AME

AME8831

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

■ General Description

The AME8831 family of positive, linear regulators feature low quiescent current (17µA 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 1µA typical at T_A= 25°C.

The AME8831 is stable with an output capacitance of 4.7µF or larger.

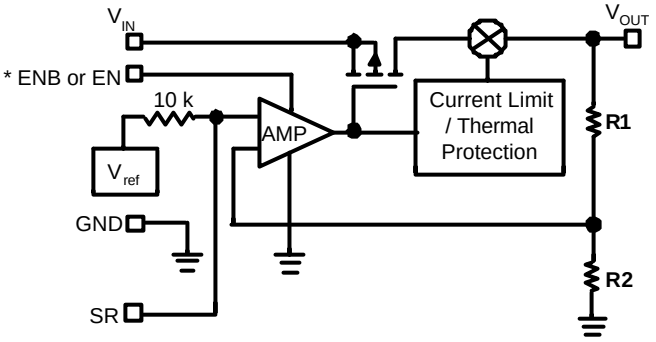
■ Features

- Guaranteed 150mA Output
- Dropout Voltage Typically 150 mV at 150 mA
- 17µA 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

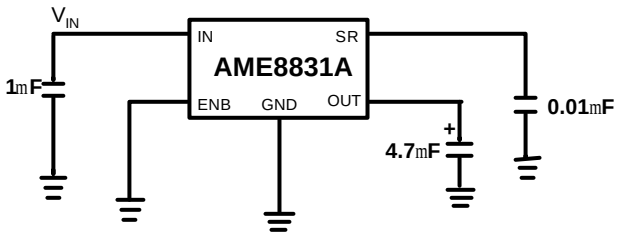
- Instrumentation
- Portable Electronics
- Wireless Devices
- Cordless Phones
- PC Peripherals
- Battery Powered Widgets
- Electronic Scales

