MICROCHIP

M9112X1

2.5-170 MHz High Performance MEMS Oscillator

Features

- Any Frequency Between 2.5 MHz and 170 MHz Accurate to 6 Decimal Places
- CMOS-Compatible Output
- Very Low Phase Jitter: 0.65 ps (12 kHz to 20 MHz)
- Wide Temperature Range: –40°C to + 125°C
- Standard 6-Lead Packages: 7.0 mm × 5.0 mm, 5.0 mm × 3.2 mm, 3.2 mm × 2.5 mm, 2.5 mm × 2.0 mm
- Low Standby Current at 2.5 µA Typical

Applications

- Computing, Storage, Networking, Telecom, Industrial Control
- SATA, SAS, Ethernet, PCI Express, Video, Wi-Fi
- Military Systems

PERFORMANCE SPECIFICATIONS

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Output Frequency	f_{OUT}	2.5	—	170	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		
Aging	f_{AGING}	–5	—	+5	ppm	25°C, ±1 ppm after 1st year
Operating Temperature Range	T_{OP}	–40	—	+125	°C	Automotive
		–40	—	+105		Extended Industrial
		–40	—	+85		Industrial
		–20	—	+70		Commercial
Supply Voltage	V_{DD}	2.25	2.5	2.75	V	—
		2.52	2.8	3.08		
		2.97	3.3	3.63		
Current Consumption	I_{DD}	—	27	—	mA	No load condition, f = 100 MHz, V_{DD} = 2.5V, 2.8V, or 3.3V
OE Disable Current	I_{OD}	—	23	—	mA	f = 100 MHz, OE Disabled
Standby Current	I_{STD}	—	2.5	5	µA	V_{DD} = 3.3V
Duty Cycle	DC	45	—	55	%	—
Rise Time	t_r	—	1.3	—	ns	20% to 80% V_{DD}; C_L = 15 pF Standard Drive Strength
Fall Time	t_f	—	1.3	—	ns	20% to 80% V_{DD}; C_L = 15 pF Standard Drive Strength
Output High Voltage	V_{OH}	80%	—	—	V_{DD}	+10 mA
Output Low Voltage	V_{OL}	—	—	20%	V_{DD}	–10 mA
Input High Voltage	V_{IH}	75%	—	—	V_{DD}	Pin 1, OE or ST
Input Low Voltage	V_{IL}	—	—	25%	V_{DD}	Pin 1, OE or ST
Enable Pull-Up Resistor	Z_{IN}	—	1.5	—	MΩ	—
Start-Up Time	t_{START}	—	5.5	6	ms	T = +25°C

M9112X1

PERFORMANCE SPECIFICATIONS (CONTINUED)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
OE Enable/Disable Time	t_{oe}	—	—	350	ns	—
RMS Period Jitter	t_{JITT}	—	2.5	10	ps	f = 100 MHz
Cycle-to-Cycle Peak Jitter	CC_{JITT}	—	8	—	ps	f = 100 MHz
RMS Phase Jitter (random)	T_{PHJ}	—	0.65	1	ps	f = 10 MHz, Integration bandwidth = 12 kHz to 20 MHz

ABSOLUTE MAXIMUM RATINGS

Parameter	Minimum	Maximum
Storage Temperature	–65°C	+150°C
V_{DD}	–0.5V	+4.0V
Electrostatic Discharge	—	2000V
Soldering Temperature (follow standard Pb-Free soldering guidelines)	—	+260°C
Number of Program Writes	—	1
Program Retention over -40 to 125°C, Process, V_{DD} (–0.5 to 4.0V)	1,000+ years	—

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

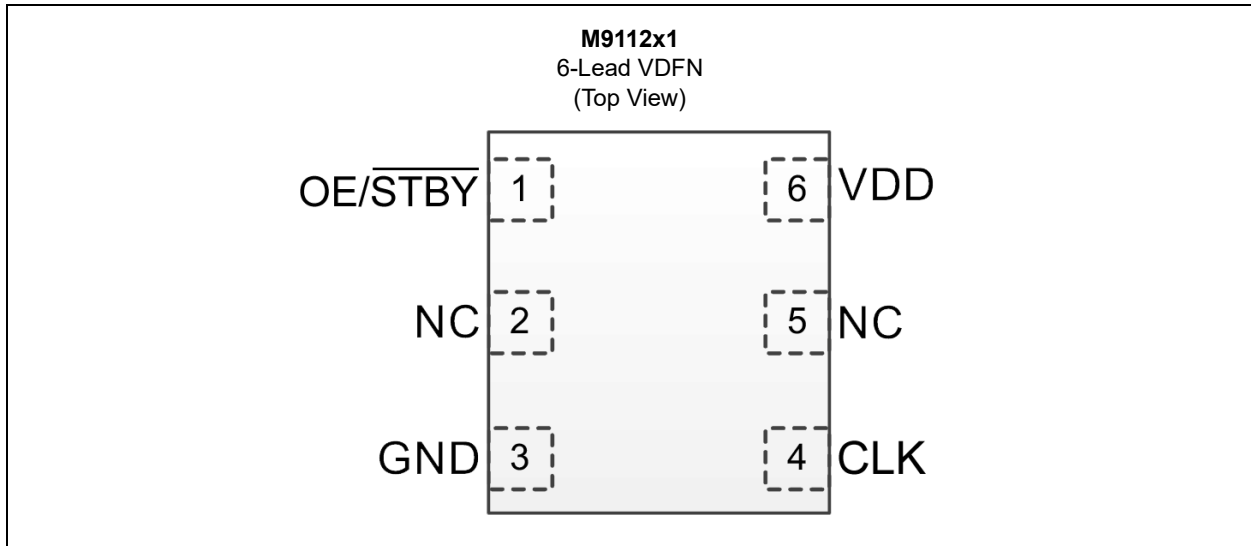The descriptions of the pins are listed in Table 1-1.

