3-Terminal
Negative voltage Regulators

DESCRIPTION

These voltage regulators are designed as fixed negative voltage regulators for a wide variety of applications including local, on-card regulation. Although designed primarily as a fixed voltage regulator, these devices can be used with external components to obtain adjustable voltages and currents.

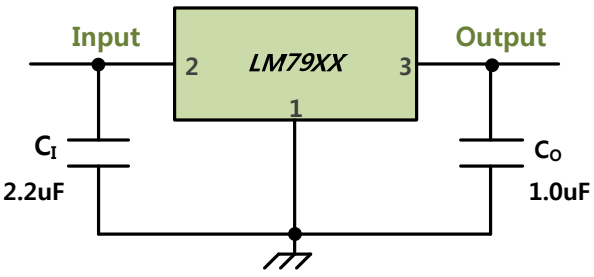
FEATURES

- **Output current in excess of 1.0A**
- **No external components required**
- **Output Voltages (-5V, -6V, -8V, -9V, -10V, -12V, -15V, -18V)**
- **Internal Thermal shutdown and SOA protection**
- **Output voltage offered in 4% Tolerance**
- Pb-Free Packages are available
- High ESD Level (HBM>8000V, MM>800V)

TYPICAL APPLICATION

The input voltage must remain typically 2.0V above the output voltage even during the low point on the ripple voltage.

* C_I is required if regulator is located an appreciable Distance from power filter.
* C_O improves transient response. Values of ≤ 1.0 μF could cause instability.



1.0A ,Negative voltage Regulators

Maximum Ratings (T_A=25 °C, unless otherwise noted)

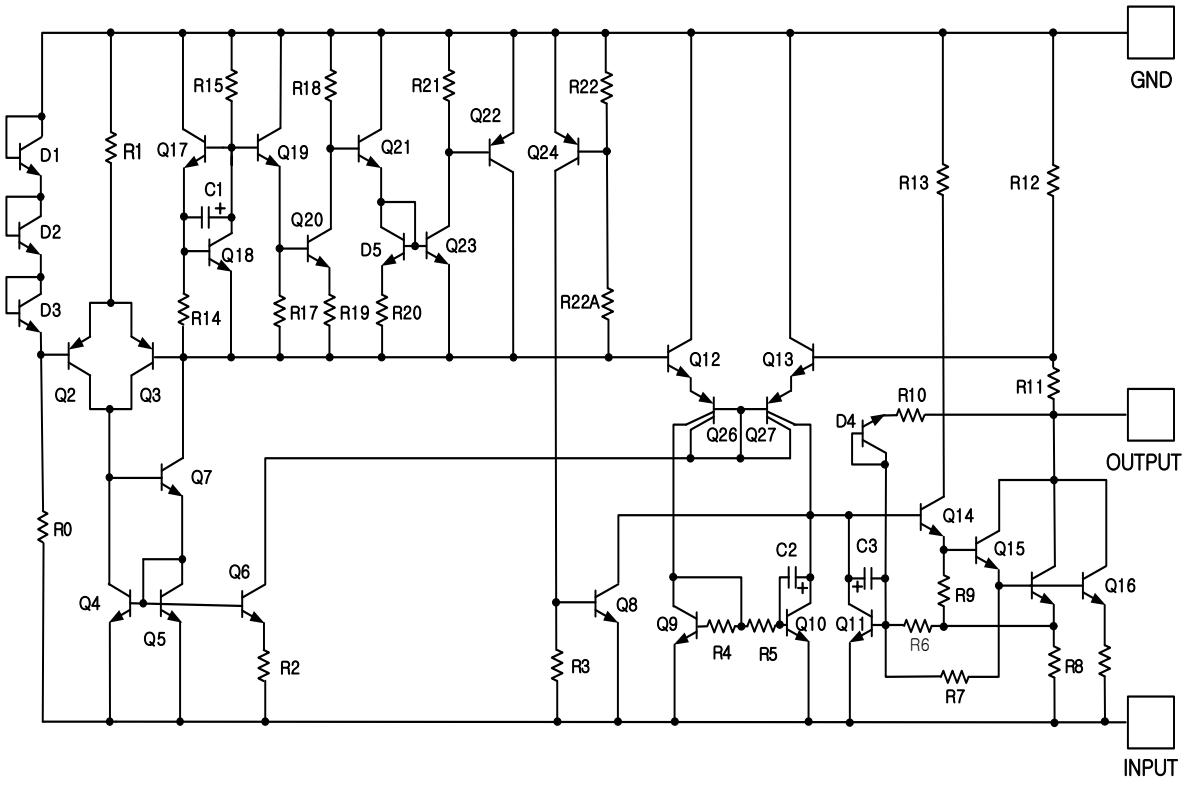
Rating		Symbol	Value			Unit
			TO-220F	TO-220	TO-252	
Input Voltage	-5V ~ -18V	VI	-35			V
	-24V		-40			
Power Dissipation		PD	2	2	1.3	W
Thermal Resistance of Junction to Ambient		RθJA	65	65	92	°C/W
Thermal Resistance of Junction to Case		RθJC	5	5	5	°C/W
Storage Temperature		TSTG	-55 ~ 125			°C
Junction Temperature		TJ	+ 150			°C
Operating Temperature		TOPR	-40 ~ 125			°C

