

# MOSFET

## OptiMOS™ Power-Transistor, 60 V

### Features

- Optimized for high performance SMPS, e.g. sync. rec.
- 175°C rated
- 100% avalanche tested
- Superior thermal resistance
- N-channel
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

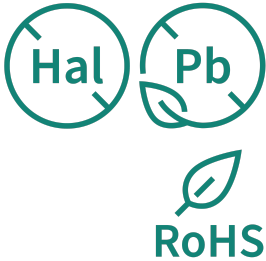
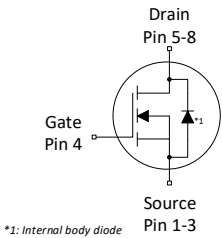
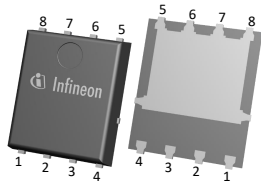
### Product validation

Fully qualified according to JEDEC for Industrial Applications

Table 1 Key Performance Parameters

Parameter	Value	Unit
$V_{DS}$	60	V
$R_{DS(on),max}$	2.8	mΩ
$I_D$	137	A
$Q_{oss}$	43	nC
$Q_G(0..10V)$	37	nC

PG-TDSON-8



Type/Ordering Code	Package	Marking	Related Links
BSC028N06NS	PG-TDSON-8	028N06NS	-



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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 <sup>1)</sup>	$I_D$	-	-	137 97 24	A	$V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$ , $T_A=25\text{ °C}$ , $R_{thJA}=50\text{K/W}$ <sup>2)</sup>
Pulsed drain current <sup>3)</sup>	$I_{D,pulse}$	-	-	548	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse <sup>4)</sup>	$E_{AS}$	-	-	100	mJ	$I_D=50\text{ A}$ , $R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-20	-	20	V	-
Power dissipation	$P_{tot}$	-	-	100 3.0	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$ , $R_{thJA}=50\text{ K/W}$ <sup>3)</sup>
Operating and storage temperature	$T_j$ , $T_{stg}$	-55	-	175	°C	-

<sup>1)</sup> Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature at 25°C. For higher case temperature please refer to Diagram 2. De-rating will be required based on the actual environmental conditions.

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

<sup>3)</sup> See Diagram 3 for more detailed information

<sup>4)</sup> 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	$R_{thJC}$	-	0.9	1.5	K/W	-
Thermal resistance, junction - case, top	$R_{thJC}$	-	-	20	K/W	-
Device on PCB, 6 cm <sup>2</sup> cooling area <sup>5)</sup>	$R_{thJA}$	-	-	50	K/W	-

<sup>5)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (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	$V_{(BR)DSS}$	60	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	2.1	2.8	3.3	V	$V_{DS}=V_{GS}$ , $I_D=50\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	0.5 10	1 100	$\mu\text{A}$	$V_{DS}=60\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ }^\circ\text{C}$ $V_{DS}=60\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ }^\circ\text{C}$
Gate-source leakage current	$I_{GSS}$	-	10	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	2.3 3.4	2.8 4.2	m $\Omega$	$V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ $V_{GS}=6\text{ V}$ , $I_D=12.5\text{ A}$
Gate resistance <sup>6)</sup>	$R_G$	-	1.3	1.95	$\Omega$	-
Transconductance	$g_{fs}$	50	100	-	S	$ V_{DS} >2 I_D R_{DS(on)max}$ , $I_D=50\text{ A}$

<sup>6)</sup> Defined by design. Not subject to production test

**Table 5 Dynamic characteristics <sup>7)</sup>**

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Input capacitance	$C_{iss}$	2025	2700	3375	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$
Output capacitance	$C_{oss}$	495	660	825	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$
Reverse transfer capacitance	$C_{rss}$	8.5	28	56	pF	$V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	11	22	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=3\text{ }\Omega$
Rise time	$t_r$	-	38	57	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=3\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	19	38	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=3\text{ }\Omega$
Fall time	$t_f$	-	8	16	ns	$V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=50\text{ A}$ , $R_{G,ext}=3\text{ }\Omega$

<sup>7)</sup> Defined by design. Not subject to production test

**Table 6 Gate charge characteristics <sup>8)</sup>**

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	9	12	16.5	nC	$V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	6	8	11	nC	$V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge	$Q_{gd}$	5	7	10.3	nC	$V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Switching charge	$Q_{sw}$	8	12	17	nC	$V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total	$Q_g$	31	37	49	nC	$V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	4.0	4.6	5.2	V	$V_{DD}=30\text{ V}$ , $I_D=50\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	27	33	43	nC	$V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }10\text{ V}$

