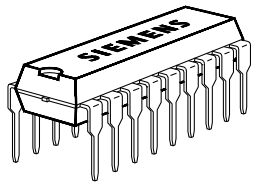
SIEMENS

Quad Driver Incl. Short-Circuit Signaling FZL 4145 D

Bipolar IC

Features

- Short-circuit shutdown with clock generator
- Four driver circuits for controlling power transistors
- Overload and short-circuit signaling



P-DIP-18-1

Type	Ordering Code	Package
FZL 4145 D	Q67000-H8437	P-DIP-18-1

General Description

The IC comprises four driver circuits capable of driving power transistors for high output currents. The output transistors are protected against short-circuit to ground and supply voltage. The input threshold can be adjusted between 1.5 V and 7 V. Overload or short-circuit failure at an output will be indicated at pin SQ (signaling output).

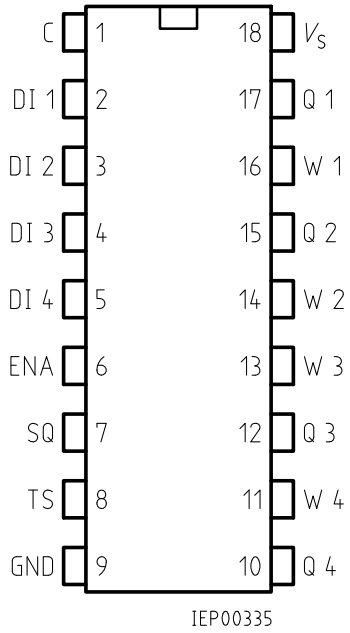
Functional Description

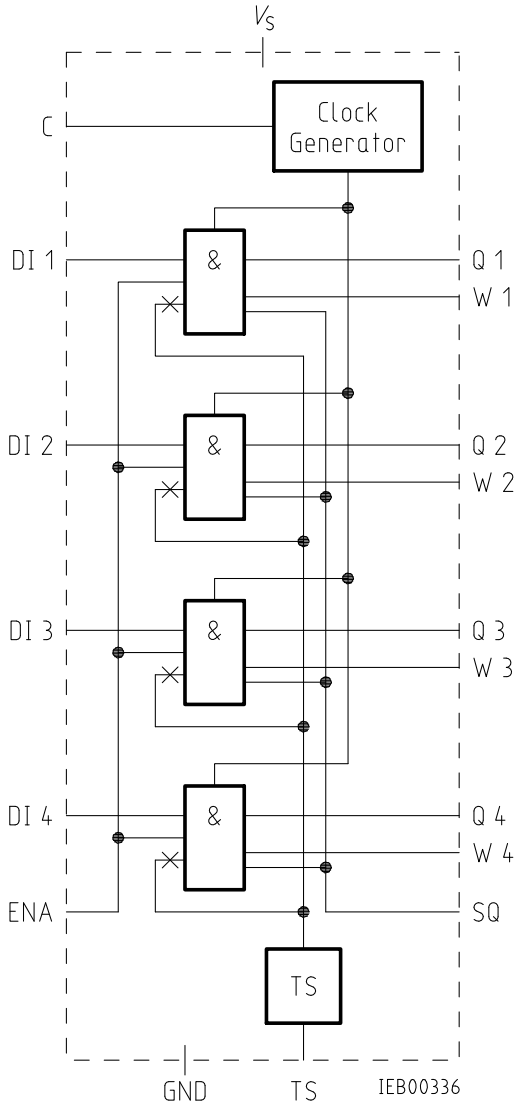
Each driver circuit has one active high driver input Dl and a common enable input (ENA) (active high) is provided for all stages. The (Q) outputs are designed to drive the output transistors. The load current is sampled via pin W. If the load current exceeds the preset value, the output stage switches off. Switching-on again is provided by the built-in clock generator. Its operation requires an external capacitor C_T at pin C. If C_T is bridged by a break-key, switching on can only be carried out by operating a key. The duty cycle of the clock generator is 1:50 (e.g. 40 µs/2 ms with C_T = 33 nF).

In case of overcurrent or short-circuit failure at any output stage the signaling output (SQ) will go low. In clock-governed operation (i.e. when there is automatic switching on by the clock and not by a key), SQ goes high and low at the clock rate as long as a short-circuit or overload exists. SQ is an open-collector output.

Unused W pins must be connected to V_s. Open W pins would simulate a short-circuit and activate the signaling output.

