

Description

The Abracon AK3B 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, 1.8V or a continuous voltage option of 2.375V - 3.63V. The AK3B series, offered in a 3.2mm x 2.5mm ceramic SMD package, is capable of an RMS Jitter (BW:12kHz to 20MHz) of 54 fs at a 156.25MHz carrier frequency.



Features

- Available in industry standard frequencies between 100MHz & 250MHz
- ± 25 ppm stability over industrial operating temperature (-40°C to $+105^{\circ}\text{C}$)
- 1.8V, 2.5V, 3.3V, 2.375 to 3.63V Continuous supply voltage options
- LVPECL, LVDS, HCSL differential output logic
- Industry standard 3.2 x 2.5 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
- RoHS and REACH Compliant

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		250	MHz	Supply voltage and output logic dependent
Standard Available Frequencies		100.000, 122.880, 125.000, 148.500, 150.000, 155.520, 156.250, 200.000, 212.500 & 250.000			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"
		1.71	1.8	1.89		Option "C" (≤ 175 MHz only)
		2.375		3.63		Option "D"
Supply Current (Idd)	LVPECL		52	65	mA	@ 200MHz; @ Vdd=3.3V
	LVDS		25	35		@ 200MHz; @ Vdd=3.3V
	HCSL		32	40		@ 156.25MHz; @ Vdd=3.3V
Operating Temperature Range		-20		70	$^{\circ}\text{C}$	Option "D"
		-40		85		Option "F" or "Q"
		-40		105		Option "N"
Storage Temperature		-55		150	$^{\circ}\text{C}$	
Frequency Tolerance ^[Note 2]		-10	$< \pm 5$	10	ppm	
Frequency Stability over ^[Note 3,4] Operating Temperature Range		-15	$< \pm 10$	15	ppm	Option "D" (-20°C to $+70^{\circ}\text{C}$)
		-20	$< \pm 15$	20		Option "Q" (-40°C to $+85^{\circ}\text{C}$)
		-25	$< \pm 20$	25		Option "F" (-40°C to $+85^{\circ}\text{C}$)
		-25	$< \pm 20$	25		Option "N" (-40°C to $+105^{\circ}\text{C}$)

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 +85°C)
Rise (Tr) / Fall (Tf) Time [Notes 6]	LVPECL		0.15	0.4	ns	R _L =50Ω to V _{dd} -2.0V on outputs	
	LVDS		0.15	0.3		R _L =100Ω between outputs	
	HCSL		0.2	0.6		R _L =50Ω to ground on each output	
Duty Cycle			45		55	%	Measured at 50% amplitude of single-ended signal
Start-up Time [Note 3]				< 2	5	ms	
Output High Voltage (V _{OH}) Output Low Voltage (V _{OL})	LVPECL	V _{OH}	V _{dd} -1.085	V _{dd} -0.95	V _{dd} -0.86	V	R _L =50Ω to V _{dd} -2.0V on each output
		V _{OL}	V _{dd} -1.81	V _{dd} -1.7	V _{dd} -1.62		
	HCSL	V _{OH}	0.55	0.74	1.00		R _L =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	R _L = 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 (V _{opp})			0.800			V	LVPECL
			0.494				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					200	ns	
Output Disable Current Consumption					30	μA	OE ≤ 0.3V
RMS Phase Jitter (12kHz to 20MHz from Carrier)			See Table 1 below				V _{dd} , output logic type and Carrier frequency dependent

Note 1: Supply voltage (V_{dd}) = 1.8V options not available with LVPECL output, LVDS option only available ≤175MHz

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, V_{DD}=1.8V,2.5V,3.3V [Note 7, 8]

Carrier Frequency	Output Logic	Supply Voltage (1.8V)		Supply Voltage (2.5V)		Supply Voltage (3.3V)	
		RMS Jitter		RMS Jitter		RMS Jitter	
		Typ. (fs)	Max (fs)	Typ. (fs)	Max (fs)	Typ. (fs)	Max (fs)
100	LVDS	110	120	93	120	93	120
	LVPECL	NA	NA	97	120	97	120
	HCSL	96	120	97	120	97	120
125	LVDS	78	120	63	120	63	120
	LVPECL	NA	NA	64	100	64	100
	HCSL	69	120	66	100	66	100
156.25	LVDS	68	80	54	75	54	75
	LVPECL	NA	NA	54	75	54	75
	HCSL	61	80	54	75	54	75
200	LVDS	NA	NA	40	60	40	60
	LVPECL	NA	NA	43	60	43	60
	HCSL	NA	NA	NA	NA	NA	NA
250	LVDS	NA	NA	37	50	37	50
	LVPECL	NA	NA	35	50	35	50
	HCSL	NA	NA	NA	NA	NA	NA

