

Ultra-Small, Ultra-Low Power MEMS Oscillator

Features

- Wide Frequency Range: 3.5 kHz to 100 MHz
- Ultra-Low Power Consumption: 3 mA/1 μ A (Active/Standby)
- Ultra-Small Footprints
 - 1.6 mm $\times$ 1.2 mm
 - 2.0 mm $\times$ 1.6 mm
 - 2.5 mm $\times$ 2.0 mm
- Frequency Select Input Supports Two Pre-Defined Frequencies
- High Stability: ± 20 ppm, ± 25 ppm, ± 50 ppm
- Wide Temperature Range
 - Automotive: -40°C to $+125^{\circ}\text{C}$
 - Ext. Industrial: -40°C to $+105^{\circ}\text{C}$
 - Industrial: -40°C to $+85^{\circ}\text{C}$
 - Ext. Commercial: -20° to $+70^{\circ}\text{C}$
- Excellent Shock and Vibration Immunity
 - Qualified to MIL-STD-883
- High Reliability
 - 20x Better MTF Than Quartz Oscillators
- Supply Range of 1.71V to 3.63V
- Short Sample Lead Time: <2 weeks
- Lead Free & RoHS Compliant
- Automotive Version Available: DSA61xxB

Applications

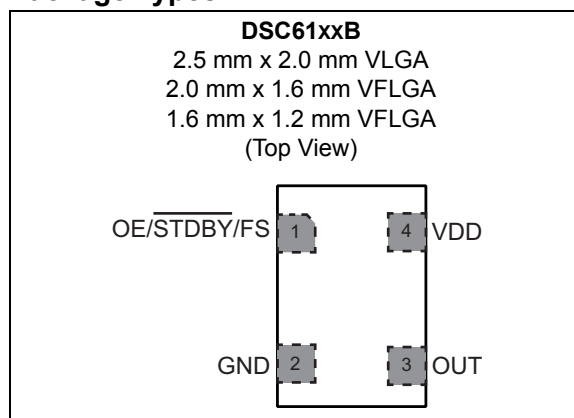
- Low Power/Portable Applications: IoT, Embedded/Smart Devices
- Consumer: Home Healthcare, Fitness Devices, Home Automation
- Industrial: Building/Factory Automation, Surveillance Camera
- Automotive (Please Refer to the DSA61xx Family)

General Description

The DSC61xxB family of MEMS oscillators combines the industry leading low power consumption and ultra-small packages with exceptional frequency stability and jitter performance over temperature. The single-output DSC61xxB MEMS oscillators are excellent choices for use as clock references in small, battery-powered devices such as wearable and Internet of Things (IoT) devices in which small size, low power consumption, and long-term reliability are paramount.

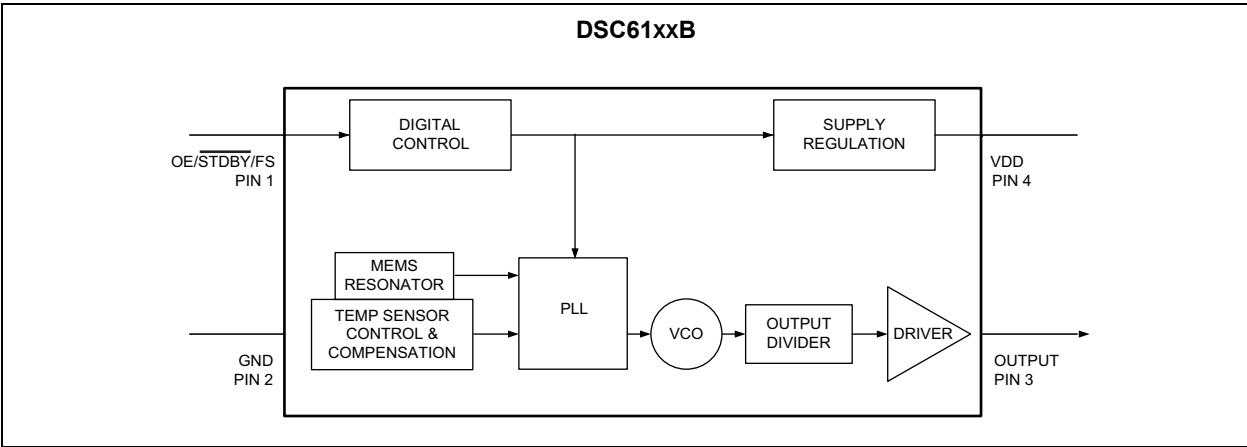
The DSC61xxB family is available in ultra-small 1.6 mm $\times$ 1.2 mm, 2.0 mm $\times$ 1.6 mm, and 2.5 mm $\times$ 2.0 mm packages. These packages are “drop-in” replacements for standard 4-pin CMOS quartz crystal oscillators. The Automotive Grade AEC-Q100 qualified option is also available for this device.

Package Types



DSC61XXB

Block Diagram



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings

Supply Voltage	–0.3V to +4.0V
Input Voltage (V_{IN})	–0.3V to $V_{DD}+0.3V$
ESD Protection	4 kV HBM, 400V MM, 2 kV CDM

