LM79XX

3-Terminal 1A Negative Voltage Regulator

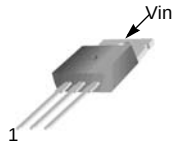
Features

- Output Current in Excess of 1A
- Output Voltages of -5, -6, -8 , -9, -10, -12, -15, -18 and -24V
- Internal Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Compensation

Description

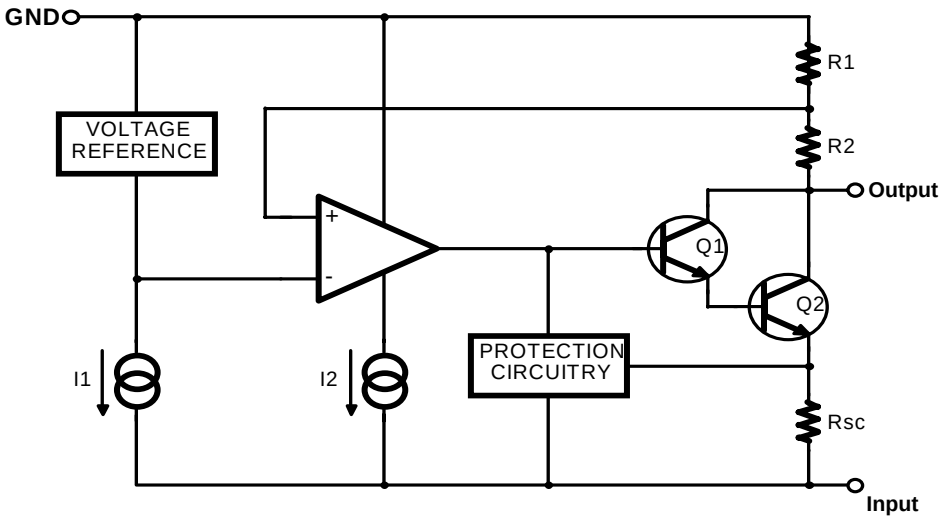
The LM79XX series of three terminal negative regulators are available in TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible.

TO-220 (Single Gauge)



1. GND 2. Input 3. Output

Internal Block Digram



Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Input Voltage	V_I	-35	V
Thermal Resistance Junction-Case (Note1)	$R_{\theta JC}$	5	°C/W
Thermal Resistance Junction-Air (Note1, 2)	$R_{\theta JA}$	65	
Operating Temperature Range	T_{OPR}	0 ~ +125	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Note:

1. Thermal resistance test board
   Size: 76.2mm * 114.3mm * 1.6mm(1S0P)
   JEDEC standard: JESD51-3, JESD51-7
2. Assume no ambient airflow

Electrical Characteristics (LM7905)

(V_I = -10V, I_O = 500mA, 0°C ≤T_J ≤ +125°C, C_I =2.2μF, C_O =1μF, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +25°C		-4.8	-5.0	-5.2	V
		I_O = 5mA to 1A, P_O ≤ 15W V_I = -7V to -20V		-4.75	-5.0	-5.25	
Line Regulation (Note3)	ΔV_O	T_J = +25°C	V_I = -7V to -25V	-	35	100	mV
			V_I = -8V to -12V	-	8	50	
Load Regulation (Note3)	ΔV_O	T_J = +25°C I_O = 5mA to 1.5A		-	10	100	mV
		T_J =+25°C I_O = 250mA to 750mA		-	3	50	
Quiescent Current	I_Q	T_J =+25°C		-	3	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		-	0.05	0.5	mA
		V_I = -8V to -25V		-	0.1	0.8	
Temperature Coefficient of V_D	$\Delta Vo/\Delta T$	I_O = 5mA		-	- 0.4	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100kHz T_A =+25°C		-	40	-	μV
Ripple Rejection	RR	f = 120Hz ΔV_I = 10V		54	60	-	dB
Dropout Voltage	V_D	T_J = +25°C I_O = 1A		-	2	-	V
Short Circuit Current	I_{SC}	T_J =+25°C, V_I = -35V		-	300	-	mA
Peak Current	I_{PK}	T_J =+25°C		-	2.2	-	A

Note

3. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM7906) (Continued)

