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AMC7635

300mA CMOS LOW DROPOUT REGULATOR

DESCRIPTION

The AMC7635 of positive, linear regulator features low noise and low dropout voltage, making it ideal for battery applications. The space-saving SOT-23-5 package is attractive for "Pocket" and "Hand Held" applications.

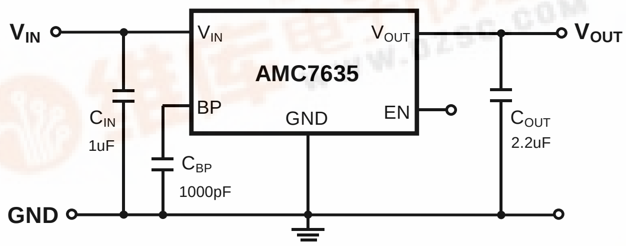
In applications requiring a low noise, regulated supply, place a 1000pF capacitor between Bypass and Ground.

The AMC7635 is stable with an output capacitance of 2.2μF or greater.

FEATURES

- **Guaranteed 300mA Output**
- **Accurate to within 1.5%**
- **Very Low Dropout Voltage**
- **Over-Temperature Shutdown**
- **Power-Saving Shutdown Mode**
- **Current Limiting**
- **Noise Reduction Bypass Capacitor**
- **Factory Pre-set Output Voltages**
- **Low Temperature Coefficient**
- **Available in SOT-23-5 packages**

TYPICAL APPLICATION CIRCUIT



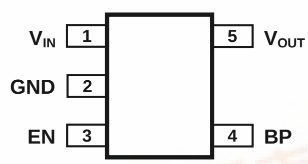
APPLICATIONS

- **Wireless Devices**
- **Portable Electronics**
- **Cordless Phones**
- **PC Peripherals**
- **Battery Powered Widgets**
- **Electronic Scales**
- **Instrumentation**

VOLTAGE OPTIONS

AMC7635-1.5	– 1.5V Fixed
AMC7635-1.8	– 1.8V Fixed
AMC7635-2.0	– 2.0V Fixed
AMC7635-2.5	– 2.5V Fixed
AMC7635-2.8	– 2.8V Fixed
AMC7635-3.0	– 3.0V Fixed
AMC7635-3.1	– 3.1V Fixed
AMC7635-3.3	– 3.3V Fixed
AMC7635	– Adjustable Output

PACKAGE PIN OUT



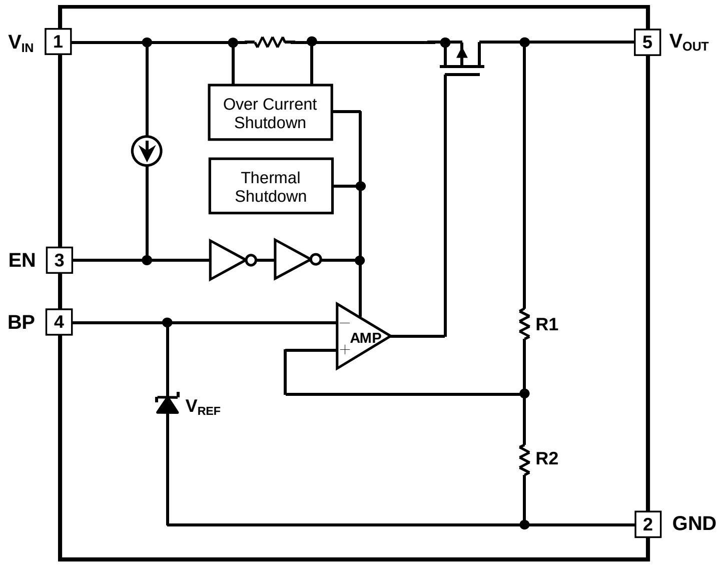
5-Pin Plastic SOT-23-5
Surface Mount
(Top View)

ORDER INFORMATION

T_A (°C)	DB Plastic SOT-23-5 5-pin
0 to 70	**AMC7635-X.XDBFT (Lead Free)**

Note: 1. All surface-mount packages are available in Tape & Reel. Append the letter “T” to part number (i.e. AMC7635-X.XDBT).
Note: 2. The letter “F” is marked for Lead Free process.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Note)

Input Voltage, V_{IN}	7V
Operating Junction Temperature Range, T_J	0°C to 150°C
Storage Temperature Range, T_{STG}	-65°C to 150°C
Lead Temperature (soldering, 10 seconds)	260°C

Note: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground.
Currents are positive into, negative out of the specified terminal.

