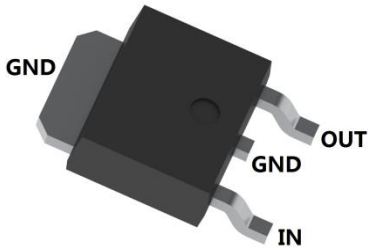
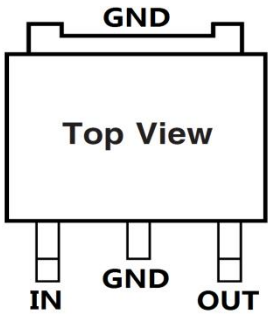
PLASTIC-ENCAPSULATE VOLTAGE REGULATORS

FEATURES

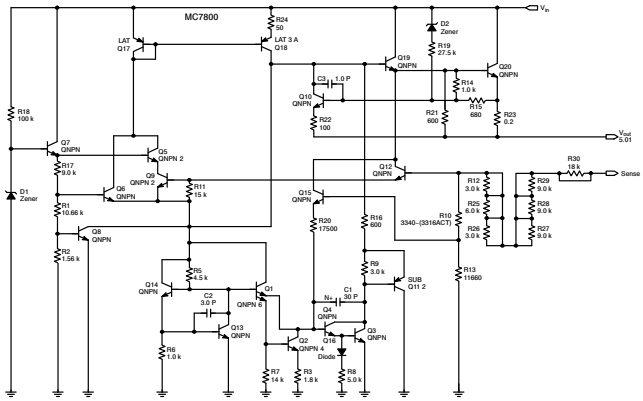
- Maximum Output Current I_O: 1A
- Output Voltage V_O: 5V,6V,8V,9V,10V,12V,15V,18V,24V;
- Continuous Total Dissipation
  P_D: 1.25 W (Ta= 25 ℃)
- Surface Mount device



