Order this document by MC7800/D

MOTOROLA

Three-Terminal Positive Voltage Regulators

MC7800, MC7800A, LM340, LM340A Series

THREE–TERMINAL POSITIVE FIXED VOLTAGE REGULATORS

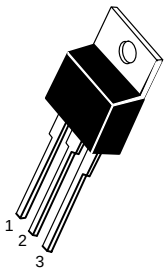
SEMICONDUCTOR TECHNICAL DATA

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 they can deliver output currents in excess of 1.0 A. Although designed primarily as a fixed voltage regulator, these devices can be used with external components to obtain adjustable voltages and currents.

- Output Current in Excess of 1.0 A
- No External Components Required
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting
- Output Transistor Safe–Area Compensation
- Output Voltage Offered in 2% and 4% Tolerance
- Available in Surface Mount D^{2}PAK and Standard 3–Lead Transistor Packages
- Previous Commercial Temperature Range has been Extended to a Junction Temperature Range of –40°C to +125°C

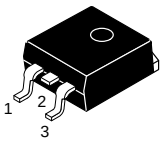
T SUFFIX
PLASTIC PACKAGE
CASE 221A

Heatsink surface connected to Pin 2.



Pin 1. Input
2. Ground
3. Output

D2T SUFFIX
PLASTIC PACKAGE
CASE 936
(D^{2}PAK)

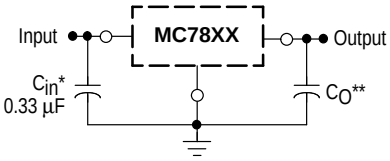


Heatsink surface (shown as terminal 4 in case outline drawing) is connected to Pin 2.

DEVICE TYPE/NOMINAL OUTPUT VOLTAGE

MC7805AC LM340AT–5 MC7805C LM340T–5	5.0 V	MC7812C LM340T–12	12 V
		MC7815AC LM340AT–15 MC7815C LM340T–15	15 V
MC7806AC MC7806C	6.0 V		
MC7808AC MC7808C	8.0 V	MC7818AC MC7818C	18 V
MC7809C	9.0 V	MC7824AC MC7824C	24 V
MC7812AC LM340AT–12	12 V		

STANDARD APPLICATION



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

XX, These two digits of the type number indicate nominal voltage.

* C_{in} is required if regulator is located an appreciable distance from power supply filter.

** C_O is not needed for stability; however, it does improve transient response. Values of less than 0.1 µF could cause instability.

ORDERING INFORMATION

Device	Output Voltage Tolerance	Operating Temperature Range	Package
MC78XXACT	2%	T_J = –40° to +125°C	Insertion Mount
LM340AT–XX			
MC78XXACD2T			Surface Mount
MC78XXCT	4%		Insertion Mount
LM340T–XX			
MC78XXCD2T			Surface Mount

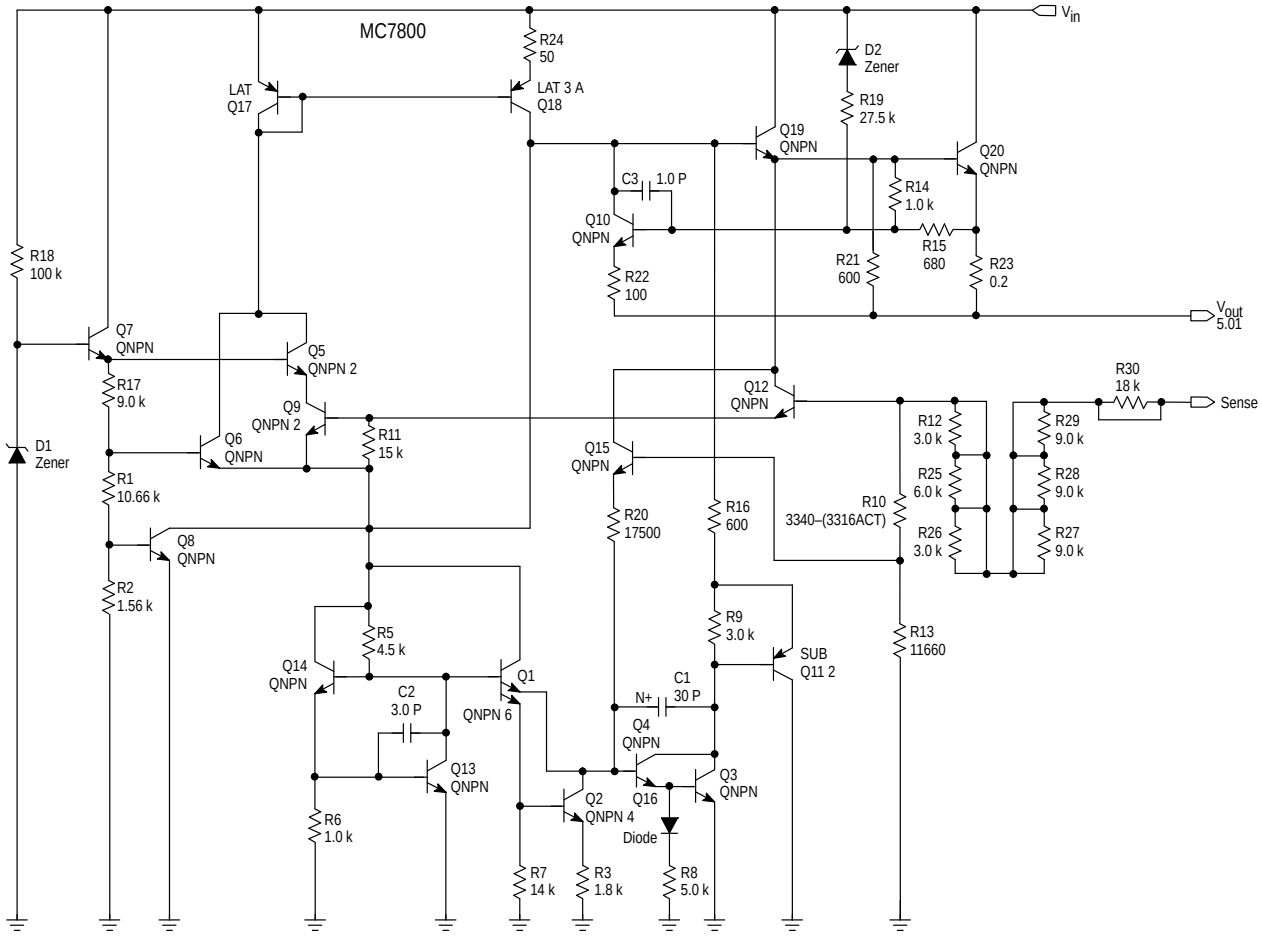
XX indicates nominal voltage.

