3-TERMINAL 1A POSITIVE VOLTAGE REGULATOR

1. Features

- Output current up to 1A
- Fixed output voltage of 5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V, 20V and 24V available
- Thermal overload shutdown protection
- Output transistor SOA protection

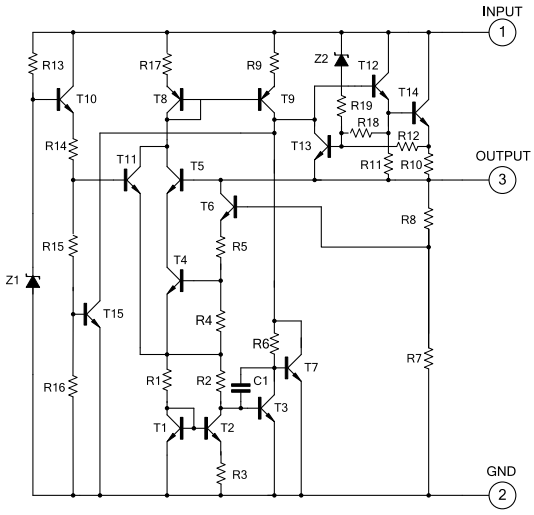
2. Applications

- Industrial Power Supplies
- SMPS Post Regulation
- HVAC Systems
- AC Inventors
- Test and Measurement Equipment
- Brushed and Brushless DC Motor Drivers
- Solar Energy String Invertors

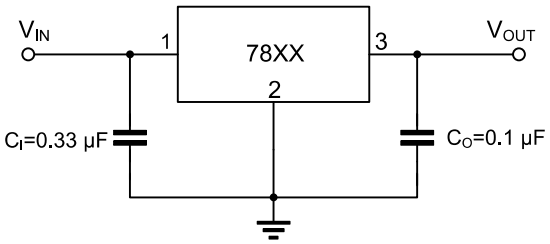
3. Description

These voltage regulators are monolithic integrated circuits designed as fixed−voltage regulators for a wide variety of applications including local, on−card regulation. These regulators employ internal current limiting, thermal shutdown, and safe−area compensation. With adequate heatsinking they can deliver output currents in excess of 1.0A. Although designed primarily as a fixed voltage regulator, these devices can be used with external components to obtain adjustable voltages and currents.

4. Test Circuit



5. Application Circuit



Note

1. To specify an output voltage, substitute voltage value for "XX".

2. Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

6. Ordering Information

Part Number	Package Type	Packing
L7805ABV	TO-220-3L	Tube
L7806ABV	TO-220-3L	Tube
L7807ABV	TO-220-3L	Tube
L7808ABV	TO-220-3L	Tube
L7809ABV	TO-220-3L	Tube
L7810ABV	TO-220-3L	Tube
L7812ABV	TO-220-3L	Tube
L7815ABV	TO-220-3L	Tube
L7818ABV	TO-220-3L	Tube
L7820ABV	TO-220-3L	Tube
L7824ABV	TO-220-3L	Tube
L7805ABD2T	TO-263-2L	Reel
L7806ABD2T	TO-263-2L	Reel
L7807ABD2T	TO-263-2L	Reel
L7808ABD2T	TO-263-2L	Reel
L7809ABD2T	TO-263-2L	Reel
L7810ABD2T	TO-263-2L	Reel
L7812ABD2T	TO-263-2L	Reel
L7815ABD2T	TO-263-2L	Reel
L7818ABD2T	TO-263-2L	Reel
L7820ABD2T	TO-263-2L	Reel
L7824ABD2T	TO-263-2L	Reel
L7805CV	TO-220-3L	Tube
L7806CV	TO-220-3L	Tube
L7807CV	TO-220-3L	Tube
L7808CV	TO-220-3L	Tube
L7809CV	TO-220-3L	Tube
L7810CV	TO-220-3L	Tube
L7812CV	TO-220-3L	Tube
L7815CV	TO-220-3L	Tube
L7818CV	TO-220-3L	Tube
L7820CV	TO-220-3L	Tube
L7824CV	TO-220-3L	Tube
L7805CD2T	TO-263-2L	Reel
L7806CD2T	TO-263-2L	Reel
L7807CD2T	TO-263-2L	Reel
L7808CD2T	TO-263-2L	Reel

L7809CD2T	TO-263-2L	Reel
L7810CD2T	TO-263-2L	Reel
L7812CD2T	TO-263-2L	Reel
L7815CD2T	TO-263-2L	Reel
L7818CD2T	TO-263-2L	Reel
L7820CD2T	TO-263-2L	Reel
L7824CD2T	TO-263-2L	Reel

Note: If the physical information is inconsistent with the ordering information, please refer to the actual product.

