

MOSFET

OptiMOS™ 5 Power-Transistor, 30 V

Features

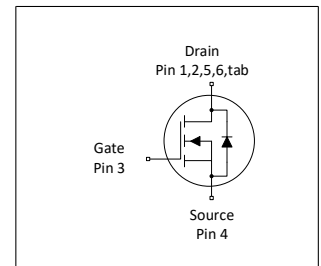
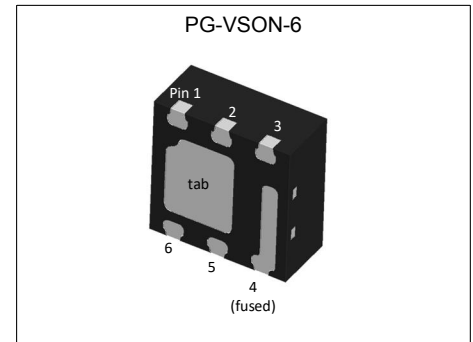
- Lowest on-resistance $R_{DS(on)}$ in a 2x2 package
- Optimized for highest performance and power density
- 100% avalanche tested
- Superior thermal resistance for a 2x2 package
- N-channel
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

Product validation

Fully qualified according to JEDEC for Industrial Applications

Table 1 Key Performance Parameters

| Parameter | Value | Unit |
|------------------|-------|------------|
| V_{DS} | 30 | V |
| $R_{DS(on),max}$ | 3.6 | m Ω |
| I_D | 81 | A |
| Q_{oss} | 8.2 | nC |
| $Q_G(0V..4.5V)$ | 7.2 | nC |



RoHS

| Type / Ordering Code | Package | Marking | Related Links |
|----------------------|-----------|---------|---------------|
| ISK036N03LM5 | PG-VSON-6 | 3603 | - |

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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 | - | - | 81 51 16.5 | A | $V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_A=25\text{ °C}$, $R_{thJA}=60\text{ °C/W}^2)$ |
| Pulsed drain current ³⁾ | $I_{D,pulse}$ | - | - | 323 | A | $T_C=25\text{ °C}$ |
| Avalanche energy, single pulse ⁴⁾ | E_{AS} | - | - | 7 | mJ | $I_D=20\text{ A}$, $R_{GS}=25\text{ }\Omega$ |
| Gate source voltage | V_{GS} | -16 | - | 16 | V | - |
| Power dissipation | P_{tot} | - | - | 39 2.1 | W | $T_C=25\text{ °C}$ $T_A=25\text{ °C}$, $R_{thJA}=60\text{ °C/W}^2)$ |
| Operating and storage temperature | T_j , T_{stg} | -55 | - | 150 | °C | - |

2 Thermal characteristics

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

Table 3 Thermal characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|------------|--------|------|------|------|-----------------------|
| | | Min. | Typ. | Max. | | |
| Thermal resistance, junction - case, bottom | R_{thJC} | - | 1.6 | 3.2 | °C/W | - |
| Device on PCB, 6 cm ² cooling area ²⁾ | R_{thJA} | - | - | 60 | °C/W | - |

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

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 | $V_{(BR)DSS}$ | 30 | - | - | V | $V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$ |
| Gate threshold voltage | $V_{GS(th)}$ | 1.2 | 1.6 | 2.0 | V | $V_{DS}=V_{GS}$, $I_D=250\text{ }\mu\text{A}$ |
| Zero gate voltage drain current | I_{DSS} | - | 0.1 10 | 1 100 | μA | $V_{DS}=24\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$ $V_{DS}=24\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ °C}$ |
| Gate-source leakage current | I_{GSS} | - | 10 | 100 | nA | $V_{GS}=16\text{ V}$, $V_{DS}=0\text{ V}$ |
| Drain-source on-state resistance | $R_{DS(on)}$ | - | 2.6 3.3 | 3.6 4.6 | m Ω | $V_{GS}=10\text{ V}$, $I_D=20\text{ A}$ $V_{GS}=4.5\text{ V}$, $I_D=20\text{ A}$ |
| Gate resistance ¹⁾ | R_G | - | 0.7 | 1.2 | Ω | - |
| Transconductance | g_{fs} | - | 96 | - | S | $ V_{DS} \geq 2 I_D /R_{DS(on)max}$, $I_D=20\text{ A}$ |

Table 5 Dynamic characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|--------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Input capacitance ¹⁾ | C_{iss} | - | 1010 | 1300 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$ |
| Output capacitance ¹⁾ | C_{oss} | - | 270 | 350 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$ |
| Reverse transfer capacitance ¹⁾ | C_{rss} | - | 32 | 56 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=15\text{ V}$, $f=1\text{ MHz}$ |
| Turn-on delay time | $t_{d(on)}$ | - | 7.7 | - | ns | $V_{DD}=15\text{ V}$, $V_{GS}=4.5\text{ V}$, $I_D=20\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time | t_r | - | 1.4 | - | ns | $V_{DD}=15\text{ V}$, $V_{GS}=4.5\text{ V}$, $I_D=20\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time | $t_{d(off)}$ | - | 14.6 | - | ns | $V_{DD}=15\text{ V}$, $V_{GS}=4.5\text{ V}$, $I_D=20\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time | t_f | - | 1.5 | - | ns | $V_{DD}=15\text{ V}$, $V_{GS}=4.5\text{ V}$, $I_D=20\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$ |

