MC78M00, MC78M00A, NCV78M00 Series

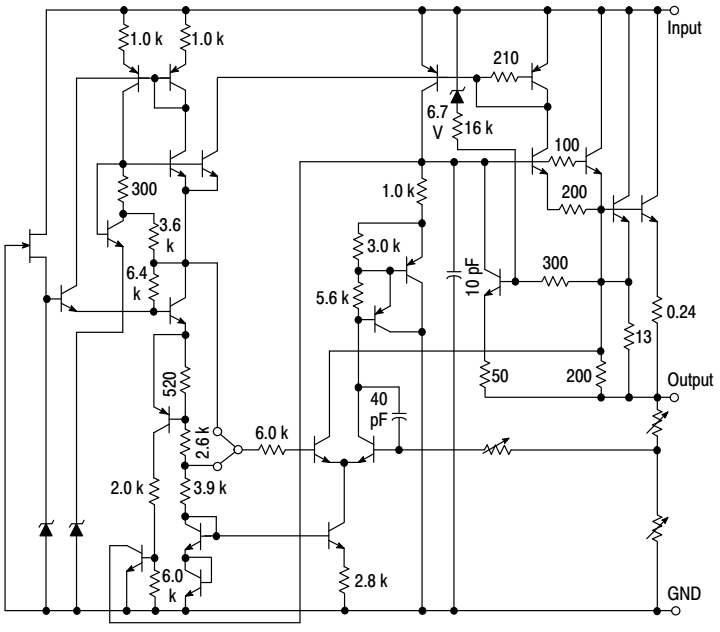
500 mA Positive Voltage Regulators

The MC78M00/MC78M00A Series positive voltage regulators are identical to the popular MC7800 Series devices, except that they are specified for only half the output current. Like the MC7800 devices, the MC78M00 three−terminal regulators are intended for local, on−card voltage regulation.

Internal current limiting, thermal shutdown circuitry and safe−area compensation for the internal pass transistor combine to make these devices remarkably rugged under most operating conditions. Maximum output current, with adequate heatsinking is 500 mA.

Features

- No External Components Required
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting
- Output Transistor Safe−Area Compensation
- MC78M00A High Accuracy (±2%)
  Available for 5.0 V, 8.0 V, 12 V and 15 V
- Pb−Free Packages are Available*
- NCV Prefix for Automotive and Other Applications Requiring Site and Control Changes



This device contains 28 active transistors.

Figure 1. Representative Schematic Diagram

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

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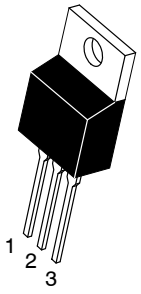
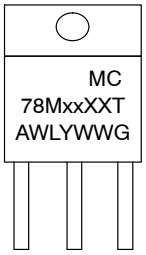
MARKING DIAGRAMS

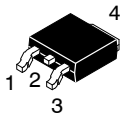


TO−220
T SUFFIX
CASE 221AB

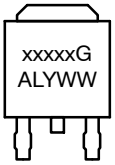
Heatsink surface connected to Pin 2.



xx = Voltage Option
XX = Appropriate Suffix Options
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week
G = Pb−Free Package



DPAK−3
DT SUFFIX
CASE 369C



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

xxxxx = Device Type and Voltage Option Code
A = Assembly Location
L = Wafer Lot
Y = Year
WW = Work Week
G = Pb−Free Package

Pin 1. Input
2. Ground
3. Output

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 10−14 of this data sheet.

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 10 of this data sheet.

Publication Order Number:
MC78M00/D

MAXIMUM RATINGS (T_A = 25°C, unless otherwise noted) (Note 1)

Rating	Symbol	Value	Unit
Input Voltage (5.0 V–18 V)	V_I	35	Vdc
(20 V–24V)		40	
Power Dissipation (Package Limitation)			
Plastic Package, T Suffix			
T_A = 25°C	P_D	Internally Limited	
Thermal Resistance, Junction–to–Air	θ_{JA}	70	°C/W
Thermal Resistance, Junction–to–Case	θ_{JC}	5.0	°C/W
Plastic Package, DT Suffix			
T_A = 25°C	P_D	Internally Limited	
Thermal Resistance, Junction–to–Air	θ_{JA}	92	°C/W
Thermal Resistance, Junction–to–Case	θ_{JC}	5.0	°C/W
Operating Junction Temperature Range	T_J	+150	°C
Storage Temperature Range	T_{stg}	–65 to +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.

