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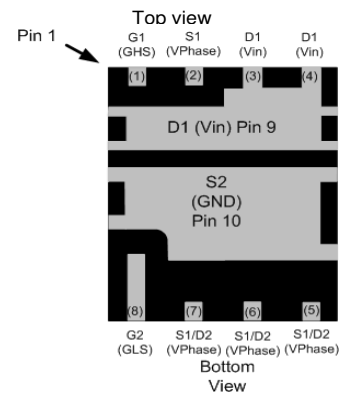
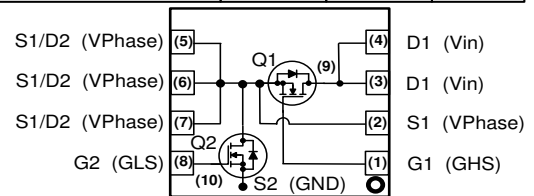


Power Block
Features

- Dual asymmetric N-channel OptiMOS™5 MOSFET
- Logic level (4.5V rated)
- Optimized for high performance buck converters
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC¹⁾ for target applications
- Halogen-free according to IEC61249-2-21
- Monolithic integrated Schottky like diode

Product Summary

| | | Q1 | Q2 | |
|------------------|-----------------------|----|-----|----|
| V_{DS} | | 25 | 25 | V |
| $R_{DS(on),max}$ | $V_{GS}=10\text{ V}$ | 3 | 1.2 | mΩ |
| | $V_{GS}=4.5\text{ V}$ | 4 | 1.7 | |
| I_D | | 50 | 50 | A |



| Type | Package | Marking |
|------------|-------------|---------|
| BSG0813NDI | PG-TISON8-4 | 0813NDI |

Maximum ratings, at $T_j=25^\circ\text{C}$, unless otherwise specified ²⁾

| Parameter | Symbol | Conditions | Value | | Unit |
|-------------------------------------|----------------|---|-------------|------|------------------|
| | | | Q1 | Q2 | |
| Continuous drain current | I_D | $T_C=70^\circ\text{C}$, $V_{GS}=10\text{ V}$ | 50 | 50 | A |
| | | $T_C=70^\circ\text{C}$, $V_{GS}=4.5\text{ V}$ | 50 | 50 | |
| | | $T_A=25^\circ\text{C}$, $V_{GS}=4.5\text{ V}^{3)}$ | 31 | 50 | |
| | | $T_A=25^\circ\text{C}$, $V_{GS}=4.5\text{ V}^{4)}$ | 19 | 33 | |
| Pulsed drain current | $I_{D,pulse}$ | $T_C=70^\circ\text{C}$ | 160 | 160 | |
| Avalanche energy, single pulse | E_{AS} | Q1: $I_D=10\text{ A}$, Q2: $I_D=20\text{ A}$, $R_{GS}=25\ \Omega$ | 30 | 90 | mJ |
| Gate source voltage | V_{GS} | $T_j=25^\circ\text{C}$ | ± 16 | | V |
| Power dissipation | P_{tot} | $T_A=25^\circ\text{C}^{3)}$ | 6.25 | 6.25 | W |
| | | $T_A=25^\circ\text{C}^{4)}$ | 2.5 | 2.5 | |
| Operating and storage temperature | T_j, T_{stg} | | -55 ... 150 | | $^\circ\text{C}$ |
| IEC climatic category; DIN IEC 68-1 | | | 55/150/56 | | |

¹⁾ 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 | | | - | - | 2.2 | |
| Thermal resistance, junction - ambient ²⁾ | Q1 | R_{thJA} | Application specific board ³⁾ | - | - | 20 | |
| | Q2 | | | | | | |
| | Q1 | 6 cm ² cooling area ⁴⁾ | - | - | 50 | | |
| | Q2 | | | | | | |

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

Static characteristics

| | | | | | | | |
|---|----|---------------------|--|------------------|-----|-----|---------------|
| Drain-source breakdown voltage | Q1 | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$ | 25 ⁶⁾ | - | - | V |
| | Q2 | | | | | | |
| Breakdown voltage temperature coefficient | Q1 | $dV_{(BR)DSS}/dT_j$ | $I_D=10\text{ mA}$, referenced to 25 °C | - | 15 | - | mV/K |
| | Q2 | | | | | | |
| Gate threshold voltage | Q1 | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\text{ }\mu\text{A}$ | 1.2 | 1.6 | 2 | V |
| | Q2 | | | | | | |
| Zero gate voltage drain current | Q1 | I_{DSS} | $V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$ | - | - | 1 | μA |
| | Q2 | | | | | 500 | |
| | Q1 | | $V_{DS}=20\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$ | - | - | 100 | mA |
| | Q2 | | | | | 1 | |
| Gate-source leakage current | Q1 | I_{GSS} | $V_{GS}=16\text{ V}, V_{DS}=0\text{ V}$ | - | - | 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 Ω |
| | Q2 | | | | | 1.7 | |
| | Q1 | | $V_{GS}=10\text{ V}, I_D=20\text{ A}$ | - | 2.4 | 3.0 | |
| | Q2 | | | | | 1.2 | |
| Gate resistance | Q1 | R_G | | - | 0.7 | 1.2 | Ω |
| | Q2 | | | | | 1.7 | |
| Transconductance | Q1 | g_{fs} | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=20\text{ A}$ | 46 | 93 | - | S |
| | Q2 | | | | | 70 | |

²⁾ Only one of both transistors active

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

Dynamic characteristics

| | | | | | | | |
|------------------------------|----|--------------|--|---|------|------|----|
| Input capacitance | Q1 | C_{iss} | $V_{GS}=0\text{ V},$ $V_{DS}=12\text{ V}, f=1\text{ MHz}$ | - | 780 | 1100 | pF |
| | Q2 | | | - | 2200 | 2900 | |
| Output capacitance | Q1 | C_{oss} | | - | 390 | 520 | |
| | Q2 | | | - | 1300 | 1700 | |
| Reverse transfer capacitance | Q1 | C_{rss} | | - | 38 | - | |
| | Q2 | | | - | 71 | - | |
| Turn-on delay time | Q1 | $t_{d(on)}$ | $V_{IN}=12\text{ V},$ $V_{DRV}=5\text{ V},$ $F_{SW}=500\text{ KHz},$ $I_{OUT}=20\text{ A}^{5)}$ | - | 4.3 | - | ns |
| | Q2 | | | - | 3.6 | - | |
| Rise time | Q1 | t_r | | - | 4.7 | - | |
| | Q2 | | | - | 2.8 | - | |
| Turn-off delay time | Q1 | $t_{d(off)}$ | | - | 4.3 | - | |
| | Q2 | | | - | 5.7 | - | |
| Fall time | Q1 | t_f | | - | 1.4 | - | |
| | Q2 | | | - | 1.7 | - | |

Gate Charge Characteristics

| | | | | | | | | |
|-----------------------|----|---------------|--|--|-----|-----|----|----|
| Gate to source charge | Q1 | Q_{gs} | $V_{DD}=12\text{ V},$ $I_D=20\text{ A},$ $V_{GS}=0\text{ to }4.5\text{ V}$ | - | 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} | | $V_{DD}=12\text{ V},$ $I_D=20\text{ A},$ $V_{GS}=0\text{ to }4.5\text{ V}$ | - | 5.2 | - | nC |
| Gate to drain charge | | Q_{gd} | | | - | 3.1 | - | |
| Gate charge total | | Q_g | | | - | 15 | 22 | |
| Gate plateau voltage | | $V_{plateau}$ | | | - | 2.3 | - | |
| Output charge | Q1 | Q_{oss} | $V_{DD}=12\text{ V}, V_{GS}=0\text{ V}$ | | - | 8 | - | nC |
| | Q2 | | | | - | 27 | - | |

³⁾ 8 Layers copper 70µm thickness. PCB in still air

⁴⁾ 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.