M9112x1
6-Lead VDFN
(Top View)

OE/$\overline{\text{STBY}}$ | 1   6 | VDD

NC | 2   5 | NC

GND | 3   4 | CLK

TABLE 1-1:   PIN FUNCTION TABLE

Pin Number	Pin Name	Description
1	OE or $\overline{\text{STBY}}$	Input. H or Open: Specified frequency output. L: Output is high impedance.
2	NC	NA. Do not connect; leave it floating.
3	GND	VDD Power Supply Ground.
4	NC	NA. Do not connect; leave it floating.
5	CLK	Clock output.
6	VDD	Power Supply Voltage.

M9112X1

2.0   FUNCTIONAL BLOCK DIAGRAM
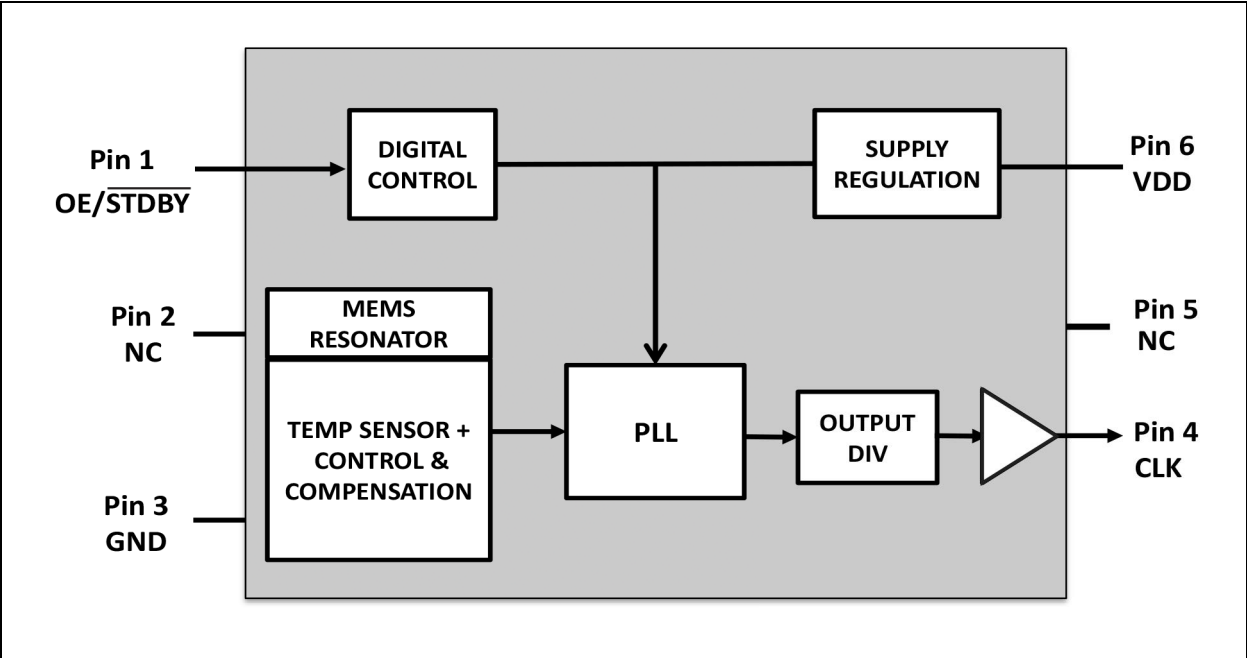
3.0   RECOMMENDED REFLOW PROFILES FOR Pb-Free & Sn-Pb
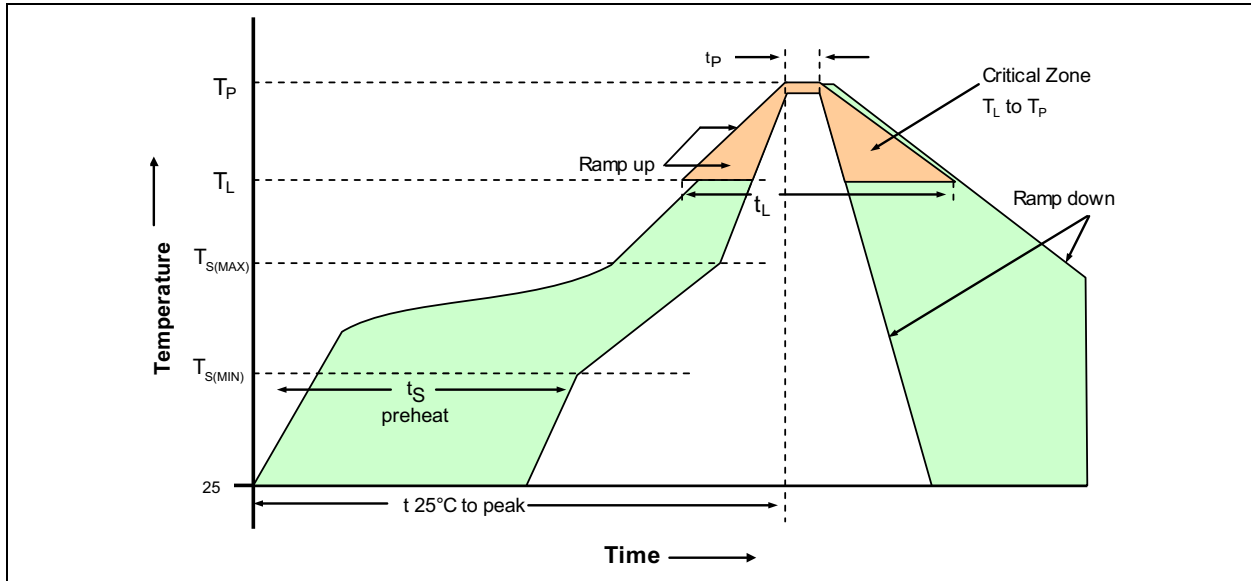
FIGURE 3-1:   *Reflow Profile.*

