

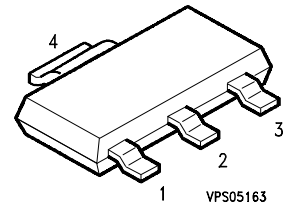
Smart Lowside Power Switch

Features

- Logic Level Input
- Input Protection (ESD)
- Thermal shutdown with auto restart
- Overload protection
- Short circuit protection
- Overvoltage protection
- Current limitation
- Analog driving possible

Product Summary

Drain source voltage	V_{DS}	40	V
On-state resistance	$R_{DS(on)}$	50	m Ω
Nominal load current	$I_{D(Nom)}$	3	A
Clamping energy	E_{AS}	500	mJ



Application

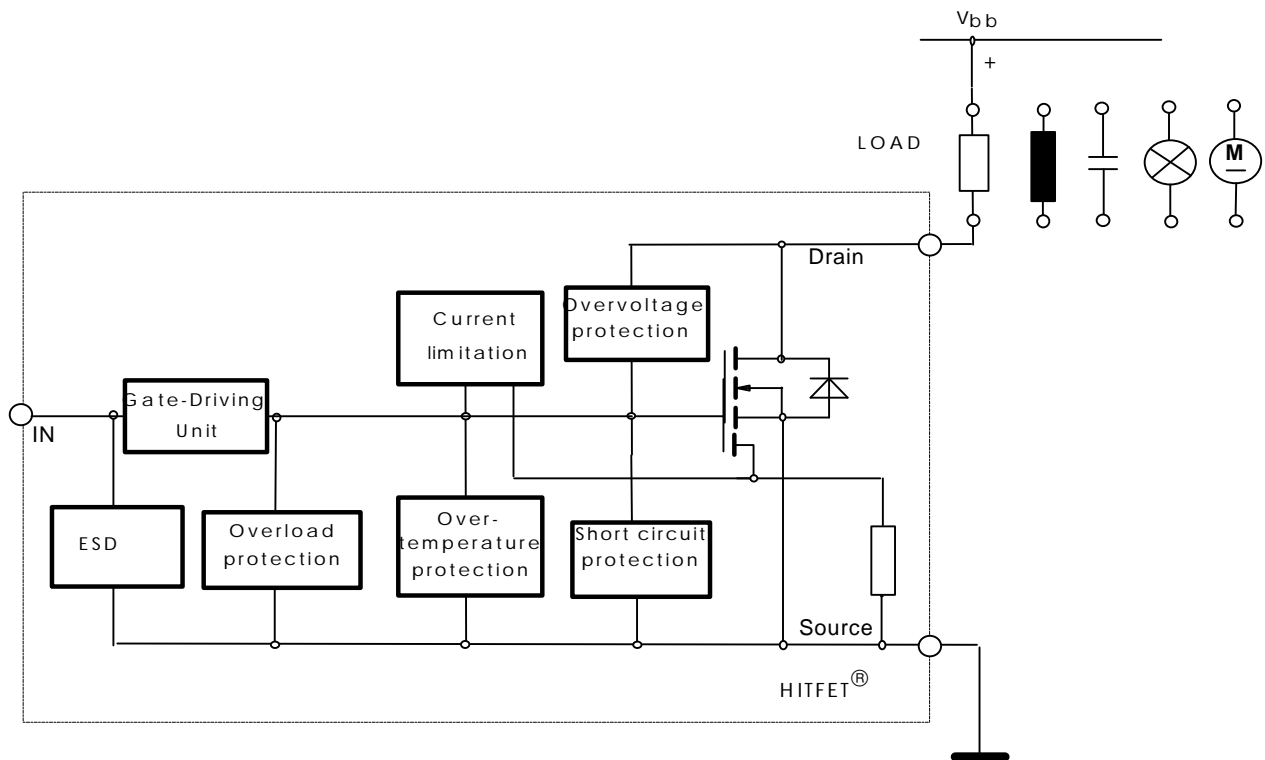
- All kinds of resistive, inductive and capacitive loads in switching or linear applications
- μ C compatible power switch for 12 V and 24 V DC applications
- Replaces electromechanical relays and discrete circuits

