

## AME8831

### ■ General Description

The AME8831 family of positive, linear regulators feature low quiescent current (17 $\mu$ A typ.) with low dropout voltage, making them ideal for battery applications. The space-saving SOT-25 package is attractive for "Pocket" and "Hand Held" applications.

These rugged devices have both Thermal Shutdown, and Current limitation to prevent device failure under the "Worst" of operating conditions. In applications requires a low noise regulated supply. The AME8831 family uses the SR pin to program the output voltage's slew rate to control the in-rush current. This is specifically used in the USB application where large load capacitance is present at start-up.

The AME8831 also features a logic-enabled sleep mode to shutdown the regulator, reducing quiescent current to 1 $\mu$ A typical at  $T_A = 25^\circ\text{C}$ .

The AME8831 is stable with an output capacitance of 4.7 $\mu$ F or larger.

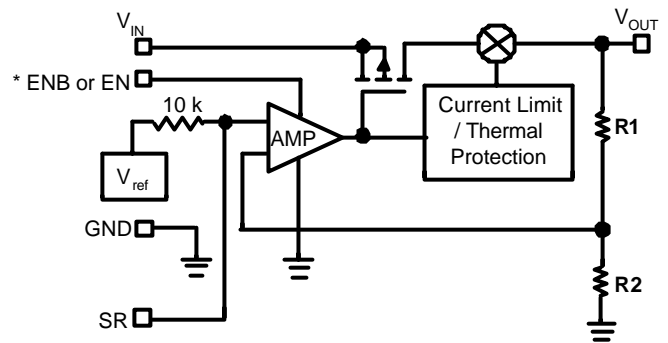
### ■ Features

- Guaranteed 150mA Output
- Dropout Voltage Typically 150 mV at 150 mA
- 17 $\mu$ A Quiescent Current
- Over-Temperature Shutdown
- Over-Current Limitation
- Noise Reduction Bypass Capacitor
- Power-Saving Shutdown Mode
- Space-Saving SOT-25 Package
- Factory Pre-set Output Voltages
- Enable pin option
  - ENB active low enable
  - EN active high enable
- All AME's Lead Free Products Meet RoHS Standards

### ■ Applications

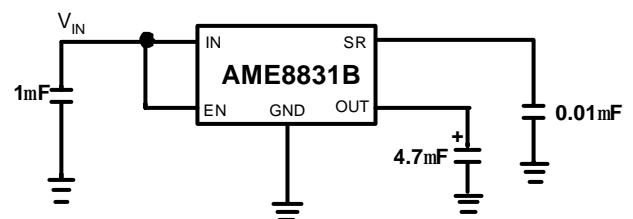
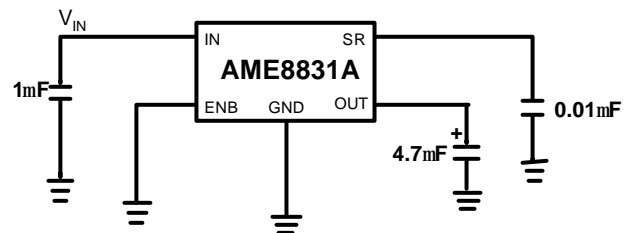
- Instrumentation
- Portable Electronics
- Wireless Devices
- Cordless Phones
- PC Peripherals
- Battery Powered Widgets
- Electronic Scales

### ■ Function Block Diagram



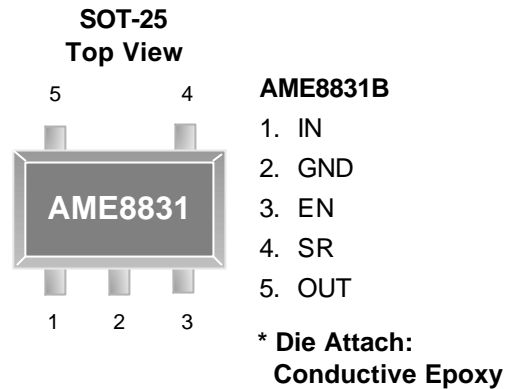
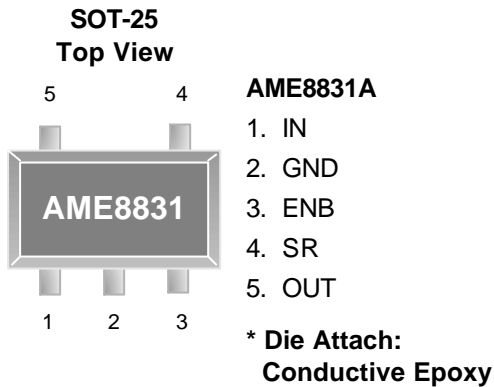
\* AME8831A: ENB, AME8831B: EN

