

# SiC Power MOSFET

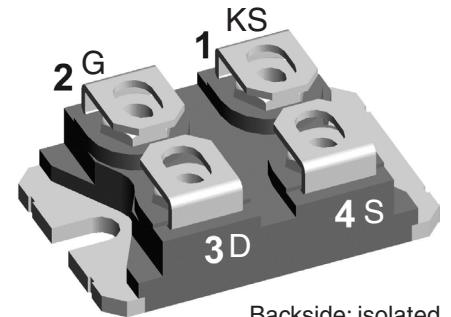
$$I_{D25} = 90 \text{ A}$$

$$V_{DSS} = 1700 \text{ V}$$

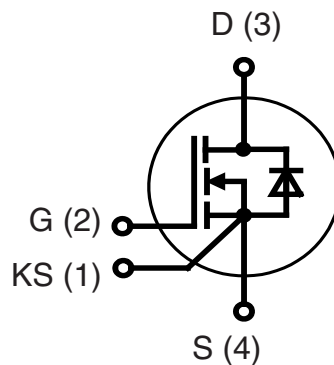
$$R_{DS(on) \text{ max}} = 35 \text{ m}\Omega$$

Kelvin Source gate connection

**Part number**  
IXFN90N170SK



Backside: isolated  
 E72873



## Features / Advantages:

- High speed switching with low capacitances
- High blocking voltage with low  $R_{DS(on)}$
- Easy to parallel and simple to drive
- Resistant to latch-up
- Real Kelvin source connection

## Applications:

- Solar inverters
- High voltage DC/DC converters
- Motor drives
- Switch mode power supplies
- UPS
- Battery chargers
- Induction heating

## Package: SOT-227B (minibloc)

- Isolation Voltage: 2500 V~
- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0
- Base plate with Aluminium nitride isolation
- Advanced power cycling

