Micropower, 150mA Low Noise CMOS Regulator with Fast Response

Features

- Available with 1.5V, 1.8V, 2.5V, 2.8V, 2.9V, 3.0V, 3.1V or 3.3V outputs
- Fast (60µs) V_{OUT} response when enabled
- Ultra low noise (35µV rms typ.)
- Delivers up to 150mA output current
- Very low dropout (150mV at 150mA)
- Low quiescent operating current (110µA)
- Stable with low-ESR ceramic capacitors
- "Zero" disable mode current consumption
- Thermal overload protection
- Foldback overload current protection
- -40°C to +85°C temperature operation
- Tiny SOT23 package

Applications

- Wireless handsets, PDAs, MP3 players, digital cameras
- PCs and notebooks
- Graphics cards, set-top boxes
- Compact Flash memory cards
- Battery-powered devices
- PC cards

CM3018 Regulator Family

PRODUCT	OUTPUT VOLTAGE	PRODUCT	OUTPUT VOLTAGE
CM3018-15ST	1.5V	CM3018-29ST	2.9V
CM3018-18ST	1.8V	CM3018-30ST	3.0V
CM3018-25ST	2.5V	CM3018-31ST	3.1V
CM3018-28ST	2.8V	CM3018-33ST	3.3V

Product Description

The CM3018 is a very low dropout, low noise regulator that delivers up to 150mA of load current at a fixed output voltage.

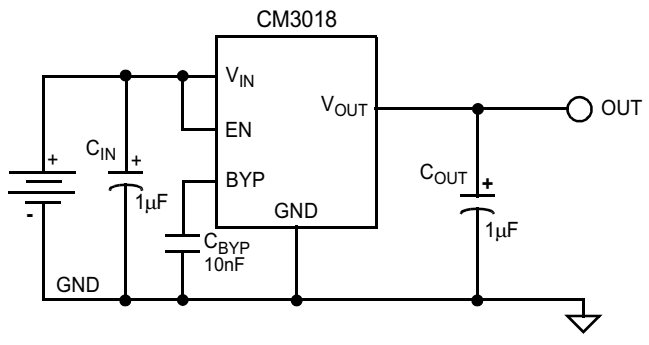
A dedicated control input (EN, Active High) provides power-up sequencing flexibility. When this input is taken low, the regulator is disabled. In this state, the supply current will drop to near zero. An internal discharge MOSFET resistance (300Ω) will force the output to ground whenever the device is disabled.

An optional bypass pin is provided for further improvement of noise performance and to maximize the power supply ripple rejection.

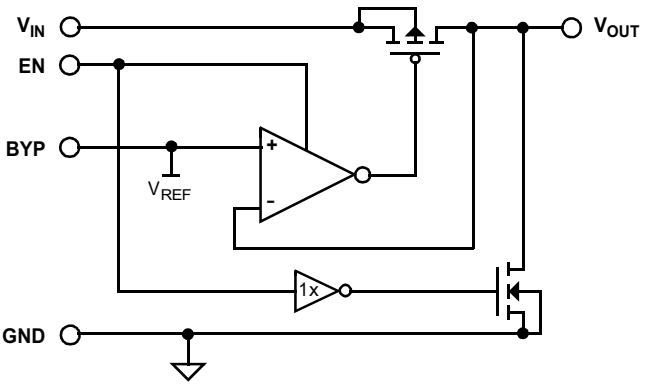
The CM3018 is fully protected, offering both overload current limiting and high temperature thermal shutdown.

Available in a tiny 5 lead SOT-23 package, the device is ideal for space critical applications.

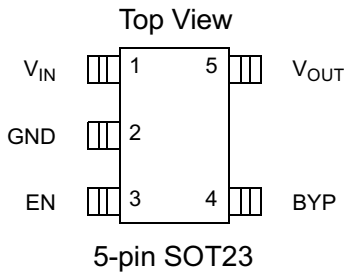
Typical Application Circuit



Simplified Electrical Schematic



PACKAGE / PINOUT DIAGRAM



Note: This drawing is not to scale.

