DSA1001/3/4

1.8V-3.3V Low-Power Precision CMOS Oscillators for Automotive

Features

- Automotive AEC-Q100 Qualified
- Frequency Range: 1 MHz to 150 MHz
- Exceptional Stability over Temperature
  - ±20 ppm, ±25 ppm, ±50 ppm
- Operating Voltage
  - 1.7 to 3.6V
- Operating Temperature Range
  - Automotive Grade 2: –40°C to 105°C
  - Automotive Grade 3: –40°C to 85°C
- Low Operating and Standby Current
  - 6 mA Operating (1 MHz)
  - 15 µA Standby (Max.)
- Ultra Miniature Footprint
  - 2.5 mm x 2.0 mm x 0.85 mm
  - 3.2 mm x 2.5 mm x 0.85 mm
  - 5.0 mm x 3.2 mm x 0.85 mm
- MIL-STD 883 Shock and Vibration Resistant
- Pb Free, RoHS, Reach SVHC Compliant

Applications

- Automotive Infotainment
- Automotive ADAS
- Automotive Camera Module

Benefits

- Replace High Temperature Crystals and Quartz Oscillators
- Pin for Pin “Drop-In” Replacement for Industry Standard Oscillators
- Semiconductor Level Reliability, Significantly Higher than Quartz
- Longer Battery Life/Reduced Power Consumption
- Compact Plastic Package
- Cost Effective

General Description

The DSA1001/3/4 is a silicon MEMS based CMOS family of oscillators that offers excellent jitter and stability performance over a wide range of supply voltages and temperatures. The device operates from 1 MHz to 150 MHz with supply voltages between 1.8 to 3.3 volts and temperature ranges up to –40°C to 105°C.

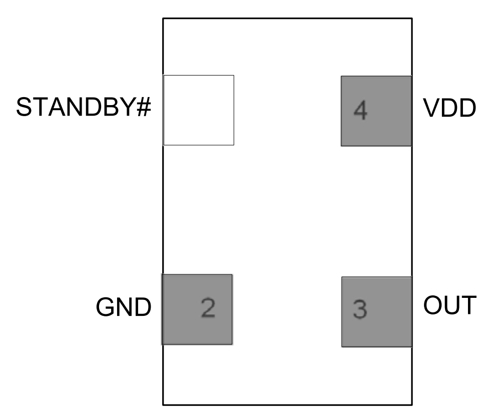
The DSA1001/3/4 incorporate an all silicon resonator that is extremely robust and nearly immune to stress related fractures, common to crystal based oscillators. Without sacrificing the performance and stability required of today’s systems, a crystal-less design allows for a higher level of reliability, making the DSA1001/3/4 ideal for rugged, industrial, and portable applications where stress, shock, and vibration can damage quartz crystal based systems.

Available in industry standard packages, the DSA1001/3/4 can be “dropped-in” to the same PCB footprint as standard crystal oscillators.

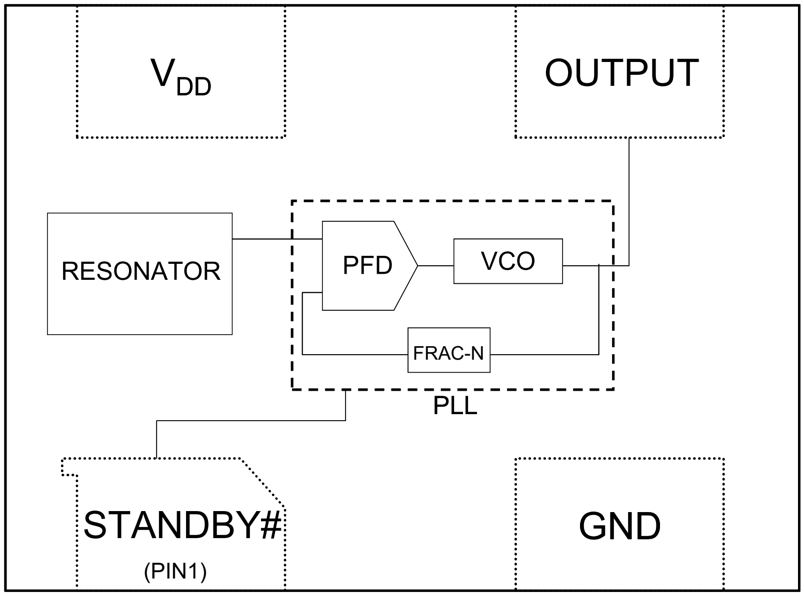
The DSA1003 and DSA1004 have the same functionality and performance as the DSA1001, but feature higher output drives of 25 pF and 40 pF, respectively.

