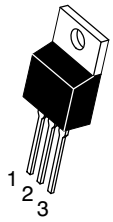
MC7800, MC7800A, MC7800AE, NCV7800

1.0 A Positive Voltage Regulators

ON Semiconductor®

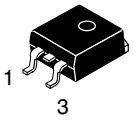
These voltage regulators are monolithic integrated circuits designed as fixed−voltage regulators for a wide variety of applications including local, on−card regulation. These regulators employ internal current limiting, thermal shutdown, and safe−area compensation. With adequate heatsinking they can 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 1.5%, 2% and 4% Tolerance
- Available in Surface Mount D^{2}PAK−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



TO−220−3
T SUFFIX
CASE 221AB

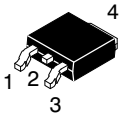
Heatsink surface connected to Pin 2.



Pin 1. Input
2. Ground
3. Output

D^{2}PAK−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

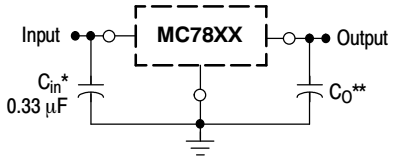
MAXIMUM RATINGS (T_A = 25°C, unless otherwise noted)

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	$R_{\theta JA}$	92	65	Figure 15	°C/W
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	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

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

*This device series contains ESD protection and exceeds the following tests:
Human Body Model 2000 V per MIL_STD_883, Method 3015.
Machine Model Method 200 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

See detailed ordering and shipping information in the package dimensions section on page 23 of this data sheet.

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 30 of this data sheet.

Publication Order Number:
MC7800/D

ELECTRICAL CHARACTERISTICS (V_{in} = 33 V, I_O = 500 mA, T_J = T_{low} to 125°C (Note 28), 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)	V_O							Vdc
27 Vdc ≤ V_{in} ≤ 38 Vdc		–	–	–	22.8	24	25.2	
28 Vdc ≤ V_{in} ≤ 38 Vdc		22.8	24	25.2	–	–	–	
Line Regulation, (Note 29)	Reg_{line}							mV
27 Vdc ≤ V_{in} ≤ 38 Vdc		–	11.5	480	–	2.7	60	
30 Vdc ≤ V_{in} ≤ 36 Vdc		–	3.8	240	–	2.7	48	
Load Regulation, (Note 29)	Reg_{load}	–	2.1	480	–	4.4	65	mV
5.0 mA ≤ I_O ≤ 1.5 A								
Quiescent Current	I_B	–	3.6	8.0	–	3.6	6.5	mA
Quiescent Current Change	ΔI_B							mA
27 Vdc ≤ V_{in} ≤ 38 Vdc		–	–	–	–	–	1.0	
5.0 mA ≤ I_O ≤ 1.0 A		–	–	0.5	–	–	0.5	
Ripple Rejection	RR	–	54	–	50	54	–	dB
28 Vdc ≤ V_{in} ≤ 38 Vdc, f = 120 Hz								
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)	V_n	–	10	–	–	10	–	$\mu V/V_O$
10 Hz ≤ f ≤ 100 kHz								
Output Resistance f = 1.0 kHz	r_O	–	1.4	–	–	1.4	–	mΩ
Short Circuit Current Limit (T_A = 25°C)	I_{SC}	–	0.2	–	–	0.2	–	A
V_{in} = 35 Vdc								
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

28. T_{low} = 0°C for MC78XXC, MC78XXAC,
= −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
29. 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} = 33 V, I_O = 1.0 A, T_J = T_{low} to 125°C (Note 30), 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)	V_O	23.2	24	25.8	Vdc
27.3 Vdc ≤ V_{in} ≤ 38 Vdc					
Line Regulation (Note 31)	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 31)	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	RR	45	54	–	dB
28 Vdc ≤ V_{in} ≤ 38 Vdc, f = 120 Hz, I_O = 500 mA					
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)	V_n	–	10	–	$\mu V/V_O$
10 Hz ≤ f ≤ 100 kHz					
Output Resistance (f = 1.0 kHz)	r_O	–	1.4	–	mΩ
Short Circuit Current Limit (T_A = 25°C)	I_{SC}	–	0.2	–	A
V_{in} = 35 Vdc					
Peak Output Current (T_J = 25°C)	I_{max}	–	2.2	–	A
Average Temperature Coefficient of Output Voltage	TCV_O	–	−2.0	–	mV/°C

30. T_{low} = 0°C for MC78XXC, MC78XXAC,
= −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB

31. 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.

