

AK5

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ESD Sensitive



5.0 x 3.2 x 1.3 mm
RoHS/RoHS II Compliant
MSL Level = 1

Features

- 3rd overtone solution
- Ultra-Low jitter: 75 fs typ RMS (F= 156.25MHz LVPECL)
- Frequency range: 100MHz to 212.5MHz
- Lowest in-class power consumption (16mA typ LVDS)
- $\pm 20\text{ppm}$ & $\pm 25\text{ppm}$ stability (-40 to +85°C) options available (dependent on frequency)
- 3.3V, 2.5V, 1.8V Vdd supply
- LVPECL, LVDS, & HCSL differential output options
- Output enable standard

Applications

- Networking and communications
- Gigabit Ethernet
- Fibre Channel
- SONET/SDH
- RF systems, base stations (BTS)
- Datacenter
- PCI Express
- Test & measurement

Common Key Electrical Specifications

Parameters		Min.	Typ.	Max.	Units	Notes
Frequency Range		100		212.5	MHz	
Standard Available Frequencies		100MHz 122.88MHz 125MHz 148.5MHz 156.25MHz 200MHz 212.5MHz				Contact Abrac on for availability of frequencies not listed
Supply Voltage (Vdd) <small>[Note 1]</small>	2.97	3.3	3.63	V	Option "A" Option "B" Option "C"	
	2.37	2.5	2.62			
	1.71	1.8	1.89			
Supply Current (Idd)	LVPECL		30	50	mA	@ 200MHz; @ Vdd=3.3V
	LVDS		16	27		@ 200MHz; @ Vdd=3.3V
	HCSL		17	30		@ 200MHz; @ Vdd=3.3V
Operating Temperature Range		-20		+70	°C	Option "D"
		-40		+85		Option "F" or "Q"
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
Frequency Stability over <small>[Note 2, 3]</small> Operating Temperature Range		-15		+15	ppm	Option "D" (-20°C to +70°C)
		-20		+20		Option "Q" (-40°C to +85°C)
		-25		+25		Option "F" (-40°C to +85°C)
Aging over 20 Year Product Life <small>[Note 4]</small>		-15		+15	ppm	

ClearClock™ Oscillator Family | Low Jitter | 5.0x3.2mm XO

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Common Key Electrical Specifications Cont.

Parameters		Min.	Typ.	Max.	Units	Notes	
All-Inclusive Frequency Accuracy (Total Stability) over 20 Year Product Life [Notes 4, 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)	
Rise (Tr) / Fall (Tf) Time 20% to 80% Vpeak to peak		LVPECL	0.2	0.4	ns	@ Vdd=3.3V, RL=50Ω	
		LVPECL	0.3	0.6		@ Vdd=2.5V, RL=50Ω	
		LVDS	0.15	0.4		@ Vdd=3.3V, RL=100Ω	
		LVDS	0.15	0.4		@ Vdd=2.5V, RL=100Ω	
		LVDS	0.3	0.5		@ Vdd=1.8V, RL=100Ω	
		HCSL	0.3	0.5		@ Vdd=3.3V, RL=50Ω to GND	
		HCSL	0.3	0.5		@ Vdd=2.5V, RL=50Ω to GND	
		HCSL	0.3	0.6		@ Vdd=1.8V, RL=50Ω to GND	
Duty Cycle		45		55	%		
Start-up Time [Note 2]			< 2	5.0	ms		
Differential Output High Voltage (V _{OH}) Output Low Voltage (V _{OL})	LVPECL	V _{OH}	Vdd-1.03		V	RL=50Ω to Vdd-2.0V on both outputs	
		V _{OL}	Vdd-1.85			RL=100Ω between both outputs	
	LVDS	V _{OH}		1.40		RL=50Ω to ground on each output	
		V _{OL}	0.90	1.10			
	HCSL	V _{OH}	0.40	0.74			
		V _{OL}	-0.15	0.00			
Output Voltage Swing		0.595	0.750	0.930	V	LVPECL	
		0.250	0.350	0.450		LVDS	
		0.620	0.700	0.780		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 [Note 6, 7, 8] @ +25°C (12kHz-20MHz BW)	@ 200 MHz	LVPECL	115	140	fsec	@ Vdd=3.3V	
			115	140		@ Vdd=2.5V	
	LVDS		125	150		@ Vdd=3.3V	
			65	90		@ Vdd=2.5V	
	HCSL		120	145		@ Vdd=3.3V	
			125	150		@ Vdd=2.5V	

Note 1: Supply voltage (Vdd) = 1.8V option not available with LVPECL output

Note 2: Relative to initial measured frequency @ +25°C

Note 3: Option Q only available in select frequencies. Please contact Abracon for availability

Note 4: Relative to post-reflow frequency

Note 5: Includes temperature stability, initial frequency accuracy, load pulling, power supply variation, and 20-year aging



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Common Key Electrical Specifications Cont.

