



AME5172

0.85V Single Cell Boost DC-DC Converter

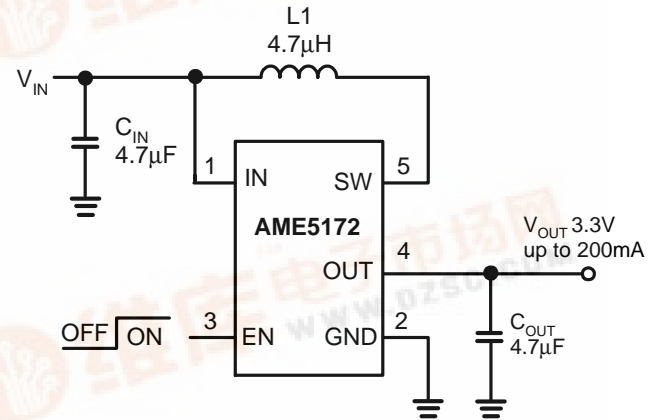
■ General Description

The AME5172 is a high-efficiency, current mode, synchronous PWM Boost DC-DC Converter with fixed 3.3V output voltage for system applications powered by single or double cell NiMH or Alkaline battery pack.

Built-in 0.35Ω NMOS switch and 0.45Ω PMOS synchronous rectification significantly improves efficiency and reduces external components count. High switching frequency (at 1.2MHz) allows easy filtering and faster loop performance.

AME5172 uses SOT-25 package that gives a small size solution.

■ Typical Application



■ Features

- PWM Control with 1.2MHz Fixed Frequency
- Up to 92% Efficiency
- 0.85V Low Start-up Input Voltage
- Internal Synchronous Rectifier
- Fixed 3.3V Output Voltage Options
- 0.8A, 0.35Ω Power MOSFET
- 1µA Shutdown Current
- True Shutdown
- SOT-25 Package
- All AME's Lead Free Products Meet RoHS Standards

■ Applications

- Hand-held Devices
- Digital Cameras
- Portable Applications
- MP3 Players
- LCD Bias Power
- Wireless Handsets

