

2.5-450 MHz High Performance Differential MEMS Oscillator

Features

- Any Frequency Between 2.5 MHz and 450 MHz Accurate to 6 Decimal Places
- LVPECL and LVDS Output Signaling Types
- 0.65 ps RMS Phase Jitter (Random) Over 12 kHz to 20 MHz Bandwidth
- Low Current Consumption
- Industrial and Extended Commercial Temperature Ranges to +105°C
- Industry-Standard Packages: 2.5 mm × 2.0 mm, 3.2 mm × 2.5 mm, 5.0 mm × 3.2 mm, and 7.0 mm × 5.0 mm

Applications

- SONET, Synchronous Ethernet, SATA, SAS, 10 GB
- Ethernet, Fibre Channel, PCI-Express
- Telecom, Networking, Broadband, Instrumentation
- Military Application

PERFORMANCE SPECIFICATIONS

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
LVPECL and LVDS, Common AC Characteristics						
Output Frequency Range	f_{OUT}	2.5	—	450	MHz	—
Frequency Stability	f_{STAB}	-20	—	+20	ppm	Inclusive of initial tolerance at +25°C and variations over operating temperature, rated power supply voltage, and load.
		-25	—	+25		
		-50	—	+50		
First Year Aging	f_{AGING}	-5	—	+5	ppm	25°C, ±1 ppm after 1st year
Operating Temperature Range	T_{OP}	-20	—	+70	°C	Commercial
		-40	—	+85		Industrial
		-40	—	+105		Extended Industrial
Start-Up Time	t_{START}	—	5.5	6.0	ms	—
Duty Cycle	DC	48	—	52	%	—
LVPECL, DC, and AC Characteristics						
Supply Voltage	V_{DD}	2.97	3.3	3.63	V	Pin 6 should connect with 0.1 μ F cap
		2.25	2.5	2.75		
Current Consumption	I_{DD}	—	50	—	mA	f = 100 MHz
OE Disable Supply Current		—	23	—	mA	OE = Low, f = 100 MHz
Output High Voltage	V_{OH}	$V_{DD} - 1.145$	—	—	V	See Figure 1, RL = 50 Ω
Output Low Voltage	V_{OL}	—	—	$V_{DD} - 1.695$	V	See Figure 1, RL = 50 Ω
Output Differential Voltage Swing	V_{SWING}	—	800	—	mV	See Figure 1, RL = 50 Ω
Rise Time	t_r	—	200	250	ps	20% to 80%
Fall Time	t_f	—	250	300	ps	20% to 80%
OE Enable/Disable Time	t_{oe}	—	—	350	ns	—

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PERFORMANCE SPECIFICATIONS

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Enable Pull-Up Resistor	R_{PU}	—	1.5	—	M Ω	Output enabled if Pin 1 is floated
RMS Period Jitter	t_{JITT}	—	2.0	—	ps	f = 156.25 MHz
RMS Phase Jitter (random)	t_{PHJ}	—	0.65	—	ps	f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz
LVDS, DC, and AC Characteristics						
Supply Voltage	V_{DD}	2.97	3.3	3.63	V	Pin 6 should connect with 0.1 μ F cap
		2.25	2.5	2.75		
Current Consumption	I_{DD}	—	32	—	mA	f = 100 MHz
OE Disable Supply Current	I_{OE}	—	23	—	mA	OE = Low, f = 100 MHz
Differential Output Voltage	V_{OD}	250	350	450	mV	See Figure 2, Single-Ended
Offset Voltage	V_{OS}	1.15	1.25	1.35	V	See Figure 2, R = 100 Ω
Rise Time	t_r	120	170	220	ps	20% to 80%
Fall Time	t_f	—	—	220	ns	—
OE Enable/Disable Time	t_{oe}	—	—	350	ns	—
Enable Pull-Up Resistor	R_{PU}	—	1.5	—	M Ω	Output enabled if Pin 1 is floated
RMS Period Jitter	t_{JITT}	—	2.5	—	ps	f = 156.25 MHz
RMS Phase Jitter (random)	t_{PHJ}	—	0.65	—	ps	12 kHz to 20 MHz @ 158.25 MHz, T_A = -40°C to +105°C
		—	0.9	—		2 kHz to 20 MHz @ 158.25 MHz, T_A = -40°C to +125°C

ABSOLUTE MAXIMUM RATINGS

Parameter	Minimum	Maximum
Storage Temperature	-55°C	+150°C
V_{DD}	-0.3V	+4.0V
Electrostatic Discharge (HBM)	—	+4000V
Soldering Temperature (follow standard Pb-Free soldering guidelines)	—	+260°C

ENVIRONMENTAL COMPLIANCE

Parameter	Condition/Test Method
Mechanical Shock	MIL-STD-883F, Method 2002
Mechanical Vibration	MIL-STD-883F, Method 2007
Temperature Cycle	JESD22, Method A104
Solderability	MIL-STD-883F, Method 2003
Moisture Sensitivity Level	MSL1 @ 260°C

1.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in [Table 1-1](#).

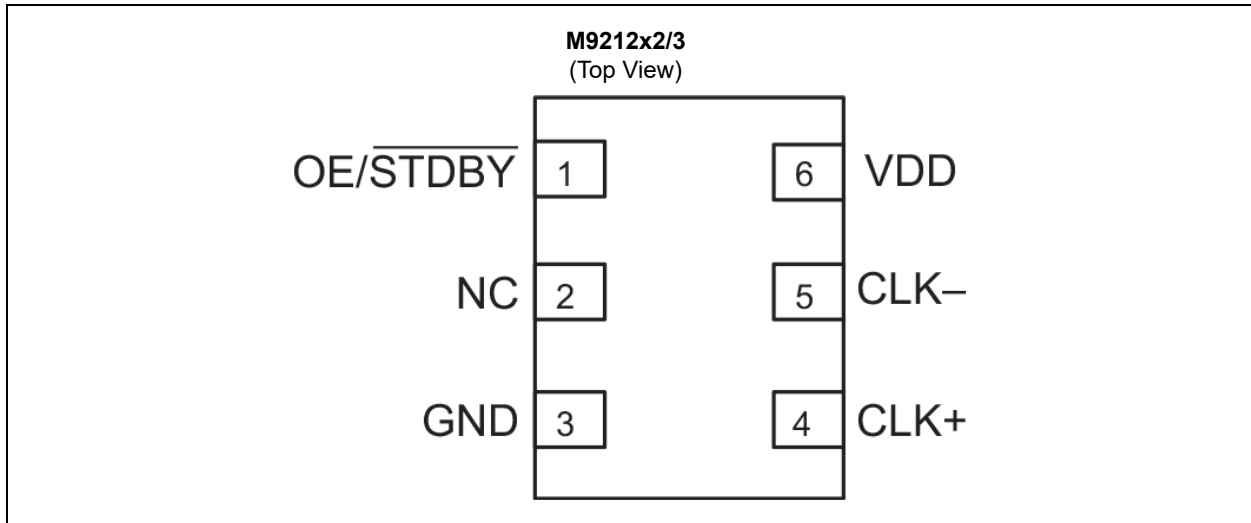


TABLE 1-1: PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1	OE or $\overline{\text{STBY}}$	Input. Open Enable or Active-Low Standby (with pull-up). H or Open: Specified frequency output. L: Output is high impedance.
H2	NC	Do Not Connect. Leave it floating.
3	GND	VDD Power Supply Ground.
4	OUT+	Oscillator Output.
5	OUT-	Complementary Oscillator Output.
6	VDD	Power Supply Voltage.

