AT7800

1.0 A Three-Terminal Positive Voltage Regulators

Immense Advance Tech.

FEATURES

- Output current up to 1A
- 3-Terminal Regulators
- Internal Thermal Overload Protection
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Protection
- TO-220 and TO-252 Packages
- High Power Dissipation Capability
- Direct replacements for LM7800
- Output Voltage 5V,6V,8V,9V,10V,12V,15V,18V, 20V,24V

APPLICATION

- Post-Regulator Switching DC/DC Converters
- Bias Supply for Analog Circuits
- Instrumentation and Audio Systems
- Logic Systems
- Others too numerous to mention

DESCRIPTION

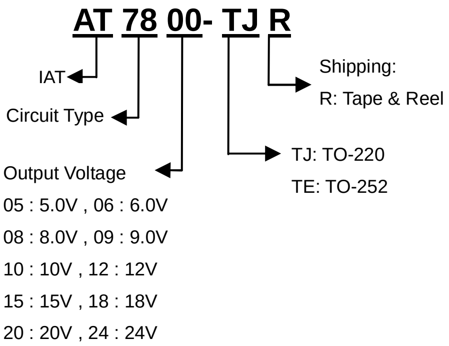
The AT7800 series are classic regulators, which are useful in a wide range of applications. For example, you can use them for local on-card regulation to eliminate the distribution and problems associated with single point regulation.

The wide range of output voltages (5V to 24V) make them useful in an endless list of applications. Although designed as fixed voltage regulators, you can add a few external components to make adjustable voltages and currents.

Current limiting prevents the peak output current to a safe value. Safe-area protection of the output transistor limits internal power dissipation. If internal power dissipation becomes too high for the heat sinking provided, the thermal shutdown circuit activates to prevent the regulator from overheating. These versatile workhorses are easy to use. You do not need to bypass the output, although this does improve transient response. Input bypassing is needed only if you place the regulator far from the filter capacitor of the power supply.

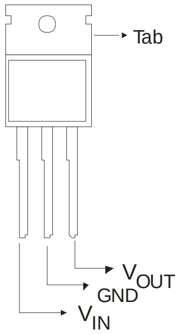
The AT7800 series is available in TO-220 and TO-252 packages.

ORDER INFORMATION

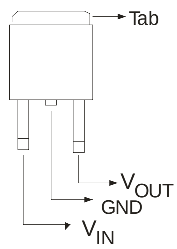


PIN CONFIGURATIONS (TOP VIEW)

