AEC Qualified

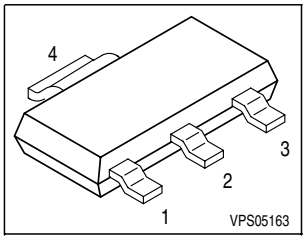
RoHS

## Features

- Logic Level Input
- Input Protection (ESD)
- Thermal shutdown
- Green product (RoHS compliant)
- Overload protection
- Short circuit protection
- Overvoltage protection
- Current limitation
- Analog driving possible

## Product Summary

| | | | |
|---|---|---|---|
| Drain source voltage | $V_{DS}$ | 42 | V |
| On-state resistance | $R_{DS(on)}$ | 200 | mΩ |
| Nominal load current | $I_{D(Nom)}$ | 1.4 | A |
| Clamping energy | $E_{AS}$ | 150 | mJ |

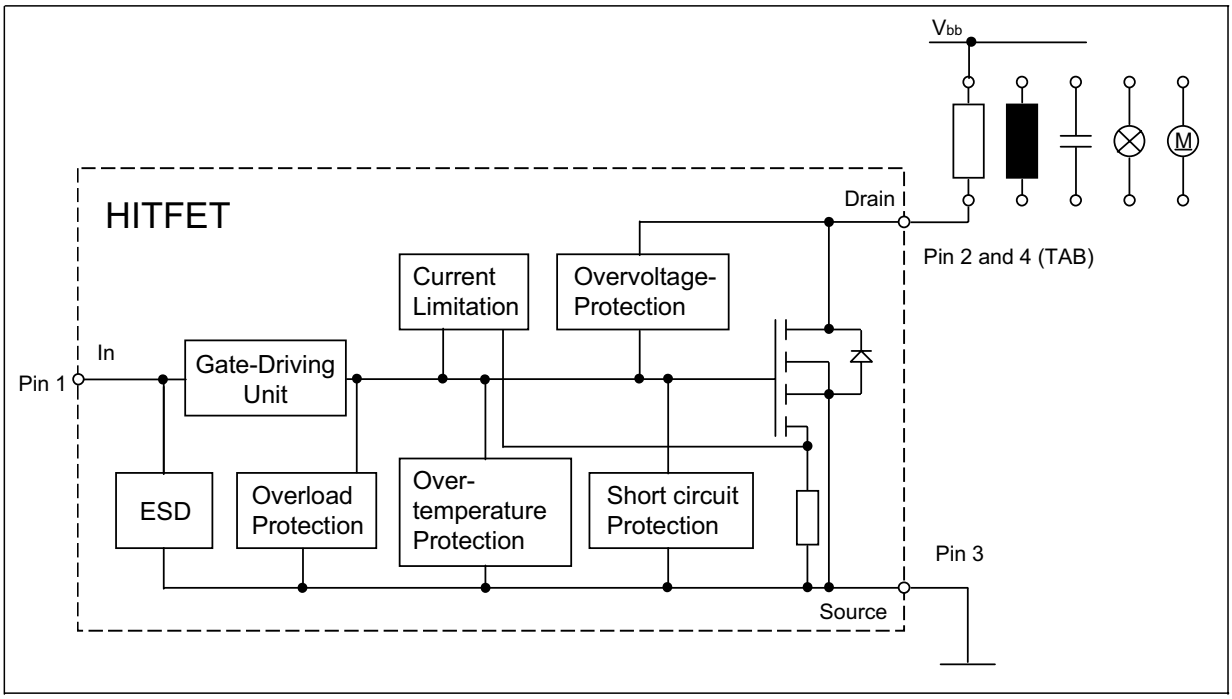



## Application

- All kinds of resistive, inductive and capacitive loads in switching or linear applications
- µC compatible power switch for 12 V DC applications
- Replaces electromechanical relays and discrete circuits

## General Description

N channel vertical power FET in Smart SIPMOS® technology. Fully protected by embedded protection functions.