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2.0 TERMINATION CIRCUIT EXAMPLES

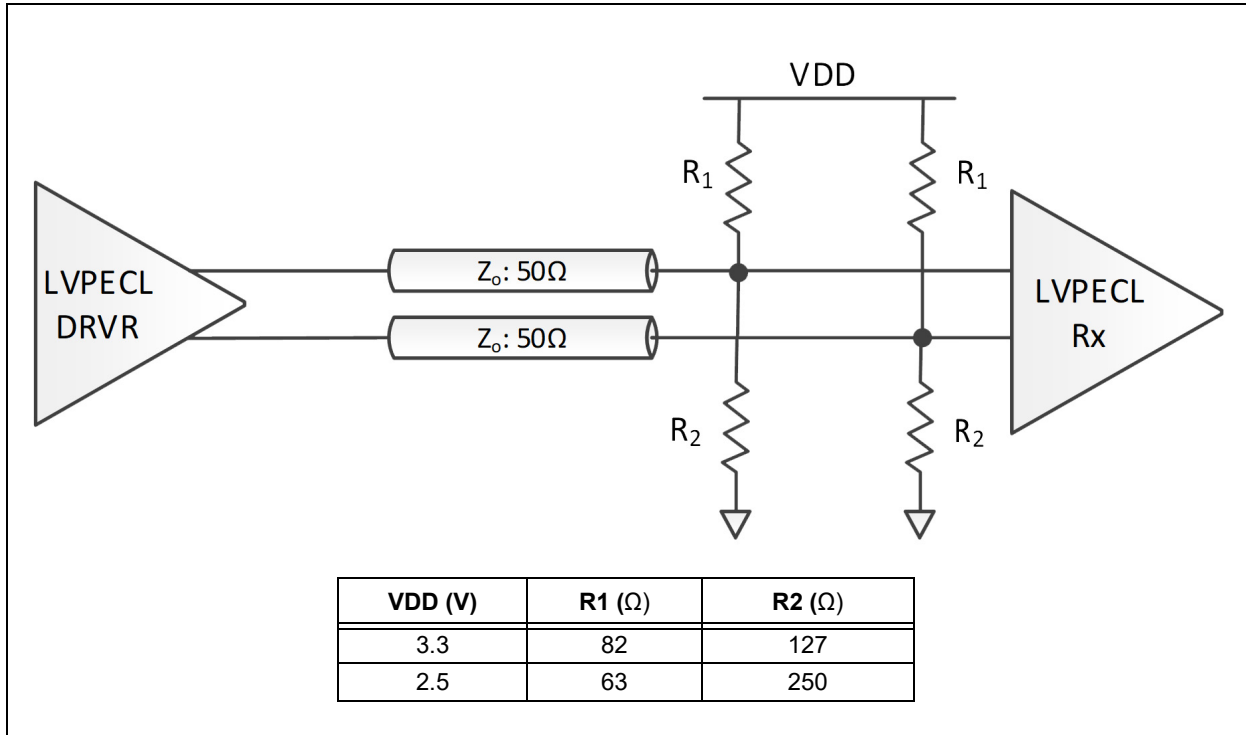


FIGURE 2-1: LVPECL TYPICAL TERMINATION.

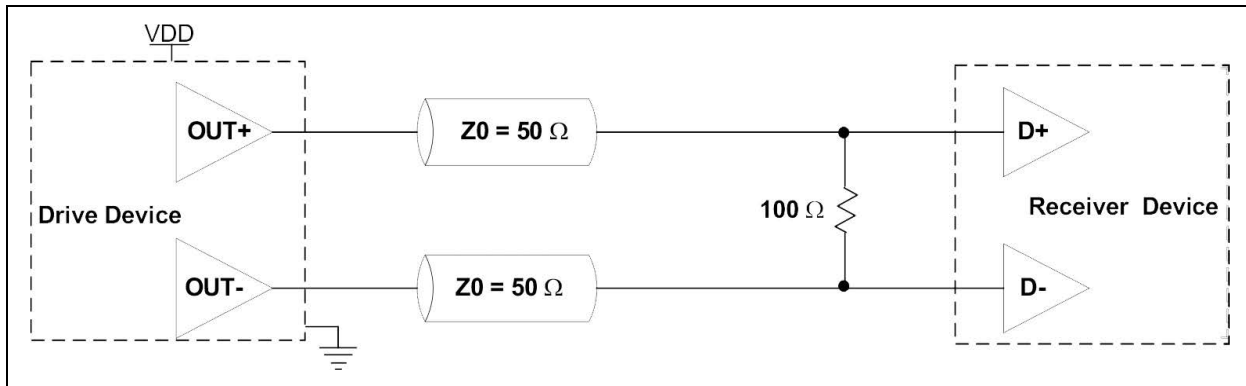
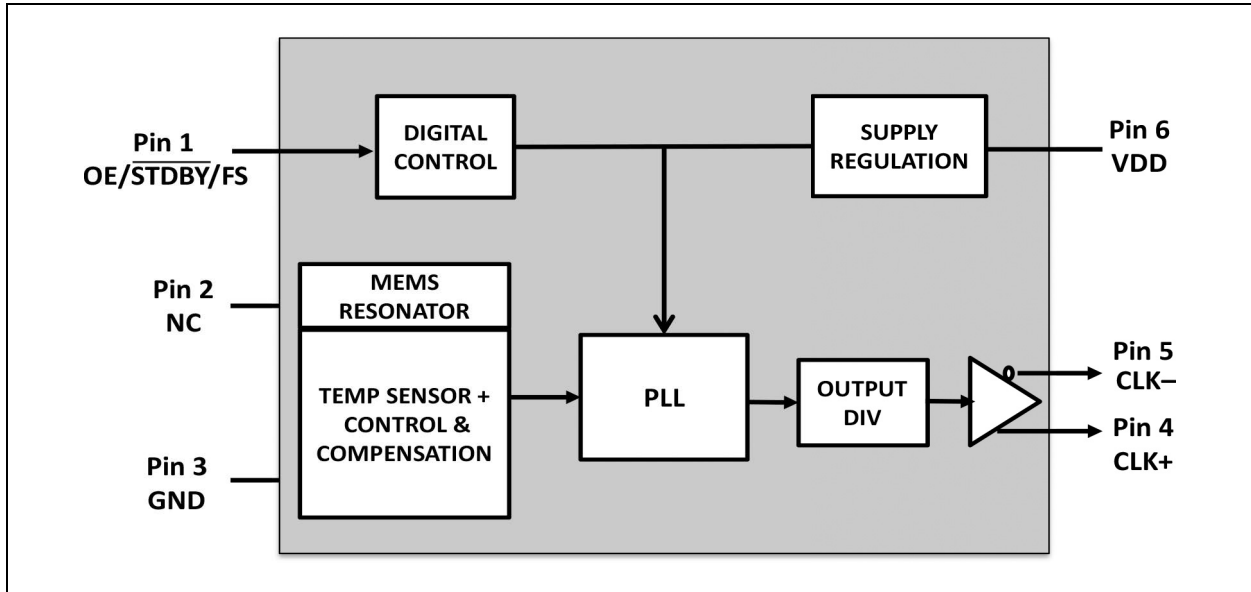


