New Product
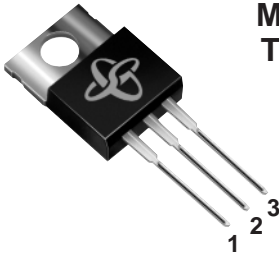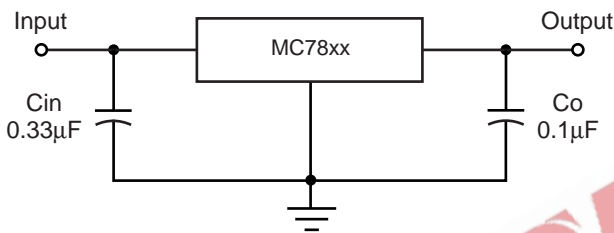
3-Terminal Fixed Positive Voltage Regulators

**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.

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 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.
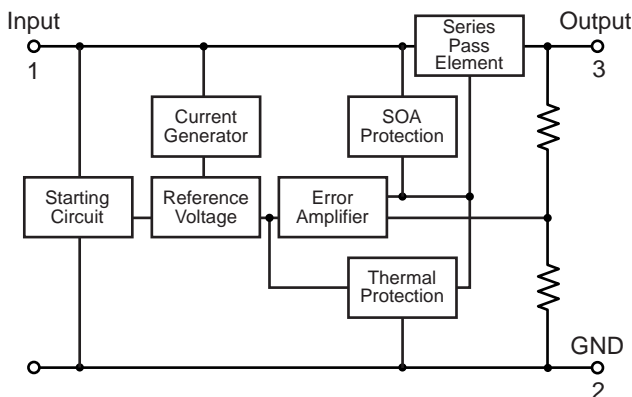
Features

• 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.

Internal Block Diagram

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

V_{in} = 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 $\leq$ T$_J$ $\leq$ 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 $\leq$ Vin $\leq$ 21V, 5mA $\leq$ I$_{out}$ $\leq$ 1.0A, P$_D$ $\leq$ 15W	5.83	—	6.17	
Line Regulation (T$_J$ = 25°C)	ΔREG$_{line}$	8V $\leq$ Vin < 25V	–	5	120	mV
		9V $\leq$ Vin < 13V	–	1.5	60	
Load Regulation (T$_J$ = 25°C)	ΔREG$_{load}$	10mA $\leq$ I$_{out}$ < 1.5A	–	14	120	mV
		250mA $\leq$ 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 $\leq$ Vin $\leq$ 25V	—	—	1.3	mA
		5mA $\leq$ I$_{out}$ $\leq$ 1.0A	—	—	0.5	
Output Noise Voltage	Vn	10Hz$\leq$f$\leq$100KHz, T$_A$ = 25°C	—	45	—	μV
Ripple Rejection Ratio	RR	f = 120Hz, 9V $\leq$ Vin $\leq$ 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	ΔV$_{out}$/ΔT$_J$	I$_{out}$ = 5mA, 0°C $\leq$ T$_J$ $\leq$ 125°C	—	−0.8	—	mV/°C

Electrical Characteristics – MC7808

Vin = 14V, I$_{out}$ = 500mA, 0°C $\leq$ T$_J$ $\leq$ 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 $\leq$ Vin $\leq$ 23V, 5mA $\leq$ I$_{out}$ $\leq$ 1.0A, P$_D$ $\leq$ 15W	7.74	—	8.26	
Line Regulation (T$_J$ = 25°C)	ΔREG$_{line}$	10.5V $\leq$ Vin < 25V	–	6	160	mV
		11V $\leq$ Vin < 15V	–	2	80	
Load Regulation (T$_J$ = 25°C)	ΔREG$_{load}$	10mA $\leq$ I$_{out}$ < 1.5A	–	12	160	mV
		250mA $\leq$ 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 $\leq$ Vin $\leq$ 25V	—	—	1	mA
		5mA $\leq$ I$_{out}$ $\leq$ 1.0A	—	—	0.5	
Output Noise Voltage	Vn	10Hz$\leq$f$\leq$100KHz, T$_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	ΔV$_{out}$/ΔT$_J$	I$_{out}$ = 5mA, 0°C $\leq$ T$_J$ $\leq$ 125°C	—	−0.8	—	mV/°C

