

Description

The DFS11HH12EZE1 is a H 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
- 11mΩ $R_{ds(on)}$ @ $T_j = 25^{\circ}C, V_{GS} = 18V$
- 18mΩ $R_{ds(on)}$ @ $T_j = 175^{\circ}C, V_{GS} = 18V$
- Low Switching Losses
- 175°C maximum junction temperature
- Thermistor inside

Applications

- Solar Inverter
- UPS
- Fuel cell-DC/DC converter
- Energy Storage Systems

Circuit diagram

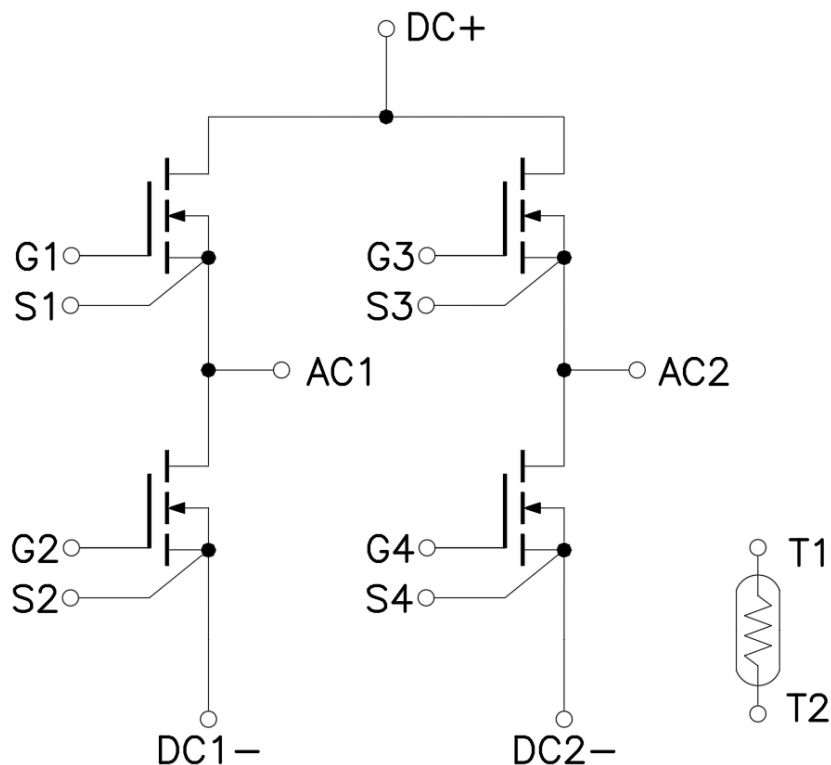


Figure 1. Out drawing & circuit diagram for DFS11HH12EZE1

Pin Configuration and Marking Information

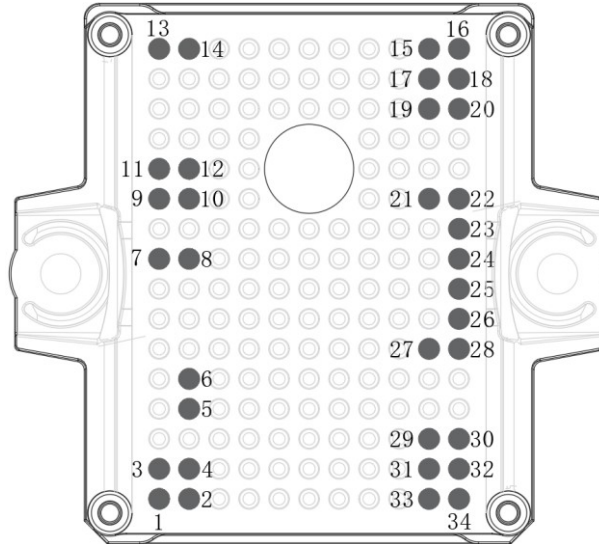


Figure 2. Pin configuration

| PIN No. | Symbol |
|-------------|--------|
| 1-4 | AC2 |
| 5 | S3 |
| 6 | G3 |
| 7 | G1 |
| 8 | S1 |
| 9-12 | AC1 |
| 13 | T2 |
| 14 | T1 |
| 15 | G2 |
| 16,18-20 | DC1- |
| 17 | S2 |
| 21-28 | DC+ |
| 29,30,32,34 | DC2- |
| 31 | S4 |
| 33 | G4 |

Module

| Parameter | Conditions | 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 | - |

