Voltage Regulators

LM340 series voltage regulators

general description

The LM340-XX series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation, eliminating the distribution problems associated with single point regulation. The voltages available allow these regulators to be used in logic systems, instrumentation, HiFi, and other solid state electronic equipment. Although designed primarily as fixed voltage regulators these devices can be used with external components to obtain adjustable voltages and currents.

The LM340-XX series is available in two power packages. Both the plastic TO-220 and metal TO-3 packages allow these regulators to deliver over 1.0A if adequate heat sinking is provided. Even with over 1.0A of output current available the regulators are essentially blow-out proof. Current limiting is included to limit the peak output current to a safe value. Safe area protection for the output transistor is provided to limit internal power dissipation. If internal power dissipation becomes too high for the heat sinking provided, the thermal shutdown circuit takes over preventing the IC from overheating.

Considerable effort was expended to make the LM340-XX series of regulators easy to use and minimize the number of external components. It is not necessary to bypass the output, although this does improve transient response. Input bypassing is needed only if the regulator is located far from the filter capacitor of the power supply.

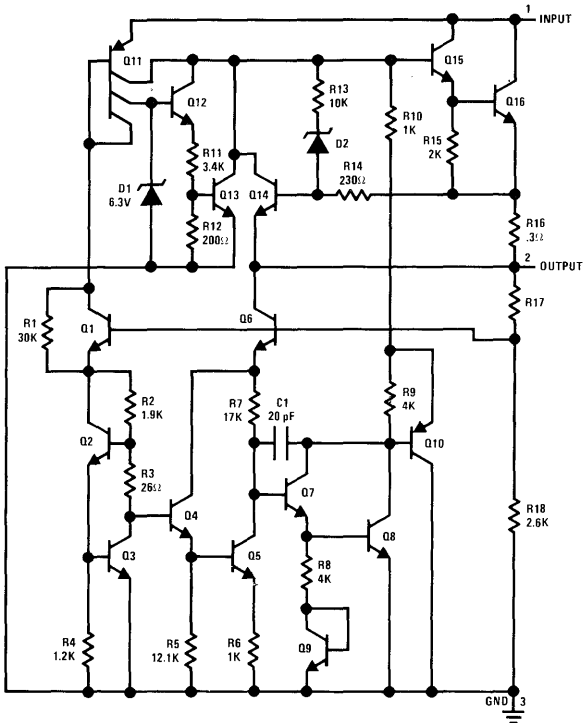
features

- Output current in excess of 1A
- Internal thermal overload protection
- No external components required
- Output transistor safe area protection
- Internal short circuit current limit
- Available in plastic TO-220 and metal TO-3 packages

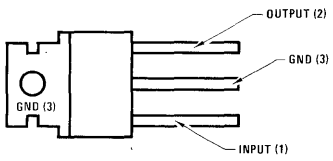
voltage range

LM340-05	5V	LM340-15	15V
LM340-06	6V	LM340-18	18V
LM340-08	8V	LM340-24	24V
LM340-12	12V		

schematic and connection diagrams



TO-220 (T)



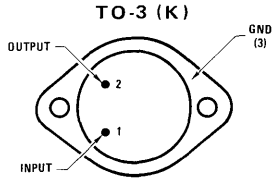
TOP VIEW

Order Numbers:

LM340-05T LM340-15T
LM340-06T LM340-18T
LM340-08T LM340-24T
LM340-12T

See Package 26

TO-3 (K)



BOTTOM VIEW

Order Numbers:

LM340-05K LM340-15K
LM340-06K LM340-18K
LM340-08K LM340-24K
LM340-12K

See Package 18

absolute maximum ratings

Input Voltage (V_O = 5V through 18V)	35V
(V_O = 24V)	40V
Internal Power Dissipation (Note 1)	Internally Limited
Operating Temperature Range	0°C to 70°C
Maximum Junction Temperature	
TO-3 Package	150°C
TO-220 Package	125°C
Storage Temperature Range	−65°C to 150°C
Lead Temperature	
To-3 Package (Soldering, 10 sec)	300°C
TO-220 Package (Soldering, 10 sec)	230°C

electrical characteristics

LM340-05 (V_{IN} = 10V, I_{OUT} = 500 mA, 0°C ≤ T_A ≤ 70°C, unless otherwise specified)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	T_j = 25°C	4.8	5.0	5.2	V
Line Regulation	T_j = 25°C, 7V ≤ V_{IN} ≤ 25V				
	I_{OUT} = 100 mA			50	mV
	I_{OUT} = 500 mA			100	mV
Load Regulation	T_j = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5A			100	mV
Output Voltage	7V ≤ V_{IN} ≤ 20V, 5 mA ≤ I_{OUT} ≤ 1.0A, P_D ≤ 15W	4.75		5.25	V
Quiescent Current	T_j = 25°C		6.0	10	mA
Quiescent Current Change	7V ≤ V_{IN} ≤ 25V			1.3	mA
	5 mA ≤ I_{OUT} ≤ 1.5A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		40		μV
Long Term Stability				20	mV
Ripple Rejection	I_{OUT} = 20 mA, f = 120 Hz		70		dB
Dropout Voltage	T_j = 25°C, I_{OUT} = 1.0A		2.0		V

LM340-06 (V_{IN} = 11V, I_{OUT} = 500 mA, 0°C ≤ T_A ≤ 70°C, unless otherwise specified)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	T_j = 25°C	5.75	6.0	6.25	V
Line Regulation	T_j = 25°C, 8V ≤ V_{IN} ≤ 25V				
	I_{OUT} = 100 mA			60	mV
	I_{OUT} = 500 mA			120	mV
Load Regulation	T_j = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5A			120	mV
Output Voltage	8V ≤ V_{IN} ≤ 21V, 5 mA ≤ I_{OUT} ≤ 1.0A, P_D ≤ 15W	5.7		6.3	V
Quiescent Current	T_j = 25°C		6.0	10	mA
Quiescent Current Change	8V ≤ V_{IN} ≤ 25V			1.3	mA
	5 mA ≤ I_{OUT} ≤ 1.5A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		45		μV
Long Term Stability				24	mV
Ripple Rejection	I_{OUT} = 20 mA, f = 120 Hz		65		dB
Dropout Voltage	T_j = 25°C, I_{OUT} = 1.0A		2.0		V

Note 1: Thermal resistance without a heat sink for junction to case temperature is 4.0°C/W for the TO-3 package and 2.0°C/W for the TO-220 package. Thermal resistance for case to ambient temperature is 35°C/W for the TO-3 package and 50°C/W for the TO-220 package.

electrical characteristics (con't)

LM340-08 (V_{IN} = 14V, I_{OUT} = 500 mA, 0°C ≤ T_A ≤ 70°C, unless otherwise specified)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	T_j = 25°C	7.7	8.0	8.3	V
Line Regulation	T_j = 25°C, 10.5V ≤ V_{IN} ≤ 25V				
	I_{OUT} = 100 mA			80	mV
	I_{OUT} = 500 mA			160	mV
Load Regulation	T_j = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5A			160	mV
Output Voltage	10.5V ≤ V_{IN} ≤ 23V, 5 mA ≤ I_{OUT} ≤ 1.0A, P_D ≤ 15W	7.6		8.4	V
Quiescent Current	T_j = 25°C		6.0	10	mA
Quiescent Current Change	10.5V ≤ V_{IN} ≤ 25V			1.0	mA
	5 mA ≤ I_{OUT} ≤ 1.5A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		52		μV
Long Term Stability				32	mV
Ripple Rejection	I_{OUT} = 20 mA, f = 120 Hz		62		dB
Dropout Voltage	T_j = 25°C, I_{OUT} = 1.0A		2.0		V