PIN DESCRIPTIONS

PIN(S)	NAME	DESCRIPTION
1	V_{IN}	The input power supply for the regulator. If this input is within a few inches of the main supply filter, a capacitor may not be necessary. Otherwise an input filter capacitor of approximately 1μF will ensure adequate filtering.
2	GND	The negative reference for all voltages.
3	EN	A logic input control to enable the regulator output. When EN is asserted (logic high), it allows output regulation to commence. When EN is deasserted (logic low), the regulator pass transistor is forced into a high impedance mode, and an internal discharge resistance (300Ω) is applied to the output.
4	BYP	This pin is connected to the internal voltage reference of the regulator. An external bypass capacitor C_{BYP} of 10nF is recommended to improve the noise performance and to maximize the power supply ripple rejection.
5	V_{OUT}	The regulator voltage output used to power the load. A nominal output capacitor of 1μF is sufficient to minimize any transient disturbances under normal operating conditions. Additional output capacitance can be used to further improve transient load response.

Ordering Information

PART NUMBERING INFORMATION

Pins	Output Voltage	Package	Ordering Part Number[1]	Part Marking
5	1.5V	SOT23-5	CM3018-15ST	EA15
5	1.8V	SOT23-5	CM3018-18ST	EA18
5	2.5V	SOT23-5	CM3018-25ST	EA25
5	2.8V	SOT23-5	CM3018-28ST	EA28
5	2.9V	SOT23-5	CM3018-29ST	EA29
5	3.0V	SOT23-5	CM3018-30ST	EA30
5	3.1V	SOT23-5	CM3018-31ST	EA31
5	3.3V	SOT23-5	CM3018-33ST	EA33

Note 1: Parts are shipped in Tape & Reel form unless otherwise specified.

Specifications

ABSOLUTE MAXIMUM RATINGS		
PARAMETER	**RATING**	**UNITS**
ESD Protection (HBM)	±2000	V
Pin Voltages		
V_{IN} (pin 1)	[GND - 0.6] to [+6.0]	V
EN (pin 3)	[GND - 0.6] to [V_{IN} + 0.6]	V
V_{OUT} (pin 5)	[GND - 0.6] to [V_{IN} + 0.6]	V
Storage Temperature Range	-65 to +150	°C
Operating Temperature Range		
Ambient	-40 to +85	°C
Junction	0 to +130	°C
Power Dissipation (Notes 1,2)	Internally Limited	W

Note 1: The CM3018 contains a thermal overload circuit that automatically disables the device thereby preventing excessive junction temperature. When the SOT23-5 package housing the device is mounted on a typical multi-layer board with moderate heat spreading copper area (2 square inches) will allow up to 0.315W to be safely dissipated. (Please consult with factory for thermal evaluation assistance)

Note 2: Consult CAMD Technical Support to obtain detailed power dissipation information for the CM3018 packaged in the SOT23 package.

STANDARD OPERATING CONDITIONS		
PARAMETER	**RATING**	**UNITS**
V_{IN}	2.7 to 5.5	V
V_{IN} (See Note 1)	3.6 to 5.5	V
Ambient Operating Temperature Range	-40 to +85	°C
Load Current	0 to +150	mA
C_{OUT}	1 ±20%	µF

Note 1: This rating applies specifically to the CM3018-33ST (EA33) and CM3018-31ST (EA31) devices only.

Specifications (continued)

