

# MOSFET

Metal Oxide Semiconductor Field Effect Transistor

## OptiMOS™

OptiMOS™ 5 Power-Transistor, 80 V  
IPB049N08N5

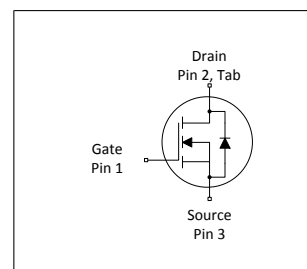
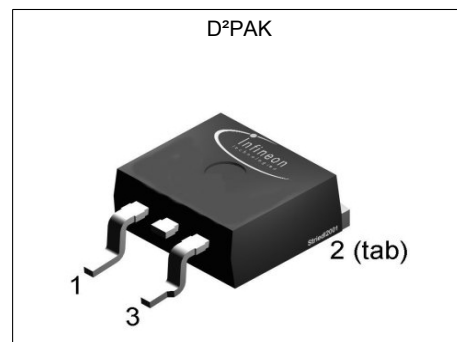
## Data Sheet

Rev. 2.0  
Final

## 1 Description

### Features

- Ideal for high frequency switching and sync. rec.
- Optimized technology for DC/DC converters
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Very low on-resistance  $R_{DS(on)}$
- N-channel, normal level
- 100% avalanche tested
- Pb-free plating; RoHS compliant
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Halogen-free according to IEC61249-2-21



**Table 1 Key Performance Parameters**

| Parameter        | Value | Unit |
|------------------|-------|------|
| $V_{DS}$         | 80    | V    |
| $R_{DS(on),max}$ | 4.9   | mΩ   |
| $I_D$            | 80    | A    |
| $Q_{oss}$        | 51    | nC   |
| $Q_G(0V..10V)$   | 42    | nC   |

| Type / Ordering Code | Package     | Marking  | Related Links |
|----------------------|-------------|----------|---------------|
| IPB049N08N5          | PG-TO 263-3 | 049N08N5 | -             |

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

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## 2 Maximum ratings

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

**Table 2 Maximum ratings**

| Parameter                                    | Symbol         | Values |      |          | Unit | Note / Test Condition                             |
|----------------------------------------------|----------------|--------|------|----------|------|---------------------------------------------------|
|                                              |                | Min.   | Typ. | Max.     |      |                                                   |
| Continuous drain current                     | $I_D$          | -      | -    | 80<br>80 | A    | $T_C=25\text{ °C}$<br>$T_C=100\text{ °C}$         |
| Pulsed drain current <sup>1)</sup>           | $I_{D,pulse}$  | -      | -    | 320      | A    | $T_C=25\text{ °C}$                                |
| Avalanche energy, single pulse <sup>2)</sup> | $E_{AS}$       | -      | -    | 84       | mJ   | $I_D=80\text{ A}$ , $R_{GS}=25\text{ }\Omega$     |
| Gate source voltage                          | $V_{GS}$       | -20    | -    | 20       | V    | -                                                 |
| Power dissipation                            | $P_{tot}$      | -      | -    | 125      | W    | $T_C=25\text{ °C}$                                |
| Operating and storage temperature            | $T_j, T_{stg}$ | -55    | -    | 175      | °C   | IEC climatic category;<br>DIN IEC 68-1: 55/175/56 |

## 3 Thermal characteristics

**Table 3 Thermal characteristics**

| Parameter                                                                            | Symbol     | Values |      |      | Unit | Note / Test Condition |
|--------------------------------------------------------------------------------------|------------|--------|------|------|------|-----------------------|
|                                                                                      |            | Min.   | Typ. | Max. |      |                       |
| Thermal resistance, junction - case                                                  | $R_{thJC}$ | -      | 0.9  | 1.2  | K/W  | -                     |
| Thermal resistance, junction - ambient, minimal footprint                            | $R_{thJA}$ | -      | -    | 62   | K/W  | -                     |
| Thermal resistance, junction - ambient, 6 cm <sup>2</sup> cooling area <sup>3)</sup> | $R_{thJA}$ | -      | -    | 40   | K/W  | -                     |
| Soldering temperature, wave and reflow soldering are allowed                         | $T_{sld}$  | -      | -    | 260  | °C   | reflow MSL1           |

<sup>1)</sup> See figure 3 for more detailed information

<sup>2)</sup> See figure 13 for more detailed information

<sup>3)</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.

