AME

AME5125

High Efficiency 500KHz Step-Up Converter

■ General Description

The AME5125 is a high-performance current mode synchronous boost converter with integrated Power MOSFETs which on-resistance of internal main switch is only 50mΩ and rectifier switch resistance is 50mΩ to maintain high efficiency in heavy load conditions that supports switch peak current of up to 5.5A. The integrated circuit supports an input voltage range of 2.7V to 5.5V.

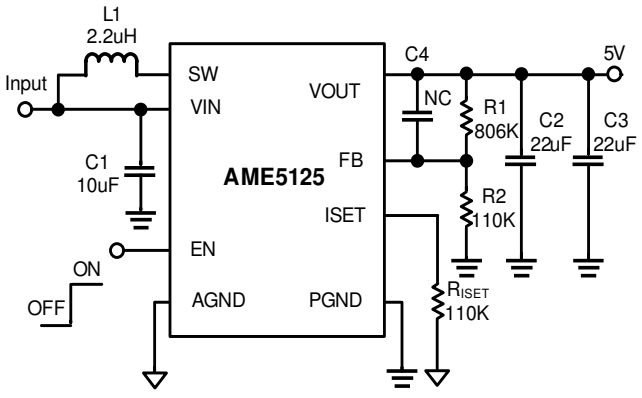
The converter can be disabled to minimize battery drain. During shutdown, the load (V_{OUT}) is completely disconnected from the battery (V_{IN}). Additional functions include an internal soft-start function in order to easy inrush current control. The circuit protection includes Over Voltage Protection and Thermal Shutdown to prevent device failure under the "Worst" of operating conditions.

This device is available in SOP-8/PP with exposed pad for low thermal resistance.

■ Applications

- Battery Bank
- Portable Devices

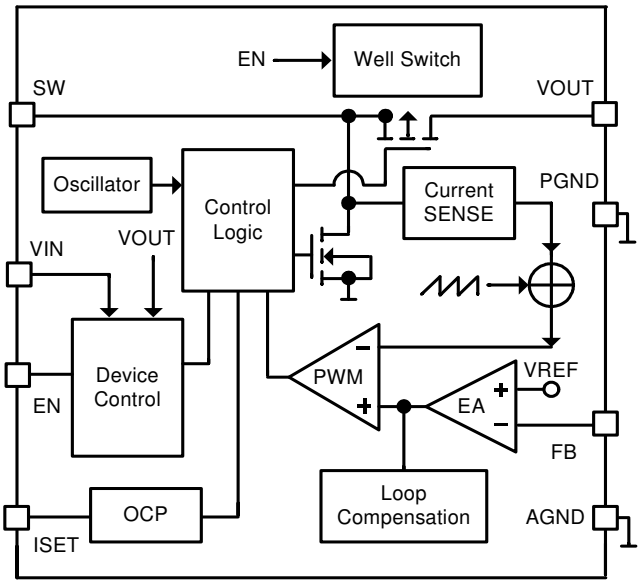
■ Typical Application



■ Features

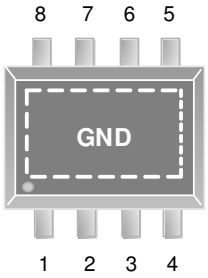
- High Efficiency Synchronous Boost Converter
- Internal Low $R_{DS(ON)}$ Power MOSFETs
  H: 50mΩ(PMOS) / L: 50mΩ(NMOS) Typical
- Operating (Input) Range: 2.7V ~ 5.5V
- Up to 5.5V Output Voltage
- 500KHz Switching Frequency
- Provide High Efficiency at Light Loading
- Load Disconnect During Shutdown
- Adjust Peak Switch Current
- Short Circuit into Hiccup Mode
- Internal Soft Start
- Integrated Over-Voltage Protection
- Thermal Shutdown
- All AME's Lead Free Products Meet RoHS Standards

