MIC5270

µCap Negative Low-Dropout Regulator

Features

- Stable with Ceramic or Tantalum Capacitor
- Low Dropout Voltage: 500 mV @ 100 mA
- Low Ground Current: 35 µA @ Load = 100 µA
- Tight Initial Accuracy: ±2%
- Tight Load and Line Regulation
- Thermal Shutdown
- Current Limiting
- IttyBitty® SOT-23-5 Packaging

Applications

- GaAsFET Bias
- Portable Cameras and Video Recorders
- PDAs
- Battery-Powered Equipment

General Description

The MIC5270 is a µCap 100 mA negative regulator in a SOT-23-5 package. With better than 2% initial accuracy, this regulator provides a very accurate supply voltage for applications that require a negative rail. The MIC5270 sinks 100 mA of output current at very low dropout voltage (600 mV maximum at 100 mA of output current).

The µCap regulator design is optimized to work with low-value, low-cost ceramic capacitors. The output typically requires only a 1 µF capacitance for stability.

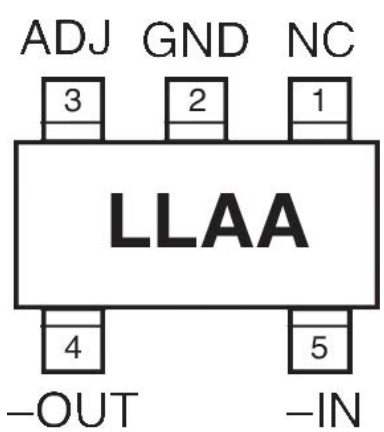
Designed for applications where small packaging and efficiency are critical, the MIC5270 combines LDO design expertise with IttyBitty® packaging to improve performance and reduce power dissipation. Ground current is optimized to help improve battery life in portable applications.

The MIC5270 is available in the SOT-23-5 package for space saving applications and it is available with fixed –3.0V, –4.1V, –5.0V, and adjustable outputs.

