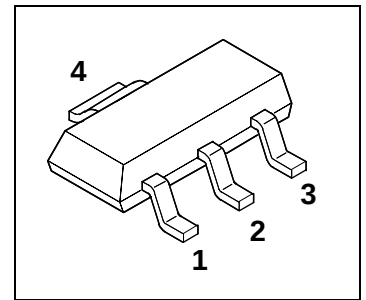


MiniPROFET

- High-side switch
- Short-circuit protection
- Input protection
- Overtemperature protection with hysteresis
- Overload protection
- Overvoltage protection
- Switching inductive load
- Clamp of negative output voltage with inductive loads
- Undervoltage shutdown
- Maximum current internally limited
- **Electrostatic discharge (ESD)** protection
- Reverse battery protection¹⁾



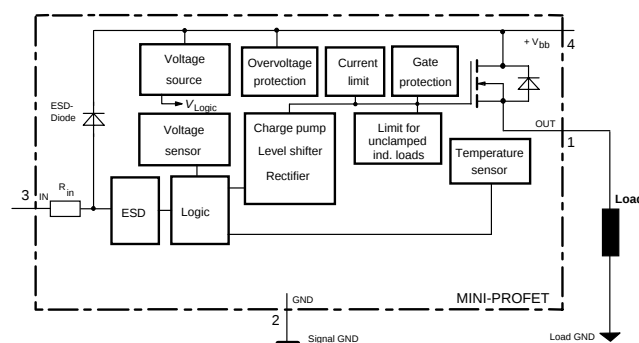
Package: SOT 223

Type	Ordering code
BSP 450	Q67000-S266

Pins			
1	2	3	4
OUT	GND	IN	V _{bb}

Maximum Ratings

Parameter	Symbol	Values	Unit
Supply voltage range	V_{bb}	-0.3...48	V
Load current self-limited	I_L	$I_{L(SC)}$	A
Maximum input voltage ²⁾	V_{IN}	-5.0... V_{bb}	V
Maximum input current	I_{IN}	±5	mA
Inductive load switch-off energy dissipation single pulse $I_L = 0.5A$, $T_A = 85^\circ C$	E_{AS}	0.5	J
Operating temperature range	T_j	-40 ...+125	°C
Storage temperature range	T_{stg}	-55 ...+150	
Max. power dissipation (DC) ³⁾ $T_A = 25^\circ C$	P_{tot}	1.4	W
Electrostatic discharge capability (ESD) ⁴⁾	V_{ESD}	±1	kV
Thermal resistance chip - soldering point: chip - ambient ³⁾	R_{thJS} R_{thJA}	7 70	K/W



1) With resistor $R_{\text{GND}}=150\ \Omega$ in GND connection, resistor in series with IN connections reverse load current limited by connected load.

2) At $V_{IN} > V_{bb}$, the input current is not allowed to exceed ± 5 mA.

3) BSP 450 on epoxy pcb 40 mm x 40 mm x 1.5 mm with 6 cm² copper area for V_{bb} connection

4) HBM according to MIL-STD 883D, Methode 3015.7

Electrical Characteristics

Parameter and Conditions at $T_j = 25^\circ\text{C}$, $V_{bb} = 24\text{V}$ unless otherwise specified	Symbol	Values			Unit
		min	typ	max	

Load Switching Capabilities and Characteristics

On-state resistance (pin 4 to 1) $I_L = 0.5\text{ A}$, $V_{in} = \text{high}$ $T_j = 25^\circ\text{C}$ $T_j = 125^\circ\text{C}$		R_{ON}	-- --	0.16 --	0.2 0.38	Ω
Nominal load current (pin 4 to 1) ⁵⁾ ISO Standard: $V_{ON} = V_{bb} - V_{OUT} = 0.5\text{ V}$ $T_S = 85^\circ\text{C}$		$I_{L(ISO)}$	0.7	--	--	A
Turn-on time to 90% V_{OUT}		t_{on}	--	60	100	μs
Turn-off time to 10% V_{OUT} $R_L = 47\ \Omega$		t_{off}	--	90	150	
Slew rate on 10 to 30% V_{OUT} , $R_L = 47\ \Omega$		dV/dt_{on}	--	2	4	V/ μs
Slew rate off 70 to 40% V_{OUT} , $R_L = 47\ \Omega$		- dV/dt_{off}	--	2	4	V/ μs