FIGURE 2-2: LVDS SINGLE TERMINATION (LOAD TERMINATED).

3.0 FUNCTIONAL BLOCK DIAGRAM



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4.0 RECOMMENDED REFLOW PROFILES FOR Pb-Free & Sn-Pb

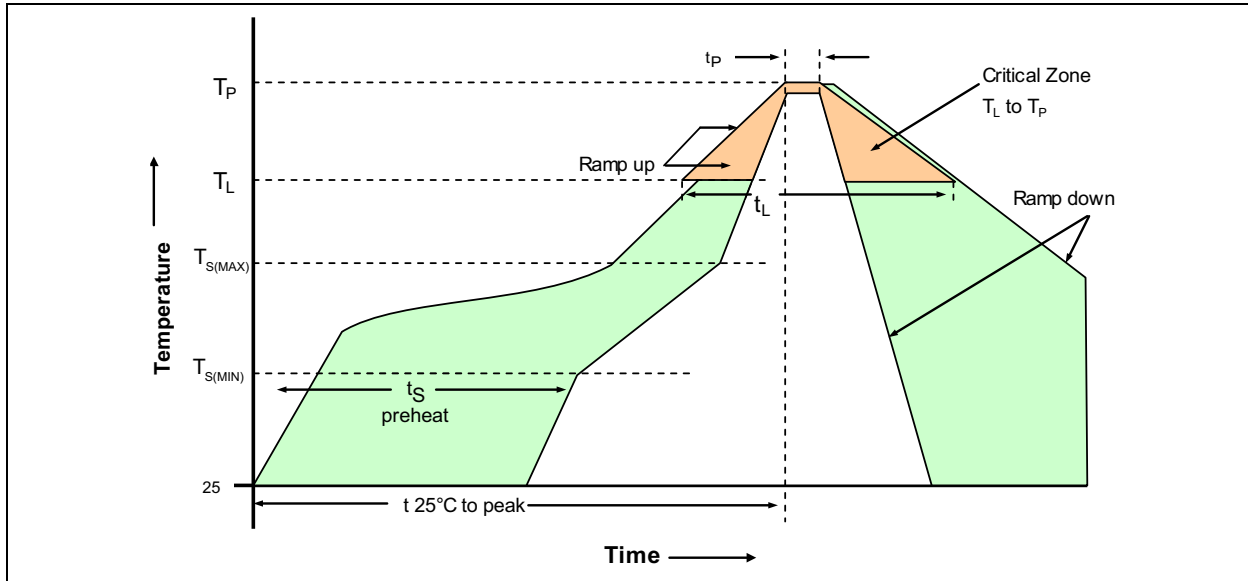


FIGURE 4-1: Reflow Profile.

TABLE 4-1: REFLOW PROFILE

Profile Feature	Symbol	Sn-Pb Assembly	Pb-Free Assembly
Average Ramp-Up Rate	T _L to T _P	3°C/second max.	3°C/second max.
Pre-Heat Minimum Temperature	T _{S(MIN)}	135°C	150°C
Pre-Heat Maximum Temperature	T _{S(MAX)}	155°C	200°C
Pre-Heat Time (from min. to max.)	t _S	60 to 90 seconds	60 to 180 seconds
T _{S(MAX)} to T _L Ramp-Up Rate	—	3°C/second max.	3°C/second max.
Low Temperature of Critical Reflow Zone	T _L	183°C	217°C
Time Maintained Above T _L	—	40 to 60 seconds	60 to 150 seconds
Peak Temperature	T _P	230°C max.	260°C max.
Time from 25°C to Peak Temperature	—	4 minutes max.	8 minutes max.
Time within 5°C of Actual Peak Temperature	t _p	10 to 20 seconds max.	20 to 40 seconds max.
Ramp-Down Rate	—	6°C/second max.	6°C/second max.

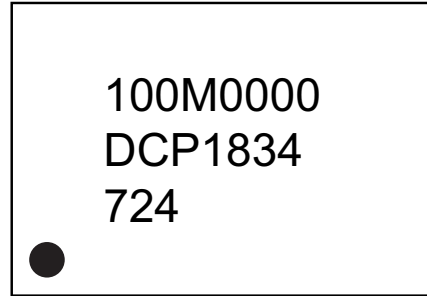
Note: All temperatures refer to the topside of the package, measured on the package body surface.

5.0 PACKAGING INFORMATION

5.1 Package Marking Information

4-Lead 7.0 mm × 5.0 mm DFN*
 4-Lead 5.0 mm × 3.2 mm VDFN*
 4-Lead 3.2 mm × 2.5 mm VDFN*
 4-Lead 2.5 mm × 2.0 mm VLGA*

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.

