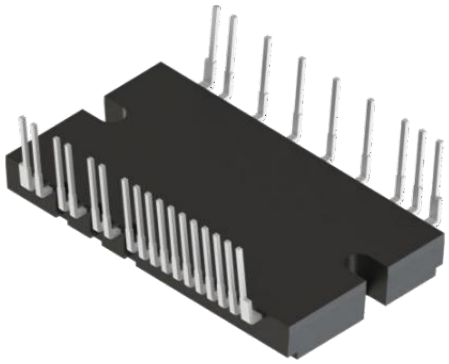
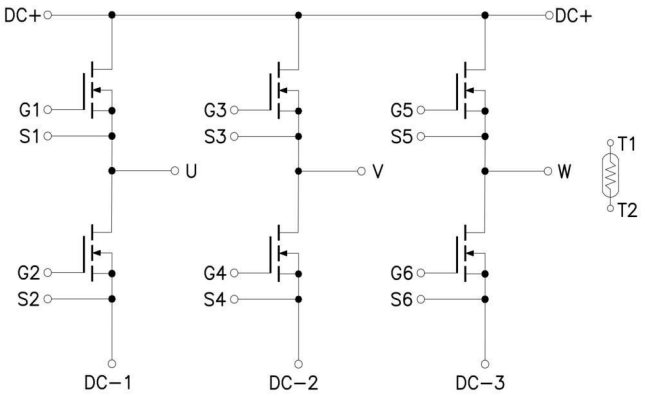
# 3 Phase Silicon Carbide MOSFET Module

| Parameter | Value | Unit |
|---|---|---|
| $V_{DS}$ | 1200 | V |
| $I_D$ | 34 | A |
| $R_{DS(ON)}$ | 80 | mΩ |



## Features

- Low Switching Losses
- 175°C Maximum Junction Temperature
- Low Thermal Resistance With Si3N4 Amb
- Thermistor Inside




## Applications

- High Frequency Switching Application
- DC/DC Converter
- Motor Drives
- UPS

## Absolute Maximum Ratings (at $T_C$=25℃ unless otherwise specified)

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Drain-source Voltage | $V_{DS}$ | $V_{GS}$=0V | 1200 | V |
| Gate-source Voltage | $V_{GS}$ | $V_{DS}$=0V; $t_{surge}$<200nsec; (Note1) | -10/+25 | V |
| Drain Current (continuous) | $I_D$ | $T_f$=25°C; $V_{GS}$=-5/+20V; (Note2) | 34 | A |
| Drain Current (continuous) | | $T_f$=100°C; $V_{GS}$=-5/+20V | 25 | |
| Drain Current (pulsed) | $I_{DM}$ | Less than 1ms; (Note3) | 80 | A |
| Storage Temperature Range | $T_{stg}$ | - | -40 to +175 | °C |
| Junction Temperature | $T_J$ | - | -40 to +175 | |

Note1: Recommended Operating Value, +20/-5V; +18V/-5V; +15V/-4V

Note2: Case temperature(Tf) is defined on the surface of AMB substrate bottom just under the chips

