Voltage Regulators

LM105/LM205/LM305 voltage regulator

general description

The LM105, LM205 and LM305 are positive voltage regulators similar to the LM100, except that an extra gain stage has been added for improved regulation. A redesign of the biasing circuitry removes any minimum load current requirement and at the same time reduces standby current drain, permitting higher voltage operation. They are direct, plug-in replacements for the LM100 in both linear and switching regulator circuits with output voltages greater than 4.5V. Important characteristics of the circuits are:

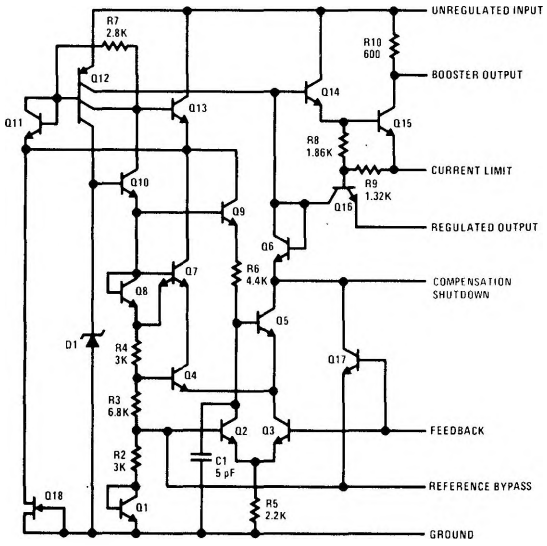
- Output voltage adjustable from 4.5V to 40V
- Output currents in excess of 10A possible by adding external transistors
- Load regulation better than 0.1%, full load with current limiting
- DC line regulation guaranteed at 0.03%/V
- Ripple rejection of 0.01%/V

Like the LM100, they also feature fast response to both load and line transients, freedom from oscillations with varying resistive and reactive loads and the ability to start reliably on any load within rating. The circuits are built on a single silicon chip and are supplied in either an 8-lead, TO-5 header or a 1/4" x 1/4" metal flat package.

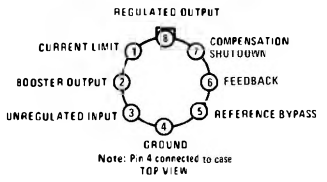
The LM205 is identical to the LM105 except that it is specified for operation from −25°C to 85°C.

The LM305 is specified for operation from 0°C to 70°C and for output voltages to 30V.

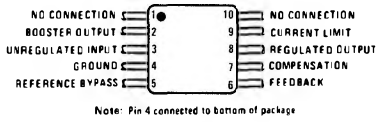
schematic and connection diagrams



Metal Can

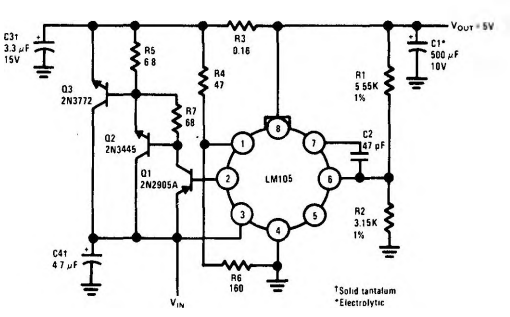


Flat Package

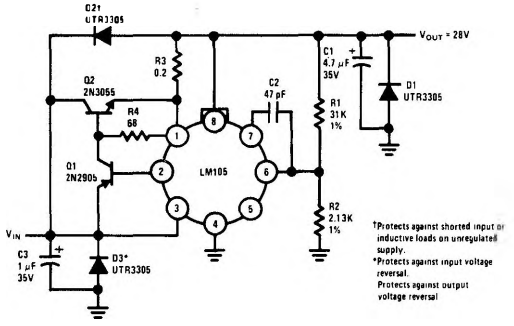


typical applications

10A Regulator with Foldback Current Limiting



1.0A Regulator with Protective Diodes



absolute maximum ratings

Input Voltage	
LM105, LM205	50V
LM305	40V
Input-Output Voltage Differential	40V
Power Dissipation (Note 1)	
LM105, LM205	800 mW
LM305	500 mW
Operating Temperature Range	0°C to 70°C
LM105	-55°C to +85°C
LM205	-25°C to +150°C
LM305	0°C to 70°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature (Soldering, 10 sec)	300°C

