AME

AME8890 150mA CMOS LDO

■ General Description

The AME8890 is a fixed 1.2V of positive, linear regulator feature low quiescent current (60μA typ.) with low dropout voltage, making them ideal for battery applications. The space-saving SOT-25/TSOT-25 packages are attractive for "Pocket" and "Hand Held" applications.

This rugged device has 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 AME8890 is stable with an output capacitor of 2.2μF or greater.

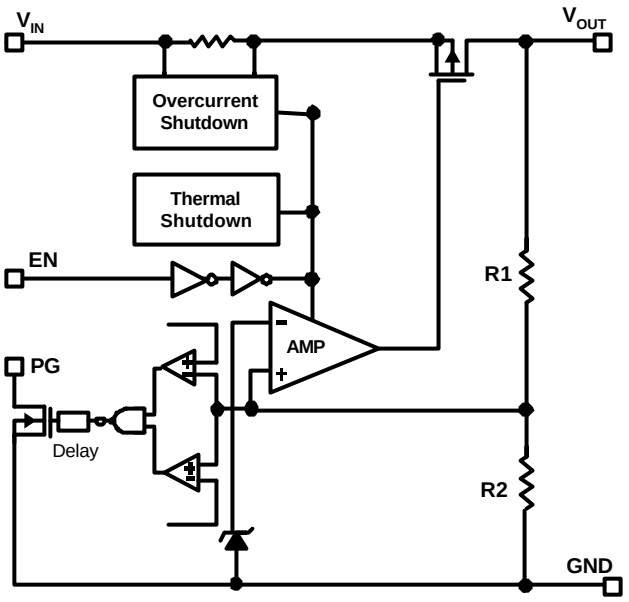
■ Features

- Very Low Dropout Voltage
- Guaranteed 150mA Output
- Accurate to within 3%
- 60μA Quiescent Current
- Over-Temperature Shutdown
- Current Limiting
- Short Circuit Current Fold-back
- Power Good Output Function
- Power-Saving Shutdown Mode
- Space-Saving SOT-25/TSOT-25
- Low Temperature Coefficient
- All AME's Lead Free Product Meet RoHS Standards

