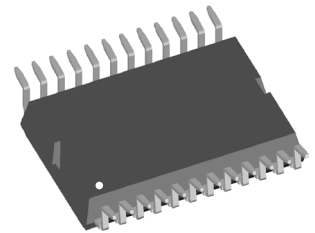
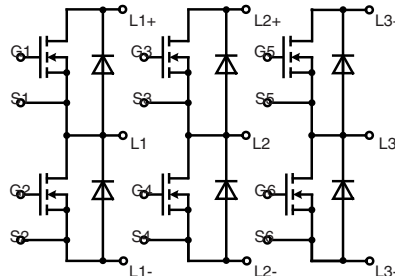


# Three phase full Bridge

with Trench MOSFETs  
in DCB isolated high current package

$V_{DSS} = 150\text{ V}$   
 $I_{D25} = 50\text{ A}$   
 $R_{DSon\ typ.} = 19\text{ m}\Omega$



### MOSFETs

| Symbol     | Conditions  | Maximum Ratings |   |
|------------|---|-----------------|---|
| $V_{DSS}$  | $T_{VJ} = 25^{\circ}\text{C to } 150^{\circ}\text{C}$ | 150             | V |
| $V_{GS}$   | continous   | $\pm 15$        | V |
|            | transient   | $\pm 20$        | V |
| $I_{D25}$  | $T_C = 25^{\circ}\text{C}$                            | 50              | A |
| $I_{D90}$  | $T_C = 90^{\circ}\text{C}$                            | 38              | A |
| $I_{D110}$ | $T_C = 110^{\circ}\text{C}$                           | 33              | A |
| $I_{F25}$  | $T_C = 25^{\circ}\text{C}$ (diode)                    | 150             | A |
| $I_{F90}$  | $T_C = 90^{\circ}\text{C}$ (diode)                    | 85              | A |
| $I_{F110}$ | $T_C = 110^{\circ}\text{C}$ (diode)                   | 65              | A |

### Applications

#### AC drives

- in automobiles
  - electric power steering
  - starter generator
- in industrial vehicles
  - propulsion drives
  - fork lift drives
- in battery supplied equipment

### Features

- MOSFETs in trench technology:
  - low  $R_{DSon}$
  - optimized intrinsic reverse diode
- package:
  - high level of integration
  - high current capability
  - aux. terminals for MOSFET control
  - terminals for soldering or welding connections
  - isolated DCB ceramic base plate with optimized heat transfer
- Space and weight savings

### Symbol Conditions Characteristic Values

( $T_{VJ} = 25^{\circ}\text{C}$ , unless otherwise specified)

| Symbol   | Conditions   | min.  | typ. | max. |                     |                  |
|--|--|---|------|------|---------------------|------------------|
| $R_{DSon}^{1)}$  | on chip level at<br>$V_{GS} = 10\text{ V}; I_D = 38\text{ A}$  | $T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$ |      | 19   | 24                  | $\text{m}\Omega$ |
|  |  |   |      |      | 38                  |                  |
| $V_{GS(th)}$   | $V_{DS} = 20\text{ V}; I_D = 1\text{ mA}$  | 2.5   |      | 4.5  | V                   |                  |
| $I_{DSS}$  | $V_{DS} = V_{DSS}; V_{GS} = 0\text{ V}$  |   | 0.5  | 5    | $\mu\text{A}$<br>mA |                  |
| $I_{GSS}$  | $V_{GS} = \pm 20\text{ V}; V_{DS} = 0\text{ V}$  |   |      | 0.2  | $\mu\text{A}$       |                  |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$  | $V_{GS} = 10\text{ V}; V_{DS} = 75\text{ V}; I_D = 38\text{ A}$  |   | 97   |      | nC                  |                  |
|  |  |   | 29   |      | nC                  |                  |
|  |  |   | 30   |      | nC                  |                  |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$  | $V_{GS} = 10\text{ V}; V_{DS} = 25\text{ V}; f = 1\text{ MHz}$   |   | 5800 |      | pF                  |                  |
|  |  |   | 490  |      | pF                  |                  |
|  |  |   | 85   |      | pF                  |                  |
| $t_{d(on)}$<br>$t_r$<br>$t_{d(off)}$<br>$t_f$<br>$E_{on}$<br>$E_{off}$<br>$E_{recoff}$ | inductive load<br>$V_{GS} = 10\text{ V}; V_{DS} = 75\text{ V}$<br>$I_D = 38\text{ A}; R_{G(on)} = 39\ \Omega; R_{G(off)} = 4.7\ \Omega$<br>$T_J = 125^{\circ}\text{C}$ |   | 120  |      | ns                  |                  |
|  |  |   | 50   |      | ns                  |                  |
|  |  |   | 100  |      | ns                  |                  |
|  |  |   | 25   |      | ns                  |                  |
|  |  |   | 0.25 |      | mJ                  |                  |
|  | 0.05   |   | mJ   |      |                     |                  |
|  | 0.02   |   | mJ   |      |                     |                  |
| $R_{thJC}$   |  |   | 1.0  |      | K/W                 |                  |
| $R_{thJH}$   | with heat transfer paste (IXYS test setup)   |   | 1.3  | 1.6  | K/W                 |                  |

