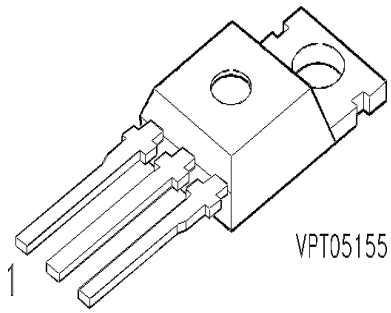
Smart Lowside Power Switch

Features

- Logic Level Input
- Input Protection (ESD)
- Temperature limitation adjustable by input voltage
- Overload protection
- Short circuit protection
- Overvoltage protection
- Current limitation
- Analog driving possible

Product Summary

Drain source voltage	V_{DS}	42	V
On-state resistance	$R_{DS(on)}$	18	mΩ
Nominal load current	$I_{D(ISO)}$	19	A
Clamping energy	E_{AS}	2	J



Application

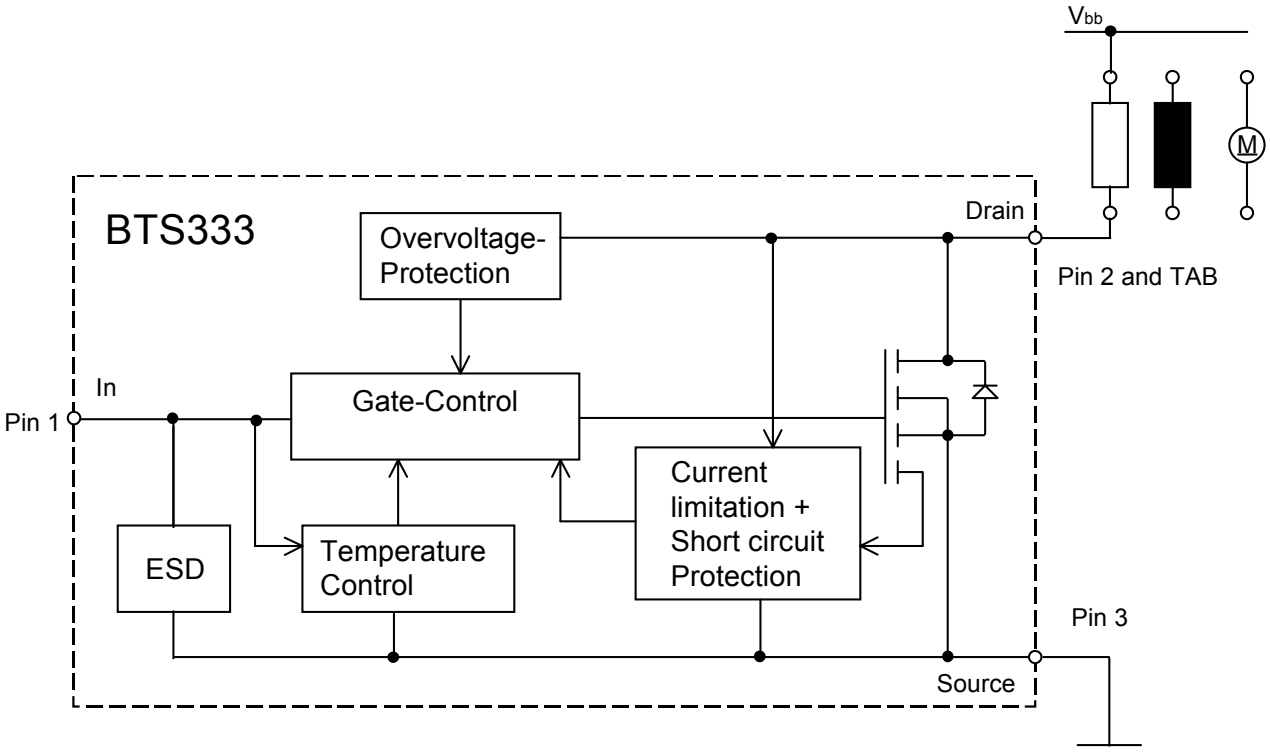
- All kinds of resistive, inductive and capacitive loads in switching or linear applications
- µC compatible power switch for 12 V and 24 V DC applications
- Replaces electromechanical relays and discrete circuits

General Description

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

Pin	Symbol		Function
1	IN		Input
2	DRAIN		Output to the load
3	SOURCE		Ground
TAB	DRAIN		Output to the load