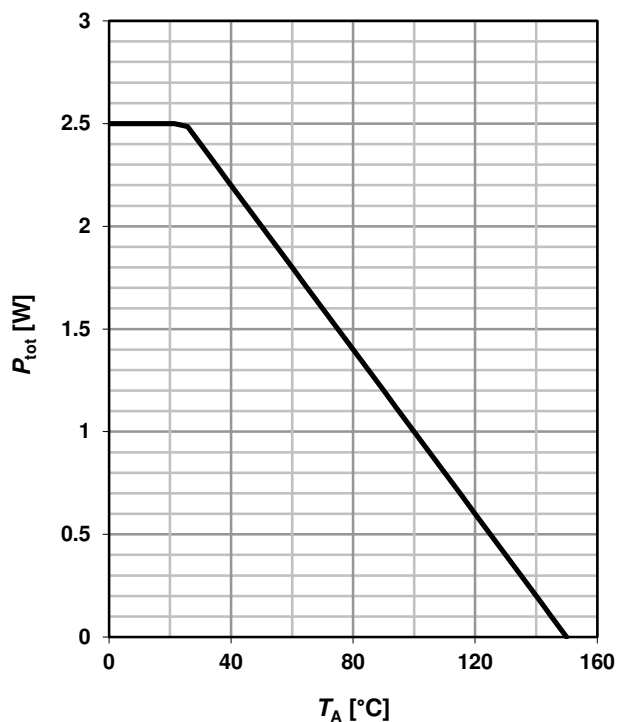
| Parameter | Symbol | Conditions | Values | | | Unit | | |
|----------------------------------|--------|---------------|---|---|------|------|-----|---|
| | | | min. | typ. | max. | | | |
| Reverse Diode | | | | | | | | |
| Diode continuous forward current | Q1 | I_S | $T_C=25\text{ °C}$ | - | - | 29 | A | |
| | Q2 | | | - | - | 50 | | |
| Diode pulse current | Q1 | $I_{S,pulse}$ | | - | - | 160 | | |
| | Q2 | | | - | - | 160 | | |
| Diode forward voltage | Q1 | V_{SD} | | $V_{GS}=0\text{ V}, I_F=20\text{ A},$ $T_j=25\text{ °C}$ | - | 0.82 | 1 | V |
| | Q2 | | | $V_{GS}=0\text{ V}, I_F=11\text{ A},$ $T_j=25\text{ °C}$ | - | 0.52 | 0.7 | |
| Reverse recovery charge | Q1 | Q_{rr} | $V_R=12\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$ | - | 10 | - | nC | |
| | Q2 | | | - | - | - | | |

⁵⁾ For more information see application note n° TBD

⁶⁾ 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 $V_{IN}=16\text{ V}$

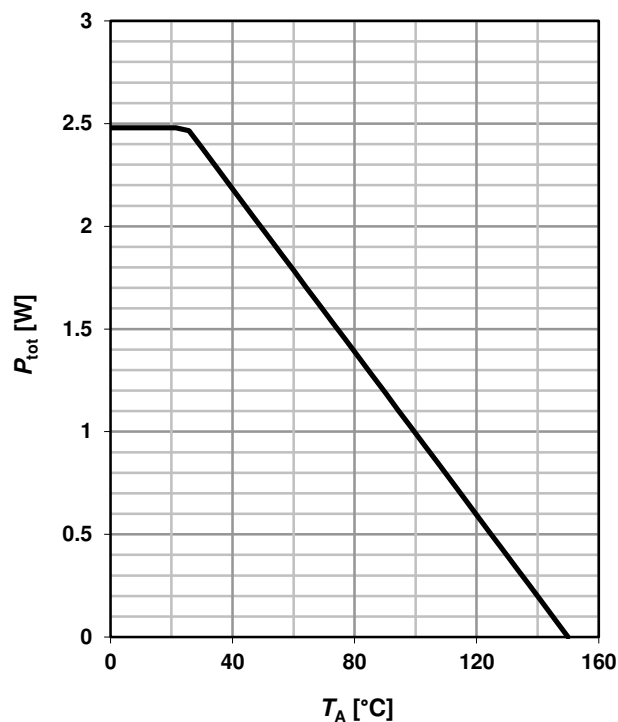
1 Power dissipation (Q1)

