

### Description

Based on our PLL technology, the AX7 series is a programmable XO with LVPECL, LVDS, HCSL, and CML output logic options. Programmed at the factory prior to shipment, this series is perfect for quick turnaround solutions with a wide frequency range of up to 2100MHz. The AX7 series comes in a 7.0 x 5.0mm package with fixed VDD options from 1.8V, 2.5V and 3.3V.



### Features

- 0.125ps typ jitter (150fs MAX f > 200MHz, 25°C)
- Highest in-class frequency range from 50 to 2100MHz
- Excellent spurious suppression
- 70mA MAX IDD (LVDS, any VDD)
- Lowest in-class power consumption
- Supports LVPECL, HCSL, LVDS, CML
- Supports ±50ppm or ±100ppm all-inclusive stability
- -40°C to 85°C or -20°C to 70°C operation
- Industry standard 5x7mm footprint

### Typical Applications

- Networking and communications
- RF systems, base stations (BTS)
- Test and measurement
- Cloud, server and storage, Fibre Channel
- 100/400GbEthernet
- PCI Express

### Electrical Specifications

Parameters		Min.	Typ.	Max.	Units	Notes
Frequency Range	LVPECL	50		2100	MHz	Option "P"
	LVDS	50		2100		Option "D"
	HCSL	50		700		Option "H"
	CML	50		2100		Option "M"
Power Supply Voltage (Vdd) <sup>[Note 1]</sup>		2.97	3.3	3.63	V	Option "A"
		2.25	2.5	2.75		Option "B"
		1.71	1.8	1.89		Option "C"
Current Consumption (Idd)	LVPECL		87	94	mA	@ Vdd=3.3V
	LVDS		64	70		
	HCSL		75	80		@ Vdd=1.8V
	CML		63	68		
Set Tolerance (as received) @ 25°C ±3°C		-5.00	<±3.00	+5.00	ppm	Relative to carrier
Operating Temperature Range (OTR)		-40		+85	°C	See Options
Storage Temperature		-55		+150	°C	
Frequency Stability over OTR		-25		+25	ppm	Options "D" or "F"
		-50		+50		Options "E" or "G"
Aging over 10-Year Product Life <sup>[Note 2]</sup>		-15		+15	ppm	
All Inclusive Frequency Accuracy over 10-Year Product Life <sup>[Note 2]</sup>		-50		+50	ppm	Specific to freq. stability options "D" or "F" (±25ppm)
		-100		+100		Specific to freq. stability options "E" or "G" (±50ppm)

**Electrical Specifications *continued***

Parameters		Min.	Typ.	Max.	Units	Notes	
Rise (Tr) / Fall (Tf) Time	LVPECL/LVDS/CML			0.35	nS	20% ↔ 80% waveform	
	HCSL			0.40			
Duty Cycle		45		55	%	@ 50% Vdd	
Start-up Time <sup>[Note 2]</sup>			< 5.0	10	ms		
Output High Voltage (VOH) Output Low Voltage (VOL)	LVPECL	VOH	V <sub>dd</sub> -1.165	V <sub>dd</sub> -0.8	V	50Ω into V <sub>dd</sub> -2.0V or Thevenin equivalent	
		VOL	V <sub>dd</sub> -2.0	V <sub>dd</sub> -1.55			
	LVDS	VOH		1.4		1.6	100Ω between OUT and OUTN
		VOL	0.9	1.1			
	HCSL	VOH	0.66			1.15	50Ω to GND
		VOL	0.0			0.15	
	CML	VOH	V <sub>dd</sub> -0.085			V <sub>dd</sub> =Max	50Ω into V <sub>dd</sub>
		VOL	V <sub>dd</sub> -0.6			V <sub>dd</sub> -0.32	
Output Enable (OE) Control		0.8*(V <sub>dd</sub> )		0.2*(V <sub>dd</sub> )	V		
Output Enable Time				2.5	ms		
Output Disable Time				10	μs		
Output Disable Current Consumption	LVPECL		85	86	mA	@ V <sub>dd</sub> =3.3V	
	LVDS		63	65			
	HCSL		77	78		@ V <sub>dd</sub> =1.8V	
	CML		62	67			
<b>RMS Phase Jitter (12kHz -20MHz BW)</b>							
201.0000MHz – 2100.0000MHz			125	150	fsec	@ V <sub>dd</sub> =3.3V	
50.0000MHz – 200.0000MHz			200	300			
156.2500MHz			< 130	200			

Note 1: Supply Voltage (V<sub>dd</sub>) = 1.8V option not available with LVPECL output

Note 2: Relative to initial measured frequency @ 25°C ±3°C

Typical Phase Noise and Jitter Characteristics (@ 25°C ± 3°C)

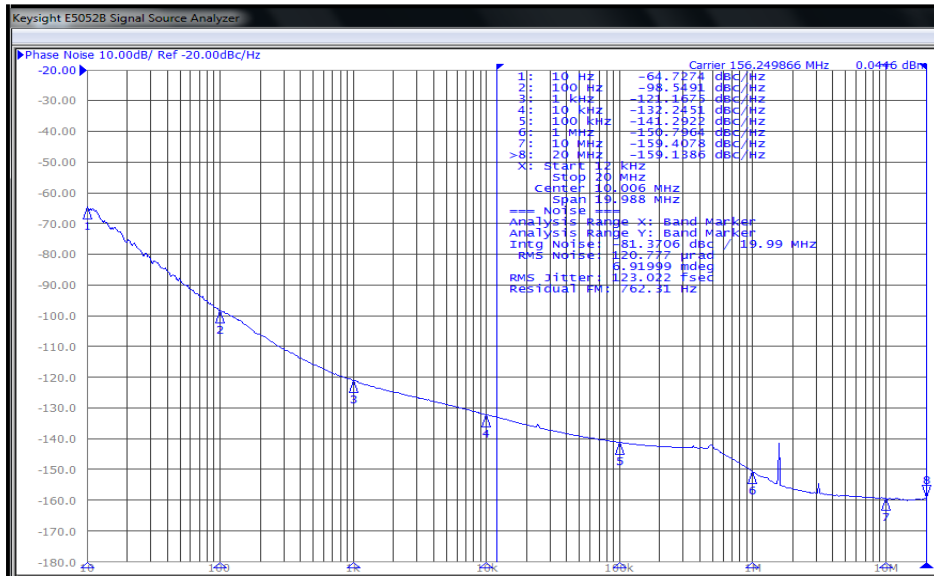
Frequency (MHz)	148.35	150	155.52	156.25	156.25	200	212.5	312.5	
RF Output	LVDS	LVPECL	LVPECL	LVPECL	HCSL	LVPECL	LVDS	LVDS	
RMS Phase Jitter (fsec) 12kHz-20MHz BW	125	137	124	123	129	122	127	114	
Phase Noise (dBc/Hz)	100Hz	-96	-98	-98	-98	-99	-90	-83	-94
	1kHz	-120	-120	-120	-121	-121	-114	-114	-115
	10kHz	-132	-132	-132	-132	-132	-129	-129	-126
	100kHz	-140	-139	-141	-141	-140	-138	-137	-134
	1MHz	-149	-150	-151	-150	-151	-148	-147	-144
	10MHz	-157	-159	-159	-159	-160	-159	-157	-156
	20MHz	-157	-159	-159	-159	-160	-159	-157	-157