LM340-12 (V_{IN} = 19V, I_{OUT} = 500 mA, 0°C ≤ T_A ≤ 70°C, unless otherwise specified)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	T_j = 25°C	11.5	12.0	12.5	V
Line Regulation	T_j = 25°C, 14.5V ≤ V_{IN} ≤ 30V				
	I_{OUT} = 100 mA			120	mV
	I_{OUT} = 500 mA			240	mV
Load Regulation	T_j = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5A			240	mV
Output Voltage	14.5V ≤ V_{IN} ≤ 27V, 5 mA ≤ I_{OUT} ≤ 1.0A, P_D ≤ 15W	11.4		12.6	V
Quiescent Current	T_j = 25°C		6.0	10	mA
Quiescent Current Change	14.5V ≤ V_{IN} ≤ 30V			1.0	mA
	5 mA ≤ I_{OUT} ≤ 1.5A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		75		μV
Long Term Stability				48	mV
Ripple Rejection	I_{OUT} = 20 mA, f = 120 Hz		61		dB
Dropout Voltage	T_j = 25°C, I_{OUT} = 1.0A		2.0		V

LM340-15 (V_{IN} = 23V, I_{OUT} = 500 mA, 0°C ≤ T_A ≤ 70°C, unless otherwise specified)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	T_j = 25°C	14.4	15.0	15.6	V
Line Regulation	T_j = 25°C, 17.5V ≤ V_{IN} ≤ 30V				
	I_{OUT} = 100 mA			150	mV
	I_{OUT} = 500 mA			300	mV
Load Regulation	T_j = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5A			300	mV
Output Voltage	17.5V ≤ V_{IN} ≤ 30V, 5 mA ≤ I_{OUT} ≤ 1.0A, P_D ≤ 15W	14.25		15.75	V
Quiescent Current	T_j = 25°C		6.0	10	mA
Quiescent Current Change	17.5V ≤ V_{IN} ≤ 30V			1.0	mA
	5 mA ≤ I_{OUT} ≤ 1.5A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		90		μV
Long Term Stability				60	mV
Ripple Rejection	I_{OUT} = 20 mA, f = 120 Hz		60		dB
Dropout Voltage	T_j = 25°C, I_{OUT} = 1.0A		2.0		V

electrical characteristics (con't)

LM340-18 (V_{IN} = 27V, I_{OUT} = 500 mA, 0°C ≤ T_A ≤ 70°C, unless otherwise specified)

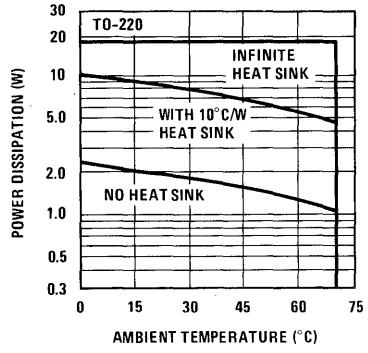
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	T_j = 25°C	17.3	18.0	18.7	V
Line Regulation	T_j = 25°C, 21V ≤ V_{IN} ≤ 33V				
	I_{OUT} = 100 mA			180	mV
	I_{OUT} = 500 mA			360	mV
Load Regulation	T_j = 25°C, 5 mA ≤ I_{OUT} ≤ 1.0A			360	mV
Output Voltage	21V ≤ V_{IN} ≤ 33V, 5 mA ≤ I_{OUT} ≤ 1.0A, P_D ≤ 15W	17.1		18.9	V
Quiescent Current	T_j = 25°C		6.0	10	mA
Quiescent Current Change	21V ≤ V_{IN} ≤ 33V			1.0	mA
	5 mA ≤ I_{OUT} ≤ 1.0A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		110		μV
Long Term Stability				72	mV
Ripple Rejection	I_{OUT} = 20 mA, f = 120 Hz		59		dB
Dropout Voltage	T_j = 25°C, I_{OUT} = 1.0A		2.0		V

LM340-24 (V_{IN} = 33V, I_{OUT} = 500 mA, 0°C ≤ T_A ≤ 70°C, unless otherwise specified)

