MIC5239

Low Quiescent Current 500 mA µCap LDO Regulator

Features

- Ultra-Low Quiescent Current (I_Q = 23 µA @ I_O = 100 µA)
- Continuous 500 mA Output Current
- Wide Input Range: 2.3V to 30V
- Low Dropout Voltage: 350 mV @ 500 mA
- ±1.0% Initial Output Accuracy
- Stable with Ceramic or Tantalum Output Capacitor
- Logic Compatible Enable Input
- Low Output Voltage Error Flag Indicator
- Overcurrent Protection
- Thermal Shutdown
- Reverse-Leakage Protection
- Reverse-Battery Protection
- High-Power SOIC-8, MSOP-8, and SOT-223 Packages

Applications

- USB Power Supply
- Keep-Alive Supply in Notebook and Portable Personal Computers
- Logic Supply from High Voltage Batteries
- Automotive Electronics
- Battery-Powered Systems

General Description

The MIC5239 is a low quiescent current, µCap low-dropout regulator. With a maximum operating input voltage of 30V and a quiescent current of 23 µA, it is ideal for supplying keep-alive power in systems with high voltage batteries.

Capable of 500 mA output, the MIC5239 has a dropout voltage of only 350 mV. It can provide high output current for applications such as USB.

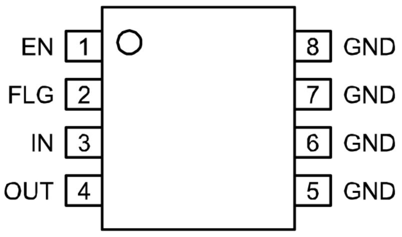
As a µCap LDO, the MIC5239 is stable with either a ceramic or a tantalum output capacitor. It only requires a 3.3 µF output capacitor for stability.

The MIC5239 includes a logic compatible enable input and an undervoltage error flag indicator. Other features of the MIC5239 include thermal shutdown, current limit, overvoltage shutdown, reverse-leakage protection, and reverse-battery protection.

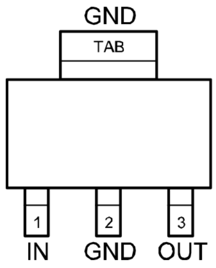
Available in the thermally enhanced SOIC-8, MSOP-8, and SOT-223, the MIC5239 comes in fixed 1.5V, 1.8V, 2.5V, 3.0V, 3.3V, and 5.0V, and adjustable voltages. For other output voltages, contact Microchip.

Package Types

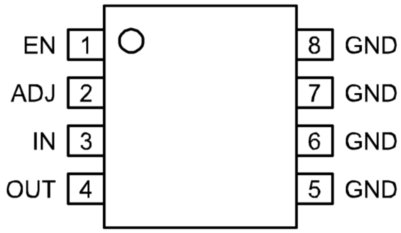
MIC5239, Fixed
8-Lead SOIC (M)
8-Lead MSOP (MM)
(Top View)



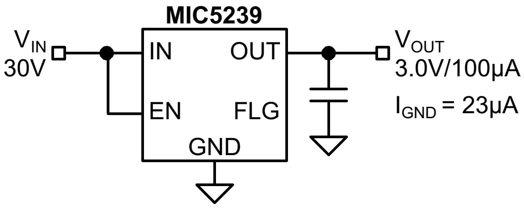
MIC5239
3-Lead SOT-223 (S)
(Top View)



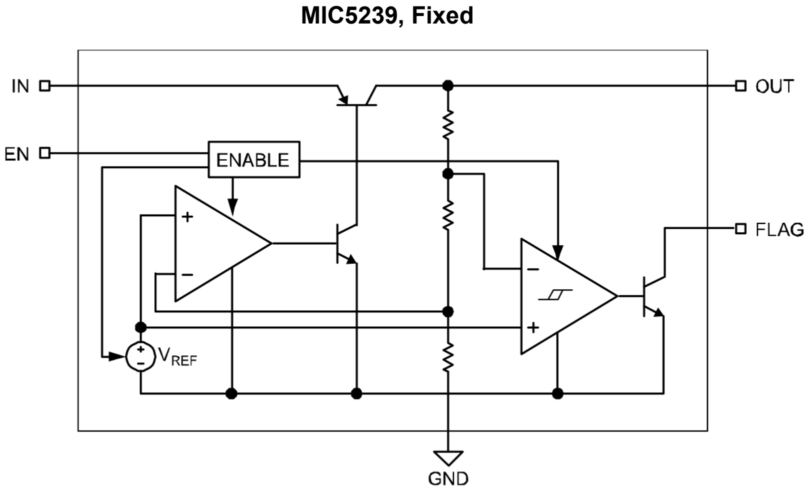
MIC5239, Adj.
8-Lead SOIC (M)
8-Lead MSOP (MM)
(Top View)

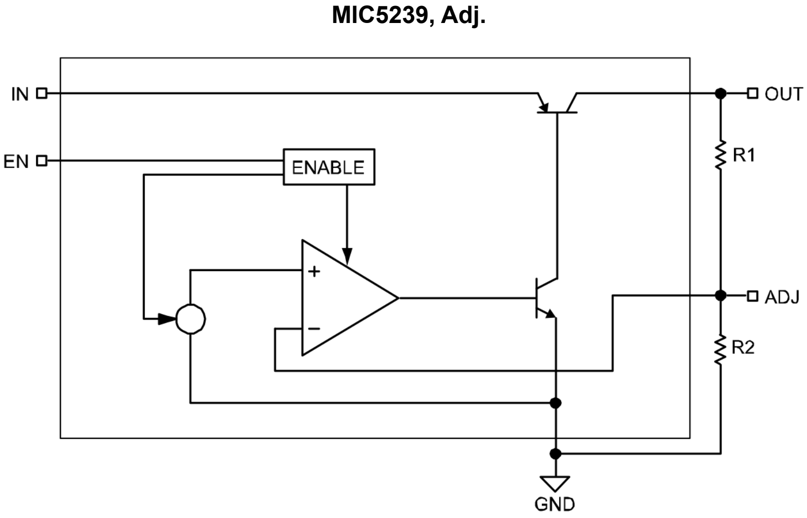


Typical Application Circuit



Functional Block Diagram





1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Supply Voltage (V_{IN}) .... –20V to +32V
Enable Input Voltage (V_{EN}) .... –0.3V to +32V
Power Dissipation (P_D) (Note 1) .... Internally Limited
ESD Rating (Note 2) (SOT-223).......... 2 kV
ESD Rating (Note 2) (8-Lead MSOP) .... 1.5 kV

Operating Ratings ‡

Supply Voltage (V_{IN}) .... +2.3V to +30V
Enable Input Voltage (V_{EN}) .... 0V to +30V

† 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: The maximum allowable power dissipation of any T_A (ambient temperature) is $P_{D(MAX)} = (T_{J(MAX)} – T_A) ÷ θ_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown. The $θ_{JA}$ of the MIC5239-x.xYMM (all versions) is 80°C/W, the MIC5239-x.xYM (all versions) is 63°C/W, and the MIC5239-x.xYS (all versions) is 50°C/W mounted on a PC board, see “Thermal Characteristics” for further details.

