This Pletronics Inc. catalog is OBSOLETE

This is being provided as reference information only.

The latest data sheets and product information are available on the Pletronics Web Site.

August 2005

Pletronics, Inc.
19013 36th Ave. W, Suite H ▪ Lynnwood, WA 98036 USA
425.776.1880, Fax: 425.776.2760, www.pletronics.com
Manufacturer of High Quality Frequency Control Products

Pletronics, Inc.

19013 36th Ave. W, Suite H ▪ Lynnwood, WA 98036 USA

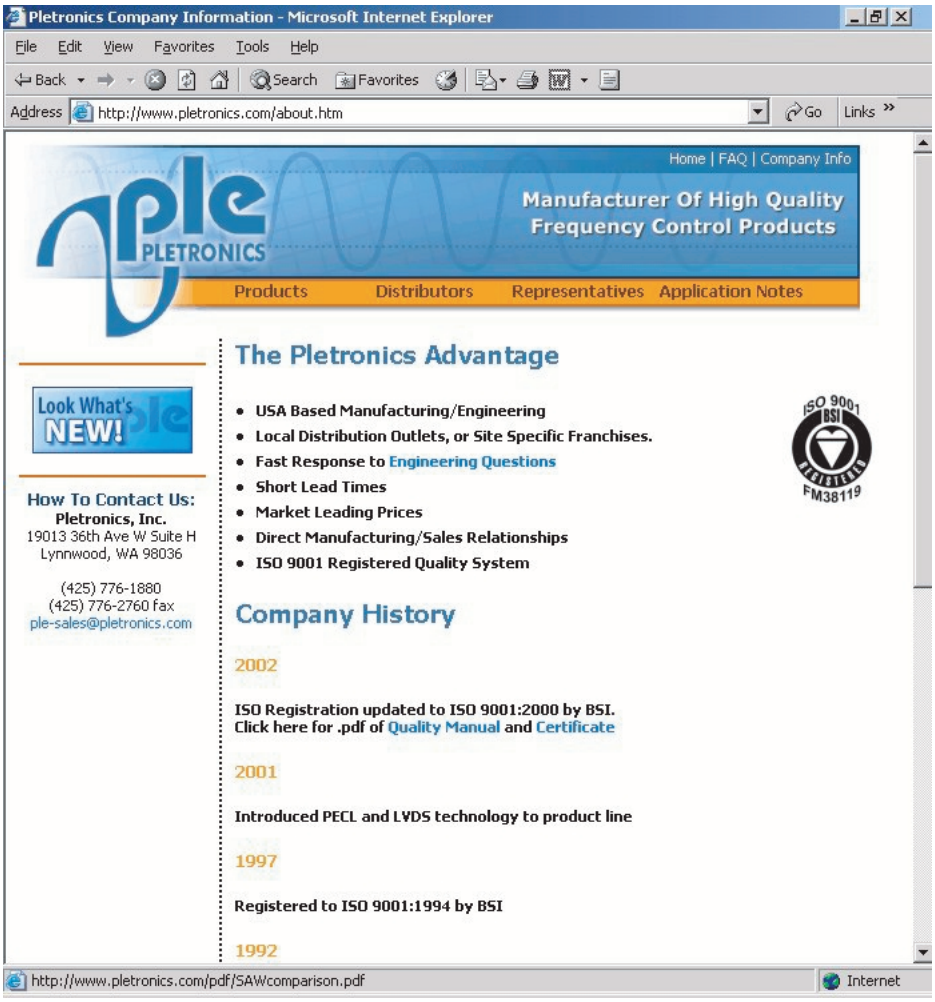
Manufacturer of High Quality Frequency Control Products

Pletronics Inc. is a USA based manufacturer of high quality frequency control products in thru-hole and surface mount packages. The Pletronics product line includes crystals (for microprocessors and communication equipment), crystal filters and crystal oscillators (CMOS, TTL, PECL & LVDS clock oscillators, OCXO, TCXO, VCXO and TCVCXO).

Lynnwood, Washington is the home of our corporate office. Research and development and quality assurance for all products are done here. Manufacturing is done in our facility in Lynnwood and our affiliate factories offshore.

Engineering & manufacturing staff are available for customer consultation and custom design. Pletronics welcomes both crystal and oscillator challenges - meeting them with high quality products, reasonable prices and USA based production and test facilities.

See www.pletronics.com for up to date changes and information!



Jun 2004

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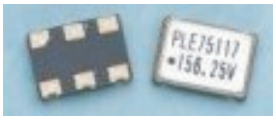
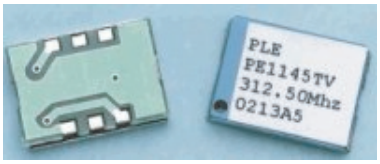
Manufacturer of High Quality Frequency Control Products

High Frequency, Low Jitter Networking Solutions for: Infiniband, Fibre Channel, Ethernet, Sonet, Xaui, ADSL

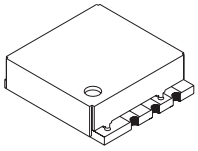
PECL
10 MHz - 650 MHz
Pages 1 - 3A



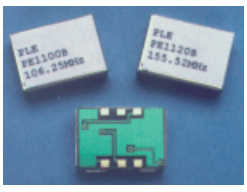
PE7745D PECL Series
40.00 – 250.00 MHz



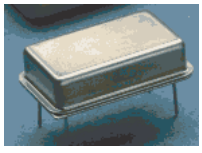
PE1145T PECL Series
110.00 – 650.00 MHz



PE7645D PECL Series
40.00 – 250.00 MHz

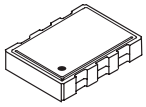


PE1145B PECL Series
PE3X45B PECL Series
10.00 – 170.00 MHz

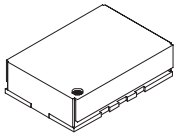


PE1145M PECL Series
10.00 – 170.00 MHz

LVDS
up to 650 MHz
Pages 4 - 5

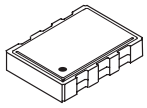


LV7745D LVDS Series
80.00 – 250.00 MHz

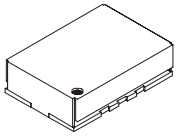


LV1145B LVDS Series
10.00 – 650.00 MHz

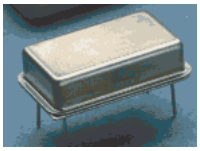
PECL, LVDS VCXO
up to 650 MHz
Pages 19 - 22



LV7 LVDS VCXO Series
PV7 PECL VCXO Series
70.00 – 200.00 MHz

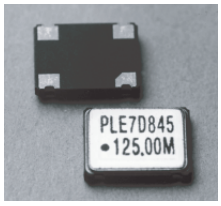


LVB LVDS VCXO Series
PVB PECL VCXO Series
1.00 – 650.00 MHz

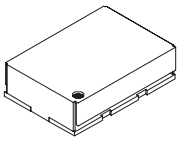


PVM PECL VCXO Series
1.00 – 650.00 MHz

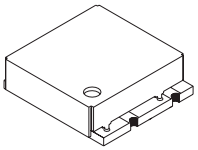
CMOS 3rd OT
70 - 170 MHz
Pages 8 - 11



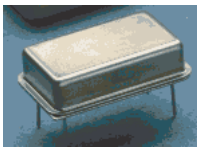
SM7745D CMOS Series
4 pad Leadless 7x5mm Ceramic

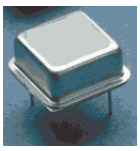


SM1145BD CMOS Series
4 pad Leadless, Grounded PCB
Base/ Metal Cover



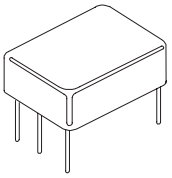
SM7645D CMOS Series
J Package Replacement





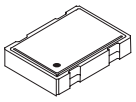
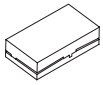
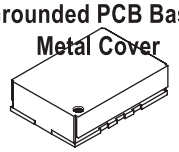
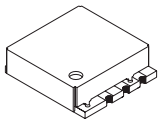
P1145-3SD Series **SQ3345D Series**
Full or Half Size Metal Thru-Hole

OCXO
1 kHz to 100 MHz
Page 7



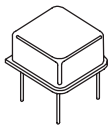
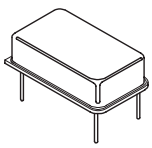
Pletronics, Inc. Clock Oscillator Selection Guide

Surface Mount Clock Oscillators

				Pg
Leadless Ceramic 	**PE7745D Series**	6 pad 7x5mm, **Differential PECL** Output, E/D	**40.00 – 250.00 MHz**	**1A**
	LV7745D Series	6 pad 7x5mm, **LVDS** Output, E/D	**80.00 – 250.00 MHz**	**4**
	***SM7745D Series**	4 pad 7x5mm, **3rd Overtone**, CMOS, Enable/Disable	**70.00 – 170.00 MHz**	**8**
	***SM7745H Series**	4 pad 7x5mm, CMOS, Enable/Disable	**1.50 – 69.99 MHz**	**12**
	SM5545T Series	4 pad 5x3.2mm, CMOS, Enable/Disable	**2.50 –125.00 MHz**	**13**
	**S3883, S3884**	4 pad 6.5x4mm, **Low Power,** Enable/Disable	**32.768 kHz**	**17**
	PE1145T Series	6 pad, **Differential LV PECL** Output, Enable/Disable	**110.00 – 650.00 MHz**	**2A**
Leadless, Grounded PCB Base Metal Cover 	**PE1145B Series**	6 pad, **Differential PECL** Output, Enable/Disable	**10.00 – 170.00 MHz**	**2A**
	PE3145B Series	4 pad, **Differential PECL** Output	**10.00 – 170.00 MHz**	**3**
	PE3345B Series	6 pad, **Differential PECL** Output, Enable/Disable	**10.00 – 170.00 MHz**	**2A**
	PE3745B Series	6 pad, **Differential PECL** Output, Enable/Disable	**10.00 – 170.00 MHz**	**2A**
	LV1145B Series	6 pad, **LVDS** Output, Enable/Disable	**10.00 – 650.00 MHz**	**5**
	***SM1145BD Series**	4 pad, **3rd Overtone**, CMOS, Enable/Disable	**70.00 – 170.00 MHz**	**9**
4 Lead Plastic 	***SM1145C Series**	CMOS, Enable/ Disable	**1.00 – 60.00 MHz**	**14**
J Lead Replacement 	***SM7645D Series**	4 pad, Plastic replacement, CMOS, Enable/ Disable	**70.00 –170.00 MHz**	**11**
	***SM7645H Series**	4 pad, Plastic replacement, CMOS, Enable/ Disable	**1.50 – 69.99 MHz**	**11A**
	PE7645D Series	6 pad, Plastic replacement, **Differential PECL,** E/D	**40.00 –250.00 MHz**	**2**
	OCXO Series	Various packages	**1.0 kHz –100.00 MHz**	**7**

* Solder Pad Compatible with the Epson SG615 and SG8002J

Thru-Hole Clock Oscillators – Full and Half Size

				Pg
4 Lead Half Size (8 Pin DIP) 	**SQ3345D Series**	**3rd Overtone** CMOS, Enable/Disable	**70.00 – 170.00 MHz**	**10**
	† **SQ3345 Series**	CMOS, Enable/Disable	**650 kHz – 69.99 MHz**	**15**
	† **SQ2245 Series**	CMOS w/o Enable/Disable	**650 kHz – 69.99 MHz**	**15**
	† **ST2245 Series**	**True TTL,** w/o Enable/Disable	**4.00 – 60.00 MHz**	**18**
4 Lead Full Size (14 Pin DIP) 	**PE1145M Series**	**Differential PECL** Output	**10.00 – 170.00 MHz**	**3A**
	P1145-3SD Series	**3rd Overtone** CMOS, Enable/ Disable	**70.00 – 170.00 MHz**	**10**
	† **P1145-3S Series**	CMOS, Enable/ Disable	**650 kHz – 69.99 MHz**	**16**
	† **P1145-HC Series**	CMOS w/o Enable/Disable	**650 kHz – 69.99 MHz**	**16**
	P1145-HCM-32.768k	**Low Power**, CMOS, Enable/Disable	**32.768 kHz**	**17A**
	† **P1145 Series**	**True TTL,** w/o Enable/Disable	**4.00 – 60.00 MHz**	**18**

† Available as SMD (Surface Mounted on PCB Platform)

All specifications are subject to change without notice

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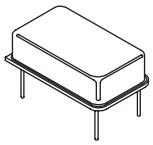
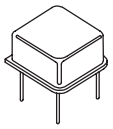
Pletronics VCXO, TCXO, TCVCXO Selection Guide

VCXO Voltage Controlled Xtal Oscillators

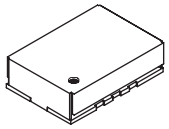
Half or Full Size Metal





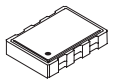
PVM	VC1 Series
1.0 –650.0 MHz	2.0 –160.0 MHz
PECL	CMOS /TTL
Page 20	Page 23

6 pad Leadless, Grounded PCB Base/ Metal Cover



LVB	PVB	VC2, VC3
1.0 – 650.0 MHz		1.5 – 200.0 MHz
LVDS	PECL	CMOS /TTL
Page 22	Page 20	Page 24

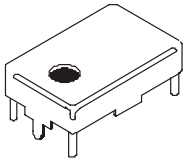
Leadless Ceramic 6 pad 7x5mm

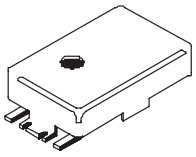


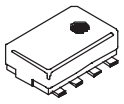
PV7	LV7	VC7
70.0 – 200.0 MHz		8.0 – 70.0 MHz
PECL	LVDS	CMOS/TTL
Page 19	Page 21	Page 25

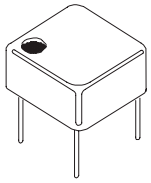
TCXO Temperature Compensated Xtal Oscillators
TCVCXO Temp. Compensated Voltage Controlled Xtal Oscillators

Pkg 6 **Pkg 7** **Pkg 8** **Pkg 9**









Pg 26 **TC4 TCXO**

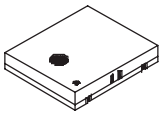
Pg 27 **TV4 TCVCXO**

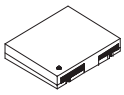
10.00 – 60.00 MHz

Thru-hole	Surface mount	Surface mount	Thru-hole
19x12.5x5mm	21.8x.11.7x5.5mm	11.6x11.6x4mm	20.3x20.3x8.5mm

HCMOS, Sine Wave or Clipped Sine Wave, 3.3 or 5.0 volt

Pkg 1 & 8 **Pkg 9**





Pg 28 **TV5 TCVCXO**

10.00 – 60.00 MHz

11.4x9.6x2mm	11.4x9.6x2mm	9x7x2mm
No trimmer	With trimmer	No trimmer

Clipped Sine Wave, 3.3 or 5.0 volt

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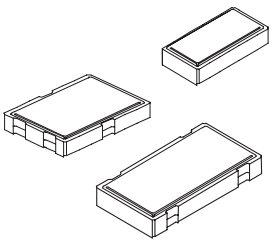
Pletronics, Inc. Crystal Selection Guide

Surface Mount Crystals

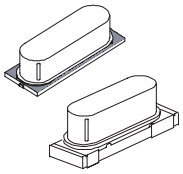
Leadless Ceramic



SM10T	4 pad 3.2x2.5mm	**16.00 – 60.00 MHz**	**29**
SM11T	4 pad 5x3.2mm	**12.00 – 32.00 MHz**	**30**
SM12T	4 pad 6x3.5mm	**10.01 – 50.00 MHz**	**31**
SM12H, SM12H2	**SM12H2**: 2 pad or **SM12H**: 4 pad 6x3.5mm	**13.00 – 120.00 MHz**	**32**
SM13T	4 pad 7x5 mm	**6.01 – 80.00 MHz**	**33**
SM13TS	**High Shock Applications,** 4 pad 7x5 mm	**8.00 – 72.00 MHz**	**33**
SM13H, SM13H2	**SM13H2**: 2 pad or **SM13H**: 4 pad 7x5mm	**9.00 – 120.00 MHz**	**34**
SM23C	4 pad 11x5.5mm	**3.57 – 120.00 MHz**	**35**

SM12T & SM12H Solder pad compatible, SM13T & SM13TS Solder pad compatible with SM13H

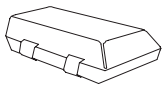
HC-49/SMD



SM42, SM30, SM25	2 pad in 3 different heights	**3.20 – 70.00 MHz**	**36**
***SM55, SM45, SM40**	4 pad on Platform in 3 Different Heights	**3.20 – 70.00 MHz**	**37**

* Solder pad compatible to each other and with other surface mount crystals from EPSON, MEIDEN and CITIZEN

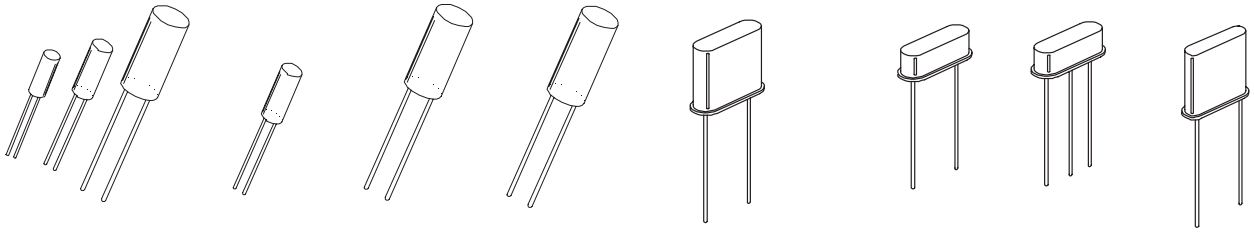
4 Leaded Plastic



***SM39S**	12.5x4.6mm	**3.50 – 70.00 MHz**	**38**
SM13S	7x1.5mm , tuning fork watch crystal	**32.768 kHz**	**39**
SM15S	6.8x3.1mm , tuning fork watch crystal	**32.768 kHz**	**39**
SM20S	8x3.8mm, tuning fork watch crystal	**32.768 kHz**	**39**

Thru-Hole Crystals in Metal Packages

Cylindrical | **HC49U** | **HC49U/S** | **UM**



WX, WX15, 26	**CY26**	**CY39**	**CY310**	**MP49**	**LP49, LP24, LP21**	**3LP49**	**UM1, 4, 5**
32.768 kHz Watch Xtal 1.5x5.1 mm 2.1x6.2 mm 3.1x8.2 mm	30.0 – 150.0 kHz 2x6 mm	4.00 – 70.00 MHz 3x9 mm	3.50 – 3.99 MHz 30.0 – 150.0 kHz 3x10 mm	1.8432 – 210.00 MHz	3.20 – 70.00 MHz LP49: 3.56mm LP24: 2.5mm LP21: 2.1mm	3rd Lead	10.00 – 150.00 MHz 3 heights
Pg 40	**Pg 41**	**Pg 42**	**Pg 42**	**Pg 43**	**Pg 44**		**Pg 45**

All specifications are subject to change without notice

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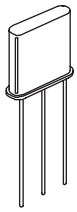
Pletronics, Inc. Supplementary Directory

Monolithic Crystal Filters Pg



Waveforms, Test Circuits, Etc. Pg

All specifications are subject to change without notice

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Manufacturer of High Quality Frequency Control Products

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Differential PECL Series

- Differential PECL Output, Some with Enable/ Disable Function
- Available in 9 Different Package/Configurations, See Next Pages

Standard Specifications

Overall Frequency Stability	± 50 PPM, ± 25 PPM, ± 20 PPM over Operating Temperature Range
Operating Temperature Range	0 to +80°C is standard, but can be extended to - 40 to +85°C
Storage Temperature Range	- 55 to +125°C
Supply Voltage (Vcc)	3.3 volts ± 5% standard, but 5.0 volts or 2.5 volts also available. See Test Cirucit 5.
Supply Current (Icc)	< 250 MHz = 90 mA maximum, 250 MHz and above = 100 mA maximum
Output High Level	2.275 V minimum referenced to Ground, Vcc = 3.300V, 0.975 V minimum referenced to termination voltage, - 1.025 V minimum referenced to Vcc
Output Low Level	1.680 V maximum referenced to Ground, Vcc = 3.300V, 0.380 V maximum referenced to termination voltage, - 1.620 V maximum referenced to Vcc
Output Symmetry	45/55% referenced to 50% of amplitude
Output Rise & Fall (Tr & Tf)	1.0 nS maximum when Vth is 10% and 90% of waveform
Jitter	1 pS RMS maximum measured from 12 kHz to 20 MHz from Fnominal
E/D Internal Pullup	50 kohm minimum to Vcc
V disable	0.3 Vcc maximum referenced to Ground
V enable	0.7 Vcc minumum referenced to Ground

PE7745D only Output Enable / Disable

High Level Input Current	-20 uA maximum at Enable / Disable Pin = 0.7 Vcc
Low Level Input Current	-200 uA maximum at Enable / Disable Pin = 0 V
Output Enable Time	200 nS maximum at output enable or 1 mS maximum at output enabled and stable
Output Disable Time	200 nS maximum at output disable

Vcc Supply Current disabled < 1 mA. Both outputs are high impedance when disabled.

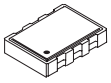
All other models Output Enable/Disable (E/D)

Output Enable Time	100 nS maximum
Output Disable Time	100 nS maximum
When Disabled	Q Output = Logic Low, QN Output = Logic High. Both Outputs are active

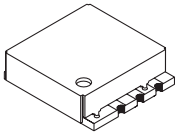
Note 1: PECL and ECL are identical circuits.
ECL has the most positive pin as ground and is ideally terminated by 50 ohms to - 2.00 V
PECL has the most negative pin as ground and is ideally terminated by 50 ohms to the most (positive voltage less 2.00 V)

Mechanical: See Next Pages

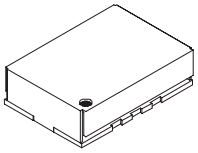
D Package



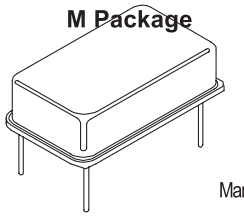
J Package Replacement



B Package



M Package



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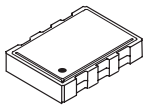
PE7745D PECL Series

- Differential PECL Output with Enable/ Disable Function
- 6 Pad 7x5mm Leadless Surface Mount Ceramic Clock Oscillator



40.00 MHz – 250.00 MHz

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

PE77 45 D V - 80.0M - XXX (Internal Code or blank)

Packaging
Tray or
16mm tape,
8mm pitch

Model
PE77 = E/D on pin 1
PE73 = E/D on pin 2

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

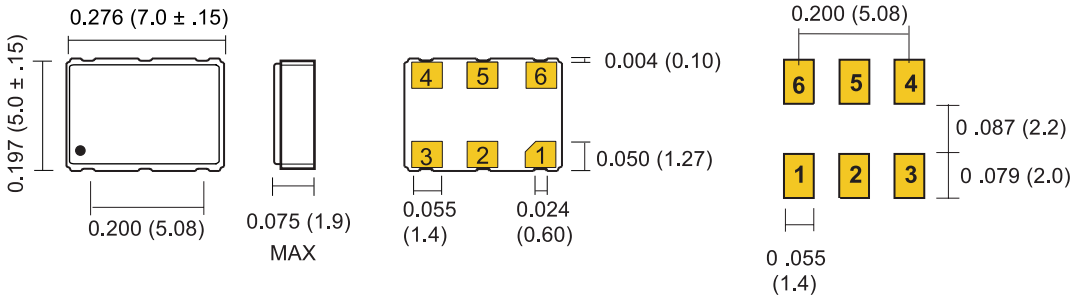
Frequency in MHz

Special Specifications (choose all that apply)
E: Extended Operating Temperature Range (- 40 to +85°C)
F: 47.5 /52.5% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%
W: Supply Voltage of 2.5 volts ± 5%
Y: Supply Voltage of 5.0 volts ± 10%

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



Lead Free

PE7745D

PIN	SIGNAL
1	E/D
2	N.C.
3	GND
4	Q OUT
5	QN OUT
6	Vcc

Preferred

PE7345D

PIN	SIGNAL
1	N.C.
2	E/D
3	GND
4	Q OUT
5	QN OUT
6	Vcc

See page 6 for Layout Guidelines

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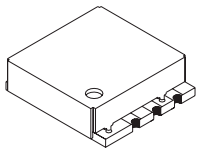
PE7645D PECL Series



- Differential PECL Output with Enable/ Disable Function
- 6 Pad Leadless Surface Mount Clock Oscillator
- Replacement for PE1145J Series

40.00 MHz – 250.00 MHz

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

PE76 45 D V - 80.0M - XXX (Internal Code or blank)

Model Series

Frequency in MHz

Special Specifications (choose all that apply)

E: Extended Operating Temperature Range (- 40 to +85°C)
F: 47.5 /52.5% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%
W: Supply Voltage of 2.5 volts ± 5%
Y: Supply Voltage of 5.0 volts ± 10%

Frequency Stability

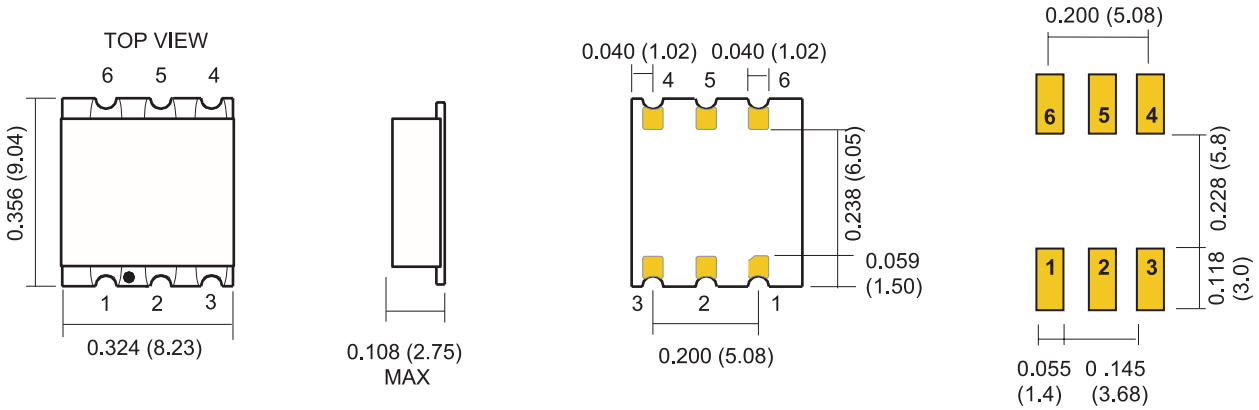
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Packaging
Tube or
24mm tape,
16mm pitch

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



PIN	SIGNAL
1	E/D
2	N.C.
3	GND
4	Q OUT
5	QN OUT
6	Vcc

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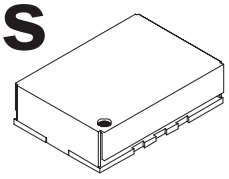
6 Pad 'B Pkg' PECL Series

PE1145T, PE1145B, PE3345B, PE3745B



- Differential PECL Output with Enable/ Disable Function
- 6 Pad 14x10x3mm Leadless Surface Mount Clock Oscillator

10.00 MHz – 650.00 MHz

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

PE11 45 B V - 70.0M - XXX (Internal Code or blank)

Model Series

110.0 MHz to 650 MHz
PE1145T = E/D on pin2

10.0 MHz to 170 MHz
PE1145B = E/D on pin2, QN on pin 1
PE3345B = E/D on pin 2, QN on pin 5
PE3745B = E/D on pin 1, QN on pin 5

Packaging
Tube or
24mm tape,
16mm pitch

Frequency in MHz

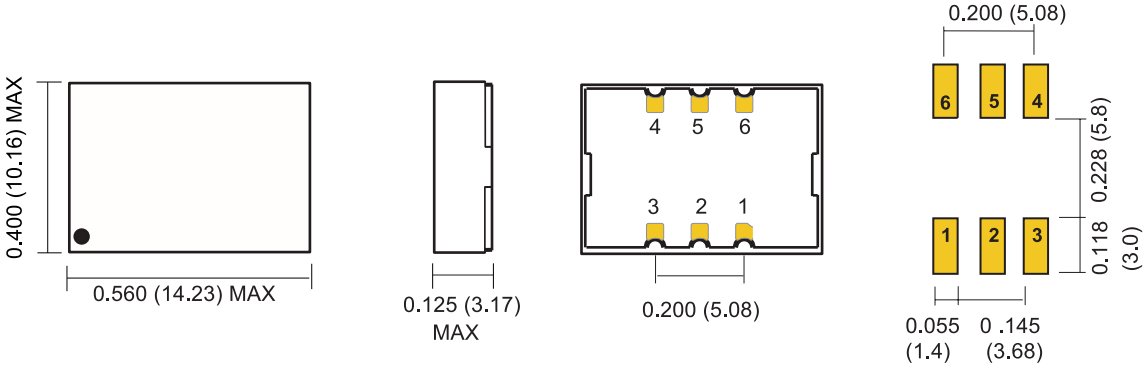
Special Specifications (choose all that apply)
E: Extended Operating Temperature Range (- 40 to +85°C)
F: 47.5 /52.5% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%
W: Supply Voltage of 2.5 volts ± 5% (consult factory)
Y: Supply Voltage of 5.0 volts ± 10%

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



PE1145T

PIN	SIGNAL
1	N.C.
2	E/D
3	GND
4	Q OUT
5	QN OUT
6	Vcc

110.0 MHz to 650.0 MHz

PE1145B

PIN	SIGNAL
1	QN OUT
2	E/D
3	GND
4	Q OUT
5	N.C.
6	Vcc

PE3345B

PIN	SIGNAL
1	N.C.
2	E/D
3	GND
4	Q OUT
5	QN OUT
6	Vcc

PE3745B

PIN	SIGNAL
1	E/D
2	N.C.
3	GND
4	Q OUT
5	QN OUT
6	Vcc

10.0 MHz to 170.0 MHz

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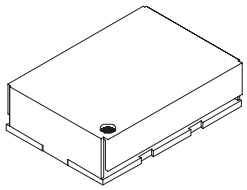
PE3145B PECL Series



- Differential PECL Output without Enable/ Disable Function
- 4 Pad 14x10x3mm Leadless Surface Mount Clock Oscillator

10.00 MHz – 170.00 MHz

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

PE31 45 B V - 70.0M - XXX (Internal Code or blank)

Model Series

Frequency in MHz

Packaging
Tube or
24mm tape,
16mm pitch

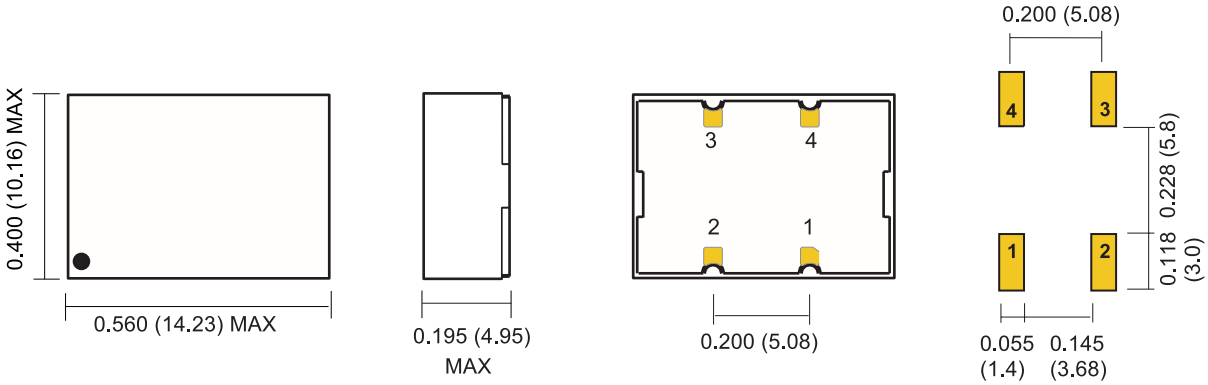
Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Special Specifications (choose all that apply)
E: Extended Operating Temperature Range (- 40 to +85°C)
F: 47.5 /52.5% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%
W: Supply Voltage of 2.5 volts ± 5% (consult factory)
Y: Supply Voltage of 5.0 volts ± 10%

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



PIN	SIGNAL
1	QN OUT
2	GND
3	Q OUT
4	Vcc

See page 6 for Layout Guidelines

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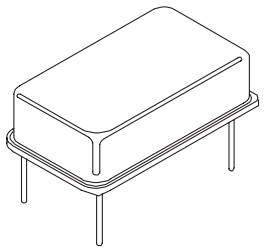
PE1145M PECL Series

- Differential PECL Output without Enable/ Disable Function
- 4 Lead Full Size (14 Pin DIP) Metal Clock Oscillator



10.00 MHz – 170.00 MHz

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

PE11 45 M V - 70.0M - XXX (Internal Code or blank)

Model Series

Frequency in MHz

Special Specifications (choose all that apply)
E: Extended Operating Temperature Range (- 40 to +85°C)
F: 47.5 /52.5% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%
W: Supply Voltage of 2.5 volts ± 5% (consult factory)
Y: Supply Voltage of 5.0 volts ± 10%

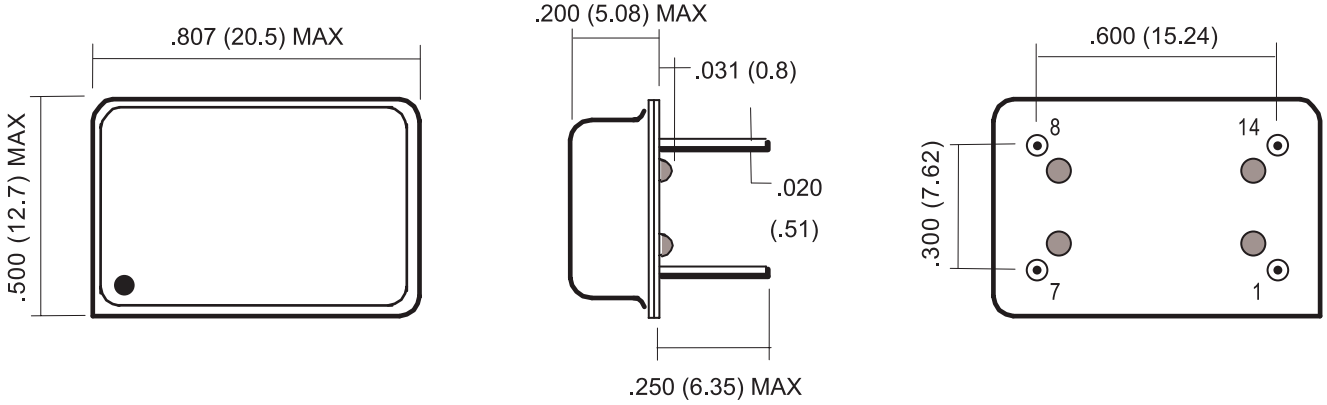
Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Packaging
Tube

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



PIN	SIGNAL
1	E/D
7	GND
8	OUT
14	Vcc

See page 6 for Layout Guidelines

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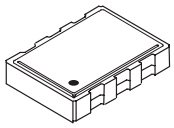
LV7745D LVDS Series



- Low Voltage Differential Signal Output with Enable / Disable
- 6 Pad 7 x 5mm Leadless Surface Mount Oscillator

80.00 MHz – 250.00 MHz
Consult factory for **higher** frequencies

Standard Specifications

Overall Frequency Stability	LV7745D: ± 50 PPM, LV7744D: ± 25 PPM, LV7720D: ± 20 PPM over Operating Temp. Range
Operating Temperature Range	0 to +80°C is standard, can be extended to - 40 to +85°C
Operable Supply Voltage (Vcc)	3.3 V ± 5% standard, 2.5 V ± 5% also available
High Level Output Voltage	1.43 V typical and 1.60 V maximum with output enabled (100 ohm load, R1 = 50 ohms) See Test circuit #6
Low Level Output Voltage	0.90 V minimum and 1.10 V typical with output enabled (same conditions as above)
Differential Output Voltage	247 V minimum, 330 V typical and 454 V maximum with output enabled (same conditions as above)
Differential Output Error	50 mV maximum with output enabled (same conditions as above)
Offset Voltage	1.125 V minimum, 1.25 V typical and 1.375 V maximum with output enabled (same as above)
Offset Voltage Error	50 mV maximum with output enabled (same as above)
Output Leakage Current	10 uA maximum with output disabled
Supply Current (Icc)	35 mA typical and 47 mA maximum with output enabled, 30 uA maximum with output disabled
Symmetry (DC1)	45/55% measured at crossing point 0°C <= Ta <= 70°C, 40/60% measured at Ta < 0°C and Ta > 70°C
Symmetry (DC2)	45/55% measured at 50% of output swing 0°C <= Ta <= 70°C, 40/60% measured at 50% of output swing
Rise and Fall Time (Tr & Tf)	1.5 nS max at 20% to 80% output swing (100 ohm load) See Test circuit #6 and Waveform #2
RMS Jitter	1.5 pS max at12 kHz to 20 MHz from the output

Enable / Disable Pin:

The Enable / Disable pin has an internal pull up and if the pin is not connected the oscilaltor is enabled. Pletronics strongly recommends connecting the Enable / Disable pin to Vcc, if the oscillator is to be enabled at all times. In the disable condition, the output becomes a high impedance and the internal oscillator circuit is inhibited (the internal circuit is stopped).

