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September 2014

KA79XX / KA79XXA / LM79XX
3-Terminal 1 A Negative Voltage Regulator

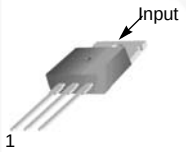
Features

- 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

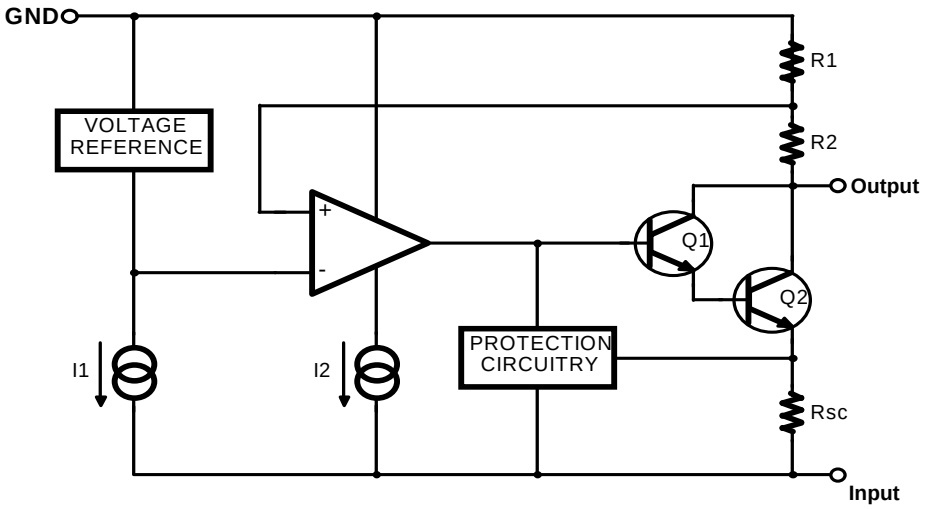


Figure 1. Block Diagram

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°C unless otherwise noted.

Symbol	Parameter	Value	Unit
V_I	Input Voltage	-35	V
$R_{\theta JC}$	Thermal Resistance, Junction-Case(1)	5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-Air(1, 2)	65	°C/W
T_{OPR}	Operating Temperature Range	0 to +125	°C
T_{STG}	Storage Temperature Range	- 65 to +150	°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, $P_O \leq$ 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	
$\Delta Vo/\Delta T$	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	
ΔVo/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	V_I = -10.5 V to -25 V		10	160	mV
			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	
ΔVo/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	V_I = -11.5 V to -26 V		10	180	mV
			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	
$\Delta Vo/\Delta T$	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 1A, 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	V_I = -12.5 V to -28 V		12	200	mV
			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	
$\Delta Vo/\Delta T$	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	V_I = -14.5 V to -30 V		12	240	mV
			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	
$\Delta Vo/\Delta T$	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	V_I = -17.5 V to -30 V		12	300	mV
			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	
$\Delta Vo/\Delta T$	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	V_I = -21 V to -33 V		15	360	mV
			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	
$\Delta Vo/\Delta T$	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	V_I = -27 V to -38 V		15	480	mV
			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	
$\Delta Vo/\Delta T$	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, Io = 1 A		12	120	mV
			V_I= -16 V to -22 V, Io = 1 A		6	60	
		V_I = -14.8 V to -30 V			12	120	
		V_I = -16 V to -22 V, Io = 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, Io = 1 A		12	150	mV
			V_I = -20 V to -26 V, Io = 1 A		6	75	
		V_I = -17.9 V to -30 V			12	150	
		V_I = -20 V to -26 V, Io = 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	
ΔVo/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

