

## LM137QML 3-Terminal Adjustable Negative Regulators

Check for Samples: [LM137QML](#)

### FEATURES

- Output voltage adjustable from  $-37V$  to  $-1.2V$
- 1.5A output current guaranteed,  $-55^{\circ}C$  to  $+150^{\circ}C$
- 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/ $^{\circ}C$  temperature coefficient
- Temperature-independent current limit
- Internal thermal overload protection

- Standard 3-lead transistor package
- Output is short circuit protected

**Table 1. LM137 Series Packages and Power Capability**

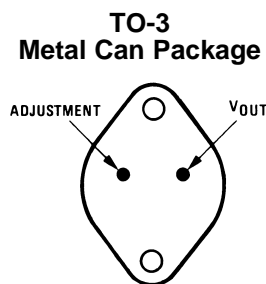
Device	Package	Rated Power Dissipation	Design Load Current
LM137	TO-3 (K)	20W	1.5A
	TO-39 (H)	2W	0.5A

### 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.

### Connection Diagram



NOTE: Case is Input

**Figure 1. Bottom View**



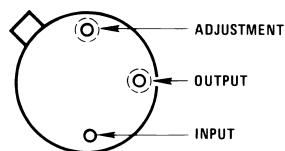
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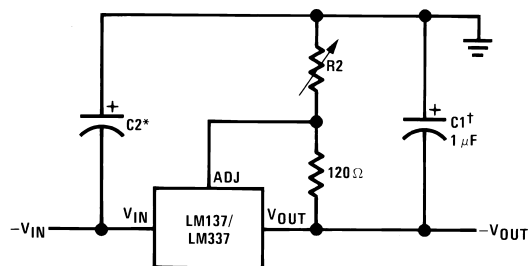
**TO-39  
Metal Can Package**



NOTE: Case Is Input

**Figure 2. Bottom View**

## Typical Applications



Full output current not available at high input-output voltages

$$-V_{OUT} = -1.25\text{V} \left( 1 + \frac{R_2}{120} \right) + (-I_{ADJ} \times R_2)$$

$^\dagger C_1 = 1\ \mu\text{F}$  solid tantalum or  $10\ \mu\text{F}$  aluminum electrolytic required for stability

$^* C_2 = 1\ \mu\text{F}$  solid tantalum is required only if regulator is more than 4" from power-supply filter capacitor

Output capacitors in the range of  $1\ \mu\text{F}$  to  $1000\ \mu\text{F}$  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 <sup>(1)</sup>

Power Dissipation <sup>(2)</sup>	Internally Limited
Input-Output Voltage Differential	40V
Operating Ambient Temperature Range	$-55^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$
Operating Junction Temperature Range	$-55^{\circ}\text{C} \leq T_J \leq +150^{\circ}\text{C}$
Storage Temperature	$-65^{\circ}\text{C} \leq T_A \leq +150^{\circ}\text{C}$
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	
$\theta_{JA}$	
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
$\theta_{JC}$	
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 <sup>(3)</sup>	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 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.
- (2) The maximum power dissipation must be derated at elevated temperatures and is dictated by  $T_{Jmax}$  (maximum junction temperature),  $\theta_{JA}$  (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 1.5K $\Omega$

## Recommended Operating Conditions

$T_A$	$-55^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$
Input Voltage Range	-41.25V to -4.25V