2: Devices are inherently ESD sensitive. Handling precautions required. Human body model: 1.5 kΩ in series with 100 pF.

ELECTRICAL CHARACTERISTICS

Electrical Characteristics: $V_{IN} = V_{OUT}$ + 1V; V_{EN} ≥ 2.0V; I_{OUT} = 100 µA; T_J = +25°C, **bold** values valid for –40°C ≤ T_J ≤ +125°C; unless noted. (Note 1)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Output Voltage Accuracy	V_{OUT}	–1	—	1	%	Variation from nominal V_{OUT}
		–2	—	**2**		
Line Regulation	$ΔV_{OUT}/V_{OUT}$	—	0.06	0.5	%	$V_{IN} = V_{OUT}$ + 1V to 30V
Load Regulation	$ΔV_{OUT}/V_{OUT}$	—	15	30	mV	I_{OUT} = 100 µA to 500 mA, Note 2
Dropout Voltage, Note 3	ΔV	—	50	—	mV	I_{OUT} = 100 µA
		—	260	350		I_{OUT} = 150 mA
		—	—	**400**		
		—	350	—		I_{OUT} = 500 mA
Ground Pin Current	I_{GND}	—	23	40	µA	V_{EN} ≥ 2.0V, I_{OUT} = 100 µA
		—	—	**45**		
		—	1.3	5	mA	V_{EN} ≥ 2.0V, I_{OUT} = 150 mA
		—	8.5	15		V_{EN} ≥ 2.0V, I_{OUT} = 500 mA
Ground Pin Shutdown Current	$I_{GND(SHDN)}$	—	0.1	1	µA	V_{EN} ≤ 0.6V, V_{IN} = 30V
Short-Circuit Current	I_{SC}	—	850	**1200**	mA	V_{OUT} = 0V
Output Noise	e_n	—	160	—	$µV_{RMS}$	10 Hz to 100 kHz, V_{OUT} = 3.0V, C_L = 3.3 µF

ELECTRICAL CHARACTERISTICS (CONTINUED)

Electrical Characteristics: $V_{IN} = V_{OUT}$ + 1V; V_{EN} ≥ 2.0V; I_{OUT} = 100 µA; T_J = +25°C, **bold** values valid for –40°C ≤ T_J ≤ +125°C; unless noted. (Note 1)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
FLAG Output						
Low Threshold	V_{FLG}	—	94	—	%	% of V_{OUT}
High Threshold		—	95	—		
FLAG Output Low Voltage	V_{OL}	—	150	—	mV	$V_{IN} = V_{OUT(NOM)} – 0.12V_{OUT}$, I_{OL} = 200 µA
FLAG Output Leakage Current	I_{LEAK}	—	0.1	—	µA	V_{OH} = 30V
Enable Input						
Input Low Voltage	V_{IL}	—	—	0.6	V	Regulator off
Input High Voltage	V_{IH}	2.0	—	—	V	Regulator on
Enable Input Current	I_{IN}	–1.0		1.0	µA	V_{EN} = 0.6V, regulator off
		–2.0	0.01	**2.0**		
		—	0.15	1.0		V_{EN} = 2.0V, regulator on
		—	—	**2.0**		
		—	0.5	2.5		V_{EN} = 30V, regulator on
		—	—	**5.0**		

Note 1: Specification for packaged product only.

2: Regulation is measured at constant junction temperature using pulse testing with a low duty-cycle. Changes in output voltage due to heating effects are covered by the specification for thermal regulation.

3: Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1.0V differential.

TEMPERATURE SPECIFICATIONS (Note 1)

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Temperature Ranges						
Junction Temperature Range	T_J	–40	—	+125	°C	—
Storage Temperature Range	T_S	–65	—	+150	°C	—
Lead Temperature	—	—	—	+260	°C	Soldering, 5 sec.
Package Thermal Resistance						
Thermal Resistance, MSOP 8-Ld	θ_{JA}	—	80	—	°C/W	—
Thermal Resistance, SOT-223 3-Ld	θ_{JA}	—	50	—	°C/W	—

Note 1: The maximum allowable power dissipation is a function of ambient temperature, the maximum allowable junction temperature and the thermal resistance from junction to air (i.e., T_A, T_J, θ_{JA}). Exceeding the maximum allowable power dissipation will cause the device operating junction temperature to exceed the maximum +125°C rating. Sustained junction temperatures above +125°C can impact the device reliability.

2.0 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.