## 4 Electrical characteristics

**Table 4 Static characteristics**

| Parameter                        | Symbol        | Values |            |            | Unit          | Note / Test Condition                                                                                                                                       |
|----------------------------------|---------------|--------|------------|------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  |               | Min.   | Typ.       | Max.       |               |                                                                                                                                                             |
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | 80     | -          | -          | V             | $V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$                                                                                                                     |
| Gate threshold voltage           | $V_{GS(th)}$  | 2.2    | 3.0        | 3.8        | V             | $V_{DS}=V_{GS}$ , $I_D=66\text{ }\mu\text{A}$                                                                                                               |
| Zero gate voltage drain current  | $I_{DSS}$     | -      | 0.1<br>10  | 1<br>100   | $\mu\text{A}$ | $V_{DS}=80\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_J=25\text{ }^\circ\text{C}$<br>$V_{DS}=80\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_J=125\text{ }^\circ\text{C}$ |
| Gate-source leakage current      | $I_{GSS}$     | -      | 1          | 100        | nA            | $V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$                                                                                                                  |
| Drain-source on-state resistance | $R_{DS(on)}$  | -      | 4.3<br>5.7 | 4.9<br>6.6 | m $\Omega$    | $V_{GS}=10\text{ V}$ , $I_D=80\text{ A}$<br>$V_{GS}=6\text{ V}$ , $I_D=40\text{ A}$                                                                         |
| Gate resistance <sup>1)</sup>    | $R_G$         | -      | 1.1        | 1.7        | $\Omega$      | -                                                                                                                                                           |
| Transconductance                 | $g_{fs}$      | 52     | 104        | -          | S             | $ V_{DS} >2 I_D R_{DS(on)max}$ , $I_D=80\text{ A}$                                                                                                          |

**Table 5 Dynamic characteristics<sup>1)</sup>**

| Parameter                    | Symbol       | Values |      |      | Unit | Note / Test Condition                                                                              |
|------------------------------|--------------|--------|------|------|------|----------------------------------------------------------------------------------------------------|
|                              |              | Min.   | Typ. | Max. |      |                                                                                                    |
| Input capacitance            | $C_{iss}$    | -      | 2900 | 3770 | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=40\text{ V}$ , $f=1\text{ MHz}$                                      |
| Output capacitance           | $C_{oss}$    | -      | 490  | 637  | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=40\text{ V}$ , $f=1\text{ MHz}$                                      |
| Reverse transfer capacitance | $C_{rss}$    | -      | 23   | 40   | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=40\text{ V}$ , $f=1\text{ MHz}$                                      |
| Turn-on delay time           | $t_{d(on)}$  | -      | 17   | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=80\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time                    | $t_r$        | -      | 7    | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=80\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time          | $t_{d(off)}$ | -      | 27   | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=80\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time                    | $t_f$        | -      | 7    | -    | ns   | $V_{DD}=40\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=80\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |

**Table 6 Gate charge characteristics<sup>2)</sup>**

| Parameter                          | Symbol        | Values |      |      | Unit | Note / Test Condition                                                       |
|------------------------------------|---------------|--------|------|------|------|-----------------------------------------------------------------------------|
|                                    |               | Min.   | Typ. | Max. |      |                                                                             |
| Gate to source charge              | $Q_{gs}$      | -      | 15   | -    | nC   | $V_{DD}=40\text{ V}$ , $I_D=80\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate to drain charge <sup>1)</sup> | $Q_{gd}$      | -      | 9.4  | 14   | nC   | $V_{DD}=40\text{ V}$ , $I_D=80\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Switching charge                   | $Q_{sw}$      | -      | 16   | -    | nC   | $V_{DD}=40\text{ V}$ , $I_D=80\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total <sup>1)</sup>    | $Q_g$         | -      | 42   | 53   | nC   | $V_{DD}=40\text{ V}$ , $I_D=80\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate plateau voltage               | $V_{plateau}$ | -      | 5.2  | -    | V    | $V_{DD}=40\text{ V}$ , $I_D=80\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total, sync. FET       | $Q_{g(sync)}$ | -      | 36   | -    | nC   | $V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }10\text{ V}$                    |
| Output charge <sup>1)</sup>        | $Q_{oss}$     | -      | 51   | 68   | nC   | $V_{DD}=40\text{ V}$ , $V_{GS}=0\text{ V}$                                  |

<sup>1)</sup> Defined by design. Not subject to production test.

<sup>2)</sup> See "Gate charge waveforms" for parameter definition

**Table 7 Reverse diode**

| Parameter                             | Symbol        | Values |      |      | Unit | Note / Test Condition                                                      |
|---------------------------------------|---------------|--------|------|------|------|----------------------------------------------------------------------------|
|                                       |               | Min.   | Typ. | Max. |      |                                                                            |
| Diode continuous forward current      | $I_S$         | -      | -    | 80   | A    | $T_C=25\text{ °C}$                                                         |
| Diode pulse current                   | $I_{S,pulse}$ | -      | -    | 320  | A    | $T_C=25\text{ °C}$                                                         |
| Diode forward voltage                 | $V_{SD}$      | -      | 0.98 | 1.2  | V    | $V_{GS}=0\text{ V}$ , $I_F=80\text{ A}$ , $T_J=25\text{ °C}$               |
| Reverse recovery time <sup>1)</sup>   | $t_{rr}$      | -      | 56   | 112  | ns   | $V_R=40\text{ V}$ , $I_F=80\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge <sup>1)</sup> | $Q_{rr}$      | -      | 92   | 184  | nC   | $V_R=40\text{ V}$ , $I_F=80\text{ A}$ , $di_F/dt=100\text{ A}/\mu\text{s}$ |

<sup>1)</sup> Defined by design. Not subject to production test.

