MC78M00, MC78M00A Series

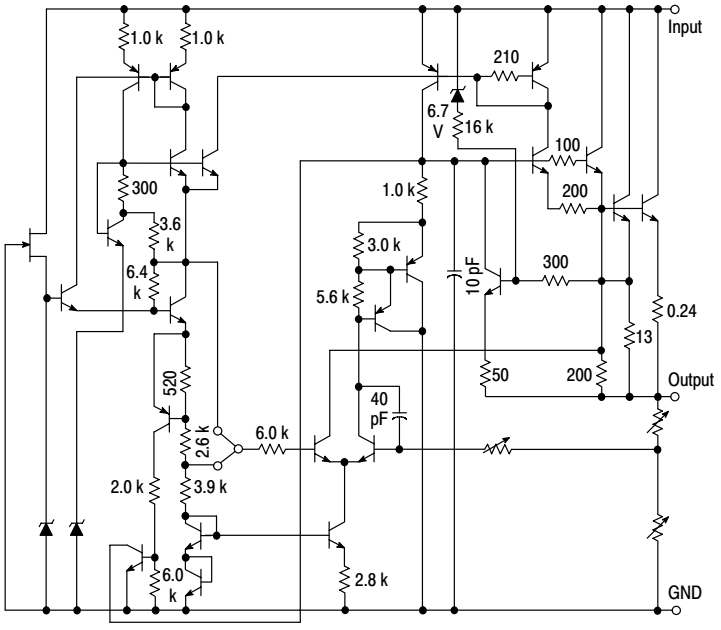
500 mA Positive Voltage Regulators

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*



This device contains 28 active transistors.

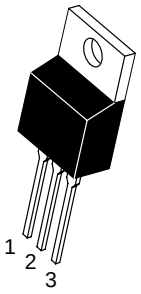
Figure 1. Representative Schematic Diagram

*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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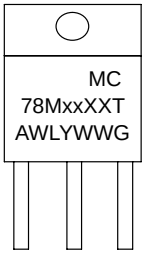
http://onsemi.com

MARKING DIAGRAMS

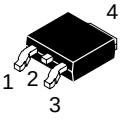


TO−220
T SUFFIX
CASE 221A

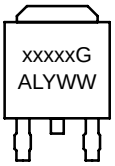
Heatsink surface connected to Pin 2.



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.

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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

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.

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 ELECTRICAL CHARACTERISTICS (V_I = 10 V, I_O = 350 mA, T_J = T_{low} to T_{high}, $P_D \le$ 5.0 W, unless otherwise noted) (Note 2)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = 25°C)	V_O				Vdc
MC78M05C		4.8	5.0	5.2	
MC78M05AC		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)					
MC78M05C		4.75	−	5.25	
MC78M05AC		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}	−	50	−	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
   = −40°C for MC78MxxAB, B

MC78M06C ELECTRICAL CHARACTERISTICS (V_I = 11 V, I_O = 350 mA, 0°C < T_J < 125°C, $P_D \le$ 5.0 W, unless otherwise noted)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = 25°C)	V_O	5.75	6.0	6.25	Vdc
Output Voltage Variation (8.0 Vdc ≤ V_I ≤ 21 Vdc, 5.0 mA ≤ I_O ≤ 350 mA)	V_O	5.7	−	6.3	Vdc
Line Regulation (T_J = 25°C, 8.0 Vdc ≤ V_I ≤ 25 Vdc, I_O = 200 mA)	Reg_{line}	−	5.0	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}	 − −	 20 10	 120 60	mV
Input Bias Current (T_J = 25°C)	I_{IB}	−	3.2	6.0	mA
Quiescent Current Change (9.0 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	−	45	−	μV
Ripple Rejection (I_O = 100 mA, f = 120 Hz, 9.0 V ≤ V_I ≤ 19 V) (I_O = 300 mA, f = 120 Hz, 9.0 V ≤ V_I ≤ 19 V, T_J = 25°C)	RR	 59 59	 − 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}	−	50	−	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

