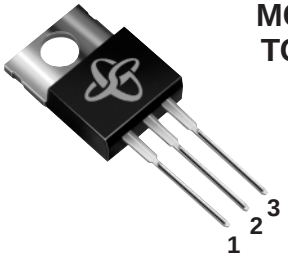
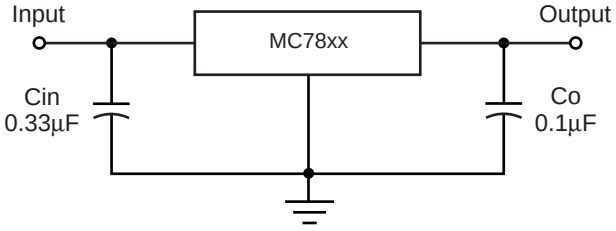
3-Terminal Fixed Positive Voltage Regulators



MC78xxCT
TO-220AB

Pin Definition
1. Input
2. Ground
3. Output (Heatsink/tab connected to pin 2)

Standard Application



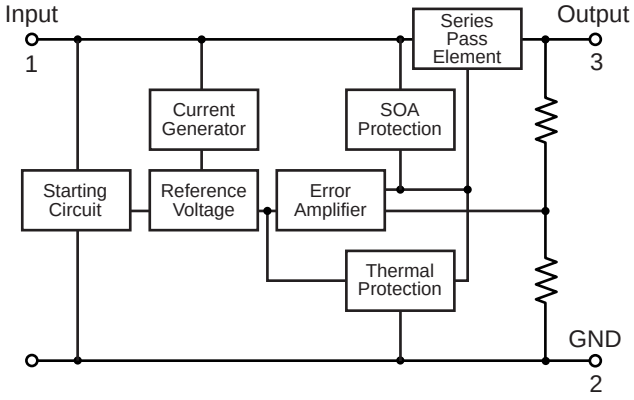
Notes:
A common ground is required between the input and the output voltages. The input voltage must remain typically 2.0V above the output voltage even during the low point on the input ripple voltage.

xx = these two digits of the part number indicate output voltage.

Cin is required if regulator is located an appreciable distance from power supply filter.

Co is not needed for stability, however, it does improve transient response.

Internal Block Diagram



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 shut-down, and safe-area compensation. With adequate heatsinking the MC78xxCT can deliver output currents in excess of 1.5 ampere.

Although designed primarily as a fixed voltage regulator, these devices can be used with external components to obtain adjustable voltages with currents.

Features

- Output current in excess of 1.0 ampere
- No external components required
- Internal thermal overload protection
- Internal short-circuit current limiting
- Output transistor safe-area compensation
- Output voltage offered in 2% tolerance

Mechanical Data

Case: TO-220 Package

Case outline is on the back page.

Maximum Ratings

Ratings at 25°C ambient temperature unless otherwise specified.

Parameter	Symbol	Value	Unit
Input Voltage(1)	V_{in}	30	V
Input Voltage(2)	V_{in}	40	V
Thermal Resistance(3)	$R_{\theta JC}$	5	°C/W
Operating Junction Temperature Range	T_J	–20 to +150	°C
Storage Junction Temperature Range	T_{stg}	–65 to +150	°C

Notes: (1) MC7805 to MC7818
(2) MC7824
(3) Follow the derating curve (fig. 1)

Electrical Characteristics – MC7805

Vin = 10V, I_{out} = 500mA, 0°C ≤ T_J ≤ 125°C, Cin = 0.33μF, C_{out} = 0.1μF; unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{out}	T_J = 25°C	4.90	5	5.10	V
		7V ≤ Vin ≤ 20V, 5mA ≤ I_{out} ≤ 1.0A, P_D ≤ 15W	4.85	—	5.15	
Line Regulation (T_J = 25°C)	ΔREG_{line}	7V ≤ Vin < 25V	–	3	100	mV
		8V ≤ Vin < 13V	–	1	50	
Load Regulation (T_J = 25°C)	ΔREG_{load}	10mA ≤ I_{out} < 1.5A	–	15	100	mV
		250mA ≤ I_{out} < 750mA	–	5	50	
Quiescent Current	I_q	I_{out} = 0, T_J = 25°C	—	4.2	8	mA
Quiescent Current Change	ΔI_q	7V ≤ Vin ≤ 25V	—	—	1.3	mA
		5mA ≤ I_{out} ≤ 1.0A	—	—	0.5	
Output Noise Voltage	Vn	10Hz ≤ f ≤ 100KHz, T_J = 25°C	—	40	—	μV
Ripple Rejection Ratio	RR	f = 120Hz	62	78	—	dB
Dropout Voltage	V_{drop}	I_{out} = 1.0A, T_J = 25°C	—	2	—	V
Output Resistance	R_{out}	f = 1KHz	—	17	—	mΩ
Output Short Circuit Current	I_{os}	T_J = 25°C	—	750	—	mA
Peak Output Current	$I_{o\ peak}$	T_J = 25°C	—	1.5	—	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_J$	I_{out} = 5mA, 0°C ≤ T_J ≤ 125°C	—	–1.1	—	mV/°C

