300mA Low Drop-out Linear Regulator

Features

- Low Dropout Voltage of 250mV at 300mA
- Guaranteed 300mA Output Current
- Very Low Quiescent Current of about 30µA
- Output Voltage Accuracy of ±2% for 1.5V~3.6V
- Needs only 1µF Capacitor for Stability
- Thermal Shutdown Protection
- Current Limit Protection
- Low-ESR Ceramic Capacitor for Output Stability
- Tiny SOT-23 and SOT-89 packages
- RoHS-compliant and Halogen-free

Applications

- DVD, CD-ROM and CD/RW drives
- Wireless Devices
- LCD Modules
- Battery Power Systems
- Card Readers
- XDSL Routers

Description

The APE8800-3 series are low dropout, positive linear regulators with very low quiescent current, and can supply 300mA of output current with a low drop-out voltage of 250mV.

The APE8800-3 regulator is able to operate with output capacitors as small as 1µF for stability. As well as current limit protection, the APE8800-3 also offers an on-chip thermal shutdown feature providing protection against overload or conditions where the junction temperature exceeds the specified thermal shutdown temperature.

The APE8800-3 is available with several fixed output voltages from 1.5V to 3.6V, and is packaged in low-profile, space-saving 3-lead SOT-23 and SOT-89 packages.

Typical Application Circuit

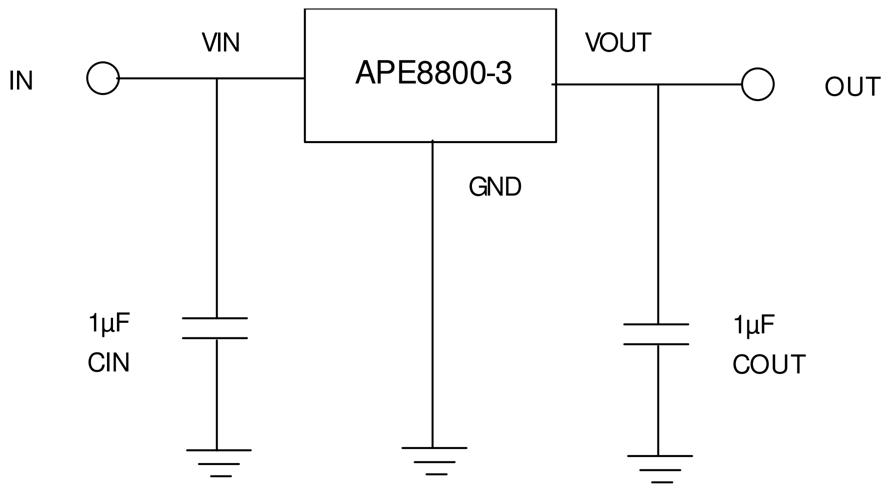


Figure 1. Typical Application Circuit of APE8800

Note : To prevent oscillation, it is recommended to use X7R or X5R dielectric capacitors of at least 1µF if ceramic capacitors are used on the input or output .

Ordering Information

APE8800xx-yy-HF-3TR

Package Type:
N : RoHS-compliant halogen-free SOT-23
G/GR : RoHS-compliant halogen-free SOT-89

Fixed Output Voltage Options
yy = 15 : 1.5V 18 : 1.8V
25 : 2.5V 28 : 2.8V
30 : 3.0V 33 : 3.3V
36 : 3.6V

Packing:
TR : Products are shipped on tape and reel: 3000pcs/reel for SOT-23.
1000pcs/reel for SOT-89.

The device is rated MSL3 for moisture sensitivity, and the reel is packed in a moisture-barrier bag.