Parameters			Min.	Typ.	Max.	Units	Notes
RMS Phase Jitter [Note 6, 7, 8] @ +25°C (12kHz- 20MHz BW)	@ 156.25 MHz	LVPECL		75	100	fsec	@ Vdd=3.3V
				80	105		@ Vdd=2.5V
		LVDS		75	100		@ Vdd=3.3V
				100	125		@ Vdd=2.5V
		HCSL		120	145		@ Vdd=3.3V
				120	145		@ Vdd=2.5V
	@ 148.5 MHz	LVPECL		75	100	fsec	@ Vdd=3.3V
				80	105		@ Vdd=2.5V
		LVDS		125	150		@ Vdd=3.3V
				120	145		@ Vdd=2.5V
		HCSL		115	140		@ Vdd=3.3V
				115	140		@ Vdd=2.5V
	@ 125 MHz	LVPECL		95	120	fsec	@ Vdd=3.3V
				125	150		@ Vdd=2.5V
		LVDS		185	210		@ Vdd=3.3V
				175	300		@ Vdd=2.5V
		HCSL		145	170		@ Vdd=1.8V
				135	160		@ Vdd=3.3V
				125	150		@ Vdd=2.5V
				135	160		@ Vdd=1.8V
	@ 122.88 MHz	LVPECL		105	130	fsec	@ Vdd=3.3V
				115	140		@ Vdd=2.5V
		LVDS		195	220		@ Vdd=3.3V
				180	205		@ Vdd=2.5V
		HCSL		145	170		@ Vdd=1.8V
				125	150		@ Vdd=3.3V
				115	140		@ Vdd=2.5V
				180	205		@ Vdd=1.8V
	@ 100 MHz	LVPECL		185	210	fsec	@ Vdd=3.3V
				160	185		@ Vdd=2.5V
		LVDS		305	330		@ Vdd=3.3V
				300	325		@ Vdd=2.5V
		HCSL		195	220		@ Vdd=1.8V
				170	195		@ Vdd=3.3V
				180	205		@ Vdd=2.5V
				175	200		@ Vdd=1.8V

Note 6: Guaranteed by characterization; RMS Phase Jitter specifications are inclusive of any spurs

Note 7: Phase jitter measured with Keysight E5052B Signal Source Analyzer

Note 8: Refer to the next section for phase noise test setup and representative phase noise plots



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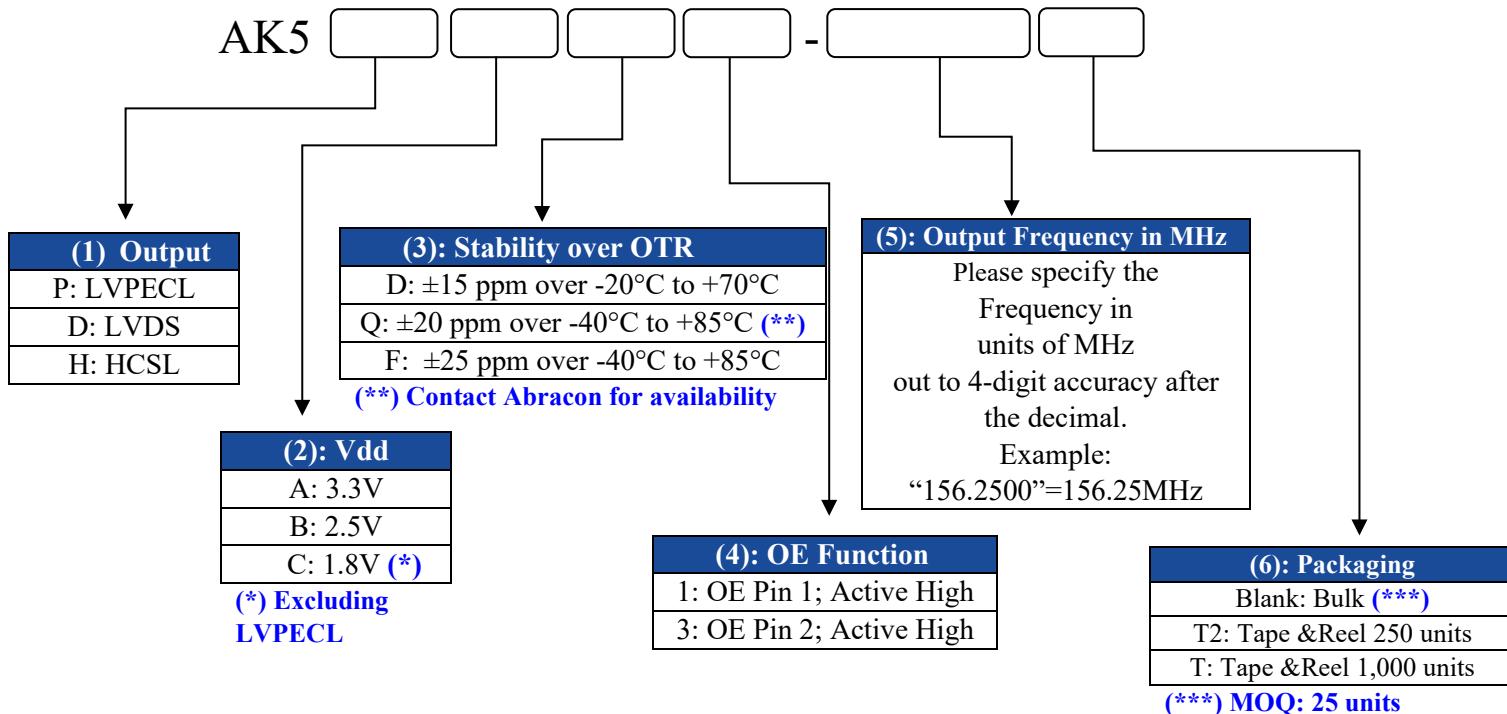


