查询"MIC5320"供应商

MIC5320

Dual, High Performance 150mA μCap ULDO™

General Description

The MIC5320 is a tiny Dual Ultra Low-Dropout (ULDO™) linear regulator ideally suited for portable electronics. It is ideal for general purpose/ digital applications which require high power supply ripple rejection (PSRR) >65dB, eliminating the need for a bypass capacitor and providing two enable pins for maximum flexibility. The MIC5320 integrates two high-performance; 150mA ULDOs into a tiny 6-pin 1.6mm x 1.6mm leadless MLF® package, which provides exceptional thermal package characteristics.

The MIC5320 is a μCap design which enables operation with very small ceramic output capacitors for stability, thereby reducing required board space and component cost. The combination of extremely low-drop-out voltage, high power supply rejection and exceptional thermal package characteristics makes it ideal for powering cellular phone camera modules, imaging sensors for digital still cameras, PDAs, MP3 players and WebCam applications.

The MIC5320 ULDO™ is available in fixed-output voltages in the tiny 6-pin 1.6mm x 1.6mm leadless MLF® package which is only 2.56mm^2 in area, less than 30% the area of the SOT-23, TSOP and MLF® 3x3 packages. It's also available in the thin SOT-23-6 lead package. Additional voltage options are available. For more information, contact Micrel marketing department.

Data sheets and supporting documentation can be found on Micrel's web site at www.micrel.com.

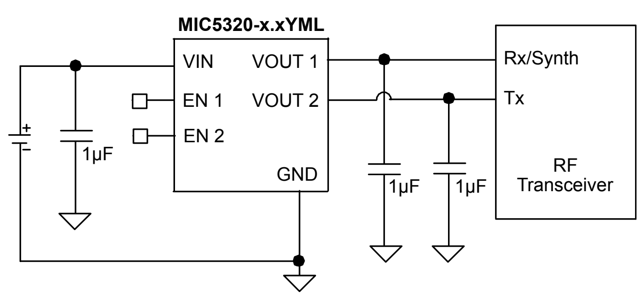
Features

- 2.3V to 5.5V input voltage range
- Ultra-low dropout voltage ULDO™ 35mV @ 150mA
- Tiny 6-pin 1.6mm x 1.6mm MLF® leadless package
- Low cost TSOT-23-6 package
- Independent enable pins
- PSRR – >65dB on each LDO
- 150mA output current per LDO
- μCap stable with 1μF ceramic capacitor
- Low quiescent current – 85μA per output
- Fast turn-on time – 30μs
- Thermal shutdown protection
- Current limit protection

Applications

- Mobile phones
- PDAs
- GPS receivers
- Portable electronics
- Portable media players
- Digital still and video cameras

