μA7800 SERIES

THREE - TERMINAL POSITIVE VOLTAGE REGULATORS

FAIRCHILD LINEAR INTEGRATED CIRCUITS

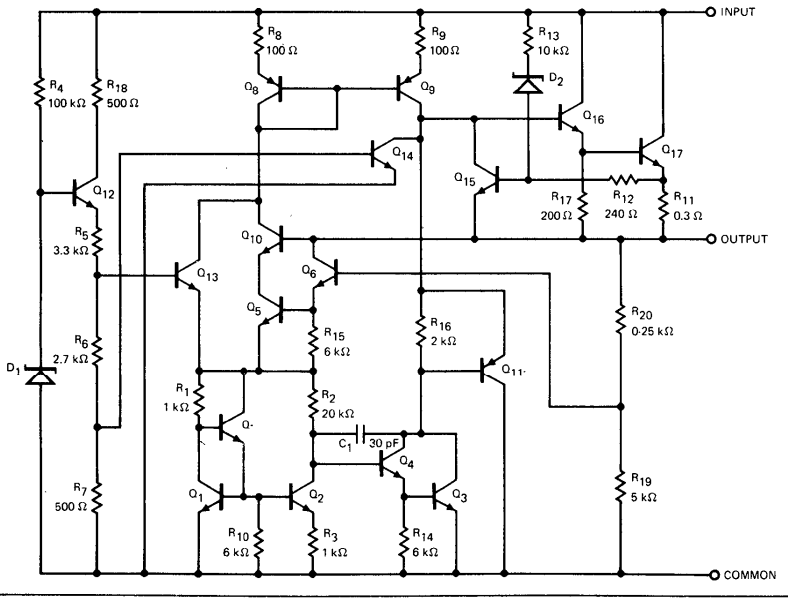
GENERAL DESCRIPTION – The μA7800 series of Three-Terminal Positive Voltage Regulators are constructed using the Fairchild Planar* epitaxial process. These regulators employ internal current limiting, thermal shutdown and safe-area compensation making them essentially blow-out proof. If adequate heat sinking is provided, they can deliver over 1A output current. They are intended as fixed-voltage regulators in a wide range of applications including local, on-card regulation for elimination of noise and distribution problems associated with single point regulation. In addition to use as fixed voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents and as the power pass element in precision regulators.

- **OUTPUT CURRENT IN EXCESS OF 1 AMP**
- **NO EXTERNAL COMPONENTS**
- **INTERNAL THERMAL OVERLOAD PROTECTION**
- **INTERNAL SHORT CIRCUIT CURRENT LIMITING**
- **OUTPUT TRANSISTOR SAFE-AREA COMPENSATION**
- **AVAILABLE IN THE PLASTIC TO-220 AND THE METAL TO-3 PACKAGE**

ABSOLUTE MAXIMUM RATINGS

Input Voltage (5 V through 18 V)	35 V
(24 V)	40 V
Internal Power Dissipation (Note 1)	Internally Limited
Storage Temperature Range	−65°C to +150°C
Operating Junction Temperature Range	0°C to +125°C
Lead Temperature (Soldering, 60 second time limit) TO-3 Package	300°C
(Soldering, 10 second time limit) TO-220 Package	230°C

EQUIVALENT CIRCUIT

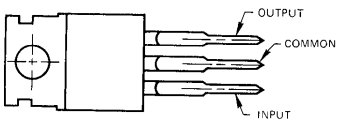


Note on following page.

VOLTAGE RANGE

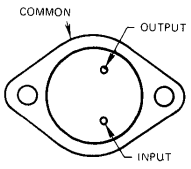
μA7805	5 V
μA7806	6 V
μA7808	8 V
μA7812	12 V
μA7815	15 V
μA7818	18 V
μA7824	24 V

CONNECTION DIAGRAMS
TO-220 PLASTIC POWER PACKAGE
(TOP VIEW)



ORDER PART NOS: UGH7805393
UGH7806393
UGH7808393
UGH7812393
UGH7815393
UGH7818393
UGH7824393

TO-3 PACKAGE
(TOP VIEW)



ORDER PART NOS: UGJ7805393
UGJ7806393
UGJ7808393
UGJ7812393
UGJ7815393
UGJ7818393
UGJ7824393

*Planar is a patented Fairchild process.

