LM109
LM209
LM309

3

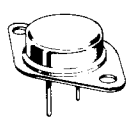
POSITIVE THREE-TERMINAL FIXED VOLTAGE REGULATORS

POSITIVE VOLTAGE REGULATORS

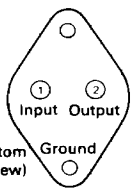
A versatile positive fixed +5.0-volt regulator designed for easy application as an on-card, local voltage regulator for digital logic systems. Current limiting and thermal shutdown are provided to make the units extremely rugged.

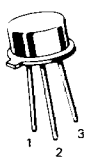
In most applications only one external component, a capacitor, is required in conjunction with the LM109 Series devices. Even this component may be omitted if the power-supply filter is not located an appreciable distance from the regulator.

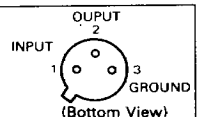
- High Maximum Output Current — Over 1.0 Ampere in K Suffix Package — Over 200 mA in H Suffix Package
- Minimum External Components Required
- Internal Short-Circuit Protection
- Internal Thermal Overload Protection
- Excellent Line and Load Transient Rejection
- Designed for Use with Popular MDTL and MTTL Logic



K SUFFIX
METAL PACKAGE
CASE 1







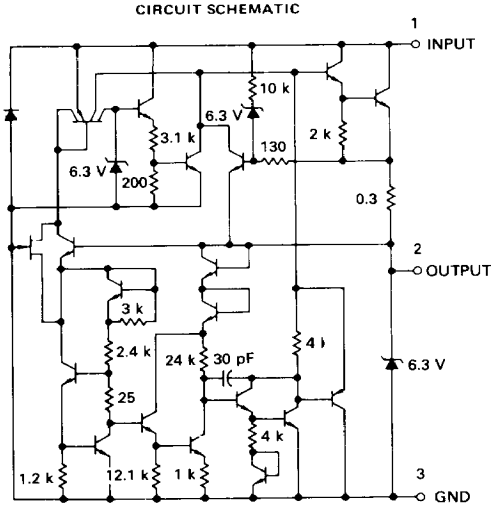
H SUFFIX
METAL PACKAGE
CASE 79

CASE IS GROUND

ORDERING INFORMATION

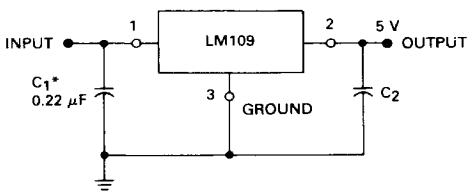
Device	Tested Operating Temperature Range	Package
LM109H	T_J = −55°C to +150°C	Metal Can
LM109K	T_J = −55°C to +150°C	Metal Power
LM209H	T_J = −25°C to +150°C	Metal Can
LM209K	T_J = −25°C to +150°C	Metal Power
LM309H	T_J = 0°C to +125°C	Metal Can
LM309K	T_J = 0°C to +125°C	Metal Power

CIRCUIT SCHEMATIC



TYPICAL APPLICATION

FIXED 5.0 V REGULATOR



*Required if regulator is located an appreciable distance from power supply filter. Although no output capacitor is needed for stability, it does improve transient response.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Input Voltage	V_{in}	35	Vdc
Power Dissipation	P_D	Internally Limited	
Junction Temperature Range LM109 LM209 LM309	T_J	 −55 to +150 −25 to +150 0 to +150	°C
Storage Temperature Range	T_{stg}	−65 to +150	°C
Lead Temperature (soldering, t = 60 s)	T_S	300	°C

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	LM109/LM209[1] Min	LM109/LM209[1] Typ	LM109/LM209[1] Max	LM309[2] Min	LM309[2] Typ	LM309[2] Max	Unit
Output Voltage (T_J = +25°C)	V_O	4.7	5.05	5.3	4.8	5.05	5.2	Vdc
Input Regulation (T_J = +25°C) 7.0 ≤ V_{in} ≤ 25 V	Reg_{line}	—	4.0	50	—	4.0	50	mV
Load Regulation (T_J = +25°C) Case 1-03 5.0 mA ≤ I_O ≤ 1.5 A Case 79-03 5.0 mA ≤ I_O ≤ 0.5 A	Reg_{load}	 — —	 50 20	 100 50	 — —	 50 20	 100 50	mV
Output Voltage Range 7.0 V ≤ V_{in} ≤ 25 V 5.0 mA ≤ I_O ≤ I_{max}, P ≤ P_{max}	V_O	4.6	—	5.4	4.75	—	5.25	Vdc
Quiescent Current (7.0 V ≤ V_{in} ≤ 25 V) Quiescent Current Change (7.0 V ≤ V_{in} ≤ 25 V) 5.0 mA ≤ I_O ≤ I_{max}	I_B ΔI_B	— — —	5.2 — —	10 0.5 0.8	— — —	5.2 — —	10 0.5 0.8	mAdc
Output Noise Voltage (T_A = +25°C) 10 Hz ≤ f ≤ 100 kHz	V_N	—	40	—	—	40	—	μV
Long Term Stability	S	—	—	10	—	—	20	mV
Thermal Resistance, Junction to Case[3] Case 1-03 Case 79-03	θJC	 — —	 3.0 15	 — —	 — —	 3.0 15	 — —	°C/W

