

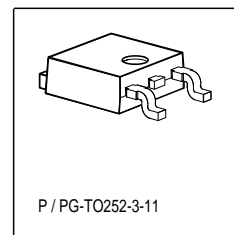


Features

- Logic Level Input
- Input Protection (ESD)
- Thermal shutdown with auto restart
- 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 | $R_{DS(on)}$ | 28 | m Ω |
| Nominal load current | $I_{D(Nom)}$ | 4.6 | A |
| Clamping energy | E_{AS} | 3.5 | J |

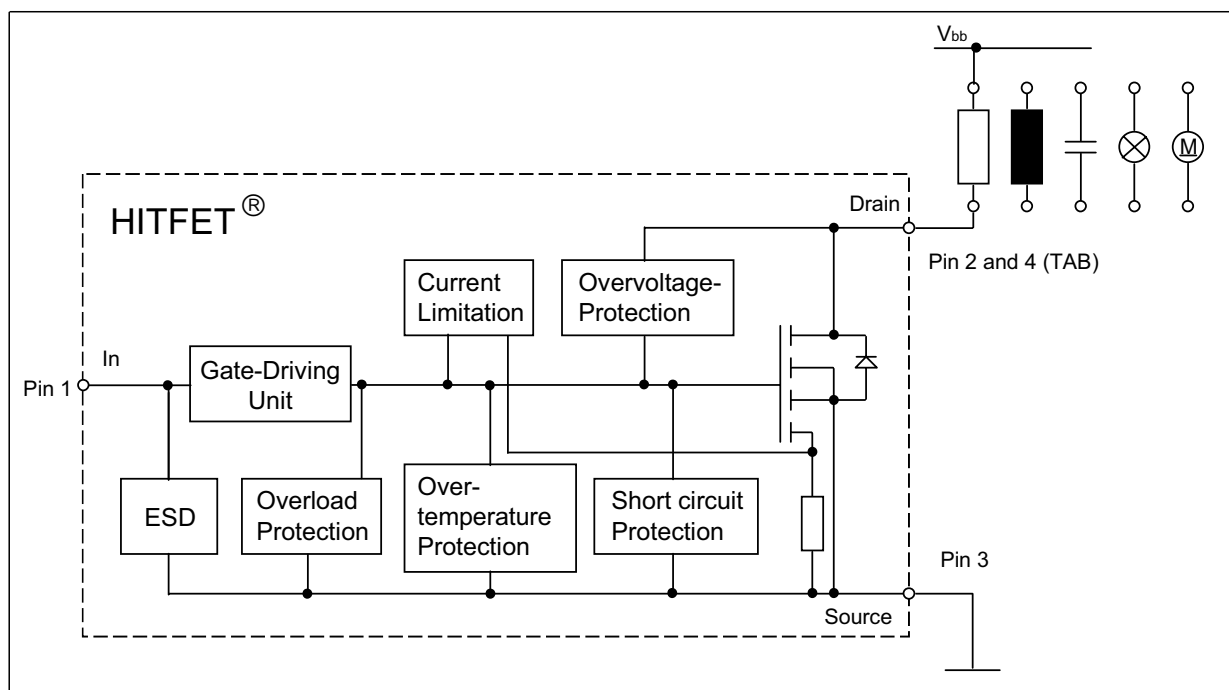


Application

- All kinds of resistive, inductive and capacitive loads in switching or linear applications
- μ C 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.



Complete product spectrum and additional information <http://www.infineon.com/hitfet>

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

| Parameter | Symbol | Value | Unit |
|--|--------------|-----------------------------------|------------------|
| Drain source voltage | V_{DS} | 42 | V |
| Supply voltage for full short circuit protection | $V_{bb(SC)}$ | 42 | |
| Continuous input voltage ¹⁾ | V_{IN} | -0.2 ²⁾ ... +10 | |
| Continuous input current ²⁾ -0.2V $\leq V_{IN} \leq$ 10V $V_{IN} < -0.2V$ or $V_{IN} > 10V$ | I_{IN} | self limited $ I_{IN} \leq 2$ | mA |
| Operating temperature | T_j | -40 ... +150 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | -55 ... +150 | |
| Power dissipation ⁵⁾ $T_C = 85^\circ\text{C}$ 6cm ² cooling area, $T_A = 85^\circ\text{C}$ | P_{tot} | 59 1.1 | W |
| Unclamped single pulse inductive energy ²⁾ | E_{AS} | 3.5 | J |
| Load dump protection $V_{LoadDump}^{2)3)} = V_A + V_S$ $V_{IN} = 0$ and 10 V, $t_d = 400$ ms, $R_I = 2 \Omega$, $R_L = 3 \Omega$, $V_A = 13.5$ V | V_{LD} | 67.5 | V |
| Electrostatic discharge voltage²⁾ (Human Body Model) according to Jedec norm EIA/JESD22-A114-B, Section 4 | V_{ESD} | 2 | kV |
| | | | |
| | | | |

