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September 2014

KA79XX / KA79XXA / LM79XX

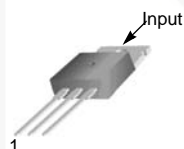
3-Terminal 1 A Negative Voltage Regulator

Features

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

Description

The KA79XX / KA79XXA / LM79XX series of three-terminal negative regulators are available in a TO-220 package with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shutdown, and safe operating area protection.

TO-220

1. GND 2. Input 3. Output

Ordering Information

Product Number	Output Voltage Tolerance	Package	Packing Method	Operating Temperature
KA7905TU	±4%	TO-220 (Dual Gauge)	Rail	0 to +125°C
KA7906TU				
KA7908TU				
KA7909TU				
KA7912TU				
KA7915TU				
KA7918TU				
KA7924TU				
KA7912ATU	±2%			
KA7915ATU				
LM7905CT	±4%	TO-220 (Single Gauge)		
LM7908CT				
LM7909CT				
LM7910CT				
LM7912CT				
LM7915CT				
LM7918CT				

Block Diagram

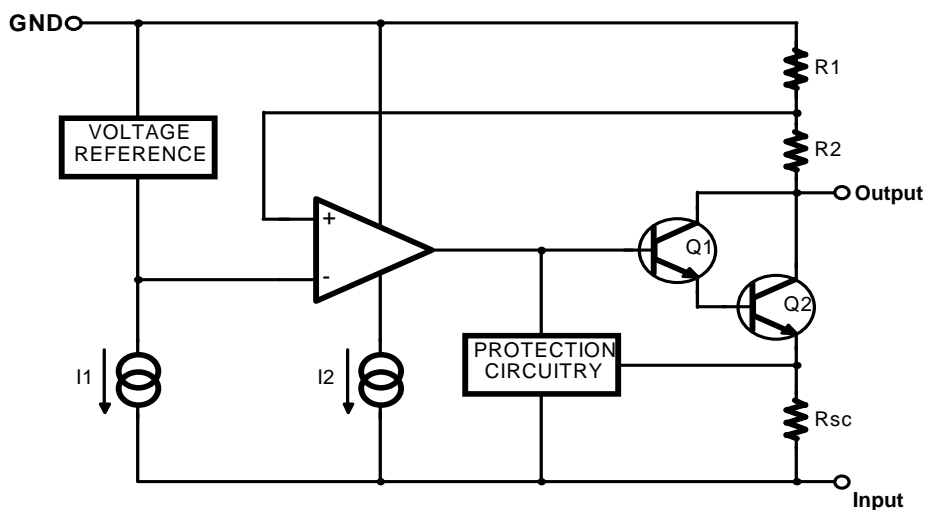


Figure 1. Block Diagram

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at $T_A = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Value	Unit
V_I	Input Voltage	-35	V
$R_{\theta JC}$	Thermal Resistance, Junction-Case ⁽¹⁾	5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-Air ^(1, 2)	65	$^\circ\text{C/W}$
T_{OPR}	Operating Temperature Range	0 to +125	$^\circ\text{C}$
T_{STG}	Storage Temperature Range	- 65 to +150	$^\circ\text{C}$

Notes:

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

Electrical Characteristics (KA7905 / LM7905)(V_I = -10 V, I_O = 500 mA, 0°C ≤ T_J ≤ +125°C, C_I = 2.2 μF, C_O = 1 μF; unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _O	Output Voltage	T _J = +25°C	-4.80	-5.00	-5.20	V
		I _O = 5 mA to 1 A, P _O ≤ 15 W, V _I = -7 V to -20 V	-4.75	-5.00	-5.25	
ΔV _O	Line Regulation ⁽³⁾	T _J = +25°C	V _I = -7 V to -25 V	35	100	mV
			V _I = -8 V to -12 V	8	50	
ΔV _O	Load Regulation ⁽³⁾	T _J = +25°C, I _O = 5 mA to 1.5 A		10	100	mV
		T _J = +25°C, I _O = 250 mA to 750 mA		3	50	
I _Q	Quiescent Current	T _J = +25°C		3	6	mA
ΔI _Q	Quiescent Current Change	I _O = 5 mA to 1 A		0.05	0.50	mA
		V _I = -8 V to -25 V		0.10	0.80	
ΔV _O /ΔT	Temperature Coefficient of V _D	I _O = 5 mA		-0.4		mV/°C
V _N	Output Noise Voltage	f = 10 Hz to 100 kHz, T _A = +25°C		40		μV
RR	Ripple Rejection	f = 120 Hz, ΔV _I = 10 V		54	60	dB
V _D	Dropout Voltage	T _J = +25°C, I _O = 1 A		2		V
I _{SC}	Short-Circuit Current	T _J = +25°C, V _I = -35 V		300		mA
I _{PK}	Peak Current	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 (KA7906)(V_I = -11 V, I_O = 500 mA, 0°C ≤ T_J ≤ +125°C, C_I = 2.2 μF, C_O = 1 μF; unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _O	Output Voltage	T _J = +25°C	-5.75	-6.00	-6.25	V
		I _O = 5 mA to 1 A, P _O ≤ 15 W, V _I = -9 V to -21 V	-5.70	-6.00	-6.30	
ΔV _O	Line Regulation ⁽⁴⁾	T _J = +25°C	V _I = -8 V to -25 V	10	120	mV
			V _I = -9 V to -13 V	5	60	
ΔV _O	Load Regulation ⁽⁴⁾	T _J = +25°C, I _O = 5 mA to 1.5 A		10	120	mV
		T _J = +25°C, I _O = 250 mA to 750 mA		3	60	
I _Q	Quiescent Current	T _J = +25°C		3	6	mA
ΔI _Q	Quiescent Current Change	I _O = 5 mA to 1 A		0.05	0.50	mA
		V _I = -8 V to -25 V		0.10	1.30	
ΔV _O /ΔT	Temperature Coefficient of V _D	I _O = 5 mA		-0.5		mV/°C
V _N	Output Noise Voltage	f = 10 Hz to 100 kHz, T _A = +25°C		130		μV
RR	Ripple Rejection	f = 120 Hz, ΔV _I = 10 V		54	60	dB
V _D	Dropout Voltage	T _J = +25°C, I _O = 1 A		2		V
I _{SC}	Short-Circuit Current	T _J = +25°C, V _I = -35 V		300		mA
I _{PK}	Peak Current	T _J = +25°C		2.2		A

Note:

4. 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 (KA7908 / LM7908)(V_I = -14 V, I_O = 500 mA, 0°C ≤ T_J ≤ +125°C, C_I = 2.2 μF, C_O = 1 μF; unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _O	Output Voltage	T _J = +25°C	-7.7	-8.0	-8.3	V
		I _O = 5 mA to 1 A, P _O ≤ 15 W, V _I = -10 V to -23 V	-7.6	-8.0	-8.4	
ΔV _O	Line Regulation ⁽⁵⁾	T _J = +25°C		10	160	mV
		V _I = -10.5 V to -25 V V _I = -11 V to -17 V		5	80	
ΔV _O	Load Regulation ⁽⁵⁾	T _J = +25°C, I _O = 5 mA to 1.5 A		12	160	mV
		T _J = +25°C, I _O = 250 mA to 750 mA		4	80	
I _Q	Quiescent Current	T _J = +25°C		3	6	mA
ΔI _Q	Quiescent Current Change	I _O = 5 mA to 1 A		0.05	0.50	mA
		V _I = -10.5 V to -25 V		0.10	1.00	
ΔV _O /ΔT	Temperature Coefficient of V _D	I _O = 5 mA		-0.6		mV/°C
V _N	Output Noise Voltage	f = 10 Hz to 100 kHz, T _A = +25°C		175		μV
RR	Ripple Rejection	f = 120 Hz, ΔV _I = 10 V	54	60		dB
V _D	Dropout Voltage	T _J = +25°C, I _O = 1 A		2		V
I _{SC}	Short-Circuit Current	T _J = +25°C, V _I = -35 V		300		mA
I _{PK}	Peak Current	T _J = +25°C		2.2		A