NOTES:
1. Unless otherwise specified, these specifications apply for −55°C ≤ T_J ≤ +150° (−25°C ≤ T_J ≤ +150°C for the LM209). For Case 79-03 V_{in} = 10 V, I_O = 0.1 A, I_{max} = 0.2 A and P_{max} = 2.0 W. For Case 1-03 V_{in} = 10 V, I_O = 0.5 A, I_{max} = 1.0 A and P_{max} = 20 W.
2. Unless otherwise specified, these specifications apply for 0°C ≤ T_J ≤ +125°C, V_{in} = 10 V. For Case 79-03 I_O = 0.1 A, I_{max} = 0.2 A and P_{max} = 2.0 W. For Case 1-03 I_O = 0.5 A, I_{max} = 1.0 A and P_{max} = 20 W.
3. Without a heat sink, the thermal resistance of the Case 79-03 package is about 150°C/W, while that of the Case 1-03 package is approximately 35°C/W. With a heat sink, the effective thermal resistance can only approach the values specified, depending on the efficiency of the heat sink.

TYPICAL CHARACTERISTICS

(V_{in} = 10 V, T_A = +25°C unless otherwise noted.)

FIGURE 1 – MAXIMUM AVERAGE POWER DISSIPATION
(LM109K, LM209K)

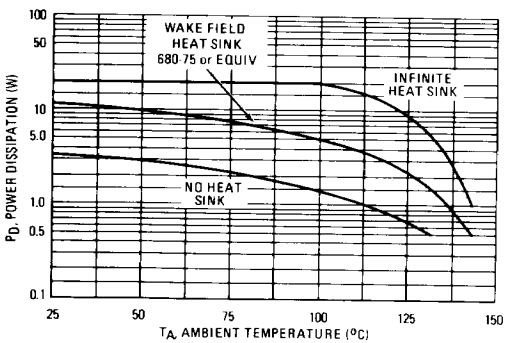
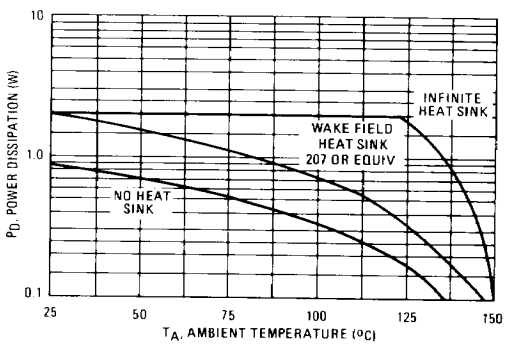


FIGURE 2 – MAXIMUM AVERAGE POWER DISSIPATION
(LM109H, LM209H)



3

TYPICAL CHARACTERISTICS (continued)

(V_{in} = 10 V, T_A = +25°C unless otherwise noted.)

FIGURE 3 – MAXIMUM AVERAGE POWER DISSIPATION (LM309K)

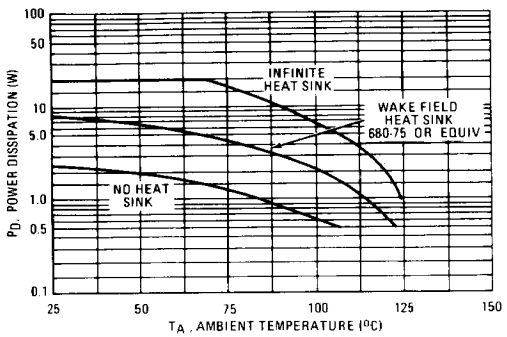


FIGURE 4 – MAXIMUM AVERAGE POWER DISSIPATION (LM309H)