TO-252



SCHEMATIC DIAGRAM



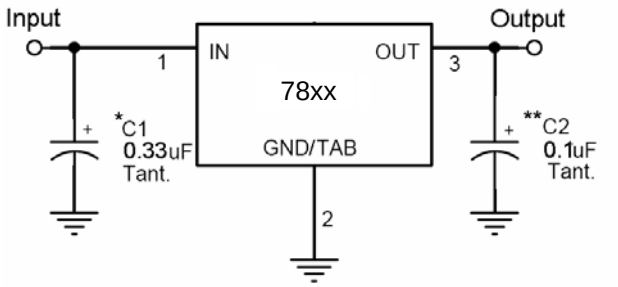
MECHANICAL DATA

- Case: TO-252
- Case Material: Molded Plastic. UL flammability
- Classification Rating: 94V-0
- Weight: 0.055 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		$R_{\theta JA}$	92	°C/W
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	7.5V≤V_i≤20V,I_O=10mA~1A,P_D≤15W
Line regulation	ΔV_O		3	100	mV	7.5V≤V_i≤25V,T_J=+25°C
			1	50	mV	8V≤V_i≤12V,T_J=+25°C
Load Regulation	ΔV_O		15	100	mV	I_O=10mA~1.0A,T_J=+25°C
			5	50	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		4.2	8	mA	I_O=0, T_J=+25°C
Quiescent Current Change	ΔI_q			1.3	mA	7.5V≤V_i≤25V,0°C≤T_J≤+125°C
				0.5	mA	10mA≤I_O≤1.0A,-0°C≤T_J≤+125°C
Output Noise Voltage	V_N		40		μV	10Hz≤f≤100kHz,T_J=+25°C
Ripple Rejection	RR	62	78		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		17		mΩ	f=1kHz
Short Circuit Current	I_{SC}		750		mA	T_J=+25°C
Peak Current	I_{pk}		2.2		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-0.6		mV/°C	I_O=10mA,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	8.5V≤V_i≤21V,I_O=10mA~1A,P_D≤15W
Line regulation	ΔV_O		5	120	mV	8V≤V_i≤25V,I_O=500mA,T_J=+25°C
			1.5	60	mV	9V≤V_i≤13V,I_O=500mA,T_J=+25°C
Load Regulation	ΔV_O		14	120	mV	I_O=10mA~1.0A,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	8.5V≤V_i≤25V,-25°C≤T_J≤+125°C
				0.5	mA	10mA≤I_O≤1A,-25°C≤T_J≤+125°C
Output Noise Voltage	V_N		45		μV	10Hz≤f≤100kHz,T_J=+25°C
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		19		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	$\Delta V_O/\Delta T_J$		-0.7		mV/°C	I_O=10mA,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 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=10mA~1A,P_D≤15W
Line regulation	ΔV_O		6	160	mV	10.5V≤V_i≤25V,I_O=500mA,T_J=+25°C
			2	80	mV	11V≤V_i≤17V,I_O=500mA,T_J=+25°C
Load Regulation	ΔV_O		12	160	mV	I_O=10mA~1A,T_J=+25°C
			4	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,0°C≤T_J≤+125°C
				0.5	mA	10mA≤I_O≤1A,0°C≤T_J≤+125°C
Output Noise Voltage	V_N		52		μV	10Hz≤f≤100kHz,T_J=+25°C
Ripple Rejection	RR	56	72		dB	11V≤V_i≤21V,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}		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=10mA,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 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≤23V,I_O=10mA~1A,P_D≤15W
Line regulation	ΔV_O		6	180	mV	11.5V≤V_i≤26V,T_J=+25°C
			2	90	mV	12V≤V_i≤17V,T_J=+25°C
Load Regulation	ΔV_O		12	180	mV	I_O=10mA~1A,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≤26V,0°C≤T_J≤+125°C
				0.5	mA	10mA≤I_O≤1A,0°C≤T_J≤+125°C
Output Noise Voltage	V_N		52		μV	10Hz≤f≤100kHz,T_J=+25°C
Ripple Rejection	RR	55	72		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		16		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	$\Delta V_O/\Delta T_J$		-1		mV/°C	I_O=10mA,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 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≤25V,I_O=10mA~1A,P_D≤15W
Line regulation	ΔV_O		7	200	mV	12.5V≤V_i≤28V,T_J=+25°C
			2	100	mV	13V≤V_i≤17V,T_J=+25°C
Load Regulation	ΔV_O		12	200	mV	I_O=10mA~1A,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≤28V,0°C≤T_J≤+125°C
				0.5	mA	10mA≤I_O≤1A,0°C≤T_J≤+125°C
Output Noise Voltage	V_N		70		μV	10Hz≤f≤100kHz,T_J=+25°C
Ripple Rejection	RR	55	71		dB	13V≤V_i≤23V,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		mV/°C	I_O=10mA,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 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	11.53	12	12.48	V	T_J=+25°C
		11.42	12	12.60	V	14.5V≤V_i≤27V,I_O=10mA~1A,P_D≤15W
Line regulation	ΔV_O		10	240	mV	14.5V≤V_i≤30V,T_J=+25°C
			3	120	mV	15V≤V_i≤19V,T_J=+25°C
Load Regulation	ΔV_O		12	240	mV	I_O=10mA~1A,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=1.0A,T_J=+25°C
Quiescent Current Change	ΔI_q			1	mA	14.5V≤V_i≤30V
				0.5	mA	10mA≤I_O≤1A
Output Noise Voltage	V_N		75		μV	10Hz≤f≤100kHz,T_J=+25°C
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=10mA,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 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=10mA~1A,P_D≤15W
Line regulation	ΔV_O		12	300	mV	17.5V≤V_i≤30V,T_J=+25°C
			3	150	mV	18V≤V_i≤22V,T_J=+25°C
Load Regulation	ΔV_O		12	300	mV	I_O=10mA~1A,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
				0.5	mA	10mA≤I_O≤1A,
Output Noise Voltage	V_N		90		μV	10Hz≤f≤100kHz,T_J=+25°C
Ripple Rejection	RR	54	70		dB	18V≤V_i≤28V,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}		2.2		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-1		mV/°C	I_O=10mA,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 7818 AT SPECIFIED VIRTUAL JUNCTION TEMPERATURE

