Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

Smart Lowside Power Switch

HITFET® BSP 75N

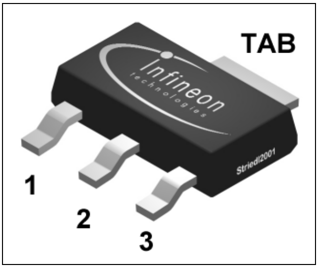
AEC Qualified

RoHS

Data Sheet Rev. 1.4

Features

- Logic Level Input
- Input protection (ESD)
- Thermal shutdown with auto restart
- Overload protection
- Short circuit protection
- Overvoltage protection
- Current limitation
- Green Product (RoHS compliant)
- AEC Stress Test Qualification



Application

- All kinds of resistive, inductive and capacitive loads in switching applications
- µC compatible power switch for 12 V and 24 V DC applications and for 42 Volt Powernet
- Replaces electromechanical relays and discrete circuits

General Description

N channel vertical power FET in Smart Power Technology. Fully protected by embedded protection functions.

Type	Ordering Code	Package
HITFET® BSP 75N	on request	PG-SOT223-4

Product Summary

Parameter	Symbol	Value	Unit
Continuous drain source voltage	V_{DS}	60	V
On-state resistance	$R_{DS(ON)}$	550	mΩ
Current limitation	$I_{D(lim)}$	1	A
Nominal load current	$I_{D(Nom)}$	0.7	A
Clamping energy	E_{AS}	550	mJ

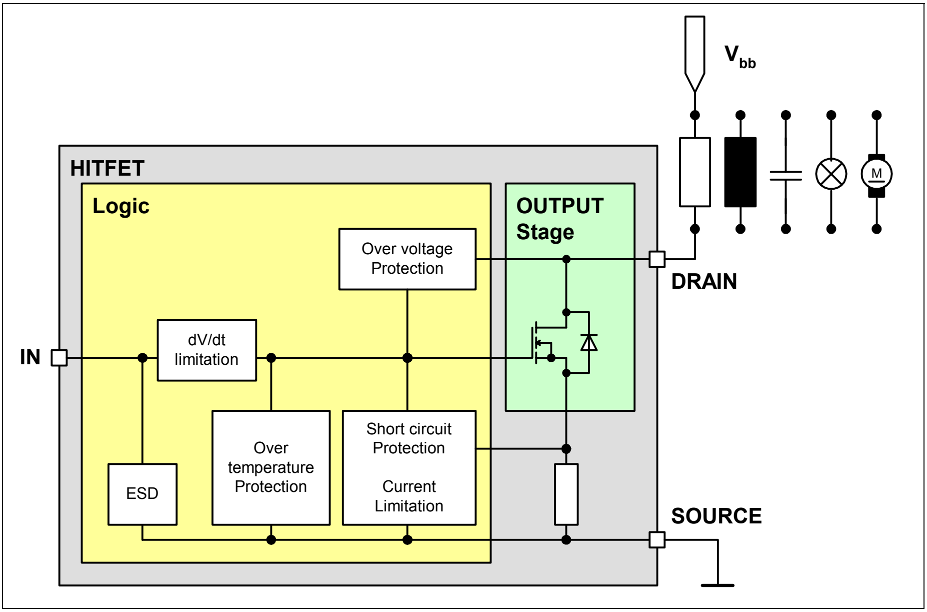


Figure 1 Block Diagram

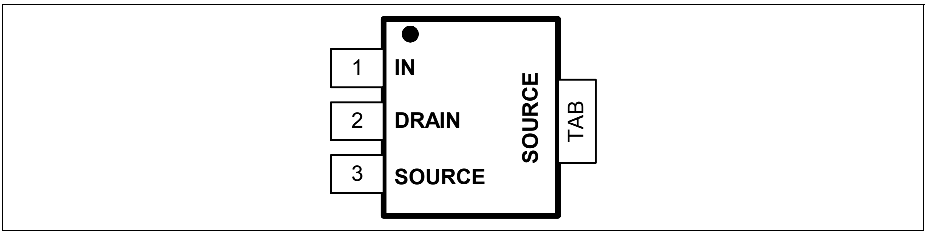


Figure 2 Pin Configuration

Pin Definitions and Functions

Pin No.	Symbol	Function
1	IN	**Input**; activates output and supplies internal logic
2	DRAIN	**Output to the load**
3 + TAB	SOURCE	**Ground**; pin3 and TAB are internally connected

Circuit Description

The BSP 75N is a monolithic power switch in Smart Power Technology (SPT) with a logic level input, an open drain DMOS output stage and integrated protection functions. It is designed for all kind of resistive and inductive loads (relays, solenoid) in automotive and industrial applications.

