



FUKUCOM COMPANY LTD.

福 靈 有 限 公 司

FLAT P, 3/F., EVEREST INDUSTRIAL CENTRE, 396 KWUN TONG ROAD,
KWUN TONG, KOWLOON, HONG KONG.

TEL: 852-2790 0314 FAX: 852-2790 0206

MC7800, MC7800A, 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.

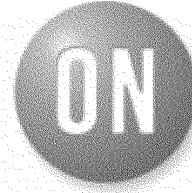
- Output Current in Excess of 1.0 A
- No External Components Required
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting
- Output Transistor Safe-Area Compensation
- Output Voltage Offered in 2% and 4% Tolerance
- Available in Surface Mount D²PAK-3, DPAK-3 and Standard 3-Lead Transistor Packages
- NCV Prefix for Automotive and Other Applications Requiring Site and Control Changes
- Pb-Free Packages are Available

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

Rating	Symbol	Value			Unit
		369C	221A	936	
Input Voltage (5.0 - 18 V) (24 V)	V _I	35 40			Vdc
Power Dissipation	P _D	Internally Limited			W
Thermal Resistance, Junction-to-Ambient	R _{θJA}	92	65	Figure 14	°C/W
Thermal Resistance, Junction-to-Case	R _{θJC}	5.0	5.0	5.0	°C/W
Storage Junction Temperature Range	T _{stg}	-65 to +150			°C
Operating Junction Temperature	T _J	+150			°C

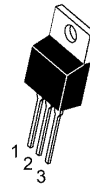
Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

NOTE: ESD data available upon request.



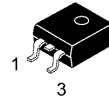
ON Semiconductor®

<http://onsemi.com>



TO-220-3
T SUFFIX
CASE 221A

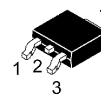
Heatsink surface
connected to Pin 2.



Pin 1. Input
2. Ground
3. Output

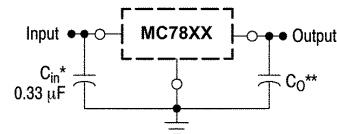
D²PAK-3
D2T SUFFIX
CASE 936

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



DPAK-3
DT SUFFIX
CASE 369C

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 21 of this data sheet.

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 25 of this data sheet.



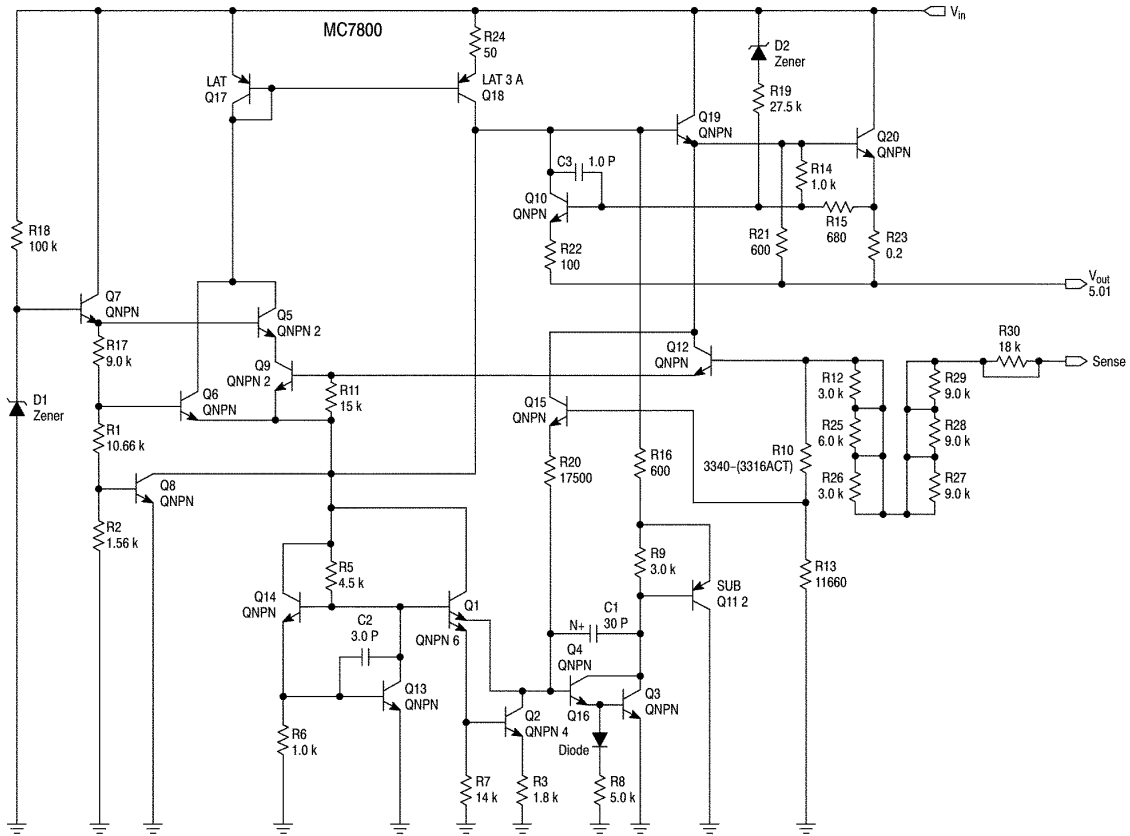
FUKUCOM COMPANY LTD.