Package Types

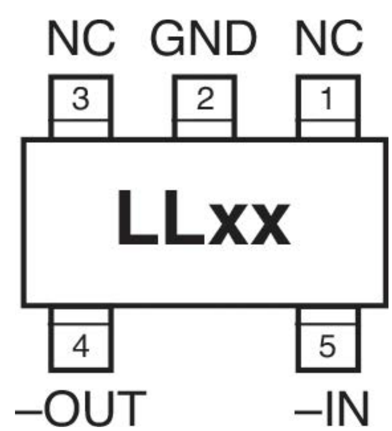
MIC5270BM5

Adjustable Voltage



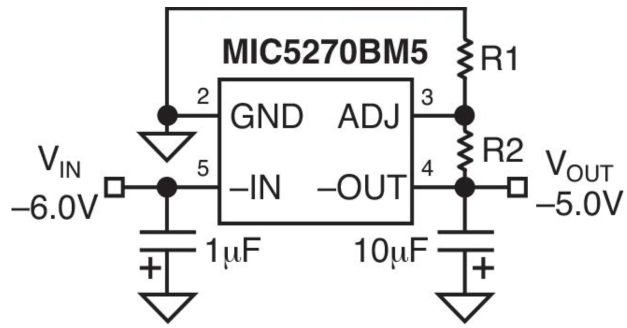
MIC5270-x.xBM5

Fixed Output Voltage

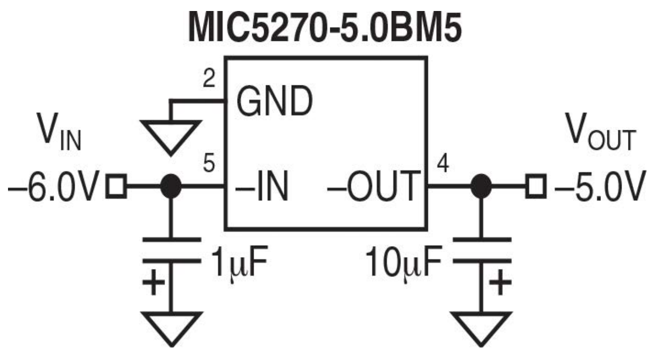


Typical Application Circuits

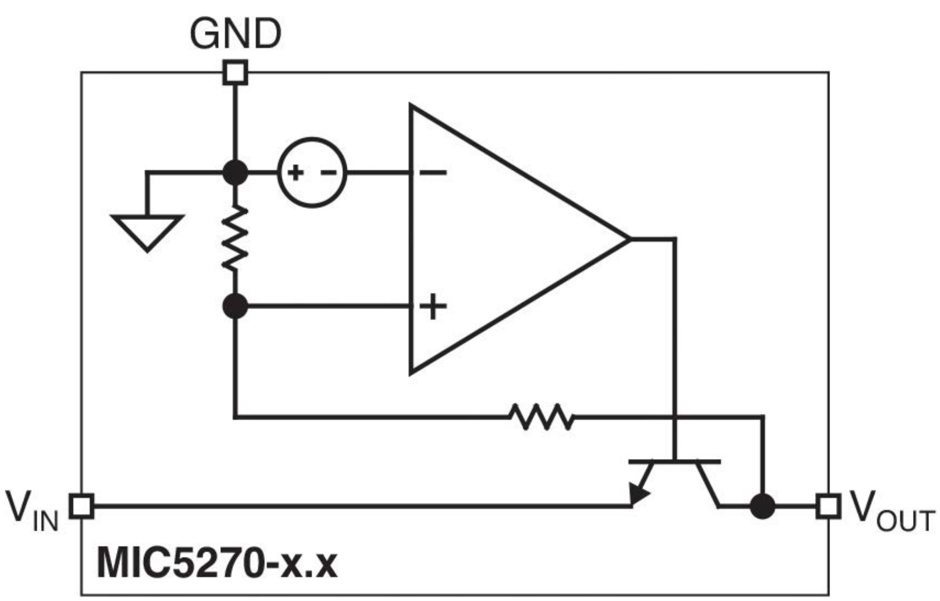
Regulator with Adjustable Output



Regulator with Fixed Output



Functional Block Diagram



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Input Voltage (V_{IN}) .... –20V to +0.3V
Power Dissipation (P_D) .... Internally Limited
ESD Rating, Note 1

Operating Ratings ‡

Input Voltage (V_{IN}) .... –16V to –3.3V

† 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.

ELECTRICAL CHARACTERISTICS

$V_{IN} = V_{OUT} – 1.0V$; $C_{OUT} = 4.7$ µF, $I_{OUT} = 100$ µA; $T_A = 25°C$, **bold** values indicate –40°C ≤ T_A ≤ +125°C; unless noted. (Note 1)

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Output Voltage Accuracy	V_{OUT}	–2	—	2	%	Variation from nominal V_{OUT}
		–3	—	**3**		
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	—	100	—	ppm/°C	Note 2
Line Regulation	$\Delta V_{OUT}/V_{OUT}$	—	0.05	0.15	%/V	$V_{IN} = V_{OUT} – 1V$ to –16V
		—	—	**0.2**		
Load Regulation	$\Delta V_{OUT}/V_{OUT}$	—	1.5	1.8	%	$I_{OUT} = 100$ µA to 100 mA, Note 3
		—	—	**2.0**		
Dropout Voltage, Note 4	$V_{IN} – V_{OUT}$	—	40	—	mV	$I_{OUT} = 100$ µA
		—	360	500		$I_{OUT} = 50$ mA
		—	500	700		$I_{OUT} = 100$ mA
		—	—	**900**		

Note 1: Specification for packaged product only.

2: Output voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.

3: Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 100 µA to 100 mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.

4: Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

5: Ground pin current is the regulator quiescent current plus pass transistor base current. The total current drawn from the supply is the sum of the load current plus the ground pin current.

6: Thermal regulation is defined as the change in output voltage at a time “t” after a change in power dissipation is applied, excluding load or line regulation effects. Specifications are for a 100 mA load pulse at V_{IN} = –16V for t = 10 ms.

ELECTRICAL CHARACTERISTICS (CONTINUED)

$V_{IN} = V_{OUT} – 1.0V$; C_{OUT} = 4.7 µF, I_{OUT} = 100 µA; T_A = 25°C, **bold** values indicate –40°C ≤ T_A ≤ +125°C; unless noted. (Note 1)

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Ground Current, Note 5	I_{GND}	—	35	**100**	µA	I_{OUT} = 100 µA
		—	0.7	—	mA	I_{OUT} = 50 mA
		—	2.1	3.0	mA	I_{OUT} = 100 mA
Ripple Rejection	PSRR	—	50	—	dB	f = 120 Hz
Current Limit	I_{LIMIT}	—	160	**300**	mA	V_{OUT} = 0V
Thermal Regulation	$\Delta V_{OUT}/\Delta P_D$	—	0.05	—	%/W	Note 6

Note 1: Specification for packaged product only.

2: Output voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.

3: Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 100 µA to 100 mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.

4: Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

5: Ground pin current is the regulator quiescent current plus pass transistor base current. The total current drawn from the supply is the sum of the load current plus the ground pin current.

6: Thermal regulation is defined as the change in output voltage at a time “t” after a change in power dissipation is applied, excluding load or line regulation effects. Specifications are for a 100 mA load pulse at V_{IN} = –16V for t = 10 ms.

TEMPERATURE SPECIFICATIONS (Note 1)

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Temperature Ranges						
Junction Temperature Range	T_J	–40	—	+125	°C	—
Maximum Junction Temperature	$T_{J(MAX)}$	—	—	+125	°C	—
Lead Temperature	—	—	—	+260	°C	Soldering, 5 seconds
Storage Temperature	T_S	–65	—	+150	°C	—
Package Thermal Resistance						
Thermal Resistance, SOT-23	θ_{JA}	—	235	—	°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}). The maximum allowable power dissipation at any ambient temperature is calculated using: $P_{D(max)} = (T_{J(max)} – A) \div \theta_{JA}$. 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.

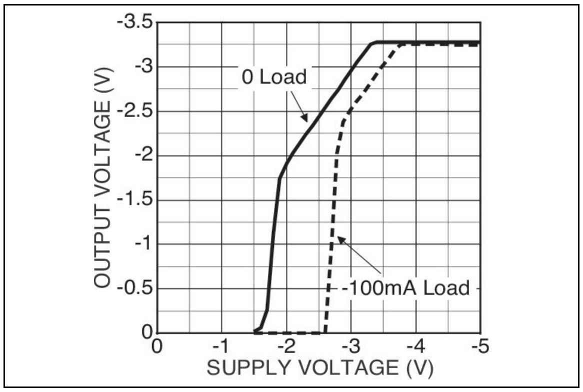


FIGURE 2-1: Dropout Characteristics.

