



Product Change Notification / SYST-20SKSO824

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**Date:**

24-Aug-2021

**Product Category:**

Linear Regulators

**PCN Type:**

Document Change

**Notification Subject:**

Data Sheet - MIC5236 Data Sheet Document Revision

**Affected CPNs:**

[SYST-20SKSO824\\_Affected\\_CPN\\_08242021.pdf](#)

[SYST-20SKSO824\\_Affected\\_CPN\\_08242021.csv](#)

**Notification Text:**

SYST-20SKSO824

Microchip has released a new Product Documents for the MIC5236 Data Sheet of devices. If you are using one of these devices please read the document located at [MIC5236 Data Sheet](#).

**Notification Status:** Final

**Description of Change:**

- 1) Converted Micrel document MIC5236 to Microchip data sheet DS20006574A.
- 2) Minor text changes throughout.

**Impacts to Data Sheet:** None

**Reason for Change:** To Improve Productivity

**Change Implementation Status:** Complete

**Date Document Changes Effective:** 24 Aug 2021

**NOTE:** Please be advised that this is a change to the document only the product has not been changed.

**Markings to Distinguish Revised from Unrevised Devices:** N/A

## **Attachments:**

[MIC5236 Data Sheet](#)

Please contact your local [Microchip sales office](#) with questions or concerns regarding this notification.

## **Terms and Conditions:**

If you wish to receive Microchip PCNs via email please register for our PCN email service at our [PCN home page](#) select register then fill in the required fields. You will find instructions about registering for Microchips PCN email service in the [PCN FAQ](#) section.

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Affected Catalog Part Numbers (CPN)

MIC5236-2.5YM  
MIC5236-2.5YM-TR  
MIC5236-2.5YMM  
MIC5236-2.5YMM-TR  
MIC5236-3.0YM  
MIC5236-3.0YM-TR  
MIC5236-3.0YMM  
MIC5236-3.0YMM-TR  
MIC5236-3.3YM  
MIC5236-3.3YM-TR  
MIC5236-3.3YMM  
MIC5236-3.3YMM-TR  
MIC5236-5.0YM  
MIC5236-5.0YM-TR  
MIC5236-5.0YMM  
MIC5236-5.0YMM-TR  
MIC5236YM  
MIC5236YM-TR  
MIC5236YMM  
MIC5236YMM-TR

## Low Quiescent Current $\mu$ Cap LDO Regulator

### Features

- Ultra-Low Quiescent Current ( $I_Q = 20 \mu\text{A} @ I_O = 100 \mu\text{A}$ )
- Wide Input Range: 2.3V to 30V
- Low Dropout:
  - 230 mV @50 mA;
  - 300 mV @150 mA
- Fixed 2.5V, 3.0V, 3.3V, 5.0V, and Adjustable Outputs
- $\pm 1.0\%$  Initial Output Accuracy
- Stable with Ceramic or Tantalum Output Capacitor
- Load Dump Protection:  $-20\text{V}$  to  $+60\text{V}$  Input Transient Survivability
- Logic Compatible Enable Input
- Low Output Flag Indicator
- Overcurrent Protection
- Thermal Shutdown
- Reverse-Leakage Protection
- Reverse-Battery Protection
- High-Power SOIC-8 and MSOP-8 Package Options

### Applications

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

### General Description

The MIC5236 is a low quiescent current,  $\mu$ Cap low-dropout regulator. With a maximum operating input voltage of 30V and a quiescent current of 20  $\mu\text{A}$ , it is ideal for supplying keep-alive power in systems with high-voltage batteries.

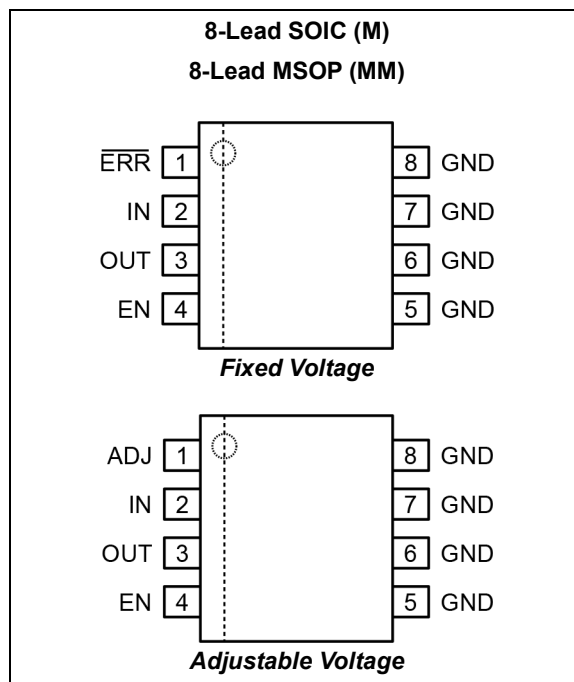
Capable of 150 mA output, the MIC5236 has a dropout voltage of only 300 mV. It can also survive an input transient of  $-20\text{V}$  to  $+60\text{V}$ .

As a  $\mu$ Cap LDO, the MIC5236 is stable with either a ceramic or a tantalum output capacitor. It only requires a 1.0  $\mu\text{F}$  output capacitor for stability.

The MIC5236 includes a logic compatible enable input and an undervoltage error flag indicator. Other features of the MIC5236 include thermal shutdown, current-limit, overvoltage shutdown, load-dump protection, reverse leakage protections, and reverse battery protection.

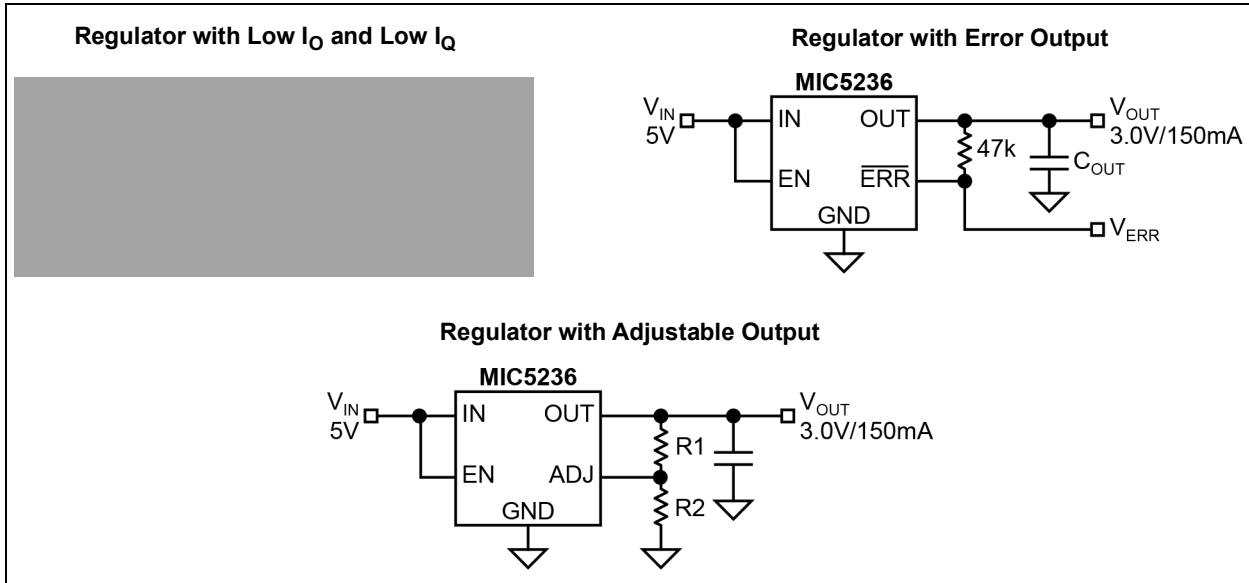
Available in the thermally enhanced SOIC-8 and MSOP-8, the MIC5236 comes in fixed 2.5V, 3.0V, 3.3V, 5.0V, and adjustable voltages. For other output voltages, contact Microchip.