Stresses exceeding Maximum ratings may damage the device. Maximum ratings are stress ratings. Functional operation above the recommended operating conditions is not implied.

Extended exposure to stresses the above the recommended operating conditions may affect device reliability.

PD(max) = (TJ(max)–TA) ÷ θJA. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown.

Representative Schematic of LM79XX



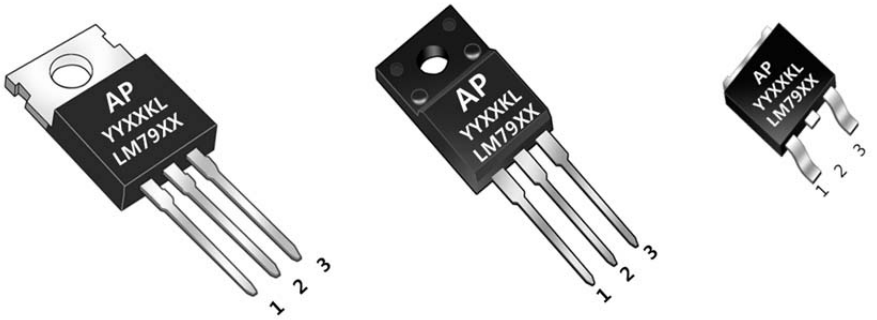
REV. 03

Ordering Information

Part No	Package	Packing	Finish	Halogen	Packing Unit	Remark
LM79XXRTRL	TO-252	Reel & Tape	Sn	Free	2,500ea	XX : Output Voltage option *
LM79XXFTL	TO-220F	Tube	Sn	Free	5,000ea	XX : Output Voltage option *
LM79XXTL	TO-220	Tube	Sn	Free	5,000ea	XX : Output Voltage option *

* Voltage option (XX) : -5V(05), -6V(06), -8V(08), -9V(09), -10V(10), -12V(12), -15V(15), -18V(18),-24V(24)

Package Outline



TO-220 TO-220F TO-252

PIN INFO. 1. GND PIN 2. INPUT PIN 3. OUTPUT PIN

Electrical characteristics

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

Electrical characteristics (LM7905)

(T_J = 0 to 125 °C, V_{IN}=10V, I_O=500 mA, C_I=2.2 µF, C_O=1.0 µF, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	VO	TJ=25°C	-4.8	-5.0	-5.2	V
		5.0mA ≤ IO ≤ 1.0A, PD≤15W -7.0V ≥ VIN ≥ -20.0V	-4.75	-5.0	-5.25	
Line regulation (TJ=25°C) (**Note 1**)	Regline	-7.0V ≥ VIN ≥ -25.0V			100	mV
		-8.0V ≥ VIN ≥ -12.0V			50	
Load regulation (TJ=25°C) (**Note 1**)	Regload	5.0 mA ≤ IO ≤ 1.5A			100	mV
		250 mA ≤ IO ≤ 750 mA			50	
Quiescent current	IQ	TJ=25°C			6.0	mA
Quiescent current change	Δ IQ	5.0 mA ≤ IO ≤ 1.0 A			0.5	mA
		-8.0V ≥ VIN ≥ -25.0V			0.8	
Output Voltage Drift	ΔVO/ΔT	IO = 5.0 mA		-0.4		mV/°C
Output noise voltage	VN	10 Hz ≤ f ≤ 100 KHz, TA=25°C		40		µV/VO
Ripple rejection	RR	-8.0V ≥ VIN ≥ -18.0V, f=120 Hz	54	60		dB
Dropout voltage	VDROP	IO = 1.0A, TJ=25°C		1.3		V
Short circuit current limit	ISC	VIN = -35V, TA=25°C		500		mA
Peak output current	IPK	TJ=25°C		2.2		A

