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OptiMOS® -T PN Half Bridge

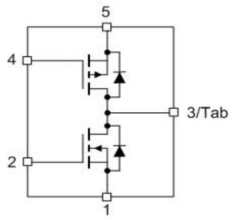
Features

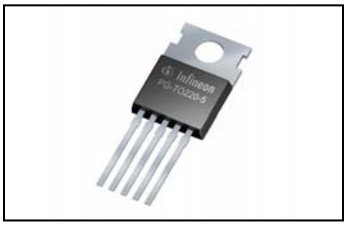
- Dual p- and n-channel MOSFET
- Automotive AEC Q101 qualified
- Green package (RoHS compliant)
- Ultra low $R_{DS(on)}$
- 150 °C operating temperature

Product Summary

	P	N	
V_{DS}	-30	55	V
$R_{DS(on),max}$	13	12	mΩ
I_D	-40	40	A

PG-TO220-5-13





Type	Package	Marking
BTS7904S	PG-TO220-5-13	7904S

Maximum ratings, at T_j=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value		Unit
			P	N	
Continuous drain current[1)]	I_D	T_C=25 °C	-40	40	A
		T_C=100 °C	-40	40	
Pulsed drain current[2)]	$I_{D,pulse}$	T_C=25 °C	-160	160	
Avalanche energy, single pulse[2)]	E_{AS}	I_D=±20 A	350	200	mJ
Avalanche current, single pulse	I_{AS}		-40	40	A
Gate source voltage	V_{GS}		-16 / +5	+16 / -16[3)]	V
Power dissipation[2)]	P_{tot}	T_C=25 °C	96	69	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150		°C
IEC climatic category; DIN IEC 68-1			55/150/56		

Parameter		Symbol	Conditions	Values			Unit
				min.	typ.	max.	

Thermal characteristics

Parameter		Symbol	Conditions	min.	typ.	max.	Unit
Thermal resistance, junction - case	P	R_{thJC}		-	-	1.3	K/W
	N			-	-	1.8	
SMD version, device on PCB[5)]		R_{thJA}	minimal footprint	-	-	62	
			6 cm^2 cooling area[4)]	-	-	45	

Electrical characteristics, at T_j=25 °C, unless otherwise specified

Static characteristics

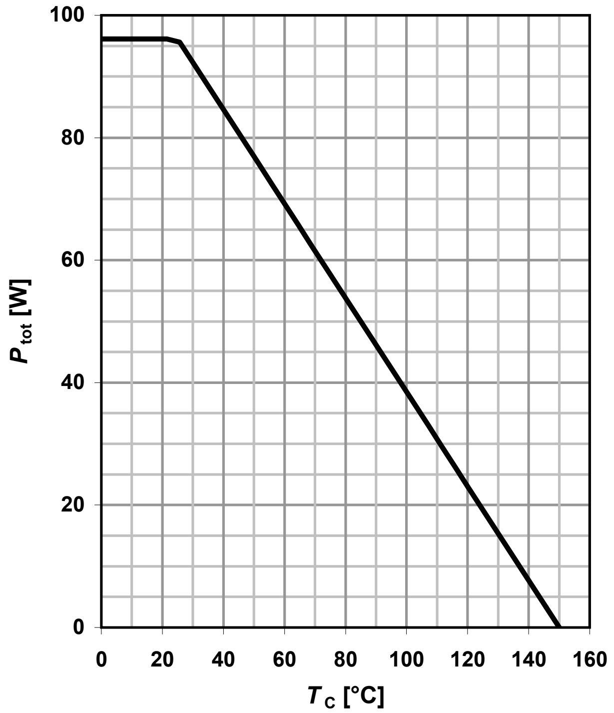
Parameter		Symbol	Conditions	min.	typ.	max.	Unit
Drain-source breakdown voltage	P	$V_{(BR)DSS}$	V_{GS}=0 V, I_D=-1 mA	-30	-	-	V
	N		V_{GS}=0 V, I_D=1 mA	55	-	-	
Gate threshold voltage	P	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=-70 µA	-1	-1.5	-2.1	
	N		V_{DS}=V_{GS}, I_D=40 µA	1.2	1.7	2.2	
Zero gate voltage drain current	P	I_{DSS}	V_{DS}=-18 V, V_{GS}=0 V, T_j=25 °C	-	-0.01	-1	µA
			V_{DS}=-18 V, V_{GS}=0 V, T_j=125 °C	-	-1	-100	
	N		V_{DS}=18 V, V_{GS}=0 V, T_j=25 °C	-	0.01	1	
			V_{DS}=18 V, V_{GS}=0 V, T_j=125 °C	-	1	100	
Gate-source leakage current	P	I_{GSS}	V_{GS}=-16 V, V_{DS}=0 V	-	-10	-100	nA
	N		V_{GS}=16 V, V_{DS}=0 V	-	1	100	
Drain-source on-state resistance	P	$R_{DS(on)}$	V_{GS}=-10 V, I_D=-20 A	-	7.2	13	mΩ
	N		V_{GS}=10 V, I_D=20 A	-	9.7	12	
	P		V_{GS}=-4.5 V, I_D=-12.5 A	-	17.5	21	
	N		V_{GS}=4.5 V, I_D=20 A	-	16.8	20.5	

Parameter		Symbol	Conditions	Values			Unit
				min.	typ.	max.	
Dynamic characteristics							
Input capacitance	P	C_{iss}	V_{GS}=0 V, V_{DS}=±25 V, f=1 MHz	-	3900	5200	pF
	N			-	4600	6100	
Output capacitance	P	C_{oss}		-	1000	1300	
	N			-	570	760	
Reverse transfer capacitance	P	C_{rss}		-	850	1300	
	N			-	550	820	
Turn-on delay time	P	$t_{d(on)}$	V_{DD}=15 V, V_{GS}=10 V N: I_D=30 A, R_G=2 Ω P: I_D=-30 A, R_G=2 Ω	-	22	-	ns
	N			-	15	-	
Rise time	P	t_r		-	94	-	
	N			-	77	-	
Turn-off delay time	P	$t_{d(off)}$		-	104	-	
	N			-	31	-	
Fall time	P	t_f		-	150	-	
	N			-	8	-	
Gate Charge Characteristics[2)]							
Gate to source charge	P	Q_{gs}	V_{DD}=-24 V, I_D=-40 A, V_{GS}=0 to - 10 V	-	-12	-16	nC
Gate to drain charge		Q_{gd}		-	-30	-45	
Switching charge		Q_g		-	-80	-121	
Gate plateau voltage		$V_{plateau}$		-	-3.0	-	
Gate to source charge	N	Q_{gs}	V_{DD}=44 V, I_D=40 A, V_{GS}=0 to 10 V	-	20	27	
Gate to drain charge		Q_{gd}		-	32	48	
Gate charge		Q_g		-	82	123	
Gate plateau voltage		$V_{plateau}$			4.2		

