National Semiconductor

LM120/LM320
Series 3-Terminal Negative Regulators

General Description

The LM120 series are three-terminal negative regulators with a fixed output voltage of −5V, −12V, and −15V, and up to 1.5A load current capability. Where other voltages are required, the LM137 and LM137HV series provide an output voltage range of −1.2V to −47V.

The LM120 need only one external component—a compensation capacitor at the output, making them easy to apply. Worst case guarantees on output voltage deviation due to any combination of line, load or temperature variation assure satisfactory system operation.

Exceptional effort has been made to make the LM120 Series immune to overload conditions. The regulators have current limiting which is independent of temperature, combined with thermal overload protection. Internal current limiting protects against momentary faults while thermal shutdown prevents junction temperatures from exceeding safe limits during prolonged overloads.

Although primarily intended for fixed output voltage applications, the LM120 Series may be programmed for higher output voltages with a simple resistive divider. The low quiescent drain current of the devices allows this technique to be used with good regulation.

Features

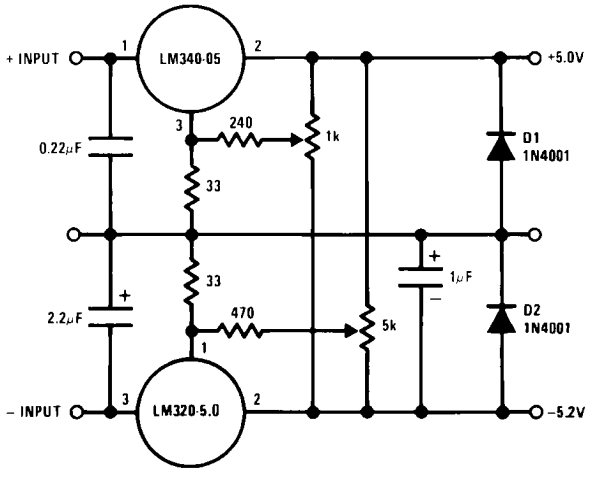
- Preset output voltage error less than ±3%
- Preset current limit
- Internal thermal shutdown
- Operates with input-output voltage differential down to 1V
- Excellent ripple rejection
- Low temperature drift
- Easily adjustable to higher output voltage

LM120 Series Packages and Power Capability

Device	Package	Rated Power Dissipation	Design Load Current
LM120/LM320	TO-3 (K)	20W	1.5A
	TO-39 (H)	2W	0.5A
LM320	TO-220 (T)	15W	1.5A

Typical Applications

Dual Trimmed Supply



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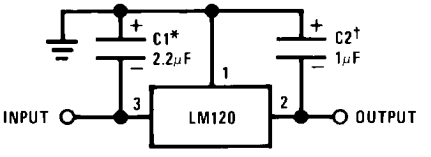
Fixed Regulator



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*Required if regulator is separated from filter capacitor by more than 3 inches. For value given, capacitor must be solid tantalum. 25 μF aluminum electrolytic may be substituted.

†Required for stability. For value given, capacitor must be solid tantalum. 25 μF aluminum electrolytic may be substituted. Values given may be increased without limit.

For output capacitance in excess of 100 μF, a high current diode from input to output (1N4001, etc.) will protect the regulator from momentary input shorts.

Absolute Maximum Ratings

−15 Volt Regulators (Note 13)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