### Package Types

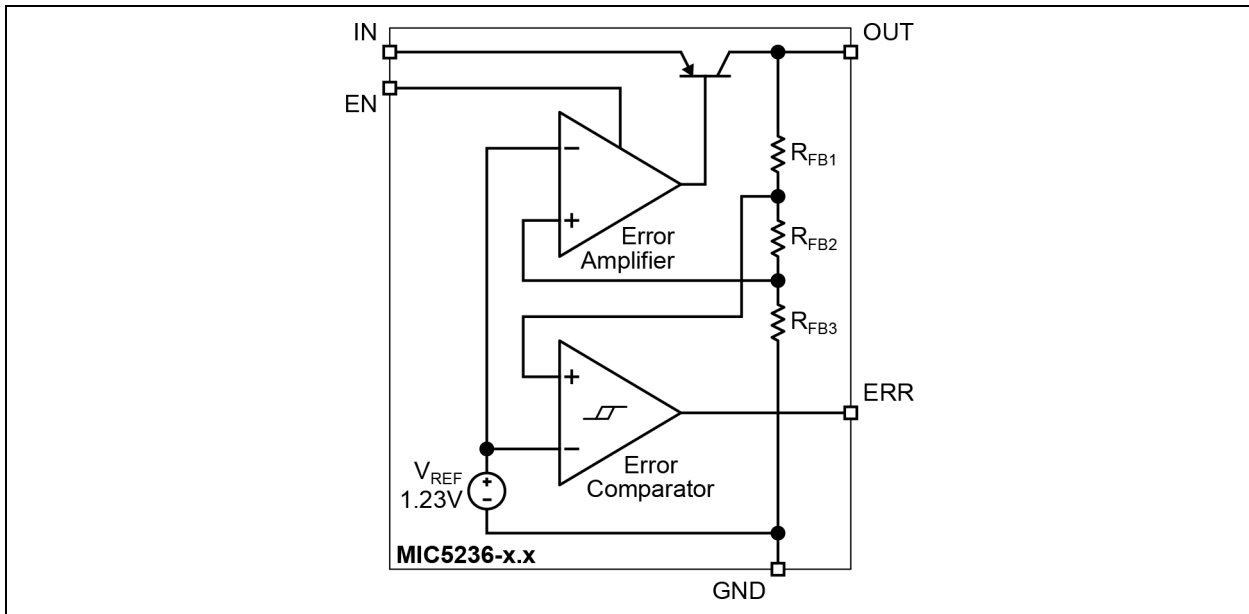


# MIC5236

## Typical Application Circuits



## Functional Block Diagram



## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings †

Supply Voltage ( $V_{IN}$ ), [Note 1](#) ..... –20V to +60V  
 Power Dissipation ( $P_D$ ), [Note 2](#) ..... Internally Limited  
 ESD Rating, [Note 3](#)

### Operating Ratings ‡

Supply Voltage ( $V_{IN}$ ) ..... + 2.3V 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 absolute maximum positive supply voltage (60V) must be of limited duration ( $\leq 100$  ms) and duty cycle ( $\leq 1\%$ ). The maximum continuous supply voltage is 30V.

**2:** The maximum allowable power dissipation of any  $T_A$  (ambient temperature) is  $P_{D(MAX)} = (T_{J(MAX)} - T_A) \div \theta_{JA}$ . Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown. The  $\theta_{JA}$  of the MIC5236-x.xYM (all versions) is 63°C/W, and the MIC5236-x.xYMM (all versions) is 80°C/W, mounted on a PC board (see [Package Thermal Resistance](#) for further details).

**3:** Devices are ESD sensitive. Handling precautions recommended. Human body model, 1.5 k $\Omega$  in series with 100pF.

## ELECTRICAL CHARACTERISTICS

**Electrical Characteristics:**  $V_{IN} = 6.0V$ ;  $V_{EN} = 2.0V$ ;  $C_{OUT} = 4.7 \mu F$ ,  $I_{OUT} = 100 \mu A$ ;  $T_J = 25^\circ C$ , **bold** values indicate  $-40^\circ C \leq T_J \leq +125^\circ C$ ; unless noted

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Output Voltage Accuracy	$V_{OUT}$	-1	—	1	%	Variation from nominal $V_{OUT}$
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	—	50	—	ppm/ $^\circ C$	<a href="#">Note 1</a>
Line Regulation	$\Delta V_{OUT}/V_{OUT}$	—	0.2	0.5	%	$V_{IN} = V_{OUT} + 1V$ to 30V
Load Regulation	$\Delta V_{OUT}/V_{OUT}$	—	0.15	0.3	%	$I_{OUT} = 100 \mu A$ to 50 mA, <a href="#">Note 2</a>
		—	0.3	0.6	%	
Dropout Voltage, <a href="#">Note 3</a>	$\Delta V$	—	50	<b>100</b>	mV	$I_{OUT} = 100 \mu A$
		—	230	<b>400</b>	mV	$I_{OUT} = 50$ mA
		—	270	—	mV	$I_{OUT} = 100$ mA
		—	300	<b>500</b>	mV	$I_{OUT} = 150$ mA
Ground Pin Current	$I_{GND}$	—	20	<b>30</b>	$\mu A$	$V_{EN} \geq 2.0V$ , $I_{OUT} = 100 \mu A$
		—	0.5	<b>0.8</b>	mA	$V_{EN} \geq 2.0V$ , $I_{OUT} = 50$ mA
		—	1.5	—	mA	$V_{EN} \geq 2.0V$ , $I_{OUT} = 100$ mA
		—	2.8	4.0	mA	$V_{EN} \geq 2.0V$ , $I_{OUT} = 150$ mA
		—	—	<b>5.0</b>	mA	
Ground Pin in Shutdown	$I_{GND(SHDN)}$	—	0.1	1	$\mu A$	$V_{EN} \leq 0.6V$ , $V_{IN} = 3$
Short Circuit Current	$I_{SC}$	—	260	<b>350</b>	mA	$V_{OUT} = 0V$
Output Noise	$e_n$	—	160	—	$\mu V_{rms}$	10 Hz to 100 kHz, $V_{OUT} = 3.0V$ , $C_L = 1.0 \mu F$

# MIC5236

## ELECTRICAL CHARACTERISTICS (CONTINUED)

**Electrical Characteristics:**  $V_{IN} = 6.0V$ ;  $V_{EN} = 2.0V$ ;  $C_{OUT} = 4.7 \mu F$ ;  $I_{OUT} = 100 \mu A$ ;  $T_J = 25^\circ C$ , **bold** values indicate  $-40^\circ C \leq T_J \leq +125^\circ C$ ; unless noted

