

MOSFET

OptiMOS™ 5 Power-Transistor, 150 V

Features

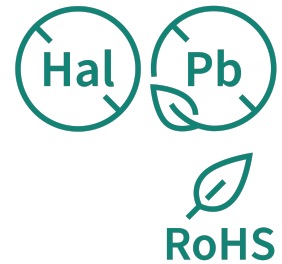
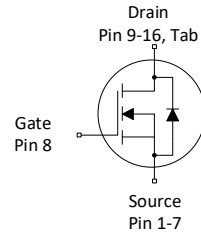
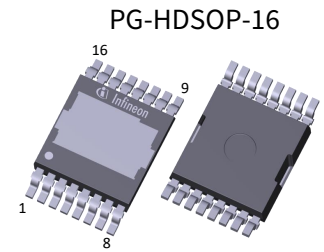
- N-channel, normal level
- Very low on-resistance $R_{DS(on)}$
- Superior thermal resistance
- 100% avalanche tested
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

Product validation

Fully qualified according to JEDEC for Industrial Applications

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	150	V
$R_{DS(on),max}$	3.9	mΩ
I_D	190	A
Q_{oss}	207	nC
Q_G	74	nC



Type/Ordering Code	Package	Marking	Related Links
IPTC039N15NM5	PG-HDSOP-16	039N15N5	-



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1 Maximum ratings

unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Continuous drain current ¹⁾	I_D	-	-	190 134 128 21	A	$V_{GS}=10\text{ V}, T_C=25\text{ °C}$ $V_{GS}=10\text{ V}, T_C=100\text{ °C}$ $V_{GS}=8\text{ V}, T_C=100\text{ °C}$ $V_{GS}=10\text{ V}, T_A=25\text{ °C}, R_{thJA}=40\text{ °C/W}^2)$
Pulsed drain current ³⁾	$I_{D,pulse}$	-	-	760	A	$T_A=25\text{ °C}$
Avalanche energy, single pulse ⁴⁾	E_{AS}	-	-	344	mJ	$I_D=100\text{ A}, R_{GS}=25\text{ }\Omega$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	319 3.8	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}, R_{thJA}=40\text{ °C/W}^2)$
Operating and storage temperature	T_j, T_{stg}	-55	-	175	°C	-

¹⁾ Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature as specified. For other case temperatures please refer to Diagram 2. De-rating will be required based on the actual environmental 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

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	0.47	°C/W	-
Thermal resistance, junction - ambient, 6 cm ² cooling area ⁵⁾	R_{thJA}	-	-	40	°C/W	-
Thermal resistance, junction - ambient, minimum footprint	R_{thJA}	-	-	62	°C/W	-

⁵⁾ 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 Electrical characteristics

unless otherwise specified

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	150	-	-	V	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	3.0	3.8	4.6	V	$V_{DS}=V_{GS}, I_D=243\text{ }\mu\text{A}$
Zero gate voltage drain current	I_{DSS}	-	0.1 10	1.0 100	μA	$V_{DS}=120\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^\circ\text{C}$ $V_{DS}=120\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ }^\circ\text{C}$
Gate-source leakage current	I_{GSS}	-	10	100	nA	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	3.5 3.8	3.9 4.3	m Ω	$V_{GS}=10\text{ V}, I_D=50\text{ A}$ $V_{GS}=8\text{ V}, I_D=25\text{ A}$
Gate resistance ⁶⁾	R_G	-	1.1	1.6	Ω	-
Transconductance	g_{fs}	-	110	-	S	$ V_{DS} \geq 2 I_D R_{DS(on)max}, I_D=50\text{ A}$

⁶⁾ Defined by design. Not subject to production test.

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Input capacitance ⁷⁾	C_{iss}	-	5600	7300	pF	$V_{GS}=0\text{ V}, V_{DS}=75\text{ V}, f=1\text{ MHz}$
Output capacitance ⁷⁾	C_{oss}	-	1400	1930	pF	$V_{GS}=0\text{ V}, V_{DS}=75\text{ V}, f=1\text{ MHz}$
Reverse transfer capacitance ⁷⁾	C_{rss}	-	31	55	pF	$V_{GS}=0\text{ V}, V_{DS}=75\text{ V}, f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	19	-	ns	$V_{DD}=75\text{ V}, V_{GS}=10\text{ V}, I_D=50\text{ A}, R_{G,ext}=1.6\text{ }\Omega$
Rise time	t_r	-	4.5	-	ns	$V_{DD}=75\text{ V}, V_{GS}=10\text{ V}, I_D=50\text{ A}, R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	23.5	-	ns	$V_{DD}=75\text{ V}, V_{GS}=10\text{ V}, I_D=50\text{ A}, R_{G,ext}=1.6\text{ }\Omega$
Fall time	t_f	-	5.5	-	ns	$V_{DD}=75\text{ V}, V_{GS}=10\text{ V}, I_D=50\text{ A}, R_{G,ext}=1.6\text{ }\Omega$

⁷⁾ Defined by design. Not subject to production test.