Absolute Maximum Ratings (at T_A=25℃)

Input Voltage (VIN) -- 6V
Power Dissipation, SOT-23 ------------------------ 0.4W
SOT-89 ------------------------ 0.57W

Lead Temperature (Soldering, 10 sec.) T_{LEAD} ------ 260℃
Storage Temperature Range --------------------------- -65℃ to +150℃
Maximum Junction Temperature ---------------------- 150℃
Maximum Thermal Resistance, Junction-ambient:
SOT-23 ------- 250℃/W
SOT-89 ------- 175℃/W

Recommended Operating Conditions

Input Voltage (VIN) --------------------------------------- 2.8 to 5.5V
Operating Junction Temperature Range (T_J) ------ -40°C to +125°C
Ambient Temperature (T_A) ----------------------------- -40°C to +85°C

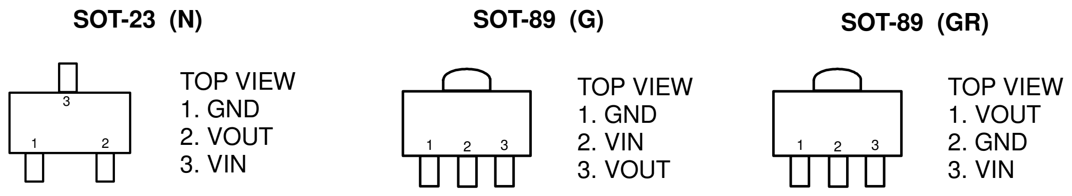
Electrical Specifications

(V_{IN}=V_{OUT}+1V or V_{IN}=2.8V whichever is greater, C_{IN}=1uF, C_{OUT}=1uF, T_A=25°C, unless otherwise specified)

Parameter	SYM	TEST CONDITION	MIN	TYP	MAX	UNITS
Output Voltage Accuracy	ΔV_{OUT}	I_O= 1mA	-2	-	2	%
Current Limit	I_{LIMIT}	R_{Load}=1Ω	300		-	mA
Quiescent Current	I_Q	I_O= 0mA	-	30	50	μA
Dropout Voltage (Note 1)	VDROP	I_O=300mA, 1.2V<V_{OUT}<2.0V I_O=300mA, 2.0V<V_{OUT}<2.8V I_O=300mA, 2.8V<V_{OUT}<4.5V		1100 350 250		mV mV mV
Line Regulation	ΔV_{LINE}	I_O=1mA, V_{IN}=V_{OUT} +1V to 5V	-	1	5	mV
Load Regulation (Note 2)	ΔV_{LOAD}	I_O=0mA to 300mA	-	6	20	mV
Ripple Rejection	PSRR	Io=1mA, C_{OUT}=1uF, f_{RIPPLE} = 120Hz	-	60	-	dB
Temperature Coefficient	TC	I_{OUT} = 1mA, V_{IN} = 5V	-	50	-	ppm/ °C
Thermal Shutdown Temperature	TSD		-	160	-	°C
Thermal Shutdown Hysteresis	ΔTSD		-	25	-	°C

Note 1: The dropout voltage is defined as V_{IN}-V_{OUT}, which is measured when V_{OUT} drops about 100mV.
Note 2: Regulation is measured at a constant junction temperature by using pulse current and load regulation in the load range from 0mA to 300mA.

Pin Configuration



Pin Descriptions

Pin Symbol	Pin Function
VIN	Power is supplied to the device through this pin and requires an input filter capacitor. In general, an input capacitor in the range of 1µF to 10µF is sufficient.
VOUT	The output supplies power to loads. The output capacitor is required to provide a stable output voltage. The APE8800-3 is stable with an output capacitor of 1µF or greater. A larger output capacitor will be required for applications with large transient loads to limit peak voltage transients, and can also reduce output noise, improve stability and PSRR.
GND	Common ground pin