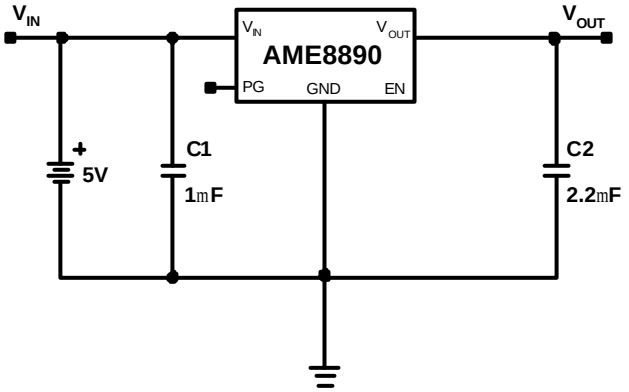
■ Applications

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

■ Functional Block Diagram



■ Typical Application



■ Typical Application

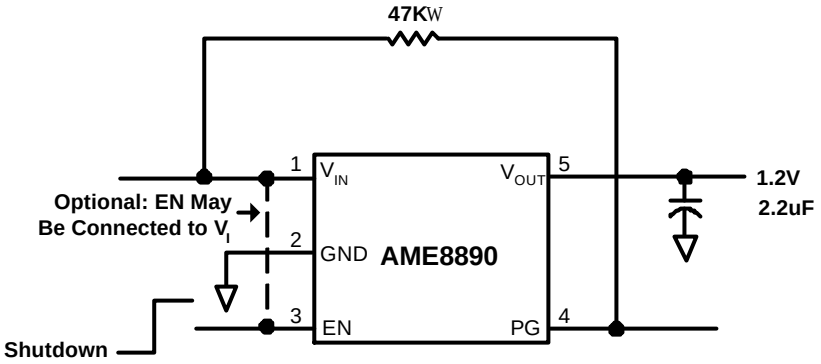


Figure 1. Typical Application Schematic

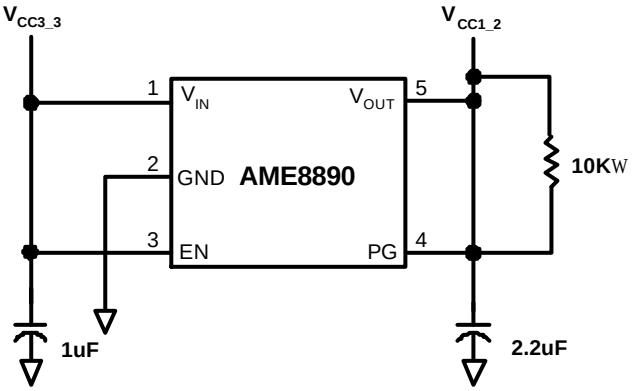
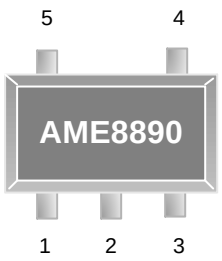


Figure 2. Typical Application For Processor VID Code Power Sequencing Schematic

■ Pin Configuration

SOT-25/TSOT-25
Top View



AME8890

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

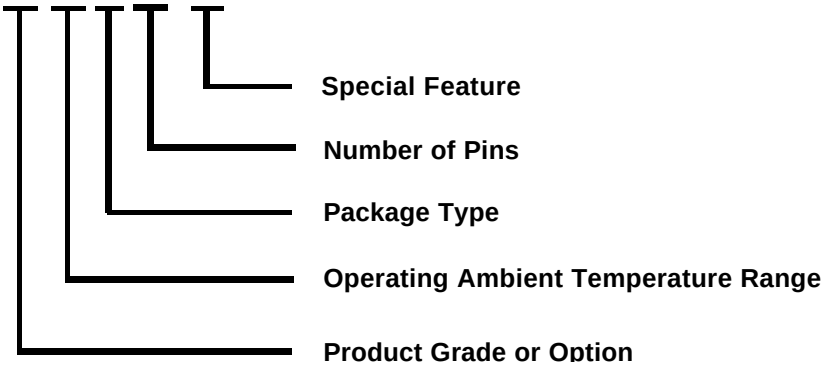
*** Die Attach:**
Conductive Epoxy

■ Pin Description

Pin Number	Pin Name	Pin Description
1	IN	Supply Input
2	GND	Ground
3	EN	Enable/Shutdown (Input) : CMOS compatible input. Logic high = enable;logic low = shutdown. Do not leave open.
4	PG	Power Good Output
5	OUT	Regulator Output

■ Ordering Information

AME8890 x x x x x



Product Grade or Option	Operating Ambient Temperature Range	Package Type	Number of Pins	Special Feature
T: 1.2V	E: -40°C to +85°C	E: SOT-2X	V: 5	L: Low Profile Y: Lead Free & Low Profile Z: Lead Free

■ Ordering Information

Part Number	Marking*	Output Voltage	Package	Operating Ambient Temperature Range
AME8890TEEV	ATBww	1.2V	SOT-25	- 40°C to +85°C
AME8890TEEVL	ATBww	1.2V	TSOT-25	- 40°C to +85°C
AME8890TEEVZ	ATBww	1.2V	SOT-25	- 40°C to +85°C
AME8890TEEVY	ATBww	1.2V	TSOT-25	- 40°C to +85°C

Note: ww represents the date code and pls refer to Date Code Rule before Package Dimension.
* A line on top of the first character represents lead free plating such as $\overline{\text{ATBww}}$.
Please consult AME sales office or authorized Rep./Distributor for package type availability.

■ Absolute Maximum Ratings

Parameter	Maximum	Unit
Input Voltage	-0.3 to +7	V
EN Voltage	-0.3 to +7	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: 2000V~3999V

■ Recommended Operating Conditions

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

■ Thermal Information

Parameter	Package	Die Attach	Symbol	Maximum	Unit
Thermal Resistance* (Junction to Case)	SOT-25 TSOT-25	Conductive Epoxy	θ_{JC}	81	^oC / W
Thermal Resistance (Junction to Ambient)	SOT-25 TSOT-25	Conductive Epoxy	θ_{JA}	260	^oC / W
Internal Power Dissipation	SOT-25 TSOT-25	Conductive Epoxy	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

