ClearClock™ | Ultra-Low Jitter & Power Optimized 3.2 x 2.5 mm XO

AX3

ESD Sensitive

3.2 x 2.5 x 1.0 mm
RoHS/RoHS II Compliant
MSL = 1

Features

- Exceptionally Low RMS Jitter: < 80fs Typ (150fs Max @ 156.25MHz)
- Available in industry standard frequencies between 100MHz and 200MHz
- Lowest power consumption in its class (16mA Typ LVDS @ 156.25MHz)
- ±25ppm stability over industrial operating temperature (-40 to +85ºC)
- 3.3V, 2.5V, 1.8V supply voltage options
- LVPECL, LVDS, HCSL differential outputs
- Industry standard 3.2 x 2.5 x 1.0 mm footprint
- Available in Abracon's Global Distribution Network

Applications

- PCI Express
- 10G/40G/100G optical Ethernet
- Networking & communication
- RF systems, base stations (BTS)
- Data center
- Test & measurement

Options and Part Identification [Note 1]

AX3 ☐ ☐ ☐ ☐ — ☐ ☐

(1): Output
- P: LVPECL
- D: LVDS
- H: HCSL

(2): V_{dd}
- A: 3.3V
- B: 2.5V
- C: 1.8V (*)

(*) Excluding LVPECL

(3): Stability over OTR
- D: ±15ppm over -20°C to +70°C
- F: ±25ppm over -40°C to +85°C

(4): OE Function
- 1: OE Pin 1; Active High
- 2: OE Pin 1; Active Low
- 3: OE Pin 2; Active High
- 4: OE Pin 2; Active Low

(5): Output Frequency in MHz

Please specify the frequency in units of MHz out to **4 digit** accuracy after the decimal.
Example: "156.2500"=156.25MHz

(6): Packaging
- Blank: Bulk*
- T: Tape & Reel 1,000 units
- T3: Tape & Reel 3,000 units

(*) MOQ: 250 units

Part Number Example:

AX3PAD1-156.2500T

Note 1: Contact Abracon for non-standard configurations and/or requests with carrier frequency callouts up to 5 & 6 digit accuracy after the decimal.

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RoHS/RoHS II Compliant
MSL = 1

Electrical Characteristics

Parameters			Min.	Typ.	Max.	Unit	Notes
Frequency Range			100		200	MHz	
Supply Voltage (V_{dd}) [Note 2]			2.97	3.3	3.63	V	Option A
			2.37	2.5	2.62		Option B
			1.71	1.8	1.89		Option C
Supply Current (I_{dd})	LVPECL			30	50	mA	Max. @ 200MHz; 3.3V
	LVDS			16	27		Max. @ 200MHz; 3.3V
	HCSL			17	30		Max. @ 200MHz; 3.3V
Operating Temperature Range			-20		+70	°C	Option "D"
			-40		+85		Option "F"
Storage Temperature			-55		+150	°C	
Frequency Accuracy (Initial Set-Tolerance) at time of shipment (Pre-Reflow) @ +25°C			-10	< ±5	+10	ppm	Relative to carrier
Frequency Stability over Operating Temperature Range (Relative to Post Reflow Frequency)			-15		+15	ppm	Over -20°C to +70°C
			-25		+25		Over -40°C to +85°C
Aging over 20 Year Product Life [Note 3, 4]			-15		+15	ppm	
All-Inclusive Frequency Accuracy (Total Stability) over 20 Year Product Life [Note 3]			-40		+40	ppm	Over -20°C to +70°C
			-50		+50		Over -40°C to +85°C
Rise (Tr) / Fall (Tf) Time (20% to 80% V_{pp})				300	500	ps	20% to 80% V_{pp}
Duty Cycle			45		55	%	
Startup Time [Note 3]				< 2	5	ms	
Output High Voltage (V_{OH}) Output Low Voltage (V_{OL})	LVPECL	V_{OH}	V_{dd}-1.03		V_{dd}-0.60	V	50Ω to V_{dd}–2.0V or Thevenin equivalent
		V_{OL}	V_{dd}-1.85		V_{dd}-1.60		
	LVDS	V_{OH}		1.40	1.60		100Ω between OUT-P and OUT-N
		V_{OL}	0.9	1.10			
	HCSL	V_{OH}	0.66	0.74	0.85		50Ω to Ground
		V_{OL}	-0.15	0	0.15		
Output Enable & Disable Control			0.7*(V_{dd})			V	Output Enable; or No Connect
					0.3*(V_{dd})		Output Disable; High Impedance
Output Enable Time					10	ms	
Output Disable Time					0.2	µs	
Output Disable Current Consumption					< 10	µA	OE ≤ 0.3V
RMS Phase Jitter (12kHz-20MHz BW)				≤ 75	150	fs	@156.25MHz, 3.3V, LVPECL

