

# UNISONIC TECHNOLOGIES CO., LTD

## LM2937

## LINEAR INTEGRATED CIRCUIT

# 500mA LOW DROPOUT VOLTAGE REGULATOR

#### DESCRIPTION

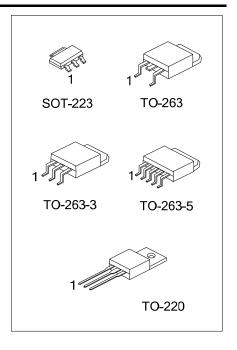
The UTC LM2937 is a positive voltage regulator capable of supplying up to 500mA of load current. The use of a PNP power transistor provides a low dropout voltage characteristic. With a load current of 500mA the minimum input to output voltage differential required for the output to remain in regulation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

The UTC 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 UTC LM2937 is stable for all ESR below 3Ω. This allows the use of low ESR chip capacitors.

Ideally suited for automotive applications, the UTC LM2937 will protect itself and any load circuitry from reverse battery connections. 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**

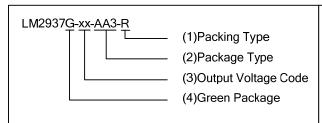
- \* Fully specified for operation over -40°C~ +125°C
- \* Output current in excess of 500mA
- \* Output trimmed for 5% tolerance under all operating conditions
- \* Typical dropout voltage of 0.5V at full rated load current
- \* Wide output capacitor ESR range, up to 3Ω
- \* Reverse battery protection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



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### ■ ORDERING INFORMATION

Order I	Number	Dookogo	Dooking
Lead Free	Halogen Free	Package	Packing
-	LM2937G-xx-AA3-R	SOT-223	Tape Reel
LM2937L-xx-TA3-T	LM2937G-xx-TA3-T	TO-220	Tube
LM2937L-xx-TQ2-R	LM2937G-xx-TQ2-R	TO-263	Tape Reel
LM2937L-xx-TQ2-T	LM2937G-xx-TQ2-T	TO-263	Tube
LM2937L-xx-TQ3-R	LM2937G-xx-TQ3-R	TO-263-3	Tape Reel
LM2937L-xx-TQ3-T	LM2937G-xx-TQ3-T	TO-263-3	Tube
LM2937L-xx-TQ5-R	LM2937G-xx-TQ5-R	5-R TO-263-5 Tape	
LM2937L-xx-TQ5-T	LM2937G-xx-TQ5-T	TO-263-5	Tube



- (1) T: Tube, R: Tape Reel
- (2) AA3: SOT-223, TA3: TO-220, TQ2: TO-263

TQ3: TO-263-3, TQ5: TO-263-5

- (3) xx: refer to Marking Information
- (4) G: Halogen Free and Lead Free, L: Lead Free

## ■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-223		Voltage Code
TO-220 TO-263 TO-263-3	33 :3.3V 50 :5.0V 80 :8.0V 10 :10V 12 :12V 15 :15V	UTC L: Lead Free  Lot Code UDIDIDIDIDIDIDIDIDIDIDIDIDIDIDIDIDIDIDI
TO-263-5		UTC Li Lead Free G: Halogen Free  Voltage Code  1 2 3 4 5  L: Lead Free G: Halogen Free Date Code

## ■ PIN CONFIGURATION

PIN NO.		
SOT-223/TO-220 TO-263/TO-263-3	TO-263-5	PIN NAME
1	4	Input
2	3	GND
3	5	Output
-	1	N/C
-	2	ON/OFF

## ABSOLUTE MAXIMUM RATINGS (Note 1)

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	$V_{IN}$	26	V
Power Dissipation(Note 2)	$P_D$	Internally limited	
Maximum Junction Temperature	TJ	+150	°C
Storage Temperature	T <sub>STG</sub>	-40 ~ +150	°C

- Notes: 1. Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Electrical Specifications do not apply when operating the device outside of its rated Operating Conditions.
  - 2. The maximum allowable power dissipation at any ambient temperature is  $P_{MAX} = (125-T_A)/\theta_{JA}$ , where 125 is the maximum junction temperature for operation,  $T_A$  is the ambient temperature, and  $\theta_{JA}$  is the junction to ambient thermal resistance. If this dissipation is exceeded, the die temperature will rise above 125°C and the electrical specifications do not apply. If the die temperature rises above 150°C, the LM2937 will go into thermal shutdown.

