DSC61XX

Ultra-Small, Ultra-Low Power MEMS Oscillator

Features

- Wide Frequency Range: 2 KHz to 100 MHz
- Ultra–Low Power Consumption: 3 mA/12 μA (Active/Standby)
- Ultra-Small Footprints
  - 1.6 mm × 1.2 mm
  - 2.0 mm × 1.6 mm
  - 2.5 mm × 2.0 mm
  - 3.2 mm × 2.5 mm
- Frequency Select Input Supports 2 Predefined Frequencies
- High Stability: ±25, ±50 ppm
- Wide Temperature Range
  - Industrial: –40°C to 85°C
  - Ext. Commercial: –20° to 70°C
- Excellent Shock & 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
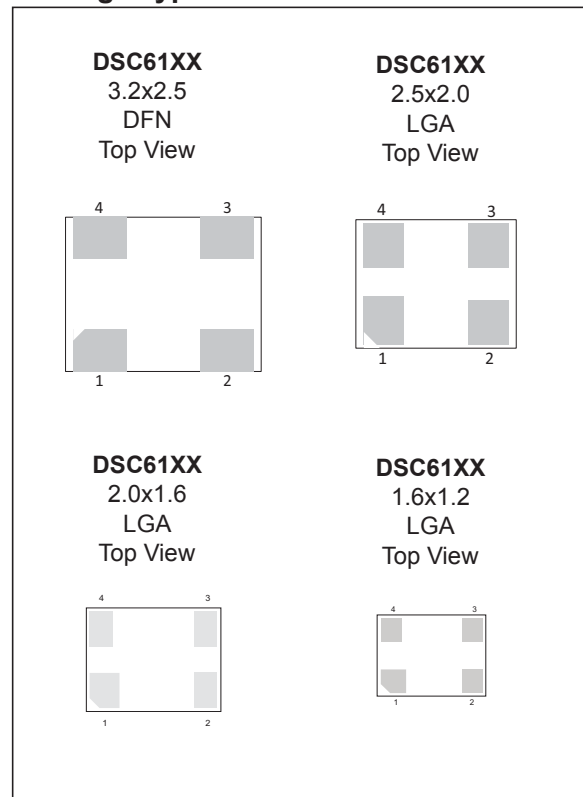- Lead Free & RoHS Compliant

Applications

- Low Power/portable Applications - IoT, Embedded/smart Devices
- Consumer - Home Healthcare, Fitness Devices, Home Automation
- Automotive - Rear View/surround View Cameras, Infotainment System
- Industrial - Building/ Factory Automation, Surveillance Camera

General Description

The DSC61xx 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 DSC61xx 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. They also meet the stringent mechanical durability and reliability requirements within Automotive Electronics Council standard Q100 (AEC-Q100), so they are well suited for under-hood applications as well.
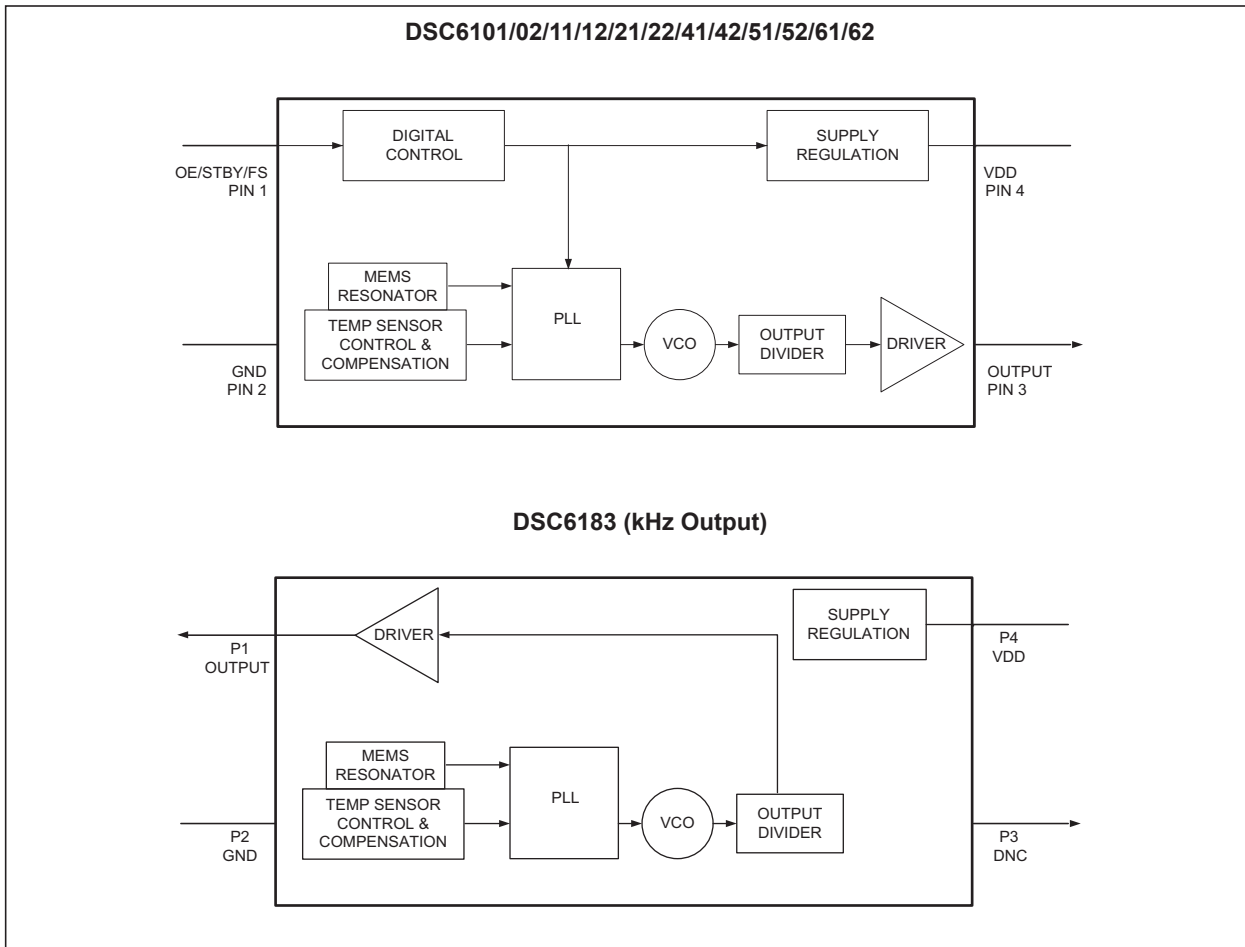
The DSC61xx family is available in ultra-small 1.6 mm x 1.2 mm and 2.0 mm x 1.6 mm packages. Other package sizes include: 2.5 mm x 2.0 mm and 3.2 mm x 2.5 mm. These packages are "drop-in" replacements for standard 4-pin CMOS quartz crystal oscillators.

