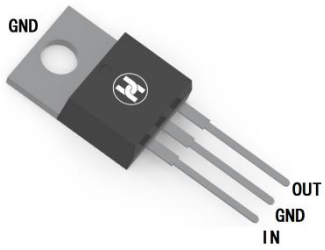
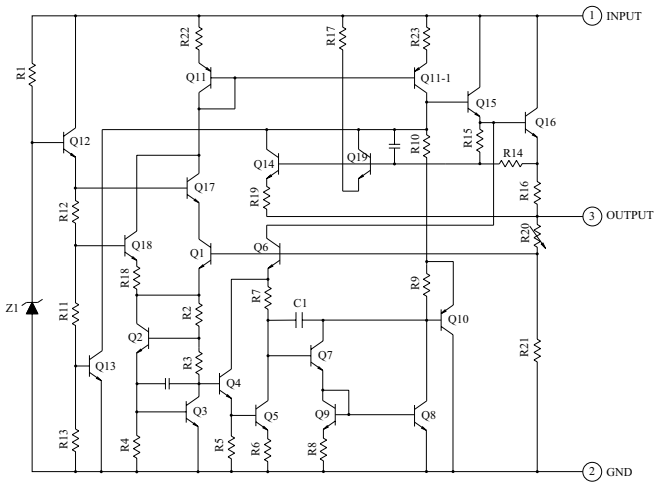
PLASTIC-ENCAPSULATE VOLTAGE REGULATORS



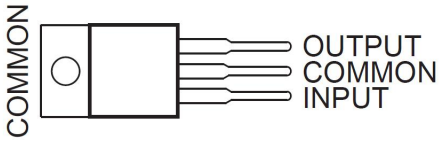
FEATURES

- Maximum Output Current I_O: 1.5A
- Output Voltage V_O: 5V,6V,7V,8V,9V,10V,12V,15V,18V,24V;
- Continuous Total Dissipation
  P_D: 1.5 W (Ta= 25 ℃)
- Surface Mount device

SCHEMATIC DIAGRAM



TO-220



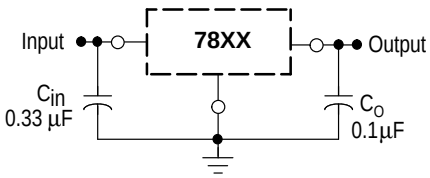
MECHANICAL DATA

- Case: TO-220
- Case Material: Molded Plastic. UL flammability
- Classification Rating: 94V-0
- Weight: 2.30 grams (approximate)

MAXIMUM RATINGS (Operating temperature range applies unless otherwise specified)

Parameter		Symbol	Value	Unit
Input Voltage	V_O=5.0-18V	V_i	35	V
	V_O=24V		40	
Power Dissipation		P_D	Internally Limited	mW
Thermal Resistance from Junction to Ambient		$R_{\theta JA}$	66.7	°C/W
Thermal Resistance from Junction to Case		$R_{\theta JC}$	5.0	
Operating Junction Temperature		T_J	150	°C
Storage Temperature Range		T_{STG}	-65 ~+150	°C

TYPICAL APPLICATION



Note: Bypass capacitors are recommended for optimum stability and transient response and should be located as close as Possible to the regulators.

