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Dual N-Channel OptiMOS™ MOSFET

Features

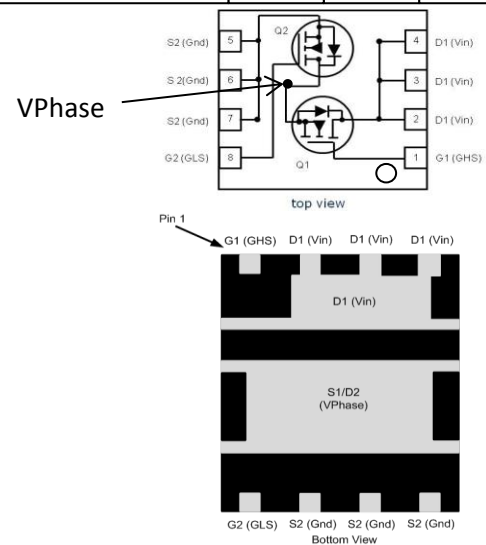
- Dual N-channel OptiMOS™ MOSFET
- Integrated monolithic Schottky-like diode
- Optimized for high performance Buck converter
- Logic level (4.5V rated)
- 100% avalanche tested
- Qualified according to JEDEC¹⁾ for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-22



Type	Package	Marking
BSC0924NDI	PG-TISON-8	0924NDI

Product Summary

	Q1	Q2	
V_{DS}	30	30	V
$R_{DS(on),max}$	$V_{GS}=10\text{ V}$	5	3.7
	$V_{GS}=4.5\text{ V}$	7	5.2
I_D	40	40	A



Maximum ratings, at $T_j=25\text{ °C}$, unless otherwise specified ²⁾

Parameter	Symbol	Conditions	Value		Unit
			Q1	Q2	
Continuous drain current	I_D	$T_C=70\text{ °C}, V_{GS}=10\text{V}$	40	40	A
		$T_A=25\text{ °C}, V_{GS}=4.5\text{V}^{3)}$	17	32	
		$T_A=70\text{ °C}, V_{GS}=4.5\text{V}^{3)}$	14	25	
		$T_A=25\text{ °C}, V_{GS}=10\text{V}^{4)}$	10	13	
Pulsed drain current ⁵⁾	$I_{D,pulse}$	$T_C=70\text{ °C}$	160	160	
Avalanche energy, single pulse	E_{AS}	Q1: $I_D=20\text{ A}$, Q2: $I_D=20\text{ A}$, $R_{GS}=25\ \Omega$	9	10	mJ
Gate source voltage	V_{GS}		±20		V
Power dissipation	P_{tot}	$T_A=25\text{ °C}^{2)}$	2.5	2.5	W
		$T_A=25\text{ °C}$, minimum footprint ³⁾	1.0	1.0	
Operating and storage temperature	T_j, T_{stg}		-55 ... 150		°C
IEC climatic category; DIN IEC 68-1			55/150/56		

¹⁾ J-STD20 and JESD22

²⁾ One transistor active

³⁾ Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 μm thick) copper area for drain connection. PCB is vertical in still air.

⁴⁾ Device mounted on a minimum pad (one layer, 70 μm thick). One transistor active

⁵⁾ See figure 3 for more detailed information.

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - case	Q1	R_{thJC}		-	-	4.2	K/W
	Q2			-	-	3.4	
Thermal resistance, junction - ambient ¹⁾	Q1	R_{thJA}	6 cm ² cooling area ²⁾	-	-	50	
	Q2			-	-	50	
	Q1		minimal footprint, steady state ³⁾	-	-	125	
	Q2			-	-	125	

Electrical characteristics, at $T_j=25\text{ }^\circ\text{C}$, unless otherwise specified
Static characteristics

Drain-source breakdown voltage	Q1	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=10\text{ mA}$	30	-	-	V
	Q2			-	-	-	
Breakdown voltage temperature coefficient	Q1	$dV_{(BR)DSS}/dT_j$	$I_D=10\text{ mA}$, referenced to $25\text{ }^\circ\text{C}$	-	15	-	mV/K
	Q2			-	-	-	
Gate threshold voltage	Q1	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\text{ }\mu\text{A}$	1.2	-	2	V
	Q2			-	-	-	
Zero gate voltage drain current	Q1	I_{DSS}	$V_{DS}=24\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^\circ\text{C}$	-	-	1	μA
	Q2			-	-	500	
	Q1		$V_{DS}=24\text{ V}, V_{GS}=0\text{ V}, T_j=150\text{ }^\circ\text{C}$	-	-	0.1	mA
	Q2			-	3	-	
Gate-source leakage current	Q1	I_{GSS}	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	-	100	nA
	Q2			-	-	-	
Drain-source on-state resistance	Q1	$R_{DS(on)}$	$V_{GS}=4.5\text{ V}, I_D=20\text{ A}$	-	5.4	7.0	m Ω
	Q2			-	4.2	5.2	
	Q1		$V_{GS}=10\text{ V}, I_D=20\text{ A}$	-	3.8	5.0	
	Q2			-	2.8	3.7	
Gate resistance	Q1	R_G		1.3	2.6	5.2	Ω
	Q2			0.5	0.9	1.8	
Transconductance	Q1	g_{fs}	$ V_{DS} >2 I_D R_{DS(on)max}, I_D=20\text{ A}$	32	65	-	S
	Q2			36	71	-	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics

Input capacitance	Q1	C_{iss}	$V_{GS}=0\text{ V},$ $V_{DS}=15\text{ V}, f=1\text{ MHz}$	-	870	1160	pF
	Q2			-	1100	1470	
Output capacitance	Q1	C_{oss}		-	330	439	
	Q2			-	460	612	
Reverse transfer capacitance	Q1	C_{rss}		-	49	-	
	Q2			-	64	-	
Turn-on delay time	Q1	$t_{d(on)}$	$V_{DD}=15\text{ V},$ $V_{GS}=10\text{ V}, R_G=1.6\ \Omega,$ $I_D=20\text{ A}$	-	4.7		ns
	Q2			-	3.3	-	
Rise time	Q1	t_r		-	3.8	-	
	Q2			-	2.8	-	
Turn-off delay time	Q1	$t_{d(off)}$		-	17	-	
	Q2			-	15	-	
Fall time	Q1	t_f		-	3.0	-	
	Q2			-	2.2	-	

Gate Charge Characteristics

Gate to source charge	Q1	Q_{gs}	$V_{DD}=15\text{ V},$ $I_D=30\text{ A},$ $V_{GS}=0\text{ to }4.5\text{ V}$	-	2.4	3.2	nC	
Gate to drain charge		Q_{gd}		-	2.2	2.9		
Gate charge total		Q_g		-	6.7	10		
Gate plateau voltage		$V_{plateau}$		-	2.8	-		V
Gate to source charge	Q2	Q_{gs}		-	2.9	3.9	nC	
Gate to drain charge		Q_{gd}		-	2.9	3.8		
Gate charge total		Q_g		-	8.5	12.8		
Gate plateau voltage		$V_{plateau}$		-	2.7			V
Output charge	Q1	Q_{oss}		$V_{DD}=15\text{ V}, V_{GS}=0\text{ V}$	-	9	12	nC
	Q2				-	12	16	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Reverse Diode