POWER DISSIPATION TABLE

DB PACKAGE:	
Thermal Resistance from Junction to Ambient, θ_{JA}	220℃/W

Junction Temperature Calculation: $T_J = T_A + (PD \times \theta_{JA})$.
The θ_{JA} numbers are guidelines for the thermal performance of the device/pc-board system. Connect the ground pin to ground using a large pad or ground plane for better heat dissipation. All of the above assume no ambient airflow.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min.	Typ.	Max.	Units
Input Voltage	V_{IN}	$V_{OUT} + \Delta V$		6	V
Load Current (with adequate heat-sinking)	I_O	5			mA
Junction temperature	T_J			125	°C

ELECTRICAL CHARACTERISTICS

$V_{IN} = V_{OUT(Nominal)} + 0.5V$, $V_{IN,MAX} = 6V$, $T_A = 25℃$ (unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Output Voltage Accuracy	V_{OUT}	$I_O = 1mA$	-1.5		+1.5	%
		$I_O = 1$ to 300mA	-2.5		+2.5	
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_I V_{OUT}}$	$I_O = 1mA$, $V_{OUT} + 0.5V < V_{IN} < 6V$		0.15	0.35	%/V
Load Regulation	ΔV_{OUT}	$1mA \le I_O \le 300mA$		10	70	mV
Dropout Voltage	ΔV	I_O=150mA, $V_{OUT}=V_{OUT(NOM)}$-2.0%; $V_{OUT(NOM)} \le 2.0V$		330	500	mV
		I_O=150mA, $V_{OUT}=V_{OUT(NOM)}$-2.0%; $2.0V<V_{OUT(NOM)}\le 2.5V$		220	350	
		I_O=150mA, $V_{OUT}=V_{OUT(NOM)}$-2.0%; $V_{OUT(NOM)} > 2.5V$		165	250	
		I_O=300mA, $V_{OUT}=V_{OUT(NOM)}$-2.0%; $V_{OUT} \le 2.0V$			1300	
		I_O=300mA, $V_{OUT}=V_{OUT(NOM)}$-2.0%; $2.0V<V_{OUT}\le 2.5V$			900	
		I_O=300mA, $V_{OUT}=V_{OUT(NOM)}$-2.0%; $V_{OUT} > 2.5V$			600	
Maximum Output Current	I_O	$V_{OUT} > 0.96 \times V_{RATING}$	300			mA
Current Limit	I_{LIMIT}	$V_{OUT} > 1.2V$	300	400		
Ground Pin Current	I_Q	I_O = 0mA ~ 10mA		50	100	µA
		I_O = 10mA ~ 150mA		100	150	
		I_O = 150mA ~ 300mA		120	180	
Output Shutdown Delay		$C_{BP} = 0\mu F$, $C_{OUT} = 1\mu F$, $I_O = 100mA$		600		µS
EN "high" Bias Current	I_{IH}	$V_{EN} = V_{IN}$			0.1	uA
EN "low" Bias Current	I_{IL}	$V_{EN} = 0V$			0.5	
Shutdown Supply Current		V_{EN} = GND		0.01	1	µA
EN "low" Input Threshold	V_{IL}	V_{IN} = 2.5 to 5.5V	0		0.4	V
EN "high" Input Threshold	V_{IH}	V_{IN} = 2.5 to 5.5V	2		V_{IN}	
Power Supply Rejection Ratio	PSRR	I_O=100mA, C_{BP}=0.01uF, C_{OUT}=2.2uF; f = 1kHz		60		dB
		I_O=100mA, C_{BP}=0.01uF, C_{OUT}=2.2uF; f = 10kHz		50		
		I_O=100mA, C_{BP}=0.01uF, C_{OUT}=2.2uF; f = 100kHz		40		
Thermal Protection Temperature				150		°C
Thermal Protection Temperature Hysteresis				30		

Note 1: For the adjustable device, the minimum load current is the minimum current required to maintain regulation. Normally the current in the resistor divider used to set the output voltage is selected to meet the minimum load current requirement.