MAXIMUM RATINGS (T_A = 25°C, unless otherwise noted.)

Rating	Symbol	Value	Unit
Input Voltage (5.0 – 18 V) (24 V)	V_I	35 40	Vdc
Power Dissipation Case 221A T_A = 25°C Thermal Resistance, Junction–to–Ambient Thermal Resistance, Junction–to–Case Case 936 (D^2PAK) T_A = 25°C Thermal Resistance, Junction–to–Ambient Thermal Resistance, Junction–to–Case	 P_D $R_{\theta JA}$ $R_{\theta JC}$ P_D $R_{\theta JA}$ $R_{\theta JA}$	 Internally Limited 65 5.0 Internally Limited See Figure 13 5.0	 W °C/W °C/W W °C/W °C/W
Storage Junction Temperature Range	T_{stg}	–65 to +150	°C
Operating Junction Temperature	T_J	+150	°C

NOTE: ESD data available upon request.

Representative Schematic Diagram



This device contains 22 active transistors.

ELECTRICAL CHARACTERISTICS (V_{in} = 10 V, I_O = 500 mA, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7805C/LM340T–5			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	4.8	5.0	5.2	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 7.0 Vdc ≤ V_{in} ≤ 20 Vdc 8.0 Vdc ≤ V_{in} ≤ 20 Vdc	V_O	 4.75 –	 5.0 –	 5.25 –	Vdc
Line Regulation (Note 2) 7.5 Vdc ≤ V_{in} ≤ 20 Vdc, 1.0 A 8.0 Vdc ≤ V_{in} ≤ 12 Vdc	Reg_{line}	 – –	 0.5 0.8	 20 10	mV
Load Regulation (Note 2) 5.0 mA ≤ I_O ≤ 1.0 A 5.0 mA ≤ I_O ≤ 1.5 A (T_A = 25°C)	Reg_{load}	 – -	 1.3 1.3	 25 25	mV
Quiescent Current	I_B	–	3.2	6.5	mA
Quiescent Current Change 7.0 Vdc ≤ V_{in} ≤ 25 Vdc 5.0 mA ≤ I_O ≤ 1.0 A (T_A = 25°C)	ΔI_B	 – –	 0.3 0.08	 1.0 0.8	mA
Ripple Rejection 8.0 Vdc ≤ V_{in} ≤ 18 Vdc, f = 120 Hz	RR	62	83	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I - V_O$	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	μV/V_O
Output Resistance f = 1.0 kHz	r_O	–	0.9	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.6	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.3	–	mV/°C

ELECTRICAL CHARACTERISTICS (V_{in} = 10 V, I_O = 1.0 A, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7805AC/LM340AT–5			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	4.9	5.0	5.1	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 7.5 Vdc ≤ V_{in} ≤ 20 Vdc	V_O	4.8	5.0	5.2	Vdc
Line Regulation (Note 2) 7.5 Vdc ≤ V_{in} ≤ 25 Vdc, I_O = 500 mA 8.0 Vdc ≤ V_{in} ≤ 12 Vdc, I_O = 1.0 A 8.0 Vdc ≤ V_{in} ≤ 12 Vdc, I_O = 1.0 A, T_J = 25°C 7.3 Vdc ≤ V_{in} ≤ 20 Vdc, I_O = 1.0 A, T_J = 25°C	Reg_{line}	 – – – –	 0.5 0.8 1.3 4.5	 10 12 4.0 10	mV
Load Regulation (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A, T_J = 25°C 5.0 mA ≤ I_O ≤ 1.0 A 250 mA ≤ I_O ≤ 750 mA	Reg_{load}	 – – –	 1.3 0.8 0.53	 25 25 15	mV
Quiescent Current	I_B	–	3.2	6.0	mA
Quiescent Current Change 8.0 Vdc ≤ V_{in} ≤ 25 Vdc, I_O = 500 mA 7.5 Vdc ≤ V_{in} ≤ 20 Vdc, T_J = 25°C 5.0 mA ≤ I_O ≤ 1.0 A	ΔI_B	 – – –	 0.3 – 0.08	 0.8 0.8 0.5	mA
Ripple Rejection 8.0 Vdc ≤ V_{in} ≤ 18 Vdc, f = 120 Hz, I_O = 500 mA	RR	68	83	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I - V_O$	–	2.0	–	Vdc

NOTES: 1. T_{low} = –40°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX

2. 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 (continued) (V_{in} = 10 V, I_O = 1.0 A, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7805AC/LM340AT–5			Unit
		Min	Typ	Max	
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	μV/V_O
Output Resistance (f = 1.0 kHz)	r_O	–	0.9	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.3	–	mV/°C

NOTES: 1. T_{low} = –40°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX

2. 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 (V_{in} = 11 V, I_O = 500 mA, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7806C			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	5.75	6.0	6.25	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 8.0 Vdc ≤ V_{in} ≤ 21 Vdc 9.0 Vdc ≤ V_{in} ≤ 21 Vdc	V_O	 5.7 –	 6.0 –	 6.3 –	Vdc
Line Regulation, T_J = 25°C (Note 2) 8.0 Vdc ≤ V_{in} ≤ 25 Vdc 9.0 Vdc ≤ V_{in} ≤ 13 Vdc	Reg_{line}	 – –	 0.5 0.8	 24 12	mV
Load Regulation, T_J = 25°C (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A	Reg_{load}	–	1.3	30	mV
Quiescent Current (T_J = 25°C)	I_B	–	3.3	8.0	mA
Quiescent Current Change 8.0 Vdc ≤ V_{in} ≤ 25 Vdc 5.0 mA ≤ I_O ≤ 1.0 A	ΔI_B	 – –	 0.3 0.08	 1.3 0.5	mA
Ripple Rejection 9.0 Vdc ≤ V_{in} ≤ 19 Vdc, f = 120 Hz	RR	58	65	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I – V_O$	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	μV/V_O
Output Resistance f = 1.0 kHz	r_O	–	0.9	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.3	–	mV/°C