TABLE 3-1:   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.
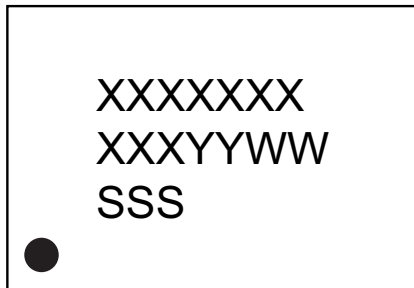
M9112X1

4.0   PACKAGING INFORMATION

4.1   Package Marking Information

6-Lead 7.0 mm × 5.0 mm VDFN*
6-Lead 5.0 mm x 3.2 mm VDFN*
6-Lead 3.2 mm × 2.5 mm VDFN*
6-Lead 2.5 mm × 2.0 mm VDFN*

```
XXXXXXX
XXXYYWW
SSS
●
```

Example

```
0400000
DCP1834
724
●
```

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.

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

TOP VIEW

SIDE VIEW

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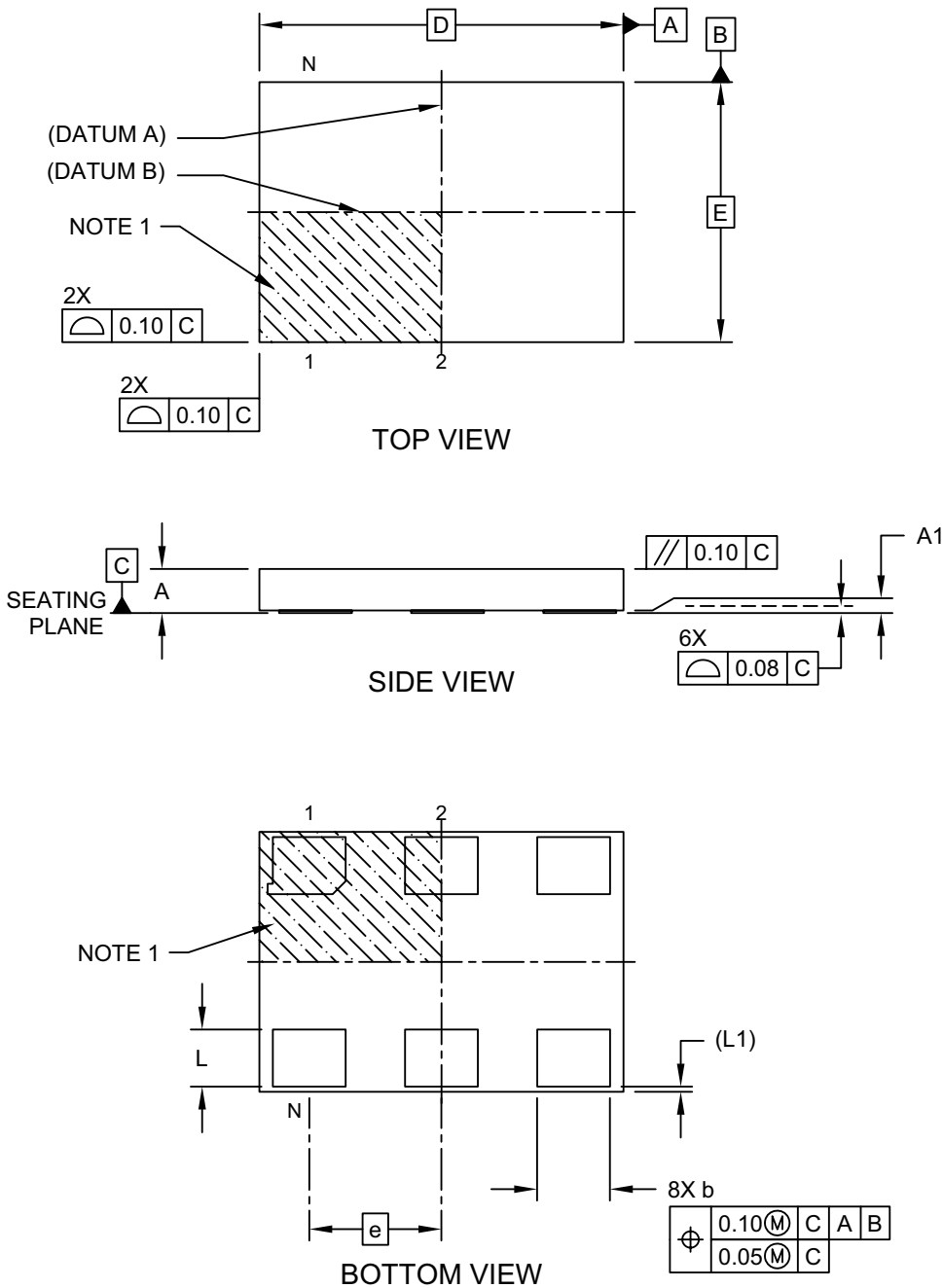
Microchip Technology Drawing C04-1227 Rev A Sheet 1 of 2

