DESCRIPTION

The A7122A is a high-efficiency, DC-to-DC step-down switching regulators, capable of delivering up to 2A of output current. The device operates from an input voltage range of 2.5V to 5.5V and provides an output voltage from 0.6V to V_{IN}, making the A7122A ideal for low voltage power conversions. Running at a fixed frequency of 1.3MHz allows the use of small external components, such as ceramic input and output caps, as well as small inductors, while still providing low output ripples. This low noise output along with its excellent efficiency achieved by the internal synchronous rectifier, making A7122A an ideal green replacement for large power consuming linear regulators. Internal soft-start control circuitry reduces inrush current. Short-circuit and thermal-overload protection improves design reliability.

The A7122A is available in SOT-26 and SOT-25 packages.

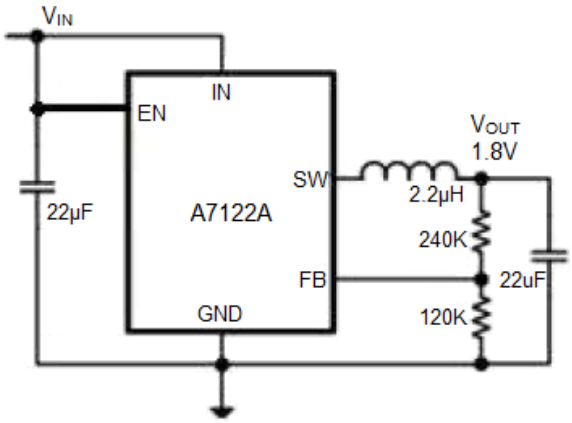
FEATURES

- High Efficiency: Up to 97%
- Capable of Delivering 2A
- 1.3MHz Switching Frequency
- No External Schottky Diode Needed
- Light-load Mode
- Internal Compensation and Soft-Start
- Current Mode control
- 0.6V Reference for Low Output voltages
- Logic Control Shutdown (I_Q<1uA)
- Thermal shutdown and UVLO
- Available in SOT-26 and SOT-25 Packages

APPLICATION

- Digital Cameras
- MP3 and MP4 players
- Set top boxes
- Wireless and DSL Modems
- USB supplied Devices in Notebooks
- Portable Devices

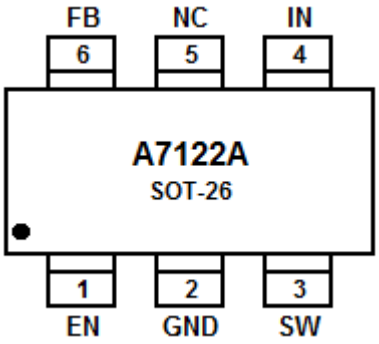
TYPICAL APPLICATION



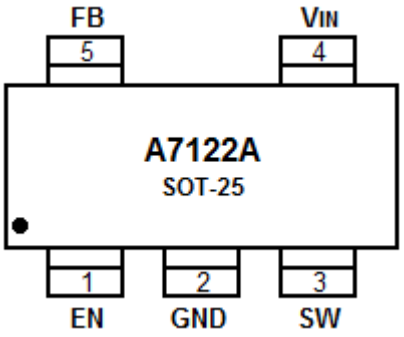
ORDERING INFORMATION

Package Type	Part Number	
SOT-26	E6	A7122AE6R
		A7122AE6VR
SOT-25	E5	A7122AE5R
		A7122AE5VR
Note	V: Halogen free Package R: Tape & Reel SPQ: 3,000pcs/Reel	
AiT provides all RoHS products Suffix " V " means Halogen free Package		

PIN DESCRIPTION



Top View



Top View

Pin #		Symbol	Function
SOT-26	SOT-25		
1	1	EN	Enable pin
2	2	GND	Ground
3	3	SW	Power Switch Output
4	4	IN	Power Supply Input
5	-	NC	Not Connected
6	5	FB	Feedback input pin

ABSOLUTE MAXIMUM RATINGS

Max Input Voltage		6.5V
T_J, Max Operating Junction Temperature		125°C
T_A, Ambient Temperature		-40°C ~ 85°C
Maximum Power Dissipation	SOT-25	400mW
T_S, Storage Temperature		-40°C ~ 150°C
Lead Temperature & Time		260°C, 10s