1. 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.

MC78M05C/AC/B/AB, NCV78M05AB/B ELECTRICAL CHARACTERISTICS (V_I = 10 V, I_O = 350 mA, T_J = T_{low} to T_{high}, $P_D \leq$ 5 W, unless otherwise noted) (Note 2)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = 25°C)	V_O				Vdc
MC78M05B/MC78M05C/NCV78M05B		4.8	5.0	5.2	
MC78M05AB/MC78M05AC/NCV78M05AB		4.9	5.0	5.1	
Output Voltage Variation	V_O				Vdc
(7.0 Vdc ≤ V_I ≤ 20 Vdc, 5.0 mA ≤ I_O ≤ 350 mA)					
MC78M05B/MC78M05C/NCV78M05B		4.75	–	5.25	
MC78M05AB/MC78M05AC/NCV78M05AB		4.80	–	5.20	
Line Regulation	Reg_{line}	–	3.0	50	mV
(T_J = 25°C, 7.0 Vdc ≤ V_I ≤ 25 Vdc, I_O = 200 mA)					
Load Regulation	Reg_{load}				mV
(T_J = 25°C, 5.0 mA ≤ I_O ≤ 500 mA)		–	20	100	
(T_J = 25°C, 5.0 mA ≤ I_O ≤ 200 mA)		–	10	50	
Input Bias Current (T_J = 25°C)	I_{IB}	–	3.2	6.0	mA
Quiescent Current Change	ΔI_{IB}				mA
(8.0 Vdc ≤ V_I ≤ 25 Vdc, I_O = 200 mA)		–	–	0.8	
(5.0 mA ≤ I_O ≤ 350 mA)		–	–	0.5	
Output Noise Voltage (T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	40	–	μV
Ripple Rejection	RR				dB
(I_O = 100 mA, f = 120 Hz, 8.0 V ≤ V_I ≤ 18 V)		62	–	–	
(I_O = 300 mA, f = 120 Hz, 8.0 ≤ V_I ≤ 18 V, T_J = 25°C)		62	80	–	
Dropout Voltage	V_I–V_O	–	2.0	–	Vdc
(T_J = 25°C)					
Short Circuit Current Limit (T_J = 25°C, V_I = 35 V)	I_{OS}	–	350	–	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	–	±0.2	–	mV/°C
(I_O = 5.0 mA)					
Peak Output Current	I_O	–	700	–	mA
(T_J = 25°C)					

2. T_{low} = 0°C for MC78MxxAC, C T_{high} = +125°C for MC78MxxAB, AC, B, C, NCV78MxxAB, B
   = –40°C for MC78MxxAB, B, NCV78MxxAB, B

MC78M09C/B ELECTRICAL CHARACTERISTICS (V_I = 15 V, I_O = 350 mA, T_J = T_{low} to T_{high}, $P_D \le$ 5.0 W, unless otherwise noted) (Note 4)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = 25°C)	V_O	8.64	9.0	9.45	Vdc
Output Voltage Variation (11.5 Vdc ≤ V_I ≤ 23 Vdc, 5.0 mA ≤ I_O ≤ 350 mA)	V_O	8.55	–	9.45	Vdc
Line Regulation (T_J = 25°C, 11.5 Vdc ≤ V_I ≤ 25 Vdc, I_O = 200 mA)	Reg_{line}	–	6.0	50	mV
Load Regulation (T_J = 25°C, 5.0 mA ≤ I_O ≤ 500 mA) (T_J = 25°C, 5.0 mA ≤ I_O ≤ 200 mA)	Reg_{load}	 – –	 25 10	 180 90	mV
Input Bias Current (T_J = 25°C)	I_{IB}	–	3.2	6.0	mA
Quiescent Current Change (11.5 Vdc ≤ V_I ≤ 25 Vdc, I_O = 200 mA) (5.0 mA ≤ I_O ≤ 350 mA)	ΔI_{IB}	 – –	 – –	 0.8 0.5	mA
Output Noise Voltage (T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	52	–	μV
Ripple Rejection (I_O = 100 mA, f = 120 Hz, 12.5 V ≤V_I ≤ 22.5 V) (I_O = 300 mA, f = 120 Hz, 12.5 V ≤V_I ≤ 22.5 V, T_J = 25°C)	RR	 56 56	 – 80	 – –	dB
Dropout Voltage (T_J = 25°C)	V_I–V_O	–	2.0	–	Vdc
Short Circuit Current Limit (T_J = 25°C, V_I = 35 V)	I_{OS}	–	350	–	mA
Average Temperature Coefficient of Output Voltage (I_O = 5.0 mA)	$\Delta V_O/\Delta T$	–	±0.2	–	mV/°C
Peak Output Current (T_J = 25°C)	I_O	–	700	–	mA