Pin Configuration
(top view)





DI	Driver inputs
ENA	Enable input
C	Clock capacitor
Q	Outputs
TS	Input for threshold switching
W	Input for output current limiter
SQ	Signaling output
GND	Ground

Block Diagram

The switching threshold at inputs Dl and ENA can be adjusted between 1.5 V and 7 V via connection TS:

V_{TS} = 0 V; input threshold = 1.5 V (for 5 V logic)
V_{TS} = 0 to 5 V; input threshold = V_{TS} + 1.5 V
V_{TS} = V_S: input threshold = 7 V (for 12/15 V and 24/28 V logic)

If the output is disabled due to the logic states of inputs Dl or ENA this disable is effective over the total supply voltage range between V_S = 0 V and V_S = 35 V.

The inputs are protected with clamp diodes.

Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Supply voltage	V_S	– 0.3	35	V	
	V_S	– 0.3	45	V	100 ms duration, 1 s interval
Input voltage at DI and ENA	$V_{DI, ENA}$	– 0.3	35	V	1)
Voltage at TS and SQ	$V_{TS, SQ}$	– 0.3	45	V	
Output voltage V_Q and voltage at C	V_Q, V_C	– 0.3	V_S	V	
Voltage at W	V_W	V_S – 5	V_S	V	3)
Input current at DI and ENA	$I_{DI, ENA}$	– 3	1	mA	2)
	$I_{DI, ENA}$	– 6	2	mA	2) 100 ms duration, 1 s interval
	$I_{DI, ENA}$	– 6	5	mA	2) 100 µs duration, 1 ms interval
Output current at SQ	I_{SQ}		8	mA	
Power dissipation of all input diodes	P_{tot}		50	mW	
Storage temperature	T_{stg}	– 65	125	°C	
Thermal resistance system - air	$R_{th\ SA}$		65	K/W	
system - case	$R_{th\ SC}$		45	K/W	

Operating Range

Supply voltage for input threshold					
1.5 V	V_S	4.5	35	V	V_{TS} = 0 V
1.5 V to 6.5 V	V_S	V_{TS} + 4.5	35	V	V_{TS} = 0 V to 5 V
7 V	V_S	10	35	V	V_{TS} = V_S
Ambient temperature	T_A	– 25	85	°C	

Notes: 1) $V_{DI, ENA}$ > 35 V requires a protective resistor before DI, ENA.
2) $V_{DI, ENA}$ may increase to more than 35 V during current nodes.
3) Unused W connections must be connected to V_S.

