AK2A series

ClearClock™ Oscillator Family | Ultra-Low Jitter | 2.5x2.0mm XO

Description

The Abracon AK2A series is a 3rd overtone quartz oscillator, offering a range of frequency stability options starting as low as ±15 ppm over -20°C to 70°C. This series is available with either a fixed voltage of 3.3V, 2.5V or a continuous voltage option of 2.375V - 3.63V. The AK2A series, offered in a 2.5mm x 2.0mm ceramic SMD package, is capable of an RMS Jitter (BW:12kHz to 20MHz) of 64 fs at a 156.25MHz carrier frequency.



Features

- Available in industry standard frequencies between 100MHz & 200MHz
- ±25ppm stability over industrial operating temperature (-40ºC to +85ºC)
- 2.5V, 3.3V, 2.25V to 3.63V Continuous supply voltage options
- LVPECL, LVDS, HCSL differential output logic
- Industry standard 2.5 x 2.0 x 1.0 mm footprint
- Based on 3rd overtone, quartz crystal technology
- Available in Abracon's global distribution network
- Output Enable (Pad 1 or Pad 2 Active High) options available

Typical Applications

- Optical Transceivers and Modules
- Data Centers, Storage, and Servers
- Networking switches and gateways
- 100G/200G/400G/800G Ethernet
- Fibre Channel/SONET/SDH/PCIe
- Industrial and FPGA applications
- Test & measurement

Electrical Specifications

Parameters		Min.	Typ.	Max.	Units	Notes
Frequency Range		100		200	MHz	
Standard Available Frequencies		100.000, 114.285, 122.880. 125.000, 148.500, 150.000, 155.520, 156.250 & 200.000			MHz	Contact Abracon for availability of frequencies not listed
Supply Voltage (Vdd) [Note 1]		2.97	3.3	3.63	V	Option "A"
		2.375	2.5	2.625		Option "B"
		2.375		3.63		Option "D"
Supply Current (Idd)	LVPECL		40	60	mA	@ 200MHz; @ Vdd=3.3V
	LVDS		17	35		@ 200MHz; @ Vdd=3.3V
	HCSL		27	40		@ 200MHz; @ Vdd=3.3V
Operating Temperature Range		-20		70	°C	Option "D"
		-40		85		Option "F" or "Q"
		-40		105		Option "N"
Storage Temperature		-55		125	°C	
Frequency Tolerance [Note 2]		-10	< ±5	10	ppm	
Frequency Stability over [Note 3,4] Operating Temperature Range		-15	< ±10	15	ppm	Option "D" (-20°C to +70°C)
		-20	< ±15	20		Option "Q" (-40°C to +85°C)
		-25	< ±20	25		Option "F" (-40°C to +85°C)
		-25	< ±20	25		Option "N" (-40°C to +105°C)

Parameters			Min.	Typ.	Max.	Units	Notes
First Year Aging			-3		3	ppm	At 25°C
All-Inclusive Frequency Accuracy (Total Stability) [Notes 5]			-40		40	ppm	Option "D" (-20°C to +70°C)
			-45		45		Option "Q" (-40°C to +85°C)
			-50		50		Option "F" (-40°C to +85°C)
			-50		50		Option "N" (-40°C to +105°C)
Rise (Tr) / Fall (Tf) Time [Notes 6]	LVPECL			0.2	0.4	ns	@ Vdd=3.3V, RL=50Ω
	LVDS			0.2	0.4		@ Vdd=3.3V, RL=100Ω
				0.2	0.4		@ Vdd=2.5V, RL=100Ω
	HCSL			0.5	0.8		@ Vdd=3.3V, RL=50Ω to GND
				0.5	0.8		@ Vdd=2.5V, RL=50Ω to GND
Duty Cycle			45		55	%	
Start-up Time [Note 3]				< 2	5	ms	
Output High Voltage Output Low Voltage	LVPECL	V_{OH}	Vdd-1.025	Vdd-0.95	Vdd-0.88	V	RL=50Ω to Vdd–2.0V
		V_{OL}	Vdd-1.81	Vdd-1.7	Vdd-1.62		
	HCSL	V_{OH}	0.50	0.74	0.85		RL=50Ω to ground on each output
		V_{OL}	-0.15	0.00	0.15		
Output Voltage	LVDS	V_{OD}	0.247	0.330	0.454	V	RL= 100Ω (Between Outputs)
		ΔV_{OD}			0.050		
Offset Voltage		V_{OS}	1.125	1.250	1.375		
		ΔV_{OS}			0.050		
Differential Output Voltage Swing (Vopp)			0.800			V	LVPECL
			0.500				LVDS
			0.800				HCSL
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				< 1	5.0	ms	
Output Disable Time					0.2	µs	
Output Disable Current Consumption					10	µA	OE ≤ 0.3V
RMS Phase Jitter (12kHz to 20MHz from Carrier)			See Table 1 below				Vdd, output logic type and Carrier frequency dependent