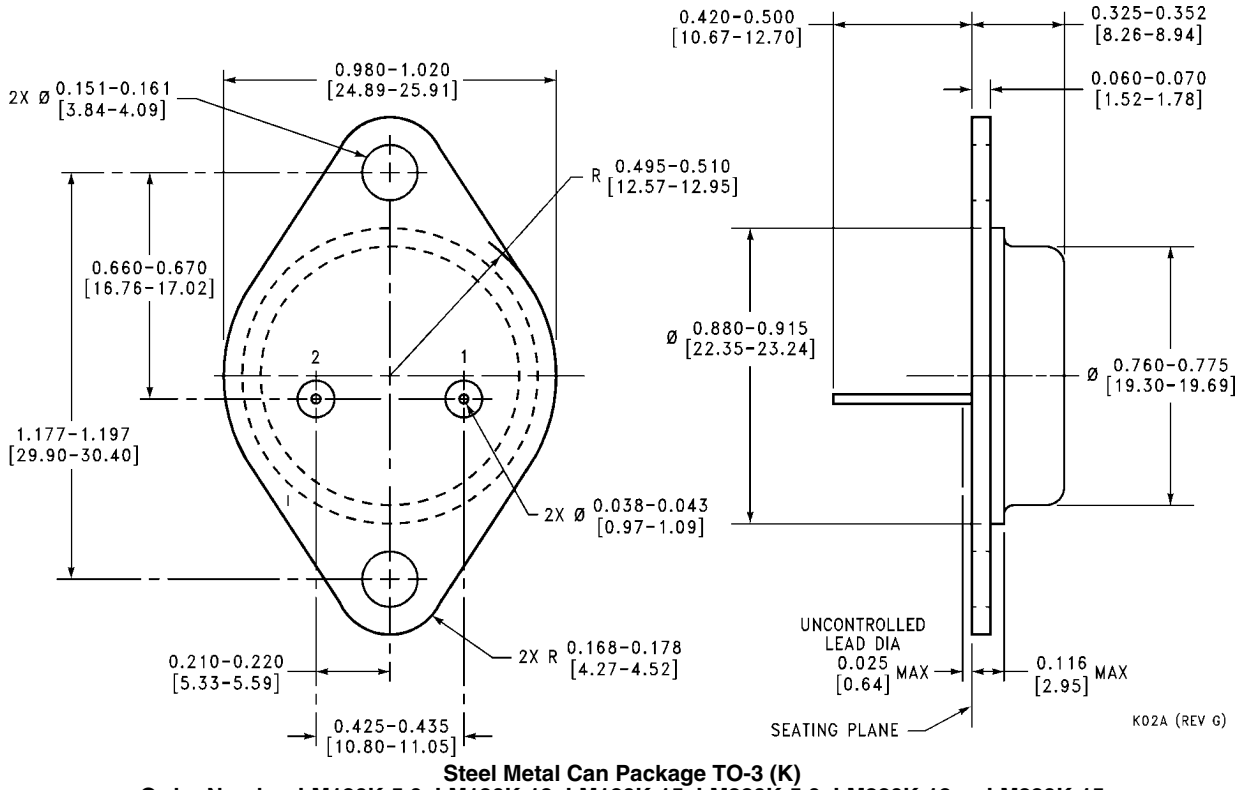
Power Dissipation	Internally Limited
Input Voltage	
LM120/LM320	−40V
LM320T	−35V
Input-Output Voltage Differential	30V
Junction Temperatures	(Note 10)
Storage Temperature Range	−65°C to +150°C
Lead Temperature	
(Soldering, 10 sec.)	300°C