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

Parameter	Symbol	Value	Unit
Drain source voltage	V_{DS}	40	V
Drain source voltage for short circuit protection	$V_{DS(SC)}$	40	
Continuous input voltage	V_{IN}	-0.2 ... +10	
Peak input voltage ($I_{IN} \leq 2 \text{ mA}$)	$V_{IN(peak)}$	-0.2 ... V_{DS}	
Operating temperature	T_j	-40 ... +150	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 ... +150	
Power dissipation, $T_C = 85^\circ\text{C}$	P_{tot}	1.7	W
Unclamped single pulse inductive energy ^{F)}	E_{AS}	500	mJ
Electrostatic discharge voltage (Human Body Model) according to MIL STD 883D, method 3015.7 and EOS/ESD assn. standard S5.1 - 1993	V_{ESD}	2000	kV
DIN humidity category, DIN 40 040		E	
IEC climatic category; DIN IEC 68-1		40/150/56	

Thermal resistance

junction - ambient: @ min. footprint @ 6 cm ² cooling area ^{F)}	R_{thJA}	125 72	K/W
junction-soldering point:	R_{thJS}	17	K/W

¹not tested, specified by design

²Device on 50mm+50mm*1.5mm epoxy PCB FR4 with 6 cm² (one layer, 70µm thick) copper area for Drain connection. PCB is vertical without blown air.

Electrical Characteristics

Parameter at $T_j = 25^\circ\text{C}$, unless otherwise specified	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
Drain source clamp voltage $T_j = -40 \dots +150$, $I_{\text{mess}} = 10 \text{ mA}$	$V_{\text{DS(AZ)}}$	40	-	55	V
Off-state drain current $T_j = -40 \dots +150^\circ\text{C}$ $V_{\text{IN}} = 0 \text{ V}$, $V_{\text{DS}} = 32 \text{ V}$	I_{DSS}	-	-	10	μA
Input treshold voltage $I_{\text{D}} = 0.7 \text{ mA}$	$V_{\text{IN(th)}}$	1.3	1.7	2.2	V
On state input current	$I_{\text{IN(on)}}$	-	10	30	μA
On-state resistance $I_{\text{D}} = 3 \text{ A}$, $V_{\text{IN}} = 5 \text{ V}$, $T_j = 25^\circ\text{C}$ $I_{\text{D}} = 3 \text{ A}$, $V_{\text{IN}} = 5 \text{ V}$, $T_j = 150^\circ\text{C}$	$R_{\text{DS(on)}}$	-	45	60	$\text{m}\Omega$
On-state resistance $I_{\text{D}} = 3 \text{ A}$, $V_{\text{IN}} = 10 \text{ V}$, $T_j = 25^\circ\text{C}$ $I_{\text{D}} = 3 \text{ A}$, $V_{\text{IN}} = 10 \text{ V}$, $T_j = 150^\circ\text{C}$	$R_{\text{DS(on)}}$	-	75	120	
Nominal load current $V_{\text{DS}} = 0.5 \text{ V}$, $T_{\text{S}} = 85^\circ\text{C}$, $T_j < 150^\circ\text{C}$, $V_{\text{IN}} = 10 \text{ V}$	$I_{\text{D(Nom)}}$	3	-	-	A
Current limit (active if $V_{\text{DS}} > 2.5 \text{ V}$) $V_{\text{IN}} = 10 \text{ V}$, $V_{\text{DS}} = 12 \text{ V}$	$I_{\text{D(lim)}}$	16	24	32	A

Dynamic Characteristics

Turn-on time V_{IN} to 90% I_{D} : $R_{\text{L}} = 5 \Omega$, $V_{\text{IN}} = 0$ to 10 V , $V_{\text{bb}} = 12 \text{ V}$	t_{on}	-	60	150	μs
Turn-off time V_{IN} to 10% I_{D} : $R_{\text{L}} = 5 \Omega$, $V_{\text{IN}} = 10$ to 0 V , $V_{\text{bb}} = 12 \text{ V}$	t_{off}	-	60	150	
Slew rate on 70 to 50% V_{bb} : $R_{\text{L}} = 5 \Omega$, $V_{\text{IN}} = 0$ to 10 V , $V_{\text{bb}} = 12 \text{ V}$	$-dV_{\text{DS}}/dt_{\text{on}}$	-	0.4	1	V/ μs
Slew rate off 50 to 70% V_{bb} : $R_{\text{L}} = 5 \Omega$, $V_{\text{IN}} = 10$ to 0 V , $V_{\text{bb}} = 12 \text{ V}$	$dV_{\text{DS}}/dt_{\text{off}}$	-	0.7	1	

