DESCRIPTION

The A7533 is a step-up converter that provides a boosted output voltage from a low voltage source. Because of its proprietary design, it starts up at a very low input voltage down to 850mV, making it an ideal choice for single cell alkaline/ NiMH battery operations.

A switching frequency of 1MHz minimizes solution footprint by allowing the use of tiny, low profile inductors and ceramic capacitors. The current mode PWM design is internally compensated, reducing external parts count.

The A7533 is available in SOT-25 and SOT-89-3 Package.

ORDER INFORMATION

Package Type	Part Number	
SOT-25	E5	A7533E5R-XX
		A7533E5VR-XX
SOT-89-3	K3	A7533K3R-XX
		A7533K3VR-XX
Note	XX=Output , ADJ=Adjustable V: Green Package R : Tape & Reel	
AiT provides all Pb free products Suffix " V " means Green Package		

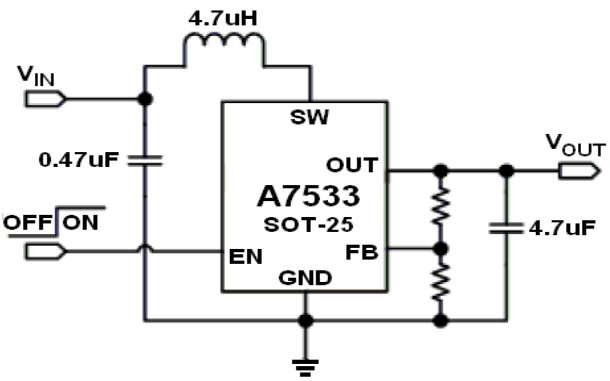
FEATURES

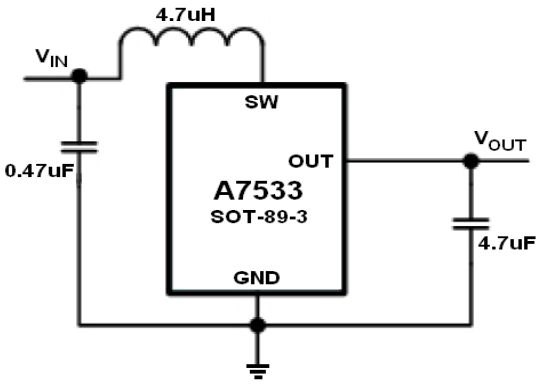
- Up to 95% Efficiency
- Output voltage accuracy ±3%
- 1MHz Switching Frequency allows small inductor and output cap
- Input boost-strapping allows using small or no input cap
- Low V_{IN} Start-up Voltage down to 850mV Ideal for Single Alkaline Cell operations
- Maximum Output Current up to 300mA
- Low Noise PWM control
- Internally Compensated Current Mode Control
- Internal Synchronous Rectifier
- Logic Control Shutdown (IQ < 1uA)
- Available in SOT-25 and SOT-89-3 Package.

APPLICATION

- One to Three Cell Battery Operated Devices
- Medical Instruments
- Bluetooth Headsets
- Flash-Based MP3 Players
- Noise Canceling Headphones

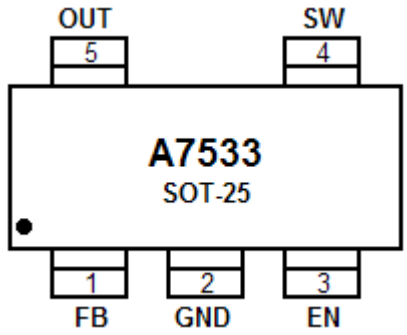
TYPICAL APPLICATION



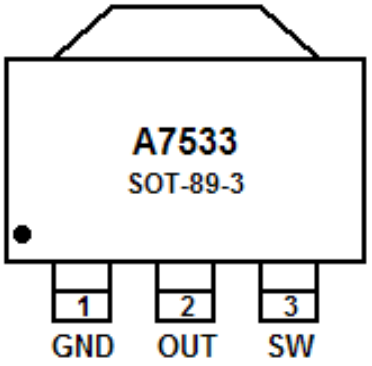


NOTE: Input capacitor (C_{IN} = 0.47uF) and Output capacitor (C_{OUT} ≥ 4.7uF) are recommended in all application circuit.