TO-220

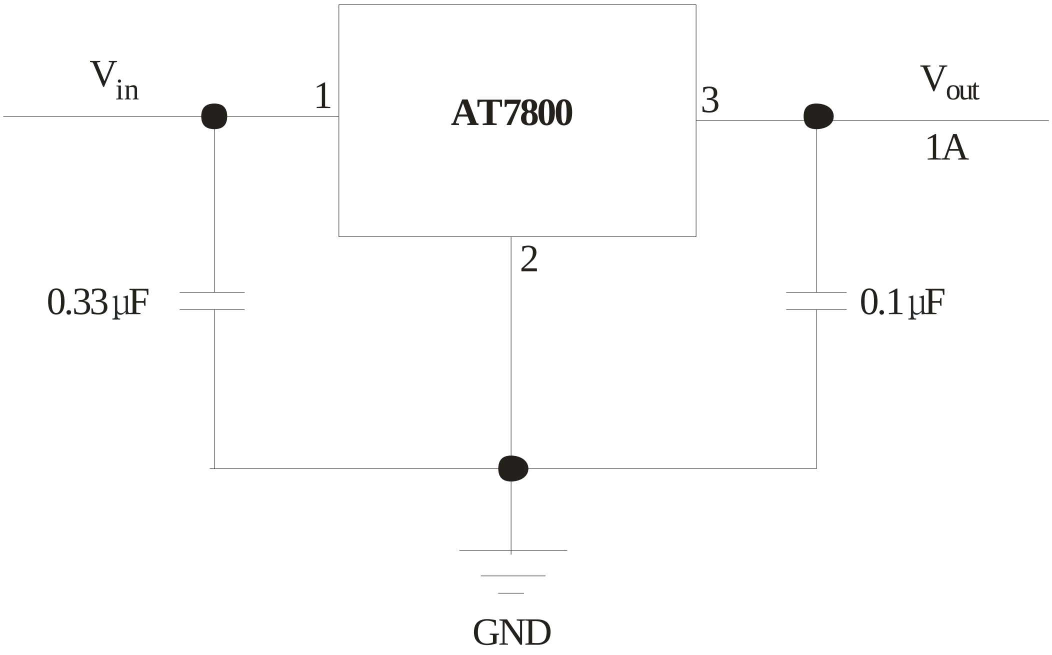


TO-252



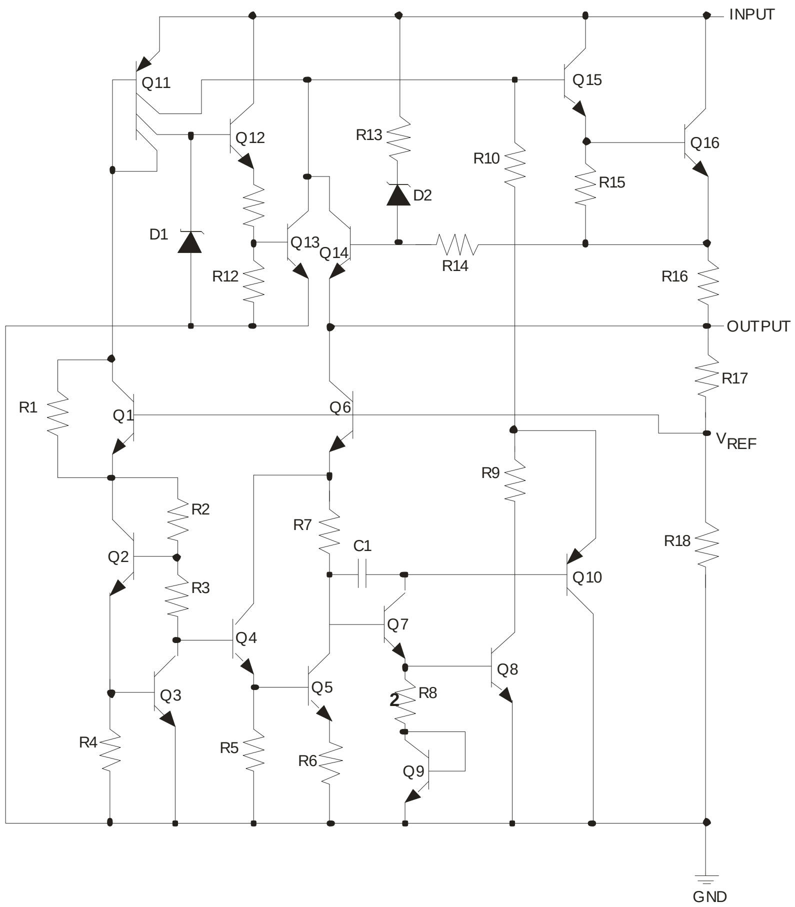
*Tab=GND

TYPICAL APPLICATION CIRCUITS



For a positive regulator, a 0.33μF bypass capacitor should be used on the input terminals. While not necessary for stability, an output capacitor of 0.1μF may be used to improve the transient response of the regulator. These capacitors should be on or as near as possible to the regulator terminals .

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Note 1)

Parameter		Symbol	Max Value	Unit
Input Voltage V_O = 5.0-12V V_O = 15V-24V		V_{IN}	35 40	V
Operating junctions Temperature Range		T_J	-40 to +150	℃
Storage Temperature Range		T_{STG}	-65 to +150	℃
Lead Temperature(Soldering) 5 Sec.		T_{LEAD}	260	℃
Thermal Resistance Junction to Case	TO-220	$R_{\theta JC}$	5	℃ / W
	TO-252		8	

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.