ELECTRICAL OPERATING CHARACTERISTICS[1]						
SYMBOL	**PARAMETER**	**CONDITIONS**	**MIN**	**TYP**	**MAX**	**UNITS**
V_{OUT}	Regulator Output Voltage	T_A = 25°C; 0mA ≤ I_{LOAD} ≤ 150mA; V_{IN}-V_{OUT} = 1V	-1%		+1%	V
		0°C < T_A < 125°C; 0mA ≤ I_{LOAD} ≤ 150mA; V_{IN}-V_{OUT} = 1V	-2%		+2%	V
		-40°C < T_A < 125°C; 0mA ≤ I_{LOAD} ≤ 150mA; V_{IN}-V_{OUT} = 1V	-3%		+3%	V
V_{OUTRT}	Regulator Response Time	No Load; C_{OUT} = 1µf Ceramic Cap		60		µS
$R_{DROPOUT}$	Dropout Resistance	0mA ≤ I_{LOAD} ≤ 150mA		1	1.3	Ω
$V_{R\ LOAD}$	Load Regulation	V_{IN}-V_{OUT} = 1V; 10mA ≤ I_{LOAD} ≤ 150mA		.25		%
$V_{R\ LINE}$	Line Regulation	3.3V ≤ V_{IN} ≤ 4.3V; I_{LOAD} = 5mA		1		%/V
I_{LIM}	Overload Current Limit			400		mA
I_{SC}	Short Circuit Current Limit	V_{OUT} < 1V		200		mA
R_{DISCH}	Discharge Resistance	EN tied to ground; V_{IN} = 3.0V		300		Ω
I_{GND}	Ground Current	with EN tied to V_{IN}; I_{LOAD} = 0mA:		100	200	µA
		with EN tied to V_{IN}; I_{LOAD} = 150mA:		110	250	µA
		with EN tied to GND (Disable Mode):		0.1	10	µA
V_{IH}	Enable High Threshold	Regulator enabled		0.8	1.2	V
V_{IL}	Enable Low Threshold	Regulator shutdown	0.4	0.7		V
I_{EN}	Enable Input Current			.01		µA
$T_{DISABLE}$	Shutdown Temperature	V_{IN} = 5V for EA33 and EA31 devices, V_{IN} = 3.3V for all other devices.		150		°C
T_{HYST}	Thermal Hysteresis	V_{IN} = 5V for EA33 and EA31 devices, V_{IN} = 3.3V for all other devices.		15		°C
PSRR	Ripple Rejection	f = 120Hz; V_{IN} − V_{OUT} = 1V; I_{LOAD}= 100µA; C_{OUT} = 1µF Ceramic; C_{BYP} = 10nF		60		dB
e_N	Output Noise	300Hz-100kHz; C_{OUT} = 10µF Ceramic; C_{BYP} = 10nF		35		µVrms

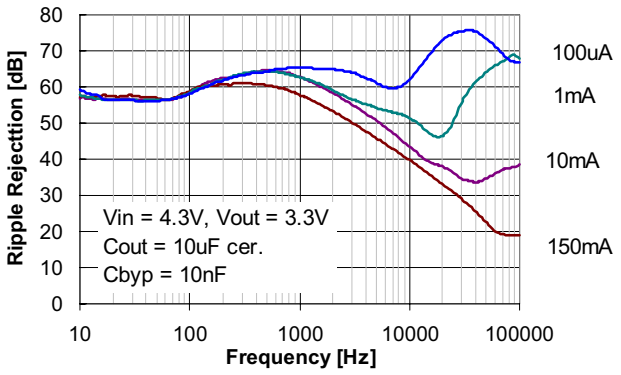
Note 1: Electrical operating characteristics are guaranteed over standard operating conditions unless otherwise noted.

