

5-V Low-Drop Fixed Voltage Regulator

ILE4270

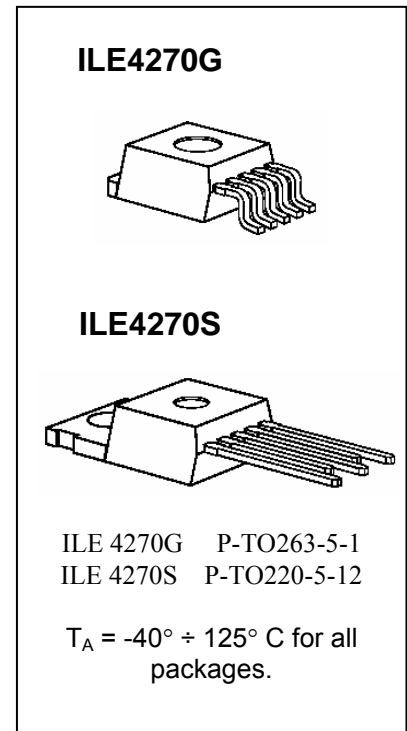
Functional Description

This device is a 5-V low-drop fixed-voltage regulator. The maximum input voltage is 42 V (65 V, ≤ 400 ms). Up to an input voltage of 26 V and for an output current up to 550 mA it regulates the output voltage within a 2 % accuracy. The short circuit protection limits the output current of more than 650 mA.

The device incorporates over voltage protection and temperature protection that disables the circuit at unpermissibly high temperatures.

Features

- Output voltage tolerance $\leq \pm 2$ %
- Low-drop voltage
- Integrated overtemperature protection
- Reverse polarity protection
- Input voltage up to 42 V
- Overvoltage protection up to 65 V (≤ 400 ms)
- Short-circuit proof
- Suitable for use in automotive electronics
- Wide temperature range
- Adjustable reset time
- ESD protection > 4000 V



Application Description

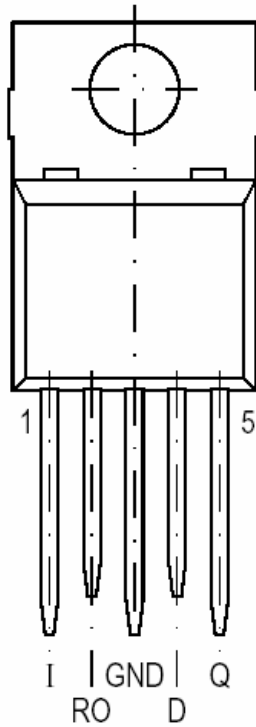
The IC regulates an input voltage in the range of $5.5 \text{ V} < V_I < 36 \text{ V}$ to $V_{Qnom} = 5.0 \text{ V}$. Up to 26 V it produces a regulated output current of more than 550 mA. Above 26 V the save-operating-area protection allows operation up to 36 V with a regulated output current of more than 300 mA. Overvoltage protection limits operation at 42 V. The overvoltage protection hysteresis restores operation if the input voltage has dropped below 36 V. A reset signal is generated for an output voltage of $V_Q < 4.5 \text{ V}$. The delay for power-on reset can be set externally with a capacitor.

Design Notes for External Components

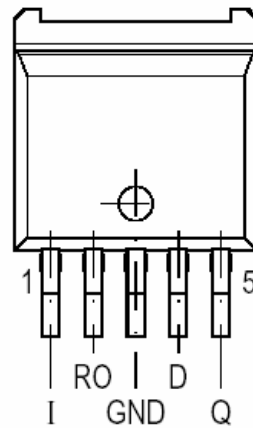
An input capacitor C_I is necessary for compensation of line influences. The resonant circuit consisting of lead inductance and input capacitance can be damped by a resistor of approx. 1Ω in series with C_I . An output capacitor C_Q is necessary for the stability of the regulating circuit. Stability is guaranteed at values of $C_Q \geq 22 \mu\text{F}$ and an ESR of $< 3 \Omega$.

Pin Configuration

P-TO220-5-12



P-TO263-5-1



Pin Definitions and Functions

Pin	Symbol	Function
1	I	Input : block to ground directly on the IC with ceramic capacitor
2	RO	Reset Output : the open collector output is connected to the 5 V output via an integrated resistor of 30 kΩ.
3	GND	Ground : internally connected to heatsink.
4	D	Reset Delay : connect a capacitor to ground for delay time adjustment.
5	Q	5-V Output : block to ground with 22 μF capacitor, ESR < 3 Ω.

