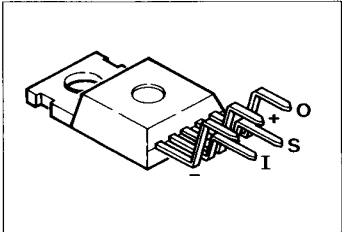


PROFET

BTS 413 A
Not for new design
(Replacement: BTS 412 B)

- High-side switch
- Short-circuit protection
- Overtemperature protection with latch
- Overload protection
- Input protection
- Open-load detection in off-condition
- Clamp of negative output voltage with inductive loads
- In case of fault, the output trips and remains open
- Status output (CMOS)
- In case of fault, the status changes from "H" to "L" and remains on "L"
- Restart: $V_{in(off)}/V_{in(on)}$



Type	Ordering code
BTS 413 A	C67078-A5307-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Breakdown voltage	$V_{bb(BR)}$	45	V
Short-circuit current	I_{SC}	self-limited	–
Max. power dissipation	P_{tot}	75	W
Operating and storage temperature range	T_j T_{stg}	– 55 ... + 150	°C
Thermal resistance			K/W
Chip – case	$R_{th JC}$	1.67	
Chip – ambient	$R_{th JA}$	50	

Electrical Characteristicsat $T_j = 25\text{ }^{\circ}\text{C}$, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
On-state resistance (pin 3 to 5) $V_{bb} = 24\text{ V}$, $I_L = 2\text{ A}$, $V_{in} = 5\text{ V}$ $V_{bb} = 12\text{ V}$, $I_L = 2\text{ A}$, $V_{in} = 5\text{ V}$	R_{on}	–	0.25	0.29	Ω
		–	0.35	0.40	
Operating voltage (pin 3 to 1)	V_{bb}	*)	–	35	V
Load current (pin 5 to 1) $T_C = 25\text{ }^{\circ}\text{C}$, $V_{bb} = 24\text{ V}$	I_L	–	–	11	A
Short-circuit current $V_{bb} = 12\text{ V}$	I_{SC}	–	25	–	
Standby current (pin 3 to 1 and 5) (with and without load) $V_{bb} = 12\text{ V}$, $T_j = 25\text{ }^{\circ}\text{C}$ $T_j = 115\text{ }^{\circ}\text{C}$	I_R	–	–	0.20	mA
		–	–	0.25	
Input voltage (pin 2 to 1) $V_{bb} = 12\text{ V}$	$V_{in(off)}$ $V_{in(on)}$	–0.5 3	– –	1.5 35	V
Input current (pin 2 to 1) $V_{in(off)} = 0.4\text{ V}$, $V_{in(on)} = 3.5\text{ V}$	$I_{in(off)}$ $I_{in(on)}$	1 3	– –	20 50	μA
Input capacitance (pin 2 to 1) $V_{in} = 0$	C_{in}	–	2	–	pF
Trip temperature automatic tripping when $T_j \geq 150\text{ }^{\circ}\text{C}$	T_i	150	–	–	$^{\circ}\text{C}$
Turn-on time	t_{on}	15	–	60	μs
Turn-off time	t_{off}	5	–	30	
Switching edge $V_{bb} = 12\text{ V}$, $I_L = 2\text{ A}$	dv/dt	–	–	10	V/ μs
Status $I_{St} = 50\text{ }\mu\text{A}$, $V_{bb} = 12\text{ V}$ Status determination $> 50\text{ }\mu\text{s}$ after switching edge	$V_{St(high)}$ $V_{St(low)}$	4.5 –	– –	6.5 0.4	V

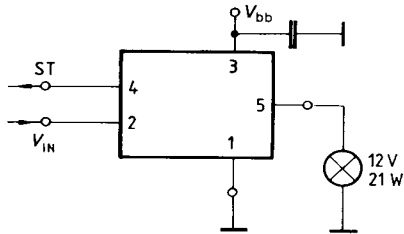
*) see diagram $I_{L(max)} = f(V_{bb})$

Truth Table

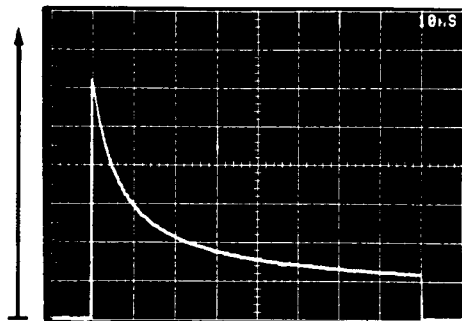
L = "Low" level H = "High" level	Input voltage	Status	Output voltage
Normal operation	L H	H H	L H
Open load	L H	L H	*) H
Short-circuit	L H	H L	L L
Overtemperature	L H	L L	L L

