MIC2545A/49A

Programmable Current-Limit High-Side Switch

Features

- 2.7V to 5.5V Input
- Adjustable Current-limit up to 3A
- Reverse Current Flow Blocking
- 90 µA Typical On-state Supply Current
- 1 µA Typical Off-state Supply Current
- 50 mΩ Maximum On-resistance
- Open-drain Fault Flag
- Thermal Shutdown
- Thermal-shutdown Output Latch (MIC2549A)
- 2 ms (Slow) Soft-start Turn-on, Fast Turnoff
- Available with Active-high or Active-low Enable

Applications

- USB Power Distribution
- PCI Bus Power Switching
- Notebook PC
- ACPI Power Distribution
- PC Card Hot Swap Applications
- Inrush Current-limiting

General Description

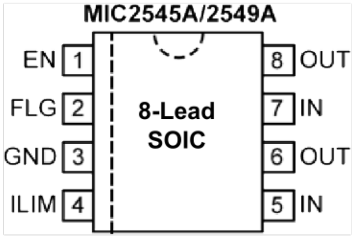
The MIC2545A and MIC2549A are integrated high-side power switches optimized for low-loss DC power switching and other power-management applications, including advanced configuration and power interface (ACPI). The MIC2545A/49A is a cost-effective, highly-integrated solution that requires few external components to satisfy USB and ACPI requirements.

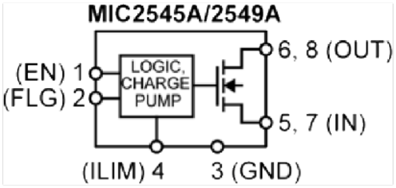
Load current management features include a precision, resistor-programmable output current-limit and a soft-start circuit, which minimizes inrush current when the switch is enabled. Thermal shutdown, along with adjustable current limit, protects the switch and the attached device.

The MIC2545A/49A's open-drain flag output is used to indicate current-limiting or thermal shutdown to a local controller. The MIC2549A has an additional internal latch which turns the output off upon thermal shutdown, providing robust fault control. The enable signal is compatible with both 3V and 5V logic, and is also used as the thermal shutdown latch reset for the MIC2549A.

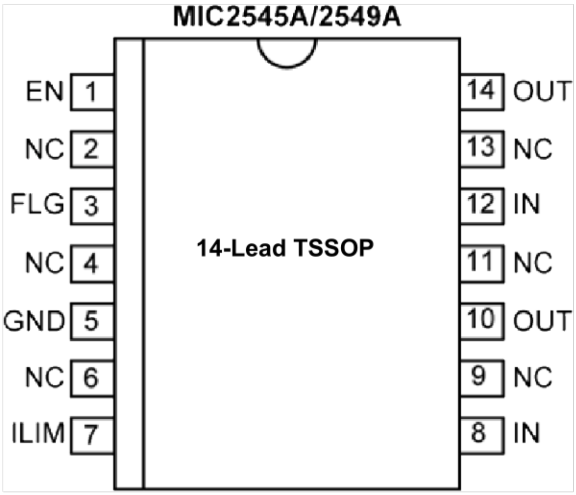
The MIC2545A and MIC2549A are available in active-high and active-low enable versions in 8-lead PDIP and SOIC packages as well as a 14-lead TSSOP package.

Package Types



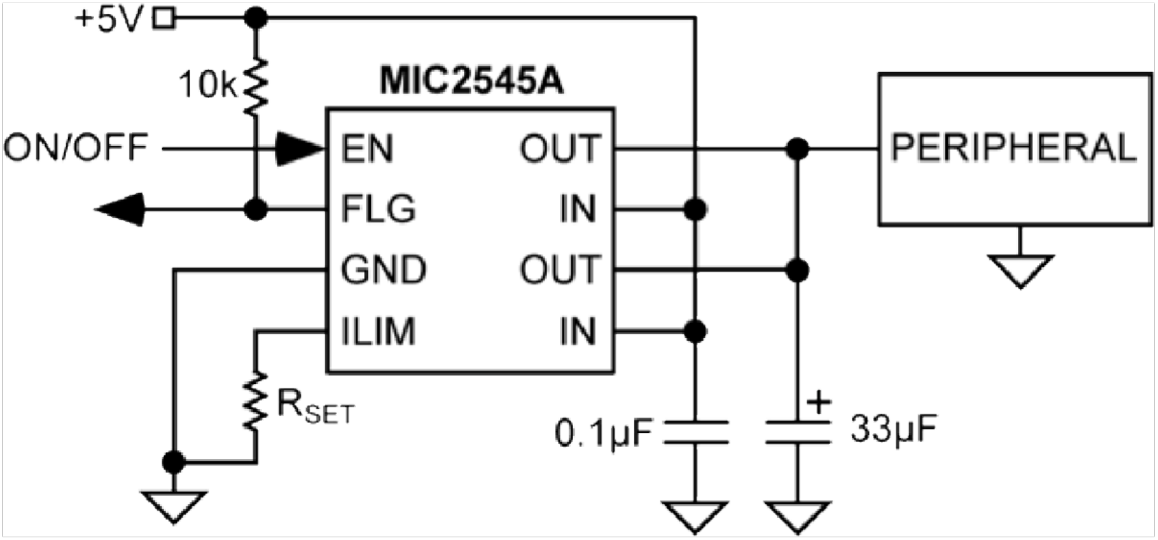


8-Lead PDIP

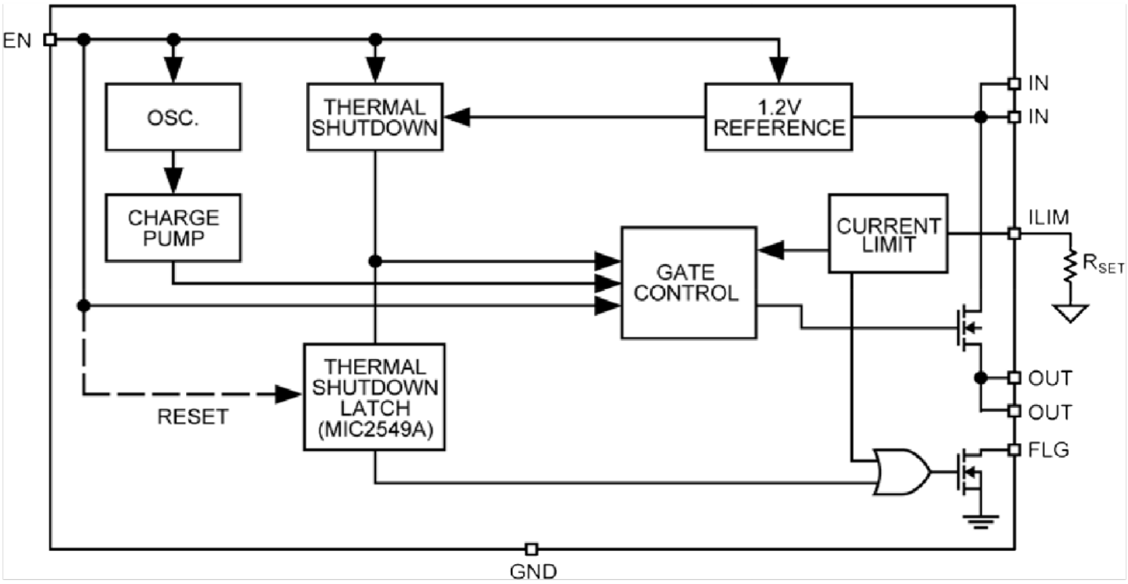


Typical Application Circuits

MIC2545A/49A



Functional Block Diagram



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1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Supply Voltage (V_{IN})	+7.0V
Output Voltage (V_{OUT})	+7.0V
Output Current (I_{OUT})	Internally Limited
Enable Input (V_{EN})	−0.3V to +7V
Fault Flag Voltage (V_{FLG})	+7.0V
Fault Flag Current (I_{FLG})	50 mA
ESD Rating (Note 1)	1500V

Operating Ratings ‡

Supply Voltage (V_{IN})	+2.7V to +5.5V
Current-Limit Set Range (Note 2)	0.5A to 3A

† 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 operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

‡ Notice: The device is not guaranteed to function outside its operating ratings.

Note 1: Devices are ESD sensitive. Handling precautions recommended. Human body model: 1.5 kΩ in series with 100 pF.

2: Current limit is determined by $I_{LIMIT} = 230 / R_{SET}$, where R_{SET} is in Ωs, and 230 is typical current-limit factor in volts.