Electrical Characteristics

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

Protection Functions

Thermal overload trip temperature	T_{jt}	150	165	-	$^\circ\text{C}$
Thermal hysteresis	ΔT_{jt}	-	10	-	K
Input current protection mode	$I_{IN(\text{Prot})}$	-	-	300	μA
Unclamped single pulse inductive energy ^{F)} $I_D = 3 \text{ A}$, $T_j = 25 \text{ }^\circ\text{C}$, $V_{bb} = 12 \text{ V}$ $I_D = 3 \text{ A}$, $T_j = 150 \text{ }^\circ\text{C}$, $V_{bb} = 12 \text{ V}$	E_{AS}	500 300	- -	- -	mJ

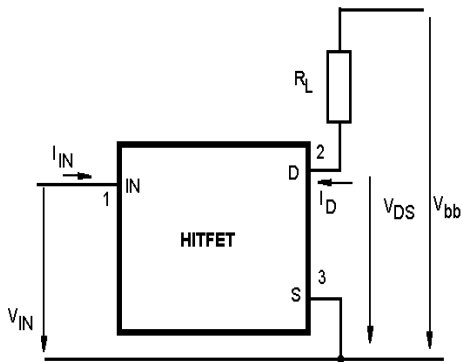
Inverse Diode

Continuous source drain voltage $V_{IN} = 0 \text{ V}$, $-I_D = 5 \cdot 3 \text{ A}$, $t_p = 300 \text{ } \mu\text{s}$	V_{SD}	-	1.1	-	V
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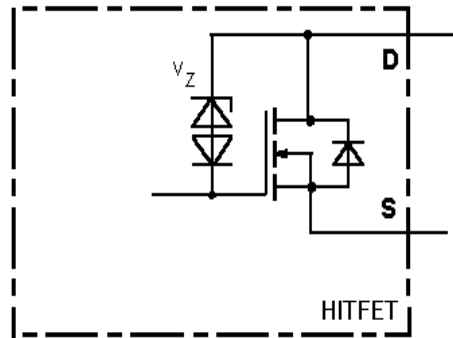
^{F)}not tested, specified by design

Block diagram

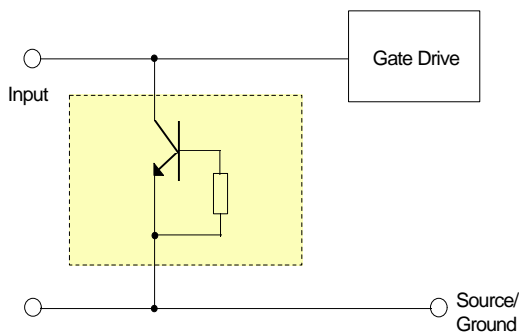
Terms



Inductive and overvoltage output clamp

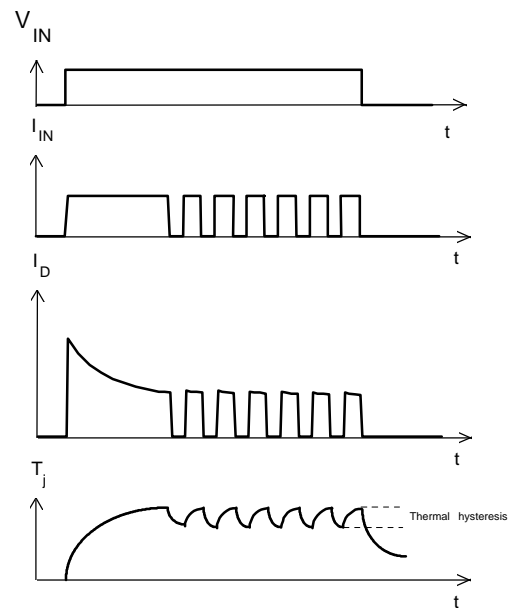


Input circuit (ESD protection)



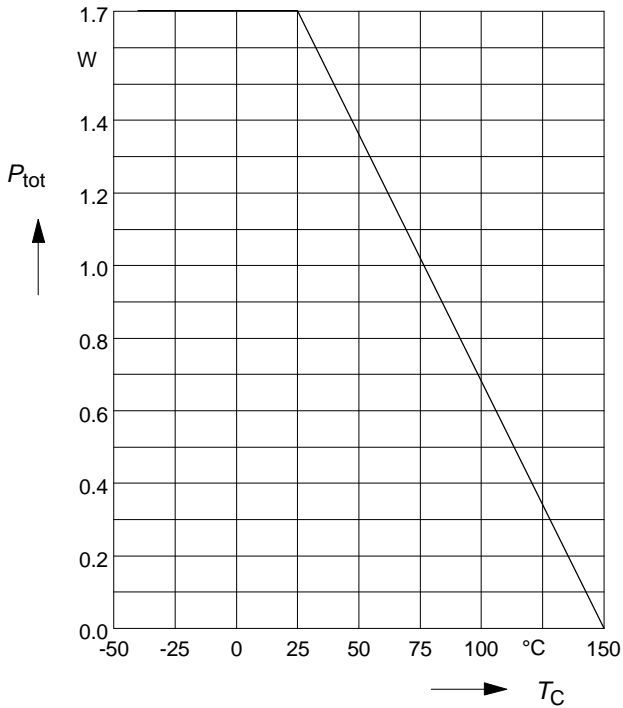
Input is not designed for DC current > 2 mA

