

■ General Description

The AME8844 family of positive, linear regulators feature low quiescent current (45µA typ.) with low dropout voltage, making them ideal for battery applications.

Output voltages are set at the factory and trimmed to 1.5% accuracy.

These rugged devices have both Thermal Shutdown, and Current Fold-back to prevent device failure under the "Worst" operating conditions.

An additional feature is a "Power Good" detector, which pulls low when the output is out of regulation.

The AME8844 is stable with an output capacitance of 4.7µF or greater.

■ Features

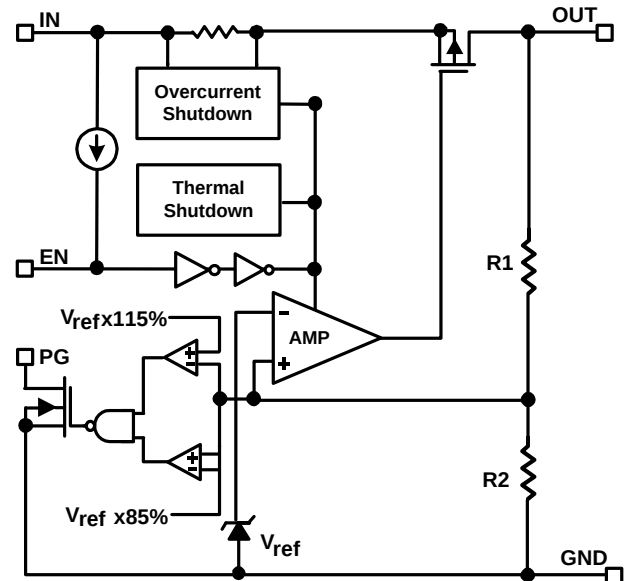
- Very Low Dropout Voltage
- Guaranteed 750mA Output
- Accurate to within 1.5%
- 45µA Quiescent Current Typically
- Over-Temperature Shutdown
- Current Limiting
- Short Circuit Current Fold-back
- Noise Reduction Bypass Capacitor (Fixed Versions)
- Power-Saving Shutdown Mode
- Space-Saving MSOP-8 Package
- 6 Factory Pre-set Output Voltages
- Low Temperature Coefficient
- Adjustable Version
- Power Good Output Function.
- All AME's Lead Free Products Meet RoHS Standards

■ Applications

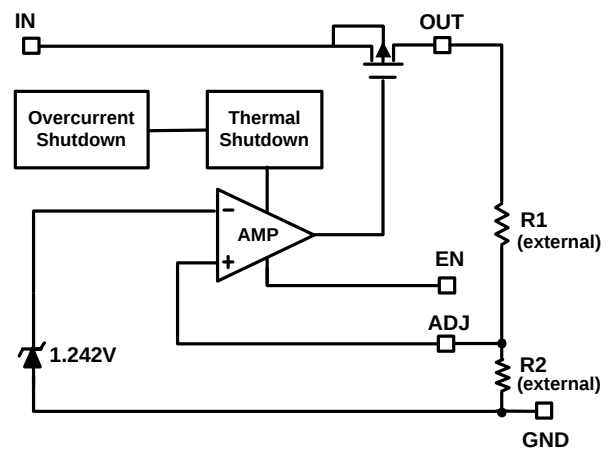
- Instrumentation
- Portable Electronics
- Wireless Devices
- PC Peripherals
- Battery Powered Widgets

■ Functional Block Diagram

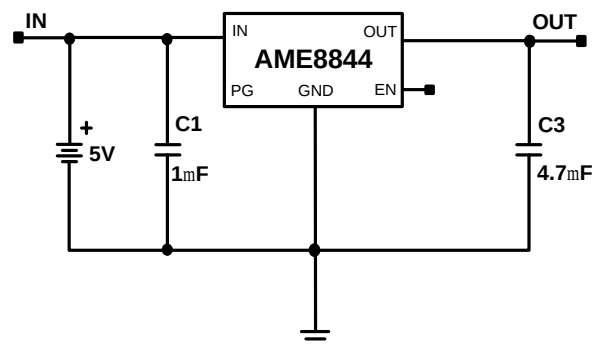
(Fixed Versions)



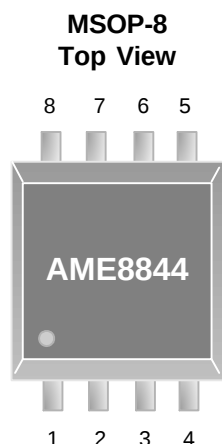
(Adjustable Version)



