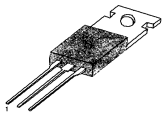
LM78XX (KA78XX, MC78XX) FIXED VOLTAGE REGULATOR (POSITIVE)

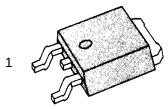
3-TERMINAL 1A POSITIVE VOLTAGE REGULATORS

The LM78XX series of three-terminal positive regulators are available in the TO-220/D-PAK 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 area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

TO-220



D-PAK



1: Input 2: GND 3: Output

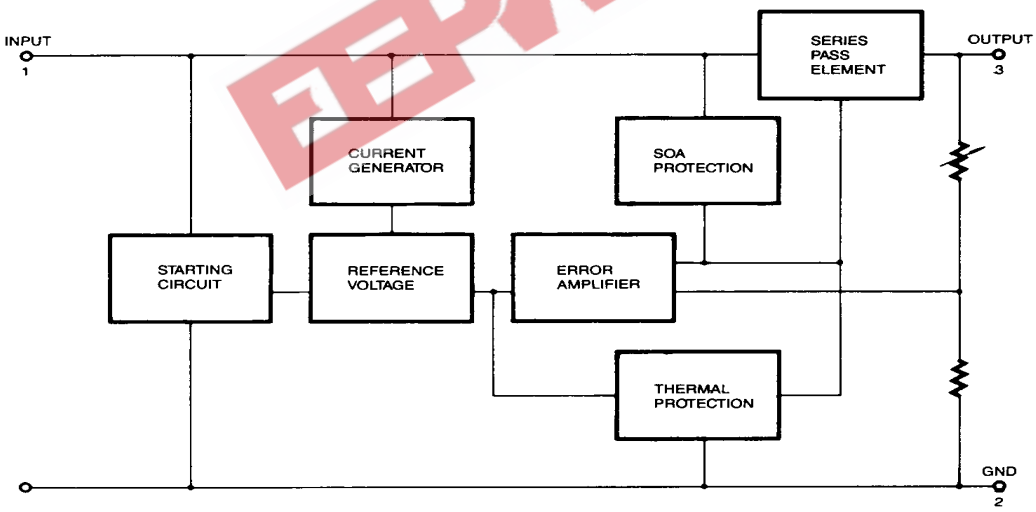
FEATURES

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 11, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor SOA Protection

ORDERING INFORMATION

Device	Output Voltage Tolerance	Packag	Operating Temperature
KA78XXCT	± 4%	TO-220	0 ~ +125 °C
KA78XXAT	± 2%		
KA78XXIT	± 4%		-40 ~ +125 °C
KA78XXR		D-PAK	0 ~ +125 °C
KA78XXAR	± 2%		
KA78XXIR	± 4%		-40 ~ +125 °C

BLOCK DIAGRAM



FAIRCHILD SEMICONDUCTOR TM

LM78XX (KA78XX, MC78XX) FIXED VOLTAGE REGULATOR (POSITIVE)

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C, unless otherwise specified)

Characteristic	Symbol	Value	Unit
Input Voltage (for V_O = 5V to 18V) (for V_O = 24V)	V_I V_I	35 40	V V
Thermal Resistance Junction-Cases	$R_{\theta JC}$	5	°C/W
Thermal Resistance Junction-Air	$R_{\theta JA}$	65	°C/W
Operating Temperature Range KA78XX/A/R/RA KA78XXI/RI	T_{OPR}	0 ~ +125 -40 ~ +125	°C °C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

LM7805/I/R/RI ELECTRICAL CHARACTERISTICS

(Refer to test circuit, $T_{MIN} < T_J < T_{MAX}$, I_O = 500mA, V_I = 10V, C_I= 0.33µF, C_O= 0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions	LM7805I			LM7805			Unit
			Min	Typ	Max	Min	Typ	Max	
Output Voltage	V_O	T_J =+25 °C	4.8	5.0	5.2	4.8	5.0	5.2	V
		5.0mA ≤ I_O ≤1.0A, P_O ≤ 15W V_I = 7V to 20V V_I = 8V to 20V	4.75	5.0	5.25	4.75	5.0	5.25	
Line Regulation	ΔV_O	T_J=+25°C, V_O = 7V to 25V		4.0	100		4.0	100	mV
		T_J=+25°C, V_I = 8V to 12V		1.6	50		1.6	50	
Load Regulation	ΔV_O	T_J=+25°C, I_O = 5.0mA to1.5A		9	100		9	100	mV
		T_J=+25°C, I_O =250mA to 750mA		4	50		4	50	
Quiescent Current	I_Q	T_J =+25 °C		5.0	8		5.0	8	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1.0A		0.03	0.5		0.03	0.5	mA
		V_I= 7V to 25V					0.3	1.3	
		V_I= 8V to 25V		0.3	1.3				
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O= 5mA		-0.8			-0.8		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100Khz, T_A=+25 °C		42			42		µV/Vo
Ripple Rejection	RR	f = 120Hz V_O = 8 to 18V	62	73		62	73		dB
Dropout Voltage	V_O	I_O = 1A, T_J =+25 °C		2			2		V
Output Resistance	R_O	f = 1KHz		15			15		mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A =+25 °C		230			230		mA
Peak Current	I_{PK}	T_J =+25 °C		2.2			2.2		A

* $T_{MIN} < T_J < T_{MAX}$
LM78XXI/RI: T_{MIN}= - 40 °C, T_{MAX} = +125 °C
LM78XX/R: T_{MIN}= 0 °C, T_{MAX}= +125 °C

* 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.

LM7806/I/R/RI ELECTRICAL CHARACTERISTICS

(Refer to test circuit, $T_{MIN} < T_J < T_{MAX}$, I_O=500mA, V_I= 11V C_I= 0.33μF, C_O= 0.1μF, unless otherwise specified)

Characteristic	Symbol	Test Conditions	LM7806I			LM7806			Unit
			Min	Typ	Max	Min	Typ	Max	
Output Voltage	V_O	T_J =+25 °C	5.75	6.0	6.25	5.75	6.0	6.25	V
		5.0mA ≤ I_O ≤1.0A, P_D ≤ 15W V_I = 8.0V to 21V V_I = 9.0V to 21V	5.7	6.0	6.3	5.7	6.0	6.3	
Line Regulation	ΔV_O	T_J=+25 °C, V_I = 8V to 25V		5	120		5	120	mV
		T_J=+25 °C, V_I = 9V to 13V		1.5	60		1.5	60	
Load Regulation	ΔV_O	T_J=+25 °C, I_O =5mA to 1.5A		9	120		9	120	mV
		T_J=+25 °C, I_O =250mA to750A		3	60		3	60	
Quiescent Current	I_Q	T_J =+25 °C		5.0	8		5.0	8	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A			0.5			0.5	mA
		V_I = 8V to 25V						1.3	
		V_I = 9V to 25V			1.3				
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA		-0.8			-0.8		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100Khz, T_A =+25 °C		45			45		μV/V_O
Ripple Rejection	RR	f = 120Hz V_I = 9V to 19V	59	75		59	75		dB
Dropout Voltage	V_D	I_O = 1A, T_J =+25 °C		2			2		V
Output Resistance	R_D	f = 1KHz		19			19		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A=+25°C		250			250		mA
Peak Current	I_{PK}	T_J =+25 °C		2.2			2.2		A