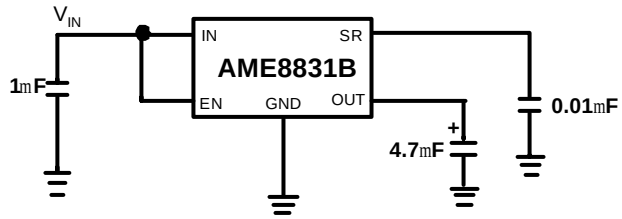
■ Function Block Diagram



* AME8831A: ENB, AME8831B: EN

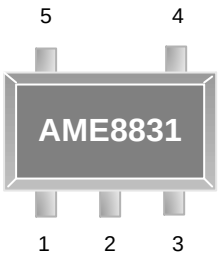
■ Typical Application





■ Pin Configuration

SOT-25
Top View

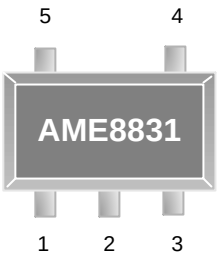


AME8831A

1. IN
2. GND
3. ENB
4. SR
5. OUT

*** Die Attach:**
Conductive Epoxy

SOT-25
Top View



AME8831B

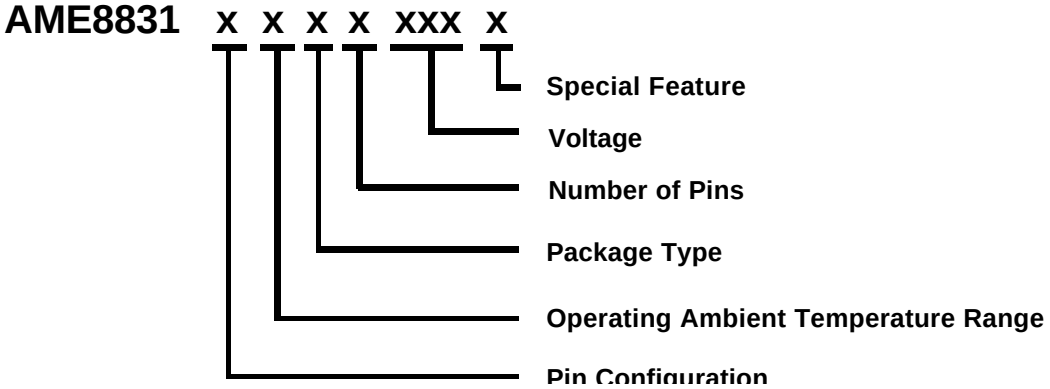
1. IN
2. GND
3. EN
4. SR
5. OUT

*** Die Attach:**
Conductive Epoxy

■ Pin Description

Pin Number	Pin Name	Pin Description
1	IN	Input voltage pin. It should be decoupled with 1μF 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 1μA.
	ENB	Enable bar pin. When pulled high, the PMOS pass transistor turns off, current consuming less than 1μA.
4	SR	The SR(Slew Rate) terminal is used to control the V_{OUT} in-rush current.
5	OUT	LDO voltage regulator output pin. It should be decoupled with a 1μF 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^{O}C to +85^{O}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

■ 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.

■ 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	^oC
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	θ_{JC}	81	^oC / W
Thermal Resistance (Junction to Ambient)			θ_{JA}	260	
Internal Power Dissipation			P_D	400	mW
Maximum Junction Temperature				150	^oC
Solder Iron (10 Sec)**				350	^oC

* Measure θ_{JC} on center of molding compound if IC has no tab.
** MIL-STD-202G 210F

■ Electrical Specifications

Over operating temperature range(T_J=-40°C to +125°C), V_{IN}=$V_{OUT(nom)}$ + 1V, or V_{IN}=$V_{IN(Min)}$ whichever is greater, I_{OUT}=1mA, V_{EN}=V_{IN}(V_{ENB}=0), and C_{OUT}=4.7uF, C_{IN}=1uF unless otherwise noted. Typical values are at T_A=25°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°C		-1.5		1.5	%
		T_J= -40°C to +125°C		-3		3	
Line Regulation $\frac{\frac{\Delta V_{OUT}}{V_{OUT}}*\%}{\Delta V_{IN}}$	REG_{LINE}	V_{OUT}=1.8, 2.5V<V_{IN}<5.5V	T_A=25°C	-0.30	0.2	0.3	%/V
			T_J= -40°C to +125°C	-0.40		0.4	
		V_{OUT}=2.5, 3V<V_{IN}<5.5V	T_A=25°C	-0.25	0.15	0.25	
			T_J= -40°C to +125°C	-0.35		0.35	
		V_{OUT}=2.85, 3.3V<V_{IN}<5.5V	T_A=25°C	-0.25	0.15	0.25	
			T_J= -40°C to +125°C	-0.35		0.35	
		V_{OUT}=3.0, 3.5V<V_{IN}<5.5V	T_A=25°C	-0.25	0.15	0.25	
			T_J= -40°C to +125°C	-0.35		0.35	
		V_{OUT}=3.3, 3.8V<V_{IN}<5.5V	T_A=25°C	-0.2	0.1	0.2	
			T_J= -40°C to +125°C	-0.3		0.3	
Output Current	I_{OUT}	(See Note2)		150			mA
Output Current Limit	I_{LIM}	V_{OUT}=0V		200	350	750	mA
Quiescent Current	I_Q	10µA<I_{OUT}<150mA	T_A=25°C		17	25	µA
		10µA<I_{OUT}<150mA	T_J = -40°C to +125°C			30	
Load Regulation = $\frac{\frac{\Delta V_{OUT}}{V_{OUT}}*\%}{\Delta I(mA)}$	REG_{LOAD}	10µA<=I_{OUT}<=150mA	T_A=25°C	-0.1	0.0025	0.1	%/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°C		800	850	mV
			T_J=-40°C to +125°C			900	
		$V_{OUT(nom)}$=2.5V, I_{OUT}=150mA	T_A=25°C		450	500	
			T_J=-40°C to +125°C			550	
		$V_{OUT(nom)}$=2.85V, I_{OUT}=150mA	T_A=25°C		350	400	
			T_J=-40°C to +125°C			450	
		$V_{OUT(nom)}$=3V, I_{OUT}=150mA	T_A=25°C		250	350	
			T_J=-40°C to +125°C			400	
		$V_{OUT(nom)}$=3.3V, I_{OUT}=150mA	T_A=25°C		150	250	
			T_J=-40°C to +125°C			300	
Over Temerature Shutdown	OTS	Thermal shutdown increasing			150		°C
Over Temerature Hysterisis	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}=10µF, $C_{(SR)}$=0.01µF	T_A=25°C		65		dB
Output Voltage Noise	e_N	BW=200Hz to 100kHz, I_{OUT}=150mA, C_{OUT}=10µF, $C_{(SR)}$=0.47µF	T_A=25°C		100		µVRMS
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	µA
Shutdown Current	I_{SD}	ENB=V_{IN}, EN=0 V_{IN}=2.5V to 5.5V			1	2	µA
Start up Time	T_{STR}	V_{OUT}=3.3V, R_{LOAD}=22Ω, C_{OUT}=10µF	C_{SR}=0.01µF, T_A=25°C		20		ms
			C_{SR}=0.1µF, T_A=25°C		200		
			C_{SR}=0.22µF, T_A=25°C		450		

