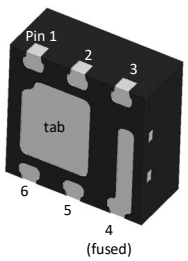
MOSFET

OptiMOS™ 6 Power-Transistor, 40 V

PG-VSON-6



Features

- N-channel, logic level
- Lowest on-resistance $R_{DS(on)}$ in a 2x2 package
- Superior thermal resistance for a 2x2 package
- 100% avalanche tested
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21
- Optimized for highest performance and power density

Product validation

Fully qualified according to JEDEC for Industrial Applications

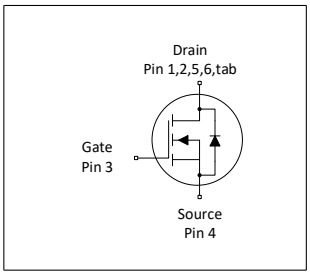


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	40	V
$R_{DS(on),\ max}$	5.75	mΩ
I_D	64	A
Q_{oss}	11	nC
$Q_G(0V..10V)$	9.7	nC

Type / Ordering Code	Package	Marking	Related Links
ISK057N04LM6	PG-VSON-6	5704	-

Table of Contents

1 Maximum ratings

at T_A=25 °C, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current[1]	I_D	- - - -	- - - -	64 40 34 15	A	V_{GS}=10 V, T_C=25 °C V_{GS}=10 V, T_C=100 °C V_{GS}=4.5 V, T_C=100 °C[2] V_{GS}=10 V,T_A=25 °C,R_{thJA}=60 °C/W[2]
Pulsed drain current[3]	$I_{D,pulse}$	-	-	254	A	T_C=25 °C
Avalanche energy, single pulse[4]	E_{AS}	-	-	17	mJ	I_D=20 A, R_{GS}=25 Ω
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	- -	- -	39.1 2.1	W	T_C=25 °C T_A=25 °C, R_{thJA}=60 °C/W[2]
Operating and storage temperature	T_j, T_{stg}	-55	-	150	°C	-

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case, bottom	R_{thJC}	-	1.6	3.2	°C/W	-
Device on PCB, 6 cm² cooling area[2]	R_{thJA}	-	-	60	°C/W	-

[1] Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperatureas specified. For other case temperatures please refer to Diagram 2. De-rating will be required based on the actualenvironmental conditions.
[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] See Diagram 3 for more detailed information
[4] See Diagram 13 for more detailed information

3 Electrical characteristics

at T_j=25 °C, unless otherwise specified

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	40	-	-	V	V_{GS}=0 V, I_D=1 mA
Gate threshold voltage	$V_{GS(th)}$	1.3	1.8	2.3	V	V_{DS}=V_{GS}, I_D=250 µA
Zero gate voltage drain current	I_{DSS}	- -	0.1 10	1 100	µA	V_{DS}=40 V, V_{GS}=0 V, T_j=25 °C V_{DS}=40 V, V_{GS}=0 V, T_j=125 °C
Gate-source leakage current	I_{GSS}	-	-	100	nA	V_{GS}=20 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	- -	5.1 6.9	5.75 8.3	mΩ	V_{GS}=10 V, I_D=20 A V_{GS}=4.5 V, I_D=20 A
Gate resistance[1)]	R_G	-	0.7	1.2	Ω	-
Transconductance	g_{fs}	-	65	-	S	|V_{DS}|≥2|I_D|$R_{DS(on)max}$, I_D=20 A

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance[1)]	C_{iss}	-	670	870	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Output capacitance[1)]	C_{oss}	-	220	290	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Reverse transfer capacitance[1)]	C_{rss}	-	12	21	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	5.7	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=20 A, $R_{G,ext}$=1.6 Ω
Rise time	t_r	-	2.9	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=20 A, $R_{G,ext}$=1.6 Ω
Turn-off delay time	$t_{d(off)}$	-	9.5	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=20 A, $R_{G,ext}$=1.6 Ω
Fall time	t_f	-	1.8	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=20 A, $R_{G,ext}$=1.6 Ω

Table 6 Gate charge characteristics[2)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	1.9	-	nC	V_{DD}=20 V, I_D=20 A, V_{GS}=0 to 10 V
Gate charge at threshold	$Q_{g(th)}$	-	1.0	-	nC	V_{DD}=20 V, I_D=20 A, V_{GS}=0 to 10 V
Gate to drain charge[1)]	Q_{gd}	-	1.3	2.0	nC	V_{DD}=20 V, I_D=20 A, V_{GS}=0 to 10 V
Switching charge	Q_{sw}	-	2.2	-	nC	V_{DD}=20 V, I_D=20 A, V_{GS}=0 to 10 V
Gate charge total[1)]	Q_g	-	9.7	12	nC	V_{DD}=20 V, I_D=20 A, V_{GS}=0 to 10 V
Gate plateau voltage	$V_{plateau}$	-	2.9	-	V	V_{DD}=20 V, I_D=20 A, V_{GS}=0 to 10 V
Gate charge total	Q_g	-	4.7	-	nC	V_{DD}=20 V, I_D=20 A, V_{GS}=0 to 4.5 V
Gate charge total, sync. FET	$Q_{g(sync)}$	-	9.0	-	nC	V_{DS}=0.1 V, V_{GS}=0 to 10 V
Output charge[1)]	Q_{oss}	-	11	14	nC	V_{DD}=20 V, V_{GS}=0 V