Package Types

DSA1001/3/4
CDFN/DFN
(Top View)



Block Diagram



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Input Voltage (V_{IN}) .... –0.3V to V_{DD} + 0.3V
ESD Protection .... 4 kV HBM, ±200V MM, 1.5 kV CDM

Recommended Operating Conditions

Supply Voltage (V_{DD}) .... +1.7V to +3.6V
Output Load (Z_L) .... R > 10 kΩ, C ≤ 15 pF

† Notice: 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.

TABLE 1-1: ELECTRICAL CHARACTERISTICS

Electrical Characteristics: V_{DD} = 1.8 to 3.3V; T_A = +85°C unless otherwise specified.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Frequency	F_0	1	—	150	MHz	Single Frequency
Frequency Tolerance	Δf	—	—	±20	ppm	Includes frequency variations due to initial tolerance, temperature and power supply voltage
		—	—	±25		
		—	—	±50		
Aging	Δf	—	—	±5	ppm	1 year @ +25°C
Supply Current, Standby	I_{DD}	—	—	15	µA	T = +25°C
Output Startup Time (Note 1)	t_{SU}	—	1.0	1.3	ms	T = +25°C
Output Disable Time	t_{DA}	—	20	100	ns	—
Output Duty Cycle	SYM	45	—	55	%	—
Input Logic Level High	V_{IH}	0.75 x V_{DD}	—	—	V	—
Input Logic Level Low	V_{IL}	—	—	0.25 x V_{DD}	V	—
V_{DD} = 1.8V						
Supply Current, No Load	I_{DD}	—	6.0	6.3	mA	1 MHz; C_L = 0 pF, R_L = ∞, T = +25°C
		—	6.5	7.1		27 MHz
		—	7.2	8.5		70 MHz
		—	8.3	11.9		150 MHz
Output Logic Level High	V_{OH}	0.8 x V_{DD}	—	—	V	–6 mA, DSA1004, C_L = 40 pF
		0.8 x V_{DD}	—	—	V	–6 mA, DSA1003, C_L = 25 pF
		0.8 x V_{DD}	—	—	V	–4 mA, DSA1001, C_L = 15 pF
Output Logic Level Low	V_{OL}	—	—	0.2 x V_{DD}	V	6 mA, DSA1004, C_L = 40 pF
		—	—	0.2 x V_{DD}	V	6 mA, DSA1003, C_L = 25 pF
		—	—	0.2 x V_{DD}	V	6 mA, DSA1001, C_L = 15 pF

Note 1: t_{SU} is time to stable output frequency after V_{DD} is applied. t_{SU} and t_{EN} (after EN is asserted) are identical values.

2: Measured over 50k clock cycles.

TABLE 1-1: ELECTRICAL CHARACTERISTICS (CONTINUED)

Electrical Characteristics: V_{DD} = 1.8 to 3.3V; T_A = +85°C unless otherwise specified.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions	
Output Transition Rise Time	t_R	—	1.4	3.0	ns	DSA1001, C_L = 15 pF	T = +25°C, 20% to 80%
		—	1.5	3.0		DSA1003, C_L = 25 pF	
		—	1.8	3.0		DSA1004, C_L = 40 pF	
Output Transition Fall Time	t_F	—	1.0	3.0	ns	DSA1001, C_L = 15 pF	T = +25°C, 20% to 80%
		—	1.1	3.0		DSA1003, C_L = 25 pF	
		—	1.2	3.0		DSA1004, C_L = 40 pF	
Jitter, Max. Cycle-to-Cycle	J_{CC}	—	60	—	ps	f = 100 MHz (Note 2)	
Period Jitter	J_P	—	10	15	ps_{RMS}	f = 100 MHz (Note 2)	
V_{DD} = 2.5V							
Supply Current, No Load	I_{DD}	—	6.0	6.4	mA	1 MHz	C_L = 0 pF, R_L = ∞, T = +25°C
		—	6.7	7.5		27 MHz	
		—	7.7	9.4		70 MHz	
		—	9.6	13.9		150 MHz	
Output Logic Level High	V_{OH}	0.9 x V_{DD}	—	—	V	–6 mA, DSA1004, C_L = 40 pF	
		0.8 x V_{DD}	—	—	V	–6 mA, DSA1003, C_L = 25 pF	
		0.8 x V_{DD}	—	—	V	–4 mA, DSA1001, C_L = 15 pF	
Output Logic Level Low	V_{OL}	—	—	0.1 x V_{DD}	V	6 mA, DSA1004, C_L = 40 pF	
		—	—	0.2 x V_{DD}	V	6 mA, DSA1003, C_L = 25 pF	
		—	—	0.2 x V_{DD}	V	4 mA, DSA1001, C_L = 15 pF	
Output Transition Rise Time	t_R	—	1.0	2.0	ns	DSA1001, C_L = 15 pF	T = +25°C, 20% to 80%
		—	1.1	2.0		DSA1003, C_L = 25 pF	
		—	1.2	2.0		DSA1004, C_L = 40 pF	
Output Transition Fall Time	t_F	—	0.9	2.0	ns	DSA1001, C_L = 15 pF	T = +25°C, 20% to 80%
		—	1.0	2.0		DSA1003, C_L = 25 pF	
		—	1.1	2.0		DSA1004, C_L = 40 pF	

Note 1: t_{SU} is time to stable output frequency after V_{DD} is applied. t_{SU} and t_{EN} (after EN is asserted) are identical values.