Short circuit behaviour



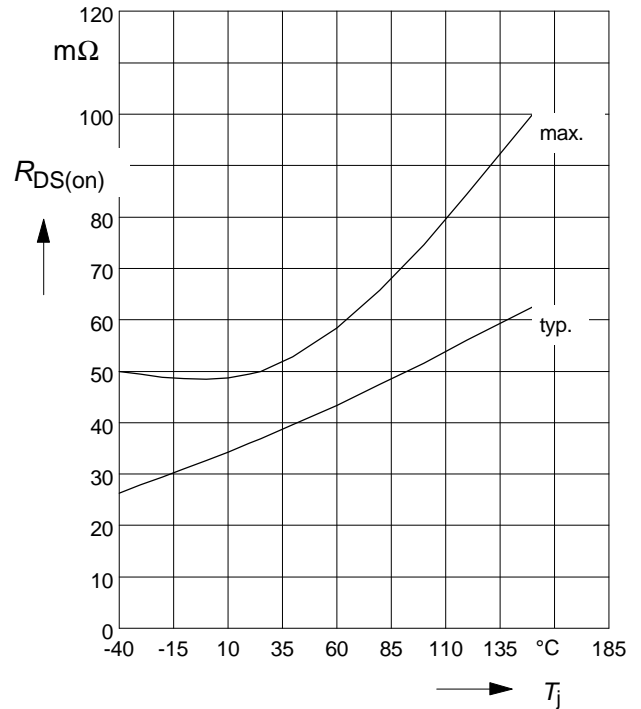
Maximum allowable power dissipation

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



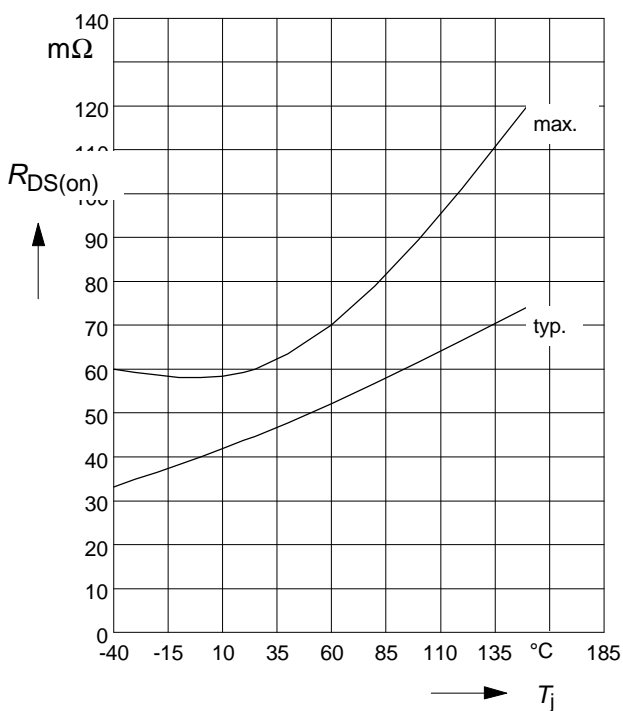
On-state resistance

$$R_{ON} = f(T_j); I_D=3A; V_{IN}=10V$$



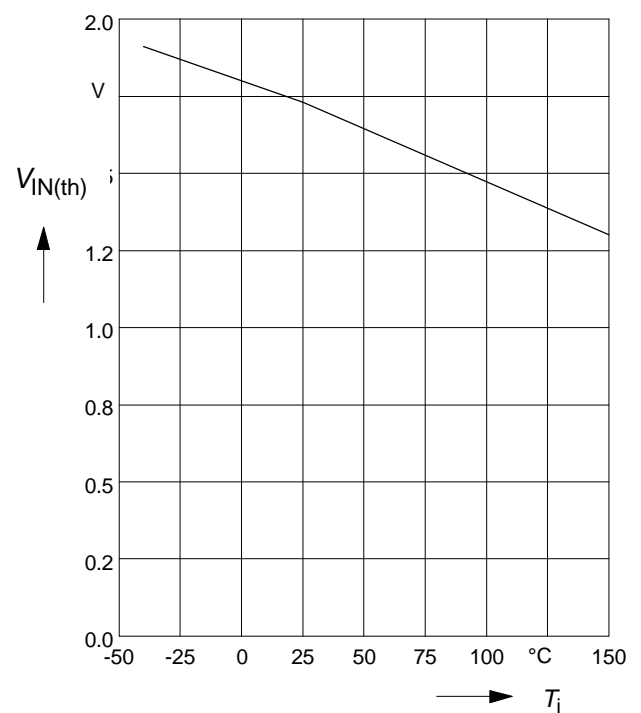