Block Diagram



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 full SCP SCP Type I, $V_{IN} \leq 10V$ SCP Type II, $V_{IN} \leq 7V$	$V_{DS(SC)}$	 36 24	
Continuous input current $-0.2V \leq V_{IN} \leq 10V$ $V_{IN} < -0.2V$ or $V_{IN} > 10V$	I_{IN}	 no limit $\lvert I_{IN} \rvert \leq 4$	mA
Operating temperature[1)]	T_j	-40 ...+175	°C
Storage temperature	T_{stg}	-55 ... +150	
Power dissipation T_C = 85 °C	P_{tot}	100	W
Unclamped single pulse inductive energy [2)] I_D = 19 A, T_j = 25 °C, V_{bb} = 12 V I_D = 19 A, T_j = 150 °C, V_{bb} = 12 V	E_{AS}	 2 0.5	J
Load dump protection $V_{LoadDump}$[3)] = V_A + V_S V_{IN} = 0 and 10 V, t_d = 400 ms, R_I = 2 Ω, R_L = 1 Ω, V_A = 13.5 V	V_{LD}	55	V
Electro**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
DIN humidity category, DIN 40 040		E	
IEC climatic category; DIN IEC 68-1		40/150/56	

Thermal resistance

junction - case:	R_{thJC}	0.8	K/W
junction - case:	R_{thJA}	75	

[1] Temperatures above 175°C will reduce lifetime of the device

[2] Not tested, specified by design.

[3] $V_{Loaddump}$ is setup without the DUT connected to the generator per ISO 7637-1 and DIN 408

Electrical Characteristics

Parameter at T_j = 25°C, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
Drain source clamp voltage T_j = - 40 ...+ 150, I_D = 10 mA	$V_{DS(AZ)}$	42	-	55	V
Off-state drain current V_{DS} = 32 V, T_j=-40 ... +85°C , V_{IN} = 0 V V_{DS} = 32 V, T_j=-40 ... +150°C , V_{IN} = 0 V	I_{DSS}	 - -	 1 1	 5 20	µA
Gate threshold voltage, V_{GS} = V_{DS} I_D = 1.9 mA, T_j = -40 °C I_D = 1.9 mA, T_j = 25 °C	$V_{GS(th)}$	 - 1.3	 - 1.7	 2.4 2.2	V
On state input current (temp. limit. inactiv) V_{IN} = 10 V V_{IN} = 5 V	$I_{IN(on)}$	 - -	 200 10	 300 30	µA
On-state resistance V_{IN} = 5 V, I_D = 19 A, T_j = 25 °C V_{IN} = 5 V, I_D = 19 A, T_j = 150 °C	$R_{DS(on)}$	 - -	 18 29	 23 46	mΩ
On-state resistance V_{IN} = 10 V, I_D = 19 A, T_j = 25 °C V_{IN} = 10 V, I_D = 19 A, T_j = 150 °C	$R_{DS(on)}$	 - -	 14 26	 18 36	
Nominal load current V_{IN} = 10 V, T_j < 150°C, T_A = 85 °C	$I_{D(ISO)}$	19	-	-	A
Continuous drain current[1)] T_C = 120 °C, V_{IN} = 10 V	I_D	25	-	-	
Current limit (active if V_{DS}>2.5 V)[2)] V_{IN} = 10 V, V_{DS} = 12 V, t_m = 300 µs	$I_{D(lim)}$	35	50	65	

[1] if not limited by current limitation

[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.

Electrical Characteristics

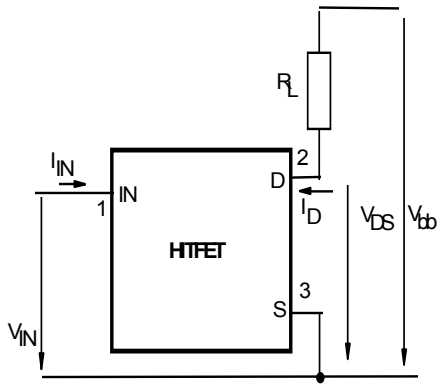
Parameter at T_j = 25°C, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Turn-on time V_{IN} to 90% I_D: R_L = 2 Ω, V_{IN} = 0 to 10 V, V_{bb} = 12 V	t_{on}	-	140	250	µs
Turn-off time V_{IN} to 10% I_D: R_L = 2 Ω, V_{IN} = 10 to 0 V, V_{bb} = 12 V	t_{off}	-	250	350	
Slew rate on 70 to 50% V_{bb}: R_L = 2 Ω, V_{IN} = 0 to 10 V, V_{bb} = 12 V	$-dV_{DS}/dt_{on}$	-	0.1	1	V/µs
Slew rate off 50 to 70% V_{bb}: R_L = 2 Ω, V_{IN} = 10 to 0 V, V_{bb} = 12 V	dV_{DS}/dt_{off}	-	0.2	1	
Protection Functions					
Input current protection mode V_{IN} = 5 V V_{IN} = 10 V	$I_{IN(Prot)}$	 - -	 -- -	 300 400	µA