Table 6 Gate charge characteristics ⁸⁾

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	30	-	nC	$V_{DD}=75\text{ V}, I_D=50\text{ A}, V_{GS}=0\text{ to }10\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	21	-	nC	$V_{DD}=75\text{ V}, I_D=50\text{ A}, V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge ⁹⁾	Q_{gd}	-	15	22	nC	$V_{DD}=75\text{ V}, I_D=50\text{ A}, V_{GS}=0\text{ to }10\text{ V}$
Switching charge	Q_{sw}	-	23	-	nC	$V_{DD}=75\text{ V}, I_D=50\text{ A}, V_{GS}=0\text{ to }10\text{ V}$
Gate charge total ⁹⁾	Q_g	-	74	93	nC	$V_{DD}=75\text{ V}, I_D=50\text{ A}, V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	5.4	-	V	$V_{DD}=75\text{ V}, I_D=50\text{ A}, V_{GS}=0\text{ to }10\text{ V}$
Output charge ⁹⁾	Q_{oss}	-	207	275	nC	$V_{DS}=75\text{ V}, V_{GS}=0\text{ V}$

⁸⁾ See "Gate charge waveforms" for parameter definition

⁹⁾ Defined by design. Not subject to production test.

Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	190	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	760	A	$T_C=25\text{ °C}$
Diode forward voltage	V_{SD}	-	0.81	1.0	V	$V_{GS}=0\text{ V}, I_F=50\text{ A}, T_j=25\text{ °C}$
Reverse recovery time ¹⁰⁾	t_{rr}	-	53.5	107	ns	$V_R=75\text{ V}, I_F=50\text{ A}, di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge ¹⁰⁾	Q_{rr}	-	77	155	nC	$V_R=75\text{ V}, I_F=50\text{ A}, di_F/dt=100\text{ A}/\mu\text{s}$

¹⁰⁾ Defined by design. Not subject to production test.

