µA78M00 SERIES
3-TERMINAL POSITIVE VOLTAGE REGULATORS
FAIRCHILD LINEAR INTEGRATED CIRCUITS

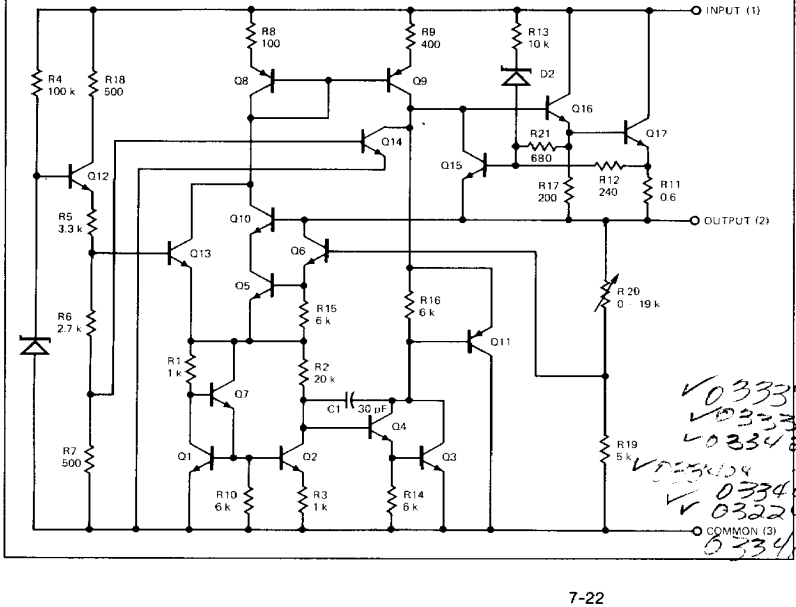
GENERAL DESCRIPTION – The µA78M00 series of 3-Terminal Medium Current Positive Voltage Regulators is constructed using the Fairchild Planar* epitaxial process. These regulators employ internal current limiting, thermal shutdown and safe area compensation making them essentially indestructible. If adequate heat sinking is provided, they can deliver in excess of 500 mA output current. They are intended as fixed voltage regulators in a wide range of applications including local or 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.

- **OUTPUT CURRENT IN EXCESS OF 0.5 A**
- **NO EXTERNAL COMPONENTS**
- **INTERNAL THERMAL OVERLOAD PROTECTION**
- **INTERNAL SHORT CIRCUIT CURRENT LIMITING**
- **OUTPUT TRANSISTOR SAFE AREA COMPENSATION**
- **AVAILABLE IN JEDEC TO-220 AND TO-39 PACKAGES**
- **OUTPUT VOLTAGES OF 5 V, 6 V, 8 V, 12 V, 15 V, 20 V AND 24 V**
- **MILITARY AND COMMERCIAL TEMPERATURE RANGE**

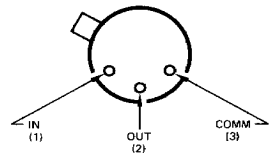
ABSOLUTE MAXIMUM RATINGS

Input Voltage	
(5 V through 15 V)	35 V
(20 V, 24 V)	40 V
Internal Power Dissipation	Internally Limited
Storage Temperature Range	
TO-39	−65°C to +150°C
TO-220	−55°C to +150°C
Operating Junction Temperature Range	
µA78M00	−55°C to +150°C
µA78M00C	0°C to +150°C
Lead Temperatures (Soldering, 60 s time limit) TO-39	300°C
(Soldering, 10 s time limit) TO-220	230°C

EQUIVALENT CIRCUIT



CONNECTION DIAGRAM
TO-39 PACKAGE
(TOP VIEW)

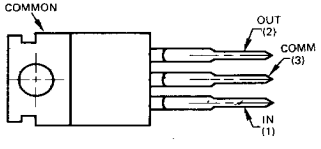


ORDER INFORMATION

OUTPUT VOLTAGE	TYPE	PART NO.
5 V	µA78M05	µA78M05HM
6 V	µA78M06	µA78M06HM
8 V	µA78M08	µA78M08HM
12 V	µA78M12	µA78M12HM
15 V	µA78M15	µA78M15HM
20 V	µA78M20	µA78M20HM
24 V	µA78M24	µA78M24HM
5 V	µA78M05C	µA78M05HC
6 V	µA78M06C	µA78M06HC
8 V	µA78M08C	µA78M08HC
12 V	µA78M12C	µA78M12HC
15 V	µA78M15C	µA78M15HC
20 V	µA78M20C	µA78M20HC
24 V	µA78M24C	µA78M24HC

