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# LM79XX

## 3-Terminal 1A Negative Voltage Regulator

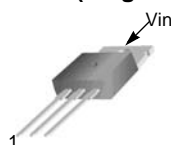
### Features

- 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

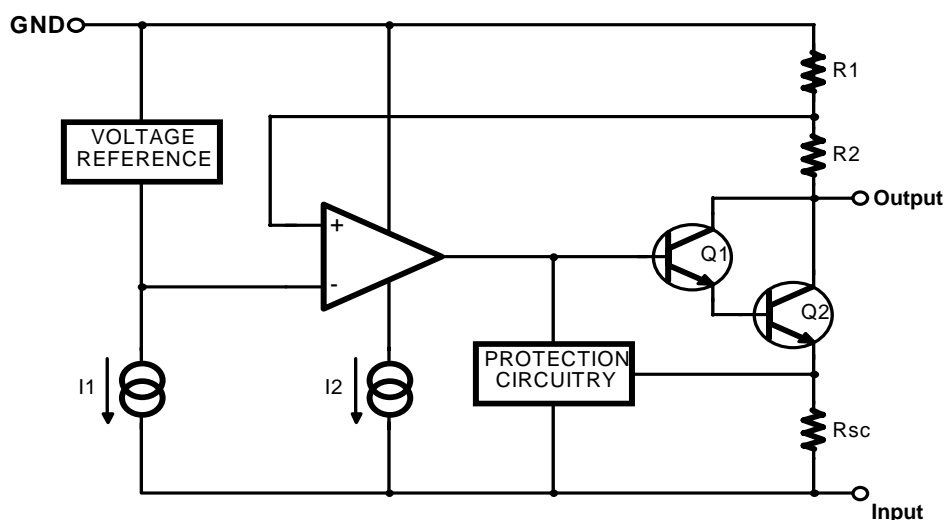
The LM79XX series of three terminal negative regulators are available in TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially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

#### TO-220 (Single Gauge)



1. GND 2. Input 3. Output

### Internal Block Diagram



## 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:

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

## Electrical Characteristics (LM7905)

( $V_I = -10V$ ,  $I_O = 500mA$ ,  $0^\circ C \leq T_J \leq +125^\circ C$ ,  $C_I = 2.2\mu F$ ,  $C_O = 1\mu F$ , unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	VO	TJ = +25°C		-4.8	-5.0	-5.2	V
		IO = 5mA to 1A, PO ≤ 15W VI = -7V to -20V		-4.75	-5.0	-5.25	
Line Regulation (Note3)	ΔVO	TJ = +25°C	VI = -7V to -25V	-	35	100	mV
			VI = -8V to -12V	-	8	50	
Load Regulation (Note3)	ΔVO	TJ = +25°C IO = 5mA to 1.5A		-	10	100	mV
		TJ =+25°C IO = 250mA to 750mA		-	3	50	
Quiescent Current	IQ	TJ =+25°C		-	3	6	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 1A		-	0.05	0.5	mA
		VI = -8V to -25V		-	0.1	0.8	
Temperature Coefficient of VD	ΔVo/ΔT	IO = 5mA		-	- 0.4	-	mV/°C
Output Noise Voltage	VN	f = 10Hz to 100kHz TA =+25°C		-	40	-	μV
Ripple Rejection	RR	f = 120Hz ΔVI = 10V		54	60	-	dB
Dropout Voltage	VD	TJ = +25°C IO = 1A		-	2	-	V
Short Circuit Current	ISC	TJ =+25°C, VI = -35V		-	300	-	mA
Peak Current	IPK	TJ =+25°C		-	2.2	-	A