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



2 Power dissipation (Q2)

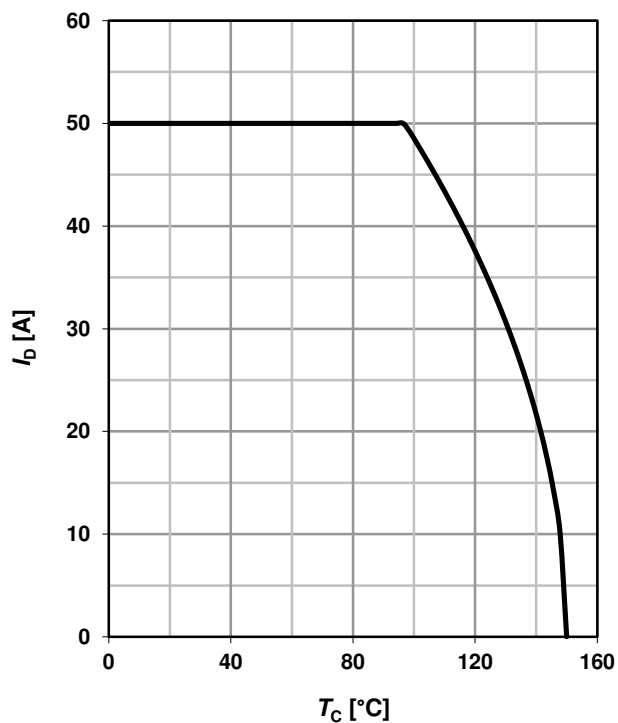
$$P_{tot}=f(T_A)^4$$



3 Drain current (Q1)

$$I_D=f(T_C)$$

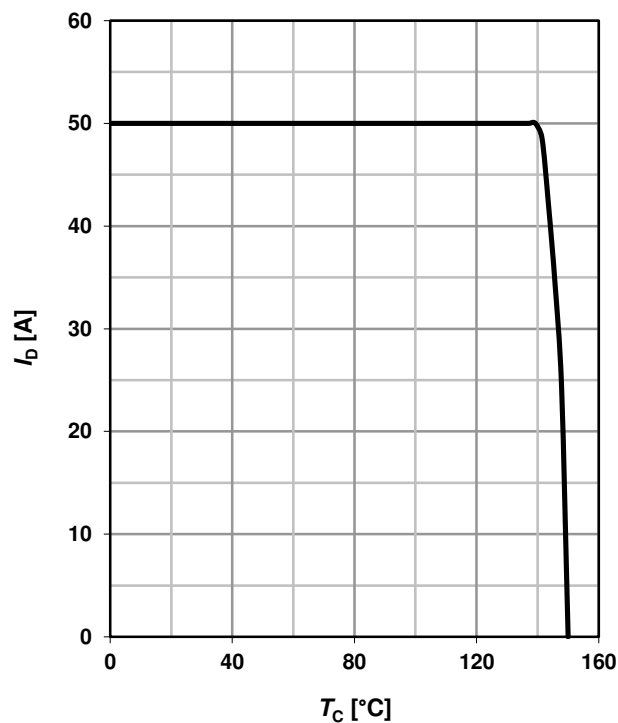
parameter: $V_{GS} \geq 10$ V



4 Drain current (Q2)

$$I_D=f(T_C)$$

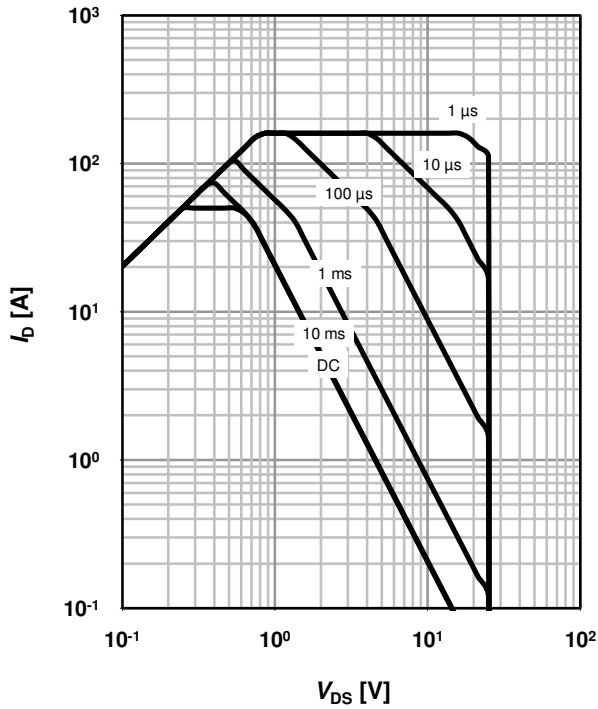
parameter: $V_{GS} \geq 10$ V



5 Safe operating area (Q1)

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

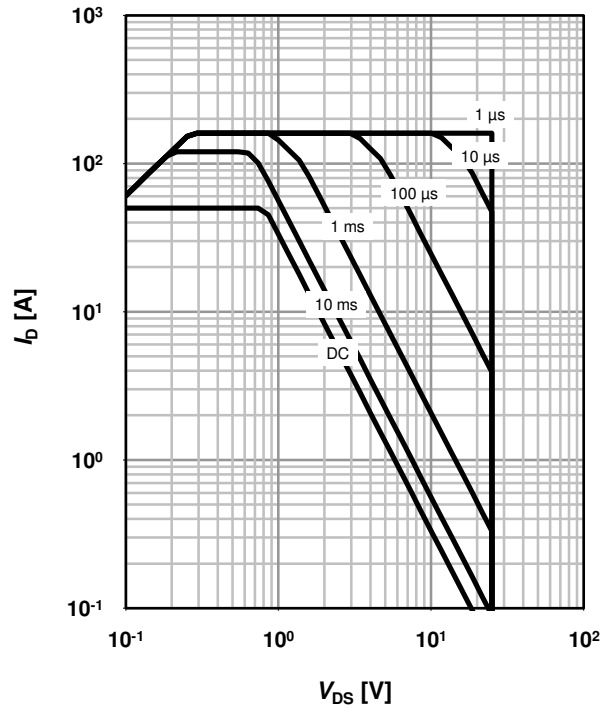
parameter: t_p



6 Safe operating area (Q2)

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

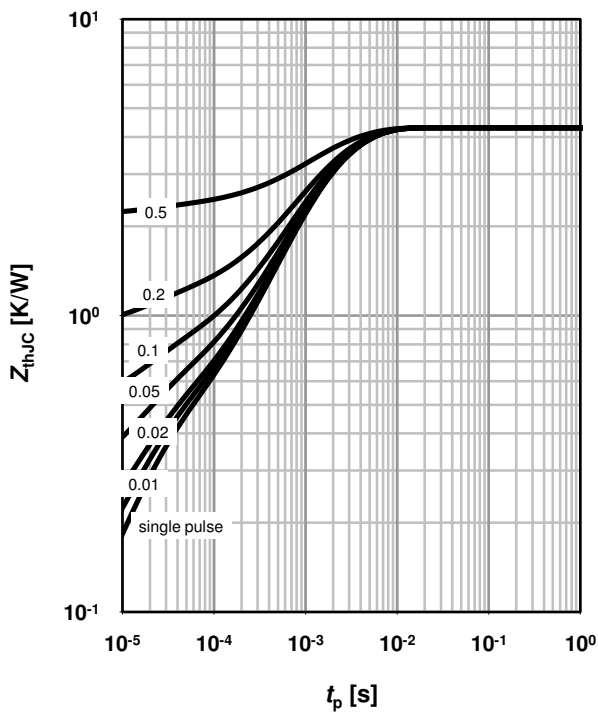
parameter: t_p



7 Max. transient thermal impedance (Q1)

$Z_{thJC}=f(t_p)$

