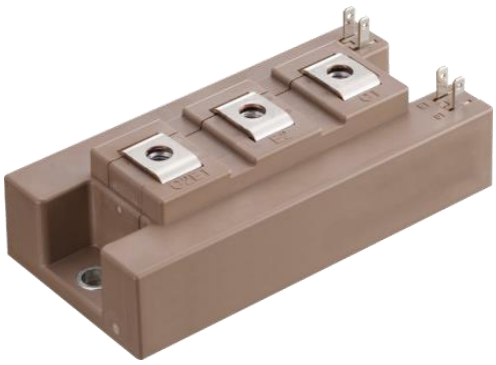
# 2MSI200VAB-120-53

**SiC Hybrid Modules**

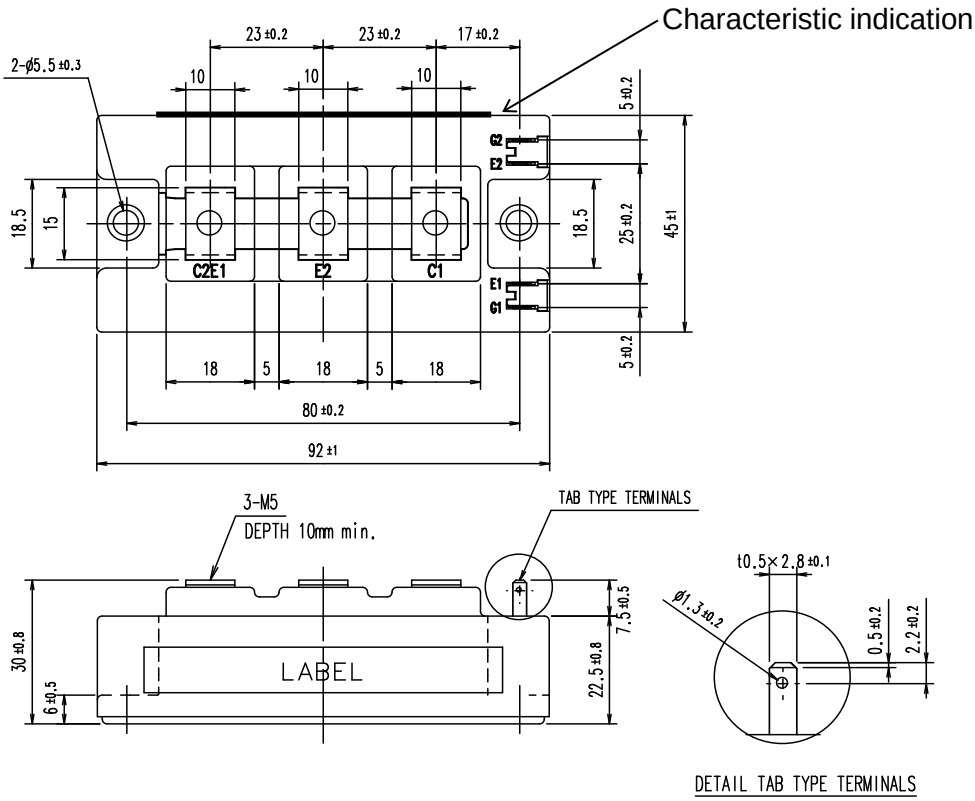
## Power Module (V-series IGBT & SiC SBD Hybrid type)
## 1200V / 200A / 2-in-1 package



### ■ Features
High speed switching
Voltage drive
Low switching loss
Low inductance module structure

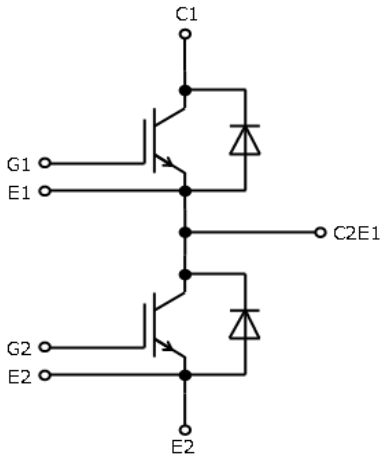
### ■ Applications
Inverter for Motor Drive
AC and DC Servo Drive Amplifier
Uninterruptible Power Supply
Active Front End

### ■ Outline drawing ( Unit : mm )




Weight: 270g (typ.)

