ULTRA LOW NOISE, LOW-DROPOUT 150mA LINEAR REGULATOR

FEATURES

- Low Dropout Voltage Of 150mV at 150mA Output Current
- Guaranteed 150mA Output Current
- Low 30uVrms Output Noise around 10Hz to 100KHz
- Very Low Quiescent Current about 40uA
- 2% Accuracy Output Voltage for 1.5~3.3V
- Needs Only 1μF Capacitor for Stability
- Thermal Shutdown and Current Limiting Protection Functions
- RoHS Compliant

APPLICATION

- Portable Instruments
- Battery Power System
- GSM and CDMA Cellular Handsets
- Wireless Devices
- PDA and Notebook Computers

DESCRIPTION

The APE3985 is CMOS low dropout, positive linear regulators with very low noise and quiescent current. With an external 0.01uF bypass capacitor, output noise is about 30μVrms over a 10Hz to 100KHz bandwidth. The APE3985 can supply 150mA output current with a lower dropout voltage about 150mV.

The APE3985 is suitable for portable RF and wireless application such as Cellular Handsets, The APE3985 is designed and optimized to work with low-value, low cost ceramic capacitors.

The APE3985 consumes less than 0.1uA during shutdown mode. Besides its current limit protection and on chip thermal shutdown features provide protection against any combination of overload or ambient temperature that could exceed junction temperature.

The APE3985 includes a reference bypass pin in order to reduce output noise and a logic-controlled shut- down input. The APE3985 is available in fixed output voltage range of 1.5V to 3.3V which dependent on customer requests. The space-saving tiny SOT-25 packages are attractive for hand-held applications.

TYPICAL APPLICATION

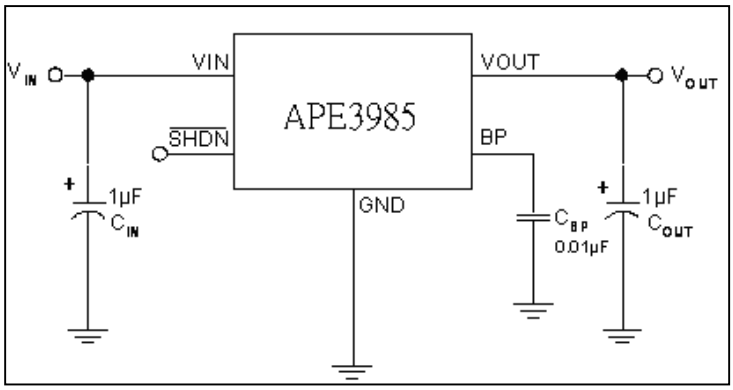

Figure1. Typical Application Circuit of APE3985

ORDERING INFORMATION

APE3985–□□

Package Type
Y5 : SOT-25

Output Voltage
15 : 1.5V 2J : 2.85V
18 : 1.8V 29 : 2.9V
20 : 2.0V 30 : 3.0V
25 : 2.5V 33 : 3.3V
28 : 2.8V

