# DFS10HF12EYA2

## 1200V/10mΩ Half Bridge SiC MOSFET Module

## Description

The DFS10HF12EYA2 is a Half Bridge SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as Solar Inverter, UPS, Fuel cell-DC/DC converter, Energy storage Systems.

## Features

- Blocking voltage:1200V
- $R_{ds(on)}$=10.1mΩ
- Low Switching Losses
- 175°C maximum junction temperature
- Thermistor inside

## Applications

- Solar inverter Systems
- Fuel cell-DC/DC converter
- Uninterruptible Power Supplier
- Energy Storage Systems

## Circuit diagram

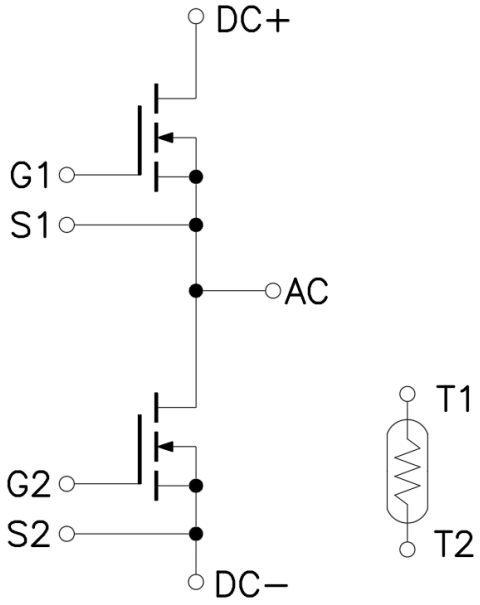



Figure 1. Out drawing & circuit diagram for DFS10HF12EYA2

## Pin Configuration and Marking Information

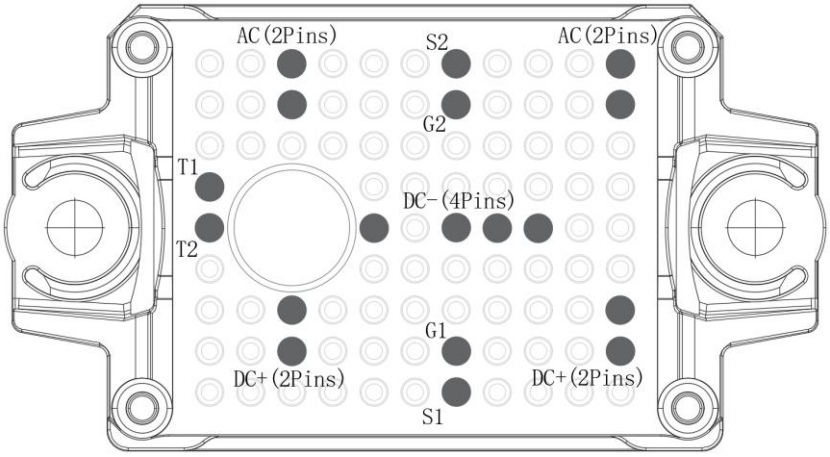



Figure 2. Pin configuration

| Symbol | Description |
|---|---|
| AC | Output terminal of half bridge |
| S2 | Low side source signal terminal |
| G2 | Low side gate signal terminal |
| DC+ | DC+ Bus connection |
| DC– | DC– Bus connection |
| S1 | High side source signal terminal |
| G1 | High side gate signal terminal |
| T1 | Thermistor connection 1 |
| T2 | Thermistor connection 2 |

## Module

| Parameter | Condition | Value | Unit |
|---|---|---|---|
| Isolation Voltage | RMS, f =50Hz, t =1min | 3.4 | kV |
| Clearance | Terminal to Terminal | 5 | mm |
| | Terminal to Heatsink | 10 | mm |
| Creepage distance | Terminal to Terminal | 6.3 | mm |
| | Terminal to Heatsink | 12.7 | mm |
| Comparative Tracking Index | - | 400 | - |
| Weight | - | 24 | g |

## Maximum Ratings ($T_j$ =25°C unless otherwise specified)

| Symbol | Parameter | Condition | Ratings | Unit |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | G-S Short | 1200 | V |
| $V_{GS,max}$ | Gate-Sourse Voltage | D-S Short, Note1 | -8/+19 | V |
| $I_{DS}$ | DC Continuous Drain Current | $T_f$ =75°C , $V_{GS}$ =18V | 100 | A |
| $I_{SD}$ | Source (Body Diode) Current | $T_f$ =75°C, with ON signal | 100 | A |
| $I_{DSM}$ | Pulse Drain Current | $T_C$ =100°C, Pulse width =1ms, $V_{GS}$ =15V, Note2 | 200 | A |
| $P_{tot}$ | Total Power Dissipation | $T_C$ =25°C | 440 | W |
| $T_j$ | junction temperature | - | -40 to 175 | °C |
| $T_{stg}$ | Storage temperature | - | -40 to 125 | °C |

