MC7800, MC7800A, LM340, LM340A Series, NCV7805

1.0 A Positive Voltage Regulators

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^2PAK, DPAK and Standard 3–Lead Transistor Packages

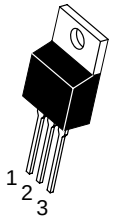
MAXIMUM RATINGS (T_A = 25°C, unless otherwise noted.)

Rating	Symbol	Value	Unit
Input Voltage (5.0 – 18 V) (24 V)	V_I	35 40	Vdc
Power Dissipation			
Case 221A (TO–220) T_A = 25°C	P_D	Internally Limited	W
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	65	°C/W
Thermal Resistance, Junction–to–Case	$R_{\theta JC}$	5.0	°C/W
Case 936 (D^2PAK) T_A = 25°C	P_D	Internally Limited	W
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	See Figure 14	°C/W
Thermal Resistance, Junction–to–Case	$R_{\theta JA}$	5.0	°C/W
Case 369A (DPAK) T_A = 25°C	P_D	Internally Limited	W
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	92	°C/W
Thermal Resistance, Junction–to–Case	$R_{\theta JC}$	5.0	°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.

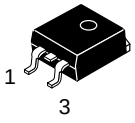
ON Semiconductor®

http://onsemi.com



TO–220
T SUFFIX
CASE 221A

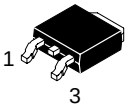
Heatsink surface connected to Pin 2.



D^2PAK
D2T SUFFIX
CASE 936

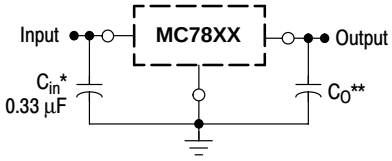
Pin 1. Input
2. Ground
3. Output

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



DPAK
DT SUFFIX
CASE 369A

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.

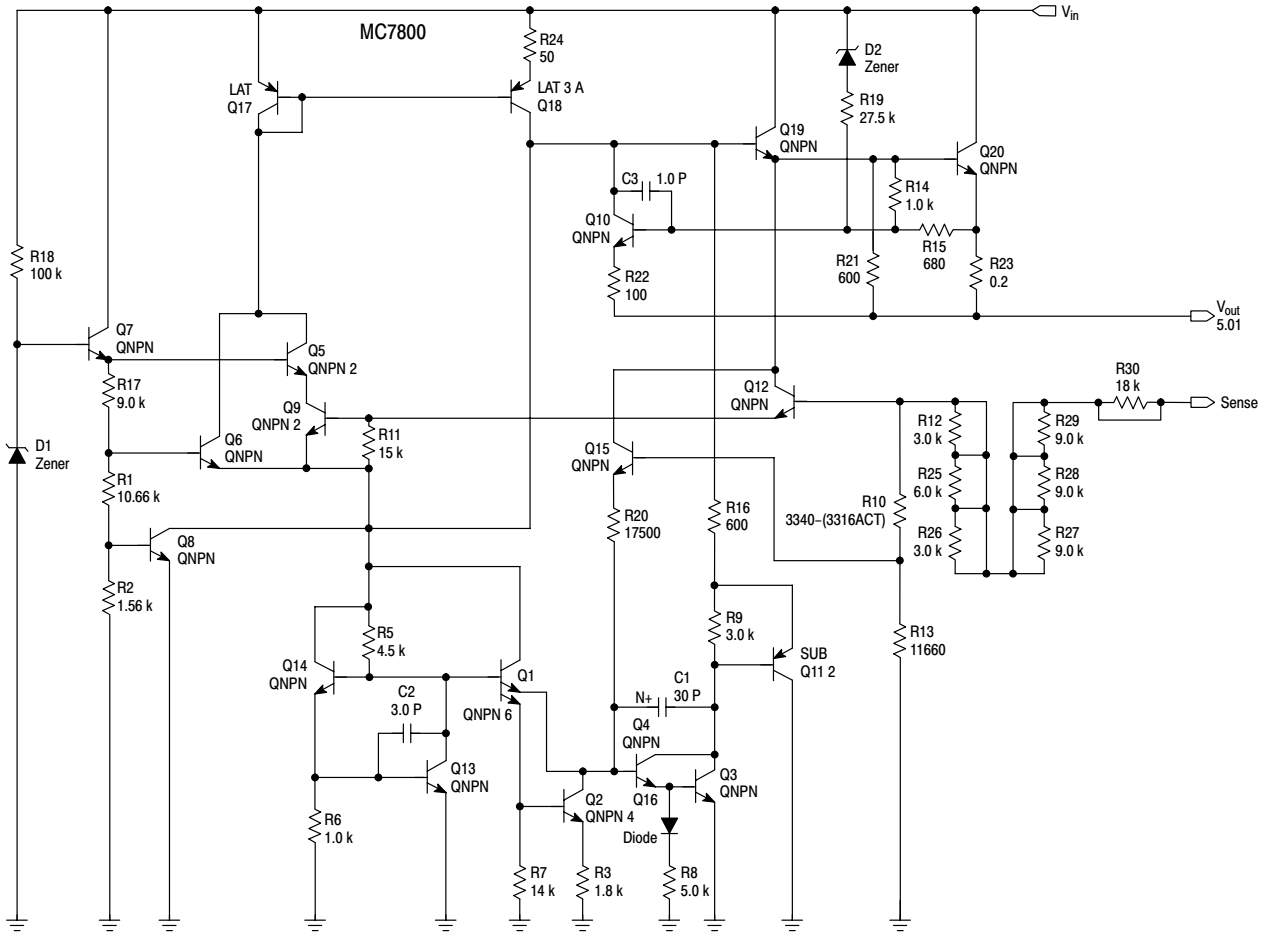
** C_O is not needed for stability; however, it does improve transient response. Values of less than 0.1 µF could cause instability.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 16 of this data sheet.