ESD Sensitive



5.0 x 3.2 x 1.3 mm
RoHS/RoHS II Compliant
MSL Level = 1

Options and Part Identification [Note 10]



Part Number Example:

AK5PAF1-156.2500

AK5PAF1-156.2500T2

AK5PAF1-156.2500T

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

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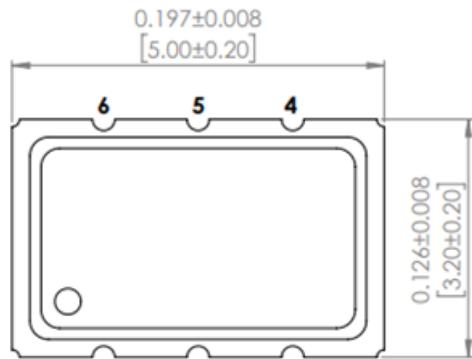


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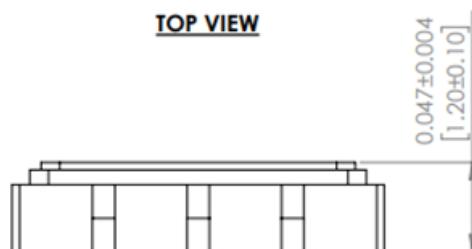


5.0 x 3.2 x 1.3 mm
RoHS/RoHS II Compliant
MSL Level = 1

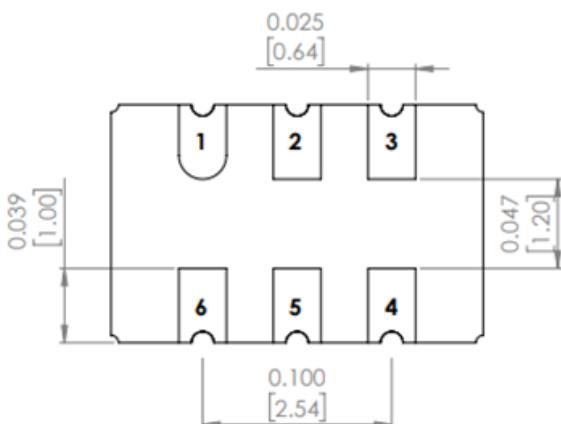
Mechanical Dimensions



TOP VIEW

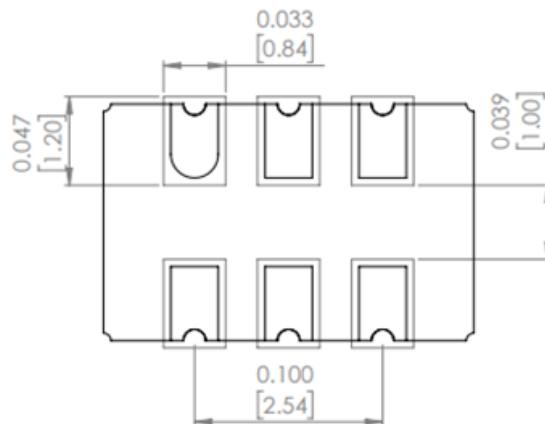


SIDE VIEW



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)

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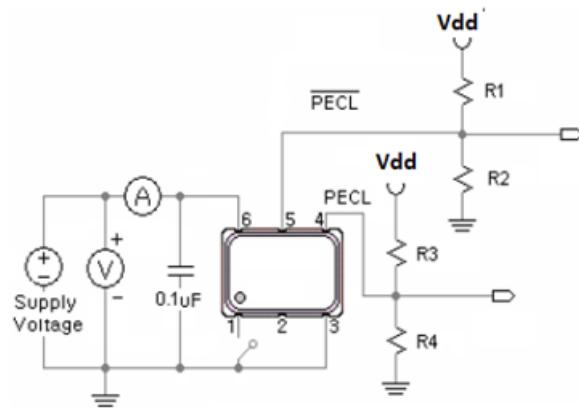
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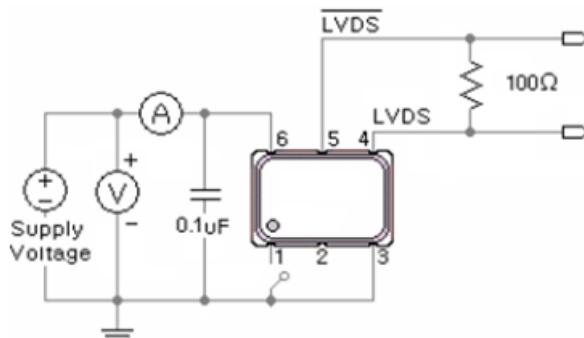
5.0 x 3.2 x 1.3 mm
RoHS/RoHS II Compliant
MSL Level = 1

Recommended Test Circuit [Note 11]