TO-220 PACKAGE

(Available in U1 and U2 packages)



ORDER INFORMATION

OUTPUT VOLTAGE	TYPE	PART NO.
5 V	µA78M05C	µA78M05UC
6 V	µA78M06C	µA78M06UC
8 V	µA78M08C	µA78M08UC
12 V	µA78M12C	µA78M12UC
15 V	µA78M15C	µA78M15UC
20 V	µA78M20C	µA78M20UC
24 V	µA78M24C	µA78M24UC

*Planar is a patented Fairchild process.

μA78M05

ELECTRICAL CHARACTERISTICS: V_{IN} = 10 V, I_{OUT} = 350 mA, −55°C ≤ T_J ≤ 150°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		4.8	5.0	5.2	V
Line Regulation		T_J = 25°C	7 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA		3.0	50	mV
			8 V ≤ V_{IN} ≤ 20 V, I_{OUT} = 200 mA		1.0	25	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		20	50	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	25	mV
Output Voltage		8 V ≤ V_{IN} ≤ 20 V, 5 mA ≤ I_{OUT} ≤ 350 mA		4.7		5.3	V
Quiescent Current		T_J = 25°C			4.5	6.0	mA
Quiescent Current Change	with line	8 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			8	40	μV/V_{OUT}
Ripple Rejection		f = 120 Hz, 8 V ≤ V_{IN} ≤ 18 V	I_{OUT} = 100 mA	62			dB
			I_{OUT} = 300 mA, T_J = 25°C	62	80		dB
Dropout Voltage		T_A = 25°C, I_{OUT} = 350 mA			2.0	2.5	V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			300	600	mA
Peak Output Current		T_J = 25°C		0.4	0.7	1.4	A
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA	−55°C ≤ T_J ≤ +25°C			0.4	mV/°C/
			+25°C ≤ T_J ≤ +150°C			0.3	V_{OUT}

μA78M05C

ELECTRICAL CHARACTERISTICS: V_{IN} = 10 V, I_{OUT} = 350 mA, 0°C ≤ T_J ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		4.8	5.0	5.2	V
Line Regulation		T_J = 25°C	7 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA		3.0	100	mV
			8 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA		1.0	50	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		20	100	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	50	mV
Output Voltage		7 V ≤ V_{IN} ≤ 20 V, 5 mA ≤ I_{OUT} ≤ 350 mA		4.75	5.0	5.25	V
Quiescent Current		T_J = 25°C			4.5	6.0	mA
Quiescent Current Change	with line	8 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			40		μV
Ripple Rejection		f = 120 Hz, 8 V ≤ V_{IN} ≤ 18 V	I_{OUT} = 100 mA	62			dB
			I_{OUT} = 300 mA, T_J = 25°C	62	80		dB
Dropout Voltage		T_A = 25°C			2.0		V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			300		mA
Peak Output Current		T_J = 25°C			700		mA
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA			−1.0		mV/°C

NOTE:
1. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (t_w ≤ 10 ms, duty cycle ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

μA78M06

ELECTRICAL CHARACTERISTICS: V_{IN} = 11 V, I_{OUT} = 350 mA, −55°C ≤ T_J ≤ 150°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		5.75	6.0	6.25	V
Line Regulation		T_J = 25°C	8 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA		5.0	60	mV
			9 V ≤ V_{IN} ≤ 20 V, I_{OUT} = 200 mA		1.5	30	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		20	60	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	30	mV
Output Voltage		9 V ≤ V_{IN} ≤ 21 V, 5 mA ≤ I_{OUT} ≤ 350 mA		5.7	5%	6.3	V
Quiescent Current		T_J = 25°C			4.5	6.0	mA
Quiescent Current Change	with line	9 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			8	40	μV/V_{OUT}
Ripple Rejection		f = 120 Hz, 9 V ≤ V_{IN} ≤ 19 V	I_{OUT} = 100 mA	59			dB
			I_{OUT} = 300 mA, T_J = 25°C	59	80		dB
Dropout Voltage		T_A = 25°C, I_{OUT} = 350 mA			2.0	2.5	V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			300	600	mA
Peak Output Current		T_J = 25°C		0.4	0.7	1.4	A
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA	−55°C ≤ T_J ≤ +25°C		0.4	.4	mV/°C/ V_{OUT}
			+25°C ≤ T_J ≤ 150°C		0.3	.3	