### ■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
	SOT-223		174	
Junction to Ambient	TO-220	$\theta_{JA}$	65	
	TO-263/ TO-263-5	73		°C/M
	SOT-223		15	°C/W
Junction to Case	TO-220	$\theta_{JC}$	3	
	TO-263/ TO-263-5		4	

#### ELECTRICAL CHARACTERISTICS

(V<sub>IN</sub>=V<sub>NOM</sub>+5V, I<sub>OUT</sub>=500mA, C<sub>OUT</sub>=10μF, T<sub>J</sub>=Ta=25°C, unless otherwise specified.)

### For LM2937-3.3V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V <sub>OUT</sub>	5mA≤I <sub>OUT</sub> ≤500mA	3.21	3.30	3.39	V
Line Regulation	$\triangle V_{OUT}$	V <sub>OUT</sub> +2V≤V <sub>IN</sub> ≤26V, I <sub>OUT</sub> =5mA		9	30	mV
Load Regulation	$\triangle V_{OUT}$	5mA≤I <sub>OUT</sub> ≤500mA		3	30	mV
Quiescent Current		(V <sub>O</sub> +2V)≤V <sub>IN</sub> ≤26V, I <sub>OUT</sub> =5mA		2	10	mA
Quiescent Current	ΙQ	V <sub>IN</sub> = V <sub>OUT</sub> +5V, I <sub>OUT</sub> =500mA		10	20	mA
Output Noise Voltage	eN	10Hz-100kHz, I <sub>OUT</sub> =5mA		100		μVrms
Long Term Stability		1000Hrs		12		mV
Dronout Voltage	\/	I <sub>OUT</sub> =500mA		0.5	1.0	V
Dropout Voltage	$V_D$	I <sub>OUT</sub> =50mA		110	250	mV
Short Circuit Current	I <sub>SC</sub>		0.6	1.0		Α
Peak Line Transient Voltage	T <sub>IN</sub>	t <sub>F</sub> ≤100ms, R <sub>L</sub> =100Ω	60	75		V
Reverse DC Input Voltage	$V_{RIN}$	V <sub>OUT</sub> ≥-0.6V, R <sub>L</sub> =100Ω	-15	-30		V
Reverse Transient Input Voltage	$V_{TRRI}$	$t_F$ <1ms, $R_L$ =100 $\Omega$	-50	-75		V

## ■ ELECTRICAL CHARACTERISTICS (Cont.)

### For LM2937-5.0V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	5mA≤I <sub>OUT</sub> ≤500mA	4.85	5.00	5.15	V
Line Regulation	$ riangle V_OUT$	V <sub>OUT</sub> +2V≤V <sub>IN</sub> ≤26V, I <sub>OUT</sub> =5mA		15	50	mV
Load Regulation	$\triangle V_{OUT}$	5mA≤I <sub>OUT</sub> ≤500mA		5	50	mV
Outro and Outro		(V <sub>OUT</sub> +2V)≤V <sub>IN</sub> ≤26V, I <sub>OUT</sub> =5mA		2	10	mA
Quiescent Current	IQ	V <sub>IN</sub> = V <sub>OUT</sub> +5V, I <sub>OUT</sub> =500mA		10	20	mA
Output Noise Voltage	eN	10Hz-100kHz, I <sub>OUT</sub> =5mA		150		μVrms
Long Term Stability		1000Hrs		20		mV
Daniel A Vellenie		I <sub>OUT</sub> =500mA		0.5	1.0	V
Dropout Voltage	$V_D$	I <sub>OUT</sub> =50mA		110	250	mV
Short Circuit Current	I <sub>SC</sub>		0.6	1.0		Α
Peak Line Transient Voltage	T <sub>IN</sub>	t <sub>F</sub> ≤100ms, R <sub>L</sub> =100Ω	60	75		V
Reverse DC Input Voltage	$V_{RIN}$	V <sub>OUT</sub> ≥-0.6V, R <sub>L</sub> =100Ω	-15	-30		V
Reverse Transient Input Voltage	$V_{TRRI}$	$t_F$ <1ms, R <sub>L</sub> =100 $\Omega$	-50	-75		V