PLASTIC-ENCAPSULATE VOLTAGE REGULATORS

ELECTRICAL CHARACTERISTICS OF 7805 AT SPECIFIED VIRTUAL JUNCTION TEMPERATURE (Vi=10V,Io=500mA,Ci=0.33uF,,Co=0.1uF, 0°C≤T_J≤+125°C unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Output voltage	V_O	4.80	5.0	5.20	V	T_J=+25°C
		4.75	5.0	5.25	V	7V≤V_i≤20V,I_O=5mA~1A,P_D≤15W
Line regulation	ΔV_O		4	100	mV	7V≤V_i≤25V,T_J=+25°C
			1.6	50	mV	8V≤V_i≤12V,T_J=+25°C
Load Regulation	ΔV_O		9	100	mV	I_O=5mA~1.5A,T_J=+25°C
			4	50	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		5	8	mA	I_O=0,T_J=+25°C
Quiescent Current Change	ΔI_q		0.3	1.3	mA	7V≤V_i≤25V,T_J=25°C
			0.03	0.5	mA	5mA≤I_O≤1.0A,T_J=25°C
Output Noise Voltage	V_N		42		μV	10Hz≤f≤100kHz
Ripple Rejection	RR	62	73		dB	8V≤V_i≤18V,f=120Hz
Dropout Voltage	V_d		2		V	I_O=1.0A,T_J=+25°C
Output Resistance	R_O		10		mΩ	f=1kHz
Short Circuit Current	I_{SC}		230		mA	T_J=+25°C
Peak Current	I_{pk}		2.2		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-1.1		mV/°C	I_O=5mA,0°C≤T_J≤+125°C

Note:Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

ELECTRICAL CHARACTERISTICS OF 7806 AT SPECIFIED VIRTUAL JUNCTION TEMPERATURE (Vi=11V,Io=500mA,Ci=0.33uF,,Co=0.1uF, 0°C≤T_J≤+125°C unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Output voltage	V_O	5.75	6.0	6.25	V	T_J=+25°C
		5.7	6.0	6.3	V	8V≤V_i≤21V,I_O=5mA~1A,P_D≤15W
Line regulation	ΔV_O		5	120	mV	8V≤V_i≤25V,T_J=+25°C
			1.5	60	mV	9V≤V_i≤13V,T_J=+25°C
Load Regulation	ΔV_O		14	120	mV	I_O=5mA~1.5A,T_J=+25°C
			4	60	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		4.3	8	mA	I_O=0,T_J=+25°C
Quiescent Current Change	ΔI_q			1.3	mA	8V≤V_i≤25V,T_J=25°C
				0.5	mA	5mA≤I_O≤1A,T_J=25°C
Output Noise Voltage	V_N		45		μV	10Hz≤f≤100kHz
Ripple Rejection	RR	59	75		dB	9V≤V_i≤19V,f=120Hz
Dropout Voltage	V_d		2		V	I_O=1.0A,T_J=+25°C
Output Resistance	R_O		10		mΩ	f=1kHz
Short Circuit Current	I_{SC}		550		mA	T_J=+25°C
Peak Current	I_{pk}		2.2		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-0.8		mV/°C	I_O=5mA,0°C≤T_J≤+125°C

Note:Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

PLASTIC-ENCAPSULATE VOLTAGE REGULATORS

ELECTRICAL CHARACTERISTICS OF 7807 AT SPECIFIED VIRTUAL JUNCTION TEMPERATURE (Vi=12V,Io=500mA,Ci=0.33uF,,Co=0.1uF, 0°C≤T_J≤+125°C unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Output voltage	V_O	6.7	7.0	7.3	V	T_J=+25°C
		6.6	7.0	7.4	V	9V≤V_i≤22V,I_O=5mA~1A,P_D≤15W
Line regulation	ΔV_O		5	140	mV	9V≤V_i≤25V,T_J=+25°C
			2	70	mV	10V≤V_i≤14V,T_J=+25°C
Load Regulation	ΔV_O		15	140	mV	I_O=5mA~1.5A,T_J=+25°C
			5	70	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		4.3	8	mA	I_O=0,T_J=+25°C
Quiescent Current Change	ΔI_q			1.3	mA	9V≤V_i≤25V,T_J=25°C
				0.5	mA	5mA≤I_O≤1A,T_J=25°C
Output Noise Voltage	V_N		60		μV	10Hz≤f≤100kHz
Ripple Rejection	RR	59	75		dB	10V≤V_i≤20V,I_O=100mA,f=120Hz
Dropout Voltage	V_d		2		V	I_O=1A,T_J=+25°C
Output Resistance	R_O		16		mΩ	f=1kHz
Short Circuit Current	I_{SC}		500		mA	T_J=+25°C
Peak Current	I_{pk}		2.2		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-0.8		mV/°C	I_O=5mA,0°C≤T_J≤+125°C