Note:

5. 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 (KA7909 / LM7909)(V_I = -15 V, I_O = 500 mA, 0°C ≤ T_J ≤ +125°C, C_I = 2.2 μF, C_O = 1 μF; unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _O	Output Voltage	T _J = +25°C	-8.7	-9.0	-9.3	V
		I _O = 5 mA to 1 A, P _O ≤ 15 W, V _I = -1.5 V to -23 V	-8.6	-9.0	-9.4	
ΔV _O	Line Regulation ⁽⁶⁾	T _J = +25°C		10	180	mV
		V _I = -11.5 V to -26 V V _I = -12 V to -18 V		5	90	
ΔV _O	Load Regulation ⁽⁶⁾	T _J = +25°C, I _O = 5 mA to 1.5 A		12	180	mV
		T _J = +25°C, I _O = 250 mA to 750 mA		4	90	
I _Q	Quiescent Current	T _J = +25°C		3	6	mA
ΔI _Q	Quiescent Current Change	I _O = 5 mA to 1 A		0.05	0.50	mA
		V _I = -11.5 V to -26 V		0.10	1.00	
ΔV _O /ΔT	Temperature Coefficient of V _D	I _O = 5 mA		-0.6		mV/°C
V _N	Output Noise Voltage	f = 10 Hz to 100 kHz, T _A = +25°C		175		μV
RR	Ripple Rejection	f = 120 Hz, ΔV _I = 10 V	54	60		dB
V _D	Dropout Voltage	T _J = +25°C, I _O = 1 A		2		V
I _{SC}	Short-Circuit Current	T _J = +25°C, V _I = -35 V		300		mA
I _{PK}	Peak Current	T _J = +25°C		2.2		A

Note:

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _O	Output Voltage	T _J = +25°C	-9.6	-10.0	-10.4	V
		I _O = 5 mA to 1 A, P _d ≤ 15 W, V _I = -12 V to -28 V	-9.5	-10.0	-10.5	
ΔV _O	Line Regulation ⁽⁷⁾	T _J = +25°C		12	200	mV
		V _I = -12.5 V to -28 V V _I = -14 V to -20 V		6	100	
ΔV _O	Load Regulation ⁽⁷⁾	T _J = +25°C, I _O = 5 mA to 1.5 A		12	200	mV
		T _J = +25°C, I _O = 250 mA to 750 mA		4	100	
I _Q	Quiescent Current	T _J = +25°C		3	6	mA
ΔI _Q	Quiescent Current Change	I _O = 5 mA to 1 A		0.05	0.50	mA
		V _I = -12.5 V to -28 V		0.10	1.00	
ΔV _O /ΔT	Temperature Coefficient of V _O	I _O = 5 mA		-1		mV/°C
V _N	Output Noise Voltage	10 Hz ≤ f ≤ 100 kHz, T _A = +25°C		280		μV
RR	Ripple Rejection	f = 120 Hz, ΔV _I = 10 V	54	60		dB
V _D	Dropout Voltage	T _J = +25°C, I _O = 1 A		2		V
I _{SC}	Short-Circuit Current	T _J = +25°C, V _I = -35 V		300		mA
I _{PK}	Peak Current	T _J = +25°C		2.2		A

Note:

7. 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 (KA7912 / LM7912)(V_I = -19 V, I_O = 500 mA, 0°C ≤ T_J ≤ +125°C, C_I = 2.2 μF, C_O = 1 μF; unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _O	Output Voltage	T _J = +25°C	-11.5	-12.0	-12.5	V
		I _O = 5 mA to 1 A, P _O ≤ 15 W V _I = -15.5 V to -27 V	-11.4	-12.0	-12.6	
ΔV _O	Line Regulation ⁽⁸⁾	T _J = +25°C		12	240	mV
		V _I = -14.5 V to -30 V V _I = -16 V to -22 V		6	120	
ΔV _O	Load Regulation ⁽⁸⁾	T _J = +25°C, I _O = 5 mA to 1.5 A		12	240	mV
		T _J = +25°C, I _O = 250 mA to 750 mA		4	120	
I _Q	Quiescent Current	T _J = +25°C		3	6	mA
ΔI _Q	Quiescent Current Change	I _O = 5 mA to 1 A		0.05	0.50	mA
		V _I = -14.5 V to -30 V		0.10	1.00	
ΔV _O /ΔT	Temperature Coefficient of V _D	I _O = 5 mA		-0.8		mV/°C
V _N	Output Noise Voltage	f = 10 Hz to 100 kHz, T _A = +25°C		200		μV
RR	Ripple Rejection	f = 120 Hz, ΔV _I = 10 V	54	60		dB
V _D	Dropout Voltage	T _J = +25°C, I _O = 1 A		2		V
I _{SC}	Short-Circuit Current	T _J = +25°C, V _I = -35 V		300		mA
I _{PK}	Peak Current	T _J = +25°C		2.2		A

Note:

8. 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 (KA7915 / LM7915)(V_I = -23 V, I_O = 500 mA, 0°C ≤ T_J ≤ +125°C, C_I = 2.2 μF, C_O = 1 μF; unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _O	Output Voltage	T _J = +25°C	-14.40	-15.00	-15.60	V
		I _O = 5 mA to 1 A, P _O ≤ 15 W V _I = -18 V to -30 V	-14.25	-15.00	-15.75	
ΔV _O	Line Regulation ⁽⁹⁾	T _J = +25°C		12	300	mV
		V _I = -17.5 V to -30 V V _I = -20 V to -26 V		6	150	
ΔV _O	Load Regulation ⁽⁹⁾	T _J = +25°C, I _O = 5 mA to 1.5 A		12	300	mV
		T _J = +25°C, I _O = 250 mA to 750 mA		4	150	
I _Q	Quiescent Current	T _J = +25°C		3	6	mA
ΔI _Q	Quiescent Current Change	I _O = 5 mA to 1 A		0.05	0.50	mA
		V _I = -17.5 V to -30 V		0.10	1.00	
ΔV _O /ΔT	Temperature Coefficient of V _D	I _O = 5 mA		-0.9		mV/°C
V _N	Output Noise Voltage	f = 10 Hz to 100 kHz, T _A = +25°C		250		μV
RR	Ripple Rejection	f = 120 Hz, ΔV _I = 10 V	54	60		dB
V _D	Dropout Voltage	T _J = +25°C, I _O = 1 A		2		V
I _{SC}	Short-Circuit Current	T _J = +25°C, V _I = -35 V		300		mA
I _{PK}	Peak Current	T _J = +25°C		2.2		A

Note:

9. 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 (KA7918 / LM7918)(V_I = -27 V, I_O = 500 mA, 0°C ≤ T_J ≤ +125°C, C_I = 2.2 μF, C_O = 1 μF, unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _O	Output Voltage	T _J = +25°C	-17.3	-18.0	-18.7	V
		I _O = 5 mA to 1 A, P _O ≤ 15 W V _I = -22.5 V to -33 V	-17.1	-18.0	-18.9	
ΔV _O	Line Regulation ⁽¹⁰⁾	T _J = +25°C		15	360	mV
		V _I = -21 V to -33 V V _I = -24 V to -30 V		8	180	
ΔV _O	Load Regulation ⁽¹⁰⁾	T _J = +25°C, I _O = 5 mA to 1.5 A		15	360	mV
		T _J = +25°C, I _O = 250 mA to 750 mA		5	180	
I _Q	Quiescent Current	T _J = +25°C		3	6	mA
ΔI _Q	Quiescent Current Change	I _O = 5 mA to 1 A		0.05	0.50	mA
		V _I = -21 V to -33 V		0.10	1.00	
ΔV _O /ΔT	Temperature Coefficient of V _D	I _O = 5 mA		-1		mV/°C
V _N	Output Noise Voltage	f = 10 Hz to 100 kHz, T _A = +25°C		300		μV
RR	Ripple Rejection	f = 120 Hz, ΔV _I = 10 V	54	60		dB
V _D	Dropout Voltage	T _J = +25°C, I _O = 1 A		2		V
I _{SC}	Short-Circuit Current	T _J = +25°C, V _I = -35 V		300		mA
I _{PK}	Peak Current	T _J = +25°C		2.2		A

Note:

10. 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 (KA7924)(V_I = -33 V, I_O = 500 mA, 0°C ≤ T_J ≤ +125°C, C_I = 2.2 μF, C_O = 1 μF; unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _O	Output Voltage	T _J = +25°C	-23.0	-24.0	-25.0	V
		I _O = 5 mA to 1 A, P _O ≤ 15 W, V _I = -27 V to -38 V	-22.8	-24.0	-25.2	
ΔV _O	Line Regulation ⁽¹¹⁾	T _J = +25°C		15	480	mV
		V _I = -27 V to -38 V V _I = -30 V to -36 V		8	180	
ΔV _O	Load Regulation ⁽¹¹⁾	T _J = +25°C, I _O = 5 mA to 1.5 A		15	480	mV
		T _J = +25°C, I _O = 250 mA to 750 mA		5	240	
I _Q	Quiescent Current	T _J = +25°C		3	6	mA
ΔI _Q	Quiescent Current Change	I _O = 5 mA to 1 A		0.05	0.50	mA
		V _I = -27 V to -38 V		0.10	1.00	
ΔV _O /ΔT	Temperature Coefficient of V _D	I _O = 5 mA		-1		mV/°C
V _N	Output Noise Voltage	f = 10 Hz to 100 kHz, T _A = +25°C		400		μV
RR	Ripple Rejection	f = 120 Hz, ΔV _I = 10 V	54	60		dB
V _D	Dropout Voltage	T _J = +25°C, I _O = 1 A		2		V
I _{SC}	Short-Circuit Current	T _J = +25°C, V _I = -35 V		300		mA
I _{PK}	Peak Current	T _J = +25°C		2.2		A

Note:

11. 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 (KA7912A)(V_I = -19 V, I_O = 500 mA, 0°C ≤ T_J ≤ +125°C, C_I = 2.2 μF, C_O = 1 μF; unless otherwise specified.)

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V _O	Output Voltage	T _J = +25°C		-11.75	-12.00	-12.25	V
		I _O = 5 mA to 1 A, P _O ≤ 15 W, V _I = -15.5 V to -27 V		-11.50	-12.00	-12.50	
ΔV _O	Line Regulation ⁽¹²⁾	T _J = +25°C	V _I = -14.5 V to -27 V, I _O = 1 A		12	120	mV
			V _I = -16 V to -22 V, I _O = 1 A		6	60	
		V _I = -14.8 V to -30 V			12	120	
		V _I = -16 V to -22 V, I _O = 1 A			12	120	
ΔV _O	Load Regulation ⁽¹²⁾	T _J = +25°C, I _O = 5 mA to 1.5 A			12	150	mV
		T _J = +25°C, I _O = 250 mA to 750 mA			4	75	
I _Q	Quiescent Current	T _J = +25°C			3	6	mA
ΔI _Q	Quiescent Current Change	I _O = 5 mA to 1 A			0.05	0.50	mA
		V _I = -15 V to -30 V			0.10	1.00	
ΔVo/ΔT	Temperature Coefficient of V _D	I _O = 5 mA			-0.8		mV/°C
V _N	Output Noise Voltage	f = 10 Hz to 100 kHz, T _A = +25°C			200		μV
RR	Ripple Rejection	f = 120 Hz, ΔV _I = 10 V		54	60		dB
V _D	Dropout Voltage	T _J = +25°C, I _O = 1 A			2		V
I _{SC}	Short-Circuit Current	T _J = +25°C, V _I = -35 V			300		mA
I _{PK}	Peak Current	T _J = +25°C			2.2		A

