MC78M00, MC78M00A Series

500 mA Positive Voltage Regulators

ON Semiconductor™

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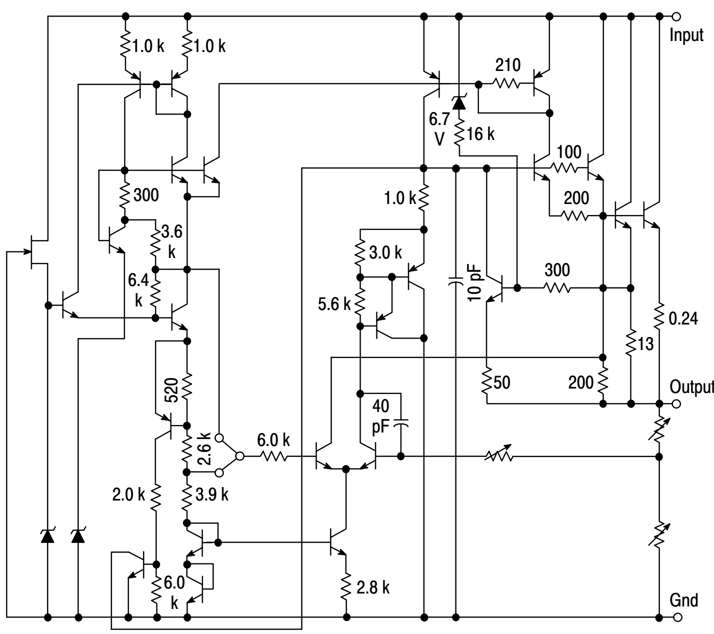
The MC78M00/MC78M00A Series positive voltage regulators are identical to the popular MC7800 Series devices, except that they are specified for only half the output current. Like the MC7800 devices, the MC78M00 three–terminal regulators are intended for local, on–card voltage regulation.

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.

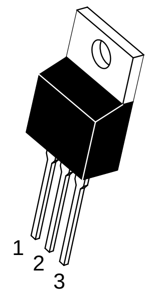
- No External Components Required
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting
- Output Transistor Safe–Area Compensation
- MC78M00A High Accuracy (±2%) Available for 5.0 V, 8.0 V, 12 V and 15 V



This device contains 28 active transistors.

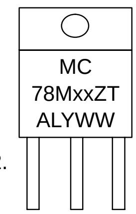
Figure 1. Representative Schematic Diagram

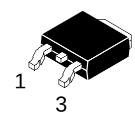
MARKING DIAGRAMS



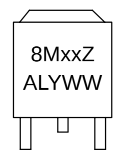
TO–220
T SUFFIX
CASE 221A

Heatsink surface connected to Pin 2.





DPAK
DT SUFFIX
CASE 369A



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

Pin 1. Input
2. Ground
3. Output

xx = Voltage Option
Z = A, B, or C Option
A = Assembly Location
L = Wafer Lot
Y = Year
WW = Work Week

ORDERING INFORMATION

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

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

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

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) MC78M05C MC78M05AC	V_O	 4.8 4.9	 5.0 5.0	 5.2 5.1	Vdc
Output Voltage Variation (7.0 Vdc ≤ V_I ≤ 20 Vdc, 5.0 mA ≤ I_O ≤ 350 mA) MC78M05C MC78M05AC	V_O	 4.75 4.80	 – –	 5.25 5.20	Vdc
Line Regulation (T_J = 25°C, 7.0 Vdc ≤ V_I ≤ 25 Vdc, I_O = 200 mA)	Reg_{line}	–	3.0	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	 100 50	mV
Input Bias Current (T_J = 25°C)	I_{IB}	–	3.2	6.0	mA
Quiescent Current Change (8.0 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	–	40	–	µV
Ripple Rejection (I_O = 100 mA, f = 120 Hz, 8.0 V ≤ V_I ≤ 18 V) (I_O = 300 mA, f = 120 Hz, 8.0 ≤ V_I ≤ 18 V, T_J = 25°C)	RR	 62 62	 – 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

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

MC78M06C ELECTRICAL CHARACTERISTICS (V_I = 11 V, I_O = 350 mA, 0°C < T_J < 125°C, P_D ≤ 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 ≤ 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
= –40°C for MC78MxxAB, B
T_{high} = +125°C for MC78MxxAB, AC, B, C

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 ≤ 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 ELECTRICAL CHARACTERISTICS (V_I = 27 V, I_O = 350 mA, 0°C < T_J < 125°C, P_D ≤ 5.0 W, unless otherwise noted.)