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

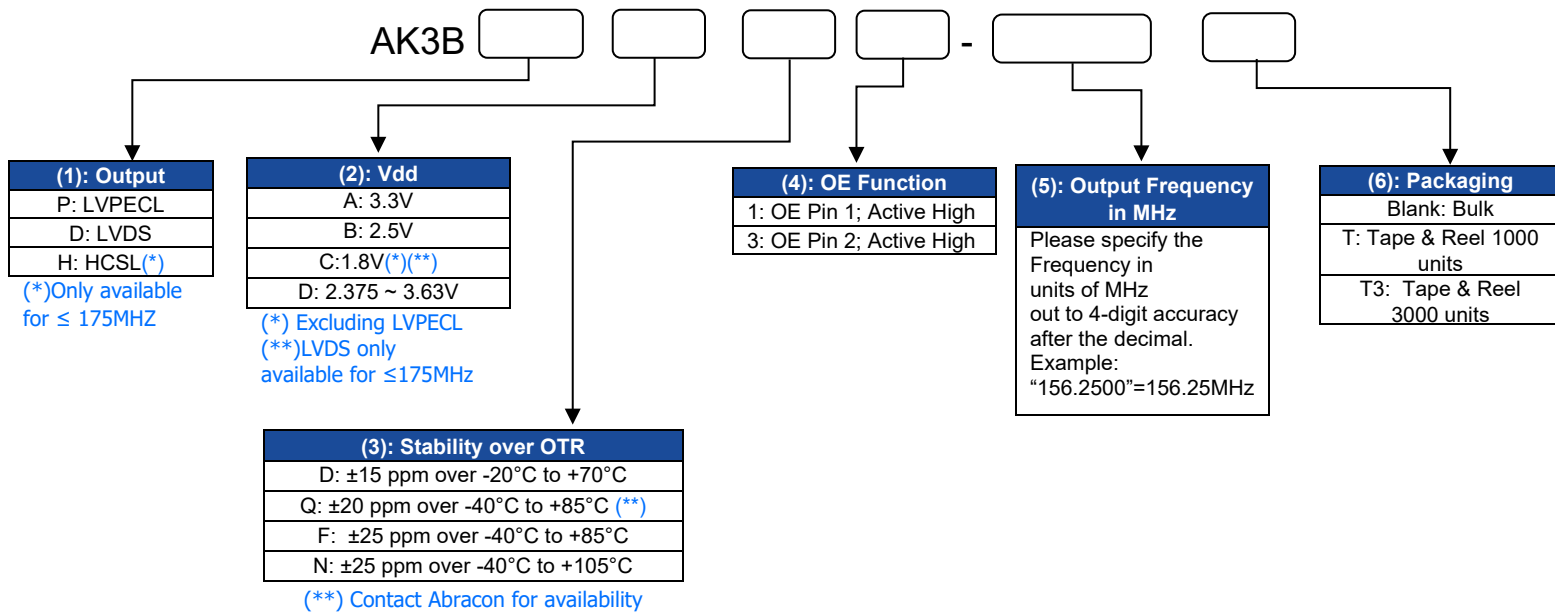
Absolute Maximum Ratings [Note 9]

Parameters	Min.	Typ.	Max.	Unit	Notes
Supply Voltage	-0.3		4.5	V	
Input Voltage	-0.3		V _{DD} +0.3	V	
Output Voltage	-0.3		V _{DD} +0.3	V	
Maximum Junction Operating Temperature			150	°C	
Ambient Operating Temperature Range	-40		85	°C	Industrial
Ambient Operating Temperature Range	-20		70	°C	Extended Commercial
Reflow Temperature			260	°C	See Reflow Profile
ESD Protection	4kV HBM, 300V MM, 2kV CDM				

Note 9: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.