Note 1: Supply voltage (Vdd) = 2.5V and 2.375~3.63V options not available with LVPECL output
Note 2: Frequency Accuracy (Initial Set-Tolerance), at time of shipment (pre-reflow), relative to carrier frequency, @ +25°C
Note 3: Relative to initial measured frequency @ +25°C
Note 4: Option Q only available in select frequencies. Please contact Abracon for availability
Note 5: Includes post reflow frequency accuracy, temperature stability, load pulling, power supply variation, and 10-year aging
Note 6: Measured over 20% to 80% of waveform

Table 1
RMS Phase Jitter 12kHz – 20MHz BW, Vdd=3.3V [Note 7, 8, 9]

Frequency (MHz)	Output	RMS Jitter	
		Typ. (fs)	Max (fs)
100	LVDS	184	200
	LVPECL	166	200
	HCSL	152	185
125	LVDS	118	150
	LVPECL	94	125
	HCSL	90	115
156.25	LVDS	83	125
	LVPECL	64	100
	HCSL	71	100
200	LVDS	55	100
	LVPECL	75	100
	HCSL	70	100

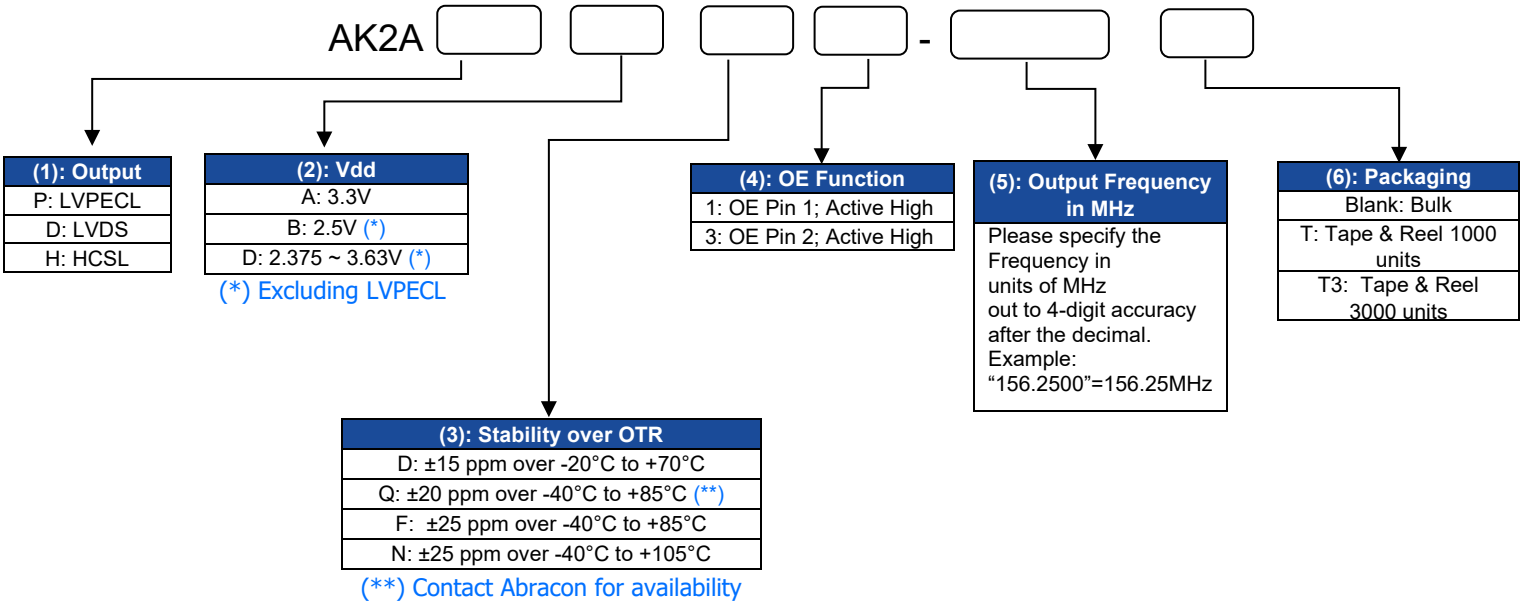
Note 7: Guaranteed by characterization; RMS Phase Jitter specifications are inclusive of any spurs
Note 8: Phase jitter measured with Keysight E5052B Signal Source Analyzer
Note 9: Refer to the next section for phase noise test setup and representative phase noise plots

Absolute Maximum Ratings [Note 10]

Parameters	Min.	Typ.	Max.	Unit	Notes
Supply Voltage	Vss-0.5		5	V	
Input Voltage	Vdd-0.5		VDD+0.5	V	
Output Voltage	Vdd-0.5		VDD+0.5	V	
Maximum Junction Operating			150	ºC	
Ambient Operating Temperature	-40		105	ºC	Industrial
Ambient Operating Temperature	-20		70	ºC	Extended
Reflow Temperature			260	°C	See Reflow Profile
ESD Protection	4kV HBM, 300V MM, 2kV CDM				

Note 10: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability. The data sheet limits are not guaranteed if the device is operated beyond the recommended operating conditions.