(V_I = -11V, I_O = 500mA, 0°C ≤T_J ≤ +125°C, C_I =2.2μF, C_O =1μF, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +25°C		-5.75	-6	-6.25	V
		I_O = 5mA to 1A, P_O ≤ 15W V_I = -9V to -21V		-5.7	-6	-6.3	
Line Regulation (Note1)	ΔV_O	T_J = +25°C	V_I = -8V to -25V	-	10	120	mV
			V_I = -9V to -13V	-	5	60	
Load Regulation (Note1)	ΔV_O	T_J = +25°C I_O = 5mA to 1.5A		-	10	120	mV
		T_J =+25°C I_O = 250mA to 750mA		-	3	60	
Quiescent Current	I_Q	T_J =+25°C		-	3	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		-	0.05	0.5	mA
		V_I = -8V to -25V		-	0.1	1.3	
Temperature Coefficient of V_D	$\Delta Vo/\Delta T$	I_O = 5mA		-	-0.5	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100kHz T_A =+25°C		-	130	-	μV
Ripple Rejection	RR	f = 120Hz ΔV_I = 10V		54	60	-	dB
Dropout Voltage	V_D	T_J = +25°C I_O = 1A		-	2	-	V
Short Circuit Current	I_{SC}	T_J = +25°C, V_I = -35V		-	300	-	mA
Peak Current	I_{PK}	T_J = +25°C		-	2.2	-	A

Note

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM7908) (Continued)

(V_I = -14V, I_O = 500mA, 0°C ≤T_J ≤ +125°C, C_I =2.2μF, C_O =1μF, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +25°C		-7.7	-8	-8.3	V
		I_O = 5mA to 1A, P_O ≤ 15W V_I = -10V to -23V		-7.6	-8	-8.4	
Line Regulation (Note1)	ΔV_O	T_J = +25°C	V_I = -10.5V to -25V	-	10	160	mV
			V_I = -11V to -17V	-	5	80	
Load Regulation (Note1)	ΔV_O	T_J = +25°C I_O = 5mA to 1.5A		-	12	160	mV
		T_J =+25°C I_O = 250mA to 750mA		-	4	80	
Quiescent Current	I_Q	T_J =+25°C		-	3	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		-	0.05	0.5	mA
		V_I = -10.5V to -25V		-	0.1	1	
Temperature Coefficient of V_D	$\Delta Vo/\Delta T$	I_O = 5mA		-	-0.6	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100kHz T_A =+25°C		-	175	-	μV
Ripple Rejection	RR	f = 120Hz ΔV_I = 10V		54	60	-	dB
Dropout Voltage	V_D	T_J = +25°C I_O = 1A		-	2	-	V
Short Circuit Current	I_{SC}	T_J = +25°C, V_I = -35V		-	300	-	mA
Peak Current	I_{PK}	T_J = +25°C		-	2.2	-	A

Note

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM7909) (Continued)

(V_I = -15V, I_O = 500mA, 0°C ≤T_J ≤ +125°C, C_I =2.2μF, C_O =1μF, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +25°C		-8.7	-9.0	-9.3	V
		I_O = 5mA to 1A, P_O ≤ 15W V_I = -1.5V to -23V		-8.6	-9.0	-9.4	
Line Regulation (Note1)	ΔV_O	T_J = +25°C	V_I = -11.5V to -26V	-	10	180	mV
			V_I = -12V to -18V	-	5	90	
Load Regulation (Note1)	ΔV_O	T_J = +25°C I_O = 5mA to 1.5A		-	12	180	mV
		T_J = +25°C I_O = 250mA to 750mA		-	4	90	
Quiescent Current	I_Q	T_J = +25°C		-	3	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		-	0.05	0.5	mA
		V_I = -11.5V to -26V		-	0.1	1	
Temperature Coefficient of V_D	$\Delta Vo/\Delta T$	I_O = 5mA		-	-0.6	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100kHz T_A = +25°C		-	175	-	μV
Ripple Rejection	RR	f = 120Hz ΔV_I = 10V		54	60	-	dB
Dropout Voltage	V_D	T_J = +25°C I_O = 1A		-	2	-	V
Short Circuit Current	I_{SC}	T_J = +25°C, V_I = -35V		-	300	-	mA
Peak Current	I_{PK}	T_J = +25°C		-	2.2	-	A