## For LM2937-8.0V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V <sub>OUT</sub>	5mA≤I <sub>OUT</sub> ≤500mA	7.76	8.00	8.24	V
Line Regulation	$\triangle V_{OUT}$	V <sub>OUT</sub> +2V≤V <sub>IN</sub> ≤26V, I <sub>OUT</sub> =5mA		24	80	mV
Load Regulation	$\triangle V_{OUT}$	5mA≤I <sub>OUT</sub> ≤500mA		8	80	mV
Quiaccent Current		$(V_{OUT}+2V) \le V_{IN} \le 26V, I_{OUT}=5mA$		2	10	mA
Quiescent Current	lQ	V <sub>IN</sub> = Vo+5V, I <sub>OUT</sub> =500mA		10	20	mA
Output Noise Voltage	eN	10Hz-100kHz, I <sub>OUT</sub> =5mA		240		μVrms
Long Term Stability		1000Hrs		32		mV
Draw and Maltage	V <sub>D</sub>	I <sub>OUT</sub> =500mA		0.5	1.0	V
Dropout Voltage		I <sub>OUT</sub> =50mA		110	250	mV
Short Circuit Current	I <sub>SC</sub>		0.6	1.0		Α
Peak Line Transient Voltage	T <sub>IN</sub>	t <sub>F</sub> ≤100ms, R <sub>L</sub> =100Ω	60	75		V
Reverse DC Input Voltage	$V_{RIN}$	V <sub>OUT</sub> ≥-0.6V, R <sub>L</sub> =100Ω	-15	-30		V
Reverse Transient Input Voltage	$V_{TRRI}$	$t_F$ <1ms, $R_L$ =100 $\Omega$	-50	-75		V

## For LM2937-10.0V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	5mA≤l <sub>OUT</sub> ≤500mA	9.70	10.00	10.30	V
Line Regulation	$\triangle V_{OUT}$	V <sub>OUT</sub> +2V≤V <sub>IN</sub> ≤26V, I <sub>OUT</sub> =5mA		30	100	mV
Load Regulation	$\triangle V_{OUT}$	5mA≤l <sub>OUT</sub> ≤500mA		10	100	mV
Out and Out of the Control of the Co		$(V_{OUT}+2V) \le V_{IN} \le 26V, I_{OUT}=5mA$		2	10	mA
Quiescent Current	In.	V <sub>IN</sub> = V <sub>OUT</sub> +5V, I <sub>OUT</sub> =500mA		10	20	mA
Output Noise Voltage	eN	10Hz-100kHz, I <sub>OUT</sub> =5mA		300		μVrms
Long Term Stability		1000Hrs		40		mV
Dran aut Valtaga	V <sub>D</sub>	I <sub>OUT</sub> =500mA		0.5	1.0	V
Dropout Voltage		I <sub>OUT</sub> =50mA		110	250	mV
Short Circuit Current	I <sub>SC</sub>		0.6	1.0		Α
Peak Line Transient Voltage	$T_IN$	t <sub>F</sub> ≤100ms ,R <sub>L</sub> =100Ω	60	75		V
Reverse DC Input Voltage	$V_{RIN}$	V <sub>OUT</sub> ≥-0.6V ,R <sub>L</sub> =100Ω	-15	-30		V
Reverse Transient Input Voltage	$V_{TRRI}$	$t_F$ <1ms ,R <sub>L</sub> =100 $\Omega$	-50	-75		V

