Rochester Electronics

Datasheet

PART NUMBER

LM104HB-ROCV

Rochester Electronics Manufactured Components

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All re-creations are done with the approval of the Original Component Manufacturer. (OCM)

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceeds the OCM data sheet.

Quality Overview

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-38535
    - Class Q Military
    - Class V Space Level

Qualified Suppliers List of Distributors (QSLD)

- Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OCM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

Rochester Electronics

Datasheet

PART NUMBER

LM104H883-ROCS

Rochester Electronics Manufactured Components

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All re-creations are done with the approval of the Original Component Manufacturer. (OCM)

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceeds the OCM data sheet.

Quality Overview

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-38535
    - Class Q Military
    - Class V Space Level

Qualified Suppliers List of Distributors (QSLD)

- Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OCM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

National Semiconductor is now part of

Texas Instruments.

Search http://www.ti.com/ for the latest technical

information and details on our current products and services.

National Semiconductor

LM104/LM204/LM304 Negative Regulator

General Description

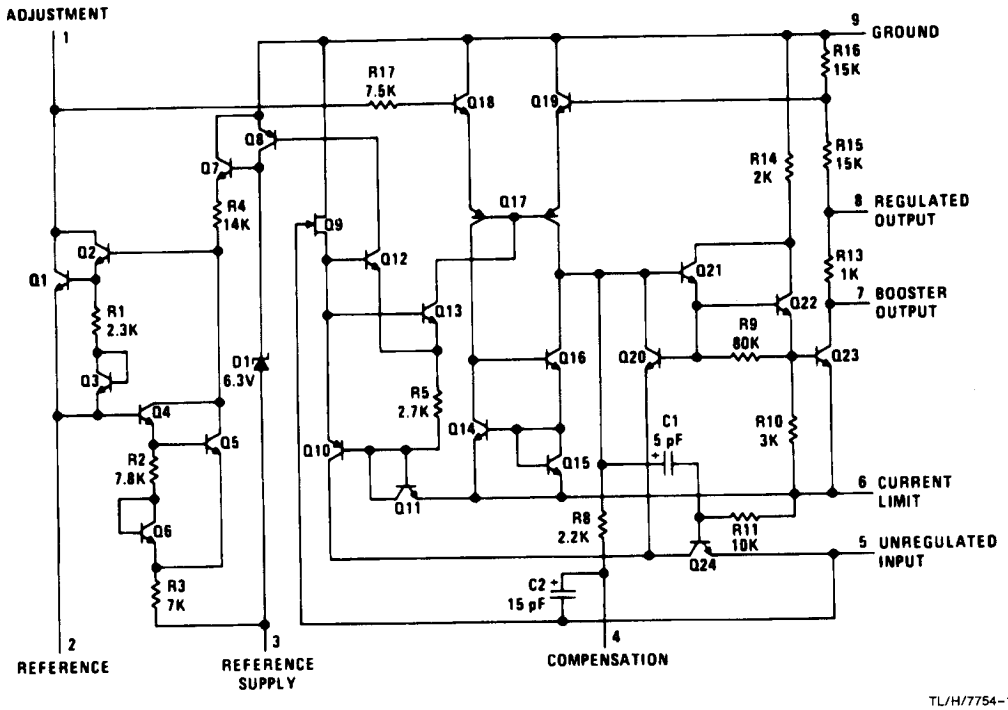
The LM104 series are precision voltage regulators which can be programmed by a single external resistor to supply any voltage from 40V down to zero while operating from a single unregulated supply. They can also provide 0.01-percent regulation in circuits using a separate, floating bias supply, where the output voltage is limited only by the breakdown of external pass transistors. Although designed primarily as linear, series regulators, the circuits can be used as switching regulators, current regulators or in a number of other control applications. Typical performance characteristics are:

- Subsurface zener reference
- 1 mV regulation no load to full load
- 0.01%/V line regulation
- 0.2 mV/V ripple rejection
- 0.3% temperature stability over military temperature range

The LM104 series is the complement of the LM105 positive regulator, intended for systems requiring regulated negative voltages which have a common ground with the unregulated supply. By themselves, they can deliver output currents to 25 mA, but external transistors can be added to get any desired current. The output voltage is set by external resistors, and either constant or foldback current limiting is made available.

The LM104 is specified for operation over the −55°C to +125°C military temperature range. The LM204 is specified for operation over the −25°C to +85°C temperature range. The LM304 is specified for operation from 0°C to +70°C.