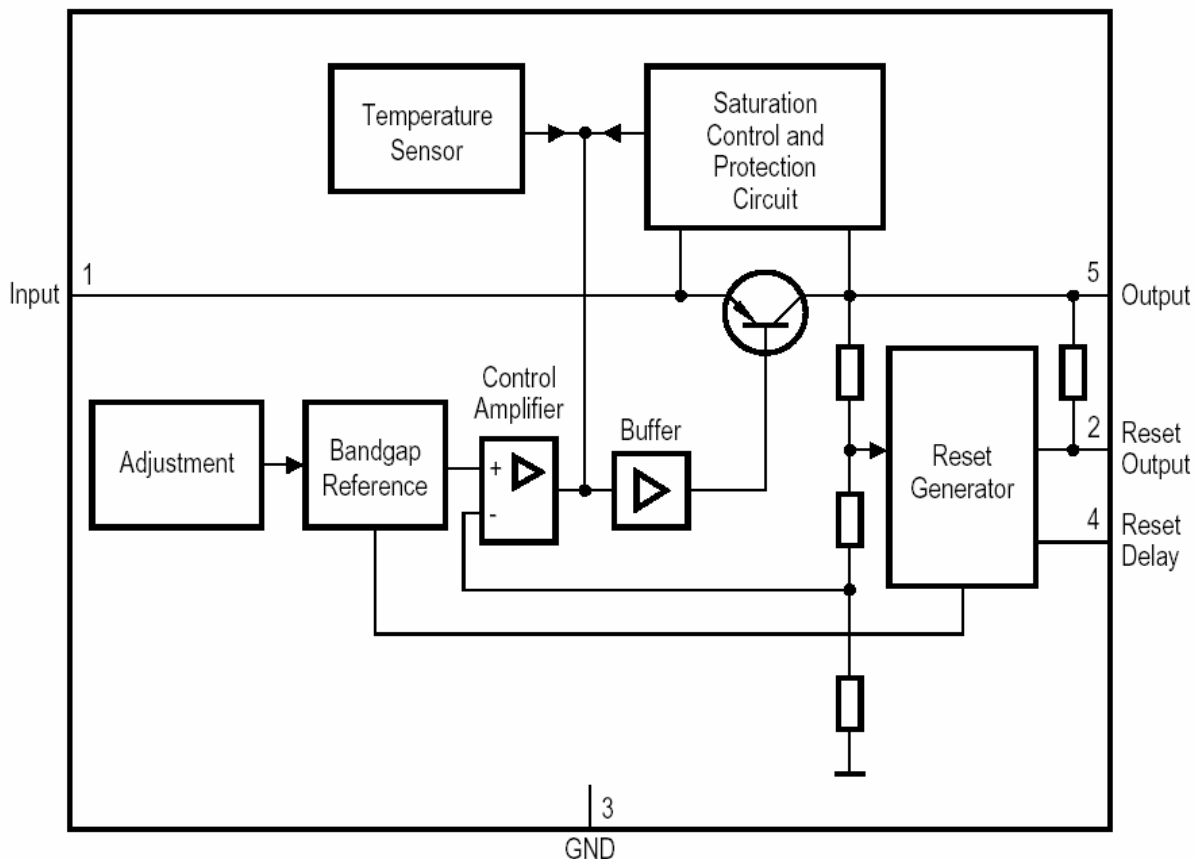
Circuit Description

The control amplifier compares a reference voltage, which is kept highly accurate by resistance adjustment, to a voltage that is proportional to the output voltage and drives the base of a series transistor via a buffer. Saturation control as a function of the load current prevents any over-saturation of the power element. If the output voltage decreases below 4.5 V, an external capacitor C_D on pin 4 (D) will be discharged by the reset generator. If the voltage on this capacitor drops below V_{DRL} , a reset signal is generated on pin 2 (RO), i.e. reset output is set low. If the output voltage rises above 4.5 V, C_D will be charged with constant current. After the power-on-reset time the voltage on the capacitor reaches V_{DU} and the reset output will be set high again. The value of the power-on-reset time can be set within a wide range depending of the capacitance of C_D .

The IC also incorporates a number of internal circuits for protection against:

- Overload
- Overvoltage
- Overtemperature
- Reverse polarity

Block Diagram



Absolute Maximum Ratings

$T_j = -40$ to 150 °C

Parameter	Symbol	Limit Values		Unit	Notes
		min.	max.		
Input					
Voltage	VI	- 42	42	V	$t \leq 400$ ms internally limited
Voltage	VI		65	V	
Current	II				
Reset Output					
Voltage	VR	- 0.3	7	V	Internally limited
Current	IR				
Reset Delay					
Voltage	VD	- 0.3	7	V	Internally limited
Current	ID				
Output					
Voltage	VQ	- 1.0	16	V	Internally limited
Current	IQ				
Ground					
Current	IGND	- 0.5	-	A	-
Temperatures					
Junction temperature	Tj		150	°C	-
Storage temperature	Tstg	- 50	150	°C	

Optimum reliability and life time are guaranteed if the junction temperature does not exceed 125 °C in operating mode. Operation at up to the maximum junction temperature of 150 °C is possible in principle. Note, however, that operation at the maximum permitted ratings could affect the reliability of the device.

