LM137QML 3-Terminal Adjustable Negative Regulators

Check for Samples: LM137QML

FEATURES

- **Output Voltage Adjustable from −37V to −1.2V**
- **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**
- **77 dB Ripple Rejection**
- **Excellent Rejection of Thermal Transients**
- **50 ppm/°C Temperature Coefficient**
- **Temperature-independent Current Limit**
- **Internal Thermal Overload Protection**
- **Standard 3-lead Transistor Package**
- **Output is Short Circuit Protected**

DESCRIPTION

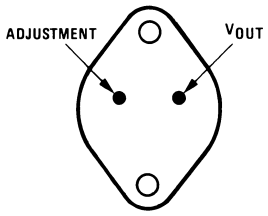
The LM137 are adjustable 3-terminal negative voltage regulators capable of supplying in excess of −1.5A over an output voltage range of −37V to −1.2V. These regulators are exceptionally easy to apply, requiring only 2 external resistors to set the output voltage and 1 output capacitor for frequency compensation. The circuit design has been optimized for excellent regulation and low thermal transients. Further, the LM137 series features internal current limiting, thermal shutdown and safe-area compensation, making them virtually blowout-proof against overloads.

The LM137 serve a wide variety of applications including local on-card regulation, programmable-output voltage regulation or precision current regulation. The LM137 are ideal complements to the LM117 adjustable positive regulators.

Table 1. LM137 Series Packages and Power Capability

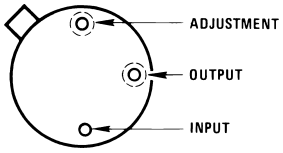
Device	Package	Rated Power Dissipation	Design Load Current
LM137	TO-3 (K)	20W	1.5A
	TO-39 (NDT)	2W	0.5A

Connection Diagram



NOTE: Case is Input

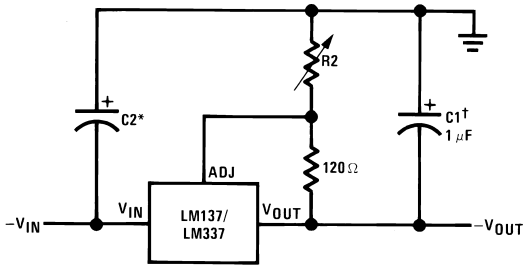
Figure 1. TO-3, Bottom View
Metal Can Package



NOTE: Case Is Input

**Figure 2. TO-39, Bottom View
Metal Can Package**

Typical Applications



Full output current not available at high input-output voltages

$$-V_{OUT} = -1.25V\left(1 + \frac{R2}{120}\right) + \left(-I_{ADJ} \times R2\right)$$

†C1 = 1 µF solid tantalum or 10 µF aluminum electrolytic required for stability
*C2 = 1 µF solid tantalum is required only if regulator is more than 4″ from power-supply filter capacitor
Output capacitors in the range of 1µF to 1000 µF of aluminum or tantalum electrolytic are commonly used to provide improved output impedance and rejection of transients

Figure 3. Adjustable Negative Voltage Regulator

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings[1]

Power Dissipation[2]			Internally Limited
Input-Output Voltage Differential			40V
Operating Ambient Temperature Range			$-55°C \le T_A \le +125°C$
Operating Junction Temperature Range			$-55°C \le T_J \le +150°C$
Storage Temperature			$-65°C \le T_A \le +150°C$
Maximum Junction Temperature			150°C
Lead Temperature (Soldering, 10 sec.)			300°C
Minimum Input Voltage			−41.25V
Maximum Power Dissipation (@25°C)	T0–3		28 Watts
	T0–39		2.5 Watts
Thermal Resistance	θ_{JA}	T0–3 Metal Can (Still Air)	40°C/W
		T0–3 Metal Can (500LF/Min Air Flow)	14°C/W
		T0–39 Metal Can (Still Air @ 0.5W)	174°C/W
		T0–39 Metal Can (500LF/Min Air Flow @ 0.5W)	64°C/W
	θ_{JC}	T0–3	4°C/W
		T0–39 Metal Can (@ 1.0W)	15°C/W
Package Weight (typical)	T0–3		12,750mg
	T0–39 Metal Can		955mg
ESD Rating [3]			4000V

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics. The ensured specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.
(2) The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{Jmax} (maximum junction temperature), θ_{JA} (package junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is $P_{Dmax} = (T_{Jmax} - T_A)/\theta_{JA}$ or the number given in the Absolute Maximum Ratings, whichever is lower.
(3) Human body model, 100pF discharged through 1.5KΩ

Recommended Operating Conditions

T_A	$-55°C \le T_A \le +125°C$
Input Voltage Range	−41.25V to −4.25V

Quality Conformance Inspection

Table 2. Mil-Std-883, Method 5005 — Group A[1]

Subgroup	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

(1) Group “A” sample only, test at all temps.

