AT7171/AT7171E

1.5A 1.5MHz Synchronous Buck Converter

Immense Advance Tech.

FEATURES

- 2.5V to 5.5V input voltage range
- Up to 1.5A Output Current
- 170/130mΩ Internal Power MOSFET Switch
- Stable with Low ESR Output Ceramic Capacitors
- Up to 95% Efficiency
- Less than 1μA Shutdown Current
- 1.5Mhz Switching Frequency
- Thermal Shutdown Protection
- Current limit and short circuit protections
- Output Adjustable from 0.6V to VIN
- Available in SOT-25,TSOP-25 Pb-Free Package
- Buildin soft start function

APPLICATION

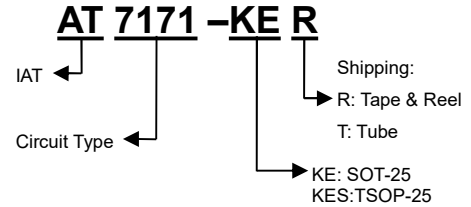
- Cellular and Smart Phones
- Microprocessors and DSP Core Supplies
- Set Top Box
- USB Dongle
- Digital Still and Video Cameras
- Portable Navigation Device

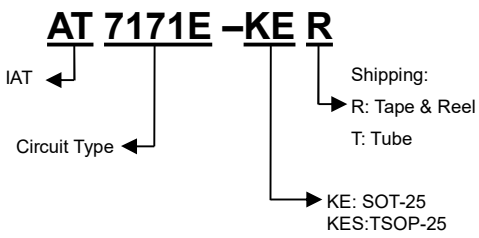
DESCRIPTION

AT7171/AT7171E is a monolithic synchronous buck regulator with a built in internal power MOSFET. It achieves 1.5A continuous output current fix switching frequency with excellent load and line regulation. Current mode operation provides fast transient response and eases of loop stabilization.

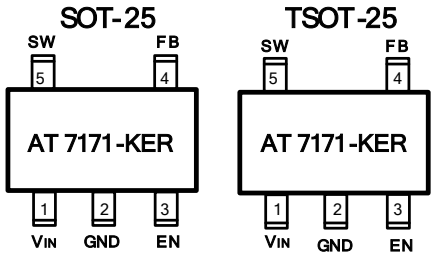
Fault condition protection includes cycle-by-cycle current limiting, output short circuit protection and thermal shutdown. In shutdown mode the regulator draws less than 1μA of supply current. Internal soft-start minimizes the inrush supply current at initial startup. AT7171/AT7171E requires a minimum number of readily available standard external components. It is available in SOT25, TSOP-25 package.

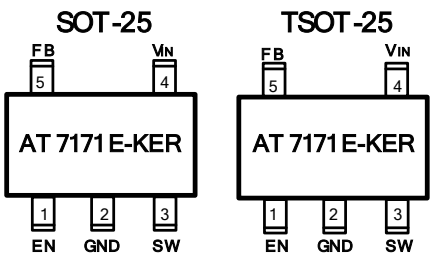
ORDER INFORMATION





PIN CONFIGURATIONS (TOP VIEW)