[1)] Defined by design. Not subject to production test.
[2)] See ″Gate charge waveforms″ for parameter definition

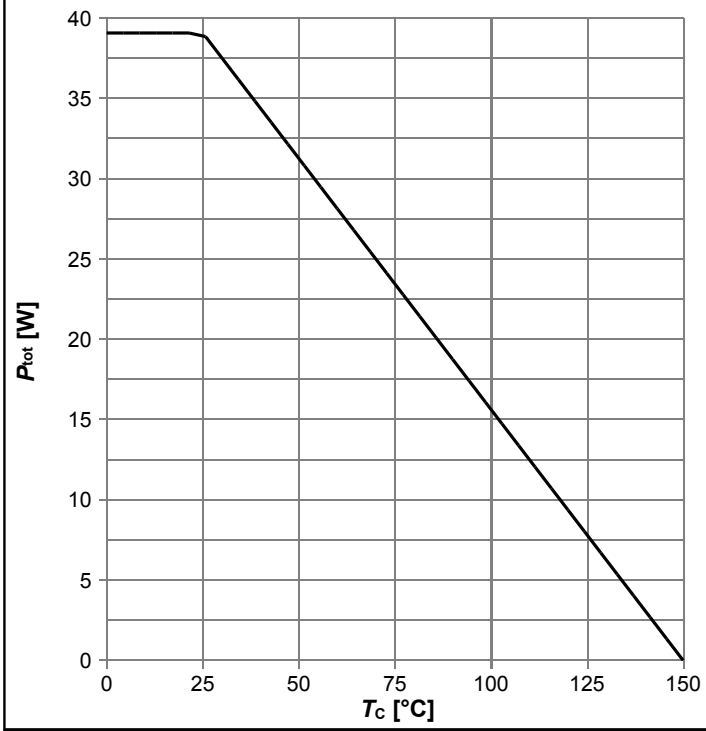
Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	36	A	T_C=25 °C
Diode pulse current	$I_{S,pulse}$	-	-	254	A	T_C=25 °C
Diode forward voltage	V_{SD}	-	0.84	1.0	V	V_{GS}=0 V, I_F=20 A, T_j=25 °C
Reverse recovery time[1)]	t_{rr}	-	48	96	ns	V_R=20 V, I_F=20 A, di_F/dt=100 A/µs
Reverse recovery charge[1)]	Q_{rr}	-	29	58	nC	V_R=20 V, I_F=20 A, di_F/dt=100 A/µs
Reverse recovery time[1)]	t_{rr}	-	16	32	ns	V_R=20 V, I_F=20 A, di_F/dt=500 A/µs
Reverse recovery charge[1)]	Q_{rr}	-	32	64	nC	V_R=20 V, I_F=20 A, di_F/dt=500 A/µs

[1)] Defined by design. Not subject to production test.

