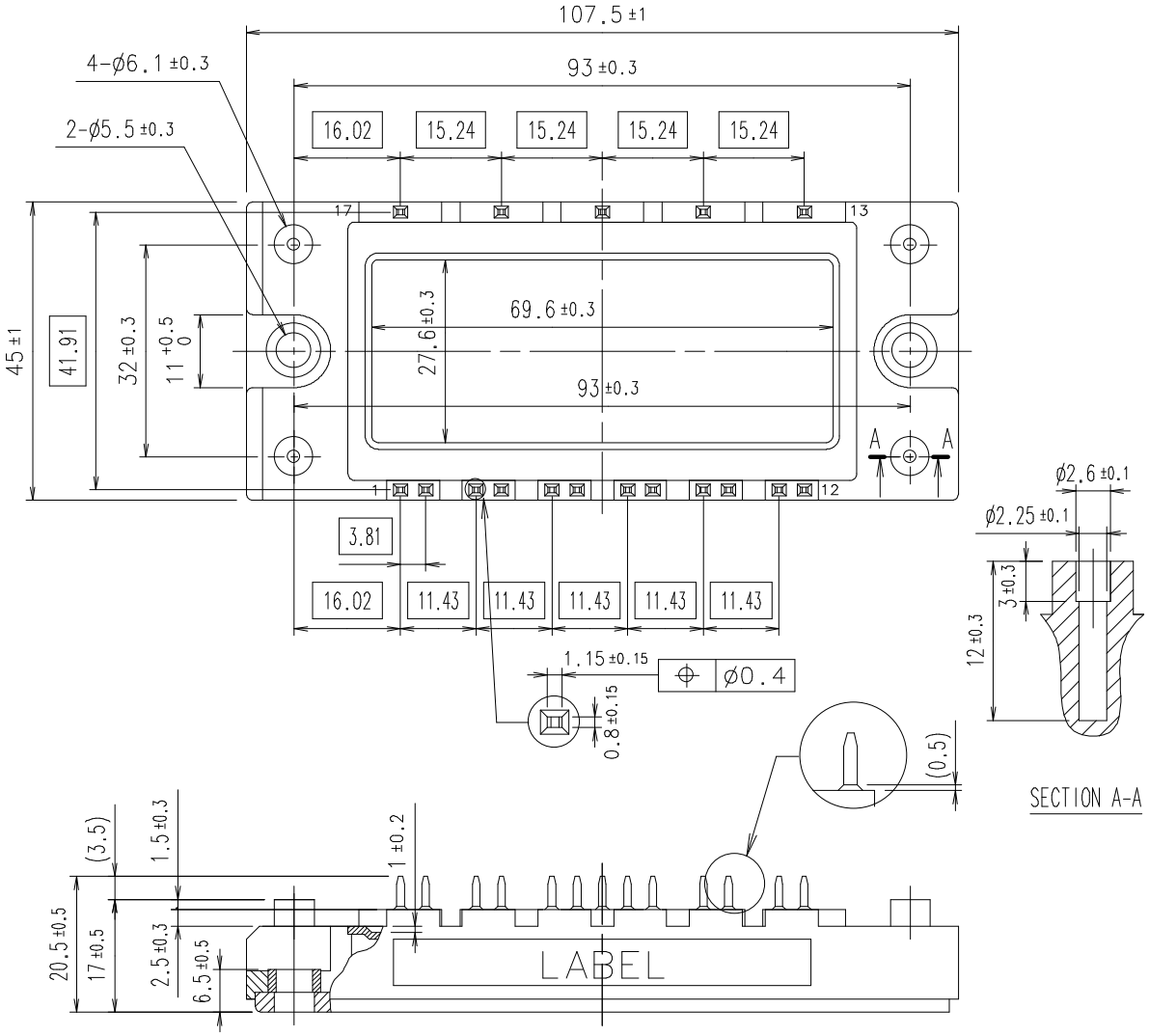
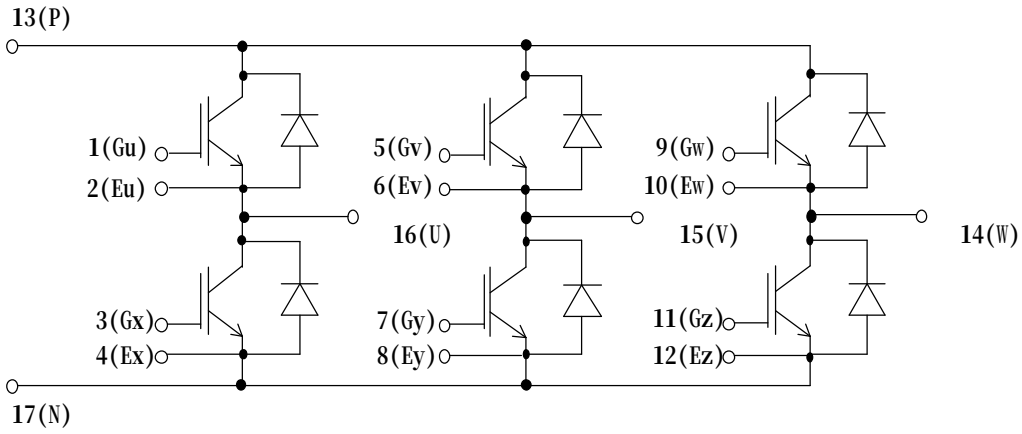
1. Outline Drawing ( Unit : mm )




