

Automotive MOSFET

OptiMOS™ 7 Power-Transistor



Features

- OptiMOS™ power MOSFET for automotive applications
- N-channel - Enhancement mode - Normal Level
- Extended qualification beyond AEC-Q101
- Enhanced electrical testing
- Robust design
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- RoHS compliant
- 100% Avalanche tested

Potential Applications

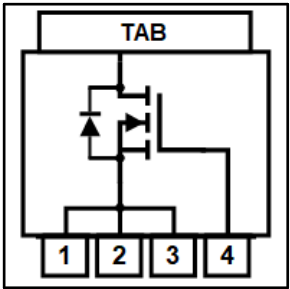
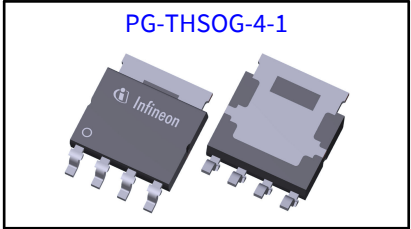
General automotive applications.

Product Validation

Qualified for automotive applications. Product validation according to AEC-Q101.

Product Summary

|                      |     |    |
|----------------------|-----|----|
| $V_{DS}$             | 40  | V  |
| $R_{DS(on)}$         | 4.7 | mΩ |
| $I_D$ (chip limited) | 79  | A  |



| Type           | Package      | Marking  |
|----------------|--------------|----------|
| IAUCN04S7N047G | PG-THSOG-4-1 | 7N04N047 |



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## Maximum Ratings

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

| Parameter                                    | Symbol        | Conditions                                                                              | Value        | Unit             |
|----------------------------------------------|---------------|-----------------------------------------------------------------------------------------|--------------|------------------|
| Continuous drain current                     | $I_D$         | $V_{GS} = 10\text{ V}$ , Chip limitation <sup>1,2)</sup>                                | 79           | A                |
|                                              |               | $V_{GS} = 10\text{ V}$ , DC current                                                     | 79           |                  |
|                                              |               | $T_a = 100^\circ\text{C}$ , $V_{GS} = 10\text{ V}$ , $R_{thJA}$ on 2s2p <sup>2,3)</sup> | 19           |                  |
| Pulsed drain current <sup>2)</sup>           | $I_{D,pulse}$ | $T_C = 25^\circ\text{C}$ , $t_p = 100\text{ }\mu\text{s}$                               | 160          |                  |
| Avalanche energy, single pulse <sup>2)</sup> | $E_{AS}$      | $I_D = 15\text{ A}$                                                                     | 42           | mJ               |
| Avalanche current, single pulse              | $I_{AS}$      | –                                                                                       | 30           | A                |
| Gate source voltage                          | $V_{GS}$      | –                                                                                       | $\pm 20$     | V                |
| Power dissipation                            | $P_{tot}$     | $T_C = 25^\circ\text{C}$                                                                | 50           | W                |
| Operating temperature                        | $T_j$         | –                                                                                       | -55 ... +175 | $^\circ\text{C}$ |

## Thermal Characteristics<sup>2)</sup>

| Parameter                                            | Symbol     | Conditions | Values |      |      | Unit |
|------------------------------------------------------|------------|------------|--------|------|------|------|
|                                                      |            |            | min.   | typ. | max. |      |
| Thermal resistance, junction - case                  | $R_{thJC}$ | –          | –      | –    | 2.98 | K/W  |
| Thermal resistance, junction - ambient <sup>3)</sup> | $R_{thJA}$ | –          | –      | 30.6 | –    |      |

## Electrical Characteristics

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

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

### Static Characteristics

|                                  |               |                                                                                    |     |     |     |               |
|----------------------------------|---------------|------------------------------------------------------------------------------------|-----|-----|-----|---------------|
| Drain-source breakdown voltage   | $V_{(Br)DSS}$ | $V_{GS} = 0\text{ V}$ ,<br>$I_D = 1\text{ mA}$                                     | 40  | –   | –   | V             |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS} = V_{GS}$ , $I_D = 10\text{ }\mu\text{A}$                                  | 2.2 | 2.6 | 3.0 |               |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS} = 40\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_j = 25^\circ\text{C}$          | –   | –   | 1   | $\mu\text{A}$ |
|                                  |               | $V_{DS} = 40\text{ V}$ , $V_{GS} = 0\text{ V}$ ,<br>$T_j = 100^\circ\text{C}^{2)}$ | –   | –   | 3   |               |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$                                     | –   | –   | 100 | nA            |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS} = 7\text{ V}$ , $I_D = 20\text{ A}$                                        | –   | 5.2 | 6.1 | m $\Omega$    |
|                                  |               | $V_{GS} = 10\text{ V}$ , $I_D = 40\text{ A}$                                       | –   | 4.0 | 4.7 |               |
| Gate resistance <sup>2)</sup>    | $R_G$         | –                                                                                  | –   | 1.6 | –   | $\Omega$      |