Typical Application



RF Power Supply Circuit

Ordering Information

Part number	Manufacturing Part Number	Voltage	Junction Temperature Range	Package
MIC5320-1.8/1.5YML	MIC5320-GFYML	1.8V/1.5V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-1.8/1.6YML	MIC5320-GWYML	1.8V/1.6V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.5/1.8YML	MIC5320-JGYML	2.5V/1.8V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.5/2.5YML	MIC5320-JJYML	2.5V/2.5V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.6/1.85YML	MIC5320-KDYML	2.6V/1.85	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.6/1.8YML	MIC5320-KGYML	2.6V/1.8V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.7/2.7YML	MIC5320-LLYML	2.7V/2.7V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.8/1.5YML	MIC5320-MFYML	2.8V/1.5V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.8/1.8YML	MIC5320-MGYML	2.8V/1.8V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.8/2.6YML	MIC5320-MKYML	2.8V/2.6V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.8/2.8YML	MIC5320-MMYML	2.8V/2.8V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.8/2.85YML	MIC5320-MNYML	2.8V/2.85V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.85/1.85YML	MIC5320-NDYML	2.85V/1.85V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.85/2.6YML	MIC5320-NKYML	2.85V/2.6V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.85/2.85YML	MIC5320-NNYML	2.85V/2.85V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.9/1.5YML	MIC5320-OFYML	2.9V/1.5V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.9/1.8YML	MIC5320-OGYML	2.9V/1.8V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-2.9/2.9YML	MIC5320-OOYML	2.9V/2.9V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.0/1.8YML	MIC5320-PGYML	3.0V/1.8V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.0/2.5YML	MIC5320-PJYML	3.0V/2.5V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.0/2.6YML	MIC5320-PKYML	3.0V/2.6V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.0/2.8YML	MIC5320-PMYML	3.0V/2.8V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.0/2.85YML	MIC5320-PNYML	3.0V/2.85V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.0/3.0YML	MIC5320-PPYML	3.0V/3.0V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.3/1.5YML	MIC5320-SFYML	3.3V/1.5V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.3/1.8YML	MIC5320-SGYML	3.3V/1.8V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.3/2.5YML	MIC5320-SJYML	3.3V/2.5V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.3/2.6YML	MIC5320-SKYML	3.3V/2.6V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.3/2.7YML	MIC5320-SLYML	3.3V/2.7V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.3/2.8YML	MIC5320-SMYML	3.3V/2.8V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.3/2.85YML	MIC5320-SNYML	3.3V/2.85V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.3/2.9YML	MIC5320-SOYML	3.3V/2.9V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.3/3.0YML	MIC5320-SPYML	3.3V/3.0V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.3/3.2YML	MIC5320-SRYML	3.3V/3.2V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-3.3/3.3YML	MIC5320-SSYML	3.3V/3.3V	–40°C to +125°C	6-Pin 1.6x1.6 MLF®
MIC5320-1.8/1.5YD6	MIC5320-GFYD6	1.8V/1.5V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-1.8/1.6YD6	MIC5320-GWYD6	1.8V/1.6V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.5/1.8YD6	MIC5320-JGYD6	2.5V/1.8V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.5/2.5YD6	MIC5320-JJYD6	2.5V/2.5V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.6/1.85YD6	MIC5320-KDYD6	2.6V/1.85	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.6/1.8YD6	MIC5320-KGYD6	2.6V/1.8V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.7/2.7YD6	MIC5320-LLYD6	2.7V/2.7V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.8/1.5YD6	MIC5320-MFYD6	2.8V/1.5V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.8/1.8YD6	MIC5320-MGYD6	2.8V/1.8V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.8/2.6YD6	MIC5320-MKYD6	2.8V/2.6V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.8/2.8YD6	MIC5320-MMYD6	2.8V/2.8V	–40°C to +125°C	6-Pin TSOT-23

MIC5320-2.8/2.85YD6	MIC5320-MNYD6	2.8V/2.85V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.85/1.85YD6	MIC5320-NDYD6	2.85V/1.85V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.85/2.6YD6	MIC5320-NKYD6	2.85V/2.6V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.85/2.85YD6	MIC5320-NNYD6	2.85V/2.85V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.9/1.5YD6	MIC5320-OFYD6	2.9V/1.5V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.9/1.8YD6	MIC5320-OGYD6	2.9V/1.8V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-2.9/2.9YD6	MIC5320-OOYD6	2.9V/2.9V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.0/1.8YD6	MIC5320-PGYD6	3.0V/1.8V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.0/2.5YD6	MIC5320-PJYD6	3.0V/2.5V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.0/2.6YD6	MIC5320-PKYD6	3.0V/2.6V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.0/2.8YD6	MIC5320-PMYD6	3.0V/2.8V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.0/2.85YD6	MIC5320-PNYD6	3.0V/2.85V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.0/3.0YD6	MIC5320-PPYD6	3.0V/3.0V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.3/1.5YD6	MIC5320-SFYD6	3.3V/1.5V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.3/1.8YD6	MIC5320-SGYD6	3.3V/1.8V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.3/2.5YD6	MIC5320-SJYD6	3.3V/2.5V	–40°C to +125°C	6-Pin TSOT-23
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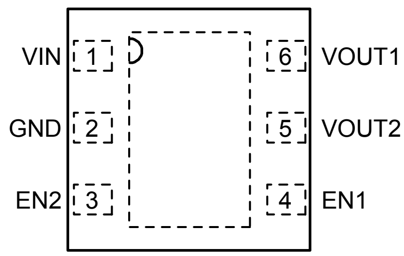
MIC5320-3.3/2.7YD6	MIC5320-SLYD6	3.3V/2.7V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.3/2.8YD6	MIC5320-SMYD6	3.3V/2.8V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.3/2.85YD6	MIC5320-SNYD6	3.3V/2.85V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.3/2.9YD6	MIC5320-SOYD6	3.3V/2.9V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.3/3.0YD6	MIC5320-SPYD6	3.3V/3.0V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.3/3.2YD6	MIC5320-SRYD6	3.3V/3.2V	–40°C to +125°C	6-Pin TSOT-23
MIC5320-3.3/3.3YD6	MIC5320-SSYD6	3.3V/3.3V	–40°C to +125°C	6-Pin TSOT-23