High Level Input Voltage	0.7 Vcc minimum at Enable / Disable Pin
Low Level Input Voltage	0.3 Vcc maximum at Enable / Disable Pin
High Level Input Current	-20 uA maximum at Enable / Disable Pin = 0.7 Vcc
Low Level Input Current	-200 uA maximum at Enable / Disable Pin = 0 V
Output Enable Time	200 nS maximum at output enable or 1 mS maximum at output enabled and stable
Output Disable Time	200 nS maximum at output disable

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

Packaging
Tube or
16mm tape
8mm pitch

LV77 45 D V - 100.0M - XXX (Internal Code or blank)

Model

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Frequency in MHz

Special Specifications (choose all that apply)
E: Extended Operating Temp Range (-40 to +85°C)
V: Supply Voltage of 3.3 volts ±5%
W: Supply Voltage of 2.5 volts ±5%

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

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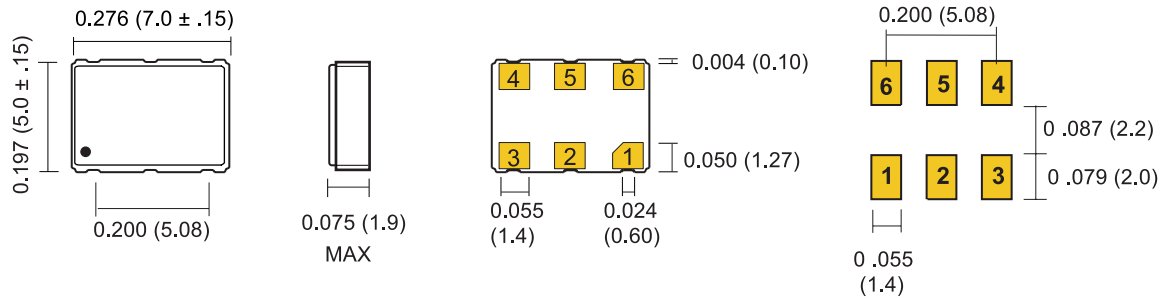
LV7745D LVDS Series

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



LV7745D

PIN	SIGNAL
1	E/D
2	N.C.
3	GND
4	VoD+
5	VoD-
6	Vcc

Preferred

LV7345D

PIN	SIGNAL
1	N.C.
2	E/D
3	GND
4	VoD+
5	VoD-
6	Vcc

Lead Free

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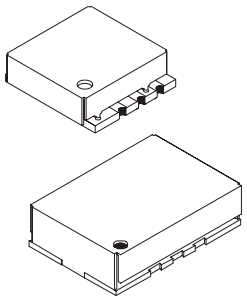

LV1145B LVDS Series

- Low Voltage Differential Signal Output with Enable/Disable
- 6 Pad Leadless Surface Mount Oscillator

10.00 MHz – 650.00 MHz
Consult factory for **higher** frequencies

Standard Specifications

Overall Frequency Stability	LV1145B: ± 50 PPM, LV1144B: ± 25 PPM, LV1120B: ± 20 PPM over Operating Temp. Range
Operating Temperature Range	0 to +80°C is standard, can be extended to - 40 to +85°C
Operable Supply Voltage (Vcc)	3.3 V ± 5% standard, 5.0 V ± 10% also available (2.5 V different package)
High Level Output Voltage	1.43 V typical and 1.60 V maximum with output enabled (100 ohm load) See Test circuit #6
Low Level Output Voltage	0.90 V minimum and 1.10 V typical with output enabled (100 ohm load) See TC #6
Differential Output Voltage	247 V minimum, 330 V typical and 454 V maximum with output enabled (100 ohm load) See TC #6
Offset Voltage	1.125 V minimum, 1.25 V typical and 1.375 V maximum with output enabled (100 ohm load) See TC #6
Output Leakage Current	10 uA maximum with output disabled
Supply Current (Icc) Enabled	50 mA max < 200 MHz, 60 mA max < 500 MHz, 70 mA max 500 MHz and above
Supply Current (Icc) Disabled	20 mA max < 200 MHz, 30 mA max < 500 MHz, 40 mA max 500 MHz and above
Symmetry (DC)	45/55% measured at 0°C <= Ta <= 70°C, 40/60% measured at Ta < 0°C and Ta > 70°C
Rise and Fall Time (Tr & Tf)	1.0 nS max at 20% to 80% output swing (100 ohm load) See Test circuit #6 and Waveform #2
RMS Jitter	1.0 pS max at12 kHz to 20 MHz from the output

Enable / Disable Pin:

The Enable / Disable pin has an internal pull up and if the pin is not connected the oscilaltor is enabled. Pletronics strongly recommends connecting the Enable / Disable pin to Vcc, if the oscillator is to be enabled at all times. In the disable condition, the output becomes a high impedance.

High Level Input Voltage	0.7 Vcc minimum at Enable / Disable Pin
Low Level Input Voltage	0.3 Vcc maximum at Enable / Disable Pin
High Level Input Current	-20 uA maximum at Enable / Disable Pin = 0.7 Vcc
Low Level Input Current	-200 uA maximum at Enable / Disable Pin = 0 V
Output Enable Time	200 nS maximum
Output Disable Time	200 nS maximum

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

LV11 45 B V - 70.0M - XXX (Internal Code or blank)

Packaging
Tube or
24mm tape
16mm pitch

Model
LV11 = Pin 1 N.C.
LV33 = Pin 1 E/D
LV37 = Pin 1 E/D

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Frequency in MHz

Special Specifications (choose all that apply)
E: Extended Operating Temp Range (-40 to +85°C)
V: Supply Voltage of 3.3 volts ±5%
Y: Supply Voltage of 5.0 volts ±10%,
W: Supply Voltage of 2.5 volts ± 5% (different package)

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

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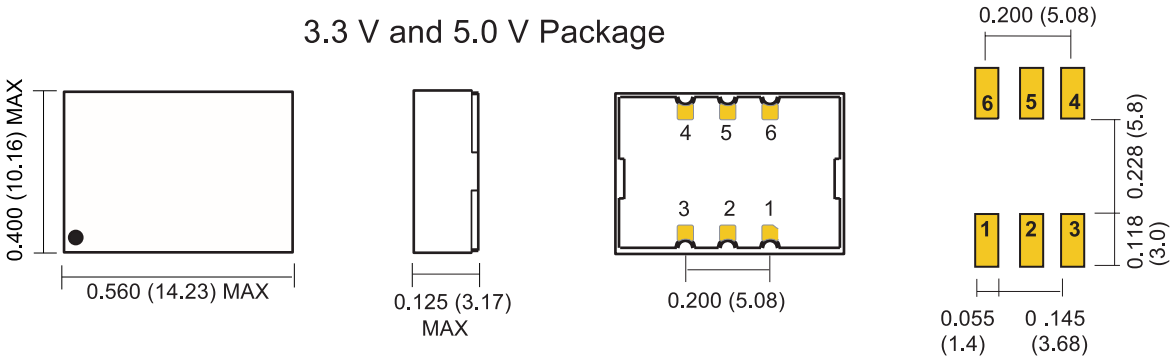
Manufacturer of High Quality Frequency Control Products

LV1145B LVDS Series

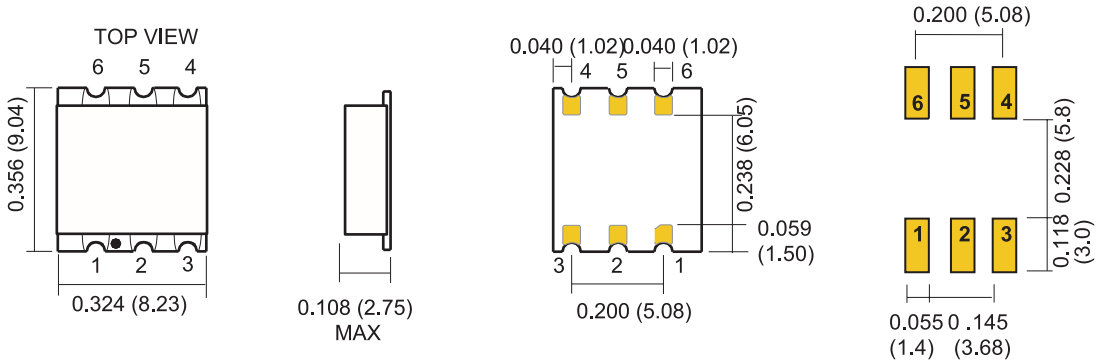
Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.

3.3 V and 5.0 V Package



2.5 V Package



See page 6 for Layout Guidelines

LV1145B

PIN	SIGNAL
1	N.C.
2	E/D
3	GND
4	VoD+
5	VoD-
6	Vcc

LV3345B

PIN	SIGNAL
1	E/D
2	E/D
3	GND
4	VoD+
5	VoD-
6	Vcc

LV3745B

PIN	SIGNAL
1	E/D
2	N.C.
3	GND
4	VoD+
5	VoD-
6	Vcc

Jun 2004

Pletronics, Inc. (425) 776 -1880, Fax: (425) 776-2760, ple-sales@pletronics.com, www.pletronics.com

Pletronics, Inc.
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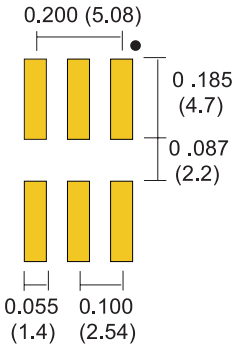
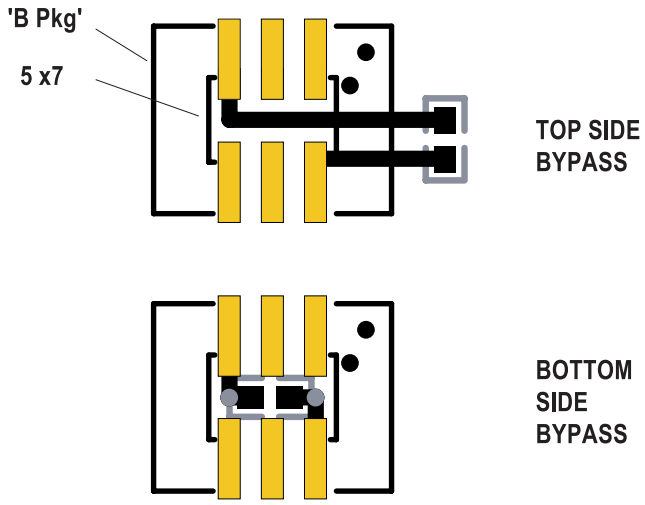
Manufacturer of High Quality Frequency Control Products

PECL and LVDS Layout Guidelines

SUGGESTED PCB LAYOUTS

Solder Pad Layout which accommodates all PECL surface mount devices

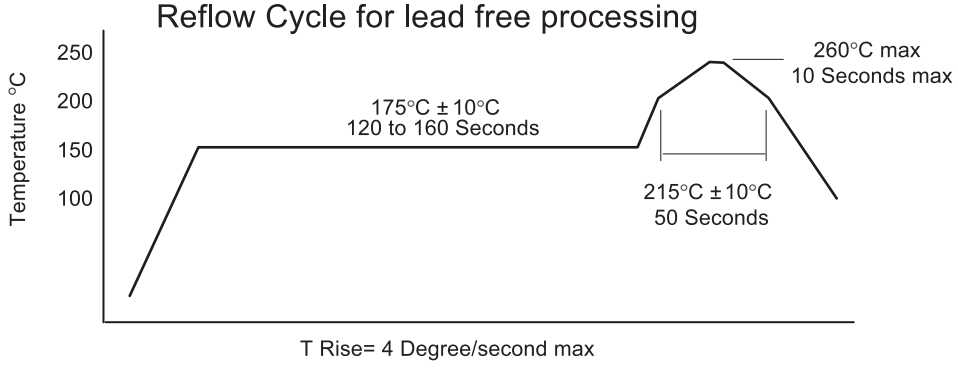




The output line should be designed with proper characteristic impedance. Pletronics recommends laying out for the larger 'B package' with pads long enough to accept the smaller 5 x 7mm device. This permits the best option for alternate sources of device. Pletronics also recommends connecting Pin 1 and Pin 2 together on the models with Q & QN OUT on pins 4 & 5. This allows having E/D on either pin 1 or pin 2.

For Optimum Jitter Performance, Pletronics recommends:

- A ground plane under the device with any other signals below the ground plane
- Minimize other RF signals near device
- No large transient signals (both current and voltage) should be routed under the device
- Do not layout near a large magnetic field such as a high frequency switching power supply
- Do not place near piezoelectric buzzers or mechancial fans



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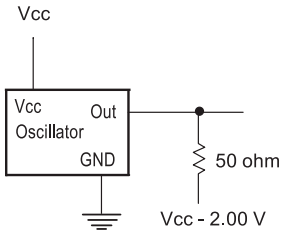
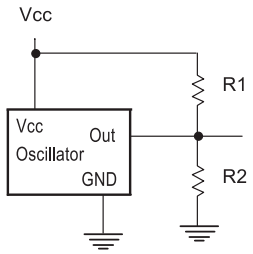
PECL and LVDS Layout Guidelines Continued

PECL Terminations:

Suggested Terminations for 50 ohm impedance matched termination

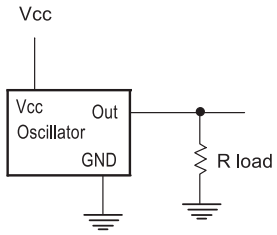




Thevenin Equivalent Termination

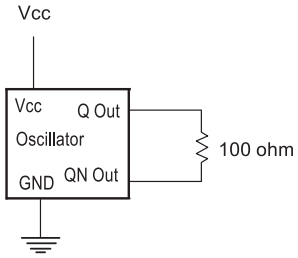
Vcc	R1	R2
5.0 V	82 ohm	130 ohm
3.3 V	130 ohm	82 ohm
2.5 V	249 ohm	61.9 ohm

Simple termination for NON impedance matched termination



Vcc	R load
5.0 V	274 ohm
3.3 V	147 ohm
2.5 V	86.6 ohm

LVDS Terminations:



Design PCB traces for 50 ohm characteristic impedance

Mixed System Power Supply:

PECL To use multiple supply voltages requires level translation. Direct circuit connection is not valid.

ECL Mixed supply voltages are allowed. No translation is necessary. (ECL is returned to the most positive supply and this is common to all circuits)

LVDS Mixed supply voltages are allowed. LVDS signal levels are power supply independent. 3.3 V LVDS oscillators properly interface 2.5 V Logic Arrays for example.

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Manufacturer of High Quality Frequency Control Products

OCXO Series

- Oven Controlled Xtal Oscillator (Electronic or Mechanical Tuning)
- Available in Various Package and Supply Versions
- Output Signals: Logic, Sinewave, etc.
- Excellent Phase Noise Characteristics

1.00 kHz – 100.00 MHz

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special p/n may be assigned.

Frequency Stability is typically inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

OCxxx H 12 A 27 - 10.0M - XXX (Internal Code or blank)

Model Series

Logic
H: HCMOS
S: Sine Wave
P: PECL
T: TTL
L: LVDS
C: Clipped Sinewave

Supply Voltage
03: +3.3 Vdc
05: +5.0 Vdc
12: +12.0 Vdc
15: +15.0 Vdc
24: +24.0 Vdc

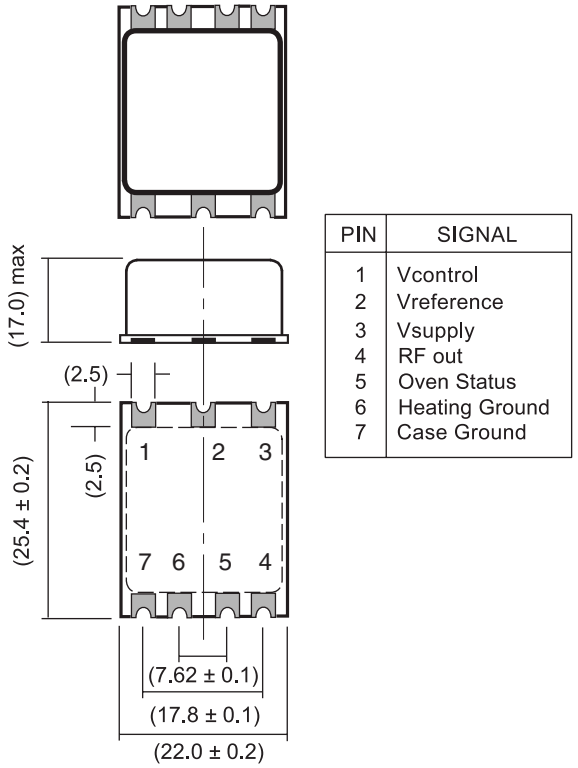
Operating Temperature Range
A: 0 to +50°C
B: 0 to +70°C
C: -10 to +70°C
D: -20 to +70°C
E: -40 to +70°C

Frequency Stability
27 = ± 2 x 10^{-7}
59 = ± 5 x 10^{-9}
17 = ± 1 x 10^{-7}
Typical

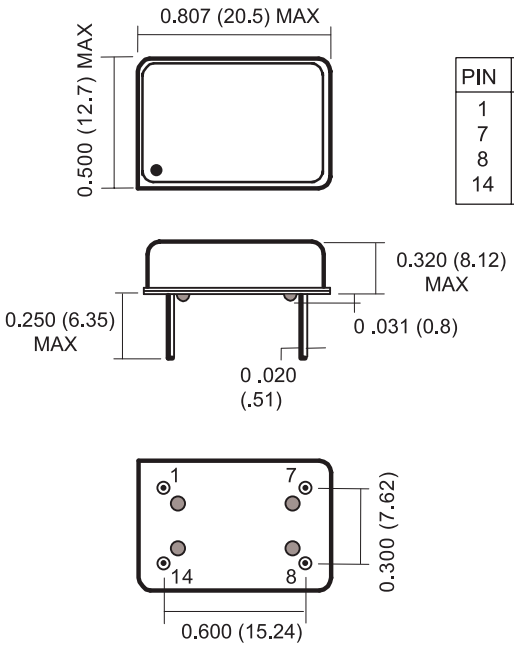
Frequency in MHz
Standard Frequencies: 10 MHz, 32.768 MHz & 100 MHz

Typical Mechanical: inches (mm) not to scale

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



PIN	SIGNAL
1	Vcontrol
2	Vreference
3	Vsupply
4	RF out
5	Oven Status
6	Heating Ground
7	Case Ground



PIN	SIGNAL
1	N.C.
7	GND
8	RF OUT
14	Vcc

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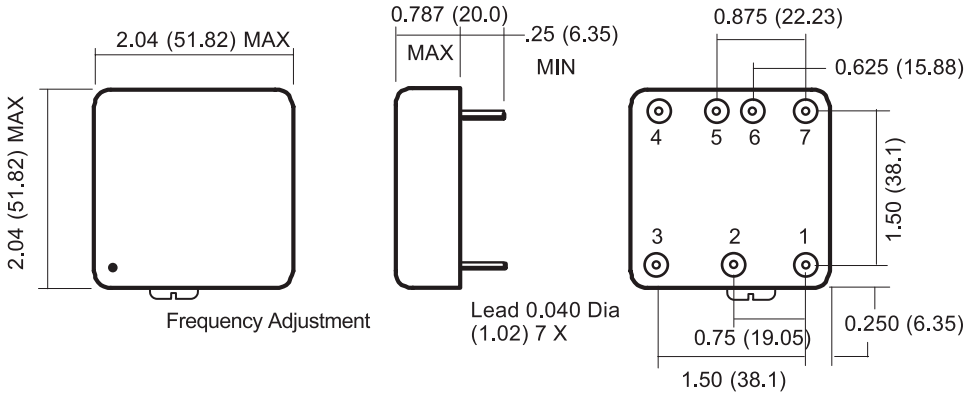
OCXO Series

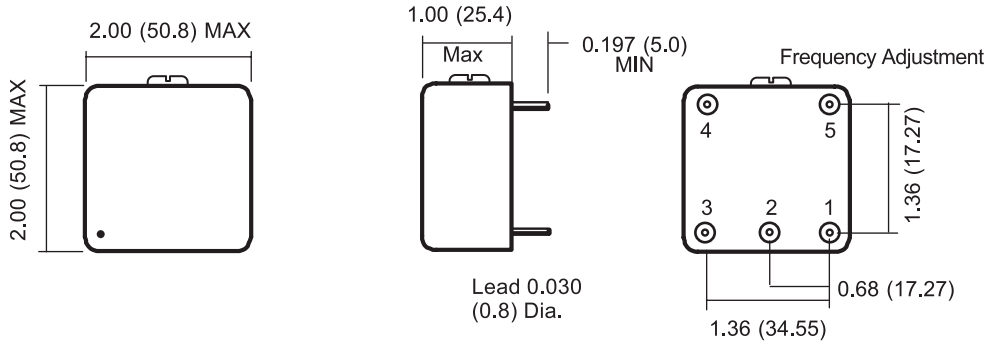
1.00 kHz – 100.00 MHz

Typical Mechanical: inches (mm) **not to scale**

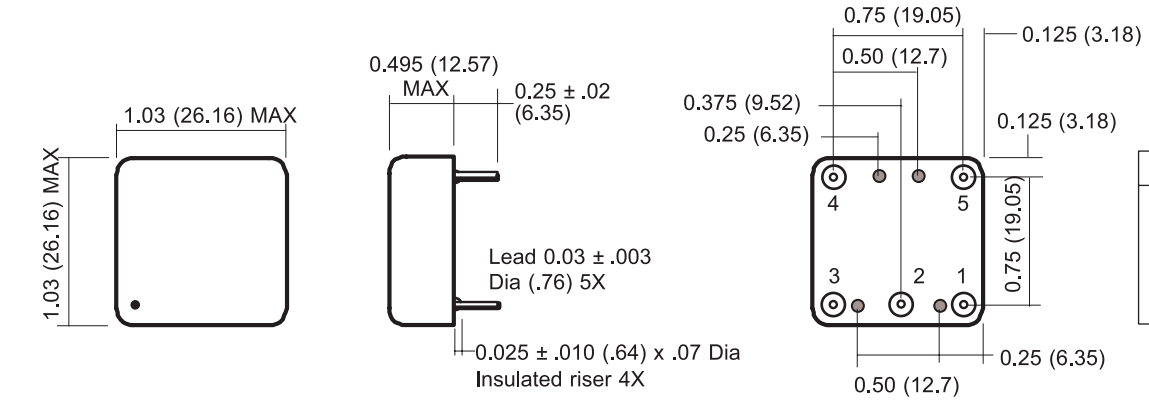
Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



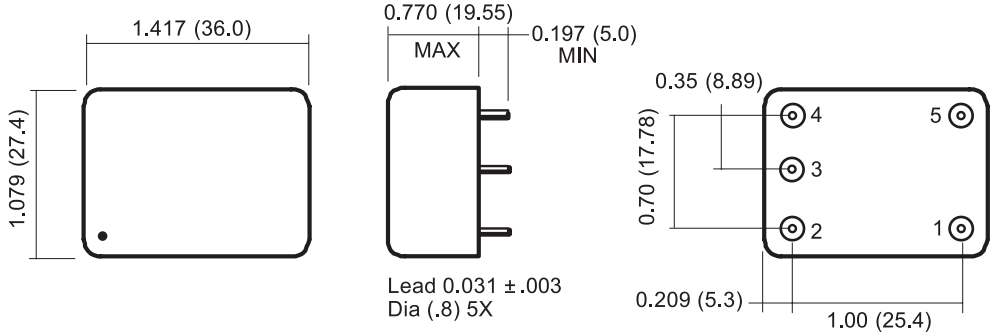
PIN	SIGNAL
1	Oven Return / CASE GND
2	Oscillator Supply, +Vdc
3	Frequency Control
4	RF / CASE GND
5	Oven Monitor or CASE GND
6	RF OUT
7	Oven Supply, +Vdc



PIN	SIGNAL
1	V control
2	N.C.
3	Output
4	RF & Case Ground
5	+Vdc



PIN	SIGNAL
1	OUT
2	RF / CASE GND
3	Vcontrol
4	N.C.
5	+Vdc



PIN	SIGNAL
1	GND, 10K Other end
2	10K Wiper end
3	10K One end
4	DC Input
5	Output

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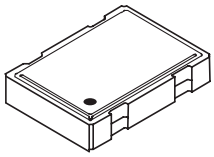
SM7745D CMOS Series



- CMOS with Enable/ Disable, 3rd Overtone Crystal Used
- 4 Pad 7 x 5mm Leadless Surface Mount Ceramic Clock Oscillator
- Low Jitter

70.00 MHz – 170.00 MHz
Consult factory for **higher** frequencies

Standard Specifications

Overall Frequency Stability	SM7745D: ± 50 PPM, SM7744D: ± 25 PPM, SM7720D: ± 20 PPM over Operating Temp. Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to - 40 to +85°C for certain frequencies
Supply Voltage (Vcc)	5.0, 3.3, and 2.5 volts available, .01 µF bypass cap recommended, consult factory for 1.8 volts
Symmetry (Duty Cycle)	40/60 to 60/40% is standard, but 45/55% at 50% of Vcc is also available (see Waveform 1)
Logic Levels	**Logic "1"** 90% of Vcc MIN; **Logic "0"** 10% of Vcc MAX
Jitter	1 pS RMS maximum, from 12 kHz to 20 MHz from carrier
Output Load	Standard load is 15 pF (typ. 1 ASIC) maximum, see Test Circuit 2 (consult factory for **heavier** loads)
Enable/Disable Option (E/D)	Output enabled when Pin #1 is open or at Logic "1"; Output disabled when Pin #1 is at Logic "0".

Frequency Range (MHz)	Max. Supply Current Icc (mA) w/ 15pF load		Max. Rise and Fall Time Tr & Tf (nS) w/ 15pF load	
	2.5V, 3.3V	5.0V	2.5V	3.3V, 5.0V
70.000 – 79.999	30	45	3.5	3.0
80.000 – 110.000	40	80	2.5	1.5
110.001 – 119.999	50	90	2.5	1.0
120.000 – 170.000	60	95	1.5	1.0

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM77 45 D V - 70.0M - 30 - XXX (Internal Code or blank)

Packaging
Tray or
16mm tape
8mm pitch

Model

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Frequency in MHz

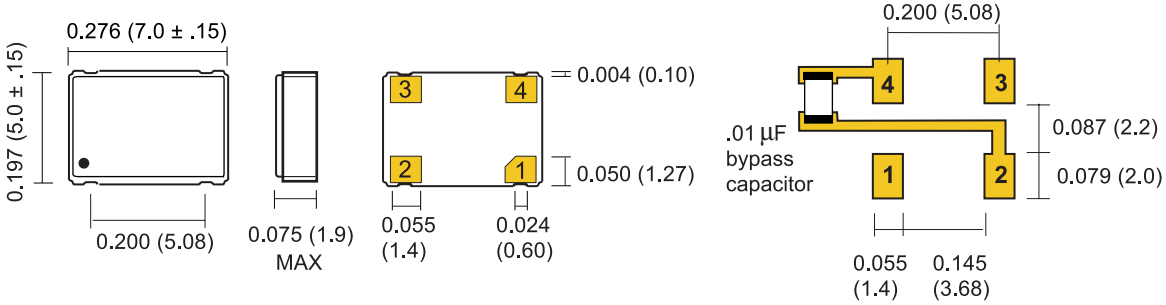
Non-Std Output Load
Blank = 15 pF max, 30 = 30 pF max

Special Specifications (choose all that apply)
Y: Std Specs (5.0V ± 10%, 0 to +70 °C, 40/60% Symmetry)
E: Extended Operating Temperature Range (- 40 to +85°C)
S: 45/55% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%
W: Supply Voltage of 2.5 volts ± 5%
X: Supply Voltage of 1.8 volts ± 5% (Consult factory)

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



PIN	SIGNAL
1	E/D
2	GND
3	OUT
4	Vcc

Lead Free

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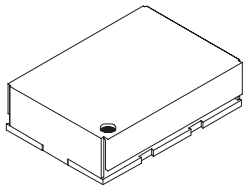
SM1145BD CMOS Series



- CMOS with Enable/ Disable, 3rd Overtone Crystal Used
- Low Jitter
- 4 Pad Surface Mount Clock Oscillator
- Solder Pad Compatible to our SM11 Series, Epson SG615 & SG8002J

70.00 MHz – 170.00 MHz
Consult factory for **higher** frequencies

Standard Specifications

Overall Frequency Stability	SM1145BD: ± 50 PPM, SM1144BD: ± 25 PPM, SM1120BD: ± 20 PPM over Operating Temp. Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to – 40 to +85°C for certain frequencies
Supply Voltage (Vcc)	5.0 volts, 3.3 volts, and 2.5 volts available, consult factory for 1.8 volts
Symmetry (Duty Cycle)	40/60 to 60/40% is standard, but 45/55% at 50% of Vcc is also available (see Waveform 1)
Logic Levels	**Logic "1"** 90% of Vcc MIN; **Logic "0"** 10% of Vcc MAX
Jitter	1 pS RMS maximum, from 12 kHz to 20 MHz from carrier
Output Load	Standard load is 15pF (typ. 1 ASIC) maximum, see Test Circuit 3 (consult factory for **heavier** loads)
Enable/Disable Option (E/D)	Output enabled when Pin #1 is open or at Logic "1"; Output disabled when Pin #1 is at Logic "0".

Frequency Range (MHz)	Max. Supply Current Icc (mA) w/ 15pF load		Max. Rise and Fall Time Tr & Tf (nS) w/ 15pF load	
	2.5V, 3.3V	5.0V	2.5V	3.3V, 5.0V
70.000 – 79.999	30	45	3.5	3.0
80.000 – 110.000	40	80	2.5	1.5
110.001 – 119.999	50	90	2.5	1.0
120.000 – 170.000	60	95	1.5	1.0

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM11 45 BD V - 70.0M - 30 - XXX (Internal Code or blank)

Packaging
Tube or
24mm tape
16mm pitch

Model

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Frequency in MHz

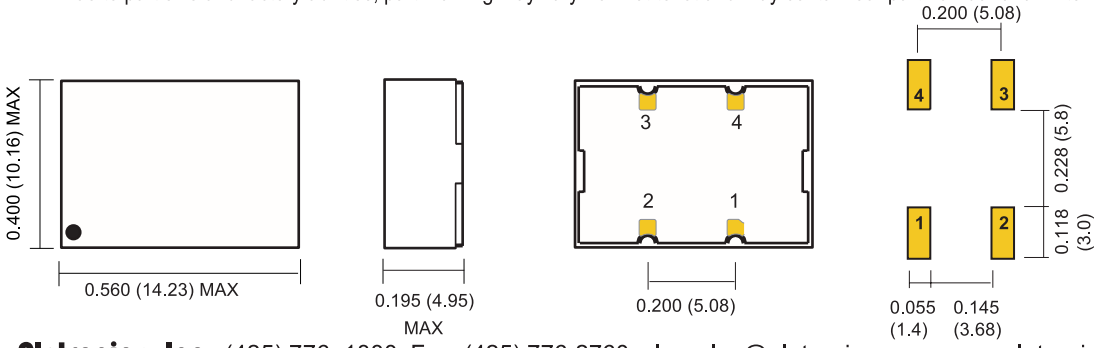
Non-Std Output Load
Blank = 15 pF max, 30 = 30 pF max

Special Specifications (choose all that apply)
Y: Std Specs (5.0V ± 10%, 0 to +70°C, 40/60% Symmetry)
E: Extended Operating Temperature Range (- 40 to +85°C)
S: 45/55% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%
W: Supply Voltage of 2.5 volts ± 5%
X: Supply Voltage of 1.8 volts ± 5% (Consult factory)

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



PIN	SIGNAL
1	E/D
2	GND
3	OUT
4	Vcc

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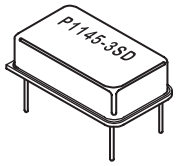
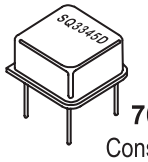
High Frequency Thru-Hole





- CMOS with Enable/ Disable, 3rd Overtone Crystal Used
- Low Jitter
- Full Size or Half Size Metal Thru-Hole Clock Oscillator

70.00 MHz – 170.00 MHz
Consult factory for **higher** frequencies

Standard Specifications

Overall Frequency Stability	± 50 PPM is standard, but ± 25 PPM and ± 20 PPM over Operating Temp. Range also available
Operating Temperature Range	0 to +70°C is standard, but can be extended to – 40 to +85°C for certain frequencies
Supply Voltage (Vcc)	5.0 volts, 3.3 volts, and 2.5 volts available, consult factory for 1.8 volts
Symmetry (Duty Cycle)	40/60 to 60/40% is standard, but 45/55% at 50% of Vcc is also available (see Waveform 1)
Logic Levels	**Logic "1"** 90% of Vcc MIN; **Logic "0"** 10% of Vcc MAX
Jitter	1 pS RMS maximum, from 12 kHz to 20 MHz from carrier
Output Load	Standard load is 15pF (typ. 1 ASIC) maximum, see Test Circuit 3 (consult factory for **heavier** loads)
Enable/Disable Option (E/D)	Output enabled when Pin #1 is open or at Logic "1"; Output disabled when Pin #1 is at Logic "0".