4 Electrical characteristics diagrams

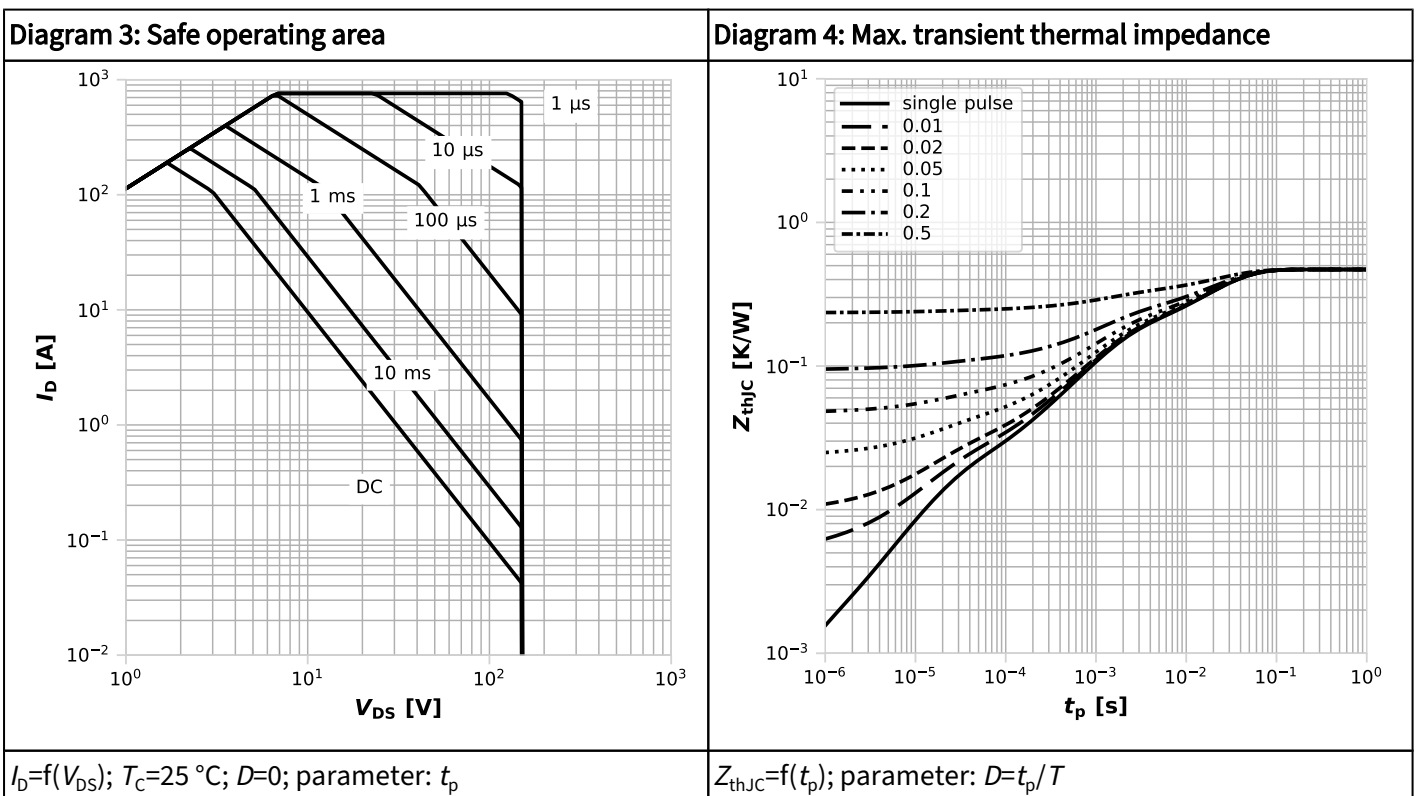
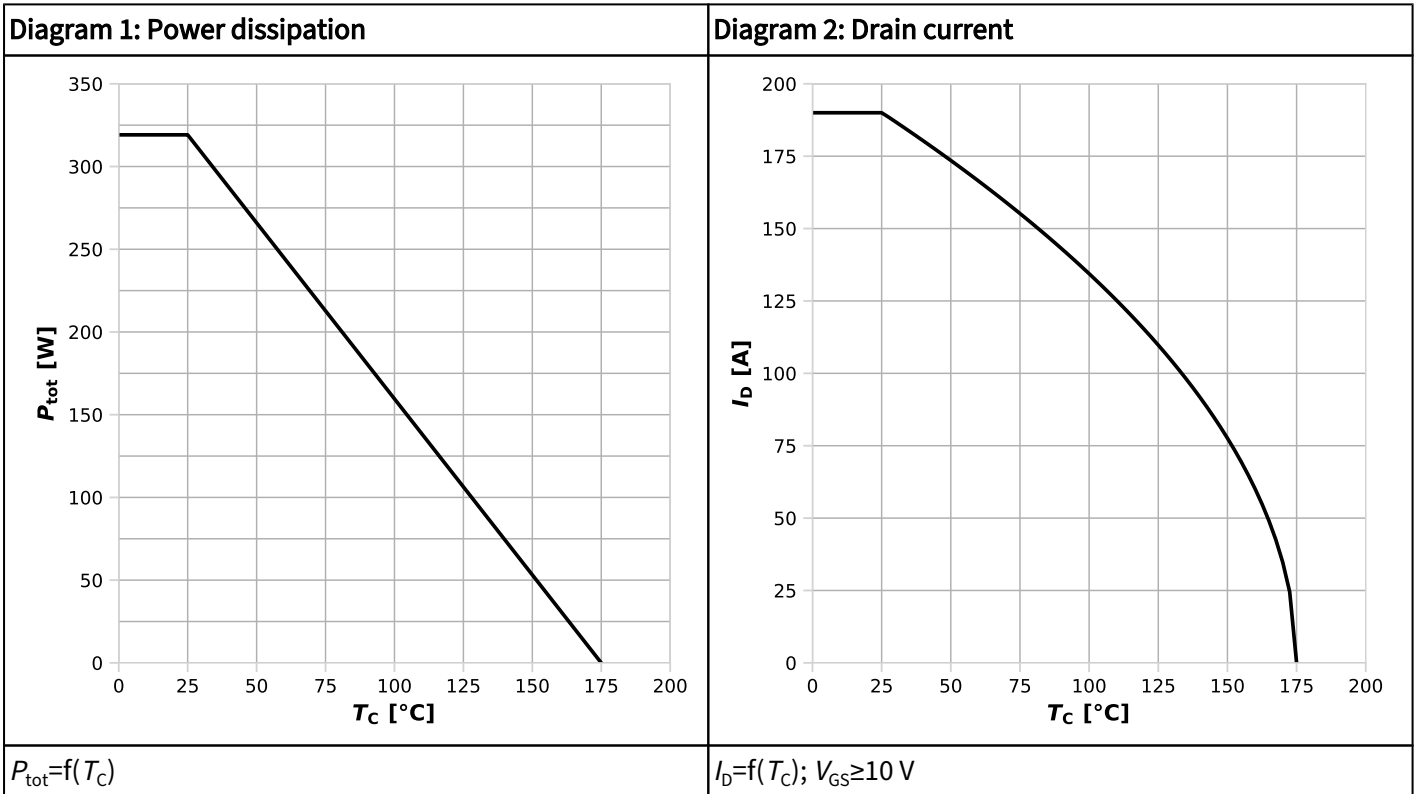
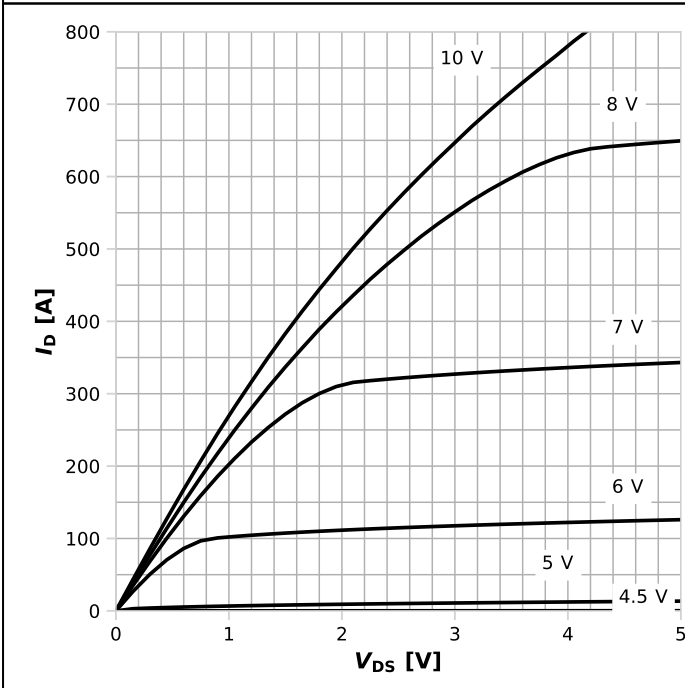
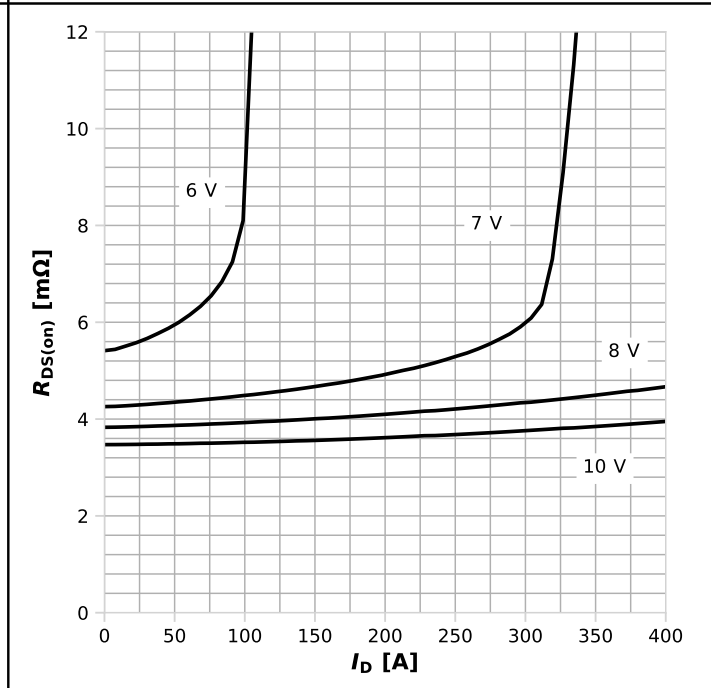