Part Identification

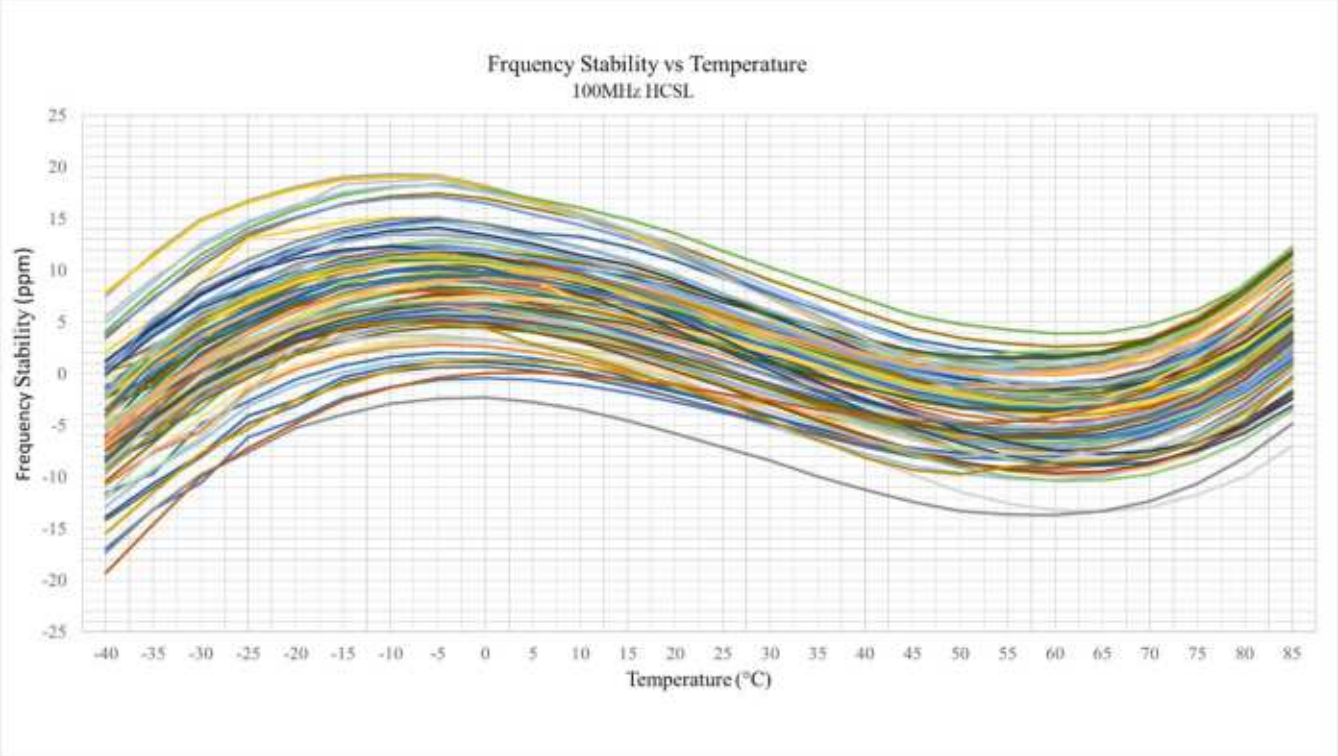


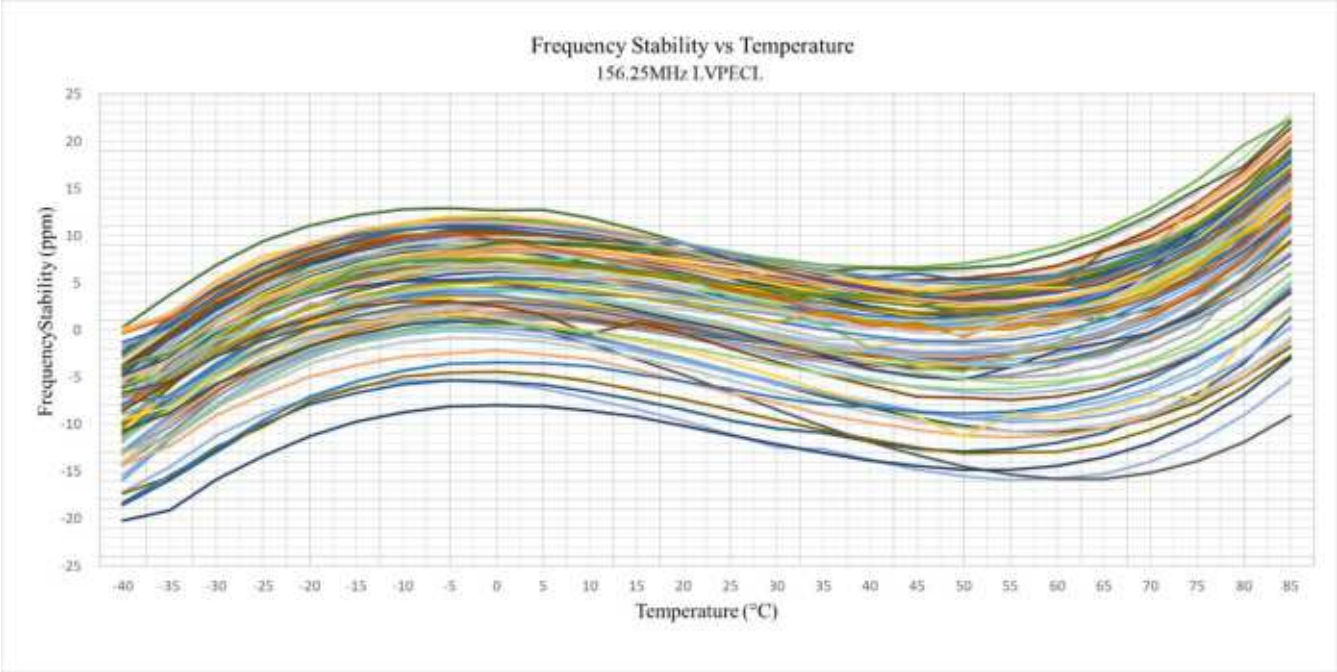
Part Number Example:

AK2APAF1-156.2500
AK2APAF1-156.2500T
AK2APAF1-156.2500T3

Note 11: Contact Abracon for non-standard part number configurations and/or requests with carrier frequency callouts up to 5 & 6 digit accuracy after the decimal

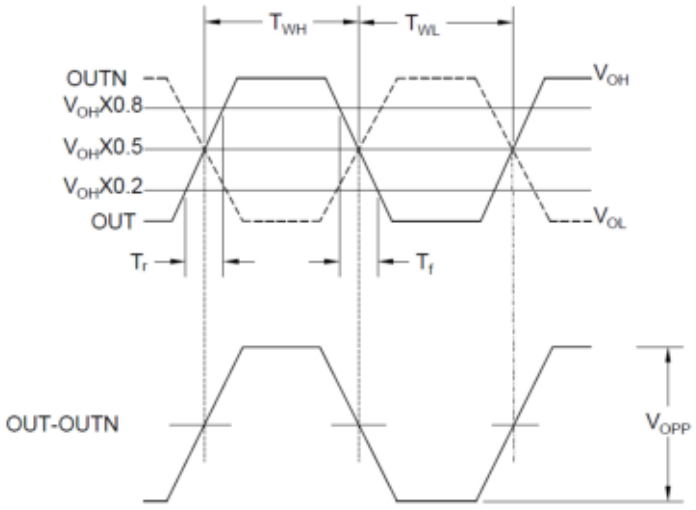
Typical Frequency vs. Temperature Characteristics





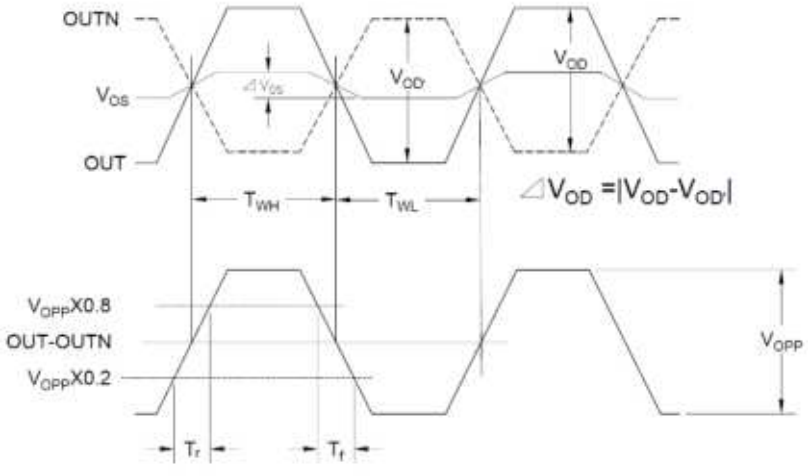
Differential Output Waveform

LVPECL: Output Wave Form (Duty, V_{OH}, V_{OL}, T_r, T_f, V_{OPP})