ABSOLUTE MAXIMUM RATINGS

Supply input voltage (V_{IN}) ..... -0.3 to +6V

Maximum Junction Temperature (T_J)..... 150℃

Power dissipation：

SOT- 25 (P_D)..... 0.4W

Storage Temperature Range ..... -65℃ to 150 ℃

Package Thermal Resistance,θ_{JA} ..... 250℃/W

Lead Temperature (Soldering, 10 sec.) ..... 300℃

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

RECOMMENDED OPERATING CONDITIONS

Supply Voltage, V_{IN} ..... 2.8V to 5.5V

Operation Temperature Range ..... -40℃ to +125 ℃

Ambient Temperature Range ..... -40℃ to +125 ℃

PACKAGE INFORMATION

SOT-25 Package Y5

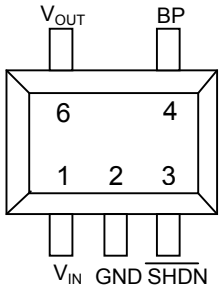


Figure2. Pin Assignment of APE3985

ELECTRICAL SPECIFICATION

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

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage Accuracy	$\triangle V_{OUT}$	I_O=1 mA		-2		2	%
Current Limit	I_{limit}	R_{LOAD}=1Ω		200			mA
Quiescent Current	I_Q	I_O=0 mA			40		uA
Dropout Voltage	V_{DROP}	I_O=150mA	1.5V≦V_{OUT}≦2V		1200		mV
			2.0V≦V_{OUT}≦2.8V		250		mV
			2.8V≦V_{OUT}≦4.5V		150		mV
Line Regulation	$\triangle V_{LINE}$	I_O=1mA,V_{IN}=V_{OUT}+1V to 5V			3	10.0	mV
Load Regulation	$\triangle V_{LOAD}$	I_O=0mA to 150mA			20	60	mV
Ripple Rejection	PSRR	V_{IN}=V_{OUT}+1V,f_{RIPPLE}=1KHz,C_{OUT}=1uF			68		dB
Output Noise	E_{NO}	10Hz TO 100KHz,C_{BP}=0.01uF			30		μVrms
Standby Current	I_{STBY}	$\overline{SHDN}$ = GND,Shutdown				0.2	uA
$\overline{SHDN}$ Input Bias Current	I_{IBSD}	$\overline{SHDN}$ = V_{IN} or Ground				100	nA

ELECTRICAL SPECIFICATION

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
$\overline{SHDN}$ Threshold(High)	V_{IH}	V_{IN}=5V,Start-up	1			V
$\overline{SHDN}$ Threshold(Low)	V_{IL}	V_{IN}=5V,Shutdown			0.4	V
Temperature Coefficient	T_C	I_{OUT}=1mA,V_{IN}=5V		50		ppm/ dueºC
Thermal Shutdown Temperature	T_{SD}			160		℃
Thermal Shutdown Hysteresis	$\triangle T_{SD}$			25		℃

PIN DESCRIPTION

PIN Name	Pin Function
V_{OUT}	The output supplies power to loads. The output capacitor is required to prevent output voltage unstable. The APE3985 is stable with an output capacitor 1uF or greater. The larger output capacitor will be required for application with large transit load to limit peak voltage transits, besides could reduce output noise, improve stability, PSRR.
GND	Common ground pin
$\overline{SHDN}$	Logic input control this device ective or shut off. The shutdown pin can't be left floating and must be tied to the V_{IN} pin if not used.
V_{IN}	Power is supplied to this device form this pin which is required an input filter capacitor. In general, the input capacitor in the range of 1uF is sufficient.
BP	The noise Bypass.The BP Pin is used to augment the internal low pass filter to improve noise performance. Any value capacitor may be used; larger values will result in lower output noise but it will increase initial power start-up time. The shutdown exit delay time also will be affected. If not used, this pin must be left unconnected.