Electrical characteristics (LM7906)

(T_J = 0 to 125 °C, V_{IN}=11V, I_O=500 mA, C_I=2.2 µF, C_O=1.0 µF, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	VO	TJ=25°C	-5.75	-6.0	-6.25	V
		5.0mA ≤ IO ≤ 1.0A, PD≤15W -8.0V ≥ VIN ≥ -21.0V	-5.7	-6.0	-6.3	
Line regulation (TJ=25°C) (**Note 1**)	Regline	-8.0V ≥ VIN ≥ -25.0V			120	mV
		-9.0V ≥ VIN ≥ -13.0V			60	
Load regulation (TJ=25°C) (**Note 1**)	Regload	5.0 mA ≤ IO ≤ 1.5A			120	mV
		250 mA ≤ IO ≤ 750 mA			60	
Quiescent current	IQ	TJ=25°C			6.0	mA
Quiescent current change	Δ IQ	5.0 mA ≤ IO ≤ 1.0 A			0.5	mA
		-8.0V ≥ VIN ≥ -25.0V			1.3	
Output Voltage Drift	ΔVO/ΔT	IO = 5.0 mA		-0.5		mV/°C
Output noise voltage	VN	10 Hz ≤ f ≤ 100 KHz, TA=25°C		130		µV/VO
Ripple rejection	RR	-9.0V ≥ VIN ≥ -19.0V, f=120 Hz	54	60		dB
Dropout voltage	VDROP	IO = 1.0A, TJ=25°C		1.3		V
Short circuit current limit	ISC	VIN = -35V, TA=25°C		500		mA
Peak output current	IPK	TJ=25°C		2.2		A

Electrical characteristics (LM7908)

(T_J = 0 to 125 °C, V_{IN}=14V, I_O=500 mA, C_I=2.2 µF, C_O=1.0 µF, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	VO	TJ=25°C	-7.7	-8.0	-8.3	V
		5.0mA ≤ IO ≤ 1.0A, PD≤15W -10.5V ≥ VIN ≥ -23.0V	-7.6	-8.0	-8.4	
Line regulation (TJ=25°C) (**Note 1**)	Regline	-10.5V ≥ VIN ≥ -25.0V			160	mV
		-11.5V ≥ VIN ≥ -17.0V			80	
Load regulation (TJ=25°C) (**Note 1**)	Regload	5.0 mA ≤ IO ≤ 1.5A			160	mV
		250 mA ≤ IO ≤ 750 mA			80	
Quiescent current	IQ	TJ=25°C			6.0	mA
Quiescent current change	Δ IQ	5.0 mA ≤ IO ≤ 1.0 A			0.5	mA
		-10.5V ≥ VIN ≥ -25.0V			1.0	
Output Voltage Drift	ΔVO/ΔT	IO = 5.0 mA		-0.6		mV/°C
Output noise voltage	VN	10 Hz ≤ f ≤ 100 KHz, TA=25°C		175		µV/VO
Ripple rejection	RR	-11.5V ≥VIN ≥ -21.5V, f=120 Hz	54	60		dB
Dropout voltage	VDROP	IO = 1.0A, TJ=25°C		1.3		V
Short circuit current limit	ISC	VIN = -35V, TA=25°C		500		mA
Peak output current	IPK	TJ=25°C		2.2		A

Electrical characteristics (LM7909)

