National Semiconductor

MICROCIRCUIT DATA SHEET

MRLM140-05-H-RH REV 0A0

Original Creation Date: 04/20/99
Last Update Date: 04/29/99
Last Major Revision Date:

VOLTAGE REGULATOR, +5 VOLTS AT 0.5A, GUARANTEED TO 100K RADS(Si) TESTED TO MIL-STD-883, METHOD 1019.5, CONDITION A

General Description

The LM140 monolithic 3-terminal positive voltage regulators employ internal current limiting, thermal shutdown and safe-area compensation, making them essentially indestructible. If adequate heat sinking is provided, they can deliver over 0.5A 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.

Considerable effort was expended to make the entire series of regulators easy to use and minimize the number of external components. It is not necessary to bypass the output, although this does improve transient response. Input bypassing is needed only if the regulator is located far from the filter capacitor of the power supply.

Industry Part Number

LM140

NS Part Numbers

LM140H-5.0RQML
LM140H-5.0RQMLV

Prime Die

LM141

Controlling Document

SEE FEATURES SECTION

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 5005

Subgrp	Description	Temp (^{o}C)
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55

Features

- Output current in excess of 0.5A
- No external components
- Internal thermal overload protection
- Internal short circuit current-limiting
- Output transistor safe-area compensation
- CONTROLLING DOCUMENTS:
  LM140H-5.0RQML 5962R9955101QXA
  LM140H-5.0RQMLV 5962R9955101VXA

(Absolute Maximum Ratings)
(Note 1)

DC Input Voltage	35V
Internal Power Dissipation (Note 2)	Internally Limited
Maximum Junction Temperature	150 C
Storage Temperature Range	-65 C to +150 C
Lead Temperature	
Soldering, (10 seconds)	300 C
Thermal Resistance	
ThetaJA	
(Still Air)	232 C/W
(500 LF/Min Air Flow)	77 C/W
ThetaJC	15 C/W
ESD Susceptibility (Note 3)	2KV

Note 1: Absolute Maximum Ratings are limits beyond which damage to the device may occur. Operating Conditions are conditions under which the device functions but the specification might not be guaranteed. For guaranteed specifications and test conditions see the Electrical Characteristics.
Note 2: The Maximum allowable power dissipation at any ambient temperature is a function of the maximum junction temperature for operation (TjMAX = 150 C), the junction-to-ambient thermal resistance (ThetaJA), and the ambient temperature (TA). PDMAX = (TjMAX - TA)/ThetaJA. If this dissipation is exceeded, the die temperature will rise above TjMAX and the electrical specifications do not apply. If the die temperature rises above 150 C, the device will go into the thermal shutdown.
Note 3: Human body model, 100pF discharged through 1.5K Ohms

Recommended Operating Conditions
(Note 1)

Temperature Range (TA) (Note 2)	-55 C to +125 C

Note 1: Absolute Maximum Ratings are limits beyond which damage to the device may occur. Operating Conditions are conditions under which the device functions but the specification might not be guaranteed. For guaranteed specifications and test conditions see the Electrical Characteristics.
Note 2: The Maximum allowable power dissipation at any ambient temperature is a function of the maximum junction temperature for operation (TjMAX = 150 C), the junction-to-ambient thermal resistance (ThetaJA), and the ambient temperature (TA). PDMAX = (TjMAX - TA)/ThetaJA. If this dissipation is exceeded, the die temperature will rise above TjMAX and the electrical specifications do not apply. If the die temperature rises above 150 C, the device will go into thermal shutdown.