2: Measured over 50k clock cycles.

TABLE 1-1: ELECTRICAL CHARACTERISTICS (CONTINUED)

Electrical Characteristics: V_{DD} = 1.8 to 3.3V; T_A = +85°C unless otherwise specified.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions	
Jitter, Max. Cycle-to-Cycle	J_{CC}	—	50	—	ps	f = 100 MHz (Note 2)	
Period Jitter	J_P	—	5	10	ps_{RMS}	f = 100 MHz (Note 2)	
V_{DD} = 3.3V							
Supply Current, No Load	I_{DD}	—	6.0	6.5	mA	1 MHz	C_L = 0 pF, R_L = ∞, T = +25°C
		—	6.8	8.0		27 MHz	
		—	8.2	10.5		70 MHz	
		—	10.8	16.6		150 MHz	
Output Logic Level High	V_{OH}	0.9 x V_{DD}	—	—	V	–8 mA, DSA1004, C_L = 40 pF	
		0.9 x V_{DD}	—	—	V	–6 mA, DSA1003, C_L = 25 pF	
		0.8 x V_{DD}	—	—	V	–4 mA, DSA1001, C_L = 15 pF	
Output Logic Level Low	V_{OL}	—	—	0.1 x V_{DD}	V	8 mA, DSA1004, C_L = 40 pF	
		—	—	0.1 x V_{DD}	V	6 mA, DSA1003, C_L = 25 pF	
		—	—	0.2 x V_{DD}	V	4 mA, DSA1001, C_L = 15 pF	
Output Transition Rise Time	t_R	—	1.0	2.0	ns	DSA1001, C_L = 15 pF	T = +25°C, 20% to 80%
		—	1.1	2.0		DSA1003, C_L = 25 pF	
		—	1.2	2.0		DSA1004, C_L = 40 pF	
Output Transition Fall Time	t_F	—	0.9	2.0	ns	DSA1001, C_L = 15 pF	T = +25°C, 20% to 80%
		—	1.0	2.0		DSA1003, C_L = 25 pF	
		—	1.1	2.0		DSA1004, C_L = 40 pF	
Jitter, Max. Cycle-to-Cycle	J_{CC}	—	50	—	ps	f = 100 MHz (Note 2)	
Period Jitter	J_P	—	5	10	ps_{RMS}	f = 100 MHz (Note 2)	

Note 1: t_{SU} is time to stable output frequency after V_{DD} is applied. t_{SU} and t_{EN} (after EN is asserted) are identical values.

2: Measured over 50k clock cycles.

TEMPERATURE SPECIFICATIONS (Note 1)

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Temperature Ranges						
Operating Temperature Range (T)	T_A	–40	—	+105	°C	Ordering Option L
		–40	—	+85	°C	Ordering Option I
Junction Operating Temperature	T_J	—	—	+150	°C	—
Storage Temperature Range	T_A	–55	—	+150	°C	—
Soldering Temperature Range	T_S	—	—	+260	°C	40 sec. max

Note 1: The maximum allowable power dissipation is a function of ambient temperature, the maximum allowable junction temperature and the thermal resistance from junction to air (i.e., T_A, T_J, θ_{JA}). Exceeding the maximum allowable power dissipation will cause the device operating junction temperature to exceed the maximum +150°C rating. Sustained junction temperatures above +150°C can impact the device reliability.

2.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 2-1.

TABLE 2-1: CDFN PACKAGE PIN FUNCTION TABLE

Pin Number	Symbol	Description
1	STANDBY#	Standby input (**Section 4.1 "Standby Function"**)
2	GND	Power supply ground
3	OUT	Oscillator output
4	VDD	Positive power supply