BLOCK DIAGRAM

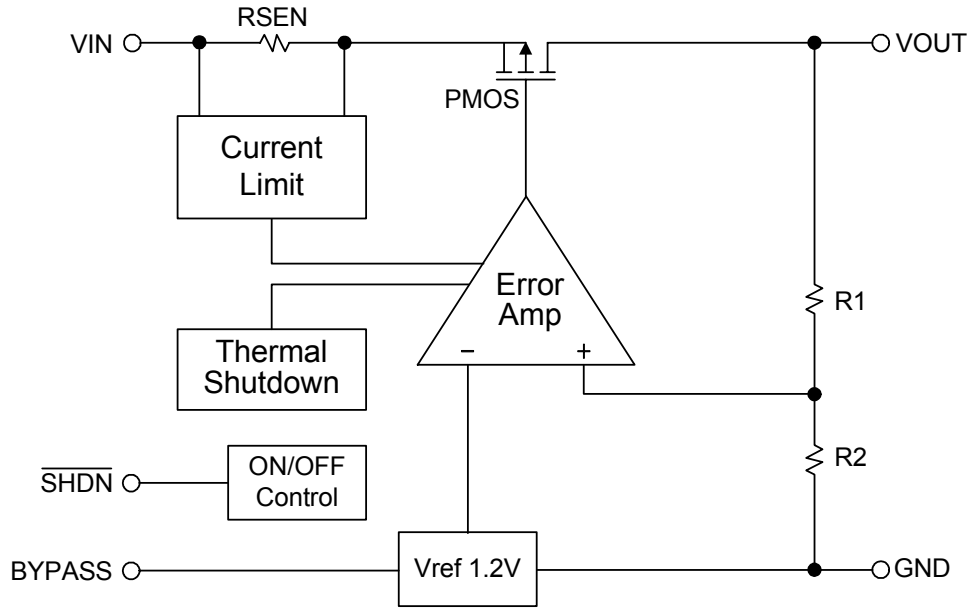
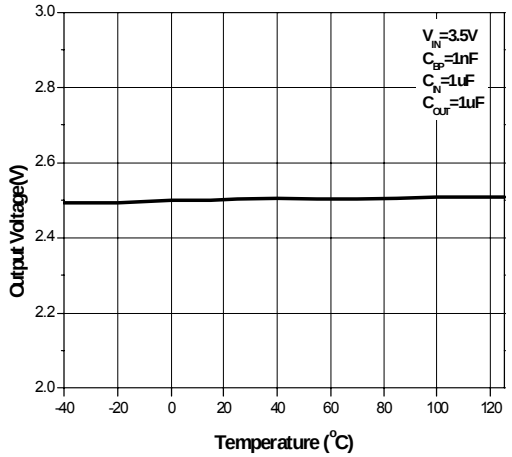
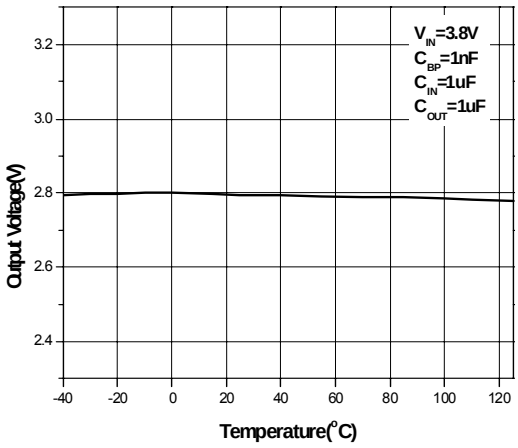


Figure3. Block Diagram of APE3985

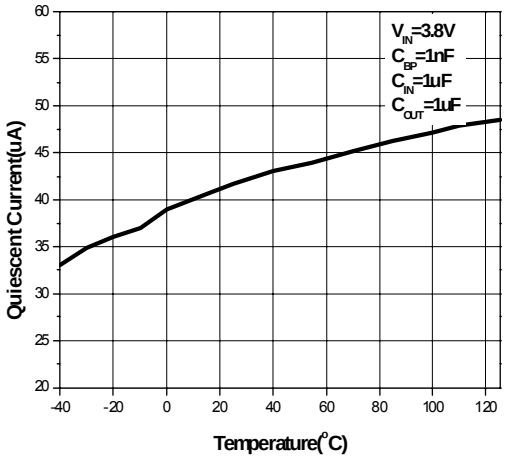
TYPICAL PERFORMANCE CURVE



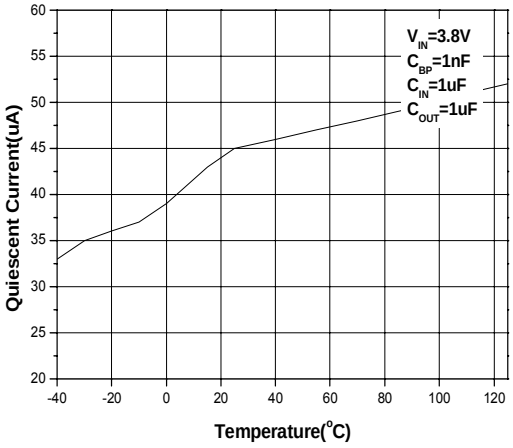
1. Output Voltage vs. Temperature (V_{OUT}=2.5V)



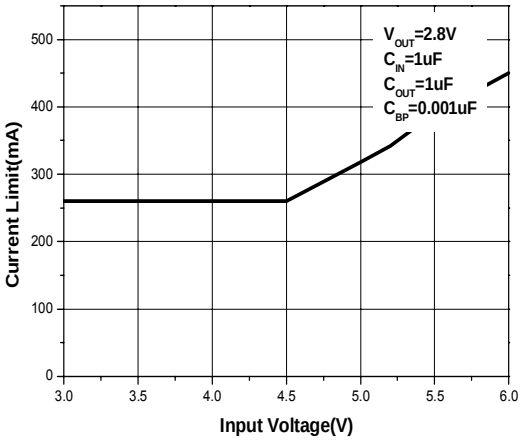
2. Output Voltage vs. Temperature (V_{OUT}=2.8V)