* $T_{MIN} < T_J < T_{MAX}$
  LM78XXI/RI: T_{MIN}= - 40 °C, T_{MAX} = +125 °C
  LM78XX/R: T_{MIN}= 0 °C, T_{MAX}= +125 °C
* Load and line regulation are specified at constant, junction temperature. Change in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

LM7808/I/R/RI ELECTRICAL CHARACTERISTICS

(Refer to test Circuit, $T_{MIN} < T_J < T_{MAX}$, I_O = 500mA, V_I = 14V, C_I = 0.33µF, C_O= 0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions	LM7808I			LM7808			Unit
			Min	Typ	Max	Min	Typ	Max	
Output Voltage	V_O	T_J =+25 °C	7.7	8.0	8.3	7.7	8.0	8.3	V
		5.0mA ≤ I_O ≤ 1.0A, P_O ≤ 15W V_I = 10.5V to 23V V_I = 11.5V to 23V	7.6	8.0	8.4	7.6	8.0	8.4	
Line Regulation	ΔV_O	T_J =+ 25°C, V_I = 10.5V to 25V		5.0	160		5.0	160	mV
		T_J =+ 25°C, V_I = 11.5V to 17V		2.0	80		2.0	80	
Load Regulation	ΔV_O	T_J = +25°C, I_O = 5.0mA to 1.5A		10	160		10	160	mV
		T_J = +25°C, I_O= 250mA to 750mA		5.0	80		5.0	80	
Quiescent Current	I_Q	T_J =+25 °C		5.0	8		5.0	8	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1.0A		0.05	0.5		0.05	0.5	mA
		V_I = 10.5A to 25V					0.5	1.0	
		V_I = 11.5V to 25V		0.5	1.0				
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA		-0.8			-0.8		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100Khz, T_A =+25 °C		52			52		µV/Vo
Ripple Rejection	RR	f = 120Hz, V_I= 11.5V to 21.5	56	73		56	73		dB
Dropout Voltage	V_D	I_O = 1A, T_J=+25 °C		2			2		V
Output Resistance	R_O	f = 1KHz		17			17		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A =+25 °C		230			230		mA
Peak Current	I_{PK}	T_J =+25 °C		2.2			2.2		A

* $T_{MIN} < T_J < T_{MAX}$
  LM78XXI/RI: T_{MIN}= - 40 °C, T_{MAX} = +125 °C
  LM78XX/R: T_{MIN}= 0 °C, T_{MAX}= +125 °C
* Load and line regulation are specified at constant, junction temperature. Change in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

LM7809/I/R/RI ELECTRICAL CHARACTERISTICS

(Refer to test circuit. $T_{MIN} < T_J < T_{MAX}$, I_O= 500mA, V_I= 15V, C_I = 0.33µF, C_O = 0.1µF. unless otherwise specified)

Characteristic	Symbol	Test Conditions	LM7809I			LM7809			Unit
			Min	Typ	Max	Min	Typ	Max	
Output Voltage	V_O	T_J =+25 °C	8.65	9	9.35	8.65	9	9.35	V
		5.0mA ≤ I_O ≤1.0A, P_D ≤15W V_I= 11.5V to 24V V_I = 12.5V to 24V	8.6	9	9.4	8.6	9	9.4	
Line Regulation	ΔV_O	T_J=+25 °C, V_I = 11.5V to 25V		6	180		6	180	mV
		T_J=+25 °C, V_I = 12V to 25v		2	90		2	90	
Load Regulation	ΔV_O	T_J=+25 °C, I_O = 5mA to 1.5A		12	180		12	180	mV
		T_J=+25 °C, I_O = 250mA to 750mA		4	90		4	90	
Quiescent Current	I_Q	T_J=+25 °C		5.0	8		5.0	8	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1.0A			0.5			0.5	mA
		V_I = 11.5V to 26V						1.3	
		V_I = 12.5V to 26V			1.3				
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA		-1			-1		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100Khz, T_A =+25 °C		58			58		µV/V_O
Ripple Rejection	RR	f = 120Hz V_I = 13V to 23V	56	71		56	71		dB
Dropout Voltage	V_D	I_O = 1A, T_J=+25 °C		2			2		V
Output Resistance	R_O	f = 1KHz		17			17		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A =+25 °C		250			250		mA
Peak Current	I_{PK}	T_J= +25 °C		2.2			2.2		A

* $T_{MIN} < T_J < T_{MAX}$
  LM78XXI/RI: T_{MIN}= - 40 °C, T_{MAX} = +125 °C
  LM78XX/R: T_{MIN}= 0 °C, T_{MAX}= +125 °C
* Load and line regulation are specified at constant, junction temperature. Change in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

LM7810/I/R/RI ELECTRICAL CHARACTERISTICS

(Refer to test circuit, $T_{MIN} < T_J < T_{MAX}$, I_O= 500mA, V_I =16V, C_I = 0.33µF, C_O= 0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions	LM7810I			LM7810			Unit
			Min	Typ	Max	Min	Typ	Max	
Output Voltage	V_O	T_J =+25 °C	9.6	10	10.4	9.6	10	10.4	V
		5.0mA ≤ I_O≤1.0A, P_D ≤15W V_I = 12.5V to 25V V_I= 13.5V to 25V	9.5	10	10.5	9.5	10	10.5	
Line Regulation	ΔV_O	T_J =+25°C, V_I = 12.5V to 25V		10	200		10	200	mV
		T_J =+25°C, V_I = 13V to 25V		3	100		3	100	
Load Regulation	ΔV_O	T_J =+25°C, I_O = 5mA to 1.5A		12	200		12	200	mV
		T_J =+25°C, I_O = 250mA to 750mA		4	400		4	400	
Quiescent Current	I_Q	T_J =+25 °C		5.1	8		5.1	8	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1.0A			0.5			0.5	mA
		V_I = 12.5V to 29V						1.0	
		V_I = 13.5V to 29V			1.0				
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA		-1			-1		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100Khz, T_A =+25 °C		58			58		µV/Vo
Ripple Rejection	RR	f = 120Hz V_I = 13V to 23V	56	71		56	71		dB
Dropout Voltage	V_D	I_O = 1A, T_J=+25 °C		2			2		V
Output Resistance	R_O	f = 1KHz		17			17		mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A=+25 °C		250			250		mA
Peak Current	I_{PK}	T_J =+25 °C		2.2			2.2		A