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

| Symbol | Parameter | Conditions | Ratings | Unit |
|-----------------------|--|---------------------------------------|------------|------|
| V _{DSS} | Drain-Source Voltage | G-S Short | 1200 | V |
| V _{GSS} | Gate-Source Voltage(+) | D-S Short | +18 | V |
| V _{GSS} | Gate-Source Voltage(-) | D-S Short | -4 | V |
| V _{GSSsurge} | G-S Voltage(t _{surge} <300nsec) | D-S Short, Note1 | -8 to 22 | V |
| I _{DS} | DC Continuous Drain Current | T _f =110°C | 100 | A |
| I _{SD} | Source (Body Diode) Current | T _f =110°C, with ON signal | 100 | A |
| I _{DSM} | Drain Pulse Current, Peak | Less than 1ms, Note2 | 200 | A |
| T _j | junction temperature | - | -40 to 175 | °C |
| T _{stg} | Storage temperature | - | -40 to 125 | °C |

Note1: Recommended Operating Value, +18V/-4V; +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 R100 | T _C =100°C, R ₁₀₀ =493Ω | -5 | - | 5 | % |
| P ₂₅ | Power dissipation | T _C =25°C | - | - | 20 | mW |
| B _{25/50} | B-value | R ₂ =R ₂₅ exp [B _{25/50} (1/T ₂ - 1/(298,15 K))] | - | 3375 | - | K |
| B _{25/80} | B-value | R ₂ =R ₂₅ exp [B _{25/80} (1/T ₂ - 1/(298,15 K))] | - | 3411 | - | K |
| B _{25/100} | B-value | R ₂ =R ₂₅ exp [B _{25/100} (1/T ₂ - 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 =0.3mA | 1200 | - | - | V | |
| I _{DSS} | Zero gate voltage drain Current | V _{DS} =1200V, V _{GS} =0V | - | - | 400 | μA | |
| V _{GS(th)} | Gate-Source threshold Voltage | I _D =30mA, V _{DS} =V _{GS} | 1.9 | 2.6 | 3.5 | V | |
| I _{GSS+} | Gate-Source Leakage Current | V _{GS} =+18V, V _{DS} =0V | - | 30 | 300 | nA | |
| I _{GSS-} | | V _{GS} =-8V, V _{DS} =0V | - | 30 | 300 | nA | |
| R _{DS(on)} (Chip) | Static drain-source | I _D =100A V _{GS} =+15V | T _j =25°C | - | 12.8 | - | mΩ |
| | On-state resistance | | T _j =175°C | - | 19.5 | - | mΩ |
| R _{DS(on)} (Chip) | Static drain-source | I _D =100A V _{GS} =+18V | T _j =25°C | - | 11.2 | - | mΩ |
| | On-state resistance | | T _j =175°C | - | 18.9 | - | mΩ |
| V _{DS(on)} (Chip) | Static drain-source | I _D =100A V _{GS} =+15V | T _j =25°C | - | 1.28 | - | V |
| | On-state Voltage | | T _j =175°C | - | 1.95 | - | V |
| V _{DS(on)} (Chip) | Static drain-source | I _D =100A V _{GS} =+18V | T _j =25°C | - | 1.12 | - | V |
| | On-state Voltage | | T _j =175°C | - | 1.89 | - | V |
| C _{iss} | Input Capacitance | V _{DS} =1000V, V _{GS} =0V, f =1MHz | - | 7321 | - | pF | |
| C _{oss} | Output Capacitance | | - | 331 | - | pF | |
| C _{rss} | Reverse transfer Capacitance | | - | 37 | - | pF | |
| Q _G | Total gate charge | V _{DD} =800V, I _D =105A, V _{GS} =+18/0V | - | 348 | - | nC | |
| R _{Gint} | Internal Gate Resistance | T _j =25°C | - | 0.33 | - | Ω | |
| t _{d(on)} | Turn-on delay time | V _{DD} =600V I _D =100A V _{GS} =+15/-4V R _G =5.0Ω Inductive load switching operation | T _j =25°C | - | 24 | - | ns |
| | | | T _j =150°C | - | 23 | - | |
| t _r | Rise time | | T _j =25°C | - | 19 | - | ns |
| | | | T _j =150°C | - | 16 | - | |
| t _{d(off)} | Turn-off delay time | | T _j =25°C | - | 35 | - | ns |
| | | | T _j =150°C | - | 40 | - | |
| t _f | Fall time | | T _j =25°C | - | 19 | - | ns |
| | | | T _j =150°C | - | 21 | - | |
| E _{on} | Turn-on power dissipation | | T _j =25°C | - | 1.14 | - | mJ |
| | | | T _j =150°C | - | 1.71 | - | |
| E _{off} | Turn-off power dissipation | | T _j =25°C | - | 0.53 | - | mJ |
| | | | T _j =150°C | - | 0.60 | - | |
| R _{th(j-c)} | FET Thermal Resistance | | Junction to Case/MOSFET | - | 0.18 | - | K/W |
| R _{th(c-f)} | Contact thermal resistance | | With thermal conductive grease/MOSFET | - | 0.12 | - | 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 I _{SD} = 100A | T _j = 25°C | - | 5.0 | - | V |
| | | | T _j = 175°C | - | 4.5 | - | |
| T _{rr} | Reverse recovery time | V _{DD} = 600V I _D = 80A | T _j = 25°C | - | 25 | - | ns |
| | | | T _j = 150°C | - | 27 | - | |
| Q _{rr} | Reverse recovery charge | V _{GS} = +15/-4V R _G = 1.0Ω | T _j = 25°C | - | 0.5 | - | μC |
| | | | T _j = 150°C | - | 0.9 | - | |
| E _{rr} | Diode switching power dissipation | Inductive load switching operation | T _j = 25°C | - | 0.64 | - | mJ |
| | | | T _j = 150°C | - | 1.24 | - | |