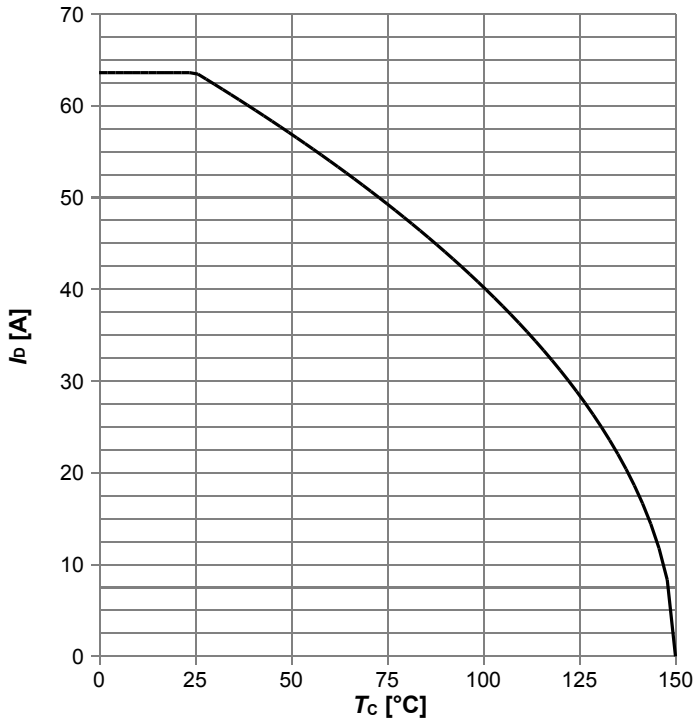
4 Electrical characteristics diagrams

Diagram 1: Power dissipation



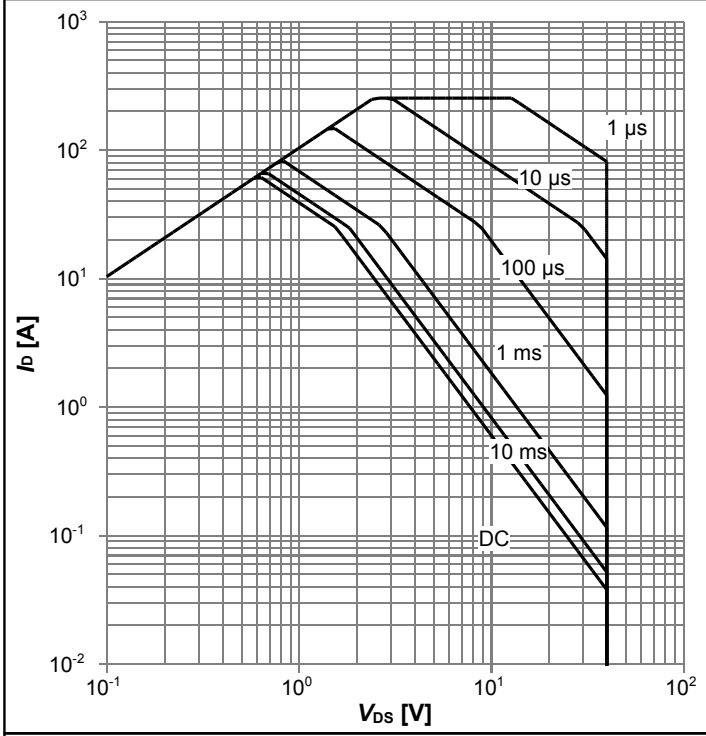
$P_{tot}=f(T_C)$

Diagram 2: Drain current



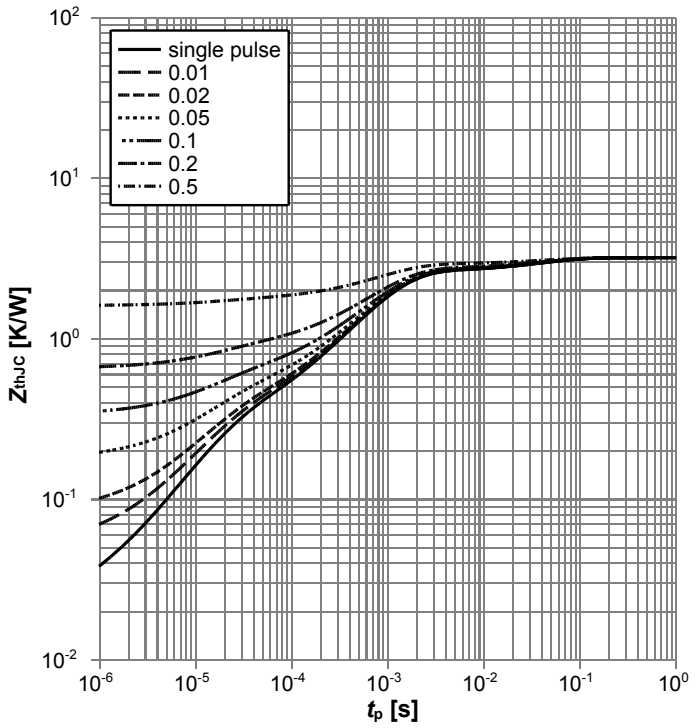
$I_D=f(T_C)$; $V_{GS}\geq 10$ V

Diagram 3: Safe operating area



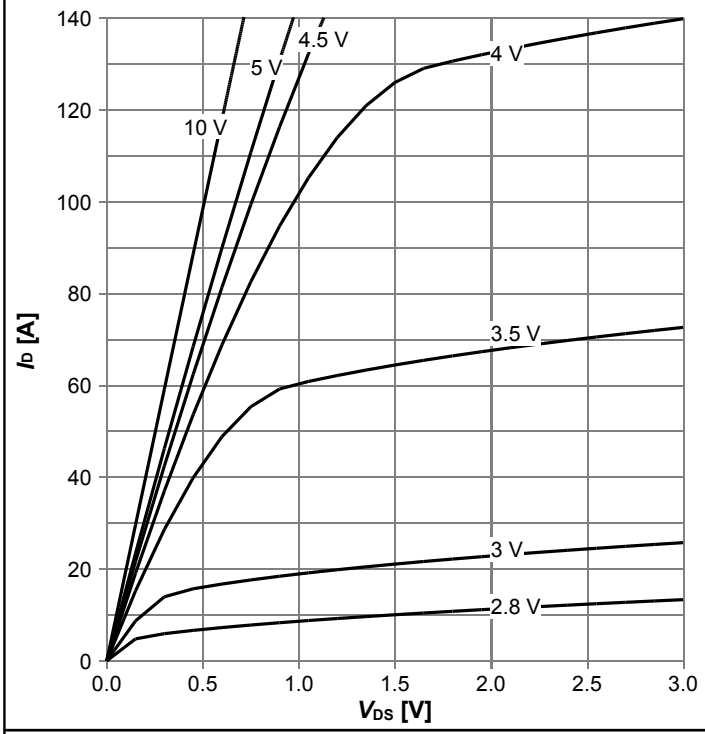
$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$; parameter: t_p