Note 2: Supply Voltage (V_{dd}) = 1.8V option not available with LVPECL output
Note 3: Relative to initial measured frequency @ +25°C
Note 4: Includes temperature stability, initial frequency accuracy, load pulling, power supply variation, and 20 year aging

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MSL = 1

RMS Phase Jitter (12kHz -20MHz BW) | V_{dd} = 3.3V

Frequency (MHz)	Output	RMS Jitter	
		Typ. (fs)	Max (fs)
100	HCSL	153	200
	LVPECL	211	300
	LVDS	304	500
114.285	LVPECL	264	500
	LVDS	239	500
122.88	HCSL	122	200
	LVPECL	228	300
	LVDS	198	300
125	HCSL	138	200
	LVPECL	91	150
	LVDS	186	300
148.5	LVPECL	154	200
	LVDS	158	200
150	LVPECL	154	200
	LVDS	153	200
155.52	LVPECL	121	150
156.25	HCSL	113	150
	LVPECL	75	150
	LVDS	115	150
200	LVDS	70	150

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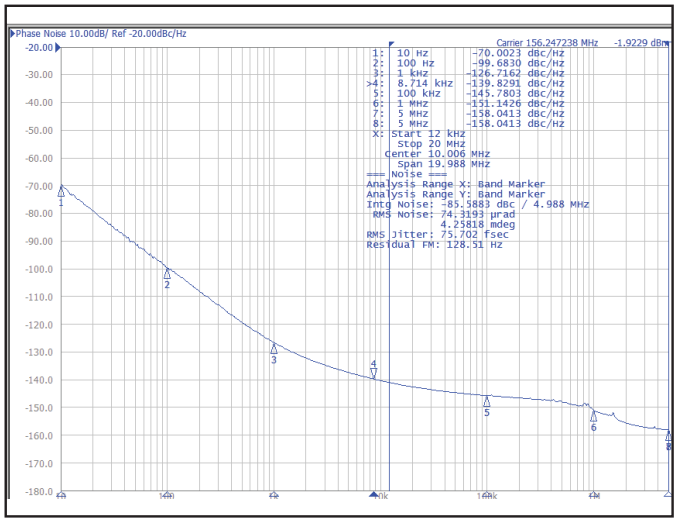
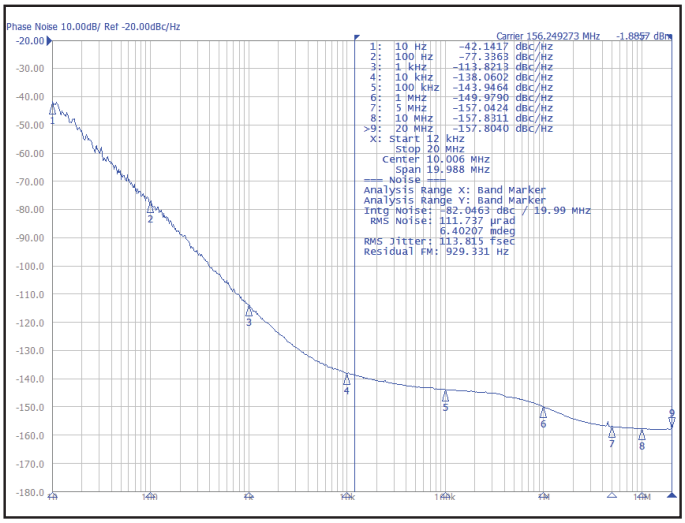
Phase Noise Test Setup [Note 5]

- Keysight E5052B Signal Source Analyzer
- Integration Bandwidth = 12kHz to 20MHz
- Spurious Activity (entire plot trace) = Not Omitted (Normalized in dBc/Hz)
- Specifed Spur Omission Function = Not Enabled
- IF Gain = 20dB
- Correlation = 5
- Average = 3

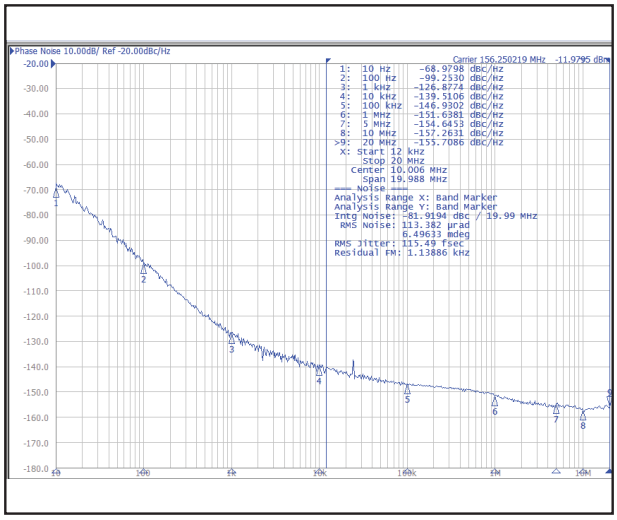
F=156.2500MHz | V_{dd}=3.3V | LVPECL
RMS Phase Jitter = 75 fs