LM137H 883 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified. V_{IN} = −4.25V, I_L = 8mA, V_{OUT} = V_{Ref} (1) (2)

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
V_{Ref}	Reference Voltage			-1.275	-1.225	V	1
				-1.3	-1.2	V	2, 3
		V_{IN} = -42V		-1.275	-1.225	V	1
		V_{IN} = -41.3V		-1.3	-1.2	V	2, 3
I_Q	Minimum Load Current	V_{OUT} = -1.7V			3.0	mA	1, 2, 3
		V_{OUT} = -1.7V, V_{IN} = -11.75V			3.0	mA	1, 2, 3
		V_{OUT} = -1.7V, V_{IN} = -42V			5.0	mA	1
		V_{OUT} = -1.7V, V_{IN} = -41.3V			5.0	mA	2, 3
R_{Line}	Line Regulation	-42V ≤ V_{IN} ≤ -4.25V		-9.0	9.0	mV	1
		-41.3V ≤ V_{IN} ≤ -4.25V		-23	23	mV	2, 3
R_{Load}	Load Regulation	5mA ≤ I_L ≤ 500mA, V_{IN} = -6.25V		-25	25	mV	1, 2, 3
		5mA ≤ I_L ≤ 500mA, V_{IN} = -14.5V		-25	25	mV	1
		5mA ≤ I_L ≤ 150mA, V_{IN} = -40V		-25	25	mV	1, 2, 3
I_{Adj}	Adjustment Pin Current	I_L = 5 mA			100	µA	1, 2, 3
		V_{IN} = -42V			100	µA	1
		V_{IN} = -41.3V			100	µA	2, 3
Δ I_{Adj} / V_{Line}	Adjust Pin Current Change vs. Line Voltage	-42V ≤ V_{IN} ≤ -4.25V, I_L = 5 mA		-5.0	5.0	µA	1
		-41.3V ≤ V_{IN} ≤ -4.25V, I_L = 5 mA		-5.0	5.0	µA	2, 3
Δ I_{Adj} / I_{Load}	Adjust Pin Current Change vs. Load Current	5 mA ≤ I_L ≤ 500 mA, V_{IN} = -6.5V		-5.0	5.0	µA	1, 2, 3
θ_R	Thermal Regulation	V_{IN} = -14.5V, I_L = 500mA, t = 10mS		-5.0	5.0	mV	1
		V_{IN} = -14.5V, I_L = 5mA, t = 10mS		-5.0	5.0	mV	1
θ_{JC}	Thermal Resistance		(3)		15	°C/W	1
I_{CL}	Current Limit	V_{IN} = -5V		-1.8	-0.5	A	1, 2, 3
		V_{IN} = -40V		-0.65	-0.15	A	1, 2, 3
V_O	Output Voltage			-1.28	-1.22	V	1
				-1.3	-1.2	V	2, 3

(1) V_{IN} = −41.3V at +125°C and −55°C
(2) −41.3V ≤ V_{IN} ≤ −4.25V at +125°C and −55°C
(3) Ensured parameter, not tested.

LM137H 883 Electrical Characteristics AC Parameters

R_R	Ripple Rejection Ratio	V_{IN} = -6.25V, V_{OUT} = V_{Ref}, I_L = 125mA, e_I = 1V_{RMS}, F = 120Hz	(1)(2) (1)	66		dB	4, 5, 6

(1) Bench test, refer to (SG)RPI-3-362.
(2) Test at +25°C, ensured but not tested at +125°C and −55°C

LM137K 883 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified. V_{IN} = −4.25V, I_L = 8mA, V_{OUT} = V_{Ref} (1) (2)

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
V_{Ref}	Reference Voltage			-1.275	-1.225	V	1
				-1.3	-1.2	V	2, 3
		V_{IN} = -42V		-1.275	-1.225	V	1
		V_{IN} = -41.3V		-1.3	-1.2	V	2, 3
I_Q	Minimum Load Current	V_{OUT} = -1.7V			3.0	mA	1, 2, 3
		V_{OUT} = -1.7V, V_{IN} = -11.75V			3.0	mA	1, 2, 3
		V_{OUT} = -1.7V, V_{IN} = -42V			5.0	mA	1
		V_{OUT} = -1.7V, V_{IN} = -41.3V			5.0	mA	2, 3
R_{Line}	Line Regulation	-42V ≤ V_{IN} ≤ -4.25V		-9.0	9.0	mV	1
		-41.3V ≤ V_{IN} ≤ -4.25V		-23	23	mV	2, 3
R_{Load}	Load Regulation	V_{IN} = -6.25V, 8mA ≤ I_L ≤ 1.5A		-25	25	mV	1, 2, 3
		V_{IN} = -14.5V, 8mA ≤ I_L ≤ 1.5A		-25	25	mV	1
		V_{IN} = -40V, 8mA ≤ I_L ≤ 300 mA		-25	25	mV	1
		V_{IN} = -40V, 8mA ≤ I_L ≤ 250 mA		-25	25	mV	2, 3
I_{Adj}	Adjustment Pin Current				100	µA	1, 2, 3
		V_{IN} = -42V			100	µA	1
		V_{IN} = -41.3V			100	µA	2, 3
Δ I_{Adj} / V_{Line}	Adjust Pin Current Change vs. Line Voltage	-42V ≤ V_{IN} ≤ -4.25V		-5.0	5.0	µA	1
		-41.3V ≤ V_{IN} ≤ -4.25V		-5.0	5.0	µA	2, 3
Δ I_{Adj} / I_{Load}	Adjust Pin Current Change vs. Load Current	8 mA ≤ I_L ≤ 1.5A, V_{IN} = -6.25V		-5.0	5.0	µA	1, 2, 3
V_{Rth}	Thermal Regulation	V_{IN} = -14.5V, I_L = 1.5mA, t = 10mS		-5.0	5.0	mV	1
		V_{IN} = -14.5V, I_L = 8mA, t = 10mS		-5.0	5.0	mV	1
θ_{JC}	Thermal Resistance		(3)		4.0	°C/W	1
I_{CL}	Current Limit	V_{IN} = -5V		-3.5	-1.5	A	1, 2, 3
		V_{IN} = -40V		-1.2	-0.24	A	1, 2, 3

(1) V_{IN} = −41.3V at +125°C and −55°C
(2) −41.3V ≤ V_{IN} ≤ −4.25V at +125°C and −55°C
(3) Ensured parameter, not tested.