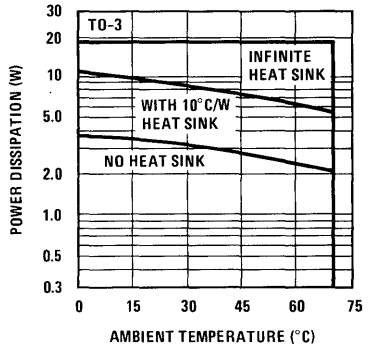
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	T_j = 25°C	23.0	24.0	25.0	V
Line Regulation	T_j = 25°C, 27V ≤ V_{IN} ≤ 38V				
	I_{OUT} = 100 mA			240	mV
	I_{OUT} = 500 mA			480	mV
Load Regulation	T_j = 25°C, 5 mA ≤ I_{OUT} ≤ 1.0A			480	mV
Output Voltage	27V < V_{IN} < 38V, 5 mA ≤ I_{OUT} ≤ 1.0A, P_D ≤ 15W	22.8		25.2	V
Quiescent Current	T_j = 25°C		6.0	10	mA
Quiescent Current Change	27V ≤ V_{IN} ≤ 38V			1.0	mA
	5 mA ≤ I_{OUT} ≤ 1.0A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		170		μV
Long Term Stability				96	mV
Ripple Rejection	I_{OUT} = 20 mA, f = 120 Hz		56		dB
Dropout Voltage	T_j = 25°C, I_{OUT} = 1.0A		2.0		V

typical performance characteristics

Maximum Average Power Dissipation

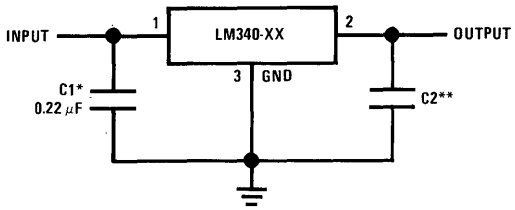


Maximum Average Power Dissipation



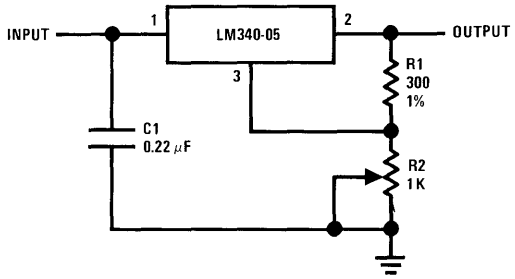
typical applications

Fixed Output Regulator



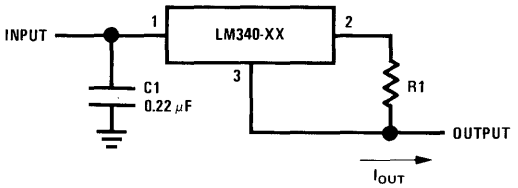
*Required if the regulator is located far from the power supply filter.
**Although no output capacitor is needed for stability, it does help transient response.
(If needed use 0.1 μF, ceramic, disc.)

Adjustable Output Regulator



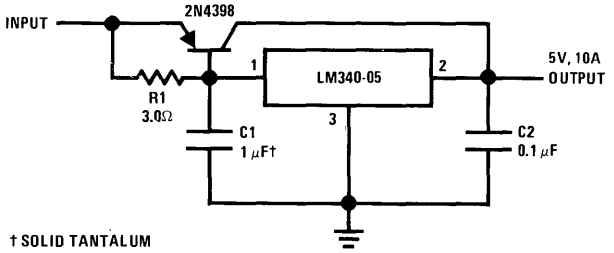
$V_{OUT} = 5V + (16.7\ mA + I_Q)\ R_2$
$\Delta I_Q = 1.5$ mA over line and load changes

Current Regulator



$I_{OUT} = \frac{V_{2\text{-}3}}{R_1} + I_Q$
$\Delta I_Q = 1.5$ mA over line and load changes

High Current Voltage Regulator



† SOLID TANTALUM

$T_A = 25°C$
@ V_{IN} 10V, $0A \leq I_L \leq 10A$
Load Regulation = 2 mV
@ I_L = 10A, $9V \leq V_{IN} \leq 12V$
Line Regulation = 20 mV