Table 6 Gate charge characteristics²⁾

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--------------------------|---------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Gate to source charge | Q_{gs} | - | 2.5 | 3.4 | nC | $V_{DD}=15\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge at threshold | $Q_{g(th)}$ | - | 1.6 | 2.2 | nC | $V_{DD}=15\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate to drain charge | Q_{gd} | - | 1.8 | 2.7 | nC | $V_{DD}=15\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Switching charge | Q_{sw} | - | 2.7 | 3.9 | nC | $V_{DD}=15\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge total | Q_g | - | 7.2 | 9.0 | nC | $V_{DD}=15\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate plateau voltage | $V_{plateau}$ | - | 2.5 | - | V | $V_{DD}=15\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge total | Q_g | - | 15.2 | 20.2 | nC | $V_{DD}=15\text{ V}$, $I_D=20\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Output charge | Q_{oss} | - | 8.2 | 10.9 | nC | $V_{DD}=15\text{ V}$, $V_{GS}=0\text{ V}$ |

¹⁾ Defined by design. Not subject to production test.

²⁾ See figure 16 for gate charge 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 | - | - | 37 | A | $T_C=25\text{ °C}$ |
| Diode pulse current | $I_{S,pulse}$ | - | - | 323 | A | $T_C=25\text{ °C}$ |
| Diode forward voltage | V_{SD} | - | 0.79 | 1.0 | V | $V_{GS}=0\text{ V}, I_F=20\text{ A}, T_j=25\text{ °C}$ |
| Reverse recovery time ¹⁾ | t_{rr} | - | 25.8 | 51.6 | ns | $V_R=15\text{ V}, I_F=20\text{ A}, di_F/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge ¹⁾ | Q_{rr} | - | 17.0 | 34 | nC | $V_R=15\text{ V}, I_F=20\text{ A}, di_F/dt=100\text{ A}/\mu\text{s}$ |

¹⁾ Defined by design. Not subject to production test.