μA7805

ELECTRICAL CHARACTERISTICS (V_{IN} = 10 V, I_{OUT} = 500 mA, 0°C < T_J < 125°C, unless otherwise specified)

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	T_J = 25°C	4.8	5.0	5.2	V
Line Regulation	T_J = 25°C, I_{OUT} = 100 mA				
	7 V ≤ V_{IN} ≤ 25 V		7.0	50	mV
	8 V ≤ V_{IN} ≤ 12 V		2.0	25	mV
	T_J = 25°C, I_{OUT} = 500 mA				
	7 V ≤ V_{IN} ≤ 25 V		35	100	mV
	8 V ≤ V_{IN} ≤ 12 V		8.0	50	mV
Load Regulation	T_J = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5 A		11	100	mV
	250 mA ≤ I_{OUT} ≤ 750 mA		4.0	50	mV
Output Voltage	7 V ≤ V_{IN} ≤ 20 V, 5 mA ≤ I_{OUT} ≤ 1.0 A p ≤ 15 W	4.75		5.25	V
Quiescent Current	T_J = 25°C		4.3	8.0	mA
Quiescent Current Change	7 V ≤ V_{IN} ≤ 25 V			1.3	mA
	5 mA ≤ I_{OUT} ≤ 1.5 A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		40		μV
Long Term Stability				20	mV
Ripple Rejection	I_{OUT} = 20 mA, f = 120 Hz		70		dB
Dropout Voltage	I_{OUT} = 1A, T_J = 25°C		2.0		V
Output Resistance			30		mΩ
Short Circuit Current Limit	T_J = 25°C		750		mA
Average Temperature Coefficient of Output Voltage	I_{OUT} = 5 mA, 0°C ≤ T_A ≤ 125°C		−1.3		mV/°C

μA7806

ELECTRICAL CHARACTERISTICS (V_{IN} = 11 V, I_{OUT} = 500 mA, 0°C < T_J < 125°C, unless otherwise specified)

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	T_J = 25°C	5.75	6.0	6.25	V
Line Regulation	T_J = 25°C, I_{OUT} = 100 mA				
	8 V ≤ V_{IN} ≤ 25 V		9.0	60	mV
	9 V ≤ V_{IN} ≤ 13 V		3.0	30	mV
	T_J = 25°C, I_{OUT} = 500 mA				
	8 V ≤ V_{IN} ≤ 25 V		43	120	mV
	9 V ≤ V_{IN} ≤ 13 V		10	60	mV
Load Regulation	T_J = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5 A		13	120	mV
	250 mA ≤ I_{OUT} ≤ 750 mA		5.0	60	mV
Output Voltage	8 V ≤ V_{IN} ≤ 21 V, 5 mA ≤ I_{OUT} ≤ 1.0 A p ≤ 15 W	5.7		6.3	V
Quiescent Current	T_J = 25°C		4.3	8.0	mA
Quiescent Current Change	8 V ≤ V_{IN} ≤ 25 V			1.3	mA
	5 mA ≤ I_{OUT} ≤ 1.5 A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		45		μV
Long Term Stability				24	mV
Ripple Rejection	I_{OUT} = 20 mA, f = 120 Hz		65		dB
Dropout Voltage	I_{OUT} = 1 A, T_J = 25°C		2.0		V
Output Resistance	I_{OUT} = 500 mA		35		mΩ
Short Circuit Current Limit	T_J = 25°C		550		mA
Average Temperature Coefficient of Output Voltage	I_{OUT} = 5 mA, 0°C ≤ T_A ≤ 125°C		−1.0		mV/°C

NOTE 1. Thermal resistance without a heat sink for junction to case temperature is 4.0°C/W for TO-3 package, 2.0°C/W for TO-220 package; ambient to case temperature is 35°C/W for TO-3 package and 50°C/W for TO-220 package.

