SIEMENS
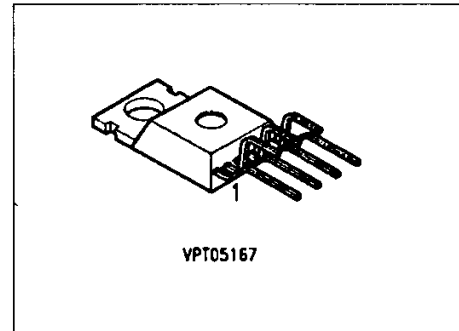
Dimmer

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

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

VPT05167

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	$m\Omega$
Operating voltage (pin 4 to GND) $T_j = +25\ldots+150\,°C$ $T_j = -40\ldots+150\,°C$	V_{bb}	5.5 [1] 5.9	– –	16.9 [2] 16.9	V
Nominal current, calculated value (pin 4 to 7) ISO-proposal: $V_{bb}-V_{out} \leq 0.5\,V$, $T_C = 85\,°C$	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) $R_L = 6\,\Omega$	$V_{bb(LOW)}$	3.0	4.2	5.4	V
Overvoltage threshold (Pin 4 to GND) $R_L = 6\,\Omega$	$V_{bb(HI)}$	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.

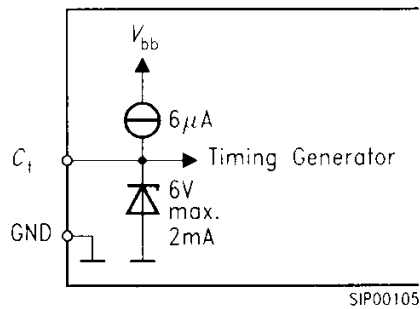| Parameter	Symbol	Values			Unit
		min.	typ.	max.	
PWM reduction threshold (pin 4 to GND), R_L = 6 Ω	V_{bb}	12.6	13.9	14.1	V
Max. output voltage (RMS) (pin 7 to GND), R_L = 6 Ω	V_{RMSmax}	12.2	13.5	13.7	
Reference voltage (pin 3 to pin 1) V_{bb} = 12 V, I_{REF} = 10 mA	V_{REF}	2.0	2.5	3.0	
Reference 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)

V_{Ref}

$2\mu A$

V_C ⟶ Pulse-Width-Comparator

6V
max.
2mA

GND

SIP00104
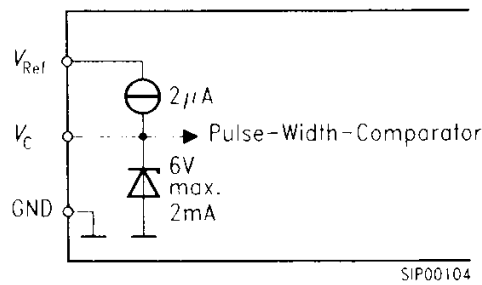
**Triangular wave form
Generator Input C_t (5)**

V_{bb}

$6\mu A$

C_t ⟶ Timing Generator

6V
max.
2mA

GND

SIP00105

Voltage Sensor (typ)