Frequency Range (MHz)	Max. Supply Current Icc (mA) w/ 15pF load		Max. Rise and Fall Time Tr & Tf (nS) w/ 15pF load	
	2.5V, 3.3V	5.0V	2.5V	3.3V, 5.0V
70.000 – 79.999	30	45	3.5	3.0
80.000 – 110.000	40	80	2.5	1.5
110.001 – 119.999	50	90	2.5	1.0
120.000 – 170.000	60	95	1.5	1.0

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

Packaging
Tube or
on Pads

SQ33 45 D V -- 70.0M - 30 - XXX (Internal Code or blank)
P11 45 - 3SD V – 70.0M - 30 - XXX

Model
P11xx-3SD (Full Size)
SQ33xxD (Half Size)

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Non-Std Output Load
Blank = 15 pF max, 30 = 30 pF max

Frequency in MHz

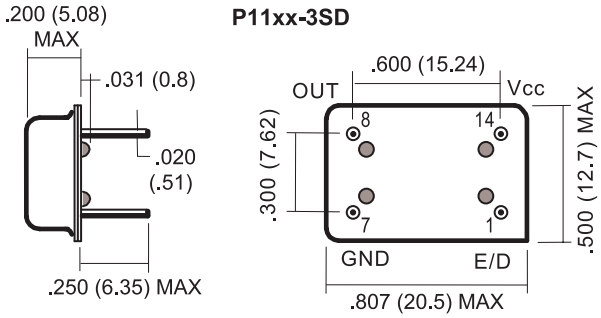
Special Specifications (choose all that apply)
Blank: Std Specs (5.0V ± 10%, 0 to +70°C, 40/60% Symmetry)
E: Extended Operating Temperature Range (- 40 to +85°C)
S: 45/55% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ±10%
W: Supply Voltage of 2.5 volts ± 5%
X: Supply Voltage of 1.8 volts ± 5% (Consult factory)

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

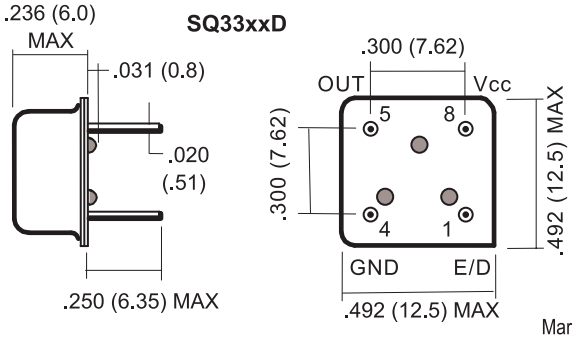
Mechanical: inches (mm) not to scale

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.

P11xx-3SD



SQ33xxD



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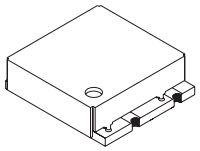
SM7645D CMOS Series



- CMOS with Enable/ Disable, 3rd Overtone Crystal Used
- Low Jitter
- 4 Pad Leadless Surface Mount Clock Oscillator

70.00 MHz – 170.00 MHz
Consult factory for **higher** frequencies

Standard Specifications

Overall Frequency Stability	SM7645D: ± 50 PPM, SM7644D: ± 25 PPM, SM7620D: ± 20 PPM over Operating Temp. Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to - 40 to +85°C for certain frequencies
Supply Voltage (Vcc)	5.0, 3.3, and 2.5 volts available, .01 µF bypass cap recommended, consult factory for 1.8 volts
Symmetry (Duty Cycle)	40/60 to 60/40% is standard, but 45/55% at 50% of Vcc is also available (see Waveform 1)
Logic Levels	**Logic "1"** 90% of Vcc MIN; **Logic "0"** 10% of Vcc MAX
Jitter	1 pS RMS maximum, from 12 kHz to 20 MHz from carrier
Output Load	Standard load is 15 pF (typ. 1 ASIC) maximum, see Test Circuit 2 (consult factory for **heavier** loads)
Enable/Disable Option (E/D)	Output enabled when Pin #1 is open or at Logic "1"; Output disabled when Pin #1 is at Logic "0".

Frequency Range (MHz)	Max. Supply Current Icc (mA) w/ 15pF load		Max. Rise and Fall Time Tr & Tf (nS) w/ 15pF load	
	2.5V, 3.3V	5.0V	2.5V	3.3V, 5.0V
70.000 – 79.999	30	45	3.5	3.0
80.000 – 110.000	40	80	2.5	1.5
110.001 – 119.999	50	90	2.5	1.0
120.000 – 170.000	60	95	1.5	1.0

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM76 45 D V - 70.0M - 30 - XXX (Internal Code or blank)

Packaging
Tray or
24mm tape
16mm pitch

Model

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Frequency in MHz

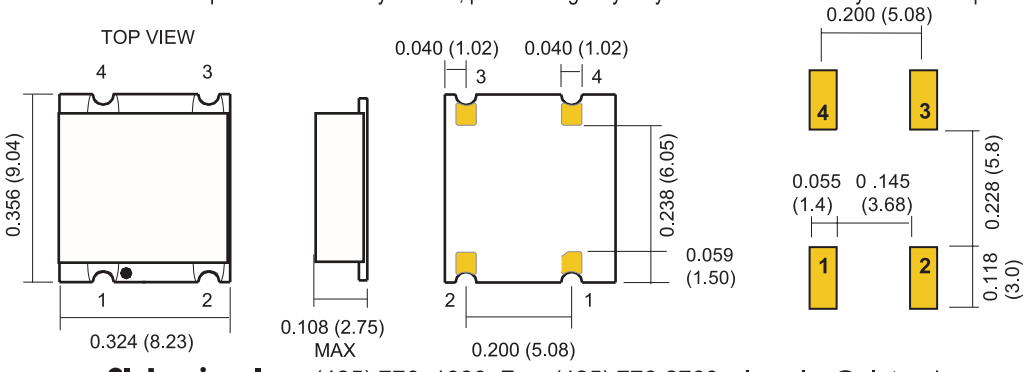
Non-Std Output Load
Blank = 15 pF max, 30 = 30 pF max

Special Specifications (choose all that apply)
Y: Std Specs (5.0V ± 10%, 0 to +70 °C, 40/60% Symmetry)
E: Extended Operating Temperature Range (- 40 to +85°C)
S: 45/55% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%
W: Supply Voltage of 2.5 volts ± 5%
X: Supply Voltage of 1.8 volts ± 5% (Consult factory)

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



PIN	SIGNAL
1	E/D
2	GND
3	OUT
4	Vcc

Mar 2004

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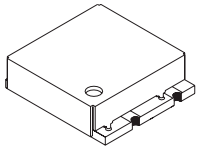
Manufacturer of High Quality Frequency Control Products

SM7645H CMOS Series



- CMOS with Enable/ Disable or Optional Stand By Mode (3.3 V)
- Fundamental or 3rd Overtone Crystal Used
- 4 Pad Leadless Surface Mount Clock Oscillator

1.500 MHz – 69.999 MHz

Standard Specifications

Overall Frequency Stability	SM7645H: ± 50 PPM, SM7644H: ± 25 PPM, SM7620H: ± 20 PPM over Operating Temp. Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to - 40 to +85°C for certain frequencies
Supply Voltage (Vcc)	5.0 volts, 3.3 volts, 2.5 volts and 1.8 volts available, .01 µF bypass cap recommended
Symmetry (Duty Cycle)	40/60 to 60/40% is standard, but 45/55% at 50% of Vcc is also available (see Waveform 1)
Logic Levels	**Logic "1"** 90% of Vcc MIN; **Logic "0"** 10% of Vcc MAX
Output Load	Standard load is 15 pF (typ. 1 ASIC) maximum, see Test Circuit 2 (consult factory for **heavier** loads)
Enable/Disable Option (E/D)	Output enabled when Pin #1 is open or at Logic "1"; Output disabled when Pin #1 is at Logic "0".

Frequency Range (MHz)	Max. Supply Current Icc (mA) w/ 15pF load		Max. Rise and Fall Time Tr & Tf (nS) w/ 15pF load
	2.5V, 3.3V	5.0V	2.5V to 5.0V
1.500 – 10.999	7	10	5.0
11.000 – 23.999	15	15	5.0
24.000 – 29.999	15	20	5.0
30.000 – 45.999	20	30	5.0
46.000 – 69.999	25	45	4.5

Frequency Range (MHz)	Max. Icc (mA) w/ 15pF load	Max. Tr & Tf (nS) w/ 15pF load
	1.8V	1.8V
1.500 – 39.999	10	5.0
40.000 – 69.999	25	3.0

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM76 45 H V - 50.0M - SB - 30 - XXX (Internal Code or blank)

Packaging
Tray or
24mm tape
16mm pitch

Model

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Special Specifications (choose all that apply)
Y: Std Specs (5.0V ± 10%, 0 to +70°C, 40/60% Symmetry)
E: Extended Operating Temperature Range (- 40 to +85°C)
S: 45/55% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%
W: Supply Voltage of 2.5 volts ± 5%
X: Supply Voltage of 1.8 volts ± 5% (consult factory)

Frequency in MHz

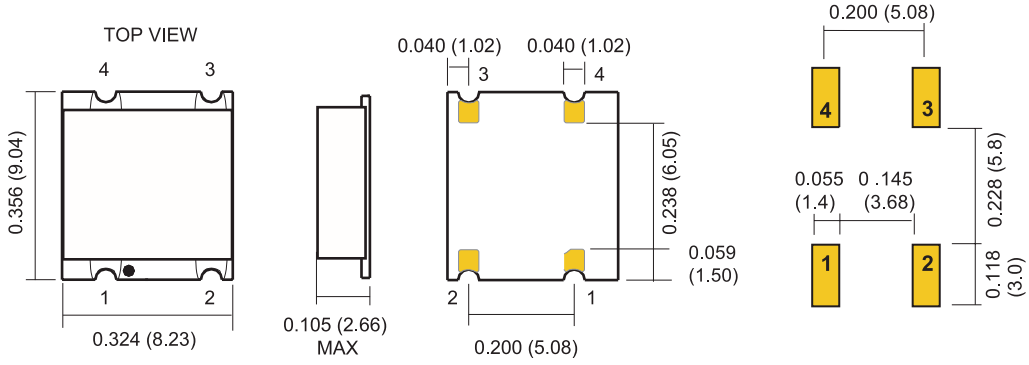
Optional Stand By Mode (3.3 volt only)

Non-Std Output Load Blank = 15 pF max, 30 = 30 pF max

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



PIN	SIGNAL
1	E/D
2	GND
3	OUT
4	Vcc

Jun 2004

Pletronics, Inc. (425) 776-1880, Fax: (425) 776-2760, ple-sales@pletronics.com, www.pletronics.com

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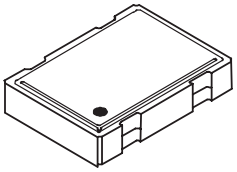
Manufacturer of High Quality Frequency Control Products

SM7745H CMOS Series



- CMOS with Enable/ Disable or Optional Stand By Mode (3.3 V)
- Fundamental or 3rd Overtone Crystal Used
- 4 Pad 7 x 5mm Leadless Surface Mount Ceramic Clock Oscillator

1.500 MHz – 69.999 MHz

Standard Specifications

Overall Frequency Stability	SM7745H: ± 50 PPM, SM7744H: ± 25 PPM, SM7720H: ± 20 PPM over Operating Temp. Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to - 40 to +85°C for certain frequencies
Supply Voltage (Vcc)	5.0 volts, 3.3 volts, 2.5 volts and 1.8 volts available, .01 µF bypass cap recommended
Symmetry (Duty Cycle)	40/60 to 60/40% is standard, but 45/55% at 50% of Vcc is also available (see Waveform 1)
Logic Levels	**Logic "1"** 90% of Vcc MIN; **Logic "0"** 10% of Vcc MAX
Output Load	Standard load is 15 pF (typ. 1 ASIC) maximum, see Test Circuit 2 (consult factory for **heavier** loads)
Enable/Disable Option (E/D)	Output enabled when Pin #1 is open or at Logic "1"; Output disabled when Pin #1 is at Logic "0".

Frequency Range (MHz)	Max. Supply Current Icc (mA) w/ 15pF load		Max. Rise and Fall Time Tr & Tf (nS) w/ 15pF load
	2.5V, 3.3V	5.0V	2.5V to 5.0V
1.500 – 10.999	7	10	5.0
11.000 – 23.999	15	15	5.0
24.000 – 29.999	15	20	5.0
30.000 – 45.999	20	30	5.0
46.000 – 69.999	25	45	4.5

Frequency Range (MHz)	Max. Icc (mA) w/ 15pF load	Max. Tr & Tf (nS) w/ 15pF load
	1.8V	1.8V
1.500 – 39.999	10	5.0
40.000 – 69.999	25	3.0

CMOS < 80 MHz
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Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM77 45 H V - 50.0M - SB - 30 - XXX (Internal Code or blank)

Packaging
Tray or
16mm tape
8mm pitch

Model

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Special Specifications (choose all that apply)
Y: Std Specs (5.0V ± 10%, 0 to +70°C, 40/60% Symmetry)
E: Extended Operating Temperature Range (- 40 to +85°C)
S: 45/55% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%
W: Supply Voltage of 2.5 volts ± 5%
X: Supply Voltage of 1.8 volts ± 5% (consult factory)

Frequency in MHz

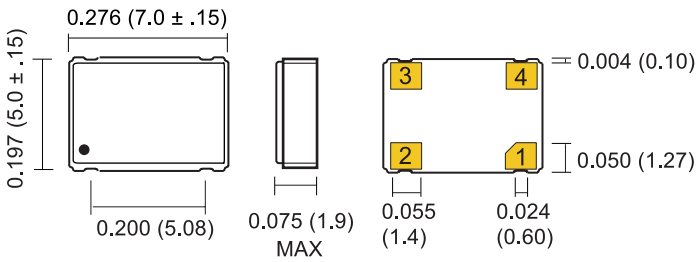
Optional Stand By Mode (3.3 volt only)

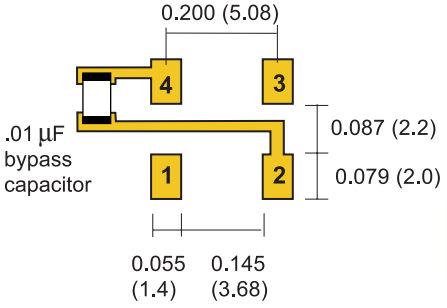
Non-Std Output Load Blank = 15 pF max, 30 = 30 pF max

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.





PIN	SIGNAL
1	E/D or SB
2	GND
3	OUT
4	Vcc

Lead Free

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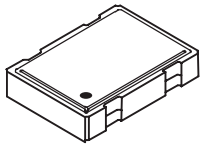
Manufacturer of High Quality Frequency Control Products

SM5545T CMOS Series



- CMOS with Enable/ Disable
- Fundamental or 3rd Overtone Crystal Used
- 4 Pad 5x 3.2mm Leadless Surface Mount Ceramic Clock Oscillator

2.500 MHz – 125.000 MHz

CMOS < 80 MHz
Page 11A - 16

Standard Specifications

Overall Frequency Stability	SM5545T: ± 50 PPM, SM5544T: ± 25 PPM, SM5520T: ± 20 PPM over Operating Temp. Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to – 40 to +85°C for certain frequencies
Supply Voltage (Vcc)	5.0 volts and 3.3 volts available, .01 µF bypass cap recommended
Symmetry (Duty Cycle)	40/60 to 60/40% is standard, but 45/55% at 50% of Vcc is also available (see Waveform 1)
Logic Levels	**Logic "1"** 90% of Vcc MIN; **Logic "0"** 10% of Vcc MAX
Output Load	Standard load is 15 pF (typ. 1 ASIC) maximum, see Test Circuit 2 (consult factory for **heavier** loads)
Enable/Disable Option (E/D)	Output enabled when Pin #1 is open or at Logic "1"; Output disabled when Pin #1 is at Logic "0".
Rise and Fall Time (Tr & Tf)	10 nS maximum

Frequency Range (MHz)	Max. Supply Current Icc (mA) w/ 15pF load	
	3.3V	5.0V
2.500 – 33.000	12	20
33.000 – 50.000	25	45
50.000 – 70.000	35	50
70.000 – 125.00	60	100

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM55 45 T V - 50.0M - 30 - XXX (Internal Code or blank)

Packaging
Tray or
16mm tape
8mm pitch

Model

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Frequency in MHz

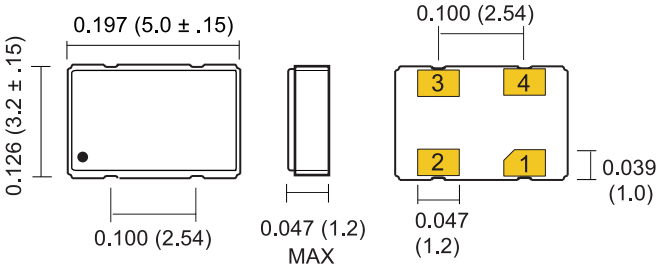
Non-Std Output Load Blank = 15 pF max, 30 = 30 pF max

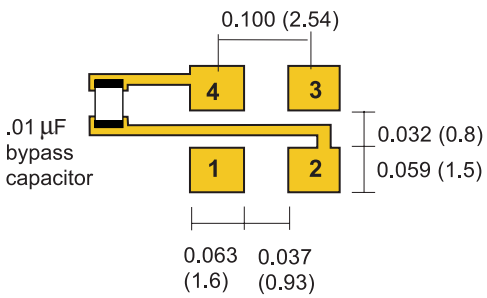
Special Specifications (choose all that apply)
Y: Std Specs (5.0V ± 10%, 0 to +70°C, 40/60% Symmetry)
E: Extended Operating Temperature Range (- 40 to +85°C)
S: 45/55% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.





PIN	SIGNAL
1	E/D
2	GND
3	OUT
4	Vcc

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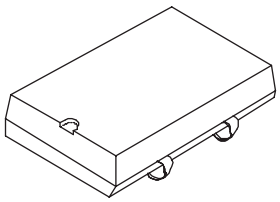
Manufacturer of High Quality Frequency Control Products

SM1145C CMOS Series



- CMOS with Enable/ Disable
- 4 Lead Surface Mount Plastic Clock Oscillator
- Solder Pad Compatible to our SM11 Series, Epson SG615 & SG8002J

1.000 MHz – 60.000 MHz

Standard Specifications

Overall Frequency Stability	SM1145C: ± 50 PPM, SM1144C: ± 25 PPM over Operating Temperature Range
Operating Temperature Range	0 to +70°C is standard, extended range not available
Supply Voltage (Vcc)	5.0 volts and 3.3 volts available, .01 µF bypass cap recommended
Symmetry (Duty Cycle)	40/60 to 60/40% is standard, but 45/55% at 50% of Vcc is also available (see Waveform 1)
Logic Levels	**Logic "1"** 90% of Vcc MIN; **Logic "0"** 10% of Vcc MAX
Output Load	Standard load is 15 pF (typ. 1 ASIC) maximum, see Test Circuit 2 (consult factory for **heavier** loads)
Enable/Disable Option (E/D)	Output enabled when Pin #1 is open or at Logic "1"; Output disabled when Pin #1 is at Logic "0".

Frequency Range (MHz)	Max. Supply Current Icc (mA) w/ 15pF load		Rise and Fall Time Tr & Tf (nS) w/ 15pF load	
	3.3V	5.0V	Typical	Maximum
1.000 – 7.999	5	10	5.5	6.5
8.000 – 23.999	10	15	5.5	6.5
24.000 – 29.999	10	15	4.5	5.5
30.000 – 50.000	20	30	2.5	3.5
50.001 – 60.000	25	40	2.5	3.5

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

Packaging
Tube or
24mm tape
12mm pitch

SM11 45 C V - 50.0M - 30 - XXX (Internal Code or blank)

Non-Std Output Load
Blank = 15 pF max, 30 = 30 pF max

Model

Frequency in MHz

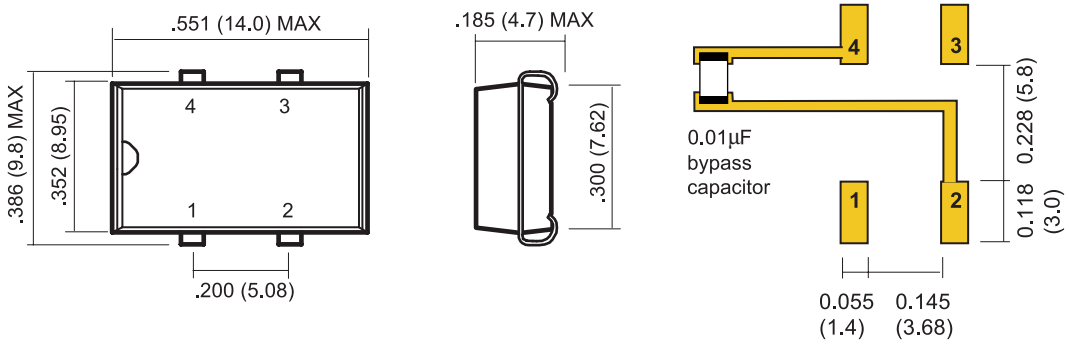
Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM

Special Specifications (choose all that apply)
Y: Std Specs (5.0V ± 10%, 0 to +70°C, 40/60% Symmetry)
S: 45/55% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



PIN	SIGNAL
1	E/D
2	GND
3	OUT
4	Vcc

Jun 2004

Pletronics, Inc.
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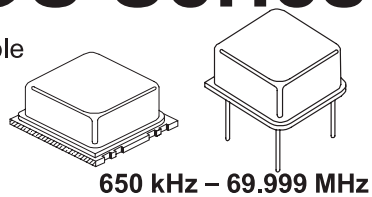
Manufacturer of High Quality Frequency Control Products

SQ3345, SQ2245 CMOS Series

- SQ3345: CMOS with Enable/ Disable, SQ2245 without Enable/Disable
- Lower Ringing Noise Option Available to Reduce EMI
- Half Size (8 Pin DIP) Metal Clock Oscillator
- Available in Thru-Hole or Surface Mount Configuration



650 kHz – 69.999 MHz

CMOS < 80 MHz
Page 11A - 16

Standard Specifications

Overall Frequency Stability	± 50 PPM, ± 25 PPM, ± 20 PPM over Operating Temperature Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to – 40 to +85°C for certain frequencies
Supply Voltage (Vcc)	5.0 volts and 3.3 volts available
Symmetry (Duty Cycle)	40/60 to 60/40% is standard, but 45/55% at 50% of Vcc is also available (see Waveform 1)
Logic Levels	**Logic "1"** 90% of Vcc MIN; **Logic "0"** 10% of Vcc MAX
Output Load	Standard load is 15 pF (typ. 1 ASIC) maximum, see Test Circuit 3 (consult factory for **heavier** loads)
Ringing Noise	Depends on frequency and output load. See EMI application note
SQ33: Enable/Disable Option (E/D)	Output enabled when Pin #1 is open or at Logic "1"; Output disabled when Pin #1 is at Logic "0".

Frequency Range (MHz)	Max. Supply Current Icc (mA) w/ 15pF load		Rise and Fall Time Tr & Tf (nS) w/ 15pF load	
	3.3V	5.0V	Typical	Maximum
0.650 – 10.000	7	10	3.0	4.0
10.001 – 25.999	10	20	2.5	3.5
26.000 – 34.999	15	25	2.5	3.5
35.000 – 50.000	20	30	2.5	3.5
50.001 – 69.999	25	35	2.5	3.5

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SQ33 45 V -- 60.0M - 30 - SMD - XXX (Internal Code or blank)

Packaging
Tube or on Pads,
SMD: Bulk

Model
SQ33 with E/D
SQ22 no E/D

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Special Specifications (choose all that apply)
Blank: Std Specs (5.0V ± 10%, 0 to +70°C, 40/60% Symmetry)
E: Extended Operating Temperature Range (- 40 to +85°C)
N: Lower Ringing Noise
S: 45/55% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%

Frequency in MHz

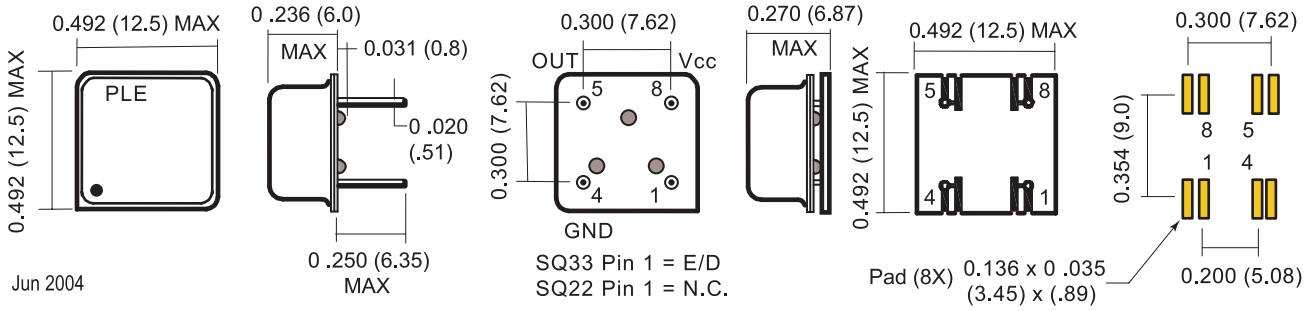
Non-Std Output Load
Blank = 15 pF max, 30 = 30 pF max

Surface Mount Option

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Surface Mount Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



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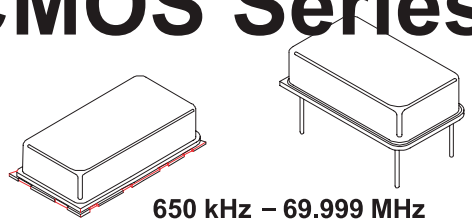
Manufacturer of High Quality Frequency Control Products

P1145-3S, P1145-HC CMOS Series

- P1145-3S: CMOS with Enable/ Disable, P1145-HC without E/D
- Lower Ringing Noise Option Available to Reduce EMI
- Full Size (14 Pin DIP) Metal Clock Oscillator
- Available in Thru-Hole or Surface Mount Configuration



650 kHz – 69.999 MHz

Standard Specifications

Overall Frequency Stability	± 50 PPM, ± 25 PPM, ± 20 PPM over Operating Temperature Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to - 40 to +85°C for certain frequencies
Supply Voltage (Vcc)	5.0 volts and 3.3 volts available
Symmetry (Duty Cycle)	40/60 to 60/40% is standard, but 45/55% at 50% of Vcc is also available (see Waveform 1)
Logic Levels	**Logic "1"** 90% of Vcc MIN; **Logic "0"** 10% of Vcc MAX
Output Load	Standard load is 15pF (typ. 1 ASIC) maximum, see Test Circuit 3 or 1 (consult factory for **heavier** loads)
Ringing Noise	Depends on frequency and output load. See EMI application note
-3S: Enable/Disable Option (E/D)	Output enabled when Pin #1 is open or at Logic "1"; Output disabled when Pin #1 is at Logic "0".

Frequency Range (MHz)	Max. Supply Current Icc (mA) w/ 15pF load		Rise and Fall Time Tr & Tf (nS) w/ 15pF load	
	3.3V	5.0V	Typical	Maximum
0.650 – 10.000	7	10	3.0	4.0
10.001 – 25.999	10	20	2.5	3.5
26.000 – 34.999	15	25	2.5	3.5
35.000 – 50.000	20	30	2.5	3.5
50.001 – 69.999	25	35	2.5	3.5

CMOS < 80 MHz
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Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

P11 45 - 3S V - 60.0M - 30 - SMD - XXX (Internal Code or blank)

Packaging
Tube or on Pads,
SMD: Bulk

Series

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM
20 = ± 20 PPM

Model
-3S with E/D
-HC no E/D

Special Specifications (choose all that apply)
Blank: Std Specs (5.0V ± 10%, 0 to +70°C, 40/60% Sym)
E: Extended Operating Temperature Range (- 40 to +85°C)
N: Lower Ringing Noise
S: 45/55% Symmetry at 50% of Vcc
V: Supply Voltage of 3.3 volts ± 10%

Frequency in MHz

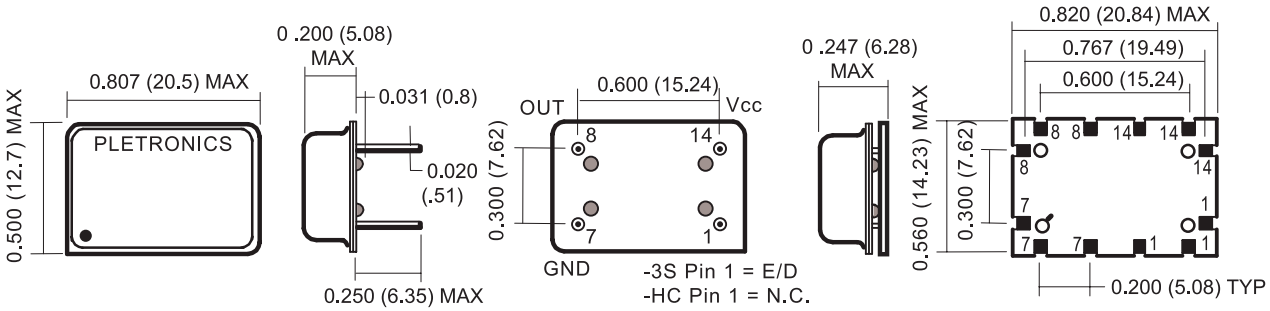
Non-Std Output Load: Blank = 15 pF max, 30 = 30 pF max

Surface Mount Option

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Surface Mount

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



Solder pad layout may use any combination of pins 1, 7, 8 & 14 shown.
Recommended pad size is .12 (3.1) x .07 (1.8) typical.

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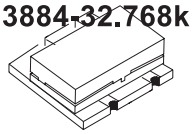
S3883, S3884 Oscillators


S3883-32.768k


S3884-32.768k

32.768 kHz

- 32.768kHz CMOS with Enable/ Disable with Low Power Consumption
- Fast Start-Up Time: 500 mS or Less
- Clock Oscillator Available in 4 Pad Miniature Surface Mount (**S3883**) and Surface Mounted Compatible to our SM11 Series (**S3884**)
- 0.01 µF Bypass Filter Included

Standard Specifications

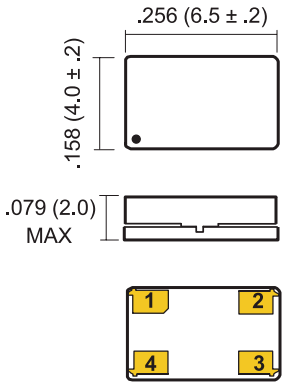
Frequency Calibration Tolerance	± 30 PPM maximum at 25°C
Operating Temperature Range with Downward Frequency Drift	when operating at 0 to +70° C: – 60 PPM maximum when operating at – 40 to +85°C: – 200 PPM maximum
Supply Voltage Range (Vcc)	1.5 volts to 6.0 volts ± 10%
Symmetry (Duty Cycle)	45/55 to 55/45% at 50% of Vcc (see Waveform 1)
Logic Levels	**Logic "1"** 90% of Vcc MIN; **Logic "0"** 10% of Vcc MAX
Output Load	Standard load is 15 pF (typ. 1 ASIC) maximum, see Test Circuit 3 (consult factory for **heavier** loads)
Rise and Fall Time (Tr & Tf)	100 nS typical, 150 nS maximum with 15 pF load
Enable/Disable Option (E/D)	Output enabled when Pin #1 is open or at Logic "1"; Output disabled when Pin #1 is at Logic "0".

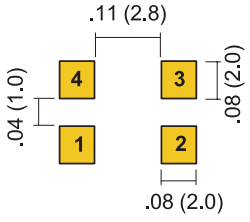
	Vcc	1.5 V	1.8 V	2.0 V	2.7 V	3.3 V	5.0 V
Supply Current	Icc µA typical	3.3	4.0	4.2	5.0	6.0	8.0
w/ 15pF load	Icc µA max	9.0	10.0	11.0	12.0	15.0	20.0

Mechanical: inches (mm) not to scale

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.

S3883-32.768K-XXX
(Internal Code or blank)

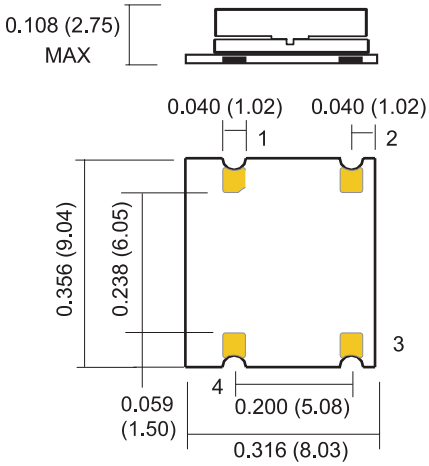


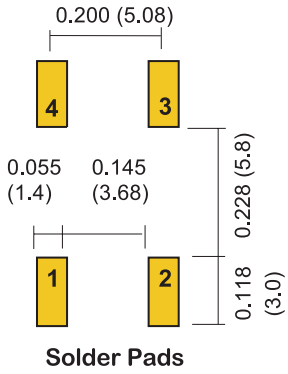


Solder Pads

Packaging
16mm tape
8mm pitch

S3884-32.768K-XXX
(Was S3883-32.768K-SMD-XXX)





Solder Pads

Packaging
24mm tape
16mm pitch

PIN	SIGNAL
1	E/D
2	GND
3	OUT
4	Vcc

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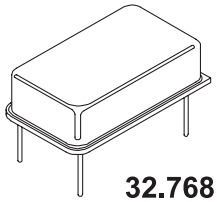
P1145-HCM-32.768k Oscillator

- 32.768kHz CMOS with Enable/ Disable with Low Power Consumption
- Fast Start-Up Time: 500 mS or Less
- 0.01 µF Bypass Filter Included
- Clock Oscillator in Full Size Metal Thru-Hole



32.768 kHz

Standard Specifications

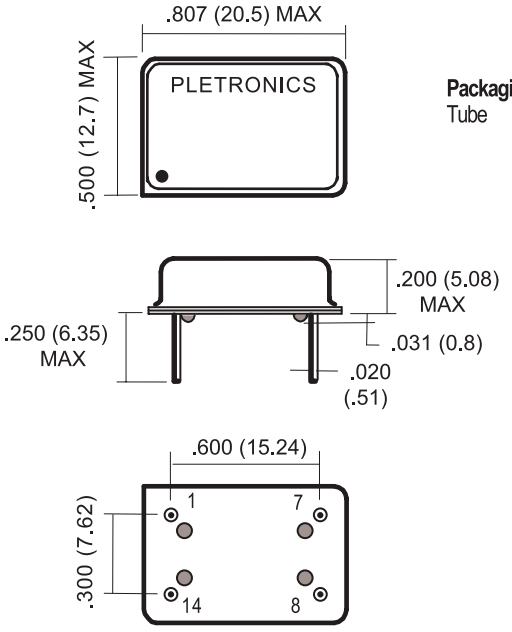
Frequency Calibration Tolerance	± 30 PPM maximum at 25°C
Operating Temperature Range	when operating at 0 to +70° C: – 60 PPM maximum
with Downward Frequency Drift	when operating at – 40 to +85°C: – 200 PPM maximum
Supply Voltage Range (Vcc)	1.5 volts to 6.0 volts ± 10%
Symmetry (Duty Cycle)	45/55 to 55/45% at 50% of Vcc (see Waveform 1)
Logic Levels	**Logic "1"** 90% of Vcc MIN; **Logic "0"** 10% of Vcc MAX
Output Load	Standard load is 15 pF (typ. 1 ASIC) maximum, see Test Circuit 3 (consult factory for **heavier** loads)
Rise and Fall Time (Tr & Tf)	100 nS typical, 150 nS maximum with 15 pF load
Enable/Disable Option (E/D)	Output enabled when Pin #1 is open or at Logic "1"; Output disabled when Pin #1 is at Logic "0".