V_{IN} = 2.7V, V_{EN} = V_{IN}, I_{OUT}=100μA,T_A = 25°C unless otherwise noted

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Input Voltage	V_{IN}			2.7		6	V
Output Voltage Accuracy	V_O	I_O=0.1mA		-3		3	%
Dropout Voltage	$V_{DROPOUT}$	I_O=150mA, V_{OUT}=V_O -2.0%	1.0V<$V_{O(NOM)}$<=2.0V			1300	mV
			2.0V<$V_{O(NOM)}$<=2.8V			N/A	
			2.8V<$V_{O(NOM)}$			N/A	
Current Limit	I_{LIM}	V_O< 0.1V		150	350		mA
Quiescent Current	I_Q	V_{IN}=6V, I_O=0mA, V_O=V_O(nom)			55	80	μA
Ground Pin Current	I_{GND}	V_{IN}=6V, I_O =1mA to 150mA			35		μA
Line Regulation $\frac{\Delta V_{OUT}}{\Delta V_{IN}} \times 100\%$	REG_{LINE}	I_O=100μA, V_{IN}=2.7V to 6V	1.0<= V_O <= 2.0V	-0.3		0.3	%
Load Regulation	REG_{LOAD}	I_O=100μA to 150mA		-4	1	4	%
Over Temperature Shutdown	OTS				150		°C
Over Temperature Hysterisis	OTH				30		°C
V_O Temperature Coefficient	TC				30		ppm/°C
Power Supply Rejection	PSRR	I_O=100mA, C_O=2.2μF	f=1kHz		50		dB
			f=10kHz		20		
			f=100kHz		15		
Output Voltage Noise	eN	f=10Hz to 100kHz, I_O=10mA	Co=2.2μF		30		μVrms
EN Input Threshold	V_{EH}			1.6		Vin	V
	V_{EL}			0		0.4	V
EN Input Bias Current	I_{EH}	V_{EN}=V_{IN}			0.1		μA
	I_{EL}	V_{EN}=0V			0.1		μA
Shutdown Supply Current	I_{SD}	V_{IN}=5V, V_O=0V, V_{EN}=0V			0.5	1	μA
Shutdown Output Voltage	$V_{O,SD}$	Output Loading<=1200Ω, V=0V		0		0.4	V
Output Under Voltage	V_{UV}	PG ON @ % of V_{OUT}				85	%$V_{O(NOM)}$
PG Leakage Current	I_{LC}	V_{PG}=6V , PG is off			0.1		μA
PG Voltage Low	V_{OL}	I_{SINK}=0.1mA				0.1	V
V_{PG} Delay	T_{PGD}	See Timing Diagram on page 9		1.5		5	ms

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

■ Detailed Description

The AME8890 family of CMOS regulators contain a PMOS pass transistor, voltage reference, error amplifier, over-current protection, thermal shutdown, and power good function.

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 150°C, or the current exceeds 300mA. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 120°C.

The AME8890 switches from voltage mode to current mode when the load exceeds the rated output current. This prevents over-stress. The AME8890 also incorporates current foldback to reduce power dissipation when the output is short circuited. This feature becomes active when the output drops below 0.8volts, and reduces the current flow by 65%. Full current is restored when the voltage exceeds 0.8 volts.

■ External Capacitors

The AME8890 is stable with an output capacitor to ground of 2.2µF 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 Vin. 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 normally floats high. When actively, pulled low, the PMOS pass transistor shuts off, and all internal circuits are powered down. In this state, the quiescent current is less than 1µA. This pin behaves much like an electronic switch.

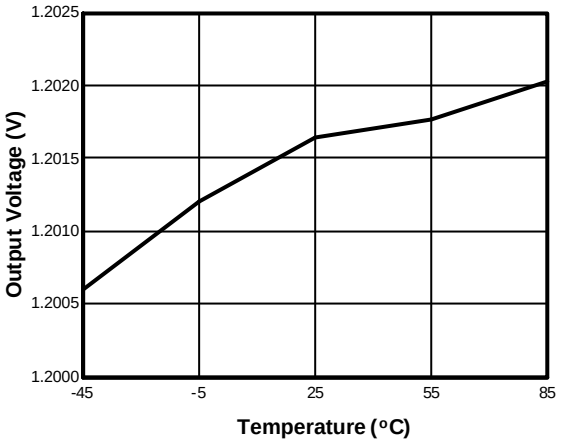
■ Power Good

The AME8890 includes the Power Good feature. When the output is not within ±15% of the specified voltage, it pulls low. This can occur under the following conditions:

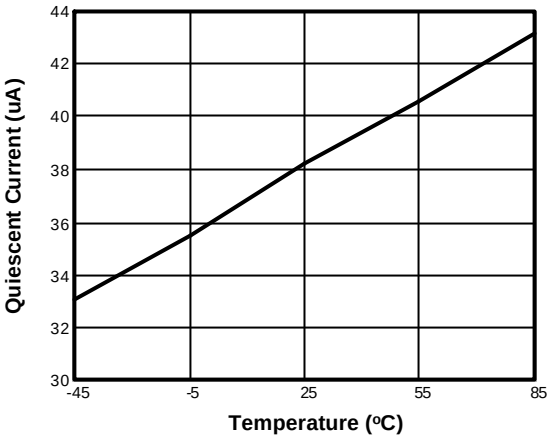
1) Input Voltage too low.
2) During Over-Temperature.
3) During Over-Current.
4) If output is pulled up.

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

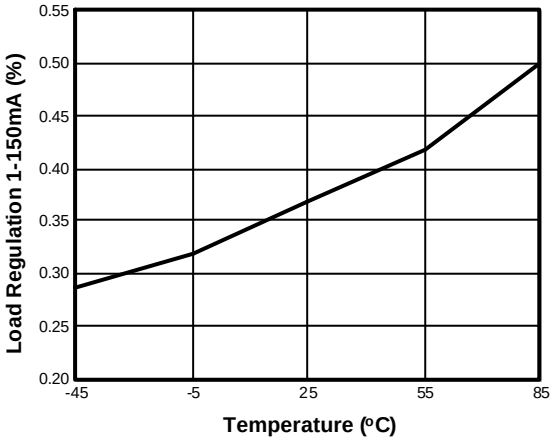
Output Voltage vs. Temperature



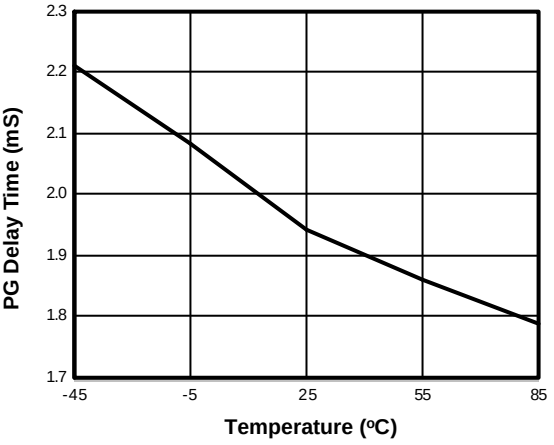
Quiescent Current vs. Temperature



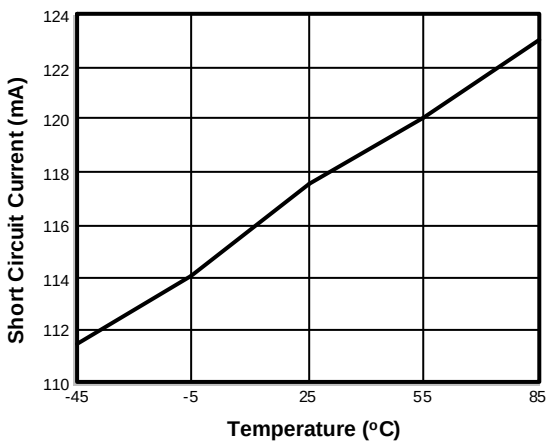
Load Regulation vs. Temperature



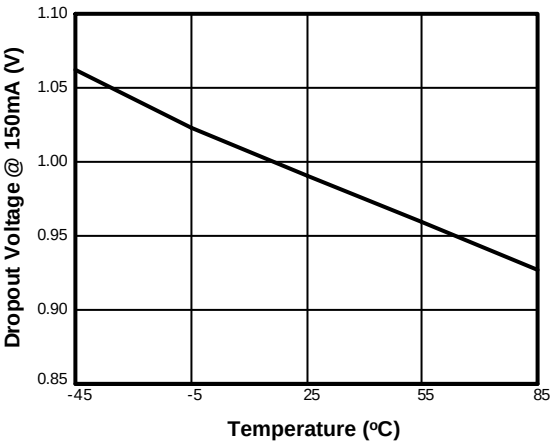
PG Delay Time vs. Temperature