Electrical Characteristics – MC7809

Vin = 15V, I_out = 500mA, 0°C ≤ T_J ≤ 125°C, Cin = 0.33μF, Cout = 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
		$11.5V \leq Vin \leq 24V$, $5mA \leq I_{out} \leq 1.0A$, $P_D \leq 15W$	8.77	—	9.23	
Line Regulation (T_J = 25°C)	ΔREG_{line}	$11.5V \leq Vin < 27V$	–	6	160	mV
		$12V \leq Vin < 16V$	–	2	80	
Load Regulation (T_J = 25°C)	ΔREG_{load}	$5mA \leq I_{out} < 1.5A$	–	12	160	mV
		$250mA \leq I_{out} < 750mA$	–	4	80	
Quiescent Current	I_q	$I_{out} = 0$, $T_J = 25°C$	—	4.3	8	mA
Quiescent Current Change	ΔI_q	$11.5V \leq Vin \leq 27V$	—	—	1	mA
		$5mA \leq I_{out} \leq 1.0A$	—	—	0.5	
Output Noise Voltage	Vn	$10Hz \leq f \leq 100KHz$, $T_J = 25°C$	—	52	—	μV
Ripple Rejection Ratio	RR	$f = 120Hz$, $12V \leq Vin \leq 22V$	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	$\Delta V_{out}/\Delta T_J$	$I_{out} = 5mA$, $0°C \leq T_J \leq 125°C$	—	−1	—	mV/°C

Electrical Characteristics – MC7810

Vin = 16V, I_out = 500mA, 0°C ≤ T_J ≤ 125°C, Cin = 0.33μF, Cout = 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
		$12.5V \leq Vin \leq 25V$, $5mA \leq I_{out} \leq 1.0A$, $P_D \leq 15W$	9.75	—	10.25	
Line Regulation (T_J = 25°C)	ΔREG_{line}	$12.5V \leq Vin < 28V$	–	10	240	mV
		$13V \leq Vin < 17V$	–	3	120	
Load Regulation (T_J = 25°C)	ΔREG_{load}	$10mA \leq I_{out} < 1.5A$	–	12	240	mV
		$250mA \leq I_{out} < 750mA$	–	4	120	
Quiescent Current	I_q	$I_{out} = 0$, $T_J = 25°C$	—	4.3	8	mA
Quiescent Current Change	ΔI_q	$12.5V \leq Vin \leq 28V$	—	—	1	mA
		$5mA \leq I_{out} \leq 1.0A$	—	—	0.5	
Output Noise Voltage	Vn	$10Hz \leq f \leq 100KHz$, $T_J = 25°C$	—	52	—	μV
Ripple Rejection Ratio	RR	$f = 120Hz$, $13V \leq Vin \leq 23V$	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	$\Delta V_{out}/\Delta T_J$	$I_{out} = 5mA$, $0°C \leq T_J \leq 125°C$	—	−1	—	mV/°C

Electrical Characteristics – MC7812

Vin = 19V, I$_{out}$ = 500mA, 0°C ≤ T$_J$ ≤ 125°C, Cin = 0.33µF, Cout = 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)	∆REG$_{line}$	14V ≤ Vin < 30V	–	10	240	mV
		15V ≤ Vin < 19V	–	3	120	
Load Regulation (T$_J$ = 25°C)	∆REG$_{load}$	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	∆I$_q$	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	∆V$_{out}$/∆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, Cout = 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)	∆REG$_{line}$	17.5V ≤ Vin < 30V	–	11	300	mV
		13V ≤ Vin < 17V	–	3	150	
Load Regulation (T$_J$ = 25°C)	∆REG$_{load}$	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	∆I$_q$	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	∆V$_{out}$/∆T$_J$	I$_{out}$ = 5mA, 0°C ≤ T$_J$ ≤ 125°C	—	−1	—	mV/°C