* $T_{MIN} < T_J < T_{MAX}$
  LM78XXI/RI: T_{MIN}= - 40 °C, T_{MAX} = +125 °C
  LM78XX/R: T_{MIN}= 0 °C, T_{MAX}= +125 °C
* Load and line regulation are specified at constant junction temperature. Change in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

LM7811/I/R/RI ELECTRICAL CHARACTERISTICS

(Refer to test circuit, $T_{MIN}<T_J<T_{MAX}$, I_O = 500mA, V_I=18V, C_I=0.33µF, C_O = 0.IµF, unless otherwise specified)

Characteristic	Symbol	Test Conditions	LM7811I			LM7811			Unit
			Min	Typ	Max	Min	Typ	Max	
Output Voltage	V_O	T_J =+25 °C	10.6	11	11.4	10.6	11	11.4	V
		5.0mA ≤ I_O ≤1.0A, P_D ≤15W V_I = 13.5V to 26V V_I= 14.5V to 26V	10.5	11	11.5	10.5	11	11.5	
Line Regulation	ΔV_O	T_J =+25°C, V_I = 13.5V to 25V		10	220		10	220	mV
		T_J =+25°C, V_I = 14V to 21V		3.0	110		3	110	
Load Regulation	ΔV_O	T_J =+25°C, I_O = 5.0mA to 1.5A		12	220		12	220	mV
		T_J =+25°C, I_O = 250mA to 750mA		4	110		4	110	
Quiescent Current	I_Q	T_J =+25 °C		5.1	8		5.1	8	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1.0A			0.5			0.5	mA
		V_I = 13.5V to 29V						1.0	
		V_I = 14.5V to 29V			1.0				
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA		-1			-1		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100Khz, T_A =+25 °C		70			70		µV/V_O
Ripple Rejection	RR	f = 120Hz V_I = 14V to 24V	55	71		55	71		dB
Dropout Voltage	V_D	I_O = 1A, T_J=+25 °C		2			2		V
Output Resistance	R_O	f = 1KHz		18			18		mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A=+25 °C		250			250		mA
Peak Current	I_{PK}	T_J =+25 °C		2.2			2.2		A

* $T_{MIN}<T_J<T_{MAX}$
  LM78XXI/RI: T_{MIN}= - 40 °C, T_{MAX} = +125 °C
  LM78XX/R: T_{MIN}= 0 °C, T_{MAX}= +125 °C
* Load and line regulation are specified at constant, junction temperature. Change in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

LM7812/I/R/RI ELECTRICAL CHARACTERISTICS

(Refer to test circuit, $T_{MIN} < T_J < T_{MAX}$, I_O=500mA, V_I=19V, C_I= 0.33μF, C_O= 0.1.μF, unless otherwise specified)

Characteristic	Symbol	Test Conditions		LM7812I			LM7812			Unit
				Min	Typ	Max	Min	Typ	Max	
Output Voltage	V_O	T_J =+25 °C		11.5	12	12.5	11.5	12	12.5	V
		5.0mA ≤ I_O≤1.0A, P_D≤15W V_I = 14.5V to 27V V_I= 15.5V to 27V		11.4	12	12.6	11.4	12	12.6	
Line Regulation	ΔV_O	T_J =+25°C	V_I = 14.5V to 30V		10	240		10	240	mV
			V_I = 16V to 22V		3.0	120		3.0	120	
Load Regulation	ΔV_O	T_J =+25°C	I_O = 5mA to 1.5A		11	240		11	240	mV
			I_O = 250mA to 750mA		5.0	120		5.0	120	
Quiescent Current	I_Q	T_J =+25 °C			5.1	8		5.1	8	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1.0A			0.1	0.5		0.1	0.5	mA
		V_I = 14.5V to 30V						0.5	1.0	
		V_I = 15V to 30V				1.0				
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA		0.5	-1			-1		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100Khz, T_A =+25 °C			76			76		mV/V_O
Ripple Rejection	RR	f = 120Hz V_I = 15V to 25V		55	71		55	71		dB
Dropout Voltage	V_D	I_O = 1A, T_J=+25 °C			2			2		V
Output Resistance	R_O	f = 1KHz			18			18		mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A=+25 °C			230			230		mA
Peak Current	I_{PK}	T_J = +25 °C			2.2			2.2		A

$T_{MIN} < T_J < T_{MAX}$

LM78XXI/RI: T_{MIN}= - 40 °C, T_{MAX} = +125 °C

LM78XX/R: T_{MIN}= 0 °C, T_{MAX}= +125 °C

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

LM7815/I/R/RI ELECTRICAL CHARACTERISTICS

(Refer to test circuit, $T_{MIN}<T_J<T_{MAX}$, I_O =500mA, V_I =23V, C_I =0.33µF, C_O =0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions	LM7815I			LM7815			Unit
			Min	Typ	Max	Min	Typ	Max	
Output Voltage	V_O	T_J =+25 °C	14.4	15	15.6	14.4	15	15.6	V
		5.0mA ≤ I_O≤1.0A, P_D≤15W V_I = 17.5V to 30V V_I= 18.5V to 30V	14.25	15	15.75	14.25	15	15.75	
Line Regulation	ΔV_O	T_J =+25°C, V_I = 17.5V to 30V		11	300		11	300	mV
		T_J =+25°C, V_I = 20V to 26V		3	150		3	150	
Load Regulation	ΔV_O	T_J =+25°C, I_O = 5mA to 1.5A		12	300		12	300	mV
		T_J =+25°C, I_O = 250mA to 750mA		4	150		4	150	
Quiescent Current	I_Q	T_J =+25 °C		5.2	8		5.2	8	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1.0A			0.5			0.5	mA
		V_I = 17.5V to 30V						1.0	
		V_I = 18.5V to 30V			1.0				
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA		-1			-1		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100Khz, T_A =+25 °C		90			90		µV/V_O
Ripple Rejection	RR	f = 120Hz V_I = 18.5V to 28.5V	54	70		54	70		dB
Dropout Voltage	V_D	I_O = 1A, T_J=+25 °C		2			2		V
Output Resistance	R_O	f = 1KHz		19			19		mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A=+25 °C		250			250		mA
Peak Current	I_{PK}	T_J =+25 °C		2.2			2.2		A