Note:Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

ELECTRICAL CHARACTERISTICS OF 7808 AT SPECIFIED VIRTUAL JUNCTION TEMPERATURE (Vi=14V,Io=500mA,Ci=0.33uF,,Co=0.1uF, 0°C≤T_J≤+125°C unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Output voltage	V_O	7.7	8.0	8.3	V	T_J=+25°C
		7.6	8.0	8.4	V	10.5V≤V_i≤23V,I_O=5mA~1A,P_D≤15W
Line regulation	ΔV_O		12	160	mV	10.5V≤V_i≤25V,T_J=+25°C
			4	80	mV	11V≤V_i≤17V,T_J=+25°C
Load Regulation	ΔV_O		6	160	mV	I_O=5mA~1.5A,T_J=+25°C
			2	80	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		4.3	8	mA	I_O=0,T_J=+25°C
Quiescent Current Change	ΔI_q			1	mA	10.5V≤V_i≤25V,T_J=25°C
				0.5	mA	10mA≤I_O≤1A,T_J=25°C
Output Noise Voltage	V_N		52		μV	10Hz≤f≤100kHz
Ripple Rejection	RR	55	72		dB	11.5V≤V_i≤21.5V,f=120Hz
Dropout Voltage	V_d		2		V	I_O=1A,T_J=+25°C
Output Resistance	R_O		10		mΩ	f=1kHz
Short Circuit Current	I_{SC}		450		mA	T_J=+25°C
Peak Current	I_{pk}		2.2		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-0.8		mV/°C	I_O=5mA,0°C≤T_J≤+125°C

Note:Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

PLASTIC-ENCAPSULATE VOLTAGE REGULATORS

ELECTRICAL CHARACTERISTICS OF 7809 AT SPECIFIED VIRTUAL JUNCTION TEMPERATURE (Vi=15V,Io=500mA,Ci=0.33uF,,Co=0.1uF, 0°C≤T_J≤+125°C unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Output voltage	V_O	8.65	9.0	9.35	V	T_J=+25°C
		8.55	9.0	9.45	V	11.5V≤V_i≤24V,I_O=5mA~1A,P_D≤15W
Line regulation	ΔV_O		7	180	mV	11.5V≤V_i≤27V,T_J=+25°C
			2	90	mV	13V≤V_i≤19V,T_J=+25°C
Load Regulation	ΔV_O		12	180	mV	I_O=5mA~1.5A,T_J=+25°C
			4	90	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		4.3	8	mA	I_O=0,T_J=+25°C
Quiescent Current Change	ΔI_q			1	mA	11.5V≤V_i≤27V,T_J=25°C
				0.5	mA	5mA≤I_O≤1A,T_J=25°C
Output Noise Voltage	V_N		60		μV	10Hz≤f≤100kHz
Ripple Rejection	RR	55	70		dB	12V≤V_i≤22V,f=120Hz
Dropout Voltage	V_d		2		V	I_O=1.0A,T_J=+25°C
Output Resistance	R_O		18		mΩ	f=1kHz
Short Circuit Current	I_{SC}		400		mA	T_J=+25°C
Peak Current	I_{pk}		2.2		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-1.0		mV/°C	I_O=5mA,0°C≤T_J≤+125°C

