National Semiconductor

MICROCIRCUIT DATA SHEET

MRLM137-K-RH REV 1B0

Original Creation Date: 04/30/99
Last Update Date: 04/08/02
Last Major Revision Date: 07/05/00

3-TERMINAL VOLTAGE REGULATOR, -37 VOLTS ≤ VO ≤ -1.25 VOLTS AT 1.5A GUARANTEED TO 30K RAD(Si) TESTED TO MIL-STD-883, METHOD 1019.5, CONDITION A

General Description

The LM137K is an adjustable 3-terminal negative voltage regulator capable of supplying in excess of 1.5A over an output voltage range of -1.2V to -37V. This regulator is exceptionally easy to apply, requiring only 2 external resistors to set the output voltage and 1 output capacitor for frequency compensation. The circuit design has been optimized for excellent regulation and low thermal transients. Futher, the LM137K features internal current limiting, thermal shutdown and safe-area compensation, making it virtually blowout-proof against overloads.

The LM137K serves a wide variety of applications including local on-card regulation, programmable-output voltage regulation or precision current regulation. The LM137K is an ideal complement to the LM117K adjustable positive regulator.

Industry Part Number

LM137

NS Part Numbers

LM137KPQMLV

Prime Die

LM137

Controlling Document

SEE FEATURES SECTION

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 5005

Subgrp	Description	Temp (°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 voltage adjustable from -1.2V to -37V
- 1.5A output current guaranteed, -55 C to +150 C
- Line regulation typically 0.01%/V
- Load regulation typically 0.3%
- Excellent thermal regulation, 0.002%/W
- 50 ppm/ C temperature coefficient
- Temperature-independent current limit
- Internal thermal overload protection
- Stantard 3-lead transistor package
- Output short circuit protected
- CONTROLLING DOCUMENTS
  LM137KPQMLV 5962P9951702VYA

(Absolute Maximum Ratings)
(Note 1)

Power Dissipation	Internally Limited
Input-Output Voltage Differential	40V
Operating Junction Temperature	-55 C ≤ Ta ≤ +150 C
Maximum Junction Temperature (Note 2)	150 C
Maximum Power Dissipation (@ 25 C)	28 Watts
Minimum Input Voltage	-41.25V
Storage Temperature	-65 C ≤ Ta ≤ +150 C
Lead Temperature (Soldering, 10 seconds)	300 C
Thermal Resistance	
ThetaJA	
(Still Air)	40 C/W
(500LF/Min Air Flow)	14 C/W
ThetaJC	4 C/W
Package Weight (Typical)	12750mg
ESD Rating (Note 3)	4000V

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Rating indicate conditions for which the device is functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.
Note 2: The maximum power dissipation must be derated at elevated temperatures and is dictated by Tjmax (maximum junction temperature), ThetaJA (package junction to ambient thermal resistance), and TA (ambient temperature). The maximum allowable power dissipation at any temperature is Pdmax = (Tjmax - TA) /ThetaJA or the number given in the Absolute Maximum Ratings, whichever is lower.
Note 3: Human body model, 100pF discharged through 1.5K Ohms

Recommended Operating Conditions

Ta	-55 C ≤ Ta ≤ +125 C
Input Voltage Range	-41.25V to -4.25V

Electrical Characteristics

DC PARAMETERS: (SEE NOTE 3)

