

8961724 TEXAS INSTR (LIN/INTFC)

55C 34533 D

T-58-11-13

**LINEAR
INTEGRATED
CIRCUITS****SERIES LM340
POSITIVE-VOLTAGE REGULATORS**

D2332, SEPTEMBER 1977—REVISED MARCH 1983

- 3-Terminal Regulators
- Output Current up to 1.5 A
- No External Components
- Internal Thermal Overload
- High Power Dissipation Capability
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Compensation
- Output Load Regulation . . . 0.3% Typ
- Direct Replacements for National LM340 Series

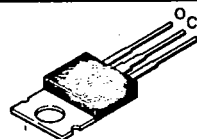
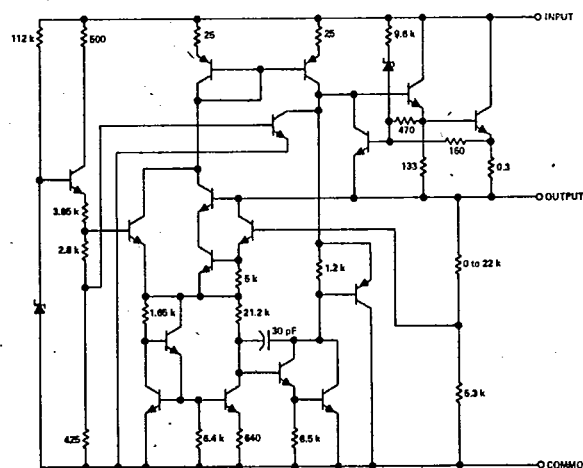
NOMINAL OUTPUT VOLTAGE	REGULATOR
5 V	LM340-5
12 V	LM340-12
15 V	LM340-15

description

This series of fixed-voltage monolithic integrated-circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. Any of these regulators can deliver up to 1.5 amperes of output current. The internal current limiting and thermal shutdown features of these regulators make them essentially immune to overload. In addition to use as fixed-voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents and also as the power-pass element in precision regulators.

KC PACKAGE**(TOP VIEW)**

THE COMMON TERMINAL IS IN
ELECTRICAL CONTACT WITH
THE MOUNTING BASE
TO-220AB

**schematic**

Resistor values shown are nominal and in ohms.

Copyright © 1983 by Texas Instruments Incorporated

8961724 TEXAS INSTR (LIN/INTFC)

55C 34534 D

T-58-11-13

SERIES LM340 POSITIVE-VOLTAGE REGULATORS

absolute maximum ratings over operating temperature range (unless otherwise noted)

Input voltage	35 V
Continuous total dissipation at 25°C free-air temperature (see Note 1)	2 W
Continuous total dissipation at (or below) 25°C case temperature (see Note 1)	16 W
Operating free-air, case, or virtual junction temperature range	-55°C to 150°C
Storage temperature range	-65°C to 150°C
Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds	260°C

NOTE 1: For operation above 25°C free-air or case temperature, refer to Figures 1 and 2. To avoid exceeding the design maximum virtual junction temperature, these ratings should not be exceeded. Due to variations in individual device electrical characteristics and thermal resistance, the built-in thermal overload protection may be activated at power levels slightly above or below the rated dissipation.

Voltage Regulators

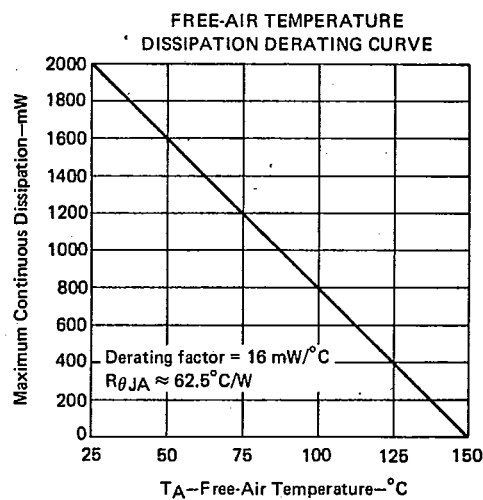


FIGURE 1

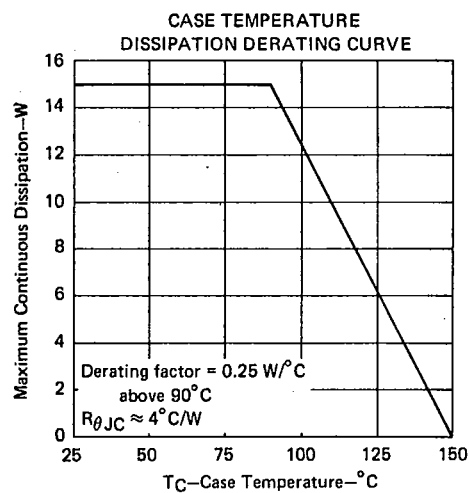


FIGURE 2

recommended operating conditions

		MIN	MAX	UNIT
Input voltage, V_I	LM340-5	7	25	V
	LM340-12	14.5	30	
	LM340-15	17.5	30	
Output current, I_O			1.5	A
Operating virtual junction temperature, T_J		0	125	°C