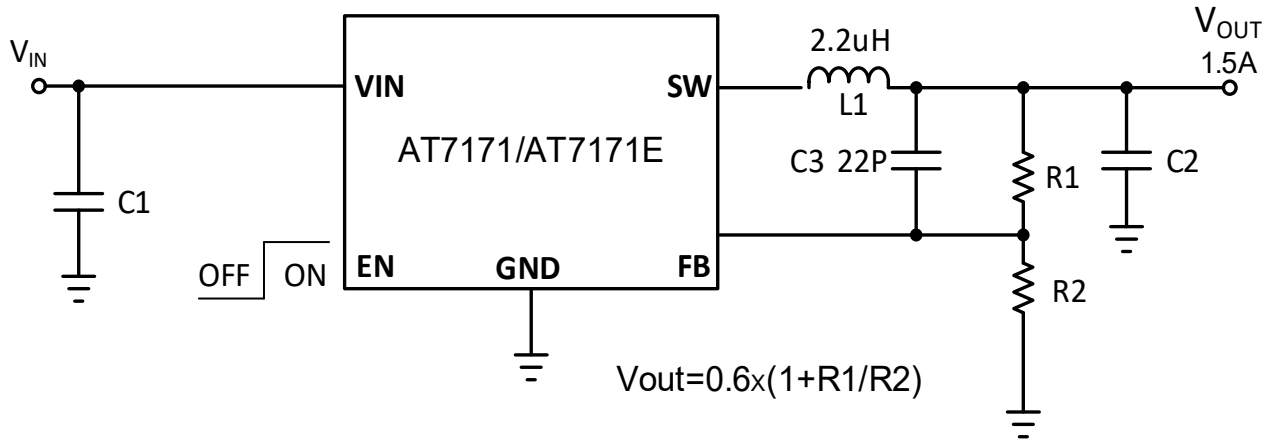




PIN DESCRIPTIONS

Pin Symbol	Pin Description
EN	On/Off Control Input. Pull EN above 1.5V to turn the device on.
GND	Ground. This pin is the voltage reference for the regulated output voltage. For this reason care must be taken in its layout.
SW	Inductor Connection. Connect an inductor between SW and the regulator output.
VIN	Power Supply Input. Drive 2.5V to 5.5V voltage to this pin to power on this chip. Connecting a 10uF ceramic bypass capacitor between VIN and GND to eliminate noise.
FB	Feedback Input. Connect FB to the center point of the external resistor divider. The feedback threshold voltage is 0.6V.

TYPICAL APPLICATION CIRCUITS



$V_{OUT}=V_{FB}$ x(1+R1/R2),V_{FB}=0.6V,R2 suggest 10k~300kΩ

Figure 1

VOUT	R2	R1	C1	C2	L1
1.0V	150K	100K	10μF	10μF×2 or 22μF	2.2μH
1.2V	100K	100K	10μF	10μF×2 or 22μF	2.2μH
1.5V	100K	150K	10μF	10μF×2 or 22μF	2.2μH
1.8V	100K	200K	10μF	10μF×2 or 22μF	2.2μH
2.5V	47K	150K	10μF	10μF	2.2μH
3.3V	68K	300K	10μF	10μF	2.2μH

