Advanced Power
Electronics Corp.

APE8800

300mA LOW DROPOUT LINEAR REGULATOR

FEATURES

- **Low Dropout Voltage of 250mV at 300mA**
- **Guaranteed 300mA Output Current**
- **Very Low Quiescent Current at 30μA**
- **±2% Output Voltage Accuracy**
- **Needs Only 1μF Capacitor for Stability**
- **Thermal Shutdown Protection**
- **Current Limit Protection**
- **Low-ESR Ceramic Capacitor for Output Stability**
- **Tiny Package: SOT-23, SOT-89**
- **RoHS Compliant & Halogen Free**

APPLICATIONS

- **DVD/CD-ROMs, CD/RWs**
- **Wireless Devices**
- **LCD Modules**
- **Battery Power Systems**
- **Card Readers**
- **XDSL Routers**

DESCRIPTIOON

The APE8800 series are low dropout, positive linear regulators with very low quiescent current. The APE8800 can supply 300mA output current with a low dropout voltage at about 250mV.

The APE8800 regulator is able to operate with output capacitors as small as 1μF for stability. Other than the current limit protection APE8800 also offers on chip thermal shutdown feature providing protection against overload or any condition when the ambient temperature exceeds the junction temperature.

The APE8800 series are offering three different fixed output voltage types including 1.5V, 1.8V, 2.5V, 2.8V, 3V, 3.3 & 3.6 volt.

The APE8800 series are available in low-profile, space-saving 3-lead SOT-23 and SOT-89 packages.

TYPICAL APPLICATION

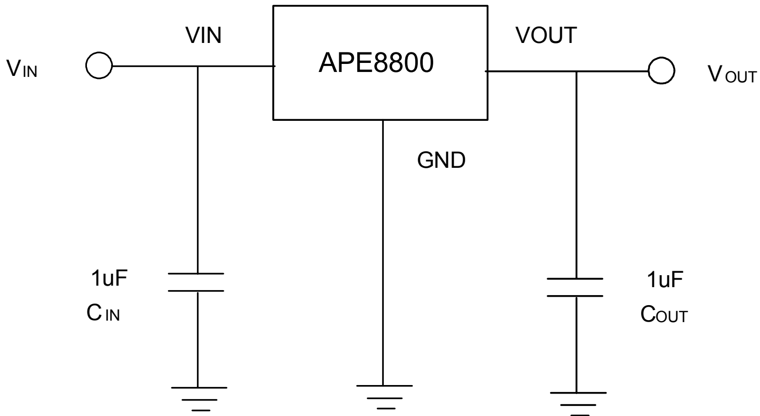


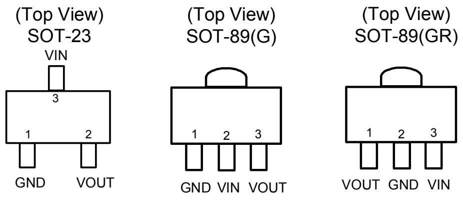
Figure 1. Typical Application Circuit of APE8800

Note：To prevent oscillation, it is recommended to use minimum 1μF X7R or X5R dielectric capacitors if ceramics are used as input/output capacitors.

ORDERING / PACKAGE INFORMATION

APE8800X - X

Package Type	Output Voltage
N : SOT-23 G : SOT-89 GR : SOT-89	15 : 1.5V ; 30 : 3.0V 18 : 1.8V ; 33 : 3.3V 25 : 2.5V ; 36 : 3.6V 28 : 2.8V



ABSOLUTE MAXIMUM RATINGS

Supply Input Voltage (V_{IN}) ------------------------------- 6V

Power Dissipation --

SOT-23 -------- 0.4W

SOT-89 -------- 0.57W

Storage Temperature Range (T_{stg}) -------------------- -65°C To 150°C

Maximum Junction Temperature (T_J) ----------------- 150°C

Lead Temperature (Soldering, 10sec, T_{LEAD}) ------- 260°C

Thermal Resistance Junction to Ambient (R_{thja})

SOT-23 -------- 250°C/W

SOT-89 -------- 175°C/W

Note：Stresses beyond those listed under “Absolute Maximum Ratings" may cause permanent damage to the device.