(T_J = 0 to 125 °C, V_{IN}=15V, I_O=500 mA, C_I=2.2 µF, C_O=1.0 µF, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	VO	TJ=25°C	-8.65	-9.0	-9.35	V
		5.0mA ≤ IO ≤ 1.0A, PD≤15W -11.5V ≥ VIN ≥ -24.0V	-8.6	-9.0	-9.4	
Line regulation (TJ=25°C) (**Note 1**)	Regline	-11.5V ≥ VIN ≥ -25.0V			180	mV
		-12.0V ≥ VIN ≥ -17.0V			90	
Load regulation (TJ=25°C) (**Note 1**)	Regload	5.0 mA ≤ IO ≤ 1.5A			180	mV
		250 mA ≤ IO ≤ 750 mA			90	
Quiescent current	IQ	TJ=25°C			6.0	mA
Quiescent current change	Δ IQ	5.0 mA ≤ IO ≤ 1.0 A			0.5	mA
		-11.5V ≥ VIN ≥ -26.0V			1.0	
Output Voltage Drift	ΔVO/ΔT	IO = 5.0 mA		-0.6		mV/°C
Output noise voltage	VN	10 Hz ≤ f ≤ 100 KHz, TA=25°C		175		µV/VO
Ripple rejection	RR	-13.0V ≥VIN ≥ -23.0V, f=120 Hz	54	60		dB
Dropout voltage	VDROP	IO = 1.0A, TJ=25°C		1.3		V
Short circuit current limit	ISC	VIN = -35V, TA=25°C		500		mA
Peak output current	IPK	TJ=25°C		2.2		A

Electrical characteristics (LM7910)

(T_J = 0 to 125 °C, V_{IN}=16V, I_O=500 mA, C_I=2.2 µF, C_O=1.0 µF, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	VO	TJ=25°C	-9.6	-10.0	-10.4	V
		5.0mA ≤ IO ≤ 1.0A, PD≤15W -12.5V ≥ VIN ≥ -25.0V	-9.5	-10.0	-10.5	
Line regulation (TJ=25°C) (**Note 1**)	Regline	-12.5V ≥ VIN ≥ -25.0V			200	mV
		-13.0V ≥ VIN ≥ -25.0V			100	
Load regulation (TJ=25°C) (**Note 1**)	Regload	5.0 mA ≤ IO ≤ 1.5A			200	mV
		250 mA ≤ IO ≤ 750 mA			100	
Quiescent current	IQ	TJ=25°C			6.0	mA
Quiescent current change	Δ IQ	5.0 mA ≤ IO ≤ 1.0 A			0.5	mA
		-12.5V ≥ VIN ≥ -29.0V			1.0	
Output Voltage Drift	ΔVO/ΔT	IO = 5.0 mA		-1.0		mV/°C
Output noise voltage	VN	10 Hz ≤ f ≤ 100 KHz, TA=25°C		280		µV/VO
Ripple rejection	RR	-13.0V ≥VIN ≥ -23.0V, f=120 Hz	54	60		dB
Dropout voltage	VDROP	IO = 1.0A, TJ=25°C		2.0		V
Short circuit current limit	ISC	VIN = -35V, TA=25°C		500		mA
Peak output current	IPK	TJ=25°C		2.2		A

Electrical characteristics (LM7912)

(T_J = 0 to 125 °C, V_{IN}=19V, I_O=500 mA, C_I=2.2 µF, C_O=1.0 µF, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	VO	TJ=25°C	-11.5	-12.0	-12.5	V
		5.0mA ≤ IO ≤ 1.0A, PD≤15W -14.5V ≥ VIN ≥ -27.0V	-11.4	-12.0	-12.6	
Line regulation (TJ=25°C) (**Note 1**)	Regline	-14.5V ≥ VIN ≥ -30.0V			240	mV
		-16.0V ≥ VIN ≥ -22.0V			120	
Load regulation (TJ=25°C) (**Note 1**)	Regload	5.0 mA ≤ IO ≤ 1.5A			240	mV
		250 mA ≤ IO ≤ 750 mA			120	
Quiescent current	IQ	TJ=25°C			6.0	mA
Quiescent current change	Δ IQ	5.0 mA ≤ IO ≤ 1.0 A			0.5	mA
		-14.5V ≥ VIN ≥ -30.0V			1.0	
Output Voltage Drift	ΔVO/ΔT	IO = 5.0 mA		-0.8		mV/°C
Output noise voltage	VN	10 Hz ≤ f ≤ 100 KHz, TA=25°C		200		µV/VO
Ripple rejection	RR	-15.0V ≥VIN ≥ -25.0V, f=120 Hz	54	60		dB
Dropout voltage	VDROP	IO = 1.0A, TJ=25°C		1.3		V
Short circuit current limit	ISC	VIN = -35V, TA=25°C		500		mA
Peak output current	IPK	TJ=25°C		2.2		A