PIN DESCRIPTION



Top View



Top View

Pin #		Symbol	Function
SOT-25	SOT-89-3		
1	-	FB	Feedback Input Pin
2	1	GND	Ground Pin
3	-	EN	Chip Enable Pin
4	3	SW	Power Switch Pin
5	2	OUT	Power Output Pin

ABSOLUTE MAXIMUM RATINGS

SW Voltage	-0.3V to +6V
EN, FB, OUT Voltage	-0.3V to +6V
Junction to Ambient Thermal Resistance	190℃/W
Maximum Power Dissipation	0.45 W
Operating Temperature Range	-40℃ ~ 150℃
Storage Temperature	-55℃ ~ 150℃
IR Reflow Lead Temperature and Time	260℃, 10s

Stresses above may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

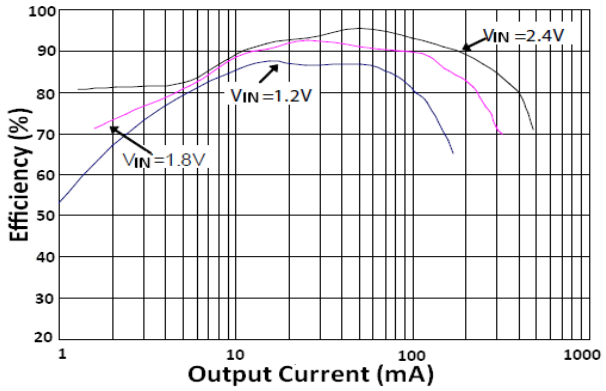
Test condition: V_{IN}=1.8V, V_{OUT}=3.3V, T_A=25℃, unless otherwise specified.

Parameter	Conditions	MIN	TYP	MAX	Unit
Minimum Input Voltage		-	0.7	-	V
Startup Voltage		-	0.85	1.1	V
Dropout Voltage, V_{OUT} ≥ 2.8V	FB = OUT	-	3.3	-	V
	FB = GND	-	5	-	V
FB Feedback Voltage	V_{OUT} = 2.5 to 5V	-	0.6	-	V
FB Input Current		-	-	50	nA
Output Voltage Range	External divider	2.5	-	5	V
Quiescent Current at OUT	V_{FB} = 0.7V	-	25	-	μA
Shutdown Supply Current at OUT	EN = G	-	0.1	1	μA
NMOS Switch ON Resistance	I_{SW} = 100mA	-	0.3	-	ohm
PMOS Switch ON Resistance	I_{SW} = 100mA	-	0.7	-	ohm
NMOS Switch Current Limit		1	-	-	A
SW Leakage Current	V_{OUT} = 5.5V, V_{SW} = 0 or 5.5V, EN = GND	-	-	1	uA
EN Input Current		-	-	1	uA
EN Input Voltage for “Low”		-	-	0.3	V
EN Input Voltage for “High”		0.6	-	-	V

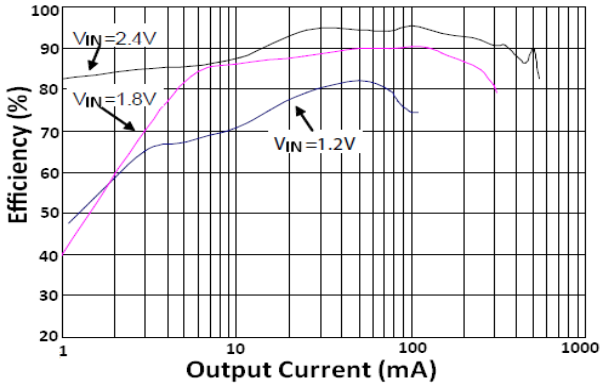
TYPICAL PERFORMANCE CHARACTERISTICS

Typical values are tested at T_A = 25℃, unless otherwise specified.

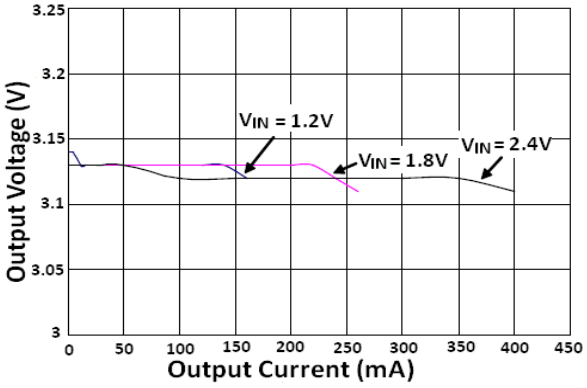
1. Efficiency vs. Output Current
   V_{OUT} = 3.3V, T_A = 25℃