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vout	Output Voltage	Vin = -4.25V, Il = 5mA	3		-1.275	-1.225	V	1
			3		-1.3	-1.2	V	2, 3
		Vin = -4.25V, Il = 1.5A	3		-1.275	-1.225	V	1
			3		-1.3	-1.2	V	2, 3
		Vin = -41.25V, Il = 5mA	3		-1.275	-1.225	V	1
			3		-1.3	-1.2	V	2, 3
		Vin = -41.25V, Il = 200mA	3		-1.275	-1.225	V	1
			3		-1.3	-1.2	V	2, 3
Vrline	Line Regulation	-41.25V ≤ Vin ≤ -4.25, Il = 5mA	3		-9	9	mV	1
			3		-23	23	mV	2, 3
Vrload	Load Regulation	Vin = -6.25V, Il = 5mA to 1.5A	3		-6	6	mV	1
			3		-12	12	mV	2, 3
		Vin = -41.25V, Il = 5mA to 200mA	3		-6	6	mV	1
			3		-12	12	mV	2, 3
Vrth	Thermal Regulation	Vin = -14.6V, Il = 1.5A	3		-5	5	mV	1
Iadj	Adjust Pin Current	Vin = -4.25V, Il = 5mA	3		25	100	uA	1, 2, 3
		Vin = -41.25V, Il = 5mA	3		25	100	uA	1, 2, 3
Delta Iadj(line)	Adjust Pin Current Change vs. Line Voltage	-41.25V ≤ Vin ≤ -4.25, Il = 5mA	3		-5	5	uA	1, 2, 3
Delta Iadj(load)	Adjust Pin Current Change vs. Load Current	Vin = -6.25V, Il = 5mA to 1.5A	3		-5	5	uA	1, 2, 3
Ios	Output Short Circuit Current	Vin = -4.25V	3		1.5	3.5	A	1, 2, 3
		Vin = -40V	3		0.2	1	A	1, 2, 3
Vout (Recovery)	Output Voltage Recovery	Vin = -4.25V	3		-1.275	-1.225	V	1
			3		-1.3	-1.2	V	2, 3
		Vin = -40V	3		-1.275	-1.225	V	1
			3		-1.3	-1.2	V	2, 3

Electrical Characteristics

DC PARAMETERS: (SEE NOTE 3) (Continued)

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Iq	Minimum Load Current	Vin = -4.25V	3		0.2	3	mA	1, 2, 3
		Vin = -14.25V	3		0.2	3	mA	1, 2, 3
		Vin = -41.25V	3		1	5	mA	1, 2, 3
Vstart	Voltage Start-up	Vin = 4.25V, Il = 1.5A	3		-1.275	-1.225	V	1
			3		-1.3	-1.2	V	2, 3
Vout	Output Voltage	Vin = -6.25V, Il = 5mA	1, 3		-1.3	-1.2	V	2

AC PARAMETERS: (SEE NOTE 3)

Delta Vin/Delta Vout	Ripple Rejection	Vin = -6.25V, ei = 1Vrms at 2400Hz, Il = 500mA	3		50		dB	9
Vno	Output Noise Voltage	Vin = -6.25V, Il = 100mA	3			120	uVrms	9
Delta Vout/Delta Vin	Line Transient Response	Vin = -6.25V, Il = 100mA, Vpulse = -1V	3			80	mV/V	9
Delta Vout/Delta Il	Load Transient Response	Vin = -6.25V, Il = 100mA, Delta Il = 400mA	2, 3			60	mV	9

DC PARAMETERS: DRIFT VALUES (See NOTE 3)

(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 = -4.25V, Il = 5mA	3		-0.01	0.01	V	1
		Vin = -4.25V, Il = 1.5mA	3		-0.01	0.01	V	1
		Vin = -41.25V, Il = 5mA	3		-0.01	0.01	V	1
		Vin = -41.25V, Il = 200mA	3		-0.01	0.01	V	1
Vrline	Line Regulation	Vin = -41.25V to -4.25, Il = 5mA	3		-4	4	mV	1
Iadj	Adjust Pin Current	Vin = -4.25V, Il = 5mA	3		-10	10	uA	1
		Vin = -41.25V, Il = 5mA	3		-10	10	uA	1

DC PARAMETERS: POST RADIATION LIMITS +25 C (See NOTE 3)

Delta Iadj (line)	Adjust Pin Current Change vs. Line Voltage	-41.25V ≤ Vin ≤ -4.25V, Il = 5mA	3		-20	20	uA	1
Vrload	Load Regulation	-6.25V, 5mA to 1.5A	3		-7.5	7.5	mV	1