## ■ ELECTRICAL CHARACTERISTICS (Cont.)

## For LM2937-12.0V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	5mA≤I <sub>OUT</sub> ≤500mA	11.64	12.00	12.36	V
Line Regulation	$\triangle V_{OUT}$	V <sub>OUT</sub> +2V≤V <sub>IN</sub> ≤26V, I <sub>OUT</sub> =5mA		36	120	mV
Load Regulation	$\triangle V_{OUT}$	5mA≤I <sub>OUT</sub> ≤500mA		12	120	mV
Out and a second Comment		$(V_{OUT}+2V) \le V_{IN} \le 26V, I_{OUT}=5mA$		2	10	mA
Quiescent Current	In.	V <sub>IN</sub> = V <sub>OUT</sub> +5V, I <sub>OUT</sub> =500mA		10	20	mA
Output Noise Voltage	eN	10Hz-100kHz, I <sub>OUT</sub> =5mA		360		μVrms
Long Term Stability		1000Hrs		44		mV
Danie and Maller and	I Vn	I <sub>OUT</sub> =500mA		0.5	1.0	V
Dropout Voltage		I <sub>OUT</sub> =50mA		110	250	mV
Short Circuit Current	I <sub>SC</sub>		0.6	1.0		Α
Peak Line Transient Voltage	$T_IN$	t <sub>F</sub> ≤100ms, R <sub>L</sub> =100Ω	60	75		V
Reverse DC Input Voltage	$V_{RIN}$	V <sub>OUT</sub> ≥-0.6V, R <sub>L</sub> =100Ω	-15	-30		V
Reverse Transient Input Voltage	$V_{TRRI}$	$t_F$ <1ms, $R_L$ =100 $\Omega$	-50	-75		V

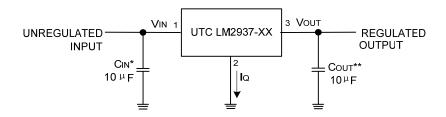
## For LM2937-15.0V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	5mA≤I <sub>OUT</sub> ≤500mA	14.55	15.00	15.45	V
Line Regulation	$ riangle V_OUT$	V <sub>OUT</sub> +2V≤V <sub>IN</sub> ≤26V, I <sub>OUT</sub> =5mA		45	150	mV
Load Regulation	$ riangle V_OUT$	5mA≤I <sub>OUT</sub> ≤500mA		15	150	mV
Outroport Compant	,	$(V_{OUT}+2V) \le V_{IN} \le 26V, I_{OUT}=5mA$		2	10	mA
Quiescent Current	I	V <sub>IN</sub> = V <sub>OUT</sub> +5V, I <sub>OUT</sub> =500mA		10	20	mA
Output Noise Voltage	eN	10Hz-100kHz, I <sub>OUT</sub> =5mA		450		μVrms
Long Term Stability		1000Hrs		56		mV
Draw and Maltage	l Vn	I <sub>OUT</sub> =500mA		0.5	1.0	V
Dropout Voltage		I <sub>OUT</sub> =50mA		110	250	mV
Short Circuit Current	I <sub>SC</sub>		0.6	1.0		Α
Peak Line Transient Voltage	T <sub>IN</sub>	t <sub>F</sub> ≤100ms, R <sub>L</sub> =100Ω	60	75		V
Reverse DC Input Voltage	$V_{RIN}$	V <sub>OUT</sub> ≥-0.6V, R <sub>L</sub> =100Ω	-15	-30		V
Reverse Transient Input Voltage	$V_{TRRI}$	$t_F$ <1ms, $R_L$ =100 $\Omega$	-50	-75		V

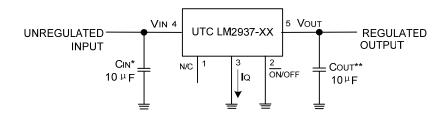
## ■ ON/OFF CONTROL (For 5 pins only)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
ON/OFF Threshold Voltage ON	$V_{ON}$	I <sub>OUT</sub> ≦ 0.5A			8.0	<b>V</b>
ON/OFF Threshold Voltage OFF	$V_{OFF}$	$I_{OUT} \leq 0.5A$	2.0			V
ON/OFF Threshold Current	I <sub>ON/OFF</sub>	V <sub>ON/OFF</sub> =2.0V, I <sub>OUT</sub> =0.5A		50	100	μ <b>А</b>

## ■ TYPICAL APPLICATION



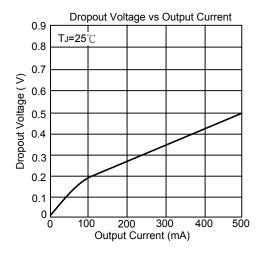
## ■ ON/OFF CONTROL APPLICATION

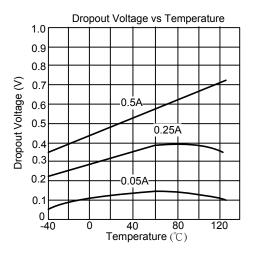


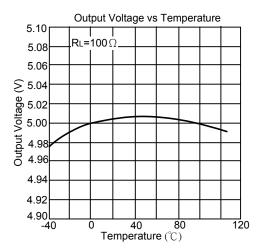
<sup>\*</sup> Required if the regulator is located more than 3 inches from the power supply filter capacitors.