Note:

12. 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 (KA7915A)(V_I = -23 V, I_O = 500 mA, 0°C ≤ T_J ≤ +125°C, C_I = 2.2 μF, C_O = 1 μF; unless otherwise specified.)

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V _O	Output Voltage	T _J = +25°C		-14.7	-15.0	-15.3	V
		I _O = 5 mA to 1 A, P _O ≤ 15 W, V _I = -18 V to -30 V		-14.4	-15.0	-15.6	
ΔV _O	Line Regulation ⁽¹³⁾	T _J = +25°C	V _I = -17.5 V to -30 V, I _O = 1 A		12	150	mV
			V _I = -20 V to -26 V, I _O = 1 A		6	75	
		V _I = -17.9 V to -30 V			12	150	
		V _I = -20 V to -26 V, I _O = 1 A			6	150	
ΔV _O	Load Regulation ⁽¹³⁾	T _J = +25°C, I _O = 5 mA to 1.5 A			12	150	mV
		T _J = +25°C, I _O = 250 mA to 750 mA			4	75	
I _Q	Quiescent Current	T _J = +25°C			3	6	mA
ΔI _Q	Quiescent Current Change	I _O = 5 mA to 1 A			0.05	0.50	mA
		V _I = -18.5 V to -30 V			0.10	1.00	
ΔV _O /ΔT	Temperature Coefficient of V _D	I _O = 5 mA			-0.9		mV/°C
V _N	Output Noise Voltage	f = 10 Hz to 100 kHz, T _A = +25°C			250		μV
RR	Ripple Rejection	f = 120 Hz, ΔV _I = 10 V		54	60		dB
V _D	Dropout Voltage	T _J = +25°C, I _O = 1 A			2		V
I _{SC}	Short-Circuit Current	T _J = +25°C, V _I = -35 V			300		mA
I _{PK}	Peak Current	T _J = +25°C			2.2		A

Note:

13. 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

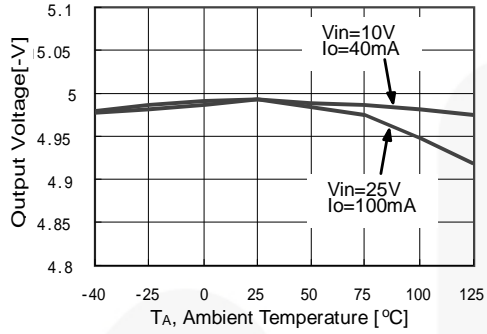


Figure 2. Output Voltage

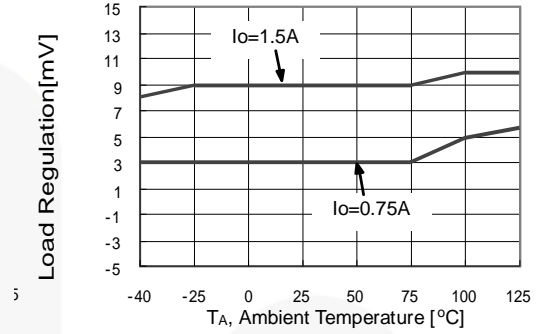


Figure 3. Load Regulation

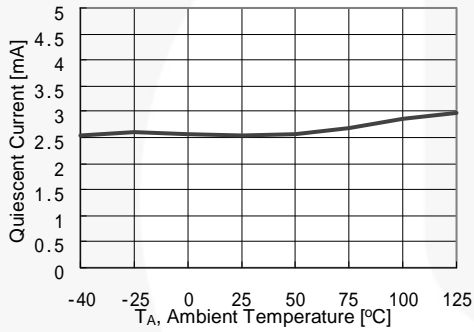


Figure 4. Quiescent Current

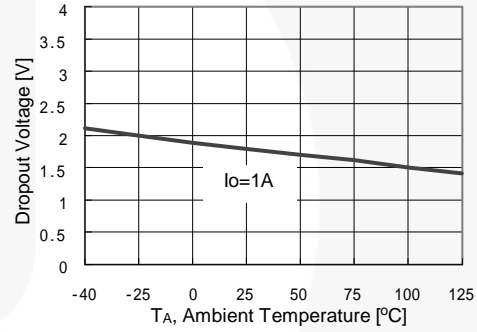


Figure 5. Dropout Voltage

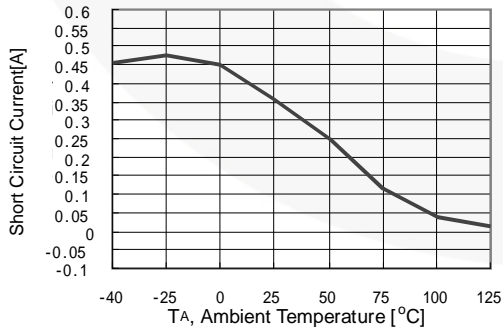


Figure 6. Short-Circuit Current

Typical Applications

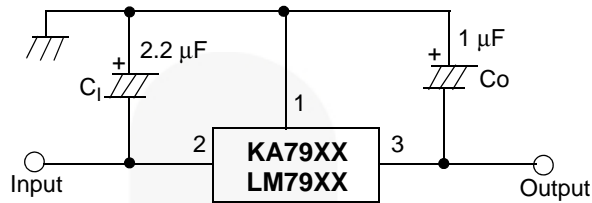


Figure 7. Negative Fixed Output Regulator

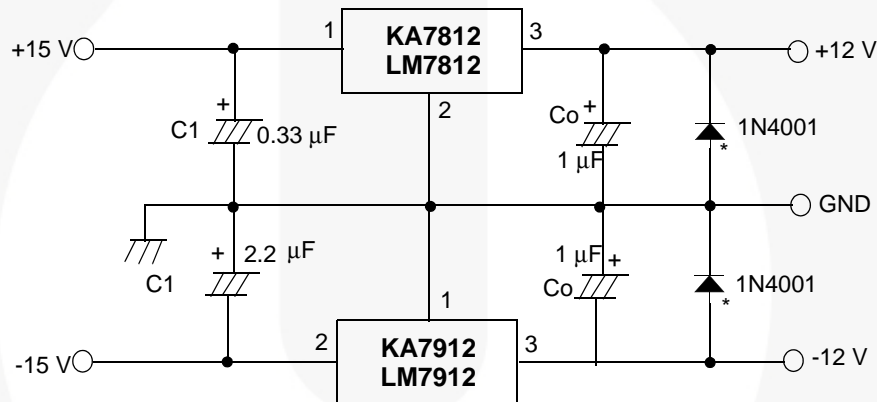


Figure 8. Split Power Supply ($\pm 12\text{ V} / 1\text{ A}$)

Notes:

14. To specify an output voltage, substitute voltage value for "XX".
15. C_1 is required if the regulator is located an appreciable distance from the power supply filter. For value given, capacitor must be solid tantalum. If aluminium electrolytics are used, at least ten times the value shown should be selected.
16. C_O improves stability and 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.