### ■ Equivalent Circuit



# 2MSI200VAB-120-53



## ■ Absolute Maximum Ratings (at $T_C$= 25°C unless otherwise specified)

| Items | | Symbols | Conditions | Maximum Ratings | Units |
|---|---|---|---|---|---|
| Collector-Emitter voltage | | $V_{CES}$ | | 1200 | V |
| Gate-Emitter voltage | | $V_{GES}$ | | ±20 | V |
| Collector current | | $I_C$ | Continuous $T_c$ = 100°C | 200 | A |
| | | $I_C$ pulse | 1 msec | 400 | |
| Forward current | | $I_F$ | Continuous | 200 | |
| | | $I_F$ pulse | 1 msec | 400 | |
| Collector power dissipation | | $P_C$ | 1 device | 1500 | W |
| Junction temperature | | $T_{vj}$ | | 175 | °C |
| Operating junction temperature (under switching conditions) | | $T_{vjop}$ | | 150 | |
| Case temperature | | $T_C$ | | 125 | |
| Storage temperature | | $T_{stg}$ | | -40 ~ 125 | |
| Isolation voltage | between terminal and copper base (*1) | $V_{iso}$ | AC: 1 min. | 2500 | Vrms |
| Screw Torque | Mounting (*2) | - | | 3.5 | N m |
| | Terminals (*2) | - | | 3.5 | |

(*1) All terminals should be connected together during the test.
(*2) Recommendable Value : 2.5 - 3.5 Nm (M5)

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## ■ Electrical characteristics (at $T_{vj}$= 25°C unless otherwise specified)

**NOTICE:**
The external gate resistance ($R_G$) shown in below is one of our recommend value for the purpose of minimum switching loss. However the optimum $R_G$ depends on circuit configuration and/or environment. We recommend that the $R_G$ has to be carefully chosen based on consideration if IGBT module matches design criteria, for example, switching loss, EMC/EMI, spike voltage, surge current and no unexpected oscillation and so on. Especially, we recommend to choose $R_G$ value shown in below or more.

| Items | Symbols | Conditions | | Characteristics min. | Characteristics typ. | Characteristics max. | Units |
|---|---|---|---|---|---|---|---|
| Zero gate voltage Collector current | $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 1200 V | | - | - | 2.5 | mA |
| Gate-Emitter leakage current | $I_{GES}$ | $V_{CE}$ = 0 V, $V_{GE}$ = ±20 V | | - | - | 400 | nA |
| Gate-Emitter threshold voltage | $V_{GE(th)}$ | $V_{CE}$ = 20 V, $I_C$ = 200 mA | | 6.0 | 6.5 | 7.0 | V |
| Collector-Emitter saturation voltage | $V_{CE(sat)}$ (terminal) | $V_{GE}$ = 15 V, $I_C$ = 200 A | $T_{vj}$=25°C | - | 1.95 | 2.40 | V |
| | | | $T_{vj}$=125°C | - | 2.25 | - | |
| | | | $T_{vj}$=150°C | - | 2.30 | - | |
| | $V_{CE(sat)}$ (chip) | $V_{GE}$ = 15 V, $I_C$ = 200 A | $T_{vj}$=25°C | - | 1.75 | 2.20 | |
| | | | $T_{vj}$=125°C | - | 2.05 | - | |
| | | | $T_{vj}$=150°C | - | 2.10 | - | |
| Internal gate resistance | $r_{g(int)}$ | - | | - | 3.75 | - | Ω |
| Input capacitance | $C_{ies}$ | $V_{CE}$= 10 V, $V_{GE}$= 0 V, $f$=100 kHz | | - | 17.0 | - | nF |
| Turn-on time | $t_{on}$ | $V_{CC}$ = 600 V, $I_C$ = 200 A, $V_{GE}$ = ±15 V, $R_G$ = 2.7Ω, $T_{vj}$ = 150°C, $L_s$ = 70nH | | - | 690 | - | nsec |
| | $t_r$ | | | - | 230 | - | |
| | $t_{r(i)}$ | | | - | 50 | - | |
| Turn-off time | $t_{off}$ | | | - | 720 | - | |
| | $t_f$ | | | - | 90 | - | |
| Forward on voltage | $V_F$ (terminal) | $V_{GE}$ = 0 V, $I_F$ = 200 A | $T_{vj}$=25°C | - | 1.75 | 2.10 | V |
| | | | $T_{vj}$=125°C | - | 2.25 | - | |
| | | | $T_{vj}$=150°C | - | 2.45 | - | |
| | $V_F$ (chip) | $V_{GE}$ = 0 V, $I_F$ = 200 A | $T_{vj}$=25°C | - | 1.60 | 1.90 | |
| | | | $T_{vj}$=125°C | - | 2.05 | - | |
| | | | $T_{vj}$=150°C | - | 2.25 | - | |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 200A | | - | 40 | - | nsec |