4 Electrical characteristics diagrams

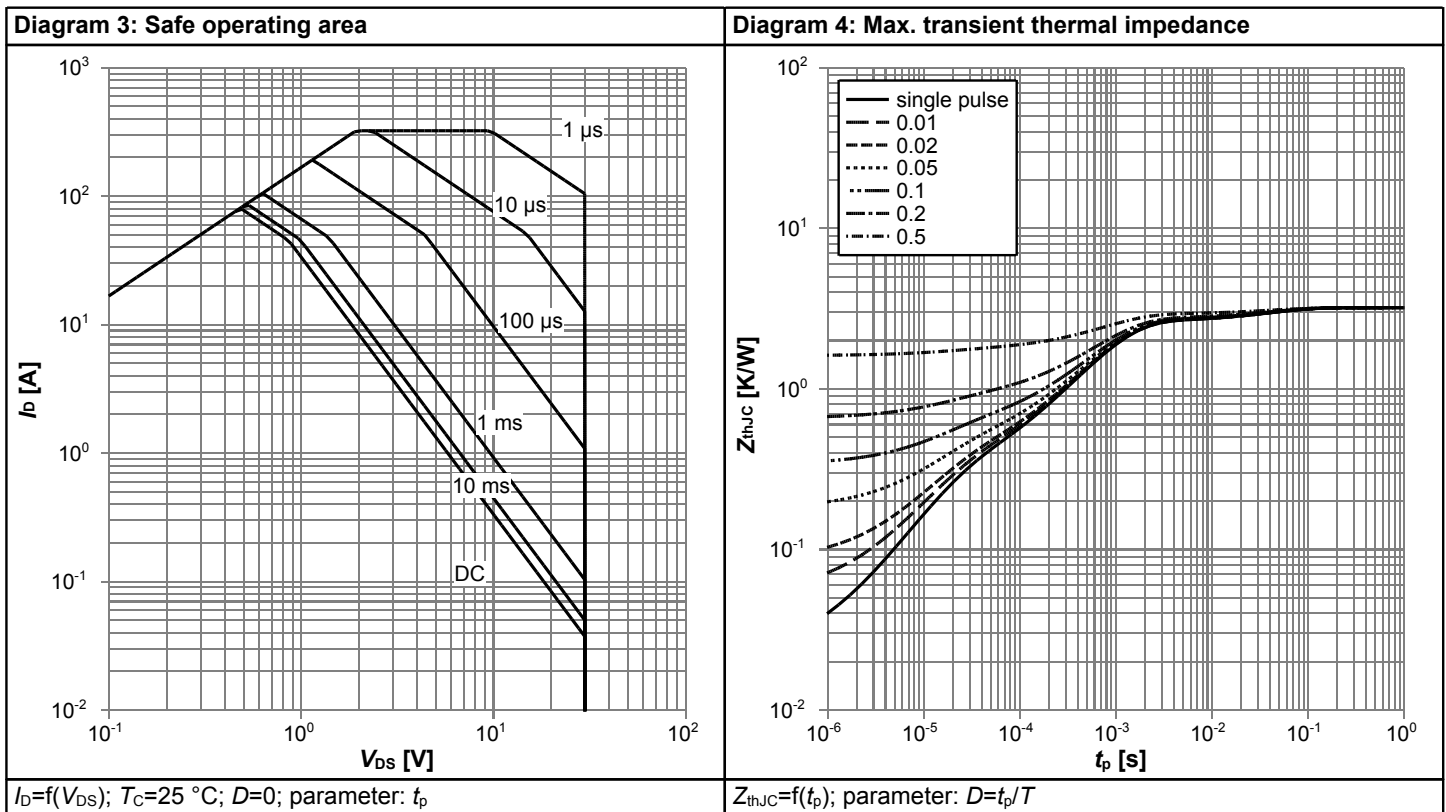
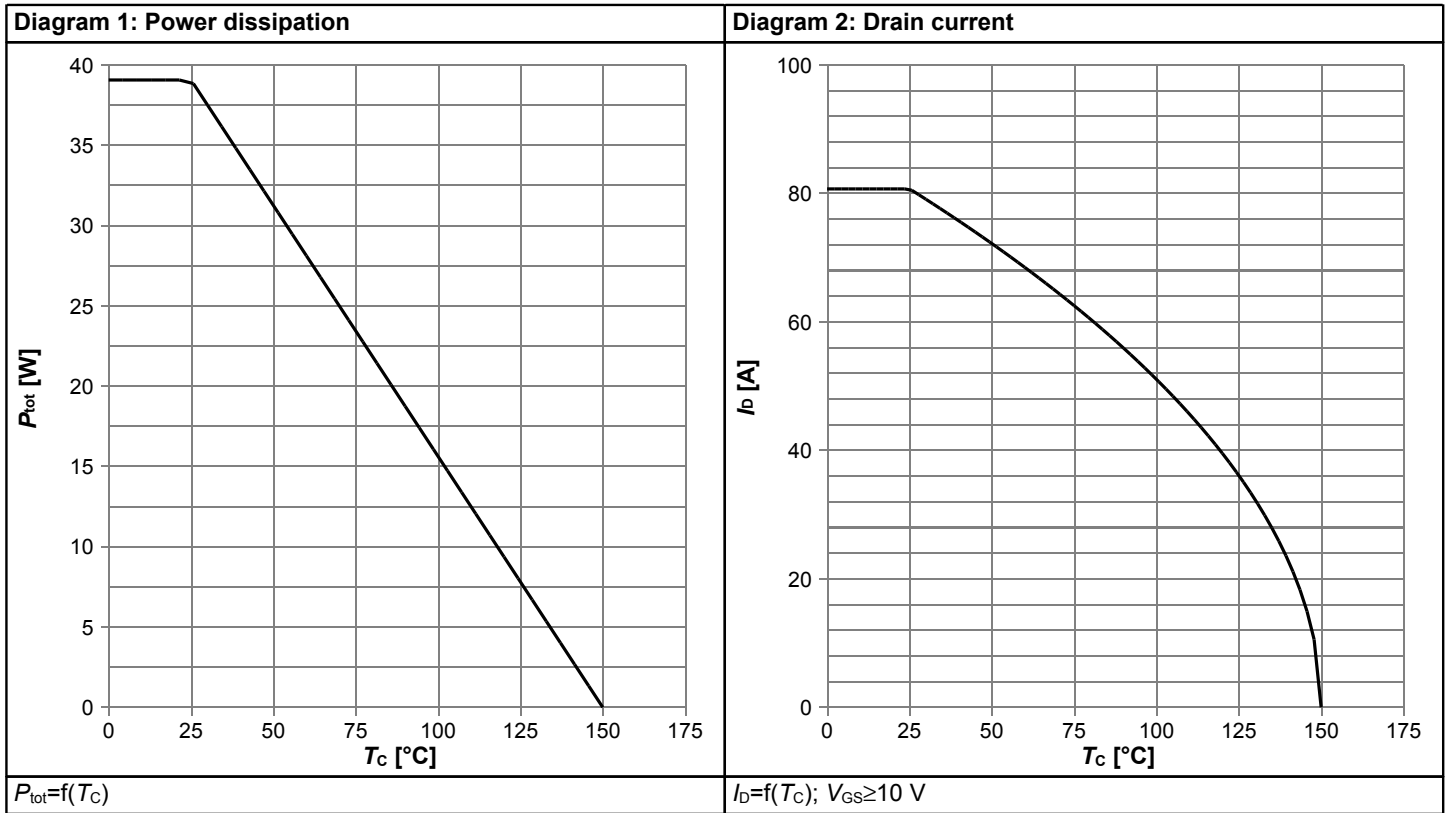
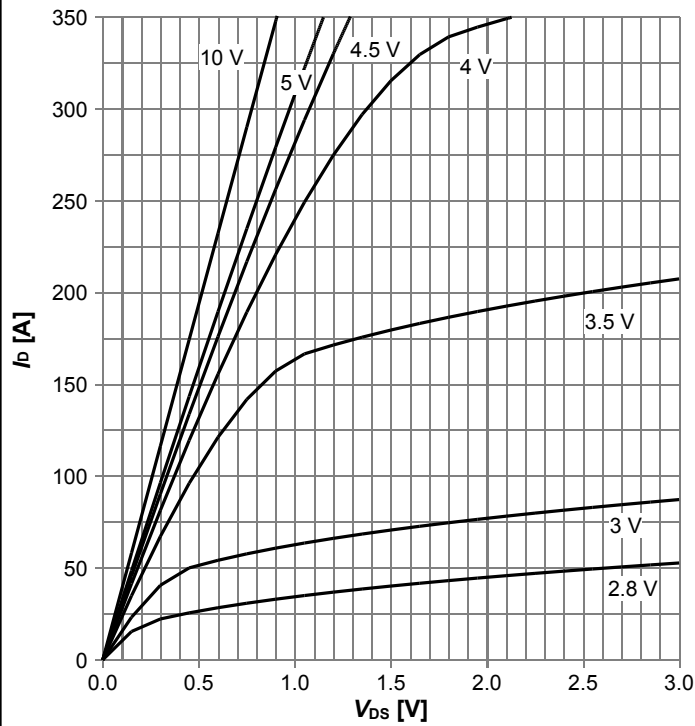
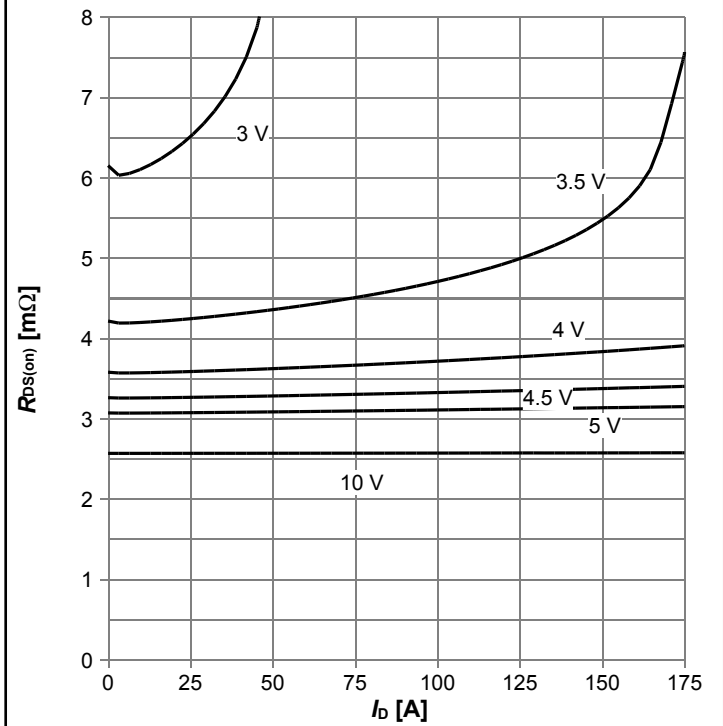