Frequency (MHz)	322.265625		491.52	644.53125	1000	1244.16	1500	2100	
RF Output	LVPECL	HCSL	LVPECL	LVPECL	LVDS	LVDS	LVDS	LVPECL	
RMS Phase Jitter (fsec) 12kHz-20MHz BW	121	121	123	127	114	127	112	138	
Phase Noise (dBc/Hz)	100Hz	-91	-92	-91	-77	-76	-78	-79	-77
	1kHz	-113	-114	-111	-107	-102	-102	-101	-98
	10kHz	-125	-125	-122	-119	-115	-113	-112	-108
	100kHz	-133	-133	-131	-127	-124	-122	-120	-117
	1MHz	-144	-144	-138	-138	-134	-131	-130	-124
	10MHz	-157	-157	-154	-154	-150	-149	-145	-145
	20MHz	-159	-159	-154	-155	-152	-150	-145	-148

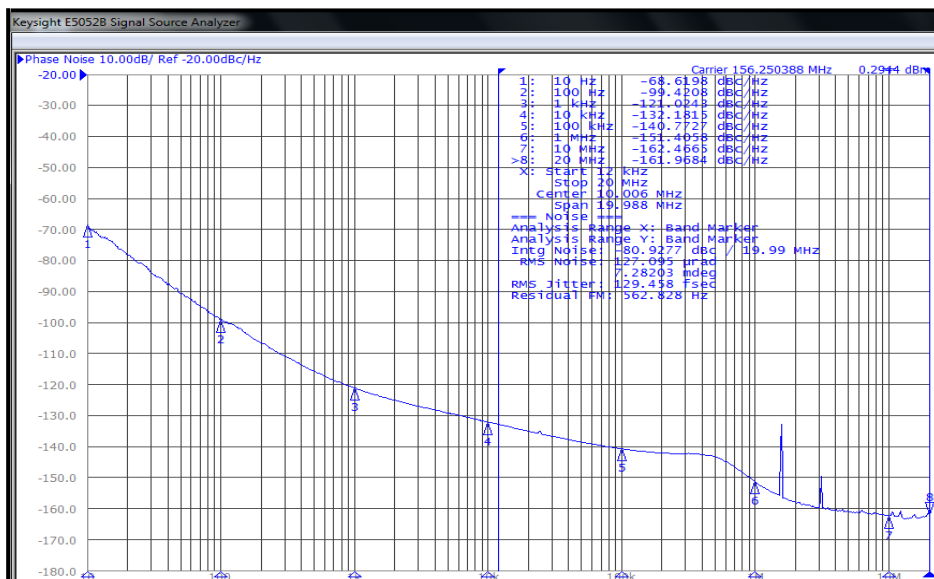
Note 3: Refer to Section 1.2 for selected Phase Noise Plots

