MOTOROLA

LM109
LM209
LM309

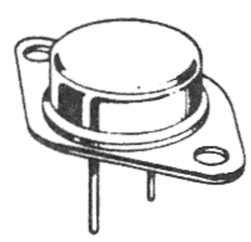
POSITIVE THREE-TERMINAL FIXED VOLTAGE REGULATORS

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.

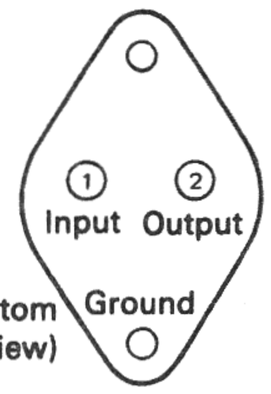
In most applications only one external component, a capacitor, is required in conjunction with the LM109 Series devices. Even this component may be omitted if the power-supply filter is not located an appreciable distance from the regulator.

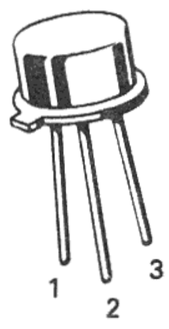
- High Maximum Output Current — Over 1.0 Ampere in K Suffix Package — Over 200 mA in H Suffix Package
- Minimum External Components Required
- Internal Short-Circuit Protection
- Internal Thermal Overload Protection
- Excellent Line and Load Transient Rejection
- Designed for Use with Popular MDTL and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