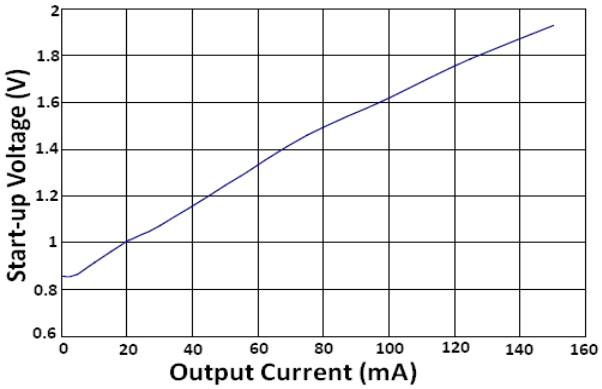
2. Efficiency vs. Output Current
   V_{OUT} = 5V, T_A = 25℃



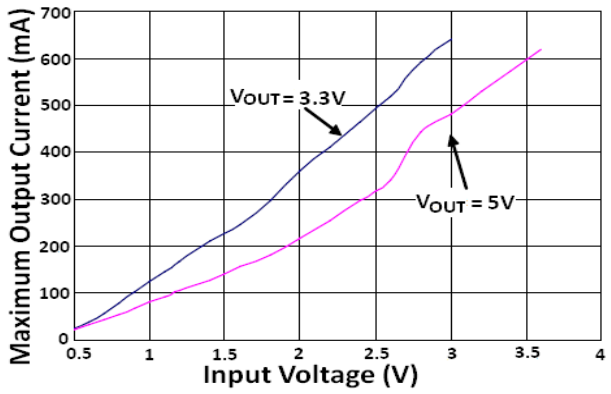
3. Output Voltage vs. Output Current
   V_{OUT} = 3.3V, T_A = 25℃



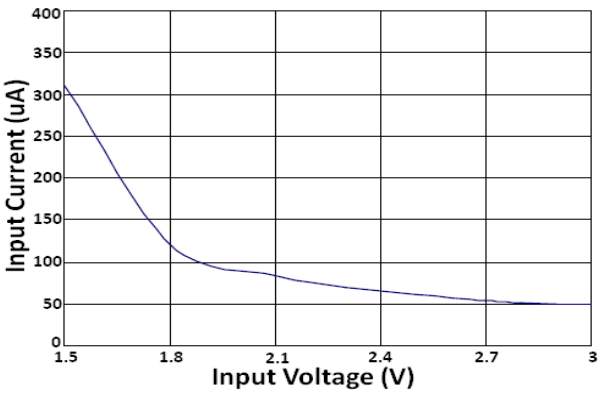
4. Minimum Start-Up Voltage vs. Output Current
   V_{OUT} = 3.3V, T_A = 25℃



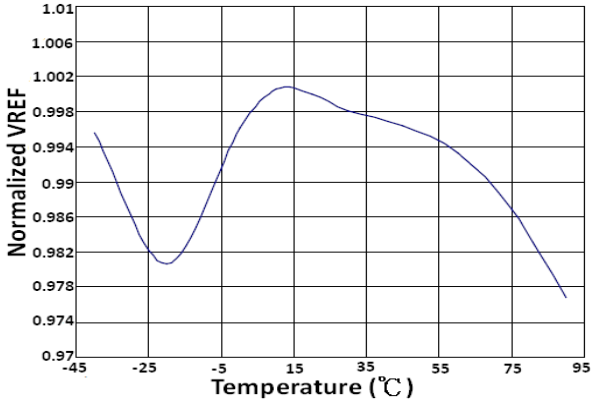
5. Maximum Output Current vs. Input Voltage
   L = 4.7uH, T_A = 25℃



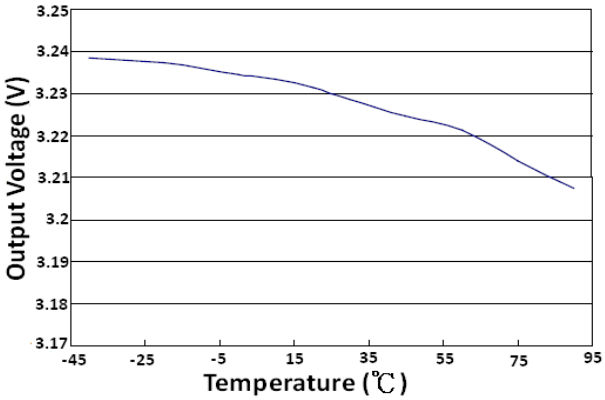
6. No Load Input Current vs. Input Voltage
   V_{OUT} = 3.3V, T_A = 25℃, No load



