UMW MIC5200-xx

1.Description

The MIC5200 is an efficient linear voltage regulator with very low dropout voltage (typically 17 mV at light loads and 200 mV at 100 mA), and very low ground current (1 mA at 100 mA output), offering better than 1% initial accuracy with a logic-compatible ON/OFF switching input. Designed especially for hand-held battery-powered devices, the MIC5200 is switched by a CMOS- or TTL-compatible logic signal.The ENABLE control may be tied directly to VIN if unneeded.When disabled, power consumption drops nearly to zero.The ground current of the MIC5200 increases only slightly in dropout, further prolonging battery life.

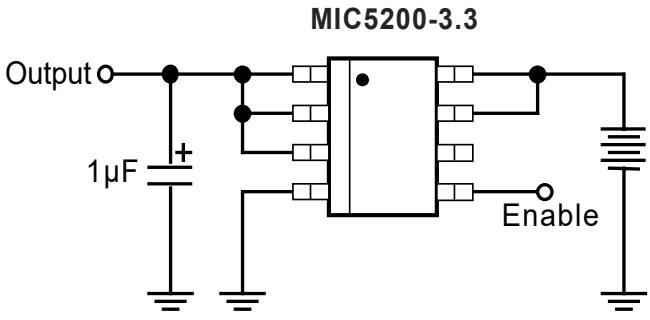
2.Features

- High output voltage accuracy
- Variety of output voltages
- Guaranteed 100mA output
- Low quiescent current
- Low dropout voltage
- Extremely tight load and line regulation
- Very low temperature coefficient
- Current and thermal limiting
- Zero OFF mode current
- Logic-controlled electronic shutdown
- Available in 8-lead SOP, and SOT-223 packages

3.Applications

- Cellular Telephones
- Laptop, Notebook, and Palmtop Computers
- Battery Powered Equipment
- PCMCIA V_{CC} and V_{PP} Regulation/Switching
- Bar Code Scanners
- SMPS Post-Regulator/ DC to DC Modules
- High Efficiency Linear Power Supplies

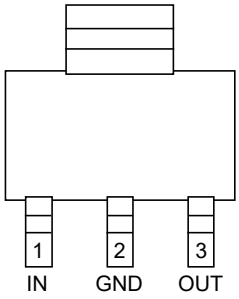
4.Typical Application



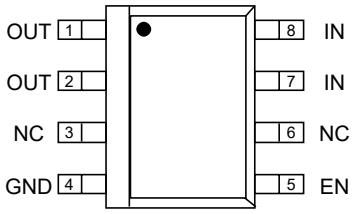
5.Pinning information

Part Number	Voltage	Accuracy	Junction Temp. Range	Package
MIC5200-3.0YM	3.0	1%	-40°C to +125°C	SOP-8
MIC5200-3.3YM	3.3	1%	-40°C to +125°C	SOP-8
MIC5200-5.0YM	5.0	1%	-40°C to +125°C	SOP-8
MIC5200-3.0YS	3.0	1%	-40°C to +125°C	SOT-223
MIC5200-3.3YS	3.3	1%	-40°C to +125°C	SOT-223
MIC5200-5.0YS	5.0	1%	-40°C to +125°C	SOT-223

6.Pinning information



MIC5200-x.xYS
(SOT-223)



MIC5200-x.xYM
(SOP-8)

SOT-223	SOP-8	Pin Name	Pin Function
3	1,2	OUT	Output: Pins 1 and 2 must be externally connected together
	3,6	NC	(not internally connected): Connect to ground plane for lowest thermal resistance
2, TAB	4	GND	Ground: Ground pin and TAB are internally connected
	5	EN	Enable/Shutdown (Input): TTL compatible input. High = enabled; low = shutdown
1	7,8	IN	Supply Input: Pins 7 and 8 must be extenally connected together

7.Absolute Maximum Ratings

Parameter	Value
Power Dissipation	Internally Limited
Lead Temperature (soldering, 5 sec.)	260°C
Junction Temperature Range	-40°C to +125°C
Input Supply Voltage	-20V to +60V
Enable Input Voltage	-20V to +60V
Thermal Characteristics	
SOT-223 (θ_{JC})	15°C/W

8.Recommended Operating Conditions

Parameter	Value
Input Voltage	2.5V to 26V
Junction Temperature Range	-40°C to +125°C
Enable Input Voltage	-20V to V_{IN}