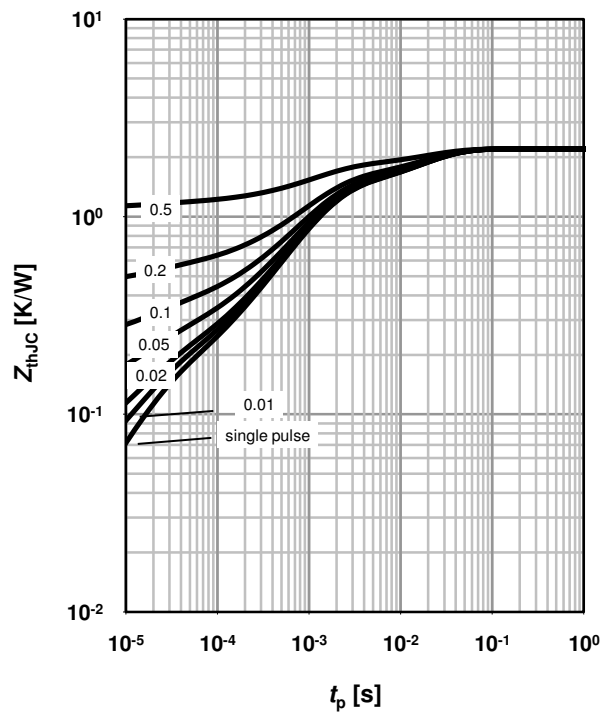
parameter: $D=t_p/T$



8 Max. transient thermal impedance (Q2)

$Z_{thJC}=f(t_p)$

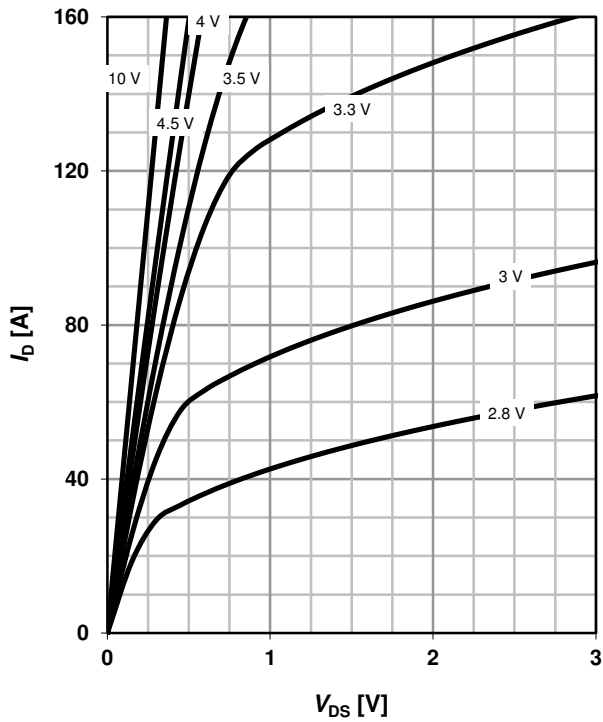
parameter: $D=t_p/T$



9 Typ. output characteristics (Q1)

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

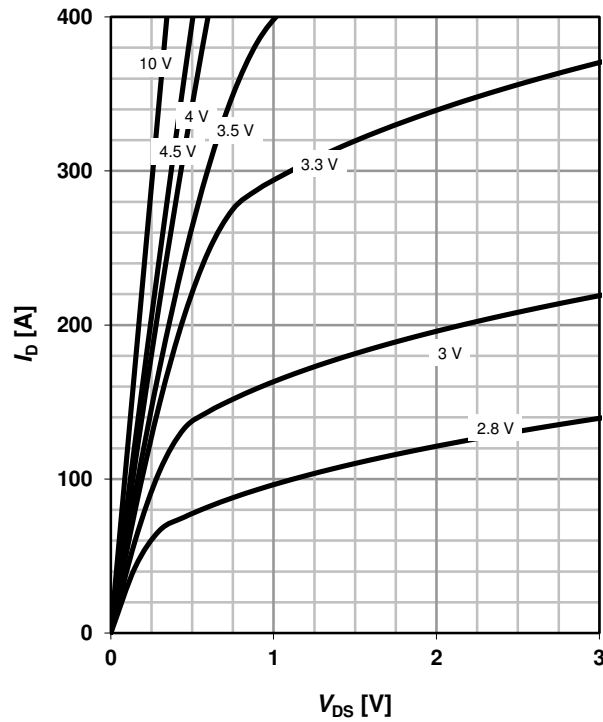
parameter: V_{GS}



10 Typ. output characteristics (Q2)

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

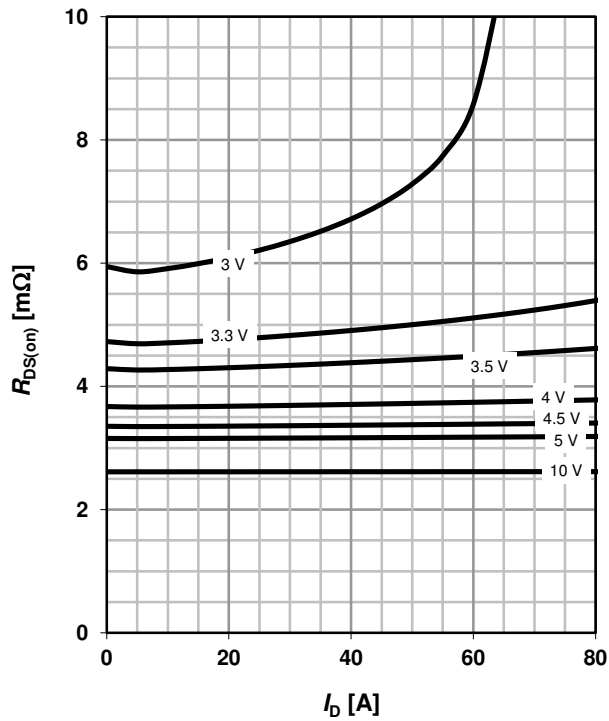
parameter: V_{GS}



11 Typ. drain-source on resistance (Q1)

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

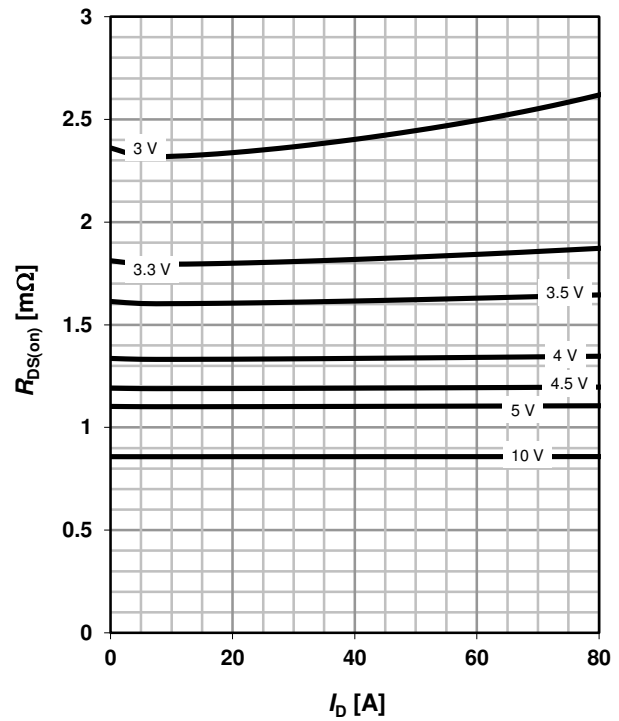
parameter: V_{GS}



12 Typ. drain-source on resistance (Q2)

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