福 靈 有 限 公 司

FLAT P, 3/F., EVEREST INDUSTRIAL CENTRE, 396 KWUN TONG ROAD,
KWUN TONG, KOWLOON, HONG KONG.

TEL: 852-2790 0314 FAX: 852-2790 0206

MC7800, MC7800A, NCV7805



This device contains 22 active transistors.

Figure 1. Representative Schematic Diagram



FUKUCOM COMPANY LTD.

福 靈 有 限 公 司

FLAT P, 3/F., EVEREST INDUSTRIAL CENTRE, 396 KWUN TONG ROAD,
KWUN TONG, KOWLOON, HONG KONG.

TEL: 852-2790 0314 FAX: 852-2790 0206

MC7800, MC7800A, NCV7805

ELECTRICAL CHARACTERISTICS ($V_{in} = 15\text{ V}$, $I_O = 500\text{ mA}$, $T_J = T_{low}$ to T_{high} (Note 13), unless otherwise noted)

Characteristic	Symbol	MC7809B			MC7809C			Unit
		Min	Typ	Max	Min	Typ	Max	
Output Voltage ($T_J = 25^\circ\text{C}$)	V_O	8.65	9.0	9.35	8.65	9.0	9.35	Vdc
Output Voltage ($5.0\text{ mA} \leq I_O \leq 1.0\text{ A}$, $P_D \leq 15\text{ W}$) $11.5\text{ Vdc} \leq V_{in} \leq 24\text{ Vdc}$	V_O	8.55	9.0	9.45	8.55	9.0	9.45	Vdc
Line Regulation, $T_J = 25^\circ\text{C}$ (Note 14) $11\text{ Vdc} \leq V_{in} \leq 26\text{ Vdc}$ $11.5\text{ Vdc} \leq V_{in} \leq 17\text{ Vdc}$	Reg_{line}	-	6.2	32	-	6.2	32	mV
Load Regulation, $T_J = 25^\circ\text{C}$ (Note 14) $5.0\text{ mA} \leq I_O \leq 1.5\text{ A}$	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 $11.5\text{ Vdc} \leq V_{in} \leq 26\text{ Vdc}$ $5.0\text{ mA} \leq I_O \leq 1.0\text{ A}$	ΔI_B	-	-	1.0	-	-	1.0	mA
Ripple Rejection $11.5\text{ Vdc} \leq V_{in} \leq 21.5\text{ Vdc}$, $f = 120\text{ Hz}$	RR	56	61	-	56	61	-	dB
Dropout Voltage ($I_O = 1.0\text{ A}$, $T_J = 25^\circ\text{C}$)	$V_I - V_O$	-	2.0	-	-	2.0	-	Vdc
Output Noise Voltage ($T_A = 25^\circ\text{C}$) $10\text{ Hz} \leq f \leq 100\text{ kHz}$	V_n	-	10	-	-	10	-	$\mu\text{V}/V_O$
Output Resistance $f = 1.0\text{ kHz}$	r_O	-	1.0	-	-	1.0	-	$\text{m}\Omega$
Short Circuit Current Limit ($T_A = 25^\circ\text{C}$) $V_{in} = 35\text{ Vdc}$	I_{SC}	-	0.2	-	-	0.2	-	A
Peak Output Current ($T_J = 25^\circ\text{C}$)	I_{max}	-	2.2	-	-	2.2	-	A
Average Temperature Coefficient of Output Voltage	TCV_O	-	-0.5	-	-	-0.5	-	$\text{mV}/^\circ\text{C}$