ELECTRICAL CHARACTERISTICS

V_{IN} = +5V, and T_A = 25°C, but **bold** values indicate –40°C to +85°C, unless noted.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Supply Current	I_{VIN}	—	0.75	5	µA	Switch off, OUT = Open (Note 1)
		—	90	125	µA	Switch on, OUT = Open (Note 1)
		—	—	150	µA	
Enable Input Voltage	V_{EN}	2.4	1.6	—	V	Enable high transition (Note 1)
		—	1.5	0.8	V	Enable low transition (Note 1)
Enable Input Current	I_{EN}	—	0.01	1	µA	$V_{EN} = V_{OH(MIN)} = 2.4V$
		—	0.01	1	µA	$V_{EN} = V_{OL(MAX)} = 0.8V$
Enable Input Capacitance	C_{EN}	—	1	—	pF	**Note 2**
Switch Resistance	$R_{DS(ON)}$	—	35	50	mΩ	I_{OUT} = 500 mA
Current-Limit Factor	CLF	184	230	276	V	I_{LIMIT} = 0.5A to 3A, V_{OUT} = 1V to 4V (Note 3)
		195	230	264	V	I_{LIMIT} = 1A to 2.5A, V_{OUT} = 1A to 4V (Note 3)

Note 1: Off is ≤ 0.8V and on is ≥ 2.4V for the MIC2545A-1 and MIC2549A-1. Off is ≥ 2.4V and on is ≤ 9.8V for the MIC2545A-2 and MIC2549A-2. The enable input has about 100 mV of hysteresis.

2: Guaranteed by design but not production tested.

3: Current limit is determined by $I_{LIMIT} = 230 / R_{SET}$, where R_{SET} is in Ωs, and 230 is typical current-limit factor in volts.

ELECTRICAL CHARACTERISTICS (CONTINUED)

V_{IN} = +5V, and T_A = 25°C, but **bold** values indicate –40°C to +85°C, unless noted.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Output Leakage Current	OUT_{LEAK}	—	1	10	µA	Switch off, V_{OUT} = 0V
Output Turn-on Delay	t_{ON}	1	2	5	ms	R_L = 10Ω, C_L = 1 µF (**see Figure 3-1 and Figure 3-2**)
Output Turn-on Rise Time	t_R	0.75	1.8	4.9	ms	R_L = 10Ω, C_L = 1 µF (**see Figure 1a and Figure 1b**)
Output Turn-off Delay	t_{OFF}	—	25	—	µs	R_L = 10Ω, C_L = 1 µF (**see Figure 3-1 and Figure 3-2**)
Output Turn-off Fall Time	t_F	—	23	—	µs	R_L = 10Ω, C_L = 1 µF (**see Figure 3-1 and Figure 3-2**)
Overtemperature Threshold Shutdown	T_J	—	135	—	˚C	T_J increasing
		—	120	—	˚C	T_J decreasing
Error Flag Off Current	I_{FLAG}	—	0.01	1	µA	V_{FLG} = 5V
EN Pulse Reset Width	t_{RST}	1	—	—	µs	MIC2549A thermal-shutdown latch (Note 2)
VIN to EN Set-up	t_{SET}	0	—	—	µs	MIC2549 (Note 2), **see Figure 3-3**
Current-limit Response Time	t_{CL}	—	40	—	µs	V_{OUT} = 0V to I_{OUT} = 2A, I_{SET} = 1A (Note 2)
Error Flag Output Resistance	R_{FLAG}	—	4	15	Ω	I_{FLG} = 10 mA

Note 1: Off is ≤ 0.8V and on is ≥ 2.4V for the MIC2545A-1 and MIC2549A-1. Off is ≥ 2.4V and on is ≤ 9.8V for the MIC2545A-2 and MIC2549A-2. The enable input has about 100 mV of hysteresis.

2: Guaranteed by design but not production tested.

3: Current limit is determined by I_{LIMIT} = 230 / R_{SET}, where R_{SET} is in Ωs, and 230 is typical current-limit factor in volts.

TEMPERATURE SPECIFICATIONS

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Junction Temperature Range	T_J	—	—	—	°C	Internally limited
Ambient Temperature Range	T_A	–40	—	+85	°C	—
Storage Temperature Range	T_s	–65	—	+150	°C	—
Lead Temperature	—	—	+260	—	°C	Soldering, 10 seconds
Package Thermal Resistance						
8-Lead PDIP	θ_{JA}	—	+130	—	°C/W	—
8-Lead SOIC	θ_{JA}	—	+160	—	°C/W	—
14-Lead TSSOP	θ_{JA}	—	+100	—	°C/W	Assumes a 4-layer PCB is used.

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2.0 TEST CIRCUIT

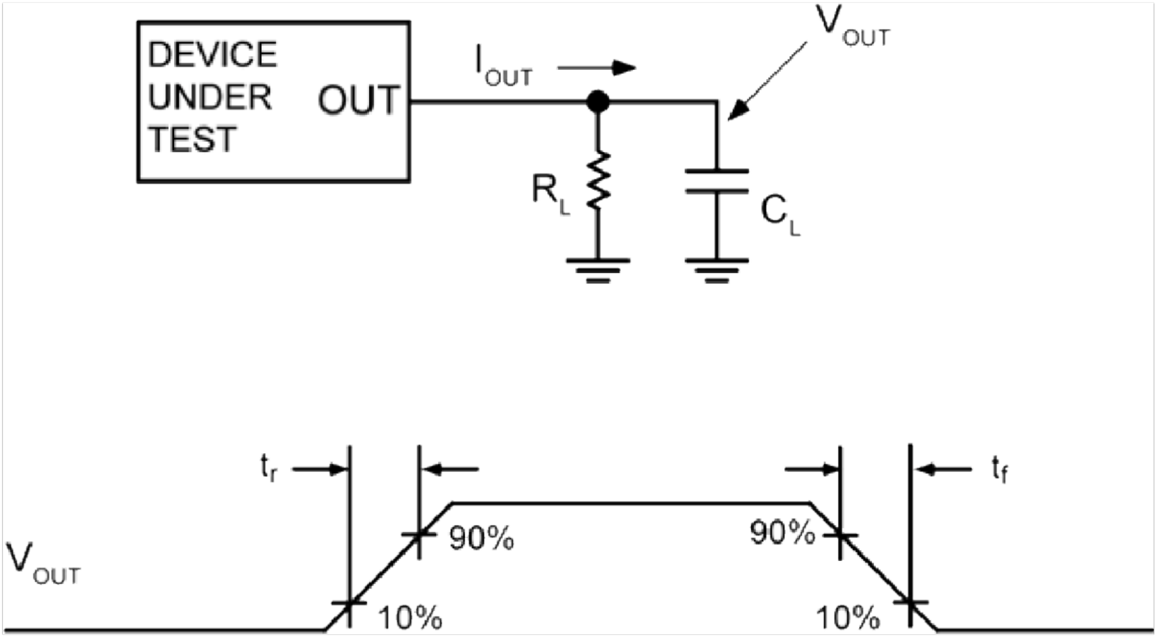

FIGURE 2-1: Functional Characteristics Test Circuit.