■ Typical Applications

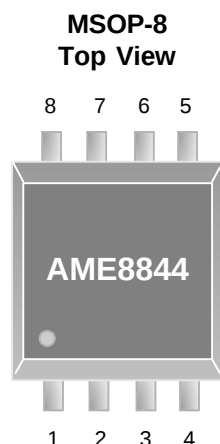


■ Pin Configuration


AME 8844AEQAxxx

1. EN
2. IN
3. PG
4. OUT
5. GND
6. GND
7. GND
8. GND

*** Die Attach:
Conductive Epoxy**


AME 8844BEQAADJ

1. EN
2. IN
3. ADJ
4. OUT
5. GND
6. GND
7. GND
8. GND

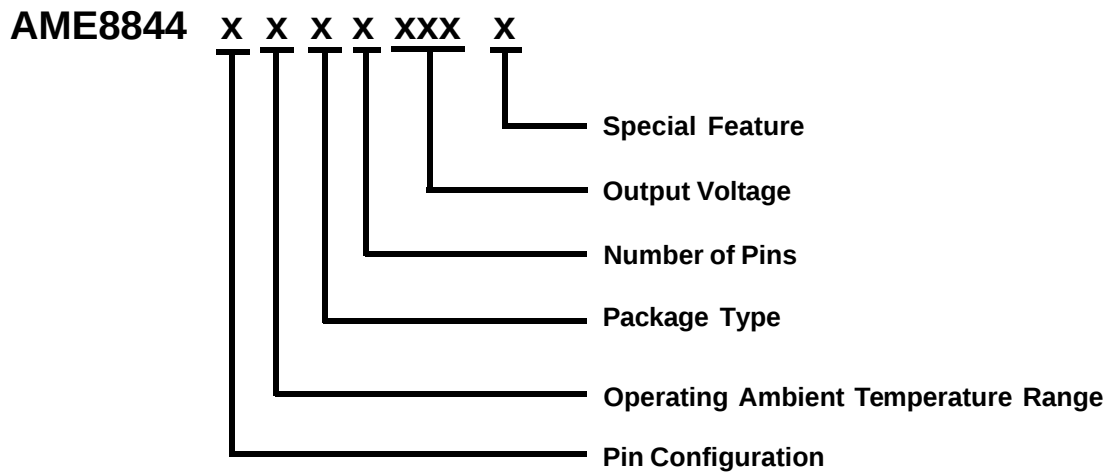
*** Die Attach:
Conductive Epoxy**

■ Pin Description

Pin Number		Pin Name	Pin Description
AME8844AEQA	AME8844BEQA		
1	1	EN	Enable pin. When pulled low, the PMOS pass transistor turns off, current consuming less than 1 μ A.
2	2	IN	Input voltage pin. It should be decoupled with 1 μ F or greater capacitor.
N/A	3	ADJ	Feedback output voltage for adjustable device.
3	N/A	PG	Power-Good output. This open-drain output is low when output is out of regulation.
4	4	OUT	LDO voltage regulator output pin. It should be decoupled with a 4.7 μ F or greater value low ESR ceramic capacitor.
5, 6, 7, 8		GND	Ground connection pin.



■ Ordering Information



Pin Configuration	Operating Ambient Temperature Range	Package Type	Number of Pins	Output Voltage	Special Feature
A: 1. EN (MSOP-8) 2. IN 3. PG 4. OUT 5. GND 6. GND 7. GND 8. GND B: 1. EN (MSOP-8) 2. IN 3. ADJ 4. OUT 5. GND 6. GND 7. GND 8. GND	E: -40°C to 85°C	Q: MSOP	A: 8	ADJ: Adjustable 150: V=1.5V 180: V=1.8V 250: V=2.5V 330: V=3.3V	Z: Lead Free

■ Ordering Information

Part Number	Marking*	Output Voltage	Package	Operating Ambient Temperature Range
AME8844AEQA150Z	8844 Lyww	1.50	MSOP-8	- 40°C to 85°C
AME8844AEQA180	8844 Myww	1.80	MSOP-8	- 40°C to 85°C
AME8844AEQA180Z	8844 Myww	1.80	MSOP-8	- 40°C to 85°C
AME8844AEQA250Z	8844 Dyww	2.50	MSOP-8	- 40°C to 85°C
AME8844AEQA330Z	8844 Ayww	3.30	MSOP-8	- 40°C to 85°C
AME8844BEQAADJ	8844 Byww	ADJ	MSOP-8	- 40°C to 85°C
AME8844BEQAADJZ	8844 Byww	ADJ	MSOP-8	- 40°C to 85°C

Note: yww represents the date code

* A line on top of the first character represents lead free plating such as $\overline{8844}$

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

■ Absolute Maximum Ratings

Parameter	Maximum	Unit
Input Voltage	-0.3 to 8	V
EN Voltage	-0.3 to 8	V
Output Voltage	-0.3 to $V_{IN} + 0.3$	V
PG Voltage	-0.3 to $V_{IN} + 0.3$	V
Output Current	$P_D / (V_{IN} - V_{OUT})$	mA
ESD Classification	B*	

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

* HBM B: 2000~3999V

■ Recommended Operating Conditions

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

■ Thermal Information

Parameter	Package	Die Attach	Symbol	Maximum	Unit
Thermal Resistance * (Junction to Case)	MSOP-8	Conductive Epoxy	θ_{JC}	100	$^{\circ}\text{C} / \text{W}$
Thermal Resistance (Junction to Ambient)			θ_{JA}	206	
Internal Power Dissipation			P_D	625	mW
Maximum Junction Temperature				150	$^{\circ}\text{C}$
Solder Iron(10 Sec)**				350	$^{\circ}\text{C}$

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

** MIL-STD-202G 210F



■ Electrical Specifications

$V_{IN} = V_{O(NOM)} + 2V$, $V_{EN} = V_{IN}$, $T_A = 25^\circ C$ unless otherwise noted