Parameter		Symbol	Conditions	Values			Unit
				min.	typ.	max.	
Reverse Diode							
Diode continuous forward current[2)]	P	I_S	T_C=25 °C	-	-	-40	A
	N					40	
Diode pulse current	P	$I_{S,pulse}$		-	-	-160	
	N					160	
Diode forward voltage	P	V_{SD}	V_{GS}=0 V, I_F=-40 A, T_j=25 °C	-	-1.00	-1.2	V
	N		V_{GS}=0 V, I_F=40 A, T_j=25 °C	-	0.90	1.2	
Reverse recovery time[2)]	P	t_{rr}	V_R=15 V, I_F=I_S, di_F/dt=400 A/µs	-	41	-	ns
	N			-	47	-	
Reverse recovery charge[2)]	P	Q_{rr}		-	-40	-	nC
	N			-	50	-	

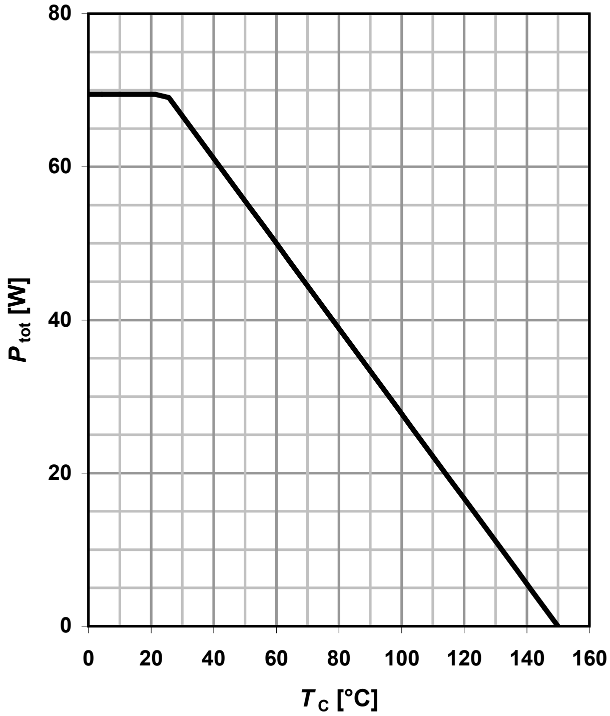
1 Power dissipation (P)

P_{tot}=f(T_C), V_{GS}≥6 V



2 Power dissipation (N)

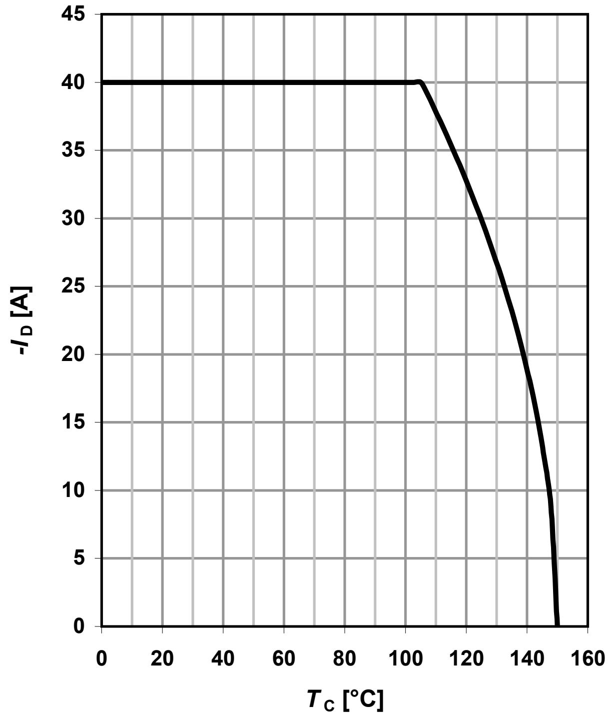
P_{tot}=f(T_C), V_{GS}≥6 V



3 Drain current (P)

I_D=f(T_C)

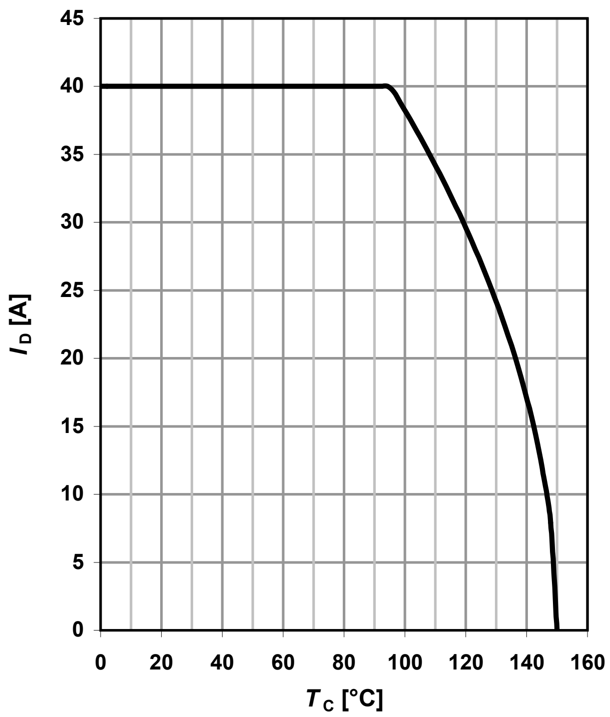
parameter: V_{GS}≥6 V



4 Drain current (N)

I_D=f(T_C)