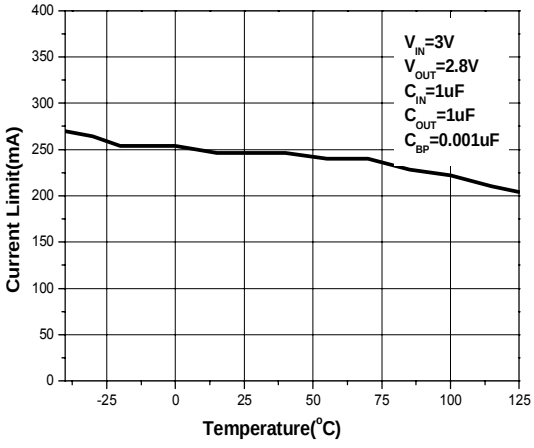
3. Quiescent Current vs. Temperature (V_{OUT}=2.5V)



4.Quiescent Current vs. Temperature(V_{OUT}=2.8V)

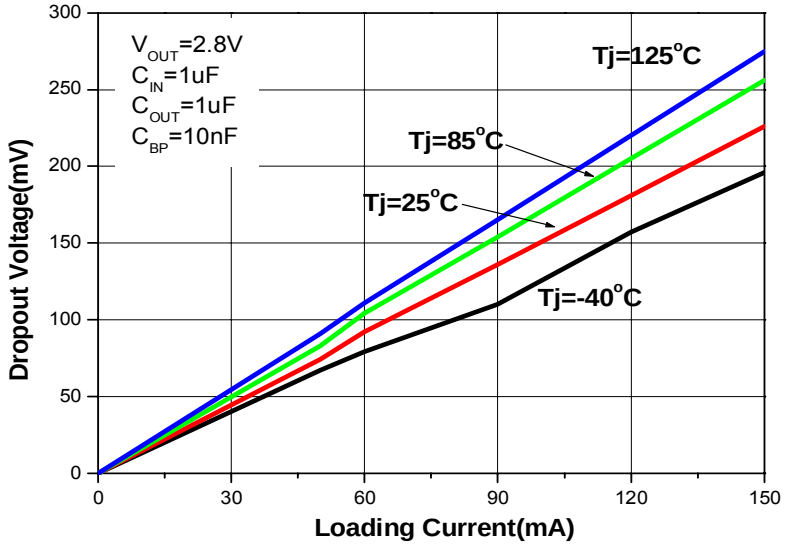


5. Current limit vs. Input Voltage

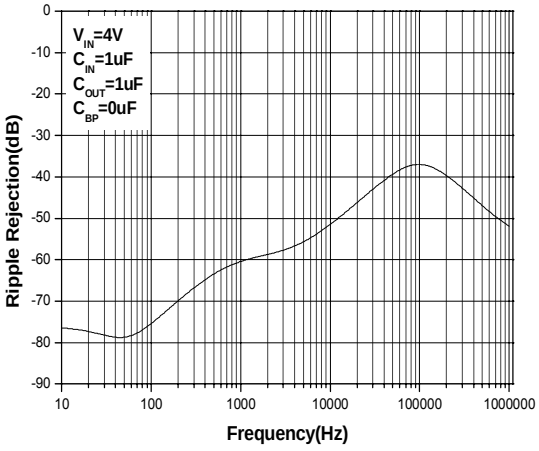


6. Current limit vs. Temperature

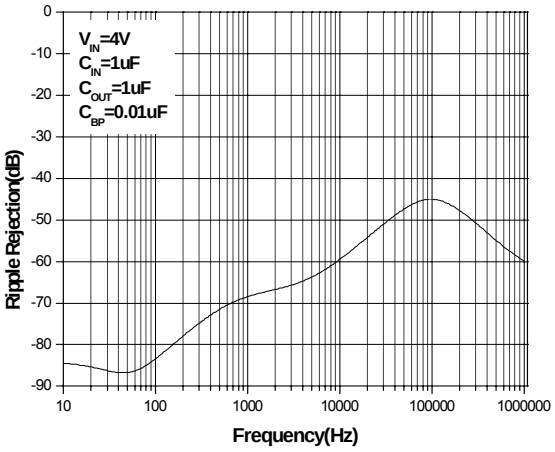
TYPICAL PERFORMANCE CURVE



7. Dropout Voltage vs. Loading Current



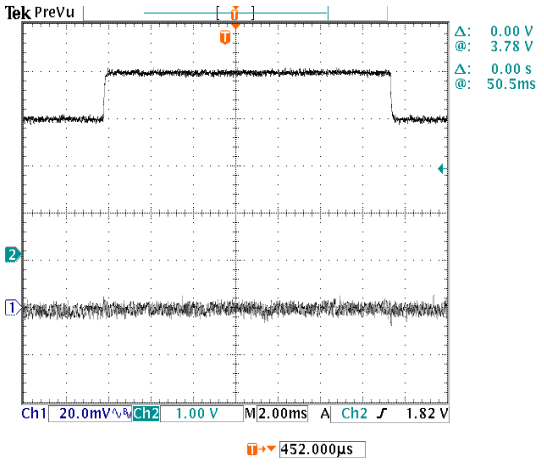
8. Ripple Rejection



9. Ripple Rejection

V_{IN}=4~5V V_{OUT}=2.8V I_{OUT}=1mA

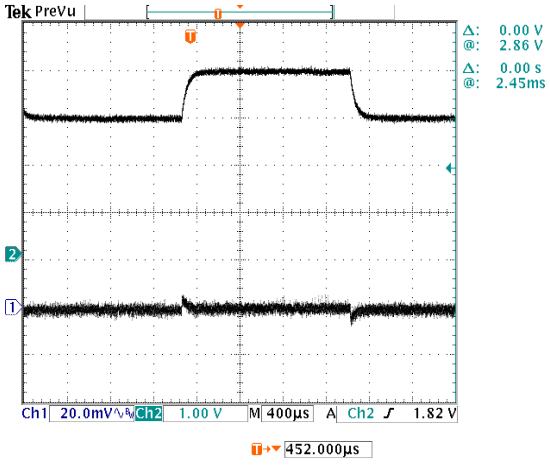
C_{IN}=C_{OUT}=2.2uF C_{BP}=0.001uF



10. Line Transition Response

V_{IN}=4~5V V_{OUT}=2.8V I_{OUT}=10mA

C_{IN}=C_{OUT}=2.2uF C_{BP}=0.001uF

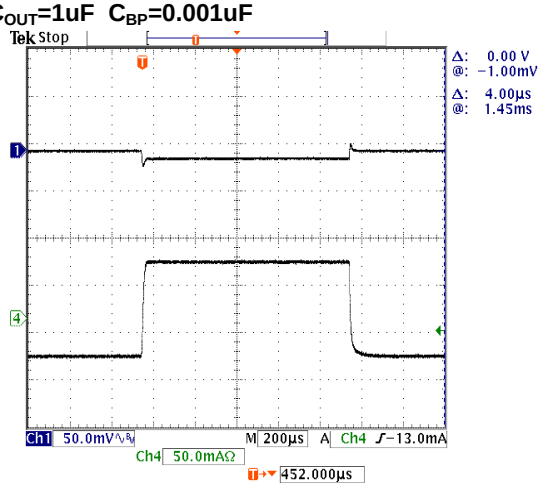


11. Line Transition Response

TYPICAL PERFORMANCE CURVE

V_{IN}=4V V_{OUT}=2.8V I_{OUT}=1~100mA

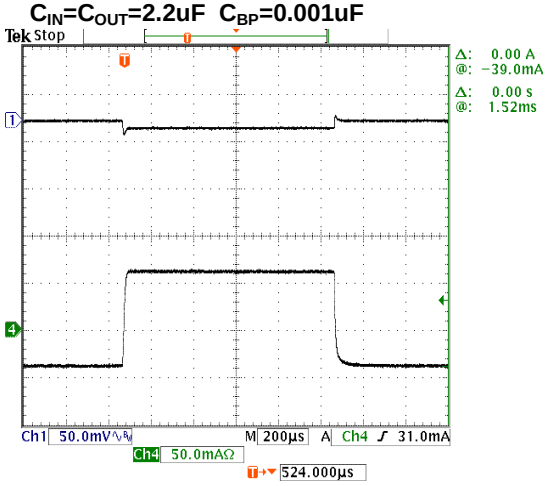
C_{IN}=C_{OUT}=1uF C_{BP}=0.001uF



12. Load Transition Response

V_{IN}=4V V_{OUT}=2.8V I_{OUT}=1~100mA

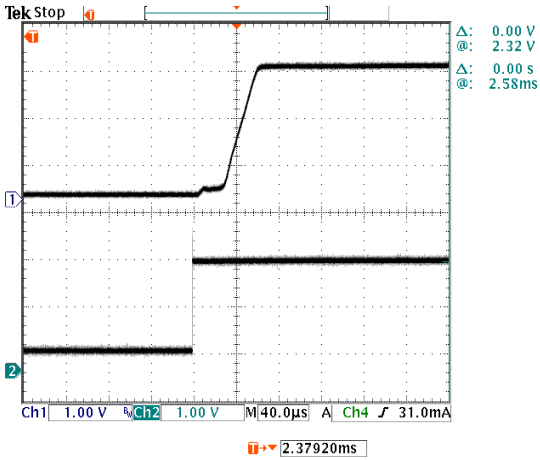
C_{IN}=C_{OUT}=2.2uF C_{BP}=0.001uF



13. Load Transition Response