13. $T_{low} = 0^\circ\text{C}$ for MC78XXAC, C $T_{high} = +125^\circ\text{C}$ for MC78XXAC, C, NCV7805
= -40°C for MC78XXB, MC78XXAB, NCV7805

14. 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.



FUKUCOM COMPANY LTD.

福 靈 有 限 公 司

FLAT P, 3/F., EVEREST INDUSTRIAL CENTRE, 396 KWUN TONG ROAD,
KWUN TONG, KOWLOON, HONG KONG.

TEL: 852-2790 0314 FAX: 852-2790 0206

MC7800, MC7800A, NCV7805

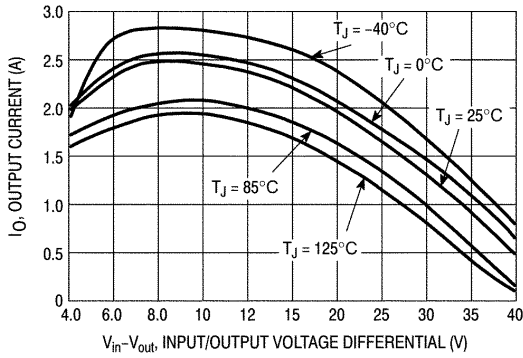


Figure 2. Peak Output Current as a Function of Input/Output Differential Voltage (MC78XXC, AC, B)

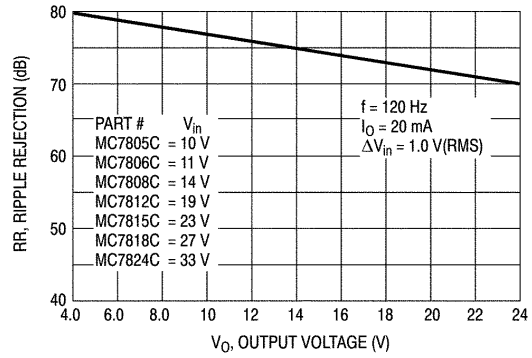


Figure 3. Ripple Rejection as a Function of Output Voltages (MC78XXC, AC, B)

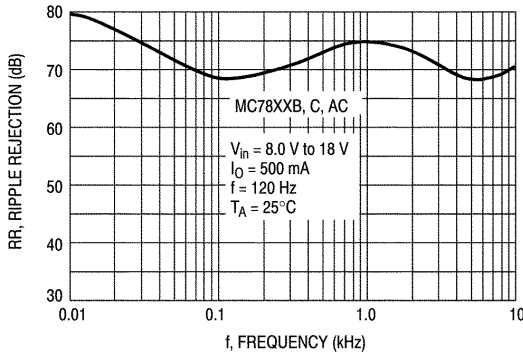


Figure 4. Ripple Rejection as a Function of Frequency (MC78XXC, AC, B)

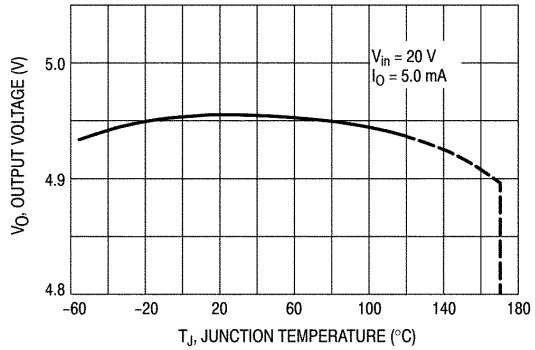


Figure 5. Output Voltage as a Function of Junction Temperature (MC7805C, AC, B)

