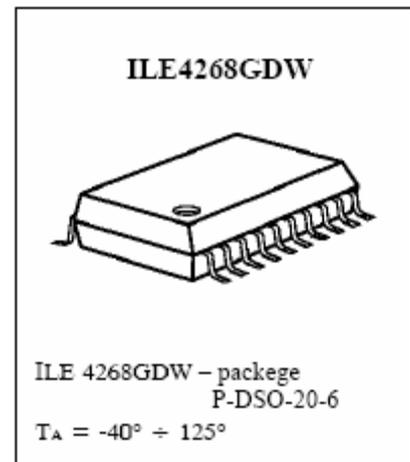


5-V Low-Drop Fixed Voltage Regulator

ILE4268

Features

- Output voltage tolerance $< \pm 2 \%$
- Very low current consumption
- Low-drop voltage
- Watchdog
- Settable reset threshold
- Overtemperature protection
- Reverse polarity protection
- Short-circuit proof
- Suitable for use in automotive electronics
- Wide temperature range



Functional Description

This device is a 5-V low-drop fixed-voltage regulator. The maximum input voltage is 45 V. It can deliver an output current of at least 180 mA. The IC is short-circuit proof and features temperature protection that disables the circuit in the event of impermissibly high temperatures. The watchdog function is disabled as a function of the load, so that a controller is not interrupted during sleep mode by a watchdog reset.

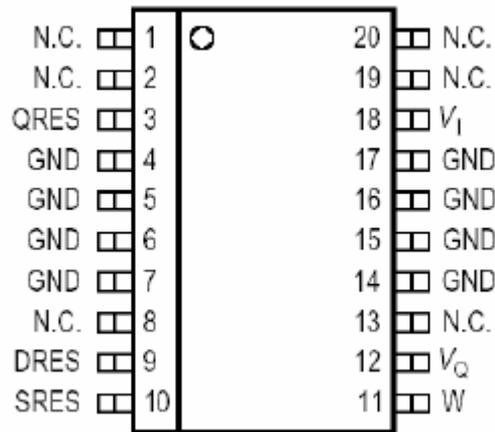
Application Description

The IC regulates an input voltage V_i in the range $5.5 \text{ V} < V_i < 45 \text{ V}$ to $V_{\text{rated}} = 5.0 \text{ V}$. In the event of an output voltage $V_Q < V_{\text{RT}}$, a reset signal is generated. The wiring of the reset switching threshold input enables the value of V_{RT} to be reduced. The reset delay time can be adjusted using an external capacitor. The integrated watchdog monitors the connected active controller. If there is no positive-going edge at the watchdog input, the reset output is set to low. The reset delay capacitor provides a wide adjustment range for the pulse repetition time. The watchdog function is only activated if the load exceeds 8 mA. This ensures that a microcontroller is not activated during power-down and the current drain is not increased. The IC is protected against overload and overtemperature.

Pin Configuration

(top view)

P-DSO-20-6



Pin Definitions and Functions

Pin	Symbol	Function
1, 2, 8, 13, 19, 20	N. C.	Not connected.
3	QRES	Reset output ; the open collector output is connected to the 5-V output via an integrated resistor of 30 kΩ.
4 ... 7, 14 ... 17	GND	Ground
9	DRES	Reset delay ; connect a capacitor to ground for delay time adjustment.
10	SRES	Reset switching threshold ; for setting the switching threshold, output to ground with voltage divider. If this input is connected to ground, the reset is triggered at an output voltage of 4.5 V.
11	W	Watchdog input ; positive-edge-triggered input for monitoring a microcontroller.
12	V _Q	5-V output voltage ; block to ground with 22-μF capacitor, ESR < 3 Ω.
18	V _i	Input voltage ; block to ground directly on the IC with ceramic