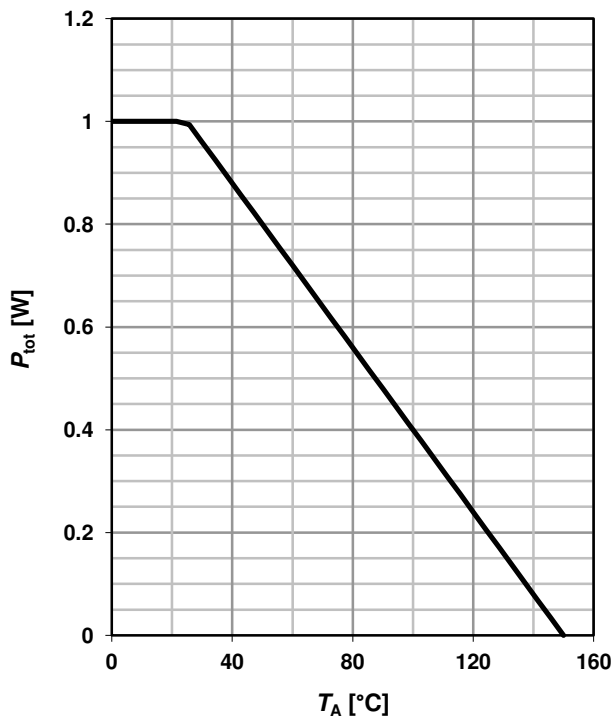
Diode continuous forward current	Q1	I_S	$T_C=25\text{ °C}$	-	-	30	A		
	Q2					40			
Diode pulse current	Q1	$I_{S,pulse}$		-	-	160			
	Q2			-	-	160			
Diode forward voltage	Q1	V_{SD}		$V_{GS}=0\text{ V}, I_F=20\text{ A},$ $T_j=25\text{ °C}$	-	0.86		1	V
	Q2			$V_{GS}=0\text{ V}, I_F=3\text{ A},$ $T_j=25\text{ °C}$	-	0.56		0.7	
Reverse recovery charge	Q1	Q_{rr}	$V_R=15\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	5	-	nC		
	Q2			-	5	-			

²⁾ Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 μm thick) copper area for drain connection. PCB is vertical in still air.

³⁾ device mounted on a minimum pad (one layer, 70 μm thick)

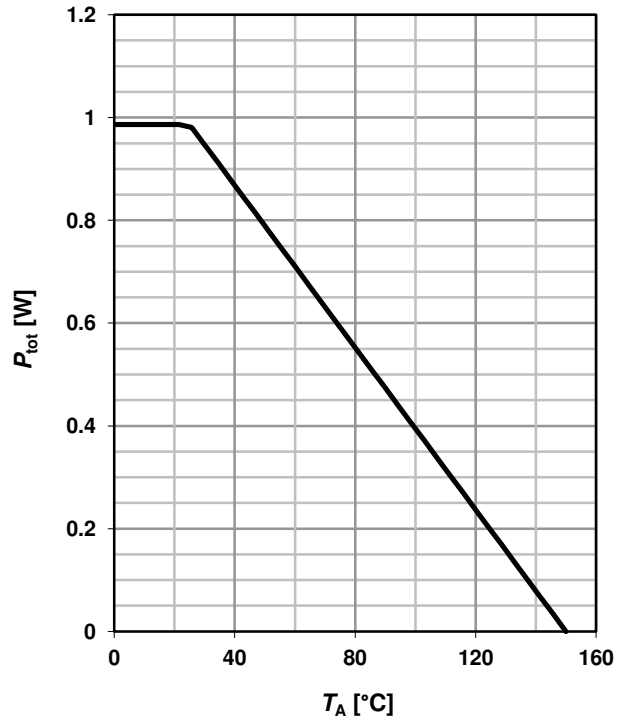
1 Power dissipation (Q1)