LM137K 883 Electrical Characteristics AC Parameters

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
R_R	Ripple Rejection Ratio	V_{IN} = -6.25V, V_{OUT} = V_{Ref}, f = 120Hz, I_L = 0.5A, e_I = 1V_{RMS}	(1)(2) (1)	66		dB	4, 5, 6

(1) Bench test, refer to (SG)RPI-3-362.
(2) Test at +25°C, ensured but not tested at +125°C and −55°C

LM137H RH Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified. (1)

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
V_{OUT}	Output Voltage	V_{IN} = -4.25V, I_L = 5mA		-1.275	-1.225	V	1
				-1.3	-1.2	V	2, 3
		V_{IN} = -4.25V, I_L = 500mA		-1.275	-1.225	V	1
				-1.3	-1.2	V	2, 3
		V_{IN} = -41.25V, I_L = 5mA		-1.275	-1.225	V	1
				-1.3	-1.2	V	2, 3
		V_{IN} = -41.25V, I_L = 50mA		-1.275	-1.225	V	1
				-1.3	-1.2	V	2, 3
$V_{R\ Line}$	Line Regulation	V_{IN} = -41.25V to -4.25V, I_L = 5mA		-9.0	9.0	mV	1
				-23	23	mV	2, 3
$V_{R\ Load}$	Load Regulation	V_{IN} = -6.25V, I_L = 5mA to 500mA		-12	12	mV	1
				-24	24	mV	2, 3
		V_{IN} = -41.25V, I_L = 5mA to 50mA		-6.0	6.0	mV	1
				-12	12	mV	2, 3
		V_{IN} = -6.25V, I_L = 5mA to 200mA		-6.0	6.0	mV	1
				-12	12	mV	2, 3
V_{Rth}	Thermal Regulation	V_{IN} = -14.6V, I_L = 500mA		-5.0	5.0	mV	1
I_{Adj}	Adjust Pin Current	V_{IN} = -4.25V, I_L = 5mA		25	100	µA	1, 2, 3
		V_{IN} = -41.25V, I_L = 5mA		25	100	µA	1, 2, 3
$\Delta I_{Adj} / V_{Line}$	Adjust Pin Current Change vs. Line Voltage	V_{IN} = -41.25V to -4.25V, I_L = 5mA		-5.0	5.0	µA	1, 2, 3
$\Delta I_{Adj} / I_{Load}$	Adjust Pin Current Change vs. Load Current	V_{IN} = -6.25V, I_L = 5mA to 500mA		-5.0	5.0	µA	1, 2, 3
I_{OS}	Output Short Circuit Current	V_{IN} = -4.25V		0.5	1.8	A	1, 2, 3
		V_{IN} = -40V		0.05	0.5	A	1, 2, 3
V_{OUT} Recovery	Output Voltage Recovery After Output Short Circuit Current	V_{IN} = -4.25V		-1.275	-1.225	V	1
				-1.3	-1.2	V	2, 3
		V_{IN} = -40V		-1.275	-1.225	V	1
				-1.3	-1.2	V	2, 3
I_Q	Minimum Load Current	V_{IN} = -4.25V		0.2	3.0	mA	1, 2, 3
		V_{IN} = -14.25V		0.2	3.0	mA	1, 2, 3
		V_{IN} = -41.25V		1.0	5.0	mA	1, 2, 3
V_{Start}	Voltage Start-up	V_{IN} = -4.25V, I_L = 500mA		-1.275	-1.225	V	1
				-1.3	-1.2	V	2, 3
V_{OUT}	Output Voltage	V_{IN} = -6.25V, I_L = 5mA	(2)	-1.3	-1.2	V	2

(1) 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 specified only for the conditions as specified in Mil-Std-883, Method 1019.5, Condition A.

(2) Tested at +125°C ; correlated to +150°C

LM137H RH Electrical Characteristics AC Parameters

The following conditions apply, unless otherwise specified.
(1)

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
ΔV_{IN} / ΔV_{OUT}	Ripple Rejection	V_{IN} = -6.25V, I_L = 125mA, e_I = $1V_{RMS}$ at 2400Hz		48		dB	9
V_{NO}	Output Noise Voltage	V_{IN} = -6.25V, I_L = 50mA			120	μV_{RMS}	9
ΔV_{OUT} / ΔV_{IN}	Line Transient Response	V_{IN} = -6.25V, V_{Pulse} = -1V, I_L = 50mA			80	mV/V	9
ΔV_O / ΔI_L	Load Transient Response	V_{IN} = -6.25V, I_L = 50mA, ΔI_L = 200mA	(2)		60	mV	9

(1) 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 specified only for the conditions as specified in Mil-Std-883, Method 1019.5, Condition A.
(2) Limit of 0.3mV/mA is equivalent to 60mV

LM137H RH Electrical Characteristics DC Parameters Drift Values

The following conditions apply, unless otherwise specified.
(1)

Delta calculations performed on QMLV devices at group B, subgroup 5 only.

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
V_{OUT}	Output Voltage	V_{IN} = -4.25V, I_L = 5mA		-0.01	0.01	V	1
		V_{IN} = -4.25V, I_L = 500mA		-0.01	0.01	V	1
		V_{IN} = -41.25V, I_L = 5mA		-0.01	0.01	V	1
		V_{IN} = -41.25V, I_L = 50mA		-0.01	0.01	V	1
$V_{R\ Line}$	Line Regulation	V_{IN} = -41.25V to -4.25V, I_L = 5mA		-4.0	4.0	mV	1
I_{Adj}	Adjust Pin Current	V_{IN} = -4.25V, I_L = 5mA		-10	10	µA	1
		V_{IN} = -41.25V, I_L = 5mA		-10	10	µA	1

(1) 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 specified only for the conditions as specified in Mil-Std-883, Method 1019.5, Condition A.