Diagram 5: Typ. output characteristics



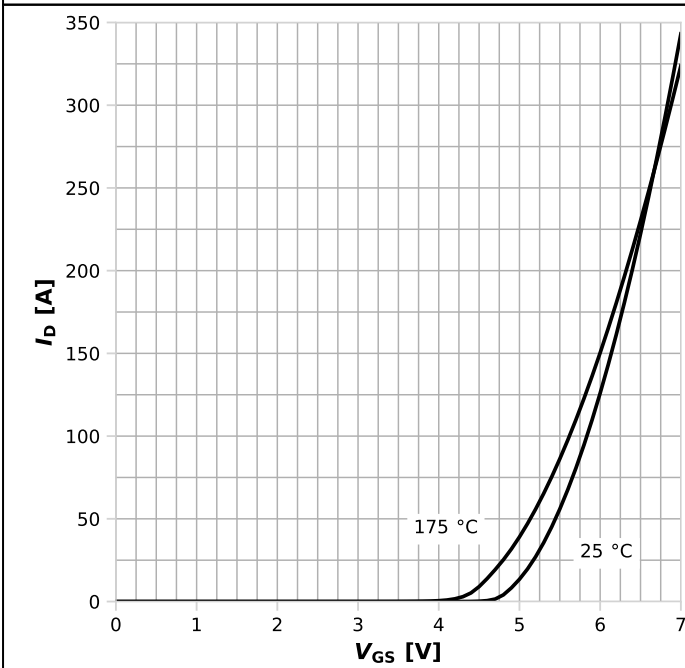
$I_D = f(V_{DS})$, $T_j = 25\text{ °C}$; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



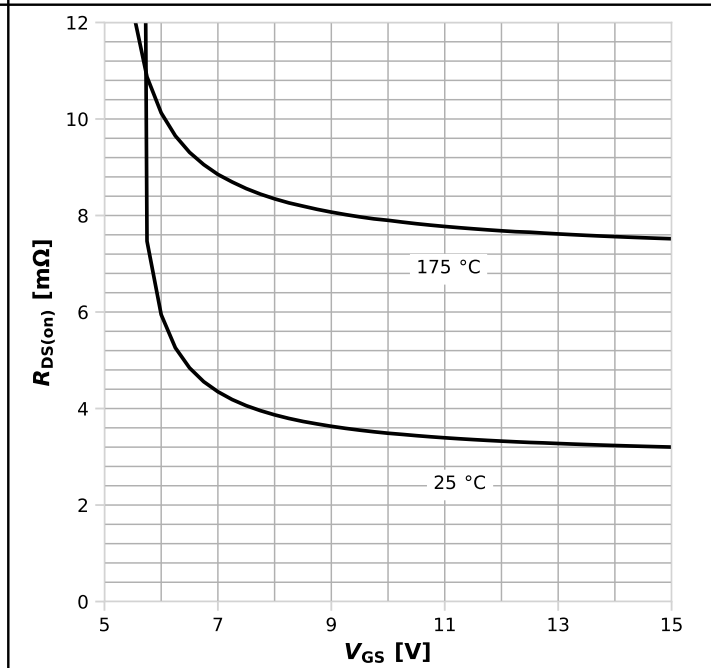
$R_{DS(on)} = f(I_D)$, $T_j = 25\text{ °C}$; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