9.Electrical characteristics

Limits in standard typeface are for T_J=25°C and limits in boldface apply over the junction temperature range of -40°C to +125°C. Unless otherwise specified, V_{IN}=V_{OUT}+1V, I_L=1mA, C_L=3.3μF, and V_{ENABLE}=V_{DD}.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage Accuracy	V_O	Variation from specified V_{OUT}	-1		1	%
			-2		2	%
Output Voltage	ΔV_O	(Note 2)		40	150	ppm/°C
Temperature Coef.	ΔT					
Line Regulation	ΔV_O	V_{IN}=V_{OUT}+1V to 26V		0.004	0.1	%
	V_{IN}				0.4	
Load Regulation	ΔV_O	I_L=0.1mA to 100mA (Note 3)		0.04	0.16	%
	V_{OUT}				0.3	
Dropout Voltage (Note 4)	V_{IN}-V_O	I_L=100μA		17		mV
		I_L=20mA		130		
		I_L=30mA		150		
		I_L=50mA		190		
		I_L=100mA		230	350	
Quiescent Current	I_{GND}	V_{ENABLE}≤0.7V (Shutdown)		0.01	10	μA
Ground Pin Current	I_{GND}	V_{ENABLE}≥2.0V, I_L=100μA		130	350	
		I_L=20mA		270		
		I_L=30mA		330		
		I_L=50mA		500		
		I_L=100mA		1000	1500	
Ripple Rejection	PSRR			70		dB
Ground Pin Current at Dropout	I_{GNDDO}	V_{IN}= 0.5V less than specified V_{OUT} I_L=100μA(Note 5)		270	330	μA
Current Limit	I_{LIMIT}	V_{OUT}=0V	100	250		mA

Thermal Regulation	ΔV_O / ΔP_D	(Note 6)		0.05		%/W
Output Noise	e_n			100		μV
Input Voltage Level Logic Low	V_{IL}	OFF			0.7	V
Logic High		ON	2			
ENABLE Input Current	I_{IL}	V_{IL}≤0.7V		0.01	1	μA
	I_{IH}	V_{IH}≥2V		15	50	

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: $P_{(MAX)}=(T_{J(MAX)}-T_A)\div\theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will gointo thermal shutdown. The θ_{JC} of the MIC5200-xxYS is 15°C/W and θ_{JA} for the MIC5200YM is 160°C/W mounted on a PCboard (see “Thermal Considerations” section for further details).

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. Parts are tested for load regulation in the load range from 0.1mA to 100mA. 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 100mA load pulse at V_{IN}=26V for t=10ms.