Input

Allowable input voltage range, (pin 3 to 2)		V_{IN}	-3.0	--	V_{bb}	V
Input turn-on threshold voltage  $V_{bb} = 18\text{...}30\text{V}$ $T_j = -25\text{...}+125^\circ\text{C}$		$V_{IN(T+)}$	--	--	3.0	V
Input turn-off threshold voltage  $V_{bb} = 18\text{...}30\text{V}$ $T_j = -25\text{...}+125^\circ\text{C}$		$V_{IN(T-)}$	1.82	--	--	V
Input threshold hysteresis		$\Delta V_{IN(T)}$	--	0.1	--	V
Off state input current (pin 3) $V_{IN(off)} = 1.82\text{ V}$ $T_j = -25\text{...}+125^\circ\text{C}$		$I_{IN(off)}$	20	--	--	μA
On state input current (pin 3) $V_{IN(on)} = 3.0\text{ V to } V_{bb}$ $T_j = -25\text{...}+125^\circ\text{C}$		$I_{IN(on)}$	--	--	110	μA
Input resistance $T_j = -25\text{...}+125^\circ\text{C}$		R_{IN}	1.5	2.8	3.5	k Ω

⁵⁾ $I_{L(ISO)}$ is limited by the current limitation, see $I_{L(SC)}$

Parameter and Conditions at $T_j = 25^\circ\text{C}$, $V_{bb} = 24\text{V}$ unless otherwise specified	Symbol	Values			Unit
		min	typ	max	

Operating Parameters

Operating voltage	$T_j = -25\dots+125^\circ\text{C}$	$V_{bb(\text{on})}$	12	--	40	V
Undervoltage shutdown	$T_j = -25\dots+125^\circ\text{C}$	$V_{bb(\text{under})}$	7	--	10.5	V
Undervoltage restart	$T_j = -25\dots+125^\circ\text{C}$	$V_{bb(\text{u rst})}$	--	--	11	V
Undervoltage hysteresis		$\Delta V_{bb(\text{under})}$	--	0.4	--	V
Standby current (pin 4), $V_{in} = \text{low}$	$T_j = -25\dots+100^\circ\text{C}$ $T_j = 125^\circ\text{C}^{(6)}$	$I_{bb(\text{off})}$	--	10	25 50	μA
Operating current (pin 2), $V_{in} = \text{high}$	$T_j = -25\dots+125^\circ\text{C}$	I_{GND}	--	1	1.6	mA
leakage current (pin 1) $V_{in} = \text{low}$	$T_j = -25\dots+125^\circ\text{C}$	$I_{L(\text{off})}$	--	--	2	μA

Protection Functions

Current limit (pin 4 to 1)	$T_j = 25^\circ\text{C}$ $T_j = -25\dots+125^\circ\text{C}$	$I_{L(\text{SC})}$	0.7 0.7	1.5 --	2 2.4	A
Overvoltage protection $I_{bb}=4\text{mA}$	$T_j = -25\dots+125^\circ\text{C}$	$V_{bb(\text{AZ})}$	48	--	--	V
Output clamp (ind. load switch off) at $V_{\text{OUT}} = V_{bb} - V_{\text{ON}(\text{CL})}$, $I_{bb} = 4\text{mA}$		$V_{\text{ON}(\text{CL})}$	--	72	--	V
Thermal overload trip temperature		T_{jt}	135	150	--	$^\circ\text{C}$
Thermal hysteresis		ΔT_{jt}	--	10	--	K
Inductive load switch-off energy dissipation ⁷⁾ $T_{j \text{ Start}} = 85^\circ\text{C}$, single pulse, $I_L = 0.5\text{A}$, $V_{bb} = 12\text{V}$		E_{AS}	--	--	0.5	J