Stress beyond above listed “Absolute Maximum Ratings” may lead permanent damage to the device. These are stress ratings only and operations of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Max	Unit
V_{IN} Supply Voltage	V_{IN}	2.5	5.5	V
Operating Temperature	T_{OPT}	-40	85	℃

ELECTRICAL CHARACTERISTICS

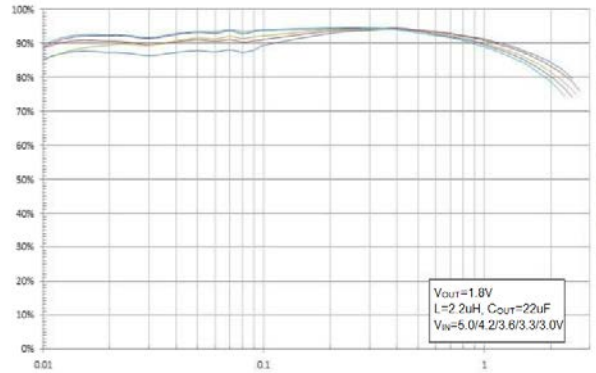
V_{DD}=5V, T_A=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Voltage Range	V_{IN}		2.5		5.5	V
Feedback Voltage	V_{FB}		0.585	0.6	0.615	V
Feedback Leakage Current	I_{FB}			0.1	0.4	μA
Quiescent Current	I_Q	Active, V_{FB}=0.65V		50		μA
Shutdown Current	I_{SD}	Shutdown			1	μA
Switching Frequency	F_{SW}			1.3		MHz
PMOSFET R_{DSON}	R_{ONP}			120		mΩ
NMOSFET R_{DSON}	R_{ONN}			80		mΩ
Peak Current Limit	I_{LIMIT}		2.5			A
SW Leakage Current	I_{SW}	V_{IN}=5.5V,V_{SW}=0 or 5.5V, V_{EN}=0V			10	μA
EN Leakage Current	I_{EN}				1	μA
EN Input High Voltage	V_{ENH}		1.5			V
EN Input Low Voltage	V_{ENL}				0.4	V
Thermal Shutdown	TSD			150		℃
Thermal Shutdown Hysteresis	HYSTSD			15		℃