Thermal resistance

| | | | |
|---|------------|-----------|-----|
| junction - case: | R_{thJC} | 1.1 | K/W |
| SMD: junction - ambient @ min. footprint @ 6 cm ² cooling area ⁴⁾ | R_{thJA} | 115 55 | |

¹For input voltages beyond these limits I_{IN} has to be limited.

²not subject to production test, specified by design

³ $V_{Loaddump}$ is setup without the DUT connected to the generator per ISO 7637-1 and DIN 40839

⁴ Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 μ m thick) copper area for drain connection. PCB mounted vertical without blown air.

⁵not subject to production test, calculated by R_{thJA} and $R_{ds(on)}$

Electrical Characteristics

| Parameter at $T_j = 25^\circ\text{C}$, unless otherwise specified | Symbol | Values | | | Unit |
|--|--------------|------------|-----------|----------|------------------|
| | | min. | typ. | max. | |
| Characteristics | | | | | |
| Drain source clamp voltage $T_j = -40 \dots +150^\circ\text{C}$, $I_D = 10\text{ mA}$ | $V_{DS(AZ)}$ | 42 | - | 55 | V |
| Off-state drain current $T_j = -40\dots+85^\circ\text{C}$, $V_{DS} = 32\text{ V}$, $V_{IN} = 0\text{ V}$ $T_j = 150^\circ\text{C}$ | I_{DSS} | - - | 1.5 10 | 8 20 | μA |
| Input threshold voltage $I_D = 2.4\text{ mA}$, $T_j = 25^\circ\text{C}$ $I_D = 2.4\text{ mA}$, $T_j = 150^\circ\text{C}$ | $V_{IN(th)}$ | 1.3 0.8 | 1.7 - | 2.2 - | V |
| On state input current | $I_{IN(on)}$ | - | 10 | 30 | μA |
| On-state resistance $V_{IN} = 5\text{ V}$, $I_D = 4.6\text{ A}$, $T_j = 25^\circ\text{C}$ $V_{IN} = 5\text{ V}$, $I_D = 4.6\text{ A}$, $T_j = 150^\circ\text{C}$ | $R_{DS(on)}$ | - - | 27 54 | 34 68 | $\text{m}\Omega$ |
| On-state resistance $V_{IN} = 10\text{ V}$, $I_D = 4.6\text{ A}$, $T_j = 25^\circ\text{C}$ $V_{IN} = 10\text{ V}$, $I_D = 4.6\text{ A}$, $T_j = 150^\circ\text{C}$ | $R_{DS(on)}$ | - - | 23 46 | 28 56 | |
| Nominal load current ⁵⁾ $T_j < 150^\circ\text{C}$, $V_{IN} = 10\text{ V}$, $T_A = 85^\circ\text{C}$, SMD ¹⁾ | $I_{D(Nom)}$ | 4.6 | 5.5 | - | A |
| Nominal load current ⁵⁾ $V_{IN} = 10\text{ V}$, $V_{DS} = 0.5\text{ V}$, $T_C = 85^\circ\text{C}$, $T_j < 150^\circ\text{C}$ | $I_{D(ISO)}$ | 12.6 | 15.3 | - | |
| Current limit (active if $V_{DS} > 2.5\text{ V}$) ²⁾ $V_{IN} = 10\text{ V}$, $V_{DS} = 12\text{ V}$, $t_m = 200\text{ }\mu\text{s}$ | $I_{D(lim)}$ | 30 | 45 | 55 | |

¹⁾@ 6 cm² cooling area

²⁾Device switched on into existing short circuit (see diagram Determination of $I_{D(lim)}$). If the device is in on condition and a short circuit occurs, these values might be exceeded for max. 50 μs .