Note1: Recommended Operating Value, +15V/-4V

Note2: Pulse width limited by maximum junction temperature

## NTC characteristics

| Symbol | Parameter | Condition | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| $R_{25}$ | Resistance | $T_C$ =25°C | - | 5 | - | kΩ |
| ΔR/R | Deviation of $R_{100}$ | $T_C$ =100°C, $R_{100}$ =493Ω | -5 | - | 5 | % |
| $P_{25}$ | Power dissipation | $T_C$ =25°C | - | - | 20 | mW |
| $B_{25/50}$ | B-value | R2 =R25 exp [$B_{25/50}$(1/T2 - 1/(298,15 K))] | - | 3375 | - | K |
| $B_{25/80}$ | B-value | R2 =R25 exp [$B_{25/80}$(1/T2 - 1/(298,15 K))] | - | 3411 | - | K |
| $B_{25/100}$ | B-value | R2 =R25 exp [$B_{25/100}$(1/T2 - 1/(298,15 K))] | - | 3433 | - | K |

## MOSFET Electrical characteristics ($T_j$ =25°C unless otherwise specified, chip)

| Symbol | Item | Condition | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max | |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ =0V, $I_D$ =400μA | | 1200 | - | - | V |
| $I_{DSS}$ | Zero gate voltage drain Current | $V_{DS}$ =1200V, $V_{GS}$ =0V | | - | - | 200 | μA |
| $V_{GS(th)}$ | Gate-source threshold Voltage | $I_D$ =40mA, $V_{DS}$ =$V_{GS}$ | $T_j$ =25°C | 1.8 | 2.6 | - | V |
| | | | $T_j$ =175°C | - | 1.9 | - | V |
| $I_{GSS+}$ | Gate-Source Leakage Current | $V_{GS}$ =15V, $V_{DS}$ =0V, $T_j$ =25°C | | - | 10 | 800 | nA |
| $I_{GSS-}$ | | $V_{GS}$ = -4V, $V_{DS}$ =0V, $T_j$ =25°C | | -800 | -10 | - | nA |
| $R_{DS(on)}$ (Chip) | Static drain-source On-state resistance | $I_D$ =100A , $V_{GS}$ =15V | $T_j$ =25°C | - | 10.1 | - | mΩ |
| | | | $T_j$ =175°C | - | 18.8 | - | mΩ |
| $V_{DS(on)}$ (Chip) | Static drain-source On-state Voltage | $I_D$ =100A , $V_{GS}$ =15V | $T_j$ =25°C | - | 1.01 | - | V |
| | | | $T_j$ =175°C | - | 1.88 | - | V |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ =1000V, $V_{GS}$ =0V, f =100kHz, $T_j$ =25°C | | - | 9200 | - | pF |
| $C_{oss}$ | Output Capacitance | | | - | 475 | - | pF |
| $C_{rss}$ | Reverse transfer Capacitance | | | - | 29 | - | pF |
| $Q_G$ | Total gate charge | $V_{DD}$ =800V, $I_D$ =100A, $V_{GS}$ =-4/+15V | | - | 398 | - | nC |
| $R_{Gint}$ | Internal Gate Resistance | $T_j$ =25°C | | - | 1.5 | - | Ω |
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ =600V $I_D$ =100A $V_{GS}$ =+15/-4V $R_{gon}$ = $R_{goff}$ =5.1Ω Inductive load switching operation | $T_j$ =25°C | - | 23 | - | ns |
| | | | $T_j$ =150°C | - | 21 | - | |
| $t_r$ | Rise time | | $T_j$ =25°C | - | 18 | - | ns |
| | | | $T_j$ =150°C | - | 15 | - | |
| $t_{d(off)}$ | Turn-off delay time | | $T_j$ =25°C | - | 33 | - | ns |
| | | | $T_j$ =150°C | - | 21 | - | |
| $t_f$ | Fall time | | $T_j$ =25°C | - | 15 | - | ns |
| | | | $T_j$ =150°C | - | 14 | - | |
| $E_{on}$ | Turn-on power dissipation | | $T_j$ =25°C | - | 1050 | - | μJ |
| | | | $T_j$ =150°C | - | 1455 | - | |
| $E_{off}$ | Turn-off power dissipation | | $T_j$ =25°C | - | 245 | - | μJ |
| | | | $T_j$ =150°C | - | 350 | - | |
| $R_{th(j-c)}$ | FET Thermal Resistance | Junction to Case/MOSFET | | - | 0.34 | - | K/W |
| $R_{th(c-f)}$ | Contact thermal resistance | With thermal conductive grease /MOSFET | | - | 0.15 | - | K/W |