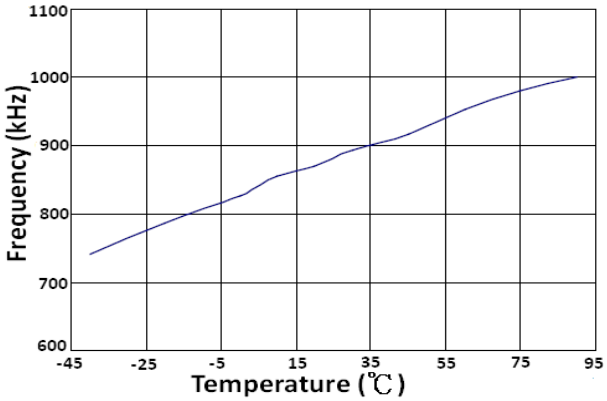
7. $V_{REF}(T) / V_{REF}(T = 20℃)$ vs. Temperature



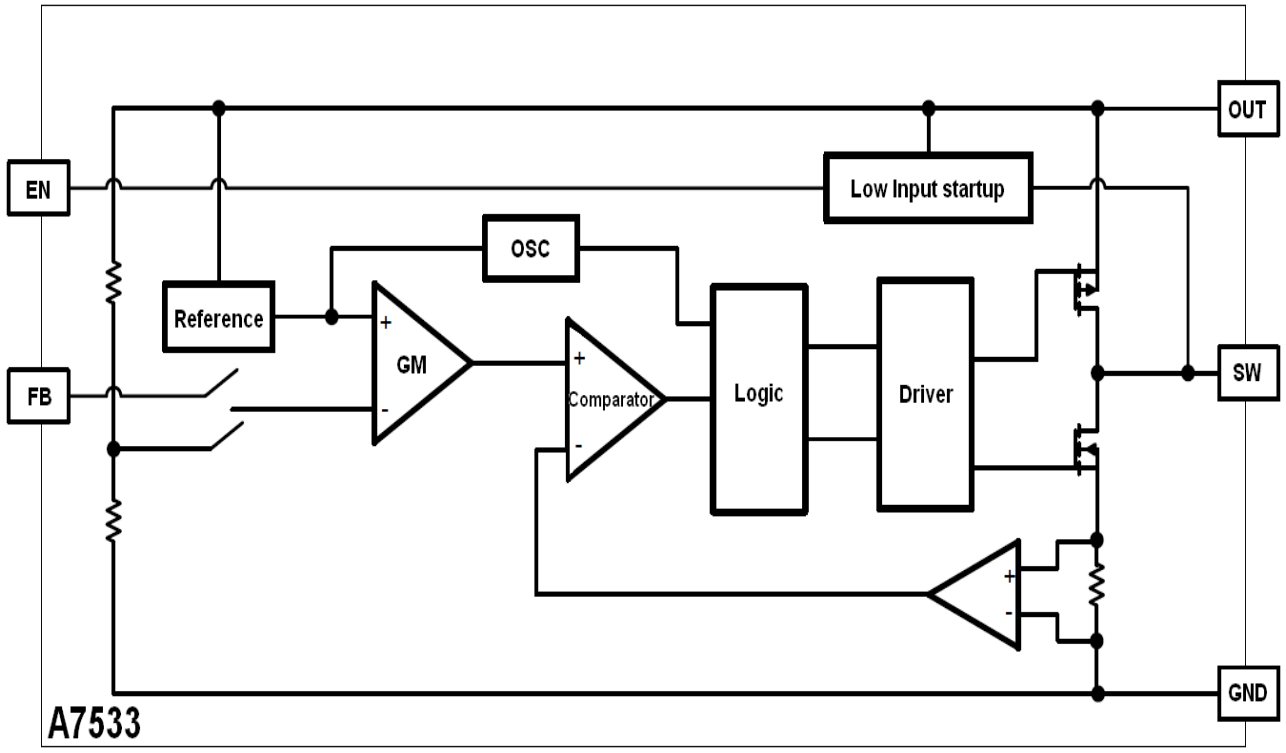
8. Output Voltage vs. Temperature



9. Frequency vs. Temperature



BLOCK DIAGRAM



DETAIL INFORMATION

A7533 is a low input voltage start up, current mode DC-DC step up converter. It's operation can be best understood by referring to the block diagram. Upon starting up, the low voltage startup circuitry drives SW with on-off cycles, transferring energy from input to OUT by storing energy in the inductor during on-time and releasing it to the output during off-time. When OUT reaches 2V, the startup circuit turns off and the main controller takes over. The main control loop consists of a reference, a GM error amplifier, a PWM controller, a current sense amplifier, an oscillator, a PWM logic control, and it is power stage including its driver. The main control loop is a classic current mode control loop. The GM stage integrates the error between FB and REF, and its output is used to compare with a triangular wave which the summing result of the current sense amplifier output and a slope compensation voltage. The output of the comparator is used to drive the power stage to reach regulation.

