

AME8846

■ General Description

The AME8846A/B family of positive CMOS linear regulators provides ultra low-dropout voltage (210mV @3A) and low quiescent current (typically 600uA), thus making them ideal for power-saving system. These rugged devices have both Thermal Shutdown and Current limit to prevent device failure under the "Worst" of operating conditions. The AME8846A/B also provides SS time in order to reduce inrush current in different applications.

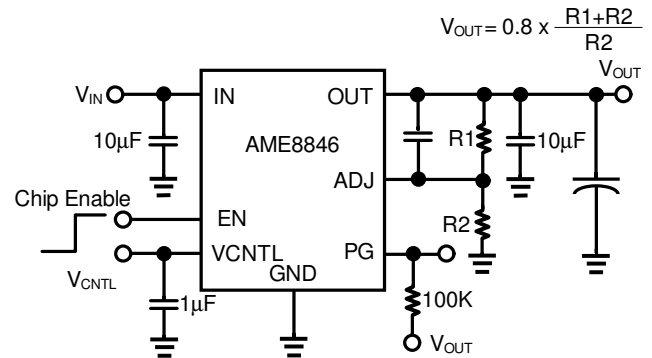
■ Features

- Low Dropout Voltage: 210mV @3A, 25°C
- Adjustable Output Voltage (0.8V to 3.3V)
- High Output Accuracy $\pm 1.5\%$
- Support Low ESR Multi-layer ceramic capacitors (MLCC) Application
- Power Good Output
- Fast Transient Response
- Soft-Start Function
- Over-Temperature Shutdown with Hysteresis
- Current Limiting and Short Current Limit Protection
- Green Products Meet RoHS Standards

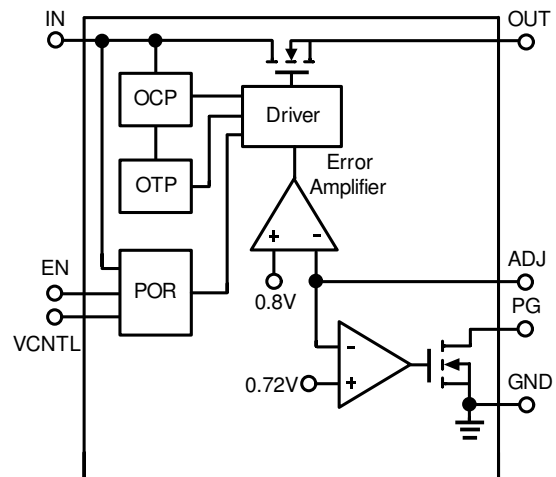
■ Applications

- Motherboard Application
- Notebook Application
- Front Side Bus VTT(1.2V/3A)

■ Typical Application

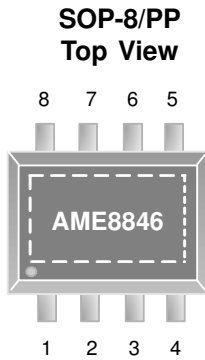


■ Functional Block Diagram



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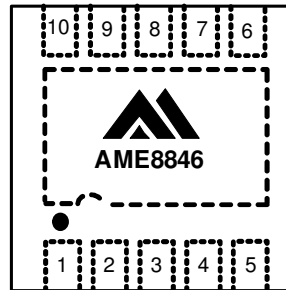
■ Pin Configuration



AME8846x-xxxADJ

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

**DFN-10B
(3mmx3mmx0.75mm)
Top View**



AME8846x-xxxADJ

1. OUT
2. OUT
3. OUT
4. ADJ
5. PG
6. EN
7. IN
8. IN
9. IN
10. VCNTL

Note: Connect exposed pad (heat sink on the back) to GND.