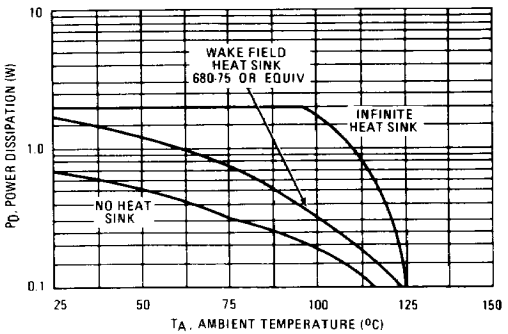


FIGURE 5 - OUTPUT IMPEDANCE versus FREQUENCY

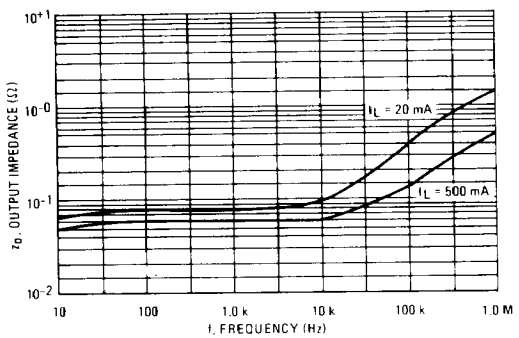


FIGURE 6 – PEAK OUTPUT CURRENT (K PACKAGE)

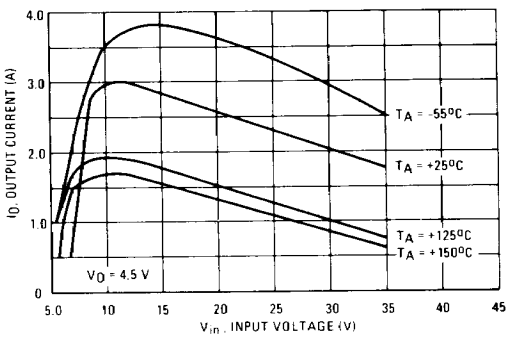


FIGURE 7 – PEAK OUTPUT CURRENT (H PACKAGE)

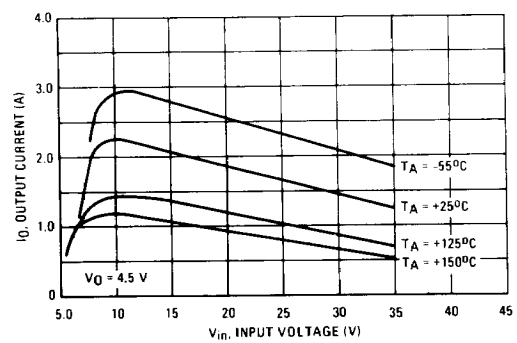
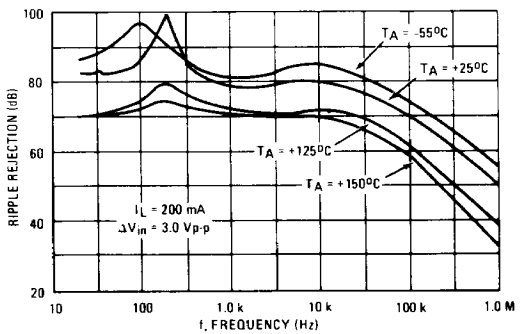


FIGURE 8 – RIPPLE REJECTION



TYPICAL CHARACTERISTICS (continued)

FIGURE 9 – DROPOUT VOLTAGE

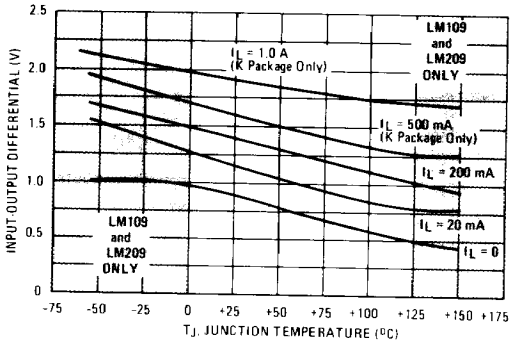


FIGURE 10 – DROPOUT CHARACTERISTIC
(K PACKAGE)