Operating Range

Parameter	Symbol	Limit Values		Unit	Notes
		min.	max.		
Input voltage	VI	6	42	V	-
Junction temperature	Tj	- 40	150	°C	-
Thermal Resistance					
Junction ambient	Rthja	-	65	K/W	TO263
Junction case	Rthjc	-	3	K/W	$t < 1$ ms
	Zthjc		2	K/W	TO263

Characteristics

$V_I = 13.5 \text{ V}$; $-40 \text{ }^\circ\text{C} \leq T_j \leq 125 \text{ }^\circ\text{C}$ (unless otherwise specified)

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Output voltage	V_Q	4.90	5.00	5.10	V	$5 \text{ mA} \leq I_Q \leq 550 \text{ mA}$; $6 \text{ V} \leq V_I \leq 26 \text{ V}$
Output voltage	V_Q	4.90	5.00	5.10	V	$26 \text{ V} \leq V_I \leq 36 \text{ V}$; $I_Q \leq 300 \text{ mA}$
Output current limiting	I_{Qmax}	650	850	–	mA	$V_Q = 0 \text{ V}$
Current consumption $I_q = I_I - I_Q$	I_q	–	1	1.5	mA	$I_Q = 5 \text{ mA}$
Current consumption $I_q = I_I - I_Q$	I_q	–	55	75	mA	$I_Q = 550 \text{ mA}$
Current consumption $I_q = I_I - I_Q$	I_q	–	70	90	mA	$I_Q = 550 \text{ mA}$; $V_I = 5 \text{ V}$
Drop voltage	V_{dr}	–	350	700	mV	$I_Q = 550 \text{ mA}$)

1) Drop voltage = $V_I - V_Q$ (measured when the output voltage has dropped 100 mV from the nominal value obtained at 13.5 V input)

Characteristics (cont'd)

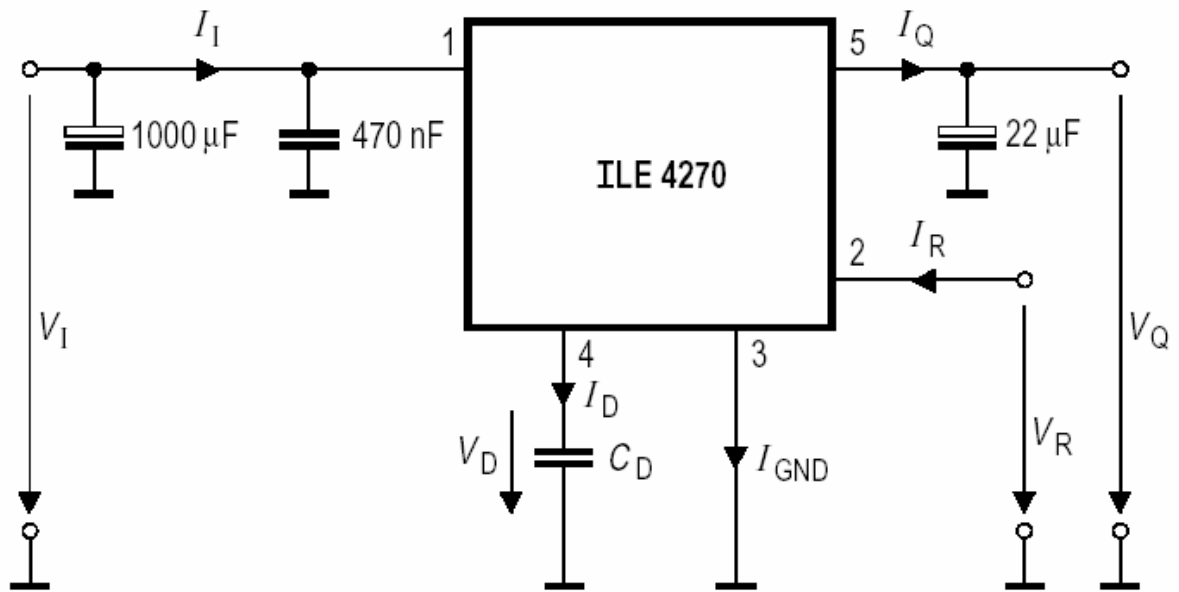
$V_I = 13.5 \text{ V}$; $-40 \text{ }^\circ\text{C} \leq T_j \leq 125 \text{ }^\circ\text{C}$ (unless otherwise specified)