10.1Typical characteristic

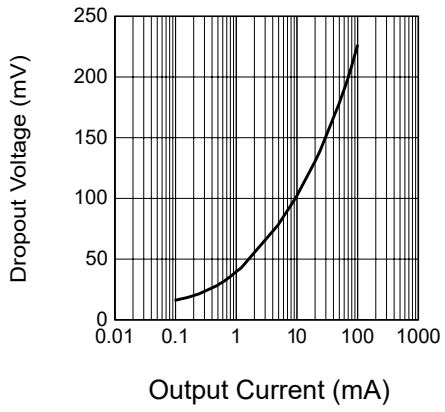


Figure 1: Dropout Voltage vs. Output Current

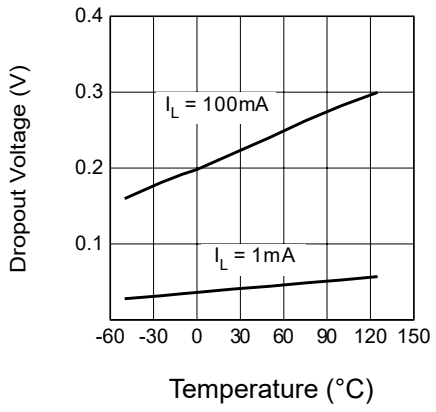


Figure 2: Dropout Voltage vs. Temperature

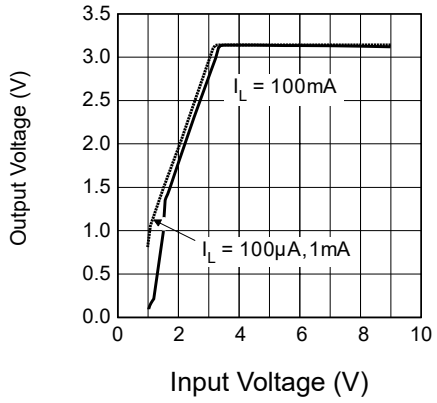


Figure 3: Dropout Characteristics

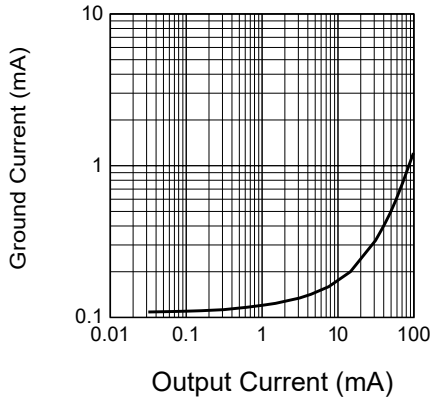


Figure 4: Ground Current vs. Output Current

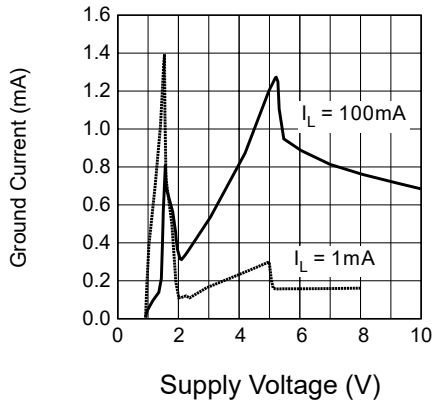


Figure 5: Ground Current vs. Supply Voltage

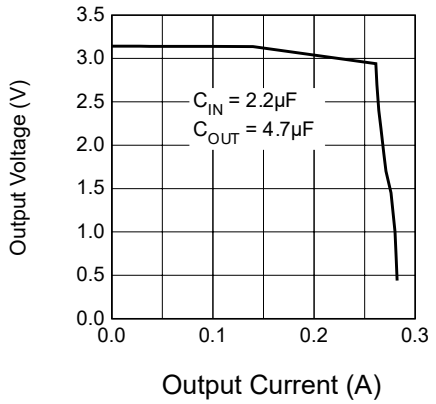


Figure 6: Output Voltage vs. Output Current

10.2Typical characteristic

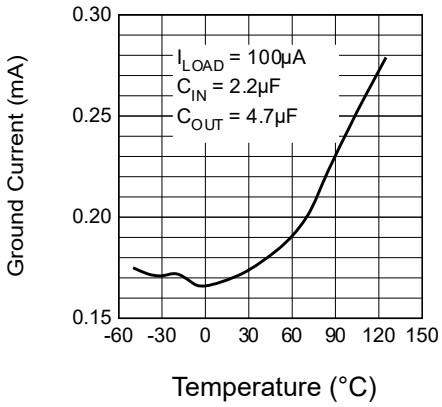


Figure 7: Ground Current vs. Temperature

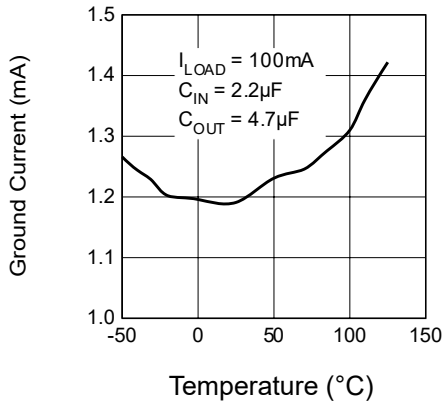


Figure 8: Ground Current vs. Temperature

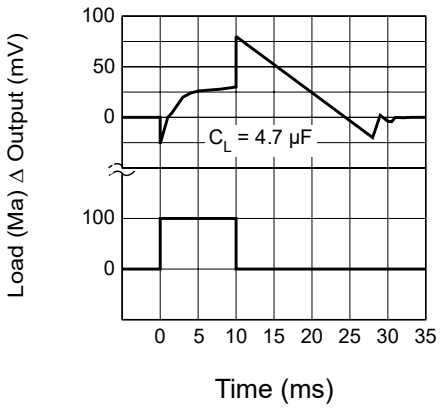


Figure 9: Thermal Regulation (3.3V Version)

