

FEATURES

- Output voltage $5V \pm 2\%$
- Very low current consumption
- Power-on and undervoltage reset
- Reset low down to $V_Q = 1V$
- Very Low-drop voltage
- Short-circuit-proof
- Reverse polarity proof
- Suitable for use in automotive electronics

DESCRIPTION

The LM2931C is a monolithic integrated low-drop voltage regulator in a 5 pin TO-18 package. An input voltage up to 45 V is regulated to $V_Q = 5.0V$. The IC is able to drive loads up to 450 mA and is short-circuit proof. At over temperature the LM2931C is disabled by the incorporated temperature protection. A reset signal is generated for an output voltage V_Q of typ. 4.65 V. The delay time can be programmed by the external delay capacitor.

DIMENSIONING Information on External Components

The input capacitor C_I is necessary for compensating line influences. The output capacitor C_Q is necessary for the stability of the regulation circuit. Stability is guaranteed at values $C_Q \geq 22 \mu F$ and an ESR of $\leq 5 \Omega$ within the operating temperature range.

Circuit Description

The control amplifier compares a reference voltage to a voltage that is proportional to the output voltage and drives the base of the series transistor via a buffer. Saturation control as a function of the load current prevents any oversaturation of the power element. The IC also incorporates a number of internal circuits for protection against:

- Overload
- Over-temperature
- Reverse polarity

PIN CONFIGURATION
(top view)