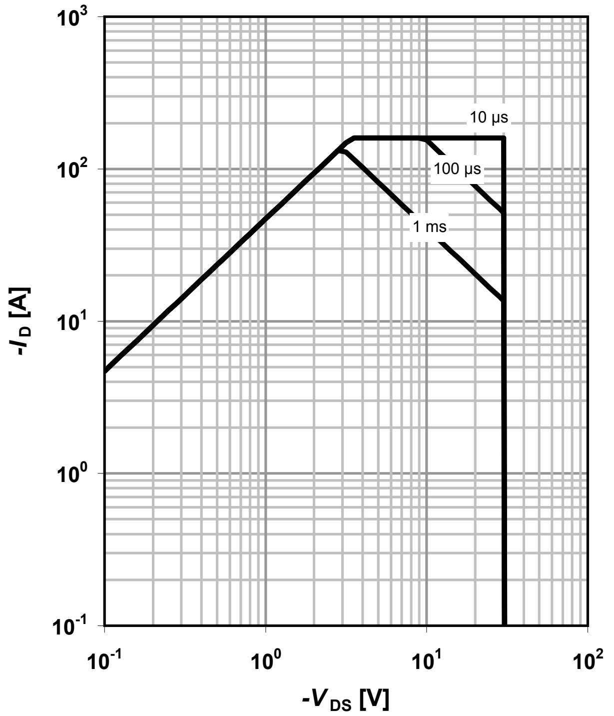
parameter: V_{GS}≥6 V



5 Safe operating area (P)

I_D=f(V_{DS}); T_C=25 °C; D=0

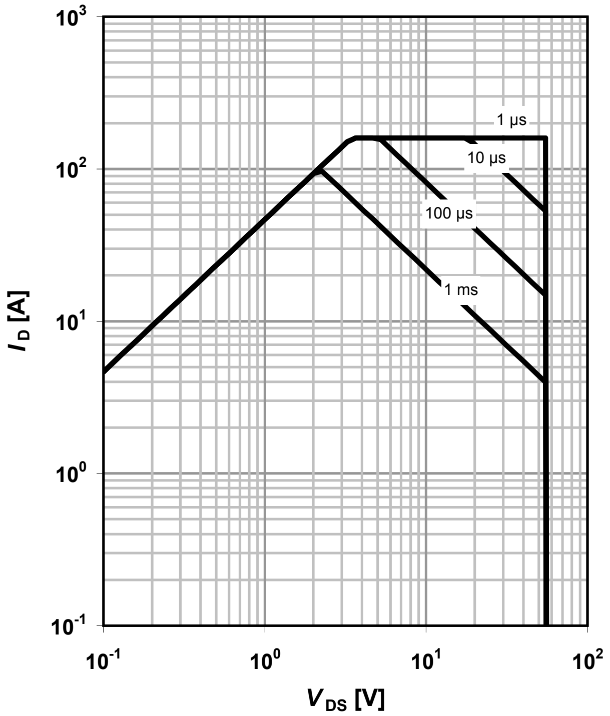
parameter: t_p



6 Safe operating area (N)

I_D=f(V_{DS}); T_C=25 °C; D=0

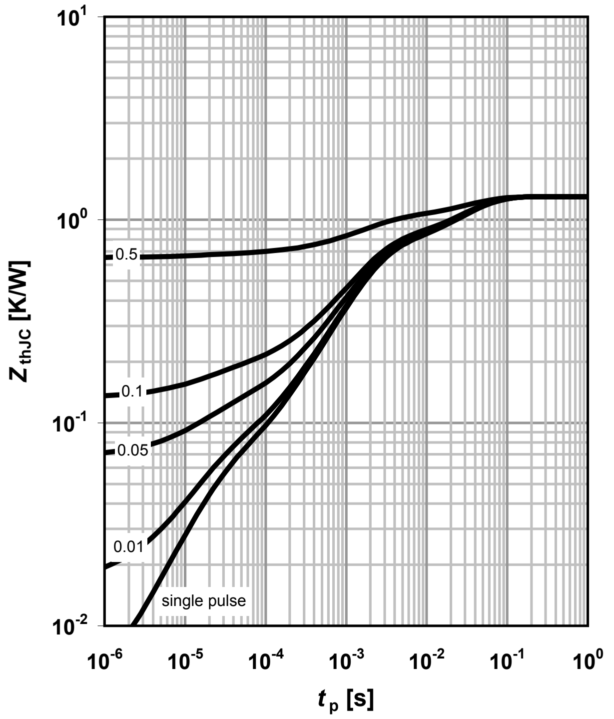
parameter: t_p



7 Max. transient thermal impedance (P)

Z_{thJC}=f(t_p)

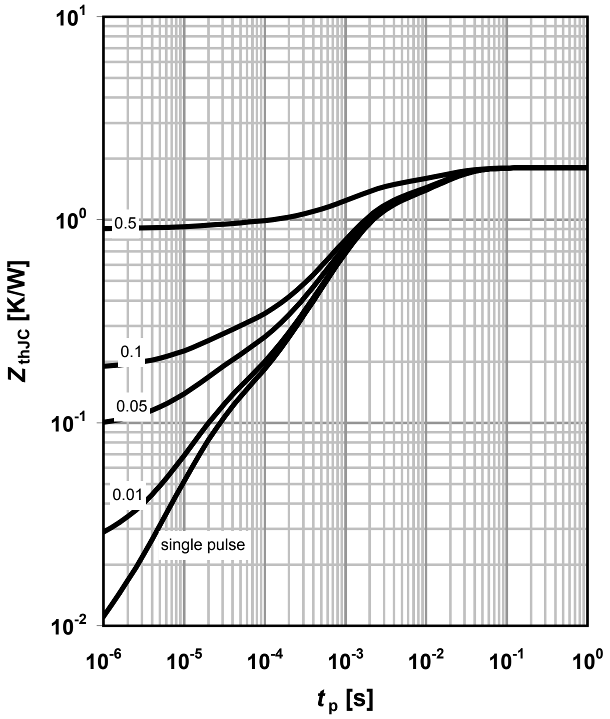
parameter: D=t_p/T



8 Max. transient thermal impedance (N)

Z_{thJC}=f(t_p)