<sup>1)</sup>  $V_{DS} = I_D \cdot (R_{DS(on)} + 2R_{Pin\ to\ Chip})$

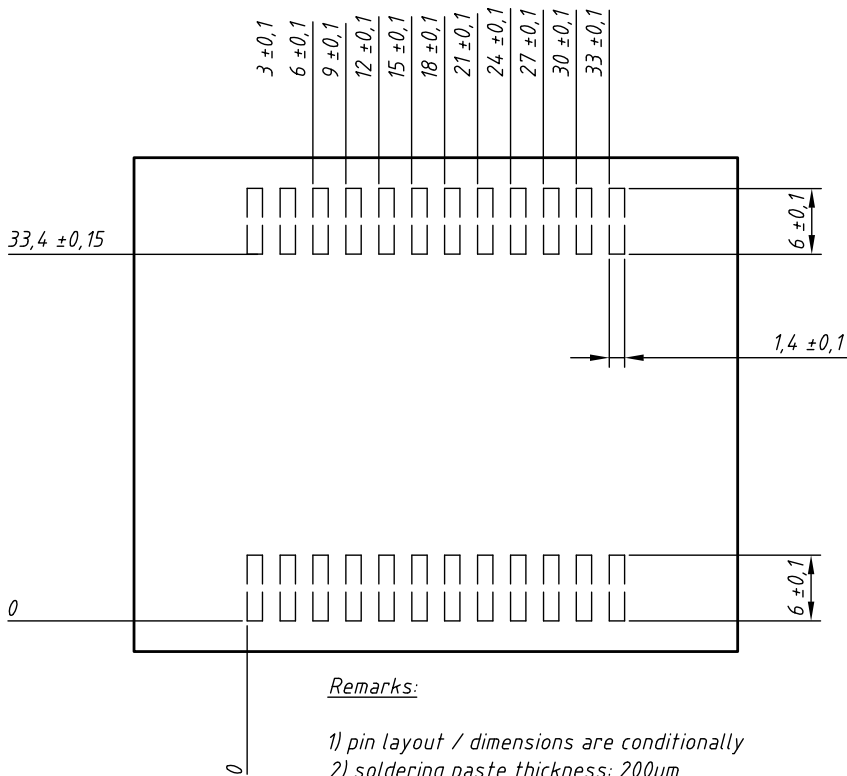
**Source-Drain Diode**

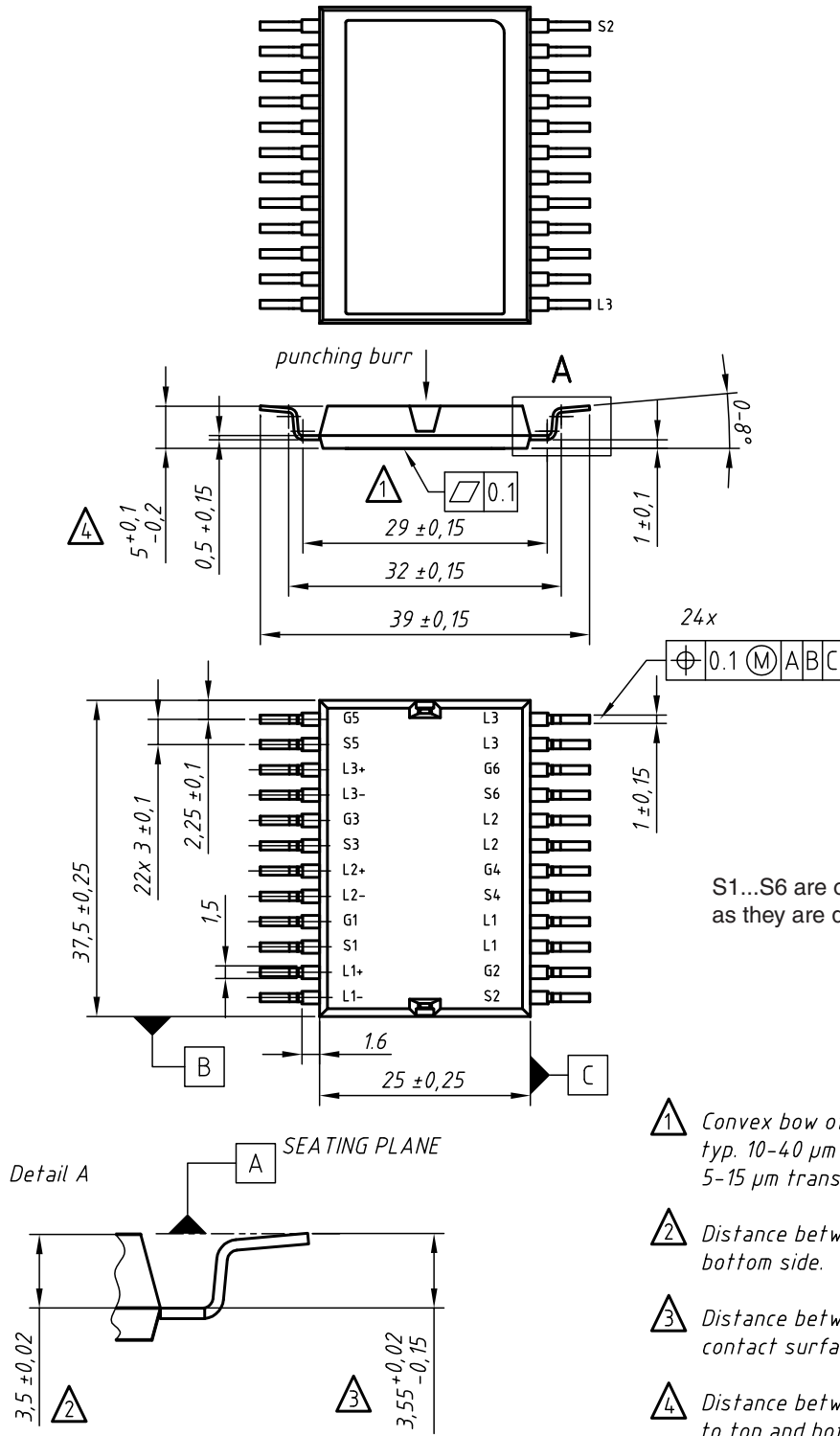
| Symbol   | Conditions   | Characteristic Values |      |               |
|--|--|-----------------------|------|---------------|
|  |  | min.                  | typ. | max.          |
| ( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |  |                       |      |               |
| $V_{SD}$   | (diode) $I_F = 38\text{ A}$ ; $V_{GS} = 0\text{ V}$  | 0.85                  | 1.0  | V             |
| $t_{rr}$   | $I_F = 38\text{ A}$ ; $-di_F/dt = 900\text{ A}/\mu\text{s}$ ;<br>$R_{G(on)} = 39\ \Omega$ ; $V_R = 75\text{ V}$ ; $T_{VJ} = 125^\circ\text{C}$ |                       | 65   | ns            |
| $Q_{RM}$   |  |                       | 1.6  | $\mu\text{C}$ |
| $I_{RM}$   |  |                       | 40   | A             |