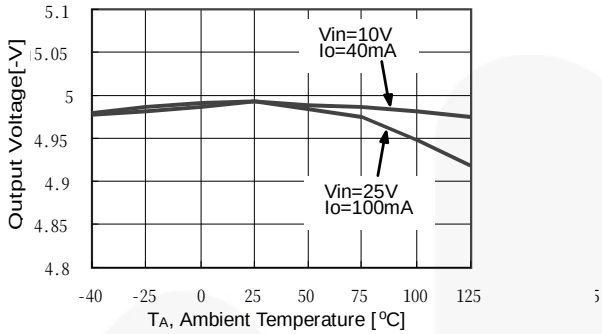


Figure 2. Output Voltage

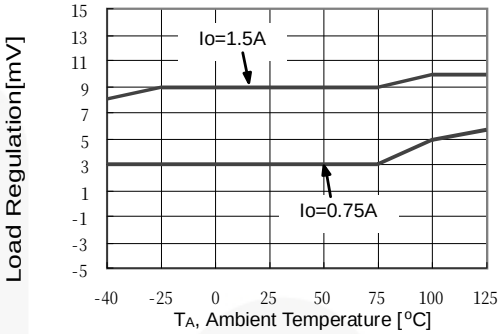


Figure 3. Load Regulation

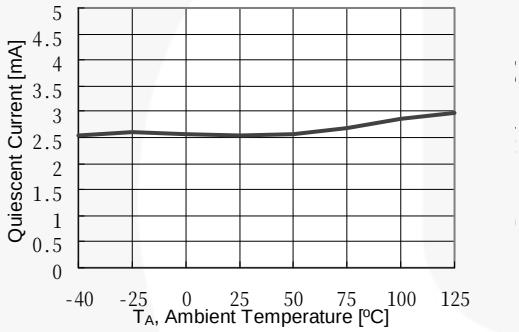


Figure 4. Quiescent Current

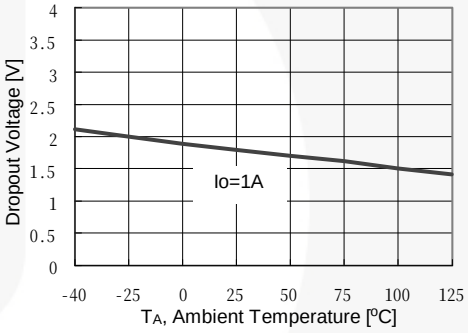


Figure 5. Dropout Voltage

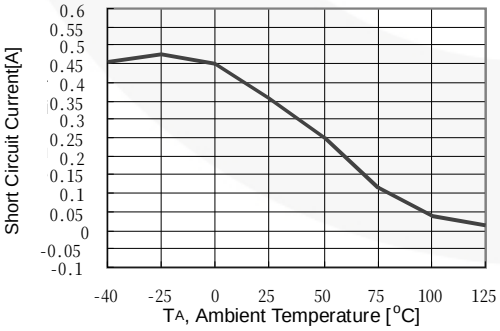


Figure 6. Short-Circuit Current

Typical Applications

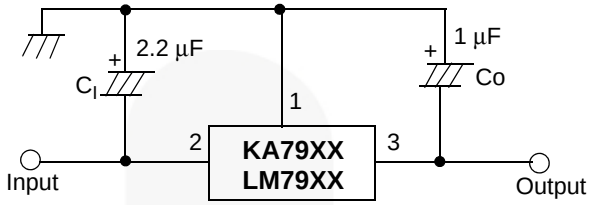


Figure 7. Negative Fixed Output Regulator

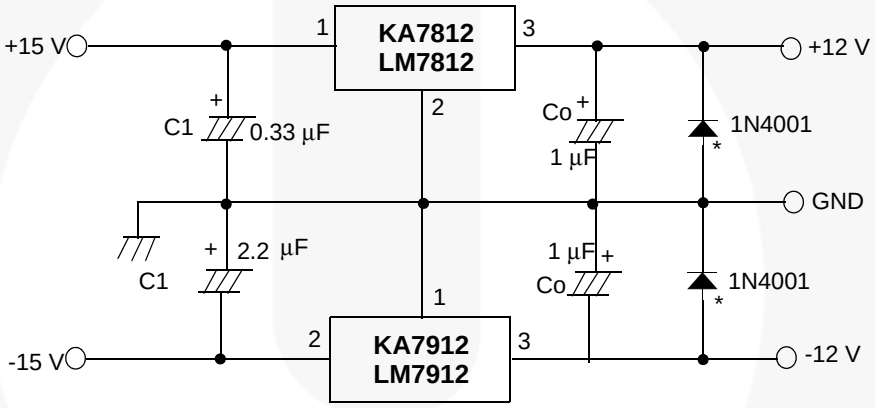


Figure 8. Split Power Supply (±12 V / 1 A)