* $T_{MIN}<T_J<T_{MAX}$
  LM78XXI/RI: T_{MIN}= - 40 °C, T_{MAX} = +125 °C
  LM78XX/R: T_{MIN}= 0 °C, T_{MAX}= +125 °C
* Load and line regulation are specified at constant, junction temperature. Change in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

LM7818/I/R/RI ELECTRICAL CHARACTERISTICS

(Refer to test circuit, $T_{MIN}<T_J<T_{MAX}$, I_O =500mA, V_I =27V, C_I =0.33μF, C_O =0.1μF, unless otherwise specified)

Characteristic	Symbol	Test Conditions		LM7818I			LM7818			Unit
				Min	Typ	Max	Min	Typ	Max	
Output Voltage	V_O	T_J =+25 °C		17.3	18	18.7	17.3	18	18.7	V
		5.0mA ≤ I_O ≤1.0A, P_D ≤15W V_I = 21V to 33V V_I= 22V to 33V		17.1	18	18.9	17.1	18	18.9	
Line Regulation	ΔV_O	T_J =+25°C	V_I = 21V to 33V		15	360		15	360	mV
			V_I = 24V to 30V		5	180		5	180	
Load Regulation	ΔV_O	T_J =+25°C	I_O = 5mA to 1.5A		15	360		15	360	mV
			I_O = 250mA to 750mA		5.0	180		5.0	180	
Quiescent Current	I_Q	T_J =+25 °C			5.2	8		5.2	8	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1.0A				0.5			0.5	mA
		V_I = 21V to 33V							1	
		V_I = 22V to 33V				1.0				
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA			-1			-1		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100Khz, T_A =+25 °C			110			110		μV/V_O
Ripple Rejection	RR	f = 120Hz V_I = 22V to 32V		53	69		53	69		dB
Dropout Voltage	V_D	I_O = 1A, T_J=+25 °C			2			2		V
Output Resistance	R_O	f = 1KHz			22			22		mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A=+25 °C			250			250		mA
Peak Current	I_{PK}	T_J =+25 °C			2.2			2.2		A

* $T_{MIN}<T_J<T_{MAX}$
  LM78XXI/RI: T_{MIN}= - 40 °C, T_{MAX} = +125 °C
  LM78XX/R: T_{MIN}= 0 °C, T_{MAX}= +125 °C
* Load and line regulation are specified at constant, junction temperature. Change in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

LM7824/I/R/RI ELECTRICAL CHARACTERISTICS

(Refer to test circuit, $T_{MIN}<T_J<T_{MAX}$, I_O = 500mA, V_I = 33V, C_I = 0.33µF, C_O = 0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions	LM7824I			LM7824			Unit
			Min	Typ	Max	Min	Typ	Max	
Output Voltage	V_O	T_J =+25 °C	23	24	25	23	24	25	V
		5.0mA ≤ I_O ≤ 1.0A, P_D ≤ 15W V_I = 27V to 38V V_I= 28V to 38V	22.8	24	25.2	22.8	24	25.25	
Line Regulation	ΔV_O	T_J =+25°C, V_I = 27V to 38V		17	480		17	480	mV
		T_J =+25°C, V_I = 30V to 36V		6	240		6	240	
Load Regulation	ΔV_O	T_J =+25°C, I_O = 5mA to 1.5A		15	480		15	480	mV
		T_J =+25°C, I_O = 250mA to 750mA		5.0	240		5.0	240	
Quiescent Current	I_Q	T_J =+25 °C		5.2	8		5.2	8	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1.0A		0.1	0.5		0.1	0.5	mA
		V_I = 27V to 38V					0.5	1	
		V_I = 28V to 38V		0.5	1				
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA		-1.5			-1.5		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A =+25 °C		160			60		µV/V_O
Ripple Rejection	RR	f = 120Hz V_I = 28V to 38V	50	67		50	67		dB
Dropout Voltage	V_D	I_O = 1A, T_J=+25 °C		2			2		V
Output Resistance	R_O	f = 1KHz		28			28		mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A=+25 °C		230			230		mA
Peak Current	I_{PK}	T_J =+25 °C		2.2			2.2		A

* $T_{MIN}<T_J<T_{MAX}$
  LM78XXI/RI: T_{MIN}= - 40 °C, T_{MAX} = +125 °C
  LM78XX/R: T_{MIN}= 0 °C, T_{MAX}= +125 °C
* Load and line regulation are specified at constant, junction temperature. Change in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

LM7805A/RA ELECTRICAL CHARACTERISTICS

(Refer to the test circuits. T_J = 0 to +I25 °C, I_O = 1A, V_I = 10V, C_I= 0.33µF, C_O= 0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_O	T_J =+25 °C	4.9	5	5.1	V
		I_O = 5mA to 1A, $P_D \leq$ 5W V_I = 7.5 to 20V	4.8	5	5.2	
Line Regulation	ΔV_O	V_I = 7.5 to 25V I_O = 500mA		5	50	V
		V_I = 8V to 12V		3	50	
		T_J =+25 °C, V_I= 7.3V to 25V		5	50	
		T_J =+25 °C, V_I= 8V to 12V		1.5	25	
Load Regulation	ΔV_O	T_J =+25 °C I_O = 5mA to 1.5A		9	100	V
		I_O = 5mA to 1A		9	100	
		I_O = 250 to 750mA		4	50	
Quiescent Current	I_Q	T_J =+25 °C		5.0	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A			0.5	mA
		V_I = 8 V to 25V, I_O = 500mA			0.8	
		V_I = 7.5V to 20V, T_J =+25 °C			0.8	
Output Voltage Drift	$\Delta V/\Delta T$	I_O = 5mA		-0.8		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100KHz T_A =+25 °C		10		µV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 500mA V_I = 8V to 18V		68		dB
Dropout Voltage	V_D	I_O = 1A, T_J =+25 °C		2		V
Output Resistance	R_O	f = 1KHz		17		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A =+25 °C		250		mA
Peak Current	I_{PK}	T_J= +25 °C		2.2		A