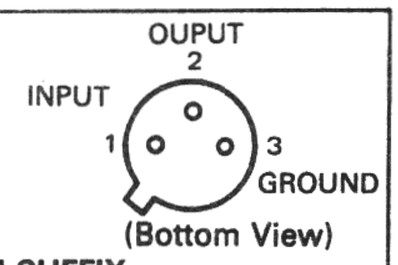
POSITIVE VOLTAGE REGULATORS



K SUFFIX
METAL PACKAGE
CASE 1-03





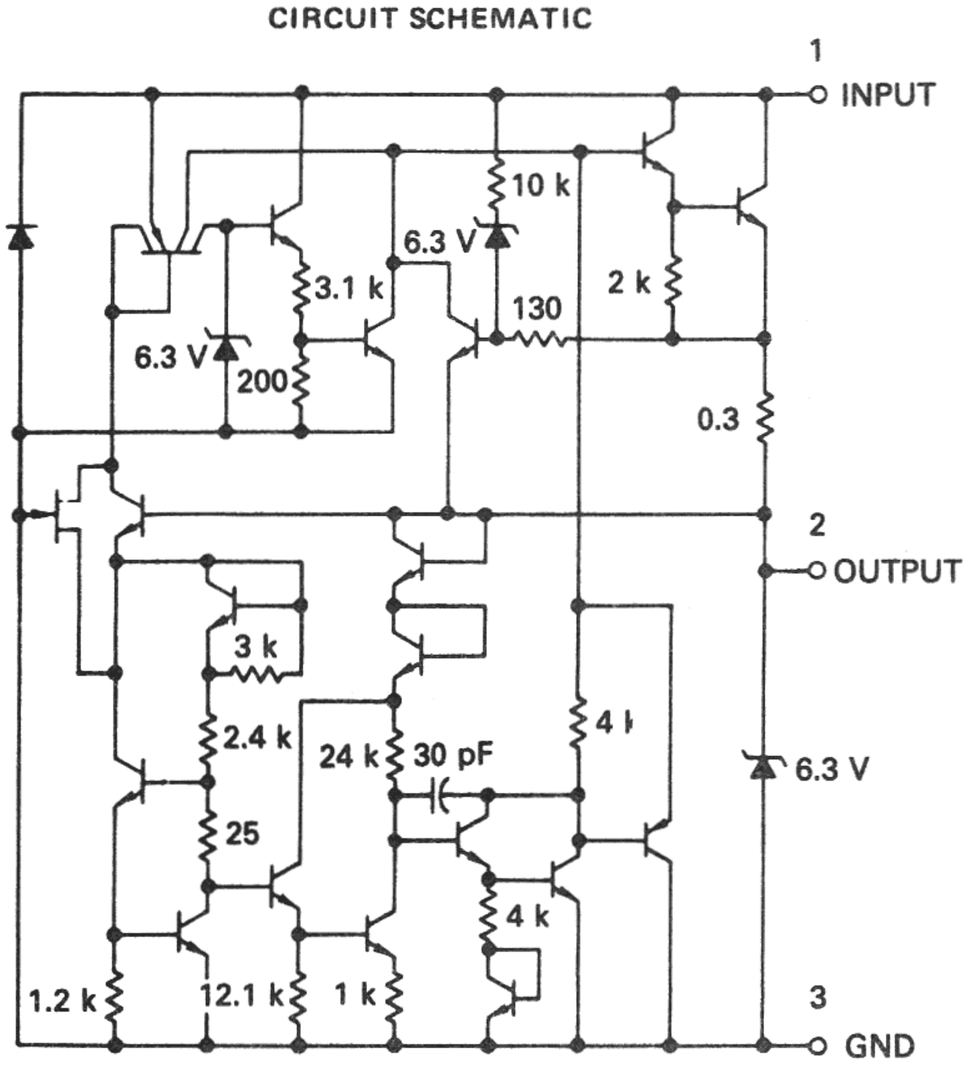


H SUFFIX
METAL PACKAGE
CASE 79-05

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.

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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.