μA78M06C

ELECTRICAL CHARACTERISTICS: V_{IN} = 11 V, I_{OUT} = 350 mA, 0°C ≤ T_J ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		5.75	6.0	6.25	V
Line Regulation		T_J = 25°C	8 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA		5.0	100	mV
			9 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA		1.5	50	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		20	120	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	60	mV
Output Voltage		8 V ≤ V_{IN} ≤ 21 V, 5 mA ≤ I_{OUT} ≤ 350 mA		5.7	5%	6.3	V
Quiescent Current		T_J = 25°C			4.5	6.0	mA
Quiescent Current Change	with line	9 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			45		μV
Ripple Rejection		f = 120 Hz, 9 V ≤ V_{IN} ≤ 19 V	I_{OUT} = 100 mA	59			dB
			I_{OUT} = 300 mA, T_J = 25°C	59	80		dB
Dropout Voltage		T_A = 25°C			2.0		V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			270		mA
Peak Output Current		T_J = 25°C			700		mA
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA			−0.5		mV/°C

NOTE:

1. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (t_w ≤ 10 ms, duty cycle ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

μA78M08

ELECTRICAL CHARACTERISTICS: V_{IN} = 14 V, I_{OUT} = 350 mA, −55°C ≤ T_J ≤ 150°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		7.7	8.0	8.3	V
Line Regulation		T_J = 25°C	10.5 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA		6.0	60	mV
			11 V ≤ V_{IN} ≤ 20 V, I_{OUT} = 200 mA		2.0	30	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		25	80	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	40	mV
Output Voltage		11.5 V ≤ V_{IN} ≤ 23 V, 5 mA ≤ I_{OUT} ≤ 350 mA		7.6	5%	8.4	V
Quiescent Current		T_J = 25°C			4.6	6.0	mA
Quiescent Current Change	with line	11.5 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			8	40	μV/V_{OUT}
Ripple Rejection		f = 120 Hz, 11.5 V ≤ V_{IN} ≤ 21.5 V	I_{OUT} = 100 mA	56			dB
			I_{OUT} = 300 mA, T_J = 25°C	56	80		dB
Dropout Voltage		T_A = 25°C, I_{OUT} = 350 mA			2.0	2.5	V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			300	600	mA
Peak Output Current		T_J = 25°C		0.4	0.7	1.4	A
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA	−55°C ≤ T_J ≤ +25°C			0.4	mV/°C
			+25°C ≤ T_J ≤ 150°C			0.3	

μA78M08C

ELECTRICAL CHARACTERISTICS: V_{IN} = 14 V, I_{OUT} = 350 mA, 0°C ≤ T_J ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		7.7	8.0	8.3	V
Line Regulation		T_J = 25°C	10.5 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA		6.0	100	mV
			11 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA		2.0	50	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		25	160	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	80	mV
Output Voltage		10.5 V ≤ V_{IN} ≤ 23 V, 5 mA ≤ I_{OUT} ≤ 350 mA		7.6	5%	8.4	V
Quiescent Current		T_J = 25°C			4.6	6.0	mA
Quiescent Current Change	with line	10.5 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			52		μV
Ripple Rejection		f = 120 Hz, 11.5 V ≤ V_{IN} ≤ 21.5 V	I_{OUT} = 100 mA	56			dB
			I_{OUT} = 300 mA, T_J = 25°C	56	80		dB
Dropout Voltage		T_A = 25°C			2.0		V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			250		mA
Peak Output Current		T_J = 25°C			700		mA
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA			−0.5		mV/°C

NOTE:
1. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (t_w ≤ 10 ms, duty cycle ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

μA78M12

ELECTRICAL CHARACTERISTICS: V_{IN} = 19 V, I_{OUT} = 350 mA, −55°C ≤ T_J ≤ 150°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		11.5	12	12.5	V
Line Regulation		T_J = 25°C	14.5 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA		8.0	60	mV
			16 V ≤ V_{IN} ≤ 25 V, I_{OUT} = 200 mA		2.0	30	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		25	120	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	60	mV
Output Voltage		15.5 V ≤ V_{IN} ≤ 27 V, 5 mA ≤ I_{OUT} ≤ 350 mA		11.4		12.6	V
Quiescent Current		T_J = 25°C			4.8	6.0	mA
Quiescent Current Change	with line	15 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			8	40	μV/V_{OUT}
Ripple Rejection		f = 120 Hz, 15 V ≤ V_{IN} ≤ 25 V	I_{OUT} = 100 mA	55			dB
			I_{OUT} = 300 mA, T_J = 25°C	55	80		dB
Dropout Voltage		T_A = 25°C, I_{OUT} = 350 mA			2.0	2.5	V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			300	600	mA
Peak Output Current		T_J = 25°C		0.4	0.7	1.4	A
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA	−55°C ≤ T_J ≤ +25°C			0.4	mV/°C/
			+25°C ≤ T_J ≤ +150°C			0.3	V_{OUT}