Note:Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

ELECTRICAL CHARACTERISTICS OF 7810 AT SPECIFIED VIRTUAL JUNCTION TEMPERATURE (Vi=16V,Io=500mA,Ci=0.33uF,,Co=0.1uF, 0°C≤T_J≤+125°C unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Output voltage	V_O	9.6	10	10.4	V	T_J=+25°C
		9.5	10	10.5	V	12.5V≤V_i≤27V,I_O=5mA~1A,P_D≤15W
Line regulation	ΔV_O		8	200	mV	12.5V≤V_i≤27V,T_J=+25°C
			2.5	100	mV	14V≤V_i≤20V,T_J=+25°C
Load Regulation	ΔV_O		12	200	mV	I_O=5mA~1.5A,T_J=+25°C
			4	100	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		4.3	8	mA	I_O=0,T_J=+25°C
Quiescent Current Change	ΔI_q			1	mA	12.5V≤V_i≤27V,T_J=25°C
				0.5	mA	5mA≤I_O≤1A,T_J=25°C
Output Noise Voltage	V_N		63		μV	10Hz≤f≤100kHz
Ripple Rejection	RR	55	72		dB	13.5V≤V_i≤23.5V,f=120Hz
Dropout Voltage	V_d		2		V	I_O=1.0A,T_J=+25°C
Output Resistance	R_O		16		mΩ	f=1kHz
Short Circuit Current	I_{SC}		400		mA	T_J=+25°C
Peak Current	I_{pk}		2.2		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-0.8		mV/°C	I_O=5mA,0°C≤T_J≤+125°C

Note:Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

PLASTIC-ENCAPSULATE VOLTAGE REGULATORS

ELECTRICAL CHARACTERISTICS OF 7812 AT SPECIFIED VIRTUAL JUNCTION TEMPERATURE (Vi=19V,Io=500mA,Ci=0.33uF,,Co=0.1uF, 0°C≤T_J≤+125°C unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Output voltage	V_O	11.5	12	12.5	V	T_J=+25°C
		11.4	12	12.6	V	14.5V≤V_i≤27V,I_O=5mA~1A,P_D≤15W
Line regulation	ΔV_O		10	240	mV	14.5V≤V_i≤30V,T_J=+25°C
			3	120	mV	16V≤V_i≤22V,T_J=+25°C
Load Regulation	ΔV_O		12	240	mV	I_O=5mA~1.5A,T_J=+25°C
			4	120	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		4.3	8	mA	I_O=0,T_J=+25°C
Quiescent Current Change	ΔI_q			1	mA	14.5V≤V_i≤30V,T_J=+25°C
				0.5	mA	5mA≤I_O≤1A,T_J=+25°C
Output Noise Voltage	V_N		75		μV	10Hz≤f≤100kHz
Ripple Rejection	RR	55	71		dB	15V≤V_i≤25V,f=120Hz
Dropout Voltage	V_d		2		V	I_O=1.0A,T_J=+25°C
Output Resistance	R_O		18		mΩ	f=1kHz
Short Circuit Current	I_{SC}		350		mA	T_J=+25°C
Peak Current	I_{pk}		2.2		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-1		mV/°C	I_O=5mA,0°C≤T_J≤+125°C

Note:Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

ELECTRICAL CHARACTERISTICS OF 7815 AT SPECIFIED VIRTUAL JUNCTION TEMPERATURE (Vi=23V,Io=500mA,Ci=0.33uF,,Co=0.1uF, 0°C≤T_J≤+125°C unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Output voltage	V_O	14.4	15	15.6	V	T_J=+25°C
		14.25	15	15.75	V	17.5V≤V_i≤30V,I_O=5mA~1A,P_D≤15W
Line regulation	ΔV_O		12	300	mV	17.5V≤V_i≤30V,T_J=+25°C
			3	150	mV	20V≤V_i≤26V,T_J=+25°C
Load Regulation	ΔV_O		12	300	mV	I_O=5mA~1.5A,T_J=+25°C
			4	150	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		4.3	8	mA	I_O=0,T_J=+25°C
Quiescent Current Change	ΔI_q			1	mA	17.5V≤V_i≤30V,T_J=+25°C
				0.5	mA	5mA≤I_O≤1A,T_J=+25°C
Output Noise Voltage	V_N		90		μV	10Hz≤f≤100kHz
Ripple Rejection	RR	54	70		dB	18.5V≤V_i≤28.5V,f=120Hz
Dropout Voltage	V_d		2		V	I_O=1.0A,T_J=+25°C
Output Resistance	R_O		19		mΩ	f=1kHz
Short Circuit Current	I_{SC}		230		mA	T_J=+25°C
Peak Current	I_{PK}		2.1		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-1		mV/°C	I_O=5mA,0°C≤T_J≤+125°C