3.0 TIMING DIAGRAMS

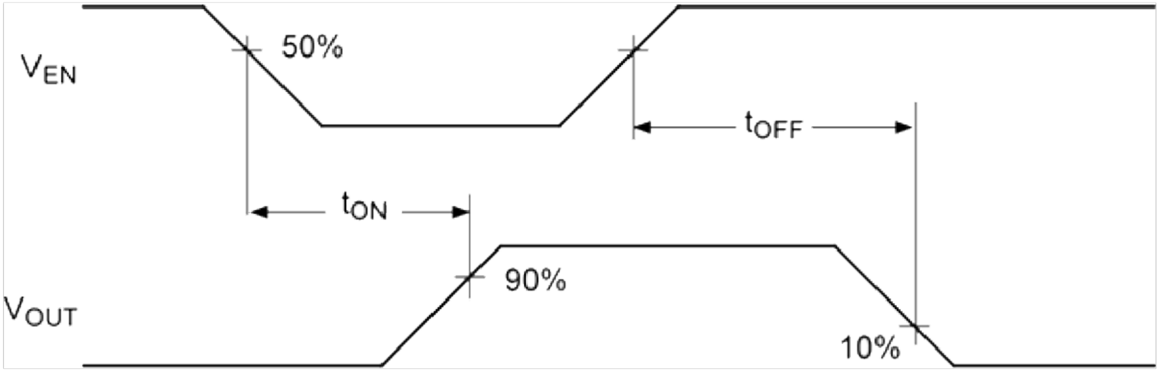

FIGURE 3-1: *MIC2545A/49A-2.*

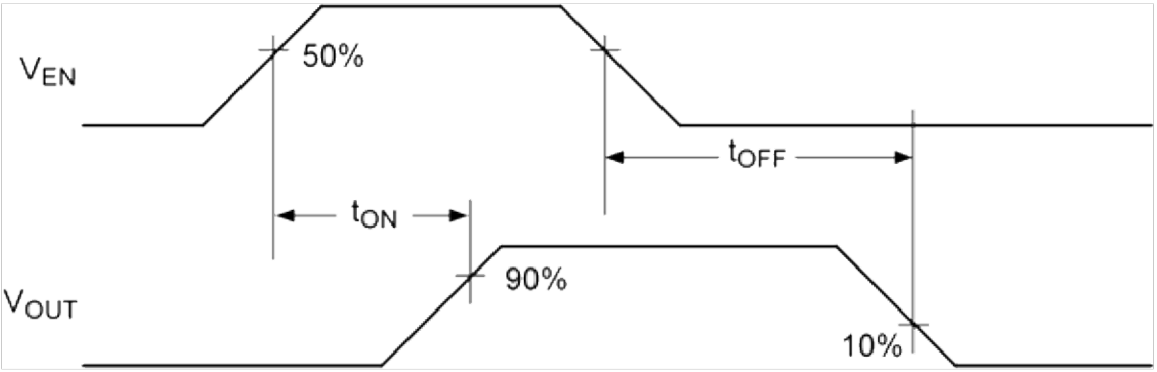

FIGURE 3-2: *MIC2545A/49A-1.*

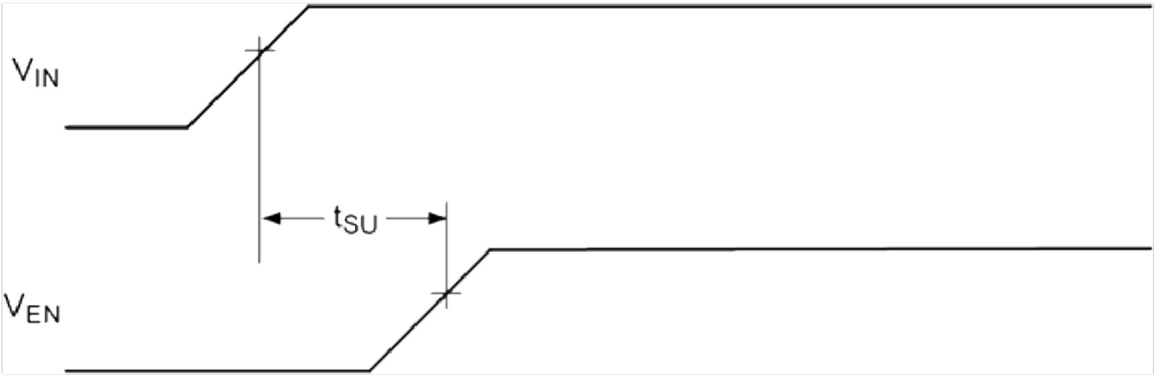

FIGURE 3-3: *Input-to-Enable Setup Timing.*

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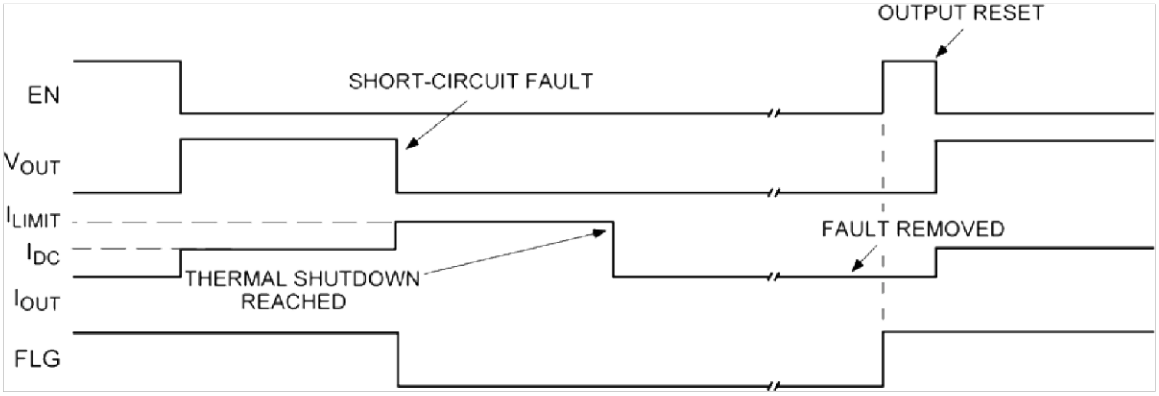

FIGURE 3-4: *MIC2545A-2 Timing: Output is Reset by Toggling EN.*

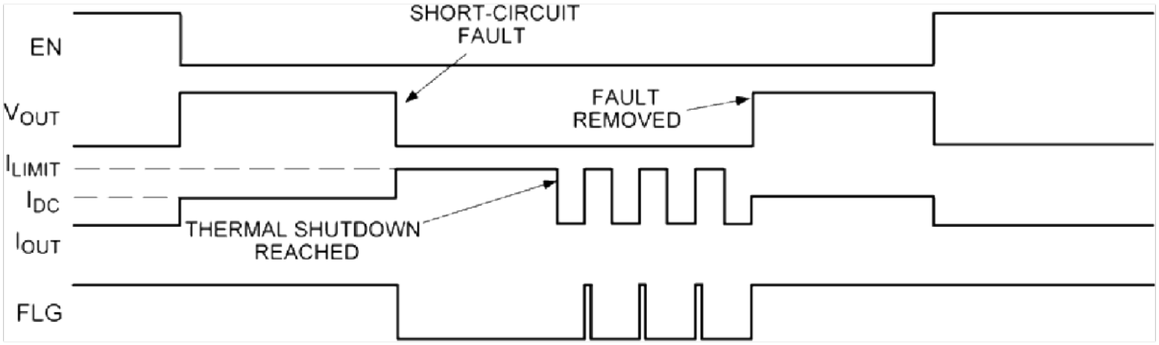

FIGURE 3-5: *MIC2545A-2 Timing.*

4.0 TYPICAL PERFORMANCE CURVES

Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

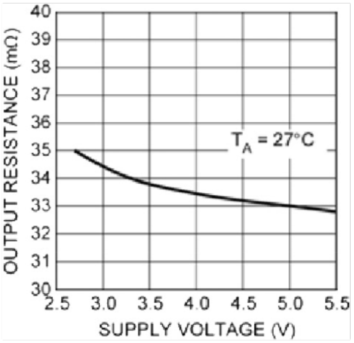

FIGURE 4-1: *Output On-resistance vs. Supply Voltage.*

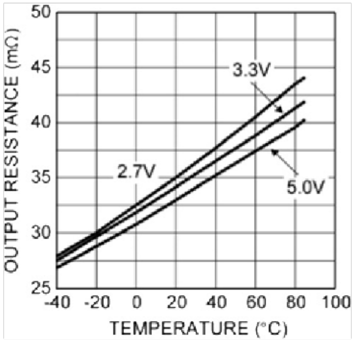

FIGURE 4-2: *Output On-resistance Vs. Temperature.*

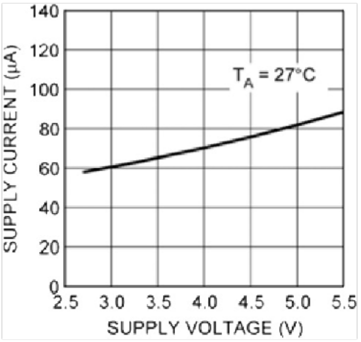

FIGURE 4-3: *On-state Supply Current vs. Supply Voltage.*

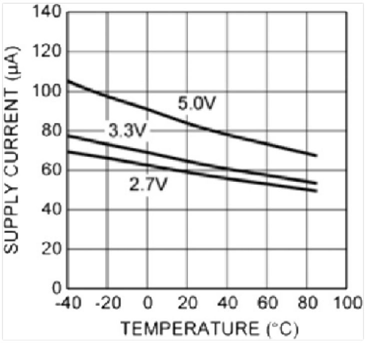

FIGURE 4-4: *On-state Supply Current vs. Temperature.*

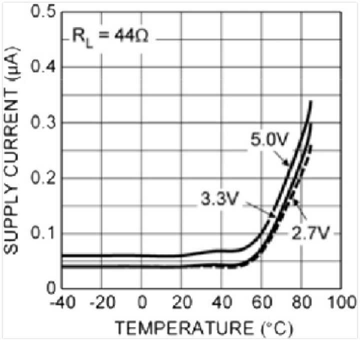

FIGURE 4-5: *Off-state Supply Current vs. Temperature.*

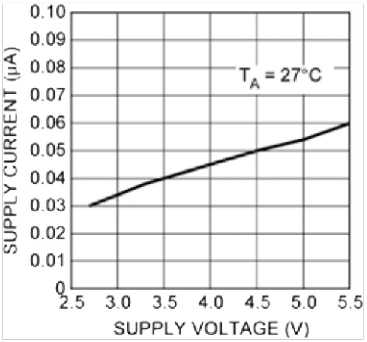

FIGURE 4-6: *Off-State Supply Current vs. Supply Voltage.*

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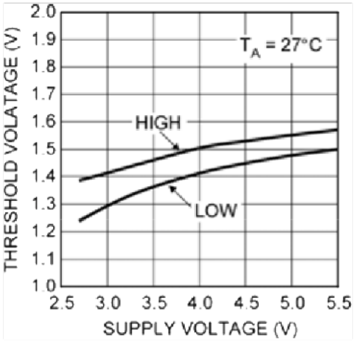