Block Diagram

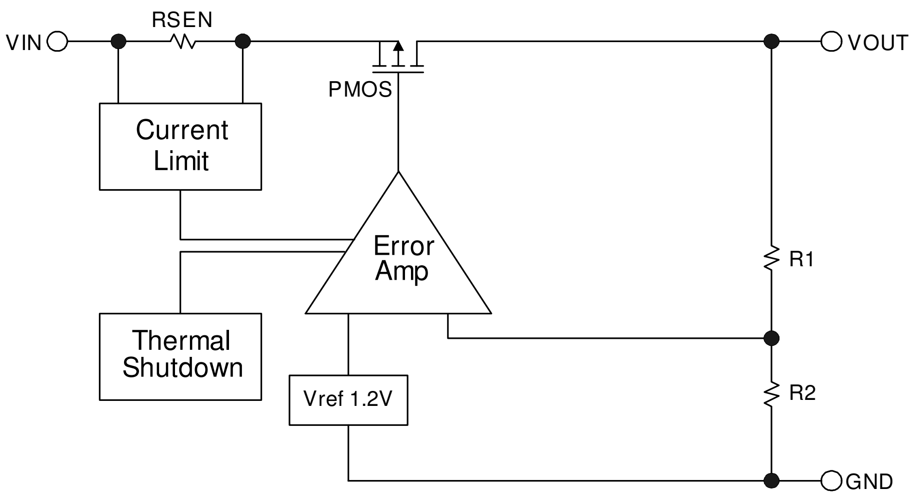


Figure 2. Block diagram of APE8800-3

Application Description

The APE8800-3 series are low dropout linear regulators that can provide 300mA output current with a drop-out voltage of about 2-300mV. Also, current limit and on-chip thermal shutdown features provide protection against any combination of overload or junction temperature that exceeds the shutdown temperature.

1.Output and Input Capacitor

The APE8800-3 regulator is designed to be stable with a wide range of output capacitors. The ESR of the output capacitor affects stability. Larger values of the output capacitor decrease the peak deviations and provide improved transient response for larger current changes.

The various capacitor types (aluminum, ceramic, tantalum) have different characteristics such as temperature and voltage coefficients. All ceramic capacitors are manufactured with a variety of dielectrics, each with different behavior across temperature and applications. Common dielectrics used are X5R, X7R and Y5V. It is recommended to use 1uF to 10uF X5R or X7R dielectric ceramic capacitors with 30mΩ to 50mΩ ESR range between device outputs to ground for transient stability. The APE8800-3 is designed to be stable with low ESR ceramic capacitors, and higher values of capacitors and ESR can improve output stability. So the ESR of the output capacitor is very important because it generates a zero to provide phase lead for loop stability.

There are no requirements for the ESR on the input capacitor, but its voltage and temperature coefficient have to be considered for the device application environment.

2.Protection Features

In order to prevent overloading or a thermal condition from damaging the device, the APE8800-3 regulator has internal thermal and current-limiting functions designed to protect the device. It will rapidly shut off the internal P-channel MOSFET pass element during overloading or an over-temperature condition.

3.Thermal Consideration

The power handling capability of the device is limited by the maximum operation junction temperature (125°C). The power dissipated by the device can be estimated by $PD = IOUT \times (VIN-VOUT)$. This power dissipation must be lower than the maximum power dissipation listed in the "Absolute Maximum Ratings" section.