LVPECL

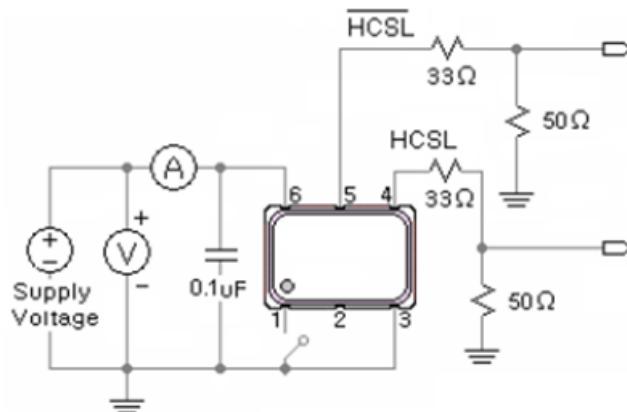


LVDS



Vdd= 3.3V: R1=R3=127Ω; R2=R4=82.5Ω
Vdd= 2.5V: R1=R3=250Ω, R2=R4=62.5Ω

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.

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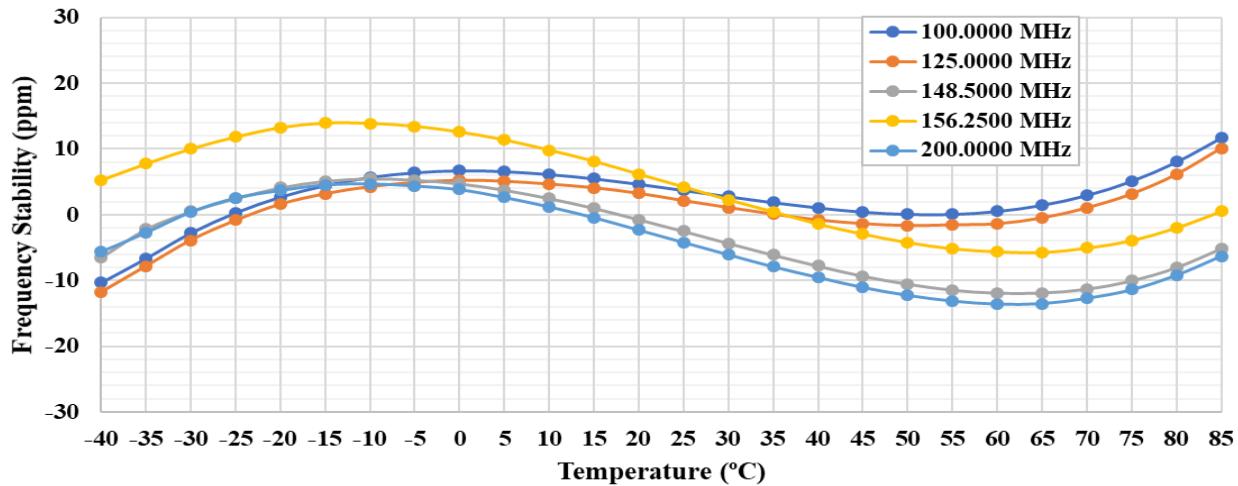
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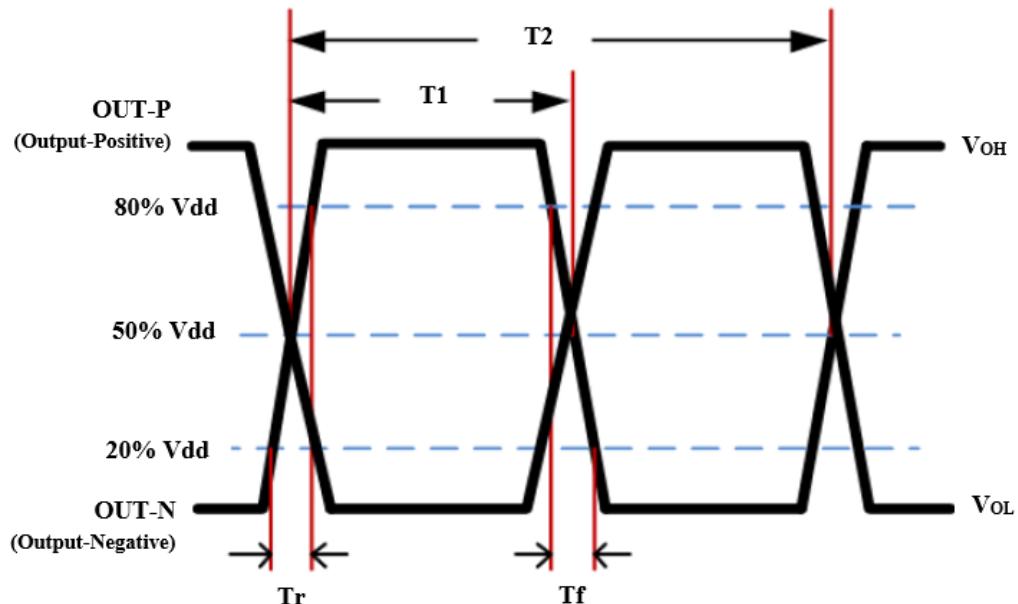
5.0 x 3.2 x 1.3 mm
RoHS/RoHS II Compliant
MSL Level = 1