NOTES: 1. T_{low} = –40°C for MC78XXAC, C T_{high} = +125°C for MC78XXAC, C

2. 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 (V_{in} = 11 V, I_O = 1.0 A, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7806AC			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	5.88	6.0	6.12	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 8.6 Vdc ≤ V_{in} ≤ 21 Vdc	V_O	5.76	6.0	6.24	Vdc
Line Regulation (Note 2) 8.6 Vdc ≤ V_{in} ≤ 25 Vdc, I_O = 500 mA 9.0 Vdc ≤ V_{in} ≤ 13 Vdc, I_O = 1.0 A	Reg_{line}	 – –	 5.0 1.4	 12 15	mV
Load Regulation (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A, T_J = 25°C 5.0 mA ≤ I_O ≤ 1.0 A 250 mA ≤ I_O ≤ 750 mA	Reg_{load}	 – – –	 1.3 0.9 0.2	 25 25 15	mV
Quiescent Current	I_B	–	3.3	6.0	mA
Quiescent Current Change 9.0 Vdc ≤ V_{in} ≤ 25 Vdc, I_O = 500 mA 9.0 Vdc ≤ V_{in} ≤ 21 Vdc, I_O = 1.0 A, T_J = 25°C 5.0 mA ≤ I_O ≤ 1.0 A	ΔI_B	 – – –	 – – –	 0.8 0.8 0.5	mA
Ripple Rejection 9.0 Vdc ≤ V_{in} ≤ 19 Vdc, f = 120 Hz, I_O = 500 mA	RR	58	65	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I - V_O$	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	μV/V_O
Output Resistance (f = 1.0 kHz)	r_O	–	0.9	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.3	–	mV/°C

ELECTRICAL CHARACTERISTICS (V_{in} = 14 V, I_O = 500 mA, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7808C			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	7.7	8.0	8.3	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 10.5 Vdc ≤ V_{in} ≤ 23 Vdc	V_O	7.6	8.0	8.4	Vdc
Line Regulation, T_J = 25°C, (Note 2) 10.5 Vdc ≤ V_{in} ≤ 25 Vdc 11 Vdc ≤ V_{in} ≤ 17 Vdc	Reg_{line}	 – –	 6.0 1.7	 32 16	mV
Load Regulation, T_J = 25°C (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A	Reg_{load}	–	1.4	35	mV
Quiescent Current	I_B	–	3.3	8.0	mA
Quiescent Current Change 10.5 Vdc ≤ V_{in} ≤ 25 Vdc 5.0 mA ≤ I_O ≤ 1.0 A	ΔI_B	 – –	 – –	 1.0 0.5	mA
Ripple Rejection 11.5 Vdc ≤ V_{in} ≤ 18 Vdc, f = 120 Hz	RR	56	62	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I - V_O$	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	μV/V_O

NOTES: 1. T_{low} = –40°C for MC78XXAC, C T_{high} = +125°C for MC78XXAC, C

2. 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 (continued) (V_{in} = 14 V, I_O = 500 mA, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7808C			Unit
		Min	Typ	Max	
Output Resistance f = 1.0 kHz	r_O	–	0.9	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.4	–	mV/°C

ELECTRICAL CHARACTERISTICS (V_{in} = 14 V, I_O = 1.0 A, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7808AC			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	7.84	8.0	8.16	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 10.6 Vdc ≤ V_{in} ≤ 23 Vdc	V_O	7.7	8.0	8.3	Vdc
Line Regulation (Note 2)	Reg_{line}				mV
10.6 Vdc ≤ V_{in} ≤ 25 Vdc, I_O = 500 mA		–	6.0	15	
11 Vdc ≤ V_{in} ≤ 17 Vdc, I_O = 1.0 A		–	1.7	18	
10.4 Vdc ≤ V_{in} ≤ 23 Vdc, T_J = 25°C		–	5.0	15	
Load Regulation (Note 2)	Reg_{load}				mV
5.0 mA ≤ I_O ≤ 1.5 A, T_J = 25°C		–	1.4	25	
5.0 mA ≤ I_O ≤ 1.0 A		–	1.0	25	
250 mA ≤ I_O ≤ 750 mA		–	0.22	15	
Quiescent Current	I_B	–	3.3	6.0	mA
Quiescent Current Change	ΔI_B				mA
11 Vdc ≤ V_{in} ≤ 25 Vdc, I_O = 500 mA		–	–	0.8	
10.6 Vdc ≤ V_{in} ≤ 23 Vdc, I_O = 1.0 A, T_J = 25°C		–	–	0.8	
5.0 mA ≤ I_O ≤ 1.0 A		–	–	0.5	
Ripple Rejection 11.5 Vdc ≤ V_{in} ≤ 21.5 Vdc, f = 120 Hz, I_O = 500 mA	RR	56	62	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I – V_O$	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	μV/V_O
Output Resistance f = 1.0 kHz	r_O	–	0.9	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.4	–	mV/°C

NOTES: 1. T_{low} = –40°C for MC78XXAC, C T_{high} = +125°C for MC78XXAC, C

2. 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 (V_{in} = 15 V, I_O = 500 mA, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7809CT			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	8.65	9.0	9.35	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 11.5 Vdc ≤ V_{in} ≤ 24 Vdc	V_O	8.55	9.0	9.45	Vdc
Line Regulation, T_J = 25°C (Note 2) 11 Vdc ≤ V_{in} ≤ 26 Vdc 11.5 Vdc ≤ V_{in} ≤ 17 Vdc	Reg_{line}	 – –	 6.2 1.8	 32 16	mV
Load Regulation, T_J = 25°C (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A	Reg_{load}	–	1.5	35	mV
Quiescent Current	I_B	–	3.4	8.0	mA
Quiescent Current Change 11.5 Vdc ≤ V_{in} ≤ 26 Vdc 5.0 mA ≤ I_O ≤ 1.0 A	ΔI_B	 – –	 – –	 1.0 0.5	mA
Ripple Rejection 11.5 Vdc ≤ V_{in} ≤ 21.5 Vdc, f = 120 Hz	RR	56	61	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I - V_O$	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	$\mu V/V_O$
Output Resistance f = 1.0 kHz	r_O	–	1.0	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.5	–	mV/°C