*) Power transistor off, internal pullup current source (typ 30 μ A)
for open load detection

Figure 1: Switching a lamp



Output current
2 A/Div



Output voltage
5 V/Div

Input voltage
5 V/Div

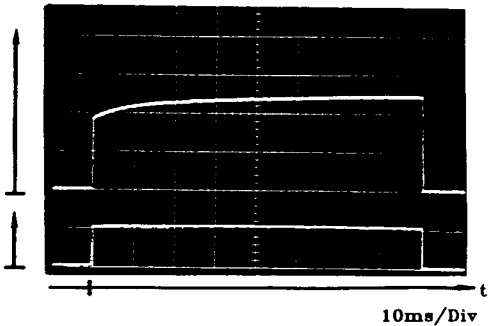


Figure 2: Switching a solenoid

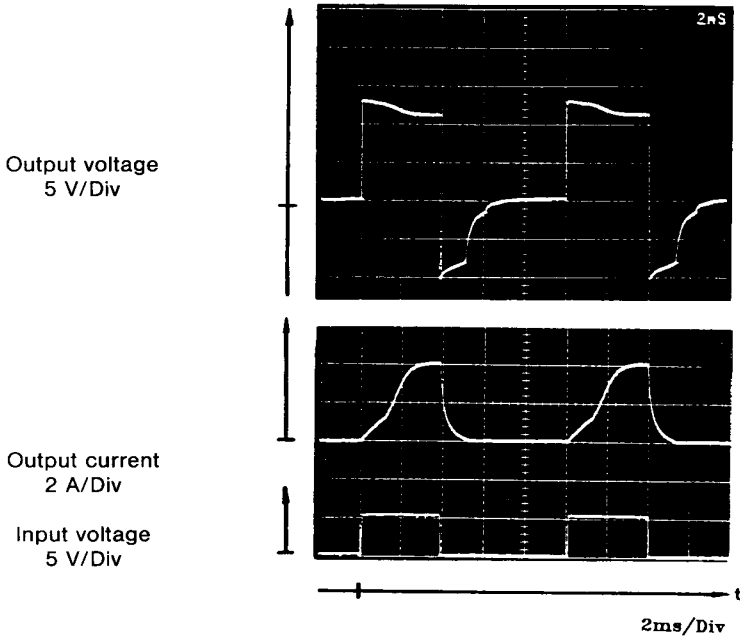
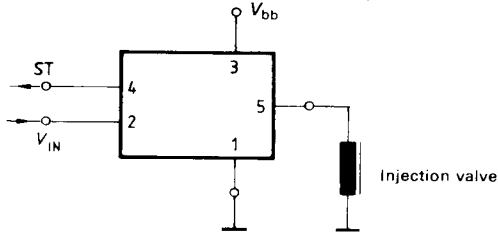
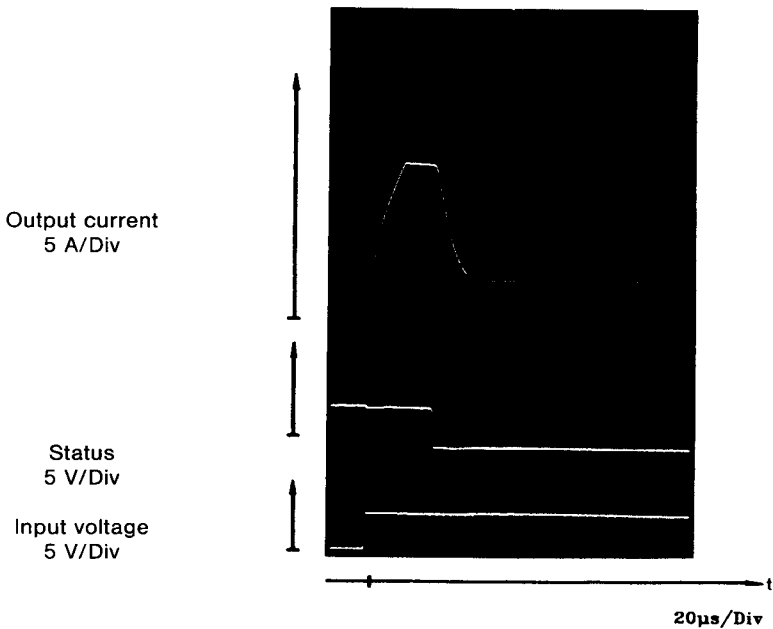
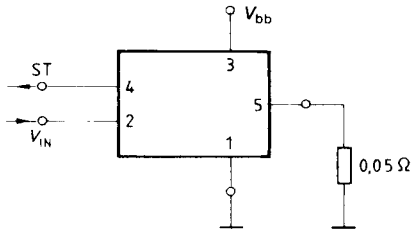
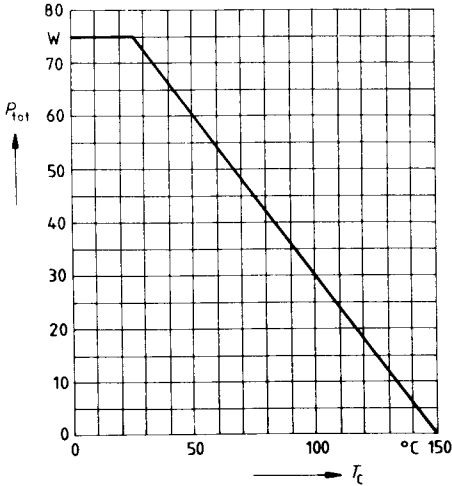