Performance Information

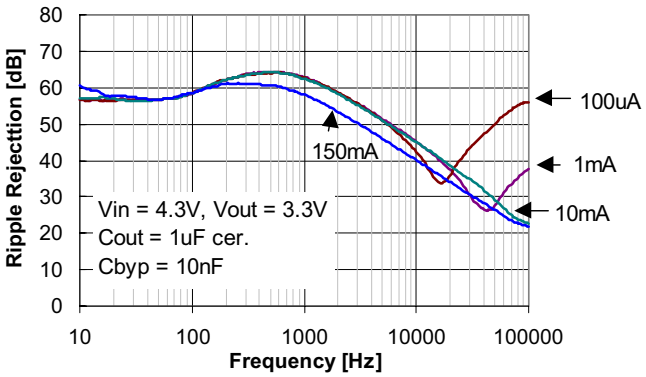
Typical Noise Characteristics

Curves shown for CM3018-33ST, 3.3V output unless noted otherwise

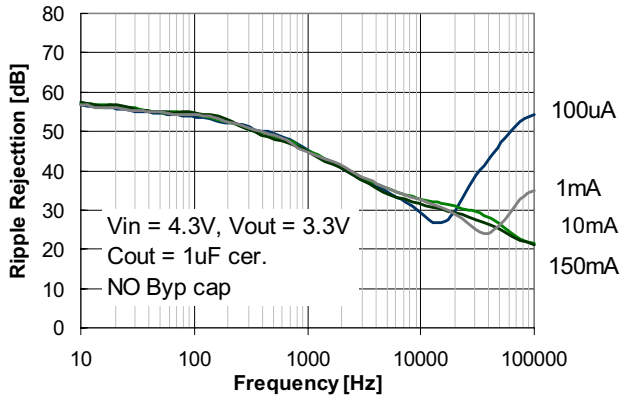
Power Supply Ripple Rejection



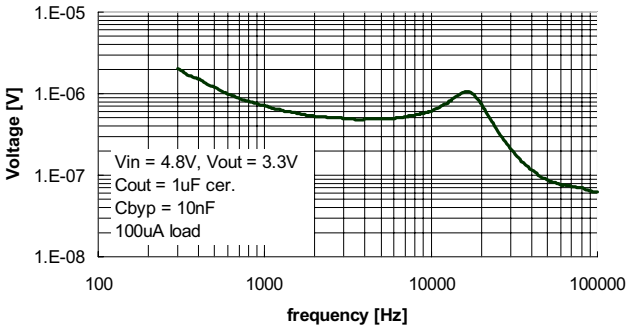
Power Supply Ripple Rejection



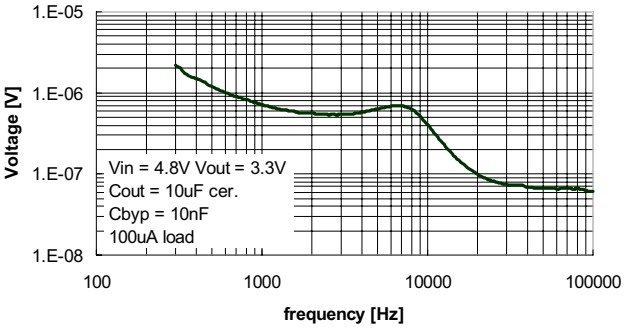
Power Supply Ripple Rejection



Noise Performance



Noise Performance

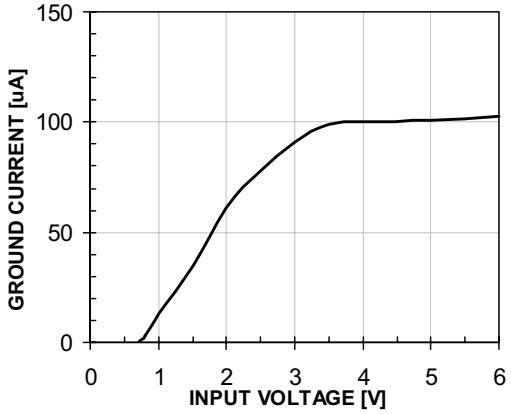


Performance Information (cont'd)

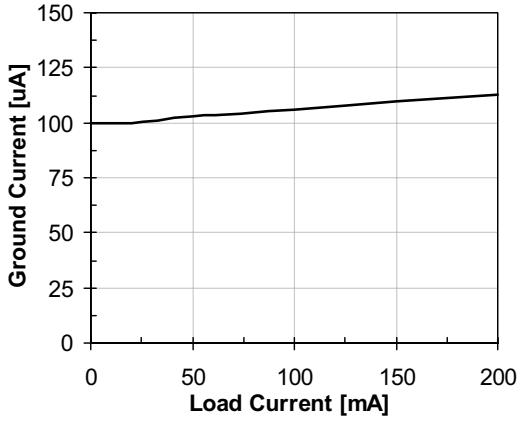
Typical DC Characteristics (nominal conditions unless otherwise specified)

Curves shown for CM3018-33ST, 3.3V output unless noted otherwise

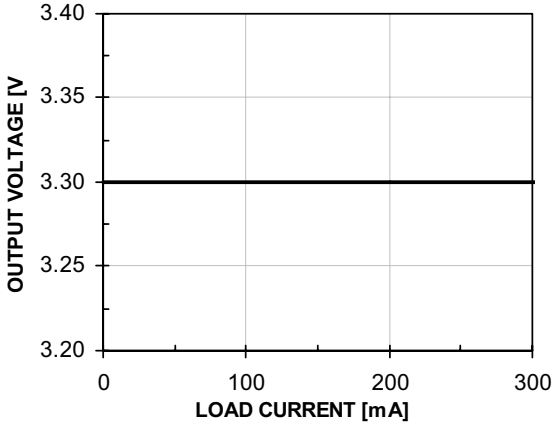
Ground Current vs. Input (5mA Load)