■ 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

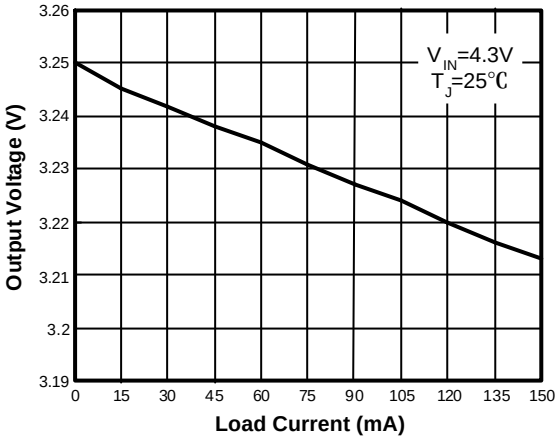
The AME8831 is stable with an output capacitor to ground of 4.7µF or greater. Ceramic capacitors have the lower ESR, and will offer the best AC performance. Conversely, Aluminum Electrolytic capacitors exhibit the higher ESR, resulting in the poor AC response. Unfortunately, large value ceramic capacitors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

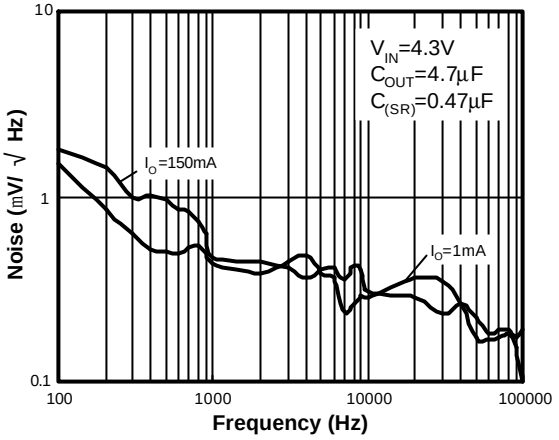
■ Enable

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 1µA.