MC78M12C/AC/B/AB, NCV78M12B ELECTRICAL CHARACTERISTICS (V_I = 19 V, I_O = 350 mA, T_J = T_{low} to T_{high}, $P_D \le$ 5 W, unless otherwise noted) (Note 4)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = 25°C) MC78M12B/MC78M12C/NCV78M12B MC78M12AB/MC78M12AC	V_O	 11.50 11.76	 12 12	 12.50 12.24	Vdc
Output Voltage Variation (14.5 Vdc ≤ V_I ≤ 27 Vdc, 5.0 mA ≤ I_O ≤ 350 mA) MC78M12B/MC78M12C/NCV78M12B MC78M12AB/MC78M12AC	V_O	 11.4 11.5	 – –	 12.6 12.5	Vdc
Line Regulation (T_J = 25°C, 14.5 Vdc ≤ V_I ≤ 30 Vdc, I_O = 200 mA)	Reg_{line}	–	8.0	50	mV
Load Regulation (T_J = 25°C, 5.0 mA ≤ I_O ≤ 500 mA) (T_J = 25°C, 5.0 mA ≤ I_O ≤ 200 mA)	Reg_{load}	 – –	 25 10	 240 120	mV
Input Bias Current (T_J = 25°C)	I_{IB}	–	3.2	6.0	mA
Quiescent Current Change (14.5 Vdc ≤ V_I ≤ 30 Vdc, I_O = 200 mA) (5.0 mA ≤ I_O ≤ 350 mA)	ΔI_{IB}	 – –	 – –	 0.8 0.5	mA
Output Noise Voltage (T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz)	V_n	–	75	–	μV
Ripple Rejection (I_O = 100 mA, f = 120 Hz, 15 V ≤V_I ≤ 25 V) (I_O = 300 mA, f = 120 Hz, 15 V ≤V_I ≤ 25 V, T_J = 25°C)	RR	 55 55	 – 80	 – –	dB
Dropout Voltage (T_J = 25°C)	V_I–V_O	–	2.0	–	Vdc
Short Circuit Current Limit (T_J = 25°C, V_I = 35 V)	I_{OS}	–	350	–	mA
Average Temperature Coefficient of Output Voltage (I_O = 5.0 mA)	$\Delta V_O/\Delta T$	–	±0.3	–	mV/°C
Peak Output Current (T_J = 25°C)	I_O	–	700	–	mA

4. T_{low} = 0°C for MC78MxxAC, C T_{high} = +125°C for MC78MxxAB, AC, B, C, NCV78MxxAB, B
   = −40°C for MC78MxxAB, B, NCV78MxxAB, B