Inverse Diode

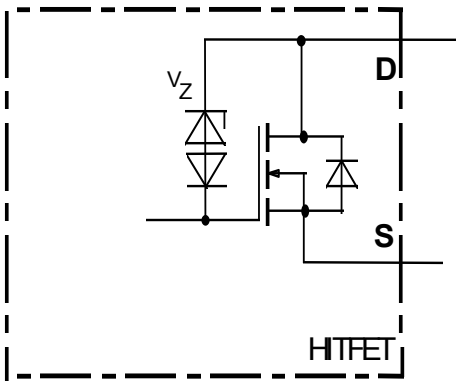
Inverse diode forward voltage t_m = 250 µs, V_{IN} = 0 V, $-I_D$ = 5*19 A, t_P = 300 µs	V_{SD}	-	1.0	-	V

Block diagram

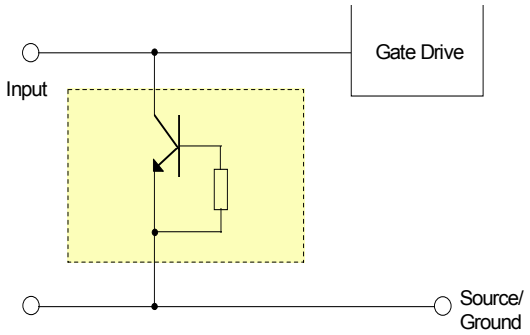
Terms



Inductive and overvoltage output clamp



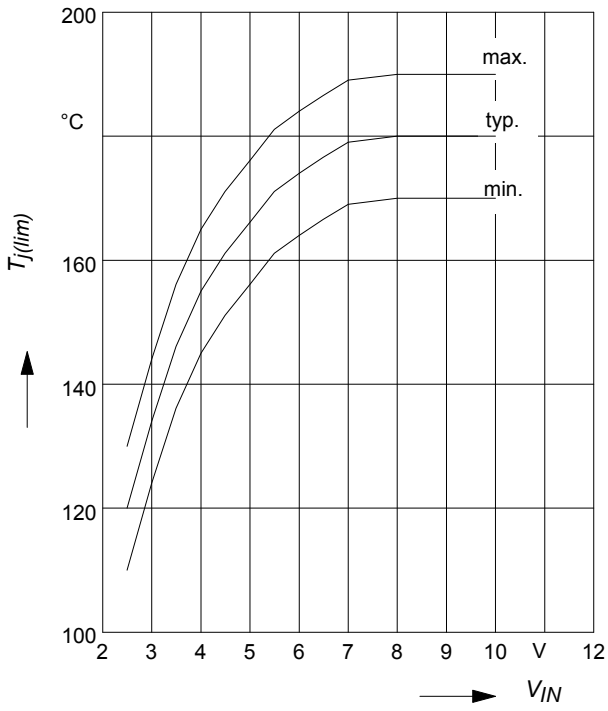
Input circuit (ESD protection)