3.0 NOMINAL PERFORMANCE CHARACTERISTICS

Note:	The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

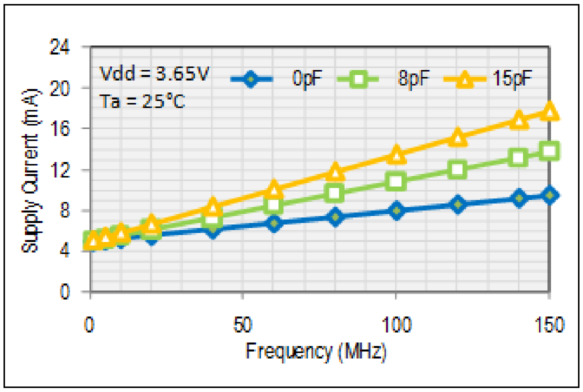


FIGURE 3-1: *Supply Current.*

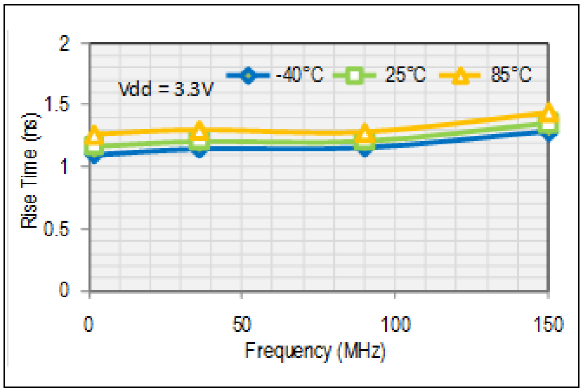


FIGURE 3-2: *Rise Time.*

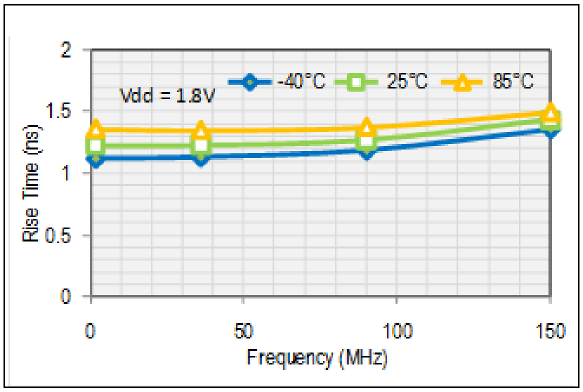


FIGURE 3-3: *Rise Time.*

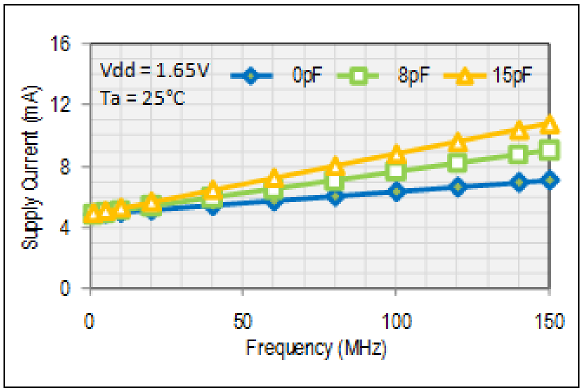


FIGURE 3-4: *Supply Current.*

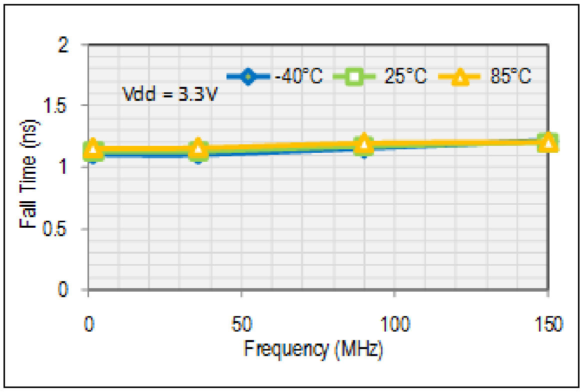


FIGURE 3-5: *Fall Time.*

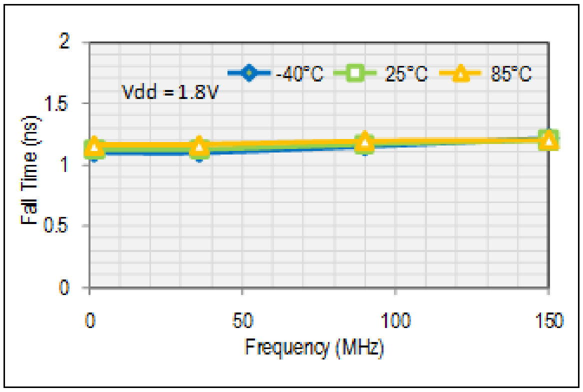


FIGURE 3-6: *Fall Time.*

4.0 OUTPUT WAVEFORM

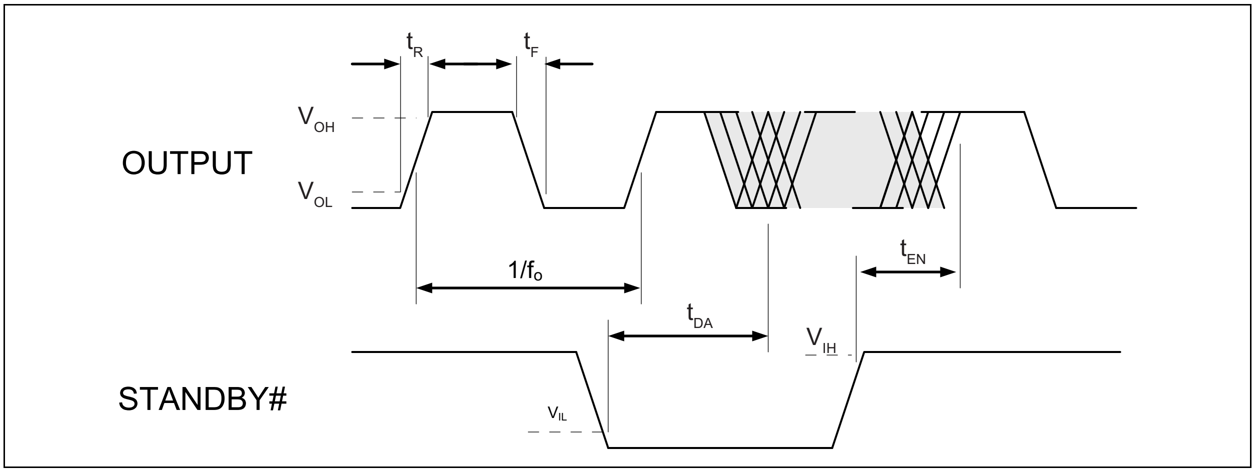


FIGURE 4-1: Output Waveform.

4.1 Standby Function

Standby# (Pin 1)	Output (Pin 3)
High Level	Output ON
Open (no connect)	Output ON
Low Level	High Impedance