### ■ Typical Application



## AME8831

### ■ Pin Configuration

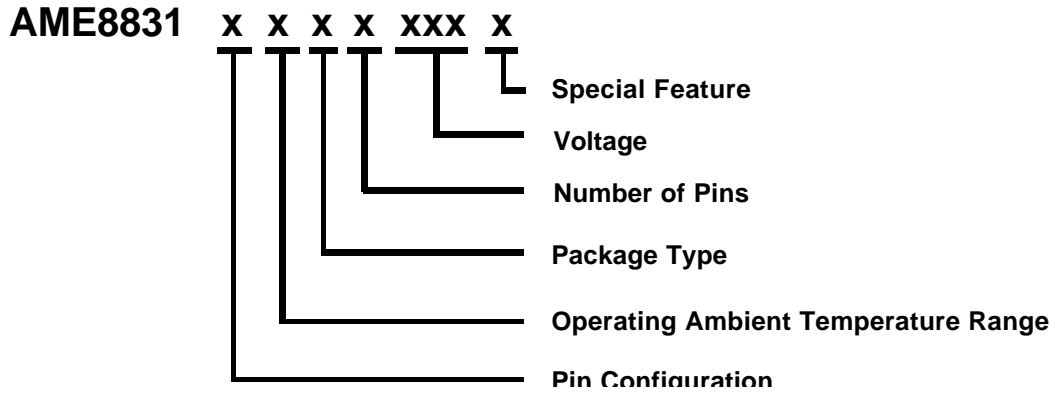


### ■ Pin Description

Pin Number	Pin Name	Pin Description
1	IN	Input voltage pin. It should be decoupled with 1 $\mu$ F or greater capacitor.
2	GND	Ground connection pin.
3	EN	Enable pin. When pulled low, the PMOS pass transistor turns off, current consuming less than 1 $\mu$ A.
	ENB	Enable bar pin. When pulled high, the PMOS pass transistor turns off, current consuming less than 1 $\mu$ A.
4	SR	The SR(Slew Rate) terminal is used to control the V <sub>OUT</sub> in-rush current.
5	OUT	LDO voltage regulator output pin. It should be decoupled with a 1 $\mu$ F or greater value low ESR ceramic capacitor.



■ Ordering Information



Pin Configuration	Operating Ambient Temperature Range	Package Type	Number of Pins	Output Voltage	Special Feature
A: 1. IN (SOT-25) 2. GND 3. ENB 4. SR 5. OUT  B: 1. IN (SOT-25) 2. GND 3. EN 4. SR 5. OUT	E: -40°C to +85°C	E: SOT-2X	V: 5	180: V=1.8V 250: V=2.5V 285: V=2.85V 300: V=3.0V 330: V=3.3V	Y: Lead free & Low profile Z: Lead free



# 150mA Hi-PSRR, Low-Quiescent LDO with In-Rush Current Control For USB Application

## AME8831

### ■ Ordering Information

Part Number	Marking*	Output Voltage	Package	Operating Ambient Temperature Range
AME8831AEEV180Z	BIKww	1.8V	SOT-25	- 40°C to +85°C
AME8831AEEV180Y	BIKww	1.8V	TSOT-25	- 40°C to +85°C
AME8831AEEV250Z	BILww	2.5V	SOT-25	- 40°C to +85°C
AME8831AEEV250Y	BILww	2.5V	TSOT-25	- 40°C to +85°C
AME8831AEEV285Z	BIHww	2.85V	SOT-25	- 40°C to +85°C
AME8831AEEV285Y	BIHww	2.85V	TSOT-25	- 40°C to +85°C
AME8831AEEV300Z	BIMww	3.0V	SOT-25	- 40°C to +85°C
AME8831AEEV300Y	BIMww	3.0V	TSOT-25	- 40°C to +85°C
AME8831AEEV330Z	BDVww	3.3V	SOT-25	- 40°C to +85°C
AME8831AEEV330Y	BDVww	3.3V	TSOT-25	- 40°C to +85°C
AME8831BEEV180Z	BEYww	1.8V	SOT-25	- 40°C to +85°C
AME8831BEEV180Y	BEYww	1.8V	TSOT-25	- 40°C to +85°C
AME8831BEEV250Z	BFJww	2.5V	SOT-25	- 40°C to +85°C
AME8831BEEV250Y	BFJww	2.5V	TSOT-25	- 40°C to +85°C
AME8831BEEV285Z	BEZww	2.85V	SOT-25	- 40°C to +85°C
AME8831BEEV285Y	BEZww	2.85V	TSOT-25	- 40°C to +85°C
AME8831BEEV300Z	BFAww	3.0V	SOT-25	- 40°C to +85°C
AME8831BEEV300Y	BFAww	3.0V	TSOT-25	- 40°C to +85°C
AME8831BEEV330Z	BFBww	3.3V	SOT-25	- 40°C to +85°C
AME8831BEEV330Y	BFBww	3.3V	TSOT-25	- 40°C to +85°C

Note: ww represents the date code and pls refer to the Date Code Rule before Package Dimension.