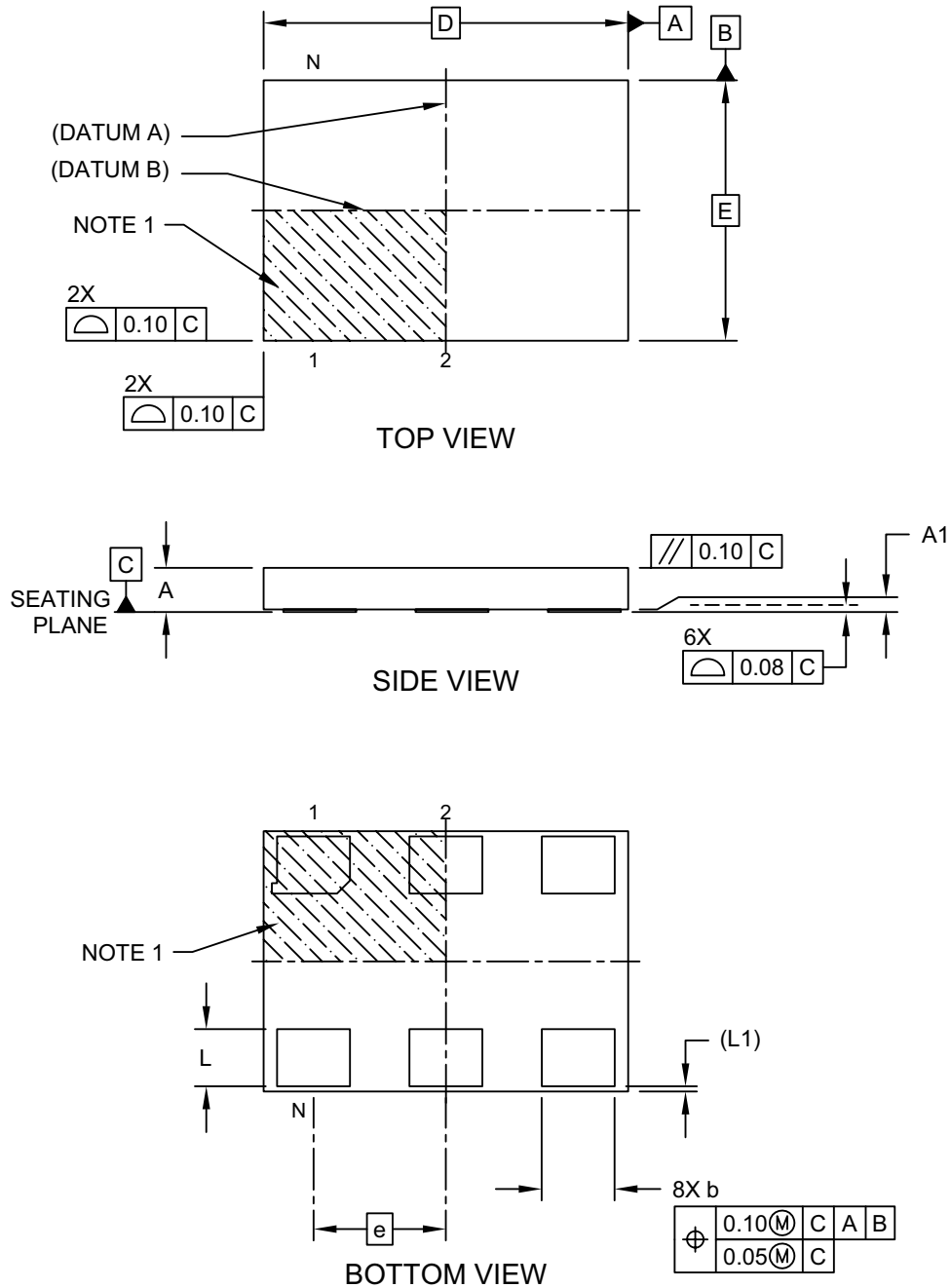
Underbar () and/or Overbar () symbol may not be to scale.

Note: If the full seven-character YYWWSSS code cannot fit on the package, the following truncated codes are used based on the available marking space:
 6 Characters = YWWSSS; 5 Characters = WWSSS; 4 Characters = WSSS; 3 Characters = SSS;
 2 Characters = SS; 1 Character = S.

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6-Lead Very Thin Plastic Dual Flat, No-Lead Package (HPA) - 7.0 mm × 5.0 mm Body [VDFN]

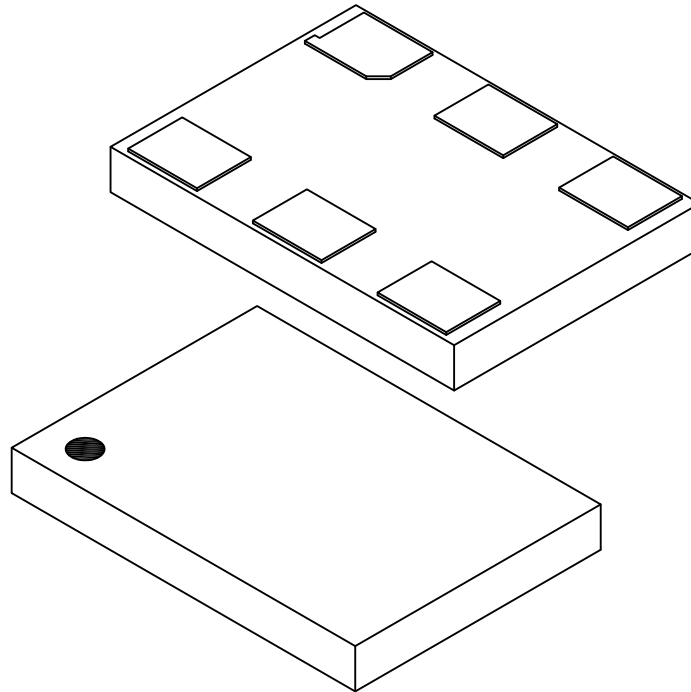
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-1227 Rev A Sheet 1 of 2

6-Lead Very Thin Plastic Dual Flat, No-Lead Package (HPA) - 7.0 mm × 5.0 mm Body [VDFN]

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
Number of Terminals	N	6		
Pitch	e	2.54 BSC		
Overall Height	A	0.80	0.85	0.90
Standoff	A1	0.00	0.02	0.05
Overall Length	D	7.00 BSC		
Overall Width	E	5.00 BSC		
Terminal Width	b	1.30	1.40	1.50
Terminal Length	L	1.00	1.10	1.20
Pullback	L1	0.10 REF		

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.

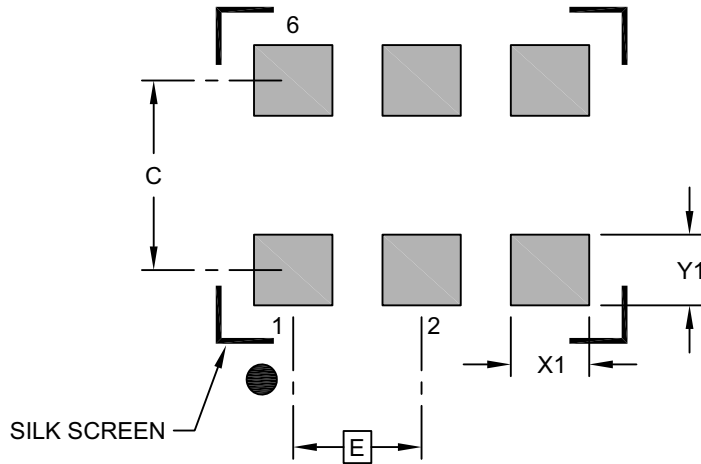
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-1227 Rev A Sheet 2 of 2

M9212X2/3

6-Lead Very Thin Plastic Dual Flat, No-Lead Package (HPA) - 7.0 mm × 5.0 mm Body [VDFN]