μA78M12C

ELECTRICAL CHARACTERISTICS: V_{IN} = 19 V, I_{OUT} = 350 mA, 0°C ≤ T_J ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		11.5	12	12.5	V
Line Regulation		T_J = 25°C	14.5 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA		8.0	100	mV
			16 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA		2.0	50	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		25	240	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	120	mV
Output Voltage		14.5 V ≤ V_{IN} ≤ 27 V, 5 mA ≤ I_{OUT} ≤ 350 mA		11.4		12.6	V
Quiescent Current		T_J = 25°C			4.8	6.0	mA
Quiescent Current Change	with line	14.5 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			75		μV
Ripple Rejection		f = 120 Hz, 15 V ≤ V_{IN} ≤ 25 V	I_{OUT} = 100 mA	55			dB
			I_{OUT} = 300 mA, T_J = 25°C	55	80		dB
Dropout Voltage		T_A = 25°C			2.0		V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			240		mA
Peak Output Current		T_J = 25°C			700		mA
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA			−1.0		mV/°C

NOTE:
1. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (t_w ≤ 10 ms, duty cycle ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

μA78M15

ELECTRICAL CHARACTERISTICS: V_{IN} = 23 V, I_{OUT} = 350 mA, −55°C ≤ T_J ≤ 150°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		14.4	15	15.6	V
Line Regulation		T_J = 25°C	17.5 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA		10	60	mV
			20 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA		3.0	30	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		25	150	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	75	mV
Output Voltage		18.5 V ≤ V_{IN} ≤ 30 V, 5 mA ≤ I_{OUT} ≤ 350 mA		14.25	5%	15.75	V
Quiescent Current		T_J = 25°C			4.8	6.0	mA
Quiescent Current Change	with line	18.5 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			8	40	μV/V_{OUT}
Ripple Rejection		f = 120 Hz, 18.5 V ≤ V_{IN} ≤ 28.5 V	I_{OUT} = 100 mA	54			dB
			I_{OUT} = 300 mA, T_J = 25°C	54	70		dB
Dropout Voltage		T_A = 25°C			2.0	2.5	V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			300	600	mA
Peak Output Current		T_J = 25°C		0.4	0.7	1.4	A
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA	−55°C ≤ T_J ≤ +25°C			0.4	mV/°C/ V_{OUT}
			+25°C ≤ T_J ≤ +150°C			0.3	

μA78M15C

ELECTRICAL CHARACTERISTICS: V_{IN} = 23 V, I_{OUT} = 350 mA, 0°C ≤ T_J ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		14.4	15	15.6	V
Line Regulation		T_J = 25°C	17.5 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA		10	100	mV
			20 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA		3.0	50	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		25	300	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	150	mV
Output Voltage		17.5 V ≤ V_{IN} ≤ 30 V, 5 mA ≤ I_{OUT} ≤ 350 mA		14.25	5%	15.75	V
Quiescent Current		T_J = 25°C			4.8	6.0	mA
Quiescent Current Change	with line	17.5 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			90		μV
Ripple Rejection		f = 120 Hz, 18.5 V ≤ V_{IN} ≤ 28.5 V	I_{OUT} = 100 mA	54			dB
			I_{OUT} = 300 mA, T_J = 25°C	54	70		dB
Dropout Voltage		T_A = 25°C			2.0		V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			240		mA
Peak Output Current		T_J = 25°C			700		mA
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA			−1.0		mV/°C

NOTE:
1. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (t_w ≤ 10 ms, duty cycle ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