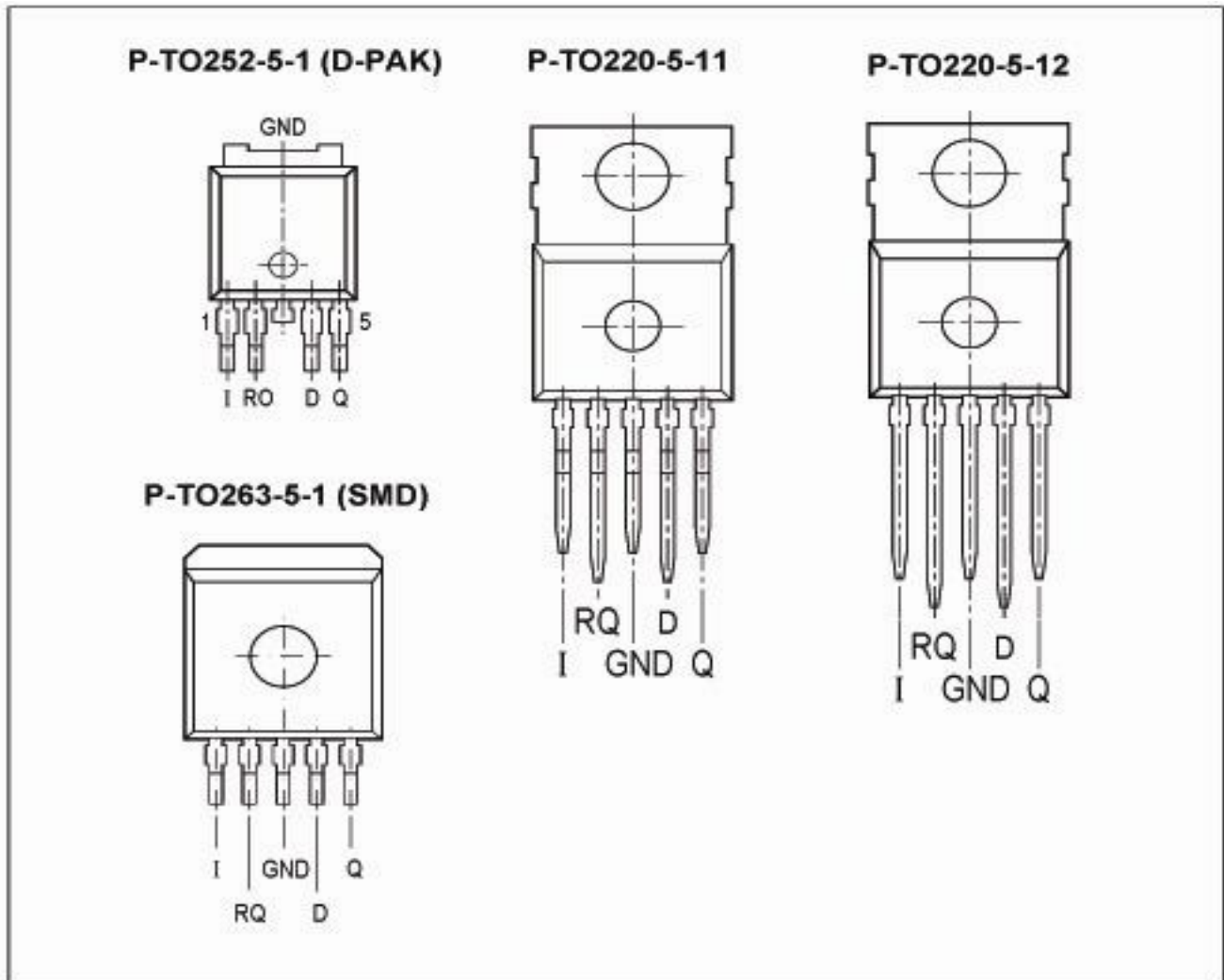


Figure 1.

Pin Definitions and Functions

Pin No	Symbol	Function
1	I	Input; block to ground directly at the IC with a ceramic capacitor
2	RQ	Reset Output; open collector output
3	GND	Ground; Pin 3 internally connected to heatsink
4	D	Reset Delay; connected capacitor to GND for setting delay time
5	Q	Output; block to ground with a $\geq 22 \mu\text{F}$ capacitor, $\text{ESR} < 5 \Omega$ at 10 kHz