| Parameter                             | Symbol              | Conditions                                                                                       | Values |      |      | Unit |
|---------------------------------------|---------------------|--------------------------------------------------------------------------------------------------|--------|------|------|------|
|                                       |                     |                                                                                                  | min.   | typ. | max. |      |
| Dynamic Characteristics <sup>2)</sup> |                     |                                                                                                  |        |      |      |      |
| Input capacitance                     | C <sub>iss</sub>    | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 20 V, f = 1 MHz                                         | –      | 824  | 1072 | pF   |
| Output capacitance                    | C <sub>oss</sub>    |                                                                                                  | –      | 407  | 530  |      |
| Reverse transfer capacitance          | C <sub>rss</sub>    |                                                                                                  | –      | 26   | 39   |      |
| Turn-on delay time                    | t <sub>d(on)</sub>  | V <sub>DD</sub> = 20 V, V <sub>GS</sub> = 10 V,<br>I <sub>D</sub> = 40 A, R <sub>G</sub> = 3.5 Ω | –      | 3.6  | –    | ns   |
| Rise time                             | t <sub>r</sub>      |                                                                                                  | –      | 9.4  | –    |      |
| Turn-off delay time                   | t <sub>d(off)</sub> |                                                                                                  | –      | 7.3  | –    |      |
| Fall time                             | t <sub>f</sub>      |                                                                                                  | –      | 10.2 | –    |      |

**Gate Charge Characteristics<sup>2)</sup>**

|                       |               |                                                                                  |   |      |      |    |
|-----------------------|---------------|----------------------------------------------------------------------------------|---|------|------|----|
| Gate to source charge | $Q_{gs}$      | $V_{DD} = 20\text{ V}, I_D = 40\text{ A},$<br>$V_{GS} = 0\text{ to }10\text{ V}$ | – | 3.8  | 4.9  | nC |
| Gate to drain charge  | $Q_{gd}$      |                                                                                  | – | 2.8  | 4.2  |    |
| Gate charge total     | $Q_g$         |                                                                                  | – | 13.0 | 16.9 |    |
| Gate plateau voltage  | $V_{plateau}$ |                                                                                  | – | 4.6  | –    | V  |

**Reverse Diode**

|                                                |               |                                                                                |   |      |     |    |
|------------------------------------------------|---------------|--------------------------------------------------------------------------------|---|------|-----|----|
| Diode continuous forward current <sup>2)</sup> | $I_S$         | $T_C = 25^\circ\text{C}$                                                       | – | –    | 79  | A  |
| Diode pulse current <sup>2)</sup>              | $I_{S,pulse}$ | $T_C = 25^\circ\text{C}, t_p = 100\ \mu\text{s}$                               | – | –    | 160 |    |
| Diode forward voltage                          | $V_{SD}$      | $V_{GS} = 0\text{ V}, I_F = 40\text{ A}, T_j = 25^\circ\text{C}$               | – | 0.85 | 1   | V  |
| Reverse recovery time <sup>2)</sup>            | $t_{rr}$      | $V_R = 20\text{ V}, I_F = 50\text{ A}$<br>$di_F/dt = 100\text{ A}/\mu\text{s}$ | – | 11   | 17  | ns |
| Reverse recovery charge <sup>2)</sup>          | $Q_{rr}$      |                                                                                | – | 1.2  | 2.4 | nC |

<sup>1)</sup> Practically the current is limited by the overall system design including the customer-specific PCB.

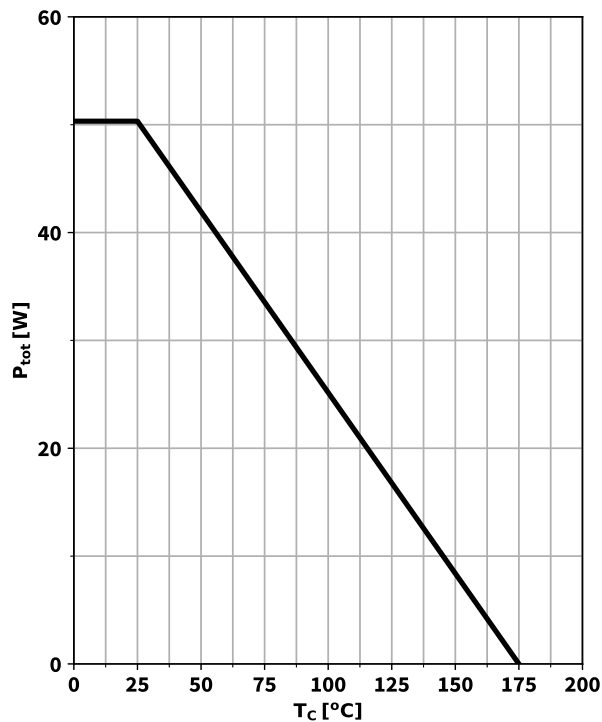
<sup>2)</sup> The parameter is not subject to production testing – specified by design.