$$P_{\text{tot}} = f(T_A)^3$$



2 Power dissipation (Q2)

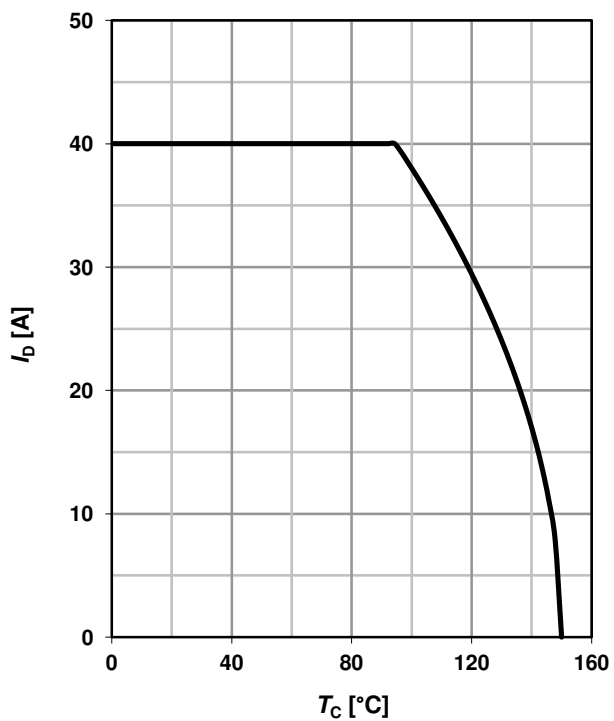
$$P_{\text{tot}} = f(T_A)^3$$



3 Drain current (Q1)

$$I_D = f(T_C)$$

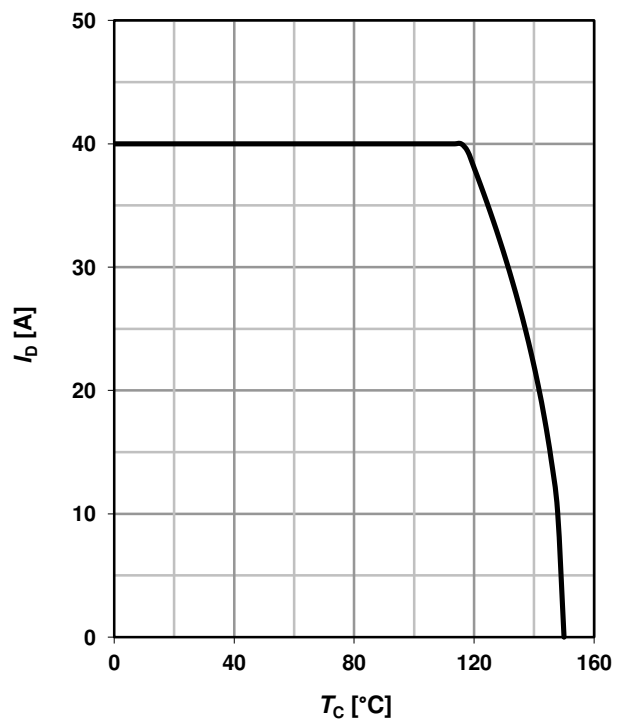
parameter: $V_{GS} \geq 10$ V



4 Drain current (Q2)

$$I_D = f(T_C)$$

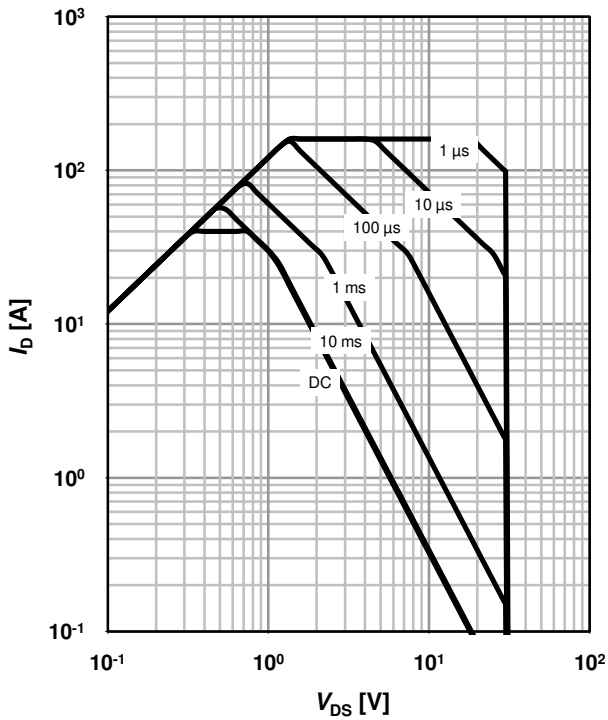
parameter: $V_{GS} \geq 10$ V



5 Safe operating area (Q1)

$I_D=f(V_{DS}); T_C=25\text{ }^\circ\text{C}; D=0$

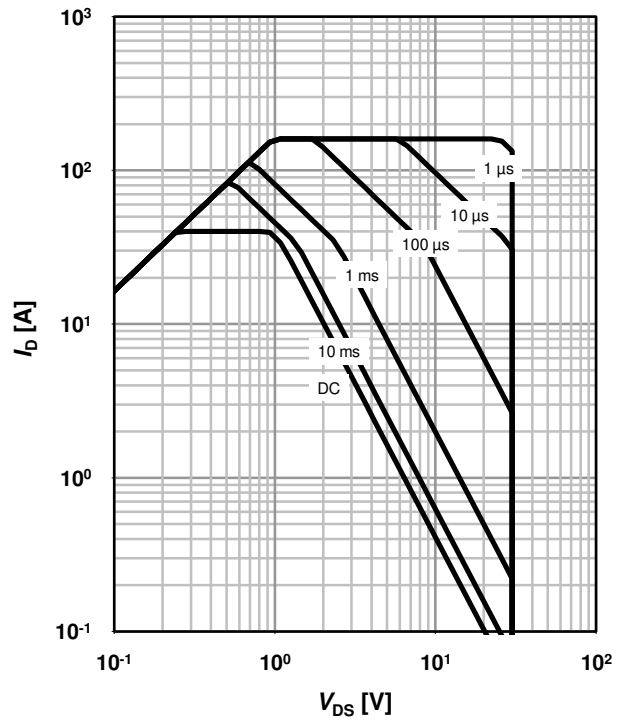
parameter: t_p



6 Safe operating area (Q2)

$I_D=f(V_{DS}); T_C=25\text{ }^\circ\text{C}; D=0$

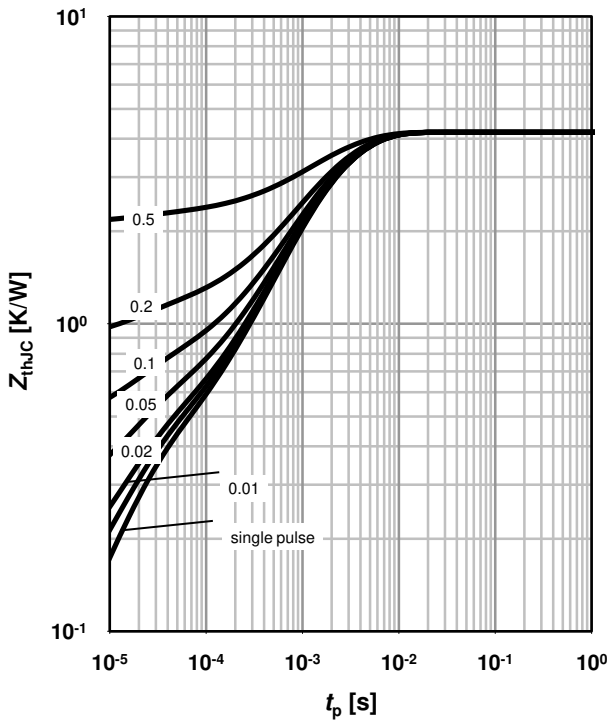
parameter: t_p



7 Max. transient thermal impedance (Q1)

$Z_{thJC}=f(t_p)$

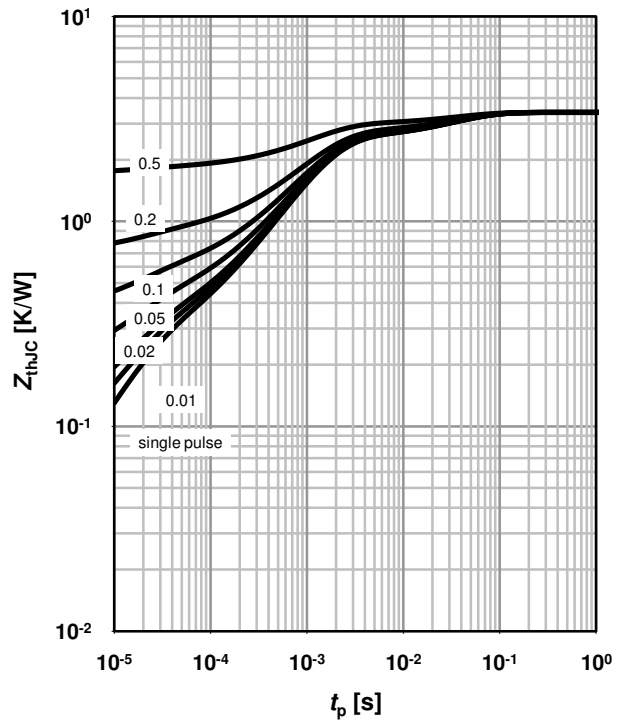
