www.DataSheet4U.com

μA104 • μA304

NEGATIVE VOLTAGE REGULATORS

FAIRCHILD LINEAR INTEGRATED CIRCUITS

GENERAL DESCRIPTION — The 104 family of Precision Negative Voltage Regulators is constructed using the Fairchild Planar* epitaxial process. This device can be programmed by a single external resistor to supply any voltage from 0 V to 30 V from a single unregulated supply. When used with a separate floating bias supply, the 104/304 can provide 0.01% regulation with the output voltage limited only by the breakdown of external pass transistors. The 104 and 304 provide complementary operation with the 105 positive regulator family. Although primarily designed as a linear series regulator, the 104 family can be used as a current regulator, switching regulator, or in control applications. Without external pass elements, the device can supply currents up to 25 mA; with external pass transistors, the output current is limited only by the capacity of the pass transistors. External resistors establish the output voltage and either constant or fold-back current limiting.

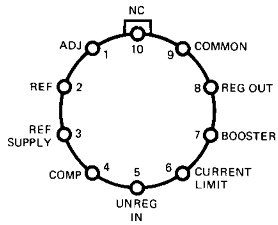
- **1 mV REGULATION WITH FULL LOAD**
- **0.01%/V LINE REGULATION**
- **0.2 mV/V RIPPLE REJECTION**
- **0.3% TEMPERATURE STABILITY OVER FULL TEMPERATURE RANGE**

ABSOLUTE MAXIMUM RATINGS

Input Voltage	
μA104	50 V
μA304	40 V
Input/Output Voltage Differential	
μA104	50 V
μA304	40 V
Power Dissipation (Note 1)	500 mW
Operating Temperature Range	
Military grade (μA104)	−55°C to +125°C
Commercial grade (μA304)	0°C to +70°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 s)	300°C

DataSheet4U.com

CONNECTION DIAGRAM
10-LEAD METAL CAN
(TOP VIEW)



Note: Pin 5 connected to case.

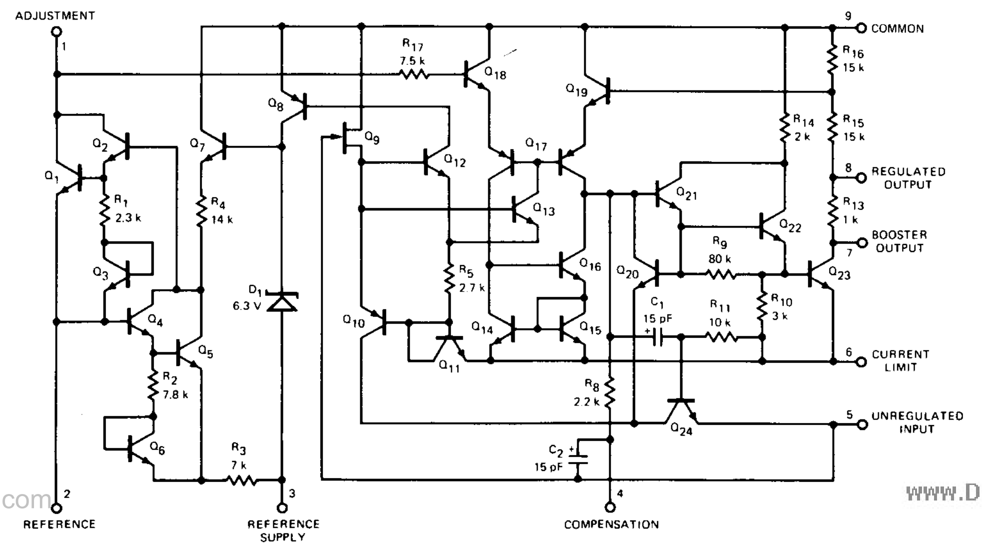
ORDER INFORMATION

TYPE	PART NO.
μA104	μA104HM
μA304	μA304HC

DataSheet4U.com

7

EQUIVALENT CIRCUIT



DataSheet4U.com
www.DataSheet4U.com

Notes on following pages.

*Planar is a patented Fairchild process.