RECOMMENDED OPERATING CONDITIONS

Input Voltage (V_{IN}) -- 2.8 to 5.5V

Operating Junction Temperature Range (T_J) ------- -40 to 125°C

Ambient Temperature (T_A) ----------------------------- -40 to 125°C

ELECTRICAL SPECIFICATIONS

(V_{IN}=V_{OUT}+1V or V_{IN}=2.8V whichever is greater, C_{IN}=1μF, C_{OUT}=1μF, 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	55	μA
Dropout Voltage (Note 1)	V_{DROP}	I_O=300mA	1.2V ≦ V_{OUT} ≦ 2.0V	-	1100	-	mV
			2.0V < V_{OUT} ≦ 2.8V	-	350	-	
			2.8V < V_{OUT} ≦ 4.5V	-	250	-	
Line Regulation	ΔV_{LINE}	I_O=1mA, V_{IN}=V_{OUT} +1V or 5V		-	1	5	mV
Load Regulation (Note 2)	ΔV_{LOAD}	I_O=0mA to 300mA		-	6	20	mV
Ripple Rejection	PSRR	V_{IN}=V_{OUT}+1V 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} drop about 100mV.

Note 2：Regulation is measured at a constant junction temperature by using 40ms current pulse and load regulation in the load range from 0mA to 300mA.

PIN DESCRIPTIONS

PIN SYMBOL	PIN DESCRIPTION
VIN	Power is supplied to this device from this pin which is required an input filter capacitor. In general, the input capacitor in the range of 1μF to 10μF is sufficient.
VOUT	The output supplies power to loads. The output capacitor is required to prevent output voltage from oscillation. The APE8800 is stable with an output capacitor 1μF or greater. The larger output capacitor will be required for application with larger load transients. The large output capacitor could reduce output noise, improve stability and PSRR.
GND	Common ground pin

BLOCK DIAGRAM

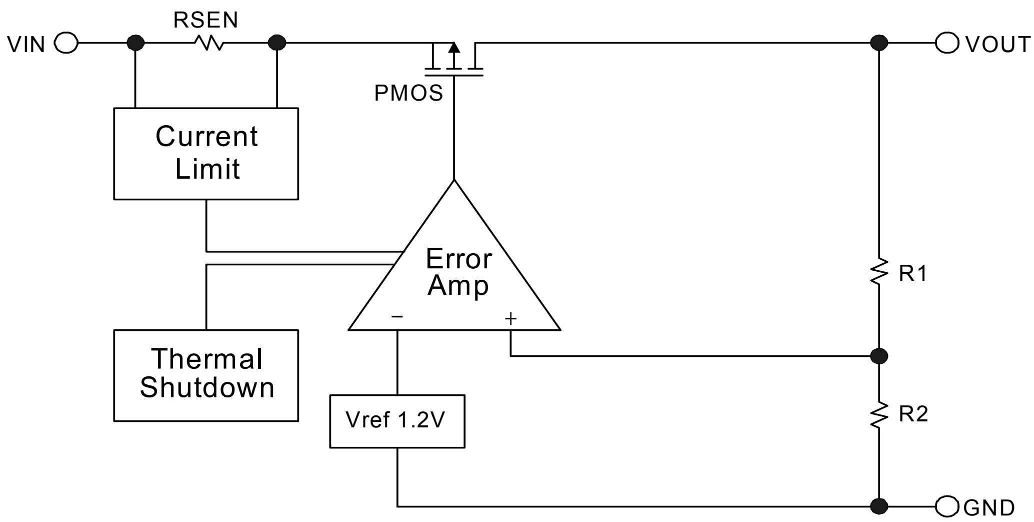


Figure 2. Block Diagram of APE8800

APPLICATION INFORMATION

The APE8800 series are low dropout linear regulators that could provide 300mA output current at dropout voltage about 300mV. Besides, current limit and on chip thermal shutdown features provide protection against any combination of overload or ambient temperature that could exceed junction temperature.

Output & Input Capacitor

The APE8800 regulator is designed to be stable with a wide range of output capacitors. The ESR of the output capacitor affects stability. Larger value of the output capacitor decreases the peak deviations and provides to improve transition response for larger current changes.

The capacitor types (aluminum, ceramic, and tant- alum) have different characterizations 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 betw- een device outputs to ground for transient stability. The APE8800 is designed to be stable with low ESR ceramic capacitors and higher values of capacitors and ESR could improve output stability. So the ESR of 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 device application environment.