ELECTRICAL CHARACTERISTICS

Electrical Characteristics: Unless otherwise indicated, $V_{DD} = 1.8V -5\%$ to $3.3V +10\%$, $T_A = -40^{\circ}C$ to $+125^{\circ}C$.						
Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Supply Voltage	V_{DD}	1.71	—	3.63	V	Note 1
Power Supply Ramp	t_{PU}	0.1	—	100	ms	Note 8
Active Supply Current	I_{DD}	—	3.0	—	mA	$f_{OUT} = 27$ MHz, $V_{DD} = 1.8V$, No Load
Standby Supply Current	I_{STBY}	—	1	—	μA	$V_{DD} = 1.8/2.5V$, Note 2
		—	1.5	—		$V_{DD} = 3.3V$, Note 2
Output Duty Cycle	SYM	45	—	55	%	—
Frequency	f_0	0.0035	—	100	MHz	—
Frequency Stability	Δf	—	—	± 20 ± 25 ± 50	ppm	All temp ranges, Note 3
Aging	Δf	—	—	± 5	ppm	1st year @ $25^{\circ}C$
		—	—	± 1		Per year after first year
Startup Time	t_{SU}	—	—	1.5	ms	From 90% V_{DD} to valid clock output, $T = 25^{\circ}C$
Input Logic Levels	V_{IH}	$0.7 \times V_{DD}$	—	—	V	Input Logic High, Note 4
	V_{IL}	—	—	$0.3 \times V_{DD}$	V	Input Logic Low, Note 4
Output Disable Time	t_{DA}	—	—	200 + 2 Periods	ns	Note 5
Output Enable Time	t_{EN}	—	—	1	μs	Note 6
Enable Pull-up Resistor	—	—	300	—	k Ω	If configured, Note 7

- Note 1:** Pin 4 V_{DD} should be filtered with 0.1 μF capacitor.
- 2:** Not including current through pull-up resistor on EN pin (if configured). Higher standby current seen at $>3.3V V_{DD}$.
- 3:** Includes frequency variations due to initial tolerance, temp. and power supply voltage.
- 4:** Input waveform must be monotonic with rise/fall time < 10 ms
- 5:** Output Disable time takes up to two periods of the output waveform + 200 ns.
- 6:** For parts configured with OE, not Standby.
- 7:** Output is enabled if pad is floated or not connected.
- 8:** Time to reach 90% of target V_{DD} . Power ramp rise must be monotonic.

DSC61XXB

ELECTRICAL CHARACTERISTICS (CONTINUED)

Electrical Characteristics: Unless otherwise indicated, $V_{DD} = 1.8V -5\%$ to $3.3V +10\%$, $T_A = -40^{\circ}C$ to $+125^{\circ}C$.							
Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions	
Output Logic Levels	V_{OH}	$0.8 \times V_{DD}$	—	—	V	Output Logic High, $I = 3$ mA, Std. Drive	
						Output Logic High, $I = 6$ mA, High Drive	
	V_{OL}	—	—	$0.2 \times V_{DD}$	V	Output Logic Low, $I = -3$ mA, Std. Drive	
						Output Logic Low, $I = -6$ mA, High Drive	
Output Transition Time Rise Time/Fall Time	t_{RX}/t_{FX}	—	1	1.5	ns	DSC61x2 High Drive, 20% to 80% $C_L = 15$ pF	$V_{DD} = 1.8V$
		—	0.5	1.0	ns		$V_{DD} = 2.5V/3.3V$
	t_{RY}/t_{FY}	—	1.2	2.0	ns	DSC61x1 Std Drive, 20% to 80% $C_L = 10$ pF	$V_{DD} = 1.8V$
		—	0.6	1.2	ns		$V_{DD} = 2.5V/3.3V$
Period Jitter, RMS	J_{PER}	—	8.5	—	ps_{RMS}	$f_{OUT} = 27$ MHz	$V_{DD} = 1.8V$
		—	7	—			$V_{DD} = 2.5V/3.3V$
Cycle-to-Cycle Jitter (Peak)	J_{Cy-Cy}	—	50	70	ps	$f_{OUT} = 27$ MHz	$V_{DD} = 1.8V$
		—	35	60			$V_{DD} = 2.5V/3.3V$
Period Jitter (Peak-to-Peak)	J_{PP}	—	70	—	ps	$f_{OUT} = 27$ MHz	$V_{DD} = 1.8V$
		—	60	—			$V_{DD} = 2.5V/3.3V$

- Note 1:** Pin 4 V_{DD} should be filtered with 0.1 μF capacitor.
- 2:** Not including current through pull-up resistor on EN pin (if configured). Higher standby current seen at $>3.3V$ V_{DD} .
- 3:** Includes frequency variations due to initial tolerance, temp. and power supply voltage.
- 4:** Input waveform must be monotonic with rise/fall time < 10 ms
- 5:** Output Disable time takes up to two periods of the output waveform + 200 ns.
- 6:** For parts configured with OE, not Standby.
- 7:** Output is enabled if pad is floated or not connected.
- 8:** Time to reach 90% of target V_{DD} . Power ramp rise must be monotonic.

TEMPERATURE SPECIFICATIONS (Note 1)

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Temperature Ranges						
Junction Operating Temperature	T_J	-40	—	+150	°C	—
Storage Ambient Temperature Range	T_A	-55	—	+150	°C	—
Soldering Temperature	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.

DSC61XXB

2.0 PIN DESCRIPTIONS

The DSC61xxB is a highly configurable device and can be factory programmed in many different ways to meet the customer's needs. Microchip's ClockWorks® Configurator <http://clockworks.microchip.com/Timing/> must be used to choose the necessary options, create the final part number, data sheet, and order samples. The descriptions of the pins are listed in [Table 2-1](#).

TABLE 2-1: DSC61XXB PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1 (Note 1)	OE	Output Enable: H = Active, L = Disabled (High Impedance).
	$\overline{\text{STDBY}}$	Standby: H = Device is active, L = Device is in standby (Low Power Mode).
	FS	Frequency Select: H = Output Frequency 1, L = Output Frequency 2.
2	GND	Ground.
3	Output	Oscillator clock output.
4	VDD	Power supply: 1.71V to 3.63V.