■ Function Diagram



■ Pin Configuration

SOP-8/PP
Top View



AME5125

1. EN
2. PGND
3. VIN
4. SW
5. VOUT
6. AGND
7. FB
8. ISET

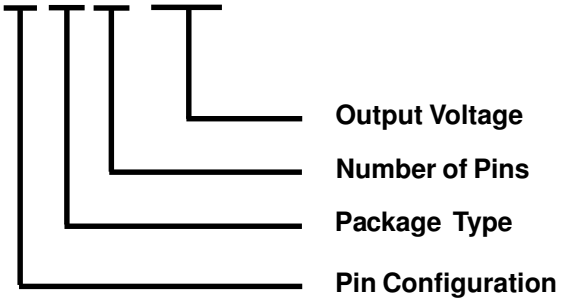
*** Die Attach:**
Conductive Epoxy

■ Pin Description

Pin Number	Pin Name	Pin Description
1	EN	Enable Input. When EN is floating, the device will be turn off.
2	PGND	Power Ground.
3	VIN	Input Voltage
4	SW	Switching Node.
5	VOUT	Output Voltage.
6	AGND	Analog Ground.
7	FB	Feedback Input.
8	ISET	Switch Current Limit Adjustable Pin, Connect a Resistor to GND.
9	Exposed Pad	Power Ground.

■ Ordering Information

AME5125 - x x x xxx



Pin Configuration	Package Type	Number of Pins	Output Voltage
A (SOP-8/PP) 1. EN 2. PGND 3. VIN 4. SW 5. VOUT 6. AGND 7. FB 8. ISET	Z: SOP/PP	A: 8	ADJ: Adjustable

■ Absolute Maximum Ratings

Parameter	Maximum	Unit
Input Voltage	-0.3 to +7	V
Switch Voltage	0.3 to +7	V
All Other Pins	-0.3 to +7	V
Electrostatic Discharge (HBM)	2000	V
Electrostatic Discharge (MM)	200	V
Electrostatic Discharge (CDM)	1000	V
Junction Temperature	150	°C
Storage Temperature Range	-65 to +150	°C

■ Recommended Operating Conditions

Parameter	Symbol	Rating	Unit
Input Voltage	V_{IN}	2.7~5.5	V
Output Voltage	V_{OUT}	3.3 to 5.5	V
Junction Temperature Range	T_J	-40 to +125	°C
Ambient Temperature Range	T_A	-40 to +85	°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
Thermal Resistance (Junction to Ambient)			θ_{JA}	84	
Internal Power Dissipation			P_D	1450	mW
Solder Iron (10 Sec)**				350	°C

■ Electrical Specifications

Typical values V_{IN}=3.7V, V_{OUT}=5V with typical T_A=25°C, unless otherwise specified.

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Input Voltage Operating Range	V_{IN}		2.7		5.5	V
Output Voltage Operating Range	V_{OUT}		3.3		5.5	V
Feedback Voltage	V_{FB}		0.588	0.6	0.612	V
Switching Frequency	F_{SW}		400	500		KHz
Max. Duty Cycle	D_{MAX}			90		%
Quiescent Current	V_{OUT} I_Q	No switching		60		μA
Shutdown Current	I_{SD}	V_{EN}=0V		0.1	1	uA
Rectifying Switch on Resistance	$R_{DS(ON)_P}$			50		mΩ
Main Switch on Resistance	$R_{DS(ON)_N}$			50		mΩ
UVLO Rising Threshold Voltage	V_{UVLOR}	V_{IN} Voltage		2.6		V
UVLO Falling Threshold Voltage	V_{UVLOF}	V_{IN} Voltage		2.4		V
Switch Current Limit	R_{ISET}	R_L=110 KΩ, V_{OUT}>V_{IN}	4.0	5.5		A
EN Logic-High Voltage	V_{IH}		1.4			V
EN Logic-Low Voltage	V_{IL}				0.6	V
EN Input Current	I_{EN}			0.1		uA
Output OVP	V_{OVP}	V_{FB}=0.6V		1.16xV_{FB}		V
		V_{OUT}=5V		6		V
Thermal Shutdown	T_{SD}			150		°C
Thermal Shutdown Hysteresis	T_{SDHYS}			20		°C

■ Application Information

Over Voltage Protection

The AME5125 has output over-voltage protections. The thresholds output OVP circuit minimum 116% x V_{OUT}, respectively. Once the output voltage is higher than the threshold, the NMOS driver is turned off. When the output voltage drops lower than the threshold, the NMOS driver will be enabled again.