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>/ERR Output</b>						
Low Threshold	$V_{ERR}$	90	94	—	%	% of $V_{OUT}$
High Threshold		—	95	98	%	
/ERR Output Low Voltage	$V_{OL}$	—	150	250	mV	$V_{IN} = V_{OUT(nom)} - 0.12V_{OUT}$ , $I_{OL} = 200 \mu A$
		—	150	<b>400</b>	mV	
/ERR Output Leakage	$I_{LEAK}$	—	0.1	1	$\mu A$	$V_{OH} = 30V$
		—	0.1	<b>2</b>	$\mu A$	
<b>Enable Input</b>						
Input Low Voltage	$V_{IL}$	—	—	0.6	V	Regulator off
Input High Voltage	$V_{IH}$	2.0	—	—	V	Regulator on
Enable Input Current	$I_{IN}$	—	0.01	1.0	$\mu A$	$V_{EN} = 0.6V$ , regulator off
		—	—	<b>2.0</b>	$\mu A$	
		—	0.15	1.0	$\mu A$	$V_{EN} = 2.0V$ , regulator on
		—	—	<b>2.0</b>	$\mu A$	
		—	0.5	2.5	$\mu A$	$V_{EN} = 30V$ , regulator on
		—	—	<b>5.0</b>	$\mu A$	

- Note 1:** Output voltage temperature coefficient is defined as the worst-case voltage change divided by the total temperature range.
- 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.

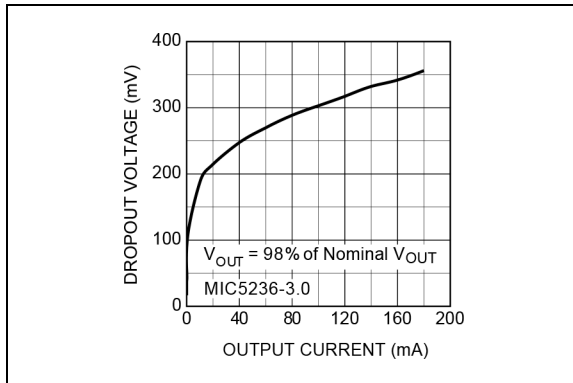
## TEMPERATURE SPECIFICATIONS (Note 1)

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
<b>Temperature Ranges</b>						
Junction Temperature Range	$T_J$	-40	—	+125	$^\circ C$	—
Maximum Junction Temperature	$T_{J(MAX)}$	—	—	+150	$^\circ C$	—
Lead Temperature	—	—	—	+260	$^\circ C$	Soldering, 5 seconds
Storage Temperature	$T_S$	-65	—	+150	$^\circ C$	—
<b>Package Thermal Resistance</b>						
Thermal Resistance, SOIC-8	$\theta_{JA}$	—	80	—	$^\circ C/W$	—
Thermal Resistance, MSOP-8	$\theta_{JA}$	—	63	—	$^\circ C/W$	—

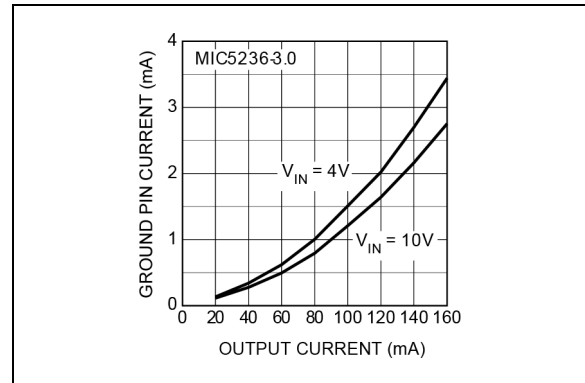
- Note 1:** The maximum allowable power dissipation is a function of ambient temperature, the maximum allowable junction temperature and the thermal resistance from junction to air (i.e.,  $T_A$ ,  $T_J$ ,  $\theta_{JA}$ ). Exceeding the maximum allowable power dissipation will cause the device operating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

## 2.0 TYPICAL PERFORMANCE CURVES

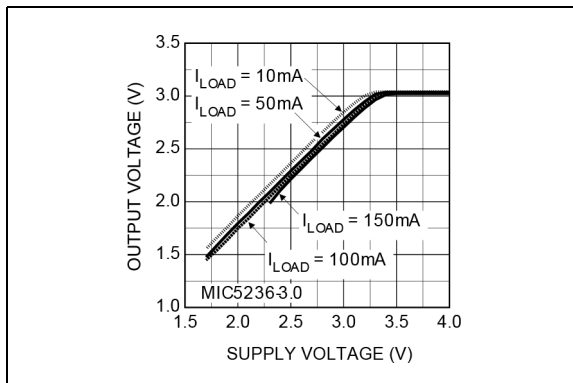
**Note:** The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be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



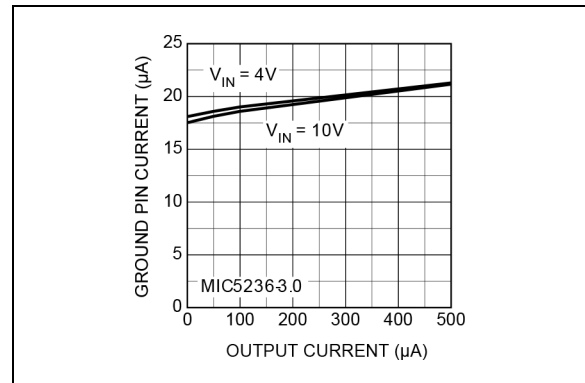
**FIGURE 2-1:** Dropout Voltage vs. Output Current.



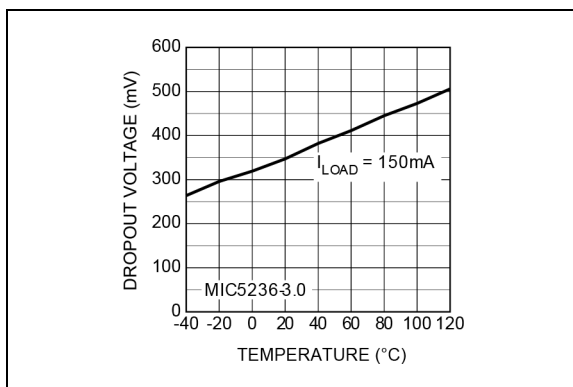
**FIGURE 2-4:** Ground Current vs. Output Current.



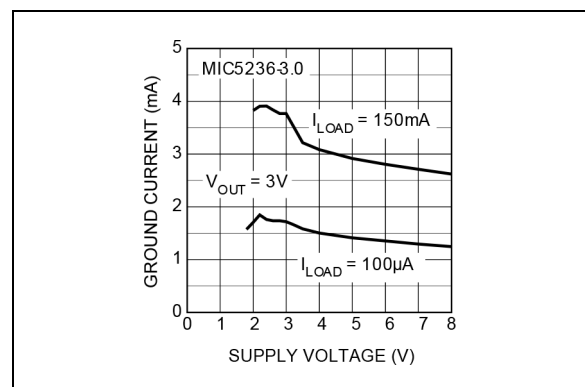
**FIGURE 2-2:** Dropout Characteristics



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



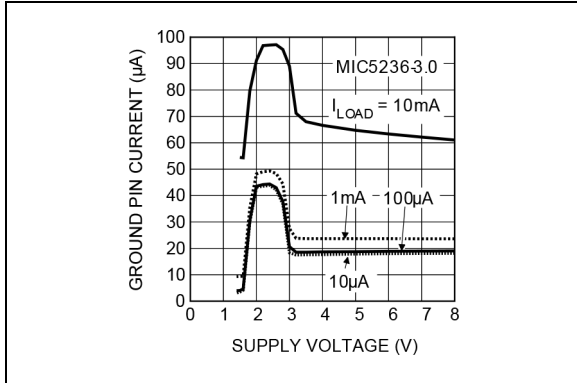
**FIGURE 2-3:** Dropout Voltage vs. Temperature.