**Maximum Ratings at $T_j$ = 25°C, unless otherwise specified**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain source voltage | $V_{DS}$ | 42 | V |
| Drain source voltage for short circuit protection<br>$T_j$ = -40...150°C | $V_{DS(SC)}$ | 18 | |
| Continuous input current<br>-0.2V ≤ $V_{IN}$ ≤ 10V<br>$V_{IN}$ < -0.2V or $V_{IN}$ > 10V | $I_{IN}$ | <br>no limit<br>$\lvert I_{IN} \rvert \le 2$ | mA |
| Operating temperature | $T_j$ | -40 ...+150 | °C |
| Storage temperature | $T_{stg}$ | -55 ... +150 | |
| Power dissipation<br>$T_C$ = 85 °C | $P_{tot}$ | 3.8 | W |
| Unclamped single pulse inductive energy [1] | $E_{AS}$ | 150 | mJ |
| Load dump protection $V_{LoadDump}$[2] = $V_A$ + $V_S$<br>$V_{IN}$ = 0 and 10 V, $t_d$ = 400 ms, $R_I$ = 2 Ω,<br>$R_L$ = 9 Ω, $V_A$ = 13.5 V | $V_{LD}$ | 50 | V |
| **E**lectro**s**tatic **d**ischarge voltage (Human Body Model) according to MIL STD 883D, method 3015.7 and EOS/ESD assn. standard S5.1 - 1993 | $V_{ESD}$ | 2 | kV |
| | | | |
| | | | |

**Thermal resistance**

| | | | |
|---|---|---|---|
| junction - ambient:<br>@ min. footprint<br>@ 6 cm² cooling area [3] | $R_{thJA}$ | <br>125<br>72 | K/W |
| junction-soldering point: | $R_{thJS}$ | 17 | K/W |

[1] Not tested, specified by design.

[2] $V_{Loaddump}$ is setup without the DUT connected to the generator per ISO 7637-1 and DIN 40839

[3] Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70µm thick) copper area for drain connection. PCB mounted vertical without blown air.

## Electrical Characteristics

| Parameter<br>at $T_j$ = 25°C, unless otherwise specified | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| **Characteristics** | | | | | |
| Drain source clamp voltage<br>$T_j$ = - 40 ...+ 150, $I_D$ = 10 mA | $V_{DS(AZ)}$ | 42 | - | 55 | V |
| Off-state drain current $T_j$ = -40 ... +150°C<br>$V_{DS}$ = 32 V, $V_{IN}$ = 0 V | $I_{DSS}$ | - | 1.5 | 10 | µA |
| Input threshold voltage<br>$I_D$ = 0.3 mA, $T_j$ = 25 °C<br>$I_D$ = 0.3 mA, $T_j$ = 150 °C | $V_{IN(th)}$ | <br>1.3<br>0.8 | <br>1.7<br>- | <br>2.2<br>- | V |
| On state input current | $I_{IN(on)}$ | - | 10 | 30 | µA |
| On-state resistance<br>$V_{IN}$ = 5 V, $I_D$ = 1.4 A, $T_j$ = 25 °C<br>$V_{IN}$ = 5 V, $I_D$ = 1.4 A, $T_j$ = 150 °C | $R_{DS(on)}$ | <br>-<br>- | <br>190<br>350 | <br>240<br>480 | mΩ |
| On-state resistance<br>$V_{IN}$ = 10 V, $I_D$ = 1.4 A, $T_j$ = 25 °C<br>$V_{IN}$ = 10 V, $I_D$ = 1.4 A, $T_j$ = 150 °C | $R_{DS(on)}$ | <br>-<br>- | <br>150<br>280 | <br>200<br>400 | |
| Nominal load current<br>$V_{DS}$ = 0.5 V, $T_j$ < 150°C, $V_{IN}$ = 10 V, $T_A$ = 85 °C | $I_{D(Nom)}$ | <br>1.4 | <br>- | <br>- | A |
| Current limit (active if $V_{DS}$>2.5 V)[1)]<br>$V_{IN}$ = 10 V, $V_{DS}$ = 12 V, $t_m$ = 200 µs | $I_{D(lim)}$ | 5 | 7.5 | 10 | |

[1]Device switched on into existing short circuit (see diagram Determination of $I_{D(lim)}$). If the device is in on condit and a short circuit occurs, these values might be exceeded for max. 50 µs.