electrical characteristics (Note 2)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range					
LM105, LM205		8.5		50	V
LM305		8.5		40	V
Output Voltage Range					
LM105, LM205		4.5		40	V
LM305		4.5		30	V
Output-Input Voltage Differential		3.0		30	V
Load Regulation (Note 3)					
LM105	$0 \leq I_O \leq 12$ mA				
	$R_{SC} = 18\Omega$, $T_A = 25°C$		0.02	0.05	%
	$R_{SC} = 10\Omega$, $T_A = 125°C$		0.03	0.1	%
	$R_{SC} = 18\Omega$, $T_A = -55°C$		0.03	0.1	%
LM205	$0 \leq I_o \leq 12\ \mu A$				
	$R_{SC} = 18\Omega$, $T_A = 25°C$		0.02	0.05	%
	$R_{SC} = 10\Omega$, $T_A = 85°C$		0.03	0.1	%
	$R_{SC} = 18\Omega$, $T_A = -25°C$		0.03	0.1	%
LM305	$0 \leq I_O \leq 12$ mA				
	$R_{SC} = 18\Omega$, $T_A = 25°C$		0.02	0.05	%
	$R_{SC} = 15\Omega$, $T_A = 70°C$		0.03	0.1	%
	$R_{SC} = 18\Omega$, $T_A = 0°C$		0.03	0.0	%
Line Regulation	$V_{IN} - V_{OUT} \leq 5V$		0.025	0.06	%/V
	$V_{IN} - V_{OUT} > 5V$		0.015	0.03	%/V
Ripple Rejection	$C_{REF} = 10\ \mu F$, f = 120 Hz		0.003	0.01	%/V
Temperature Stability					
LM105	$-55°C \leq T_A \leq 125°C$		0.3	1.0	%
LM205	$-25°C \leq T_A \leq 85°C$		0.3	1.0	%
LM305	$0°C \leq T_A \leq 70°C$		0.3	1.0	%
Feedback Sense Voltage		1.63	1.7	1.81	V
Output Noise Voltage	10 Hz ≤ f ≤ 10 kHz				
	$C_{REF} = 0$		0.005		%
	$C_{REF} > 0.1\ \mu F$		0.002		%
Standby Current Drain					
LM105, LM205	$V_{IN} = 40V$		0.8	2.0	mA
LM305	$V_{IN} = 50V$		0.8	2.0	mA
Long Term Stability			0.1	1.0	%

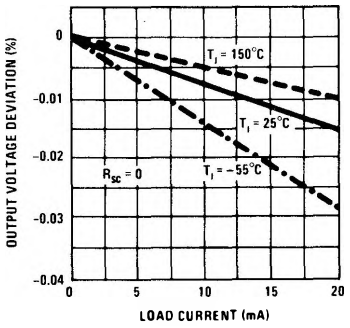
Note 1: The maximum junction temperature of the LM105 is 150°C, while that for the LM205 is 100°C, and that for the LM305 is 85°C. For operating at elevated temperatures, devices in the TO-5 package must be derated based on a thermal resistance of 150°C/W, junction to ambient, or 45°C/W, junction to case. For the flat package, the derating is based on a thermal resistance of 185°C/W when mounted on a 1/16-inch-thick epoxy glass board with ten, 0.03-inch-wide, 2-ounce copper conductors. Peak dissipations to 1W are allowable providing the dissipation rating is not exceeded with the power averaged over a five second interval for the LM105 and LM205, and averaged over a two second interval for the LM305.

Note 2: These specifications apply for input and output voltages within the ranges given, and for a divider impedance seen by the feedback terminal of 2 kΩ, unless otherwise specified. The load and line regulation specifications are for constant junction temperature. Temperature drift effects must be taken into account separately when the unit is operating under conditions of high dissipation. With the LM205, however, all temperature specifications are limited to -25°C to 85°C.