Package Types

DSC61XX

Block Diagram

DSC6101/02/11/12/21/22/41/42/51/52/61/62

```
OE/STBY/FS          DIGITAL                    SUPPLY
PIN 1               CONTROL                    REGULATION         VDD
                                                                  PIN 4

         MEMS
         RESONATOR
                            PLL      VCO    OUTPUT     DRIVER
         TEMP SENSOR                        DIVIDER
GND      CONTROL &                                                OUTPUT
PIN 2    COMPENSATION                                             PIN 3
```

DSC6183 (kHz Output)

```
P1                  DRIVER                    SUPPLY
OUTPUT                                        REGULATION         P4
                                                                 VDD

         MEMS
         RESONATOR
                            PLL      VCO    OUTPUT
         TEMP SENSOR                        DIVIDER
P2       CONTROL &                                               P3
GND      COMPENSATION                                            DNC
```

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 ....4000V HBM, 400V MM, 2000V CDM

DSC61XX ELECTRICAL CHARACTERISTICS

Electrical Characteristics: Unless otherwise indicated, V_{DD}= 1.8V –5% to 3.3V +10%, T_A= –40°C to 85°C.						
Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Supply Voltage, Note 1	V_{DD}	1.71	—	3.63	V	—
Active Supply Current	I_{DD}	—	3.0	—	mA	F_{OUT} = 27 MHz, V_{DD} = 1.8V, No Load
Standby Supply Current Note 2	I_{STBY}	—	12	—	µA	V_{DD} = 1.8/2.5V
		—	80	—		V_{DD} = 3.3V
Frequency Stability Note 3	Δf	—	—	±25 ±50	ppm	All temp ranges
Aging	Δf	—	—	±5	ppm	1st year @25°C
		—	—	±1		Per year after first year
Startup Time	t_{SU}	—	—	1.3	ms	From 90% V_{DD} to valid clock output, T = 25°C
Input Logic Levels Note 4 Input Logic High	V_{IH}	0.7xV_{DD}	—	—	V	—
Input Logic Low	V_{IL}	—	—	0.3xV_{DD}	V	
Output Disable Time Note 5	t_{DA}	—	—	200+Period	ns	—
Output Enable Time Note 6	t_{EN}	—	—	1	µs	—
Enable Pull-up Resistor Note 7	—	—	300	—	kΩ	If configured
Output Logic Levels Output Logic High	V_{OH}	0.8xV_{DD}	—	—	V	I = 6mA
Output Logic Low	V_{OL}	—	—	0.2xV_{DD}	V	I = –6mA

Note 1: Pin 4 V_{DD} should be filtered with 0.1 uf 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 1 Period 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.

DSC61XX

DSC61XX ELECTRICAL CHARACTERISTICS (CONTINUED)

Electrical Characteristics: Unless otherwise indicated, V_{DD}= 1.8V –5% to 3.3V +10%, T_A= –40°C to 85°C.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions	
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
		—	1.5	2.2	ns		V_{DD} = 2.5V/3.3V
Frequency	f_0	0.002	—	100	MHz	Output on Pin 1 for < 1 MHz	
Output Duty Cycle	SYM	45	—	55	%	—	
Period Jitter, RMS	J_{PER}	—	9.5	11	ps_{RMS}	F_{OUT} = 27 MHz	V_{DD} = 1.8V
		—	7.5	9			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

Note 1: Pin 4 V_{DD} should be filtered with 0.1 uf 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 1 Period 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.

TEMPERATURE SPECIFICATIONS

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Temperature Ranges						
Junction Operating Temperature	T_J	—	+150	—	°C	—
Storage Temperature Range	T_A	–55	—	+150	°C	—
Soldering Temperature	T_S	—	+260	—	°C	40 Sec. Max.

DSC61XX

2.0   PIN DESCRIPTIONS

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

TABLE 2-1:   DSC6101/03/11/13/21/23/41/43/51/53/61/63 PIN FUNCTION TABLE (OUTPUT FREQUENCY ≥1MHZ)

Pin Number	Pin Name	Pin Type	Description
1	OE	I	Output Enable: H = Specified Frequency Output, Note 1 L = Output is high impedance
	STDBY		Standby: H = Specified Frequency Output, Note 1 L = Output is high impedance. Device is in low power mode, supply current is at I_{STBY}
	FS		Frequency Select: H = Output Frequency 1, Note 2 L = Output Frequency 2
2	GND	Power	Power supply ground
3	Output	O	Oscillator clock output
4	VDD	Power	Power supply

Note 1:   DSC610x/1x/2x has 300 kΩ internal pull-up resistor on pin1. DSC614x/5x/6x has no internal pull-up resistor on pin1 and needs external pull-up or being driven by other chip.

   2:   Two pre-programmed frequencies can be configured at http://clockworks.microchip.com/timing/

   3:   Bypass with 0.1µF capacitor placed as close to V_{DD} pin as possible.