Test Conditions

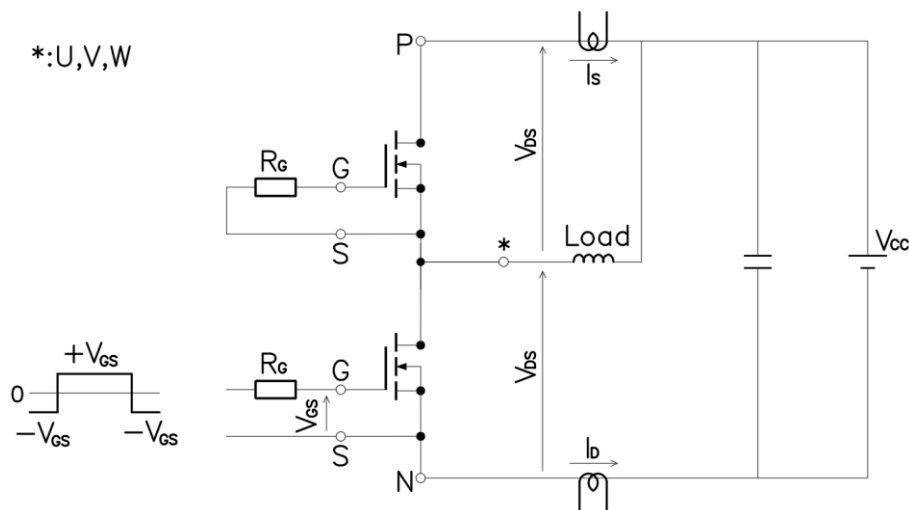


Figure 3. Switching time measure circuit

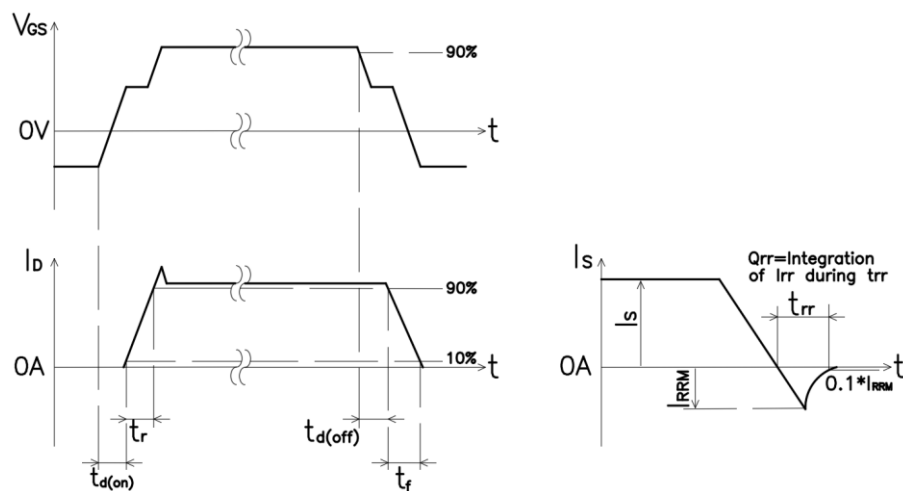


Figure 4. Switching time definition

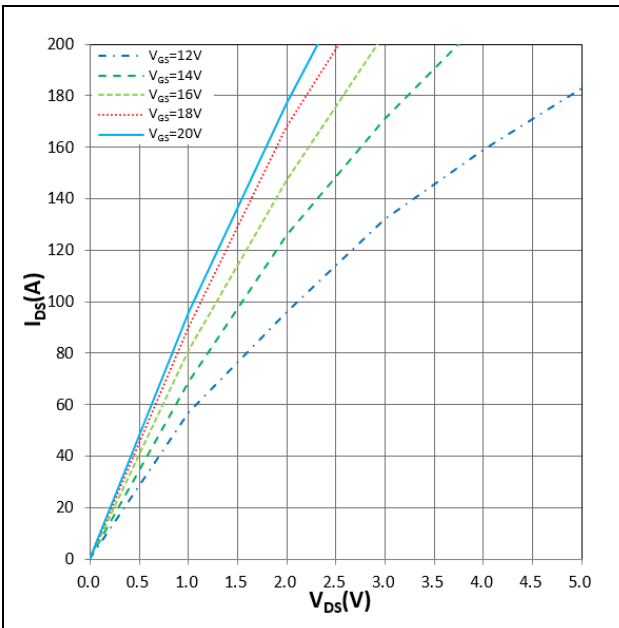


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