## Electrical Characteristics

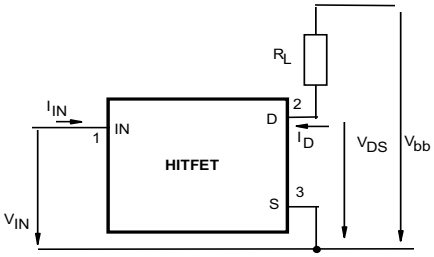
| Parameter<br>at $T_j$ = 25°C, unless otherwise specified | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| **Dynamic Characteristics** | | | | | |
| Turn-on time $V_{IN}$ to 90% $I_D$:<br>$R_L$ = 4.7 Ω, $V_{IN}$ = 0 to 10 V, $V_{bb}$ = 12 V | $t_{on}$ | - | 45 | 100 | µs |
| Turn-off time $V_{IN}$ to 10% $I_D$:<br>$R_L$ = 4.7 Ω, $V_{IN}$ = 10 to 0 V, $V_{bb}$ = 12 V | $t_{off}$ | - | 60 | 100 | |
| Slew rate on 70 to 50% $V_{bb}$:<br>$R_L$ = 4.7 Ω, $V_{IN}$ = 0 to 10 V, $V_{bb}$ = 12 V | $-dV_{DS}/dt_{on}$ | - | 0.4 | 1.5 | V/µs |
| Slew rate off 50 to 70% $V_{bb}$:<br>$R_L$ = 4.7 Ω, $V_{IN}$ = 10 to 0 V, $V_{bb}$ = 12 V | $dV_{DS}/dt_{off}$ | - | 0.6 | 1.5 | |
| **Protection Functions**[1)] | | | | | |
| Thermal overload trip temperature | $T_{jt}$ | 150 | 175 | - | °C |
| Input current protection mode | $I_{IN(Prot)}$ | 25 | 50 | 300 | µA |
| Input current protection mode<br>$T_j$ = 150 °C | $I_{IN(Prot)}$ | - | 40 | 300 | |
| Unclamped single pulse inductive energy [2)]<br>$I_D$ = 1.4 A, $T_j$ = 25 °C, $V_{bb}$ = 12 V | $E_{AS}$ | 150 | - | - | mJ |
| **Inverse Diode** | | | | | |
| Inverse diode forward voltage<br>$I_F$ = 7 A, $t_m$ = 250 µs, $V_{IN}$ = 0 V,<br>$t_P$ = 300 µs | $V_{SD}$ | - | 1 | - | V |

[1] Integrated protection functions are designed to prevent IC destruction under fault conditions described in the data sheet. Fault conditions are considered as "outside" normal operating range. Protection functions are not designed for continuous repetitive operation.

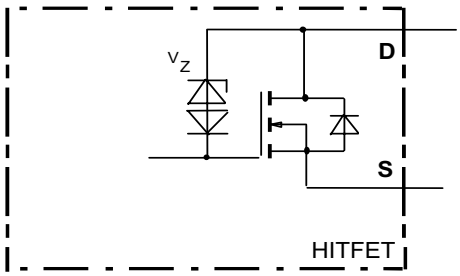
[2] Not tested, specified by design.