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 18 of this data sheet.



This device contains 22 active transistors.

Figure 1. Representative Schematic Diagram

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

Characteristic	Symbol	MC7805B, NCV7805			MC7805C/LM340T–5			Unit
		Min	Typ	Max	Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	4.8	5.0	5.2	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	 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}	 – –	 5.0 1.3	 100 50	 – –	 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 0.15	 100 50	 – –	 1.3 1.3	 25 25	mV
Quiescent Current	I_B	–	3.2	8.0	–	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	 – –	 – –	 – 0.5	 – –	 0.3 0.08	 1.0 0.8	mA
Ripple Rejection 8.0 Vdc ≤ V_{in} ≤ 18 Vdc, f = 120 Hz	RR	–	68	–	62	83	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I – V_O$	–	2.0	–	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	–	10	–	$\mu V/V_O$
Output Resistance f = 1.0 kHz	r_O	–	0.9	–	–	0.9	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	–	0.6	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.3	–	–	–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	MC7805AB/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

1. T_{low} = 0°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX, NCV7805
   = –40°C for MC78XXB, MC78XXAB, NCV7805
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	MC7805AB/MC7805AC/LM340AT–5			Unit
		Min	Typ	Max	
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
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} = 11 V, I_O = 500 mA, T_J = T_{low} to T_{high} [Note 1], unless otherwise noted.)

Characteristic	Symbol	MC7806B			MC7806C			Unit
		Min	Typ	Max	Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	5.75	6.0	6.25	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	 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}	 – –	 5.5 1.4	 120 60	 – –	 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	120	–	1.3	30	mV
Quiescent Current (T_J = 25°C)	I_B	–	3.3	8.0	–	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	 – –	 – –	 – 0.5	 – –	 0.3 0.08	 1.3 0.5	mA
Ripple Rejection 9.0 Vdc ≤ V_{in} ≤ 19 Vdc, f = 120 Hz	RR	–	65	–	58	65	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I – V_O$	–	2.0	–	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	–	10	–	μV/V_O
Output Resistance f = 1.0 kHz	r_O	–	0.9	–	–	0.9	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.3	–	–	–0.3	–	mV/°C

1. T_{low} = 0°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX, NCV7805
   = –40°C for MC78XXB, MC78XXAB, NCV7805
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	–	$\mu V/V_O$
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	MC7808B			MC7808C			Unit
		Min	Typ	Max	Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	7.7	8.0	8.3	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 11.5 Vdc ≤ V_{in} ≤ 23 Vdc	V_O	 – 7.6	 – 8.0	 – 8.4	 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	 160 80	 – –	 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	160	–	1.4	35	mV
Quiescent Current	I_B	–	3.3	8.0	–	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	 – –	 – –	 – 0.5	 – –	 – –	 1.0 0.5	mA

1. T_{low} = 0°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX, NCV7805
   = –40°C for MC78XXB, MC78XXAB, NCV7805
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	MC7808B			MC7808C			Unit
		Min	Typ	Max	Min	Typ	Max	
Ripple Rejection 11.5 Vdc ≤ V_{in} ≤ 18 Vdc, f = 120 Hz	RR	–	62	–	56	62	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I – V_O$	–	2.0	–	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	–	10	–	μV/V_O
Output Resistance f = 1.0 kHz	r_O	–	0.9	–	–	0.9	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.4	–	–	–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	MC7808AB/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) 10.6 Vdc ≤ V_{in} ≤ 25 Vdc, I_O = 500 mA 11 Vdc ≤ V_{in} ≤ 17 Vdc, I_O = 1.0 A 10.4 Vdc ≤ V_{in} ≤ 23 Vdc, T_J = 25°C	Reg_{line}	 – – –	 6.0 1.7 5.0	 15 18 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}	 – – –	 1.4 1.0 0.22	 25 25 15	mV
Quiescent Current	I_B	–	3.3	6.0	mA
Quiescent Current Change 11 Vdc ≤ V_{in} ≤ 25 Vdc, I_O = 500 mA 10.6 Vdc ≤ V_{in} ≤ 23 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 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