**Table 6 Gate charge characteristics** <sup>8)</sup>

Parameter	Symbol	Values			Unit	Note/ Test Condition
		Min.	Typ.	Max.		
Output charge	$Q_{oss}$	32	43	54	nC	$V_{DD}=30\text{ V}$ , $V_{GS}=0\text{ V}$

<sup>8)</sup> See "Gate charge waveforms" for parameter definition. 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	$I_S$	-	-	91	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	548	A	$T_C=25\text{ °C}$
Diode forward voltage	$V_{SD}$	-	0.9	1.2	V	$V_{GS}=0\text{ V}$ , $I_F=50\text{ A}$ , $T_J=25\text{ °C}$
Reverse recovery time <sup>9)</sup>	$t_{rr}$	14	35	56	ns	$V_R=30\text{ V}$ , $I_F=50\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge <sup>9)</sup>	$Q_{rr}$	14	29	58	nC	$V_R=30\text{ V}$ , $I_F=50\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$

<sup>9)</sup> Defined by design. Not subject to production test

## 4 Electrical characteristics diagrams

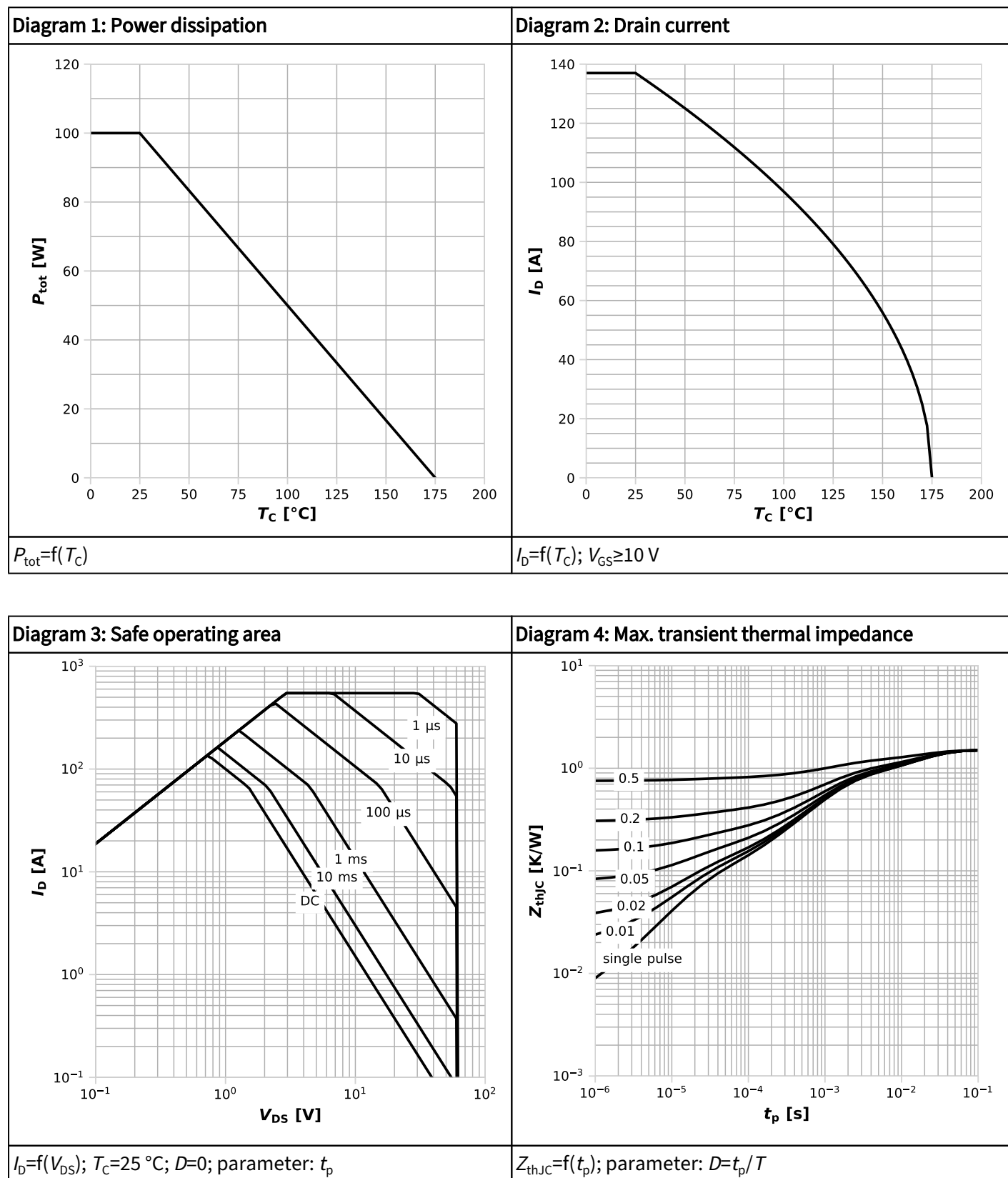
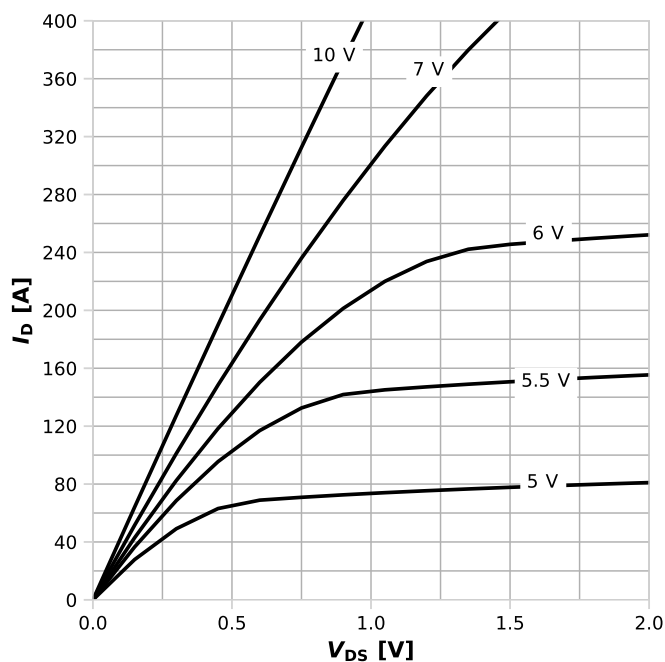
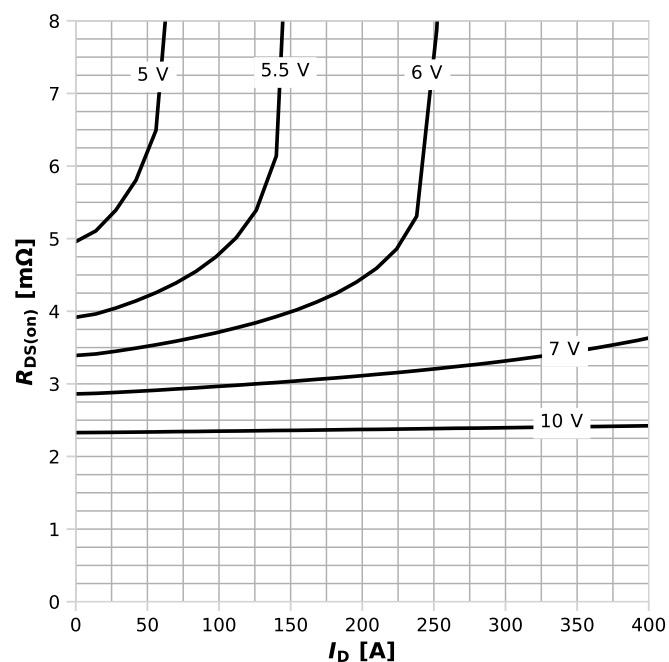


