MTCH102/5/8

2, 5 and 8-Channel Proximity/Touch Controller Data Sheet

Description

The Microchip mTouch® MTCH102/5/8 Proximity/Touch Controller with simple digital output provides an easy way to add proximity or touch detection to any application. This device family implements capacitive sensors with active guarding capability. The sensitivity and power mode can be configured through the MTSA and MTPM pins. The MTCH102/5/8 devices also use an advanced optimization algorithm to actively suppress noise from the signal to achieve reliable proximity/touch detection.

Features

- Capacitive Proximity and Touch Detection System:
  - High Signal to Noise Ratio (SNR)
  - Adjustable sensitivity with compensation for different sensor sizes
  - Multi-stage active noise suppression filters
  - Automatic environmental compensation
  - Support wide range of sensor shapes and sizes
- Simple I/O Interface with Existing System
- Smart Scan Scheduling
- Threshold Hysteresis
- Flexible Low-Power mode
- Brown-Out Protection
- Operating Voltage Range:
  - 2.05V to 3.6V
- Operating Temperature:
  - 40°C to +85°C

Typical Application

- Light Switch
- Portable Device Enabler
- White Goods and Appliance
- Office Equipment and Toys
- Display and Keypad Back-lighting Activation

TABLE 1: MTCH10X FAMILY TYPES

Device	Data Sheet Index	Sensor Input	Driven Shield	Digital Output
MTCH101	**(A)**	1	N	1
MTCH102	**(B)**	2(1)	Y(1)	2
MTCH105	**(B)**	5(1)	Y(1)	5
MTCH108	**(B)**	8(1)	Y(1)	8

Note 1: One of the sensor inputs can be configured as Driven Shield output.

Data Sheet Index: (Unshaded devices are described in this document.)

A: DS40001664 *MTCH101 Single-Channel Proximity Detector*

B: DS40001793 *MTCH102/105/108 Dual-Channel Proximity/Touch Controller*

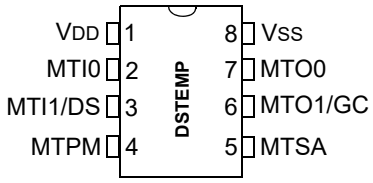
Note: For other small form-factor package availability and marking information, please visit **http://www.microchip.com/packaging** or contact your local sales office.

TABLE 2: PACKAGES

Packages	MSOP	TSSOP	SSOP	UDFN	QFN	UQFN
MTCH102	X	—	—	X	—	—
MTCH105	—	X	—	—	X	—
MTCH108	—	—	X	—	—	X

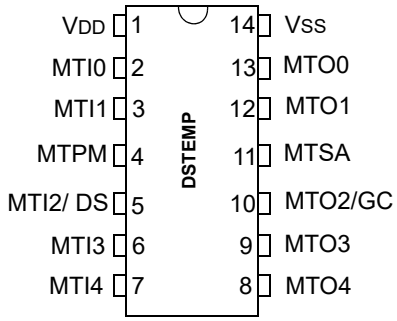
PIN DIAGRAMS

FIGURE 1: 8-LEAD MSOP, UDFN



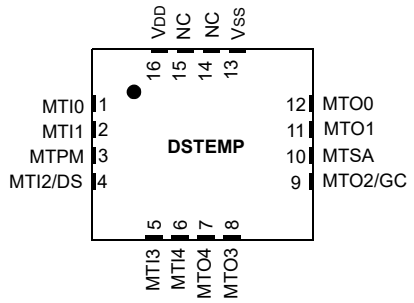
Note: See Table 3 for the pin allocation table.

FIGURE 2: 14-LEAD TSSOP



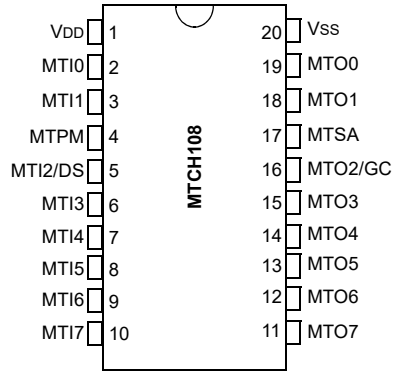
Note: See Table 4 for the pin allocation table.

FIGURE 3: 16-LEAD QFN



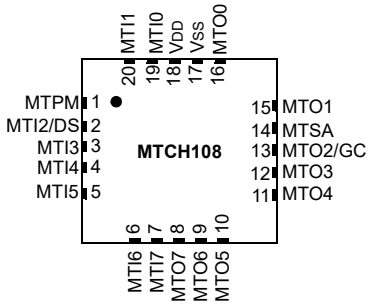
Note: See Table 4 for the pin allocation table.

FIGURE 4: 20-LEAD SSOP



Note: See Table 5 for the pin allocation table.

FIGURE 5: 20-LEAD UQFN



Note: See Table 5 for the pin allocation table.

PIN ALLOCATION TABLES

TABLE 3: 8-PIN DESCRIPTION (MTCH102)

Name	8-Lead MSOP and UDFN	Description
VDD	1	Power Supply Input
MTI0	2	Proximity/Touch Sensor 0 Input
MTI1/DS	3	Proximity/Touch Sensor 1 Input/Driven Shield
MTPM	4	Low-Power Mode Select
MTSA	5	Sensitivity Adjust Input
MTO1/GC	6	MTI1 Detect Output (Active-Low)/Driven Shield Control
MTO0	7	MTI0 Detect Output (Active-Low)
VSS	8	Ground

TABLE 4: 14-/16-PIN DESCRIPTION (MTCH105)

Name	14-Lead TSSOP	16-Lead QFN	Description
VDD	1	16	Power Supply Input
MTI0	2	1	Proximity/Touch Sensor 0 Input
MTI1	3	2	Proximity/Touch Sensor 1 Input
MTPM	4	3	Low-Power Mode Select
MTI2/DS	5	4	Proximity/Touch Sensor 2 Input/Driven Shield
MTI3	6	5	Proximity/Touch Sensor 3 Input
MTI4	7	6	Proximity/Touch Sensor 4 Input
MTO4	8	7	MTI4 Detect Output (Active-Low)
MTO3	9	8	MTI3 Detect Output (Active-Low)
MTO2/GC	10	9	MTI2 Detect Output (Active-Low) /Driven Shield Control
MTSA	11	10	Sensitivity Adjust Input
MTO1	12	11	MTI1 Detect Output (Active-Low)
MTO0	13	12	MTI0 Detect Output (Active-Low)
VSS	14	13	Ground

TABLE 5: 20-PIN DESCRIPTION (MTCH108)

Name	20-Lead SSOP	20-Lead UQFN	Description
VDD	1	18	Power Supply Input
MTI0	2	19	Proximity/Touch Sensor 0 Input
MTI1	3	20	Proximity/Touch Sensor 1 Input
MTPM	4	1	Low-Power Mode Select
MTI2/DS	5	2	Proximity/Touch Sensor 2 Input/Driven Shield
MTI3	6	3	Proximity/Touch Sensor 3 Input
MTI4	7	4	Proximity/Touch Sensor 4 Input
MTI5	8	5	Proximity/Touch Sensor 5 Input
MTI6	9	6	Proximity/Touch Sensor 6 Input
MTI7	10	7	Proximity/Touch Sensor 7 Input
MTO7	11	8	MTI7 Detect Output (Active-Low)
MTO6	12	9	MTI6 Detect Output (Active-Low)
MTO5	13	10	MTI5 Detect Output (Active-Low)
MTO4	14	11	MTI4 Detect Output (Active-Low)
MTO3	15	12	MTI3 Detect Output (Active-Low)
MTO2/GC	16	13	MTI2 Detect Output (Active-Low)/Driven Shield Control
MTSA	17	14	Sensitivity Adjust Input
MTO1	18	15	MTI1 Detect Output (Active-Low)
MTO0	19	16	MTI0 Detect Output (Active-Low)
VSS	20	17	Ground

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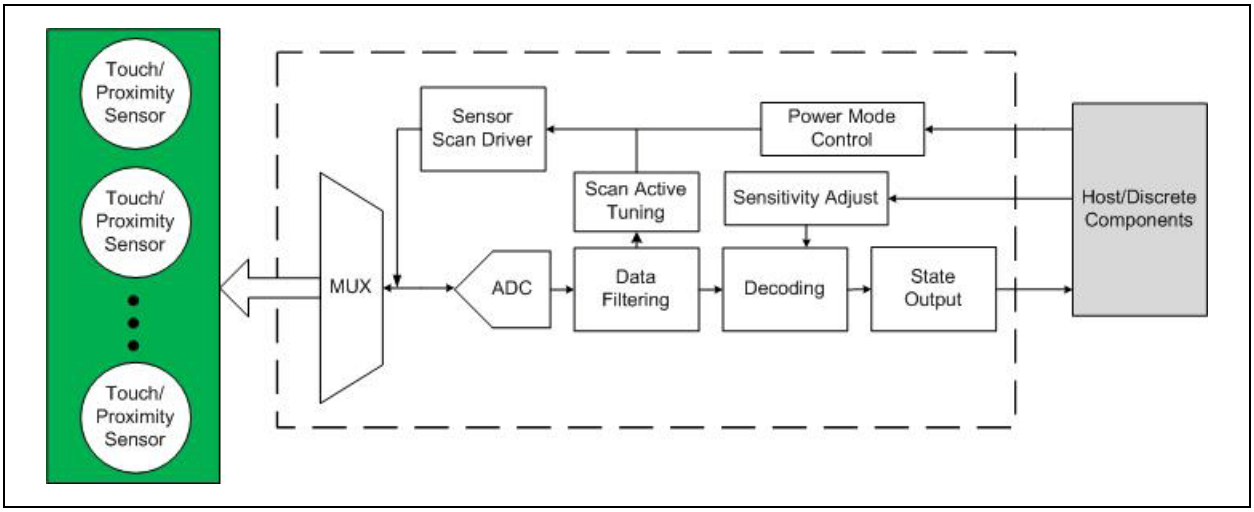
1.0 DEVICE OVERVIEW

The MTCH102/5/8 provides an easy way to add proximity or touch detection to any application with human machine interface. These devices can integrate up to two, five and eight capacitive touch/proximity detection sensors which can work through plastic, wood or even metal front panels with Microchip's proprietary Metal over Capacitive technology. It also supports a wide range of conductive materials as sensors, like copper pad on PCB, silver ink, PEDOT or carbon printing on plastic film, Indium Tin Oxide (ITO) pad, wire/cable, etc.