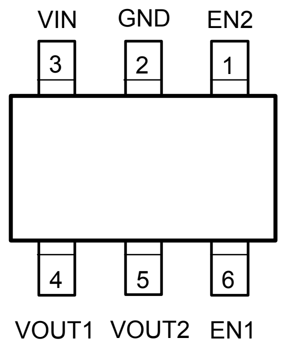
Note:

1. Other Voltages available. Contact Micrel for detail.

Pin Configuration



6-Pin 1.6mm x 1.6mm MLF (ML)
Top View



TSOT-23-6 (D6)
Top View

Pin Description

Pin Number MLF-6	Pin Number TSOT-23-6	Pin Name	Pin Function
1	3	VIN	Supply Input.
2	2	GND	Ground
3	1	EN2	Enable Input (regulator 2). Active High Input. Logic High = On; Logic Low = Off; Do not leave floating.
4	6	EN1	Enable Input (regulator 1). Active High Input. Logic High = On; Logic Low = Off; Do not leave floating.
5	5	VOUT2	Regulator Output – LDO2
6	4	VOUT1	Regulator Output – LDO1

Absolute Maximum Ratings[1]

Supply Voltage (V_{IN})....................................0V to +6V
Enable Input Voltage (V_{EN})...........................0V to +6V
Power Dissipation.................... Internally Limited[3]
Lead Temperature (soldering, 3sec)..................260°C
Storage Temperature (T_S)................ –65°C to +150°C
ESD Rating[4] 2kV

Operating Ratings[2]

Supply Voltage (V_{IN})............................. +2.3V to +5.5V
Enable Input Voltage (V_{EN}).............................. 0V to V_{IN}
Junction Temperature (T_J) .... –40°C to +125°C
Junction Thermal Resistance
MLF-6 (θ_{JA})... 100°C/W
TSOT-6 (θ_{JA}) .... 235°C/W

Electrical Characteristics[5]

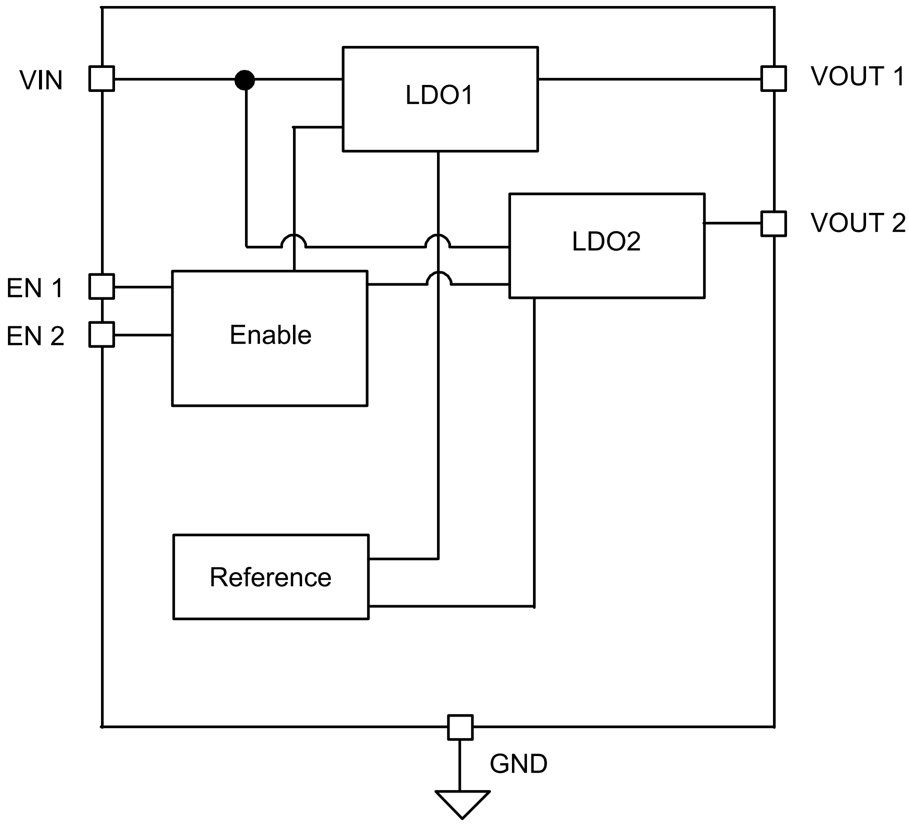
V_{IN} = EN1 = EN2 = V_{OUT} + 1.0V; higher of the two regulator outputs, $I_{OUTLDO1}$ = $I_{OUTLDO2}$ = 100µA; C_{OUT1} = C_{OUT2} = 1µF; T_J = 25°C, **bold** values indicate –40°C ≤ T_J ≤ +125°C, unless noted.