Protection Features

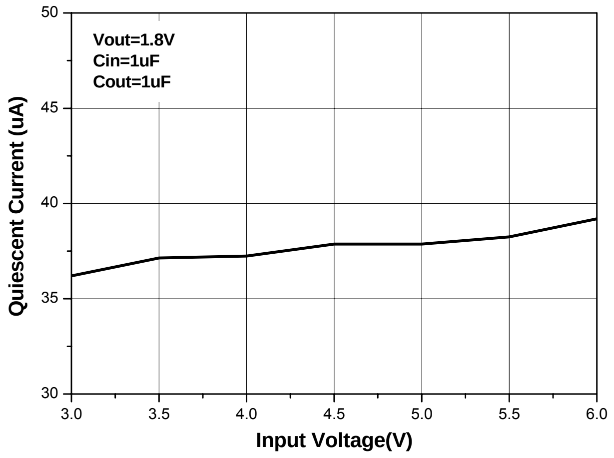
In order to prevent overloading or thermal cond- ition from damaging the device, APE8800 regulator has internal thermal and current limiting functions designed to protect the device. It will rapidly shut off PMOS pass element during overloading or over temperature condition.

Thermal Consideration

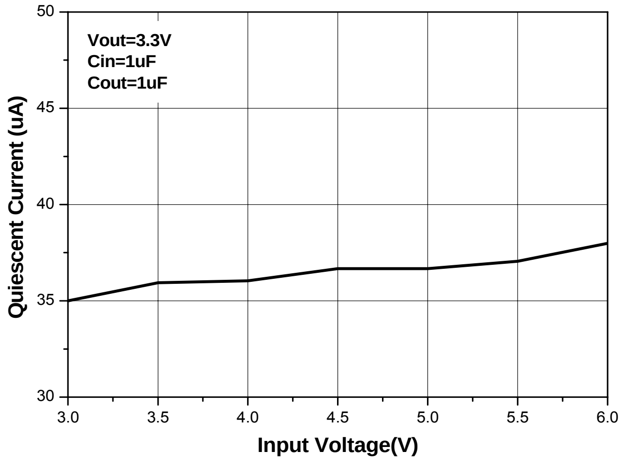
The power handling capability of the device will be limited by maximum operation junction temperature (125°C). The power dissipated by the device will be estimated by $P_D = I_{OUT} \times (V_{IN} - V_{OUT})$. The power dissipation should be lower than the maximum power dissipation listed in “Absolute Maximum Ratings” section.