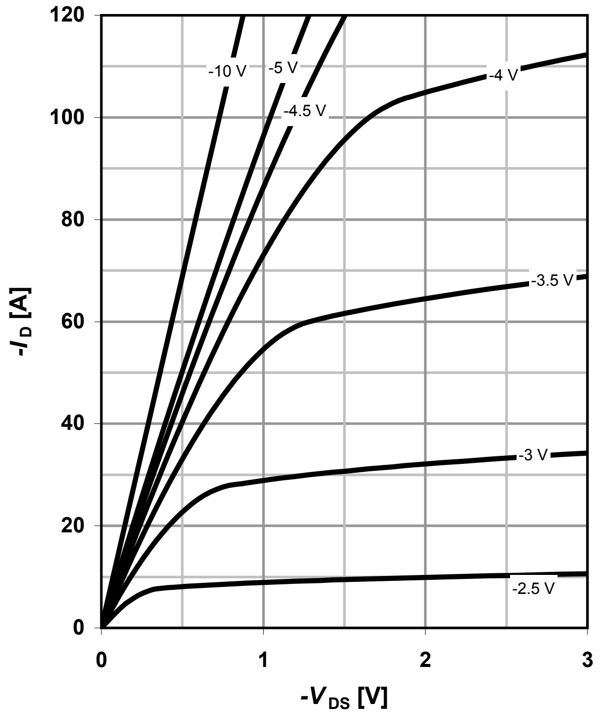
parameter: D=t_p/T



9 Typ. output characteristics (P)

I_D=f(V_{DS}); T_j=25 °C

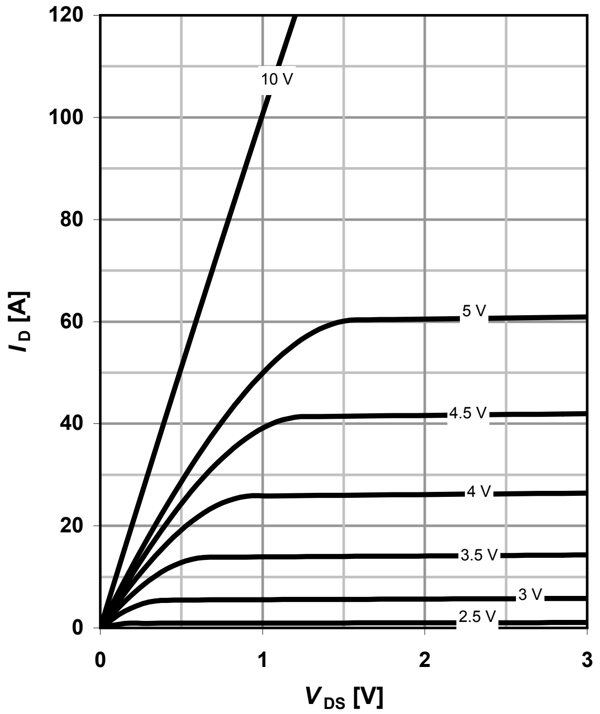
parameter: V_{GS}



10 Typ. output characteristics (N)

I_D=f(V_{DS}); T_j=25 °C

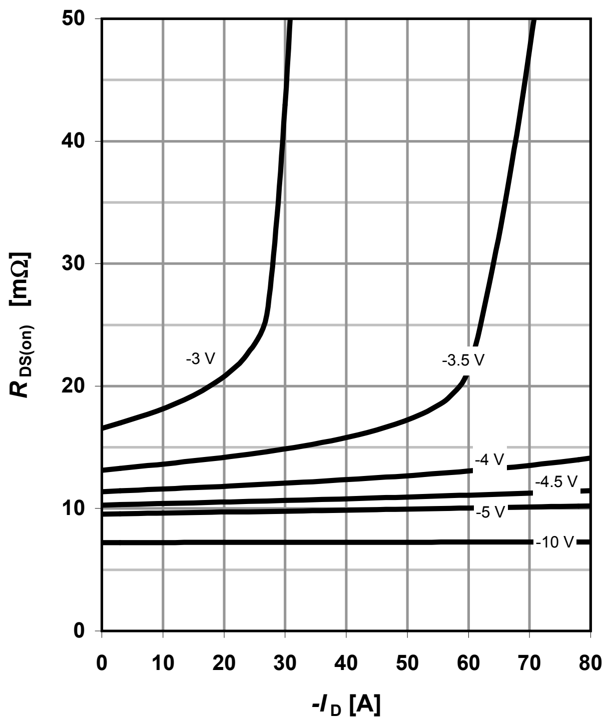
parameter: V_{GS}



11 Typ. drain-source on resistance (P)

$R_{DS(on)}$=f(I_D); T_j=25 °C

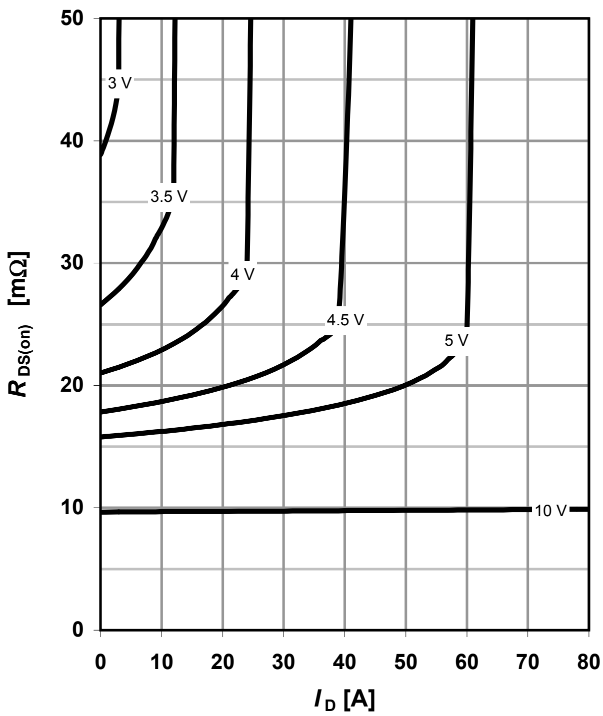
parameter: V_{GS}



