LM120/LM320 Series 3-Terminal Negative Regulators

Check for Samples: LM120, LM320-N

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**

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.

Table 1. 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

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

All trademarks are the property of their respective owners.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

Copyright © 2004–2010, Texas Instruments Incorporated

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

Typical Applications

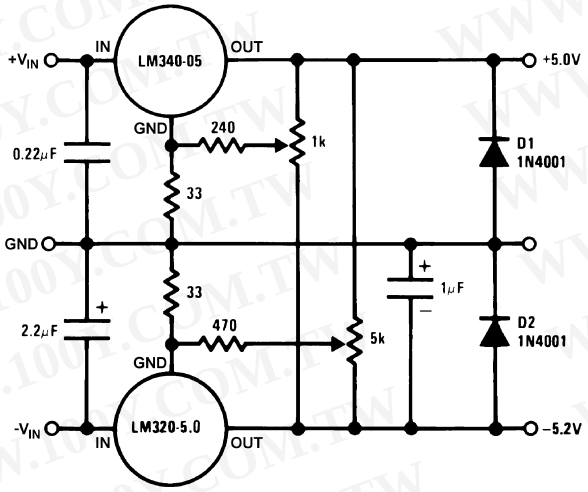
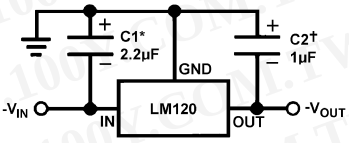


Figure 1. Dual Trimmed Supply



*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.

Figure 2. Fixed Regulator

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings−5 Volt Regulators (1) (2)

Power Dissipation	Internally Limited
Input Voltage	−25V
Input-Output Voltage Differential	25V
Junction Temperatures	(3)
Storage Temperature Range	−65°C to +150°C
Lead Temperature	
(Soldering, 10 sec.)	300°C
Plastic	260°C

(1) Refer to RETS120-5H drawing for LM120H-5.0 or RETS120-5K drawing for LM120-5K military specifications.
(2) For −5V 3 amp regulators, see LM145 data sheet.
(3) This specification applies over $-55°C \le T_J \le +150°C$ for the LM120 and $0°C \le T_J \le +125°C$ for the LM320.

Copyright © 2004–2010, Texas Instruments Incorporated

LM120K-5.0 and LM320K-5.0 Electrical Characteristics (1)

Order Numbers		Metal Can Package						Units
		LM120K-5.0 (TO-3)			LM320K-5.0 (TO-3)			
Design Output Current (I_D) Device Dissipation (P_D)		1.5A 20W						
Parameter	Conditions (2)	Min	Typ	Max	Min	Typ	Max	
Output Voltage	T_J = 25°C, V_{IN} =10V,	−5.1	−5	−4.9	−5.2	−5	−4.8	V
	I_{LOAD} = 5 mA							
Line Regulation	T_J = 25°C, I_{LOAD} = 5 mA,		10	25		10	40	mV
	$V_{MIN} \le V_{IN} \le V_{MAX}$							
Input Voltage		−25		−7	−25		−7	V
Ripple Rejection	f = 120 Hz	54	64		54	64		dB
Load Regulation,	T_J = 25°C, V_{IN} = 10V,		50	75		60	100	mV
(3)	5 mA ≤ $I_{LOAD} \le I_D$							
Output Voltage,	−7.5V ≤ $V_{IN} \le V_{MAX}$,	−5.20		−4.80	−5.25		−4.75	V
(2)	5 mA ≤ $I_{LOAD} \le I_D$, P ≤ P_D							
Quiescent Current	$V_{MIN} \le V_{IN} \le V_{MAX}$		1	2		1	2	mA
Quiescent Current	T_J = 25°C							
Change	$V_{MIN} \le V_{IN} \le V_{MAX}$		0.1	0.4		0.1	0.4	mA
	5 mA ≤ $I_{LOAD} \le I_D$		0.1	0.4		0.1	0.4	mA
Output Noise Voltage	T_A = 25°C, C_L = 1 µF, I_L = 5 mA,		150			150		µV
	V_{IN} = 10V, 10 Hz ≤ f ≤ 100 kHz							
Long Term Stability			5	50		5	50	mV
Thermal Resistance								
Junction to Case				3			3	°C/W
Junction to Ambient				35			35	°C/W

(1) For −5V 3 amp regulators, see LM145 data sheet.
(2) This specification applies over −55°C ≤ T_J ≤ +150°C for the LM120 and 0°C ≤ T_J ≤ +125°C for the LM320.
(3) Regulation is measured at constant junction temperature. Changes in output voltage due to heating effects must be taken into account separately. To ensure constant junction temperature, low duty cycle, pulse testing is used. The LM120/LM320 series does have low thermal feedback, improving line and load regulation. On all other tests, even though power dissipation is internally limited, electrical specifications apply only up to P_D.

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

LM120H-5.0 Electrical Characteristics [1]

Order Numbers		Metal Can Package			Units
		LM120H-5.0 (TO-39)			
Design Output Current (I_D) Device Dissipation (P_D)		0.5A 2W			
Parameter	Conditions [2]	Min	Typ	Max	
Output Voltage	T_J = 25°C, V_{IN} =10V,	−5.1	−5	−4.9	V
	I_{LOAD} = 5 mA				
Line Regulation	T_J = 25°C, I_{LOAD} = 5 mA,		10	25	mV
	$V_{MIN} \le V_{IN} \le V_{MAX}$				
Input Voltage		−25		−7	V
Ripple Rejection	f = 120 Hz	54	64		dB
Load Regulation,	T_J = 25°C, V_{IN} = 10V,		30	50	mV
[3]	5 mA ≤ $I_{LOAD} \le I_D$				
Output Voltage,	$-7.5V \le V_{IN} \le V_{MAX}$,	−5.20		−4.80	V
[4]	5 mA ≤ $I_{LOAD} \le I_D$, $P \le P_D$				
Quiescent Current	$V_{MIN} \le V_{IN} \le V_{MAX}$		1	2	mA
Quiescent Current	T_J = 25°C				
Change	$V_{MIN} \le V_{IN} \le V_{MAX}$		0.05	0.4	mA
	5 mA ≤ $I_{LOAD} \le I_D$		0.04	0.4	mA
Output Noise Voltage	T_A = 25°C, C_L = 1 µF, I_L = 5 mA,		150		µV
	V_{IN} = 10V, 10 Hz ≤ f ≤ 100 kHz				
Long Term Stability			5		mV
Thermal Resistance					
Junction to Case				[5]	°C/W
Junction to Ambient				[5]	°C/W