Typical Frequency vs. Temperature Characteristics

Frequency Stability vs. Temperature AK5



Differential Output Waveform



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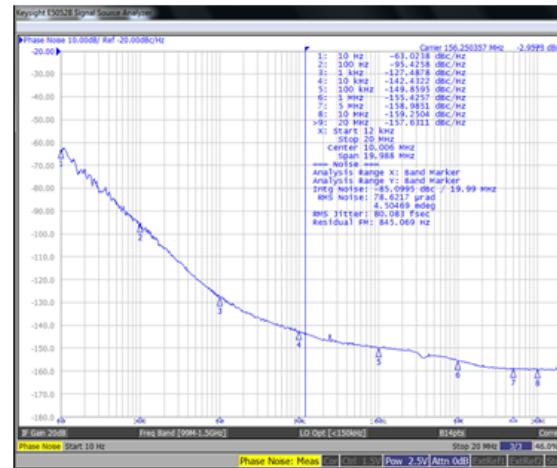
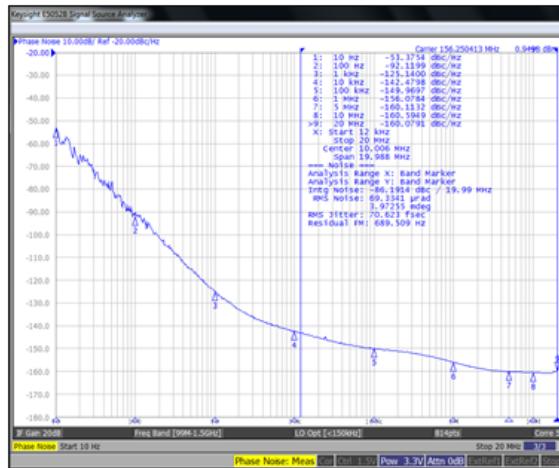
5.0 x 3.2 x 1.3 mm
RoHS/RoHS II Compliant
MSL Level = 1

Phase Noise Test Setup [Note 9]

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

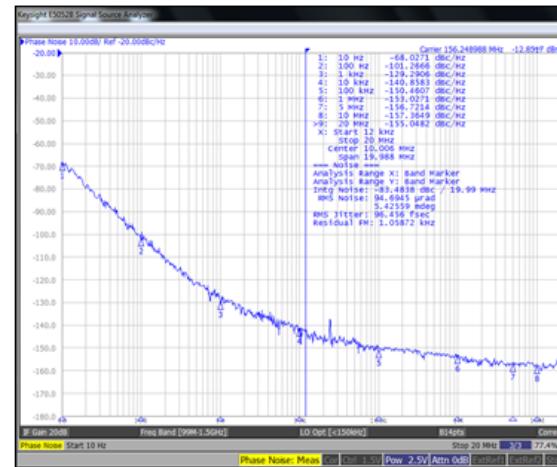
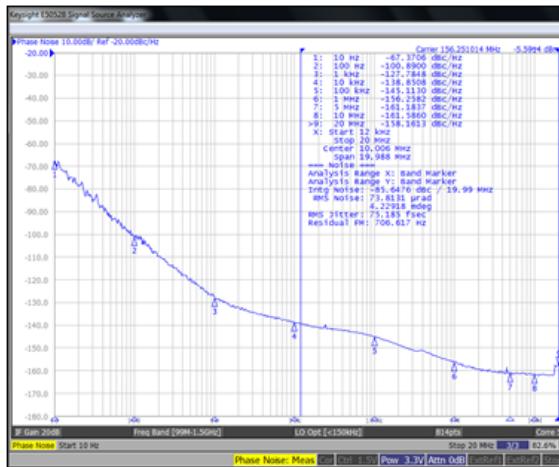
F=156.2500MHz | V_{dd}=3.3V | LVPECL
RMS Phase Jitter = 70 fsec

F=156.2500MHz | V_{dd}=2.5V | LVPECL
RMS Phase Jitter = 80 fsec



F=156.2500MHz | V_{dd}=3.3V | LVDS
RMS Phase Jitter = 75 fsec

F=156.2500MHz | V_{dd}=2.5V | LVDS
RMS Phase Jitter = 96 fsec



Note 9: Contact Abracon for phase noise plots at alternative supply voltage (V_{dd}) & differential output formats