V_{OUT} = 3V

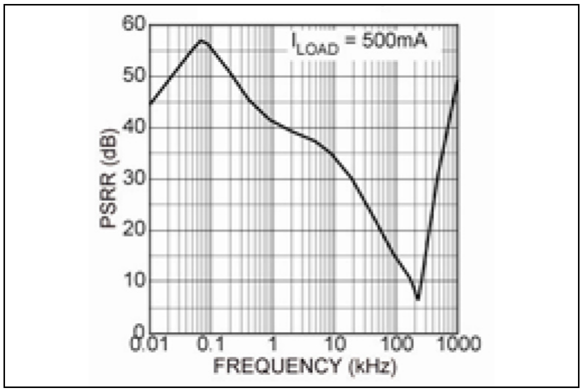


FIGURE 2-1: *Power Supply Rejection Ratio.*

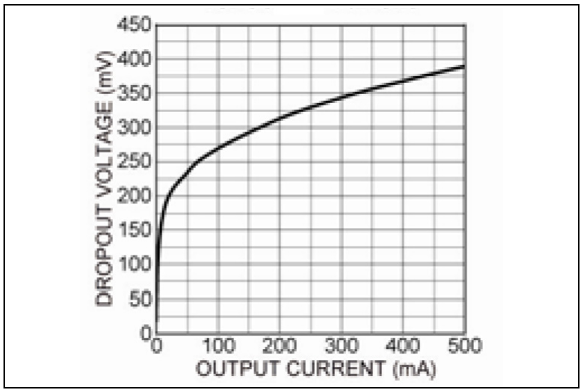


FIGURE 2-2: *Dropout Voltage vs. Output Current.*

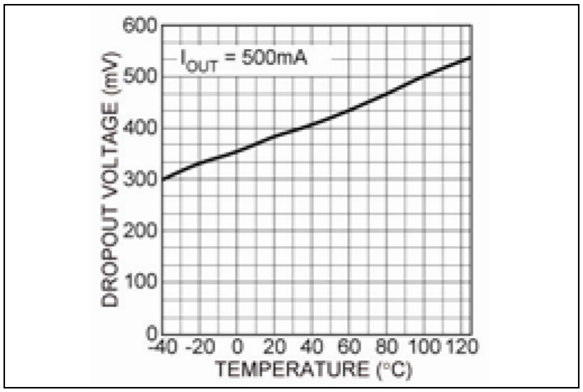


FIGURE 2-3: *Dropout Voltage vs. Temperature.*

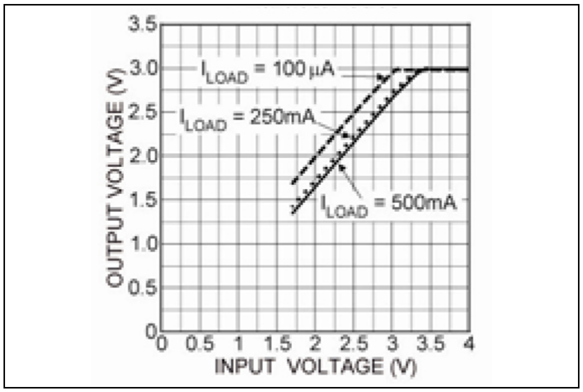


FIGURE 2-4: *Dropout Characteristics.*

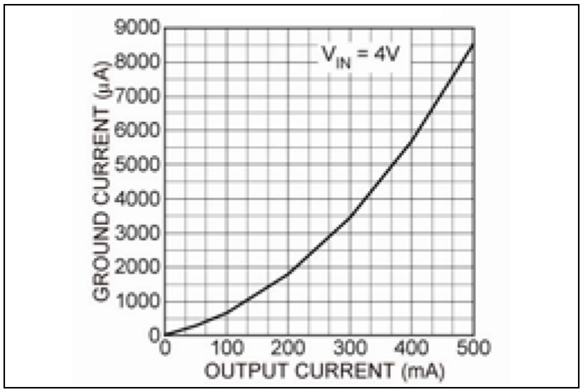


FIGURE 2-5: *Ground Pin Current vs. Output Current.*

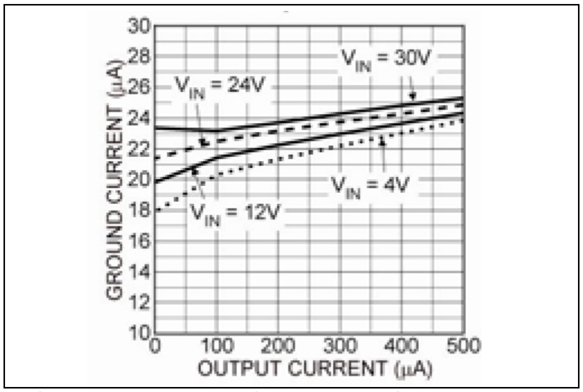


FIGURE 2-6: *Ground Pin Current vs. Output Current.*

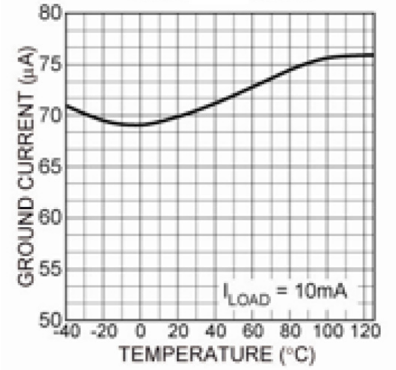


FIGURE 2-7: Ground Pin Current vs. Temperature.

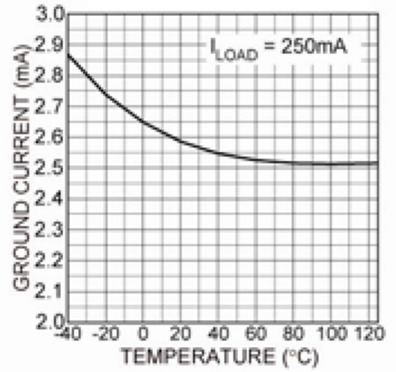


FIGURE 2-8: Ground Pin Current vs. Temperature.

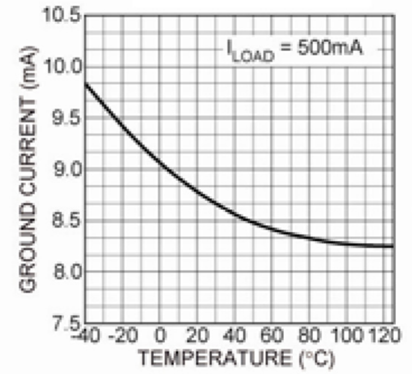


FIGURE 2-9: Ground Pin Current vs. Temperature.

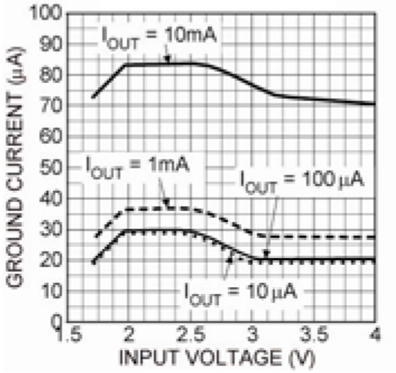


FIGURE 2-10: Ground Pin Current vs. Input Voltage.

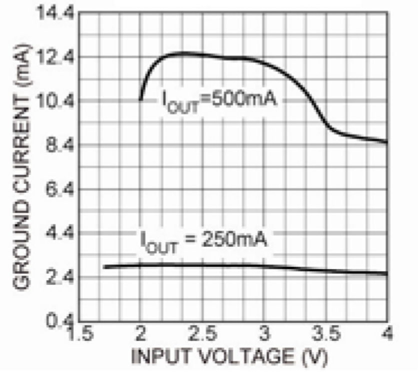


FIGURE 2-11: Ground Pin Current vs. Input Voltage.

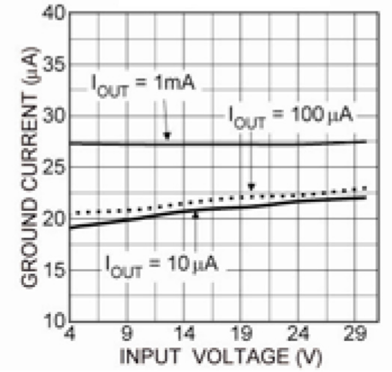


FIGURE 2-12: Ground Pin Current vs. Input Voltage.