(1) For −5V 3 amp regulators, see LM145 data sheet.
(2) This specification applies over $-55°C \le T_J \le +150°C$ for the LM120 and $0°C \le T_J \le +125°C$ for the LM320.
(3) Regulation is measured at constant junction temperature. Changes in output voltage due to heating effects must be taken into account separately. To ensure constant junction temperature, low duty cycle, pulse testing is used. The LM120/LM320 series does have low thermal feedback, improving line and load regulation. On all other tests, even though power dissipation is internally limited, electrical specifications apply only up to P_D.
(4) This specification applies over $-55°C \le T_J \le +150°C$ for the LM120 and $0°C \le T_J \le +125°C$ for the LM320.
(5) Thermal resistance of typically 85°C/W (in 400 linear feet air flow), 224°C/W (in static air) junction to ambient, of typically 21°C/W junction to case.

Absolute Maximum Ratings−12 Volt Regulators [1]

Power Dissipation	Internally Limited
Input Voltage	−35V
Input-Output Voltage Differential	30V
Junction Temperatures	[2]
Storage Temperature Range	−65°C to +150°C
Lead Temperature	
(Soldering, 10 sec.)	300°C

(1) Refer to RETS120H-12 drawing for LM120H-12 or RETS120-12K drawing for LM120K-12 military specifications.
(2) This specification applies over $-55°C \le T_J \le +150°C$ for the LM120 and $0°C \le T_J \le +125°C$ for the LM320.

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

Copyright © 2004–2010, Texas Instruments Incorporated

LM120K-12 Electrical Characteristics

Order Numbers		Metal Can Package			Units
		LM120K-12 (TO-3)			
Design Output Current (I_D)		1A			
Device Dissipation (P_D)		20W			
Parameter	**Conditions** (1)	**Min**	**Typ**	**Max**	
Output Voltage	T_J = 25°C, V_{IN} = 17V,	−12.3	−12	−11.7	V
	I_{LOAD} = 5 mA				
Line Regulation	T_J = 25°C, I_{LOAD} = 5 mA,		4	10	mV
	$V_{MIN} \le V_{IN} \le V_{MAX}$				
Input Voltage		−32		−14	V
Ripple Rejection	f = 120 Hz	56	80		dB
Load Regulation,	T_J = 25°C, V_{IN} = 17V,		30	80	mV
(2)	5 mA ≤ $I_{LOAD} \le I_D$				
Output Voltage,	14.5V ≤ $V_{IN} \le V_{MAX}$,	−12.5		−11.5	V
(1)	5 mA ≤ $I_{LOAD} \le I_D$, $P \le P_D$				
Quiescent Current	$V_{MIN} \le V_{IN} \le V_{MAX}$		2	4	mA
Quiescent Current	T_J = 25°C				
Change	$V_{MIN} \le V_{IN} \le V_{MAX}$		0.1	0.4	mA
	5 mA ≤ $I_{LOAD} \le I_D$		0.1	0.4	mA
Output Noise Voltage	T_A = 25°C, C_L = 1 µF, I_L = 5 mA,		400		µV
	V_{IN} = 17V, 10 Hz ≤ f ≤ 100 kHz				
Long Term Stability			12	120	mV
Thermal Resistance					
Junction to Case				3	°C/W
Junction to Ambient				35	°C/W

(1) This specification applies over −55°C ≤ T_J ≤ +150°C for the LM120 and 0°C ≤ T_J ≤ +125°C for the LM320.
(2) Regulation is measured at constant junction temperature. Changes in output voltage due to heating effects must be taken into account separately. To ensure constant junction temperature, low duty cycle, pulse testing is used. The LM120/LM320 series does have low thermal feedback, improving line and load regulation. On all other tests, even though power dissipation is internally limited, electrical specifications apply only up to P_D.

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

LM120H-12 Electrical Characteristics

Order Numbers		Metal Can Package			Units
		LM120H-12 (TO-39)			
Design Output Current (I_D)		0.2A			
Device Dissipation (P_D)		2W			
Parameter	Conditions (1)	Min	Typ	Max	
Output Voltage	T_J = 25°C, V_{IN} = 17V,	−12.3	−12	−11.7	V
	I_{LOAD} = 5 mA				
Line Regulation	T_J = 25°C, I_{LOAD} = 5 mA,		4	10	mV
	$V_{MIN} \le V_{IN} \le V_{MAX}$				
Input Voltage		−32		−14	V
Ripple Rejection	f = 120 Hz	56	80		dB
Load Regulation,	T_J = 25°C, V_{IN} = 17V,		10	25	mV
(2)	5 mA ≤ $I_{LOAD} \le I_D$				
Output Voltage,	14.5V ≤ $V_{IN} \le V_{MAX}$,	−12.5		−11.5	V
(1)	5 mA ≤ $I_{LOAD} \le I_D$, P ≤ P_D				
Quiescent Current	$V_{MIN} \le V_{IN} \le V_{MAX}$		2	4	mA
Quiescent Current	T_J = 25°C				
Change	$V_{MIN} \le V_{IN} \le V_{MAX}$		0.05	0.4	mA
	5 mA ≤ $I_{LOAD} \le I_D$		0.03	0.4	mA
Output Noise Voltage	T_A = 25°C, C_L = 1 µF, I_L = 5 mA,		400		µV
	V_{IN} = 17V, 10 Hz ≤ f ≤ 100 kHz				
Long Term Stability			12	120	mV
Thermal Resistance					
Junction to Case				(3)	°C/W
Junction to Ambient				(3)	°C/W