## Disclaimer Notice

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| MOSFET         |   |   |  | Ratings |      |         |     |
|----------------|---|---|--|---------|------|---------|-----|
| Symbol         | Definitions                             | Conditions  | min.   | typ.    | max. |         |     |
| $V_{(BR)DSS}$  | drain source breakdown voltage          | $I_D = 200 \mu A$ $T_{VJ} = 25^\circ C$   | 1700   |         |      | V       |     |
| $V_{GS(max)}$  | max transient gate source voltage       |   | -10  |         | +25  | V       |     |
| $V_{GS}$       | continous gate source voltage           | recommended operational value   | -5   |         | +20  | V       |     |
| $I_{D25}$      | drain current                           | $V_{GS} = 20 V$   |  |         | 90   | A       |     |
| $I_{D80}$      |   |   | $T_C = 25^\circ C$   |         |      | 67      | A   |
| $I_{D100}$     |   |   | $T_C = 80^\circ C$   |         |      | 56      | A   |
| $R_{DS(on)}$   | static drain source on resistance       | $I_D = 100 A; V_{GS} = 20 V$  | $T_{VJ} = 25^\circ C$  |         | 23   | 35      | mΩ  |
|                |   |   | $T_{VJ} = 150^\circ C$   |         | 45   |         | mΩ  |
| $V_{GS(th)}$   | gate threshold voltage                  | $I_D = 36 mA; V_{GS} = V_{DS}$  | $T_{VJ} = 25^\circ C$  | 2.0     | 2.4  | 4.0     | V   |
|                |   |   | $T_{VJ} = 150^\circ C$   |         | 1.8  |         | V   |
| $I_{DSS}$      | drain source leakage current            | $V_{DS} = 1700 V; V_{GS} = 0 V$ $T_{VJ} = 25^\circ C$   |  | 5       | 200  | $\mu A$ |     |
| $I_{GSS}$      | gate source leakage current             | $V_{DS} = 0 V; V_{GS} = 20 V$ $T_{VJ} = 25^\circ C$   |  |         | 1.2  | $\mu A$ |     |
| $R_G$          | internal gate resistance                | $f = 1 MHz, V_{AC} = 25 mV, ESR \text{ of } C_{ISS}$  |  | 1.9     |      | Ω       |     |
| $C_{ISS}$      | input capacitance                       | $V_{DS} = 1000 V; V_{GS} = 0 V; f = 1 MHz T_{VJ} = 25^\circ C$  |  | 7340    |      | pF      |     |
| $C_{OSS}$      | output capacitance                      |   |  | 342     |      | pF      |     |
| $C_{RSS}$      | reverse transfer (Miller) capacitance   |   |  | 13.5    |      | pF      |     |
| $Q_g$          | total gate charge                       | $V_{DS} = 1200 V; I_D = 100A; V_{GS} = -5/20 V$<br>$T_{VJ} = 25^\circ C$  |  | 376     |      | nC      |     |
| $Q_{gs}$       | gate source charge                      |   |  | 88      |      | nC      |     |
| $Q_{gd}$       | gate drain (Miller) charge              |   |  | 114     |      | nC      |     |
| $t_{d(on)}$    | turn-on delay time                      | Inductive switching<br>$V_{DS} = 1200 V; I_D = 70 A$ $T_{VJ} = 25^\circ C$<br>$V_{GS} = -5 / 20 V; R_G = 2.5 \Omega$ (external)<br>Free wheeling diode:<br>Body diode @ $V_{GS} = -5 V$ |  | 34      |      | ns      |     |
| $t_r$          | current rise time                       |   |  | 13      |      | ns      |     |
| $t_{d(off)}$   | turn-off delay time                     |   |  | 75      |      | ns      |     |
| $t_f$          | current fall time                       |   |  | 27      |      | ns      |     |
| $E_{on}$       | turn-on energy per pulse                |   |  | 2.58    |      | mJ      |     |
| $E_{off}$      | turn-off energy per pulse               |   |  | 0.77    |      | mJ      |     |
| $E_{rec(off)}$ | reverse recovery losses at turn-off     |   |  | 0.66    |      | mJ      |     |
| $t_{d(on)}$    | turn-on delay time                      |   | Inductive switching<br>$V_{DS} = 1200 V; I_D = 70 A$ $T_{VJ} = 150^\circ C$<br>$V_{GS} = -5 / 20 V; R_G = 2.5 \Omega$ (external)<br>Free wheeling diode:<br>Body diode @ $V_{GS} = -5 V$ |         | 36   |         | ns  |
| $t_r$          | current rise time                       |   |  |         | 13   |         | ns  |
| $t_{d(off)}$   | turn-off delay time                     |   |  |         | 105  |         | ns  |
| $t_f$          | current fall time                       |   |  | 33      |      | ns      |     |
| $E_{on}$       | turn-on energy per pulse                |   |  | 4.90    |      | mJ      |     |
| $E_{off}$      | turn-off energy per pulse               |   |  | 1.05    |      | mJ      |     |
| $E_{rec(off)}$ | reverse recovery losses at turn-off     |   |  | 1.89    |      | mJ      |     |
| $R_{thJC}$     | thermal resistance junction to case     | with heatsink compound; IXYS test setup   |  |         | 0.30 | 0.22    | K/W |
| $R_{thJH}$     | thermal resistance junction to heatsink |   |  |         |      | K/W     |     |

| Source-Drain Diode |   |  |                        | Ratings |      |            |
|--------------------|---|--|------------------------|---------|------|------------|
| Symbol             | Definitions                               | Conditions   | min.                   | typ.    | max. |            |
| $V_{SD}$           | forward voltage drop                      | $I_F = 70 A; V_{GS} = -5 V$  | $T_{VJ} = 25^\circ C$  | 4.3     |      | V          |
|                    |   |  | $T_{VJ} = 150^\circ C$ | 3.8     |      | V          |
| $t_{rr}$           | reverse recovery time                     | $V_{GS} = -5 V; I_F = 70 A; V_R = 1200 V$ $T_{VJ} = 25^\circ C$<br>Mosfet gate drive:<br>$V_{GS} = -5 / 20 V; R_G = 2.5 \Omega$  |                        | 24      |      | ns         |
| $Q_{RM}$           | reverse recovery charge (intrinsic diode) |  |                        | 1.4     |      | $\mu C$    |
| $I_{RM}$           | max. reverse recovery current             |  |                        | 92      |      | A          |
| $dI_F/dt$          | current slew rate                         |  |                        | 7300    |      | A/ $\mu s$ |
| $t_{rr}$           | reverse recovery time                     | $V_{GS} = -5 V; I_F = 70 A; V_R = 1200 V$ $T_{VJ} = 150^\circ C$<br>Mosfet gate drive:<br>$V_{GS} = -5 / 20 V; R_G = 2.5 \Omega$ |                        | 38      |      | ns         |
| $Q_{RM}$           | reverse recovery charge (intrinsic diode) |  |                        | 3.9     |      | $\mu C$    |
| $I_{RM}$           | max. reverse recovery current             |  |                        | 170     |      | A          |
| $dI_F/dt$          | current slew rate                         |  |                        | 6350    |      | A/ $\mu s$ |