Table 1 Recommended Component Selection

BLOCK DIAGRAM

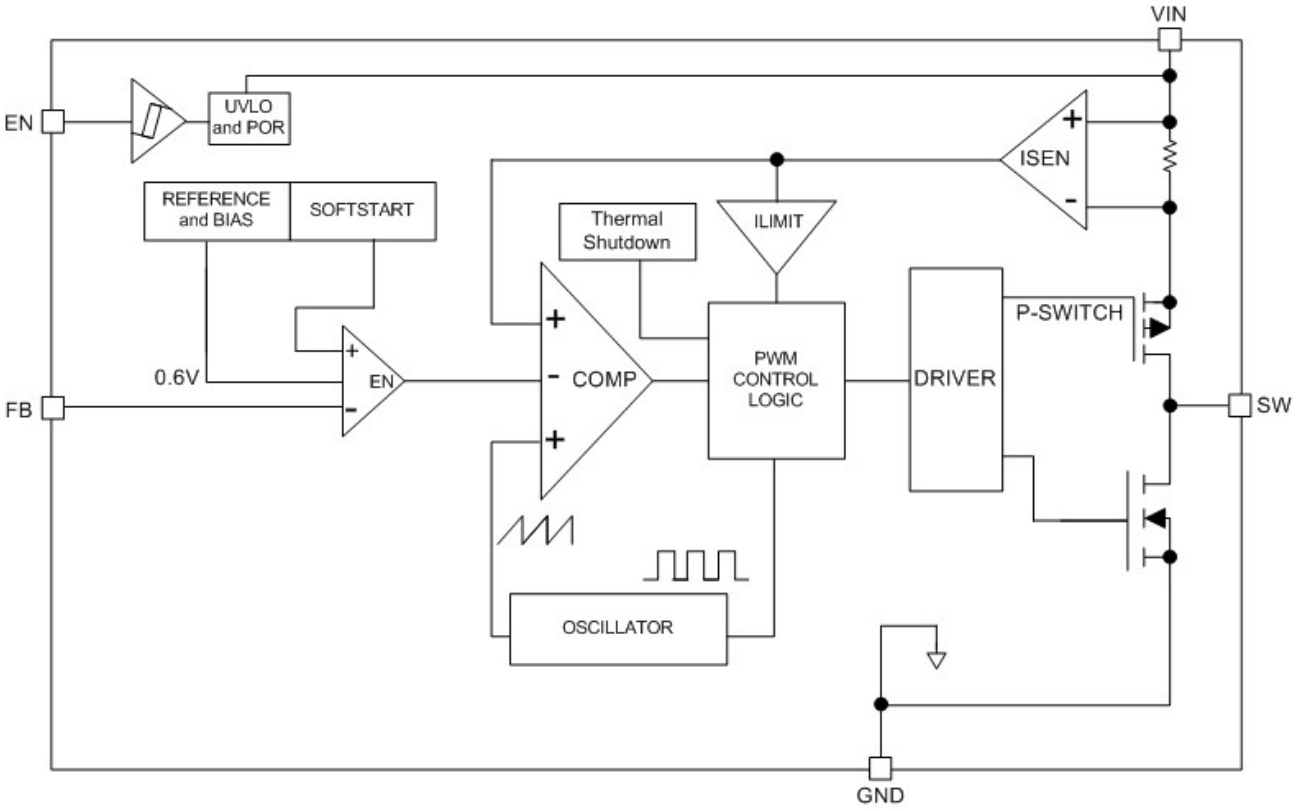


Figure 2

ABSOLUTE MAXIMUM RATINGS (Note 1)

Parameter		Symbol	Max Value	Unit
VCC pin voltage		V_{IN}	-0.3 to 7	V
SW pin voltage		V_{SW}	-0.7 to VIN+0.3	V
EN, FB pins voltage			-0.3 to VIN+0.3	V
Junction Temperature		T_J	150	°C
Storage Temperature Range		T_{STG}	-65 to +150	°C
Lead Temperature(Soldering) 5 Sec.		T_{LEAD}	260	°C
Power Dissipation, P_D @ T_A=25°C (Note 2)	SOT-25	P_D	450	mW
	TSOT-25		450	
Thermal Resistance Junction to Ambient	SOT-25 (Note 3)	θ_{JA}	220	°C/ W
	TSOT-25		220	
Thermal Resistance Junction to Case	SOT-25	θ_{JC}	106.6	°C/ W
	TSOT-25		106.6	
ESD Rating (Human Body Model) (Note 4)		V_{ESD}	2	kV

RECOMMENDED OPERATING CONDITIONS (Note 5)

Parameter	Symbol	Operation Conditions	Unit
Supply Voltage, V_{IN}	V_{IN}	2.5 to 5.5	V
Output Voltage, V_{OUT}	V_{OUT}	0.6 to 5.5	V
Operating Junction Temperature Range	T_J	-40 to +125	°C
Operating Ambient Temperature Range	T_A	-40 to +85	°C

Note 1: Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Note 2: Thermal Resistance is specified with the component mounted on a low effective thermal conductivity test board in free air at T_A=25°C.

Note 3: Thermal Resistance is specified with approximately 1 square of 1 oz copper.

Note 4: Devices are ESD sensitive. Handling precaution recommended.

Note 5: The device is not guaranteed to function outside its operating conditions.

ELECTRICAL CHARACTERISTICS

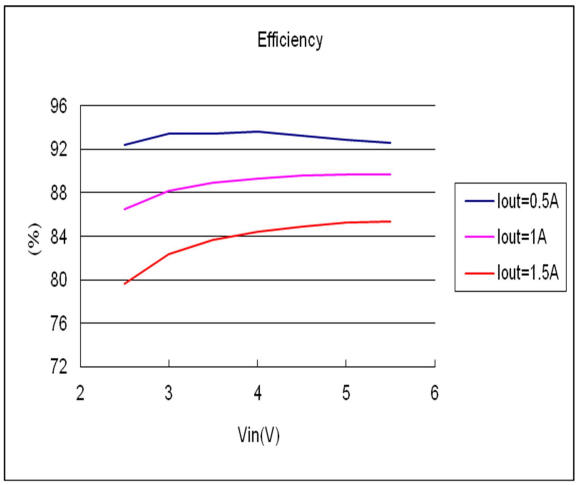
VIN = 5V, VEN = 5V, VOUT = 3.3V, TA = 25°C