M9112X1

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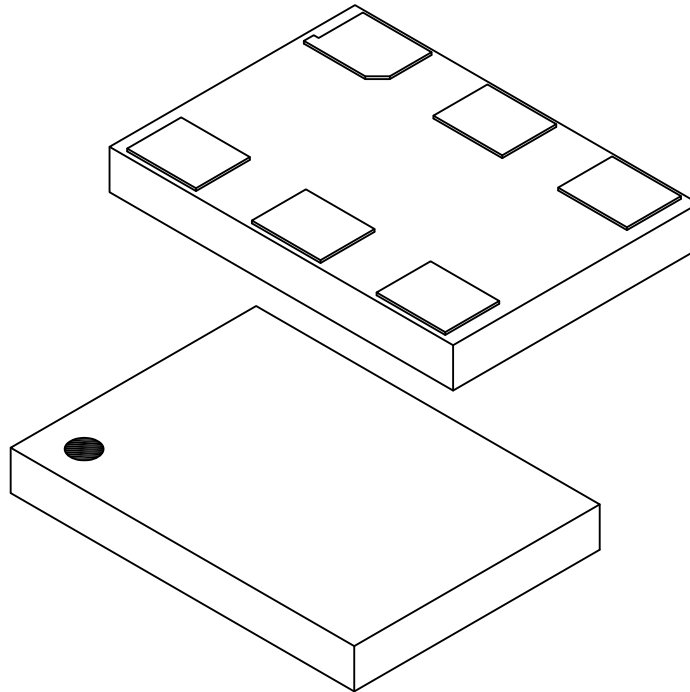
Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N		6	
Pitch	e		2.54 BSC	
Overall Height	A	0.80	0.85	0.90
Standoff	A1	0.00	0.02	0.05
Overall Length	D		7.00 BSC	
Overall Width	E		5.00 BSC	
Terminal Width	b	1.30	1.40	1.50
Terminal Length	L	1.00	1.10	1.20
Pullback	L1		0.10 REF	

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

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
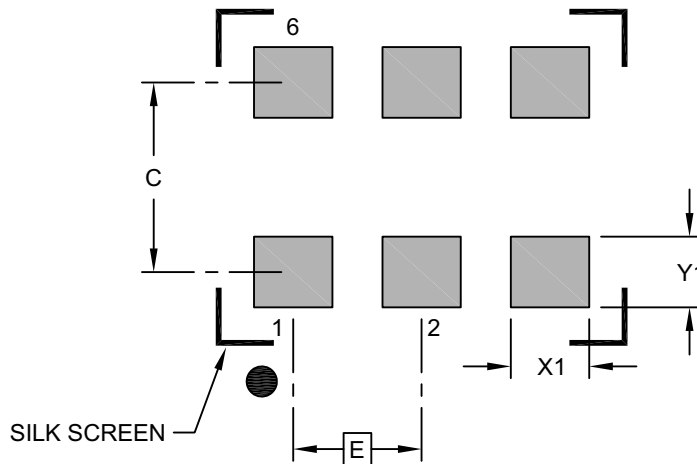
RECOMMENDED LAND PATTERN

	Units	MILLIMETERS		
Dimension Limits		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:

1. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
2. 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

M9112X1

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

TOP VIEW

SIDE VIEW

BOTTOM VIEW

Microchip Technology Drawing C04-1009 Rev A Sheet 1 of 2
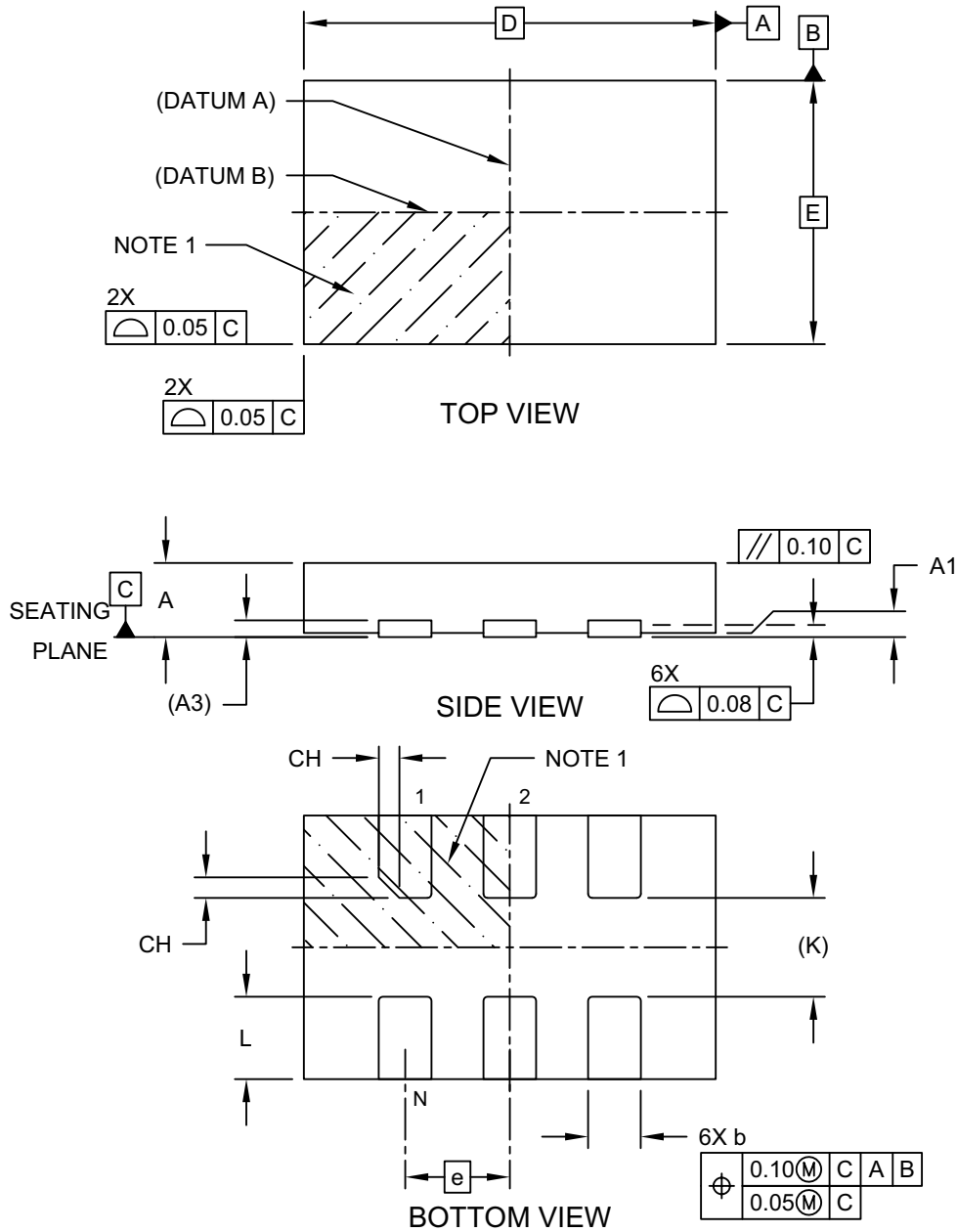
6-Lead Very Thin Plastic Dual Flat, No-Lead Package (H7A) - 5.0 mm × 3.2 mm Body [VDFN]