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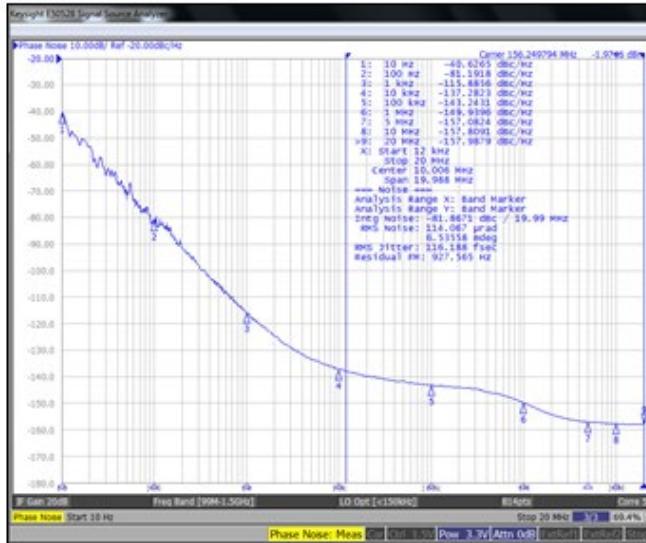
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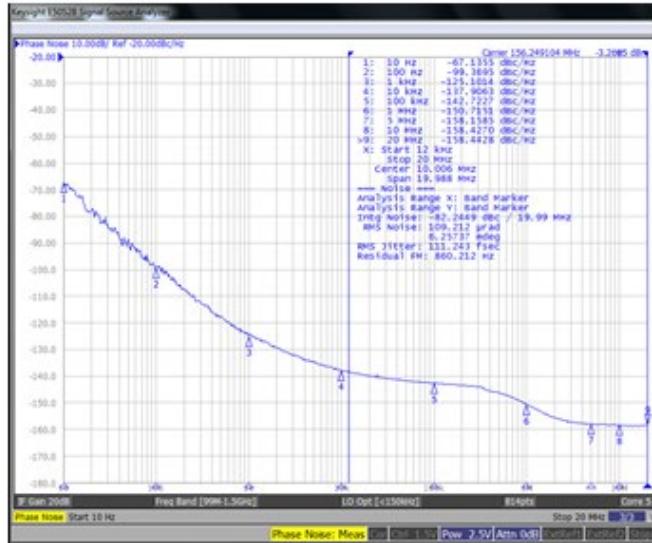
5.0 x 3.2 x 1.3 mm
RoHS/RoHS II Compliant
MSL Level = 1

Representative Phase Noise Plots @ +25°C [Note 9]

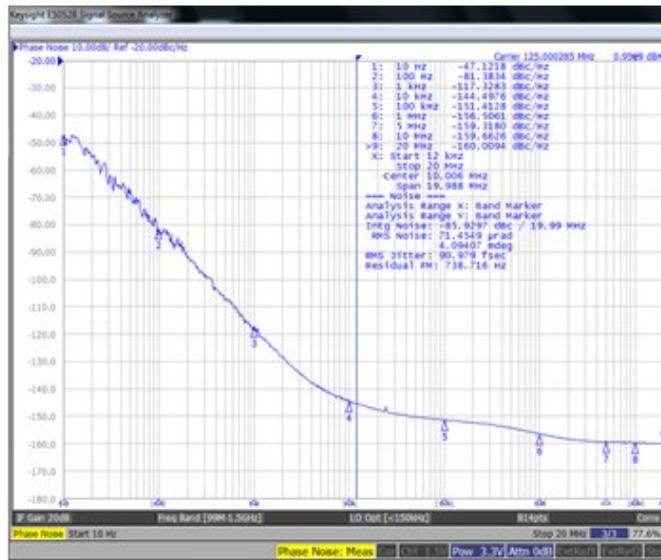
F=156.2500MHz | V_{dd}=3.3V | HCSL
RMS Phase Jitter = 116 fsec



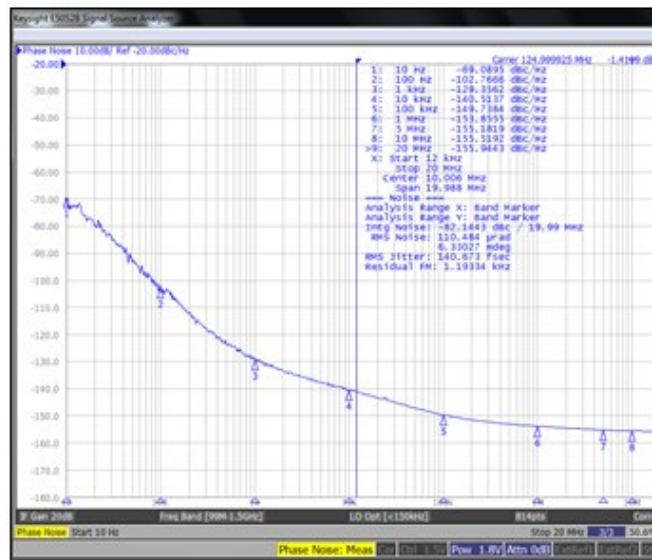
F=156.2500MHz | V_{dd}=2.5V | HCSL
RMS Phase Jitter = 111 fsec



F=125.0000MHz | V_{dd}=3.3V | LVPECL
RMS Phase Jitter = 90 fsec



F=125.0000MHz | V_{dd}=1.8V | LVDS
RMS Phase Jitter = 140 fsec



Note 9: Contact Abracon for phase noise plots at alternative supply voltage (V_{dd}) & differential output formats



