



BSG0811ND

## Power Block

## Features

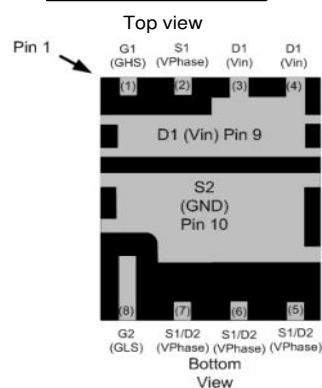
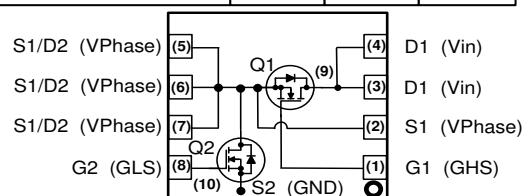
- Dual asymmetric N-channel OptiMOS™5 MOSFET
- Logic level (4.5V rated)
- Optimized for high performance buck converters
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21



| Type      | Package     | Marking |
|-----------|-------------|---------|
| BSG0811ND | PG-TISON8-4 | 0811ND  |

## Product Summary

|                  | Q1                    | Q2 |    |
|------------------|-----------------------|----|----|
| $V_{DS}$         | 25                    | 25 | V  |
| $R_{DS(on),max}$ | $V_{GS}=10\text{ V}$  | 3  | mΩ |
|                  | $V_{GS}=4.5\text{ V}$ | 4  |    |
| $I_D$            | 50                    | 50 | A  |

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

| Parameter                           | Symbol         | Conditions                                                                 | Value       |      | Unit |
|-------------------------------------|----------------|----------------------------------------------------------------------------|-------------|------|------|
|                                     |                |                                                                            | Q1          | Q2   |      |
| Continuous drain current            | $I_D$          | $T_C=70\text{ °C}$ , $V_{GS}=10\text{ V}$                                  | 50          | 50   | A    |
|                                     |                | $T_C=70\text{ °C}$ , $V_{GS}=4.5\text{ V}$                                 | 50          | 50   |      |
|                                     |                | $T_A=25\text{ °C}$ , $V_{GS}=4.5\text{ V}^{3)}$                            | 31          | 50   |      |
|                                     |                | $T_A=25\text{ °C}$ , $V_{GS}=4.5\text{ V}^{4)}$                            | 19          | 41   |      |
| Pulsed drain current                | $I_{D,pulse}$  | $T_C=70\text{ °C}$                                                         | 160         | 160  |      |
| Avalanche energy, single pulse      | $E_{AS}$       | Q1: $I_D=10\text{ A}$ ,<br>Q2: $I_D=20\text{ A}$ ,<br>$R_{GS}=25\text{ Ω}$ | 30          | 160  | mJ   |
| Gate source voltage                 | $V_{GS}$       |                                                                            | $\pm 16$    |      | V    |
| Power dissipation                   | $P_{tot}$      | $T_A=25\text{ °C}^{3)}$                                                    | 6.25        | 6.25 | W    |
|                                     |                | $T_A=25\text{ °C}^{4)}$                                                    | 2.5         | 2.5  |      |
| Operating and storage temperature   | $T_j, T_{stg}$ |                                                                            | -55 ... 150 |      | °C   |
| IEC climatic category; DIN IEC 68-1 |                |                                                                            | 55/150/56   |      |      |

<sup>1)</sup> J-STD20 and JESD22

| Parameter | Symbol | Conditions | Values |      |      | Unit |
|-----------|--------|------------|--------|------|------|------|
|           |        |            | min.   | typ. | max. |      |

### Thermal characteristics

|                                                      |    |            |                                              |   |   |     |     |
|------------------------------------------------------|----|------------|----------------------------------------------|---|---|-----|-----|
| Thermal resistance, junction - case                  | Q1 | $R_{thJC}$ |                                              | - | - | 4.3 | K/W |
|                                                      | Q2 |            |                                              | - | - | 1.8 |     |
| Thermal resistance, junction - ambient <sup>2)</sup> | Q1 | $R_{thJA}$ | application specific board <sup>3)</sup>     | - | - | 20  |     |
|                                                      | Q2 |            |                                              | - | - |     |     |
|                                                      | Q1 |            | 6 cm <sup>2</sup> cooling area <sup>4)</sup> | - | - | 50  |     |
|                                                      | Q2 |            |                                              | - | - |     |     |

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

### Static characteristics

|                                  |    |               |                                                                          |                  |     |     |               |
|----------------------------------|----|---------------|--------------------------------------------------------------------------|------------------|-----|-----|---------------|
| Drain-source breakdown voltage   | Q1 | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$                                     | 25 <sup>6)</sup> | -   | -   | V             |
|                                  | Q2 |               |                                                                          |                  |     |     |               |
| Gate threshold voltage           | Q1 | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=250\text{ }\mu\text{A}$                              | 1.2              | 1.6 | 2   |               |
|                                  | Q2 |               |                                                                          |                  |     |     |               |
| Zero gate voltage drain current  | Q1 | $I_{DSS}$     | $V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^{\circ}\text{C}$  | -                | -   | 1   | $\mu\text{A}$ |
|                                  | Q2 |               |                                                                          |                  |     |     |               |
|                                  | Q1 |               | $V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=150\text{ }^{\circ}\text{C}$ | -                | -   | 100 |               |
|                                  | Q2 |               |                                                                          |                  |     |     |               |
| 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 | $R_{DS(on)}$  | $V_{GS}=4.5\text{ V}, I_D=20\text{ A}$                                   | -                | 3.2 | 4.0 | m $\Omega$    |
|                                  | Q2 |               |                                                                          | -                | 0.9 | 1.1 |               |
|                                  | Q1 |               | $V_{GS}=10\text{ V}, I_D=20\text{ A}$                                    | -                | 2.4 | 3.0 |               |
|                                  | Q2 |               |                                                                          | -                | 0.7 | 0.8 |               |
| Gate resistance                  | Q1 | $R_G$         |                                                                          | -                | 0.7 | 1.2 | $\Omega$      |
|                                  | Q2 |               |                                                                          | -                | 0.7 | 1.2 |               |
| Transconductance                 | Q1 | $g_{fs}$      | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=20\text{ A}$                          | 46               | 93  | -   | S             |
|                                  | Q2 |               |                                                                          | 90               | 180 | -   |               |

<sup>2)</sup> Only one of both transistors active

<sup>3)</sup> 8 Layers copper 70 $\mu\text{m}$  thickness. PCB in still air.

<sup>4)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical in still air.



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| Parameter | Symbol | Conditions | Values |      |      | Unit |
|-----------|--------|------------|--------|------|------|------|
|           |        |            | min.   | typ. | max. |      |

## Dynamic characteristics

|                              |    |              |                                                                                                          |   |      |      |    |
|------------------------------|----|--------------|----------------------------------------------------------------------------------------------------------|---|------|------|----|
| Input capacitance            | Q1 | $C_{iss}$    | $V_{GS}=0\text{ V},$<br>$V_{DS}=12\text{ V}, f=1\text{ MHz}$                                             | - | 780  | 1100 | pF |
|                              | Q2 |              |                                                                                                          | - | 2700 | 3700 |    |
| Output capacitance           | Q1 | $C_{oss}$    |                                                                                                          | - | 390  | 520  |    |
|                              | Q2 |              |                                                                                                          | - | 1400 | 1900 |    |
| Reverse transfer capacitance | Q1 | $C_{rss}$    |                                                                                                          | - | 38   | -    |    |
|                              | Q2 |              |                                                                                                          | - | 130  | -    |    |
| Turn-on delay time           | Q1 | $t_{d(on)}$  | $V_{IN}=12\text{ V},$<br>$V_{DRV}=5\text{ V},$<br>$F_{SW}=500\text{ KHz},$<br>$I_{OUT}=30\text{ A}^{5)}$ | - | 4.3  | -    | ns |
|                              | Q2 |              |                                                                                                          | - | 5.6  | -    |    |
| Rise time                    | Q1 | $t_r$        |                                                                                                          | - | 4.7  | -    |    |
|                              | Q2 |              |                                                                                                          | - | 4.3  | -    |    |
| Turn-off delay time          | Q1 | $t_{d(off)}$ |                                                                                                          | - | 4.3  | -    |    |
|                              | Q2 |              |                                                                                                          | - | 8.8  | -    |    |
| Fall time                    | Q1 | $t_f$        |                                                                                                          | - | 1.4  | -    |    |
|                              | Q2 |              |                                                                                                          | - | 2.6  | -    |    |