F=156.2500MHz | V_{dd}=3.3V | HCSL
RMS Phase Jitter = 113 fs



F= 156.2500MHz | V_{dd}=3.3V | LVDS
RMS Phase Jitter = 115 fs



Note 5: Contact Abracon for phase noise plots at any desired combination of V_{dd}, differential output format, and carrier frequency within the available range

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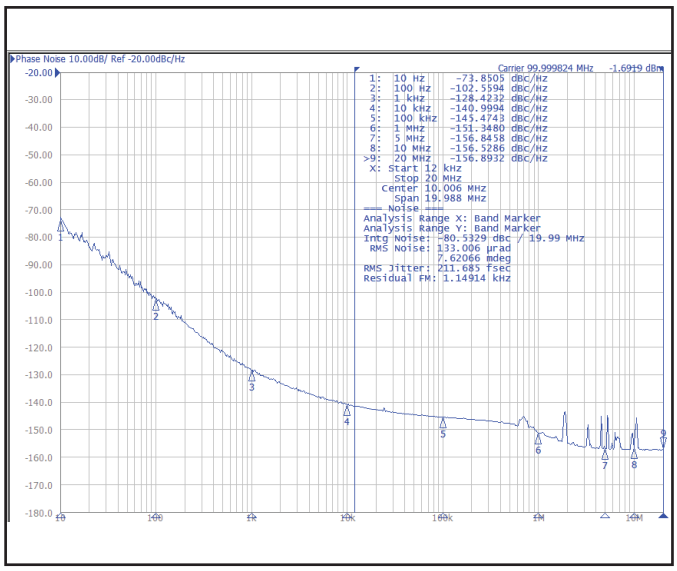
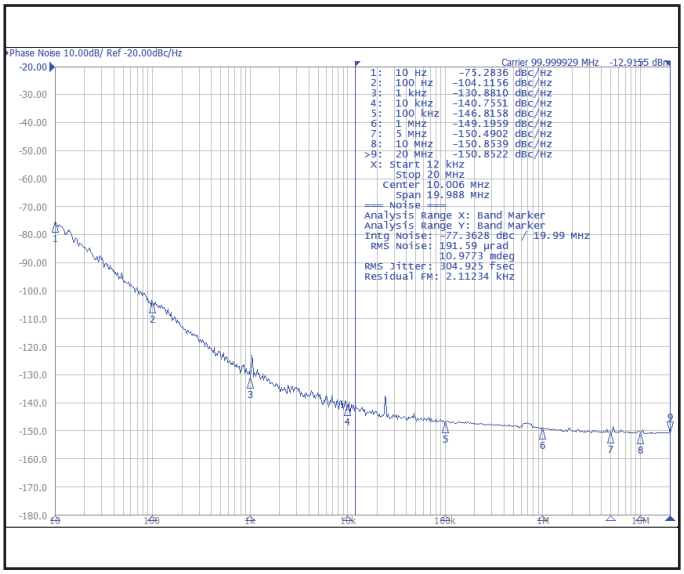
MSL = 1

Representative Phase Noise Plots

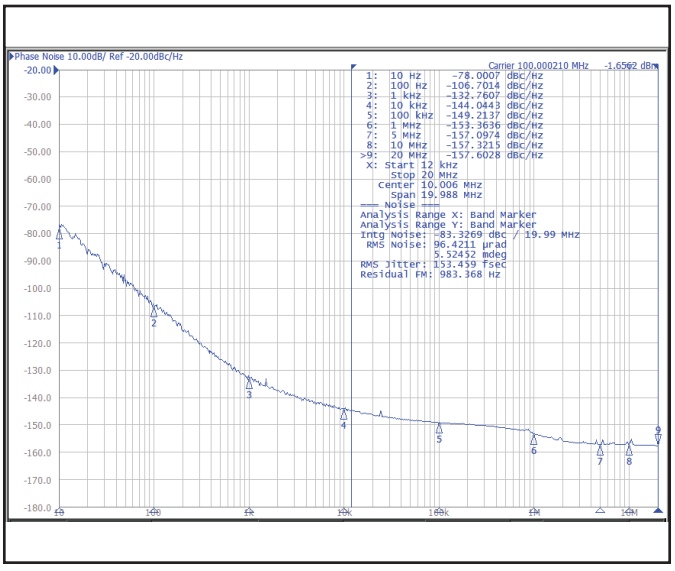
F=100.0000MHz | V_{dd}=3.3V | LVPECL
RMS Phase Jitter = 211 fs