Electrical Characteristics – MC7818

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{out}	TJ = 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 (TJ = 25°C)	ΔREG_{line}	21V ≤ Vin < 33V	–	15	360	mV
		22V ≤ Vin < 26V	–	5	180	
Load Regulation (TJ = 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, TJ = 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, TJ = 25°C	—	110	—	mV
Ripple Rejection Ratio	RR	f = 120Hz, 21V ≤ Vin ≤ 31V	53	69	—	dB
Dropout Voltage	V_{drop}	I_{out} = 1.0A, TJ = 25°C	—	2	—	V
Output Resistance	R_{out}	f = 1KHz	—	22	—	mΩ
Output Short Circuit Current	I_{os}	TJ = 25°C	—	200	—	mA
Peak Output Current	$I_{o\ peak}$	TJ = 25°C	—	1.5	—	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_J$	I_{out} = 5mA, 0°C ≤ TJ ≤ 125°C	—	–1	—	mV/°C

Electrical Characteristics – MC7824

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

| Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{out}	TJ = 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 (TJ = 25°C)	ΔREG_{line}	26V ≤ Vin < 38V	–	18	480	mV
		27V ≤ Vin < 32V	–	6	240	
Load Regulation (TJ = 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, TJ = 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, TJ = 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, TJ = 25°C	—	2	—	V
Output Resistance	R_{out}	f = 1KHz	—	28	—	mΩ
Output Short Circuit Current	I_{os}	TJ = 25°C	—	150	—	mA
Peak Output Current	$I_{o\ peak}$	TJ = 25°C	—	1.5	—	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_J$	I_{out} = 5mA, 0°C ≤ TJ ≤ 125°C	—	–1.5	—	mV/°C

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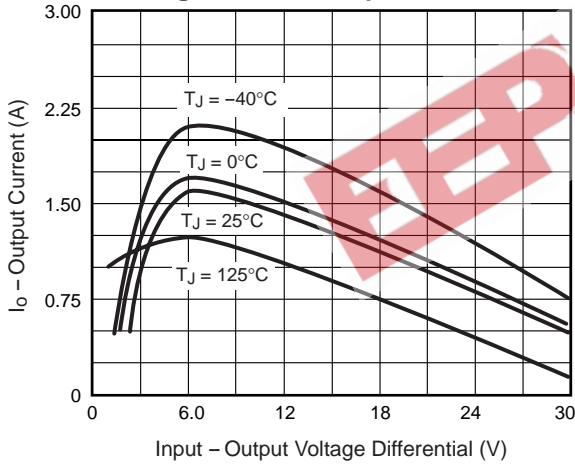# Characteristic Curves (T_A = 25°C unless otherwise noted)

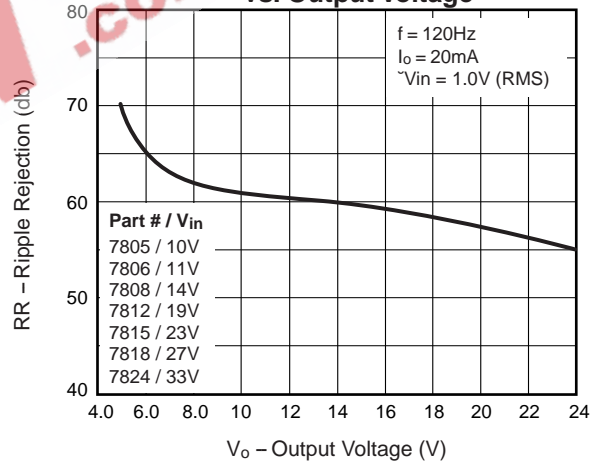### Fig. 1 – Power Dissipation vs. Ambient Temperature (MC78xxCT)
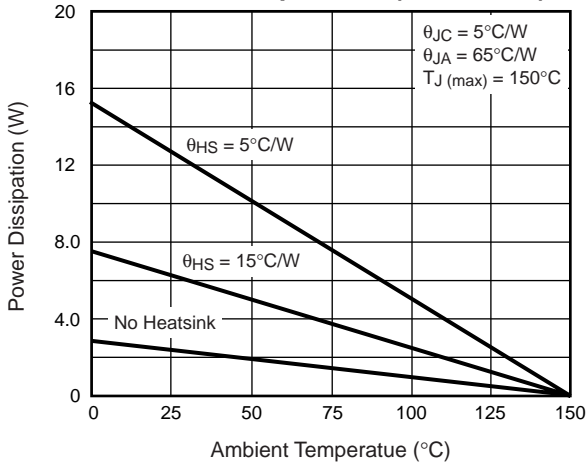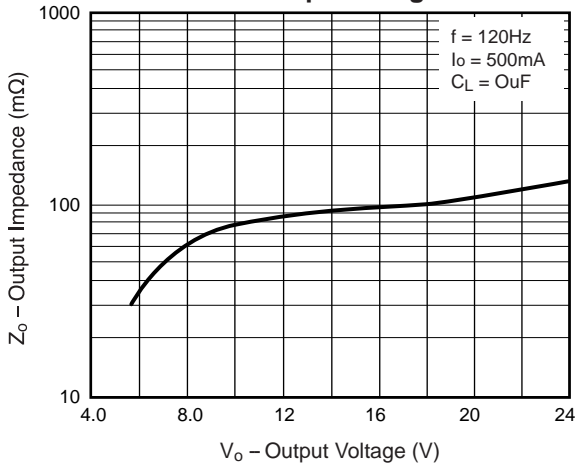