Electrical Characteristics

DC PARAMETERS: SEE NOTE 5

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vout (1)	Output Voltage	Vin = 8V, Il = -5mA	5		4.75	5.25	V	1, 2, 3
		Vin = 8V, Il = -500mA	5		4.75	5.25	V	1, 2, 3
		Vin = 20V, Il = -5mA	5		4.75	5.25	V	1, 2, 3
		Vin = 20V, Il = -500mA	5		4.75	5.25	V	1, 2, 3
		Vin = 35V, Il = -5mA	5		4.75	5.25	V	1, 2, 3
		Vin = 35V, Il = -50mA	5		4.75	5.25	V	1, 2, 3
VRLINE	Line Regulation	8V ≤ Vin ≤ 35V, Il = -50mA	5		-150	150	mV	1, 2, 3
		8V ≤ Vin ≤ 25V, Il = -350mA	5		-50	50	mV	1, 2, 3
VRLOAD	Load Regulation	Vin = 10V, -500mA ≤ Il ≤ -5mA	5		-100	100	mV	1, 2, 3
		Vin = 35V, -50mA ≤ Il ≤ -5mA	5		-150	150	mV	1, 2, 3
ISCD	Stand by Current Drain	Vin = 10V, Il = -5mA	5		-7	-0.5	mA	1, 2, 3
		Vin = 35V, Il = -5mA	5		-8	-0.5	mA	1, 2, 3
Delta ISCD (LINE)	Stand by Current Drain vs. Line Voltage	8V ≤ Vin ≤ 35V, Il = -5mA	5		-1	1	mA	1, 2, 3
Delta ISCD (LOAD)	Stand by Current Drain vs. Load Current	Vin = 10V, -500mA ≤ Il ≤ -5mA	5		-0.5	0.5	mA	1, 2, 3
Iol	Overload Current	Vin = 8V, FORCED Delta Vout = -0.48V	5		-2	-0.5	A	1, 2, 3
Ios	Output Short Circuit Current	Vin = 10V	5		-2	-0.01	A	1, 2, 3
		Vin = 25V	5		-1.5	-0.01	A	1, 2, 3
		Vin = 35V	5		-1	-0.01	A	1, 2, 3
Vout (2)	Output Voltage	Vin = 10V, Il = -5mA	1, 5		4.7	5.3	V	2
Delta Vout/ Delta T	Average Temperature Coefficient of Output Voltage	Vin=10V, Il = -5mA, 25 C ≤ TA ≤ 125 C	4, 5		-2	2	mV/C	2
		Vin=10V, Il = -5mA, -55 C ≤ TA ≤ 25 C	4, 5		-2	2	mV/C	3

Electrical Characteristics

AC PARAMETERS: SEE NOTE 5

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vout	Output Voltage	Vin = 10V, Il = -5mA	2, 5		4.75	5.25	V	1, 2, 3
NO	Output Noise Voltage	Vin = 10V, Il = -50mA	3, 5			125	uVrms	9
Delta Vout/Delta Vin	Transient Line Response	Vin = 10V, VPulse = 3V, Il = -5mA	5			30	mV/V	9
Delta Vout/ Delta Il	Transient Load Response	Vin = 10V, Delta Il = -200mA, Il = -50mA	5			2.5	mV/mA	9
Delta Vin/Delta Vout	Ripple Rejection	Vin = 10V, ei = 1Vrms at f = 2400Hz, Il = -125mA	5		60		dB	9

DC PARAMETERS: DRIFT VALUES

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: "Delta calculations performed on JAN S and QMLV devices at group B, subgroup 5 only".

Vout	Output Voltage	Vin = 8V, Il = -5mA			-0.025	0.025	V	1
		Vin = 8V, Il = -500mA			-0.025	0.025	V	1
		Vin = 20V, Il = -5mA			-0.025	0.025	V	1
		Vin = 20V, Il = -500mA			-0.025	0.025	V	1
		Vin = 35V, Il = -5mA			-0.025	0.025	V	1
		Vin = 35V, Il = -50mA			-0.025	0.025	V	1
ISCD	Stand by Current Drain	Vin = 10V, Il = -5mA			-20	20	%	1