## 5 Electrical characteristics diagrams

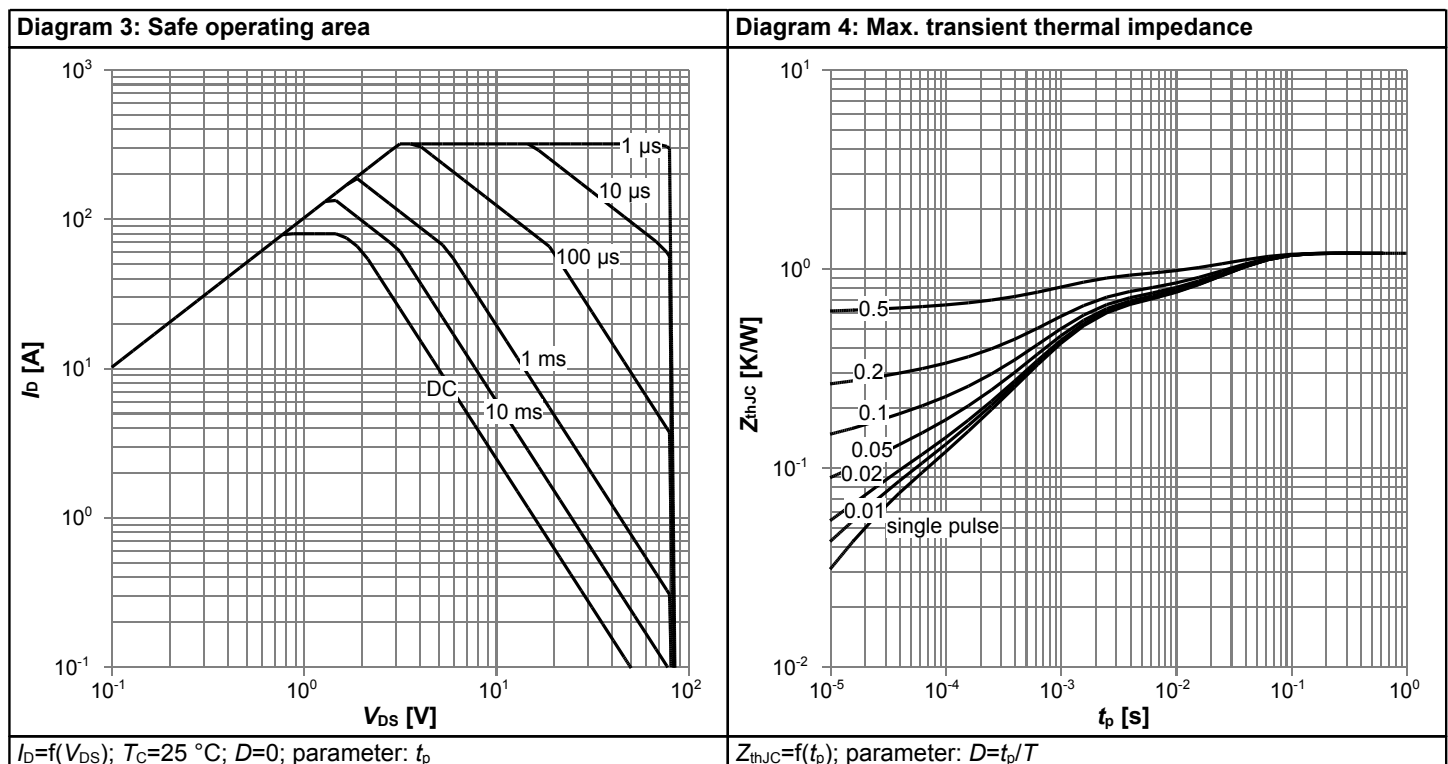
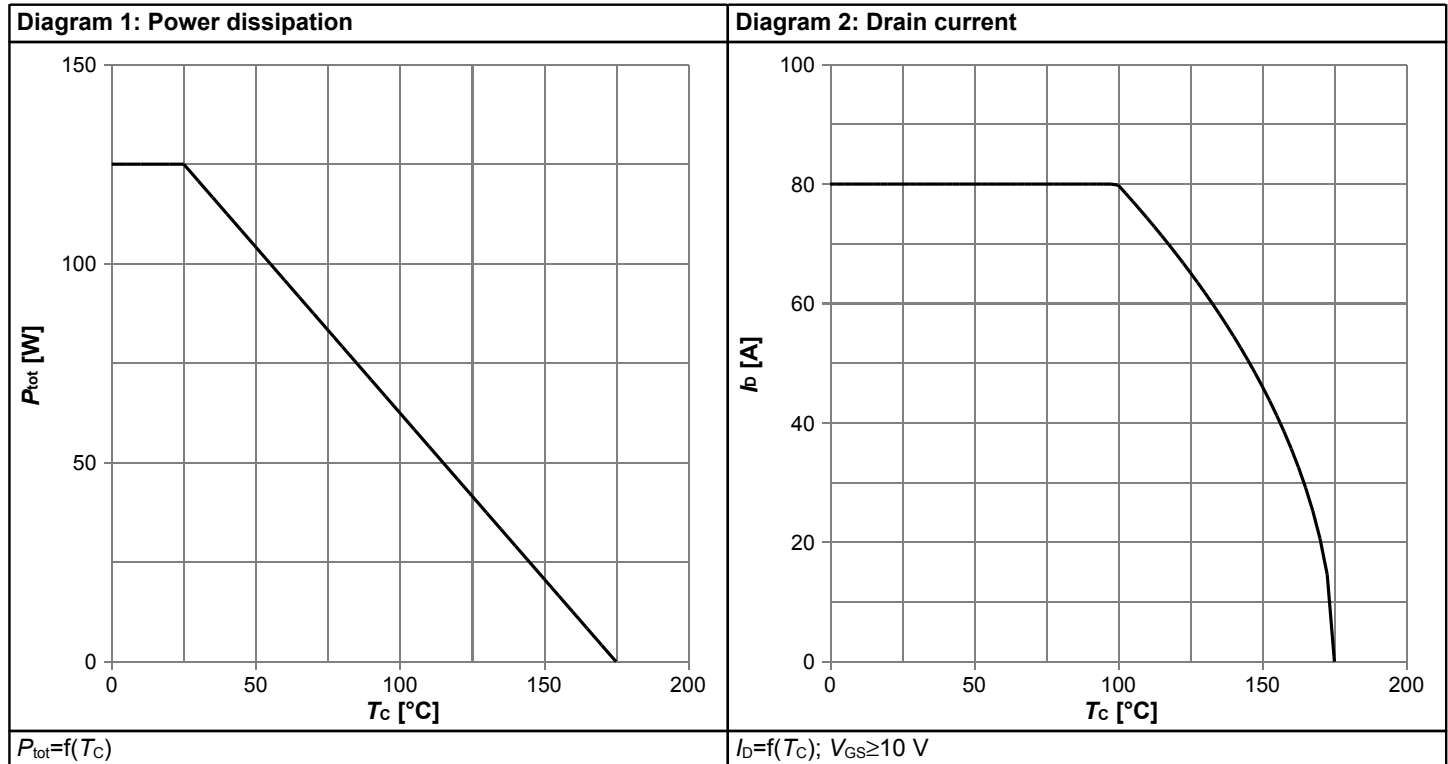