MC78M08C/AC/B/AB ELECTRICAL CHARACTERISTICS (V_I = 14 V, I_O = 350 mA, $T_J = T_{low}$ to T_{high}, $P_D \le$ 5.0 W, unless otherwise noted) (Note 3)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = 25°C) MC78M08C MC78M08AC	V_O	 7.70 7.84	 8.0 8.0	 8.30 8.16	Vdc
Output Voltage Variation (10.5 Vdc ≤ V_I ≤ 23 Vdc, 5.0 mA ≤ I_O ≤ 350 mA) MC78M08C MC78M08AC	V_O	 7.6 7.7	 − −	 8.4 8.3	Vdc
Line Regulation (T_J = 25°C, 10.5 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	 160 80	mV
Input Bias Current (T_J = 25°C)	I_{IB}	−	3.2	6.0	mA
Quiescent Current Change (10.5 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, 11.5 V ≤V_I ≤ 21.5 V) (I_O = 300 mA, f = 120 Hz, 11.5 V ≤V_I ≤ 21.5 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}	−	50	−	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

3. T_{low} = 0°C for MC78MxxAC, C T_{high} = +125°C for MC78MxxAB, AC, B, C
   = −40°C for MC78MxxAB, 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}	−	50	−	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 ELECTRICAL CHARACTERISTICS (V_I = 19 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) MC78M12C 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) MC78M12C 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}	−	50	−	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
= −40°C for MC78MxxAB, B
T_{high} = +125°C for MC78MxxAB, AC, B, C

MC78M15C/AC/B/AB ELECTRICAL CHARACTERISTICS (V_I = 23 V, I_O = 350 mA, T_J = T_{low} to T_{high}, $P_D \le$ 5.0 W, unless otherwise noted) (Note 5)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = 25°C) MC78M15C MC78M15AC	V_O	 14.4 14.7	 15 15	 15.6 15.3	Vdc
Output Voltage Variation (17.5 Vdc ≤ V_I ≤ 30 Vdc, 5.0 mA ≤ I_O ≤ 350 mA) MC78M15C MC78M15AC	V_O	 14.25 14.40	 – –	 15.75 15.60	Vdc
Input Regulation (T_J = 25°C, 17.5 Vdc ≤ V_I ≤ 30 Vdc, I_O = 200 mA)	Reg_{line}	–	10	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	 300 150	mV
Input Bias Current (T_J = 25°C)	I_{IB}	–	3.2	6.0	mA
Quiescent Current Change (17.5 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	–	90	–	μV
Ripple Rejection (I_O = 100 mA, f = 120 Hz, 18.5 V ≤ V_I ≤ 28.5 V) (I_O = 300 mA, f = 120 Hz, 18.5 V ≤ V_I ≤ 28.5 V, T_J = 25°C)	RR	 54 54	 – 70	 – –	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}	–	50	–	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

MC78M18C/B ELECTRICAL CHARACTERISTICS (V_I = 27 V, I_O = 350 mA, T_J = T_{low} to T_{high}, $P_D \le$ 5.0 W, unless otherwise noted) (Note 5)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = 25°C)	V_O	17.3	18	18.7	Vdc
Output Voltage Variation (21 Vdc ≤ V_I ≤ 33 Vdc, 5.0 mA ≤ I_O ≤ 350 mA)	V_O	17.1	–	18.9	Vdc
Line Regulation (T_J = 25°C, 21 Vdc ≤ V_I ≤ 33 Vdc, I_O = 200 mA)	Reg_{line}	–	10	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}	 – –	 30 10	 360 180	mV
Input Bias Current (T_J = 25°C)	I_{IB}	–	3.2	6.5	mA
Quiescent Current Change (21 Vdc ≤ V_I ≤ 33 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	–	100	–	μV
Ripple Rejection (I_O = 100 mA, f = 120 Hz, 22 V ≤ V_I ≤ 32 V) (I_O = 300 mA, f = 120 Hz, 22 V ≤ V_I ≤ 32 V, T_J = 25°C)	RR	 53 53	 – 70	 – –	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}	–	50	–	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

