

## Filed Stop & Trench Type 1200V IGBT Module

### Description

The IGBT Module devices are optimized to reduce losses and switching noise in high frequency power conditioning electrical systems.

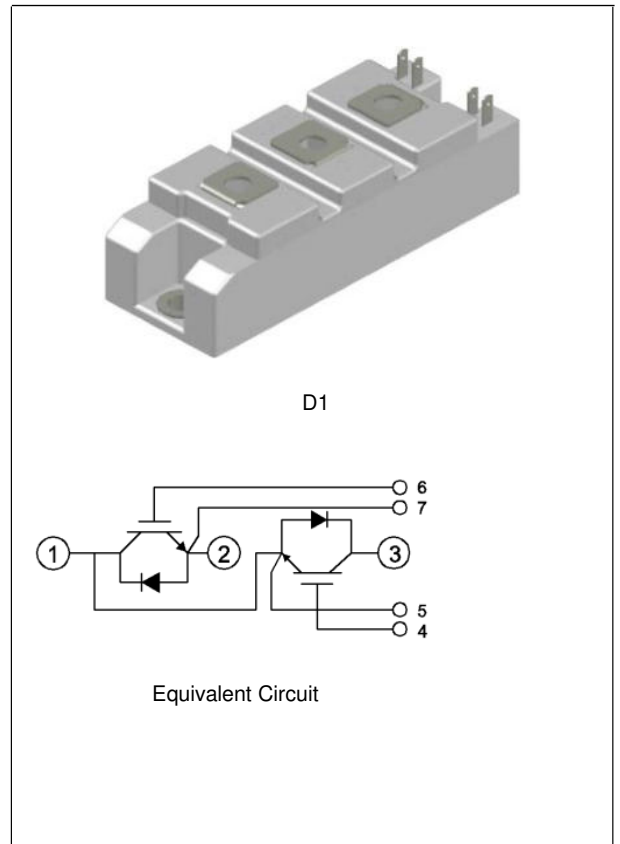
These IGBT Module series are ideally suited for High Power Converters, Motor Drivers, Induction Heating, UPS, Welding Machine where switching losses are significant portion of the total losses.

### Features

- Low Conduction Loss:  $V_{CE(sat)} = 2.1V @ I_C=75A$
- $V_{CE(sat)}$  with positive temperature coefficient
- Fast & Soft Anti-Parallel FWD
- Maximum junction temperature 175°C
- Short Circuit rated: 10us at  $T_C=100^\circ C$
- Isolated Type Package

### Applications

- High Power Converters
- Motor Drivers
- Induction Heating
- UPS (Uninterruptible Power Supplies)
- Welding Machine



## IGBT Characteristics

### Absolute Maximum Ratings

| Symbol    | Parameter                         | Conditions                               | Value    | Unit |
|-----------|-----------------------------------|------------------------------------------|----------|------|
| $V_{CES}$ | Collector to Emitter Voltage      | $T_{vj}=25^\circ C$                      | 1200     | V    |
| $V_{GES}$ | Gate-Emitter Voltage              |                                          | $\pm 20$ | V    |
| $I_C$     | Continuous Collector Current      | $T_C=25^\circ C, T_{vjmax}=175^\circ C$  | 100      | A    |
|           |                                   | $T_C=100^\circ C, T_{vjmax}=175^\circ C$ | 75       |      |
| $I_{CRM}$ | Repetitive Peak Collector Current | $t_b=1ms$                                | 150      | A    |
| $P_D$     | Total Power Dissipation           | $T_C=25^\circ C, T_{vjmax}=150^\circ C$  | 625      | W    |