ELECTRICAL CHARACTERISTICS at specified Junction Temperature

AT7805:V_I= 10V, I_O= 500mA, TA=25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_O		4.8	5.0	5.2	V
		I_O= 5mA to 1A V_I=7.5V to 20V, P≤15W	4.75	5	5.25	
Input Regulation	Reg_{line}	V_I=7V to 25V V_I=8V to 12V	–	3 1	50 25	mV
Ripple Rejection	RR	V_I=8V to 18V, f = 120Hz	62	78	–	dB
Output Regulation	Reg_{load}	I_O=5mA to 1.5A I_O=250mA to 750mA	–	15 5	50 25	mV
Output Resistance	r_O	f = 1kHz	–	0.017	–	Ω
Temperature Coefficient Output Voltage	TCV_O	I_O= 5mA	–	-0.3	–	mV/^{o}C
Output Noise Voltage	e_n	f = 10Hz to 100kHz	–	10	–	μV
Dropout Voltage	V_I-V_O	I_O= 1A	–	20	–	V
Ground Current	I_G		–	4.2	8	mA
Ground Current Change	△I_G	V_I= 7V to 25V I_O=5mA to 1A	–	–	1.3 0.5	mA
Peak Output Current	I_{max}		–	2.2	–	A

AT7806:V_I= 11V, I_O= 500mA, TA=25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_O		5.75	6	6.25	V
		I_O= 5mA to 1A V_I=8V to 21V, P≤15W	5.7	6	6.3	
Input Regulation	Reg_{line}	V_I=8V to 25V V_I=9V to 13V	–	5 2	60 30	mV
Ripple Rejection	RR	V_I=9V to 19V, f = 120Hz	59	75	–	dB
Output Regulation	Reg_{load}	I_O=5mA to 1.5A I_O=250mA to 750mA	–	25 10	60 30	mV
Output Resistance	r_O	f = 1kHz	–	0.019	–	
Temperature Coefficient Output Voltage	TCV_O	I_O= 5mA	–	45	–	mV/^{o}C
Output Noise Voltage	e_n	f = 10Hz to 100kHz	–	2.0	–	μV
Dropout Voltage	V_I-V_O	I_O= 1A	–	4.3	8	V
Ground Current	I_G		–	–	1.3 0.5	mA

Ground Current Change	ΔI_G	V_I= 8V to 25V I_O=5mA to 1A	—	—	1.3 0.5	mA
Peak Output Current	I_{max}		—	2.2	—	A

*Pulse testing tehniques are used to maintain the junction temperature as close to the ambient temperature as possible.

Thermal effects must be taken into account.

** The specification applies only for DC power dissipation permitted by absolute maximum ratings.

***TA=0℃ to 125℃.

ELECTRICAL CHARACTERISTICS at specified Junction Temperature

AT7808:V_I= 14V, I_O= 500mA, TA=25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_O		7.7	8	8.3	V
		I_O= 5mA to 1A V_I=10.5V to 23V, P≤15W	7.6	8	8.4	
Input Regulation	Reg_{line}	V_I=10.5V to 25V V_I=11.5V to 17V	—	8 3	60 30	mV
Ripple Rejection	RR	V_I=11.5V to 21.5V, f = 120Hz	55	72	—	dB
Output Regulation	Reg_{load}	I_O=5mA to 1.5A I_O=250mA to 750mA	—	30 10	80 40	mV
Output Resistance	r_O	f = 1kHz	—	0.016	—	
Temperature Coefficient Output Voltage	TCV_O	I_O= 5Ma	—	-0.8	—	mV/°C
Output Noise Voltage	e_n	f = 10Hz to 100kHz	—	52	—	μV
Dropout Voltage	V_I-V_O	I_O= 1A	—	2.0	—	V
Ground Current	I_G		—	4.3	8	mA
Ground Current Change	ΔI_G	V_I= 10.5V to 25V I_O=5mA to 1A	—	—	1.0 0.5	mA
Peak Output Current	I_{max}		—	2.2	—	A