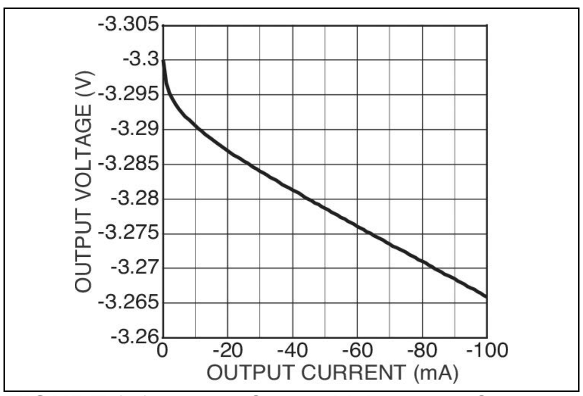


FIGURE 2-2: Output Voltage vs. Output Current.

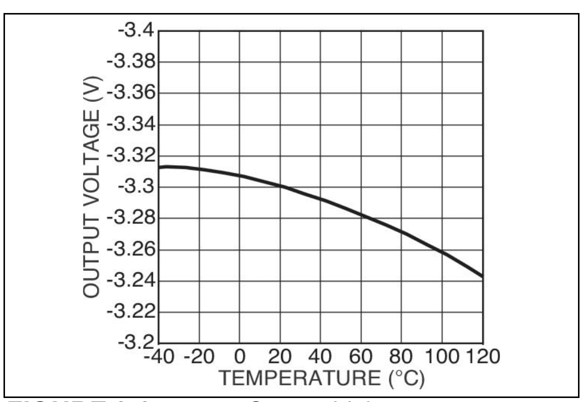


FIGURE 2-3: Output Voltage vs. Temperature.

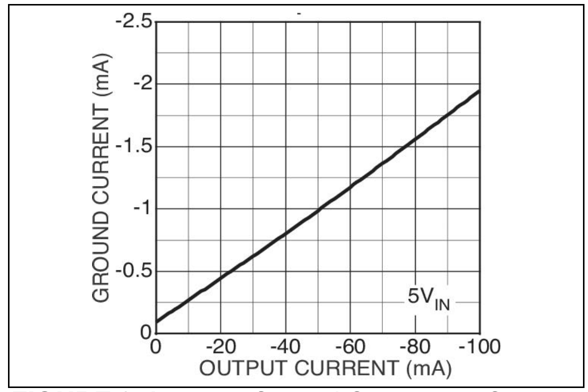


FIGURE 2-4: Ground Current vs. Output Current.

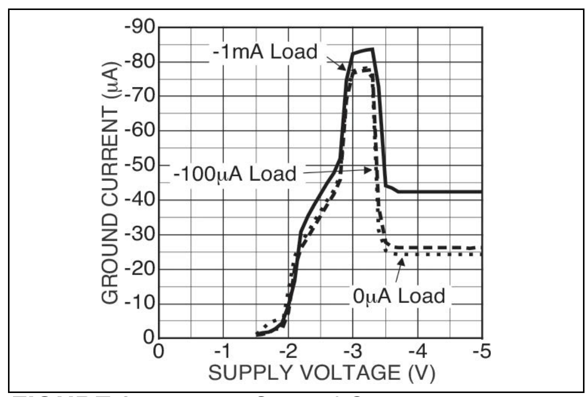


FIGURE 2-5: Ground Current Characteristics.

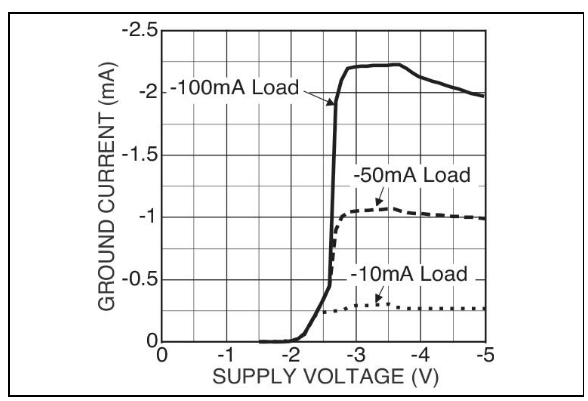


FIGURE 2-6: Ground Current Characteristics.