μA78M20

ELECTRICAL CHARACTERISTICS: V_{IN} = 29 V, I_{OUT} = 350 mA, −55°C ≤ T_J ≤ 150°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		19.2	20	20.8	V
Line Regulation		T_J = 25°C	23 V ≤ V_{IN} ≤ 35 V, I_{OUT} = 200 mA		10	60	mV
			24 V ≤ V_{IN} ≤ 35 V, I_{OUT} = 200 mA		5.0	30	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		30	200	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	100	mV
Output Voltage		24 V ≤ V_{IN} ≤ 35 V, 5 mA ≤ I_{OUT} ≤ 350 mA		19		21	V
Quiescent Current		T_J = 25°C			4.9	6.0	mA
Quiescent Current Change	with line	24 V ≤ V_{IN} ≤ 35 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			8	40	μV/V_{OUT}
Ripple Rejection		f = 120 Hz, 24 V ≤ V_{IN} ≤ 34 V	I_{OUT} = 100 mA	53			dB
			I_{OUT} = 300 mA, T_J = 25°C	53	70		dB
Dropout Voltage		T_A = 25°C, I_{OUT} = 350 mA			2.0	2.5	V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			300	600	mA
Peak Output Current		T_J = 25°C		0.4	0.7	1.4	A
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA	−55°C ≤ T_J ≤ +25°C			0.4	mV/°C/V_{OUT}
			+25°C ≤ T_J ≤ 150°C			0.3	

μA78M20C

ELECTRICAL CHARACTERISTICS: V_{IN} = 29 V, I_{OUT} = 350 mA, 0°C ≤ T_J ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		19.2	20	20.8	V
Line Regulation		T_J = 25°C	23 V ≤ V_{IN} ≤ 35 V, I_{OUT} = 200 mA		10	100	mV
			24 V ≤ V_{IN} ≤ 35 V, I_{OUT} = 200 mA		5.0	50	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		30	400	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	200	mV
Output Voltage		23 V ≤ V_{IN} ≤ 35 V, 5 mA ≤ I_{OUT} ≤ 350 mA		19		21	V
Quiescent Current		T_J = 25°C			4.9	6.0	mA
Quiescent Current Change	with line	23 V ≤ V_{IN} ≤ 35 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			110		μV
Ripple Rejection		f = 120 Hz, 24 V ≤ V_{IN} ≤ 34 V	I_{OUT} = 100 mA	53			dB
			I_{OUT} = 300 mA, T_J = 25°C	53	70		dB
Dropout Voltage		T_A = 25°C			2.0		V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			240		mA
Peak Output Current		T_J = 25°C			700		mA
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA			−1.1		mV/°C

NOTE:
1. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (t_w ≤ 10 ms, duty cycle ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

μA78M24

ELECTRICAL CHARACTERISTICS: V_{IN} = 33 V, I_{OUT} = 350 mA, −55°C ≤ T_J ≤ 150°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		23	24	25	V
Line Regulation		T_J = 25°C	27 V ≤ V_{IN} ≤ 38 V, I_{OUT} = 200 mA		10	60	mV
			30 V ≤ V_{IN} ≤ 36 V, I_{OUT} = 200 mA		5.0	30	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		30	240	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	120	mV
Output Voltage		28 V ≤ V_{IN} ≤ 38 V, 5 mA ≤ I_{OUT} ≤ 350 mA		22.8		25.2	V
Quiescent Current		T_J = 25°C			5.0	6.0	mA
Quiescent Current Change	with line	28 V ≤ V_{IN} ≤ 38 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			8	40	μV/V_{OUT}
Ripple Rejection		f = 120 Hz, 28 V ≤ V_{IN} ≤ 38 V	I_{OUT} = 100 mA	50			dB
			I_{OUT} = 300 mA, T_J = 25°C	50	70		dB
Dropout Voltage		T_A = 25°C, I_{OUT} = 350 mA			2.0	2.5	V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			300	600	mA
Peak Output Current		T_J = 25°C		0.4	0.7	1.4	mA
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA	−55°C ≤ T_J ≤ +25°C			0.4	mV/°C/
			+25°C ≤ T_J ≤ 150°C			0.3	V_{OUT}

μA78M24C

ELECTRICAL CHARACTERISTICS: V_{IN} = 33 V, I_{OUT} = 350 mA, 0°C ≤ T_J ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise specified.