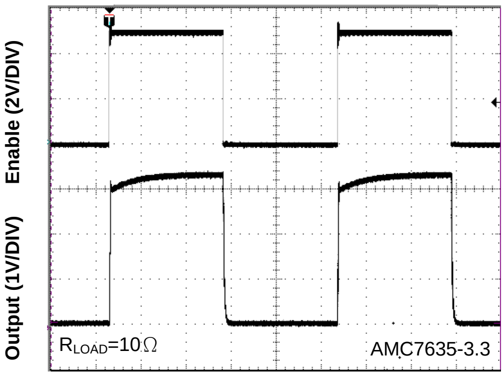
Note 2: These parameters, although guaranteed, are not tested in production.

CHARACTERIZATION CURVES

Unless otherwise specified, V_{IN} = 5V, C_{IN} = 1μF, C_{BP} = 0.01uF, C_{OUT} = 2.2μF, T_A = 25 °C.

Chip Enable Transient Response

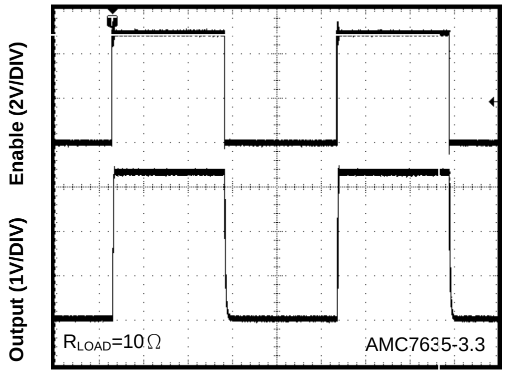
V_{IN}=5V, C_{IN}=1uF, C_{OUT}=2.2uF, C_{BP}=1000pF



TIME= 1 ms/DIV

Chip Enable Transient Response

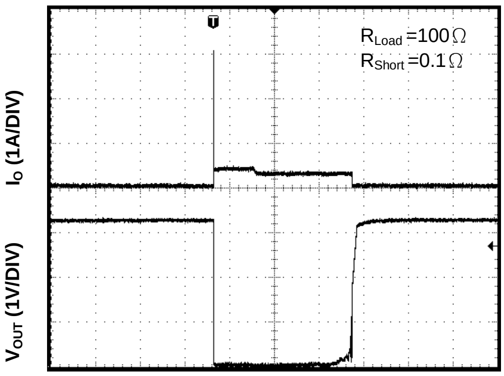
V_{IN}=5V, C_{IN}=1uF, C_{OUT}=2.2uF, C_{BYP}=Open



TIME= 1 ms/DIV

Short Circuit Response

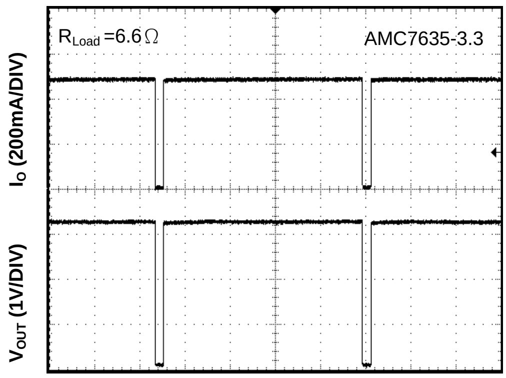
V_{IN}=5V, C_{IN}=1uF, C_{OUT}=2.2uF,C_{BP}=0.01uF



TIME= 20 ms/DIV

Over Temperature Shutdown

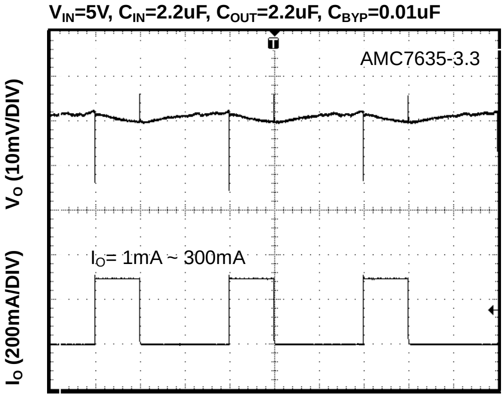
V_{IN}=5V, C_{IN}=1uF, C_{OUT}=2.2uF,C_{BYP}=0.01uF



TIME= 400 ms/DIV

Load Step (1mA~300mA)