Diagram 5: Typ. output characteristics

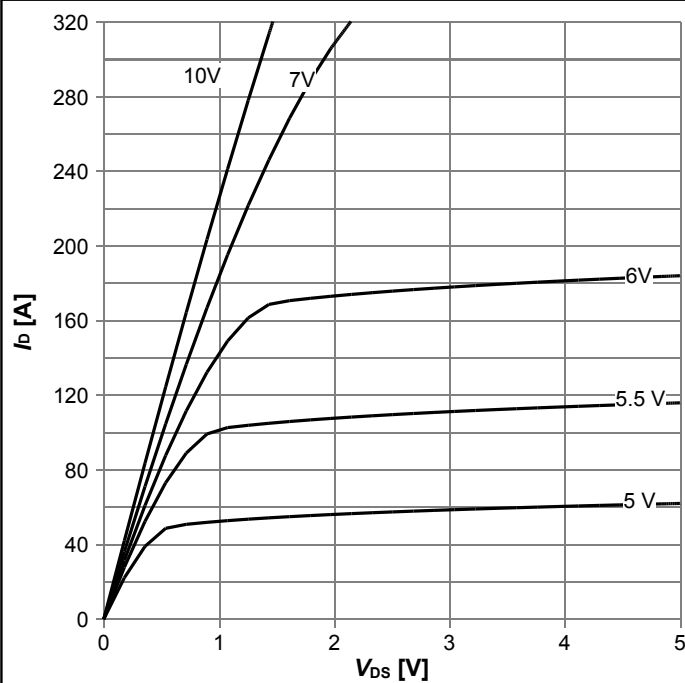

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$ 

Diagram 6: Typ. drain-source on resistance

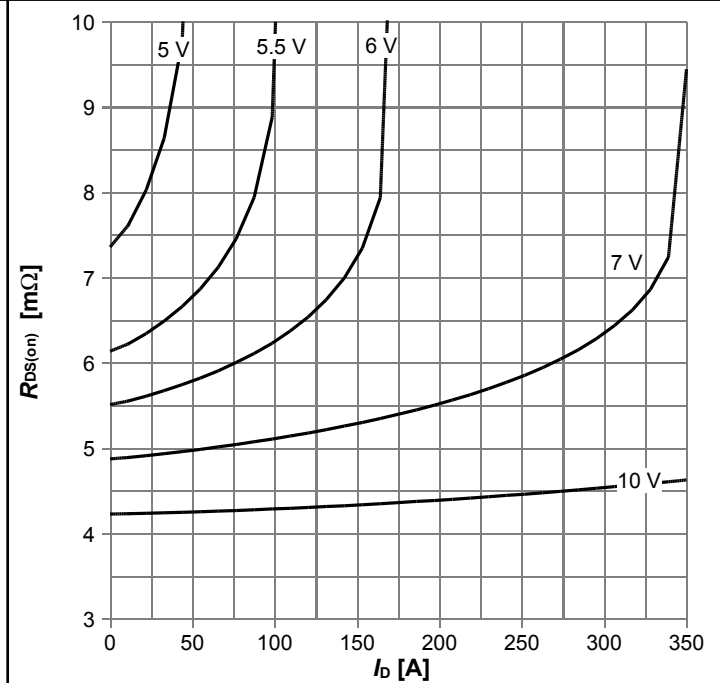

 $R_{DS(on)} = f(I_D); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$ 