⁵⁾not subject to production test, calculated by R_{thJA} and $R_{ds(on)}$

Electrical Characteristics

| Parameter at $T_j = 25^\circ\text{C}$, unless otherwise specified | Symbol | Values | | | Unit |
|---|--------|--------|------|------|------|
| | | min. | typ. | max. | |

Dynamic Characteristics

| | | | | | |
|---|--------------------|---|-----|-----|------------------|
| Turn-on time V_{IN} to 90% I_D : $R_L = 4.7 \Omega$, $V_{IN} = 0$ to 10 V, $V_{bb} = 12$ V | t_{on} | - | 60 | 120 | μs |
| Turn-off time V_{IN} to 10% I_D : $R_L = 4.7 \Omega$, $V_{IN} = 10$ to 0 V, $V_{bb} = 12$ V | t_{off} | - | 60 | 120 | |
| Slew rate on 70 to 50% V_{bb} : $R_L = 4.7 \Omega$, $V_{IN} = 0$ to 10 V, $V_{bb} = 12$ V | $-dV_{DS}/dt_{on}$ | - | 0.3 | 1.5 | V/ μs |
| Slew rate off 50 to 70% V_{bb} : $R_L = 4.7 \Omega$, $V_{IN} = 10$ to 0 V, $V_{bb} = 12$ V | dV_{DS}/dt_{off} | - | 0.3 | 1.5 | |

Protection Functions¹⁾

| | | | | | |
|--|-----------------|-----|-----|-----|------------------|
| Thermal overload trip temperature | T_{jt} | 150 | 175 | - | $^\circ\text{C}$ |
| Thermal hysteresis ²⁾ | ΔT_{jt} | - | 10 | - | K |
| Input current protection mode $T_j = 150^\circ\text{C}$ | $I_{IN(Prot)}$ | - | 180 | 400 | μA |
| Unclamped single pulse inductive energy ²⁾ $I_D = 4.6$ A, $T_j = 25^\circ\text{C}$, $V_{bb} = 12$ V | E_{AS} | 3.5 | - | - | J |

Inverse Diode

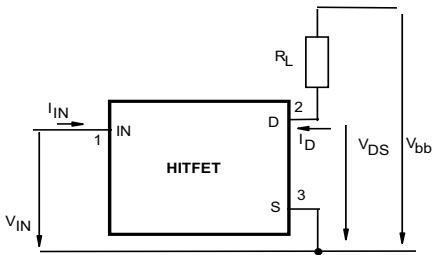
| | | | | | |
|---|----------|---|-----|-----|---|
| Inverse diode forward voltage $I_F = 51$ A, $t_m = 250 \mu\text{s}$, $V_{IN} = 0$ V, $t_P = 300 \mu\text{s}$ | V_{SD} | - | 1.0 | 1.5 | V |
|---|----------|---|-----|-----|---|

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.

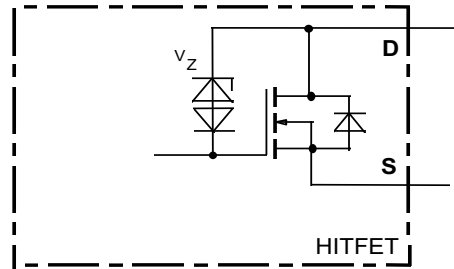
²⁾not subject to production test, specified by design

Block diagram

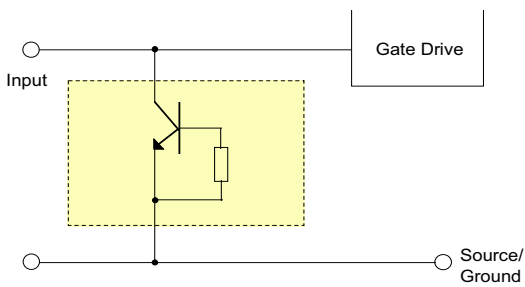
Terms



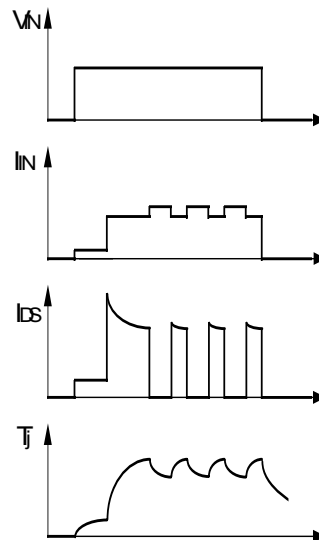
Inductive and overvoltage output clamp



Input circuit (ESD protection)