ELECTRICAL CHARACTERISTICS (V_{in} = 19 V, I_O = 500 mA, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7812C/LM340T–12			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	11.5	12	12.5	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 14.5 Vdc ≤ V_{in} ≤ 27 Vdc	V_O	11.4	12	12.6	Vdc
Line Regulation, T_J = 25°C (Note 2) 14.5 Vdc ≤ V_{in} ≤ 30 Vdc 16 Vdc ≤ V_{in} ≤ 22 Vdc 14.8 Vdc ≤ V_{in} ≤ 27 Vdc, I_O = 1.0 A	Reg_{line}	 – – –	 3.8 0.3 –	 24 24 48	mV
Load Regulation, T_J = 25°C (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A	Reg_{load}	–	8.1	60	mV
Quiescent Current	I_B	–	3.4	6.5	mA
Quiescent Current Change 14.5 Vdc ≤ V_{in} ≤ 30 Vdc, I_O = 1.0 A, T_J = 25°C 15 Vdc ≤ V_{in} ≤ 30 Vdc 5.0 mA ≤ I_O ≤ 1.0 A	ΔI_B	 – – –	 – – –	 0.7 0.8 0.5	mA
Ripple Rejection 15 Vdc ≤ V_{in} ≤ 25 Vdc, f = 120 Hz	RR	55	60	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I - V_O$	–	2.0	–	Vdc

NOTES: 1. T_{low} = –40°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX

2. 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 (continued) (V_{in} = 19 V, I_O = 500 mA, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7812C/LM340T–12			Unit
		Min	Typ	Max	
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	μV/V_O
Output Resistance f = 1.0 kHz	r_O	–	1.1	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.8	–	mV/°C

ELECTRICAL CHARACTERISTICS (V_{in} = 19 V, I_O = 1.0 A, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7812AC/LM340AT–12			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	11.75	12	12.25	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 14.8 Vdc ≤ V_{in} ≤ 27 Vdc	V_O	11.5	12	12.5	Vdc
Line Regulation (Note 2) 14.8 Vdc ≤ V_{in} ≤ 30 Vdc, I_O = 500 mA 16 Vdc ≤ V_{in} ≤ 22 Vdc, I_O = 1.0 A 14.5 Vdc ≤ V_{in} ≤ 27 Vdc, T_J = 25°C	Reg_{line}	 – – –	 3.8 2.2 6.0	 18 20 120	mV
Load Regulation (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A, T_J = 25°C 5.0 mA ≤ I_O ≤ 1.0 A	Reg_{load}	 – –	 – –	 25 25	mV
Quiescent Current	I_B	–	3.4	6.0	mA
Quiescent Current Change 15 Vdc ≤ V_{in} ≤ 30 Vdc, I_O = 500 mA 14.8 Vdc ≤ V_{in} ≤ 27 Vdc, T_J = 25°C 5.0 mA ≤ I_O ≤ 1.0 A, T_J = 25°C	ΔI_B	 – – –	 – – –	 0.8 0.8 0.5	mA
Ripple Rejection 15 Vdc ≤ V_{in} ≤ 25 Vdc, f = 120 Hz, I_O = 500 mA	RR	55	60	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I – V_O$	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	μV/V_O
Output Resistance (f = 1.0 kHz)	r_O	–	1.1	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.8	–	mV/°C

NOTES: 1. T_{low} = –40°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX

2. 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 (V_{in} = 23 V, I_O = 500 mA, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7815C/LM340T–15			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	14.4	15	15.6	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 17.5 Vdc ≤ V_{in} ≤ 30 Vdc	V_O	14.25	15	15.75	Vdc
Line Regulation, T_J = 25°C (Note 2) 17.9 Vdc ≤ V_{in} ≤ 30 Vdc 20 Vdc ≤ V_{in} ≤ 26 Vdc	Reg_{line}	 – –	 8.5 3.0	 30 28	mV
Load Regulation, T_J = 25°C (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A	Reg_{load}	–	1.8	55	mV
Quiescent Current	I_B	–	3.5	6.5	mA
Quiescent Current Change 17.5 Vdc ≤ V_{in} ≤ 30 Vdc 17.5 Vdc ≤ V_{in} ≤ 30 Vdc, I_O = 1.0 A, T_J = 25°C 5.0 mA ≤ I_O ≤ 1.0 A	ΔI_B	 – – –	 – – –	 0.8 0.7 0.5	mA
Ripple Rejection 18.5 Vdc ≤ V_{in} ≤ 28.5 Vdc, f = 120 Hz	RR	54	58	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I – V_O$	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	$\mu V/V_O$
Output Resistance f = 1.0 kHz	r_O	–	1.2	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–1.0	–	mV/°C

ELECTRICAL CHARACTERISTICS (V_{in} = 23 V, I_O = 1.0 A, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7815AC/LM340AT–15			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	14.7	15	15.3	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 17.9 Vdc ≤ V_{in} ≤ 30 Vdc	V_O	14.4	15	15.6	Vdc
Line Regulation (Note 2) 17.9 Vdc ≤ V_{in} ≤ 30 Vdc, I_O = 500 mA 20 Vdc ≤ V_{in} ≤ 26 Vdc 17.5 Vdc ≤ V_{in} ≤ 30 Vdc, I_O = 1.0 A, T_J = 25°C	Reg_{line}	 – – –	 8.5 3.0 7.0	 20 22 20	mV
Load Regulation (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A, T_J = 25°C 5.0 mA ≤ I_O ≤ 1.0 A 250 mA ≤ I_O ≤ 750 mA	Reg_{load}	 – – –	 1.8 1.5 1.2	 25 25 15	mV
Quiescent Current	I_B	–	3.5	6.0	mA
Quiescent Current Change 17.5 Vdc ≤ V_{in} ≤ 30 Vdc, I_O = 500 mA 17.5 Vdc ≤ V_{in} ≤ 30 Vdc, I_O = 1.0 A, T_J = 25°C 5.0 mA ≤ I_O ≤ 1.0 A	ΔI_B	 – – –	 – – –	 0.8 0.8 0.5	mA

NOTES: 1. T_{low} = –40°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX

2. 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 (continued) (V_{in} = 23 V, I_O = 1.0 A, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7815AC/LM340AT–15			Unit
		Min	Typ	Max	
Ripple Rejection 18.5 Vdc ≤ V_{in} ≤ 28.5 Vdc, f = 120 Hz, I_O = 500 mA	RR	60	80	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I – V_O$	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	μV/V_O
Output Resistance f = 1.0 kHz	r_O	–	1.2	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–1.0	–	mV/°C