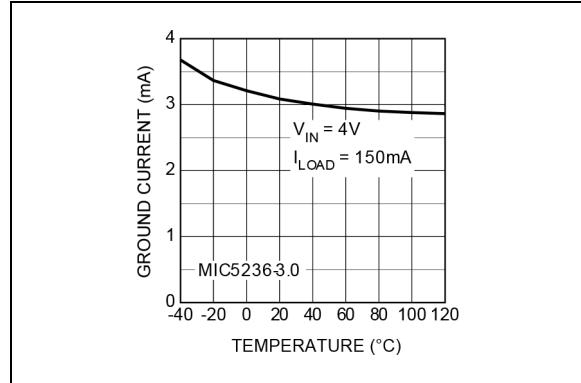
**FIGURE 2-6:** Ground Current vs. Supply Voltage.



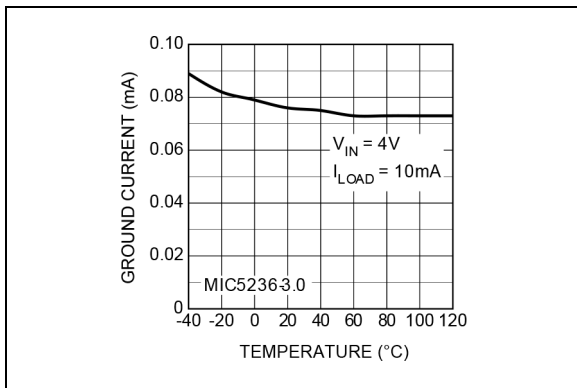
# MIC5236



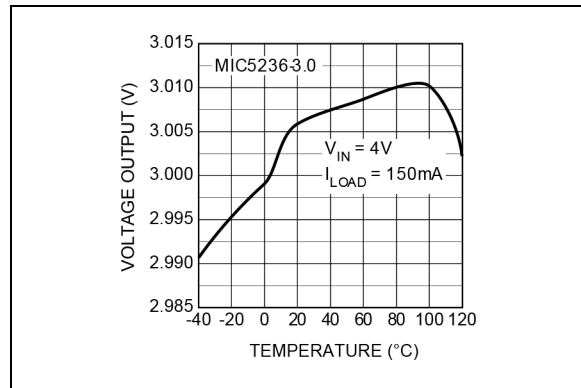
**FIGURE 2-7:** Ground Current vs. Supply Voltage.



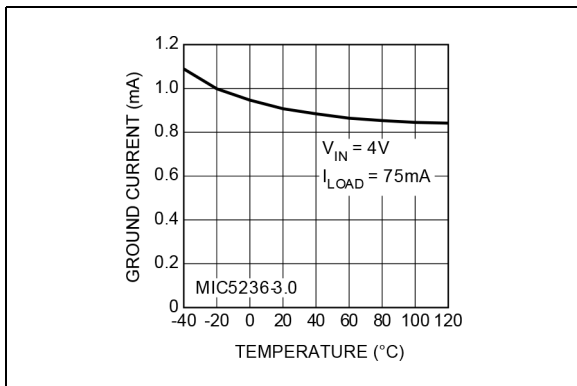
**FIGURE 2-10:** Ground Current vs. Temperature.



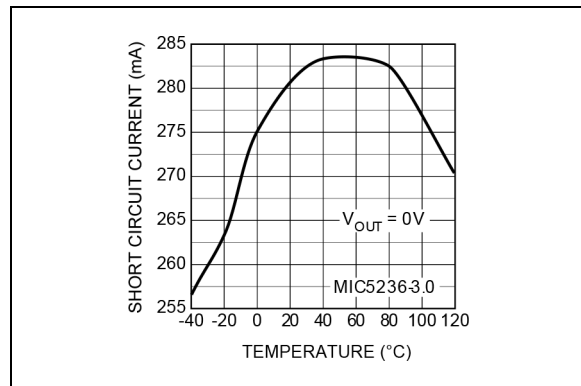
**FIGURE 2-8:** Ground Current vs. Temperature.



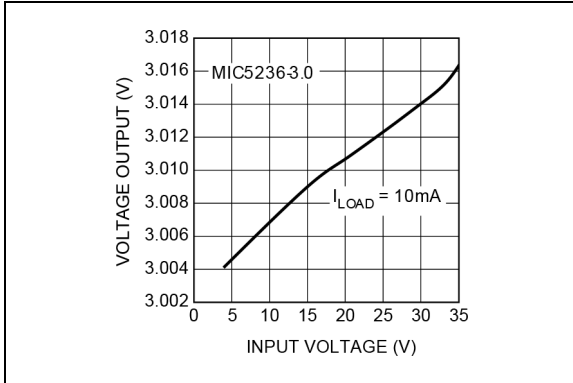
**FIGURE 2-11:** Output Voltage vs. Temperature.



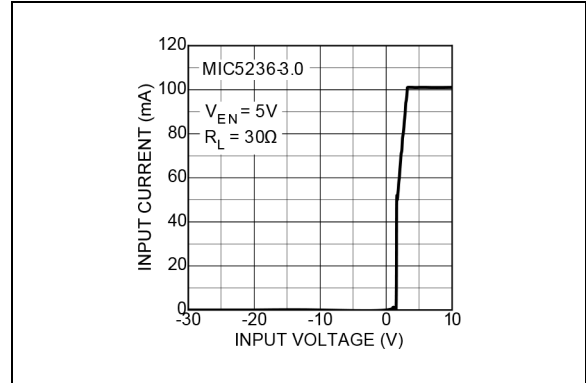
**FIGURE 2-9:** Ground Current vs. Temperature.



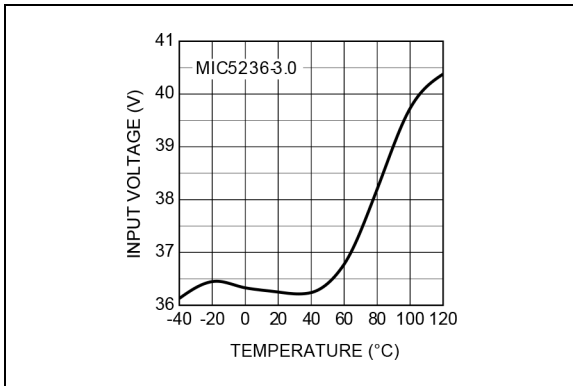
**FIGURE 2-12:** Short Circuit Current vs. Temperature.



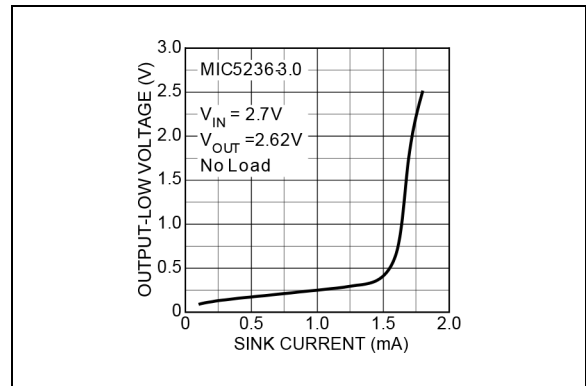
**FIGURE 2-13:** Line Regulation.



