signetics

FIVE-VOLT REGULATORS

LM109
LM309

LINEAR INTEGRATED CIRCUITS

DESCRIPTION

The LM109 and LM309 are complete 5 volt regulators fabricated on a single silicon chip. These regulators are designed for local "on card" regulation to eliminate many of the noise and ground loop problems associated with single-point regulation. They employ internal current limiting, thermal shutdown, and safe-area compensation which makes the circuitry essentially blow-out proof. If adequate heat sinking is provided, the devices can deliver output currents in excess of 200mA from the TO-5 package, and 1A from the TO-3 package. In addition to their use as fixed 5 volt regulators, these devices may be used with external components to obtain adjustable output levels. They may also be used as the power pass element in precision regulators.

FEATURES

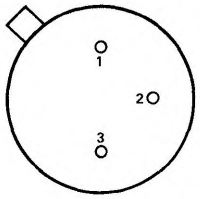
- **OUTPUT CURRENTS IN EXCESS OF 1 amp**
- **INTERNAL THERMAL OVERLOAD PROTECTION**
- **INTERNAL CURRENT LIMITING**
- **NO EXTERNAL COMPONENTS REQUIRED**

ABSOLUTE MAXIMUM RATINGS

Input Voltage	35V
Power Dissipation	Internally Limited
Operating Junction Temperature Range	
LM109	-55°C to 150°C
LM309	0°C to 125°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature (Soldering, 10 sec)	300°C

PIN CONFIGURATIONS

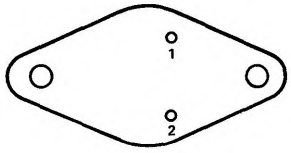
H PACKAGE
(Top View)



1. Input
2. Output
3. Ground

ORDER PART NOS. LM109H/LM309H

K PACKAGE

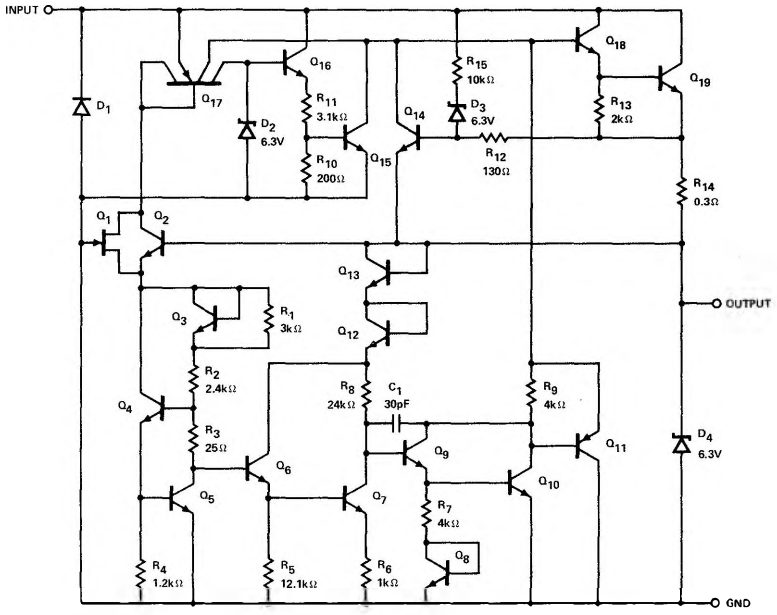


1. Input
2. Output

Case is connected to ground.

ORDER PART NOS. LM109K/LM309K

EQUIVALENT CIRCUIT



ELECTRICAL CHARACTERISTICS (Note 1)