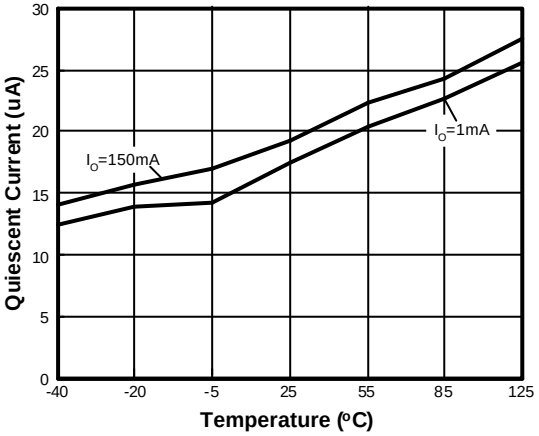
Output Voltage vs Load Current



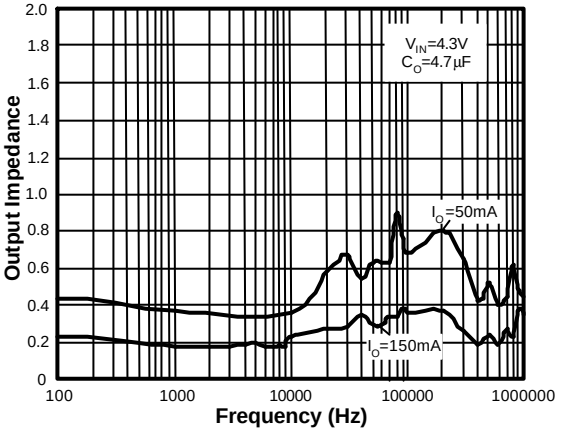
Output Noise Spectral Density



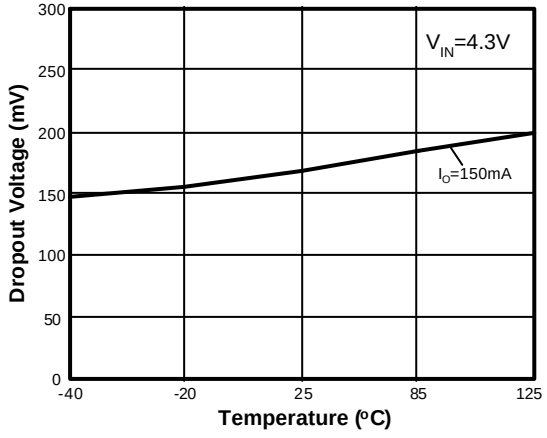
Quiescent Current vs Temperature



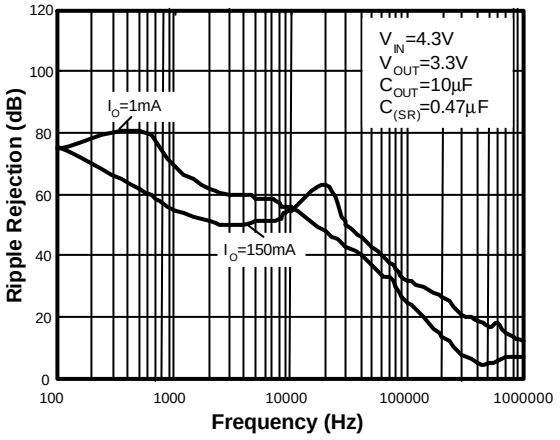
Output Impedance vs Frequency



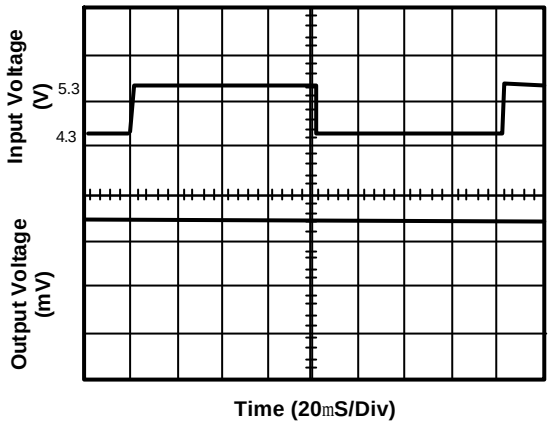
Dropout Voltage vs. Temperature