ELECTRICAL CHARACTERISTICS (V_{in} = 27 V, I_O = 500 mA, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7818C			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	17.3	18	18.7	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 21 Vdc ≤ V_{in} ≤ 33 Vdc	V_O	17.1	18	18.9	Vdc
Line Regulation, (Note 2) 21 Vdc ≤ V_{in} ≤ 33 Vdc 24 Vdc ≤ V_{in} ≤ 30 Vdc	Reg_{line}	 – –	 9.5 3.2	 50 25	mV
Load Regulation, (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A	Reg_{load}	–	2.0	55	mV
Quiescent Current	I_B	–	3.5	6.5	mA
Quiescent Current Change 21 Vdc ≤ V_{in} ≤ 33 Vdc 5.0 mA ≤ I_O ≤ 1.0 A	ΔI_B	 – –	 – –	 1.0 0.5	mA
Ripple Rejection 22 Vdc ≤ V_{in} ≤ 33 Vdc, f = 120 Hz	RR	53	57	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_{il} – V_O$	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	μV/V_O
Output Resistance f = 1.0 kHz	r_O	–	1.3	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–1.5	–	mV/°C

NOTES: 1. T_{low} = –40°C for MC78XXAC, C T_{high} = +125°C for MC78XXAC, C

2. 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 (V_{in} = 27 V, I_O = 1.0 A, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7818AC			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	17.64	18	18.36	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 21 Vdc ≤ V_{in} ≤ 33 Vdc	V_O	17.3	18	18.7	Vdc
Line Regulation (Note 2) 21 Vdc ≤ V_{in} ≤ 33 Vdc, I_O = 500 mA 24 Vdc ≤ V_{in} ≤ 30 Vdc, I_O = 1.0 A 24 Vdc ≤ V_{in} ≤ 30 Vdc, I_O = 1.0 A, T_J = 25°C 20.6 Vdc ≤ V_{in} ≤ 33 Vdc, I_O = 1.0 A, T_J = 25°C	Reg_{line}	 – – – –	 9.5 3.2 3.2 8.0	 22 25 10.5 22	mV
Load Regulation (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A, T_J = 25°C 5.0 mA ≤ I_O ≤ 1.0 A 250 mA ≤ I_O ≤ 750 mA	Reg_{load}	 – – –	 2.0 1.8 1.5	 25 25 15	mV
Quiescent Current	I_B	–	3.5	6.0	mA
Quiescent Current Change 21 Vdc ≤ V_{in} ≤ 33 Vdc, I_O = 500 mA 21.5 Vdc ≤ V_{in} ≤ 30 Vdc, T_J = 25°C 5.0 mA ≤ I_O ≤ 1.0 A	ΔI_B	 – – –	 – – –	 0.8 0.8 0.5	mA
Ripple Rejection 22 Vdc ≤ V_{in} ≤ 32 Vdc, f = 120 Hz, I_O = 500 mA	RR	53	57	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I - V_O$	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	$\mu V/V_O$
Output Resistance f = 1.0 kHz	r_O	–	1.3	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–1.5	–	mV/°C

ELECTRICAL CHARACTERISTICS (V_{in} = 33 V, I_O = 500 mA, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7824C			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	23	24	25	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 27 Vdc ≤ V_{in} ≤ 38 Vdc	V_O	22.8	24	25.2	Vdc
Line Regulation, (Note 2) 27 Vdc ≤ V_{in} ≤ 38 Vdc 30 Vdc ≤ V_{in} ≤ 36 Vdc	Reg_{line}	 – –	 2.7 2.7	 60 48	mV
Load Regulation, (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A	Reg_{load}	–	4.4	65	mV
Quiescent Current	I_B	–	3.6	6.5	mA
Quiescent Current Change 27 Vdc ≤ V_{in} ≤ 38 Vdc 5.0 mA ≤ I_O ≤ 1.0 A	ΔI_B	 – –	 – –	 1.0 0.5	mA

NOTES: 1. T_{low} = –40°C for MC78XXAC, C T_{high} = +125°C for MC78XXAC, C

2. 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 (continued) (V_{in} = 33 V, I_O = 500 mA, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7824C			Unit
		Min	Typ	Max	
Ripple Rejection 28 Vdc ≤ V_{in} ≤ 38 Vdc, f = 120 Hz	RR	50	54	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I - V_O$	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	μV/V_O
Output Resistance f = 1.0 kHz	r_O	–	1.4	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–2.0	–	mV/°C

ELECTRICAL CHARACTERISTICS (V_{in} = 33 V, I_O = 1.0 A, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7824AC			Unit
		Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	23.5	24	24.5	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 27.3 Vdc ≤ V_{in} ≤ 38 Vdc	V_O	23.2	24	25.8	Vdc
Line Regulation (Note 2)	Reg_{line}				mV
27 Vdc ≤ V_{in} ≤ 38 Vdc, I_O = 500 mA		–	11.5	25	
30 Vdc ≤ V_{in} ≤ 36 Vdc, I_O = 1.0 A		–	3.8	28	
30 Vdc ≤ V_{in} ≤ 36 Vdc, T_J = 25°C		–	3.8	12	
26.7 Vdc ≤ V_{in} ≤ 38 Vdc, I_O = 1.0 A, T_J = 25°C		–	10	25	
Load Regulation (Note 2)	Reg_{load}				mV
5.0 mA ≤ I_O ≤ 1.5 A, T_J = 25°C		–	2.1	15	
5.0 mA ≤ I_O ≤ 1.0 A		–	2.0	25	
250 mA ≤ I_O ≤ 750 mA		–	1.8	15	
Quiescent Current	I_B	–	3.6	6.0	mA
Quiescent Current Change	ΔI_B				mA
27.3 Vdc ≤ V_{in} ≤ 38 Vdc, I_O = 500 mA		–	–	0.8	
27 Vdc ≤ V_{in} ≤ 38 Vdc, T_J = 25°C		–	–	0.8	
5.0 mA ≤ I_O ≤ 1.0 A		–	–	0.5	
Ripple Rejection 28 Vdc ≤ V_{in} ≤ 38 Vdc, f = 120 Hz, I_O = 500 mA	RR	45	54	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I - V_O$	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	μV/V_O
Output Resistance (f = 1.0 kHz)	r_O	–	1.4	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–2.0	–	mV/°C

NOTES: 1. T_{low} = –40°C for MC78XXAC, C T_{high} = +125°C for MC78XXAC, C

2. 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.