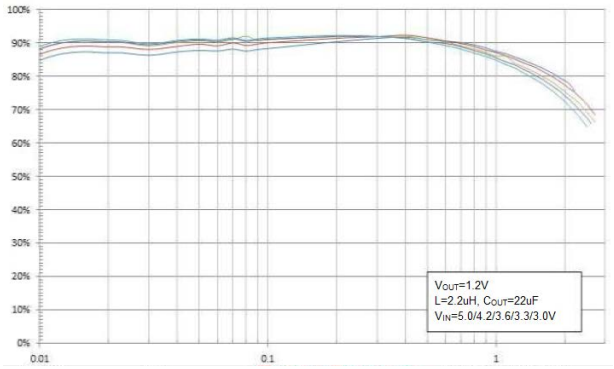
TYPICAL OPERATING CHARACTERISTICS

Tested under T_A=25°C, unless otherwise specified

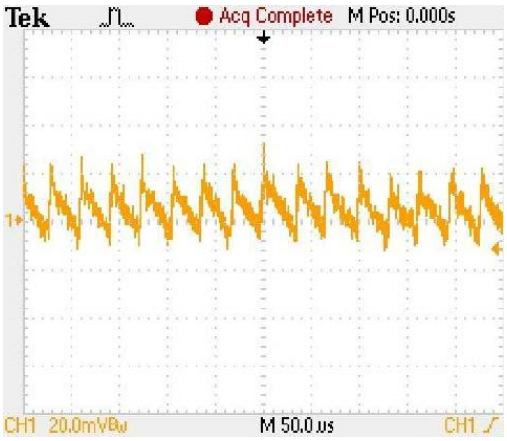
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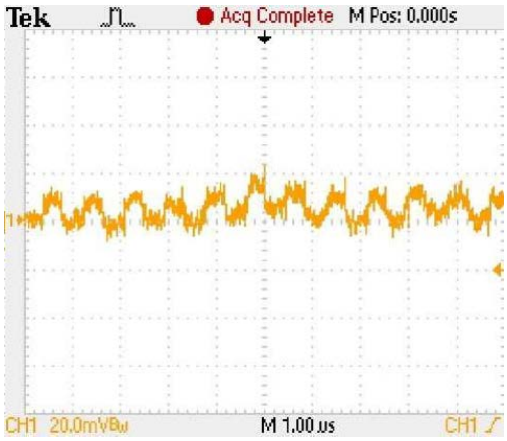
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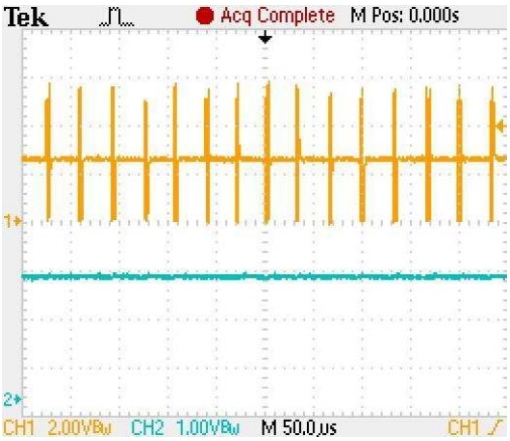
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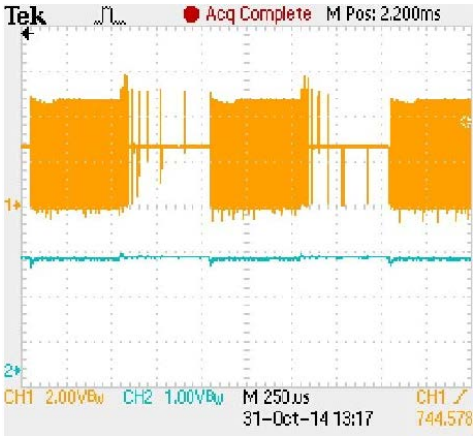
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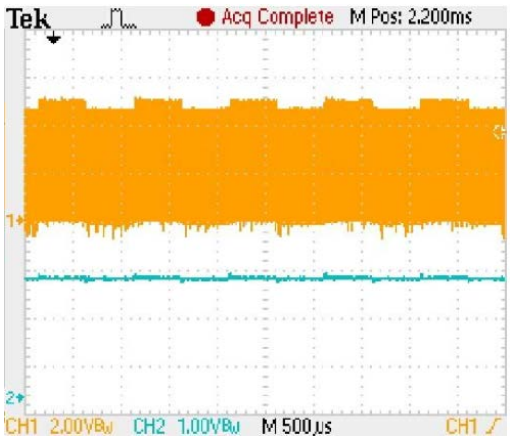
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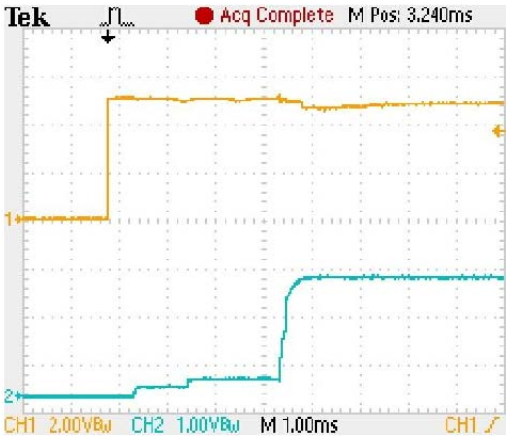
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Acq Complete M Pos: 2.200ms
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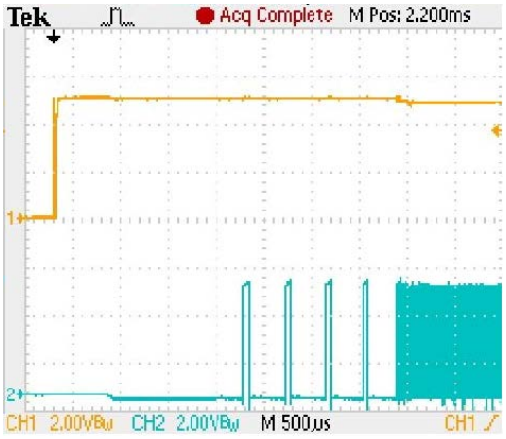
8.