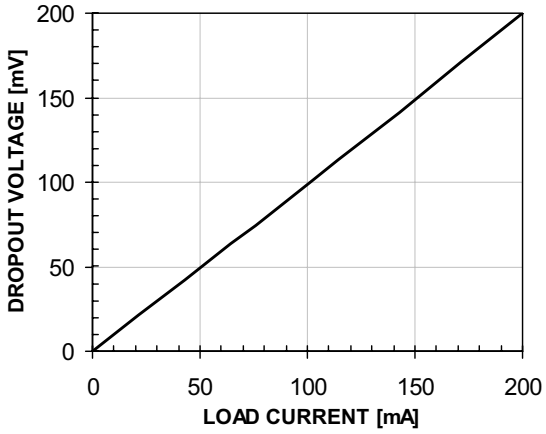
Ground Current vs. Load (VIN = 5V)



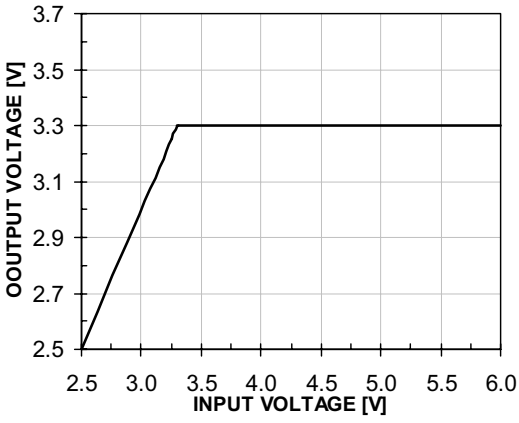
Load Regulation (VIN = 5V)



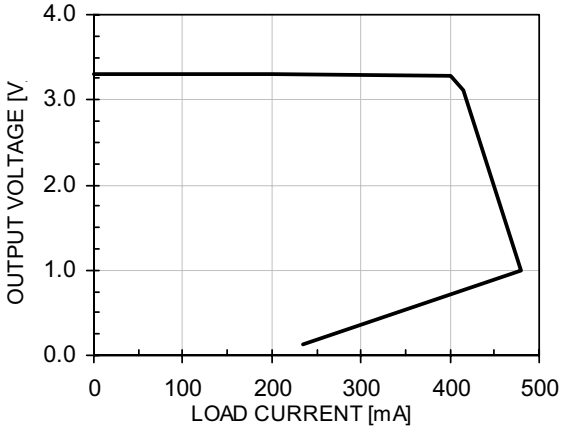
Dropout Voltage vs. Load Current (VOUT = 3.25V)



Line Regulation (5mA Load)



Foldback Current Limiting (VIN = 3.8V)

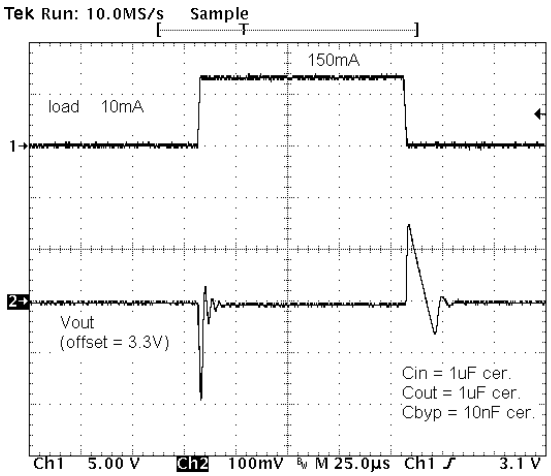


Performance Information (cont'd)

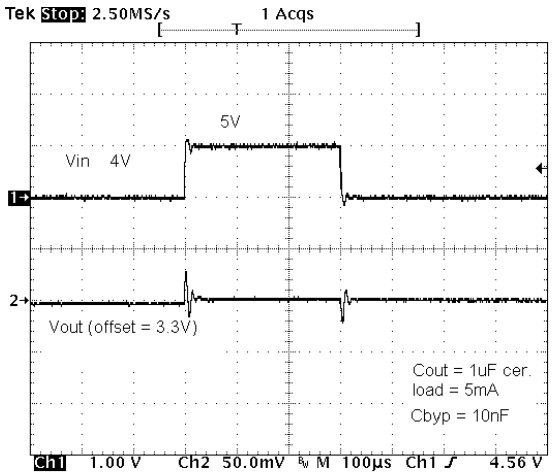
Typical Transient Characteristics (nominal conditions unless specified otherwise)