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
= –40°C for MC78MxxAB, B
T_{high} = +125°C for MC78MxxAB, AC, B, C

MC78M20C ELECTRICAL CHARACTERISTICS (V_I = 29 V, I_O = 350 mA, 0°C < T_J < 125°C, P_D ≤ 5.0 W, unless otherwise noted.)

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 ELECTRICAL CHARACTERISTICS (V_I = 33 V, I_O = 350 mA, 0°C < T_J < 125°C, P_D ≤ 5.0 W, unless otherwise noted.)

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

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.

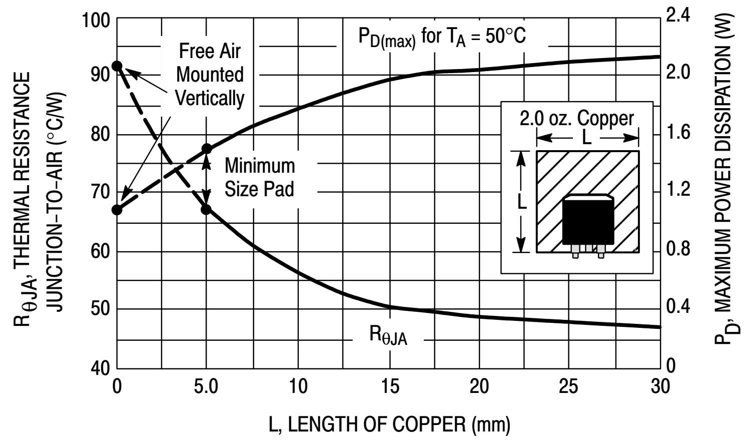


Figure 2. DPAK Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length

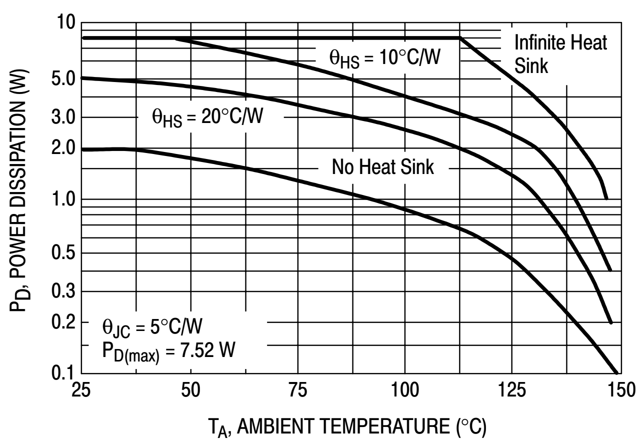


Figure 3. Worst Case Power Dissipation versus Ambient Temperature (TO–220)