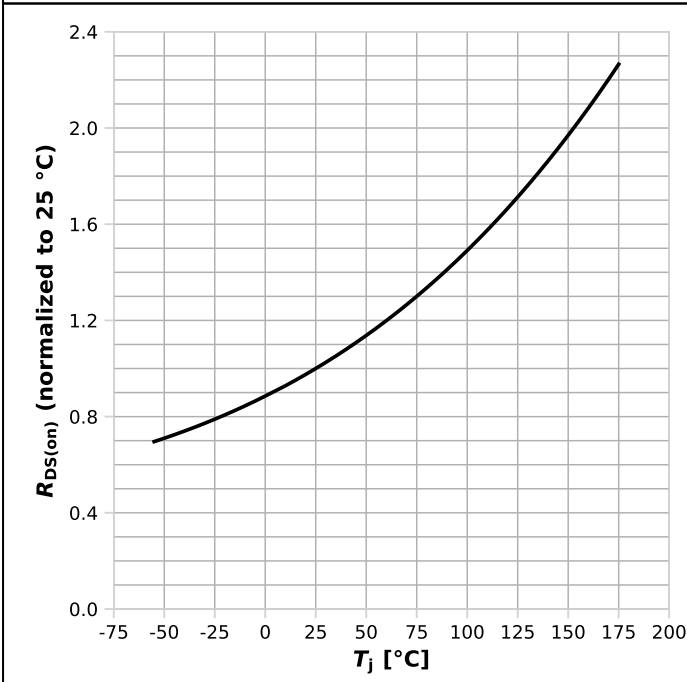
$I_D = f(V_{GS})$, $|V_{DS}| > 2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. drain-source on resistance



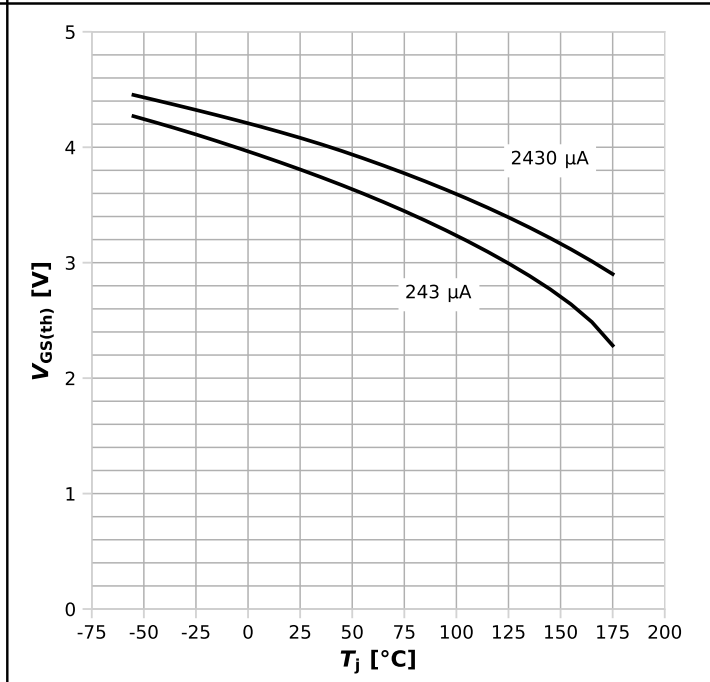
$R_{DS(on)} = f(V_{GS})$, $I_D = 50\text{ A}$; parameter: T_j

Diagram 9: Normalized drain-source on resistance



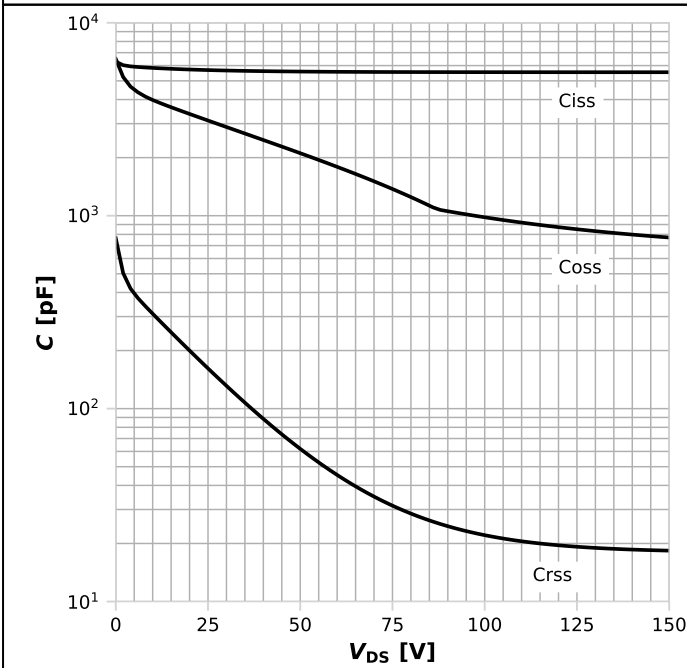
$R_{DS(on)}=f(T_j), I_D=50\text{ A}, V_{GS}=10\text{ V}$