## Gate Charge Characteristics

|                       |    |               |                                                                                  |   |     |     |    |
|-----------------------|----|---------------|----------------------------------------------------------------------------------|---|-----|-----|----|
| Gate to source charge | Q1 | $Q_{gs}$      | $V_{DD}=12\text{ V},$<br>$I_D=30\text{ A},$<br>$V_{GS}=0\text{ to }4.5\text{ V}$ | - | 2.0 | -   | nC |
| Gate to drain charge  |    | $Q_{gd}$      |                                                                                  | - | 1.4 | -   |    |
| Gate charge total     |    | $Q_g$         |                                                                                  | - | 5.6 | 8.4 |    |
| Gate plateau voltage  |    | $V_{plateau}$ |                                                                                  | - | 2.6 | -   | V  |
| Gate to source charge | Q2 | $Q_{gs}$      |                                                                                  | - | 6.4 | -   | nC |
| Gate to drain charge  |    | $Q_{gd}$      |                                                                                  | - | 4.7 | -   |    |
| Gate charge total     |    | $Q_g$         |                                                                                  | - | 20  | 29  |    |
| Gate plateau voltage  |    | $V_{plateau}$ |                                                                                  | - | 2.3 | -   | V  |
| Output charge         | Q1 | $Q_{oss}$     | $V_{DD}=12\text{ V}, V_{GS}=0\text{ V}$                                          | - | 8   | -   | nC |
|                       | Q2 |               |                                                                                  | - | 27  | -   |    |

<sup>5)</sup> For more information see application note n° TBD

<sup>6)</sup> The device can withstand a pulse of not more than 30 V for a duration of up to 2 ns at a frequency of 600 kHz with maximum buck converter input voltage  $V_{IN}=16\text{ V}$ .

| Parameter | Symbol | Conditions | Values |      |      | Unit |
|-----------|--------|------------|--------|------|------|------|
|           |        |            | min.   | typ. | max. |      |

**Reverse Diode**

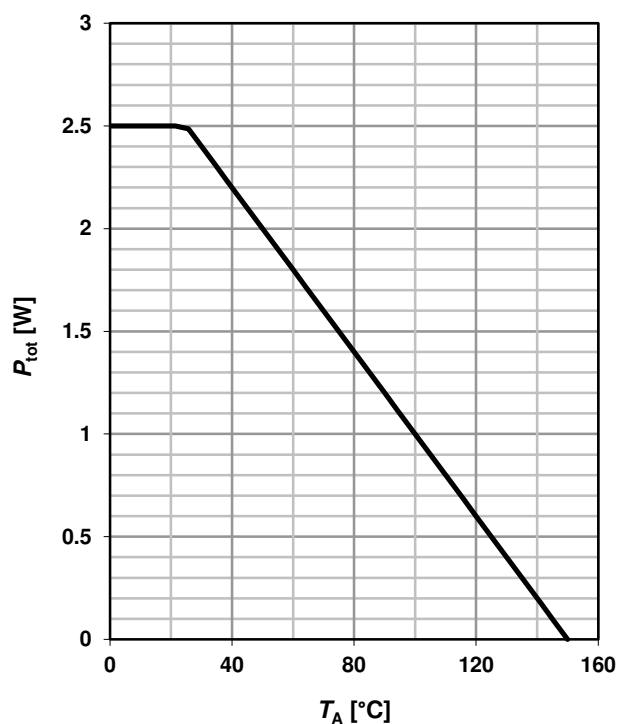
|                                  |    |               |                                                                   |   |      |     |    |
|----------------------------------|----|---------------|-------------------------------------------------------------------|---|------|-----|----|
| Diode continuous forward current | Q1 | $I_S$         | $T_C=25\text{ °C}$                                                | - | -    | 29  | A  |
|                                  | Q2 |               |                                                                   | - | -    | 50  |    |
| Diode pulse current              | Q1 | $I_{S,pulse}$ |                                                                   | - | -    | 160 |    |
|                                  | Q2 |               |                                                                   | - | -    | 160 |    |
| Diode forward voltage            | Q1 | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=20\text{ A},$<br>$T_j=25\text{ °C}$       | - | 0.84 | 1   | V  |
|                                  | Q2 |               |                                                                   | - | 0.77 | 1   |    |
| Reverse recovery charge          | Q1 | $Q_{rr}$      | $V_R=12\text{ V}, I_F=I_S,$<br>$di_F/dt=100\text{ A/}\mu\text{s}$ | - | 10   | -   | nC |
|                                  | Q2 |               |                                                                   | - | 20   | -   |    |



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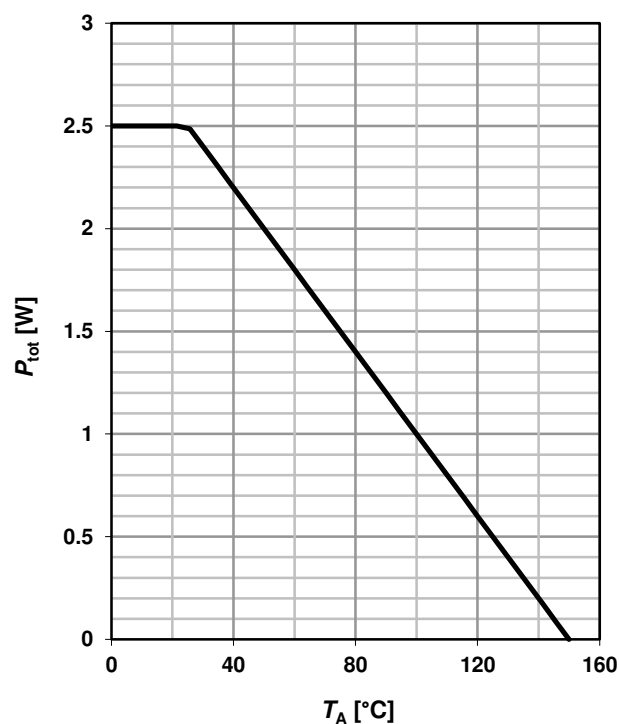
### 1 Power dissipation (Q1)