(1) This specification applies over −55°C ≤ T_J ≤ +150°C for the LM120 and 0°C ≤ T_J ≤ +125°C for the LM320.
(2) Regulation is measured at constant junction temperature. Changes in output voltage due to heating effects must be taken into account separately. To ensure constant junction temperature, low duty cycle, pulse testing is used. The LM120/LM320 series does have low thermal feedback, improving line and load regulation. On all other tests, even though power dissipation is internally limited, electrical specifications apply only up to P_D.
(3) Thermal resistance of typically 85°C/W (in 400 linear feet/min air flow), 224°C/W (in static air) junction to ambient, of typically 21°C/W junction to case.

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

Copyright © 2004–2010, Texas Instruments Incorporated

LM320T-12 Electrical Characteristics

Order Numbers		Power Plastic Package			Units
		LM320T-12 (TO-220)			
Design Output Current (I_D)		1A			
Device Dissipation (P_D)		15W			
Parameter	Conditions (1)	Min	Typ	Max	
Output Voltage	T_J = 25°C, V_{IN} = 17V,	−12.4	−12	−11.6	V
	I_{LOAD} = 5 mA				
Line Regulation	T_J = 25°C, I_{LOAD} = 5 mA,		4	20	mV
	$V_{MIN} \le V_{IN} \le V_{MAX}$				
Input Voltage		−32		−14.5	V
Ripple Rejection	f = 120 Hz	56	80		dB
Load Regulation,	T_J = 25°C, V_{IN} = 17V,		30	80	mV
(2)	5 mA ≤ $I_{LOAD} \le I_D$				
Output Voltage,	14.5V ≤ $V_{IN} \le V_{MAX}$,	−12.6		−11.4	V
(1)	5 mA ≤ $I_{LOAD} \le I_D$, P ≤ P_D				
Quiescent Current	$V_{MIN} \le V_{IN} \le V_{MAX}$		2	4	mA
Quiescent Current	T_J = 25°C				
Change	$V_{MIN} \le V_{IN} \le V_{MAX}$		0.1	0.4	mA
	5 mA ≤ $I_{LOAD} \le I_D$		0.1	0.4	mA
Output Noise Voltage	T_A = 25°C, C_L = 1 µF, I_L = 5 mA,		400		µV
	V_{IN} = 17V, 10 Hz ≤ f ≤ 100 kHz				
Long Term Stability			24		mV
Thermal Resistance Junction to Case			4		°C/W
Junction to Ambient			50		°C/W

(1) This specification applies over −55°C ≤ T_J ≤ +150°C for the LM120 and 0°C ≤ T_J ≤ +125°C for the LM320.
(2) Regulation is measured at constant junction temperature. Changes in output voltage due to heating effects must be taken into account separately. To ensure constant junction temperature, low duty cycle, pulse testing is used. The LM120/LM320 series does have low thermal feedback, improving line and load regulation. On all other tests, even though power dissipation is internally limited, electrical specifications apply only up to P_D.

Absolute Maximum Ratings−15 Volt Regulators (1)

Power Dissipation	Internally Limited
Input Voltage	
LM120/LM320	−40V
LM320T	−35V
Input-Output Voltage Differential	30V
Junction Temperatures	(2)
Storage Temperature Range	−65°C to +150°C
Lead Temperature	
(Soldering, 10 sec.)	300°C

(1) Refer to RETS120-15H drawing for LM120H-15 or RETS120-15K drawing for LM120K-15 military specifications.
(2) This specification applies over −55°C ≤ T_J ≤ +150°C for the LM120 and 0°C ≤ T_J ≤ +125°C for the LM320.

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

LM120K-15 and LM320K-15 Electrical Characteristics

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

(1) This specification applies over −55°C ≤ T_J ≤ +150°C for the LM120 and 0°C ≤ T_J ≤ +125°C for the LM320.

(2) Regulation is measured at constant junction temperature. Changes in output voltage due to heating effects must be taken into account separately. To ensure constant junction temperature, low duty cycle, pulse testing is used. The LM120/LM320 series does have low thermal feedback, improving line and load regulation. On all other tests, even though power dissipation is internally limited, electrical specifications apply only up to P_D.

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

Copyright © 2004–2010, Texas Instruments Incorporated

LM120H-15 Electrical Characteristics

Order Numbers		Metal Can Package			Units
		LM120H-15 (TO-39)			
Design Output Current (I_D)		0.2A			
Device Dissipation (P_D)		2W			
Parameter	Conditions (1)	Min	Typ	Max	
Output Voltage	T_J = 25°C, V_{IN} = 20V,	−15.3	−15	−14.7	V
	I_{LOAD} = 5 mA				
Line Regulation	T_J = 25°C, I_{LOAD} = 5 mA,		5	10	mV
	$V_{MIN} \le V_{IN} \le V_{MAX}$				
Input Voltage		−35		−17	V
Ripple Rejection	f = 120 Hz	56	80		dB
Load Regulation,	T_J = 25°C, V_{IN} = 20V,		10	25	mV
(2)	5 mA ≤ $I_{LOAD} \le I_D$				
Output Voltage,	17.5V ≤ $V_{IN} \le V_{MAX}$,	−15.5		−14.5	V
(1)	5 mA ≤ $I_{LOAD} \le I_D$, P ≤ P_D				
Quiescent Current	$V_{MIN} \le V_{IN} \le V_{MAX}$		2	4	mA
Quiescent Current	T_J = 25°C				
Change	$V_{MIN} \le V_{IN} \le V_{MAX}$		0.05	0.4	mA
	5 mA ≤ $I_{LOAD} \le I_D$		0.03	0.4	mA
Output Noise Voltage	T_A = 25°C, C_L = 1 µF, I_L = 5 mA,		400		µV
	V_{IN} = 20V, 10 Hz ≤ f ≤ 100 kHz				
Long Term Stability			15	150	mV
Thermal Resistance					
Junction to Case				(3)	°C/W
Junction to Ambient				(3)	°C/W