Note:

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM7910) (Continued)

(V_I = -17V, I_O = 500mA, 0°C ≤T_J ≤ +125°C, C_I =2.2μF, C_O =1μF, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +25°C		-9.6	-10	-10.4	V
		I_O = 5mA to 1A, P_d ≤ 15W V_I = -12V to -28		-9.5	-10	-10.5	
Line Regulation (Note1)	ΔV_O	T_J = +25°C	V_I = -12.5V to -28V	-	12	200	mV
			V_I = -14V to -20V	-	6	100	
Load Regulation (Note1)	ΔV_O	T_J = +25°C I_O = 5mA to 1.5A		-	12	200	mV
		T_J = +25°C I_O = 250mA to 750mA		-	4	100	
Quiescent Current	I_Q	T_J = +25°C		-	3	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		-	0.05	0.5	mA
		V_I = -12.5V to -28V		-	0.1	1	
Temperature Coefficient of V_O	$\Delta Vo/\Delta T$	I_O = 5mA		-	-1	-	mV/°C
Output Noise Voltage	V_N	10Hz ≤ f ≤ 100kHz T_A =+25°C		-	280	-	μV
Ripple Rejection	RR	f = 120Hz ΔV_I = 10V		54	60	-	dB
Dropout Voltage	V_D	T_J = +25°C I_O = 1A		-	2	-	V
Short Circuit Current	I_{SC}	T_J = +25°C, V_I = -35V		-	300	-	mA
Peak Current	I_{PK}	T_J = +25°C		-	2.2	-	A

Note:

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM7912) (Continued)

(V_I = -19V, I_O = 500mA, 0°C ≤T_J ≤ +125°C, C_I =2.2μF, C_O =1μF, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +25°C		-11.5	-12	-12.5	V
		I_O = 5mA to 1A, P_O ≤ 15W V_I = -15.5V to -27V		-11.4	-12	-12.6	
Line Regulation (Note1)	ΔV_O	T_J = +25°C	V_I = -14.5V to -30V	-	12	240	mV
			V_I = -16V to -22V	-	6	120	
Load Regulation (Note1)	ΔV_O	T_J = +25°C I_O = 5mA to 1.5A		-	12	240	mV
		T_J = +25°C I_O = 250mA to 750mA		-	4	120	
Quiescent Current	I_Q	T_J = +25°C		-	3	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		-	0.05	0.5	mA
		V_I = -14.5V to -30V		-	0.1	1	
Temperature Coefficient of V_D	$\Delta Vo/\Delta T$	I_O = 5mA		-	-0.8	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100kHz T_A = +25°C		-	200	-	μV
Ripple Rejection	RR	f = 120Hz ΔV_I = 10V		54	60	-	dB
Dropout Voltage	V_D	T_J = +25°C I_O = 1A		-	2	-	V
Short Circuit Current	I_{SC}	T_J = +25°C, V_I = -35V		-	300	-	mA
Peak Current	I_{PK}	T_J = +25°C		-	2.2	-	A

Note:

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM7915) (Continued)

(V_I = -23V, I_O = 500mA, 0°C ≤T_J ≤ +125°C, C_I =2.2μF, C_O =1μF, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +25°C		-14.4	-15	-15.6	V
		I_O = 5mA to 1A, P_O ≤ 15W V_I = -18V to -30V		-14.25	-15	-15.75	
Line Regulation (Note1)	ΔV_O	T_J = +25°C	V_I = -17.5V to -30V	-	12	300	mV
			V_I = -20V to -26V	-	6	150	
Load Regulation (Note1)	ΔV_O	T_J = +25°C I_O = 5mA to 1.5A		-	12	300	mV
		T_J = +25°C I_O = 250mA to 750mA		-	4	150	
Quiescent Current	I_Q	T_J = +25°C		-	3	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		-	0.05	0.5	mA
		V_I = -17.5V to -30V		-	0.1	1	
Temperature Coefficient of V_D	$\Delta Vo/\Delta T$	I_O = 5mA		-	-0.9	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100kHz T_A =+25°C		-	250	-	μV
Ripple Rejection	RR	f = 120Hz ΔV_I = 10V		54	60	-	dB
Dropout Voltage	V_D	T_J = +25°C I_O = 1A		-	2	-	V
Short Circuit Current	I_{SC}	T_J = +25°C, V_I = -35V		-	300	-	mA
Peak Current	I_{PK}	T_J = +25°C		-	2.2	-	A