<sup>3)</sup> Device on 2s2p FR4 PCB defined in accordance with JEDEC standards (JESD51-5, -7). PCB is vertical in still air.

## Electrical characteristics diagrams

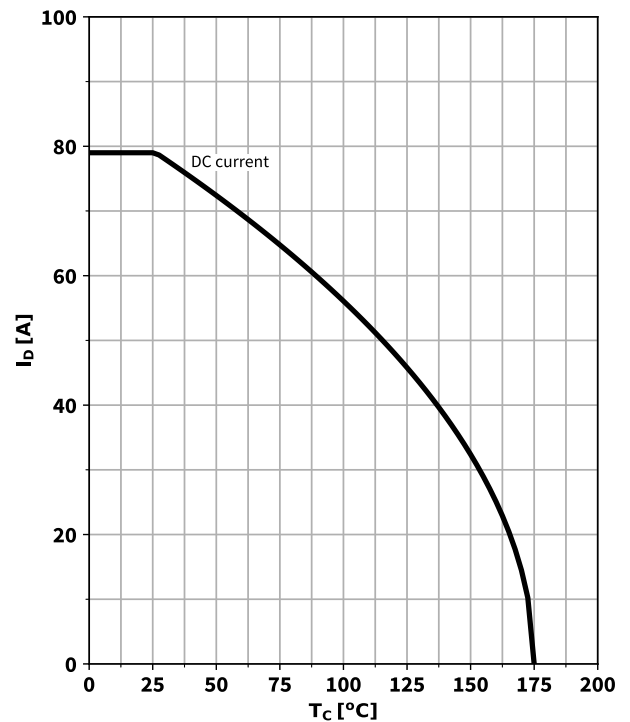
### 1 Power dissipation

$$P_{\text{tot}} = f(T_C); V_{\text{GS}} \geq 6 \text{ V}$$



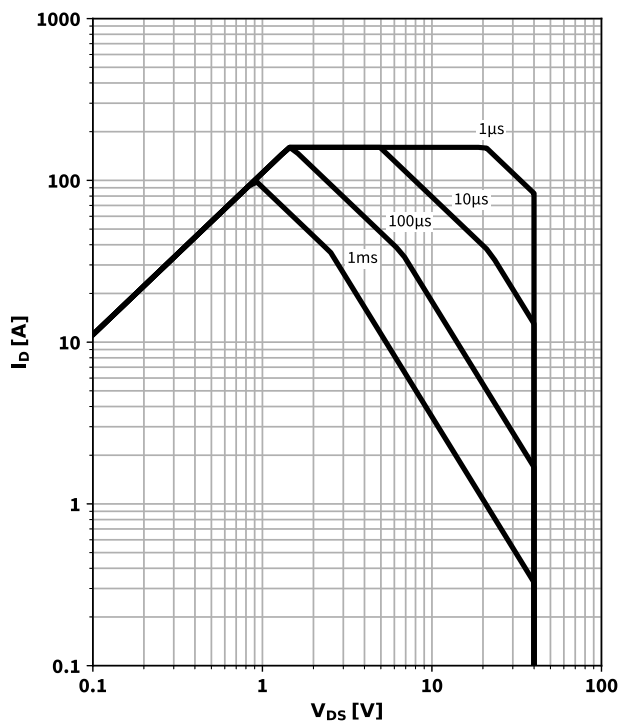
### 2 Drain current

$$I_D = f(T_C); V_{\text{GS}} \geq 6 \text{ V}$$