Electrical Characteristics – MC7806

Vin = 11V, I_{out} = 500mA, 0°C ≤ T_J ≤ 125°C, Cin = 0.33μF, C_{out} = 0.1μF; unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{out}	T_J = 25°C	5.88	6.0	6.12	V
		8V ≤ Vin ≤ 21V, 5mA ≤ I_{out} ≤ 1.0A, P_D ≤ 15W	5.83	—	6.17	
Line Regulation (T_J = 25°C)	ΔREG_{line}	8V ≤ Vin < 25V	–	5	120	mV
		9V ≤ Vin < 13V	–	1.5	60	
Load Regulation (T_J = 25°C)	ΔREG_{load}	10mA ≤ I_{out} < 1.5A	–	14	120	mV
		250mA ≤ I_{out} < 750mA	–	4	60	
Quiescent Current	I_q	I_{out} = 0, T_J = 25°C	—	4.3	8.0	mA
Quiescent Current Change	ΔI_q	8V ≤ Vin ≤ 25V	—	—	1.3	mA
		5mA ≤ I_{out} ≤ 1.0A	—	—	0.5	
Output Noise Voltage	Vn	10Hz ≤ f ≤ 100KHz, T_A = 25°C	—	45	—	μV
Ripple Rejection Ratio	RR	f = 120Hz, 9V ≤ Vin ≤ 19V	59	75	—	dB
Dropout Voltage	V_{drop}	I_{out} = 1.0A, T_J = 25°C	—	2	—	V
Output Resistance	R_{out}	f = 1KHz	—	19	—	mΩ
Output Short Circuit Current	I_{os}	T_J = 25°C	—	550	—	mA
Peak Output Current	$I_{o\ peak}$	T_J = 25°C	—	1.5	—	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_J$	I_{out} = 5mA, 0°C ≤ T_J ≤ 125°C	—	–0.8	—	mV/°C

Electrical Characteristics – MC7808

Vin = 14V, I_{out} = 500mA, 0°C ≤ T_J ≤ 125°C, Cin = 0.33μF, C_{out} = 0.1μF; unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{out}	T_J = 25°C	7.84	8.0	8.16	V
		10.5V ≤ Vin ≤ 23V, 5mA ≤ I_{out} ≤ 1.0A, P_D ≤ 15W	7.74	—	8.26	
Line Regulation (T_J = 25°C)	ΔREG_{line}	10.5V ≤ Vin < 25V	–	6	160	mV
		11V ≤ Vin < 15V	–	2	80	
Load Regulation (T_J = 25°C)	ΔREG_{load}	10mA ≤ I_{out} < 1.5A	–	12	160	mV
		250mA ≤ I_{out} < 750mA	–	4	80	
Quiescent Current	I_q	I_{out} = 0, T_J = 25°C	—	4.3	8.0	mA
Quiescent Current Change	ΔI_q	10.5V ≤ Vin ≤ 25V	—	—	1	mA
		5mA ≤ I_{out} ≤ 1.0A	—	—	0.5	
Output Noise Voltage	Vn	10Hz ≤ f ≤ 100KHz, T_J = 25°C	—	52	—	μV
Ripple Rejection Ratio	RR	f = 120Hz	56	72	—	dB
Dropout Voltage	V_{drop}	I_{out} = 1.0A, T_J = 25°C	—	2	—	V
Output Resistance	R_{out}	f = 1KHz	—	16	—	mΩ
Output Short Circuit Current	I_{os}	T_J = 25°C	—	450	—	mA
Peak Output Current	$I_{o\ peak}$	T_J = 25°C	—	1.5	—	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_J$	I_{out} = 5mA, 0°C ≤ T_J ≤ 125°C	—	–0.8	—	mV/°C