(1) This specification applies over −55°C ≤ T_J ≤ +150°C for the LM120 and 0°C ≤ T_J ≤ +125°C for the LM320.
(2) Regulation is measured at constant junction temperature. Changes in output voltage due to heating effects must be taken into account separately. To ensure constant junction temperature, low duty cycle, pulse testing is used. The LM120/LM320 series does have low thermal feedback, improving line and load regulation. On all other tests, even though power dissipation is internally limited, electrical specifications apply only up to P_D.
(3) Thermal resistance of typically 85°C/W (in 400 linear feet/min air flow), 224°C/W (in static air) junction to ambient, of typically 21°C/W junction to case.

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

LM320T-15 Electrical Characteristics

Order Numbers		Power Plastic Package			Units
		LM320T-15 (TO-220)			
Design Output Current (I_D)		1A			
Device Dissipation (P_D)		15W			
Parameter	Conditions (1)	Min	Typ	Max	
Output Voltage	T_J = 25°C, V_{IN} = 20V,	−15.5	−15	−14.5	V
	I_{LOAD} = 5 mA				
Line Regulation	T_J = 25°C, I_{LOAD} = 5 mA,		5	20	mV
	$V_{MIN} \le V_{IN} \le V_{MAX}$				
Input Voltage		−35		−17.5	V
Ripple Rejection	f = 120 Hz	56	80		dB
Load Regulation,	T_J = 25°C, V_{IN} = 20V,		30	80	mV
(2)	5 mA ≤ $I_{LOAD} \le I_D$				
Output Voltage,	17.5V ≤ $V_{IN} \le V_{MAX}$,	−15.7		−14.3	V
(1)	5 mA ≤ $I_{LOAD} \le I_D$, P ≤ P_D				
Quiescent Current	$V_{MIN} \le V_{IN} \le V_{MAX}$		2	4	mA
Quiescent Current	T_J = 25°C				
Change	$V_{MIN} \le V_{IN} \le V_{MAX}$		0.1	0.4	mA
	5 mA ≤ $I_{LOAD} \le I_D$		0.1	0.4	mA
Output Noise Voltage	T_A = 25°C, C_L = 1 µF, I_L = 5 mA,		400		µV
	V_{IN} = 20V, 10 Hz ≤ f ≤ 100 kHz				
Long Term Stability			30		mV
Thermal Resistance					
Junction to Case			4		°C/W
Junction to Ambient			50		°C/W

(1) This specification applies over −55°C ≤ T_J ≤ +150°C for the LM120 and 0°C ≤ T_J ≤ +125°C for the LM320.
(2) Regulation is measured at constant junction temperature. Changes in output voltage due to heating effects must be taken into account separately. To ensure constant junction temperature, low duty cycle, pulse testing is used. The LM120/LM320 series does have low thermal feedback, improving line and load regulation. On all other tests, even though power dissipation is internally limited, electrical specifications apply only up to P_D.

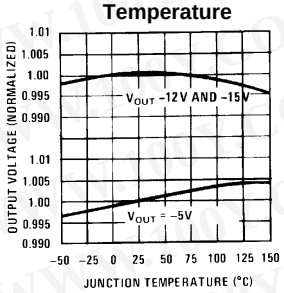
勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

Copyright © 2004–2010, Texas Instruments Incorporated

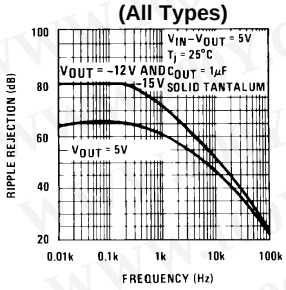
勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

Typical Performance Characteristics

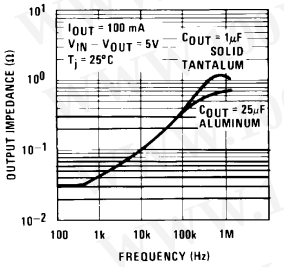
Output Voltage vs Temperature



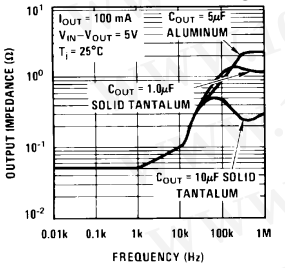
Ripple Rejection (All Types)



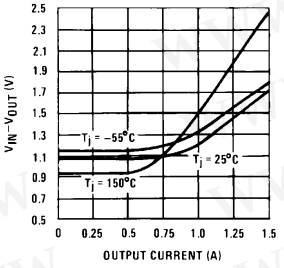
Output Impedance TO-3 and TO-220 Packages



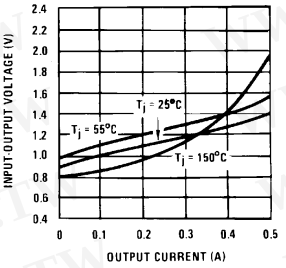
Output Impedance TO-5 and TO-202 Packages



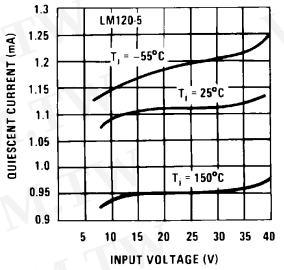
Minimum Input-Output Differential TO-3 and TO-220 Packages



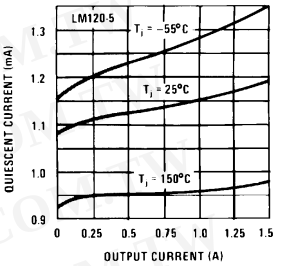
Minimum Input-Output Differential TO-5 and TO-202 Packages