DataSheet4U.com

www.DataSheet4U.com

μA104

ELECTRICAL CHARACTERISTICS: V_{IN} = −40 V to −8.0 V, T_A = 0°C to 70°C, unless otherwise specified, Note 2

CHARACTERISTICS	CONDITIONS		MIN	TYP	MAX	UNITS
Input Voltage Range			−50		−8.0	V
Output Voltage Range			−40		−0.015	V
Output/Input Voltage Differential (Note 3)	I_L = 20 mA		2.0		50	V
	I_L = 5 mA		0.5		50	V
Load Regulation (Note 4)	0 ≤ I_L ≤ 20 mA, R_{SC} = 15 Ω			1.0	5.0	mV
Line Regulation (Note 5)	V_O ≤ −5 V, ΔV_{IN} = 0.1 V_{IN}			0.056	0.1	%
Ripple Rejection	C2 = 10 μF,	V_{IN} ≥ −15 V		0.2	0.5	mV/V
	f = 120 Hz,	−7 V ≥ V_{IN} ≥ −15 V		0.5	1.0	mV/V
Output Voltage Scale Factor V_O/R2	R1 = 2.4 kΩ		1.8	2.0	2.2	V/kΩ
Temperature Stability	V_O ≤ −1 V, −55°C ≤ T_A ≤ 125°C			0.3	1.0	%
Output Noise Voltage	10 Hz ≤ f ≤ 10 kHz,	C2 = 0		0.007		%
	V_O ≤ −5 V,	C2 = 10 μF		15		μV
Standby Current Drain	I_L = 5 mA	V_O = 0		1.7	2.5	mA
		V_O = −40 V		3.6	5.0	mA
Long Term Stability	V_O ≤ −1 V			0.1	1.0	%

μA304

ELECTRICAL CHARACTERISTICS: V_{IN} = −50 V to −8.0 V, T_A = −55°C to 125°C, unless otherwise specified, Note 2

CHARACTERISTICS	CONDITIONS		MIN	TYP	MAX	UNITS
Input Voltage Range			−40		−8.0	V
Output Voltage Range			−30		−0.035	V
Output/Input Voltage Differential (Note 3)	I_L = 20 mA		2.0		40	V
	I_L = 5 mA		0.5		40	V
Load Regulation (Note 4)	0 ≤ I_L ≤ 20 mA, R_{SC} = 15 Ω			1.0	5.0	mV
Line Regulation (Note 5)	V_O ≤ −5 V, ΔV_{IN} = 0.1 V_{IN}			0.056	0.1	%
Ripple Rejection	C2 = 10 μF,	V_{IN} < −15 V		0.2	0.5	mV/V
	f = 120 Hz,	−7 V ≥ V_{IN} ≥ −15 V		0.5	1.0	mV/V
Output Voltage Scale Factor V_O/R2	R1 = 2.4 kΩ		1.8	2.0	2.2	V/kΩ
Temperature Stability	V_O ≤ −1 V, 0°C ≤ T_A ≤ 70°C			0.3	1.0	%
Output Noise Voltage	10 Hz ≤ f ≤ 10 kHz,	C2 = 0		0.007		%
	V_O ≤ −5 V,	C2 = 10 μF		15		μV
Standby Current Drain	I_L = 5 mA	V_O = 0		1.7	2.5	mA
		V_O = −30 V		3.6	5.0	mA
Long Term Stability	V_O ≤ −1 V			0.1	1.0	%

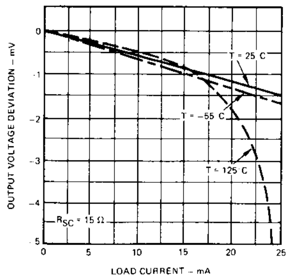
NOTES:
1. Rating applies to ambient temperatures up to 70°C. Above 70°C ambient derate linearly at 6.3 mW/°C.
2. The load and line regulation specifications are for constant junction temperature. Temperature drift effects must be taken into account separately when the unit is operating under conditions of high dissipation. See Basic Regulator Circuit.
3. When external booster transistors are used, the minimum output-input voltage differential is increased, in the worst case, by approximately 1 V.
4. The output currents given, as well as the load regulation, can be increased by the addition of external transistors. The improvement factor will be roughly equal to the composite current gain of the added transistors.
5. With zero output, the dc line regulation is determined from the ripple rejection. Hence, with output voltages between 0 V and −5 V, a dc output variation, determined from the ripple rejection, must be added to find the worst-case line regulation.