Input is not designed for DC current > 4 mA

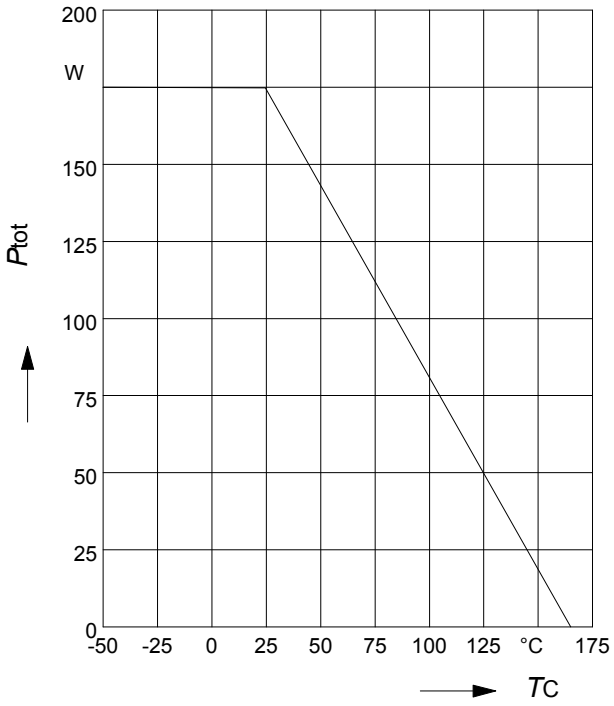
Temperature limitation

$T_{j(lim)}$ = f(V_{IN}); V_{DS} = 6V; I_D = 10A;
t_m = 150...400µs (guaranteed by charact.)