Reverse Battery

Reverse battery voltage ⁸⁾		$-V_{bb}$			30	V
Continuous reverse drain current	$T_A = 25^\circ\text{C}$	$-I_S$	--	--	1	A
Drain-Source diode voltage $I_F = 1\text{A}$, $V_{in} = \text{low}$	$V_{\text{OUT}} > V_{bb}$	$-V_{\text{ON}}$	--	--	1.2	V

6) increase of standby current at $T_j = 125^\circ\text{C}$ caused by temperature sense current

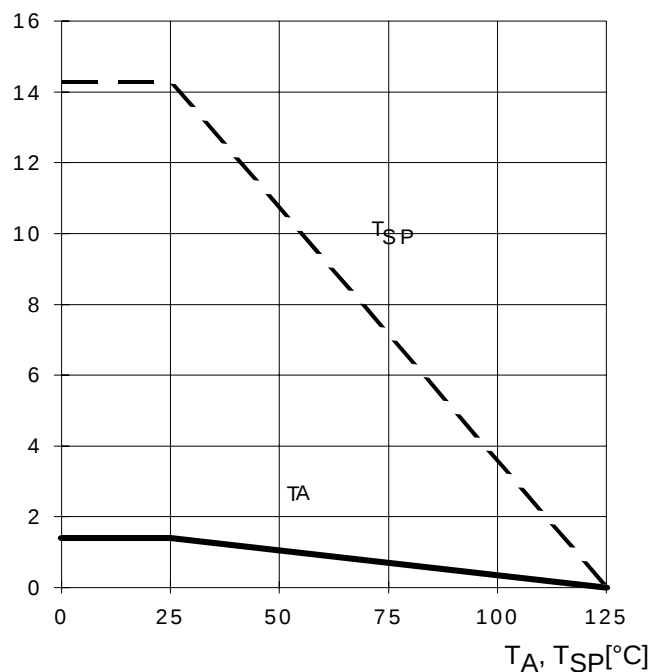
7) while demagnetizing load inductance, dissipated energy is $E_{\text{AS}} = \int (V_{\text{ON}(\text{CL})} * i_L(t) dt$,
approx. $E_{\text{AS}} = \frac{1}{2} * L * I_L^2 * \left(\frac{V_{\text{ON}(\text{CL})}}{V_{\text{ON}(\text{CL})} - V_{bb}} \right)$

8) Requires $150\ \Omega$ resistor in GND connection. Reverse load current (through intrinsic drain-source diode) is normally limited by the connected load.

Max allowable power dissipation

$$P_{\text{tot}} = f(T_A, T_{\text{SP}})$$

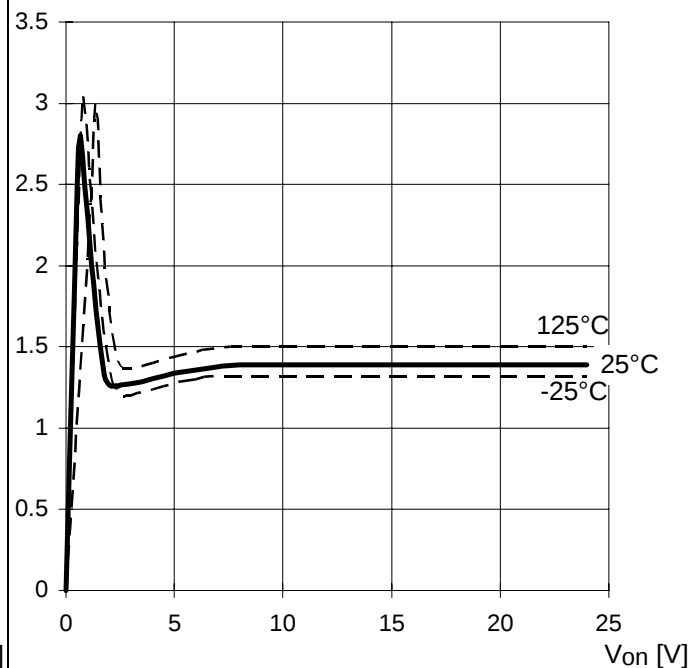
P_{tot} [W]