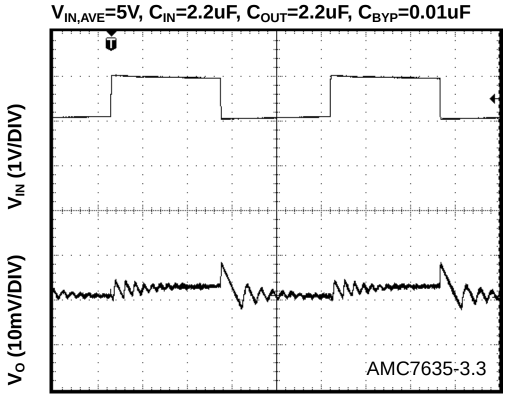
V_{IN}=5V, C_{IN}=2.2uF, C_{OUT}=2.2uF, C_{BYP}=0.01uF



TIME= 10 ms/DIV

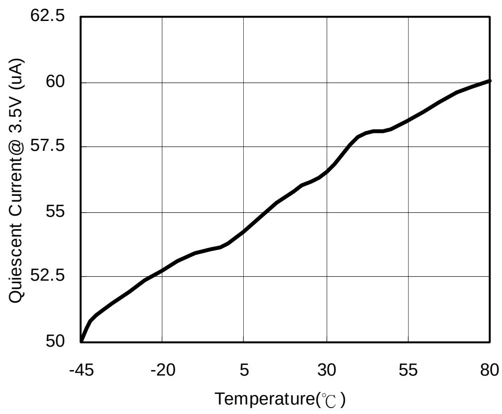
Line Transient Response

$V_{IN,AVE}$=5V, C_{IN}=2.2uF, C_{OUT}=2.2uF, C_{BYP}=0.01uF

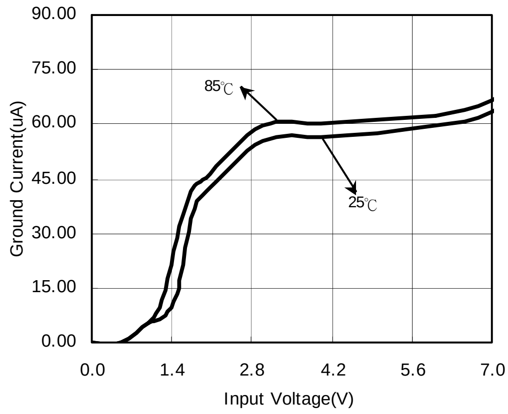


TIME= 2 ms/DIV

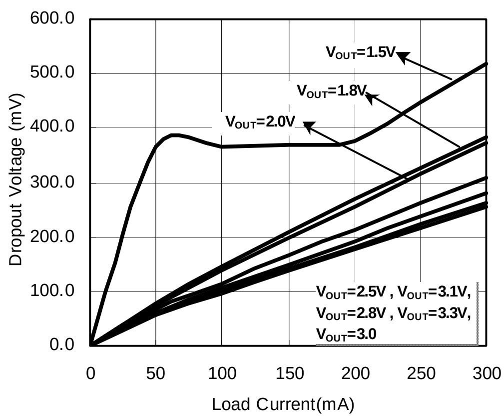
Ground Pin Current vs. Temperature



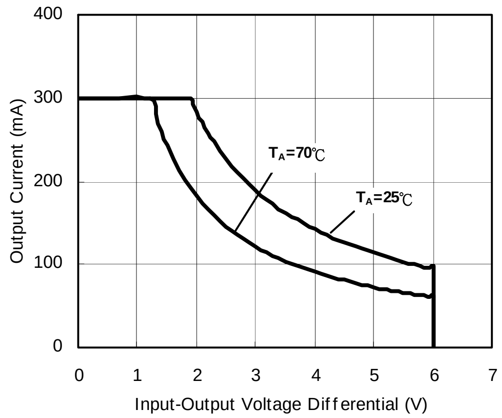
Ground Current vs. Input Voltage



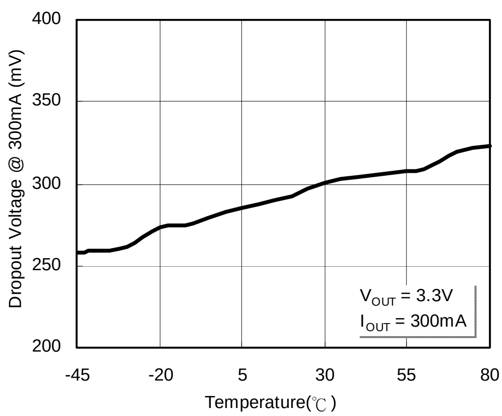
Drop Out Voltage vs. Load Current



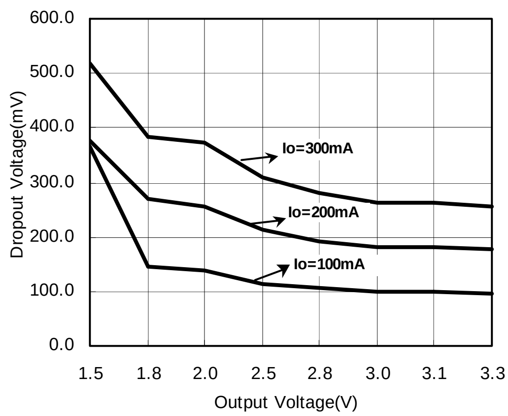
Sofe Operating Area

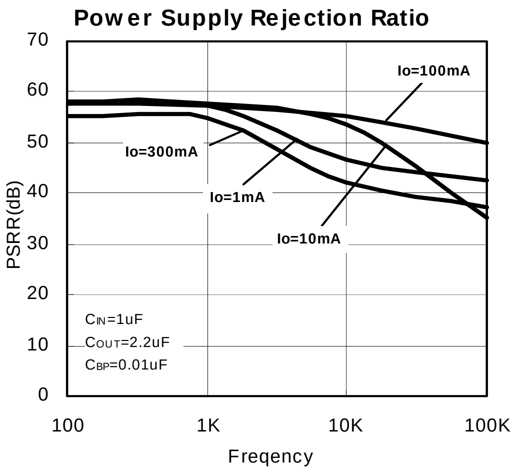


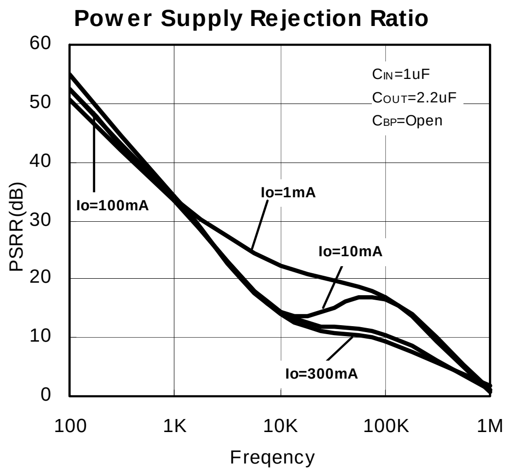
Dropout Voltage vs. Temperature

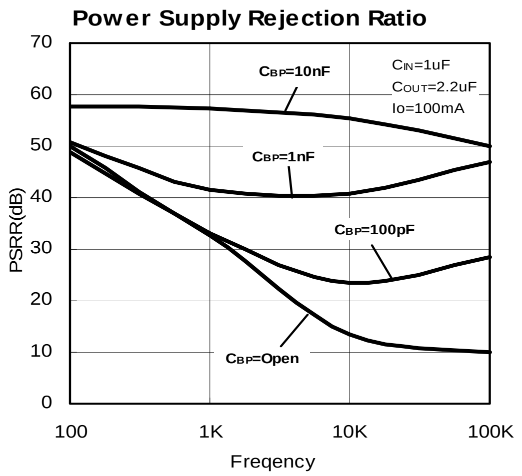