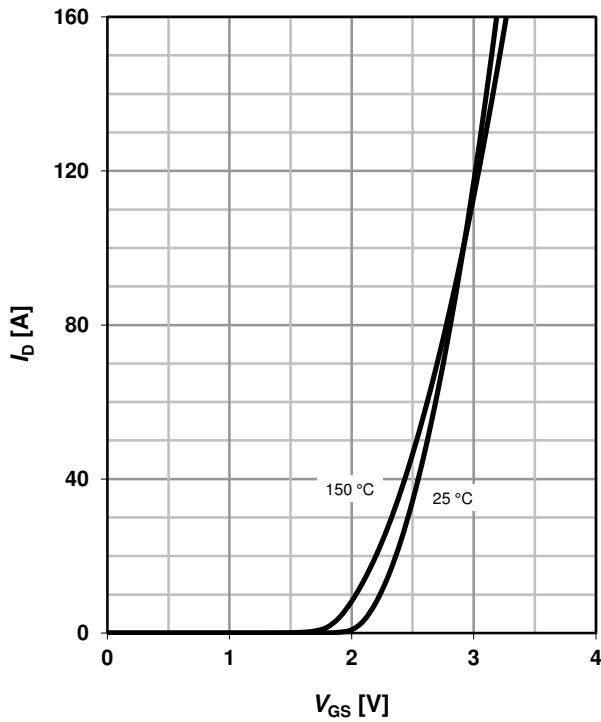
parameter: V_{GS}



13 Typ. transfer characteristics (Q1)

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

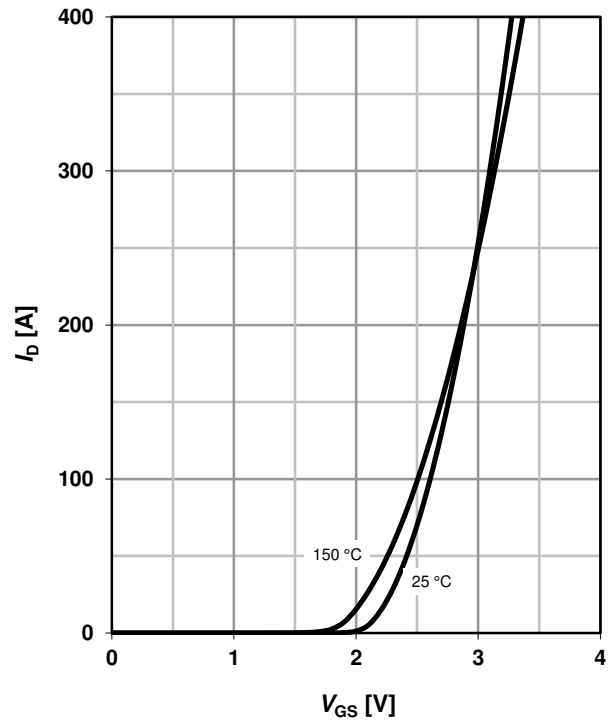
parameter: T_j



14 Typ. transfer characteristics (Q2)

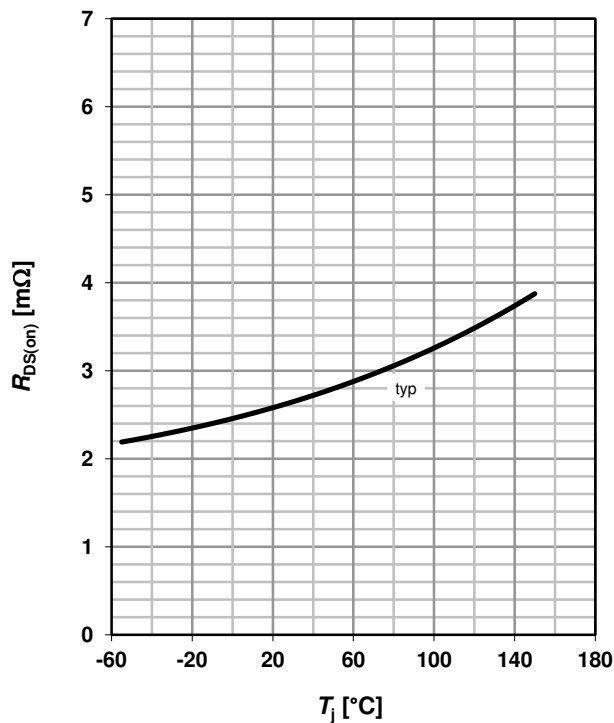
$$I_D = f(V_{GS}); |V_{DS}| > 2 |I_D| R_{DS(on)max}$$

parameter: T_j



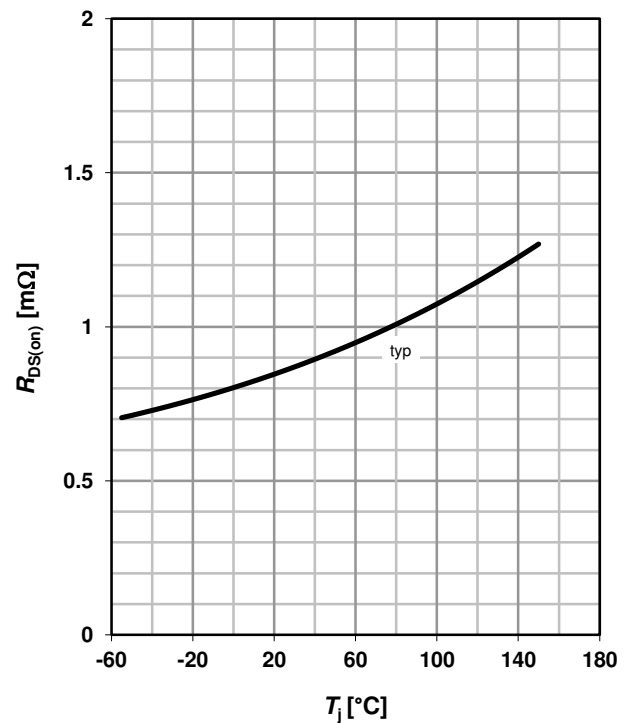
15 Drain-source on-state resistance (Q1)

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



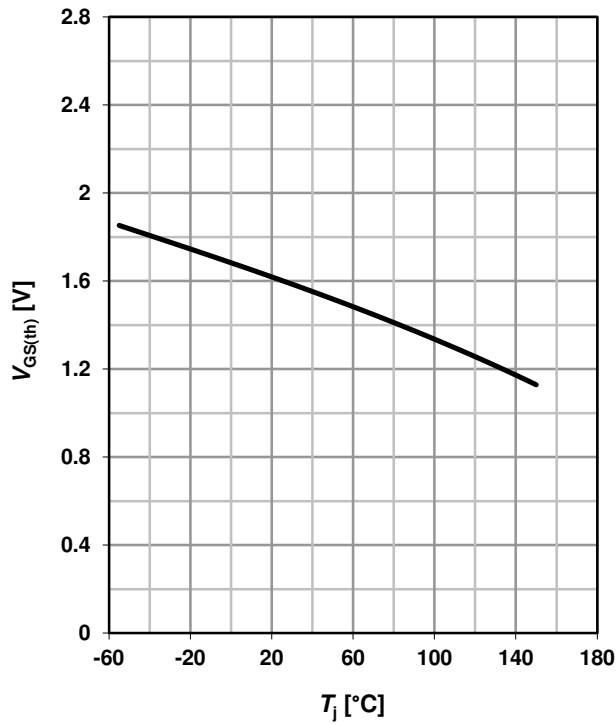
16 Drain-source on-state resistance (Q2)

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



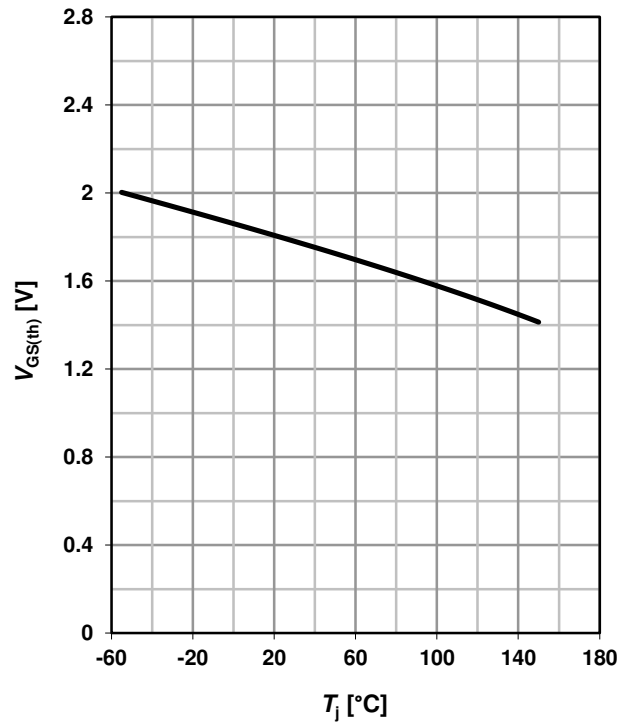
17 Typ. gate threshold voltage (Q1)