Inductor Selection

The inductor is required to supply current to the load while being driven by the switched input voltage. It will result in less ripple current that will in turn result in lower output ripple voltage. In addition minimum inductance value is proportional to the operating frequency. Make sure that the peak inductor current is below the maximum switch current limit. Determine inductance is to allow the peak-to-peak ripple current to be approximately 30% of the maximum load current. The inductance value can be calculated by:

$$L=(V_{IN}/V_{OUT})^2 (V_{OUT}-V_{IN}) / F_{SW} \times I_{OUT} \times 40\%$$

F_{SW} is the switching frequency I_{OUT} is the max output current.

Over Current Protection

The AME5125 cycle-by-cycle limits the peak inductor current to protect NMOS driver. The NMOS driver will turn off when switching current reaches OCP level that can be set by external RISET.

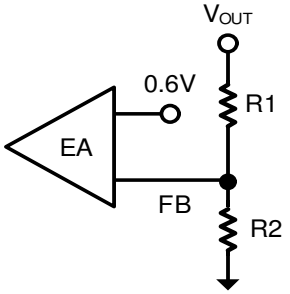
Thermal Shutdown

The AME5125 protects itself from overheating with an internal thermal shutdown circuit. If the junction temperature exceeds the thermal shutdown trigger point, the NMOS driver is turned off. The part is restarted when the junction temperature drops 20°C below the thermal shutdown trigger point.

Setting the Output Voltage

The output voltage is using a resistive voltage divider connected from the output voltage to FB. It divides the output voltage down to the feedback voltage by the ratio:

$$V_{OUT}=0.6x(1+R1/R2)$$



Input Capacitor C_{IN}

The input current to the boost converter is discontinuous, therefore a capacitor is required to supply the AC current while maintaining the DC input voltage. Use low ESR capacitors for the best performance. Ceramic capacitors are preferred.

The ripple current through input capacitor is calculated was list below:

$$I_{CIN_RMS}=V_{IN}x(V_{OUT}-V_{IN})/3.46xLxF_{SW}xV_{OUT}$$

The input capacitor is selected to handle the input ripple noise requirements. Suggesting to use X5R or X7R grade ceramic capacitor.

Output capacitor C_{OUT}

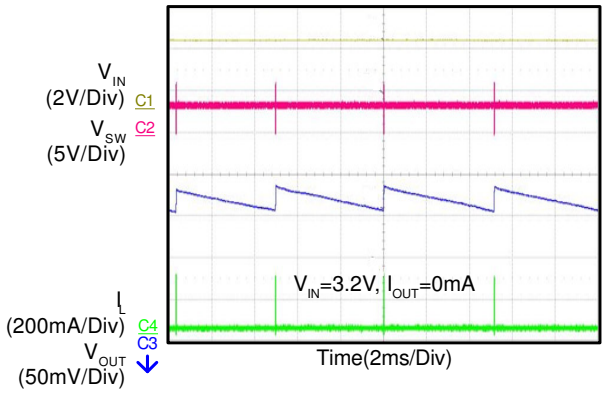
The outpour capacitor is required to maintain the DC output voltage. Ceramic, tantalum, or low ESR electrolytic capacitors are recommended. The Low ESR capacitors are preferred to keep the lower output voltage ripple. It's recommended X5R or X7R ceramic capacitor with enough voltage rating.