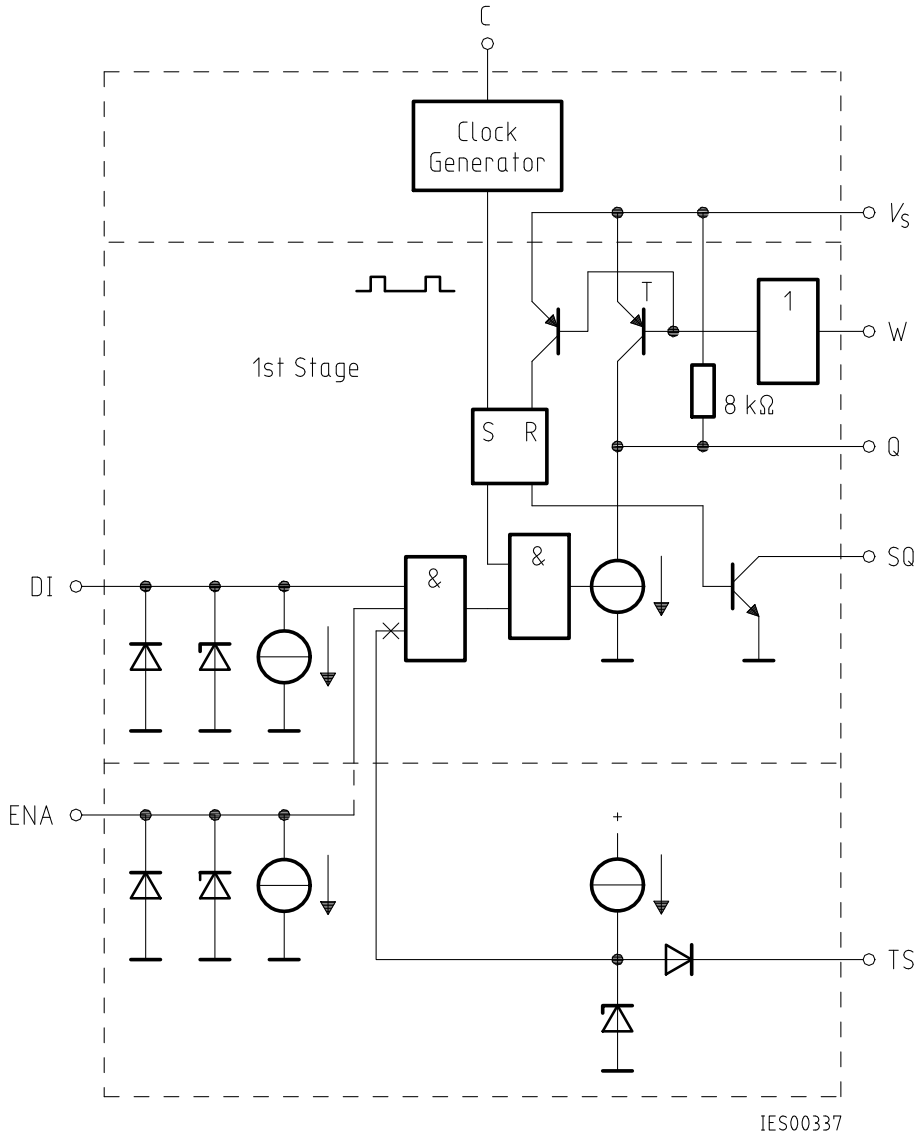
Characteristics

Supply voltage 4.5 V ≤ V_S ≤ 30 V

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Supply current	I_S		6	8.5	mA	V_{ENA} = 0 V, $V_W = V_S$
H-input voltage at DI, ENA	V_{IH}	2			V	V_{TS} = 0 V
H-input voltage at DI, ENA	V_{IH}	8			V	$V_{TS} = V_S$
L-input voltage at DI, ENA	V_{IL}			0.7	V	V_{TS} = 0 V
L-input voltage at DI, ENA	V_{IL}			6	V	$V_{TS} = V_S$
Input current at DI, ENA	$I_{DI, ENA}$	50		200	µA	0.5 V ≤ $V_{DI, ENA}$ ≤ 30 V
L-output voltage at SQ	$V_{SQ\,L}$			0.5	V	I_{SQ} = 5 mA
Output current available[1]	I_Q	1.5	2.5		mA	$V_Q = V_S$ – 1.5 V
	I_Q	1.7			mA	T_A = 0 °C, $V_Q = V_S$ – 1.5 V
Current from TS	$-I_{TS}$		2	10	µA	V_{TS} = 0 V
Switching threshold at W	V_W	V_S – 0.6	V_S – 0.5	V_S – 0.4	V	
Current in W	I_W			100	µA	
Current from C	$-I_C$	12	20	34	µA	T_A = 20 °C
Current in C	I_C	0.6	1	1.7	mA	T_A = 20 °C
Upper switching threshold at C	V_{CU}	1.6	2.1	1.7	V	T_A = 20 °C
Lower switching threshold at C	V_{CL}	0.6	0.9	1.2	V	T_A = 20 °C
Saturation voltage at T[2]	$V_{Q\,R}$		V_S – 0.3		V	$V_W = V_S$ – 2 V, I_Q = 0
H-output voltage	$V_{Q\,H}$	V_S – 0.25	V_S – 0.02		V	V_{ENA} = 0 V