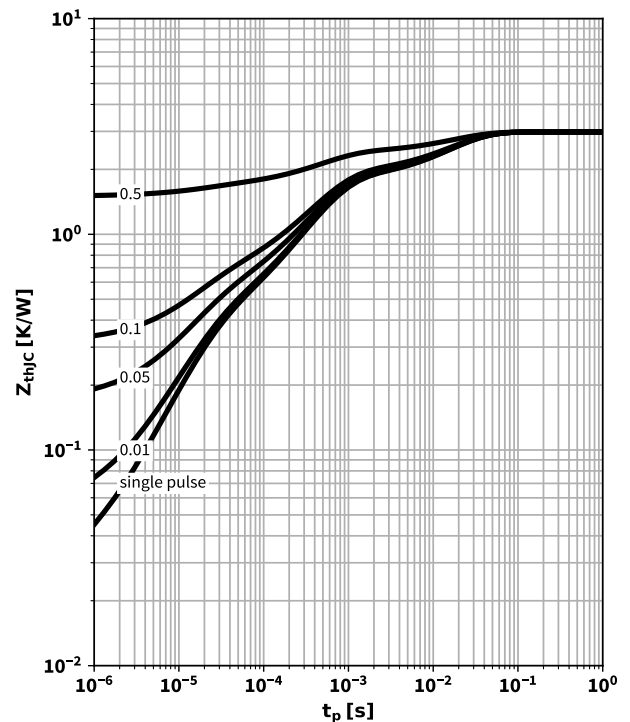
### 3 Safe operating area

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



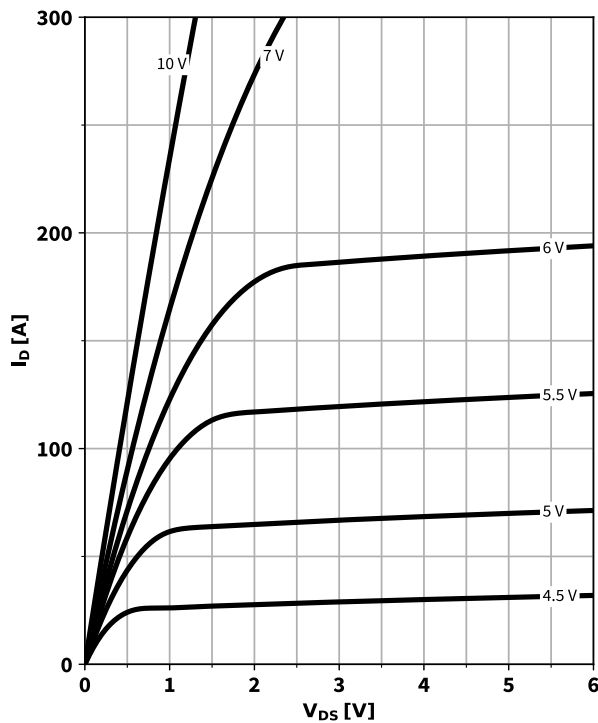
### 4 Max. transient thermal impedance

$$Z_{\text{thJC}} = f(t_p); \text{parameter: } D = t_p/T$$



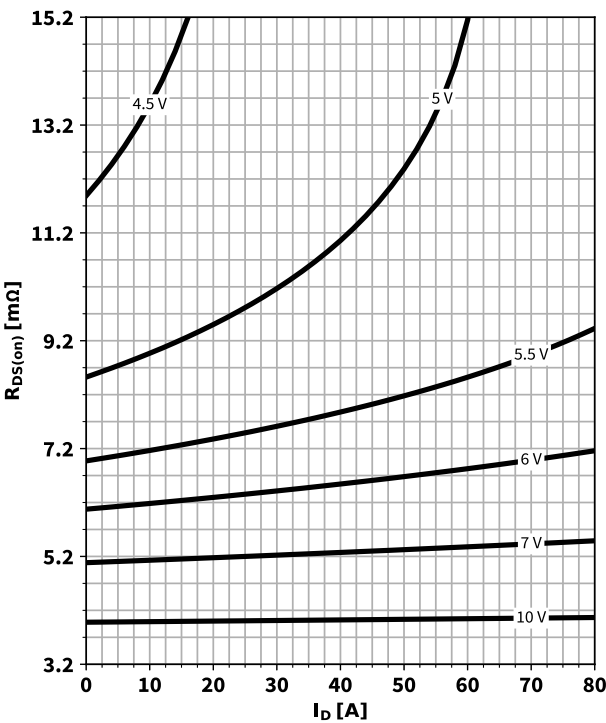
5 Typ. output characteristics

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