### Note

- 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<sub>I</sub> = -11V, I<sub>O</sub> = 500mA, 0°C ≤ T<sub>J</sub> ≤ +125°C, C<sub>I</sub> = 2.2μF, C<sub>O</sub> = 1μF, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = +25°C		-5.75	-6	-6.25	V
		I <sub>O</sub> = 5mA to 1A, P <sub>O</sub> ≤ 15W V <sub>I</sub> = -9V to -21V		-5.7	-6	-6.3	
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C	V <sub>I</sub> = -8V to -25V	-	10	120	mV
			V <sub>I</sub> = -9V to -13V	-	5	60	
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 5mA to 1.5A		-	10	120	mV
		T <sub>J</sub> = +25°C I <sub>O</sub> = 250mA to 750mA		-	3	60	
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = +25°C		-	3	6	mA
Quiescent Current Change	ΔI <sub>Q</sub>	I <sub>O</sub> = 5mA to 1A		-	0.05	0.5	mA
		V <sub>I</sub> = -8V to -25V		-	0.1	1.3	
Temperature Coefficient of V <sub>D</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA		-	-0.5	-	mV/°C
Output Noise Voltage	V <sub>N</sub>	f = 10Hz to 100kHz T <sub>A</sub> = +25°C		-	130	-	μV
Ripple Rejection	RR	f = 120Hz ΔV <sub>I</sub> = 10V		54	60	-	dB
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 1A		-	2	-	V
Short Circuit Current	I <sub>SC</sub>	T <sub>J</sub> = +25°C, V <sub>I</sub> = -35V		-	300	-	mA
Peak Current	I <sub>PK</sub>	T <sub>J</sub> = +25°C		-	2.2	-	A

**Note**

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

**Electrical Characteristics (LM7908)** (Continued)(V<sub>I</sub> = -14V, I<sub>O</sub> = 500mA, 0°C ≤ T<sub>J</sub> ≤ +125°C, C<sub>I</sub> = 2.2μF, C<sub>O</sub> = 1μF, unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = +25°C	-7.7	-8	-8.3	V
		I <sub>O</sub> = 5mA to 1A, P <sub>O</sub> ≤ 15W V <sub>I</sub> = -10V to -23V	-7.6	-8	-8.4	
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C	-	10	160	mV
		V <sub>I</sub> = -10.5V to -25V V <sub>I</sub> = -11V to -17V		5	80	
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 5mA to 1.5A	-	12	160	mV
		T <sub>J</sub> = +25°C I <sub>O</sub> = 250mA to 750mA	-	4	80	
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = +25°C	-	3	6	mA
Quiescent Current Change	ΔI <sub>Q</sub>	I <sub>O</sub> = 5mA to 1A	-	0.05	0.5	mA
		V <sub>I</sub> = -10.5V to -25V	-	0.1	1	
Temperature Coefficient of V <sub>D</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA	-	-0.6	-	mV/°C
Output Noise Voltage	V <sub>N</sub>	f = 10Hz to 100kHz T <sub>A</sub> = +25°C	-	175	-	μV
Ripple Rejection	RR	f = 120Hz ΔV <sub>I</sub> = 10V	54	60	-	dB
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 1A	-	2	-	V
Short Circuit Current	I <sub>SC</sub>	T <sub>J</sub> = +25°C, V <sub>I</sub> = -35V	-	300	-	mA
Peak Current	I <sub>PK</sub>	T <sub>J</sub> = +25°C	-	2.2	-	A

**Note**

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

**Electrical Characteristics (LM7909)** (Continued)(V<sub>I</sub> = -15V, I<sub>O</sub> = 500mA, 0°C ≤ T<sub>J</sub> ≤ +125°C, C<sub>I</sub> = 2.2μF, C<sub>O</sub> = 1μF, unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = +25°C	-8.7	-9.0	-9.3	V
		I <sub>O</sub> = 5mA to 1A, P <sub>O</sub> ≤ 15W V <sub>I</sub> = -1.5V to -23V	-8.6	-9.0	-9.4	
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C				mV
		V <sub>I</sub> = -11.5V to -26V	-	10	180	
		V <sub>I</sub> = -12V to -18V	-	5	90	
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 5mA to 1.5A	-	12	180	mV
		T <sub>J</sub> = +25°C I <sub>O</sub> = 250mA to 750mA	-	4	90	
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = +25°C	-	3	6	mA
Quiescent Current Change	ΔI <sub>Q</sub>	I <sub>O</sub> = 5mA to 1A	-	0.05	0.5	mA
		V <sub>I</sub> = -11.5V to -26V	-	0.1	1	
Temperature Coefficient of V <sub>D</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA	-	-0.6	-	mV/°C
Output Noise Voltage	V <sub>N</sub>	f = 10Hz to 100kHz T <sub>A</sub> = +25°C	-	175	-	μV
Ripple Rejection	RR	f = 120Hz ΔV <sub>I</sub> = 10V	54	60	-	dB
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 1A	-	2	-	V
Short Circuit Current	I <sub>SC</sub>	T <sub>J</sub> = +25°C, V <sub>I</sub> = -35V	-	300	-	mA
Peak Current	I <sub>PK</sub>	T <sub>J</sub> = +25°C	-	2.2	-	A