Function Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		2.5	-	5.5	V
Input UVLO	UVLO	I_{OUT}=0A	1.8	2.2	2.5	V
Input OVLO (Note6)	OVLO	I_{OUT}=0A	-	6.0	-	V
Quiescent Current	I_{CCQ}	V_{FB} = 1V	-	250	350	μA
Shutdown Current	I_{SD}	V_{EN} = 0V	-	0.1	1	μA
FB Pin Voltage	V_{FB}		0.588	0.6	0.612	V
FB Pin Current (Note7)	I_{FB}		-	-	±50	nA
Load Regulation		0A < I_{OUT}<1.5A	-	0.6	-	%
Line Regulation		2.5V<V_{IN}<5.5V	-	0.3	-	%/V
EN Pin Voltage High	V_{ENH}		1.5	-	-	V
EN Pin Voltage Low	V_{ENL}		-	-	0.4	V
EN Pin Leakage Current		V_{EN} = 3V	-	0.1	1	μA
Switching Frequency	F_{OSC}		1.1	1.5	1.9	MHz
Current Limit	C_L		-	2.2	-	A
Switching Maximum Duty	Dmax		-	-	100	%
Minimum Duty	Dmin		0	-	-	%
P-Switch RDS(ON)	$R_{DS(ON)-P}$		-	170	-	mΩ
N-Switch RDS(ON) (Note7)	$R_{DS(ON)-N}$		-	130	-	mΩ
Low Side Discharger			-	60	-	Ω
Thermal Shutdown	T_{SD}		-	155	-	°C
Thermal Shutdown Protection hysteresis	T_{SH}		-	30	-	°C

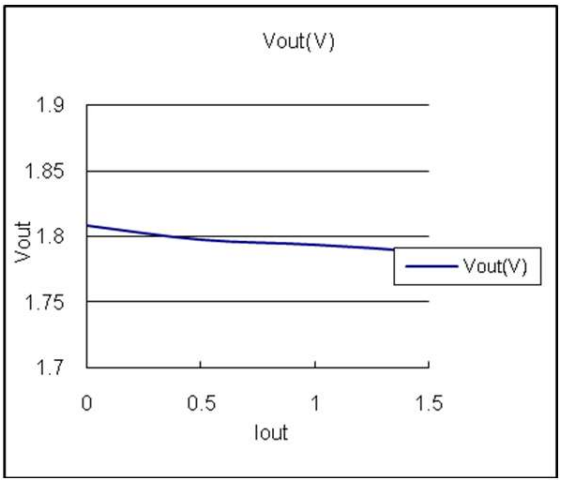
Note6: Over Voltage Lock out.
Note7: Guaranteed by design.