AT7809:VI= 15V, I_O= 500mA, TA=25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_O		8.65	9	9.35	V
		I_O= 5mA to 1A V_I=10.5V to 23V, P≤15W	8.55	9	9.45	
Input Regulation	Reg_{line}	V_I=10.5V to 25V V_I=11.5V to 17V	—	8 3	90 45	mV
Ripple Rejection	RR	V_I=11.5V to 21.5V, f = 120Hz	55	70	—	dB

Output Regulation	Reg_{load}	I_O=5mA to 1.5A I_O=250mA to 750mA	—	30 10	90 45	mV
Output Resistance	r_O	f = 1kHz	—	0.018	—	
Temperature Coefficient Output Voltage	TCV_O	I_O= 5Ma	—	-0.1	—	mV/°C
Output Noise Voltage	e_n	f = 10Hz to 100kHz	—	60	—	μV
Dropout Voltage	V_I-V_O	I_O= 1A	—	2.0	—	V
Ground Current	I_G		—	4	8	mA
Ground Current Change	ΔI_G	V_I= 10.5V to 25V I_O=5mA to 1A	—	—	1.0 0.5	mA
Peak Output Current	I_{max}		—	2.2	—	A

*Pulse testing tehniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account.

** The specification applies only for DC power dissipation permitted by absolute maximum ratings.

***TA=0℃ to 125℃.

AT7810:V_I= 16V, I_O= 500mA, TA=25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_O		9.6	10	10.4	V
		I_O= 5mA to 1A V_I=12.5V to 25V, P≤15W	9.5	10	10.5	
Input Regulation	Reg_{line}	V_I=12.5V to 26V V_I=13V to 25V	—	10 3	100 50	mV
Ripple Rejection	RR	V_I=11.5V to 21.5V, f = 120Hz	55	71	—	dB
Output Regulation	Reg_{load}	I_O=5mA to 1.5A I_O=250mA to 750mA	—	30 10	100 50	mV
Output Resistance	r_O	f = 1kHz	—	0.018	—	
Temperature Coefficient Output Voltage	TCV_O	I_O= 5Ma	—	-1.0	—	mV/°C
Output Noise Voltage	e_n	f = 10Hz to 100kHz	—	70	—	μV
Dropout Voltage	V_I-V_O	I_O= 1A	—	2.0	—	V
Ground Current	I_G		—	4	8	mA
Ground Current Change	ΔI_G	V_I= 10.5V to 25V I_O=5mA to 1A	—	—	1.0 0.5	mA
Peak Output Current	I_{max}		—	2.2	—	A

ELECTRICAL CHARACTERISTICS at specified Junction Temperature

AT7812:V_I= 19V, I_O= 500mA, TA=25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_O		11.5	12	12.5	V
		I_O= 5mA to 1A V_I=14.5V to 27V, P≤15W	11.4	12	12.6	
Input Regulation	Reg_{line}	V_I=14.5V to 30V V_I=16V to 22V	—	10 3	120 60	mV
Ripple Rejection	RR	V_I=15V to 25V, f = 120Hz	55	71	—	dB
Output Regulation	Reg_{load}	I_O=5mA to 1.5A I_O=250mA to 750mA	—	30 10	120 60	mV
Output Resistance	r_O	f = 1kHz	—	0.018	—	
Temperature Coefficient Output Voltage	TCV_O	I_O= 5mA	—	-1.0	—	mV/^{o}C
Output Noise Voltage	e_n	f = 10Hz to 100kHz	—	70	—	μV
Dropout Voltage	V_I-V_O	I_O= 1A	—	2.0	—	V
Ground Current	I_G		—	4	8	mA
Ground Current Change	ΔI_G	V_I= 14.5V to 30V I_O=5mA to 1A	—	—	1.0 0.5	mA
Peak Output Current	I_{max}		—	2.2	—	A

*Pulse testing tehniques are used to maintain the junction temperature as close to the ambient temperature as possible.