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TYPICAL CHARACTERISTICS

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

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

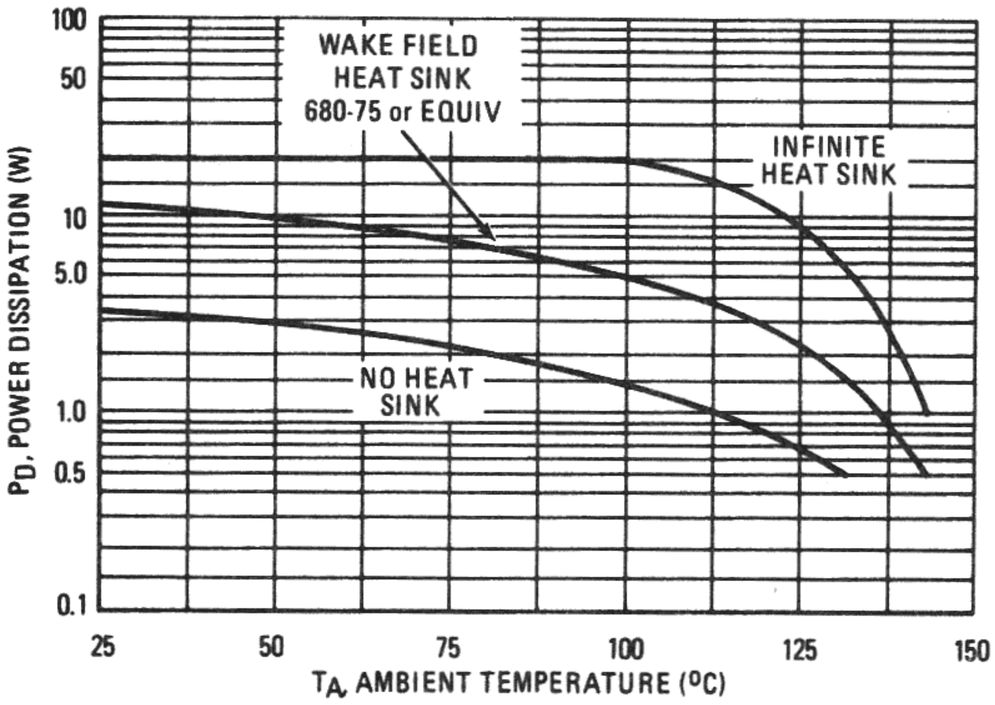
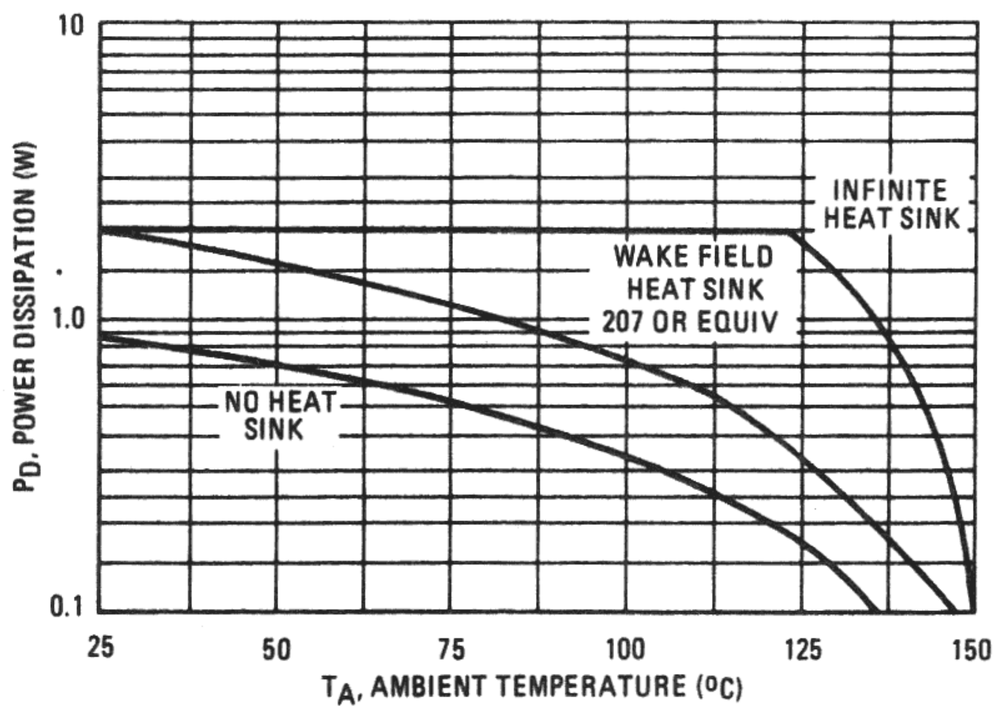