\* A line on top of the first character represents lead free plating such as BDVww.

Please consult AME sales office or authorized Rep./Distributor for output voltage and package type availability.

**AME8831**
**■ Absolute Maximum Ratings**

Parameter	Maximum	Unit
Input Voltage	6	V
Output Current	$P_D / (V_{IN} - V_{OUT})$	mA
Output Voltage	GND-0.3 to $V_{IN}+0.3$	V
ESD Classification	C*	

Caution: Stress above the listed absolute maximum rating may cause permanent damage to the device

\*HBM C: 4000V+

**■ Recommended Operating Conditions**

Parameter	Symbol	Rating	Unit
Ambient Temperature Range	$T_A$	- 40 to +85	°C
Junction Temperature Range	$T_J$	- 40 to +125	
Storage Temperature Range	$T_{STG}$	-65 to +150	

**■ Thermal Information**

Parameter	Package	Die Attach	Symbol	Maximum	Unit
Thermal Resistance* (Junction to Case)	SOT-25	Conductive Epoxy	$\theta_{JC}$	81	°C / W
Thermal Resistance (Junction to Ambient)			$\theta_{JA}$	260	
Internal Power Dissipation			$P_D$	400	mW
Maximum Junction Temperature				150	°C
Solder Iron (10 Sec)**				350	°C

\* Measure  $\theta_{JC}$  on center of molding compound if IC has no tab.

\*\* MIL-STD-202G 210F

## AME8831

### ■ Electrical Specifications

Over operating temperature range ( $T_J = -40^\circ\text{C}$  to  $+125^\circ\text{C}$ ),  $V_{IN} = V_{OUT(nom)} + 1\text{V}$ , or  $V_{IN} = V_{IN(Min)}$  whichever is greater,  $I_{OUT} = 1\text{mA}$ ,  $V_{EN} = V_{IN}$  ( $V_{ENB} = 0$ ), and  $C_{OUT} = 4.7\mu\text{F}$ ,  $C_{IN} = 1\mu\text{F}$  unless otherwise noted. Typical values are at  $T_A = 25^\circ\text{C}$ .

Parameter	Symbol	Test Condition	Min	Typ	Max	Units	
Input Voltage	$V_{IN}$		Note1		5.5	V	
Output Voltage Accuracy	$V_{OUT(nom)}$	$T_A = 25^\circ\text{C}$ $T_J = -40^\circ\text{C}$ to $+125^\circ\text{C}$	-1.5 -3		1.5 3	%	
Line Regulation $\frac{\Delta V_{OUT} * \%}{V_{OUT}} \div \Delta V_{IN}$	REG <sub>LINE</sub>	$V_{OUT} = 1.8,$ $2.5\text{V} < V_{IN} < 5.5\text{V}$	$T_A = 25^\circ\text{C}$ $T_J = -40^\circ\text{C}$ to $+125^\circ\text{C}$	-0.30 -0.40	0.2	0.3 0.4	%/ $V$
		$V_{OUT} = 2.5,$ $3\text{V} < V_{IN} < 5.5\text{V}$	$T_A = 25^\circ\text{C}$ $T_J = -40^\circ\text{C}$ to $+125^\circ\text{C}$	-0.25 -0.35	0.15	0.25 0.35	
		$V_{OUT} = 2.85,$ $3.3\text{V} < V_{IN} < 5.5\text{V}$	$T_A = 25^\circ\text{C}$ $T_J = -40^\circ\text{C}$ to $+125^\circ\text{C}$	-0.25 -0.35	0.15	0.25 0.35	
		$V_{OUT} = 3.0,$ $3.5\text{V} < V_{IN} < 5.5\text{V}$	$T_A = 25^\circ\text{C}$ $T_J = -40^\circ\text{C}$ to $+125^\circ\text{C}$	-0.25 -0.35	0.15	0.25 0.35	
		$V_{OUT} = 3.3,$ $3.8\text{V} < V_{IN} < 5.5\text{V}$	$T_A = 25^\circ\text{C}$ $T_J = -40^\circ\text{C}$ to $+125^\circ\text{C}$	-0.2 -0.3	0.1	0.2 0.3	
		Output Current	$I_{OUT}$	(See Note2)	150		
Output Current Limit	$I_{LIM}$	$V_{OUT} = 0\text{V}$	200	350	750	mA	
Quiescent Current	$I_Q$	$10\mu\text{A} < I_{OUT} < 150\text{mA}$	$T_A = 25^\circ\text{C}$		17	25	$\mu\text{A}$
		$10\mu\text{A} < I_{OUT} < 150\text{mA}$	$T_J = -40^\circ\text{C}$ to $+125^\circ\text{C}$			30	
Load Regulation = $\frac{\Delta V_{OUT} * \%}{V_{OUT}} \div \Delta I(mA)$	REG <sub>LOAD</sub>	$10\mu\text{A} < I_{OUT} < 150\text{mA}$	$T_A = 25^\circ\text{C}$	-0.1	0.0025	0.1	%/ $\text{mA}$