FIGURE 4-7: *Control Threshold Voltage vs. Supply Voltage.*

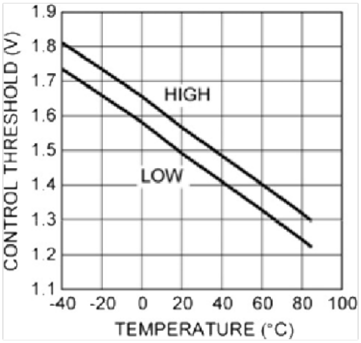

FIGURE 4-8: *Control Threshold Voltage vs. Temperature.*

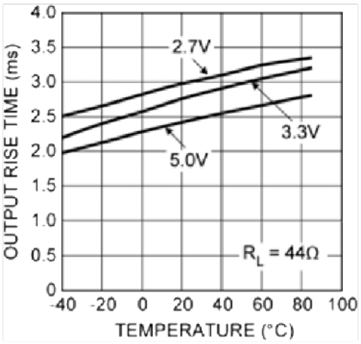

FIGURE 4-9: *Rise Time vs. Temperature.*

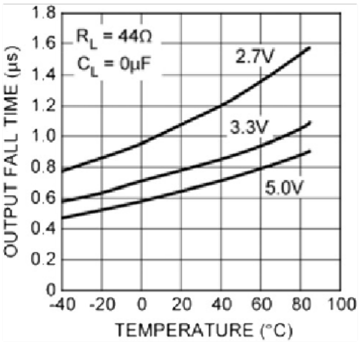

FIGURE 4-10: *Output Fall Time vs. Temperature.*

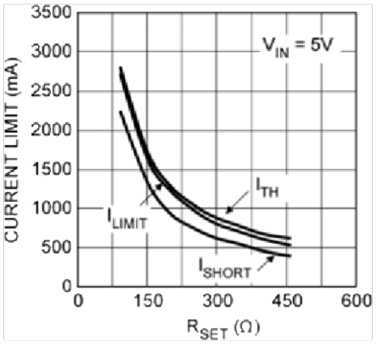

FIGURE 4-11: *Current Limit vs. R_{SET}.*

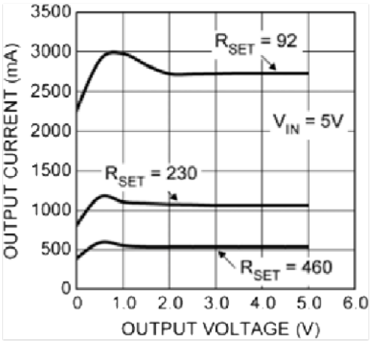

FIGURE 4-12: *Output Current vs. Output Voltage.*

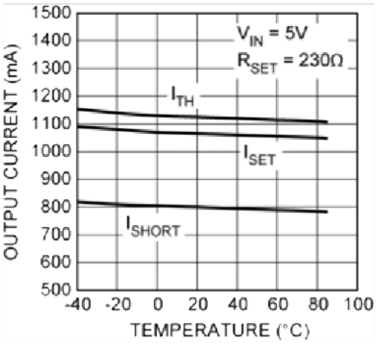

FIGURE 4-13: *Current Limit vs. Temperature.*

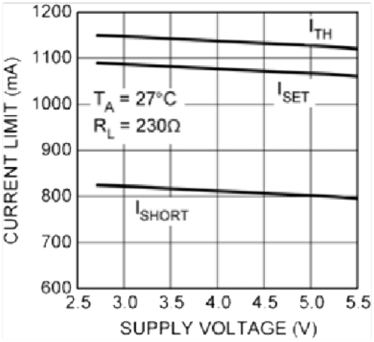

FIGURE 4-14: *Current Limit vs. Supply Voltage.*

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5.0 TYPICAL FUNCTIONAL CHARACTERISTICS

Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

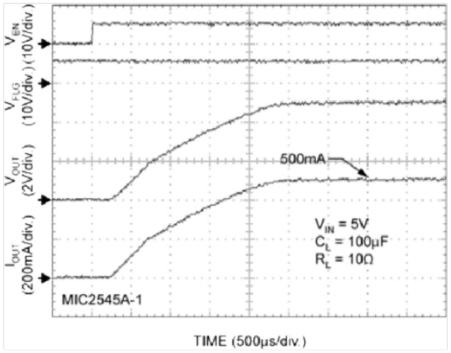

FIGURE 5-1: *Turn-on Response.*

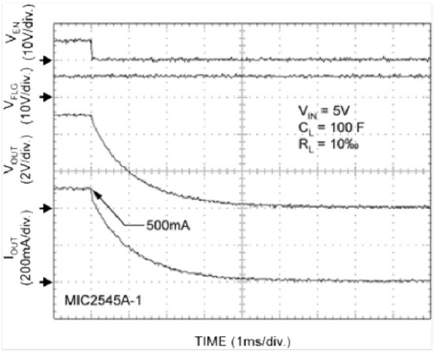

FIGURE 5-2: *Turn-off Response.*

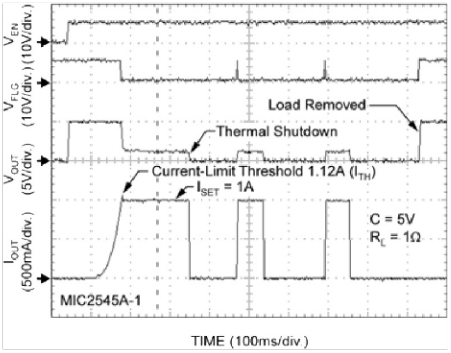

FIGURE 5-3: *Current-limit Response.*

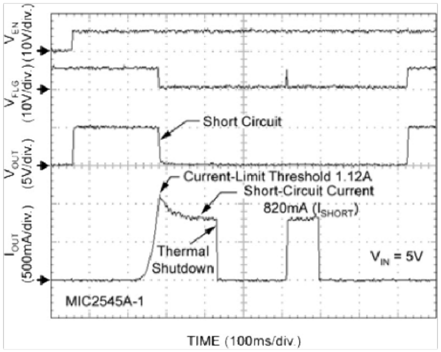

FIGURE 5-4: *Short-Circuit Response.*

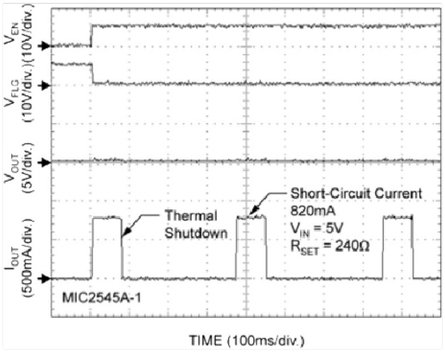

FIGURE 5-5: *Enable into Short Circuit.*

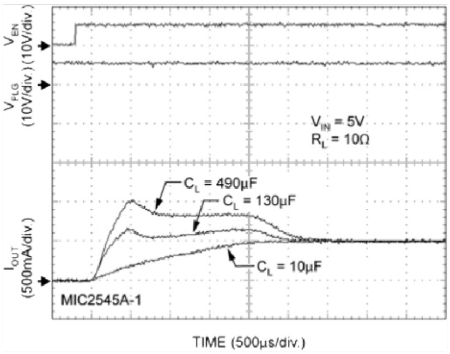

FIGURE 5-6: *Inrush Current Response.*

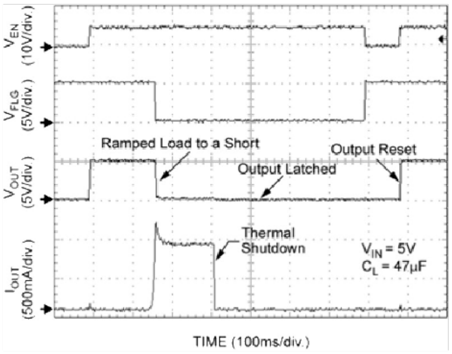

FIGURE 5-7: *Thermal Shutdown (Output Reset by Toggling Enable—MIC2549-1).*

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6.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 6-1.

TABLE 6-1: PIN FUNCTION TABLE

Pin Number (PDIP, SOIC)	Pin Number (TSSOP)	Pin Name	Description
1	1	EN	Enable (Input): Logic-compatible enable input (−1 version is active high, −2 version is active low). High input >1.8V typical; low input <1.4V typical. Do not float. MIC2549A only: Also resets thermal-shutdown latch.
2	3	FLG	Fault Flag (Output): Active-low, open-drain output. Indicates overcurrent or thermal shutdown. MIC2549A only: Latched low on thermal shutdown.
3	5	GND	Ground: Supply return.
4	7	ILIM	Current Limit: Sets current-limit threshold using an external resistor (R_{SET}) connected to ground. $76.8\Omega < R_{SET} < 459\Omega$.
5, 7	8, 12	IN	Supply Input: Output MOSFET drain. Also powers internal circuitry. Both IN pins must be externally connected together.
6, 8	10, 14	OUT	Switch Output: Output MOSFET source. Both OUT pins must be externally connected together.
—	2, 4, 6, 9, 11, 13	NC	Not internally connected.