LM137H RH Electrical Characteristics DC Parameters Post Radiation Limits +25°C 5962P9951701VXA(1)

The following conditions apply, unless otherwise specified.
(2)

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
ΔI_{Adj} / V_{Line}	Adjust Pin Current Change vs. Line Voltage	V_{IN} = -41.25V to -4.25V, I_L = 5mA		-20	20	µA	1

(1) Pre Burn-In stress test per RPI-5-025.
(2) 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 specified only for the conditions as specified in Mil-Std-883, Method 1019.5, Condition A.

LM137H RH Electrical Characteristics DC Parameters Post Radiation Limits +25°C 5962P9951708VXA(1)

The following conditions apply, unless otherwise specified.
(2)

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
V_{OUT}	Output Voltage	V_{IN} = -41.25V, I_L = 5mA		-1.30	-1.225	V	1
		V_{IN} = -41.25V, I_L = 50mA		-1.30	-1.225	V	1
$V_{R\ Line}$	Line Regulation	V_{IN} = -41.25V to -4.25V, I_L = 5mA		-9.0	+50	mV	1
I_{Adj}	Adjust Pin Current	V_{IN} = -41.25V, I_L = 5mA		25	140	µA	1
ΔI_{Adj} / V_{Line}	Adjust Pin Current Change vs. Line Voltage	V_{IN} = -41.25V to -4.25V, I_L = 5mA		-70	+20	µA	1
V_{OUT} Recovery	Output Voltage Recovery After Output Short Circuit Current	V_{IN} = -4.25V		-1.30	-1.225	V	1

(1) Pre Burn-In stress test per RPI-5-025.
(2) 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 specified only for the conditions as specified in Mil-Std-883, Method 1019.5, Condition A.

APPLICATION INFORMATION

Schematic Diagram

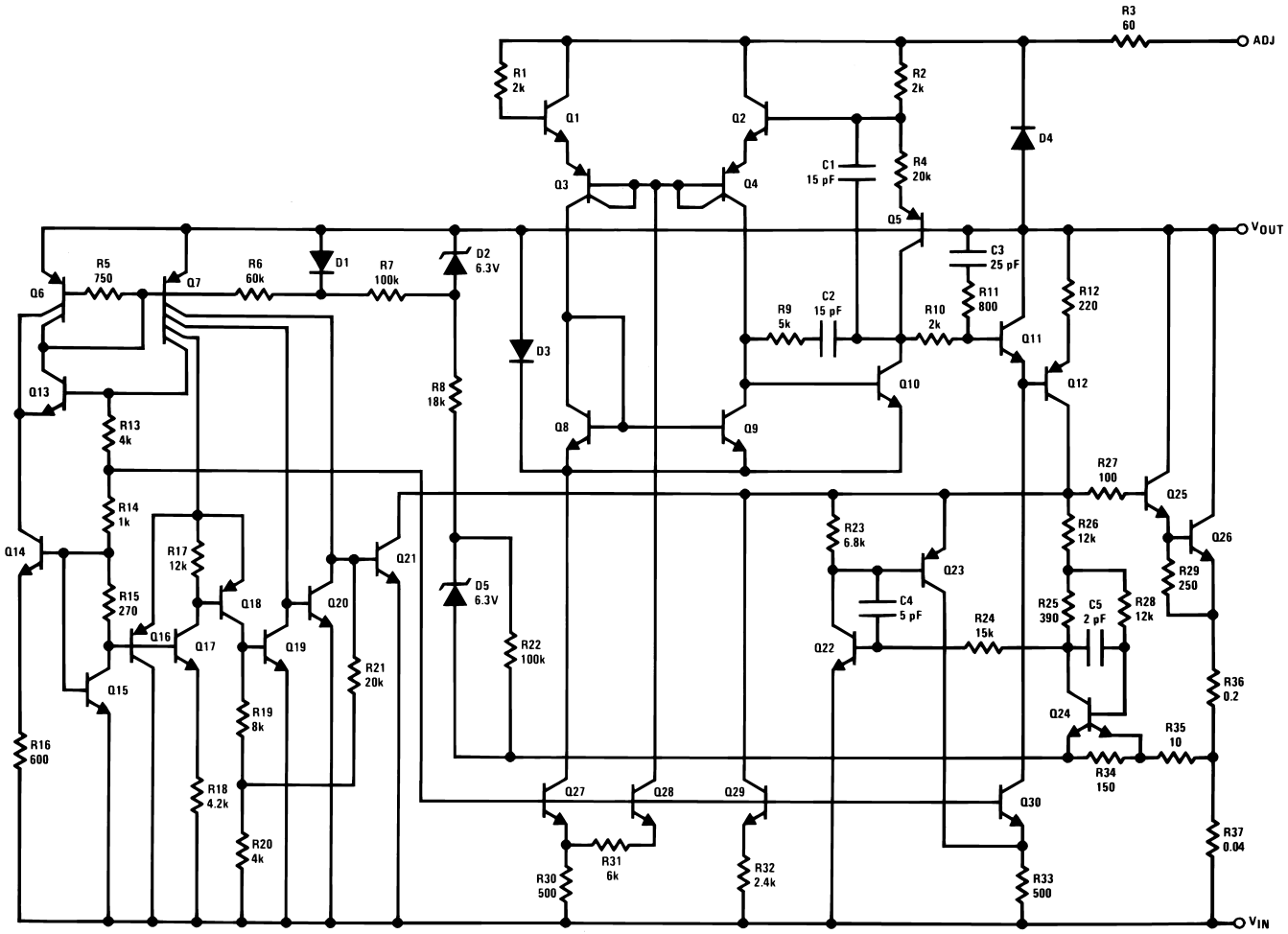
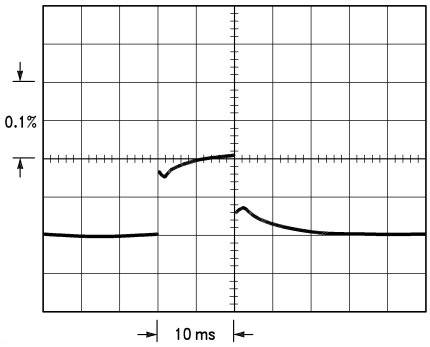