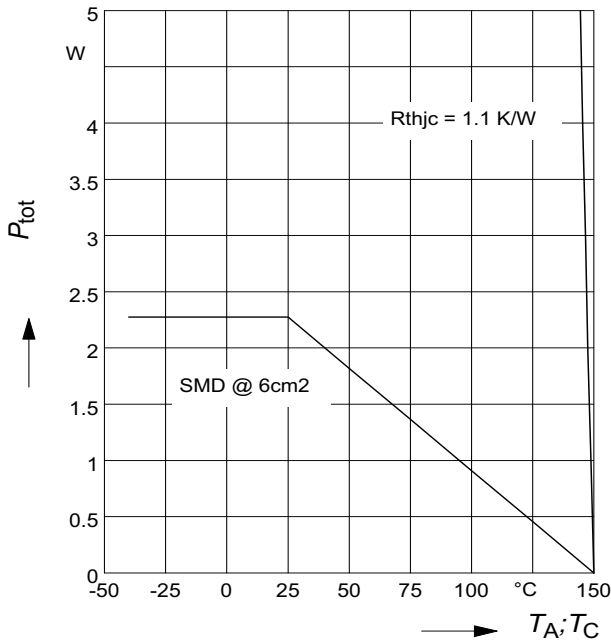
Short circuit behaviour



1 Maximum allowable power dissipation

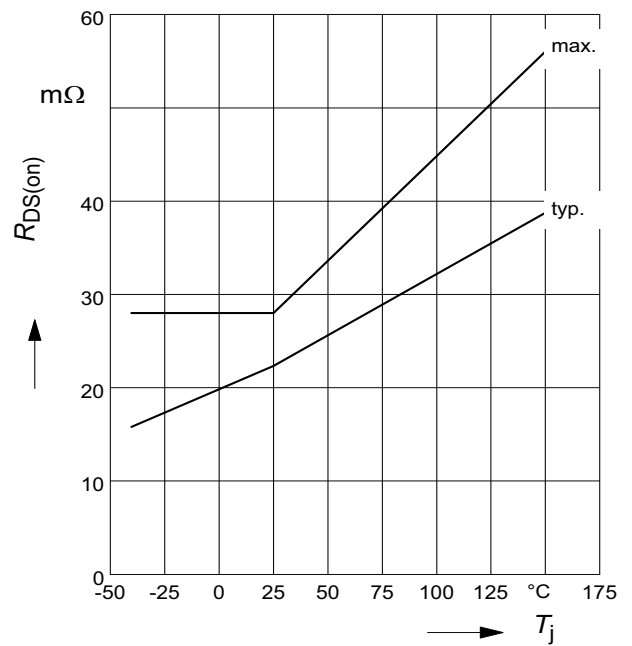
$P_{tot} = f(T_C)$ resp.