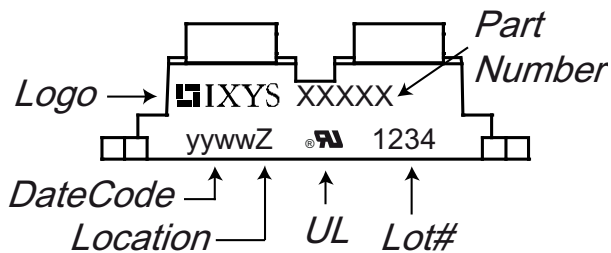
**Note:**

 When using SiC Body Diode the maximum recommended  $V_{GS} = -5V$

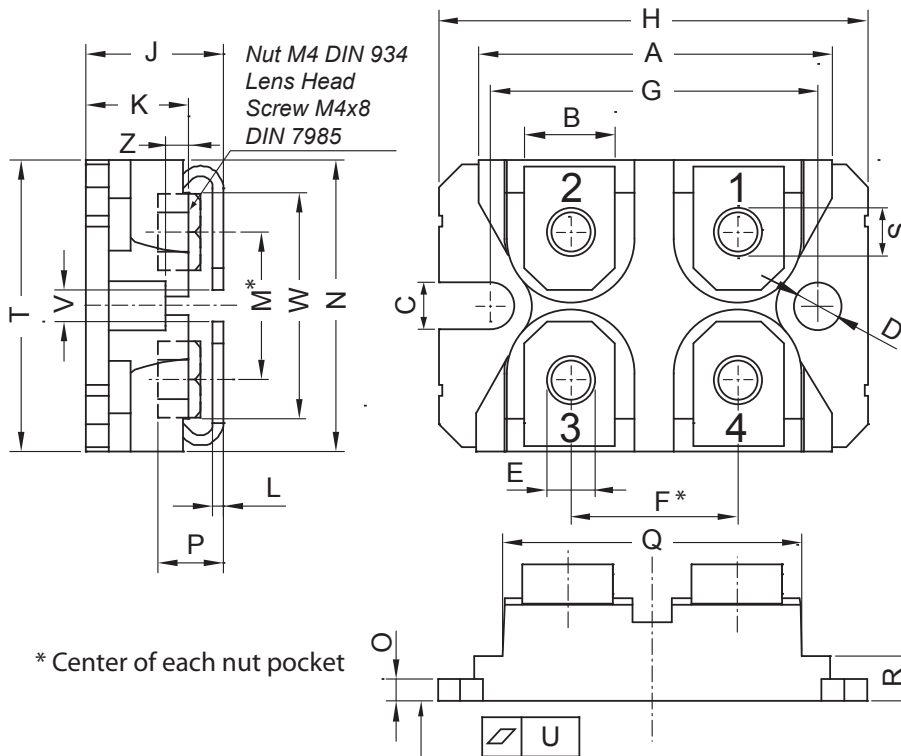
| Package Outlines SOT-227B (minibloc) |                               |   | Ratings      |      |            |          |
|--------------------------------------|-------------------------------|---|--------------|------|------------|----------|
| Symbol                               | Definitions                   | Conditions  | min.         | typ. | max.       | Unit     |
| $I_{RMS}$                            | RMS current                   | per terminal  |              |      | 100        | A        |
| $T_{stg}$                            | storage temperature           |   | -40          |      | 150        | °C       |
| $T_{op}$                             | operation temperature         |   | -40          |      | 150        | °C       |
| $T_{vJ}$                             | virtual junction temperature  |   | -40          |      | 175        | °C       |
| <b>Weight</b>                        |                               |   |              | 30   |            | g        |
| $M_D$                                | mounting torque <sup>1)</sup> | screws to heatsink<br>terminal connection screws                          |              |      | 1.5<br>1.3 | Nm<br>Nm |
| $d_{Spp}$                            | creepage distance on surface  | terminal to terminal  | 10.5         |      |            | mm       |
| $d_{Spb}$                            |                               | terminal to backside  | 8.5          |      |            | mm       |
| $d_{App}$                            | striking distance through air | terminal to terminal  | 3.2          |      |            | mm       |
| $d_{Apb}$                            |                               | terminal to backside  | 6.8          |      |            | mm       |
| $V_{ISOL}$                           | isolation voltage             | $I_{ISOL} \leq 1 \text{ mA}; 50/60 \text{ Hz}$                            | 3000<br>2500 |      |            | V<br>V   |
| $C_p$                                | coupling capacity per switch  | between drain and back side metallization<br>with gate and source shorted |              | 42   |            | pF       |