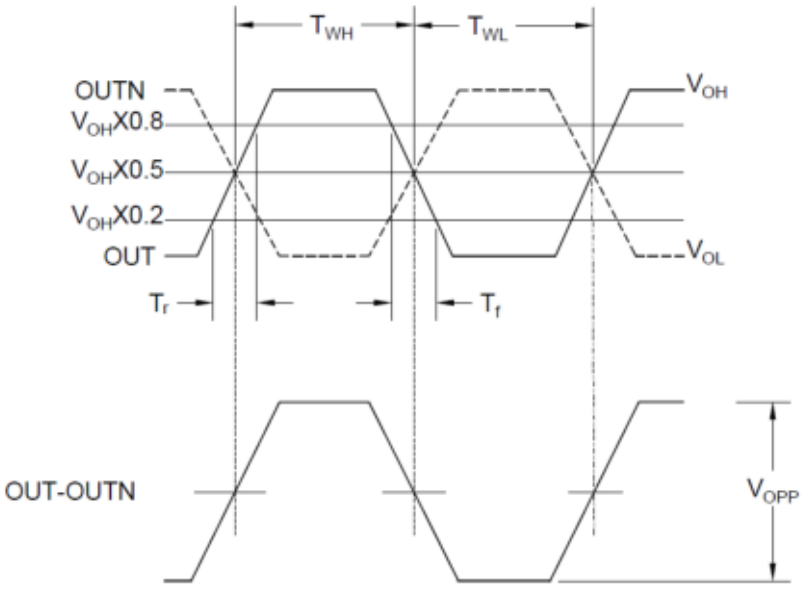
$$\text{Duty Cycle} = \frac{T_{WH}}{T_{WH}+T_{WL}} \times 100\%$$

LVDS: Output Wave Form (Duty, Tr, Tf, V_{OD}, ΔV_{OD}, V_{OS}, ΔV_{OS}, V_{OPP})



$$\text{Duty} = \frac{T_{WH}}{T_{WH}+T_{WL}} \times 100\%$$

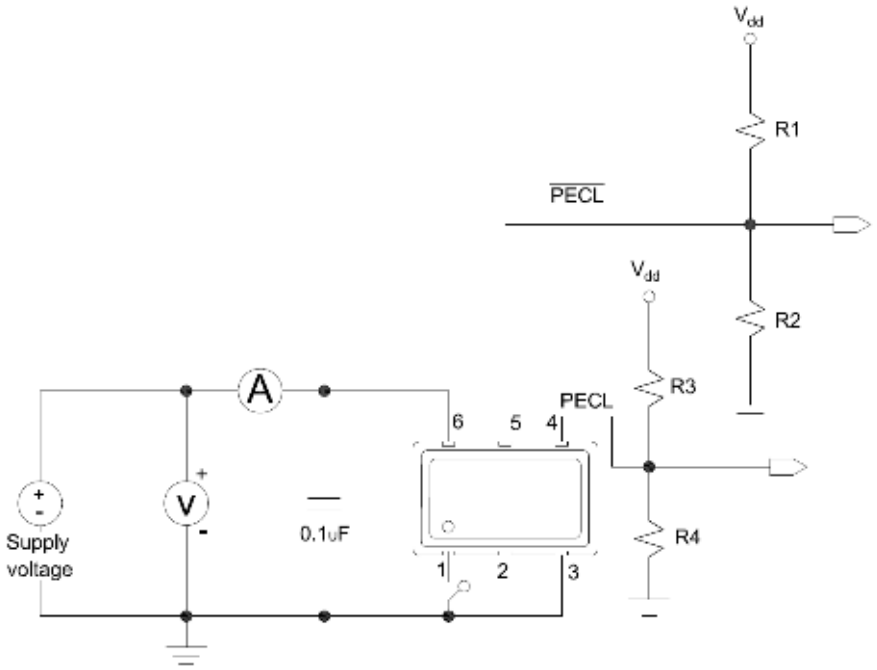
HCSL: Output Wave Form (Duty, V_{OH}, V_{OL}, T_r, T_f, V_{OPP})



$$\text{Duty Cycle} = \frac{T_{WH}}{T_{WH}+T_{WL}} \text{ X } 100\%$$

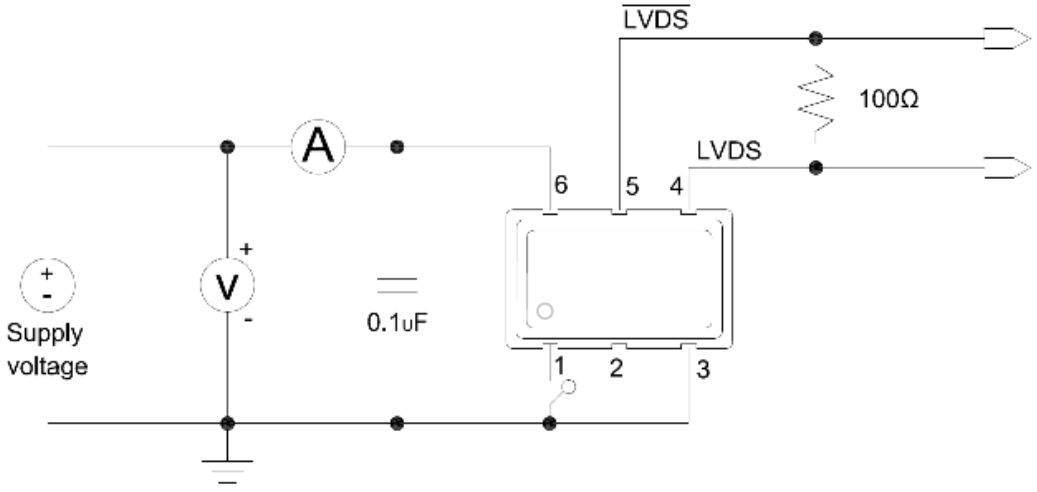
Recommended Test Circuit [Note 12]