TYPICAL PERFORMANCE CHARACTERISTICS

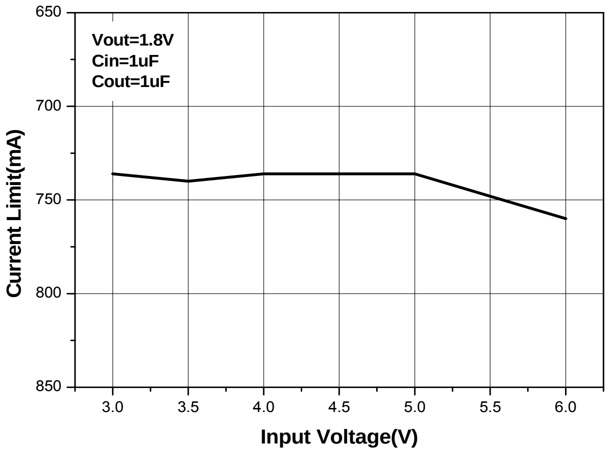
Quiescent Current vs. Input Voltage



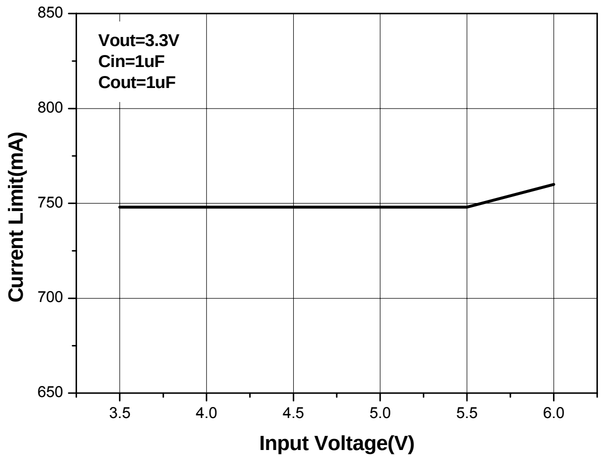
Quiescent Current vs. Input Voltage



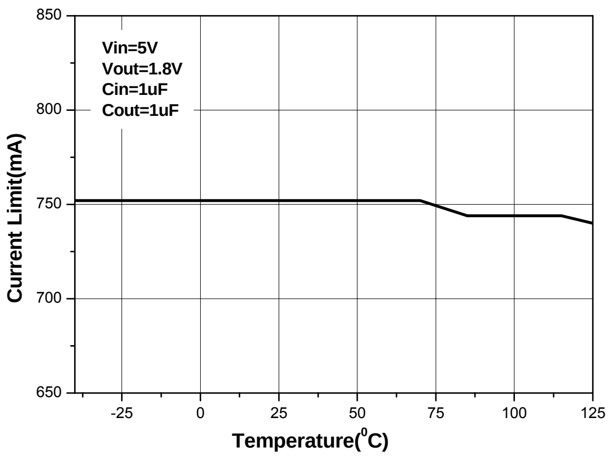
Current Limit vs. Input Voltage



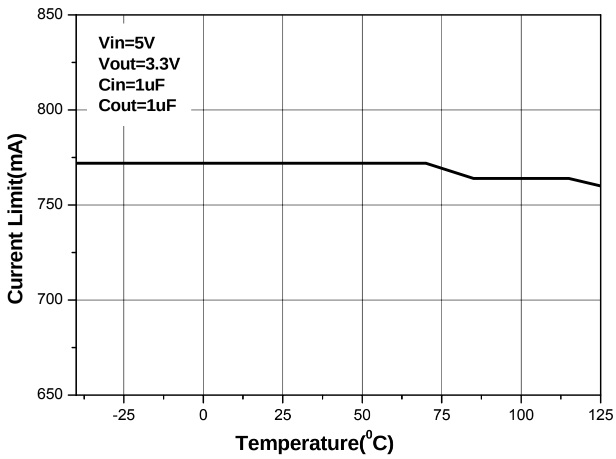
Current Limit vs. Input Voltage



Current Limit vs. Temperature

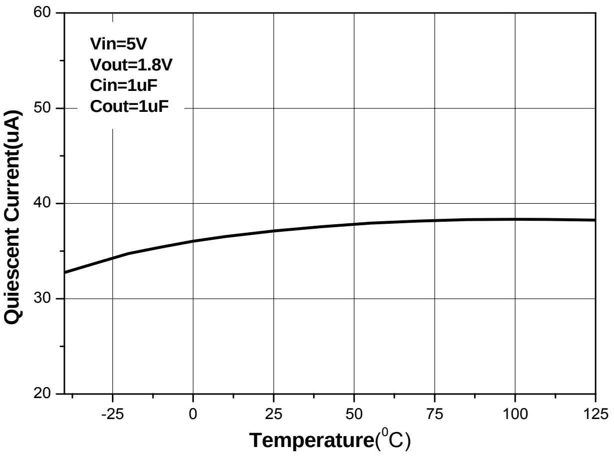


Current Limit vs. Temperature



TYPICAL PERFORMANCE CHARACTERISTICS

Quiescent Current vs. Temperature



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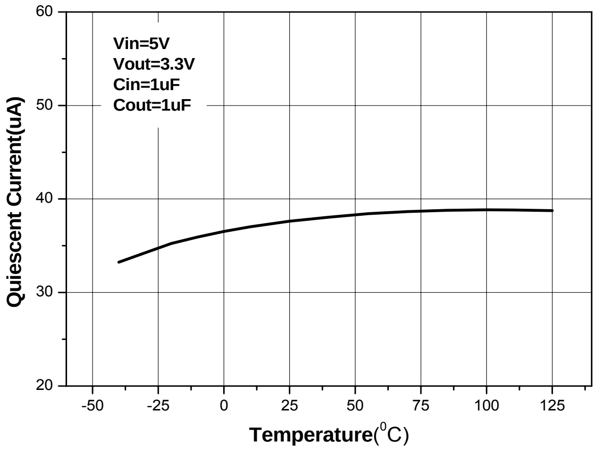
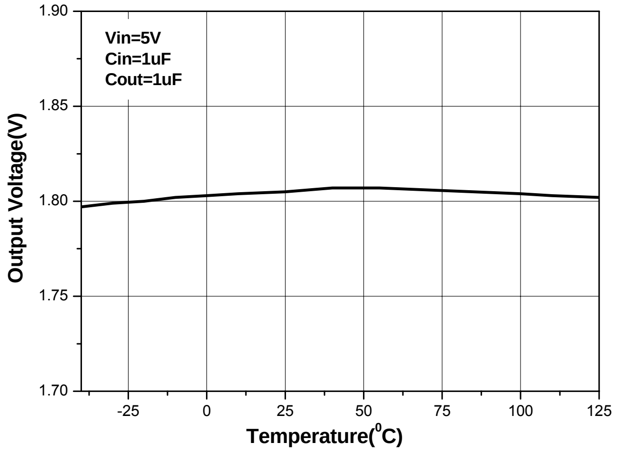
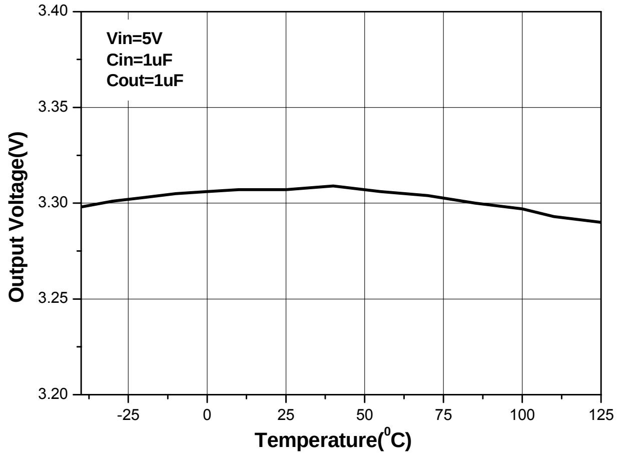