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

LM7806A/RA ELECTRICAL CHARACTERISTICS

(Refer to the test circuits. T_J = 0 to+150 °C, I_O = 1A, V_I = 11V, C_I= 0.33µF, C_O= 0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J =+25 °C		5.58	6	6.12	V
		I_O = 5mA to 1A, $P_D \leq$ 15W V_I = 8.6 to 21V		5.76	6	6.24	
Line Regulation	ΔV_O	V_I= 8.6 to 25V I_O = 500mA			5	60	mV
		V_I= 9V to 13V			3	60	
		T_J =+25 °C	V_I= 8.3V to 21V		5	60	
			V_I= 9V to 13V		1.5	30	
Load Regulation	ΔV_O	T_J =+25 °C I_O = 5mA to 1.5A			9	100	mV
		I_O = 5mA to 1A			4	100	
		I_O = 250 to 750mA			5.0	50	
Quiescent Current	I_Q	T_J =+25 °C			4.3	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A				0.5	mA
		V_I = 9V to 25V, I_O = 500mA				0.8	
		V_I= 8.5V to 21V, T_J =+25 °C				0.8	
Output Voltage Drift	$\Delta V/\Delta T$	I_O = 5mA			-0.8		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100KHz T_A =+25 °C			10		µ V/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 500mA V_I = 9V to 19V			65		dB
Dropout Voltage	V_D	I_O = 1A, T_J =+25 °C			2		V
Output Resistance	R_O	f = 1KHz			17		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A =+25 °C			250		mA
Peak Current	I_{PK}	T_J=+25 °C			2.2		A

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

LM7808A/RA ELECTRICAL CHARACTERISTICS

(Refer to the test circuits. T_J = 0 to+150 °C, I_O = 1A, V_I = 14V, C_I = 0.33µF, C_O=0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_O	T_J =+25 °C	7.84	8	8.16	V
		I_O = 5mA to 1A, P_D ≤15W V_I = 8.6 to 21V	7.7	8	8.3	
Line Regulation	ΔV_O	V_I= 10.6 to 25V I_O = 500mA		6	80	mV
		V_I= 11to 17V		3	80	
		T_J =+25 °C, V_I= 10.4V to 23V		6	80	
		T_J =+25 °C, V_I= 11V to 17V		2	40	
Load Regulation	ΔV_O	T_J =+25 °C I_O = 5mA to 1.5A		12	100	mV
		I_O = 5mA to 1A		12	100	
		I_O = 250 to 750mA		5	50	
Quiescent Current	I_Q	T_J =+25 °C		5.0	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A			0.5	mA
		V_I = 11V to 25V, I_O = 500mA			0.8	
		V_I= 10.6V to 23V, T_J =+25 °C			0.8	
Output Voltage Drift	$\Delta V/\Delta T$	I_O = 5mA		-0.8		mV /°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz T_A =+25 °C		10		µV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 500mA V_I = 11.5V to 21.5V		62		dB
Dropout Voltage	V_D	I_O = 1A, T_J =+25 °C		2		V
Output Resistance	R_O	f = 1KHz		18		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A =+25°C		250		mA
Peak Current	I_{PK}	T_J=+25 °C		2.2		A

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

LM7809A/RA ELECTRICAL CHARACTERISTICS

(Refer to the test circuits. T_J = 0 to +125 °C, I_O = 1A, V_I = 15V, C_I = 0.33µF, C_O = 0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J =+25 °C		8.82	9.0	9.18	V
		I_O = 5mA to 1A, P_D ≤15W V_I = 11.2 to 24V		8.65	9.0	9.35	
Line Regulation	ΔV_O	V_I= 11.7 to 25V I_O = 500mA			6	90	mV
		V_I= 12.5 to 19V			4	45	
		T_J =+25 °C	V_I= 11.5V to 24V		6	90	
			V_I= 12.5V to 19V		2	45	
Load Regulation	ΔV_O	T_J =+25 °C I_O = 5mA to 1.0A			12	100	mV
		I_O = 5mA to 1.0A			12	100	
		I_O = 250 to 750mA			5	50	
Quiescent Current	I_Q	T_J =+25 °C			5.0	6.0	mA
Quiescent Current Change	ΔI_Q	V_I = 11.7V to 25V, T_J=+25 °C				0.8	mA
		V_I = 12V to 25V, I_O = 500mA				0.8	
		I_O = 5mA to 1.0A				0.5	
Output Voltage Drift	ΔV/ΔT	I_O = 5mA			-1.0		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100KHz T_A =+25 °C			10		µV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 500mA V_I = 12V to 22V			62		dB
Dropout Voltage	V_D	I_O = 1A, T_J =+25 °C			2.0		V
Output Resistance	R_O	f = 1KHz			17		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A =+25 °C			250		mA
Peak Current	I_{PK}	T_J=+25 °C			2.2		A

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

LM7810A/RA ELECTRICAL CHARACTERISTICS

(Refer to the test circuits. T_J = 0 to+125 °C, I_O = 1A, V_I = 16V, C_I = 0.33µF, C_O = 0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J =+25 °C		9.8	10	10.2	V
		I_O = 5mA to 1A, $P_D \leq$ 15W V_I =12.8 to 25V		9.6	10	10.4	
Line Regulation	ΔV_O	V_I= 12.8 to 26V I_O = 500mA			8	100	mV
		V_I= 13to 20V			4	50	
		T_J =+25 °C	V_I= 12.5V to 25V		8	100	
			V_I= 13V to 20V		3	50	
Load Regulation	ΔV_O	T_J =+25 °C I_O = 5mA to 1.5A			12	100	mV
		I_O = 5mA to 1.0A			12	100	
		I_O = 250 to 750mA			5	50	
Quiescent Current	I_Q	T_J =+25 °C			5.0	6.0	mA
Quiescent Current Change	ΔI_Q	V_I = 13V to 26V, T_J=+25 °C				0.5	mA
		V_I = 12.8V to 25V, I_O = 500mA				0.8	
		I_O = 5mA to 1.0A				0.5	
Output Voltage Drift	$\Delta V/\Delta T$	I_O = 5mA			-1.0		mV °C
Output Noise Voltage	V_N	f = 10Hz to 100KHz T_A =+25 °C			10		µV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 500mA V_I = 14V to 24V			62		dB
Dropout Voltage	V_D	I_O = 1A, T_J =+25 °C			2.0		V
Output Resistance	R_O	f = 1KHz			17		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A =+25 °C			250		mA
Peak Current	I_{PK}	T_J=+25 °C			2.2		A