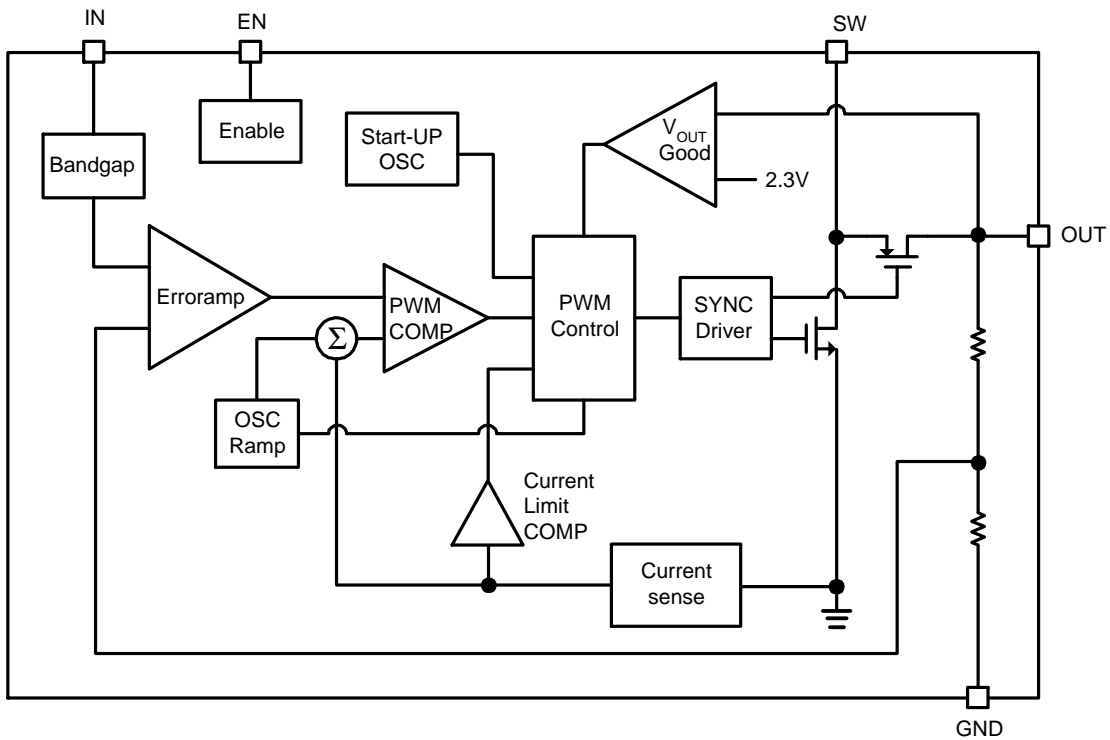


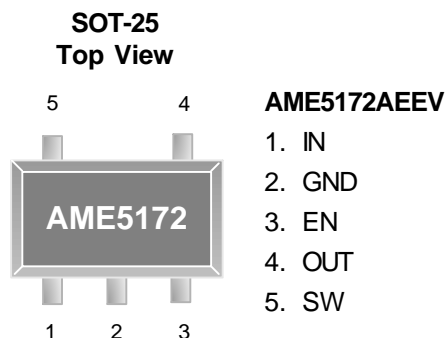
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■ Function Block Diagram



AME5172
■ Pin Configuration


*** Die Attach:
Conductive Epoxy**

■ Pin Description

Pin Number	Pin Name	Pin Description
1	IN	Input Supply Pin. Place bypass capacitor as close to V_{IN} as possible.
2	GND	Ground connection Pin.
3	EN	Enable Control Input Pin. (Active High)
4	OUT	Power Output Pin. PCB layout from output capacitor should be as short and wide as possible..
5	SW	This is the switch pin and is connected to the drain of the internal NMOS power switch. Minimize the metal trace area connected to this pin to minimize EMI.

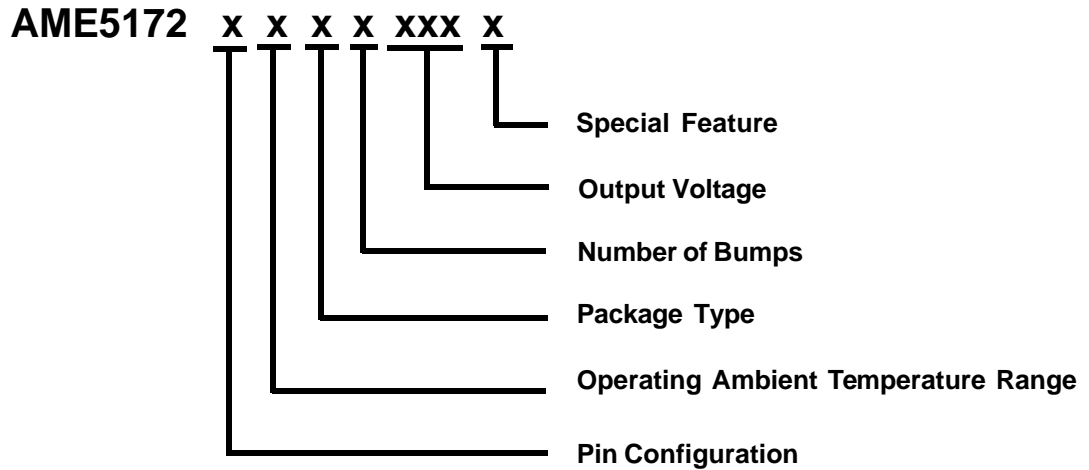


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■ Ordering Information



Pin Configuration	Operating Ambient Temperature Range	Package Type	Number of Pins	Output Voltage	Special Feature
A 1. IN (SOT-25) 2. GND 3. EN 4. OUT 5. SW	E: -40°C to 85°C	E: SOT-2x	V: 5	330: 3.3V	Z: Lead free

■ Ordering Information

Part Number	Marking*	Output Voltage	Package	Operating Ambient Temperature Range
AME5172AEEV330Z	BTWww	3.3V	SOT-25	-40°C to 85°C

Note: ww represents the date code and pls refer to Date Code Rule on Package Dimension.

