MIC49150

1.5A Low Voltage LDO Regulator w/Dual Input Voltages

Features

- Input Voltage Range:
  - V_{IN}: 1.4V to 6.5V
  - V_{BIAS}: 3.0V to 6.5V
- Stable with 1 µF Ceramic Capacitor
- ±1% Initial Tolerance
- Maximum Dropout Voltage (V_{IN}–V_{OUT}) of 500 mV over Temperature
- Adjustable Output Voltage down to 0.9V
- Ultra Fast Transient Response (up to 10 MHz Bandwidth)
- Excellent Line and Load Regulation Specifications
- Logic Controlled Shutdown Option
- Thermal Shutdown and Current Limit Protection
- Power MSOP-8 and S-Pak Packages
- Junction Temperature Range: –40°C to +125°C

Applications

- Graphics Processors
- PC Add-in Cards
- Microprocessor Core Voltage Supply
- Low Voltage Digital ICs
- High Efficiency Linear Power Supplies
- SMPS Post Regulators

General Description

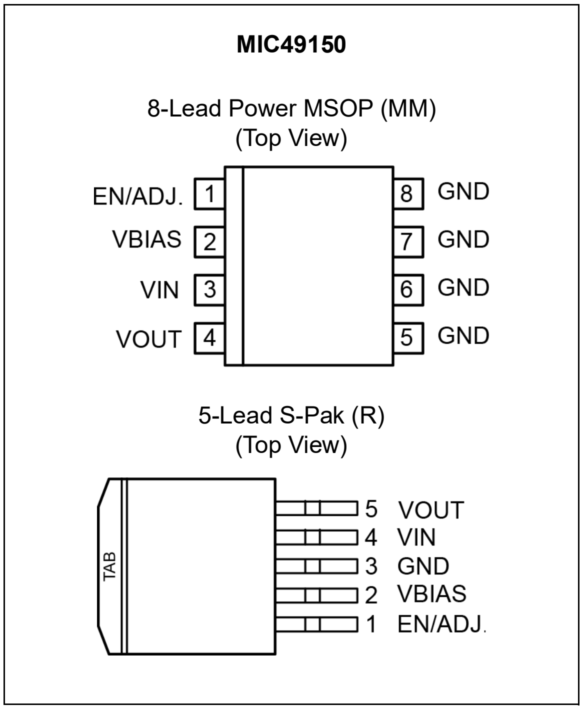
The MIC49150 is a high-bandwidth, low-dropout, 1.5A voltage regulator ideal for powering core voltages of low-power microprocessors. The MIC49150 implements a dual supply configuration allowing for very low output impedance and very fast transient response.

The MIC49150 requires a bias input supply and a main input supply, allowing for ultra-low input voltages on the main supply rail. The input supply operates from 1.4V to 6.5V and the bias supply requires between 3V and 6.5V for proper operation. The MIC49150 offers fixed output voltages from 0.9V to 1.8V and adjustable output voltages down to 0.9V.

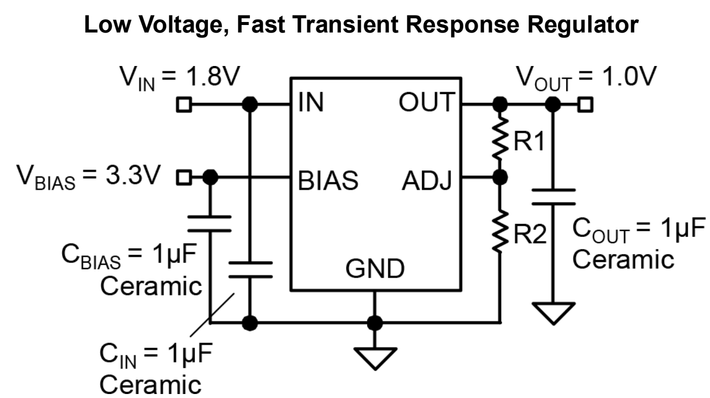
The MIC49150 requires a minimum of output capacitance for stability, working optimally with small ceramic capacitors.

The MIC49150 is available in an 8-lead power MSOP package and a 5-lead S-Pak. Its operating temperature range is –40°C to +125°C.

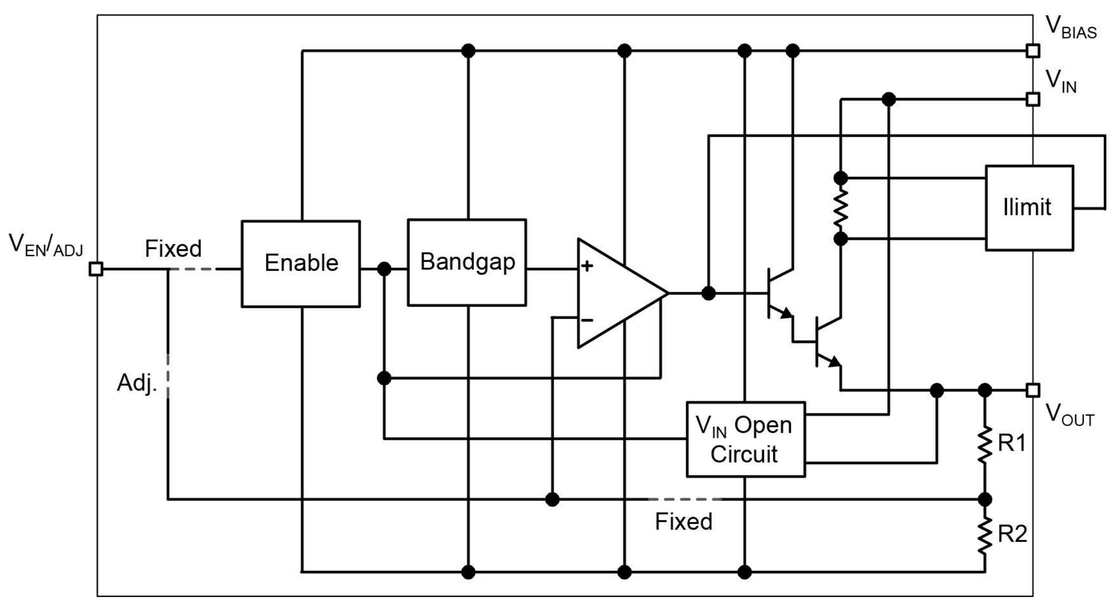
Package Types



Typical Application Circuit



Functional Block Diagram



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Supply Voltage (V_{IN}) .... +8V
Bias Supply Voltage (V_{BIAS}).......... +8V
Enable Input Voltage (V_{EN}).......... +8V
Power Dissipation .... Internally Limited
ESD Rating, Note 1 .... +4 kV

Operating Ratings ‡

Supply Voltage (V_{IN}). .... +1.4V to +6.5V
Bias Supply Voltage (V_{BIAS}).......... +3V to +6.5V
Enable Input Voltage (V_{EN}).. .... 0V to +6.5V

† 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.