### 5. Thermal resistance characteristics

| Items | Symbols | Conditions | Characteristics min. | Characteristics typ. | Characteristics max. | Units |
|---|---|---|---|---|---|---|
| Thermal resistance(1device) | $R_{th(j-c)}$ | IGBT | - | - | 0.100 | °C/W |
| | | FWD (SiC-SBD) | - | - | 0.120 | |
| Contact thermal resistance (1device) (*1) | $R_{th(c-f)}$ | with Thermal Compound | - | 0.025 | - | |

(*1) This is the value which is defined mounting on the additional cooling fin with thermal compound.

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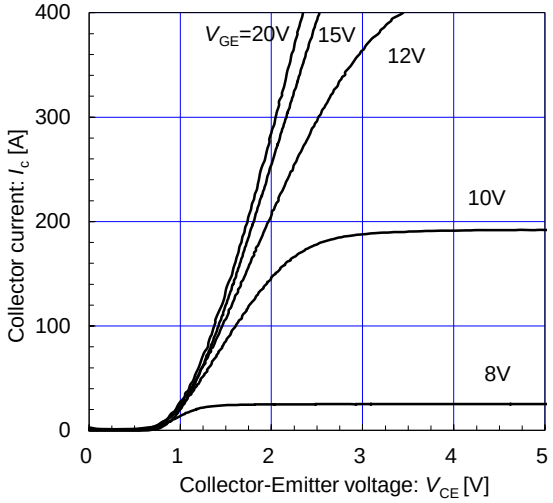
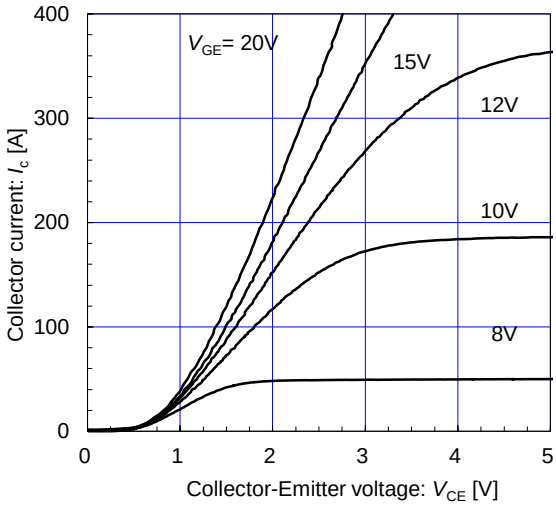
**SiC Hybrid Modules**