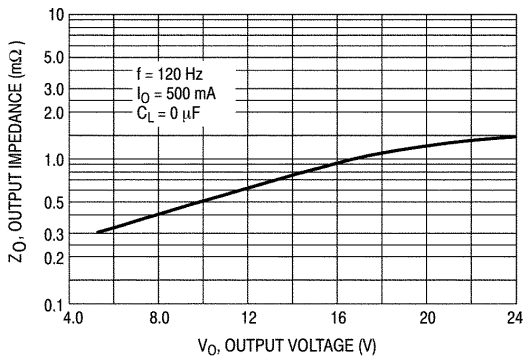


Figure 6. Output Impedance as a Function of Output Voltage (MC78XXC, AC, B)

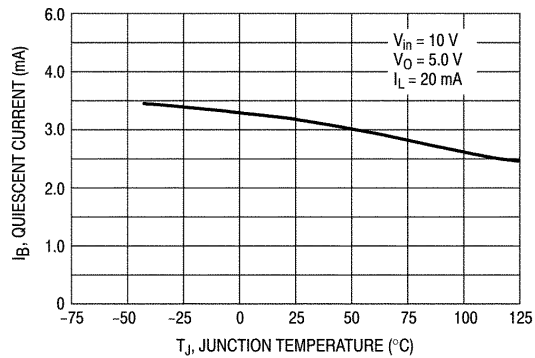


Figure 7. Quiescent Current as a Function of Temperature (MC78XXC, AC, B)



FUKUCOM COMPANY LTD.

福 靈 有 限 公 司

FLAT P, 3/F., EVEREST INDUSTRIAL CENTRE, 396 KWUN TONG ROAD,
KWUN TONG, KOWLOON, HONG KONG.

TEL: 852-2790 0314 FAX: 852-2790 0206

MC7800, MC7800A, NCV7805

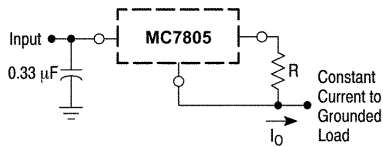
APPLICATIONS INFORMATION

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.



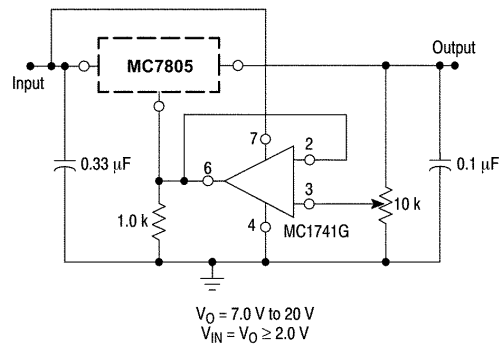
The MC7800 regulators can also be used as a current source when connected as above. In order to minimize dissipation the MC7805C is chosen in this application. Resistor R determines the current as follows:

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

$$I_B \approx 3.2 \text{ mA over line and load changes.}$$

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

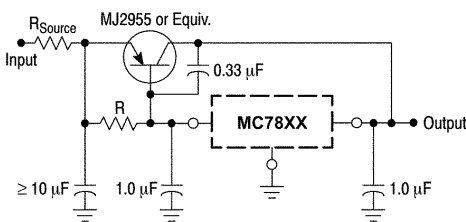


$$V_O = 7.0 \text{ V to } 20 \text{ V}$$

$$V_{IN} = V_O \geq 2.0 \text{ V}$$

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.

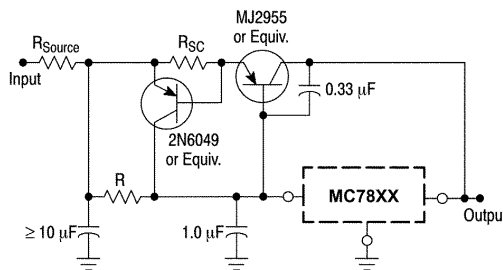
Figure 9. Adjustable Output Regulator



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



FUKUCOM COMPANY LTD.

福 靈 有 限 公 司

FLAT P, 3/F., EVEREST INDUSTRIAL CENTRE, 396 KWUN TONG ROAD,
KWUN TONG, KOWLOON, HONG KONG.