Physical Dimensions

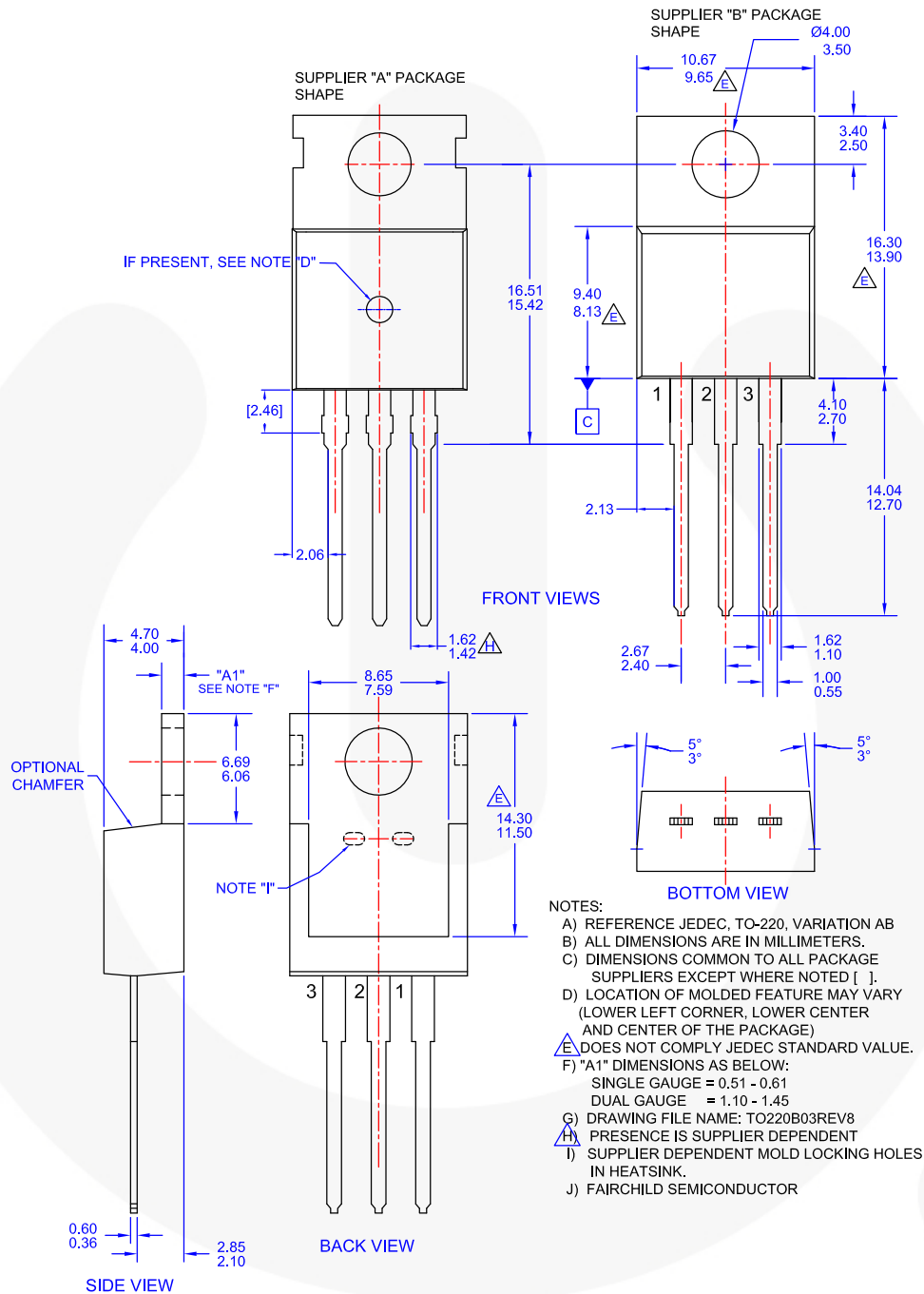


Figure 9. TO-220, MOLDED, 3-LEAD, JEDEC VARIATION AB (ACTIVE)



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