**Component**

| Symbol     | Conditions  | Maximum Ratings |                  |
|------------|---|-----------------|------------------|
| $I_{RMS}$  | per pin in main current paths (L+, L-, N-, L1, L2, L3)<br>may be additionally limited by external connections<br>2 pins for output L1, L2, L3 | 75              | A                |
| $T_J$      |   | -55...+175      | $^\circ\text{C}$ |
| $T_{stg}$  |   | -55...+125      | $^\circ\text{C}$ |
| $V_{ISOL}$ | $I_{ISOL} \leq 1\text{ mA}$ , 50/60 Hz, $f = 1\text{ minute}$   | 1000            | V~               |
| $F_c$      | mounting force with clip  | 50 - 250        | N                |

| Symbol                   | Conditions   | Characteristic Values |      |                  |
|--------------------------|--|-----------------------|------|------------------|
|                          |  | min.                  | typ. | max.             |
| $R_{pin\ to\ chip}^{1)}$ | L+ to L1/L2/L3 or L- to L1/L2/L3                                   |                       | 0.9  | $\text{m}\Omega$ |
| $C_P$                    | coupling capacity between shorted pins and back side metallization |                       | 160  | pF               |
| <b>Weight</b>            |  |                       | 13   | g                |

<sup>1)</sup>  $V_{DS} = I_D \cdot (R_{DS(on)} + 2R_{Pin\ to\ Chip})$ 
**Recommended printed circuit board lay-out**




S1...S6 are only for the use of the gate drive as they are designed as Kelvin contacts

**contact pin:**

- galv. tin plating, per pin side: Sn 10...25  $\mu$ m, undercoating Ni 0,2...1  $\mu$ m
- stamping edges may be free of tin
- punching burr:  $\leq 0,05$ mm

| Leads | Ordering | Part Name & Packing Unit Marking | Part Marking   | Delivering Mode | Base Qty. | Ordering Code |
|-------|----------|----------------------------------|----------------|-----------------|-----------|---------------|
| SMD   | Standard | GMM 3x60-015X2 - SMD             | GMM 3x60-015X2 | Tube            | 13        | 518037        |

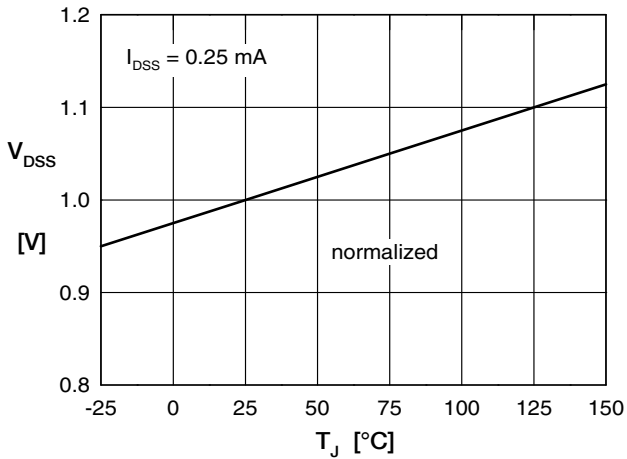


Fig. 1 Drain source breakdown voltage  $V_{DSS}$  vs. junction temperature  $T_{VJ}$