Note:	For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging
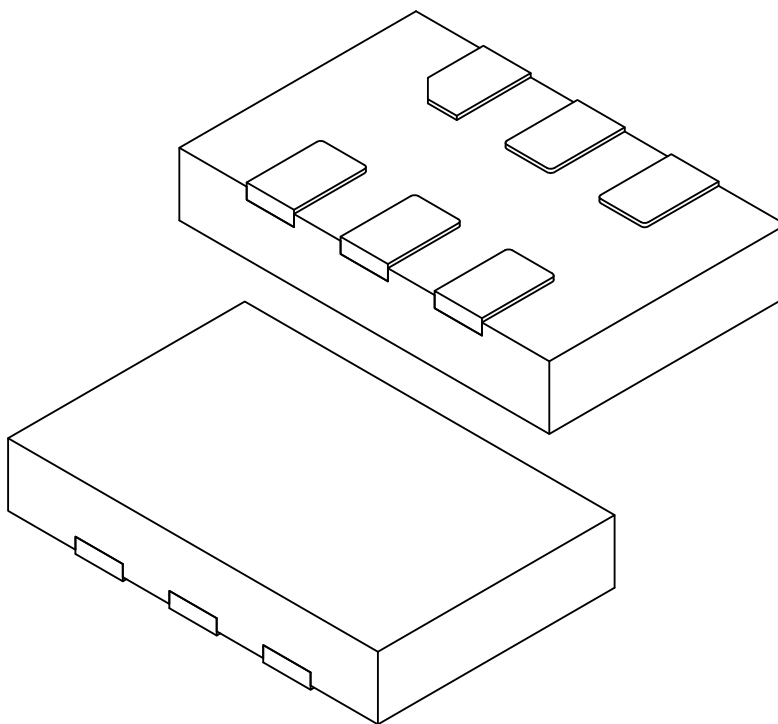
	Units	MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N	6		
Pitch	e	1.27 BSC		
Overall Height	A	0.80	0.85	0.90
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	A3	0.203 REF		
Overall Length	D	5.00 BSC		
Overall Width	E	3.20 BSC		
Terminal Width	b	0.59	0.64	0.69
Terminal Length	L	0.90	1.00	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
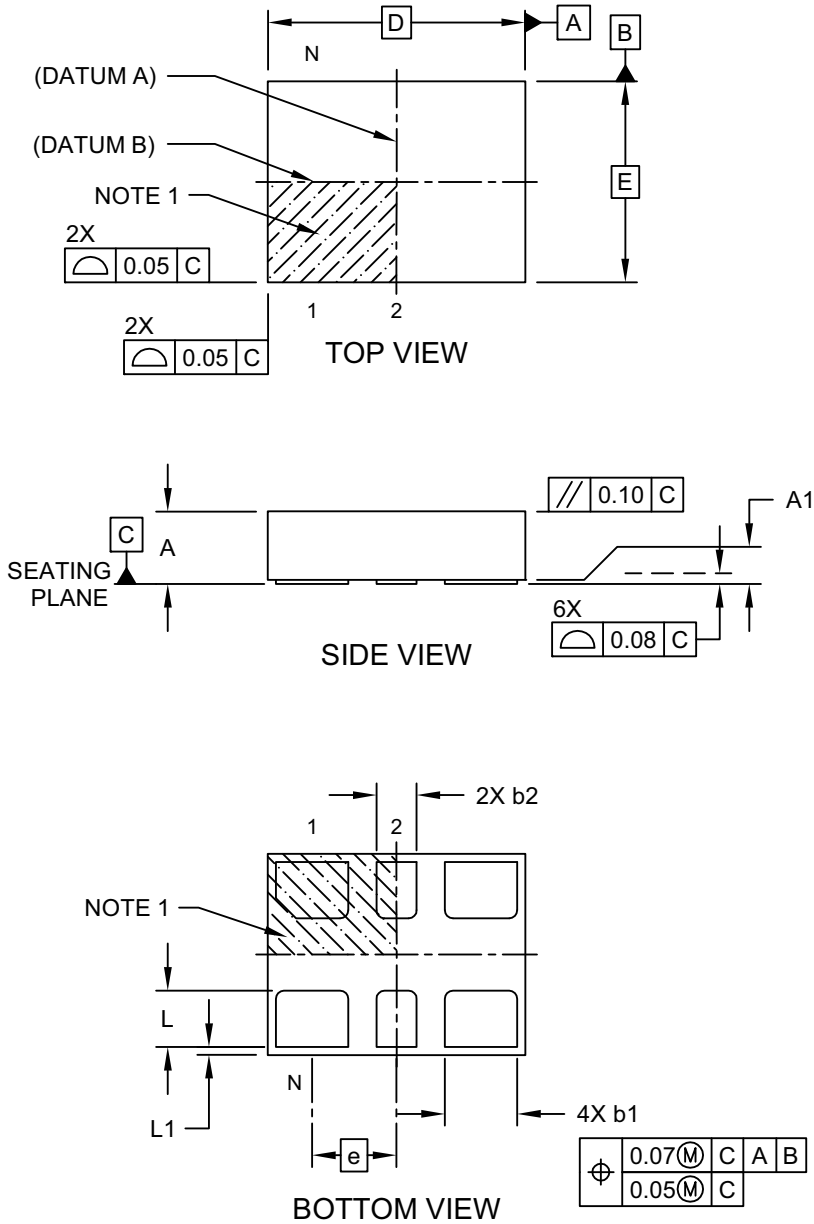3. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
   REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-1009 Rev A Sheet 2 of 2