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Load regulation	ΔV_Q	–	25	50	mV	$I_Q = 5 \text{ to } 550 \text{ mA}$; $V_I = 6 \text{ V}$
Supply voltage regulation	ΔV_Q	–	12	25	mV	$V_I = 6 \text{ to } 26 \text{ V}$ $I_Q = 5 \text{ mA}$
Power supply Ripple rejection	$PSRR$	–	54	–	dB	$f_r = 100 \text{ Hz}$; $V_r = 0.5 V_{SS}$
Reset Generator						
Switching threshold	V_{RT}	4.5	4.65	4.8	V	–
Reset High voltage	V_{ROH}	4.5	–	–	V	–
Reset low voltage	V_{ROL}	–	60	–	mV	$R_{intern} = 30 \text{ k}\Omega$); $1.0 \text{ V} \leq V_Q \leq 4.5 \text{ V}$
Reset low voltage	V_{ROL}	–	200	400	mV	$I_R = 3 \text{ mA}$, $V_Q = 4.4 \text{ V}$
Reset pull-up	R	18	30	46	$\text{k}\Omega$	internally connected to Q
Lower reset timing threshold	V_{DRL}	0.2	0.45	0.8	V	$V_Q < V_{RT}$
Charge current	I_d	8	14	25	μA	$V_D = 1.0 \text{ V}$
Upper timing threshold	V_{DU}	1.4	1.8	2.3	V	–
Delay time	t_d	–	13	–	ms	$C_D = 100 \text{ nF}$
Reset reaction time	t_{RR}	–	–	3	μs	$C_D = 100 \text{ nF}$
Overvoltage Protection						
Turn-Off voltage	$V_{I, ov}$	42	44	46	V	–

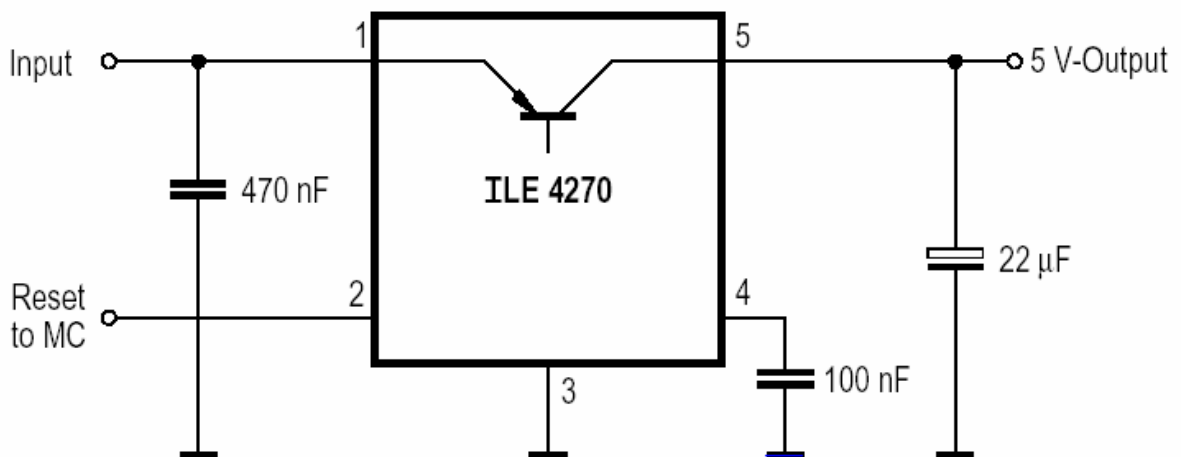
1) Drop voltage = $V_I - V_Q$ (measured when the output voltage has dropped 100 mV from the nominal value obtained at 13.5 V input)

2) Reset peak is always lower than 1.0 V.