Typical Phase Noise and Jitter Characteristics (@ 25°C ± 3°C) Continued

156.25MHz – LVPECL – Vdd=3.3V

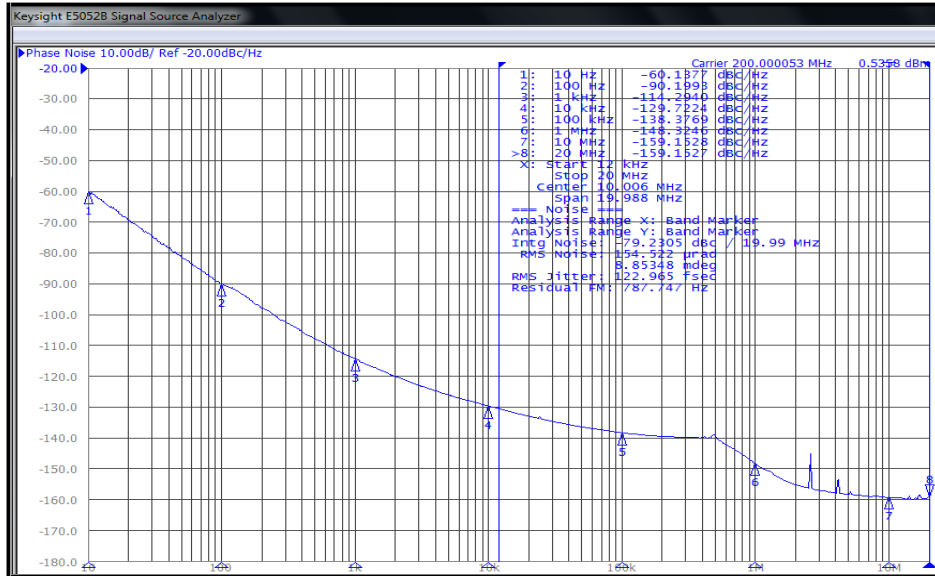


156.25MHz – HCSL – Vdd=1.8V

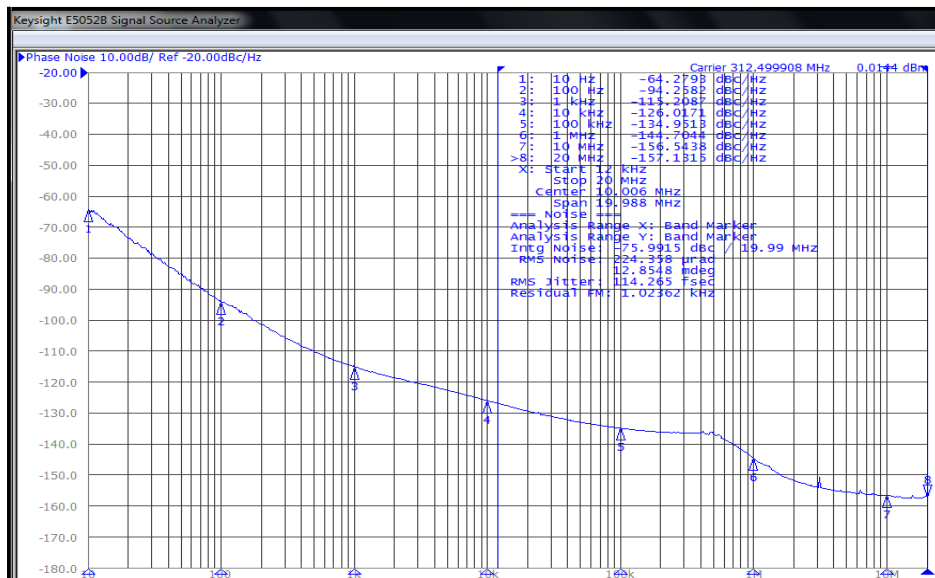


Typical Phase Noise and Jitter Characteristics (@ 25°C ± 3°C) Continued

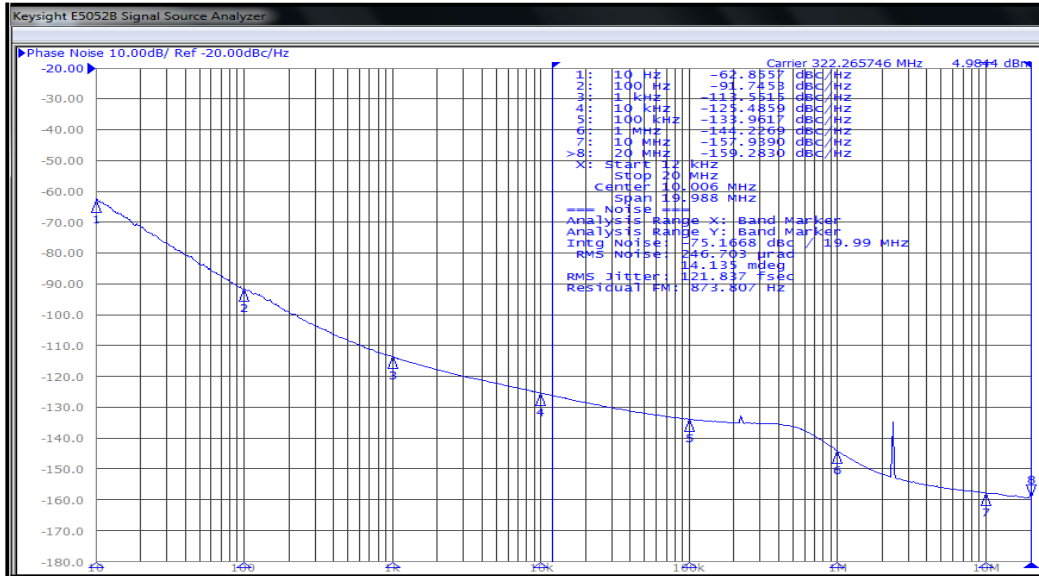
200MHz – LVPECL – Vdd=3.3V