Schematic Diagram



TL/H/7754–1

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

(Note 6)

	LM104/LM204	LM304
Input Voltage	50V	40V
Input-Output Voltage Differential	50V	40V
Power Dissipation (Note 1)	500 mW	500 mW
Operating Temperature Range		
LM104	−55°C to +125°C	
LM204	−25°C to +85°C	
LM304		0°C to +70°C
Storage Temperature Range	−65°C to +150°C	−65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	260°C for plastic	300°C for hermetic

Electrical Characteristics

Parameter	Conditions	LM104/LM204			LM304			Units
		Min	Typ	Max	Min	Typ	Max	
Input Voltage Range		−50		−8	−40		−8	V
Output Voltage Range		−40		−0.015	−30		−0.035	V
Output-Input Voltage Differential (Note 3)	I_O = 20 mA I_O = 5 mA	2.0 0.5		50 50	2.0 0.5		40 40	V V
Load Regulation (Note 4)	$O \le I_O \le 20$ mA $R_{SC} = 15\Omega$		1	5		1	5	mV
Line Regulation (Note 5)	$V_{OUT} \le -5V$ $\Delta V_{IN} = 0.1\ V_{IN}$		0.056	0.1		0.056	0.1	%
Ripple Rejection	$C_{19} = 10\ \mu F$, f = 120 Hz $V_{IN} < -15V$ $-7V \ge V_{IN} \ge -15V$		0.2 0.5	0,.5 1.0		0.2 0.5	0.5 1.0	mV/V mV/V
Output Voltage Scale Factor	R_{2-3} = 2.4k	1.8	2.0	2.2	1.8	2.0	2.2	V/kΩ
Temperature Stability	$V_O \le -1V$		0.3	1.0		0.3	1.0	%
Output Noise Voltage	10 Hz ≤ f ≤ 10 kHz $V_O \le -5V$, $C_{1-9} = 0$ $C_{1-9} = 10\ \mu F$		0.007 15			0.007 15		% μV
Standby Current Drain	I_L = 5 mA, V_O = 0 $V_O = -30V$ $V_O = -40V$		1.7 3.6	2.5 5.0		1.7 3.6	2.5 5.0	mA mA mA
Long Term Stability	$V_O \le -1V$		0.01	1.0		0.01	1.0	%

Note 1: The maximum junction temperature of the LM104 is 150°C, while that of the LM204 is 125°C and LM304 is 100°C. For operating at elevated temperatures, devices in the H10C package must be derated based on a thermal resistance of 150°C/W, junction to ambient, or 45°C/W, junction to case.

Note 2: These specifications apply for junction temperatures between −55°C and 150°C (between −25°C and 100°C for the LM204 and 0°C to +85°C for the LM304) and for input and output voltages within the ranges given, unless otherwise specified. 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.

Note 3: When external booster transistors are used, the minimum output-input voltage differential is increased, in the worst case, by approximately 1V.

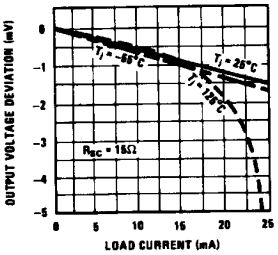
Note 4: The output currents given, as well as the load regulation, can be increased by the addition of external transistors. The improvement factor will be roughly equal to the composite current gain of the added transistors.

Note 5: With zero output, the dc line regulation is determined from the ripple rejection. Hence, with output voltages between 0V and − 5V, a dc output variation, determined from the ripple rejection, must be added to find the worst-case line regulation.

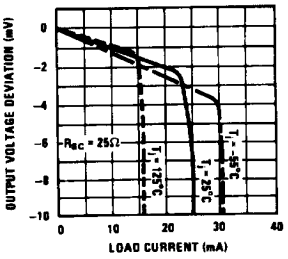
Note 6: Refer to RETS104X drawing for military specifications for the LM104.

Typical Performance Characteristics

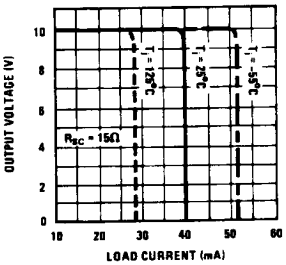
Load Regulation



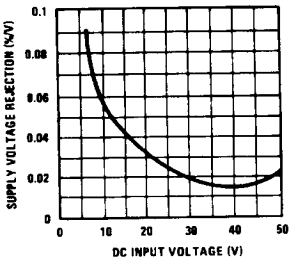
Load Regulation



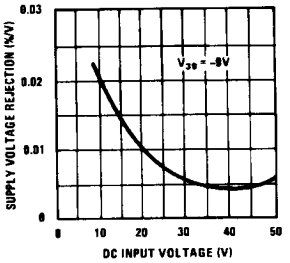
Current Limiting



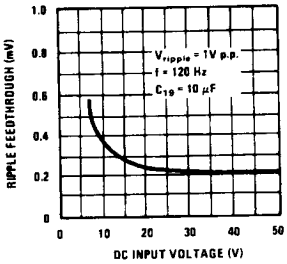
Supply Voltage Rejection



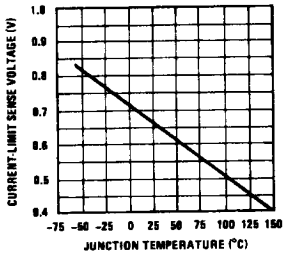
Supply Voltage Rejection With Preregulated Reference Supply