1. T_{low} = 0°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX, NCV7805
   = –40°C for MC78XXB, MC78XXAB, NCV7805
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	MC7809B			MC7809C			Unit
		Min	Typ	Max	Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	8.65	9.0	9.35	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	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	 – –	 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	–	1.5	35	mV
Quiescent Current	I_B	–	3.4	8.0	–	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	 – –	 – –	 1.0 0.5	mA
Ripple Rejection 11.5 Vdc ≤ V_{in} ≤ 21.5 Vdc, f = 120 Hz	RR	56	61	–	56	61	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I – V_O$	–	2.0	–	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	–	10	–	$\mu V/V_O$
Output Resistance f = 1.0 kHz	r_O	–	1.0	–	–	1.0	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.5	–	–	–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	MC7812B			MC7812C/LM340T–12			Unit
		Min	Typ	Max	Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	11.5	12	12.5	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 15.5 Vdc ≤ V_{in} ≤ 27 Vdc	V_O	 – 11.4	 – 12	 – 12.6	 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}	 – – –	 7.5 2.2 –	 240 120 –	 – – –	 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}	–	1.6	240	–	8.1	60	mV
Quiescent Current	I_B	–	3.4	8.0	–	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	 – – –	 – – –	 – 1.0 0.5	 – – –	 – – –	 0.7 0.8 0.5	mA
Ripple Rejection 15 Vdc ≤ V_{in} ≤ 25 Vdc, f = 120 Hz	RR	–	60	–	55	60	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I – V_O$	–	2.0	–	–	2.0	–	Vdc

1. T_{low} = 0°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX, NCV7805
   = −40°C for MC78XXB, MC78XXAB, NCV7805
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	MC7812B			MC7812C/LM340T–12			Unit
		Min	Typ	Max	Min	Typ	Max	
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	–	10	–	μV/V_O
Output Resistance f = 1.0 kHz	r_O	–	1.1	–	–	1.1	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–0.8	–	–	–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	MC7812AB/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

1. T_{low} = 0°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX, NCV7805
   = –40°C for MC78XXB, MC78XXAB, NCV7805
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	MC7815B			MC7815C/LM340T–15			Unit
		Min	Typ	Max	Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	14.4	15	15.6	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 18.5 Vdc ≤ V_{in} ≤ 30 Vdc	V_O	 – 14.25	 – 15	 – 15.75	 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	 300 150	 – –	 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	300	–	1.8	55	mV
Quiescent Current	I_B	–	3.5	8.0	–	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	 – – –	 – – –	 – 1.0 0.5	 – – –	 – – –	 0.8 0.7 0.5	mA
Ripple Rejection 18.5 Vdc ≤ V_{in} ≤ 28.5 Vdc, f = 120 Hz	RR	–	58	–	54	58	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I – V_O$	–	2.0	–	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	–	10	–	$\mu V/V_O$
Output Resistance f = 1.0 kHz	r_O	–	1.2	–	–	1.2	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–1.0	–	–	–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	MC7815AB/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

1. T_{low} = 0°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX, NCV7805
   = –40°C for MC78XXB, MC78XXAB, NCV7805
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	MC7815AB/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	MC7818B			MC7818C			Unit
		Min	Typ	Max	Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	17.3	18	18.7	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 22 Vdc ≤ V_{in} ≤ 33 Vdc	V_O	 – 17.1	 – 18	 – 18.9	 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	 360 180	 – –	 9.5 3.2	 50 25	mV
Load Regulation, (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A	Reg_{load}	–	2.0	360	–	2.0	55	mV
Quiescent Current	I_B	–	3.5	8.0	–	3.5	6.5	mA
Quiescent Current Change 21 Vdc ≤ V_{in} ≤ 33 Vdc 5.0 mA ≤ I_O ≤ 1.0 A	ΔI_B	 – –	 – –	 – 0.5	 – –	 – –	 1.0 0.5	mA
Ripple Rejection 22 Vdc ≤ V_{in} ≤ 33 Vdc, f = 120 Hz	RR	–	57	–	53	57	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_{il} – V_O$	–	2.0	–	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	–	10	–	μV/V_O
Output Resistance f = 1.0 kHz	r_O	–	1.3	–	–	1.3	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–1.5	–	–	–1.5	–	mV/°C

1. T_{low} = 0°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX, NCV7805
   = −40°C for MC78XXB, MC78XXAB, NCV7805
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	–	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

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

Characteristic	Symbol	MC7824B			MC7824C			Unit
		Min	Typ	Max	Min	Typ	Max	
Output Voltage (T_J = 25°C)	V_O	23	24	25	23	24	25	Vdc
Output Voltage (5.0 mA ≤ I_O ≤ 1.0 A, P_D ≤ 15 W) 27 Vdc ≤ V_{in} ≤ 38 Vdc 28 Vdc ≤ V_{in} ≤ 38 Vdc	V_O	 – 22.8	 – 24	 – 25.2	 22.8 –	 24 –	 25.2 –	Vdc
Line Regulation, (Note 2) 27 Vdc ≤ V_{in} ≤ 38 Vdc 30 Vdc ≤ V_{in} ≤ 36 Vdc	Reg_{line}	 – –	 11.5 3.8	 480 240	 – –	 2.7 2.7	 60 48	mV
Load Regulation, (Note 2) 5.0 mA ≤ I_O ≤ 1.5 A	Reg_{load}	–	2.1	480	–	4.4	65	mV
Quiescent Current	I_B	–	3.6	8.0	–	3.6	6.5	mA
Quiescent Current Change 27 Vdc ≤ V_{in} ≤ 38 Vdc 5.0 mA ≤ I_O ≤ 1.0 A	ΔI_B	 – –	 – –	 – 0.5	 – –	 – –	 1.0 0.5	mA