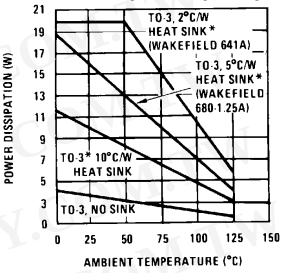
Quiescent Current vs Input Voltage



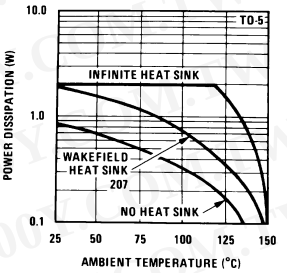
Quiescent Current vs Load Current



Maximum Average Power Dissipation (TO-3)



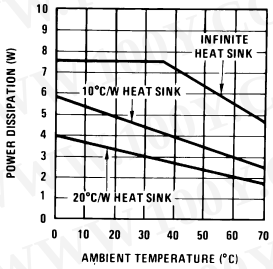
Maximum Average Power Dissipation (TO-5)



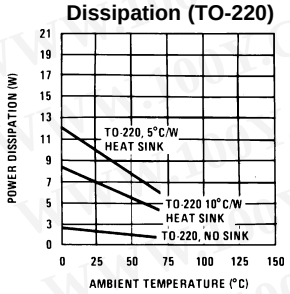
*These curves for LM120. Derate 25°C further for LM320.

Typical Performance Characteristics (continued)

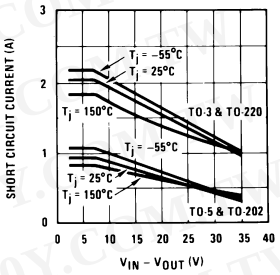
Maximum Average Power Dissipation (TO-202)



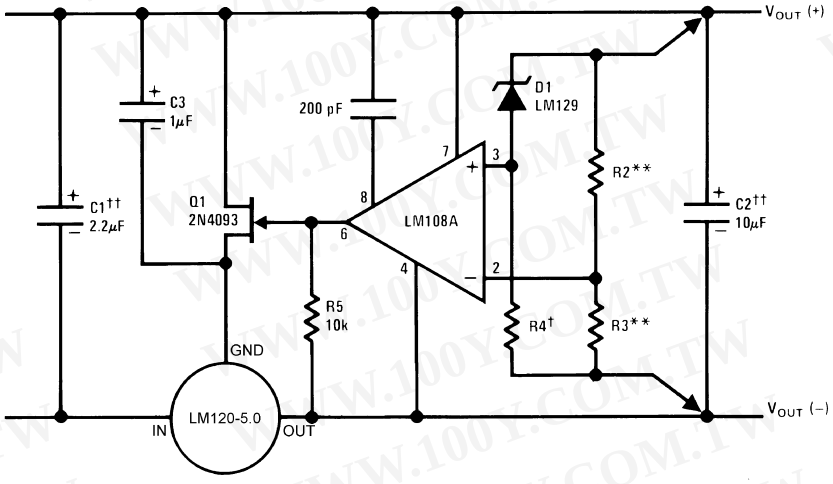
Maximum Average Power Dissipation (TO-220)



Short Circuit Current



Typical Applications



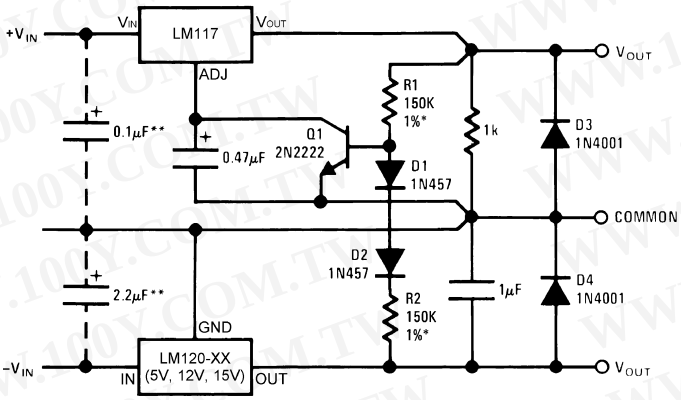
Lead and line regulation — 0.01% temperature stability — 0.2%
†Determines Zener current.
††Solid tantalum.
An LM120-12 or LM120-15 may be used to permit higher input voltages, but the regulated output voltage must be at least −15V when using the LM120-12 and −18V for the LM120-15.
**Select resistors to set output voltage. 2 ppm/°C tracking suggested.

Figure 3. High Stability 1 Amp Regulator

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

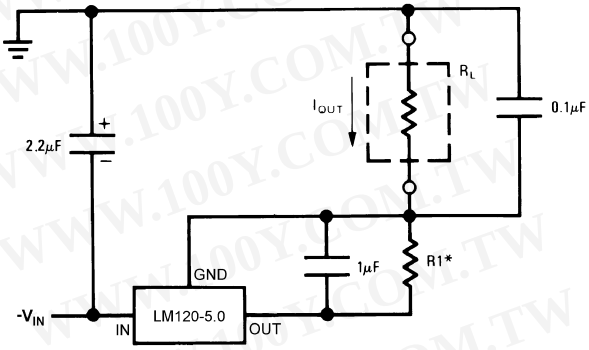
Copyright © 2004–2010, Texas Instruments Incorporated

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw



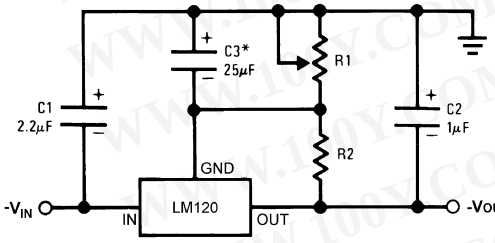
*Resistor tolerance of R1 and R2 determine matching of (+) and (−) inputs.
**Necessary only if raw supply capacitors are more than 3″ from regulators
An LM3086N array may substitute for Q1, D1 and D2 for better stability and tracking. In the array diode transistors Q5 and Q4 (in parallel) make up D2; similarly, Q1 and Q2 become D1 and Q3 replaces the 2N2222.