ELECTRICAL CHARACTERISTICS

T_A = 25°C with $V_{BIAS} = V_{OUT}$ + 2.1V; $V_{IN} = V_{OUT}$ + 1V; **bold** values indicate –40°C< T_J < +125°C, unless noted (Note 1)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Output Voltage Accuracy	V_{OUT}	–1	—	+1	%	At 25°C
		–2	—	**+2**	%	Over temperature range
Line Regulation	$\Delta V_{OUT}/V_{OUT}$	**–0.1**	0.01	**+0.1**	%/V	$V_{IN} = V_{OUT}$ +1V to 6.5V
Load Regulation	$\Delta V_{OUT}/V_{OUT}$	—	0.2	1	%	I_L = 0 mA to 1.5A
		—	—	**1.5**	%	
Dropout Voltage	$(V_{IN} - V_{OUT})$	—	130	200	mV	IL = 750 mA
		—	—	**300**	mV	
		—	280	400	mV	IL = 1.5A
		—	—	**500**	mV	
Dropout Voltage, Note 2	$(V_{BIAS} - V_{OUT})$	—	1.3	—	V	IL = 750 mA
		—	1.65	1.9	V	IL = 1.5A
		—	—	**2.1**	V	IL = 1.5A
Ground Pin Current, Note 3	I_{GND}	—	15	—	mA	IL = 0 mA
		—	15	25	mA	IL = 1.5A
		—	—	**30**	mA	IL = 1.5A
Ground Pin Current in Shutdown	$I_{GND(SHDN)}$	—	0.5	1	µA	V_{EN} ≤ 0.6V, (I_{BIAS} + I_{CC}), Note 4
		—	—	**2**	µA	
Current through V_{BIAS}	I_{BIAS}	—	9	15	mA	IL = 0 mA
		—	—	**25**	mA	IL = 0 mA
		—	32	—	mA	IL = 1.5A
Current Limit	I_{LIM}	1.6	2.3	3.4	A	—
		—	—	**4**	A	

ELECTRICAL CHARACTERISTICS

T_A = 25°C with V_{BIAS} = V_{OUT} + 2.1V; V_{IN} = V_{OUT} + 1V; **bold** values indicate –40°C< T_J < +125°C, unless noted (Note 1)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Enable Input (Note 4)						
Enable Input Threshold (Fixed Voltage only)	V_{IH}	**1.6**	—	—	V	Regulator enable
	V_{IL}	—	—	**0.6**	V	Regulator shutdown
Enable Pin Input Current	I_{IN}	—	0.1	1	µA	Independent of state
Reference						
Reference Voltage	V_{REF}	0.891	0.9	0.909	V	—
		0.882	—	**0.918**	V	—

Note 1: Specification for packaged product only.

2: For V_{OUT} ≤1V, V_{BIAS} dropout specification does not apply due to a minimum 3V V_{BIAS} input.

3: I_{GND} = I_{BIAS} + (I_{IN} – I_{OUT}). At high loads, input current on V_{IN} will be less than the output current, due to drive current being supplied by V_{BIAS}.

4: Fixed output voltage versions only.

TEMPERATURE SPECIFICATIONS (Note 1)

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Temperature Ranges						
Junction Temperature Range	T_J	–40	—	+125	°C	—
Lead Temperature	—	—	—	+260	°C	—
Storage Temperature	T_S	–65	—	+150	°C	—
Package Thermal Resistance						
Thermal Resistance, MSOP-8	θ_{JA}	—	80	—	°C/W	—
Thermal Resistance, S-Pak	θ_{JC}	—	2	—	°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 rating. Sustained junction temperatures above that maximum can impact 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.