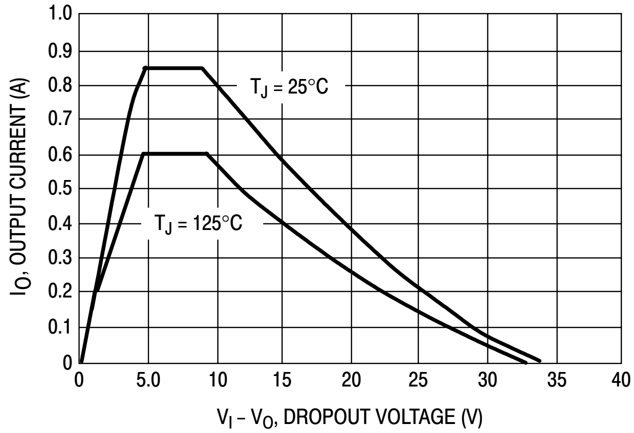


Figure 4. Peak Output Current versus Dropout Voltage

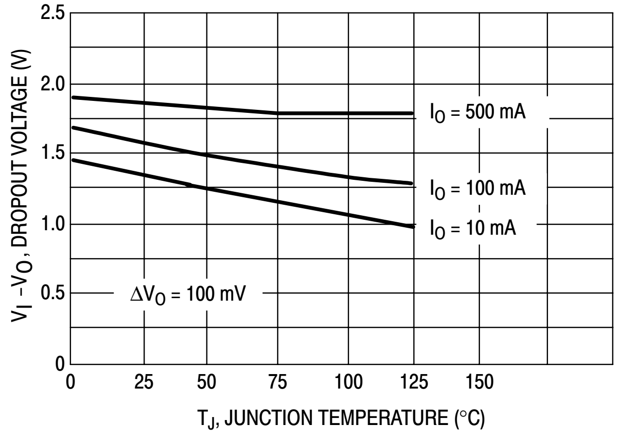


Figure 5. Dropout Voltage versus Junction Temperature

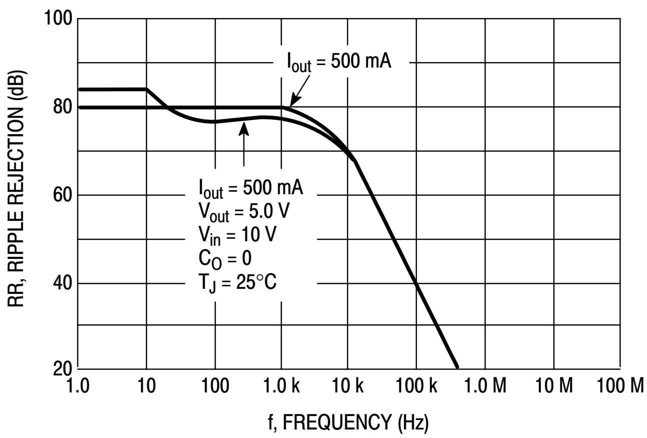


Figure 6. Ripple Rejection versus Frequency

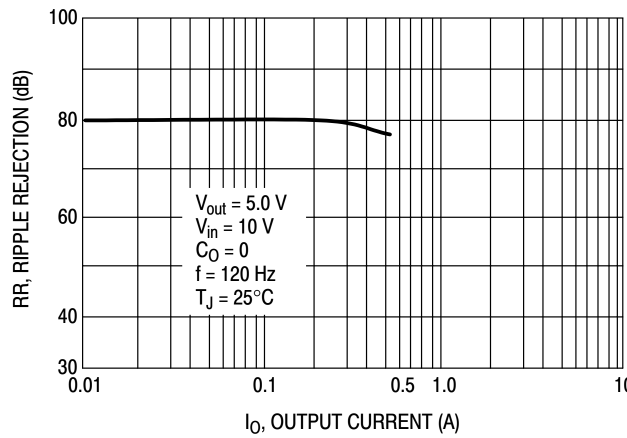


Figure 7. Ripple Rejection versus Output Current

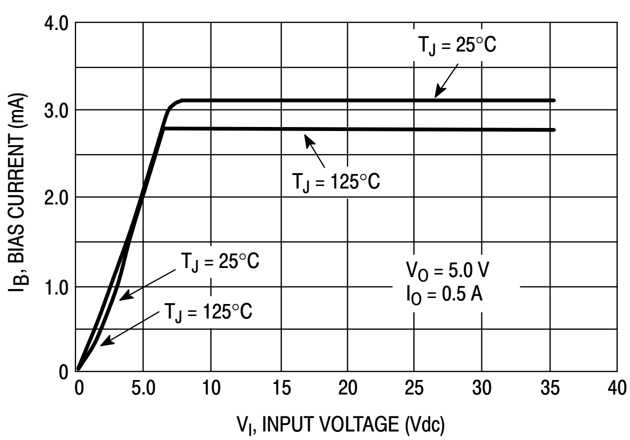


Figure 8. Bias Current versus Input Voltage

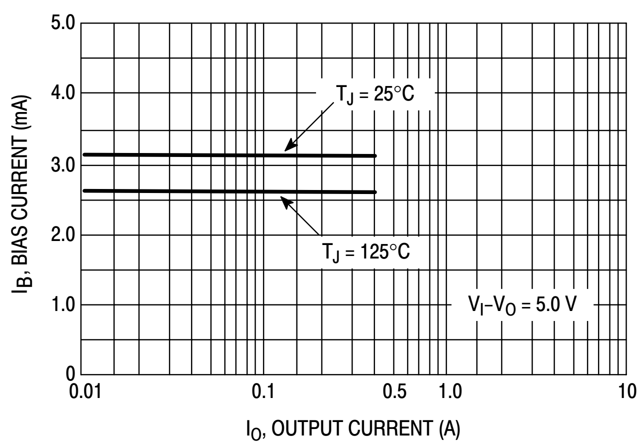


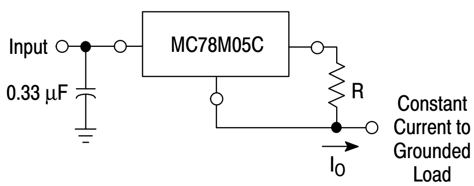
Figure 9. Bias Current versus Output Current

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.