Diagram 5: Typ. output characteristics



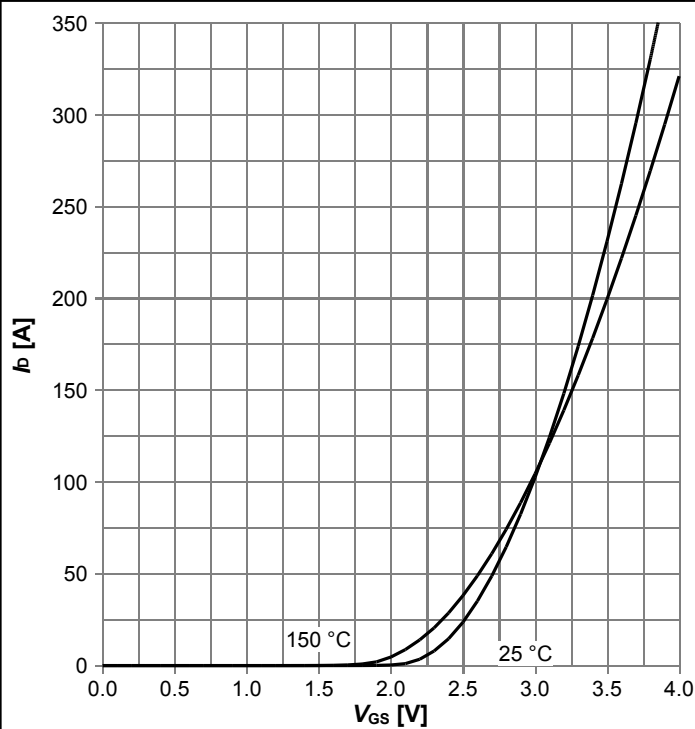
$I_D = f(V_{DS})$, $T_j = 25\text{ °C}$; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