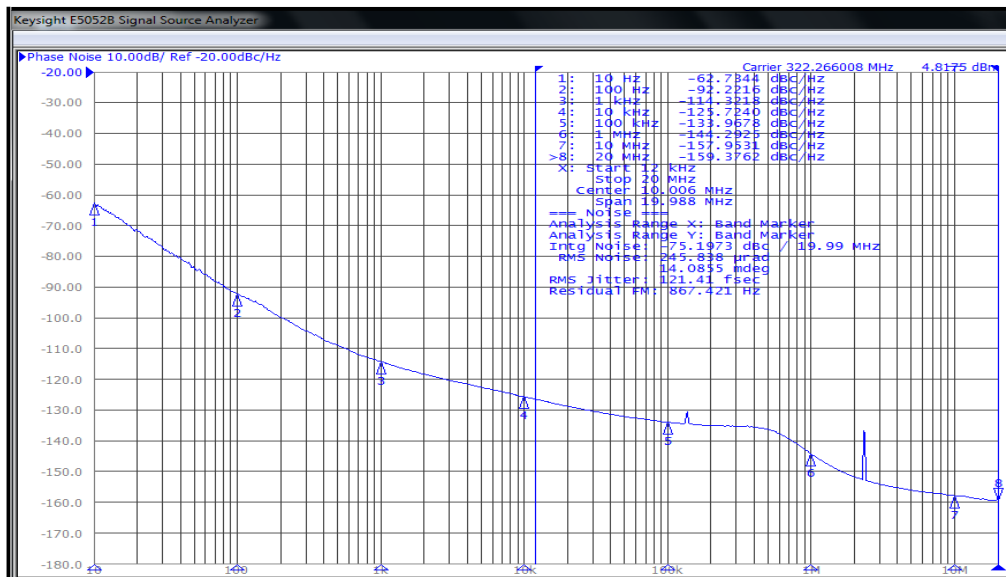
312.5MHz – LVDS – Vdd=3.3V



**322.265625MHz – LVPECL – Vdd=3.3V**

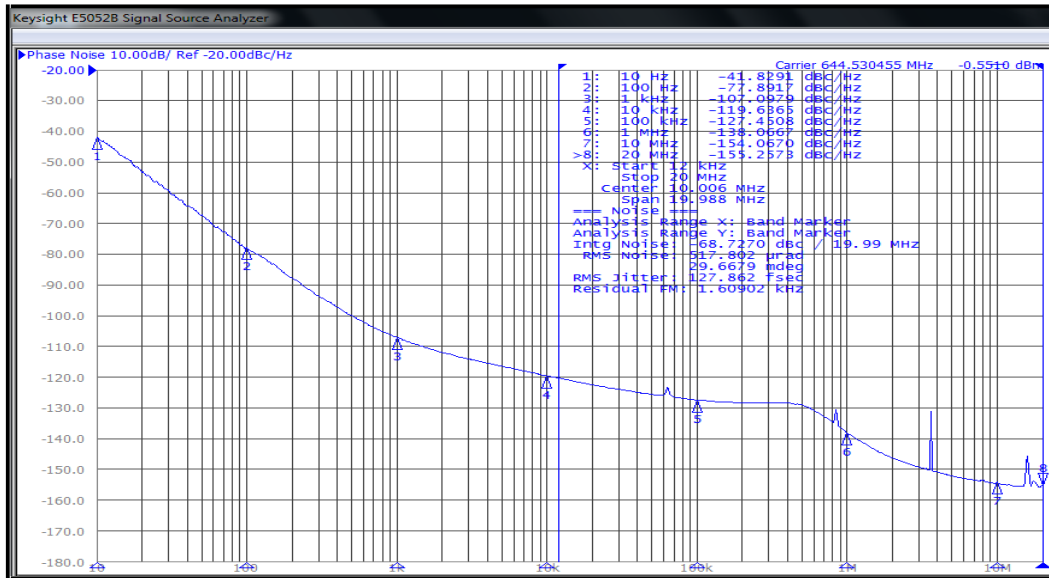


**322.265625MHz – HCSL – Vdd=3.3V**

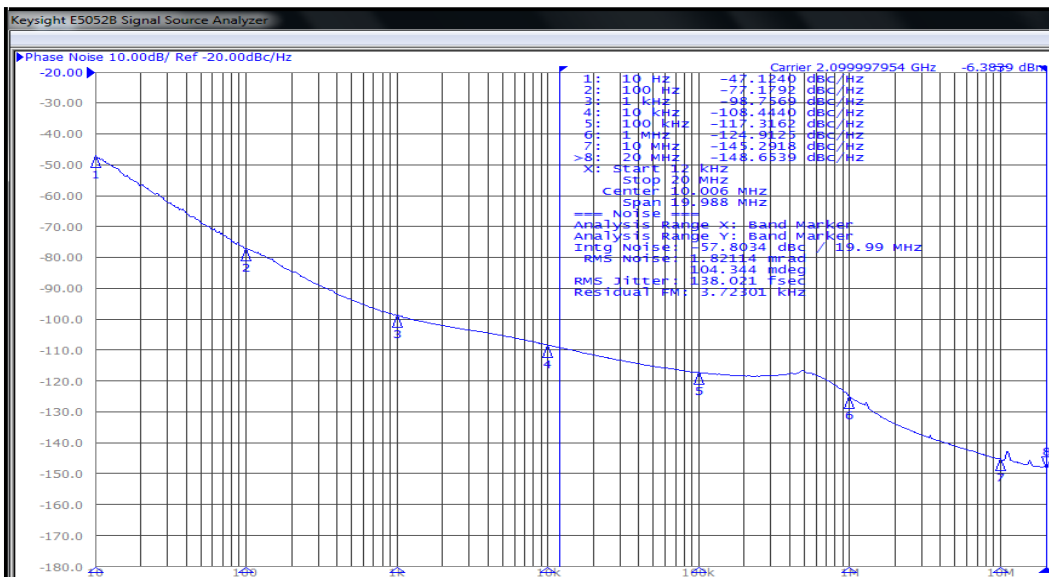


Typical Phase Noise and Jitter Characteristics (@ 25°C ± 3°C) Continued

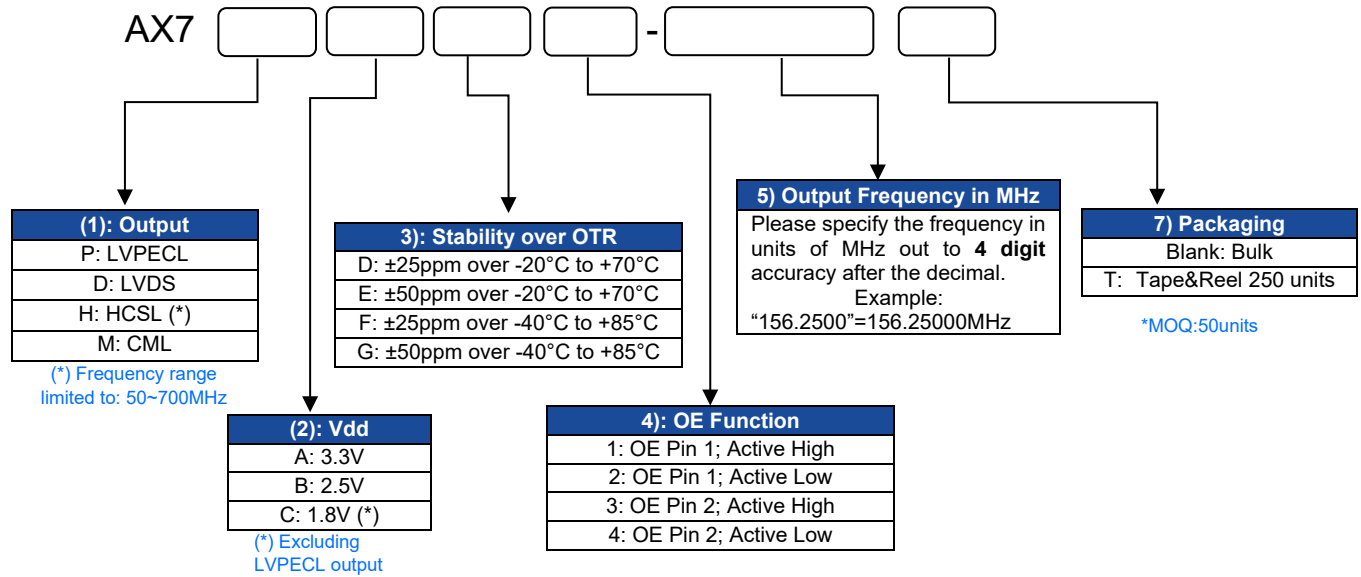