7. ABSOLUTE MAXIMUM RATING

(T_A=25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATING	UNIT
Input voltage	V_{OUT}=5~18V	VIN	35	V
	V_{OUT}=24V		40	V
Output Current		I_{OUT}	1	A
Power Dissipation		P_D	Internally Limited	W
Junction Temperature		T_J	+150	°C
Operating Temperature		T_{OPR}	-40 ~ +125	°C
Storage Temperature		T_{STG}	-55 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

8. THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/TO-263	θ_{JA}	65	°C/W
Junction to Case	TO-220/TO-263	θ_{JC}	5	°C/W

9. ELECTRICAL CHARACTERISTICS

(I_{OUT}=0.5A, T_J= 0°C~125°C, C_I =0.33μF, C_O=0.1μF, unless otherwise specified) (Note 1)

L7805

(V_{IN} =10V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	4.80	5.0	5.20	V
		V_{IN} =7.5V ~ 20V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	4.75		5.25	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A			50	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			25	mV
Line regulation	ΔV_{OUT}	V_{IN} =7V ~ 25V, T_J =25°C			50	mV
		V_{IN} =7.5V ~ 20V, T_J =25°C, I_{OUT}=1.0A			50	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =7.5V ~ 20V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		40		μV
Ripple Rejection	RR	V_{IN} =8V ~ 18V, f=120Hz, T_J =25°C	59	80		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

L7806

(V_{IN} =11V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	5.76	6.0	6.24	V
		V_{IN} =8.5V ~ 21V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	5.70		6.30	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A			60	mV
		T_J =25°C, I_{OUT}=0.25A~ 0.75A			30	mV
Line regulation	ΔV_{OUT}	V_{IN} =8V ~ 25V, T_J =25°C			60	mV
		V_{IN} =8.5V ~ 21V, T_J =25°C, I_{OUT}=1.0A			60	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =8.5V ~ 21V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		45		μV
Ripple Rejection	RR	V_{IN} =9V ~ 19V, f=120Hz, T_J =25°C	56	75		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

L7807

(V_{IN} =13V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I^{OUT}=5mA - 1.0A	6.72	7.0	7.28	V
		V_{IN} =9.5V ~ 22V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	6.65		7.35	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A			70	mV
		T^J =25°C, I_{OUT}=0.25A ~ 0.75A			35	mV
Line regulation	ΔV_{OUT}	V_{IN} =9V ~ 25V, T_J =25°C			70	mV
		V^{IN} =9.5V ~ 22V, T^J =25°C, I_{OUT}=1.0A			70	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =9.5V ~ 22V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		50		μV
Ripple Rejection	RR	V_{IN} =10V ~ 20V, f=120Hz, T_J =25°C	56	75		dB
Peak Output Current	I_{PEAK}	T^J =25°C		1.7		A

L7808

(V_{IN} =14V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA~ 1.0A	7.68	8.0	8.32	V
		V_{IN} =10.5V ~ 23V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	7.60		8.40	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A			80	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			40	mV
Line regulation	ΔV_{OUT}	V_{IN} =10.5V ~ 25V, T_J =25°C			80	mV
		V_{IN} =10.5V ~ 23V, T_J =25°C, I_{OUT}=1.0A			80	mV
Quiescent Current	I_Q	T_J =25°C, I^{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =10.5V ~ 23V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		58		μV
Ripple Rejection	RR	V_{IN} =11.5V ~ 21.5V, f=120Hz, T_J =25°C	53	72		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