Note:

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM7918) (Continued)

(V_I = -27V, I_O = 500mA, 0°C ≤T_J ≤ +125°C, C_I =2.2μF, C_O =1μF, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +25°C		-17.3	-18	-18.7	V
		I_O = 5mA to 1A, P_O ≤ 15W V_I = -22.5V to -33V		-17.1	-18	-18.9	
Line Regulation (Note1)	ΔV_O	T_J = +25°C	V_I = -21V to -33V	-	15	360	mV
			V_I = -24V to -30V	-	8	180	
Load Regulation (Note1)	ΔV_O	T_J = +25°C I_O = 5mA to 1.5A		-	15	360	mV
		T_J = +25°C I_O = 250mA to 750mA		-	5	180	
Quiescent Current	I_Q	T_J = +25°C		-	3	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		-	0.05	0.5	mA
		V_I = -21V to -33V		-	0.1	1	
Temperature Coefficient of V_D	$\Delta Vo/\Delta T$	I_O = 5mA		-	-1	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100kHz T_A = +25°C		-	300	-	μV
Ripple Rejection	RR	f = 120Hz ΔV_I = 10V		54	60	-	dB
Dropout Voltage	V_D	T_J = +25°C I_O = 1A		-	2	-	V
Short Circuit Current	I_{SC}	T_J = +25°C, V_I = -35V		-	300	-	mA
Peak Current	I_{PK}	T_J = +25°C		-	2.2	-	A

Note:

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Electrical Characteristics (LM7924) (Continued)

(V_I = -33V, I_O = 500mA, 0°C ≤T_J ≤ +125°C, C_I =2.2μF, C_O =1μF, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +25°C		-23	-24	-25	V
		I_O = 5mA to 1A, P_O ≤ 15W V_I = -27V to -38V		-22.8	-24	-25.2	
Line Regulation (Note1)	ΔV_O	T_J = +25°C	V_I = -27V to -38V	-	15	480	mV
			V_I = -30V to -36V	-	8	180	
Load Regulation (Note1)	ΔV_O	T_J = +25°C I_O = 5mA to 1.5A		-	15	480	mV
		T_J = +25°C I_O = 250mA to 750mA		-	5	240	
Quiescent Current	I_Q	T_J = +25°C		-	3	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		-	0.05	0.5	mA
		V_I = -27V to -38V		-	0.1	1	
Temperature Coefficient of V_D	$\Delta Vo/\Delta T$	I_O = 5mA		-	-1	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100kHz T_A = +25°C		-	400	-	μV
Ripple Rejection	RR	f = 120Hz ΔV_I = 10V		54	60	-	dB
Dropout Voltage	V_D	T_J = +25°C I_O = 1A		-	2	-	V
Short Circuit Current	I_{SC}	T_J = +25°C, V_I = -35V		-	300	-	mA
Peak Current	I_{PK}	T_J = +25°C		-	2.2	-	A

Note:

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Typical Performance Characteristics