Figure 4. Schematic Diagram

Thermal Regulation

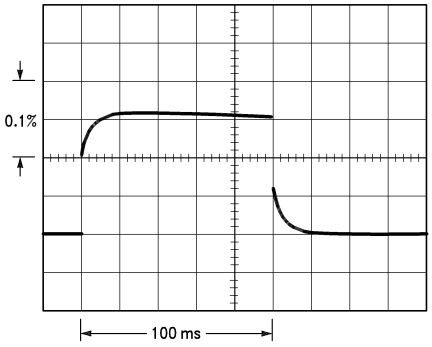
When power is dissipated in an IC, a temperature gradient occurs across the IC chip affecting the individual IC circuit components. With an IC regulator, this gradient can be especially severe since power dissipation is large. Thermal regulation is the effect of these temperature gradients on output voltage (in percentage output change) per Watt of power change in a specified time. Thermal regulation error is independent of electrical regulation or temperature coefficient, and occurs within 5 ms to 50 ms after a change in power dissipation. Thermal regulation depends on IC layout as well as electrical design. The thermal regulation of a voltage regulator is defined as the percentage change of V_{OUT}, per Watt, within the first 10 ms after a step of power is applied. The LM137's specification is 0.02%/W, max.



LM137, V_{OUT} = −10V
V_{IN} − V_{OUT} = −40V
I_{IL} = 0A → 0.25A → 0A
Vertical sensitivity, 5 mV/div

Figure 5.

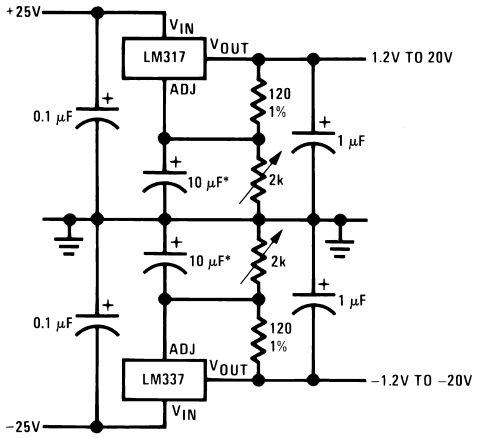
In Figure 5, a typical LM137's output drifts only 3 mV (or 0.03% of V_{OUT} = −10V) when a 10W pulse is applied for 10 ms. This performance is thus well inside the specification limit of 0.02%/W × 10W = 0.2% max. When the 10W pulse is ended, the thermal regulation again shows a 3 mV step as the LM137 chip cools off. Note that the load regulation error of about 8 mV (0.08%) is additional to the thermal regulation error. In Figure 6, when the 10W pulse is applied for 100 ms, the output drifts only slightly beyond the drift in the first 10 ms, and the thermal error stays well within 0.1% (10 mV).



LM137, V_{OUT} = −10V
V_{IN} − V_{OUT} = −40V
I_L = 0A → 0.25A → 0A
Horizontal sensitivity, 20 ms/div

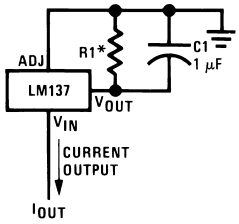
Figure 6.

Typical Applications



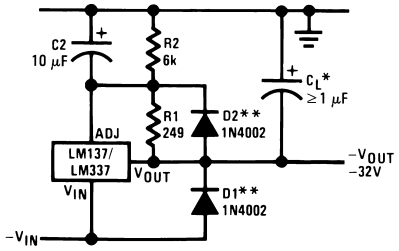
Full output current not available
at high input-output voltages
*The 10 µF capacitors are optional to improve ripple rejection

Figure 7. Adjustable Lab Voltage Regulator



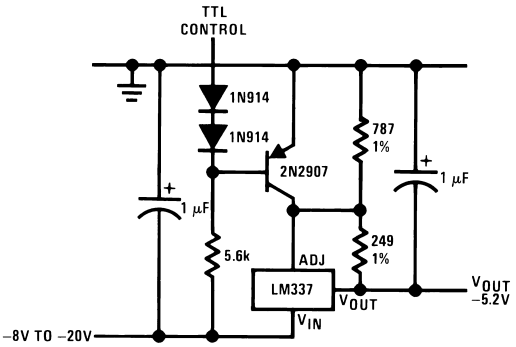
$I_{OUT} = \frac{1.250V}{R1}$
*0.8Ω ≤ R1 ≤ 120Ω