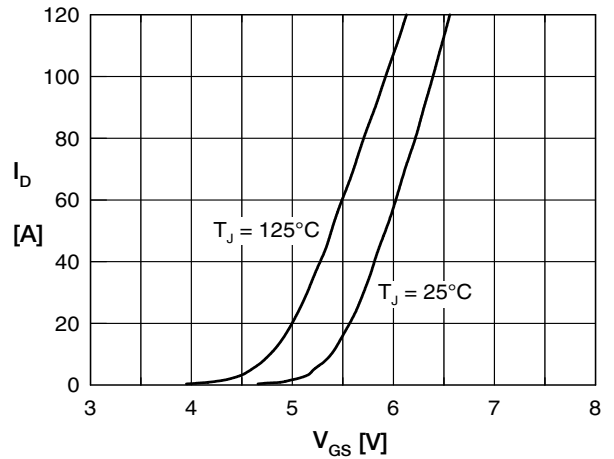


Fig. 2 Typ. transfer characteristics

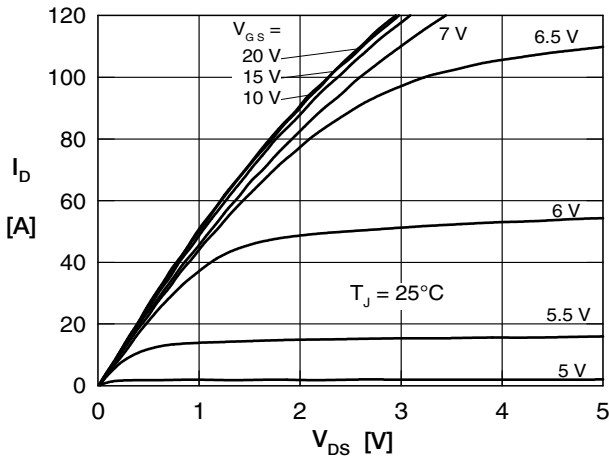


Fig. 3 Typ. output characteristics

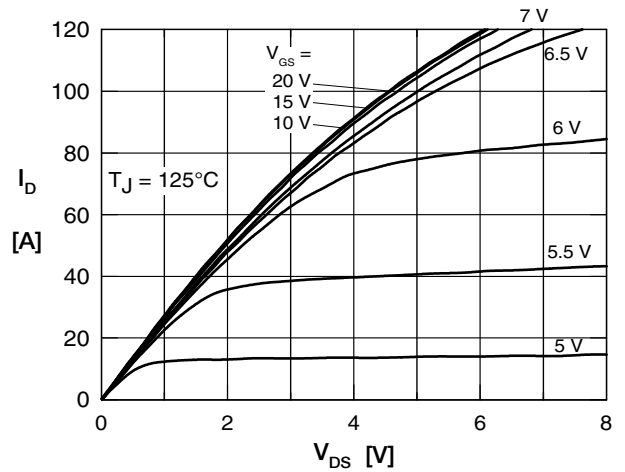


Fig. 4 Typ. output characteristics

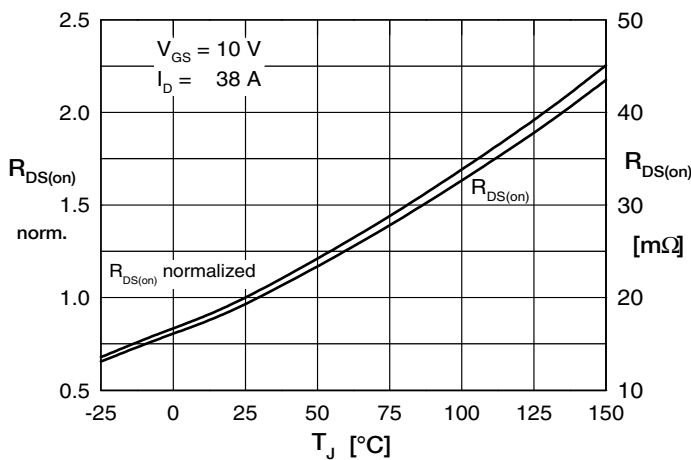


Fig. 5 Drain source on-state resistance  $R_{DS(on)}$  versus junction temperature  $T_{VJ}$