8961724 TEXAS INSTR (LIN/INTFC)

55C 34535 D

T-58-11-13

SERIES LM340
POSITIVE-VOLTAGE REGULATORS

LM340-5 electrical characteristics at specified virtual junction temperature, $V_I = 10\text{ V}$, $I_O = 1\text{ A}$
(unless otherwise noted)

PARAMETER	TEST CONDITIONS†			MIN	TYP	MAX	UNIT
Output voltage	$I_O = 5\text{ mA to }1\text{ A}$		25°C	4.8	5	5.2	V
	$V_I = 7\text{ V to }20\text{ V}$, $I_O = 5\text{ mA to }1\text{ A}$, $P \leq 15\text{ W}$		0°C to 125°C	4.75		5.25	
Input regulation	$I_O = 500\text{ mA}$	$V_I = 7\text{ V to }25\text{ V}$	25°C		3	50	mV
		$V_I = 8\text{ V to }20\text{ V}$	0°C to 125°C			50	
	$I_O = 1\text{ A}$	$V_I = 7.3\text{ V to }20\text{ V}$	25°C			50	
		$V_I = 8\text{ V to }12\text{ V}$	0°C to 125°C			25	
Ripple rejection	$V_I = 8\text{ V to }18\text{ V}$, $f = 120\text{ Hz}$	$I_O \leq 1\text{ A}$	25°C	62	80		dB
		$I_O \leq 500\text{ mA}$	0°C to 125°C	62			
Output regulation	$I_O = 250\text{ mA to }750\text{ mA}$		25°C			25	mV
	$I_O = 5\text{ mA to }1.5\text{ A}$				10	50	
	$I_O = 5\text{ mA to }1\text{ A}$		0°C to 125°C			50	
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$		25°C		40		μV
Dropout voltage	$I_O = 1\text{ A}$		25°C		2		V
Temperature coefficient of output voltage	$I_O = 5\text{ mA}$		0°C to 125°C		-0.6		mV/°C
Output impedance	$f = 1\text{ kHz}$		25°C		8		mΩ
Bias current	$I_O \leq 1\text{ A}$		25°C			8	mA
			0°C to 125°C			8.5	
Bias current change	$V_I = 7.5\text{ V to }20\text{ V}$, $I_O \leq 1\text{ A}$		25°C			1	mA
	$V_I = 7\text{ V to }25\text{ V}$, $I_O \leq 500\text{ mA}$		0°C to 125°C			1	
	$I_O = 5\text{ mA to }1\text{ A}$					0.5	
Peak output current			25°C		2.4		A
Short-circuit current			25°C		2.1		A

† All characteristics are measured with a capacitor across the input of 0.22 μF and a capacitor across the output of 0.1 μF. All characteristics except noise voltage rejection ratio are measured using pulse techniques ($t_W \leq 10\text{ ms}$, duty cycle $\leq 5\%$). Output voltage changes due to changes in internal temperature must be taken into account separately.

Voltage Regulators



8961724 TEXAS INSTR (LIN/INTFC)

55C 34536 D

T-58-11-13

SERIES LM340 **POSITIVE-VOLTAGE REGULATORS**

LM340-12 electrical characteristics at specified virtual junction temperature, $V_I = 19\text{ V}$, $I_O = 1\text{ A}$
(unless otherwise noted)