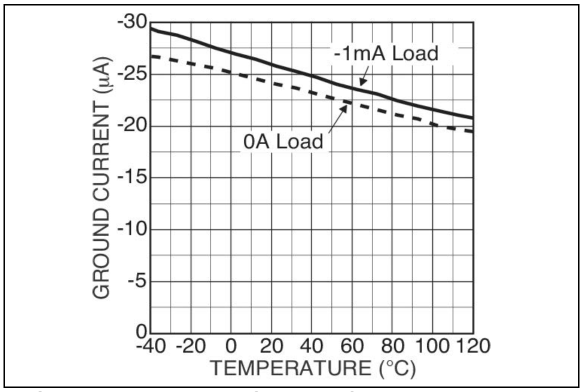


FIGURE 2-7: *Ground Current vs. Temperature.*

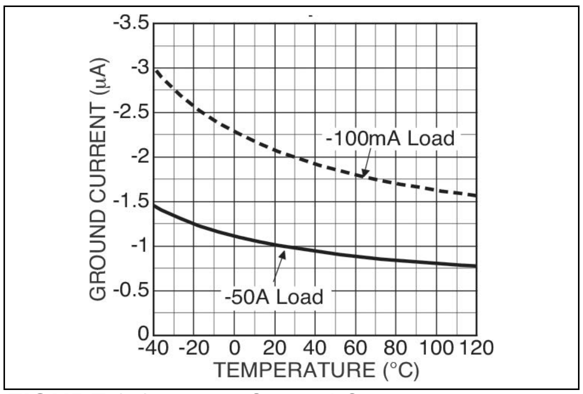


FIGURE 2-8: *Ground Current vs. Temperature.*

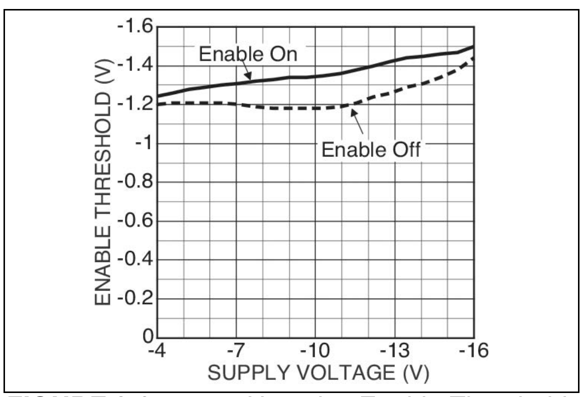


FIGURE 2-9: *Negative Enable Threshold vs. Supply Voltage.*

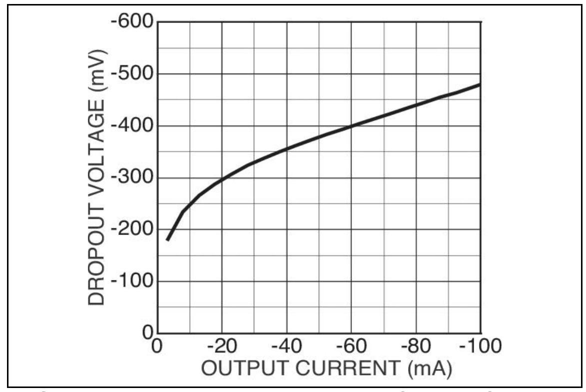


FIGURE 2-10: *Dropout vs. Output Current.*

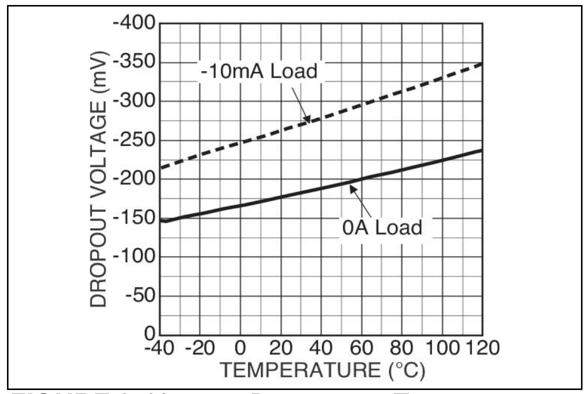


FIGURE 2-11: *Dropout vs. Temperature.*

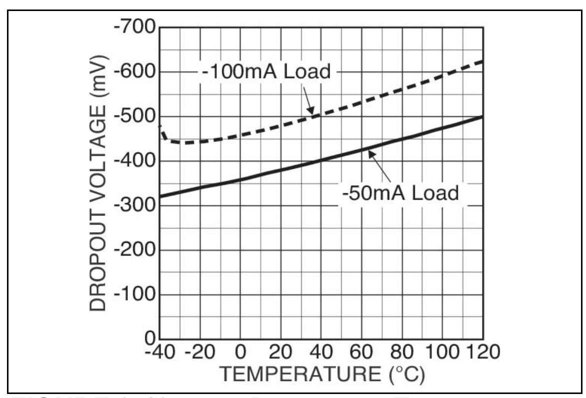


FIGURE 2-12: *Dropout vs. Temperature.*

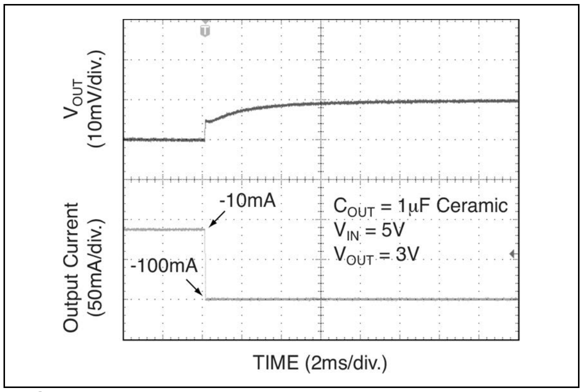


FIGURE 2-13: *Load Transient.*

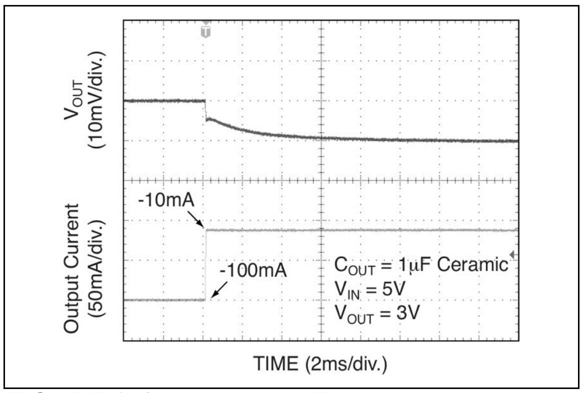


FIGURE 2-14: *Load Transient.*

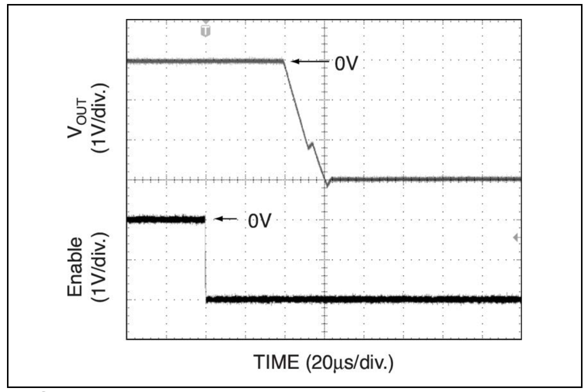


FIGURE 2-15: *Negative Enable Transient.*

3.0 PIN DESCRIPTIONS

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

TABLE 3-1: PIN FUNCTION TABLE

Pin Number (Adj.)	Pin Number (Fixed)	Pin Name	Description
1	1	NC	Not internally connected.
2	2	GND	Ground.
—	3	NC	Not internally connected.
3	—	ADJ	Adjustable (Input): Adjustable feedback output connects to resistor voltage divider.
4	4	-OUT	Negative Regulator Output.
5	5	-IN	Negative Supply Input.

4.0 APPLICATION INFORMATION

The MIC5270 is a general-purpose negative regulator that can be used in any system that requires a clean negative voltage from a negative output. This includes post regulating of DC-DC converters (transformer based or charge pump based voltage converters). These negative voltages typically require a negative low-dropout voltage regulator to provide a clean output from typically noisy lines.

4.1 Input Capacitor

A 1 µF input capacitor should be placed from IN to GND if there is more than 2 inches of wire or trace between the input and the AC filter capacitor, or if a battery is used as the input.

4.2 Output Capacitor

The MIC5270 requires an output capacitor for stable operation. A minimum of 1 µF of output capacitance is required. The output capacitor can be increased without limitation to improve transient response. The output does not require ESR to maintain stability, therefore a ceramic capacitor can be used. High-ESR capacitors may cause instability. Capacitors with an ESR of 3Ω or greater at 100 kHz may cause a high frequency oscillation.

Low-ESR tantalums are recommended due to the tight capacitance tolerance over temperature.