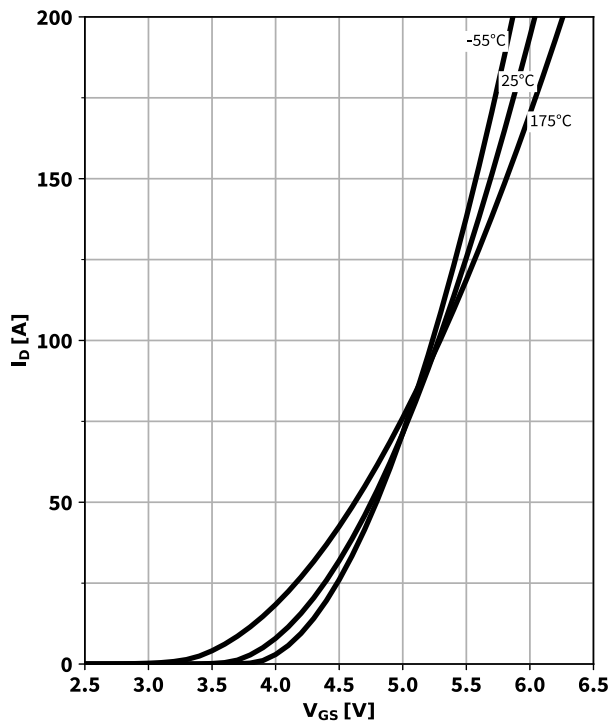
6 Typ. drain-source on-state resistance

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



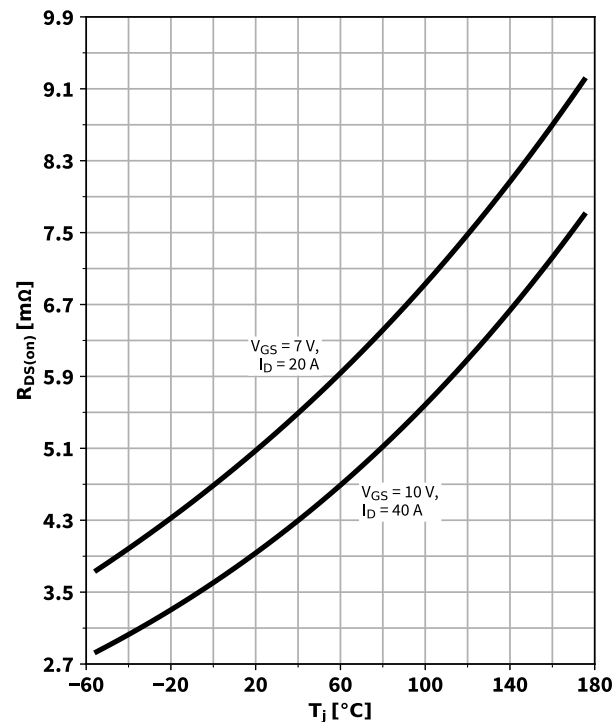
7 Typ. transfer characteristics

$I_D = f(V_{GS}); V_{DS} = 6\text{ V}; \text{parameter: } T_j$



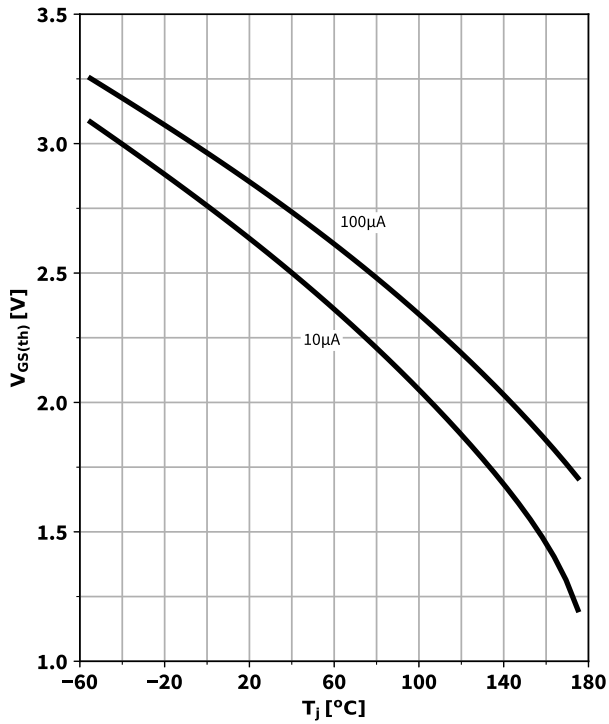
8 Typ. drain-source on-state resistance

