AT805

600mA Ultra Low Dropout Regulator

Immense Advance Tech.

FEATURES

- Typically 250mV Dropout @600mA
- Input Voltage Range: 1.8V to 5.5V
- Enable Function
- Over Current and Over Temperature Protection
- 5μA Quiescent Current in Shutdown
- P-CH Design to Reduce the Operation Current
- Full Industrial Temperature Range
- Adjustable Output Voltage Range 0.8V to 5V
- Output Voltage Accuracy ±2%
- Supply Current Typically 0.4mA
- Built-In Over Shoot Protection Circuit
- Ultra Fast Transient Response

APPLICATION

- Notebook Computers
- Battery Powered Systems
- Motherboards/Peripheral Cards
- Telecom/Networking Cards
- Industrial Applications
- Set Top Boxes
- Wireless Infrastructure
- Medical Equipment

DESCRIPTION

The AT805 is a high performance positive voltage regulator designed for use in applications requiring very low input voltage and very low dropout voltage at 600mA amps. It operates with a V_{IN} as low as 1.8V, with output voltage programmable as low as 0.8V. The AT805 features ultra low dropout, ideal for applications where V_{OUT} is very close to V_{IN}. Additionally, the AT805 has an enable pin to further reduce power dissipation while shut down. The enable pin may be tied to V_{IN} if it is not required for ON/OFF control. The AT805 provides excellent regulation over variations in line, load and temperature.

The adjustable output version that can be programmed from 0.8V to 5V with two external resistors.

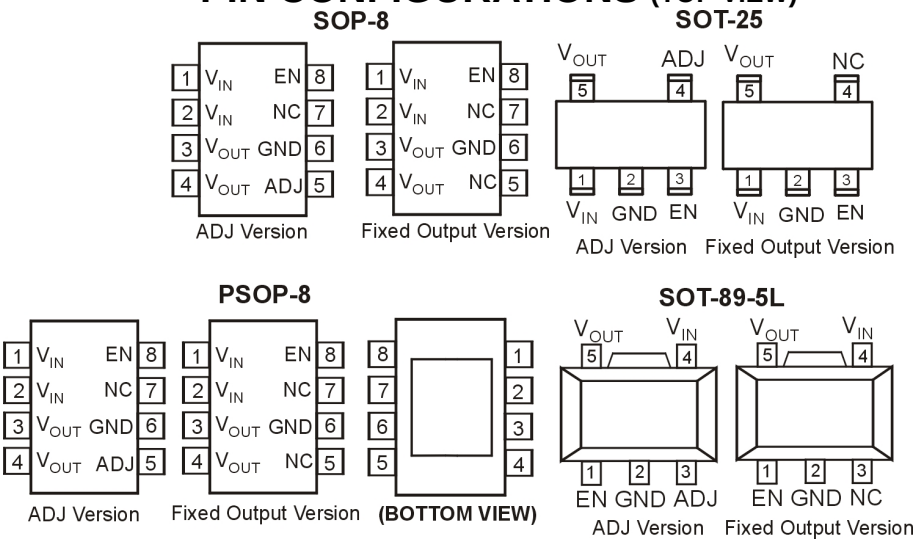
The optimum thermal condition has to consider the layout placement and application to achieve its satisfied high output current requirement.

ORDER INFORMATION

AT 805- X.X S8 R

- IAT
- Circuit Type
- Output Voltage:
  A: ADJ; 1.0: 1.0V
  1.2: 1.2V, 1.5: 1.5V
  1.8: 1.8V, 2.5: 2.5V
  2.8: 2.8V, 3.0: 3.0V
  3.3: 3.3V
- S8: SOP-8
  SF8: PSOP-8
  KE: SOT-25
  KG5: SOT-89-5L
- Shipping:
  R: Tape & Reel
  T: Tube

PIN CONFIGURATIONS (TOP VIEW)



PIN DESCRIPTIONS

Pin Name	Pin Description
EN	Enable Input. Pulling this pin below 0.4V turn the regulator off, reducing the quiescent current to a fraction of its operating value. The device will be enabled if this pin is left open. Connect to V_{IN} if not being used.
V_{IN}	Input Voltage. A large bulk capacitance should be placed closely to this pin to ensure that the input supply does not sag below 1.8V.
V_{OUT}	The pin is the power output of the device.
ADJ	For the adjustable versions of the AT805. This is the input to the error amplifier. The ADJ reference voltage is 0.8Vreferenced to ground. The output range is 0.8V to 5V: $V_{OUT} = \frac{0.8(R1+R2)}{R2}$ Volts
GND	Reference Ground.
PG	Power Good. Assert high once V_{OUT} reaches 92% of its rating voltage. Open-drain output.

