MIC5208

Dual 50mA LDO Regulator

Final Information

The Infinite Bandwidth Company™

General Description

The MIC5208 is a dual linear voltage regulator with very low dropout voltage (typically 20mV at light loads and 250mV at 50mA), very low ground current (225µA at 10mA output), and better than 3% initial accuracy. It also features individual logic-compatible enable/shutdown control inputs.

Designed especially for hand-held battery powered devices, the MIC5208 can be switched by a CMOS or TTL compatible logic signal, or the enable pin can be connected to the supply input for 3-terminal operation. When disabled, power consumption drops nearly to zero. Dropout ground current is minimized to prolong battery life.

Key features include current limiting, overtemperature shutdown, and protection against reversed battery.

The MIC5208 is available in 3.0V, 3.3V, 3.6V, 4.0V and 5.0V fixed voltage configurations. Other voltages are available; contact Micrel for details.

Features

- Micrel Mini 8™ MSOP package
- Guaranteed 50mA output
- Low quiescent current
- Low dropout voltage
- Wide selection of output voltages
- Tight load and line regulation
- Low temperature coefficient
- Current and thermal limiting
- Reversed input polarity protection
- Zero off-mode current
- Logic-controlled electronic enable

Applications

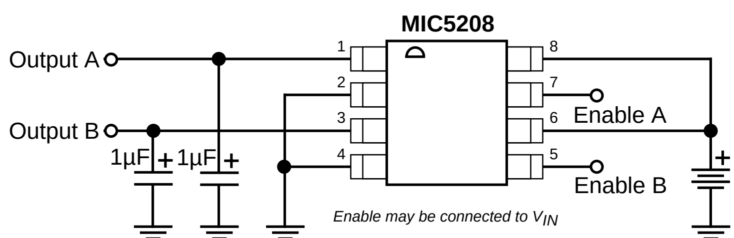
- Cellular telephones
- Laptop, notebook, and palmtop computers
- Battery powered equipment
- Bar code scanners
- SMPS post regulator/dc-to-dc modules
- High-efficiency linear power supplies

Ordering Information

Part Number	Voltage	Accuracy	Junction Temp. Range*	Package
MIC5208-3.0BMM	3.0	3%	–40°C to +125°C	8-lead MSOP
MIC5208-3.3BMM	3.3	3%	–40°C to +125°C	8-lead MSOP
MIC5208-3.6BMM	3.6	3%	–40°C to +125°C	8-lead MSOP
MIC5208-4.0BMM	4.0	3%	–40°C to +125°C	8-lead MSOP
MIC5208-5.0BMM	5.0	3%	–40°C to +125°C	8-lead MSOP

Other voltages available. Contact Micrel for details.

Typical Application



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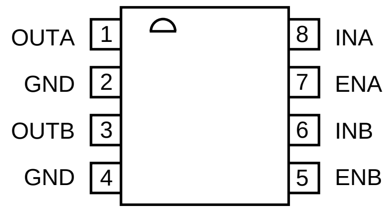
Pin Configuration



MIC5208BMM

Pin Description

Pin Number	Pin Name	Pin Function
1	OUTA	Regulator Output A
2, 4	GND	Ground: Both pins must be connected together.
3	OUTB	Regulator Output B
5	ENB	Enable/Shutdown B (Input): CMOS compatible input. Logic high = enable, logic low or open = shutdown. Do not leave floating.
6	INB	Supply Input B
7	ENA	Enable/Shutdown A (Input): CMOS compatible input. Logic high = enable, logic low or open = shutdown. Do not leave floating.
8	INA	Supply Input A

Absolute Maximum Ratings

Supply Input Voltage (V_{IN}) .... –20V to +20V
Enable Input Voltage (V_{EN}) .... –20V to +20V
Power Dissipation (P_D) .... Internally Limited
Storage Temperature Range .... –60°C to +150°C
Lead Temperature (soldering, 5 sec.) .... 260°C

Recommended Operating Conditions

Supply Input Voltage (V_{IN}) .... 2.5V to 16V
Enable Input Voltage (V_{EN}) .... 0V to 16V
Junction Temperature (T_J) .... –40°C to +125°C
8-lead MSOP (θ_{JA}) .... **Note 1**

Electrical Characteristics

$V_{IN} = V_{OUT} + 1V$; $I_L = 1mA$; $C_L = 1\mu F$, and $V_{EN} \geq 2.0V$; $T_J = 25°C$, **bold** values indicate –40°C to +125°C; for one-half of dual MIC5208; unless noted.