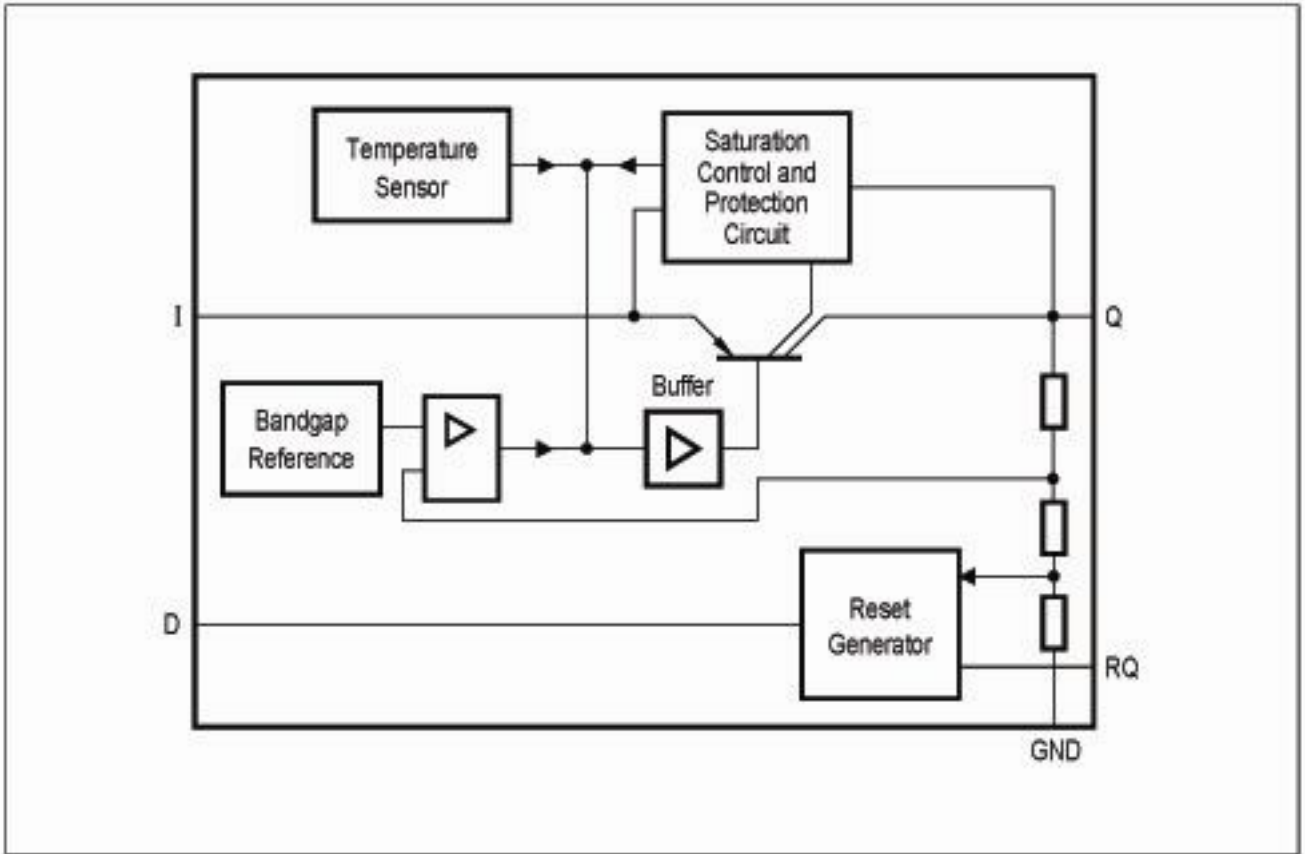


Figure 2.
Block Diagram

ABSOLUTE MAXIMUM RATINGS

$T_j = -40$ to $150\text{ }^\circ\text{C}$

Parameter	Symbol	Limit	Values	Unit	Test Condition
		min	max		
Voltage Regulator					
Input					
Voltage	V_i	- 42	45	V	-
Current	I_i	-	-	-	Internally limited
Output					
Voltage	V_o	- 1.0	16	V	-
Current	I_o	-			Internally limited
Reset Output					
Voltage	V_{RO}	- 0.3	25	V	-
Current	I_{RO}	- 5	5	mA	-
Reset Delay					
Voltage	V_D	- 0.3	7	V	-
Current	I_D	- 2	2	mA	-
Temperature					
Junction temperature	T_j	-	150	$^\circ\text{C}$	-
Storage temperature	T_{stg}	- 50	150	$^\circ\text{C}$	-

Note: Maximum ratings are absolute ratings; exceeding any one of these values may cause irreversible damage to the integrated circuit.

OPERATING RANGE

Parameter	Symbol	Limit	Values	Unit	Remarks
		min	max		
Input voltage	V_i	5.5	42	V	-
Junction temperature	T_j	- 40	150	$^\circ\text{C}$	-

CHARACTERISTICS

$V_i = 13.5\text{ V}; -40\text{ }^\circ\text{C} < T_J < 150\text{ }^\circ\text{C}$ (unless otherwise specified)

Parameter	Symbol	Limit Values			Unit	Measuring Condition
		min	typ	max		
Output						
Output voltage	V_Q	4.9	5.0	5.1	V	$5\text{ mA} < I_Q < 400\text{ mA}$ $6\text{ V} < V_I < 40\text{ V}$
Output current limitation ¹⁾	I_Q	450	700	-	mA	-
Current consumption; $I_q = I_I - I_Q$	I_q	-	150	200	μA	$I_Q = 1\text{ mA}$ $T_I = 25\text{ }^\circ\text{C}$
Current consumption; $I_q = I_I - I_Q$	I_q	-	150	220	μA	$I_Q = 1\text{ mA}$ $T_I \leq 85\text{ }^\circ\text{C}$
Current consumption; $I_q = I_I - I_Q$	I_q I_q	-	5 12	10 22	mA	$I_Q = 250\text{ mA}$ $I_Q = 400\text{ mA}$
Drop voltage ¹⁾	V_{dr}	-	250	500	mV	$I_Q = 300\text{ mA}$ $V_{dr} = V_I - V_Q$
Load regulation	ΔV_Q	-	15	30	mV	$I_Q = 5\text{ mA to } 400\text{ mA}$
Line regulation	ΔV_Q	-15	5	15	mV	$\Delta V_I = 8\text{ V to } 32\text{ V}$ $I_Q = 5\text{ mA}$

CHARACTERISTICS (cont' d)

$V_i = 13.5\text{ V}; -40\text{ }^\circ\text{C} < T_J < 150\text{ }^\circ\text{C}$ (unless otherwise specified)

Parameter	Symbol	Limit Values			Unit	Measuring Condition
		min	typ	max		
Power supply ripple rejection	PSRR	-	60	-	dB	$F_r = 100\text{ Hz}$ $V_r = 0.5\text{ Vpp}$
Temperature output Voltage drift	dV_Q/dT	-	0.5	-	mV/K	-
Reset Timing D and Output RQ						
Reset switching threshold	V_{RT}	4.5	4.65	4.8	V	-
Reset output low voltage	V_{RQL}	-	0.2	0.4	V	$R_{ext} \geq 5\Omega$, $V_Q > 1\text{ V}$
Reset output leakage current	I_{RQH}	-	0	2	μA	$V_{RQH} > 4.5\text{ V}$
Reset charging current	I_d	3	6	9	μA	$V_D = 1\text{ V}$
Upper timing threshold	V_{DU}	1.5	1.8	2.2	V	-
Lower timing threshold	V_{DL}	0.2	0.4	0.7	V	-
Reset delay time	T_D	10	16	22	ms	$C_D = 47\text{ nF}$
Reset reaction time	T_{RR}	-	0.5	2	μs	$C_D = 47\text{ nF}$

1) Measured when the output voltage V_Q has dropped 100 mV from the nominal value obtained at $V_i = 13.5\text{ V}$