TYPICAL OPERATINGCHARACTERITICS

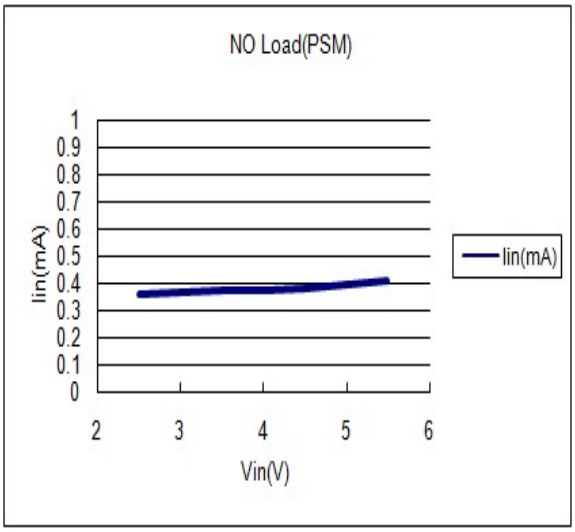
Efficiency_Vout=1.8V，Iout=0.5A



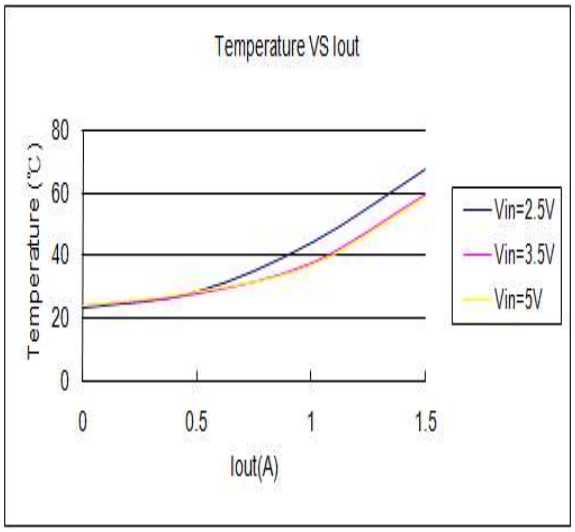
Load regulation_Vin



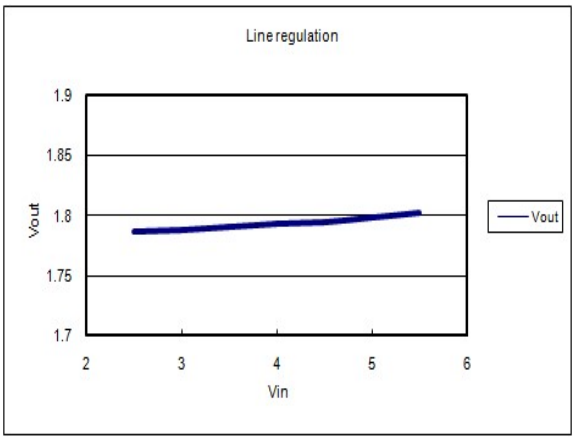
No load



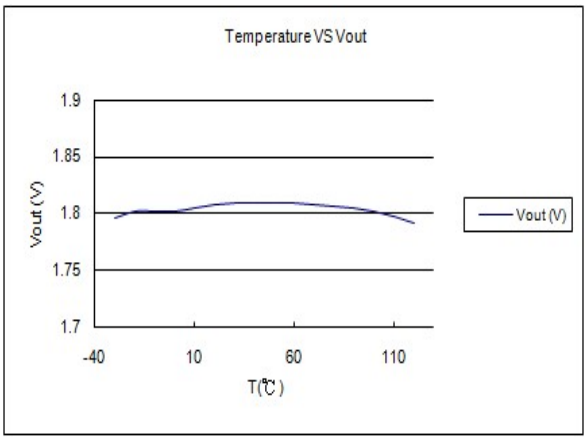
Iout VS Temperature



Line regulation_Iout=0.5A



Temperature vs Vout_Vin=5V，Load=18kΩ



APPLICATION INFORMATION

Normal Operation

The AT7171/AT7171E uses a user adjustable frequency, current mode, synchronous step-down architecture with internal power switch. During normal operation, the internal power switch is turned on each cycle when the oscillator sets the SR latch, and turned off when the comparator resets the SR latch. The peak inductor current at which comparator resets the SR latch is controlled by the output of error amplifier EA.

Setting the Output Voltage

Application circuit item shows the basic application circuit with adjustable output version. The external resistor sets the output voltage according to the following equation:

$V_{OUT}=V_{FB} \times (1+R1/R2)$

V_{FB} = 0.6V, R2 suggest 10k~300kΩ

Table 1 Resistor select for output voltage setting

VOUT	R2	R1
1.0V	150K	100K
1.2V	100K	100K
1.5V	100K	150K
1.8V	100K	200K
2.5V	47K	150K
3.3V	68K	300K

Dropout Operation

As the input supply voltage decreases to a value approaching the output voltage, the duty cycle increases toward the maximum on-time. Further reduction of the supply voltage forces the high-side switch to remain on for more than one cycle until it reaches 100% duty cycle. The output voltage is dropped from the input supply for the voltage which across the high-side switch.

Over Temperature Protection

In most applications the AT7171/AT7171E does not dissipate much heat due to high efficiency .But, in applications where the AT7171/AT7171E is running at high ambient temperature with low supply voltage and high duty cycles, such as in dropout, the heat dissipated may exceed the maximum junction temperature of the part. If the junction temperature reaches approximately 155°C, the internal high-side power switch will be turned off and the SW node will become high impedance.

Over Current Protection

The cycle-by-cycle current limit of T7171/AT7171E limits the peak inductor current to protect embedded switch from damage. Hence the maximum output current (the average of inductor current) is also limited. In case the load increases, the inductor current is also increase. Whenever the current limit level is reached, the output voltage cannot be regulated and starting to drop.