$$P_{\text{tot}} = f(T_A)^{(4)}$$



### 2 Power dissipation (Q2)

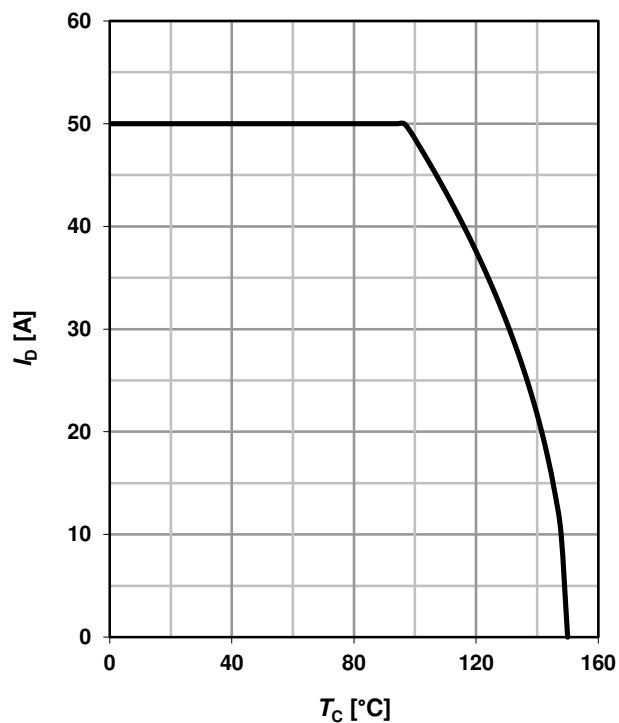
$$P_{\text{tot}} = f(T_A)^{(4)}$$



### 3 Drain current (Q1)

$$I_D = f(T_C)$$

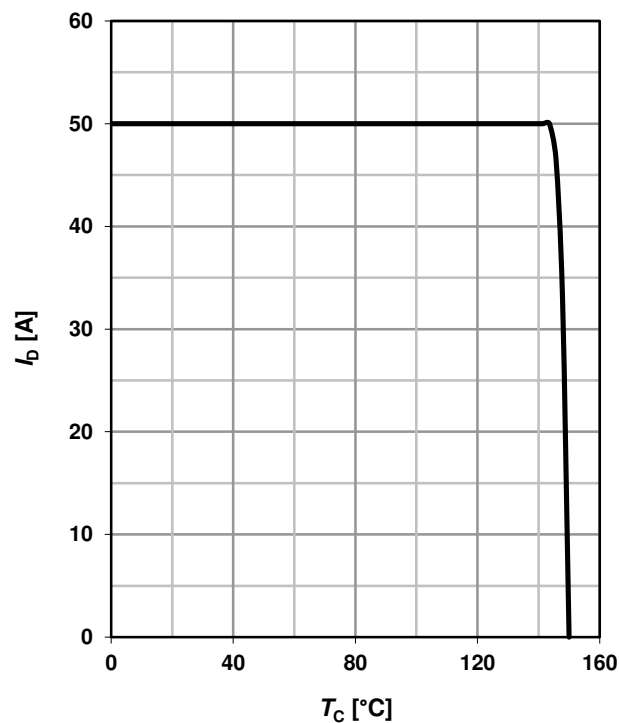
parameter:  $V_{GS} \geq 10$  V



### 4 Drain current (Q2)

$$I_D = f(T_C)$$

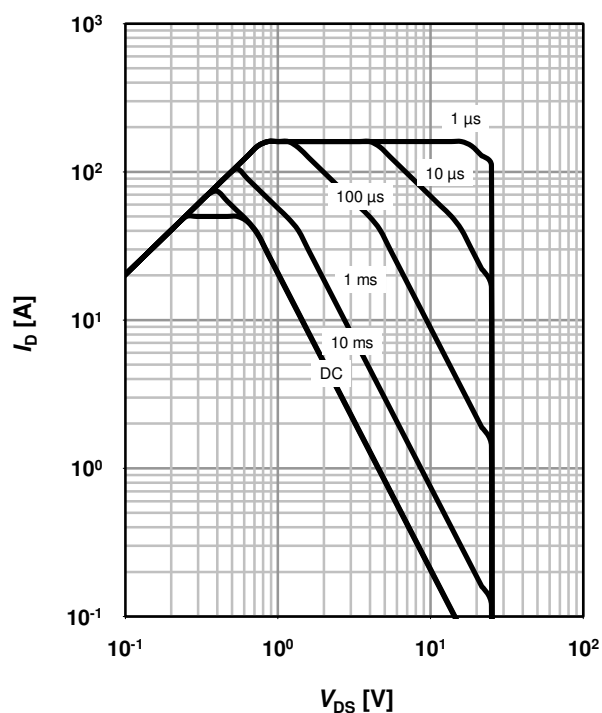
parameter:  $V_{GS} \geq 10$  V



## 5 Safe operating area (Q1)

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

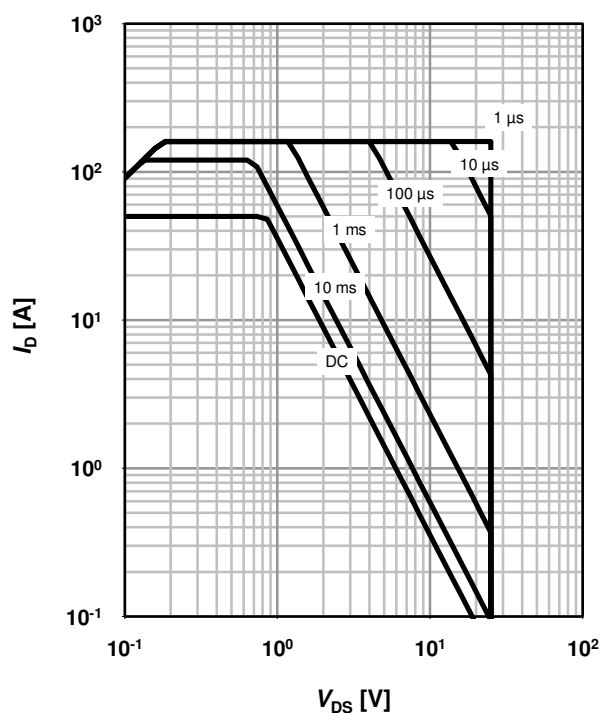
parameter:  $t_p$



## 6 Safe operating area (Q2)

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

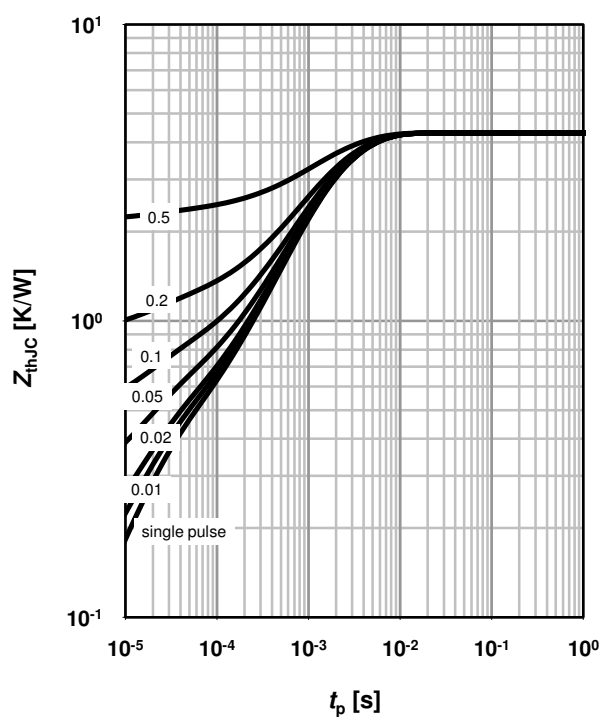
parameter:  $t_p$



## 7 Max. transient thermal impedance (Q1)

$$Z_{thJC} = f(t_p)$$

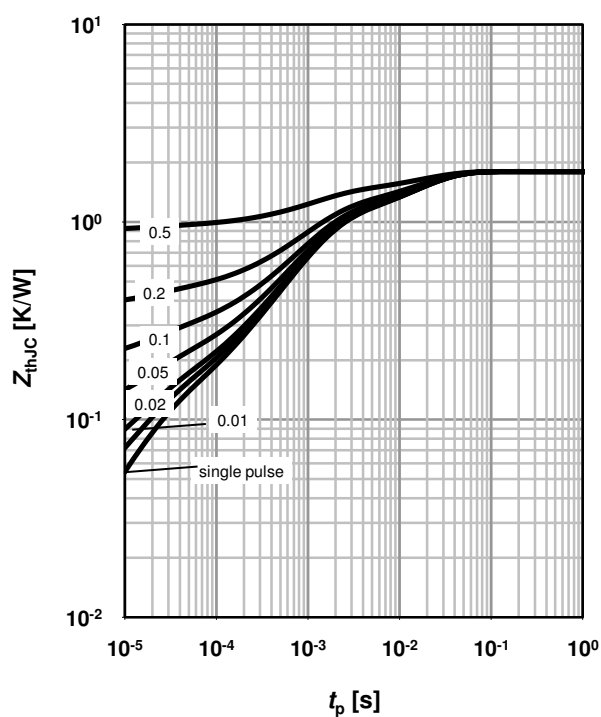
parameter:  $D = t_p/T$



## 8 Max. transient thermal impedance (Q2)

$$Z_{thJC} = f(t_p)$$

parameter:  $D = t_p/T$



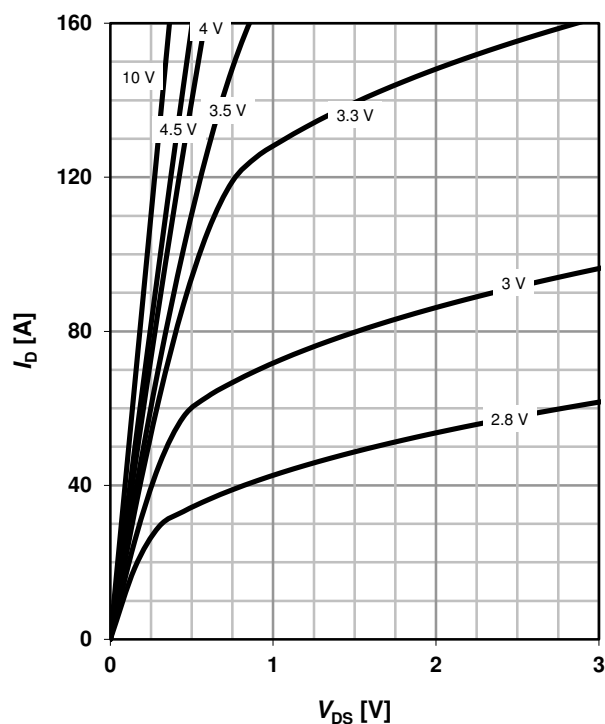


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## 9 Typ. output characteristics (Q1)

