

| Pin | Symbol | Function                                                         |
|-----|--------|------------------------------------------------------------------|
| 1   | OUT O  | Output to the load                                               |
| 2   | GND -  | Logic ground                                                     |
| 3   | IN I   | Input, activates the power switch in case of logical high signal |
| 4   | Vbb +  | Positive power supply voltage                                    |

## Maximum Ratings at $T_j = 25^\circ\text{C}$ unless otherwise specified

| Parameter                                                                                                                                                                                                              | Symbol                   | Values             | Unit             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------|------------------|
| Supply voltage                                                                                                                                                                                                         | $V_{bb}$                 | 40                 | V                |
| Load current self-limited                                                                                                                                                                                              | $I_L$                    | $I_{L(SC)}$        | A                |
| Maximum input voltage <sup>2)</sup>                                                                                                                                                                                    | $V_{IN}$                 | -5.0... $V_{bb}$   | V                |
| Maximum input current                                                                                                                                                                                                  | $I_{IN}$                 | $\pm 5$            | mA               |
| Inductive load switch-off energy dissipation, single pulse<br>$I_L = 0.5\text{A}$ , $T_A = 150^\circ\text{C}$<br>(not tested, specified by design)                                                                     | $E_{AS}$                 | 0.5                | J                |
| Load dump protection <sup>3)</sup> $V_{LoadDump} = U_A + V_S$ $R_L = 24\Omega$<br>$R_I = 2\Omega$ , $t_d = 400\text{ms}$ , IN= low or high, $U_A = 13.5\text{V}$ $R_L = 80\Omega$<br>(not tested, specified by design) | $V_{Load\ dump}^{4)}$    | 60<br>80           | V                |
| Electrostatic discharge capability (ESD) <sup>5)</sup> PIN 3<br>PIN 1,2,4                                                                                                                                              | $V_{ESD}$                | $\pm 1$<br>$\pm 2$ | kV               |
| Operating temperature range                                                                                                                                                                                            | $T_j$                    | -40 ... +150       | $^\circ\text{C}$ |
| Storage temperature range                                                                                                                                                                                              | $T_{stg}$                | -55 ... +150       | $^\circ\text{C}$ |
| Max. power dissipation (DC) <sup>6)</sup> $T_A = 25^\circ\text{C}$                                                                                                                                                     | $P_{tot}$                | 1.8                | W                |
| Thermal resistance chip - soldering point:<br>chip - ambient: <sup>6)</sup>                                                                                                                                            | $R_{thJS}$<br>$R_{thJA}$ | 7<br>70            | K/W              |

<sup>2)</sup> At  $V_{IN} > V_{bb}$ , the input current is not allowed to exceed  $\pm 5\text{ mA}$ .

<sup>3)</sup> Supply voltages higher than  $V_{bb(AZ)}$  require an external current limit for the GND pin, e.g. with a  $150\Omega$  resistor in the GND connection. A resistor for the protection of the input is integrated.

<sup>4)</sup>  $V_{Load\ dump}$  is setup without the DUT connected to the generator per ISO 7637-1 and DIN 40839

<sup>5)</sup> HBM according to MIL-STD 883D, Methode 3015.7

<sup>6)</sup> BSP 452 on epoxy pcb 40 mm x 40 mm x 1.5 mm with  $6\text{ cm}^2$  copper area for  $V_{bb}$  connection

## Electrical Characteristics

| Parameter and Conditions<br>at $T_j = 25^\circ\text{C}$ , $V_{bb} = 13.5\text{V}$ unless otherwise specified | Symbol | Values |     |     | Unit |
|--------------------------------------------------------------------------------------------------------------|--------|--------|-----|-----|------|
|                                                                                                              |        | min    | typ | max |      |