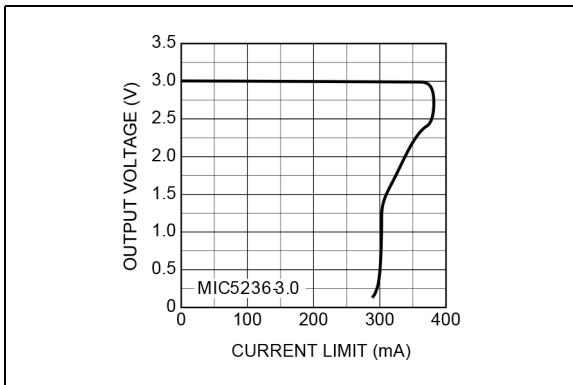
**FIGURE 2-16:** Input Current.



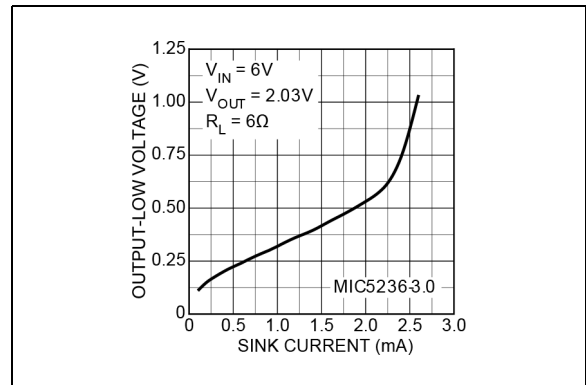
**FIGURE 2-14:** Overvoltage Threshold vs. Temperature.



**FIGURE 2-17:** Dropout Induced Error Flag.

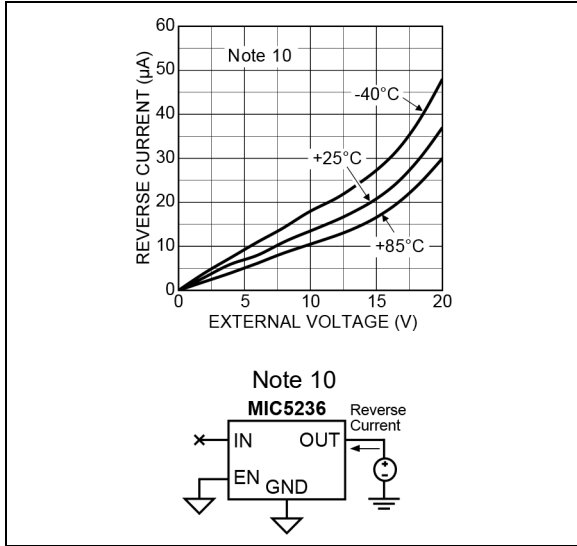


**FIGURE 2-15:** Current Limit vs. Output Voltage.

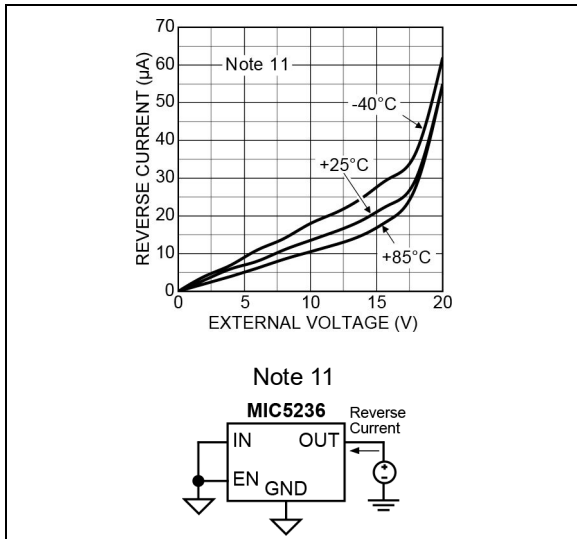


**FIGURE 2-18:** Current Limit Induced Error Flag.

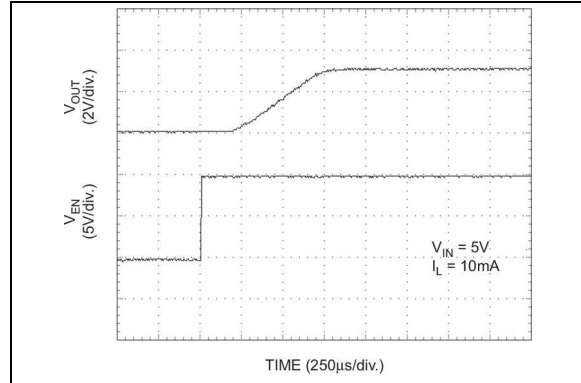
# MIC5236



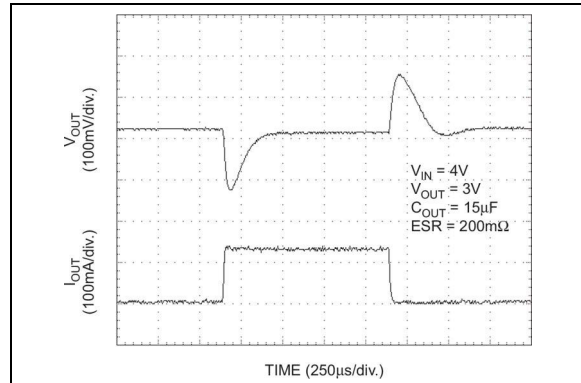
**FIGURE 2-19:** Reverse Current (Open Input).



**FIGURE 2-20:** Reverse Current (Grounded Input).



**FIGURE 2-21:** Enable Transient Response.



**FIGURE 2-22:** Load Transient Response.

## 3.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in [Table 3-1](#).

**TABLE 3-1: PIN FUNCTION TABLE**

Pin Number	Pin Name	Description
1	/ERR	Error (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.
1	ADJ	Adjustable Feedback Input. Connect to voltage divider network.
2	IN	Power Supply Input.
3	OUT	Regulated Output.
4	EN	Enable (Input): Logic low = shutdown; logic high = enabled.
5-8	GND	Ground: Pins 5, 6, 7, and 8 are internally connected in common via the leadframe.

# MIC5236

## 4.0 APPLICATION INFORMATION

The MIC5236 provides all of the advantages of the MIC2950: wide input voltage range, load dump (positive transients up to 60V), 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  $\mu\text{A}$ .

### 4.1 Enable

A low on the enable pin disables the part, forcing the quiescent current to less than 0.1  $\mu\text{A}$ . Thermal shutdown and the error flag are not functional while the device is disabled. The maximum enable bias current is 2  $\mu\text{A}$  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 k $\Omega$  pull-up resistor tied to the input voltage.

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

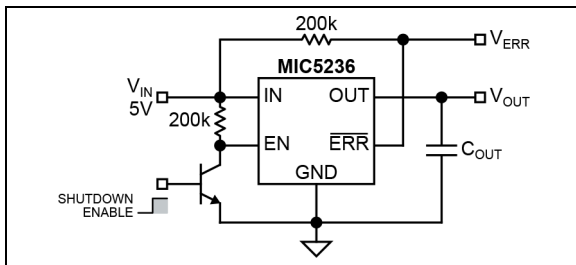


FIGURE 4-1: Remote Enable.