<sup>1)</sup> further information see application note IXAN0073 on [www.ixys.com/TechnicalSupport/appnotes.aspx](http://www.ixys.com/TechnicalSupport/appnotes.aspx) (General / Isolation, Mounting, Soldering, Cooling)

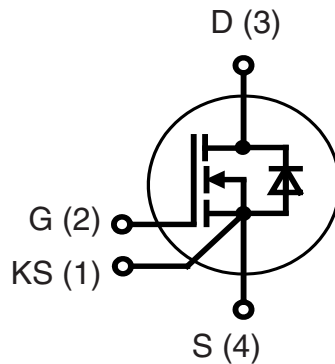
## Product Marking

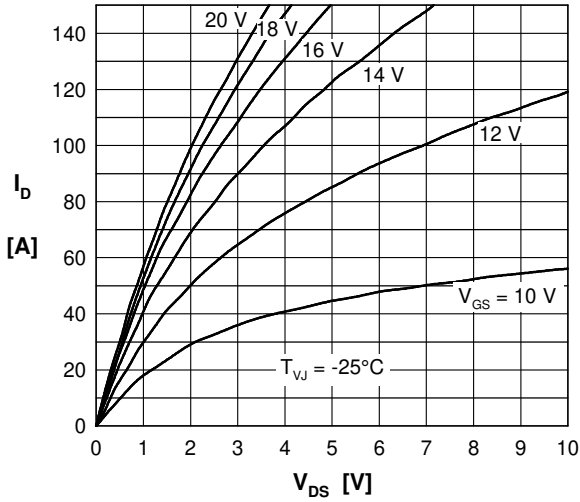
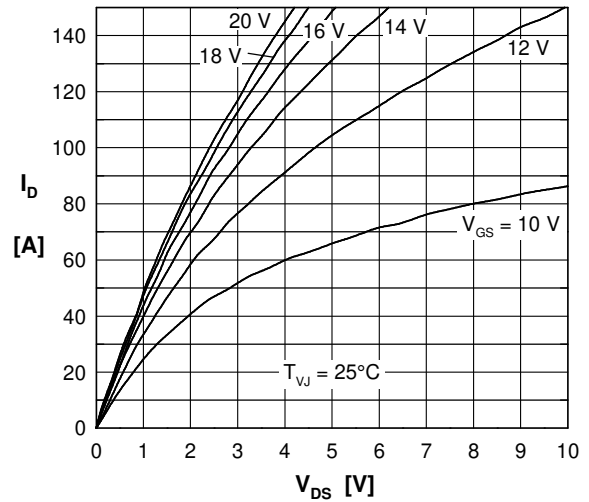
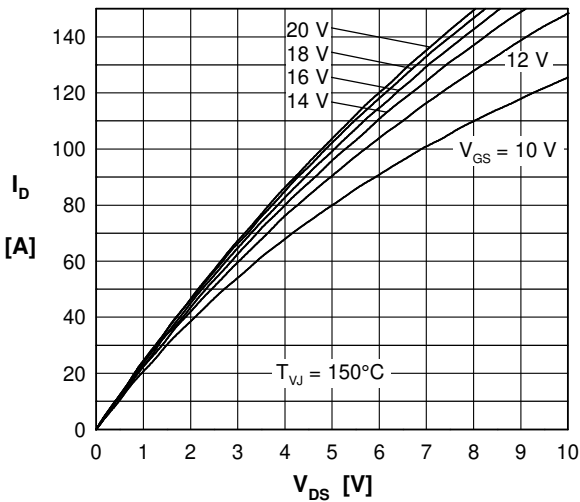
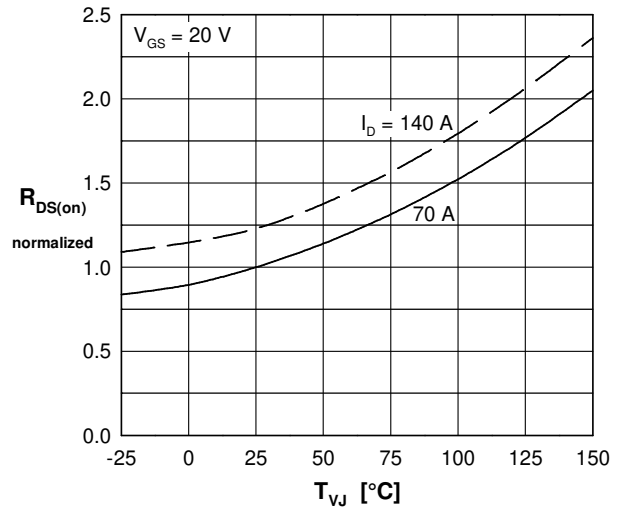
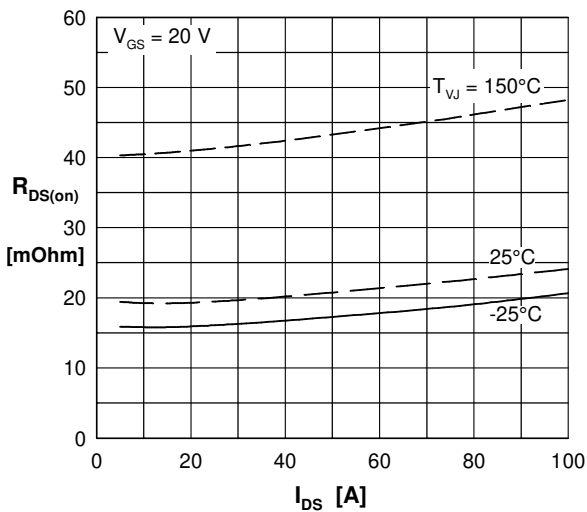
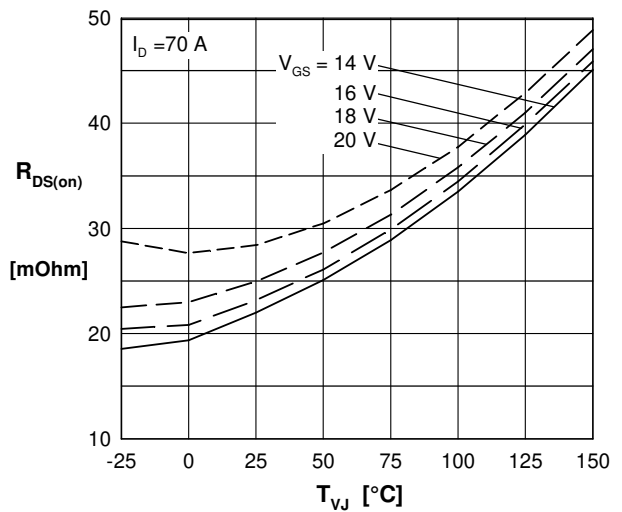