## Load Switching Capabilities and Characteristics

|                                                                                                                                            |                |          |            |            |                        |
|--------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------|------------|------------|------------------------|
| On-state resistance (pin 4 to 1)<br>$I_L = 0.5\text{ A}$ , $V_{in} = \text{high}$<br>$T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | $R_{ON}$       | --<br>-- | 0.16<br>-- | 0.2<br>0.4 | $\Omega$               |
| Nominal load current (pin 4 to 1) <sup>7)</sup><br>ISO Standard: $V_{ON} = V_{bb} - V_{OUT} = 0.5\text{ V}$<br>$T_s = 85^\circ\text{C}$    | $I_{L(ISO)}$   | 0.7      | --         | --         | A                      |
| Turn-on time<br>to 90% $V_{OUT}$<br>$R_L = 24\ \Omega$                                                                                     | $t_{on}$       | --       | 60         | 100        | $\mu\text{s}$          |
| Turn-off time<br>to 10% $V_{OUT}$<br>$R_L = 24\ \Omega$                                                                                    | $t_{off}$      | --       | 60         | 150        | $\mu\text{s}$          |
| Slew rate on<br>10 to 30% $V_{OUT}$ , $R_L = 24\ \Omega$                                                                                   | $dV/dt_{on}$   | --       | 2          | 4          | $\text{V}/\mu\text{s}$ |
| Slew rate off<br>70 to 40% $V_{OUT}$ , $R_L = 24\ \Omega$                                                                                  | $-dV/dt_{off}$ | --       | 2          | 4          | $\text{V}/\mu\text{s}$ |

## Input

|                                                                                                                                                            |                    |      |     |          |                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------|-----|----------|------------------|
| Allowable input voltage range, (pin 3 to 2)                                                                                                                | $V_{IN}$           | -3.0 | --  | $V_{bb}$ | V                |
| Input turn-on threshold voltage <br>$T_j = -40\dots+150^\circ\text{C}$  | $V_{IN(T+)}$       | --   | --  | 3.5      | V                |
| Input turn-off threshold voltage <br>$T_j = -40\dots+150^\circ\text{C}$ | $V_{IN(T-)}$       | 1.5  | --  | --       | V                |
| Input threshold hysteresis                                                                                                                                 | $\Delta V_{IN(T)}$ | --   | 0.5 | --       | V                |
| Off state input current (pin 3)<br>$V_{IN(off)} = 1.2\text{ V}$<br>$T_j = -40\dots+150^\circ\text{C}$                                                      | $I_{IN(off)}$      | 10   | --  | 60       | $\mu\text{A}$    |
| On state input current (pin 3)<br>$V_{IN(on)} = 3.0\text{ V to } V_{bb}$<br>$T_j = -40\dots+150^\circ\text{C}$                                             | $I_{IN(on)}$       | 10   | --  | 100      | $\mu\text{A}$    |
| Input resistance                                                                                                                                           | $R_{IN}$           | 1.5  | 2.8 | 3.5      | $\text{k}\Omega$ |

<sup>7)</sup>  $I_{L(ISO)}$  is limited by current limitation, see  $I_{L(SC)}$ , next page

| Parameter and Conditions<br>at $T_j = 25^\circ\text{C}$ , $V_{bb} = 13.5\text{V}$ unless otherwise specified    | Symbol                        | Values |     |            | Unit          |  |
|-----------------------------------------------------------------------------------------------------------------|-------------------------------|--------|-----|------------|---------------|--|
|                                                                                                                 |                               | min    | typ | max        |               |  |
| <b>Operating Parameters</b>                                                                                     |                               |        |     |            |               |  |
| Operating voltage <sup>8)</sup><br>$T_j = -40\dots+150^\circ\text{C}$                                           | $V_{bb(\text{on})}$           | 5.0    | --  | 34         | V             |  |
| Undervoltage shutdown<br>$T_j = -40\dots+150^\circ\text{C}$                                                     | $V_{bb(\text{under})}$        | 3.5    | --  | 5          | V             |  |
| Undervoltage restart<br>$T_i = -40\dots+25^\circ\text{C}$<br>$T_j = +150^\circ\text{C}$                         | $V_{bb(\text{u rst})}$        | --     | --  | 6.5<br>7.0 | V             |  |
| Undervoltage restart of charge pump<br>see diagram page 7                                                       | $V_{bb(\text{ucp})}$          | --     | 5.6 | 7          | V             |  |
| Undervoltage hysteresis<br>$\Delta V_{bb(\text{under})} = V_{bb(\text{u rst})} - V_{bb(\text{under})}$          | $\Delta V_{bb(\text{under})}$ | --     | 0.3 | --         | V             |  |
| Overvoltage shutdown<br>$T_j = -40\dots+150^\circ\text{C}$                                                      | $V_{bb(\text{over})}$         | 34     | --  | 42         | V             |  |
| Overvoltage restart<br>$T_j = -40\dots+150^\circ\text{C}$                                                       | $V_{bb(\text{o rst})}$        | 33     | --  | --         | V             |  |
| Overvoltage hysteresis<br>$T_j = -40\dots+150^\circ\text{C}$                                                    | $\Delta V_{bb(\text{over})}$  | --     | 0.7 | --         | V             |  |
| Standby current (pin 4), $V_{in} = \text{low}$<br>$T_j = -40\dots+150^\circ\text{C}$                            | $I_{bb(\text{off})}$          | --     | 10  | 25         | $\mu\text{A}$ |  |
| Operating current (pin 2), $V_{in} = 5\text{ V}$                                                                | $I_{\text{GND}}$              | --     | 1   | 1.6        | mA            |  |
| leakage current (pin 1) $V_{in} = \text{low}$<br>$T_j = -40\dots+25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | $I_{\text{L}(\text{off})}$    | --     | 2   | 5<br>7     | $\mu\text{A}$ |  |