Figure 1. Peak Output Current as a Function of Input/Output Differential Voltage (MC78XXC, AC)

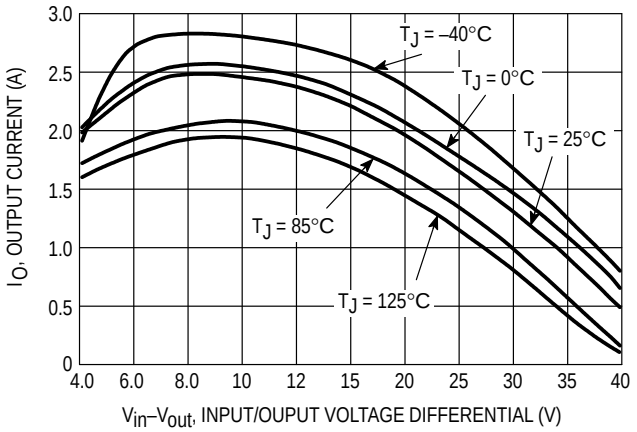


Figure 2. Ripple Rejection as a Function of Output Voltages (MC78XXC, AC)

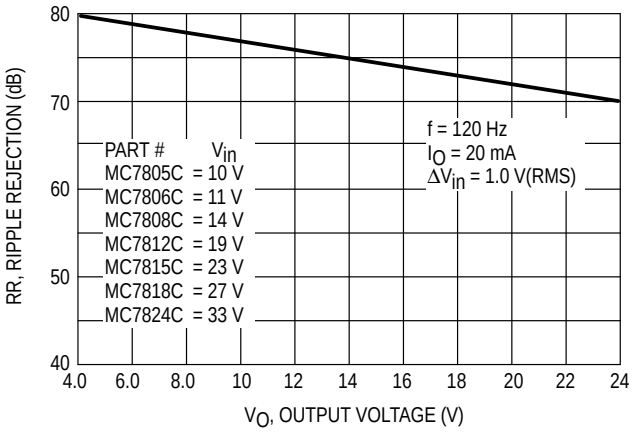


Figure 3. Ripple Rejection as a Function of Frequency (MC78XXC, AC)

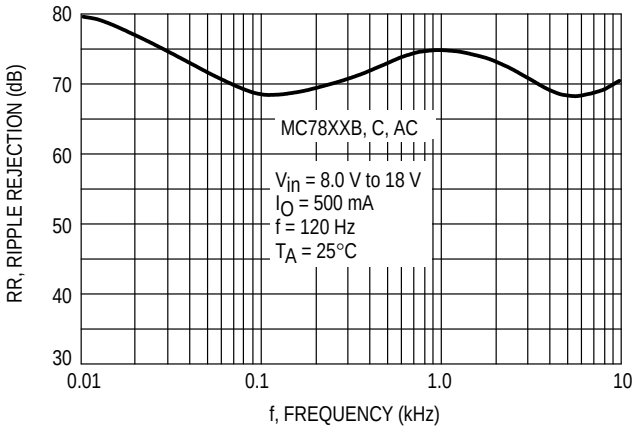


Figure 4. Output Voltage as a Function of Junction Temperature (MC7805C, AC)

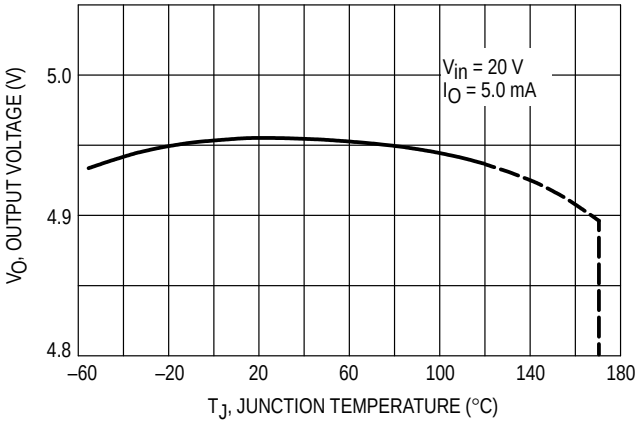


Figure 5. Output Impedance as a Function of Output Voltage (MC78XXC, AC)

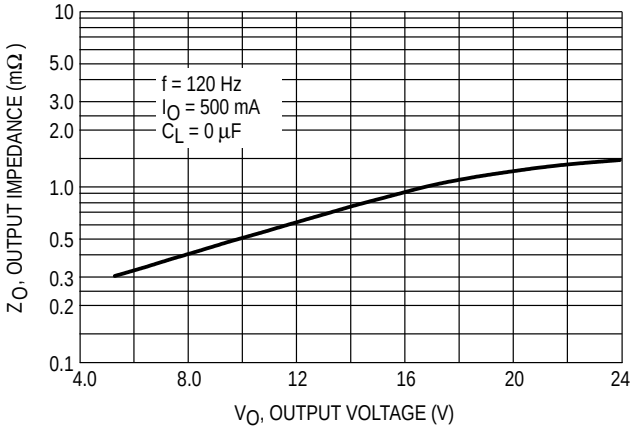
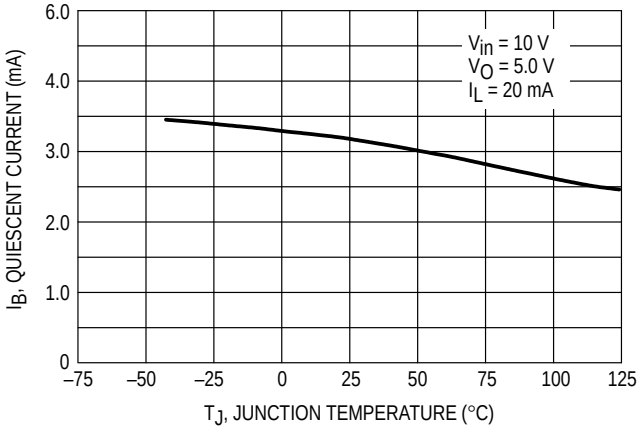


Figure 6. Quiescent Current as a Function of Temperature (MC78XXC, AC)



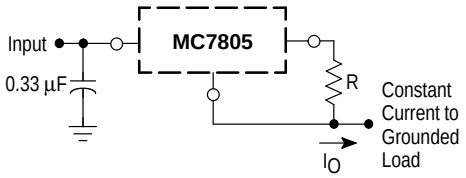
APPLICATIONS INFORMATION

Design Considerations

The MC7800 Series of fixed voltage regulators are designed with Thermal Overload Protection that shuts down the circuit when subjected to an excessive power overload condition, Internal Short Circuit Protection that limits the maximum current the circuit will pass, and Output Transistor Safe–Area Compensation that reduces the output short circuit current as the voltage across the pass transistor is increased.