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

MC78M20C/B ELECTRICAL CHARACTERISTICS (V_I = 29 V, I_O = 350 mA, T_J = T_{low} to T_{high}, $P_D \le$ 5.0 W, unless otherwise noted) (Note 6)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = 25°C)	V_O	19.2	20	20.8	Vdc
Output Voltage Variation (23 Vdc ≤ V_I ≤ 35 Vdc, 5.0 mA ≤ I_O ≤ 350 mA)	V_O	19	−	21	Vdc
Line Regulation (T_J = 25°C, 23 Vdc ≤ V_I ≤ 35 Vdc, I_O = 200 mA)	Reg_{line}	−	10	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}	 − −	 30 10	 400 200	mV
Input Bias Current (T_J = 25°C)	I_{IB}	−	3.2	6.5	mA
Quiescent Current Change (23 Vdc ≤ V_I ≤ 35 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	−	110	−	μV
Ripple Rejection (I_O = 100 mA, f = 120 Hz, 24 V ≤ V_I ≤ 34 V) (I_O = 300 mA, f = 120 Hz, 24 V ≤ V_I ≤ 34 V, T_J = 25°C)	RR	 52 52	 − 70	 − −	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}	−	50	−	mA
Average Temperature Coefficient of Output Voltage (I_O = 5.0 mA)	$\Delta V_O/\Delta T$	−	±0.5	−	mV/°C
Peak Output Current (T_J = 25°C)	I_O	−	700	−	mA

MC78M24C/B ELECTRICAL CHARACTERISTICS (V_I = 33 V, I_O = 350 mA, T_J = T_{low} to T_{high}, $P_D \le$ 5.0 W, unless otherwise noted) (Note 6)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = 25°C)	V_O	23	24	25	Vdc
Output Voltage Variation (27 Vdc ≤ V_I ≤ 38 Vdc, 5.0 mA ≤ I_O ≤ 350 mA)	V_O	22.8	−	25.2	Vdc
Line Regulation (T_J = 25°C, 27 Vdc ≤ V_I ≤ 38 Vdc, I_O = 200 mA)	Reg_{line}	−	10	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}	 − −	 30 10	 480 240	mV
Input Bias Current (T_J = 25°C)	I_{IB}	−	3.2	7.0	mA
Quiescent Current Change (27 Vdc ≤ V_I ≤ 38 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	−	170	−	μV
Ripple Rejection (I_O = 100 mA, f = 120 Hz, 28 V ≤ V_I ≤ 38 V) (I_O = 300 mA, f = 120 Hz, 28 V ≤ V_I ≤ 38 V, T_J = 25°C)	RR	 50 50	 − 70	 − −	dB
Dropout Voltage (T_J = 25°C)	$V_I - V_O$	−	2.0	−	Vdc
Short Circuit Current Limit (T_J = 25°C)	I_{OS}	−	50	−	mA
Average Temperature Coefficient of Output Voltage (I_O = 5.0 mA)	$\Delta V_O/\Delta T$	−	±0.5	−	mV/°C
Peak Output Current (T_J = 25°C)	I_O	−	700	−	mA

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

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.

Input Bias 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.

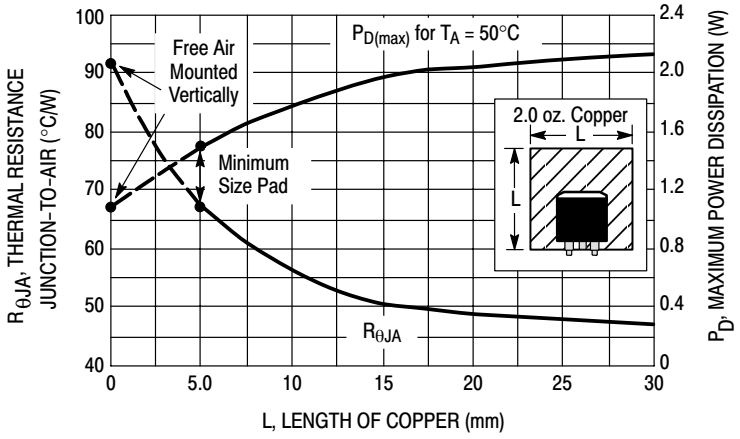


Figure 2. DPAK Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length

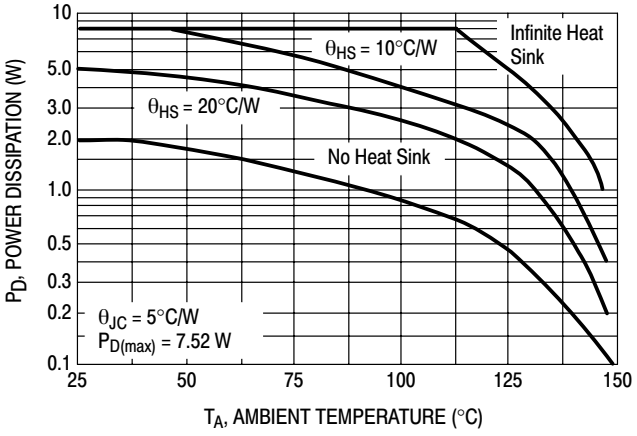


Figure 3. Worst Case Power Dissipation versus Ambient Temperature (TO−220)