Assumes Thermal Conductivity of grease is 2.8 W/m・K and thickness is 50um.

## Body Diode Electrical characteristics ($T_j$ =25°C unless otherwise specified, chip: Target)

| Symbol | Item | Condition | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max | |
| $V_{SD}$ | Body Diode Forward Voltage | $V_{GS}$ =-4V<br>$I_{SD}$ =100A | $T_j$ =25°C | - | 4.6 | - | V |
| | | | $T_j$ =175°C | - | 4.1 | - | |
| $T_{rr}$ | Reverse recovery time | $V_{RR}$ =600V, $I_D$ =100A<br>$V_{GS}$ =+15/-4V<br>$R_{gon}$ = $R_{goff}$ =5.1Ω<br>Inductive load switching operation | $T_j$ =25°C | - | 23 | - | ns |
| | | | $T_j$ =150°C | - | 24 | - | |
| $Q_{rr}$ | Reverse recovery charge | | $T_j$ =25°C | - | 0.44 | - | μC |
| | | | $T_j$ =150°C | - | 0.76 | - | |
| $E_{rr}$ | Diode switching power dissipation | | $T_j$ =25°C | - | 450 | - | μJ |
| | | | $T_j$ =150°C | - | 890 | - | |

## Test Conditions

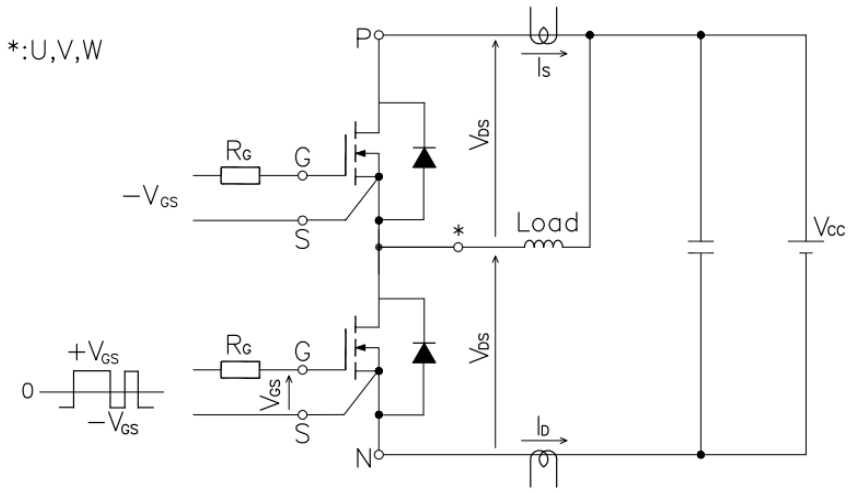



Figure 3. Switching time measure circuit

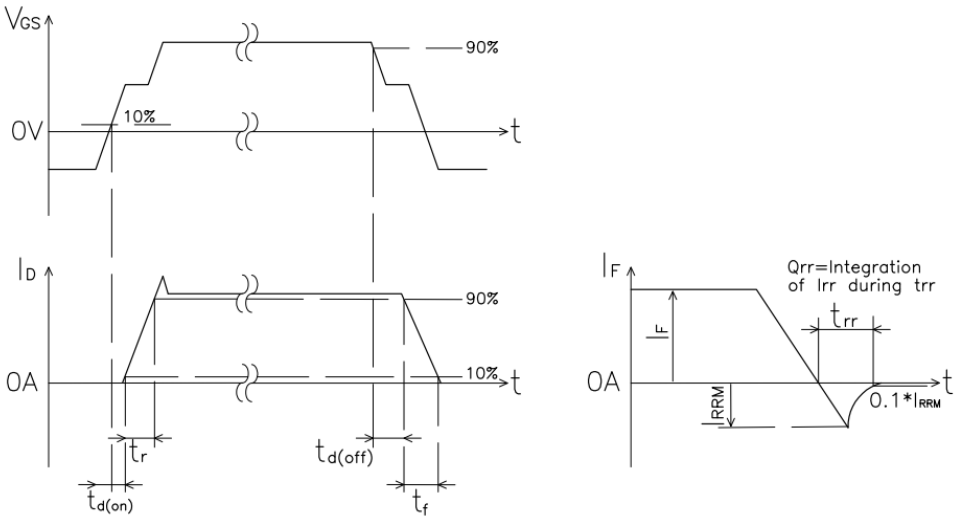



Figure 4. Switching time definition

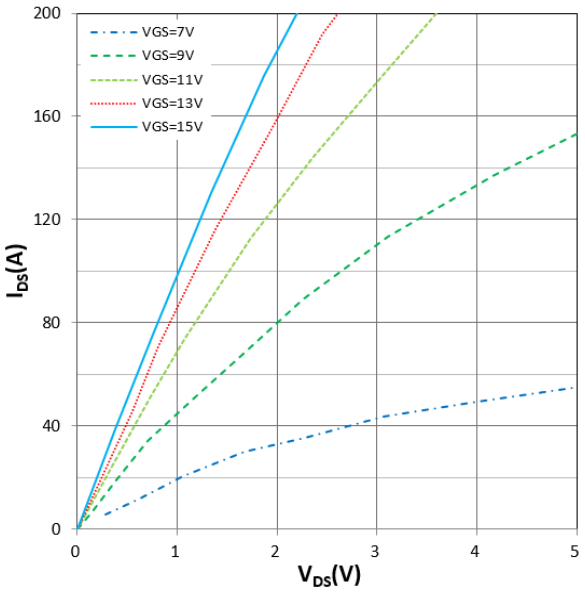