Note 1: DSC610xB/1xB/3xB has a 300 k Ω internal pull-up resistor on pin 1. DSC614xB/5xB/7xB has no internal pull-up resistor on pin 1 and needs an external pull-up or to be driven by another chip.

An explanation of the different options listed in [Table 2-1](#) follows.

2.1 Pin 1

This is a control pin and may be configured to fulfill one of three different functions. If not actively driven, a 10 k Ω pull-up resistor is recommended.

2.1.1 OUTPUT ENABLE (OE)

Pin 1 may be configured as OE. Oscillator output may be turned on and off according to the state of this pin.

2.1.2 $\overline{\text{STDBY}}$

Pin 1 may be configured as Standby. When the pin is low, both output buffer and PLL will be off and the device will enter a low power mode.

2.1.3 FREQUENCY SELECT (FS)

Pin 1 may be configured as FS. The output may be set to one of two pre-programmed frequencies. The output clock frequencies can only be set to either kHz or MHz. A combination of kHz and MHz cannot be set.

2.2 Pins 2 through 4

Pins 2 and 4 are the supply terminals, GND and VDD respectively. Pin 3 is the clock output, programmable to Standard and High Drive strength settings. Visit [ClockWorks® Configurator](#) to customize your device.

2.3 Output Buffer Options

The DSC61xx family is available in multiple output driver configurations.

The standard-drive (61x1) and high-drive (61x2) deliver respective output currents of greater than 3 mA and 6 mA at 20%/80% of the supply voltage. For heavy loads of 15 pF or higher, the high-drive option is recommended.

3.0 DIAGRAMS

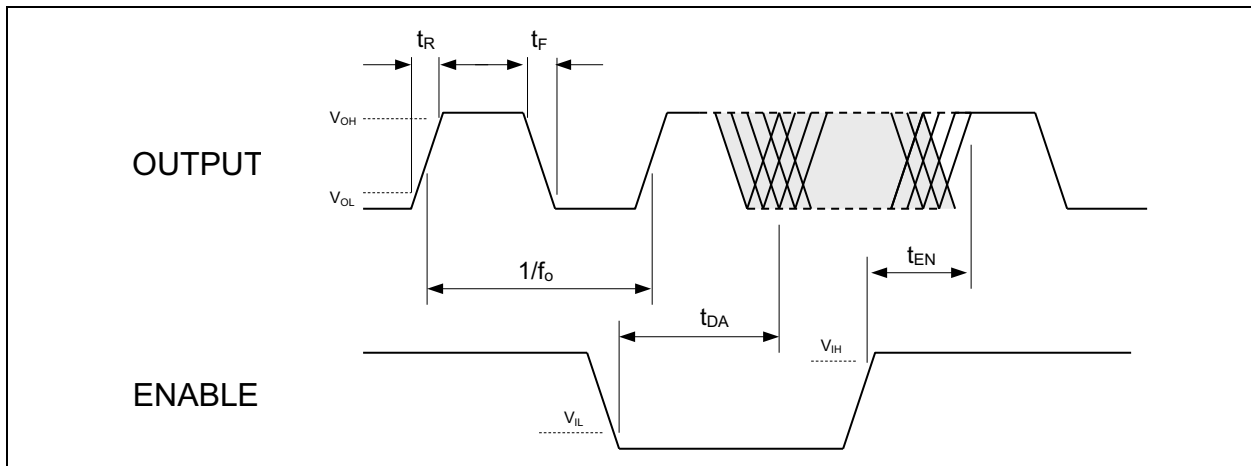


FIGURE 3-1: Output Waveform.

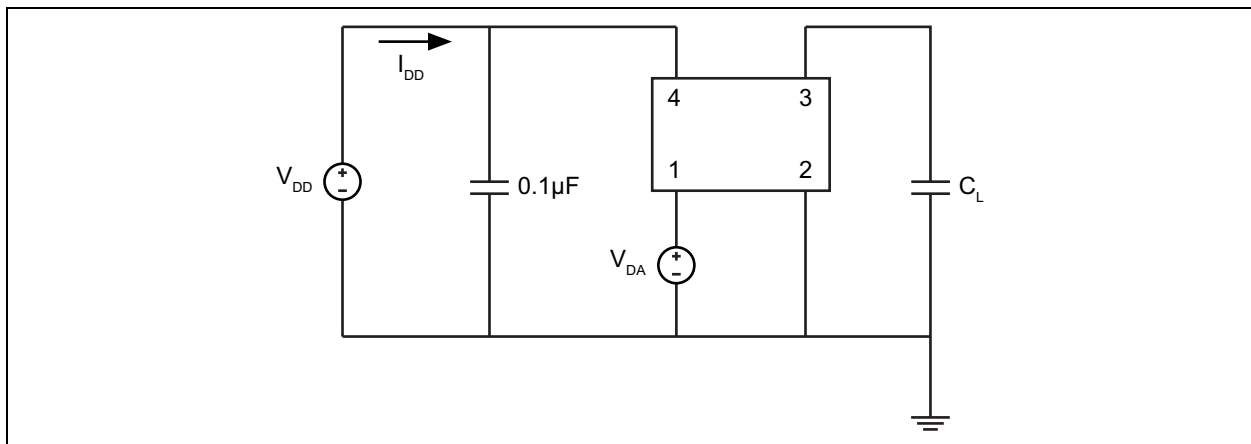


FIGURE 3-2: Test Circuit.