parameter: $D=t_p/T$



8 Max. transient thermal impedance (Q2)

$Z_{thJC}=f(t_p)$

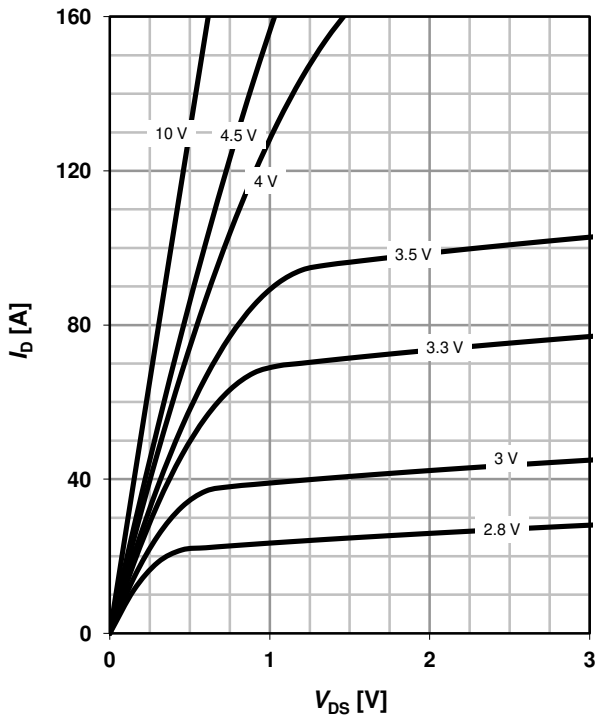
parameter: $D=t_p/T$



9 Typ. output characteristics (Q1)

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

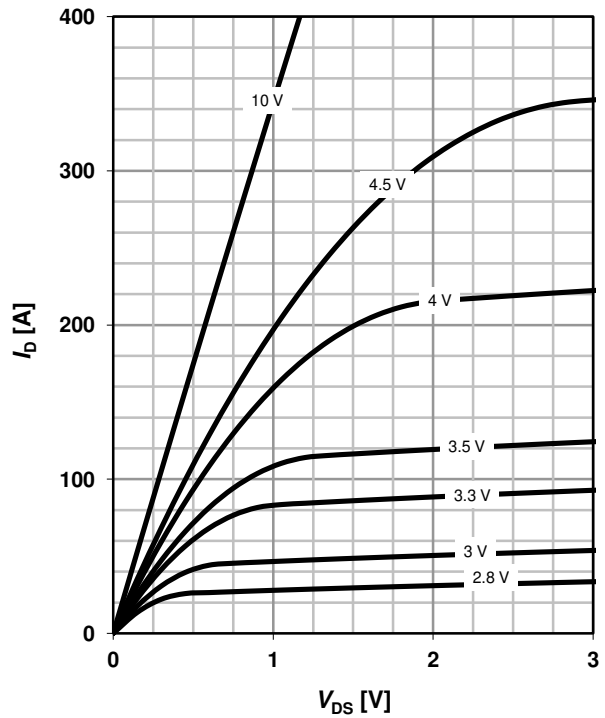
parameter: V_{GS}



10 Typ. output characteristics (Q2)

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

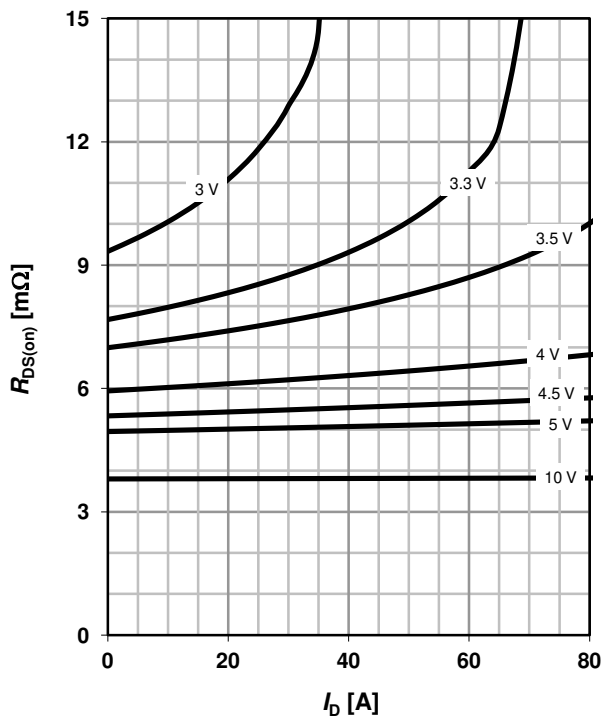
parameter: V_{GS}



11 Typ. drain-source on resistance (Q1)

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

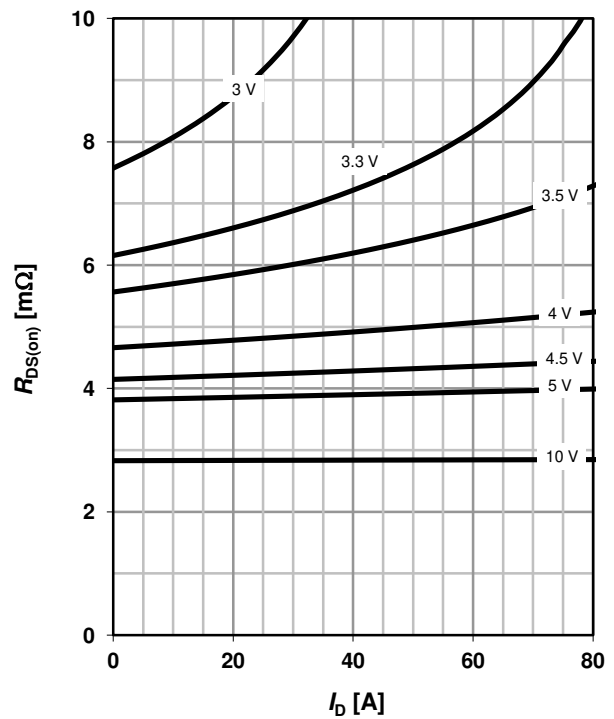
parameter: V_{GS}



12 Typ. drain-source on resistance (Q2)

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