TABLE 2-2:   DSC6183 PIN FUNCTION TABLE (OUTPUT FREQUENCY <1MHZ)

Pin Number	Pin Name	Pin Type	Description
1	Output	O	Kilohertz Oscillator clock output
2	GND	Power	Power supply ground
3	DNC	DNC	Do Not Connect
4	VDD	Power	Power supply, Note 1

Note 1:   Bypass with 0.1 µF capacitor placed as close to V_{DD} pin as possible.

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 OUTPUT WAVEFORM

FIGURE 3-1: **OUTPUT WAVEFORM**
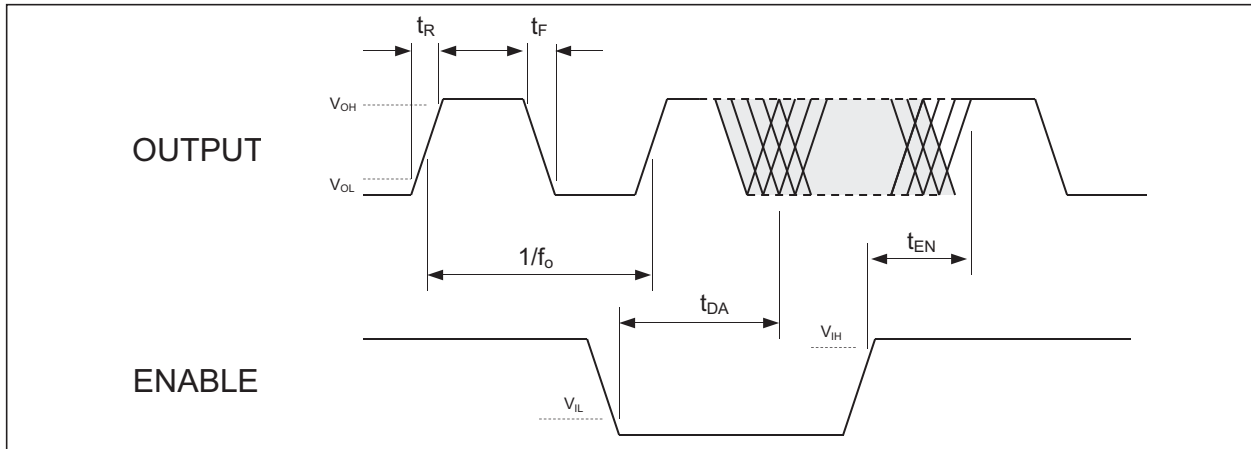
4.0 TEST CIRCUIT

FIGURE 4-1: **TEST CIRCUIT**
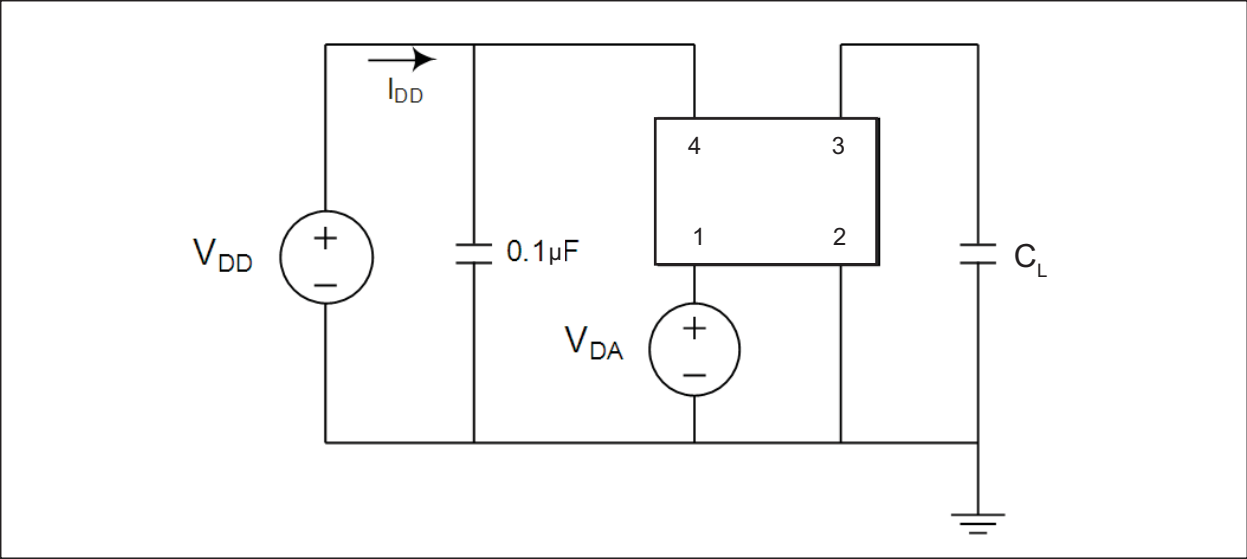
5.0   BOARD LAYOUT (RECOMMENDED)

FIGURE 5-1:   BOARD LAYOUT (RECOMMENDED)
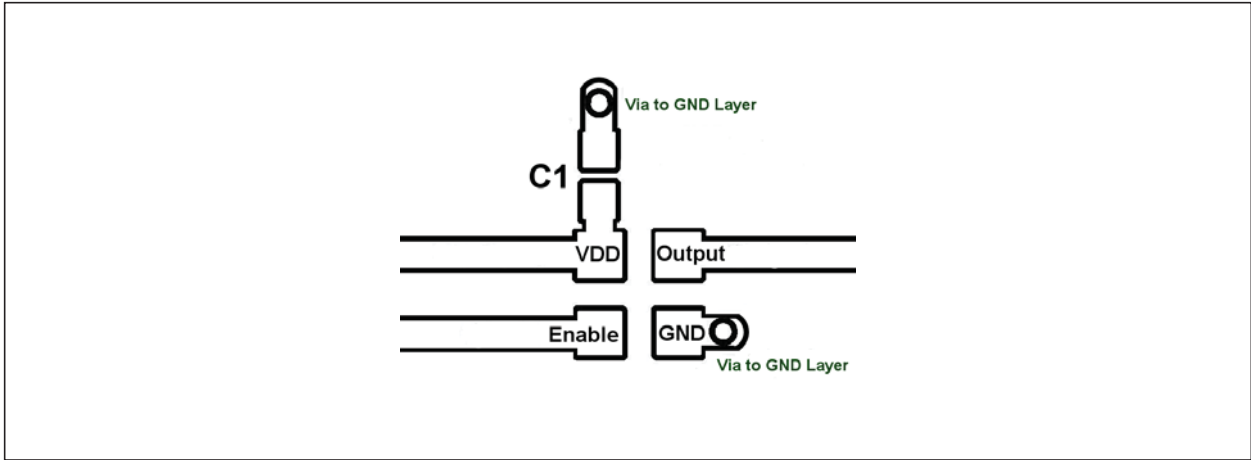
DSC61XX