Diagram 5: Typ. output characteristics



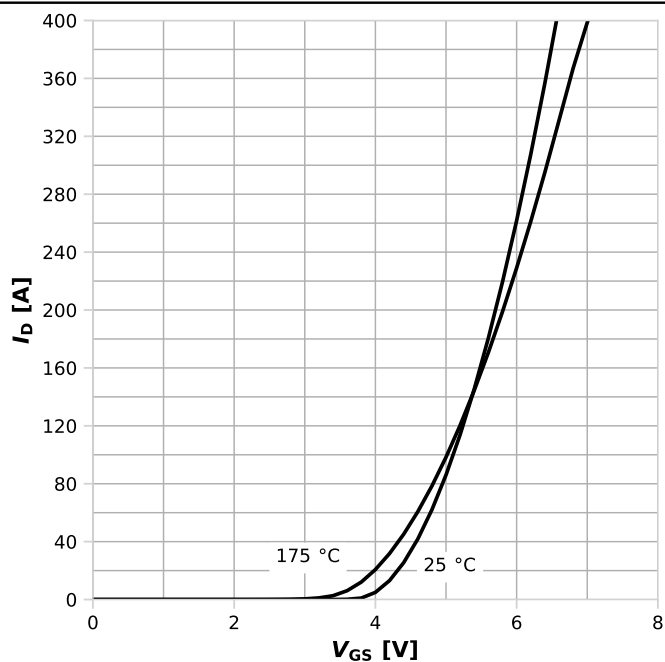
$I_D = f(V_{DS})$ ;  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