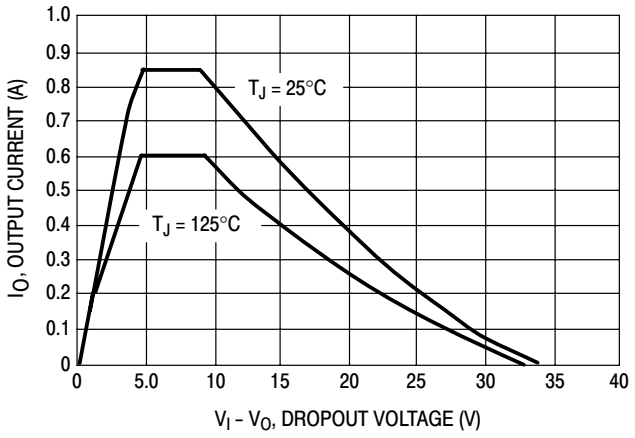


Figure 4. Peak Output Current versus Dropout Voltage

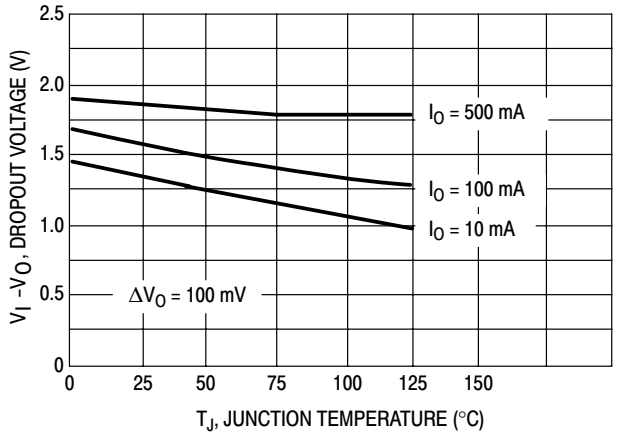


Figure 5. Dropout Voltage versus Junction Temperature

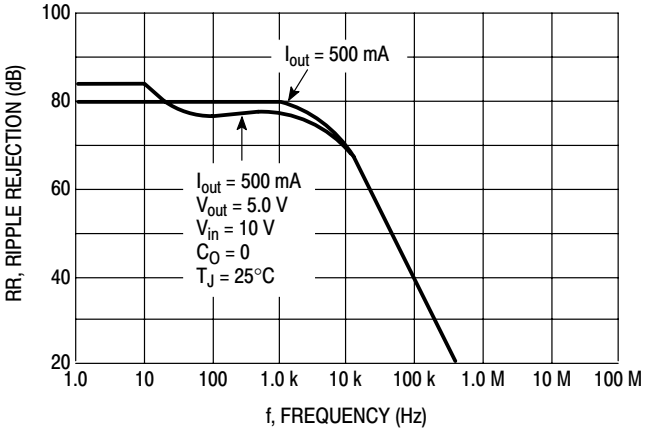


Figure 6. Ripple Rejection versus Frequency

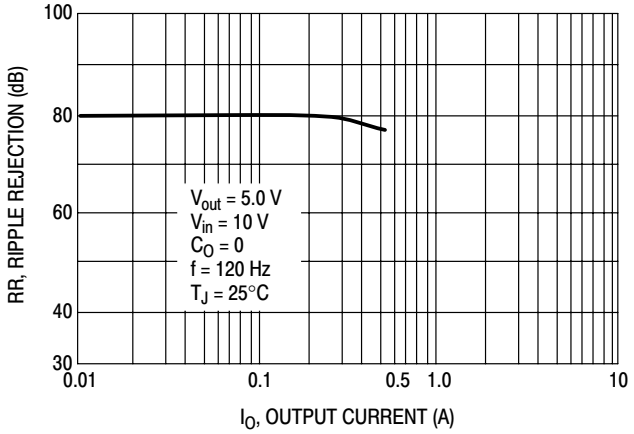


Figure 7. Ripple Rejection versus Output Current

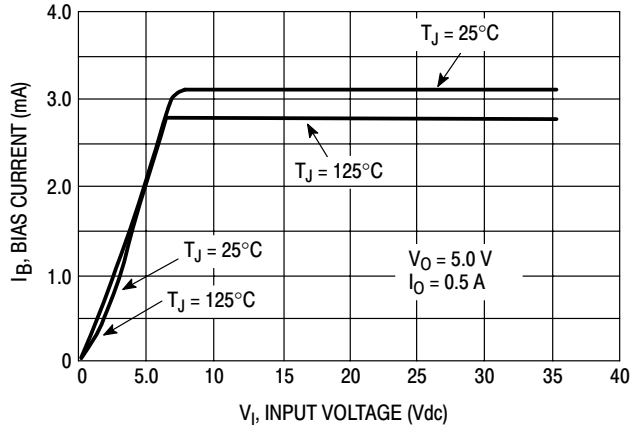


Figure 8. Bias Current versus Input Voltage

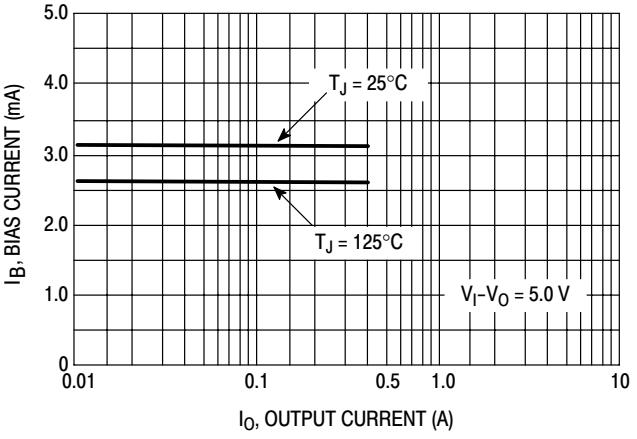


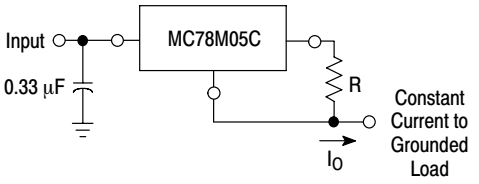
Figure 9. Bias Current versus Output Current

APPLICATIONS INFORMATION

Design Considerations

The MC78M00/MC78M00A 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 regulator's 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.