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Input Voltage	V _{IN}			Note 1		7	V
Output Voltage Accuracy	V _O	I _O =1mA		-1.5		1.5	%
Dropout Voltage	V _{DROPOUT}	I _O =750mA V _O =V _{ONOM} -2.0%	V _{O(NOM)} =1.5V		See chart	1000	mV
			V _{O(NOM)} =1.8V			650	
			V _{O(NOM)} >=2.0V			500	
Output Current	I _O	V _O >1.2V		750			mA
Current Limit	I _{LIM}	V _O >1.2V		750			mA
Short Circuit Current	I _{SC}	V _{IN} =V _{O(NOM)} +1V, V _O < 0.4V			750		mA
Quiescent Current	I _Q	I _O =0mA			45	70	μA
Ground Pin Current	I _{GND}	I _O =1mA to 750mA			45		μA
Line Regulation	REG _{LINE}	I _O =1mA V _{IN} =V _O +1 to V _O +2	V _O < 2.0V	-0.15		0.15	%
			4.0 > V _O >= 2.0V	-0.1	0.02	0.1	%
			4.0V <= V _O	-0.4		0.4	%
Load Regulation	REG _{LOAD}	I _O =1mA to 750mA		-1	0.2	1	%
Over Temperature Shutdown	OTS				150		°C
Over Temperature Hysterisis	OTH				30		°C
V _O Temperature Coefficient	TC				30		ppm/°C
ADJ Input Bias Current	I _{ADJ}				1		μA
Minimum Load Current	I _{load}	Vin = 2.5V				70	μA
ADJ Reference Voltage	V _{REF}			1.221	1.240	1.26	V
Power Supply Rejection	PSRR	I _O =100mA C _O =4.7μF ceramic	f=1kHz		75		dB
			f=10kHz		55		
			f=100kHz		30		
Output Voltage Noise	eN	f=10Hz to 100kHz I _O =10mA	Co=4.7μF		30		μVrms
EN Input Threshold	V _{EH}	V _{IN} =2.7V to 7V		2.0		Vin	V
	V _{EL}	V _{IN} =2.7V to 7V		0		0.4	V
EN Input Bias Current	I _{EH}	V _{EN} =V _{IN} , V _{IN} =2.7V to 7V				1	μA
	I _{EL}	V _{EN} =0V, V _{IN} =2.7V to 7V				1	μA
Shutdown Supply Current	I _{SD}	V _{IN} =5V, V _O =0V, V _{EN} <V _{EL}			0.5	2	μA
Output Under Voltage	V _{UV}	PG goes Low when V _{OUT} too Low				84	%V _{O(NOM)}
Output Over Voltage	V _{OV}	PG goes Low when V _{OUT} too High		105			%V _{O(NOM)}
PG Leakage Current	I _{LC}	V _{PG} =7V				1	μA
PG Voltage Low	V _{OL}	I _{SINK} =0.25mA				0.4	V

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



■ Detailed Description

The AME8844 family of CMOS regulators contain a PMOS pass transistor, voltage reference, error amplifier, over-current protection, and thermal shutdown.

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. Over-current and Thermal shutdown circuits become active when the junction temperature exceeds 140°C, or the current exceeds 2.2A. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 120°C.

The AME8844 behaves like a current source when the load reaches 2.2A. However, if the load impedance drops below 0.3 ohms, the current drops back to 600mA to prevent excessive power dissipation. Normal operation is restored when the load resistance exceeds 0.75 ohms.

■ External Capacitors

The AME8844 is stable with an output capacitor to ground of 4.7μF 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 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

When EN pin is pulled low, the PMOS pass transistor shuts off, and all internal circuits are powered down. In this state, the quiescent current is less than 2μA. This pin behaves much like an electronic switch.

100K ohms resistor is necessary between V_{EN} source and EN pin when V_{EN} is higher than V_{IN} .

*(Note: There is no internal pull-up for EN pin.
It can not be floating)*

■ Adjustable Version

The adjustable version uses external feedback resistors to generate an output voltage anywhere from 1.5V to 5.0V. V_{adj} is trimmed to 1.24V and V_{OUT} is given by the equation:

$$V_{OUT} = V_{adj} (1 + R1 / R2)$$

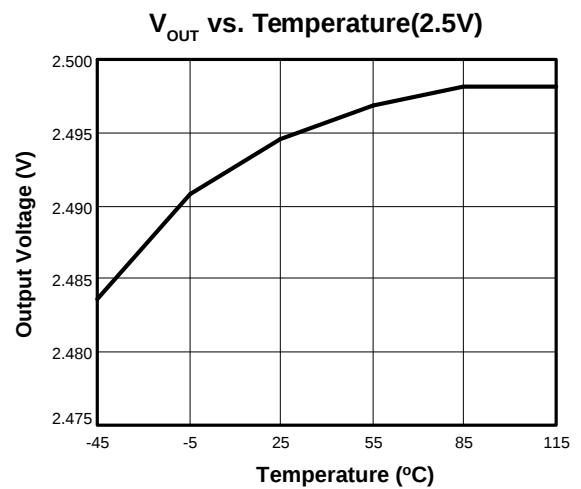
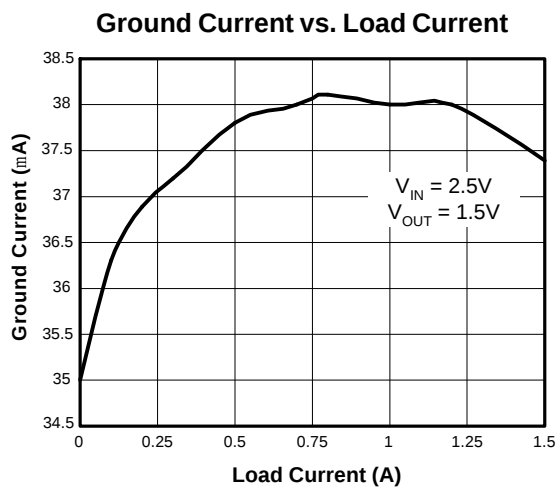
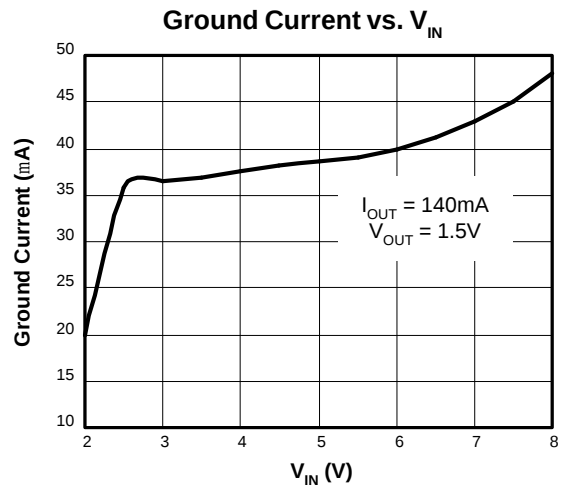
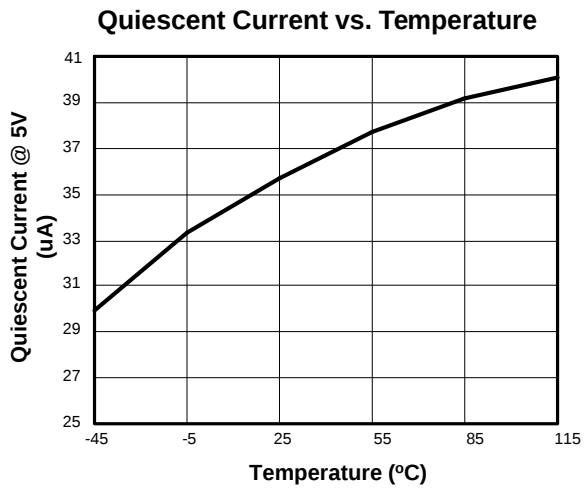
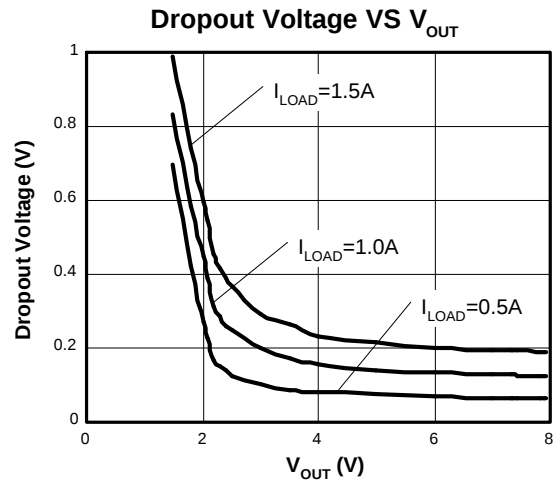
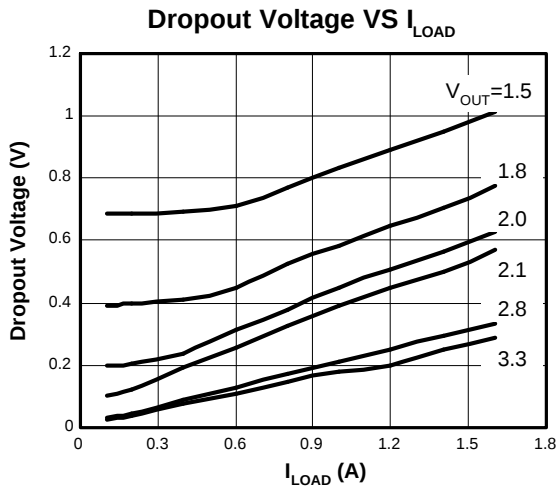
Feedback resistors $R1$ and $R2$ should be high enough to keep quiescent current low, but increasing $R1 + R2$ will reduce stability. In general, $R1$ and $R2$ in the 10 kΩ will produce adequate stability, given reasonable layout precautions. To improve stability characteristics, keep parasitics on the ADJ pin to a minimum, and lower $R1$ and $R2$ values.

■ Power Good

The AME8844 includes the Power Good feature. When the output is not within ± 5% of the specified voltage, it pulls low. This can occur under the following conditions:

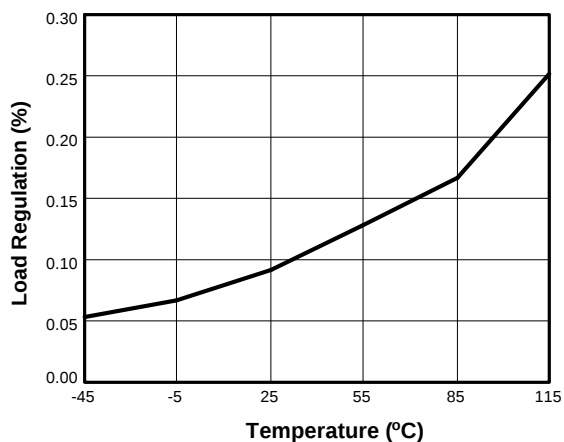
- 1) Input Voltage too low.
- 2) During Over-Temperature.
- 3) During Over-Current.
- 4) If output is pulled up.