Note3: Pulse width limited by maximum junction temperature

## MOSFET Characteristics

| Parameter | Symbol | Conditions | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| **Static characteristics** (at $T_C$=25°C unless otherwise specified) | | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DS}$ | $V_{GS}$=0V; $I_D$=1mA | | 1200 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=1200V; $V_{GS}$=0V | | - | 3 | - | μA |
| Gate-Body Leakage Current | $I_{GSS}$+ | $V_{GS}$=20V; $V_{DS}$=0V | $T_J$=25°C | - | - | 100 | nA |
| | $I_{GSS}$- | $V_{GS}$=-5V; $V_{DS}$=0V | $T_J$=25°C | -100 | - | - | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$; $I_D$=10mA | $T_J$=25°C | 2 | 2.8 | 4 | V |
| Static Drain-Source on Resistance | $R_{DS(on)}$ | $V_{GS}$=20V; $I_D$=20A | $T_J$=25°C | - | 80 | 100 | mΩ |
| | | | $T_J$=175°C | - | 149 | - | |
| Internal gate resistor | $R_{Gint}$ | | $T_J$=25°C | - | 3 | - | Ω |
| **Dynamic characteristics** (at $T_C$=25°Cunless otherwise specified) | | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=1000V; $V_{GS}$=0V; f=200KHz; $V_{AC}$=25mV | | - | 146 | - | pF |
| Output Capacitance | $C_{oss}$ | | | - | 62 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | - | 3 | - | |
| Turn-on Energy | $E_{on}$ | $V_{GS}$=-5/+20V; $I_D$=20A; $V_{DD}$=800V;$R_{g(ext)}$=2.5Ω; Inductive load switching operation | $T_J$=25°C | - | 410 | - | uJ |
| | | | $T_J$=150°C | - | 530 | - | |
| Turn-off Energy | $E_{off}$ | | $T_J$=25°C | - | 18 | - | |
| | | | $T_J$=150°C | - | 61 | - | |
| Gate-Source Charge | $Q_G$ | $V_{DD}$=800V; $V_{GS}$=-5/+20V; $I_D$=20A | | - | 58 | - | nC |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{GS}$=-5/+20V; $I_D$=20A; $V_{DD}$=800V; $R_{g(ext)}$=2.5Ω; Inductive load switching operation | $T_J$=25°C | - | 10 | - | ns |
| | | | $T_J$=150°C | - | - | - | |
| Rise Time | $t_r$ | | $T_J$=25°C | - | 7 | - | |
| | | | $T_J$=150°C | - | - | - | |
| Turn-off Delay Time | $t_{d(off)}$ | | $T_J$=25°C | - | 17 | - | |
| | | | $T_J$=150°C | - | - | - | |
| Fall Time | $t_f$ | | $T_J$=25°C | - | 14 | - | |
| | | | $T_J$=150°C | - | - | - | |
| FET Thermal Resistance | $R_{th(j-c)}$ | Junction to Case | | - | 0.72 | - | K/W |

## Body Diode Characteristics (at $T_J$=25℃ unless otherwise specified)

| Parameter | Symbol | Conditions | | Values | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Forward Voltage | $V_{FSD}$ | $V_{GS}$=-5V; $I_F$=20A | $T_J$=25°C | - | 4.4 | - | V |
| | | | $T_J$=175°C | - | 3.86 | - | |
| Continuous Diode Forward Current | $I_{SD}$ | $T_f$=100°C; with ON signal | | - | 25 | - | A |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$=-5/+15V; $I_F$=20A; $V_R$=800V; $R_{g(ext)}$=2.5Ω; Inductive load switching operation | $T_J$=25°C | - | 20 | - | ns |
| | | | $T_J$=150°C | - | - | - | |
| Reverse Recovery Charge | $Q_{RR}$ | | $T_J$=25°C | - | 128 | - | uC |
| | | | $T_J$=150°C | - | - | - | |

## NTC Thermistor Characteristics

| Parameter | Symbol | Conditions | Values | | | Units |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Rated Resistance | $R_{25}$ | $T_C$=25°C | - | 10 | - | kΩ |
| Deviation of $R_{100}$ | ΔR/R | $T_C$=100°C; $R_{100}$=854Ω | -3 | - | 3 | % |
| Power dissipation | $R_{25}$ | $T_C$=25°C | - | - | 326 | W |
| Beta Value for 25°C to 50°C | $B_{25/50}$ | $R_2=R_{25}\exp[B_{25/50}(1/T_2 - 1/(298.15K))]$ | - | 3590 | - | K |
| Beta Value for 25°C to 85°C | $B_{25/80}$ | $R_2=R_{25}\exp[B_{25/85}(1/T_2 - 1/(298.15K))]$ | - | 3635 | - | K |
| Beta Value for 25°C to 100°C | $B_{25/100}$ | $R_2=R_{25}\exp[B_{25/100}(1/T_2 - 1/(298.15K))]$ | - | 3650 | - | K |

## Module Physical Characteristics

| Parameter | Symbol | Conditions | Values | | | Units |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Isolation Test Voltage | $V_{ISOL}$ | RMS; f =50Hz; t=1min | - | 3.4 | - | kV |
| Clearance Distance | - | Terminal to Terminal | - | 4.3 | - | mm |
| | - | Terminal to Heatsink | - | 3.9 | - | mm |
| Creepage Distance | - | Terminal to Terminal | - | 4.3 | - | mm |
| | - | Terminal to Heatsink | - | 5.5 | - | mm |
| Terminal Connection Torque | M | M3 | 0.6 | 0.7 | 0.8 | Nm |