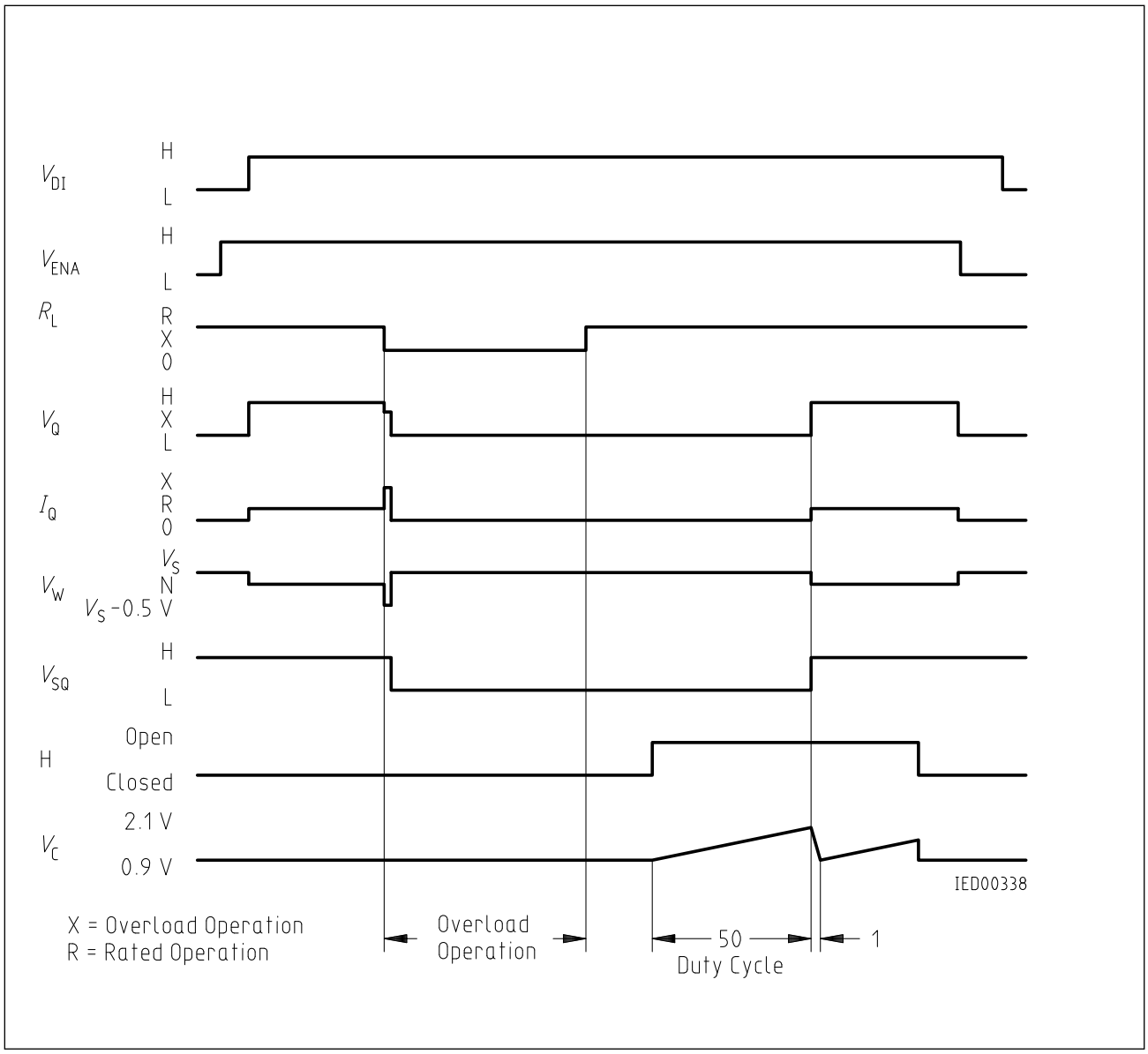
[1] The actual output current is typically 0.5 mA higher, a value which is required as current for the short-circuit protection. However, only the value specified above is available to drive the external output transistors.