F= 100.0000MHz | V_{dd}=3.3V | LVDS
RMS Phase Jitter = 304 fs



F= 100.0000MHz | V_{dd}=3.3V | HCSL
RMS Phase Jitter = 153 fs



Note 5: Contact Abracon for phase noise plots at any desired combination of V_{dd}, differential output format, and carrier frequency within the available range

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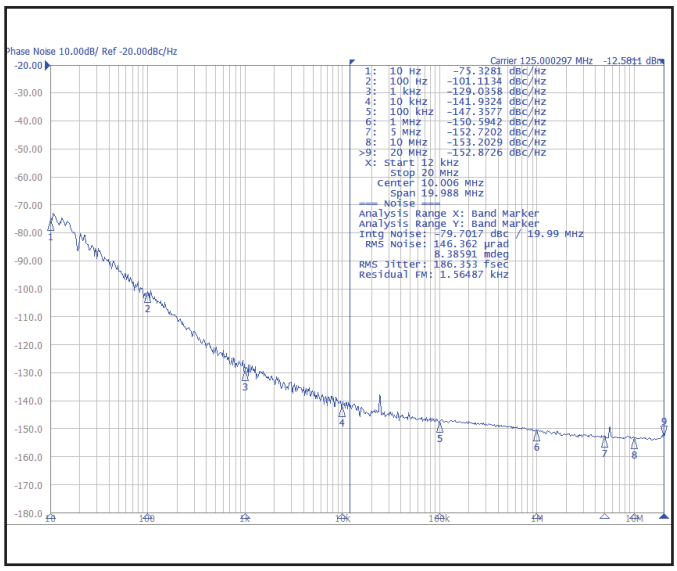
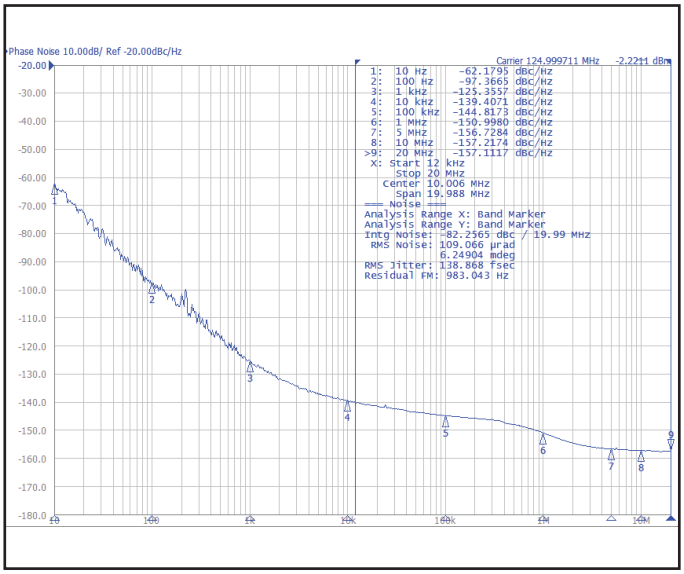
Representative Phase Noise Plots Continued

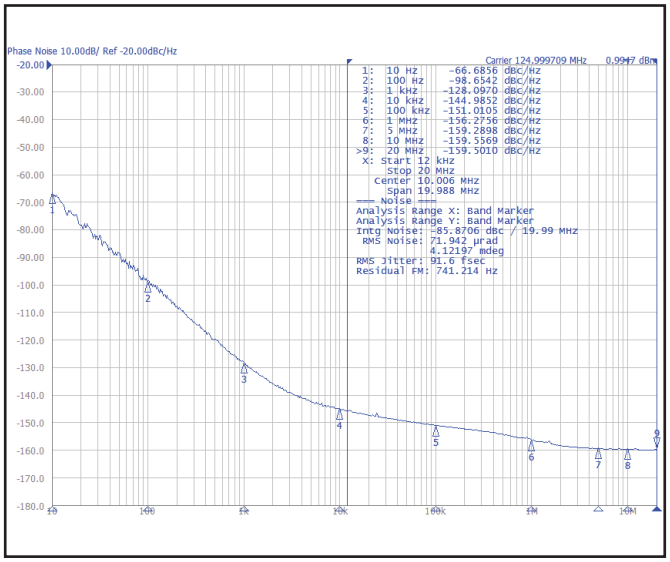
F=125.0000MHz | V_{dd}=3.3V | LVDS
RMS Phase Jitter = 186 fs



F= 125.0000MHz | V_{dd}=3.3V | HCSL
RMS Phase Jitter = 138 fs



F= 125.0000MHz | V_{dd}=3.3V | LVPECL
RMS Phase Jitter = 91 fs



Note 5: Contact Abracon for phase noise plots at any desired combination of V_{dd}, differential output format, and carrier frequency within the available range