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



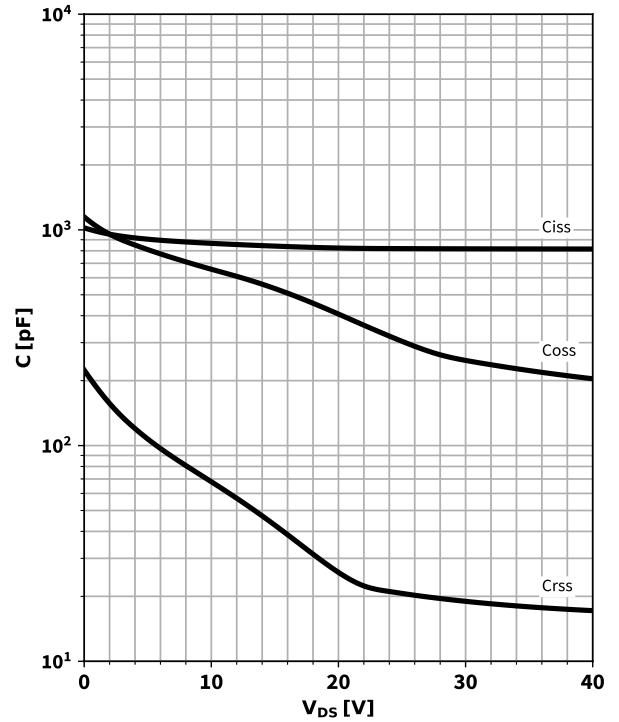
## 9 Typ. gate threshold voltage

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



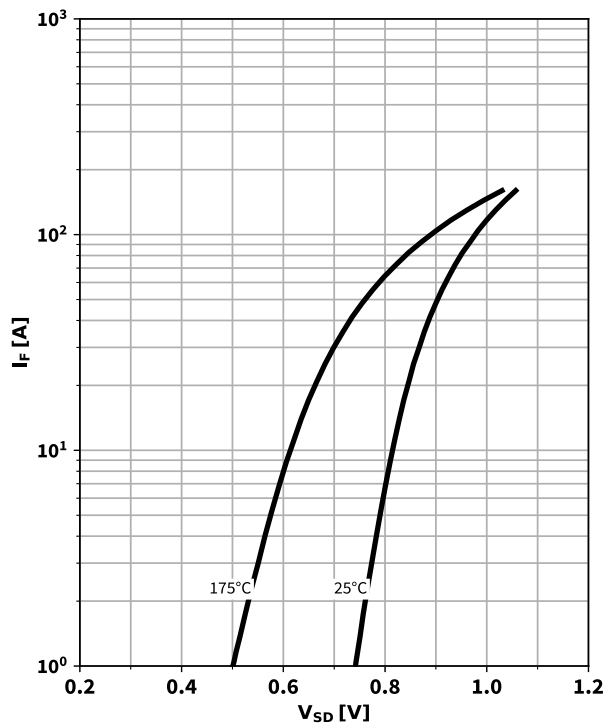
## 10 Typ. capacitances

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



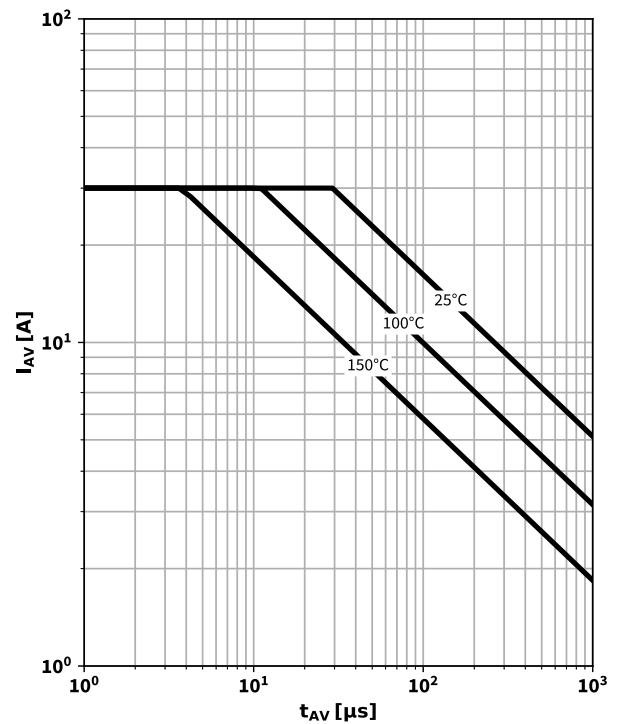
## 11 Typ. forward diode characteristics