Diagram 4: Max. transient thermal impedance



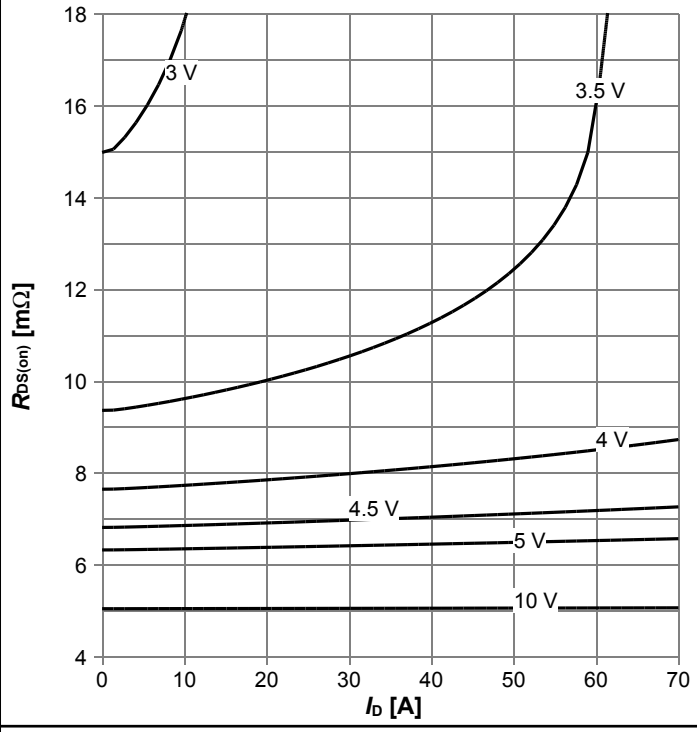
$Z_{thJC}=f(t_p)$; parameter: $D=t_p/T$

Diagram 5: Typ. output characteristics



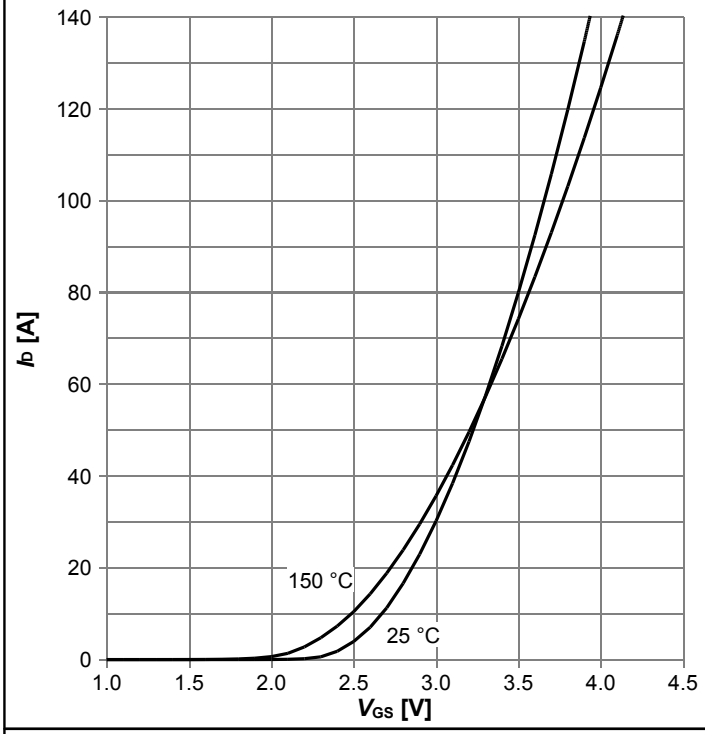
$I_D=f(V_{DS})$, $T_j=25$ °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