12 Typ. drain-source on resistance (N)

$R_{DS(on)}$=f(I_D); T_j=25 °C

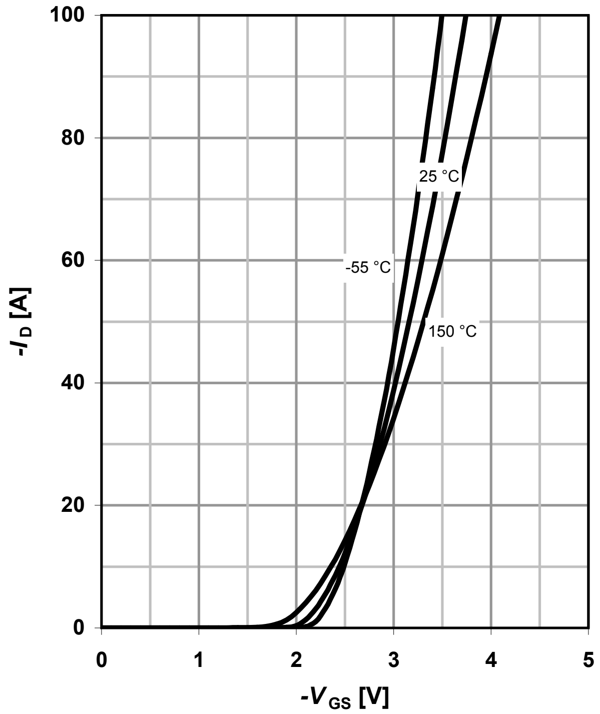
parameter: V_{GS}



13 Typ. transfer characteristics (P)

I_D=f(V_{GS}); V_{DS}=-6 V

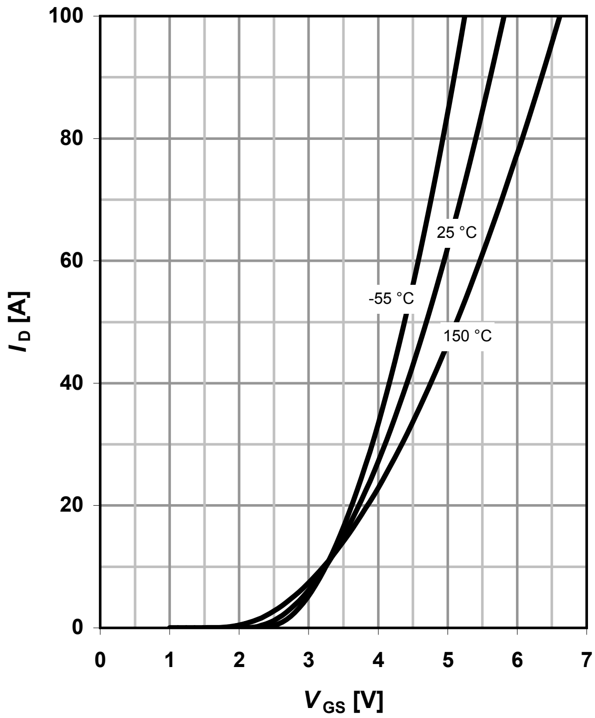
parameter: T_j



14 Typ. transfer characteristics (N)

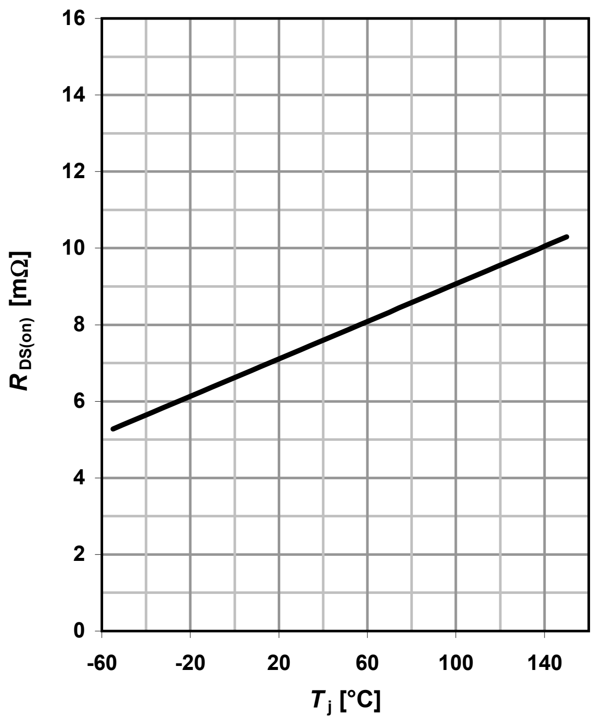
I_D=f(V_{GS}); V_{DS}=6 V

parameter: T_j



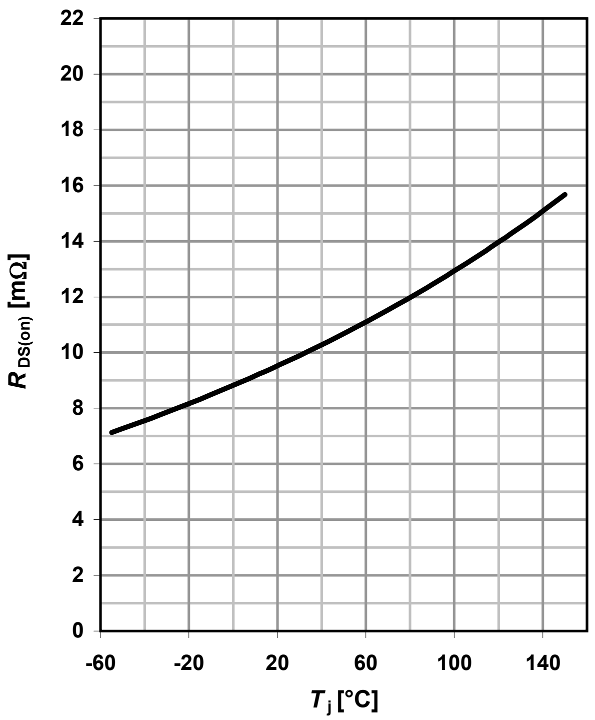
15 Drain-source on-state resistance (P)