Thermal effects must be taken into account.

** The specification applies only for DC power dissipation permitted by absolute maximum ratings.

***TA=0℃ to 125℃.

AT7815:V_I= 23V, I_O= 500mA, TA=25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_O		14.4	15	15.6	V
		I_O= 5mA to 1A V_I=17.5V to 30V, P≤15W	14.25	15	15.75	
Input Regulation	Reg_{line}	V_I=17.5V to 30V V_I=20V to 26V	—	12 5	150 75	mV
Ripple Rejection	RR	V_I=18.5V to 28.5V, f = 120Hz	54	70	—	dB
Output Regulation	Reg_{load}	I_O=5mA to 1.5A I_O=250mA to 750mA	—	35 10	150 75	mV
Output Resistance	r_O	f = 1kHz	—	0.019	—	
Temperature Coefficient	TCV_O	I_O= 5mA	—	-1.0	—	mV/^{o}C

Output Voltage						
Output Noise Voltage	e_n	f = 10Hz to 100kHz	—	90	—	μV
Dropout Voltage	V_I-V_O	I_O= 1A	—	2.0	—	V
Ground Current	I_G		—	4	8	mA
Ground Current Change	ΔI_G	V_I= 17.5V to 30V I_O=5mA to 1A	—	—	1.0 0.5	mA
Peak Output Current	I_{max}		—	2.1	—	A

AT7818:V_I= 27V, I_O= 500mA, TA=25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_O		17.3	18	18.7	V
		I_O= 5mA to 1A V_I=21V to 33V, P≤15W	17.1	18	18.9	
Input Regulation	Reg_{line}	V_I=21V to 33V V_I=24V to 30V	—	12 5	180 90	mV
Ripple Rejection	RR	V_I=22V to 32V, f = 120Hz	53	69	—	dB
Output Regulation	Reg_{load}	I_O=5mA to 1.5A I_O=250mA to 750mA	—	35 10	180 60	mV
Output Resistance	r_O	f = 1kHz	—	0.022	—	
Temperature Coefficient Output Voltage	TCV_O	I_O= 5mA	—	-1.0	—	mV/^{o}C
Output Noise Voltage	e_n	f = 10Hz to 100kHz	—	110	—	μV
Dropout Voltage	V_I-V_O	I_O= 1A	—	2.0	—	V
Ground Current	I_G		—	4	8	mA
Ground Current Change	ΔI_G	V_I= 21V to 33V I_O=5mA to 1A	—	—	1.0 0.5	mA
Peak Output Current	I_{max}		—	2.1	—	A

*Pulse testing tehniques are used to maintain the junction temperature as close to the ambient temperature as possible.

Thermal effects must be taken into account.

** The specification applies only for DC power dissipation permitted by absolute maximum ratings.

***TA=0℃ to 125℃.

ELECTRICAL CHARACTERISTICS at specified Junction Temperature

AT7820: V_I= 29V, I_O= 500mA, TA=25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_O		19.2	20	20.8	V
		I_O= 5mA to 1A V_I=23V to 35V, P≤15W	19	20	21	
Input Regulation	Reg_{line}	V_I=23V to 35V V_I=26V to 32V	—	15 6	200 100	mV
Ripple Rejection	RR	V_I=24V to 34V, f = 120Hz	51	66	—	dB
Output Regulation	Reg_{load}	I_O=5mA to 1.5A I_O=250mA to 750mA	—	35 10	200 100	mV
Output Resistance	r_O	f = 1kHz	—	0.027	—	
Temperature Coefficient Output Voltage	TCV_O	I_O= 5mA	—	-1.3	—	mV/°C
Output Noise Voltage	e_n	f = 10Hz to 100kHz	—	150	—	μV
Dropout Voltage	V_I-V_O	I_O= 1A	—	2.0	—	V
Ground Current	I_G		—	4	8	mA
Ground Current Change	ΔI_G	V_I= 23V to 35V I_O=5mA to 1A	—	—	1.0 0.5	mA
Peak Output Current	I_{max}		—	2.1	—	A