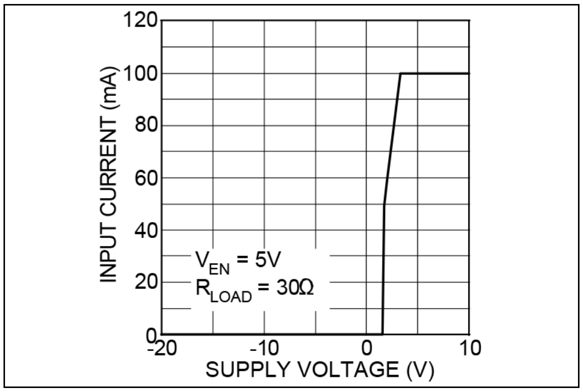


FIGURE 2-13: *Input Current.*

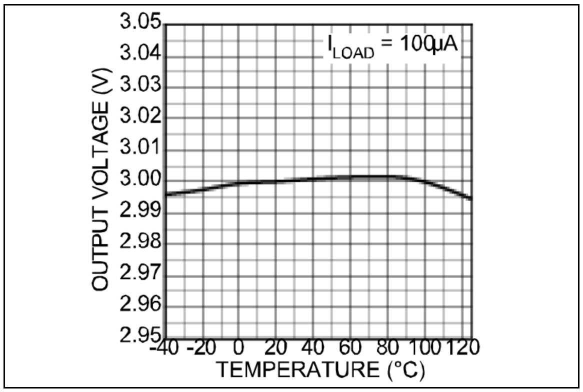


FIGURE 2-14: *Output Voltage vs. Temperature.*

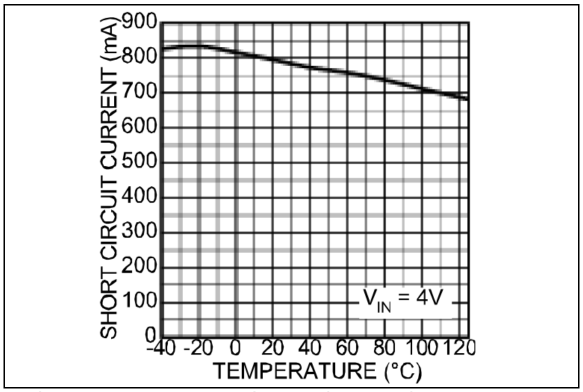


FIGURE 2-15: *Short-Circuit Current.*

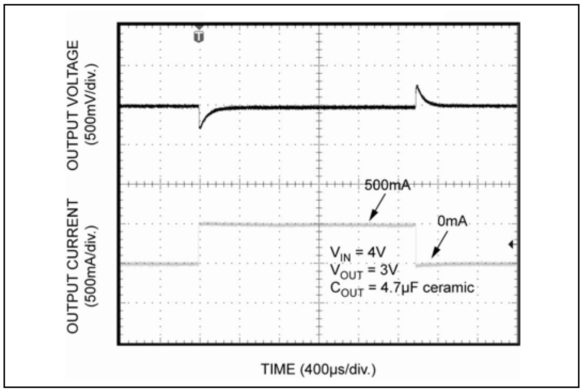


FIGURE 2-16: *Load Transient Response.*

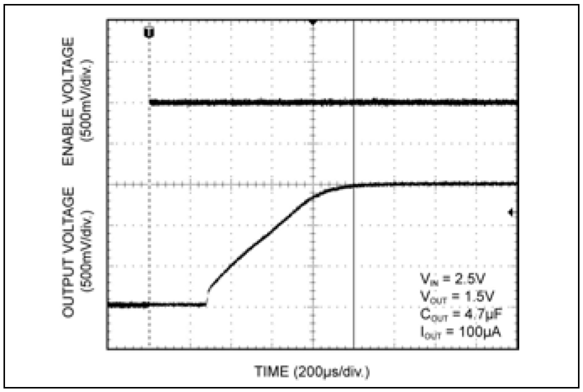


FIGURE 2-17: *Enable Turn-On.*

3.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 3-1.

TABLE 3-1: PIN FUNCTION TABLE

Pin Number MSOP/SOIC	Pin Number SOT-223	Pin Name	Description
2 (Fixed)	—	FLG	Error FLAG (Output): Open-collector output is active low when the output is out of regulation due to insufficient input voltage or excessive load. An external pull-up resistor is required.
2 (Adj.)	—	ADJ	Adjustable Feedback Input: Connect to voltage divider network.
3	1	IN	Power Supply Input.
4	3	OUT	Regulated Output.
1	—	EN	Enable (input): Logic low = shutdown; logic high = enabled.
5, 6, 7, 8	2	GND	Ground: Pins 5, 6, 7, and 8 are internally connected in common via the leadframe.

4.0 APPLICATIONS INFORMATION

The MIC5239 provides all of the advantages of the MIC2950: wide input voltage range, and reversed-battery protection, with the added advantages of reduced quiescent current and smaller package. Additionally, when disabled, quiescent current is reduced to 0.1 µA.

4.1 Enable

A low on the enable pin disables the part, forcing the quiescent current to less than 0.1 µA. Thermal shutdown and the error flag are not functional while the device is disabled. The maximum enable bias current is 2 µA for a 2.0V input. An open-collector pull-up resistor tied to the input voltage should be set low enough to maintain 2V on the enable input. Figure 4-1 shows an open-collector output driving the enable pin through a 200 kΩ pull-up resistor tied to the input voltage.

In order to avoid output oscillations, slow transitions from low-to-high should be avoided.

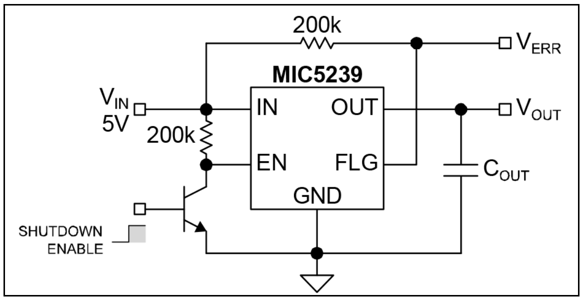


FIGURE 4-1: Remote Enable.

4.2 Input Capacitor

An input capacitor may be required when the device is not near the source power supply or when supplied by a battery. Small, surface mount ceramic capacitors can be used for bypassing. Larger values may be required if the source supply has high ripple.

4.3 Output Capacitor

The MIC5239 has been designed to minimize the effect of the output capacitor ESR on the closed loop stability. As a result, ceramic or film capacitors can be used at the output. Figure 4-2 displays a range of ESR values for a 10 µF capacitor. Virtually any 10 µF capacitor with an ESR less than 3.4Ω is sufficient for stability over the entire input voltage range. Stability can also be maintained throughout the specified load and line conditions with 4.7 µF film or ceramic capacitors.

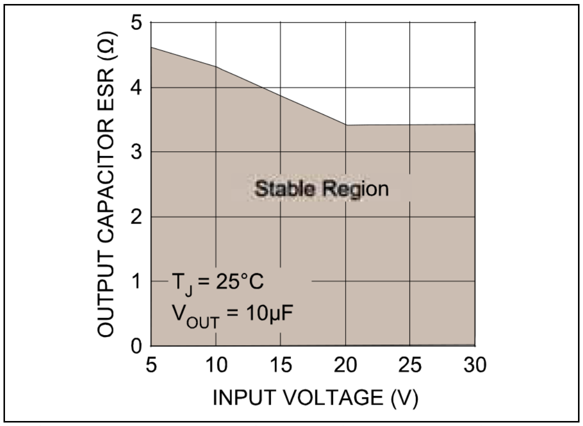


FIGURE 4-2: Output Capacitor ESR.