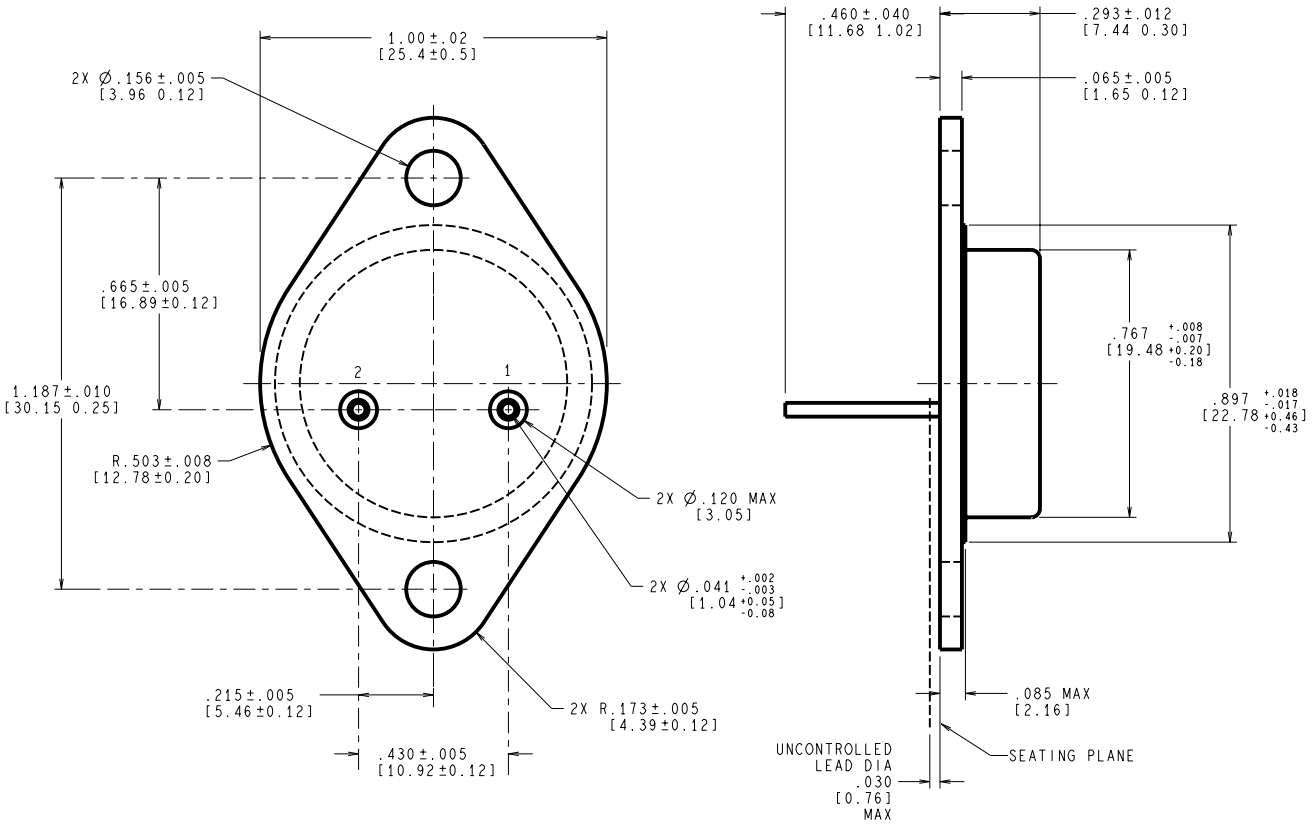
Note 1: Tested at +125 C; correlated to 150 C.
Note 2: Limit of 0.15mV/mA is equivalent to 60mV.
Note 3: Pre and post irradiation limits are identical to those listed under AC and DC electrical characteristics except as listed in the Post Radiation Limits Table. These parts may be dose rate sensitive 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
05191HRB4	METAL CAN (KA), TO-3, 2LD, LOW PROFILE (B/I CKT)
K02CRE	METAL CAN TO-3, 2LD, LOW PROFILE (P/P DWG)
P000200A	METAL CAN (KA), TO-3, 2 LD, LOW PROFILE (PINOUT)

See attached graphics following this page.

REVISIONS				
LTR	DESCRIPTION	E.C.N.	DATE	BY/APP'D
E	REDRAW ON PRO/E; UPDATE MIL/AERO STAMP; NOTE 2: MIL-PRF-38535 WAS MIL-I-38535.	11155	09/15/95	MS/



CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

NOTES: UNLESS OTHERWISE SPECIFIED

1. STANDARD HEADER TYPE SOLID BASE.
2. STANDARD LEAD FINISH:
   PER MIL-PRF-38535 TYPE X OR EQUIVALENT.
3. LEAD NOT BENT GREATER THAN 15° .
4. DIMENSIONS BASED ON JEDEC STANDARD TO-3,
   PUBLICATION 95, PAGE 98.

MIL-PRF-38535
CONFIGURATION CONTROL

APPROVALS	DATE
DRAWN: MARTA SUCHY	09/15/95
DFTG. CHK.	
ENGR. CHK.	