PARAMETER	TEST CONDITIONS†		MIN	TYP	MAX	UNIT
Output voltage	$I_O = 5\text{ mA to }1\text{ A}$	25°C	11.5	12	12.5	V
	$V_I = 14.5\text{ V to }27\text{ V}$, $I_O = 5\text{ mA to }1\text{ A}$, $P \leq 15\text{ W}$	$0^\circ\text{C to }125^\circ\text{C}$	11.4		12.6	
Input regulation	$I_O = 500\text{ mA}$	$V_I = 14.5\text{ V to }30\text{ V}$		4	120	mV
		$V_I = 15\text{ V to }27\text{ V}$			120	
	$I_O = 1\text{ A}$	$V_I = 14.5\text{ V to }27\text{ V}$			120	
		$V_I = 16\text{ V to }22\text{ V}$			120	
Ripple rejection	$V_I = 15\text{ V to }25\text{ V}$, $f = 120\text{ Hz}$	$I_O \leq 1\text{ A}$	55	72		dB
		$I_O \leq 500\text{ mA}$	55			
Output regulation	$I_O = 250\text{ mA to }750\text{ mA}$	25°C			60	mV
	$I_O = 5\text{ mA to }1.5\text{ A}$			12	120	
	$I_O = 5\text{ mA to }1\text{ A}$	$0^\circ\text{C to }125^\circ\text{C}$			120	
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$	25°C		75		μV
Dropout voltage	$I_O = 1\text{ A}$	25°C		2		V
Temperature coefficient of output voltage	$I_O = 5\text{ mA}$	$0^\circ\text{C to }125^\circ\text{C}$		-1.5		$\text{mV}/^\circ\text{C}$
Output impedance	$f = 1\text{ kHz}$	25°C		18		$\text{m}\Omega$
Bias current	$I_O \leq 1\text{ A}$	25°C			8	mA
		$0^\circ\text{C to }125^\circ\text{C}$			8.5	
Bias current change	$V_I = 14.8\text{ V to }27\text{ V}$, $I_O \leq 1\text{ A}$	25°C			1	mA
	$V_I = 14.5\text{ V to }30\text{ V}$, $I_O \leq 500\text{ mA}$				1	
	$I_O = 5\text{ mA to }1\text{ A}$	$0^\circ\text{C to }125^\circ\text{C}$			0.5	
Peak output current		25°C		2.4		A
Short-circuit current		25°C		1.5		A

† All characteristics are measured with a capacitor across the input of $0.22\text{ }\mu\text{F}$ and a capacitor across the output of $0.1\text{ }\mu\text{F}$. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ($t_w \leq 10\text{ ms}$, duty cycle $\leq 5\%$). Output voltage changes due to changes in internal temperature must be taken into account separately.

Voltage Regulators



8961724 TEXAS INSTR (LIN/INTFC)

55C 34537 D

T-58-11-13

SERIES LM340
POSITIVE-VOLTAGE REGULATORS

LM340-15 electrical characteristics at specified virtual junction temperature, $V_I = 23$ V, $I_O = 1$ A
 (unless otherwise noted)

PARAMETER	TEST CONDITIONS†		MIN	TYP	MAX	UNIT
Output voltage	$I_O = 5$ mA to 1 A	25°C	14.4	15	15.6	V
	$V_I = 17.5$ V to 30 V, $I_O = 5$ mA to 1 A, $P \leq 15$ W	0°C to 125°C	14.25		15.75	
Input regulation	$I_O = 500$ mA	$V_I = 17.5$ V to 30 V	25°C	4	150	mV
		$V_I = 18.5$ V to 30 V	0°C to 125°C		150	
	$I_O = 1$ A	$V_I = 17.7$ V to 30 V	25°C		150	
		$V_I = 20$ V to 26 V	0°C to 125°C		75	
Ripple rejection	$V_I = 18.5$ V to 28.5 V, $f = 120$ Hz	$I_O \leq 1$ A	25°C	54	70	dB
		$I_O \leq 500$ mA	0°C to 125°C	54		
Output regulation	$I_O = 250$ mA to 750 mA	25°C			75	mV
	$I_O = 5$ mA to 1.5 A			12	150	
	$I_O = 5$ mA to 1 A	0°C to 125°C			150	
Output noise voltage	$f = 10$ Hz to 100 kHz	25°C		90		μV
Dropout voltage	$I_O = 1$ A	25°C		2		V
Temperature coefficient of output voltage	$I_O = 5$ mA	0°C to 125°C		-1.8		mV/°C
Output impedance	$f = 1$ kHz	25°C		19		mΩ
Bias current	$I_O \leq 1$ A	25°C			8	mA
		0°C to 125°C			8.5	
Bias current change	$V_I = 17.9$ V to 30 V, $I_O \leq 1$ A	25°C			1	mA
	$V_I = 17.5$ V to 30 V, $I_O \leq 500$ mA	0°C to 125°C			1	
	$I_O = 5$ mA to 1 A				0.5	
Peak output current		25°C		2.4		A
Short-circuit current		25°C		1.2		A

† All characteristics are measured with a capacitor across the input of 0.22 μF and a capacitor across the output of 0.1 μF. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ($t_w \leq 10$ ms, duty cycle $\leq 5\%$). Output voltage changes due to changes in internal temperature must be taken into account separately.