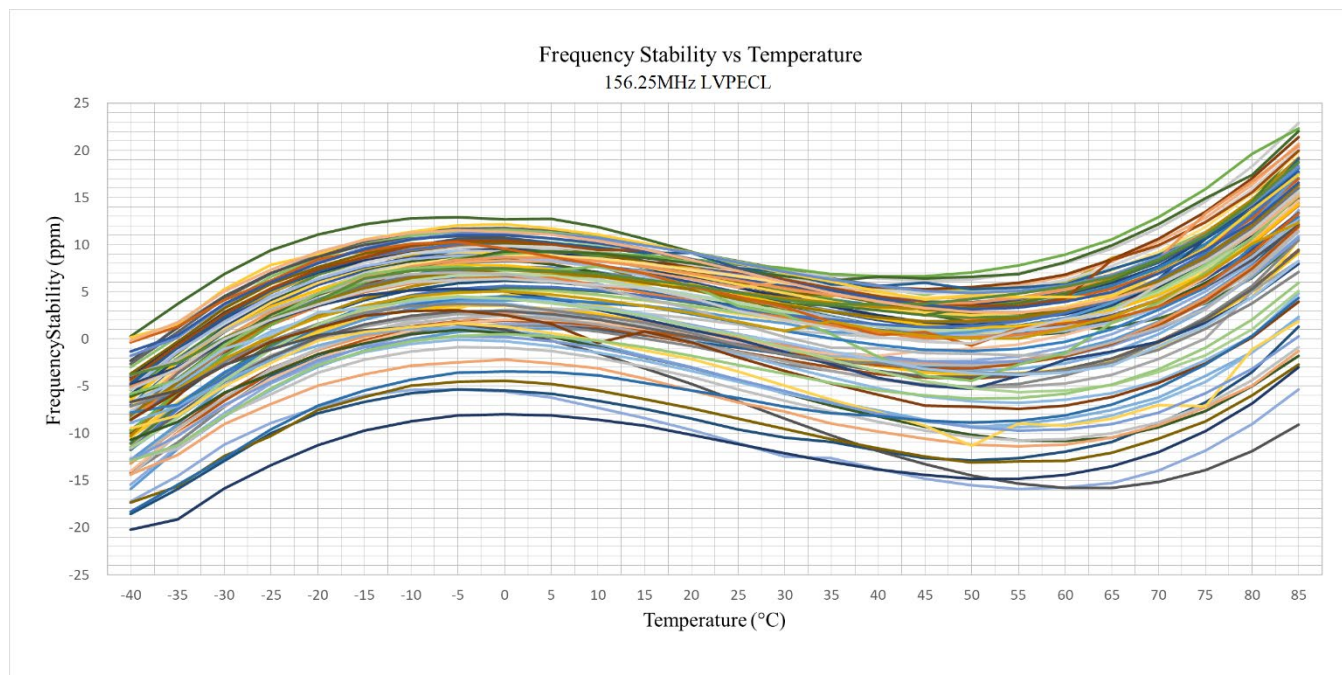
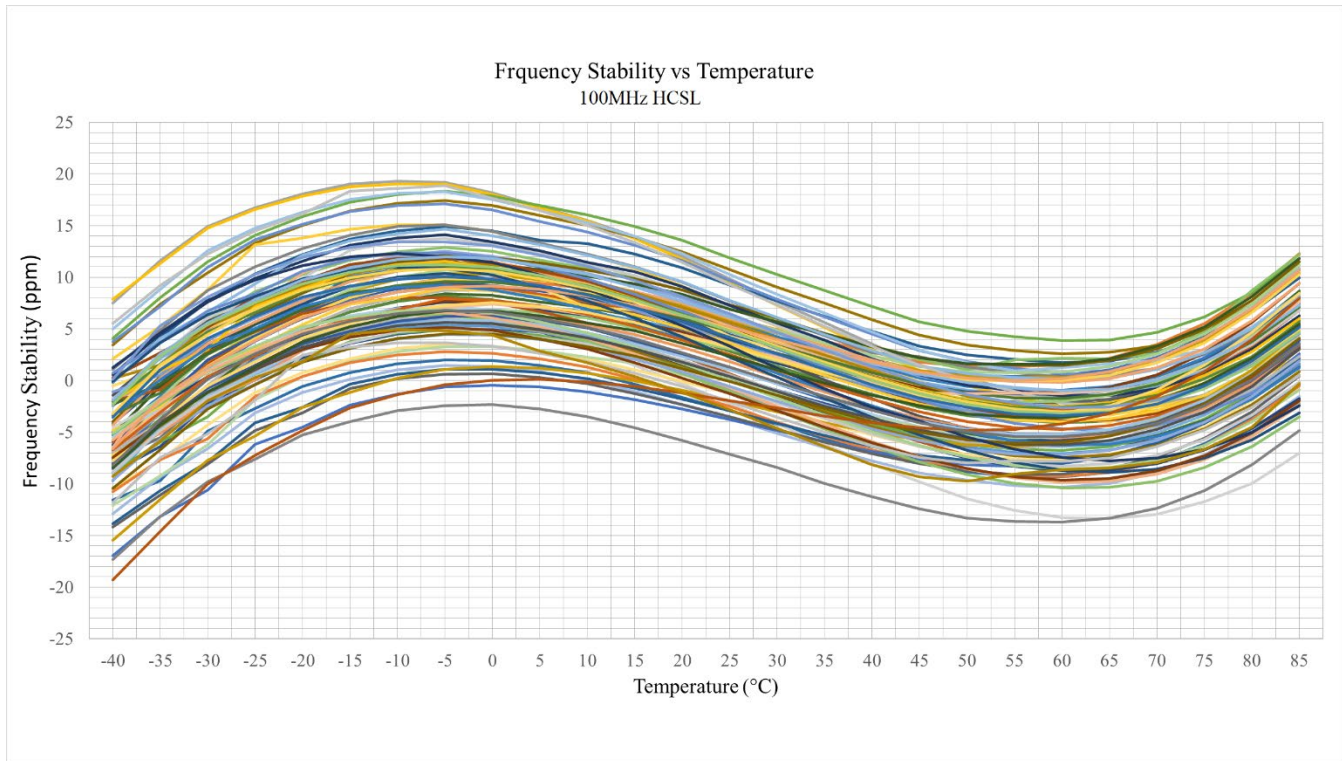
This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability. The data sheet limits are not guaranteed if the device is operated beyond the recommended operating conditions.