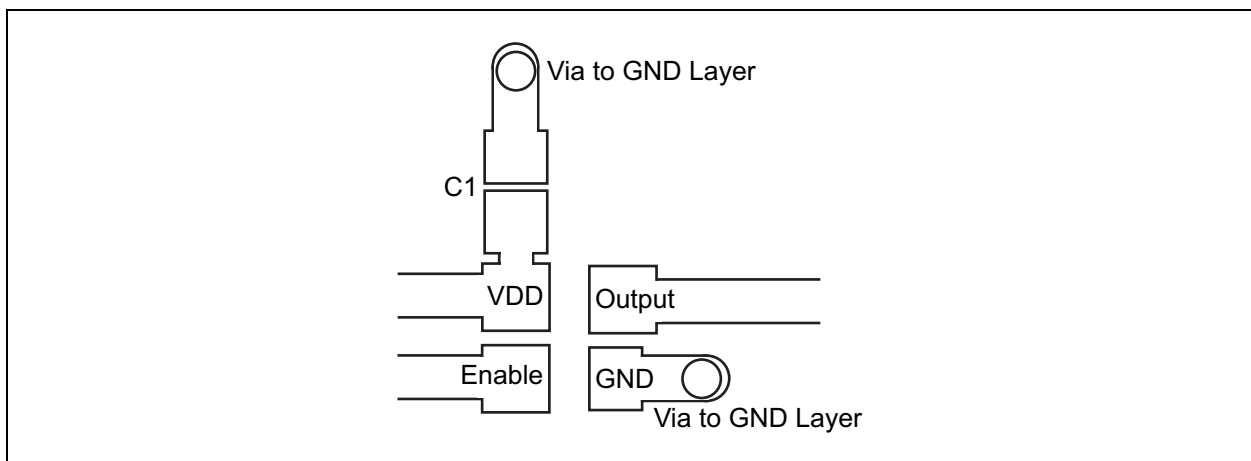


FIGURE 3-3: Recommended Board Layout.

DSC61XXB

4.0 SOLDER REFLOW PROFILE

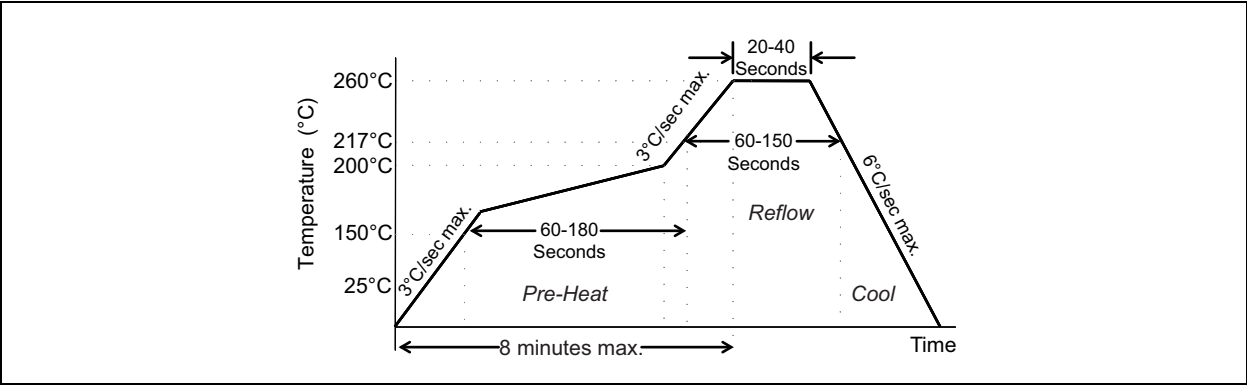


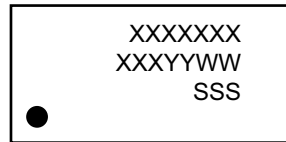
FIGURE 4-1: Solder Reflow Profile.

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.