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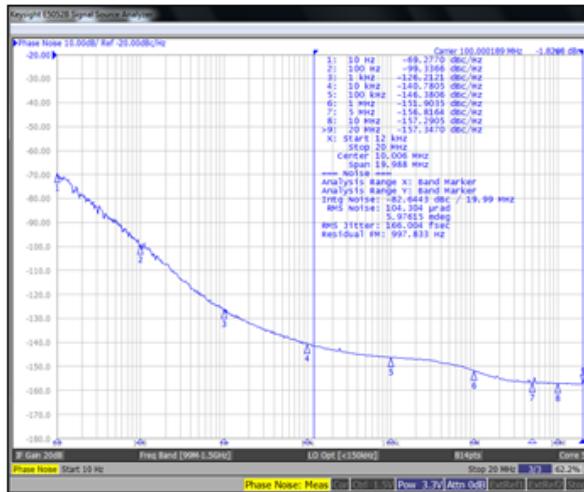
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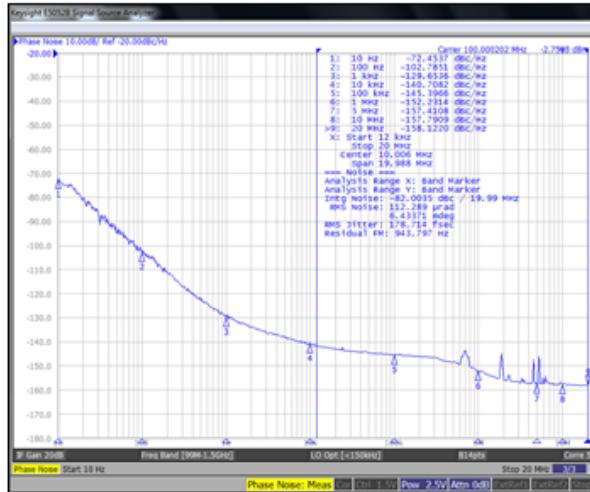
5.0 x 3.2 x 1.3 mm
RoHS/RoHS II Compliant
MSL Level = 1

Representative Phase Noise Plots @ +25°C Cont. [Note 9]

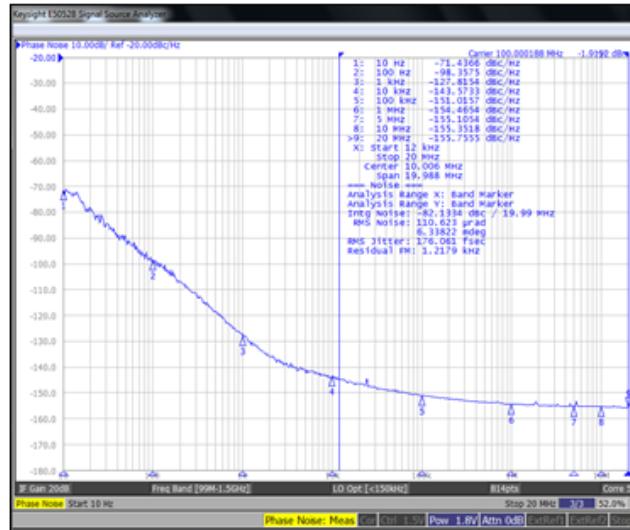
F=100.0000MHz | V_{dd}=3.3V | HCSL
RMS Phase Jitter = 166 fsec



F=100.0000MHz | V_{dd}=2.5V | HCSL
RMS Phase Jitter = 178 fsec



F=100.0000MHz | V_{dd}=1.8V | HCSL
RMS Phase Jitter = 176 fsec



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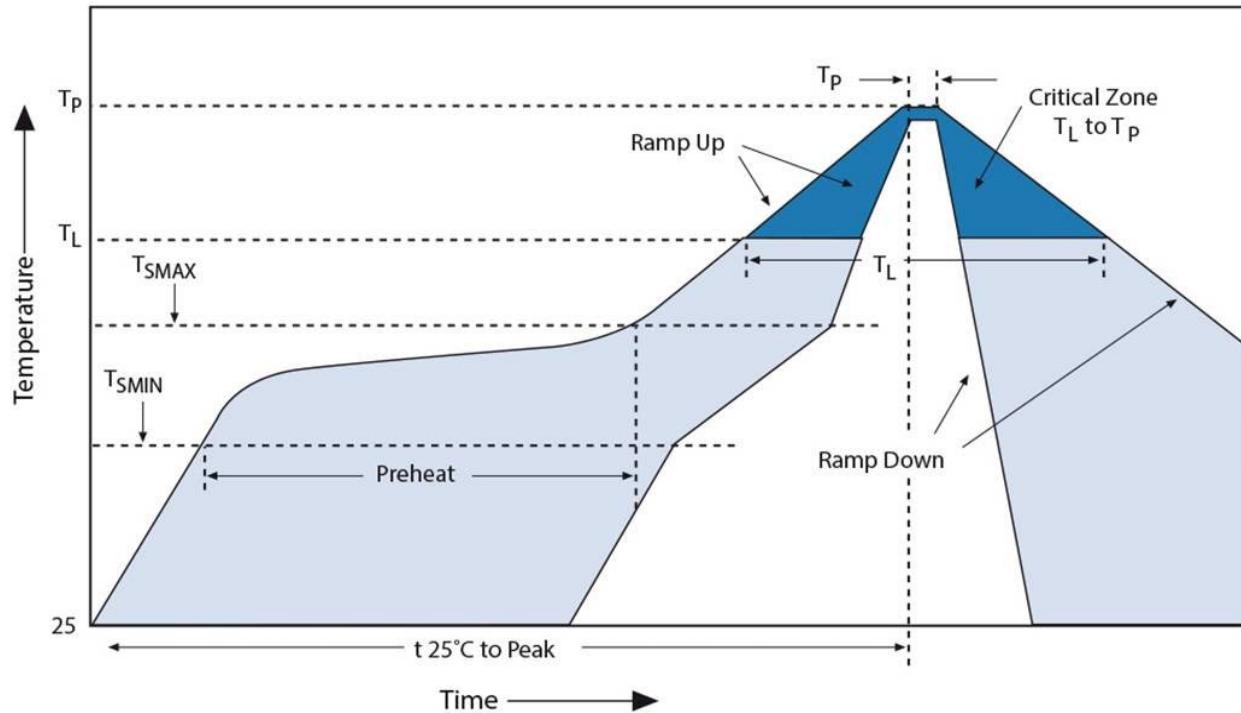