Diagram 7: Typ. transfer characteristics

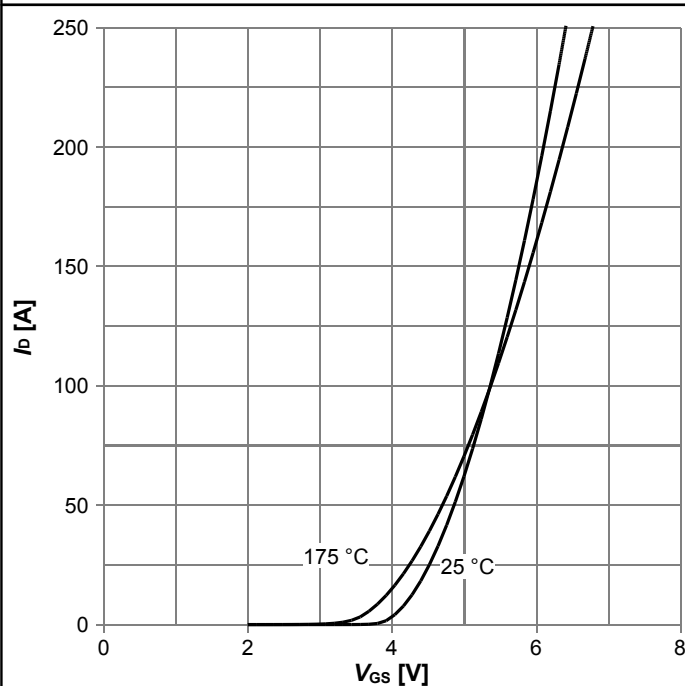

 $I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}; \text{parameter: } T_j$ 

Diagram 8: Typ. forward transconductance

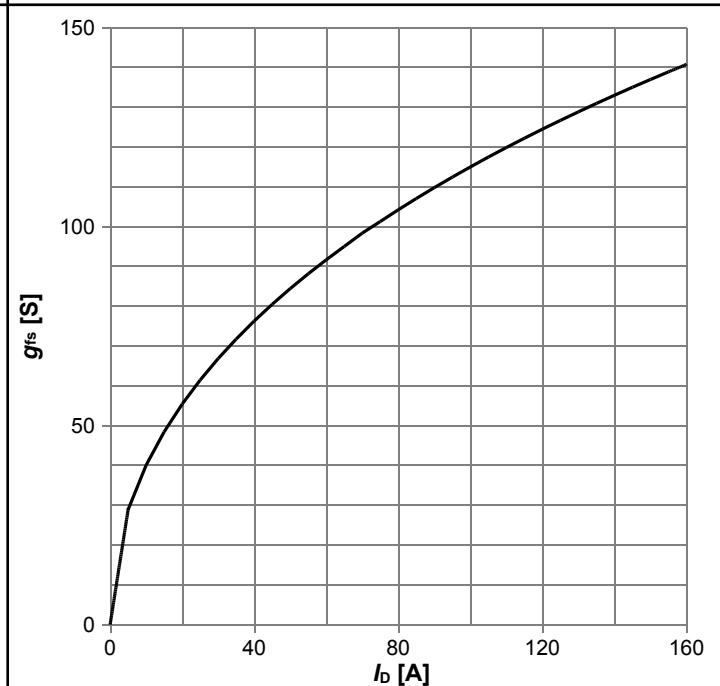
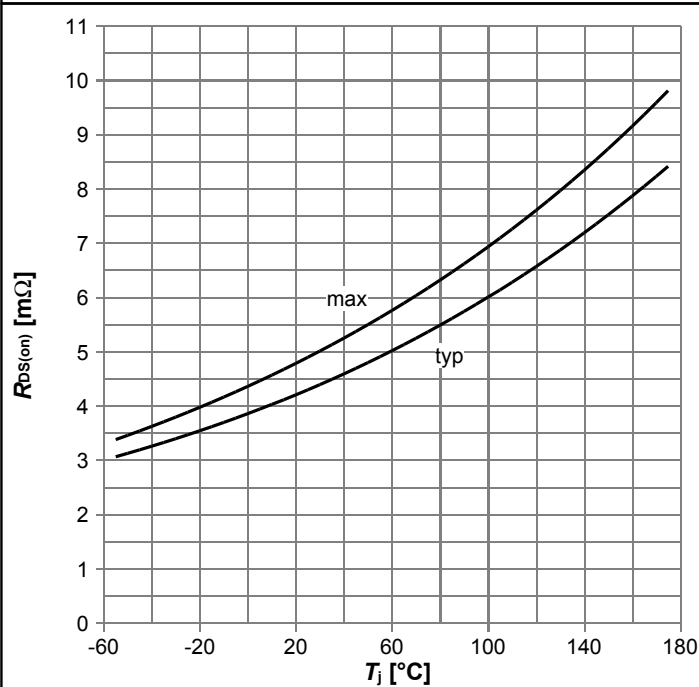