On-state resistance

$$R_{ON} = f(T_j); I_D=3A; V_{IN}=5V$$



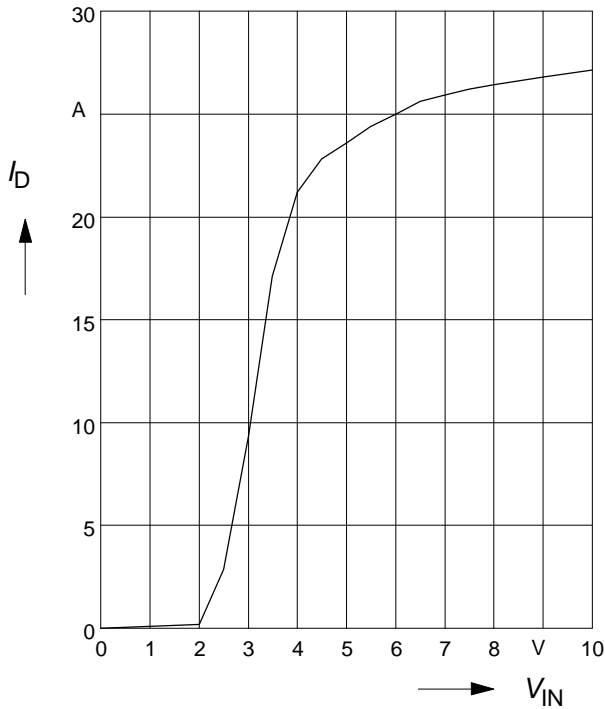
Typ. input threshold voltage

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



Typ. transfer characteristics

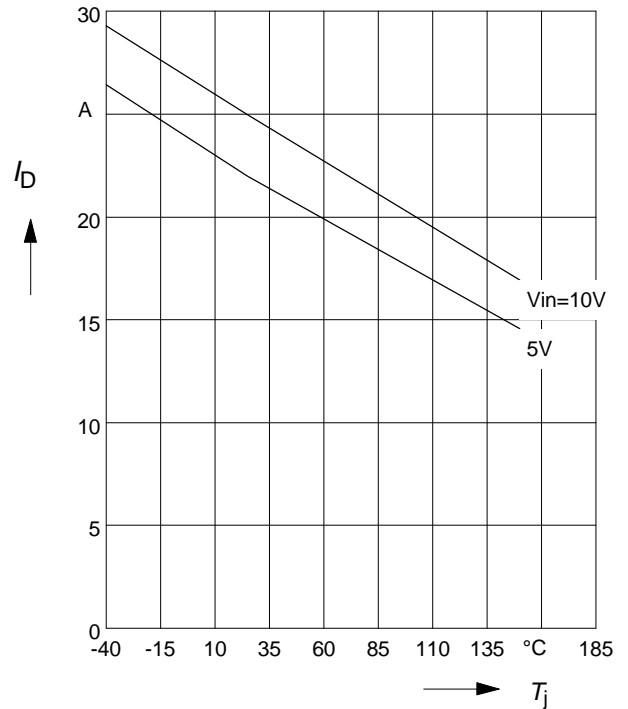
$I_D = f(V_{IN}); V_{DS}=12V; T_j=25^\circ C$