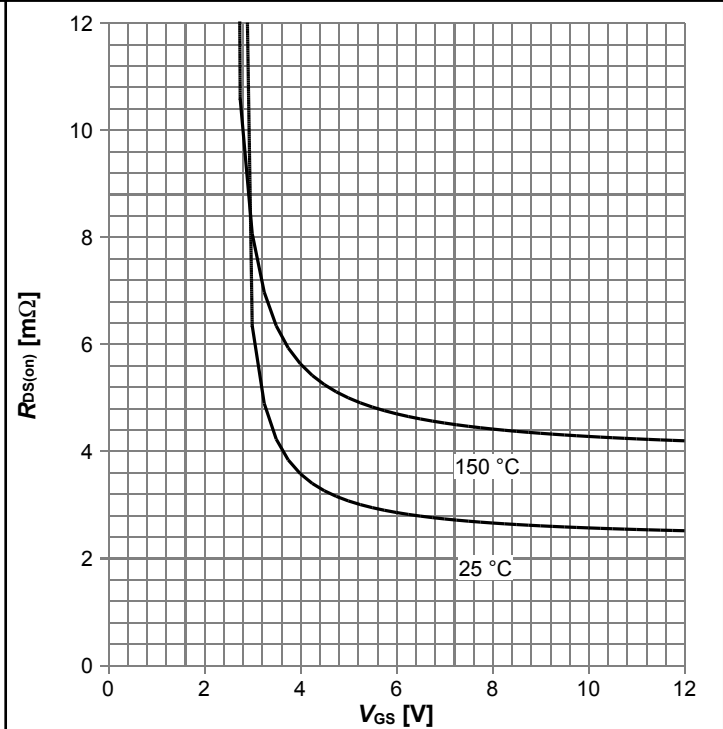
$R_{DS(on)} = f(I_D)$, $T_j = 25\text{ °C}$; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



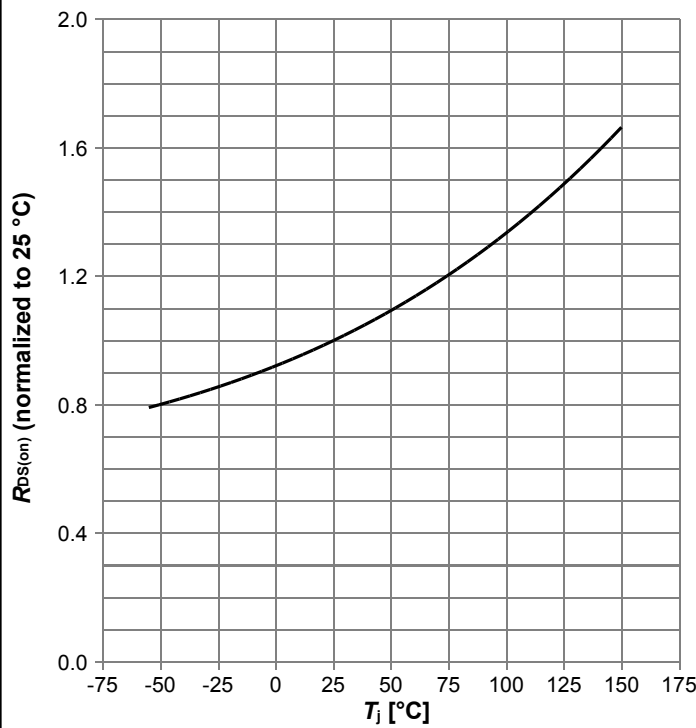
$I_D = f(V_{GS})$, $|V_{DS}| > 2|I_D|R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. drain-source on resistance