	Vcc	**1.5 V**	**1.8 V**	**2.0 V**	**2.7 V**	**3.3 V**	**5.0 V**
Supply Current	Icc µA typical	3.3	4.0	4.2	5.0	6.0	8.0
w/ 15pF load	Icc µA max	9.0	10.0	11.0	12.0	15.0	20.0

Mechanical: inches (mm) not to scale

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.

P1145-HCM-32.768K-XXX
(Internal Code or blank)



Packaging
Tube

PIN	SIGNAL
1	E/D
7	GND
8	OUT
14	Vcc

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32.768 kHz
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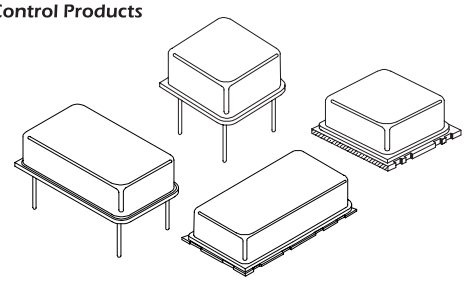
True TTL Series



- True TTL Output without Enable/Disable
- Lower EMI Due to Lower Ringing Noise (Overshoot/Undershoot)
- P1145 (Full Size) or ST2245 (Half Size) Metal Clock Oscillator
- Available in Thru-Hole or Surface Mount Configuration

4.000 MHz – 60.000 MHz

Standard Specifications

Overall Frequency Stability	± 50 PPM or ± 25 PPM over Operating Temperature Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to – 40 to +85°C for certain frequencies
Supply Voltage (Vcc)	5.0 volts ± 10%
Symmetry (Duty Cycle)	40/60 to 60/40% is standard, but 45/55% at Vcc = 1.4 volts is also available (see Waveform 1)
Logic Levels	**Logic "1"** 2.4 volts MIN; **Logic "0"** 0.4 volts MAX
Output Load	Can drive up to 10 TTL loads + 15pF (typ. 1 ASIC), see Test Circuit 4 (consult factory for **heavier** loads)
Ringing Noise	Depends on frequency and output load. See EMI application note

Frequency Range (MHz)	Supply Current Icc (mA)		Rise and Fall Time Tr & Tf (nS)	
	Typical	Maximum	Typical	Maximum
4.000 – 7.999	23.0	28.0	4.0	5.0
8.000 – 15.999	24.0	28.0	3.0	4.0
16.000 – 21.999	24.0	28.0	2.5	3.5
22.000 – 60.000	27.0	32.0	2.0	3.0

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

P11 45 E - 60.0M - 30 - SMD - XXX (Internal Code or blank)

Packaging
Tube or on Pads,
SMD: Bulk

Model
P11 = Full Size
ST22 = Half Size

Frequency Stability
45 = ± 50 PPM
44 = ± 25 PPM

Special Specifications (choose all that apply)
Blank: Std Specs (0 to +70°C, 40/60% Symmetry)
E: Extended Operating Temperature Range (- 40 to +85°C)
P: 45/55% Symmetry at Vcc = 1.4 volts

Frequency in MHz

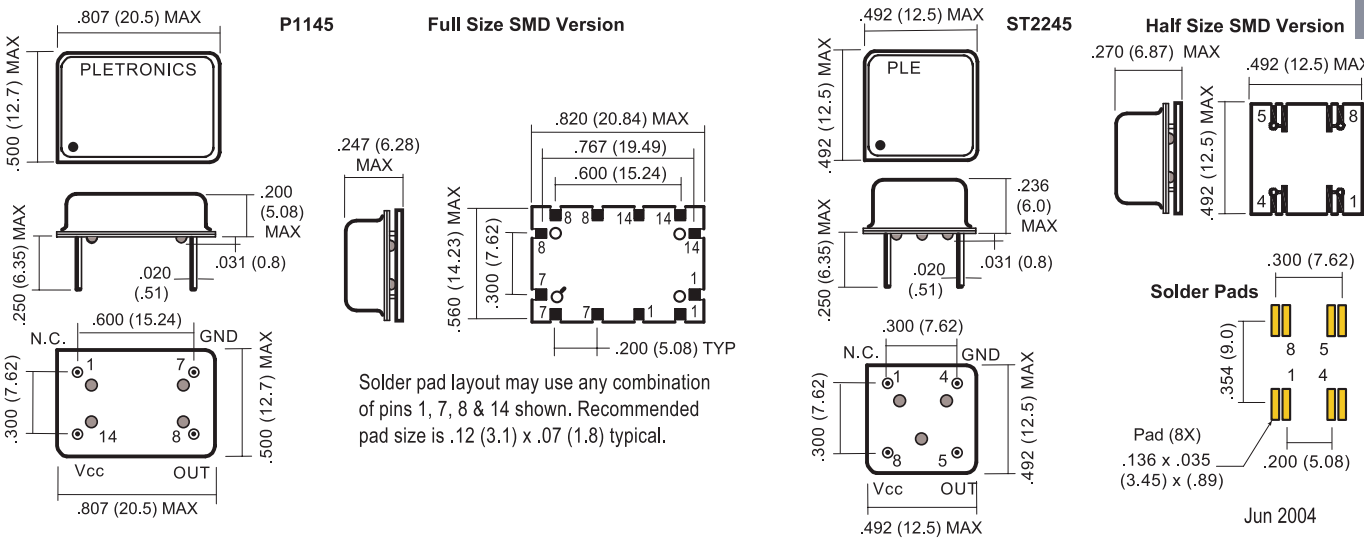
Non-Std Output Load Blank = 15 pF max, 30 = 30 pF max

Surface Mount Option

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



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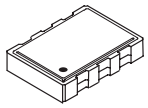
PV7 PECL VCXO Series



- Differential PECL Output with Enable/Disable
- 6 Pad Leadless Surface Mount PECL Voltage Controlled Xtal Oscillator

70.00 MHz – 200.00 MHz
Consult factory for **higher** frequencies

Standard Specifications

Overall Frequency Stability	± 50 PPM over Operating Temperature Range
Operating Temperature Range	0 to +80°C is standard, but can be extended to - 40 to +85°C
Storage Temperature Range	- 55 to +125°C
Supply Voltage (Vcc)	3.3 volts ± 5% available. See Test Cirucit 5.
Supply Current (Icc)	100 mA maximum
Output High Level	2.275 V minimum referenced to Ground, Vcc = 3.300V, 0.975 V minimum referenced to termination voltage, - 1.025 V minimum referenced to Vcc
Output Low Level	1.680 V maximum referenced to Ground, Vcc = 3.300V, 0.380 V maximum referenced to termination voltage, - 1.620 V maximum referenced to Vcc
Output Symmetry	40/60% referenced to 50% of amplitude
Output Rise & Fall (Tr & Tf)	1.0 nS maximum when Vth is 10% and 90% of waveform
Jitter	5 pS RMS maximum measured from 12 kHz to 20 MHz from output frequency
E/D Internal Pullup	50 kohm minimum to Vcc
V disable	0.3 Vcc maximum referenced to Ground
V enable	0.7 Vcc minumum referenced to Ground

Output Enable / Disable (E/D)

High Level Input Current	-20 uA maximum at Enable / Disable Pin = 0.7 Vcc
Low Level Input Current	-200 uA maximum at Enable / Disable Pin = 0 V
Output Enable Time	200 nS maximum at output enable or 1 mS maximum at output enabled and stable
Output Disable Time	200 nS maximum at output disable

Vcc Supply Current disabled < 1 mA. Both outputs are high impedance when disabled.

Linearity	± 10% typical
Slope	Positive and montonic
Control Voltage Range (CVR)	0.0 to 3.3 V
Pullability	Pull range is defined as absolute pull range. This is the pull range about the specified oscillator frequency, independent of supply, temperature range and load.

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

Packaging
Tube or
24mm tape
16mm pitch

PV7 5 V B V - 100.0M - XXX (Internal Code or blank)

Model

Frequency Stability
5 = ± 50 PPM

Supply Voltage
V = 3.3 volts ±5%
W = 2.5 volts ±5%

Operating Temperature Range
B: 0 to +70°C
F: - 40 to +85°C

Frequency Deviation (Pullability) Absolute Pull Range
V: ± 50 PPM

Frequency in MHz

Jun 2004

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

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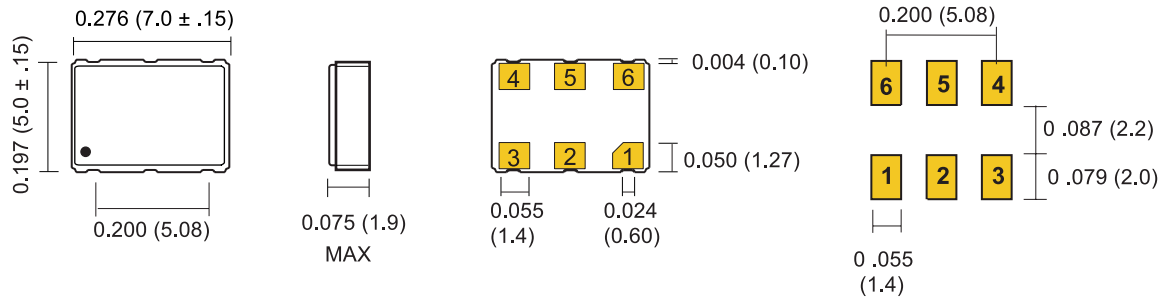
PV7 PECL VCXO Series

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



PIN	SIGNAL
1	Vcon
2	E/D
3	Vss
4	OUT
5	C OUT
6	Vcc

Lead Free

See page 6 for Layout Guidelines

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PVB, PVM PECL VCXO Series

- Differential PECL Output with Enable/Disable
- 6 Pad Leadless Surface Mount or
  4 Lead Thru-Hole PECL Voltage Controlled Xtal Oscillator

1.00 MHz – 650.00 MHz
Consult factory for **higher** frequencies

Standard Specifications

Overall Frequency Stability	± 50 PPM, ± 25 PPM, ± 20 PPM over Operating Temperature Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to - 40 to +85°C
Storage Temperature Range	- 55 to +125°C
Supply Voltage (Vcc)	3.3 volts ± 5% standard, but 5.0 volts or 2.5 volts also available. See Test Cirucit 5.
Supply Current (Icc)	< 250 MHz = 90 mA maximum, 250 MHz and above = 100 mA maximum
Output High Level	2.275 V minimum referenced to Ground, Vcc = 3.300V, 0.975 V minimum referenced to termination voltage, - 1.025 V minimum referenced to Vcc
Output Low Level	1.680 V maximum referenced to Ground, Vcc = 3.300V, 0.380 V maximum referenced to termination voltage, - 1.620 V maximum referenced to Vcc
Output Symmetry	45/55% referenced to 50% of amplitude
Output Rise & Fall (Tr & Tf)	1.0 nS maximum when Vth is 10% and 90% of waveform
Jitter	6 pS RMS maximum measured from 12 kHz to 20 MHz from output frequency
E/D Internal Pullup	50 kohm minimum to Vcc
V disable	0.3 Vcc maximum referenced to Ground
V enable	0.7 Vcc minumum referenced to Ground
Linearity	± 10% typical
Slope	Positive and montonic
Control Voltage Range (CVR)	For 5.0 Vcc, CVR = 0.5 to 4.5 V, For 3.3 Vcc, CVR = 0.0 to 3.3 V, For 2.5 Vcc, CVR = 0.0 to 2.5 V
Pullability	Pull range is defined as absolute pull range. This is the pull range about the specified oscillator frequency, independent of supply, temperature range and load. Typical values are ± 25, ± 50 and ± 100 PPM.
PVB Output Enable/Disable (E/D)	
Output Enable Time	100 nS maximum
Output Disable Time	100 nS maximum
When Disabled	Q Output = Logic Low, QN Output = Logic High. Both Outputs are active

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

PVB 5 V B V - 100.0M - XXX (Internal Code or blank)

Packaging
PVM = Tube
PVB = Tube or
24mm tape
16mm pitch

Model
PVB = B Pkg
PVM = Metal

Frequency Stability
5 = ± 50 PPM
4 = ± 25 PPM
2 = ± 20 PPM

Supply Voltage
Y = 5.0 volts ±10%
V = 3.3 volts ±5%
W = 2.5 volts ±5%

Operating Temperature Range
B: 0 to +70°C
F: - 40 to +85°C

Frequency Deviation (Pullability) Absolute Pull Range
V: ± 50 PPM
W = ± 100 PPM

Frequency in MHz

Mar 2004

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

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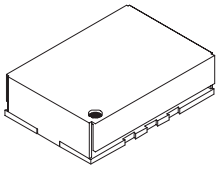
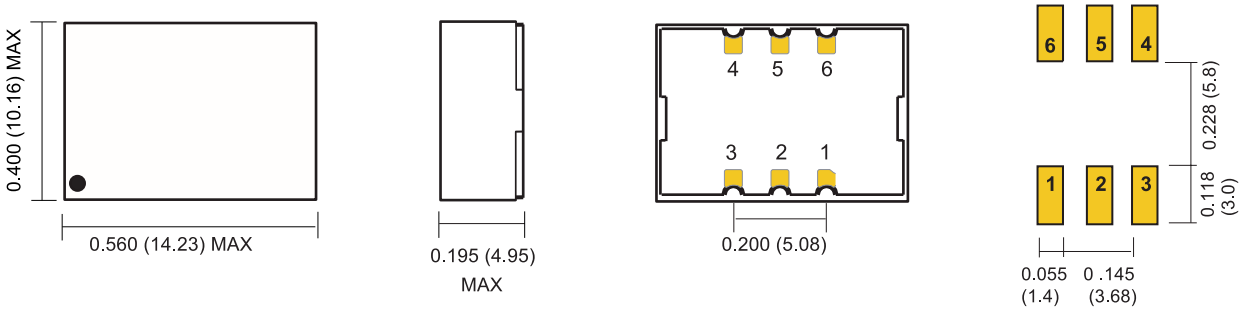
PVB, PVM PECL VCXO Series

Mechanical: inches (mm) **not to scale** **Solder Pads**

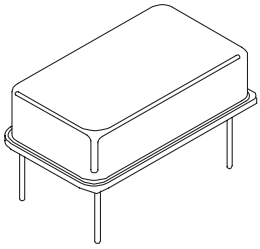
Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



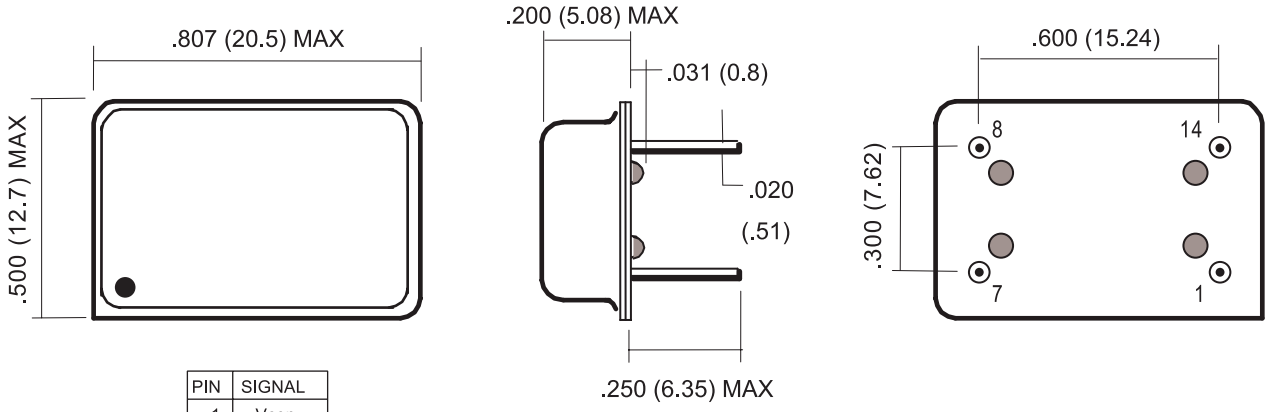
PVB Series



PIN	SIGNAL
1	Vcon
2	E/D
3	GND
4	Q OUT
5	QN OUT
6	Vcc



PVM Series



PIN	SIGNAL
1	Vcon
7	GND
8	OUT
14	Vcc

See page 6 for Layout Guidelines

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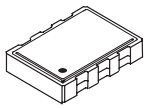
LV7 LVDS VCXO Series



- Low Voltage Differential Signal Output with Enable/Disable
- 6 Pad Leadless Surface Mount LVDS Voltage Controlled Xtal Oscillator

70.00 MHz – 200.00 MHz
Consult factory for **higher** frequencies

Standard Specifications

Overall Frequency Stability	± 50 PPM over Operating Temperature Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to - 40 to +85°C
Storage Temperature Range	- 55 to +125°C
Supply Voltage (Vcc)	3.3 volts ± 5% standard, 2.5 volts ± 5% also available
High Level Output Voltage	1.43 V typical and 1.60 V maximum with output enabled (100 ohm load) See Test circuit #6
Low Level Output Voltage	0.90 V minimum and 1.10 V typical with output enabled (same conditions as above)
Differential Output Voltage	247 V minimum, 330 V typical and 454 V maximum with output enabled (same conditions as above)
Differential Output Error	50 mV maximum with output enabled (same conditions as above)
Offset Voltage	1.125 V minimum, 1.25 V typical and 1.375 V maximum with output enabled (same as above)
Offset Voltage Error	50 mV maximum with output enabled (same as above)
Output Leakage Current	10 uA maximum with output disabled
Supply Current (Icc)	35 mA typical and 47 mA maximum with output enabled, 30 uA maximum with output disabled
Symmetry (DC1)	45/55% measured at crossing point 0°C <= Ta <= 70°C, 40/60% measured at Ta < 0°C and Ta > 70°C
Symmetry (DC2)	45/55% measured at 50% of output swing 0°C <= Ta <= 70°C, 40/60% measured at 50% of output swing
Rise and Fall Time (Tr & Tf)	1.5 nS max at 20% to 80% output swing (100 ohm load) See Test circuit #6 and Waveform #2
Jitter	6 pS RMS maximum measured from 12 kHz to 20 MHz from output frequency
E/D Internal Pullup	50 kohm minimum to Vcc
V disable	0.3 Vcc maximum referenced to Ground
V enable	0.7 Vcc minumum referenced to Ground
Output Enable/Disable (E/D)	
Output Enable Time	100 nS maximum to outputs active at 1 mS for output frequency to be stable
Output Disable Time	100 nS maximum
Linearity	± 10% typical
Slope	Positive and montonic
Control Voltage Range (CVR)	For 3.3 Vcc, CVR = 0.0 to 3.3 V, For 2.5 Vcc, CVR = 0.0 to 2.5 V
Pullability	Pull range is defined as absolute pull range. This is the pull range about the specified oscillator frequency, independent of supply, temperature range and load.

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

Packaging
Tube or
16mm tape
8mm pitch

LV7 5 V B V - 100.0M - XXX (Internal Code or blank)

Model — LV7

Frequency Stability — 5
5 = ± 50 PPM

Supply Voltage — V
V = 3.3 volts ±5%
W = 2.5 volts ±5%

Operating Temperature Range — B
B: 0 to +70°C
F: - 40 to +85°C

Frequency Deviation (Pullability) Absolute Pull Range — V
V: ± 50 PPM

Frequency in MHz — 100.0M

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

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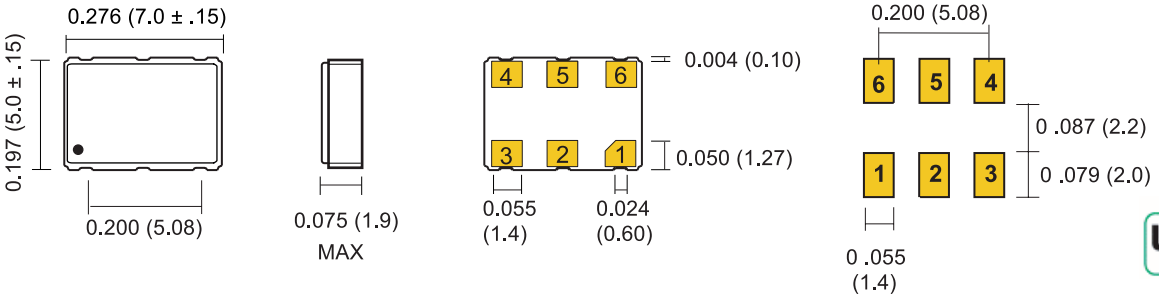
LV7 LVDS VCXO Series

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



PIN	SIGNAL
1	Vcon
2	E/D
3	GND
4	VoD+
5	VoD-
6	Vcc

Lead Free

See page 6 for Layout Guidelines

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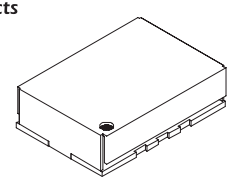
LVB LVDS VCXO Series



- Low Voltage Differential Signal (LVDS) Output with Enable/Disable
- 6 Pad Leadless Surface Mount LVDS Voltage Controlled Xtal Oscillator

1.00 MHz – 650.00 MHz
Consult factory for **higher** frequencies

Standard Specifications

Overall Frequency Stability	± 50 PPM, ± 25 PPM or ± 20 PPM over Operating Temperature Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to - 40 to +85°C
Storage Temperature Range	- 55 to +125°C
Supply Voltage (Vcc)	3.3 volts ± 5%
High Level Output Voltage	1.43 V typical and 1.60 V maximum with output enabled (100 ohm load) See Test circuit #6
Low Level Output Voltage	0.90 V minimum and 1.10 V typical with output enabled (same conditions as above)
Differential Output Voltage	247 V minimum, 330 V typical and 454 V maximum with output enabled (same conditions as above)
Differential Output Error	50 mV maximum with output enabled (same conditions as above)
Offset Voltage	1.125 V minimum, 1.25 V typical and 1.375 V maximum with output enabled (same as above)
Offset Voltage Error	50 mV maximum with output enabled (same as above)
Output Leakage Current	10 uA maximum with output disabled
Supply Current (Icc)	35 mA typical and 47 mA maximum
Symmetry (DC1)	45/55% measured at crossing point 0°C <= Ta <= 70°C, 40/60% measured at Ta < 0°C and Ta > 70°C
Symmetry (DC2)	45/55% measured at 50% of output swing 0°C <= Ta <= 70°C, 40/60% measured at 50% of output swing
Rise and Fall Time (Tr & Tf)	1.5 nS max at 20% to 80% output swing (100 ohm load) See Test circuit #6 and Waveform #2
Jitter	5 pS RMS maximum measured from 12 kHz to 20 MHz from output frequency
E/D Internal Pullup	50 kohm minimum to Vcc
V disable	0.3 Vcc maximum referenced to Ground
V enable	0.7 Vcc minumum referenced to Ground
Output Enable/Disable (E/D)	
Output Enable Time	100 nS maximum to outputs active at 1 mS for output frequency to be stable
Output Disable Time	100 nS maximum
Linearity	± 10% typical
Slope	Positive and montonic
Control Voltage Range (CVR)	0.0 to 3.3 V
Pullability	Pull range is defined as absolute pull range. This is the pull range about the specified oscillator frequency, independent of supply, temperature range and load.

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

Packaging
Tube or
24mm tape
16mm pitch

LVB 5 V B V - 100.0M - XXX (Internal Code or blank)

Model — LVB

Frequency Stability
5 = ± 50 PPM
4 = ± 25 PPM
2 = ± 20 PPM

Supply Voltage
V = 3.3 volts ±5%

Operating Temperature Range
B: 0 to +70°C
F: - 40 to +85°C

Frequency Deviation (Pullability) Absolute Pull Range
V: ± 50 PPM
W = ± 100 PPM

Frequency in MHz — 100.0M

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

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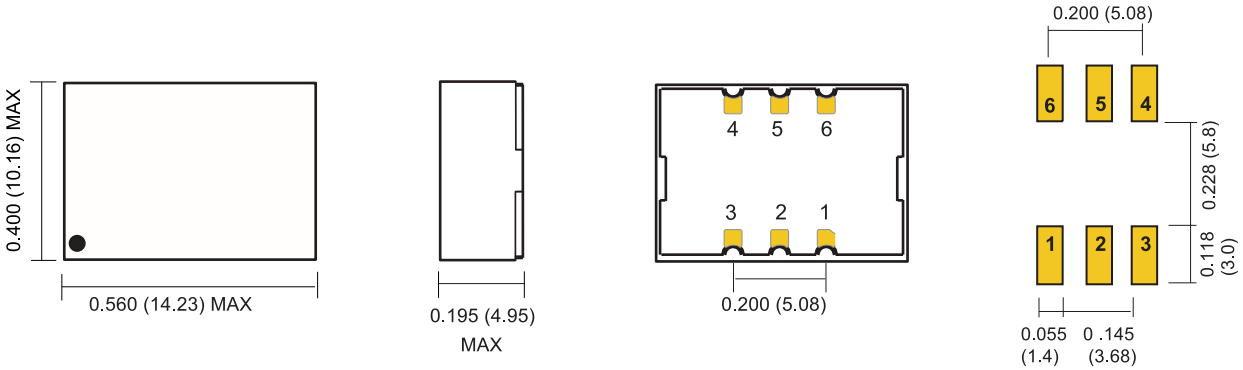
LVB LVDS VCXO Series

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



PIN	SIGNAL
1	Vcon
2	E/D
3	GND
4	VoD+
5	VoD-
6	Vcc

See page 6 for Layout Guidelines

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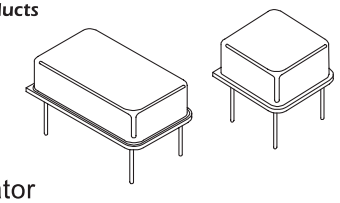
VC1 VCXO Series



- Full Size or Half Size Metal Thru-Hole Voltage Controlled Xtal Oscillator
- CMOS/ TTL Compatible

2.00 MHz – 160.00 MHz

Standard Specifications

Model	VC13 & VC15	VC14 & VC16	
Frequency Range	2.00 to 20.00 MHz	2.00 to 20.00 MHz	20.001 to 160.00 MHz
Overall Frequency Stability	± 25, 50, 100 PPM	± 15 PPM only	± 15, 25, 50, 100 PPM over OTR
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to – 40 to +85°C for certain frequencies		
Supply Voltage (Vcc)	5.0 volts and 3.3 volts available		
Output Load	Standard load is 15pF maximum, see Test Circuit 7 (consult factory for **heavier** loads)		
Control Voltage Range (CVR)	0.5 to 4.5 volts for 5.0 volt Supply; 0.0 to 3.3 volts for 3.3 volt Supply		
Pullablity over CVR	± 25, 50, 100, 150, 200 PPM. Consult factory for ± 300 PPM.		
Linearity	± 10% (Consult factory for ± 5%)		

Frequency Range (MHz)	Supply Current Icc (mA)		Rise and Fall Time Tr & Tf (nS)	
	Typical	Maximum	Typical	Maximum
2.000 – 20.000	10	15	3.5	5.0
20.001 – 30.000	20	25	3.0	4.5
30.001 – 50.000	25	30	3.0	4.0
50.001 – 60.000	30	35	2.5	3.5
60.001 –160.000	TBD	80	TBD	3.0

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

3 VC14H 100 A Z - 60.0M - XXX (Internal Code or blank)

Supply Voltage
Blank= 5.0 volts ±5%
3= 3.3 volts ±5%

Model
VC13H = Full Size, 5.08mm
VC14H = Full Size, 8.0mm
VC15H = Half Size, 6.0mm
VC16H = Half Size, 7.5mm

Packaging
Tube or
on Pads

Frequency Stability
(N/a for VC13, 15) 15: ± 15 PPM
N/a for 2.0 to 20.0 MHz (VC14, 16)
Use VC13, 15 for 2.0 to 20.0 MHz
25: ± 25 PPM
50: ± 50 PPM
100: ± 100 PPM

Operating Temperature Range
A: 0 to +50°C
B: 0 to +70°C
C: -10 to +70°C
D: -20 to +75°C
E: -30 to +75°C
F: -40 to +85°C

Frequency Deviation (Pullability) over CVR
T: ± 25 PPM
V: ± 50 PPM
W: ± 100 PPM
X: ± 150 PPM
Y: ± 200 PPM
Z: ± 300 PPM

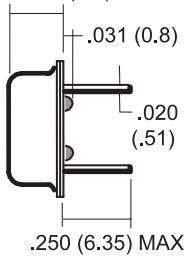
Frequency in MHz

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

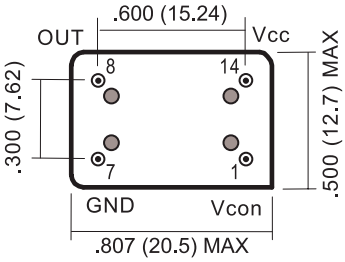
Mechanical: inches (mm) not to scale

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.

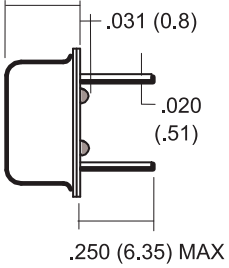
VC13: .200 (5.08)
VC14: .315 (8.0) MAX



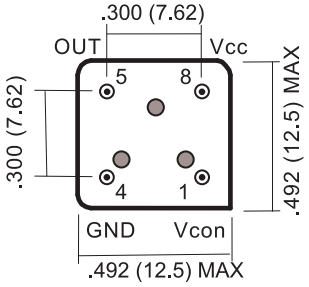
VC13 & VC14



VC15: .236 (6.0)
VC16: .295 (7.5) MAX



VC15 & VC16



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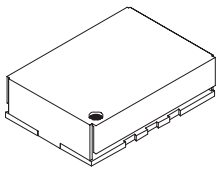
VC2, VC3 VCXO Series



- 6 Pad Leadless Surface Mount Voltage Controlled Xtal Oscillator
- CMOS/ TTL Compatible (VC2 without E/D, VC3 with E/D)

1.500 MHz – 200.00 MHz

Standard Specifications

Overall Frequency Stability	± 15, 25, 50, 100 PPM over Operating Temperature Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to – 40 to +85°C for certain frequencies
Supply Voltage (Vcc)	5.0 volts and 3.3 volts available
Output Load	Std load is 15pF max., see Test Circuit 7 for VC2, TC 8 for VC3 (consult factory for **heavier** loads)
Control Voltage Range (CVR)	0.5 to 4.5 volts for 5.0 volt Supply; 0.0 to 3.3 volts for 3.3 volt Supply
Pullablity over CVR	± 25, 50, 100, 150, 200 PPM. Consult factory for ± 300 PPM.
Linearity	± 10% (Consult factory for ± 5%)
VC3 Enable/Disable Option (E/D)	Output enabled when Pin #2 is open or at Logic "1"; Output disabled when Pin #2 is at Logic "0".

Frequency Range (MHz)	Supply Current Icc (mA)		Rise and Fall Time Tr & Tf (nS)	
	Typical	Maximum	Typical	Maximum
1.500 – 20.000	10	15	3.5	5.0
20.001 – 30.000	20	25	3.0	4.5
30.001 – 50.000	25	30	3.0	4.0
50.001 – 60.000	30	35	2.5	3.5
60.001 – 200.00	Consult Factory for values			

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

3 VC22H 100 A Z - 60.0M - XXX (Internal Code or blank)

Packaging
Tube or
24mm tape
16mm pitch

Supply Voltage
Blank= 5.0 volts ±5%
3= 3.3 volts ±5%

Model
VC22H=without E/D
VC32H=with E/D

Frequency Stability
15: ± 15 PPM
25: ± 25 PPM
50: ± 50 PPM
100: ± 100 PPM

Frequency Deviation (Pullability) over CVR
T: ± 25 PPM
V: ± 50 PPM
W: ± 100 PPM
X: ± 150 PPM
Y: ± 200 PPM
Z: ± 300 PPM

Operating Temperature Range
A: 0 to +50°C
B: 0 to +70°C
C: -10 to +70°C
D: -20 to +75°C
E: -30 to +75°C
F: -40 to +85°C

Frequency in MHz

VC22H

PIN	SIGNAL
1	Vcon
2	N.C. *
3	GND
4	OUT
5	N.C.
6	Vcc

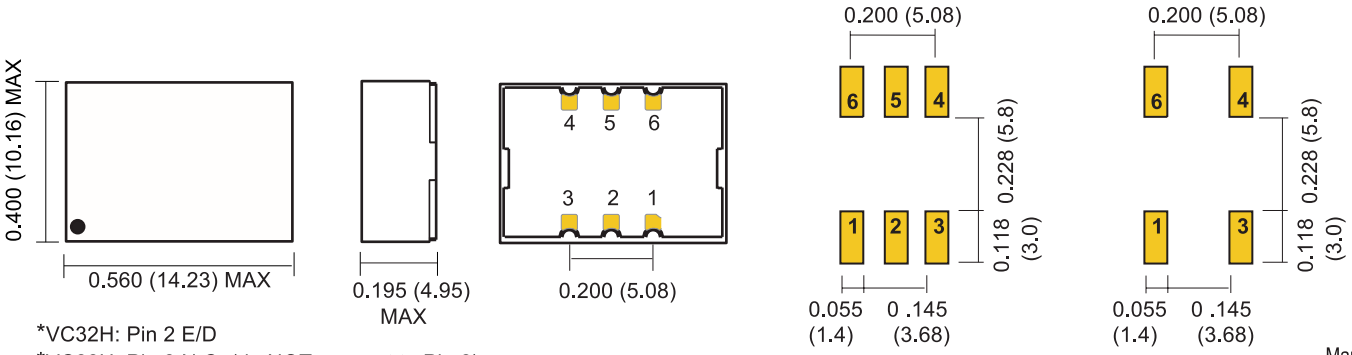
VC32H

PIN	SIGNAL
1	Vcon
2	E/D *
3	GND
4	OUT
5	N.C.
6	Vcc

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale VC3 Solder Pads VC2 Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



*VC32H: Pin 2 E/D
*VC22H: Pin 2 N.C. (do NOT connect to Pin 2)

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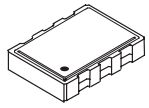
VC7 VCXO Series



- 6 Pad Leadless Ceramic Surface Mount Voltage Controlled Xtal Oscillator
- CMOS/ TTL Compatible with Enable/Disable

8.000 MHz – 70.000 MHz

Standard Specifications

Overall Frequency Stability	± 25, 50 PPM over Operating Temperature Range
Operating Temperature Range	0 to +70°C is standard, but can be extended to – 40 to +85°C for certain frequencies
Supply Voltage (Vcc)	5.0 volts and 3.3 volts available, .01 µF bypass cap recommended
Output Load	Standard load is 15pF maximum, see Test Circuit 9 (consult factory for **heavier** loads)
Control Voltage Range (CVR)	0.5 to 4.5 volts for 5.0 volt Supply; 0.0 to 3.3 volts for 3.3 volt Supply
Pullablity over CVR	± 90 PPM. Consult factory for other values.
Linearity	± 10% (Consult factory for ± 5%)
Enable/Disable Option (E/D)	Output enabled when Pin #2 is open or at Logic "1"; Output disabled when Pin #2 is at Logic "0".