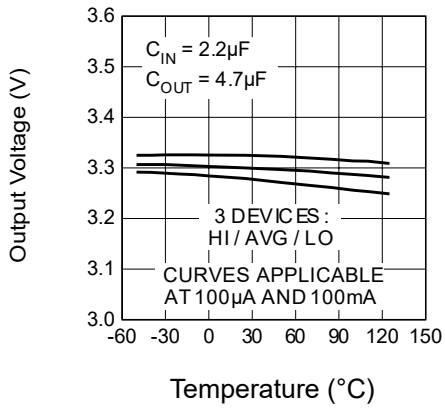


Figure 10: Output Voltage vs. Temp. (3.3V Version)

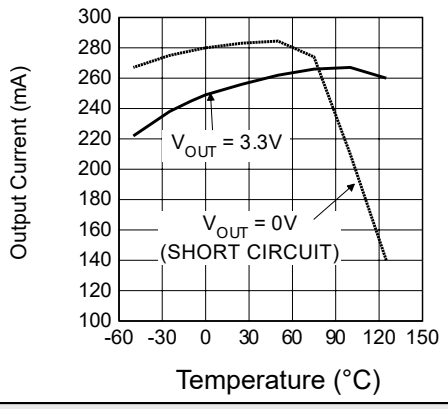


Figure 11: Output Current vs. Temperature

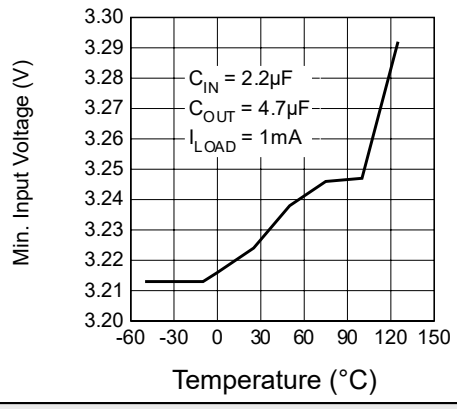


Figure 12: Minimum Input Voltage vs. Temperature

10.3Typical characteristic

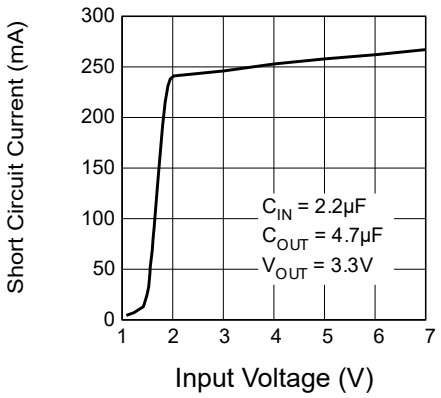


Figure 13: Short Circuit Current vs. Input Voltage

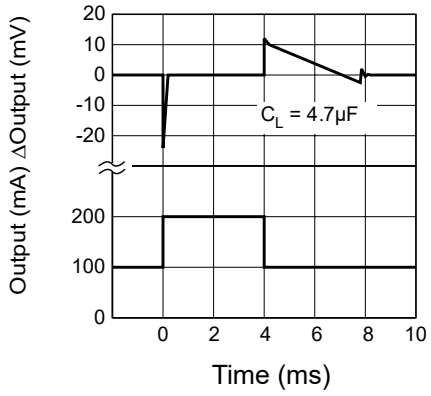


Figure 14: Load Transient

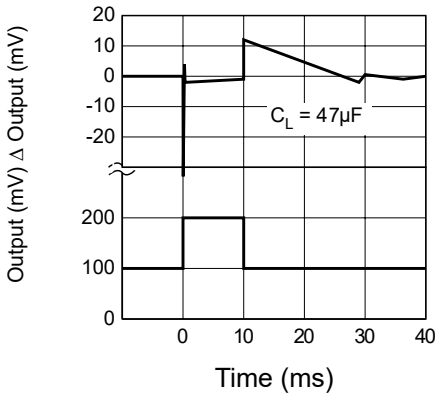


Figure 15: Load Transient

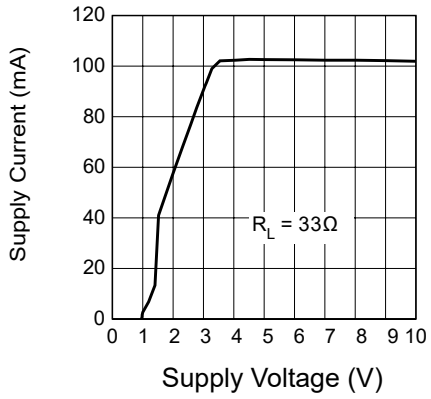


Figure 16: Supply Current vs. Supply Voltage (3.3V Version)