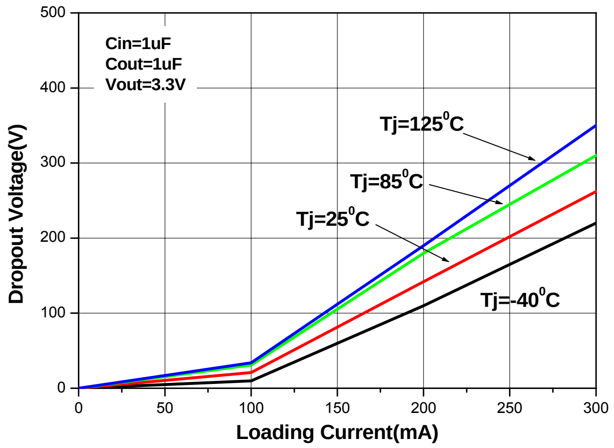
Temperature Stability



Temperature Stability



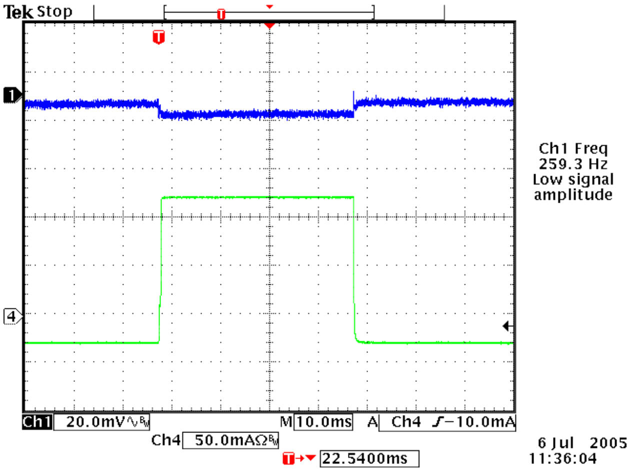
Dropout Voltage vs. Loading Current



TYPICAL PERFORMANCE CHARACTERISTICS

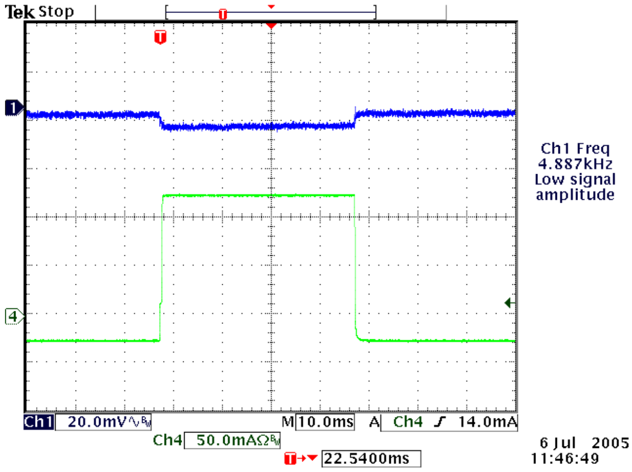
Load Transient Response

(V_{IN}=4V, I_{OUT}=1mA to 150mA, V_{OUT}=3.3V, C_{IN}=1uF, C_{OUT}=1uF)