**Quality Conformance Inspection****Table 2. Mil-Std-883, Method 5005 — Group A<sup>(1)</sup>**

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	$-42V \leq V_{IN} \leq -4.25V$		-9.0	9.0	mV	1
		$-41.3V \leq V_{IN} \leq -4.25V$		-23	23	mV	2, 3
$R_{Load}$	Load Regulation	$5mA \leq I_L \leq 500mA$ , $V_{IN} = -6.25V$		-25	25	mV	1, 2, 3
		$5mA \leq I_L \leq 500mA$ , $V_{IN} = -14.5V$		-25	25	mV	1
		$5mA \leq I_L \leq 150mA$ , $V_{IN} = -40V$		-25	25	mV	1, 2, 3
$I_{Adj}$	Adjustment Pin Current	$I_L = 5mA$			100	$\mu A$	1, 2, 3
		$V_{IN} = -42V$			100	$\mu A$	1
		$V_{IN} = -41.3V$			100	$\mu A$	2, 3
$\Delta I_{Adj} / V_{Line}$	Adjust Pin Current Change vs. Line Voltage	$-42V \leq V_{IN} \leq -4.25V$ , $I_L = 5mA$		-5.0	5.0	$\mu A$	1
		$-41.3V \leq V_{IN} \leq -4.25V$ , $I_L = 5mA$		-5.0	5.0	$\mu A$	2, 3
$\Delta I_{Adj} / I_{Load}$	Adjust Pin Current Change vs. Load Current	$5mA \leq I_L \leq 500mA$ , $V_{IN} = -6.5V$		-5.0	5.0	$\mu A$	1, 2, 3
$\theta_R$	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
$\theta_{JC}$	Thermal Resistance		(3)		15	$^{\circ}C/W$	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  $+125^{\circ}C$  and  $-55^{\circ}C$

(2)  $-41.3V \leq V_{IN} \leq -4.25V$  at  $+125^{\circ}C$  and  $-55^{\circ}C$

(3) Guaranteed 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
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(1) Bench test, refer to (SG)RPI-3-362.

(2) Test at  $+25^{\circ}C$ , guaranteed but not tested at  $+125^{\circ}C$  and  $-55^{\circ}C$

## 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	$-42V \leq V_{IN} \leq -4.25V$		-9.0	9.0	mV	1
		$-41.3V \leq V_{IN} \leq -4.25V$		-23	23	mV	2, 3
$R_{Load}$	Load Regulation	$V_{IN} = -6.25V$ , $8mA \leq I_L \leq 1.5A$		-25	25	mV	1, 2, 3
		$V_{IN} = -14.5V$ , $8mA \leq I_L \leq 1.5A$		-25	25	mV	1
		$V_{IN} = -40V$ , $8mA \leq I_L \leq 300mA$		-25	25	mV	1
		$V_{IN} = -40V$ , $8mA \leq I_L \leq 250mA$		-25	25	mV	2, 3
$I_{Adj}$	Adjustment Pin Current				100	$\mu A$	1, 2, 3
		$V_{IN} = -42V$			100	$\mu A$	1
		$V_{IN} = -41.3V$			100	$\mu A$	2, 3
$\Delta I_{Adj} / V_{Line}$	Adjust Pin Current Change vs. Line Voltage	$-42V \leq V_{IN} \leq -4.25V$		-5.0	5.0	$\mu A$	1
		$-41.3V \leq V_{IN} \leq -4.25V$		-5.0	5.0	$\mu A$	2, 3
$\Delta I_{Adj} / I_{Load}$	Adjust Pin Current Change vs. Load Current	$8mA \leq I_L \leq 1.5A$ , $V_{IN} = -6.25V$		-5.0	5.0	$\mu A$	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
$\theta_{JC}$	Thermal Resistance		(3)		4.0	$^{\circ}C/W$	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  $+125^{\circ}C$  and  $-55^{\circ}C$

(2)  $-41.3V \leq V_{IN} \leq -4.25V$  at  $+125^{\circ}C$  and  $-55^{\circ}C$

(3) Guaranteed 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  $+25^{\circ}C$ , guaranteed but not tested at  $+125^{\circ}C$  and  $-55^{\circ}C$