The Enable Operation

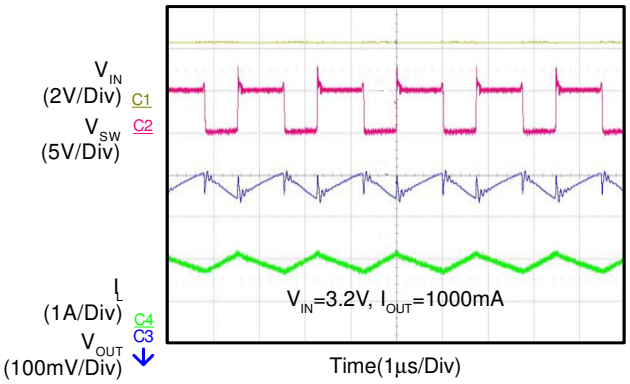
Pulling the EN pin low (<0.6V) will shutdown the device. At the shutdown mode, the AME5125 output drop to zero in addition only below 1uA standby current. When EN Pin >1.4, the AME5125 will turn on device. If EN Pin floating the AME5125 into shutdown mode.

■ Characterization Curve

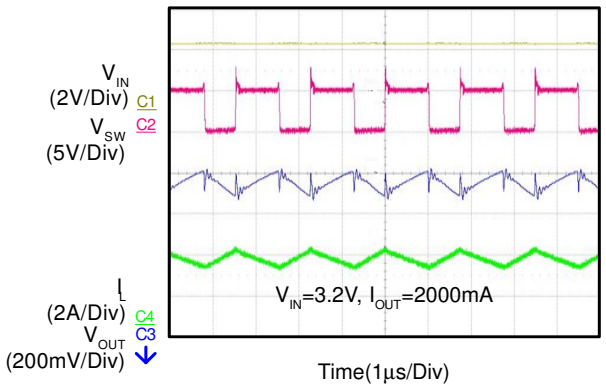
Output Voltage Ripple



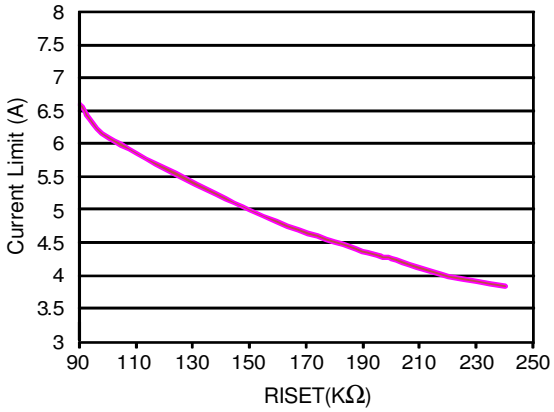
Output Voltage Ripple



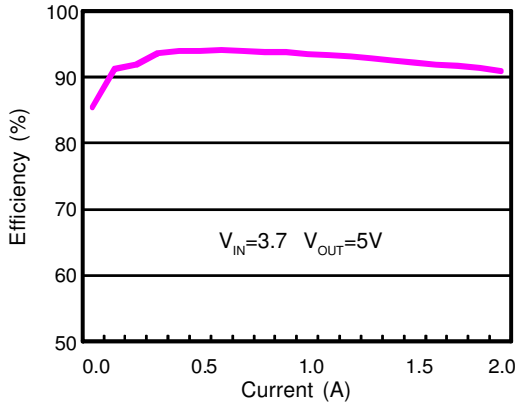
Output Voltage Ripple



RISET vs Current Limit

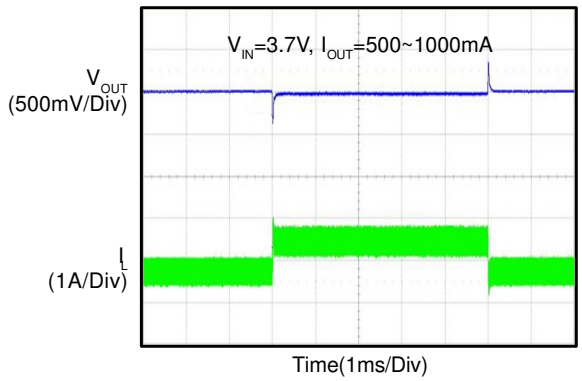


Efficiency

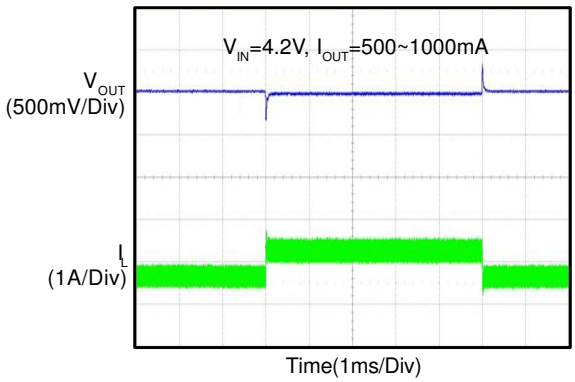


■ Characterization Curve (Contd.)