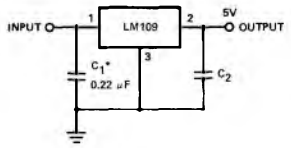
PARAMETER	CONDITIONS	LM109			LM309			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Output Voltage	$T_j = 25°C$	4.7	5.05	5.3	4.8	5.05	5.2	V
Line Regulation	$T_j = 25°C$							
	$7V \leqslant V_{IN} \leqslant 25V$		4	50		4	50	mV
Load Regulation	$T_j = 25°C$							
TO-5	$5mA \leqslant I_{OUT} \leqslant 0.5A$		20	50		20	50	mV
TO-3	$5mA \leqslant I_{OUT} \leqslant 1.5A$		50	100		50	100	mV
Output Voltage	$7V \leqslant V_{IN} \leqslant 25V$							
	$5mA \leqslant I_{OUT} \leqslant I_{max}$							
	$P < P_{max}$	4.6		5.4	4.75		5.25	V
Quiescent Current	$7V \leqslant V_{IN} \leqslant 25V$		5.2	10		5.2	10	mA
Quiescent Current Change	$7V \leqslant V_{IN} \leqslant 25V$			0.5			0.5	mA
	$5mA \leqslant I_{OUT} \leqslant I_{max}$			0.8			0.8	mA
Output Noise Voltage	$T_A = 25°C$							
	$10Hz \leqslant f \leqslant 100\ kHz$		40			40		μV
Long Term Stability				10			20	mV
Thermal Resistance								
Junction to Case (Note 2)								
TO-5			15			15		°C/W
TO-3			3			3		°C/W

NOTES:

1. Unless otherwise specified, these specifications apply for $-55°C \leqslant T_j \leqslant 150°C$ for the 5109 or $0°C \leqslant T_j \leqslant 125°C$ for the 5309, V_{IN} = 10V and I_{OUT} = 0.1A for the TO-5 package or I_{OUT} = 0.5A for the TO-3 package. For the TO-5 package, I_{max} = 0.2A and P_{max} = 2.0W. For the TO-3 package, I_{max} = 1.0A and P_{max} = 20W.
2. Without a heat sink, the thermal resistance of the TO-5 package is about 150°C/W, while that of the TO-3 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 sink.

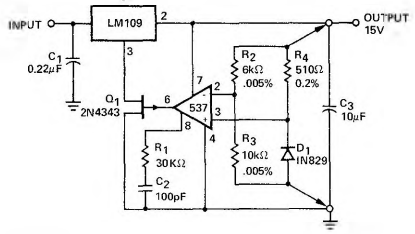
TYPICAL APPLICATIONS

FIXED 5V REGULATOR



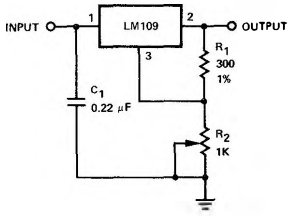
NOTES: *Required if regulator is located an appreciable distance from power supply filter.
†Although no output capacitor is needed for stability, it does improve transient response.

PRECISION VOLTAGE REGULATOR

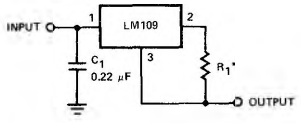


NOTES: *Regulation better than 0.01% load, line and temperature, can be obtained.
†Determines zener current. May be adjusted to minimize thermal drift.
‡Solid tantalum.

ADJUSTABLE OUTPUT REGULATOR



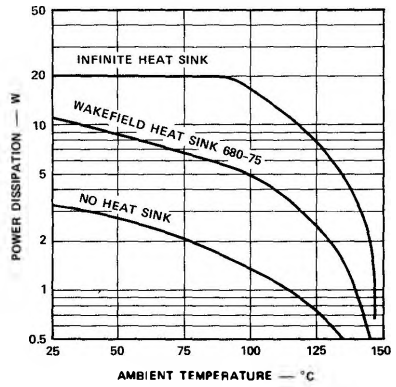
CURRENT REGULATOR



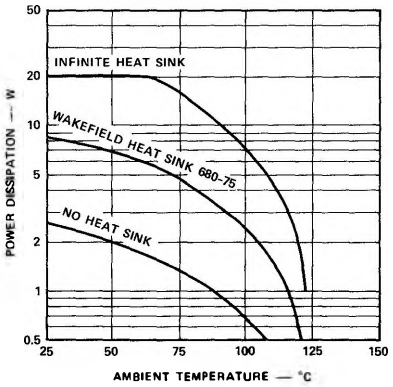
NOTES: *Determines output current.