The MTCH102/5/8 uses a sophisticated scan optimization algorithm to actively attenuate noise from the signal. The sensitivity adjustment and flexible power mode allow users to easily configure the device at run-time. An active-low output will communicate the state of the sensors to a host/master MCU or drive an indication LED.

FIGURE 1-1: MTCH102/5/8 BLOCK DIAGRAM



1.1 Pin Description

1.1.1 MTIx

Connect the sensor to this input. An additional resistor of at least 4.7 kΩ (and up to 100 kΩ depends) is recommended for best noise immunity. Sensors work best when the base capacitance is minimized. This will maximize the percentage change in capacitance when a finger is added to the circuit. The recommended sensor capacitance is 5 pF to 50 pF (the lower the better).

1.1.2 MTOx

The MTOx pin is an open-drain output which reports the touch/proximity state of the corresponding MTIx input. A pull-up resistor is required on each output. The MTOx will pull the line low when a touch/proximity event happens and release the line when the touch/ proximity is released.

1.1.3 DRIVEN SHIELD

The Driven Shield function is multiplexed with one of the MTIx pins. If the GC pin is floating, the Driven Shield pin will function as a standard MTIx sensor. If the GC pin is grounded, the Driven Shield pin will output a signal in-phase with the other sensors being scanned. This has several advantages, such as providing a mutual capacitance coupling to the sensors to increase sensitivity, and providing a low-impedance trace near the sensor to absorb noise. The Driven Shield layout should encircle the sensor and its traces so that it will shield the sensor. For more information about Driven Shield and layout guidelines, see application notes *"mTouch® Sensing Solution Acquisition Methods Capacitive Voltage Divider"* (AN1478), *"Techniques for Robust Touch Sensing Design"* (AN1334), and *"Capacitive Touch Sensor Design Guide"* (AN2934).

1.1.4 DSC

The DSC (Driven Shield Control) is multiplexed with one of the MTOx pins. By grounding the DS pin, the driven shield signal will be enabled on the DS pin.

1.1.5 MTSA

The MTSA pin is an input that determines the sensitivity of touch/proximity sensors. Applying V_{DD} will give the lowest sensitivity while applying V_{SS} will give the highest.

1.1.6 MTPM

The MTPM pin is an input that determines the power mode of MTCH10X devices. By connecting V_{SS} to the MTPM pin, the device will operate in Low-Power mode. See Figure 5-1 for current consumption and response time specifications. When applying V_{DD} on the MTCH10X MTPM pin, the device will scan the sensors at the fastest possible sampling rate. Host-controlled sampling rates are available using the Smart Scan Scheduling feature described in **Section 4.0 "Power Mode and Timeout Reset"**.

2.0 TYPICAL CIRCUIT

The MTCH102 is used as an example to show two typical circuits for MTCH10X devices in the following figures. For more information about capacitive sensor layout guidance, refer to *"Techniques for Robust Touch Sensing Design"* (AN1334).

FIGURE 2-1: TWO SENSORS AND NO DRIVEN SHIELD CIRCUIT

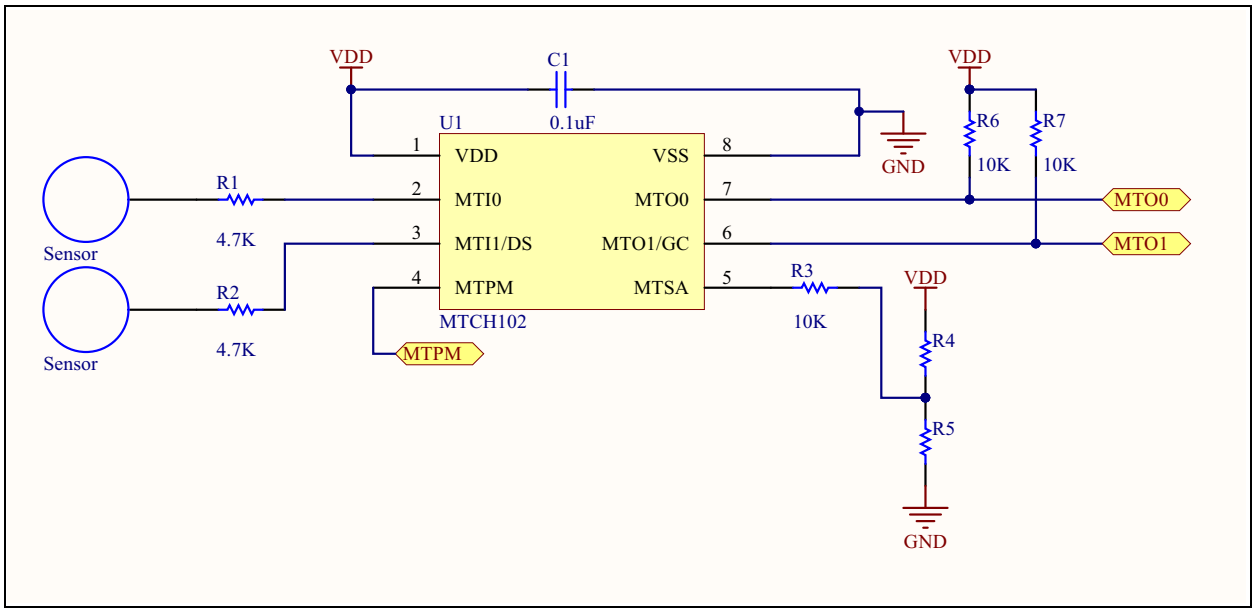
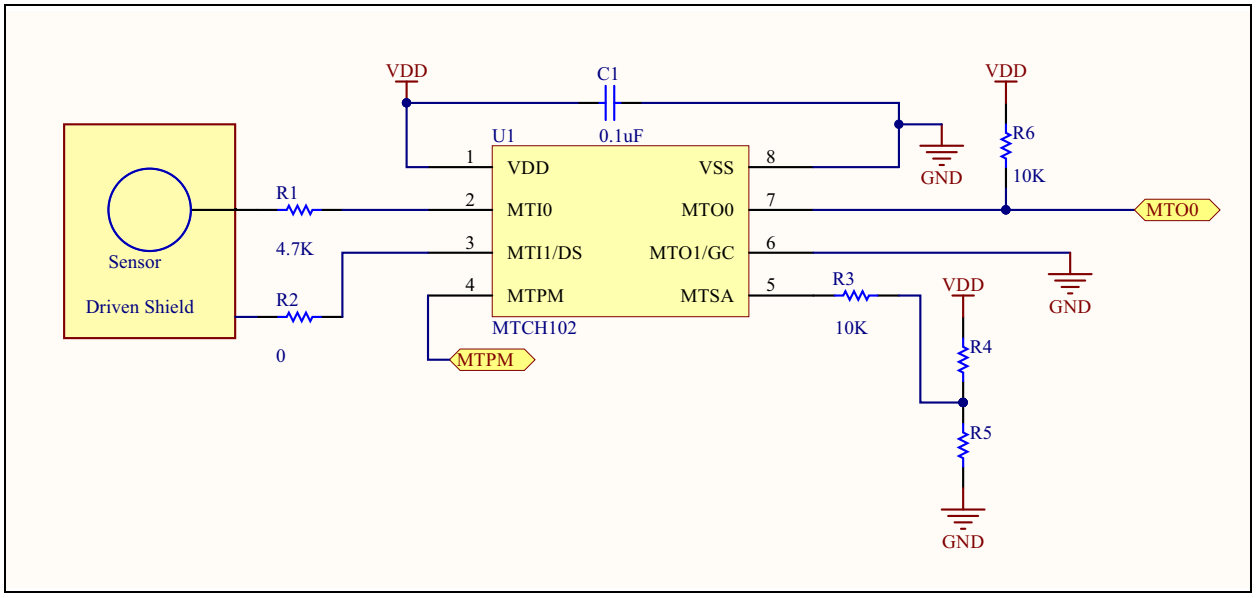


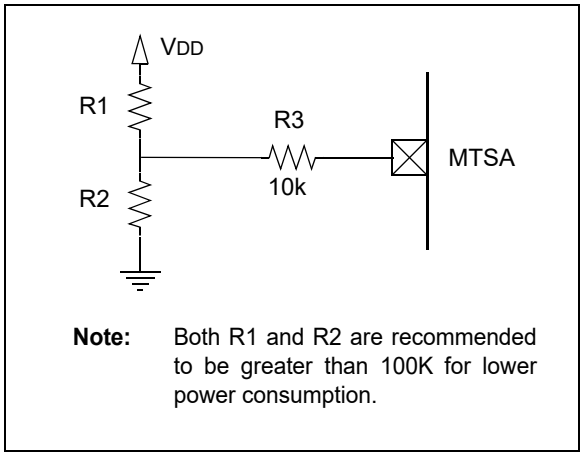
FIGURE 2-2: ONE SENSOR WITH DRIVEN SHIELD CIRCUIT



3.0 SENSITIVITY ADJUSTMENT

The sensitivity of the sensor inputs determines how far it can respond to proximity or how much capacitance is required to activate a touch. The voltage on the MTCH102/5/8 MTSA pin will determine the sensitivity. VDD voltage will give the lowest sensitivity, while VSS voltage will give the highest. The device will sample the voltage on the MTSA pin after every 32nd scan, so it does not only support setting a fixed sensitivity by a resistor ladder, but it also allows adjusting the sensitivity dynamically while the device is running. A Digital-to-Analog Converter (DAC) controlled by the host or a hardware potentiometer can be used to adjust the sensitivity. Refer to the typical circuit in Figure 3-1 to Figure 3-4.

FIGURE 3-1: FIXED SENSITIVITY USING RESISTOR LADDER



Note: Both R1 and R2 are recommended to be greater than 100K for lower power consumption.