7.0 FUNCTIONAL DESCRIPTION

The MIC2545A and MIC2549A are high-side N-channel switches available with active-high or active-low enable inputs. Fault conditions turn off or inhibit turn-on of the output transistor and activate the open-drain error flag transistor making it sink current to ground.

7.1 Input and Output

IN is the power supply connection to the logic circuitry and the drain of the output MOSFET. OUT is the source of the output MOSFET. In a typical circuit, current flows from IN to OUT toward the load. If V_{OUT} is greater than V_{IN}, current will flow from OUT to IN since the switch is bidirectional when enabled. The output MOSFET and driver circuitry are also designed to allow the MOSFET source to be externally forced to a higher voltage than the drain ($V_{OUT} > V_{IN}$) when the switch is disabled. In this situation, the MIC2545A/49A avoids undesirable current flow from OUT to IN. Both IN pins must be connected together, and both OUT pins must be connected together.

7.2 Thermal Shutdown

Thermal shutdown shuts off the output MOSFET and signals the fault flag if the die temperature exceeds 135°C. The switch can be prevented from turning on by 10°C of hysteresis until the die temperature drops to 125°C. Overtemperature detection functions only when the switch is enabled.

The MIC2549A features an internal latch which causes the part to remain off after thermal shutdown until a reset pulse is provided via the enable pin (pin1). While in current-limit, the thermal shutdown latch prevents on/off cycling of the output. Refer to Figure 3-4 and Figure 3-5 for timing diagrams. The flag remains low until reset.

7.3 Enable Input

EN must be driven logic high or logic low, or be pulled high or low for a clearly defined input. Floating the input may cause unpredictable operation. EN should not be allowed to go negative with respect to GND.

7.4 Current-Limit Operation

The current limit is user adjustable with an external set resistor. Current limiting in the range of 500 mA to 3A is available with a set point accuracy of better than ±30% (±20% for I_{SET} 1 to 2.5A). The current-limit circuit prevents damage to the output MOSFET and external load.

The current-limit response of the MIC2545A/49A is based on the type of load that is applied to the output and is defined in three parts:

1. The first mode of operation is where the device enters a constant-current mode preventing further increases in output current. The value of this current, I_{LIMIT}, is defined by the value of R_{SET} as explained further in this section.
2. When a short circuit is applied to the output of an enabled device the output current immediately folds back to a value less than I_{LIMIT} called I_{SHORT}. This further protects the load and reduces device power dissipation. Refer to Figure 4-12 for details.
3. When a load is increased, the output current will proportionally increase up to the current-limit threshold, I_{TH}, as shown in Figure 5-3. The device in this case will supply current slightly higher than the current-limit set point defined by R_{SET}. As the load is increased further the current folds back to I_{LIMIT}.

The nominal current-limit value, I_{LIMIT}, is set with an external resistor between ILIM (Pin 4) and GND (Pin 3). For a desired current-limit, the value of the external set resistor is given by Equation 7-1:

EQUATION 7-1:

$$R_{SET} = \left(\frac{230}{I_{LIMIT}}\right)$$

Where:

$$76.8\Omega < R_{SET} < 459\Omega$$

Refer to Figure 4-11 for more details.

Current through R_{SET} increases with output current. The voltage across R_{SET} could be monitored with a high-impedance comparator to provide an indication of output current. R_{SET} should be between 76.8Ω and 459Ω (1% resister value).

7.5 Fault Flag

FLG is an N-channel, open-drain MOSFET output. The fault-flag is active (low) for current-limit or thermal shutdown conditions. The flag output MOSFET is capable of sinking a 10 mA load to typically 100 mV above ground. For applications with V_{IN} = 3.6V, it is recommended that flag current be limited to 5 mA or less.

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8.0 APPLICATION INFORMATION

8.1 Supply Filtering

A 0.1 µF to 1 µF bypass capacitor from IN to GND, located near the MIC2545A and MIC2549A, is strongly recommended to control supply transients. Without a bypass capacitor, an output short may cause sufficient ringing on the input (from supply lead inductance) to damage internal control circuitry.

Input transients must not exceed the absolute maximum supply voltage (V_{IN} (max.) = 6V) even for a short duration.

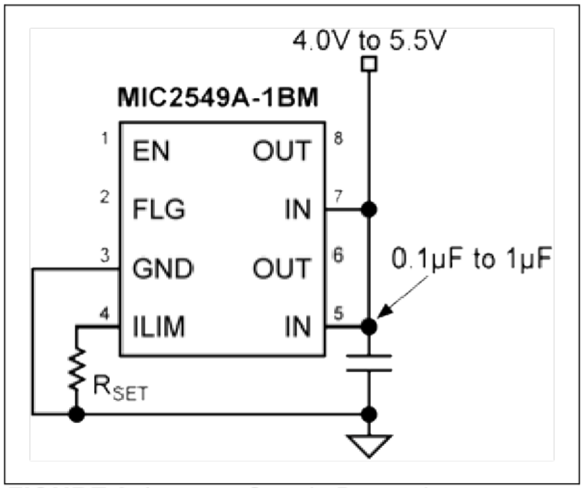

FIGURE 8-1: *Supply Bypassing.*

8.2 Power Dissipation

The device's junction temperature depends on several factors such as the load, PCB layout, ambient temperature, and package type. Equations that can be used to calculate power dissipation and junction temperature are found below.

Calculation of power dissipation can be accomplished by Equation 8-1:

EQUATION 8-1:

$$P_D = R_{DS(ON)} \times (I_{OUT})^2$$

To relate this to junction temperature, Equation 8-2 can be used:

EQUATION 8-2:

$$T_J = P_D \times \theta_{JA} + T_A$$

Where:

T_J	Junction temperature
T_A	Ambient temperature
θ_{JA}	The thermal resistance of the package

8.3 Transient Overcurrent Filter

The inrush current from the connection of a heavy capacitive load may cause the fault flag to fall for 10µs to 200 µs while the switch is in a constant-current mode, charging the capacitance. Adding an optional series resistor-capacitor (R_{SET2}) in parallel with R_{SET}, as shown in Figure 8-2, allows the transient current-limit to be set to a different value than steady state. A typical USB hot-plug inrush is 2A to 3A for 10 µs to 20 µs. If R_{SET} is 435Ω (530 mA), an R_{SET2} of 88Ω (2.5A) and C_{SET} of 1 µF (RC ≈ 90 µs) allows transient surge of 3A to pass for 90 µs without tripping the overcurrent flag (FLG).

8.4 USB Power Dissipations

The MIC2545A is ideal for meeting USB power distribution requirements. Figure 8-2 depicts a USB Host application. R_{SET} should be set to a value providing a current-limit >500 mA. The accurate current-limit of the MIC2545A will reduce power supply current requirements. Also, fast reaction to short-circuit faults prevent voltage droop in mobile PC applications.

8.5 Printed Circuit Board Hot-Plug

The MIC2545A/49A is an ideal inrush current-limiter suitable for hot-plug applications. Due to the integrated charge pump, the MIC2545A/49A presents a high impedance when off and slowly becomes a low impedance as it turns on.

This “soft start” feature effectively isolates power supplies from highly-capacitive loads by reducing inrush current during hot-plug events. Figure 8-3 shows how the MIC2545A may be used in a hot-plug application.