(Note: PG pin is an open-drain output.)

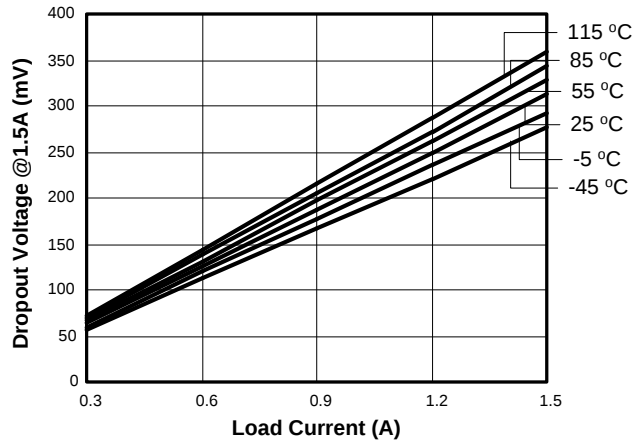




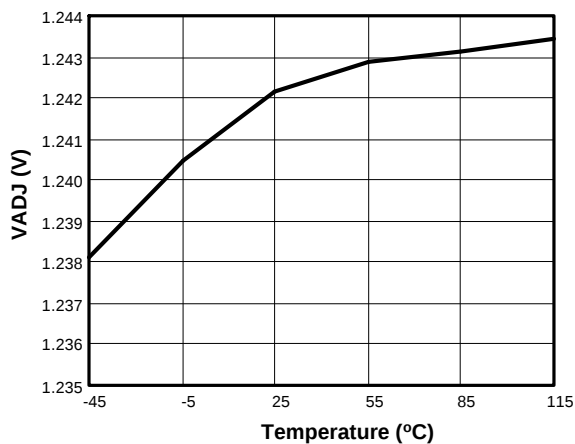
Load Regulation vs. Temperature



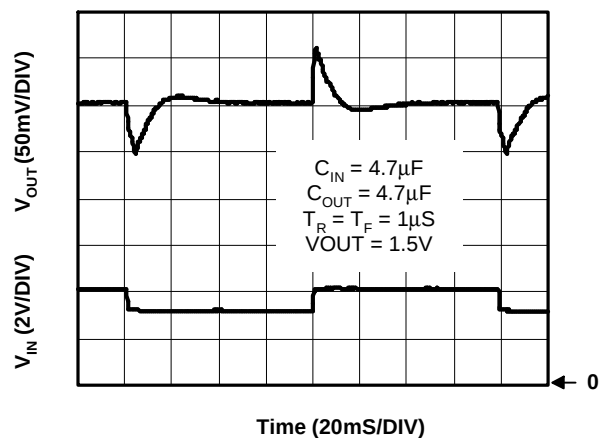
Dropout Voltage vs. Load Current(2.5V)



