

# LM2937

## 500 mA Low Dropout Regulator

### General Description

The LM2937 is a positive voltage regulator capable of supplying up to 500 mA of load current. The use of a PNP power transistor provides a low dropout voltage characteristic. With a load current of 500 mA the minimum input to output voltage differential required for the output to remain in regulation is typically 0.5V (1V guaranteed maximum over the full operating temperature range). Special circuitry has been incorporated to minimize the quiescent current to typically only 10 mA with a full 500 mA load current when the input to output voltage differential is greater than 3V.

The LM2937 requires an output bypass capacitor for stability. As with most low dropout regulators, the ESR of this capacitor remains a critical design parameter, but the LM2937 includes special compensation circuitry that relaxes ESR requirements. The LM2937 is stable for all ESR below 3Ω. This allows the use of low ESR chip capacitors.

Ideally suited for automotive applications, the LM2937 will protect itself and any load circuitry from reverse battery con-

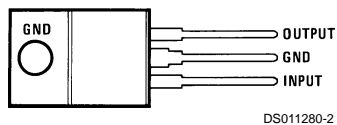
nections, two-battery jumps and up to +60V/-50V load dump transients. Familiar regulator features such as short circuit and thermal shutdown protection are also built in.

### Features

- Fully specified for operation over -40°C to +125°C
- Output current in excess of 500 mA
- Output trimmed for 5% tolerance under all operating conditions
- Typical dropout voltage of 0.5V at full rated load current
- Wide output capacitor ESR range, up to 3Ω
- Internal short circuit and thermal overload protection
- Reverse battery protection
- 60V input transient protection
- Mirror image insertion protection

### Connection Diagram and Ordering Information

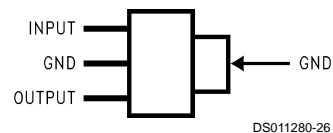
TO-220 Plastic Package



Front View

Order Number LM2937ET-5.0, LM2937ET-8.0,  
LM2937ET-10, LM2937ET-12 or LM2937ET-15  
See NS Package Number T03B

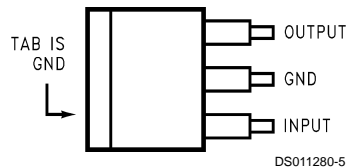
SOT-223 Plastic Package



Front View

Order Number LM2937IMP-5.0,  
LM2937IMP-8.0, LM2937IMP-10,  
LM2937IMP-12 or LM2937IMP-15  
See NS Package Number MP04A

TO-263 Surface-Mount Package



Top View

Order Number LM2937ES-5.0, LM2937ES-8.0,  
LM2937ES-10, LM2937ES-12 or LM2937ES-15  
See NS Package Number TS3B



Side View

## Connection Diagram and Ordering Information (Continued)

Temperature Range	Output Voltage					NSC Package Drawing	Package
	5.0	8.0	10	12	15		
-40°C ≤ T <sub>J</sub> ≤ 125°C	LM2937ES-5.0	LM2937ES-8.0	LM2937ES-10	LM2937ES-12	LM2937ES-15	TS3B	TO-263
	LM2937ET-5.0	LM2937ET-8.0	LM2937ET-10	LM2937ET-12	LM2937ET-15	T03B	TO-220
-40°C ≤ T <sub>J</sub> ≤ 85°C	LM2937IMP-5.0	LM2937IMP-8.0	LM2937IMP-10	LM2937IMP-12	LM2937IMP-15	MP04A	SOT-223
	LM2937IMPX-5.0	LM2937IMPX-8.0	LM2937IMPX-10	LM2937IMPX-12	LM2937IMPX-15	MP04A	SOT-223 in Tape and Reel
SOT-223 Package Markings	L71B	L72B	L73B	L74B	L75B		

The small physical size of the SOT-223 package does not allow sufficient space to provide the complete device part number. The actual devices will be labeled with the package markings shown.