Frequency Range (MHz)	Supply Current Icc (mA)		Rise and Fall Time Tr & Tf (nS)	
	Typical	Maximum	Typical	Maximum
8.000 – 20.000	10	15	3.5	5.0
20.001 – 30.000	20	25	3.0	4.5
30.001 – 70.000	25	30	3.0	4.0

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

3 VC75H 25 B S - 10.0M - XXX (Internal Code or blank)

Supply Voltage
Blank= 5.0 volts ±5%
3= 3.3 volts ±5%

Model
VC74H = E/D on 5
VC75H = E/D on 2

Frequency Stability
25: ± 25 PPM
50: ± 50 PPM

Operating Temperature Range
B: 0 to +70°C
F: -40 to +85°C

Frequency Deviation (Pullability) over CVR
S: ± 90 PPM

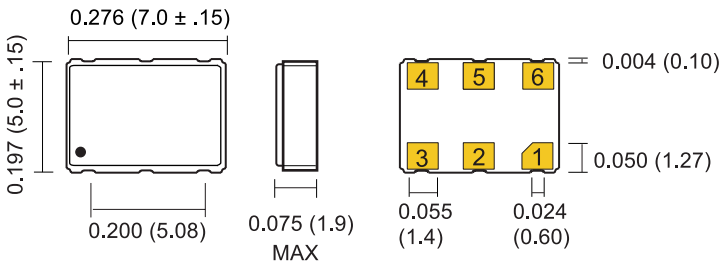
Frequency in MHz

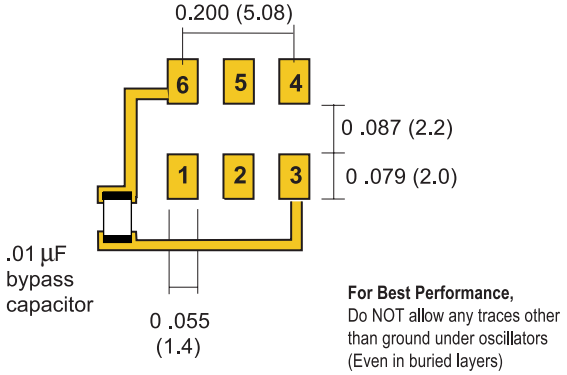
Packaging
Tray or
16mm tape
8mm pitch

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.





VC75H

PIN	SIGNAL
1	Vcon
2	E/D
3	GND
4	OUT
5	N.C.
6	Vcc

VC74H

PIN	SIGNAL
1	Vcon
2	N.C.
3	GND
4	OUT
5	E/D
6	Vcc

For Best Performance,
Do NOT allow any traces other than ground under oscillators (Even in buried layers)

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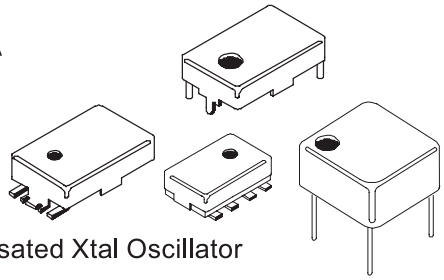
TC4 TCXO Series



- Surface Mount or Full Size Metal Thru-Hole Temperature Compensated Xtal Oscillator
- HCMOS, Clipped Sine Wave or Sine Wave Compatible

10.00 MHz – 60.00 MHz

Standard Specifications

Operating Temperature Range		0 to +50°C to -40 to +85°C available		
Overall Frequency Stability	**vs. Temp**	± 1.0 to ± 10 PPM over Operating Temperature Range available		
	vs. Vcc / Load	± 0.5 PPM maximum over Vcc ± 5% / ± 0.3 PPM maximum over Load ± 5%		
	Aging	± 3 PPM first year, ± 1 PPM per year thereafter at 25°C ± 5%		
Frequency Adj by Trimmer		± 3 PPM minimum		
Supply Voltage (Vcc)		5.0 volts and 3.3 volts available		
Output Logic		**HCMOS**	**Clipped Sine Wave**	**Sine Wave**
Output Voltage Levels		Logic "1" 90% of Vcc min Logic "0" 10% of Vcc max	1 volt p-p minimum	Consult Factory
Supply Current (Icc)		20 to 40 mA max	2 to 5 mA max	
Output Load (see Test Circuit 1)		10 TTL Loads or 15pF	10 K // 10 pF	

On Test Circuit for Clipped Sine Wave only: Add a 20 K resistor from output to ground

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

3TC4 6 H 100 A - 10.0M - XXX (Internal Code or blank)

Packaging
Tube or on Pads, SMD: bulk

Model / Supply Voltage
TC4= 5.0 volts ±5%
3TC4= 3.3 volts ±5%

TCXO Package, Max Height
6=Thru-Hole, 5.0mm
7=Surface Mount, 5.5mm
8=Surface Mount, 4.0mm
9=Thru-Hole, 8.5mm

Logic
C: Clipped Sine Wave
H: HCMOS
S: Sine Wave

Frequency Stability (FS)
010: ± 1.0 PPM
015: ± 1.5 PPM
020: ± 2.0 PPM
025: ± 2.5 PPM
030: ± 3.0 PPM
050: ± 5.0 PPM
100: ± 10.0 PPM

Operating Temperature Range {Tightest FS available}
A: 0 to +50°C {±1.0 PPM}
B: 0 to +70°C {±1.5 PPM}
C: -10 to +70°C {± 2.0 PPM}
D: -20 to +75°C {± 2.0 PPM}
E: -30 to +75°C {± 2.5 PPM}
F: -40 to +85°C {± 5.0 PPM}

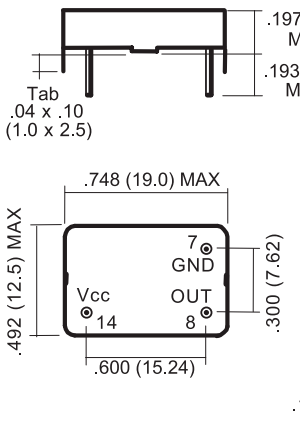
Frequency in MHz

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.
Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

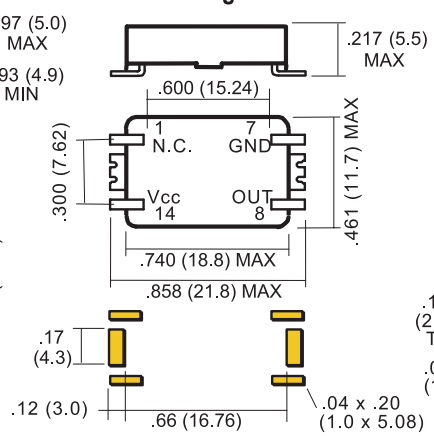
Mechanical: inches (mm) not to scale

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.

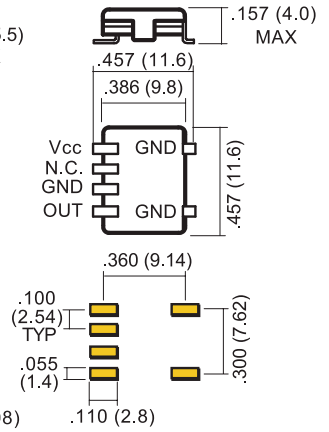
Package 6



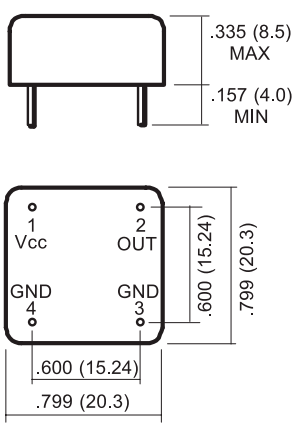
Package 7



Package 8



Package 9



Timmer hole locations may vary

Jan 2003

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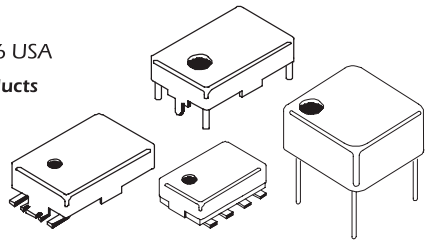


TV4 TCVCXO Series

- Surface Mount or Full Size Metal Thru-Hole Temp. Compensated Voltage Controlled Xtal Oscillator
- HCMOS, Clipped Sine Wave or Sine Wave Compatible

10.00 MHz – 60.00 MHz

Standard Specifications

Operating Temperature Range	0 to +50°C to -40 to +85°C available			
Overall Frequency Stability	**vs. Temp**	± 1.0 to ± 15 PPM over Operating Temperature Range available		
	vs. Vcc / Load	± 0.5 PPM maximum over Vcc ± 5% / ± 0.3 PPM maximum over Load ± 5%		
	Aging	± 3 PPM first year, ± 1 PPM per year thereafter at 25°C ± 5%		
Frequency Adj by Trimmer	± 3 PPM minimum			
Supply Voltage (Vcc)	5.0 volts and 3.3 volts available			
Output Logic	**HCMOS**	**Clipped Sine Wave**	**Sine Wave**	
Output Voltage Levels	Logic "1" 90% of Vcc min Logic "0" 10% of Vcc max	1 volt p-p minimum	Consult Factory	
Supply Current (Icc)	20 to 40 mA max	2 to 5 mA max		
Output Load (see Test Circuit 7)	10 TTL Loads or 15pF	10 K // 10 pF		
Control Voltage Range (CVR)	0.5 to 4.5 volts for 5.0 volt Supply; 0.0 to 3.3 volts for 3.3 volt Supply			
Pullablity over CVR	± 5, 10, 15 PPM. Consult factory for ± 25 PPM.			
Linearity	± 10% (Consult factory for ± 5%)			

On Test Circuit for Clipped Sine Wave only: Add a 20 K resistor from output to ground

Part Numbering Guide

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special p/n may be assigned.

Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

3TV4 6 H 100 A T - 60.0M - XXX (Internal Code or blank)

Model / Supply Voltage
TV4= 5.0 volts ±5%
3TV4= 3.3 volts ±5%

TCVCXO Package, Max Height
6=Thru-Hole, 5.0mm
7=Surface Mount, 5.5mm
8=Surface Mount, 4.0mm
9=Thru-Hole, 8.5mm

Logic
C: Clipped Sine Wave
H: HCMOS
S: Sine Wave

Frequency Stability (FS)
010: ± 1.0 PPM
015: ± 1.5 PPM
020: ± 2.0 PPM
025: ± 2.5 PPM
030: ± 3.0 PPM
050: ± 5.0 PPM
100: ± 10.0 PPM
150: ± 15.0 PPM

Operating Temperature Range {Tightest FS available}
A: 0 to +50°C {±1.0 PPM}
B: 0 to +70°C {±1.5 PPM}
C: -10 to +70°C {± 2.0 PPM}
D: -20 to +75°C {± 2.0 PPM}
E: -30 to +75°C {± 2.5 PPM}
F: -40 to +85°C {± 5.0 PPM}

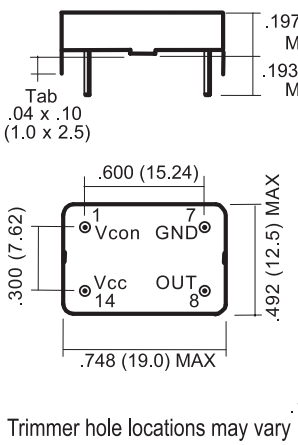
Frequency in MHz

Frequency Deviation (Pullability) over CVR
S: ± 5 PPM
R: ± 10 PPM
Q: ± 15 PPM
T: ± 25 PPM

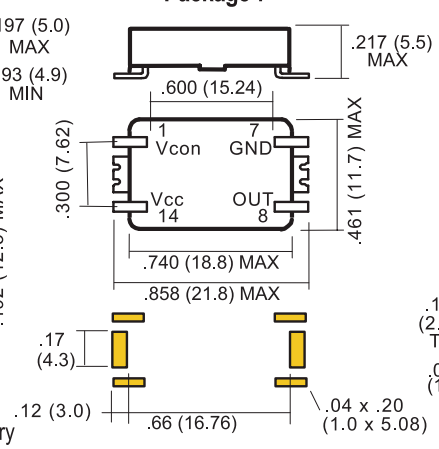
Mechanical: inches (mm) not to scale

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.

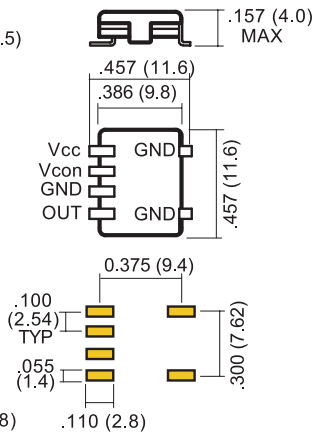
Package 6



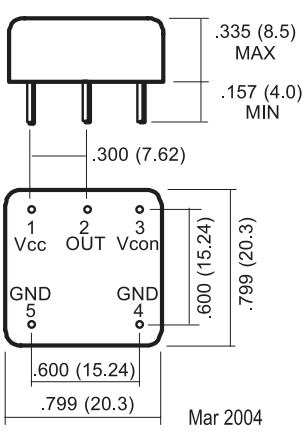
Package 7



Package 8



Package 9



Trimmer hole locations may vary

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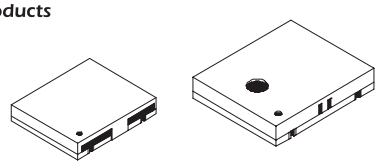
TV5 TCVCXO Series



- Surface Mount Temp. Compensated Voltage Controlled Xtal Oscillator with or without Trimmer
- Clipped Sine Wave Compatible

10.00 MHz – 60.00 MHz

Standard Specifications

Operating Temperature Range		0 to +50°C to -40 to +85°C available
Overall Frequency Stability	**vs. Temp**	± 1.5 to ± 15 PPM over Operating Temperature Range available
	vs. Vcc	± 0.5 PPM maximum over Vcc ± 5%
	Aging	± 3 PPM first year, ± 1 PPM per year thereafter at 25°C ± 5%
Frequency Adj by Trimmer		± 3 PPM minimum
Supply Voltage (Vcc)		5.0 volts and 3.3 volts available
Output Voltage Levels		1 volt p-p minimum
Supply Current (Icc)		2 to 5 mA max
Output Load (see Test Circuit 7)		10 K / 10 pF
Control Voltage Range (CVR)		0.5 to 4.5 volts for 5.0 volt Supply; 0.0 to 3.3 volts for 3.3 volt Supply
Pullablity over CVR		± 5, 10, 15 PPM. Consult factory for ± 25 PPM.
Linearity		± 10% (Consult factory for ± 5%)

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

3TV5 1 C 100 A S - 10.0M - XXX (Internal Code or blank)

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special p/n may be assigned.

Frequency Stability is inclusive of frequency shifts due to calibration, temperature, supply voltage, shock, vibration and load

Model / Supply Voltage
TV5= 5.0 volts ±5%
3TV5= 3.3 volts ±5%

TCVCXO Package
1=11.4x9.6x2mm, w/o trimmer
8=11.4x9.6x2mm, with trimmer
9=9x7x2mm, w/o trimmer

Logic
C: Clipped Sine Wave

Frequency in MHz

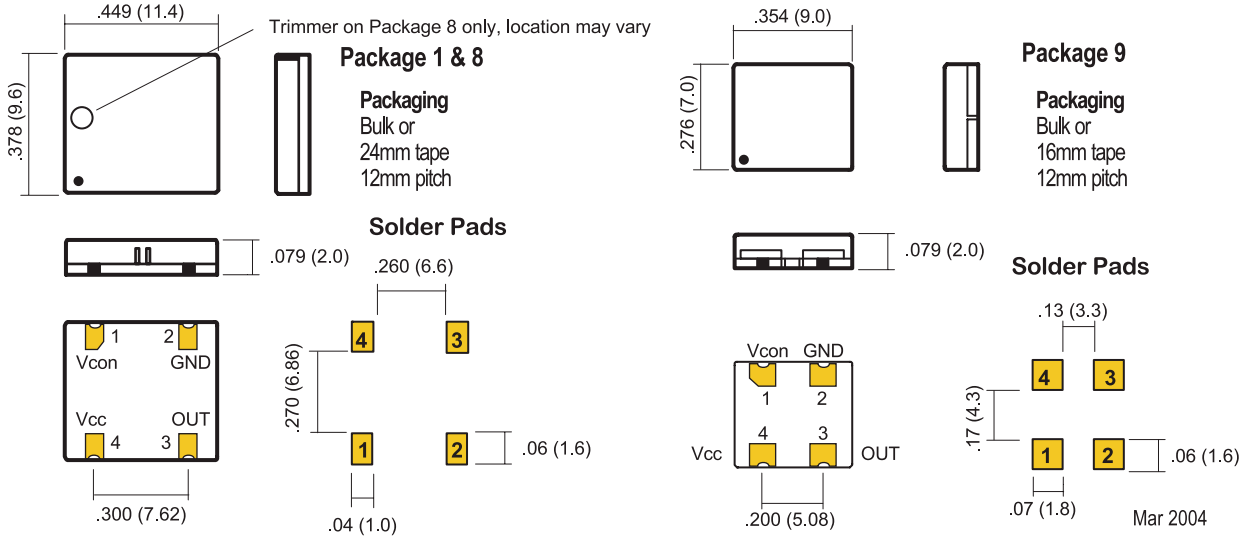
Frequency Deviation (Pullability) over CVR
S: ± 5 PPM
R: ± 10 PPM
Q: ± 15 PPM
T: ± 25 PPM

Operating Temperature Range {Tightest FS available}
A: 0 to +50°C {±1.5 PPM}
B: 0 to +70°C {±1.5 PPM}
C: -10 to +70°C {± 2.0 PPM}
D: -20 to +75°C {± 2.0 PPM}
E: -30 to +75°C {± 2.5 PPM}
F: -40 to +85°C {± 5.0 PPM}

Frequency Stability (FS)
015: ± 1.5 PPM
020: ± 2.0 PPM
025: ± 2.5 PPM
030: ± 3.0 PPM
050: ± 5.0 PPM
100: ± 10.0 PPM
150: ± 15.0 PPM

Mechanical: inches (mm) not to scale

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



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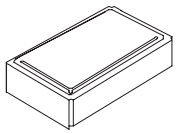
SM10T Crystal

- 4 Pad 3.2x2.5mm Surface Mount Crystal
  (Metal Cover Seam Sealed to Ceramic Base)



16.000 MHz – 60.000 MHz

Standard Specifications

Calibration Frequency Tolerance at 25°C	± 30 PPM is standard, tighter tolerances available
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR	± 50 PPM is standard, tighter tolerances available
Drive Level	100 μW is standard, customer may specify
Aging at 25°C	± 3 PPM maximum
Shunt Capacitance	5 pF maximum

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM10T B E - xx - 20.0M - XXX (Internal Code or blank)

Model

Frequency in MHz

Load Capacitance
Parallel Resonance in pF (≥ 10 pF)
SR = Series Resonance

Cal Tol / Freq Stability
Blank = 30/50
B = 30/30
C = 15/30
D = 10/20 (consult factory)

Temperature Range
Blank: 0 to +70°C
E: - 40 to +85°C
H: - 20 to +70°C

Consult factory for available frequencies and specs.
Not all options available for all frequencies. A special part number may be assigned.

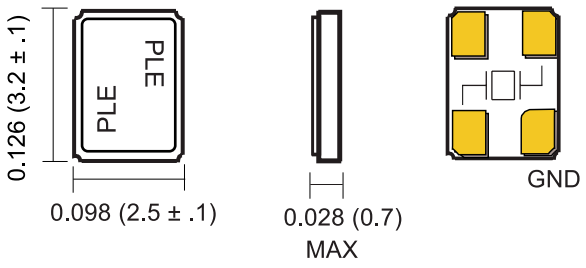
ESR Values

Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental	16.000 – 29.999	100
AT Cut	30.000 – 60.000	50

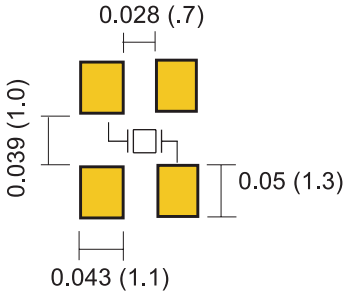
Consult factory for lower ESR

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



Packaging
8mm tape
4mm pitch



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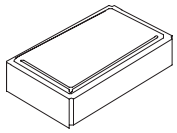
SM11T Crystal



- 4 Pad 5x3.2mm Surface Mount Crystal
  (Metal Cover Seam Sealed to Ceramic Base)

12.000 MHz – 32.000 MHz

Standard Specifications

Calibration Frequency Tolerance at 25°C	± 50 PPM is standard, tighter tolerances available
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR	± 50 PPM is standard, tighter tolerances available
Drive Level	50 µW is standard, customer may specify
Aging at 25°C	± 5 PPM maximum

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM11T B E - xx - 20.0M - XXX (Internal Code or blank)

- **Model**
- **Cal Tol / Freq Stability**
  - Blank = 50/50
  - B = 30/30
  - C = 15/30
  - D = 10/20 (consult factory)
- **Temperature Range**
  - Blank: 0 to +70°C
  - E: - 40 to +85°C
  - H: - 20 to +70°C
- **Load Capacitance**
  - Parallel Resonance in pF (≥ 8 pF)
  - SR = Series Resonance
- **Frequency in MHz**

Consult factory for available frequencies and specs.
Not all options available for all frequencies. A special part number may be assigned.

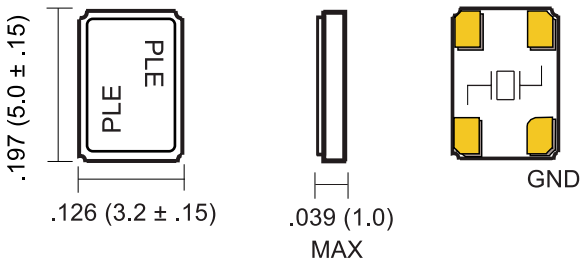
ESR Values

Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental AT Cut	12.000 – 19.999	80
	20.000 – 32.000	50

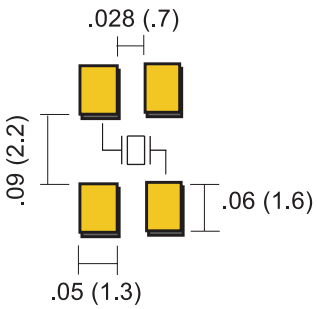
Consult factory for lower ESR

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



Packaging
16mm tape
8mm pitch



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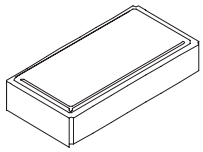
SM12T Crystal



- 4 Pad 6x3.5mm Surface Mount Crystal (Metal Cover Seam Sealed to Ceramic Base)
- Solder Pad Compatible with our SM12H

10.001 MHz – 50.000 MHz

Standard Specifications

Calibration Frequency Tolerance at 25°C	± 50 PPM is standard, tighter tolerances available
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR	± 50 PPM is standard, tighter tolerances available
Drive Level	100 μW is standard, customer may specify
Aging at 25°C	± 5 PPM maximum

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM12T B E - xx - 50.0M - XXX (Internal Code or blank)

Model

Frequency in MHz

Load Capacitance
Parallel Resonance in pF (≥ 10 pF)
SR = Series Resonance

Cal Tol / Freq Stability
Blank = 50/50
A = 30/50
B = 30/30
C = 15/30
D = 10/20 (consult factory)

Temperature Range
Blank: 0 to +70°C
E: - 40 to +85°C
H: - 20 to +70°C

Consult factory for available frequencies and specs.
Not all options available for all frequencies. A special part number may be assigned.

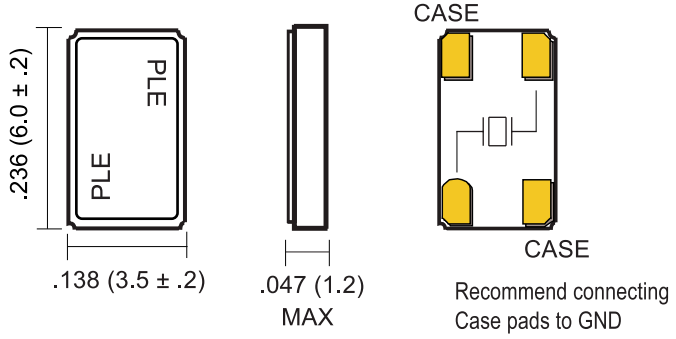
ESR Values

Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental AT Cut	10.001 – 11.000	60
	11.001 – 12.000	50
	12.001 – 14.000	40
	14.001 – 50.000	30

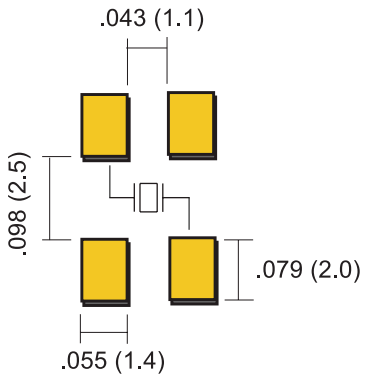
Consult factory for lower ESR

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



Packaging
16mm tape
8mm pitch



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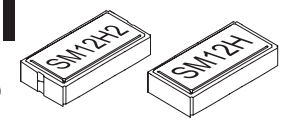
SM12H, SM12H2 Crystal



- 2 or 4 Pad 6x3.5mm Surface Mount Crystal (Ceramic Cover / Ceramic Base)
- SM12H Solder Pad Compatible with our SM12T

13.000 MHz – 120.000 MHz

Standard Specifications

Calibration Frequency Tolerance at 25°C	± 50 PPM
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR	± 50 PPM is standard, ± 100 PPM at extended temperature range
Drive Level	100 µW is standard, customer may specify
Aging at 25°C	± 5 PPM maximum

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM12H E - xx - 70.0M - XXX (Internal Code or blank)

Model
SM12H: 4 Pad
SM12H2: 2 Pad

Load Capacitance
Parallel Resonance in pF (≥ 10 pF)
SR = Series Resonance

Temperature Range
Blank: 0 to +70°C
E: - 40 to +85°C (± 50 /100 PPM)

ESR Values

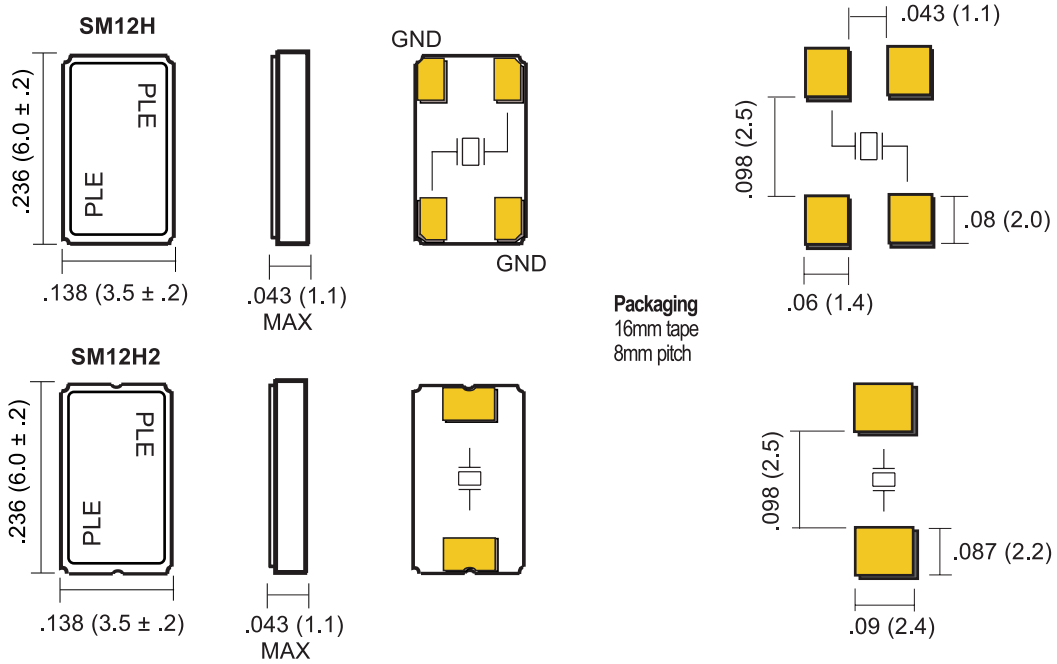
Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental AT Cut	13.000 – 20.000	80
	20.001 – 40.000	50
3rd Overtone AT Cut	25.001 – 120.000	100

Consult factory for lower ESR

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



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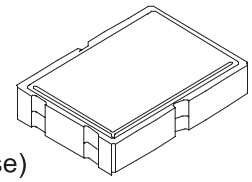
SM13T, SM13TS Crystal



- 4 Pad 7x5mm Surface Mount Crystal (Metal Cover Seam Sealed to Ceramic Base)
- SM13TS Specifically Designed for High Shock Applications
- Solder Pad Compatible with our SM13H

6.001 MHz – 80.000 MHz

Standard Specifications

Calibration Frequency Tolerance at 25°C		± 50 PPM is standard, tighter tolerances available
Operating Temperature Range (OTR)		0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR		± 50 PPM is standard, tighter tolerances available
Drive Level		100 µW is standard, customer may specify
Aging at 25°C		± 3 PPM maximum
SM13TS Only	**Mechanical Shock**	5000 g's, 1/2 sine, 0.2 mS
	Drop Test	2 meter free fall onto a concrete floor, 10 times

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM13TS B E - xx - 70.0M - XXX (Internal Code or blank)

Model
SM13T: Standard
SM13TS: High Shock

Cal Tol / Freq Stability
Blank = 50/50
A = 30/50
B = 30/30
C = 15/30
D = 10/20 (consult factory)

Temperature Range
Blank: 0 to +70°C
E: - 40 to +85°C
H: - 20 to +70°C

Load Capacitance
Parallel Resonance in pF (≥ 10 pF)
SR = Series Resonance

Frequency in MHz

Consult factory for available frequencies and specs.
Not all options available for all frequencies. A special part number may be assigned.

ESR Values

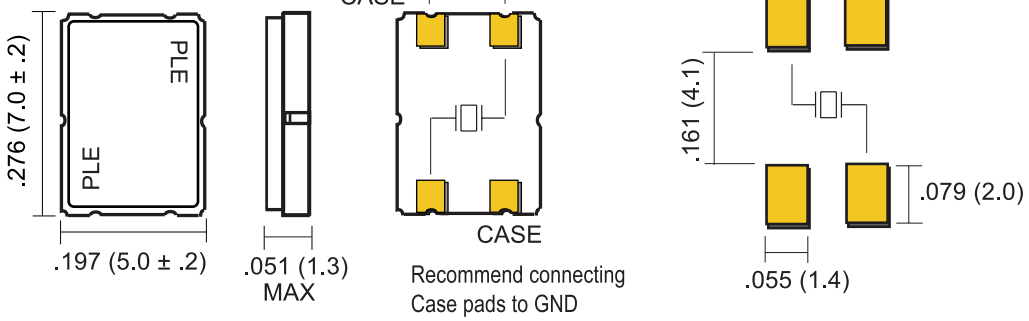
Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental AT Cut	6.001 – 8.000	150
	8.001 – 9.000	80
	9.001 – 11.000	40
	11.001 – 50.000	30
3rd Overtone AT Cut	26.000 – 80.000	80

Consult factory for lower ESR

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.

Packaging
16mm tape
12mm pitch



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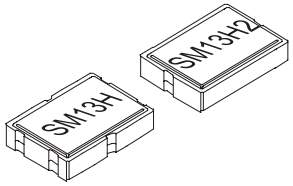
SM13H, SM13H2 Crystal



- 2 or 4 Pad 7x5mm Surface Mount Crystal (Ceramic Cover / Ceramic Base)
- SM13H Solder Pad Compatible with our SM13T

9.000 MHz – 120.000 MHz

Standard Specifications

Calibration Frequency Tolerance at 25°C	± 50 PPM
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR	± 50 PPM is standard, ± 100 PPM at extended temperature range
Drive Level	100 µW is standard, customer may specify
Aging at 25°C	± 5 PPM maximum

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM13H E - xx - 70.0M - XXX (Internal Code or blank)

Model
SM13H: 4 Pad
SM13H2: 2 Pad

Load Capacitance
Parallel Resonance in pF (≥ 10 pF)
SR = Series Resonance

Frequency in MHz

Temperature Range
Blank: 0 to +70°C
E: - 40 to +85°C (± 50 /100 PPM)

ESR Values

Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental AT Cut	9.000 – 12.000	80
	12.001 – 40.000	50
3rd Overtone AT Cut	25.001 – 120.000	80

Consult factory for lower ESR

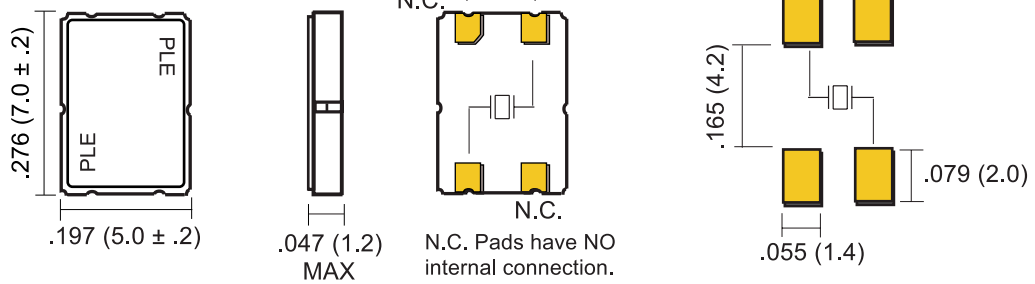
Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.