FIGURE 3-2: HARDWARE SENSITIVITY ADJUST USING POTENTIOMETER

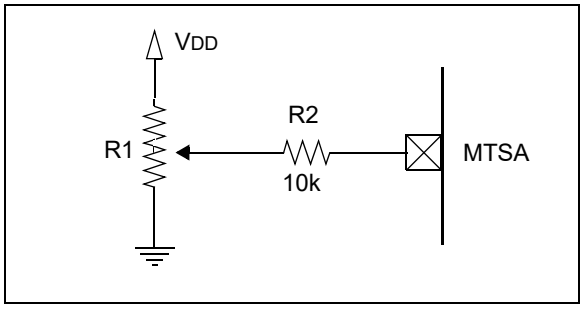


FIGURE 3-3: SENSITIVITY CONTROLLED BY HOST USING DAC

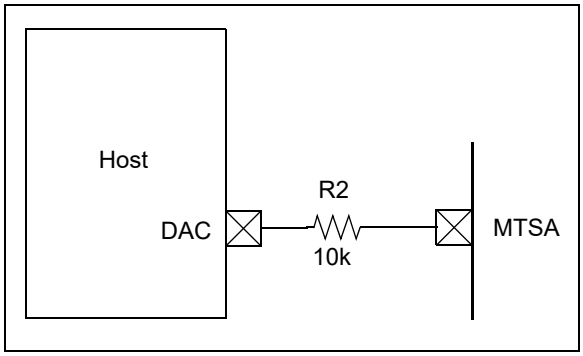
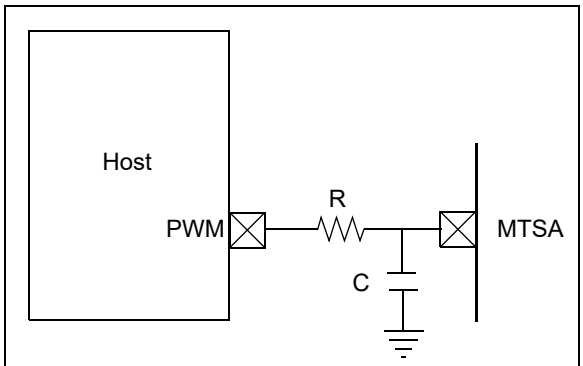


FIGURE 3-4: SENSITIVITY CONTROLLED BY HOST USING PWM



Note: Refer to Application Note *"Using PWM to Generate Analog Output"* (AN538) for details about how to choose appropriate R and C values.

4.0 POWER MODE AND TIMEOUT RESET

The MTCH102/5/8 has three power mode options to meet the needs of various applications: Normal mode, Low-Power mode and Smart-Scheduling mode. The state of the MTPM pin determines the power mode.

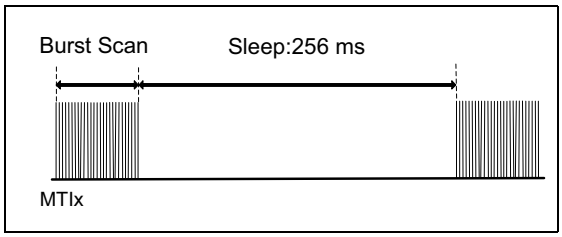
4.1 Normal Mode

The device will run in Normal mode if the MTPM pin is connected to VDD. In this mode, the MTCH102/5/8 will scan continuously; so it will achieve the shortest response time among the three power modes, but also the power consumption is the highest.

4.2 Low-Power Mode

The device will run in Low-Power mode if the MTPM pin is connected to VSS. The device will go to Sleep for 256 ms after each round of sensor scans; so it will achieve the lowest power consumption, but it will have the longest response time among the three power modes, as shown in Figure 4-1.

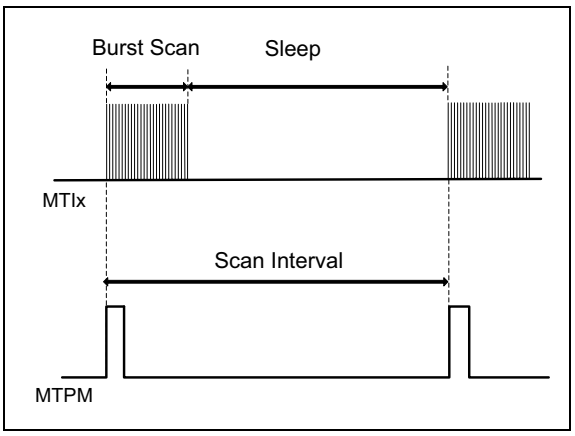
FIGURE 4-1: LOW-POWER MODE



4.3 Smart-Scheduling Mode

The MTCH102/5/8 also implements a Smart-Scheduling mode that allows a host to set the exact sampling rate by pulsing the MTPM pin, as shown in Figure 4-2. The minimum recognizable pulse width is 25 ns. If the MTPM pin is toggled during a scan cycle, the device will skip the next Sleep and immediately start a new set of scans.

FIGURE 4-2: SMART-SCHEDULING MODE



4.4 Timeout Reset

The device keeps track of the activated state duration for each MTIx input channel. The sensor state will be reset once the activated state duration exceeds the timeout duration, and the associated MTOx pin will release the line.

For the Normal and Low-Power modes, the timeout duration is approximately 10 seconds under low noise conditions. For the Smart-Scheduling mode, the timeout duration is 400 multiplied by the scan interval.

Under noise conditions the timeout reset interval may decrease. For the MTCH102 the timeout reset may decrease to 1 second. For the MTCH105/ MTCH108 the timeout reset may decrease to approximately 8 seconds. Please use the appropriate sensitivity settings to minimize the timeout reset timing reduction. The lower the sensitivity, the less impact on timeout reset.

5.0 ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings(†)

Ambient temperature under bias ..... -40°C to +125°C

Storage temperature ..... -65°C to +150°C

Voltage on pins with respect to V_{SS}

- on V_{DD} pin ..... -0.3V to +4.0V
- on all other pins ..... -0.3V to (V_{DD} + 0.3V)

Total power dissipation(1) ..... 800 mW

Maximum current

- out of V_{SS} pin
  - -40°C ≤ T_A ≤ +85°C for industrial ..... 85 mA
- into V_{DD} pin
  - -40°C ≤ T_A ≤ +85°C for industrial ..... 80 mA

Clamp current, I_K (V_{PIN} < 0 or V_{PIN} > V_{DD}) ..... ± 20 mA

Maximum output current

- sunk by any I/O pin ..... 25 mA
- sourced by any I/O pin ..... 25 mA

Note 1: Power dissipation is calculated as follows: $P_{DIS} = V_{DD} \times \{I_{DD} - \sum I_{OH}\} + \sum \{(V_{DD} - V_{OH}) \times I_{OH}\} + \sum(V_{OL} \times I_{OL})$.

† **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 operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

5.1 DC Characteristics: MTCH102/5/8

MTCH102/5/8			**Standard Operating Conditions (unless otherwise stated)** Operating temperature -40°C ≤ T_A ≥ +85°C for industrial				
Param. No.	**Sym.**	**Characteristic**	**Min.**	**Typ.†**	**Max.**	**Units**	**Conditions**
D001	V_{DD}	**Supply Voltage**	2.05	—	3.6	V	
D002*	V_{DR}	**RAM Data Retention Voltage (1)**	1.5	—	—	V	Device in Sleep mode
	V_{POR}*	**Power-on Reset Release Voltage**	—	1.6	—	V	
	V_{PORR}*	**Power-on Reset Rearm Voltage**	—	0.8	—	V	Device in Sleep mode
D004*	S_{VDD}	**V_{DD} Rise Rate** to ensure internal Power-on Reset signal	0.05	—	—	V/ms	

* These parameters are characterized but not tested.

† Data in “Typ.” column is at 3.0V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

Note 1: This is the limit to which V_{DD} can be lowered in Sleep mode without losing RAM data.

FIGURE 5-1: MTCH10X FAMILY – POWER VS RESPONSE TIME

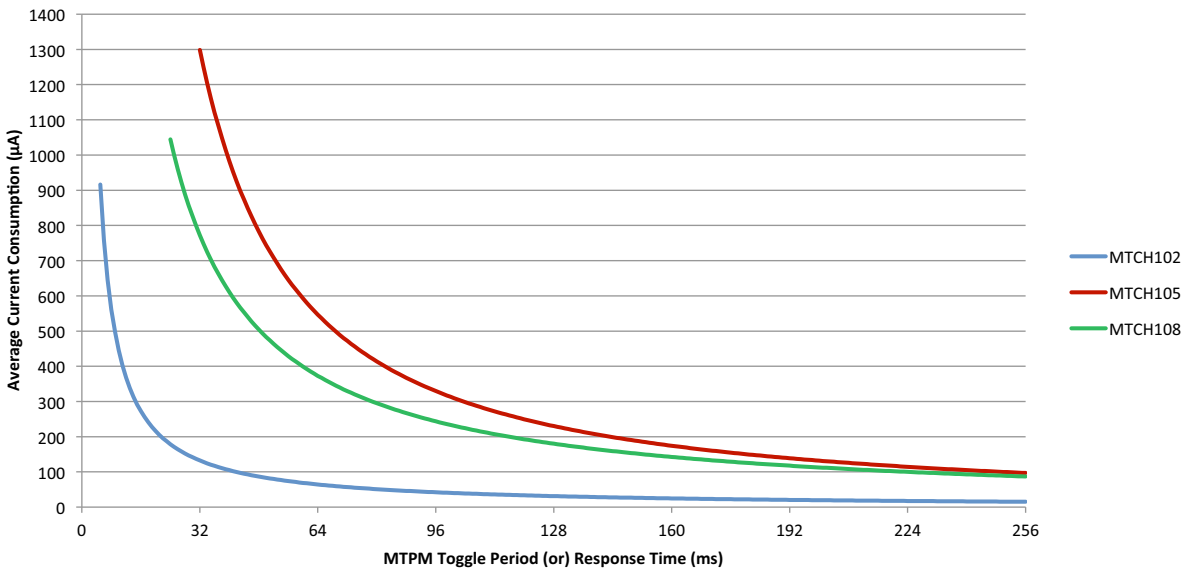
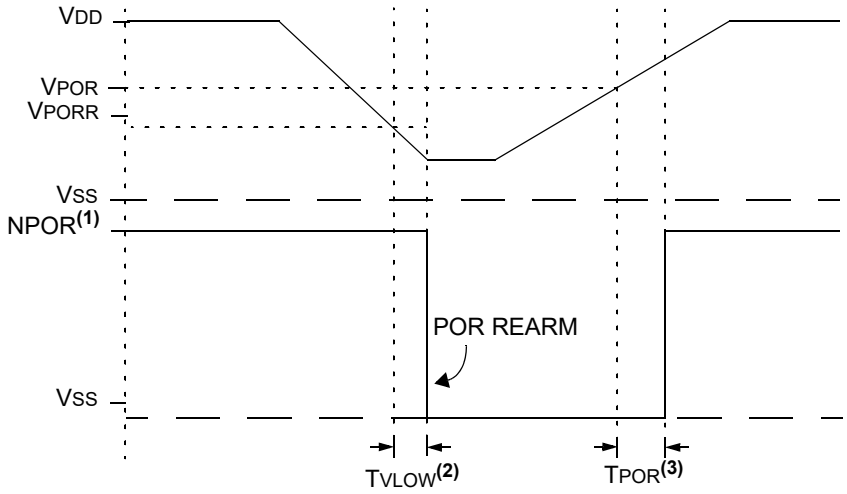


FIGURE 5-2: NPOR AND POR REARM WITH SLOW RISING VDD



Note 1: When NPOR is low, the device is held in Reset.
2: TPOR 1 µs typical.
3: TVLOW 2.7 µs typical.