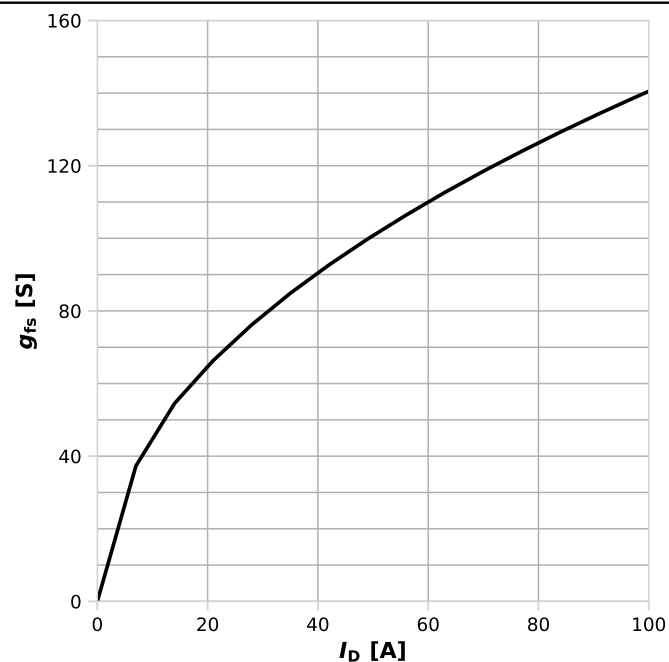
$R_{DS(on)} = f(I_D)$ ;  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



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

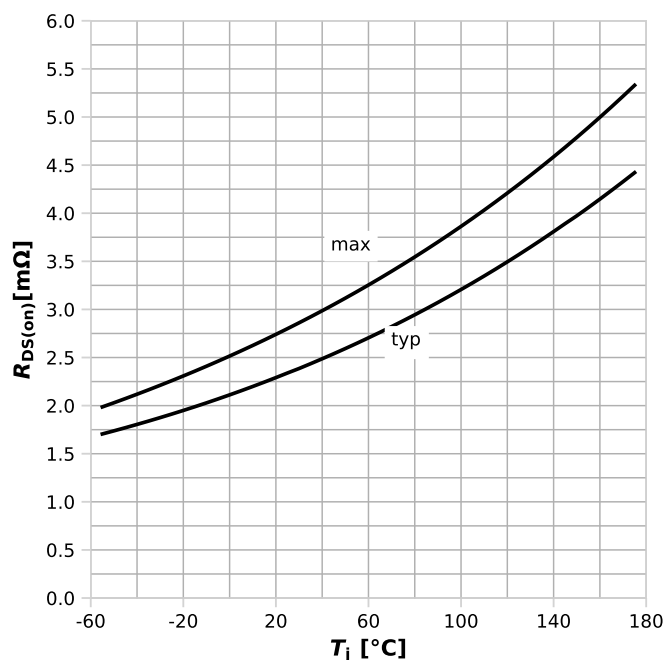
Diagram 8: Typ. forward transconductance



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

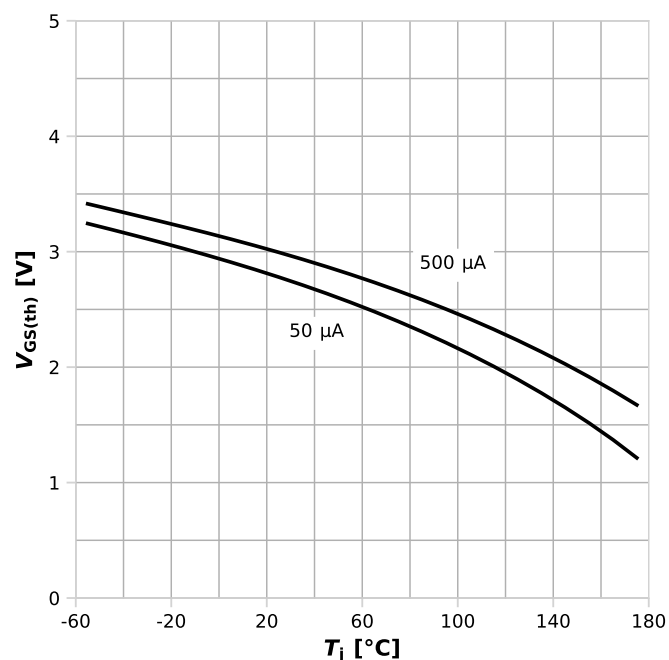


**Diagram 9: Drain-source on-state resistance**



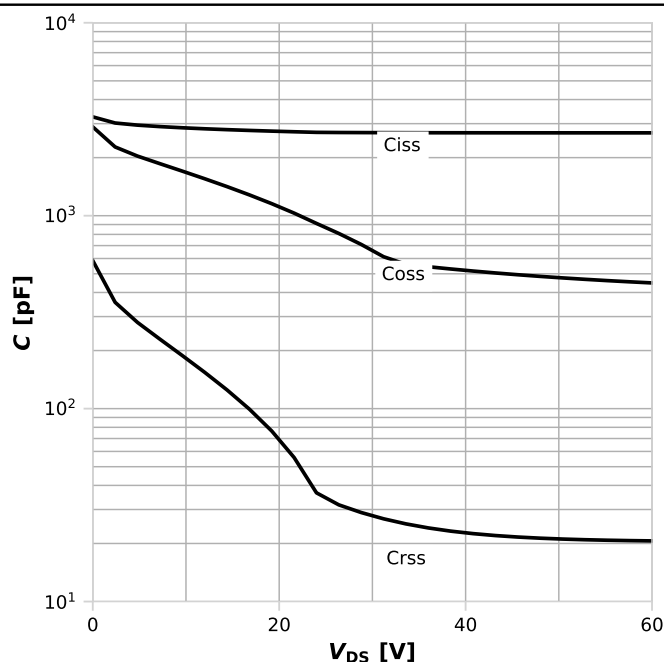
$$R_{DS(on)} = f(T_j); I_D = 50 \text{ A}; V_{GS} = 10 \text{ V}$$

**Diagram 10: Typ. gate threshold voltage**



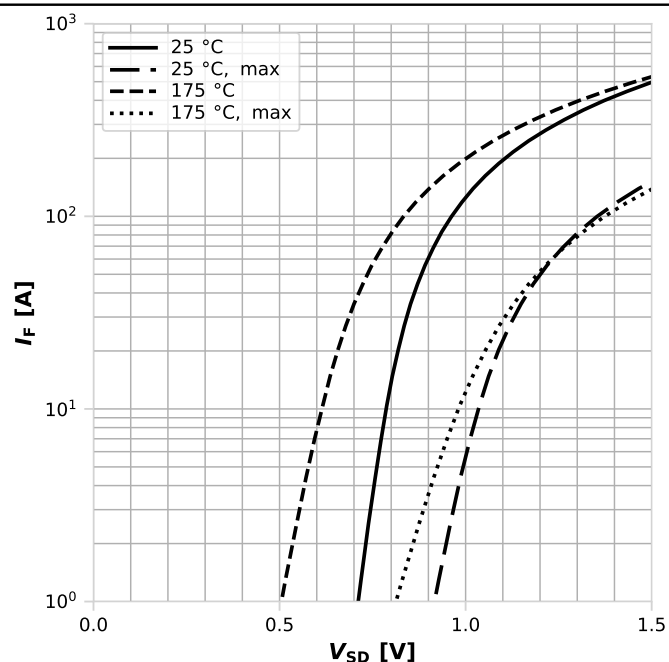
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

**Diagram 11: Typ. capacitances**

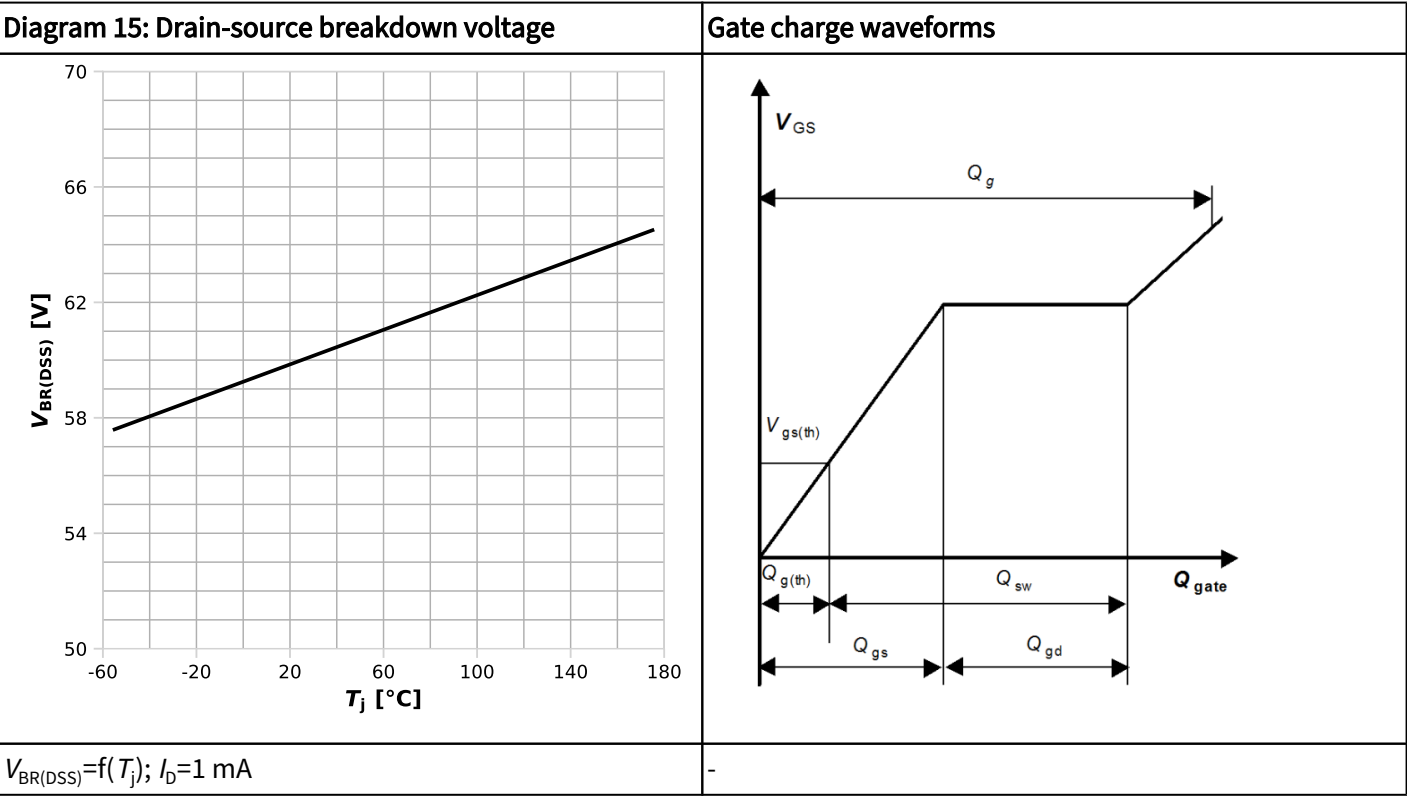
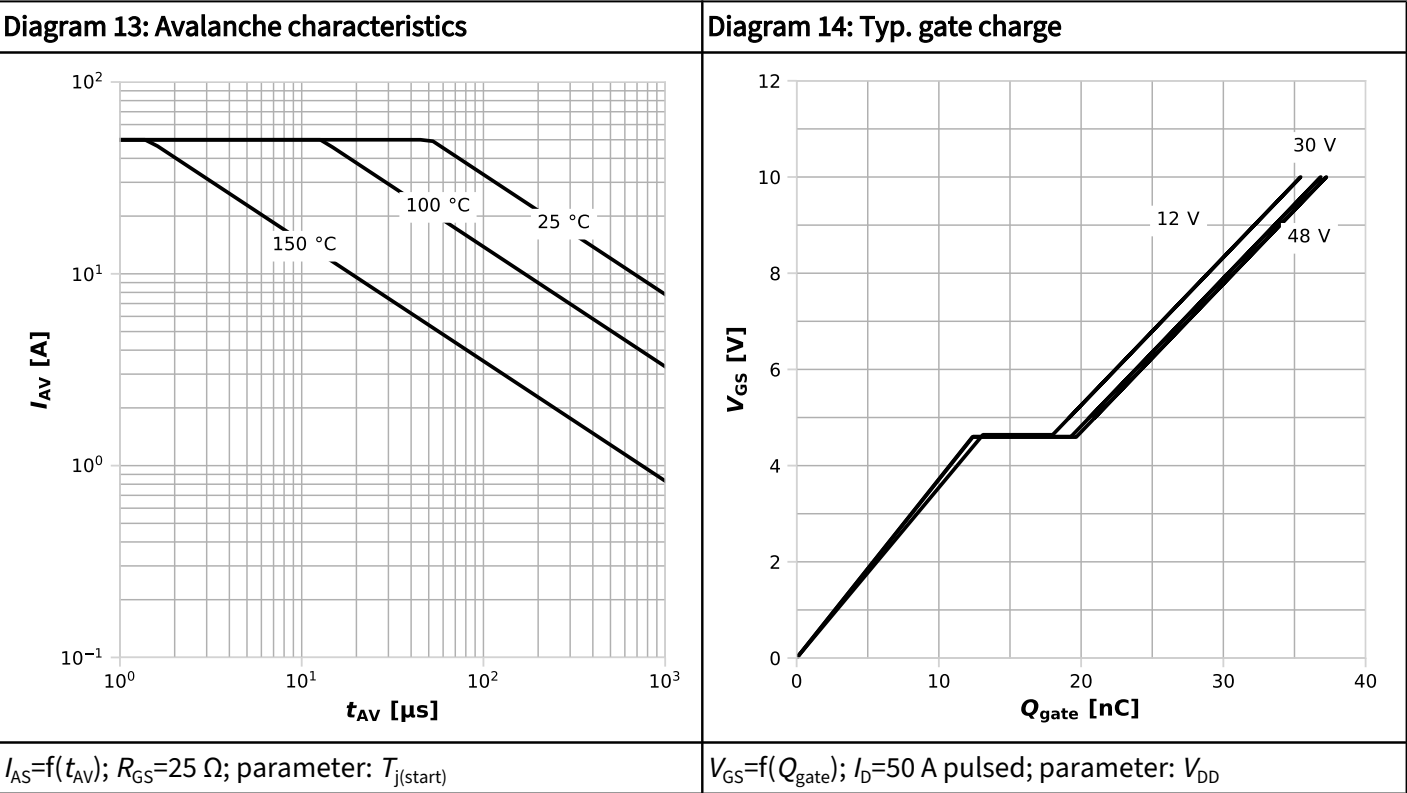


$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$

**Diagram 12: Forward characteristics of reverse diode**



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



## 5 Package Outlines

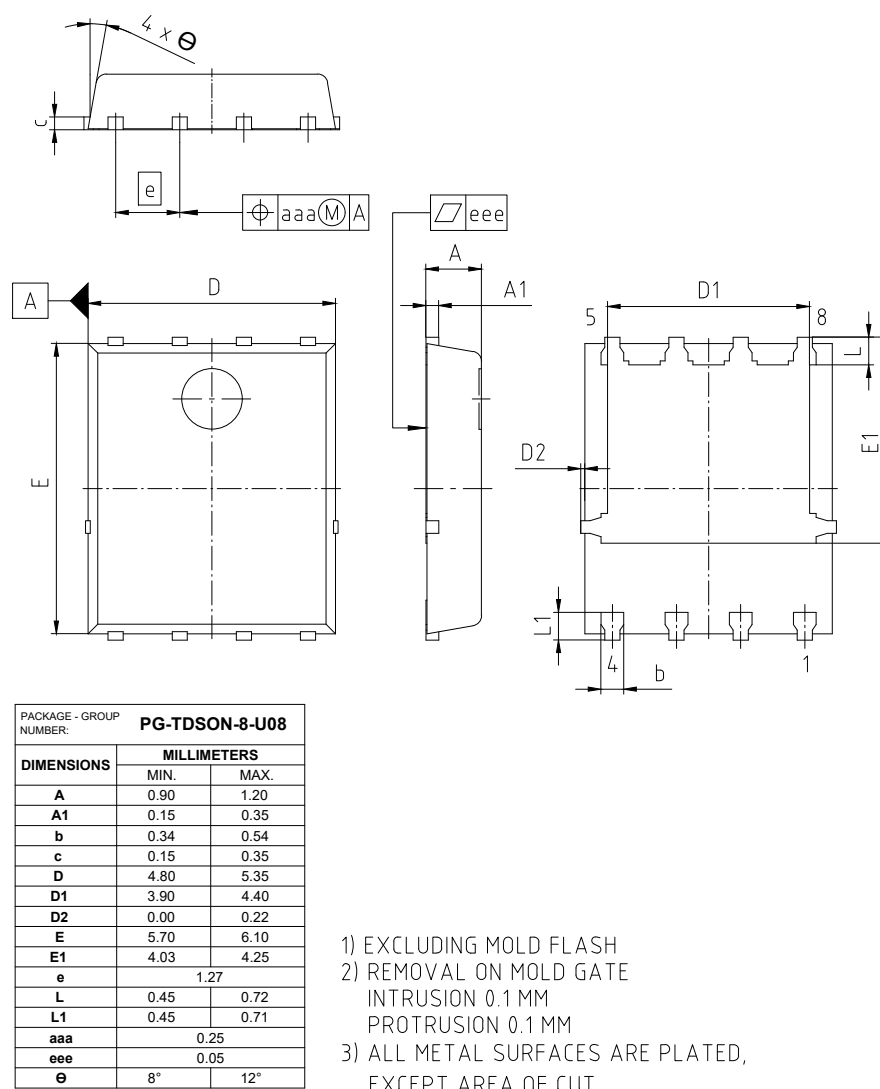


Figure 1 Outline PG-TDSON-8, dimensions in mm

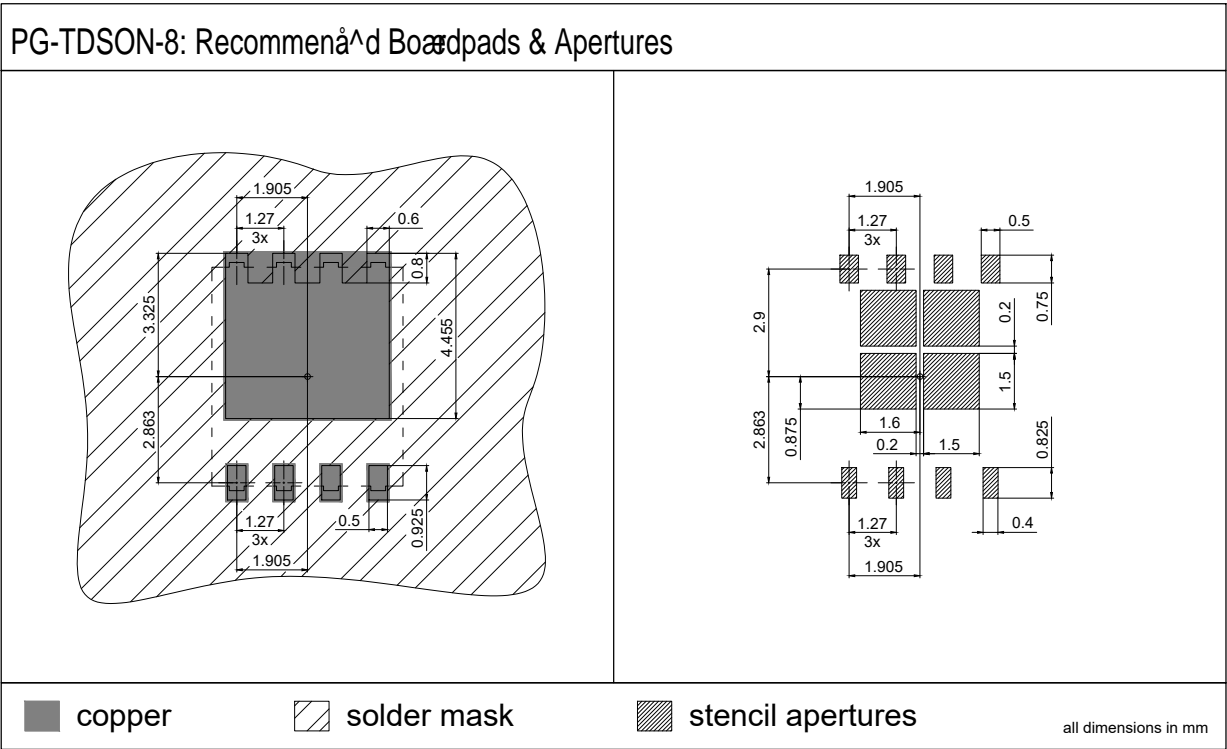
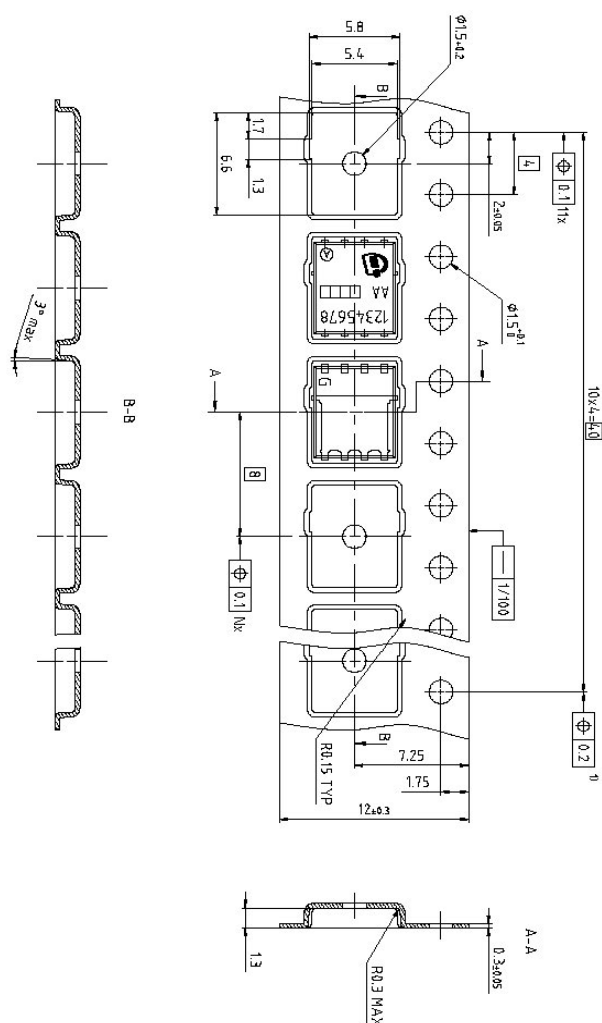


Figure 2 Outline PG-TDSON-8, dimensions in mm



Dimension in mm

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

## Revision History

BSC028N06NS

### Revision 2024-06-11, Rev. 2.6

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.3	2014-11-10	Added RthJC_typ, updated outline and footprint drawings, insert footnote "Defined by design...."
2.4	2020-02-04	Update package drawings
2.5	2020-09-21	Update current rating
2.6	2024-06-11	Upgrade Operating and storage temperature max to 175°C . Update drawings in section 5 Package Outlines. Production validation added on page1. Update Is max and Is Pulse Max.

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