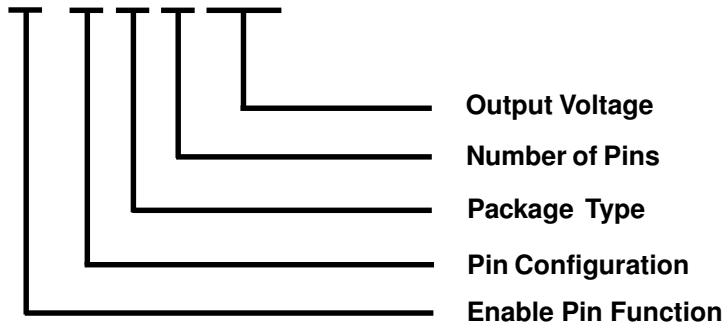
■ Pin Configuration

Pin Number		Pin Name	Pin Description
SOP-8/PP	DFN-10B		
1	5	PG	Power Good Open Drain Output.
2	6	EN	Enable Input (Active-High).
3	7, 8, 9	IN	Input Voltage.
4	10	VCNTL	Control Input Voltage.
5	N/A	NC	No Internal Connection.
6	1, 2, 3	OUT	Output Voltage.
7	4	ADJ	Set the output voltage by the external feedback resistors. $V_{OUT} = 0.8V \times \frac{(R1 + R2)}{R2}$
8	11	GND	Ground.

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■ Ordering Information

AME8846x - x x x xxx



Enable Pin Function	Pin Configuration	Package Type	Number of Pins	Output Voltage
A: Internal Pull High B: Internal Pull Low	<p>A (SOP-8PP)</p> <ol style="list-style-type: none"> 1. PG 2. EN 3. IN 4. VCNTL 5. NC 6. OUT 7. ADJ 8. GND <p>A (DFN-10B)</p> <ol style="list-style-type: none"> 1. OUT 2. OUT 3. OUT 4. ADJ 5. PG 6. EN 7. IN 8. IN 9. IN 10. VCNTL 	V: DFN Z: SOP/PP	A: 8 B: 10	ADJ: Adjustable

■ Absolute Maximum Ratings

Parameter	Maximum	Unit
Control Input Voltage, V_{CNTL}	3 to 6	V
Power Input Voltage, V_{IN}	1 to 6	
Output Voltage, V_{OUT}	GND-0.3 to $V_{\text{IN}}+0.3$	
Other Pins	-0.3 to $V_{\text{CNTL}} +0.3$	
Electrostatic Discharge (HBM)	1500	V
Electrostatic Discharge (MM)	200	V
Electrostatic Discharge (CDM)	1000	
Junction Temperature	150	°C
Storage Temperature Range	-65 to +150	

■ Recommended Operating Conditions

Parameter	Symbol	Rating	Unit
Power Input Voltage	V_{IN}	1 to 5.5	V
Control Input Voltage	V_{CNTL}	3V to 5.5	V
Ambient Temperature Range	T_{A}	- 40 to +85	°C
Junction Temperature Range	T_{J}	- 40 to +125	°C

■ Thermal Information

Parameter	Package	Die Attach	Symbol	Maximum	Unit
Thermal Resistance (Junction to Case)	SOP-8/PP	Conductive Epoxy	θ_{JC}	19	°C / W
	DFN-10B			8.5	
Thermal Resistance (Junction to Ambient)	SOP-8/PP		θ_{JA}	84	
	DFN-10B			65	
Power Dissipation	SOP-8/PP		P_D	1450	mW
	DFN-10B			1540	
Lead Temperature (Soldering 10 Sec)**				260	°C

* Measure θ_{JC} on backside center of Exposed Pad.

** MIL-STD-202G210F

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■ Electrical Specifications

$V_{IN} = V_{OUT(NOM)} + 0.5V$, $V_{CNTL} = V_{EN} = 5V$, $I_{OUT} = 1mA$, and $C_{OUT} = 10\mu F$, $C_{IN} = 10\mu F$, unless otherwise noted.
 Typical values are at $T_A = 25^\circ C$.

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Supply Input Voltage						
Power Input Voltage Range	V_{IN}		1		5.5	V
Control Input Voltage Range	V_{CNTL}		3		5.5	
POR Threshold				2.7		
POR Hysteresis				0.2		
Quiescent Current		$V_{CNTL} = 5.5V$		0.6	1.2	mA
Feedback Voltage						
Reference Voltage	V_{ADJ}		0.788	0.8	0.812	V
Dual Power Output Voltage Range		$V_{CNTL} = 5V$, $V_{IN} = 3.3V$	0.8		$V_{IN} - V_{DROP}$	
Power Input Line Regulation	ΔV_{LINE_IN}	$1.2V < V_{IN} < 4.5V$ $V_{CNTL} = V_{EN} = 5V$ $I_{OUT} = 0A$, $V_{OUT} = V_{ADJ}$		0.01	0.1	%/V
Load Regulation	ΔV_{LOAD}	$I_{OUT} = 0A \sim 3A$		0.8	1.5	%A
Dropout Voltage	V_{DROP}	$I_{OUT} = 2A$, $V_{CNTL} = V_{EN} = 5.0V$ $V_{OUT} = V_{ADJ}$		200	250	mV
		$I_{OUT} = 3A$, $V_{CNTL} = V_{EN} = 5.0V$ $V_{OUT} = V_{ADJ}$		210	350	
V_{OUT} Discharge $R_{DS(ON)}$		EN=Low		150		Ω
Enable						
EN Pin Voltage High	V_{ENH}		1.4			V
EN Pin Voltage Low	V_{ENL}				0.8	
EN Input Current	I_{EN}	$V_{CNTL} = V_{EN} = 5V$		10	12	μA
Control Input Current in Shutdown	AME8846A	I_{SHDN}	$V_{EN} = 0V$	5	10	
	AME8846B	I_{SHDN}	$V_{EN} = 0V$	0.1	1	
Soft Start Time				1.4	3	ms