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		2.54 BSC	
Contact Pad Spacing	C		3.90	
Contact Pad Width (X6)	X1			1.55
Contact Pad Length (X6)	Y1			1.40

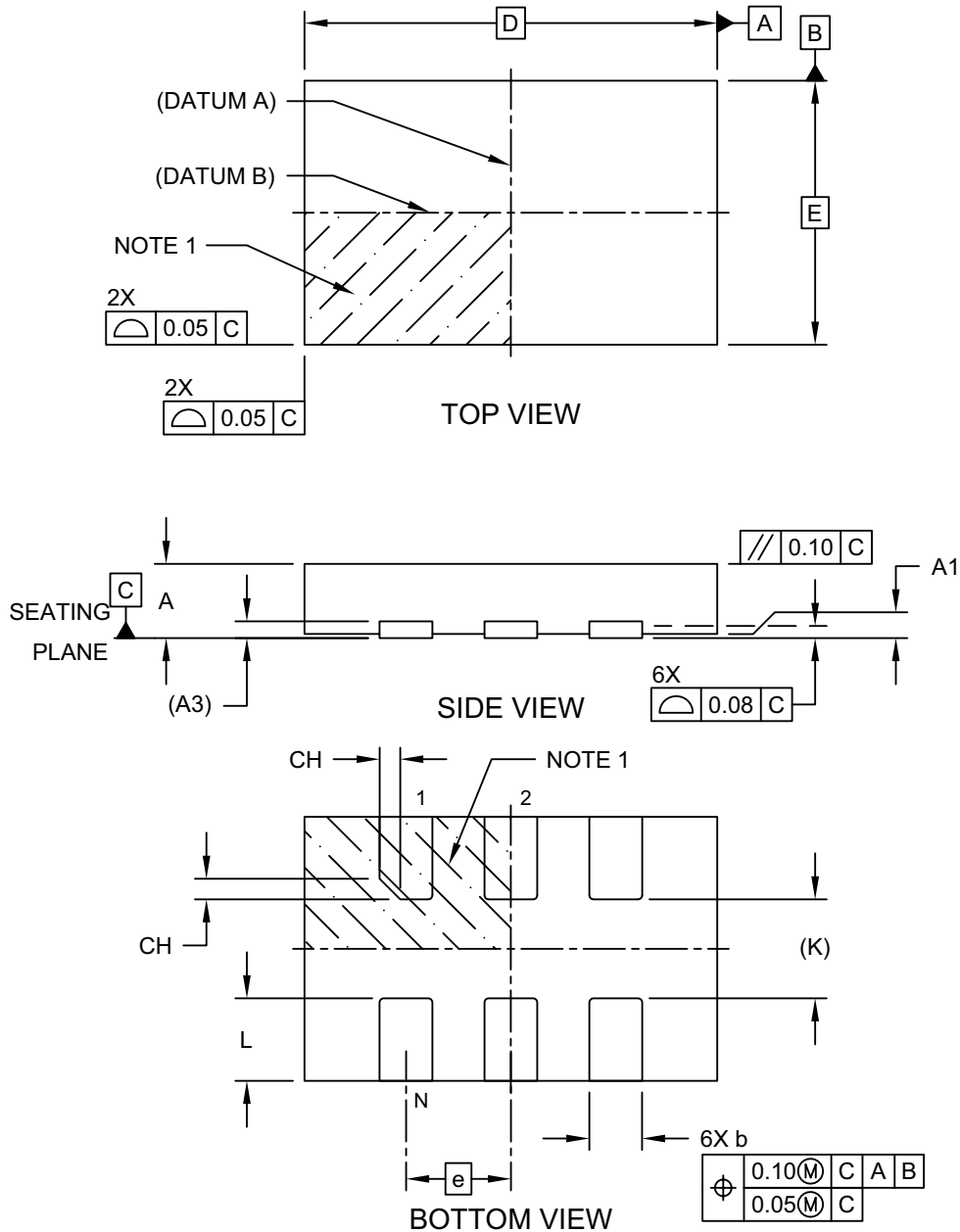
Notes:

- Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-3227 Rev A

6-Lead Very Thin Plastic Dual Flat, No-Lead Package (H7A) - 5.0 mm × 3.2 mm Body [VDFN]

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

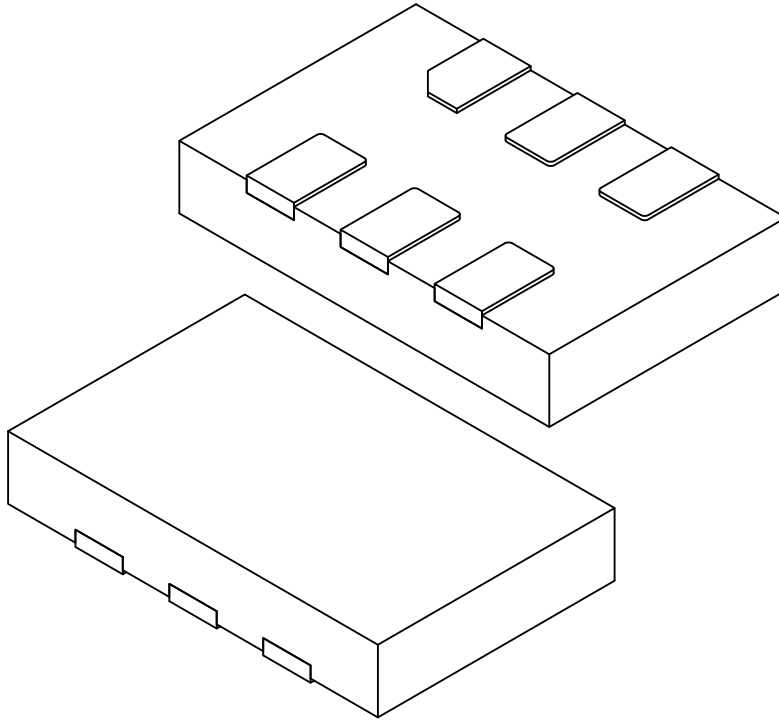


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M9212X2/3

6-Lead Very Thin Plastic Dual Flat, No-Lead Package (H7A) - 5.0 mm × 3.2 mm Body [VDFN]

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
Number of Terminals	N	6		
Pitch	e	1.27 BSC		
Overall Height	A	0.80	0.85	0.90
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	A3	0.203 REF		
Overall Length	D	5.00 BSC		
Overall Width	E	3.20 BSC		
Terminal Width	b	0.59	0.64	0.69
Terminal Length	L	0.90	1.00	1.10
Terminal 1 Index Chamfer	CH	0.25 REF		
Terminal-to-Terminal	K	1.20 REF		