TYPICAL APPLICATION CIRCUITS

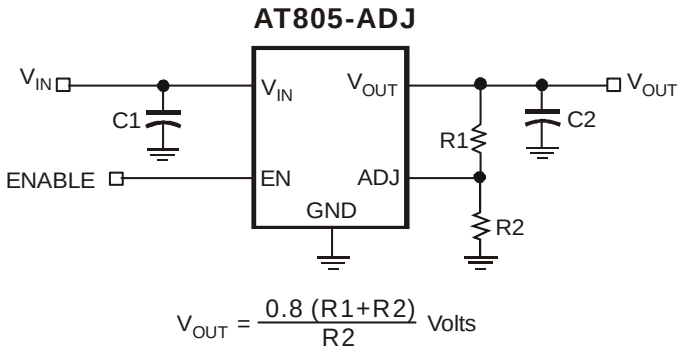


Figure 1. Adjustable Voltage Regulator

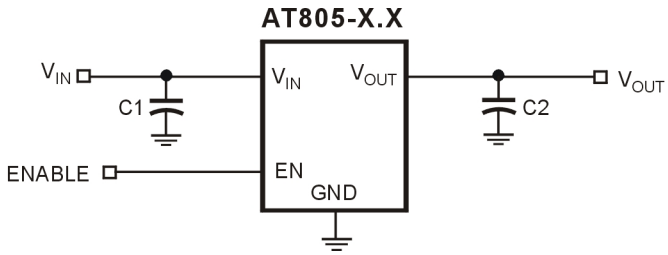
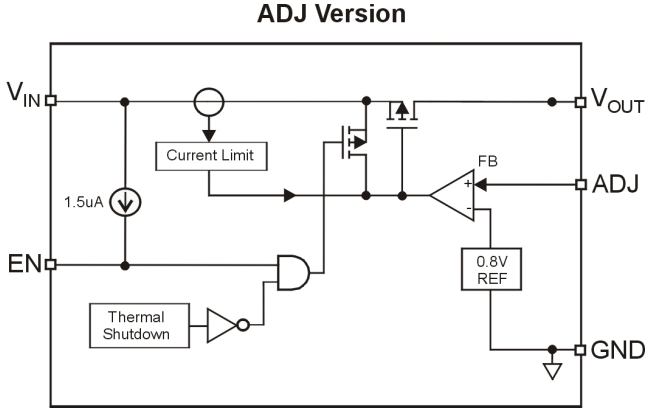
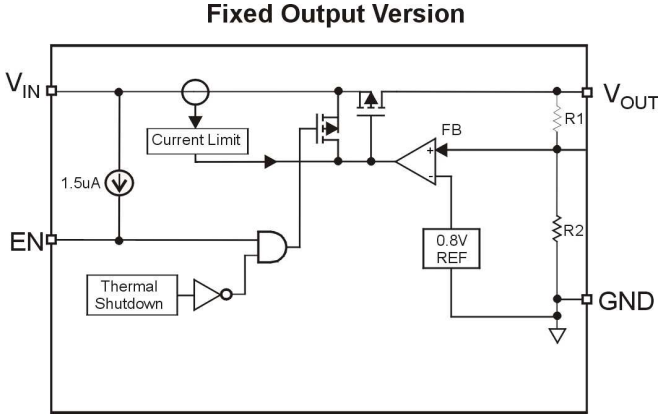


Figure 2. Fixed Voltage Regulator

BLOCK DIAGRAM





ABSOLUTE MAXIMUM RATINGS (Note 1)

Parameter		Symbol	Max Value	Unit
Supply Voltage, V_{IN}		V_{IN}	6	V
Control Voltage, EN		EN	6	V
Output Voltage, V_{OUT}		V_{OUT}	6	V
Junction Temperature		T_J	125	℃
Lead Temperature(Soldering) 5 Sec.		T_{LEAD}	260	℃
Storage Temperature Range		T_{STG}	-65 to +150	℃
Power Dissipation, P_D @ T_A=25℃(Note 2)	SOT-25	P_D	300	mW
	SOT-89-5L		641	
	SOP-8		625	
	PSOP-8		2770	
Thermal Resistance Junction to Ambient	SOT-25 (Note 3)	Θ_{JA}	333	℃/W
	SOT-89-5L		156	
	SOP-8		160	
	PSOP-8 (Note 4)		36	
Thermal Resistance Junction to Case	SOT-25	Θ_{JC}	106.6	℃/W
	PSOP-8		5.5	
ESD Rating (Human Body Model) (Note 5)		V_{ESD}	2	kV

RECOMMENDED OPERATING CONDITIONS (Note 3)

Parameter	Symbol	Operation Conditions	Unit
Supply Voltage, V_{IN}	V_{IN}	5.5	V
Operating Junction Temperature Range	T_J	-40 to +125	℃
Operating Ambient Temperature Range	T_A	-40 to +85	℃

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℃.

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

Note 4: 2 square inch of FR-4, double sided, 1 oz. minimum copper weight.

Note 5: Devices are ESD sensitive. Handling precaution recommended.

Note 6: The device is not guaranteed to function outside its operating conditions.

ELECTRICAL CHARACTERISTICS

Unless specified: V_{EN}=V_{IN}. Adjustable version: V_{IN}= 3.3V and I_{LOAD} =10μA to 600mA,
Fixed version: V_{IN}= V_{OUT} + 0.8V and I_{LOAD}=10μA to 600mA. T_A =T_J =25℃

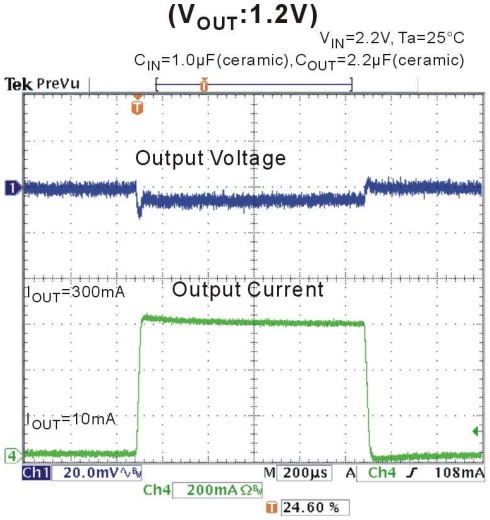
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
V_{IN}						
Supply Voltage Range	V_{IN}		1.8		5.5	V
Supply current	I_{SS}			0.4	1.45	mA
Quiescent Current	I_Q	V_{IN}= 5.5V, V_{EN}=0V		5	10	μA
V_{OUT}						
Output Voltage Accuracy (Note 7)	V_{OUT}	V_{IN}=V_{OUT} + 0.8V, I_{LOAD}= 10mA	-2.0	V_{OUT}	2.0	%
Line Regulation (Note 7)	Reg_line	V_{IN}=(V_{OUT} + 0.8V) to 5.5V, I_{LOAD} =10mA	-1.0		1.0	%/V
Load Regulation (Note 7)	Reg_load	V_{OUT}≤ 2V V_{IN}=(V_{OUT}+0.8V),10mA≤I_{LOAD}≤600mA V_{OUT} >2V		0.1	2.0 1.0	%
Dropout Voltage (Note 7,8)	V_D	1.0V≤V_{OUT}<1.2V Fix. 1.2V≤V_{OUT}≤1.5V, I_{LOAD}=600mA 1.5V< V_{OUT}		 550 250	800 650 350	mV
		Adj. V_{OUT} =2.5V I_{LOAD}=600mA		250	350	
Current Limit (Note 7,9)	I_{CL}			900		mA
ADJ (Adjustable Version Only)						
Reference Voltage (Note 7)	V_{TH_ADJ}	V_{IN}= 3.3V, V_{ADJ} =V_{OUT}, I_{LOAD}=10mA	0.788	0.8	0.812	V
Adjust Pin Current (Note 10)	V_{ADJ}	V_{ADJ}= V_{REF}		80	200	nA
EN						
Enable Pin Current	I_{EN}	V_{EN} = 0V		1.5	10	μA
Enable Pin Threshold	V_{IH}		1.6			V
	V_{IL}				0.4	V
Over Temperature Protection						
High Trip Level	T_{HI}			160		℃
Hysteresis	T_{HYST}			20		℃

Note 7: Low duty cycle pulse testing with Kelvin connections required.
Note 8: Defined as the input to output differential at which the output voltage drops to 2% below the value measured at a differential of 0.8V.
Note 9: Guaranteed by design.
Note 10: Required to maintain regulation. Voltage set resistors R1 and R2 are usually utilized to meet this requirement.