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■ Electrical Specifications (Contd.)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Power Good and Delay						
PG Threshold Voltage for Power Good		V_{FB} Rising		90		%
PG Threshold Voltage for Power Not Good		V_{FB} Falling		80		
PG Low Voltage		PG sinks 5mA		0.35	0.7	V
PG Delay Time			1.5	3	5	mS
Protection Function						
Current Limit	I_{LIM}		3.1	4.5	7	A
Short Circuit Current		$V_{OUT} < 0.3V$	0.5	1.5	3	
Thermal Shutdown Temperature	T_{SD}			160		°C
Thermal Shutdown Hysteresis	ΔT_{SD}			30		

Note 1. Quiescent Current is defined by $I_Q = I_{IN} - I_{OUT}$ ($I_{OUT} = 0mA$)

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■ Detailed Description

The AME8846A/B family of positive CMOS linear regulators provides ultra low-dropout voltage, high output current with low ground current, very low input voltage and very low dropout voltage at up to 3A. It operates with a VIN as low as 1V and VCNTL voltage 3V with output voltage programmable as low as 0.8V.

Enable

The AME8846A/B has a dedicated enable pin, when this pin is in the logic low condition, the MOS pass transistor shuts off, and all internal circuits are powered down.

For AME8846A, the EN pin is pulled up by an internal resistor to enable normal operation. So the regulator will be turn on when EN pin is floating. It is not necessary to use an external pull up resistor to save cost.

For AME8846B, the EN pin is pulled low by an internal resistor to enable normal operation. So the regulator will be turn off when EN pin is floating. It is not necessary to use an external pull low resistor to save cost.

Soft-Start

The AME8846A/B features a soft start function that limits inrush current. The soft start time is typically 1.4ms.

Current-Limit

The AME8846A/B contains an independent current limit and short circuit current protection to prevent damage during fault conditions. The current limit monitors and controls the pass transistor's gate voltage, limiting the output current to higher than 4.5A typical.

Short Circuit Current-Limit

The short circuit current-limit function reduces the current-limit level down to 1.5A (typical) when short circuit conditions.

Thermal Shutdown

A thermal shutdown circuit limits the junction temperature of AME8846A/B. When the junction temperature exceeds 160°C, the over-temperature protection circuit turns off the pass transistor allowing the device to cool down, The pass transistor turns on again after the junction temperature cools by 30°C.

Power Good and Delay

The power good function is an open-drain output. Connects a 100kΩ pull up resistor to VOUT to obtain an output voltage. The PG pin will go high 3mS (typ) after the output voltage arrives at 90% of normal output voltage.

AME8846**■ Application Information****Input Capacitor**

The input capacitance is at least 10 μ F located as close as possible to the IC is recommended.

Output Capacitor

The AME8846A/B is stable with an output capacitor to ground of 10 μ F or greater.

The output capacitor selection is dependent on ESR (equivalent series resistance) and capacitance of the output capacitor over the desired operating temperature. The Ultra-low-ESR capacitors (such as ceramic chip capacitors) and low-ESR bulk capacitors (such as solid tantalum, POSCap, and Aluminum electrolytic capacitors) can all be used as output capacitors. For applications with large load current transitions, low-ESR bulk capacitors are normally recommended. Decoupling ceramic capacitors must be placed as close as possible to the load and ground pins. The impedance of the layout must be minimized.