Current limit characteristic

$$I_L(\text{SC}) = f(V_{\text{on}}) \text{ (Von see testcircuit)}$$

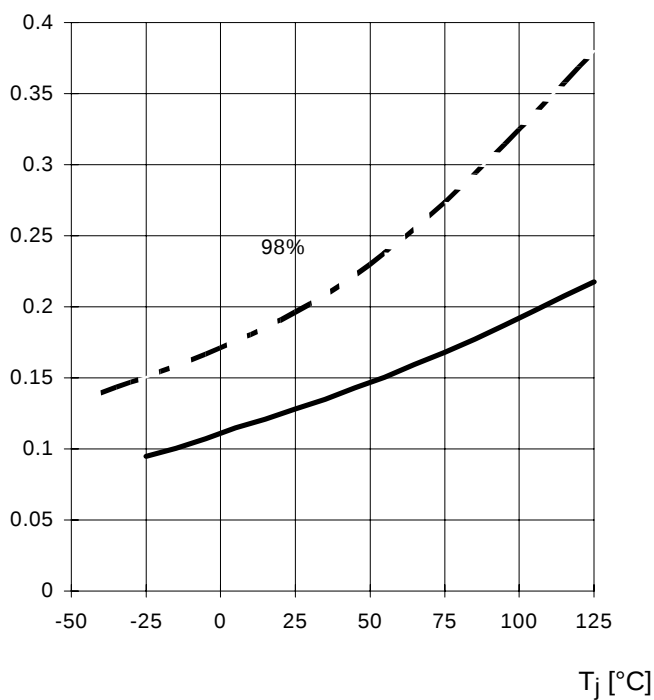
$I_L(\text{SC})$ [A]



On state resistance (Vbb-pin to OUT pin)

$$R_{\text{ON}} = f(T_j); V_{\text{bb}} = 24 \text{ V}; I_L = 0.5 \text{ A}$$

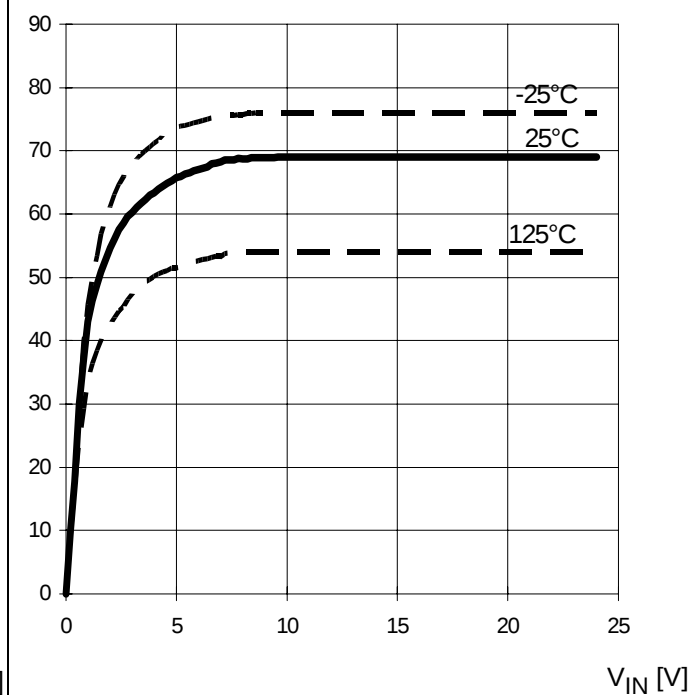
R_{ON} [Ω]