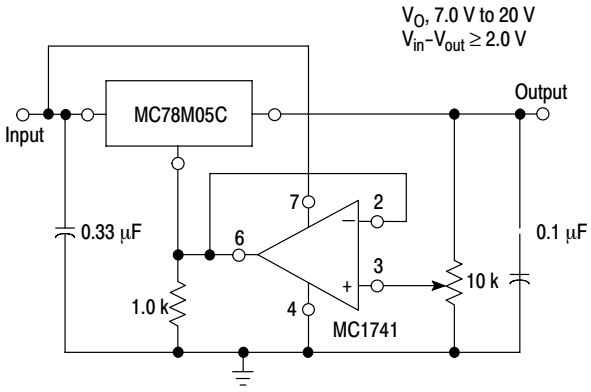
The MC78M00 regulators can also be used as a current source when connected as above. In order to minimize dissipation the MC78M05C is chosen in this application. Resistor R determines the current as follows:

$$I_O = \frac{5.0\ V}{R} + I_{IB}$$

I_{IB} = 1.5 mA over line and load changes.

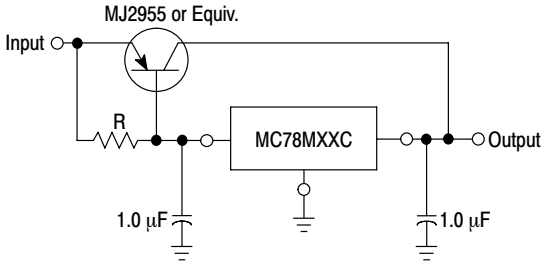
For example, a 500 mA current source would require R to be a 10 Ω, 10 W resistor and the output voltage compliance would be the input voltage less 7.0 V.

Figure 10. 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.

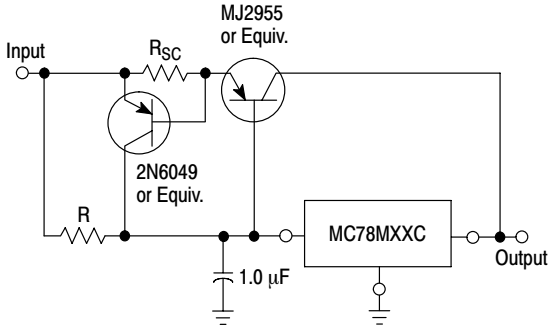
Figure 11. Adjustable Output Regulator



XX = 2 digits of type number indicating voltage.