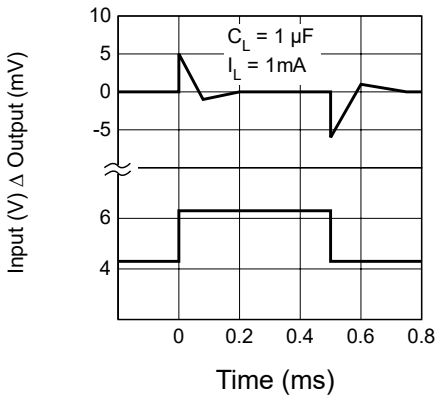


Figure 17: Line Transient

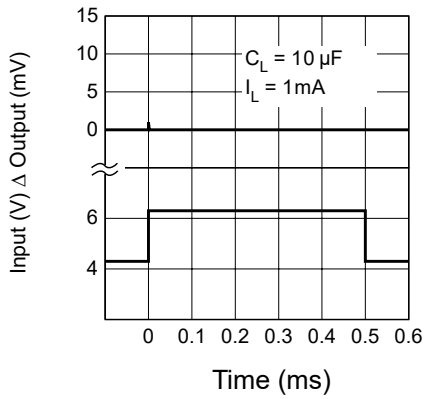


Figure 18: Line Transient

10.4Typical characteristic

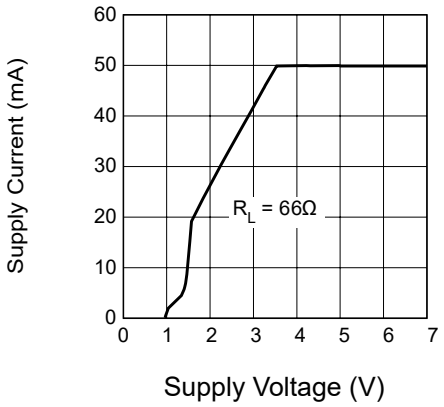


Figure 19: Supply Current vs. Supply Voltage (3.3V Version)

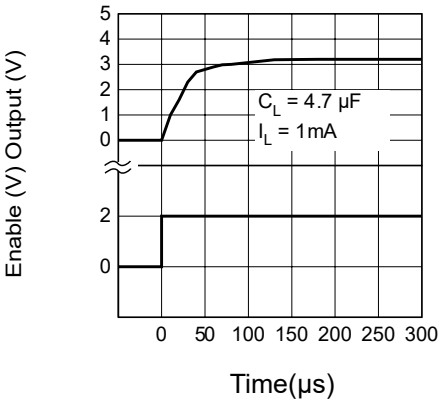


Figure 20: Enable Transient (3.3V Version)

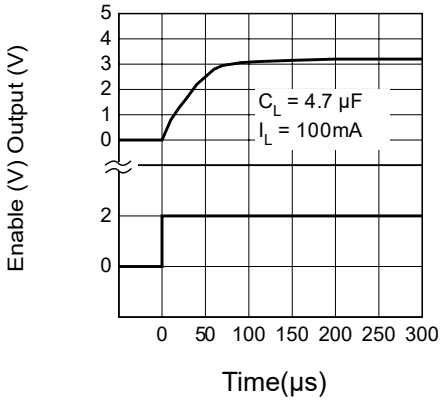


Figure 21: Enable Transient (3.3V Version)