L7809

(V_{IN} =15V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	8.64	9.0	9.36	V
		V_{IN} =11.5V ~ 24V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	8.55		9.45	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A			90	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			45	mV
Line regulation	ΔV_{OUT}	V_{IN} =11.5V ~ 25 V, T_J =25°C			90	mV
		V_{IN} =11.5V ~ 24V, T_J =25°C, I_{OUT}=1.0A			90	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =11.5V ~ 24V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		58		μV
Ripple Rejection	RR	V_{IN} =12.5V ~ 22.5V, f=120Hz, T_J =25°C	53	72		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

L7810

(V_{IN} =16V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	9.60	10.0	10.40	V
		V_{IN} =12.5V ~ 25V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	9.50		10.50	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA - 1.0A			100	mV
		T_J =25°C, I_{OUT}=0.25A - 0.75A			50	mV
Line regulation	ΔV_{OUT}	V_{IN} =13V ~ 25V, T_J =25°C			100	mV
		V_{IN} =13V ~ 25V, T_J =25°C, I_{OUT}=1.0A			100	mV
Quiescent Current	I_Q	T^J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =12.6V ~ 25V			1.0	mA
		I_{OUT}=5mA - 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		58		μV
Ripple Rejection	RR	V_{IN} =13V ~ 23V, f=120Hz, T_J =25°C	53	72		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

L7812

(V_{IN} =19V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	TJ =25°C, I_{OUT}=5mA ~ 1.0A	11.52	12.0	12.48	V
		V_{IN} =14.5V ~ 27V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	11.40		12.60	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A			120	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			60	mV
Line regulation	ΔV_{OUT}	V_{IN} =14.5V ~ 30V, T_J =25°C			120	mV
		V_{IN} =14.6V ~ 27V, T_J =25°C, I_{OUT}=1.0A			120	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =14.5V ~ 30V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		75		μV
Ripple Rejection	RR	V_{IN} =15V - 25V, f=120Hz, T_J =25°C	52	72		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

L7815

(V_{IN} =23V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	14.40	15.0	15.60	V
		V_{IN} =17.5V ~ 30V, I_{OUT}=5Ma ~ 1.0A, P_D≤15W	14.25		15.75	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A			150	mV
		T^J =25°C, I_{OUT}=0.25A ~ 0.75A			75	mV
Line regulation	ΔV_{OUT}	V_{IN} =18.5V ~ 30V, T_J =25°C			150	mV
		V_{IN} =17.7V ~ 30V, T_J =25°C, IOUT =1.0A			150	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =17.5V ~ 30V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		90		μV
Ripple Rejection	RR	V_{IN} =18.5V ~ 28.5V, f=120Hz, T_J =25°C	51	70		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

L7818

(V_{IN} =27V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	17.28	18.0	18.72	V
		V_{IN} =21V ~ 33V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	17.10		18.90	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T^J =25°C, I_{OUT}=5mA ~ 1.0A			180	mV
		T^J =25°C, I_{OUT}=0.25A ~ 0.75A			90	mV
Line regulation	ΔV_{OUT}	V_{IN} =21V ~ 33V, T_J =25°C			180	mV
		V_{IN} =21V ~ 33V, T_J =25°C, I_{OUT} =1.0A			180	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =21.5V ~ 33V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		110		μV
Ripple Rejection	RR	V_{IN} =22V ~ 32V, f=120Hz, T_J =25°C	50	69		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

L7820

(V_{IN} =31V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	19.20	20.0	20.80	V
		V_{IN} =23V ~ 35V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	19.00		21.00	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A			200	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			100	mV
Line regulation	ΔV_{OUT}	V_{IN} =23V ~ 35V, T_J =25°C			200	mV
		V_{IN} =23V ~ 35V, T_J =25°C, I_{OUT} =1.0A			200	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =23.5V ~ 35V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		110		μV
Ripple Rejection	RR	V_{IN} =24V ~ 34V, f=120Hz, T_J =25°C	50	69		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

L7824

(V_{IN} =33V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	23.04	24.0	24.96	V
		V_{IN} =27V ~ 38V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	22.80		25.20	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A			240	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			120	mV
Line regulation	ΔV_{OUT}	V_{IN} =27V ~ 38V, T_J =25°C			240	mV
		V_{IN} =27V ~ 38V, T_J =25°C, I_{OUT}=1.0A			240	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =28V ~ 38V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		170		μV
Ripple Rejection	RR	V_{IN} =28V ~ 38V, f=120Hz, T_J =25°C	49	66		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

Notes:

1.The Maximum steady state usable output current are dependent on input voltage, heat sinking, lead length of the package and copper pattern of PCB. The data above represents pulse test conditions with junction temperatures specified at the initiation of test.