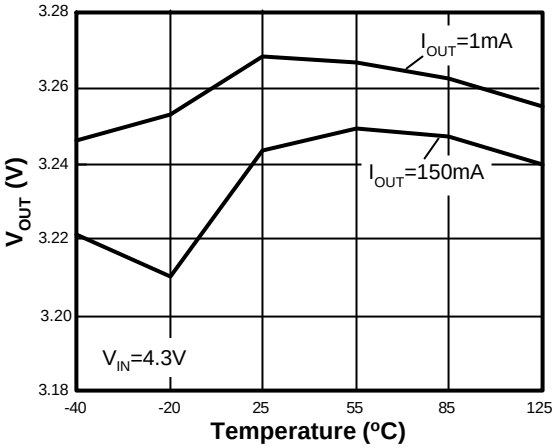
Ripple Rejection vs Frequency



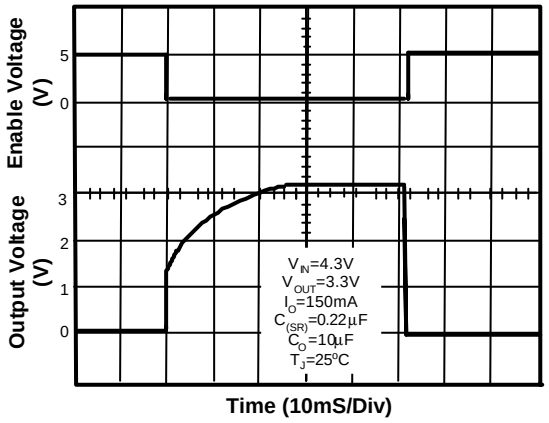
Line Transient Response



V_{OUT} vs Temperature



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



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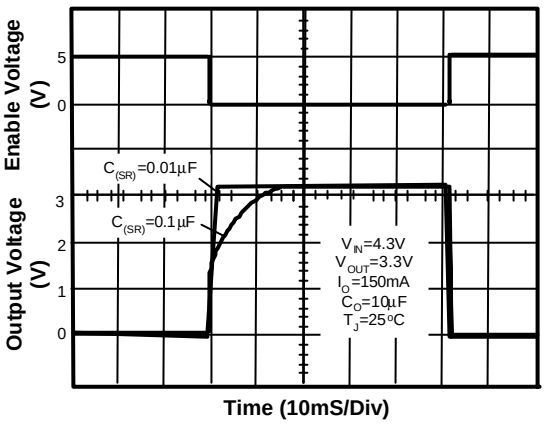
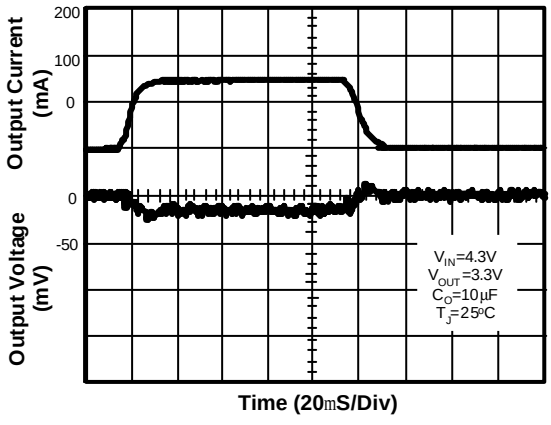
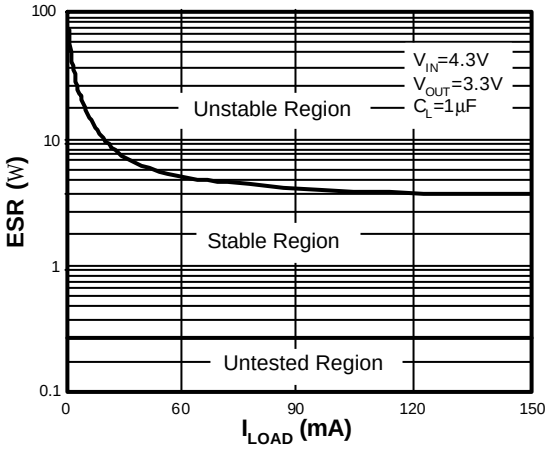