TYPICAL CHARACTERISTICS

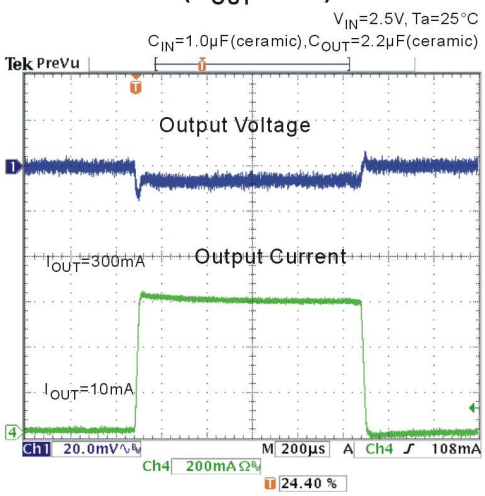
Load Transient Response

(V_{OUT}:1.2V)



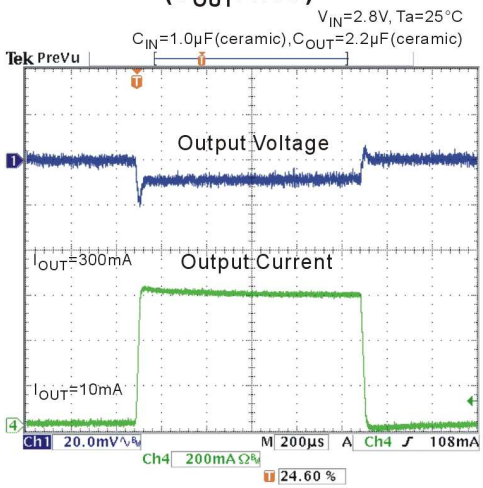
Time (200usec/div)

(V_{OUT}:1.5V)



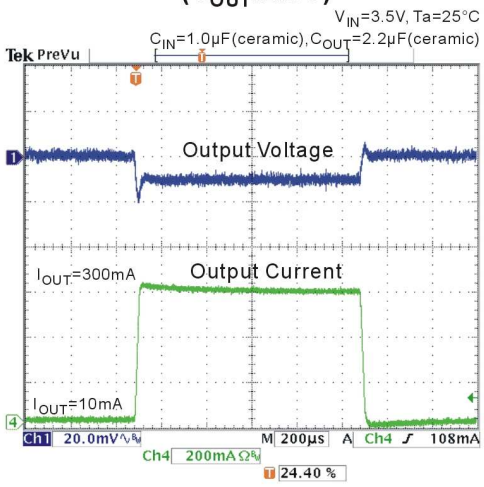
Time (200usec/div)

(V_{OUT}:1.8V)



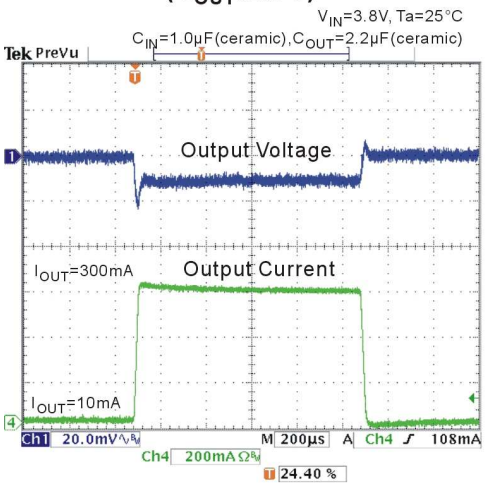
Time (200usec/div)

(V_{OUT}:2.5V)



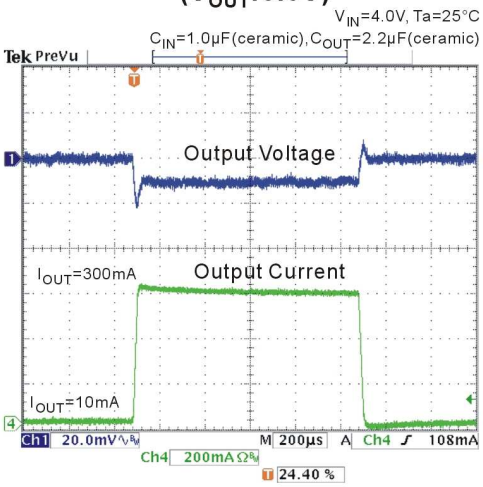
Time (200usec/div)

(V_{OUT}:2.8V)



Time (200usec/div)

(V_{OUT}:3.0V)

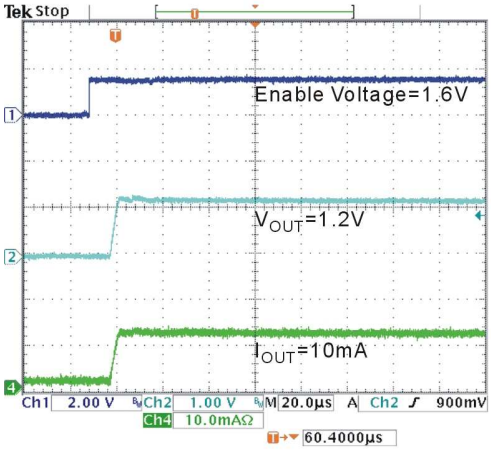


Time (200usec/div)

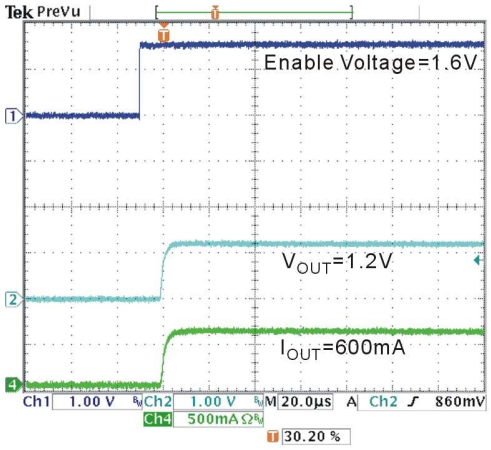
TYPICAL OPERATING CHARACTERISTICS (CONTINUED)

Start Up

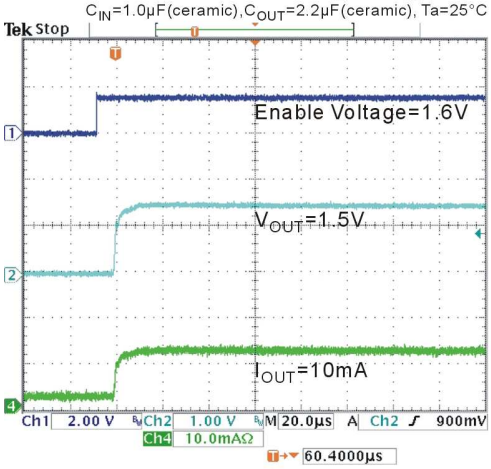
V_{IN}=2.2V,I_{OUT}=10mA
C_{IN}=1.0μF(ceramic),C_{OUT}=2.2μF(ceramic), Ta=25°C