### 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 MIC5236 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  $\mu\text{F}$  capacitor. Virtually any 10  $\mu\text{F}$  capacitor with an ESR less than 3.4 $\Omega$  is sufficient for stability over the entire input voltage range. Stability can also be maintained throughout the specified load and line conditions with 1  $\mu\text{F}$  film or ceramic capacitors.

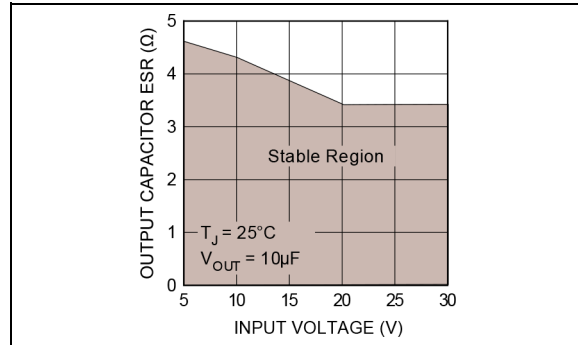


FIGURE 4-2: Output Capacitor ESR.

### 4.4 Error Detection Comparator Output

The ERR 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  $\mu\text{A}$ . In order to minimize the drain on the source used for the pull-up, a value of 200 k $\Omega$  to 1 M $\Omega$  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.

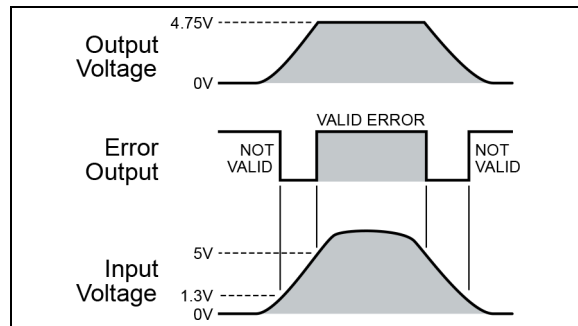


FIGURE 4-3: Error Output Timing.

### 4.5 Reverse Current Protection

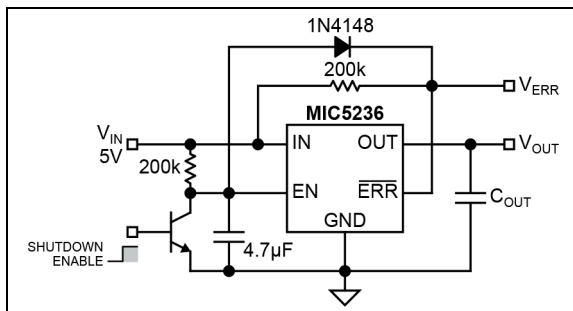
The MIC5236 is designed to limit the reverse current flow from output to input in the event that the MIC5236 output has been tied to the output of another power supply. See Figure 2-19 and Figure 2-20 detailing the reverse current flow with the input grounded and open.

## 4.6 Thermal Shutdown

The MIC5236 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 a high to a low. When disabling the device via the enable pin, transition from a high to low quickly. This will ensure that the output remains disabled in the event of a thermal shutdown.

## 4.7 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  $\mu\text{F}$  capacitor tied to the enable pin. The off time is set by the 200 k $\Omega$  resistor as it recharges the 4.7  $\mu\text{F}$  capacitor, enabling the regulator. This circuit reduces the short circuit current from 280 mA to 15 mA while allowing for regulator restart once the short is removed.



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

## 4.8 Thermal Characteristics

The MIC5236 is a high input voltage device, intended to provide 150 mA of continuous output current in two very small profile packages. The power SOIC-8 and power MSOP-8 allow the device to dissipate about 50% more power than their standard equivalents.

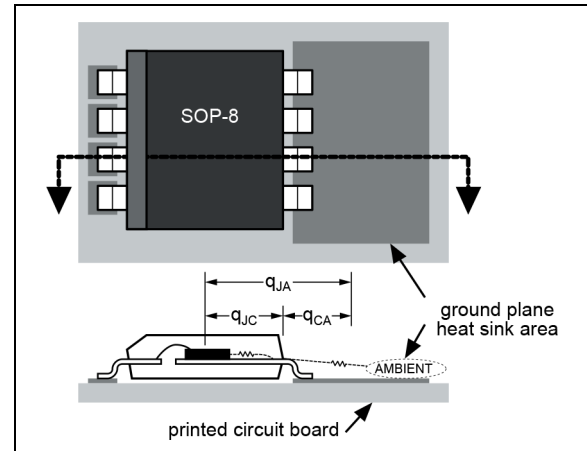
### 4.8.1 POWER SOIC-8 THERMAL CHARACTERISTICS

SOIC-8 package featuring half the thermal resistance of a standard SOIC-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.

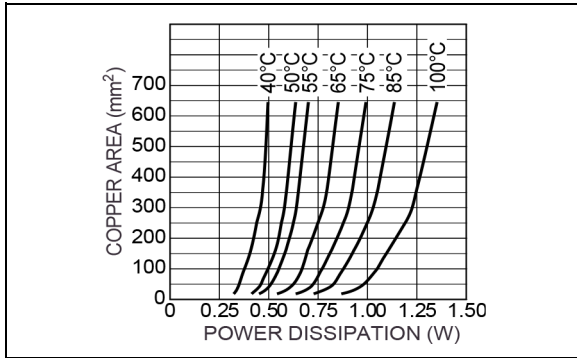
Thermal resistance consists of two main elements,  $\theta_{\text{JC}}$  (junction-to-case thermal resistance) and  $\theta_{\text{CA}}$  (case-to-ambient thermal resistance). See Figure 4-5.  $\theta_{\text{JC}}$  is the resistance from the die to the leads of the package.  $\theta_{\text{CA}}$  is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



**FIGURE 4-5:** Thermal Resistance.

Using the power SOIC-8 reduces the  $\theta_{\text{JC}}$  dramatically and allows the user to reduce  $\theta_{\text{CA}}$ . The total thermal resistance,  $\theta_{\text{JA}}$  (junction-to-ambient thermal resistance) is the limiting factor in calculating the maximum power dissipation capability of the device. Typically, the power SOIC-8 has a  $\theta_{\text{JC}}$  of 20°C/W, this is significantly lower than the standard SOIC-8 which is typically 75°C/W.  $\theta_{\text{CA}}$  is reduced because pins 5 through 8 can now be soldered directly to a ground plane which 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 heat sink must be used.



**FIGURE 4-6:** Copper Area vs. Power-SOIC Power Dissipation ( $\Delta T_{JA}$ ).

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:  
 $T_{J(MAX)} = 125^{\circ}C$   
 $T_{A(MAX)} = \text{Maximum ambient operating temperature}$

For example, the maximum ambient temperature is  $50^{\circ}C$ , the  $\Delta T$  is determined as follows:

**EQUATION 4-2:**

$$\Delta T = 125^{\circ}C - 50^{\circ}C$$

$$\Delta T = 75^{\circ}C$$

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:**

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

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

**EQUATION 4-4:**

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

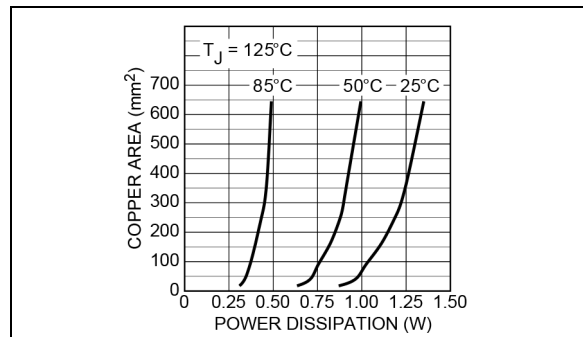
$$P_D = 625mW + 7mW = 632mW$$

From Figure 4-6, the minimum amount of copper required to operate this application at a  $\Delta T$  of  $75^{\circ}C$  is  $25 \text{ mm}^2$ .