* A line on top of the first letter represents lead free plating such as BTW.

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



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■ Absolute Maximum Ratings

Parameter	Symbol	Maximum	Unit
Input Voltage	V_{IN}	-0.3 to 6	V
EN, Output Voltages	V_{EN}, V_{OUT}	-0.3 to 6	V
Switch Voltage	V_{SW}	-0.3 to 6	V
ESD Classification	B*		

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

* HBM B:2000V~3999V exclude SW pin.

■ Recommended Operating Conditions

Parameter	Symbol	Rating	Unit
Ambient Temperature Range	T_A	-40 to 85	°C
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	°C / W
Thermal Resistance (Junction to Ambient)			θ_{JA}	260	
Internal Power Dissipation			P_D	400	mW
Solder Iron (10Sec)**				350	°C

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

** MIL-STD-202G 210F

■ Electrical Specifications
 $V_{IN} = 1.2\text{ V}$, $EN = V_{IN}$, $V_{OUT} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$ unless otherwise noted.

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Input Voltage	V_{IN}		0.85		Note 1	V
Output Voltage	V_{OUT}		3.217	3.3	3.383	
Minimum Start-Up Voltage	V_{ST}	$I_{LOAD} = 1\text{ mA}$		0.85		
Quiescent Current	I_Q	Measured on V_{OUT}			500	μA
Shutdown Current	I_{SD}	$EN = \text{GND}$			1	
NMOS Switch Current Limit	I_{CL}		600	800		mA
NMOS Switch $R_{DS(ON)}$	$R_{ON,N}$	$V_{OUT} = 3.3\text{ V}$		0.35		Ω
PMOS Switch $R_{DS(ON)}$	$R_{ON,P}$	$V_{OUT} = 3.3\text{ V}$		0.45		
Switching Frequency	f_{SW}		0.85	1.2	1.5	MHz
Maximum Duty Cycle	D_{MAX}		80	87		%
EN Input Current	I_{EN}	$EN = \text{GND or } V_{IN}$			1	μA
N/PMOS Leakage Current	I_{SW}	$V_{SW} = 5\text{ V for NMOS, } 0\text{ V for PMOS}$			5	μA
EN Input Threshold (High) (Enable the device)	EN Threshold		1		V_{IN}	V
EN Input Threshold (Low) (Shutdown)					0.35	

 Note 1: $V_{IN} < V_{OUT}$



■ Detailed Description

The AME5172 is a fixed frequency synchronous boost converter in SOT-25 package. The feature include current mode PWM control with internal frequency compensation, low $R_{DS(ON)}$ MOSFET switch, synchronous rectification and 800mA peak switching current limit.

Synchronous Rectification

Built-in 0.35Ω NMOS switch and 0.45Ω PMOS synchronous rectification significantly improves efficiency and eliminates the need for an external Schottky diode. High switching frequency (at 1.2MHz) also allows easy filtering and faster loop performance.

Low Voltage Start-Up

The AME5172 will start-up at typical input voltage of 0.85V. At start-up, switching frequency is determined by the start-up oscillator and start-up current limit. When V_{OUT} exceeds 2.3V, the start-up circuit will disabled and the PWM mode is initiated.

Thermal Shutdown Protection

The AME5172 has thermal shutdown protection at 160°C (Typ.). If the device temperature rises above 160°C , the internal power MOSFET will turn off. Once the temperature falls below 140°C , the device resumes normal operation. However, device functionality is only guaranteed to a maximum junction temperature of $+125^{\circ}\text{C}$.

■ Application Information

Inductor Selection

An inductor value of $4.7\mu\text{H}$ performs well in most application. Larger values of inductance can reduce the inductor ripple current. Choosing inductors with low ESR decrease power loss and increase efficiency.