M9112X1

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
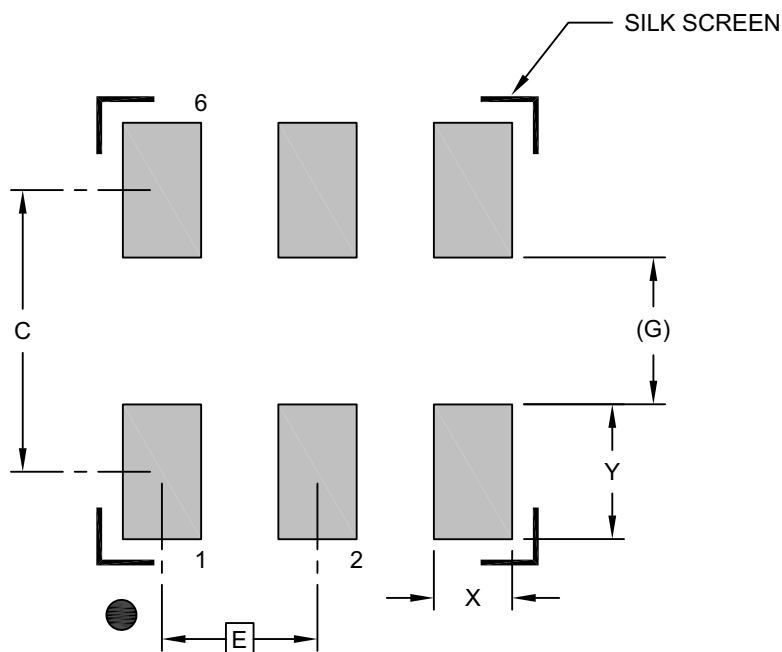
RECOMMENDED LAND PATTERN

	Units	MILLIMETERS		
Dimension Limits		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:

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

Microchip Technology Drawing C04-3009 Rev A 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

(DATUM A)

(DATUM B)

NOTE 1

2X

0.05 C

2X

0.05 C

TOP VIEW

0.10 C

A1

C

A

SEATING
PLANE

6X

0.08 C

SIDE VIEW

2X b2

NOTE 1

L

L1

N

e

4X b1

0.07 Ⓜ C A B
0.05 Ⓜ C

BOTTOM VIEW

Microchip Technology Drawing C04-1007B Sheet 1 of 2

M9112X1

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
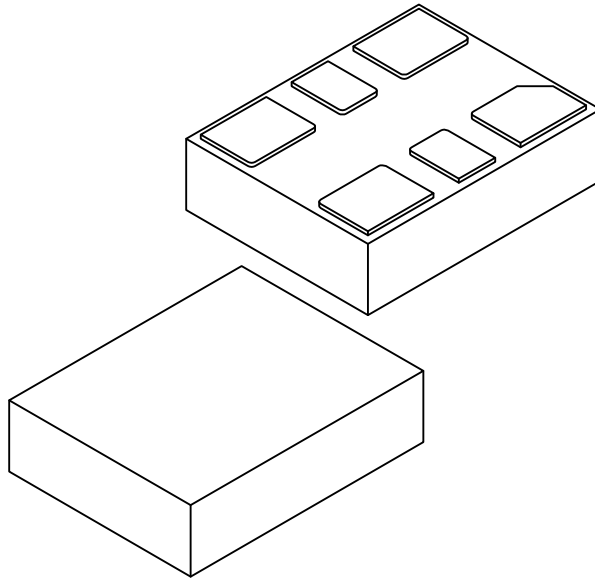
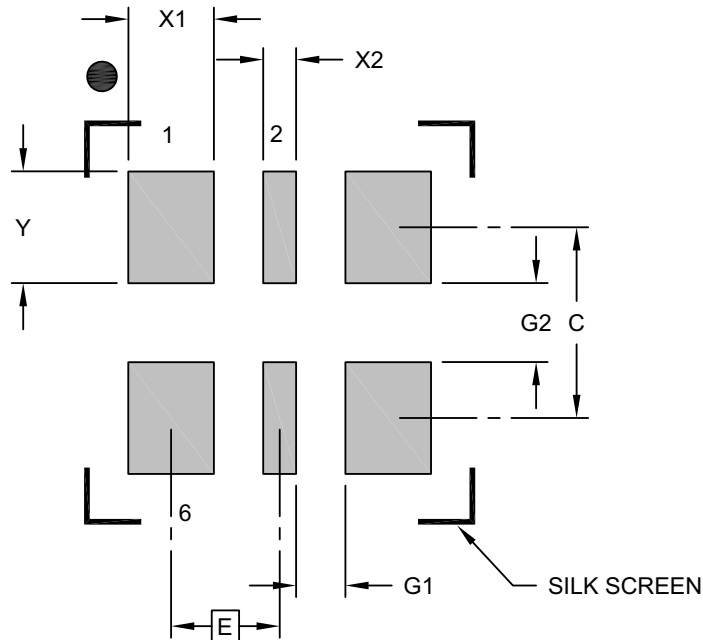|	Units	MILLIMETERS		
	Dimension Limits	MIN	NOM	MAX
Number of Terminals	N		6	
Pitch	e		1.05 BSC	
Overall Height	A	0.80	0.85	0.90
Standoff	A1	0.00	0.02	0.05
Overall Length	D		3.20 BSC	
Overall Width	E		2.50 BSC	
Terminal Width	b1	0.85	0.90	0.95
Terminal Width	b2	0.45	0.50	0.55
Terminal Length	L	0.65	0.70	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