5.2 DC Characteristics: MTCH102/5/8-I/E

DC CHARACTERISTICS			Standard Operating Conditions (unless otherwise stated) Operating temperature: -40°C ≤ TA ≤ +85°C for industrial				
Param. No.	**Sym.**	**Characteristic**	**Min.**	**Typ.†**	**Max.**	**Units**	**Conditions**
	VIL	**Input Low Voltage**					
		I/O PORT:					
D030A		with TTL buffer	—	—	0.15 VDD	V	1.8V ≤ VDD ≤ 4.5V
	VIH	**Input High Voltage**					
		I/O ports:		—	—		
D040A		with TTL buffer	0.25 VDD + 0.8	—	—	V	1.8V ≤ VDD ≤ 4.5V
	IIL	**Input Leakage Current(1)**					
D060		I/O ports	—	± 5	± 125	nA	VSS ≤ VPIN ≤ VDD, Pin at high-impedance at 85°C
			—	± 5	± 1000	nA	to 125°C
	VOL	**Output Low Voltage(2)**					
D080		I/O ports	—	—	0.6	V	IOL = 6 mA, VDD = 3.3V IOL = 1.8 mA, VDD = 1.8V
	VOH	**Output High Voltage(2)**					
D090		I/O ports	VDD - 0.7	—	—	V	IOH = 3 mA, VDD = 3.3V IOH = 1 mA, VDD = 1.8V
		Capacitive Loading Specs on Output Pins					
D101A*	CIO	All I/O pins	—	—	50	pF	

* These parameters are characterized but not tested.

† Data in "Typ." column is at 3.0V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

Note 1: Negative current is defined as current sourced by the pin.

2: Including OSC2 in CLKOUT mode.

FIGURE 5-3: BROWN-OUT RESET TIMING AND CHARACTERISTICS

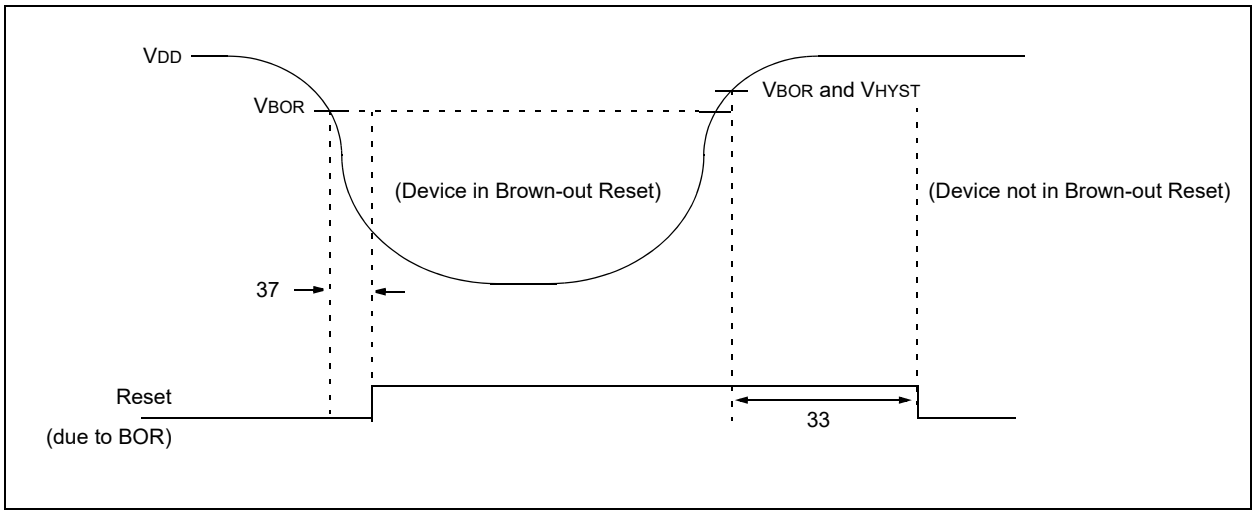


TABLE 5-1: OSCILLATOR START-UP TIMER, POWER-UP TIMER AND BROWN-OUT RESET PARAMETERS

Standard Operating Conditions (unless otherwise stated) Operating Temperature -40°C ≤ TA ≤ +125°C							
Param. No.	**Sym.**	**Characteristic**	**Min.**	**Typ.†**	**Max.**	**Units**	**Conditions**
33*	TPWRT	Power-up Timer Period	40	65	140	ms	
34*	TIOZ	I/O High-impedance from $\overline{\text{RESET}}$ Low or Watchdog Timer Reset	—	—	2.0	µs	
35	VBOR	Brown-out Reset Voltage	1.80	1.9	2.05	V	BORV = 1.9V
37*	VHYST	Brown-out Reset Hysteresis	0	25	50	mV	-40°C to +85°C
38*	TBORDC	Brown-out Reset DC Response Time	0	1	40	µs	VDD ≤ VBOR

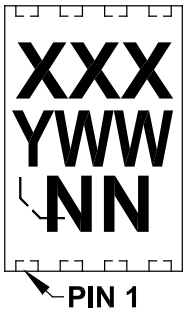
* These parameters are characterized but not tested.

† Data in “Typ.” column is at 3.0V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

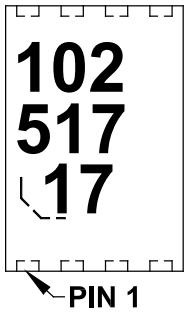
6.0 PACKAGING INFORMATION

6.1 Package Marking Information

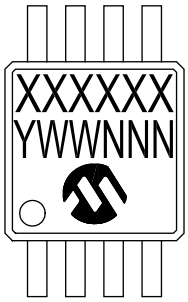
8-Lead UDFN (2x3x0.5 mm)



Example

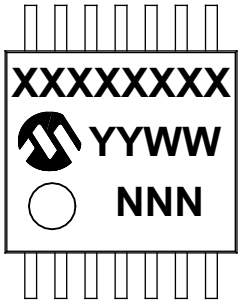


8-Lead MSOP (3x3 mm)

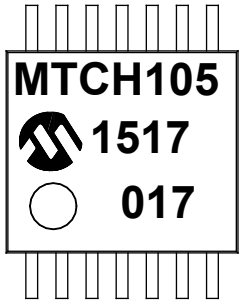


Example

14-Lead TSSOP (4.4 mm)



Example

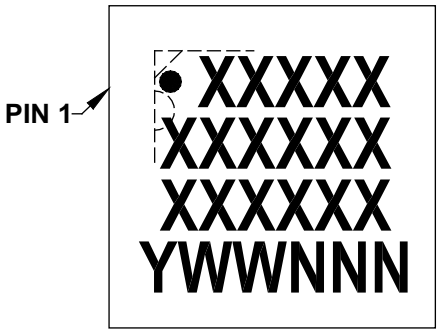


Legend:	XX...X	Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC® designator ((e3)) can be found on the outer packaging for this package.

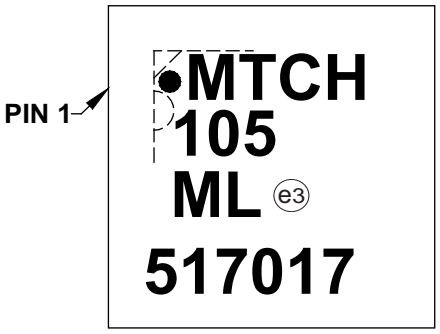
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information.

Package Marking Information (Continued)

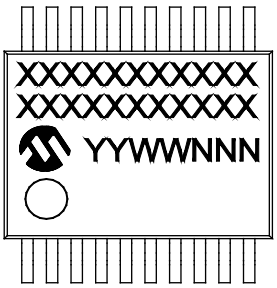
16-Lead QFN (4x4x0.9 mm)



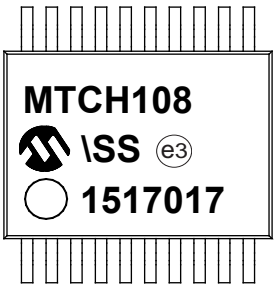
Example



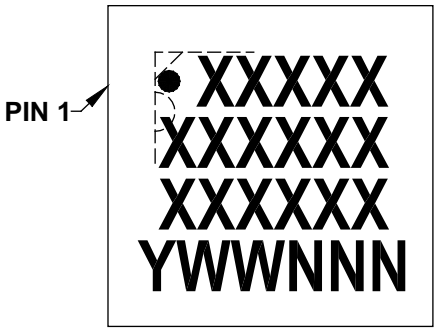
20-Lead SSOP (5.30 mm)



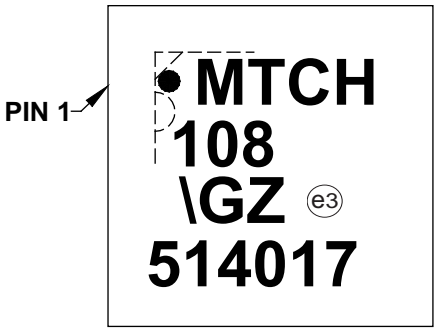
Example



20-Lead UQFN (4x4x0.9 mm)



Example



Legend:	XX...X	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')
	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.