Ceramic chip capacitors have a much greater dependence on temperature, depending upon the dielectric. The X7R is recommended for ceramic capacitors because the dielectric will change capacitance value by approximately 15% over temperature. The Z5U dielectric can change capacitance value by as much 50% over temperature, and the Y5V dielectric can change capacitance value by as much as 60% over temperature. To use a ceramic chip capacitor with the Y5V dielectric, the value must be much higher than a tantalum to ensure the same minimum capacitor value over temperature.

4.3 No-Load Stability

The MIC5270 does not require a load for stability.

4.4 Thermal Considerations

Absolute values will be used for thermal calculations to clarify what is meant by power dissipation and voltage drops across the part.

Proper thermal design for the MIC5270-5.0BM5 can be accomplished with some basic design criteria and some simple equations. The following information must be known to implement your regulator design:

- V_{IN} = input voltage
- V_{OUT} = output voltage
- I_{OUT} = output current
- T_A = ambient operating temperature
- I_{GND} = ground current

Maximum power dissipation can be determined by knowing the ambient temperature, T_A, the maximum junction temperature, 125°C, and the thermal resistance, junction to ambient. The thermal resistance for this part, assuming a minimum footprint board layout, is 235°C/W. The maximum power dissipation at an ambient temperature of 25°C can be determined with the following equation:

EQUATION 4-1:

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_A}{\theta_{JA}}$$

$$P_{D(MAX)} = \frac{125°C - 25°C}{235°C/W}$$

$$P_{D(MAX)} = 425mW$$

The actual power dissipation of the regulator circuit can be determined using one simple equation.

EQUATION 4-2:

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

Substituting $P_{D(MAX)}$, determined above, for P_D and solving for the operating conditions that are critical to the application will give the maximum operating conditions for the regulator circuit. The maximum power dissipation number cannot be exceeded for proper operation of the device. The maximum input voltage can be determined using the output voltage of 5.0V and an output current of 100 mA. Ground current, of 1 mA for 100 mA of output current, can be taken from the **"Electrical Characteristics"** section.

- 425 mW = (V_{IN} − 5.0V)100 mA + V_{IN} ×1 mA
- 425 mW = (100 mA × V_{IN} +1 mA × V_{IN}) − 500 mW
- 925 mW = 101 mA × V_{IN}
- V_{IN} = 9.16 Vmax

Therefore, a –5.0V application at 100 mA of output current can accept a maximum input voltage of –9.16V in a SOT-23-5 package. For a full discussion of heat sinking and thermal effects on voltage regulators, refer to Regulator Thermals section of Micrel's "Designing with Low-Dropout Voltage Regulators" handbook.