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5.0 x 3.2 x 1.3 mm
RoHS/RoHS II Compliant
MSL Level = 1

Recommended Reflow Profile [Note 12]



Zone	Description	Temperature	Time
1	Preheat / Soak	$T_{S\text{MIN}} \sim T_{S\text{MAX}}$ 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 12: Can withstand 2 reflows

Note 13: Ramp Up Rate ($T_L \rightarrow T_P$) = 3°C / sec. MAX

Note 14: Ramp Down Rate ($T_P \rightarrow T_L$) = 6°C / sec. MAX

Note 15: Time 25°C to Peak Temperature (25°C → T_P) = 8 minutes MAX

All temperatures refer to topside of the package, measured on the package body surface

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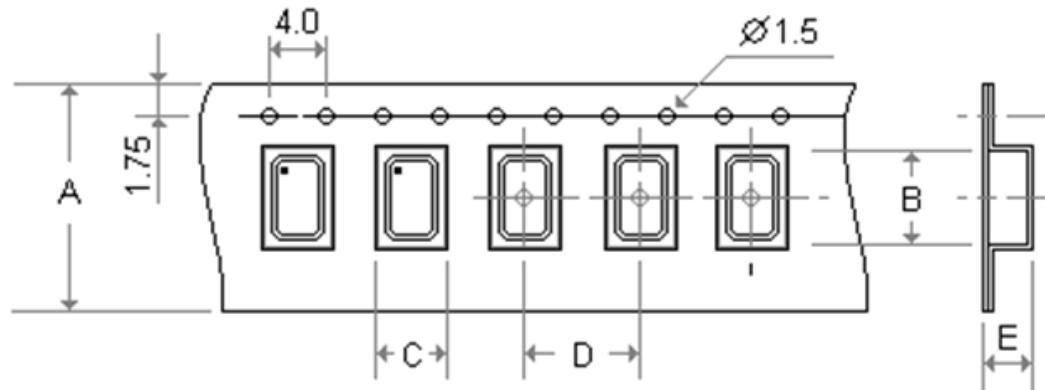


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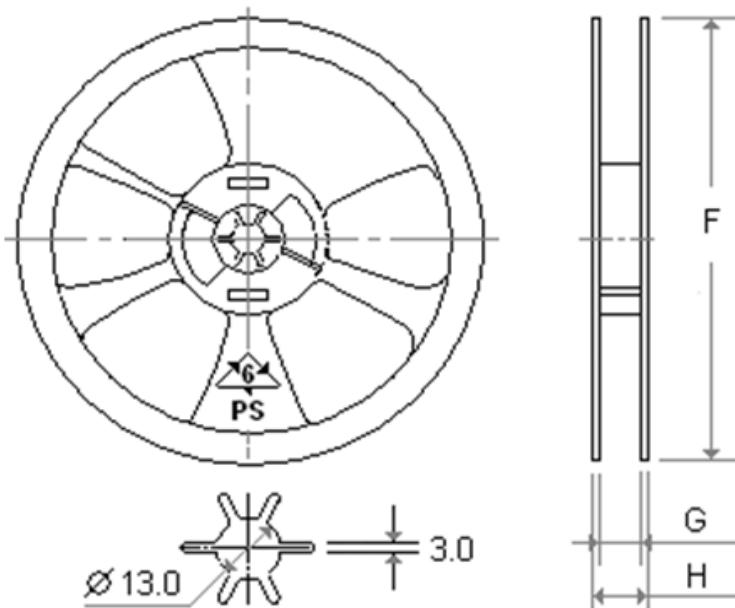
Packaging

Bulk (MOQ=25 units)
T2 = Tape & Reel 250 units/reel
T= Tape & Reel 1,000 units/reel

Feeding (PULL) Direction →



Tape Dimensions	
A	12.00
B	5.30
C	3.60
D	8.00
E	1.40
Reel Dimensions	
F	180.00
G	13.00
H	16.00



Dimensions: mm

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[AK5DBF1-100.0000T](#) [AK5DBF1-122.8800T](#) [AK5DBF1-125.0000T](#) [AK5DBF1-148.5000T](#) [AK5DBF1-156.2500T](#)
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