The MC78M00 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 12. Current Boost Regulator



XX = 2 digits of type number indicating voltage.

The circuit of Figure 12 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 4.0 A plastic power transistor is specified.

Figure 13. Current Boost with Short Circuit Protection

ORDERING INFORMATION

Device	Output Voltage	Temperature Range	Package	Marking	Shipping†
MC78M05CDT	5.0 V	T_J = 0° to +125°C	DPAK−3	78M05	75 Units / Rail
MC78M05CDTG			DPAK−3 (Pb−Free)	78M05	
MC78M05CDTRK			DPAK−3	78M05	2500 Units / Tape & Reel
MC78M05CDTRKG			DPAK−3 (Pb−Free)	78M05	
MC78M05ACDT			DPAK−3	8M05D	75 Units / Rail
MC78M05ACDTG			DPAK−3 (Pb−Free)	8M05D	
MC78M05ACDTRK			DPAK−3	8M05D	2500 Units / Tape & Reel
MC78M05ACDTRKG			DPAK−3 (Pb−Free)	8M05D	
MC78M05CT			TO−220	78M05CT	50 Units / Rail
MC78M05CTG			TO−220 (Pb−Free)	78M05CT	
MC78M05ACT			TO−220	78M05ACT	50 Units / Rail
MC78M05ACTG			TO−220 (Pb−Free)	78M05ACT	
MC78M05ABDT		T_J = −40° to +125°C	DPAK−3	8M05A	75 Units / Rail
MC78M05ABDTG			DPAK−3 (Pb−Free)	8M05A	
MC78M05ABDTRK			DPAK−3	8M05A	2500 Units / Tape & Reel
MC78M05ABDTRKG			DPAK−3 (Pb−Free)	8M05A	
MC78M05ABT			TO−220	78M05ABT	50 Units / Rail
MC78M05ABTG			TO−220 (Pb−Free)	78M05ABT	
MC78M05BDT			DPAK−3	8M05B	75 Units / Rail
MC78M05BDTG			DPAK−3 (Pb−Free)	8M05B	
MC78M05BDTRK			DPAK−3	8M05B	2500 Units / Tape & Reel
MC78M05BDTRKG			DPAK−3 (Pb−Free)	8M05B	
MC78M05BT			TO−220	78M05BT	50 Units / Rail
MC78M05BTG			TO−220 (Pb−Free)	78M05BT	

†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.

ORDERING INFORMATION

Device	Output Voltage	Temperature Range	Package	Marking	Shipping†
MC78M06CDT	6.0 V	T_J = 0° to +125°C	DPAK−3	78M06	75 Units / Rail
MC78M06CDTG			DPAK−3 (Pb−Free)	78M06	
MC78M06CDTRK			DPAK−3	78M06	2500 Units / Tape & Reel
MC78M06CDTRKG			DPAK−3 (Pb−Free)	78M06	
MC78M06CT			TO−220	78M06CT	50 Units / Rail
MC78M06CTG			TO−220 (Pb−Free)	78M06CT	
MC78M06BT		T_J = −40° to +125°C	TO−220	78M06BT	
MC78M06BTG			TO−220 (Pb−Free)	78M06BT	
MC78M08CDT	8.0 V	T_J = 0° to +125°C	DPAK−3	78M08	75 Units / Rail
MC78M08CDTG			DPAK−3 (Pb−Free)	78M08	
MC78M08CDTRK			DPAK−3	78M08	2500 Units / Tape & Reel
MC78M08CDTRKG			DPAK−3 (Pb−Free)	78M08	
MC78M08ACDT			DPAK−3	8M08D	75 Units / Rail
MC78M08ACDTG			DPAK−3 (Pb−Free)	8M08D	
MC78M08ACDTRK			DPAK−3	8M08D	2500 Units / Tape & Reel
MC78M08ACDTRKG			DPAK−3 (Pb−Free)	8M08D	
MC78M08CT			TO−220	78M08CT	50 Units / Rail
MC78M08CTG			TO−220 (Pb−Free)	78M08CT	
MC78M08ACT			TO−220	78M08ACT	
MC78M08ACTG			TO−220 (Pb−Free)	78M08ACT	
MC78M08ABDT		T_J = −40° to +125°C	DPAK−3	8M08A	75 Units / Rail
MC78M08ABDTG			DPAK−3	8M08A	
MC78M08ABDTRK			DPAK−3	8M08A	2500 Units / Tape & Reel
MC78M08ABDTRKG			DPAK−3 (Pb−Free)	8M08A	
MC78M08ABT			TO−220	78M08ABT	50 Units / Rail
MC78M08ABTG			TO−220 (Pb−Free)	78M08ABT	
MC78M08BDT			DPAK−3	8M08B	75 Units / Rail
MC78M08BDTG			DPAK−3 (Pb−Free)	8M08B	
MC78M08BDTRK			DPAK−3	8M08B	2500 Units / Tape & Reel
MC78M08BDTRKG			DPAK−3 (Pb−Free)	8M08B	
MC78M08BT			TO−220	78M08BT	50 Units / Rail
MC78M08BTG			TO−220 (Pb−Free)	78M08BT	