| Ordering | Part Name    | Marking on Product | Delivering Mode | Base Qty | Ordering Code |
|----------|--------------|--------------------|-----------------|----------|---------------|
| Standard | IXFN90N170SK | IXFN90N170SK       | Tube            | 10       | IXFN90N170SK  |

**Outlines SOT-227B (minibloc)**


| Dim. | Millimeter |       | Inches |       |
|------|------------|-------|--------|-------|
|      | min        | max   | min    | max   |
| A    | 31.50      | 31.88 | 1.240  | 1.255 |
| B    | 7.80       | 8.20  | 0.307  | 0.323 |
| C    | 4.09       | 4.29  | 0.161  | 0.169 |
| D    | 4.09       | 4.29  | 0.161  | 0.169 |
| E    | 4.09       | 4.29  | 0.161  | 0.169 |
| F    | 14.91      | 15.11 | 0.587  | 0.595 |
| G    | 30.12      | 30.30 | 1.186  | 1.193 |
| H    | 37.80      | 38.23 | 1.488  | 1.505 |
| J    | 11.68      | 12.22 | 0.460  | 0.481 |
| K    | 8.92       | 9.60  | 0.351  | 0.378 |
| L    | 0.74       | 0.84  | 0.029  | 0.033 |
| M    | 12.50      | 13.10 | 0.492  | 0.516 |
| N    | 25.15      | 25.42 | 0.990  | 1.001 |
| O    | 1.95       | 2.13  | 0.077  | 0.084 |
| P    | 4.95       | 6.20  | 0.195  | 0.244 |
| Q    | 26.54      | 26.90 | 1.045  | 1.059 |
| R    | 3.94       | 4.42  | 0.155  | 0.167 |
| S    | 4.55       | 4.85  | 0.179  | 0.191 |
| T    | 24.59      | 25.25 | 0.968  | 0.994 |
| U    | -0.05      | 0.10  | -0.002 | 0.004 |
| V    | 3.20       | 5.50  | 0.126  | 0.217 |
| W    | 19.81      | 21.08 | 0.780  | 0.830 |
| Z    | 2.50       | 2.70  | 0.098  | 0.106 |