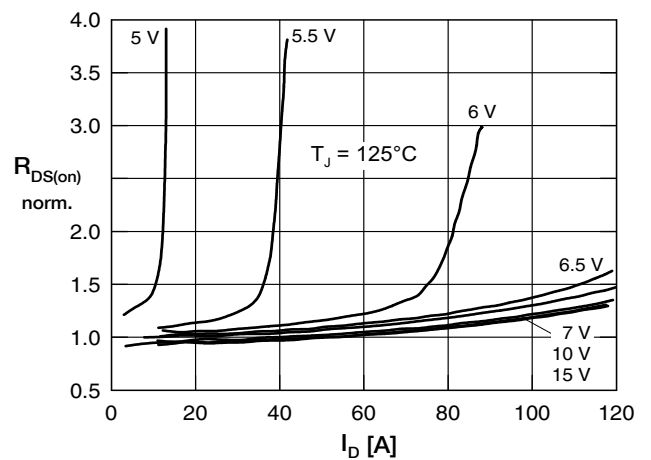


Fig. 6 Drain source on-state resistance  $R_{DS(on)}$  versus  $I_D$

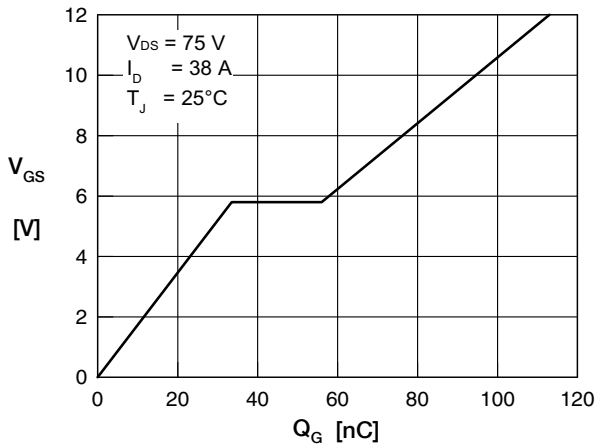


Fig. 7 Typical turn on gate charge

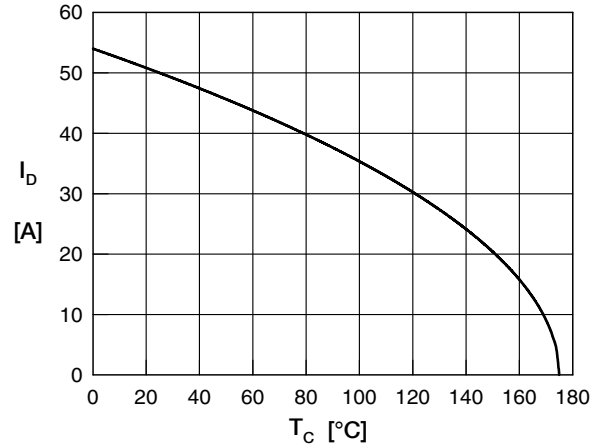
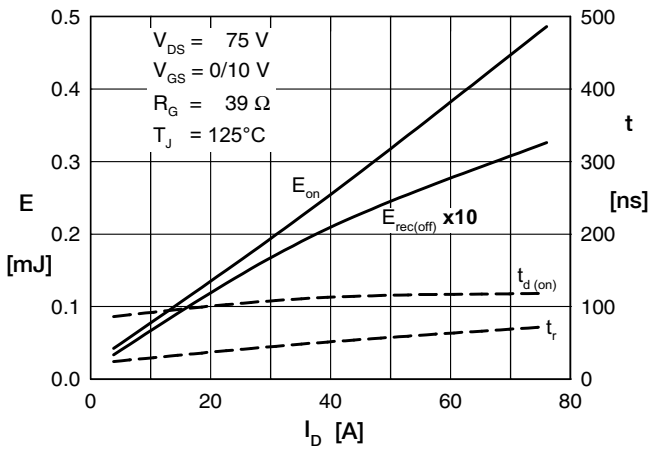

 Fig. 8 Drain current  $I_D$  vs. case temperature  $T_C$ 


Fig. 9 Typ. turn-on energy and switching times versus drain current, inductive switching