LVPECL

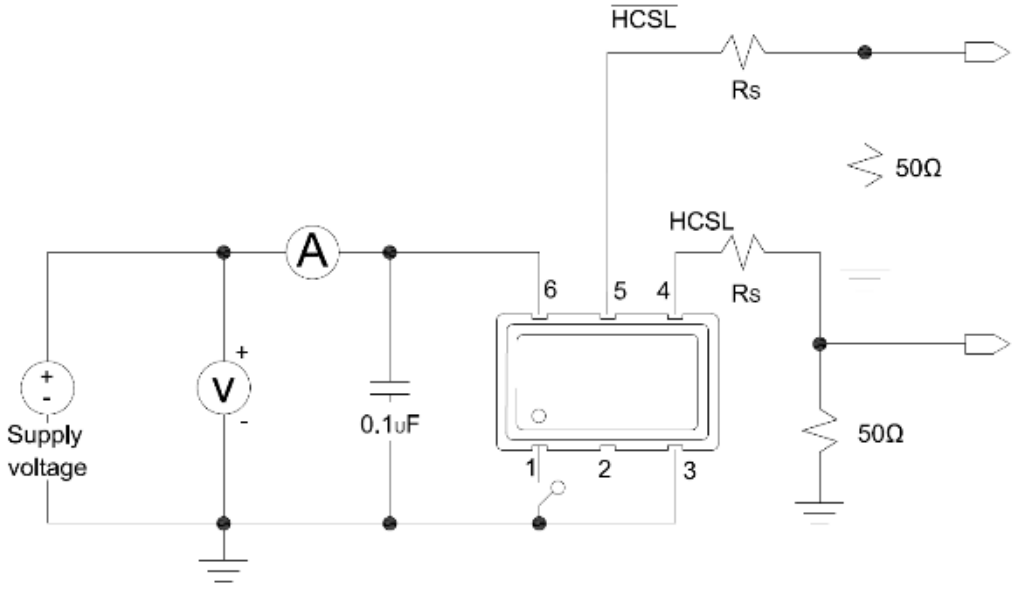


Vdd= 3.3V: R1=R3=127Ω; R2=R4=82.5Ω

LVDS



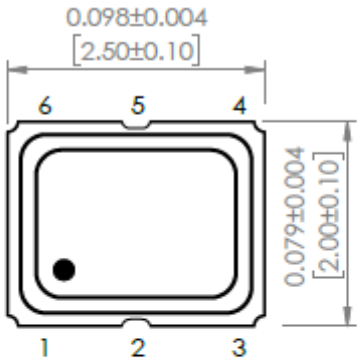
HCSL



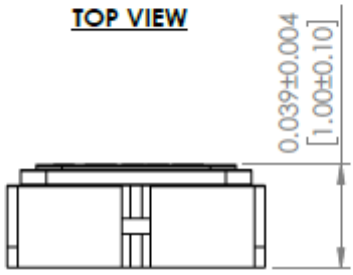
Rs= 33Ω

Note 12: Recommended test circuit images are representative of when 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.