1. T_{low} = 0°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX, NCV7805
   = –40°C for MC78XXB, MC78XXAB, NCV7805
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	MC7824B			MC7824C			Unit
		Min	Typ	Max	Min	Typ	Max	
Ripple Rejection 28 Vdc ≤ V_{in} ≤ 38 Vdc, f = 120 Hz	RR	–	54	–	50	54	–	dB
Dropout Voltage (I_O = 1.0 A, T_J = 25°C)	$V_I – V_O$	–	2.0	–	–	2.0	–	Vdc
Output Noise Voltage (T_A = 25°C) 10 Hz ≤ f ≤ 100 kHz	V_n	–	10	–	–	10	–	μV/V_O
Output Resistance f = 1.0 kHz	r_O	–	1.4	–	–	1.4	–	mΩ
Short Circuit Current Limit (T_A = 25°C) V_{in} = 35 Vdc	I_{SC}	–	0.2	–	–	0.2	–	A
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	–2.0	–	–	–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

1. T_{low} = 0°C for MC78XXAC, C, LM340AT–XX, LM340T–XX T_{high} = +125°C for MC78XXAC, C, LM340AT–XX, LM340T–XX, NCV7805
   = −40°C for MC78XXB, MC78XXAB, NCV7805
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.

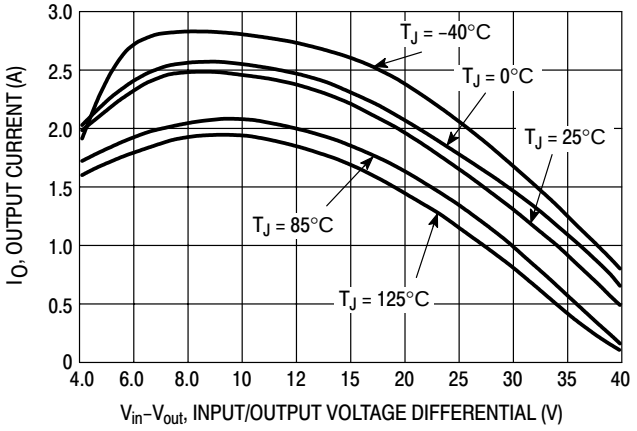


Figure 2. Peak Output Current as a Function of Input/Output Differential Voltage (MC78XXC, AC, B)

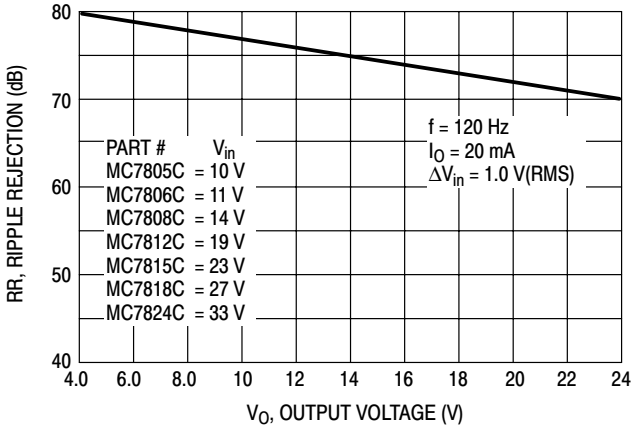


Figure 3. Ripple Rejection as a Function of Output Voltages (MC78XXC, AC, B)

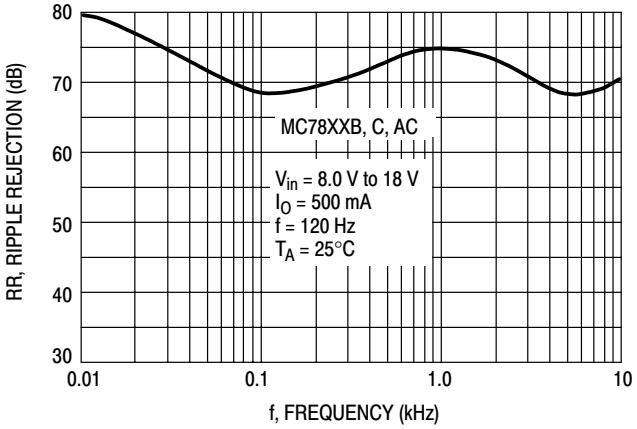


Figure 4. Ripple Rejection as a Function of Frequency (MC78XXC, AC, B)