**Note:**

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

**Electrical Characteristics (LM7910)** (Continued)(V<sub>I</sub> = -17V, I<sub>O</sub> = 500mA, 0°C ≤ T<sub>J</sub> ≤ +125°C, C<sub>I</sub> = 2.2μF, C<sub>O</sub> = 1μF, unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = +25°C	-9.6	-10	-10.4	V
		I <sub>O</sub> = 5mA to 1A, P <sub>d</sub> ≤ 15W V <sub>I</sub> = -12V to -28	-9.5	-10	-10.5	
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C	-	12	200	mV
		V <sub>I</sub> = -12.5V to -28V V <sub>I</sub> = -14V to -20V		6	100	
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 5mA to 1.5A	-	12	200	mV
		T <sub>J</sub> = +25°C I <sub>O</sub> = 250mA to 750mA	-	4	100	
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = +25°C	-	3	6	mA
Quiescent Current Change	ΔI <sub>Q</sub>	I <sub>O</sub> = 5mA to 1A	-	0.05	0.5	mA
		V <sub>I</sub> = -12.5V to -28V	-	0.1	1	
Temperature Coefficient of V <sub>O</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA	-	-1	-	mV/°C
Output Noise Voltage	V <sub>N</sub>	10Hz ≤ f ≤ 100kHz T <sub>A</sub> = +25°C	-	280	-	μV
Ripple Rejection	RR	f = 120Hz ΔV <sub>I</sub> = 10V	54	60	-	dB
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 1A	-	2	-	V
Short Circuit Current	I <sub>SC</sub>	T <sub>J</sub> = +25°C, V <sub>I</sub> = -35V	-	300	-	mA
Peak Current	I <sub>PK</sub>	T <sub>J</sub> = +25°C	-	2.2	-	A

**Note:**

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

**Electrical Characteristics (LM7912)** (Continued)(V<sub>I</sub> = -19V, I<sub>O</sub> = 500mA, 0°C ≤ T<sub>J</sub> ≤ +125°C, C<sub>I</sub> = 2.2μF, C<sub>O</sub> = 1μF, unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = +25°C	-11.5	-12	-12.5	V
		I <sub>O</sub> = 5mA to 1A, P <sub>O</sub> ≤ 15W V <sub>I</sub> = -15.5V to -27V	-11.4	-12	-12.6	
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C				mV
		V <sub>I</sub> = -14.5V to -30V	-	12	240	
		V <sub>I</sub> = -16V to -22V	-	6	120	
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 5mA to 1.5A	-	12	240	mV
		T <sub>J</sub> = +25°C I <sub>O</sub> = 250mA to 750mA	-	4	120	
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = +25°C	-	3	6	mA
Quiescent Current Change	ΔI <sub>Q</sub>	I <sub>O</sub> = 5mA to 1A	-	0.05	0.5	mA
		V <sub>I</sub> = -14.5V to -30V	-	0.1	1	
Temperature Coefficient of V <sub>D</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA	-	-0.8	-	mV/°C
Output Noise Voltage	V <sub>N</sub>	f = 10Hz to 100kHz T <sub>A</sub> = +25°C	-	200	-	μV
Ripple Rejection	RR	f = 120Hz ΔV <sub>I</sub> = 10V	54	60	-	dB
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 1A	-	2	-	V
Short Circuit Current	I <sub>SC</sub>	T <sub>J</sub> = +25°C, V <sub>I</sub> = -35V	-	300	-	mA
Peak Current	I <sub>PK</sub>	T <sub>J</sub> = +25°C	-	2.2	-	A