Electrical Characteristics – MC7809

Vin = 15V, I_{out} = 500mA, 0°C ≤ T_J ≤ 125°C, Cin = 0.33μF, C_{out} = 0.1μF; unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{out}	T_J = 25°C	8.82	9	9.18	V
		11.5V ≤ Vin ≤ 24V, 5mA ≤ I_{out} ≤ 1.0A, P_D ≤ 15W	8.77	—	9.23	
Line Regulation (T_J = 25°C)	ΔREG_{line}	11.5V ≤ Vin < 27V	–	6	160	mV
		12V ≤ Vin < 16V	–	2	80	
Load Regulation (T_J = 25°C)	ΔREG_{load}	5mA ≤ I_{out} < 1.5A	–	12	160	mV
		250mA ≤ I_{out} < 750mA	–	4	80	
Quiescent Current	I_q	I_{out} = 0, T_J = 25°C	—	4.3	8	mA
Quiescent Current Change	ΔI_q	11.5V ≤ Vin ≤ 27V	—	—	1	mA
		5mA ≤ I_{out} ≤ 1.0A	—	—	0.5	
Output Noise Voltage	Vn	10Hz ≤ f ≤ 100KHz, T_J = 25°C	—	52	—	μV
Ripple Rejection Ratio	RR	f = 120Hz, 12V ≤ Vin ≤ 22V	55	72	—	dB
Dropout Voltage	V_{drop}	I_{out} = 1.0A, T_J = 25°C	—	2	—	V
Output Resistance	R_{out}	f = 1KHz	—	16	—	mΩ
Output Short Circuit Current	I_{os}	T_J = 25°C	—	450	—	mA
Peak Output Current	$I_{o\ peak}$	T_J = 25°C	—	1.5	—	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_J$	I_{out} = 5mA, 0°C ≤ T_J ≤ 125°C	—	–1	—	mV/°C

Electrical Characteristics – MC7810

Vin = 16V, I_{out} = 500mA, 0°C ≤ T_J ≤ 125°C, Cin = 0.33μF, C_{out} = 0.1μF; unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{out}	T_J = 25°C	9.8	10	10.2	V
		12.5V ≤ Vin ≤ 25V, 5mA ≤ I_{out} ≤ 1.0A, P_D ≤ 15W	9.75	—	10.25	
Line Regulation (T_J = 25°C)	ΔREG_{line}	12.5V ≤ Vin < 28V	–	10	240	mV
		13V ≤ Vin < 17V	–	3	120	
Load Regulation (T_J = 25°C)	ΔREG_{load}	10mA ≤ I_{out} < 1.5A	–	12	240	mV
		250mA ≤ I_{out} < 750mA	–	4	120	
Quiescent Current	I_q	I_{out} = 0, T_J = 25°C	—	4.3	8	mA
Quiescent Current Change	ΔI_q	12.5V ≤ Vin ≤ 28V	—	—	1	mA
		5mA ≤ I_{out} ≤ 1.0A	—	—	0.5	
Output Noise Voltage	Vn	10Hz ≤ f ≤ 100KHz, T_J = 25°C	—	52	—	μV
Ripple Rejection Ratio	RR	f = 120Hz, 13V ≤ Vin ≤ 23V	54	72	—	dB
Dropout Voltage	V_{drop}	I_{out} = 1.0A, T_J = 25°C	—	2	—	V
Output Resistance	R_{out}	f = 1KHz	—	16	—	mΩ
Output Short Circuit Current	I_{os}	T_J = 25°C	—	450	—	mA
Peak Output Current	$I_{o\ peak}$	T_J = 25°C	—	1.5	—	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_J$	I_{out} = 5mA, 0°C ≤ T_J ≤ 125°C	—	–1	—	mV/°C