4.4 Error Detection Comparator Output

The FLAG pin is an open-collector output which goes low when the output voltage drops 5% below its internally programmed level. It senses conditions such as excessive load (current limit), low input voltage, and overtemperature conditions. Once the part is disabled via the enable input, the error flag output is not valid. Overvoltage conditions are not reflected in the error flag output. The error flag output is also not valid for input voltages less than 2.3V.

The error output has a low voltage of 400 mV at a current of 200 µA. In order to minimize the drain on the source used for the pull-up, a value of 200 kΩ to 1 MΩ is suggested for the error flag pull-up. This will guarantee a maximum low voltage of 0.4V for a 30V pull-up potential. An unused error flag can be left unconnected.

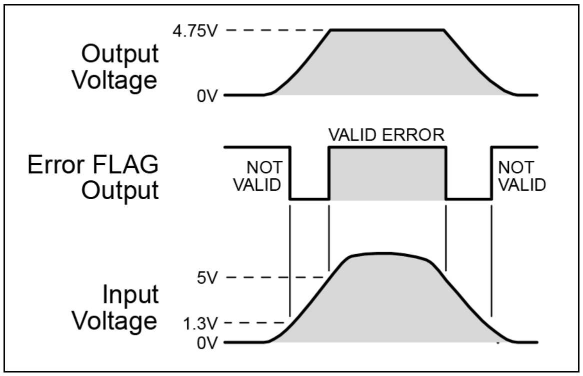


FIGURE 4-3: Error FLAG Output Timing.

4.5 Thermal Shutdown

The MIC5239 has integrated thermal protection. This feature is only for protection purposes. The device should never be intentionally operated near this temperature as this may have detrimental effects on the life of the device. The thermal shutdown may become inactive while the enable input is transitioning from a high to a low. When disabling the device via the enable pin, transition from a high to low quickly. This will insure that the output remains disabled in the event of a thermal shutdown.

4.6 Current Limit

Figure 4-4 displays a method for reducing the steady state short-circuit current. The duration that the supply delivers current is set by the time required for the error flag output to discharge the 4.7 µF capacitor tied to the enable pin. The off time is set by the 200 kΩ resistor as it recharges the 4.7 µF capacitor, enabling the regulator. This circuit reduces the short-circuit current from 800 mA to 40 mA while allowing for regulator restart once the short is removed.

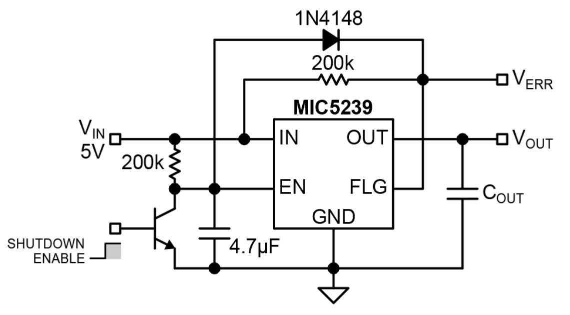


FIGURE 4-4: Remote Enable with Short-Circuit Current Foldback.

4.7 Thermal Characteristics

The MIC5239 is a high input voltage device, intended to provide 500 mA of continuous output current in two very small profile packages. The power MSOP-8 allows the device to dissipate about 50% more power than their standard equivalents.

4.7.1 POWER MSOP-8 THERMAL CHARACTERISTICS

One of the secrets of the MIC5239's performance is its power MSOP-8 package featuring half the thermal resistance of a standard MSOP-8 package. Lower thermal resistance means more output current or higher input voltage for a given package size.

Lower thermal resistance is achieved by joining the four ground leads with the die attach paddle to create a single piece electrical and thermal conductor. This concept has been used by MOSFET manufacturers for years, proving very reliable and cost effective for the user.

Thermal resistance consists of two main elements, θ_{JC} (junction-to-case thermal resistance) and θ_{CA} (case-to-ambient thermal resistance). See Figure 4-5. θ_{JC} is the resistance from the die to the leads of the package. θ_{CA} is the resistance from the leads to the ambient air and it includes θ_{CS} (case-to-sink thermal resistance) and θ_{SA} (sink-to-ambient thermal resistance).

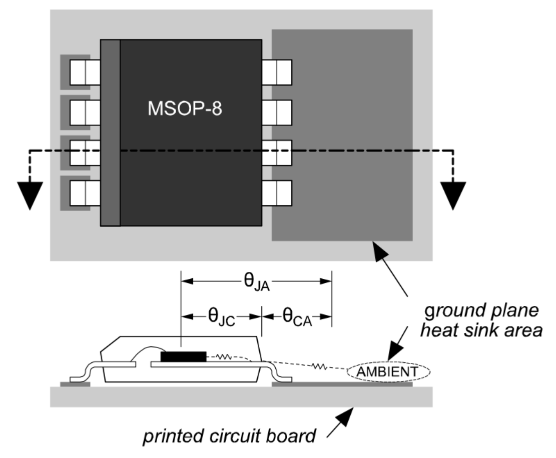


FIGURE 4-5: Thermal Resistance.

Using the power MSOP-8 reduces the θ_{JC} dramatically and allows the user to reduce θ_{CA}. The total thermal resistance, θ_{JA} (junction-to-ambient thermal resistance) is the limiting factor in calculating the maximum power dissipation capability of the device. Typically, the power MSOP-8 has a θ_{JC} of 80°C/W. This is significantly lower than the standard MSOP-8, which is typically 200°C/W. θ_{CA} is reduced because pins 5 through 8 can now be soldered directly to a ground plane that significantly reduces the case-to-sink thermal resistance and sink to ambient thermal resistance.

Low-dropout linear regulators from Microchip are rated to a maximum junction temperature of 125°C. It is important not to exceed this maximum junction temperature during operation of the device. To prevent this maximum junction temperature from being exceeded, the appropriate ground plane heatsink must be used.

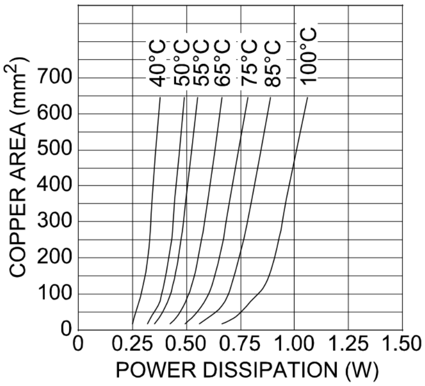


FIGURE 4-6: Copper Area vs. Power-MSOP Power Dissipation ($\Delta\theta_{JA}$).

Figure 4-6 shows copper area versus power dissipation with each trace corresponding to a different temperature rise above ambient.

From these curves, the minimum area of copper necessary for the part to operate safely can be determined. The maximum allowable temperature rise must be calculated to determine operation along which curve.

EQUATION 4-1:

$$\Delta T = T_{J(MAX)} - T_{A(MAX)}$$

Where:

$T_{J(MAX)}$ = 125°C

$T_{A(MAX)}$ = Maximum ambient operating temperature.