**Note:**

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



**Electrical Characteristics (LM7915)** (Continued)(V<sub>I</sub> = -23V, I<sub>O</sub> = 500mA, 0°C ≤ T<sub>J</sub> ≤ +125°C, C<sub>I</sub> = 2.2μF, C<sub>O</sub> = 1μF, unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = +25°C	-14.4	-15	-15.6	V
		I <sub>O</sub> = 5mA to 1A, P <sub>O</sub> ≤ 15W V <sub>I</sub> = -18V to -30V	-14.25	-15	-15.75	
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C				mV
		V <sub>I</sub> = -17.5V to -30V	-	12	300	
		V <sub>I</sub> = -20V to -26V	-	6	150	
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 5mA to 1.5A	-	12	300	mV
		T <sub>J</sub> = +25°C I <sub>O</sub> = 250mA to 750mA	-	4	150	
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = +25°C	-	3	6	mA
Quiescent Current Change	ΔI <sub>Q</sub>	I <sub>O</sub> = 5mA to 1A	-	0.05	0.5	mA
		V <sub>I</sub> = -17.5V to -30V	-	0.1	1	
Temperature Coefficient of V <sub>D</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA	-	-0.9	-	mV/°C
Output Noise Voltage	V <sub>N</sub>	f = 10Hz to 100kHz T <sub>A</sub> = +25°C	-	250	-	μV
Ripple Rejection	RR	f = 120Hz ΔV <sub>I</sub> = 10V	54	60	-	dB
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 1A	-	2	-	V
Short Circuit Current	I <sub>SC</sub>	T <sub>J</sub> = +25°C, V <sub>I</sub> = -35V	-	300	-	mA
Peak Current	I <sub>PK</sub>	T <sub>J</sub> = +25°C	-	2.2	-	A

**Note:**

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

**Electrical Characteristics (LM7918)** (Continued)(V<sub>I</sub> = -27V, I<sub>O</sub> = 500mA, 0°C ≤ T<sub>J</sub> ≤ +125°C, C<sub>I</sub> = 2.2μF, C<sub>O</sub> = 1μF, unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = +25°C	-17.3	-18	-18.7	V
		I <sub>O</sub> = 5mA to 1A, P <sub>O</sub> ≤ 15W V <sub>I</sub> = -22.5V to -33V	-17.1	-18	-18.9	
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C				mV
		V <sub>I</sub> = -21V to -33V	-	15	360	
		V <sub>I</sub> = -24V to -30V	-	8	180	
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 5mA to 1.5A	-	15	360	mV
		T <sub>J</sub> = +25°C I <sub>O</sub> = 250mA to 750mA	-	5	180	
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = +25°C	-	3	6	mA
Quiescent Current Change	ΔI <sub>Q</sub>	I <sub>O</sub> = 5mA to 1A	-	0.05	0.5	mA
		V <sub>I</sub> = -21V to -33V	-	0.1	1	
Temperature Coefficient of V <sub>D</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA	-	-1	-	mV/°C
Output Noise Voltage	V <sub>N</sub>	f = 10Hz to 100kHz T <sub>A</sub> = +25°C	-	300	-	μV
Ripple Rejection	RR	f = 120Hz ΔV <sub>I</sub> = 10V	54	60	-	dB
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 1A	-	2	-	V
Short Circuit Current	I <sub>SC</sub>	T <sub>J</sub> = +25°C, V <sub>I</sub> = -35V	-	300	-	mA
Peak Current	I <sub>PK</sub>	T <sub>J</sub> = +25°C	-	2.2	-	A

**Note:**

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

**Electrical Characteristics (LM7924)** (Continued)(V<sub>I</sub> = -33V, I<sub>O</sub> = 500mA, 0°C ≤ T<sub>J</sub> ≤ +125°C, C<sub>I</sub> = 2.2μF, C<sub>O</sub> = 1μF, unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = +25°C	-23	-24	-25	V
		I <sub>O</sub> = 5mA to 1A, P <sub>O</sub> ≤ 15W V <sub>I</sub> = -27V to -38V	-22.8	-24	-25.2	
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C				mV
		V <sub>I</sub> = -27V to -38V	-	15	480	
		V <sub>I</sub> = -30V to -36V	-	8	180	
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 5mA to 1.5A	-	15	480	mV
		T <sub>J</sub> = +25°C I <sub>O</sub> = 250mA to 750mA	-	5	240	
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = +25°C	-	3	6	mA
Quiescent Current Change	ΔI <sub>Q</sub>	I <sub>O</sub> = 5mA to 1A	-	0.05	0.5	mA
		V <sub>I</sub> = -27V to -38V	-	0.1	1	
Temperature Coefficient of V <sub>D</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA	-	-1	-	mV/°C
Output Noise Voltage	V <sub>N</sub>	f = 10Hz to 100kHz T <sub>A</sub> = +25°C	-	400	-	μV
Ripple Rejection	RR	f = 120Hz ΔV <sub>I</sub> = 10V	54	60	-	dB
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = +25°C I <sub>O</sub> = 1A	-	2	-	V
Short Circuit Current	I <sub>SC</sub>	T <sub>J</sub> = +25°C, V <sub>I</sub> = -35V	-	300	-	mA
Peak Current	I <sub>PK</sub>	T <sub>J</sub> = +25°C	-	2.2	-	A