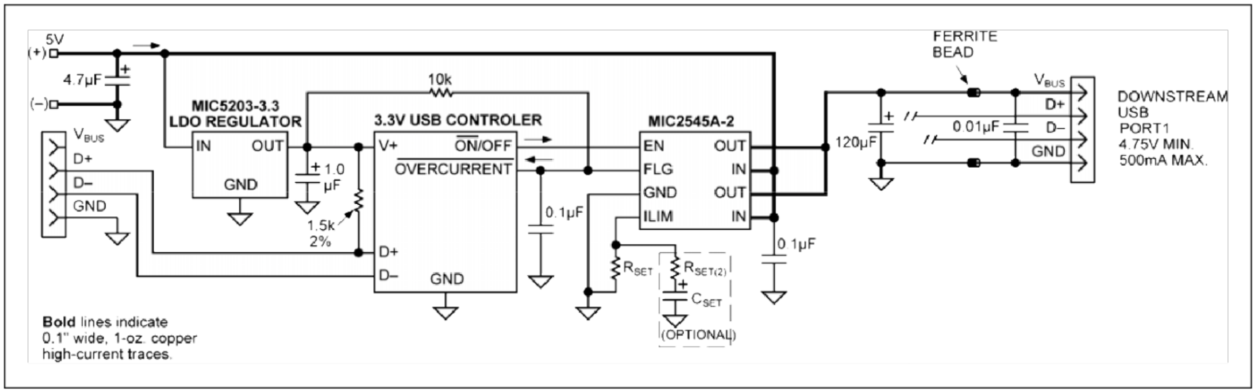

FIGURE 8-2: *USB Host Application.*

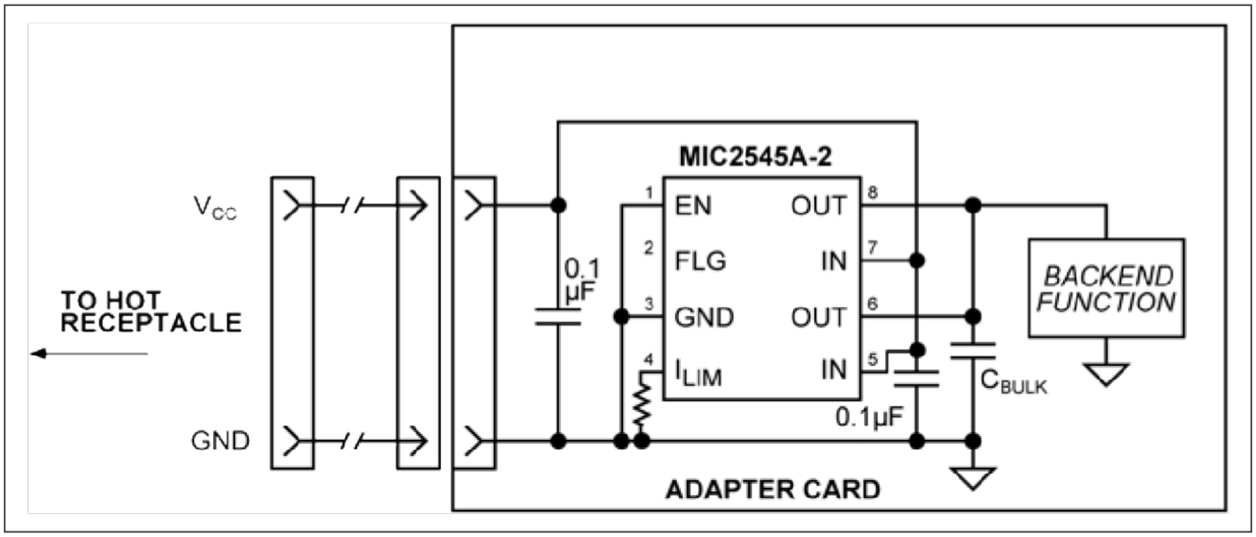

FIGURE 8-3: *Hot-plug Application.*

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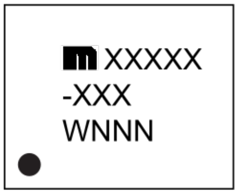
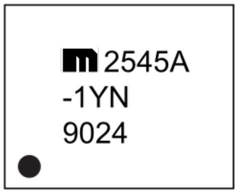
9.0 PACKAGING INFORMATION

9.1 Package Marking Information

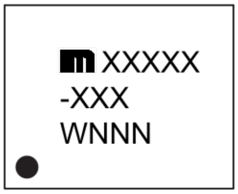
8-Lead PDIP*



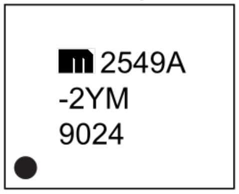
Example



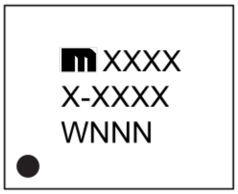
8-Lead SOIC*



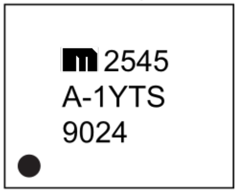
Example



14-Lead TSSOP*



Example



PACKAGE MARKING DRAWING SYMBOLS LEGEND

Symbol	Definition
XX . . . X	Product code or customer-specific information. (Note 1, Note 2)
YYWW	Date code, where YY is the last 2 digits of calendar year and WW is the work week (i.e., week of January 1 is week 01). (Note 3)
M	Month of assembly (if applicable). January is represented by “A” and each month thereafter follows the order of the alphabet through “L” for December.
NNN	Alphanumeric traceability code. (Note 3, Note 4)
ⓔ3	Pb-free JEDEC designator for Matte Tin (Sn).
*	Indicates this package is Pb-free. The Pb-free JEDEC designator (the symbol in the row above this one) 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 1: If the full Microchip part number cannot fit on one line, it will be carried over to the next line, limiting the number of available characters for customer-specific information. The package may or may not include the corporate logo.

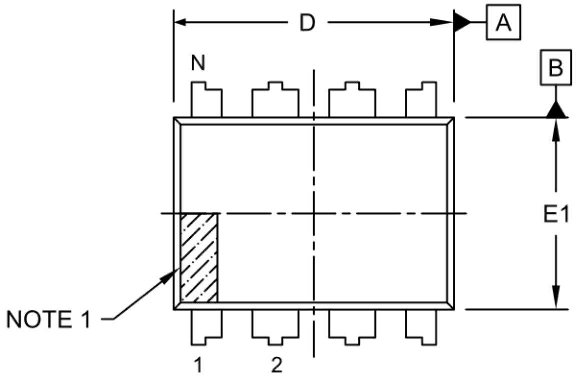
2: Any underbar (_) and/or overbar (‾) symbols shown in a package marking drawing may not be to scale.

3: If the full date code (YYWW) and the alphanumeric traceability code (NNN)—usually marked together on the last or only line of a package marking as the seven-character YYWWNNN—cannot fit on the package together, the codes will be truncated based on the number of available character spaces, as follows:
6 characters = YWWNNN; 5 characters = WWNNN; 4 characters = WNNN; 3 characters = NNN;
2 characters = NN; 1 character = N.

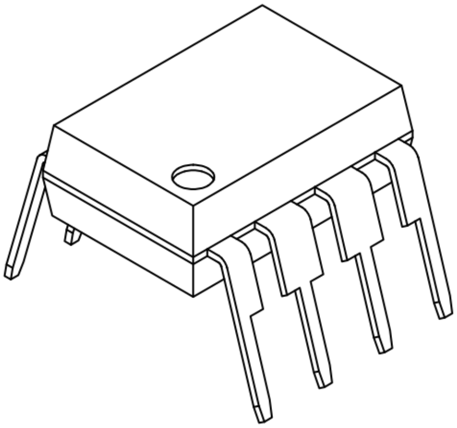
4: Some products might have a “Y” symbol at the end of the last or only line in a package marking, usually at the end of the alphanumeric traceability code (NNN or truncated versions), to indicate the product is Pb-free.

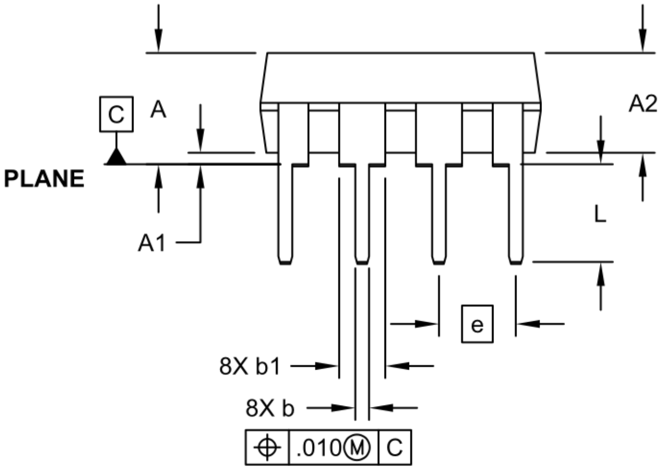
8-Lead 300 mil PDIP [C4X] Package Outline and Recommended Land Pattern

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

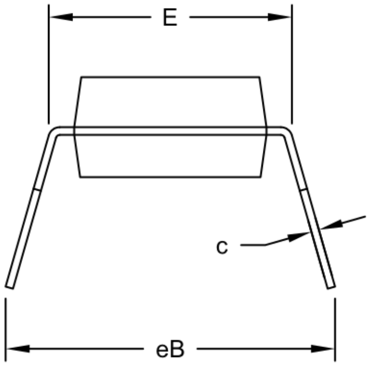


TOP VIEW





SIDE VIEW



END VIEW

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8-Lead 300 mil PDIP [C4X] Package Outline and Recommended Land Pattern

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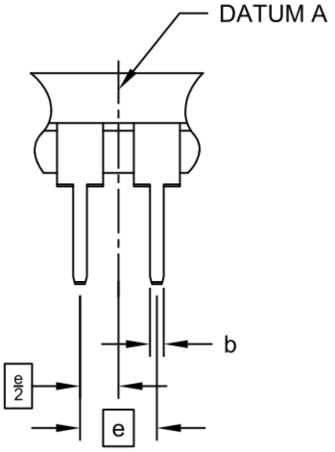
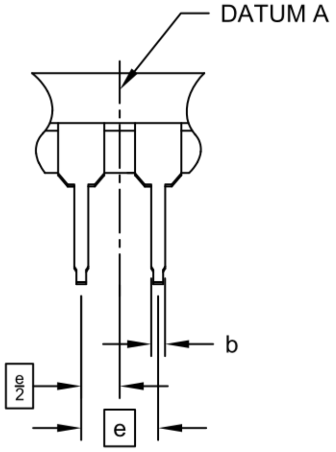