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

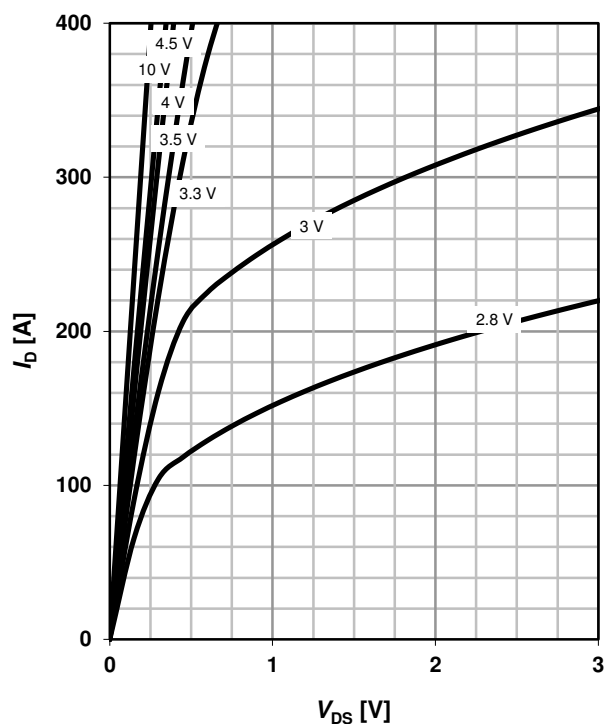
parameter:  $V_{GS}$



## 10 Typ. output characteristics (Q2)

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

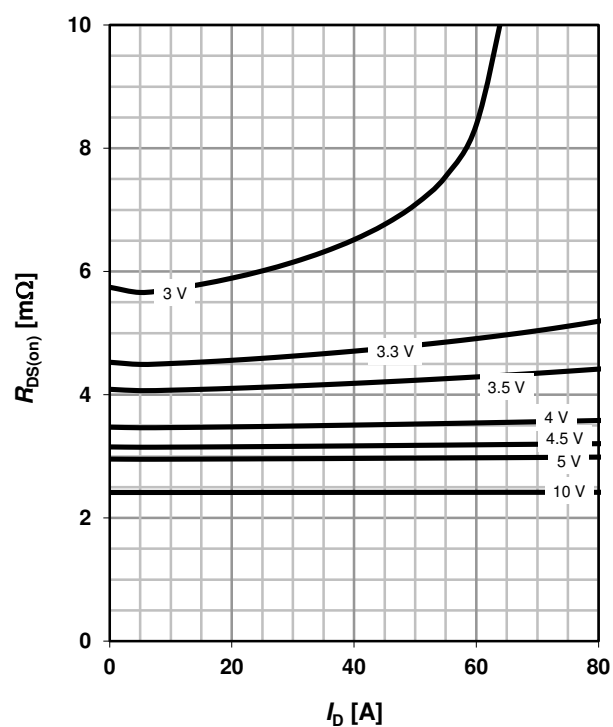
parameter:  $V_{GS}$



## 11 Typ. drain-source on resistance (Q1)

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

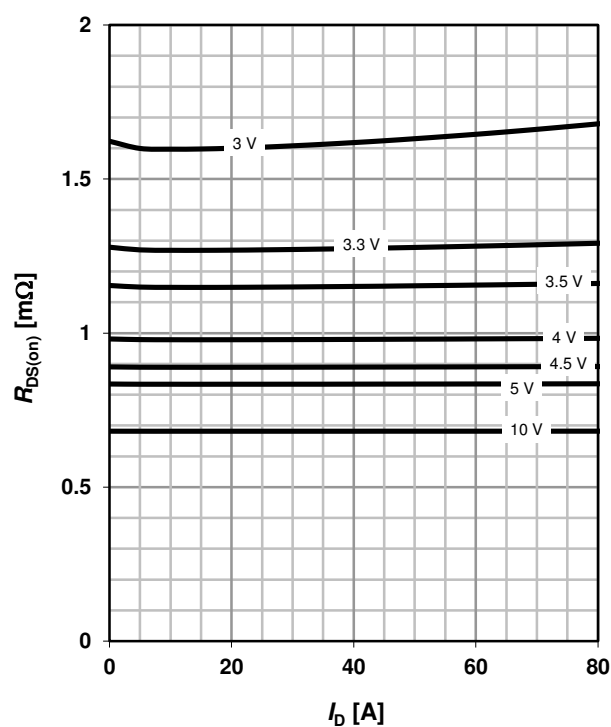
parameter:  $V_{GS}$



## 12 Typ. drain-source on resistance (Q2)

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

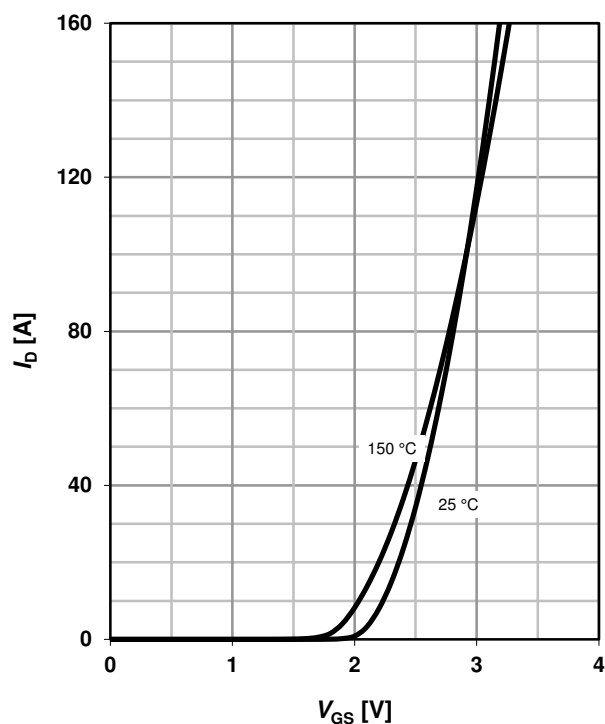
parameter:  $V_{GS}$



### 13 Typ. transfer characteristics (Q1)

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