Note:Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

PLASTIC-ENCAPSULATE VOLTAGE REGULATORS

ELECTRICAL CHARACTERISTICS OF 7818 AT SPECIFIED VIRTUAL JUNCTION TEMPERATURE (Vi=27V,Io=500mA,Ci=0.33uF, Co=0.1uF, 0°C≤T_J≤+125°C unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Output voltage	V_O	17.3	18	18.7	V	T_J=+25°C
		17.1	18	18.9	V	21V≤V_i≤33V,I_O=5mA~1A,P_D≤15W
Line regulation	ΔV_O		13	360	mV	21V≤V_i≤33V,T_J=+25°C
			4	180	mV	24V≤V_i≤30V,T_J=+25°C
Load Regulation	ΔV_O		12	360	mV	I_O=5mA~1.5A,T_J=+25°C
			4	180	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		4.5	8	mA	I_O=0mA,T_J=+25°C
Quiescent Current Change	ΔI_q			1	mA	21V≤V_i≤33V,T_J=+25°C
				0.5	mA	5mA≤I_O≤1.0A,T_J=+25°C
Output Noise Voltage	V_N		125		μV	10Hz≤f≤100kHz
Ripple Rejection	RR	52	68		dB	22V≤V_i≤32V,f=120Hz
Dropout Voltage	V_d		2		V	I_O=1.0A,T_J=+25°C
Output Resistance	R_O		16		mΩ	f=1kHz
Short Circuit Current	I_{SC}		400		mA	T_J=+25°C
Peak Current	I_{PK}		2.1		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-2.5		mV/°C	I_O=5mA,0°C≤T_J≤+125°C

Note:Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

ELECTRICAL CHARACTERISTICS OF 7820 AT SPECIFIED VIRTUAL JUNCTION TEMPERATURE (Vi=29V,Io=500mA,Ci=0.33uF,Co=0.1uF, 0°C≤T_J≤+125°C unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Output voltage	V_O	19.2	20	20.8	V	T_J=+25°C
		19	20	21	V	23V≤V_i≤35V,I_O=5mA~1A,P_D≤15W
Line regulation	ΔV_O		15	400	mV	23V≤V_i≤35V,T_J=+25°C
			5	200	mV	26V≤V_i≤32V,T_J=+25°C
Load Regulation	ΔV_O		12	400	mV	I_O=5mA~1.5A,T_J=+25°C
			4	200	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		4.6	8	mA	I_O=0,T_J=+25°C
Quiescent Current Change	ΔI_q			1	mA	23V≤V_i≤35V,T_J=+25°C
				0.5	mA	5mA≤I_O≤1A,T_J=+25°C
Output Noise Voltage	V_N		135		μV	10Hz≤f≤100kHz,T_J=+25°C
Ripple Rejection	RR	50	66		dB	24V≤V_i≤34V,f=120Hz
Dropout Voltage	V_d		2		V	I_O=1.0A,T_J=+25°C
Output Resistance	R_O		22		mΩ	f=1kHz
Short Circuit Current	I_{SC}		400		mA	T_J=+25°C
Peak Current	I_{PK}		2.1		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-3.0		mV/°C	I_O=5mA,0°C≤T_J≤+125°C