 $g_{fs} = f(I_D); T_j = 25^\circ\text{C}$

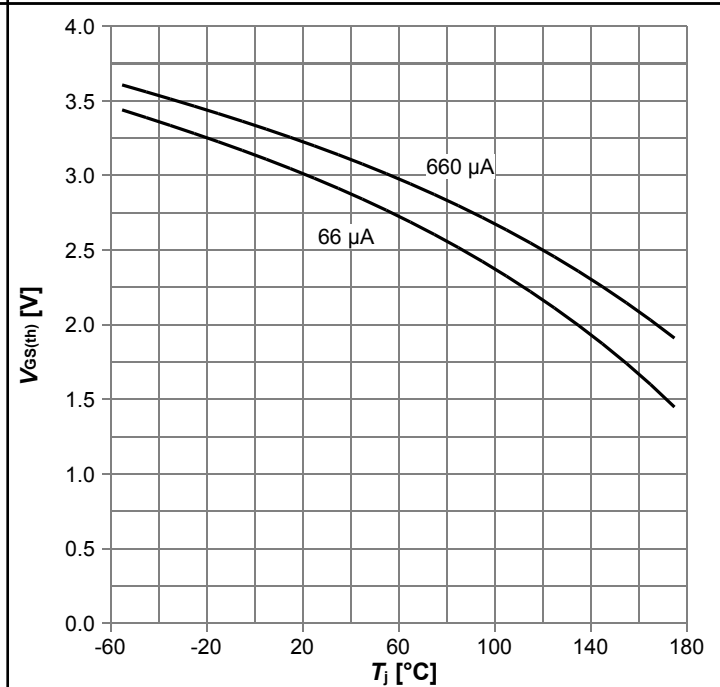


Diagram 9: Drain-source on-state resistance



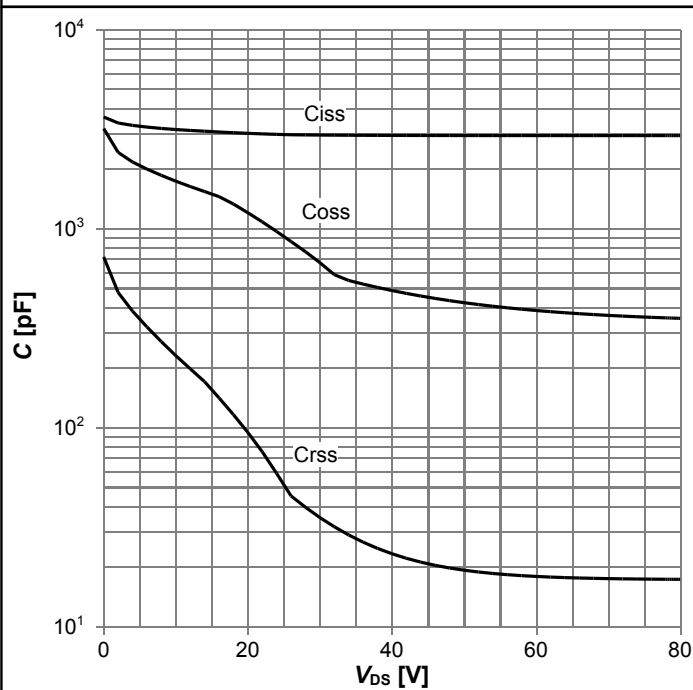
$$R_{DS(on)} = f(T_j); I_D = 80 \text{ A}; V_{GS} = 10 \text{ V}$$

Diagram 10: Typ. gate threshold voltage



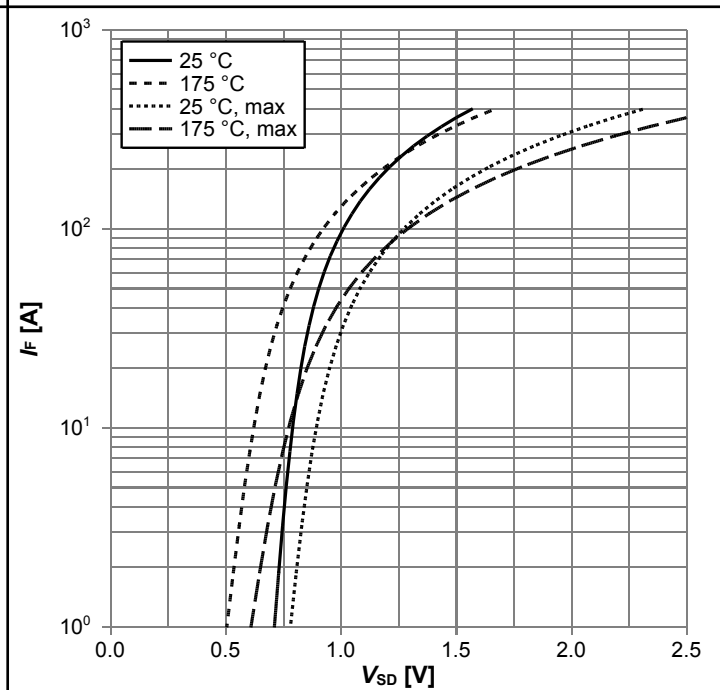
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; \text{parameter: } I_D$$