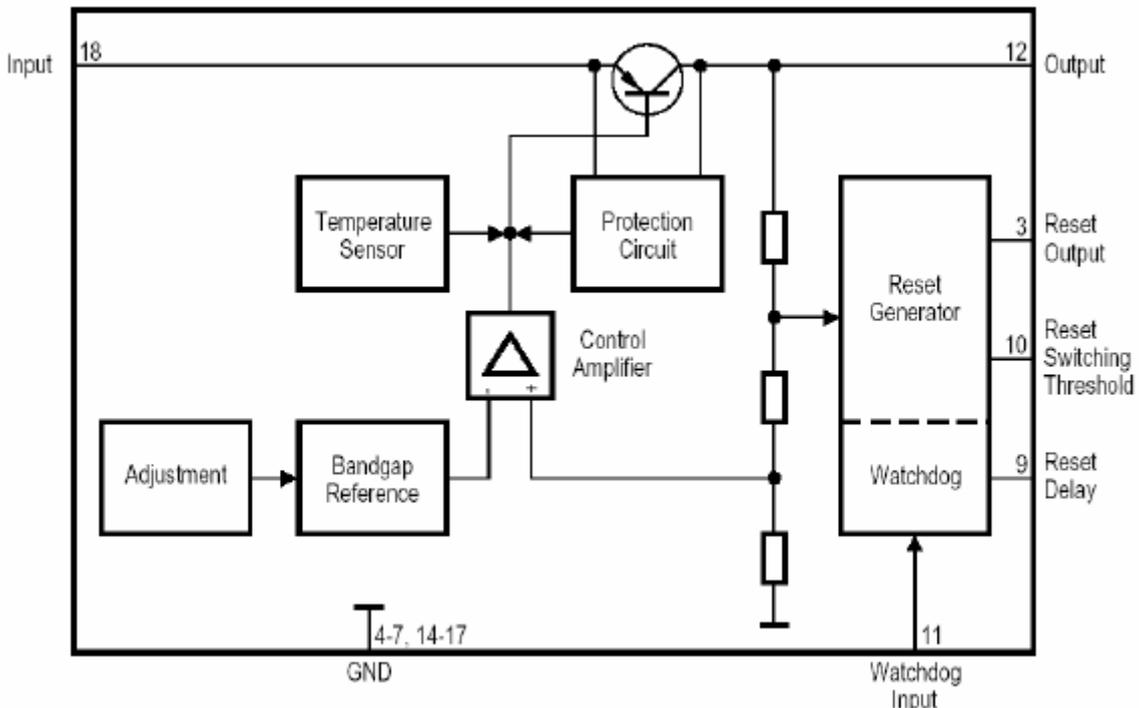
Circuit Description

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 the series transistor via a buffer. Saturation control as a function of the load current prevents any over-saturation of the power element. If The externally scaled down output voltage at the reset threshold input drops below 1.35 V, the external reset delay capacitor is discharged by the reset generator. If the voltage on the capacitor reaches the lower threshold V_{ST} , a reset signal is generated on the reset output and not cancelled again until the upper threshold voltage is exceeded. If the reset threshold input is connected to GND, reset is triggered at an output voltage of 4.5 V. A connected microcontroller is monitored by the watchdog logic. If pulses are missing, the rest output is set to low. The pulse sequence time can be set within a wide range with the reset delay capacitor.

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

- Overload
- Overtemperature
- Reverse polarity

Block Diagram



Absolute Maximum Ratings

Tj=-40 to 150°C

Parameter	Symbol	Limit Values		Unit	Notes
		min.	max.		
Input					
Input voltage	V _i	-30	45	V	Internally limited
Input current	I _i				
Reset Output					
Voltage Current	V _R I _R	-0.3	7	V	Internally limited
Reset Delay					
Voltage Current	V _D I _D	-0.3	7	V	Internally limited
Watchdog					
Watchdog input	V _w	-0.3	7	V	-
Reset Input					
Reset threshold	V _{RE}	-0.3	7	V	-
Output					
Output voltage	V _Q	-0.3	7	V	Internally limited
Output current	I _Q				
Ground					
Current	I _M	-100	50	mA	-
Temperatures					
Junction temperature	T _i		150	°C	—
Storage temperature	T _s	-50	150	°C	

Operating Range

Parameter	Symbol	Limit Values		Unit	Notes
		min.	max.		
Input voltage	V_i	-	45	V	-
Junction temperature	T_j	-40	150	°C	-
Thermal Resistance					
Junction ambient (soldered)	R_{thjA}		70	K/W	
Junction case	R_{thjC}		25	K/W	

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.