**Curves**

 Fig. 1 Typical output characteristics ( $-25^{\circ}\text{C}$ )

 Fig. 2 Typical output characteristics ( $25^{\circ}\text{C}$ )

 Fig. 3 Typical output characteristics ( $150^{\circ}\text{C}$ )

 Fig. 4  $R_{DS(on)}$  normalized vs. junction temperature  $T_{VJ}$ 

 Fig. 5  $R_{DS(on)}$  versus drain current

 Fig. 6  $R_{DS(on)}$  versus junction temperature  $T_{VJ}$

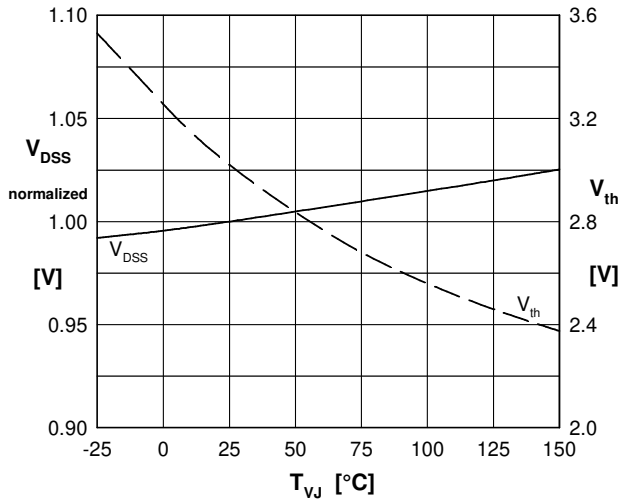
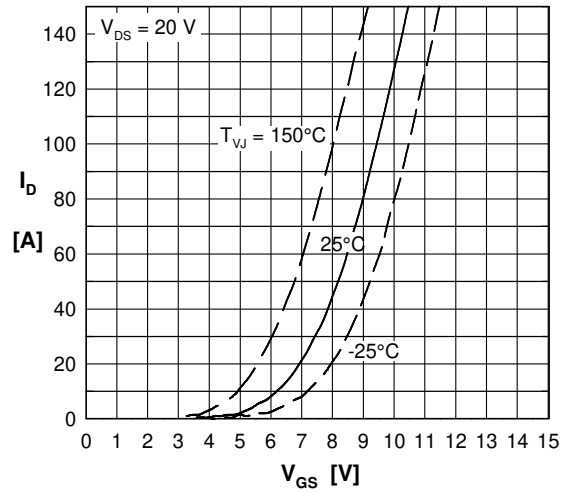
**Curves**

 Fig. 7 Threshold voltage  $V_{TH}$  and normalized  $V_{DSS}$  versus junction temperature  $T_{VJ}$ 