Undervoltage sensor
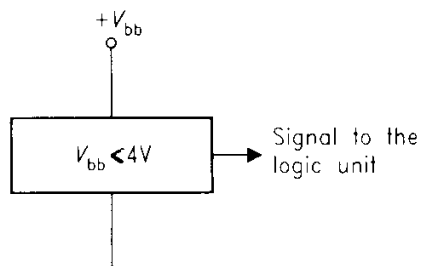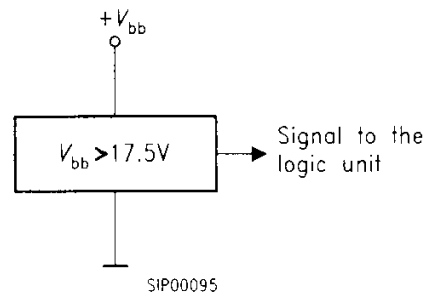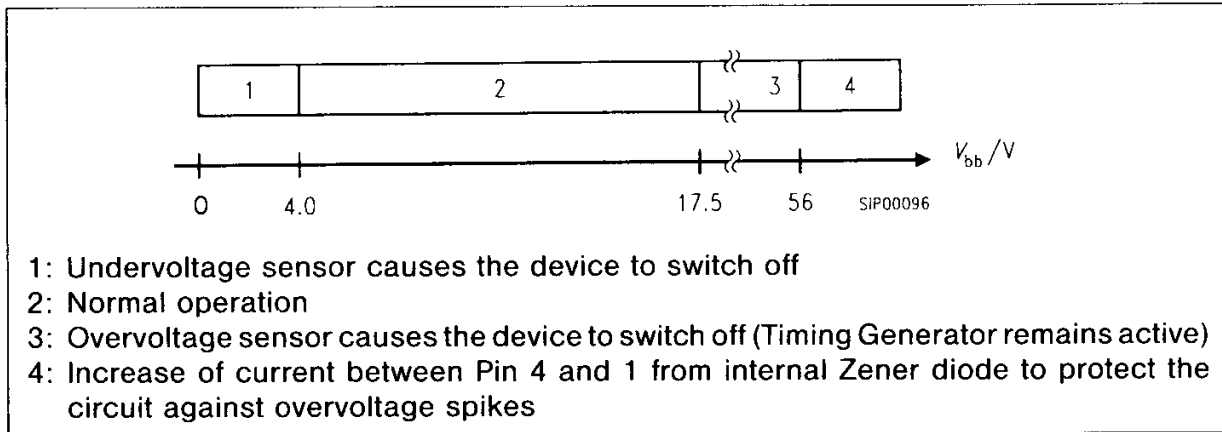
$+V_{bb}$

| $V_{bb} < 4V$ | ⟶ Signal to the logic unit |

Overvoltage sensor

$+V_{bb}$

| $V_{bb} > 17.5V$ | ⟶ Signal to the logic unit |

SIP00095

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Operating range (typ.)

| 1 | 2 | 3 | 4 |

V_{bb}/V

0   4.0   17.5   56   SIP00096

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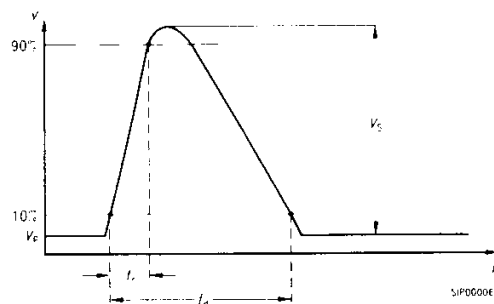
Parameters: $V_S = 50$ V (level II)
$V_P = 13.5$ V
$R_i = 0.5$ to 4 Ω
$t_d = 40$ to 400 ms
$t_r = 0.1$ to 10 ms
I_{Load} (Pin 7 to GND) $= I_L$-ISO (see page 2)
with 150 Ω in GND-line:
$V_S = 80$ V (Level III)