## Block diagram

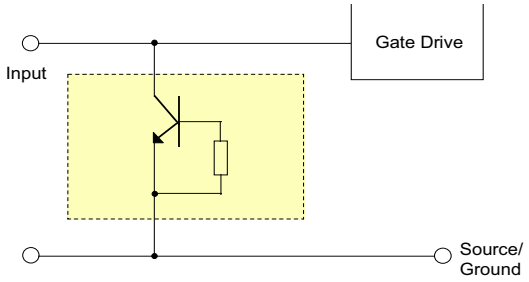
### Terms



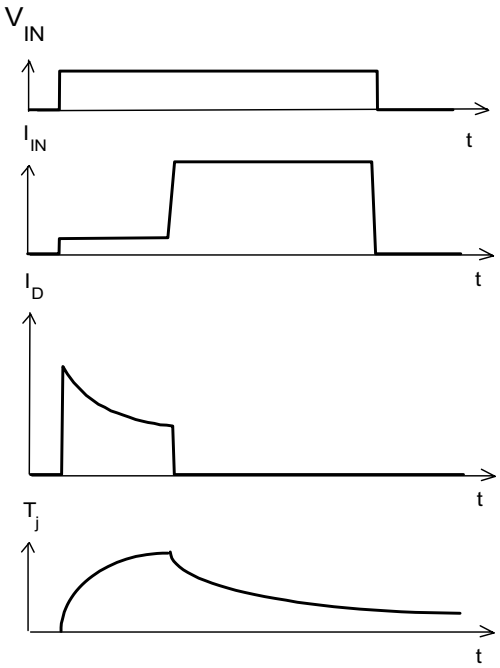

### Inductive and overvoltage output clamp




### Input circuit (ESD protection)



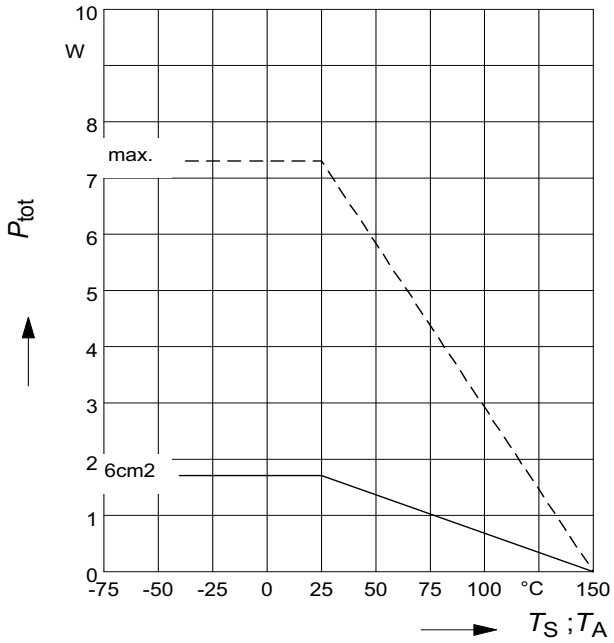

### Short circuit behaviour



### 1 Maximum allowable power dissipation

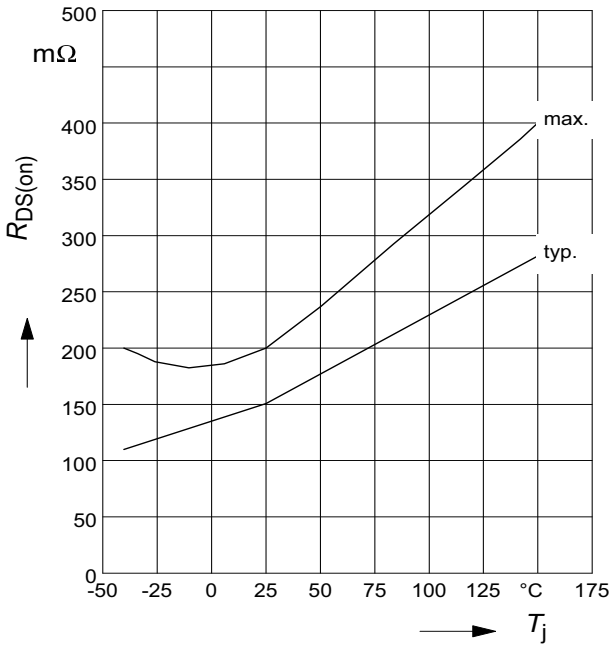
$P_{tot} = f(T_S)$ resp.