## Characteristic Values

| Symbol        | Parameter                               | Conditions                                                                                        | Value |      |      | Unit          |
|---------------|-----------------------------------------|---------------------------------------------------------------------------------------------------|-------|------|------|---------------|
|               |                                         |                                                                                                   | Min.  | Typ. | Max. |               |
| $V_{GE(th)}$  | Gate-Emitter Threshold Voltage          | $V_{GE}=V_{CE}$ , $I_C=2mA$ , $T_{vj}=25^{\circ}C$                                                | 5.0   | -    | 6.5  | V             |
| $I_{CES}$     | Collector-Emitter Cut-off Current       | $V_{CE}=1200V$ , $V_{GE}=0V$ , $T_{vj}=25^{\circ}C$                                               | -     | -    | 0.5  | mA            |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage    | $I_C=75A$ , $V_{GE}=15V$ , $T_{vj}=25^{\circ}C$                                                   | -     | 2.1  | 2.8  | V             |
|               |                                         | $I_C=75A$ , $V_{GE}=15V$ , $T_{vj}=125^{\circ}C$                                                  | -     | 2.5  | -    |               |
|               |                                         | $I_C=75A$ , $V_{GE}=15V$ , $T_{vj}=150^{\circ}C$                                                  | -     | 2.6  | -    |               |
| $Q_G$         | Gate Charge                             | $V_{GE} = -15V \dots +15V$                                                                        | -     | 0.65 | -    | uC            |
| $C_{ies}$     | Input Capacitance                       | $V_{CE}=25V$ , $V_{GE}=0V$ ,<br>$f=1MHz$ , $T_{vj}=25^{\circ}C$                                   | -     | 5.20 | -    | nF            |
| $C_{res}$     | Reverse Transfer Capacitance            |                                                                                                   | -     | 0.21 | -    | nF            |
| $R_{gint}$    | Internal Gate Resistance                | $T_{vj}=25^{\circ}C$                                                                              | -     | 7.5  | -    | $\Omega$      |
| $I_{GES}$     | Gate-Emitter leakage current            | $V_{CE}=0V$ , $V_{GE}=20V$ , $T_{vj}=25^{\circ}C$                                                 | -120  | -    | 120  | nA            |
| $t_{d(on)}$   | Turn-on Delay Time                      | $I_C = 75A$<br>$V_{CE} = 600V$<br>$V_{GE} = \pm 15V$<br>$R_G = 10\Omega$<br>$T_{vj}=25^{\circ}C$  | -     | 185  | -    | ns            |
| $t_r$         | Rise Time                               |                                                                                                   | -     | 120  | -    | ns            |
| $t_{d(off)}$  | Turn-off Delay Time                     |                                                                                                   | -     | 410  | -    | ns            |
| $t_f$         | Fall Time                               |                                                                                                   | -     | 130  | -    | ns            |
| $E_{on}$      | Energy Dissipation During Turn-on Time  |                                                                                                   | -     | 12.3 | -    | mJ            |
| $E_{off}$     | Energy Dissipation During Turn-off Time |                                                                                                   | -     | 4.7  | -    | mJ            |
| $t_{d(on)}$   | Turn-on Delay Time                      | $I_C = 75A$<br>$V_{CE} = 600V$<br>$V_{GE} = \pm 15V$<br>$R_G = 10\Omega$<br>$T_{vj}=125^{\circ}C$ | -     | 220  | -    | ns            |
| $t_r$         | Rise Time                               |                                                                                                   | -     | 125  | -    | ns            |
| $t_{d(off)}$  | Turn-off Delay Time                     |                                                                                                   | -     | 440  | -    | ns            |
| $t_f$         | Fall Time                               |                                                                                                   | -     | 240  | -    | ns            |
| $E_{on}$      | Energy Dissipation During Turn-on Time  |                                                                                                   | -     | 15.5 | -    | mJ            |
| $E_{off}$     | Energy Dissipation During Turn-off Time |                                                                                                   | -     | 6.9  | -    | mJ            |
| $t_{sc}$      | Short Circuit Withstand Time            | $V_{CC}=600V$ , $V_{GE}=\pm 15V$<br>$R_G=10\Omega$ @ $T_C=100^{\circ}C$                           | 10    | -    | -    | us            |
| $R_{thJC}$    | Thermal Resistance Junction to Case     | per IGBT                                                                                          | -     | -    | 0.24 | $^{\circ}C/W$ |