6.0   SOLDER REFLOW PROFILE

FIGURE 6-1:   SOLDER REFLOW
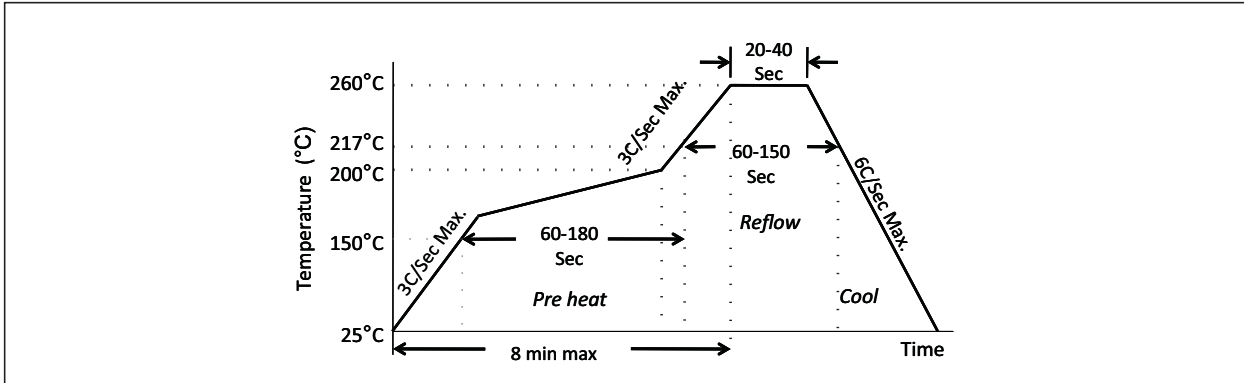
MSL 1 @ 260°C refer to JSTD-020C	
Ramp-Up Rate (200°C to Peak Temp)	3°C/Sec Max.
Preheat Time 150°C to 200°C	60-180 Sec
Time maintained above 217°C	60-150 Sec
Peak Temperature	255-260°C
Time within 5°C of actual Peak	20-40 Sec
Ramp-Down Rate	6°C/Sec Max.
Time 25°C to Peak Temperature	8 min. Max.

7.0   PACKAGING INFORMATION

4-Lead VFLGA 1.6 mm x 1.2 mm Package Outline

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
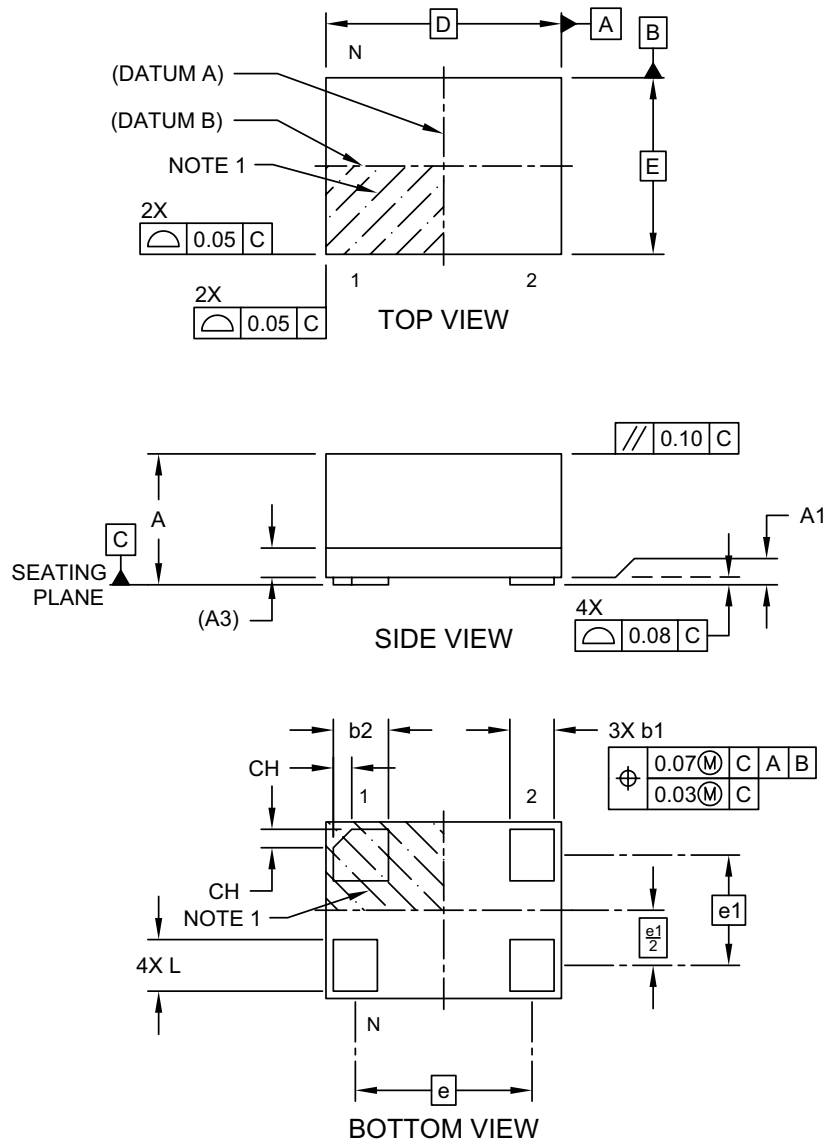
Microchip Technology Drawing C04-1199A Sheet 1 of 2