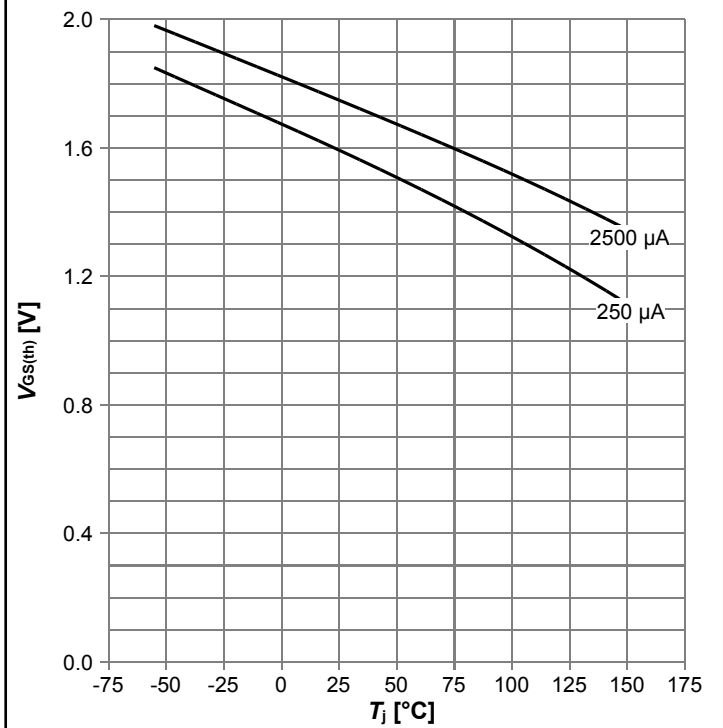
$R_{DS(on)} = f(V_{GS})$, $I_D = 20\text{ A}$; parameter: T_j

Diagram 9: Normalized drain-source on resistance



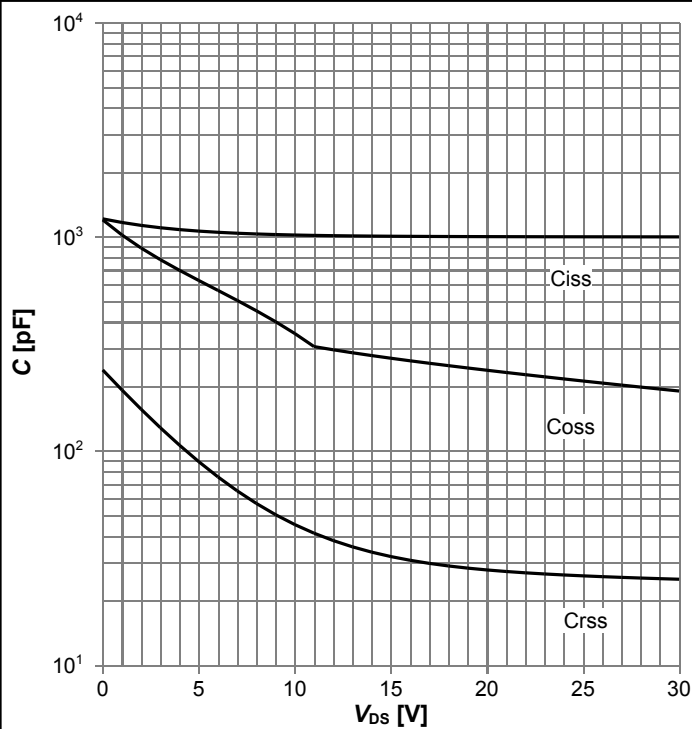
$R_{DS(on)}=f(T_j)$, $I_D=20$ A, $V_{GS}=10$ V

Diagram 10: Typ. gate threshold voltage



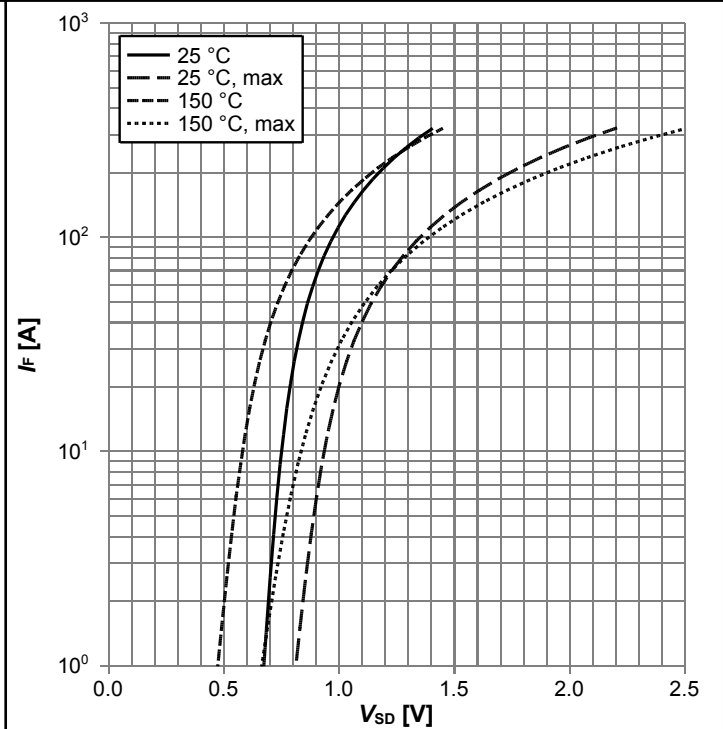
$V_{GS(th)}=f(T_j)$, $V_{GS}=V_{DS}$; parameter: I_D