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



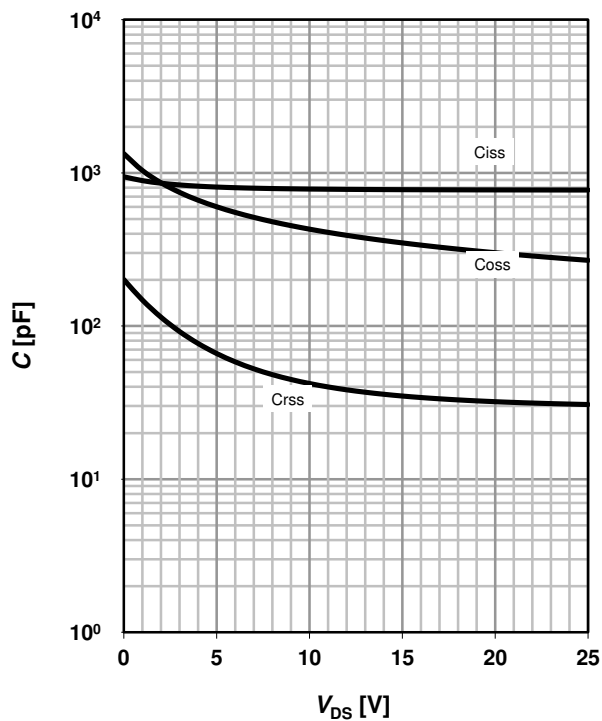
18 Typ. gate threshold voltage (Q2)

$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$; $I_D=10 \text{ mA}$



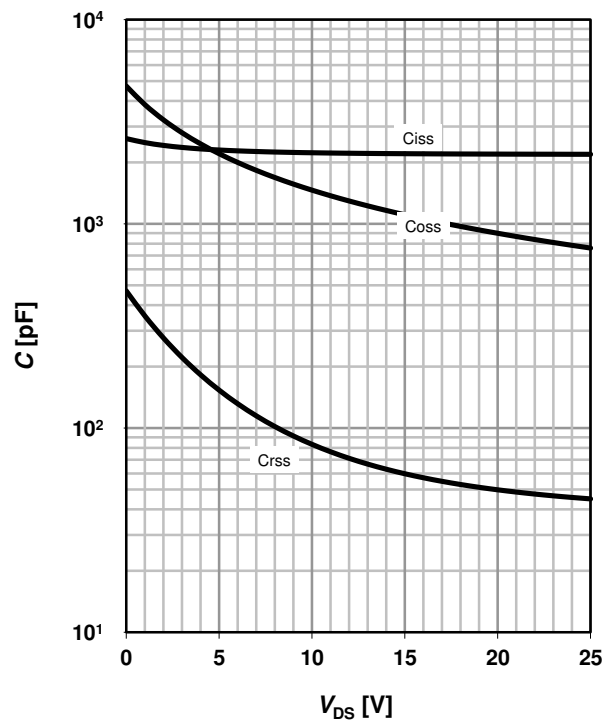
19 Typ. capacitances (Q1)

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



20 Typ. capacitances (Q2)

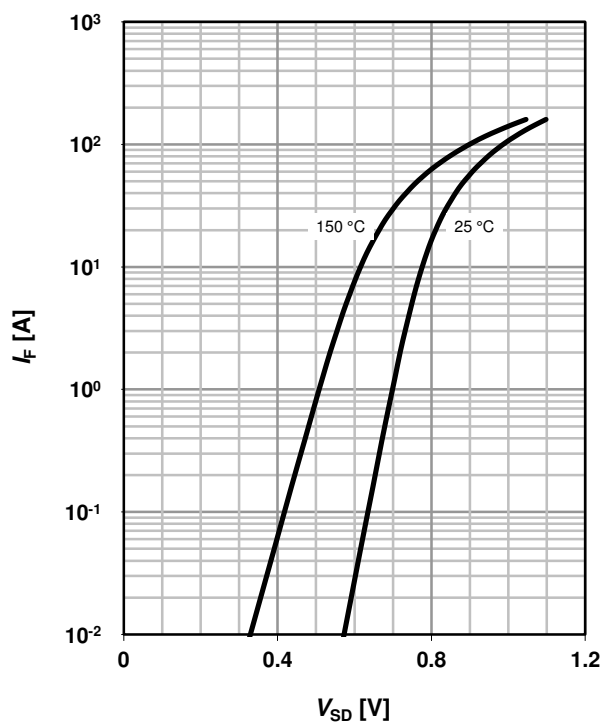
$C=f(V_{DS})$; $V_{GS}=0 \text{ V}$; $f=1 \text{ MHz}$