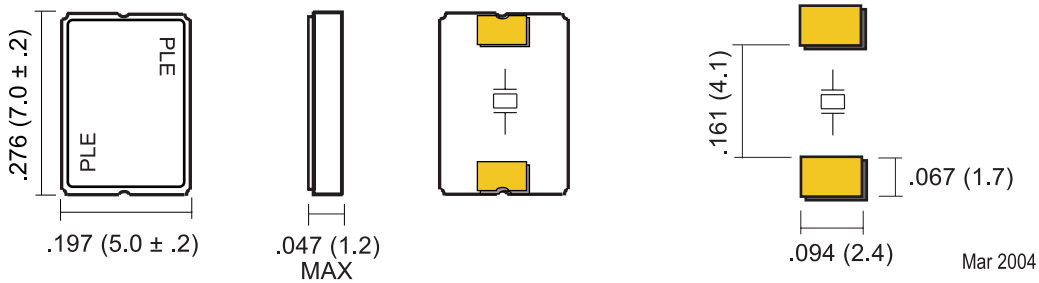
Packaging
16mm tape
12mm pitch

SM13H



N.C. Pads have NO internal connection. Recommend connecting N.C. pads to GND

SM13H2



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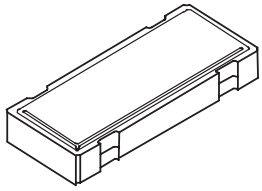
SM23C Crystal



- 4 Pad 11.6x5.5mm Surface Mount Crystal (Ceramic Cover /Ceramic Base)

3.570 MHz – 120.000 MHz

Standard Specifications

Calibration Frequency Tolerance at 25°C	± 30 PPM is standard, tighter tolerances available
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR	± 50 PPM is standard, tighter tolerances available
Drive Level	100 μW is standard, customer may specify
Aging at 25°C	± 5 PPM maximum

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM23C B E - xx - 70.0M - XXX (Internal Code or blank)

- **Model**
- **Cal Tol / Freq Stability**
  - Blank = 30/50
  - B = 30/30
  - C = 15/30
  - D = 10/20 (consult factory)
- **Temperature Range**
  - Blank: 0 to +70°C
  - E: - 40 to +85°C
  - H: - 20 to +70°C
- **Load Capacitance**
  - Parallel Resonance in pF (≥ 10 pF)
  - SR = Series Resonance
- **Frequency in MHz**

Consult factory for available frequencies and specs.
Not all options available for all frequencies. A special part number may be assigned.

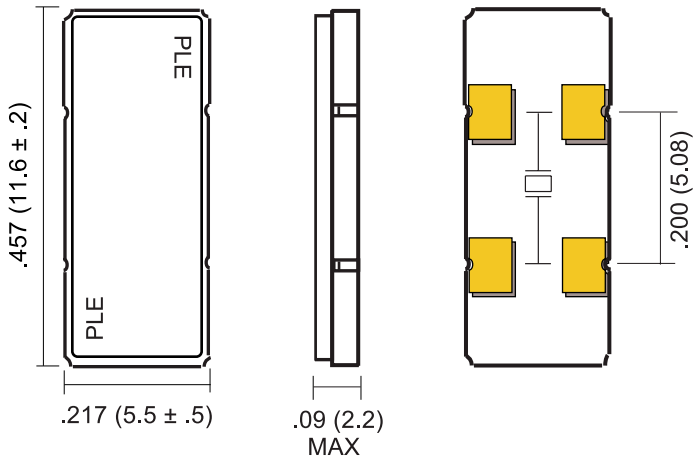
ESR Values

Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental AT Cut	3.570 – 3.999	200
	4.000 – 5.999	150
	6.000 – 8.999	100
	9.000 – 12.999	60
	13.000 – 27.000	40
3rd Overtone AT Cut	27.001 – 120.000	80

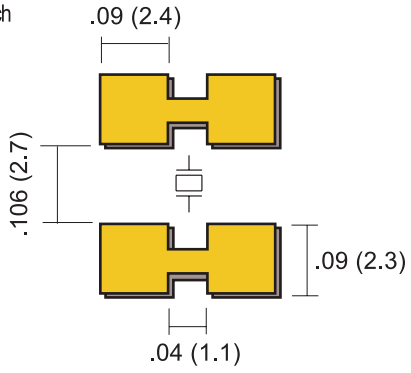
Consult factory for lower ESR

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



Packaging
24mm tape
16mm pitch



Nov 2003

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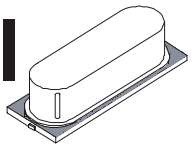
Manufacturer of High Quality Frequency Control Products

SM42, SM30, SM25 Crystal



- HC-49/US Low Profile Crystal Mounted on Surface Mount Platform (HC-49/SMD)
- Available in 3 heights, SM42: 4.4mm, SM30: 3.3mm, SM25: 2.5mm

3.200 MHz – 70.000 MHz

Standard Specifications

Calibration Frequency Tolerance at 25°C	± 30 PPM is standard, tighter tolerances available
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR	± 50 PPM is standard, tighter tolerances available
Drive Level	50 μW is standard, customer may specify
Aging at 25°C	± 5 PPM per year is standard, customer may specify ± 1 PPM
Shunt Capacitance	7 pF maximum
Pullability	

May be specified by customer in terms of frequency shift required over a certain range of load capacitance (e.g. +100 PPM from CL=12 to CL=18 pF) or as motional capacitance (fF)

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM42 B E - xx - 70.0M - XXX (Internal Code or blank)

Model
SM42: 4.4 mm
SM30: 3.3mm
SM25: 2.5mm

Cal Tol / Freq Stability
Blank = 30/50
B = 30/30
C = 15/30
D = 10/20 (consult factory)

Temperature Range
Blank: 0 to +70°C
E: - 40 to +85°C
H: - 20 to +70°C

Load Capacitance
Parallel Resonance in pF (≥ 10 pF)
SR = Series Resonance

Frequency in MHz

Consult factory for available frequencies and specs.
Not all options available for all frequencies. A special part number may be assigned.

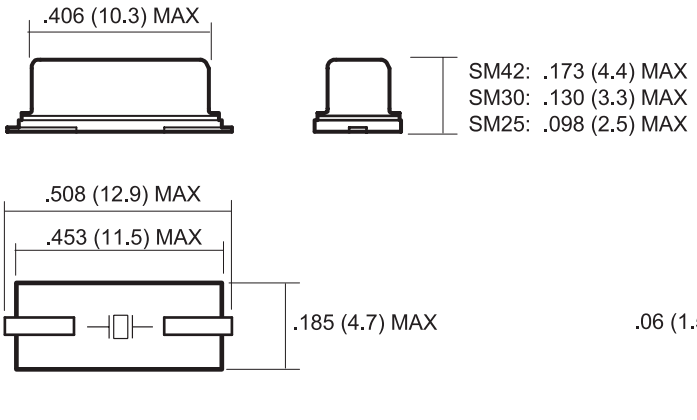
ESR Values

Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental AT Cut	3.200 – 4.999	300
	5.000 – 7.999	120
	8.000 – 11.999	70
	12.000 – 30.000	50
3rd Overtone AT Cut	25.000 – 70.000	100

Consult factory for lower ESR

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



Packaging
24mm tape
16mm pitch

Nov 2003

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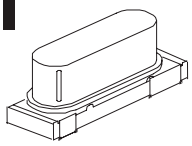
SM55, SM45, SM40 Crystal



- HC-49/US Low Profile Crystal Mounted on a Surface Mount Platform
- Available in 3 heights, SM55: 5.5mm, SM45: 4.5mm, SM40: 4.0mm
- Solder Pad Compatible with our SM39S and SMD Crystals from Epson, Meiden & Citizen
- Available in Standard 4 pad or Optional 2 pad Pinout Style

3.200 MHz – 70.000 MHz

Standard Specifications

Calibration Frequency Tolerance at 25°C	± 30 PPM is standard, tighter tolerances available
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR	± 50 PPM is standard, tighter tolerances available
Drive Level	50 μW is standard, customer may specify
Aging at 25°C	± 5 PPM per year is standard, customer may specify ± 1 PPM
Shunt Capacitance	7 pF maximum
Pullability	

May be specified by customer in terms of frequency shift required over a certain range of load capacitance (e.g. +100 PPM from CL=12 to CL=18 pF) or as motional capacitance (fF)

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM45 B E - xx - 70.0M - XXX (Internal Code or blank)

Model (Height/Pinout)
SM55: 5.5mm/Std
SM45: 4.5mm/Std
SM40: 4.0mm/Std
SMP55: 5.5mm/2 pad
SMP45: 4.5mm/2 pad
SMP40: 4.0mm/2pad

Cal Tol / Freq Stability
Blank = 30/50
B = 30/30
C = 15/30
D = 10/20 (consult factory)

Temperature Range
Blank: 0 to +70°C
E: - 40 to +85°C
H: - 20 to +70°C

Load Capacitance
Parallel Resonance in pF (≥ 10 pF)
SR = Series Resonance

Frequency in MHz

ESR Values

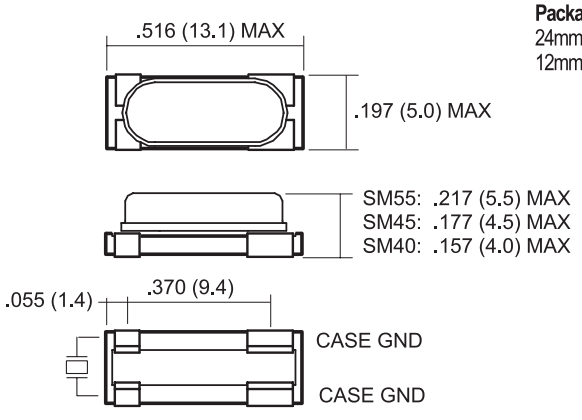
Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental AT Cut	3.200 – 4.999	300
	5.000 – 7.999	120
	8.000 – 11.999	70
	12.000 – 30.000	50
3rd Overtone AT Cut	25.000 – 70.000	100

Consult factory for lower ESR

Consult factory for available frequencies and specs.
Not all options available for all frequencies. A special part number may be assigned.

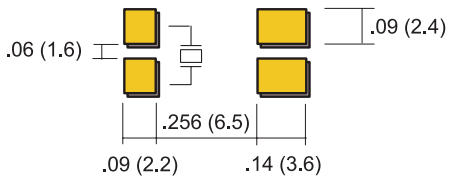
Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.

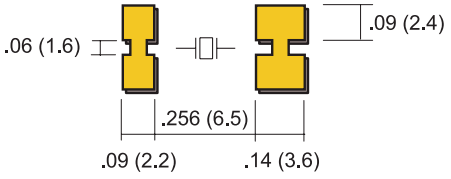


Packaging
24mm tape
12mm pitch

Standard Pinout (SM)



Optional 2 Pad Pinout (SMP)



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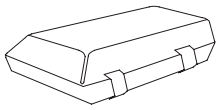
SM39S Crystal

- 4 Lead Surface Mount Plastic Crystal
- Solder Pad Compatible with our SM55, SM45, SM40 and other SM Crystals from Epson, Meiden & Citizen



3.500 MHz – 70.000 MHz

Standard Specifications

Calibration Frequency Tolerance at 25°C	± 50 PPM
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR	± 50 PPM is standard, ± 100 PPM at extended temperature range
Drive Level	50 µW is standard, customer may specify
Aging at 25°C	± 5 PPM per year
Shunt Capacitance	7 pF maximum

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SM39S E - xx - 70.0M - XXX (Internal Code or blank)

- **Model**
- **Frequency in MHz**
- **Load Capacitance**
  Parallel Resonance in pF (≥ 10 pF)
  SR = Series Resonance
- **Temperature Range**
  Blank: 0 to +70°C
  E: - 40 to +85°C (± 50 /100 PPM)

Consult factory for available frequencies and specs.
Not all options available for all frequencies. A special part number may be assigned.

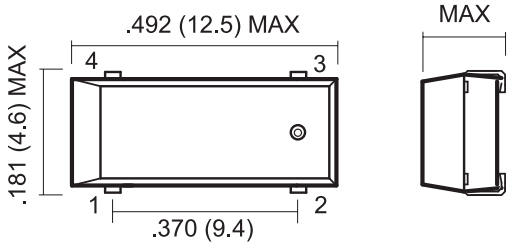
ESR Values

Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental AT Cut	3.500 – 3.999	200
	4.000 – 5.999	150
	6.000 – 9.999	100
	10.000 – 34.000	50
3rd Overtone AT Cut	27.000 – 35.999	100
	36.000 – 70.000	80

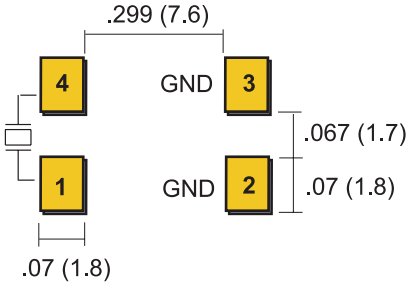
Consult factory for lower ESR

Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



Packaging
24mm tape
12mm pitch



Mar 2004

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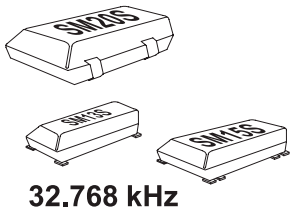
SM Watch Crystals

- 4 Lead Surface Mount Plastic Tuning Fork Watch Crystals
- **SM13S**: 7x1.5x1.4mm, **SM15S**: 6.8x3.1x1.56mm, **SM20S**: 8x3.8x2.5mm



32.768 kHz

Standard Specifications

Calibration Frequency Tolerance	± 20 PPM at 25°C std, SM20SD = ± 10 PPM
Operating Temperature Range (OTR)	-40 to +85°C
Frequency Stability over OTR	

Calculate as: Frequency shift from 25°C to T°C in PPM
$= - 0.038 \times (T - 25)^2 \pm 10\%$

Load Capacitance	12.5 pF std, 6 pF avail. SM20S only
Equivalent Series Resistance (ESR)	SM20S: 50 k ohm maximum, SM13S & SM15S: 65 k ohm maximum
Drive Level	1µW maximum
Aging at 25°C for the 1st year	± 5 PPM maximum
Shunt Capacitance	1.0 pF to 1.45 pF typical

Part Numbering Guide

SM20S - 32.768K - 6pF - XXX (Internal Code or blank)

Model
SM13S
SM15S
SM20S

Frequency in kHz

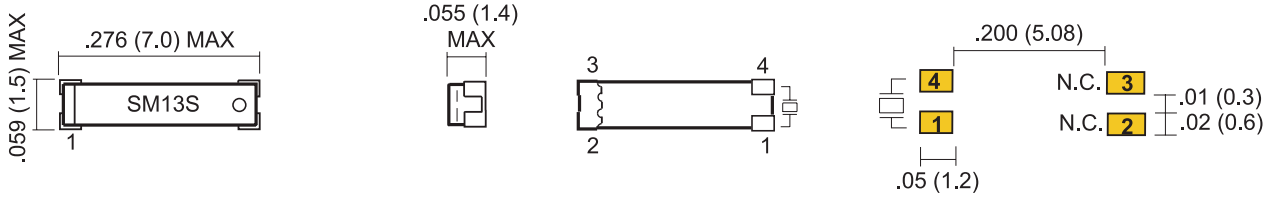
Load Capacitance
Blank = 12.5pF

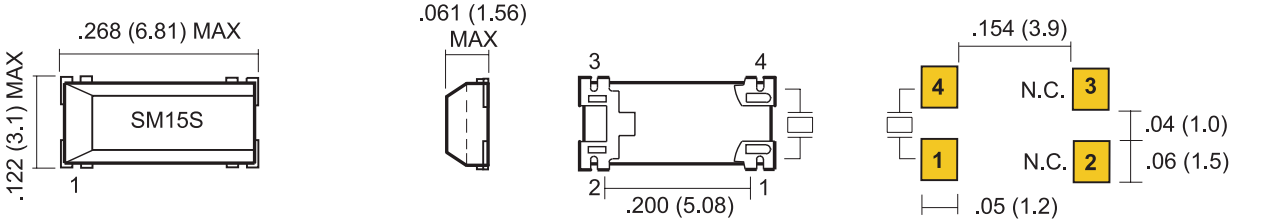
Packaging
16mm tape
8mm pitch

Consult factory for available specifications.
A special part number may be assigned.

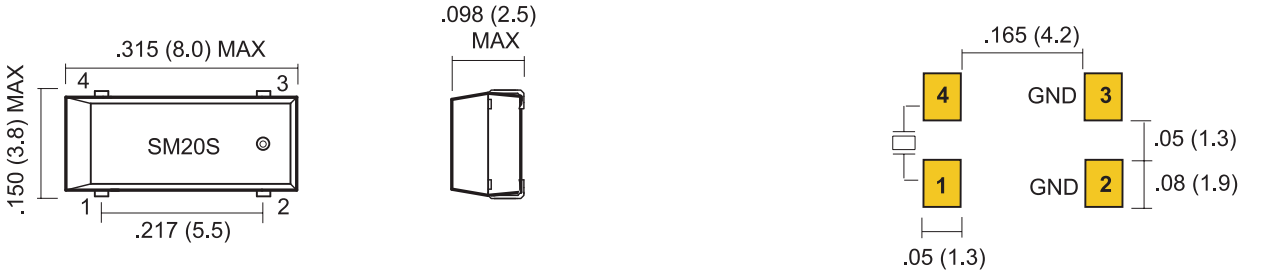
Mechanical: inches (mm) not to scale Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.





Do NOT connect to N.C.



Mar 2004

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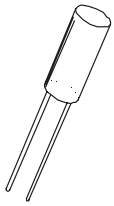
WX Watch Crystals



32.768 kHz

- 32.768 kHz Cylindrical Watch Crystals
- Available in 3 Sizes - WX: 3x8mm, WX26: 2x6mm, WX15: 1.5x5mm, WX26 also available as -SMD with formed leads

Standard Specifications

Calibration Frequency Tolerance	± 20 PPM at 25°C for 12.5 pF, ± 30 PPM at 25°C for 6 pF
Operating Temperature Range (OTR)	-10 to +60°C
Frequency Stability over OTR	
Calculate as: Frequency shift from 25°C to T°C in PPM = - 0.038 x $(T - 25)^2$ ± 10%	
Load Capacitance	12.5 pF standard for WX and WX26, 8 pF standard for WX15, 6 pF available WX26 only
Equivalent Series Resistance (ESR)	40 kΩ maximum
Drive Level	1μW maximum
Aging at 25°C for the 1st year	± 3 PPM maximum
Shunt Capacitance	1.7pF maximum

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

WX26 -- 32.768K -- 6pF - SMD - XXX (Internal Code or blank)

Model
WX: 3x8mm
WX26: 2x6mm
WX15: 1.5x5mm

Optional (WX26 only)

Non Std Load Capacitance for WX26
Blank = 12.5pF for WX and WX26,
Blank = 8pF for WX15

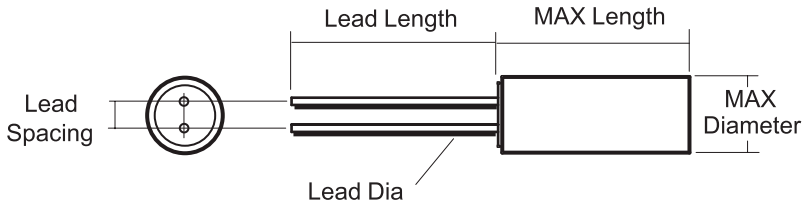
Packaging
Bulk

Frequency in kHz

Consult factory for available specifications.
A special part number may be assigned.

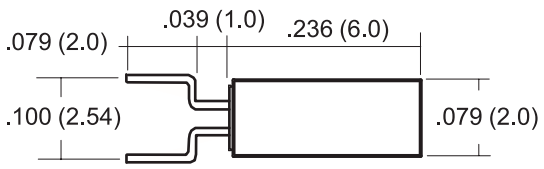
Mechanical: inches (mm) not to scale

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.

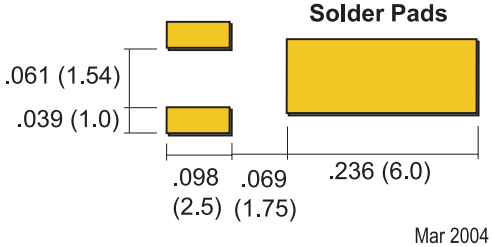


Model	Diameter	Length	Lead Length	Lead Dia	Lead Spacing
WX	.122 (3.1)	.323 (8.2)	.394 (10.0)	.014 (.35)	.043 (1.1)
WX26	.083 (2.1)	.244 (6.2)	.394 (10.0)	.010 (.26)	.028 (0.7)
WX15	.059 (1.5)	.201 (5.1)	.169 (4.3)	.008 (0.2)	.018 (.45)

WX26-32.768k-SMD



Solder Pads



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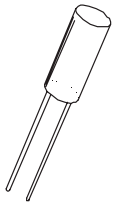
CY26 Crystal

- Cylindrical Crystals in kHz Range



30 kHz – 150 kHz

Standard Specifications

Calibration Frequency Tolerance	± 30 PPM at 25°C
Operating Temperature Range (OTR)	-10 to +60°C
Frequency Stability over OTR	
Calculate as: Frequency shift from 25°C to T°C in PPM = - 0.038 x $(T - 25)^2$ ± 10%	
Load Capacitance	12.5 pF std, customer may specify others
Equivalent Series Resistance (ESR)	50 kΩ maximum
Drive Level	1μW
Aging at 25°C for the 1st year	± 5 PPM
Shunt Capacitance	1.7 pF maximum
Motional Capacitance	1 to 4 fF

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

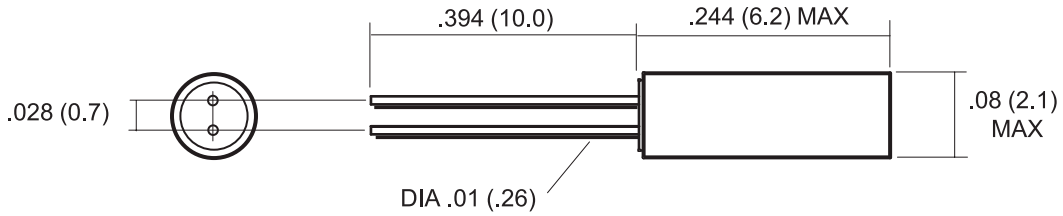
CY26 - xx - 70.0k - XXX (Internal Code or blank)

- **Model**
- **Frequency in kHz**
- **Load Capacitance**
  - Parallel Resonance in pF (12.5 pF standard)
  - SR = Series Resonance
- **Packaging**
  - Bulk

Consult factory for available frequencies and specs.
Not all options available for all frequencies. A special part number may be assigned.

Mechanical: inches (mm) not to scale

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



Sep 2002

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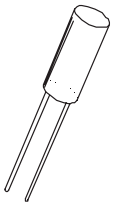
CY39, CY310 Crystals



- Cylindrical Crystals in MHz and kHz Range
- Available in 2 Sizes and Frequency Ranges,
  CY39: 3x9mm, CY310: 3x10mm

30 kHz – 150 kHz
3.500 MHz – 70.000 MHz

Standard Specifications

Frequency Range	**CY310**: 3.500 to 3.999 MHz, **CY39**: 30 to 150 kHz and 4.000 to 70.000 MHz
Calibration Frequency Tolerance at 25°C	± 50 PPM is standard, tighter tolerances available
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR	± 50 PPM is standard, tighter tolerances available
Drive Level	100 μW is standard, customer may specify
Aging at 25°C	± 5 PPM per year is standard, customer may specify ± 1 PPM
Shunt Capacitance	7 pF maximum

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

CY39 E - xx - 70.0M - XXX (Internal Code or blank)

Model (Size)
CY39: 3x9mm
CY310: 3x10mm

Temperature Range
Blank: 0 to +70°C
E: - 40 to +85°C

Load Capacitance
Parallel Resonance in pF (≥ 10 pF)
SR = Series Resonance

Frequency in MHz or kHz

Consult factory for available frequencies and specs.
Not all options available for all frequencies. A special part number may be assigned.

ESR Values

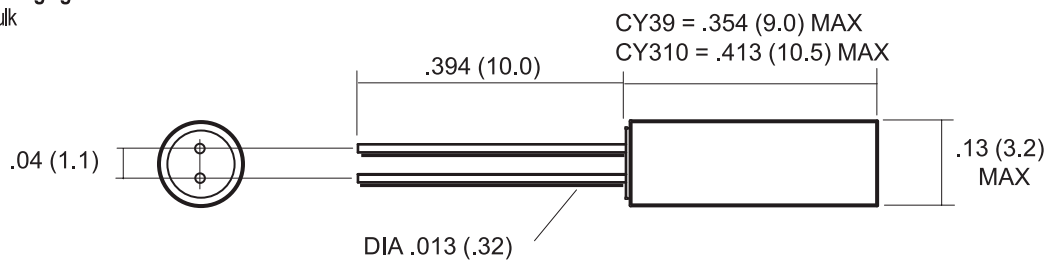
Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental AT Cut	30 – 150 kHz	50k
	3.500 – 3.999	200
	4.000 – 5.999	150
	6.000 – 9.999	100
	10.000 – 30.000	50
3rd Overtone AT Cut	30.001 – 35.999	100
	36.000 – 70.000	80

Consult factory for lower ESR

Mechanical: inches (mm) not to scale

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.

Packaging
Bulk



Sep 2002

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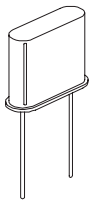
MP49 Crystal



- HC-49U Metal Thru-Hole Crystal
- Available as Gull Wing SMD or with Pull-Down Pin on Top of Can

1.8432 MHz – 210.00 MHz

Standard Specifications

Calibration Frequency Tolerance at 25°C	± 30 PPM is standard, tighter tolerances available
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR	± 50 PPM is standard, see below for tighter tolerances available per OTR options
Drive Level	50 μW is standard, customer may specify
Aging at 25°C	± 5 PPM per year is standard, customer may specify ± 1 PPM
Shunt Capacitance	7 pF maximum
Pullability	

May be specified by customer in terms of frequency shift required over a certain range of load capacitance (e.g. +100 PPM from CL=12 to CL=18 pF) or as motional capacitance (f F)

Temperature Range	Tightest FS
-10 to +60°C	± 3 PPM
-20 to +70°C	± 5 PPM
-30 to +80°C	± 10 PPM
-40 to +85°C	± 20 PPM

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

SR MP49 B E - xx - 70.0M - IN XXX (Internal Code or blank)

Series Resonance

Model

Cal Tol / Freq Stability
Blank = 30/50
B = 30/30
C = 15/30
D = 10/20 (consult factory)

Load Capacitance
Parallel Resonance in pF (≥ 10 pF)

Temperature Range & Special Mechanical
Blank: 0 to +70°C
E: - 40 to +85°C
H: - 20 to +70°C
G: Gull Wing Surface Mount Package
L: 3rd Lead (Pull-down pin) on top of can
V: Vinyl Sleeve Insulation

Frequency in MHz

Options
IN = Insulator
TR = Paper Tape & Reel
PN = Put on Pads

ESR Values

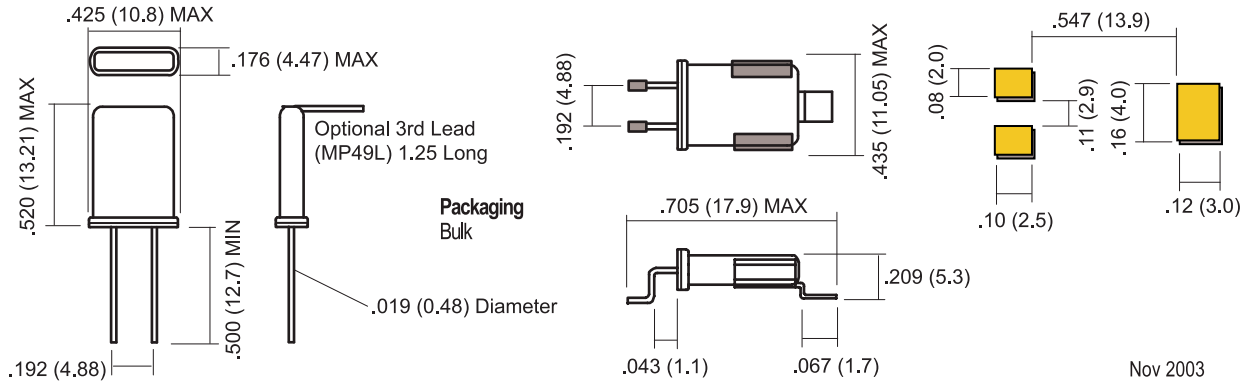
Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental AT Cut	1.8432 – 2.999	700
	3.000 – 3.999	150
	4.000 – 6.999	100
	7.000 – 9.999	50
	10.000 – 37.000	25
3rd Overtone AT Cut	21.000 – 90.000	40
5th Overtone	60.000 – 150.000	70
7th Overtone	85.000 – 210.000	100

Consult factory for lower ESR

Consult factory for available frequencies and specs. Not all options available for all frequencies. A special part number may be assigned.

Mechanical: inches (mm) not to scale Gull Wing - MP49G Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



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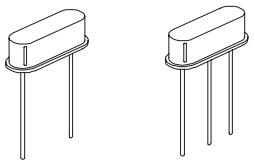
Manufacturer of High Quality Frequency Control Products

LP Crystal Series



- HC-49/US Low Profile Metal Thru-Hole Crystals
- Available in 3 heights, LP49: 3.5mm, LP24: 2.5mm, LP21: 2.1mm and with 3rd Case Pin: 3LP49

3.200 MHz – 70.000 MHz

Standard Specifications

Calibration Frequency Tolerance at 25°C	± 30 PPM is standard, tighter tolerances available
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR	± 50 PPM is standard, tighter tolerances available
Drive Level	50 μW is standard, customer may specify
Aging at 25°C	± 5 PPM per year is standard, customer may specify ± 1 PPM
Shunt Capacitance	7 pF maximum
Pullability	

May be specified by customer in terms of frequency shift required over a certain range of load capacitance (e.g. +100 PPM from CL=12 to CL=18 pF) or as motional capacitance (f F)

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

LP49 B E - xx - 70.0M - IN XXX (Internal Code or blank)

Model (Height)
LP49: 3.56mm
LP24: 2.5mm
LP21: 2.1mm
3LP49: case pin, 3.56mm

Cal Tol / Freq Stability
Blank = 30/50
B = 30/30
C = 15/30
D = 10/20 (consult factory)

Temperature Range
Blank: 0 to +70°C
E: - 40 to +85°C
H: - 20 to +70°C

Load Capacitance
Parallel Resonance in pF (≥ 10 pF)
SR = Series Resonance

Frequency in MHz

Options
IN = Insulator
TR = Paper Tape & Reel
PN = Put on Pads

Consult factory for available frequencies and specs.
Not all options available for all frequencies. A special part number may be assigned.

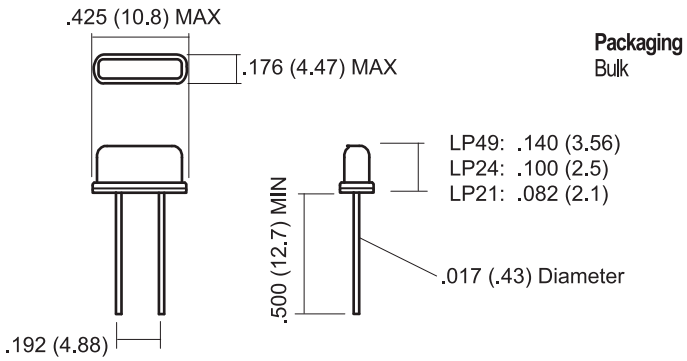
ESR Values

Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental AT Cut	3.200 – 4.999	300
	5.000 – 7.999	120
	8.000 – 11.999	70
	12.000 – 30.000	50
3rd Overtone AT Cut	25.000 – 70.000	100

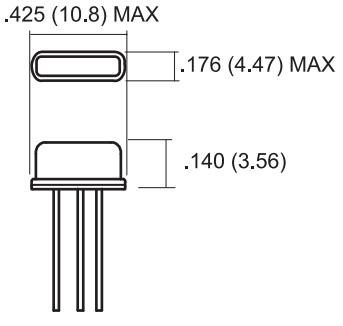
Consult factory for lower ESR

Mechanical: inches (mm) not to scale 3LP49

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



Packaging
Bulk



Center lead is case ground

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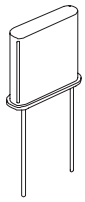
UM Crystal Series



- Miniature Metal Thru-Hole Crystal
- Available in 3 heights, UM1: 8.1mm, UM4: 4.8mm, UM5: 6.0mm and as Surface Mount Gull Wing: UM1G

10.000 MHz – 150.00 MHz

Standard Specifications

Calibration Frequency Tolerance at 25°C	± 30 PPM is standard, tighter tolerances available
Operating Temperature Range (OTR)	0 to +70°C is standard, but can be extended to -40 to +85°C
Frequency Stability (FS) over OTR	± 50 PPM is standard, see below for tighter tolerances available per OTR options
Drive Level	50 μW is standard, customer may specify
Aging at 25°C	± 5 PPM per year is standard, customer may specify ± 1 PPM
Shunt Capacitance	7 pF maximum
Pullability	May be specified by customer in terms of frequency shift required over a certain range of load capacitance (e.g. +100 PPM from CL=12 to CL=18 pF) or as motional capacitance (f F)

Temperature Range	Tightest FS
-10 to +60°C	± 3 PPM
-20 to +70°C	± 5 PPM
-30 to +80°C	± 10 PPM
-40 to +85°C	± 20 PPM

Part Numbering Guide

Portions of the part number that appear after the frequency may not be marked on part (C of C provided)

UM1 B E - xx - 70.0M - XXX (Internal Code or blank)

Model (Height)
UM1: 8.1mm
UM4: 4.8mm
UM5: 6.0mm

Frequency in MHz

Load Capacitance
Parallel Resonance in pF (≥ 8 pF)
SR = Series Resonance

Cal Tol / Freq Stability
Blank = 30/50
B = 30/30
C = 15/30
D = 10/20 (consult factory)

Temperature Range / Package
Blank: 0 to +70°C
E: - 40 to +85°C
H: - 20 to +70°C
G: Gull Wing Surface Mount Package (UM1 only)

Consult factory for available frequencies and specs.
Not all options available for all frequencies. A special part number may be assigned.