## LM137H RH Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified. <sup>(1)</sup>

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
$V_{R\ Line}$	Line Regulation	$V_{IN} = -41.25V \text{ to } -4.25V, I_L = 5mA$		-9.0	9.0	mV	1
				-23	23	mV	2, 3
$V_{R\ Load}$	Load Regulation	$V_{IN} = -6.25V, I_L = 5mA \text{ to } 500mA$		-12	12	mV	1
				-24	24	mV	2, 3
		$V_{IN} = -41.25V, I_L = 5mA \text{ to } 50mA$		-6.0	6.0	mV	1
				-12	12	mV	2, 3
$V_{Rth}$	Thermal Regulation	$V_{IN} = -6.25V, I_L = 5mA \text{ to } 200mA$		-6.0	6.0	mV	1
				-12	12	mV	2, 3
$I_{Adj}$	Adjust Pin Current	$V_{IN} = -14.6V, I_L = 500mA$		-5.0	5.0	mV	1
				-5.0	5.0	mV	1
$I_{Adj}$	Adjust Pin Current	$V_{IN} = -4.25V, I_L = 5mA$		25	100	$\mu A$	1, 2, 3
		$V_{IN} = -41.25V, I_L = 5mA$		25	100	$\mu A$	1, 2, 3
$\Delta I_{Adj} / V_{Line}$	Adjust Pin Current Change vs. Line Voltage	$V_{IN} = -41.25V \text{ to } -4.25V, I_L = 5mA$		-5.0	5.0	$\mu A$	1, 2, 3
$\Delta I_{Adj} / I_{Load}$	Adjust Pin Current Change vs. Load Current	$V_{IN} = -6.25V, I_L = 5mA \text{ to } 500mA$		-5.0	5.0	$\mu A$	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	$V_{IN} = -6.25V, I_L = 5mA$	<sup>(2)</sup>	-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 guaranteed 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
$\Delta V_{IN} / \Delta V_{OUT}$	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	$\mu V_{RMS}$	9
$\Delta V_{OUT} / \Delta V_{IN}$	Line Transient Response	$V_{IN} = -6.25V$ , $V_{Pulse} = -1V$ , $I_L = 50mA$			80	mV/V	9
$\Delta V_O / \Delta I_L$	Load Transient Response	$V_{IN} = -6.25V$ , $I_L = 50mA$ , $\Delta I_L = 200mA$	(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 guaranteed 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	$\mu A$	1
		$V_{IN} = -41.25V$ , $I_L = 5mA$		-10	10	$\mu A$	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 guaranteed 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

The following conditions apply, unless otherwise specified.

(1)

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-groups
$\Delta I_{Adj} / V_{Line}$	Adjust Pin Current Change vs. Line Voltage	$V_{IN} = -41.25V$ to $-4.25V$ , $I_L = 5mA$		-20	20	$\mu A$	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 guaranteed 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

The following conditions apply, unless otherwise specified.

(1)

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	$\mu A$	1
$\Delta I_{Adj} / V_{Line}$	Adjust Pin Current Change vs. Line Voltage	$V_{IN} = -41.25V$ to $-4.25V$ , $I_L = 5mA$		-70	+20	$\mu A$	1
$V_{OUT Recovery}$	Output Voltage Recovery After Output Short Circuit Current	$V_{IN} = -4.25V$		-1.30	-1.225	V	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 guaranteed only for the conditions as specified in Mil-Std-883, Method 1019.5, Condition A.