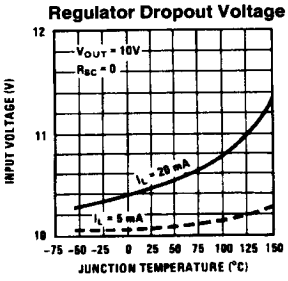
Ripple Rejection



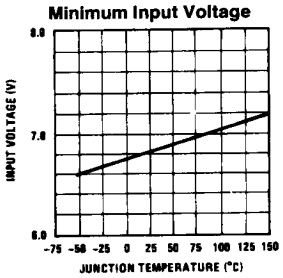
Current Limit Sense Voltage



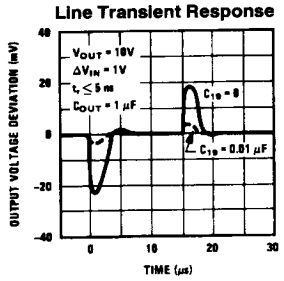
Regulator Dropout Voltage



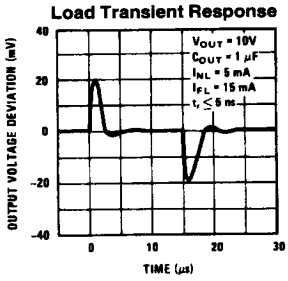
Minimum Input Voltage



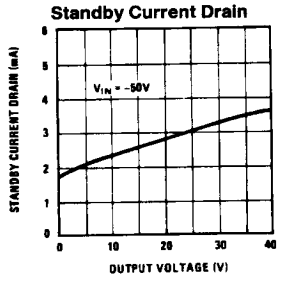
Line Transient Response



Load Transient Response



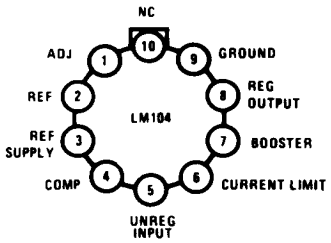
Standby Current Drain



TL/H/7754–7

Connection Diagram

Metal Can Package



TL/H/7754–2

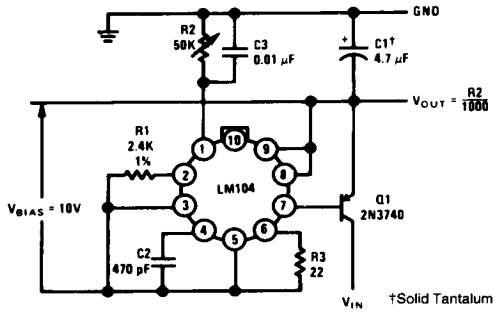
Note: Pin 5 connected to case.

Top View

Order Number LM104H, LM204H or LM304H
See NS Package H10C

Typical Applications

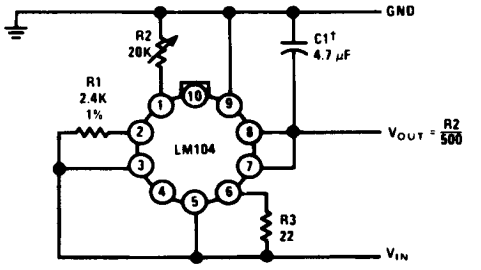
Operating with Separate Bias Supply



†Solid Tantalum

TL/H/7754–3

Basic Regulator Circuit

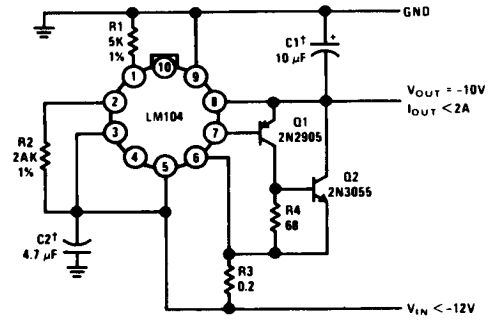


†Solid Tantalum

Trim R1 for exact scale factor.

TL/H/7754–5

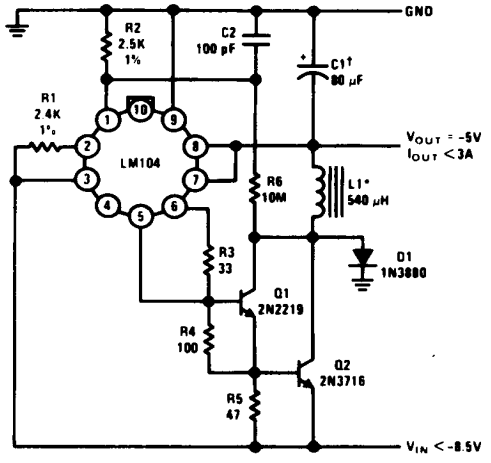
High Current Regulator



†Solid Tantalum

TL/H/7754–4

Switching Regulator



†Solid Tantalum

TL/H/7754–6

*60 turns #20 on Arnold Engineering A930157-2 Molybdenum Permalloy Core.