Note:Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

PLASTIC-ENCAPSULATE VOLTAGE REGULATORS

ELECTRICAL CHARACTERISTICS OF 7824 AT SPECIFIED VIRTUAL JUNCTION TEMPERATURE
(Vi=33V,Io=500mA,Ci=0.33uF,,Co=0.1uF,0°C≤T_J≤+125°C unless otherwise specified)

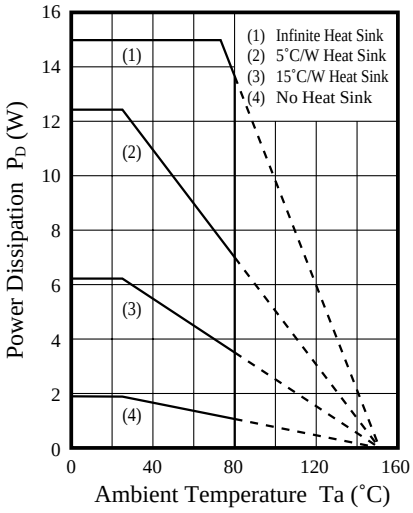
Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Output voltage	V_O	23	24	25	V	T_J=+25°C
		22.8	24	25.2	V	27V≤V_i≤38V,I_O=5mA~1A,P_D≤15W
Line regulation	ΔV_O		18	480	mV	27V≤V_i≤38V,T_J=+25°C
			6	240	mV	30V≤V_i≤36V,T_J=+25°C
Load Regulation	ΔV_O		12	480	mV	I_O=5mA~1.5A,T_J=+25°C
			4	240	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		4.6	8	mA	I_O=0mA,T_J=+25°C
Quiescent Current Change	ΔI_q			1	mA	27V≤V_i≤38V,T_J=+25°C
				0.5	mA	5mA≤I_O≤1.0A,T_J=+25°C
Output Noise Voltage	V_N		170		μV	10Hz≤f≤100kHz,T_J=+25°C
Ripple Rejection	RR	50	65		dB	28V≤V_i≤38V,f=120Hz
Dropout Voltage	V_d		2		V	I_O=1.0A,T_J=+25°C
Output Resistance	R_O		28		mΩ	f=1kHz
Short Circuit Current	I_{SC}		300		mA	V_i=38V,T_J=+25°C
Peak Current	I_{PK}		2.1		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-3.5		mV/°C	I_O=5mA,0°C≤T_J≤+125°C

Note:Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

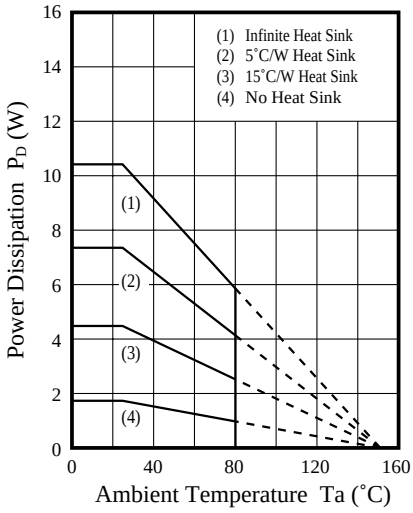
PLASTIC-ENCAPSULATE VOLTAGE REGULATORS

Typical Characteristics

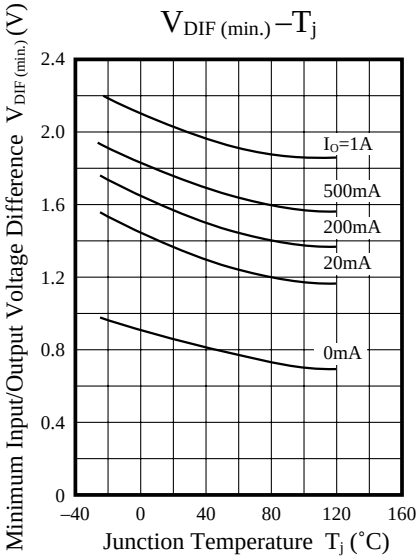
P_D–Ta (7800 Series)