For example, the maximum ambient temperature is 50°C, the ΔT is determined as follows:

EQUATION 4-2:

$$\Delta T = 125°C - 50°C = 75°C$$

Using Figure 4-6, the minimum amount of required copper can be determined based on the required power dissipation. Power dissipation in a linear regulator is calculated as follows:

EQUATION 4-3:

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_{GND}$$

If we use a 3V output device and a 28V input at moderate output current of 25 mA, then the power dissipation is as follows:

EQUATION 4-4:

$$P_D = (28V - 3V) \times 25mA + 28V \times 250\mu A$$

$$P_D = 625mW + 7mW = 632mW$$

From Figure 4-6, the minimum amount of copper required to operate this application at a ΔT of 75°C is 110 mm^2.

4.7.2 QUICK METHOD

Determine the power dissipation requirements for the design along with the maximum ambient temperature at which the device will be operated. Refer to Figure 4-7, which shows safe operating curves for three different ambient temperatures: 25°C, 50°C, and 85°C. From these curves, the minimum amount of copper can be determined by knowing the maximum power dissipation required. If the maximum ambient temperature is 50°C and the power dissipation is 632 mW, the curve in Figure 4-7 shows that the required area of copper is 110 mm^2.

The θ_{JA} of this package is ideally 80°C/W, but it will vary depending upon the availability of copper ground plane to which it is attached.

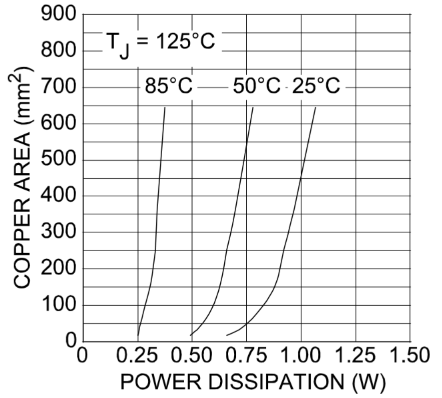


FIGURE 4-7: Copper Area vs. Power-MSOP Power Dissipation (T_A).

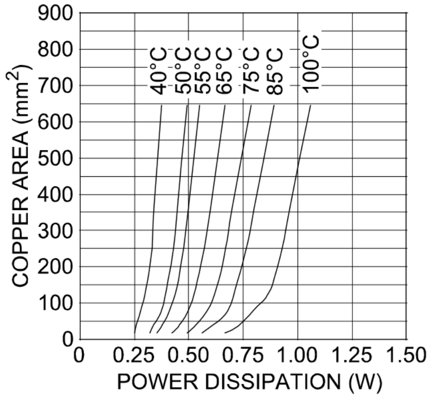


FIGURE 4-8: Copper Area vs. Power-SOIC Power Dissipation ($\Delta\theta_{JA}$).

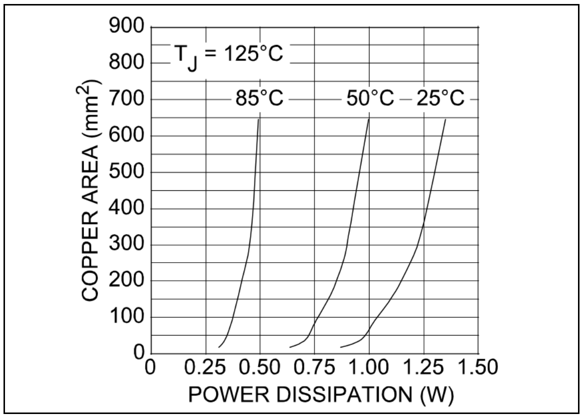


FIGURE 4-9: *Copper Area vs. Power-SOIC Power Dissipation (T_A).*

The same method of determining the heatsink area used for the power MSOP-8 can be applied directly to the power SOIC-8. The same two curves showing power dissipation versus copper area are reproduced for the power SOIC-8 and they can be applied identically.

4.8 Power SOIC-8 Thermal Characteristics

The power SOIC-8 package follows the same idea as the power MSOP-8 package, using four ground leads with the die attach paddle to create a single-piece electrical and thermal conductor, reducing thermal resistance and increasing power dissipation capability.

4.8.1 QUICK METHOD

Determine the power dissipation requirements for the design along with the maximum ambient temperature at which the device will be operated. Refer to Figure 4-9, which shows safe operating curves for three different ambient temperatures, 25°C, 50°C, and 85°C. From these curves, the minimum amount of copper can be determined by knowing the maximum power dissipation required. If the maximum ambient temperature is 50°C, and the power dissipation is 632 mW, the curve in Figure 4-9 shows that the required area of copper is less than 100 mm^2, when using the power SOIC-8.

4.9 Adjustable Regulator Application

The MIC5239YM can be adjusted from 1.24V to 20V by using two external resistors (Figure 4-10). The resistors set the output voltage based on the following equation:

EQUATION 4-5:

$$V_{OUT} = V_{REF} \times \left(1 + \frac{R1}{R2}\right)$$

Where:

V_{REF} = 1.23V

Feedback resistor R2 should be no larger than 300 kΩ.

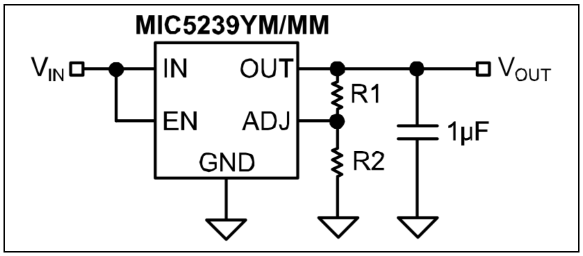
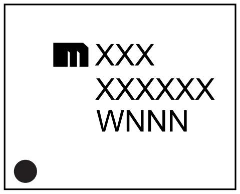


FIGURE 4-10: *Adjustable Voltage Application.*

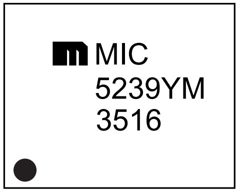
5.0 PACKAGING INFORMATION

5.1 Package Marking Information

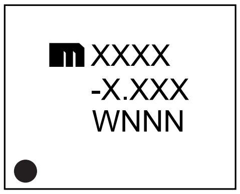
8-Lead SOIC, Adj.*



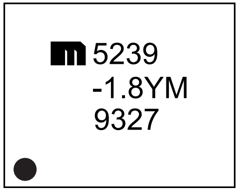
Example



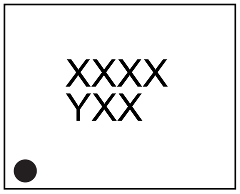
8-Lead SOIC, Fixed*



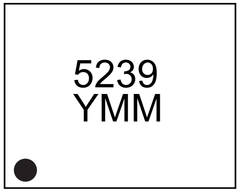
Example



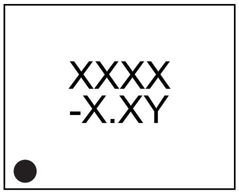
8-Lead MSOP, Adj.*



Example

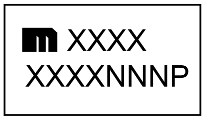


8-Lead MSOP, Fixed*



Example

3-Lead SOT-223*



Example

Legend:	XX...X	Product code or customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	ⓔ3	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator (ⓔ3) 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).