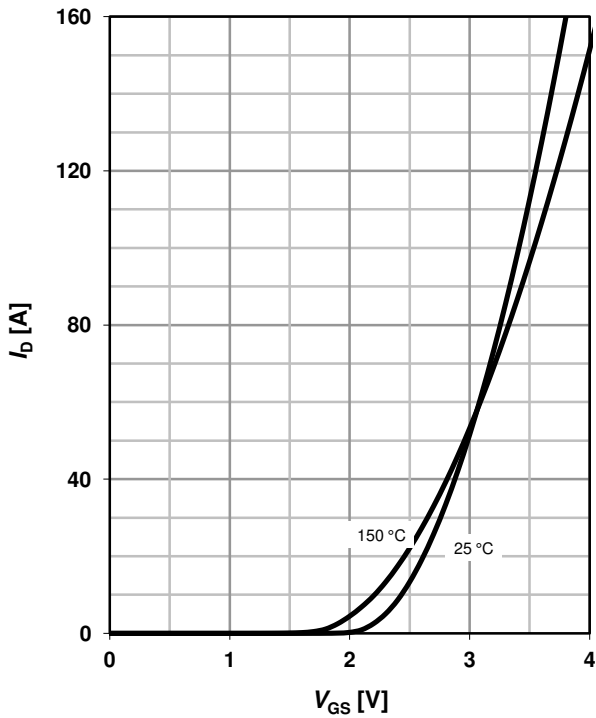
parameter: V_{GS}



13 Typ. transfer characteristics (Q1)

$$I_D = f(V_{GS}); |V_{DS}| > 2 |I_D| R_{DS(on)max}$$

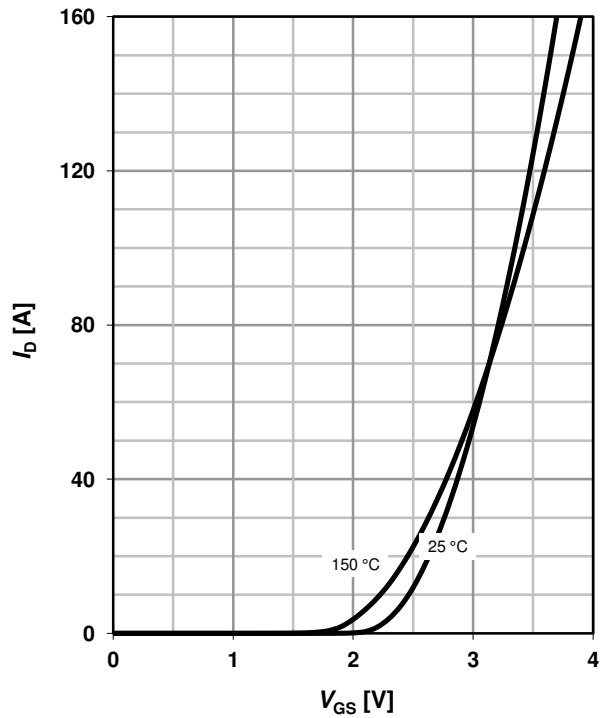
parameter: T_j



14 Typ. transfer characteristics (Q2)

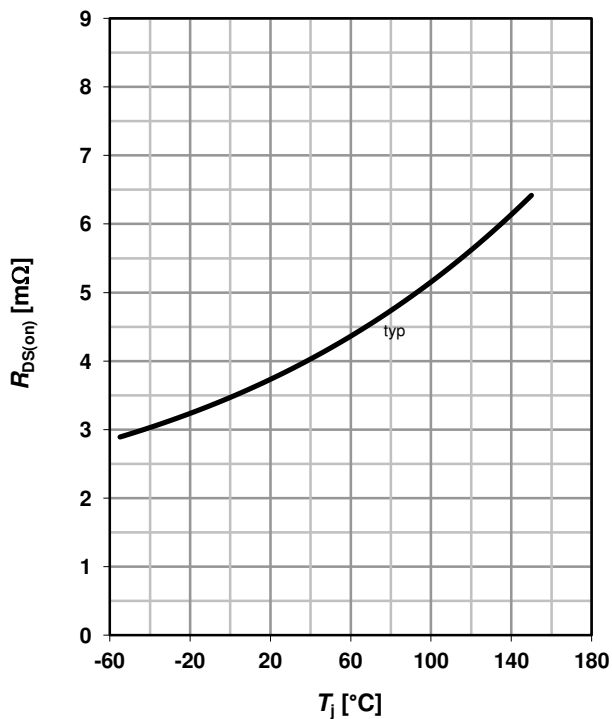
$$I_D = f(V_{GS}); |V_{DS}| > 2 |I_D| R_{DS(on)max}$$

parameter: T_j



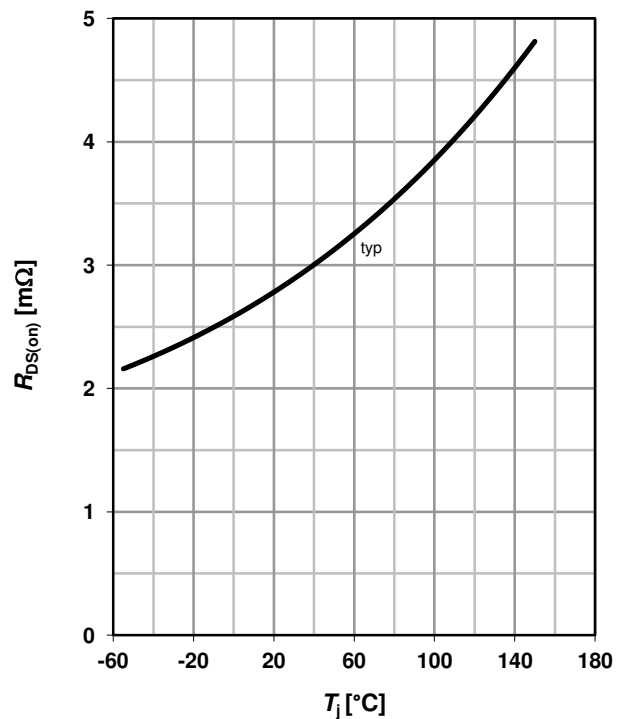
15 Drain-source on-state resistance (Q1)

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



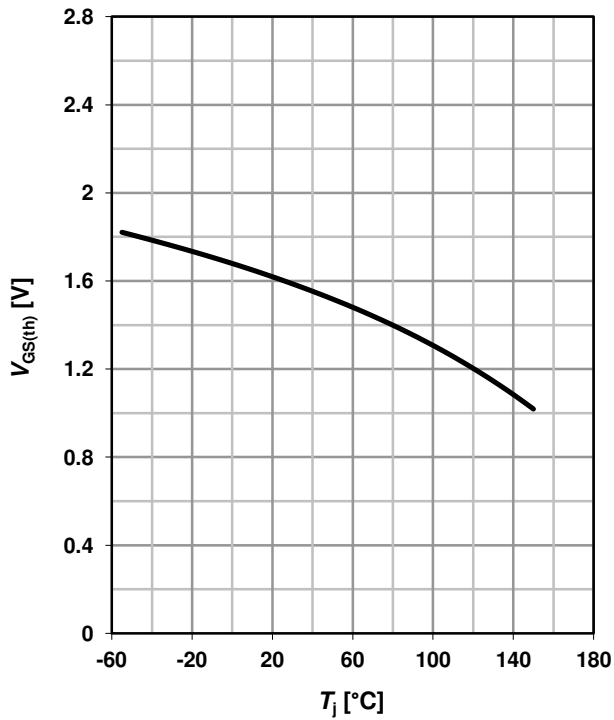
16 Drain-source on-state resistance (Q2)

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



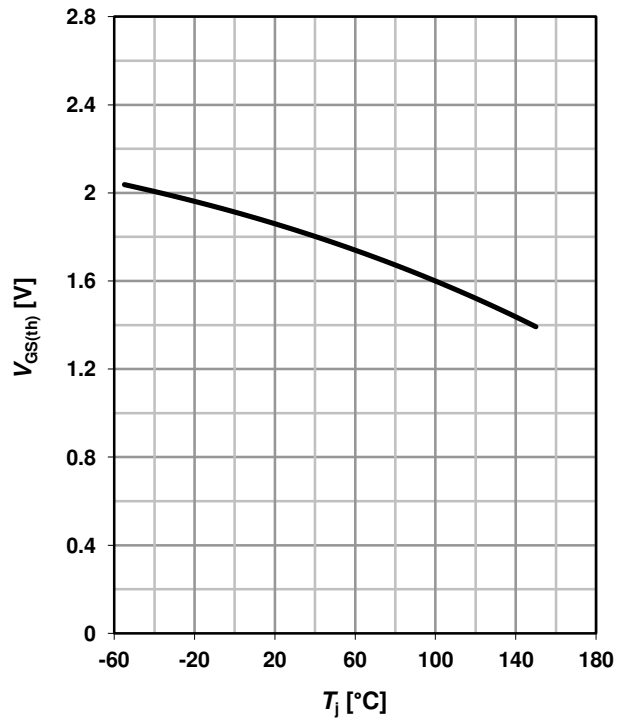
17 Typ. gate threshold voltage (Q1)