shows theoretical dimension.
( ) shows reference dimension.

2. Equivalent circuit



3. Absolute Maximum Ratings ( at Tc= 25℃ unless otherwise specified )

| Items | Symbols | Conditions | | Maximum Ratings | Units |
|---|---|---|---|---|---|
| Collector-Emitter voltage | VCES | | | 1200 | V |
| Gate-Emitter voltage | VGES | | | ±20 | V |
| Collector current | Ic | Continuous | Tc=25℃ | 25 | A |
| | | | Tc=80℃ | 15 | |
| | Ic pulse | 1ms | Tc=25℃ | 50 | |
| | | | Tc=80℃ | 30 | |
| | -Ic | | | 15 | |
| | -Ic pulse | 1ms | | 30 | |
| Collector Power Dissipation | Pc | 1 device | | 110 | W |
| Junction temperature | Tj | | | 150 | ℃ |
| Storage temperature | Tstg | | | -40～ +125 | ℃ |
| Isolation voltage(*1) | Viso | AC : 1min. | | 2500 | V |
| Mounting Screw Torque (*2) | | | | 3.5 | N • m |

(*1) All terminals should be connected together when isolation test will be done.

(*2) Recommendable Value : 2.5～3.5 N • m (M5)

4. Electrical characteristics ( at Tj= 25℃ unless otherwise specified)

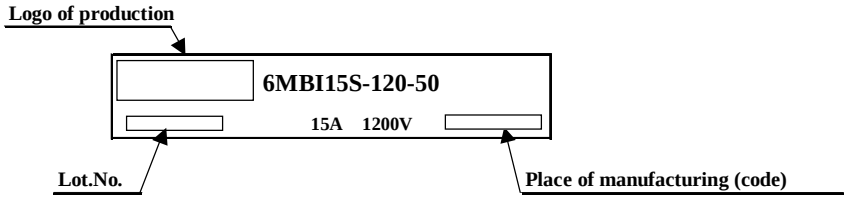
| Items | Symbols | Conditions | | Characteristics min. | typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Zero gate voltage Collector current | ICES | VGE = 0 V, VCE = 1200 V | | - | - | 1.0 | mA |
| Gate-Emitter leakage current | IGES | VCE = 0 V, VGE = ±20 V | | - | - | 200 | nA |
| Gate-Emitter threshold voltage | VGE(th) | VCE = 20 V, Ic = 15 mA | | 5.5 | 7.2 | 8.5 | V |
| Collector-Emitter saturation voltage | VCE(sat) | VGE = 15 V, Ic = 15 A | Tj = 25 ℃ | - | 2.3 | 2.6 | V |
| | | | Tj = 125 ℃ | - | 2.8 | - | |
| Input capacitance | Cies | VGE = 0 V | | - | 1800 | - | pF |
| Output capacitance | Coes | VCE = 10 V | | - | 375 | - | |
| Reverse transfer capacitance | Cres | f = 1 MHz | | - | 330 | - | |
| Turn-on time | ton | Vcc = 600 V | | - | 0.35 | 1.2 | μs |
| | tr | Ic = 15 A | | - | 0.25 | 0.6 | |
| | $tr_{(i)}$ | VGE = ±15 V | | - | 0.1 | - | |
| Turn-off time | toff | RG = 82 Ω | | - | 0.45 | 1.0 | |
| | tf | | | - | 0.08 | 0.3 | |
| Forward on voltage | VF | IF = 15 A | Tj = 25 ℃ | - | 2.5 | 3.3 | V |
| | | | Tj = 125 ℃ | - | 2.0 | - | |
| Reverse recovery time | trr | IF = 15 A | | - | - | 0.35 | μs |