Note1 :  $V_{IN(min)} = V_{OUT} + V_{DROPOUT(max)}$

Note2 : Continuous output current and operating junction temperature are limited by internal protection circuitry, but it is not recommended that the device operate under conditions beyond those specified in this table for extended periods of time.

## ■ Electrical Specifications (contd.)

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Dropout Voltage @ $V_{OUT}=V_{OUT(nom)}-2\%V_{OUT(nom)}$	$V_{DO}$	$V_{OUT(nom)}=1.8V$ $I_{OUT}=150mA$	$T_A=25^{\circ}C$		800	850	mV
			$T_J=-40^{\circ}C$ to $+125^{\circ}C$			900	
		$V_{OUT(nom)}=2.5V$ $I_{OUT}=150mA$	$T_A=25^{\circ}C$		450	500	
			$T_J=-40^{\circ}C$ to $+125^{\circ}C$			550	
		$V_{OUT(nom)}=2.85V$ $I_{OUT}=150mA$	$T_A=25^{\circ}C$		350	400	
			$T_J=-40^{\circ}C$ to $+125^{\circ}C$			450	
$V_{OUT(nom)}=3V$ $I_{OUT}=150mA$	$T_A=25^{\circ}C$		250	350			
	$T_J=-40^{\circ}C$ to $+125^{\circ}C$			400			
$V_{OUT(nom)}=3.3V$ $I_{OUT}=150mA$	$T_A=25^{\circ}C$		150	250			
	$T_J=-40^{\circ}C$ to $+125^{\circ}C$			300			
Over Temperature Shutdown	OTS	Thermal shutdown increasing			150		$^{\circ}C$
Over Temperature Hysteresis	OTH				20		
$V_{OUT}$ Temperature Coefficient	TC				30		ppm
Power Supply Ripple Rejection	PSRR	$V_{OUT}=3.3V$ , $f=1$ kHz, $I_{OUT}=100mA$ $C_{OUT}=10\mu F$ $C_{(SR)}=0.01\mu F$	$T_A=25^{\circ}C$		65		dB
Output Voltage Noise	$\epsilon_N$	BW=200Hz to 100kHz $I_{OUT}=150mA$ $C_{OUT}=10\mu F$ , $C_{(SR)}=0.47\mu F$	$T_A=25^{\circ}C$		100		$\mu VRMS$
ENB and EN Input Threshold	$V_{ENBH}$ $V_{ENH}$	$V_{IN}=2.5V$ to $5.5V$		1.4		$V_{IN}$	V
	$V_{ENBL}$ $V_{ENL}$			0		0.3	
EN or ENB Input Bias Current	$I_{EN}$	ENB=0, EN= $V_{IN}$ $V_{IN}=2.5V$ to $5.5V$			0.1	1	$\mu A$
Shutdown Current	$I_{SD}$	ENB= $V_{IN}$ , EN=0 $V_{IN}=2.5V$ to $5.5V$			1	2	$\mu A$
Start up Time	$T_{STR}$	$V_{OUT}=3.3V$ $R_{LOAD}=22\Omega$ $C_{OUT}=10\mu F$	$C_{SR}=0.01\mu F$	$T_A=25^{\circ}C$		20	ms
			$C_{SR}=0.1\mu F$			200	
			$C_{SR}=0.22\mu F$			450	

**AME8831**

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**■ Detail Description**

The AME8831 family of CMOS regulators contain a PMOS pass transistor, voltage reference, error amplifier, over-current protection, and thermal shutdown function.

The P-channel pass transistor receives data from the error amplifier, over-current limit, and thermal protection circuits. During normal operation, the error amplifier compares the output voltage to a precision reference. Over-current and Thermal shutdown circuits become active when the junction temperature exceeds 150°C, or the current exceeds about 350mA. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 120°C.

The AME8831 switches from voltage mode to current mode when the load exceeds the rated output current. This prevents over-stress.