## Protection Functions

|                                                                                                                                                                                                          |                                    |                            |     |     |     |                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------|-----|-----|-----|------------------|
| Current limit (pin 4 to 1)                                                                                                                                                                               | $T_j = 25^\circ\text{C}$           | $I_{L(\text{SC})}$         | 0.7 | 1.5 | 2   | A                |
| $V_{bb} = 20\text{V}$                                                                                                                                                                                    | $T_j = -40\dots+150^\circ\text{C}$ |                            | 0.7 | --  | 2.4 |                  |
| Overvoltage protection $I_{bb}=4\text{mA}$                                                                                                                                                               | $T_j = -40\dots+150^\circ\text{C}$ | $V_{bb(\text{AZ})}$        | 41  | --  | --  | V                |
| Output clamp (ind. load switch off)<br>at $V_{\text{OUT}}=V_{bb}-V_{\text{ON}(\text{CL})}$ , $I_{bb} = 4\text{mA}$                                                                                       |                                    | $V_{\text{ON}(\text{CL})}$ | 41  | 47  | --  | V                |
| Thermal overload trip temperature                                                                                                                                                                        |                                    | $T_{jt}$                   | 150 | --  | --  | $^\circ\text{C}$ |
| Thermal hysteresis                                                                                                                                                                                       |                                    | $\Delta T_{jt}$            | --  | 10  | --  | K                |
| Inductive load switch-off energy dissipation <sup>9)</sup><br>$T_{j \text{ Start}} = 150^\circ\text{C}$ , single pulse, $I_L = 0.5\text{A}$ , $V_{bb} = 12\text{V}$<br>(not tested, specified by design) |                                    | $E_{\text{AS}}$            | --  | --  | 0.5 | J                |
| Reverse battery (pin 4 to 2) <sup>10)</sup><br>(not tested, specified by design)                                                                                                                         |                                    | $-V_{bb}$                  | --  | --  | 30  | V                |

<sup>8)</sup> At supply voltage increase up to  $V_{bb}=5.6\text{V}$  typ without charge pump,  $V_{\text{OUT}} \approx V_{bb} - 2\text{V}$

<sup>9)</sup> While demagnetizing load inductance, dissipated energy in PROFET is  $E_{\text{AS}} = \int V_{\text{ON}(\text{CL})} \cdot i_L(t) dt$ , approx.

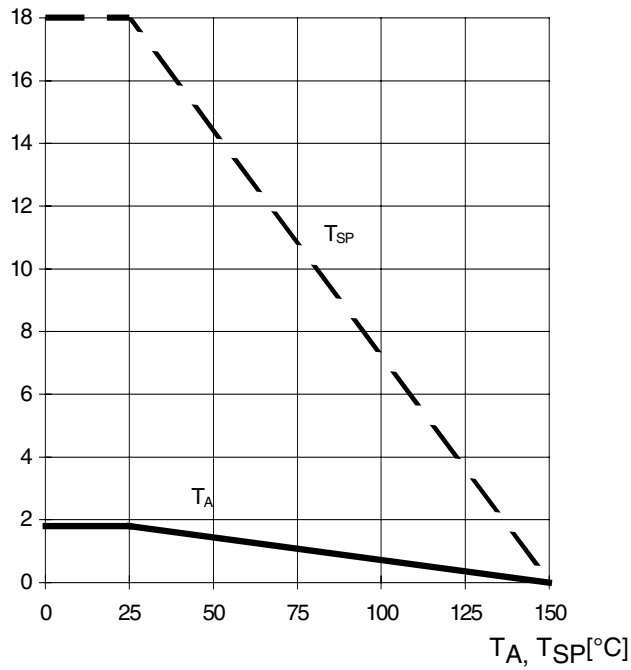
$$E_{\text{AS}} = \frac{1}{2} \cdot L \cdot I_L^2 \cdot \left( \frac{V_{\text{ON}(\text{CL})}}{V_{\text{ON}(\text{CL})} - V_{bb}} \right)$$