Voltage Regulators

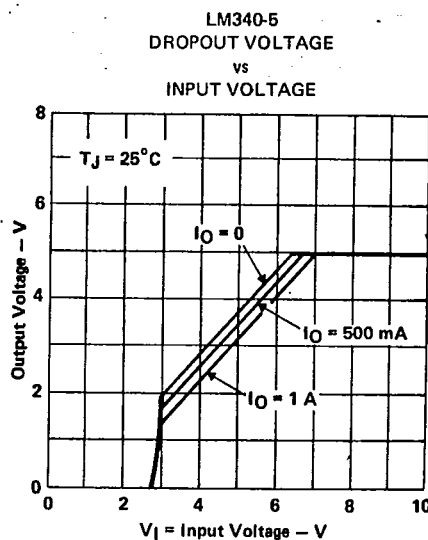
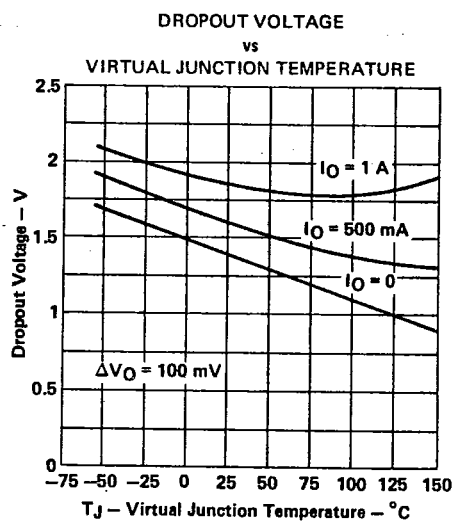
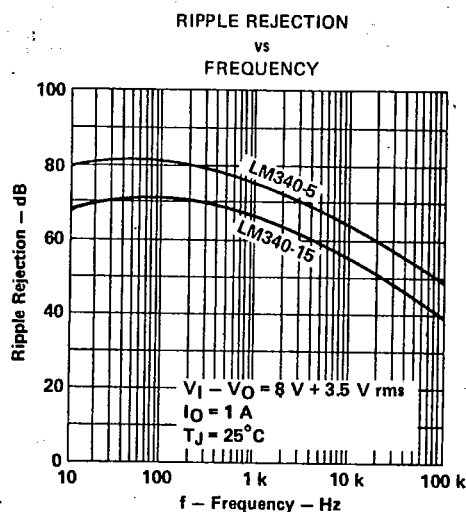
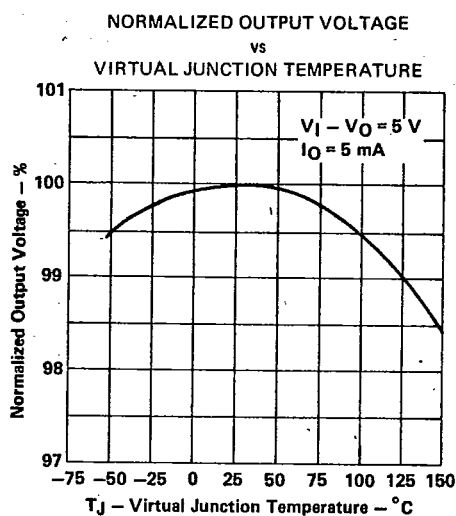
8961724 TEXAS INSTR (LIN/INTFC)