$P_{tot} = f(T_A) @ R_{thJA} = 55 \text{ K/W}$



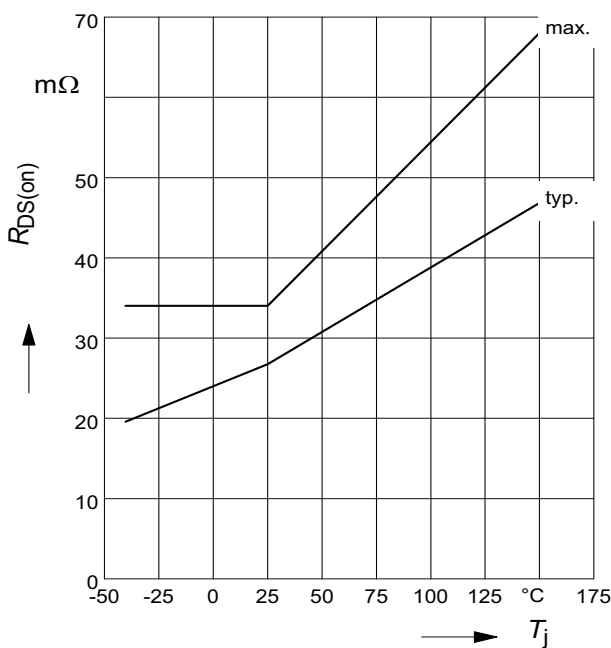
2 On-state resistance

$R_{ON} = f(T_j); I_D = 12.6 \text{ A}; V_{IN} = 10 \text{ V}$



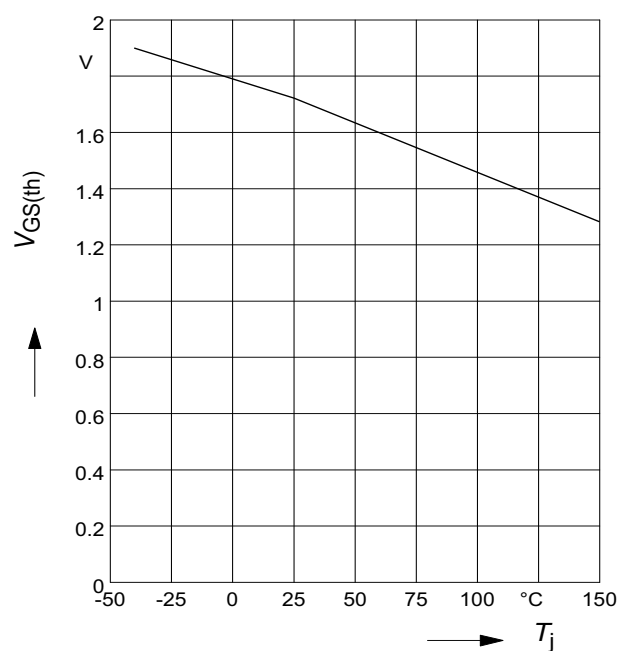
3 On-state resistance

$R_{ON} = f(T_j); I_D = 12.6 \text{ A}; V_{IN} = 5 \text{ V}$



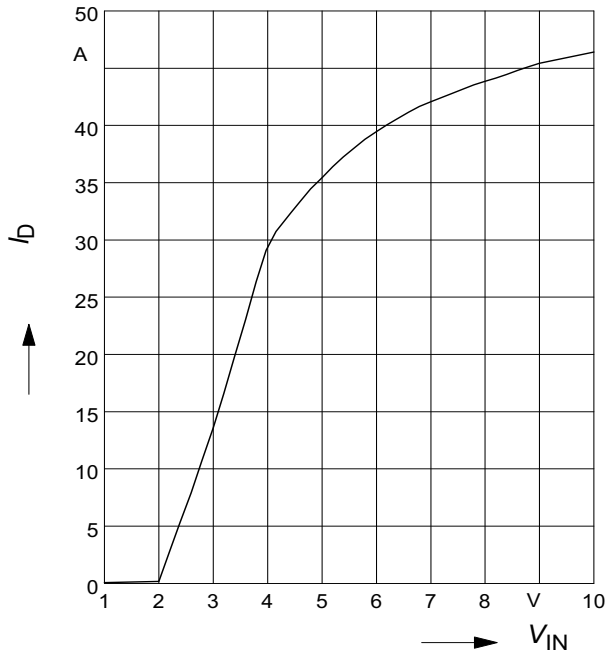
4 Typ. input threshold voltage

$V_{IN(th)} = f(T_j); I_D = 1.2 \text{ mA}; V_{DS} = 12 \text{ V}$