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



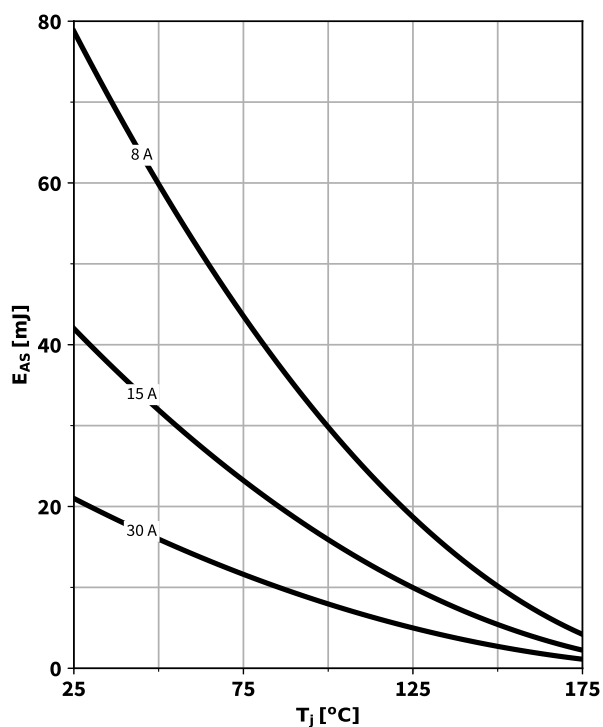
## 12 Typ. avalanche characteristics

$I_{AS} = f(t_{AV})$ ; parameter:  $T_{j(start)}$



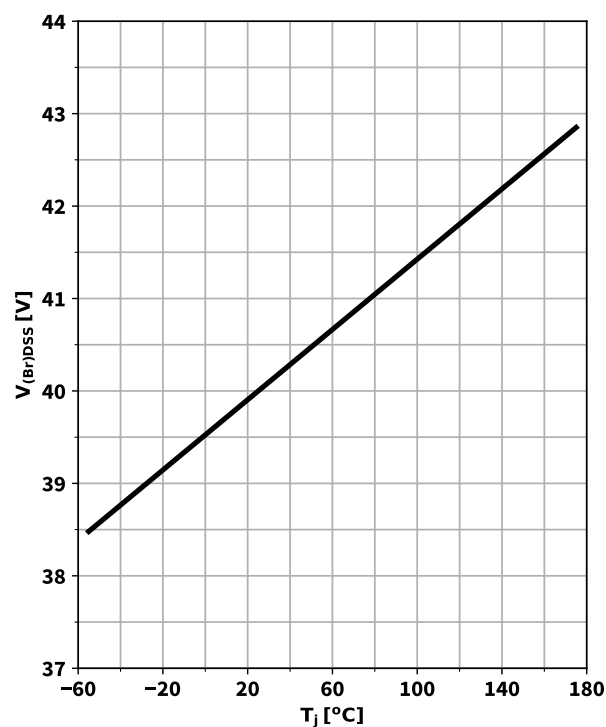
## 13 Typical avalanche energy

$E_{AS} = f(T_j)$ ; parameter:  $I_D$



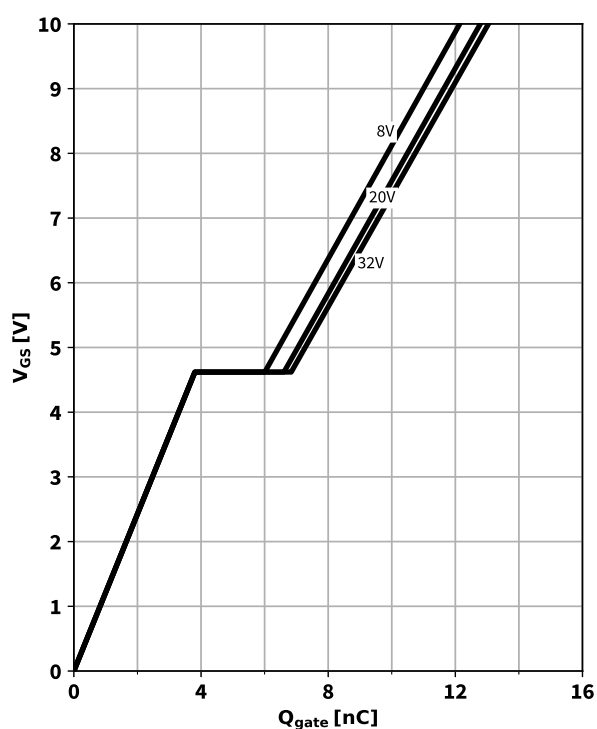
## 14 Drain-source breakdown voltage

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

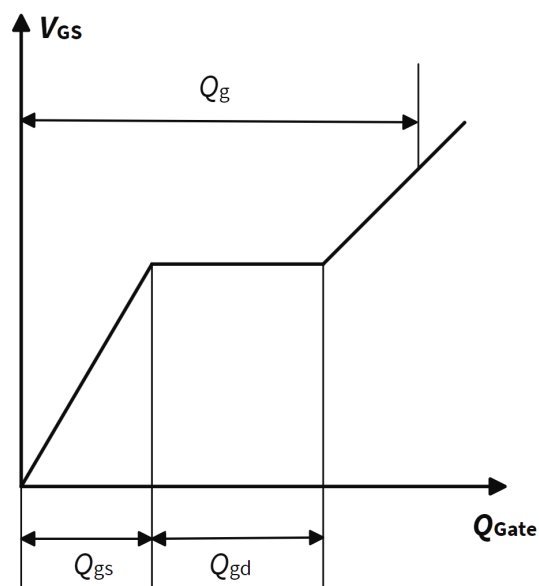


## 15 Typ. gate charge

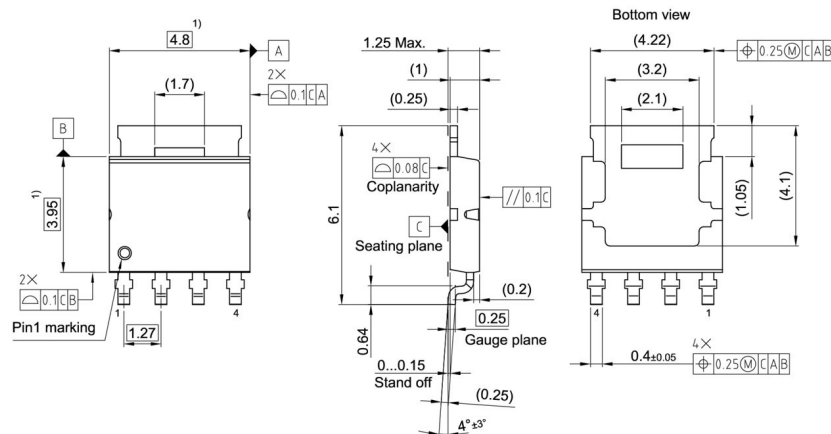
$V_{GS} = f(Q_{gate})$ ;  $I_D = 40\text{ A}$  pulsed; parameter:  $V_{DD}$



## 16 Gate charge waveforms

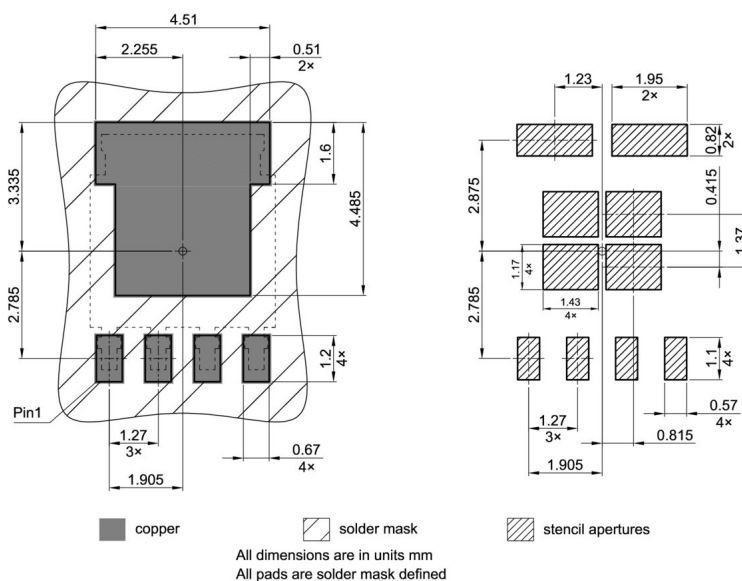


## Package Outline

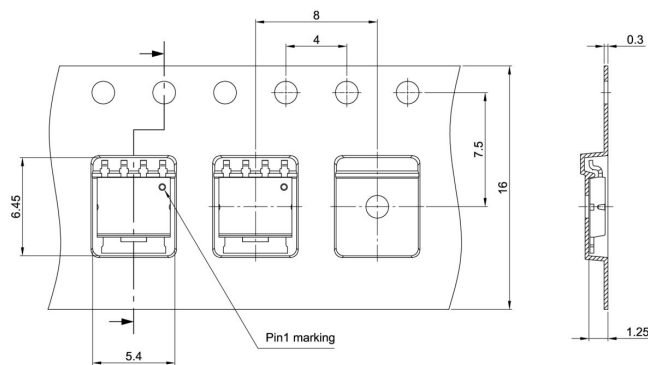


- 1) Does not include plastic protrusion which shall not exceed 0.15mm max. per side.  
2) Dambar protrusion shall be maximum 0.170mm per side.  
3) All metal surfaces are plated, except area of cut.  
All dimensions are in units mm  
The drawing is in compliance with ISO 128-30, Projection Method 1 [  ]  
Drawing according to ISO 8015, general tolerances  $\pm 0.1; \pm 0.15$

## Footprint



## Packaging



All dimensions are in units mm  
The drawing is in compliance with ISO 128-30, Projection Method 1 



Revision History

| Revision     | Date       | Changes          |
|--------------|------------|------------------|
| Revision 1.0 | 2025-12-09 | Final Data Sheet |

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