Parameter	Conditions	Min	Typ	Max	Units
Output Voltage Accuracy	Variation from nominal V_{OUT}	-2.0		+2.0	%
	Variation from nominal V_{OUT}; –40°C to +125°C	**-3.0**		**+3.0**	%
Line Regulation	V_{IN} = V_{OUT} + 1V to 5.5V; I_{OUT} = 100µA		0.02	0.3 **0.6**	%/V %/V
Load Regulation	I_{OUT} = 100µA to 150mA		0.5	**2**	%
Dropout Voltage [6]	I_{OUT} = 100µA		0.1		mV
	I_{OUT} = 50mA		12	**50**	mV
	I_{OUT} = 100mA		25	**75**	mV
	I_{OUT} = 150mA		35	**100**	mV
Ground Current	EN1 = High; EN2 = Low; I_{OUT} = 100µA to 150mA		85	120	µA
	EN1 = Low; EN2 = High; I_{OUT} = 100µA to 150mA		85	120	µA
	EN1 = EN2 = High; I_{OUT1} = 150mA, I_{OUT2} = 150mA		150	**190**	µA
Ground Current in Shutdown	EN1 = EN2 = 0V		0.01	2	µA
Ripple Rejection	f = 1kHz; C_{OUT} = 1.0µF		65		dB
	f=20kHz; C_{OUT} = 1.0µF		45		dB
Current Limit	V_{OUT} = 0V	300	550	**950**	mA
Output Voltage Noise	C_{OUT} = 1.0µF; 10Hz to 100KHz		90		µV_{RMS}
Enable Inputs (EN1 / EN2)					
Enable Input Voltage	Logic Low			**0.2**	V
	Logic High	**1.1**			V
Enable Input Current	V_{IL} ≤ 0.2V		0.01	1	µA
	V_{IH} ≥ 1.0V		0.01	1	µA
Turn-on Time (See Timing Diagram)					
Turn-on Time (LDO1 and 2)	C_{OUT} = 1.0µF		30	**100**	µs

Notes:

1. Exceeding the absolute maximum rating may damage the device.
2. The device is not guaranteed to function outside its operating rating.
3. The maximum allowable power dissipation of any T_A (ambient temperature) is $P_{D(max)} = T_{J(max)} - T_A) / \theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown.
4. Devices are ESD sensitive. Handling precautions recommended. Human body model, 1.5k in series with 100pF.
5. Specification for packaged product only.
6. Dropout voltage is defined as the input-to-output differential at which the output voltage drops 2% below its nominal V_{OUT}. For outputs below 2.3V, the dropout voltage is the input-to-output differential with the minimum input voltage 2.3V.