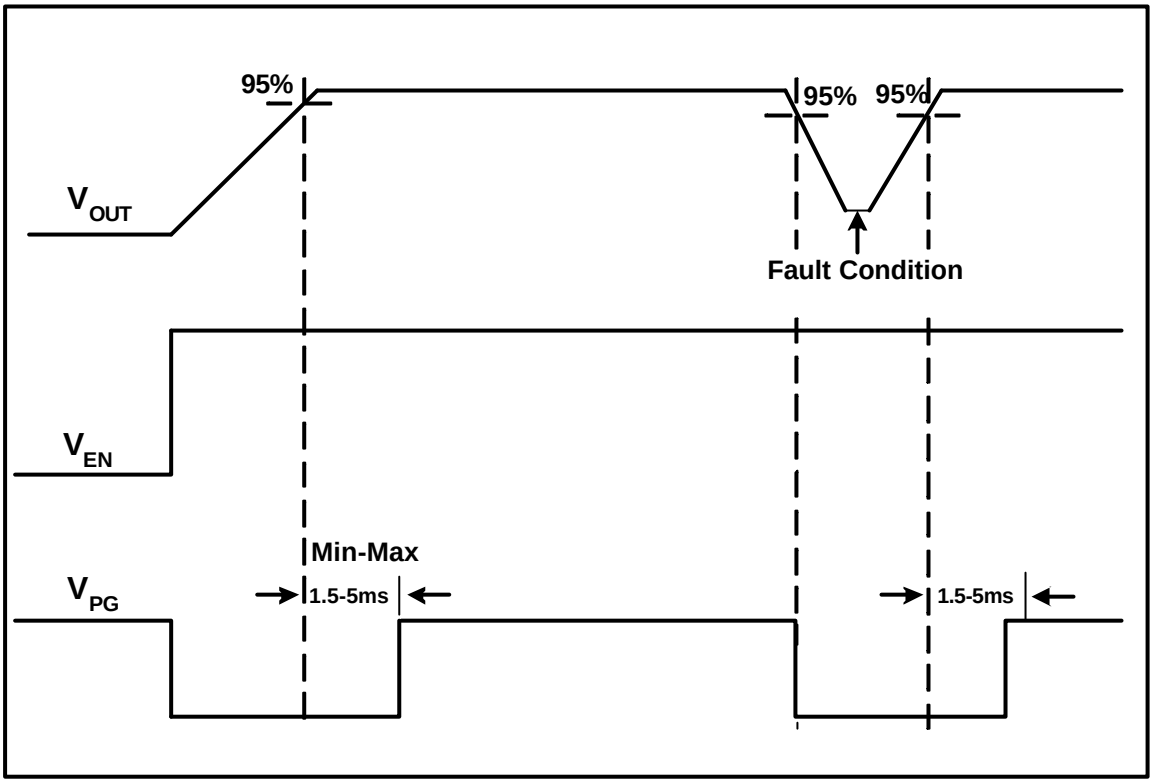
Short Circuit Current vs. Temperature



Dropout Voltage vs. Temperature



■ Timing Diagram

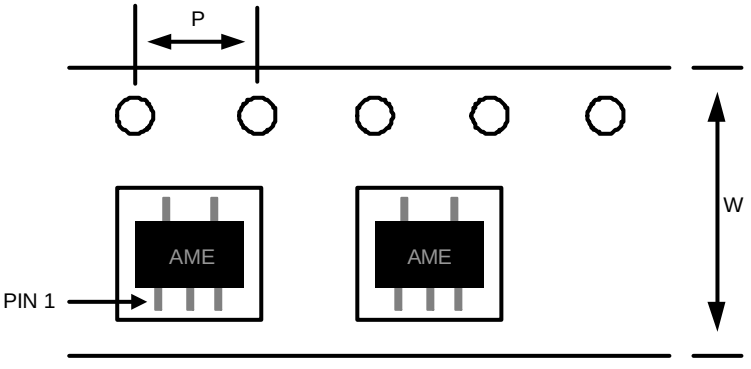


■ Date Code Rule

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

TSOT-25

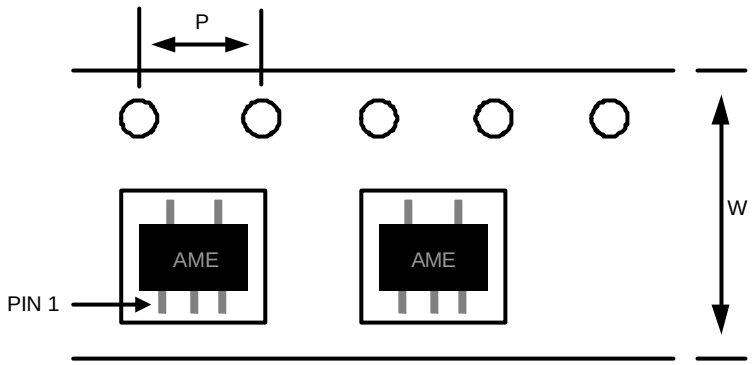


Carrier Tape, Number of Components Per Reel and Reel Size

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

■ Tape and Reel Dimension

SOT-25