FIGURE 2 – MAXIMUM AVERAGE POWER DISSIPATION (LM109H, LM209H)



TYPICAL CHARACTERISTICS (continued)

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

FIGURE 3 – MAXIMUM AVERAGE POWER DISSIPATION (LM309K)

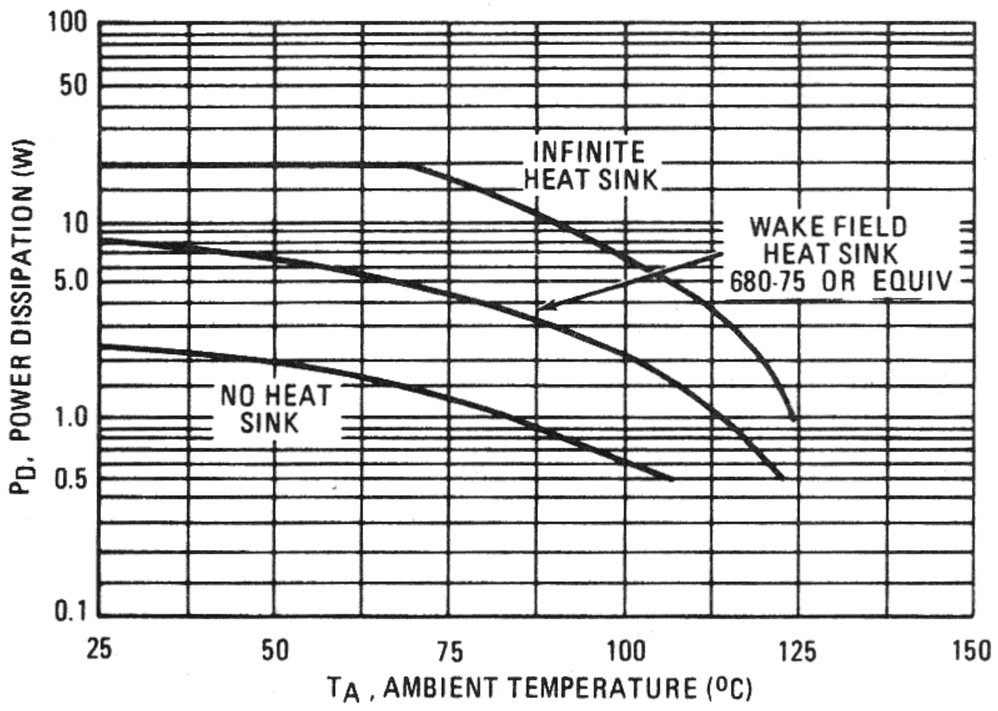
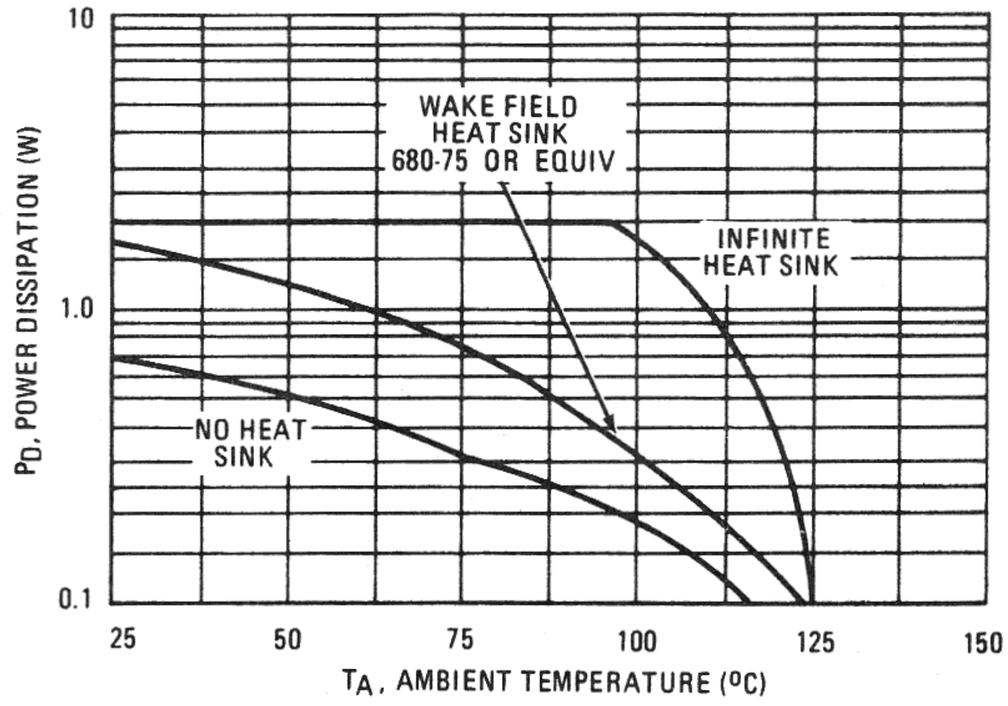