Figure 4. Wide Range Tracking Regulator



*$I_{OUT} = 1\ mA + \frac{5.0V}{R1}$

Figure 5. Current Source



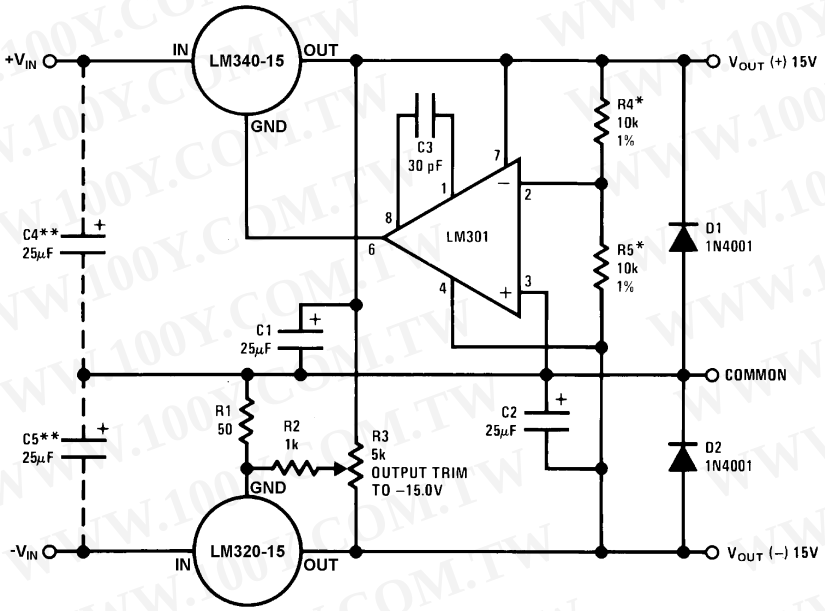
SELECT R2 AS FOLLOWS:

LM120-5	**300Ω**
LM120-12	**750Ω**
LM120-15	**1k**

$V_{OUT} = V_{SET} \frac{R1 + R2}{R2}$

*C3 optional. Improves transient response and ripple rejection.

Figure 6. Variable Output Current Source



See Performanc Typical table

*Resistor tolerance of R4 and R5 determine matching of (+) and (−) outputs.

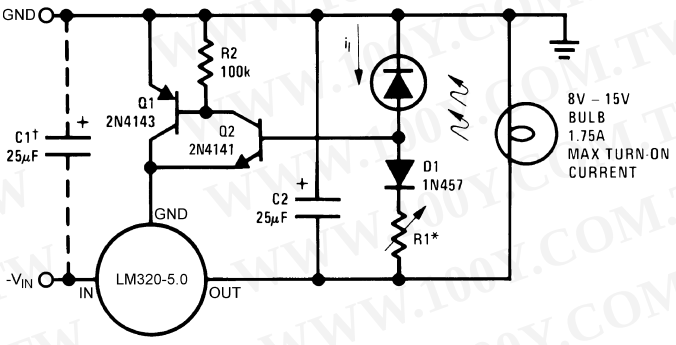
A. **Necessary only if raw supply filter capacitors are more than 2 inches from regulators.

Figure 7. ±15V, 1 Amp Tracking Regulators

Performance (Typical)

Load Regulation at ΔI_L = 1A	10 mV	1 mV
Output Ripple, C_{IN} = 3000 µF, I_L = 1A	100 µVrms	100 µVrms
Temperature Stability	+50 mV	+50 mV
Output Noise 10 Hz ≤ f ≤ 10 kHz	150 µVrms	150 µVrms

Light Controllers Using Silicon Photo Cells

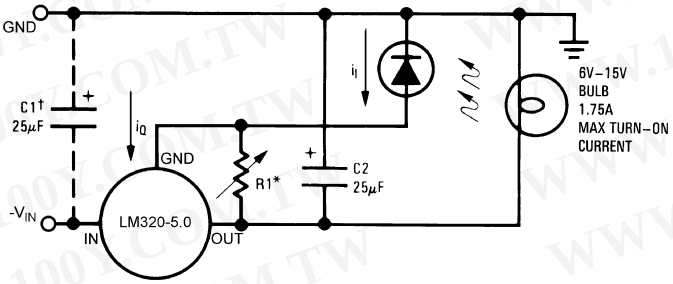


*Lamp brightness increases until i_l = 5V/R1 (i_l can be set as low as 1 µA).

†Necessary only if raw supply filter capacitor is more than 2 inches from LM320MP.

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

Copyright © 2004–2010, Texas Instruments Incorporated



*Lamp brightness increases until $i_I = i_Q$ (1 mA) + 5V/R1.
†Necessary only if raw supply filter capacitor is more than 2 inches from LM320.

Connection Diagram

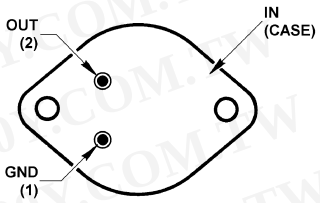


Figure 8. Steel Metal Can Package TO-3 (K)
(Bottom View)

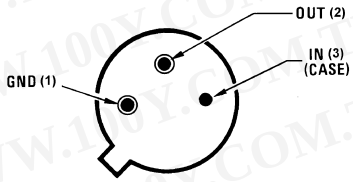


Figure 9. Metal Can Package TO-39 (H)
(Bottom View)

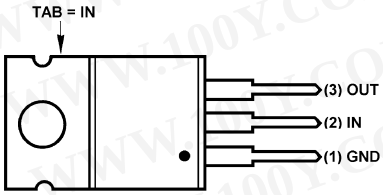


Figure 10. Power Package TO-220 (T)
(Front View)