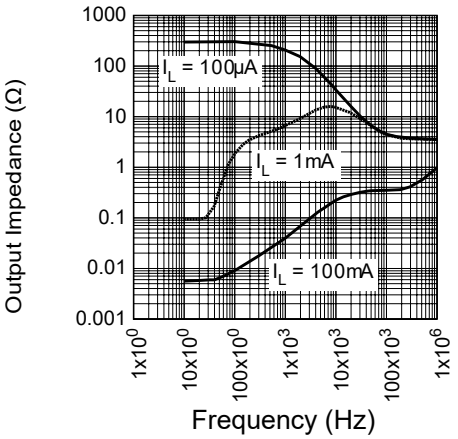


Figure 22: Output Impedance

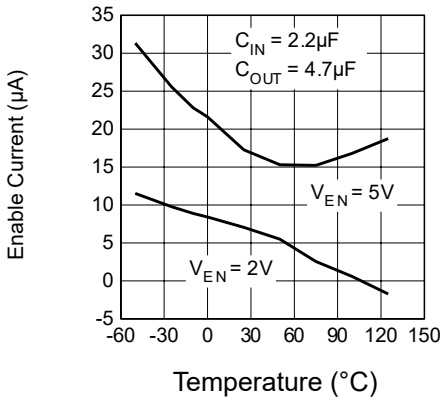


Figure 23: Enable Current Threshold vs. Temperature

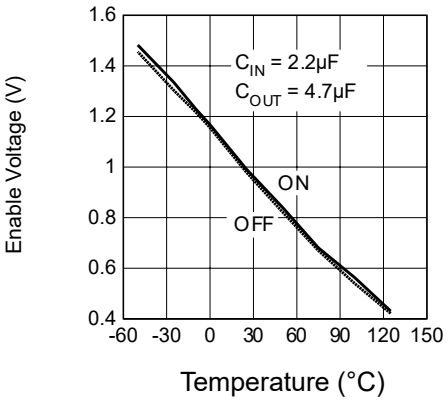


Figure 24: Enable Voltage Threshold vs. Temperature

10.5Typical characteristic

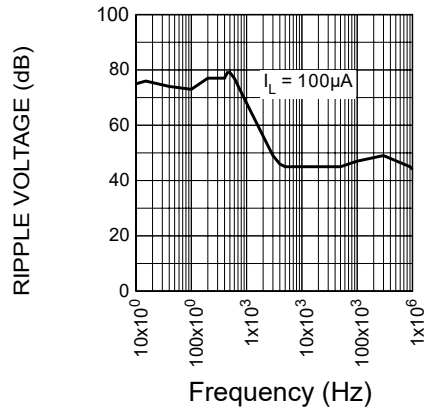


Figure 25: Ripple vs. Frequency

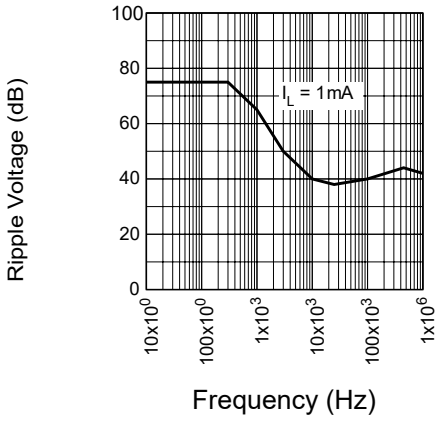


Figure 26: Ripple vs. Frequency

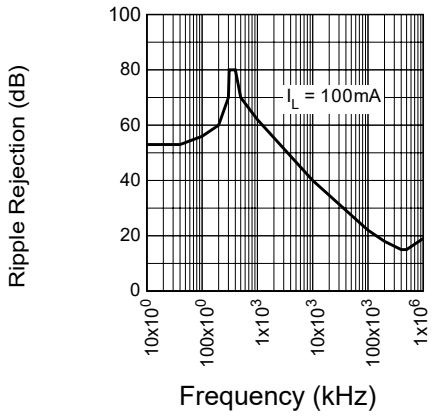


Figure 27: Ripple Rejection (I_{OUT}=3A) vs. Frequency

11.Applications Information

External Capacitors

A 1μF capacitor is recommended between the MIC5200 output and ground to prevent oscillations due to instability. Larger values serve to improve the regulator's transient response. Most types of tantalum or aluminum electrolytics will be ad-equate; film types will work, but are costly and therefore not recommended. Many aluminum electrolytics have electrolytes that freeze at about –30°C, so solid tantalum capacitors are recommended for operation below –25°C. The important pa-rameters of the capacitor are an effective series resistance of about 5Ω or less and a resonant frequency above 500kHz. The value of this capacitor may be increased without limit.