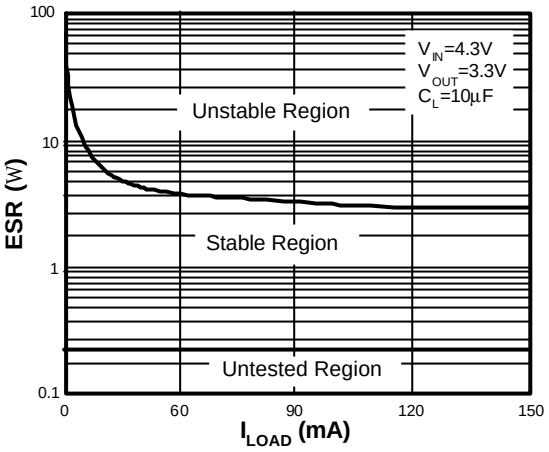
Load Transient Response



Stability vs ESR vs I_{LOAD}



Stability vs ESR vs I_{LOAD}

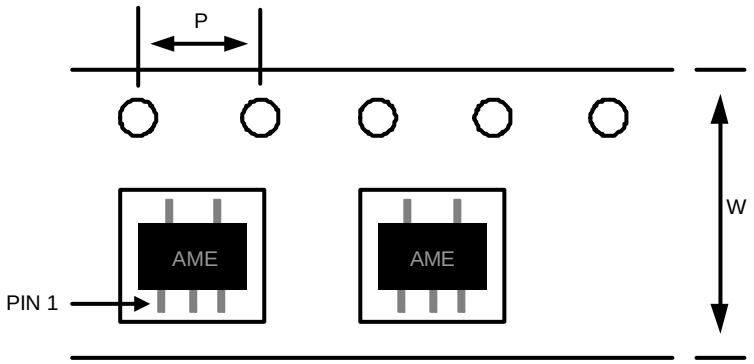


■ Date Code Rule

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

■ Tape and Reel Dimension

SOT-25

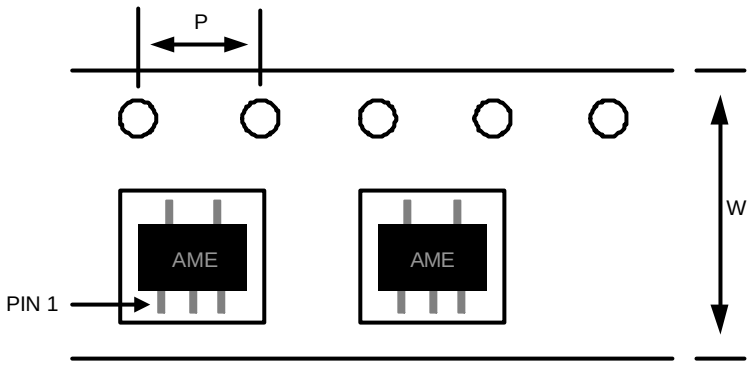


Carrier Tape, Number of Components Per Reel and Reel Size

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

■ Tape and Reel Dimension

TSOT-25



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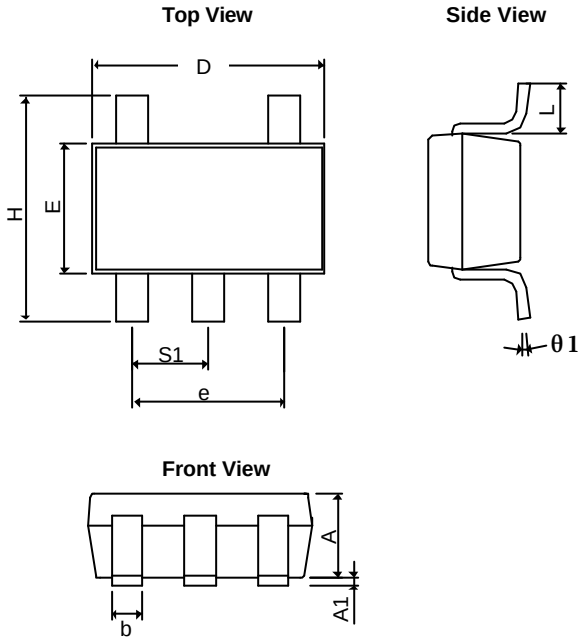
TSOT-25	8.0±0.1 mm	4.0±0.1 mm	3000pcs	180±1 mm

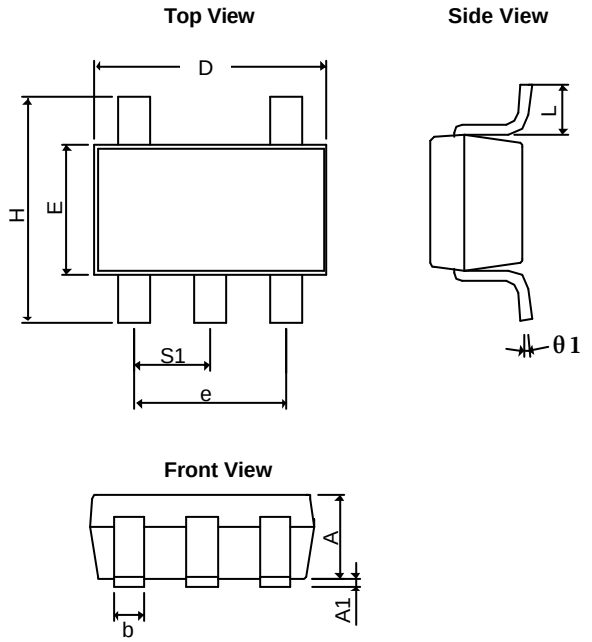
■ Package Dimension

SOT-25



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.20REF		0.0472REF	
A_1	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^o	10^o	0^o	10^o
S_1	0.95BSC		0.0374BSC	

TSOT-25



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
$A+A_1$	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^o	10^o	0^o	10^o
S_1	0.95BSC		0.0374BSC	

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