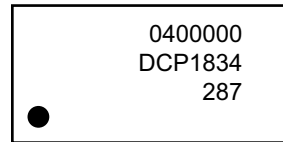
5.0 PACKAGING INFORMATION

5.1 Package Marking Information

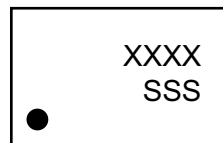
4-Lead VLGA* 2.5 x 2.0



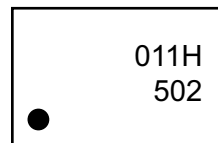
Example



4-Lead VFLGA* 2.0 x 1.6/1.6 x 1.2



Example

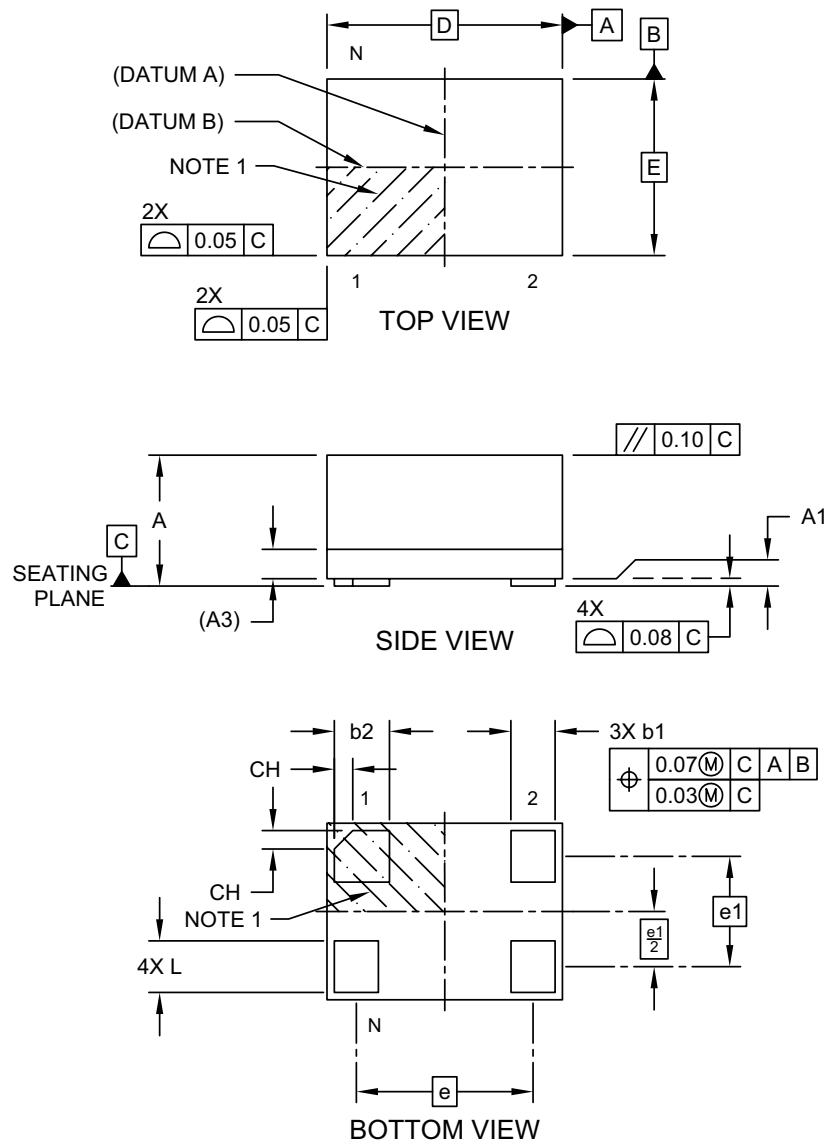


Legend:	XX...X	Product code or customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	SSS	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package 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.		

DSC61XXB

4-Lead Very Thin Fine Pitch Land Grid Array (ARA) - 1.6x1.2 mm Body [VFLGA]

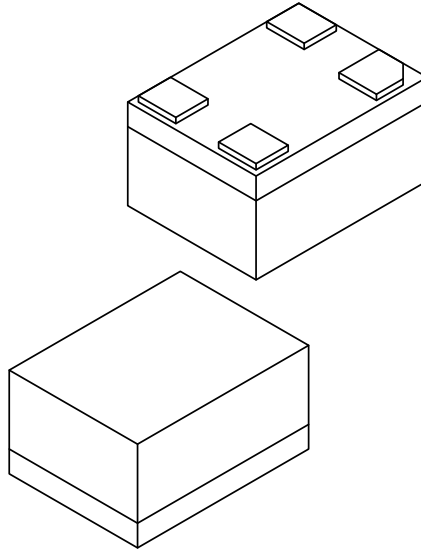
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-1199A Sheet 1 of 2

4-Lead Very Thin Fine Pitch Land Grid Array (ARA) - 1.6x1.2 mm Body [VFLGA]

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



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N	4		
Terminal Pitch	e	1.20 BSC		
Terminal Pitch	e1	0.75 BSC		
Overall Height	A	0.79	0.84	0.89
Standoff	A1	0.00	0.02	0.05
Substrate Thickness (with Terminals)	A3	0.20 REF		
Overall Length	D	1.60 BSC		
Overall Width	E	1.20 BSC		
Terminal Width	b1	0.25	0.30	0.35
Terminal Width	b2	0.325	0.375	0.425
Terminal Length	L	0.30	0.35	0.40
Terminal 1 Index Chamfer	CH	-	0.125	-

Notes:

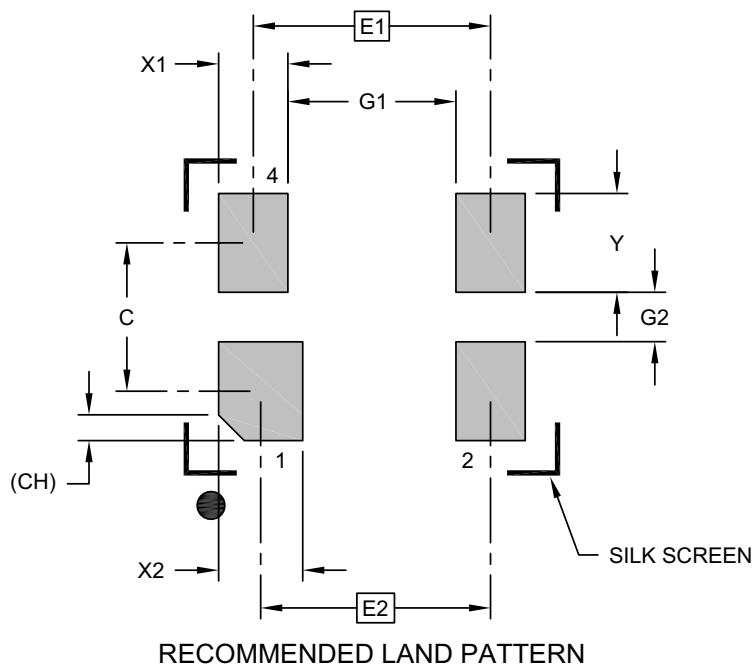
1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package is saw singulated
3. Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-1199A Sheet 2 of 2

DSC61XXB

4-Lead Very Thin Fine Pitch Land Grid Array (ARA) - 1.6x1.2 mm Body [VFLGA]

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



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E1	1.20 BSC		
Contact Pitch	E2		1.16 BSC	
Contact Spacing	C		0.75	
Contact Width (X3)	X1			0.35
Contact Width	X2			0.43
Contact Pad Length (X6)	Y			0.50
Space Between Contacts (X4)	G1	0.85		
Space Between Contacts (X3)	G2	0.25		
Contact 1 Index Chamfer	CH	0.13 X 45° REF		