Figure 3: Switching with output short-circuited

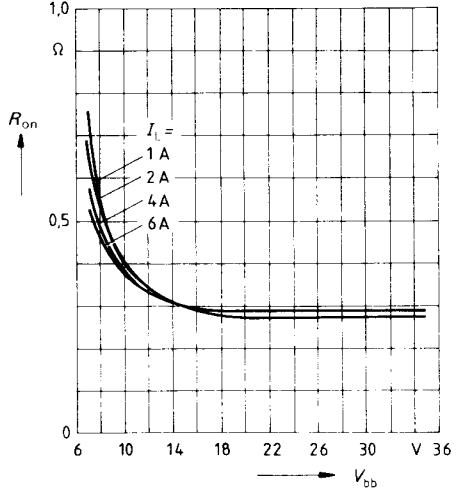


Power dissipation $P_{\text{tot}} = f(T_c)$



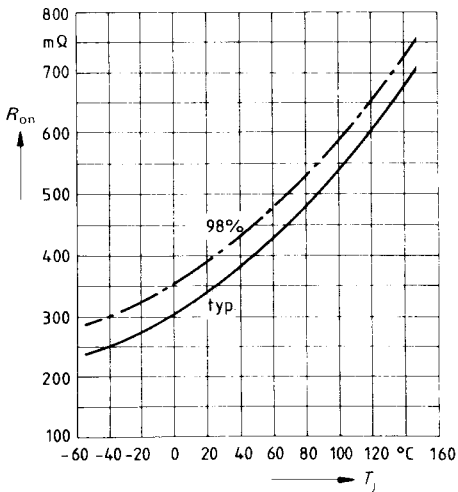
Typ. on-state resistance $R_{\text{on}} = f(V_{\text{bb}})$

Parameter: $V_{\text{in}} = 5 \text{ V}$



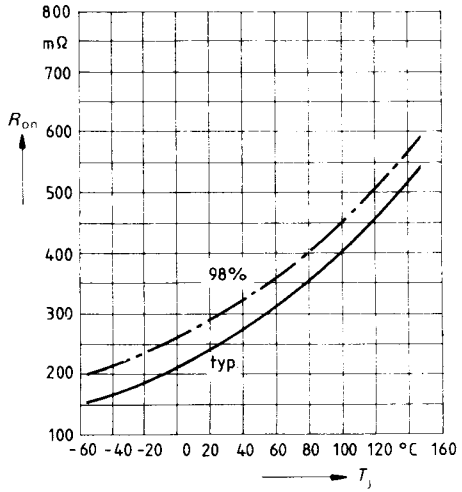
On-state resistance $R_{\text{on}} = f(T_j)$