DSC61XX

4-Lead VFLGA 1.6 mm x 1.2 mm Package Outline

> **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
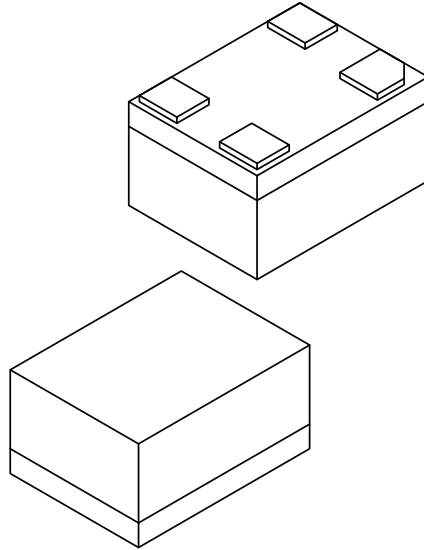
	Units	MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N		4	
Terminal Pitch	e		1.20 BSC	
Terminal Pitch	e1		0.75 BSC	
Overall Height	A	0.79	0.84	0.89
Standoff	A1	0.00	0.02	0.05
Substrate Thickness (with Terminals)	A3		0.20 REF	
Overall Length	D		1.60 BSC	
Overall Width	E		1.20 BSC	
Terminal 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.

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4-Lead VFLGA 1.6 mm x 1.2 mm Recommended Land Pattern

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

RECOMMENDED LAND PATTERN
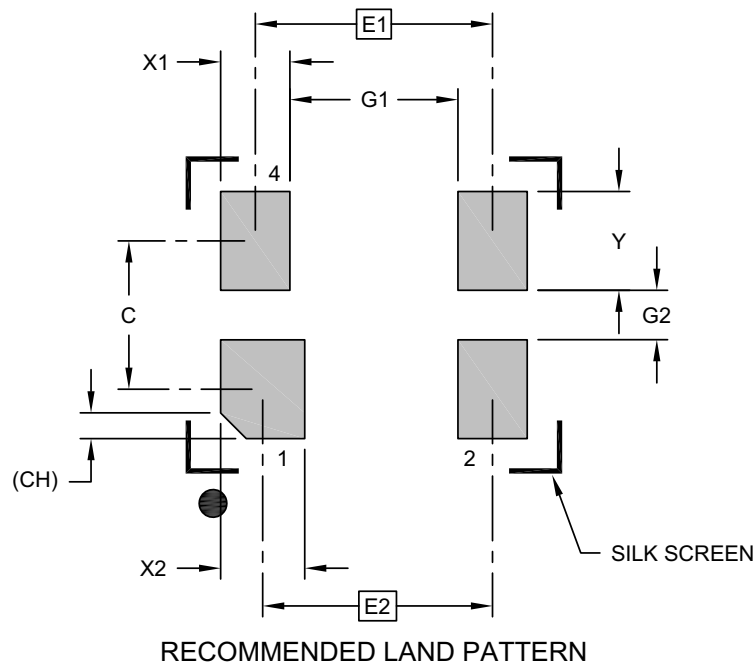
	Units	MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E1		1.20 BSC	
Contact Pitch	E2		1.16 BSC	
Contact Spacing	C		0.75	
Contact Width (X3)	X1			0.35
Contact Width	X2			0.43
Contact Pad Length (X6)	Y			0.50
Space Between Contacts (X4)	G1	0.85		
Space Between Contacts (X3)	G2	0.25		
Contact 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

DSC61XX

4-Lead VLGA 2.0 mm x 1.6 mm Package Outline

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

TOP VIEW

SIDE VIEW

BOTTOM VIEW

Microchip Technology Drawing C04-1200A Sheet 1 of 2
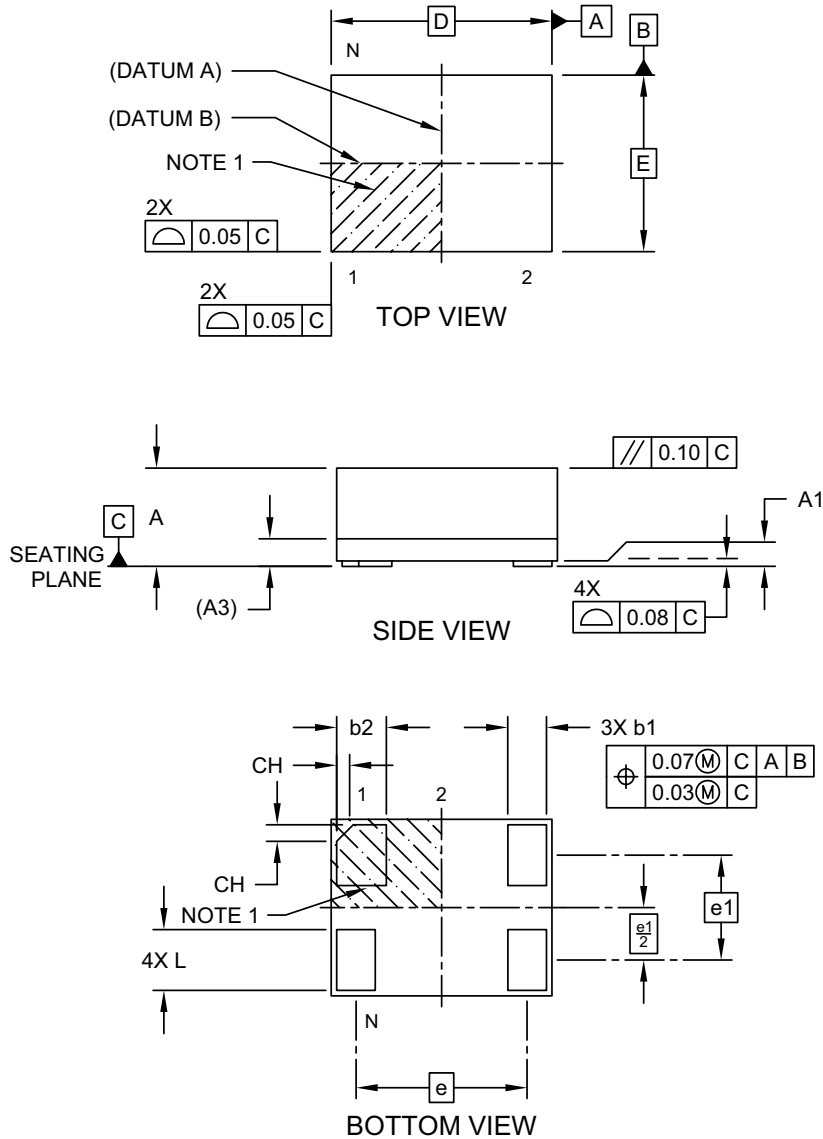
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4-Lead VLGA 2.0 mm x 1.6 mm Package Outline (Continued)