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

LM7811A/RA ELECTRICAL CHARACTERISTICS

(Refer to the test circuits. T_J = 0 to +125 °C, I_O = 1A, V_I = 18V, C_I = 0.33µF, C_O = 0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_O	T_J =+25 °C	10.8	11.0	11.2	V
		I_O = 5mA to 1A, P_D ≤15W V_I = 13.8 to 26V	10.6	11.0	11.4	
Line Regulation	ΔV_O	V_I= 12.8 to 26V I_O = 500mA		10	110	mV
		V_I= 15 to 21V		4	55	
		T_J =+25 °C, V_I= 13.5V to 26V		10	110	
		T_J =+25 °C, V_I= 15V to 21V		3	55	
Load Regulation	ΔV_O	T_J =+25 °C I_O = 5mA to 1.5A		12	100	mV
		I_O = 5mA to 1.0A		12	100	
		I_O = 250 to 750mA		5	50	
Quiescent Current	I_Q	T_J =+25 °C		5.1	6.0	mA
Quiescent Current Change	ΔI_Q	V_I = 13.8V to 26V, T_J=+25 °C			0.8	mA
		V_I = 14V to 27V, I_O = 500mA			0.8	
		I_O = 5mA to 1.0A			0.5	
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA		-1.0		mV /°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz T_A =+25 °C		10		µV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 500mA V_I = 14V to 24V		61		dB
Dropout Voltage	V_D	I_O = 1A, T_J =+25 °C		2.0		V
Output Resistance	R_O	f = 1KHz		18		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A =+25 °C		250		mA
Peak Current	I_{PK}	T_J=+25 °C		2.2		A

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

LM7812A/RA ELECTRICAL CHARACTERISTICS

(Refer to the test circuits. T_J = 0 to +125 °C, I_O = 1A, V_I = 19V, C_I = 0.33µF, C_O= 0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J =+25 °C		11.75	12	12.25	V
		I_O = 5mA to 1A, P_D ≤15W V_I = 14.8 to 27V		11.5	12	12.5	
Line Regulation	ΔV_O	V_I= 14.8 to 30V I_O = 500mA			10	120	mV
		V_I= 16 to 22V			4	120	
		T_J =+25°C	V_I= 14.5V to 27V		10	120	
			V_I= 16V to 22V		3	60	
Load Regulation	ΔV_O	T_J =+25°C I_O = 5mA to 1.5A			12	100	mV
		I_O = 5mA to 1.0A			12	100	
		I_O = 250 to 750mA			5	50	
Quiescent Current	I_Q	T_J =+25 °C			5.1	6.0	mA
Quiescent Current Change	ΔI_Q	V_I = 15V to 30V, T_J=+25 °C				0.5	mA
		V_I = 14V to 27V, I_O = 500mA				0.8	
		I_O = 5mA to 1.0A				0.8	
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA			-1.0		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100KHz T_A =+25 °C			10		µV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 500mA V_I = 14V to 24V			60		dB
Dropout Voltage	V_D	I_O = 1A, T_J =+25 °C			2.0		V
Output Resistance	R_O	f = 1KHz			18		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A =+25 °C			250		mA
Peak Current	I_{PK}	T_J=+25 °C			2.2		A

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

LM7815A/RA ELECTRICAL CHARACTERISTICS

(Refer to the test circuits. T_J = 0 to +150 °C, I_O =1A, V_I=23V, C_I = 0.33µF, C_O=0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_O	T_J =+25 °C	14.7	15	15.3	V
		I_O = 5mA to 1A, P_D ≤15W V_I = 17.7 to 30V	14.4	15	15.6	
Line Regulation	ΔV_O	V_I= 17.9 to 30V I_O = 500mA		10	150	mV
		V_I= 20 to 26V		5	150	
		T_J =+25 °C, V_I= 17.5V to 30V		11	150	
		T_J =+25 °C, V_I= 20V to 26V		3	75	
Load Regulation	ΔV_O	T_J =+25 °C I_O = 5mA to 1.5A		12	100	mV
		I_O = 5mA to 1.0A		12	100	
		I_O = 250 to 750mA		5	50	
Quiescent Current	I_Q	T_J =+25 °C		5.2	6.0	mA
Quiescent Current Change	ΔI_Q	V_I = 17.5V to 30V, T_J =+25 °C			0.5	mA
		V_I = 17.5V to 30V, I_O = 500mA			0.8	
		I_O = 5mA to 1.0A			0.8	
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA		-1.0		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100KHz T_A =+25 °C		10		µV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 500mA V_I = 18.5V to 28.5V		58		dB
Dropout Voltage	V_D	I_O = 1A, T_J =+25 °C		2.0		V
Output Resistance	R_O	f = 1KHz		19		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A =+25 °C		250		mA
Peak Current	I_{PK}	T_J=+25 °C		2.2		A

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

LM7818A/RA ELECTRICAL CHARACTERISTICS

(Refer to the test circuits. T_J = 0 to +150 °C, I_O=1A, V_I = 27V, C_I= 0.33µF, C_O = 0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J =+25 °C		17.64	18	18.36	V
		I_O = 5mA to 1A, P_D ≤15W V_I = 21 to 33V		17.3	18	18.7	
Line Regulation	ΔV_O	V_I= 21 to 33V I_O = 500mA			15	180	mV
		V_I= 21 to 33V			5	180	
		T_J =+25 °C	V_I= 20.6V to 33V		15	180	
			V_I= 24V to 30V		5	90	
Load Regulation	ΔV_O	T_J =+25 °C I_O = 5mA to 1.5A			15	100	mV
		I_O = 5mA to 1.0A			15	100	
		I_O = 250 to 750mA			7	50	
Quiescent Current	I_Q	T_J =+25 °C			5.2	6.0	mA
Quiescent Current Change	ΔI_Q	V_I = 21V to 33V, T_J=+25 °C				0.5	mA
		V_I = 21V to 33V, I_O = 500mA				0.8	
		I_O = 5mA to 1.0A				0.8	
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA			-1.0		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100KHz T_A =+25 °C			10		µV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 500mA V_I = 18.5V to 28.5V			57		dB
Dropout Voltage	V_D	I_O = 1A, T_J =+25 °C			2.0		V
Output Resistance	R_O	f = 1KHz			19		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A =+25 °C			250		mA
Peak Current	I_{PK}	T_J=+25 °C			2.2		A