Electrical Characteristics – MC7812

Vin = 19V, I_{out} = 500mA, 0°C ≤ T_J ≤ 125°C, Cin = 0.33μF, C_{out} = 0.1μF; unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{out}	T_J = 25°C	11.76	12.0	12.24	V
		14.5V ≤ Vin ≤ 27V, 5mA ≤ I_{out} ≤ 1.0A, P_D ≤ 15W	11.66	—	12.34	
Line Regulation (T_J = 25°C)	ΔREG_{line}	14V ≤ Vin < 30V	–	10	240	mV
		15V ≤ Vin < 19V	–	3	120	
Load Regulation (T_J = 25°C)	ΔREG_{load}	10mA ≤ I_{out} < 1.5A	–	12	240	mV
		250mA ≤ I_{out} < 750mA	–	4	120	
Quiescent Current	I_q	I_{out} = 0, T_J = 25°C	—	4.3	8	mA
Quiescent Current Change	ΔI_q	14.5V ≤ Vin ≤ 30V	—	—	1	mA
		5mA ≤ I_{out} ≤ 1.0A	—	—	0.5	
Output Noise Voltage	Vn	10Hz ≤ f ≤ 100KHz, T_J = 25°C	—	75	—	μV
Ripple Rejection Ratio	RR	f = 120Hz, 15V ≤ Vin ≤ 25V	55	71	—	dB
Dropout Voltage	V_{drop}	I_{out} = 1.0A, T_J = 25°C	—	2	—	V
Output Resistance	R_{out}	f = 1KHz	—	18	—	mΩ
Output Short Circuit Current	I_{os}	T_J = 25°C	—	350	—	mA
Peak Output Current	$I_{o\ peak}$	T_J = 25°C	—	1.5	—	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_J$	I_{out} = 5mA, 0°C ≤ T_J ≤ 125°C	—	–1	—	mV/°C

Electrical Characteristics – MC7815

Vin = 23V, I_{out} = 500mA, 0°C ≤ T_J ≤ 125°C, Cin = 0.33μF, C_{out} = 0.1μF; unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{out}	T_J = 25°C	14.7	15.0	15.3	V
		17.5V ≤ Vin ≤ 30V, 5mA ≤ I_{out} ≤ 1.0A, P_D ≤ 15W	14.55	—	15.45	
Line Regulation (T_J = 25°C)	ΔREG_{line}	17.5V ≤ Vin < 30V	–	11	300	mV
		13V ≤ Vin < 17V	–	3	150	
Load Regulation (T_J = 25°C)	ΔREG_{load}	10mA ≤ I_{out} < 1.5A	–	12	300	mV
		250mA ≤ I_{out} < 750mA	–	4	150	
Quiescent Current	I_q	I_{out} = 0, T_J = 25°C	—	4.4	8	mA
Quiescent Current Change	ΔI_q	17.5V ≤ Vin ≤ 30V	—	—	1	mA
		5mA ≤ I_{out} ≤ 1.0A	—	—	0.5	
Output Noise Voltage	Vn	10Hz ≤ f ≤ 100KHz, T_J = 25°C	—	90	—	μV
Ripple Rejection Ratio	RR	f = 120Hz, 18V ≤ Vin ≤ 28V	54	70	—	dB
Dropout Voltage	V_{drop}	I_{out} = 1.0A, T_J = 25°C	—	2	—	V
Output Resistance	R_{out}	f = 1KHz	—	19	—	mΩ
Output Short Circuit Current	I_{os}	T_J = 25°C	—	230	—	mA
Peak Output Current	$I_{o\ peak}$	T_J = 25°C	—	1.5	—	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_J$	I_{out} = 5mA, 0°C ≤ T_J ≤ 125°C	—	–1	—	mV/°C

Electrical Characteristics – MC7818

Vin = 27V, I_{out} = 500mA, 0°C ≤ T_J ≤ 125°C, Cin = 0.33μF, C_{out} = 0.1μF; unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{out}	T_J = 25°C	17.64	18.0	18.36	V
		21V ≤ Vin ≤ 33V, 5mA ≤ I_{out} ≤ 1.0A, P_D ≤ 15W	17.44	—	18.56	
Line Regulation (T_J = 25°C)	ΔREG_{line}	21V ≤ Vin < 33V	–	15	360	mV
		22V ≤ Vin < 26V	–	5	180	
Load Regulation (T_J = 25°C)	ΔREG_{load}	10mA ≤ I_{out} < 1.5A	–	12	360	mV
		250mA ≤ I_{out} < 750mA	–	4	180	
Quiescent Current	I_q	I_{out} = 0, T_J = 25°C	—	4.5	8	mA
Quiescent Current Change	ΔI_q	21V ≤ Vin ≤ 33V	—	—	1	mA
		5mA ≤ I_{out} ≤ 1.0A	—	—	0.5	
Output Noise Voltage	Vn	10Hz ≤ f ≤ 100KHz, T_J = 25°C	—	110	—	mV
Ripple Rejection Ratio	RR	f = 120Hz, 21V ≤ Vin ≤ 31V	53	69	—	dB
Dropout Voltage	V_{drop}	I_{out} = 1.0A, T_J = 25°C	—	2	—	V
Output Resistance	R_{out}	f = 1KHz	—	22	—	mΩ
Output Short Circuit Current	I_{os}	T_J = 25°C	—	200	—	mA
Peak Output Current	$I_{o\ peak}$	T_J = 25°C	—	1.5	—	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_J$	I_{out} = 5mA, 0°C ≤ T_J ≤ 125°C	—	–1	—	mV/°C