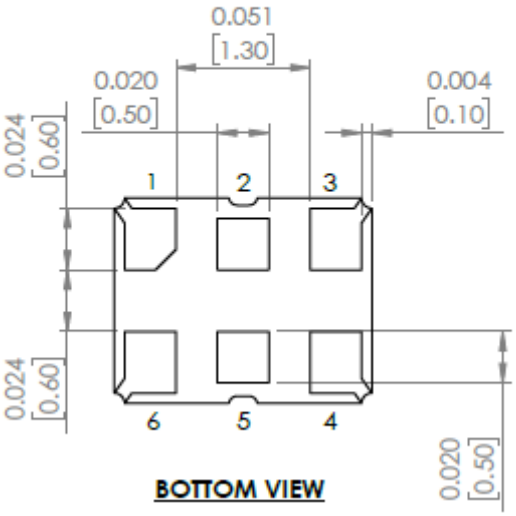
Mechanical Dimensions



TOP VIEW

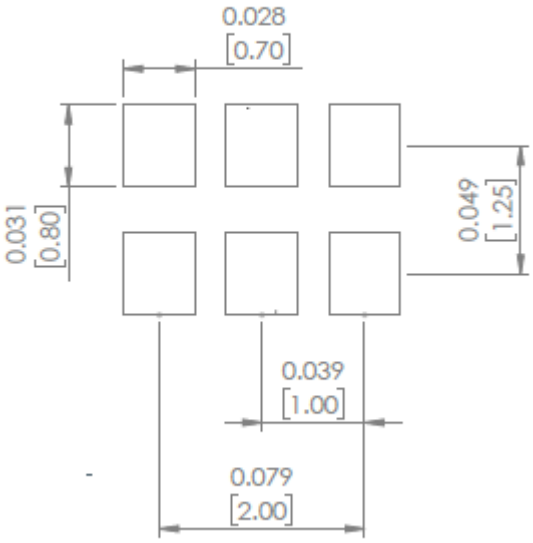


SIDE VIEW



BOTTOM VIEW

Recommended Land Pattern



Case 1 Pin #1=Output Enable/Disable Function where OE is Active HIGH		Case 2 Pin #2=Output Enable/Disable Function where OE is Active HIGH	
Pin	**Description**	**Pin**	**Description**
# 1	Output Enable = Logic High, "1", Vdd	**# 1**	No Connect
	Output Disable = Logic Low, "0", GND	**# 2**	Output Enable = Logic High, "1", Vdd
# 2	No Connect		Output Enable = Logic Low, "0", GND
# 3	GND	**# 3**	GND
# 4	Output	**# 4**	Output
# 5	Complementary output	**# 5**	Complementary output
# 6	Supply Voltage (Vdd)	**# 6**	Supply Voltage (Vdd)

Dimensions: inches (mm)

Reflow Profile [JEDEC J-STD-020]

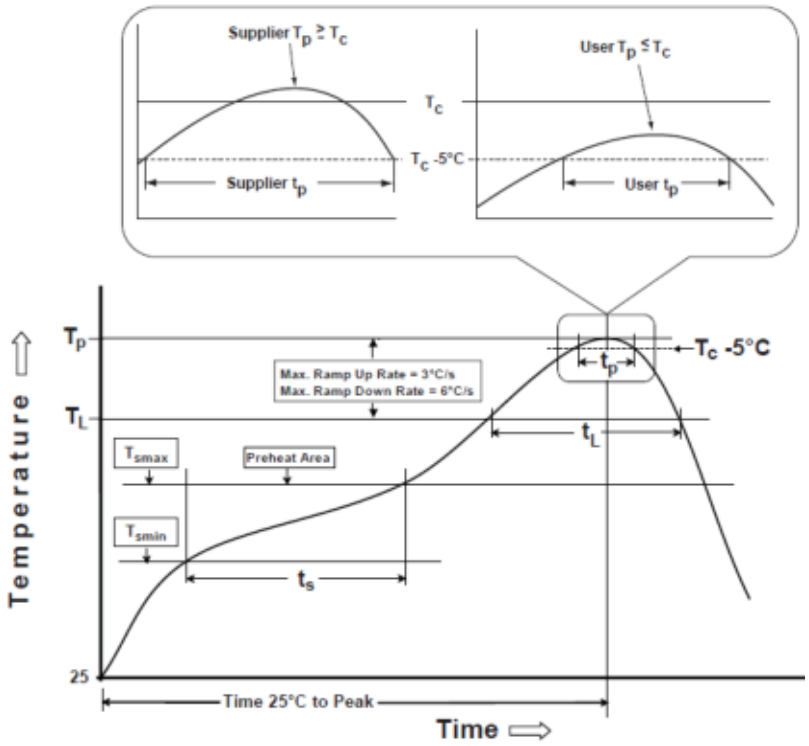


Table 1

SnPb Eutectic Process Classification Temperatures (T_c)		
Package Thickness	**Volume mm³ <350**	**Volume mm³ ≥350**
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2

Pb-Free Process Classification Temperatures (T_c)			
Package Thickness	**Volume mm³ <350**	**Volume mm³ 350-2000**	**Volume mm³ >2000**
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm - 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	250 °C	245 °C	245 °C