Figure 5. $I_{DS}$ vs $V_{DS}$
$T_j$ =25°C, $V_{GS}$ parameter

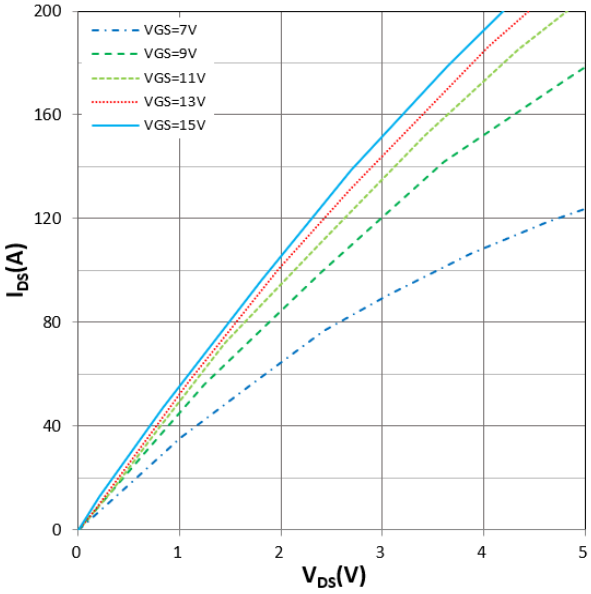



Figure 6. $I_{DS}$ vs $V_{DS}$
$T_j$ =175°C, $V_{GS}$ parameter

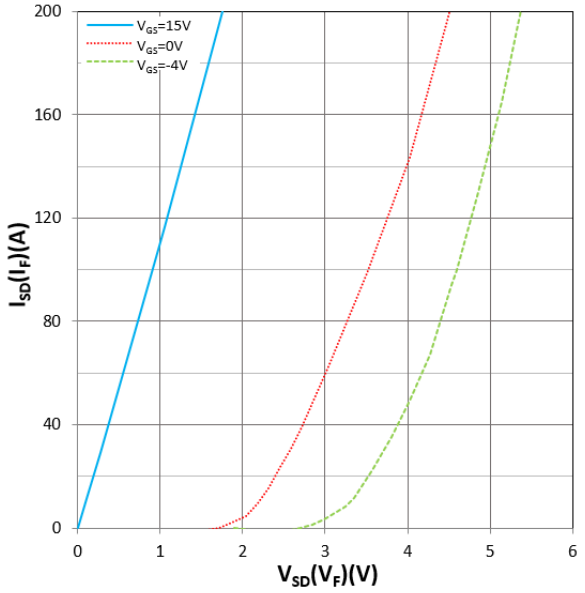



Figure 7. $I_{SD}(I_F)$ vs $V_{SD}$ ($V_F$)
$T_j$ =25°C, $V_{GS}$ parameter

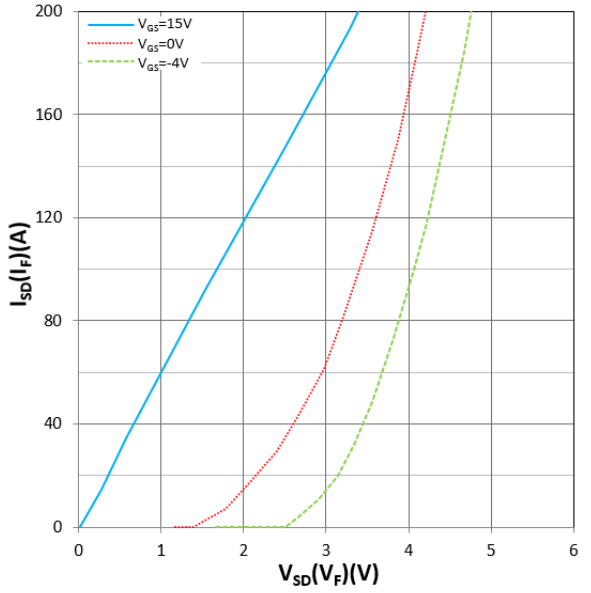



Figure 8. $I_{SD}(I_F)$ vs $V_{SD}$ ($V_F$)
$T_j$ =175°C, $V_{GS}$ parameter

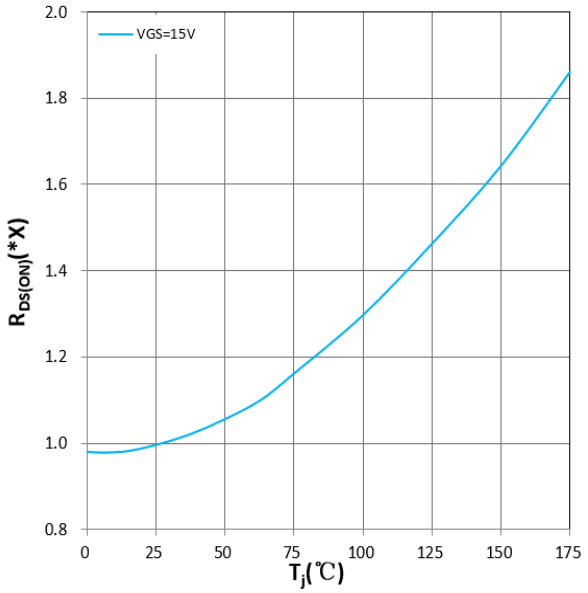



Figure 9. $R_{DS(ON)}$ vs $T_j$
$V_{GS}$ =+15V, $I_D$ =100A, 1.0X =10.1mΩ

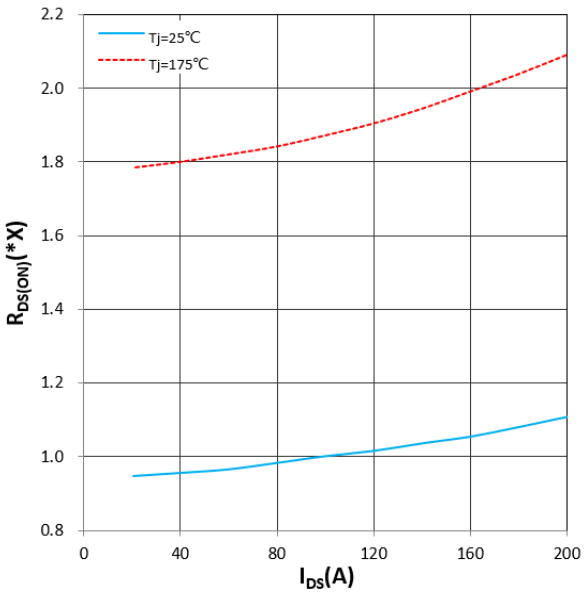