Electrical Characteristics – MC7824

Vin = 33V, I_{out} = 500mA, 0°C ≤ T_J ≤ 125°C, Cin = 0.33μF, C_{out} = 0.1μF; unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{out}	T_J = 25°C	23.52	24.0	24.48	V
		26V ≤ Vin ≤ 38V, 5mA ≤ I_{out} ≤ 1.0A, P_D ≤ 15W	23.32	—	24.68	
Line Regulation (T_J = 25°C)	ΔREG_{line}	26V ≤ Vin < 38V	–	18	480	mV
		27V ≤ Vin < 32V	–	6	240	
Load Regulation (T_J = 25°C)	ΔREG_{load}	10mA ≤ I_{out} < 1.5A	–	12	480	mV
		250mA ≤ I_{out} < 750mA	–	4	240	
Quiescent Current	I_q	I_{out} = 0, T_J = 25°C	—	4.6	8	mA
Quiescent Current Change	ΔI_q	26V ≤ Vin ≤ 38V	—	—	1	mA
		5mA ≤ I_{out} ≤ 1.0A	—	—	0.5	
Output Noise Voltage	Vn	10Hz ≤ f ≤ 100KHz, T_J = 25°C	—	170	—	μV
Ripple Rejection Ratio	R_{rej}	f = 120Hz, 26V ≤ Vin ≤ 36V	50	66	—	dB
Dropout Voltage	V_{drop}	I_{out} = 1.0A, T_J = 25°C	—	2	—	V
Output Resistance	R_{out}	f = 1KHz	—	28	—	mΩ
Output Short Circuit Current	I_{os}	T_J = 25°C	—	150	—	mA
Peak Output Current	$I_{o\ peak}$	T_J = 25°C	—	1.5	—	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_J$	I_{out} = 5mA, 0°C ≤ T_J ≤ 125°C	—	–1.5	—	mV/°C

Ratings and Characteristic Curves (T_A = 25°C unless otherwise noted)

Fig. 1 – Power Dissipation vs. Ambient Temperature (MC78xxCT)