## Diode Characteristics

### Absolute Maximum Ratings

| Symbol    | Parameter                       | Conditions                  | Value | Unit |
|-----------|---------------------------------|-----------------------------|-------|------|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage | $T_{vj}=25^{\circ}\text{C}$ | 1200  | V    |
| $I_F$     | Continuous DC Forward Current   |                             | 75    | A    |
| $I_{FRM}$ | Repetitive Peak Forward Current | $t_p=1\text{ms}$            | 150   | A    |

### Characteristic Values

| Symbol     | Parameter                           | Conditions                                                                                         | Value |      |      | Unit                 |
|------------|-------------------------------------|----------------------------------------------------------------------------------------------------|-------|------|------|----------------------|
|            |                                     |                                                                                                    | Min.  | Typ. | Max. |                      |
| $V_F$      | Forward Voltage                     | $I_F=75\text{A}, T_{vj}=25^{\circ}\text{C}$                                                        | -     | 1.90 | 2.5  | V                    |
|            |                                     | $I_F=75\text{A}, T_{vj}=125^{\circ}\text{C}$                                                       | -     | 1.65 | -    |                      |
|            |                                     | $I_F=75\text{A}, T_{vj}=150^{\circ}\text{C}$                                                       | -     | 1.60 | -    |                      |
| $Q_{rr}$   | Recovered Charge                    | $I_F=75\text{A}$<br>$V_R=600\text{V}$<br>$di_F/dt=-200\text{A/us}$<br>$T_{vj}=25^{\circ}\text{C}$  | -     | 1.4  | -    | $\mu\text{C}$        |
| $I_{rr}$   | Peak Reverse Recovery Current       |                                                                                                    | -     | 16   | -    | A                    |
| $E_{rec}$  | Reverse Recovery Energy             |                                                                                                    | -     | 3.0  | -    | mJ                   |
| $Q_{rr}$   | Recovered Charge                    | $I_F=75\text{A}$<br>$V_R=600\text{V}$<br>$di_F/dt=-200\text{A/us}$<br>$T_{vj}=125^{\circ}\text{C}$ | -     | 10   | -    | $\mu\text{C}$        |
| $I_{rr}$   | Peak Reverse Recovery Current       |                                                                                                    | -     | 28   | -    | A                    |
| $E_{rec}$  | Reverse Recovery Energy             |                                                                                                    | -     | 5.5  | -    | mJ                   |
| $R_{thJC}$ | Thermal Resistance Junction to Case | per Diode                                                                                          | -     | -    | 0.45 | $^{\circ}\text{C/W}$ |

## Module Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise specified

| Symbol               | Parameter                                | Conditions                            | Value |      |      | Unit                        |
|----------------------|------------------------------------------|---------------------------------------|-------|------|------|-----------------------------|
|                      |                                          |                                       | Min.  | Typ. | Max. |                             |
| $V_{\text{isol}}$    | Isolation voltage                        | $t=1\text{min}, f=50\text{Hz}$        | 2500  | -    | -    | V                           |
| $T_{\text{vj op}}$   | Operating Junction Temperature           |                                       | -55   | -    | 175  | $^{\circ}\text{C}$          |
| $T_{\text{stg}}$     | Storage Temperature                      |                                       | -40   | -    | 150  | $^{\circ}\text{C}$          |
| $L_{\text{CE}}$      | Stray Inductance                         |                                       | -     | 42   | -    | nH                          |
| $R_{\text{cc'+EE'}}$ | Module Lead Resistance, Terminal to Chip | $T_C=25^{\circ}\text{C}$ , per switch | -     | 1.1  | -    | m $\Omega$                  |
| $R_{\text{thCS}}$    | Thermal Resistance Case to Sink          | per Package                           | -     | 0.05 | -    | $^{\circ}\text{C}/\text{W}$ |
| $M_s$                | Module-to-Sink Torque (M5)               |                                       | 3.0   | -    | 6.0  | N·m                         |
| G                    | Weight of Module                         |                                       | -     | 155  | -    | g                           |