AT7824: V_I= 33V, I_O= 500mA, TA=25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_O		13	24	25	V
		I_O= 5mA to 1A V_I=27V to 38V, P≤15W	22.8	24	25.2	
Input Regulation	Reg_{line}	V_I=27V to 38V V_I=30V to 36V	—	15 —	240 120	mV
Ripple Rejection	RR	V_I=28V to 32V, f = 120Hz	50	66	—	dB
Output Regulation	Reg_{load}	I_O=5mA to 1.5A I_O=250mA to 750mA	—	35 10	240 120	mV
Output Resistance	r_O	f = 1kHz	—	0.028	—	
Temperature Coefficient Output Voltage	TCV_O	I_O= 5mA	—	-1.5	—	mV/°C
Output Noise Voltage	e_n	f = 10Hz to 100kHz	—	170	—	μV
Dropout Voltage	V_I-V_O	I_O= 1A	—	2.0	—	V
Ground Current	I_G		—	4	8	mA

Ground Current Change	ΔI_G	V_I= 27V to 38V I_O=5mA to 1A	—	—	1.0 0.5	mA
Peak Output Current	I_{max}		—	2.1	—	A

*Pulse testing tehniques are used to maintain the junction temperature as close to the ambient temperature as possible.

Thermal effects must be taken into account.

** The specification applies only for DC power dissipation permitted by absolute maximum ratings.

***TA=0℃ to 125℃.

APPLICATION INFORMATION

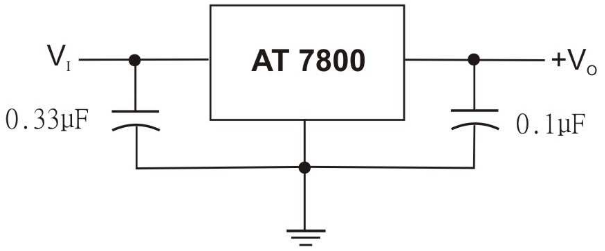


Figure 1. Fixed-Output Regulator

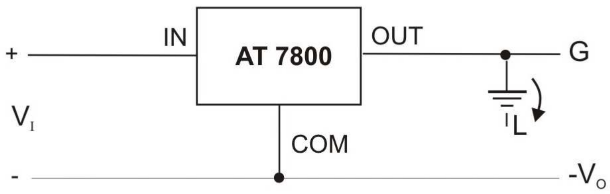
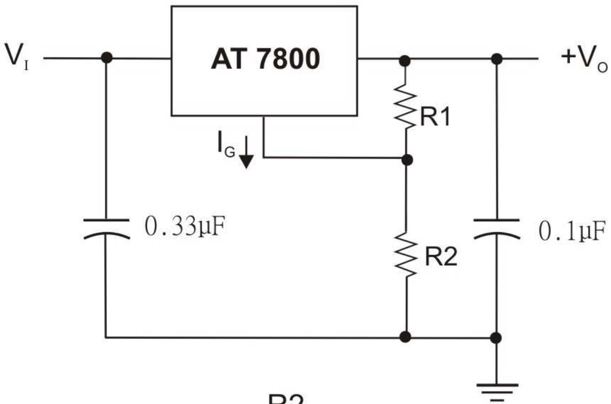
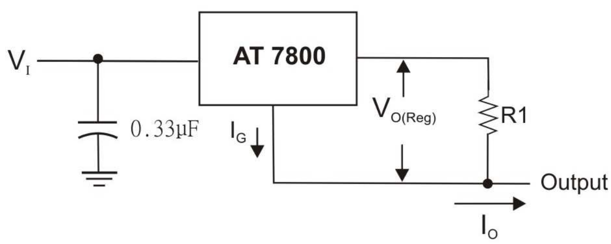