Typical Performance Characteristics

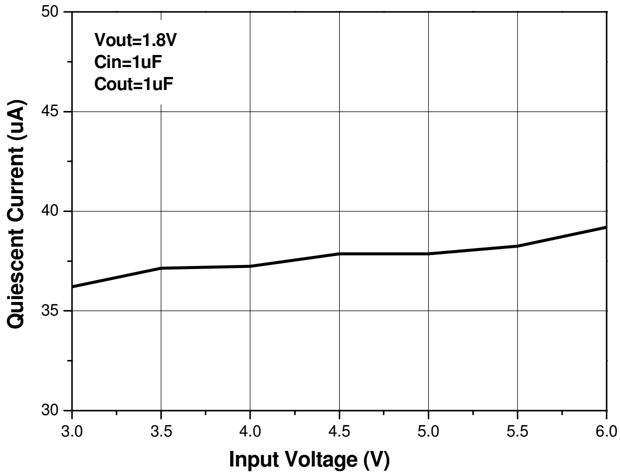


Figure 4. Quiescent Current vs. Input Voltage

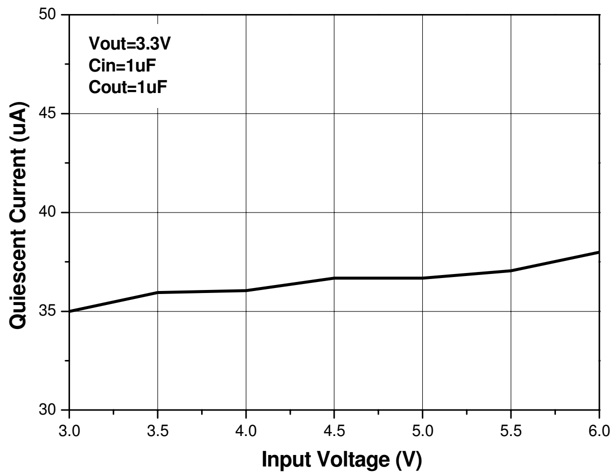


Figure 5. Quiescent Current vs. Input Voltage

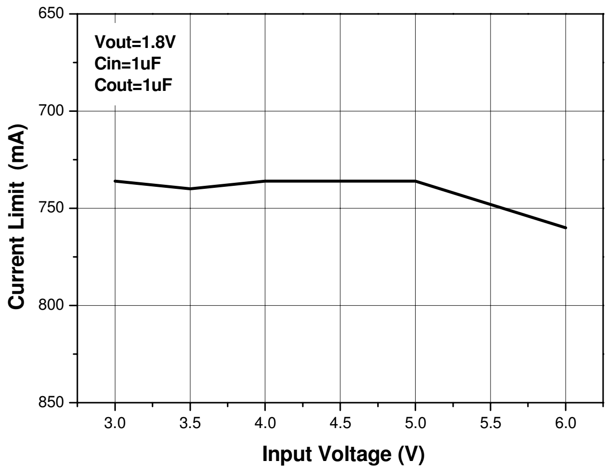


Figure 6. Current limit vs. Input Voltage

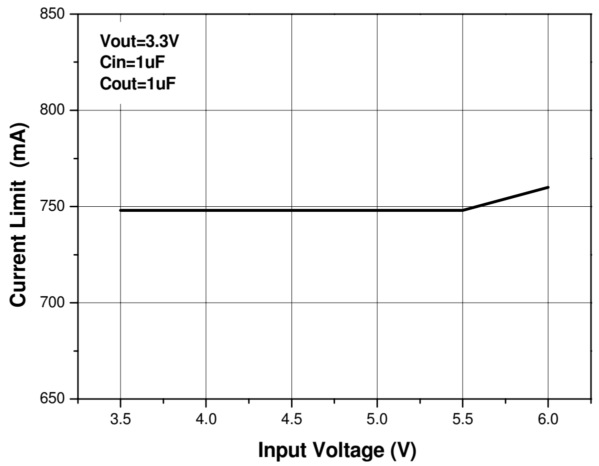


Figure 7. Current Limit vs. Input Voltage

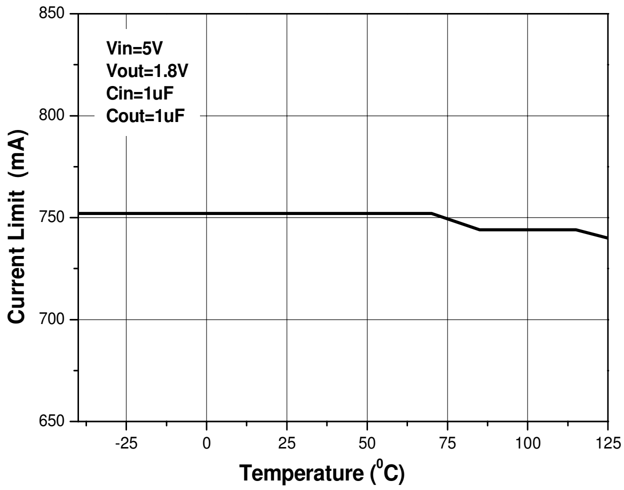