TEL: 852-2790 0314 FAX: 852-2790 0206

MC7800, MC7800A, NCV7805

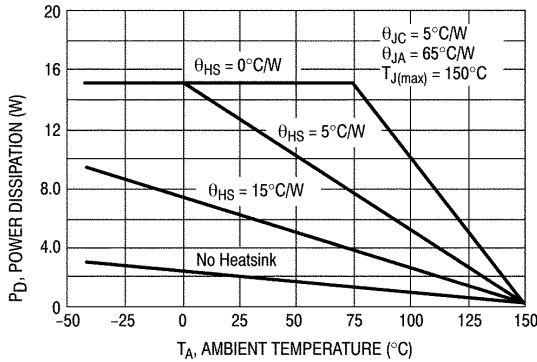


Figure 12. Worst Case Power Dissipation versus Ambient Temperature (Case 221A)

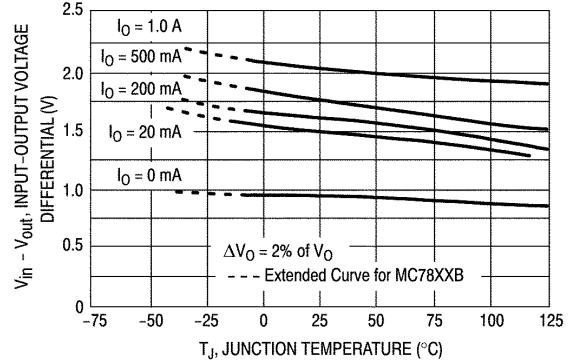


Figure 13. Input Output Differential as a Function of Junction Temperature (MC78XXC, AC, B)

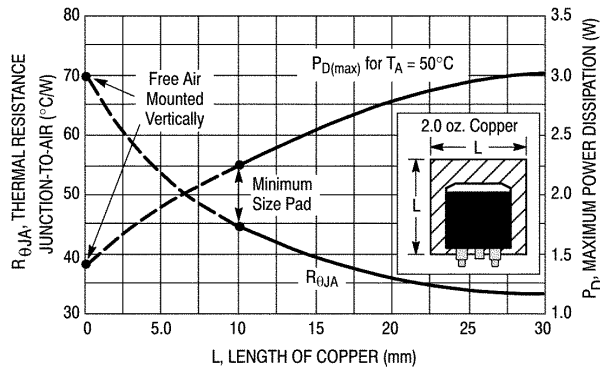


Figure 14. D²PAK Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length

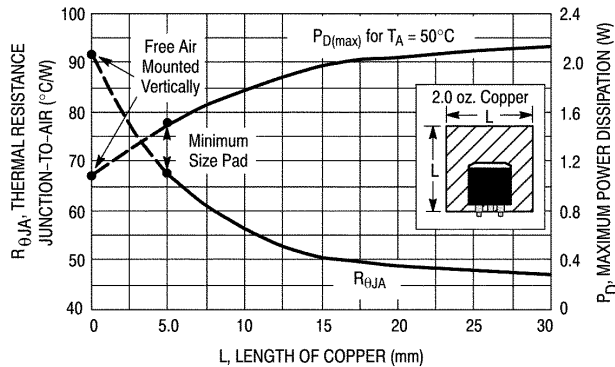


Figure 15. DPAK Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length



FUKUCOM COMPANY LTD.

福 靈 有 限 公 司

FLAT P, 3/F., EVEREST INDUSTRIAL CENTRE, 396 KWUN TONG ROAD,
KWUN TONG, KOWLOON, HONG KONG.