Electrical characteristics (LM7915)

(T_J = 0 to 125 °C, V_{IN}=23V, I_O=500 mA, C_I=2.2 µF, C_O=1.0 µF, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	VO	TJ=25°C	-14.4	-15.0	-15.6	V
		5.0mA ≤ IO ≤ 1.0A, PD≤15W -17.5V ≥ VIN ≥ -30.0V	-14.25	-15.0	-15.75	
Line regulation (TJ=25°C) (**Note 1)**	Regline	-17.5V ≥ VIN ≥ -30.0V			300	mV
		-20.0V ≥ VIN ≥ -26.0V			150	
Load regulation (TJ=25°C) (**Note 1)**	Regload	5.0 mA ≤ IO ≤ 1.5A			300	mV
		250 mA ≤ IO ≤ 750 mA			150	
Quiescent current	IQ	TJ=25°C			6.0	mA
Quiescent current change	Δ IQ	5.0 mA ≤ IO ≤ 1.0 A			0.5	mA
		-17.5V ≥ VIN ≥ -30.0V			1.0	
Output Voltage Drift	ΔVO/ΔT	IO = 5.0 mA		-0.9		mV/°C
Output noise voltage	VN	10 Hz ≤ f ≤ 100 KHz, TA=25°C		250		µV/VO
Ripple rejection	RR	-18.5V ≥VIN ≥ -28.5V, f=120 Hz	54	60		dB
Dropout voltage	VDROP	IO = 1.0A, TJ=25°C		1.3		V
Short circuit current limit	ISC	VIN = -35V, TA=25°C		500		mA
Peak output current	IPK	TJ=25°C		2.2		A

Electrical characteristics (LM7918)

(T_J = 0 to 125 °C, V_{IN}=27V, I_O=500 mA, C_I=2.2 µF, C_O=1.0 µF, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	VO	TJ=25°C	-17.3	-18.0	-18.7	V
		5.0mA ≤ IO ≤ 1.0A, PD≤15W -21.0V ≥ VIN ≥ -33.0V	-17.1	-18.0	-18.9	
Line regulation (TJ=25°C) (**Note 1)**	Regline	-21.0V ≥ VIN ≥ -33.0V			360	mV
		-24.0V ≥ VIN ≥ -30.0V			180	
Load regulation (TJ=25°C) (**Note 1)**	Regload	5.0 mA ≤ IO ≤ 1.5A			360	mV
		250 mA ≤ IO ≤ 750 mA			180	
Quiescent current	IQ	TJ=25°C			6.0	mA
Quiescent current change	Δ IQ	5.0 mA ≤ IO ≤ 1.0 A			0.5	mA
		-21.0V ≥ VIN ≥ -33.0V			1.0	
Output Voltage Drift	ΔVO/ΔT	IO = 5.0 mA		-1.0		mV/°C
Output noise voltage	VN	10 Hz ≤ f ≤ 100 KHz, TA=25°C		300		µV/VO
Ripple rejection	RR	-22.0V ≥VIN ≥ -32.0V, f=120 Hz	54	60		dB
Dropout voltage	VDROP	IO = 1.0A, TJ=25°C		1.3		V
Short circuit current limit	ISC	VIN = -35V, TA=25°C		500		mA
Peak output current	IPK	TJ=25°C		2.2		A

Electrical characteristics (LM7924)