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
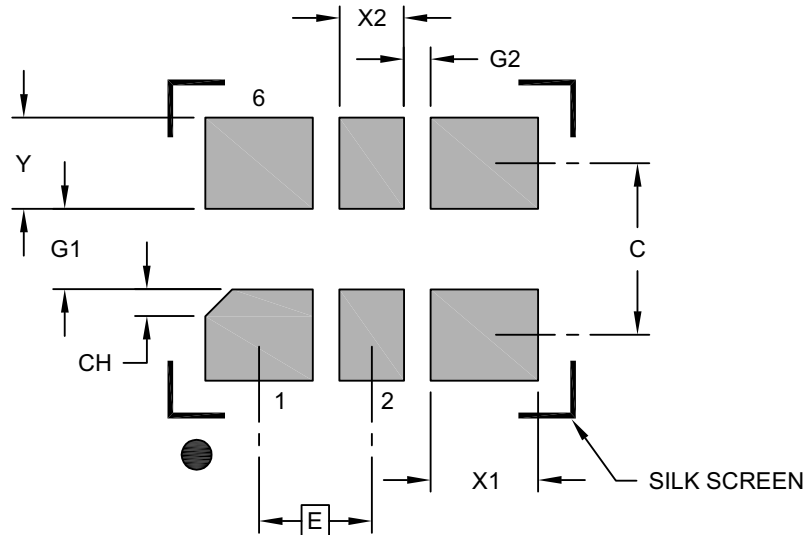
RECOMMENDED LAND PATTERN

	Units	MILLIMETERS		
Dimension Limits		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

M9112X1

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

TOP VIEW

(DATUM A)

(DATUM B)

NOTE 1

2X △ 0.05 C

2X △ 0.05 C

SIDE VIEW

SEATING PLANE

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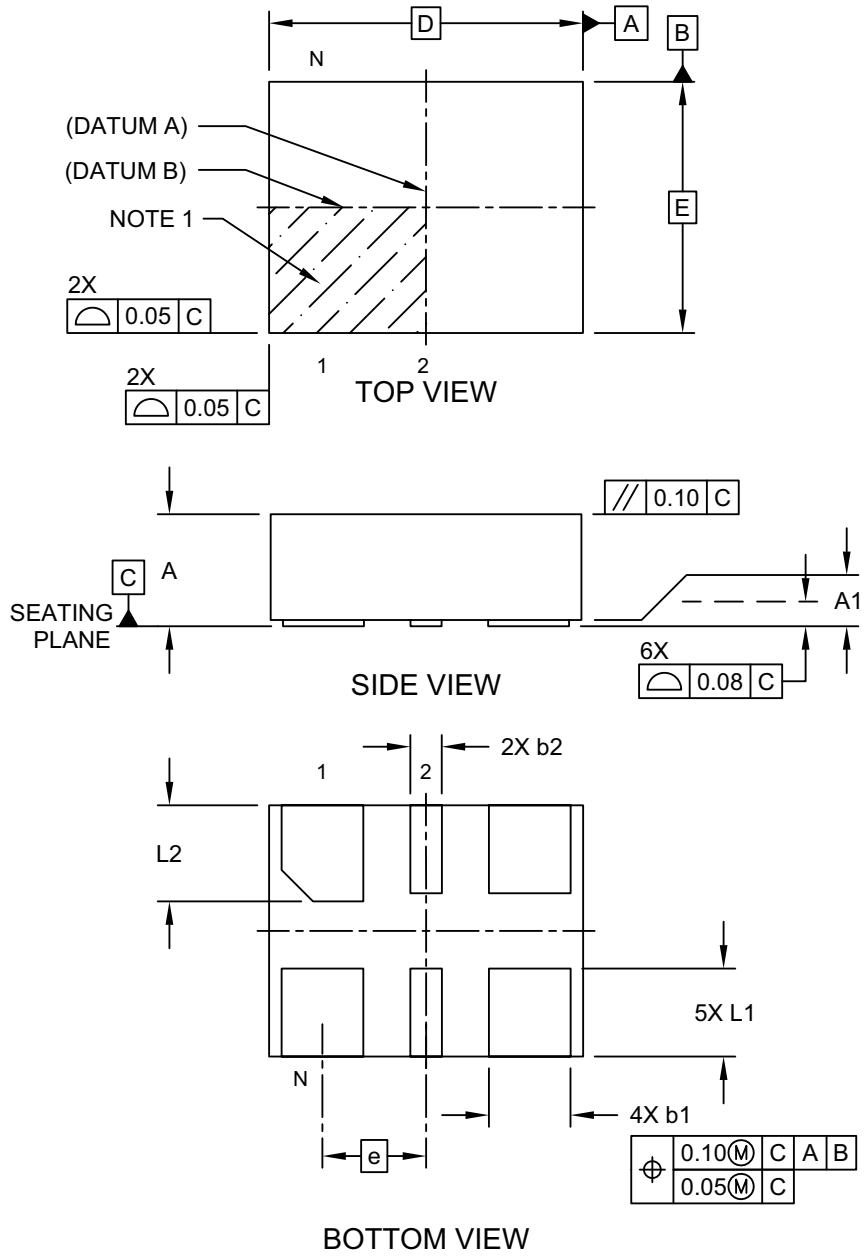
Microchip Technology Drawing C04-1005 Rev B Sheet 1 of 2