$P_{tot} = f(T_A)$ @ $R_{thJA}$=72 K/W



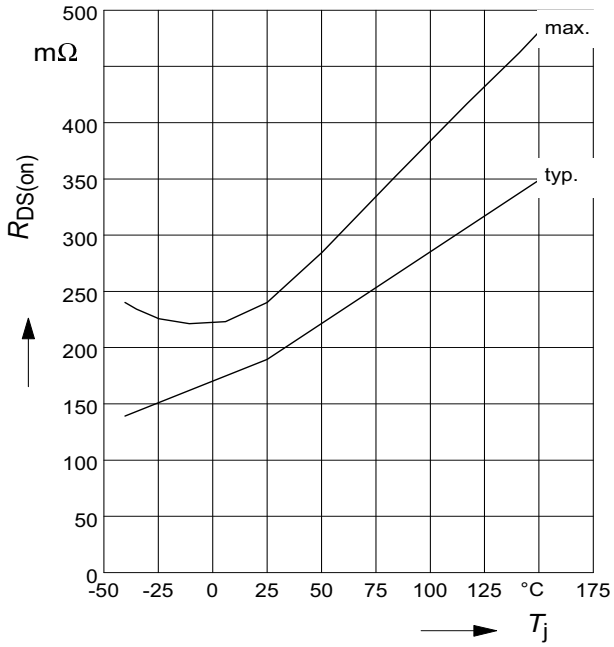

### 2 On-state resistance

$R_{ON} = f(T_j)$; $I_D$=1.4A; $V_{IN}$=10V



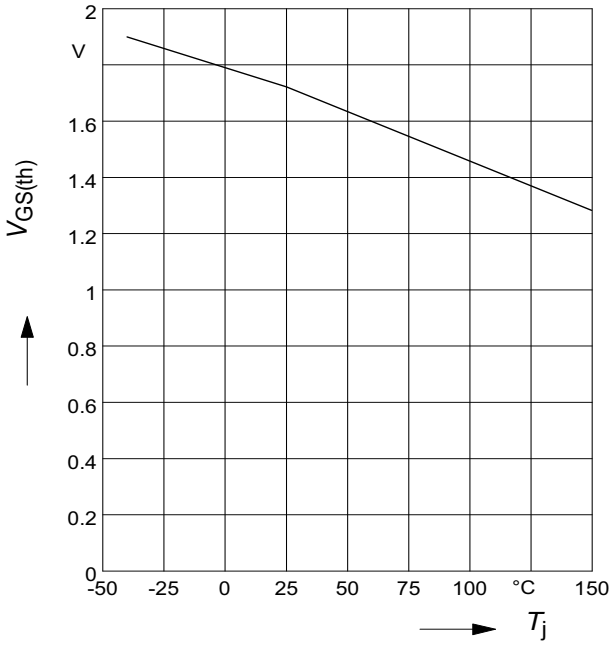

### 3 On-state resistance

$R_{ON} = f(T_j)$; $I_D$= 1.4A; $V_{IN}$=5V



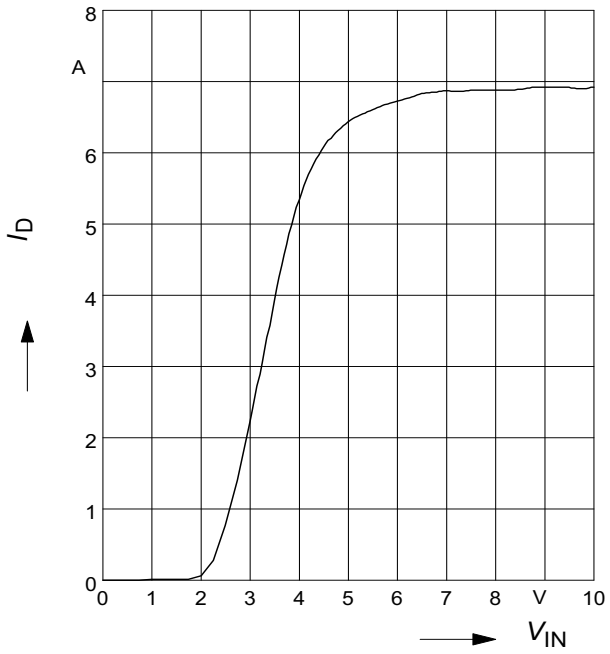

### 4 Typ. input threshold voltage

$V_{IN(th)} = f(T_j)$; $I_D$ = 0.15 mA; $V_{DS}$ = 12V



## 5 Typ. transfer characteristics

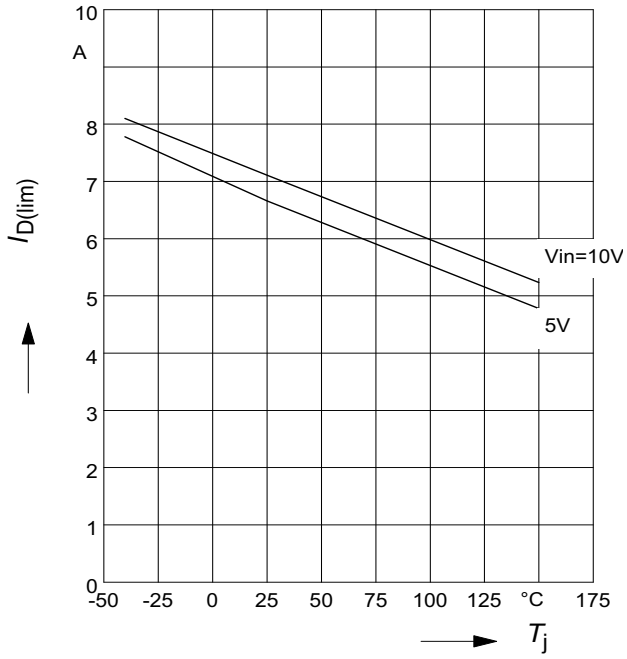
**$I_D$=f($V_{IN}$);** $V_{DS}$=12V; $T_{Jstart}$=25°C