<sup>10)</sup> 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

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

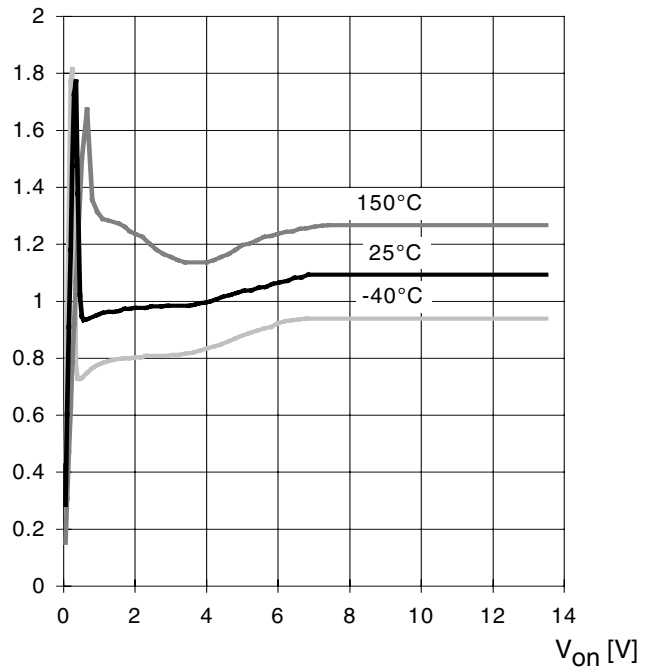
$P_{\text{tot}}$  [W]



## Current limit characteristic

$$I_{\text{L(SC)}} = f(V_{\text{on}}); (V_{\text{on}} \text{ see testcircuit})$$

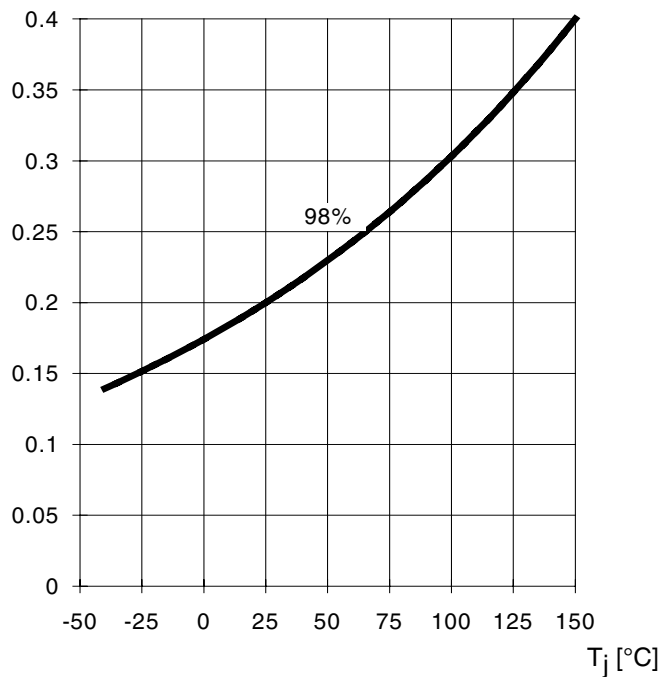
$I_{\text{L(SC)}}$  [A]



## On state resistance (Vbb-pin to OUT-pin)

$$R_{\text{ON}} = f(T_j); V_{\text{bb}} = 13.5 \text{ V}; I_{\text{L}} = 0.5 \text{ A}$$