μA7808

ELECTRICAL CHARACTERISTICS (V_{IN} = 14 V, I_{OUT} = 500 mA, 0°C < T_J < 125°C, unless otherwise specified)

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	T_J = 25°C	7.7	8.0	8.3	V
Line Regulation	T_J = 25°C, I_{OUT} = 100 mA				
	10.5 V ≤ V_{IN} ≤ 25 V		12	80	mV
	11 V ≤ V_{IN} ≤ 17 V		5.0	40	mV
	T_J = 25°C, I_{OUT} = 500 mA				
	10.5 V ≤ V_{IN} ≤ 25 V		50	160	mV
	11 V ≤ V_{IN} ≤ 17 V		22	80	mV
Load Regulation	T_J = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5 A		26	160	mV
	250 mA ≤ I_{OUT} ≤ 750 mA		9.0	80	mV
Output Voltage	10.5 V ≤V_{IN}≤ 23 V, 5 mA ≤I_{OUT} ≤ 1.0 A, p ≤ 15 W	7.6		8.4	V
Quiescent Current	T_J = 25°C		4.3	8.0	mA
Quiescent Current Change	10.5 V ≤ V_{IN} ≤ 25 V			1.0	mA
	5 mA ≤ I_{OUT} ≤ 1.5 A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		52		μV
Long Term Stability				32	mV
Ripple Rejection	I_{OUT} = 20 mA, f = 120 Hz		62		dB
Dropout Voltage	I_{OUT} = 1 A, T_J = 25°C		2.0		V
Output Resistance	I_{OUT} = 500 mA		40		mΩ
Short Circuit Current Limit	T_J = 25°C		450		mA
Average Temperature Coefficient of Output Voltage	I_{OUT} = 5 mA, 0°C ≤ T_A ≤ 125°C		−1.0		mV/°C

μA7812

ELECTRICAL CHARACTERISTICS (V_{IN} = 19 V, I_{OUT} = 500 mA, 0°C < T_J < 125°C, unless otherwise specified)

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	T_J = 25°C	11.5	12.0	12.5	V
Line Regulation	T_J = 25°C, I_{OUT} = 100 mA				
	14.5 V ≤ V_{IN} ≤ 30 V		13	120	mV
	16 V ≤ V_{IN} ≤ 22 V		6.0	60	mV
	T_J = 25°C, I_{OUT} = 500 mA				
	14.5 V ≤ V_{IN} ≤ 30 V		55	240	mV
	16 V ≤ V_{IN} ≤ 22 V		24	120	mV
Load Regulation	T_J = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5 A		46	240	mV
	250 mA ≤ I_{OUT} ≤ 750 mA		17	120	mV
Output Voltage	14.5 V ≤ V_{IN} ≤ 27 V, 5 mA ≤ I_{OUT} ≤ 1.0 A, p ≤ 15 W			12.6	V
Quiescent Current	T_J = 25°C		4.4	8.0	mA
Quiescent Current Change	14.5 V ≤ V_{IN} ≤ 30 V			1.0	mA
	5 mA ≤ I_{OUT} ≤ 1.5 A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		75		μV
Long Term Stability				48	mV
Ripple Rejection	I_{OUT} = 20 mA, f = 120 Hz		61		dB
Dropout Voltage	I_{OUT} = 1 A, T_J = 25°C		2.0		V
Output Resistance	I_{OUT} = 500 mA		75		mΩ
Short Circuit Current Limit	T_J = 25°C		350		mA
Average Temperature Coefficient of Output Voltage	I_{OUT} = 5 mA, 0°C ≤ T_A ≤ 125°C		−2.0		mV/°C

μA7815

ELECTRICAL CHARACTERISTICS (V_{IN} = 23 V, I_{OUT} = 500 mA, 0°C < T_J < 125°C, unless otherwise specified)