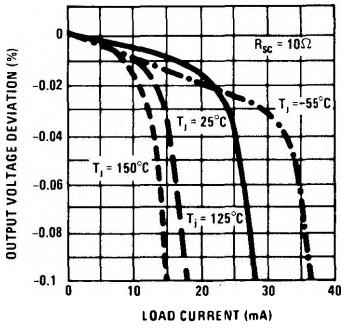
Note 3: The output currents given, as well as the load regulation, can be increased by the addition of external transistors. The improvement factor will be roughly equal to the composite current gain of the added transistors.

typical performance characteristics

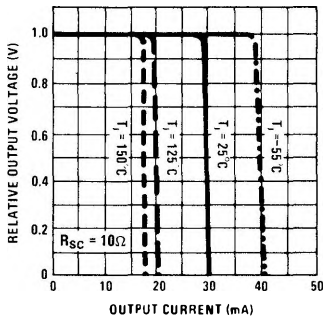
Load Regulation



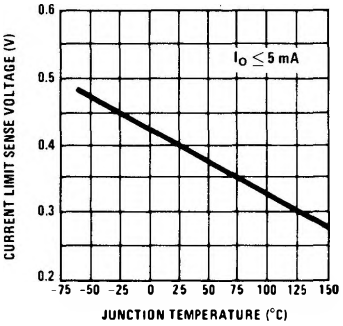
Load Regulation



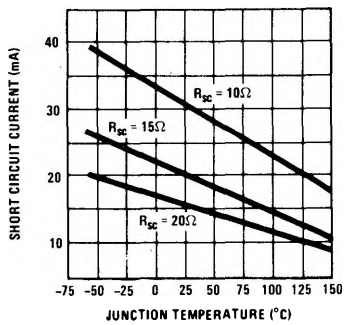
Current Limiting Characteristics



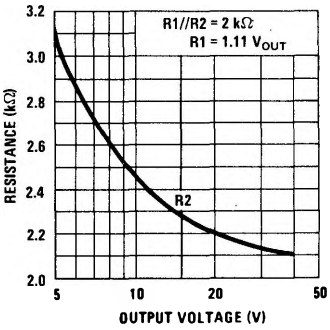
Current Limit Sense Voltage



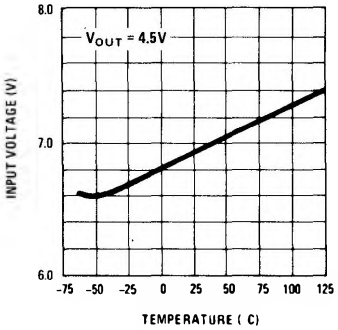
Short Circuit Current



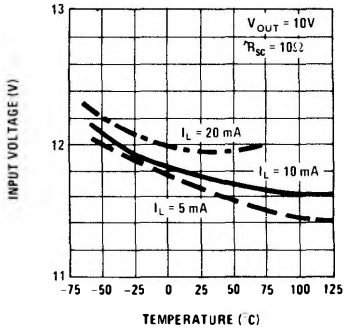
Optimum Divider Resistance Values



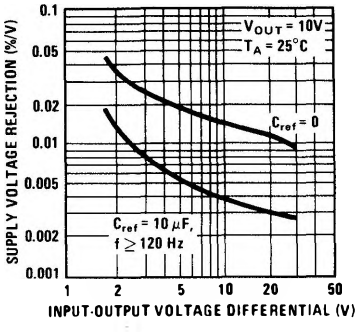
Minimum Input Voltage



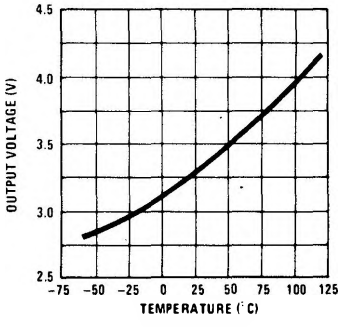
Regulator Dropout Voltage



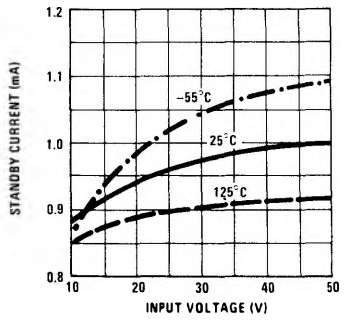
Supply Voltage Rejection



Minimum Output Voltage



Standby Current Drain



Transient Response