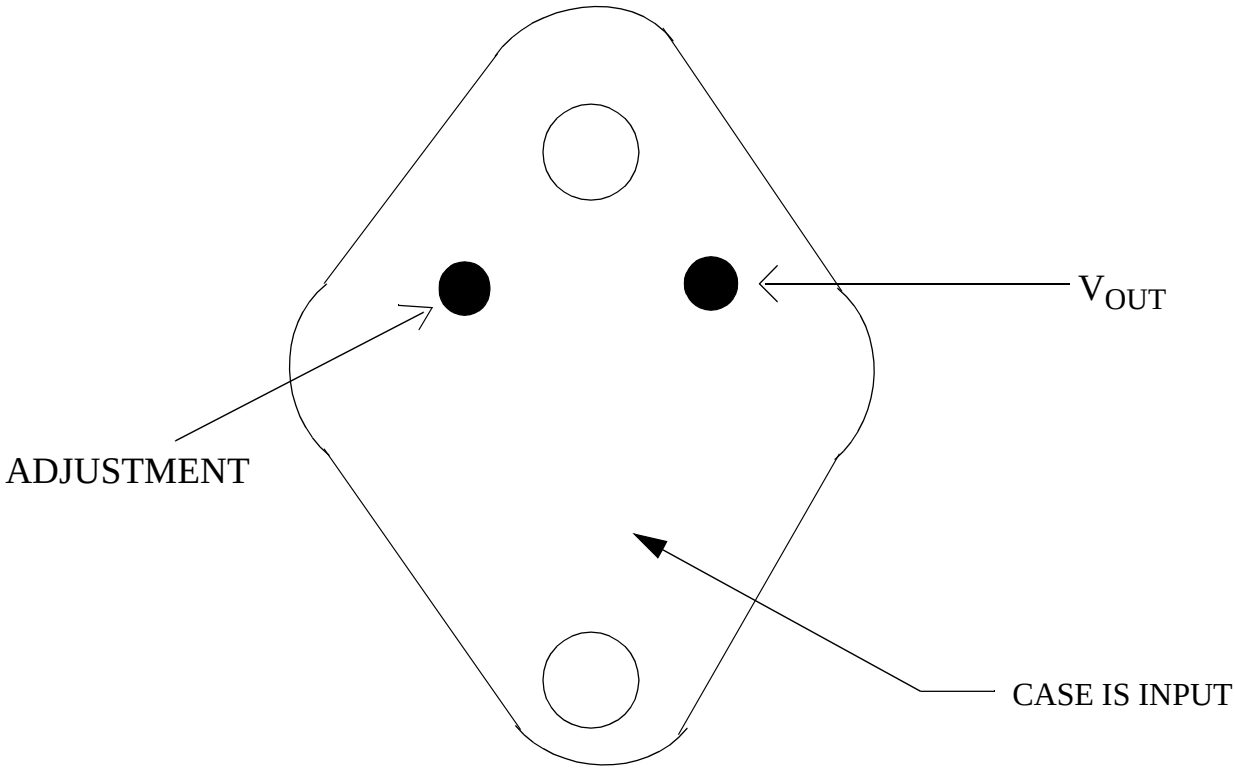
National Semiconductor
2900 Semiconductor dr, Santa Clara, CA 95052-8090

METAL CAN, TO-3, 2 LEAD, LOW PROFILE

PROJECTION
INCH [MM]

SCALE	SIZE	DRAWING NUMBER	REV
N/A	C	MKT-K02C	E

DO NOT SCALE DRAWING | SHEET 1 of 1



LM137K, LM137HVK

2 - LEAD TO3

CONNECTION DIAGRAM

BOTTOM VIEW

P000200A

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

Revision History

Rev	ECN #	Rel Date	Originator	Changes
0A0	M0003416	07/19/00	Rose Malone	Initial MDS Release: MRLM137-K-RH, Rev. 0A0 - Rad Hard Data Sheet.
1A0	M0003735	04/08/02	Rose Malone	Update MDS: MRLM137-K-RH, Rev. 0A0 to MRLM137-K-RH, Rev. 1A0. Changes made in Absolute and Recommended Section, Post Radiaton Section, Delta Iadj Parameter from -10uA Min, 10uV Max to -20uA Min, 20uA Max. Added Vrload parameter in Post Radiaton Section.
1B0	M0003991	04/08/02	Rose Malone	Update MDS: MRLM137-K-RH, Rev. 1A0 to MRLM137-K-RH, Rev. 1B0. Deleted reference to LM137KPQML from Main Table and Features Section, QML product un-available.