## 6 Typ. short circuit current

**$I_{D(lim)}$ = f(Tj);** $V_{DS}$=12V

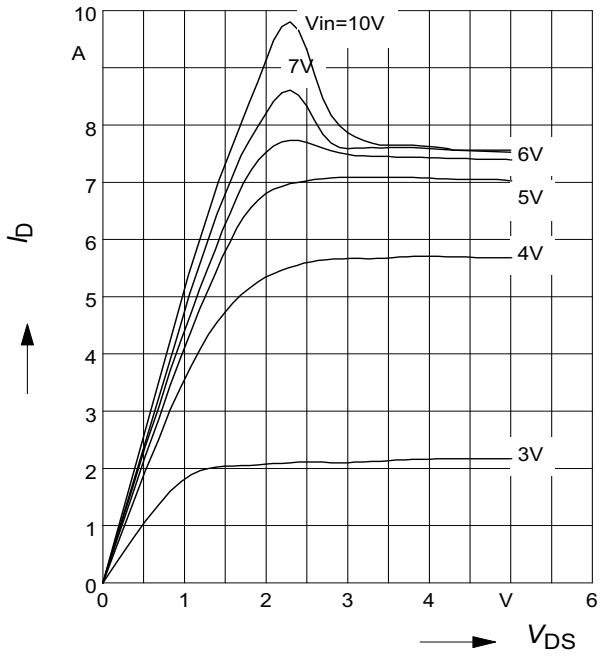
Parameter: $V_{IN}$




## 7 Typ. output characteristics

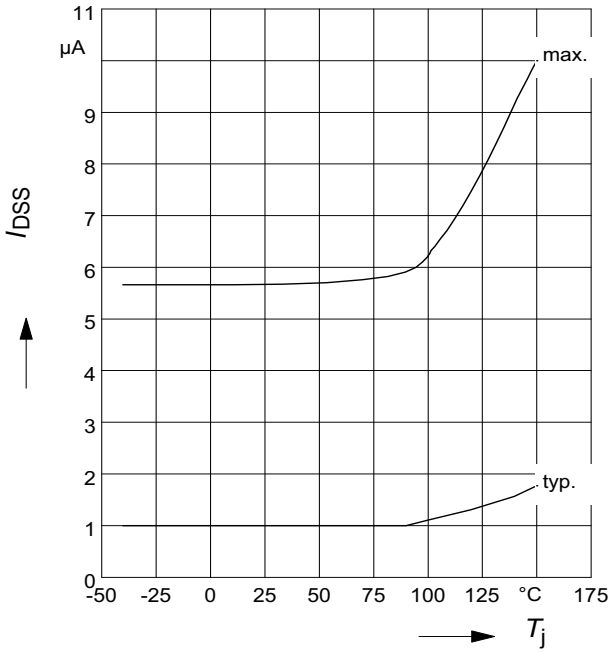
**$I_D$=f($V_{DS}$);** $T_{Jstart}$=25°C