Protection Functions

- **Over voltage protection:** An internal clamp limits the output voltage at $V_{\mathrm{DS(AZ)}}$ (min. 60V) when inductive loads are switched off.
- **Current limitation:** By means of an internal current measurement the drain current is limited at $I_{\mathrm{D(lim)}}$ (1.4 - 1.5 A typ.). If the current limitation is active the device operates in the linear region, so power dissipation may exceed the capability of the heatsink. This operation leads to an increasing junction temperature until the over temperature threshold is reached.
- **Over temperature and short circuit protection:** This protection is based on sensing the chip temperature. The location of the sensor ensures a fast and accurate junction temperature detection. Over temperature shutdown occurs at minimum 150 °C. A hysteresis of typ. 10 K enables an automatic restart by cooling.

The device is ESD protected according Human Body Model (4 kV) and load dump protected (see Maximum Ratings).

Absolute Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Values	Unit	Remarks
Continuous drain source voltage [1]	V_{DS}	60	V	–
Drain source voltage for short circuit protection	V_{DS}	36	V	–
Continuous input voltage	V_{IN}	-0.2 … +10	V	–
Peak input voltage	V_{IN}	-0.2 … +20	V	–
Continuous Input Current $-0.2V \leq V_{IN} \leq 10V$ V_{IN}<-0.2V or V_{IN}>10V	I_{IN}	 no limit $\lvert I_{IN} \rvert \leq 2mA$	mA	–
Operating temperature range Storage temperature range	T_j T_{stg}	-40 … +150 -55 … +150	°C °C	–
Power dissipation (DC)	P_{tot}	1.8	W	–
Unclamped single pulse inductive energy	E_{AS}	550	mJ	$I_{D(ISO)}$ = 0.7 A; V_{bb} =32V
Load dump protection [2] IN = low or high (8 V); R_L = 50 Ω IN = high (8 V); R_L = 22 Ω	$V_{LoadDump}$	 80 47	V	$V_{LoadDump}$ = $V_P + V_S$; V_P = 13.5 V R_I[3] = 2 Ω; t_d = 400 ms;
Electrostatic discharge voltage (Human Body Model) according to MIL STD 883D, method 3015.7 and EOS/ESD assn. standard S5.1 - 1993	V_{ESD}	4000	V	–

Thermal Resistance

Junction soldering point	R_{thJS}	≤ 10	K/W	–
Junction - ambient[4]	R_{thJA}	≤ 70	K/W	–

1) See also **Figure 7** and **Figure 10**.

2) $V_{LoadDump}$ is setup without DUT connected to the generator per ISO 7637-1 and DIN 40 839. See also **page 7**.

3) R_I = internal resistance of the load dump test pulse generator LD200.

4) Device on epoxy pcb 40 mm × 40 mm × 1.5 mm with 6 cm^2 copper area for pin 4 connection.

Electrical Characteristics

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Limit Values min.	typ.	max.	Unit	Test Conditions
Static Characteristics						
Drain source clamp voltage	$V_{DS(AZ)}$	60	–	75	V	I_D = 10 mA, T_j = -40 … +150 °C
Off state drain current	I_{DSS}	–	–	5	µA	V_{IN} = 0 V, V_{DS} = 32 V, T_j = -40 … +150 °C
Input threshold voltage	$V_{IN(th)}$	1	1.8	2.5	V	I_D = 10 mA
Input current: normal operation, $I_D < I_{D(lim)}$: current limitation mode, $I_D = I_{D(lim)}$: After thermal shutdown, I_D = 0 A:	 $I_{IN(1)}$ $I_{IN(2)}$ $I_{IN(3)}$	 – – 1000	 100 250 1500	 200 400 2000	µA	V_{IN} = 5 V
On-state resistance T_j = 25 °C T_j = 150 °C	$R_{DS(on)}$	 – –	 490 850	 675 1350	mΩ	I_D = 0.7 A, V_{IN} = 5 V
On-state resistance T_j = 25 °C T_j = 150 °C	$R_{DS(on)}$	 – –	 430 750	 550 1000	mΩ	I_D = 0.7 A, V_{IN} = 10 V
Nominal load current	$I_{D(Nom)}$	0.7	–	–	A	V_{BB} = 12 V, V_{DS} = 0.5 V, T_S = 85 °C, T_j < 150 °C
Current limit	$I_{D(lim)}$	1	1.5	1.9	A	V_{IN} = 10 V, V_{DS} = 12 V
Dynamic Characteristics [1)]						
Turn-on time V_{IN} to 90% I_D:	t_{on}	–	10	20	µs	R_L = 22 Ω, V_{IN} = 0 to 10 V, V_{BB} = 12 V
Turn-off time V_{IN} to 10% I_D:	t_{off}	–	10	20	µs	R_L = 22 Ω, V_{IN} = 10 to 0 V, V_{BB} = 12 V