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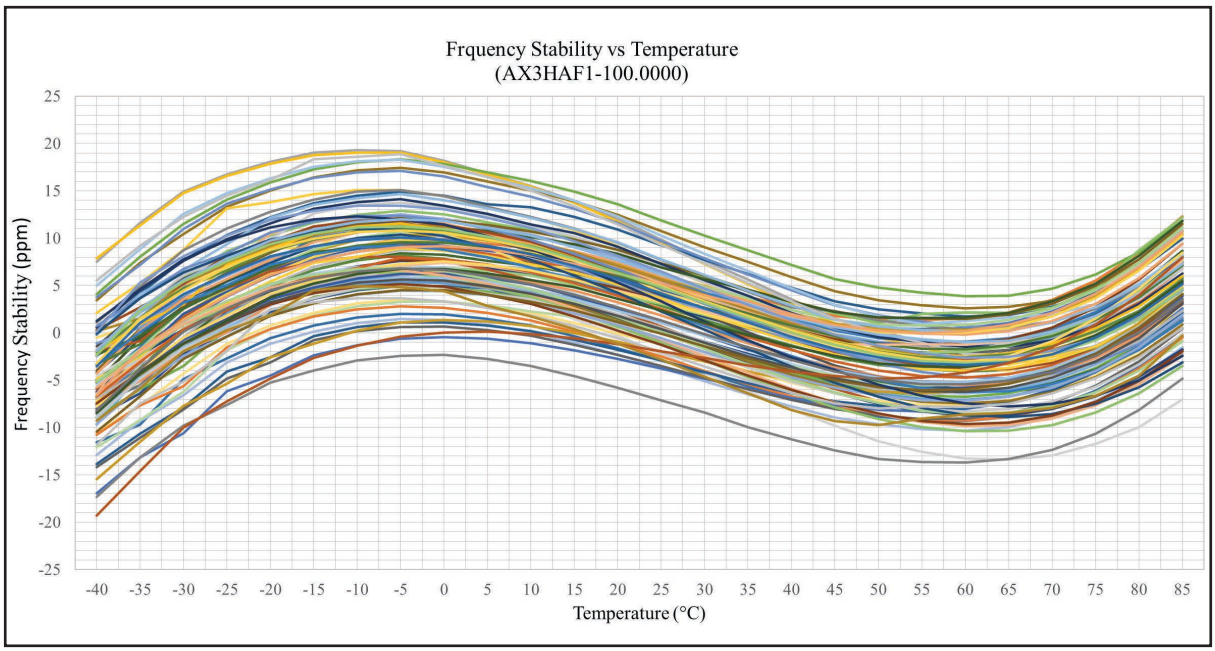
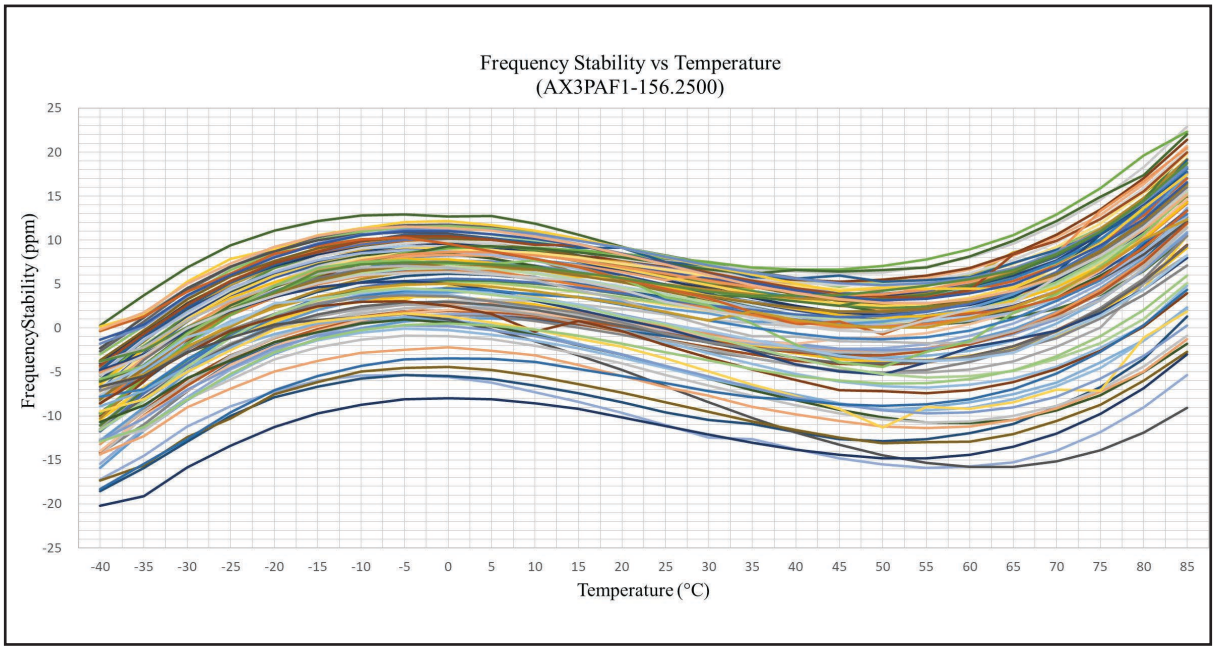
Typical Frequency vs. Temperature Characteristics