5.0 TEST CIRCUIT

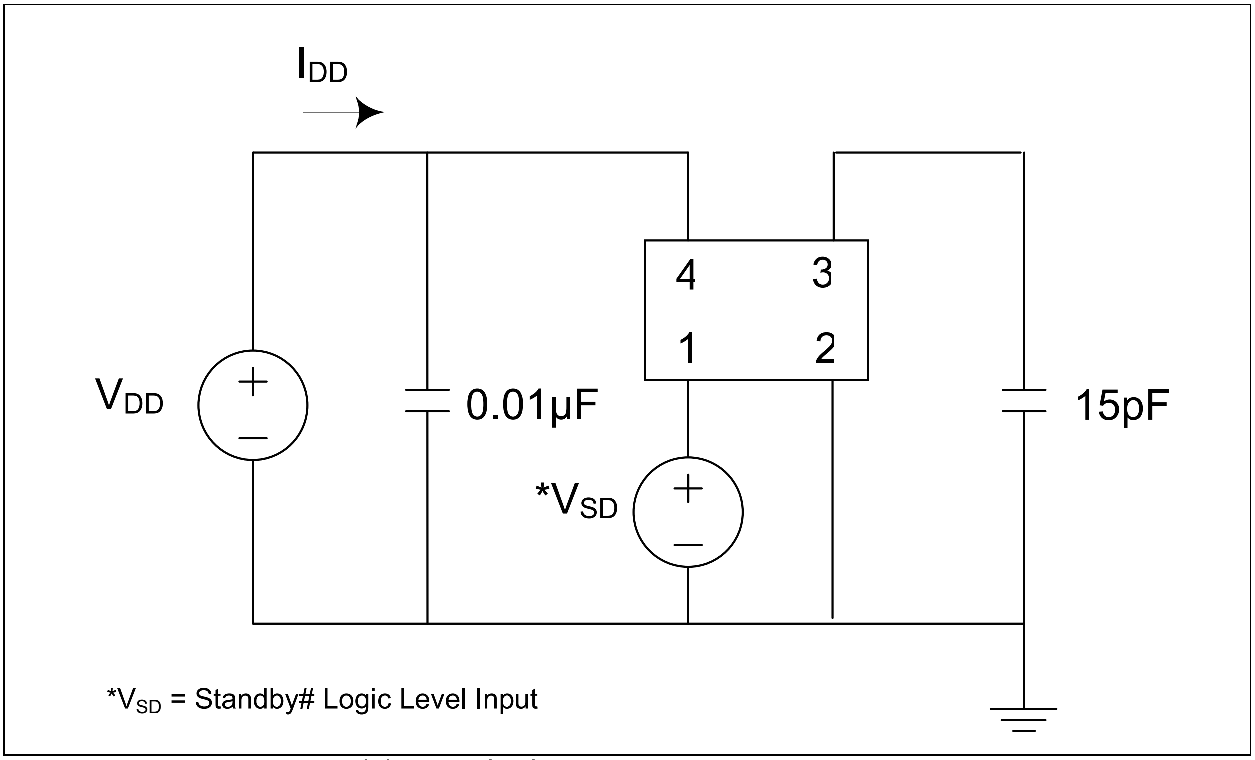


FIGURE 5-1: *DSA1001/3/4 Test Circuit.*

6.0 BOARD LAYOUT (RECOMMENDED)

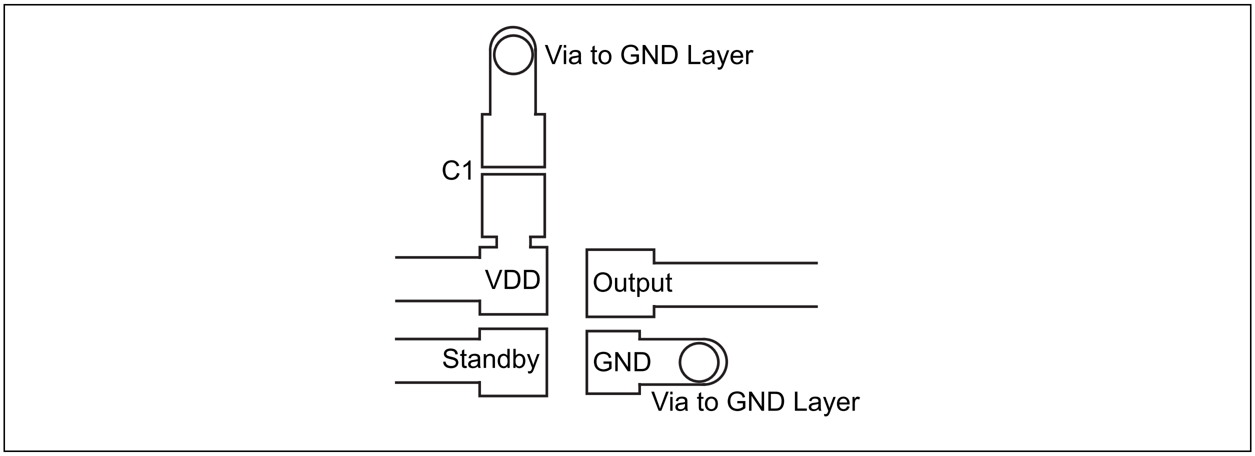


FIGURE 6-1: *Recommended Board Layout for DSA1001/3/4.*

7.0 SOLDER REFLOW PROFILE

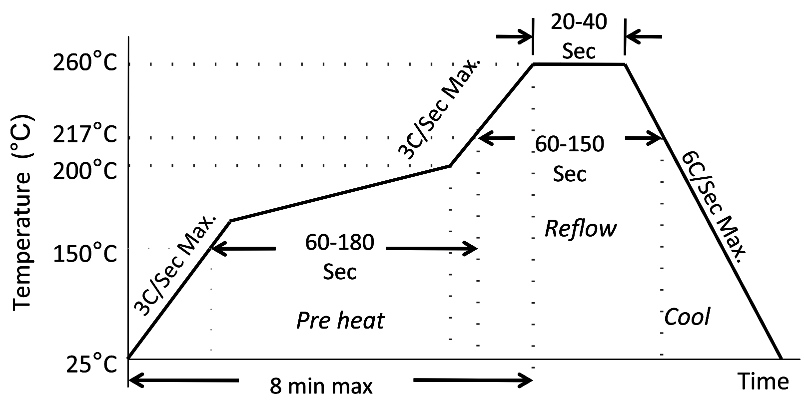


FIGURE 7-1: Solder Reflow Profile.

MSL 1 @ 260°C refer to JSTD-020C	
Ramp-Up Rate (200°C to Peak Temp)	3°C/sec. max.
Preheat Time 150°C to 200°C	60 to 180 sec.
Time maintained above 217°C	60 to 150 sec.
Peak Temperature	255°C to 260°C
Time within 5°C of Actual Peak	20 to 40 sec.
Ramp-Down Rate	6°C/sec. max.
Time 25°C to Peak Temperature	8 minutes max.

8.0 PACKAGING INFORMATION

8.1 Package Marking Information

4-Lead CDFN/DFN*	Example
XXXXXXX DCPYYWW 0SSS ●	0200000 DCP1121 0603 ●

Legend:	XX...X	Product code, customer-specific information, or frequency in MHz without printed decimal point
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.
	●, ▲, ▼	Pin one index is identified by a dot, delta up, or delta down (triangle mark).