Output Voltage selection

The output voltages can be set by connecting FB to OUT, to G or to the midpoint of a resistor divider connected to OUT. See below table for details.

FB = GND	V_{OUT} = 5.0V
FB = OUT	V_{OUT} = 3.3V
FB to resistor divider	V_{OUT} = 0.6V(1+R1/R2)

Inductor selection

With switching frequency up to 1MHz, small surface mount inductors can be used with values from 2.2uH to 4.7uH. For a given chosen inductor value and application conditions make sure the peak inductor current does not exceed the maximum current rating of the selected vendor's inductor.

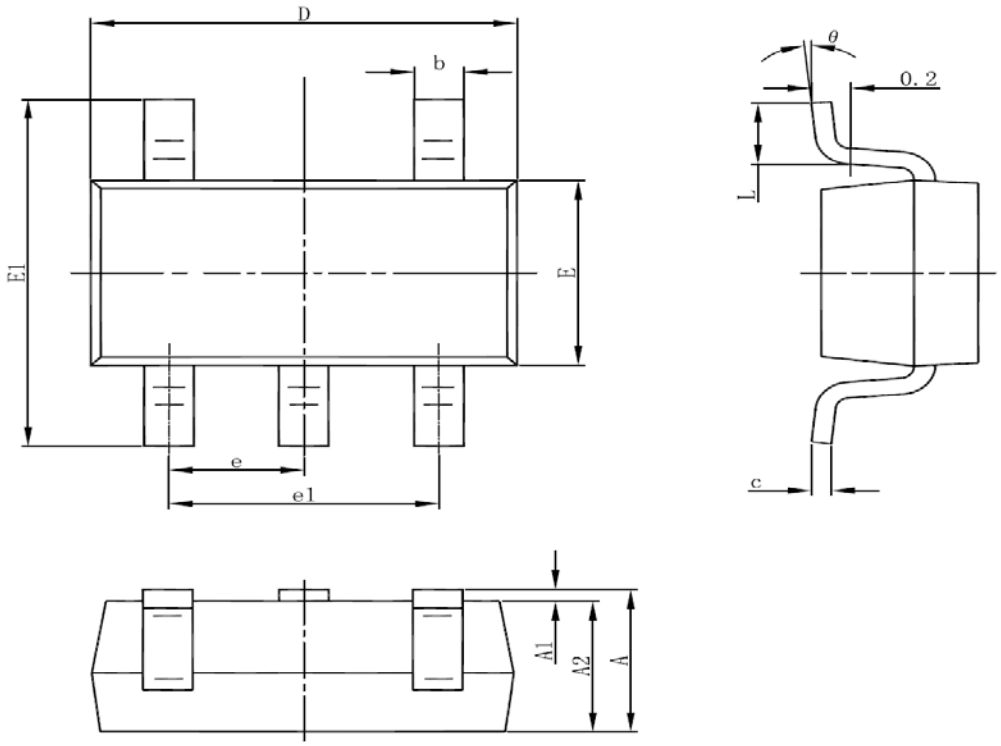
Input and output capacitor selection

The A7533's bootstrap architecture allows the use of very small input capacitor. For applications that only need to drive small output load current, the input capacitor is optional, because once output is started up, the IC's is powered by OUT, a quiet power supply.

The output capacitor is used to stabilize the loop and provide ac current to the load. A low ESR ceramic cap with values from 2.2uF to 22uF can be used. Smaller value capacitors are generally cheaper with small footprints, while larger capacitor provides lower ripples and better transient load responses. Also, when extreme low startup voltage is needed, larger output capacitors are needed for the part to startup under heavy load condition.