−15 Volt Regulators Electrical Characteristics

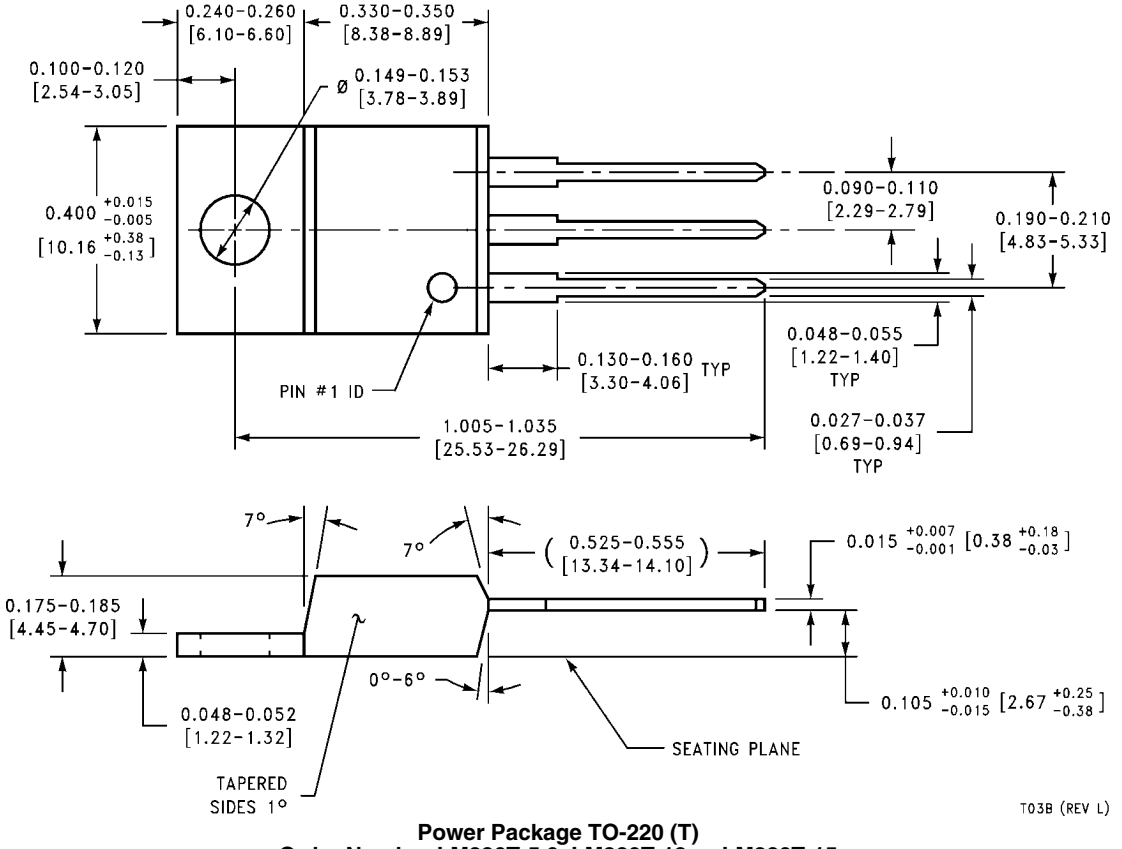
Order Numbers		Metal Can Package						Units
		LM120K-15 (TO-3)			LM320K-15 (TO-3)			
Design Output Current (I_D) Device Dissipation (P_D)		1A 20W						
Parameter	**Conditions** (Note 10)	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	
Output Voltage	$T_J = 25°C$, $V_{IN} = 20V$, $I_{LOAD} = 5$ mA	−15.3	−15	−14.7	−15.4	−15	−14.6	V
Line Regulation	$T_J = 25°C$, $I_{LOAD} = 5$ mA, $V_{MIN} \le V_{IN} \le V_{MAX}$		5	10		5	20	mV
Input Voltage		−35		−17	−35		−17	V
Ripple Rejection	f = 120 Hz	56	80		56	80		dB
Load Regulation, (Note 11)	$T_J = 25°C$, $V_{IN} = 20V$, $5\text{ mA} \le I_{LOAD} \le I_D$		30	80		30	80	mV
Output Voltage, (Note 10)	$17.5V \le V_{IN} \le V_{MAX}$, $5\text{ mA} \le I_{LOAD} \le I_D$, $P \le P_D$	−15.5		−14.5	−15.6		−14.4	V
Quiescent Current	$V_{MIN} \le V_{IN} \le V_{MAX}$		2	4		2	4	mA
Quiescent Current Change	$T_J = 25°C$							
	$V_{MIN} \le V_{IN} \le V_{MAX}$		0.1	0.4		0.1	0.4	mA
	$5\text{ mA} \le I_{LOAD} \le I_D$		0.1	0.4		0.1	0.4	mA
Output Noise Voltage	$T_A = 25°C$, $C_L = 1\ \mu F$, $I_L = 5$ mA, $V_{IN} = 20V$, 10 Hz ≤ f ≤ 100 kHz		400			400		μV
Long Term Stability			15	150		15	150	mV
Thermal Resistance								
Junction to Case				3			3	°C/W
Junction to Ambient				35			35	°C/W

−15 Volt Regulators Electrical Characteristics

Order Numbers		Metal Can Package						Units
		LM120H-15 (TO-39)			LM320H-15 (TO-39)			
Design Output Current (I_D) Device Dissipation (P_D)		0.2A 2W						
Parameter	**Conditions** (Note 10)	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	
Output Voltage	$T_J = 25°C$, $V_{IN} = 20V$, $I_{LOAD} = 5$ mA	−15.3	−15	−14.7	−15.4	−15	−14.6	V
Line Regulation	$T_J = 25°C$, $I_{LOAD} = 5$ mA, $V_{MIN} \le V_{IN} \le V_{MAX}$		5	10		5	20	mV



Steel Metal Can Package TO-3 (K)
Order Number LM120K-5.0, LM120K-12, LM120K-15, LM320K-5.0, LM320K-12 or LM320K-15
NS Package Number K02A



Power Package TO-220 (T)
Order Number LM320T-5.0, LM320T-12 or LM320T-15
NS Package Number T03B