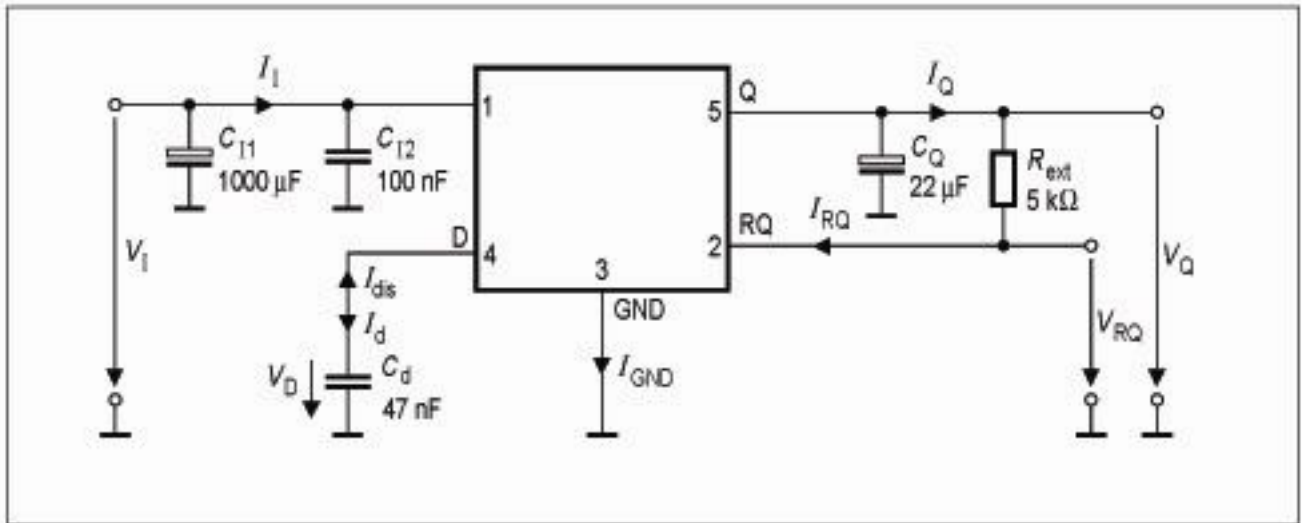


Figure 3. Test Circuit

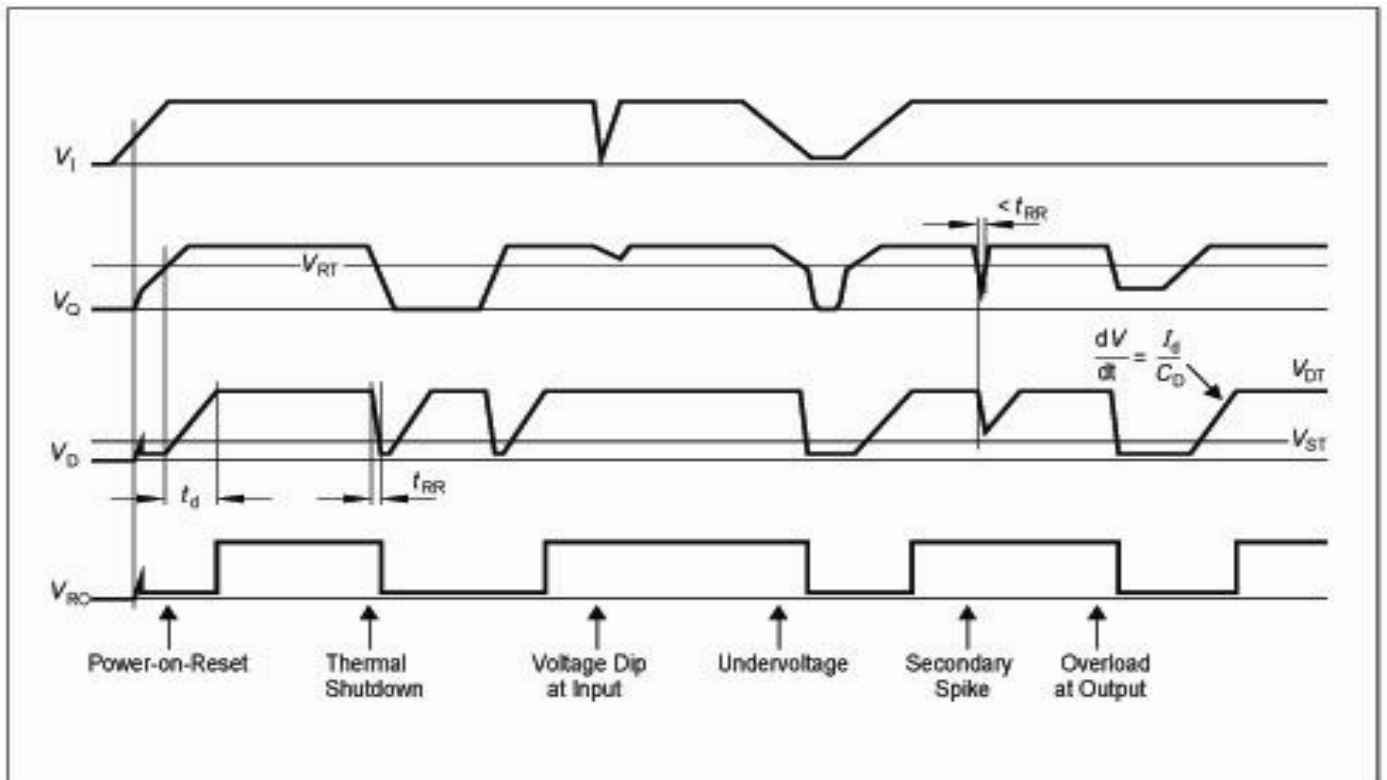
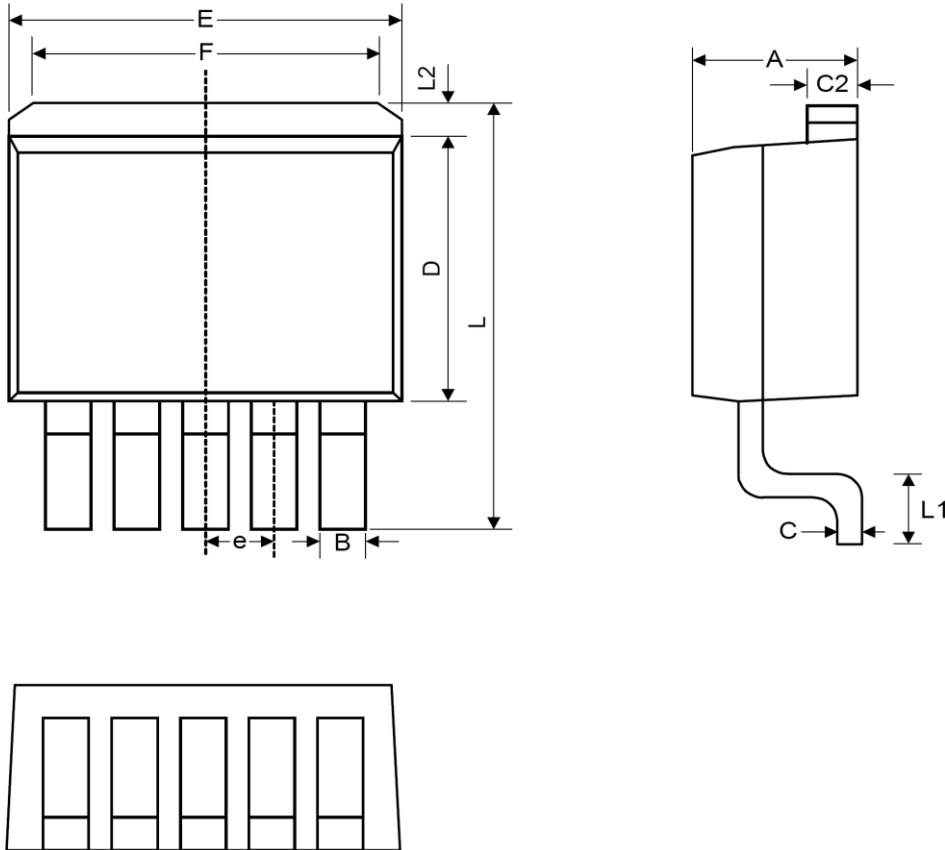


Figure 4 Reset Timing

TO-263-5L



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	4.07	4.46	4.85	0.160	0.176	0.191
B	0.66	0.84	1.02	0.026	0.033	0.040
C	0.36	0.50	0.64	0.014	0.020	0.025
C2	1.14	1.27	1.40	0.045	0.050	0.055
D	8.65	9.15	9.65	0.341	0.360	0.380
E	9.78	10.16	10.54	0.385	0.400	0.415
e	1.57	1.71	1.85	0.062	0.068	0.073
F	6.60	6.86	7.11	0.260	0.270	0.280
L	14.61	15.24	15.88	0.575	0.600	0.625
L1	2.29	2.54	2.79	0.090	0.100	0.110
L2	-	-	2.92	-	-	0.115