AMC DOC. #:AMC8878_A (LF)
Jun 2004

ADD MICROTECH CORP.

# AMC8877

## LOW NOISE 300mA LOW DROPOUT REGULATOR

### DESCRIPTION

The AMC8877 product is a low noise, low dropout linear regulator operating from 2.5V to 6.5V input. An external capacitor can be connected to the bypass pin to lower the output noise level to 30$\mu V_{RMS}$.

Designed with a P-channel MOSFET output transistor, the AMC8877 consume a low supply current, independent of the load current and dropout voltage. The internal thermal shut down circuit will limits the junction temperature to below 150°C. Other features include thermal protection, reverse battery protection and output current limit. The AMC8877 come in a miniature 5-pin SOT-23 package.

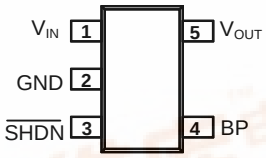
### FEATURES

- **Low output noise: 30$\mu V_{RMS}$**
- **Industry standard'2982 pin assignment (AMC8877)**
- **Output voltage precision of ±1.4% accuracy**
- **Very low dropout voltage: 50mV/50mA, 165mV/150mA & 450mV/300mA**
- **On/Off control**
- **Low $I_Q$: 1.6μA**
- Short circuit protection
- Internal thermal overload protection
- Available in surface mount 5-pin SOT-23 package.
- Enhanced pin-to-pin Compatible to the MAX8878 (AMC8877).

### APPLICATIONS

- Cellular Telephones
- Battery Powered Systems
- Hand-Held Instruments
- Pagers
- Personal Data Assistance (PDA)
- PCMCIA Cards

### PACKAGE PIN OUT




**AMC8877**

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

### ORDER INFORMATION

| Temperature Range | | |
|---|---|---|
| | **DBT** | Plastic SOT-23 5-pin |
| $0^oC \le T_A \le 70^oC$ | **AMC8877-X.XDBT** | |
| $0^oC \le T_A \le 70^oC$ | **AMC8877-X.XDBTF(Lead Free)** | |

### EXPANDED ORDER INFORMATION

| Device Name | Output Voltage | Symbolization |
|---|---|---|
| | | AMC8877 |
| AMC887□-1.8DBT | 1.8V | CG18 |
| AMC887□-2.0DBT | 2.0V | CG20 |
| AMC887□-2.5DBT | 2.5V | CG25 |
| AMC887□-2.8DBT | 2.8V | CG28 |
| AMC887□-2.85DBT | 2.85V | CG2U |
| AMC887□-3.0DBT | 3.0V | CG30 |
| AMC887□-3.2DBT | 3.2V | CG32 |
| AMC887□-3.3DBT | 3.3V | CG33 |
| AMC887□-5.0DBT | 5.0V | CG50 |

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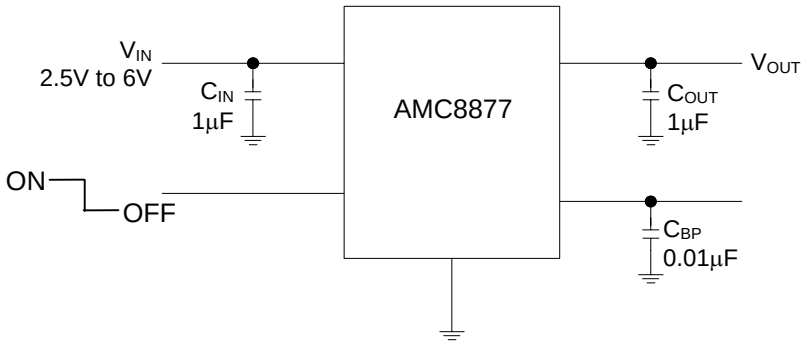
## LOW NOISE 300mA LOW DROPOUT REGULATOR

## TYPICAL APPLICATION




| ABSOLUTE MAXIMUM RATINGS (Note) | |
|---|---|
| Input Voltage, $V_{IN}$ | 12V |
| Operating Junction Temperature, $T_J$ | 150 °C |
| Storage Temperature Range | -65 °C to +150 °C |
| Lead Temperature (soldering, 10 seconds) | +260 °C |
| Power Dissipation, $P_D$ @ $T_A$ = 70 °C | 150 mW |

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.

| THERMAL DATA | |
|---|---|
| **DB PACKAGE**: | |
| Thermal Resistance from Junction to Ambient, $\theta_{JA}$ | 220 °C /W |

Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$.
The $\theta_{JA}$ 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.

**Maximum Power Calculation:**

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

$T_J$(°C): Maximum recommended junction temperature

$T_A$(°C): Ambient temperature of the application

$\theta_{JA}$(°C /W): Junction-to-junction temperature thermal resistance of the package, and other heat dissipating materials.

**The maximum power dissipation for a single-output regulator is** :

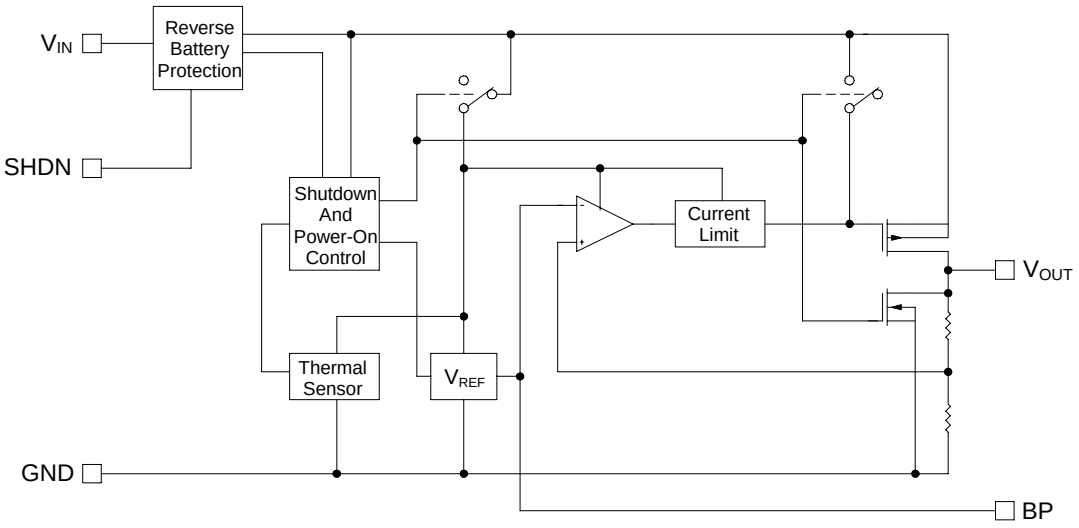
$$P_{D(MAX)} = [(V_{IN(MAX)} - V_{OUT(NOM)})] \times I_{OUT(NOM)} + V_{IN(MAX)} \times I_Q$$

Where: $V_{OUT(NOM)}$ = the nominal output voltage
$I_{OUT(NOM)}$ = the nominal output current, and
$I_Q$ = the quiescent current the regulator consumes at $I_{OUT(MAX)}$
$V_{IN(MAX)}$ = the maximum input voltage
Then $\theta_{JA} = (+150\,°C - T_A)/P_D$

# AMC8877

## LOW NOISE 300mA LOW DROPOUT REGULATOR

## BLOCK DIAGRAM




## PIN DESCRIPTION

| Pin Number | | Pin Name | Pin Function |
|---|---|---|---|
| AMC8878 | AMC8879 | | |
| 1 | 5 | $V_{IN}$ | Input |
| 2 | 2 | GND | Ground |
| 3 | 1 | $\overline{SHDN}$ | Logic control shutdown pin; HI: Device is ON, LO: Device is OFF |
| 4 | 3 | BP | Noise bypass pin; The output noise level can be reduced to $30\mu V_{RMS}$ by connecting external capacitors |
| 5 | 4 | $V_{OUT}$ | Output |

# AMC8877

## LOW NOISE 300mA LOW DROPOUT REGULATOR

| RECOMMENDED OPERATING CONDITIONS | | | | | |
|---|---|---|---|---|---|
| Parameter | Symbol | Recommended Operating Conditions | | | Units |
| | | Min. | Typ. | Max. | |
| Input Voltage | $V_{IN}$ | 2.5 | | 6.5 | V |
| Load Current | $I_o$ | 5 | | 300 | mA |
| Input Capacitor ($V_{IN}$ to GND) | | 1.0 | | | µF |
| Output Capacitor with ESR of 10Ω max., ($V_{OUT}$ to GND) | | 1.0 | | | µF |

Note:
1. $C_{IN}$: A 1.0 µF capacitor (or larger) should be placed between $V_{IN}$ to GND.
2. $C_{OUT}$: A 1.0 µF (or larger) capacitor is recommended between $V_{OUT}$ and GND for stability and improving the regulator's transient response. The ESR (Effective Series Resistance.) of this capacitor has no effect on regulator stability, but low ESR capacitors improve high frequency transient response. The value of this capacitor may be increased without limit, but values larger than 10uF tend to increase the settling time after a step change in input voltage or output current. The part may oscillate without the capacitor. Any type of capacitor can be used, but not Aluminum electrolytics when operating below -25 °C, The capacitance may be increased without limit.

**ELECTRICAL CHARACTERISTICS**

Unless otherwise specified, these specifications apply over the operating ambient temperature of 0°C to +70 °C with $V_{IN} = V_{OUT(NOMIAL)} + 0.5V$, and are for DC characteristics only. (Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

| Parameter | Symbol | Test Conditions | | AMC8877 | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ. | Max | |
| Output Voltage Accuracy | $\Delta V_{OUT}$ | $I_{OUT}$ = 10mA, $T_A$ = +25 °C | | -1.4 | | +1.4 | % |
| | | $I_{OUT}$ = 10 to 300mA | | -3 | | +2 | |
| Maximum Output Current | $I_{OUT}$ | | | | 300 | | mA |
| Current Limit | $I_{LIMIT}$ | | | 330 | | | mA |
| Ground Pin Current | $I_Q$ | $I_{OUT}$ = 10mA | | | 1.6 | 9 | µA |
| | | $I_{OUT}$ = 300mA | | | 1.7 | 9 | |
| Dropout Voltage | VDROP | $I_{OUT}$ = 50mA | | | 50 | 120 | mV |
| | | $I_{OUT}$ = 150mA | | | 165 | 300 | |
| | | $I_{OUT}$ = 300mA | | | 450 | 650 | |
| Line Regulation | $\Delta V_{OI}$ | $V_{IN}$ = ($V_{OUT}$ + 0.1V) to 6.5V, $I_{OUT}$ = 1mA | | -0.15 | 0 | 0.15 | %/V |
| Load Regulation | $\Delta V_{OL}$ | $I_{OUT}$ = 10 to 300mA, $C_{OUT}$ = 10µF | | | 40 | 80 | mV |
| Ripple Rejection | PSRR | f=100Hz, IL=100uA | | | 50 | | dB |
| Output Voltage Noise | $e_n$ | f = 10Hz - 100KHz, $C_{BP}$ = 0.01µF | $C_{OUT}$ = 10µF | | 30 | | $\mu V_{RMS}$ |
| | | | $C_{OUT}$ = 100µF | | 20 | | |
| | | | | | | | |
| Shutdown Input Threshold High | $V_{SIH}$ | $V_{IN}$ = 2.5V to 5.5V | | 2.0 | | | V |
| Shutdown Input Threshold Low | $V_{SIL}$ | $V_{IN}$ = 2.5V to 5.5V | | | | 0.4 | V |
| Shutdown Supply Current | $I_{Q(SHDN)}$ | $V_{OUT}$ = 0V | $T_A$ = +25 °C | | 0.01 | 1 | µA |
| | | | $T_A$ = +85 °C | | 0.2 | | |
| Shutdown Input Bias Current | $I_{SHDN}$ | $V_{\overline{SHDN}} = V_{IN}$ | $T_A$ = +25 °C | | 0.01 | 100 | nA |
| | | | $T_A$ = +85 °C | | 0.5 | | |
| | | | | | | | |
| Shutdown Exit Delay | $t_{delay}$ | $C_{BP}$ = 0.1µF, $C_{OUT}$ = 1µF, No load | $T_A$ = +25 °C | | 6 | | ms |
| | | | $T_A$ = +85 °C | | 6 | | |
| Thermal Shutdown Temperature | $T_{SHDN}$ | | | | +150 | | °C |

Note:
1. Current limit is measured at constant junction temperature, using pulse ON time.
2. Dropout is measured at constant junction temperature, using pulse ON time, and criterion is $V_{OUT}$ inside target value ± 2 %.
3. Regulation is measured at constant junction temperature, using pulsed ON time.

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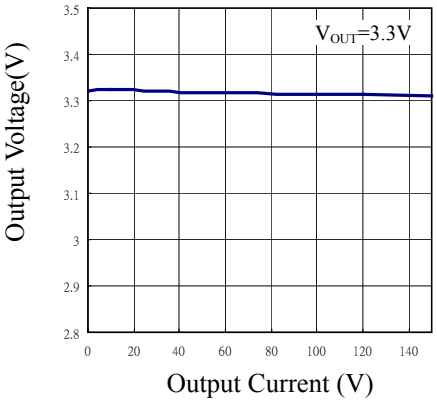
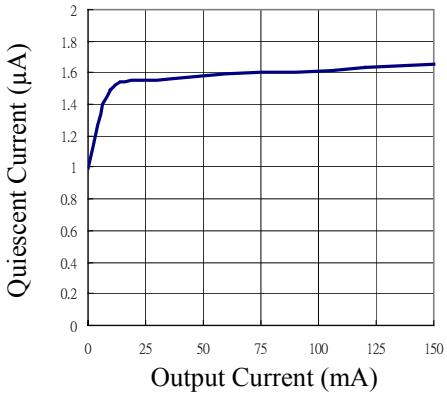
### Characterization Curves

$V_{IN}=V_{OUT(NOMINAL)}$ + 0.5V or 2.5V(whichever is greater), $C_{IN}$=1uF, $C_{OUT}$=1uF,$C_{BP}$=0.01uF, $T_A$=+25 $^oC$, ,Using plused ON time,unless otherwise noted.

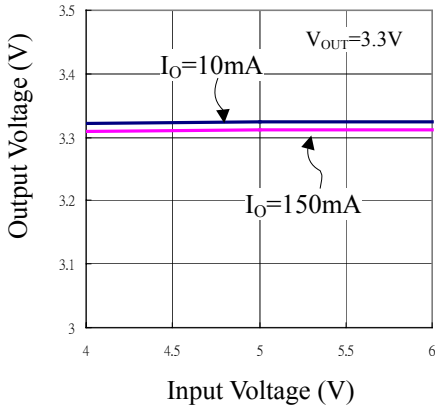
**Output Voltage v.s. Output Current**



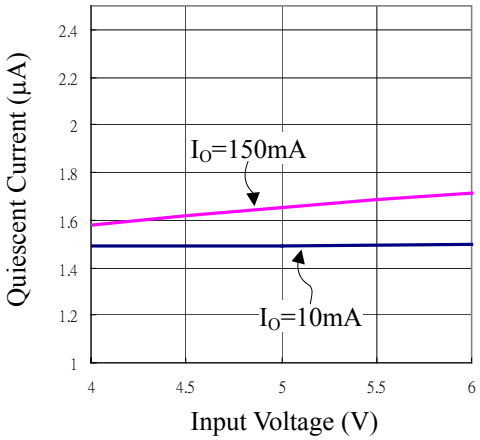

**Quiescent Current v.s. Output Current**



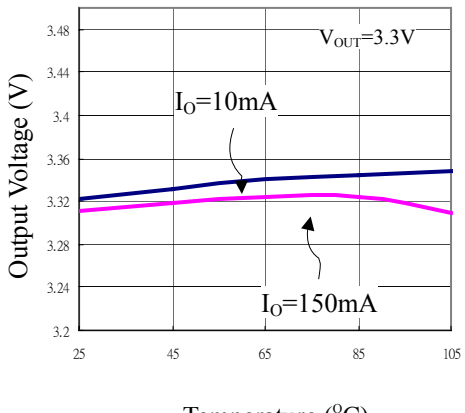

**Output Voltage v.s. Input Voltage**



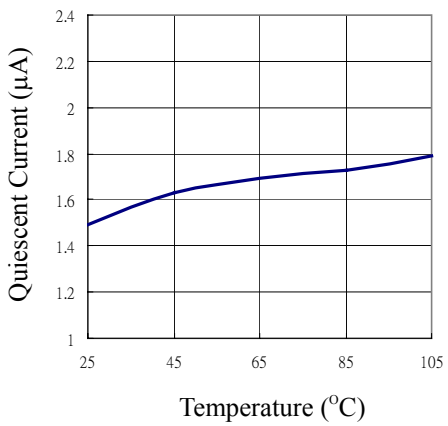

**Quiescent Current v.s. Input Voltage**




**Output Voltage v.s. Temperature**



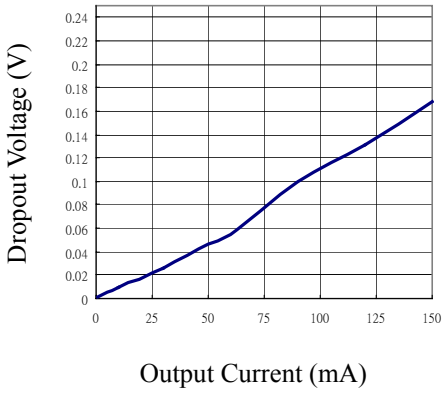

**Quiescent Current v.s. Temperature**



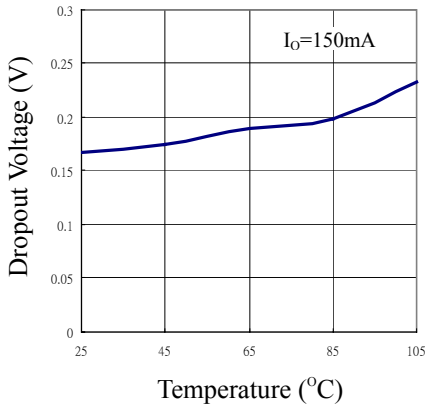
## Characterization Curves (Continued))

$V_{IN}=V_{OUT(NOMINAL)}$ + 0.5V or 2.5V(whichever is greater), $C_{IN}$=1uF, $C_{OUT}$=1uF,$C_{BP}$=0.01uF, $T_A$=+25 $^oC$, ,Using plused ON time,unless otherwise noted.

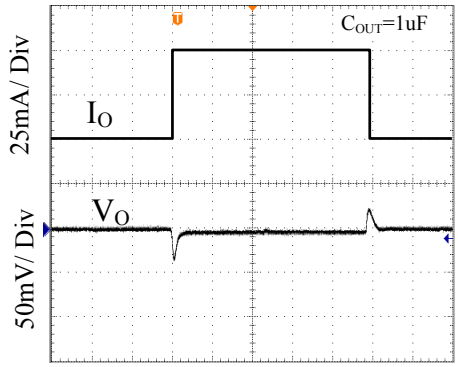
### Dropout Voltage v.s. Output Current



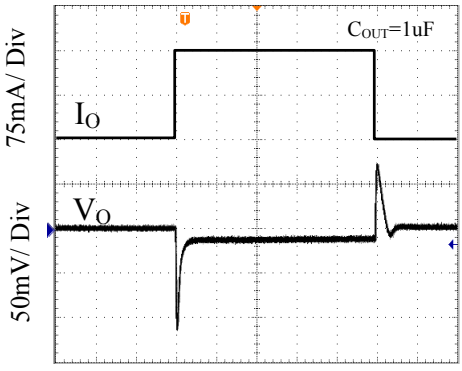

### Dropout Voltage v.s. Temperature



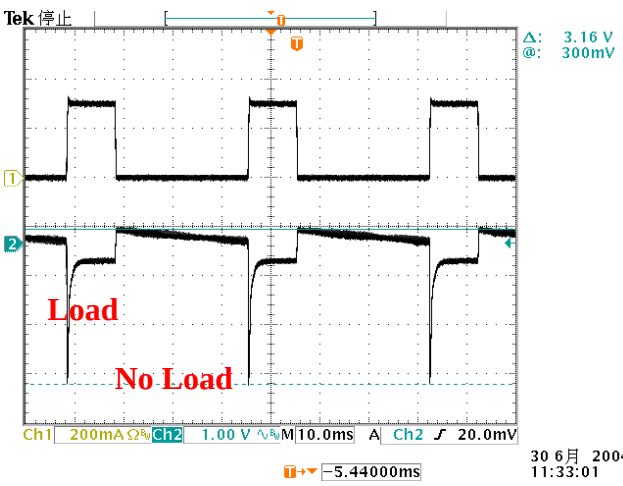

### Load Transient Response with $I_O$=50mA

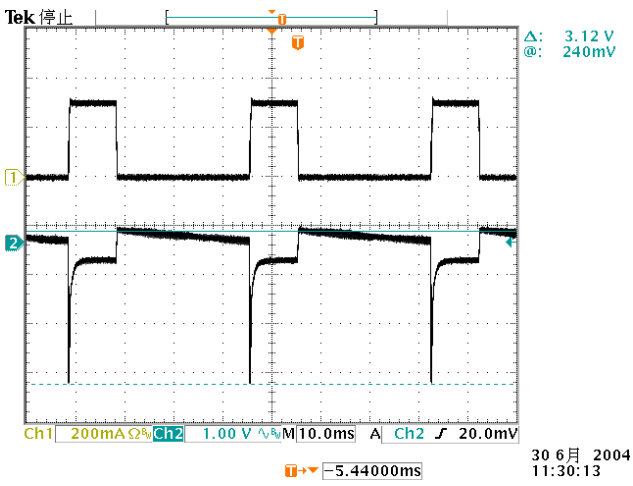



### Load Transient Response with $I_O$=150mA




**$I_{LOAD}$ = 300mA $V_{IN}$ = 3V**



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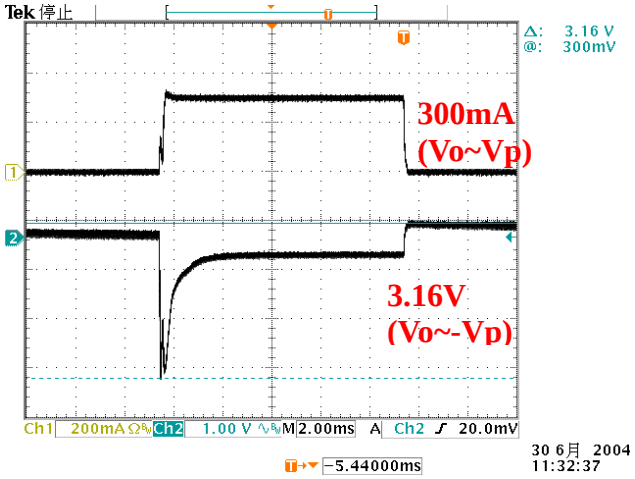
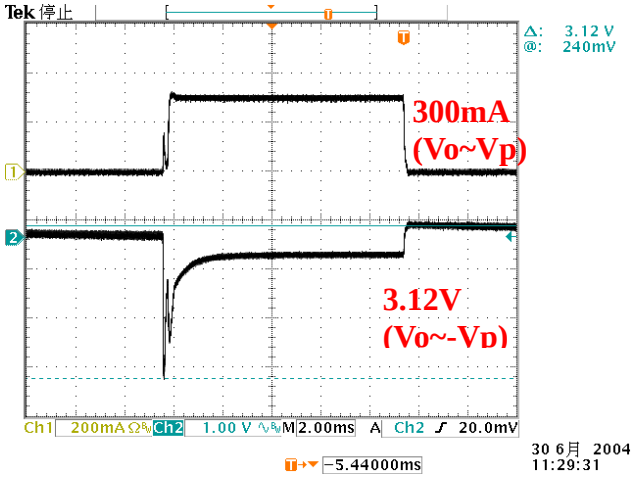
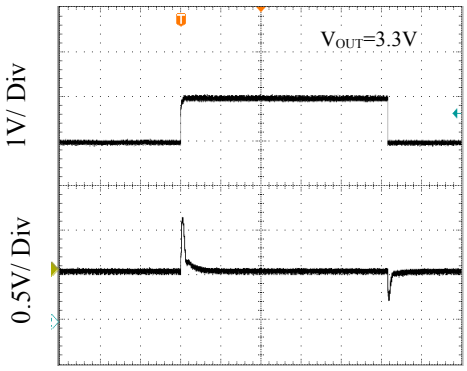
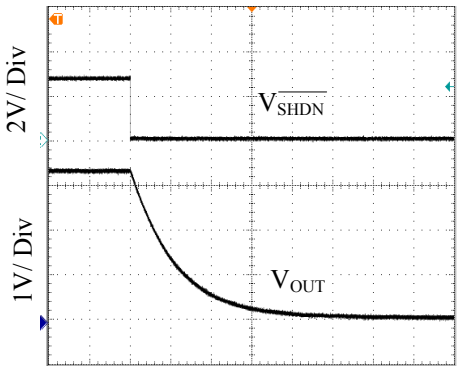


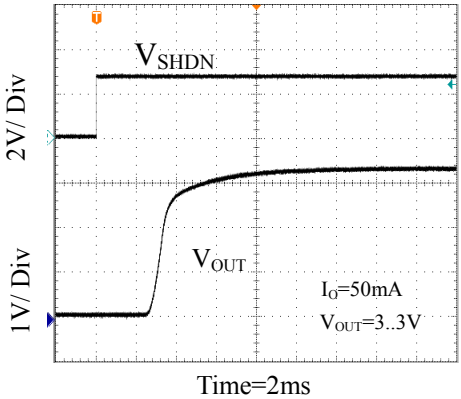

**Line Transient Response, With $I_O$=50mA**



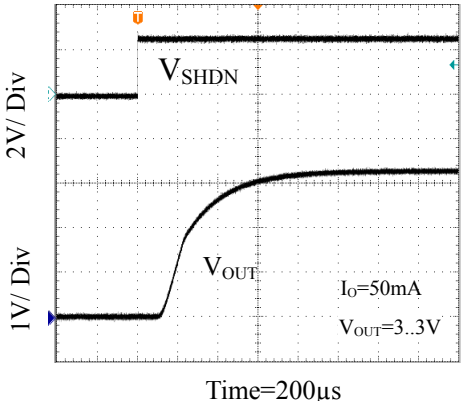

**Entering Shutdown, No Load**




**Shutdown Exit Delay, $C_{BP}$= 0.1uF**




**Shutdown Exit Delay, $C_{BP}$= 2pF**



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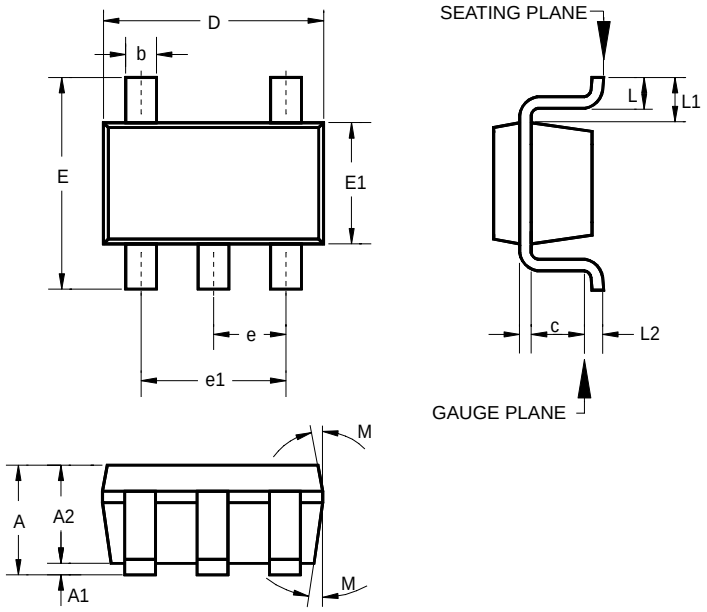
## LOW NOISE 300mA LOW DROPOUT REGULATOR

### 5-Pin SOT-23




| | 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 | 0.075BSC | | | 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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Jun 2004

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## LOW NOISE 300mA LOW DROPOUT REGULATOR

## IMPORTANT NOTICE

ADD Microtech (ADDM) reserves the right to make changes to its products or to discontinue any integrated circuit product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

A few applications using integrated circuit products may involve potential risks of death, personal injury, or severe property or environmental damage. ADDM integrated circuit products are not designed, intended, authorized, or warranted to be suitable for use in life-support applications, devices or systems or other critical applications. Use of ADDM products in such applications is understood to be fully at the risk of the customer. In order to minimize risks associated with the customer's applications, the customer should provide adequate design and operating safeguards.

ADDM assumes to no liability to customer product design or application support. ADDM warrants the performance of its products to the specifications applicable at the time of sale.


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