**Note:**

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

## Typical Performance Characteristics

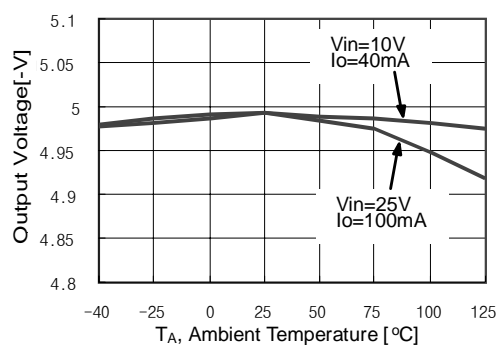


Figure 1. Output Voltage

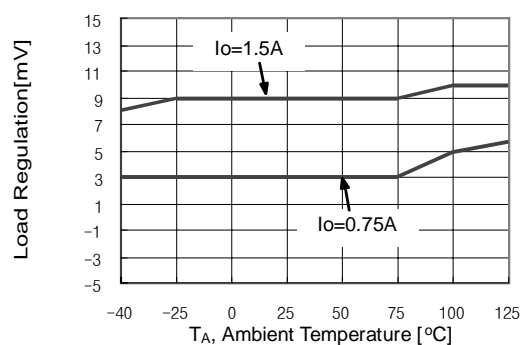


Figure 2. Load Regulation

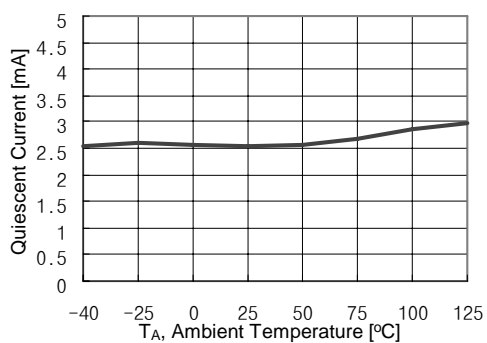


Figure 3. Quiescent Current

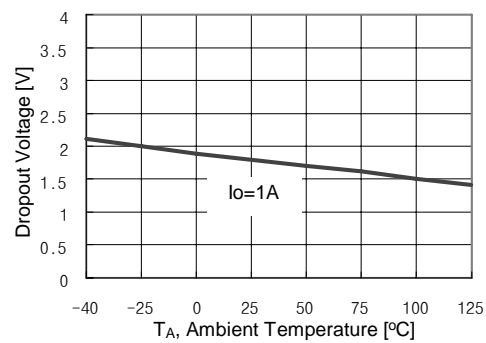


Figure 4. Dropout Voltage

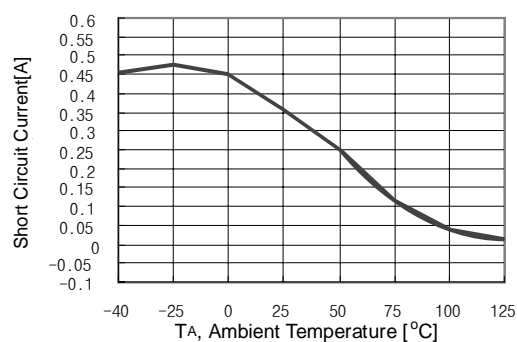


Figure 5. Short Circuit Current

## Typical Applications

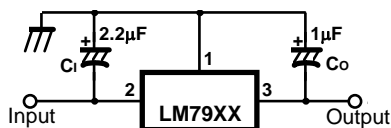


Figure 6. Negative Fixed output regulator

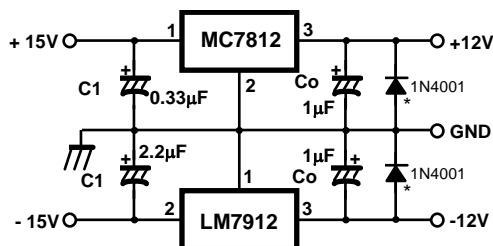


Figure 7. Split power supply ( ± 12V/1A)