Symbol	Parameter	Conditions	Min	Typical	Max	Units
V_O	Output Voltage Accuracy	variation from nominal V_{OUT}	–3 **–4**		3 **4**	% %
$\Delta V_O/\Delta T$	Output Voltage Temperature Coeffcient	**Note 2**		**50**	**200**	ppm/°C
$\Delta V_O/V_O$	Line Regulation	$V_{IN} = V_{OUT}$ +1V to 16V		0.008	0.3 **0.5**	% %
$\Delta V_O/V_O$	Load Regulation	I_L = 0.1mA to 50mA, **Note 3**		0.08	0.3 **0.5**	% %
$V_{IN} - V_O$	Dropout Voltage, **Note 4**	$I_L = 100\mu A$ $I_L = 20mA$ $I_L = 50mA$		20 200 250	 **350** **500**	mV mV mV
I_Q	Quiescent Current	$V_{EN} \leq 0.4V$ (shutdown)		0.01	10	µA
I_{GND}	Ground Pin Current **Note 5**	$V_{EN} \geq 2.0V$ (enabled), $I_L = 100\mu A$ $I_L = 20mA$ $I_L = 50mA$		180 225 850	 **750** **1200**	µA µA µA
I_{GNDDO}	Ground Pin Current at Dropout	V_{IN} = 0.5V less than designed V_{OUT}, **Note 5**		200	**300**	µA
I_{LIMIT}	Current Limit	$V_{OUT} = 0V$		180	**250**	mA
$\Delta V_O/\Delta P_D$	Thermal Regulation	**Note 6**		0.05		%/W
Control Input						
 V_{IL} V_{IH}	Input Voltage Level Logic Low Logic High	 shutdown enabled	 **2.0**		 **0.6**	 V V
I_{IL} I_{IH}	Control Input Current	$V_{IL} \leq 0.6V$ $V_{IH} \geq 2.0V$		0.01 15	1 **50**	µA µA

General Note: Devices are ESD protected, however, handling precautions are recommended.

Note 1: Absolute maximum ratings indicate limits beyond which damage to the component may occur. Electrical specifications do not apply when operating the device outside of its rated operating conditions. The maximum allowable power dissipation is a function of the maximum junction temperature, $T_{J(max)}$, the junction-to-ambient thermal resistance, θ_{JA}, and the ambient temperature, T_A. The maximum allowable power dissipation at any ambient temperature is calculated using: $P_{MAX} = (T_{J(max)} - T_A) / \theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown. θ_{JA} of the 8-lead MSOP is 200°C/W, mounted on a PC board.

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

Note 3: Regulation is measured at constant junction temperature using low duty cycle pulse testing. Changes in output voltage due to heating effects are covered by the thermal regulation specification.

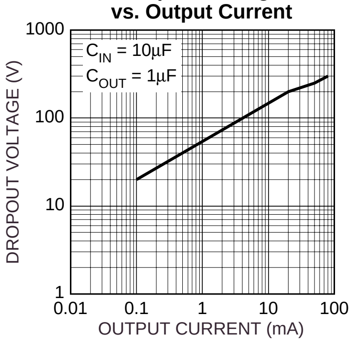
Note 4: Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

Note 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.

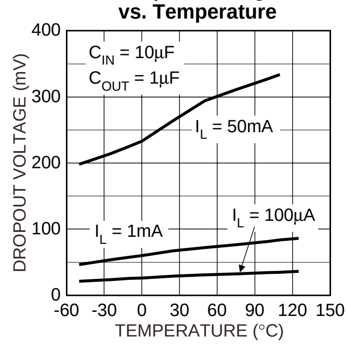
Note 6: Thermal regulation is defined as the change in output voltage at a time “t” after a change in power dissipation is applied, excluding load or line regulation effects. Specifications are for a 50mA load pulse at $V_{IN} = 16V$ for t = 10ms.