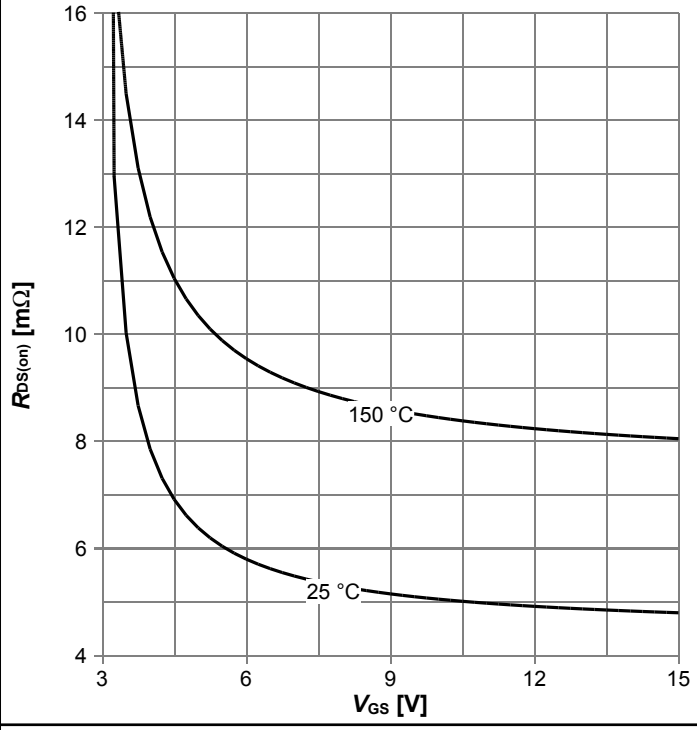
$R_{DS(on)}=f(I_D)$, $T_j=25$ °C; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



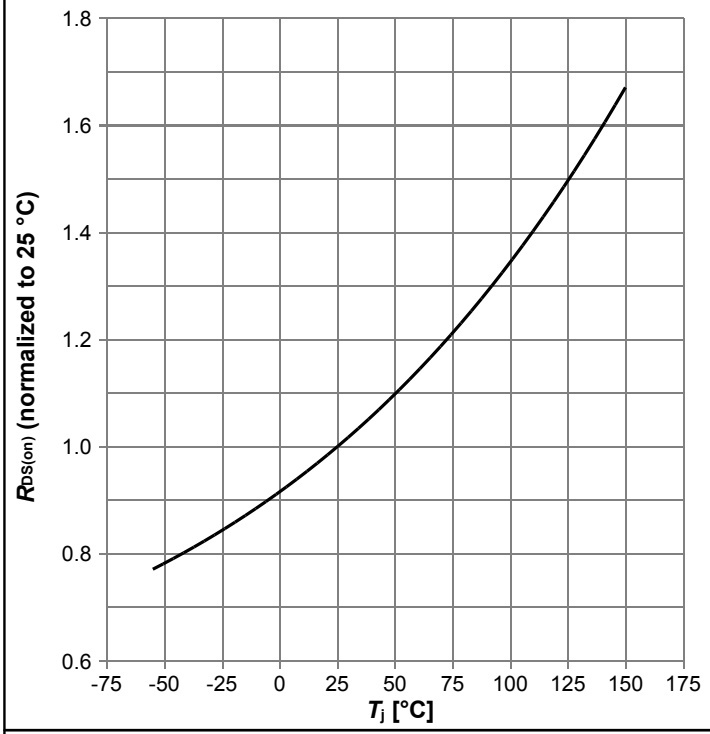
$I_D=f(V_{GS})$, $|V_{DS}|>2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. drain-source on resistance



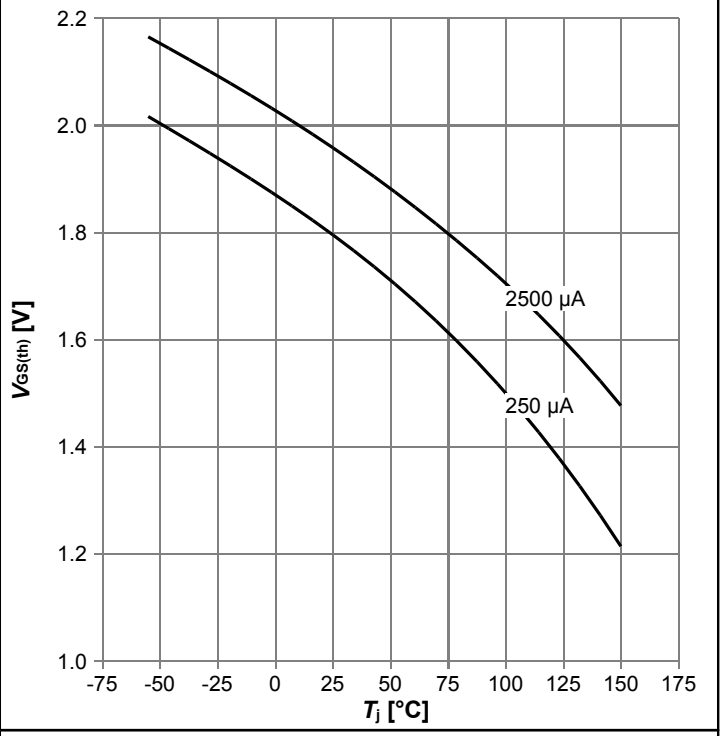
$R_{DS(on)}=f(V_{GS})$, $I_D=20$ A; parameter: T_j