Drop Out Voltage vs. Output Voltage

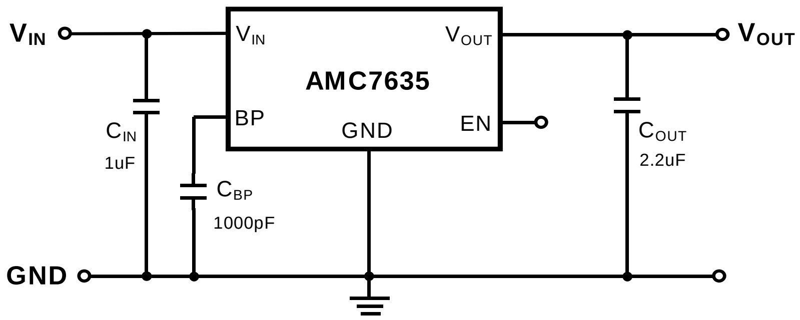



Power Supply Rejection Ratio
PSRR(dB)
Freqency
100
1K
10K
100K
0
10
20
30
40
50
60
70
Io=100mA
Io=300mA
Io=1mA
Io=10mA
CIN=1uF
COUT=2.2uF
CBP=0.01uF


Power Supply Rejection Ratio
PSRR(dB)
Freqency
100
1K
10K
100K
1M
0
10
20
30
40
50
60
CIN=1uF
COUT=2.2uF
CBP=Open
Io=100mA
Io=1mA
Io=10mA
Io=300mA


Power Supply Rejection Ratio
PSRR(dB)
Freqency
100
1K
10K
100K
0
10
20
30
40
50
60
70
CBP=10nF
CIN=1uF
COUT=2.2uF
Io=100mA
CBP=1nF
CBP=100pF
CBP=Open

APPLICATION INFORMATION



◆ Detailed Description

The AMC7635 CMOS low dropout regulator contains a PMOS pass transistor, a voltage reference, an error amplifier, over-current protection, and thermal shutdown circuit.