4.5 Adjustable Regulator Application

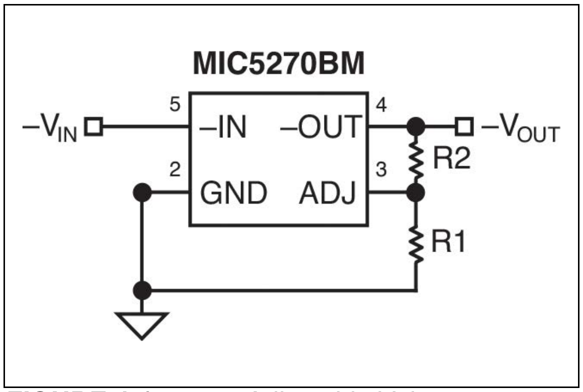


FIGURE 4-1: *Adjustable Voltage Application.*

The MIC5270BM5 can be adjusted from 1.20V to 14V by using two external resistors (Figure 1). The resistors set the output voltage based on the following equation:

EQUATION 4-3:

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

Where V_{REF} = 1.20V

5.0 PACKAGING INFORMATION

5.1 Package Marking Information

5-Lead SOT-23* (front)

XXXX

Example

LL50

5-Lead SOT-23* (back)

NNN

Example

624

ORDERING INFORMATION

Part Number				Junction		
Standard	Marking Code	PbFree	Marking Code	Voltage	Temp. Range	Package
MIC5270BM5	LLAA	MIC5270YM5	LLAA	Adj.	–40°C to +125°C	SOT-23-5
MIC5270-3.0BM5	LL30	MIC5270-3.0YM5	LL30	–3.0V	–40°C to +125°C	SOT-23-5
MIC5270-4.1BM5	LL41	MIC5270-4.1YM5	LL41	–4.1V	–40°C to +125°C	SOT-23-5
MIC5270-5.0BM5	LL50	MIC5270-5.0YM5	LL50	–5.0V	–40°C to +125°C	SOT-23-5

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).

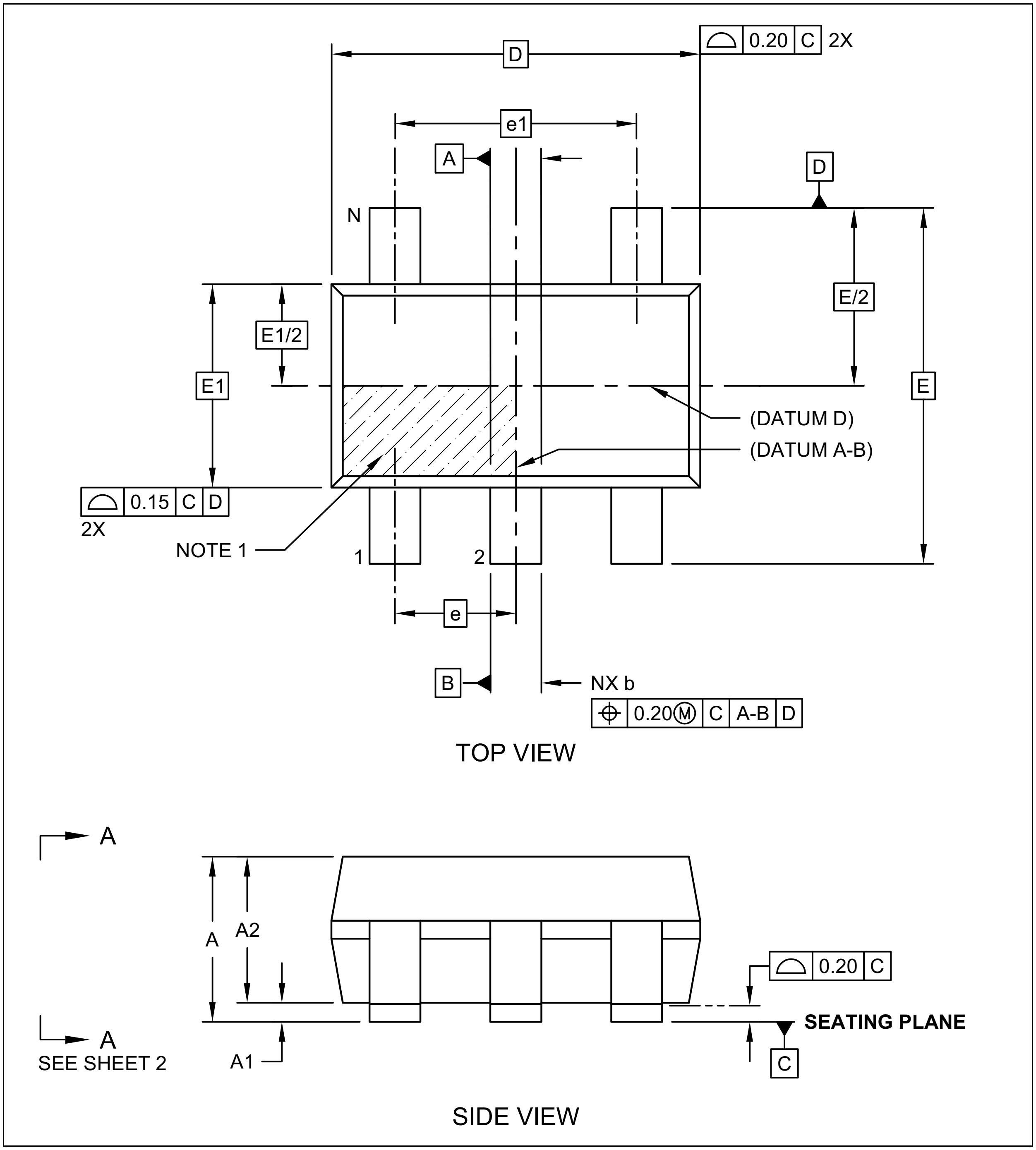
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or may not include the corporate logo.