Diagram 10: Typ. gate threshold voltage



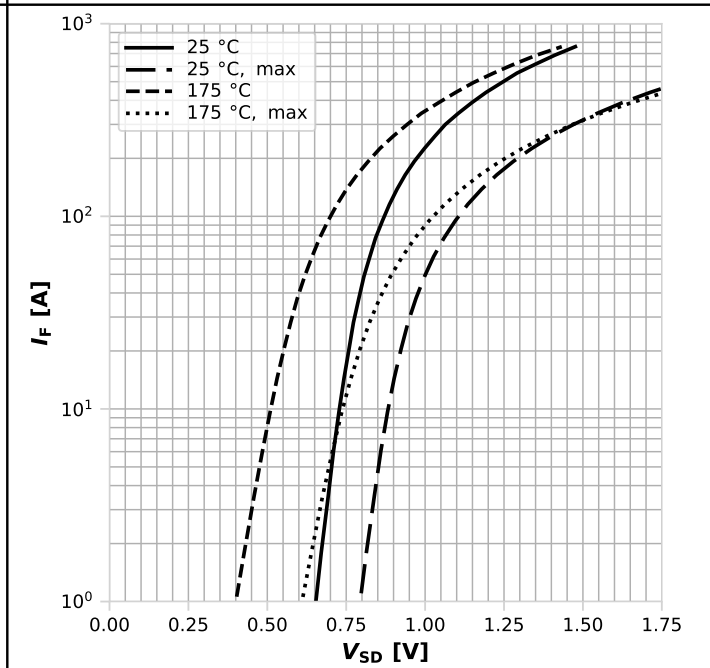
$V_{GS(th)}=f(T_j), V_{GS}=V_{DS};$ parameter: I_D

Diagram 11: Typ. capacitances



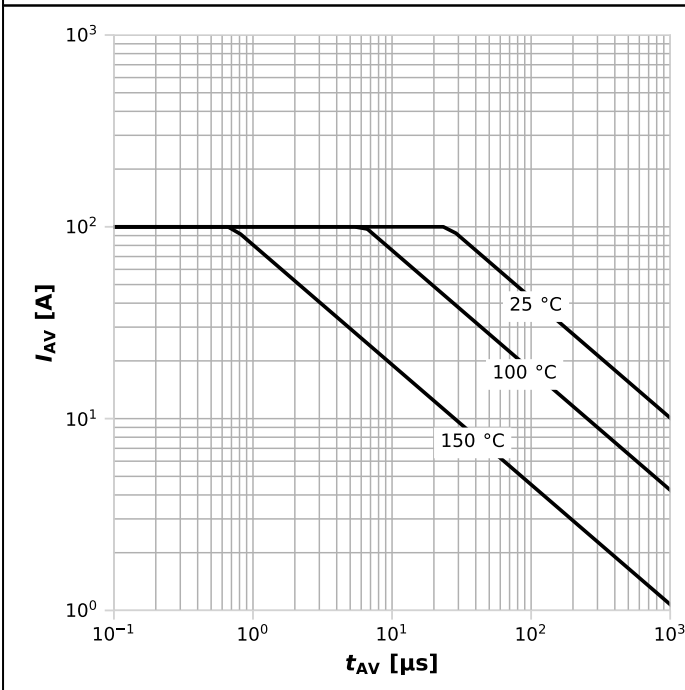
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



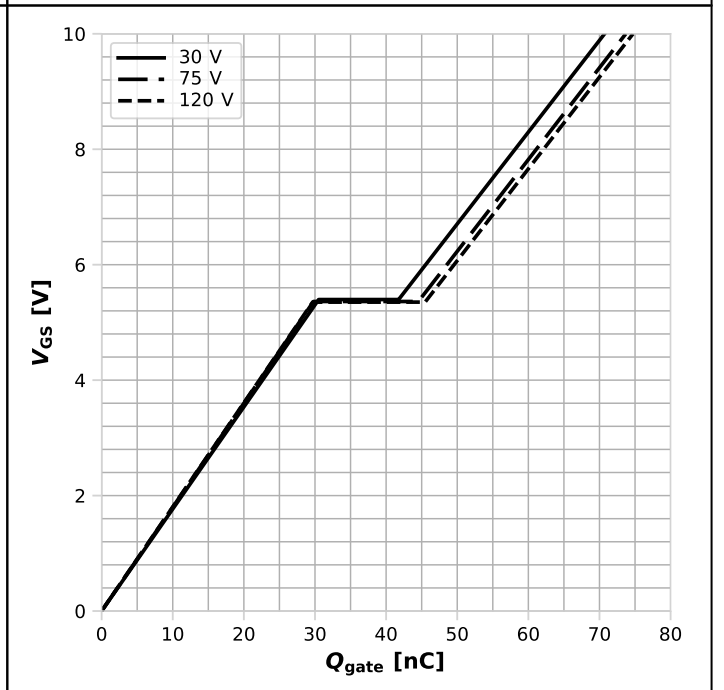
$I_F=f(V_{SD});$ parameter: T_j

Diagram 13: Avalanche characteristics



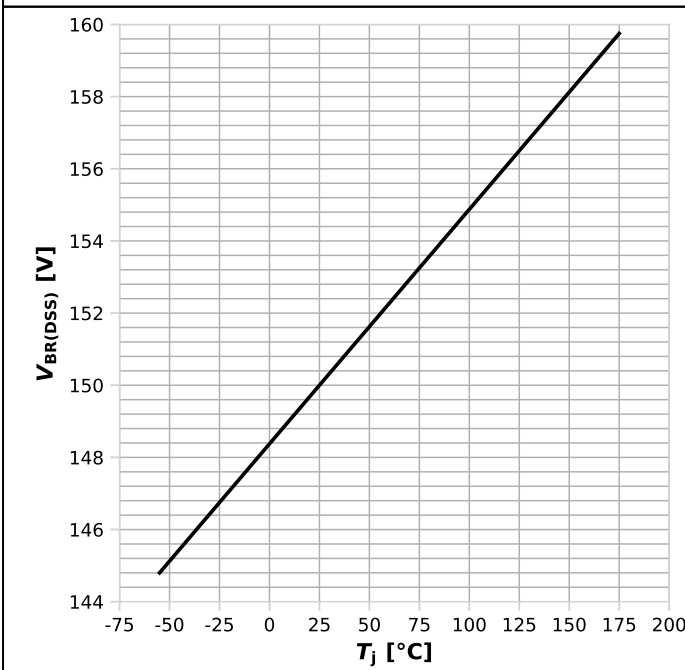
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$; parameter: $T_{j,start}$