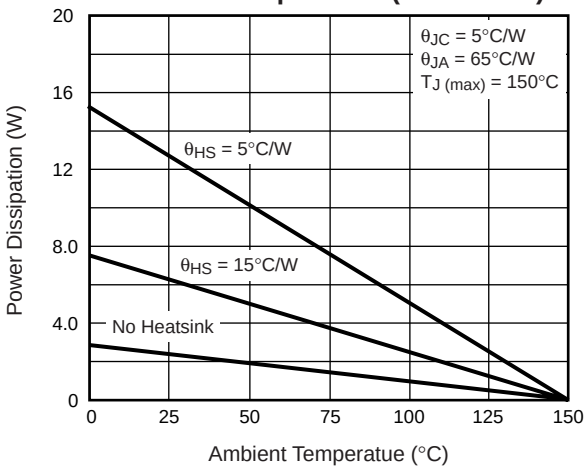


Fig. 2 – Dropout Voltage vs. Junction Temperature

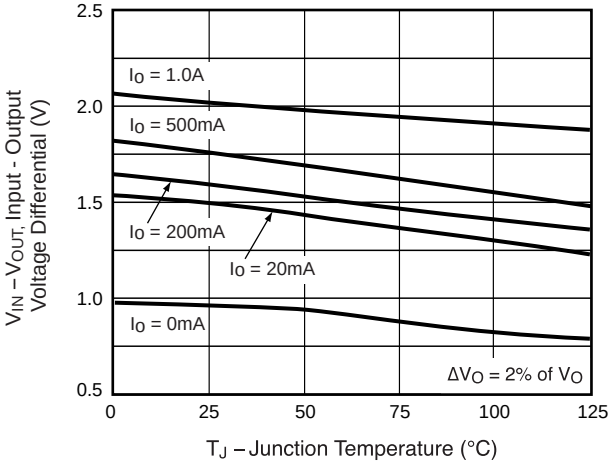


Fig. 3 – Peak Output Current

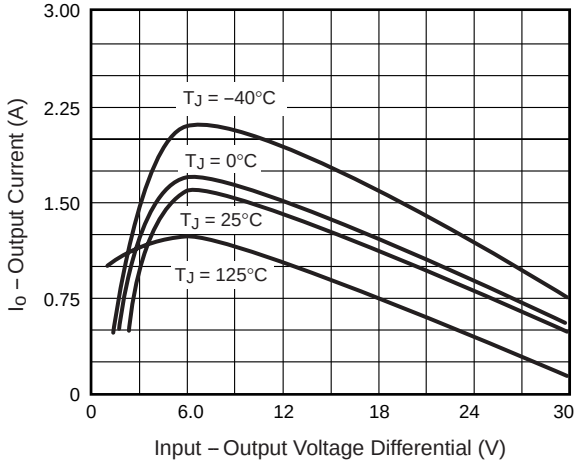


Fig. 4 –Ripple Rejection Ratio vs. Output Voltage

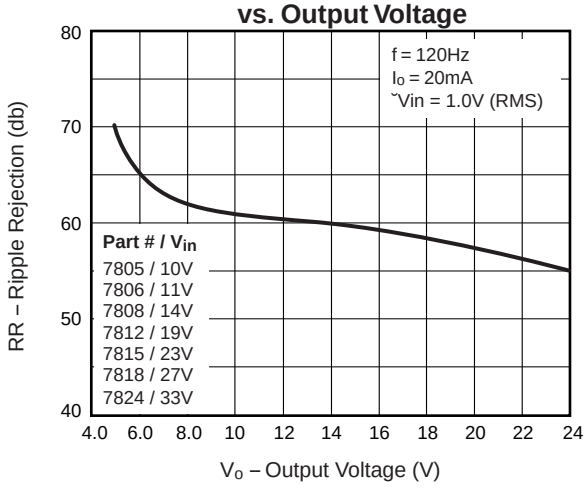


Fig. 5 – Output Impedance (mΩ) vs. Output Voltage

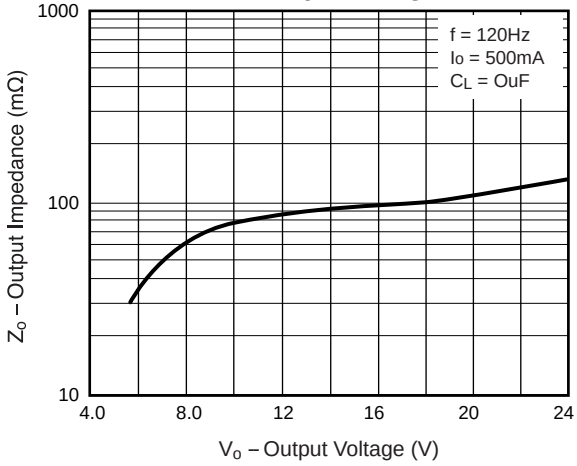
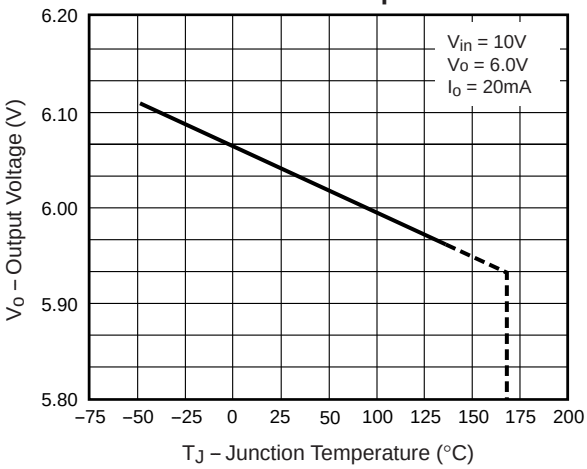


Fig. 6 – Output Voltage vs. Junction Temperature



Ratings and Characteristic Curves (T_A = 25°C unless otherwise noted)