Figure 8. Current limit vs. Temperature

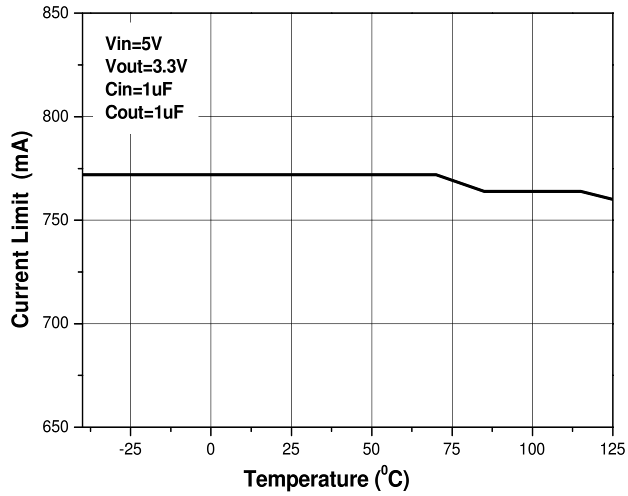


Figure 9. Current limit vs. Temperature

Typical Performance Characteristics

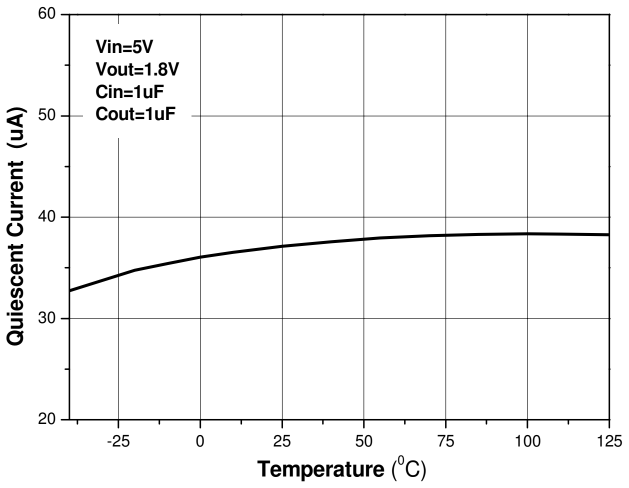


Figure 10. Quiescent Current vs. Temperature

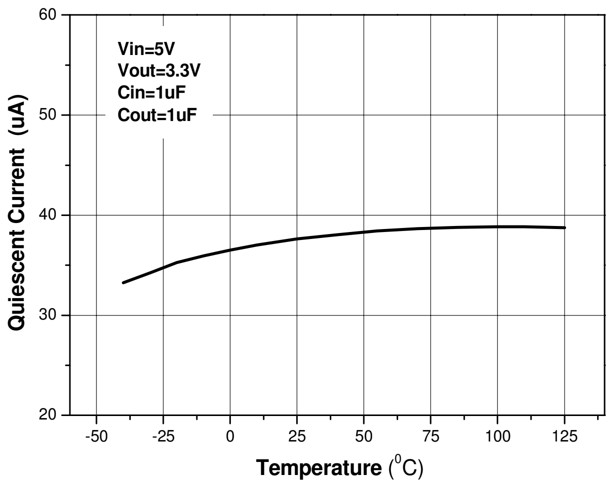


Figure 11. Quiescent Current vs. Temperature

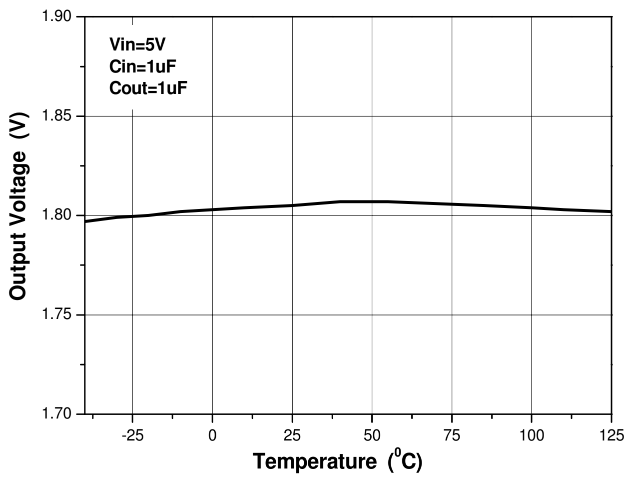


Figure 12. Temperature Stability