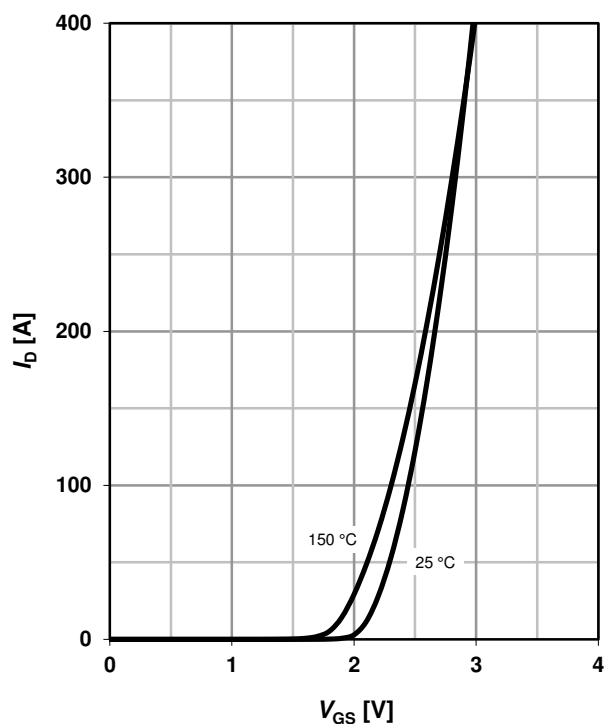
parameter:  $T_j$



### 14 Typ. transfer characteristics (Q2)

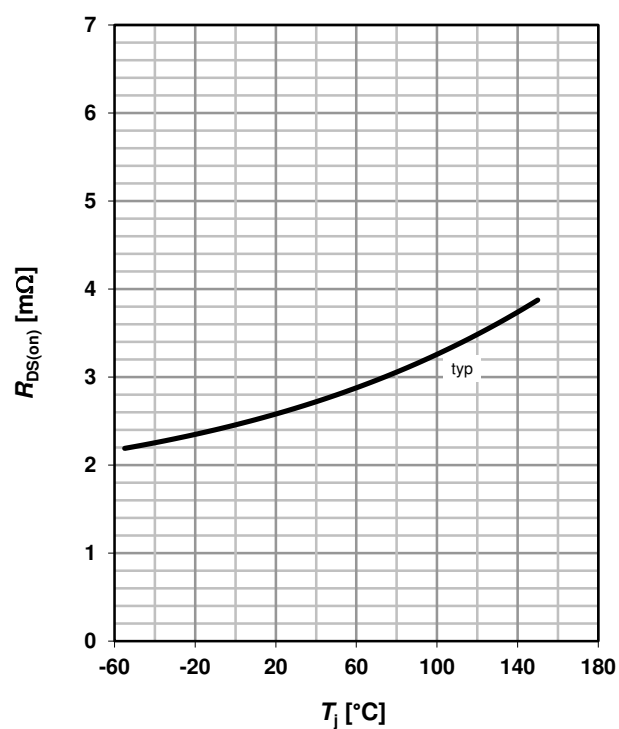
$$I_D = f(V_{GS}); |V_{DS}| > 2 |I_D| R_{DS(on)max}$$

parameter:  $T_j$



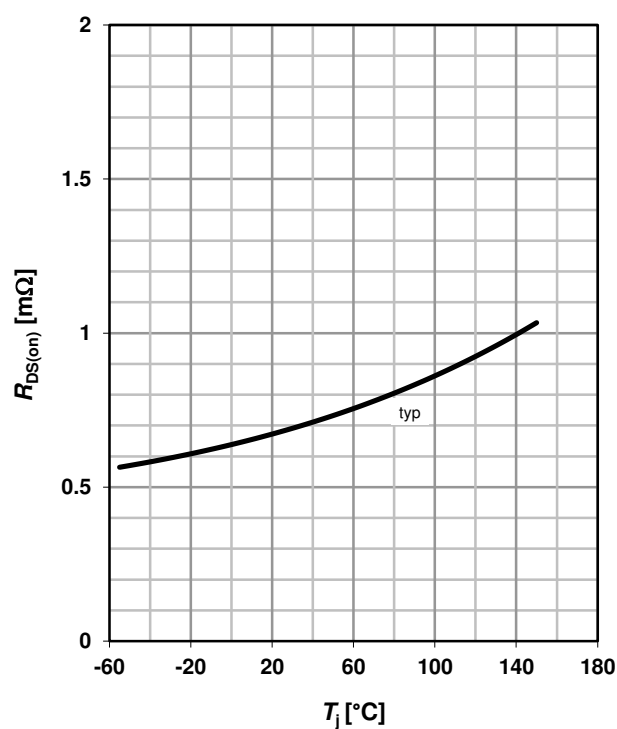
### 15 Drain-source on-state resistance (Q1)

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



### 16 Drain-source on-state resistance (Q2)

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



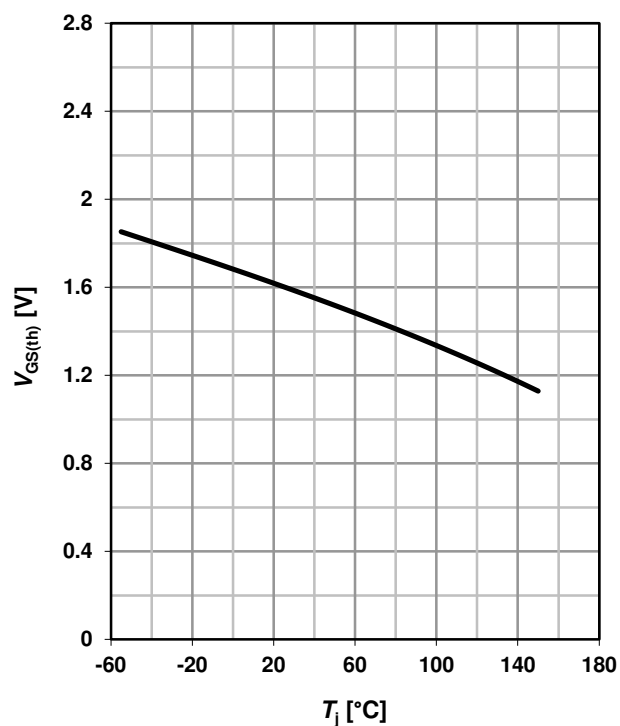




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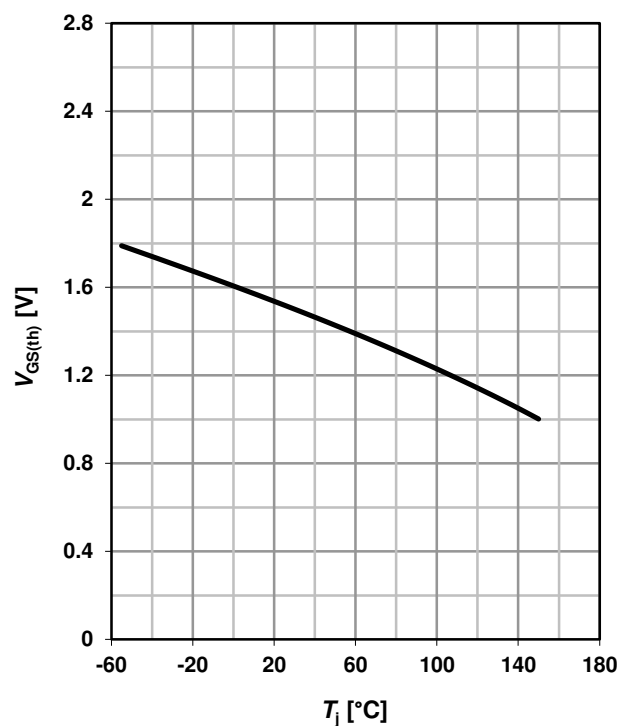
### 17 Typ. gate threshold voltage (Q1)