The approximate output current capability versus inductance value is given in the equation below:

$$I_{OUT(max)} = h(1-D) \left[I_{CL} - \frac{V_{IN} \times D}{2 \times L \times f_{SW}} \right]$$

where:

h = efficiency

$$D = \frac{V_{OUT} - V_{IN}}{V_{OUT}}$$

I_{CL} =switching peak current limit

V_{IN} =input voltage

L =inductance value

F_{SW} =switching frequency

Output Capacitor Selection

A single ceramic capacitor of value $4.7\mu\text{F}$ to $10\mu\text{F}$ will provide sufficient output capacitance for most applications. Larger capacitance with low ESR can be used to improve ripple and transient response.

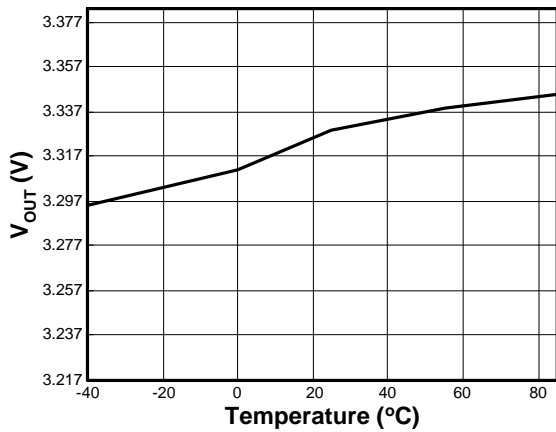
An output capacitor with excessive ESR can also reduce phase margin and cause instability. In general, if electrolytic are used, it is recommended to parallel with ceramic capacitors to reduce ringing, switching losses, and output voltage ripple.

Input Capacitor Selection

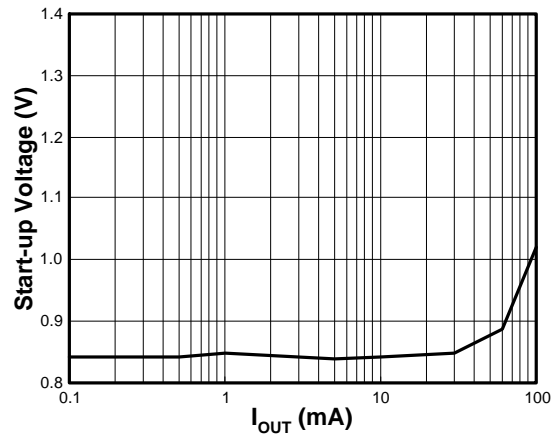
An input capacitor is required to serve as an energy reservoir for the current which must flow into the coil each time the switch turns ON. This capacitor must have extremely low ESR, so ceramic is the best choice. We recommend a nominal value of $4.7\mu\text{F}$, but larger values can be used. Since this capacitor reduces the amount of voltage ripple seen at the input pin, it also reduces the amount of EMI passed back to other circuitry.