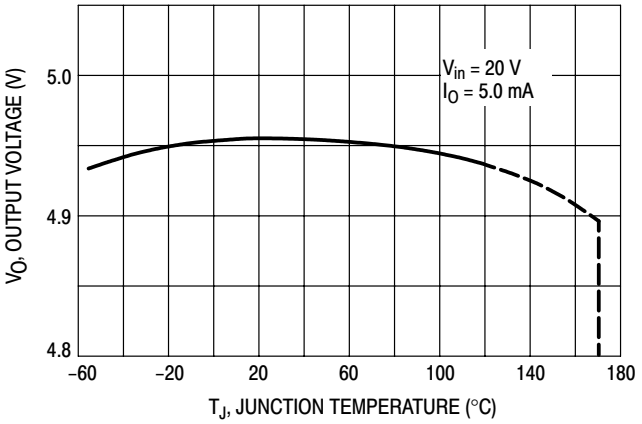


Figure 5. Output Voltage as a Function of Junction Temperature (MC7805C, AC, B)

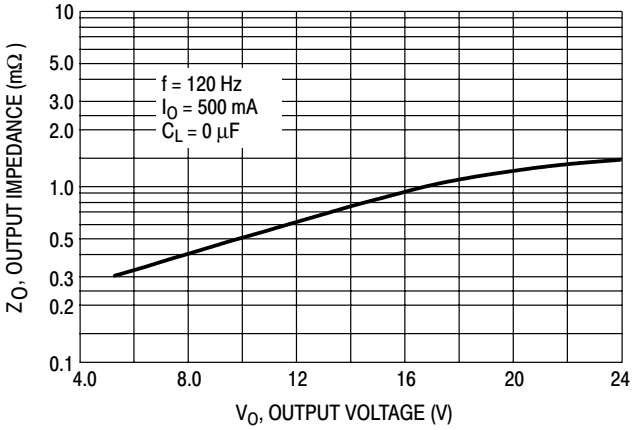


Figure 6. Output Impedance as a Function of Output Voltage (MC78XXC, AC, B)

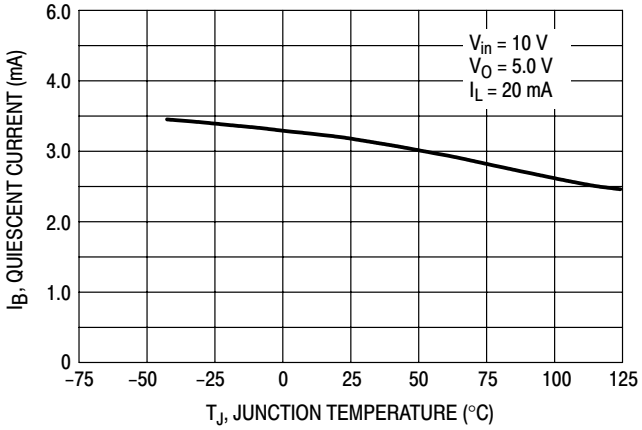


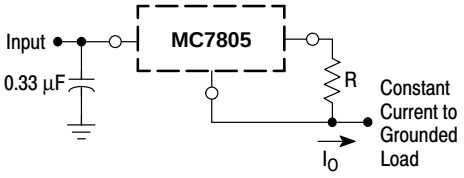
Figure 7. Quiescent Current as a Function of Temperature (MC78XXC, AC, B)

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.



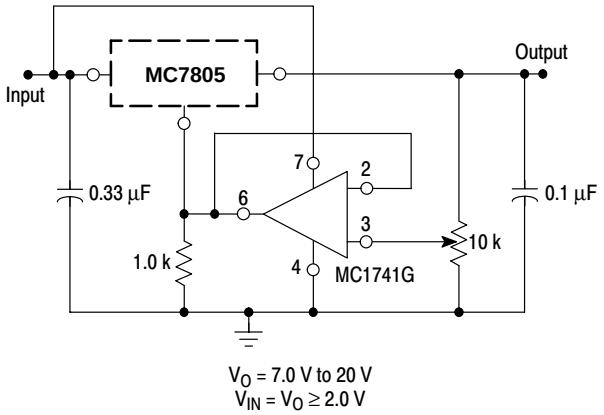
The MC7800 regulators can also be used as a current source when connected as above. In order to minimize dissipation the MC7805C is chosen in this application. Resistor R determines the current as follows:

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

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

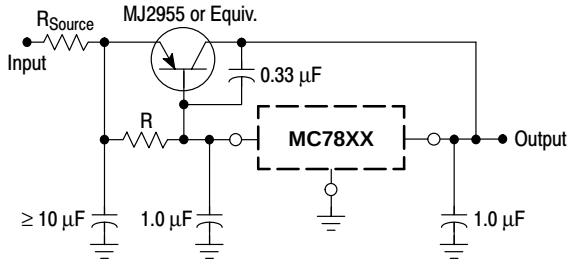
For example, a 1.0 A current source would require R to be a 5.0 Ω, 10 W resistor and the output voltage compliance would be the input voltage less 7.0 V.

Figure 8. Current Regulator



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.