## APPLICATION INFORMATION

## Schematic Diagram

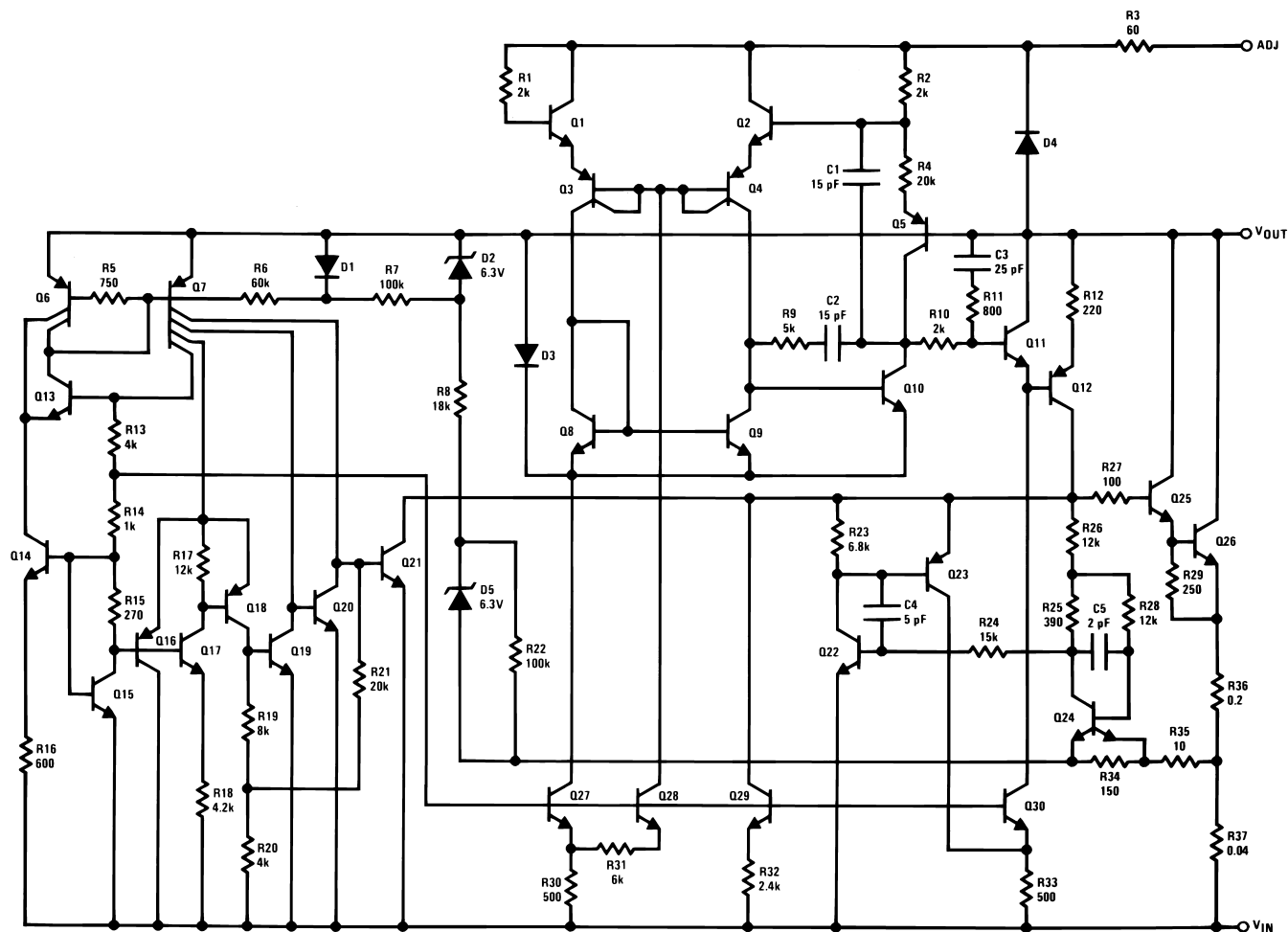
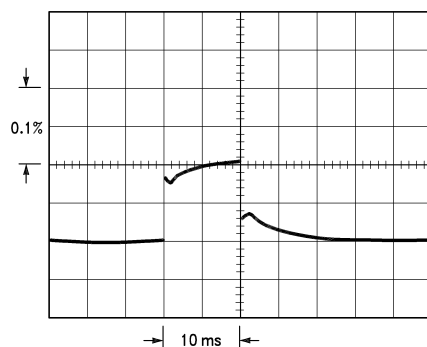