Fig. 2 – Dropout Voltage vs. Junction Temperature
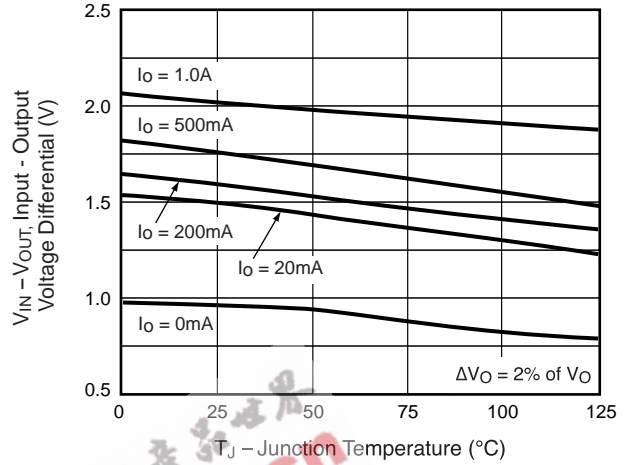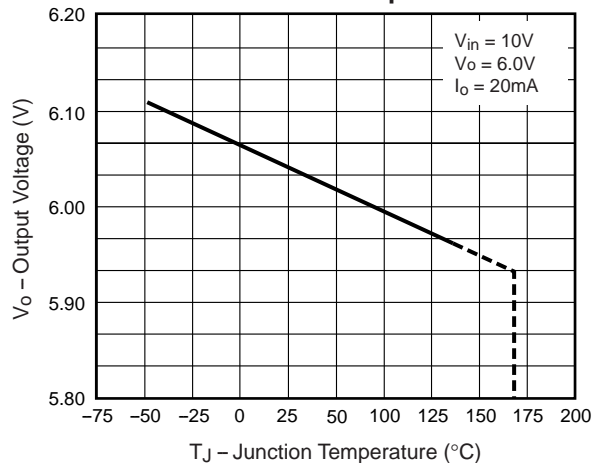

Fig. 3 – Peak Output Current

Fig. 4 –Ripple Rejection Ratio vs. Output Voltage

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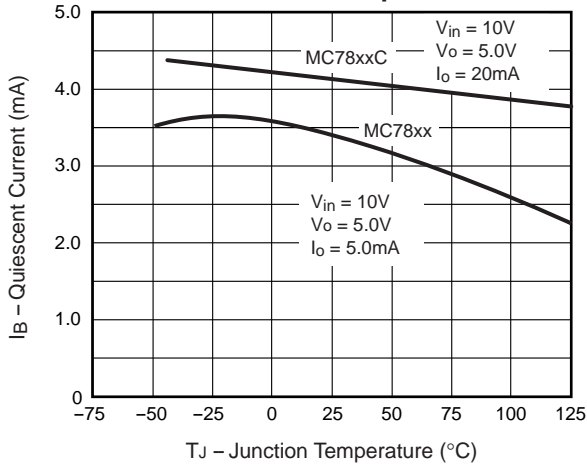