Diagram 9: Normalized drain-source on resistance



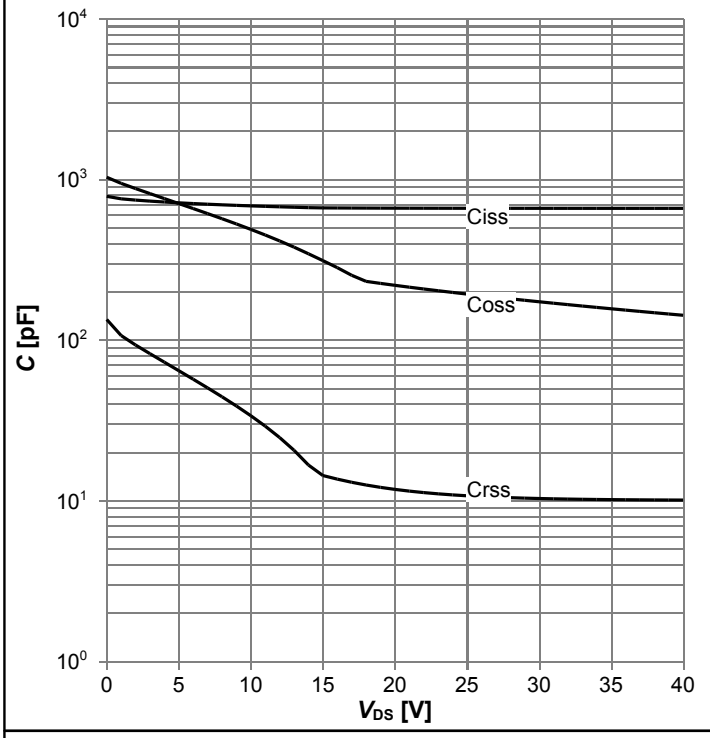
$R_{DS(on)}$=f(T_j), I_D=20 A, V_{GS}=10 V

Diagram 10: Typ. gate threshold voltage



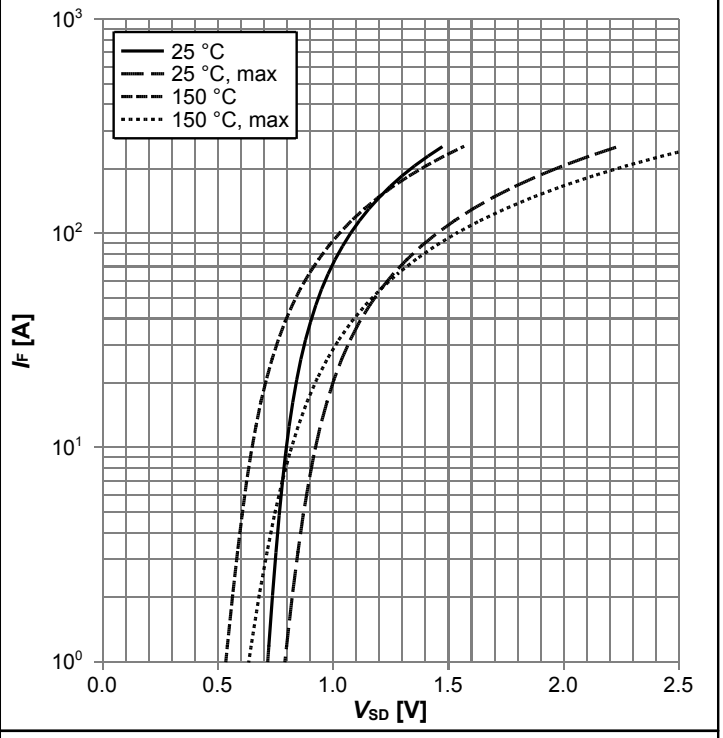
$V_{GS(th}$=f(T_j), V_{GS}=V_{DS}; parameter: I_D

Diagram 11: Typ. capacitances



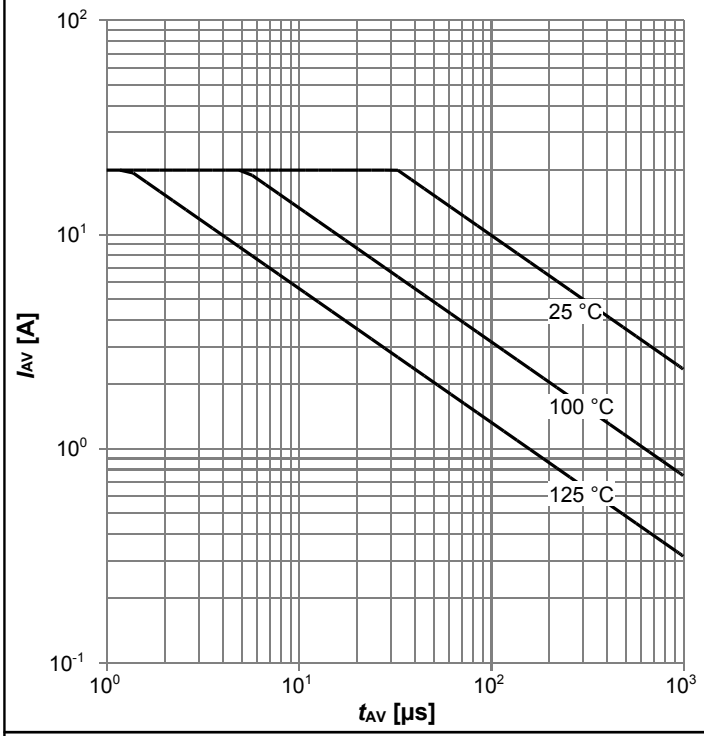
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Diagram 12: Forward characteristics of reverse diode