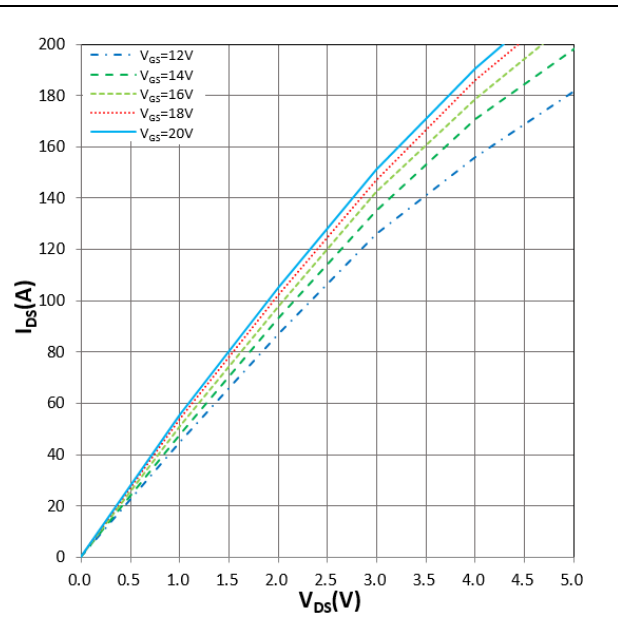


Figure 6. I_{DS} vs V_{DS}
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

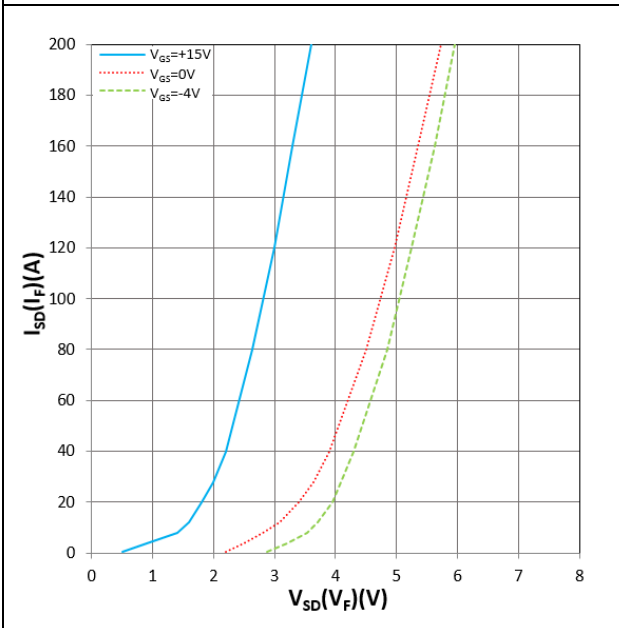


Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

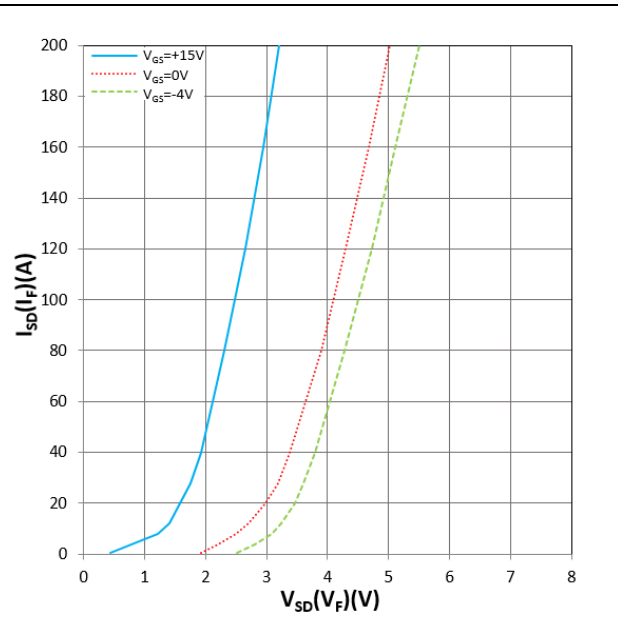


Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

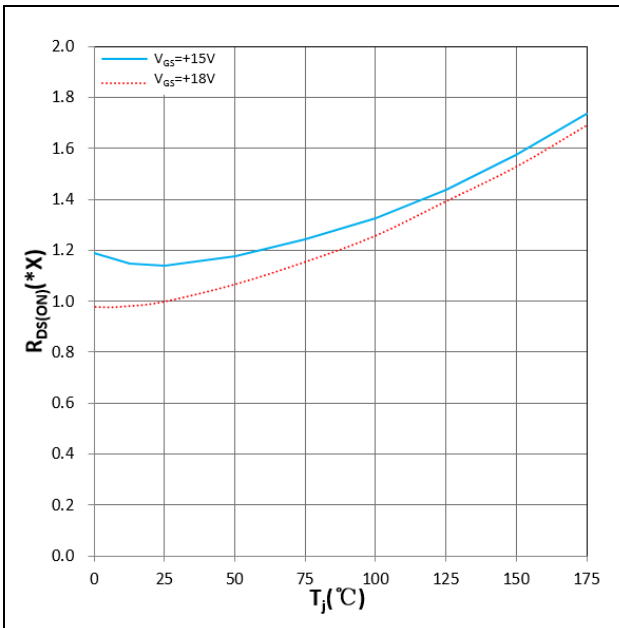


Figure 9. R_{DS(ON)} vs T_j
1.0X = 11.2mΩ

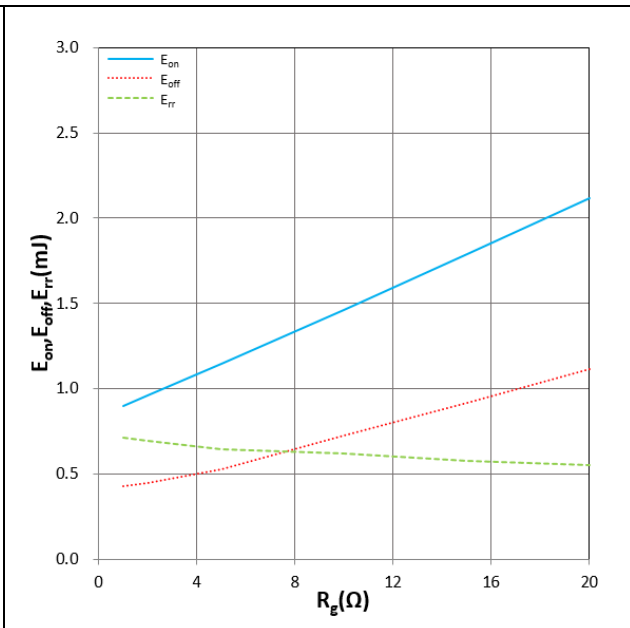


Figure 10. E_{on}, E_{off}, E_{rr} vs R_G
T_j = 25°C, I_D = 100A, V_{GS} = +15/-4V