Setting Output Voltage

The output voltage is programmed by the resistor divider connected to the FB pin. The output voltage is given by the following equation:

$$V_{OUT} = 0.8V \times \frac{(R1 + R2)}{R2}$$

The feedback resistor of resistance value support > 100K ohm and no require forward capacitor.

Power Dissipation

The power dissipation is defined as

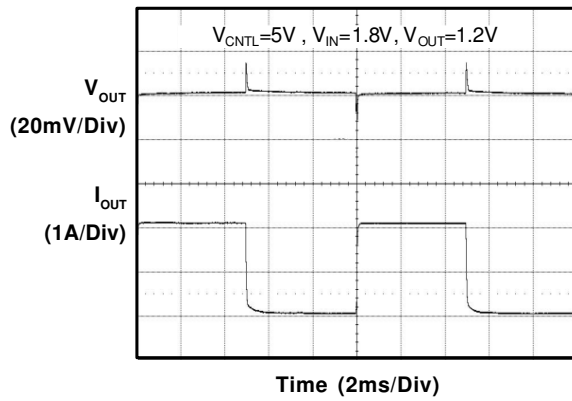
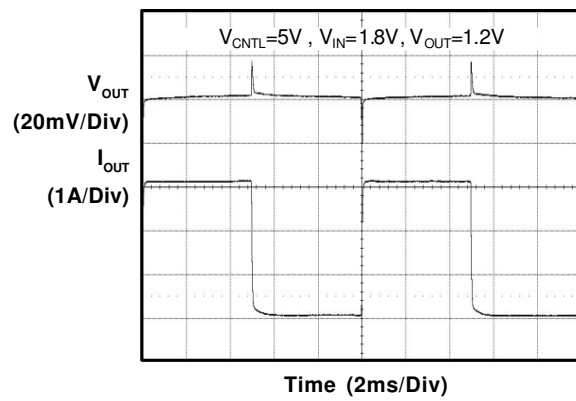
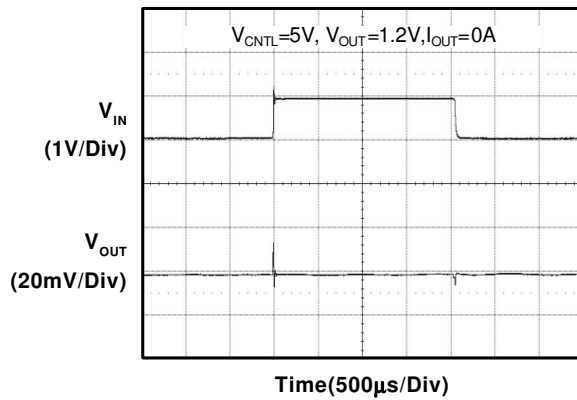
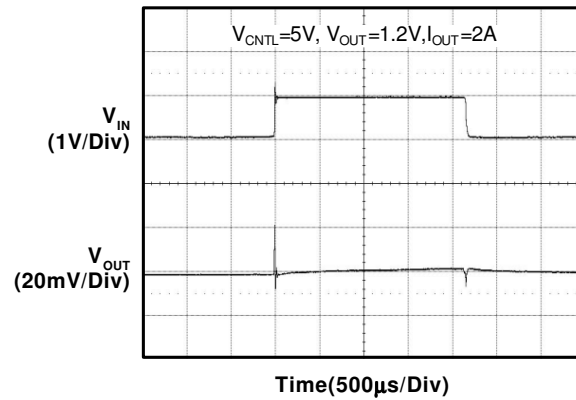
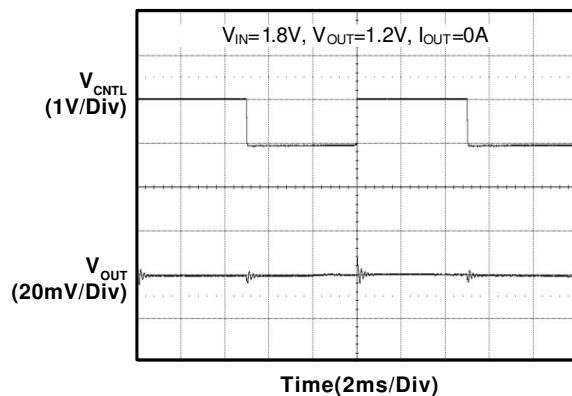
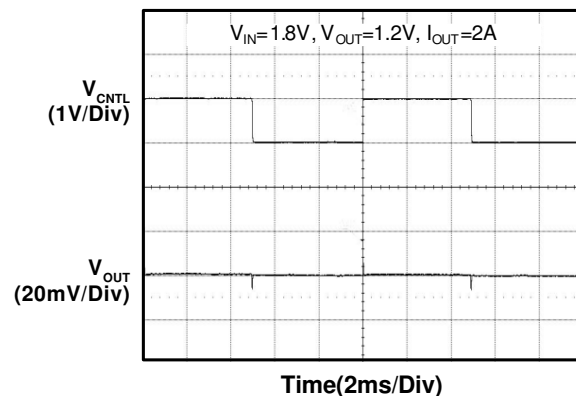
$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_Q$$