ALTERNATE LEAD DESIGN
(NOTE 5)

Units		INCHES		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N	8		
Pitch	e	.100 BSC		
Top to Seating Plane	A	-	-	.210
Molded Package Thickness	A2	.115	.130	.195
Base to Seating Plane	A1	.015	-	-
Shoulder to Shoulder Width	E	.290	.310	.325
Molded Package Width	E1	.240	.250	.280
Overall Length	D	.348	.365	.400
Tip to Seating Plane	L	.115	.130	.150
Lead Thickness	c	.008	.010	.015
Upper Lead Width	b1	.040	.060	.070
Lower Lead Width	b	.014	.018	.022
Overall Row Spacing §	eB	-	-	.430

Notes:

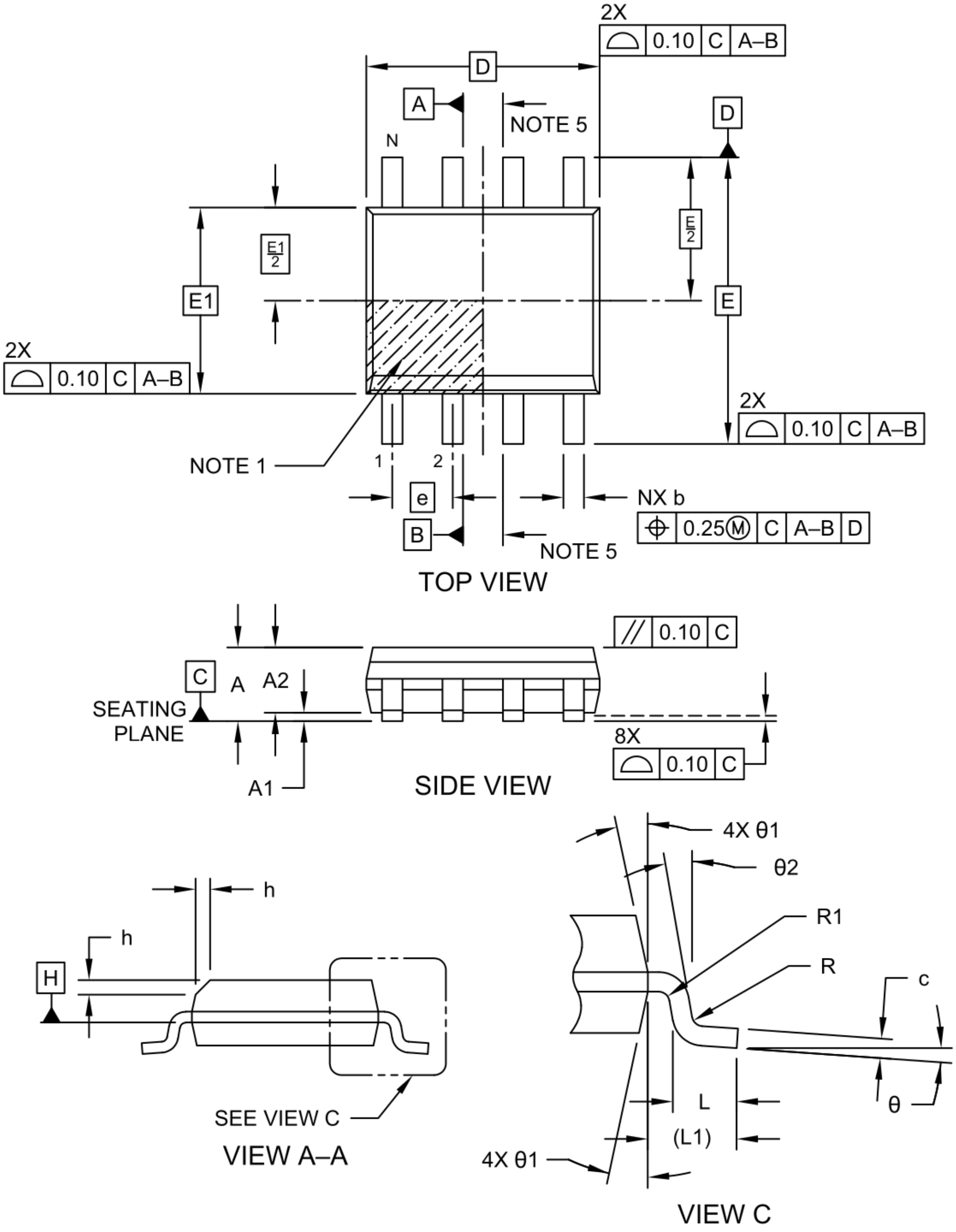
1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. § Significant Characteristic
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" per side.
4. Dimensioning and tolerancing per ASME Y14.5M

   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
5. Lead design above seating plane may vary, based on assembly vendor.

Microchip Technology Drawing No. C04-018-C4X Rev G Sheet 2 of 2

8-Lead 3.90 mm SOIC [3BX] 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



Microchip Technology Drawing No. C04-057-3BX Rev K Sheet 1 of 2

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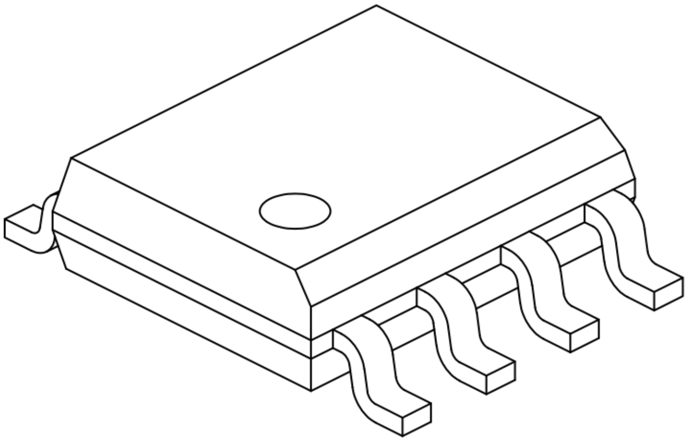
8-Lead 3.90 mm SOIC [3BX] Package Outline and Recommended Land Pattern

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



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N	8		
Pitch	e	1.27 BSC		
Overall Height	A	–	–	1.75
Molded Package Thickness	A2	1.25	–	-
Standoff §	A1	0.10	–	0.25
Overall Width	E	6.00 BSC		
Molded Package Width	E1	3.90 BSC		
Overall Length	D	4.90 BSC		
Chamfer (Optional)	h	0.25	–	0.50
Foot Length	L	0.40	–	1.27
Footprint	L1	1.04 REF		
Lead Thickness	c	0.17	–	0.25
Lead Width	b	0.31	–	0.51
Lead Bend Radius	R	0.07	–	–
Lead Bend Radius	R1	0.07	–	–
Foot Angle	θ	0°	–	8°
Mold Draft Angle	θ1	5°	–	15°
Lead Angle	θ2	0°	–	–

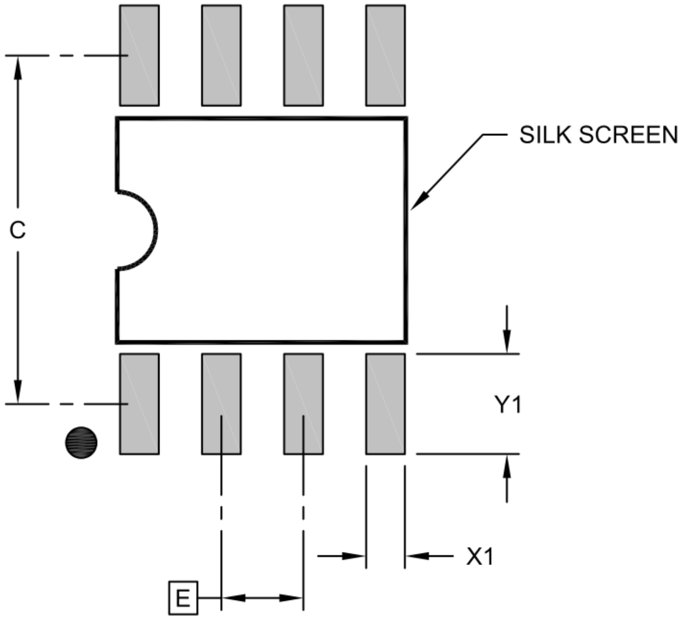
Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. § Significant Characteristic
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
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.
5. Datums A & B to be determined at Datum H.