$R_{DS(on)}$=f(T_j); I_D=-20 A; V_{GS}=-10 V



16 Drain-source on-state resistance (N)

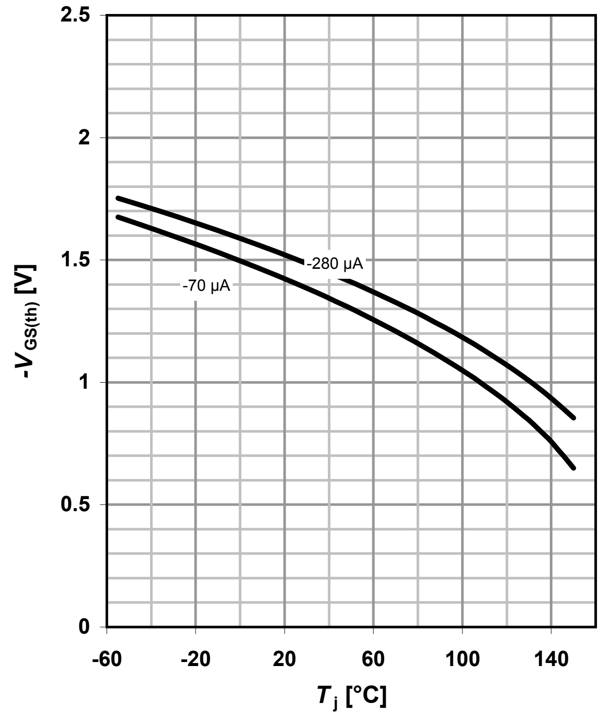
$R_{DS(on)}$=f(T_j); I_D=20 A; V_{GS}=10 V



17 Typ. gate threshold voltage (P)

$V_{GS(th)}$=f(T_j); V_{GS}=V_{DS}

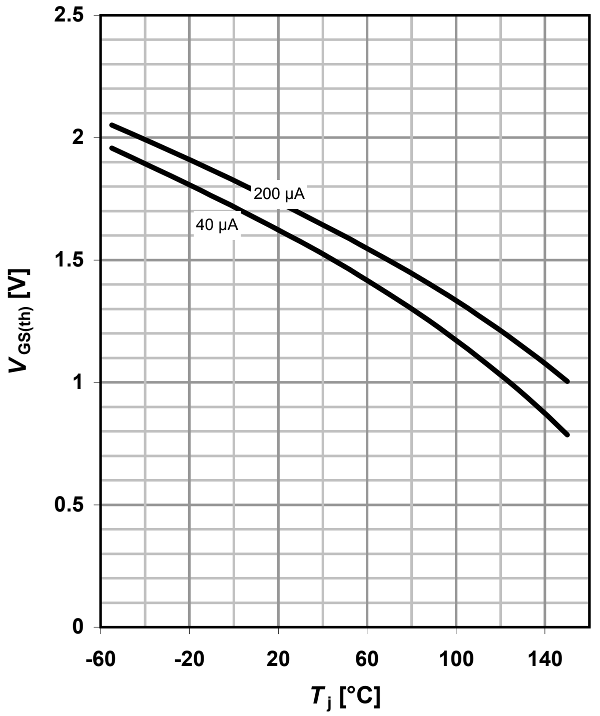
parameter: I_D



18 Typ. gate threshold voltage (N)

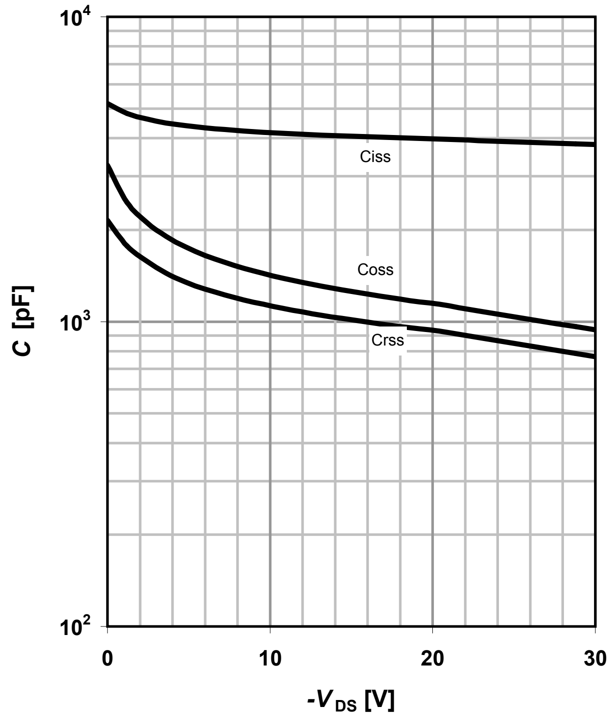
$V_{GS(th)}$=f(T_j); V_{GS}=V_{DS}

parameter: I_D



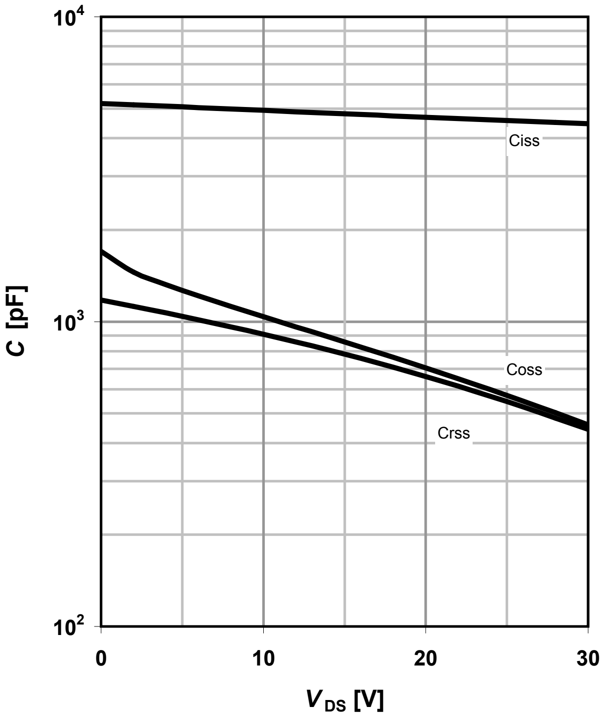
19 Typ. capacitances (P)