TEL: 852-2790 0314 FAX: 852-2790 0206

MC7800, MC7800A, NCV7805

ORDERING INFORMATION

Device	Output Voltage	Temperature Range	Package	Shipping†
MC7808CD2T	8.0 V	T = 0° to +125°C	D2PAK	50 Units / Rail
MC7808CD2TR4			D2PAK	800 / Tape & Reel
MC7808CD2TR4G			D2PAK (Pb-Free)	800 / Tape & Reel
MC7808CDT			DPAK	75 Units / Rail
MC7808CDTRK			DPAK	2500 / Tape & Reel
MC7808CDTT5			DPAK	2500 / Tape & Reel
MC7808CDTT5G			DPAK (Pb-Free)	2500 / Tape & Reel
MC7808CT			TO-220	50 Units / Rail
MC7808CTG			TO-220 (Pb-Free)	50 Units / Rail
MC7809ACT			9.0 V	T = 0° to +125°C
MC7809BT	T = -40° to +125°C	TO-220		50 Units / Rail
MC7809CD2T	T = 0° to +125°C	D2PAK		50 Units / Rail
MC7809CD2TR4		D2PAK		800 / Tape & Reel
MC7809CT		TO-220		50 Units / Rail
MC7809CTG		TO-220 (Pb-Free)		50 Units / Rail
MC7812ABD2T		12 V		T = -40° to +125°C
MC7812ABD2TR4	D2PAK		800 / Tape & Reel	
MC7812ABT	TO-220		50 Units / Rail	
MC7812ACD2T	T = 0° to +125°C		D2PAK	50 Units / Rail
MC7812ACD2TR4			D2PAK	800 / Tape & Reel
MC7812ACT			TO-220	50 Units / Rail
MC7812ACTG			TO-220 (Pb-Free)	50 Units / Rail
MC7812BD2T			T = -40° to +125°C	D2PAK
MC7812BD2TR4	D2PAK			800 / Tape & Reel
MC7812BD2TR4G	D2PAK (Pb-Free)			800 / Tape & Reel
MC7812BDT	DPAK			75 Units / Rail
MC7812BDTRK	DPAK			2500 / Tape & Reel
MC7812BT	TO-220			50 Units / Rail
MC7812BTG	TO-220 (Pb-Free)			50 Units / Rail
NCV7812BD2T*	D2PAK			50 Units / Rail
NCV7812BD2TR4*	D2PAK			800 / Tape & Reel
NCV7812BT*	TO-220			50 Units / Rail

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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



FUKUCOM COMPANY LTD.

福 靈 有 限 公 司

FLAT P, 3/F., EVEREST INDUSTRIAL CENTRE, 396 KWUN TONG ROAD,
KWUN TONG, KOWLOON, HONG KONG.

TEL: 852-2790 0314 FAX: 852-2790 0206

MC7800, MC7800A, NCV7805

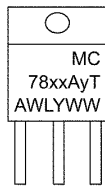
ORDERING INFORMATION

Device	Output Voltage	Temperature Range	Package	Shipping†
MC7818ACT	18 V	T = 0° to +125°C	TO-220	50 Units / Rail
MC7818BT		T = -40° to +125°C	TO-220	50 Units / Rail
MC7818CD2T		T = 0° to +125°C	D2PAK	50 Units / Rail
MC7818CD2TR4			D2PAK	800 / Tape & Reel
MC7818CT			TO-220	50 Units / Rail
MC7818CTG			TO-220 (Pb-Free)	50 Units / Rail
MC7824ACT	24 V	T = 0° to +125°C	TO-220	50 Units / Rail
MC7824ACTG			TO-220 (Pb-Free)	50 Units / Rail
MC7824BD2T		T = -40° to +125°C	D2PAK	50 Units / Rail
MC7824BD2TR4			D2PAK	800 / Tape & Reel
MC7824BT			TO-220	50 Units / Rail
MC7824BTG			TO-220 (Pb-Free)	50 Units / Rail
MC7824CD2T		T = 0° to +125°C	D2PAK	50 Units / Rail
MC7824CD2TR4			D2PAK	800 / Tape & Reel
MC7824CT			TO-220	50 Units / Rail
MC7824CTG			TO-220 (Pb-Free)	50 Units / Rail

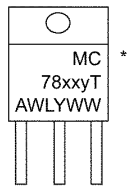
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

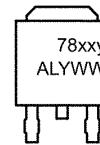
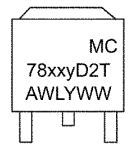
MARKING DIAGRAMS



TO-220-3
T SUFFIX
CASE 221A



D²PAK-3
D2T SUFFIX
CASE 936



DPAK-3
DT SUFFIX
CASE 369C

*This marking diagram also applies to NCV78xx family.

xx = 05, 06, 08, 09, 12, 15, 18, or 24
y = B or C
A = Assembly Location
WL, L = Wafer Lot
Y = Year
WW = Work Week



FUKUCOM COMPANY LTD.