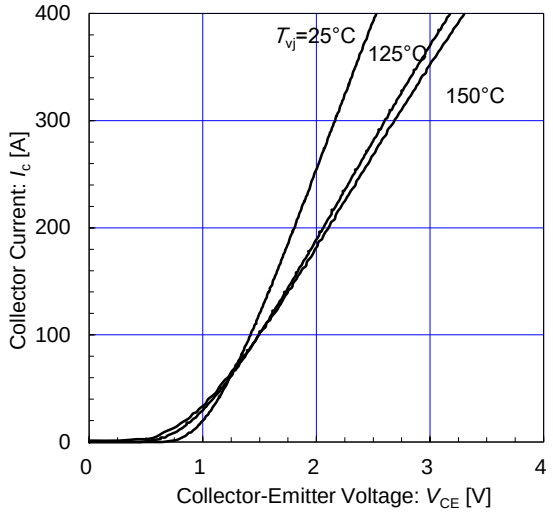
Collector current vs. Collector-Emitter voltage
$T_{vj}$ = 25°C / chip



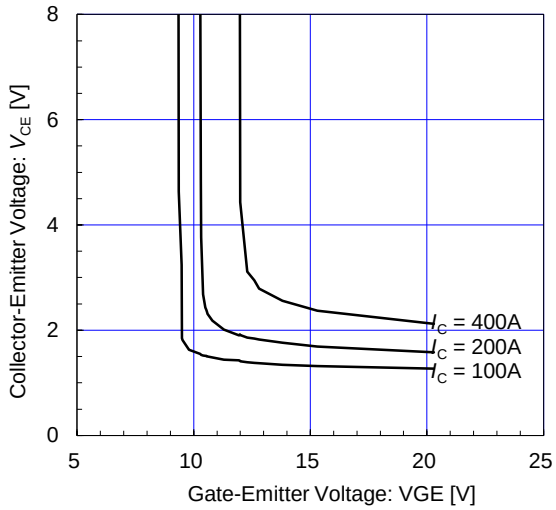

Collector current vs. Collector-Emitter voltage (typ.)
$T_{vj}$ = 150°C / chip



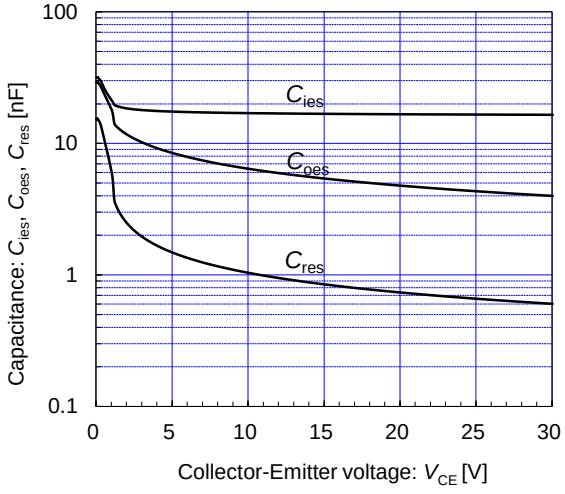

Collector current vs. Collector-Emitter voltage
$V_{GE}$ = 15V / chip



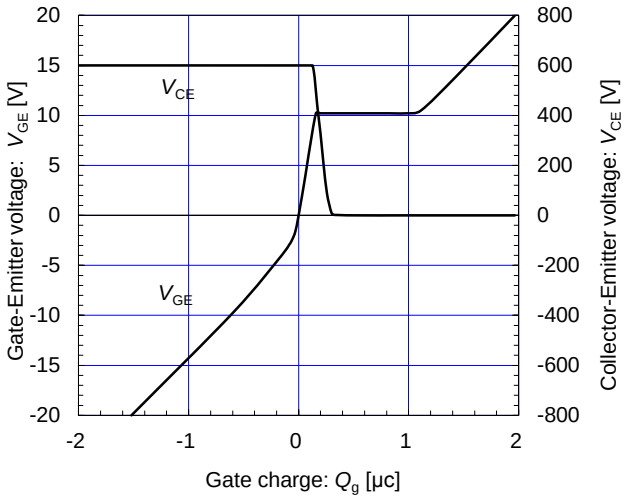

Collector-Emitter voltage vs. Gate-Emitter voltage
$T_{vj}$= 25°C / chip




Gate Capacitance vs. Collector-Emitter Voltage
$V_{GE}$ = 0 V, $f$ = 100kHz, $T_{vj}$ = 25°C