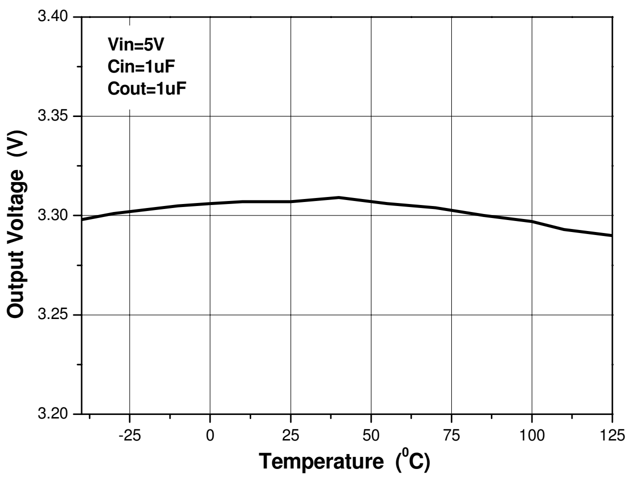


Figure 13. Temperature Stability

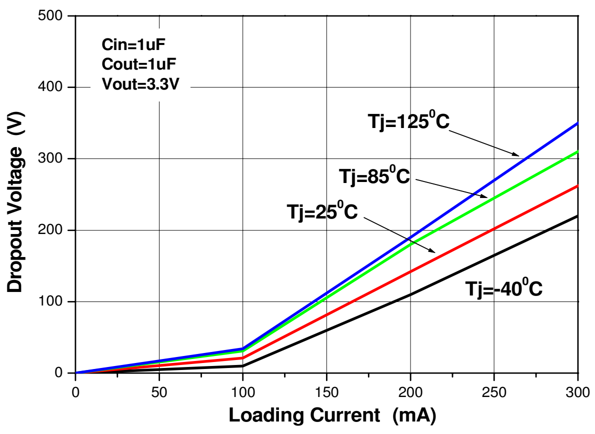


Figure 14. Dropout Voltage vs. Loading Current

Typical Performance Characteristics

V_{IN}=4V I_{OUT}= 1mA to150mA

V_{OUT}=3.3V C_{IN}=1uF C_{OUT}=1uF

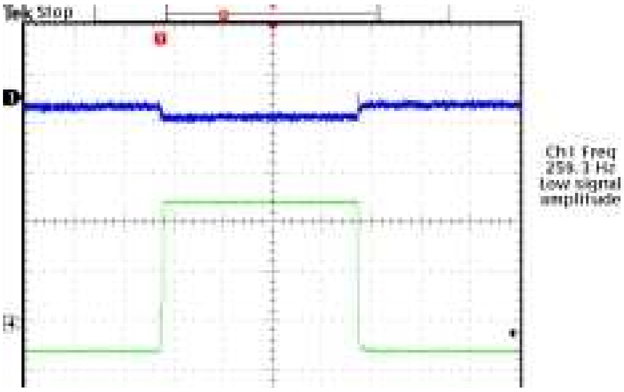


Figure 15. Load Transition Response

V_{IN}=4V I_{OUT}=1mA to 150mA

V_{OUT}=3.3V C_{IN}=1uF C_{OUT}=4.7uF