DataSheet4U.com

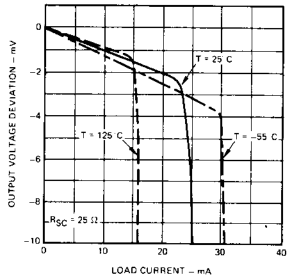
www.DataSheet4U.com

TYPICAL PERFORMANCE CURVES FOR μA104

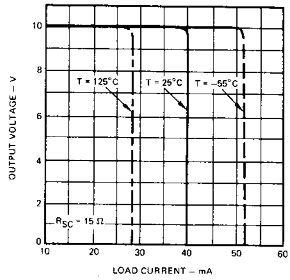
LOAD REGULATION



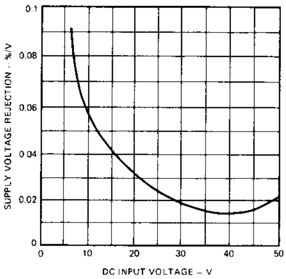
LOAD REGULATION



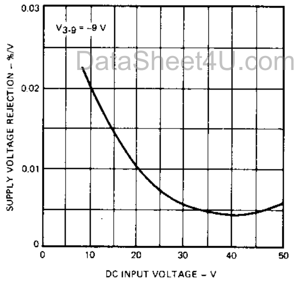
CURRENT LIMITING



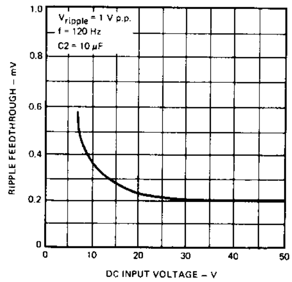
SUPPLY VOLTAGE REJECTION AS A FUNCTION OF DC INPUT VOLTAGE



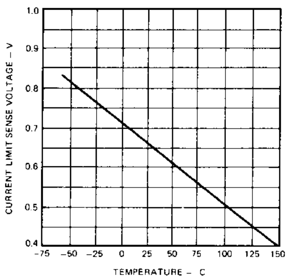
SUPPLY VOLTAGE REJECTION WITH PREREGULATED REFERENCE SUPPLY



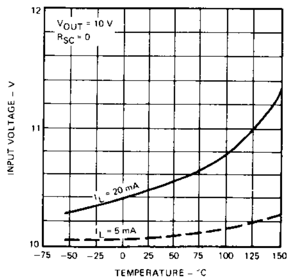
RIPPLE REJECTION



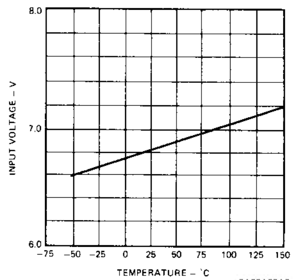
CURRENT LIMIT SENSE VOLTAGE AS A FUNCTION OF TEMPERATURE



REGULATOR DROPOUT VOLTAGE



MINIMUM INPUT VOLTAGE AS A FUNCTION OF TEMPERATURE



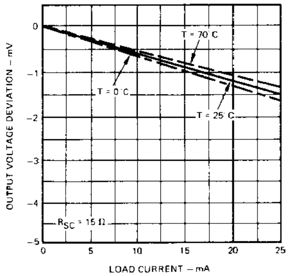
7

www.DataSheet4U.com

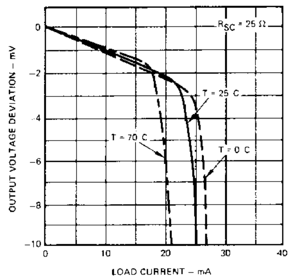
www.DataSheet4U.com

TYPICAL PERFORMANCE CURVES FOR μA304

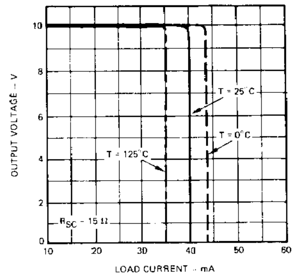
LOAD REGULATION



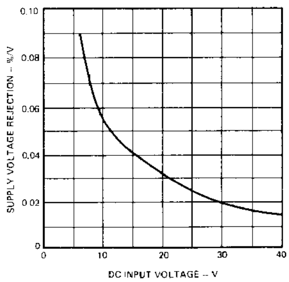
LOAD REGULATION



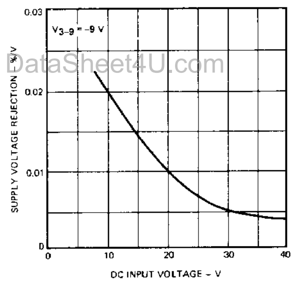
CURRENT LIMITING



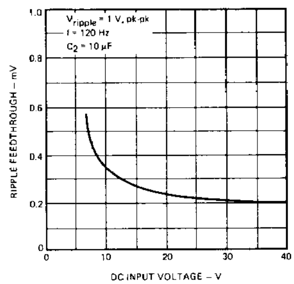
SUPPLY VOLTAGE REJECTION AS A FUNCTION OF DC INPUT VOLTAGE



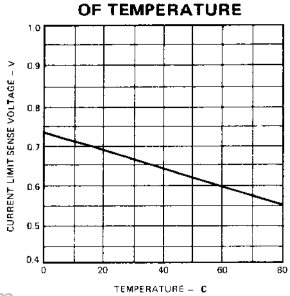
SUPPLY VOLTAGE REJECTION WITH PREREGULATED REFERENCE SUPPLY