Dynamic Gate Charge (typ.)
$V_{CC}$ = 600 V, $I_C$ = 200 A, $T_{vj}$ = 25°C



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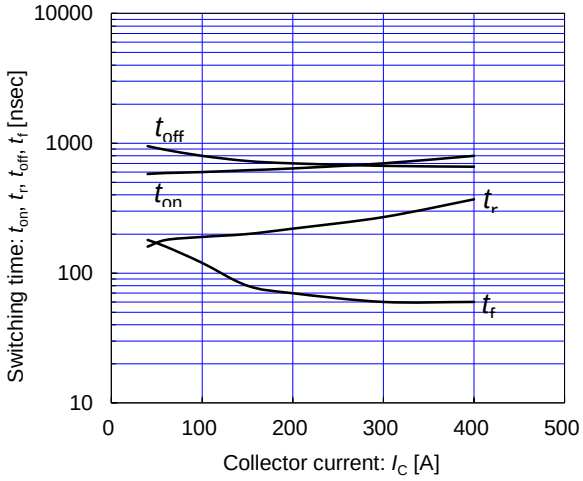
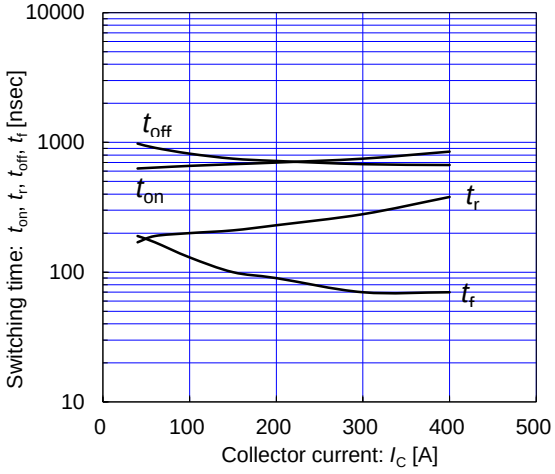
**SiC Hybrid Modules**

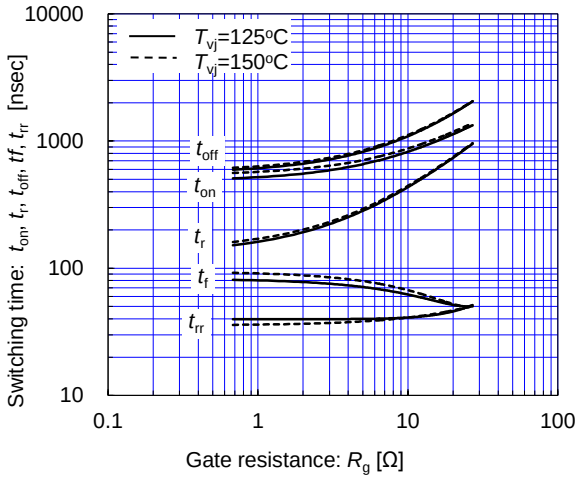
Switching time vs. Collector current (typ.)
$V_{CC}$ = 600 V, $V_{GE}$ = ±15 V, $R_G$ = 2.7 Ω, $T_{vj}$ = 125°C