C=f(V_{DS}); V_{GS}=0 V; f=1 MHz



20 Typ. capacitances (N)

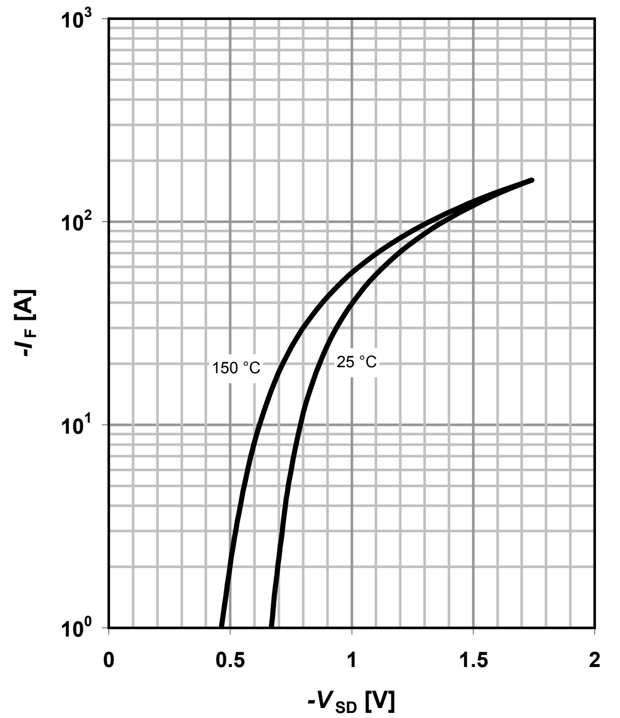
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz



21 Forward characteristics of reverse diode (P)

$I_F = f(V_{SD})$

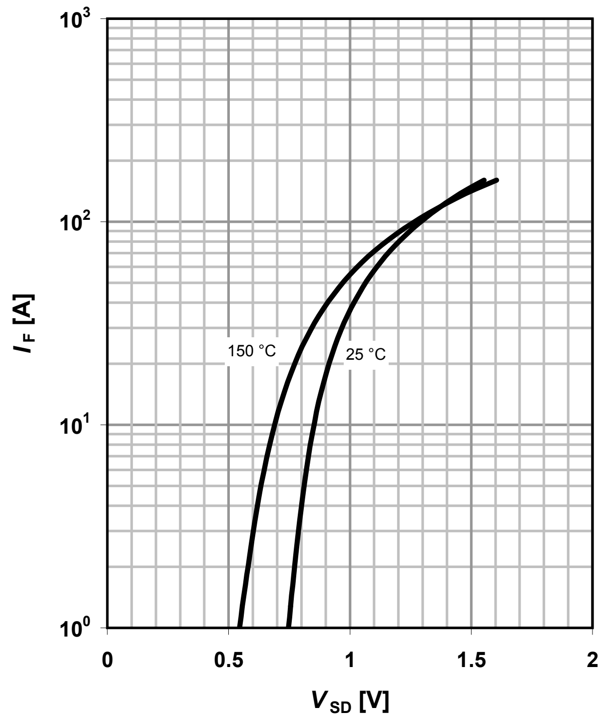
parameter: T_j



22 Forward characteristics of reverse diode (N)

$I_F = f(V_{SD})$

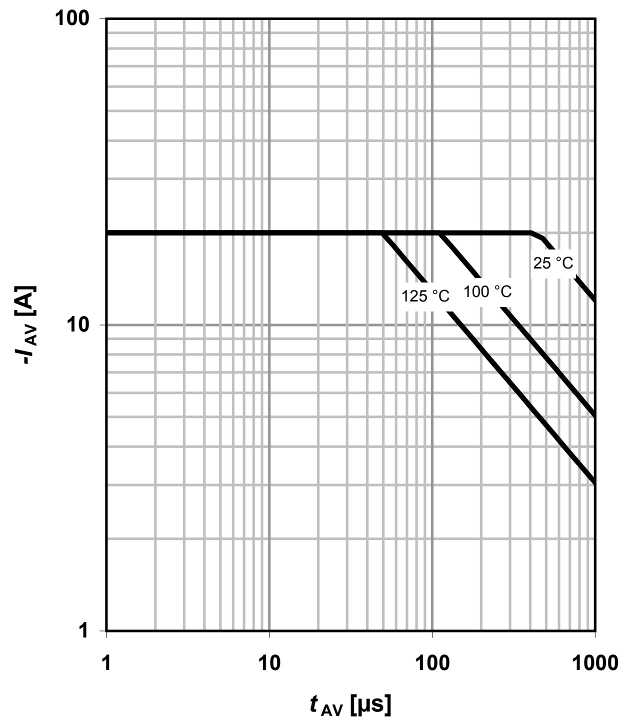
parameter: T_j



23 Avalanche characteristics (P)

$I_{AS} = f(t_{AV})$; $R_{GS} = 25\ \Omega$

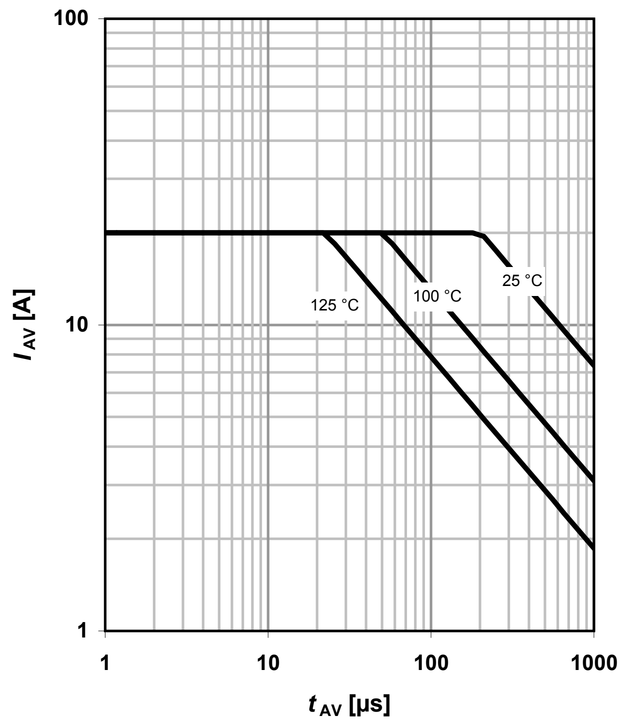
parameter: $T_{j(start)}$



24 Avalanche characteristics (N)

$I_{AS} = f(t_{AV})$; $R_{GS} = 25\ \Omega$

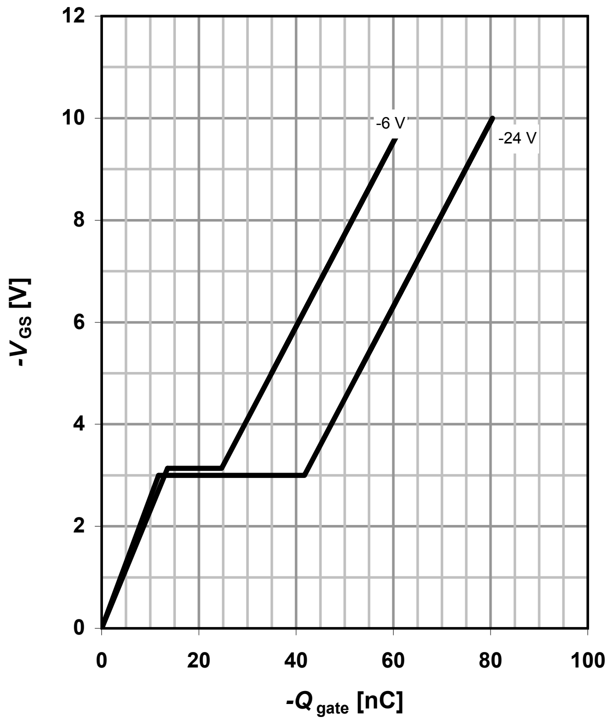
parameter: $T_{j(start)}$



25 Typ. gate charge (P)

V_{GS}=f(Q_{gate}); I_D=-40 A pulsed

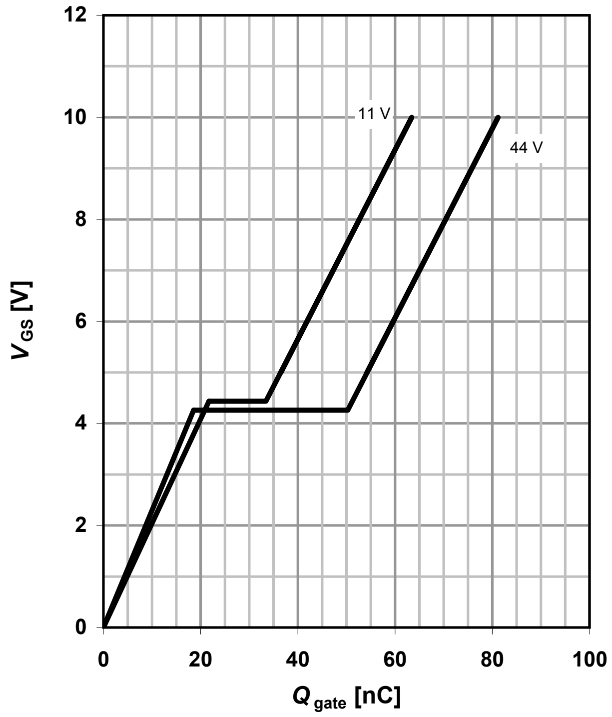
parameter: V_{DD}



26 Typ. gate charge (N)

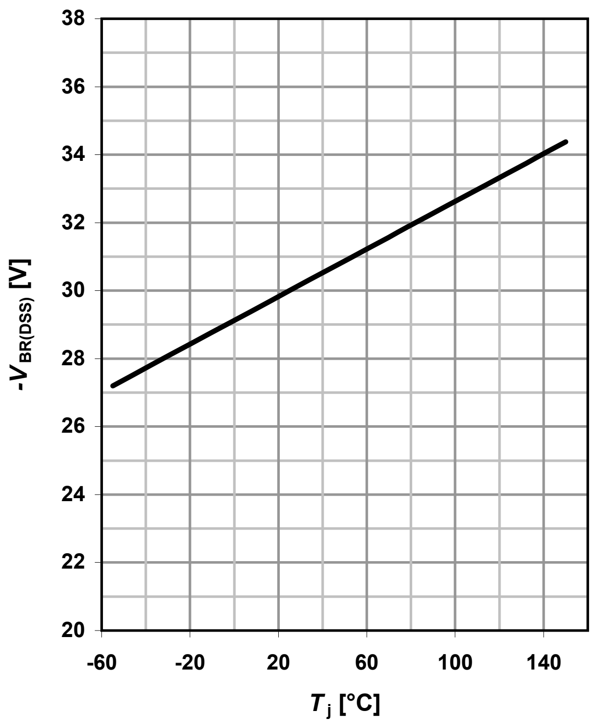
V_{GS}=f(Q_{gate}); I_D=40 A pulsed

parameter: V_{DD}



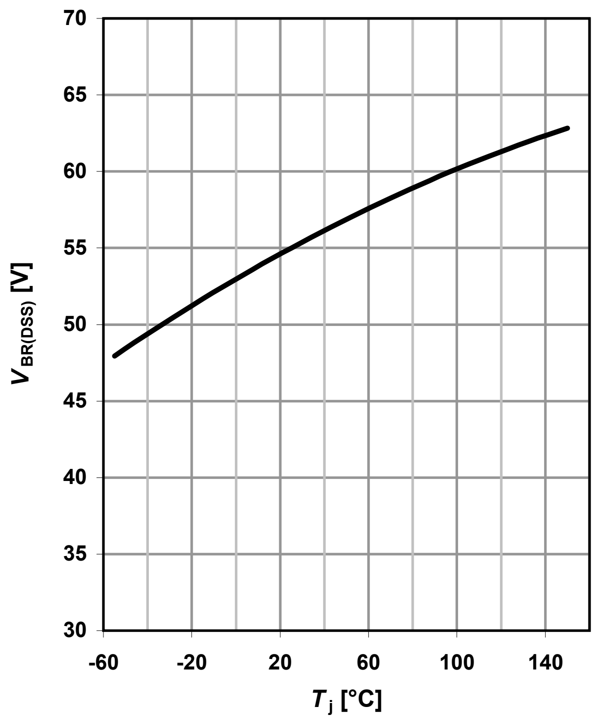
27 Drain-source breakdown voltage (P)

$V_{BR(DSS)}$=f(T_j); I_D=-1 mA



28 Drain-source breakdown voltage (N)

$V_{BR(DSS)}$=f(T_j); I_D=1 mA



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Revision History

Version	Date	Changes

[1)] Current is limited by bondwire.

With an RthJC(HS)=1.3K/W the HS chip is able to carry ID=-80A at 25°C.

With an RthJC(LS)=1.8K/W the LS chip is able to carry ID=63A at 25°C.

For detailed information see Application Note ANPS071E at www.infineon.com/optimos

[2)]Defined by design, not subject to production tests

[3)] Qualified at -5V and +16V.

[4)] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm^2 (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.