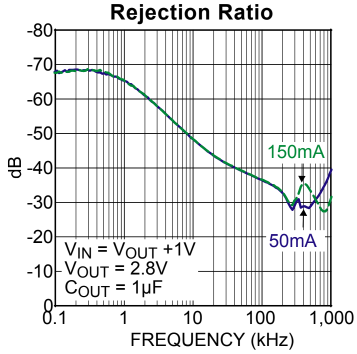
Functional Diagram



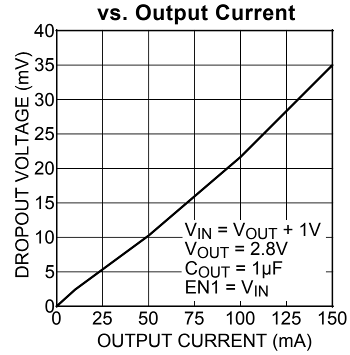
MIC5320 Block Diagram

Typical Characteristics

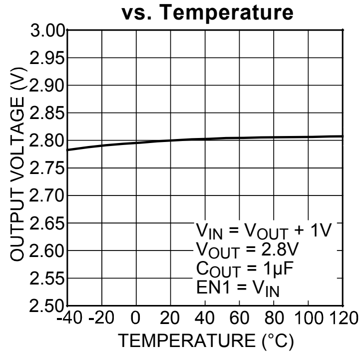
Power Supply Rejection Ratio



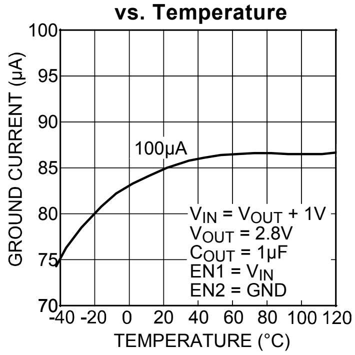
Dropout Voltage vs. Output Current



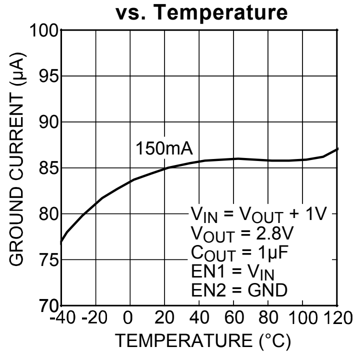
Output Voltage vs. Temperature



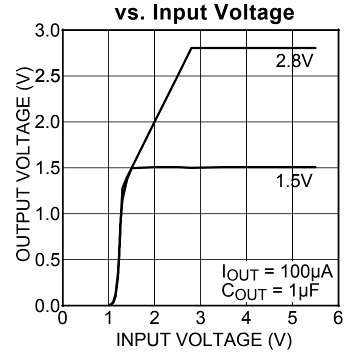
Ground Current vs. Temperature



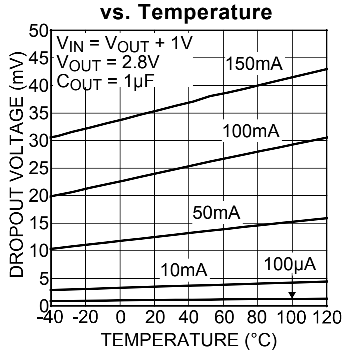
Ground Current vs. Temperature



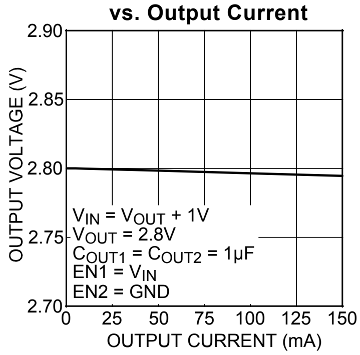