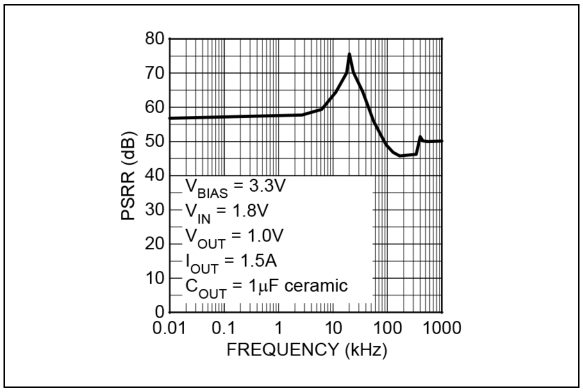


FIGURE 2-1: *Power Supply Rejection Ratio (Input Supply).*

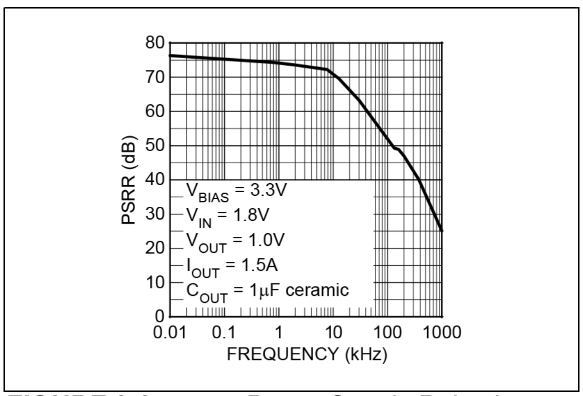


FIGURE 2-2: *Power Supply Rejection Ratio (Bias Supply).*

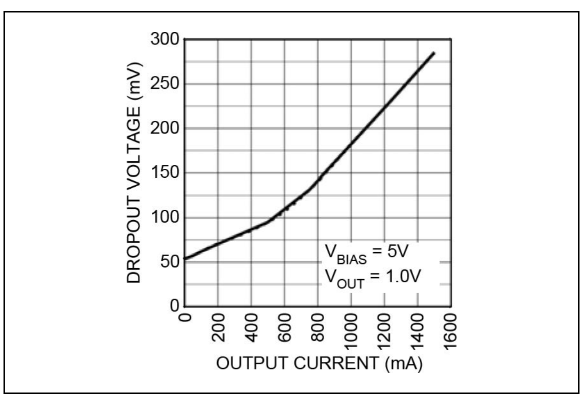


FIGURE 2-3: *Dropout Voltage (Input Supply).*

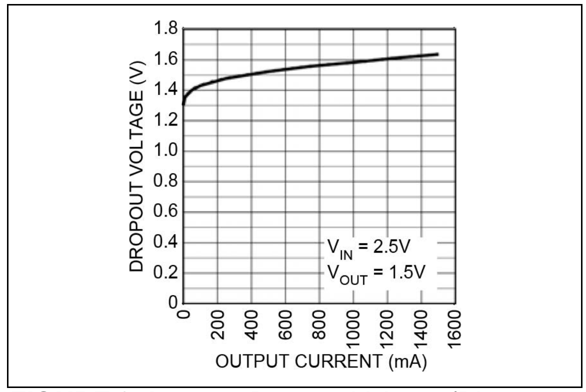


FIGURE 2-4: *Dropout Voltage (Bias Supply).*

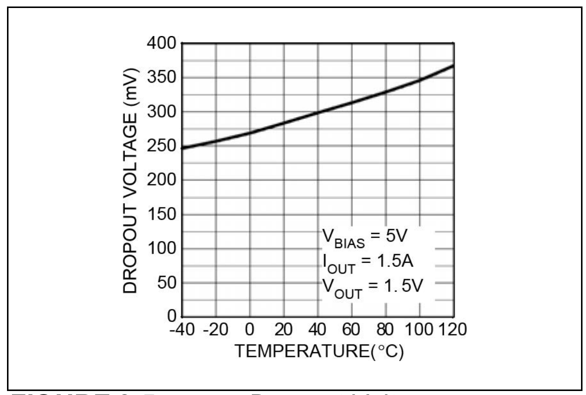


FIGURE 2-5: *Dropout Voltage vs. Temperature (Input Supply).*

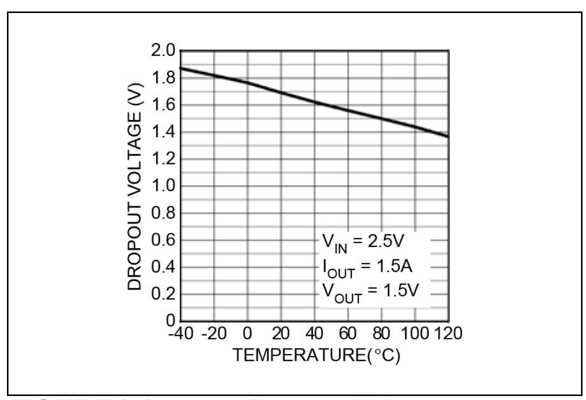


FIGURE 2-6: *Dropout Voltage vs. Temperature (Bias Supply).*

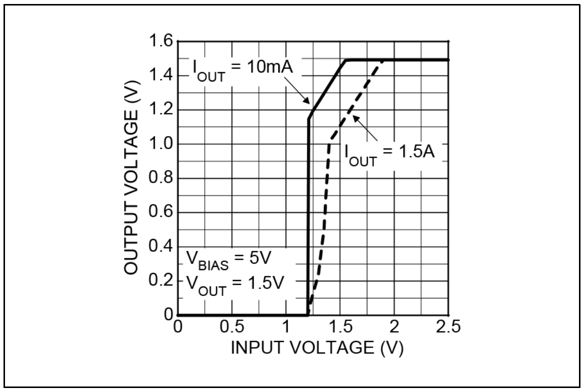


FIGURE 2-7: *Dropout Characteristics (Input Voltage).*

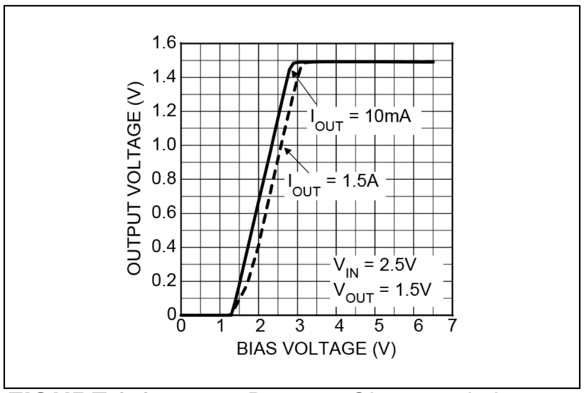


FIGURE 2-8: *Dropout Characteristics (Bias Voltage).*

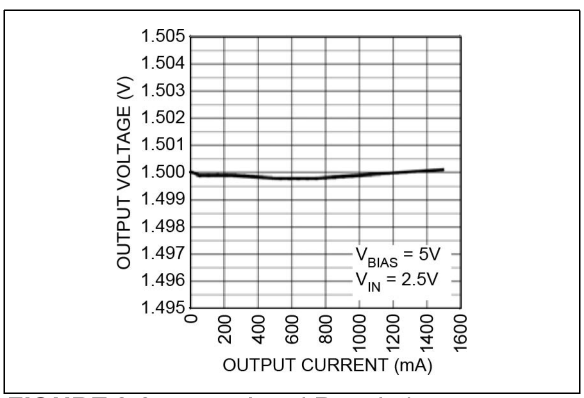


FIGURE 2-9: *Load Regulation.*

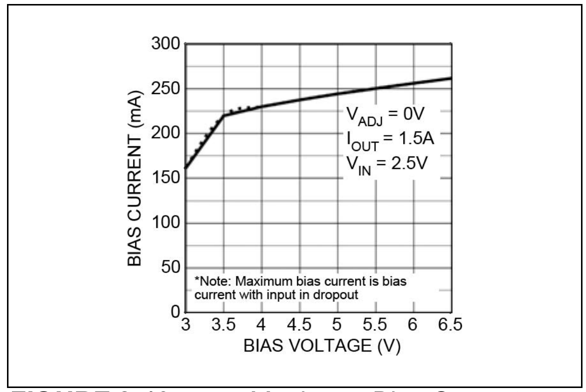


FIGURE 2-10: *Maximum Bias Current vs. Bias Voltage.*

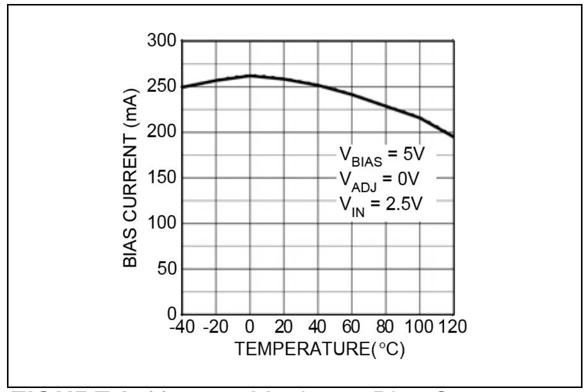


FIGURE 2-11: *Maximum Bias Current vs. Temperature.*

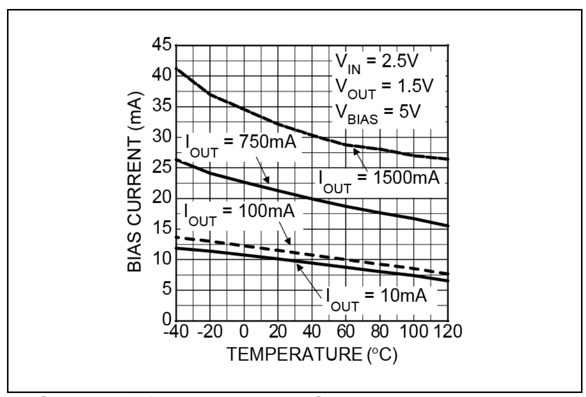


FIGURE 2-12: *Bias Current vs. Temperature.*

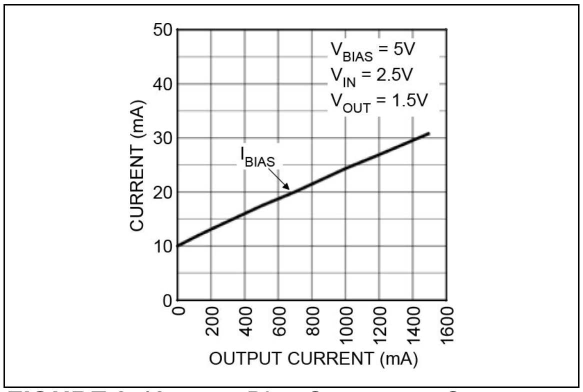


FIGURE 2-13: *Bias Current vs. Output Current.*

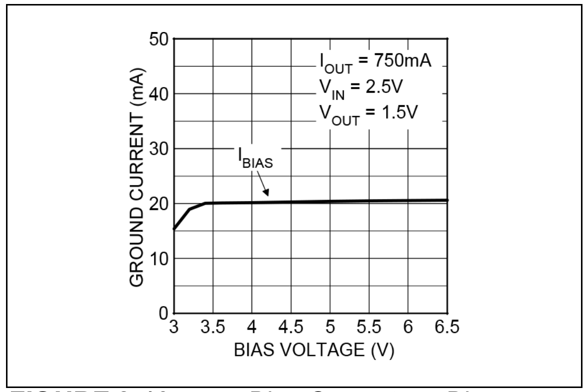


FIGURE 2-16: *Bias Current vs. Bias Voltage.*

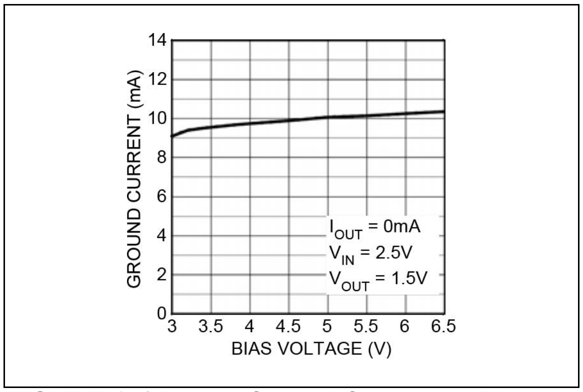


FIGURE 2-14: *Ground Current vs. Bias Voltage.*

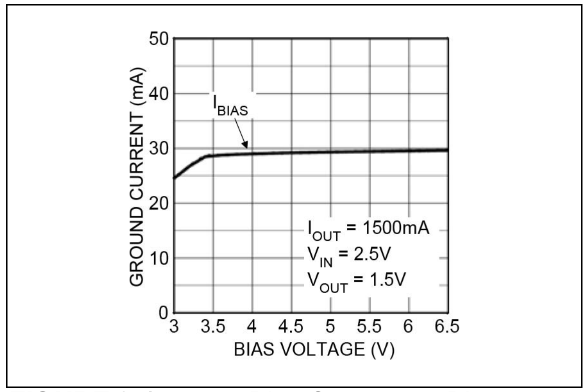