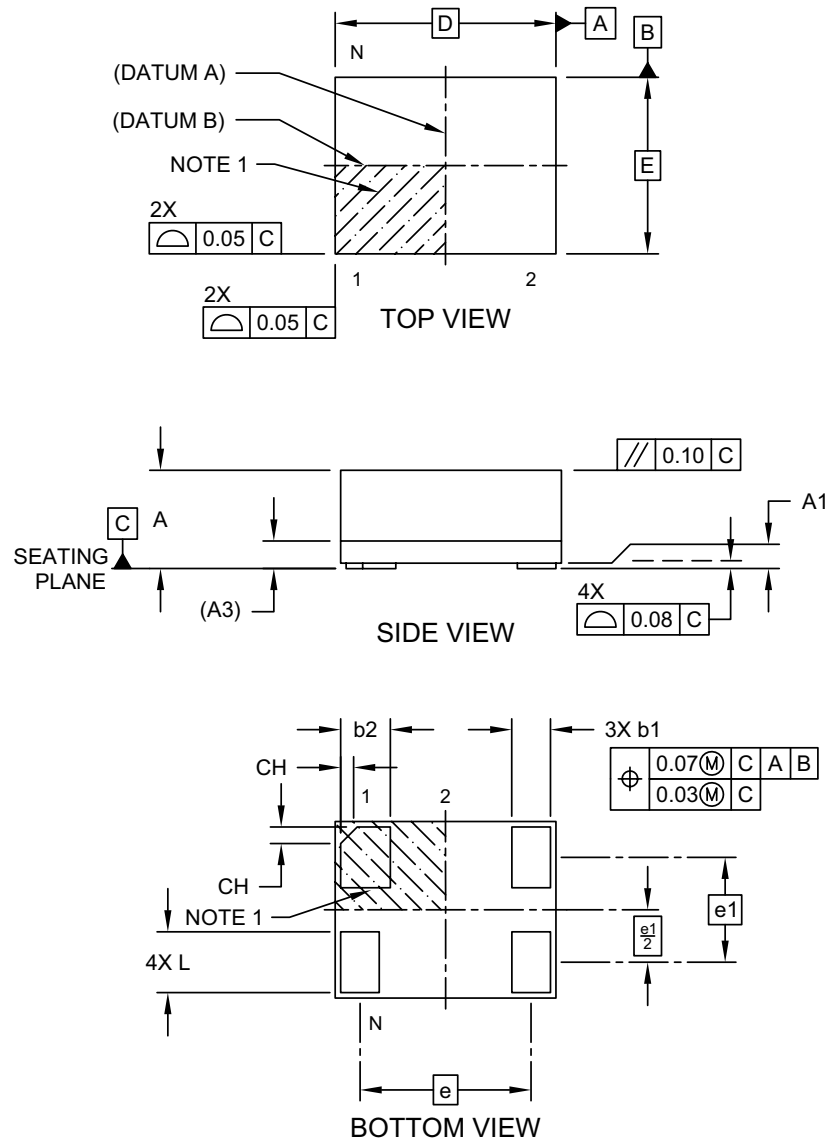
Notes:

1. Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-3199A

4-Lead Very Thin Fine Pitch Land Grid Array (ASA) - 2.0x1.6 mm Body [VFLGA]

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

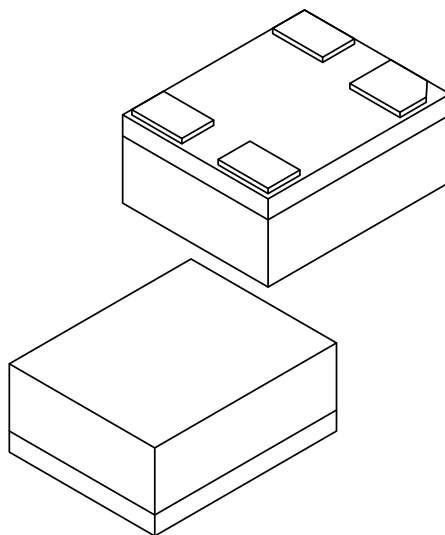


Microchip Technology Drawing C04-1200A Sheet 1 of 2

DSC61XXB

4-Lead Very Thin Fine Pitch Land Grid Array (ASA) - 2.0x1.6 mm Body [VFLGA]

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



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N	6		
Terminal Pitch	e	1.55 BSC		
Terminal Pitch	e1	0.95 BSC		
Overall Height	A	0.79	0.84	0.89
Standoff	A1	0.00	0.02	0.05
Substrate Thickness (with Terminals)	A3	0.20 REF		
Overall Length	D	2.00 BSC		
Overall Width	E	1.60 BSC		
Terminal Width	b1	0.30	0.35	0.40
Terminal Width	b2	0.40	0.45	0.50
Terminal Length	L	0.50	0.55	0.60
Terminal 1 Index Chamfer	CH	-	0.15	-

Notes:

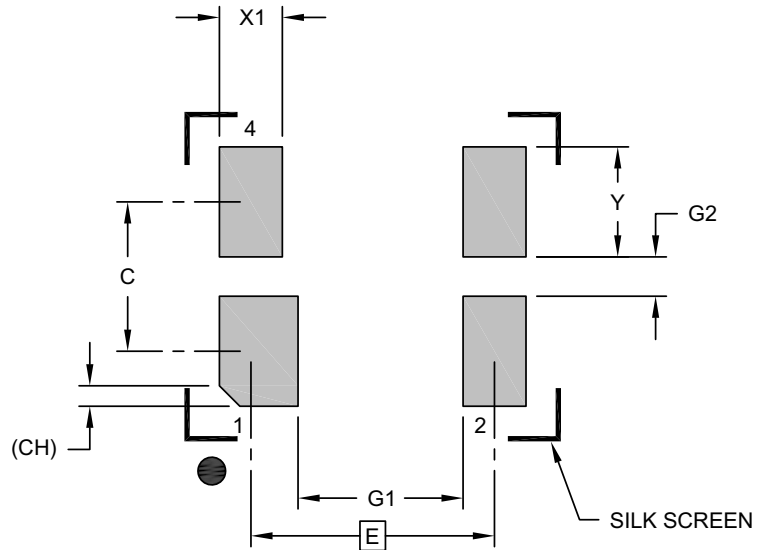
- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Package is saw singulated
- Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-1200A Sheet 2 of 2