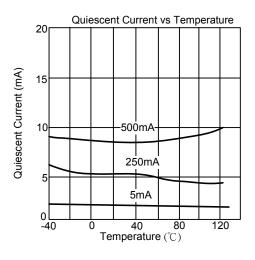
<sup>\*\*</sup>Required for stability.  $C_{OUT}$  must be at least  $10\mu F$  (over the full expected operating temperature range) and located as close as possible to the regulator. The equivalent series resistance, ESR, of this capacitor may be as high as  $3\Omega$ .

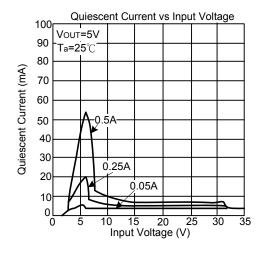
## ■ TYPICAL CHARACTERISTICS

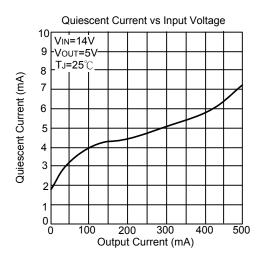




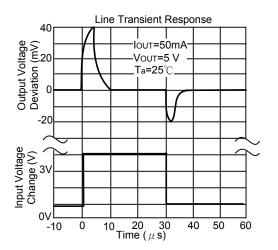


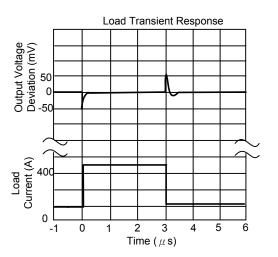


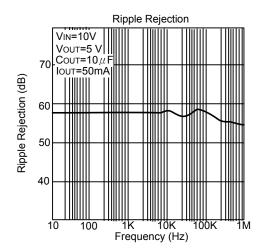


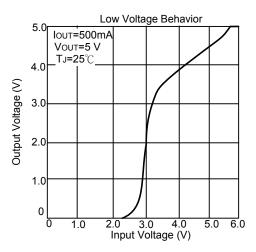


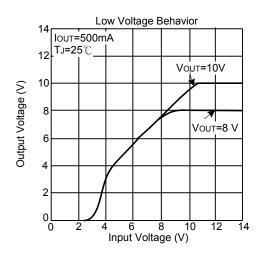
■ TYPICAL CHARACTERISTICS(Cont.)

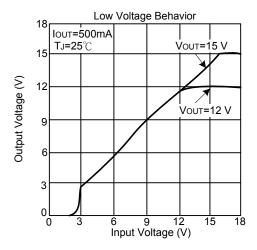




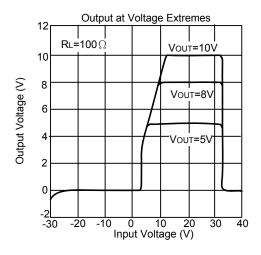


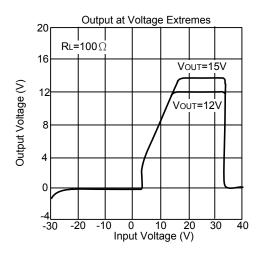


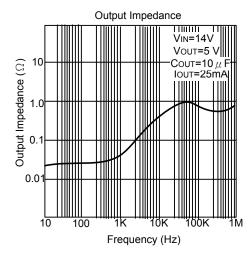


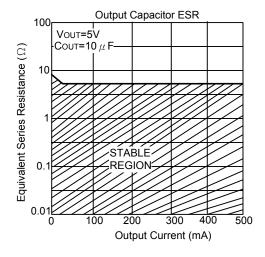


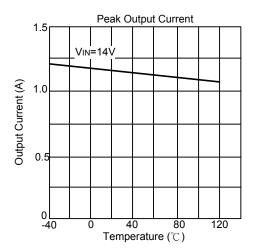
■ TYPICAL CHARACTERISTICS(Cont.)











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