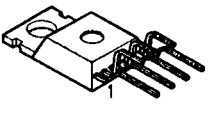
Dimmer

BTS 629
BTS 629 A

The device allows continous control of power to a lamp or LED load utilizing pulse-width-modulation.



VPT05167

Features

- High-side switch
- Overtemperature protection
- Short circuit / Overload protection through pulse width reduction an overtemperature shutdown
- Load dump protection up to 93.5 V [1])
- Undervoltage and overvoltage shutdown with auto-restart and hysteresis
- Reverse battery protection [1])
- Timing frequency adjustable
- Controlled switching rise and fall times
- Minimized Radio Frequency Interferences (RFI)
- Maximum current internally limited
- Protection against loss of signal GND [2])
- Electrostatic discharge (ESD) protection
- Package: TO-220/7 and SMD, Pin 4 is shorted to the tab

Note:
Switching frequency is programmed with an external capacitor. To assist with accurate setting of this parameter the dimmer is factory selected into two groups (see page 8). For large quantity orders, customer will need to be prepared to accept deliveries of both groups.

Type	Ordering code	Package
BTS 629	C67078-S5501-A2	TO-220/7
BTS 629 A	C67078-S5501-A5	TO-220/7

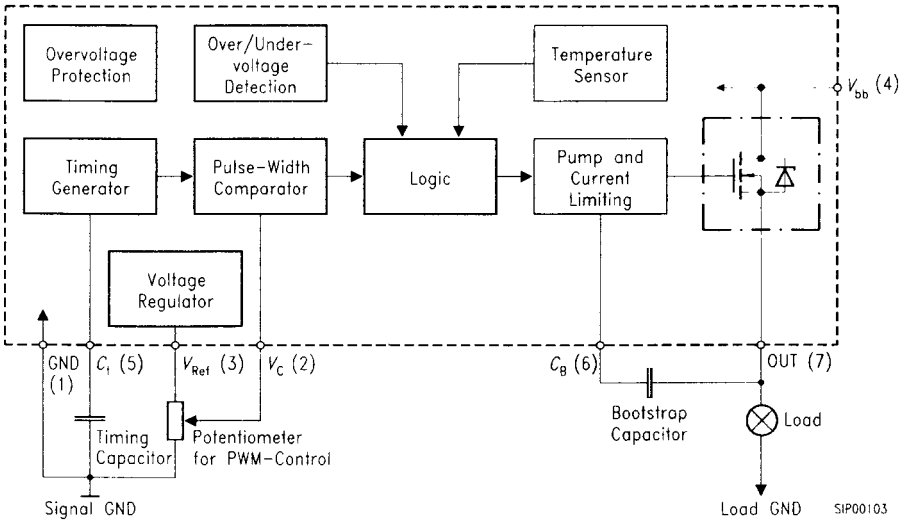
Maximum Ratings

Parameter	Symbol	Value	Unit
Active overvoltage protection	$V_{bb(AZ)}$	> 50	V
Short-circuit current	I_{SC}	self-limited	-
Operating temperature range Storage temperature range	T_j T_{stg}	-40 ... +150 -55 ... +150	°C
Power dissipation, T_C = 25 °C	P_{tot}	75	W
Thermal resistance Chip - case Chip - ambient	 R_{thJC} R_{thJA}	 ≤ 1.67 ≤ 75	K/W

[1]) With 150 Ω resistor in Signal GND connection

[2]) Potential between Signal GND and Load GND > 0.5 V

Blockdiagram



Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
On-state resistance (pin 4 to 7) I_L = 2 A, V_{bb} = 12 V	R_{on}	–	160	180	mΩ
Operating voltage (pin 4 to GND) T_j = +25 ... +150 °C T_j = −40 ... +150 °C	V_{bb}	5.5 [1] 5.9	– –	16.9 [2] 16.9	V
Nominal current, calculated value (pin 4 to 7) ISO-proposal: V_{bb}–V_{out} ≤ 0.5 V, T_C = 85 °C	I_L-ISO	–	–	2.0	A
Load current, theoretical value (pin 4 to 7) MOS-standard: T_C = 25 °C, T_j = 150 °C	I_L-MOS	–	–	14	A
Load current limit (pin 4 to 7) V_{bb} − V_{out} > 1 V	I_{LLim}	–	12	–	A
Undervoltage threshold (Pin 4 to GND) R_L = 6 Ω	$V_{bb(LOW)}$	3.0	4.2	5.4	V
Overvoltage threshold (Pin 4 to GND) R_L = 6 Ω	$V_{bb(HI)}$	17.0	17.8	18.6	V