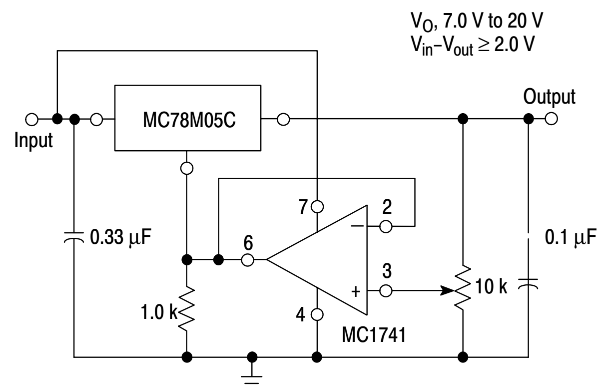
The MC78M00 regulators can also be used as a current source when connected as above. In order to minimize dissipation the MC78M05C is chosen in this application. Resistor R determines the current as follows:

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

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

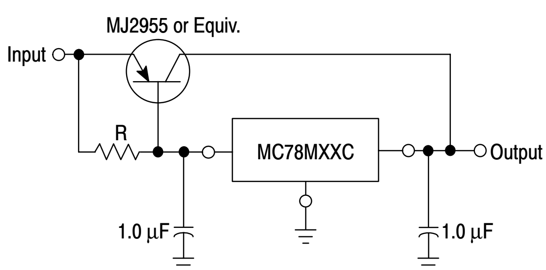
For example, a 500 mA current source would require R to be a 5.0 Ω, 10 W resistor and the output voltage compliance would be the input voltage less 7.0 V.

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.

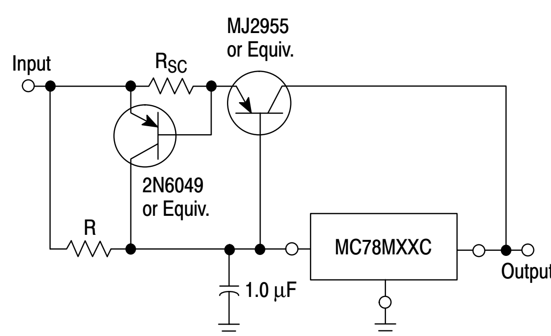
Figure 11. Adjustable Output Regulator



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.

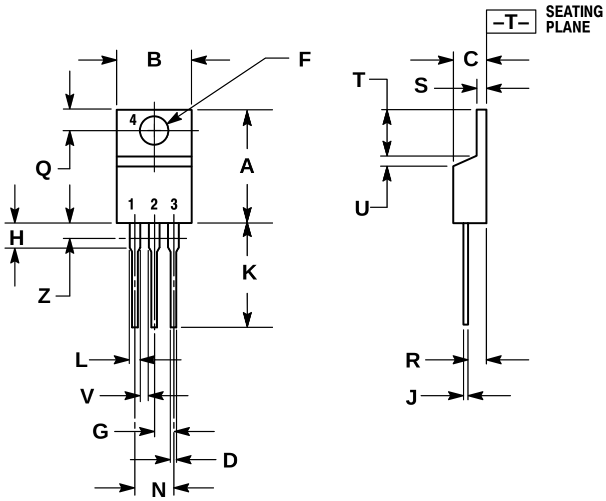
Figure 13. Current Boost with Short Circuit Protection