In many low current applications, compensation capacitors are not required. However, it is recommended that the regulator input be bypassed with a capacitor if the regulator is connected to the power supply filter with long wire lengths, or if the output load capacitance is large. An input bypass capacitor should be selected to provide good high–frequency characteristics to insure stable operation under all load conditions. A 0.33 μF or larger tantalum, mylar, or other capacitor having low internal impedance at high frequencies should be chosen. The bypass capacitor should be mounted with the shortest possible leads directly across the regulators input terminals. Normally good construction techniques should be used to minimize ground loops and lead resistance drops since the regulator has no external sense lead.

Figure 7. Current Regulator



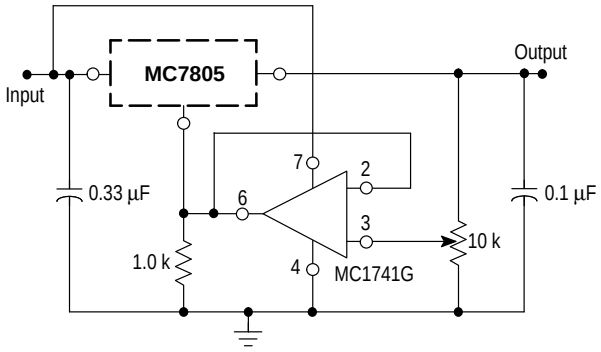
The MC7800 regulators can also be used as a current source when connected as above. In order to minimize dissipation the MC7805C is chosen in this application. Resistor R determines the current as follows:

$$I_O = \frac{5.0\ V}{R} + I_B$$

$I_B \cong 3.2$ mA over line and load changes.

For example, a 1.0 A current source would require R to be a 5.0 Ω, 10 W resistor and the output voltage compliance would be the input voltage less 7.0 V.

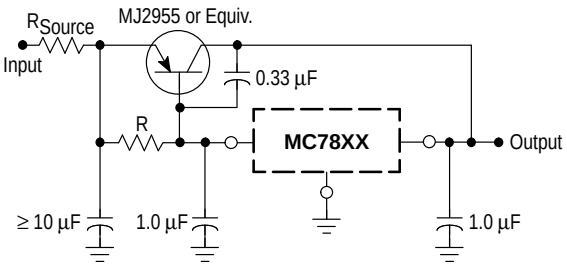
Figure 8. Adjustable Output Regulator



V_O = 7.0 V to 20 V
$V_{IN} = V_O \geq 2.0$ V

The addition of an operational amplifier allows adjustment to higher or intermediate values while retaining regulation characteristics. The minimum voltage obtainable with this arrangement is 2.0 V greater than the regulator voltage.

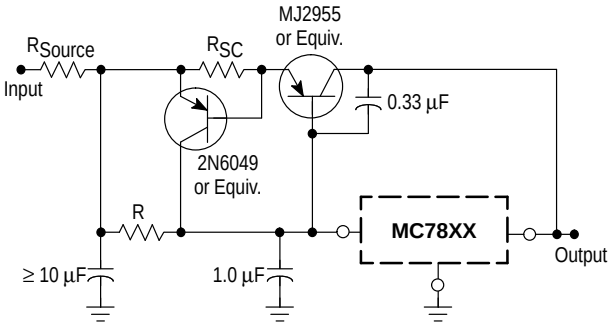
Figure 9. Current Boost Regulator



XX = 2 digits of type number indicating voltage.

The MC7800 series can be current boosted with a PNP transistor. The MJ2955 provides current to 5.0 A. Resistor R in conjunction with the V_{BE} of the PNP determines when the pass transistor begins conducting; this circuit is not short circuit proof. Input/output differential voltage minimum is increased by V_{BE} of the pass transistor.

Figure 10. Short Circuit Protection



XX = 2 digits of type number indicating voltage.

The circuit of Figure 9 can be modified to provide supply protection against short circuits by adding a short circuit sense resistor, R_{SC}, and an additional PNP transistor. The current sensing PNP must be able to handle the short circuit current of the three–terminal regulator. Therefore, a four–ampere plastic power transistor is specified.

Figure 11. Worst Case Power Dissipation versus Ambient Temperature (Case 221A)

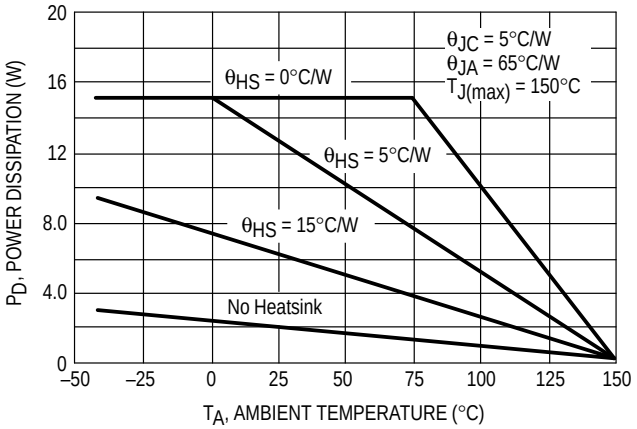


Figure 12. Input Output Differential as a Function of Junction Temperature (MC78XXC, AC)

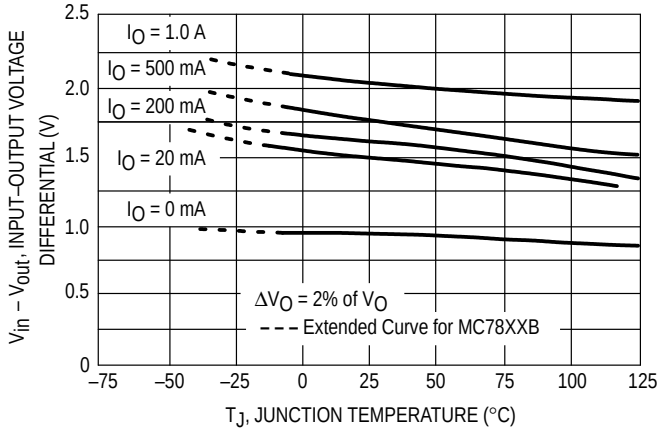
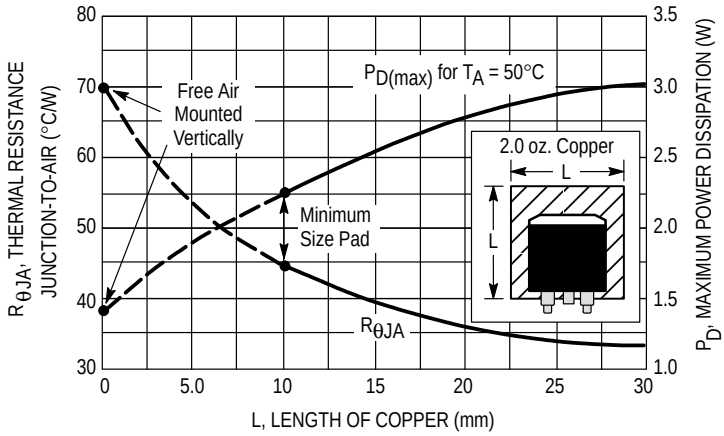


Figure 13. D²PAK Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length



DEFINITIONS

Line Regulation – The change in output voltage for a change in the input voltage. The measurement is made under conditions of low dissipation or by using pulse techniques such that the average chip temperature is not significantly affected.