Diagram 11: Typ. capacitances



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

Diagram 12: Forward characteristics of reverse diode



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

Diagram 13: Avalanche characteristics

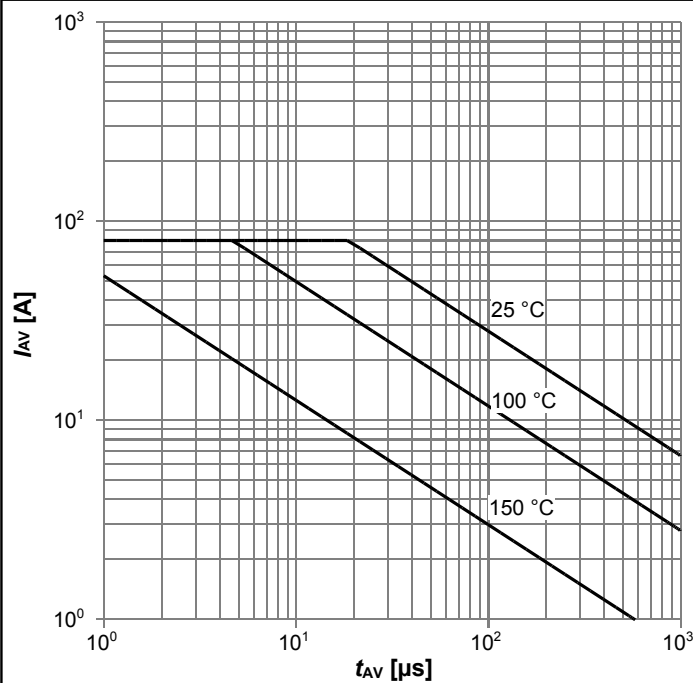

 $I_{AS}=f(t_{AV}); R_{GS}=25\ \Omega; \text{parameter: } T_{j(\text{start})}$ 

Diagram 14: Typ. gate charge

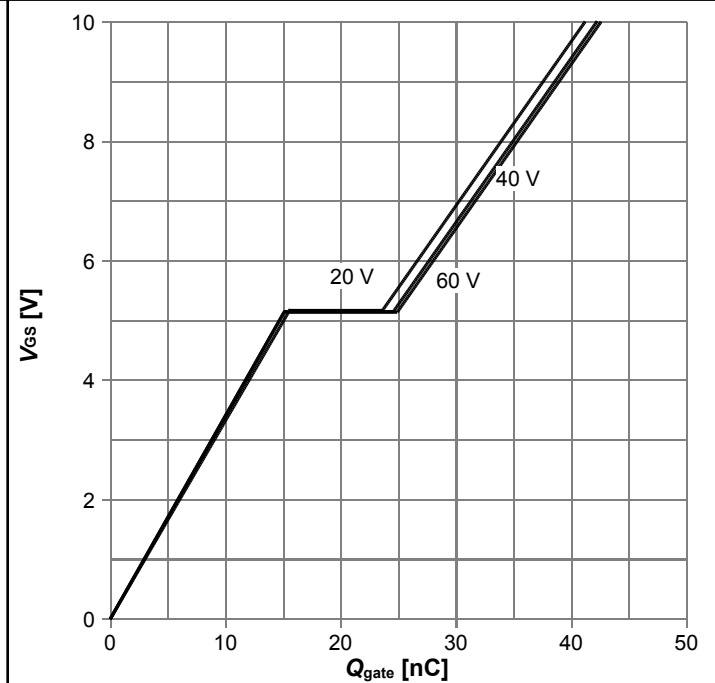
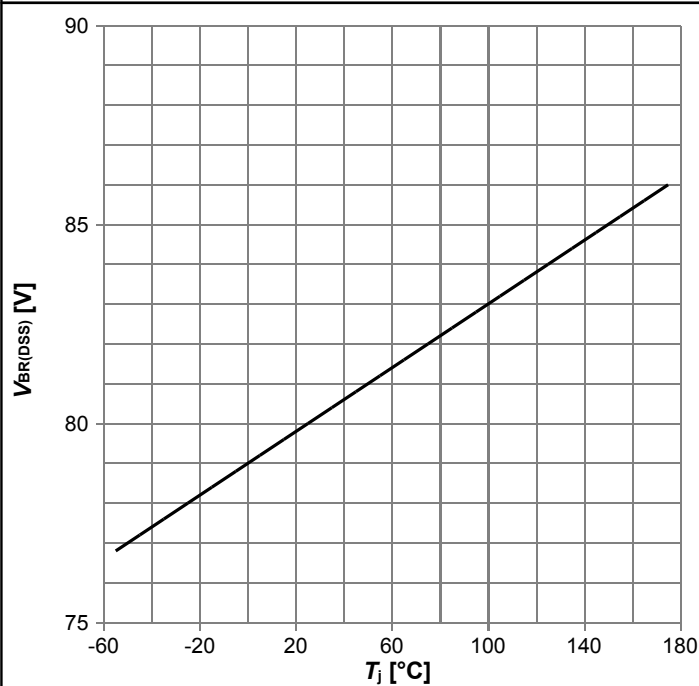
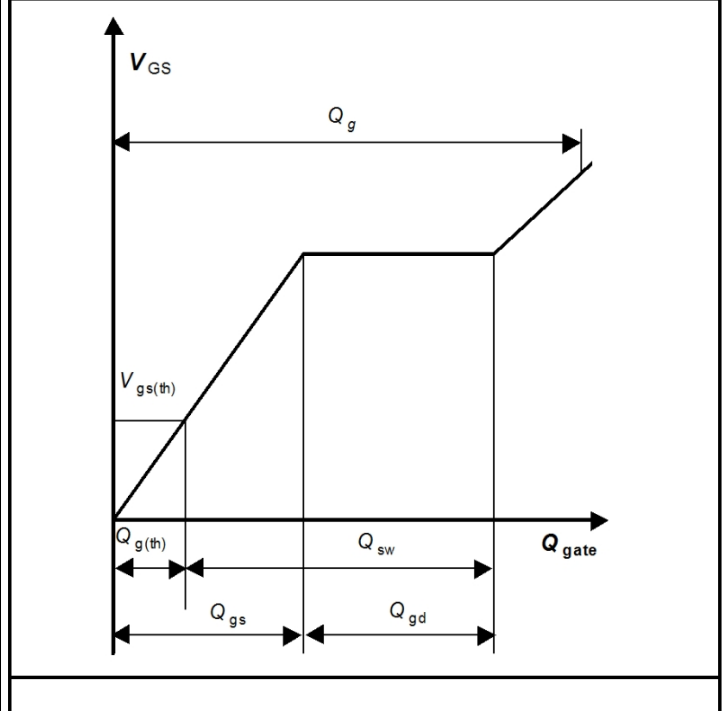