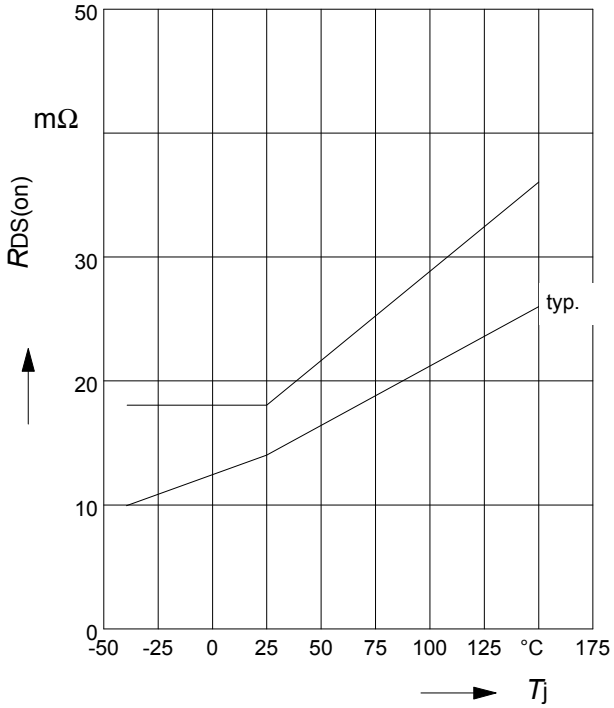
1 Maximum allowable power dissipation

$P_{tot} = f(T_C)$



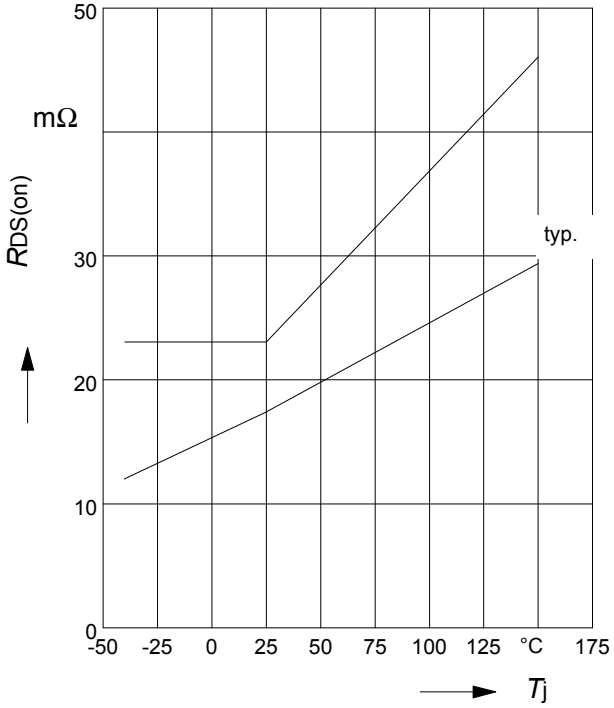
2 On-state resistance

$R_{ON} = f(T_j)$; I_D=19A; V_{IN}=10V



3 On-state resistance

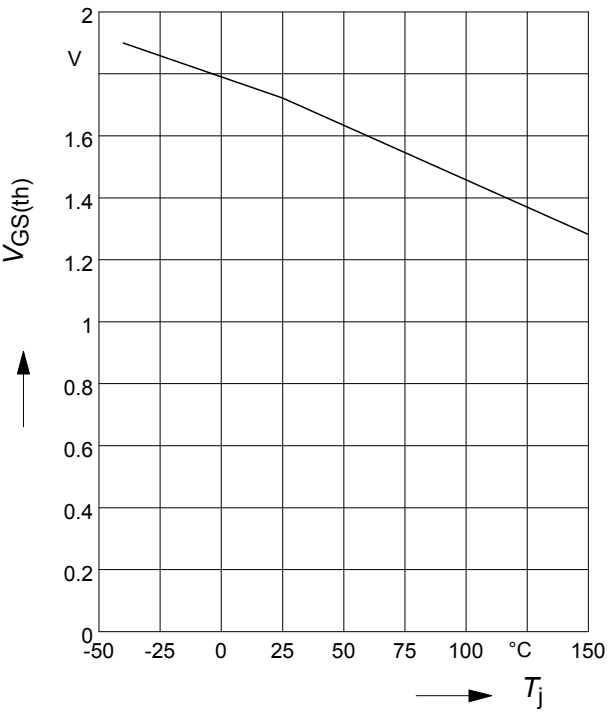
$R_{ON} = f(T_j)$; I_D= 19A; V_{IN}=5V



4 Typ. input threshold voltage

$V_{GS(th)} = f(T_j)$; I_D = 1.9 mA; V_{DS} = 12V

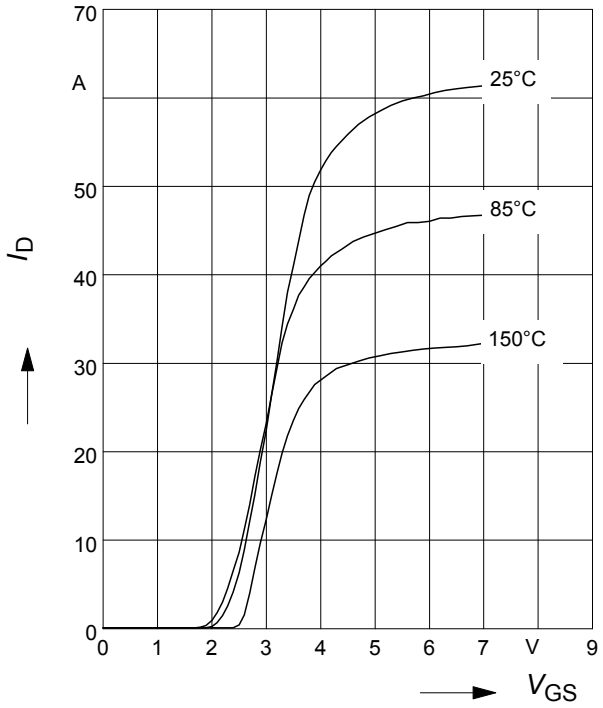
(guaranteed by characterization)



5 Typ. transfer characteristics

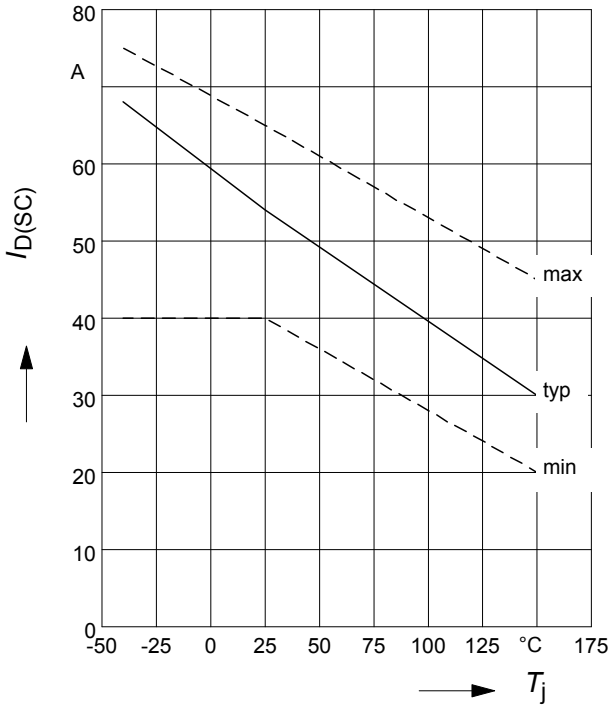
I_D=f(V_{IN}); V_{DS}=12V; Param.=T_{Jstart}

(guarantied by characterization)