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

Schematic Diagrams

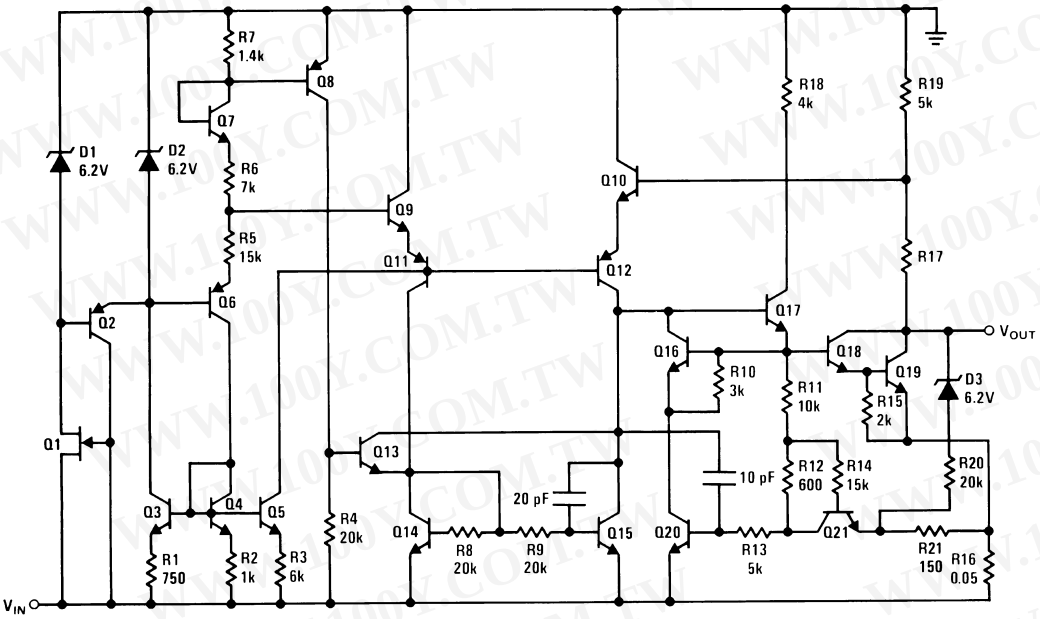


Figure 11. −5V

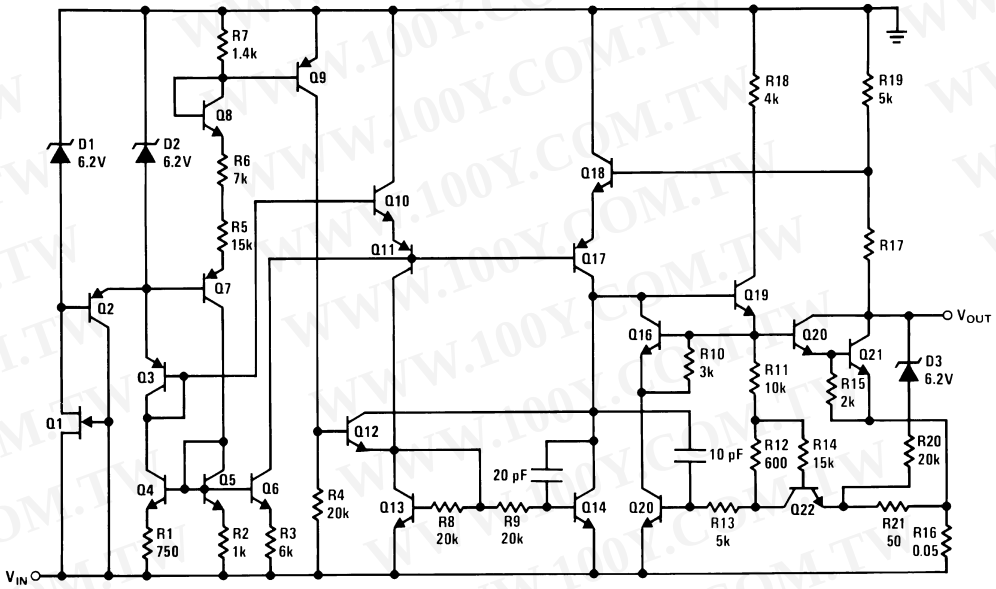


Figure 12. −12V and −15V

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

Copyright © 2004–2010, Texas Instruments Incorporated

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
LM120H-12	ACTIVE	TO	NDT	3	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	
LM120H-12/NOPB	ACTIVE	TO	NDT	3	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	
LM120H-15	ACTIVE	TO	NDT	3	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	
LM120H-15/NOPB	ACTIVE	TO	NDT	3	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	
LM120H-5.0	ACTIVE	TO	NDT	3	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	
LM120H-5.0/NOPB	ACTIVE	TO	NDT	3	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	
LM320T-15	ACTIVE	TO-220	NDE	3	45	TBD	CU SNPB	Level-1-NA-UNLIM	
LM320T-15/NOPB	ACTIVE	TO-220	NDE	3	45	Green (RoHS & no Sb/Br)	CU SN	Level-1-NA-UNLIM	