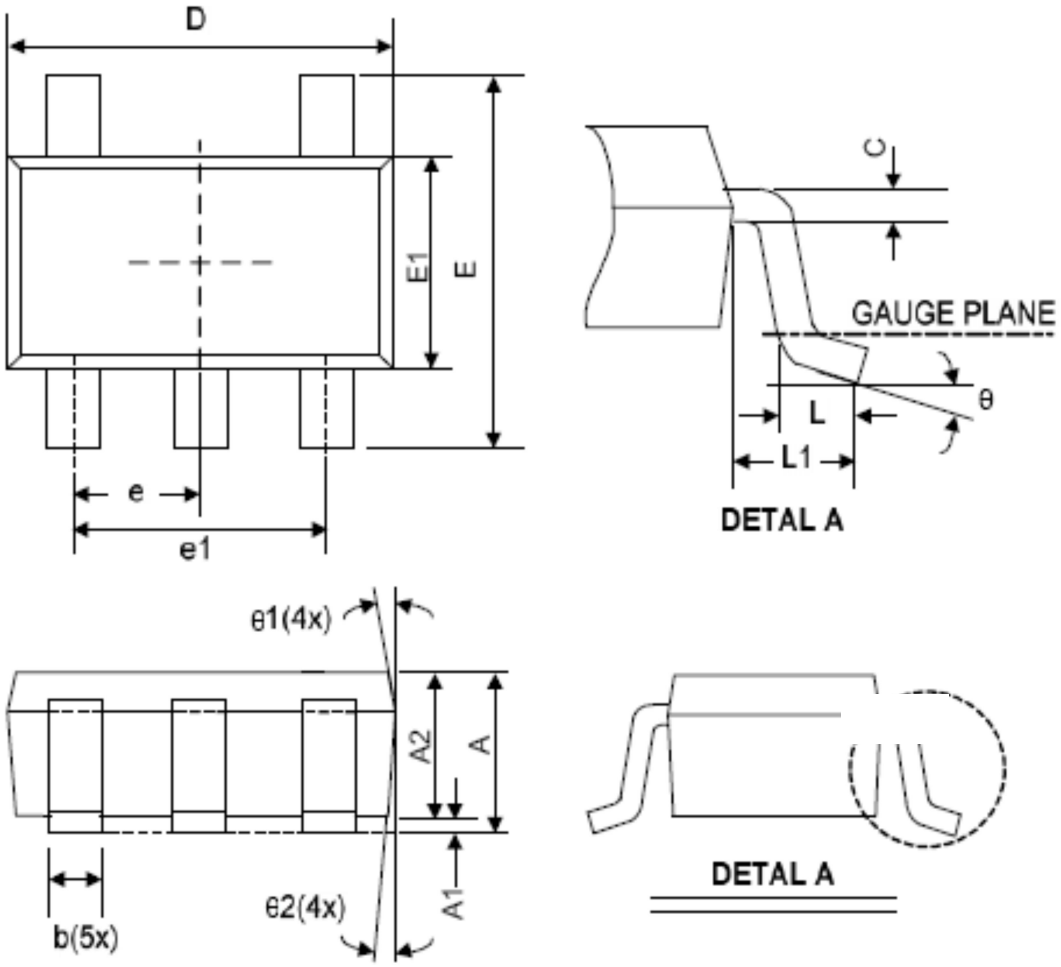
Soft-Start

The AT7171/AT7171E employs internal soft-start circuitry to reduce supply inrush current during startup conditions. When the device exits under-voltage lockout or shut-down mode, the soft-start circuitry will slowly ramp up the output voltage.