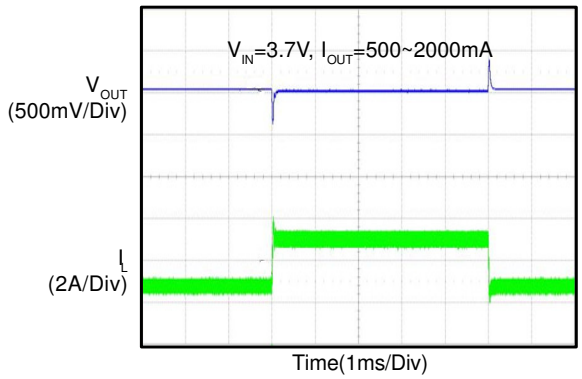
Load Transient



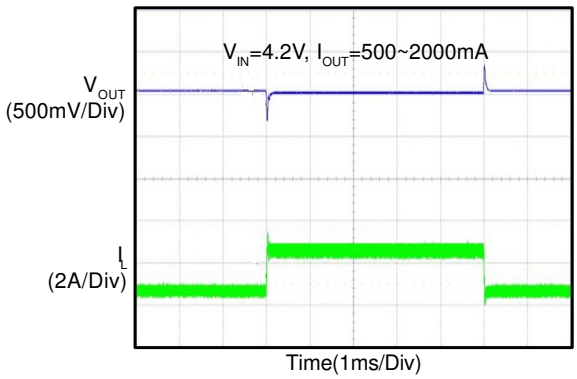
Load Transient



Load Transient

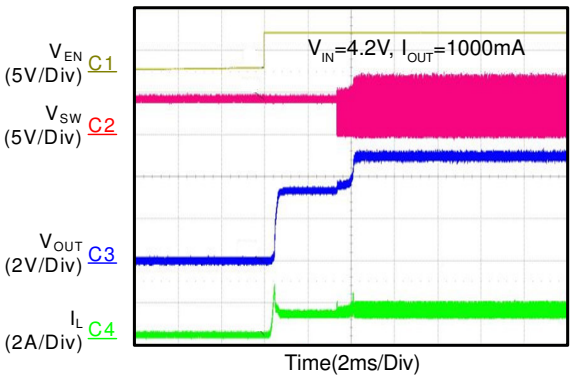


Load Transient

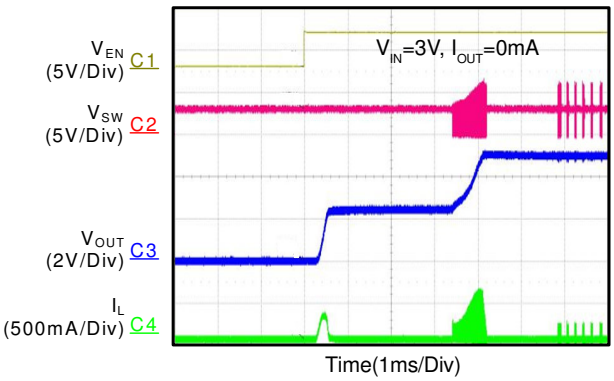


■ Characterization Curve (Contd.)