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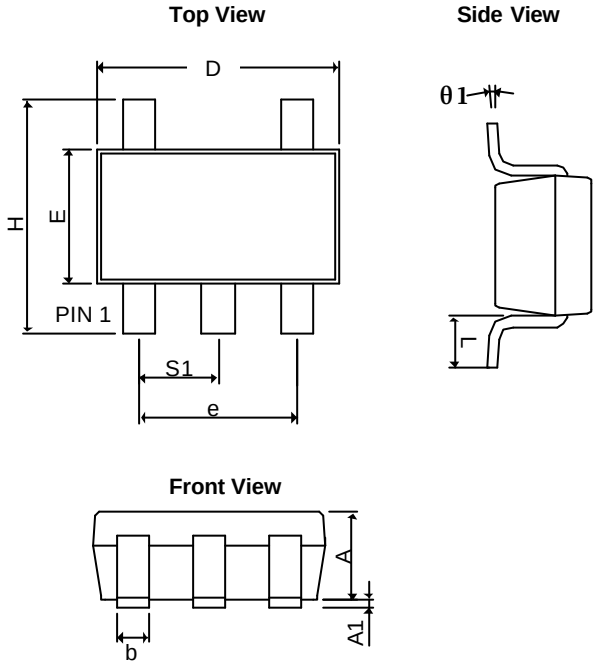
Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
SOT-25	8.0±0.1 mm	4.0±0.1 mm	3000pcs	180±1 mm

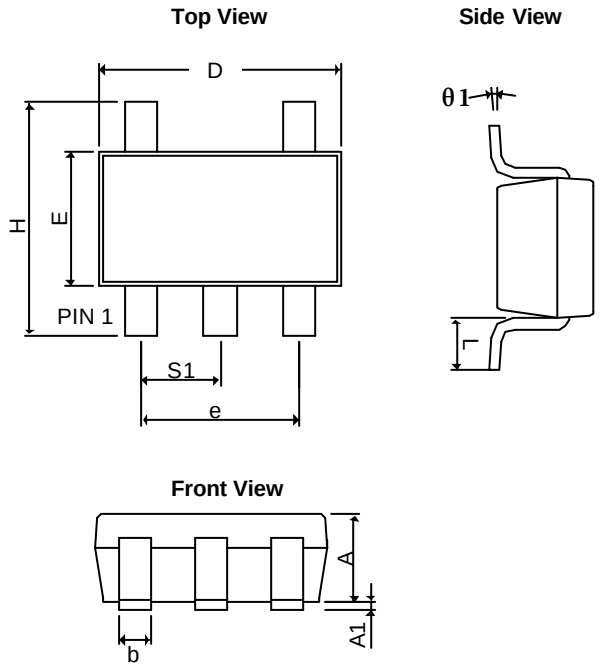
■ Package Dimension

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
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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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.
Tel: 886 2 2627-8687
Fax: 886 2 2659-2989