The maximum power dissipation depends on the thermal resistance of IC package, PCB material & PCB design (The copper area of pad), the rate of surrounding airflow and temperature difference between junction and ambient.

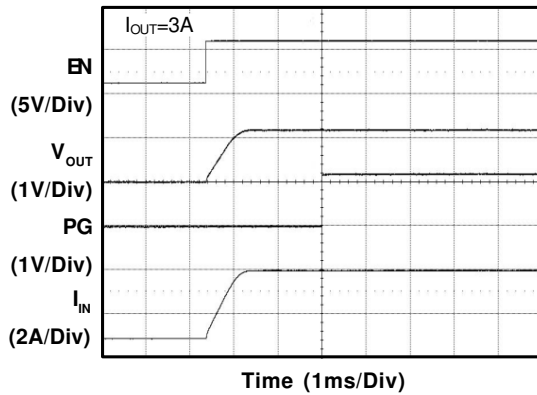
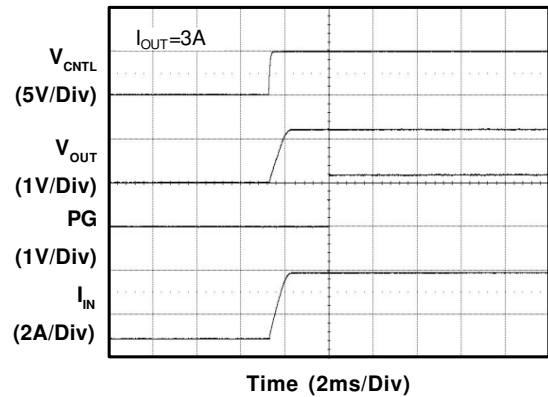
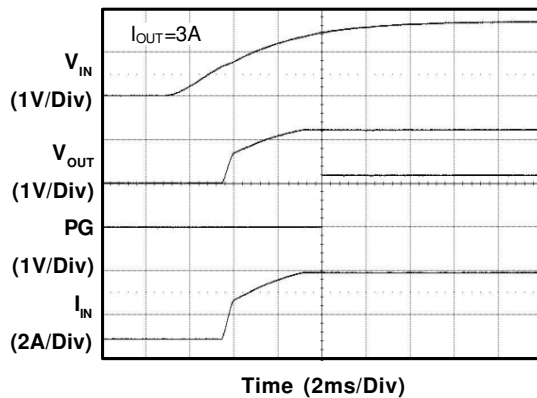
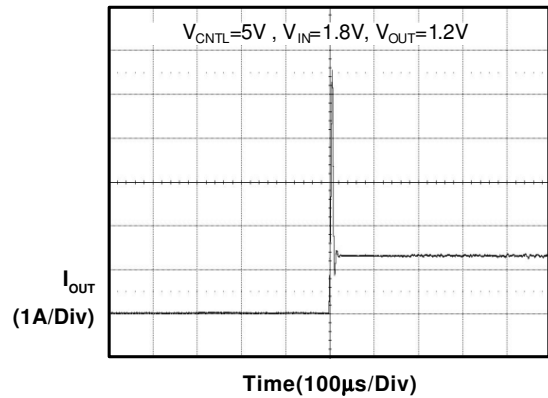
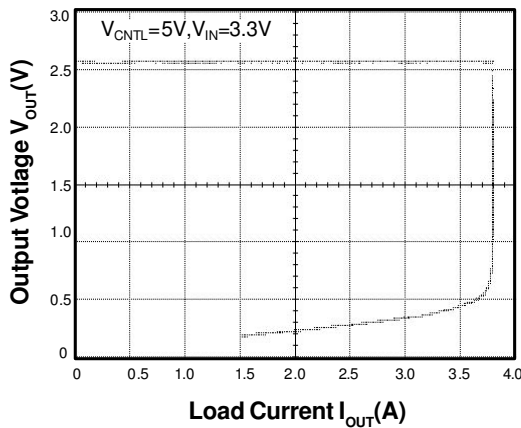
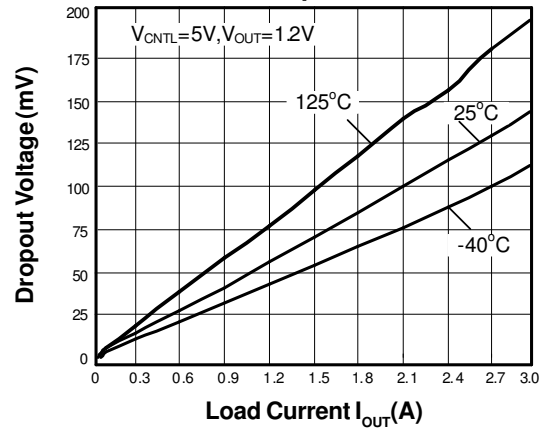
The maximum power dissipation can be calculated by the following formula:

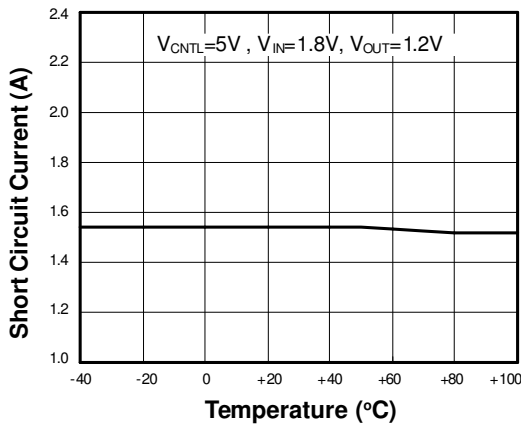
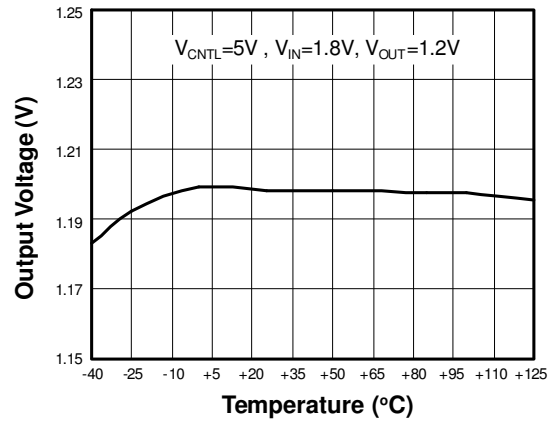
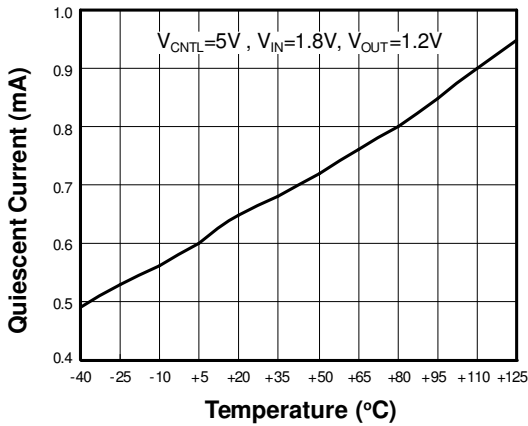
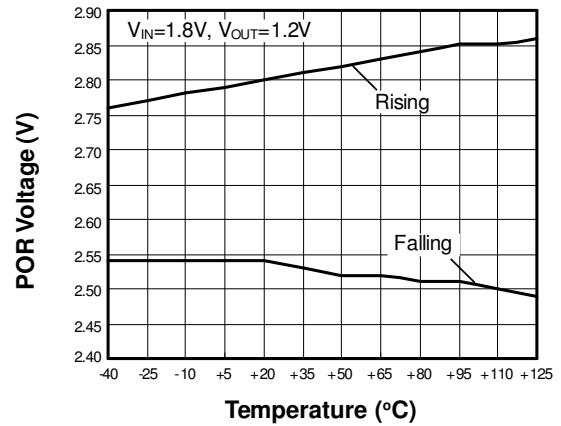
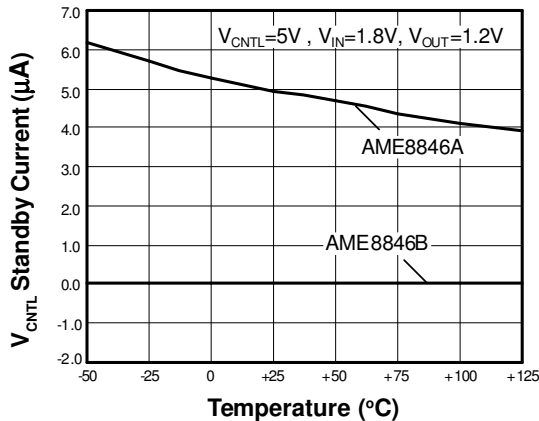
$$P_{D(MAX)} = \frac{(T_J - T_A)}{\theta_{JA}}$$