(T_J = 0 to 125 °C, V_{IN}=33V, I_O=500 mA, C_I=2.2 µF, C_O=1.0 µF, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	VO	TJ=25°C	-23.0	-24.0	-25.0	V
		5.0mA ≤ IO ≤ 1.0A, PD≤15W -27.0V ≥ VIN ≥ -38.0V	-22.8	-24.0	-25.25	
Line regulation (TJ=25°C) (**Note 1)**	Regline	-27.0V ≥ VIN ≥ -38.0V			480	mV
		-30.0V ≥ VIN ≥ -36.0V			180	
Load regulation (TJ=25°C) (**Note 1)**	Regload	5.0 mA ≤ IO ≤ 1.5A			480	mV
		250 mA ≤ IO ≤ 750 mA			240	
Quiescent current	IQ	TJ=25°C			6.0	mA
Quiescent current change	Δ IQ	5.0 mA ≤ IO ≤ 1.0 A			0.5	mA
		-27.0V ≥ VIN ≥ -38.0V			1.0	
Output Voltage Drift	ΔVO/ΔT	IO = 5.0 mA		-1.0		mV/°C
Output noise voltage	VN	10 Hz ≤ f ≤ 100 KHz, TA=25°C		400		µV/VO
Ripple rejection	RR	-28.0V ≥VIN ≥ -38.0V, f=120 Hz	54	60		dB
Dropout voltage	VDROP	IO = 1.0A, TJ=25°C		1.3		V
Short circuit current limit	ISC	VIN = -35V, TA=25°C		500		mA
Peak output current	IPK	TJ=25°C		2.2		A