†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.

ORDERING INFORMATION

Device	Output Voltage	Temperature Range	Package	Marking	Shipping†
MC78M09CDT	9.0 V	T_J = 0° to +125°C	DPAK−3	78M09	75 Units / Rail
MC78M09CDTG			DPAK−3 (Pb−Free)	78M09	75 Units / Rail
MC78M09CDTRK			DPAK−3	78M09	2500 Units / Tape & Reel
MC78M09CDTRKG			DPAK−3 (Pb−Free)	78M09	2500 Units / Tape & Reel
MC78M09CT			TO−220	78M09CT	50 Units / Rail
MC78M09CTG			TO−220 (Pb−Free)	78M09CT	50 Units / Rail
MC78M09BDT		T_J = −40° to +125°C	DPAK−3	8M09B	75 Units / Rail
MC78M09BDTG			DPAK−3 (Pb−Free)	8M09B	75 Units / Rail
MC78M09BDTRK			DPAK−3	8M09B	2500 Units / Tape & Reel
MC78M09BDTRKG			DPAK−3 (Pb−Free)	8M09B	2500 Units / Tape & Reel
MC78M12CDT	12 V	T_J = 0° to +125°C	DPAK−3	78M12	75 Units / Rail
MC78M12CDTG			DPAK−3 (Pb−Free)	78M12	
MC78M12CDTRK			DPAK−3	78M12	2500 Units / Tape & Reel
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	
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.

ORDERING INFORMATION

Device	Output Voltage	Temperature Range	Package	Marking	Shipping†
MC78M15CDT	15 V	T_J = 0° to +125°C	DPAK−3	78M15	75 Units / Rail
MC78M15CDTG			DPAK−3 (Pb−Free)	78M15	
MC78M15CDTRK			DPAK−3	78M15	2500 Units / Tape & Reel
MC78M15CDTRKG			DPAK−3 (Pb−Free)	78M15	
MC78M15ACDT			DPAK−3	8M15D	75 Units / Rail
MC78M15ACDTG			DPAK−3 (Pb−Free)	8M15D	
MC78M15ACDTRK			DPAK−3	8M15D	2500 Units / Tape & Reel
MC78M15ACDTRKG			DPAK−3 (Pb−Free)	8M15D	
MC78M15CT			TO−220	78M15CT	50 Units / Rail
MC78M15CTG			TO−220 (Pb−Free)	78M15CT	
MC78M15ACT			TO−220	78M15ACT	
MC78M15ACTG			TO−220 (Pb−Free)	78M15ACT	
MC78M15ABDT		T_J = −40° to +125°C	DPAK−3	8M15A	75 Units / Rail
MC78M15ABDTG			DPAK−3 (Pb−Free)	8M15A	
MC78M15ABDTRK			DPAK−3	8M15A	2500 Units / Tape & Reel
MC78M15ABDTRKG			DPAK−3 (Pb−Free)	8M15A	
MC78M15ABT			TO−220	78M15ABT	50 Units / Rail
MC78M15ABTG			TO−220 (Pb−Free)	78M15ABT	
MC78M15BDT			DPAK−3	8M15B	75 Units / Rail
MC78M15BDTG			DPAK−3 (Pb−Free)	8M15B	
MC78M15BDTRK			DPAK−3	8M15B	2500 Units / Tape & Reel
MC78M15BDTRKG			DPAK−3 (Pb−Free)	8M15B	
MC78M15BT			TO−220	78M15BT	50 Units / Rail
MC78M15BTG			TO−220 (Pb−Free)	78M15BT	

†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.