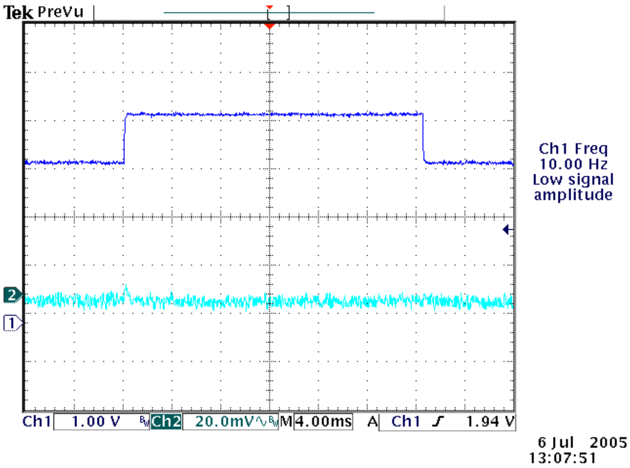
Load Transient Response

(V_{IN}=4V, I_{OUT}=1mA to 150mA, V_{OUT}=3.3V, C_{IN}=1uF, C_{OUT}=4.7uF)



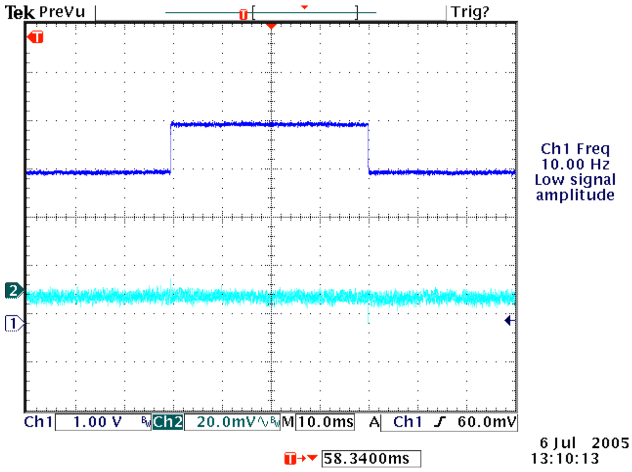
Line Transient Response

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



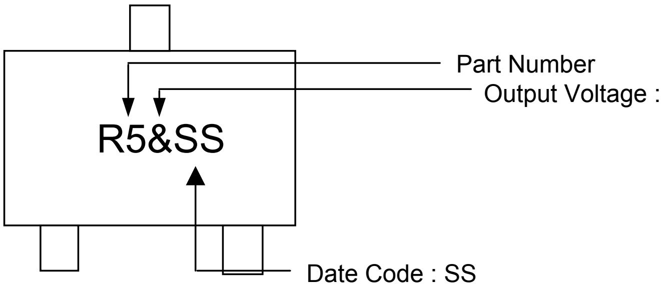
Line Transient Response

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



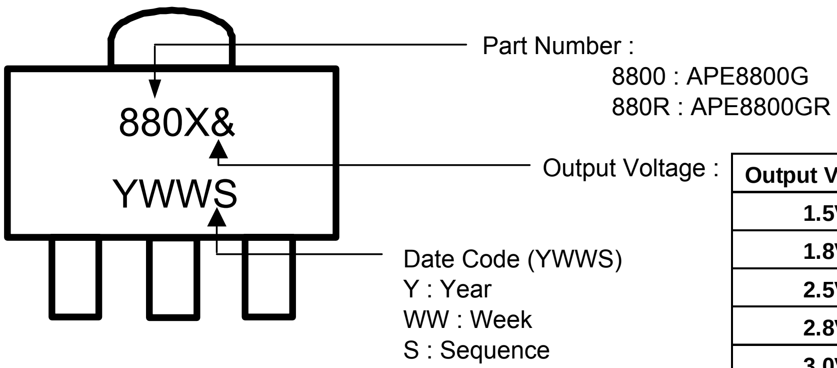
MARKING INFORMATION

SOT-23



Output Voltage	VOUT Code
1.5V	A
1.8V	B
2.5V	C
2.8V	D
3.0V	E
3.3V	F
3.6V	H

SOT-89



Output Voltage	VOUT Code
1.5V	A
1.8V	B
2.5V	C
2.8V	D
3.0V	E
3.3V	F
3.6V	H