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

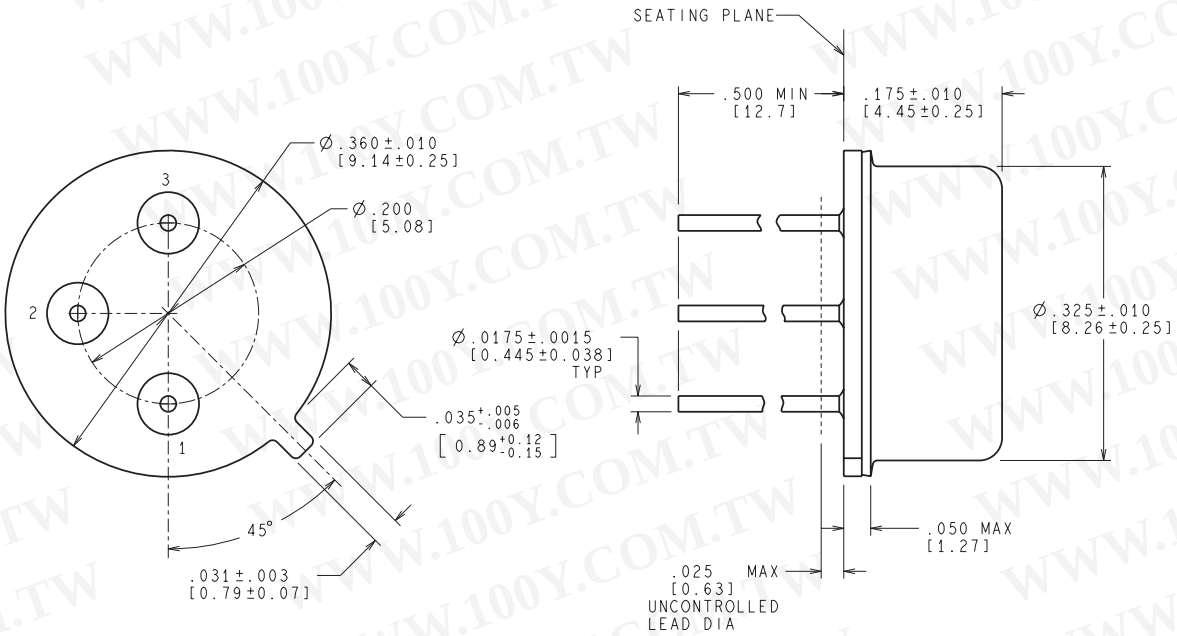
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

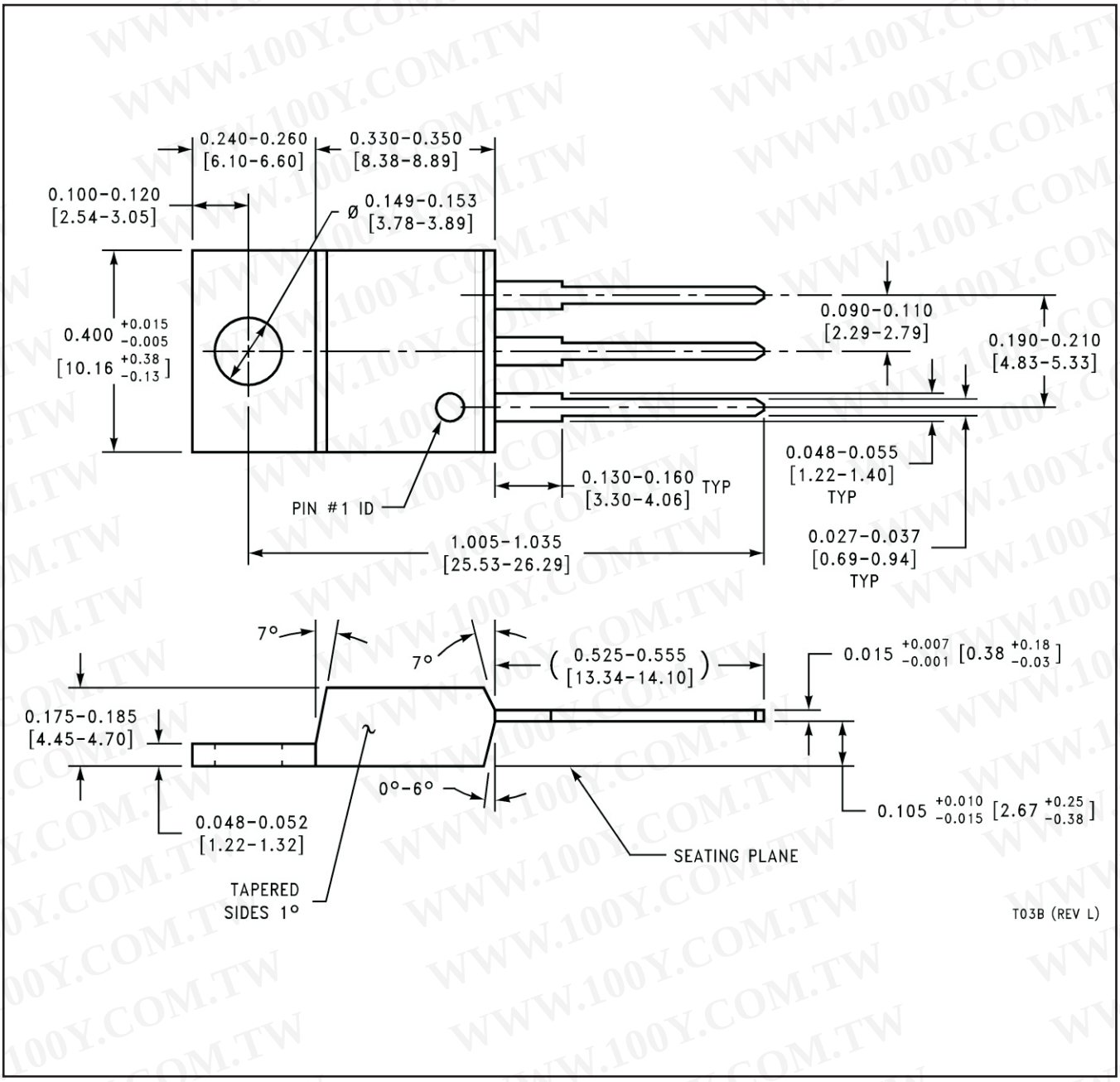


CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

MIL-PRF-38535
CONFIGURATION CONTROL

H03A (Rev D)

NDE0003B



勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers’ products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers’ products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2012, Texas Instruments Incorporated

勝 特 力 材 料 886-3-5753170
胜特力电子(上海) 86-21-34970699
胜特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw