

MOSFET

OptiMOS™ 7 Power-Transistor, 40 V

Features

- N-channel
- 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

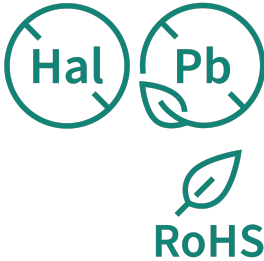
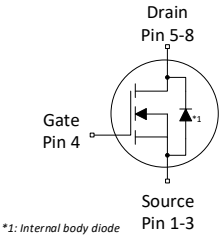
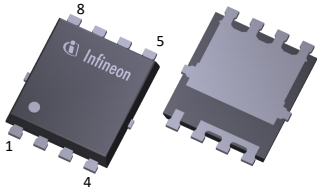
Product validation

Fully qualified according to JEDEC for Industrial Applications

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	40	V
$R_{DS(on),max}$	0.42	mΩ
I_D	541	A
Q_{oss}	167	nC
Q_G	79	nC

PG-TDSON-8



Type/Ordering Code	Package	Marking	Related Links
ISCH42N04LM7	PG-TDSON-8	42N04LM7	-



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1 Maximum ratings

at $T_A=25\text{ °C}$, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Continuous drain current ¹⁾	I_D	-	-	541 383 323 61	A	$V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$, $T_A=25\text{ °C}$, $R_{thJA}=50\text{ °C/W}$ ²⁾
Pulsed drain current ³⁾	$I_{D,pulse}$	-	-	2164	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse ⁴⁾	E_{AS}	-	-	899	mJ	$I_D=50\text{ A}$, $R_{GS}=25\text{ }\Omega$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	234 3.0	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$, $R_{thJA}=50\text{ °C/W}$ 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, bottom	R_{thJC}	-	-	0.64	°C/W	-
Thermal resistance, junction - case, top	R_{thJC}	-	-	20	°C/W	-
Thermal resistance, junction - ambient, 6 cm ² cooling area ⁵⁾	R_{thJA}	-	-	50	°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

at $T_j=25\text{ °C}$, 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	$V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	1.2	1.5	1.8	V	$V_{DS}=V_{GS}$, $I_D=130\text{ }\mu\text{A}$
Zero gate voltage drain current	I_{DSS}	-	0.1 10	1 100	μA	$V_{DS}=40\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$ $V_{DS}=40\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ °C}$
Gate-source leakage current	I_{GSS}	-	10	100	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	0.39 0.48	0.42 0.59	m Ω	$V_{GS}=10\text{ V}$, $I_D=50\text{ A}$ $V_{GS}=4.5\text{ V}$, $I_D=25\text{ A}$
Gate resistance	R_G	-	0.9	-	Ω	-
Transconductance	g_{fs}	160	320	-	S	$ V_{DS} \geq 2 I_D R_{DS(on)max}$, $I_D=50\text{ A}$

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Input capacitance ⁶⁾	C_{iss}	-	10000	13000	pF	$V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$
Output capacitance ⁶⁾	C_{oss}	-	4600	6000	pF	$V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance ⁶⁾	C_{rss}	-	140	240	pF	$V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	13	-	ns	$V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=50\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Rise time	t_r	-	7	-	ns	$V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=50\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	70	-	ns	$V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=50\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Fall time	t_f	-	22	-	ns	$V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=50\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$

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

Table 6 Gate charge characteristics ⁷⁾

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	25	-	nC	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	16	-	nC	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate to drain charge ⁸⁾	Q_{gd}	-	26	39	nC	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Switching charge	Q_{sw}	-	35	-	nC	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total ⁸⁾	Q_g	-	79	99	nC	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	2.5	-	V	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total ⁸⁾	Q_g	-	156	207	nC	$V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Output charge ⁸⁾	Q_{oss}	-	167	222	nC	$V_{DS}=20\text{ V}$, $V_{GS}=0\text{ V}$