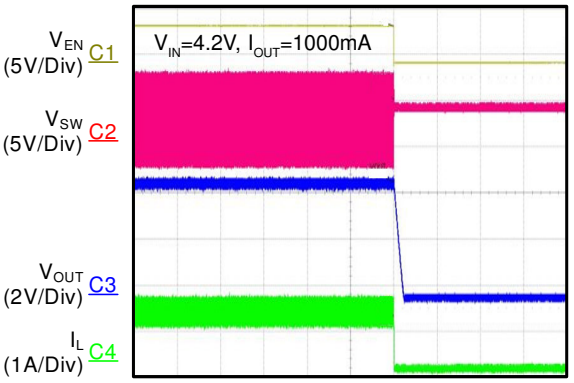
Power ON



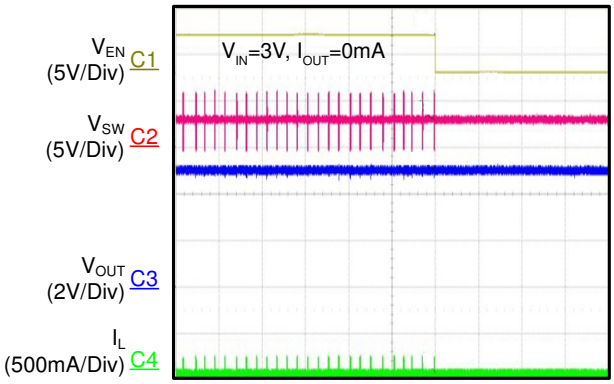
Power ON



Power OFF

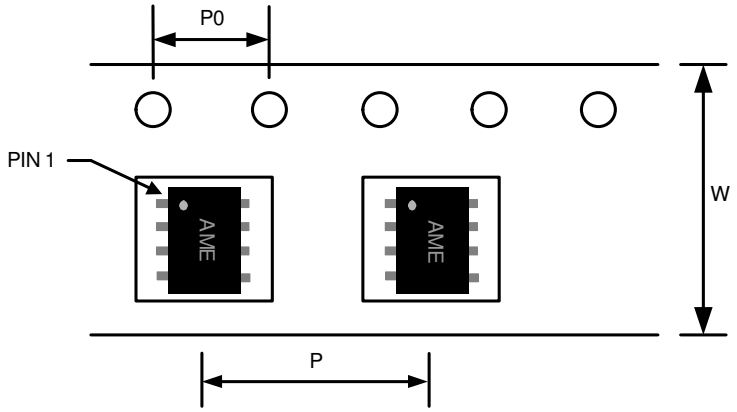


Power OFF



■ Tape and Reel Dimension

SOP-8/PP

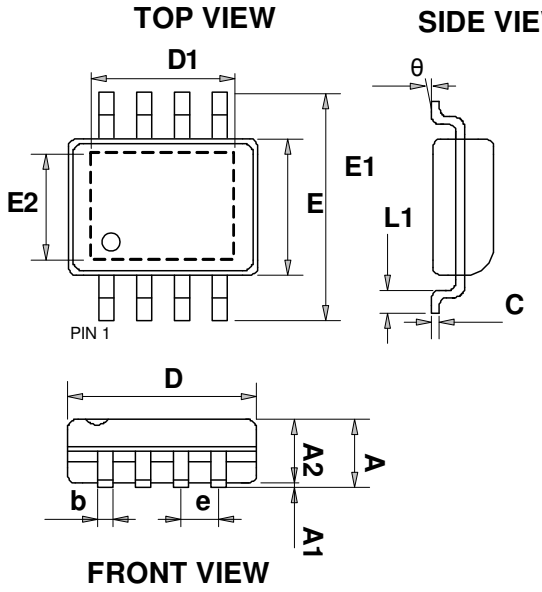


Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Pitch (P0)	Part Per Full Reel	Reel Size
SOP-8/PP	12.0±0.1 mm	8.0±0.1 mm	4.0±0.1 mm	2500pcs	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	0.150	0.000	0.006
A2	1.350	1.600	0.053	0.063
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^o	8^o	0^o	8^o
E2	2.150	2.513	0.085	0.099
D1	2.150	3.402	0.085	0.134



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E-Mail: sales@ame.com.tw

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Corporate Headquarter

AME, Inc.

2F, 302 Rui-Guang Road, Nei-Hu District
Taipei 114, Taiwan, R.O.C
Tel: 886 2 2627-8687
Fax: 886 2 2659-2989