Parameter: $V_{\text{bb}} = 12 \text{ V}$; $I_L = 2 \text{ A}$; $V_{\text{in}} = 5 \text{ V}$



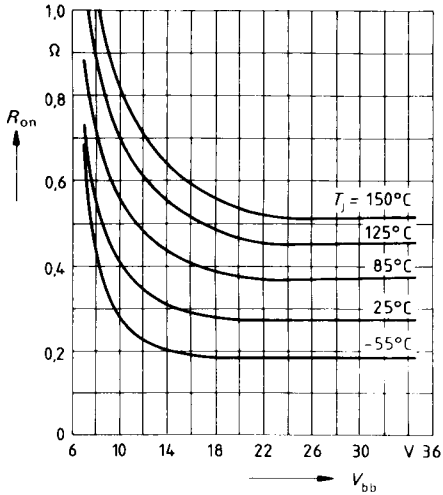
On-state resistance $R_{\text{on}} = f(T_j)$

Parameter: $V_{\text{bb}} = 24 \text{ V}$; $I_L = 2 \text{ A}$; $V_{\text{in}} = 5 \text{ V}$



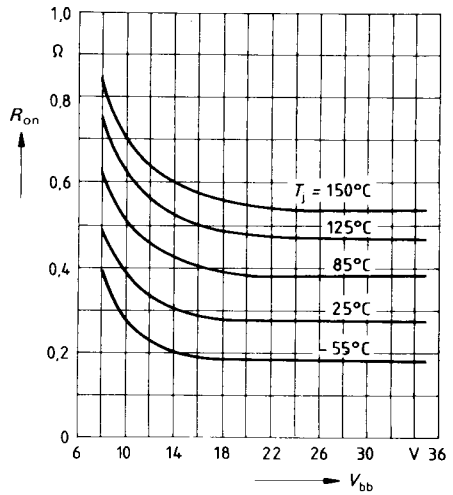
Typ. on-state resistance $R_{on} = f(V_{bb})$

Parameter: $I_L = 1.25 \text{ A}$



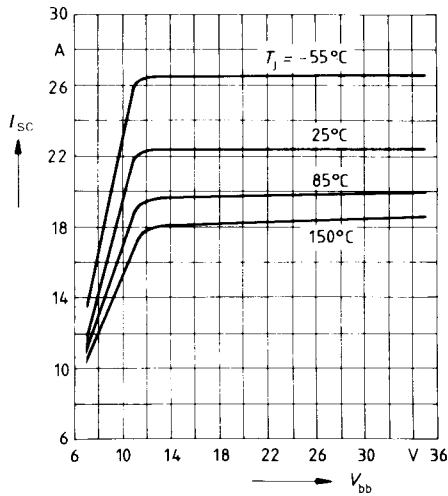
Typ. on-state resistance $R_{on} = f(V_{bb})$