Typical Performance Characteristics

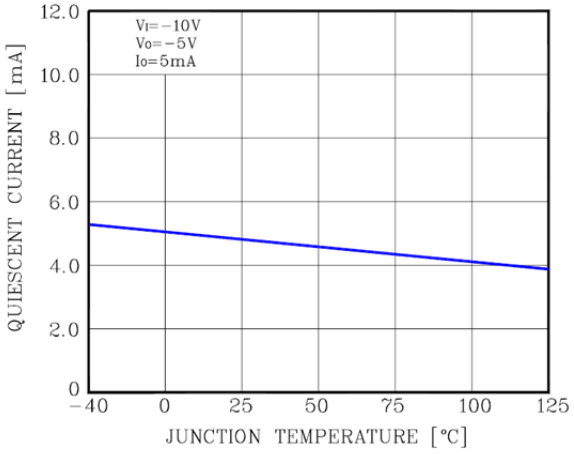


Figure 1. Quiescent Current

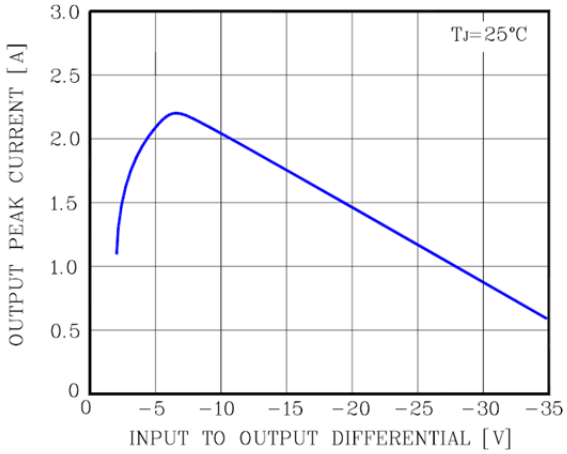


Figure 2. Output Peak Current

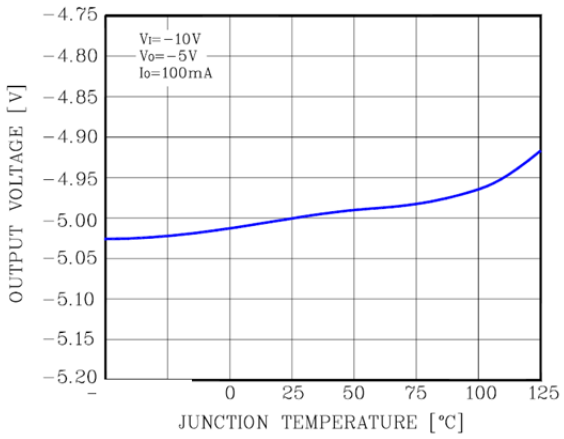


Figure 3. Output Voltage

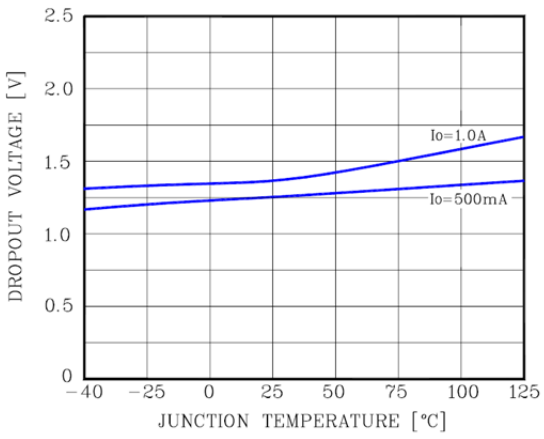


Figure 4. Dropout Voltage

Typical Applications

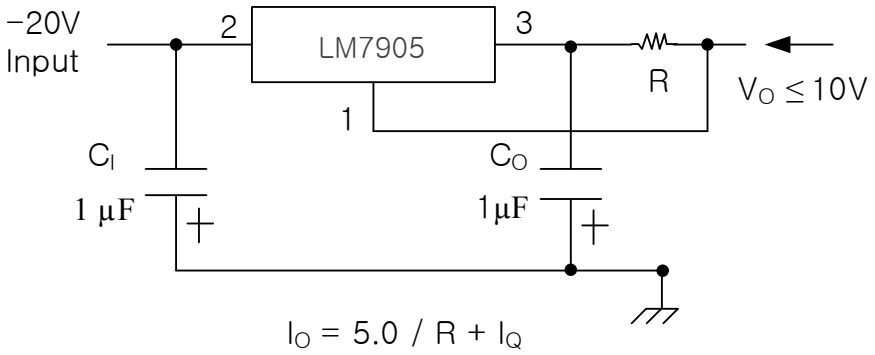


Figure 4-1 Constant Current Regulator

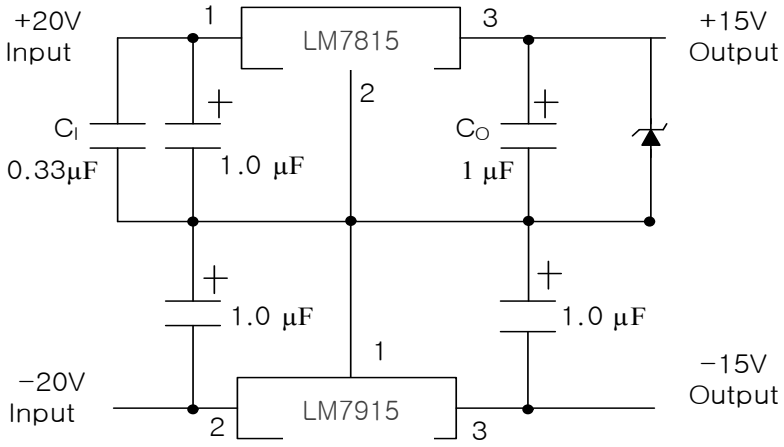
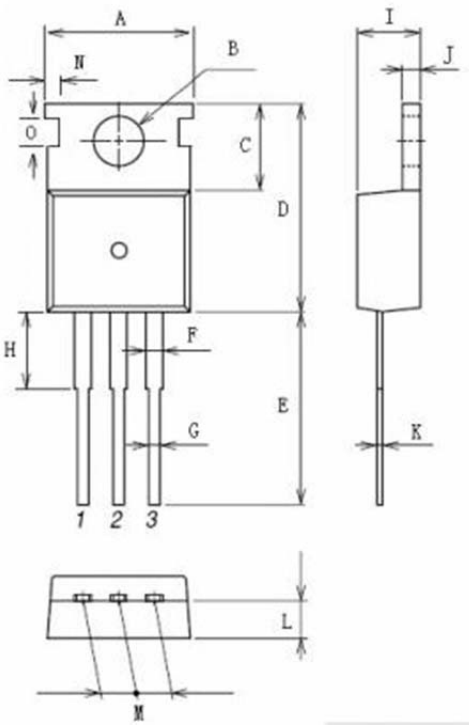