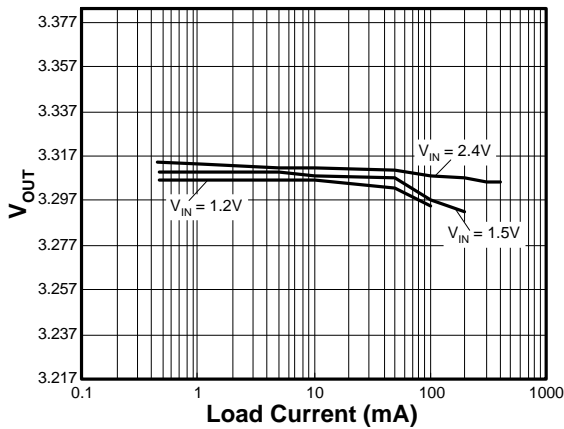
V_{OUT} vs Temperature



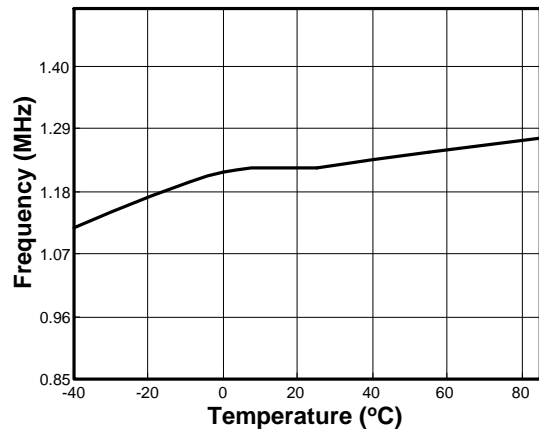
Star-up Voltage vs Load Current



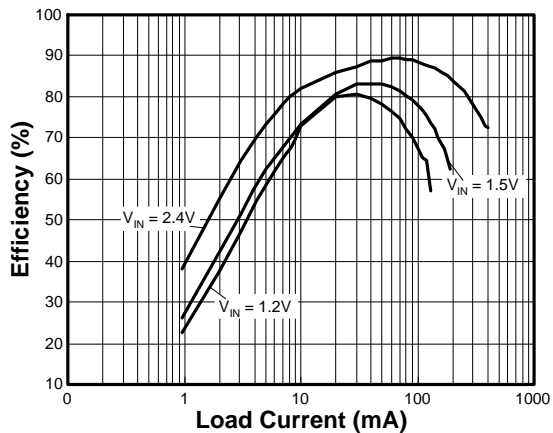
Output Voltage vs Load Current



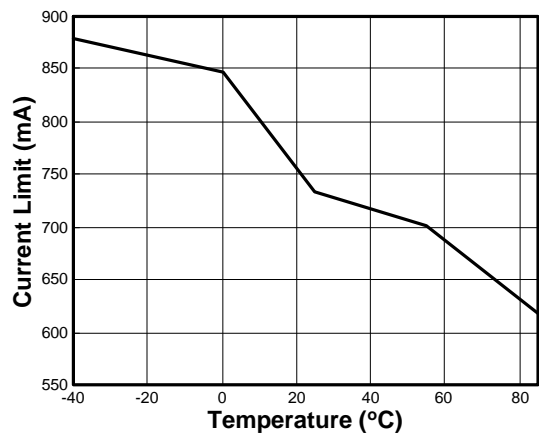
Normalized Frequency vs Temperature



Efficiency vs Load Current



Current Limit vs Temperature



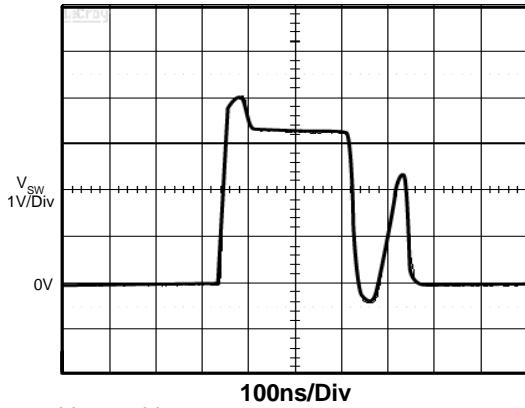


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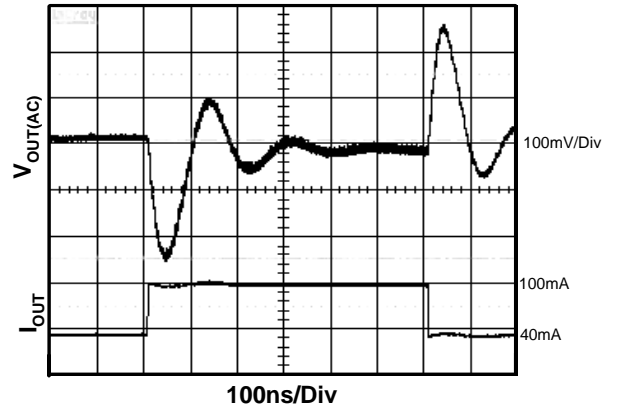
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SW Pin Operation