Parameter: $V_{IN}$




## 8 Typ. off-state drain current

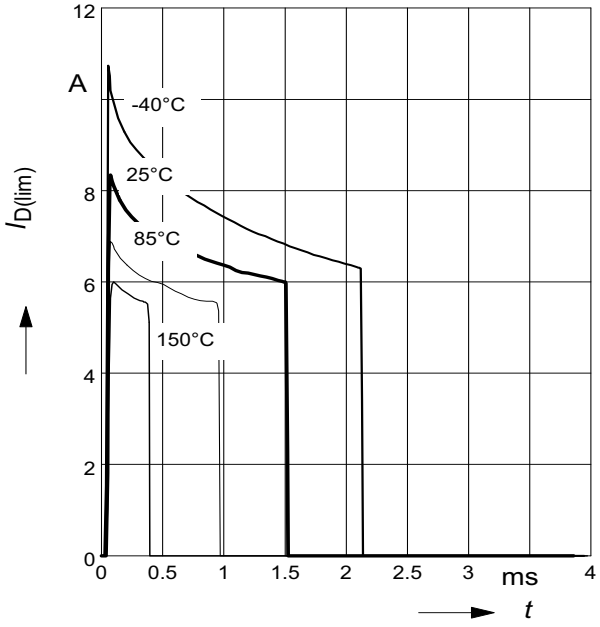
**$I_{DSS}$ = f($T_j$)**



### 9 Typ. overload current

**$I_{D(lim)}$ = f($t$)**, $V_{bb}$=12 V, no heatsink

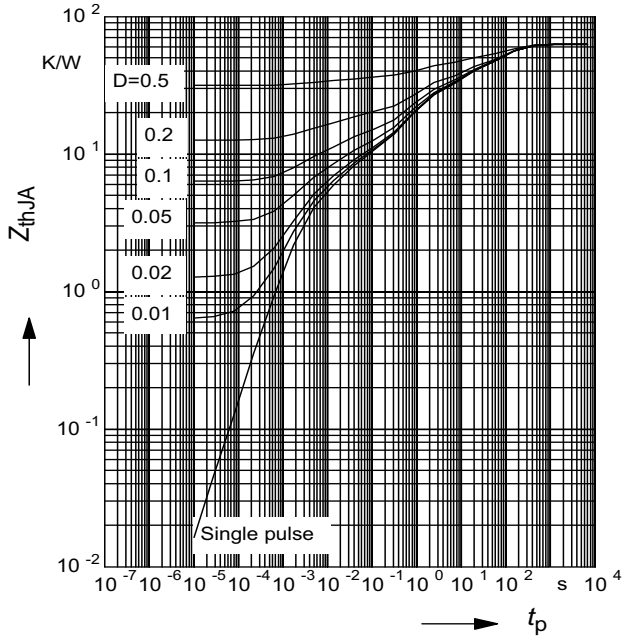
Parameter: $T_{jstart}$




### 10 Typ. transient thermal impedance

**$Z_{thJA}$=f($t_p$) @ 6 cm² cooling area**

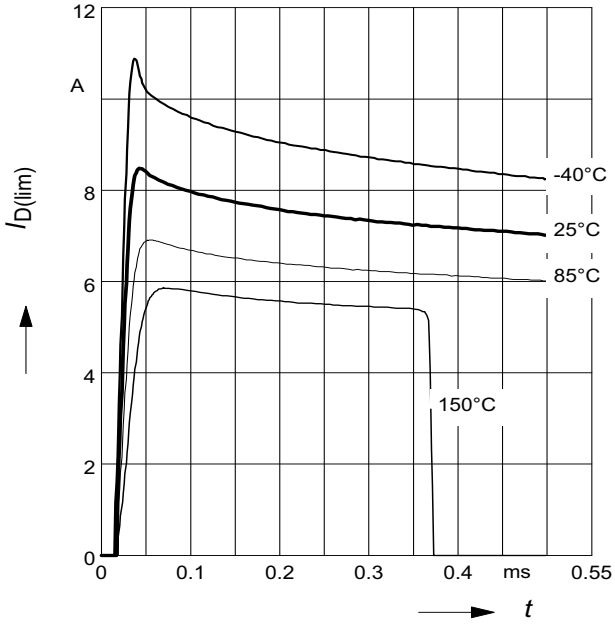
Parameter: $D=t_p/T$




### 11 Determination of $I_{D(lim)}$

**$I_{D(lim)}$ = f($t$); $t_m$ = 200µs**

Parameter: $T_{Jstart}$



# 1 Package Outlines

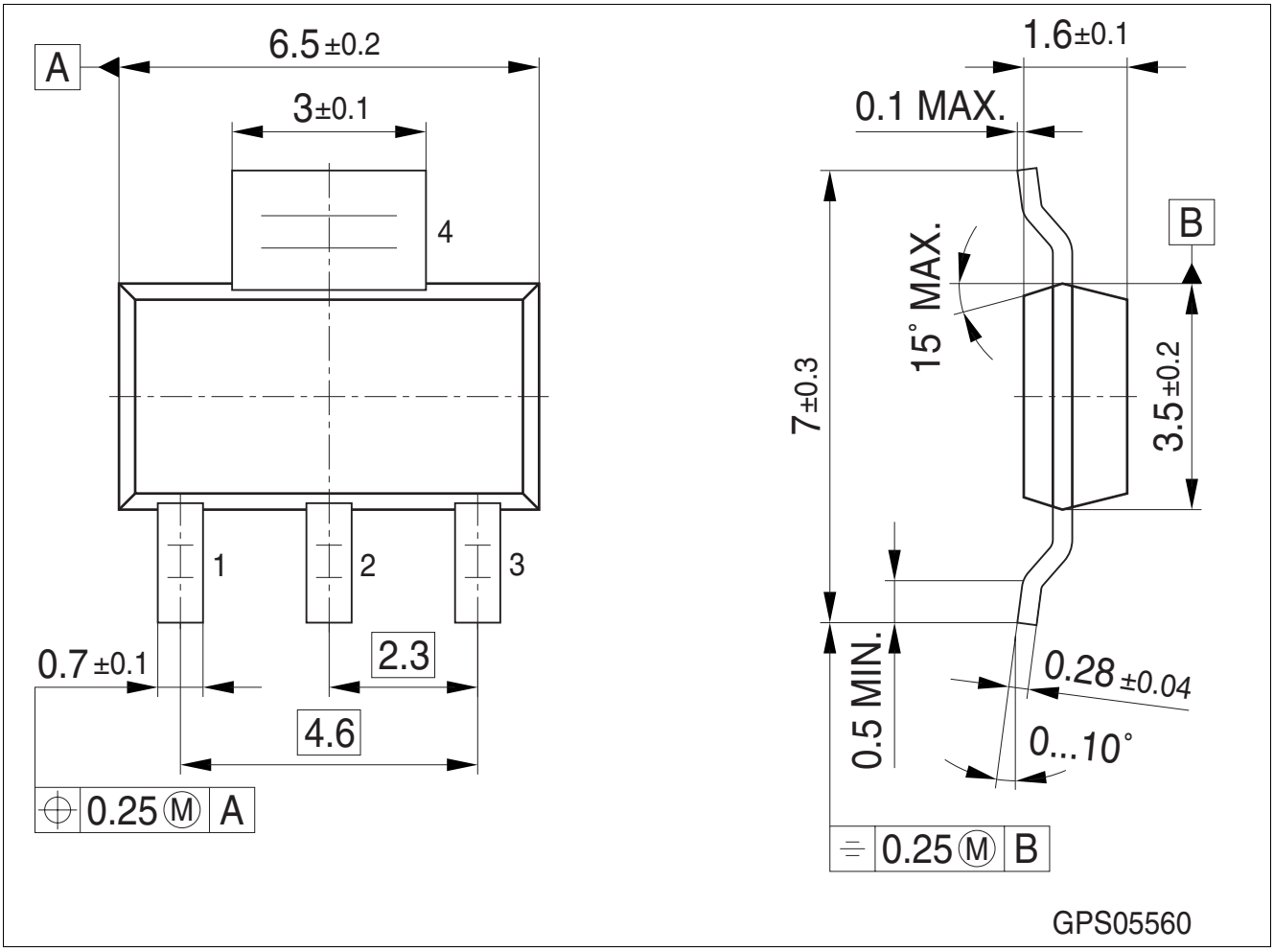



**Figure 1** **PG-SOT223-4** (Plastic Green Small Outline Transistor Package)

**Green Product (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

# 2 Revision History

| Version | Date | Changes |
|---|---|---|
| Rev. 1.3 | 2008-04-14 | Package information updated to SOT223-4 |
| Rev. 1.2 | 2007-03-28 | released automotive green version<br>Package parameter (humidity and climatic) removed in Maximum ratings<br>AEC icon added<br>RoHS icon added<br>Green product (RoHS-compliant) added to the feature list<br>Package information updated to green<br>Green explanation added |
| Rev. 1.1 | 2004-02-02 | released production version |
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