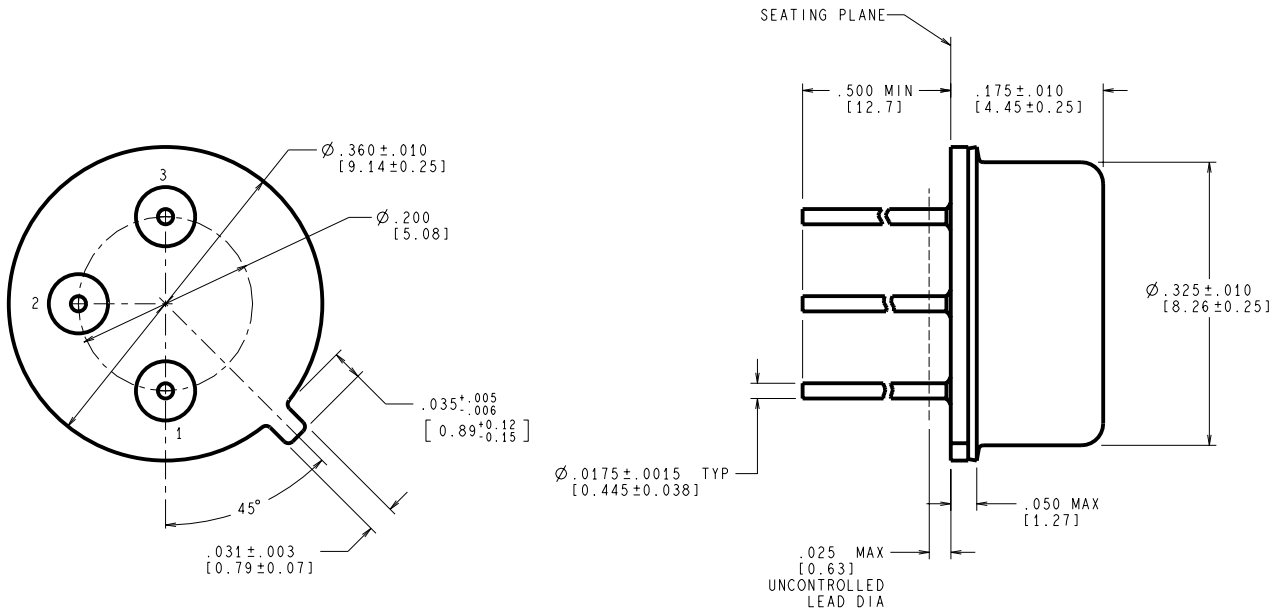
Note 1: Tested at TA = +125 C, correlated to TA = +150 C.
Note 2: Tested at extremes as a set up for Delta Vout/Delta T tests.
Note 3: Bench tested.
Note 4: Calculated parameter. For calculations use Vout at Vin = 10V, Il = -5mA. (NOTE 2)
Note 5: Pre and post irradiation limits are indentical to those listed under DC and AC electrical characteristics. These parts may be dose rate sensitive in a space environment and demonstrate enhanced low dose rate effect. Radiation end point limits for the noted parameters are guaranteed only for the conditions as specified in MIL-STD-883, Method 1019.5, Condition A.

Graphics and Diagrams

GRAPHICS#	DESCRIPTION
05879HRA2	METAL CAN (H), TO-39, 3LD, .200 DIA P.C. (B/I CKT)
H03ARD	METAL CAN (H), TO-39, 3LD, .200 DIA P.C. (P/P DWG)
P000186A	METAL CAN (H), TO-39, 3LD, .200 DIA P.C. (PINOUT)

See attached graphics following this page.

REVISIONS				
LTR	DESCRIPTION	E.C.N.	DATE	BY/APP'D
C	REVISE & REDRAW PER NEW STANDARD	10403	05/24/94	TL/GM
D	UPDATE MILAERO STAMP; Ø.325 WAS Ø.326; REVISE TOLERANCES	10798	02/28/95	TL/



CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

NOTES: UNLESS OTHERWISE SPECIFIED

1. LEADS TO BE LOCATED WITHIN .010 IN/ 0.25 mm OF THEIR TRUE POSITIONS RELATIVE TO A MAXIMUM WIDTH TAB.
2. STANDARD METAL CAN TYPE: SOLID BASE, KOVAR.
3. APPLIES TO MIL-AERO AND LINEAR PRODUCTS.
4. REFERENCE JEDEC REGISTRATION TO-39, JEDEC PUBLICATION No. 95.

MIL-I-38535
CONFIGURATION CONTROL

APPROVALS	DATE
DRAWN T. LEQUANG	05/24/94
DFTG. CHK.	
ENGR. CHK.	