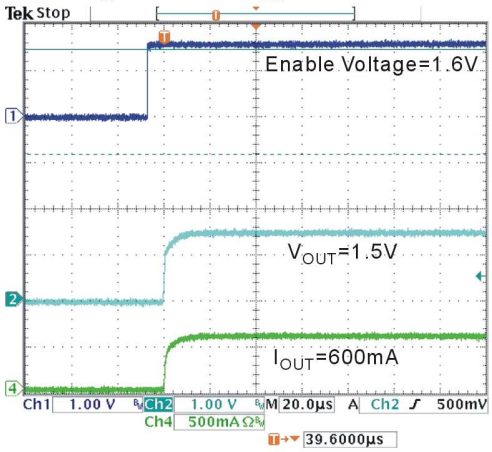
V_{IN}=2.2V,I_{OUT}=600mA
C_{IN}=1.0μF(ceramic),C_{OUT}=2.2μF(ceramic), Ta=25°C



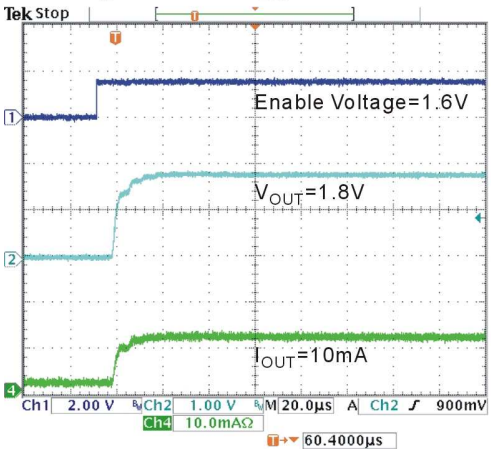
V_{IN}=2.5V,I_{OUT}=10mA
C_{IN}=1.0μF(ceramic),C_{OUT}=2.2μF(ceramic), Ta=25°C



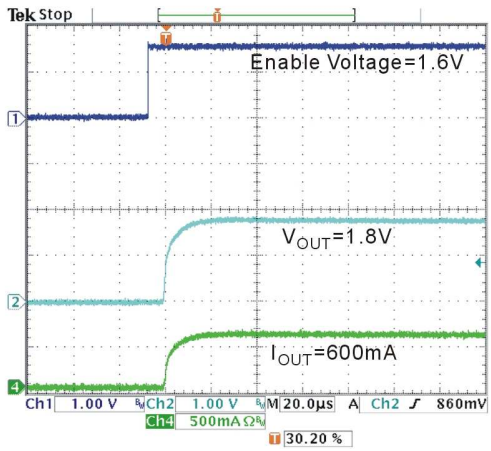
V_{IN}=2.5V,I_{OUT}=600mA
C_{IN}=1.0μF(ceramic),C_{OUT}=2.2μF(ceramic), Ta=25°C



V_{IN}=2.8V,I_{OUT}=10mA
C_{IN}=1.0μF(ceramic),C_{OUT}=2.2μF(ceramic), Ta=25°C



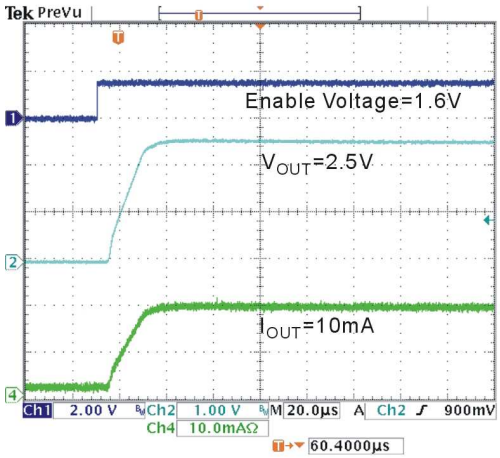
V_{IN}=2.8V,I_{OUT}=600mA
C_{IN}=1.0μF(ceramic),C_{OUT}=2.2μF(ceramic), Ta=25°C



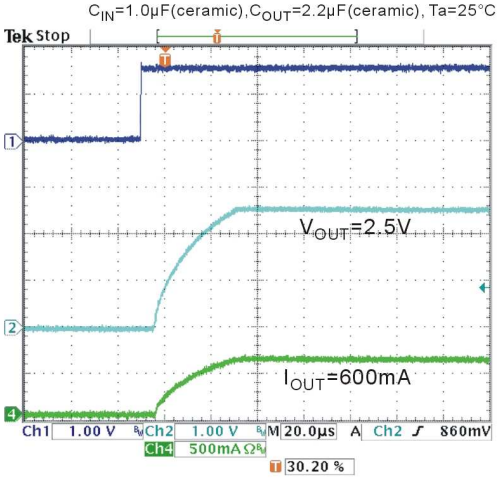
TYPICAL OPERATING CHARACTERISTICS (CONTINUED)

Start Up

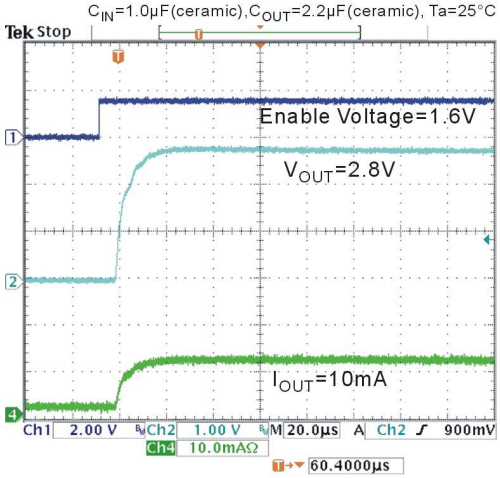
V_{IN}=3.5V,I_{OUT}=10mA
C_{IN}=1.0μF(ceramic),C_{OUT}=2.2μF(ceramic), Ta=25°C