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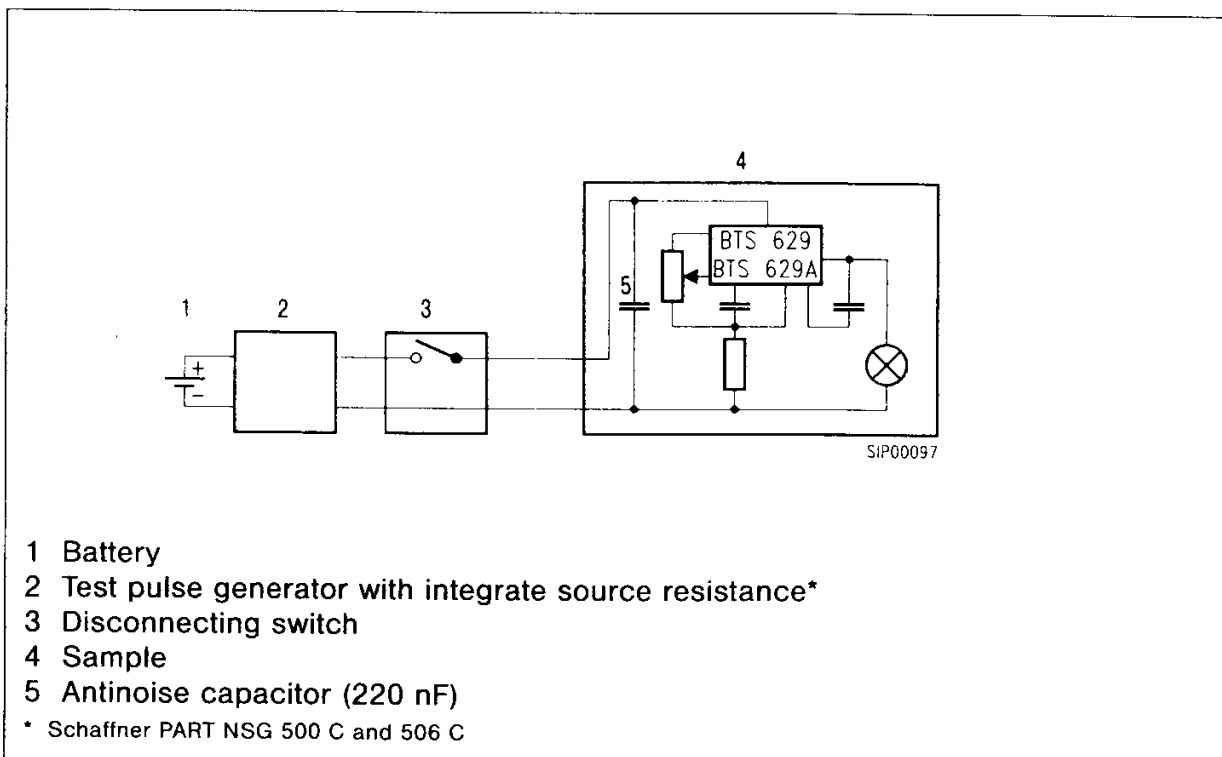
Susceptibility to electrical interference
to DIN 40 839 part 1 (12 V supply voltage)