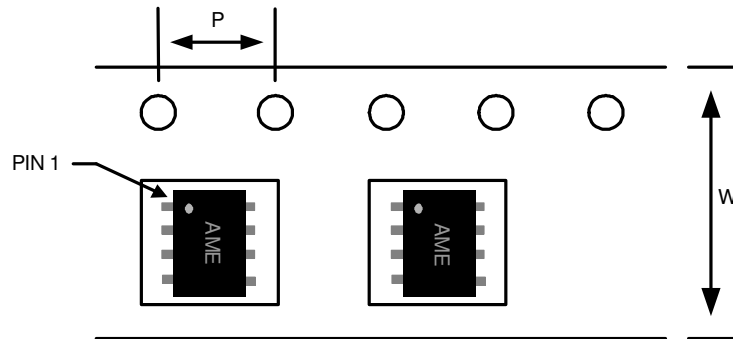
Note: Operation junction temperature not exceed 125°C

■ Characterization Curve
Load Transient Response

Load Transient Response

 V_{IN} Line Transient Response

 V_{IN} Line Transient Response

 V_{CNTL} Line Transient Response

 V_{CNTL} Line Transient Response


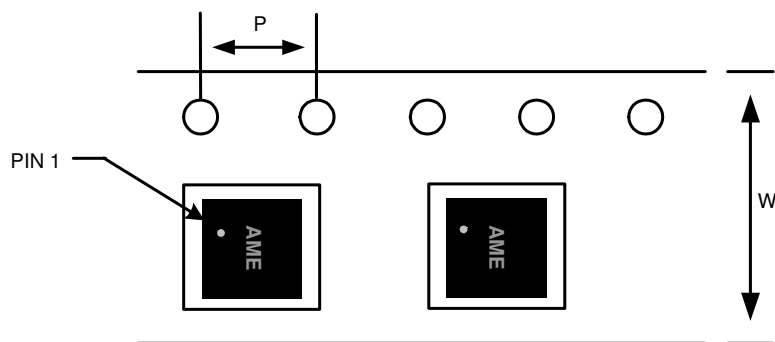
■ Characterization Curve (Contd.)

Start Up form Enable

Start Up form V_{CNTL}

Start Up form V_{IN}

Short Circuit Protection

Over Current Protection

Dropout Voltage vs Load Current & Temperature


■ Characterization Curve (Contd.)
Short Circuit Current vs. Temperature

Output Voltage vs. Temperature

Quiescent Current vs. Temperature

V_{CNTL} POR Threshold Voltage vs. Temperature

V_{CNTL} Standby Current vs. Temperature


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■ Tape and Reel Dimension
SOP-8/PP

Carrier Tape, Number of Components Per Reel and Reel Size

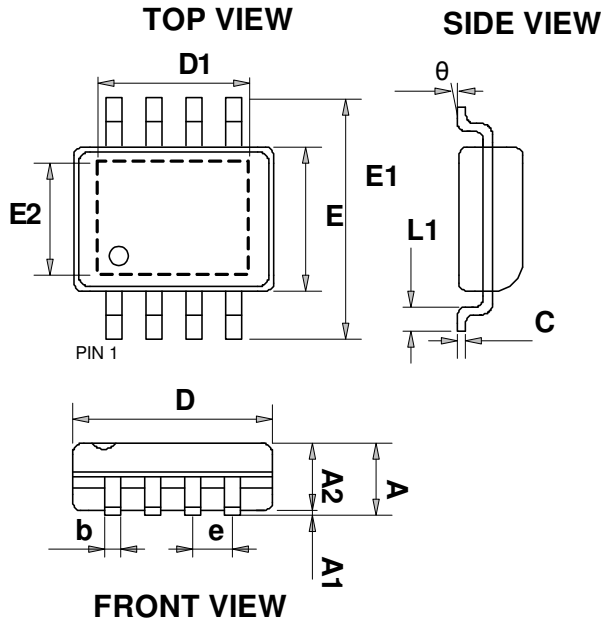
Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
SOP-8/PP	12.0±0.1 mm	4.0±0.1 mm	2500pcs	330±1 mm