Figure 4-2 Operation Amplifier Supply (±15V @ 1.0A)

Package Dimensions

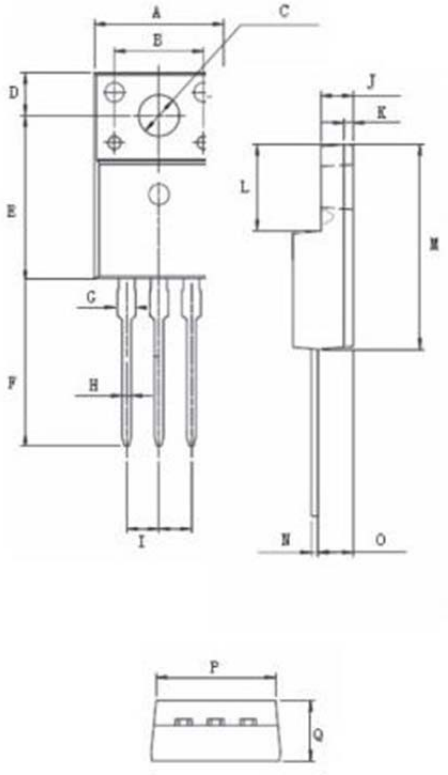
TO-220 Dual Gauge



Unit: mm

Item	Min	Max
A	9. 85	10. 15
B	3. 60	3. 70
C	6. 35	6. 55
D	15. 55	15. 95
E	12. 85	13. 15
F	1. 17	1. 37
G	0. 70	0. 90
H	2. 30	2. 70
I	4. 40	4. 60
J	1. 20	1. 40
K	0. 40	0. 60
L	2. 23	2. 53
M	4. 98	5. 18
N	0. 55	0. 75
O	1. 62	1. 82

TO-220F

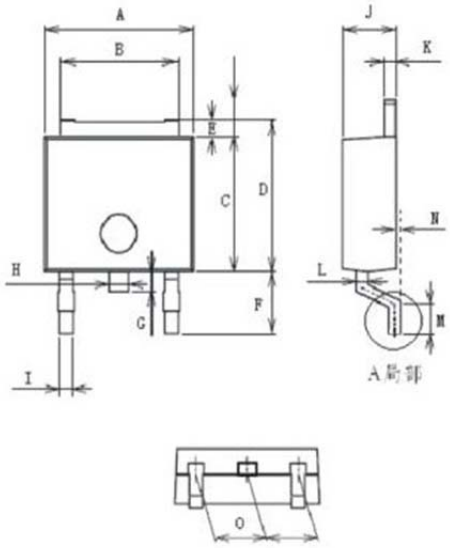


Unit: mm

Item	Min	Max
A	9. 92	10. 32
B	6. 90	7. 10
C	3. 35	3. 55
D	3. 25	3. 35
E	12. 35	12. 75
F	12. 80	13. 20
G	1. 22	1. 42
H	0. 70	0. 90
I	2. 45Typical	
J	2. 45	2. 65
K	0. 60	0. 80
L	6. 57	6. 77
M	15. 80	16. 00
N	0. 40	0. 60
O	2. 62	2. 92
P	9. 20	9. 40
Q	4. 62	4. 80

Package Dimensions

TO-252



Unit: mm

Item	Min	Max
A	6. 40	6. 70
B	5. 20	5. 40
C	6. 00	6. 30
D	6. 55	6. 85
E	0. 45	0. 60
F	3. 07	3. 35
G	0. 85	1. 05
H	0. 75	0. 95
I	0. 55	0. 75
J	2. 20	2. 40
K	0. 43	0. 58
L	0. 43	0. 58
M	0. 90	1. 10
N	0. 90	1. 10
O	2. 20	2. 40

Revision History

No	Date	Contents
1	2015-01-30	Initial Brief Datasheet Release
2	2015-06-22	ESD Level Update
3	2016-11-07	Power Dissipation Update

http://www.apsemi.com

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