Tek
Acq Complete M Pos: 2.200ms
CH1 2.00VBW CH2 1.00VBW M 500µs CH1

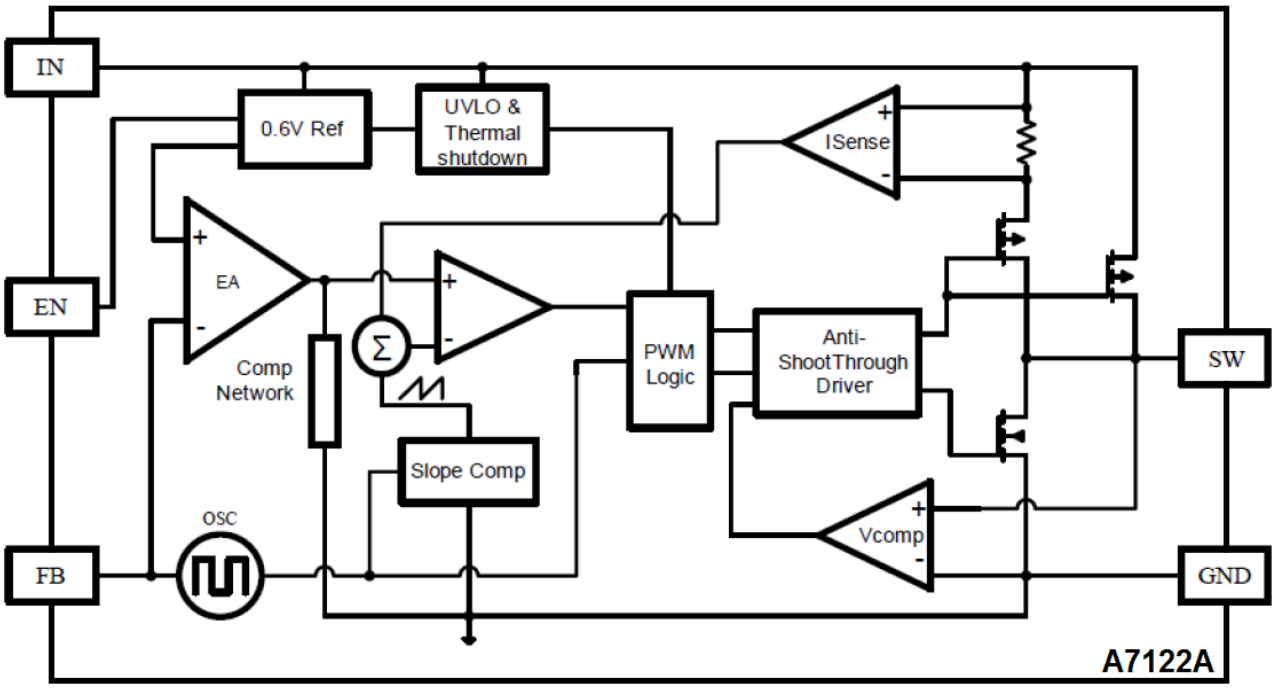
9.


Tek
Acq Complete M Pos: 3.240ms
CH1 2.00VBW CH2 1.00VBW M 1.00ms CH1

10.


Tek
Acq Complete M Pos: 2.200ms
CH1 2.00VBW CH2 2.00VBW M 500µs CH1

BLOCK DIAGRAM



DETAILED INFORMATION

Operation Description

The A7122A high-efficiency switching regulator is a small, simple, DC-to-DC step-down converter capable of delivering up to 2A of output current. The device operates in pulse-width modulation (PWM) at 1.3MHz from a 2.5V to 5.5V input voltage and provides an output voltage from 0.6V on, making the A7122A ideal for on-board post-regulation applications. An internal synchronous rectifier improves efficiency and eliminates the typical Schottky free-wheeling diode. Using the on resistance of the internal high-side MOSFET to sense switching currents eliminates current-sense resistors, further improving efficiency and cost.