Curves shown for CM3018-33ST, 3.3V output unless noted otherwise

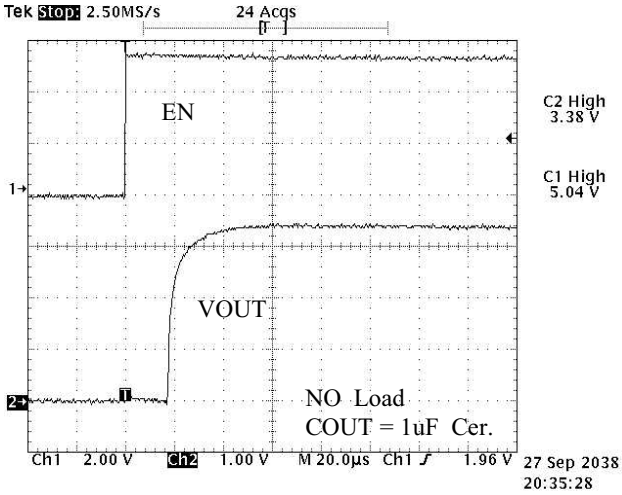
Load transient (10% to 100%) Step Response



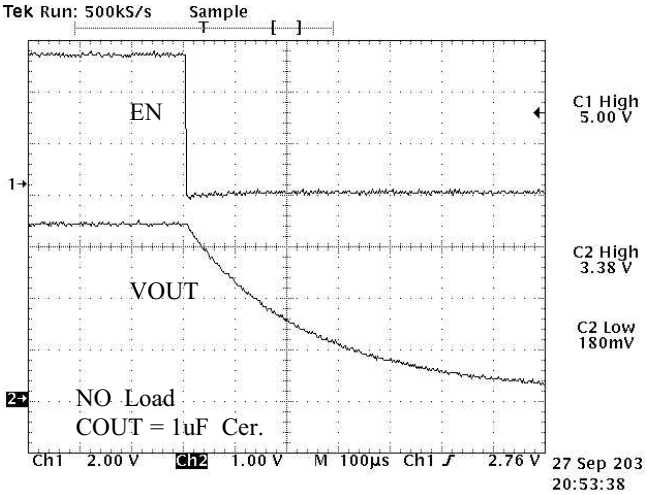
Line Transient (1Vpp) Step Response



Enable Response (CBYP = 10nF)



Disable Response (CBYP = 10nF)



Performance Information (cont'd)

Typical Thermal Characteristics

The overall junction to ambient thermal resistance (θ_{JA}) for device power dissipation (P_D) consists primarily of two paths in series. The first path is the junction to the case (θ_{JC}) which is defined by the package style, and the second path is case to ambient (θ_{CA}) thermal resistance which is dependent on board layout. The final operating junction temperature for any set of conditions can be estimated by the following thermal equation:

$$T_{JUNC} = T_{AMB} + P_D * (\theta_{JC}) + P_D * (\theta_{CA})$$

$$= T_{AMB} + P_D * (\theta_{JA})$$

The CM3018 uses a SOT23-5 package. When this package is mounted on a double-sided printed circuit board with two square inches of copper allocated for "heat spreading", the resulting θ_{JA} is 175°C/W.

Based on a maximum power dissipation of 320mW (Load x Vin-Vout = 150mA x 2.2V) with an ambient of 70°C the resulting junction temperature will be:

$$T_{JUNC} = T_{AMB} + P_D * (\theta_{JA})$$

$$= 70°C + 315mW * (175°C/W)$$

$$= 70°C + 57.75°C = 127.75°C$$

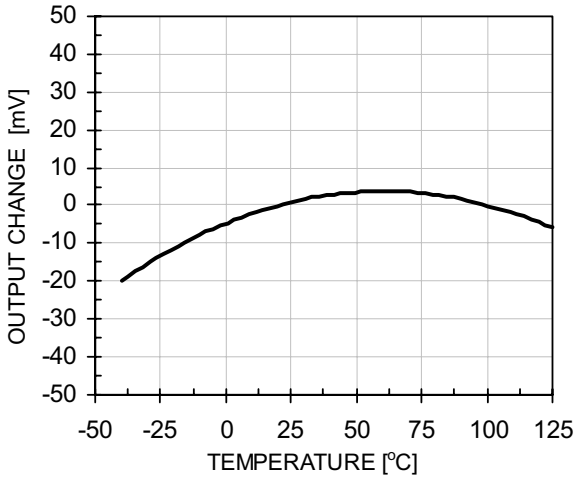
Thermal characteristics were measured using a double sided board with two square inches of copper area connected to the GND pins for "heat spreading".