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	T_J = 25°C	14.4	15.0	15.6	V
Line Regulation	T_J = 25°C, I_{OUT} = 100 mA				
	17.5 V ≤ V_{IN} ≤ 30 V		14	150	mV
	20 V ≤ V_{IN} ≤ 26 V		6.0	75	mV
	T_J = 25°C, I_{OUT} = 500 mA				
	17.5 V ≤ V_{IN} ≤ 30 V		57	300	mV
	20 V ≤ V_{IN} ≤ 26 V		27	150	mV
Load Regulation	T_J = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5 A		68	300	mV
	250 mA ≤ I_{OUT} ≤750 mA		25	150	mV
Output Voltage	17.5 V ≤ V_{IN} ≤ 30 V, 5 mA ≤ I_{OUT} ≤ 1.0 A, p ≤ 15 W	14.25		15.75	V
Quiescent Current	T_J = 25°C		4.4	8.0	mA
Quiescent Current Change	17.5 V ≤ V_{IN} ≤ 30 V			1.0	mA
	5 mA ≤ I_{OUT} ≤ 1.5 A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		90		μV
Long Term Stability				60	mV
Ripple Rejection	I_{OUT} = 20 mA, f = 120 Hz		60		dB
Dropout Voltage	I_{OUT} = 1 A, T_J = 25°C		2.0		V
Output Resistance	I_{OUT} = 500 mA		95		mΩ
Short Circuit Current Limit	T_J = 25°C		230		mA
Average Temperature Coefficient of Output Voltage	I_{OUT} = 5 mA, 0°C ≤ T_A ≤ 125°C		−2.0		mV/°C

μA7818

ELECTRICAL CHARACTERISTICS (V_{IN} = 27 V, I_{OUT} = 500 mA, 0°C < T_J < 125°C, unless otherwise specified)

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	T_J = 25°C	17.3	18.0	18.7	V
Line Regulation	T_J = 25°C, I_{OUT} = 100 mA				
	21 V ≤ V_{IN} ≤ 33 V		25	180	mV
	24 V ≤ V_{IN} ≤ 30 V		10	90	mV
	T_J = 25°C, I_{OUT} = 500 mA				
	21 V ≤ V_{IN} ≤ 33 V		90	360	mV
	24 V ≤ V_{IN} ≤ 30 V		50	180	mV
Load Regulation	T_J = 25°C, 5 mA ≤ I_{OUT} ≤ 1.0 A		110	360	mV
	250 mA ≤ I_{OUT} ≤ 750 mA		55	180	mV
Output Voltage	21 V ≤ V_{IN} ≤ 33 V, 5 mA ≤ I_{OUT} ≤ 1.0 A p ≤ 15 W	17.1		18.9	V
Quiescent Current	T_J = 25°C		4.5	8.0	mA
Quiescent Current Change	21 V ≤ V_{IN} ≤ 33 V			1.0	mA
	5 mA ≤ I_{OUT} ≤ 1.0 A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		110		μV
Long Term Stability				72	mV
Ripple Rejection	I_{OUT} = 20 mA, f = 120 Hz		59		dB
Dropout Voltage	I_{OUT} = 1 A, T_J = 25°C		2.0		V
Output Resistance	I_{OUT} = 500 mA		110		mΩ
Short Circuit Current Limit	T_J = 25°C		200		mA
Average Temperature Coefficient of Output Voltage	I_{OUT} = 5 mA, 0°C ≤ T_A ≤ 125°C		−1.0		mV/°C

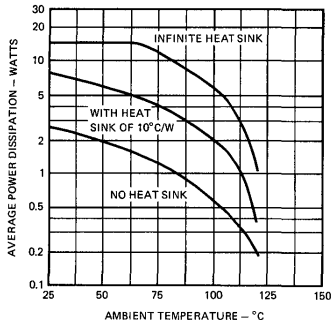
μA7824

ELECTRICAL CHARACTERISTICS (V_{IN} = 33 V, I_{OUT} = 500 mA, 0°C < T_J < 125°C, unless otherwise specified)