## Typical Performance Characteristics

Fig. 1. Typical Output Characteristics

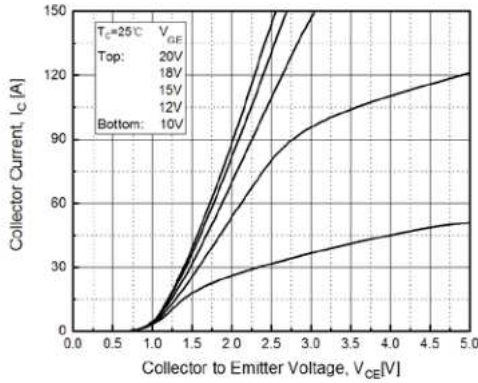


Fig. 2. Typical Output Characteristics

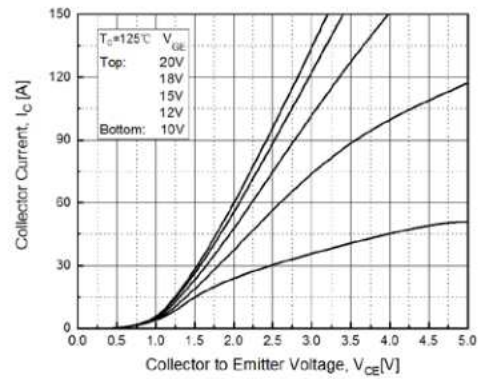


Fig. 3. Typical Saturation Voltage Characteristics

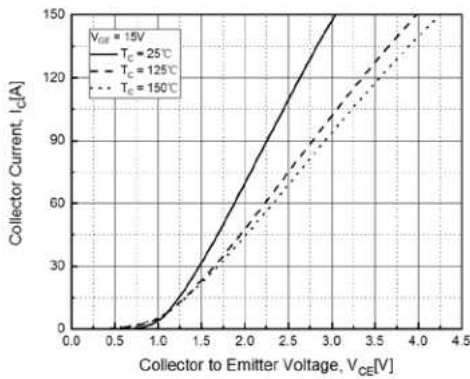


Fig. 4. Typical Transfer Characteristics

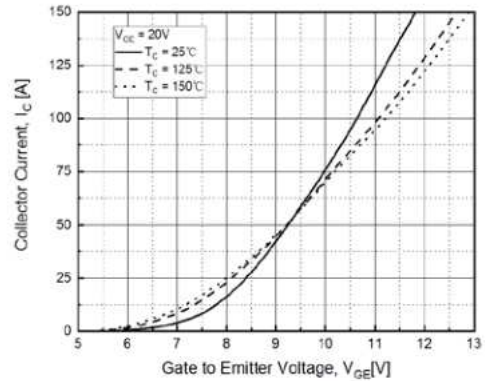


Fig. 5. Turn-on losses vs.  $R_G$

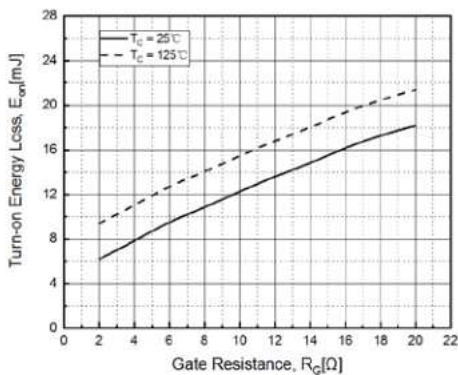
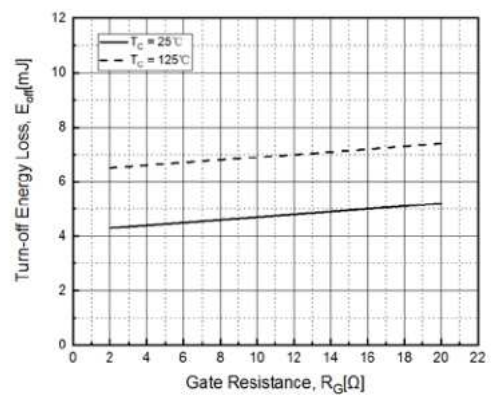