2. Power dissipation<0.5W

10. NOTES FOR USE

Thermal design

Use a thermal design that allows for a sufficient margin in light of the power dissipation (Pd) in actual operating conditions.

Absolute maximum ratings

An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down the devices, thus making impossible to identify breaking mode, such as a short circuit or an open circuit. If any over rated values will expect to exceed the absolute maximum ratings, consider adding circuit protection devices, such as fuses.

GND voltage

The potential of GND pin must be minimum potential in all operating conditions.

Actions in strong electromagnetic field

Use caution when using the IC in the presence of a strong electromagnetic field as doing so may cause the IC to malfunction.

Inter-pin shorts and mounting errors

Use caution when positioning the IC for mounting on printed circuit boards.

The IC may be damaged if there is any connection error or if pins are shorted together.

Thermal shutdown circuit

The IC incorporates a built-in thermal shutdown circuit (TSD circuit). The thermal shutdown circuit (TSD circuit) is designed only to shut the IC off to prevent thermal runaway. It is not designed to protect the IC or guarantee its operation. Do not continue to use the IC after operating this circuit or use the IC in an environment where the operation of this circuit is assumed.

Overcurrent Protection Circuit

An overcurrent protection circuit is incorporated in order to prevention destruction due to short-time overload currents.

Continued use of the protection circuits should be avoided. Please note that the current increases negatively impact the temperature.

Testing on application boards

When testing the IC on an application board, connecting a capacitor to a pin with low impedance subjects the IC to stress. Always discharge capacitors after each process or step. Always turn the IC's power supply off before connecting it to or removing it from a jig or fixture during the inspection process. Ground the IC during assembly steps as an antistatic measure. Use similar precaution when transporting or storing the IC.

Ground Wiring Pattern

When using both small signal and large current GND patterns, it is recommended to isolate the two ground patterns, placing a single ground point at the ground potential of application so that the pattern wiring resistance and voltage variations caused by large currents do not cause variations in the small signal ground voltage. Be careful not to change the GND wiring pattern of any external components, either.

Damage to the internal circuit or element may occur when the polarity of the V_{CC} pin is opposite to that of the other pins in applications. (I.e. V_{CC} is shorted with the GND pin while an external capacitor is charged.)

Use a maximum capacitance of 1000μF for the output pins. Inserting a diode to prevent back-current flow in series with V_{CC} or bypass diodes between V_{CC} and each pin is recommended.

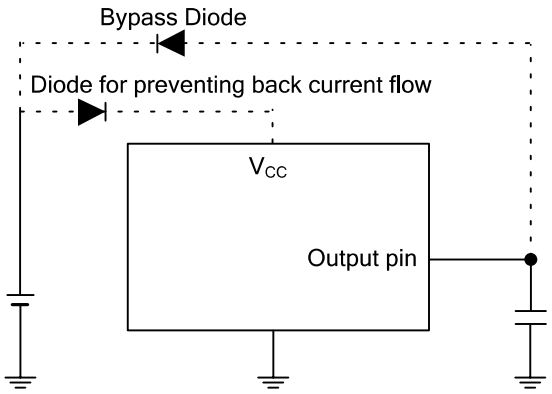
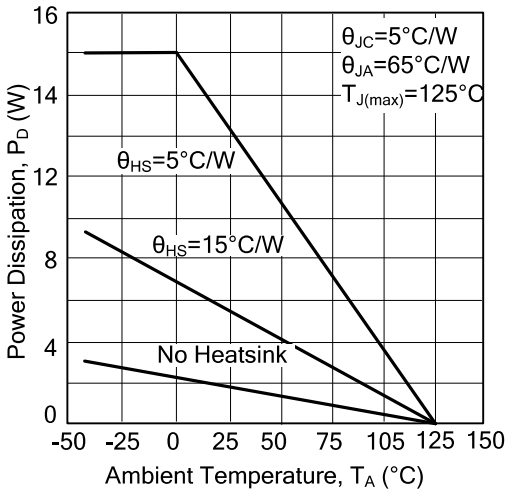