Diagram 14: Typ. gate charge



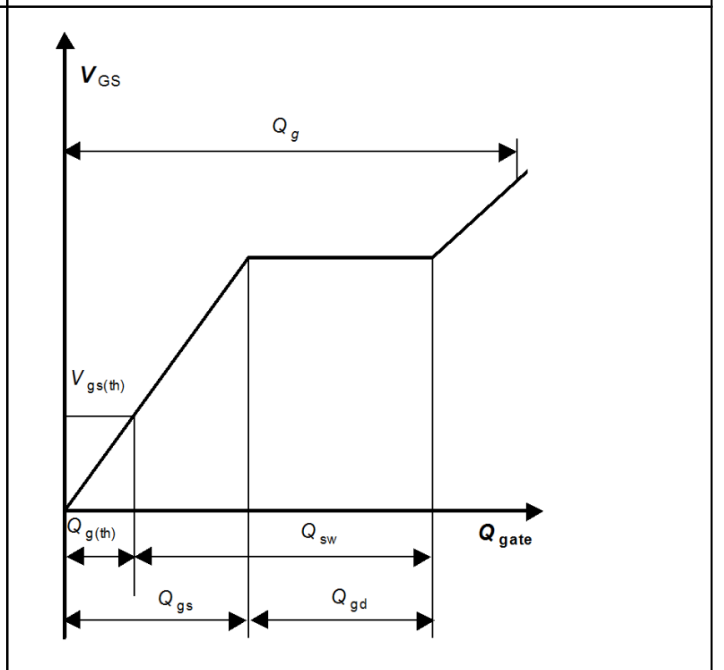
$V_{GS}=f(Q_{gate}), I_D=50$ A pulsed, $T_j=25$ °C; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage



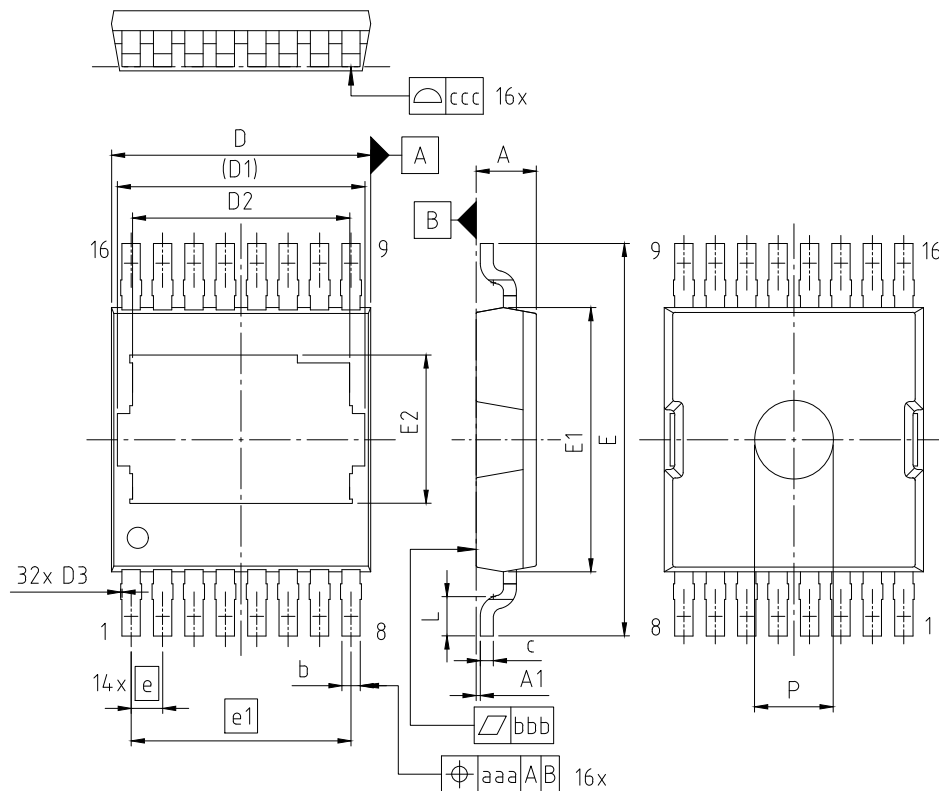
$V_{BR(DSS)}=f(T_j); I_D=1$ mA

Gate charge waveforms



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5 Package Outlines



PACKAGE - GROUP NUMBER:		PG-HDSOP-16-U04			
DIMENSIONS	MILLIMETERS		DIMENSIONS	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	2.25	2.35	e	1.20	
A1	0.01	0.16	e1	8.40	
b	0.60	0.80	L	1.40	1.60
c	0.40	0.60	P	2.90	3.10
D	9.70	10.10	aaa	0.25	
D1	9.46		bbb	0.02	
D2	8.20	8.40	ccc	0.10	
D3	---	0.15			
E	14.80	15.20			
E1	10.00	10.30			
E2	5.57	5.77			