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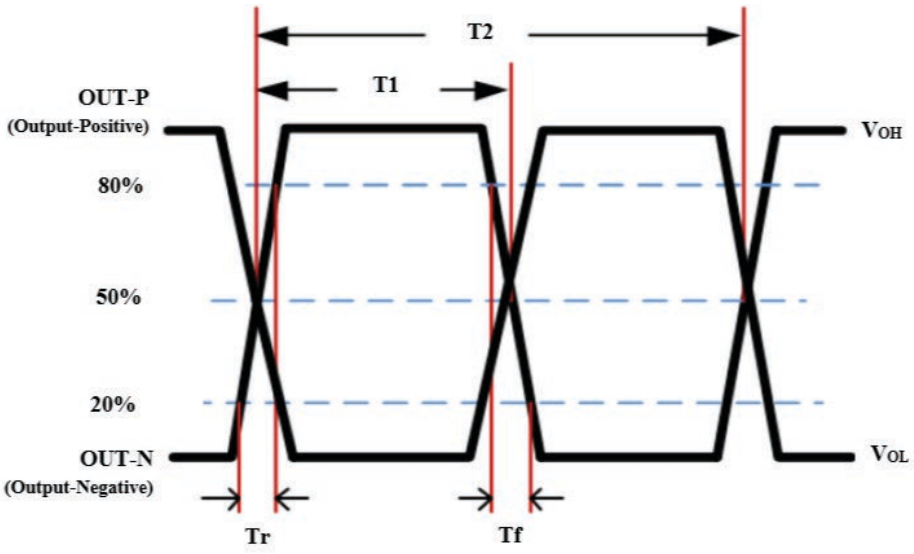
Differential Output Waveform



$$\text{Duty Cyle} = \left(\frac{T1}{T2}\right) * 100\%$$

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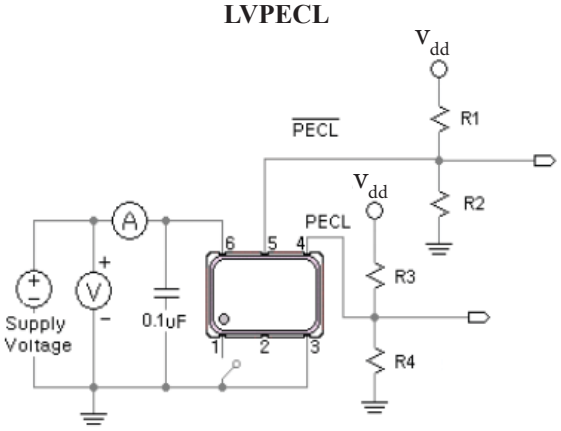
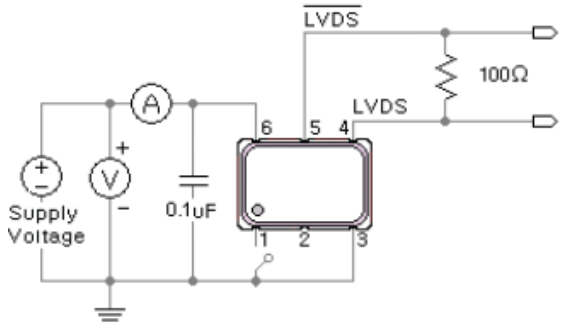
MSL = 1

Recommended Test Circuit [Note 6]

LVPECL

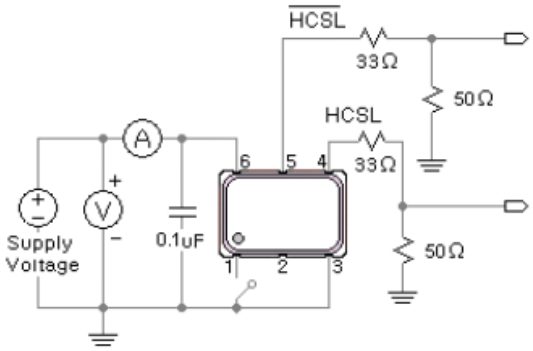


LVDS @ V_{dd} = 3.3V & 2.5V



V_{dd}=3.3V: R1=R3=127Ω; R2=R4=82.5 Ω
V_{dd}=2.5V: R1=R3=250Ω; R2=R4=62.5 Ω

HCSL



Note 6: Recommended test circuit images display OE Functions Option 1 & Option 2 where the OE Function is located on Pin 1
When the OE Function is located on Pin 2, then Pin 1=No Connect & Pin 2=OE or No Connect