Typical Characteristics

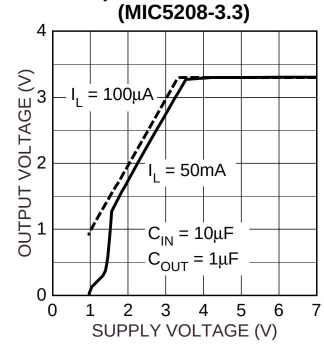
Dropout Voltage vs. Output Current



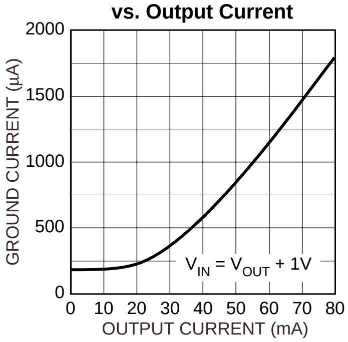
Dropout Voltage vs. Temperature



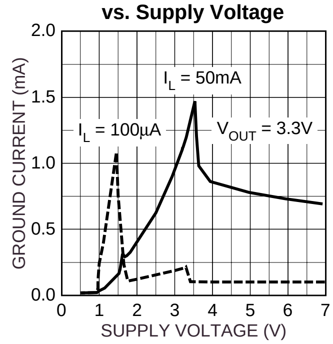
Dropout Characteristics (MIC5208-3.3)



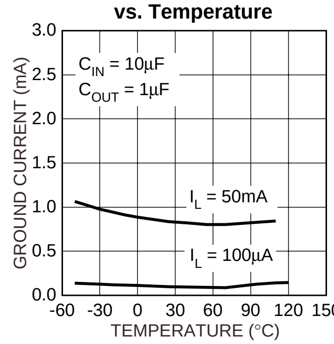
Ground Current vs. Output Current



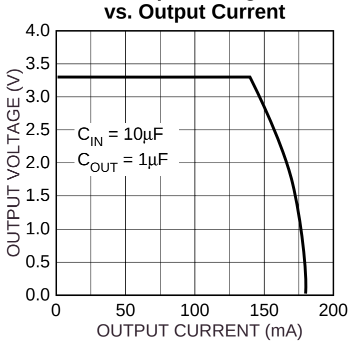
Ground Current vs. Supply Voltage



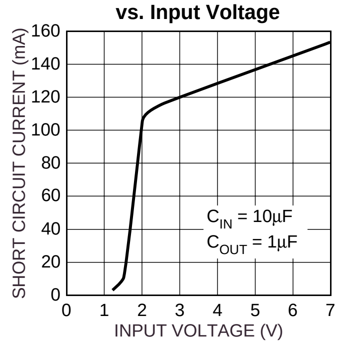
Ground Current vs. Temperature



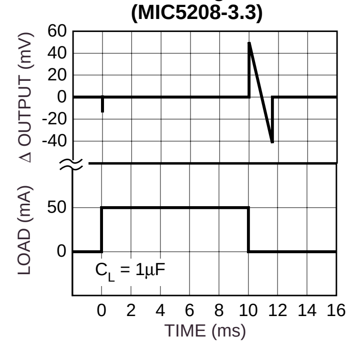
Output Voltage vs. Output Current



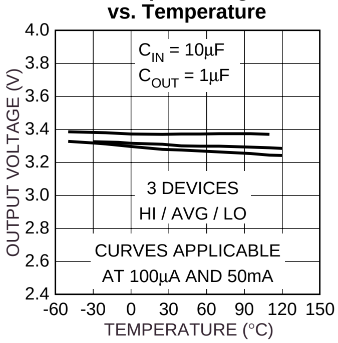
Short Circuit Current vs. Input Voltage



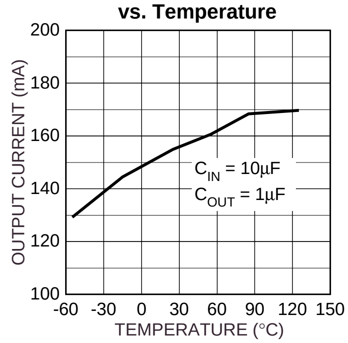
Thermal Regulation (MIC5208-3.3)