644.53125MHz – LVPECL – Vdd=3.3V



2100MHz – LVPECL – Vdd=3.3V



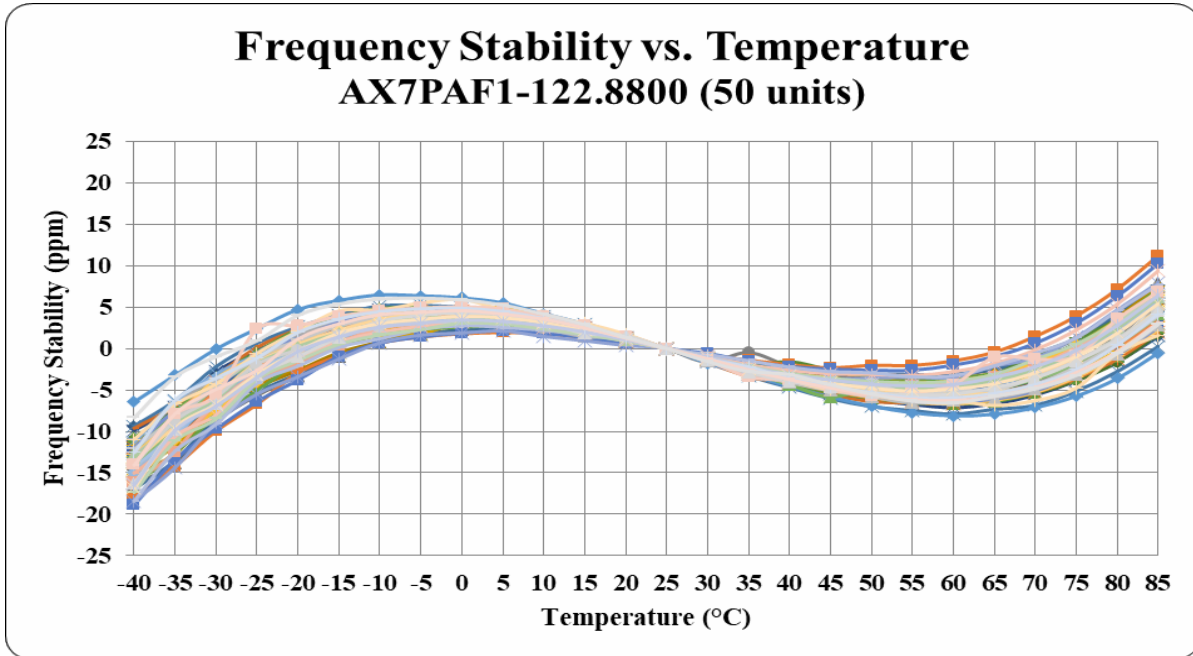
Option and Part Identification <sup>[Note 4]</sup>



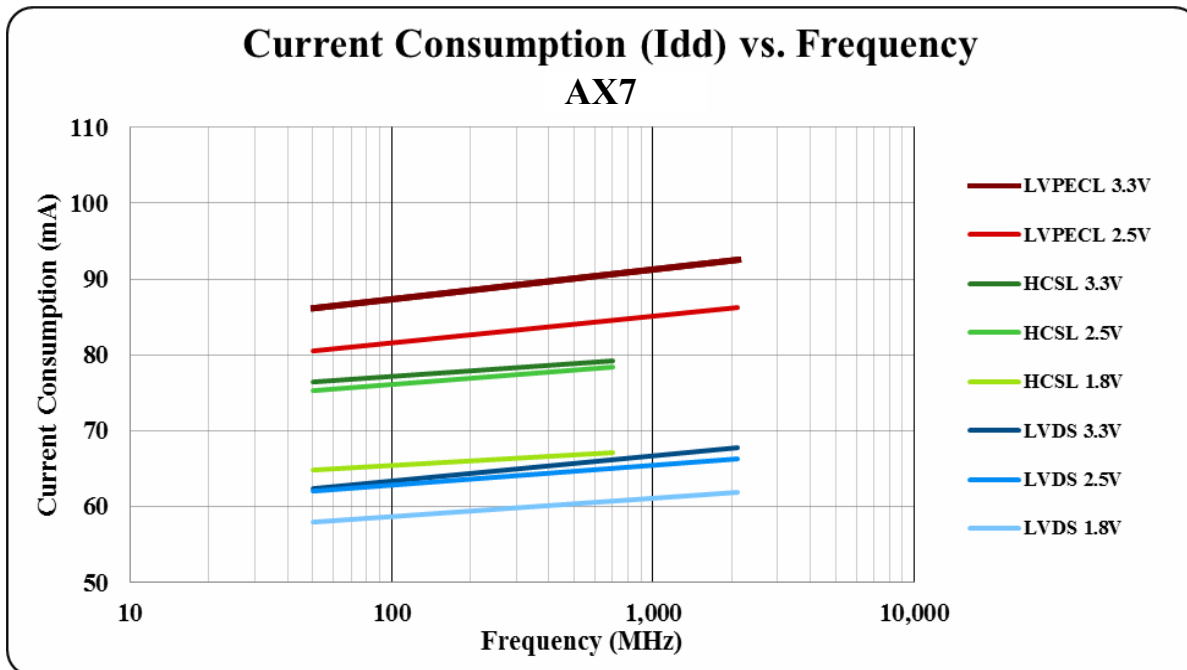
**Part Number Example:**  
**AX7PAF1-644.53125**

Note 4: Contact Abracon for part number requests with carrier frequency callouts up to 5 & 6 digit accuracy after the decimal.