(Vi=26V,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	17.30	18	18.72	V	T_J=+25°C
		17.14	18	18.90	V	21V≤V_i≤33V,I_O=10mA~1A,P_D≤15W
Line regulation	ΔV_O		15	360	mV	21V≤V_i≤33V,T_J=+25°C
			5	180	mV	22V≤V_i≤26V,T_J=+25°C
Load Regulation	ΔV_O		12	360	mV	I_O=10mA~1A,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
				0.5	mA	5mA≤I_O≤350mA
Output Noise Voltage	V_N		110		μV	10Hz≤f≤100kHz,T_J=+25°C
Ripple Rejection	RR	54	70		dB	21V≤V_i≤31V,f=120Hz
Dropout Voltage	V_d		2		V	T_J=+25°C,I_O=500mA
Output Resistance	R_O		22		mΩ	f=1kHz
Short Circuit Current	I_{SC}		200		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=10mA,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 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	24V≤V_i≤35V,I_O=10mA~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=10mA~1A,T_J=+25°C
			4	200	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		4.1	8	mA	T_J=+25°C
Quiescent Current Change	ΔI_q			1	mA	23V≤V_i≤35V,T_J=+25°C
				0.5	mA	10mA≤I_O≤1A,T_J=+25°C
Output Noise Voltage	V_N		110		μV	10Hz≤f≤100kHz,T_J=+25°C
Ripple Rejection	RR	54	70		dB	24V≤V_i≤34V,f=120Hz
Dropout Voltage	V_d		2		V	T_J=+25°C,I_O=1.0A
Output Resistance	R_O		22		mΩ	f=1kHz
Short Circuit Current	I_{SC}		180		mA	T_J=+25°C
Peak Current	I_{PK}		2.2		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-1.2		mV/°C	I_O=10mA,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 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	23.07	24	24.96	V	V_i=33V,I_O=350mA,T_J=+25°C
		22.85	24	25.20	V	27V≤V_i≤38V,I_O=10mA~1A,P_D≤15W
Line regulation	ΔV_O		18	480	mV	27V≤V_i≤38V,T_J=+25°C
			6	240	mV	28V≤V_i≤32V,T_J=+25°C
Load Regulation	ΔV_O		12	480	mV	I_O=10mA~1A,T_J=+25°C
			4	240	mV	I_O=250mA~750mA,T_J=+25°C
Quiescent Current	I_q		4.2	8	mA	I_O=0mA,T_J=+25°C
Quiescent Current Change	ΔI_q			1	mA	27V≤V_i≤38V
				0.5	mA	10mA≤I_O≤1.0A
Output Noise Voltage	V_N		170		μV	10Hz≤f≤100kHz,T_J=+25°C
Ripple Rejection	RR	54	70		dB	27V≤V_i≤37V,f=120Hz
Dropout Voltage	V_d		2		V	T_J=+25°C,I_O=1.0mA
Output Resistance	R_O		28		mΩ	f=1kHz
Short Circuit Current	I_{SC}		150		mA	T_J=+25°C
Peak Current	I_{PK}		2.2		A	T_J=+25°C
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_J$		-1.5		mV/°C	I_O=10mA,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