The P-channel pass transistor receives data from the error amplifier, over-current shutdown, and thermal protection circuits. During normal operation, the error amplifier compares the output voltage to a precision reference. Thermal shutdown and over-current circuits become active when the junction temperature exceeds 150℃, or the current exceeds 300mA. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 120℃.

◆ External Capacitors

The AMC7635 is stable with an output capacitor to ground of 2.2μF or greater. Ceramic capacitors have the lowest ESR, and will offer the best AC performance. Conversely, Aluminum Electrolytic capacitors exhibit the highest ESR, resulting in the poorest AC response. Unfortunately, large value ceramic capacitors are comparatively expensive. One option is to parallel a 0.1μF ceramic capacitor with a 10μF Aluminum Electrolytic. The benefit is low ESR, high capacitance, and low over-all cost.

A second capacitor is recommended between the input and ground to stabilize V_{IN}. The input capacitor should be at least 0.1μF to have a beneficial effect.

A third capacitor can be connected between the BP pin and GND. This capacitor can be a low cost Polyester Film variety between the value of 0.001 ~ 0.01μF. A larger capacitor improves the AC ripple rejection, but also makes the output come up slowly. This "Soft" turn-on is desirable in some applications to limit turn-on surges.

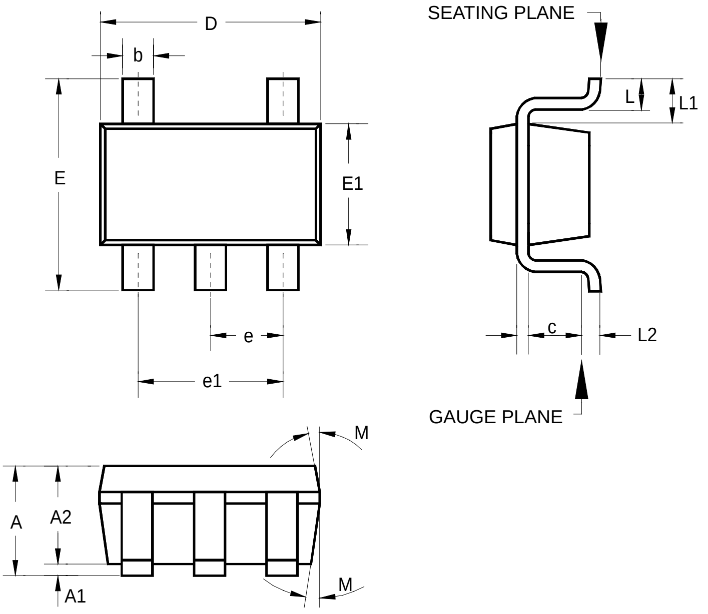
All capacitors should be placed in close proximity to the pins. A "Quiet" ground termination is desirable. This can be achieved with a "Star" connection.

◆ EN

The EN pin is normally pulled to high. When shutdown, pulled low, the PMOS pass transistor shuts off, and all internal circuits are powered down. In this state, the quiescent current is less than 1μA. This pin behaves much like an electronic switch.

PACKAGE

5-Pin SOT-23-5



	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	-	-	0.057	-	-	1.45
A1	-	-	0.006	-	-	0.15
A2	0.035	0.045	0.051	0.90	1.15	1.30
b	0.012	-	0.020	0.30	-	0.50
c	0.003	-	0.009	0.08	-	0.22
D	0.114 BSC			2.90 BSC		
E	0.110 BSC			2.80 BSC		
E1	0.063 BSC			1.60 BSC		
e	0.037 BSC			0.95 BSC		
e1	0.075 BSC			1.90 BSC		
L	0.012	0.018	0.024	0.30	0.45	0.60
L1	0.024 REF			0.60 REF		
L2	0.010 BSC			0.25 BSC		
°M	5°	10°	15°	5°	10°	15°

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