⁷⁾ See "Gate charge waveforms" for parameter definition

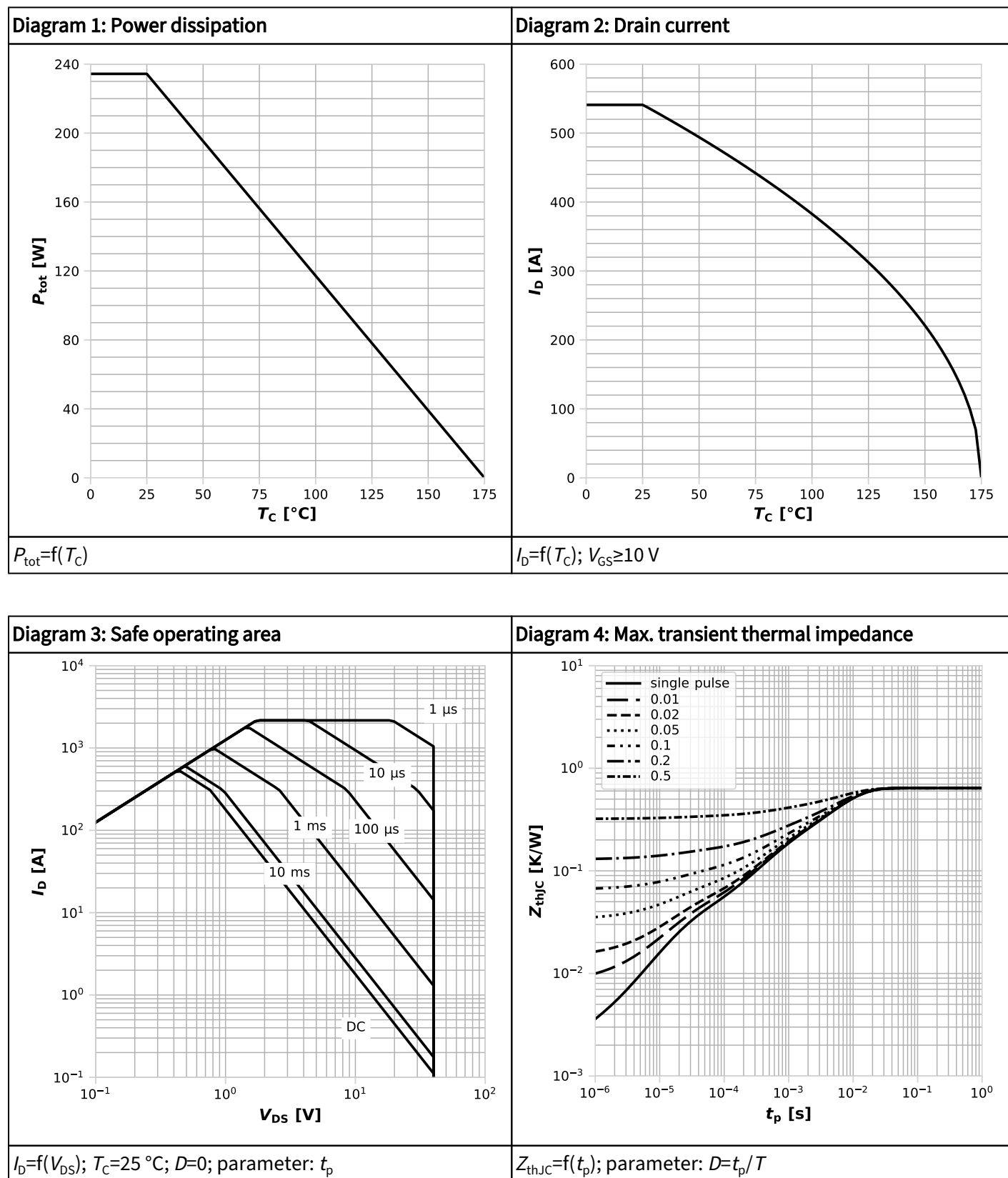
⁸⁾ Defined by design. Not subject to production test.

Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	235	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	2164	A	$T_C=25\text{ °C}$
Diode forward voltage	V_{SD}	-	0.76	1.0	V	$V_{GS}=0\text{ V}$, $I_F=50\text{ A}$, $T_J=25\text{ °C}$
Reverse recovery time ⁹⁾	t_{rr}	-	55	110	ns	$V_R=20\text{ V}$, $I_F=50\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge ⁹⁾	Q_{rr}	-	70	140	nC	$V_R=20\text{ V}$, $I_F=50\text{ A}$, $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery time ⁹⁾	t_{rr}	-	36	72	ns	$V_R=20\text{ V}$, $I_F=50\text{ A}$, $di_F/dt=1000\text{ A}/\mu\text{s}$
Reverse recovery charge ⁹⁾	Q_{rr}	-	348	696	nC	$V_R=20\text{ V}$, $I_F=50\text{ A}$, $di_F/dt=1000\text{ A}/\mu\text{s}$

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

4 Electrical characteristics diagrams



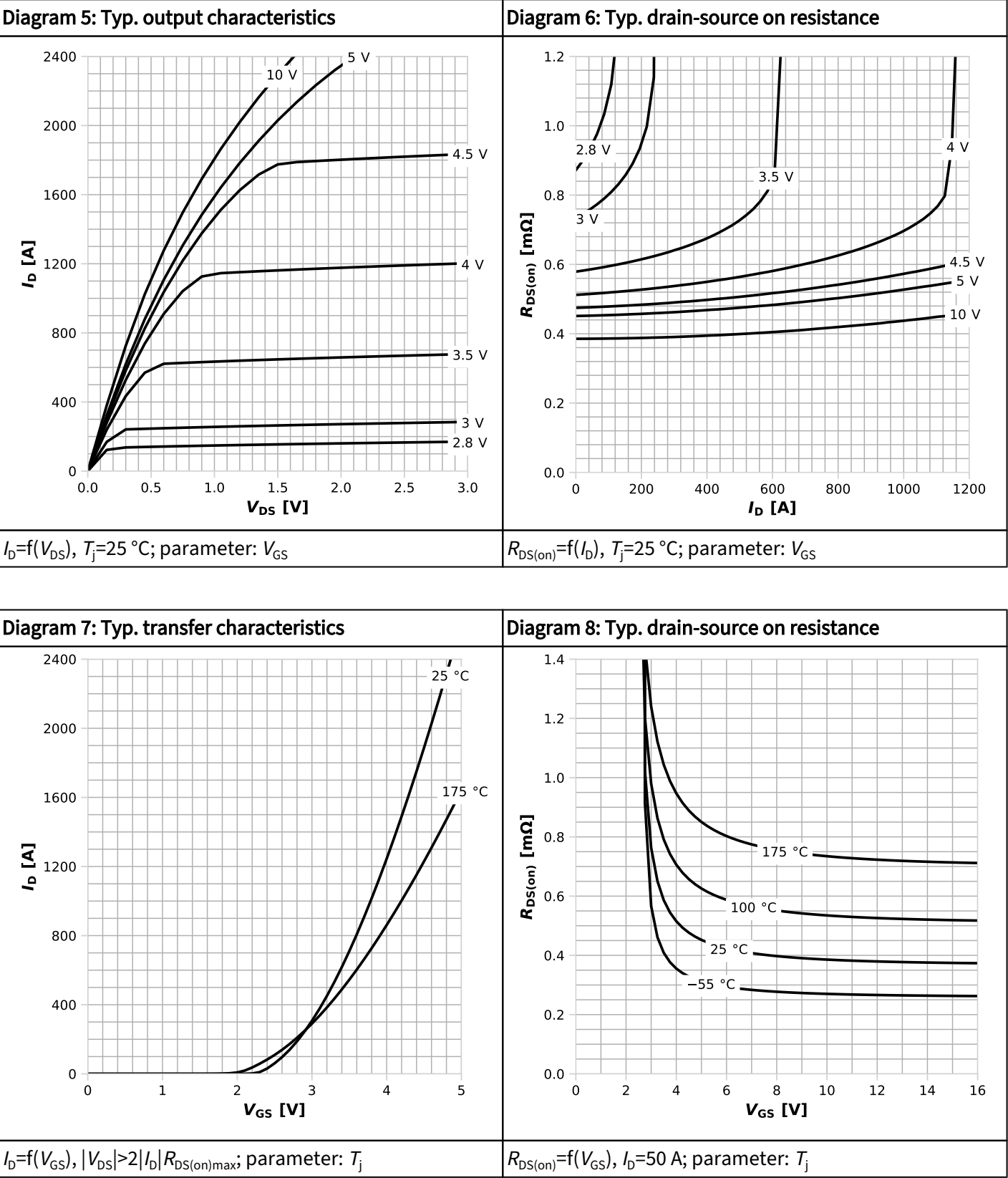
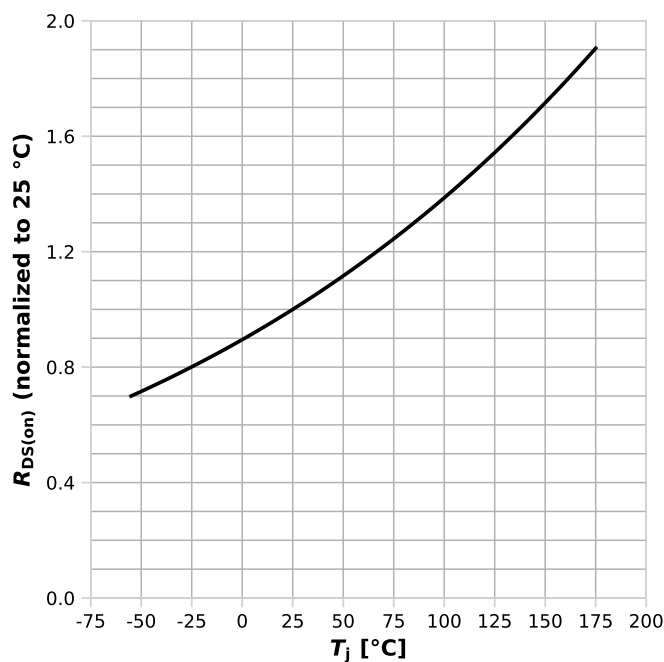
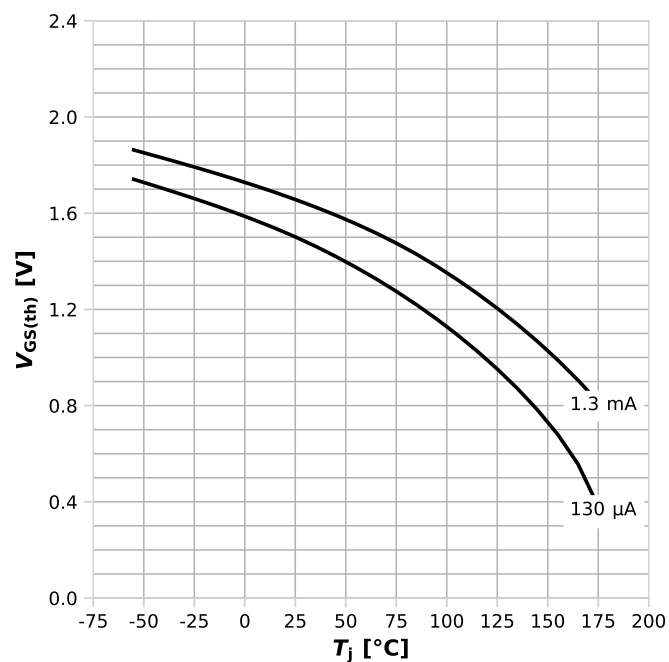


Diagram 9: Normalized drain-source on resistance



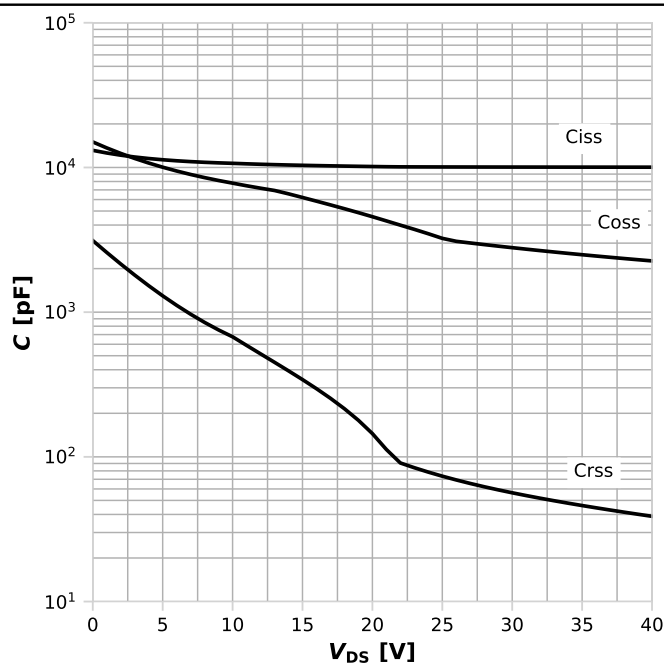
$$R_{DS(on)} = f(T_j), I_D = 50 \text{ A}, V_{GS} = 10 \text{ V}$$

Diagram 10: Typ. gate threshold voltage



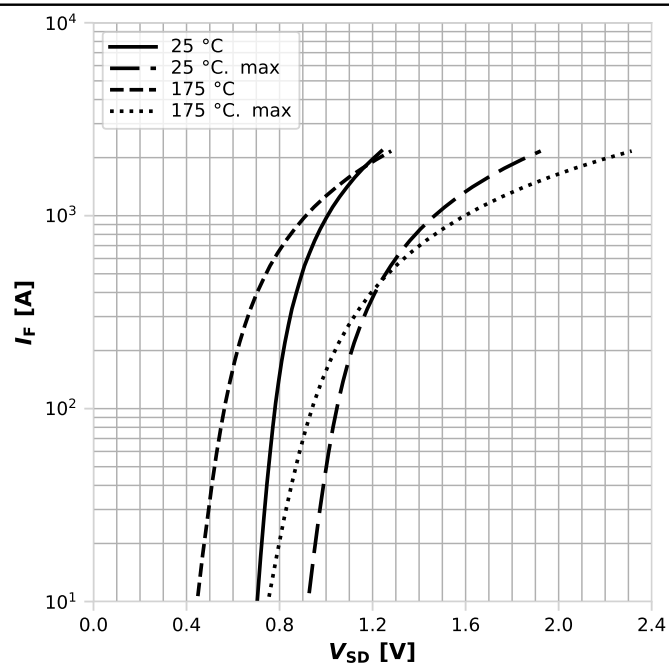
$$V_{GS(th)} = f(T_j), V_{GS} = V_{DS}; \text{ parameter: } I_D$$

Diagram 11: Typ. capacitances



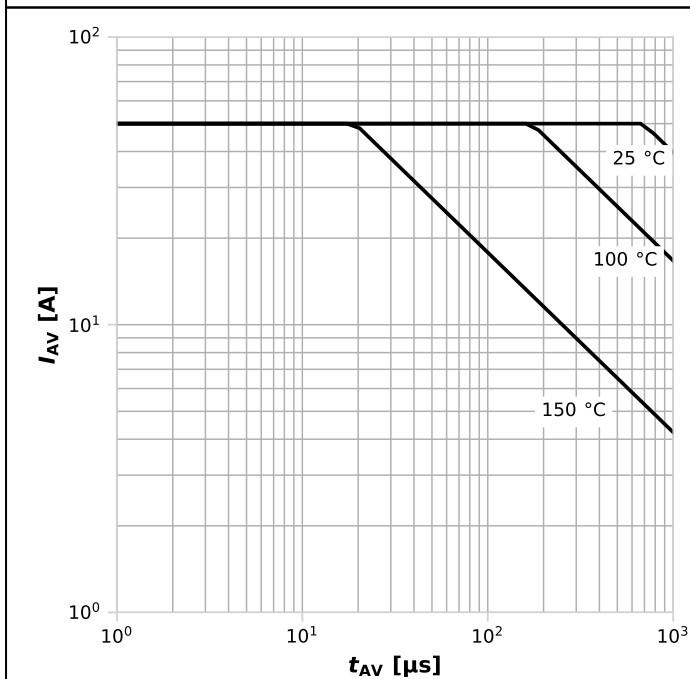
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$

Diagram 12: Forward characteristics of reverse diode



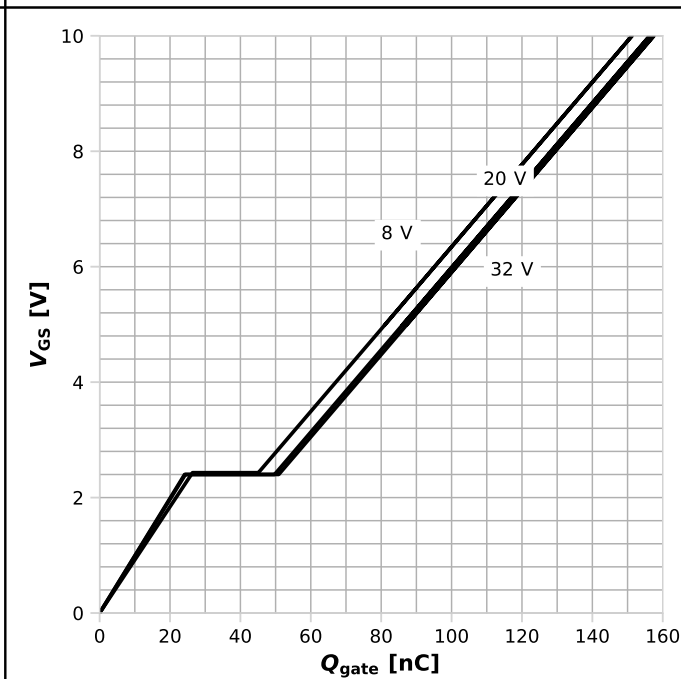
$$I_F = f(V_{SD}); \text{ parameter: } T_j$$