Measurements showing performance up to a junction temperature of 125°C were performed under light load conditions (1mA). This allows the ambient temperature to be representative of the internal junction temperature.

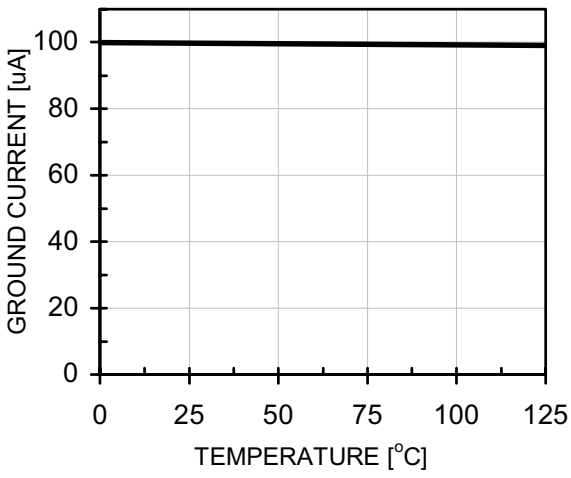
Note: The use of multi-layer board construction with separate ground and power planes will further enhance the overall thermal performance. In the event of no copper area being dedicated for heat spreading, a multi-layer board construction using only the minimum size pad layout will typically provide the CM3018 with an overall θ_{JA} of 175°C/W, which allows up to 450mW to be dissipated safely.

Please consult CAMD Technical Support for assistance with thermal analysis of the CM3018 with respect to a specific application.

Output Voltage Change vs. Temperature (VIN=5V, 1mA Load)



Ground Current vs. Temperature (VIN=5V)



Mechanical Details

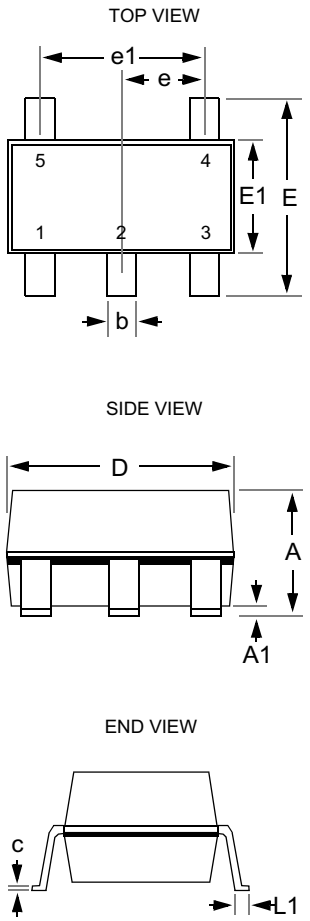
SOT23 Mechanical Specifications

Dimensions for CM3018 devices packaged in 5-pin SOT23 packages are presented below.

For complete information on the SOT23 package, see the California Micro Devices SOT23 Package Information document.

PACKAGE DIMENSIONS				
Package	SOT23 (JEDEC name is MO-178)			
Pins	5			
Dimensions	**Millimeters**		**Inches**	
	Min	**Max**	**Min**	**Max**
A	--	1.45	--	0.057
A1	0.00	0.15	0.000	0.006
b	0.30	0.50	0.012	0.020
c	0.08	0.22	0.003	0.009
D	2.75	3.05	0.108	0.120
E	2.60	3.00	0.102	0.118
E1	1.45	1.75	0.057	0.069
e	0.95 BSC		0.0374 BSC	
e1	1.90 BSC		0.0748 BSC	
L	0.60 REF		0.0236 REF	
# per tape and reel	3000 pieces			
Controlling dimension: inches				

Mechanical Package Diagrams



Package Dimensions for SOT23-5.