## Typical Characteristics

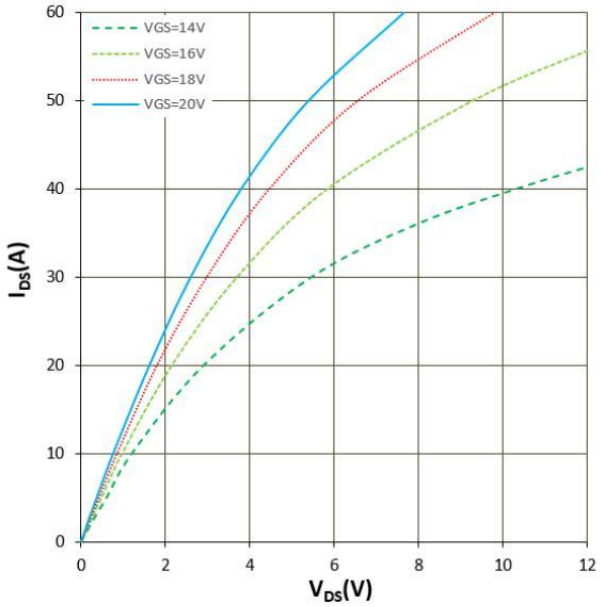



Figure 5. $I_{DS}$ vs $V_{DS}$
$T_j$ =25°C, $V_{GS}$ parameter

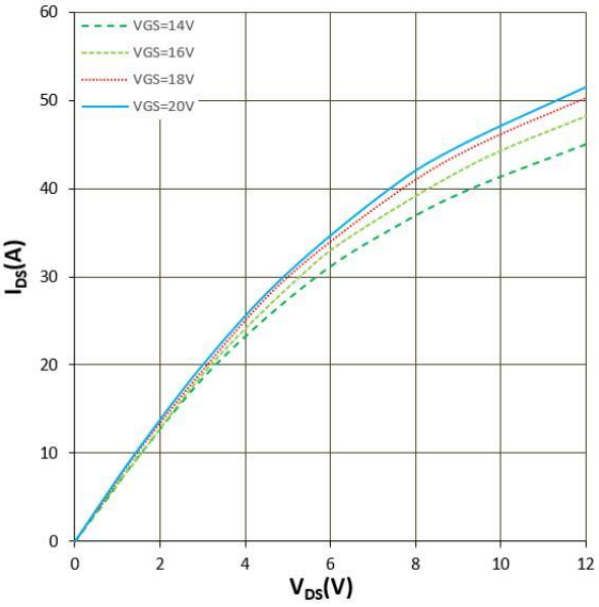



Figure 6. $I_{DS}$ vs $V_{DS}$
$T_j$ =175°C, $V_{GS}$ parameter

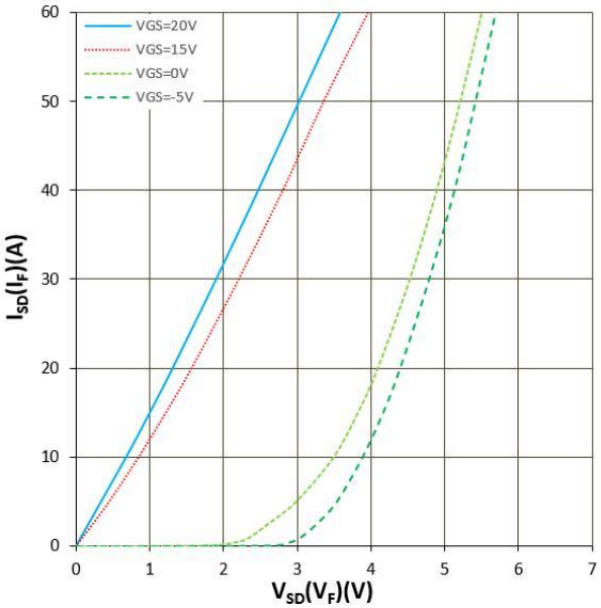



Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
$T_j$ =25°C, $V_{GS}$ parameter