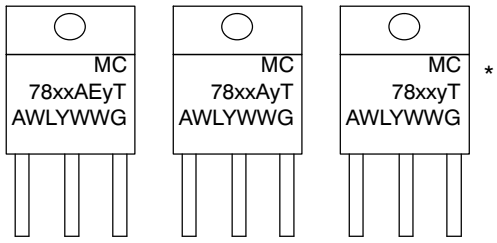
ORDERING INFORMATION

Device	Nominal Voltage	Operating Temperature Range	Package	Shipping†
MC7824ACT	24 V	T_J = 0°C to +125°C	TO−220	50 Units /Rail
MC7824ACTG			TO−220 (Pb−free)	50 Units /Rail
MC7824BD2T		T_J = −40°C to +125°C	D^2PAK	50 Units /Rail
MC7824BD2TG			D^2PAK (Pb−free)	50 Units /Rail
MC7824BD2TR4			D^2PAK	800 / Tape & Reel
MC7824BD2TR4G			D^2PAK (Pb−free)	800 / Tape & Reel
MC7824BT			TO−220	50 Units /Rail
MC7824BTG			TO−220 (Pb−free)	50 Units /Rail
MC7824CD2T		T_J = 0°C to +125°C	D^2PAK	50 Units /Rail
MC7824CD2TG			D^2PAK (Pb−free)	50 Units /Rail
MC7824CD2TR4			D^2PAK	800 / Tape & Reel
MC7824CD2TR4G			D^2PAK (Pb−free)	800 / Tape & Reel
MC7824CT			TO−220	50 Units /Rail
MC7824CTG			TO−220 (Pb−free)	50 Units /Rail

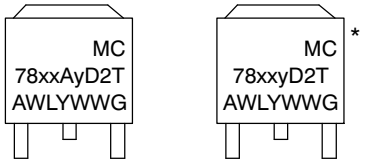
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*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.

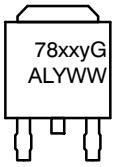
MARKING DIAGRAMS



TO−220−3
T SUFFIX
CASE 221A



D^2PAK−3
D2T SUFFIX
CASE 936



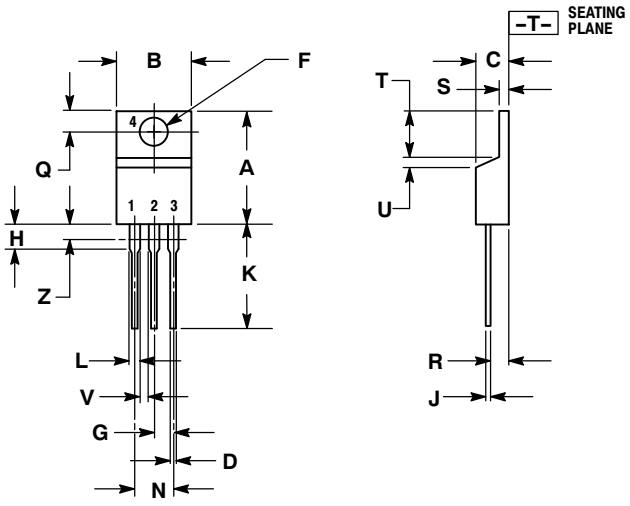
DPAK−3
DT SUFFIX
CASE 369C

*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
G = Pb−Free Device

PACKAGE DIMENSIONS

TO−220, SINGLE GAUGE
T SUFFIX
CASE 221AB−01
ISSUE O



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	0.020	0.055	0.508	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