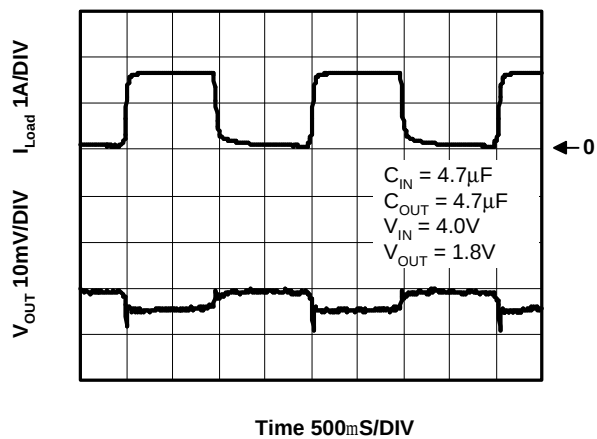
AME8844BEQA VADJ vs. Temperature



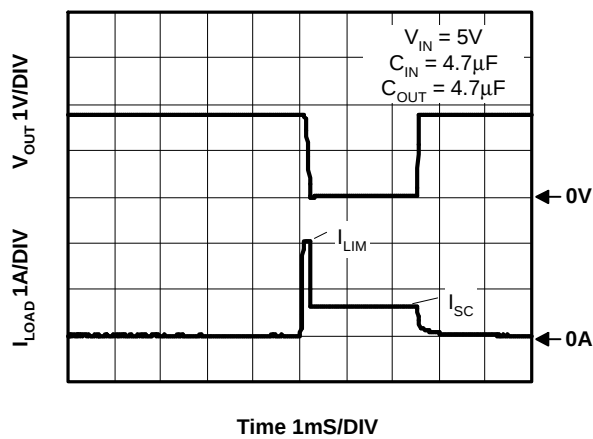
Line Transient Response



Load Step 40mA to 1.5A

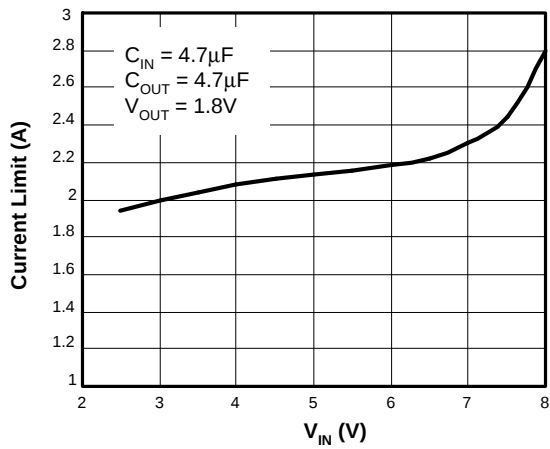


Current Limit Response

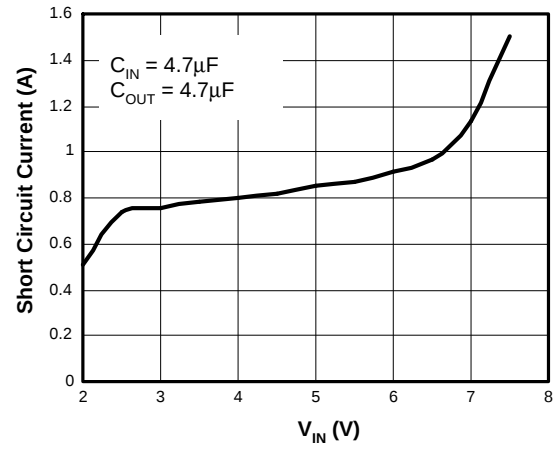




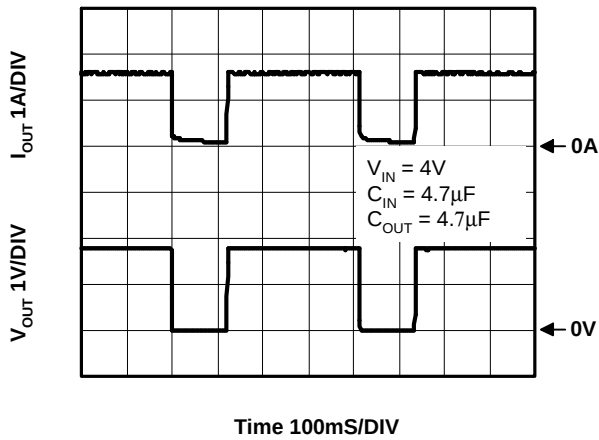
Current Limit vs. V_{IN}



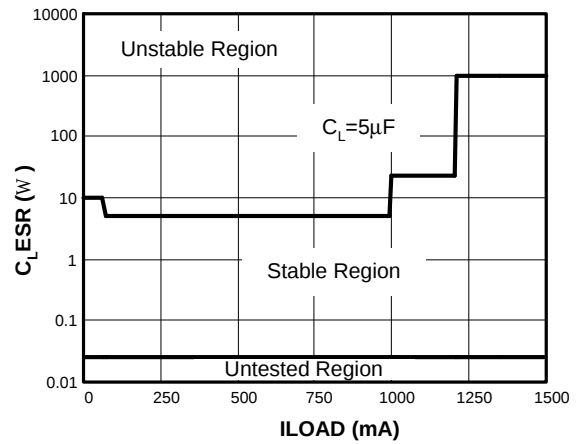
Short Circuit Current vs. V_{IN}



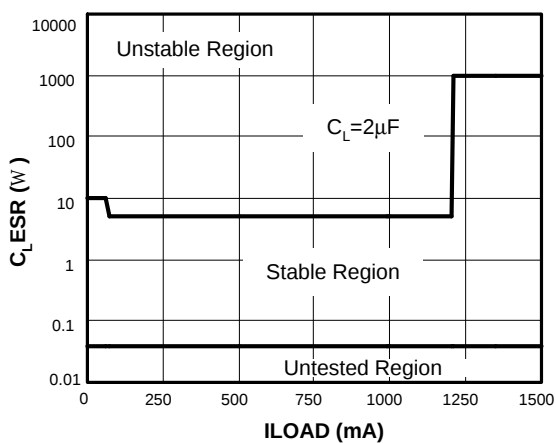
Overtemperature Shutdown



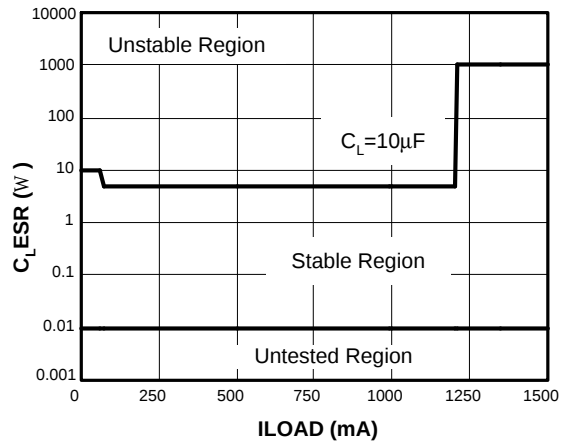
Stability vs. ESR vs. I_{Load}



Stability vs. ESR vs. I_{Load}



Stability vs. ESR vs. I_{Load}



■ External Resistor Divider Table

R1 (K Ohm)	1	2	5	10	20
Vout	$R2(kohm)=(1.24 \cdot R1(kohm))/(Vout-1.24)$				
1.30	20.67	41.33	103.33	206.67	413.33
1.35	11.27	22.55	56.36	112.73	225.45
1.40	7.75	15.50	38.75	77.50	155.00
1.45	5.90	11.81	29.52	59.05	118.10
1.50	4.77	9.54	23.85	47.69	95.38
1.55	4.00	8.00	20.00	40.00	80.00
1.60	3.44	6.89	17.22	34.44	68.89
1.65	3.02	6.05	15.12	30.24	60.49
1.70	2.70	5.39	13.48	26.96	53.91
1.75	2.43	4.86	12.16	24.31	48.63
1.80	2.21	4.43	11.07	22.14	44.29
1.85	2.03	4.07	10.16	20.33	40.66
1.90	1.88	3.76	9.39	18.79	37.58
1.95	1.75	3.49	8.73	17.46	34.93
2.00	1.63	3.26	8.16	16.32	32.63
2.05	1.53	3.06	7.65	15.31	30.62
2.10	1.44	2.88	7.21	14.42	28.84
2.15	1.36	2.73	6.81	13.63	27.25
2.20	1.29	2.58	6.46	12.92	25.83
2.25	1.23	2.46	6.14	12.28	24.55
2.30	1.17	2.34	5.85	11.70	23.40
2.35	1.12	2.23	5.59	11.17	22.34
2.40	1.07	2.14	5.34	10.69	21.38
2.45	1.02	2.05	5.12	10.25	20.50
2.50	0.98	1.97	4.92	9.84	19.68
2.55	0.95	1.89	4.73	9.47	18.93
2.60	0.91	1.82	4.56	9.12	18.24
2.65	0.88	1.76	4.40	8.79	17.59
2.70	0.85	1.70	4.25	8.49	16.99