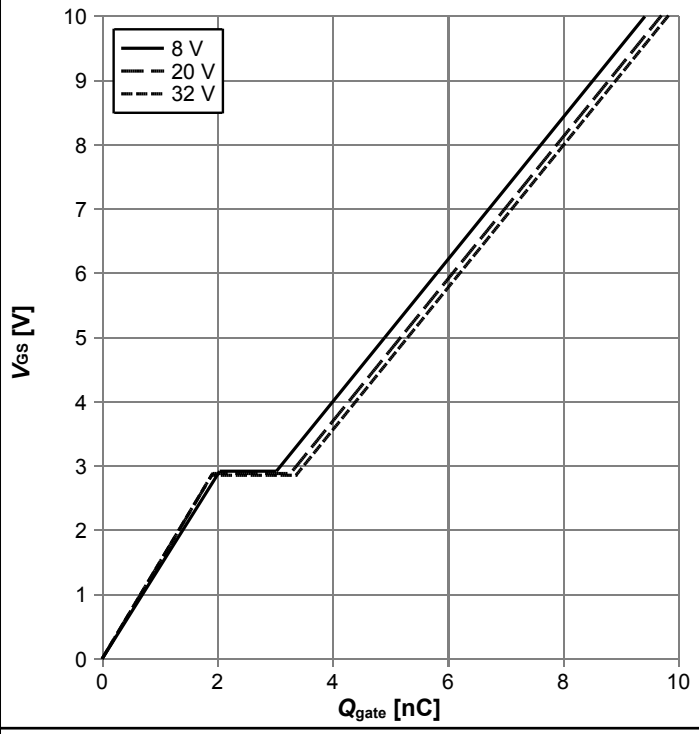
I_F=f(V_{SD}); parameter: T_j

Diagram 13: Avalanche characteristics



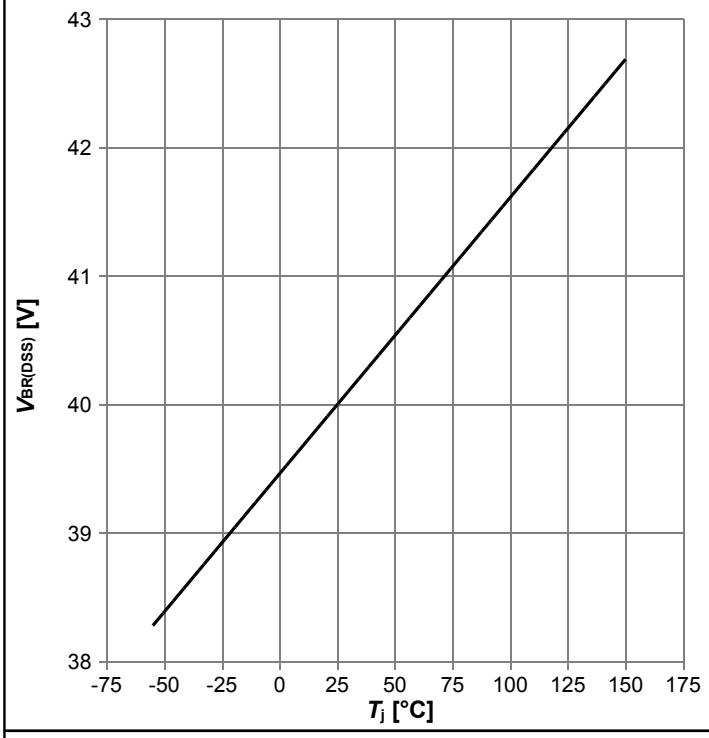
$I_{AS}=f(t_{AV})$; $R_{GS}=25\ \Omega$; parameter: $T_{j,start}$