55C 34538 D

T-58-11-13

SERIES LM340 POSITIVE-VOLTAGE REGULATORS

TYPICAL CHARACTERISTICS



Voltage Regulators

8961724 TEXAS INSTR (LIN/INTFC)

55C 34539 D

T-58-11-13

SERIES LM340 POSITIVE-VOLTAGE REGULATORS

TYPICAL CHARACTERISTICS

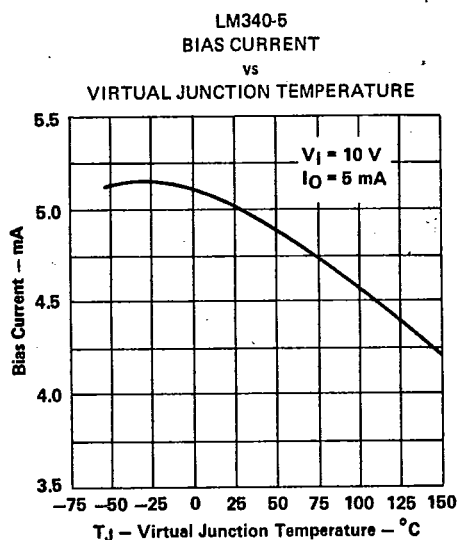


FIGURE 7

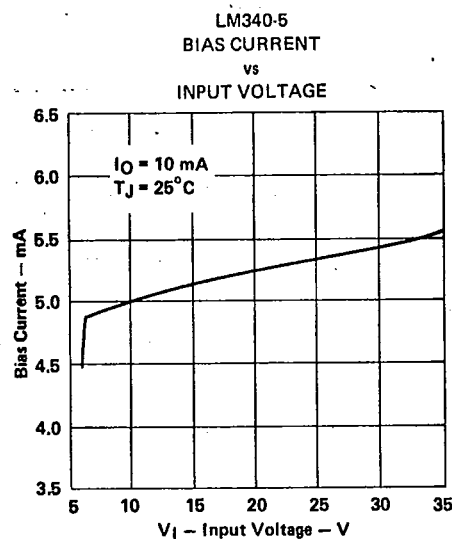


FIGURE 8

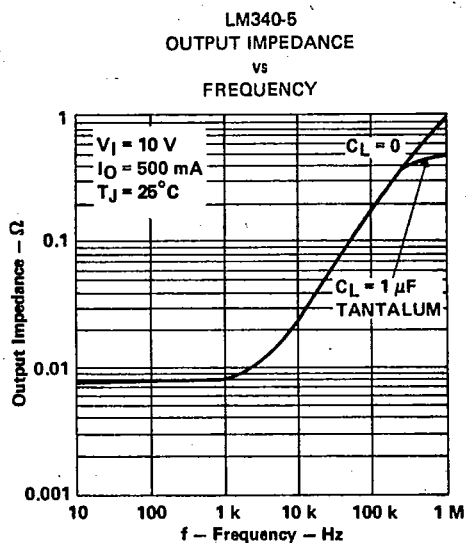


FIGURE 9

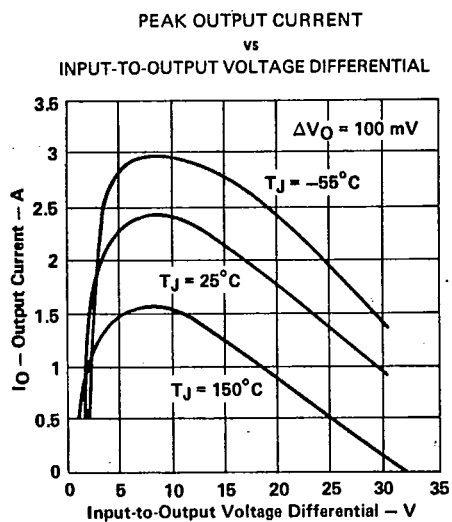


FIGURE 10

Voltage Regulators

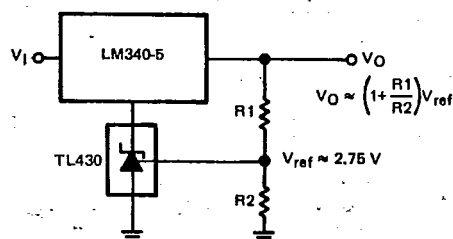
8961724 TEXAS INSTR (LIN/INTFC)

55C 34540 D

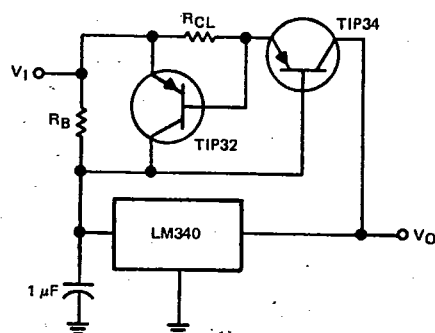
T-58-11-13

SERIES LM340 POSITIVE-VOLTAGE REGULATORS

TYPICAL APPLICATION DATA



**FIGURE 11—ADJUSTABLE SUPPLY WITH STABLE
OUTPUT FROM 8 VOLTS TO 35 VOLTS**



The boost circuit takes over at a level determined by R_B .

$$R_B \approx \frac{0.6 \text{ V}}{I_B}$$

where I_B is the LM340 operating level.

Maximum current limit I_{CL} is determined by R_{CL} .

$$R_{CL} \approx \frac{0.6 \text{ V}}{I_{CL}}$$

Example: If I_B is selected to be

0.5 A, then

$R_B = 1.2 \Omega$.

If I_{CL} is 3 A, then

$R_{CL} = 0.2 \Omega$.

FIGURE 12—OUTPUT CURRENT BOOST CIRCUIT

Voltage Regulators