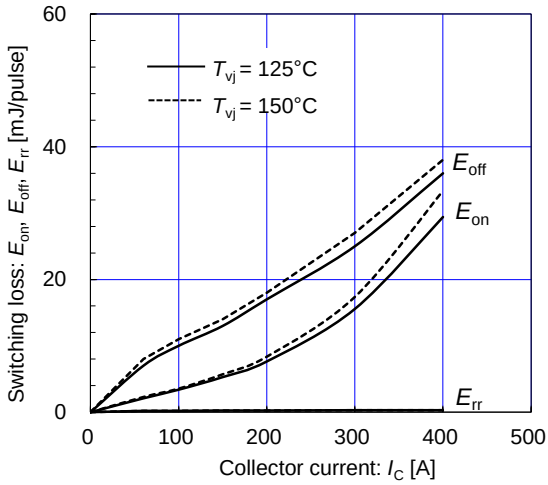

Switching time vs. Collector current (typ.)
$V_{CC}$ = 600 V, $V_{GE}$ = ±15 V, $R_G$ = 2.7 Ω, $T_{vj}$ = 150°C



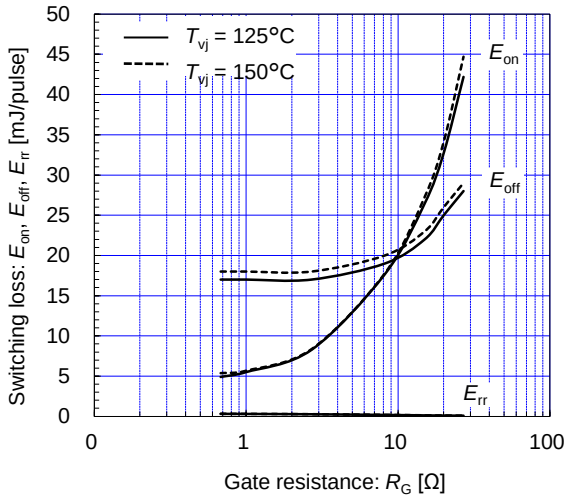

Switching time vs. Gate resistance (typ.)
$V_{CC}$ = 600 V, $I_C$ = 200 A, $V_{GE}$ = ±15 V, $T_{vj}$ = 125, 150°C



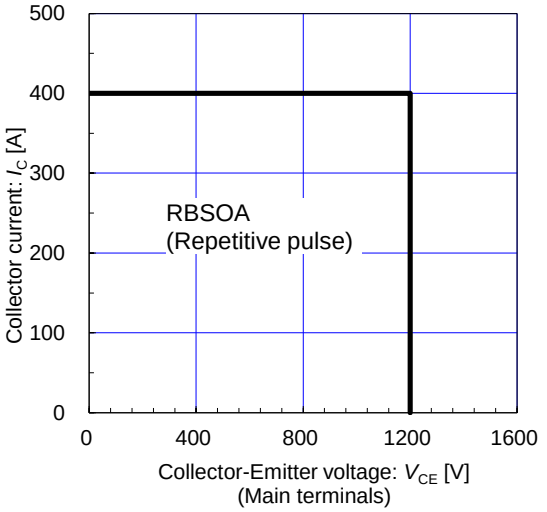

Switching loss vs. Collector current (typ.)
$V_{CC}$ = 600 V, $V_{GE}$ = ±15 V, $R_G$ = 2.7 Ω, $T_{vj}$=125, 150°C




Switching loss vs. Gate resistance (typ.)
$V_{CC}$ = 600 V, $I_C$ = 200 A, $V_{GE}$ = ±15 V, $T_{vj}$ = 125,150°C




Reverse bias safe operating area (max.)
$V_{GE}$ = ±15 V, $R_G$ = 2.7 Ω, $T_{vj}$ = 150°C