Fig. 8 Typical transfer characteristics

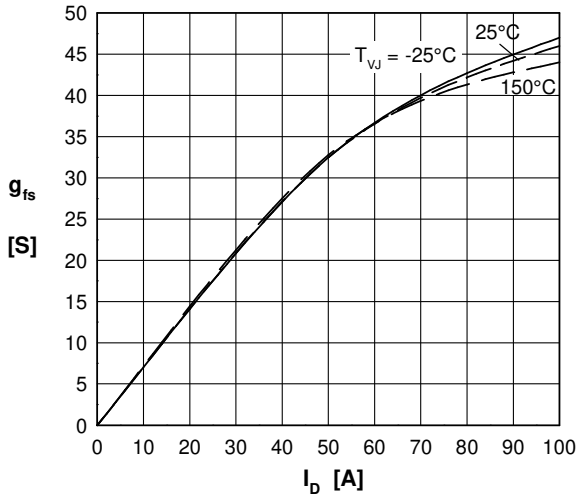
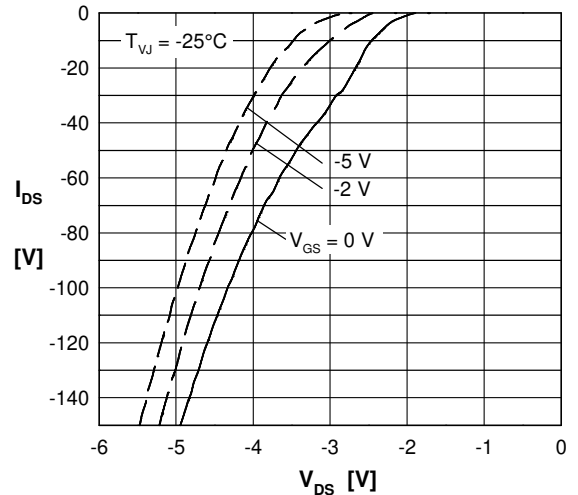
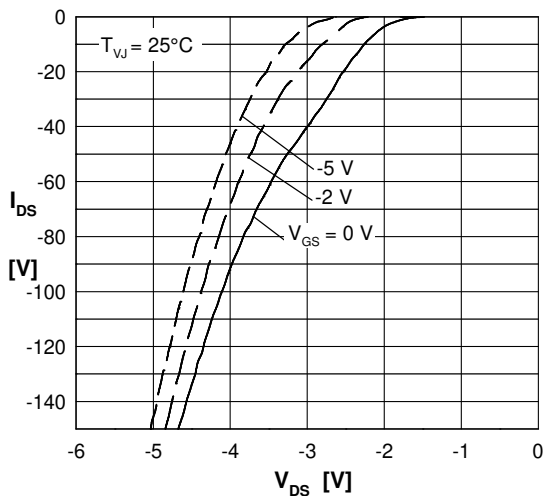
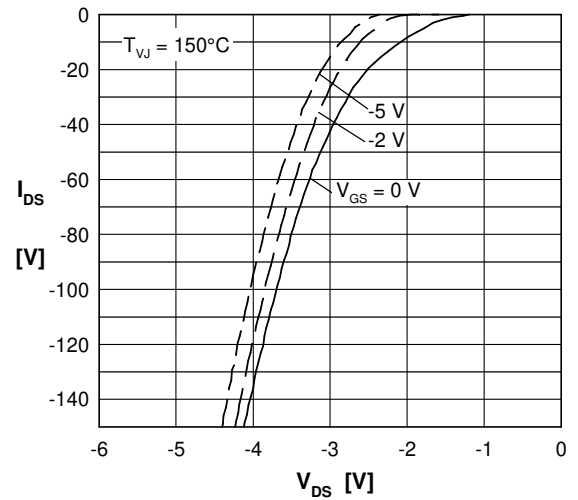


Fig. 9 Typical forward transconductance


 Fig. 10 Forward voltage drop of intrinsic diode versus  $V_{DS}$  measured at  $-25^{\circ}\text{C}$ 

 Fig. 11 Forward voltage drop of intrinsic diode versus  $V_{DS}$  measured at  $25^{\circ}\text{C}$ 

 Fig. 12 Forward voltage drop of intrinsic diode versus  $V_{DS}$  measured at  $150^{\circ}\text{C}$