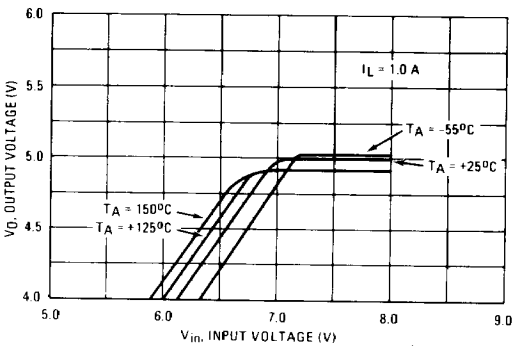


FIGURE 11 – OUTPUT VOLTAGE

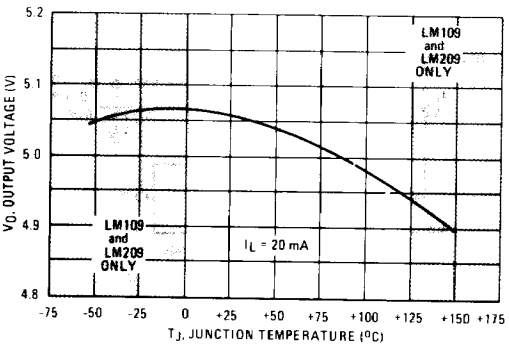


FIGURE 12 – OUTPUT NOISE VOLTAGE

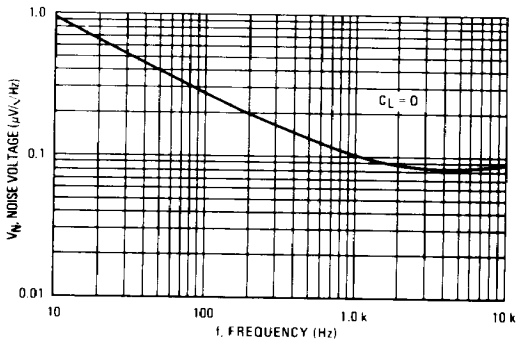


FIGURE 13 – QUIESCENT CURRENT

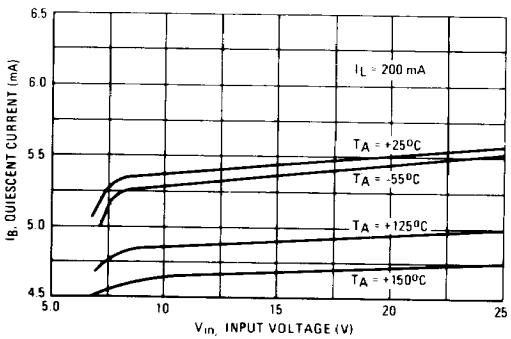
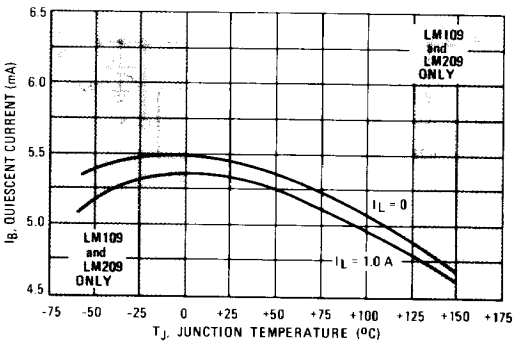


FIGURE 14 – QUIESCENT CURRENT



3

TYPICAL APPLICATIONS

FIGURE 15 – ADJUSTABLE OUTPUT REGULATOR

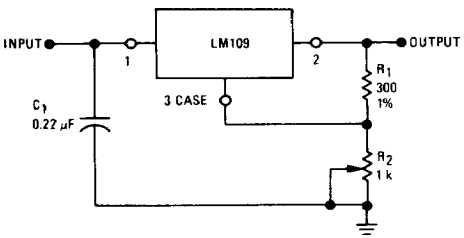
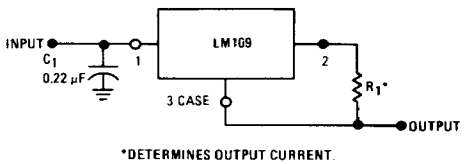


FIGURE 16 – CURRENT REGULATOR



*DETERMINES OUTPUT CURRENT.

FIGURE 17 – 5.0-VOLT, 3.0-AMPERE REGULATOR
(with plastic boost transistor)

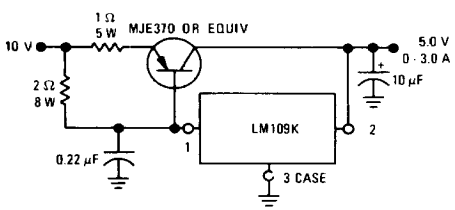


FIGURE 18 – 5.0 VOLT, 4.0-AMPERE TRANSISTOR
(with plastic Darlington boost transistor)

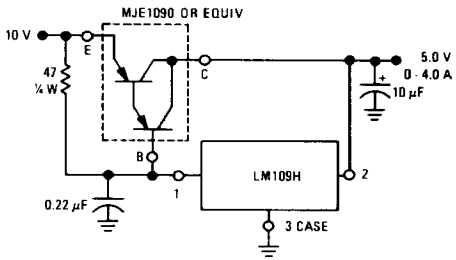


FIGURE 19 – 5.0-VOLT, 10-AMPERE REGULATOR

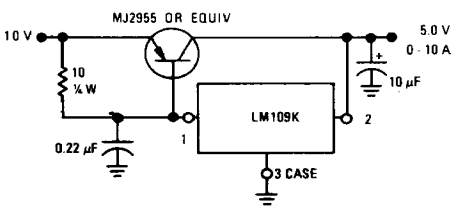


FIGURE 20 – 5.0-VOLT, 10-AMPERE REGULATOR
(with Short-Circuit Current Limiting for
Safe-Area Protection of pass transistors)