Typical Frequency vs. Temperature Characteristics

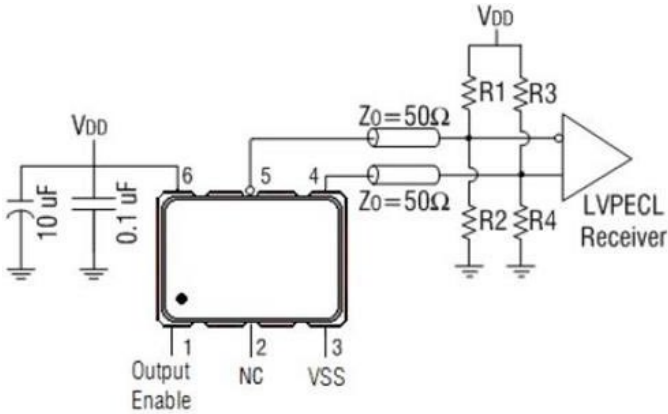


Typical Current Consumption (I<sub>dd</sub>) vs. Frequency Characteristics (@ 25°C ± 3°C)



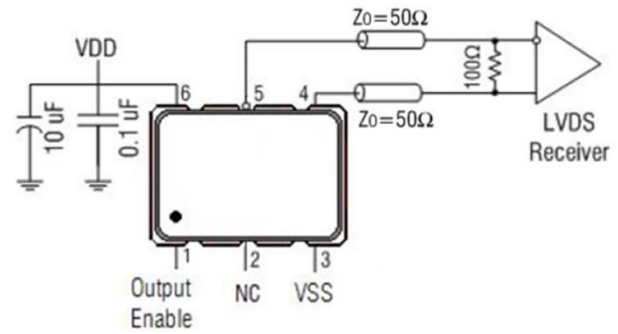
Recommended Test Circuit

LVPECL

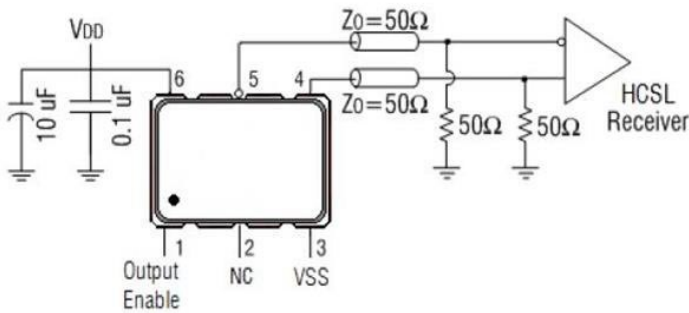


$V_{DD}=3.3V$ :  $R1=R3=127\Omega$ ;  $R2=R4=82.5\Omega$   
 $V_{DD}=2.5V$ :  $R1=R3=250\Omega$ ;  $R2=R4=62.5\Omega$