Test Pulse 3a

Test Pulse 3b
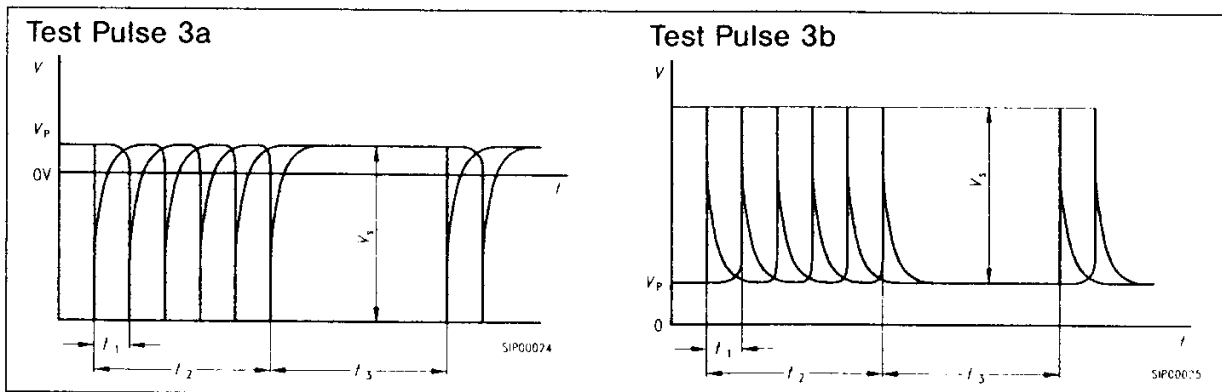
Parameters

$V_S = -150$ V

$R_i = 50$ Ω

$t_d = 0.1$ μs

$t_r = 5$ ns

$t_1 = 100$ μs

$t_2 = 10$ ms

$t_3 = 90$ ms

Parameters

$V_S = 100$ V

$R_i = 50$ Ω

$t_d = 0.1$ μs

$t_r = 5$ ns

$t_1 = 100$ μs

$t_2 = 10$ 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

SIP00098

Resistor for
reverse battery and load dump
protection
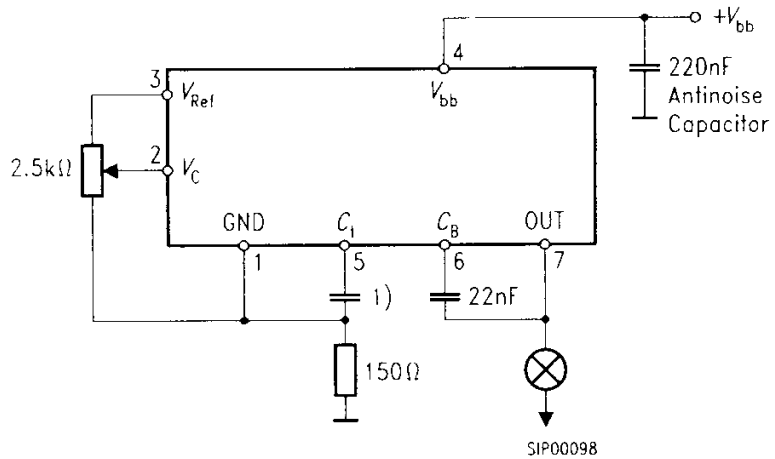
') BTS 629 $C_1 = 47$ nF
BTS 629 A $C_1 = 68$ nF