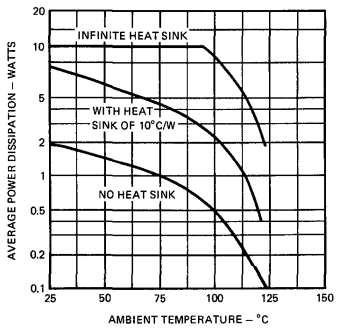
PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	T_J = 25°C	23.0	24.0	35.0	V
Line Regulation	T_J = 25°C, I_{OUT} = 100 mA				
	27 V ≤ V_{IN} ≤ 38 V		31	240	mV
	30 V ≤ V_{IN} ≤ 36 V		14	120	mV
	T_J = 25°C, I_{OUT} = 500 mA				
	27 V ≤ V_{IN} ≤ 38 V		118	480	mV
	30 V ≤ V_{IN} ≤ 36 V		70	240	mV
Load Regulation	T_J = 25°C, 5 mA ≤ I_{OUT} ≤ 1.0 A		150	480	mV
	250 mA ≤ I_{OUT} ≤ 750 mA		85	240	mV
Output Voltage	27 V ≤ V_{IN} ≤ 38 V, 5 mA ≤ I_{OUT} ≤ 1.0 A	22.8		25.2	V
	p ≤ 15 W				
Quiescent Current	T_J = 25°C		4.6	8.0	mA
Quiescent Current Change	27 V ≤ V_{IN} ≤ 38 V			1.0	mA
	5 mA ≤ I_{OUT} ≤ 1.0 A			0.5	mA
Output Noise Voltage	T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz		170		μV
Long Term Stability				96	mV
Ripple Rejection	I_{OUT} =20 mA, f = 120 Hz		56		dB
Dropout Voltage	I_{OUT} = 1 A, T_J = 25°C		2.0		V
Output Resistance	I_{OUT} = 500 mA		150		mΩ
Short Circuit Current Limit	T_J = 25°C		150		mA
Average Temperature Coefficient of Output Voltage	I_{OUT} = 5 mA, 0°C ≤ T_A ≤ 125°C		−1.0		mV/°C

TYPICAL PERFORMANCE CURVES

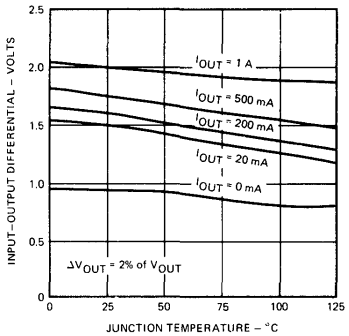
MAXIMUM AVERAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE (TO-3 PACKAGE)



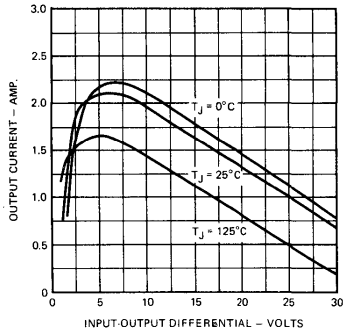
MAXIMUM AVERAGE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE (TO-220 PACKAGE)



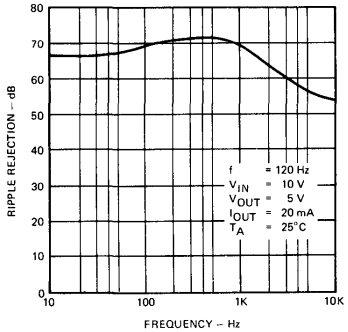
DROPOUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE



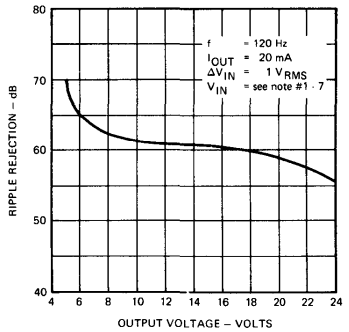
PEAK OUTPUT CURRENT AS A FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE



RIPPLE REJECTION AS A FUNCTION OF FREQUENCY

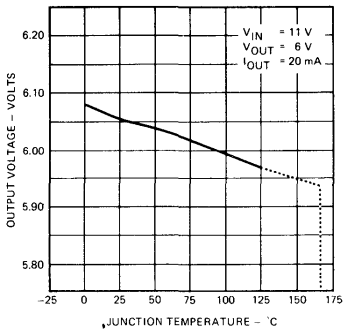


RIPPLE REJECTION AS A FUNCTION OF OUTPUT VOLTAGES

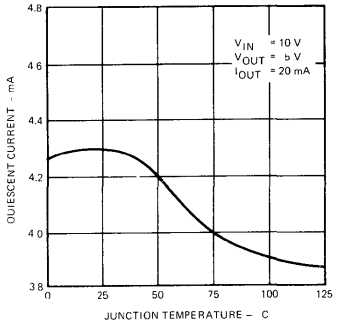


TYPICAL PERFORMANCE CURVES (cont'd)

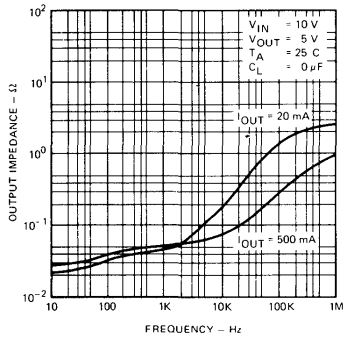
OUTPUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE



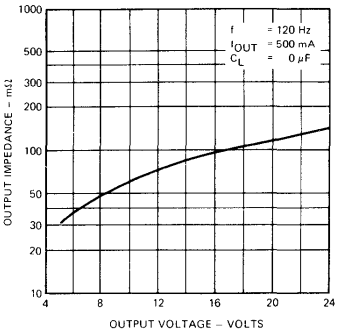
QUIESCENT CURRENT AS A FUNCTION OF TEMPERATURE



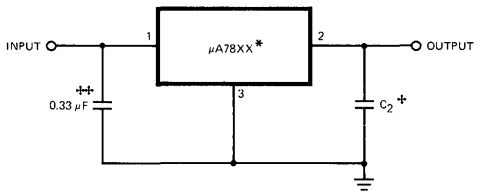
OUTPUT IMPEDANCE AS A FUNCTION OF FREQUENCY



OUTPUT IMPEDANCE AS A FUNCTION OF OUTPUT VOLTAGE

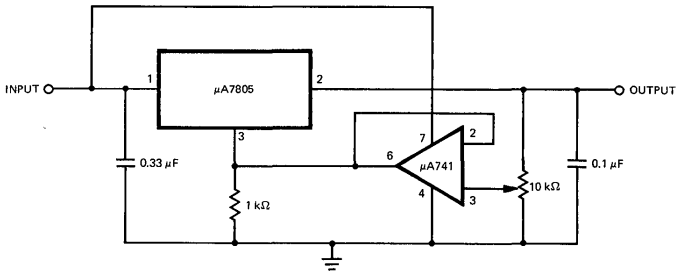


APPLICATIONS



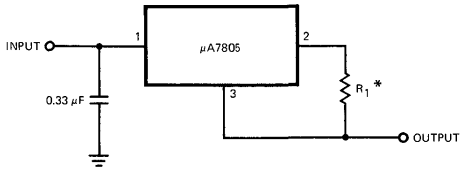
NOTES:
*To specify an output voltage, substitute voltage value for "XX".
+Although no output capacitor is needed for stability, it does improve transient response.
++Required if regulator is located an appreciable distance from power supply filter.

FIXED OUTPUT REGULATOR



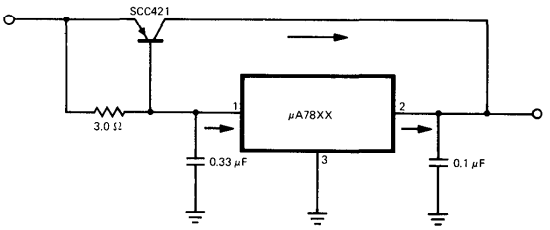
V_{OUT}, 7 V to 20 V
$V_{IN} - V_{OUT} \geq 2$ V

ADJUSTABLE OUTPUT REGULATOR – HIGH LINE REGULATION



*R_1 determines output current.

CURRENT REGULATOR



HIGH CURRENT VOLTAGE REGULATOR