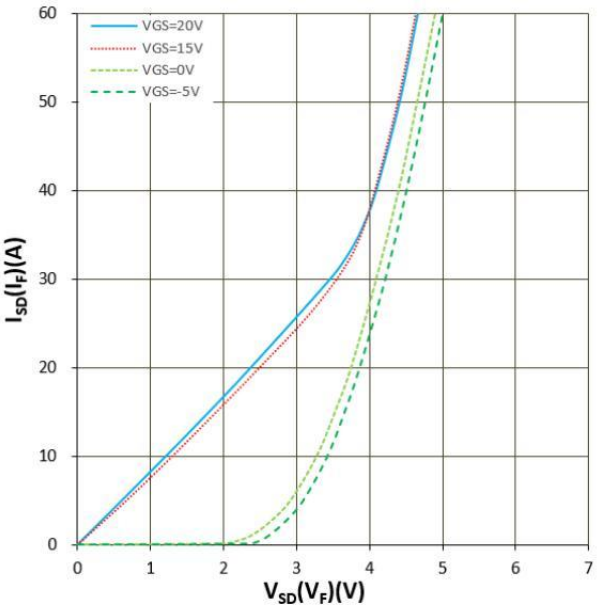



Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
$T_j$ =175°C, $V_{GS}$ parameter