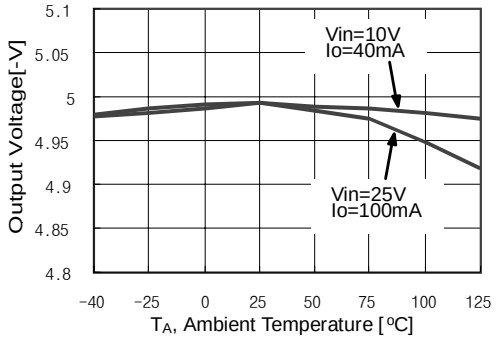


Figure 1. Output Voltage

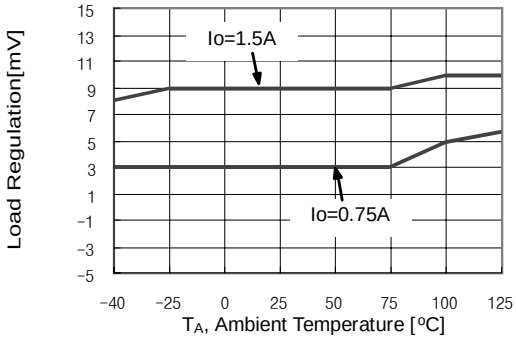


Figure 2. Load Regulation

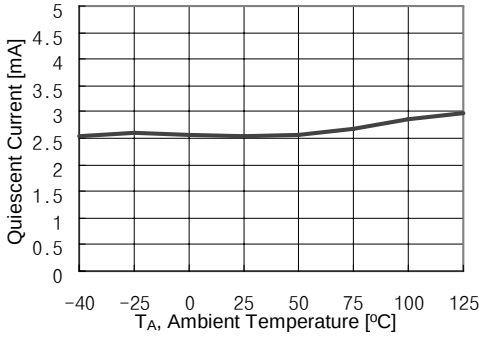


Figure 3. Quiescent Current

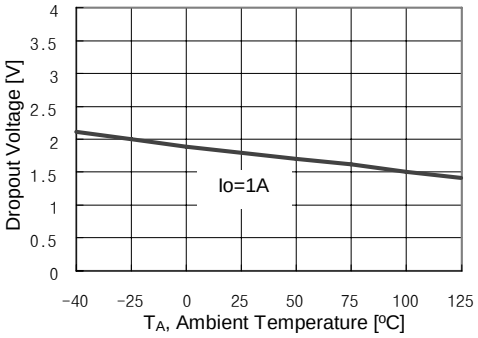


Figure 4. Dropout Voltage

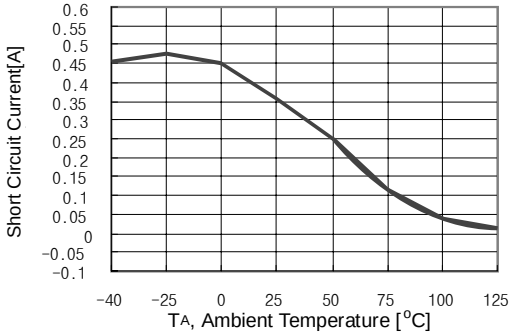


Figure 5. Short Circuit Current

Typical Applications

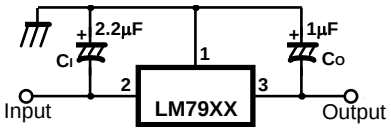


Figure 6. Negative Fixed output regulator

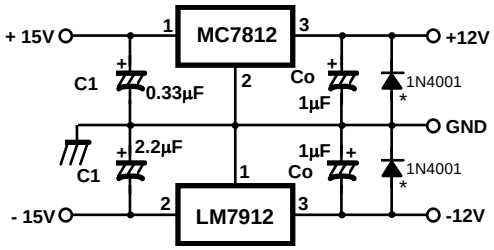


Figure 7. Split power supply (± 12V/1A)

Notes:

(1) To specify an output voltage, substitute voltage value for "XX "

(2) Required for stability. For value given, capacitor must be solid tantalum. If aluminium electronics are used, at least ten times value shown should be selected. C_I is required if regulator is located an appreciable distance from power supply filter.