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



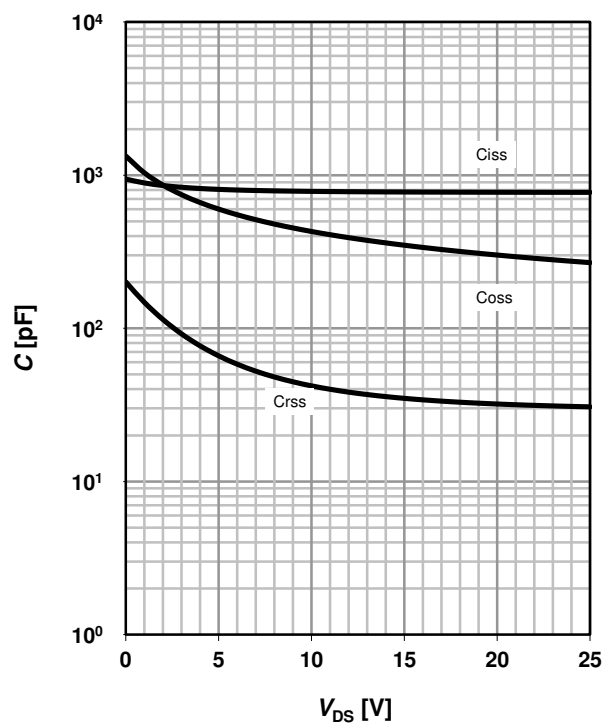
### 18 Typ. gate threshold voltage (Q2)

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



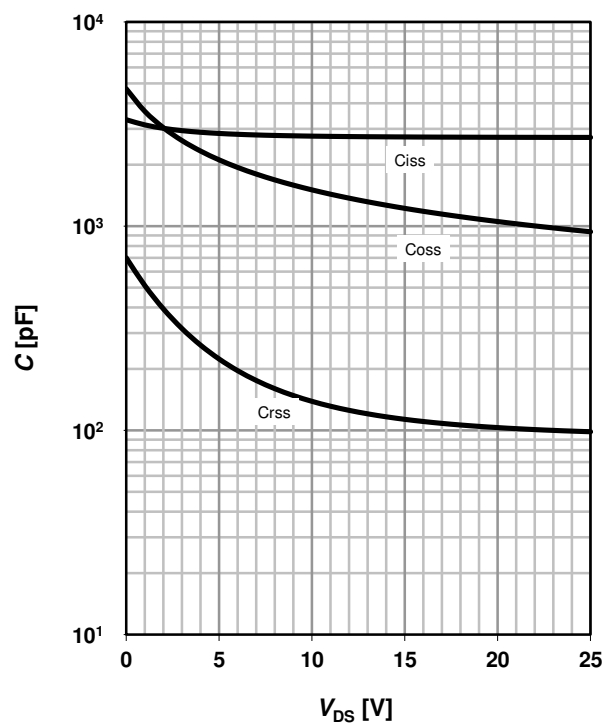
### 19 Typ. capacitances (Q1)

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



### 20 Typ. capacitances (Q2)

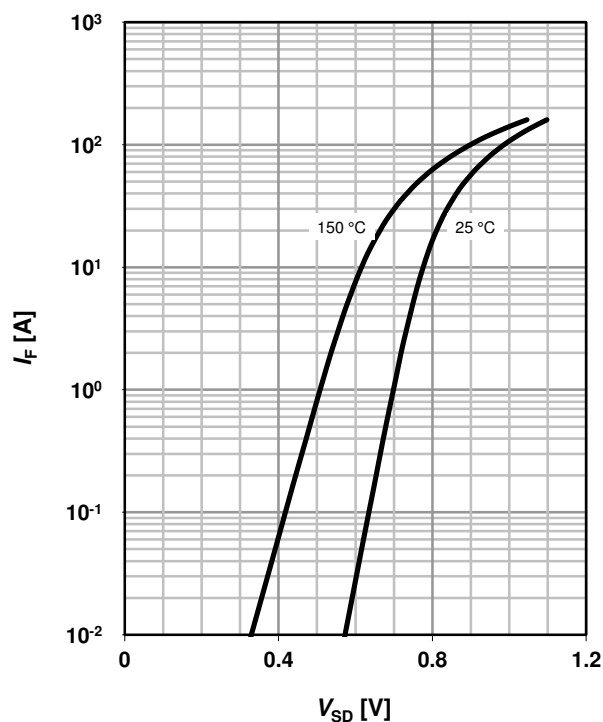
$C = f(V_{DS})$ ;  $V_{GS} = 0 V$ ;  $f = 1 MHz$