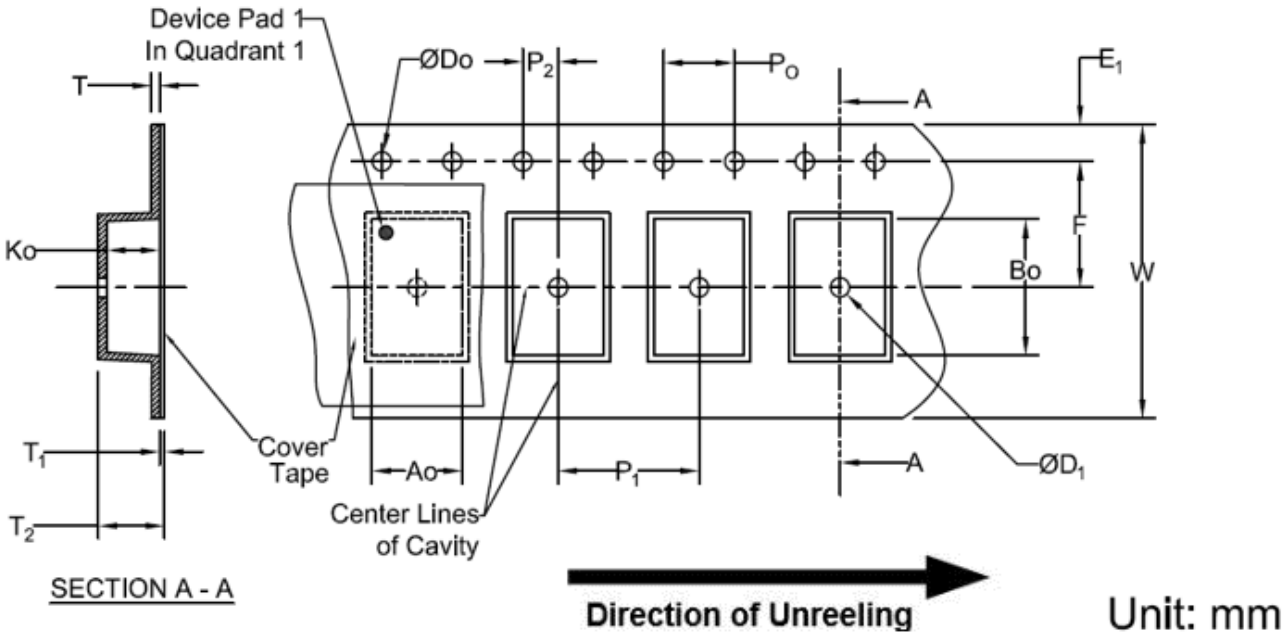
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat / soak		
Temperature minimum (T_{smin})	100°C	150°C
Temperature maximum (T_{smax})	150°C	200°C
Time (T_{smin} to T_{smax}) (t_s)	60 - 120 sec.	60 - 120 sec.
Average ramp-up rate (T_{smax} to T_P)	3°C/sec. max	3°C/sec. max
Liquidous temperature (T_L)	183°C	217°C
Time at liquidous (t_L)	60 - 150 sec.	60 - 150 sec.
Peak package body temperature (T_P)*	**see Table 1**	**see Table 2**
Time (t_p)** within 5°C of the specified classification temperature (T_C)	20 sec.	30 sec.
Ramp-down rate (T_p to T_{smax})	6°C/sec. max	6°C/sec. max
Time 25°C to peak temperature	6 min. max	8 min. max
Reflow cycles	2 max	2 max

*Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.

**Tolerance for time at peak profile temperature (t_p) is defined as supplier minimum and a user maximum.

Packaging

T: 1,000pcs/reel
T3: 3,000pcs/reel

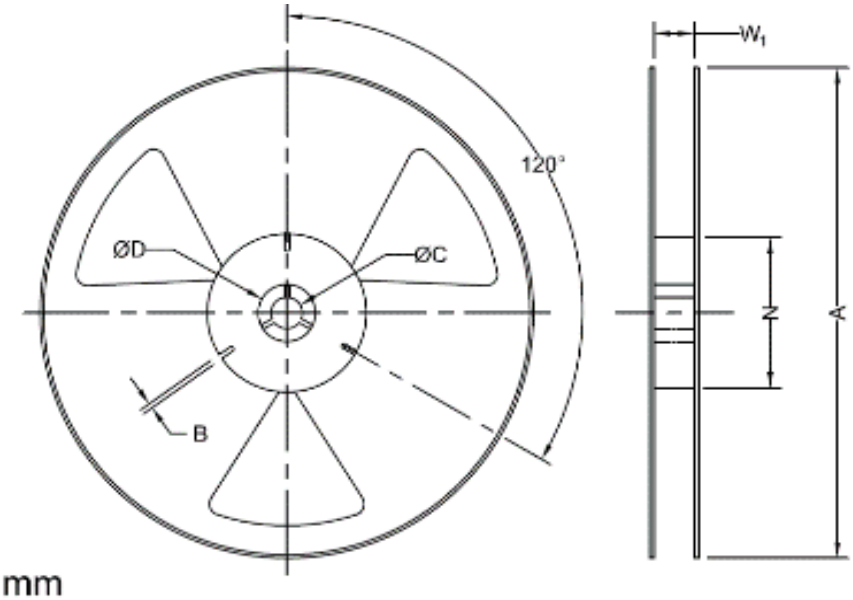


Tape Specifications (mm)							
Width	Ao	Bo	Do	D_1 (Min)	E_1	F	Ko
8mm	*	*	1.5+0.1/-0.0	1.0	1.75±0.1	3.5±0.05	*

*Note: Compliant to EIA-481

Tape Specifications (mm)							
Width	P_1	P_2	P_0	T (Max)	T_1 (Max)	T_2 (Max)	W (Max)
8mm	4.0±0.1	2.0±0.05	4.0±0.1	0.6	0.1	2.5	8.3

*Note: Compliant to EIA-481



Unit: mm

Tape Specifications (mm)							
Suffix	Qty/Reel	A (Nom)	B (Min)	C (Min)	D (Min)	N (Min)	*W_1
-T	1000	178	1.5	13.0+0.5/-0.2	20.2	50	8.4+1.5/-0.0
-T3	3000	178	1.5	13.0+0.5/-0.2	20.2	50	8.4+1.5/-0.0

*Note: Measured at Hub

Dimensions: inches (mm)