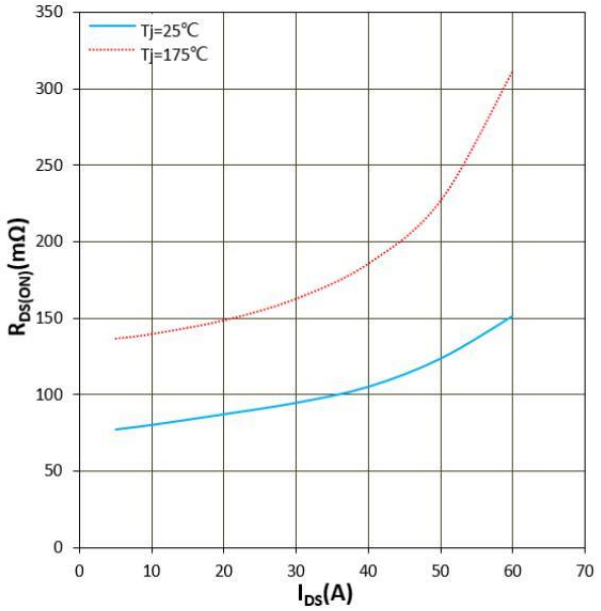



Figure 9. $R_{DS(ON)}$ vs $I_{DS}$

$V_{GS}$ =20V

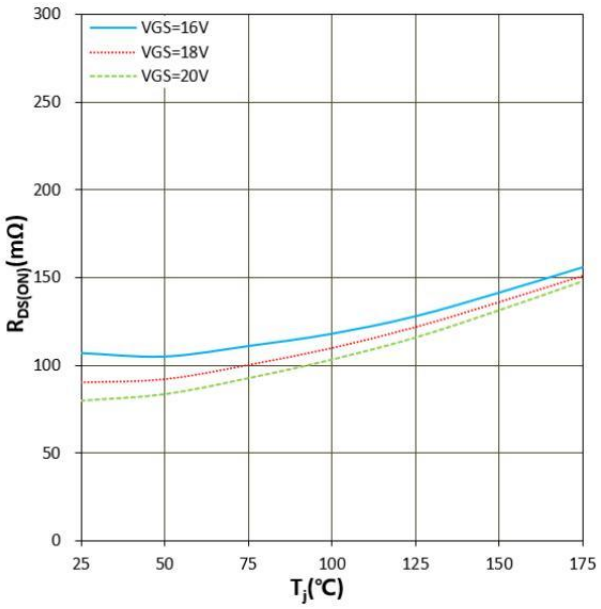



Figure 10. $R_{DS(ON)}$ vs $T_j$

$T_j$ =25°C, $I_D$ =20A

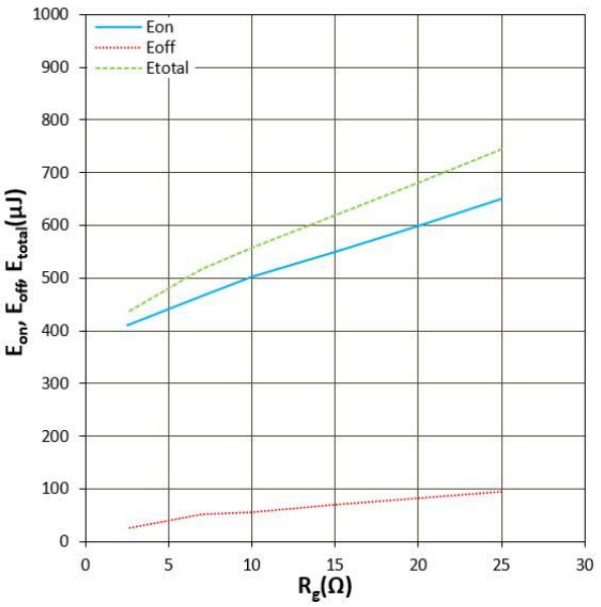



Figure 11. $E_{on}$, $E_{off}$, $E_{total}$ vs $R_G$

$T_j$ =25°C, $I_D$ =20A, $V_{GS}$ =-5/+20V

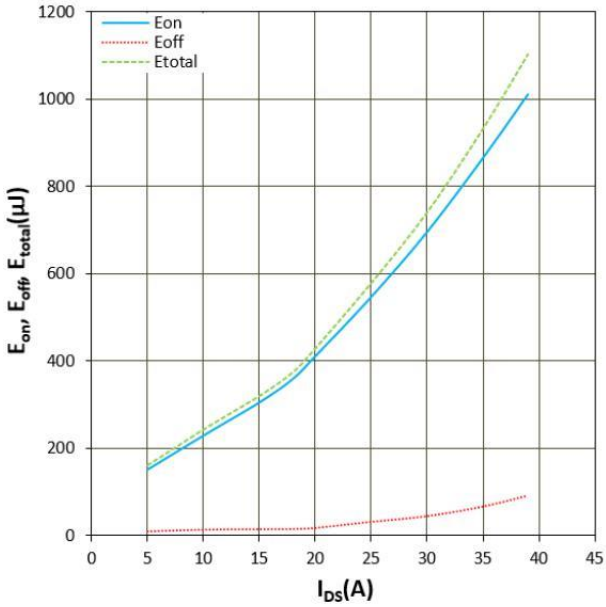



Figure 12. $E_{on}$, $E_{off}$, $E_{total}$ vs $I_D$

$T_j$ =25°C, $R_G$ =2.5Ω, $V_{GS}$ =-5/+20V