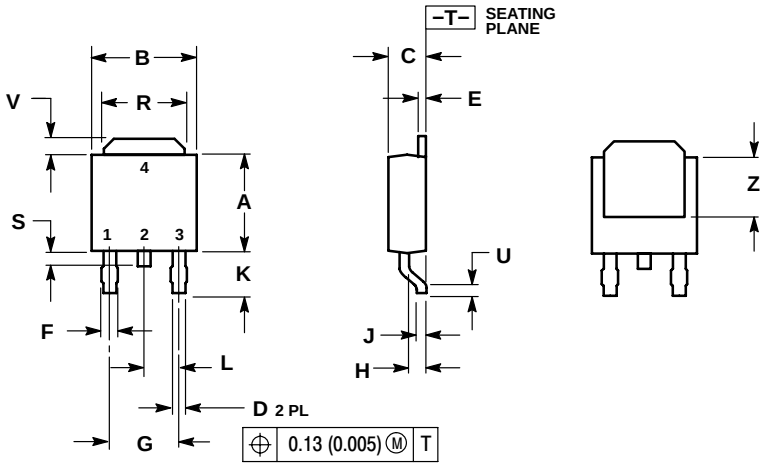
ORDERING INFORMATION

Device	Output Voltage	Temperature Range	Package	Marking	Shipping†
MC78M18CDT	18 V	T_J = 0° to +125°C	DPAK−3	78M18	75 Units / Rail
MC78M18CDTG			DPAK−3 (Pb−Free)	78M18	
MC78M18CDTRK			DPAK−3	78M18	2500 Units / Tape & Reel
MC78M18CDTRKG			DPAK−3 (Pb−Free)	78M18	
MC78M18CT			TO−220	78M18CT	50 Units / Rail
MC78M18CTG			TO−220 (Pb−Free)	78M18CT	
MC78M18BT		T_J = −40° to +125°C	TO−220	78M18BT	
MC78M18BTG			TO−220 (Pb−Free)	78M18BT	
MC78M20CT	20 V	T_J = 0° to +125°C	TO−220	78M20CT	50 Units / Rail
MC78M20CTG			TO−220 (Pb−Free)	78M20CT	
MC78M20BT		T_J = −40° to +125°C	TO−220	78M20BT	
MC78M24CT	24 V	T_J = 0° to +125°C	TO−220	78M24CT	
MC78M24CTG			TO−220 (Pb−Free)	78M24CT	
MC78M24BT		T_J = −40° to +125°C	TO−220	78M24BT	
MC78M24BTG			TO−220 (Pb−Free)	78M24BT	

†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.

PACKAGE DIMENSIONS

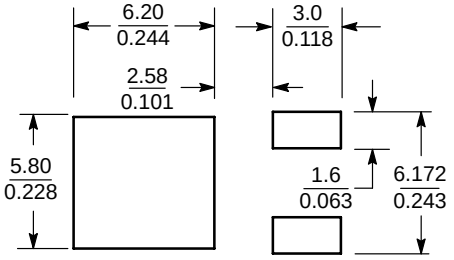
DPAK−3
DT SUFFIX
CASE 369C−01
ISSUE O



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*

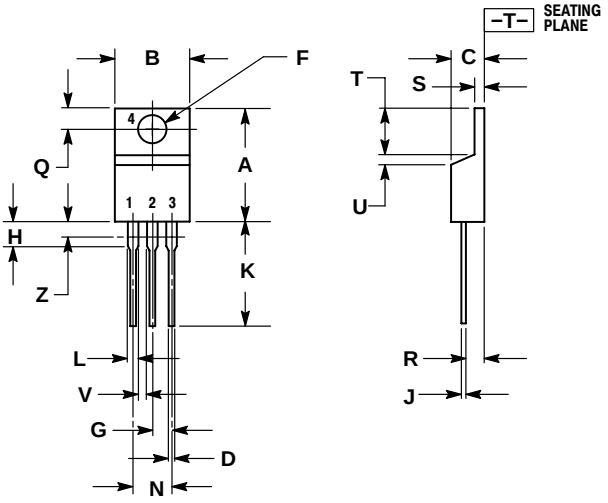


SCALE 3:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

PACKAGE DIMENSIONS

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ISSUE AA



NOTES:
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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

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