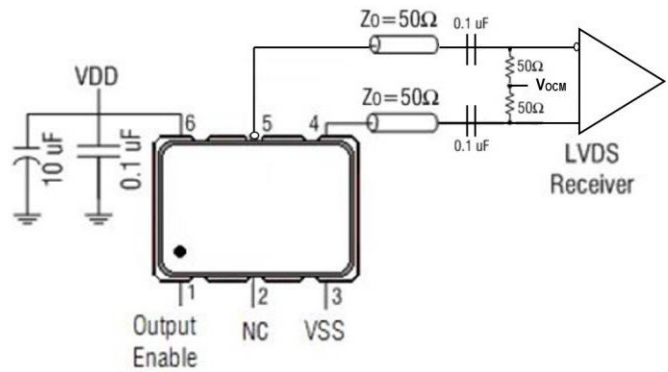
LVDS @Vdd=3.3V or 2.5V



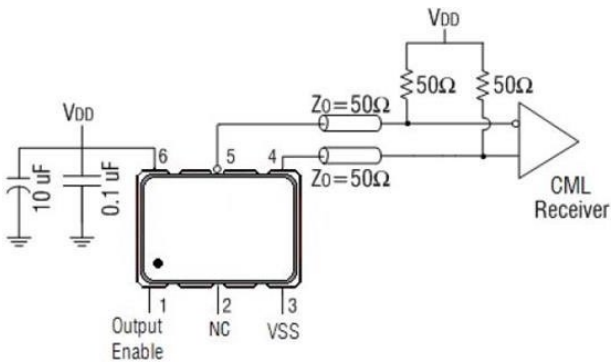
HCSL



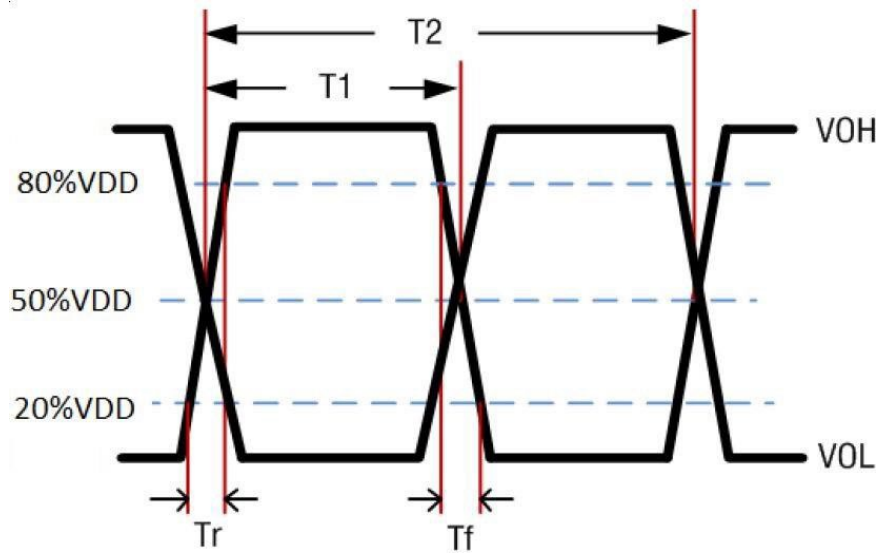
LVDS @Vdd=1.8V



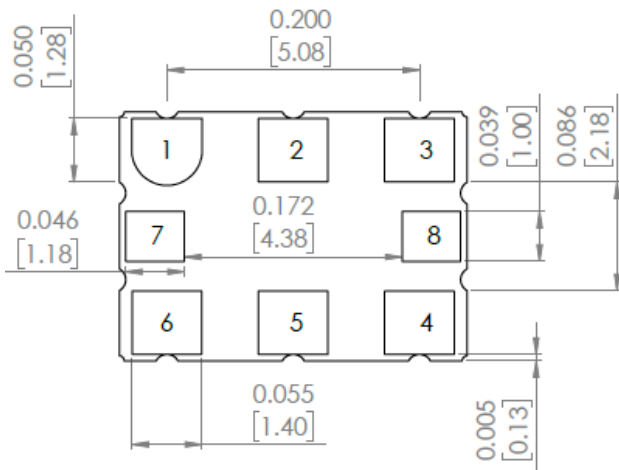
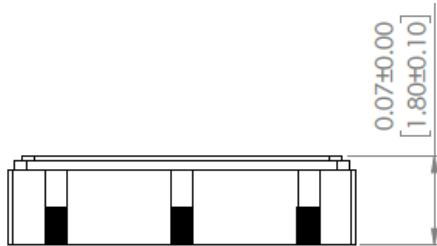
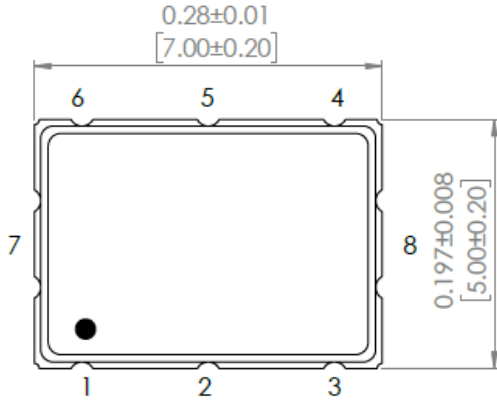
CML



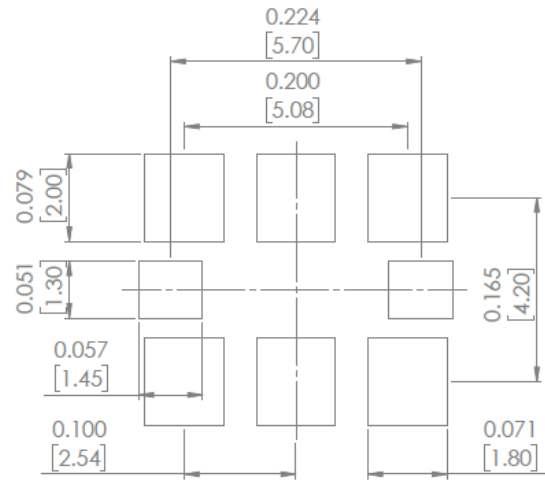
Differential Output Waveform



Mechanical Dimensions



Recommended Land Pattern



Pin #	Function
1	<b>Option 1 &amp; 2:</b> Output Enable/Disable <b>Option 3 &amp; 4:</b> No Connect
2	<b>Option 1 &amp; 2:</b> No Connect <b>Option 3 &amp; 4:</b> Output Enable/Disable
3	GND
4	Output
5	Complementary output
6	Supply Voltage (Vdd)
7	No connect
8	No connect

Dimensions: inches (mm)

Reflow Profile [JEDEC J-STD-020]

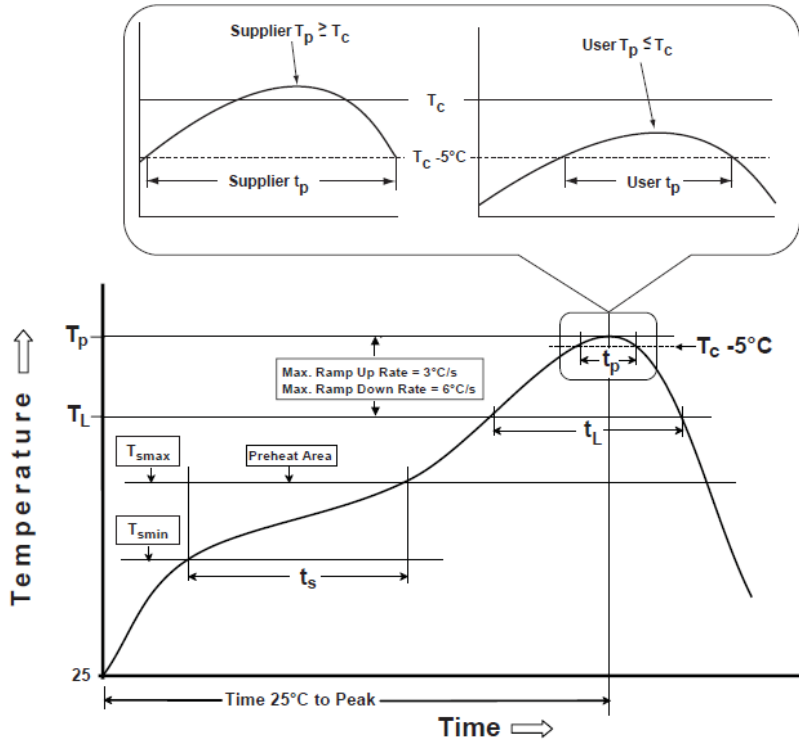


Table 1

SnPb Eutectic Process Classification Temperatures (T <sub>c</sub> )		
Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2

Pb-Free Process Classification Temperatures (T <sub>c</sub> )			
Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350-2000	Volume mm <sup>3</sup> >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 <sub>smin</sub> )	100°C	150°C
Temperature maximum (T <sub>smax</sub> )	150°C	200°C
Time (T <sub>smin</sub> to T <sub>smax</sub> ) (t <sub>s</sub> )	60 - 120 sec.	60 - 120 sec.
Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> )	3°C/sec. max	3°C/sec. max
Liquidous temperature (T <sub>L</sub> )	183°C	217°C
Time at liquidous (t <sub>L</sub> )	60 - 150 sec.	60 - 150 sec.
Peak package body temperature (T <sub>p</sub> )*	see Table 1	see Table 2
Time (t <sub>p</sub> )** within 5°C of the specified classification temperature (T <sub>c</sub> )	20 sec.	30 sec.
Ramp-down rate (T <sub>p</sub> to T <sub>smax</sub> )	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<sub>p</sub>) is defined as a supplier minimum and a user maximum.