## 21 Forward characteristics of reverse diode (Q1)

$$I_F = f(V_{SD})$$

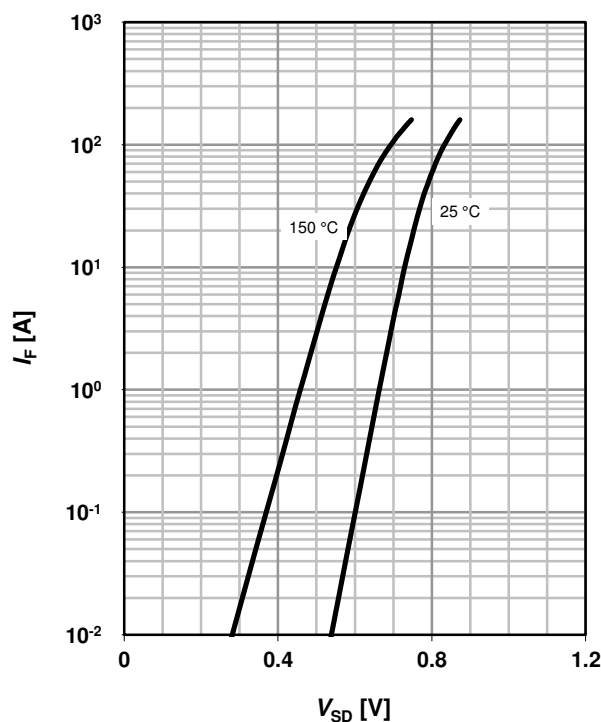
parameter:  $T_j$



## 22 Forward characteristics of reverse diode (Q2)

$$I_F = f(V_{SD})$$

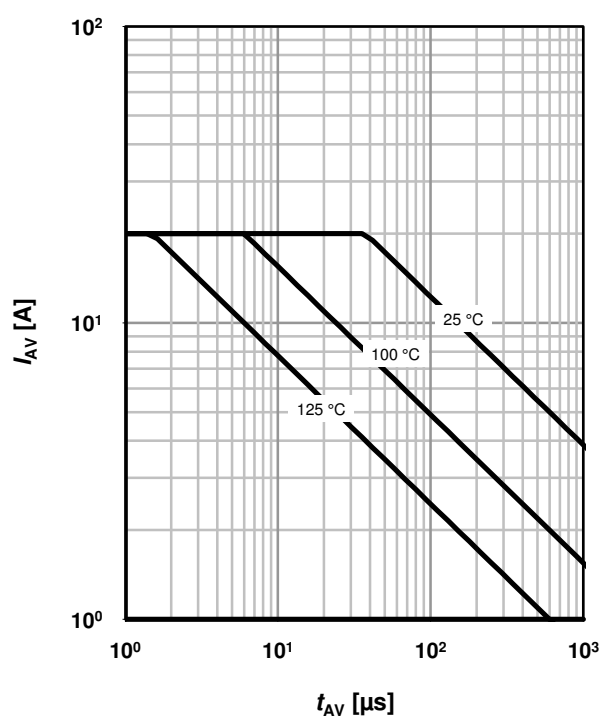
parameter:  $T_j$



## 23 Avalanche characteristics (Q1)

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

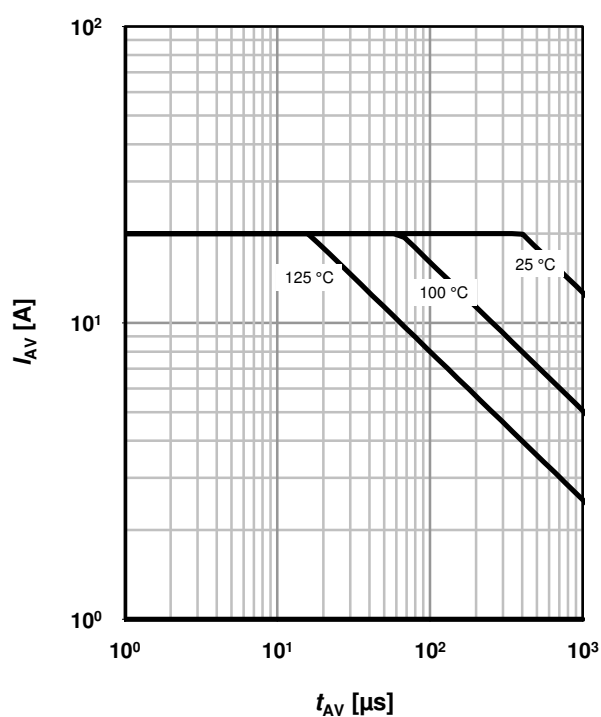
parameter:  $T_{j(start)}$



## 24 Avalanche characteristics (Q2)

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

parameter:  $T_{j(start)}$



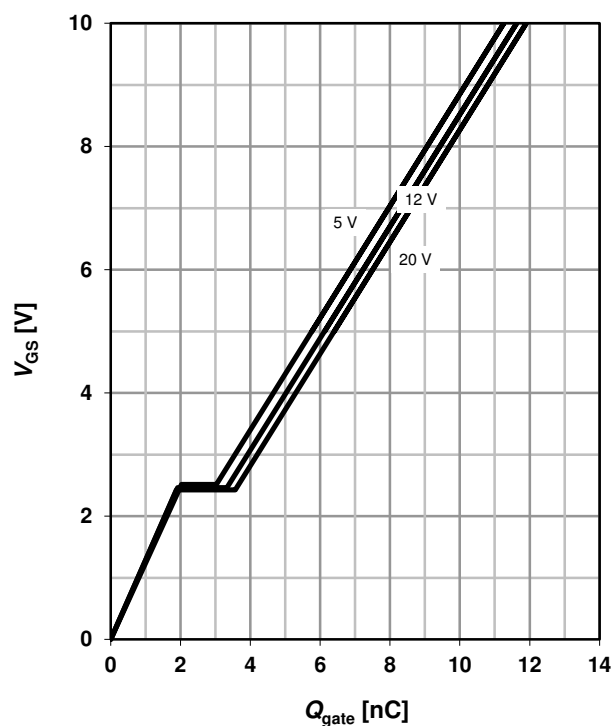


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## 25 Typ. gate charge (Q1)

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

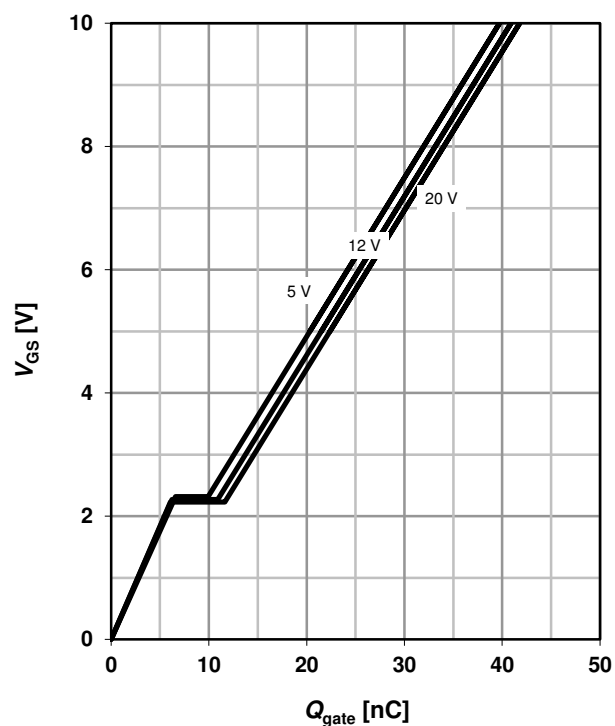
parameter:  $V_{DD}$



## 26 Typ. gate charge (Q2)

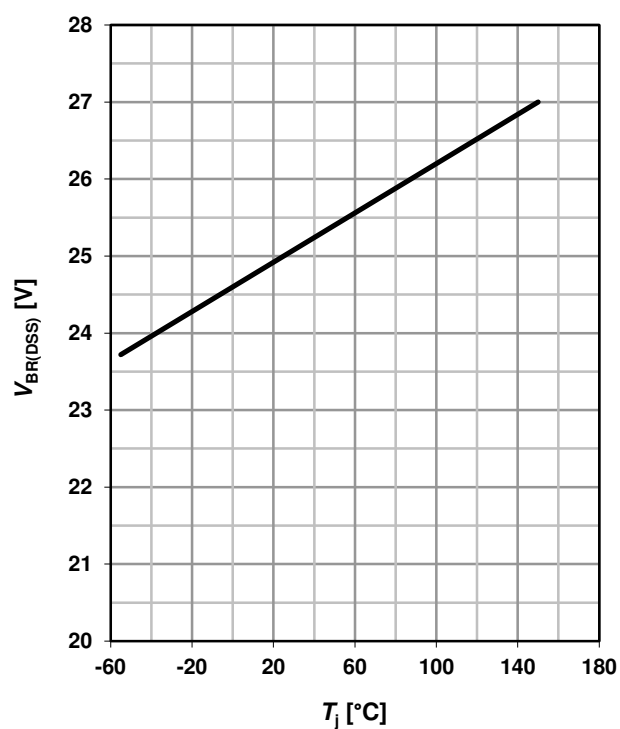
$V_{GS}=f(Q_{gate}); I_D=20\text{ A pulsed}$

parameter:  $V_{DD}$



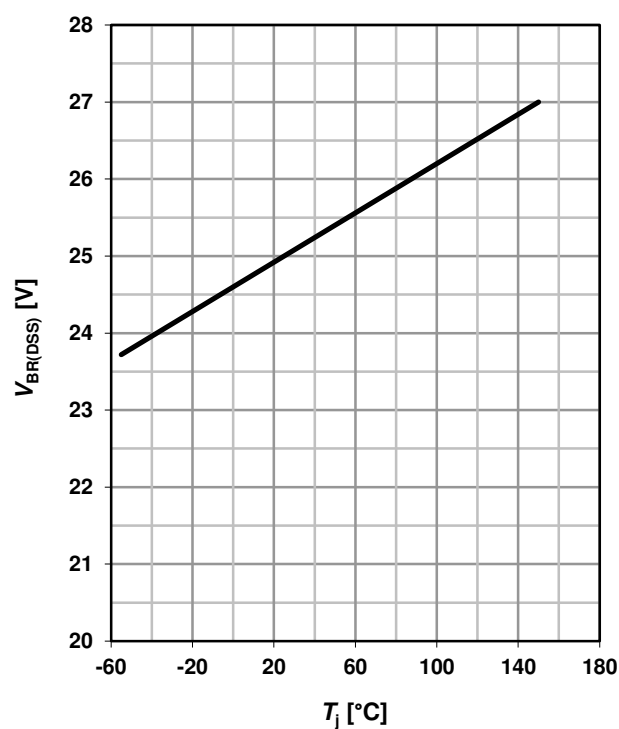
## 27 Drain-source breakdown voltage (Q1)