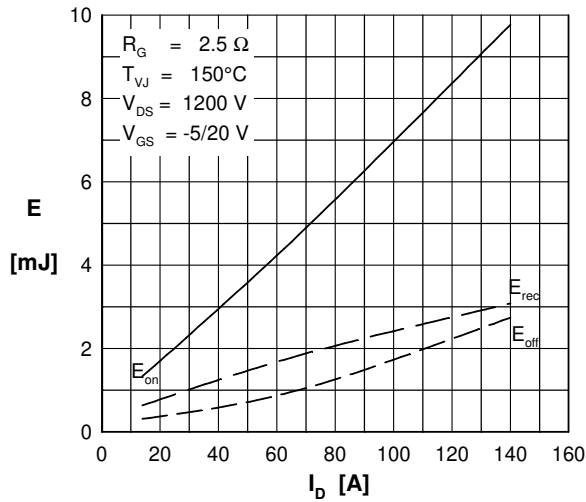
**Curves**


Fig. 13 Typical switching energy versus drain current

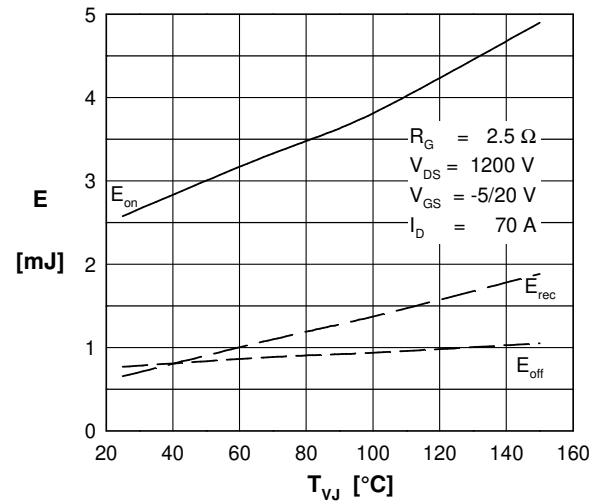


Fig. 14 Typical switching energy versus temperature

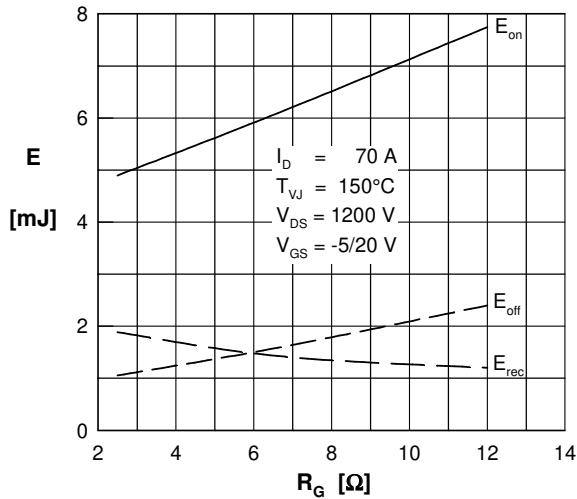


Fig. 15 Typical switching energy versus external gate resistor

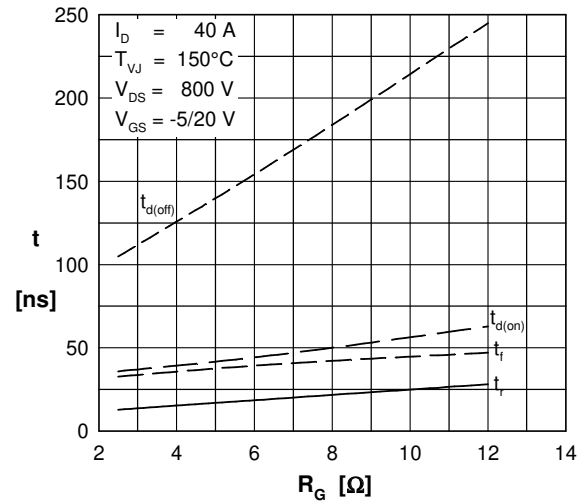


Fig. 16 Typical switching time versus external gate resistor

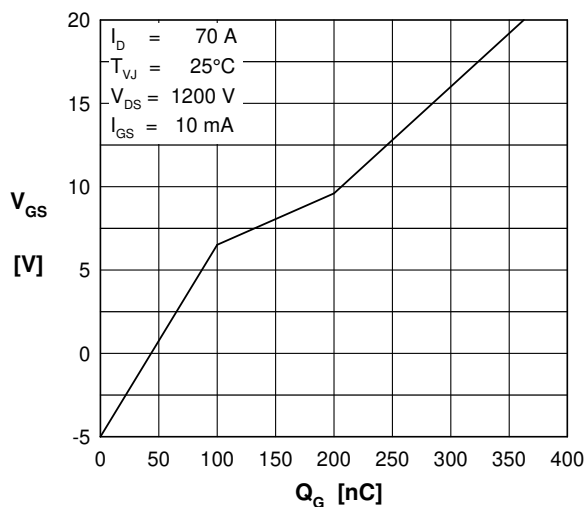


Fig. 17 Typical turn on gate charge, trendline

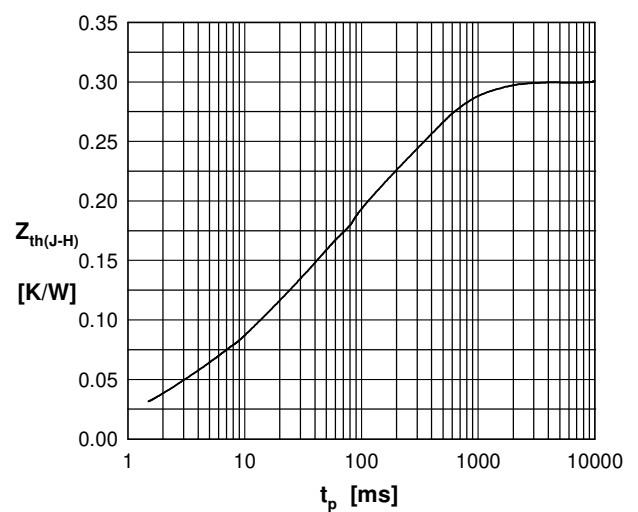


Fig. 18 Typical transient thermal impedance