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

LM7824A/RA ELECTRICAL CHARACTERISTICS

(Refer to the test circuits. T_J = 0 to +150 °C, I_O =1A, V_I = 33V, C_I= 0.33µF, C_O=0.1µF, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_O	T_J =+25 °C	23.5	24	24.5	V
		I_O = 5mA to 1A, P_D ≤15W V_I = 27.3 to 38V	23	24	25	
Line Regulation	ΔV_O	V_I= 27 to 38V I_O = 500mA		18	240	mV
		V_I= 21 to 33V		6	240	
		T_J =+25 °C, V_I= 26.7V to 38V		18	240	
		T_J =+25 °C, V_I= 30V to 36V		6	120	
Load Regulation	ΔV_O	T_J =+25 °C I_O = 5mA to 1.5A		15	100	mV
		I_O = 5mA to 1.0A		15	100	
		I_O = 250 to 750mA		7	50	
Quiescent Current	I_Q	T_J =+25 °C		5.2	6.0	mA
Quiescent Current Change	ΔI_Q	V_I = 27.3V to 38V, T_J =+25 °C			0.5	mA
		V_I = 27.3V to 38V, I_O = 500mA			0.8	
		I_O = 5mA to 1.0A			0.8	
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA		-1.5		mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100KHz T_A = 25 °C		10		µV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 500mA V_I = 18.5V to 28.5V		54		dB
Dropout Voltage	V_D	I_O = 1A, T_J =+25°C		2.0		V
Output Resistance	R_O	f = 1KHz		20		mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A =+25 °C		250		mA
Peak Current	I_{PK}	T_J=+25 °C		2.2		A

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

TYPICAL PERFORMANCE CHARACTERISTICS

Fig. 1 Quiescent Current

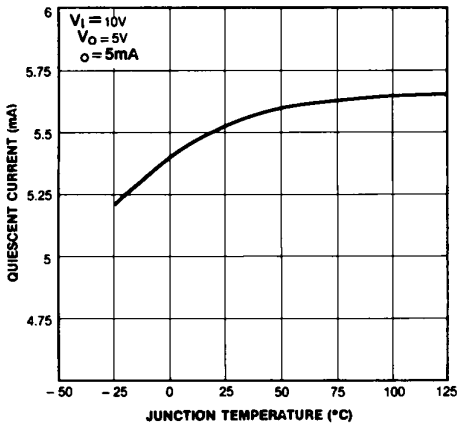


Fig. 2 Peak Output Current

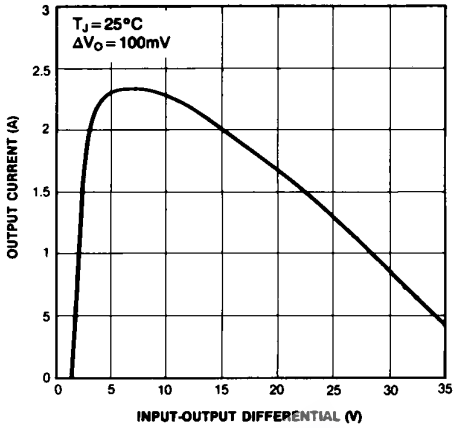


Fig. 3 Output Voltage

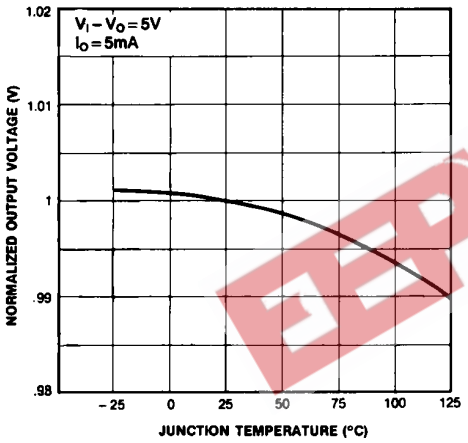
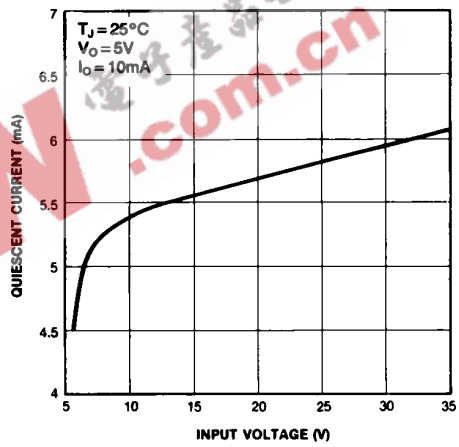


Fig. 4 Quiescent Current



TYPICAL APPLICATIONS

Fig. 5 DC Parameters

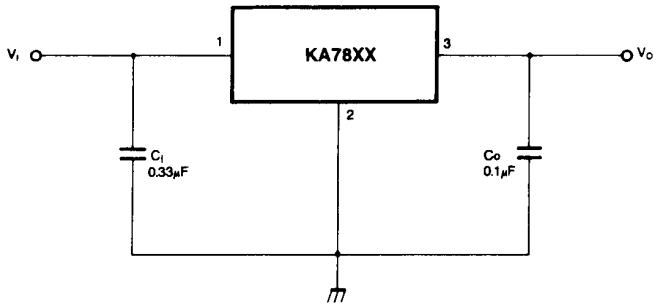


Fig. 6 Load Regulation

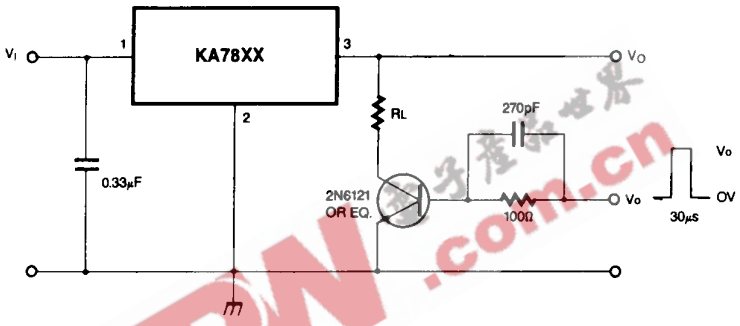
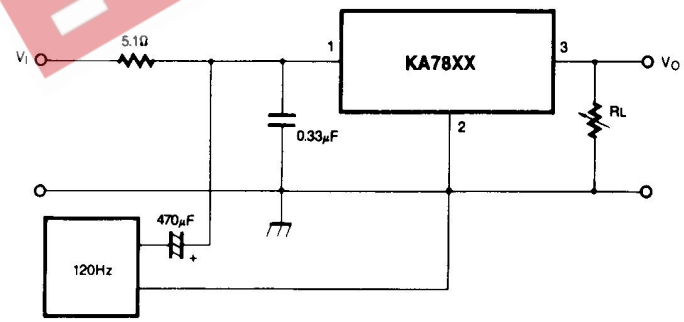


Fig. 7 Ripple Rejection



TYPICAL APPLICATIONS (Continued)