Electrical Characteristics (cont'd)

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Limit Values min.	typ.	max.	Unit	Test Conditions
Slew rate on 70 to 50% V_{BB}:	$-dV_{DS}/dt_{on}$	–	5	10	V/µs	R_L = 22 Ω, V_{IN} = 0 to 10 V, V_{BB} = 12 V
Slew rate off 50 to 70% V_{BB}:	dV_{DS}/dt_{off}	–	10	15	V/µs	R_L = 22 Ω, V_{IN} = 10 to 0 V, V_{BB} = 12 V

Protection Functions[2)]

Thermal overload trip temperature	T_{jt}	150	165	180	°C	–
Thermal hysteresis	ΔT_{jt}	–	10	–	K	–
Unclamped single pulse inductive energy T_j = 25 °C T_j = 150 °C	E_{AS}	 550 200	 – –	 – –	mJ	$I_{D(ISO)}$ = 0.7 A, V_{BB} = 32 V

Inverse Diode

Continuous source drain voltage	V_{SD}	–	1	–	V	V_{IN} = 0 V, $-I_D = 2 \times 0.7$ A

1) See also **Figure 9**.

2) Integrated protection functions are designed to prevent IC destruction under fault conditions described in the datasheet. Fault conditions are considered as "outside" normal operating range. Protection functions are not designed for continuous, repetitive operation.

EMC-Characteristics

The following EMC-Characteristics outline the behavior of typical devices. They are not part of any production test.

Table 1 Test Conditions

Parameter	Symbol	Value	Unit	Remark
Temperature	T_A	23 ±5	°C	–
Supply Voltage	V_S	13.5	V	–
Load	R_L	27	Ω	ohmic
Operation mode	PWM DC	– –	– –	f_{INx}=100Hz, D=0.5 ON / OFF
DUT specific	V_{IN}('HIGH')=5V			

Fast electrical transients

acc. to ISO 7637

Test[1)] Pulse	Max. Test Level	Test Result OUT$_x$ stressed ON	OFF	Pulse Cycle Time and Generator Impedance
1	-200V	C	C	500ms ; 10Ω
2	+200V	C	C	500ms ; 10Ω
3a	-200V	C	C	100ms ; 50Ω
3b	+200V	C	C	100ms ; 50Ω
4	-7V	C	C	0.01Ω
5	175V	E(65V)	E(75V)	400ms ; 2Ω

1) The test pulses are applied at V_S

Definition of functional status

Class	Content
C	All functions of the device are performed as designed after exposure to disturbance.
E	One or more function of a device does not perform as designed after exposure and can not be returned to proper operation without repairing or replacing the device. The value after the character shows the limit.