Fig. 7 – Quiescent Current vs. Junction Temperature

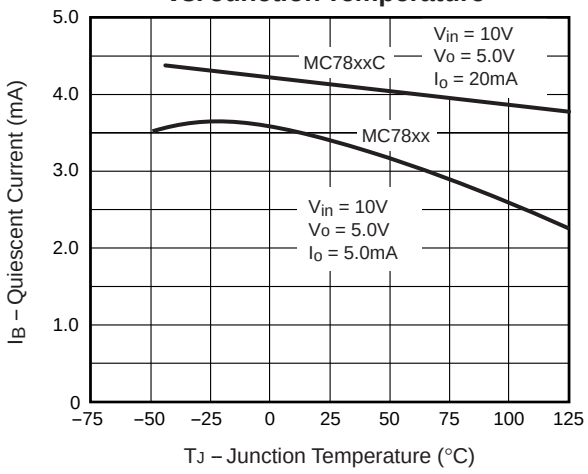
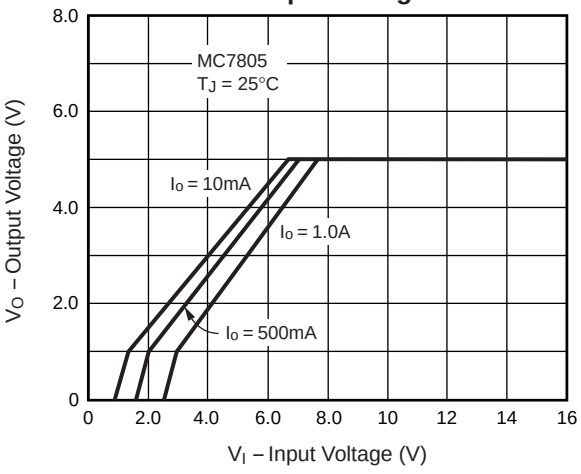
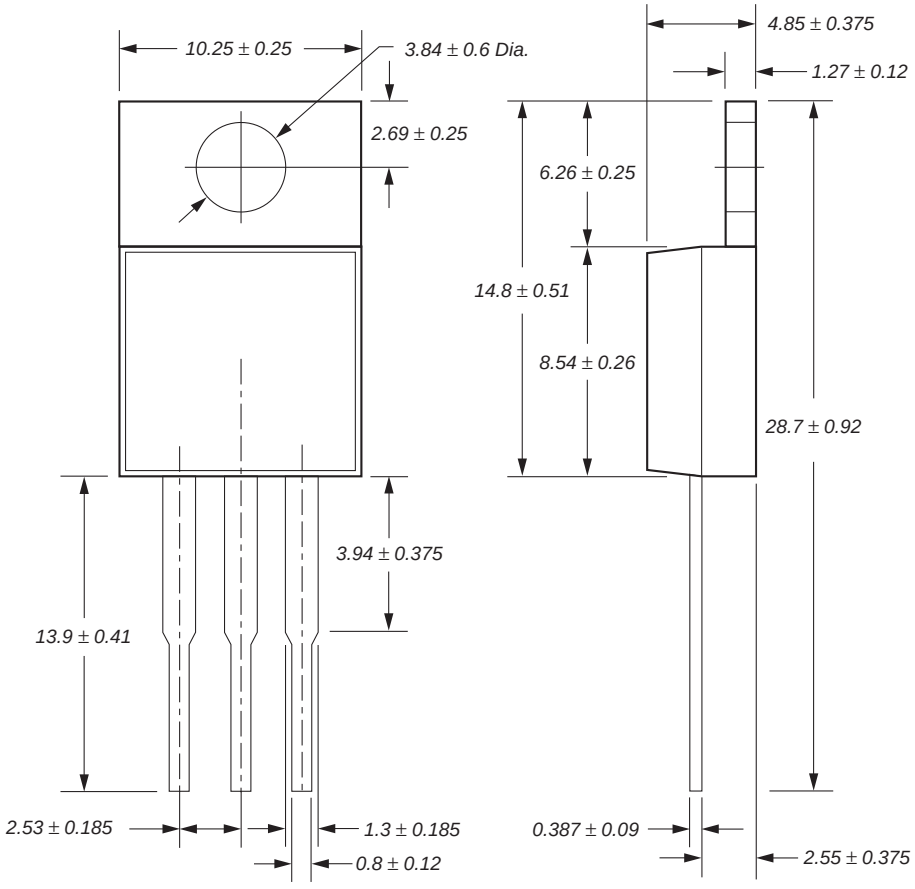


Fig. 8 – Output Voltage vs. Input Voltage



TO-220 Case Outline



Dimensions in millimeters