Characteristics

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

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Output voltage	V_Q	4.90	5.00	5.10	V	$5\text{mA} \leq I_Q \leq 150\text{mA};$ $6\text{V} \leq V_i \leq 28\text{V};$
Output current limiting	I_Q	180	250	—	mA	—
Current consumption $I_q = I_i - I_Q$	I_q	—	300	450	mA	$I_Q = 0 \text{ mA}$
Current consumption $I_q = I_i - I_Q$	I_q	—	13	20	mA	$I_Q = 150 \text{ mA}$
Drop voltage	V_{DR}	-	0.25	0.5	V	$I_Q = 150\text{mA}^{1)}$
Load regulation	ΔV_Q	-	10	30	mV	$I_Q = 5 \text{ to } 150\text{mA}$
Supply voltage regulation	ΔV_Q	—	10	30	mV	$V_i = 6 \text{ to } 28 \text{ V}$ $I_Q = 150\text{mA}$
Reset Generator						
Switching threshold	V_{RT}	4.2	4.5	4.8	V	-
Switching voltage	V_{RE}	1.28	1.35	1.45	V	-
Saturation voltage	V_R	-	0.2	0.5	V	1 mA extern
Saturation voltage	V_C	-	30	100	mV	$V_Q < V_{RT}$
Charging current	I_d	5	12	18	μA	$V_C = 1.0\text{V}$
Delay switching threshold	V_{DU}	1.4	1.8	2.2	V	—
Delay time	t_d	10	15	25	ms	$C_d = 100 \text{ nF}$
Delay time	t_f	-	2	-	ms	$C_d = 100 \text{ nF}$
Pull-up	R_R	18	30	46	kΩ	with resp. to V_Q
Lower switching threshold	V_{DRL}	0.2	0.4	0.55	V	—

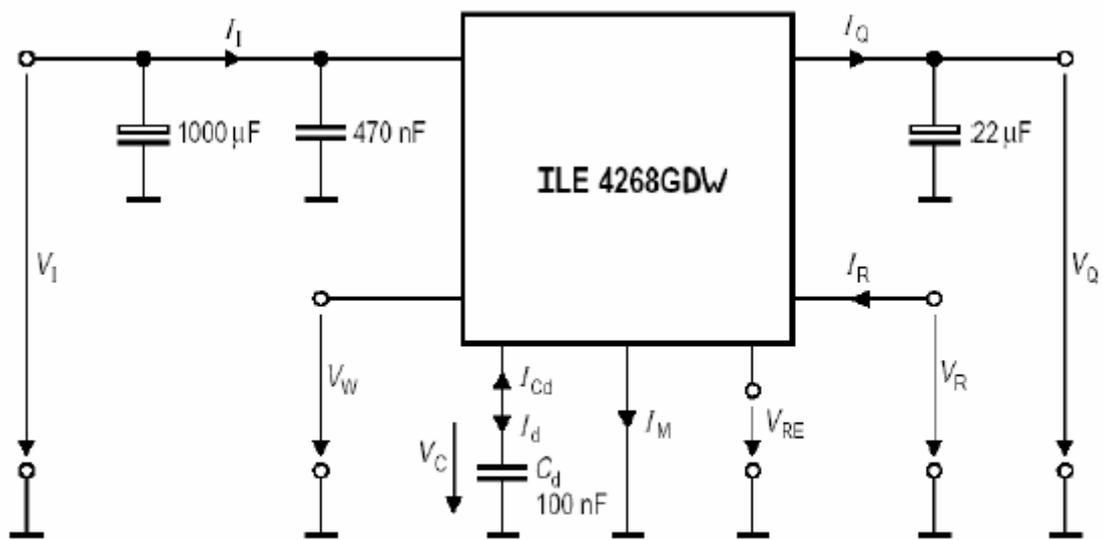
1) Drop voltage = $V_i - V_Q$ (measured when the output voltage has dropped 100 mV from the nominal value obtained at 13.5 V input)