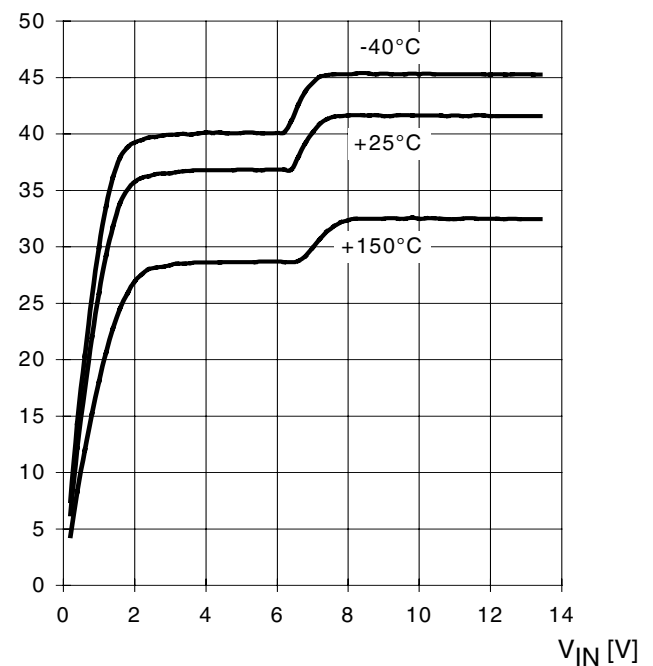
$R_{\text{ON}}$  [ $\Omega$ ]



## Typ. input current

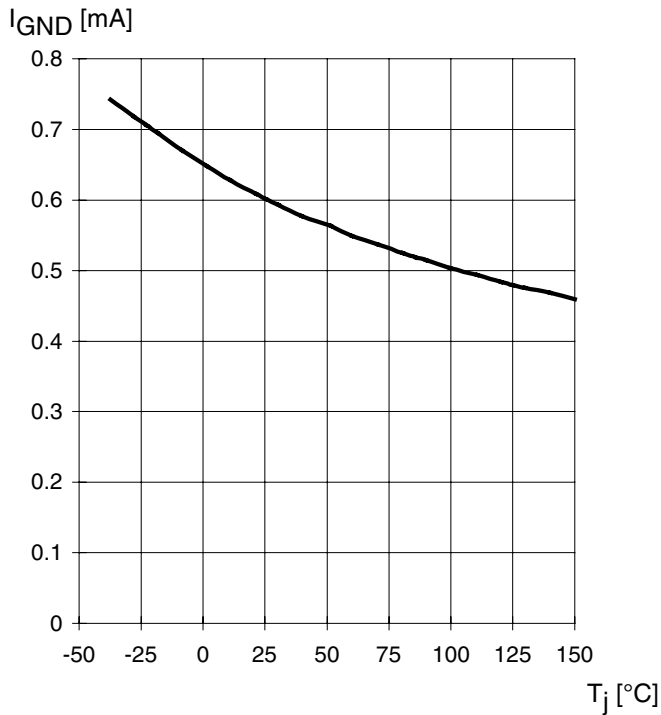
$$I_{\text{IN}} = f(V_{\text{IN}}); V_{\text{bb}} = 13.5 \text{ V}$$

$I_{\text{IN}}$  [ $\mu\text{A}$ ]