2.75	0.82	1.64	4.11	8.21	16.42
2.80	0.79	1.59	3.97	7.95	15.90
2.85	0.77	1.54	3.85	7.70	15.40
2.90	0.75	1.49	3.73	7.47	14.94
2.95	0.73	1.45	3.63	7.25	14.50
3.00	0.70	1.41	3.52	7.05	14.09
3.05	0.69	1.37	3.43	6.85	13.70
3.10	0.67	1.33	3.33	6.67	13.33



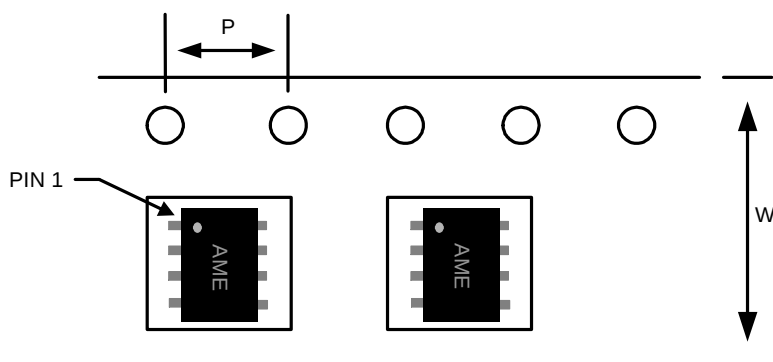
■ External Resistor Divider Table (contd.)

R1 (K Ohm)	1	2	5	10	20
Vout	$R2(kohm)=(1.242*R1(kohm))/(Vout-1.242)$				
3.15	0.65	1.30	3.25	6.49	12.98
3.20	0.63	1.27	3.16	6.33	12.65
3.25	0.62	1.23	3.08	6.17	12.34
3.30	0.60	1.20	3.01	6.02	12.04
3.35	0.59	1.18	2.94	5.88	11.75
3.40	0.57	1.15	2.87	5.74	11.48
3.45	0.56	1.12	2.81	5.61	11.22
3.50	0.55	1.10	2.74	5.49	10.97
3.55	0.54	1.07	2.68	5.37	10.74
3.60	0.53	1.05	2.63	5.25	10.51
3.65	0.51	1.03	2.57	5.15	10.29
3.70	0.50	1.01	2.52	5.04	10.08
3.75	0.49	0.99	2.47	4.94	9.88
3.80	0.48	0.97	2.42	4.84	9.69
3.85	0.48	0.95	2.38	4.75	9.50
3.90	0.47	0.93	2.33	4.66	9.32
3.95	0.46	0.92	2.29	4.58	9.15
4.00	0.45	0.90	2.25	4.49	8.99
4.05	0.44	0.88	2.21	4.41	8.83
4.10	0.43	0.87	2.17	4.34	8.67
4.15	0.43	0.85	2.13	4.26	8.52
4.20	0.42	0.84	2.09	4.19	8.38
4.25	0.41	0.82	2.06	4.12	8.24
4.30	0.41	0.81	2.03	4.05	8.10
4.35	0.40	0.80	1.99	3.99	7.97
4.40	0.39	0.78	1.96	3.92	7.85
4.45	0.39	0.77	1.93	3.86	7.73
4.50	0.38	0.76	1.90	3.80	7.61
4.55	0.37	0.75	1.87	3.75	7.49
4.60	0.37	0.74	1.85	3.69	7.38
4.65	0.36	0.73	1.82	3.64	7.27
4.70	0.36	0.72	1.79	3.58	7.17
4.75	0.35	0.71	1.77	3.53	7.07
4.80	0.35	0.70	1.74	3.48	6.97
4.85	0.34	0.69	1.72	3.43	6.87
4.90	0.34	0.68	1.69	3.39	6.78
4.95	0.33	0.67	1.67	3.34	6.68
5.00	0.33	0.66	1.65	3.30	6.60

Note: Small load(greater than 2 mA) is necessary as R1 or R2 is larger than 50 K Ohm. Otherwise, output voltage probably cannot be pulled down to 0 V on disable mode.