21 Forward characteristics of reverse diode (Q1)

$I_F=f(V_{SD})$

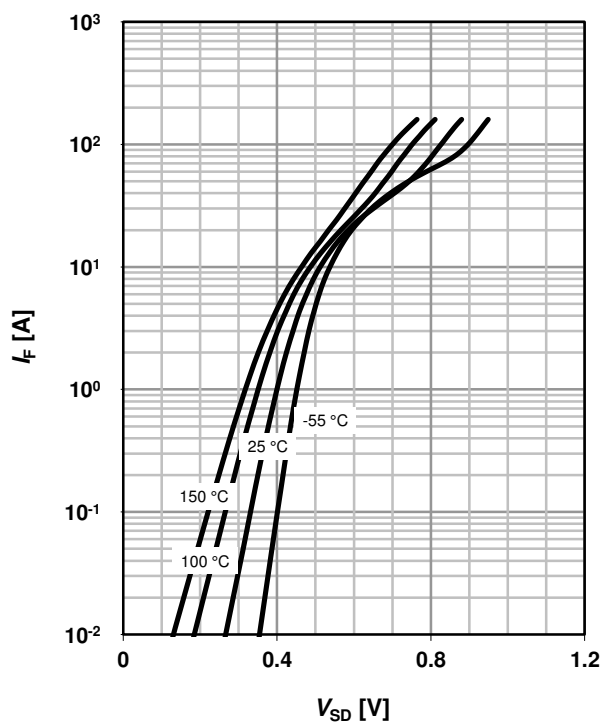
parameter: T_j



22 Forward characteristics of reverse diode (Q2)

$I_F=f(V_{SD})$

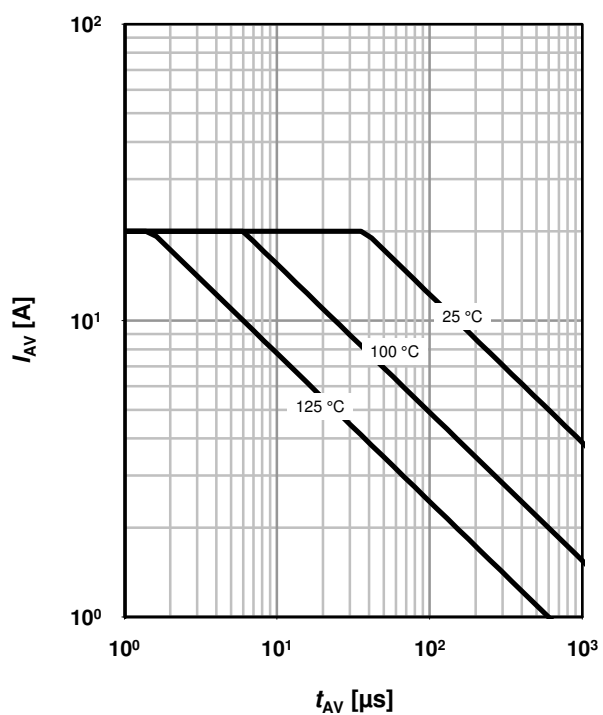
parameter: T_j



23 Avalanche characteristics (Q1)

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

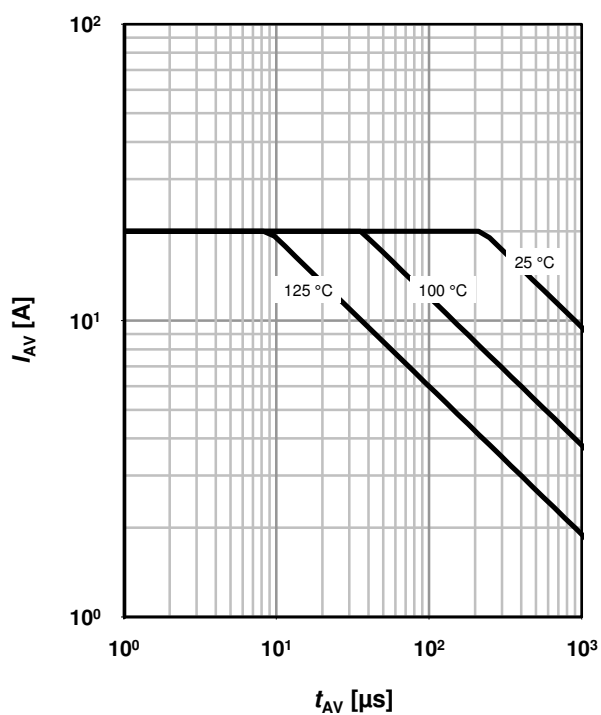
parameter: $T_{j(start)}$



24 Avalanche characteristics (Q2)

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

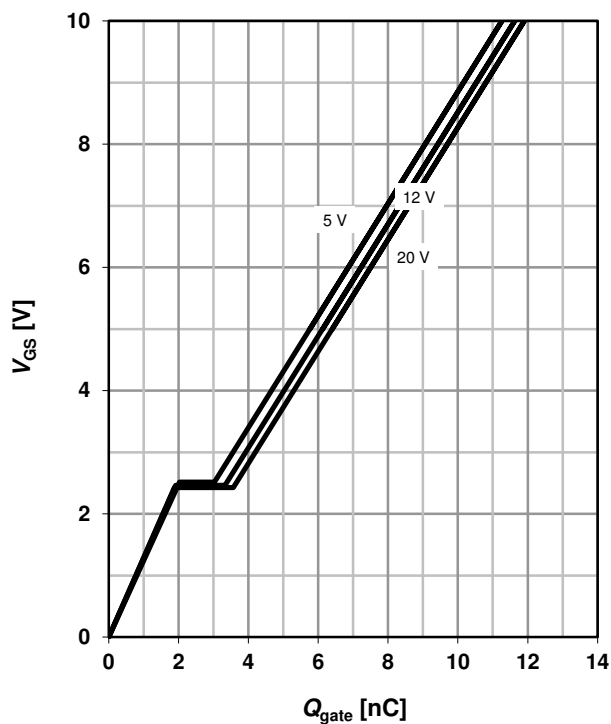
parameter: $T_{j(start)}$



25 Typ. gate charge (Q1)

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

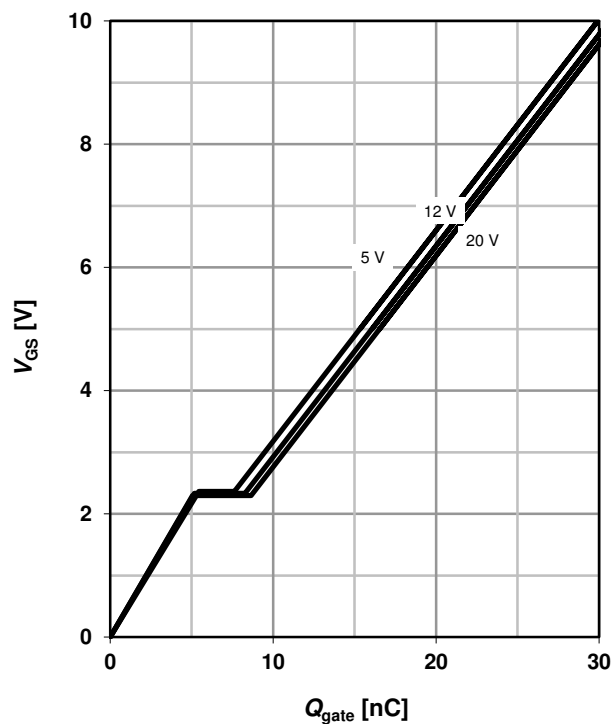
parameter: V_{DD}



26 Typ. gate charge (Q2)

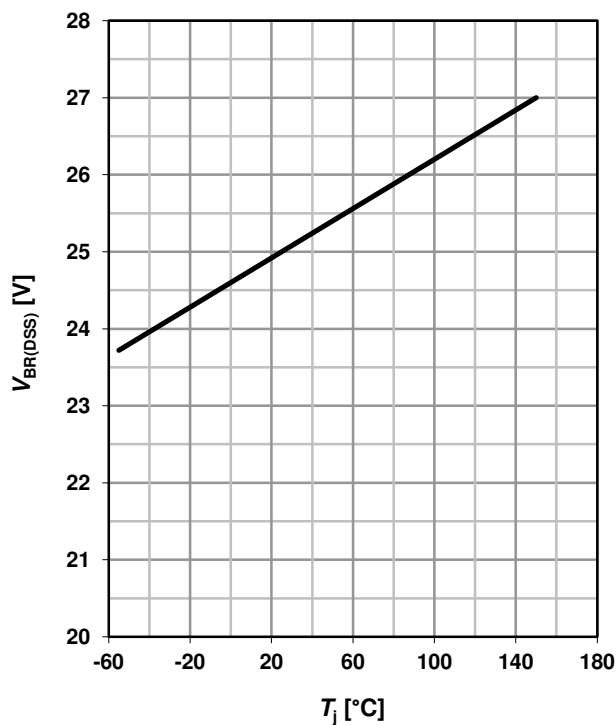
$V_{GS}=f(Q_{gate}); I_D=20\text{ A pulsed}$