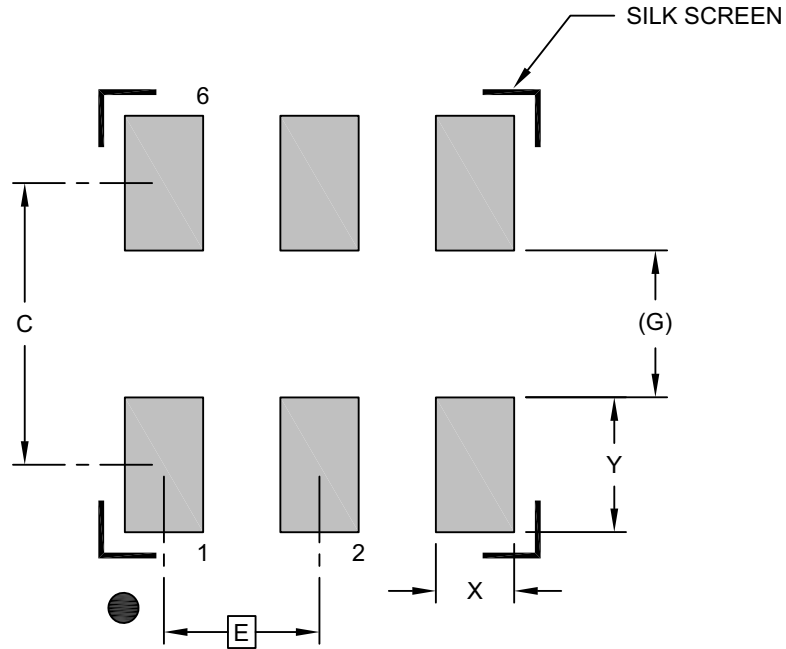
Notes:

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 C04-1009 Rev A Sheet 2 of 2

6-Lead Very Thin Plastic Dual Flat, No-Lead Package (H7A) - 5.0 mm × 3.2 mm Body [VDFN]

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	1.27 BSC		
Contact Pad Spacing	C		2.30	
Contact Pad Width (X6)	X			0.64
Contact Pad Length (X6)	Y			1.10
Contact Pad to Contact Pad (X4)	G	1.20 REF		

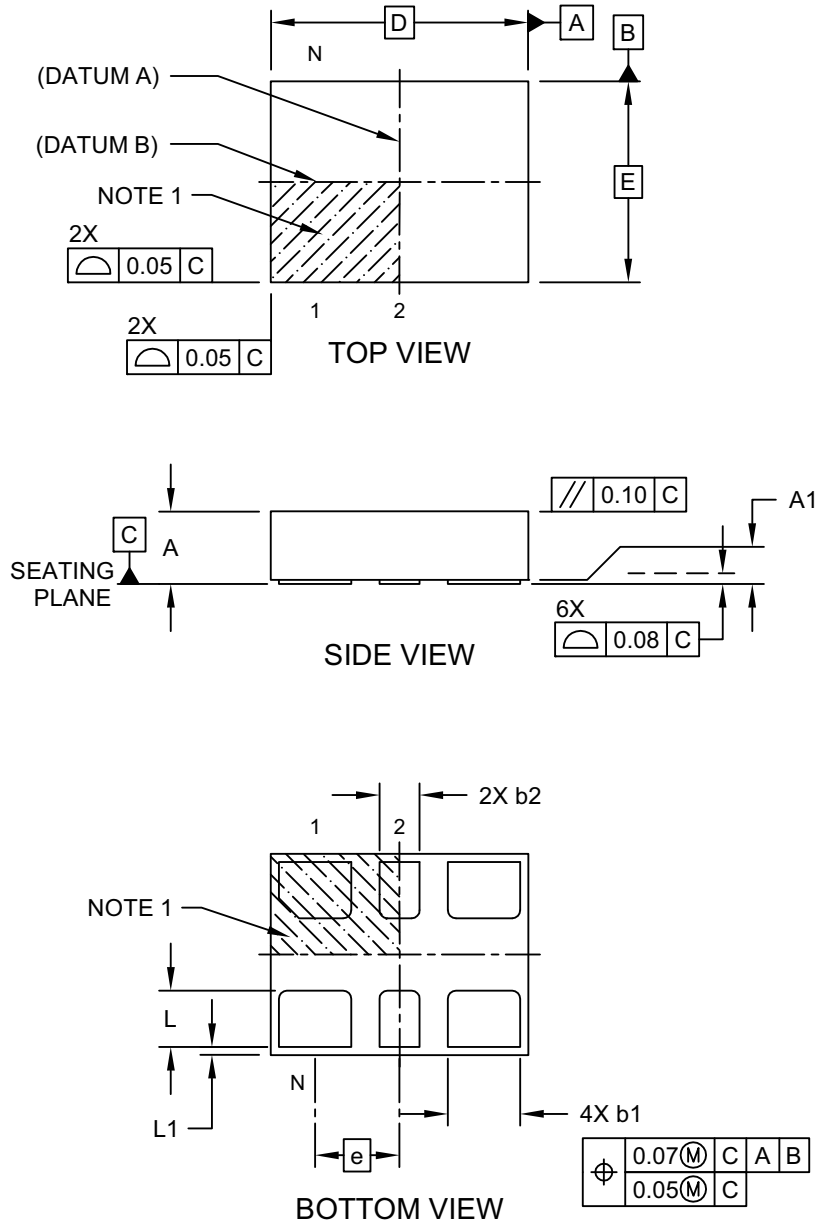
Notes:

- Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

M9212X2/3

6-Lead Very Thin Plastic Dual Flat, No-Lead Package (HSA) - 3.2 mm × 2.5 mm Body [VDFN]

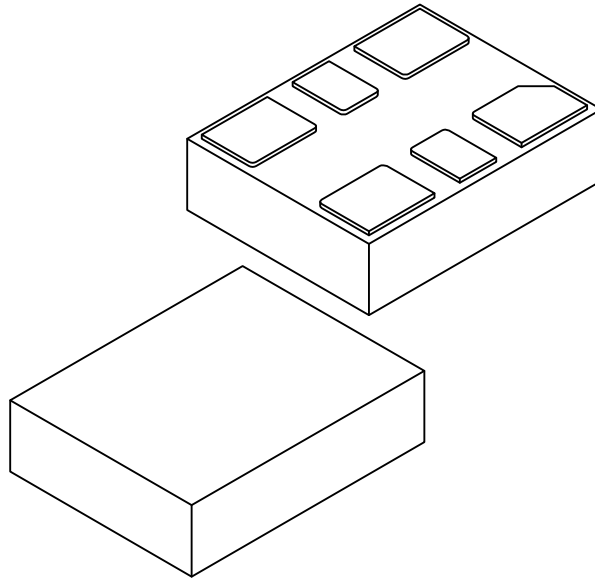
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-1007B Sheet 1 of 2

6-Lead Very Thin Plastic Dual Flat, No-Lead Package (HSA) - 3.2 mm × 2.5 mm Body [VDFN]

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
Number of Terminals	N	6		
Pitch	e	1.05 BSC		
Overall Height	A	0.80	0.85	0.90
Standoff	A1	0.00	0.02	0.05
Overall Length	D	3.20 BSC		
Overall Width	E	2.50 BSC		
Terminal Width	b1	0.85	0.90	0.95
Terminal Width	b2	0.45	0.50	0.55
Terminal Length	L	0.65	0.70	0.75
Terminal Pullback	L1	0.10 REF		

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.