Figure 8. Current Regulator



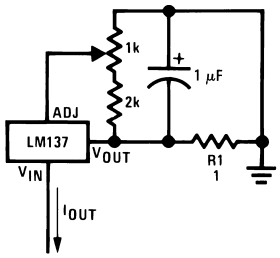
*When C_L is larger than 20 µF, D1 protects the LM137 in case the input supply is shorted
**When C2 is larger than 10 µF and $-V_{OUT}$ is larger than −25V, D2 protects the LM137 in case the output is shorted

Figure 9. Negative Regulator with Protection Diodes



*Minimum output ≈ −1.3V when control input is low

Figure 10. −5.2V Regulator with Electronic Shutdown*



$$I_{OUT} = \left(\frac{1.5V}{R1}\right) \pm 15\% \text{ adjustable}$$

Figure 11. Adjustable Current Regulator

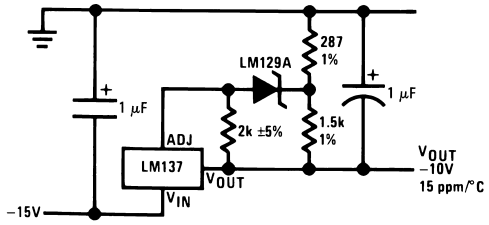


Figure 12. High Stability −10V Regulator

Typical Performance Characteristics

(NDT & K Packages)

Load Regulation

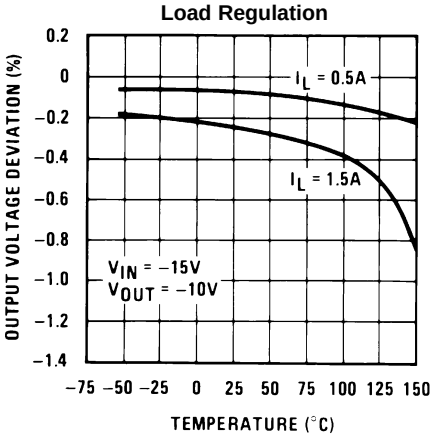


Figure 13.

Current Limit

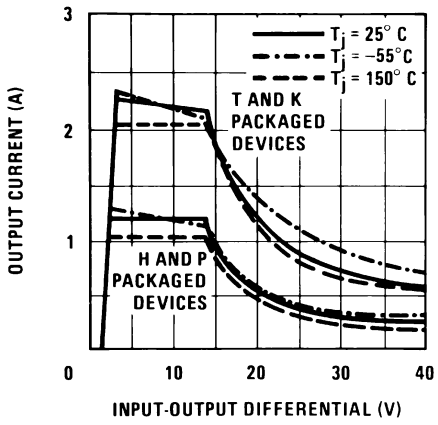


Figure 14.

Adjustment Current

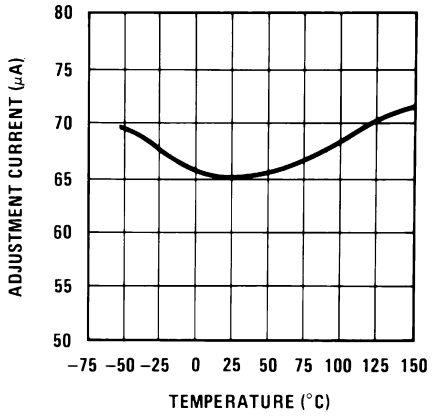


Figure 15.

Dropout Voltage

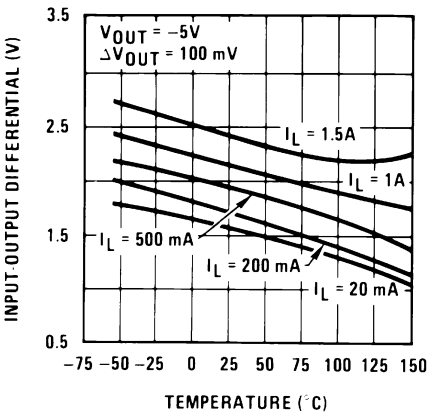


Figure 16.

Temperature Stability

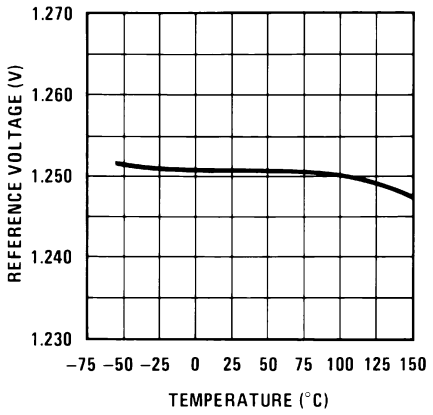


Figure 17.

Minimum Operating Current

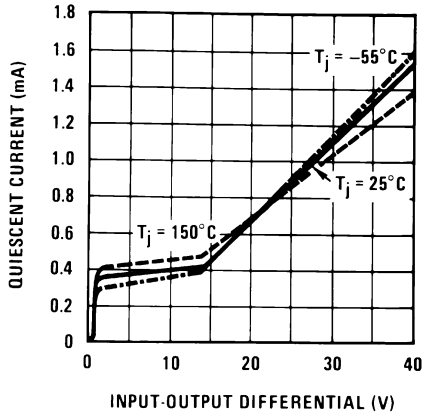


Figure 18.

Typical Performance Characteristics (continued)

(NDT & K Packages)

Ripple Rejection

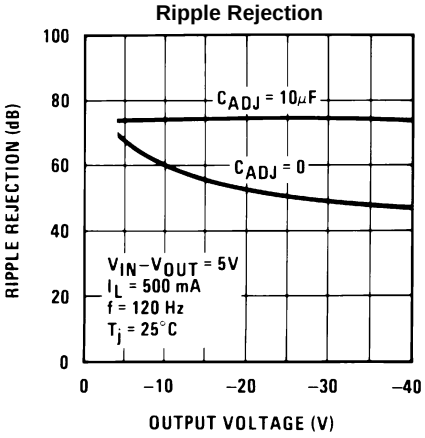


Figure 19.