[2] See block diagram

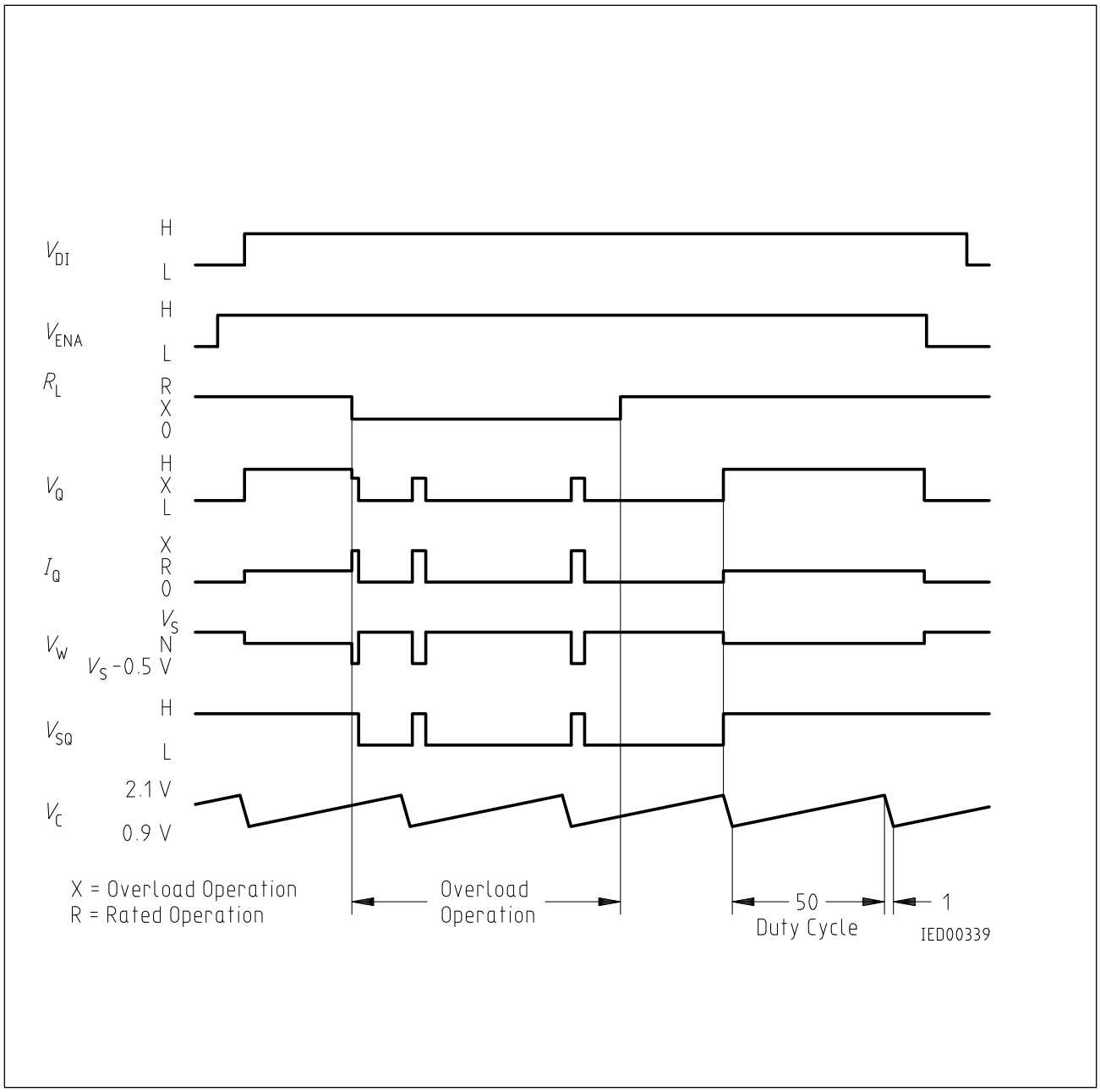


DI	Driver input
ENA	Enable input
C	Clock capacitor
SQ	Signaling output
Q	Output
TS	Input for threshold switching
W	Input for output current limiter

Schematic Circuit Diagram of One Stage



Mode of Operation: Switching-ON again after Overload with Key H



Mode of Operation: Automatic Switching-ON again after Overload

Typical Application Circuits

The load conditions at Q depend on the permissible power dissipation of the used power transistors. The pulsed power dissipation in case of a short circuit must be observed.