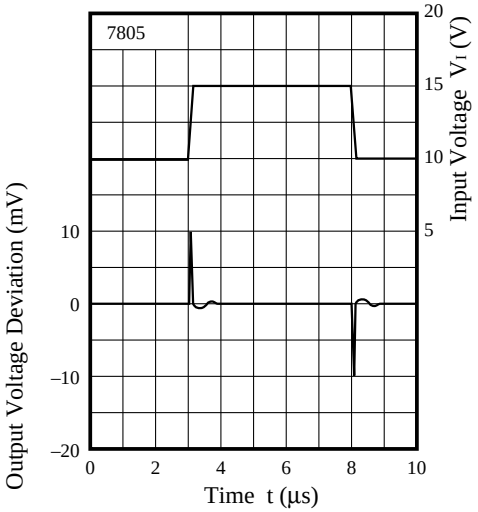
P_D–Ta (7800F Series)



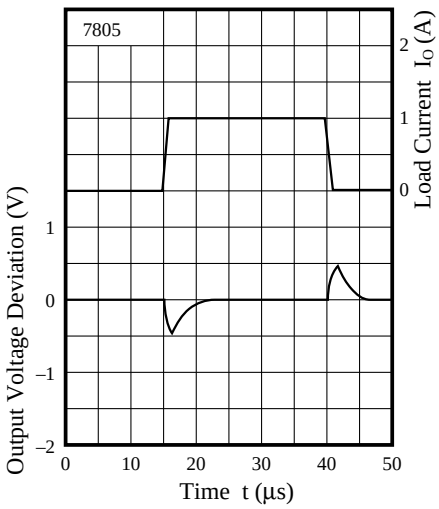
$V_{DIF\,(min.)}$–T_j



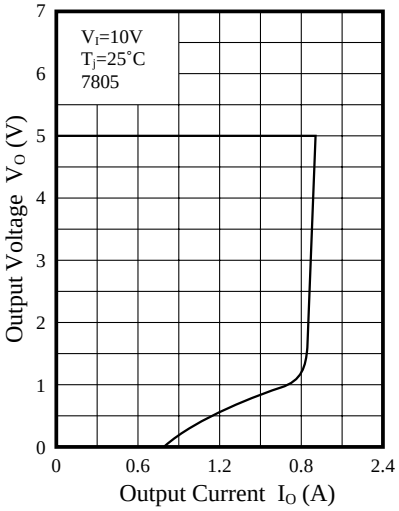
Input Transient Response



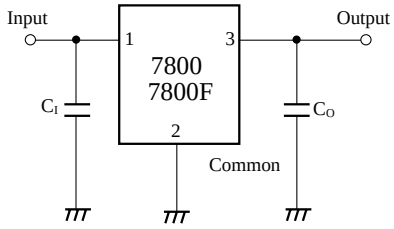
Load Transient Response



Current Limiting Characteristic



■ Basic Regulator Circuit

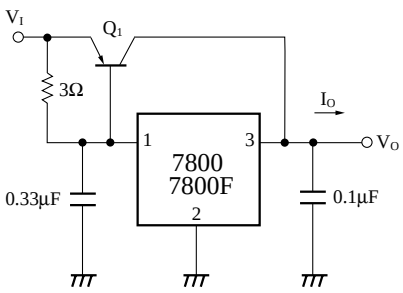


C_I is set when the input line is long.

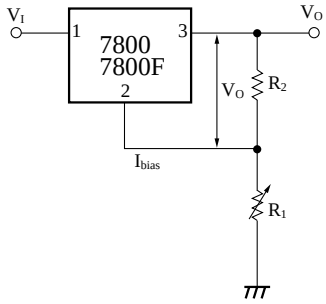
C_O improves the transient response.