Typ. input current

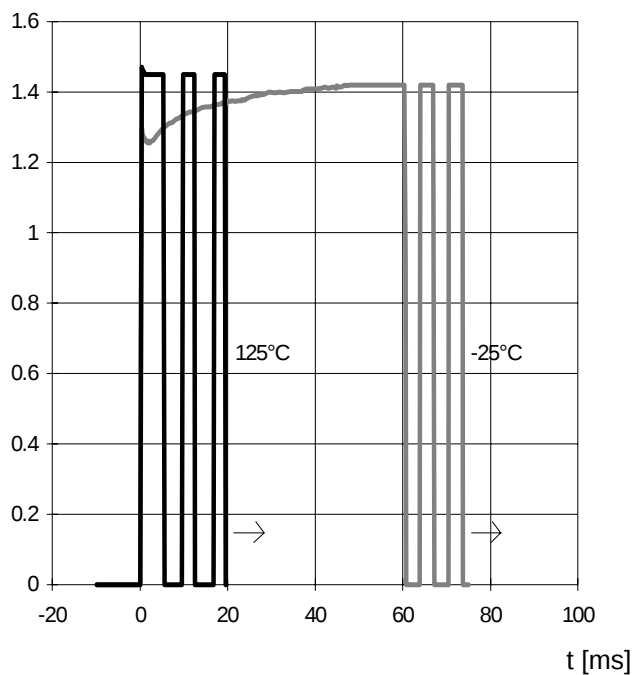
$$I_{\text{IN}} = f(V_{\text{IN}}); V_{\text{bb}} = 24 \text{ V}$$

I_{IN} [μA]



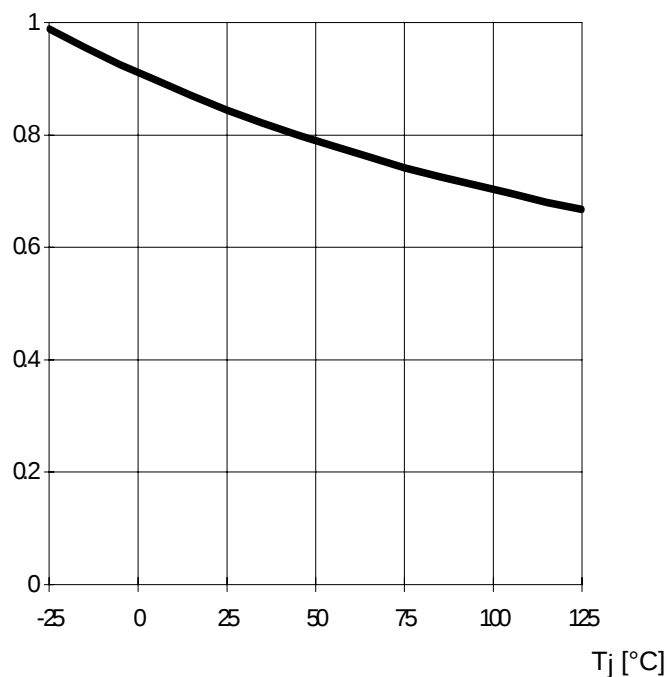
Typ. overload current

$I_{L(lim)} = f(t)$, $V_{bb}=24V$, no heatsink, Param.: T_{jstart}
 $I_{L(lim)}$ [A]