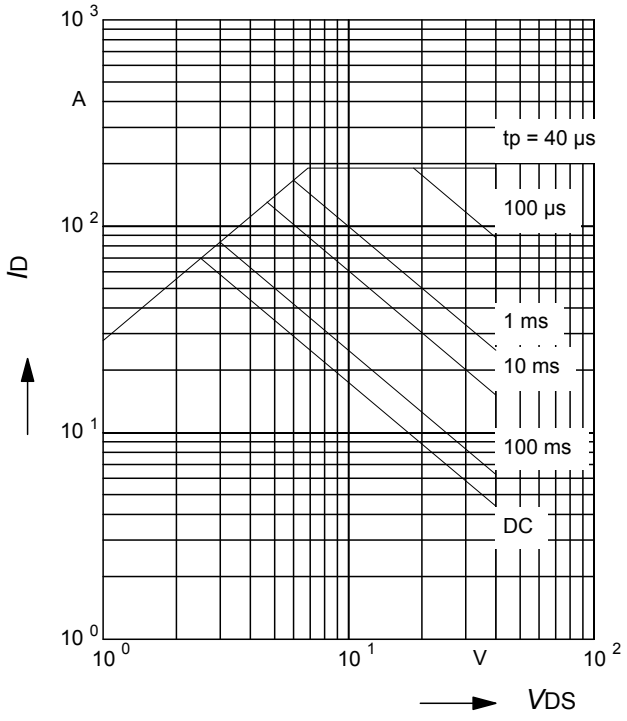
6 Typ. short circuit current

$I_{D(lim)}$ = f(T_j); V_{DS}=12V; V_{IN}=10V



7 Safe Operating Area

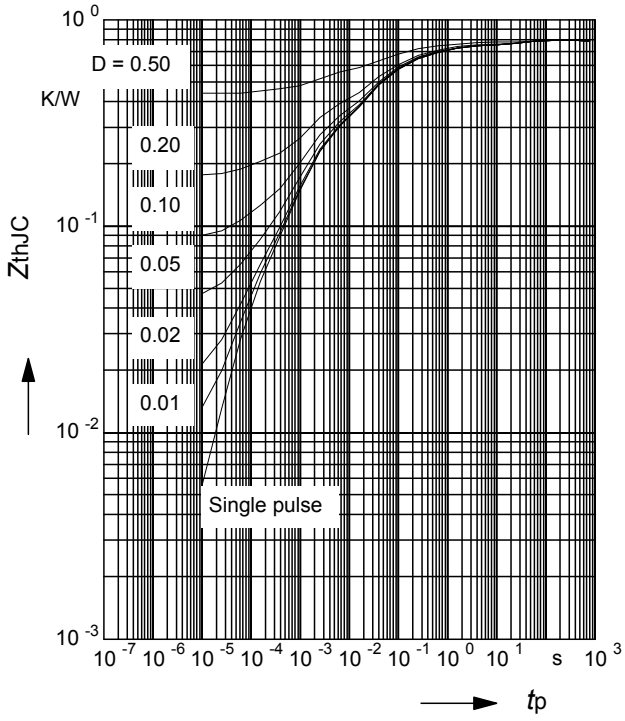
$I_{D(SC)}$ = f(V_{DS}); T_j=25°C



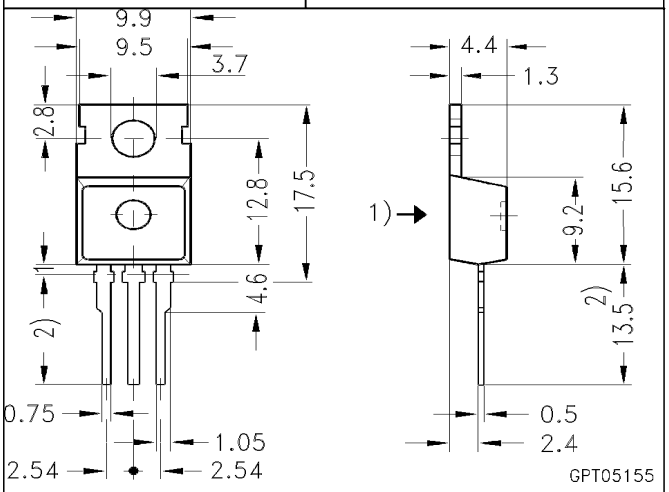
8 Typ. transient thermal impedance

Z_{thJC}=f(t_p)

Parameter: $D=t_p/T$



Package	Ordering Code
P-TO220-3-1	Q67060 S6506



1) punch direction, burr max. 0.04
2) dip tinning
3) max. 14.5 by dip tinning press burr max. 0.05

Published by
Infineon Technologies AG,
Bereichs Kommunikation
St.-Martin-Strasse 53,
D-81541 München

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