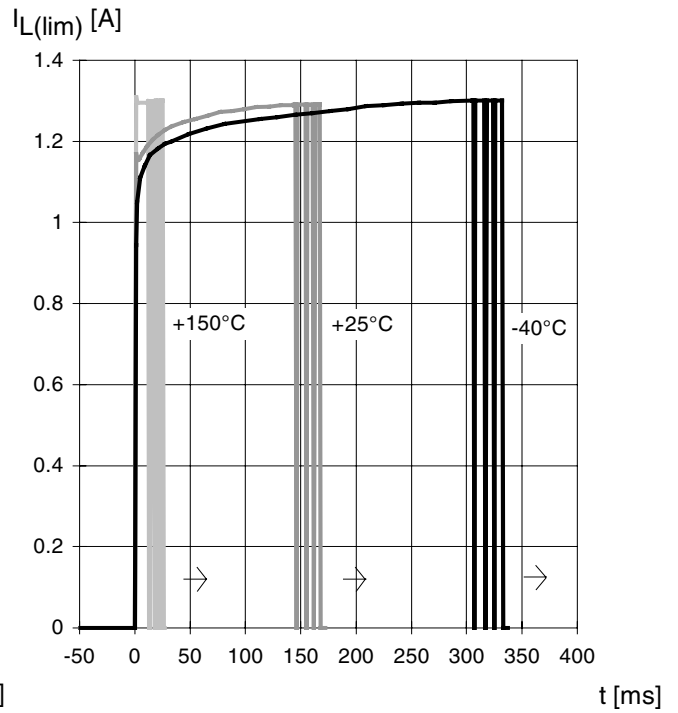
## Typ. operating current

$I_{GND} = f(T_j)$ ;  $V_{bb} = 13,5 \text{ V}$ ;  $V_{IN} = \text{high}$



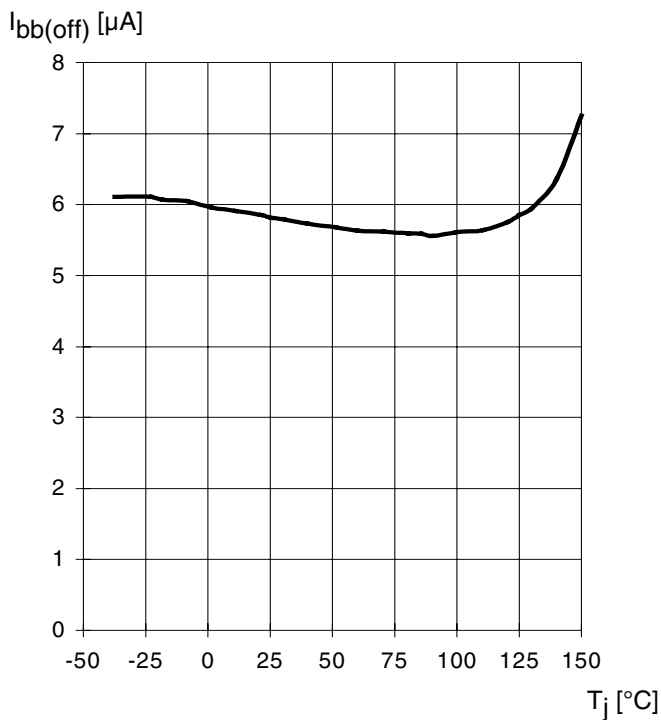
## Typ. overload current

$I_{L(\text{lim})} = f(t)$ ;  $V_{bb} = 13,5 \text{ V}$ , no heatsink, Param.:  $T_{j\text{start}}$



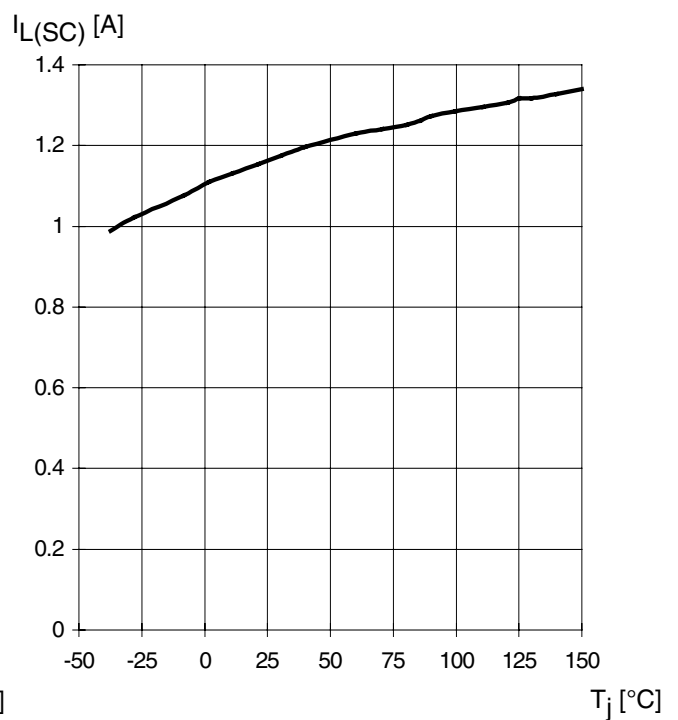
## Typ. standby current

$I_{bb(\text{off})} = f(T_j)$ ;  $V_{bb} = 13,5 \text{ V}$ ;  $V_{IN} = \text{low}$