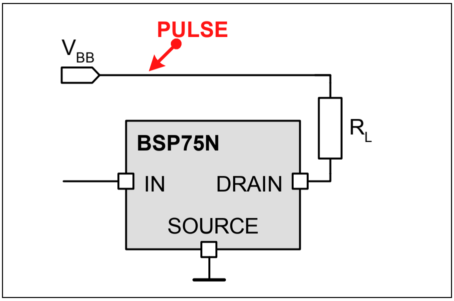
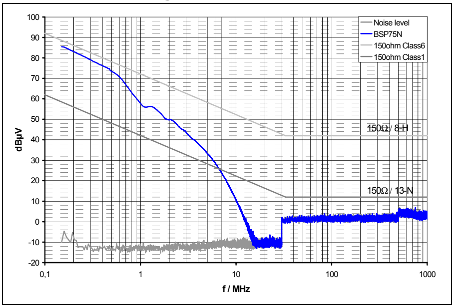


Figure 3 **Test circuit for ISO pulse**

Conducted Emissions

Acc. IEC 61967-4 (1Ω/150Ω method)

Typ. V_{bb} Emissions at PWM-mode with 150Ω-matching network



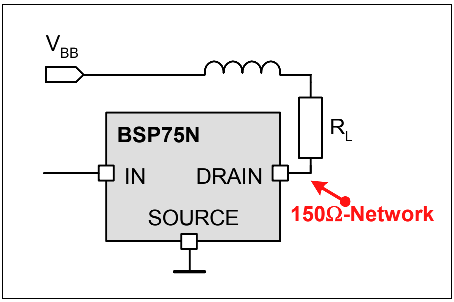


Figure 4 **Test circuit for conducted emission** [1)]

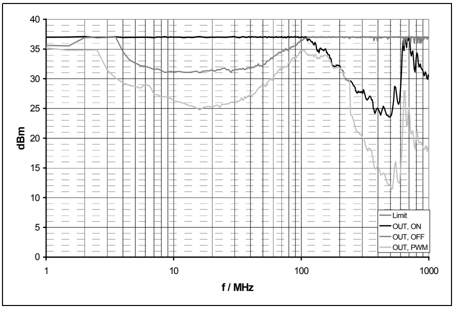
Conducted Susceptibility

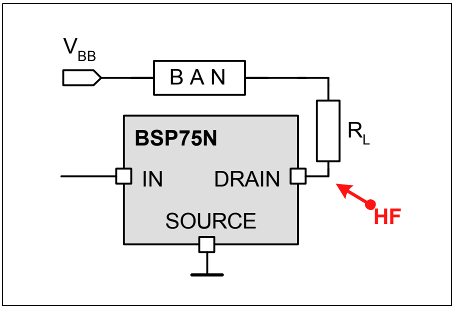
Acc. 47A/658/CD IEC 62132-4 (Direct Power Injection)

Direct Power Injection: Forward Power CW

Failure Criteria: Amplitude or frequency variation max. 10% at OUT

Typ. V_{bb} Susceptibility at DC-ON/OFF and at PWM





Test circuit for conducted susceptibility [2)]

1) For defined de coupling and high reproducibility a defined choke (5µH at 1MHz) is inserted in the Vbb-Line.

2) Broadband Artificial Network (short: BAN) consists of the same choke (5µH at 1MHz) and the same 150 Ohm-matching network as for emission measurement for defined de coupling and high reproducibility.

Block diagram

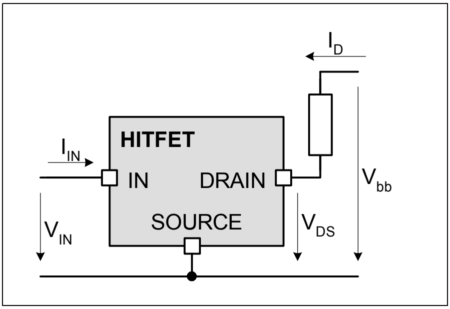


Figure 5 Terms

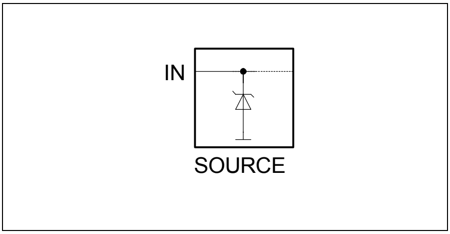


Figure 6 Input Circuit (ESD protection)

ESD zener diodes are not designed for DC current.