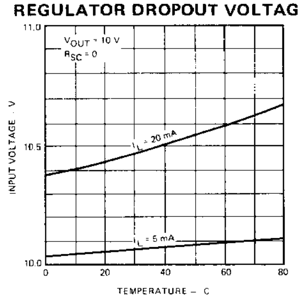
RIPPLE REJECTION



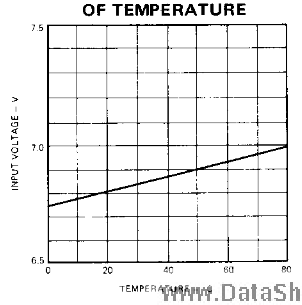
CURRENT LIMIT SENSE VOLTAGE AS A FUNCTION OF TEMPERATURE



REGULATOR DROPOUT VOLTAGE



MINIMUM INPUT VOLTAGE AS A FUNCTION OF TEMPERATURE



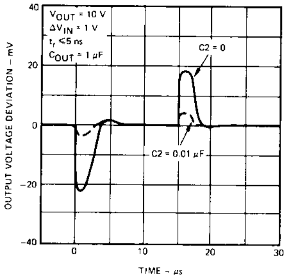
www.DataSheet4U.com

DataSheet4U.com

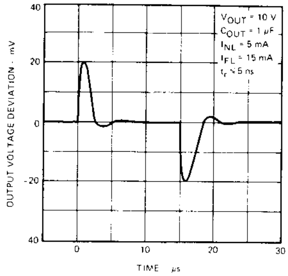
www.DataSheet4U.com

TYPICAL PERFORMANCE CURVES FOR μA104 AND μA304

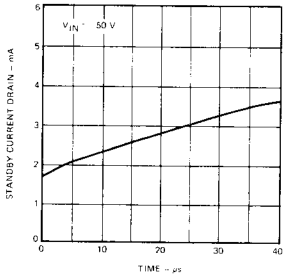
LINE TRANSIENT RESPONSE



LOAD TRANSIENT RESPONSE

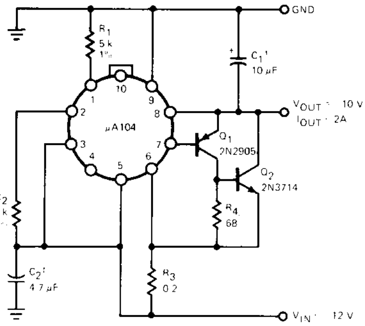


STANDBY CURRENT DRAIN AS A FUNCTION OF TIME



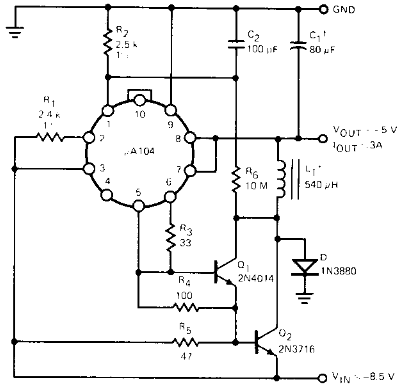
TYPICAL APPLICATIONS

HIGH CURRENT REGULATOR



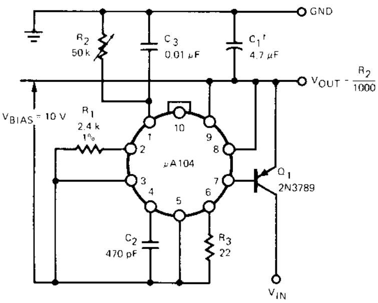
†Solid Tantalum

SWITCHING REGULATOR



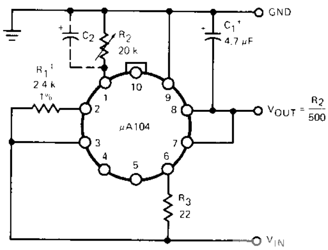
†Solid Tantalum
*60 Turns #20 on Arnold Engineering A930157-2 Molybdenum Permalloy Core.

OPERATING WITH SEPARATE BIAS SUPPLY



†Solid Tantalum

BASIC REGULATOR CIRCUIT



†Solid Tantalum
‡Trim R_1 for exact scale factor

NOTE:
A 0.01 μF capacitor may be required across the input if long leads are used from the unregulated power source. Line transient response, noise and ripple rejection can be improved by shunting R2 with a 10 μF capacitor C2.

DataSheet4U.com