Parameter: $I_L = 4 \text{ A}$

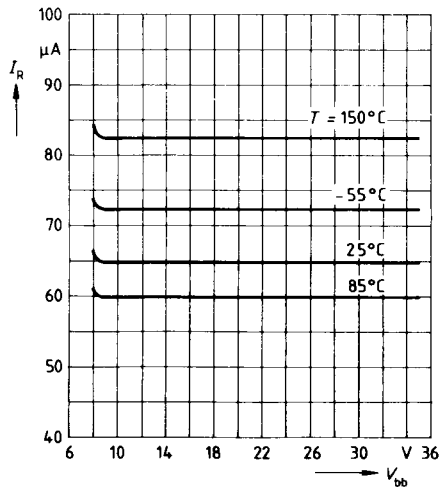


Typ. short-circuit current $I_{SC} = f(V_{bb})$

Parameter: $R_L = 0.05 \Omega$; $V_{in} = 5 \text{ V}$

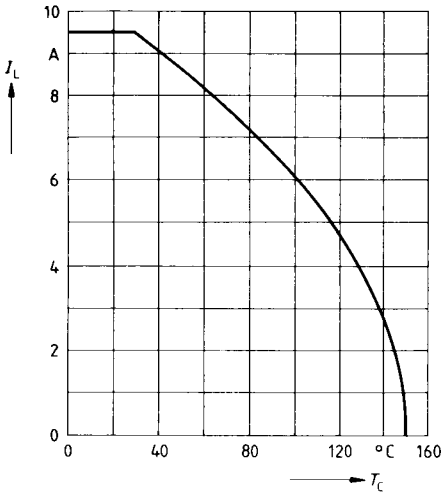


Typ. stand-by current $I_R = f(V_{bb})$



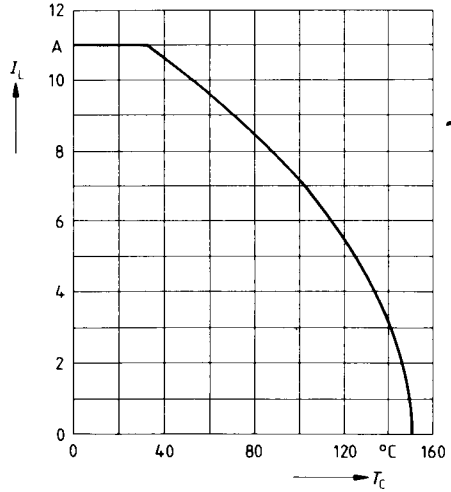
Load current $I_L = f(T_C)$

Parameter: $V_{bb} = 12\text{ V}$; $V_{in} = 5\text{ V}$



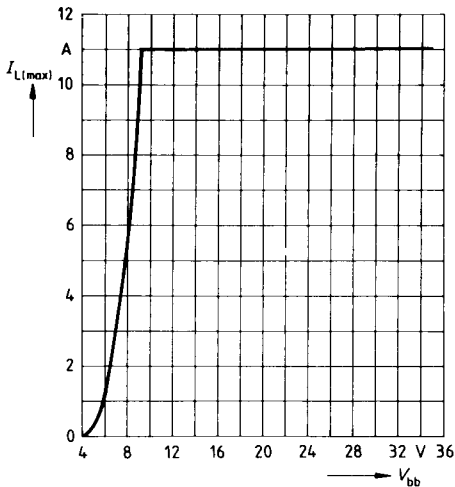
Load current $I_L = f(T_C)$

Parameter: $V_{bb} = 24\text{ V}$; $V_{in} = 5\text{ V}$



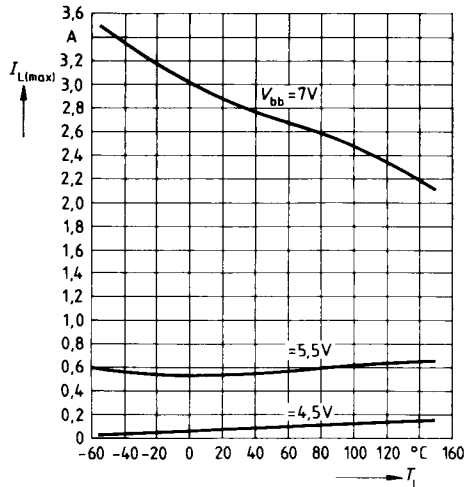
Typ. switchable load current $I_{L(max)} = f(V_{bb})$

Parameter: $V_{bb} = 12\text{ V}$; $V_{in} = 5\text{ V}$



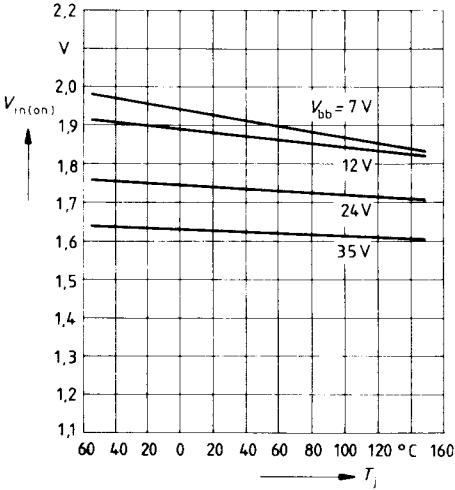
Typ. switchable load current $I_{L(max)} = f(T_j)$