Ripple Rejection

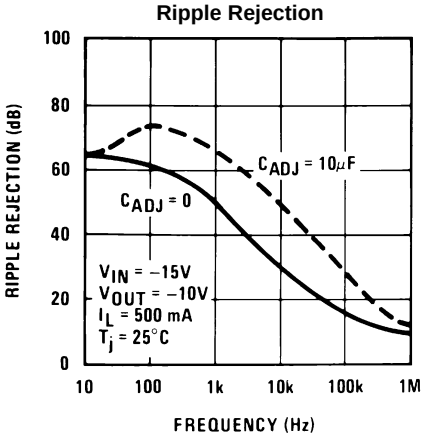


Figure 20.

Ripple Rejection

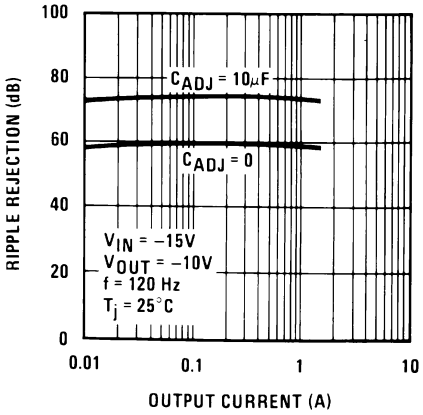


Figure 21.

Output Impedance

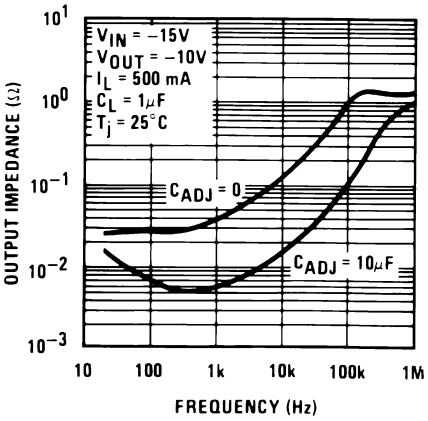


Figure 22.

Line Transient Response

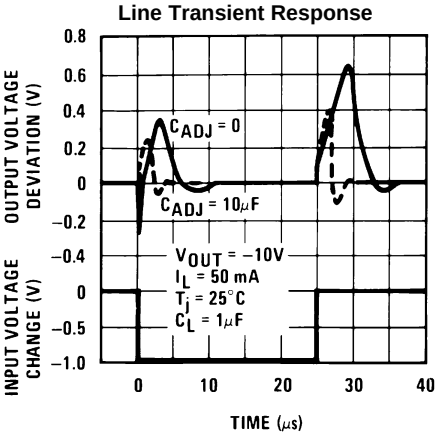


Figure 23.

Load Transient Response

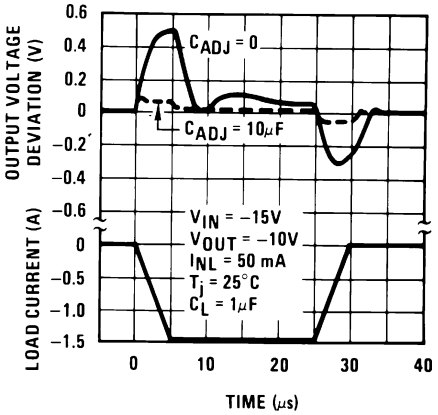


Figure 24.

REVISION HISTORY

Date Released	Revision	Section	Changes
12/08/2010	A	New Release, Corporate format	3 MDS data sheets converted into one Corp. data sheet format. MNLM137-X, Rev. 0B1, MNLM137-K Rev. 0A0, and MRLM137–X-RH Rev. 2A0. MDS data sheets will be archived.
03/16/2012	B	Ordering Information, LM137K 883 Electrical Characteristics DC Parameters., LM137H RH Electrical Characteristics DC Parameters., DC Parameters Post Radiation Limits +25 Deg. C for 701VXA., DC Parameters Post Radiation Limits +25 Deg. C for 708VXA	Ordering Info — Added new LM137H1PQMLV., For the DC Parameters of LM137K 883 and LM137 RH, widened columns to accommodate correct limits. Added to the HEADER of DC Parameters — Post Radiation Limits 5962P9951701VXA. Added the HEADER and TABLE of DC Parameters — Post Radiation Limits 5962P9951708VXA. Rev A will be archived.
04/17/2013	C		Changed layout of National Data Sheet to TI format.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM137H/883	ACTIVE	TO	NDT	3	20	TBD	Call TI	Call TI	-55 to 125	LM137H/883 Q ACO LM137H/883 Q >T	Samples
LM137K/883	ACTIVE	TO	K	2	50	TBD	Call TI	Call TI	-55 to 125	LM137K /883 Q ACO /883 Q >T	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