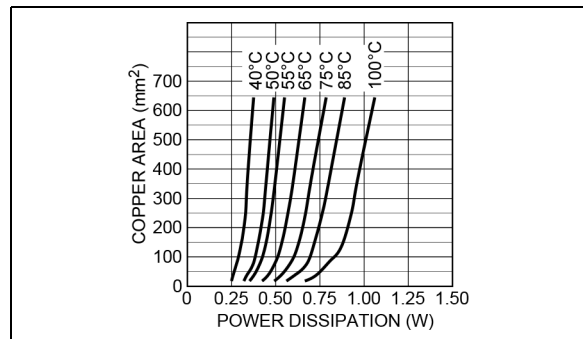
**4.8.2 QUICK METHOD**

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:  $25^{\circ}C$ ,  $50^{\circ}C$ , and  $85^{\circ}C$ . From these curves, the minimum amount of copper can be determined by knowing the maximum power dissipation required. If the maximum ambient temperature is  $50^{\circ}C$  and the power dissipation is as above, 632 mW, the curve in Figure 4-7 shows that the required area of copper is  $25 \text{ mm}^2$ .

The  $\theta_{JA}$  of this package is ideally  $63^{\circ}C/W$ , but it will vary depending upon the availability of copper ground plane to which it is attached.

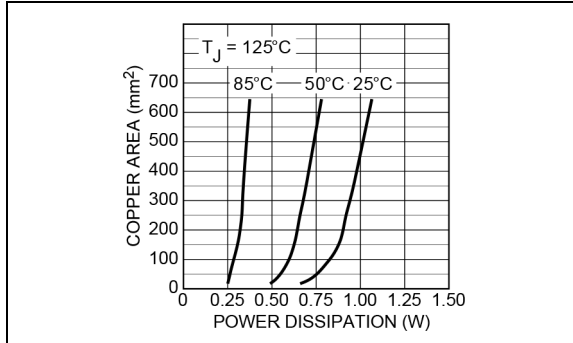


**FIGURE 4-7:** Copper Area vs. Power-SOIC Power Dissipation ( $T_A$ )



**FIGURE 4-8:** Copper Area vs. Power-MSOP Power Dissipation ( $\Delta T_{JA}$ )

The same method of determining the heat sink area used for the power SOIC-8 can be applied directly to the power MSOP-8. The same two curves showing power dissipation versus copper area are reproduced for the power MSOP-8 and they can be applied identically, see [Figure 4-8](#) and [Figure 4-9](#).



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

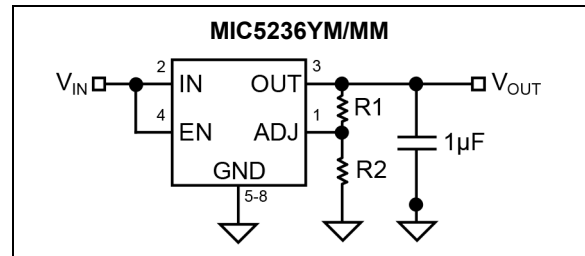
## 4.9 Power MSOP-8 Thermal Characteristics

The power MSOP-8 package follows the same idea as the power SOIC-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.

### 4.9.1 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 639 mW, the curve in [Figure 4-9](#) shows that the required area of copper is 110 mm<sup>2</sup>, when using the power MSOP-8.

## 4.10 Adjustable Regulator Application



**FIGURE 4-10:** Adjustable Voltage Application

The MIC5236YM/MM 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:

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

Where:

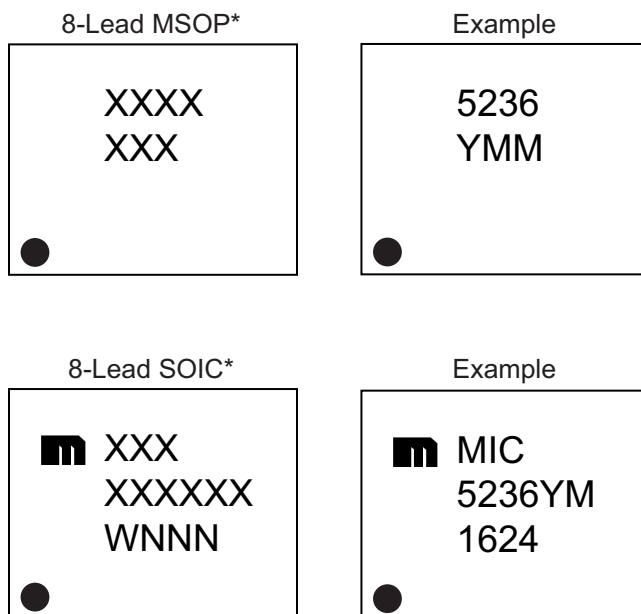
$$V_{REF} = 1.23V$$



# MIC5236

## 5.0 PACKAGING INFORMATION

### 5.1 Package Marking Information



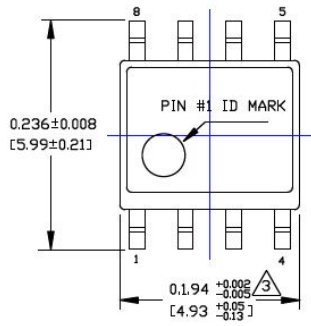
<p><b>Legend:</b> XX...X Product code or customer-specific information Y Year code (last digit of calendar year) YY Year code (last 2 digits of calendar year) WW Week code (week of January 1 is week '01') NNN Alphanumeric traceability code Ⓔ3 Pb-free JEDEC® designator for Matte Tin (Sn) * This package is Pb-free. The Pb-free JEDEC designator (Ⓔ3) can be found on the outer packaging for this package.</p> <p>•, ▲, ▼ Pin one index is identified by a dot, delta up, or delta down (triangle mark).</p>
<p><b>Note:</b> 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.</p> <p>Underbar ( _ ) and/or Overbar ( ¯ ) symbol may not be to scale.</p>

## 8-Lead SOIC Package Outline and Recommended Land Pattern

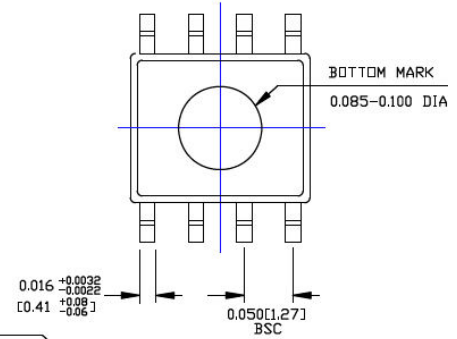
**TITLE**

8 LEAD SOICN PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

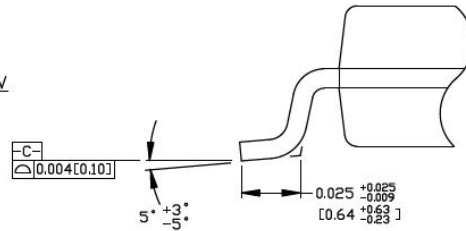
<b>DRAWING #</b>	SOICN-8LD-PL-1	<b>UNIT</b>	INCH [MM]
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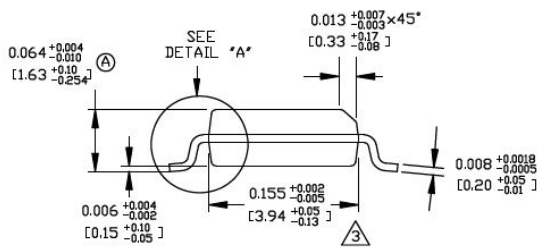
TOP VIEW