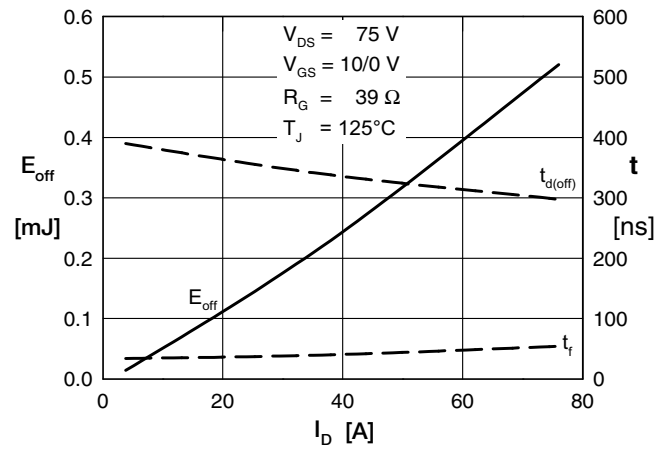


Fig. 10 Typ. turn-off energy and switching times versus drain-current, inductive switching

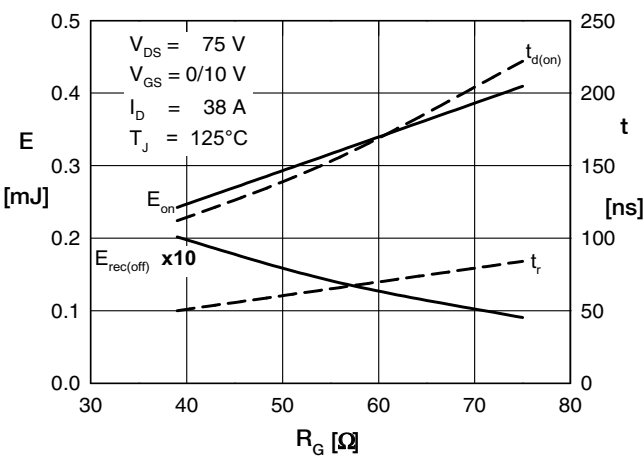


Fig. 11 Typ. turn-on energy and switching times versus gate resistor, inductive switching

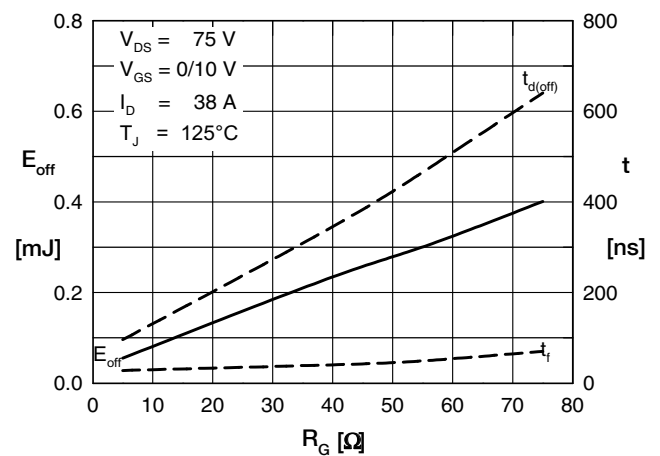


Fig. 12 Typ. turn-off energy and switching times versus gate resistor, inductive switching