$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$; $I_D=250 \mu A$



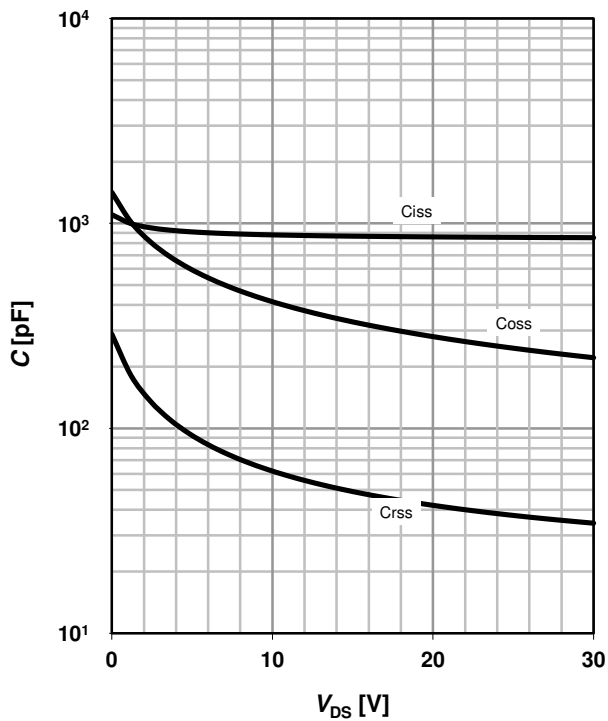
18 Typ. gate threshold voltage (Q2)

$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$; $I_D=10 \text{ mA}$



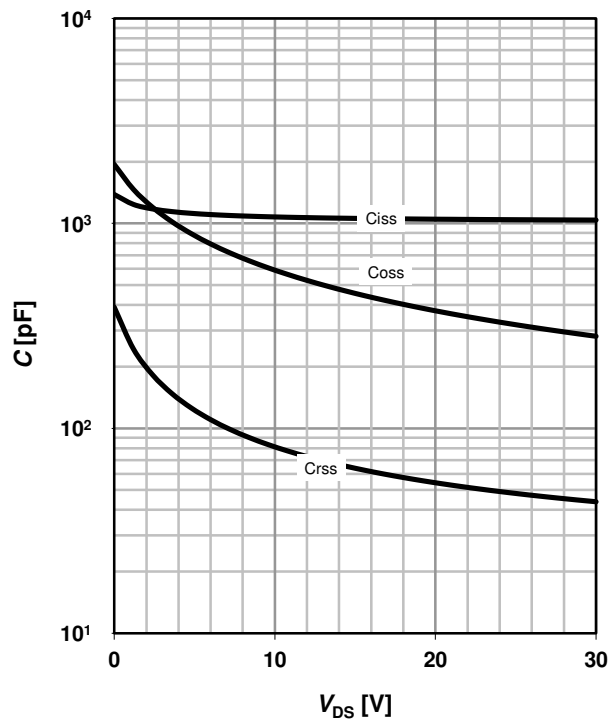
19 Typ. capacitances (Q1)

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



20 Typ. capacitances (Q2)

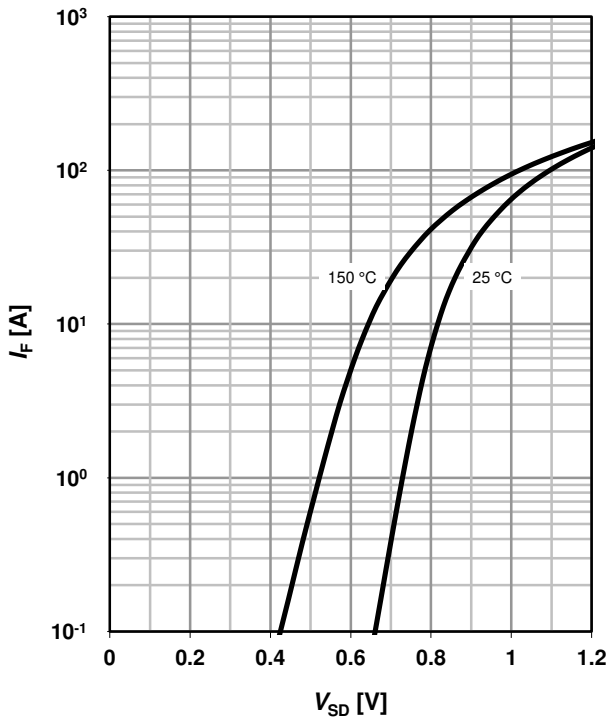
$C=f(V_{DS})$; $V_{GS}=0 \text{ V}$; $f=1 \text{ MHz}$