Microchip Technology Drawing No. C04-057-3BX Rev K Sheet 2 of 2

8-Lead 3.90 mm SOIC [3BX] 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



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	1.27 BSC		
Contact Pad Spacing	C		5.40	
Contact Pad Width (X8)	X1			0.60
Contact Pad Length (X8)	Y1			1.55

Notes:

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

Microchip Technology Drawing C04-2057-3BX Rev K

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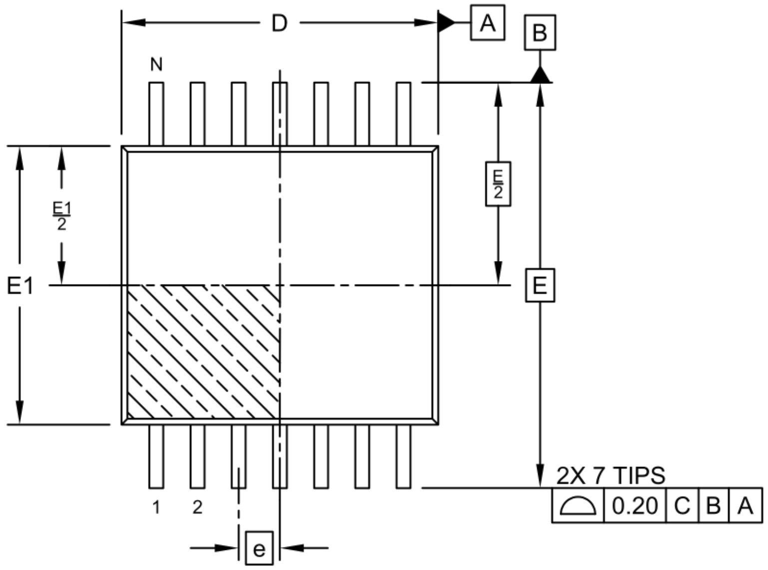
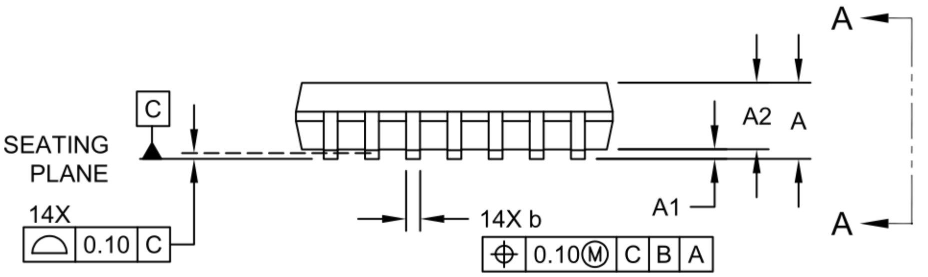
14-Lead 4.4 mm TSSOP [D4X] Package Outline and Recommended Land Pattern

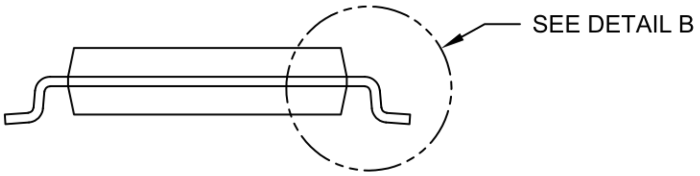
Note:	For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW



VIEW A–A

Microchip Technology Drawing C04-087-D4X Rev F Sheet 1 of 2

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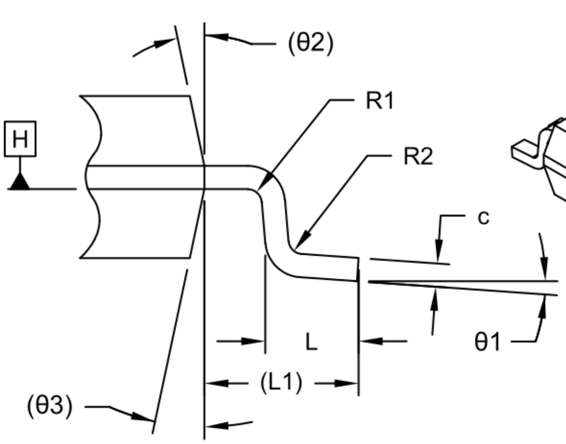
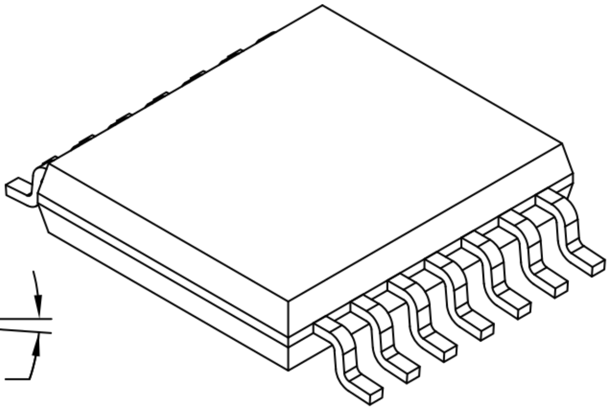
14-Lead 4.4 mm TSSOP [D4X] Package Outline and Recommended Land Pattern

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



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	–

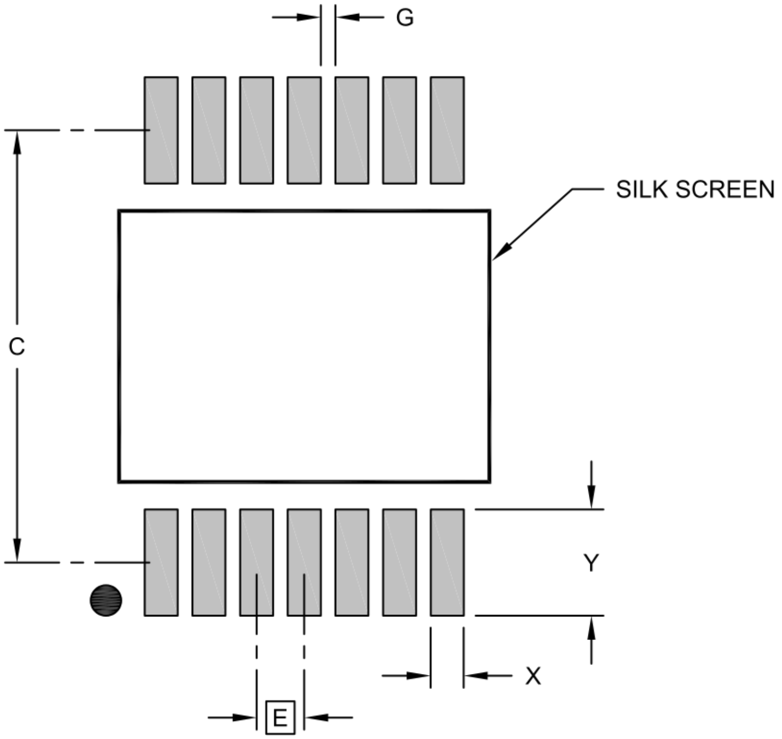
Notes:

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-D4X Rev F Sheet 2 of 2

14-Lead 4.4 mm TSSOP [D4X] 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



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 (X14)	X			0.45
Contact Pad Length (X14)	Y			1.45
Contact Pad to Contact Pad (X12)	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-D4X Rev F

NOTES:

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APPENDIX A: REVISION HISTORY

Revision A (July 2024)

- Converted Micrel document MIC2545A/49A to Microchip data sheet DS20006921A.
- Minor text changes throughout.

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NOTES:

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PRODUCT IDENTIFICATION SYSTEM

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

Part #	-X	X	XX	-XX
Device	Enable	Junction Temp. Range	Package	Media Type

Device:	MIC2545A MIC2549A		Programmable Current-Limit High-Side Switch
Enable:	-1	=	Active High
	-2	=	Active Low
Junction Temp. Range:	Y	=	–40°C to +85°C
Package:	N	=	8-Lead PDIP
	M	=	8-Lead SOIC
	TS	=	14-Lead TSSOP
Media Type:	<blank>	=	50/Tube (N package option only)
	<blank>	=	95/Tube (M package option only)
	<blank>	=	94/Tube (TS package option only)
	-TR	=	2500/Reel

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 options.

Examples:

a)	MIC2549A-1YN:	MIC2549A, Active High Enable, –40°C to +85°C Junction Temp. Range, 8-Lead PDIP, 50/Tube
b)	MIC2545A-2YM:	MIC2549A, Active Low Enable, –40°C to +85°C Junction Temp. Range, 8-Lead SOIC, 95/Tube
c)	MIC2545A-1YTS:	MIC2549A, Active High Enable, –40°C to +85°C Junction Temp. Range, 14-Lead TSSOP, 94/Tube
d)	MIC2545A-1YM-TR:	MIC2549A, Active High Enable, –40°C to +85°C Junction Temp. Range, 8-Lead SOIC, 2500/Reel
e)	MIC2545A-1YTS-TR:	MIC2549A, Active High Enable, –40°C to +85°C Junction Temp. Range, 14-Lead TSSOP, 2500/Reel
f)	MIC2549A-1YM:	MIC2549A, Active High Enable, –40°C to +85°C Junction Temp. Range, 8-Lead SOIC, 95/Tube
g)	MIC2549A-2YTS:	MIC2549A, Active Low Enable, –40°C to +85°C Junction Temp. Range, 14-Lead TSSOP, 94/Tube

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