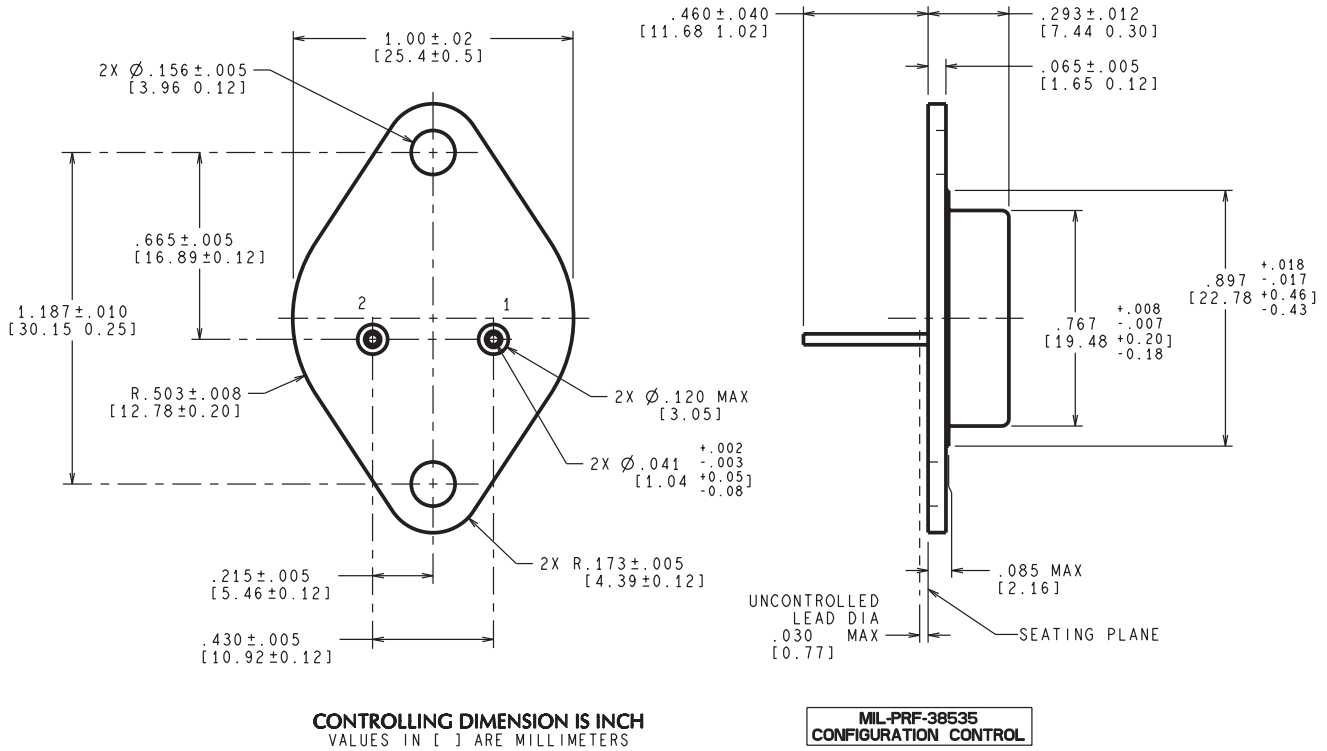
OTHER QUALIFIED VERSIONS OF LM137QML, LM137QML-SP :

- Military: LM137QML
- Space: LM137QML-SP

NOTE: Qualified Version Definitions:

- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

K0002C



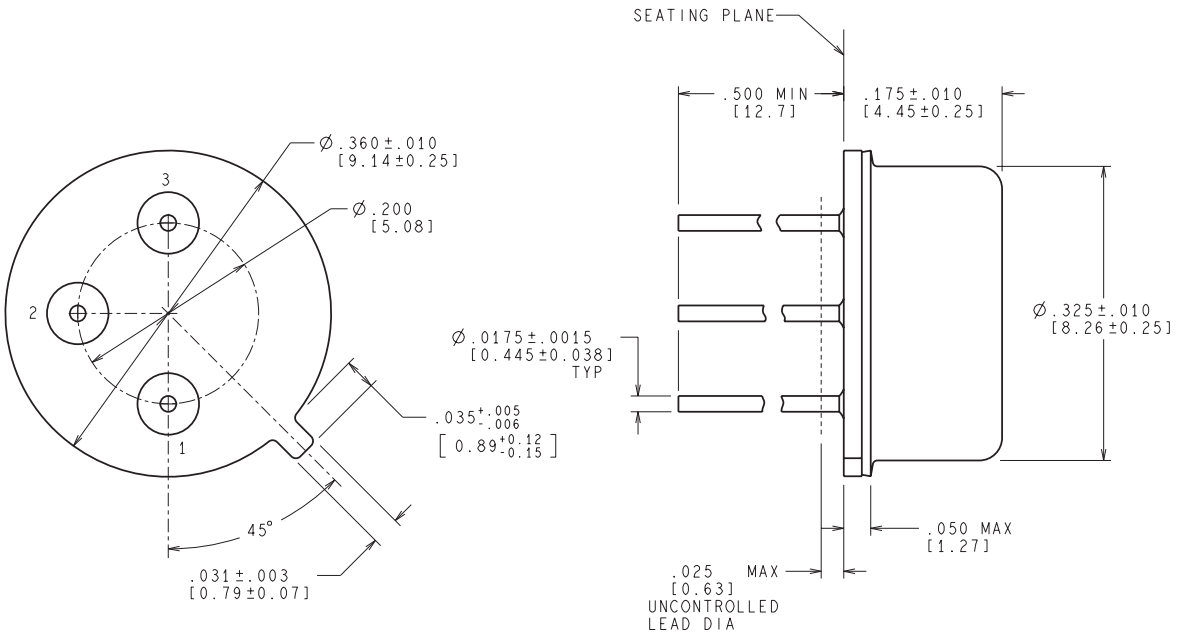
NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.

2. This drawing is subject to change without notice.

3. Leads not to be bent greater than 15º

NDT0003A



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