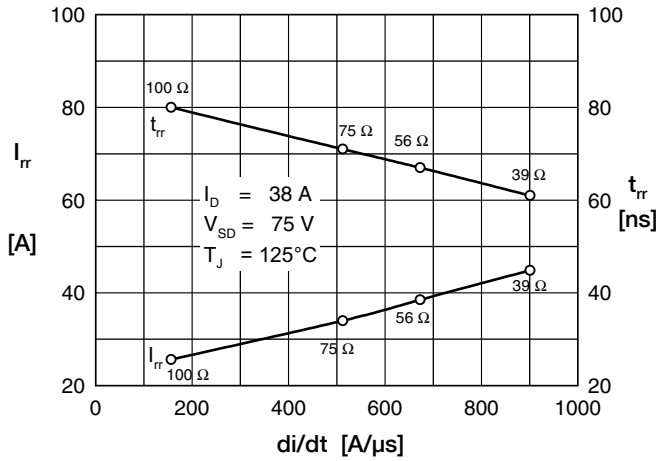


Fig. 13 Typ. reverse recovery characteristics

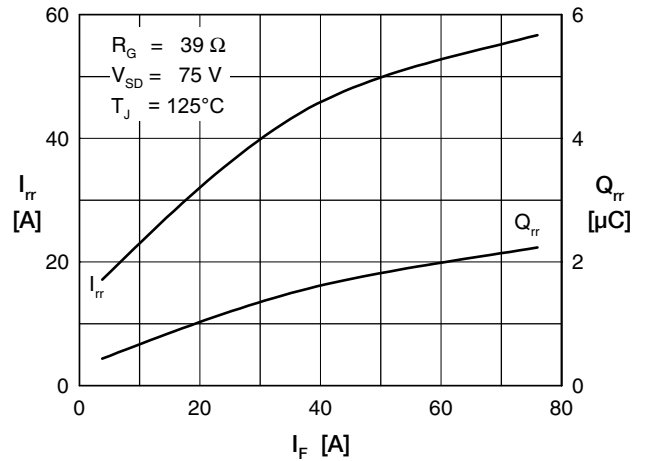


Fig. 14 Typ. reverse recovery characteristics

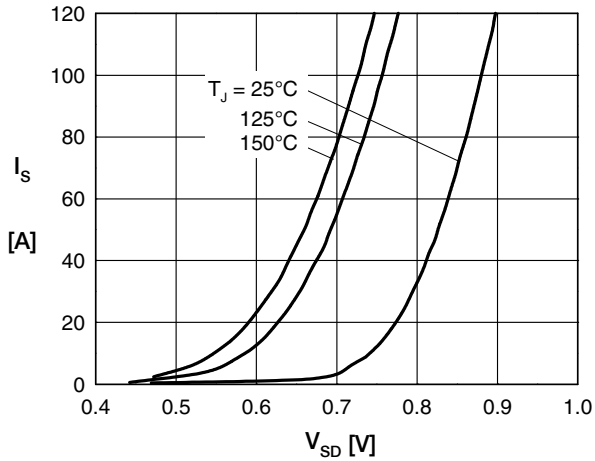


Fig. 15 Source current  $I_S$  versus source drain voltage  $V_{SD}$  (body diode)

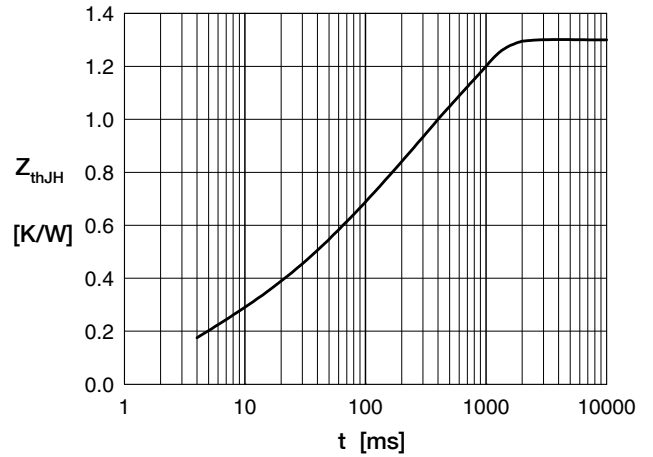


Fig. 16 Typ. thermal impedance junction to heatsink  $Z_{thJH}$  with heat transfer paste (IXYS test setup)

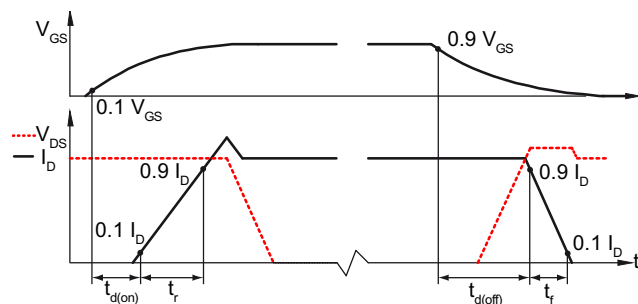


Fig. 17 Definition of switching times