Diagram 13: Avalanche characteristics



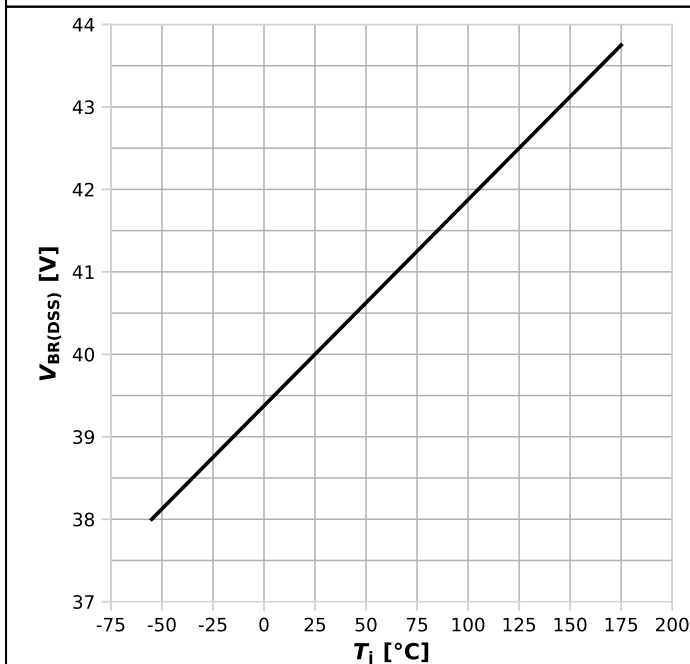
$I_{AS}=f(t_{AV})$; $R_{GS}=25\ \Omega$; parameter: $T_{j,start}$

Diagram 14: Typ. gate charge



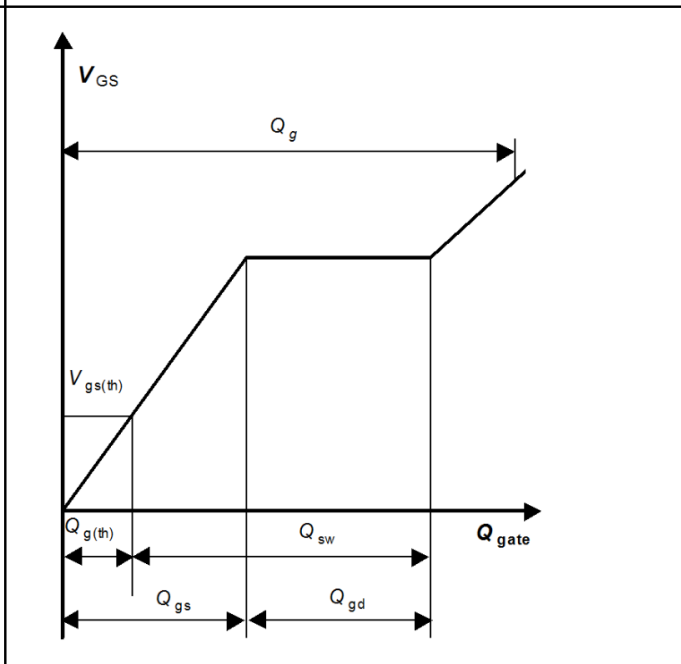
$V_{GS}=f(Q_{gate})$, $I_D=50\text{ A}$ pulsed, $T_j=25\text{ °C}$; parameter: V_{DD}