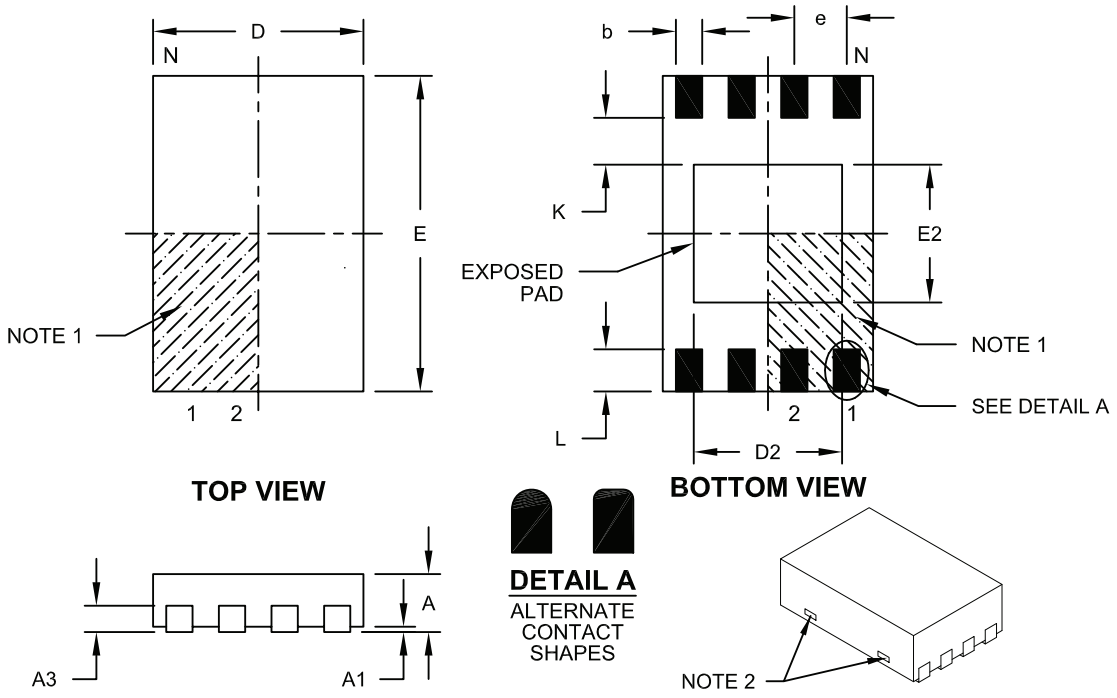
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information.

6.2 Package Details

The following sections give the technical details of the packages.

8-Lead Plastic Dual Flat, No Lead Package (MU) – 2x3x0.5 mm Body [UDFN]

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 Pins	N		8	
Pitch	e		0.50 BSC	
Overall Height	A	0.45	0.50	0.55
Standoff	A1			0.07
Contact Thickness	A3		0.127 REF	
Overall Length	D	1.95	2.00	2.05
Overall Width	E	2.95	3.00	3.05
Exposed Pad Length	D2	1.30	1.40	1.50
Exposed Pad Width	E2	1.20	1.30	1.40
Contact Width	b	0.20	0.25	0.30
Contact Length	L	0.25	0.30	0.35
Contact-to-Exposed Pad	K		0.55 REF	

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package may have one or more exposed tie bars at ends.
3. Package is saw singulated
4. Dimensioning and tolerancing per ASME Y14.5M

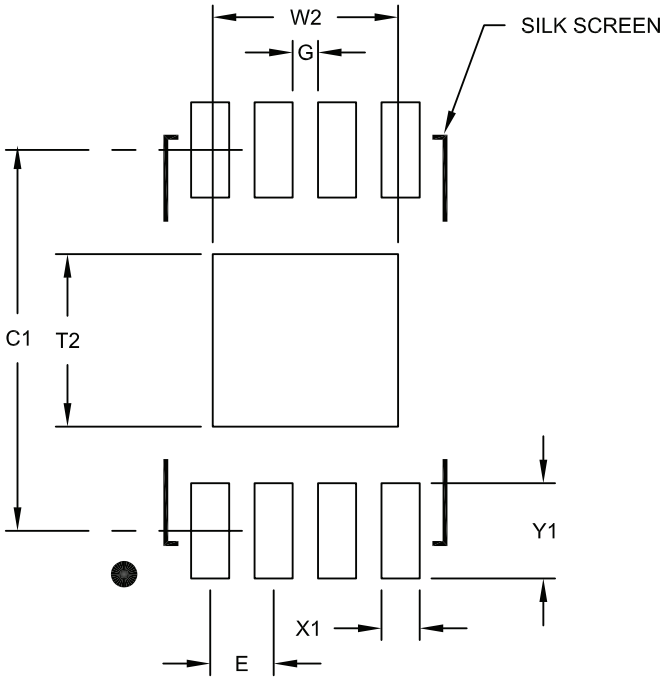
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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

Microchip Technology Drawing No. C04-136B

8-Lead Plastic Dual Flat, No Lead Package (MU) – 2x3x0.5 mm Body [UDFN]

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		0.50 BSC	
Optional Center Pad Width	W2			1.46
Optional Center Pad Length	T2			1.36
Contact Pad Spacing	C1		3.00	
Contact Pad Width (X8)	X1			0.30
Contact Pad Length (X8)	Y1			0.75
Distance Between Pads	G	0.20		

Notes:

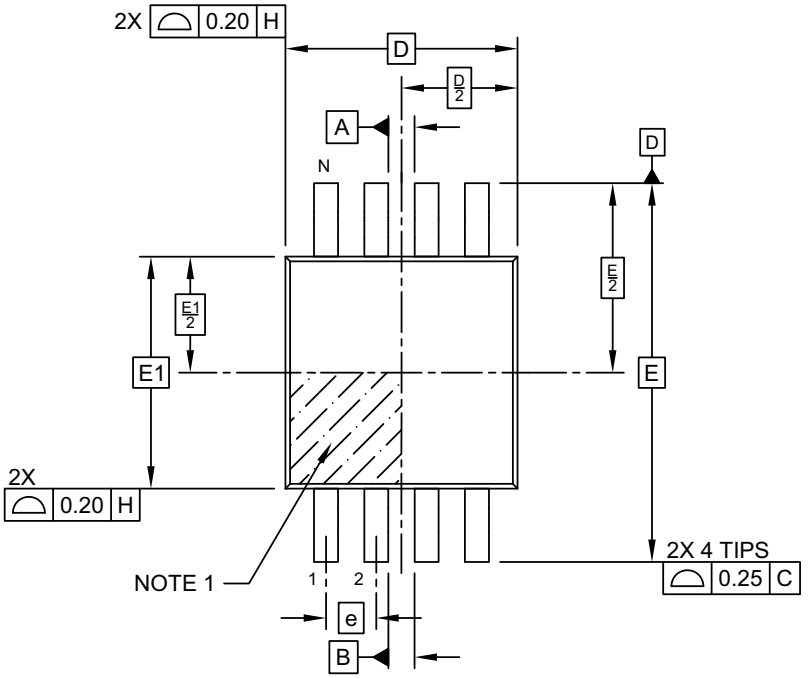
1. Dimensioning and tolerancing per ASME Y14.5M

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

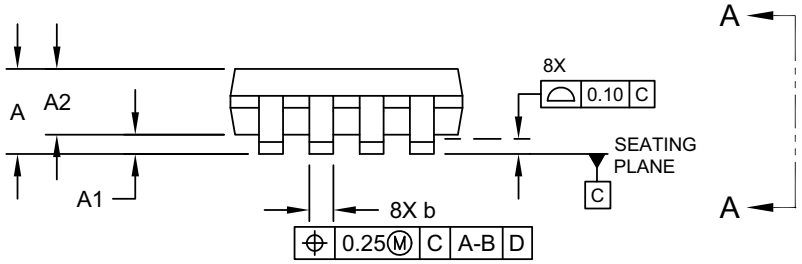
Microchip Technology Drawing No. C04-2136A

8-Lead Plastic Micro Small Outline Package (MS) - 3x3 mm Body [MSOP]

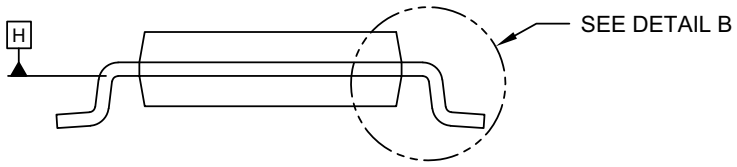
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW

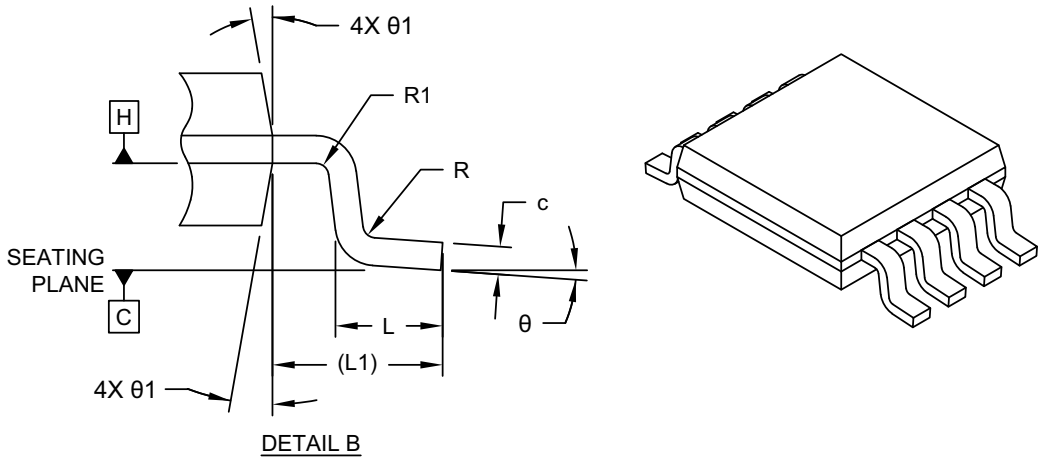


VIEW A–A

Microchip Technology Drawing C04-111-MS Rev F Sheet 1 of 2

8-Lead Plastic Micro Small Outline Package (MS) - 3x3 mm Body [MSOP]

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		8	
Pitch	e		0.65 BSC	
Overall Height	A	–	–	1.10
Standoff	A1	0.00	–	0.15
Molded Package Thickness	A2	0.75	0.85	0.95
Overall Length	D		3.00 BSC	
Overall Width	E		4.90 BSC	
Molded Package Width	E1		3.00 BSC	
Terminal Width	b	0.22	–	0.40
Terminal Thickness	c	0.08	–	0.23
Terminal Length	L	0.40	0.60	0.80
Footprint	L1		0.95 REF	
Lead Bend Radius	R	0.07	–	–
Lead Bend Radius	R1	0.07	–	–
Foot Angle	θ	0°	–	8°
Mold Draft Angle	θ1	5°	–	15°

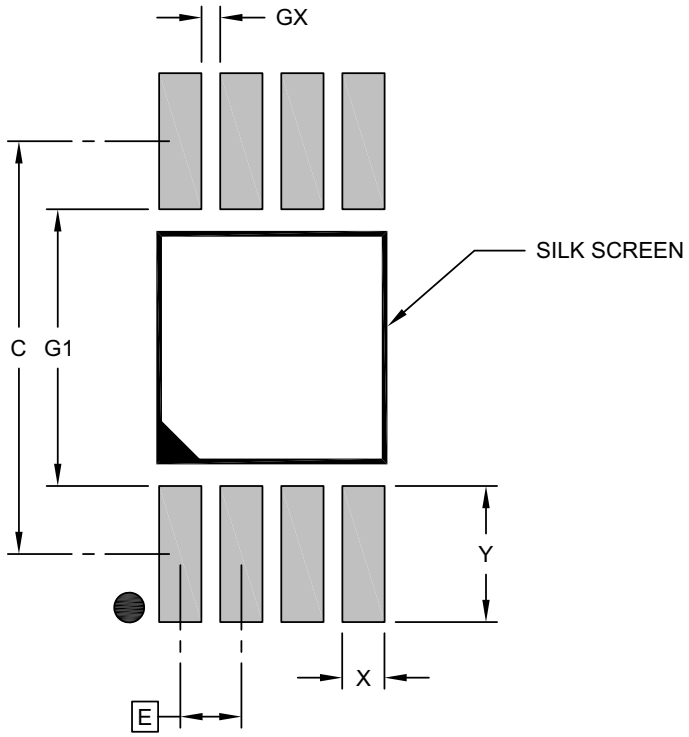
Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
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 C04-111-MS Rev F Sheet 2 of 2

8-Lead Plastic Micro Small Outline Package (MS) - 3x3 mm Body [MSOP]

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		0.65 BSC	
Contact Pad Spacing	C		4.40	
Contact Pad Width (X8)	X			0.45
Contact Pad Length (X8)	Y			1.45
Contact Pad to Contact Pad (X4)	G1	2.95		
Contact Pad to Contact Pad (X6)	GX	0.20		

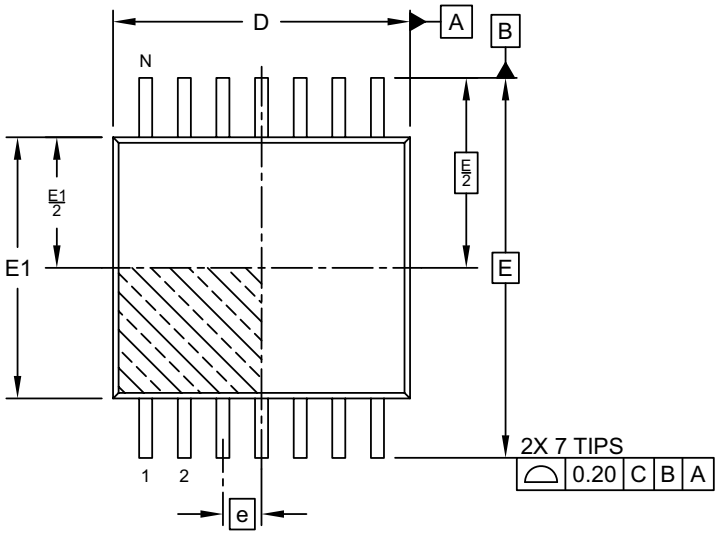
Notes:

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

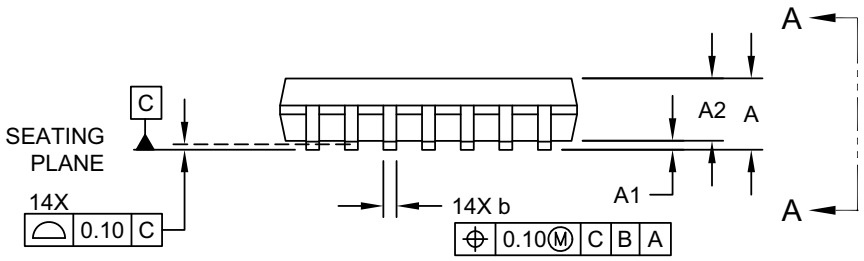
Microchip Technology Drawing C04-2111-MS Rev F

14-Lead Thin Shrink Small Outline Package [ST] – 4.4 mm Body [TSSOP]

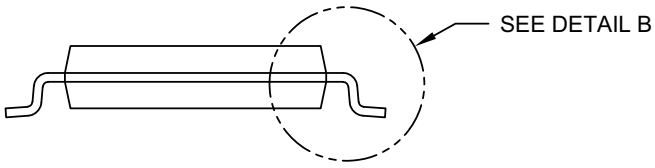
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW

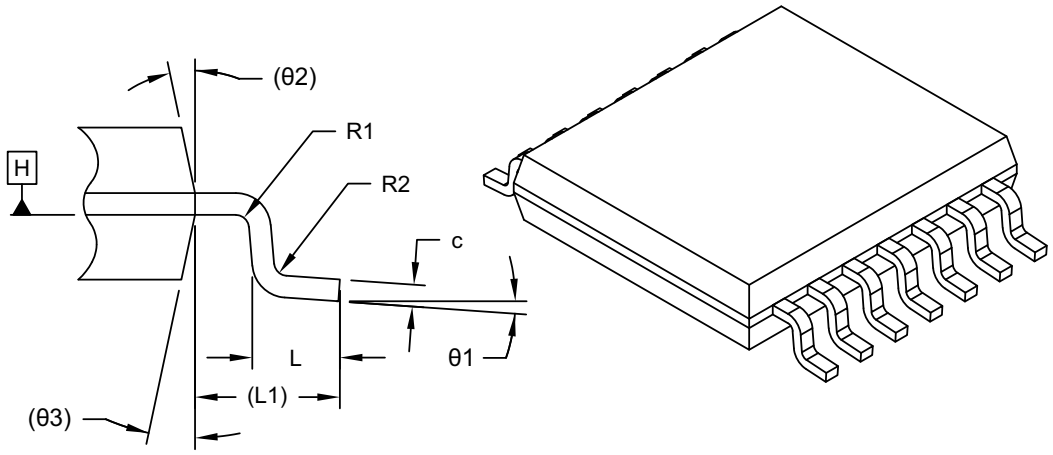


VIEW A–A

Microchip Technology Drawing C04-087 Rev E Sheet 1 of 2

14-Lead Thin Shrink Small Outline Package [ST] – 4.4 mm Body [TSSOP]

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



DETAIL B

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N		14	
Pitch	e		0.65 BSC	
Overall Height	A	–	–	1.20
Standoff	A1	0.05	–	0.15
Molded Package Thickness	A2	0.80	1.00	1.05
Overall Length	D	4.90	5.00	5.10
Overall Width	E		6.40 BSC	
Molded Package Width	E1	4.30	4.40	4.50
Terminal Width	b	0.19	–	0.30
Terminal Thickness	c	0.09	–	0.20
Terminal Length	L	0.45	0.60	0.75
Footprint	L1		1.00 REF	
Lead Bend Radius	R1	0.09	–	–
Lead Bend Radius	R2	0.09	–	–
Foot Angle	θ1	0°	–	8°
Mold Draft Angle	θ2	–	12° REF	–
Mold Draft Angle	θ3	–	12° REF	–

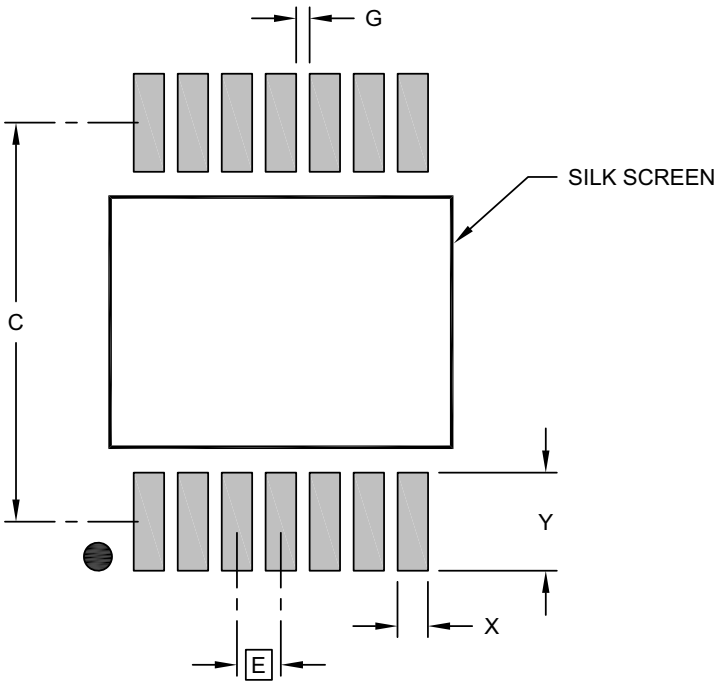
Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. 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 C04-087 Rev E Sheet 2 of 2

14-Lead Thin Shrink Small Outline Package [ST] – 4.4 mm Body [TSSOP]

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		0.65 BSC	
Contact Pad Spacing	C		5.90	
Contact Pad Width (Xnn)	X			0.45
Contact Pad Length (Xnn)	Y			1.45
Contact Pad to Contact Pad (Xnn)	G	0.20		

Notes:

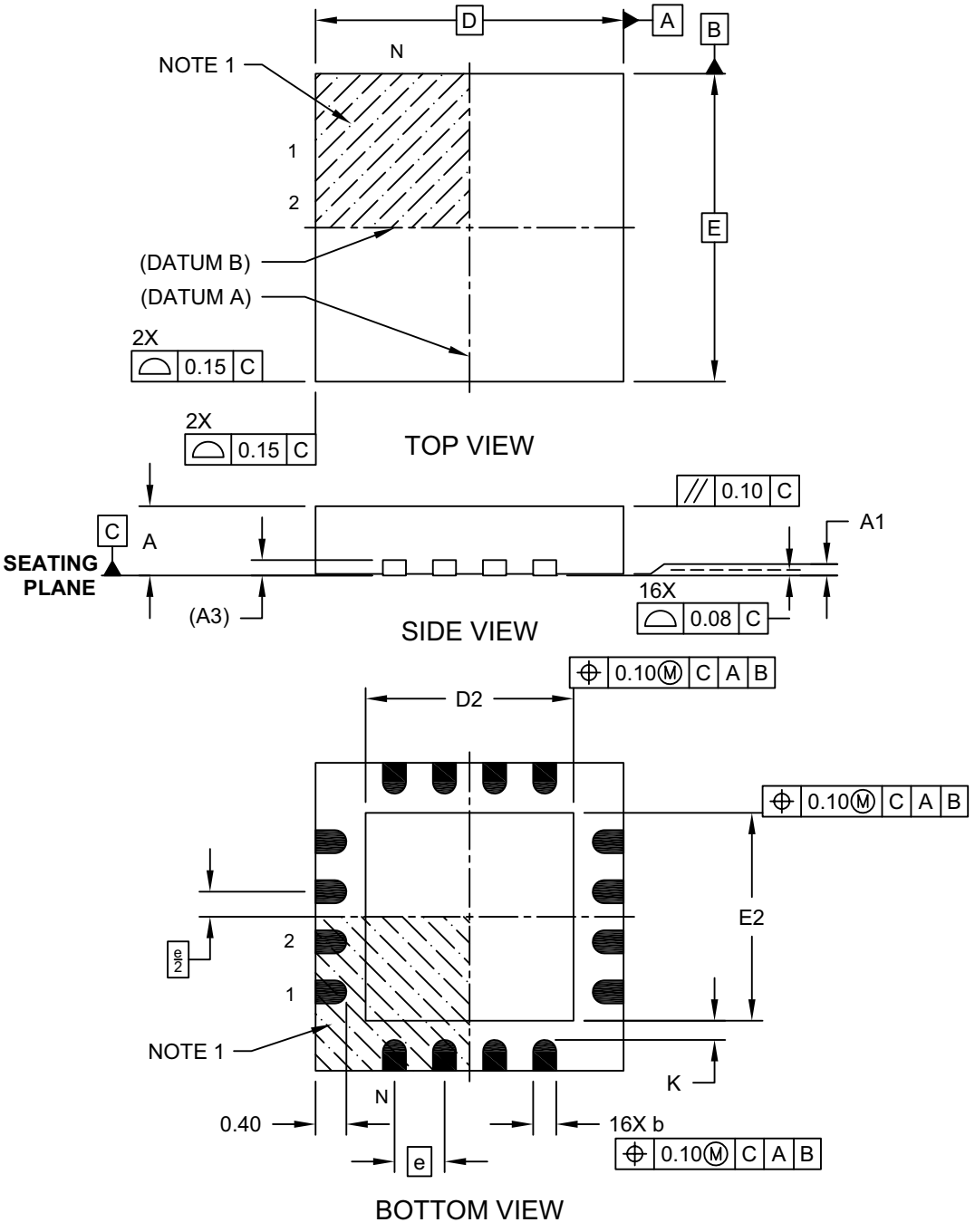
1. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing C04-2087 Rev E

16-Lead Plastic Quad Flat, No Lead Package (ML) - 4x4x0.9mm Body [QFN]

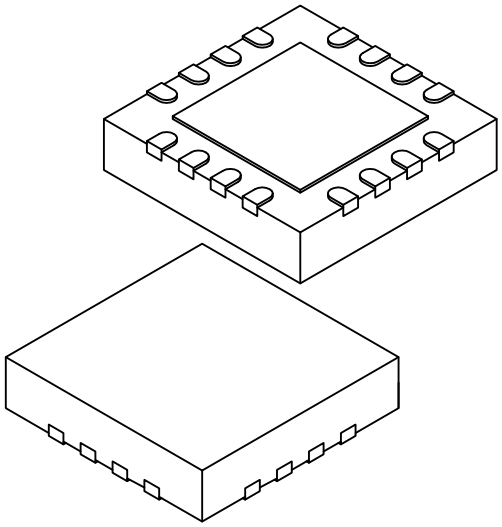
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing C04-127D Sheet 1 of 2

16-Lead Plastic Quad Flat, No Lead Package (ML) - 4x4x0.9mm Body [QFN]

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 Pins	N		16	
Pitch	e		0.65 BSC	
Overall Height	A	0.80	0.90	1.00
Standoff	A1	0.00	0.02	0.05
Contact Thickness	A3		0.20 REF	
Overall Width	E		4.00 BSC	
Exposed Pad Width	E2	2.50	2.65	2.80
Overall Length	D		4.00 BSC	
Exposed Pad Length	D2	2.50	2.65	2.80
Contact Width	b	0.25	0.30	0.35
Contact Length	L	0.30	0.40	0.50
Contact-to-Exposed Pad	K	0.20	-	-

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

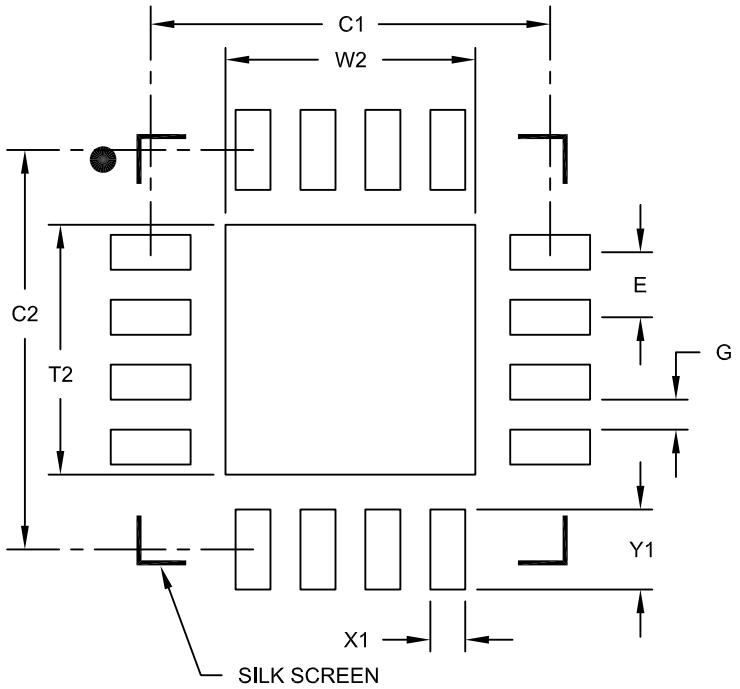
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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

Microchip Technology Drawing C04-127D Sheet 2 of 2

16-Lead Plastic Quad Flat, No Lead Package (ML) - 4x4x0.9mm Body [QFN]

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		0.65 BSC	
Optional Center Pad Width	W2			2.50
Optional Center Pad Length	T2			2.50
Contact Pad Spacing	C1		4.00	
Contact Pad Spacing	C2		4.00	
Contact Pad Width (X28)	X1			0.35
Contact Pad Length (X28)	Y1			0.80
Distance Between Pads	G	0.30		

Notes:

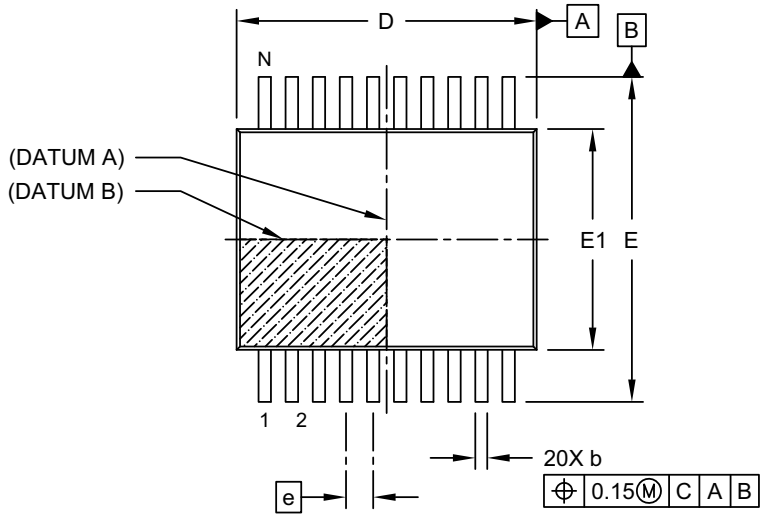
1. Dimensioning and tolerancing per ASME Y14.5M

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

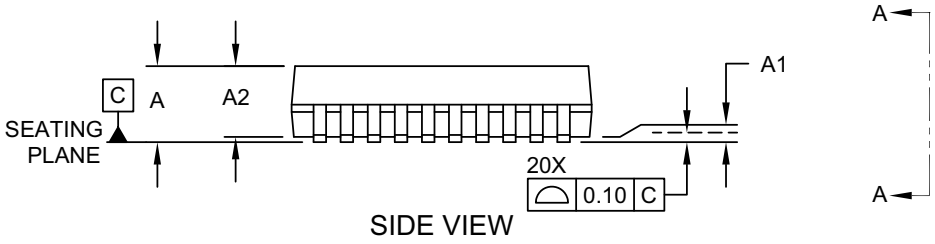
Microchip Technology Drawing No. C04-2127A

20-Lead Plastic Shrink Small Outline (SS) - 5.30 mm Body [SSOP]

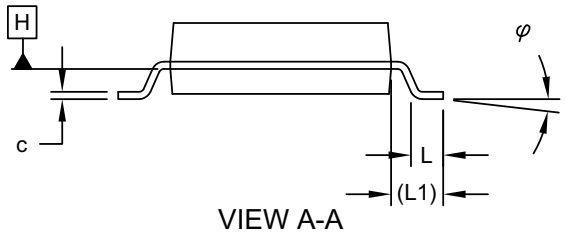
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW

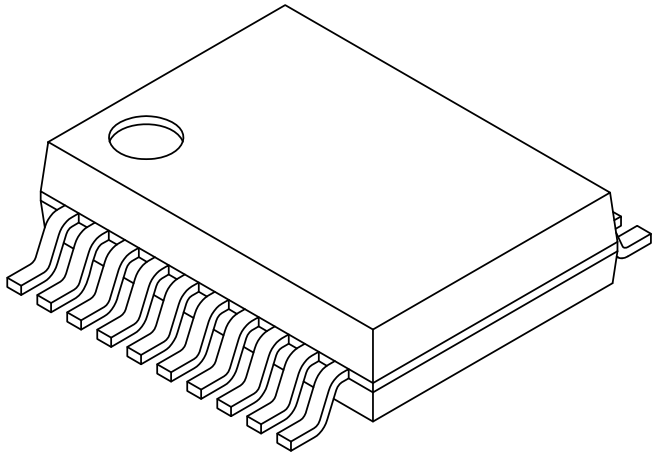


VIEW A-A

Microchip Technology Drawing C04-072 Rev C Sheet 1 of 2

20-Lead Plastic Shrink Small Outline (SS) - 5.30 mm Body [SSOP]

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 Pins	N		20	
Pitch	e		0.65 BSC	
Overall Height	A	-	-	2.00
Molded Package Thickness	A2	1.65	1.75	1.85
Standoff	A1	0.05	-	-
Overall Width	E	7.40	7.80	8.20
Molded Package Width	E1	5.00	5.30	5.60
Overall Length	D	6.90	7.20	7.50
Foot Length	L	0.55	0.75	0.95
Footprint	L1		1.25 REF	
Lead Thickness	c	0.09	-	0.25
Foot Angle	φ	0°	4°	8°
Lead Width	b	0.22	-	0.38