**DFN-10B
(3mmx3mmx0.75mm)**

Carrier Tape, Number of Components Per Reel and Reel Size

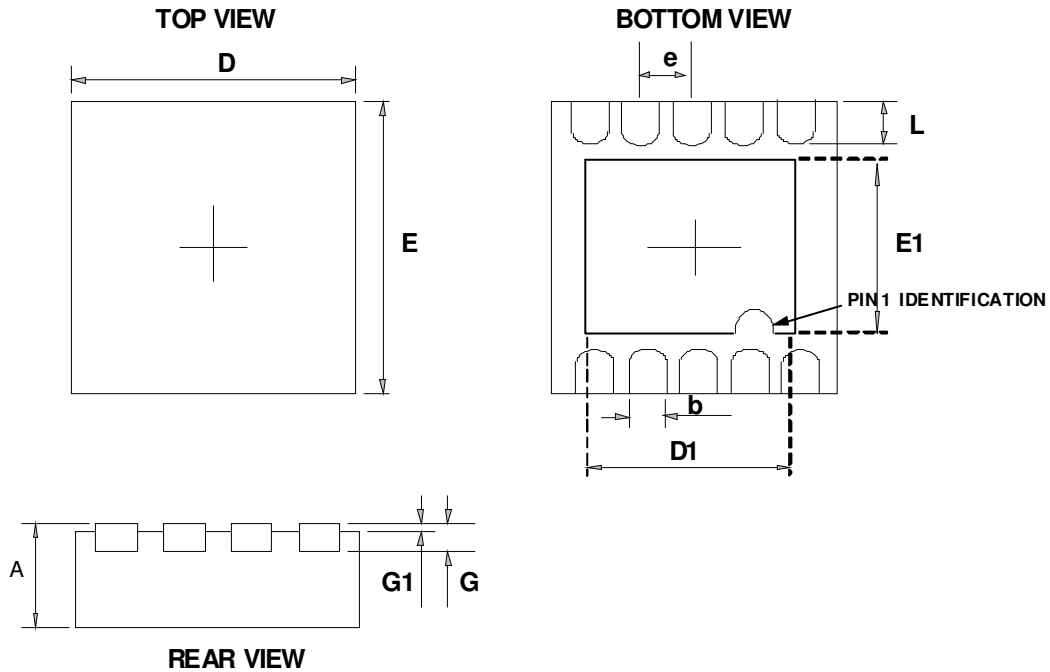
Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
DFN-10B (3x3x0.75mm)	12.0±0.1 mm	4.0±0.1 mm	3000pcs	330±1 mm

■ Package Dimension

SOP-8/PP



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.000	0.250	0.000	0.010
A2	1.250	1.650	0.049	0.065
C	0.100	0.250	0.004	0.010
E	3.750	4.150	0.148	0.163
E1	5.700	6.300	0.224	0.248
L1	0.300	1.270	0.012	0.050
b	0.310	0.510	0.012	0.020
D	4.720	5.120	0.186	0.202
e	1.270 BSC		0.050 BSC	
θ	0°	8°	0°	8°
E2	2.050	2.513	0.081	0.099
D1	2.150	3.402	0.085	0.134

AME8846
■ Package Dimension
**DFN-10B
(3mmx3mmx0.75mm)**


SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
e	0.450	0.550	0.018	0.022
D1	2.300	2.500	0.091	0.098
E1	1.600	1.800	0.063	0.071
b	0.180	0.300	0.007	0.012
L	0.300	0.500	0.012	0.020
G	0.153	0.253	0.006	0.010
G1	0.000	0.050	0.000	0.002



www.ame.com.tw
E-Mail: sales@ame.com.tw

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Corporate Headquarter

AME, Inc.

8F-1, 12, WenHu St., Nei-Hu

Taipei 114, Taiwan .

Tel: 886 2 2627-8687

Fax: 886 2 2659-2989