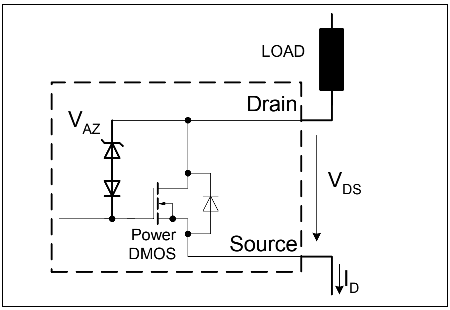


Figure 7 Inductive and Over voltage Output Clamp

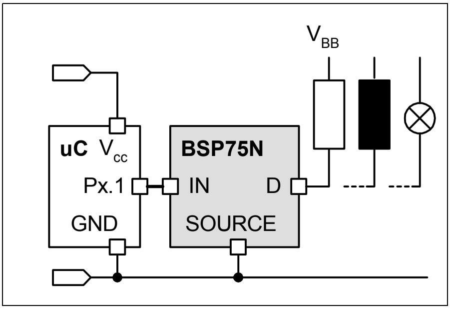


Figure 8 Application Circuit

Timing diagrams

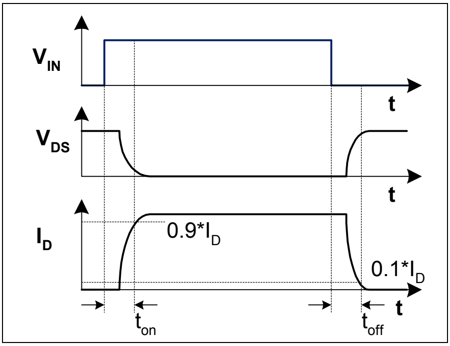


Figure 9 Switching a Resistive Load

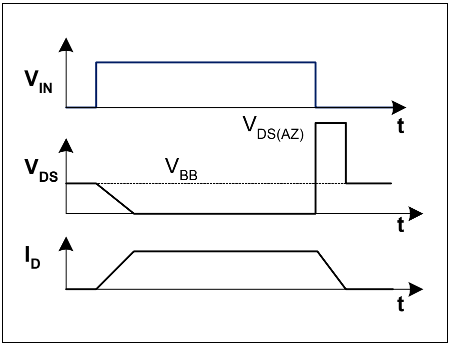


Figure 10 Switching an Inducitve Load

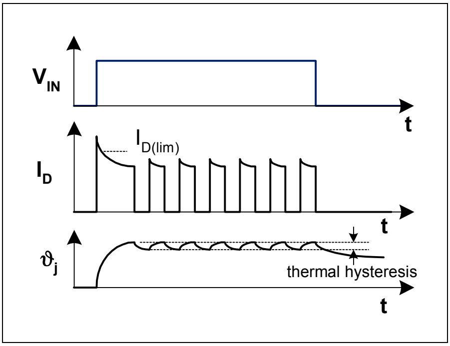
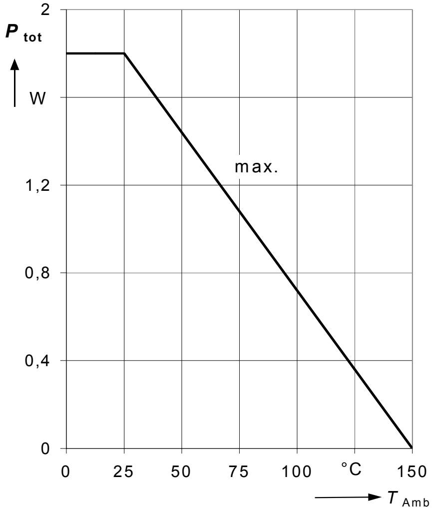
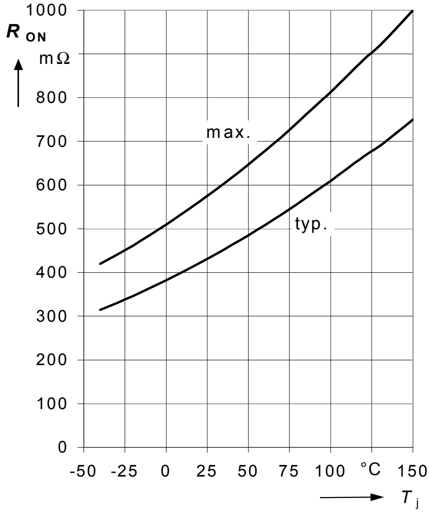