ORDERING INFORMATION

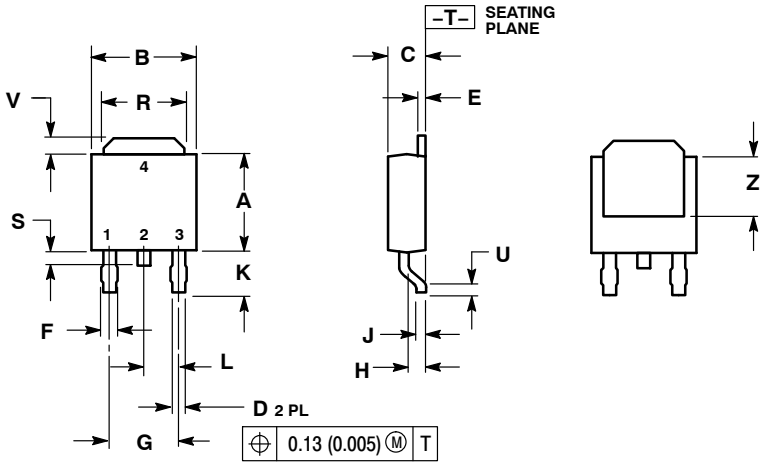
Device	Output Voltage	Temperature Range	Package	Marking	Shipping†
MC78M12CDT	12 V	T_J = 0° to +125°C	DPAK−3	78M12	75 Units / Rail
MC78M12CDTG			DPAK−3 (Pb−Free)	78M12	
MC78M12CDTT5G			DPAK−3 (Pb−Free)	78M12	2500 Units / Tape & Reel
MC78M12CDTRK			DPAK−3	78M12	
MC78M12CDTRKG			DPAK−3 (Pb−Free)	78M12	
MC78M12ACDT			DPAK−3	8M12D	75 Units / Rail
MC78M12ACDTG			DPAK−3 (Pb−Free)	8M12D	
MC78M12ACDTRK			DPAK−3	8M12D	2500 Units / Tape & Reel
MC78M12ACDTRKG			DPAK−3 (Pb−Free)	8M12D	
MC78M12CT			TO−220	78M12CT	50 Units / Rail
MC78M12CTG			TO−220	78M12CT	
MC78M12ACT			TO−220	78M12ACT	
MC78M12ACTG			TO−220 (Pb−Free)	78M12ACT	
MC78M12ABDT		T_J = −40° to +125°C	DPAK−3	8M12A	75 Units / Rail
MC78M12ABDTG			DPAK−3 (Pb−Free)	8M12A	
MC78M12ABDTRK			DPAK−3	8M12A	2500 Units / Tape & Reel
MC78M12ABDTRKG			DPAK−3 (Pb−Free)	8M12A	
MC78M12ABT			TO−220	78M12ABT	50 Units / Rail
MC78M12ABTG			TO−220 (Pb−Free)	78M12ABT	
MC78M12BDT			DPAK−3	8M12B	75 Units / Rail
MC78M12BDTG			DPAK−3 (Pb−Free)	8M12B	
MC78M12BDTRK			DPAK−3	8M12B	2500 Units / Tape & Reel
MC78M12BDTRKG			DPAK−3 (Pb−Free)	8M12B	
NCV78M12BDTRK*			DPAK−3	8M12B	2500 Units / Tape & Reel
NCV78M12BDTRKG*			DPAK−3 (Pb−Free)	8M12B	
MC78M12BT			TO−220	78M12BT	50 Units / Rail
MC78M12BTG			TO−220 (Pb−Free)	78M12BT	

†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 control change.

PACKAGE DIMENSIONS

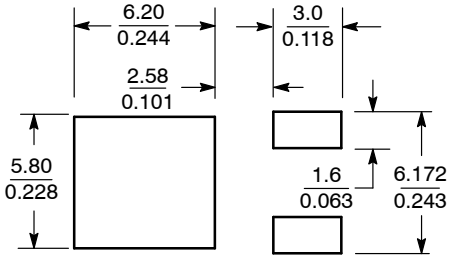
DPAK−3
DT SUFFIX
CASE 369C−01
ISSUE O



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

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.235	0.245	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	−−−

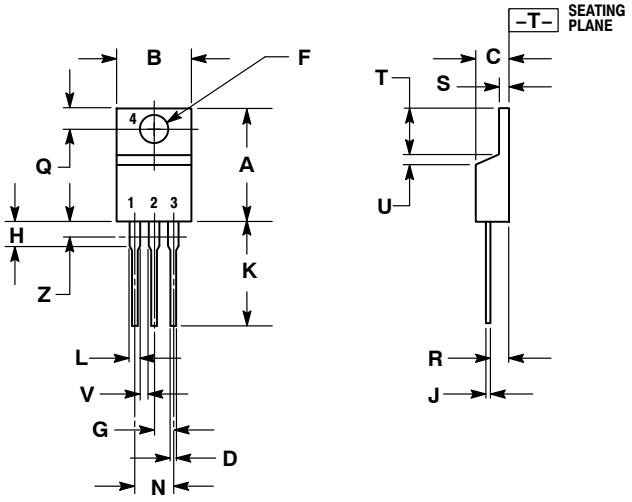
SOLDERING FOOTPRINT*



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

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