Figure 4. Schematic Diagram

## Thermal Regulation

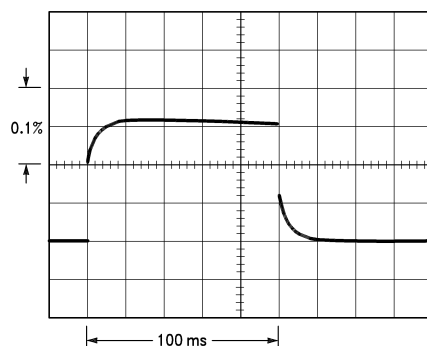
When power is dissipated in an IC, a temperature gradient occurs across the IC chip affecting the individual IC circuit components. With an IC regulator, this gradient can be especially severe since power dissipation is large. Thermal regulation is the effect of these temperature gradients on output 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,  $V_{OUT} = -10V$   
 $V_{IN} - V_{OUT} = -40V$   
 $I_L = 0A \rightarrow 0.25A \rightarrow 0A$   
 Vertical sensitivity, 5 mV/div

Figure 5.

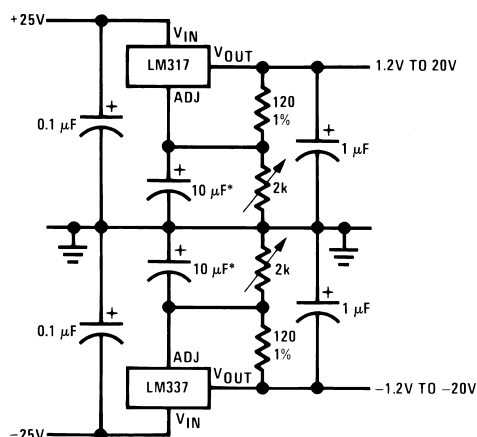
In Figure 5, a typical LM137's output drifts only 3 mV (or 0.03% of  $V_{OUT} = -10V$ ) when a 10W pulse is applied for 10 ms. This performance is thus well inside the specification limit of  $0.02\%/W \times 10W = 0.2\%$  max. When the 10W pulse is ended, the thermal regulation again shows a 3 mV step 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,  $V_{OUT} = -10V$   
 $V_{IN} - V_{OUT} = -40V$   
 $I_L = 0A \rightarrow 0.25A \rightarrow 0A$   
 Horizontal sensitivity, 20 ms/div

Figure 6.

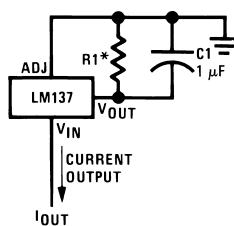
## Typical Applications



Full output current not available  
at high input-output voltages

\*The 10 μF capacitors are optional to improve ripple rejection

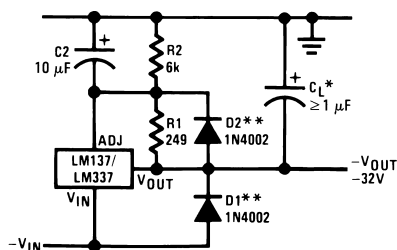
**Figure 7. Adjustable Lab Voltage Regulator**



$$I_{OUT} = \frac{1.250V}{R1}$$

\* $0.8\Omega \leq R1 \leq 120\Omega$

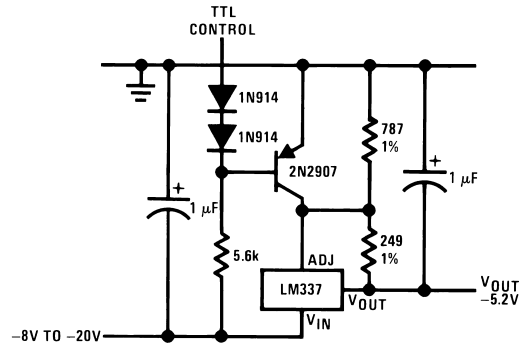
**Figure 8. Current Regulator**



\*When  $C_L$  is larger than 20 μF, D1 protects the LM137 in case the input supply is shorted

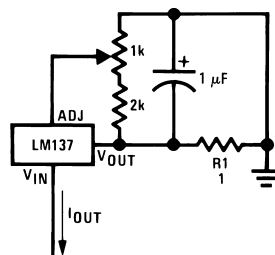
\*\*When  $C_L$  is larger than 10 μF and  $-V_{OUT}$  is larger than -25V, D2 protects the LM137 in case the output is shorted