Loop Operation

A7122A uses a PWM current-mode control scheme. An open-loop comparator compares the integrated voltage-feedback signal against the sum of the amplified current-sense signal and the slope compensation ramp. At each rising edge of the internal clock, the internal high-side MOSFET turns on until the PWM comparator terminates the on cycle. During this on-time, current ramps up through the inductor, sourcing current to the output and storing energy in the inductor. The current mode feedback system regulates the peak inductor current as a function of the output voltage error signal. During the off cycle, the internal high-side P-channel MOSFET turns off, and the internal low-side N-channel MOSFET turns on. The inductor releases the stored energy as its current ramps down while still providing current to the output.

Current Sense

An internal current-sense amplifier senses the current through the high-side MOSFET during on time and produces a proportional current signal, which is used to sum with the slope compensation signal. The summed signal then is compared with the error amplifier output by the PWM comparator to terminate the on cycle.

Current Limit

There is a cycle-by-cycle current limit on the high-side MOSFET of 2.5A. When the current flowing out of SW exceeds this limit, the high-side MOSFET turns off and the synchronous rectifier turns on. A7122A utilizes a frequency fold-back mode to prevent overheating during short-circuit output conditions. The device enters frequency fold-back mode when the FB voltage drops below 200mV, limiting the current to 2.5A and reducing power dissipation. Normal operation resumes upon removal of the short-circuit condition.

Soft-start

A7122A has a internal soft-start circuitry to reduce supply inrush current during startup conditions. When the device exits under-voltage lockout (UVLO), shutdown mode, or restarts following a thermal-overload event, the l soft-start circuitry slowly ramps up current available at SW.

UVLO and Thermal Shutdown

If IN drops below 2.5V, the UVLO circuit inhibits switching. Once IN rises above 2.5V, the UVLO clears, and the soft-start sequence activates. Thermal-overload protection limits total power dissipation in the device. When the junction temperature exceeds T_J= +150°C, a thermal sensor forces the device into shutdown, allowing the die to cool. The thermal sensor turns the device on again after the junction temperature cools by 15°C, resulting in a pulsed output during continuous overload conditions. Following a thermal-shutdown condition, the soft-start sequence begins.

Application Information

Setting Output Voltages

Output voltages are set by external resistors. The FB_ threshold is 0.6V.

$$R_{TOP} = R_{BOT} [(V_{OUT} / 0.6) - 1]$$

Input Capacitor Selection

The input capacitor in a DC-to-DC converter reduces current peaks drawn from the battery or other input power source and reduces switching noise in the controller. The impedance of the input capacitor at the switching frequency should be less than that of the input source so high-frequency switching currents do not pass through the input source. The output capacitor keeps output ripple small and ensures control-loop stability. The output capacitor must also have low impedance at the switching frequency. Ceramic, polymer, and tantalum capacitors are suitable, with ceramic exhibiting the lowest ESR and high-frequency impedance. Output ripple with a ceramic output capacitor is approximately as follows:

$$V_{RIPPLE} = I_{L(PEAK)}[1 / (2\pi \times f_{OSC} \times C_{OUT})]$$

If the capacitor has significant ESR, the output ripple component due to capacitor ESR is as follows:

$$V_{RIPPLE(ESR)} = I_{L(PEAK)} \times ESR$$

Output Capacitor and Inductor Selection

Follow the below table for Inductor and Output cap selection:

V_{OUT}	1.2V	1.5V	1.8V	2.5V	3.3V
C_{OUT}	33µF	33µF	22µF	22µF	10µF
L	1.5µH	1.5µH	2.2µH	3.3µH	4.7µH

If much smaller values are used, inductor current rises, and a larger output capacitance may be required to suppress output ripple. Larger values than LIDEAL can be used to obtain higher output current, but typically with larger inductor size.