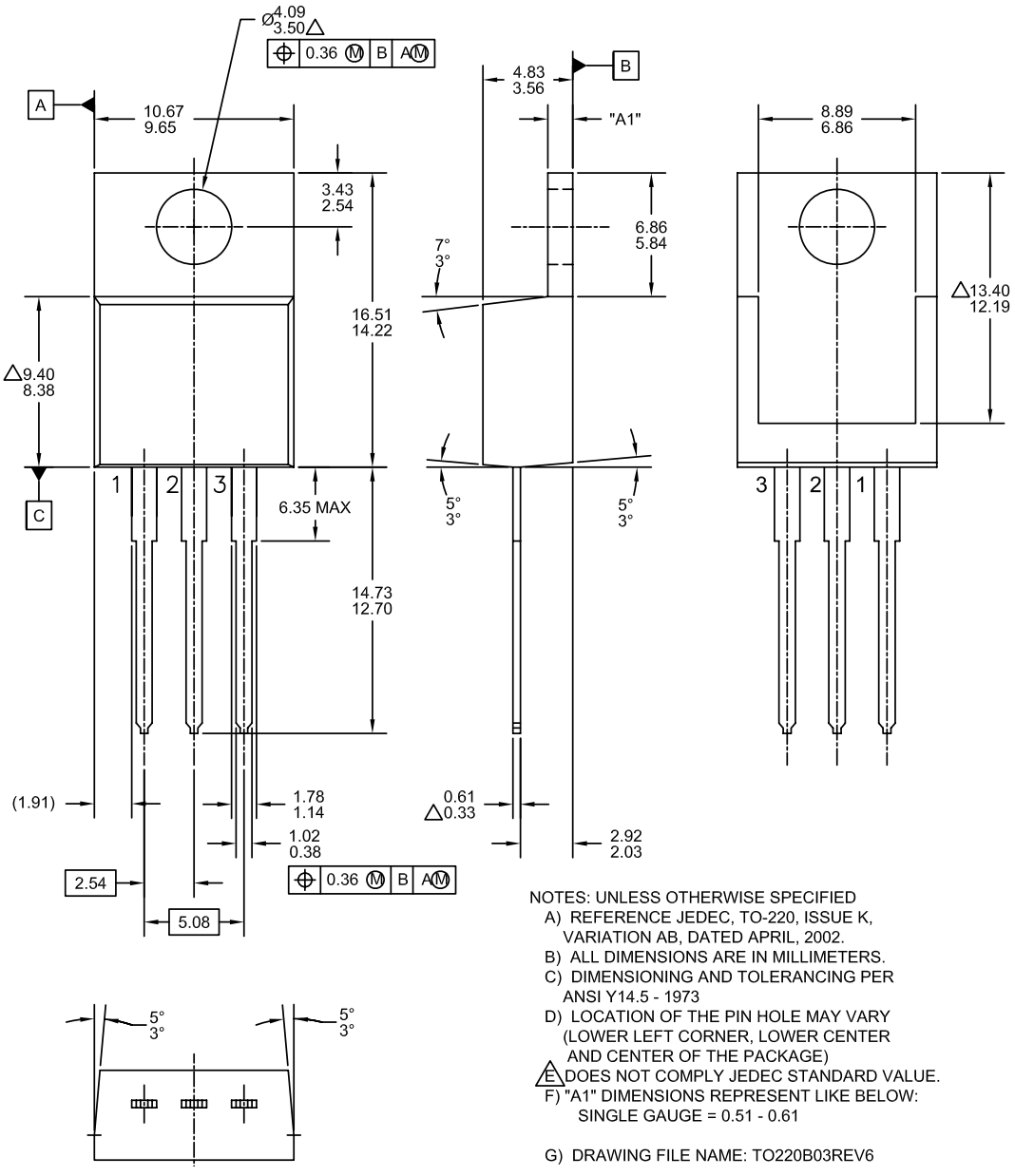
(3) To improve transient response. If large capacitors are used, a high current diode from input to output (1N400l or similar) should be introduced to protect the device from momentary input short circuit.

Mechanical Dimensions

Package

Dimensions in millimeters

TO-220 [SINGLE GAUGE]



NOTES: UNLESS OTHERWISE SPECIFIED

A) REFERENCE JEDEC, TO-220, ISSUE K, VARIATION AB, DATED APRIL, 2002.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1973

D) LOCATION OF THE PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)

△E DOES NOT COMPLY JEDEC STANDARD VALUE.

F) "A1" DIMENSIONS REPRESENT LIKE BELOW:
SINGLE GAUGE = 0.51 - 0.61

G) DRAWING FILE NAME: TO220B03REV6

Ordering Information

Product Number	Output Voltage Tolerance	Package	Operating Temperature
LM7905CT	±4%	TO-220 (Single Gauge)	0 ~ +125°C
LM7906CT			
LM7908CT			
LM7909CT			
LM7910CT			
LM7912CT			
LM7915CT			
LM7918CT			
LM7924CT			

DISCLAIMER

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1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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