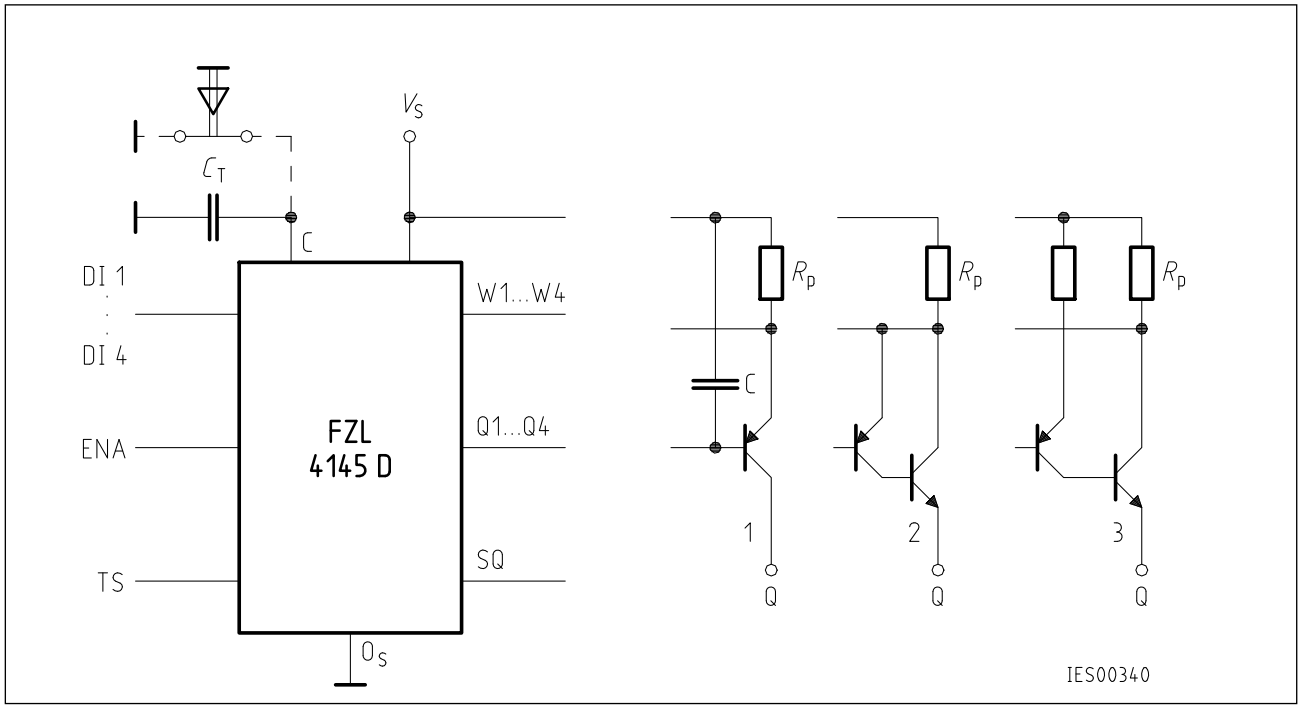
In order to suppress oscillations of the power stage in case of a short circuit, a capacitor C at Q1 to Q4 is necessary if e.g. fast switching transistors are used.

Typical value X of C: approx. 20 nF.

The output circuit 1 is suited for currents up to approx. I_Q = 100 mA.

The output circuit 2 and 3 are suited for currents up to approx. I_Q = 2 A. A minimum power dissipation can be achieved with circuit 3.

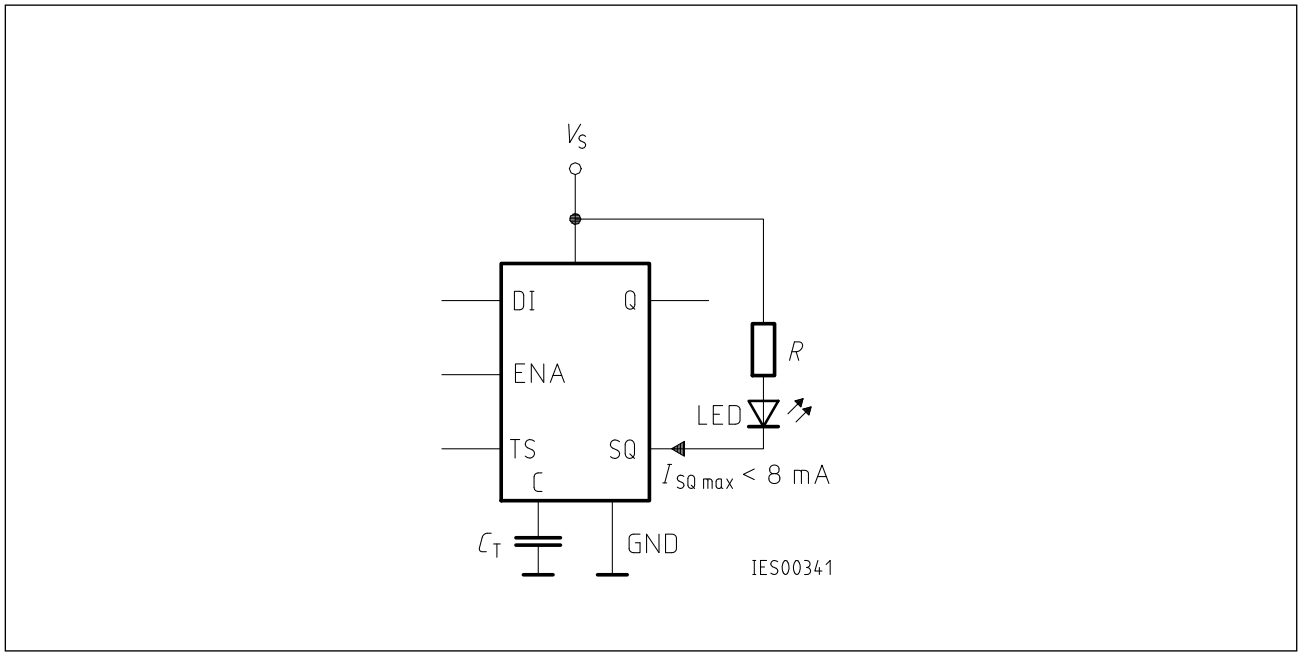
A break key in parallel to C_T allows a manual switch-on in case of short-circuit.