**Figure 9. Negative Regulator with Protection Diodes**



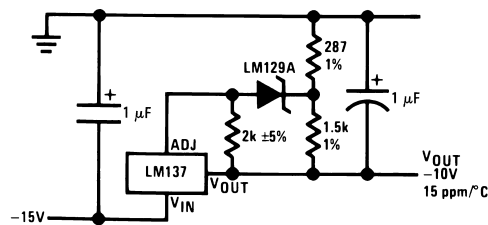
\*Minimum output  $\approx -1.3V$  when control input is low

**Figure 10. -5.2V Regulator with Electronic Shutdown\***



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

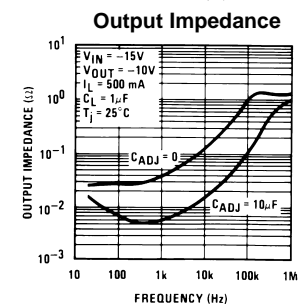
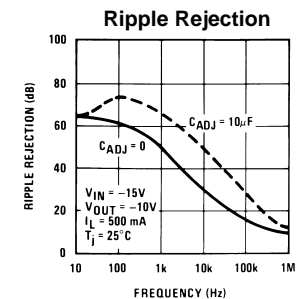
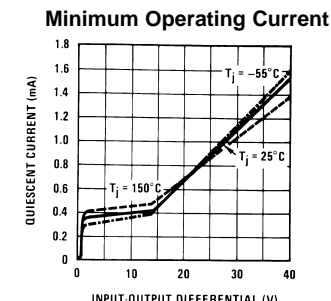
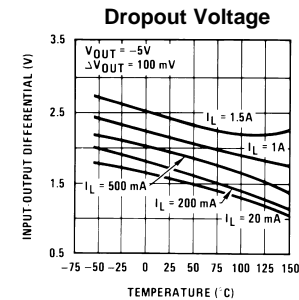
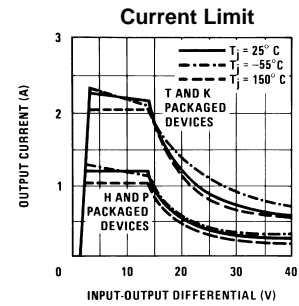
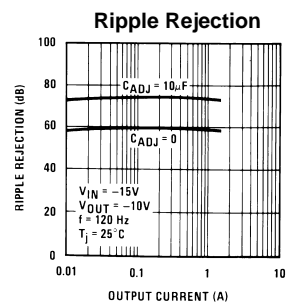
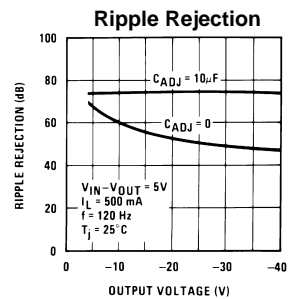
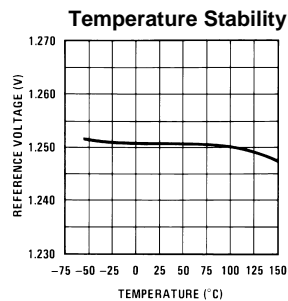
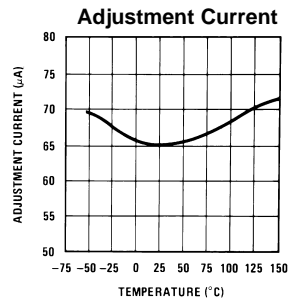
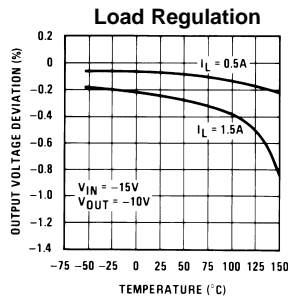
**Figure 11. Adjustable Current Regulator**