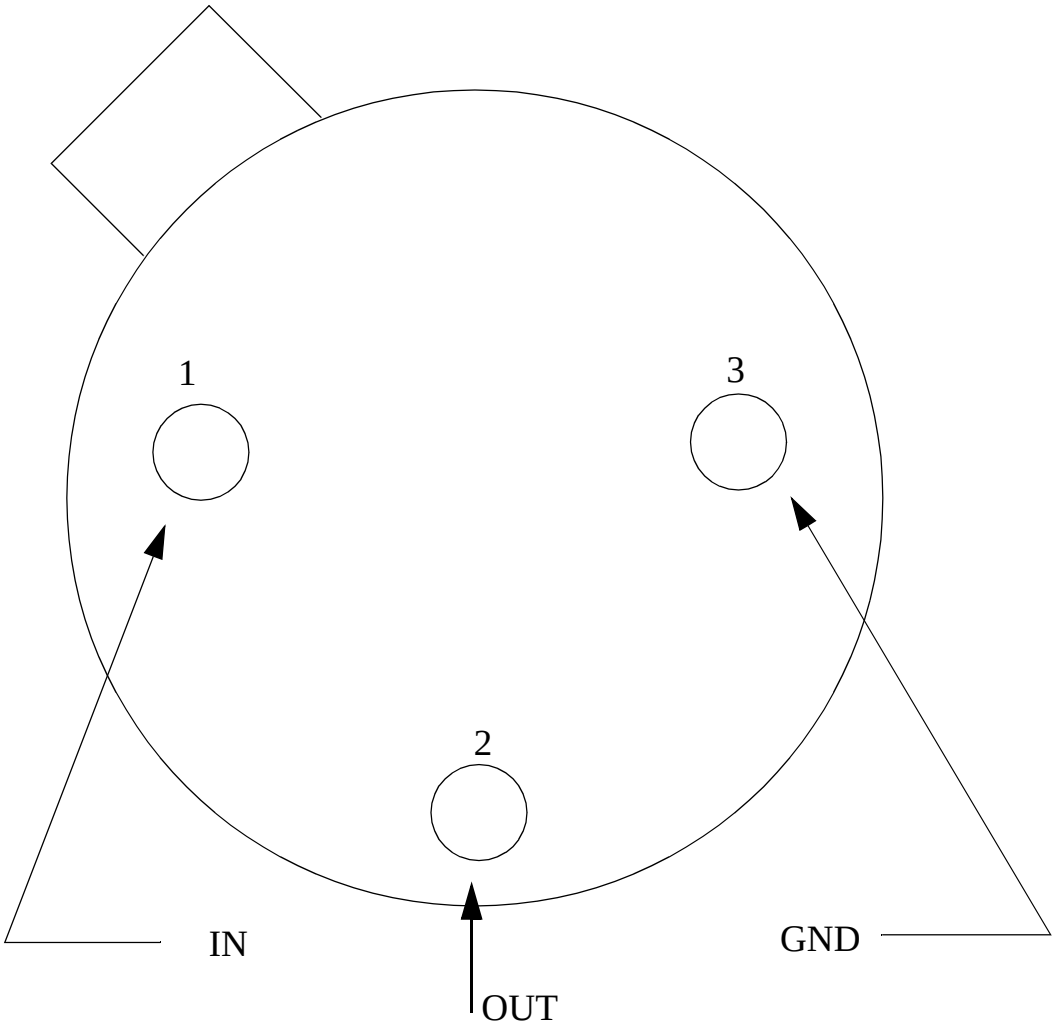
National Semiconductor
2900 Semiconductor dr, Santa Clara, CA 95052-8090

METAL CAN, TO-39, 3 LEAD, .200 DIA P.C.

PROJECTION
INCH [MM]

SCALE	SIZE	DRAWING NUMBER	REV
N/A	C	MKT-H03A	D

DO NOT SCALE DRAWING | SHEET 1 of 1



LM140H, LM140LAH
3 - LEAD TO-39
CONNECTION DIAGRAM
TOP VIEW
P000186A

National Semiconductor™
MIL/AEROSPACE OPERATIONS
2900 SEMICONDUCTOR DRIVE
SANTA CLARA, CA 95050

Revision History

Rev	ECN #	Rel Date	Originator	Changes
0A0	M0003400	04/29/99	Rose Malone	Initial MDS Release: MRLM140-05-H-RH, Rev. 0A0