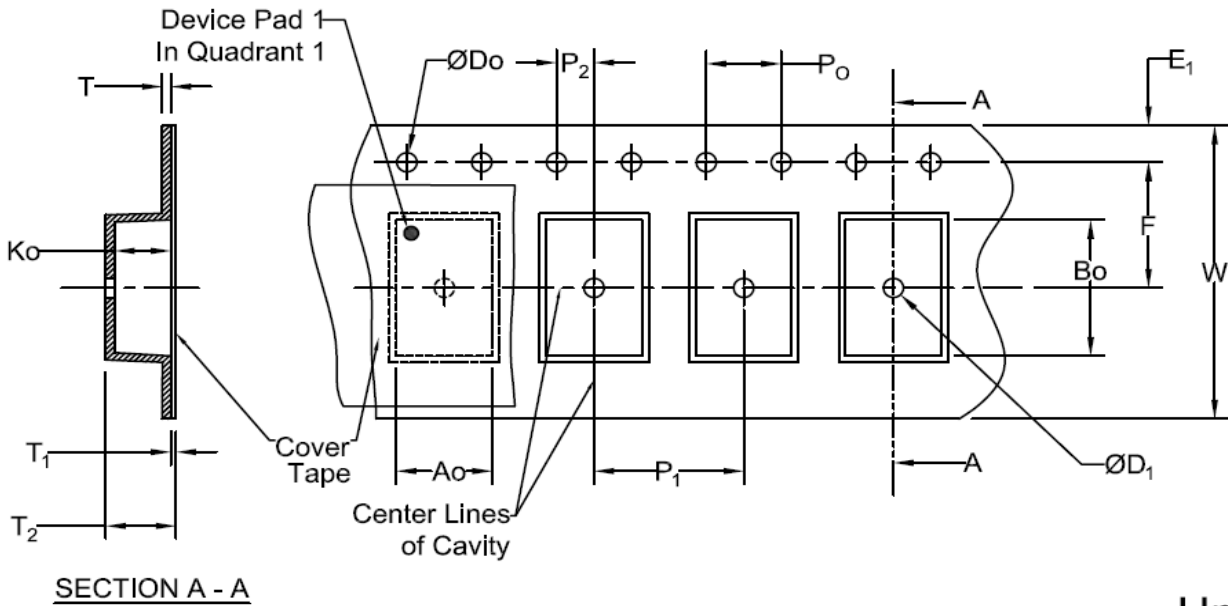
\*\*Tolerance for time at peak profile temperature (t<sub>p</sub>) is defined as supplier minimum and a user maximum.

**Packaging**

Blank = Bulk\*

T = Tape & Reel 250 units/réel

\*MOQ = 50 units



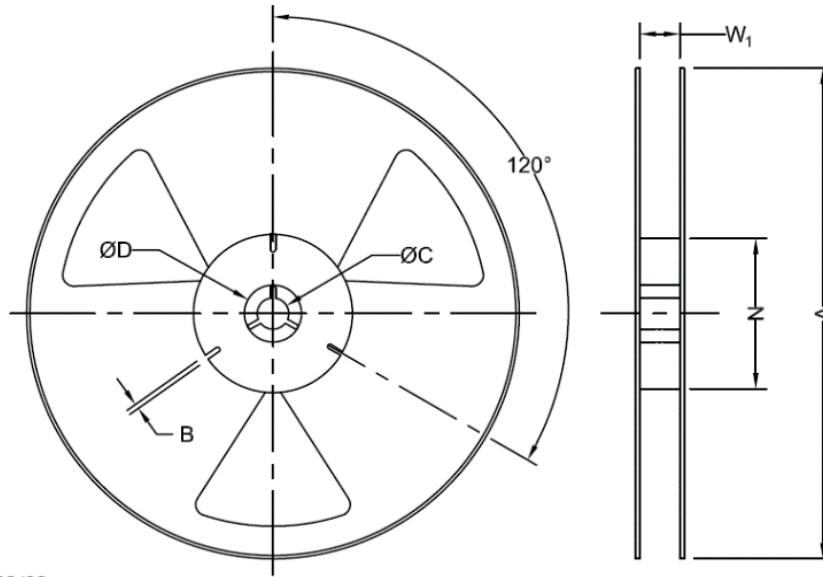
Unit: mm

Tape Specifications (mm)							
Width	Ao	Bo	Do	D <sub>1</sub> (Min)	E <sub>1</sub>	F	Ko
16mm	*	*	1.5+0.1/-0.0	1.0	1.75±0.1	5.5±0.05	*

Tape Specifications (mm)							
Width	P <sub>1</sub>	P <sub>2</sub>	P <sub>0</sub>	T (Max)	T <sub>1</sub> (Max)	T <sub>2</sub> (Max)	W (Max)
16mm	8.0±0.1	2.0±0.1	4.0±0.1	0.6	0.1	8.0	16.3

**\*Note: Compliant to EIA-481**

Dimensions: inches (mm)



Unit: mm

Tape Specifications (mm)							
Width	Qty/Reel	A (Nom)	B (Min)	C (Min)	D (Min)	N (Min)	*W <sub>1</sub>
16mm	250	180	1.5	13.0+0.5/-0.2	20.2	50	16.4+2.0/-0.0

\*Note: Measured at Hub

Dimensions: inches (mm)