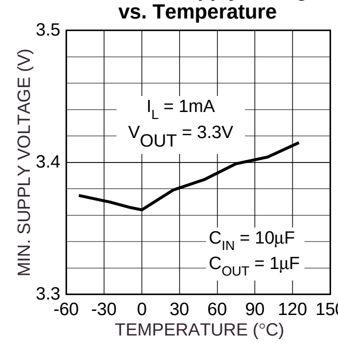
Output Voltage vs. Temperature



Short Circuit Current vs. Temperature

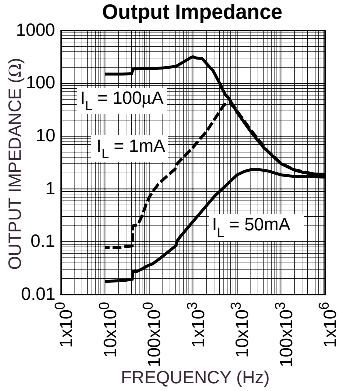


Minimum Supply Voltage vs. Temperature

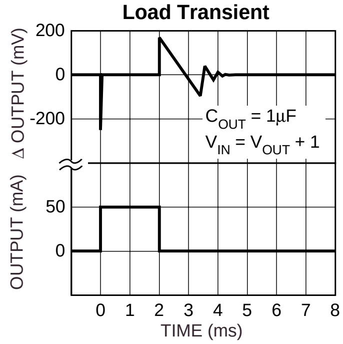


Typical Characteristics

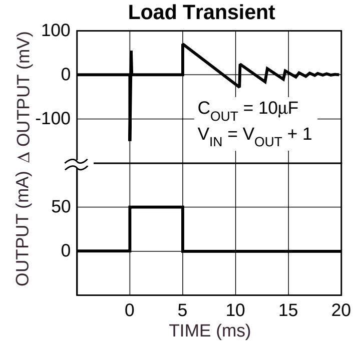
Output Impedance



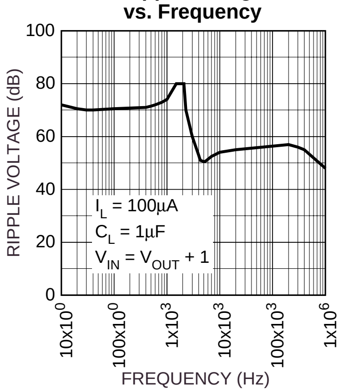
Load Transient



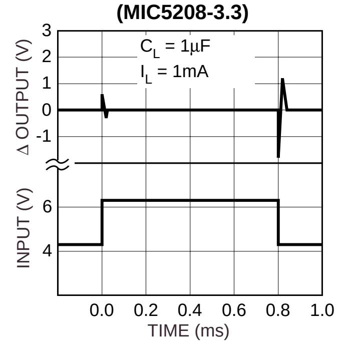
Load Transient



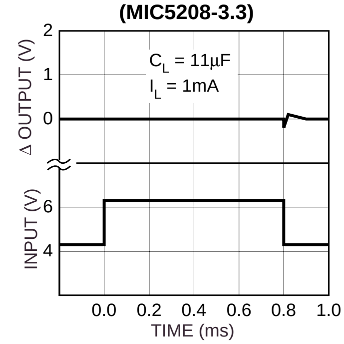
Ripple Voltage vs. Frequency



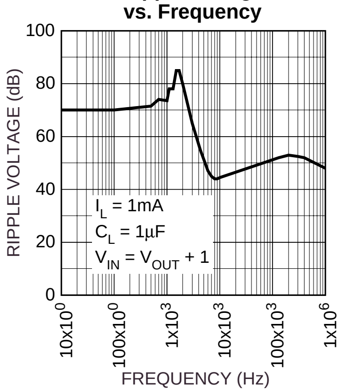
Line Transient (MIC5208-3.3)



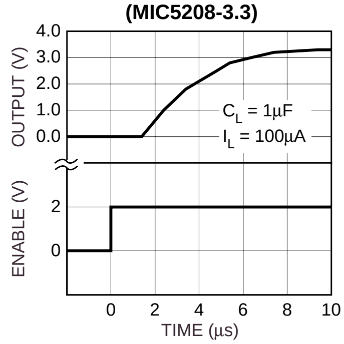
Line Transient (MIC5208-3.3)



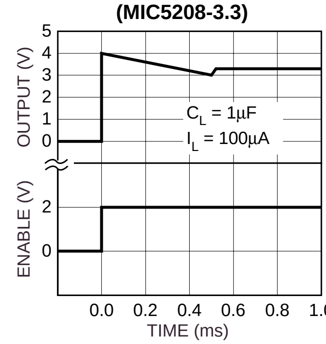
Ripple Voltage vs. Frequency



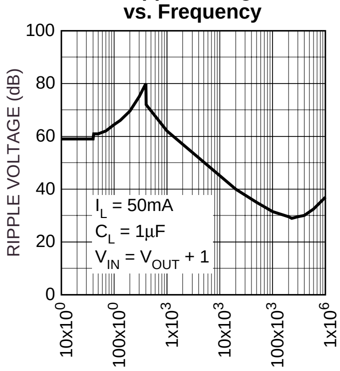
Enable Characteristics (MIC5208-3.3)