FIGURE 2-17: *Bias Current vs. Bias Voltage.*

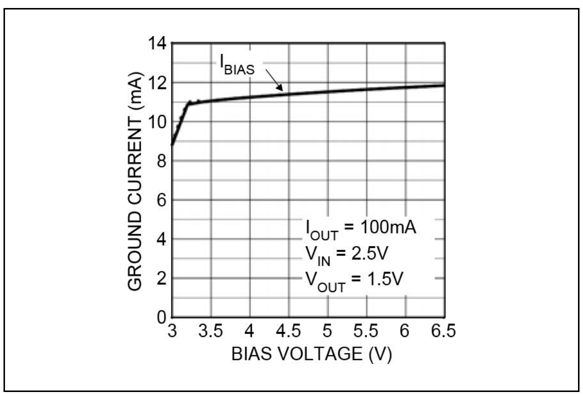


FIGURE 2-15: *Bias Current vs. Bias Voltage.*

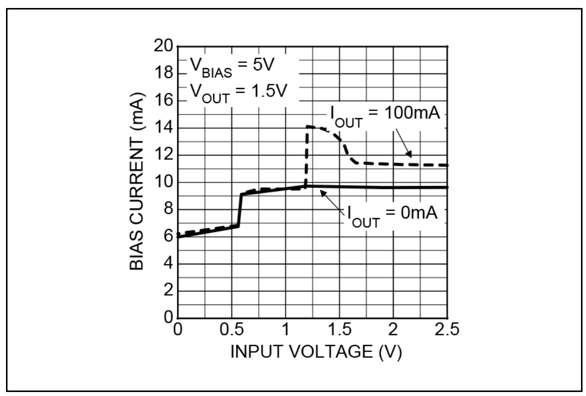


FIGURE 2-18: *Bias Current vs. Input Voltage.*

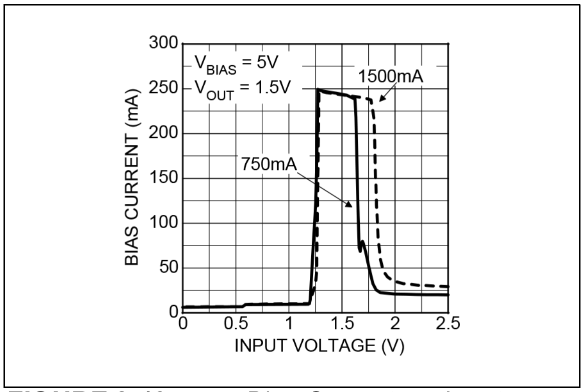


FIGURE 2-19: *Bias Current vs. Input Voltage.*

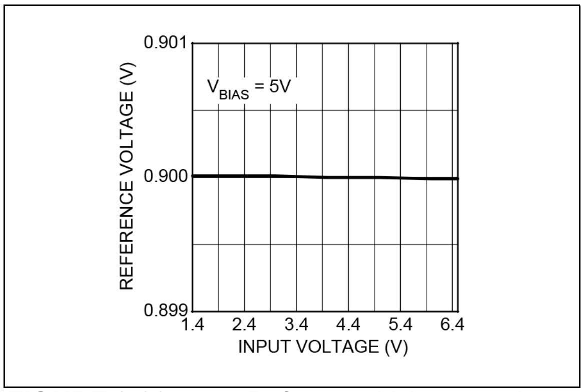


FIGURE 2-20: *Reference Voltage vs. Input Voltage.*

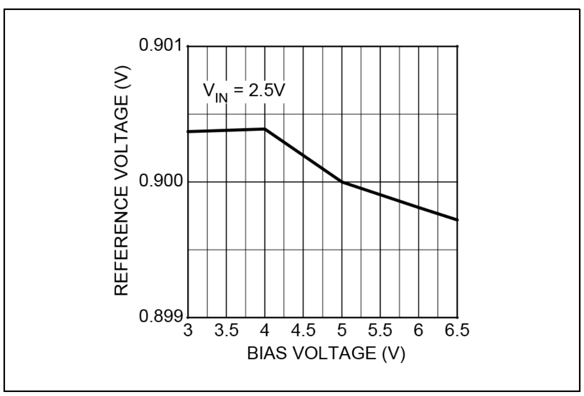


FIGURE 2-21: *Reference Voltage vs. Bias Voltage.*

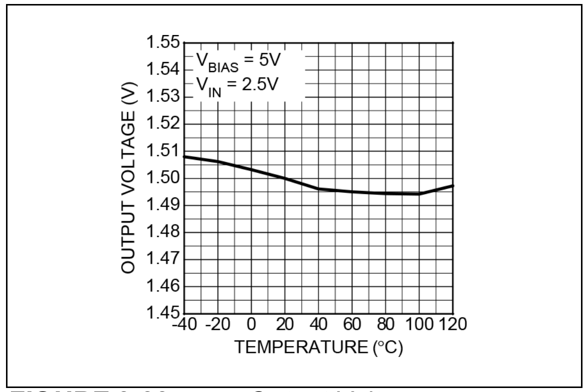


FIGURE 2-22: *Output Voltage vs. Temperature.*

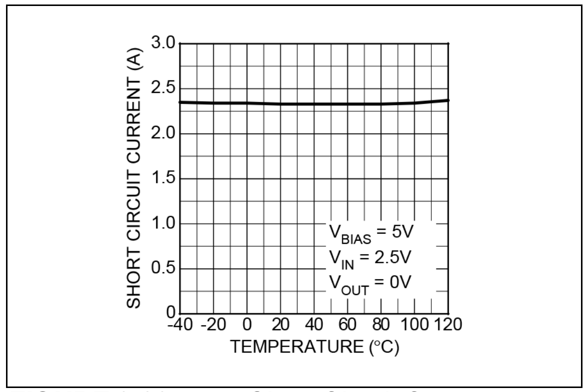


FIGURE 2-23: *Short-Circuit Current vs. Temperature.*

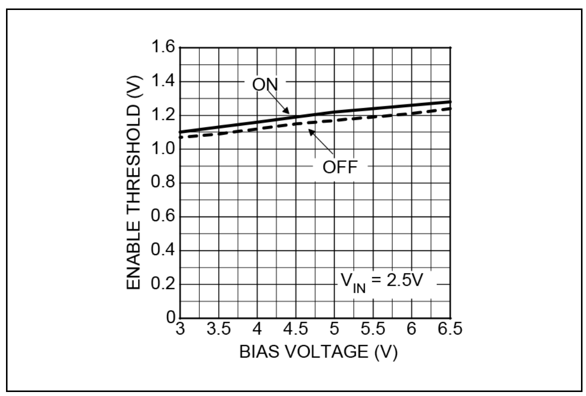


FIGURE 2-24: *Enable Threshold vs. Bias Voltage.*

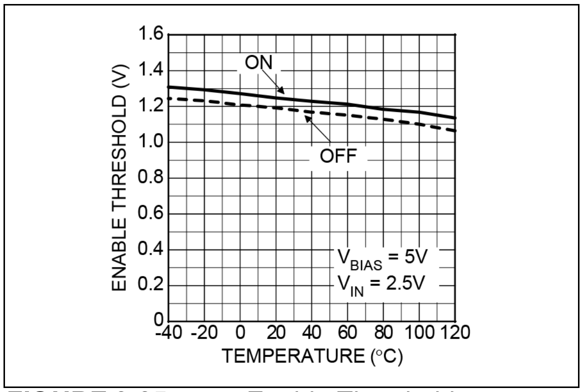


FIGURE 2-25: *Enable Threshold vs. Temperature.*

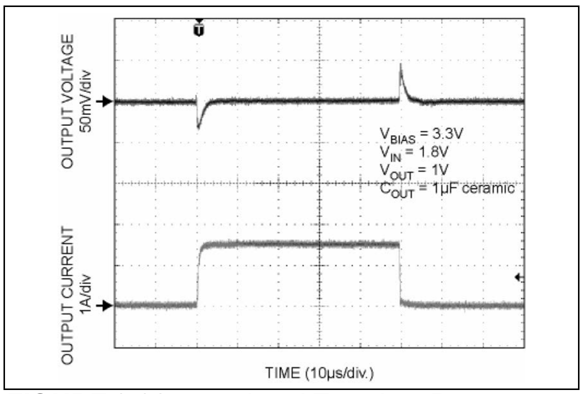


FIGURE 2-26: *Load Transient Response.*

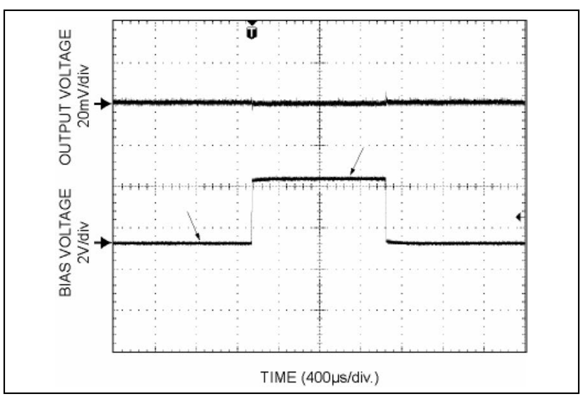


FIGURE 2-27: *Bias Voltage Line Transient Response.*

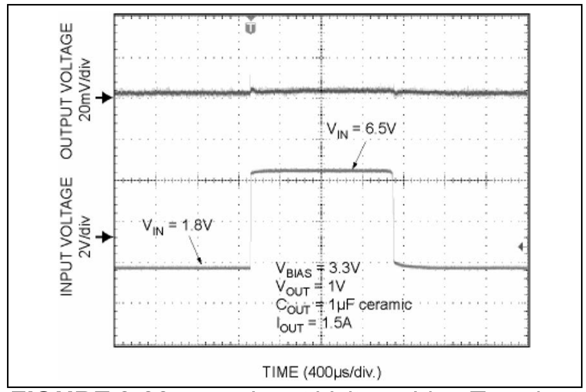


FIGURE 2-28: *Input Voltage Line Transient Response.*

3.0 PIN DESCRIPTIONS

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

TABLE 3-1: PIN FUNCTION TABLE

Pin Number MSOP-8	Pin Number S-Pak	Pin Name	Description
1	1	EN	Enable (Input): CMOS compatible input. Logic high = enable, logic low = shutdown.
		ADJ	Adjustable Regulator Feedback Input. Connect to resistor voltage divider.