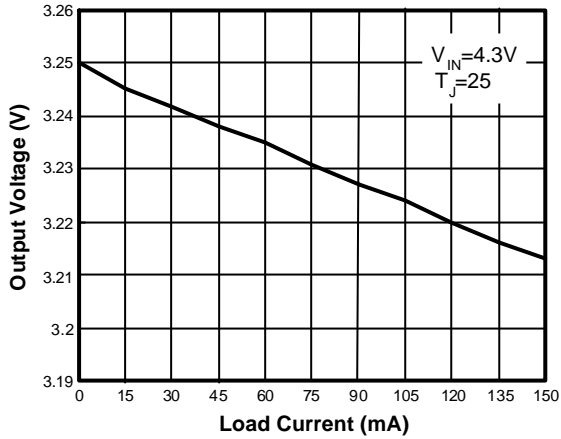
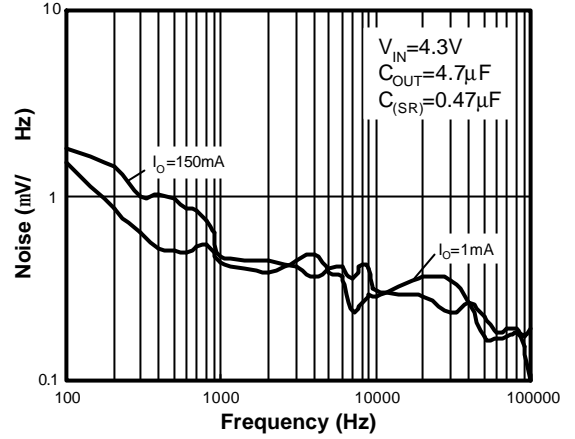
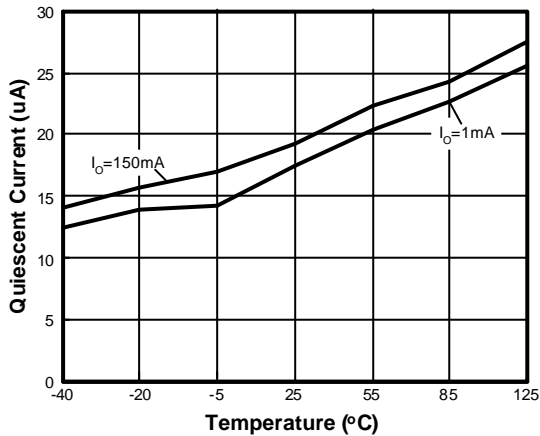
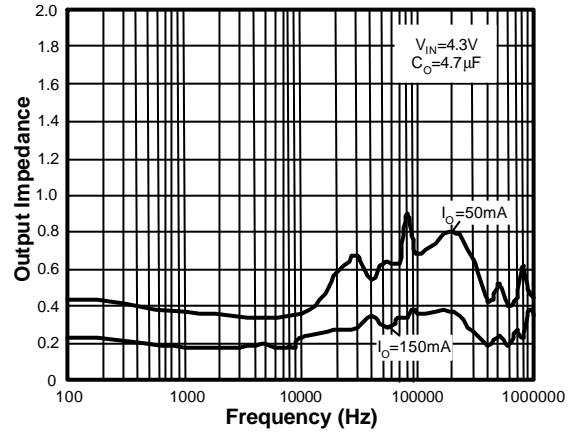
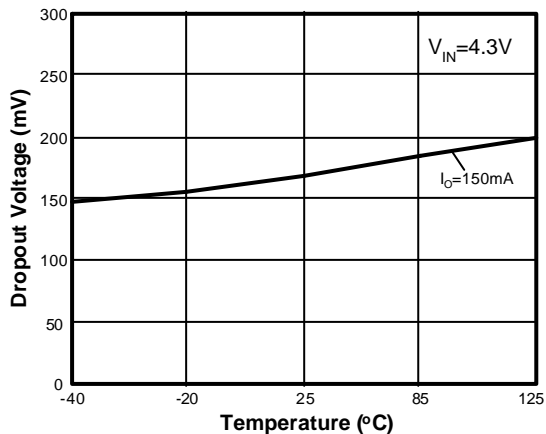
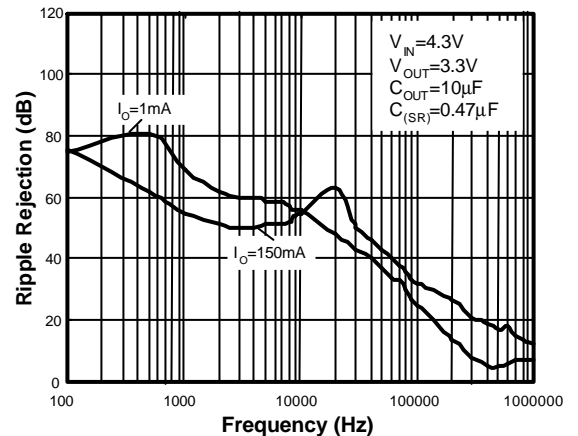
**■ External Capacitors**