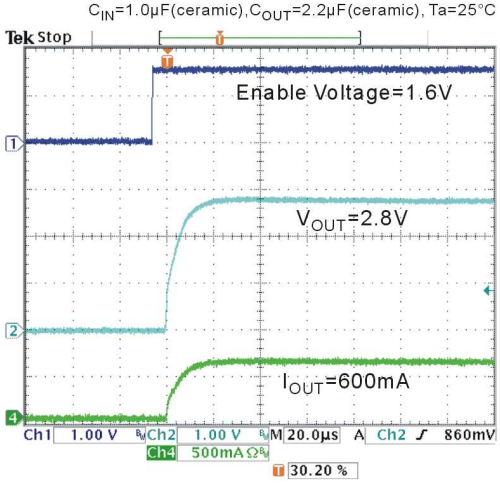
V_{IN}=3.5V,I_{OUT}=600mA
C_{IN}=1.0μF(ceramic),C_{OUT}=2.2μF(ceramic), Ta=25°C



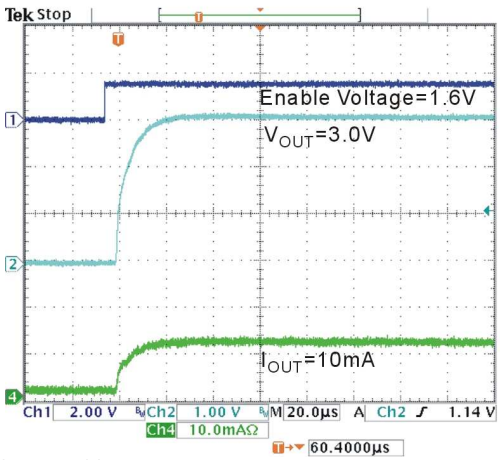
V_{IN}=3.8V,I_{OUT}=10mA
C_{IN}=1.0μF(ceramic),C_{OUT}=2.2μF(ceramic), Ta=25°C



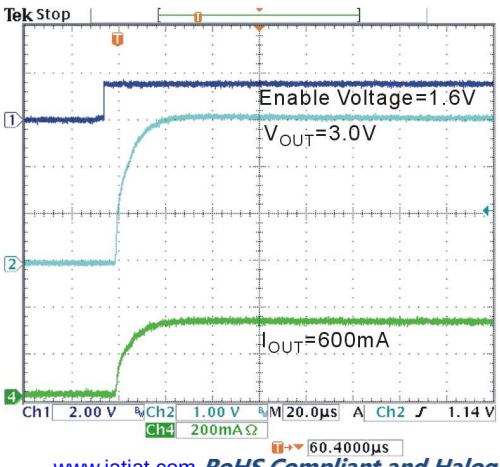
V_{IN}=3.8V,I_{OUT}=600mA
C_{IN}=1.0μF(ceramic),C_{OUT}=2.2μF(ceramic), Ta=25°C



V_{IN}=4.0V,I_{OUT}=10mA
C_{IN}=1.0μF(ceramic),C_{OUT}=2.2μF(ceramic), Ta=25°C

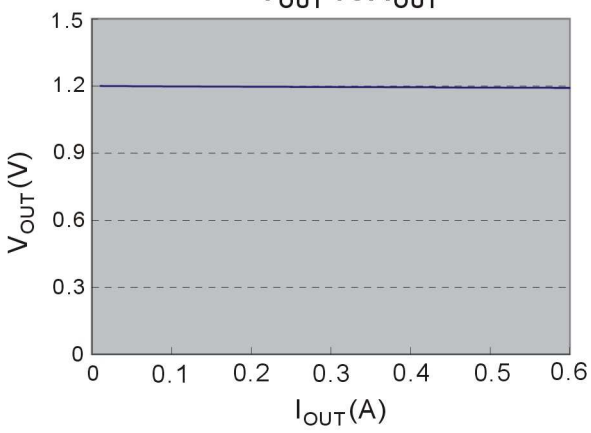


V_{IN}=4.0V,I_{OUT}=600mA
C_{IN}=1.0μF(ceramic),C_{OUT}=2.2μF(ceramic), Ta=25°C



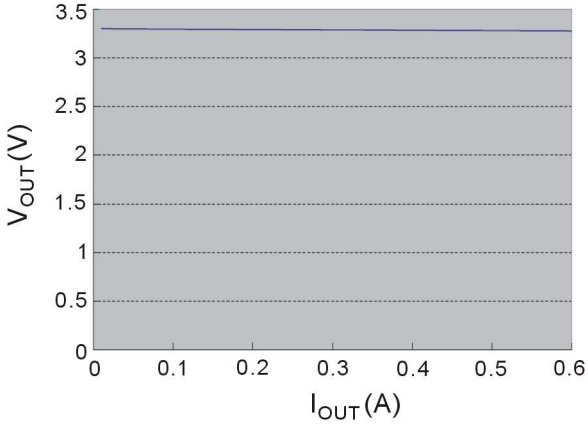
TYPICAL OPERATING CHARACTERISTICS (CONTINUED)

V_{OUT} vs. I_{OUT}



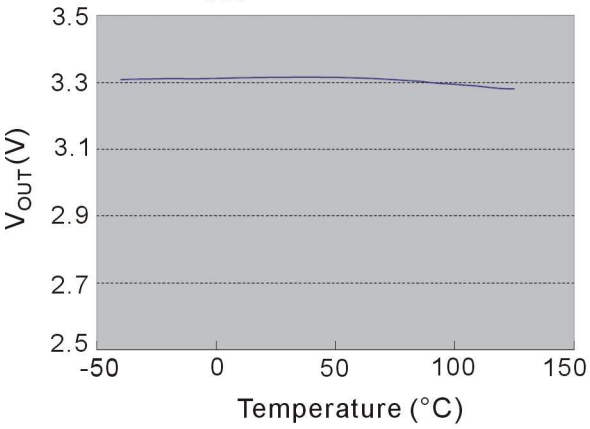
C_{IN}= C_{OUT}=1μF, V_{IN}=2.2V, V_{OUT}=1.2V