2	2	VBIAS	Input Bias Voltage. Powers all circuitry on the regulator, with the exception of the output power device.
3	4	VIN	Input Voltage. Supplies current to the output power device.
4	5	OUT	Regulator Output.
5, 6, 7, 8	3	GND	Ground (TAB is connected to ground on S-Pak).

4.0 APPLICATION INFORMATION

The MIC49150 is an ultra-high performance, low-dropout linear regulator designed for high current applications requiring fast transient response. The MIC49150 utilizes two input supplies, significantly reducing dropout voltage, perfect for low-voltage, DC-to-DC conversion. The MIC49150 requires a minimum of external components and obtains a bandwidth of up to 10 MHz. As a μCap regulator, the output is tolerant of virtually any type of capacitor including ceramic type and tantalum type capacitors.

The MIC49150 regulator is fully protected from damage due to fault conditions, offering linear current limiting and thermal shutdown.

4.1 Bias Supply Voltage

V_{BIAS}, requiring relatively light current, provides power to the control portion of the MIC49150. V_{BIAS} requires approximately 33 mA for a 1.5A load current. Dropout conditions require higher currents. Most of the biasing current is used to supply the base current to the pass transistor. This allows the pass element to be driven into saturation, reducing the dropout to 300 mV at a 1.5A load current. Bypassing on the bias pin is recommended to improve performance of the regulator during line and load transients.