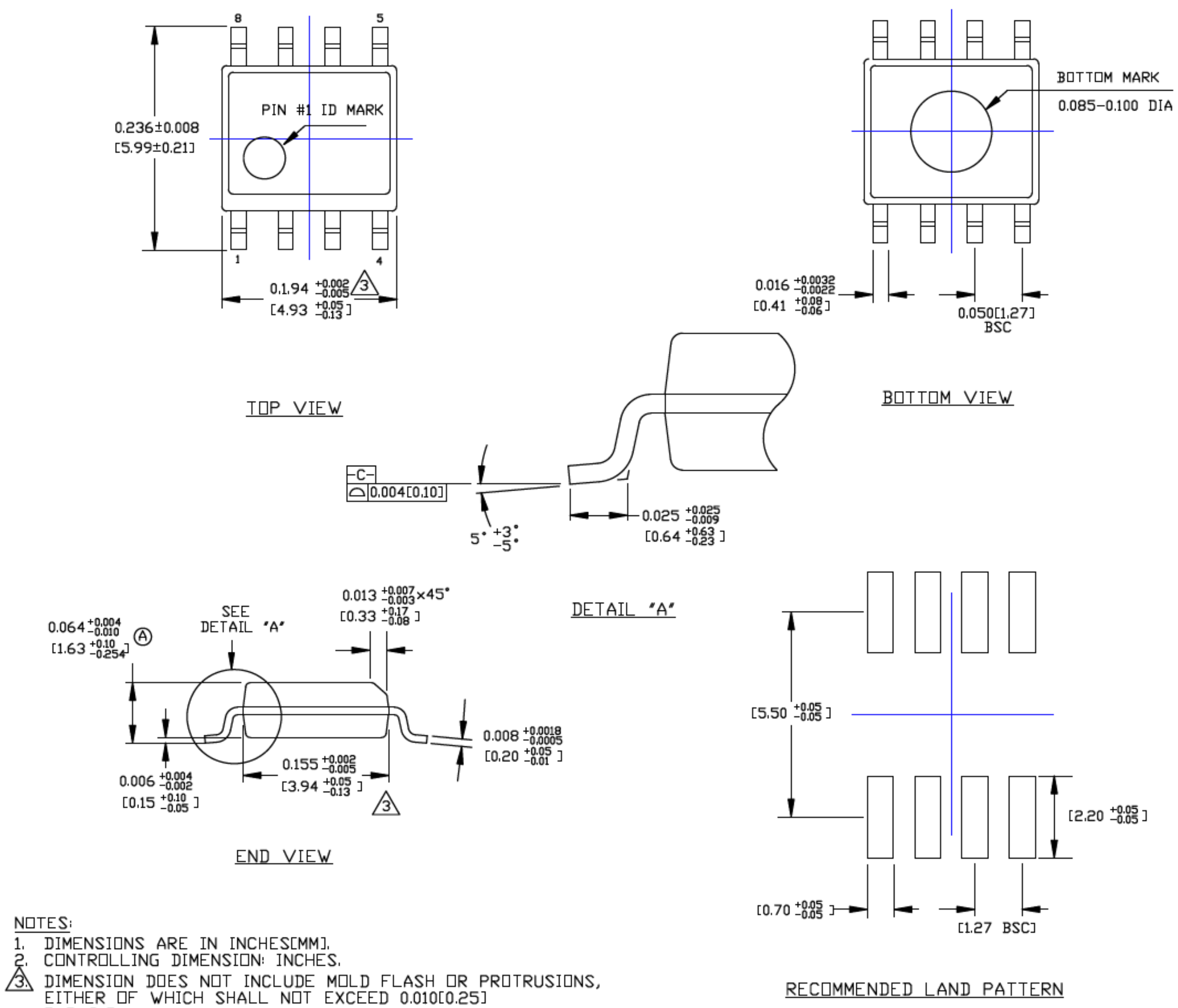
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or may not include the corporate logo.

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

8-Lead SOIC Package Outline and Recommended Land Pattern

TITLE
8 LEAD SOICN PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

DRAWING #	SOICN-8LD-PL-1	**UNIT**	INCH [MM]



NOTES:

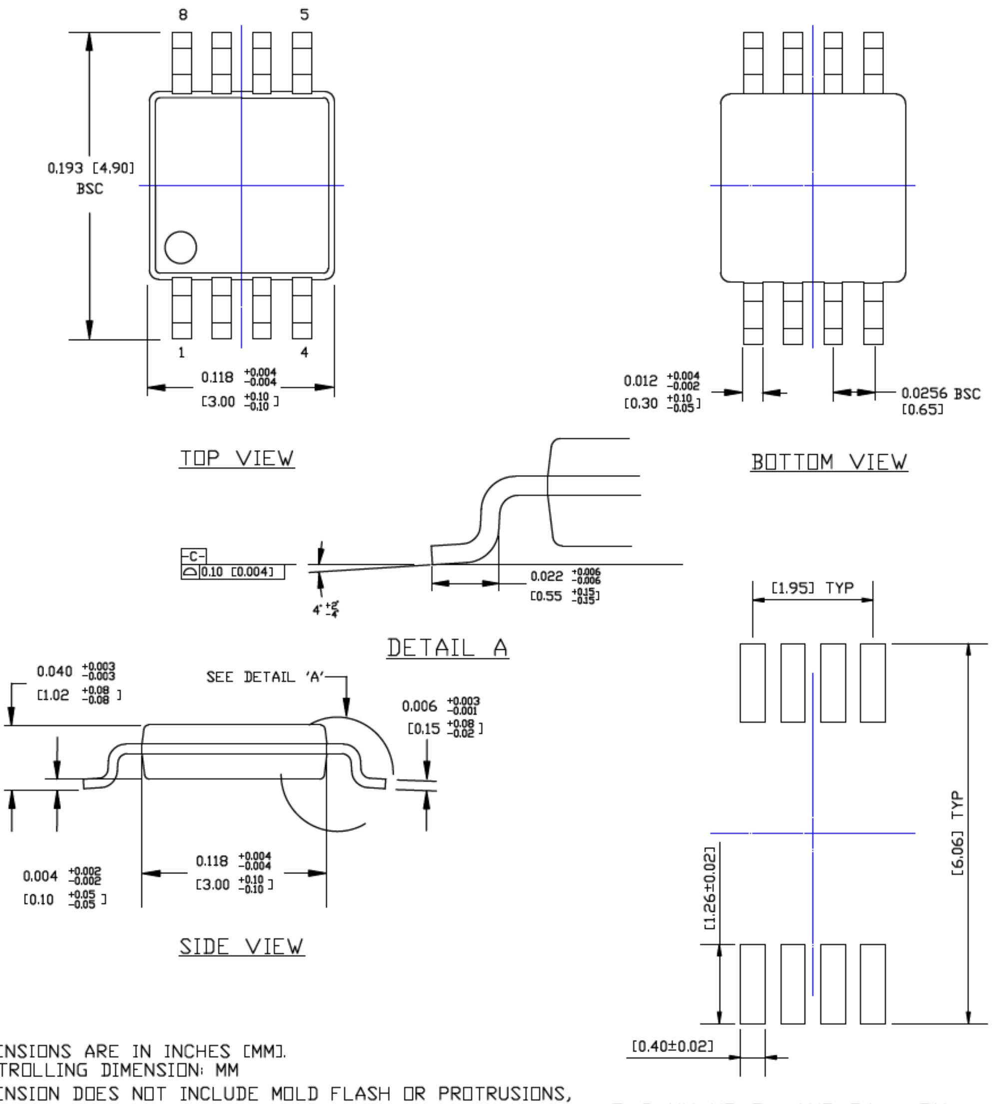
1. DIMENSIONS ARE IN INCHES[MM].
2. CONTROLLING DIMENSION: INCHES.
3. DIMENSION DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS, EITHER OF WHICH SHALL NOT EXCEED 0.010[0.25] PER SIDE.