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.20mm per side.
3. Dimensioning and tolerancing per ASME Y14.5M

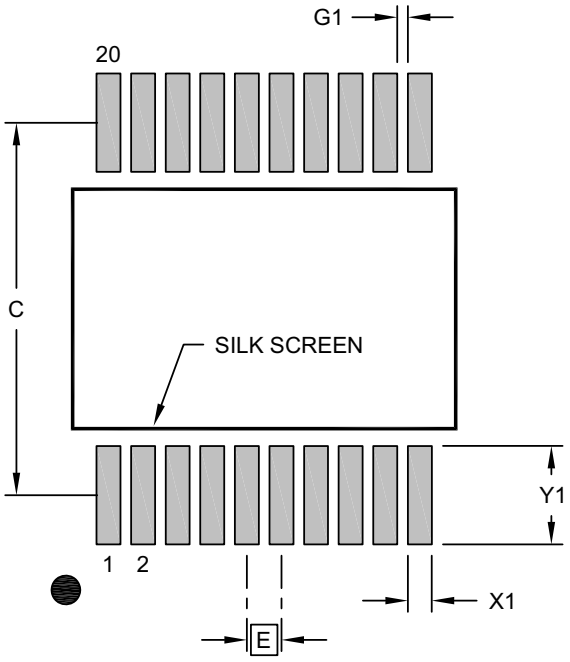
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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

Microchip Technology Drawing C04-072 Rev C Sheet 2 of 2

20-Lead Plastic Shrink Small Outline (SS) - 5.30 mm Body [SSOP]

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	0.65 BSC		
Contact Pad Spacing	C		7.00	
Contact Pad Width (X20)	X1			0.45
Contact Pad Length (X20)	Y1			1.85
Contact Pad to Center Pad (X18)	G1	0.20		

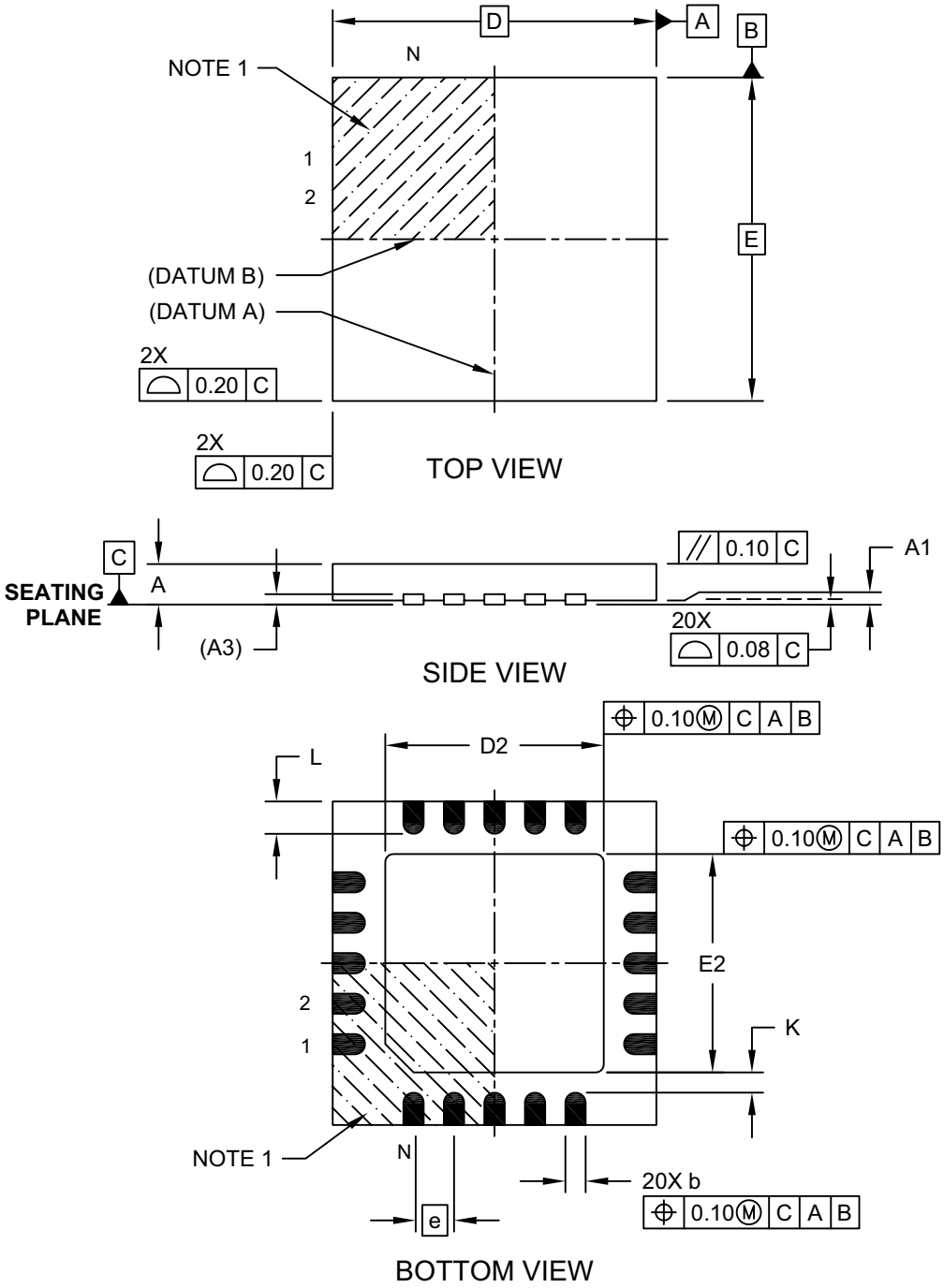
Notes:

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 C04-2072 Rev C

20-Lead Ultra Thin Plastic Quad Flat, No Lead Package (GZ) - 4x4x0.5 mm Body [UQFN]

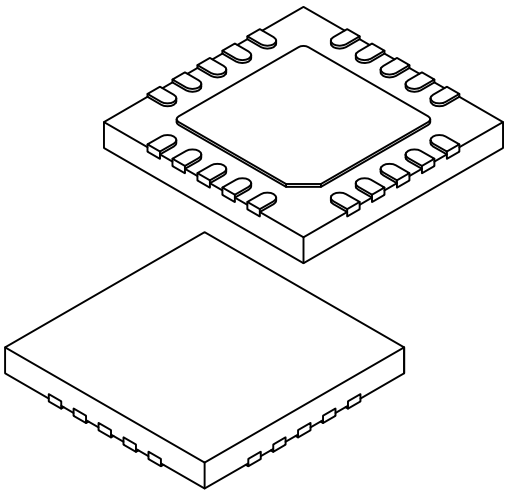
Note:	For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing C04-255A Sheet 1 of 2

20-Lead Ultra Thin Plastic Quad Flat, No Lead Package (GZ) - 4x4x0.5 mm Body [UQFN]

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		20	
Pitch	e		0.50 BSC	
Overall Height	A	0.45	0.50	0.55
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	A3		0.127 REF	
Overall Width	E		4.00 BSC	
Exposed Pad Width	E2	2.60	2.70	2.80
Overall Length	D		4.00 BSC	
Exposed Pad Length	D2	2.60	2.70	2.80
Terminal Width	b	0.20	0.25	0.30
Terminal Length	L	0.30	0.40	0.50
Terminal-to-Exposed-Pad	K	0.20	-	-

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

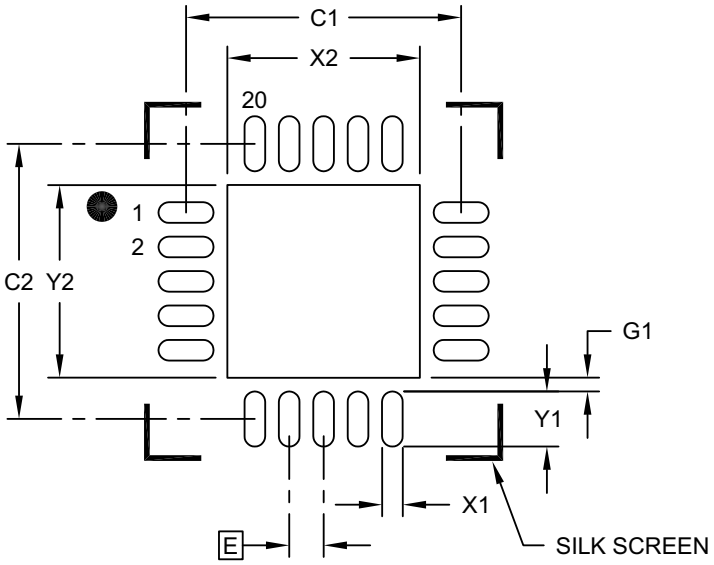
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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

Microchip Technology Drawing C04-255A Sheet 2 of 2

20-Lead Ultra Thin Plastic Quad Flat, No Lead Package (GZ) - 4x4x0.5 mm Body [UQFN]

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	0.50 BSC		
Optional Center Pad Width	X2			2.80
Optional Center Pad Length	Y2			2.80
Contact Pad Spacing	C1		4.00	
Contact Pad Spacing	C2		4.00	
Contact Pad Width (X20)	X1			0.30
Contact Pad Length (X20)	Y1			0.80
Contact Pad to Center Pad (X20)	G1	0.20		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing C04-2255A

APPENDIX A: DATA SHEET REVISION HISTORY

Revision D (12/2022)

Updated document status. Revised terminology in Tables 1, 3, 4, and 5, Figures 1, 2, 3, 4, 5, 2-1, and 2-2, Sections 1.1, and 4-4.

Revision C (04/2016)

Updated Packaging Information section. Other minor corrections.

Revision B (01/2016)

Updated Packaging Information and Product Identification System sections. Other minor corrections.

Revision A (05/2015)

Initial release of this document.

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PART NO.	[X](1)	X	/XX	XXX
Device	Tape and Reel Option	Temperature Range	Package	Pattern

Device:	MTCH102; MTCH105; MTCH108.	
Tape and Reel Option:	Blank = Standard packaging (tube or tray) T = Tape and Reel(1)	
Temperature Range:	I = -40°C to +85°C E = -40°C to +125°C	(Industrial) (Extended)
Package:	MS = MSOP SS = SSOP MU = UDFN GZ = UQFN ST = TSSOP ML = QFN	

Examples:

a) MTCH102 - I/MS = Industrial temperature, MSOP package.

b) MTCH105 - I/ML = Industrial temperature, QFN package.

c) MTCH108 - I/GZ = Industrial temperature, UQFN package.

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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