Part Identification

**Part Number Example:**

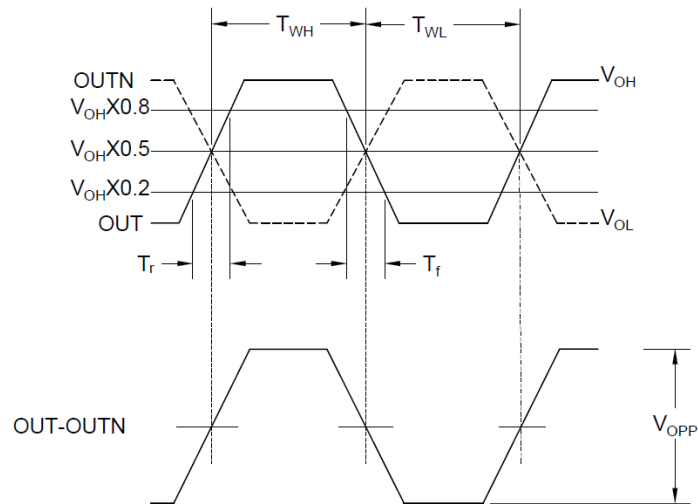
AK3BDAF1-156.2500
 AK3BDAF1-156.2500T
 AK3BDAF1-156.2500T3