[1] Note: undervoltage shutdown
[2] Note: overvoltage shutdown

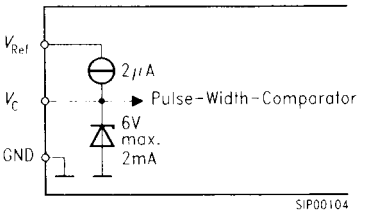
Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

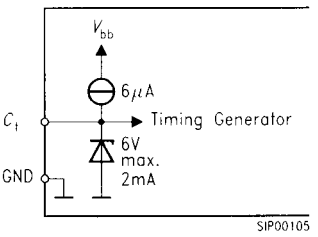
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
PWM reduction threshold (pin 4 to GND), R_L = 6 Ω	V_{bb}	12.6	13.9	14.1	V
Max. output voltage (RMS) (pin 7 to GND), R_L = 6 Ω	V_{RMSmax}	12.2	13.5	13.7	
Reference voltage (pin 3 to pin 1) V_{bb} = 12 V, I_{REF} = 10 mA	V_{REF}	2.0	2.5	3.0	
Reference current (pin 3 to pin 1) V_{bb} = 12 V, pin 3 to 1 short	I_{REF}	–	150	–	mA
Internal current consumption during operation (pin 4 to pin 1, measured in PWM gap) V_{bb} = 12 V, R pin 3 to GND = 2.5 kΩ	I_R	–	2.0	3.5	
Bootstrap voltage (pin 6 to pin 7) V_{bb} = 12 V	V_B	–	10	–	V
PWM frequency (pin 7 to GND) V_{bb} = 12 V, T_C = – 40 ... + 130 °C BTS 629 C_t = 47 nF BTS 629 A C_t = 68 nF	f_{PWM}	60	–	120	Hz
Max. pulse duty factor V_{bb} = 12 V, R_L = 6 Ω, V_C = V_{REF} (50% V_{out})	D_{fmax}	95	98	–	%
Min. pulse duty factor V_{bb} = 12 V, R_L = 6 Ω, V_C = 0 (50% V_{out})	D_{fmin}	–	8	14	
Slew rate "on" V_{bb} = 12 V, R_L = 6 Ω, 10...30% V_{out}	$dv/dt_{(on)}$	–	–	0.12	V/µs
Slew rate "off" V_{bb} = 12 V, R_L = 6 Ω, 90...10% V_{out}	$dv/dt_{(off)}$	–	–	0.12	
Slew rate "on" V_{bb} = 12 V, R_L = 6 Ω, 10...30% I_{out}	$di/dt_{(on)}$	–	–	0.02	A/µs
Slew rate "off" V_{bb} = 12 V, R_L = 6 Ω, 90...10% I_{out}	$di/dt_{(off)}$	–	–	0.02	
Thermal overload trip temperature	T_{jt}	150	–	–	°C

Circuits

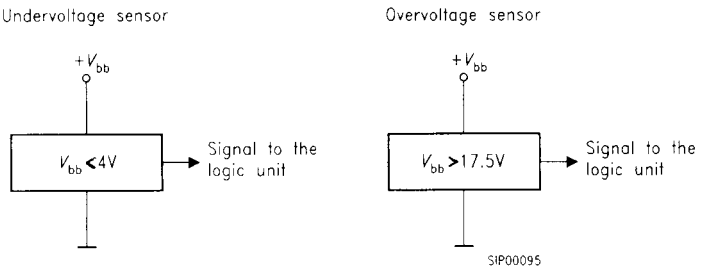
Analog Logic-Input V_C (2)



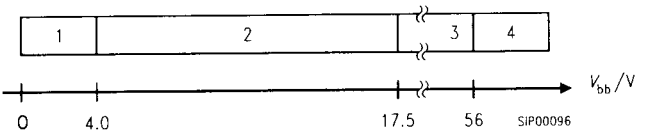
Triangular wave form Generator Input C_t (5)



Voltage Sensor (typ)



Operating range (typ.)