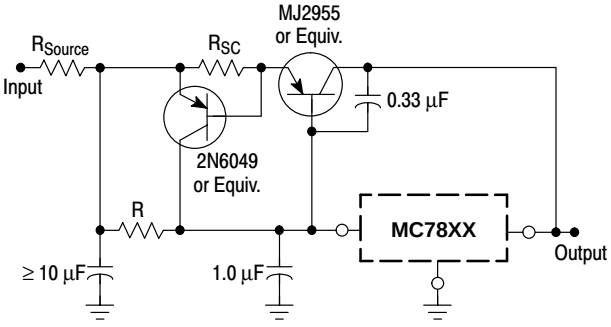
Figure 9. Adjustable Output Regulator



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. Current Boost Regulator



XX = 2 digits of type number indicating voltage.

The circuit of Figure 10 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. Short Circuit Protection

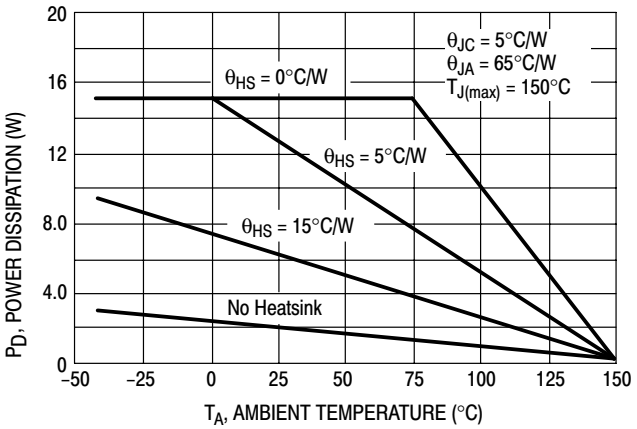


Figure 12. Worst Case Power Dissipation versus Ambient Temperature (Case 221A)

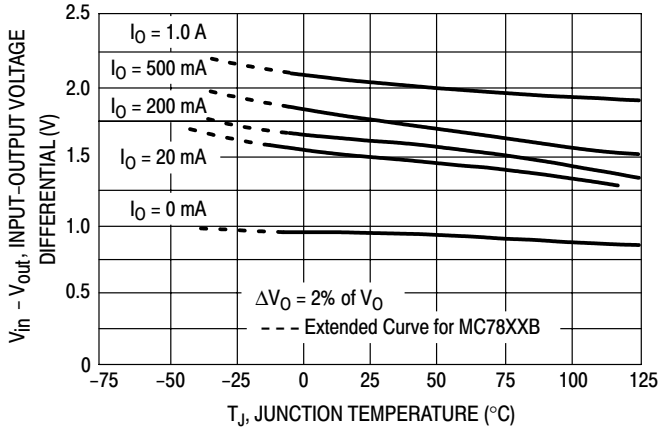


Figure 13. Input Output Differential as a Function of Junction Temperature (MC78XXC, AC, B)

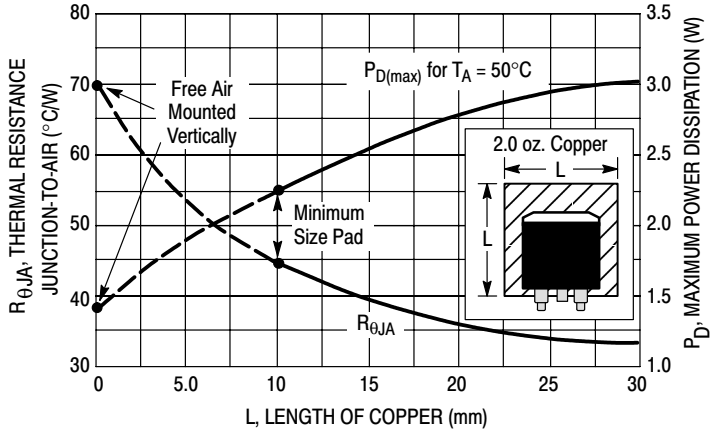


Figure 14. D²PAK Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length

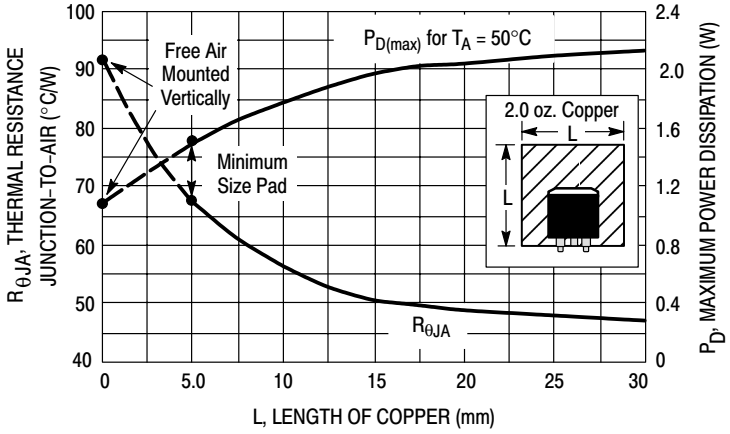


Figure 15. DPAK Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length

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.