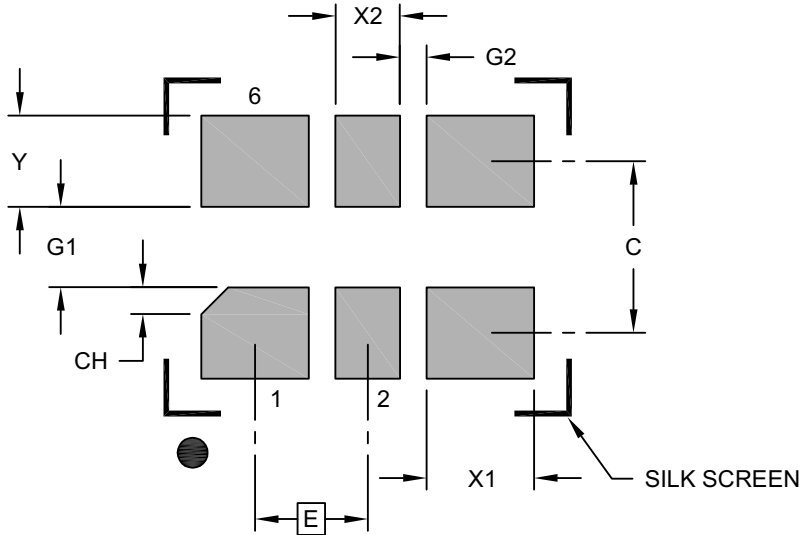
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-1007B Sheet 2 of 2

M9212X2/3

6-Lead Very Thin Plastic Dual Flat, No-Lead Package (HSA) - 3.2 mm × 2.5 mm Body [VDFN]

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	1.05 BSC		
Contact Pad Spacing	C		1.60	
Contact Pad Width (X4)	X1			1.00
Contact Pad Width (X2)	X2			0.60
Contact Pad Length (X6)	Y			0.85
Space Between Contacts (X4)	G1	0.75		
Space Between Contacts (X3)	G2	0.25		
Pin 1 Index Chamfer (X4)	CH		0.25	

Notes:

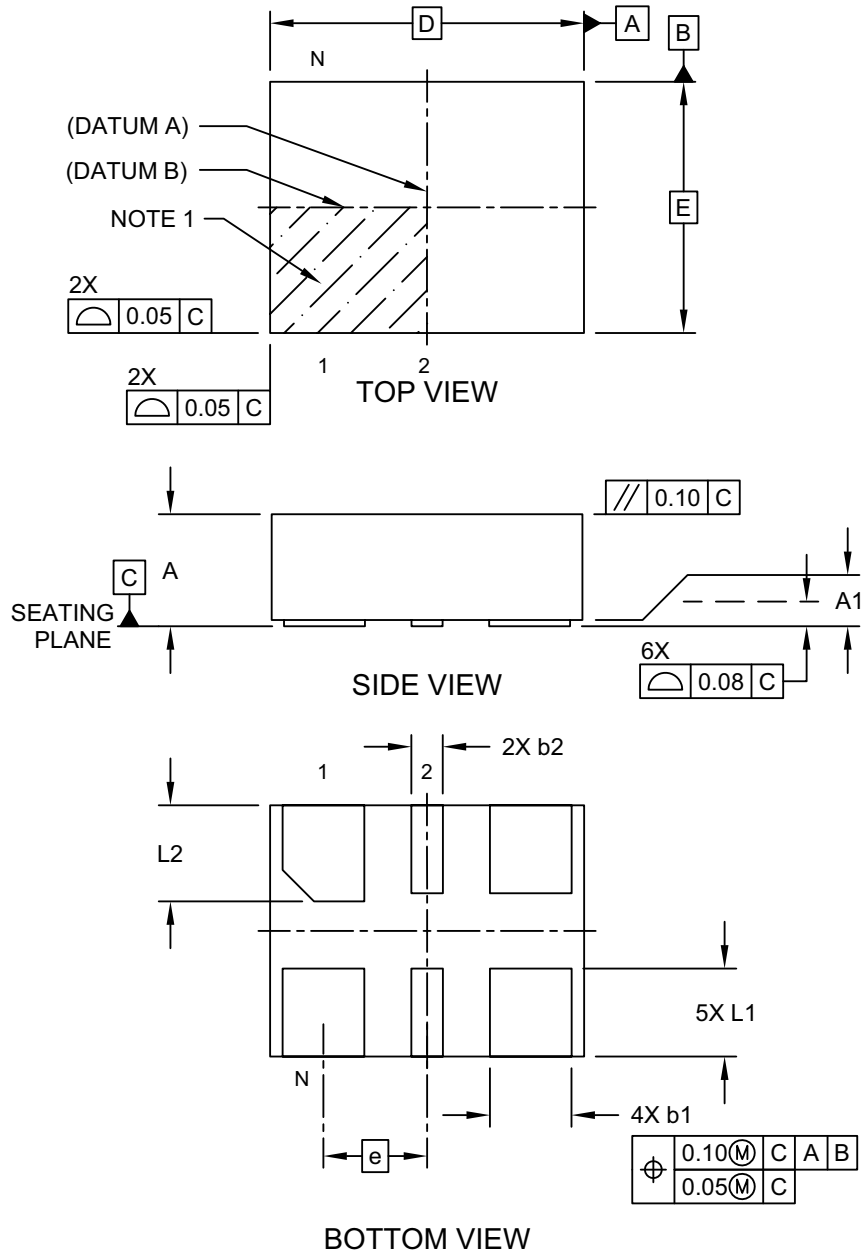
1. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing C04-3007B

6-Lead Very Thin Plastic Dual Flat, No-Lead Package (J7A) - 2.5 mm × 2.0 mm Body [VDFN]