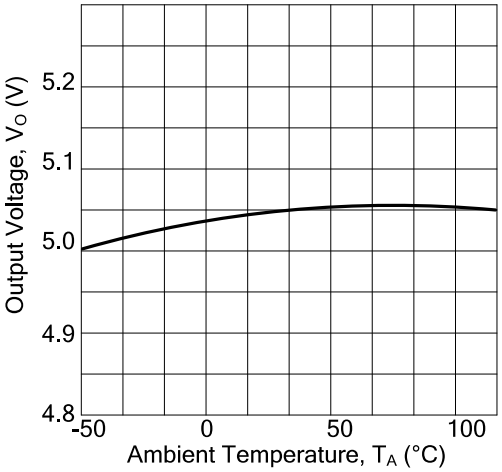
Fig. 1. Bypass Diod

11. TYPICAL CHARACTERISTICS

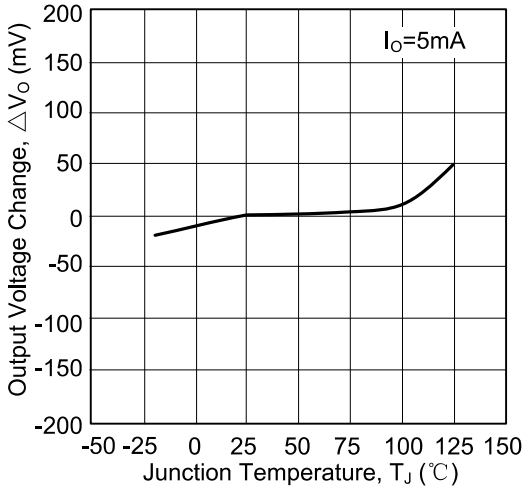
Ambient Temperature vs. Power Dissipation



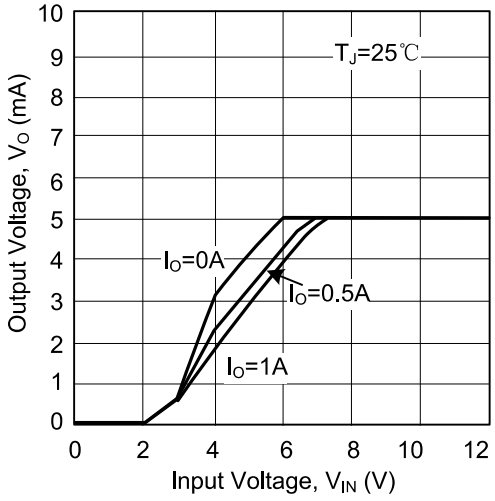
Output Voltage vs. Ambient Temperature



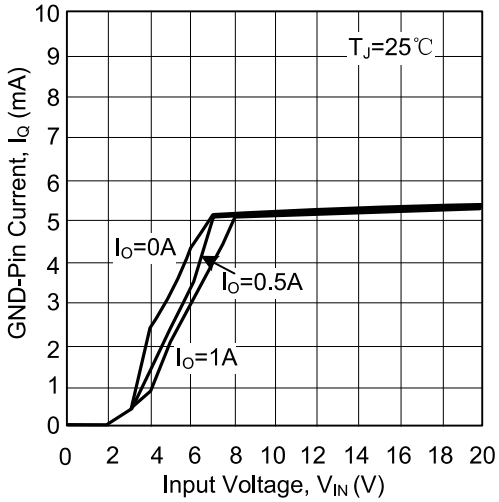
Output Voltage Change vs. Junction Temperature