Output Voltage vs. Input Voltage



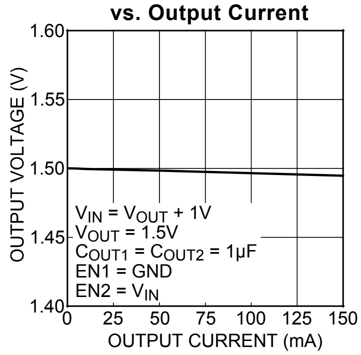
Dropout Voltage vs. Temperature



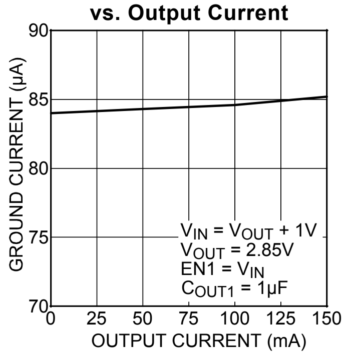
Output Voltage vs. Output Current



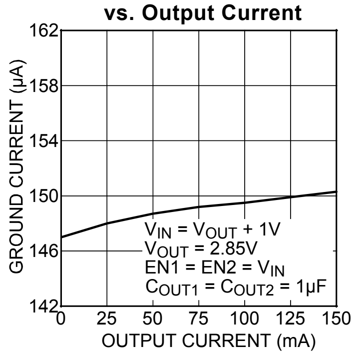
Output Voltage vs. Output Current



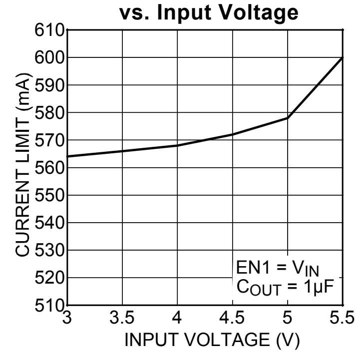
Ground Current vs. Output Current



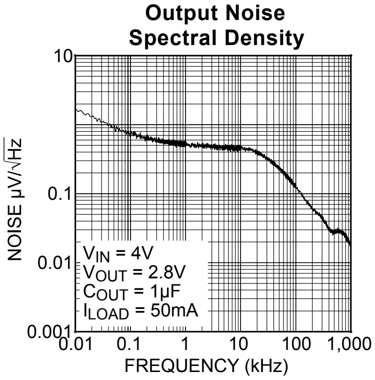
Ground Current vs. Output Current



Current Limit vs. Input Voltage

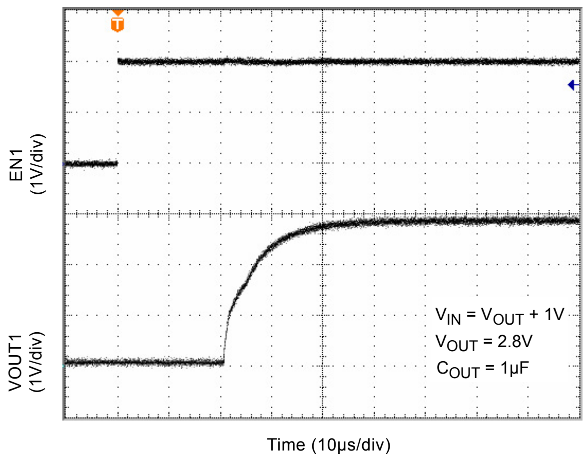


Typical Characteristics (continued)