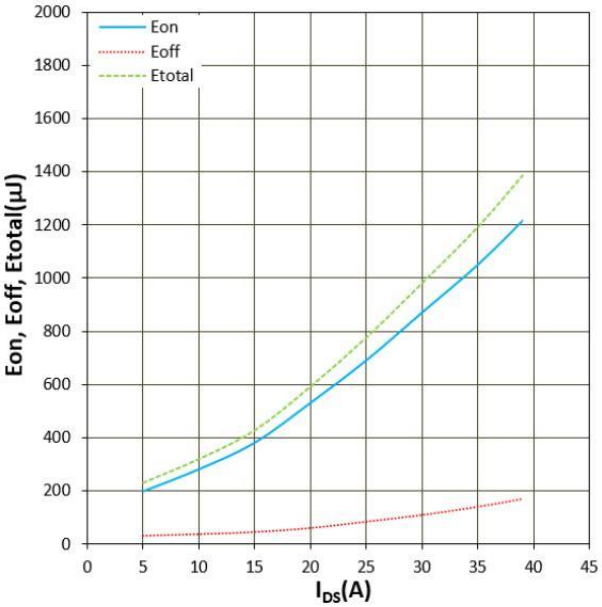



Figure 13. $E_{on}$, $E_{off}$, $E_{total}$ vs $I_D$

$T_j$ =150°C, $R_G$ =2.5Ω, $V_{GS}$ =-5/+20V

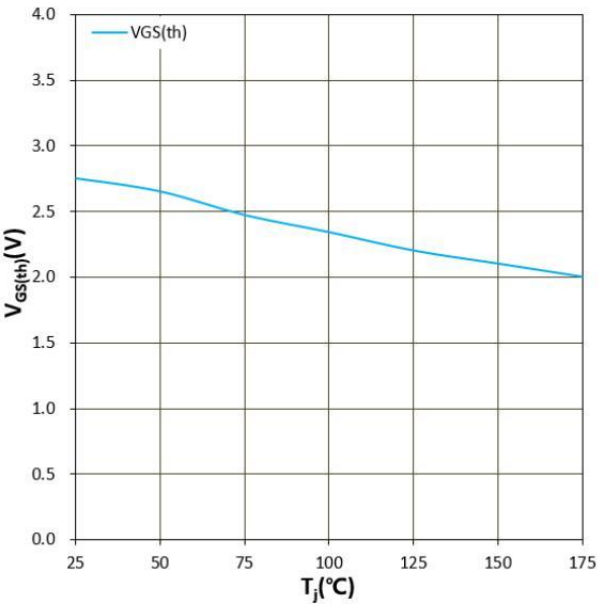



Figure 14. $V_{GS(th)}$ vs $T_j$

$V_{DS}$ =$V_{GS}$, $I_{DS}$ =10mA

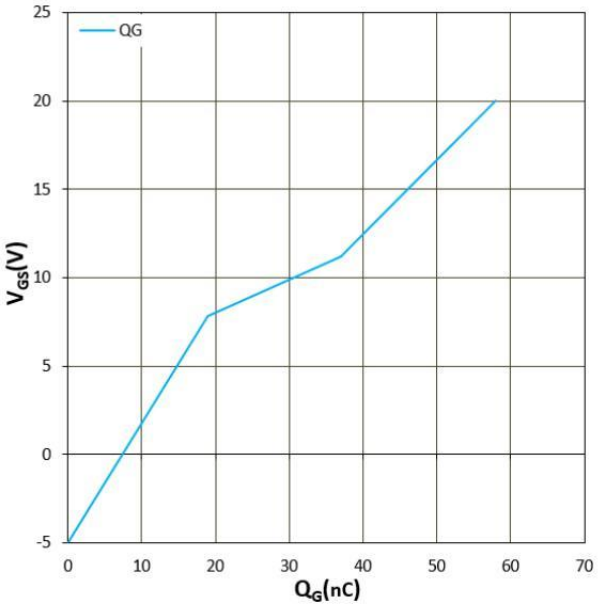



Figure 15. $V_{GS}$ vs $Q_G$

$T_j$ =25°C, $V_{DD}$ =800V, $I_D$ =20A

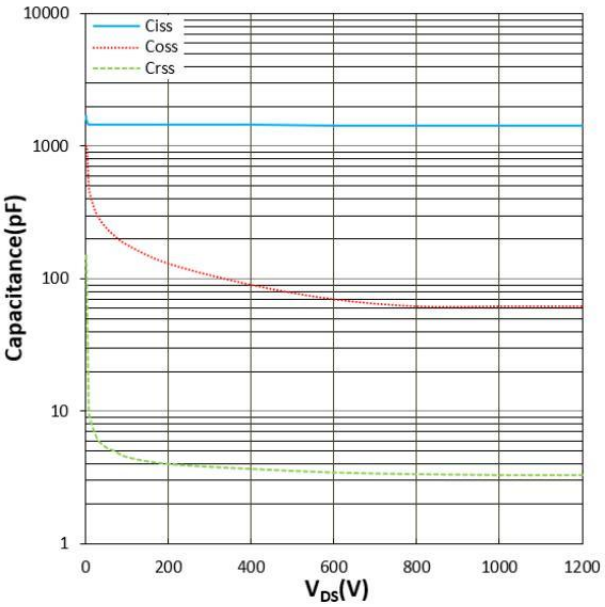
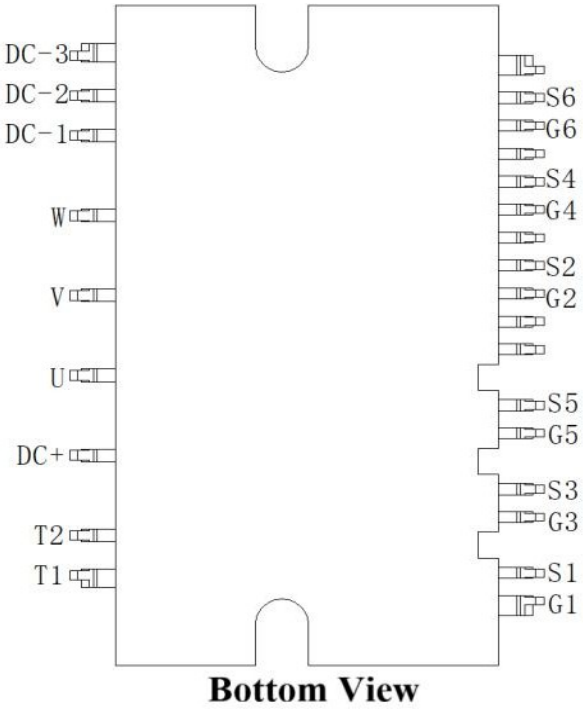
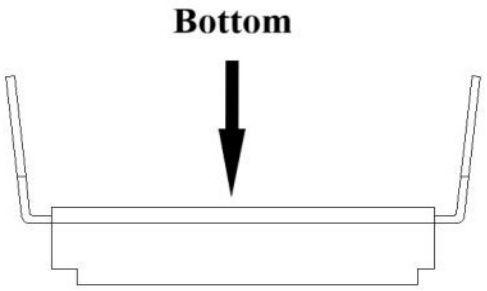