## Short circuit current

$I_{L(\text{SC})} = f(T_j)$ ;  $V_{bb} = 13,5 \text{ V}$



Typ. input turn on voltage threshold

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

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

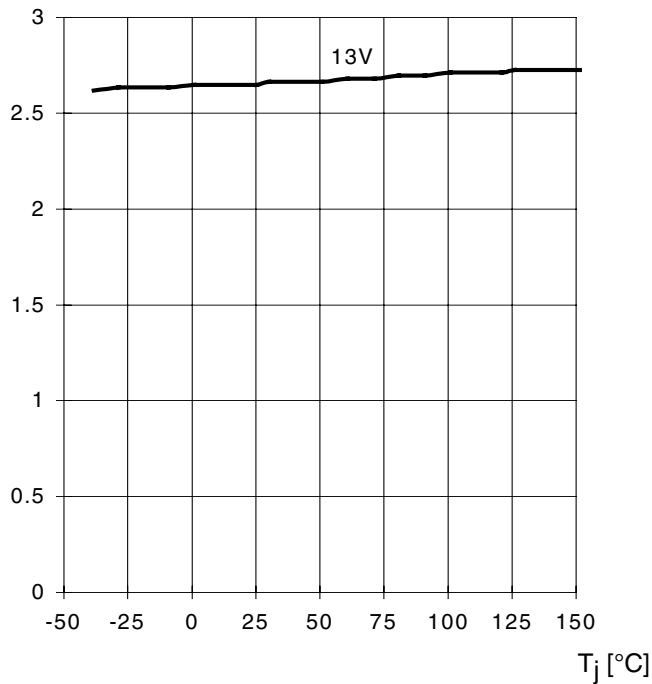
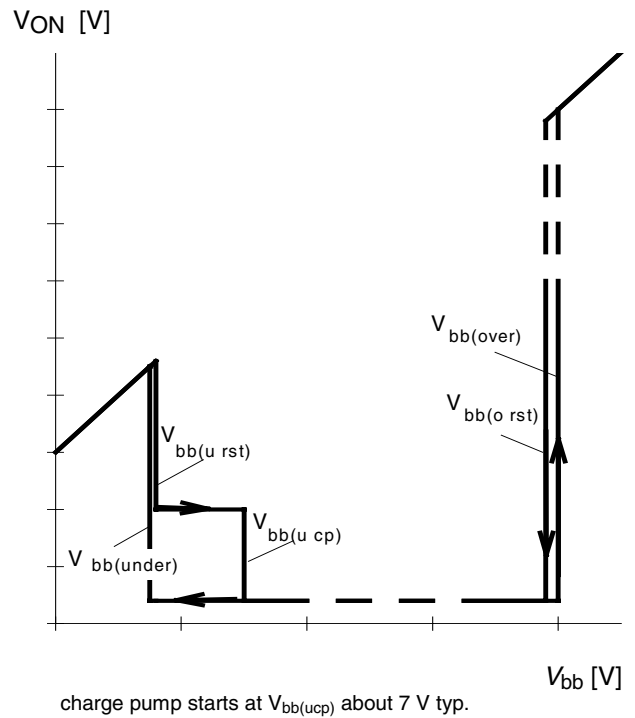


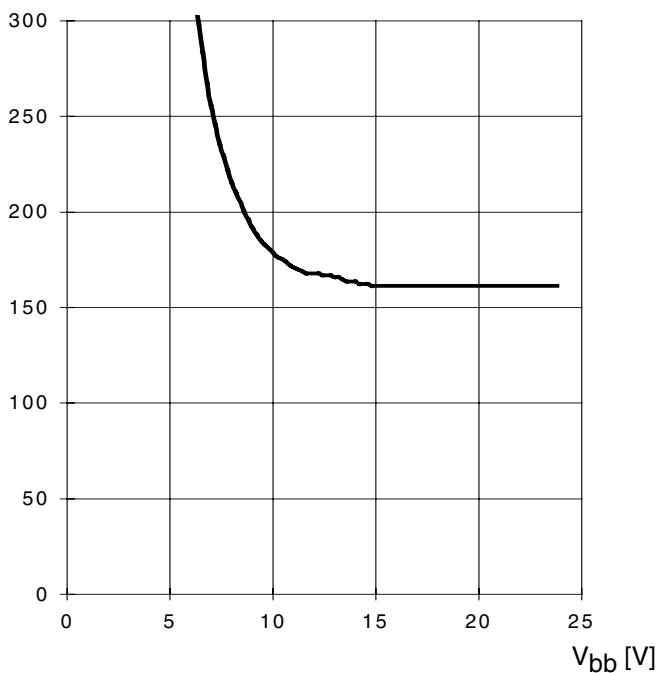
Figure 6: Undervoltage restart of charge pump