Fig. 6. Turn-off losses vs.  $R_G$



# Typical Performance Characteristics

Fig. 7. Reverse Bias Safe Operating Area

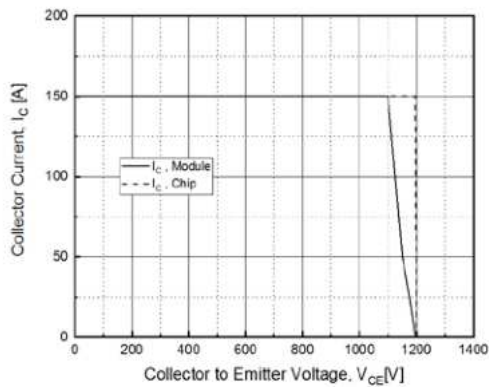


Fig. 8. Forward Characteristics of Diode

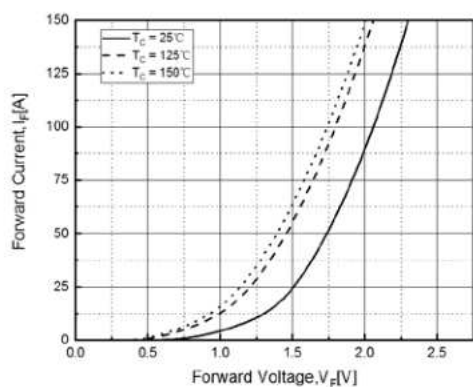


Fig. 9. Reverse Recovery Loss Characteristics vs.  $R_G$

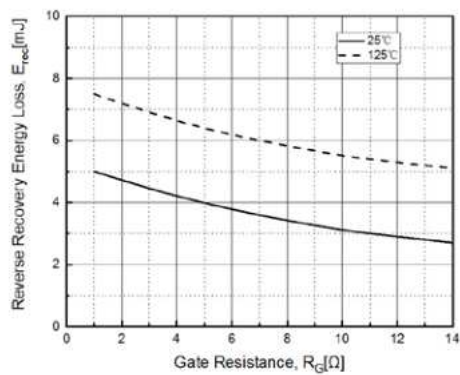
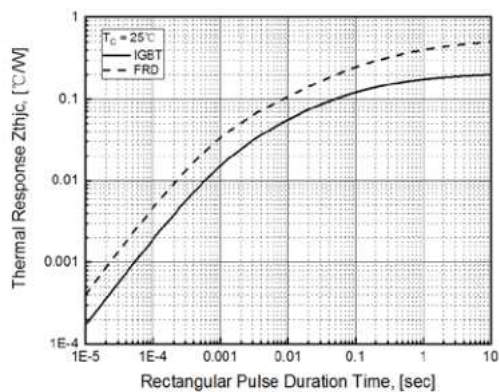
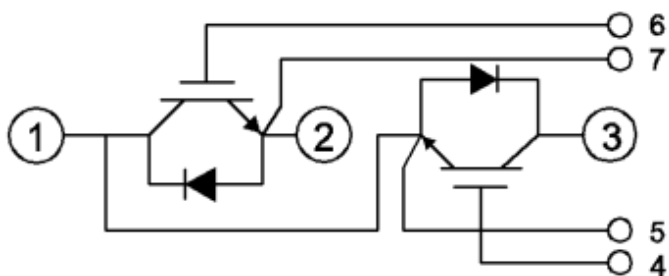


Fig. 10. Transient Thermal Impedance



## Circuit Diagram



## Package Dimensions