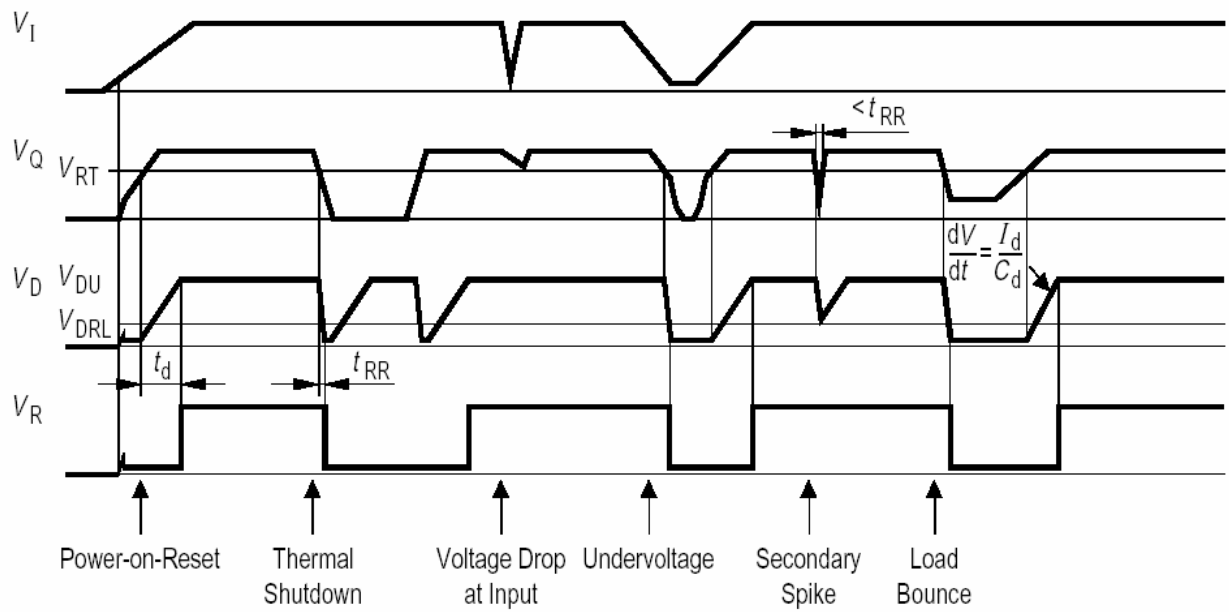
Test Circuit



Application Circuit

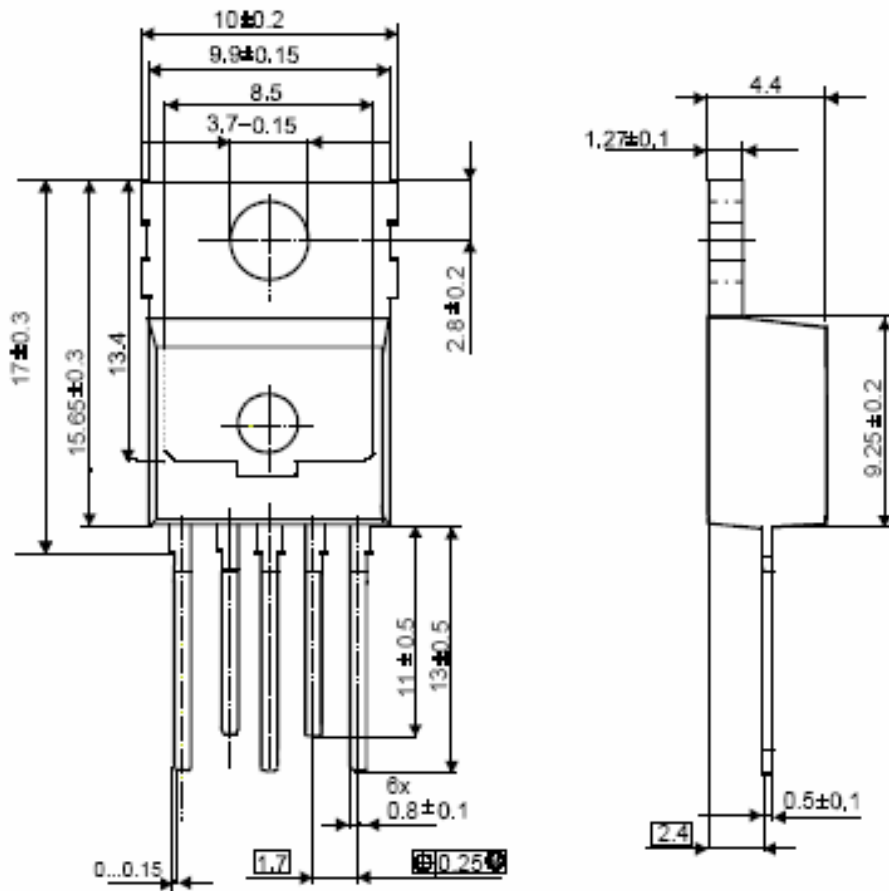


Time Response



Package Dimensions
P-TO 220-5-12

ILE4270S



ILE4270G

P-TO 263-5-1