FIGURE 4 – MAXIMUM AVERAGE POWER DISSIPATION (LM309H)



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FIGURE 5 - OUTPUT IMPEDANCE versus FREQUENCY

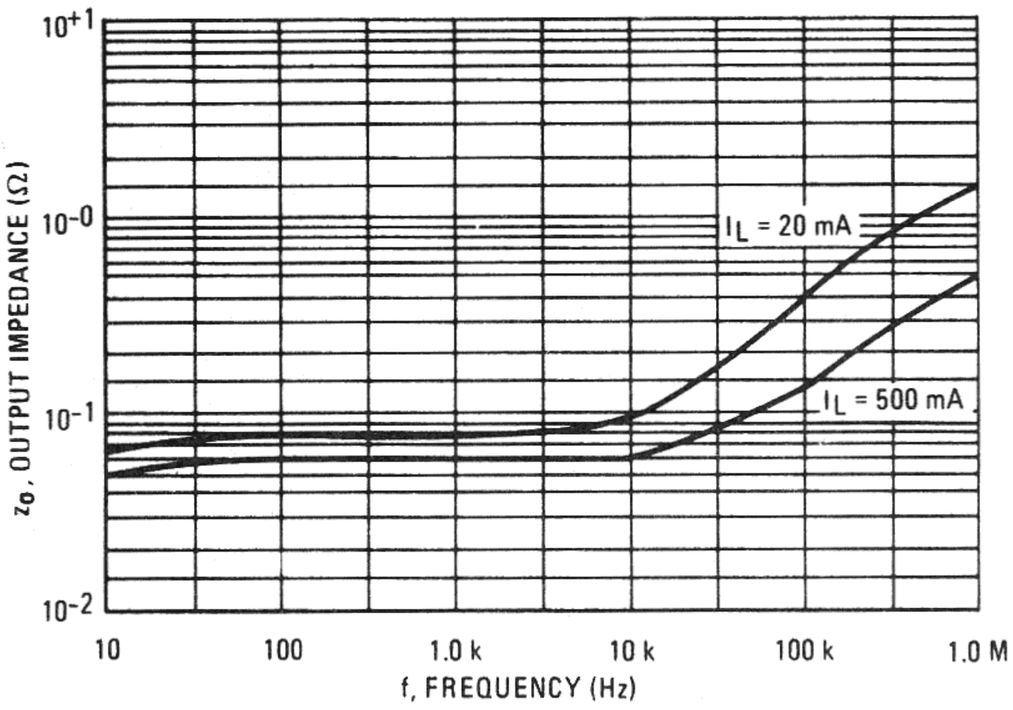


FIGURE 6 – PEAK OUTPUT CURRENT (K PACKAGE)