NOTES:
ALL METAL SURFACES TIN PLATED EXCEPT AREA OF CUT

Figure 1 Outline PG-HDSOP-16, dimensions in mm

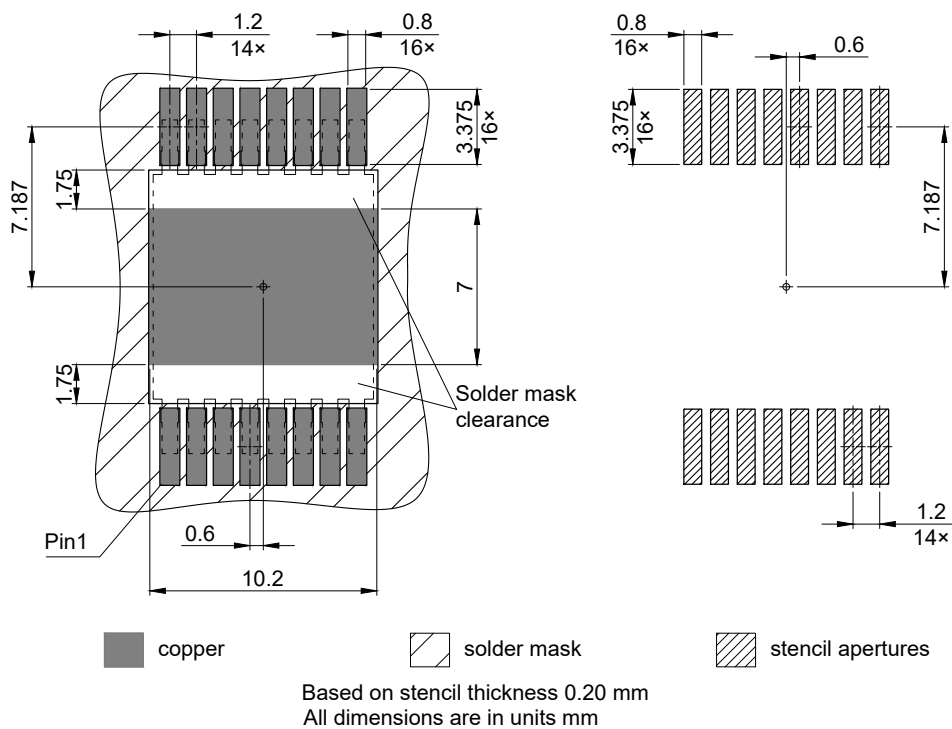
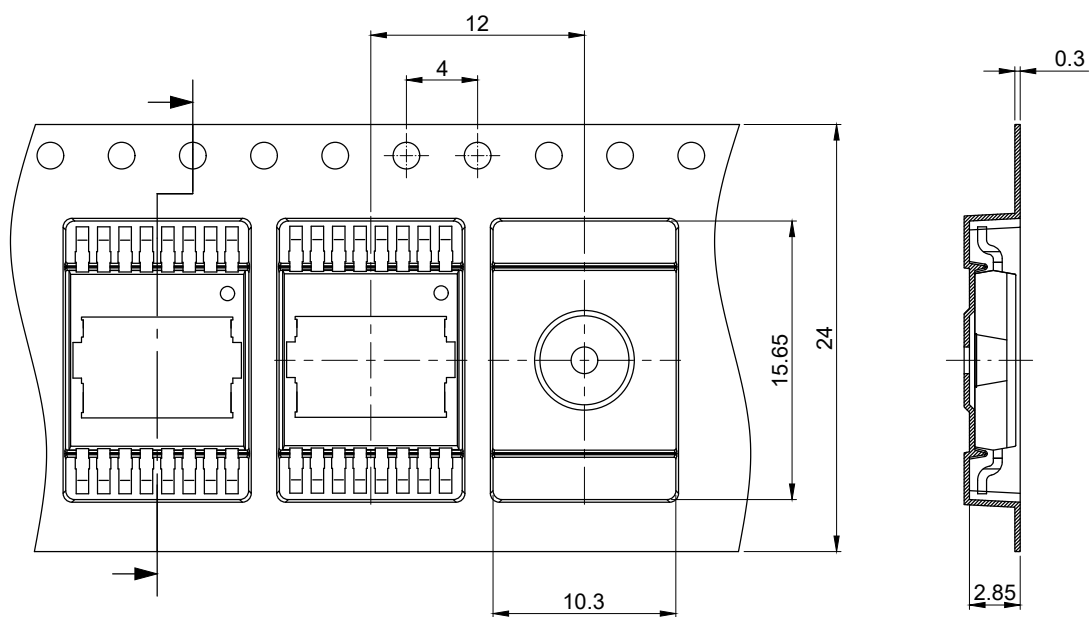


Figure 2 Outline PG-HDSOP-16, dimensions in mm



All dimensions are in units mm


The drawing is in compliance with ISO 128-30, Projection Method 1 []

Figure 3 Outline PG-HDSOP-16, dimensions in mm

Revision History

IPTC039N15NM5

Revision 2024-06-11, Rev. 2.2

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2022-05-05	Release of final version
2.1	2023-03-08	Update Coss max
2.2	2024-06-11	Update Rg

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