ORDERING INFORMATION

Device	Output Voltage	Temperature Range	Package	Shipping	
				Rails (No Suffix)	Tape & Reel (R4 Suffix)
MC7805.2CT	5.0 V	T_J = 0° to +125°C	TO–220	50 Units/Rail	–
MC7805ACD2T/R4			D2PAK		800 Units/Reel
MC7805ACT			TO–220		–
MC7805CD2T/R4			D2PAK		800 Units/Reel
MC7805CT			TO–220		–
MC7805CDT/RK			DPAK	75 Units/Rail	2500 Units/Reel
LM340T–5			TO–220	50 Units/Rail	–
LM340AT–5					
MC7805BD2T/R4		T_J = −40° to +125°C	D2PAK		800 Units/Reel
MC7805BT			TO–220		–
NCV7805BT*					–
MC7805BDT/RK			DPAK	75 Units/Rail	2500 Units/Reel
MC7805ABD2T/R4			D2PAK	50 Units/Rail	800 Units/Reel
MC7805ABT			TO–220		–
MC7806ACT	6.0 V	T_J = 0° to +125°C	TO–220		–
MC7806CT					–
MC7806BD2T/R4		T_J = −40° to +125°C	D2PAK		800 Units/Reel
MC7806BT			TO–220		–
MC7808ACT	8.0 V	T_J = 0° to +125°C			–
MC7808CD2T/R4			D2PAK		800 Units/Reel
MC7808CT			TO–220		–
MC7808CDT/RK/T5			DPAK	75 Units/Rail	2500 Units/Reel
MC7808BD2T/R4		T_J = −40° to +125°C	D2PAK	50 Units/Rail	800 Units/Reel
MC7808BT			TO–220		–
MC7808BDT/RK			DPAK	75 Units/Rail	2500 Units/Reel
MC7808ABD2T/R4			D2PAK	50 Units/Rail	800 Units/Reel
MC7808ABT			TO–220		–

*NCV7805: T_{low} = –40°C, T_{high} = +125°C. Guaranteed by design. NCV prefix is for automotive and other applications requiring site and change control.

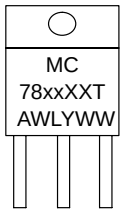
ORDERING INFORMATION (continued)

Device	Output Voltage	Temperature Range	Package	Shipping	
				Rails (No Suffix)	**Tape & Reel** (R4 Suffix)
MC7809ACT	9.0 V	T_J = 0° to +125°C	TO–220	50 Units/Rail	–
MC7809CD2T/R4			D2PAK		800 Units/Reel
MC7809CT			TO–220		–
MC7809BT		T_J = −40° to +125°C			–
MC7812ACD2T/R4	12 V	T_J = 0° to +125°C	D2PAK		800 Units/Reel
MC7812ACT			TO–220		–
MC7812CD2T/R4			D2PAK		800 Units/Reel
MC7812CT			TO–220		–
MC7812CDT/RK			DPAK	75 Units/Rail	2500 Units/Reel
LM340T–12			TO–220	50 Units/Rail	–
LM340AT–12					
MC7812BD2T/R4		T_J = −40° to +125°C	D2PAK		800 Units/Reel
MC7812BT			TO–220		–
MC7812BDT/RK			DPAK	75 Units/Rail	2500 Units/Reel
MC7812ABD2T/R4			D2PAK	50 Units/Rail	800 Units/Reel
MC7812ABT			TO–220		–
MC7815ACD2T/R4	15 V	T_J = 0° to +125°C	D2PAK		800 Units/Reel
MC7815ACT			TO–220		–
MC7815CD2T/R4			D2PAK		800 Units/Reel
MC7815CT			TO–220		–
LM340T–15					
LM340AT–15					
MC7815CDT/RK			DPAK	75 Units/Rail	2500 Units/Reel
MC7815BD2T/R4		T_J = −40° to +125°C	D2PAK	50 Units/Rail	800 Units/Reel
MC7815BT			TO–220		–
MC7815BDT/RK			DPAK	75 Units/Rail	2500 Units/Reel
MC7815ABD2T/R4			D2PAK	50 Units/Rail	800 Units/Reel
MC7815ABT			TO–220		–
MC7818ACT	18 V	T_J = 0° to +125°C	TO–220		–
MC7818CD2T/R4			D2PAK		800 Units/Reel
MC7818CT			TO–220		–
MC7818BT		T_J = −40° to +125°C			–
MC7824ACT	24 V	T_J = 0° to +125°C			–
MC7824CD2T			D2PAK		–
MC7824CT			TO–220		
MC7824BD2T/R4		T_J = −40° to +125°C	D2PAK		800 Units/Reel
MC7824BT			TO–220		–