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



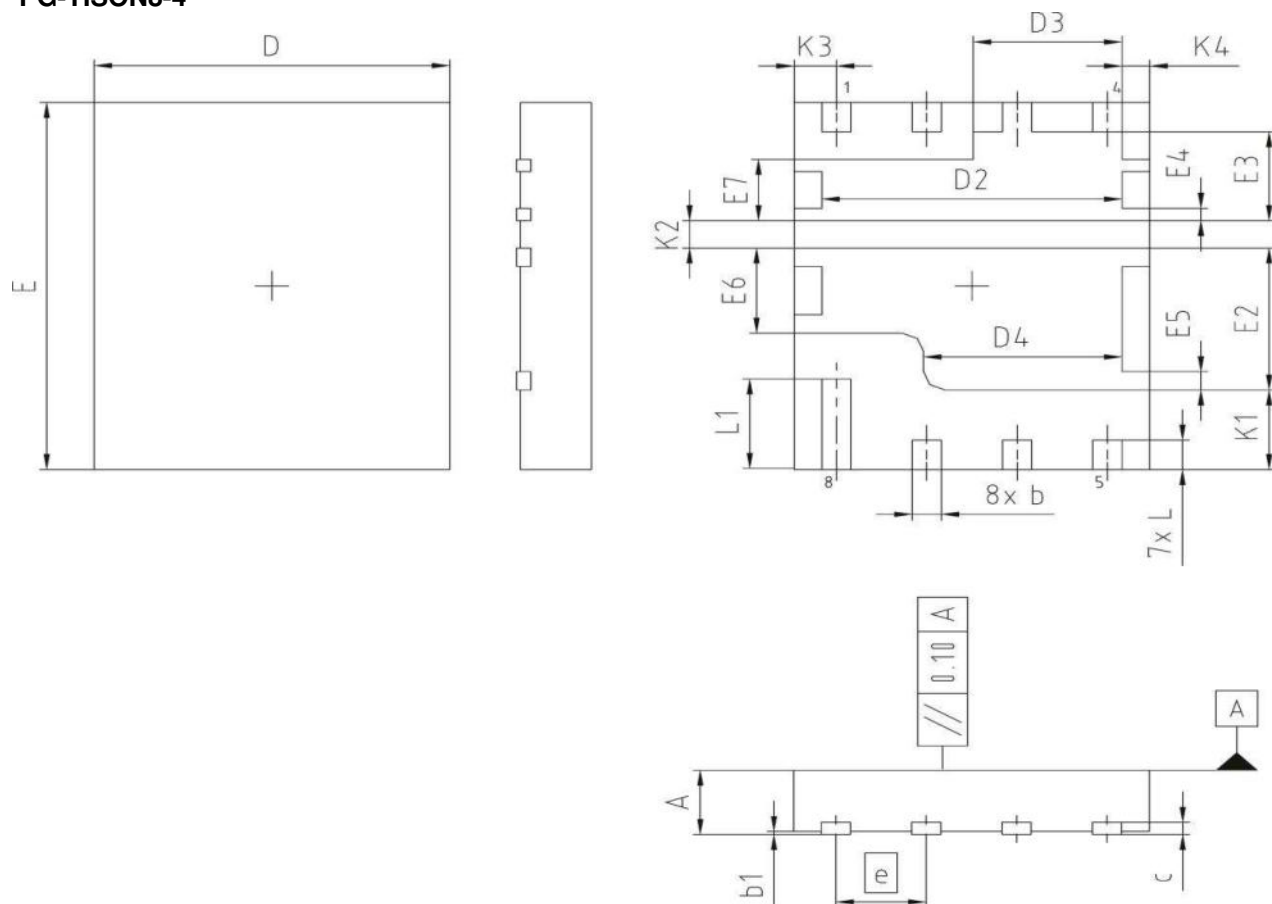
## 28 Drain-source breakdown voltage (Q2)

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

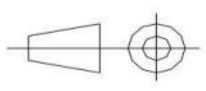


# Package Outline

## PG-TISON8-4



| 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  | 4.12        | 4.32 | 0.162      | 0.170 |
| D3  | 1.99        | 2.19 | 0.078      | 0.086 |
| D4  | 2.69        | 2.89 | 0.106      | 0.114 |
| E   | 5.90        | 6.10 | 0.232      | 0.240 |
| E2  | 2.22        | 2.42 | 0.087      | 0.095 |
| E3  | 1.35        | 1.55 | 0.053      | 0.061 |
| E4  | 0.10        | 0.30 | 0.004      | 0.012 |
| E5  | 0.20        | 0.40 | 0.008      | 0.016 |
| E6  | 1.29        | 1.49 | 0.051      | 0.059 |
| E7  | 0.90        | 1.10 | 0.035      | 0.043 |
| e   | 1.27 (BSC)  |      | 0.05 (BSC) |       |
| N   | 8           |      | 8          |       |
| L   | 0.38        | 0.58 | 0.015      | 0.023 |
| L1  | 1.38        | 1.58 | 0.054      | 0.062 |
| K1  | 1.38        | 1.58 | 0.054      | 0.062 |
| K2  | 0.35        | 0.55 | 0.014      | 0.022 |
| K3  | 0.50        | 0.70 | 0.020      | 0.028 |
| K4  | 0.29        | 0.49 | 0.011      | 0.019 |

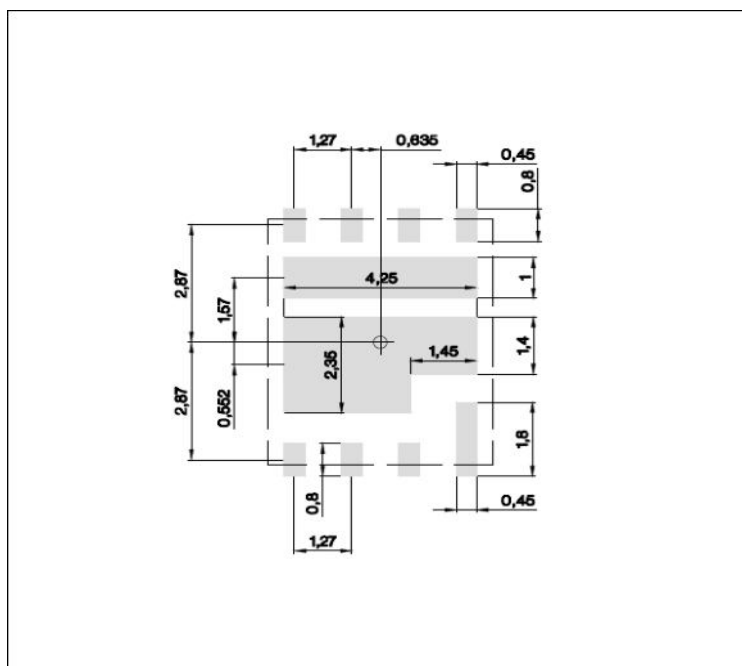
|                                                                                                              |
|--------------------------------------------------------------------------------------------------------------|
| DOCUMENT NO.<br>Z8B00176527                                                                                  |
| SCALE<br>0 2.5 5mm                                                                                           |
| EUROPEAN PROJECTION<br> |
| ISSUE DATE<br>09-08-2017                                                                                     |
| REVISION<br>02                                                                                               |



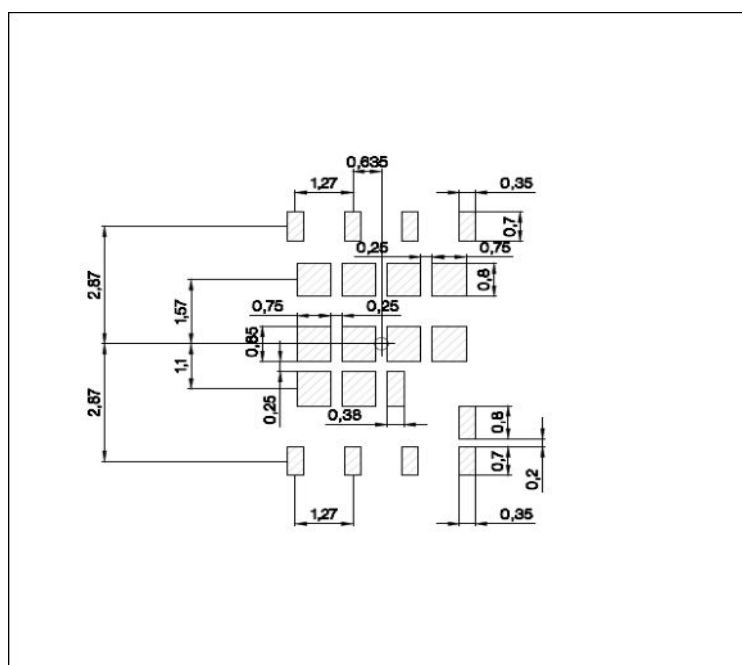
BSG0811ND

## Boardpads & Apertures

### PG-TISON8-4



 copper



 stencil apertures

All the dimensions in mm

## Revision History

BSG0811ND

**Revision: 2017-08-25, Rev. 2.2**

Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|----------------------------------------------|
| 2.0      | 2015-03-17 | Release of final version                     |
| 2.1      | 2016-03-24 | Update package drawing                       |
| 2.2      | 2017-08-25 | Update package outline                       |

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