Note 10: 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

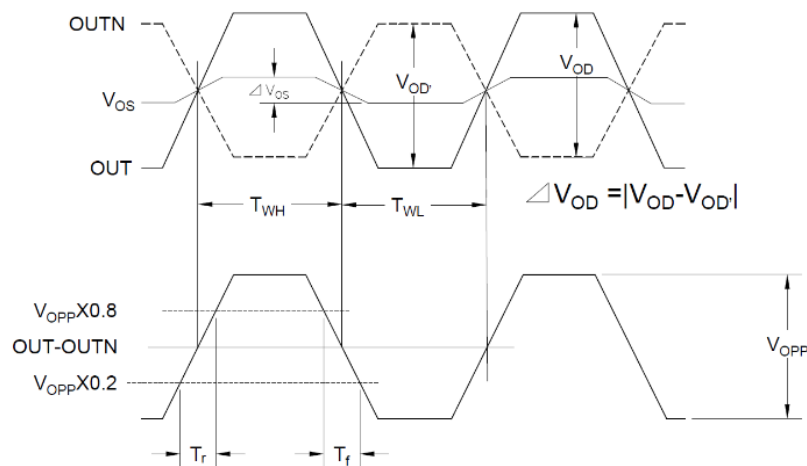
Differential Output Waveform

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



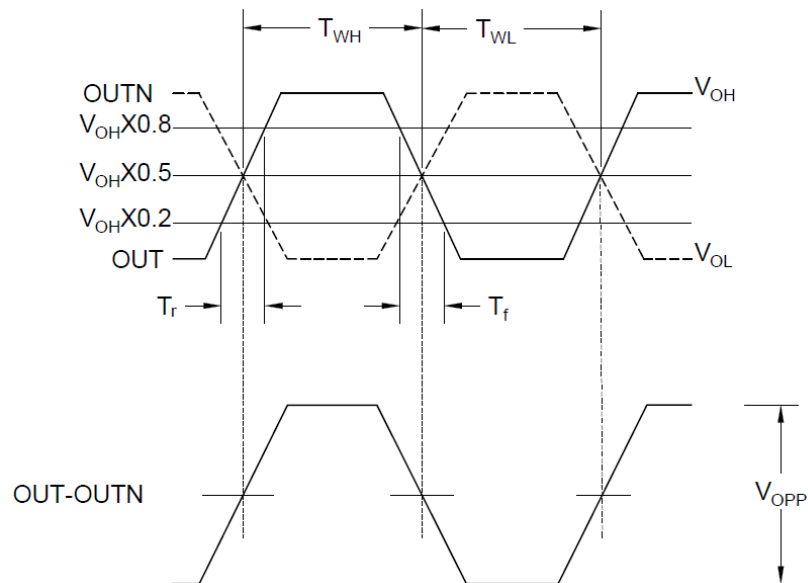
$$\text{Duty Cycle} = \frac{T_{WH}}{T_{WH} + T_{WL}} \times 100\%$$