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

Note: If the full seven-character YYWWNNN code cannot fit on the package, the following truncated codes are used based on the available marking space:
6 Characters = YWWNNN; 5 Characters = WWNNN; 4 Characters = WNNN; 3 Characters = NNN;
2 Characters = NN; 1 Character = N.

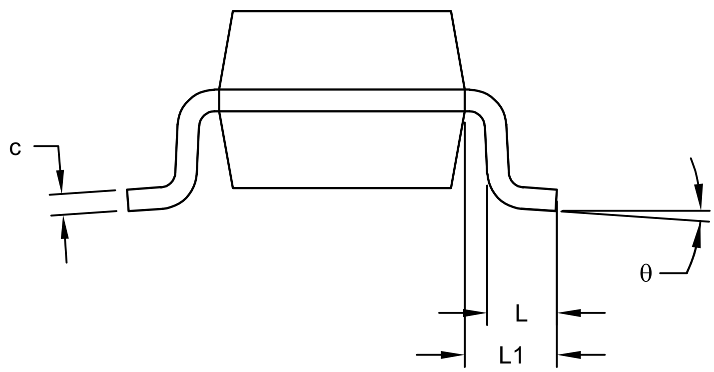
5-Lead SOT-23 Package Outline and Recommended Land Pattern

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

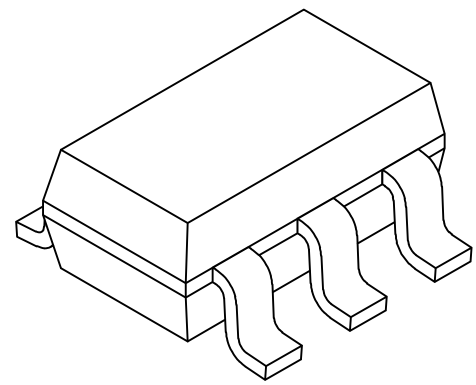


5-Lead SOT-23 Package Outline and Recommended Land Pattern

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



VIEW A-A
SHEET 1



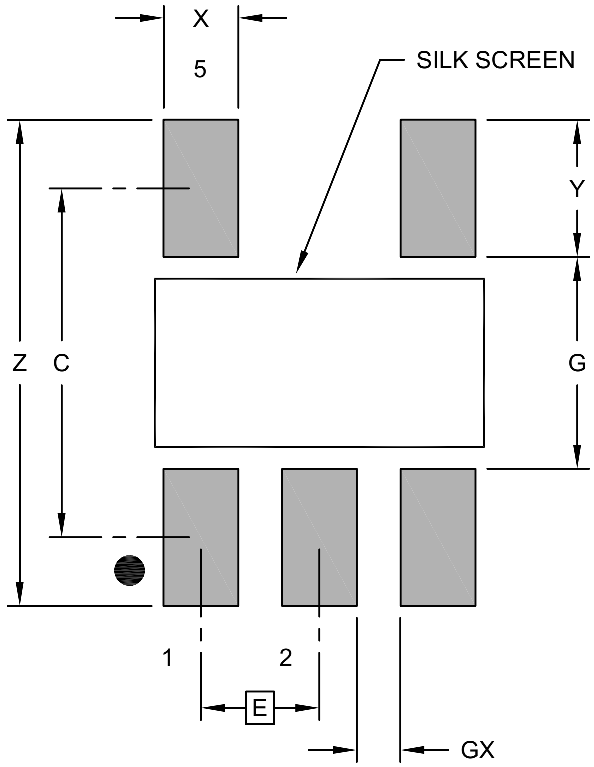
Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		5	
Pitch	e		0.95 BSC	
Outside lead pitch	e1		1.90 BSC	
Overall Height	A	0.90	-	1.45
Molded Package Thickness	A2	0.89	-	1.30
Standoff	A1	-	-	0.15
Overall Width	E		2.80 BSC	
Molded Package Width	E1		1.60 BSC	
Overall Length	D		2.90 BSC	
Foot Length	L	0.30	-	0.60
Footprint	L1		0.60 REF	
Foot Angle	ϕ	0°	-	10°
Lead Thickness	c	0.08	-	0.26
Lead Width	b	0.20	-	0.51

Notes:

1. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.25mm per side.
2. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
   REF: Reference Dimension, usually without tolerance, for information purposes only.