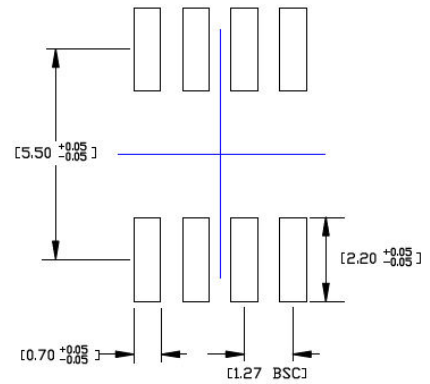
BOTTOM VIEW



DETAIL "A"



END VIEW



RECOMMENDED LAND PATTERN

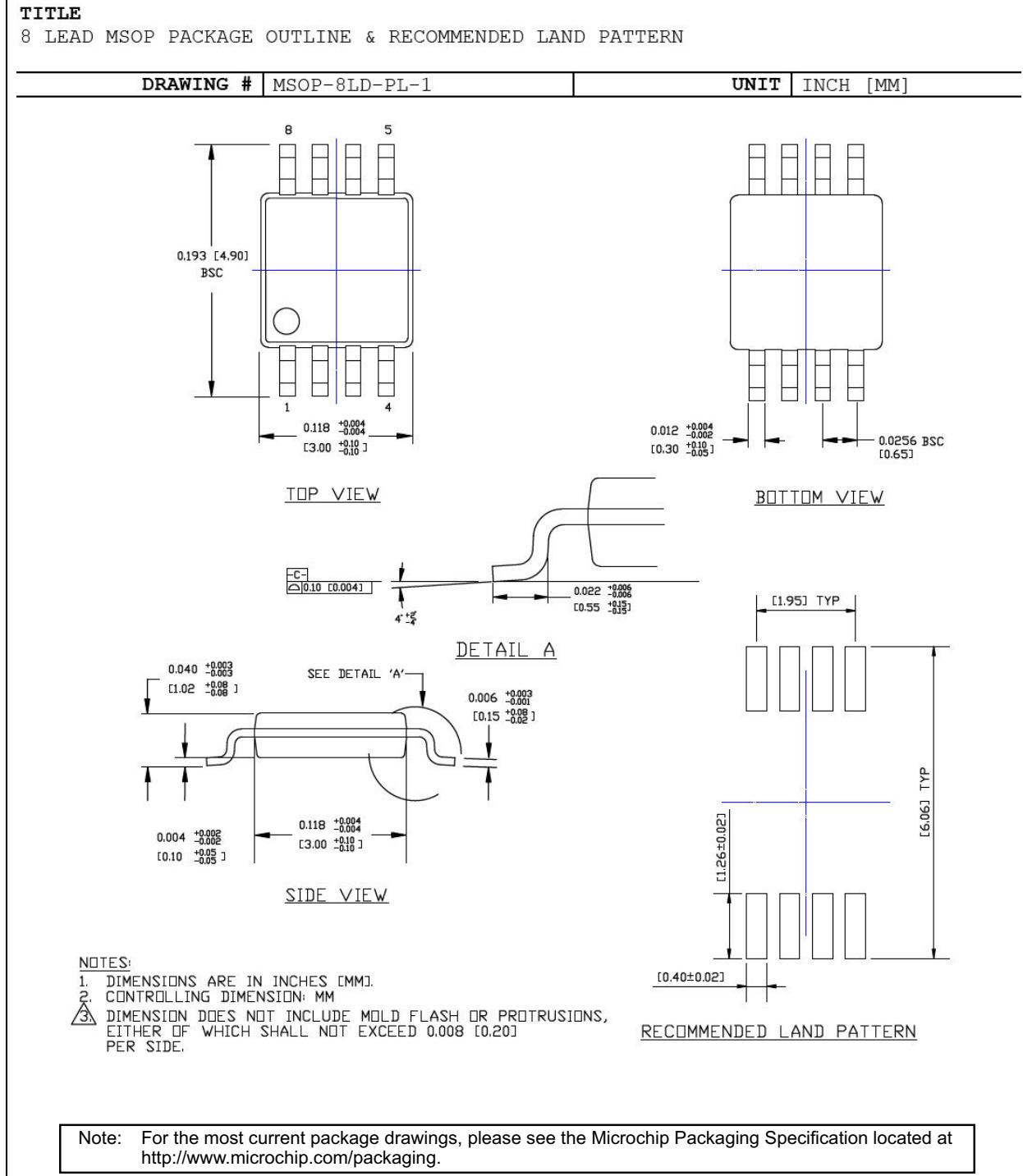
**NOTES:**

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>.

# MIC5236

## 8-Lead MSOP Package Outline and Recommended Land Pattern



## APPENDIX A: REVISION HISTORY

### Revision A (August 2021)

- Converted Micrel document MIC5236 to Microchip data sheet DS20006574A.
- Minor text changes throughout.

# MIC5236

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NOTES:

## PRODUCT IDENTIFICATION SYSTEM

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

<u>PART No.</u>	<u>-X.X</u>	<u>X</u>	<u>XX</u>	<u>-XX</u>	<b>Examples:</b>
Device	Output Voltage	Junction Temp. Range	Package	Media Type	
<b>Device:</b>	MIC5236:	Low Quiescent Current $\mu$ Cap LDO Regulator			a) MIC5236-2.5YM: MIC5236, 2.5V Output Voltage, $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ Temp. Range, 8-Lead SOIC, 95/Tube
<b>Output Voltage:</b>	<blank> = Adjustable				b) MIC5236-3.0YM-TR: MIC5236, 3.0V Output Voltage, $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ Temp. Range, 8-Lead SOIC, 2500/Reel
	-2.5 = 2.5V				c) MIC5236-3.3YMM: MIC5236, 3.3V Output Voltage, $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ Temp. Range, 8-Lead MSOP, 100/Tube
	-3.0 = 3.0V				d) MIC5236-5.0YMM-TR: MIC5236, 5.0V Output Voltage, $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ Temp. Range, 8-Lead MSOP, 2500/Reel
	-3.3 = 3.3V				e) MIC5236YMM: MIC5236, Adj. Output Voltage, $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ Temp. Range, 8-Lead MSOP, 100/Tube
	-5.0 = 5.0V				
<b>Junction Temperature Range:</b>	Y =	$-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$			<b>Note 1:</b> 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.
<b>Package:</b>	M =	8-Lead SOIC			
	MM =	8-Lead MSOP			
<b>Media Type:</b>	<blank> =	95/Tube (SOIC option only)			
	<blank> =	100/Tube (MSOP option only)			
	-TR =	2500/Reel			

# MIC5236

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NOTES:

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