At lower values of output current, less output capacitance is required for output stability. The capacitor can be reduced to 0.47μF for current below 10mA or 0.33μF for currents below 1 mA. A 1μF capacitor should be placed from the MIC5200 input to ground 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.

The MIC5200 will remain stable and in regulation with no load in addition to the internal voltage divider, unlike many other voltage regulators. This is especially important in CMOS RAM keep-alive applications.

When used in dual supply systems where the regulator load is returned to a negative supply, the output voltage must be diode clamped to ground.

ENABLE Input

The MIC5200 features nearly zero OFF mode current. When the ENABLE input is held below 0.7V, all internal circuitry is powered off. Pulling this pin high (over 2.0V) re-enables the device and allows operation. The ENABLE pin requires a small amount of current, typically 15μA. While the logic threshold is TTL/CMOS compatible, ENABLE may be pulled as high as 30V, independent of the voltage on VIN

12.Thermal Considerations

Part I. Layout

The MIC5200-xxYM (8-pin surface mount package) has the following thermal characteristics when mounted on a single layer copper-clad printed circuit board.

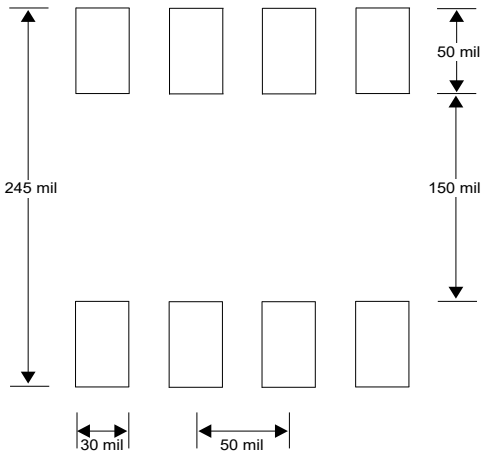
PC Board Dielectric	θ_{JA}
FR4	160°C/W
Ceramic	120°C/W

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

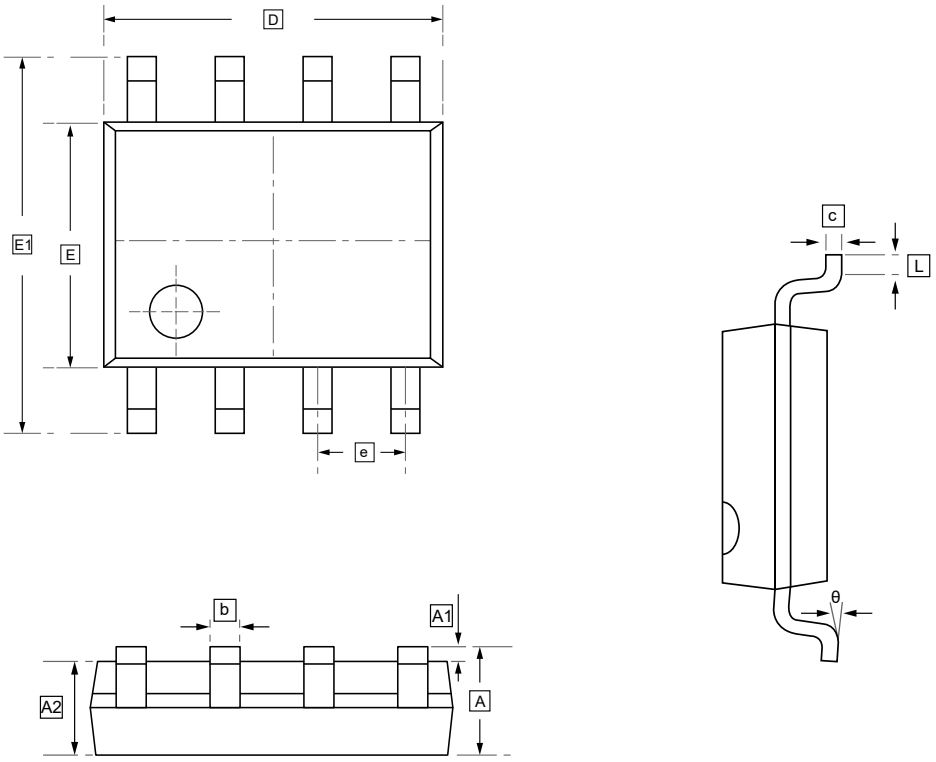
The “worst case” value of 160°C/W assumes no ground plane, minimum trace widths, and a FR4 material board.