**Figure 12. High Stability -10V Regulator**

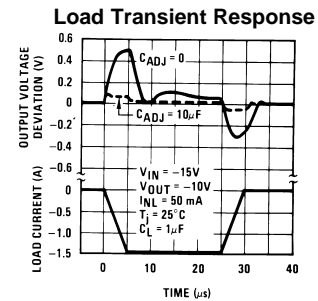
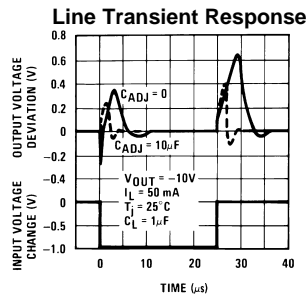
## Typical Performance Characteristics

(H &amp; K Packages)



## Typical Performance Characteristics (continued)

(H & K Packages)



## 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.

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
LM137H/883	ACTIVE	TO	NDT	3	20	TBD	POST-PLATE	Level-1-NA-UNLIM	
LM137K/883	ACTIVE	TO	K	2	50	TBD	POST-PLATE	Level-1-NA-UNLIM	

(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.

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**OTHER QUALIFIED VERSIONS OF LM137QML, LM137QML-SP :**

● Military: [LM137QML](#)

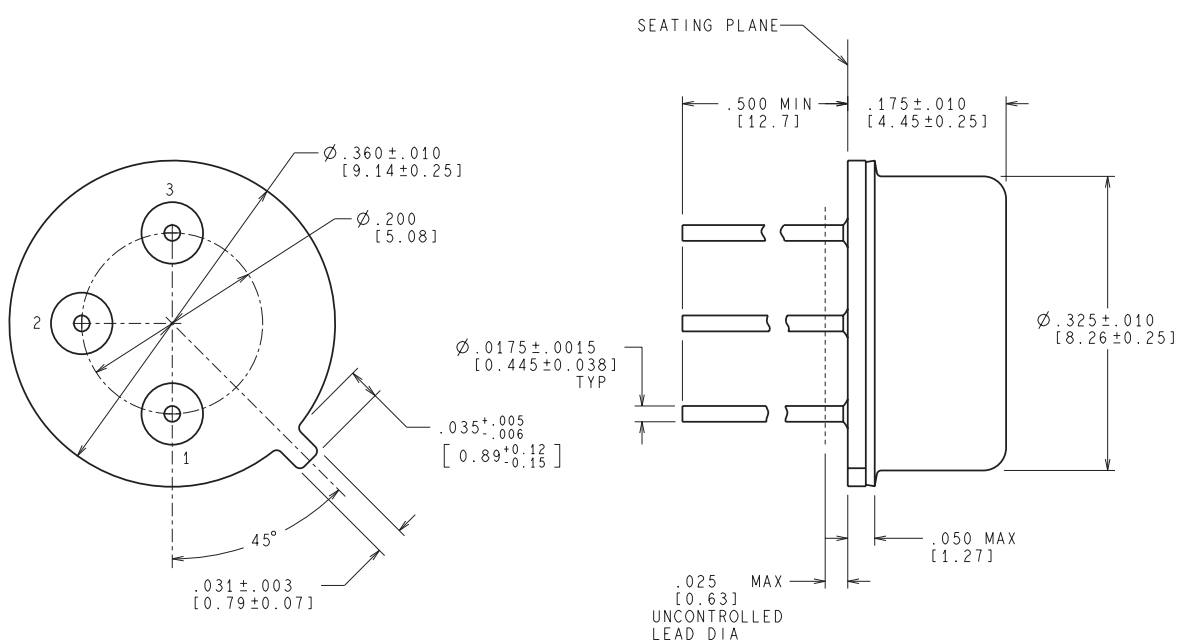
● Space: [LM137QML-SP](#)

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

NDT0003A



CONTROLLING DIMENSION IS INCH  
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MIL-PRF-38535  
CONFIGURATION CONTROL

H03A (Rev D)

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