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

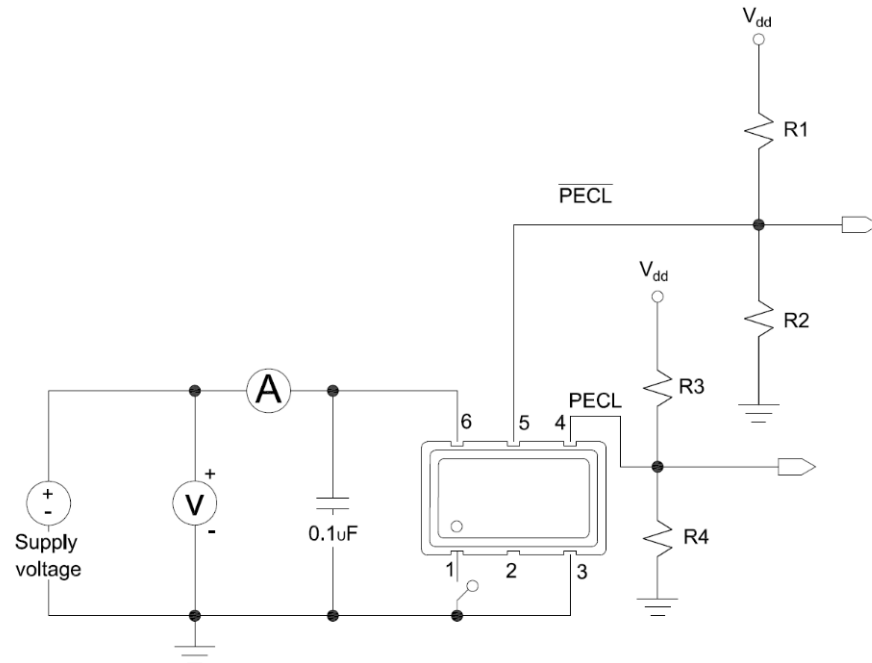


$$\text{Duty} = \frac{T_{WH}}{T_{WH} + T_{WL}} \times 100\%$$

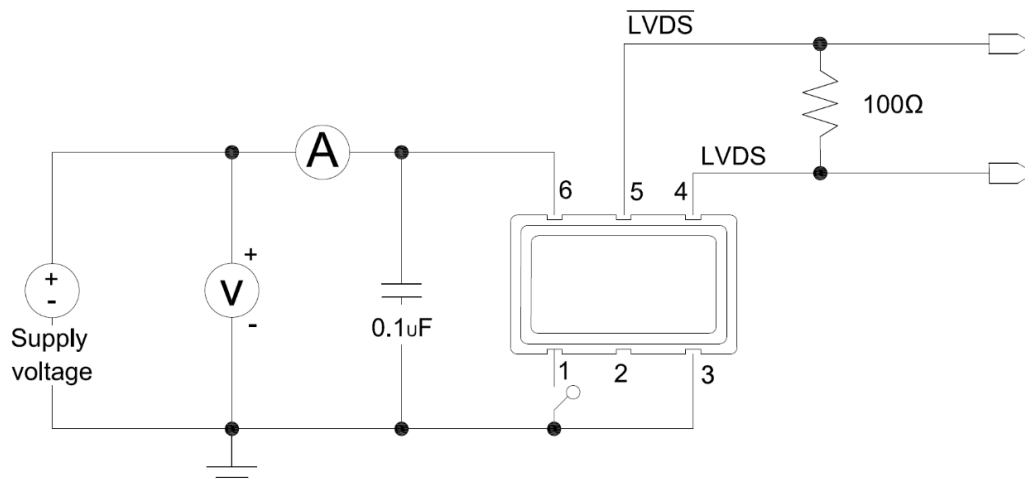
HCSL: Output Wave Form (Duty, V_{OH} , V_{OL} , T_r , T_f , V_{OPP})



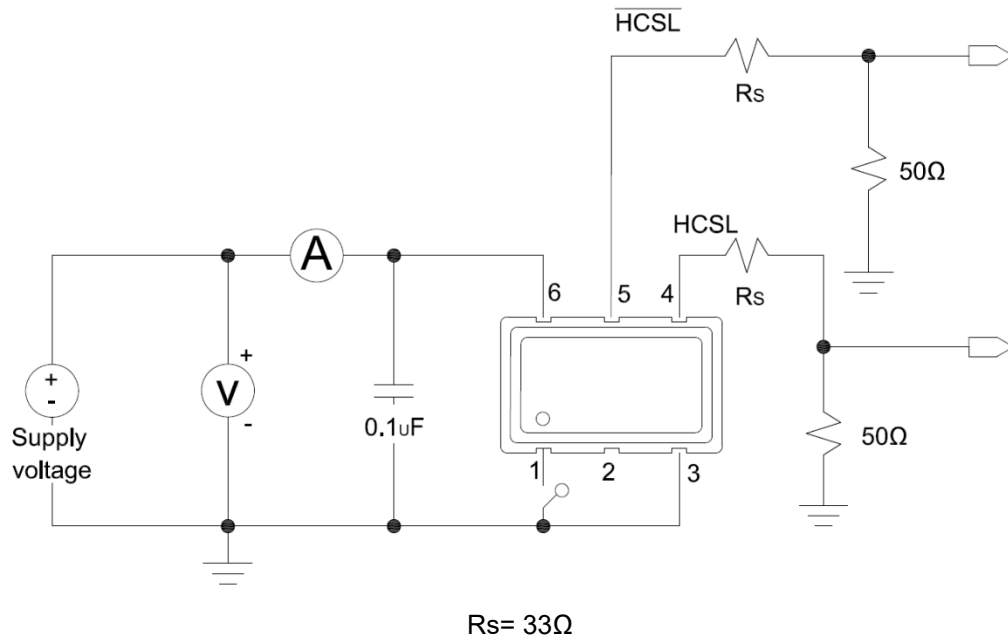
$$\text{Duty Cycle} = \frac{T_{WH}}{T_{WH} + T_{WL}} \times 100\%$$