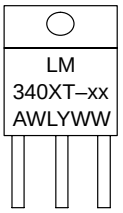
MARKING DIAGRAMS

TO−220
T SUFFIX
CASE 221A

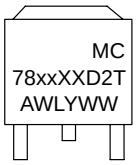
MC7800, MC7800A Series, NCV7805



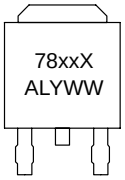
LM340, LM340A Series



D2PAK
D2T SUFFIX
CASE 936



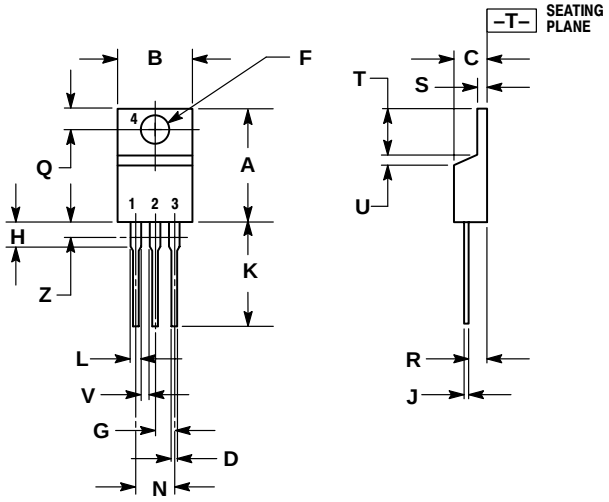
DPAK
DT SUFFIX
CASE 369A



xx = Voltage Option
XX = Appropriate Suffix Options
A = Assembly Location
WL, L = Wafer Lot
Y = Year
WW = Work Week

PACKAGE DIMENSIONS

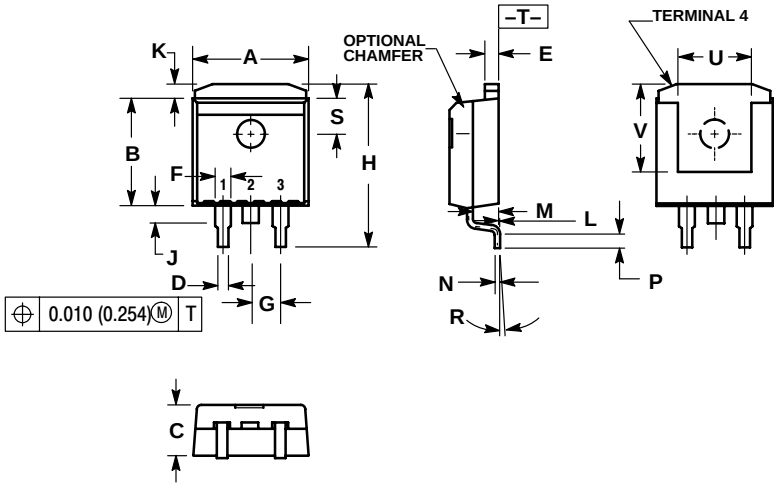
TO−220
T SUFFIX
CASE 221A−09
ISSUE AA



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION 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

D2PAK
D2T SUFFIX
CASE 936−03
ISSUE B

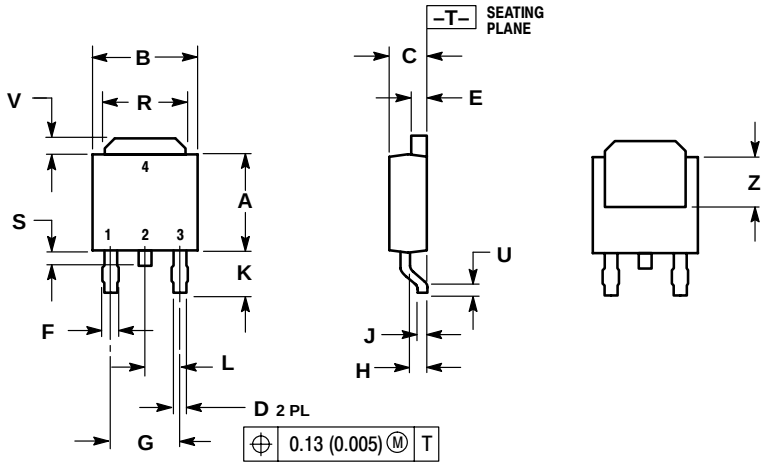


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. TAB CONTOUR OPTIONAL WITHIN DIMENSIONS A AND K.
4. DIMENSIONS U AND V ESTABLISH A MINIMUM MOUNTING SURFACE FOR TERMINAL 4.
5. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH OR GATE PROTRUSIONS. MOLD FLASH AND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

PACKAGE DIMENSIONS

DPAK
DT SUFFIX
CASE 369A–13
ISSUE AB



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.235	0.250	5.97	6.35
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.033	0.040	0.84	1.01
F	0.037	0.047	0.94	1.19
G	0.180 BSC		4.58 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.102	0.114	2.60	2.89
L	0.090 BSC		2.29 BSC	
R	0.175	0.215	4.45	5.46
S	0.020	0.050	0.51	1.27
U	0.020	---	0.51	---
V	0.030	0.050	0.77	1.27
Z	0.138	---	3.51	---

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