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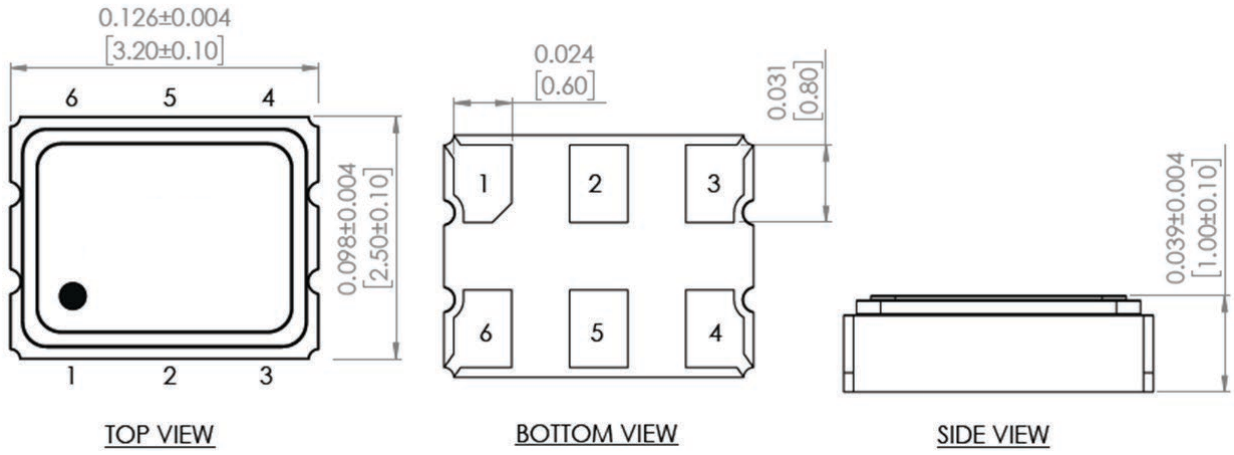
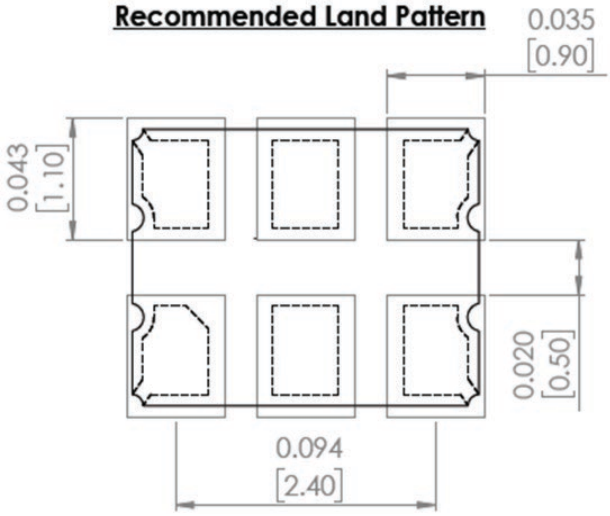
Mechanical Dimensions





Pin #	Function
# 1	Option 1 & 2:[Note 7] Output Enable/Disable
# 2	Option 3 & 4:[Note 8] Output Enable/Disable
# 3	Ground
# 4	Output
# 5	Complementary output
# 6	Supply Voltage (V_{dd})

Note 7: Option 1 = Pin 1 OE Active HIGH;
Option 2 = Pin 1 OE Active LOW;

Note 8: Option 3 = Pin 2 OE Active HIGH;
Option 4 = Pin 2 OE Active LOW;

Dimensions: mm

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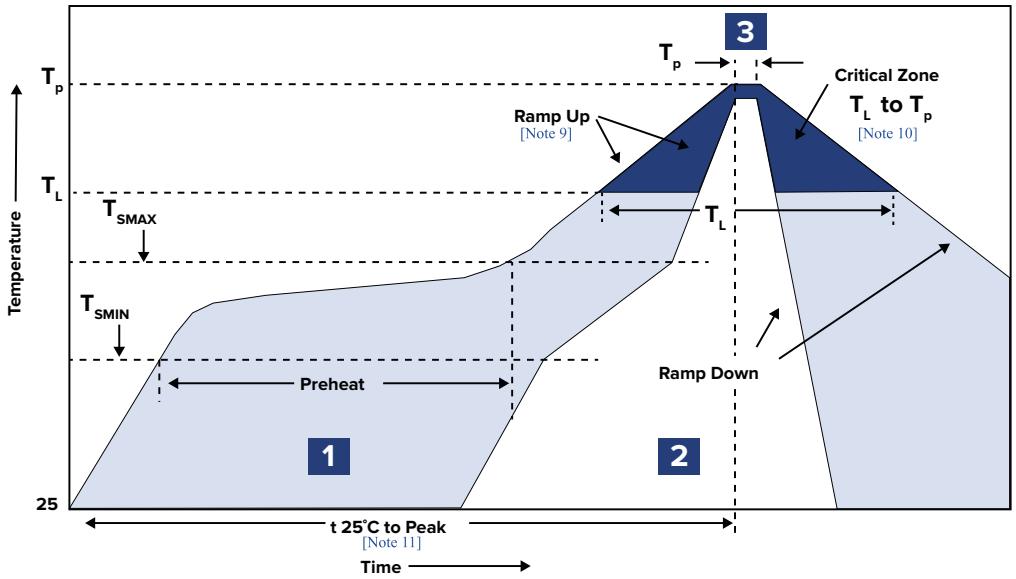
Recommended Reflow Profile [Note 12]