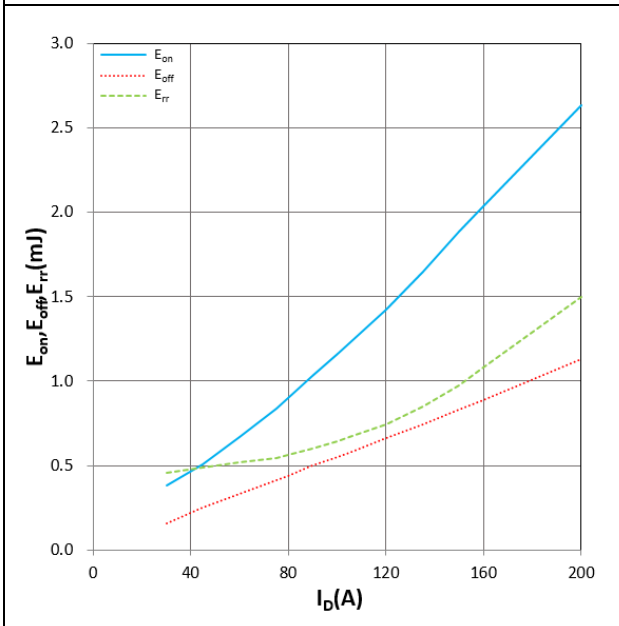


Figure 11. E_{on}, E_{off}, E_{rr} vs I_D
T_j = 25°C, R_G = 5.0Ω, V_{GS} = +15/-4V

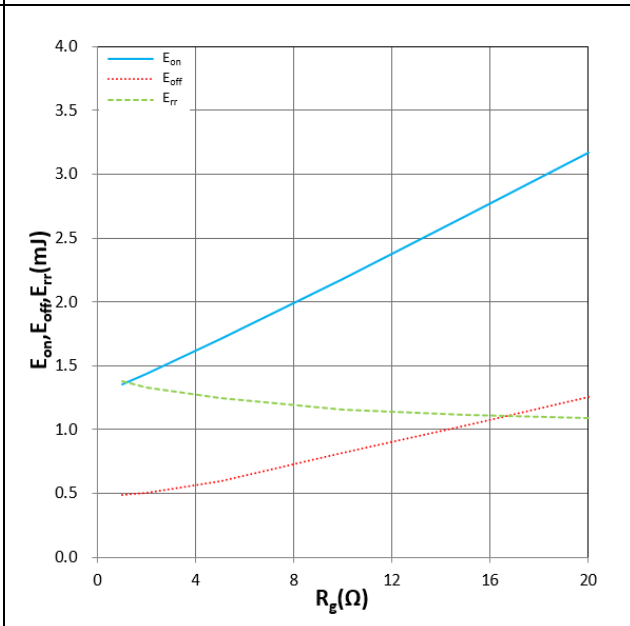


Figure 12. E_{on}, E_{off}, E_{rr} vs R_G
T_j = 150°C, I_D = 100A, V_{GS} = +15/-4V

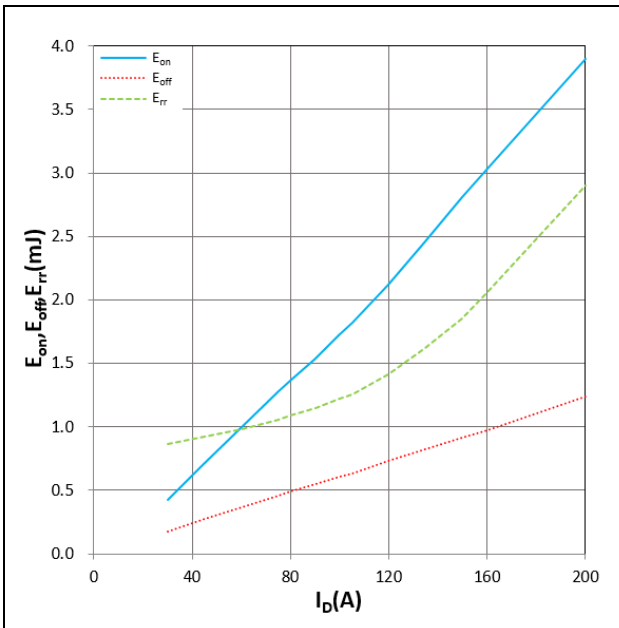


Figure 13. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j = 150^\circ\text{C}$, $R_G = 5.0\Omega$, $V_{GS} = +15/-4\text{V}$