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

8-Lead MSOP Package Outline and Recommended Land Pattern

TITLE
8 LEAD MSOP PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

DRAWING #	MSOP-8LD-PL-1	**UNIT**	INCH [MM]



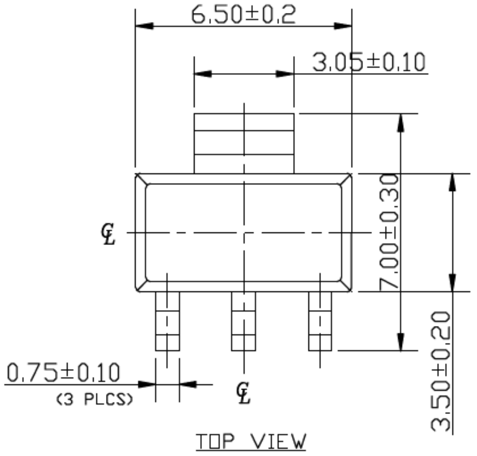
NOTES:
1. DIMENSIONS ARE IN INCHES [MM].
2. CONTROLLING DIMENSION: MM
3. DIMENSION DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS, EITHER OF WHICH SHALL NOT EXCEED 0.008 [0.20] PER SIDE.

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

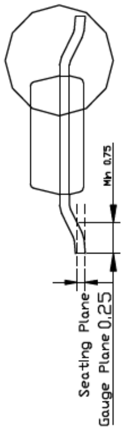
3-Lead SOT-223 Package Outline and Recommended Land Pattern

TITLE
3 LEAD SOT223 PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

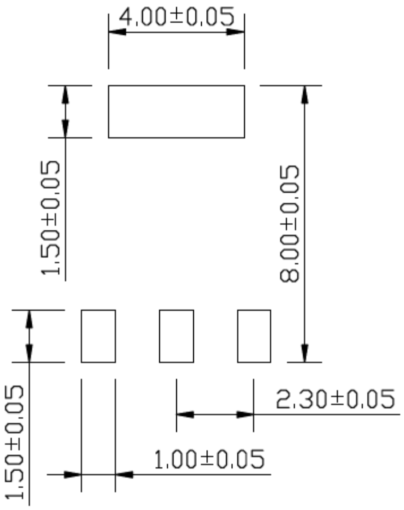
DRAWING #	SOT223-3LD-PL-1	**UNIT**	MM



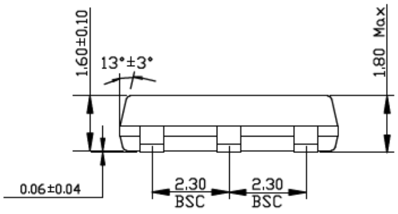
TOP VIEW



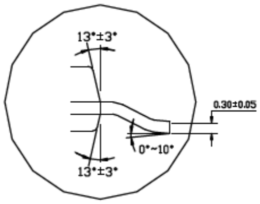
SIDE VIEW



RECOMMENDED
LAND PATTERN



SIDE VIEW



DETAILED VIEW

NOTE:

1. Dimensions and tolerances are as per ANSI Y14.5M, 1982.
2. Controlling dimension: Millimeters.
3. Dimensions are exclusive of mold flash and gate burr.
4. All specification comply to Jedec spec TO261 Issue C.

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

APPENDIX A: REVISION HISTORY

Revision A (June 2021)

- Converted Micrel document MIC5239 to Microchip data sheet DS20006544A.
- Minor text changes throughout.

NOTES:

PRODUCT IDENTIFICATION SYSTEM

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

PART No.	-X.X	X	X	-XX
Device	Output Voltage	Junction Temp. Range	Package	Media Type

Device: MIC5239: Low Quiescent Current 500 mA µCap LDO Regulator

Output Voltage:
1.5 = 1.5V
1.8 = 1.8V
2.5 = 2.5V
3.0 = 3.0V
3.3 = 3.3V
5.0 = 5.0V
<blank>= Adjustable (Not applicable to SOT-223 option)

Junction Temperature Range: Y = –40°C to +125°C

Package:
M = 8-Lead SOIC
MM = 8-Lead MSOP
S = 3-Lead SOT-223

Media Type:
<blank> = 78/Tube (SOT-223 Only)
<blank> = 95/Tube (SOIC Only)
<blank> = 100/Tube (MSOP Only)
TR = 2,500/Reel (All package options)

Examples:

a)	MIC5239-5.0YMM-TR:	MIC5239, 5.0V Output Voltage, –40°C to +125°C Temperature Range, 8-Lead MSOP, 2,500/Reel
b)	MIC5239YM:	MIC5239, Adj. Output Voltage, –40°C to +125°C Temperature Range, 8-Lead SOIC, 95/Tube
c)	MIC5239-1.8YS:	MIC5239, 1.8V Output Voltage, –40°C to +125°C Temperature Range, 3-Lead SOT-223, 78/Tube
d)	MIC5239YMM-TR:	MIC5239, Adj. Output Voltage, –40°C to +125°C Temperature Range, 8-Lead MSOP, 100/Tube
e)	MIC5239-3.0YM-TR:	MIC5239, 3.0V Output Voltage, –40°C to +125°C Temperature Range, 8-Lead SOIC, 2,500/Reel
f)	MIC5239-2.5YS-TR:	MIC5239, 2.5V Output Voltage, –40°C to +125°C Temperature Range, 3-Lead SOT-223, 2,500/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 option.

NOTES:

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- 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 and under normal conditions.
- There are dishonest and possibly illegal methods being used in attempts to breach the code protection features of the Microchip devices. We believe that these methods require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Attempts to breach these code protection features, most likely, cannot be accomplished without violating Microchip's intellectual property rights.
- Microchip is willing to work with any customer who is concerned about the integrity of its code.
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