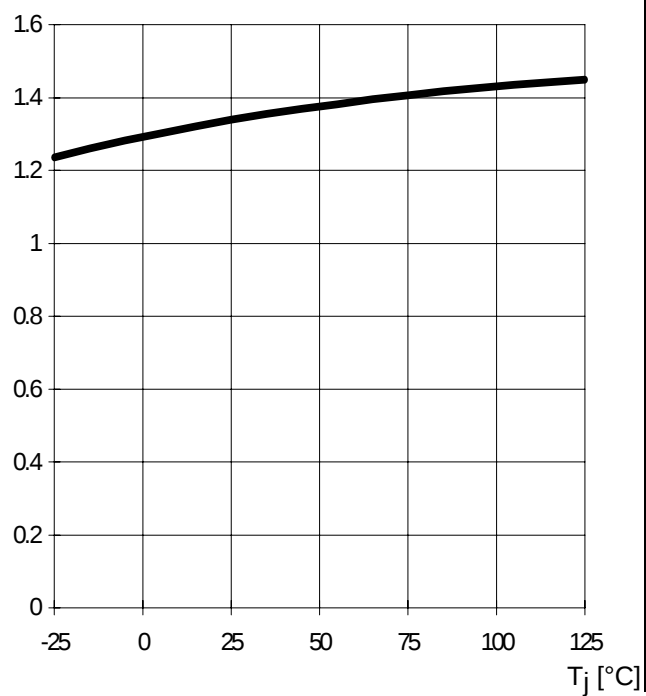
Typ. operating current

$I_{GND} = f(T_j)$, $V_{bb}=30V$, $V_{IN}=high$
 I_{GND} [mA]



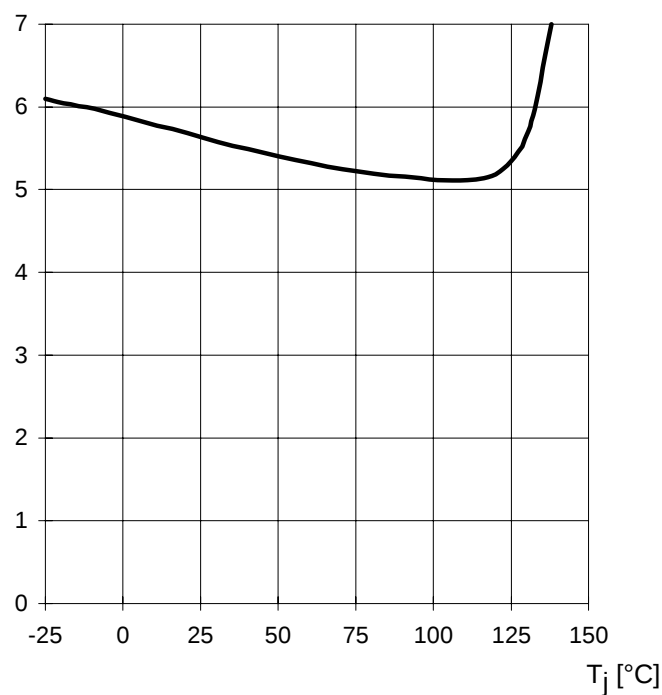
Short circuit current

$I_{L(SC)} = f(T_j)$; $V_{bb} = 30 V$;
 $I_{L(SC)}$ [A]



Typ. standby current

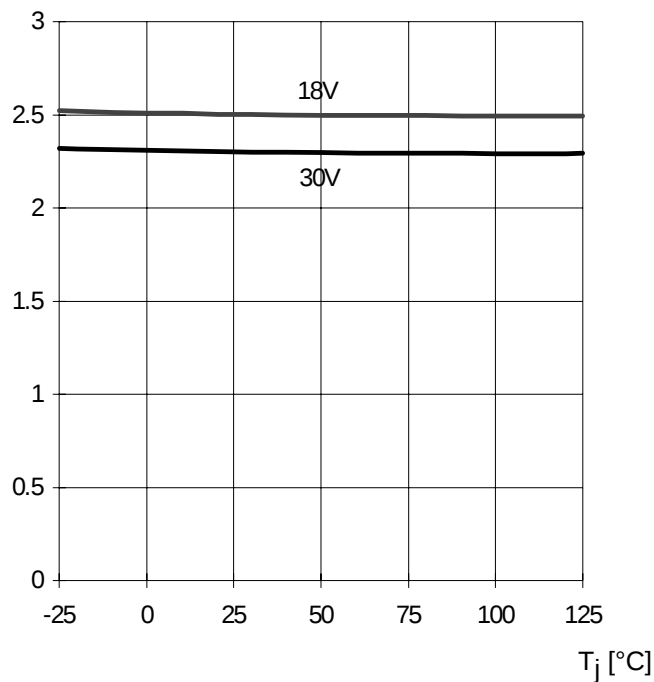
$I_{bb(off)} = f(T_j)$; $V_{bb} = 30 V$, $V_{IN} = low$
 $I_{bb(off)}$ [μA]