Diagram 15: Min. drain-source breakdown voltage



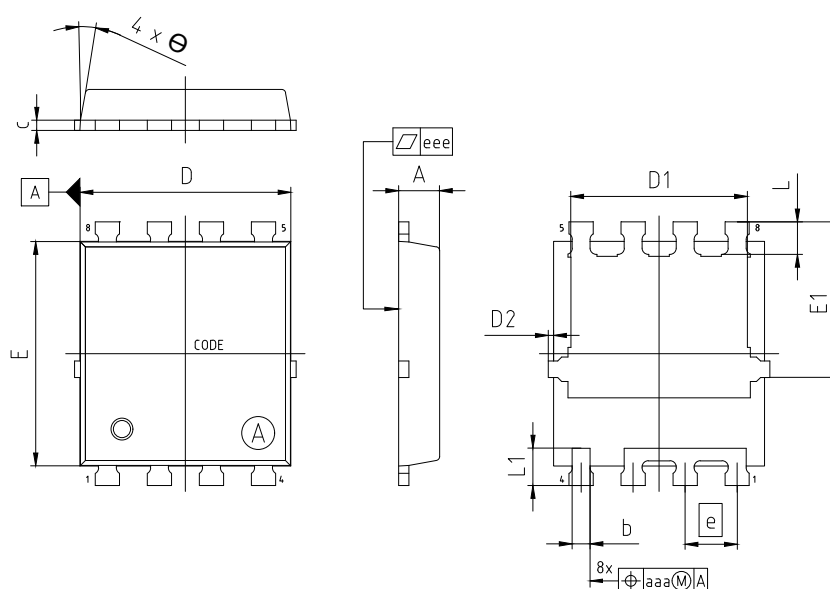
$V_{BR(DSS)}=f(T_j)$; $I_D=1\text{ mA}$

Gate charge waveforms



-

5 Package Outlines



PACKAGE - GROUP NUMBER: PG-TDSON-8-U02		
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	0.90	1.10
b	0.34	0.54
c	0.15	0.35
D	5.05	5.25
D1	4.20	4.40
D2	0.00	0.23
E	5.38	5.58
E1	3.70	3.90
e	1.27	
L	0.70	0.90
L1	0.81	1.01
Θ	8°	12°
aaa	0.25	
eee	0.03	

NOTES:

- 1) EXCLUDED MOLD FLASH
- 2) REMOVAL ON MOLD GATE:
INTRUSION 0.1mm
PROTRUSION 0.1mm
- 3) LEAD LENGTH UP TO ANTI FLASH LINE
- 4) ALL METAL SURFACES ARE PLATED,
EXCEPT AREA OF CUT