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

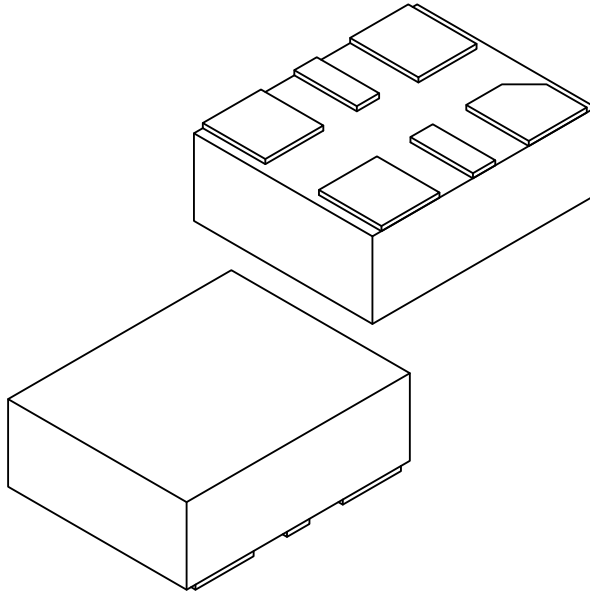


Microchip Technology Drawing C04-1005 Rev B Sheet 1 of 2

M9212X2/3

6-Lead Very Thin Plastic Dual Flat, No-Lead Package (J7A) - 2.5 mm × 2.0 mm Body [VDFN]

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
Number of Terminals	N	6		
Pitch	e	0.825 BSC		
Overall Height	A	0.80	0.85	0.90
Standoff	A1	0.00	0.02	0.05
Overall Length	D	2.50 BSC		
Overall Width	E	2.00 BSC		
Terminal Width	b1	0.60	0.65	0.70
Terminal Width	b2	0.20	0.25	0.30
Terminal Length	L1	0.60	0.70	0.80
Terminal Length	L2	0.665	0.765	0.865

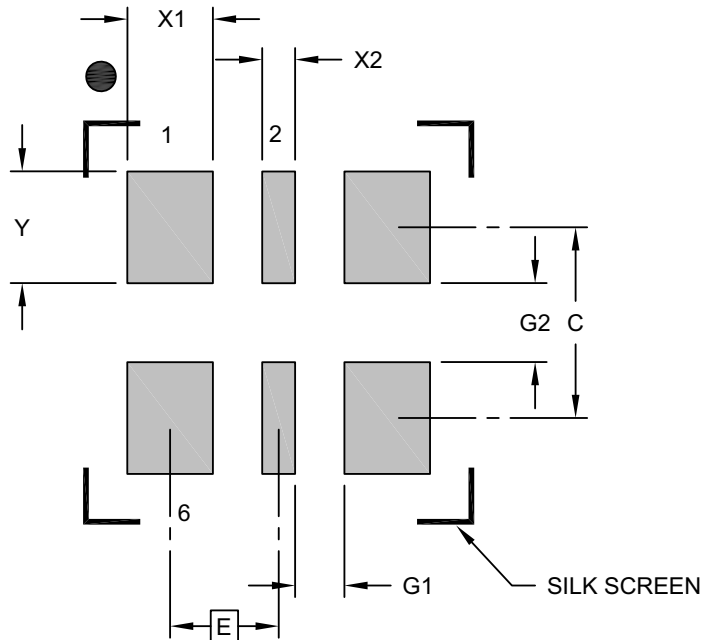
Notes:

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 C04-1005 Rev B Sheet 2 of 2

6-Lead Very Thin Plastic Dual Flat, No-Lead Package (J7A) - 2.5 mm × 2.0 mm Body [VDFN]

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	0.825 BSC		
Contact Pad Width (X4)	X1			0.65
Contact Pad Width (X2)	X2			0.25
Contact Pad Length (X6)	Y			0.85
Contact Pad Spacing	C		1.45	
Space Between Contacts (X4)	G1	0.38		
Space Between Contacts (X3)	G2	0.60		

Notes:

- Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-3005A

M9212X2/3

NOTES:

APPENDIX A: REVISION HISTORY

Revision A (April 2023)

- Initial release of M9212x2/3 as Microchip data sheet DS20006777A.

M9212X2/3

NOTES:

PRODUCT IDENTIFICATION SYSTEM

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

<u>XXXXX</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>-XXXXXXXX</u>	<u>[X]</u> <u>[X XXXX]</u>
Device	Feature Pin	Output Format	Package	Temperature Range	Stability	Frequency	Media Type
Device:	M9212	=	High Performance Differential MEMS Oscillator				
Feature Pin:	0	=	Active-Low Standby Input with Pull-Up				
	2	=	Enable/Disable Input with Pull-Up				
Output Format:	2	=	LVPECL				
	3	=	LVDS				
Package:	N	=	6-Lead 7.0 mm × 5.0 mm VDFN				
	B	=	6-Lead 5.0 mm × 3.2 mm VDFN				
	C	=	6-Lead 3.2 mm × 2.5 mm VDFN				
	D	=	6-Lead 2.5 mm × 2.0 mm VDFN				
Temperature Range:	L	=	-40°C to +105°C				
	I	=	-40°C to +85°C				
	E	=	-40°C to +70°C				
Stability:	1	=	±50 ppm				
	2	=	±25 ppm				
	3	=	±20 ppm				
Frequency:	xMxxxxxx	=	<10 MHz				
	xxMxxxxx	=	<100 MHz				
	xxxMxxxx	=	>100 MHz				
Media Type:	<blank>	=	Cut Tape/non-TR quantities				
	T	=	Tape and Reel				
	T_SNPB	=	Tin Lead (SnPb) Solder Dip				
				Examples:			
				a) M921222CL1-63M0000T	M921222, Enable/Disable Input with Pull-Up Feature Pin, LVPECL output, 6-Lead 3.2 mm × 2.5 mm VDFN Package, -40°C to +105°C Temp. Range, ±50 ppm Stability, 63.0000 MHz Frequency, Tape and Reel (1000/Reel)		
				b) M921223BI3-87M35154	M921223, Enable/Disable Input with Pull-Up Feature Pin, LVDS output, 6-Lead 5.0 mm × 3.2 mm VDFN Package, -40°C to +85°C Temp. Range, ±20 ppm Stability, 087.35154 MHz Frequency, Cut Tape/non-TR (50/Tube)		
				c) M921222DI3-25M0000T_SNPB	M921222, Enable/Disable Input with Pull-Up Feature Pin, LVPECL output, 6-Lead 2.5 mm × 2.0 mm VDFN Package, -40°C to +85°C Temp. Range, ±20 ppm Stability, 025.000 MHz Frequency, Tape and Reel (1000/Reel)		
				d) M921223CI3-25M00000	M921222, Enable/Disable Input with Pull-Up Feature Pin, LVDS output, 6-Lead 3.2 mm × 2.5 mm VDFN Package, -40°C to +85°C Temp. Range, ±20 ppm Stability, 025.000 MHz Frequency, Cut Tape/non-TR (50/Tube)		
				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.		

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TABLE 0-1: MINIMUM ORDER QUANTITY

Package or Media Type	Pieces	Notes
Package A	50 pieces per tube	100 piece minimum order
Package B	72 pieces per tube	144 piece minimum order
Package C	110 pieces per tube	—
Package M	140 pieces per tube	—
Package J	100 pieces per bag	—
Package H	100 pieces per bag	—
Tape and Reel	1000 pieces per reel	—
SnPb Solder Dip	500 pieces per reel	—

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

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