Figure 2. Positive Regulator in Negative Configuration (V, Must Float)



$$V_O = V_O\left(1+\frac{R2}{R1}\right)+I_G R2$$

Figure 3. Circuit for Increasing Output Voltage

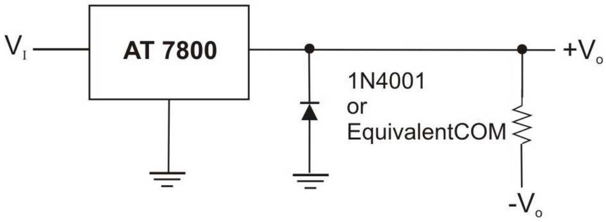


$$I_O = (V_O / R1)+I_G$$

Figure 4. Constant Current Source

Operation with a load common to a voltage of opposite polarity

In many cases, a regulator powers a load that is not connected to ground but, connected to a voltage source of opposite polarity instead (e.g.,operational amplifiers, level-shifting circuits, etc.). In these cases, a clamp diode should be connected to the regulator output as shown in Figure 5. This protects the regulator from output polarity reversals during startup and short-circuit operation.



Reverse-bias protection

Occasionally, the input voltage to the regulator can collapse faster than the output voltage. This can occur, for example, when the input supply is shorted, the output capacitor will discharge into the output of the regulator, the emitter-base junction of the series-pass element (internal or external) could break down and be damaged. To prevent this, a diode shunt can be used as shown in Figure 6.

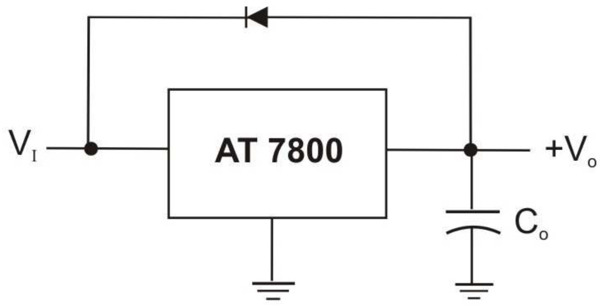
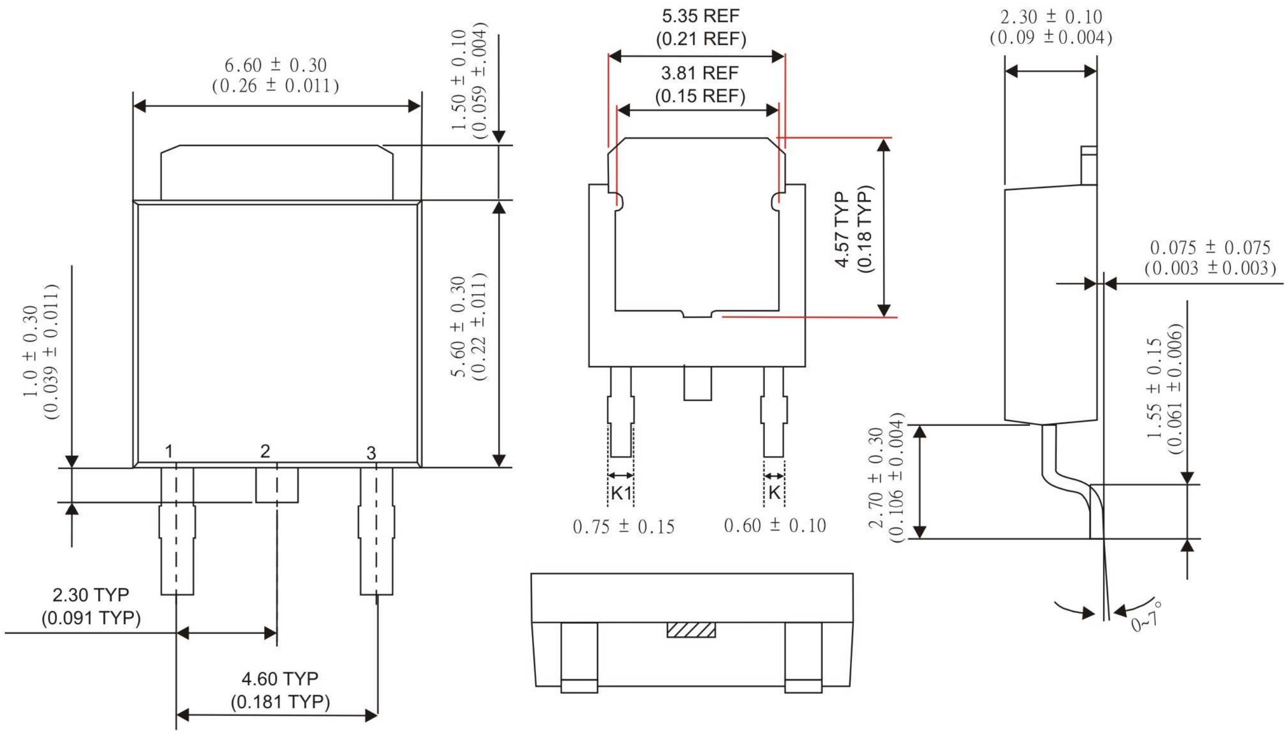