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
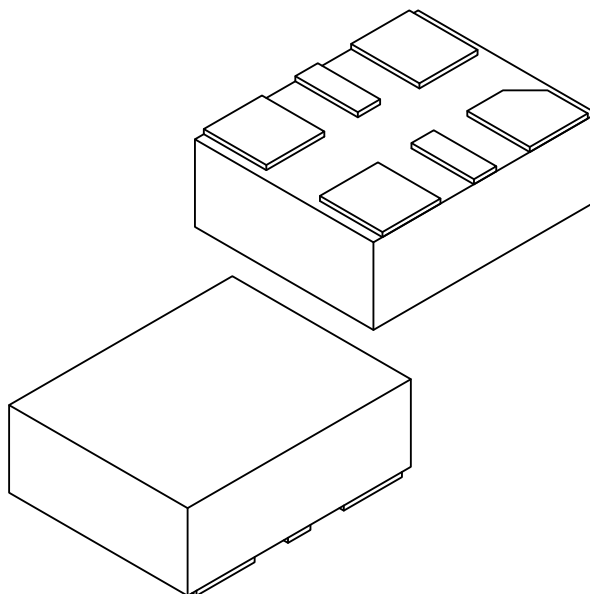
Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N		6	
Pitch	e		0.825 BSC	
Overall Height	A	0.80	0.85	0.90
Standoff	A1	0.00	0.02	0.05
Overall Length	D		2.50 BSC	
Overall Width	E		2.00 BSC	
Terminal Width	b1	0.60	0.65	0.70
Terminal Width	b2	0.20	0.25	0.30
Terminal Length	L1	0.60	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

M9112X1

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

	Units	MILLIMETERS		
Dimension Limits		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:

1. Dimensioning and tolerancing per ASME Y14.5M

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

2. 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

APPENDIX A: REVISION HISTORY

Revision A (April 2023)

- Initial release of M9112x1 as Microchip data sheet DS20006776A.

NOTES:

PRODUCT IDENTIFICATION SYSTEM

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

XXXXX	X	X	X	X	X	-XXXXXXXX	[X] [X_XXXX]
Device	Control Pin	Output Drive Strength	Package	Temperature Range	Stability	Frequency	Media Type

Device:	M9112	=	High Performance MEMS Oscillator
Control Pin:	0	=	Enable/Disable
	2	=	Standby
Output Drive Strength:	1	=	Standard
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:	A	=	–40°C to +125°C
	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

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.

Examples:

a) M911201NI2-20M48000 — M911201, Enable/Disable Control Pin, Standard Output Drive Strength, 6-Lead 7.0 mm × 5.0 mm VDFN Package, –40°C to +85°C Temp. Range, ±25 ppm Stability, 20.0000 MHz Frequency, Cut Tape/non-TR (50/Tube)

b) M911221BI1-40M00000T — M911221, Standby Control Pin, Standard Output Drive Strength, 6-Lead 5.0 mm × 3.2 mm VDFN Package, –40°C to +85°C Temp. Range, ±50 ppm Stability, 040.0000 MHz Frequency, Tape and Reel (1000/Reel)

c) M911201CI3-133M0000T — M911201, Enable/Disable Control Pin, Standard Output Drive Strength, 6-Lead 3.2 mm × 2.5 mm VDFN Package, –40°C to +85°C Temp. Range, ±20 ppm Stability, 133.000 MHz Frequency, Tape and Reel (1000/Reel)

d) M911221DI3-50M00000 — M911221, Standby Control Pin, Standard Output Drive Strength, 6-Lead 2.5 mm × 2.0 mm VDFN Package, –40°C to +85°C Temp. Range, ±20 ppm Stability, 050.0000 MHz Frequency, Cut Tape/non-TR (140/Tube)

e) M911201CI3-133M0000T_SNPB — M911201, Enable/Disable Control Pin, Standard Output Drive Strength, 6-Lead 3.2 mm × 2.5 mm VDFN Package, –40°C to +85°C Temp. Range, ±20 ppm Stability, 133.0000 MHz Frequency, Tin Lead Solder Dip (1000/Reel)

M9112X1

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:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.

- Microchip believes that its family of products is secure when used in the intended manner, within operating specifications, and under normal conditions.

- Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip product is strictly prohibited and may violate the Digital Millennium Copyright Act.

- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is "unbreakable" Code protection is constantly evolving. Microchip is committed to continuously improving the code protection features of our products.

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