21 Forward characteristics of reverse diode (Q1)

$I_F=f(V_{SD})$

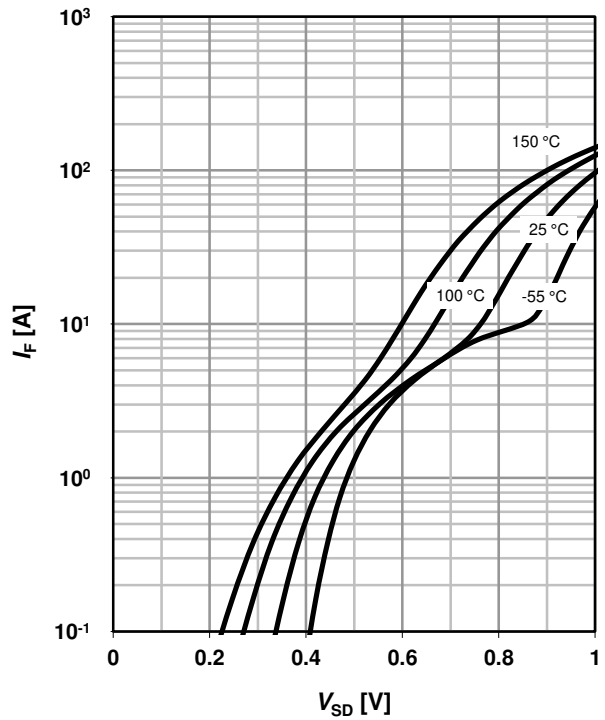
parameter: T_j



22 Forward characteristics of reverse diode (Q2)

$I_F=f(V_{SD})$

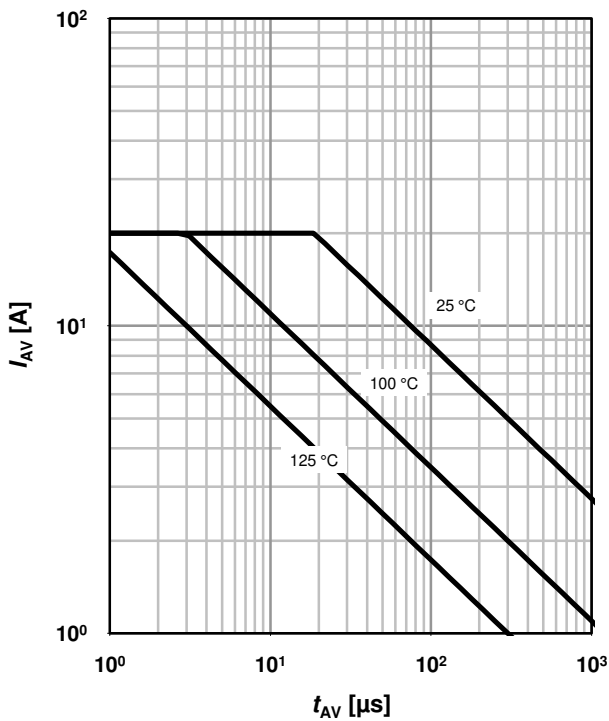
parameter: T_j



23 Avalanche characteristics (Q1)

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

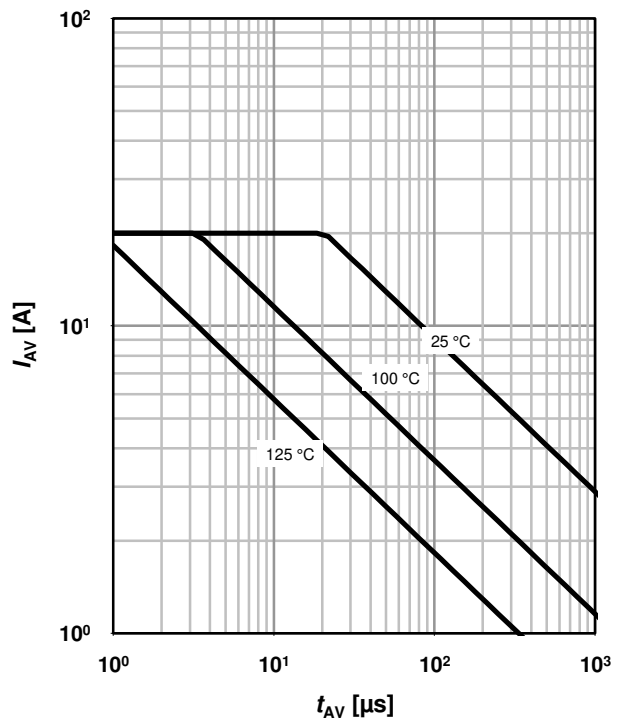
parameter: $T_{j(start)}$



24 Avalanche characteristics (Q2)

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

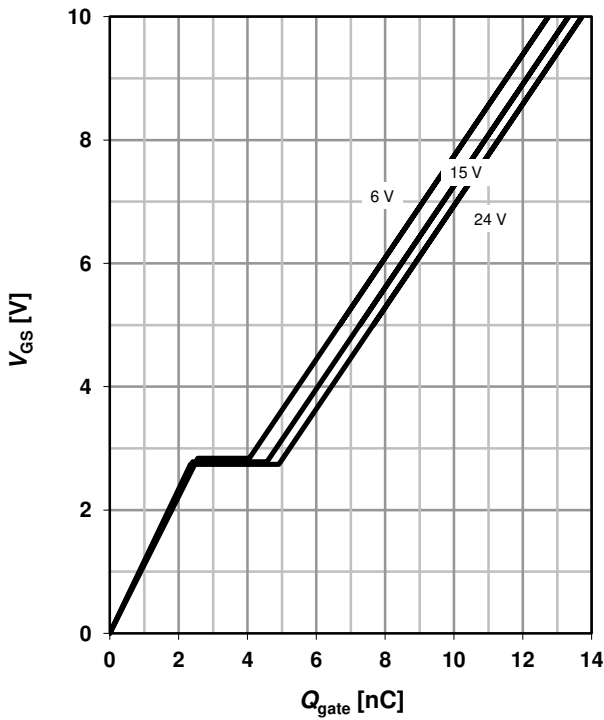
parameter: $T_{j(start)}$



25 Typ. gate charge (Q1)

$V_{GS}=f(Q_{gate}); I_D=20\text{ A pulsed}$

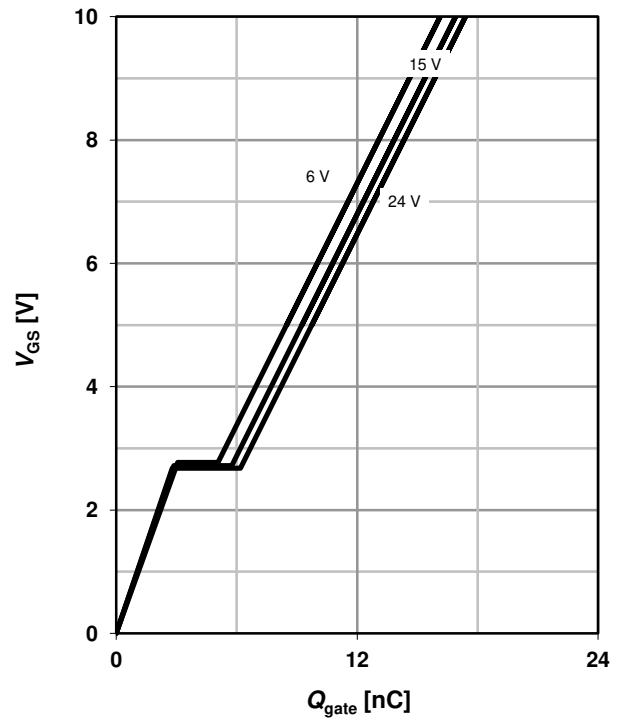
parameter: V_{DD}



26 Typ. gate charge (Q2)

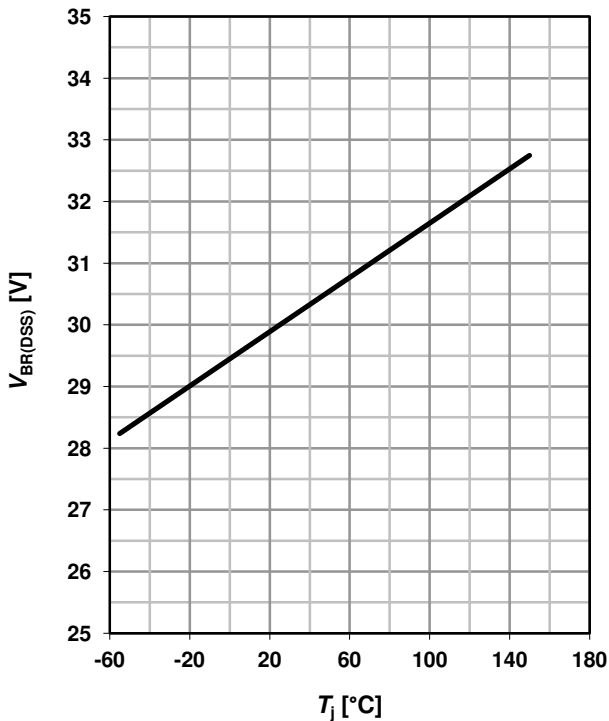
$V_{GS}=f(Q_{gate}); I_D=20\text{ A pulsed}$