福 靈 有 限 公 司

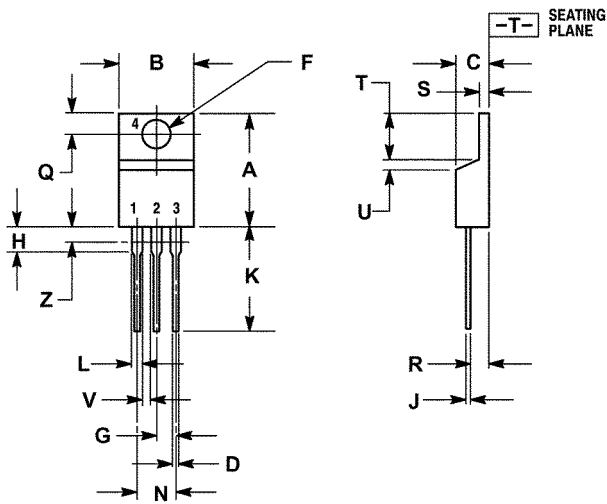
FLAT P, 3/F., EVEREST INDUSTRIAL CENTRE, 396 KWUN TONG ROAD,
KWUN TONG, KOWLOON, HONG KONG.

TEL: 852-2790 0314 FAX: 852-2790 0206

MC7800, MC7800A, NCV7805

PACKAGE DIMENSIONS

TO-220-3
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.

DIM	INCHES		MILLIMETERS	
	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



FUKUCOM COMPANY LTD.

福 靈 有 限 公 司

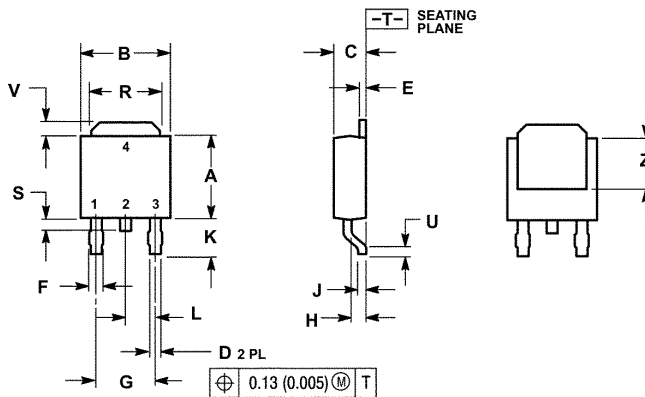
FLAT P, 3/F., EVEREST INDUSTRIAL CENTRE, 396 KWUN TONG ROAD,
KWUN TONG, KOWLOON, HONG KONG.

TEL: 852-2790 0314 FAX: 852-2790 0206

MC7800, MC7800A, NCV7805

PACKAGE DIMENSIONS

DKPAK-3
DT SUFFIX
CASE 369C-01
ISSUE O

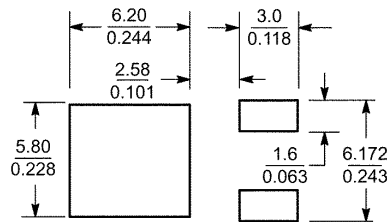


NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.22
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	0.018	0.023	0.46	0.58
F	0.037	0.045	0.94	1.14
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	0.180	0.215	4.57	5.45
S	0.025	0.040	0.63	1.01
U	0.020	---	0.51	---
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

SOLDERING FOOTPRINT*



SCALE 3:1 $\left(\frac{\text{mm}}{\text{inches}} \right)$

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ON Semiconductor and are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082-1312 USA
Phone: 480-829-7710 or 800-344-3860 Toll Free USA/Canada
Fax: 480-829-7709 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051
Phone: 81-3-5773-3850

ON Semiconductor Website: <http://onsemi.com>

Order Literature: <http://www.onsemi.com/litorder>

For additional information, please contact your local Sales Representative.

MC7800/D