1: Undervoltage sensor causes the device to switch off
2: Normal operation
3: Overvoltage sensor causes the device to switch off (Timing Generator remains active)
4: Increase of current between Pin 4 and 1 from internal Zener diode to protect the circuit against overvoltage spikes

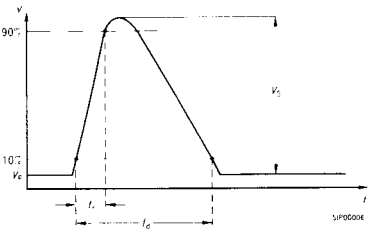
Susceptibility to electrical interference
to DIN 40 839 part 1 (12 V supply voltage)*

Test pulse	Susceptibility levels							
					with 150 Ω in GND-line			
	I	II	III	IV	I	II	III	IV
1	X	X	X	X	X	X	X	X
2	X	X	Y	Y	X	X	X	X
3a	X	X	X	X	X	X	X	X
3b	X	X	X	X	X	X	X	X
4	X	X	X	X	X	X	X	X
5	X	X	Y	Y	X	X	X	Y

Class X: All functions of the device are performed as designed after exposure to disturbance

Class Y: One or more functions of the device are not performed as designed after exposure and cannot be returned to proper operation without replacing the device

Test pulse 5: Load dump



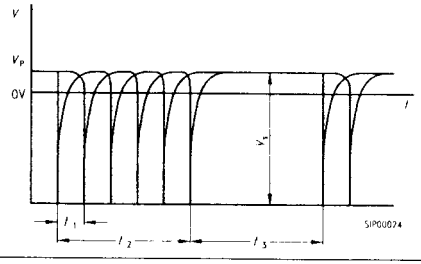
Parameters: V_S = 50 V (level II)
V_P = 13.5 V
R_i = 0.5 to 4 Ω
t_d = 40 to 400 ms
t_r = 0.1 to 10 ms
I_{Load} (Pin 7 to GND) = I_L-ISO (see page 2)
with 150 Ω in GND-line:
V_S = 80 V (Level III)

Note:
The condition are related to each other in that the high setting values of V_S, R_i and t_d belong together as do respectively the low values

*) DIN 40839: Electromagnetic compatibility (EMC) in motor vehicles; correlation with ISO-Technical Report 7637/0 and 7637/1.

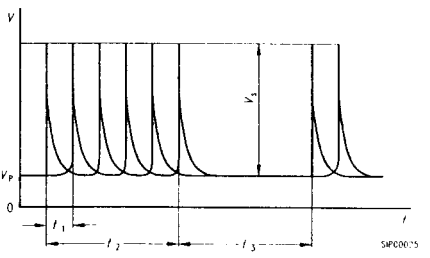
Susceptibility to electrical interference
to DIN 40 839 part 1 (12 V supply voltage)

Test Pulse 3a



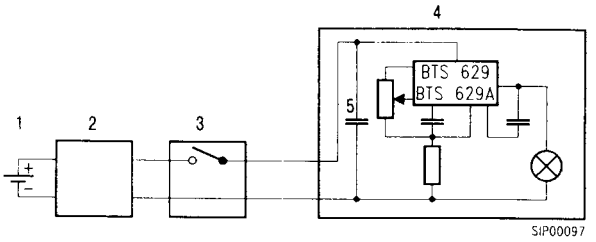
Parameters
$V_S = -150$ V
$R_i = 50\ \Omega$
$t_d = 0.1\ \mu s$
$t_r = 5$ ns
$t_1 = 100\ \mu s$
$t_2 = 10$ ms
$t_3 = 90$ ms

Test Pulse 3b



Parameters
$V_S = 100$ V
$R_i = 50\ \Omega$
$t_d = 0.1\ \mu s$
$t_r = 5$ ns
$t_1 = 100\ \mu s$
$t_2 = 10$ ms
$t_3 = 90$ ms

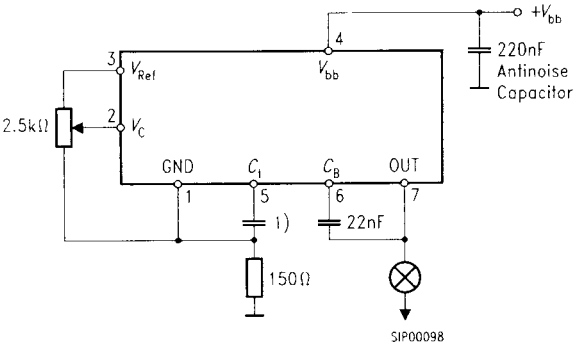
Test circuit



1 Battery
2 Test pulse generator with integrate source resistance*
3 Disconnecting switch
4 Sample
5 Antinoise capacitor (220 nF)
* Schaffner PART NSG 500 C and 506 C