Part II. Nominal Power Dissipation and Die Temperature

The MIC5200-xxYM at a 25°C ambient temperature will oper-ate reliably at up to 625mW power dissipation when mounted in the “worst case” manner described above. At an ambient temperature of 55°C, the device may safely dissipate 440mW. These power levels are equivalent to a die temperature of 125°C, the recommended maximum temperature for non-military grade silicon integrated circuits.



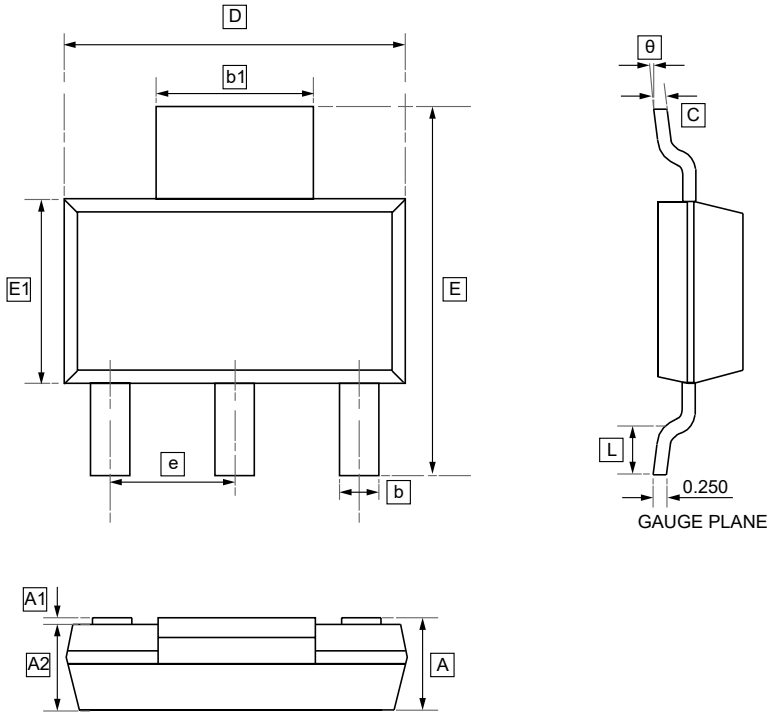
13.1SOP-8 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E	E1	e	L	θ
Min	1.350	0.000	1.350	0.330	0.170	4.700	3.800	5.800	1.270	0.400	0°
Max	1.750	0.100	1.550	0.510	0.250	5.100	4.000	6.200	BSC	1.270	8°

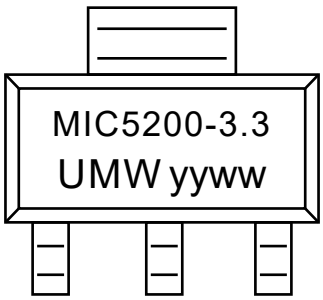
13.2SOT-223 Package Outline Dimensions

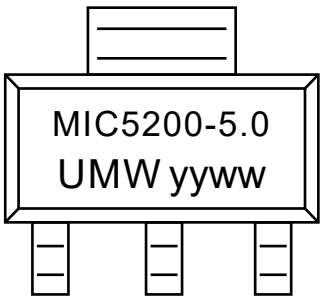


DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	b1	c	D	E	E1	e	L	θ
Min	-	0.020	1.500	0.660	2.900	0.230	6.300	6.700	3.300	2.300	0.750	0°
Max	1.800	0.100	1.700	0.840	3.100	0.350	6.700	7.300	3.700	BSC	-	10°

14.Ordering information





yy: Year Code
ww: Week Code

Order Code	Package	Base QTY	Delivery Mode
UMW MIC5200-3.0YM	SOP-8	2500	Tape and reel
UMW MIC5200-3.3YM	SOP-8	2500	Tape and reel
UMW MIC5200-5.0YM	SOP-8	2500	Tape and reel
UMW MIC5200-3.0YS	SOT-223	2500	Tape and reel
UMW MIC5200-3.3YS	SOT-223	2500	Tape and reel
UMW MIC5200-5.0YS	SOT-223	2500	Tape and reel

15.Disclaimer

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