5 Typ. transfer characteristics

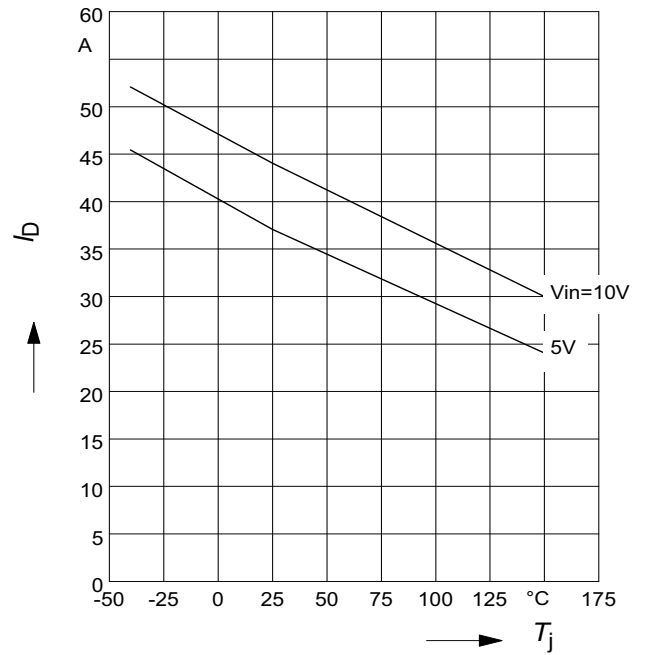
$I_D = f(V_{IN})$; $V_{DS} = 12V$; $T_{Jstart} = 25^\circ C$



6 Typ. short circuit current

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

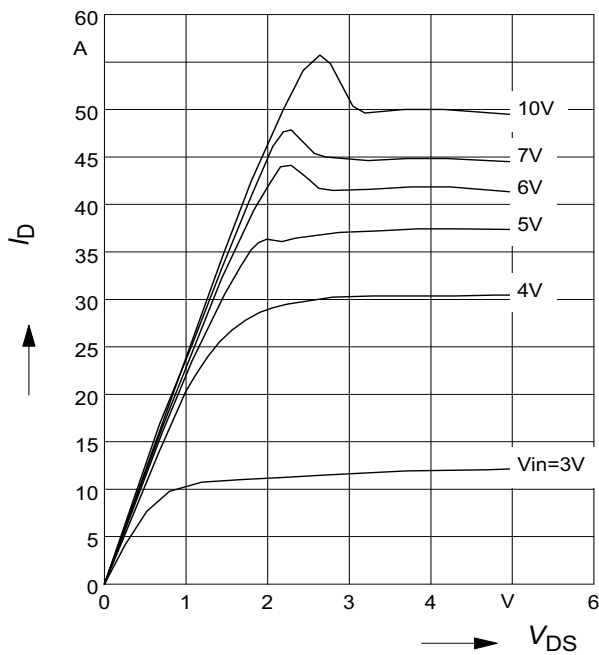
Parameter: V_{IN}



7 Typ. output characteristics

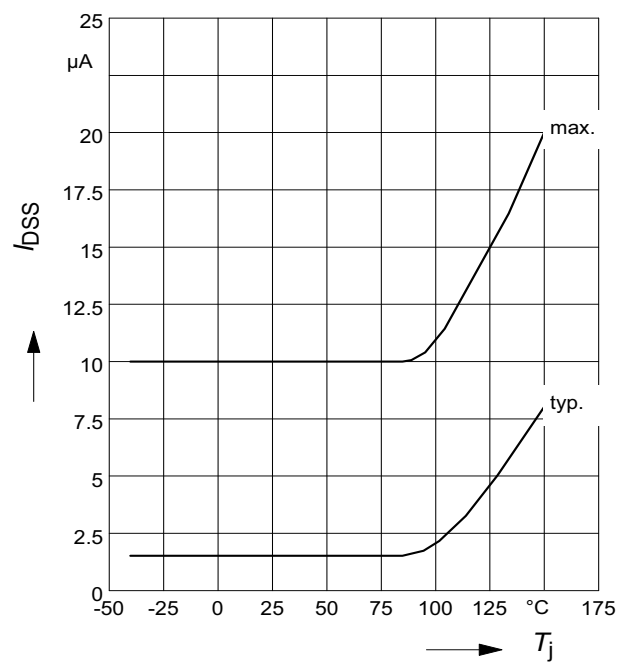
$I_D = f(V_{DS})$; $T_{Jstart} = 25^\circ C$