parameter: V_{DD}



27 Drain-source breakdown voltage (Q1)

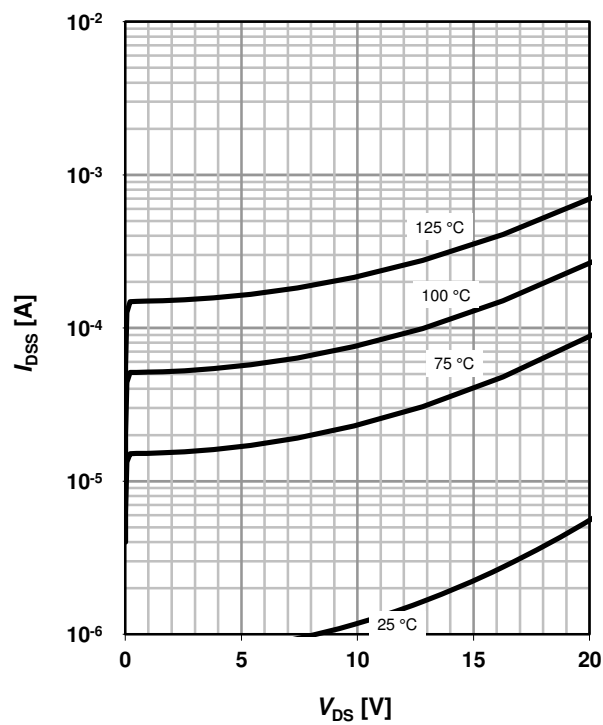
$V_{BR(DSS)}=f(T_j); I_D=1\text{ mA}$



28 Typ. drain-source leakage current (Q2)

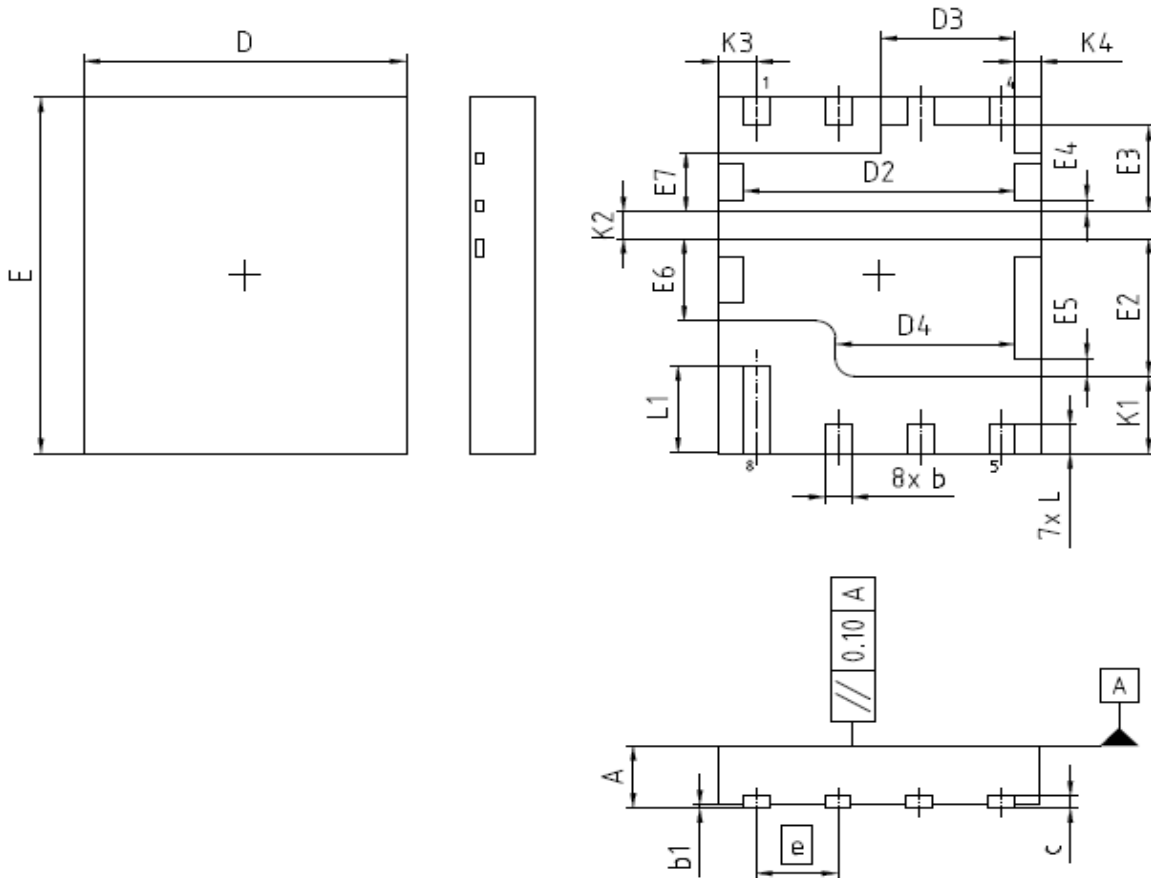
$I_{DSS}=f(V_{DS}); V_{GS}=0\text{ V}$

parameter: T_j



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 | 1.20 | 1.40 | 0.047 | 0.055 |
| 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.
Z8 B00176527

SCALE

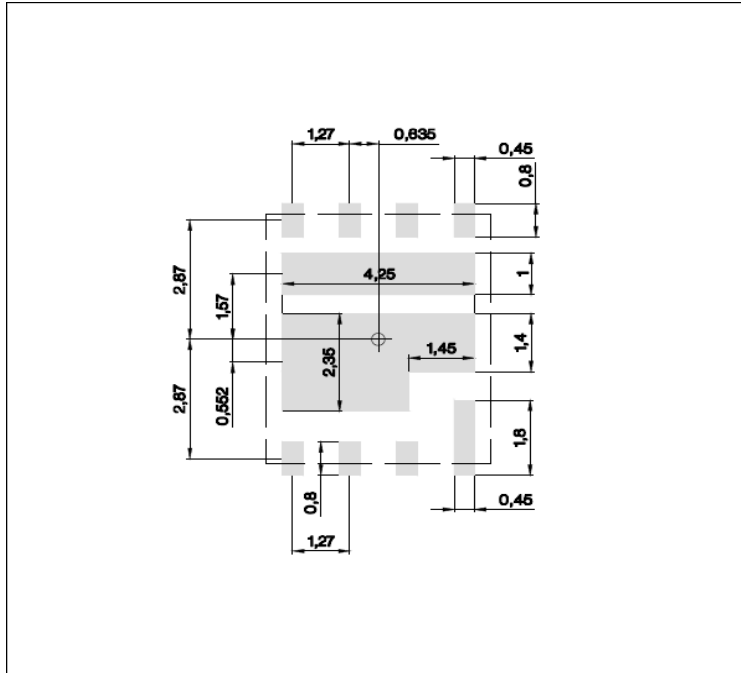
EUROPEAN PROJECTION

ISSUE DATE
13-03-2015

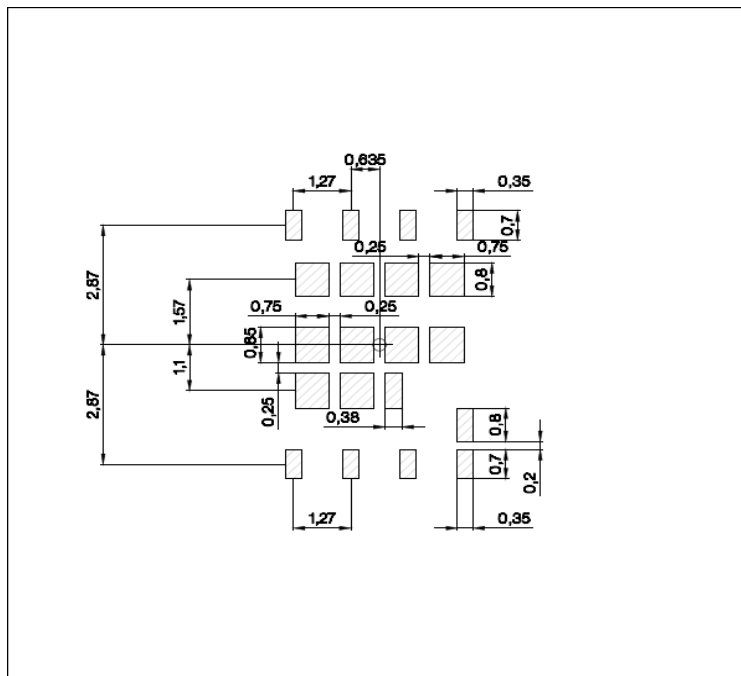
REVISION
01

Boardpads & Apertures

PG-TISON8-4



■ copper



▨ stencil apertures

All the dimensions in mm

Revision History

BSG0813NDI

Revision: 2016-03-24, Rev. 2.1

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 |

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