V_{OUT} vs. I_{OUT}

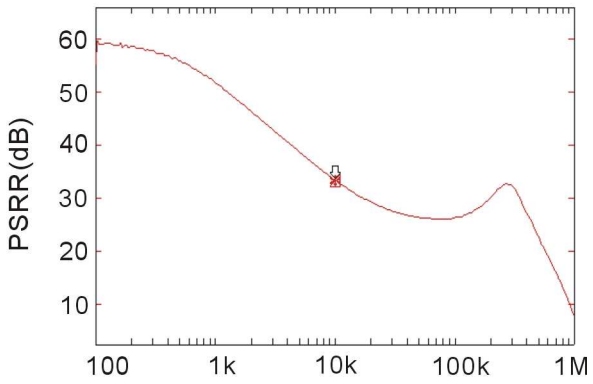


C_{IN}= C_{OUT}=1μF, V_{IN}=4.3V, V_{OUT}=3.3V

V_{OUT} vs. Temperature

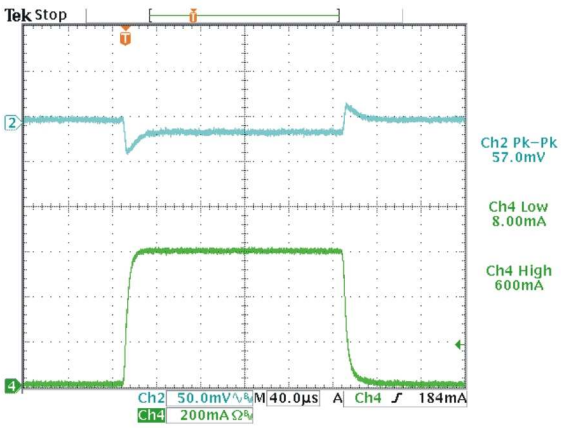


PSRR



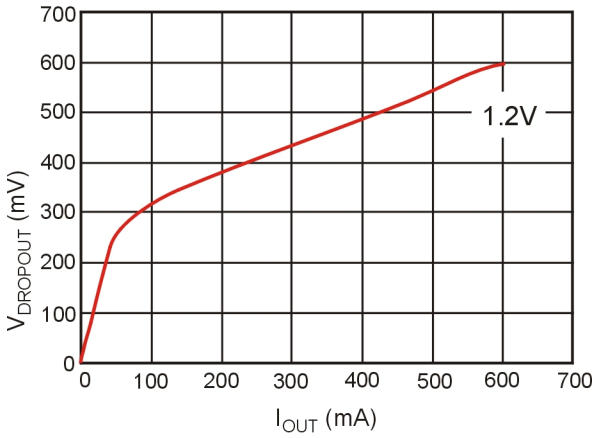
V_{IN}=4.3V, V_{OUT}=3.3V, I_{OUT}=10mA
V_{PP}=0.25V_{P-P}, C_{IN}= C_{OUT}=1μF

Load Transient Response



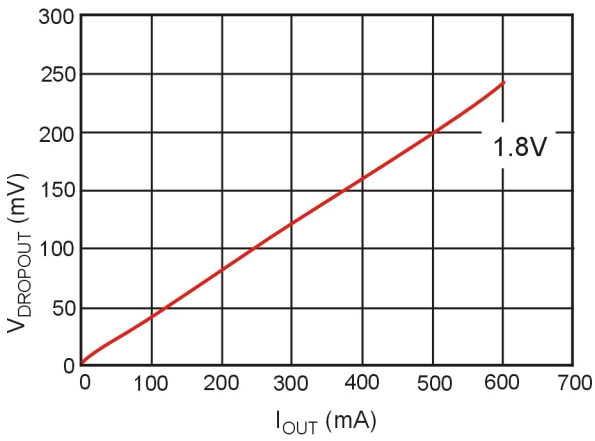
C_{IN}= C_{OUT}=1uF, V_{OUT}=3.3V, I_{OUT}=10 to 600mA

I_{OUT} vs. $V_{DROPOUT}$ (V_{OUT}=1.2V)

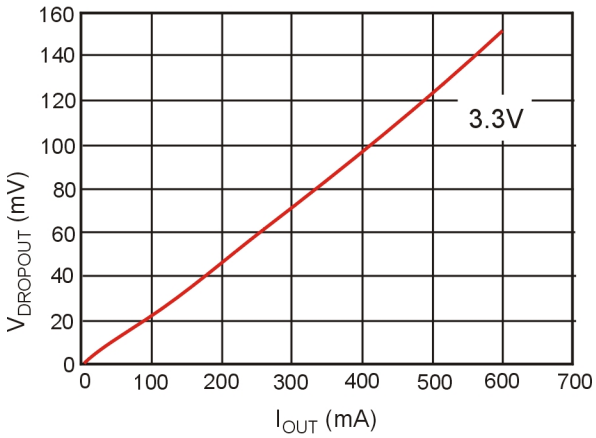


TYPICAL OPERATING CHARACTERISTICS (CONTINUED)

I_{OUT} vs. $V_{DROPOUT}$ (V_{OUT}=1.8V)



I_{OUT} vs. $V_{DROPOUT}$ (V_{OUT}=3.3V)



APPLICATION INFORMATION

Introduction

The AT805 is intended for applications where high current capability and very low dropout voltage are required. It provides a very simple, low cost solution that uses very little PCB real estate. Additional features include an enable pin to allow for a very low power consumption standby mode.

Component Selection

Input Capacitor: A minimum of 1μF ceramic capacitor is recommended to be placed directly next to the V_{IN} pin. This allows for the device being some distance from any bulk capacitance on the rail. Additionally, bulk capacitance of about 1001μF may be added closely to the input supply pin of the AT805 to ensure that V_{IN} does not sag, improves load transient response.

Output Capacitor: A minimum of 2.2μF ceramic capacitor is recommended. Increasing the bulk capacitance will improve the overall transient response. The use of multiple lower value ceramic capacitors in parallel to achieve the desired bulk capacitance will not cause stability issues. Although designed for use with ceramic output capacitors, and thus will also work comfortably with tantalum output capacitors.

External Voltage Selection Resistors: The use of 1% resistors, and consider for system stability and power losing, we recommend to design high dividing resistance (R1≦100KΩ) to strengthen the benefits which AT805 has inherent.

Noise Immunity: In very electrically noisy environments, it is recommended that 0.1μF ceramic capacitors be placed from V_{IN} to GND and V_{OUT} to GND as close to the device pins as possible.

Parallel a small cap (ex:100p) would be recommended to improve the transient response.

Thermal Considerations

The power dissipation in the AT805 is approximately equal to the product of the output current and the input to output voltage differential:

$$P_D \approx (V_{IN} - V_{OUT}) \times I_{LOAD}$$

The absolute worst-case dissipation is given by:

$$P_{D(MAX)}=(V_{IN(MAX)}-V_{OUT(MIN)})xI_{LOAD(MAX)} + V_{IN(MAX)}xI_{G(MAX)}$$

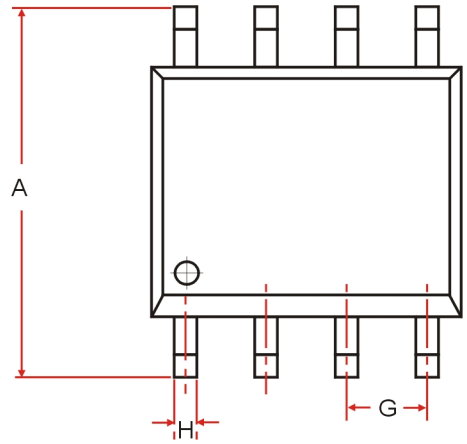
For a typical scenario, V_{IN} =3.3V ± 5%, V_{OUT}=2.8V and I_{LOAD} =0.6A, therefore: $V_{IN(MAX)}$=3.465V,$V_{OUT(MIN)}$=2.744V and $I_{G(MAX)}$=1.45μA,Thus $P_{D(MAX)}$=0.437W.