Small ceramic capacitors from V_{BIAS} to ground help reduce high frequency noise from being injected into the control circuitry from the bias rail and are good design practice. Good bypass techniques typically include one larger capacitor such as 1 μF ceramic and smaller valued capacitors such as 0.01 μF or 0.001 μF in parallel with that larger capacitor to decouple the bias supply. The V_{BIAS} input voltage must be 1.6V above the output voltage with a minimum V_{BIAS} input voltage of 3V.

4.2 Input Supply Voltage

V_{IN} provides the high current to the collector of the pass transistor. The minimum input voltage is 1.4V, allowing conversion from low-voltage supplies.

4.3 Output Capacitor

The MIC49150 requires a minimum of output capacitance to maintain stability. However, proper capacitor selection is important to ensure desired transient response. The MIC49150 is specifically designed to be stable with virtually any capacitance value and ESR. A 1 μF ceramic chip capacitor should satisfy most applications. Output capacitance can be increased without bound. See Typical Performance Curves for examples of load transient response.

X7R dielectric ceramic capacitors are recommended because of their temperature performance. X7R-type capacitors change capacitance by 15% over their operating temperature range and are the most stable type of ceramic capacitors. Z5U and Y5V dielectric capacitors change value by as much as 50% and 60% respectively over their operating temperature ranges. To use a ceramic chip capacitor with Y5V dielectric, the value must be much higher than an X7R ceramic or a tantalum capacitor to ensure the same capacitance value over the operating temperature range. Tantalum capacitors have a very stable dielectric (10% over their operating temperature range) and can also be used with this device.

4.4 Input Capacitor

An input capacitor of 1 μF or greater is recommended when the device is more than 4 inches away from the bulk supply capacitance, or when the supply is a battery. Small, surface-mount, ceramic chip capacitors can be used for the bypassing. The capacitor should be placed within 1 inch of the device for optimal performance. Larger values will help to improve ripple rejection by bypassing the input to the regulator, further improving the integrity of the output voltage.

4.5 Thermal Design

Linear regulators are simple to use. The most complicated design parameters to consider are thermal characteristics. Thermal design requires the following application-specific parameters:

- Maximum Ambient Temperature (T_A)
- Output Current (I_{OUT})
- Output Voltage (V_{OUT})
- Input Voltage (V_{IN})
- Ground Current (I_{GND})

First, calculate the power dissipation of the regulator from these numbers and the device parameters from this data sheet.

EQUATION 4-1:

$$P_D = V_{IN} \times I_{IN} + V_{BIAS} \times I_{BIAS} - V_{OUT} \times I_{OUT}$$

The input current will be less than the output current at high output currents as the load increases. The bias current is a sum of base drive and ground current. Ground current is constant over load current. Then the heat sink thermal resistance is determined with this formula:

EQUATION 4-2:

$$\theta_{SA} = \left(\frac{T_{J(MAX)} - T_A}{P_D}\right) - (\theta_{JC} + \theta_{CS})$$

The heat sink may be significantly reduced in applications where the maximum input voltage is known and large compared with the dropout voltage. Use a series input resistor to drop excessive voltage and distribute the heat between this resistor and the regulator. The low-dropout properties of the MIC49150 allow significant reductions in regulator power dissipation and the associated heat sink without compromising performance. When this technique is employed, a input and regulator ground.

4.6 Minimum Load Current

The MIC49150, unlike most other high current regulators, does not require a minimum load to maintain output voltage regulation.

4.7 Power MSOP-8 Thermal Characteristics

One of the secrets of the MIC49150'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-toambient thermal resistance). See Figure 4-1. 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).

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_{JA} of 80°C/W, this is significantly lower than the standard MSOP-8 which is typically 160°C/W.

θ_{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.

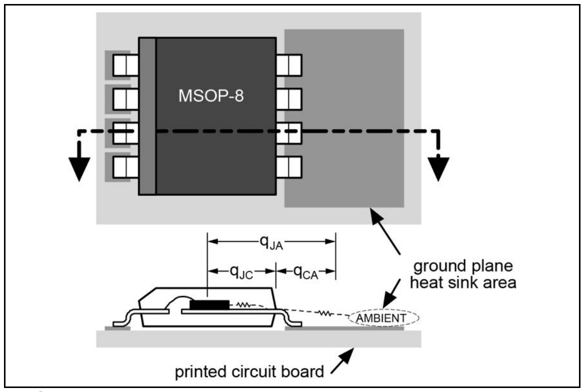


FIGURE 4-1: *Thermal Resistance*

Figure 4-2 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.

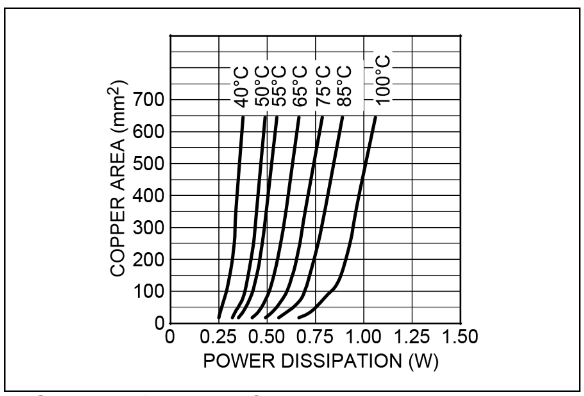


FIGURE 4-2: *Copper Area vs. Power-MSOP Power Dissipation (ΔT_{JA})*

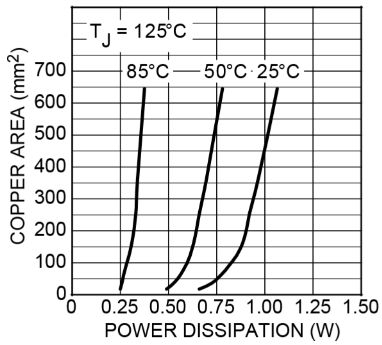


FIGURE 4-3: *Copper Area vs. Power-MSOP Power Dissipation (T_A)*

EQUATION 4-3:

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

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 4-4:

$$\Delta T = 125°C - 50°C = 75°C$$

Using Figure 4-2, 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 4-5:

$$P_D = V_{IN} \times I_{IN} + V_{BIAS} \times I_{BIAS} - V_{OUT} \times I_{OUT}$$

Using a typical application of 750 mA output current, 1.2V output voltage, 1.8V input voltage and 3.3V bias voltage, the power dissipation is as follows:

EQUATION 4-6:

$$P_D = 1.8V(730mA) + 3.3V(30mA) - 1.2V(750mA)$$

At full current, a small percentage of the output current is supplied from the bias supply, therefore the input current is less than the output current.

EQUATION 4-7:

$$P_D = 513mW$$

From Figure 4-2, the minimum current of copper required to operate this application at a ΔT of 75°C is less than 100 mm^2.

4.8 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 4-3, 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 maxi-mum power dissipation required. If the maximum ambient temperature is 50°C and the power dissipation is as above, 513 mW, the curve in Figure 4-3 shows that the required area of copper is less than 100 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.