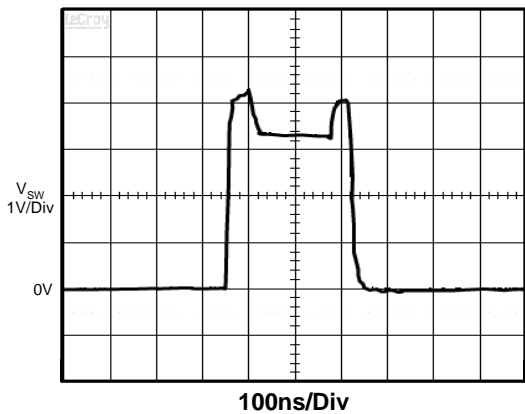
$V_{IN} = 1.3V$
 $V_{OUT} = 3.3V$
 $I_{OUT} = 10mA$
 $L = 6.8\mu H$
 $C_{OUT} = 4.7\mu F$

V_{OUT} Transient Response



$V_{IN} = 1.3V$
 $V_{OUT} = 3.3V$
 $I_{OUT} = 40mA \text{ to } 100mA$
 $L = 6.8\mu H$
 $C_{OUT} = 4.7\mu F$

SW Pin Fixed Frequency Continuous Inductor Current Operation



$V_{IN} = 1.3V$
 $V_{OUT} = 3.3V$
 $I_{OUT} = 50mA$
 $L = 6.8\mu H$
 $C_{OUT} = 4.7\mu F$

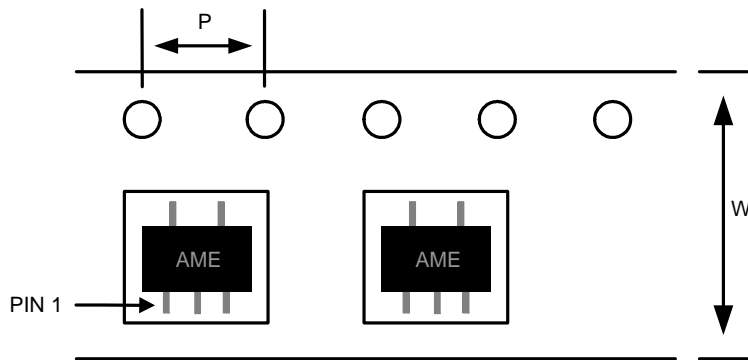


■ Date Code Rule

Marking			Date Code		Year
A	A	A	W	W	xxx0
A	A	A	W	<u>W</u>	xxx1
A	A	A	<u>W</u>	W	xxx2
A	A	A	<u>W</u>	<u>W</u>	xxx3
A	A	<u>A</u>	W	W	xxx4
A	A	<u>A</u>	W	<u>W</u>	xxx5
A	A	<u>A</u>	<u>W</u>	W	xxx6
A	A	<u>A</u>	<u>W</u>	<u>W</u>	xxx7
A	<u>A</u>	A	W	W	xxx8
A	<u>A</u>	A	W	<u>W</u>	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



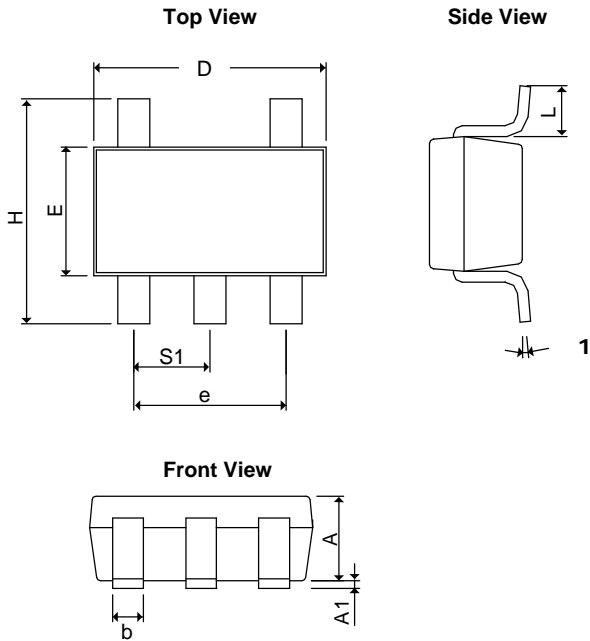
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■ Package Dimension

SOT-25



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.20REF		0.0472REF	
A₁	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°	10°	0°	10°
S₁	0.95BSC		0.0374BSC	



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