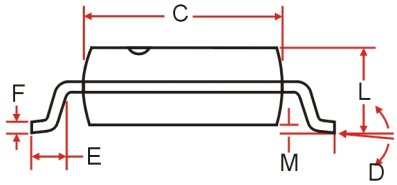
Using this formula, and assuming $T_{A(MAX)}$=85℃, we can calculate the maximum thermal impedance allowable to maintain $T_J \leq 125℃$

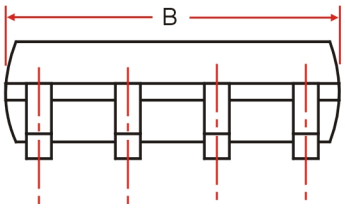
$$R_{\theta(J-A)(MAX)} = \frac{(T_{J(MAX)} - T_{A(MAX)})}{P_{D(MAX)}} = \frac{(125-85)}{0.437} = 91.5°C/W$$

PACKAGE OUTLINE DIMENSIONS

SOP-8 PACKAGE OUTLINE DIMENSIONS

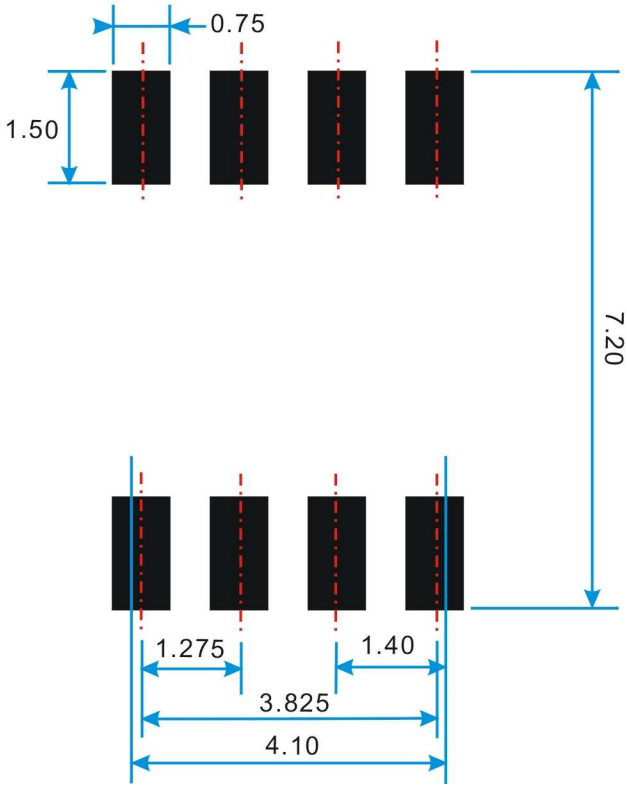






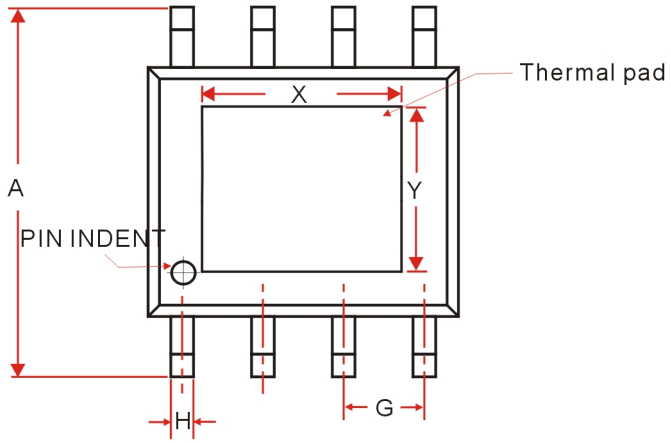
REF.	DIMENSIONS Millimeters	
	Min.	Max.
A	5.80	6.20
B	4.80	5.00
C	3.80	4.00
D	0°	8°
E	0.40	0.90
F	0.15	0.26
M	0	0.25
H	0.31	0.51
L	1.35	1.75
G	1.27 TYP.	

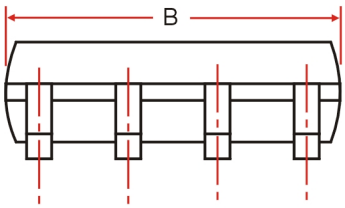
SOP-8 PACKAGE FOOTPRINT(mm)