Diagram 11: Typ. capacitances



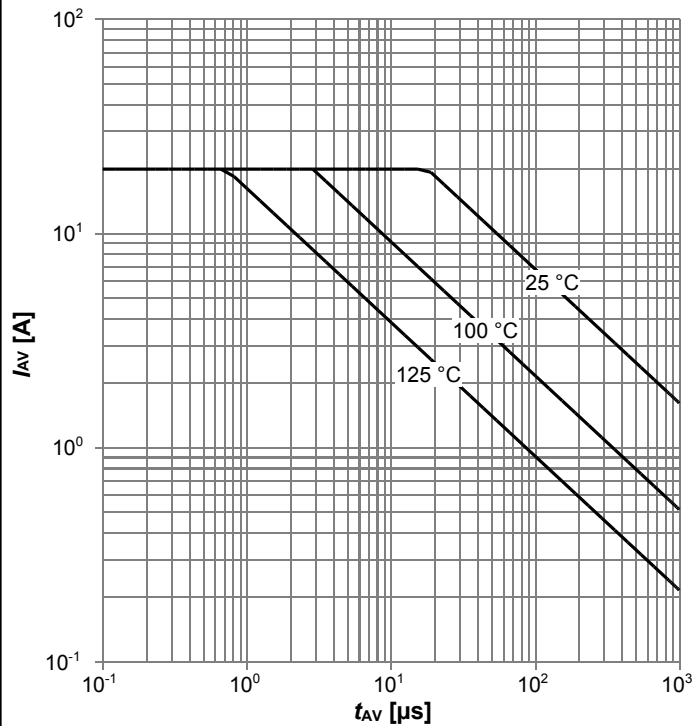
$C=f(V_{DS})$; $V_{GS}=0$ V; $f=1$ MHz

Diagram 12: Forward characteristics of reverse diode



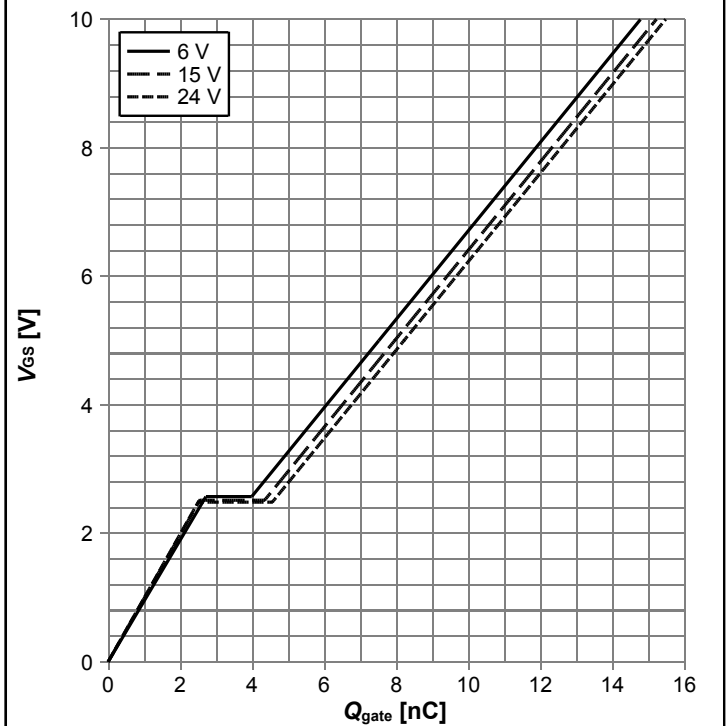
$I_F=f(V_{SD})$; parameter: T_j

Diagram 13: Avalanche characteristics



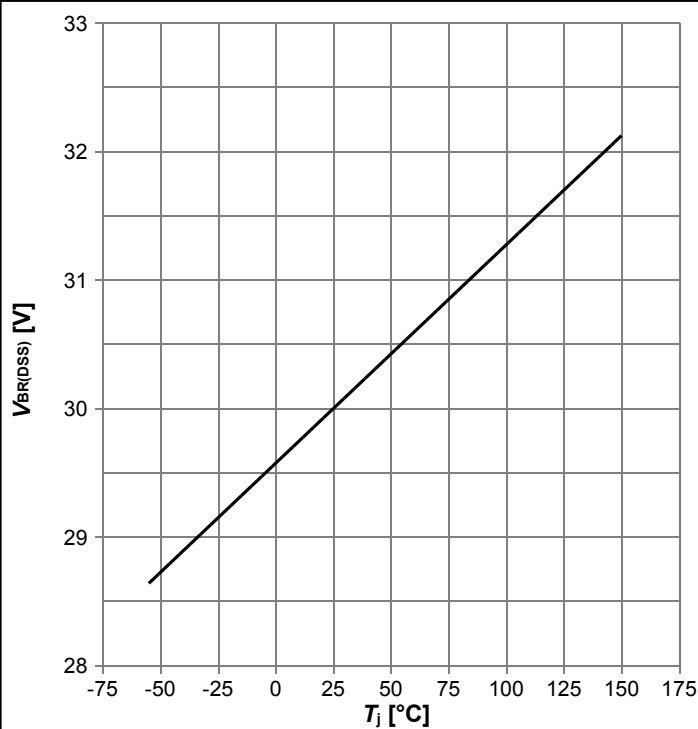
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$; parameter: $T_{j,start}$