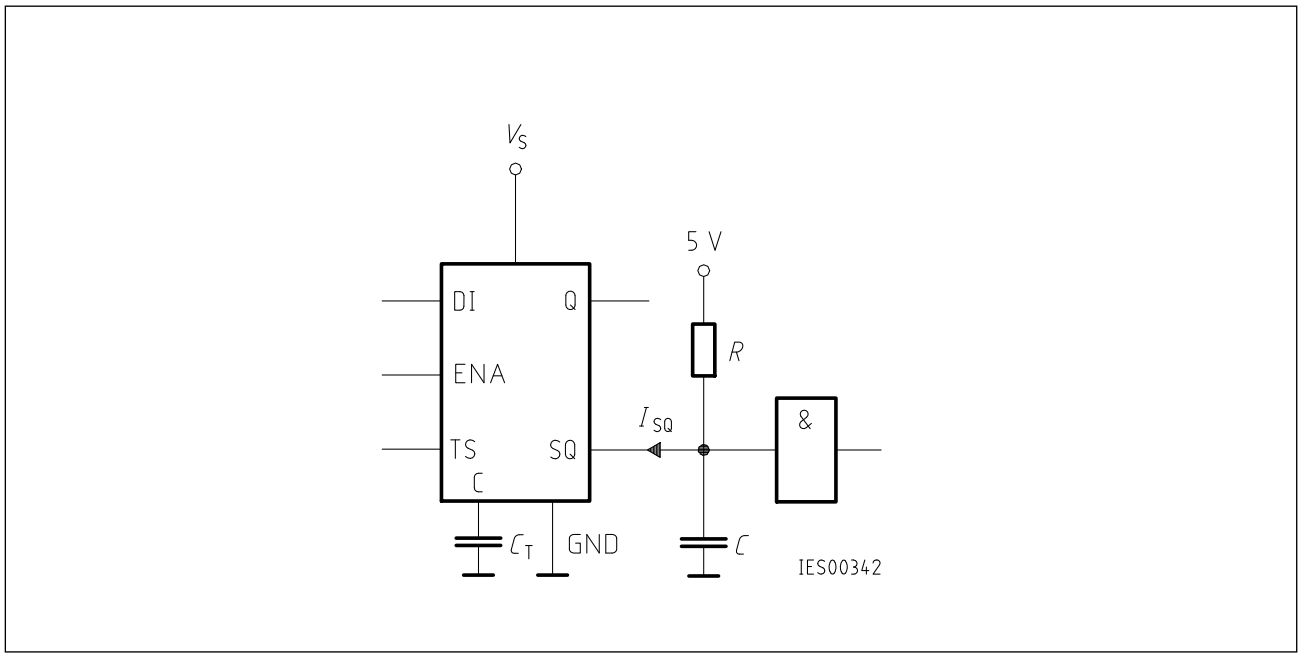
R_P = Precision resistor (current measurement)
C_T = 0.8 x t_p (nF, µs)
t_p = Short-circuit current pulse length

Note: Circuit 1 does not permit a capacitor between Q1 and Q4 and the collector.
Circuit 2 does not permit a capacitor between Q1 and Q4 and base or emitter, respectively.
Otherwise too high current spikes would arise in case of a short circuit.

Typical Application of Short-Circuit Signaling Output SQ



1. LED Display



2. TTL/CMOS/LSL Driving

If the pulses appearing at SQ during clocked operation disturb the remainder of the circuit, a lowpass filter will be necessary. For a load current of I_{SQ} = 1 mA a capacitor C of approx. 10 nF is necessary to limit the output pulses of up to 10 µs (depending on C_T) to 1 V. Signaling occurs after approx. 50 µs.