ORDERING INFORMATION

Device	Output Voltage	Temperature Range	Package	Shipping: Rails (No Suffix)	Shipping: Tape & Reel (RK Suffix)
MC78M05CDT/RK	5.0 V	T_J = 0° to +125°C	DPAK	75 Units/Rail	2500 Units/Reel
MC78M05ACDT/RK					
MC78M05CT			TO–220	50 Units/Rail	–
MC78M05ACT					
MC78M05ABDT/RK		T_J = –40° to +125°C	DPAK	75 Units/Rail	2500 Units/Reel
MC78M05ABT			TO–220	50 Units/Rail	–
MC78M05BDT/RK			DPAK	75 Units/Rail	2500 Units/Reel
MC78M05BT			TO–220	50 Units/Rail	–
MC78M06CDT/RK	6.0 V	T_J = 0° to +125°C	DPAK	75 Units/Rail	2500 Units/Reel
MC78M06CT			TO–220	50 Units/Rail	–
MC78M06BT		T_J = –40° to +125°C			
MC78M08CDT/RK	8.0 V	T_J = 0° to +125°C	DPAK	75 Units/Rail	2500 Units/Reel
MC78M08ACDT/RK					
MC78M08CT			TO–220	50 Units/Rail	–
MC78M08ACT					
MC78M08ABDT/RK		T_J = –40° to +125°C	DPAK	75 Units/Rail	2500 Units/Reel
MC78M08ABT			TO–220	50 Units/Rail	–
MC78M08BDT/RK			DPAK	75 Units/Rail	2500 Units/Reel
MC78M08BT			TO–220	50 Units/Rail	–
MC78M09CDT/RK	9.0 V	T_J = 0° to +125°C	DPAK	75 Units/Rail	2500 Units/Reel
MC78M09CT			TO–220	50 Units/Rail	–
MC78M09BDT/RK		T_J = –40° to +125°C	DPAK	75 Units/Rail	2500 Units/Reel
MC78M09BT			TO–220	50 Units/Rail	–
MC78M12CDT/RK	12 V	T_J = 0° to +125°C	DPAK	75 Units/Rail	2500 Units/Reel
MC78M12ACDT/RK					
MC78M12CT			TO–220	50 Units/Rail	–
MC78M12ACT					
MC78M12ABDT/RK		T_J = –40° to +125°C	DPAK	75 Units/Rail	2500 Units/Reel
MC78M12ABT			TO–220	50 Units/Rail	–
MC78M12BDT/RK			DPAK	75 Units/Rail	2500 Units/Reel
MC78M12BT			TO–220	50 Units/Rail	–
MC78M15CDT/RK	15 V	T_J = 0° to +125°C	DPAK	75 Units/Rail	2500 Units/Reel
MC78M15ACDT/RK					
MC78M15CT			TO–220	50 Units/Rail	–
MC78M15ACT					
MC78M15ABDT/RK		T_J = –40° to +125°C	DPAK	75 Units/Rail	2500 Units/Reel
MC78M15ABT			TO–220	50 Units/Rail	–
MC78M15BDT/RK			DPAK	75 Units/Rail	2500 Units/Reel
MC78M15BT			TO–220	50 Units/Rail	–
MC78M18CDT	18 V	T_J = 0° to +125°C	DPAK	75 Units/Rail	
MC78M18CT			TO–220	50 Units/Rail	
MC78M18BT		T_J = –40° to +125°C			
MC78M20CT	20 V	T_J = 0° to +125°C			
MC78M20BT		T_J = –40° to +125°C			
MC78M24CT	24 V	T_J = 0° to +125°C			
MC78M24BT		T_J = –40° to +125°C			

PACKAGE DIMENSIONS

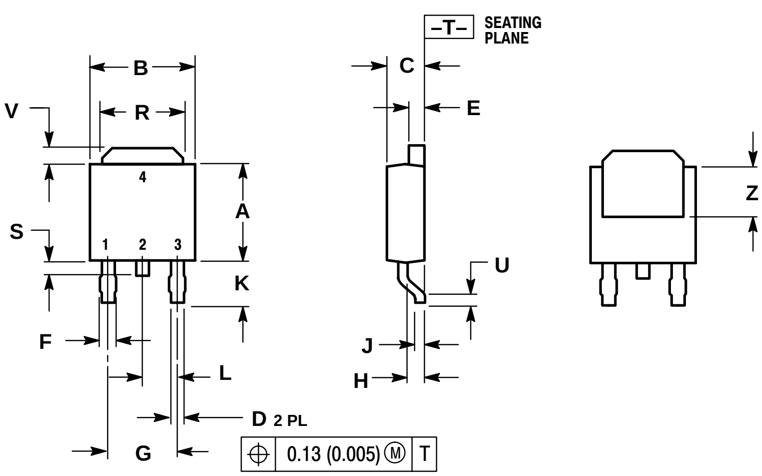
TO–220
T SUFFIX
CASE 221A–09
ISSUE AA



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.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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

DPAK
DT SUFFIX
CASE 369A–13
ISSUE Z



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

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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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