Zone	Description	Temperature	Time
1	Preheat / Soak	T_{SMIN} ~ T_{SMAX} 150°C ~ 200°C	60 ~ 180 sec.
2	Reflow	T_L 217°C	60 ~ 150 sec.
3	Peak heat	T_P 260°C±5°C	20 ~ 40 sec.

Note 9: Ramp Up Rate ($T_L \rightarrow T_P$) = 3°C / sec. MAX
Note 10: Ramp Down Rate ($T_P \rightarrow T_L$) = 6°C / sec. MAX
Note 11: Time 25°C to Peak Temperature (25°C → T_P) = 8 minutes MAX
Note 12: Can withstand: 2 reflows
All temperatures refer to topside of the package, measured on the package body surface below.

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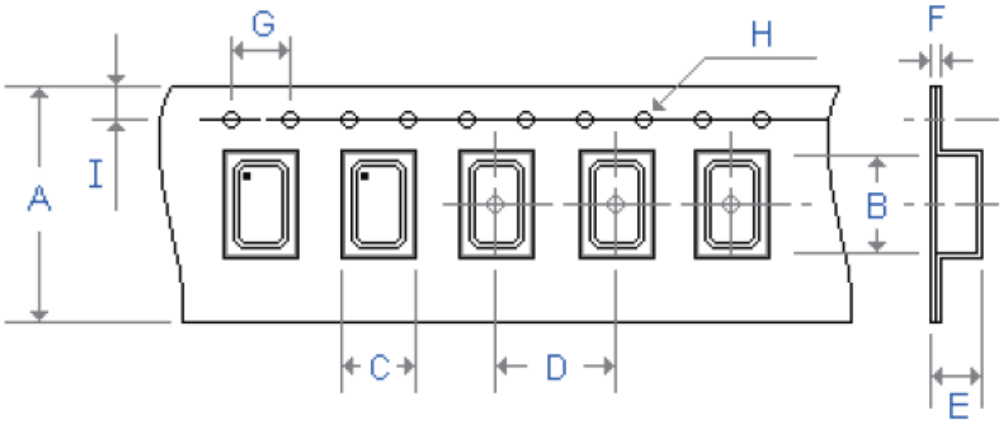
MSL = 1

Packaging

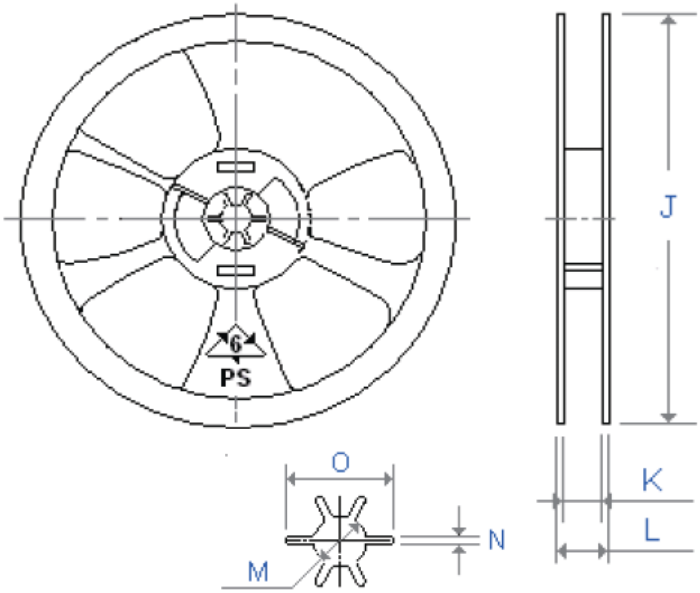
Blank = Bulk*
T = Tape & Reel 1,000 units/reel
T3 = Tape & Reel 3,000 units/reel

(*) MOQ: 250 units

Feeding (PULL) Direction →



Tape Dimensions	
A	8.00
B	3.40
C	2.70
D	4.00
E	1.40
F	0.30
G	4.00
H	Ø1.55
I	1.75
Reel Dimensions	
J	180.00
K	10.90
L	11.40
M	13.20
N	2.20
O	22.00



Dimensions: mm

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