V_{IN}=4V V_{OUT}=2.8V CBP=0uF

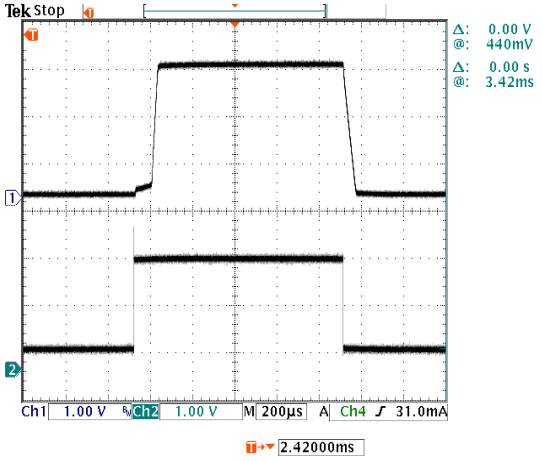
I_{OUT}=100mA C_{IN}=C_{OUT}=2.2uF



14. Shutdown Exit Time

V_{IN}=4V V_{OUT}=2.8V CBP=0uF

I_{OUT}=100mA C_{IN}=C_{OUT}=2.2uF



15. Shutdown Exit Time

APPLICATION INFORMATION

The APE3985 series are low dropout linear regulators that could provide 150mA output current at dropout voltage about 150mV. Besides, current limit and on chip thermal shutdown features provide protection against any combination of overload or ambient temperature that could exceed junction temperature.

1.Output and Input Capacitor

The APE3985 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 tantalum) have different characterizations such as temperature and voltage coefficients. All ceramic capacitors were 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 APE3985 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.

2.Protection Features

In order to prevent overloading or thermal condition to damage device, APE3985 regulator has internal thermal and current limiting functionsdesigned to protect the device. It will rapidly shut off PMOS pass element during overloading or over temperature condition.

3.Thermal Consideration

The power handling capability of the device will be limited by maximum operation junction temperature (125℃).The power dissipated by the device will be made up of P_D=IOUT X (VIN-VOUT). The power dissipation should be lower than the maximum power dissipation listed in "Absolute Maximum Ratings".

4.Noise Bypass capacitor

The BP pin connecting a 0.01uF or 0.001uF capacitorthat could reduce noise and light improve PSRR on the regulator output. Besides it also affected startup time and shutdown exit time.The smaller the capacitor value, the shorter thepower up time.

5.No-Load Stability

The APE3985 will remain stable and in regulation with no external load. This is specially important in CMOS RAM keep-active applications.

6.Active/shutdown input operation

The APE3985 is turned off by pulling the $\overline{\text{SHDN}}$ pin low and turned on by pulling it high. If this feature not used, the $\overline{\text{SHDN}}$ pin should be connected to VIN to keep the regulator output is available at all time.