FIGURE 1 - Worst Case Power Dissipation v.s. Ambient Temperature

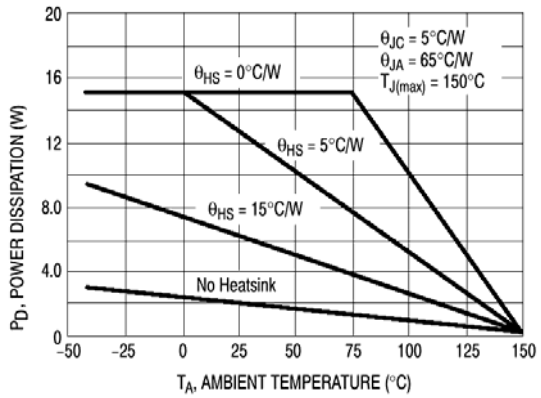


FIGURE 2 - Peak Output Current v.s. Input-Output Differential Voltage

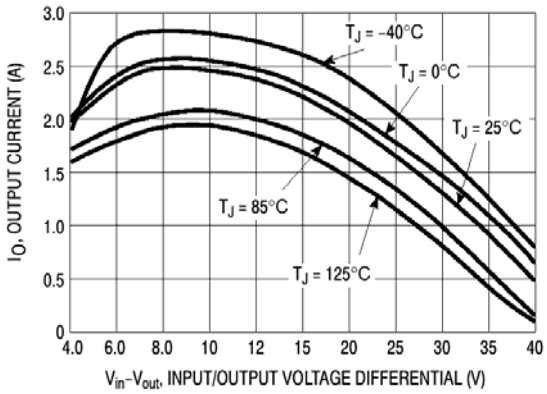


FIGURE 3 – Quiescent Current v.s. Junction Temperature

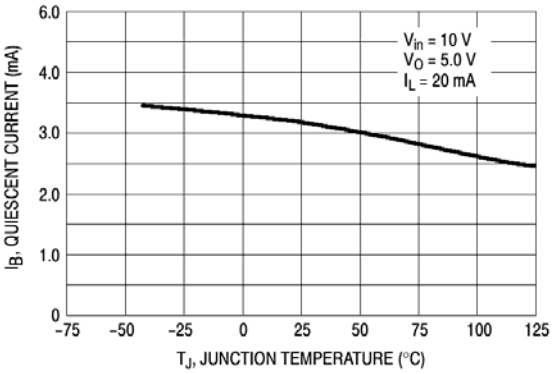


FIGURE 4 – Input Output Differential v.s. Junction Temperature

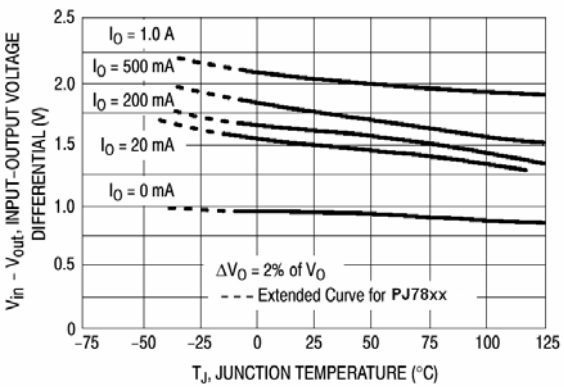


FIGURE 5 – Output Voltage v.s. Junction Temperature

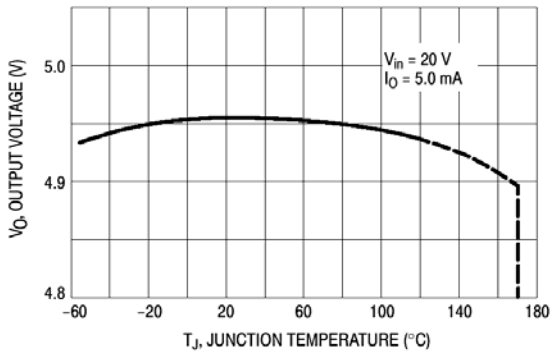


FIGURE 6 – Output Impedance v.s. Output Voltage

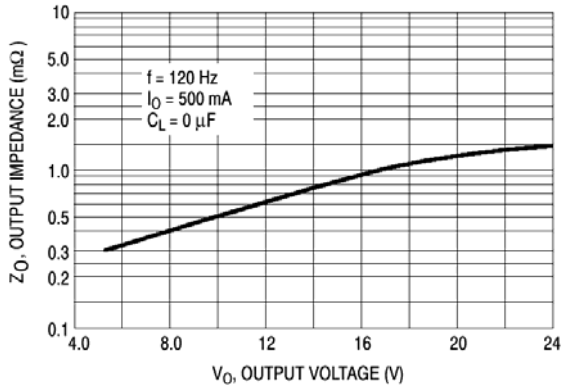


FIGURE 7 – Ripple Rejection v.s. Output Voltage

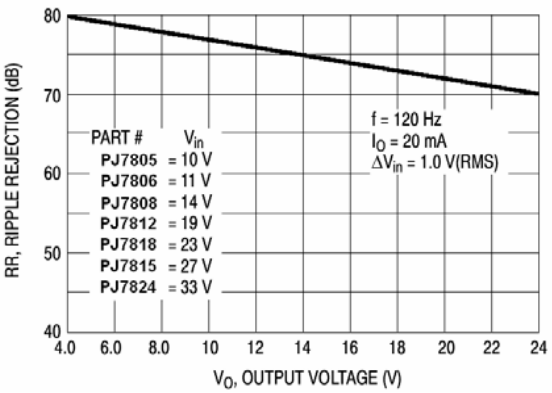
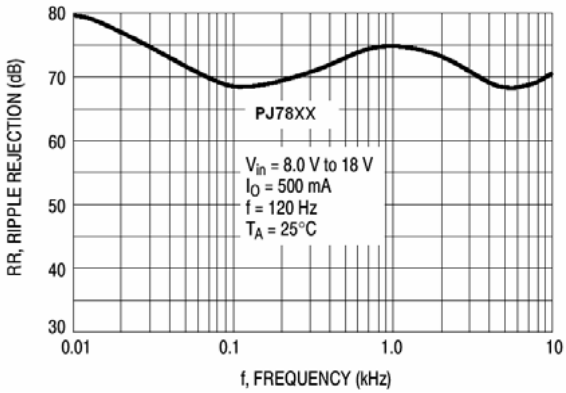