Figure 16. $C_{iss}$, $C_{oss}$, $C_{rss}$ vs $V_{DS}$

$T_j$ =25°C

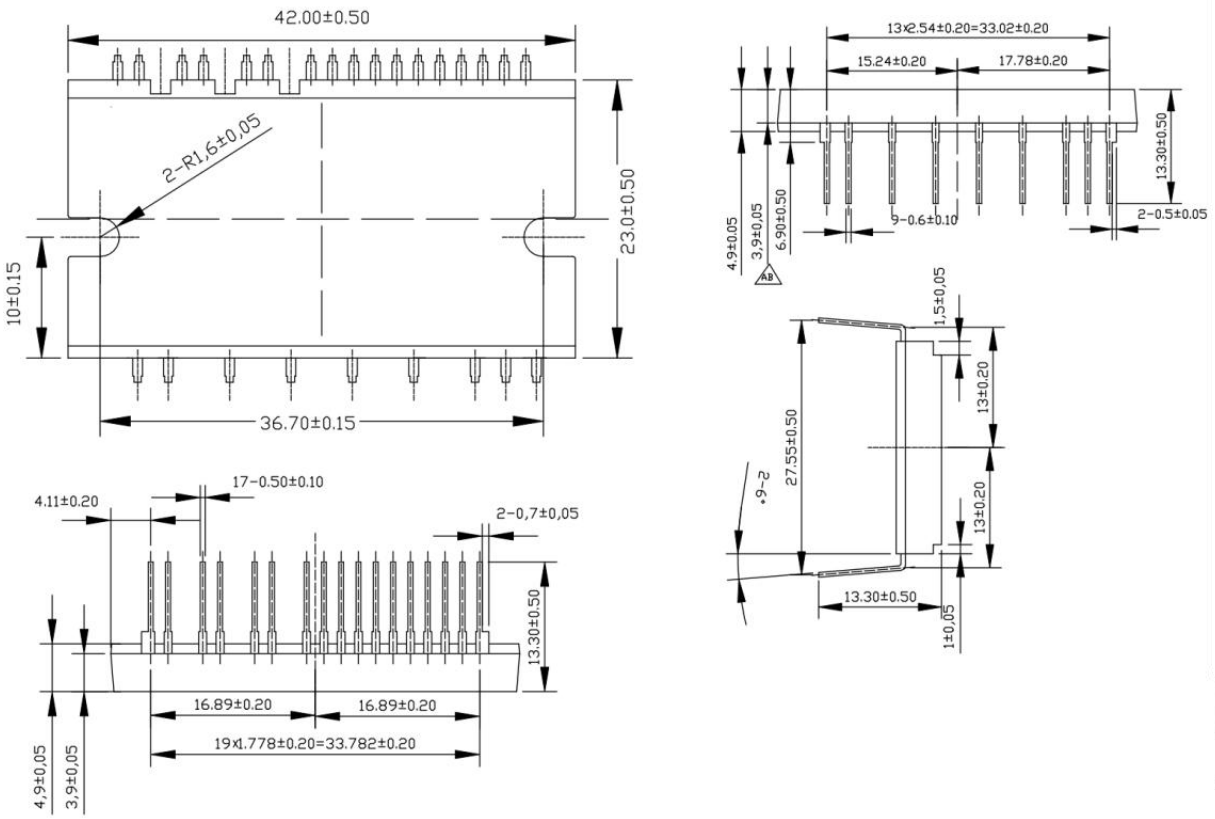
## Pin Configuration And Marking Information




| Symbol | Description |
|---|---|
| U, V, W | Output terminal of 3 Phase |
| DC-1, 2, 3 | DC- Bus connection |
| DC+ | DC+ Bus connection |
| G1, G3, G5 | High side gate signal terminal |
| S1, S3, S5 | High side source signal terminal |
| G2, G4, G6 | Low side gate signal terminal |
| S2, S4, S6 | Low side source signal terminal |
| T1 | Thermistor connection 1 |
| T2 | Thermistor connection 2 |

## Package Outlines (Unit:mm)



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