Figure 10. $R_{DS(ON)}$ vs $I_{DS}$
$V_{GS}$ =+15V, 1.0X =10.1mΩ

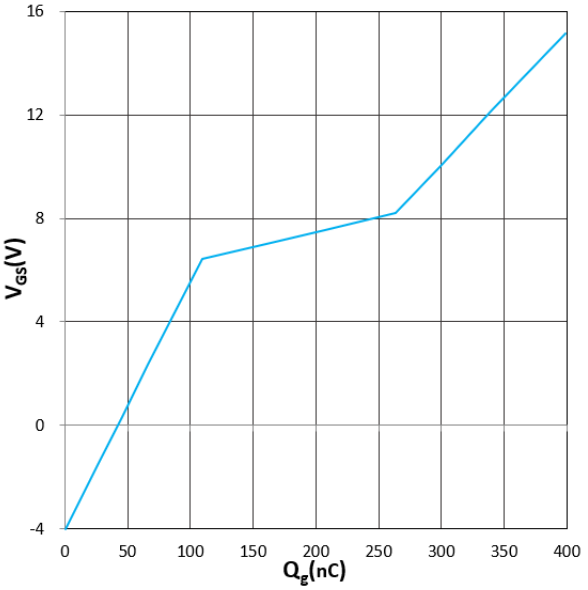



Figure 11. $V_{GS}$ vs $Q_g$
$V_{DS}$ =800V, $I_D$ =100A, $T_j$ =25°C

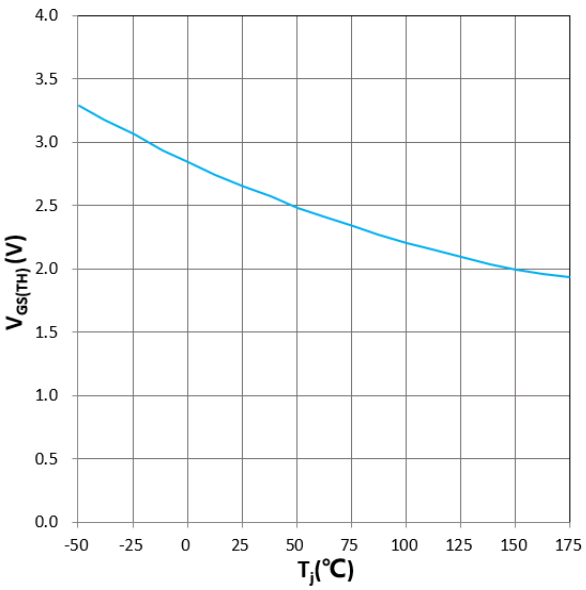



Figure 12. $V_{GS(TH)}$ vs $T_j$
$V_{GS}$ =$V_{DS}$, $I_D$ =40mA

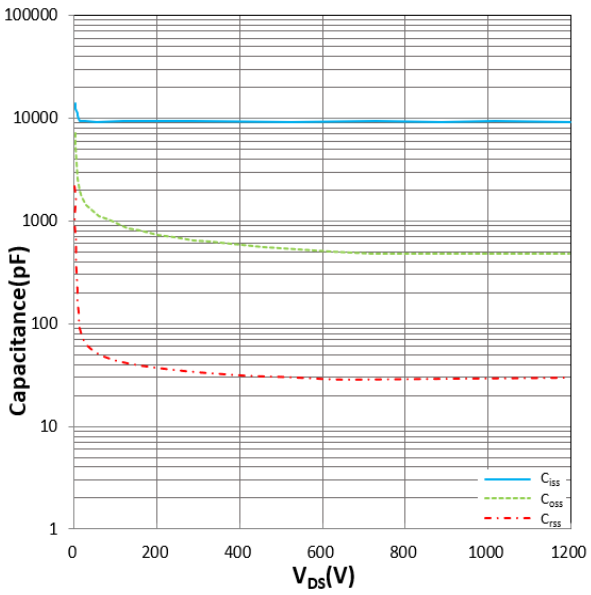



Figure 13. $C_{iss}$, $C_{oss}$, $C_{rss}$ vs $V_{DS}$
$T_j$ =25°C

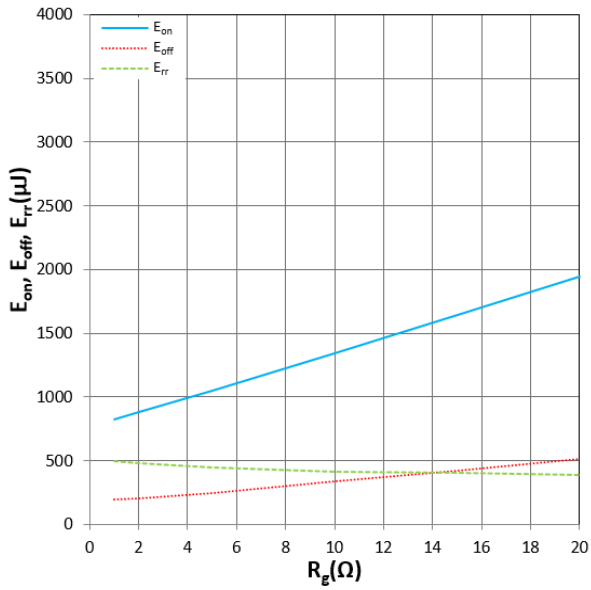



Figure 14. $E_{on}$, $E_{off}$, $E_{rr}$ vs $R_g$
$T_j$ =25°C, $I_D$ =100A, $V_{GS}$ =+15/-4V