parameter: V_{DD}



27 Drain-source breakdown voltage (Q1)

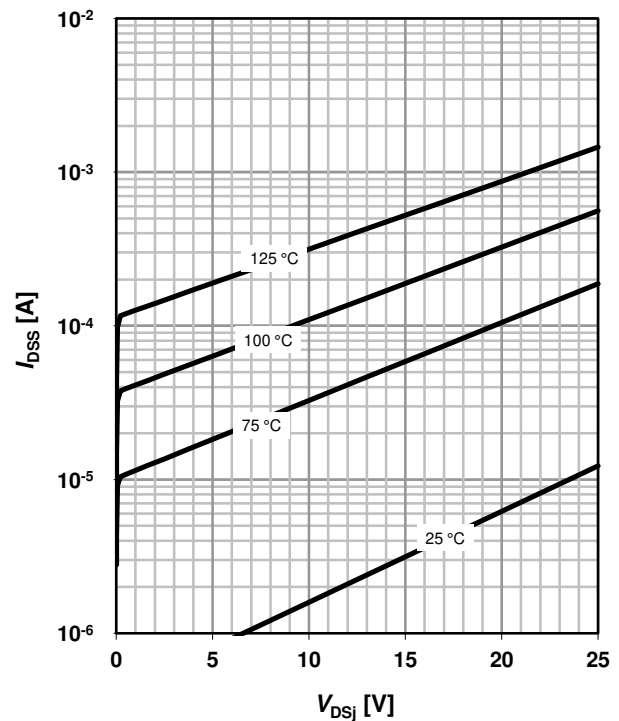
$V_{BR(DSS)}=f(T_j); I_D=1\text{ mA}$



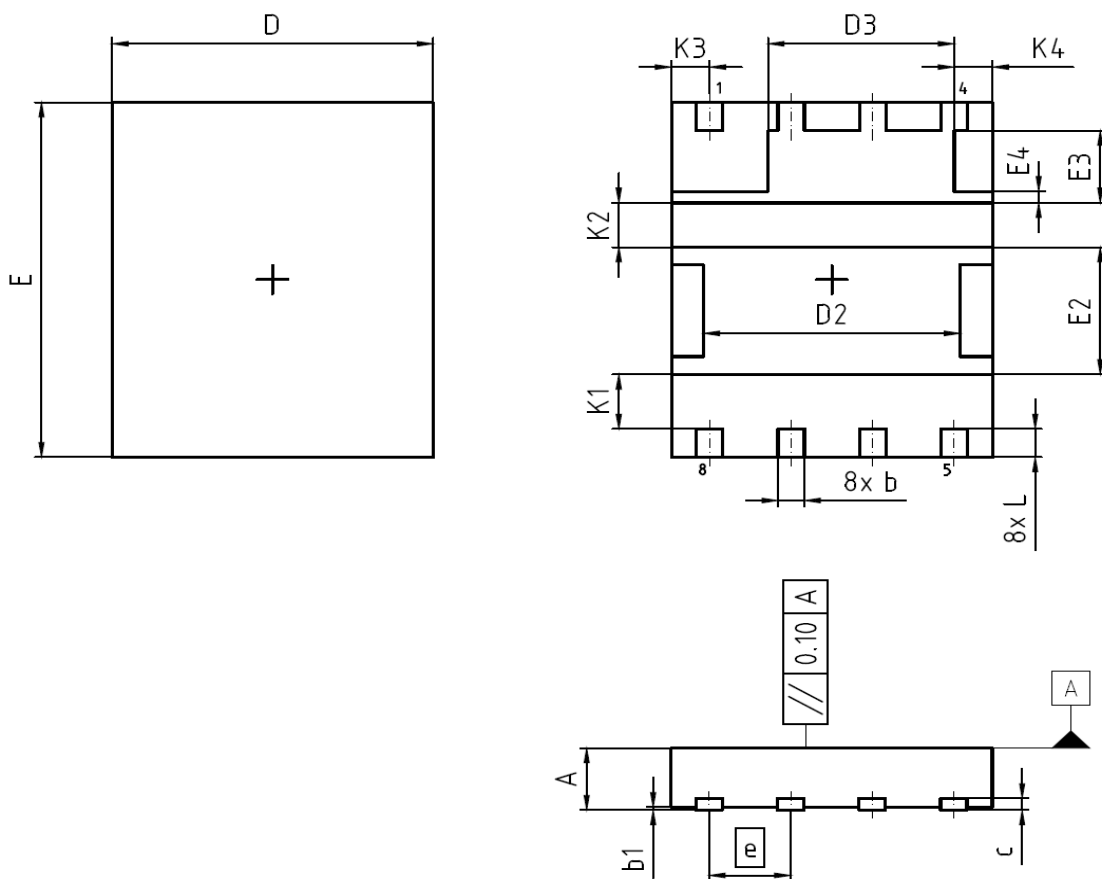
28 Typ. drain-source leakage current (Q2)

$I_{DSS}=f(V_{DS}); V_{GS}=0\text{ V}$

parameter: T_j



PG-TISON



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.90	1.15	0.035	0.045
b	0.31	0.51	0.012	0.020
b1	0.00	0.05	0.000	0.002
c	0.10	0.30	0.004	0.012
D	4.90	5.10	0.193	0.201
D2	3.90	4.10	0.154	0.161
D3	2.80	3.00	0.110	0.118
E	5.90	6.10	0.232	0.240
E2	2.05	2.25	0.081	0.089
E3	1.12	1.32	0.044	0.052
E4	0.10	0.30	0.004	0.012
e	1.27 (BSC)		0.05 (BSC)	
N	8		8	
L	0.38	0.58	0.015	0.023
K1	0.82	1.02	0.032	0.040
K2	0.65	0.85	0.026	0.033
K3 = K4	0.50	0.70	0.019	0.027

DOCUMENT NO.
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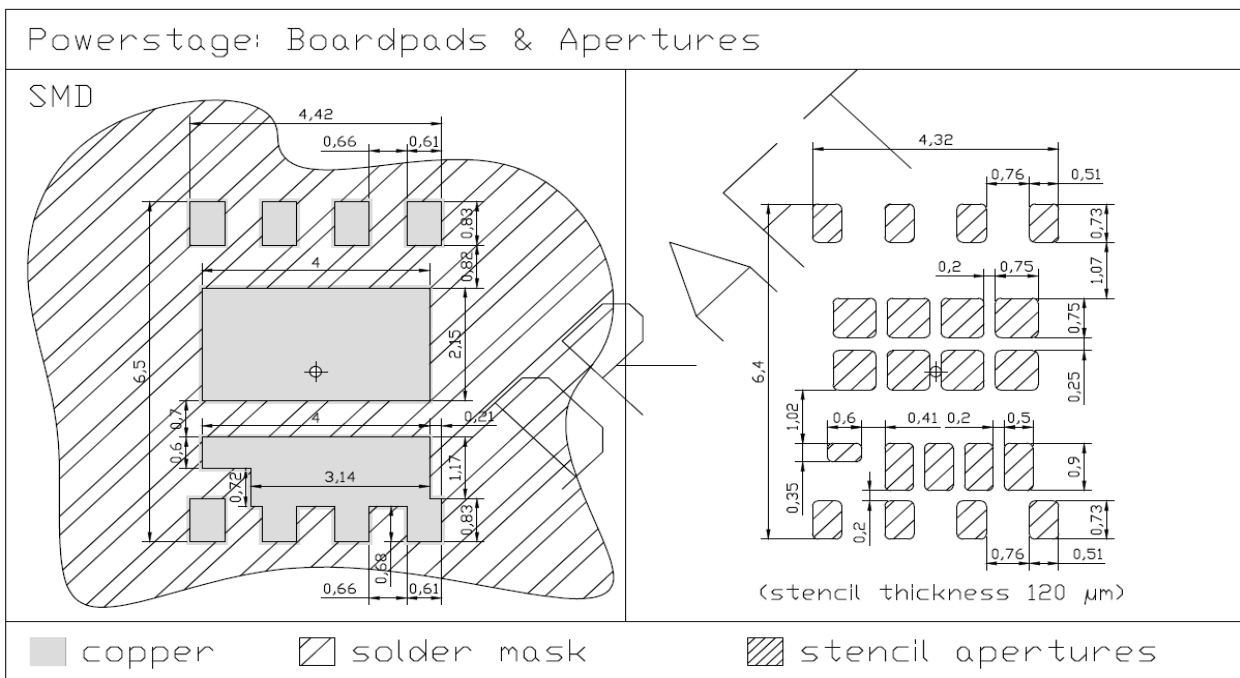
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EUROPEAN PROJECTION

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