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
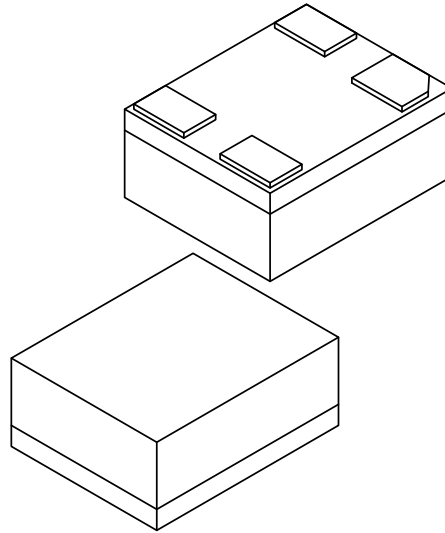
	Units	MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N		6	
Terminal Pitch	e		1.55 BSC	
Terminal Pitch	e1		0.95 BSC	
Overall Height	A	0.79	0.84	0.89
Standoff	A1	0.00	0.02	0.05
Substrate Thickness (with Terminals)	A3		0.20 REF	
Overall Length	D		2.00 BSC	
Overall Width	E		1.60 BSC	
Terminal 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:

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

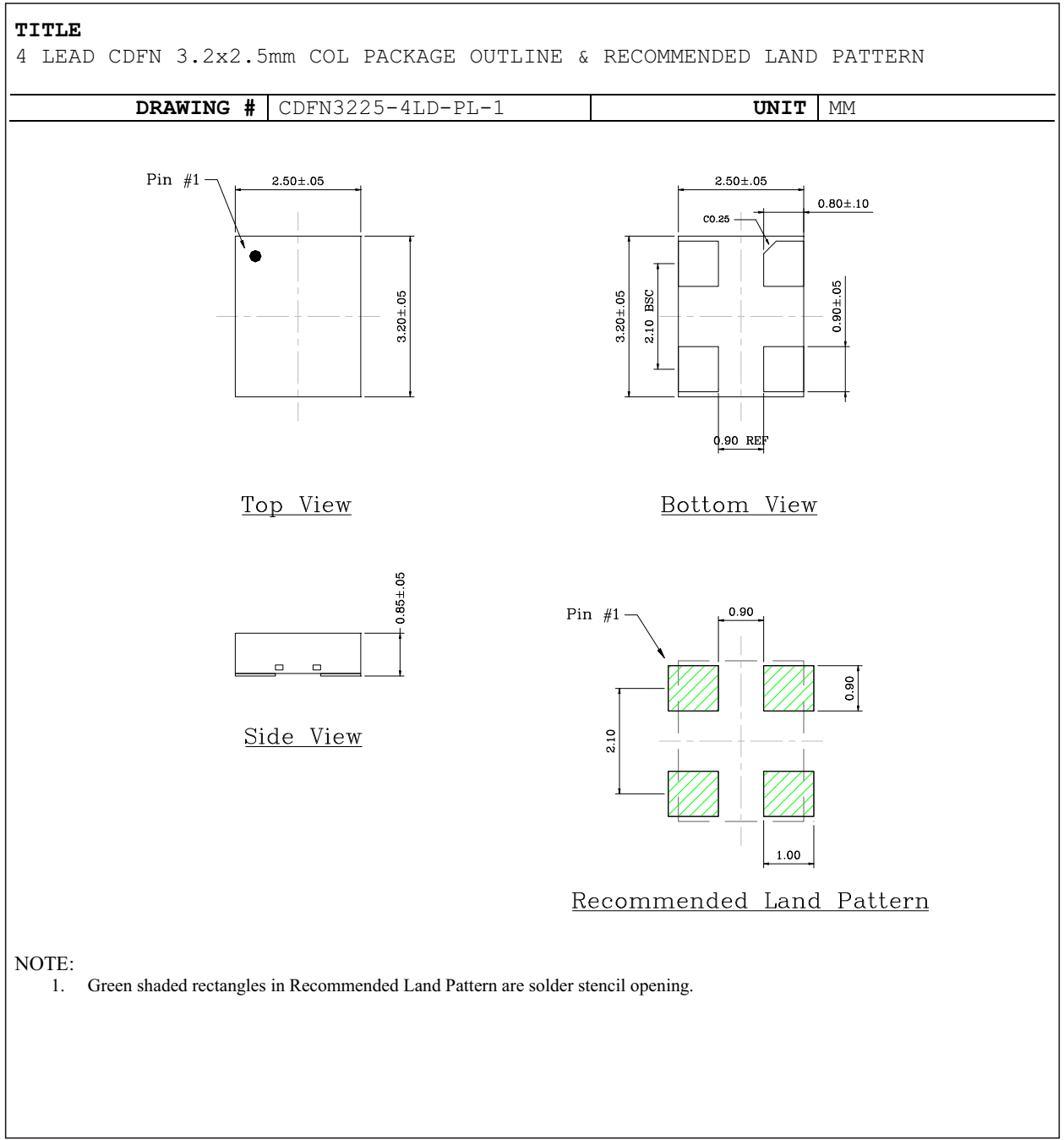   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

   REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-1200A Sheet 2 of 2

DSC61XX

4-Lead VFLGA 2.0 mm x 1.6 mm Package Outline

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
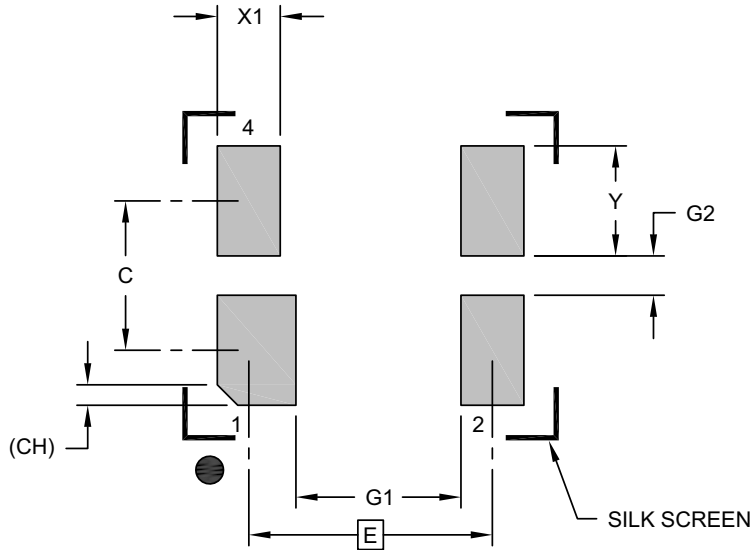
RECOMMENDED LAND PATTERN

	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:

1. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing C04-3200A

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4-Lead VLGA 2.5 mm x 2.0 mm Package Outline

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
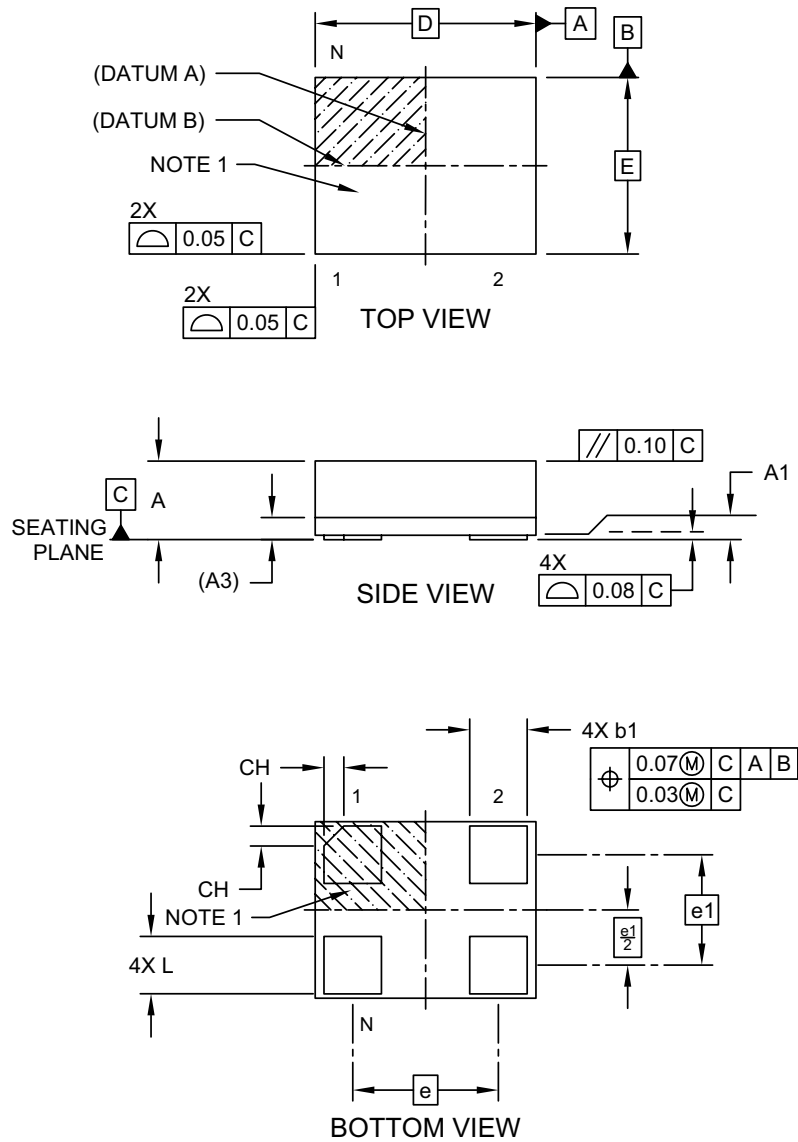
Microchip Technology Drawing C04-1202A Sheet 1 of 2

DSC61XX

4-Lead VLGA 2.5 mm x 2.0 mm Package Outline (Continued)

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
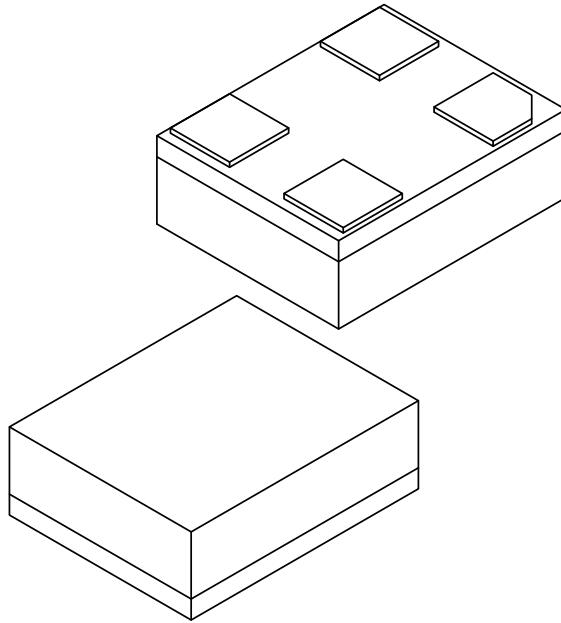
Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N		4	
Terminal Pitch	e		1.65 BSC	
Terminal Pitch	e1		1.25 BSC	
Overall Height	A	0.79	0.84	0.89
Standoff	A1	0.00	0.02	0.05
Substrate Thickness (with Terminals)	A3		0.20 REF	
Overall Length	D		2.50 BSC	
Overall Width	E		2.00 BSC	
Terminal 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:

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 C04-1202A Sheet 2 of 2

4-Lead VLGA 2.5 mm x 2.0 mm Recommended Land Pattern

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
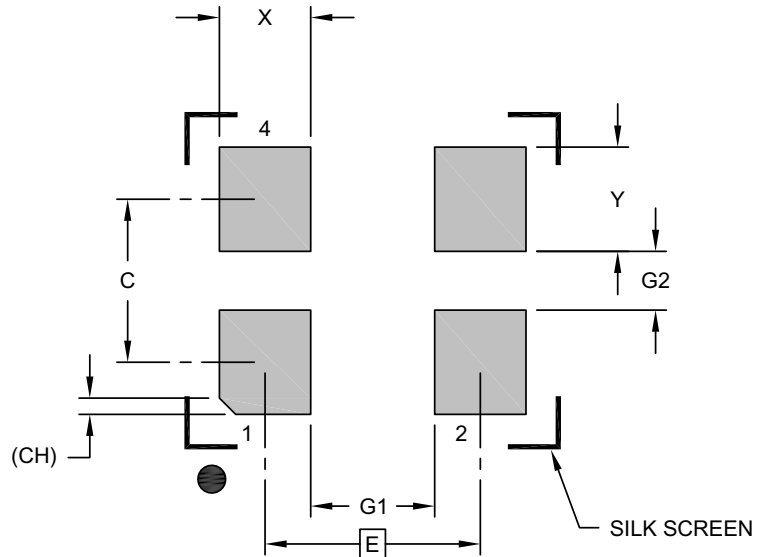
RECOMMENDED LAND PATTERN

	Units	MILLIMETERS		
Dimension Limits		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

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

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

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

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

Pin #1

2.50±.05

3.20±.05

Top View

2.50±.05

C0.25

0.80±.10

3.20±.05

2.10 BSC

0.90±.05

0.90 REF

Bottom View

0.85±.05

Side View

Pin #1

0.90

0.90

2.10

1.00

Recommended Land Pattern

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

APPENDIX A: REVISION HISTORY

Revision A (September 2016)

- Initial release of DSC61XX Microchip data sheet DS20005624A.

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. <u>X</u>   <u>X</u>   <u>X</u>   <u>X</u>   <u>X</u>   <u>X</u> – <u>XXX.XXXX</u> <u>X</u>

Device | Pin 1 Definition | Output Drive Strength | Package | Temperature Range | Frequency Stability | Revision | Frequency | Tape and Reel

Device: DSC61XX: Ultra-Low Power MEMS Oscillator

Pin Definition:

Selection	Pin 1	Internal Pull Register
0	OE	Pull-up
1	STDBY	Pull-up
2	FS	Pull-up
4	OE	None
5	STDBY	None
6	FS	None
8	KHz Output	None

Output Drive Strength:

1	Standard
2	High

Packages:

C	=	4-Lead 3.2 mm x 2.5 mm DFN
J	=	4-Lead 2.5 mm x 2.0 mm VFLGA
M	=	4-Lead 2.0 mm x 1.6 mm VFLGA
H	=	4-Lead 1.6 mm x 1.2 mm VFLGA

Temperature Range:

E	=	-20°C to +70°C (Extended Commercial)
I	=	-40°C to +85°C (Industrial)

Frequency Stability:

1	=	± 50 ppm
2	=	± 25 ppm

Revision:

A	=	Revision A

Frequency:

xxx.xxxx =	User-Defined Frequency between 001.0000 MHz and 100.0000 MHz
xxxkxxx =	User-Defined Frequency between 002.000 kHz and 999.999 kHz
xxxx =	Frequency configuration code when pin 1 = FS. Configure the part online through ClockWorks

Tape and Reel:

Blank	=	Bulk
T	=	Tape and Reel

Examples:

a) DSC6112JI2A-100.0000: Ultra–Low Power MEMS Oscillator, Pin1= Standby with internal Pull–Up, High Output Drive Strength, 4-Lead 2.5 mm x 2.0 mm VFLGA, Industrial Temperature (–40°C to +85°C), ±25 ppm, Revision A, 100 MHz Frequency, Bulk.

b) DSC6101HE1A-016.0000T: Ultra–Low Power MEMS Oscillator, Pin1= OE with Internal Pull–Up, Standard Output Drive Strength, 4-Lead 1.6 mm x1.2 mm VFLGA, Extended Commercial Temperature (–20°C to +70°C), ±50 ppm, Revision A, 16 MHz Frequency, Tape and Reel.

c) DSC6183ME1A-032k768: Ultra–Low Power MEMS Oscillator, Pin1= 32.768 KHz Clock Output, Low Output Drive Strength, 4-Lead 2.0 mm x1.6 mm VFLGA, Extended Commercial Temperature (–20°C to +70°C), ±50 ppm, Revision A, Bulk

d) DSC6121CI2A-001A: Ultra–Low Power MEMS Oscillator, Pin1= FS with internal Pull-up, Standard Output Drive Strength, 4-Lead 3.2 mm x 2.5 mm CDFN, Industrial Temperature (-40 to 85 C), ±25 ppm, Revision A, Frequency code = 001A (configured through ClockWorks), Bulk

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.

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

NOTES:

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