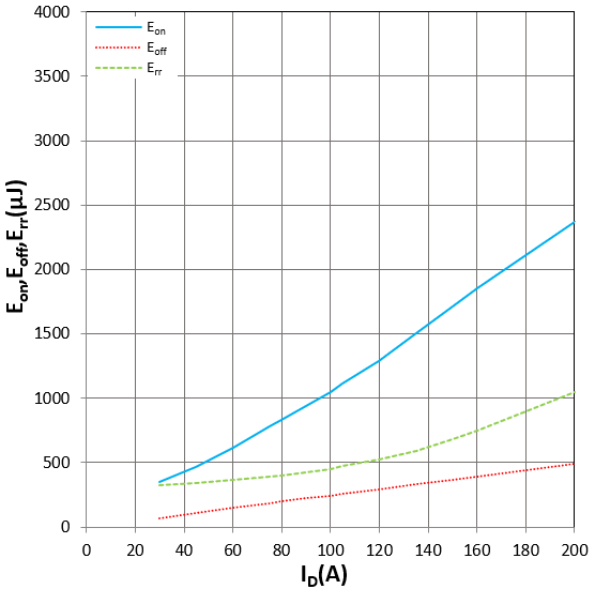



Figure 15. $E_{on}$, $E_{off}$, $E_{rr}$ vs $I_D$
$T_j$ =25°C, $R_{gon}$ =$R_{goff}$ =5.1Ω, $V_{GS}$ =+15/-4V

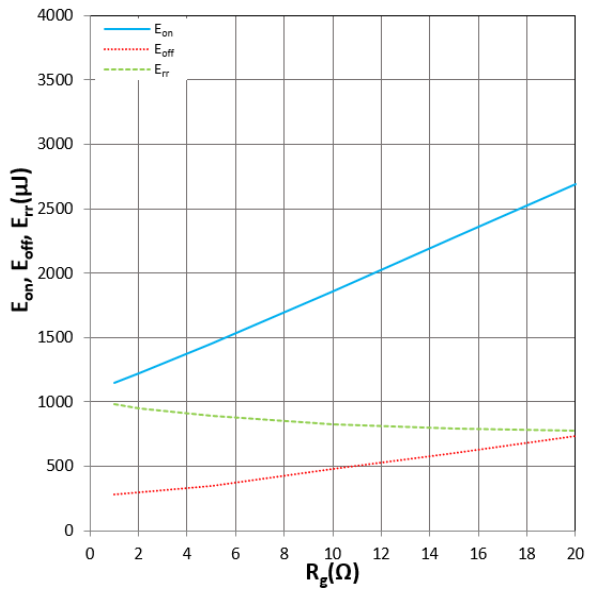



Figure 16. $E_{on}$, $E_{off}$, $E_{rr}$ vs $R_g$
$T_j$ =150°C, $I_D$ =100A, $V_{GS}$ =+15/-4V