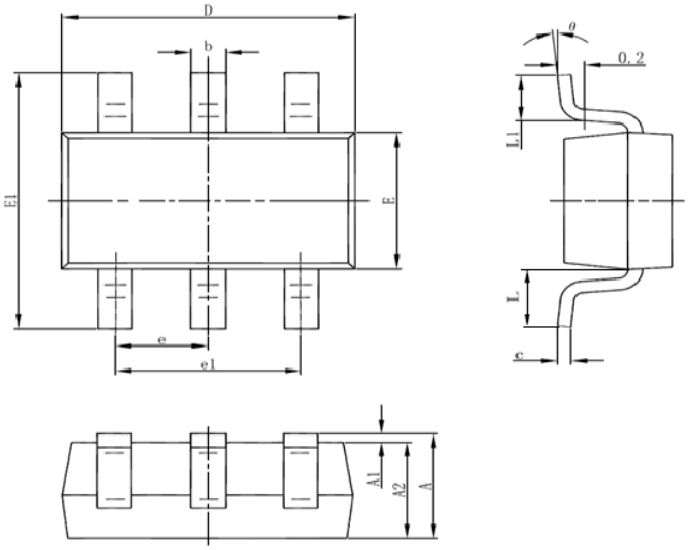
Layout Guideline

Layout is critical to achieve clean and stable operation. The switching power stage requires particular attention. Follow these guidelines for good PC board layout:

1. Place decoupling capacitors as close to the IC as possible
2. Connect input and output capacitors to the same power ground node with a star ground configuration then to IC ground.
3. Keep the high-current paths as short and wide as possible. Keep the path of switching current (C1 to IN and C1 to GND) short. Avoid vias in the switching paths.
4. If possible, connect IN, SW, and GND separately to a large copper area to help cool the IC to further improve efficiency and long-term reliability.
5. Ensure all feedback connections are short and direct. Place the feedback resistors as close to the IC as possible.
6. Route high-speed switching nodes away from sensitive analog area.

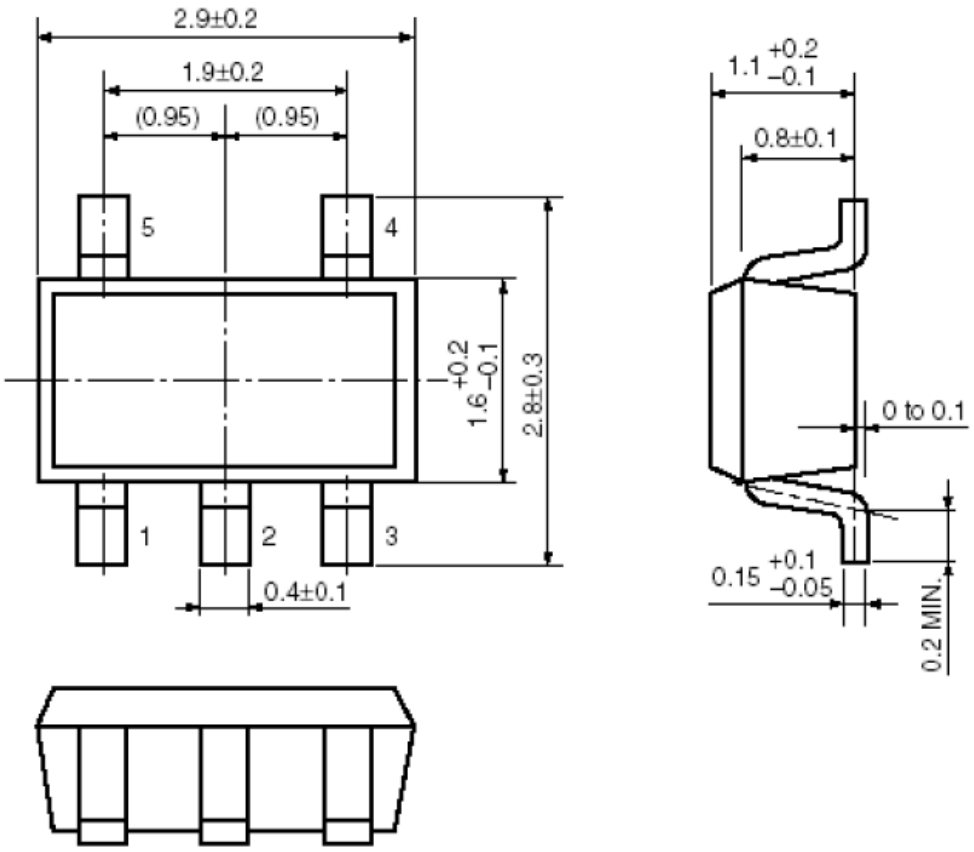
PACKAGE INFORMATION

Dimension in SOT-26 (Unit: mm)



Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.400	0.012	0.016
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.700REF		0.028REF	
L1	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

Dimension in SOT-25 (Unit: mm)



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