5. Thermal resistance characteristics

| Items | Symbols | Conditions | Characteristics min. | typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Thermal resistance (1 device) | Rth(j-c) | IGBT | - | - | 1.14 | ℃/W |
| | | FWD | - | - | 1.85 | |
| Contact Thermal resistance | Rth(c-f) | with Thermal Compound (※) | - | 0.05 | - | |

※ This is the value which is defined mounting on the additional cooling fin with thermal compound.

6. Indication on module（モジュール表示）



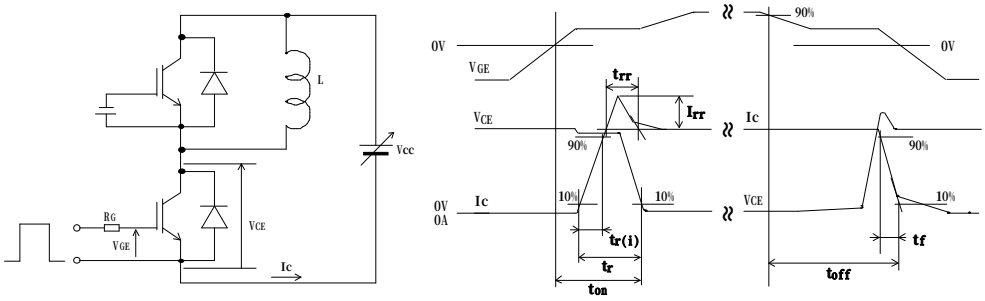

7. Applicable category

This specification is applied to IGBT Module named 6MBI15S-120-50.

8. Storage and transportation notes

- The module should be stored at a standard temperature of 5 to 35℃ and humidity of 45 to 75% .
  Be careful to solderability of the terminals if the module has passed over one year from manufacturing date, under the above storage condition.
- Store modules in a place with few temperature changes in order to avoid condensation on the module surface.
- Avoid exposure to corrosive gases and dust.
- Avoid excessive external force on the module.
- Store modules with unprocessed terminals.
- Do not drop or otherwise shock the modules when tranporting.