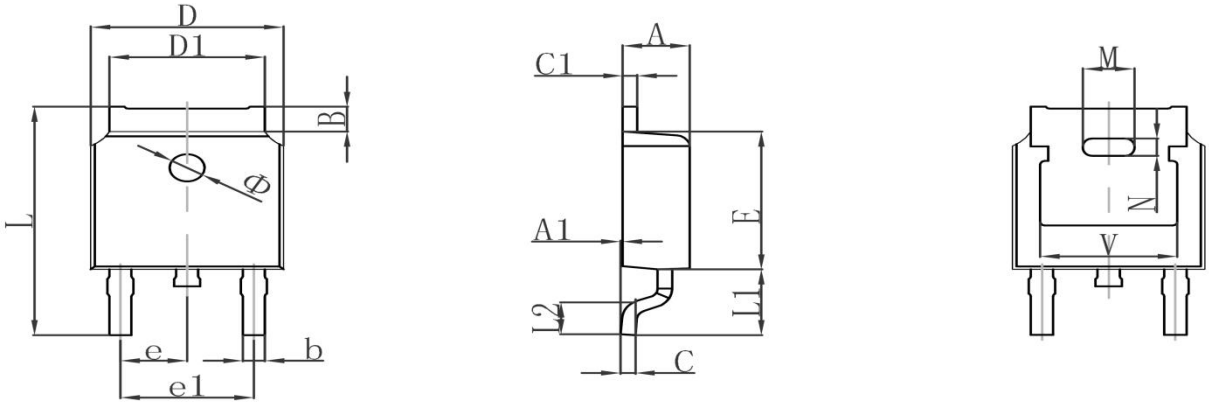


FIGURE 8 – Ripple Rejection v.s. Frequency



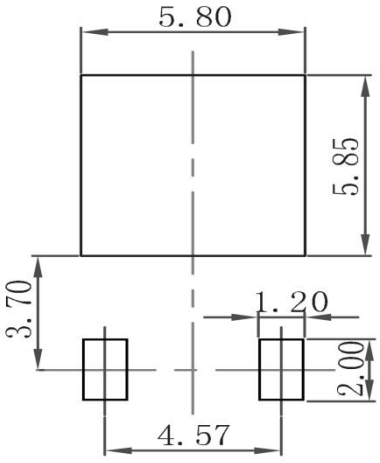
PLASTIC-ENCAPSULATE VOLTAGE REGULATORS

TO-252 Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.380	0.087	0.094
A1	0.000	0.100	0.000	0.004
B	0.800	1.400	0.031	0.055
b	0.710	0.810	0.028	0.032
c	0.460	0.560	0.018	0.022
c1	0.460	0.560	0.018	0.022
D	6.500	6.700	0.256	0.264
D1	5.130	5.460	0.202	0.215
E	6.000	6.200	0.236	0.244
e	2.286TYP		0.090TYP	
e1	4.327	4.727	0.170	0.186
M	1.778REF		0.070REF	
N	0.762REF		0.018REF	
L	9.800	10.400	0.386	0.409
L1	2.9REF		0.114REF	
L2	1.400	1.700	0.055	0.067
V	4.830REF		0.190REF	
Φ	1.100	1.300	0.043	0.051

TO-252 Suggested Pad Layout



Note:

1.Controlling dimension: in millimeters

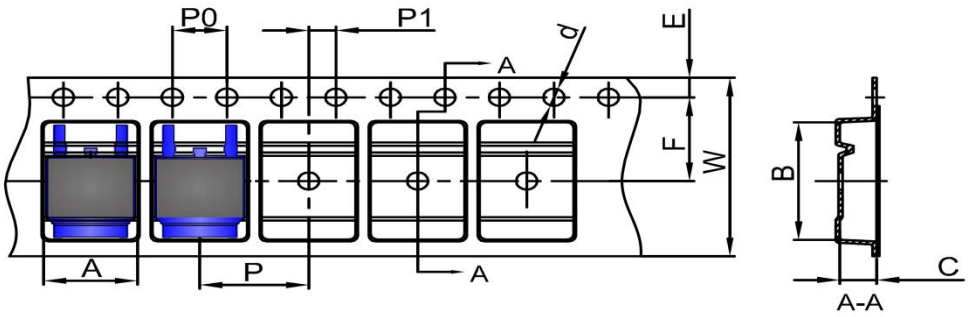
2.General tolerance: ±0.05mm

3.The pad layout is for reference purposes only

PLASTIC-ENCAPSULATE VOLTAGE REGULATORS

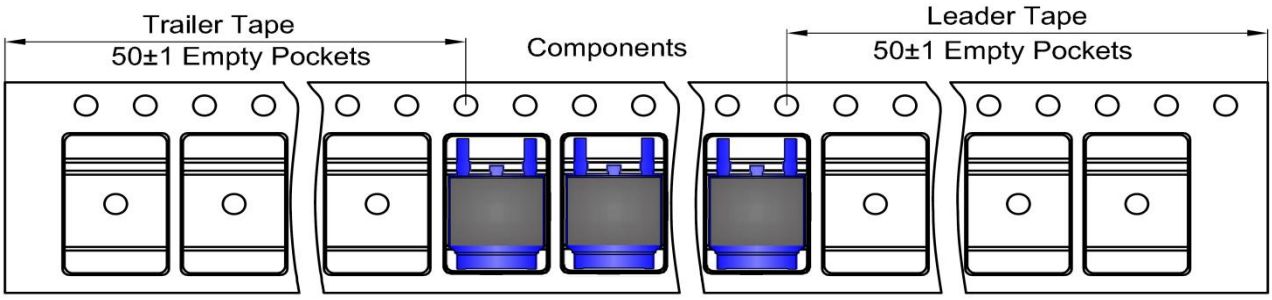
TO-252 Tape and Reel

TO-252 Embossed Carrier Tape

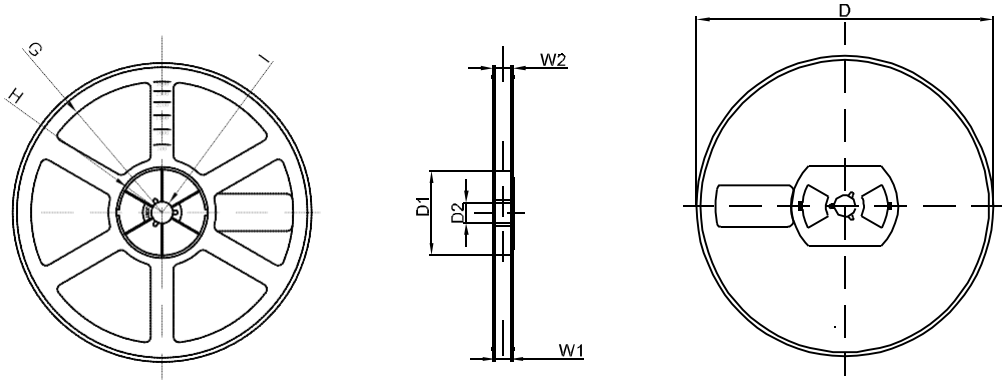


	DIMENSIONS ARE IN MILLIMETER									
TYPE	A	B	C	d	E	F	P0	P	P1	W
TO-252	6.90	10.50	2.70	Ø1.55	1.75	7.50	4.00	8.00	2.00	16.00
TOLERANCE	±0.1	±0.1	±0.1	±0.1	±0.1	±0.1	±0.1	±0.1	±0.1	±0.1

TO-252 Tape Leader and Trailer



TO-252 Reel



	DIMENSIONS ARE IN MILLIMETER							
REEL OPTION	D	D1	D2	G	H	I	W1	W2
13” DIA	Ø330.00	100.00	Φ21.00	R151.00	R56.00	R6.50	16.40	21.00
TOLERANCE	±2	±1	±1	±1	±1	±1	±1	±1