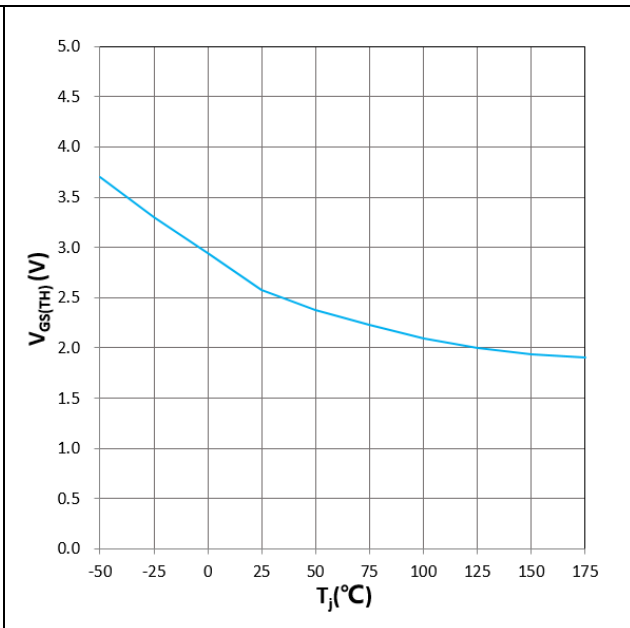


Figure 14. $V_{GS(TH)}$ vs T_j
 $V_{DS} = V_{GS}$, $I_{DS} = 30\text{mA}$

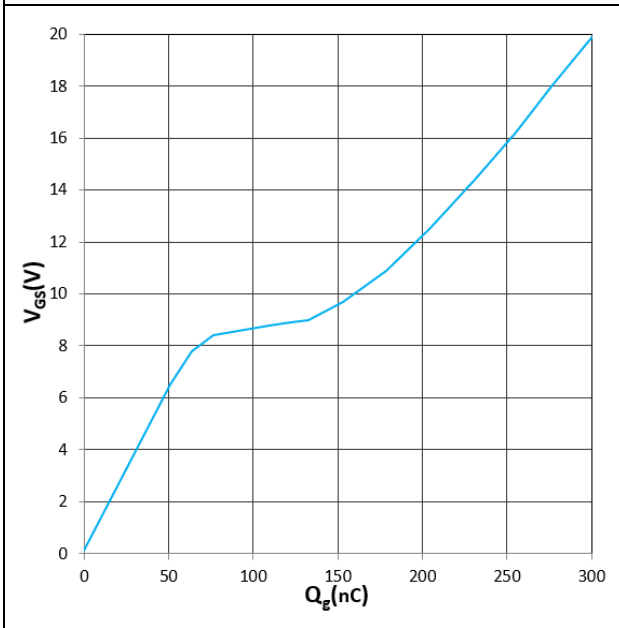


Figure 15. V_{GS} vs Q_g
 $V_{DD} = 800\text{V}$, $I_D = 100\text{A}$

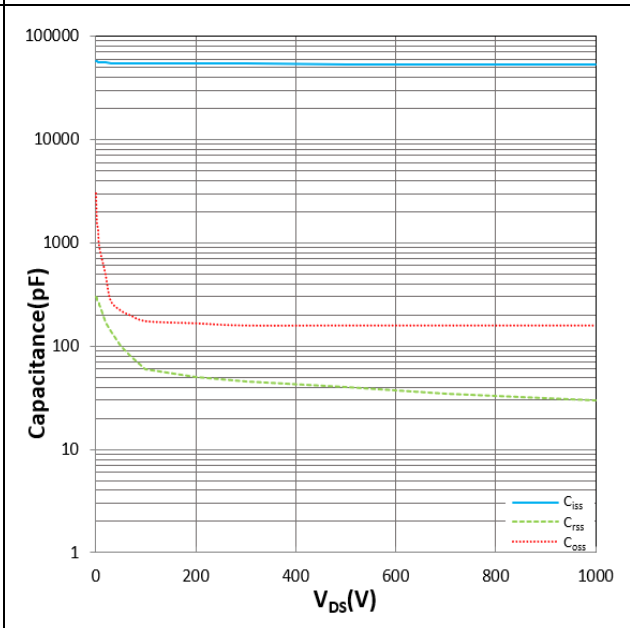
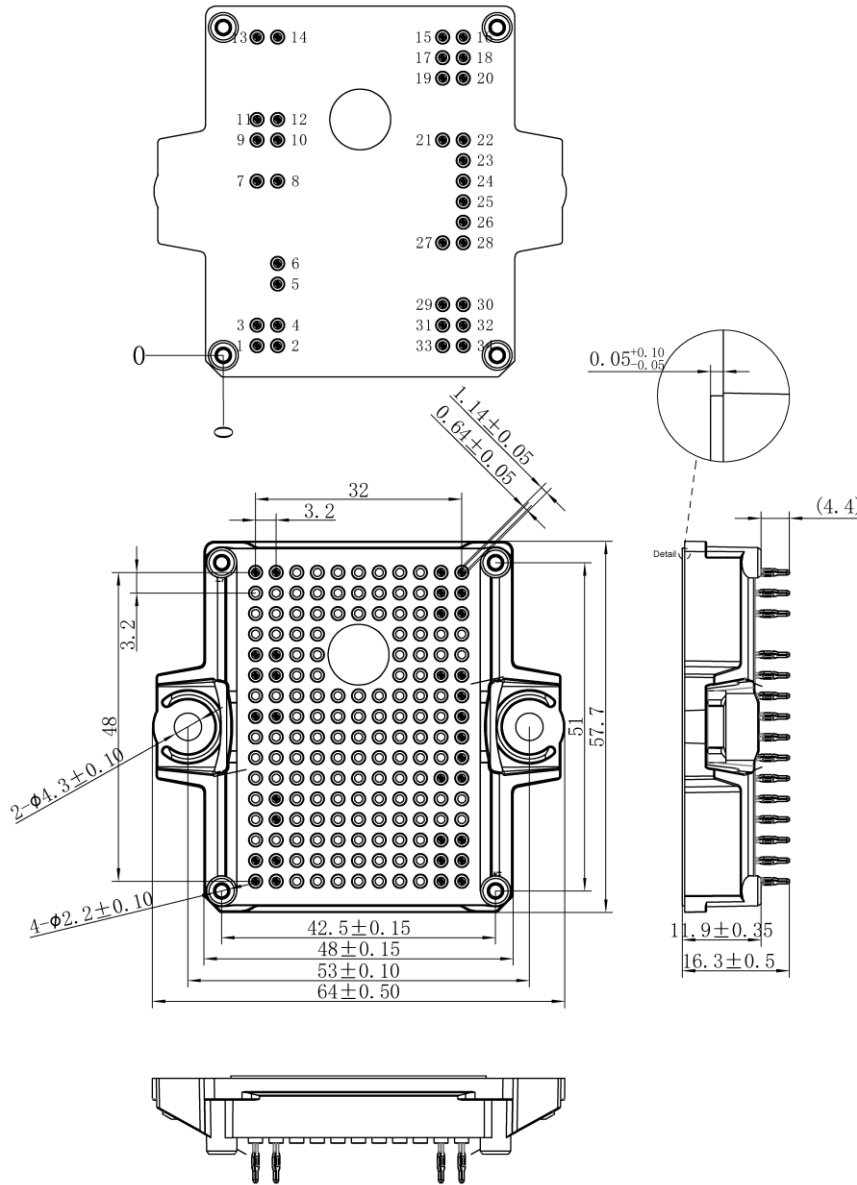


Figure 16. C_{iss} , C_{oss} , C_{rss} vs V_{DS}
 $T_j = 25^\circ\text{C}$

Package dimensions



| PIN | X | Y |
|-----|-------|-------|
| 1 | 5.25 | 1.50 |
| 2 | 8.45 | 1.50 |
| 3 | 5.25 | 4.70 |
| 4 | 8.45 | 4.70 |
| 5 | 8.45 | 11.10 |
| 6 | 8.45 | 14.30 |
| 7 | 5.25 | 27.10 |
| 8 | 8.45 | 27.10 |
| 9 | 5.25 | 33.50 |
| 10 | 8.45 | 33.50 |
| 11 | 5.25 | 36.70 |
| 12 | 8.45 | 36.70 |
| 13 | 5.25 | 49.50 |
| 14 | 8.45 | 49.50 |
| 15 | 34.05 | 49.50 |
| 16 | 37.25 | 49.50 |
| 17 | 34.05 | 46.30 |
| 18 | 37.25 | 46.30 |
| 19 | 34.05 | 43.10 |
| 20 | 37.25 | 43.10 |
| 21 | 34.05 | 33.50 |
| 22 | 37.25 | 33.50 |
| 23 | 37.25 | 30.30 |
| 24 | 37.25 | 27.10 |
| 25 | 37.25 | 23.90 |
| 26 | 37.25 | 20.70 |
| 27 | 34.05 | 17.50 |
| 28 | 37.25 | 17.50 |
| 29 | 34.05 | 7.90 |
| 30 | 37.25 | 7.90 |
| 31 | 34.05 | 4.70 |
| 32 | 37.25 | 4.70 |
| 33 | 34.05 | 1.50 |
| 34 | 37.25 | 1.50 |

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