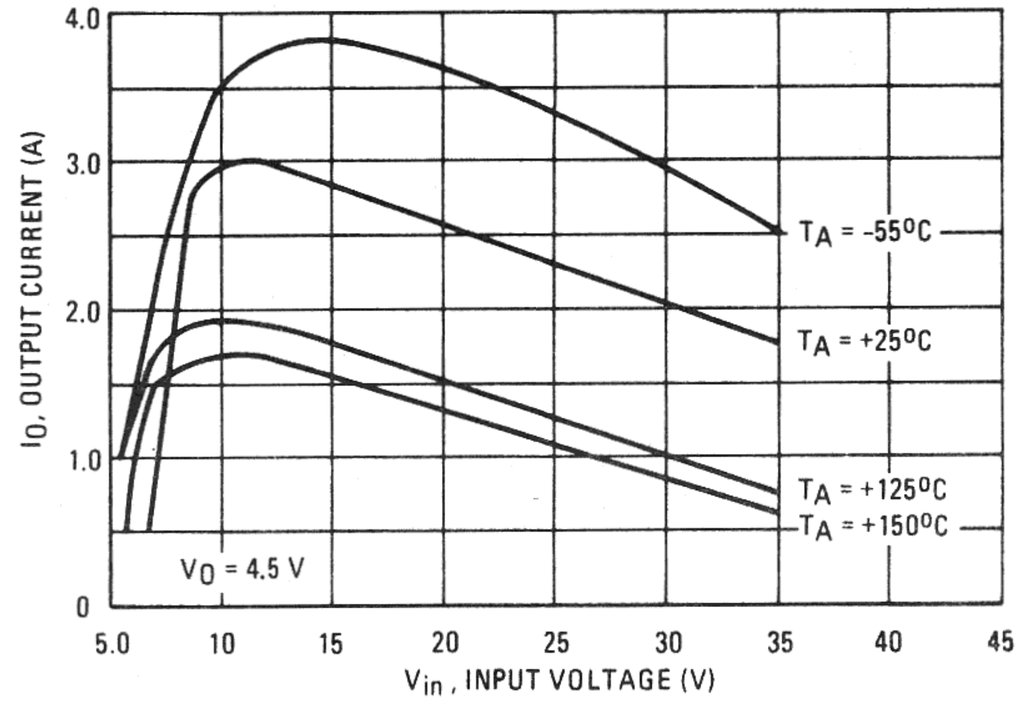


FIGURE 7 – PEAK OUTPUT CURRENT (H PACKAGE)

FIGURE 8 – RIPPLE REJECTION

TYPICAL CHARACTERISTICS (continued)

FIGURE 9 – DROPOUT VOLTAGE

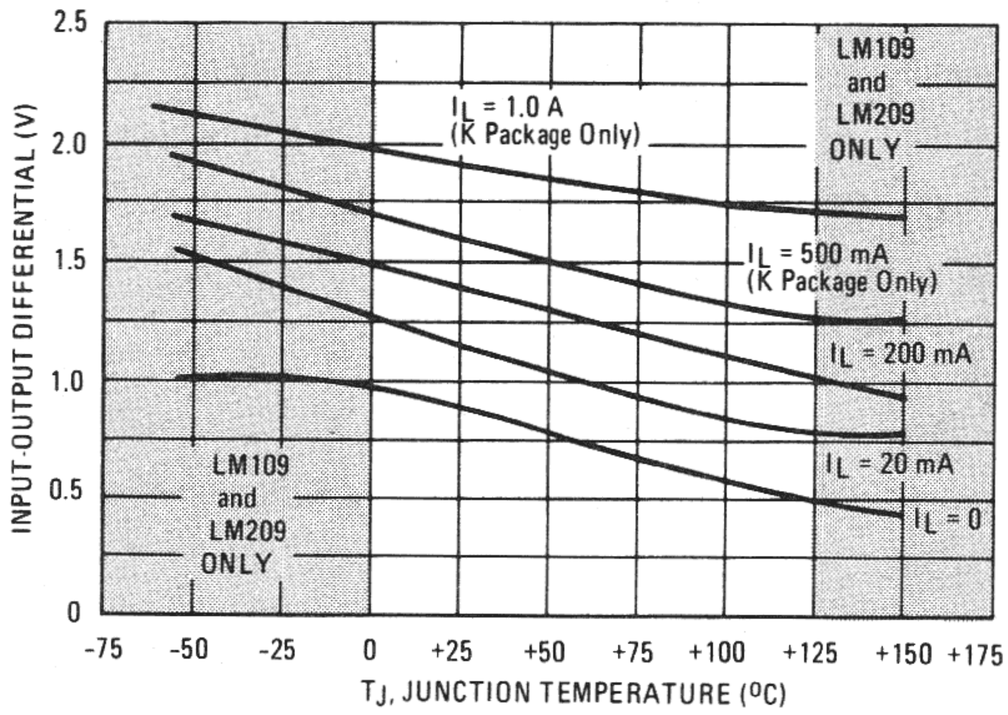
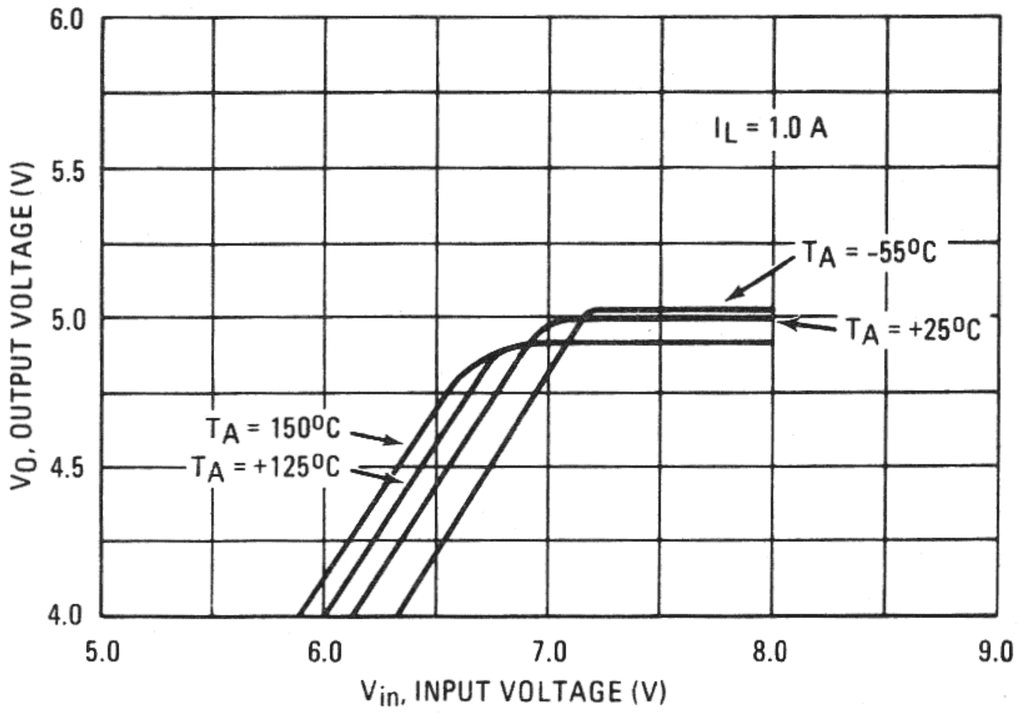