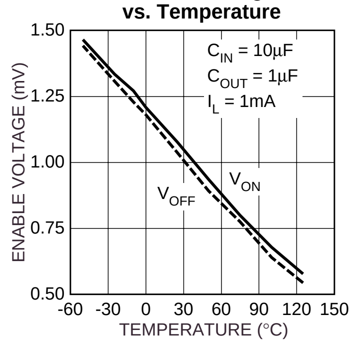
Enable Characteristics (MIC5208-3.3)



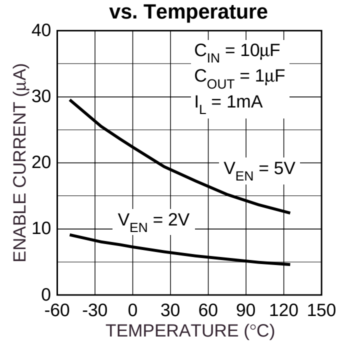
Ripple Voltage vs. Frequency



Enable Voltage vs. Temperature



Enable Current vs. Temperature



Applications Information

Supply/Ground

Both MIC5208 GND pins must be connected to the same ground potential. INA and INB can each be connected to a different supply.

Enable/Shutdown

ENA (enable/shutdown) and ENB may be enabled separately. Forcing ENA/B high (> 2V) enables the associated regulator. ENA/B requires a small amount of current, typically 15µA. While the logic threshold is TTL/CMOS compatible, ENA/B may be forced as high as 20V, independent of V_{IN}.

Input Capacitor

A 0.1µF capacitor should be placed from IN to GND if there is more than 10 inches of wire between the input and the ac filter capacitor or if a battery is used as the input.

Output Capacitor

An output capacitor is required between OUT and GND to prevent oscillation. Larger values improve the regulator's transient response. The output capacitor value may be increased without limit.

The output capacitor should have an ESR (effective series resistance) of about 5Ω or less and a resonant frequency above 500kHz. Most tantalum or aluminum electrolytic capacitors are adequate; film types will work, but are more expensive. Since many aluminum electrolytics have electrolytes that freeze at about –30°C, solid tantalums are recommended for operation below –25°C.

At lower values of output current, less output capacitance is required for output stability. The capacitor can be reduced to 0.22µF for current below 10mA or 0.1µF for currents below 1mA.

No-Load Stability

The MIC5208 will remain stable and in regulation with no load (other than the internal voltage divider) unlike many other voltage regulators. This is especially important in CMOS RAM keep-alive applications.

Thermal Shutdown

Thermal shutdown is independent on both halves of the dual MIC5208, however, an overtemperature condition in one half may affect the other half because of proximity.

Thermal Considerations

Multilayer boards having a ground plane, wide traces near the pads, and large supply bus lines provide better thermal conductivity.

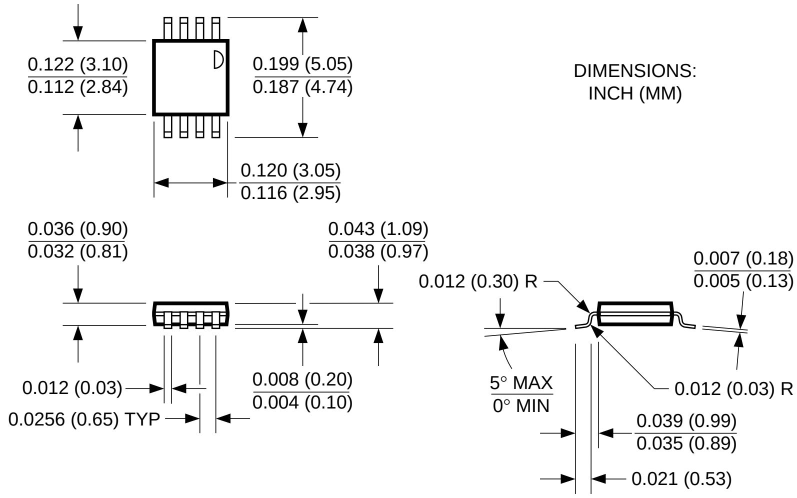
The MIC5208-xxBMM (8-lead MSOP) has a thermal resistance of 200°C/W when mounted on a FR4 board with minimum trace widths and no ground plane.

PC Board Dielectric	θ_{JA}
FR4	200°C

MSOP Thermal Characteristics

For additional heat sink characteristics, please refer to Micrel Application Hint 17, "Calculating P.C. Board Heat Sink Area For Surface Mount Packages".

Package Information



8-Pin MSOP (MM)

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