Typ. input turn on voltage threshold

$$V_{IN(T+)} = f(T_j)$$

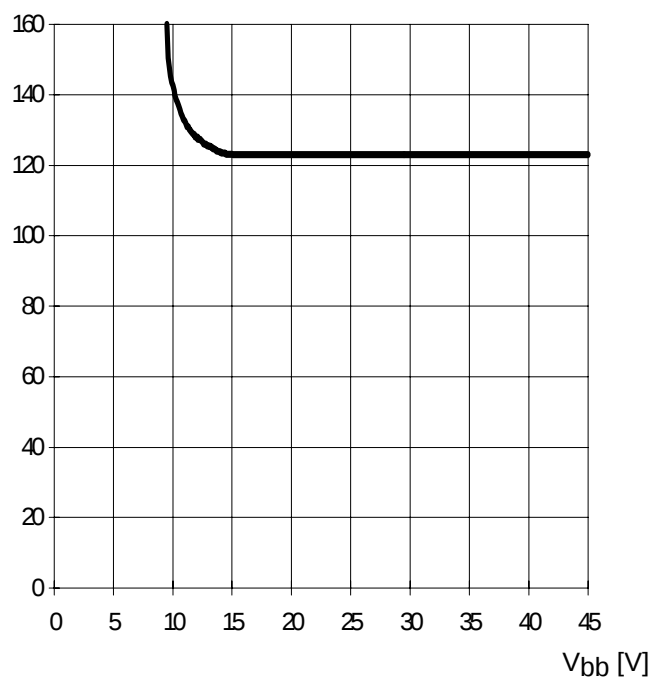
$V_{IN(T+)} [V]$



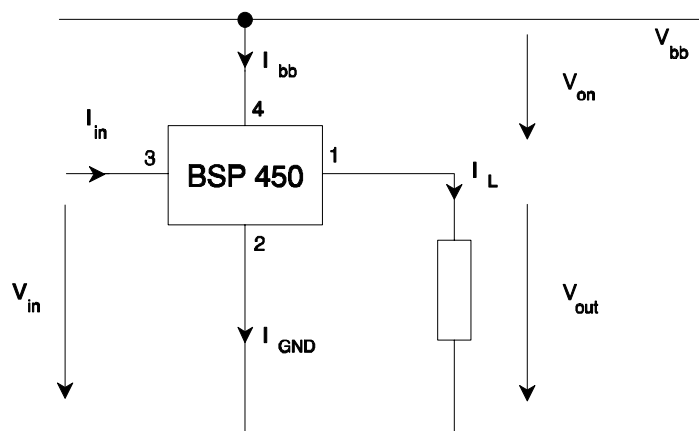
Typ. on-state resistance (Vbb-Pin to OUT-Pin)

$$R_{ON} = f(V_{bb}, I_L); I_L = 0.5A, T_j = 25^\circ C;$$

$R_{ON} [m\Omega]$



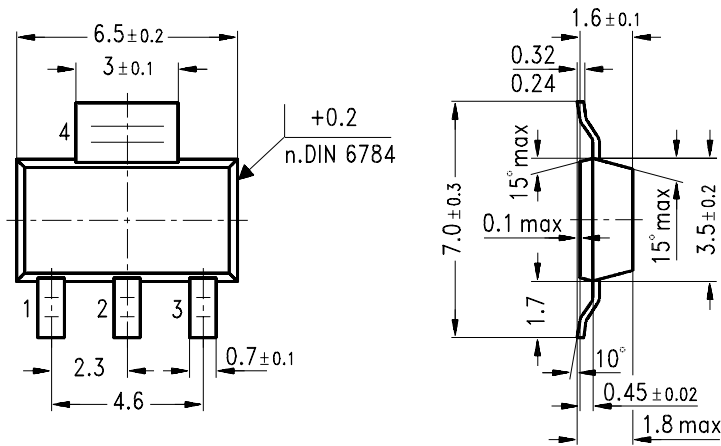
Test circuit



Package:

all dimensions in mm.

SOT 223/4:



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