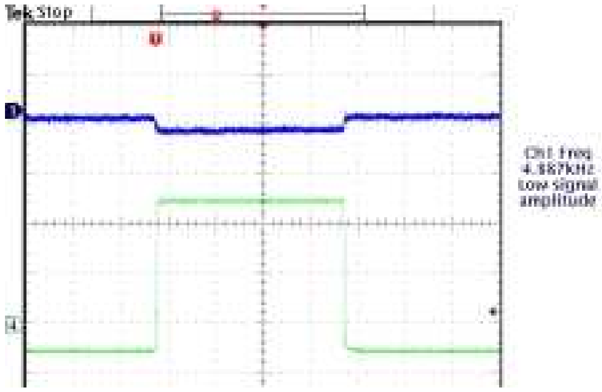


Figure 16. Load Transition Response

V_{IN}=3V to 4V I_{OUT}=10mA V_{OUT}= 1.8V C_{IN}=1uF C_{OUT}=1uF

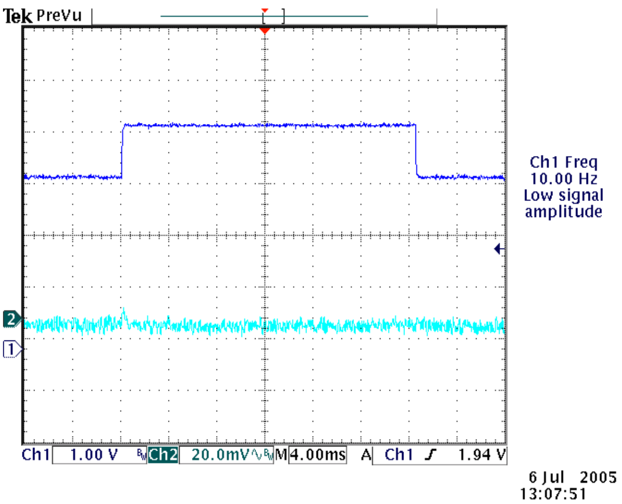


Figure 17. Line Transition Response

V_{IN}=3V to 4V I_{OUT}=10mA V_{OUT}= 1.8V C_{IN}=1uF C_{OUT}=4.7uF

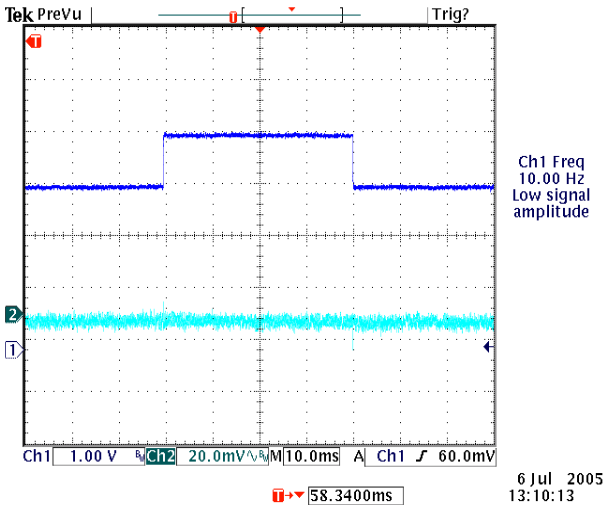
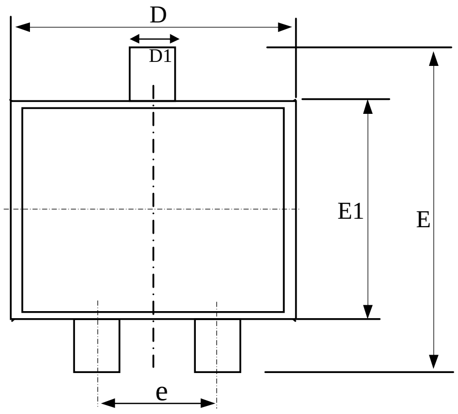
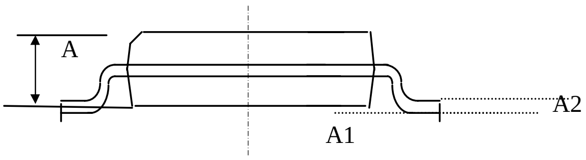