Fig. 8 Fixed Output Regulator

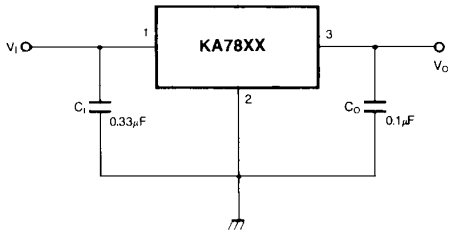
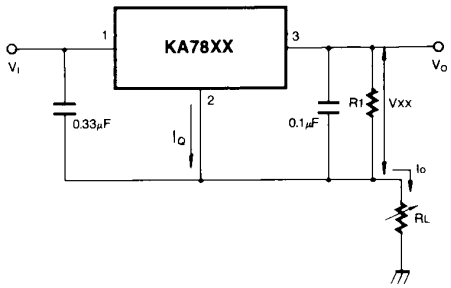


Fig. 9 Constant Current Regulator



$$I_O = \frac{}{R_1} + I_Q$$

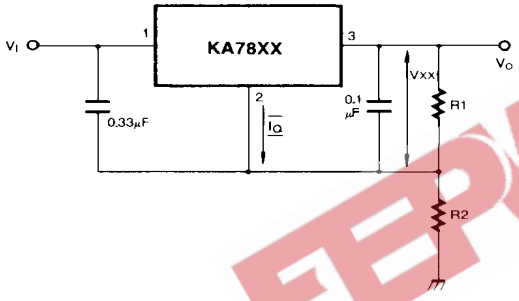
Notes:

(1) To specify an output voltage. substitute voltage value for "XX." A common ground is required between the input and the Output voltage. The input voltage must remain typically 2.0V above the output voltage even during the low point on the input ripple voltage.

(2) C_I is required if regulator is located an appreciable distance from power Supply filter.

(3) C_O improves stability and transient response.

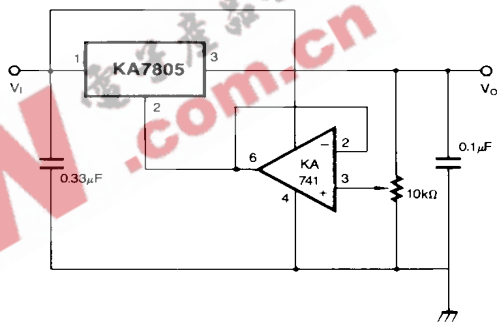
Fig. 10 Circuit for Increasing Output Voltage



$I_{RI} \geq 5\ I_Q$

$V_O = V_{XX}\,(1+R_2/R_1)+I_QR_2$

Fig. 11 Adjustable Output Regulator (7 to 30V)



TYPICAL APPLICATIONS (Continued)

Fig. 12 High Current Voltage Regulator

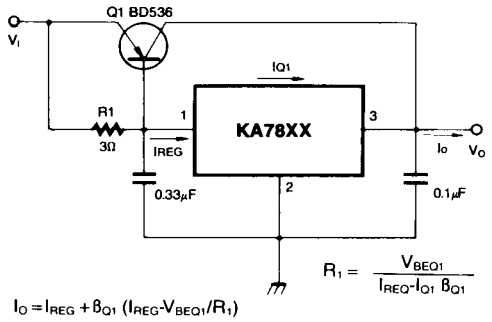


Fig. 13 High Output Current with Short Circuit Protection

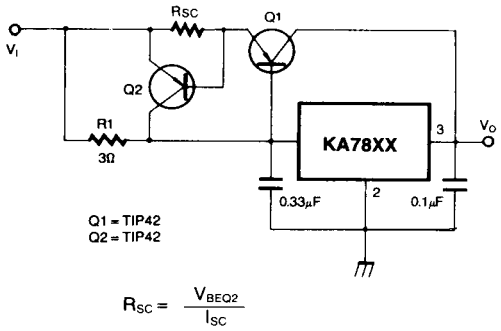


Fig. 14 Tracking Voltage Regulator

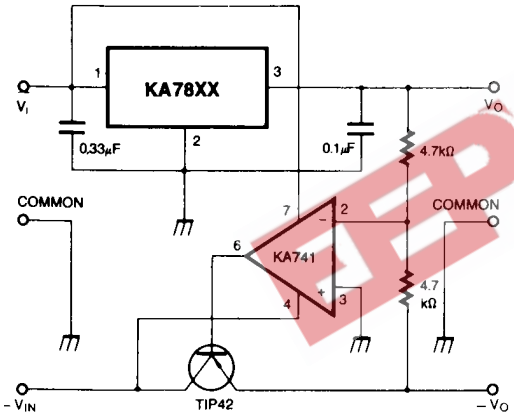
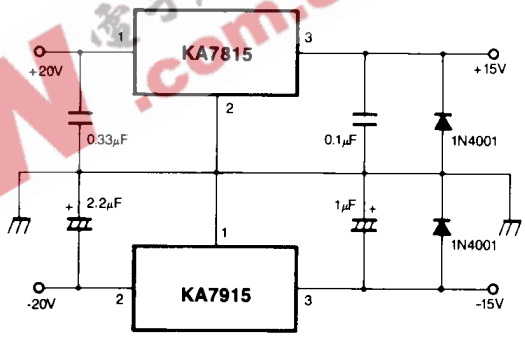


Fig. 15 Split Power Supply (±15V-1A)



TYPICAL APPLICATIONS (Continued)

Fig. 16 Negative Output Voltage Circuit

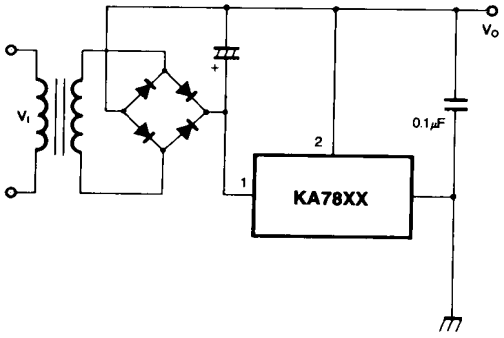
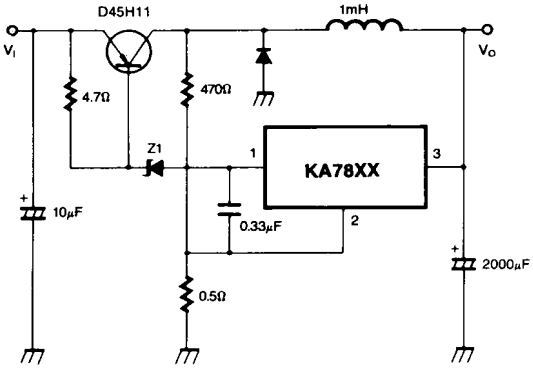


Fig. 17 switching Regulator



LM78XX (KA78XX, MC78XX) FIXED VOLTAGE REGULATOR (POSITIVE)

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