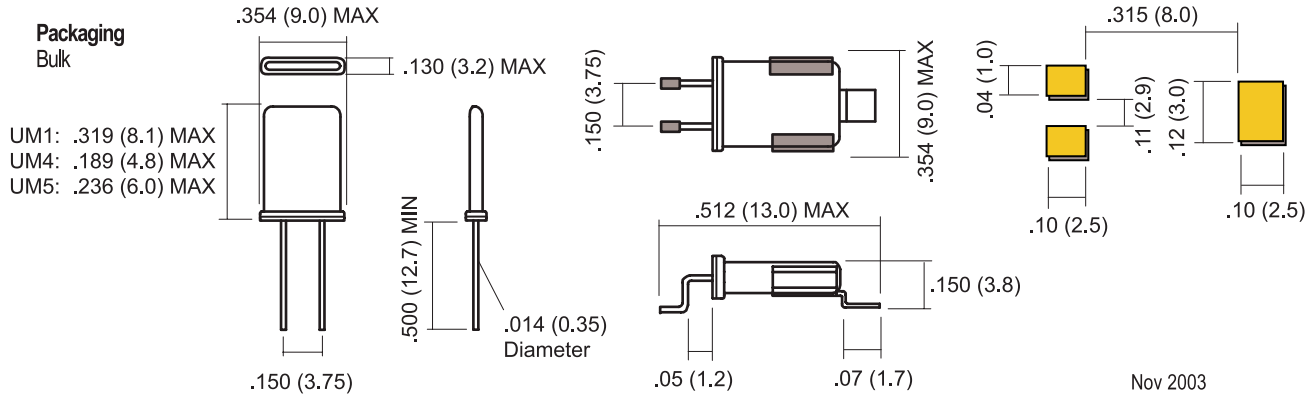
ESR Values

Oscillation Mode	Frequency Range (MHz)	Maximum ESR (Ohms)
Fundamental	10.000 – 14.999	60
AT Cut	15.000 – 37.000	35
3rd Overtone AT Cut	25.000 – 90.000	45
5th Overtone	60.000 – 150.000	100

Consult factory for lower ESR

Mechanical: inches (mm) not to scale Gull Wing - UM1G Solder Pads

Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



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Manufacturer of High Quality Frequency Control Products

10.7 MHz MONOLITHIC CRYSTAL FILTERS

Pletronics P/N	Channel Spacing	# of poles	Passband		Stopband				Ripple	Loss	Terminating Impedance	Package Code
			dB	kHz	dB	kHz	dB	kHz	dB	dB	Ω // pF // pF	
P10M8A		2	3	±3.75	18	±15.0			0.5	2.0	1600//4	A-3
P10M8B	12.5	4	3	±3.75	40	±12.5			1.0	2.5	1600//2.5//16	A-3X2
P10M8C	kHz	6	3	±3.75	45	±8.75	65	±12.5	2.0	3.5	1600//4	C-1
P10M8D		8	3	±3.75	60	±8.75	90	±12.5	2.0	4.0	1600//4	D-1
P10M8E		10	3	±3.75	75	±8.75	90	±10.5	2.0	5.0	1600//4	E-1
P10M12A		2	3	±6.0	20	±25.0			0.5	1.5	2500//2.5	A-3
P10M12B	20	4	3	±6.0	40	±20.0			1.0	2.0	2200//1.5//8	A-3X2
P10M12C	kHz	6	3	±6.0	50	±14.0	65	±20.0	2.0	3.0	3000//1.5	C-1
P10M12D		8	3	±6.0	65	±14.0	90	±20.0	2.0	3.5	3000//1.5	D-1
P10M15A		2	3	±7.5	18	±25.0			0.5	1.5	3000//2	A-3
P10M15B	25	4	3	±7.5	40	±25.0			1.0	2.0	3000//2//5.5	A-3X2
P10M15C	kHz	6	6	±7.5	45	±17.5	65	±25.0	2.0	2.5	3000//2	C-1
P10M15D		8	6	±7.5	60	±15.0	80	±20.0	2.0	3.5	3000//2	D-1
P10M15E		10	6	±7.5	75	±15.0	90	±17.5	2.0	4.0	3000//2	E-1
P10M30A		2	3	±15.0	18	±50.0			0.5	1.5	5000//0	A-3
P10M30B	50	4	3	±15.0	40	±50.0			1.0	2.0	5500//-1//0	A-3X2
P10M30C	kHz	6	6	±15.0	60	±45.0			2.0	2.5	5500//-1	C-1
P10M30D		8	6	±15.0	60	±30.0	80	±40.0	2.0	3.5	5500//-1	D-1
P10N15A	25	2	3	±7.5	18	±25.0			0.5	1.5	3000//2	A-4
P10N15B	kHz	4	3	±7.5	40	±25.0			1.0	2.0	3000//2//5.5	A-4X2

Pletronics, Inc.
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Manufacturer of High Quality Frequency Control Products

21.4 MHz MONOLITHIC CRYSTAL FILTERS (UM-1)

Pletronics P/N	Channel Spacing	# of poles	Passband		Stopband				Ripple	Loss	Terminating Impedance	Package Code
			dB	kHz	dB	kHz	dB	kHz	dB	dB	Ω // pF // pF	
P21U8A		2	3	±3.75	20	±18.0			0.5	2.0	850//6	A-5
P21U8B	12.5	4	3	±3.75	40	±14.0			1.0	2.5	850//4//16	A-5X2
P21U8C	kHz	6	3	±3.75	45	±8.75	65	±12.5	2.0	3.5	850//4	D-5
P21U8D		8	3	±3.75	60	±9.0	90	±12.5	2.0	4.0	850//4	D-5
P21U12A		2	3	±6.0	20	±25.0			0.5	1.5	1200//3	A-5
P21U12B		4	3	±6.0	40	±20.0			1.0	2.0	1200//2//10.5	A-5X2
P21U12C		6	3	±6.0	45	±14.0	65	±20.0	2.0	3.0	1200//2	D-5
P21U12D	20	8	3	±6.0	65	±14.0	90	±20.0	2.0	3.0	1200//2	D-5
P21U12E	kHz	10	3	±6.0	75	±14.0	90	±16.0	2.0	3.5	1200//2	E-5
P21U12CH		6	3	±6.0	45	±14.0	65	±20.0	2.0	3.0	1600//1.5	D-5
P21U12DH		8	3	±6.0	65	±14.0	90	±20.0	2.0	3.0	1600//1.5	D-5
P21U15A		2	3	±7.5	18	±25.0			0.5	1.5	1600//3	A-5
P21U15B	25	4	3	±7.5	40	±25.0			1.0	2.0	1600//2//7	A-5X2
P21U15C	kHz	6	6	±7.5	45	±17.5	65	±25.0	2.0	2.5	1600//2	D-5
P21U15D		8	6	±7.5	65	±17.5	90	±25.0	2.0	3.0	1600//2	D-5
P21U15E		10	6	±7.5	75	±16.0	90	±18.0	2.0	4.0	1600//2	E-5
P21U30A		2	3	±15.0	18	±50.0			0.5	1.5	2300//-1	A-5
P21U30B	50	4	3	±15.0	40	±50.0			1.0	2.0	2300//0.5//3	A-5X2
P21U30C	kHz	6	3	±15.0	45	±35.0	65	±50.0	2.0	2.5	2300//0.5	D-5
P21U30D		8	3	±15.0	65	±35.0	80	±50.0	2.0	3.0	2300//0.5	D-5

Pletronics, Inc.
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Manufacturer of High Quality Frequency Control Products

45 MHz MONOLITHIC FUNDAMENTAL CRYSTAL FILTERS

Pletronics P/N	Channel Spacing	# of poles	Passband		Stopband				Ripple	Loss	Terminating Impedance	Package Code
			dB	kHz	dB	kHz	dB	kHz	dB	dB	Ω // pF // pF	
P45U8AF	12.5	2	3	±3.75	10	±12.5	65	- 910	1.0	2.0	200//4	A-5
P45U8BF	kHz	4	3	±3.75	30	±12.5	90	±910	1.0	4.0	350//6//21	A-5X2
P45U8CF		6	3	±3.75	50	±12.5	90	±910	2.0	6.0	350//5	D-5
P45U12AF	20	2	3	±6.0	15	±20.0	65	- 910	1.0	2.0	500//5	A-5
P45U12BF	kHz	4	3	±6.0	35	±20.0	90	±910	1.0	3.0	500//4//12	A-5X2
P45U15AF		2	3	±7.5	15	±25.0	65	- 910	1.0	2.0	650//3	A-5
P45U15BF	25	4	3	±7.5	35	±25.0	90	±910	1.0	3.0	300//4//21	A-5X2
P45U15AG	kHz	2	3	±7.5	15	±25.0	65	- 910	1.0	2.0	350//1	A-5
P45U15BG		4	3	±7.5	35	±25.0	90	±910	1.0	3.0	650//3//9	A-5X2
P45U20AF		2	3	±10.0	15	±40.0	65	- 910	1.0	2.0	800//3	A-5
P45U20BF		4	3	±10.0	35	±40.0	90	±910	1.0	3.0	800//2//7	A-5X2
P45U30AF		2	3	±15.0	10	±50.0	65	- 910	1.0	2.0	1200//1.5	A-5
P45U30BF	50	4	3	±15.0	35	±50.0	90	±910	1.0	3.0	1200//1.5//4	A-5X2
P45U30AG	kHz	2	3	±15.0	10	±50.0	65	- 910	1.0	2.0	800//2	A-5
P45U30BG		4	3	±15.0	35	±50.0	90	±910	1.0	3.0	800//1//6	A-5X2

45 MHz MONOLITHIC 3rd OVERTONE CRYSTAL FILTERS

Pletronics P/N	Channel Spacing	# of poles	Passband		Stopband				Ripple	Loss	Terminating Impedance	Package Code
			dB	kHz	dB	kHz	dB	kHz	dB	dB	Ω // pF // pF	
P45U8A	12.5	2	3	±3.75	15	±14.0	35	- 910	1.0	2.0	3000//-0.5	A-5
P45U8B	kHz	4	3	±3.75	35	±14.0	80	- 910	1.0	4.0	3000//-0.5//0	A-5X2
P45U15A	25	2	3	±7.5	18	±28.0	35	- 910	1.0	2.0	4000//-1	A-5
P45U15B	kHz	4	3	±7.5	35	±25.0	80	- 910	1.0	3.0	4000//-1//-1	A-5X2
P45U20A		2	3	±10.0	15	±30.0	35	- 910	1.0	2.0	5000//-1	A-5
P45U20B		4	3	±10.0	35	±40.0	80	- 910	1.0	3.0	5000//-1//-1	A-5X2

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58.1125 MHz MONOLITHIC 3rd OVERTONE CRYSTAL FILTERS

Pletronics P/N	Channel Spacing	# of poles	Passband		Stopband				Ripple	Loss	Terminating Impedance	Package Code
			dB	kHz	dB	kHz	dB	kHz	dB	dB	Ω // pF // pF	
P58U15B	25	4	3	±7.5	35	±25.0	80	- 910	2.0	4.0	3000//-1//-0.5	A-5X2
P58U17B	kHz	4	3	±8.5	30	±25.0	80	- 910	2.0	4.0	3000//-1//-0.5	A-5X2

70 ~ 90 MHz MONOLITHIC 3rd OVERTONE CRYSTAL FILTERS

Pletronics P/N	Frequency MHz	# of poles	Passband		Stopband				Ripple	Loss	Terminating Impedance	Package Code
			dB	kHz	dB	kHz	dB	kHz	dB	dB	Ω // pF // pF	
P70U15A		2	3	±7.5	18	±30.0	35	- 910	1.0	2.0	2000//-1	A-5
P70U15B	70	4	3	±7.5	35	±25.0	80	- 910	1.0	3.0	2000//-1//-1	A-5X2
P70U20A		2	3	±10.0	15	±30.0	35	- 910	1.0	2.0	2500//-1	A-5
P70U20B		4	3	±10.0	35	±40.0	80	- 910	1.0	3.0	2500//-1//-1.5	A-5X2
P83U30B	83.16	4	3	±15.0	30	±50.0	80	- 910	1.0	3.0	5000//-1//-1	A-5X2
P90U15A		2	3	±7.5	18	±30.0	35	- 910	1.0	2.0	2000//-1	A-5
P90U15B		4	3	±7.5	35	±25.0	80	- 910	1.0	3.0	2000//-1//-1	A-5X2
P90U20A	90	2	3	±10.0	15	±30.0	35	- 910	1.0	2.0	2500//-1	A-5
P90U20B		4	3	±10.0	35	±40.0	80	- 910	1.0	3.0	2500//-1//-1.5	A-5X2
P90U30B		4	3	±15.0	30	±50.0	80	- 910	1.0	3.0	4000//-1//-1	A-5X2

26.05 MHz MONOLITHIC FUNDAMENTAL CRYSTAL FILTERS

Pletronics P/N	# of poles	Passband		Stopband				Ripple	Loss	Terminating Impedance	Package Code
		dB	kHz	dB	kHz	dB	kHz	dB	dB	Ω // pF // pF	
P26U15B	4	3	±7.5	40	±25.0	80	- 910	1.0	2.5	1600//2//5.5	A-5X2
P26U17B	4	3	±8.5	30	±25.0	80	- 910	2.0	4.0	1100//2//9	A-5X2

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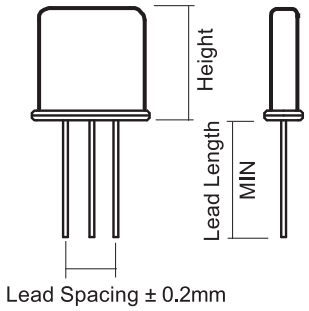
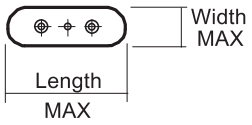
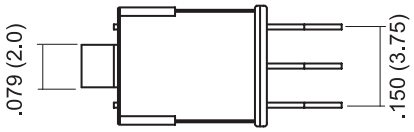
Crystal Filters Mechanical: inches (mm) not to scale

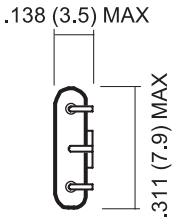
Due to part size and factory abilities, part marking may vary from lot to lot and may contain our part number or an internal code.



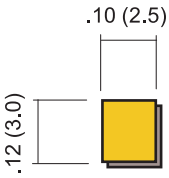
Package Code	Length	Width	Height	Lead Spacing	Lead Length	Lead Diameter	Holder
A-3	.437 (11.1)	.185 (4.7)	.441 (11.2)	.192 (4.88)	.79 (20.0)	.017 (.43)	HC-49/T
A-4	.437 (11.1)	.185 (4.7)	.394 (10.0)	.192 (4.88)	.79 (20.0)	.017 (.43)	HC-49/T1
A-5	.307 (7.8)	.126 (3.2)	.315 (8.0)	.148 (3.75)	.71 (18.0)	.014 (.35)	UM-1
A-8	.307 (7.8)	.126 (3.2)	.236 (6.0)	.148 (3.75)	.71 (18.0)	.014 (.35)	UM-5
A-9	.307 (7.8)	.126 (3.2)	.177 (4.5)	.148 (3.75)	.71 (18.0)	.014 (.35)	UM-4

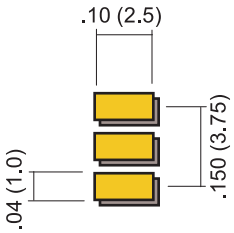


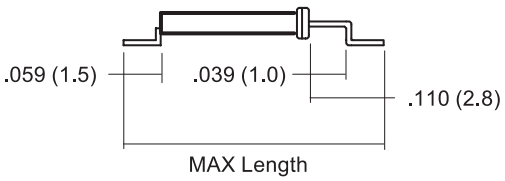




Solder Pads

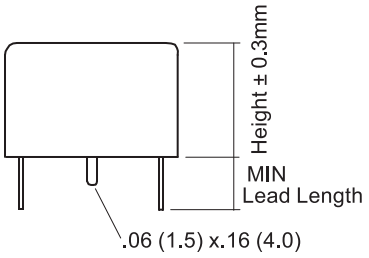


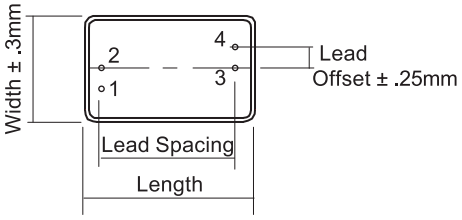




Surface Mount

Package Code	MAX Length
A-5/S	.488 (12.4)
A-8/S	.406 (10.3)
A-9/S	.354 (9.0)





Package Code	Length	Width	Height	Lead Spacing	Lead Offset	Lead Diameter
C-1	.591 (15.0)	.472 (12.0)	.591 (15.0)	.354 (9.0)	.100 (2.54)	.017 (.43)
D-1	.728 (18.5)	.472 (12.0)	.591 (15.0)	.528 (13.4)	.100 (2.54)	.017 (.43)
E-1	.906 (23.0)	.472 (12.0)	.591 (15.0)	.701 (17.8)	.100 (2.54)	.017 (.43)
D-5	.433 (11.0)	.335 (8.5)	.453 (11.5)	.291 (7.4)	.079 (2.0)	.012 (.30)
E-5	.528 (13.4)	.335 (8.5)	.453 (11.5)	.386 (9.8)	.079 (2.0)	.012 (.30)

Jan 2002

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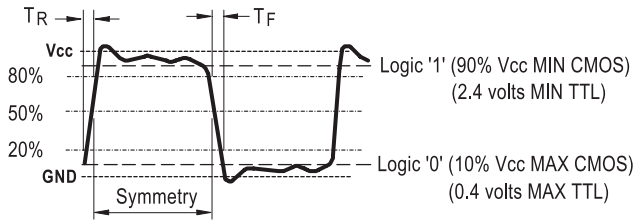
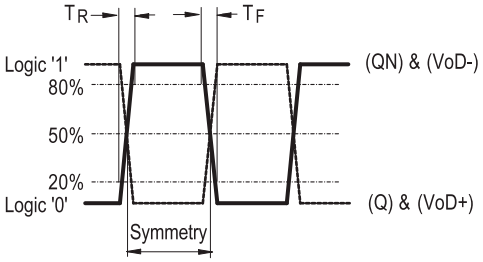
Waveforms and Test Circuits

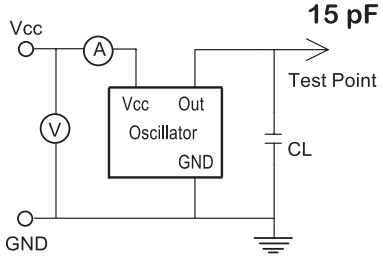
Waveform 1 (CMOS/ TTL)



Waveform 2 (PECL & LVDS)

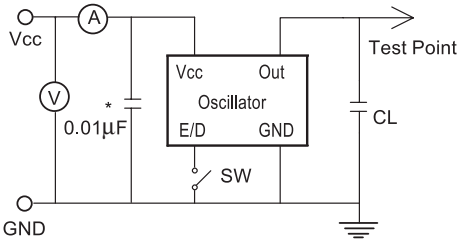


Test Circuit 1

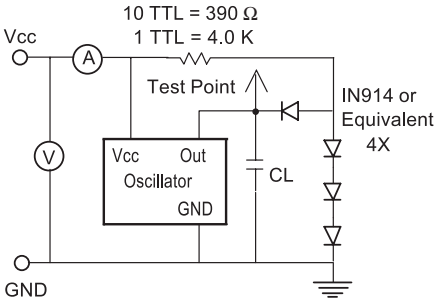


Test Circuit 2 & 3

15 pF CMOS Load

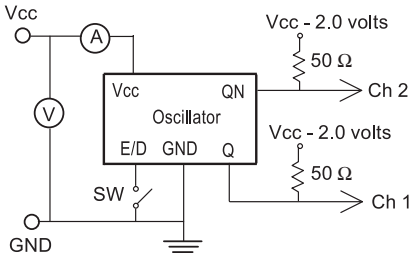


Test Circuit 4 (TTL Load)

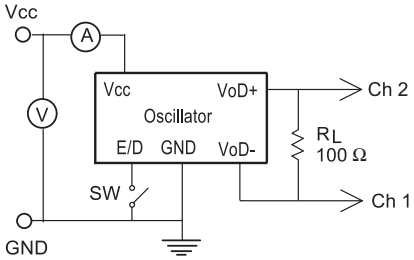


CL: Includes the input capacitance of oscilloscope.
*0.01µF external by-pass filter is recommended for Test Circuit 2
*Test Circuit 3 same as 2 with no external by-pass filter

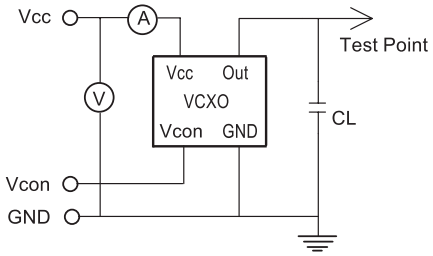
Test Circuit 5 (PECL Load)



Test Circuit 6 (LVDS Load)

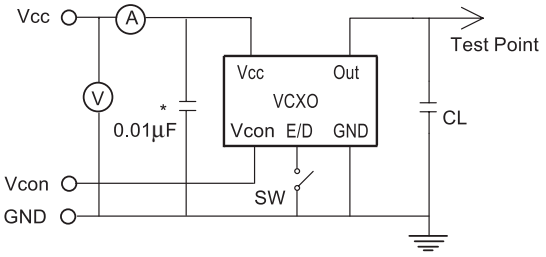


Test Circuit 7 (VCXO)



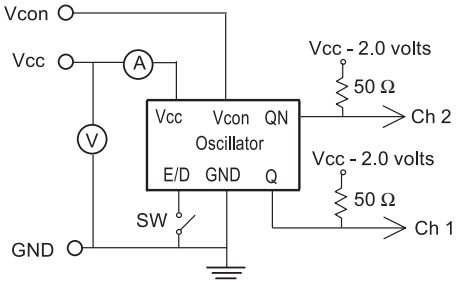
CL: Includes the input capacitance of oscilloscope.

Test Circuit 8 & 9 (VCXO)



CL: Includes the input capacitance of oscilloscope.
*0.01µF external by-pass filter is recommended for Test Circuit 9
*Test Circuit 8 same as 9 with no external by-pass filter

Test Circuit 10 (VCXO with PECL Load)



Feb 2002

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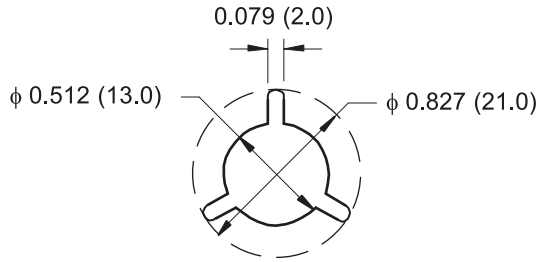
Tape and Reel Dimensions
Recommended Solder Flow Profile

Figure 1: Reel Hub **inches (mm)**



1. Pin 1 of device is toward sprocket side of tape
2. Reel size may vary from 178mm to 330mm diameter

Figure 2: 24mm Tape, 12mm Pitch

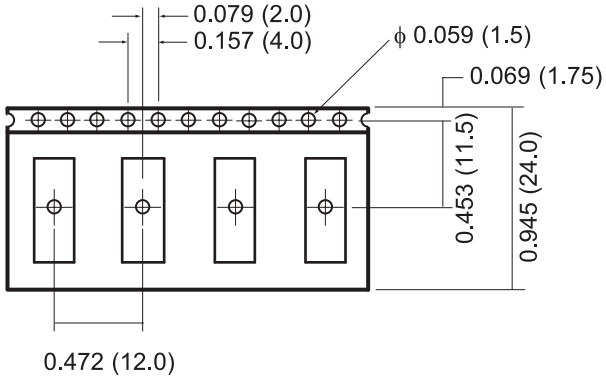


Figure 3: 24mm Tape, 16mm Pitch

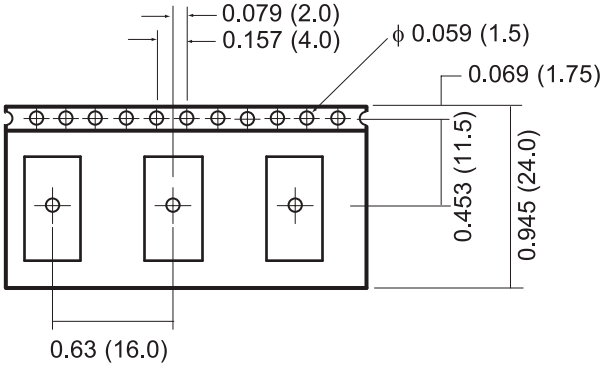


Figure 4: 16mm Tape, 8mm or 12mm Pitch

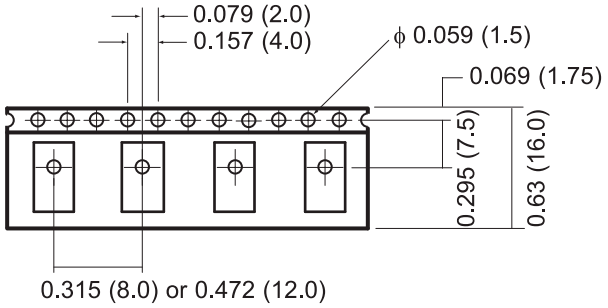
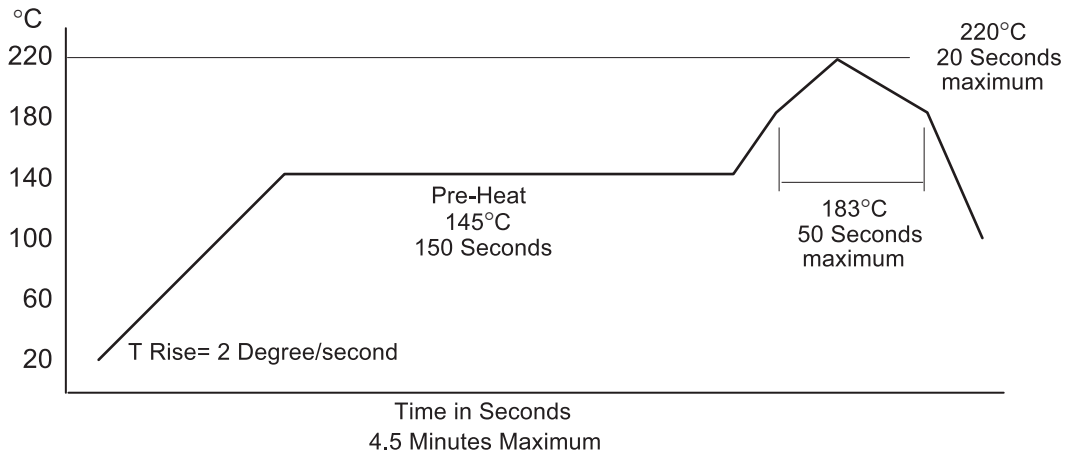


Figure 5: Recommended SN63 Solder Reflow Profile



Sep 2002

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OSCILLATOR CONSIDERATIONS FOR LOW EMI APPLICATIONS

Electromagnetic interference (EMI) is unwanted noise generated by electromagnetic energy. EMI can be coupled to electrical circuits by two mechanisms: by **Conduction,** through a current carrying conductor, and by **Radiation** as an electromagnetic wave transmitted through the air. With the advent of stricter regulations to decrease the amount of EMI emanating from electrical products, systems designers are challenged to reduce EMI at all levels.

One particular challenge to the system designer is minimizing EMI caused by the system clock oscillator. Since the clock signal is periodic by definition, a large pulse of EM energy at the clock frequency is generated during typical operation. Also, all of the harmonics of the clock frequency are also present, though with greater attenuation with increasing harmonic integer.

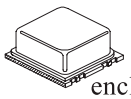
The following are 3 ways to reduce EMI in your clock oscillator.

1. Consider changing to a TTL clock output.
One simple approach to lower the EMI radiation from a clock pulse is to reduce the power of the pulse. During the rise of the wave pulse, a CMOS output is essentially a current source, and the voltage swing is fully rail-to-rail. Couple this to a rise time of a few nanoseconds and the result is a high concentration of energy at the clock oscillator frequency. The overshoot inherent in the CMOS output swing also causes undesirable harmonics of the clock frequency. Both conducted EMI on the oscillator output and radiated EMI is the result.

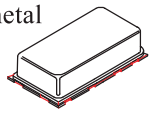
By contrast, a TTL output in the ON State will swing to a typical output voltage of a little over 3.0 volts maximum, with very little overshoot. The power of the frequency spike is thus attenuated; reducing the incidental radiated and conducted EMI. Pletronics offers the P1145 and ST2245 series with true TTL output.

2. Modified CMOS for Low EMI.
Many applications require the output to be CMOS only, so the TTL output solution mentioned above cannot be used. For this reason, Pletronics offers a proprietary, modified oscillator circuit if your application demands CMOS-only output compatibility (lower ringing noise). This design option reduces EMI by dissipating RF transmissions from electromagnetic energy into heat energy. The result is an attenuation of the peak EMI energy and significant reduction in pulse ringing. A comparison of 2 signals with and without the lower ringing noise modification is shown in Figures 1A and 1B.

3. Improve RF Shielding.
The old standard though-hole, metal DIP package affords the best EMI shielding, since the circuitry is fully enclosed in a continuous, ferrous metal structure. Neither plastic nor ceramic have sufficient susceptibility to provide the same level of RF shielding.



Pletronics now offers a DIP surface mount alternative (-SMD). The entire metal enclosure is mounted on a PCB. This affords the best RF shielding in a surface mountable package.



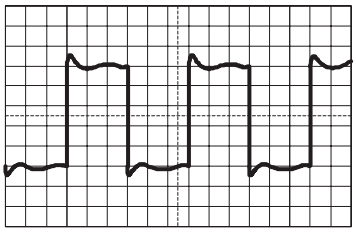


Figure 1A
Signal with overshoot at leading and trailing edges of wave train. Overshoot is responsible for increased power in the frequency spectra.

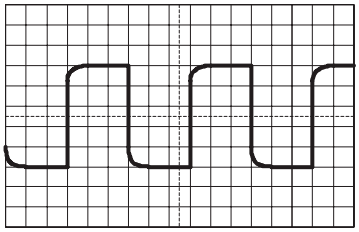


Figure 1B
Same signal employing a modified output circuit to attenuate the energy in the frequency spectra

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CRYSTAL OSCILLATORS FOR LOW JITTER APPLICATIONS

Short term instability in crystal oscillators is caused by unintentional modulation of the oscillator frequency. Random modulation or noise produced by a periodic signal due to small phase variations is considered jitter. Jitter can be observed by measuring the small variations of the output waveform period or by measuring the small variation of the phase of the output signal.

Data transmission systems such as SONET, Gigabit, Ethernet and Fibre Channel are demanding higher frequencies and smaller sizes. This has forced our competition to use phase lock loops (generating excessive noise) and SAW devices (with higher close-in noise) in their clock oscillators.

Pletronics has taken a new and different approach. The oscillators produced at Pletronics exhibit extremely small variations in phase and jitter. This is due to the in-house development of High-Q fundamental and 3rd overtone AT cut crystals up to 1 GHz. This direct frequency generation has allowed Pletronics to offer lower phase noise and lower jitter oscillators at higher output frequencies in a small size.

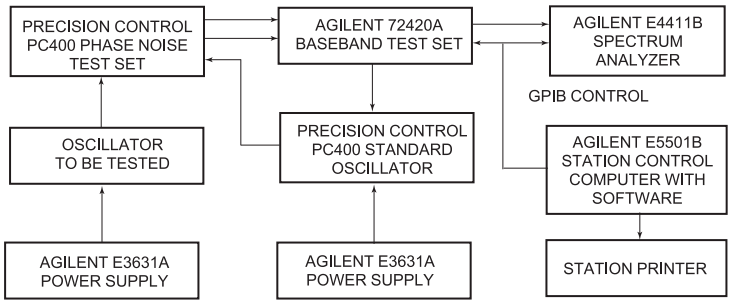
Due to the extremely low noise and jitter in Pletronics' oscillators, accurate measurement of noise becomes a challenge. Using a Timing Interval Analyzer to evaluate a transmission system in the time domain is very popular; however, using this method at the beginning of the frequency generation process has its limitations. The noise or jitter at the system reference oscillator, in many cases, is either at or below the threshold of the Timing Interval Analyzer. With the latest equipment, the limit of measurement is 1 pSecond (pS). This limitation is due to the trigger jitter of the analyzer.

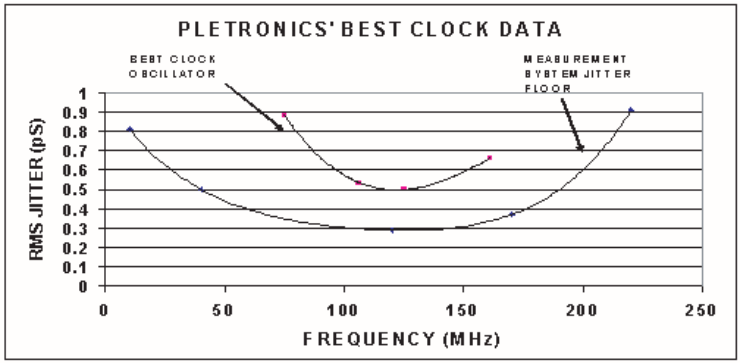
Pletronics measures noise in the frequency domain by observing the small variations in the output signal phase. The time domain Timing Interval Analyzer method is not used. Using the frequency domain method, the threshold of the measurement, when converted to jitter, is as low as 0.30 pS. This method allows Pletronics to measure and produce oscillators well below 1 pS. It also allows Pletronics to measure jitter in any bandwidth desired. Jitter can be calculated in any bandwidth between 0.1 Hz to 100 MHz.

In some high frequency oscillators, Pletronics uses direct mulitiplication. This multiplication does NOT use noisy phase lock loops. Only the sub-harmonics of the output frequency are present. Pletronics uses narrow bandpass filters to reduce the amplitude to approximately -40 dBc. Using this technique, the deterministic jitter is less than 5 pS. As higher frequency fundamental and 3rd overtone crystals are developed, direct multiplication is replaced and the deterministic jitter eliminated.

Pletronics measures phase noise using the two source method. The phase noise is integrated over the desired bandwidth and the jitter is calculated from the integrated noise. This method is regarded as the most accurate, allowing Pletronics to measure noise and jitter in the regions that are of most interest to the engineer designing the system. This method gives the engineer all the information needed, both in frequency and time domain.

Pletronics Phase Noise System





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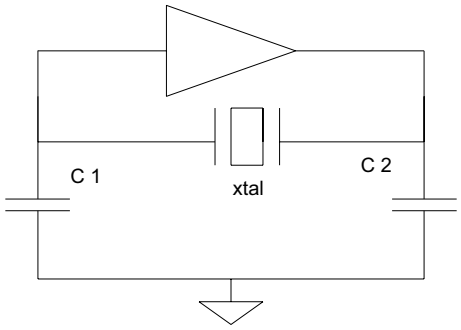
CRYSTAL LOAD CAPACITANCE EXPLAINED

The most common error in calculating load capacitance is in mistaking that the phase shift reactance network capacitors are the same as the crystal load capacitance, which is not correct.

The capacitors that the customer places on either side of the crystal and connected to ground provide the proper phase shift around the closed loop network, so that the gate input is in phase with the gate output (a necessary condition for sustained oscillation).

Referencing the circuit below, the following relationship can be used to determine the correct Cl to be used by the customer:



$$Cload = \frac{C_1 \bullet C_2}{C_1 + C_2} + C_{stray}$$

The difficulty is that the C stray value is dependent on the customer's application. Significant factors are the pin-to-pin capacitance of the microprocessor (or other digital device), the circuit trace layout and the distance between the oscillator input pins and the crystal. To a lesser degree, the PCB material and crystal grounding also should be considered. Unfortunately, measuring the stray capacitance is an extremely difficult proposition, as any measuring device tends to swamp out these small capacitance values.
Usually, it is much easier to ask the customer to try a crystal with a standard C load, and then adjust this C load value to correct the frequency.