5-Lead SOT-23 Package Outline and Recommended Land Pattern

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



RECOMMENDED LAND PATTERN

		Units	MILLIMETERS	
		Dimension Limits	MIN	NOM	MAX
Contact Pitch	E	0.95 BSC		
Contact Pad Spacing	C		2.80	
Contact Pad Width (X5)	X			0.60
Contact Pad Length (X5)	Y			1.10
Distance Between Pads	G	1.70		
Distance Between Pads	GX	0.35		
Overall Width	Z			3.90

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing No. C04-2091-6BX Rev G

APPENDIX A: REVISION HISTORY

Revision A (June 2022)

- Converted Micrel document MIC5270 to Microchip data sheet DS20006698A.
- 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.XX	X	XX	-XX
Device	Output Voltage	Junction Temp. Range	Package	Media Type

Device:	MIC5270:	µCap Negative Low-Dropout Regulator
Output Voltage:	<blank> = Adjustable -3.0 = –3.0V -4.1 = –4.1V -5.0 = –5.0V	
Junction Temperature Range:	Y =	–40°C to +125°C
Package:	M5 =	SOT-23-5
Media Type:	TR =	3000/Reel

Examples:

a) MIC5270-3.0YM5-TR: MIC5270, –3.0V Output Voltage, –40°C to +125°C Temp. Range, SOT-23-5, 3000/Reel

b) MIC5270-5.0YM5-TR: MIC5270, –5.0V Output Voltage, –40°C to +125°C Temp. Range, SOT-23-5, 3000/Reel

c) MIC5270YM5-TR: MIC5270, Adjustable Output Voltage, –40°C to +125°C Temp. Range, SOT-23-5, 3000/Reel

d) MIC5270-4.1YM5-TR: MIC5270, –4.1V Output Voltage, –40°C to +125°C Temp. Range, SOT-23-5, 3000/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:

Note the following details of the code protection feature on Microchip products:

- 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, within operating specifications, and under normal conditions.
- Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip product is strictly prohibited and may violate the Digital Millennium Copyright Act.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is "unbreakable" Code protection is constantly evolving. Microchip is committed to continuously improving the code protection features of our products.

For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.

Trademarks

ISBN:

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
http://www.microchip.com/support
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Austin, TX
Tel: 512-257-3370

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Novi, MI
Tel: 248-848-4000

Houston, TX
Tel: 281-894-5983

Indianapolis
Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453
Tel: 317-536-2380

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608
Tel: 951-273-7800

Raleigh, NC
Tel: 919-844-7510

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110
Tel: 408-436-4270

Canada - Toronto
Tel: 905-695-1980
Fax: 905-695-2078

ASIA/PACIFIC

Australia - Sydney
Tel: 61-2-9868-6733

China - Beijing
Tel: 86-10-8569-7000

China - Chengdu
Tel: 86-28-8665-5511

China - Chongqing
Tel: 86-23-8980-9588

China - Dongguan
Tel: 86-769-8702-9880

China - Guangzhou
Tel: 86-20-8755-8029

China - Hangzhou
Tel: 86-571-8792-8115

China - Hong Kong SAR
Tel: 852-2943-5100

China - Nanjing
Tel: 86-25-8473-2460

China - Qingdao
Tel: 86-532-8502-7355

China - Shanghai
Tel: 86-21-3326-8000

China - Shenyang
Tel: 86-24-2334-2829

China - Shenzhen
Tel: 86-755-8864-2200

China - Suzhou
Tel: 86-186-6233-1526

China - Wuhan
Tel: 86-27-5980-5300

China - Xian
Tel: 86-29-8833-7252

China - Xiamen
Tel: 86-592-2388138

China - Zhuhai
Tel: 86-756-3210040

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-3090-4444

India - New Delhi
Tel: 91-11-4160-8631

India - Pune
Tel: 91-20-4121-0141

Japan - Osaka
Tel: 81-6-6152-7160

Japan - Tokyo
Tel: 81-3-6880- 3770

Korea - Daegu
Tel: 82-53-744-4301

Korea - Seoul
Tel: 82-2-554-7200

Malaysia - Kuala Lumpur
Tel: 60-3-7651-7906

Malaysia - Penang
Tel: 60-4-227-8870

Philippines - Manila
Tel: 63-2-634-9065

Singapore
Tel: 65-6334-8870

Taiwan - Hsin Chu
Tel: 886-3-577-8366

Taiwan - Kaohsiung
Tel: 886-7-213-7830

Taiwan - Taipei
Tel: 886-2-2508-8600

Thailand - Bangkok
Tel: 66-2-694-1351

Vietnam - Ho Chi Minh
Tel: 84-28-5448-2100

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4485-5910
Fax: 45-4485-2829

Finland - Espoo
Tel: 358-9-4520-820

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Garching
Tel: 49-8931-9700

Germany - Haan
Tel: 49-2129-3766400

Germany - Heilbronn
Tel: 49-7131-72400

Germany - Karlsruhe
Tel: 49-721-625370

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Germany - Rosenheim
Tel: 49-8031-354-560

Israel - Ra'anana
Tel: 972-9-744-7705

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Italy - Padova
Tel: 39-049-7625286

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Norway - Trondheim
Tel: 47-7288-4388

Poland - Warsaw
Tel: 48-22-3325737

Romania - Bucharest
Tel: 40-21-407-87-50

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

Sweden - Gothenberg
Tel: 46-31-704-60-40

Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820