FIGURE 10 – DROPOUT CHARACTERISTIC (K PACKAGE)



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FIGURE 11 – OUTPUT VOLTAGE

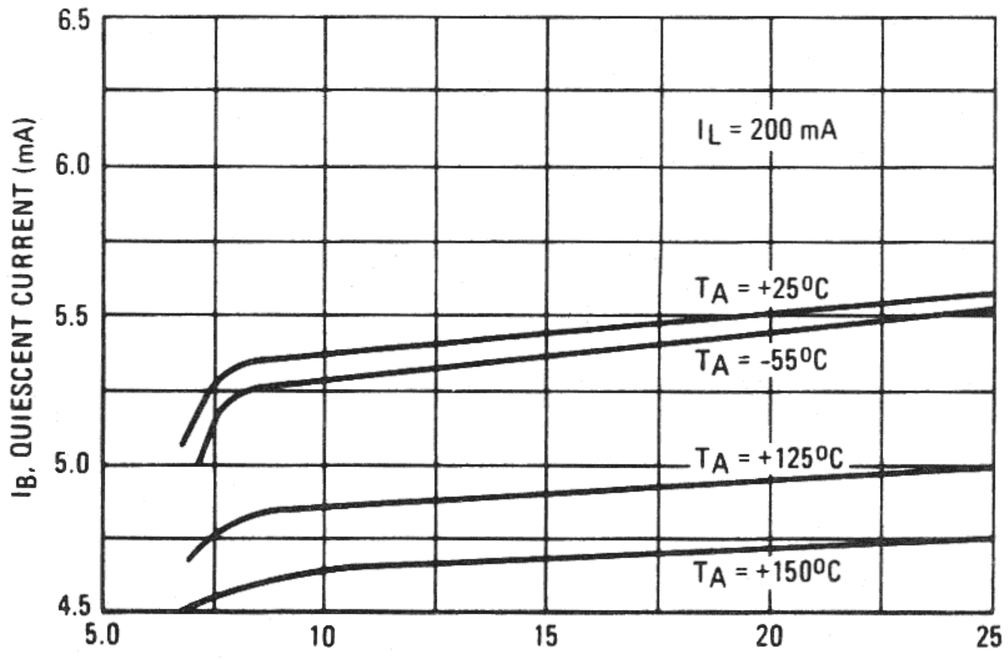


FIGURE 12 – OUTPUT NOISE VOLTAGE

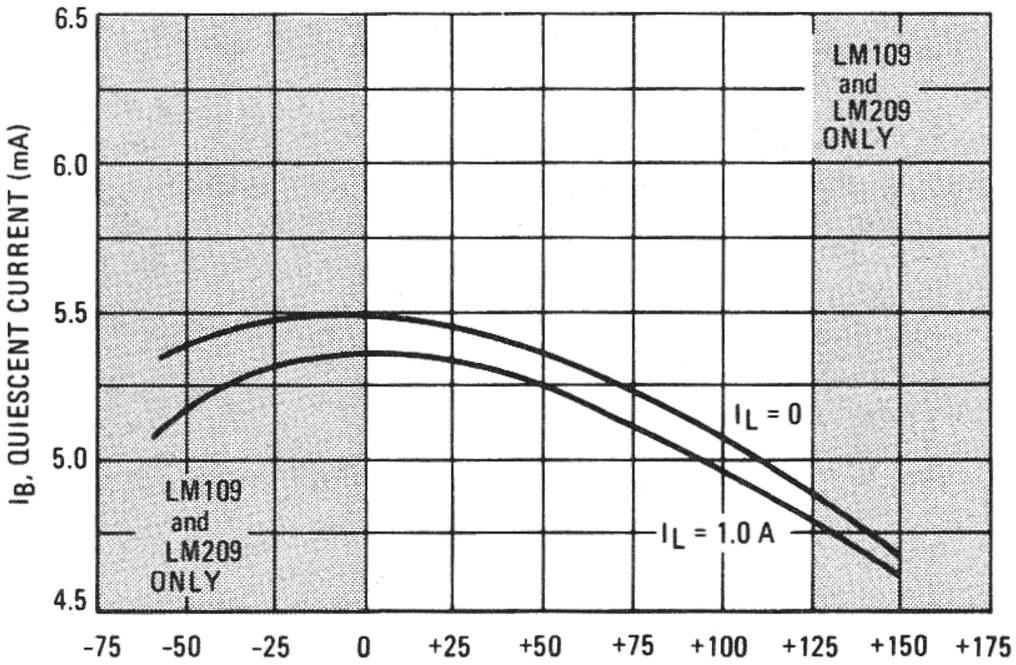


FIGURE 13 – QUIESCENT CURRENT

FIGURE 14 – QUIESCENT CURRENT

TYPICAL APPLICATIONS

FIGURE 15 – ADJUSTABLE OUTPUT REGULATOR

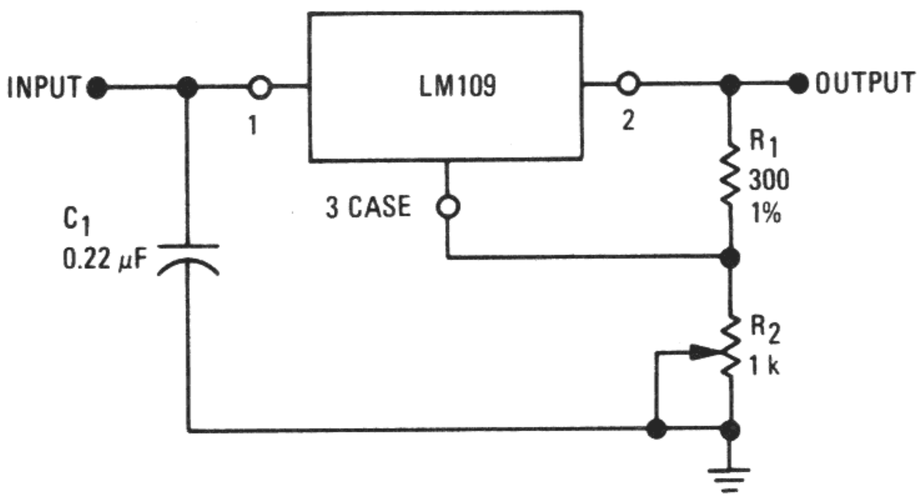
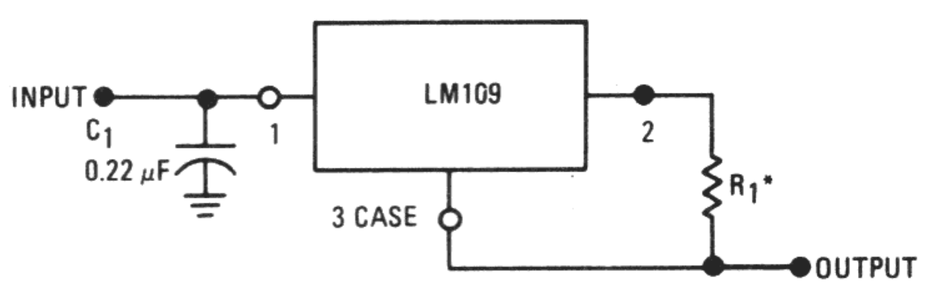


FIGURE 16 – CURRENT REGULATOR



*DETERMINES OUTPUT CURRENT.