Load Regulation – The change in output voltage for a change in load current at constant chip temperature.

Maximum Power Dissipation – The maximum total device dissipation for which the regulator will operate within specifications.

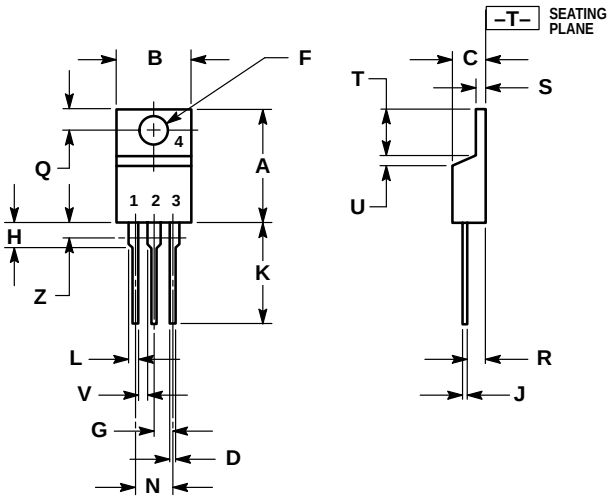
Quiescent Current – That part of the input current that is not delivered to the load.

Output Noise Voltage – The rms ac voltage at the output, with constant load and no input ripple, measured over a specified frequency range.

Long Term Stability – Output voltage stability under accelerated life test conditions with the maximum rated voltage listed in the devices' electrical characteristics and maximum power dissipation.

OUTLINE DIMENSIONS

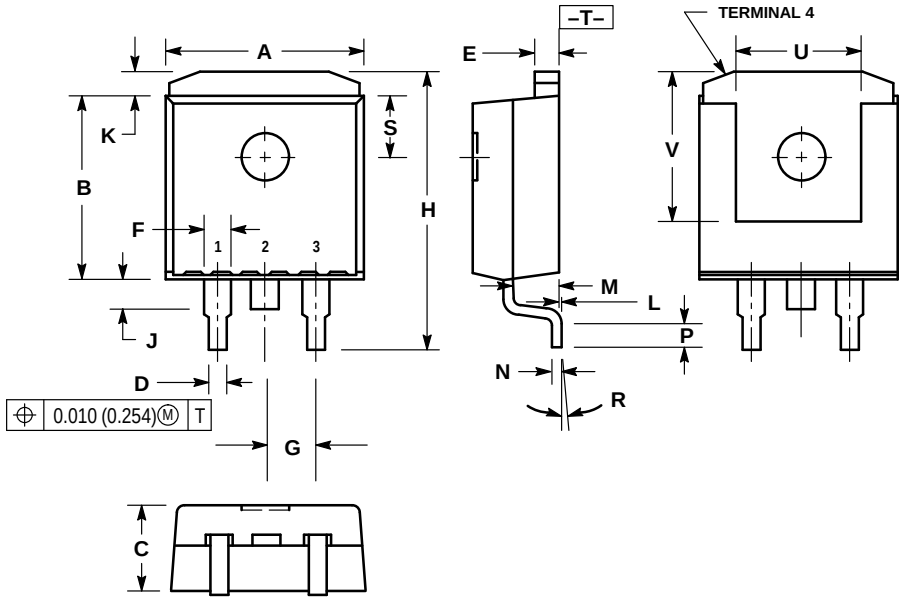
T SUFFIX
PLASTIC PACKAGE
CASE 221A–06
ISSUE Y



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIM Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	–	1.15	–
Z	–	0.080	–	2.04

D2T SUFFIX
PLASTIC PACKAGE
CASE 936–03
(D^2PAK)
ISSUE B



NOTES:
1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2 CONTROLLING DIMENSION: INCH.
3 TAB CONTOUR OPTIONAL WITHIN DIMENSIONS A AND K.
4 DIMENSIONS U AND V ESTABLISH A MINIMUM MOUNTING SURFACE FOR TERMINAL 4.
5 DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH OR GATE PROTRUSIONS. MOLD FLASH AND GATE PROTRUSIONS NOT TO EXCEED 0.025 (0.635) MAXIMUM.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.386	0.403	9.804	10.236
B	0.356	0.368	9.042	9.347
C	0.170	0.180	4.318	4.572
D	0.026	0.036	0.660	0.914
E	0.045	0.055	1.143	1.397
F	0.051 REF		1.295 REF	
G	0.100 BSC		2.540 BSC	
H	0.539	0.579	13.691	14.707
J	0.125 MAX		3.175 MAX	
K	0.050 REF		1.270 REF	
L	0.000	0.010	0.000	0.254
M	0.088	0.102	2.235	2.591
N	0.018	0.026	0.457	0.660
P	0.058	0.078	1.473	1.981
R	5° REF		5° REF	
S	0.116 REF		2.946 REF	
U	0.200 MIN		5.080 MIN	
V	0.250 MIN		6.350 MIN	

Mfax is a trademark of Motorola, Inc.

How to reach us:
USA / EUROPE / Locations Not Listed: Motorola Literature Distribution;
P.O. Box 5405, Denver, Colorado 80217. 1–303–675–2140 or 1–800–441–2447

JAPAN: Nippon Motorola Ltd.: SPD, Strategic Planning Office, 4–32–1, Nishi–Gotanda, Shinagawa–ku, Tokyo 141, Japan. 81–3–5487–8488

Customer Focus Center: 1–800–521–6274

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 1–602–244–6609
Motorola Fax Back System – US & Canada ONLY 1–800–774–1848
– http://sps.motorola.com/mfax/

HOME PAGE: http://motorola.com/sps/

ASIA / PACIFIC: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park, 51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852–26629298