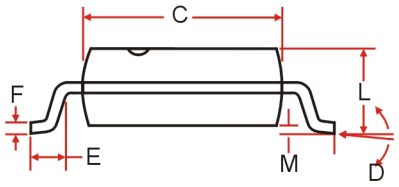


PACKAGE OUTLINE DIMENSIONS

PSOP-8 PACKAGE OUTLINE DIMENSIONS

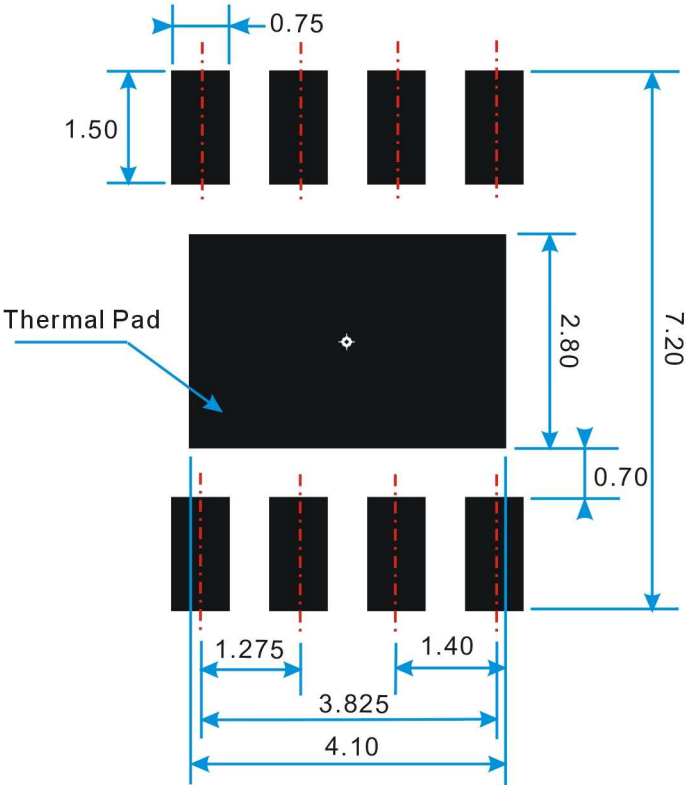






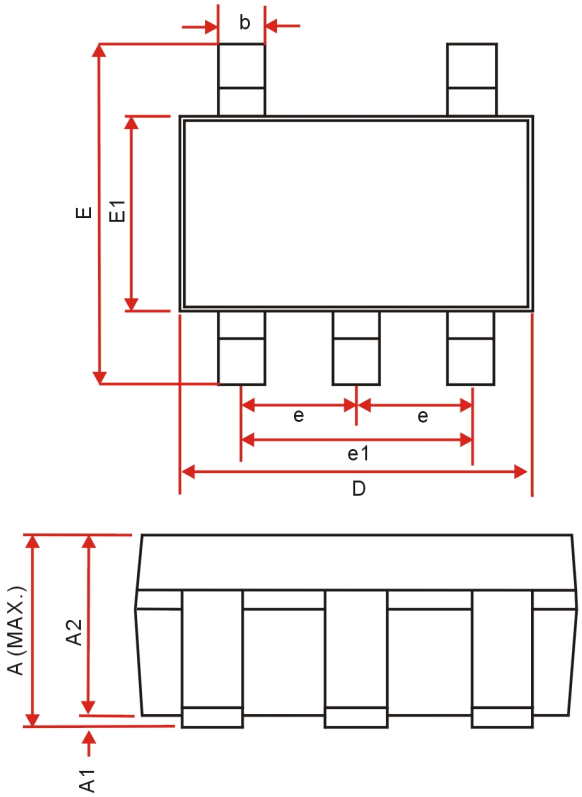
REF.	DIMENSIONS	
	Millimeters	
	Min.	Max.
A	5.80	6.20
B	4.80	5.00
C	3.80	4.00
D	0°	8°
E	0.40	0.90
F	0.15	0.26
M	0	0.25
H	0.31	0.51
L	1.35	1.75
G	1.27 TYP.	
X	3.30 TYP.	
Y	2.50 TYP.	

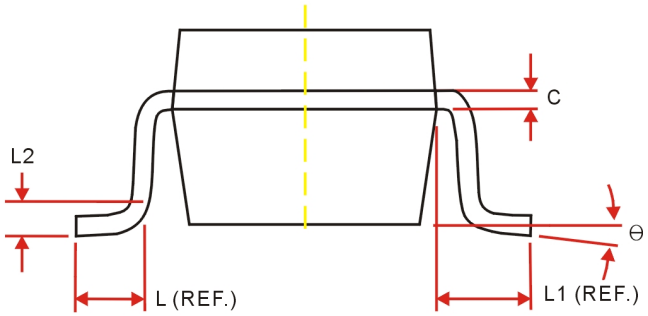
PSOP-8 PACKAGE FOOTPRINT(mm)



PACKAGE OUTLINE DIMENSIONS

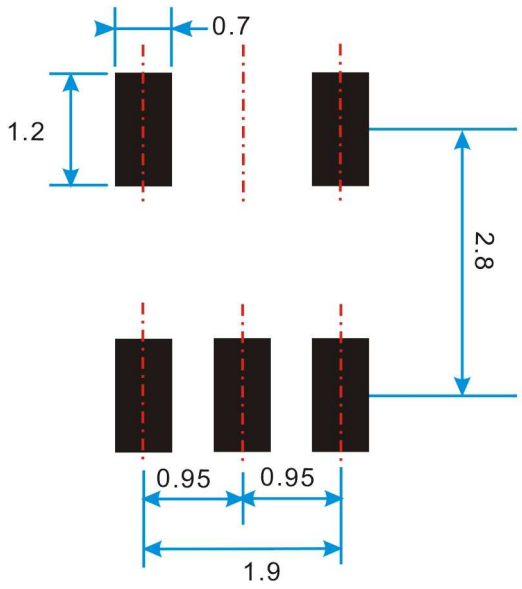
SOT-25 PACKAGE OUTLINE DIMENSIONS





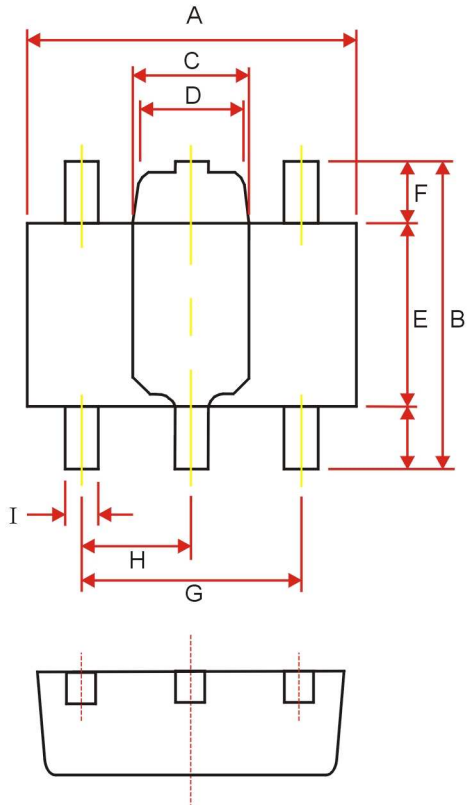
Symbol	Dimensions In Millimeters	
	Min.	Max.
A	1.45 MAX.	
A1	0	0.15
A2	0.90	1.30
C	0.08	0.22
D	2.90 BSC.	
E	2.80 BSC.	
E1	1.60 BSC.	
L	0.30	0.60
L1	0.60BSC.	
L2	0.25BSC.	
Θ	0°	10°
b	0.30	0.50
e	0.95BSC.	
e1	1.90BSC.	

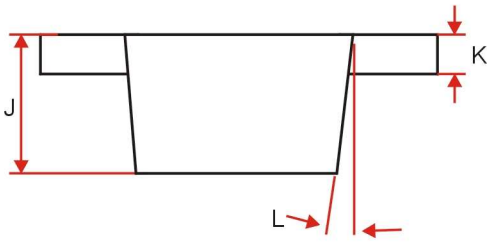
SOT-25 PACKAGE FOOTPRINT (mm)



PACKAGE OUTLINE DIMENSIONS

SOT-89-5L PACKAGE OUTLINE DIMENSIONS





REF.	Dimensions In Millimeters	
	Min.	Max.
A	4.40	4.60
B	4.05	4.25
C	1.40	1.80
D	1.30	1.50
E	2.28	2.60
F	0.80	1.20
G	3.00 REF.	
H	1.50 REF.	
I	0.32	0.56
J	1.40	1.60
K	0.35	0.45
L	5°TYP.	