Parameter: V_{IN}



8 Off-state drain current

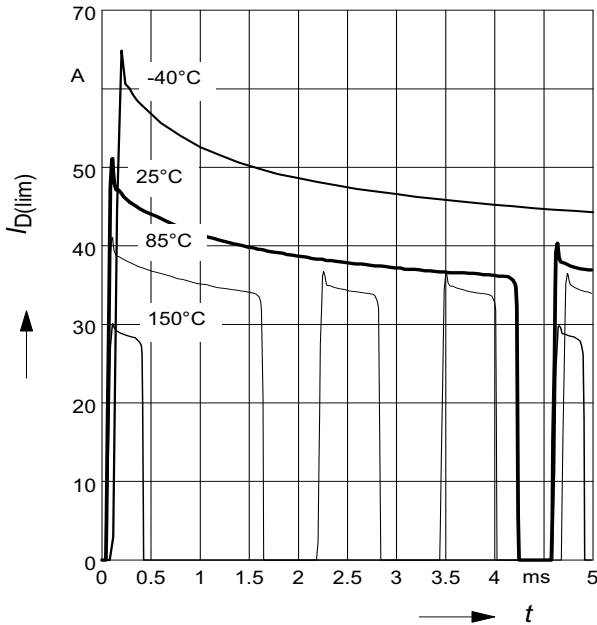
$I_{DSS} = f(T_j)$



9 Typ. overload current

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

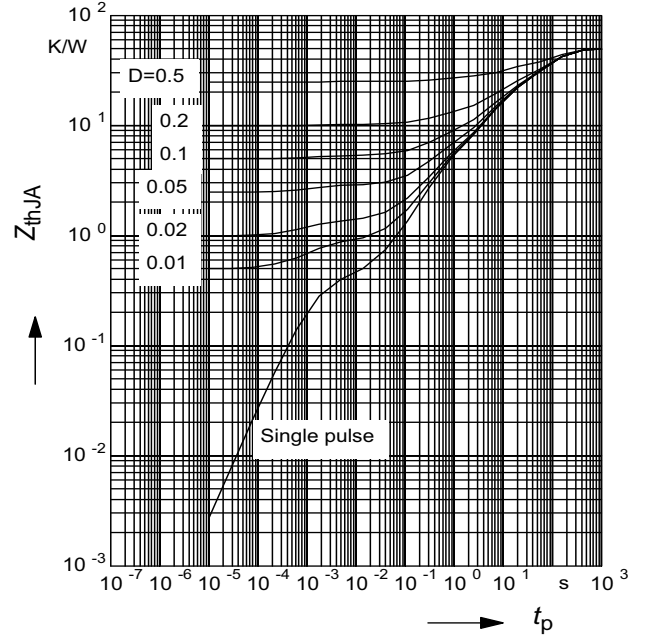
Parameter: T_{jstart}



10 Typ. transient thermal impedance

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

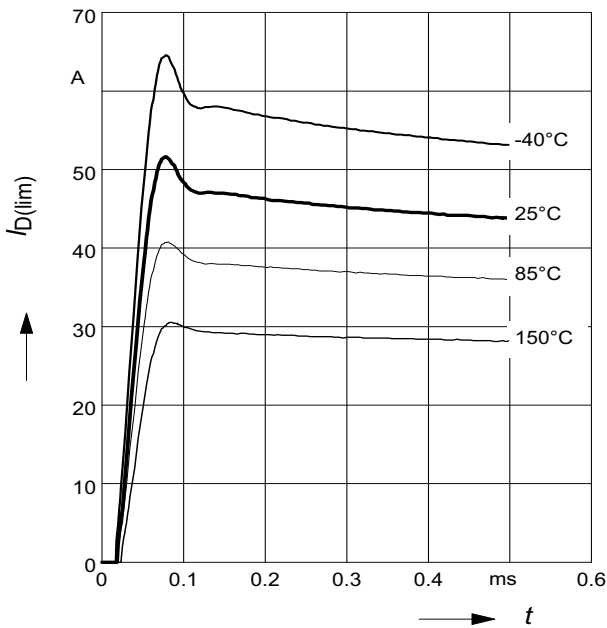
Parameter: $D=t_p/T$



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

$I_{D(lim)} = f(t)$; $t_m = 200\mu\text{s}$

Parameter: T_{jstart}



1 Package Outlines

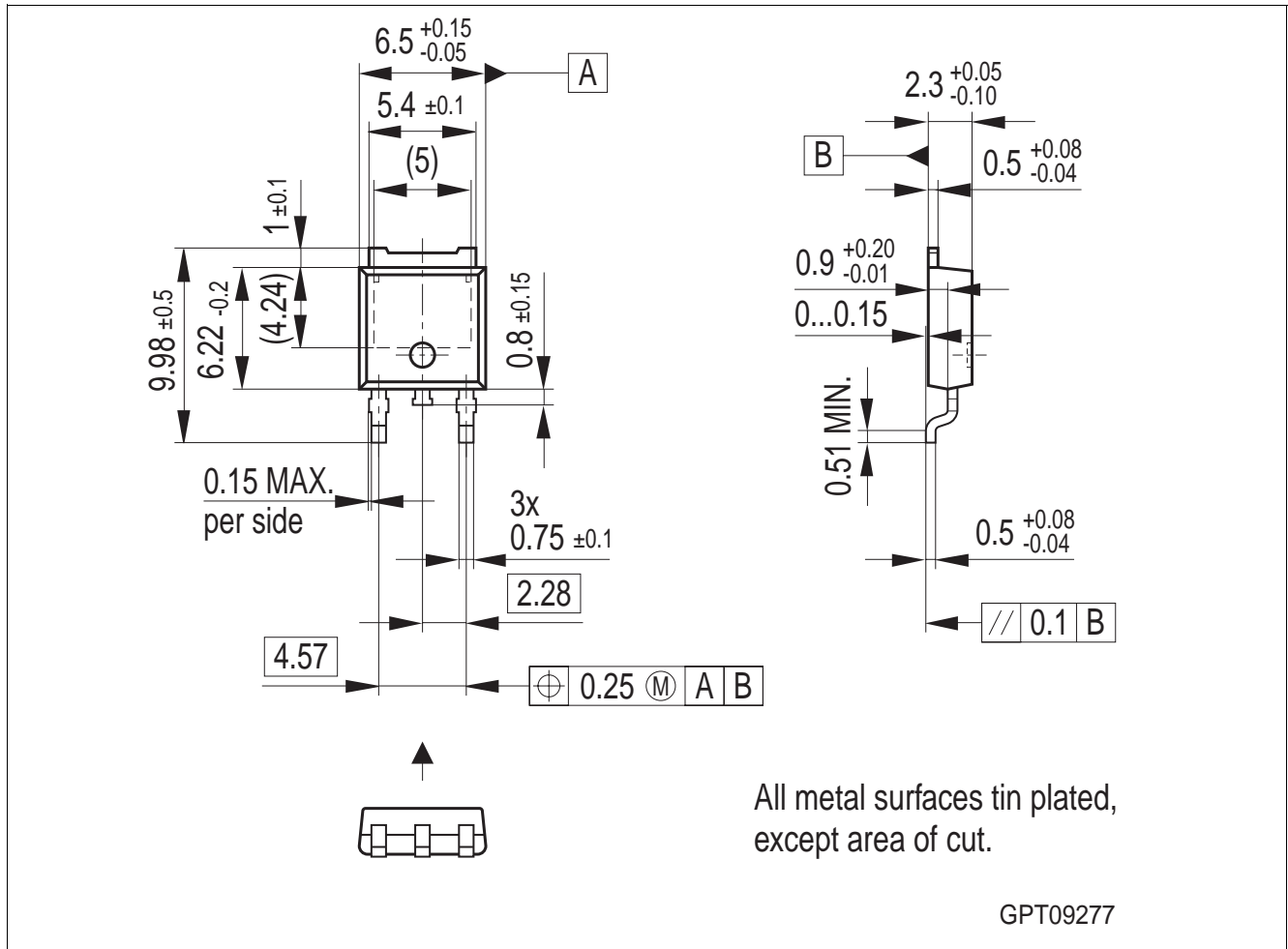


Figure 1 PG-TO252-3-11 (Plastic Dual Small Outline Package) (RoHS-Compliant)

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

2 Revision History

| Version | Date | Changes |
|----------|------------|--|
| Rev. 1.3 | 2006-12-22 | released automotive green and robust version (BTS) Package parameter (humidity and climatic) removed in Maximum ratings |
| Rev. 1.2 | 2006-12-11 | AEC icon added RoHS icon added Green product (RoHS-compliant) added to the feature list Package information updated to green Green explanation added |
| Rev. 1.1 | 2006-08-08 | released non automotive green version (ITS) |
| Rev. 1.0 | 2004-03-05 | released production version |
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