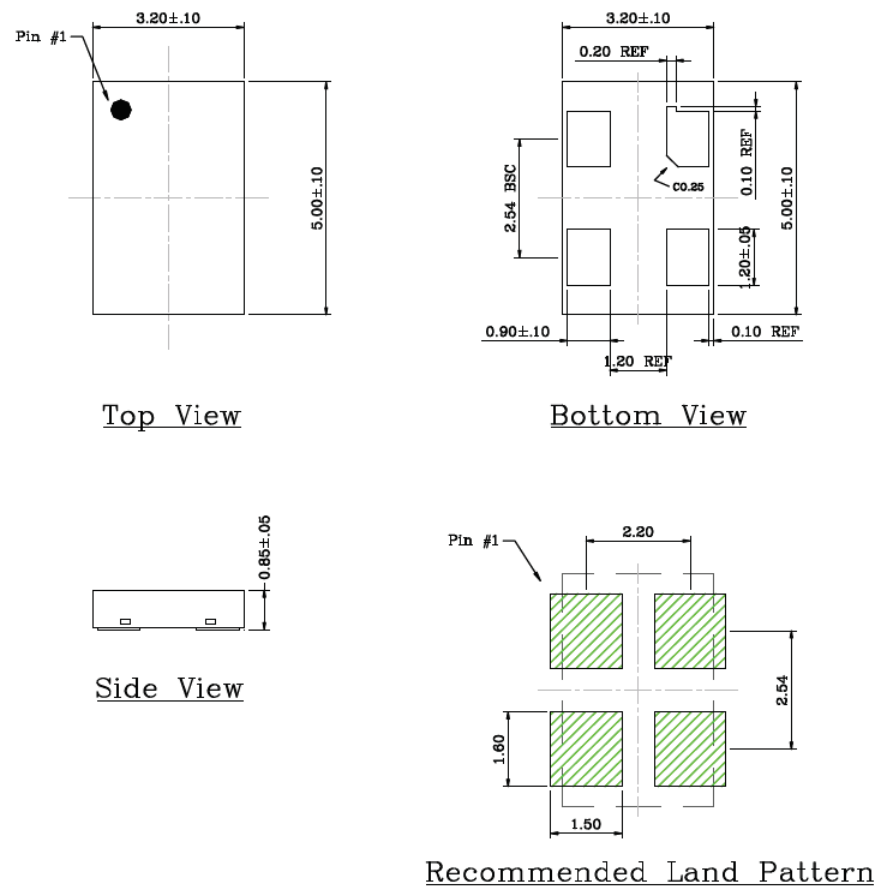
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or may not include the corporate logo.

Underbar (_) and/or Overbar (‾) symbol may not be to scale.

4-Lead CDFN 5.0 mm x 3.2 mm Package Outline & Recommended Land Pattern

TITLE
4 LEAD CDFN 5.0x3.2mm COL PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

DRAWING #	CDFN5032-4LD-PL-1	UNIT	MM



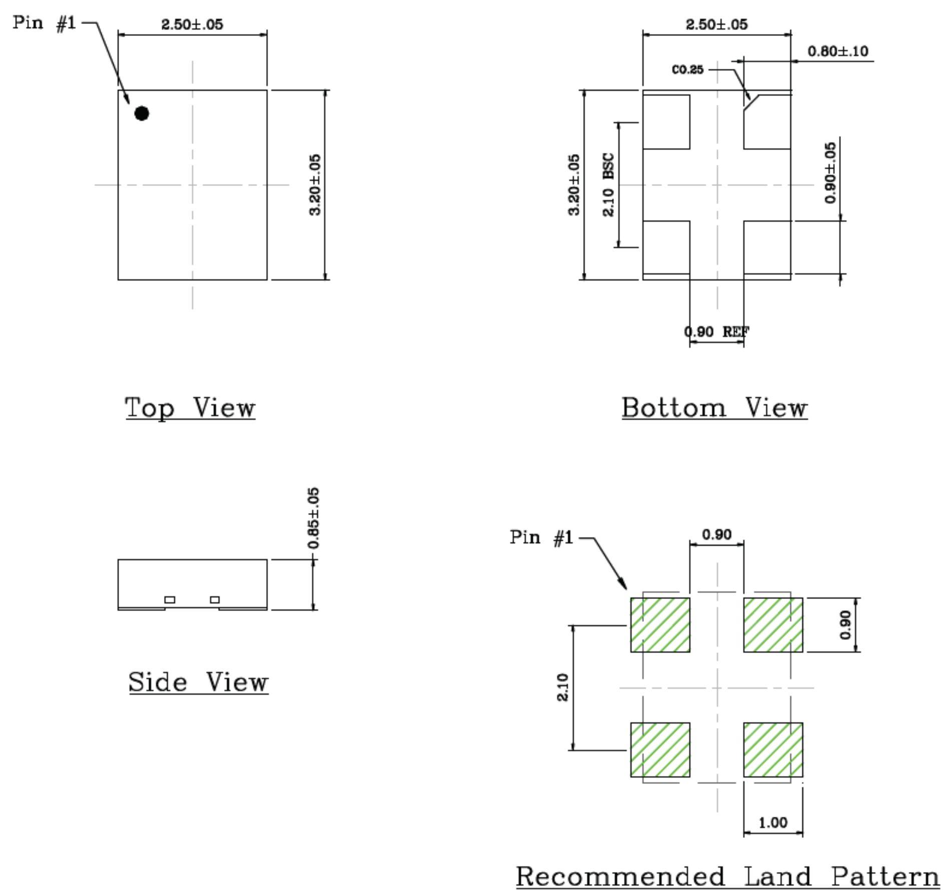
NOTE:
1. Green shaded rectangles in Recommended Land Pattern are solder stencil opening.