Figure 11 Short circuit

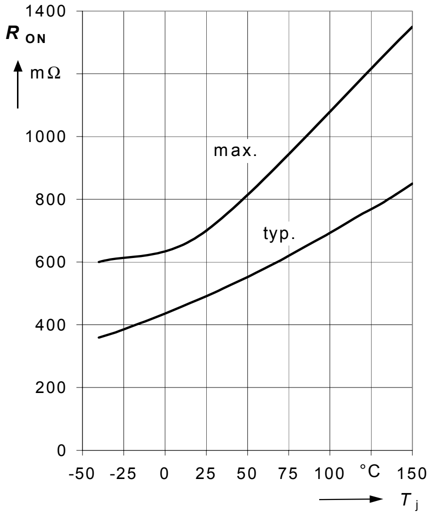
1 Max. allowable power dissipation
$P_{tot} = f(T_{Amb})$



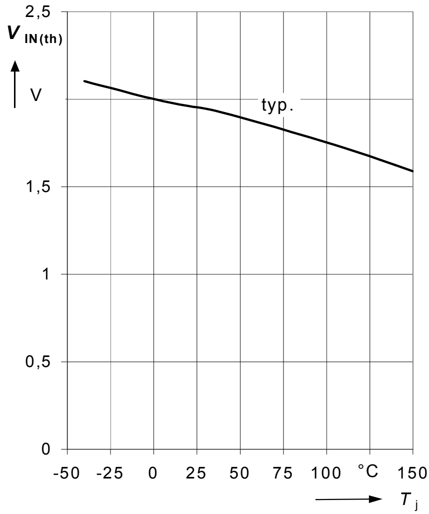
2 On-state resistance $R_{ON} = f(T_j)$;
I_D = 0.7 A; V_{IN} = 10 V



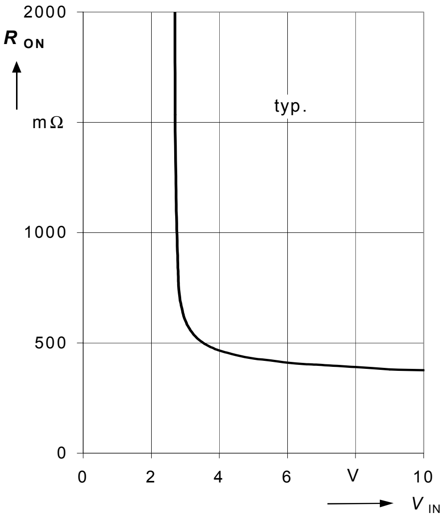
3 On-state resistance $R_{ON} = f(T_j)$;
I_D = 0.7 A; V_{IN} = 5 V



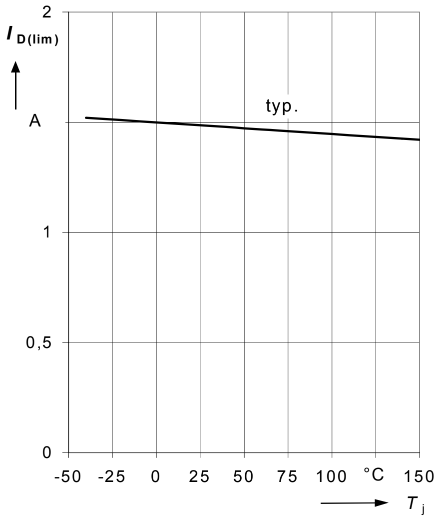
4 Typ. input threshold voltage
$V_{IN(th)} = f(T_j)$; I_D = 10 mA; V_{DS} = 12 V



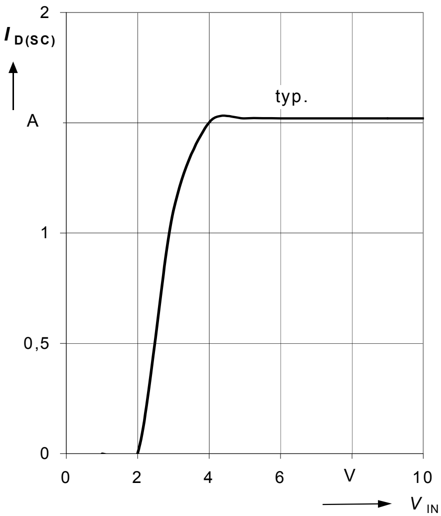
5 Typ. on-state resistance $R_{ON} = f(V_{IN})$;
I_D = 0.7 A; T_j = 25 °C