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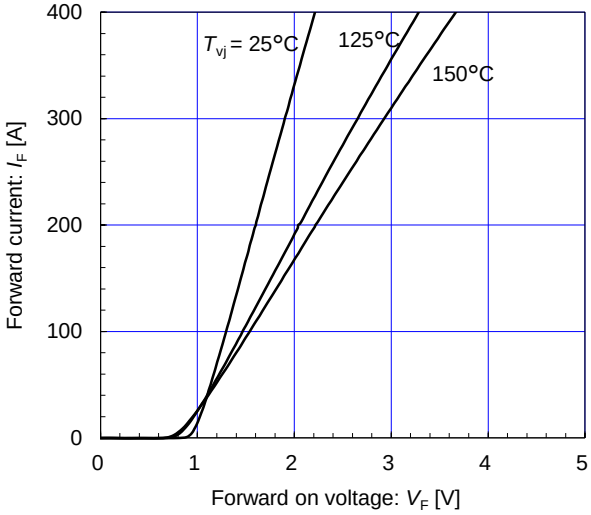
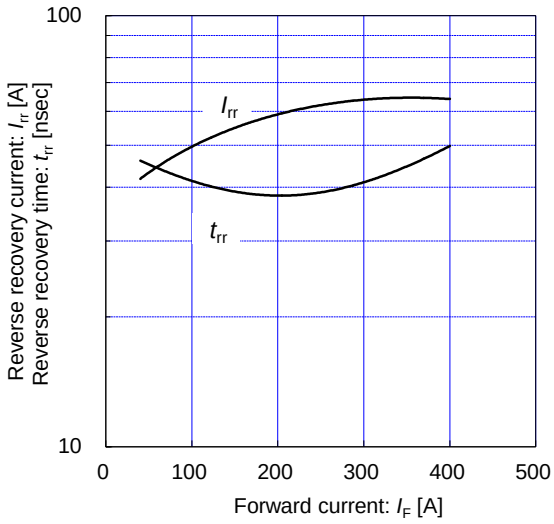
**SiC Hybrid Modules**

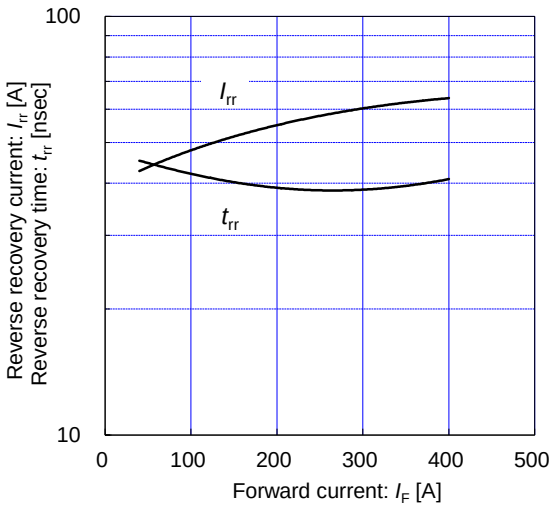
Forward Current vs. Forward Voltage (typ.)
chip



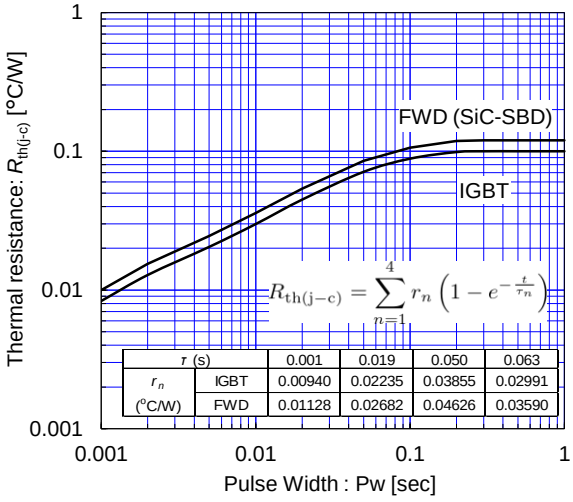

Reverse Recovery Characteristics (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = ±15V, $R_G$ = 2.7Ω, $T_{vj}$ = 125°C




Reverse Recovery Characteristics (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = ±15V, $R_g$ = 2.7Ω, $T_{vj}$ = 150°C




Transient Thermal Resistance (max.)




| $\tau$ (s) | | 0.001 | 0.019 | 0.050 | 0.063 |
|---|---|---|---|---|---|
| $r_n$ (°C/W) | IGBT | 0.00940 | 0.02235 | 0.03855 | 0.02991 |
| | FWD | 0.01128 | 0.02682 | 0.04626 | 0.03590 |

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