Figure 1 Outline PG-TDSON-8, dimensions in mm

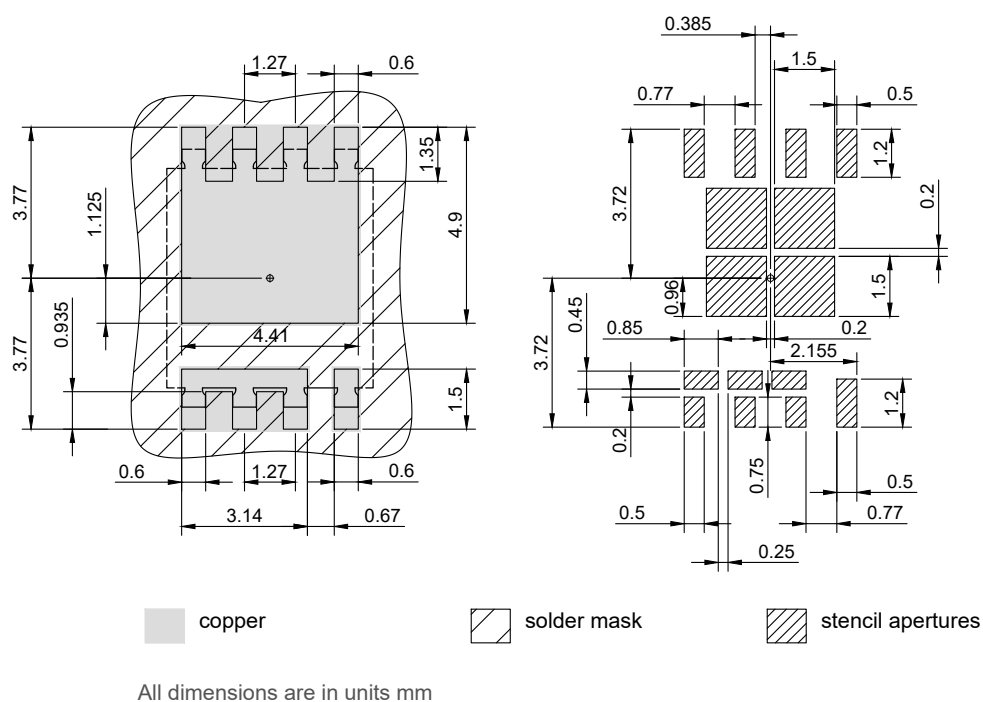
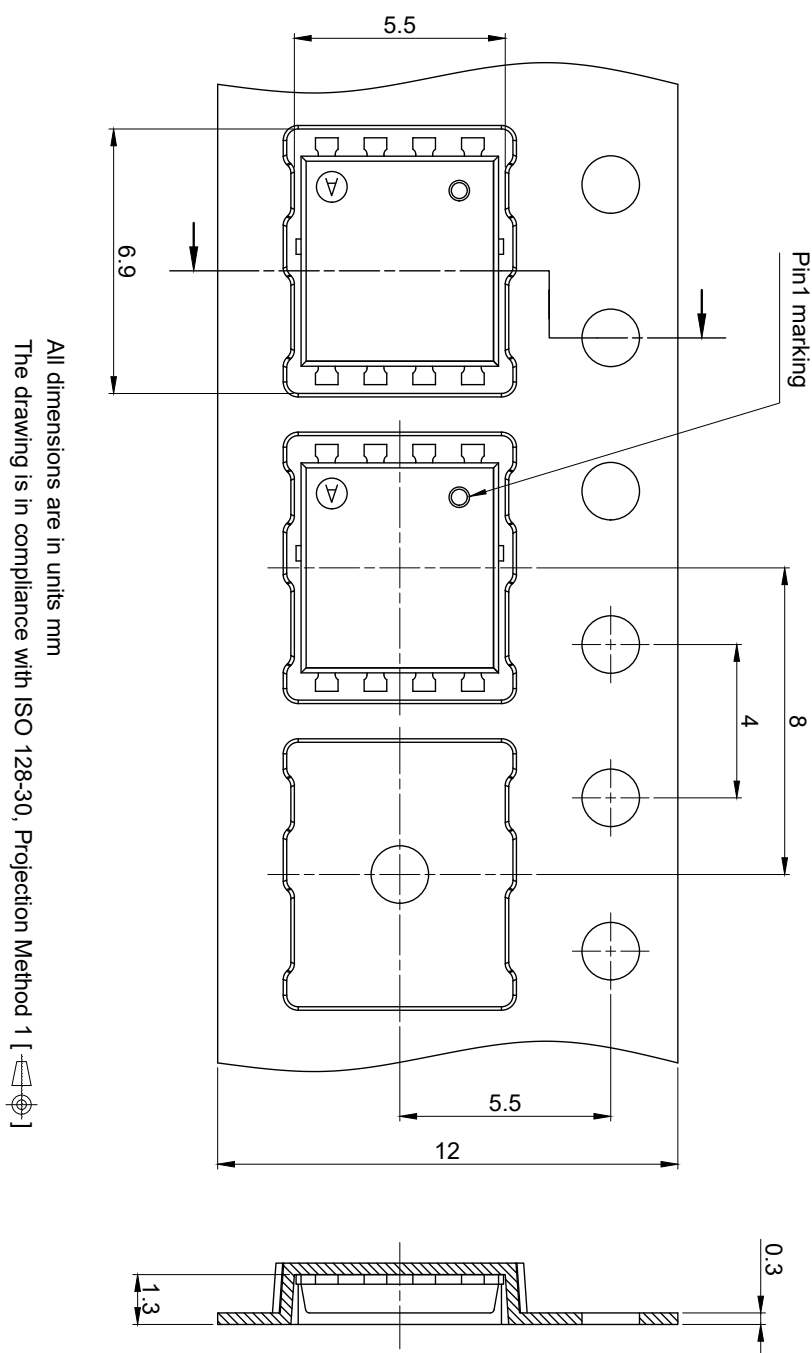


Figure 2 Outline PG-TDSON-8, dimensions in mm

**Figure 3** Outline PG-TDSON-8, dimensions in mm

Revision History

ISCH42N04LM7

Revision 2024-04-24, Rev. 2.0

Previous Revision

Revision	Date	Subjects (major changes since last revision)
0.9	2024-04-08	Release of target version
2.0	2024-04-24	Release of final

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