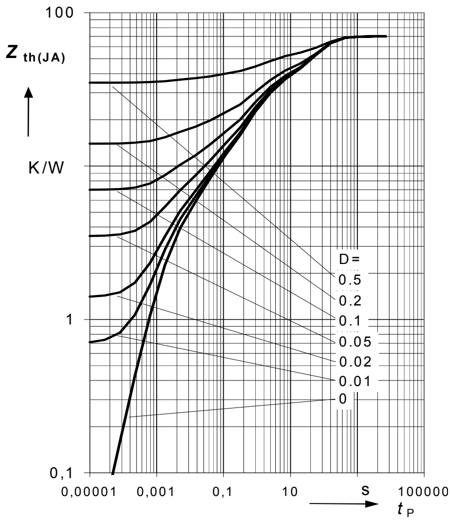
6 Typ. current limitation $I_{D(lim)} = f(T_j)$;
V_{DS} = 12 V, V_{IN} = 10 V



7 Typ. short circuit current
$I_{D(SC)} = f(V_{IN})$; V_{DS} = 12 V, T_j = 25 °C



8 Max. transient thermal impedance
$Z_{thJA} = f(t_p)$ @ 6cm²; Parameter: D = t_p/T



1 Package Outlines HITFET® BSP 75N

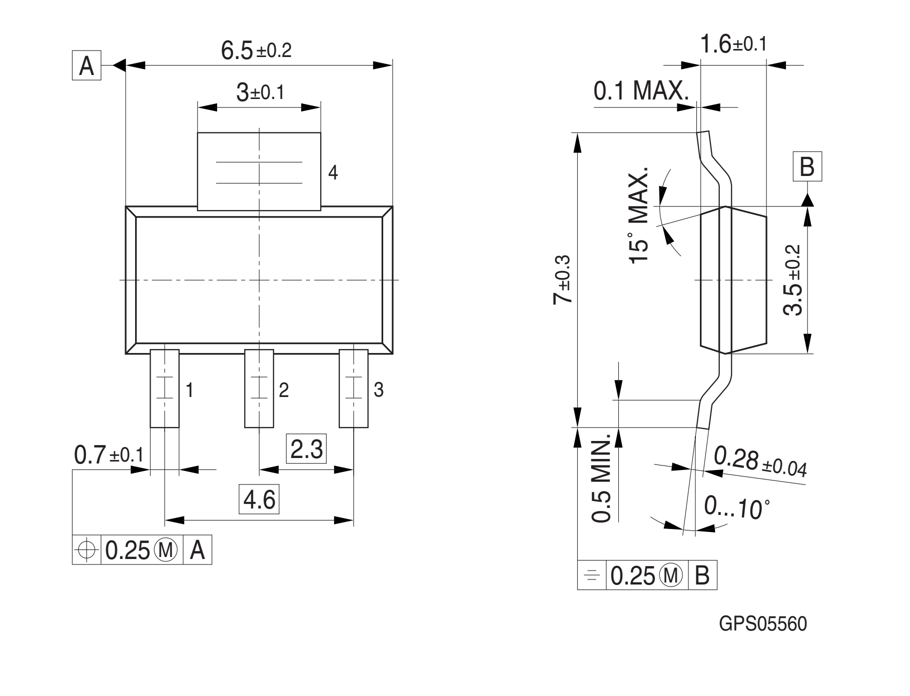


Figure 12 **PG-SOT223-4** (Plastic Green Small Outline Transistor Package)

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: **http://www.infineon.com/packages**.

Dimensions in mm

2 Revision History

Version	Date	Changes
Rev. 1.4	2008-07-10	fixed a formatting error in Disclaimer page
Rev. 1.3	2008-04-14	package naming updated to PG-SOT223-4
Rev. 1.2	2007-04-12	released automotive green version changed package naming from -11 to PG-SOT223-4-7
Rev. 1.1	2007-03-28	Package parameter (humidity and climatic) removed in Maximum ratings AEC icon added RoHS icon added Green product (RoHS-compliant) added to the feature list Package information updated to green Green explanation added
Rev. 1.0	2003-01-10	released production version

Edition 2008-07-10

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

Legal Disclaimer

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics (“Beschaffenheitsgarantie”). With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

Information

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office (**www.infineon.com**)

Warnings

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies Office.

Infineon Technologies Components may only be used in life-support devices or systems with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.