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging.

4-Lead CDFN 3.2 mm x 2.5 mm Package Outline & Recommended Land Pattern

TITLE
4 LEAD CDFN 3.2x2.5mm COL PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

DRAWING #	CDFN3225-4LD-PL-1	UNIT	MM



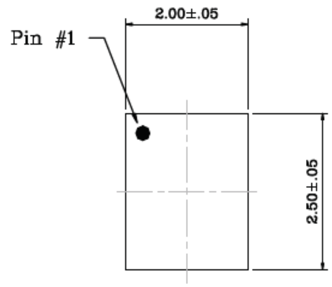
NOTE:
1. Green shaded rectangles in Recommended Land Pattern are solder stencil opening.

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging.

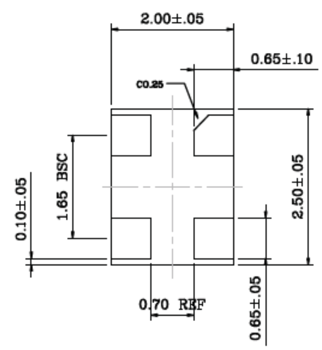
4-Lead CDFN 2.5 mm x 2.0 mm Package Outline & Recommended Land Pattern

TITLE
4 LEAD CDFN 2.5x2.0mm COL PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

DRAWING #	CDFN2520-4LD-PL-1	**UNIT**	MM

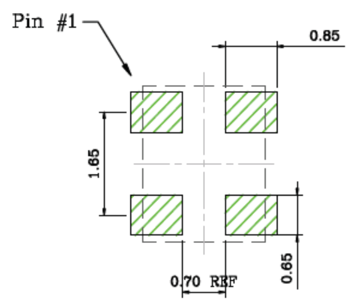


Top View



Bottom View

Side View



Recommended Land Pattern

NOTE:
1. Green shaded rectangles in Recommended Land Pattern are solder stencil opening.

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging.

APPENDIX A: REVISION HISTORY

Revision A (March 2018)

- Initial release of data sheet DSA1001/3/4 to Microchip format data sheet DS20005889A.

NOTES:

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

PART NO.	X	X	X	-XXX.XXXX	X
Device	Package	Temperature Range	Stability	Frequency	Packing Option

Device:	DSA1001/3/4:		1.8V - 3.3V Low-Power Precision CMOS Oscillator for Automotive
Package:	B	=	4-Lead 5.0 mm x 3.2 mm CDFN
	C	=	4-Lead 3.2 mm x 2.5 mm CDFN
	D	=	4-Lead 2.5 mm x 2.0 mm CDFN
Temperature Range:	I	=	–40°C to +85°C (Automotive Grade 3)
	L	=	–40°C to +105°C (Automotive Grade 2)
Stability:	1	=	±50 ppm
	2	=	±25 ppm
	3	=	±20 ppm
Frequency:	xxx.xxxx	=	1 MHz to 150 MHz (user-defined)
Packing Option:	<blank>	=	110/Tube
	T	=	1,000/Reel

Please use the Microchip Clockworks to check AEC-Q100 compliance status and build the exact part number.

Examples:

a) DSA1003BL3-030.0000: 1.8V - 3.3V Low-Power Precision CMOS Oscillator, 4-Lead 5.0 mm x 3.2 mm CDFN, Automotive Grade 2 Temperature Range, ±20 ppm, 30 MHz Output Frequency, 72/Tube

b) DSA1004DI1-075.0000T: 1.8V - 3.3V Low-Power Precision CMOS Oscillator, 4-Lead 2.5 mm x 2.0 mm CDFN, Automotive Grade 3 Temperature Range, ±50 ppm, 75 MHz Output Frequency, 1,000/Reel

Note 1: Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.

NOTES:

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
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Japan - Tokyo
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Korea - Seoul
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Malaysia - Kuala Lumpur
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Malaysia - Penang
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Taiwan - Hsin Chu
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Thailand - Bangkok
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Vietnam - Ho Chi Minh
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EUROPE

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