TYPICAL CHARACTERISTIC CURVES

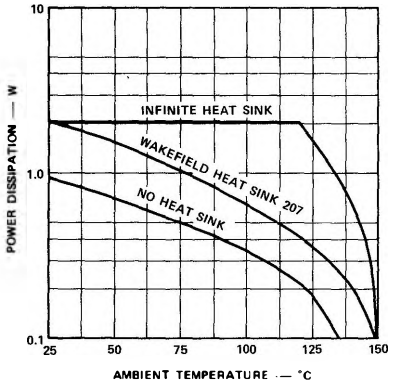
MAXIMUM AVERAGE POWER DISSIPATION LM109 (TO-3)



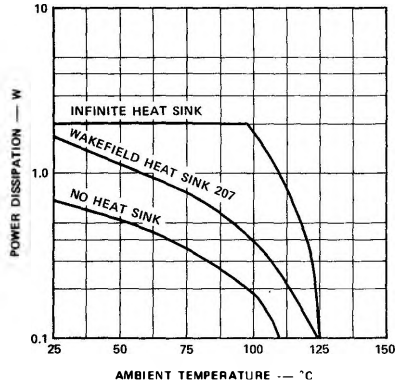
MAXIMUM AVERAGE POWER DISSIPATION LM309 (TO-3)



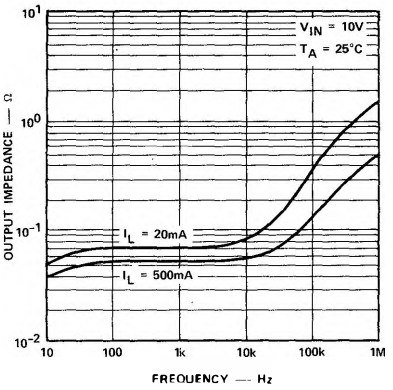
MAXIMUM AVERAGE POWER DISSIPATION LM109 (TO-5)



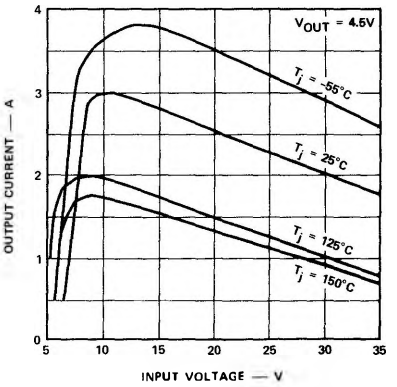
MAXIMUM AVERAGE POWER DISSIPATION LM309 (TO-5)



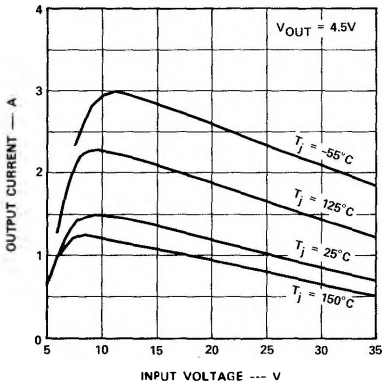
OUTPUT IMPEDANCE



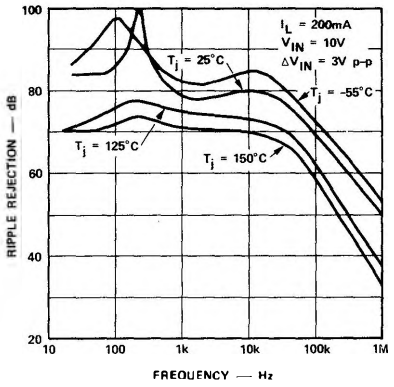
PEAK OUTPUT CURRENT K PACKAGE (TO-3)



PEAK OUTPUT CURRENT H PACKAGE (TO-5)