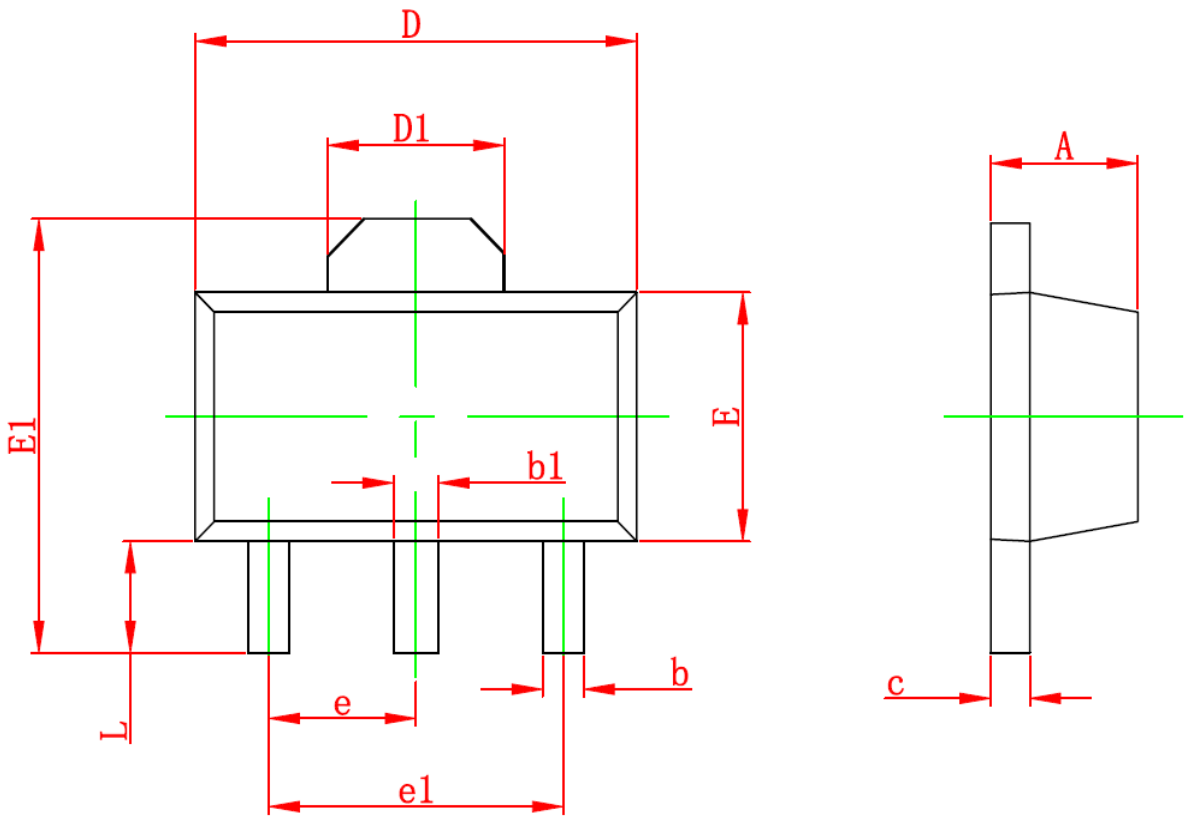
PACKAGE INFORMATION

Dimension in SOT-25 Package (Unit: mm)



Symbol	Min	Max
A	1.050	1.250
A1	0.000	0.100
A2	1.050	1.150
b	0.300	0.500
c	0.100	0.200
D	2.820	3.020
E	1.500	1.700
E1	2.650	2.950
e	0.950(BSC)	
e1	1.800	2.000
L	0.300	0.600
θ	0°	8°

Dimension in SOT-89-3 (Unit: mm)



Symbol	Min	Max
A	1.400	1.600
b	0.320	0.520
b1	0.400	0.580
c	0.350	0.440
D	4.400	4.600
D1	1.550 REF	
E	2.300	2.600
E1	3.940	4.250
e	1.500 TYP	
e1	3.000 TYP	
L	0.900	1.200

IMPORTANT NOTICE

AiT Semiconductor Inc. (AiT) reserves the right to make changes to any its product, specifications, to discontinue any integrated circuit product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

AiT Semiconductor Inc.'s integrated circuit products are not designed, intended, authorized, or warranted to be suitable for use in life support applications, devices or systems or other critical applications. Use of AiT products in such applications is understood to be fully at the risk of the customer. As used herein may involve potential risks of death, personal injury, or servere property, or environmental damage. In order to minimize risks associated with the customer's applications, the customer should provide adequate design and operating safeguards.

AiT Semiconductor Inc. assumes to no liability to customer product design or application support. AiT warrants the performance of its products of the specifications applicable at the time of sale.