Figure 18. Line Transition Response

Package Dimensions: SOT-23



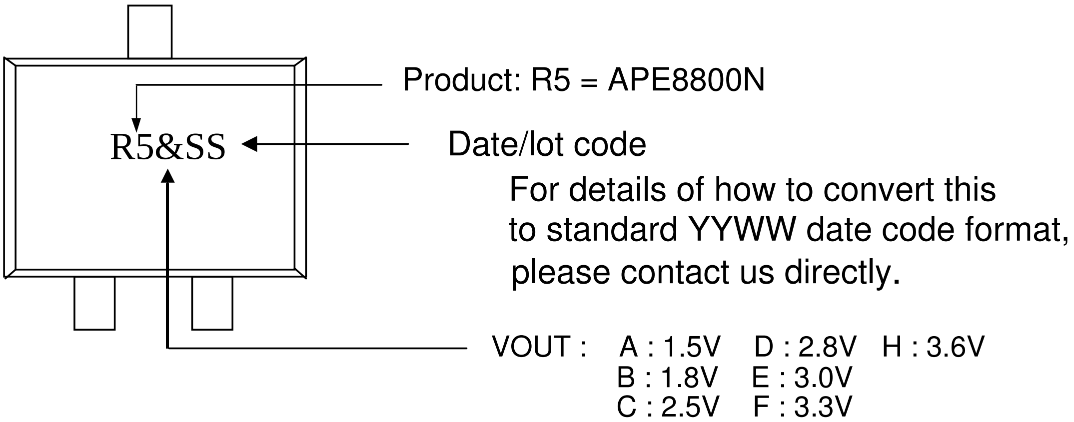
SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	1.00	1.15	1.30
A1	0.00	--	0.10
A2	0.10	0.15	0.25
D1	0.30	0.40	0.50
e	1.70	2.00	2.30
D	2.70	2.90	3.10
E	2.40	2.65	3.00
E1	1.40	1.50	1.60



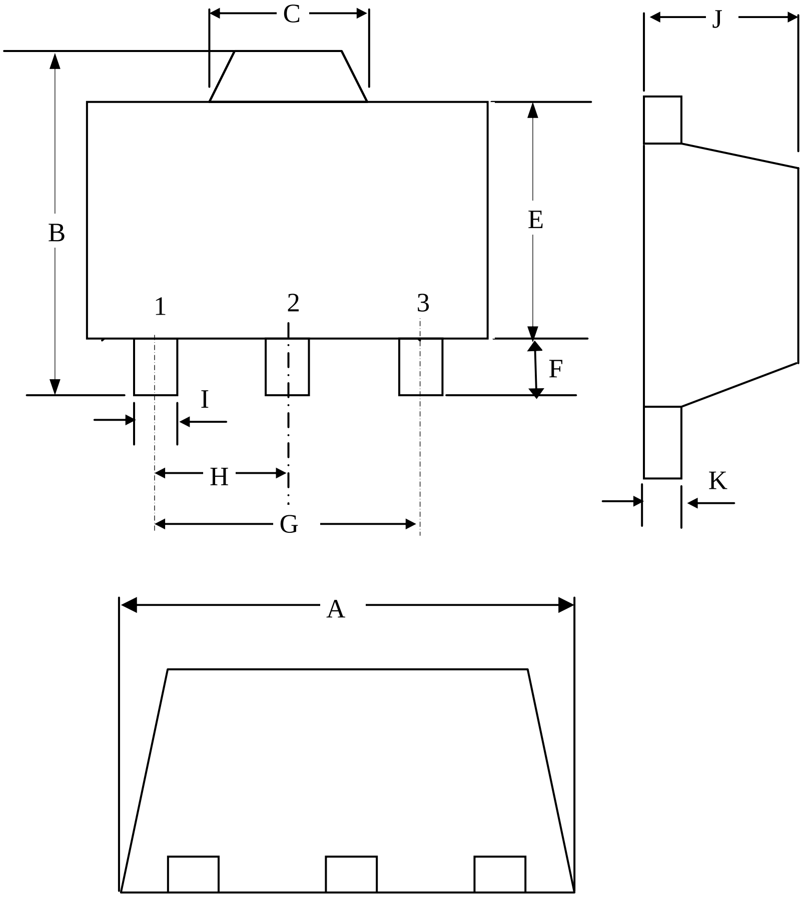
1. All dimensions are in millimeters.
2. Dimensions do not include mold protrusions.

Marking Information

Laser Marking



Package Dimensions: SOT-89



SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	4.40	-	4.60
B	4.05	-	4.25
C	1.40	-	1.75
E	2.40	-	2.60
F	0.89	-	1.20
I	0.35	-	0.55
H	----	1.50	----
G	----	3.00	----
J	1.40	-	1.60
K	0.35	-	0.43

1. All dimensions are in millimeters.
2. Dimensions do not include protrusions.

Marking Information