In general, C stray ranges from 2 to 8 pF, so if the customer has absolutely no idea of what load capacitance to specify, the equation above can be solved knowing the values of C1, C2 and assuming a C stray of 5 pF. Therefore, if the customer is using a couple of 27 pF capacitors, the following calculation may be made:

$$Cload = \frac{27 \bullet 27}{27 + 27} + 5 \quad Cload = \frac{729}{54} + 5 \quad Cload = 13.5 + 5 = 18.5\,pF$$

For this example, you would recommend a load capacitance of 18 pF.

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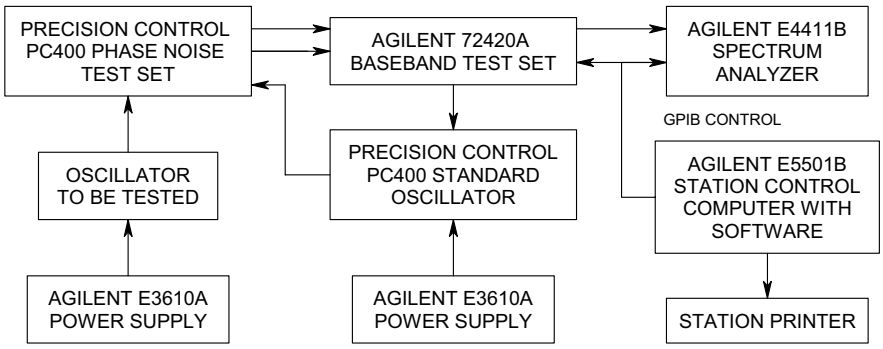
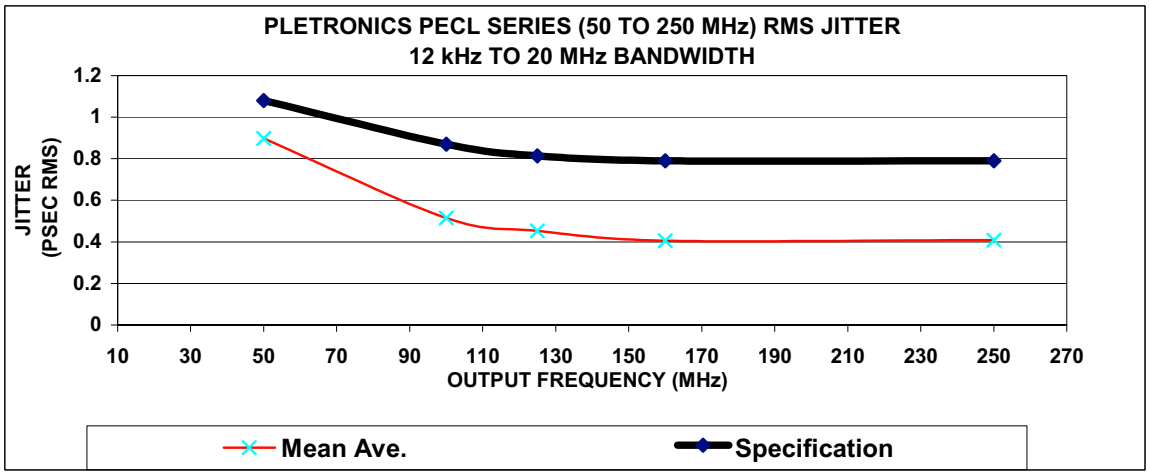
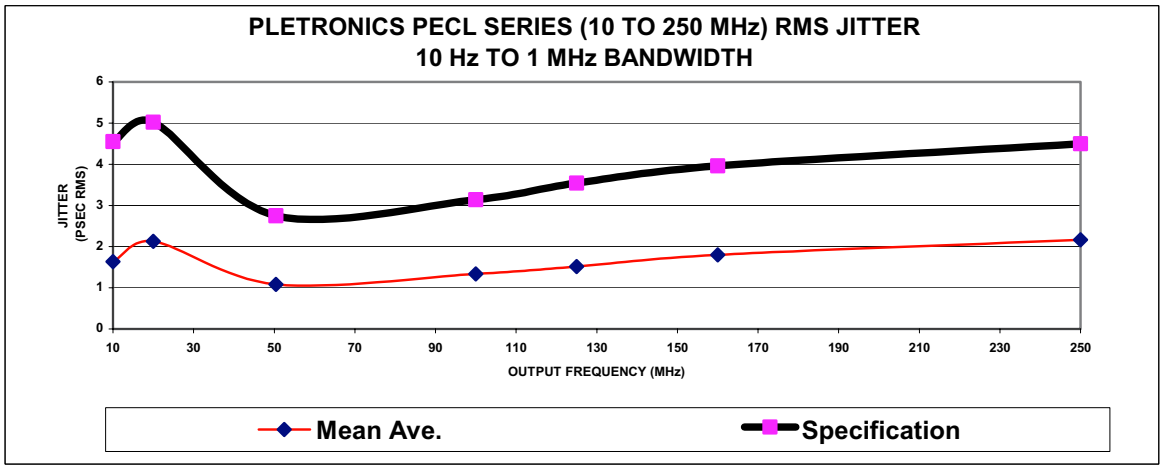
PLETRONICS PHASE NOISE AND JITTER

PHASE NOISE TEST BLOCK DIAGRAM

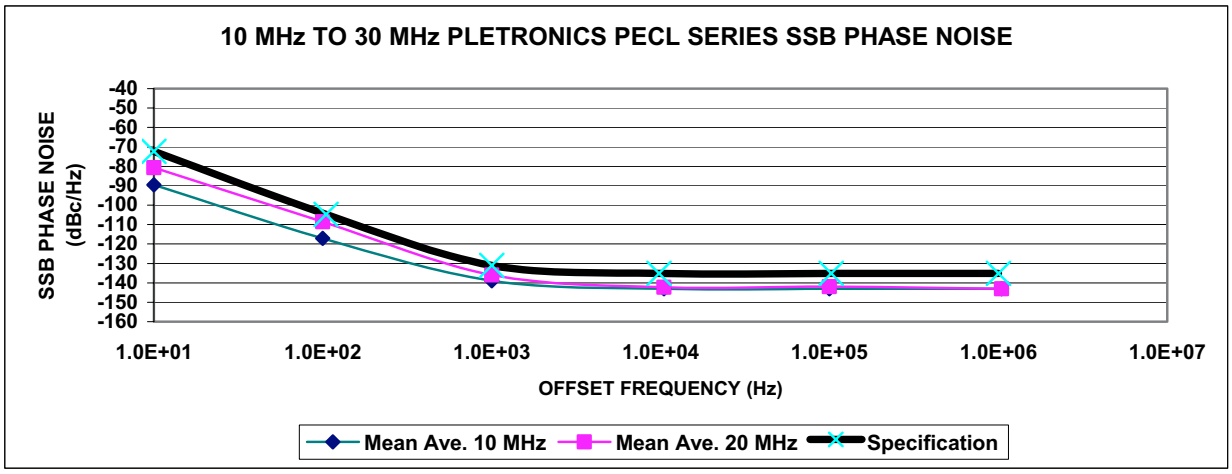


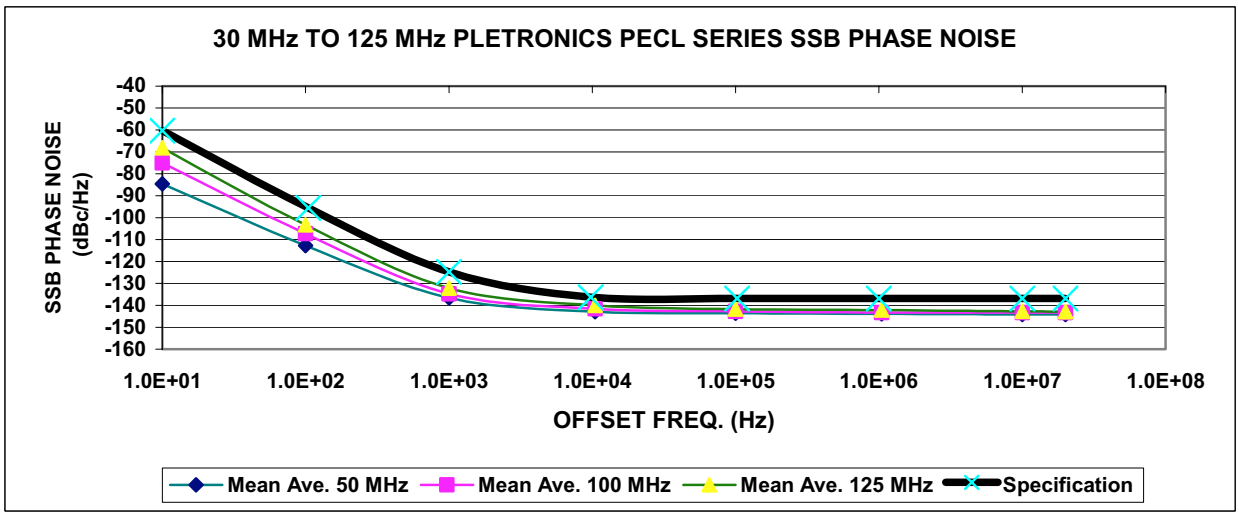
PECL Calculated Jitter Curves

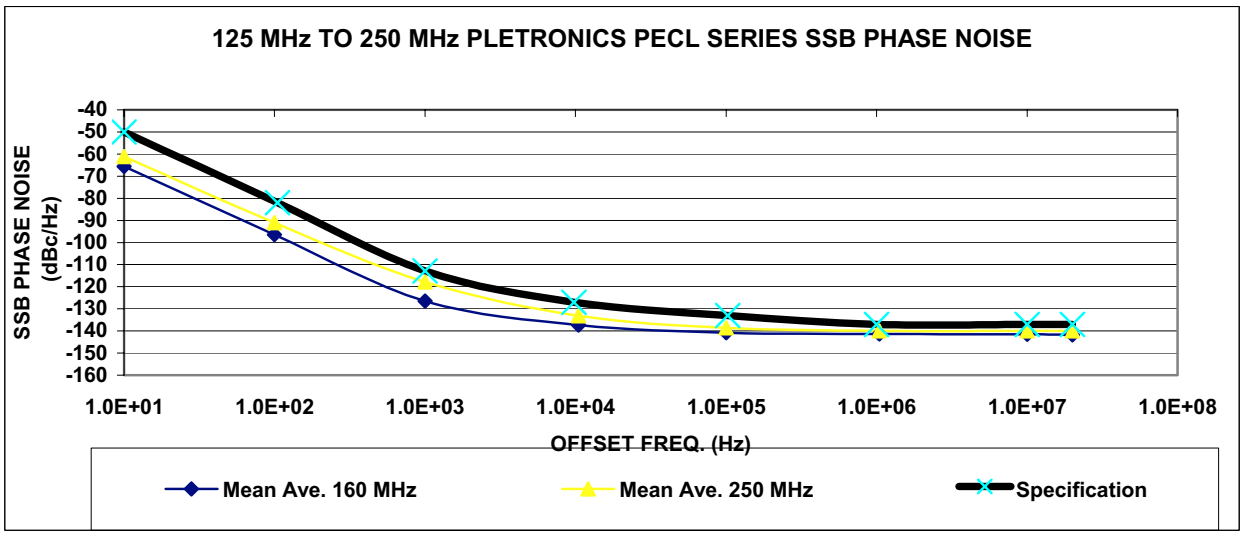




PECL Phase Noise Curves







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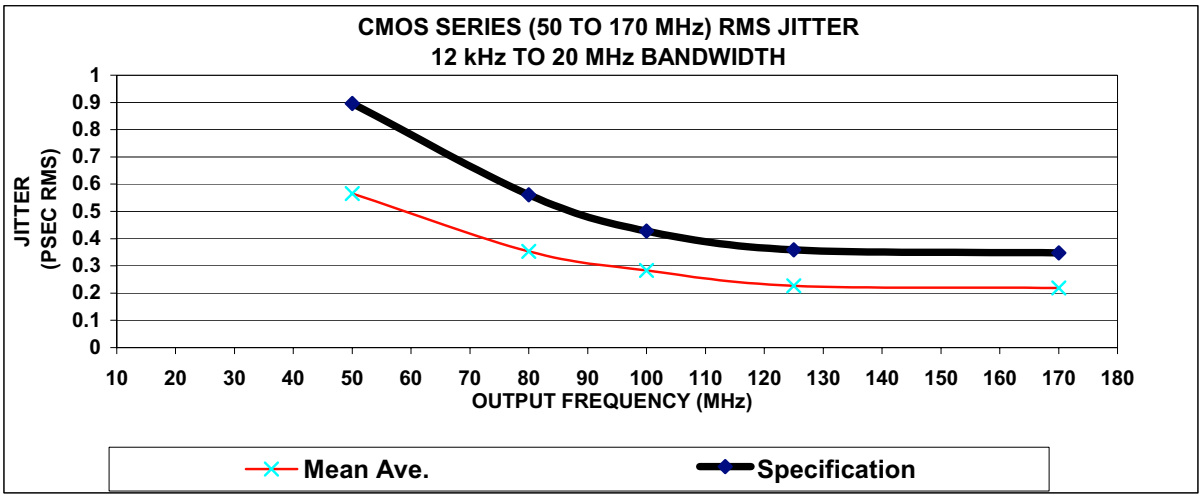
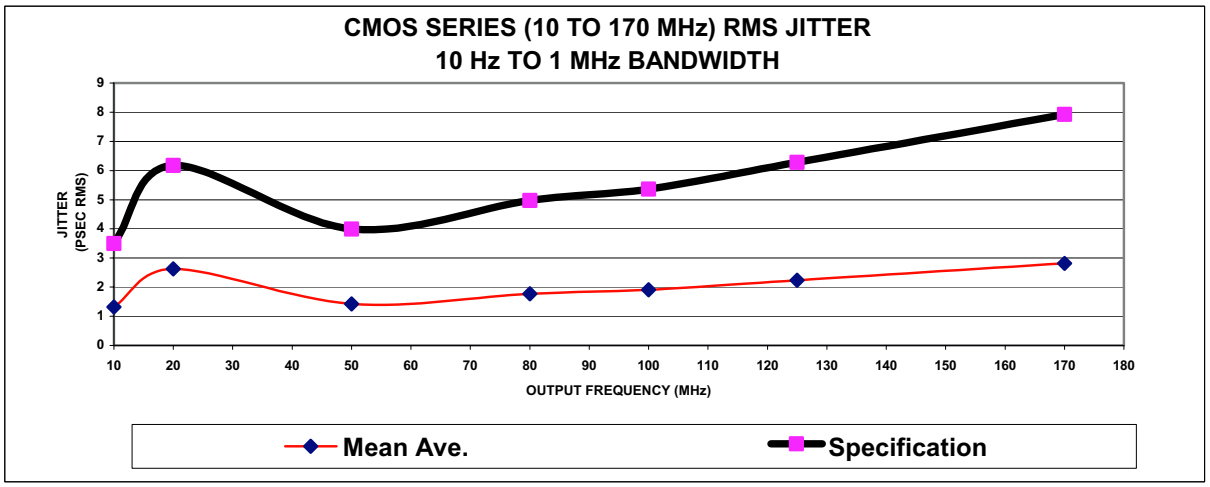
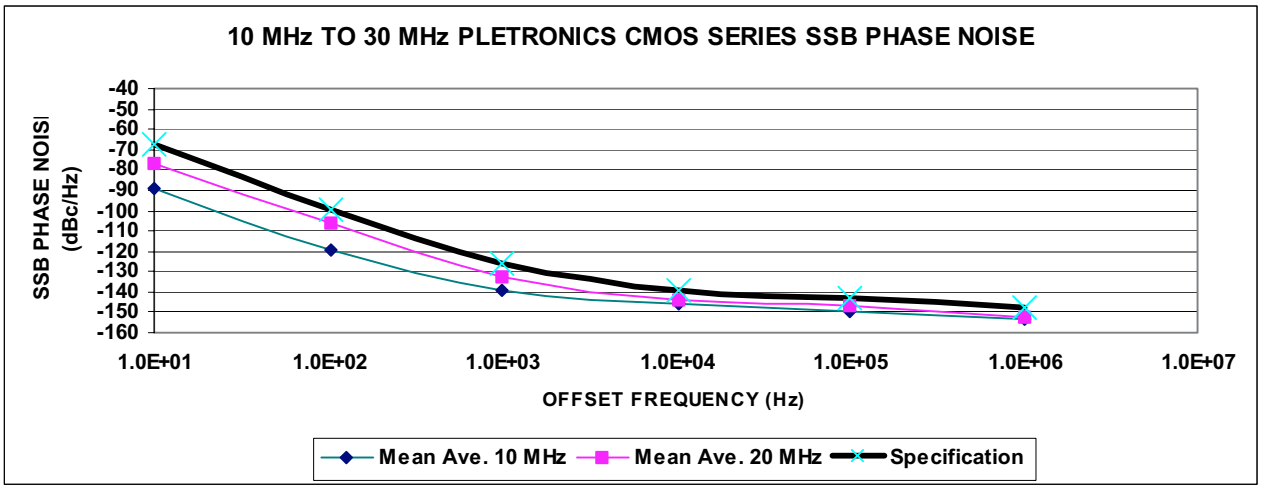
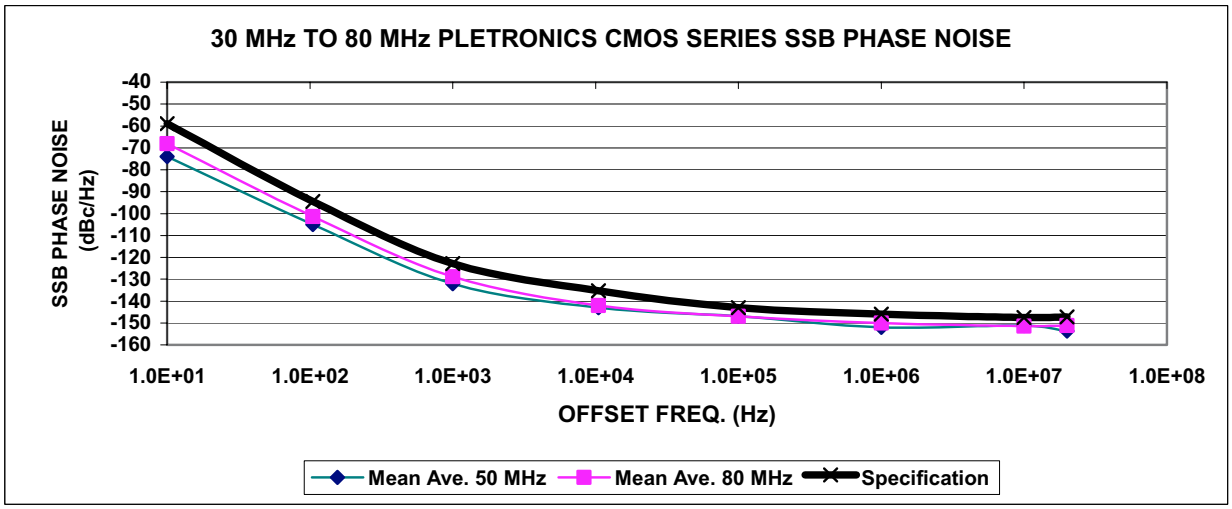
CMOS Calculated Jitter Curves

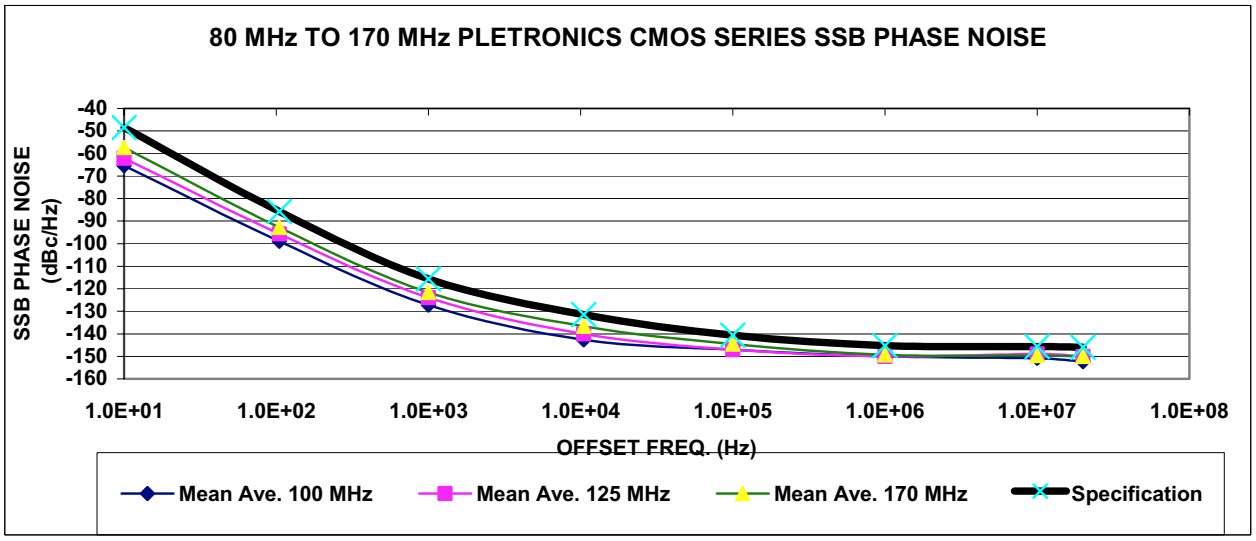




CMOS Phase Noise Curves







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Fundamental Differences Between Pletronics 3rd Overtone AT-Cut Crystal Oscillators and SAW Oscillators

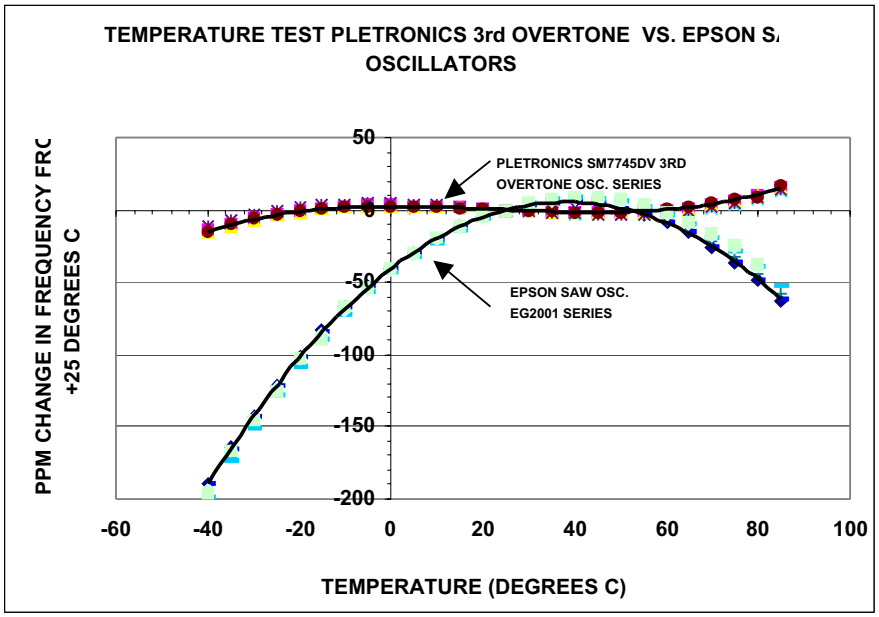
A study was conducted to determine basic fundamental differences in the parameters of both the 3rd overtone oscillator and the SAW oscillator. These parameters are extremely important in many communications systems. Two popular frequencies were chosen for this study, 106.25 MHz and 125.00 MHz.

Oscillators with a 3rd overtone AT-cut quartz crystal resonator have an output spectrum similar to oscillators with a SAW resonator; they both resonate at the output frequency. Both output spectrums do ***not*** contain sub-harmonics due to multiplication or have excessive noise due to internal phase locking.

The fundamental differences between the two resonators are the Q and the frequency-temperature coefficient. The quartz crystal resonator Q is higher and the frequency drift over temperature lower than the SAW resonator. These differences produce the following results:

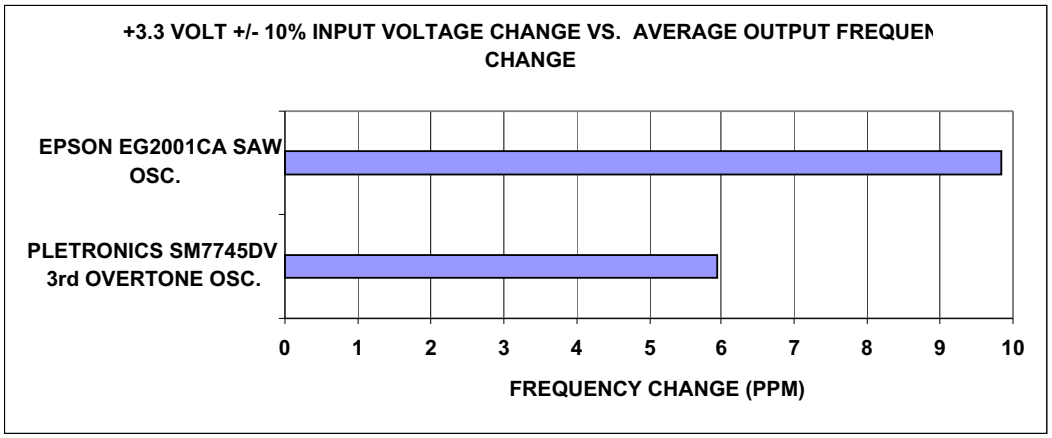
FREQUENCY STABILITY OVER THE OPERATING TEMPERATURE RANGE

The 3rd overtone AT-cut resonator frequency verses temperature characteristic follows a cubic third order curve. The SAW resonator has a frequency verses temperature curve that follows the shape of a parabola over the operating temperature range. This parabola shape for the SAW oscillators produces a very fast frequency slope at both the lower and upper ends of the operating temperature. The SAW oscillators from – 40 to +85°C are 661.21% worse than the 3rd overtone quartz oscillators. Over the temperature range of –20 to +70°C, the SAW oscillators are 305.43% worse.



OUTPUT FREQUENCY SENSITIVITY TO CHANGE OF INPUT VOLTAGE

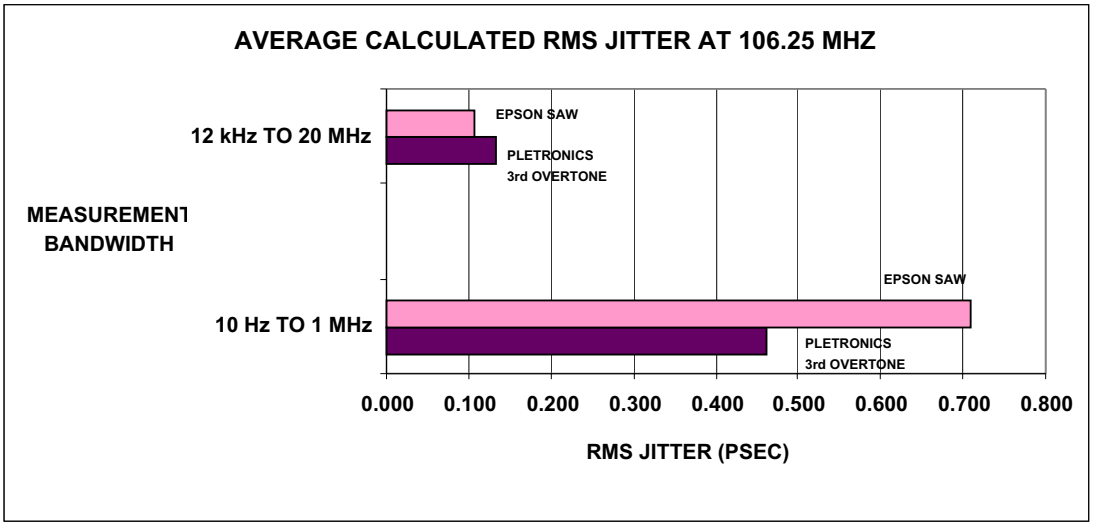
Because of the lower Q of the SAW resonator, the power supply frequency-pushing factor is 65.7% worse for the SAW oscillators than it is for the 3rd overtone oscillators. This is very important in systems that have low-level noise and ripple modulating the input voltage supply that powers the oscillator. If low frequency noise is present, it has a direct effect on the phase noise and jitter by modulating the output of the oscillator.



RMS JITTER

When the RMS jitter was calculated for the 106.25 MHz oscillators, in the 10 Hz to 1 MHz bandwidth, the SAW oscillators were 53.25% worse, and for the 125.00 MHz oscillators, they were 69.16% worse than the 3rd overtone oscillators. The better jitter for the 3rd overtone oscillators is a direct result of the higher Q of the quartz resonator.

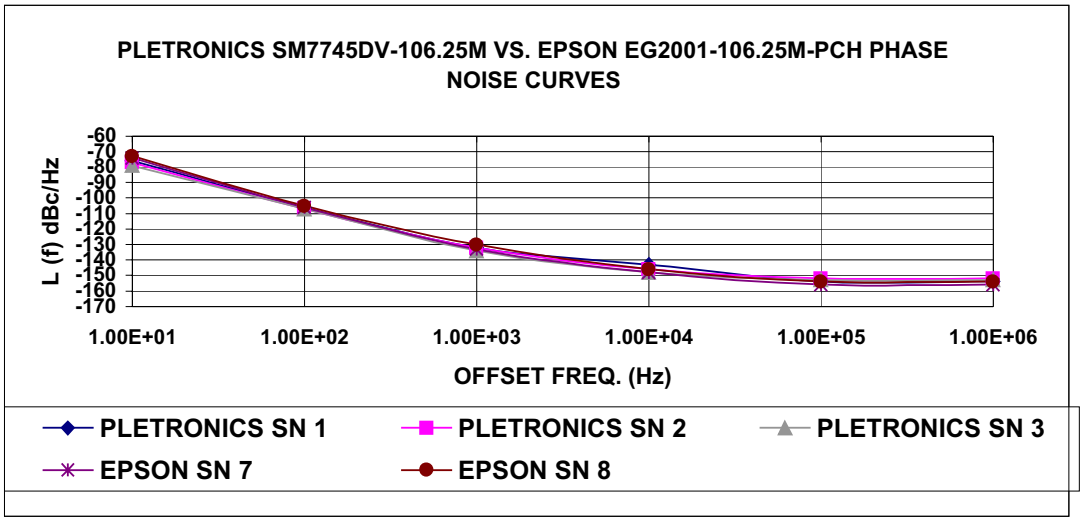
The RMS jitter in the 12 kHz to 20 MHz bandwidth, the SAW is 25.23% better for the 106.25 MHz oscillators and 16.57% worse for the 125.00 MHz oscillators as compared with the 3rd overtone oscillators. This difference is related to the phase noise floor of each oscillator's output gate.

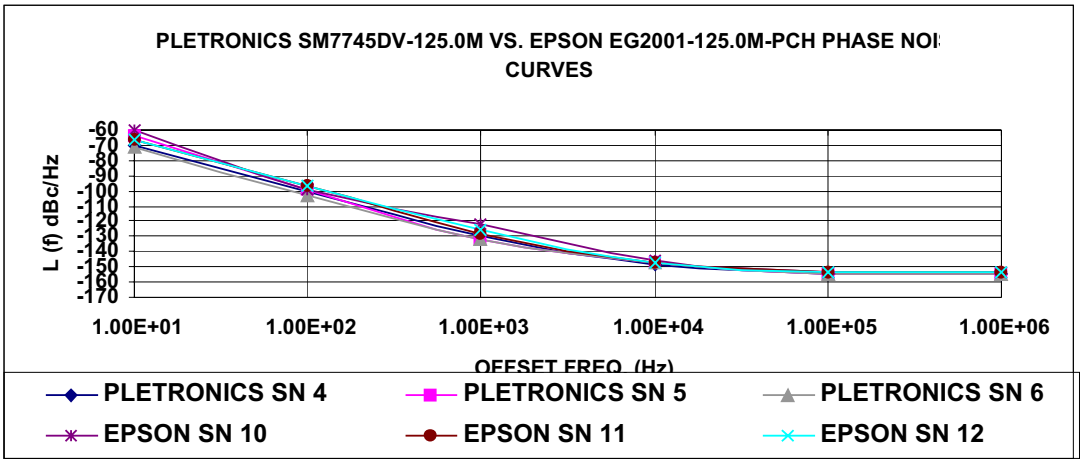


PHASE NOISE

Resonator Q has a direct effect on the in-close phase noise. The higher Q factor of the 3rd overtone resonator yields a lower phase noise spectrum. The average phase noise at 10 Hz offset of the 3rd overtone oscillators is 3.83 dB better for the 106.25 MHz output and 4.67 dB better for the 125.00 MHz output as compared to the SAW oscillators. The RMS jitter, in the 10 Hz to 1 MHz bandwidth, is largely influenced by the noise from 10 Hz to 100 Hz offset. This lower close-in phase noise of the 3rd overtone oscillators yields a lower RMS jitter than the SAW oscillators.

Phase noise in the 12 kHz to 20 MHz bandwidth produced different results for the 106.25 MHz and the 125.00 MHz oscillators. The noise floor for the 106.25 MHz SAW oscillators was 2.0 dB better than the 3rd overtone oscillators, however, for the 125.00 MHz oscillators it was 1.34 dB worse. The phase noise floor for an oscillator, with a square wave output, is largely due to the noise produced by the output gate in each oscillator, not the resonator Q.





Pletronics, Inc.
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Manufacturer of High Quality Frequency Control Products

Conclusion:
Pletronics 3rd Overtone Oscillators
vs.
SAW Oscillators

CHARACTERISTIC	SAW *Better* than 3rd OT AT-Cut By	SAW *Worse* than 3rd OT AT-Cut By
Supply Voltage vs. Frequency Change		65.70%
Frequency Stability vs. Temperature		
-40 to +85°C		661.21%
-20 to +70°C		305.43%
Jitter Related Phase Noise at 10 Hz Offset		
106.25 MHz		3.83 dB
125.0 MHz		4.67 dB
Total Integrated Phase Noise		
106.25 MHz		
10 Hz to 1 MHz Bandwidth		3.4 dB
12 kHz to 20 MHz Bandwidth	2.0 dB	
125.0 MHz		
10 Hz to 1 MHz Bandwidth		4.27 dB
12 kHz to 20 MHz Bandwidth		1.34 dB
RMS Jitter		
106.25 MHz		
10 Hz to 1 MHz Bandwidth		53.25%
12 kHz to 20 MHz Bandwidth	25.23%	
125.0 MHz		
10 Hz to 1 MHz Bandwidth		69.16%
12 kHz to 20 MHz Bandwidth		16.57%

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Request for Quote or Sample

Attention:	Distributor Sales	☐	Donna	☐	Don	☐		Date
	OEM Sales	☐	Joey	☐		☐		

Rep/Distributor Information		
Company		
Name		
Address		
City, St, Zip		
Phone, Fax		
email		
Ship Directly to Customer?		
Engineering Part Needed?		

Customer Information		
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Application		
Project		
Potential/EAU		

Quote Needed

Pletronics Part Number	Customer Part Number	Quantities to Quote

Samples Needed

Samples are shipped UPS GND unless account number provided (PLEASE – no 3rd party numbers)

Account Number:	

Pletronics Part Number	Customer Part Number	Qty	Ship Date from Pletronics

Jan 2003