**Absolute Maximum Ratings** (Note 1)

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

Input Voltage	
Continuous	26V
Transient ( $t \leq 100$ ms)	60V
Internal Power Dissipation (Note 2)	Internally Limited
Maximum Junction Temperature	150°C
Storage Temperature Range	-65°C to +150°C
TO-220 (10 seconds)	260°C

TO-263 (10 seconds)	230°C
SOT-223 (Vapor Phase, 60 seconds)	215°C
SOT-223 (Infared, 15 seconds)	220°C
ESD Susceptibility (Note 3)	2 kV

**Operating Conditions** (Note 1)

Temperature Range (Note 2)	
LM2937ET, LM2937ES	-40°C $\leq$ T <sub>J</sub> $\leq$ 125°C
LM2937IMP	-40°C $\leq$ T <sub>J</sub> $\leq$ 85°C
Maximum Input Voltage	26V

**Electrical Characteristics**

V<sub>IN</sub> = V<sub>NOM</sub> + 5V, (Note 4) I<sub>OUTmax</sub> = 500 mA for the TO-220 and TO-263 packages, I<sub>OUTmax</sub> = 400mA for the SOT-223 package, C<sub>OUT</sub> = 10  $\mu$ F unless otherwise indicated. **Boldface limits apply over the entire operating temperature range of the indicated device.**, all other specifications are for T<sub>A</sub> = T<sub>J</sub> = 25°C.

Output Voltage (V <sub>OUT</sub> )		5V		8V		10V		Units
Parameter	Conditions	Typ	Limit	Typ	Limit	Typ	Limit	
Output Voltage	5 mA $\leq$ I <sub>OUT</sub> $\leq$ I <sub>OUTmax</sub>		4.85		7.76		9.70	V(Min)
		5.00	<b>4.75</b>	8.00	<b>7.60</b>	10.00	<b>9.50</b>	V(Min)
			5.15		8.24		10.30	V(Max)
			<b>5.25</b>		<b>8.40</b>		<b>10.50</b>	V(Max)
Line Regulation	(V <sub>OUT</sub> + 2V) $\leq$ V <sub>IN</sub> $\leq$ 26V, I <sub>OUT</sub> = 5 mA	15	<b>50</b>	24	<b>80</b>	30	<b>100</b>	mV(Max)
Load Regulation	5 mA $\leq$ I <sub>OUT</sub> $\leq$ I <sub>OUTmax</sub>	5	<b>50</b>	8	<b>80</b>	10	<b>100</b>	mV(Max)
Quiescent Current	(V <sub>OUT</sub> + 2V) $\leq$ V <sub>IN</sub> $\leq$ 26V, I <sub>OUT</sub> = 5 mA	2	<b>10</b>	2	<b>10</b>	2	<b>10</b>	mA(Max)
	V <sub>IN</sub> = (V <sub>OUT</sub> + 5V), I <sub>OUT</sub> = I <sub>OUTmax</sub>	10	<b>20</b>	10	<b>20</b>	10	<b>20</b>	mA(Max)
Output Noise Voltage	10 Hz–100 kHz I <sub>OUT</sub> = 5 mA	150		240		300		$\mu$ Vrms
Long Term Stability	1000 Hrs.	20		32		40		mV
Dropout Voltage	I <sub>OUT</sub> = I <sub>OUTmax</sub>	0.5	<b>1.0</b>	0.5	<b>1.0</b>	0.5	<b>1.0</b>	V(Max)
	I <sub>OUT</sub> = 50 mA	110	<b>250</b>	110	<b>250</b>	110	<b>250</b>	mV(Max)
Short-Circuit Current		1.0	<b>0.6</b>	1.0	<b>0.6</b>	1.0	<b>0.6</b>	A(Min)
Peak Line Transient Voltage	t <sub>f</sub> < 100 ms, R <sub>L</sub> = 100 $\Omega$	75	<b>60</b>	75	<b>60</b>	75	<b>60</b>	V(Min)
Maximum Operational Input Voltage			<b>26</b>		<b>26</b>		<b>26</b>	V(Min)
Reverse DC Input Voltage	V <sub>OUT</sub> $\geq$ -0.6V, R <sub>L</sub> = 100 $\Omega$	-30	<b>-15</b>	-30	<b>-15</b>	-30	<b>-15</b>	V(Min)
Reverse Transient Input Voltage	t <sub>r</sub> < 1 ms, R <sub>L</sub> = 100 $\Omega$	-75	<b>-50</b>	-75	<b>-50</b>	-75	<b>-50</b>	V(Min)