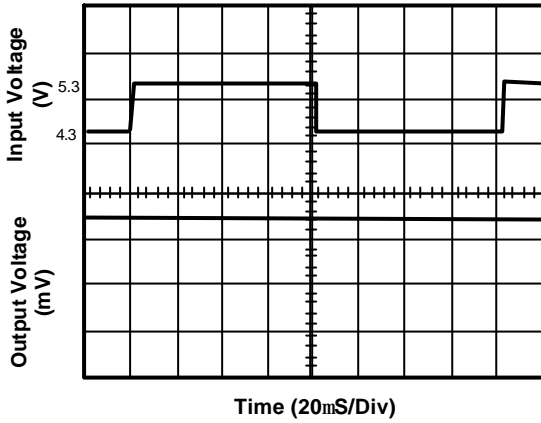
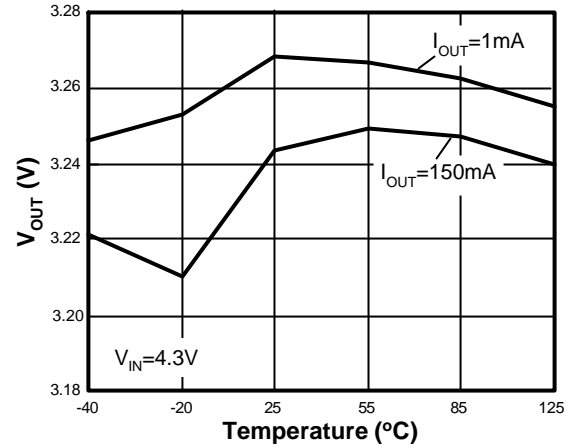
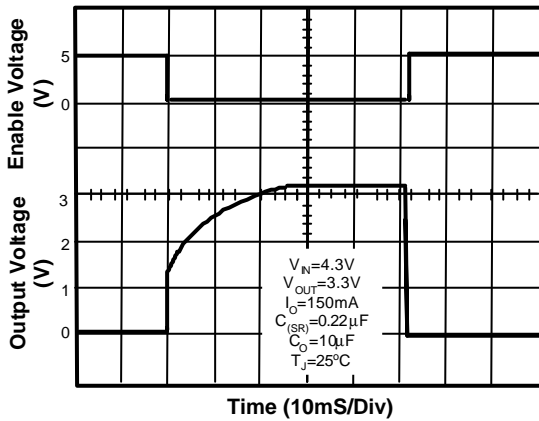
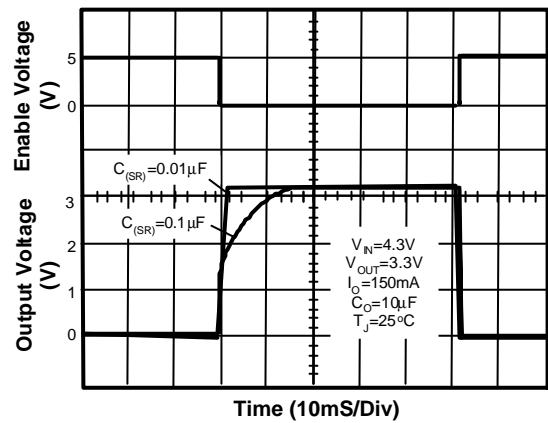
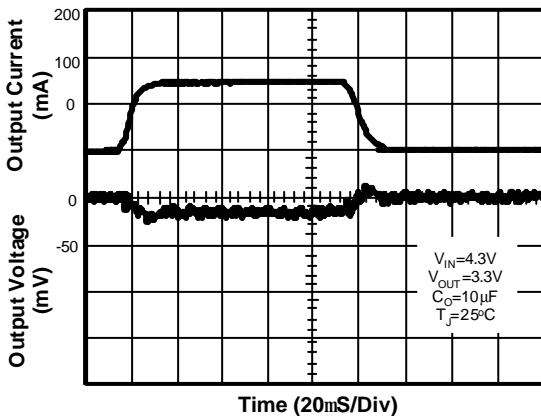
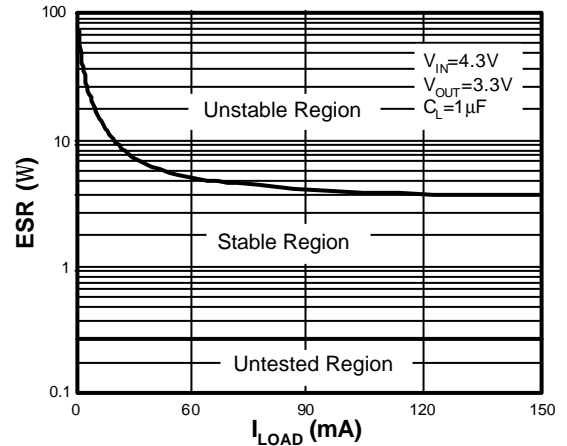
The AME8831 is stable with an output capacitor to ground of 4.7 $\mu$ F or greater. Ceramic capacitors have the lower ESR, and will offer the best AC performance. Conversely, Aluminum Electrolytic capacitors exhibit the higher ESR, resulting in the poor AC response. Unfortunately, large value ceramic capacitors are comparatively expensive. One option is to parallel a 0.1 $\mu$ F ceramic capacitor with a 10 $\mu$ F Aluminum Electrolytic. The benefit is low ESR, high capacitance, and low overall cost.