4-Lead Very Thin Fine Pitch Land Grid Array (ASA) - 2.0x1.6 mm Body [VFLGA]

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



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	1.55 BSC		
Contact Spacing	C		0.95	
Contact Width (X4)	X1			0.50
Contact Width (X2)	X2			0.40
Contact Pad Length (X6)	Y			0.70
Space Between Contacts (X4)	G1	1.05		
Space Between Contacts (X3)	G2	0.25		
Contact 1 Index Chamfer	CH	0.13 X 45° REF		

Notes:

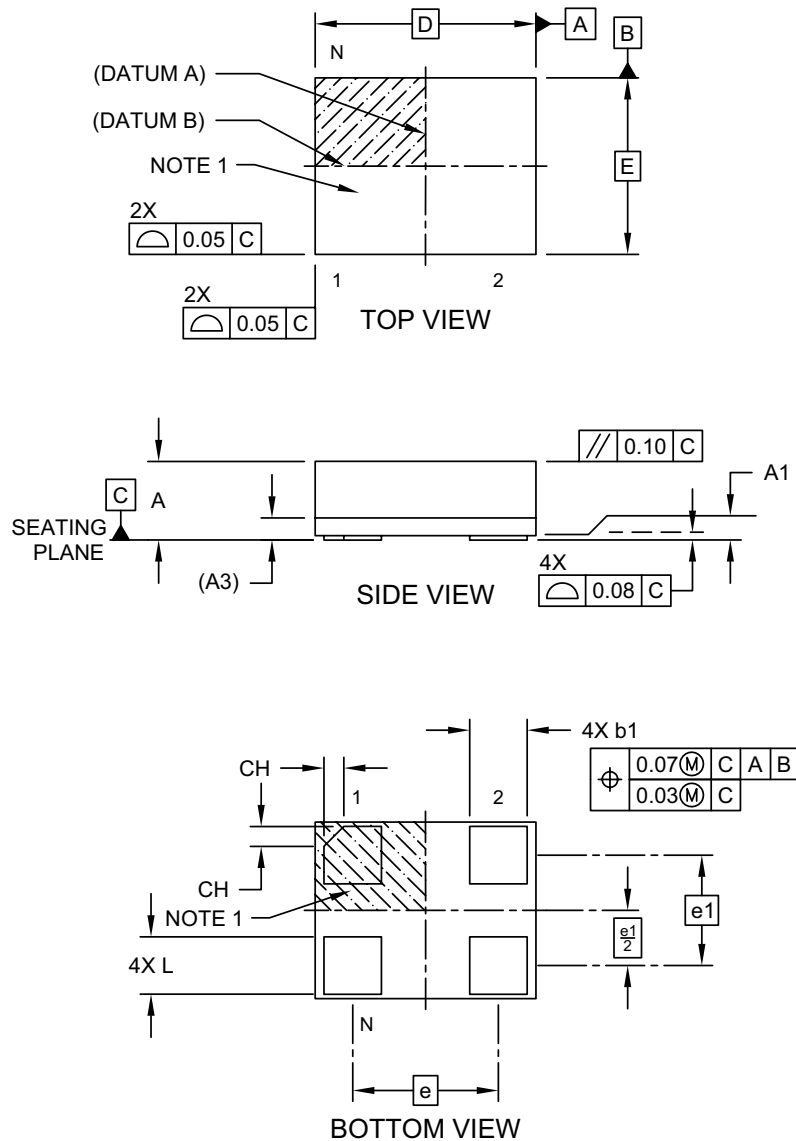
- Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-3200A

DSC61XXB

4-Lead Very Thin Land Grid Array (AUA) - 2.5x2.0 mm Body [VLGA]

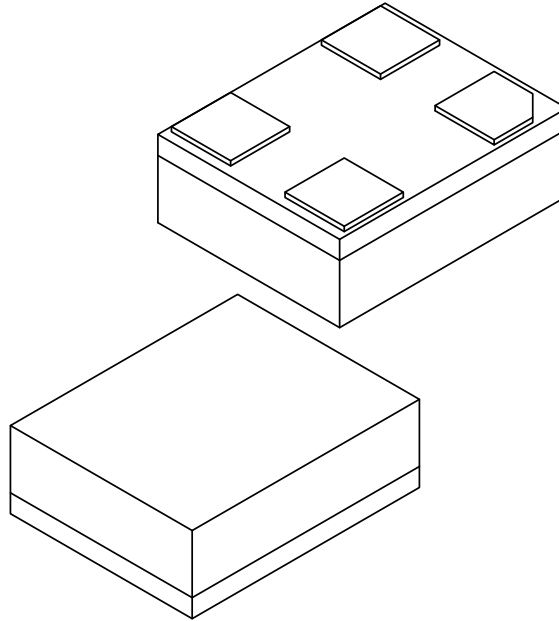
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-1202A Sheet 1 of 2

4-Lead Very Thin Land Grid Array (AUA) - 2.5x2.0 mm Body [VLGA]