Recommended Test Circuit [\[Note 11\]](#)**LVPECL**

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

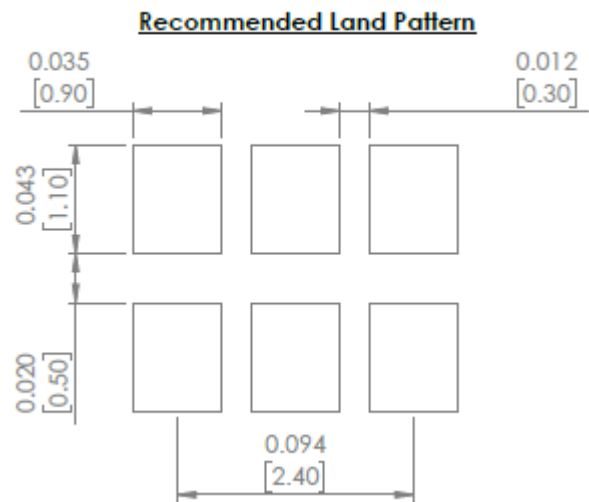
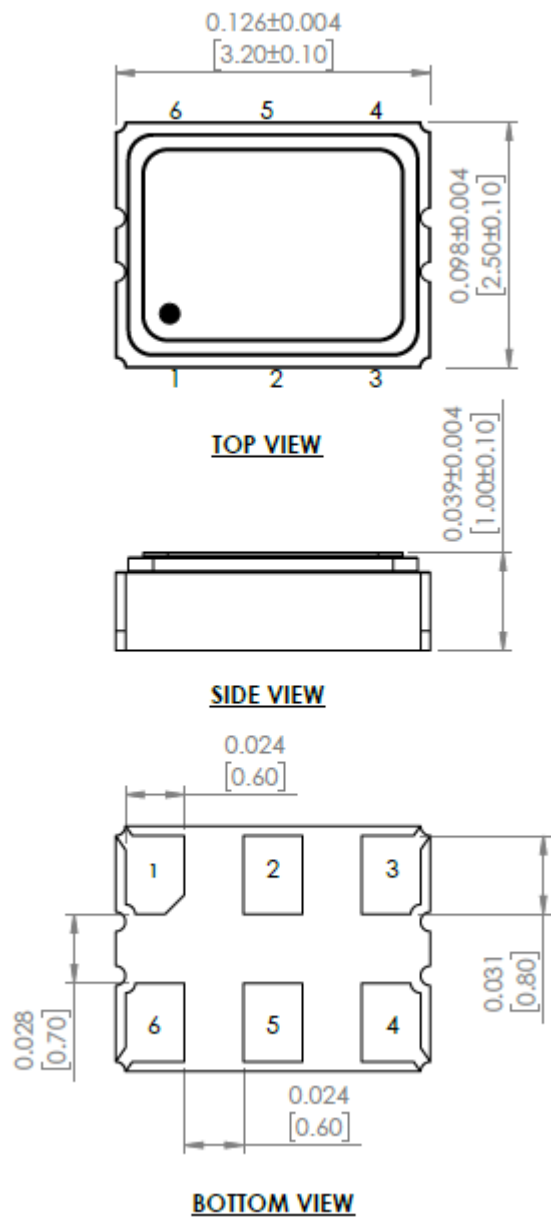
LVDS

HCSL



Note 11: 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



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]

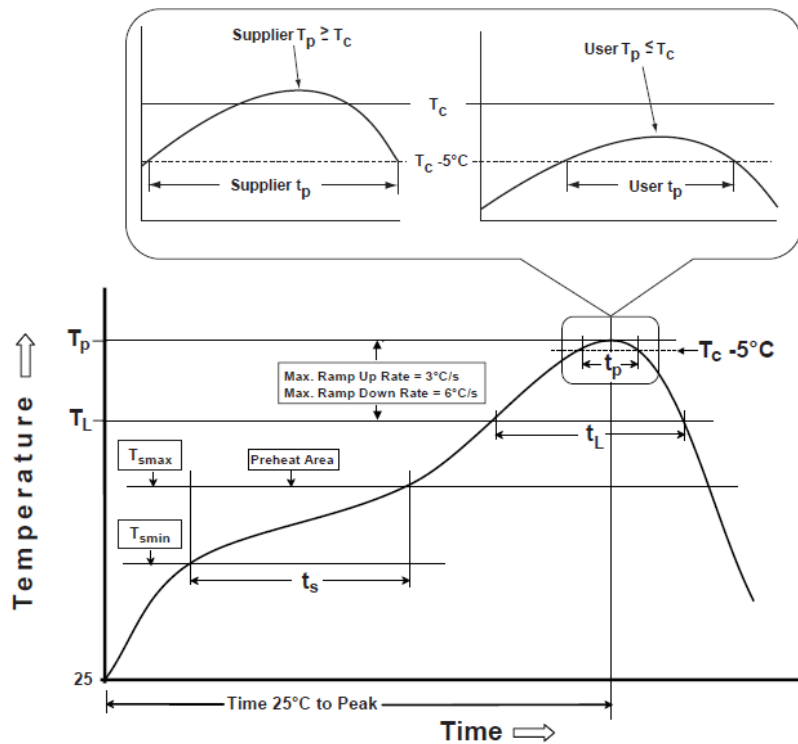


Table 1

SnPb Eutectic Process
Classification Temperatures (T_c)

Package Thickness	Volume mm ³ <350	Volume mm ³ ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2

Pb-Free Process
Classification Temperatures (T_c)