### Notes:

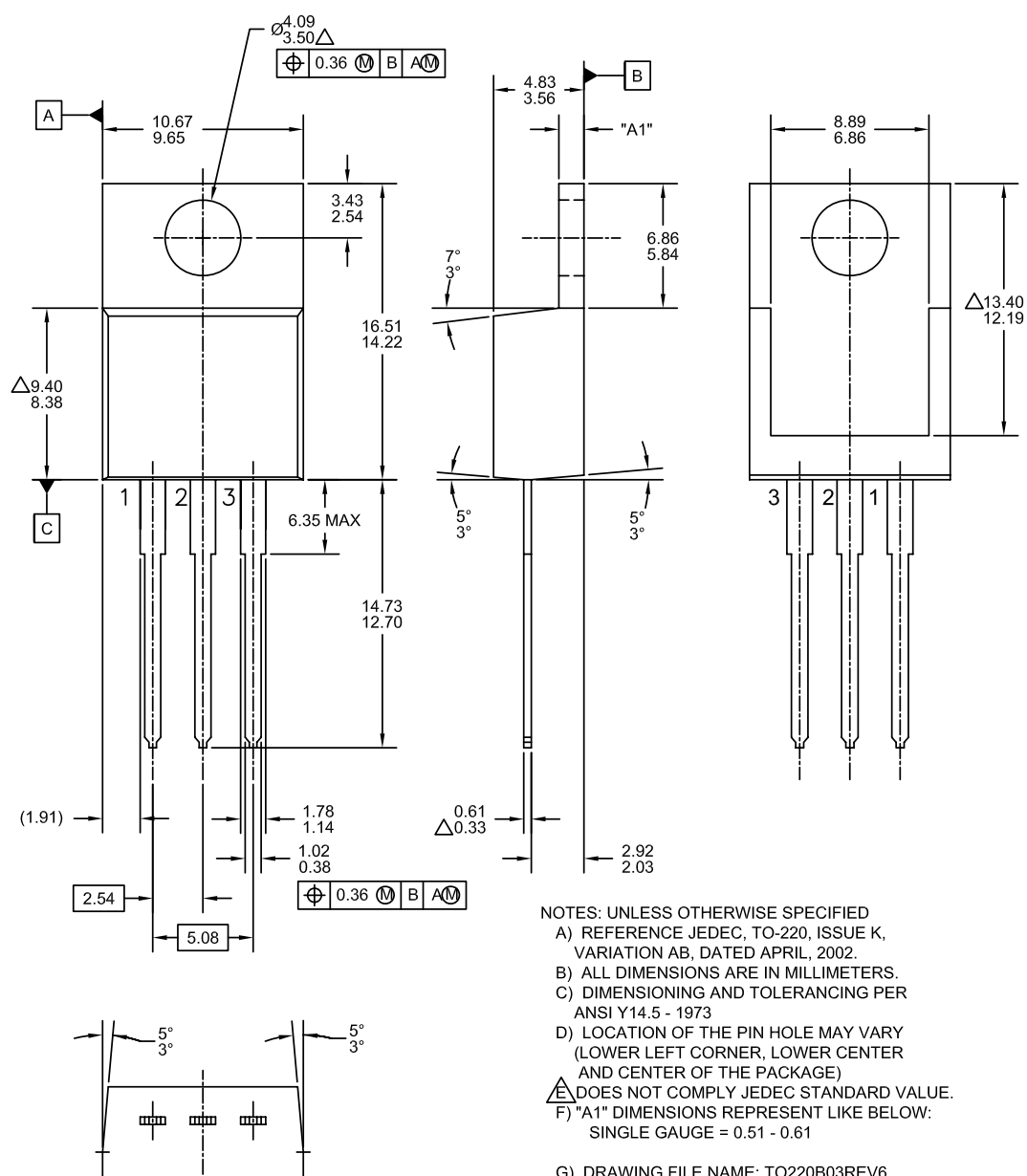
- (1) To specify an output voltage, substitute voltage value for "XX "
- (2) Required for stability. For value given, capacitor must be solid tantalum. If aluminium electrolytics are used, at least ten times value shown should be selected. C<sub>1</sub> is required if regulator is located an appreciable distance from power supply filter.
- (3) To improve transient response. If large capacitors are used, a high current diode from input to output (1N4001 or similar) should be introduced to protect the device from momentary input short circuit.

# Mechanical Dimensions

## Package

Dimensions in millimeters

## TO-220 [ SINGLE GAUGE ]



## Ordering Information

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

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