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

**■ Enable**

The Enable pin is optional. EN for active high enable, ENB for active low enable. When disable the Enable Pin EN=0, ENB= $V_{IN}$ , the PMOS pass transistor shuts off, and all internal circuits are powered down. In this state, the standby current is less than 1 $\mu$ A.

**Output Voltage vs Load Current**

**Output Noise Spectral Density**

**Quiescent Current vs Temperature**

**Output Impedance vs Frequency**

**Dropout Voltage vs. Temperature**

**Ripple Rejection vs Frequency**


**Line Transient Response**

 **$V_{OUT}$  vs Temperature**

**Output Voltage, Enable Voltage vs Time  
(Start-Up)**

**Output Voltage, Enable Voltage vs Time  
(Start-Up)**

**Load Transient Response**

**Stability vs ESR vs  $I_{LOAD}$** 


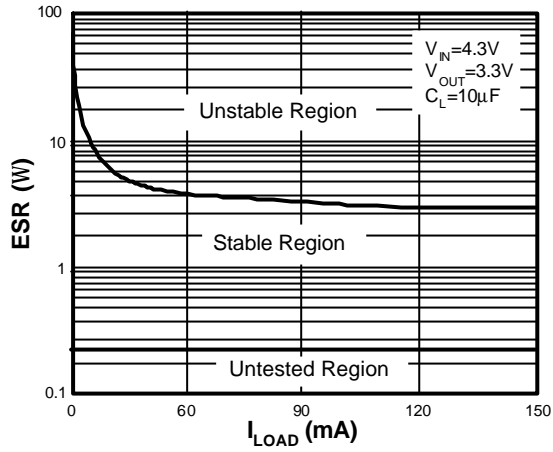


AME

# 150mA Hi-PSRR, Low-Quiescent LDO with In-Rush Current Control For USB Application

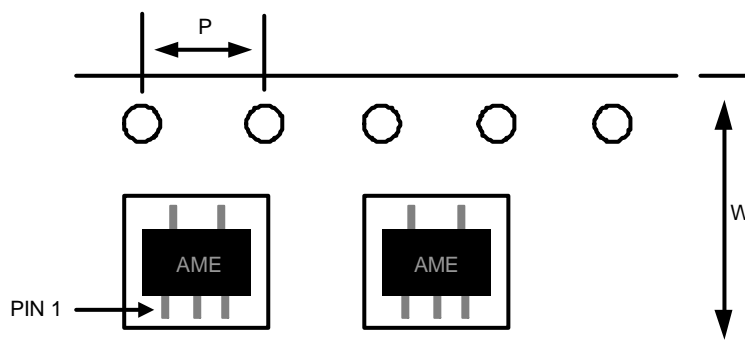
AME8831

Stability vs ESR vs  $I_{LOAD}$



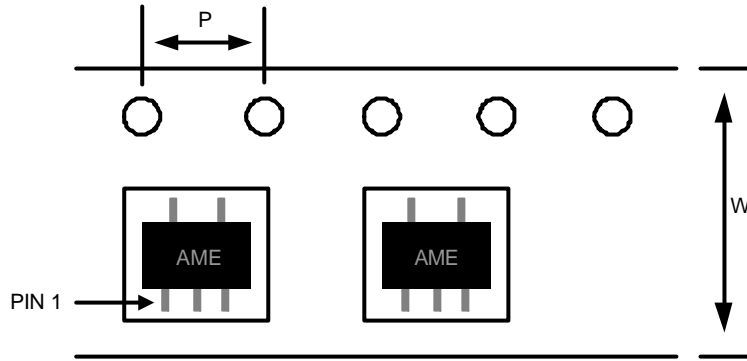
**AME8831**
**■ Date Code Rule**

Marking	Date Code	Year
A A A	W W	xxx0
A A A	W <u>W</u>	xxx1
A A A	<u>W</u> W	xxx2
A A A	<u>W</u> <u>W</u>	xxx3
A A <u>A</u>	W W	xxx4
A A <u>A</u>	W <u>W</u>	xxx5
A A <u>A</u>	<u>W</u> W	xxx6
A A <u>A</u>	<u>W</u> <u>W</u>	xxx7