Typ. short circuit current

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

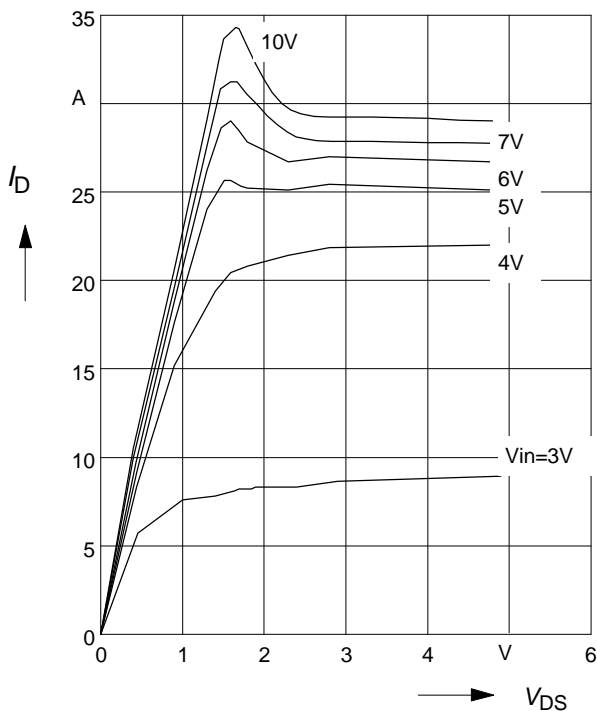
Parameter: V_{IN}



Typ. output characteristic

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

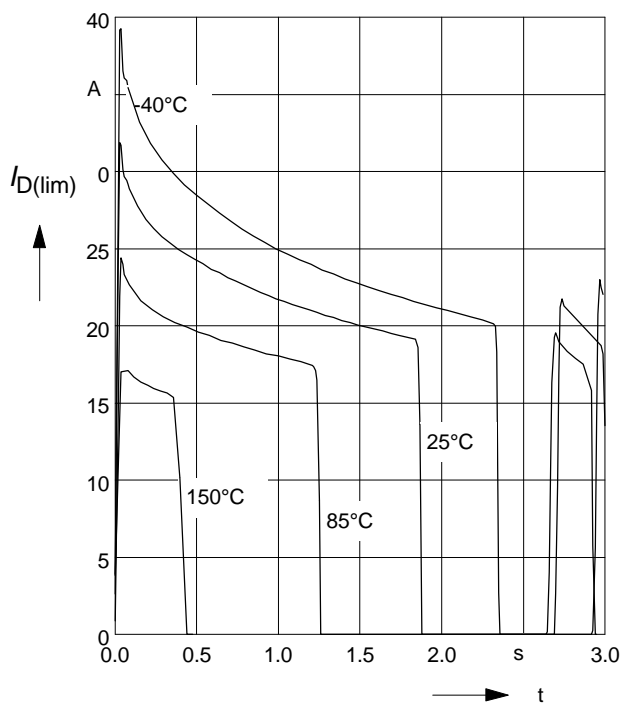
Parameter: V_{IN}



Typ. overload current

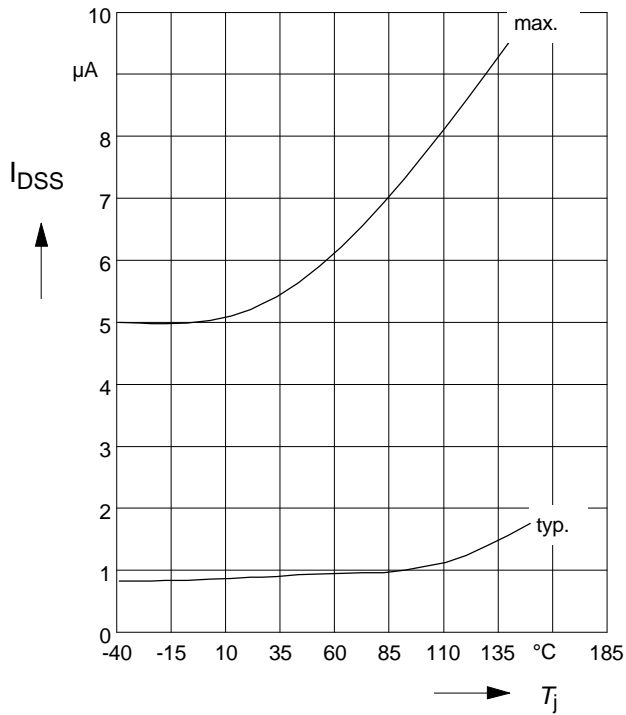
$I_{D(lim)} = f(t), V_{bb}=12V, \text{no heatsink}$

Parameter: T_{jstart}



Typ. off-state drain current

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



Transient thermal impedance

$$Z_{thJC} = f(t_p)$$

Parameter: $D = t_p/T$