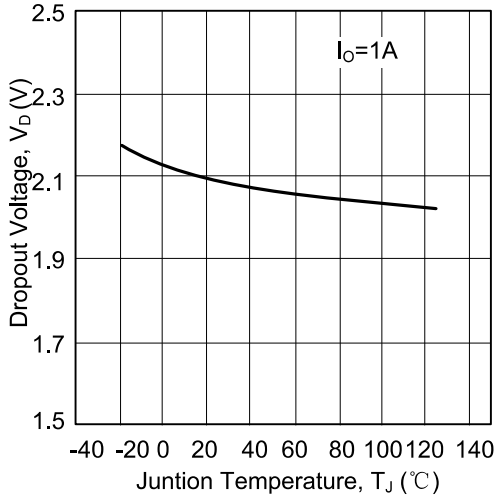
Output Voltage vs. Input Voltage



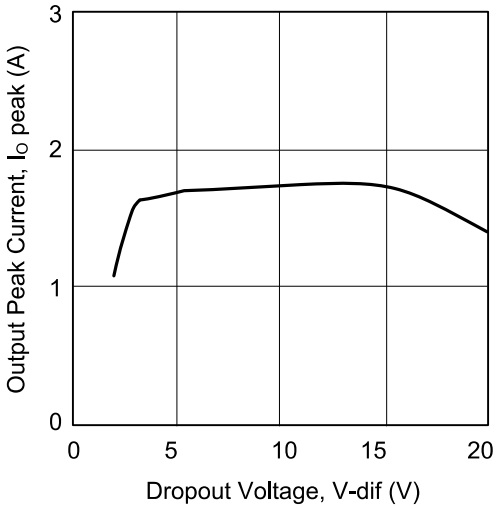
GND Current vs. Input Voltage



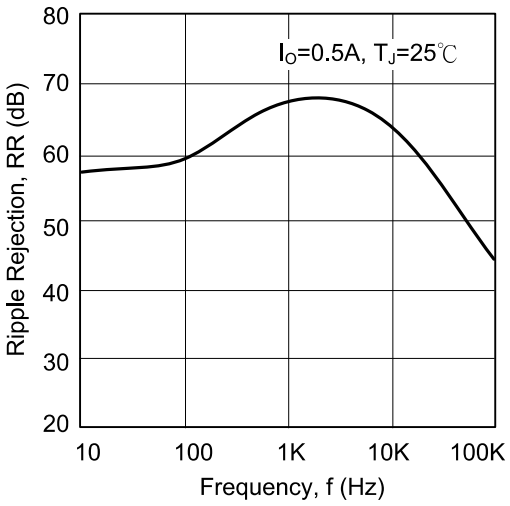
Dropout Voltage vs. Juntion Temperature



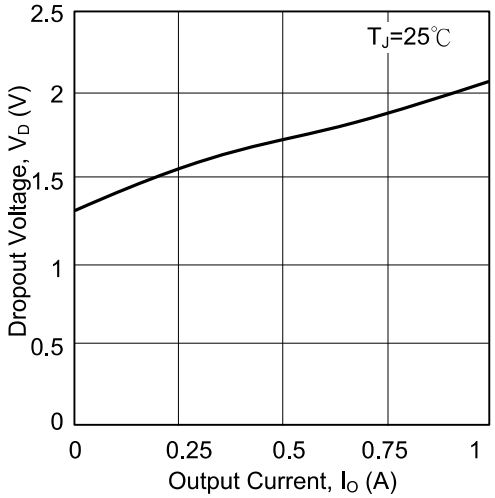
Output Peak Current vs. Dropout Voltage



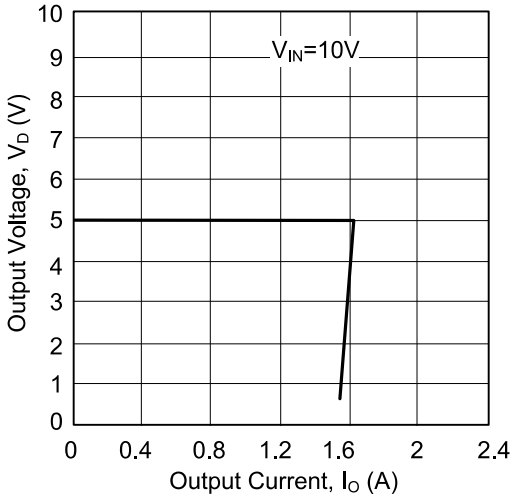
Ripple Rejection vs. Frequency



Dropout Voltage vs. Output Current



Output Voltage vs. Output Current



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