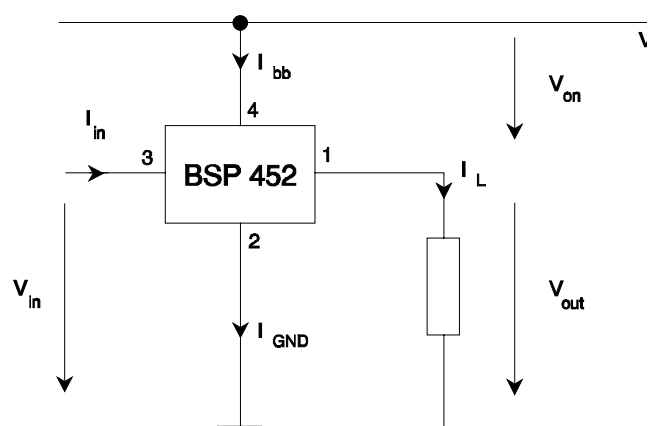
Typ. on-state resistance ( $V_{bb}$ -Pin to Out-Pin)

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

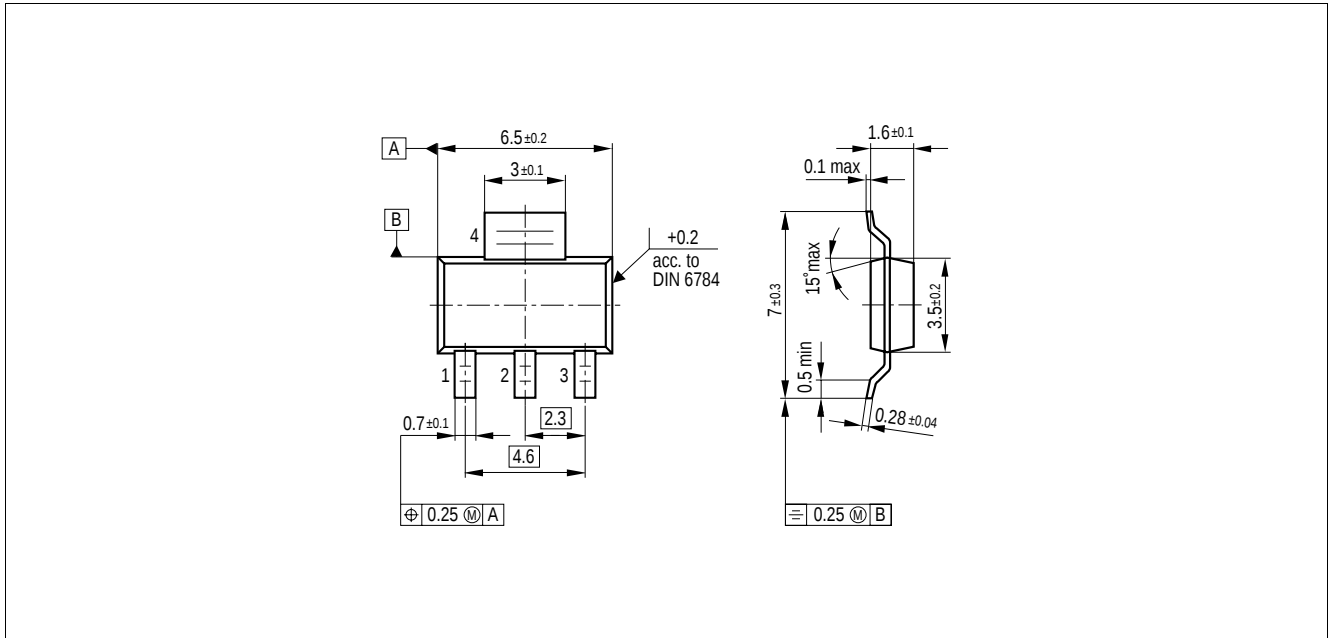
$R_{ON} [m\Omega]$



Test circuit



## Package Outlines



**Figure 1** PG-SOT-223 (Plastic Dual Small Outline Package) (RoHS-compliant)

To meet the world-wide customer requirements for environmentally friendly products and to be compliant with government regulations the device is available as a green product. Green products are RoHS-Compliant (i.e Pb-free finish on leads and suitable for Pb-free soldering according to IPC/JEDEC J-STD-020).

Please specify the package needed (e.g. green package) when placing an order

You can find all of our packages, sorts of packing and others in our Infineon Internet Page "Products": <http://www.infineon.com/products>.

Dimensions in mm

## Revision History

| Version | Date       | Changes                                                                                                                                                                                                                        |
|---------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.0     | 2007-05-25 | Creation of the green datasheet.<br>First page :<br>Adding the green logo and the AEC qualified<br>Adding the bullet AEC qualified and the RoHS compliant features<br>Package page<br>Modification of the package to be green. |

**Edition 2007-05-25**

**Published by  
Infineon Technologies AG  
81726 Munich, Germany**

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