2.5 kΩ

150 Ω

22nF

220nF
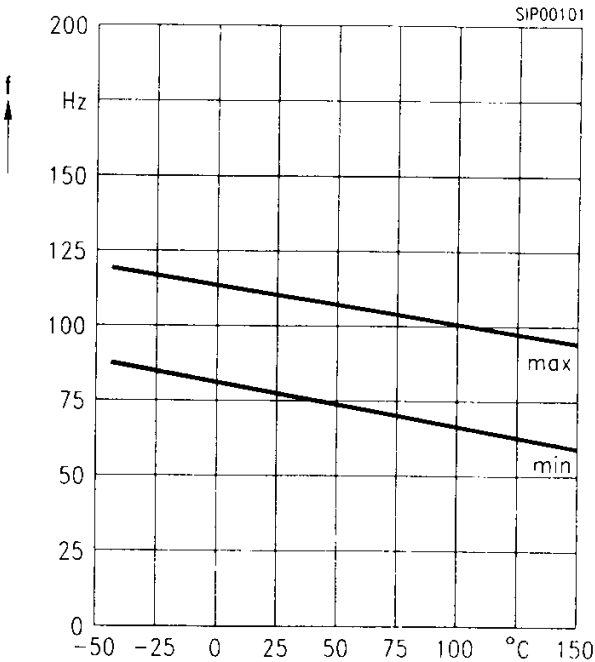Antinoise
Capacitor

Maximum Brightness

SIP00099
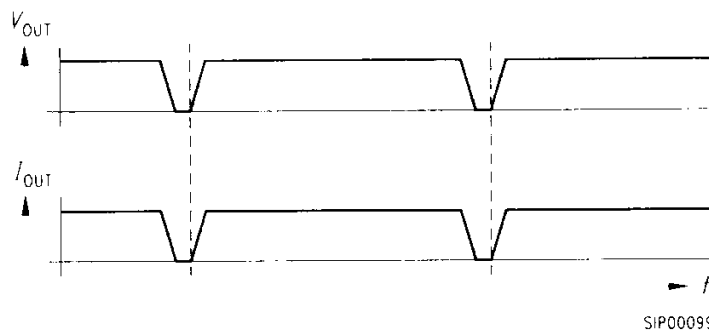
Minimum Brightness

SIP00100
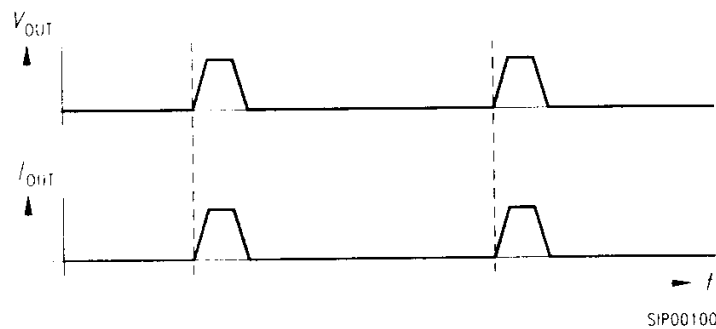
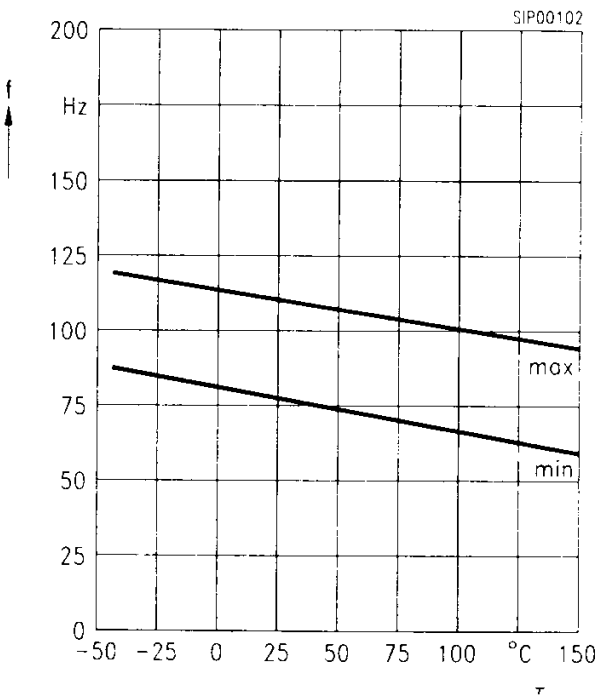**BTS 629**
PWM Frequency characteristic
min./max. Values

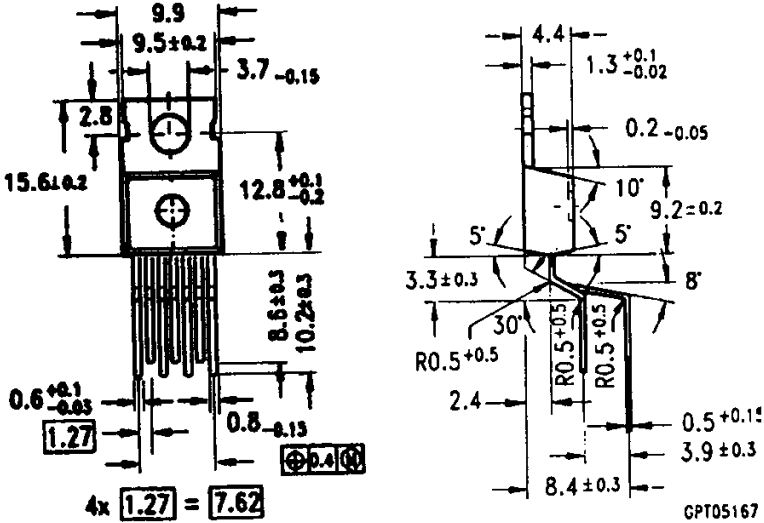$C_t = 47$ nF $\qquad V_{bb} = 12$ V
$Q_c \geq 500 / f = 10$ kHz $\quad C_B = 22$ nF

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

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

Semiconductor Group

8 - 10

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

GPT05167