4.9 Adjustable Regulator Design

The MIC49150 adjustable version allows programming the output voltage anywhere between 0.9V and 5V. Two resistors are used. The resistor value between V_{OUT} and the adjust pin should not exceed 10 kΩ. Larger values can cause instability. The resistor values are calculated by:

EQUATION 4-8:

$$R1 = R2 \times \left(\frac{V_{OUT}}{0.9} - 1\right)$$

Where:

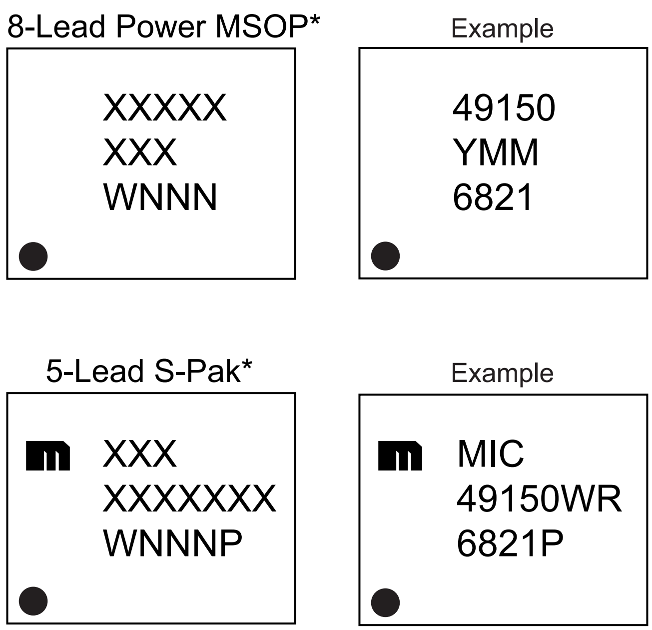
V_{OUT} is the output voltage.

4.10 Enable

The fixed output voltage versions of the MIC49150 feature an active-high enable input (EN) that allows on/off control of the regulator. Current drain reduces to “zero” when the device is shutdown, with only microamperes of leakage current. The EN input has TTL/CMOS compatible thresholds for simple logic interfacing. EN may be directly tied to V_{IN} and pulled up to the maximum supply voltage.

5.0 PACKAGING INFORMATION

5.1 Package Marking Information



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
	e3	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator (e3) can be found on the outer packaging for this package.
	●, ▲, ▼	Pin one index is identified by a dot, delta up, or delta down (triangle mark).

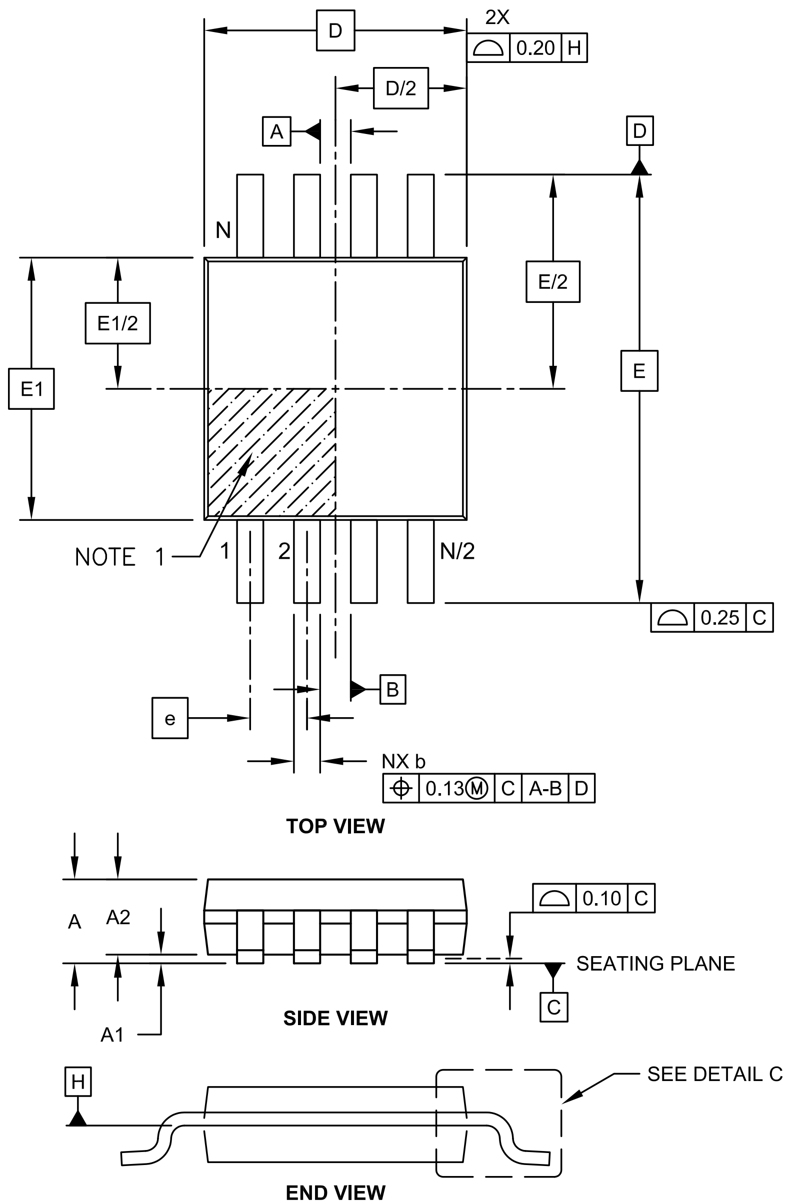
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or may not include the corporate logo.

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

8-Lead Power MSOP Package Outline and Recommended Land Pattern

8-Lead Plastic Micro Small Outline Package (MS) [MSOP]

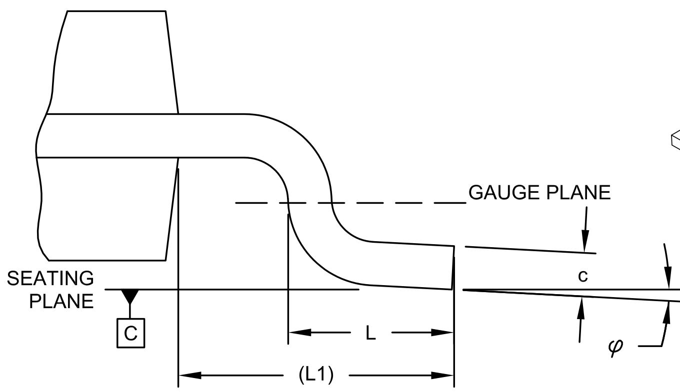
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



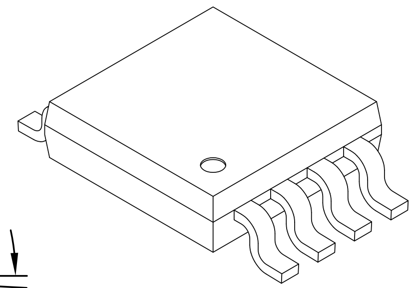
Microchip Technology Drawing C04-111C Sheet 1 of 2

8-Lead Plastic Micro Small Outline Package (MS) [MSOP]