A <u>A</u> A	W W	xxx8
A <u>A</u> A	W <u>W</u>	xxx9

**■ Tape and Reel Dimension**
**SOT-25**


**Carrier Tape, Number of Components Per Reel and Reel Size**

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
SOT-25	8.0±0.1 mm	4.0±0.1 mm	3000pcs	180±1 mm

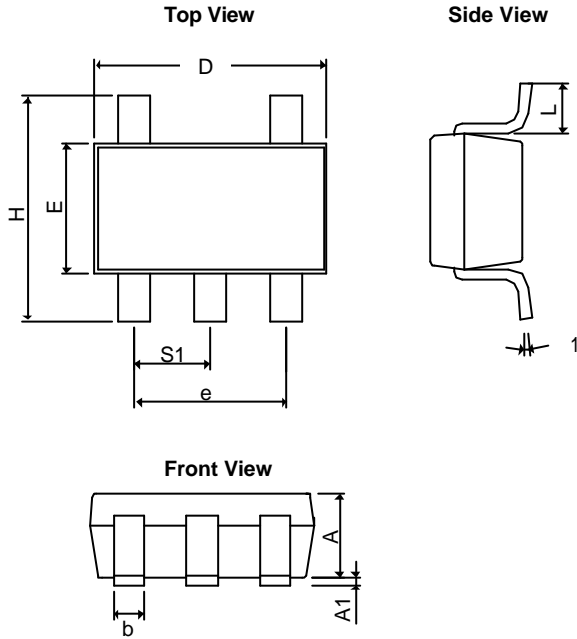
**AME8831**
**■ Tape and Reel Dimension**
**TSOT-25**

**Carrier Tape, Number of Components Per Reel and Reel Size**

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
TSOT-25	8.0±0.1 mm	4.0±0.1 mm	3000pcs	180±1 mm

## AME8831

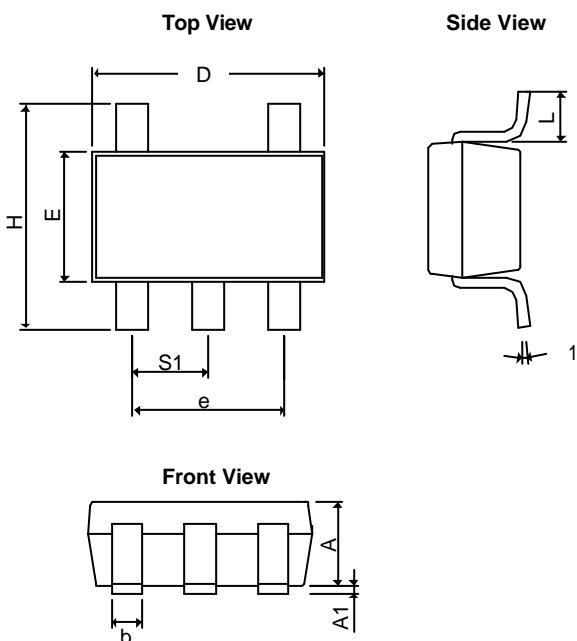
### ■ Package Dimension

#### SOT-25



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.20REF		0.0472REF	
A <sub>1</sub>	0.00	0.15	0.0000	0.0059
b	0.30	0.55	0.0118	0.0217
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
e	1.90 BSC		0.07480 BSC	
H	2.60	3.00	0.10236	0.11811
L	0.37BSC		0.0146BSC	
q1	0°	10°	0°	10°
S <sub>1</sub>	0.95BSC		0.0374BSC	

#### TSOT-25



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A+A <sub>1</sub>	0.90	1.25	0.0354	0.0492
b	0.30	0.50	0.0118	0.0197
c	0.09	0.25	0.0035	0.0098
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
e	1.90 BSC		0.07480 BSC	
H	2.40	3.00	0.09449	0.11811
L	0.35BSC		0.0138BSC	
q1	0°	10°	0°	10°
S <sub>1</sub>	0.95BSC		0.0374BSC	



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