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



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N	4		
Terminal Pitch	e	1.65 BSC		
Terminal Pitch	e1	1.25 BSC		
Overall Height	A	0.79	0.84	0.89
Standoff	A1	0.00	0.02	0.05
Substrate Thickness (with Terminals)	A3	0.20 REF		
Overall Length	D	2.50 BSC		
Overall Width	E	2.00 BSC		
Terminal Width	b1	0.60	0.65	0.70
Terminal Length	L	0.60	0.65	0.70
Terminal 1 Index Chamfer	CH	-	0.225	-

Notes:

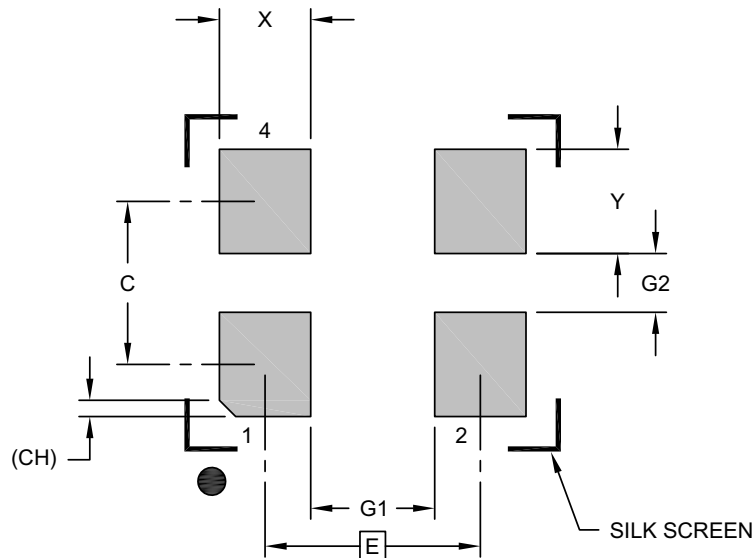
- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Package is saw singulated
- Dimensioning and tolerancing per ASME Y14.5M
 - BSC: Basic Dimension. Theoretically exact value shown without tolerances.
 - REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-1202A Sheet 2 of 2

DSC61XXB

4-Lead Very Thin Land Grid Array (AUA) - 2.5x2.0 mm Body [VLGA]

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



RECOMMENDED LAND PATTERN

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E	1.65 BSC		
Contact Spacing	C		1.25	
Contact Width (X4)	X			0.70
Contact Pad Length (X6)	Y			0.80
Space Between Contacts (X4)	G1	0.95		
Space Between Contacts (X3)	G2	0.45		
Contact 1 Index Chamfer	CH	0.13 X 45° REF		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-3202A

APPENDIX A: REVISION HISTORY

Revision A (January 2019)

- Initial creation of DSC61xxB Microchip data sheet DS20006155A.

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	X	X	X	X - XXX.XXXX	X
Device	Pin 1 Definition	Output Drive Strength	Package	Temperature Range	Frequency Stability	Revision	Frequency	Media Type	
Examples: a) DSC6112JI2B-100.0000: Ultra-Small, Ultra-Low Power MEMS Oscillator, Pin 1 = STDBY with Internal Pull-Up, High Drive Strength, 4-Lead 2.5 mm x 2.0 mm VLGA, Industrial Temperature, ±25 ppm Stability, Revision B, 100 MHz Frequency, 140/Tube b) DSC6101HE1B-016.0000T: Ultra-Small, Ultra-Low Power MEMS Oscillator, Pin 1 = OE with Internal Pull-Up, Standard Drive Strength, 4-Lead 1.6 mm x 1.2 mm VFLGA, Extended Commercial Temperature, ±50 ppm Stability, Revision B, 16 MHz Frequency, 1,000/Reel c) DSC6121MI2B-005QB: Ultra-Small, Ultra-Low Power MEMS Oscillator, Pin 1 = Freq. Select with Internal Pull-Up, Standard Drive Strength, 4-Lead 2.0 mm x 1.6 mm VFLGA, Industrial Temperature, ±25 ppm Stability, Revision B, Two Frequencies Configured through ClockWorks, 3,000/Reel Note 1: Media Type 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 different media options.									

Device:	DSC61:	Ultra-Small, Ultra-Low Power MEMS Oscillator						
Pin Definition:	Selection	Pin 1	Internal Pull-Up Register					
	0	OE	Pull-up					
	1	STDBY	Pull-up					
	2	FS	Pull-up					
	4	OE	None					
	5	STDBY	None					
	6	FS	None					
Output Drive Strength:	1	Standard						
	2	High						
Packages:	J	=	4-Lead 2.5 mm x 2.0 mm VLGA					
	M	=	4-Lead 2.0 mm x 1.6 mm VFLGA					
	H	=	4-Lead 1.6 mm x 1.2 mm VFLGA					
Temperature Range:	A	=	-40°C to +125°C (Automotive)					
	L	=	-40°C to +105°C (Extended Industrial)					
	I	=	-40°C to +85°C (Industrial)					
	E	=	-20°C to +70°C (Extended Commercial)					
Frequency Stability:	1	=	± 50 ppm					
	2	=	± 25 ppm					
	3	=	± 20 ppm					
Revision:	B	=	Revision B					
Frequency:	xxx.xxxx	=	User-Defined Frequency between 001.0000 MHz and 100.0000 MHz					
	xxxxxxx	=	User-Defined Frequency between 003.500 kHz and 999.999 kHz					
	xxxx	=	Frequency configuration code when pin 1 = FS. Configure the part online through ClockWorks					
Media Type:	<blank>	=	140/Tube (J Package Option)					
	<blank>	=	100/Bag (M & H Package Option)					
	T	=	1,000/Reel					
	B	=	3,000/Reel					

Note 1: Please visit Microchip ClockWorks® Configurator Website to configure the part number for customized frequency. <http://clockworks.microchip.com/timing/>.

DSC61XXB

NOTES:

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