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



DETAIL C



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e	0.65 BSC		
Overall Height	A	-	-	1.10
Molded Package Thickness	A2	0.75	0.85	0.95
Standoff	A1	0.00	-	0.15
Overall Width	E	4.90 BSC		
Molded Package Width	E1	3.00 BSC		
Overall Length	D	3.00 BSC		
Foot Length	L	0.40	0.60	0.80
Footprint	L1	0.95 REF		
Foot Angle	φ	0°	-	8°
Lead Thickness	c	0.08	-	0.23
Lead Width	b	0.22	-	0.40

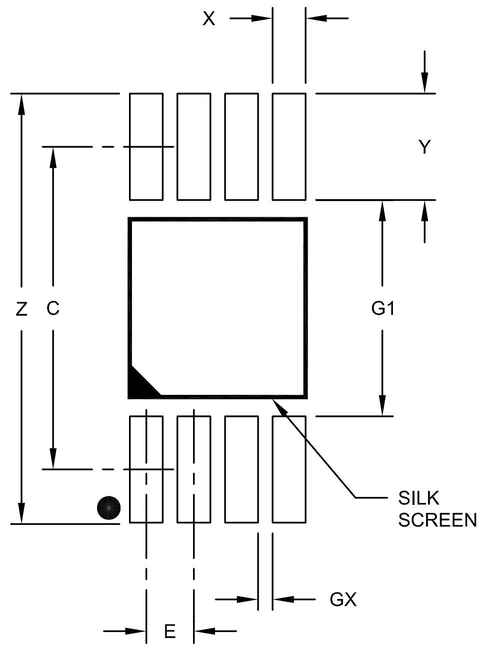
Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
3. Dimensioning and tolerancing per ASME Y14.5M.
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
   REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-111C Sheet 2 of 2

8-Lead Plastic Micro Small Outline Package (MS) [MSOP]

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



RECOMMENDED LAND PATTERN

	Units	MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.65 BSC		
Contact Pad Spacing	C		4.40	
Overall Width	Z			5.85
Contact Pad Width (X8)	X1			0.45
Contact Pad Length (X8)	Y1			1.45
Distance Between Pads	G1	2.95		
Distance Between Pads	GX	0.20		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

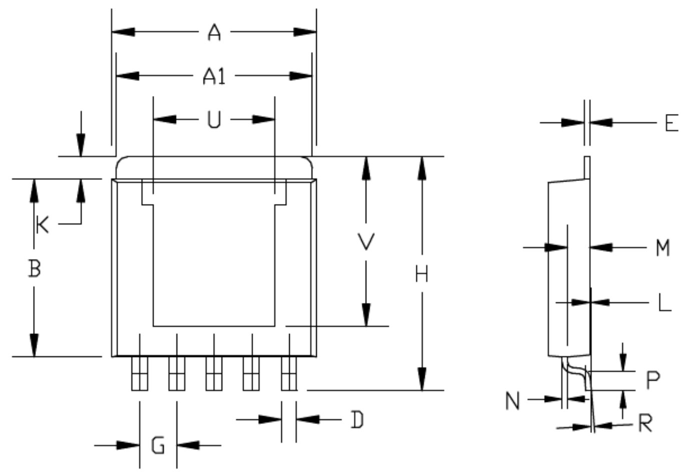
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2111A

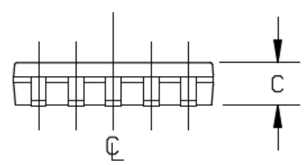
5-Lead S-Pak Package Outline and Recommended Land Pattern

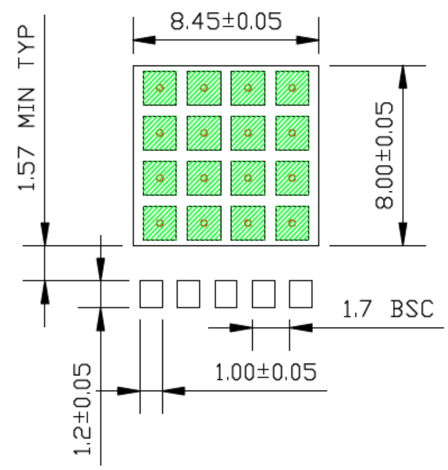
TITLE
5 LEAD SPAK PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

DRAWING #	SPAK-5LD-PL-1	UNIT	MM



	INCHES		MILLIMETERS	
A	0.365	0.375	9.27	9.52
A1	0.350	0.360	8.89	9.14
B	0.310	0.320	7.87	8.13
C	0.070	0.080	1.78	2.03
D	0.025	0.031	0.63	0.79
E	0.010	BSC	0.25	BSC
G	0.067	BSC	1.70	BSC
H	0.410	0.420	10.41	10.67
K	0.030	0.050	0.76	1.27
L	0.001	0.005	0.03	0.13
M	0.035	0.045	0.89	1.14
N	0.010	BSC	0.25	BSC
P	0.031	0.041	0.79	1.04
R	0°	6°	0°	6°
U	0.220	BSC	5.58	BSC
V	0.296	BSC	7.52	BSC





RECOMMENDED
LAND PATTERN

NOTE:
1. DIMENSION DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
2. DIMENSION INCLUDES PLATING THICKNESS.
SOLDER MASK OPENING
3. RED CIRCLES IN LAND PATTERN REPRESENT THERMAL VIA, 0.30MM IN DIAMETER & SHOULD BE CONNECTED TO GND FOR MAXIMUM PERFORMANCE
4. GREEN RECTANGLES IN LAND PATTERN REPRESENT SOLDER STENCIL OPENING (OPTIONAL), 1.50X1.50MM.

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

NOTES:

APPENDIX A: REVISION HISTORY

Revision A (September 2021)

- Converted Micrel document MIC49150 to Microchip data sheet DS20006585A.
- 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	XX	-XX
Device	Output Voltage	Junction Temp. Range	Package	Media Type

Device:	MIC49150:	1.5A Low Voltage LDO Regulator w/Dual Input Voltages
Output Voltage:	<blank> = Adjustable -0.9 = 0.9V -1.2 = 1.2V -1.5 = 1.5V -1.8 = 1.8V	
Junction Temperature Range:	Y = –40°C to +125°C (MM option only) W = –40°C to +125°C (R option only)	
Package:	MM = 8-Lead Power MSOP R = 5-Lead S-Pak	
Media Type:	<blank> = 48/Tube (R option only) <blank> = 100/Tube (MM option only) -TR = 750/Reel (R option only) -TR = 2500/Reel (MM option only)	

Examples:

a) MIC49150-1.8WR: MIC49150, 1.8V Output Voltage, –40°C to +125°C Temp. Range, 5-Lead S-Pak, 48/Tube

b) MIC49150-0.9YMM: MIC49150, 0.9V Output Voltage, –40°C to +125°C Temp. Range, 8-Lead Power MSOP, 100/Tube

c) MIC49150-1.2WR-TR: MIC49150, 1.2V Output Voltage, –40°C to +125°C Temp. Range, 5-Lead S-Pak, 750/Reel

d) MIC49150-1.5YMM-TR: MIC49150, 1.5V Output Voltage, –40°C to +125°C Temp. Range, 8-Lead Power MSOP, 2500/Reel

e) MIC49150WR: MIC49150, ADJ. Output Voltage, –40°C to +125°C Temp. Range, 5-Lead S-Pak 48/Tube

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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