Parameter: $V_{bb} = 24\text{ V}$; $V_{in} = 5\text{ V}$



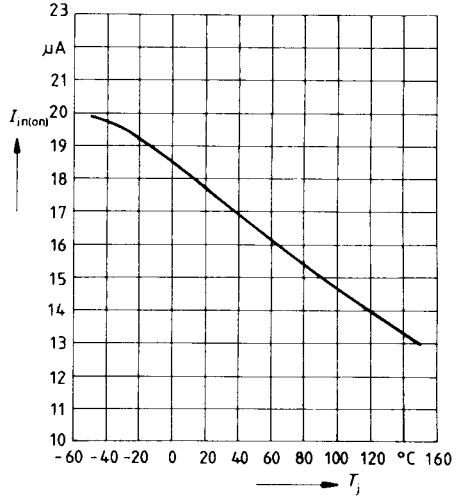
Typ. input voltage $V_{in(on)} = f(T_j)$

Parameter: $R_L = 100 \Omega$



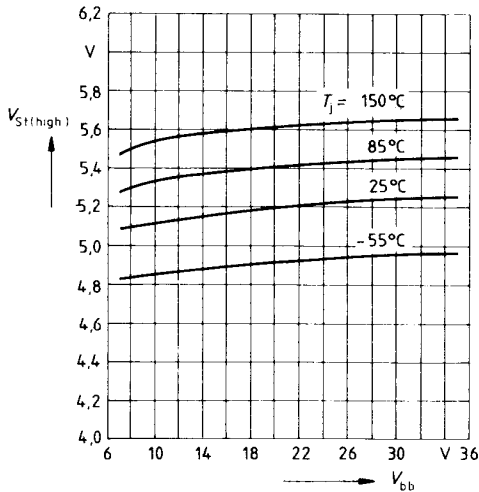
Typ. input current $I_{in(on)} = f(T_j)$

Parameter: $V_{bb} = 12 \text{ V}$; $V_{in} = 5 \text{ V}$; $R_L = 100 \Omega$



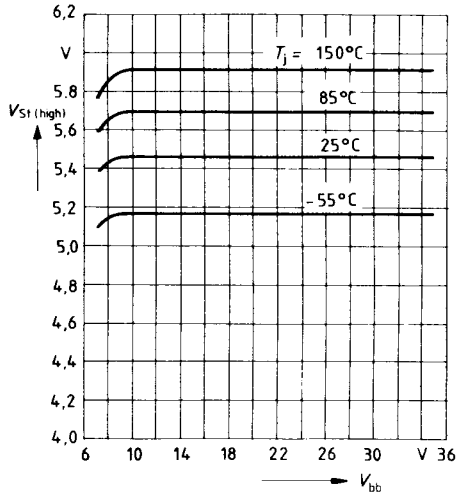
Typ. status voltage $V_{St(high)} = f(V_{bb})$
with load current

Parameter: $V_{in} = 3.5 \text{ V}$; $I_{St} = 50 \mu\text{A}$;
 $R_L = 100 \Omega$



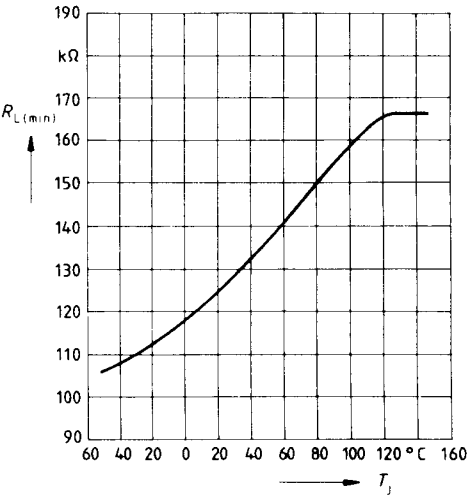
Typ. status voltage $R_{St(high)} = f(V_{bb})$
without load current

Parameter: $V_{in} = 0$; $R_L = 100 \Omega$



Typ. open load detection $R_{L(min)} = f(T_j)$

Parameter: $V_{bb} = 12\text{ V}$



Forward characteristic of reverse diode

$I_F = f(V_F)$ (pin 5 to 3)

Parameter: T_j ; $t_p = 80\text{ }\mu\text{s}$