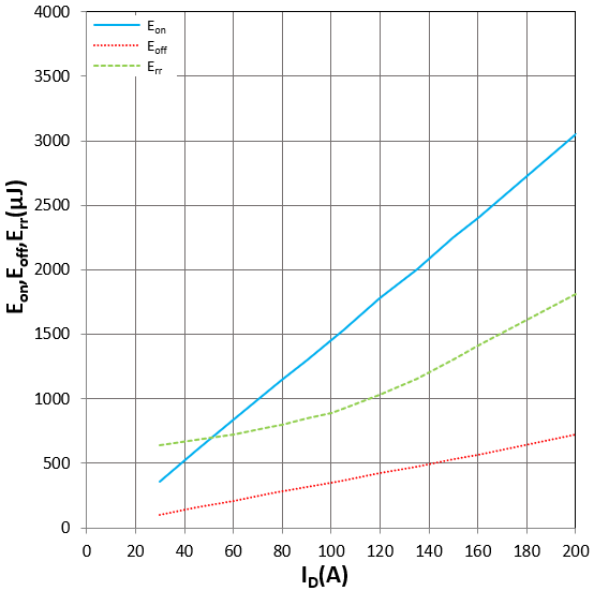
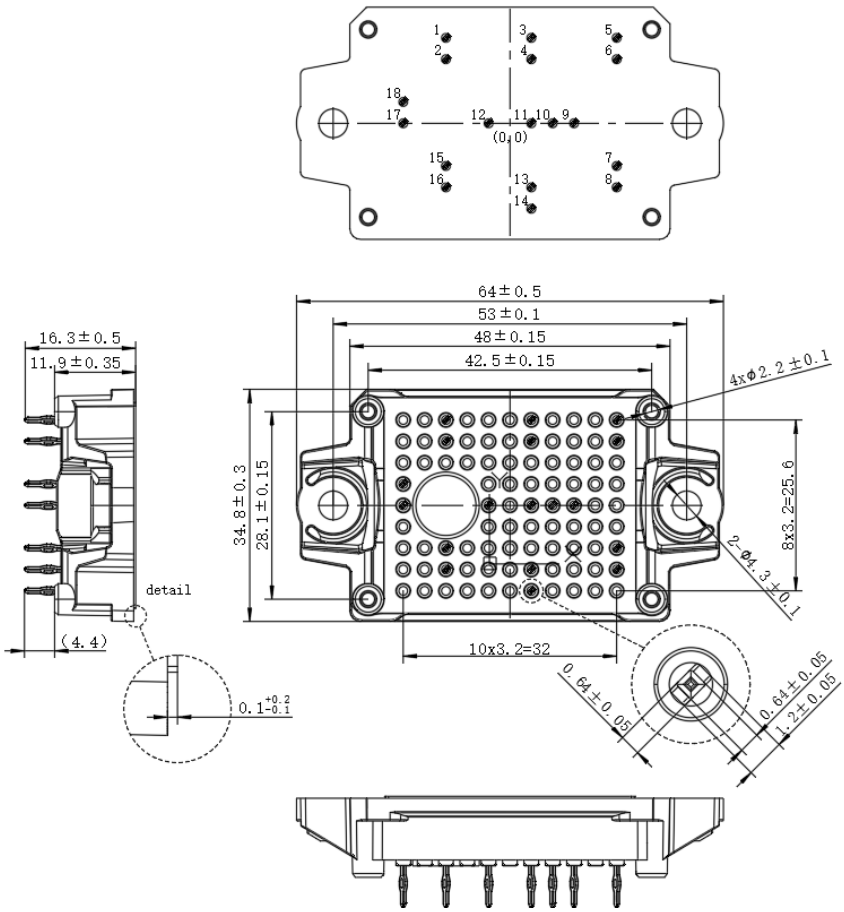



Figure 17. $E_{on}$, $E_{off}$, $E_{rr}$ vs $I_D$
$T_j$ =150°C, $R_{gon}$ =$R_{goff}$ =5.1Ω, $V_{GS}$ =+15/-4V

## Package dimensions




| Pin Table | | |
|---|---|---|
| Pin | X | Y |
| 1 | -9.6 | 12.8 |
| 2 | -9.6 | 9.6 |
| 3 | 3.2 | 12.8 |
| 4 | 3.2 | 9.6 |
| 5 | 16 | 12.8 |
| 6 | 16 | 9.6 |
| 7 | 16 | -6.4 |
| 8 | 16 | -9.6 |
| 9 | 9.6 | 0 |
| 10 | 6.4 | 0 |
| 11 | 3.2 | 0 |
| 12 | -3.2 | 0 |
| 13 | 3.2 | -9.6 |
| 14 | 3.2 | -12.8 |
| 15 | -9.6 | -6.4 |
| 16 | -9.6 | -9.6 |
| 17 | -16 | 0 |
| 18 | -16 | 3.2 |

**IMPORTANT NOTICE：**

This product data sheet describes the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively under the terms and conditions of the supply agreement. There will be no guarantee or of any kind for the product and its characteristics.

The data contained in this document is exclusively intended for technically trained staff. You and your technical departments will have to evaluate the product's suitability for the intended application and the completeness of the product data concerning such application.

Due to technical requirements, our product may contain dangerous substances. For information on the types in question, please contact the sales staff responsible for you.

Changes to this product data sheet are reserved.

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