Characteristics (cont'd)

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Watchdog						
Discharge current	I_{Cd}	1.5	3.5	5.2	μA	$V_C = 1.0V$
Charging current	I_d	5	12	18	μA	$V_C = 1.0V$
Switching voltage	V_{Cd}	1.6	1.8	2.0	V	-
Lower switching threshold	V_{DWL}	0.2	0.4	0.55	V	—
Watchdog periode	T_{WP}	30	55	75	ms	$Q = 100nF$
Watchdog trigger time	F_{WT}	25	40	60	ms	$C_d = 100nF$
Activating current	I_Q	2	8	15	mA	Activates watchdog
Slew rate	V_w	5	—	—	V/ μs	from 20 % up to 80 % V_Q

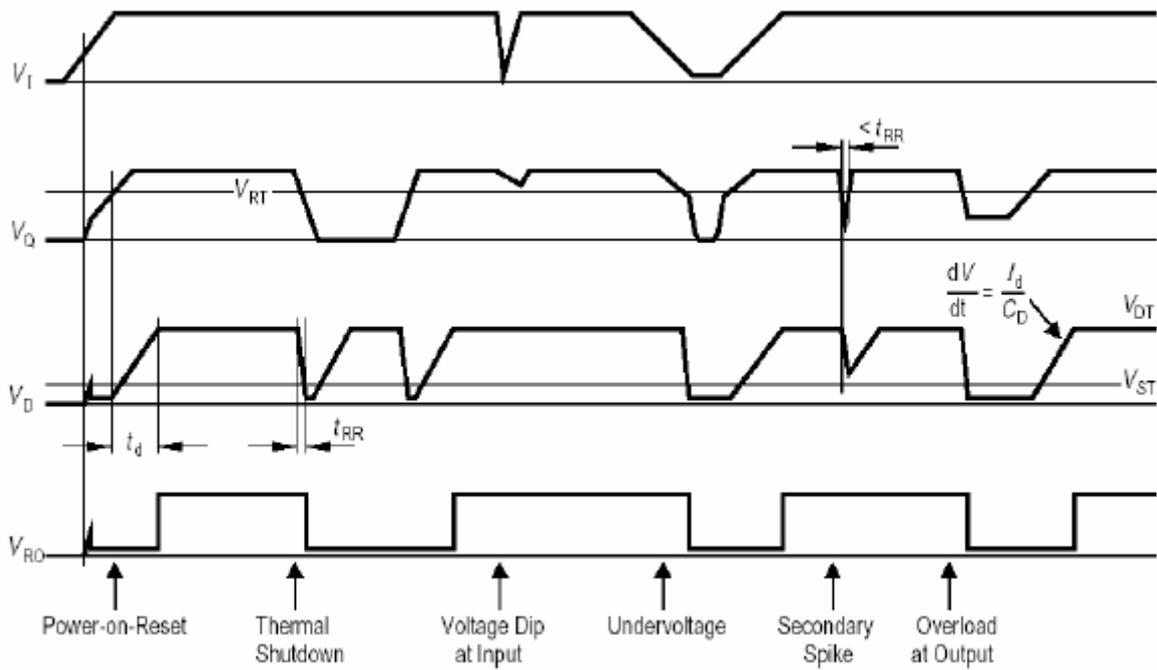
Note: The reset output is low in range from $V_Q = 1 V$ to V_{RT} .