Notes:

14. To specify an output voltage, substitute voltage value for "XX".
15. C_I 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 electronics 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

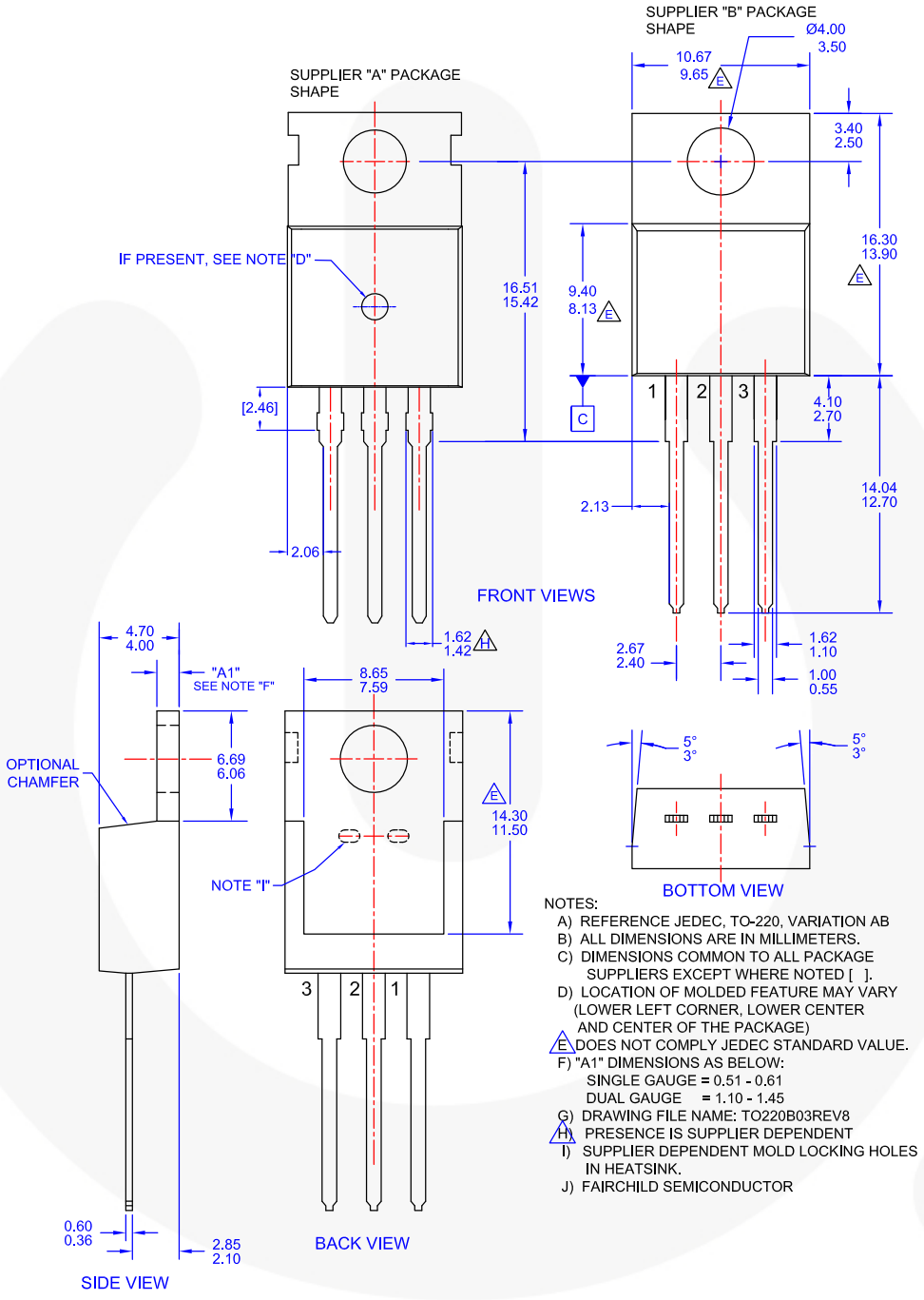


Figure 9. TO-220, MOLDED, 3-LEAD, JEDEC VARIATION AB (ACTIVE)

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