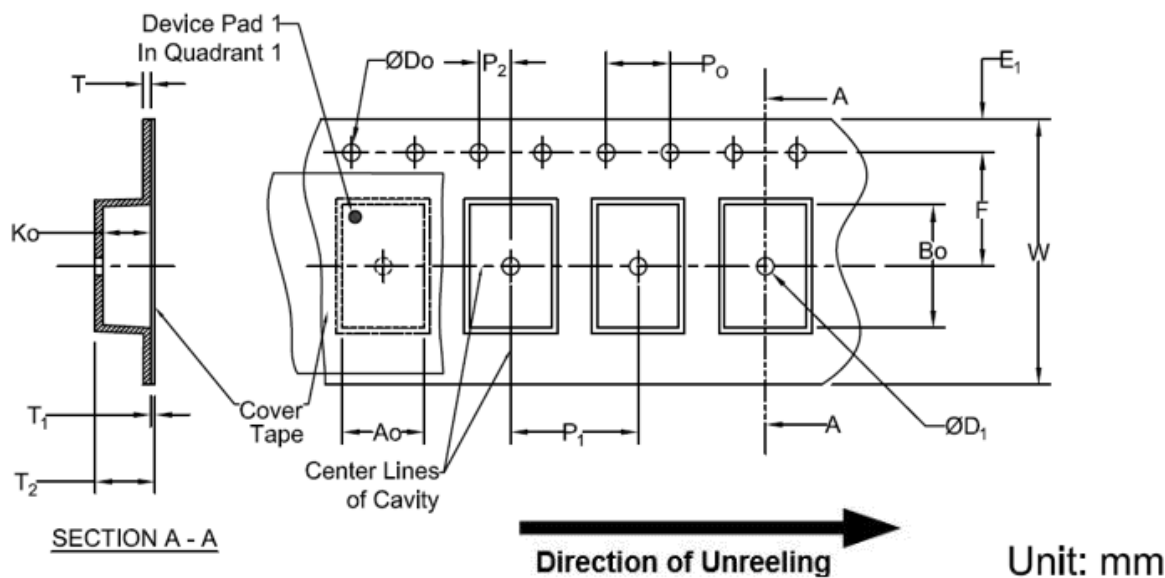
Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm - 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	250 °C	245 °C	245 °C

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

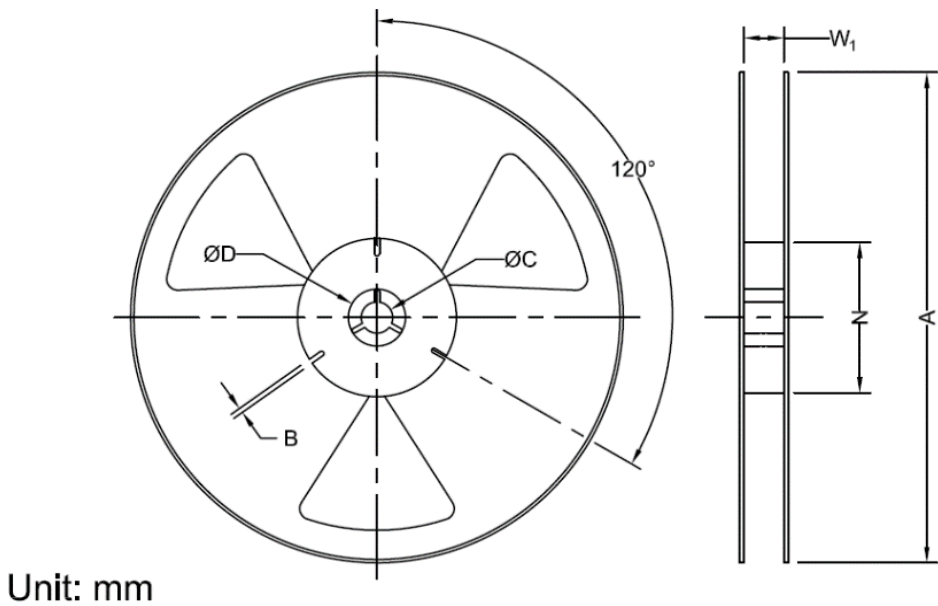


Tape Specifications (mm)							
Width	Ao	Bo	Do	D ₁ (Min)	E ₁	F	Ko
8mm	*	*	1.5+0.1/-0.0	1.0	1.75±0.1	3.5±0.05	*

*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



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]