CHARACTERISTICS		CONDITIONS (Note 1)		MIN	TYP	MAX	UNITS
Output Voltage		T_J = 25°C		23	24	25	V
Line Regulation		T_J = 25°C	27 V ≤ V_{IN} ≤ 38 V, I_{OUT} = 200 mA		10	100	mV
			28 V ≤ V_{IN} ≤ 38 V, I_{OUT} = 200 mA		5.0	50	mV
Load Regulation		T_J = 25°C	5 mA ≤ I_{OUT} ≤ 500 mA		30	480	mV
			5 mA ≤ I_{OUT} ≤ 200 mA		10	240	mV
Output Voltage		27 V ≤ V_{IN} ≤ 38 V, 5 mA ≤ I_{OUT} ≤ 350 mA		22.8		25.2	V
Quiescent Current		T_J = 25°C			5.0	6.0	mA
Quiescent Current Change	with line	27 V ≤ V_{IN} ≤ 38 V, I_{OUT} = 200 mA				0.8	mA
	with load	5 mA ≤ I_{OUT} ≤ 350 mA				0.5	mA
Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			170		μV
Ripple Rejection		f = 120 Hz, 28 V ≤ V_{IN} ≤ 38 V	I_{OUT} = 100 mA	50			dB
			I_{OUT} = 300 mA, T_J = 25°C	50	70		dB
Dropout Voltage		T_A = 25°C			2.0		V
Short Circuit Current		T_J = 25°C, V_{IN} = 35 V			240		mA
Peak Output Current		T_J = 25°C			700		mA
Average Temperature Coefficient of Output Voltage		I_{OUT} = 5 mA			−1.2		mV/°C

NOTE:
1. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (t_w ≤ 10 ms, duty cycle ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

DESIGN CONSIDERATIONS

The μA78M00 fixed voltage regulator series has thermal overload protection from excessive power, internal short circuit protection which limits the circuit's maximum current, and output transistor safe area compensation for reducing the output short circuit current as the voltage across the pass transistor is increased.

Although the internal power dissipation is limited, the junction temperature must be kept below the maximum specified temperature (150°C for 78M00, 125°C for 78M00C) in order to meet data sheet specifications. To calculate the maximum junction temperature or heat sink required, the following thermal resistance values should be used:

Package	TYP θ_{JC}	MAX θ_{JC}	TYP θ_{JA}	MAX θ_{JA}
TO-39	18	25	120	185
TO-220	3	5	62	70

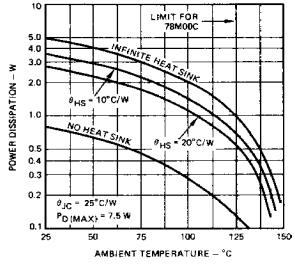
$$P_{D\,(MAX)} = \frac{T_{J\,(MAX)} - T_A}{\theta_{JC} + \theta_{CA}} \text{ or } \frac{T_{J\,(MAX)} - T_A}{\theta_{JA}} \text{ (Without a heat sink)}$$

$$\theta_{CA} = \theta_{CS} + \theta_{SA}$$

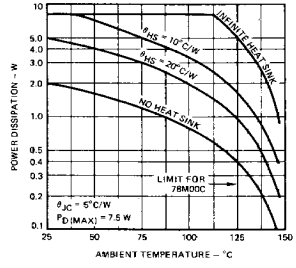
Solving for T_J: $T_J = T_A + P_D(\theta_{JC}+\theta_{CA})$ or $T_A + P_D\,\theta_{JA}$ (Without a heat sink)

Where T_J = Junction Temperature
T_A = Ambient Temperature
P_D = Power Dissipation
θ_{JC} = Junction to case thermal resistance
θ_{CA} = Case to Ambient thermal resistance
θ_{CS} = Case to heat sink to resistance
θ_{SA} = Heat sink to ambient thermal resistance
θ_{JA} = Junction to Ambient thermal resistance

WORST CASE POWER DISSIPATION VERSUS AMBIENT TEMPERATURE TO-39

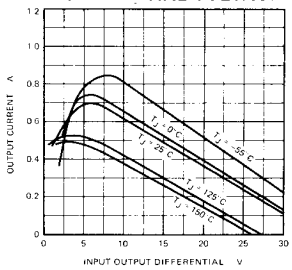


WORST CASE POWER DISSIPATION VERSUS AMBIENT TEMPERATURE TO-220

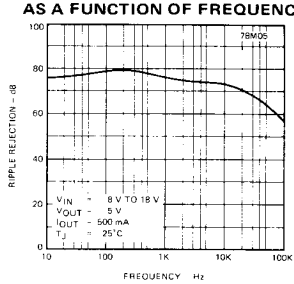


ELECTRICAL PERFORMANCE CURVES

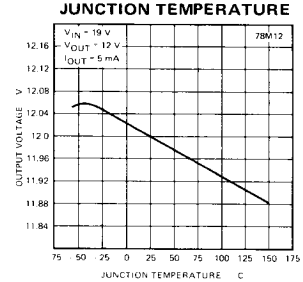
PEAK OUTPUT CURRENT AS A FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE



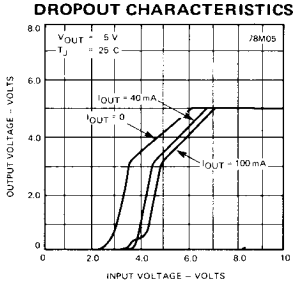
RIPPLE REJECTION AS A FUNCTION OF FREQUENCY



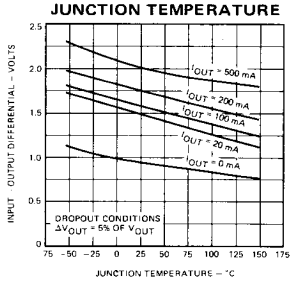
OUTPUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE



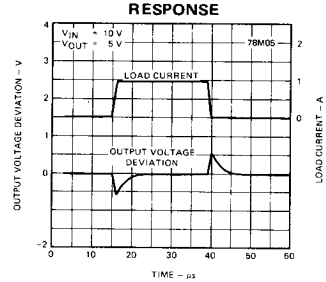
DROPOUT CHARACTERISTICS



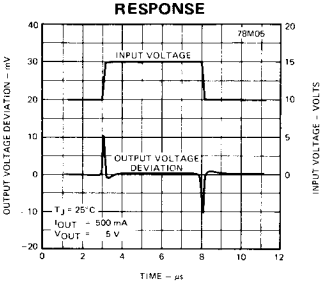
DROPOUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE



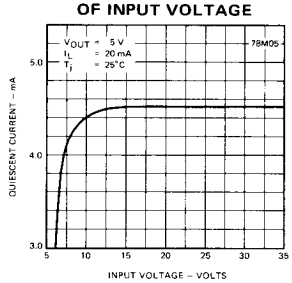
LOAD TRANSIENT RESPONSE



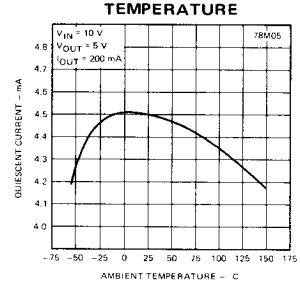
LINE TRANSIENT RESPONSE



QUIESCENT CURRENT AS A FUNCTION OF INPUT VOLTAGE

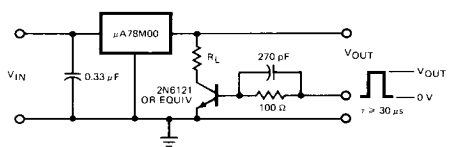


QUIESCENT CURRENT AS A FUNCTION OF TEMPERATURE

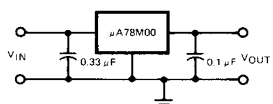


NOTE: Other μA78M00 Series devices have similar curves.

TEST CIRCUITS

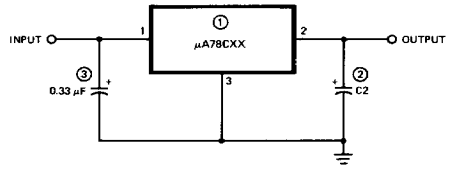


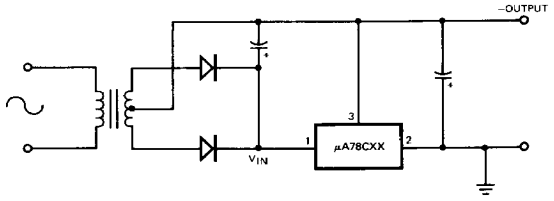
LOAD REGULATION TEST CIRCUIT



DC PARAMETER TEST CIRCUIT

APPLICATIONS

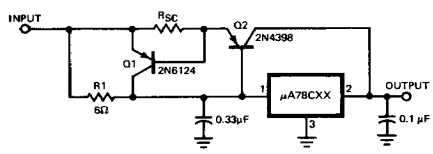


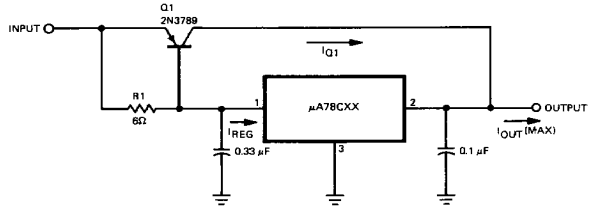


NOTES:
① To specify an output voltage, substitute voltage value for "XX".
② Although no output capacitor is needed for stability, it does improve transient response.
③ Required if regulator is located an appreciable distance from power supply filter.