Fig. 6 – Output Voltage vs. Junction Temperature
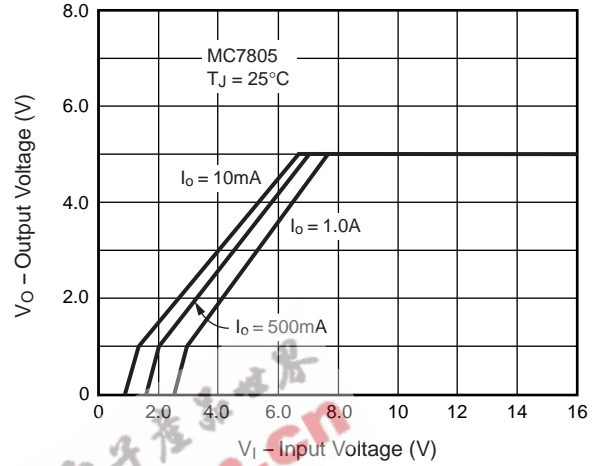
Ratings and
Characteristic Curves (T$_A$ = 25°C unless otherwise noted)
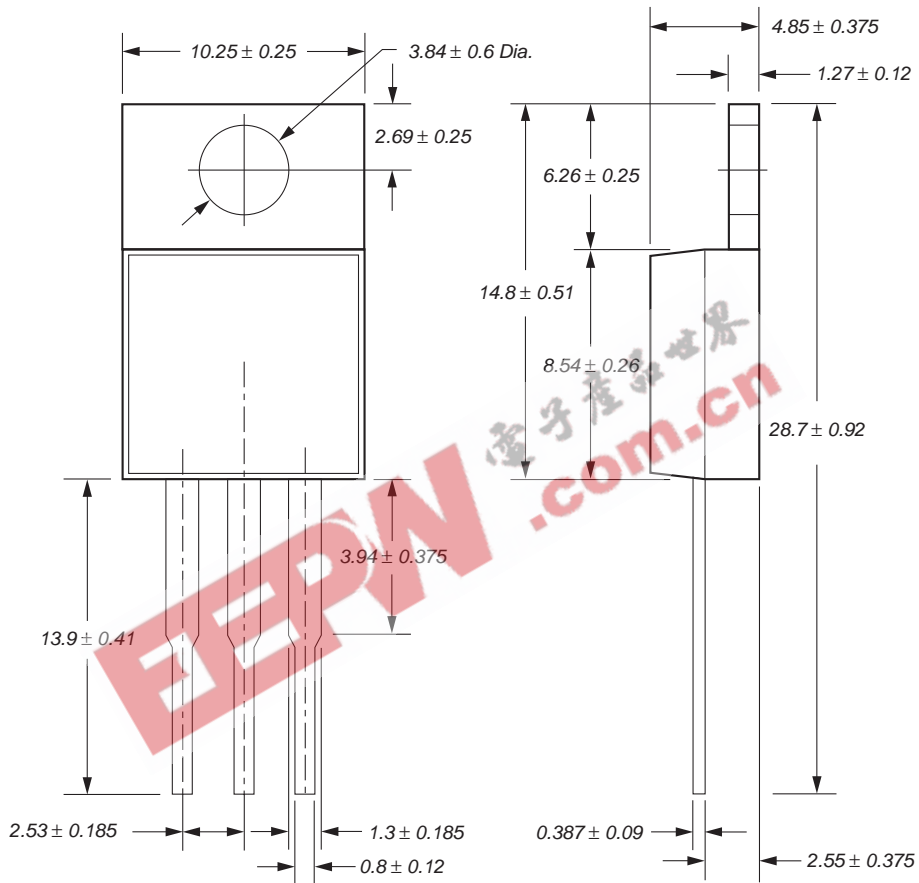
Fig. 7 – Quiescent Current vs. Junction Temperature

V$_{in}$ = 10V
V$_O$ = 5.0V
I$_O$ = 20mA

MC78xxC

MC78xx

V$_{in}$ = 10V
V$_O$ = 5.0V
I$_O$ = 5.0mA

I$_B$ – Quiescent Current (mA)

T$_J$ – Junction Temperature (°C)

Fig. 8 – Output Voltage vs. Input Voltage

MC7805
T$_J$ = 25°C

I$_O$ = 10mA

I$_O$ = 1.0A

I$_O$ = 500mA

V$_O$ – Output Voltage (V)

V$_I$ – Input Voltage (V)

TO-220 Case Outline

Dimensions in millimeters