Figure 6. Reverse-Bias-Protection Circuit

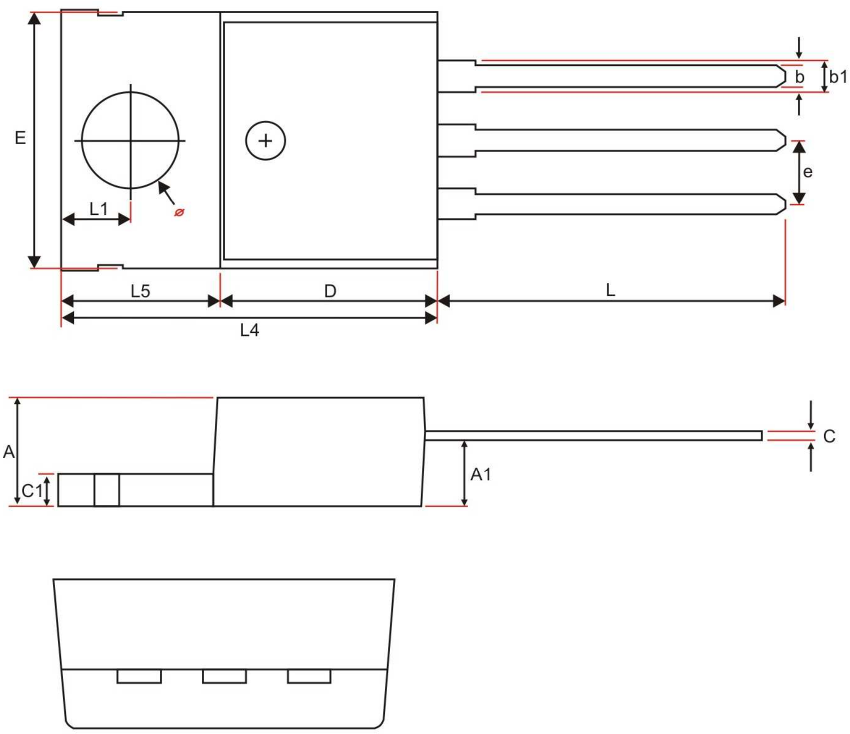
PACKAGE OUTLINE DIMENSIONS

TO-252 PACKAGE OUTLINE DIMENSIONS



Unit :mm(inch)

TO-220 PACKAGE OUTLINE DIMENSIONS



REF.	DIMENSIONS	
	Millimeter	
	Min.	Max.
A	4.40	4.80
b	0.76	1.00
D	8.60	9.00
c	0.36	0.50
E	9.80	10.4
L4	14.70	15.30
L5	6.20	6.60
c1	1.25	1.45
b1	1.17	1.47
L	13.25	14.25
e	2.54 REF.	
L1	2.60	2.89
∅	3.71	3.96
A1	2.60	2.80