FIXED OUTPUT REGULATOR

NEGATIVE OUTPUT VOLTAGE CIRCUIT





$$R1 = \frac{\beta V_{BE(Q1)}}{I_{REQ(MAX)}\,(\beta + 1) - I_{OUT(MAX)}}$$

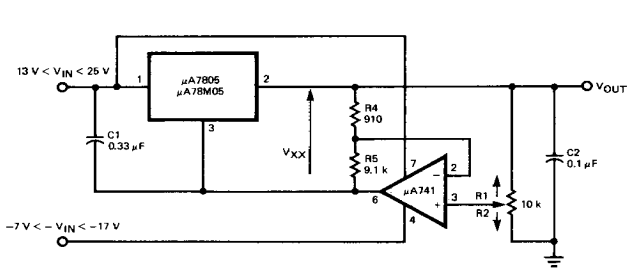
$$R_{SC} = \frac{V_{BE(Q1)}}{I_{OUT}}$$

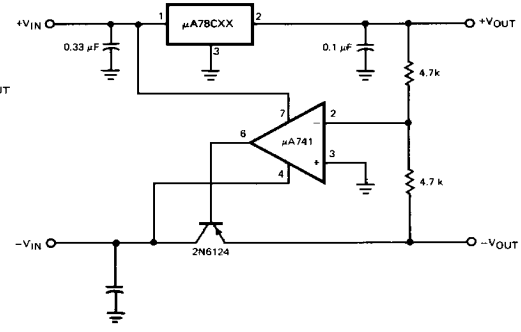
HIGH OUTPUT CURRENT, SHORT CIRCUIT PROTECTED

$$R1 = \frac{V_{BE(Q1)}}{I_{REG}} = \frac{\beta V_{BE(Q1)}}{I_{REQ(MAX)}\,(\beta + 1) - I_{OUT(MAX)}}$$

$$\beta_{Q1} \geq \frac{I_{OUT}}{I_{REG}}$$

HIGH CURRENT VOLTAGE REGULATOR

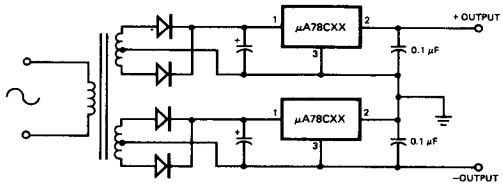




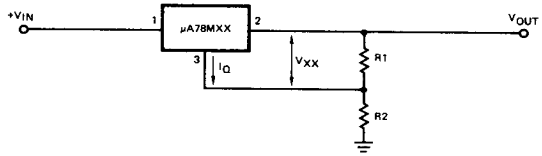
VARIABLE OUTPUT VOLTAGE, 0.5 TO 10 V

± TRACKING VOLTAGE REGULATOR

APPLICATIONS (Cont'd)

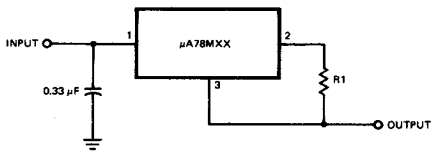


POSITIVE AND NEGATIVE REGULATOR



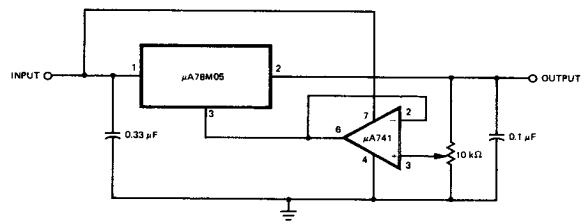
$$V_{OUT} = V_{XX}\left(1 + \frac{R2}{R1}\right) + I_Q R2$$

CIRCUIT FOR INCREASING OUTPUT VOLTAGE



$$\text{Output Current} = \frac{V_{OUT}}{R1}$$

CURRENT REGULATOR



ADJUSTABLE OUTPUT REGULATOR, 7 V TO 30 V

7