Diagram 14: Typ. gate charge



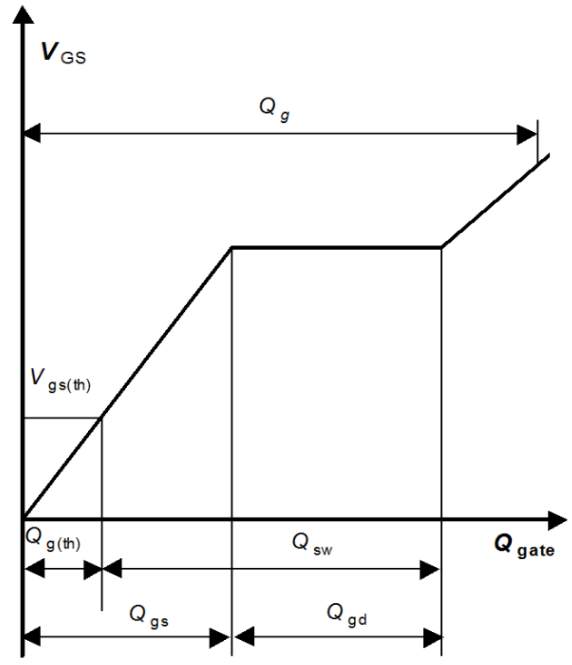
$V_{GS}=f(Q_{gate})$, $I_D=20$ A pulsed, $T_j=25$ °C; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

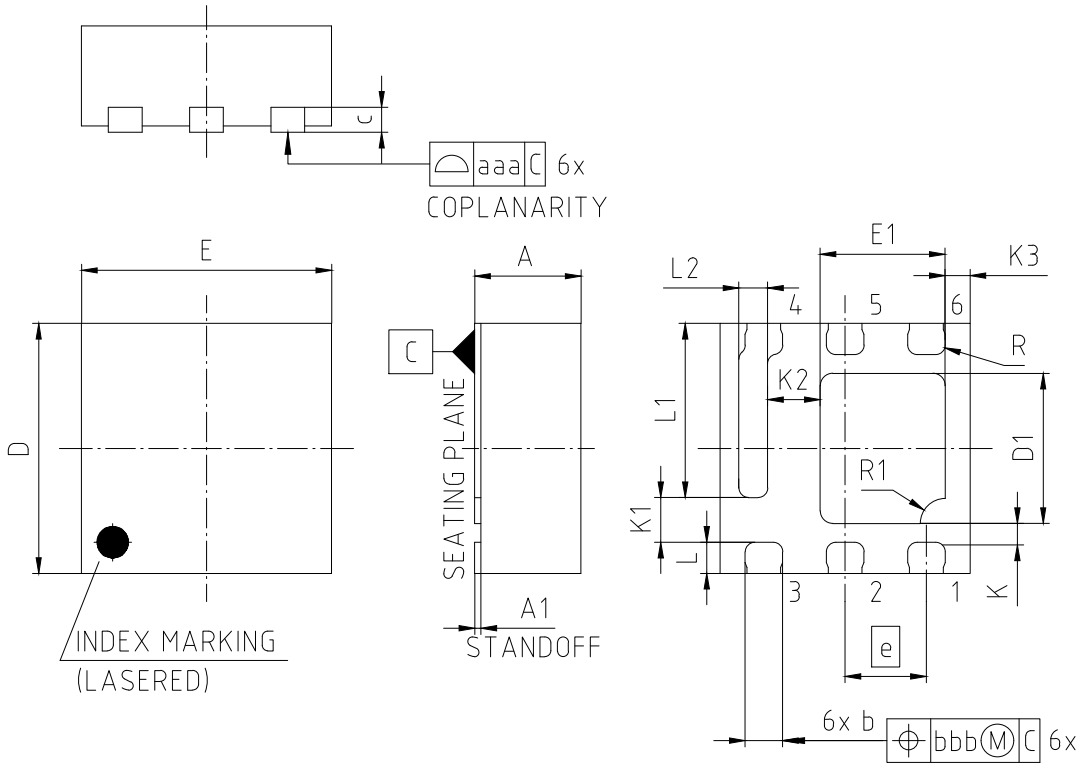


$V_{BR(DSS)}=f(T_j)$; $I_D=1$ mA

Diagram Gate charge waveforms



5 Package Outlines



PACKAGE - GROUP NUMBER:	PG-VSON-6-U02				
DIMENSIONS	MILLIMETERS		DIMENSIONS	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	---	0.90	**L**	0.20	0.30
A1	---	0.05	**L1**	1.29	1.49
b	0.20	0.40	**L2**	0.13	0.33
c	(0.20)		**R**	(0.08)	
D	1.90	2.10	**R1**	(0.20)	
D1	1.10	1.30	**N**	6	
E	1.90	2.10	**aaa**	0.08	
E1	0.90	1.10	**bbb**	0.10	
e	0.65				
K	0.05	---			
K1	0.26	---			
K2	0.42	---			
K3	0.10	0.30			

NOTE:
DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS

Figure 1 Outline PG-VSON-6, dimensions in mm

Revision History

ISK057N04LM6

Revision: 2023-12-20, Rev. 2.2

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.0	2022-12-23	Release of final version
2.1	2023-04-20	Update RTHjc, current rating and Ptot.
2.2	2023-12-20	Update POD drawing

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