Diagram 14: Typ. gate charge



$V_{GS}=f(Q_{gate}), I_D=20 \text{ A pulsed}, T_j=25 \text{ °C}$; parameter: V_{DD}

Diagram 15: Min. drain-source breakdown voltage

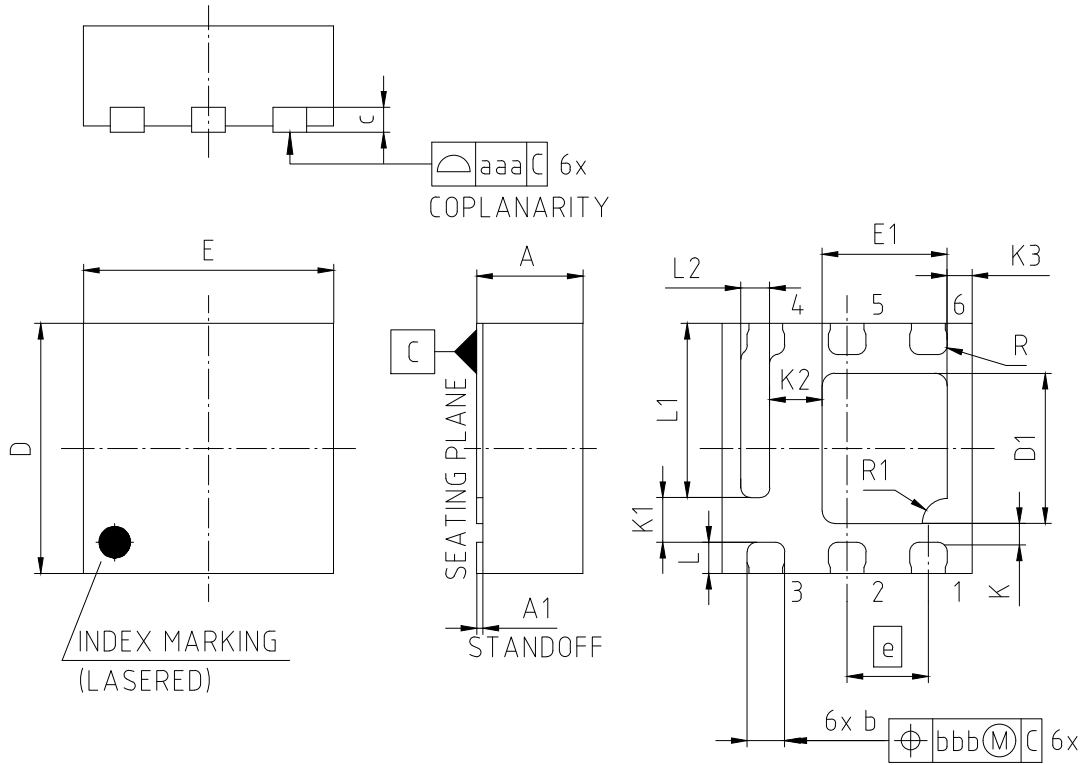


$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$

Diagram Gate charge waveforms



5 Package Outlines



| PACKAGE - GROUP NUMBER: | | PG-VSON-6-U02 | | | |
|-------------------------|-------------|---------------|------------|-------------|------|
| DIMENSIONS | MILLIMETERS | | DIMENSIONS | MILLIMETERS | |
| | MIN. | MAX. | | MIN. | MAX. |
| A | --- | 0.90 | L | 0.20 | 0.30 |
| A1 | --- | 0.05 | L1 | 1.29 | 1.49 |
| b | 0.20 | 0.40 | L2 | 0.13 | 0.33 |
| c | (0.20) | | R | (0.08) | |
| D | 1.90 | 2.10 | R1 | (0.20) | |
| D1 | 1.10 | 1.30 | N | 6 | |
| E | 1.90 | 2.10 | aaa | 0.08 | |
| E1 | 0.90 | 1.10 | bbb | 0.10 | |
| e | 0.65 | | | | |
| K | 0.05 | --- | | | |
| K1 | 0.26 | --- | | | |
| K2 | 0.42 | --- | | | |
| K3 | 0.10 | 0.30 | | | |

NOTE:
DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS

Figure 1 Outline PG-VSON-6, dimensions in mm

Revision History

ISK036N03LM5

Revision: 2024-01-08, Rev. 2.2

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|----------|------------|---|
| 2.0 | 2020-11-26 | Release of final version |
| 2.1 | 2023-06-05 | Update RthJC, Ptot, current rating, RDS(on)typ, Gfs, Capacitances and Gate charges. |
| 2.2 | 2024-01-08 | Update POD drawing |

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