■ Application Circuit

1) Current Boost Circuit



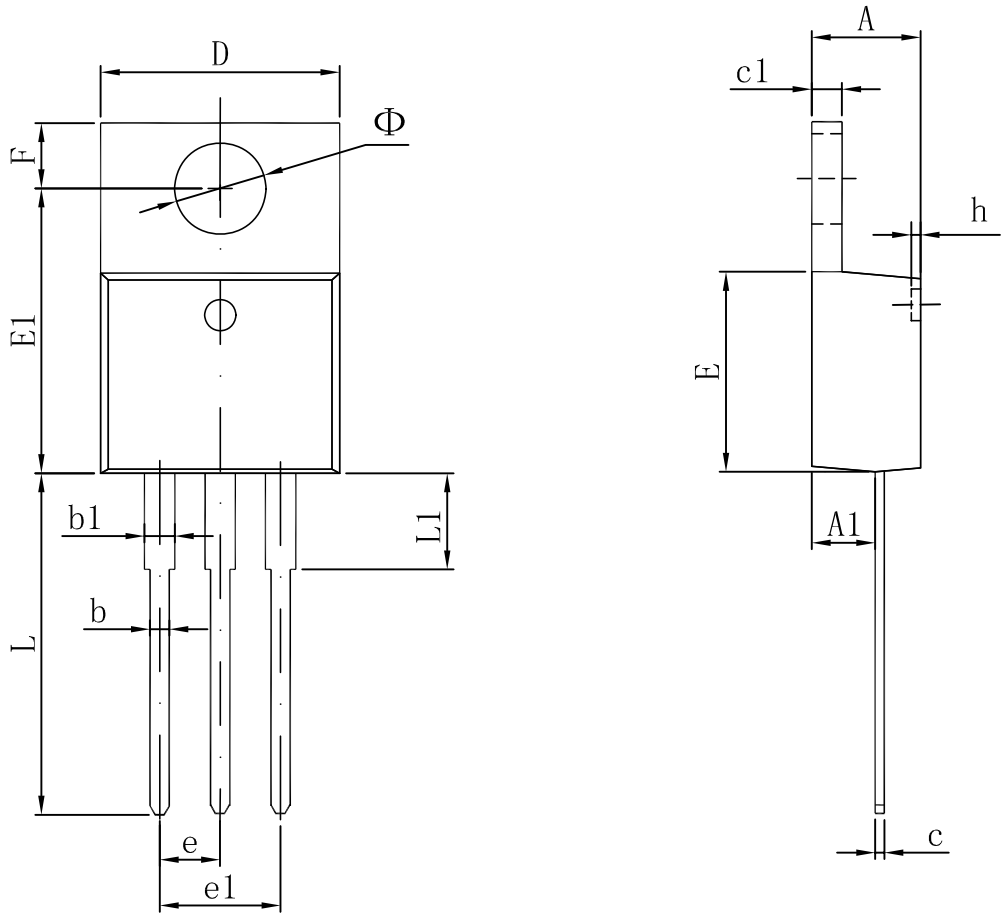
2) Adjustable Output Regulator



$$V_O = V_O + \left(I_{bias} + \frac{V_O}{R_2}\right) R_1$$

PLASTIC-ENCAPSULATE VOLTAGE REGULATORS

TO-220 Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.470	4.670	0.176	0.184
A1	2.520	2.820	0.099	0.111
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	10.010	10.310	0.394	0.406
E	8.500	8.900	0.335	0.350
E1	12.060	12.460	0.475	0.491
e	2.540 TYP		0.100 TYP	
e1	4.980	5.180	0.196	0.204
F	2.590	2.890	0.102	0.114
h	0.000	0.300	0.000	0.012
L	13.400	13.800	0.528	0.543
L1	3.560	3.960	0.140	0.156
Φ	3.735	3.935	0.147	0.155