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

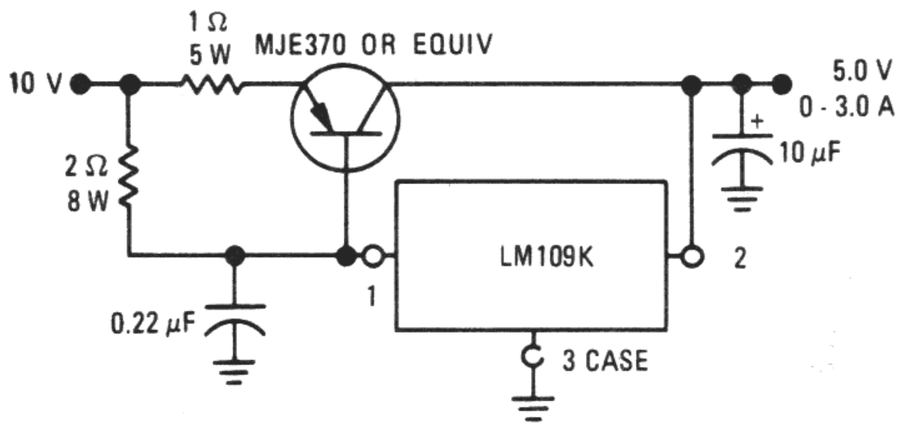
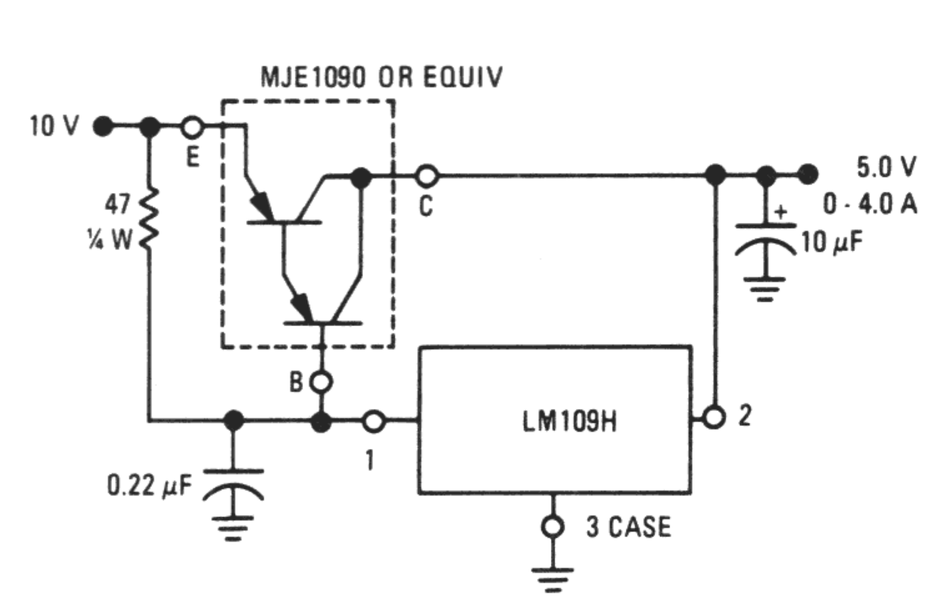


FIGURE 18 – 5.0 VOLT, 4.0-AMPERE TRANSISTOR
(with plastic Darlington boost transistor)



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FIGURE 19 – 5.0-VOLT, 10-AMPERE REGULATOR

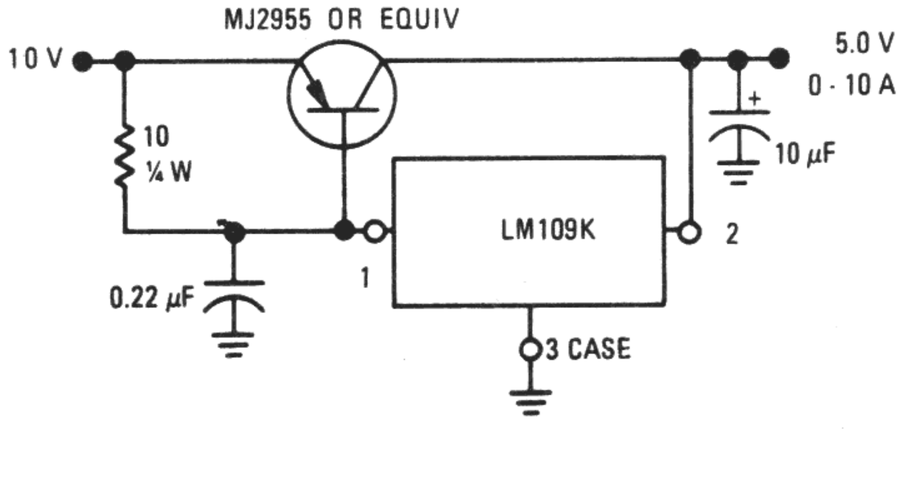


FIGURE 20 – 5.0-VOLT, 10-AMPERE REGULATOR
(with Short-Circuit Current Limiting for
Safe-Area Protection of pass transistors)