■ Tape and Reel Dimension

MSOP-8



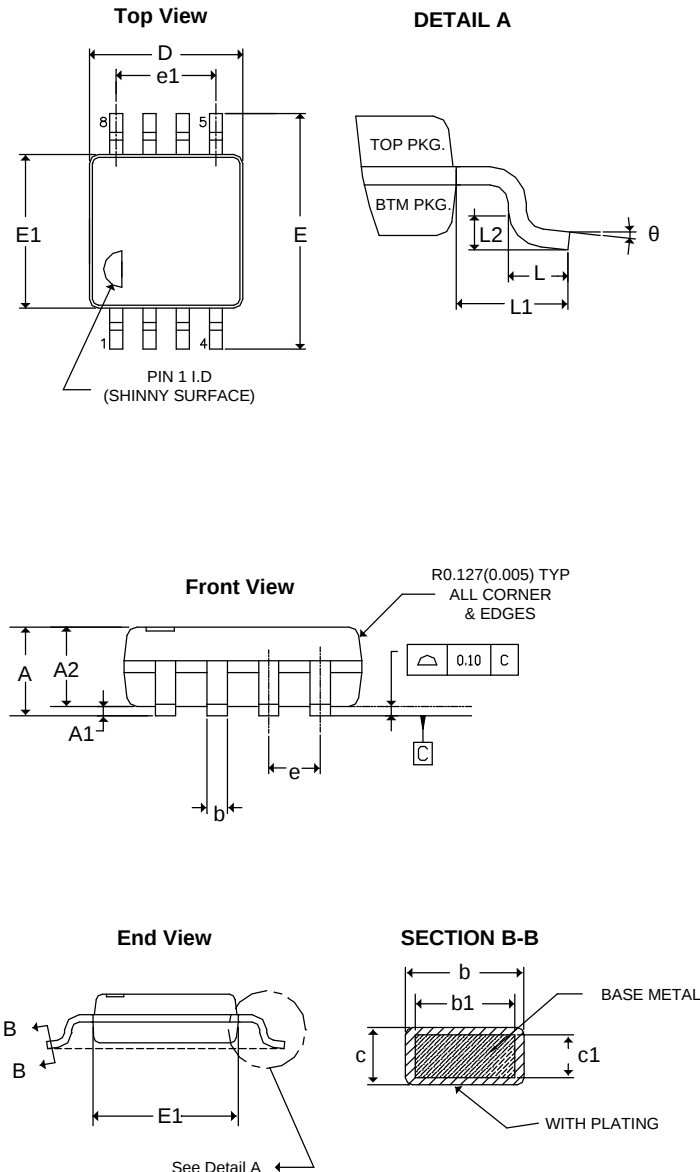
Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
MSOP-8	12.0±0.1 mm	4.0±0.1 mm	4000pcs	330±1 mm



■ Package Dimension

MSOP-8



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	-	1.07	-	0.04197
A ₁	0.05	0.20	0.002	0.008
A ₂	0.81	0.92	0.032	0.036
b	0.28	0.38	0.011	0.015
b ₁	0.28	0.33	0.011	0.013
c	0.13	0.23	0.005	0.009
c ₁	0.13	0.17	0.005	0.006
D	2.90	3.10	0.114	0.122
E	4.77	4.98	0.188	0.196
E ₁	2.90	3.10	0.114	0.122
e	0.65 TYP		0.0255 TYP	
e ₁	1.95 TYP		0.0767 TYP	
L	0.406	0.686	0.01598	0.02701
L ₁	0.94 REF		0.037 REF	
L ₂	0.254 TYP		0.010 TYP	
q	0°	8°	0°	8°

NOTE:

1. Controlling dimension : Millimeter, converted inch dimension are not necessarily exact.
2. Dimensioning and tolerancing per ANSI Y14.5M-1994.
3. Dimension "d" does not include mold flash, protrusion or gate burr, mold flash, protrusion and gate burr shall not exceed 0.15mm(0.006") per side. Dimension e₁ do not include inter-lead flash or protrusion, inter-lead flash and protrusion shall not exceed 0.15mm(0.006") per side.
4. The package top be smaller than the package bottom. Dimension d and e₁ are determined at outermost extremes of the plastic body exclusive of mold flash, tie bar burrs, gate burrs and interlead flash, but including any mismatch between the top and bottom of the plastic body.
5. Dimension 'b' does not include dambar protrusion. Allowable dambar protrusion shall be 0.08mm(0.0031) total in excess of the "b" dimension at maximum material condition.



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Life Support Policy:

These products of AME, Inc. are not authorized for use as critical components in life-support devices or systems, without the express written approval of the president of AME, Inc.

AME, Inc. reserves the right to make changes in the circuitry and specifications of its devices and advises its customers to obtain the latest version of relevant information.

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