Applications

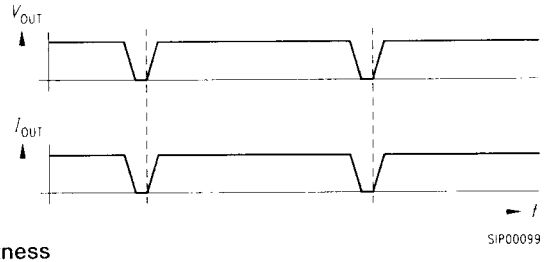
Dimming of dashboard lighting



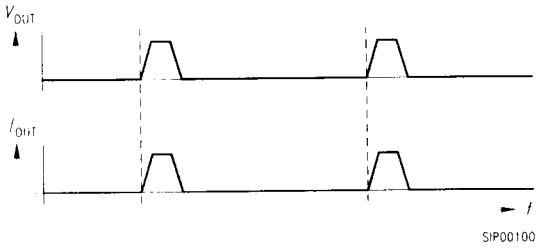
1) BTS 629 C_t = 47 nF
BTS 629 A C_t = 68 nF

Resistor for
reverse battery and load dump
protection

Maximum Brightness

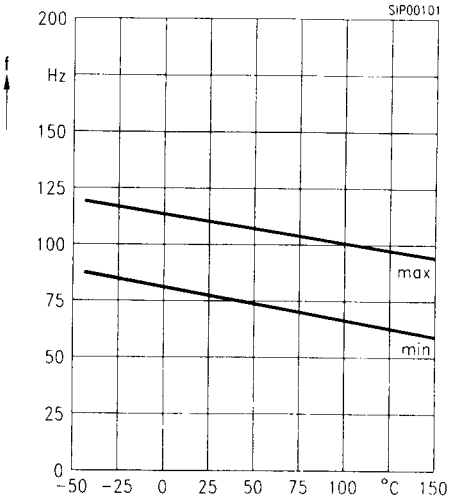


Minimum Brightness



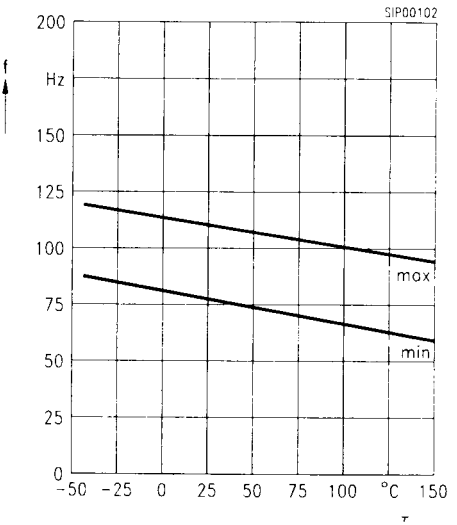
BTS 629
PWM Frequency characteristic
min./max. Values

C_t = 47 nF V_{bb} = 12 V
$Q_c \geq 500 / f = 10$ kHz C_B = 22 nF

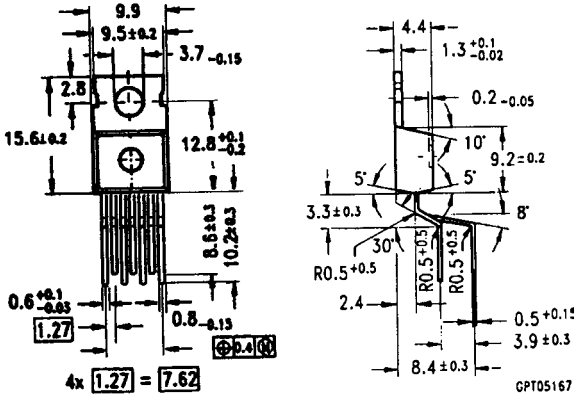


BTS 629A
PWM Frequency characteristic
min./max. Values

C_t = 68 nF V_{bb} = 12 V
$Q_c \geq 500 / f = 10$ kHz C_B = 22 nF



Package
TO-220/7
Weight: 0.5 g
Dimensions in mm



Pin	1	2	3	4	5	6	7
	GND	V_c	V_{REF}	V_{bb}	C_t	C_B	OUT