 $V_{GS}=f(Q_{\text{gate}}); I_D=80\ \text{A pulsed}; \text{parameter: } V_{DD}$ 

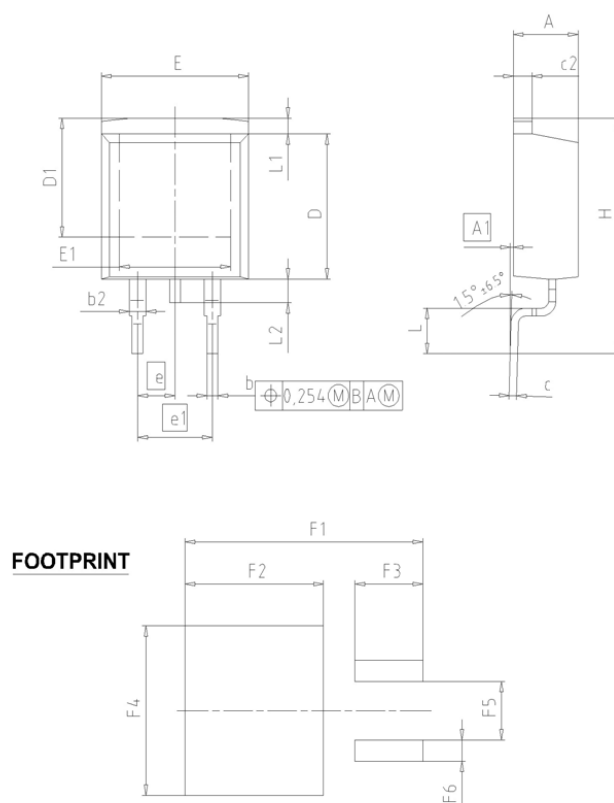
Diagram 15: Drain-source breakdown voltage


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

Gate charge waveforms



## 6 Package Outlines



| DIM | MILLIMETERS |       | INCHES |       |
|-----|-------------|-------|--------|-------|
|     | MIN         | MAX   | MIN    | MAX   |
| A   | 4.30        | 4.57  | 0.169  | 0.180 |
| A1  | 0.00        | 0.25  | 0.000  | 0.010 |
| b   | 0.65        | 0.85  | 0.026  | 0.033 |
| b2  | 0.95        | 1.15  | 0.037  | 0.045 |
| c   | 0.33        | 0.65  | 0.013  | 0.026 |
| c2  | 1.17        | 1.40  | 0.046  | 0.055 |
| D   | 8.51        | 9.45  | 0.335  | 0.372 |
| D1  | 7.10        | 7.90  | 0.280  | 0.311 |
| E   | 9.80        | 10.31 | 0.386  | 0.406 |
| E1  | 6.50        | 8.60  | 0.256  | 0.339 |
| e   | 2.54        |       | 0.100  |       |
| e1  | 5.08        |       | 0.200  |       |
| N   | 2           |       | 2      |       |
| H   | 14.61       | 15.88 | 0.575  | 0.625 |
| L   | 2.29        | 3.00  | 0.090  | 0.118 |
| L1  | 0.70        | 1.60  | 0.028  | 0.063 |
| L2  | 1.00        | 1.78  | 0.039  | 0.070 |
| F1  | 16.05       | 16.25 | 0.632  | 0.640 |
| F2  | 9.30        | 9.50  | 0.366  | 0.374 |
| F3  | 4.50        | 4.70  | 0.177  | 0.185 |
| F4  | 10.70       | 10.90 | 0.421  | 0.429 |
| F5  | 3.65        | 3.85  | 0.144  | 0.152 |
| F6  | 1.25        | 1.45  | 0.049  | 0.057 |

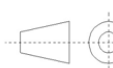
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| EUROPEAN PROJECTION                                                                   |                 |
|  |                 |
| ISSUE DATE<br>30-08-2007                                                              |                 |
| REVISION<br>01                                                                        |                 |

Figure 1 Outline PG-TO 263-3, dimensions in mm/inches

## Revision History

IPB049N08N5

**Revision: 2014-12-17, Rev. 2.0**

Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|----------------------------------------------|
| 2.0      | 2014-12-17 | Release of final version                     |

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