Short-circuit Protection

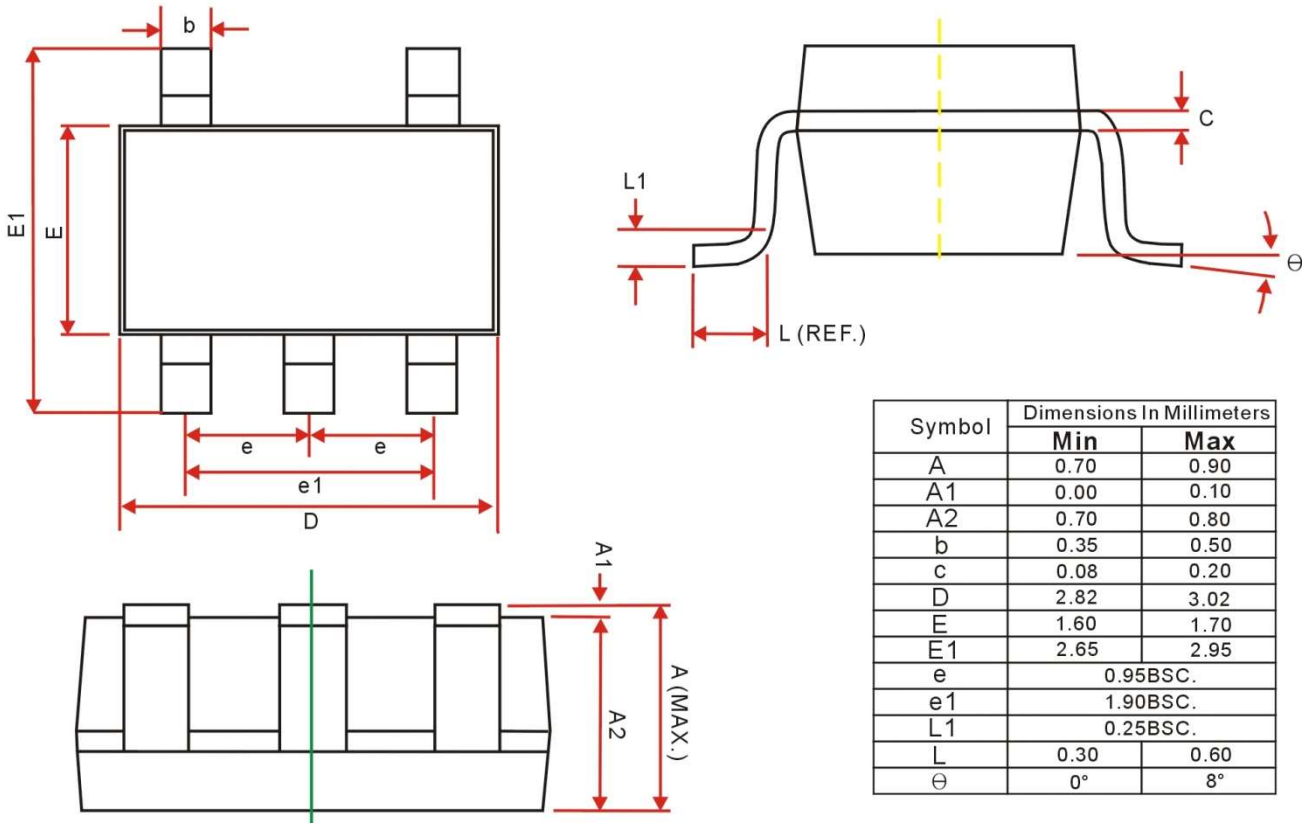
Short-circuit protection will activate once the feedback voltage falls below, and the operating frequency will be reducing normal switching frequency to reduce power delivered from input to output.

PACKAGE OUTLINE DIMENSIONS
SOT-25



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.05	-	1.35	0.041	-	0.053
A1	0.05	-	0.15	0.002	-	0.006
A2	1.00	1.10	1.20	0.039	0.043	0.047
b	0.30	-	0.50	0.012	-	0.020
C	0.08	-	0.22	0.003	-	0.009
D	2.80	2.90	3.00	0.110	0.114	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
E	2.60	2.80	3.00	0.102	0.110	0.118
L	0.30	-	0.60	0.012	-	0.024
L1	0.50	0.60	0.70	0.020	0.024	0.028
e1	1.80	1.90	2.00	0.071	0.075	0.079
e	0.85	0.95	1.05	0.033	0.037	0.041
θ	0°	4°	8°	0°	4°	8°
θ1	5°	10°	15°	5°	10°	15°
θ2	5°	10°	15°	5°	10°	15°

PACKAGE OUTLINE DIMENSIONS
TSOT-25



Symbol	Dimensions In Millimeters	
	Min	Max
A	0.70	0.90
A1	0.00	0.10
A2	0.70	0.80
b	0.35	0.50
c	0.08	0.20
D	2.82	3.02
E	1.60	1.70
E1	2.65	2.95
e	0.95BSC.	
e1	1.90BSC.	
L1	0.25BSC.	
L	0.30	0.60
θ	0°	8°

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