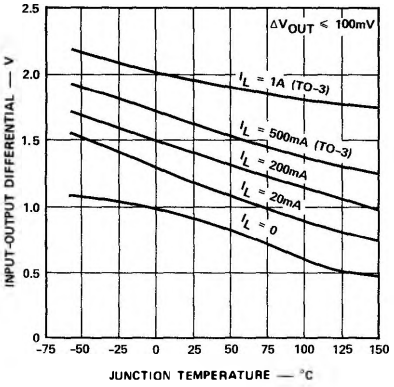


RIPPLE REJECTION

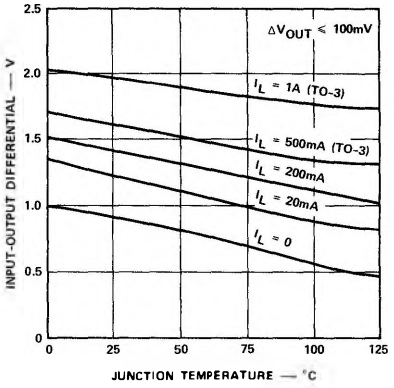


TYPICAL CHARACTERISTIC CURVES (Cont'd.)

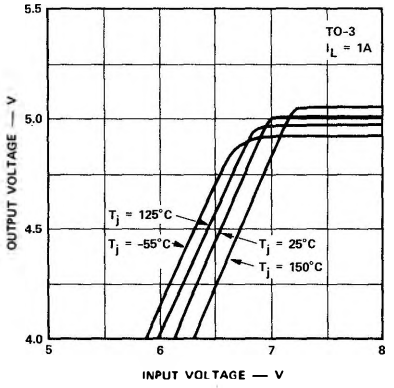
DROPOUT VOLTAGE



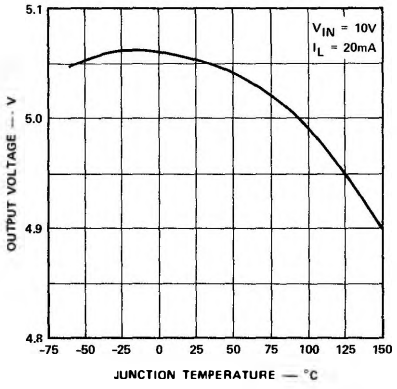
DROPOUT VOLTAGE



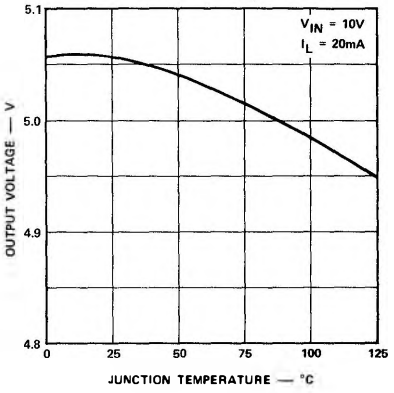
DROPOUT CHARACTERISTIC



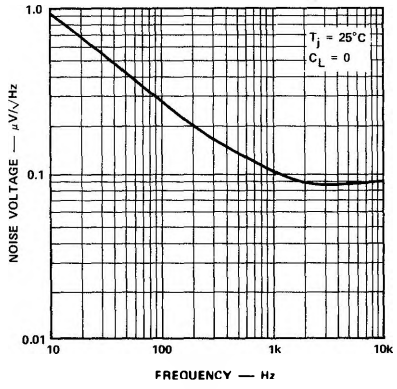
OUTPUT VOLTAGE



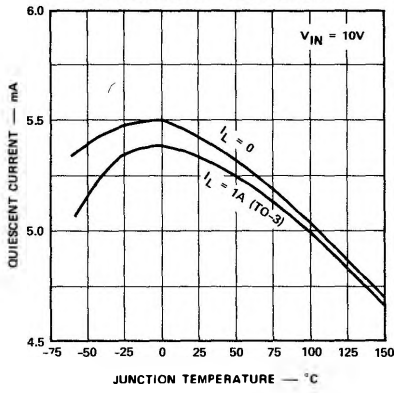
OUTPUT VOLTAGE



OUTPUT NOISE VOLTAGE



QUIESCENT CURRENT



QUIESCENT CURRENT