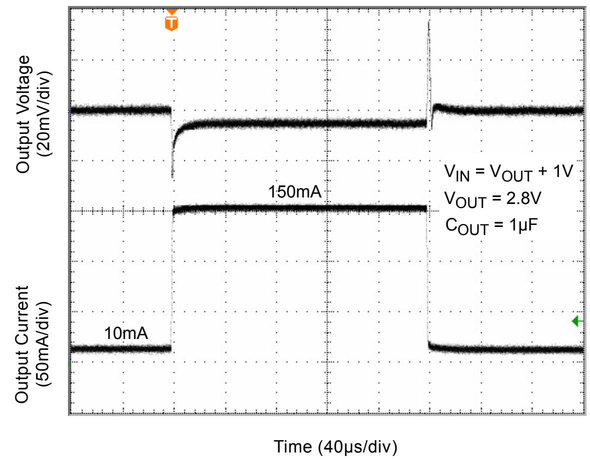


Functional Characteristics

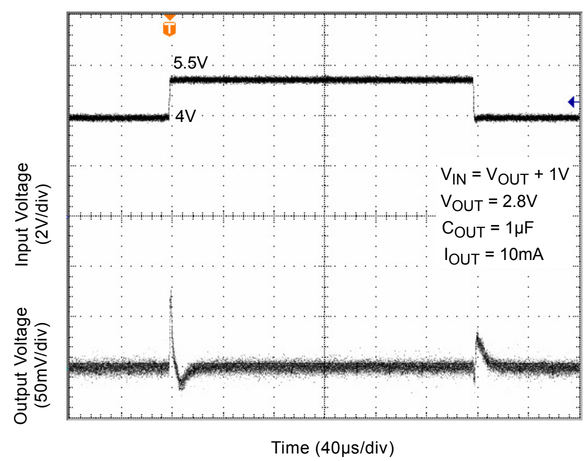
Enable Turn-On



Load Transient



Line Transient



Applications Information

Enable/Shutdown

The MIC5320 comes with dual active-high enable pins that allow each regulator to be disabled independently. Forcing the enable pin low disables the regulator and sends it into a "zero" off-mode-current state. In this state, current consumed by the regulator goes nearly to zero. Forcing the enable pin high enables the output voltage. The active-high enable pin uses CMOS technology and the enable pin cannot be left floating; a floating enable pin may cause an indeterminate state on the output.

Input Capacitor

The MIC5320 is a high-performance, high bandwidth device. Therefore, it requires a well-bypassed input supply for optimal performance. A 1µF capacitor is required from the input to ground to provide stability. Low-ESR ceramic capacitors provide optimal performance at a minimum of space. Additional high-frequency capacitors, such as small-valued NPO dielectric-type capacitors, help filter out high-frequency noise and are good practice in any RF-based circuit.

Output Capacitor

The MIC5320 requires an output capacitor of 1µF or greater to maintain stability. The design is optimized for use with low-ESR ceramic chip capacitors. High ESR capacitors may cause high frequency oscillation. The output capacitor can be increased, but performance has been optimized for a 1µF ceramic output capacitor and does not improve significantly with larger capacitance.

X7R/X5R dielectric-type 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 capacitor to ensure the same minimum capacitance over the equivalent operating temperature range.

No-Load Stability

Unlike many other voltage regulators, the MIC5320 will remain stable and in regulation with no load. This is especially important in CMOS RAM keep-alive applications.

Thermal Considerations

The MIC5320 is designed to provide 150mA of continuous current for both outputs in a very small package. Maximum ambient operating temperature can be calculated based on the output current and the voltage drop across the part. Given that the input voltage is 3.3V, the output voltage is 2.8V for V_{OUT1}, 1.5V for V_{OUT2} and the output current = 150mA. The actual power dissipation of the regulator circuit can be determined using the equation:

$$P_D = (V_{IN} - V_{OUT1})\, I_{OUT1} + (V_{IN} - V_{OUT2})\, I_{OUT2} + V_{IN}\, I_{GND}$$

Because this device is CMOS and the ground current is typically <150µA over the load range, the power dissipation contributed by the ground current is < 1% and can be ignored for this calculation.

$$P_D = (3.3V - 2.8V) \times 150mA + (3.3V - 1.5) \times 150mA$$

$$P_D = 0.345W$$

To determine the maximum ambient operating temperature of the package, use the junction-to-ambient thermal resistance of the device and the following basic equation:

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

$T_{J(max)}$ = 125°C, the maximum junction temperature of the die θ_{JA} thermal resistance = 100°C/W.

The table below shows junction-to-ambient thermal resistance for the MIC5320 in different packages.

Package	θ_{JA} Recommended Minimum Footprint	θ_{JC}
6-Pin 1.6x1.6 MLF®	100°C/W	2°C/W

Thermal Resistance

Substituting P_D for $P_{D(max)}$ and solving for the ambient operating temperature will give the maximum operating conditions for the regulator circuit. The junction-to-ambient thermal resistance for the minimum footprint is 100°C/W.

The maximum power dissipation must not be exceeded for proper operation.