Test Circuit

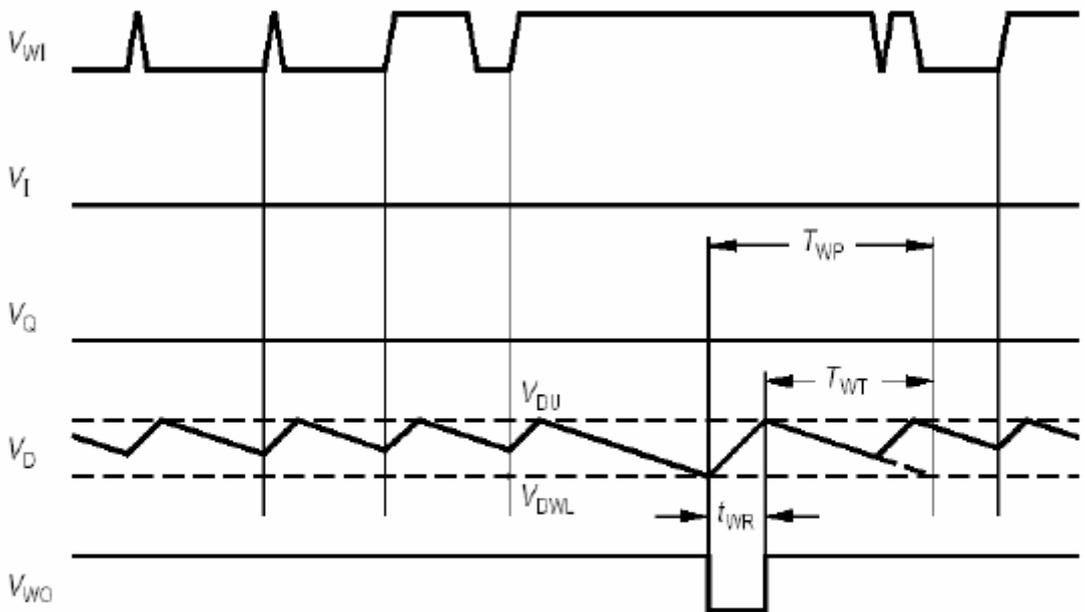


$V_{Dr} = V_I - V_Q$ Outside the control range

Timing (Watchdog Disabled)



Timing of the Watchdog Function

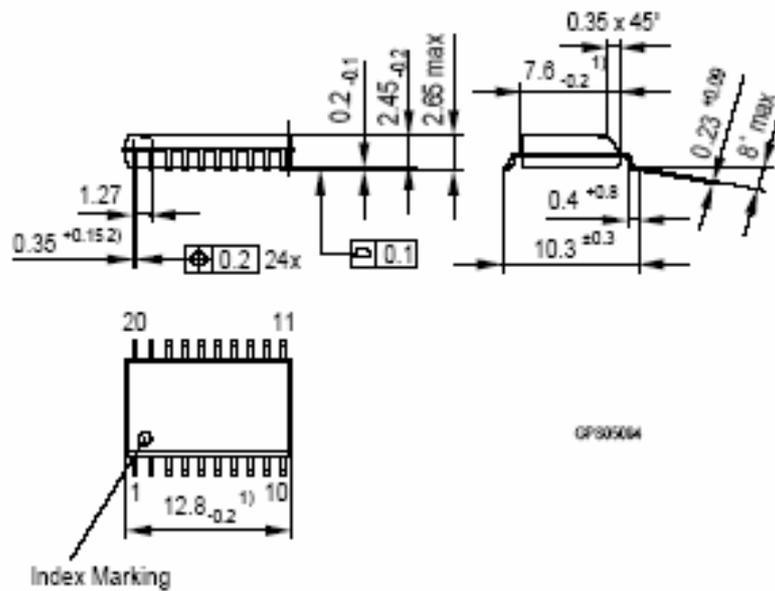


$$T_{WP} = \frac{(V_{DU} - V_{DWL})(I_d + I_{dis})}{I_d \times I_{dis}} C_D; \quad t_{WR} = \frac{(V_{DU} - V_{DWL})}{I_d} C_D; \quad T_{WT} = \frac{(V_{DU} - V_{DWL})}{I_{dis}} C_D$$

$$V_{DUL} = V_{DRL}$$

Package Dimensions

P-DSO-20-6



- 1) Does not include plastic or metal protrusions of 0.15 max per side
- 2) Does not include dambar protrusion of 0.05 max per side