For example, when operating the MIC5320-MFYML at an input voltage of 3.3V and 150mA loads at each output with a minimum footprint layout, the maximum ambient operating temperature T_A can be determined as follows:

$$0.345W = (125°C – T_A)/(100°C/W)$$

$$T_A=90.5°C$$

Therefore, a 2.8V/1.5V application with 150mA at each output current can accept an ambient operating temperature of 90.5°C in a 1.6mm x 1.6mm MLF® package. For a full discussion of heat sinking and thermal effects on voltage regulators, refer to the "Regulator Thermals" section of *Micrel's Designing with Low-Dropout Voltage Regulators* handbook. This information can be found on Micrel's website at:

http://www.micrel.com/_PDF/other/LDOBk_ds.pdf

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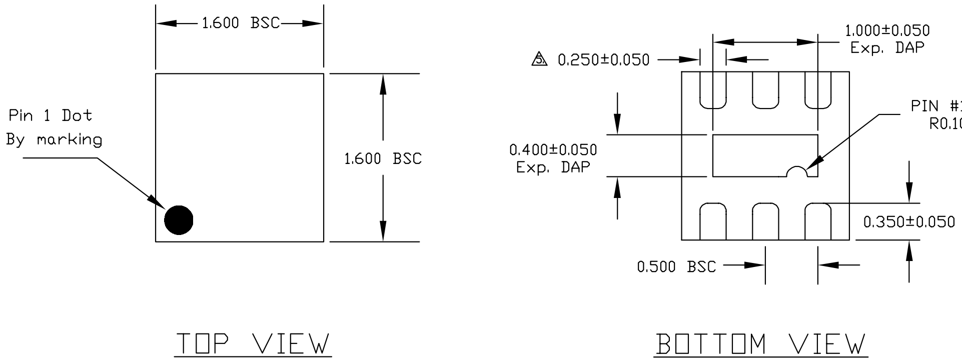
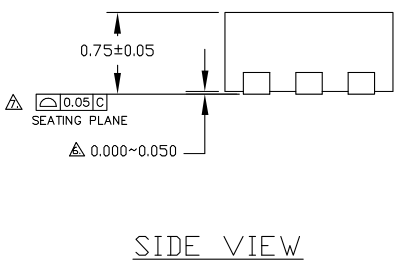
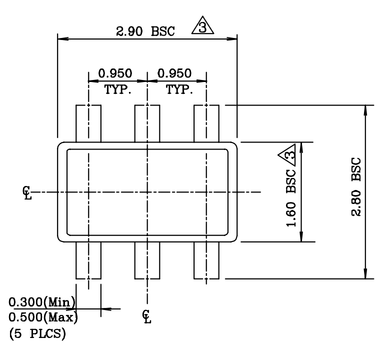
Package Information



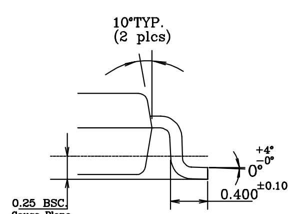


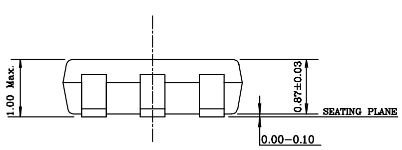
NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. MAX. PACKAGE WARPAGE IS 0.05 mm.
3. MAXIMUM ALLOWABE BURRS IS 0.076 mm IN ALL DIRECTIONS.
4. PIN #1 ID ON TOP WILL BE LASER/INK MARKED.
5. DIMENSION APPLIES TO METALIZED TERMINAL AND IS MEASURED BETWEEN 0.20 AND 0.25 mm FROM TERMINAL TIP.
6. APPLIED ONLY FOR TERMINALS.
7. APPLIED FOR EXPOSED PAD AND TERMINALS.

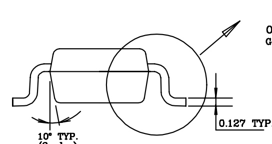
6-Pin 1.6mm x 1.6mm MLF (ML)



NOTE:
1. Dimensions and tolerances are as per ANSI Y14.5M, 1994.
2. Die is facing up for mold. Die is facing down for trim/form, ie. reverse trim/form.
3. Dimensions are exclusive of mold flash and gate burr.
4. The footlength measuring is based on the gauge plane method.
5. All specification comply to Jedec Spec MO193 Issue C.
6. All dimensions are in millimeters.







6-Pin TSOT-23 (D6)

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