9. Definitions of switching time

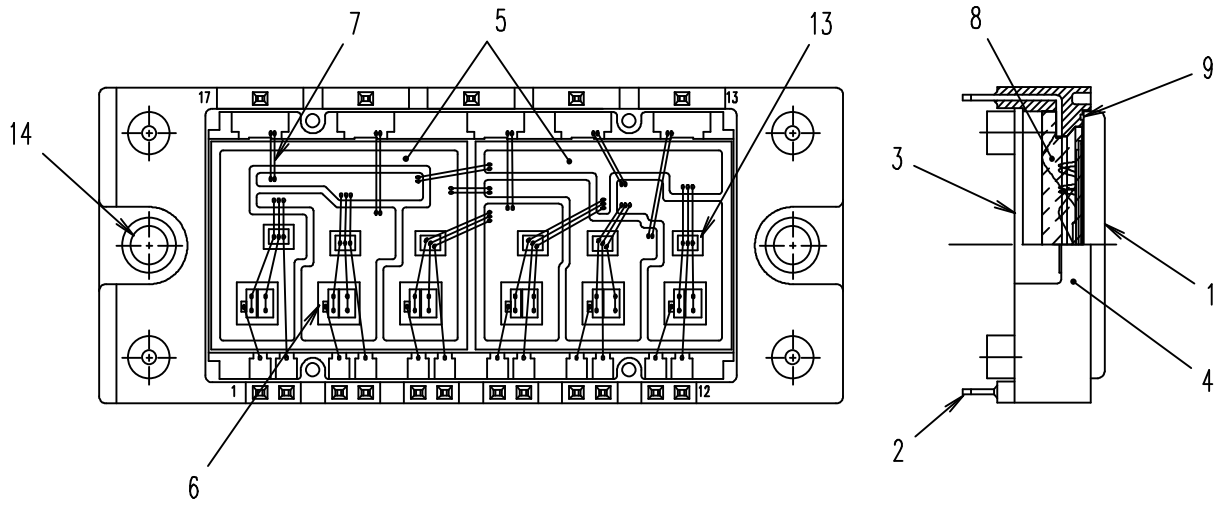



10. Packing and Labeling

Display on the packing box

- Logo of production
- Type name
- Lot No
- Products quantity in a packing box

11. List of material（材料リスト）




(Total weight of soldering material(typ): 4.8 g)

| No. | Parts | Material (main) | Ref. |
|---|---|---|---|
| 1 | Base Plate | Cu | Ni plating |
| 2 | Terminal | Cu | Ni plating (Internal) |
| | | | Lead free solder plating (External) |
| 3 | Cover | PPS resin | UL 94V-0 |
| 4 | Case | PPS resin | UL 94V-0 |
| 5 | Isolation substrate | $Al_2O_3$ + Cu | |
| 6 | IGBT chip | Silicon | |
| 7 | Wiring | Aluminum | |
| 8 | Silicone Gel | Silicone resin | |
| 9 | Adhesive | Silicone resin | |
| 10 | Solder (Under chip) | Sn/Ag base | (Not drawn in above) |
| 11 | Solder (Under Isolation substrate ) | Sn/Ag base | (Not drawn in above) |
| 12 | Label | Paper | (Not drawn in above) |
| 13 | FWD chip | Silicon | |
| 14 | Ring | Fe | Trivalent Chromate treatment |

12.RoHS Directive Compliance (RoHS指令適用について)

**本IGBTモジュールは富士電機デバイステクノロジーが発行しているRoHSに関する資料MS5F6209を適用する。日本語版(MS5F6212)は参考資料とする。**

**The document (MS5F6209) about RoHS that Fuji Electric Device Technology issued is applied to this IGBT Module. The Japanese Edition(MS5F6212) is made into a reference grade.**

13. Reliability test results

## Reliability Test Items

| Test categories | | Test items | Test methods and conditions | Reference norms EIAJ ED-4701 (Aug.-2001 edition) | Number of sample | Acceptance number |
|---|---|---|---|---|---|---|
| Mechanical Tests | 1 | Terminal Strength (Pull test) | Pull force : 20N<br>Test time : 10±1 sec. | Test Method 401 Method Ⅰ | 5 | ( 0 : 1 ) |
| | 2 | Mounting Strength | Screw torque : 2.5 ~ 3.5 N･m (M5)<br>Test time : 10±1 sec. | Test Method 402 method Ⅱ | 5 | ( 0 : 1 ) |
| | 3 | Vibration | Range of frequency : 10 ~ 500Hz<br>Sweeping time : 15 min.<br>Acceleration : 100m/s$^2$<br>Sweeping direction : Each X,Y,Z axis<br>Test time : 6 hr. (2hr./direction) | Test Method 403 Reference 1 Condition code B | 5 | ( 0 : 1 ) |
| | 4 | Shock | Maximum acceleration : 5000m/s$^2$<br>Pulse width : 1.0msec.<br>Direction : Each X,Y,Z axis<br>Test time : 3 times/direction | Test Method 404 Condition code B | 5 | ( 0 : 1 ) |
| | 5 | Solderabitlity | Solder temp. : 245±5 ℃<br>Immersion time : 5±0.5sec.<br>Test time : 1 time<br>Solder Alloy : Sn-Ag-Cu<br>Each terminal should be Immersed in solder within 1~1.5mm from the body. | Test Method 303 | 5 | ( 0 : 1 ) |
| | 6 | Resistance to Soldering Heat | Solder temp. : 260±5 ℃<br>Immersion time : 10±1sec.<br>Test time : 1 time<br>Each terminal should be Immersed in solder within 1~1.5mm from the body. | Test Method 302 Condition code A | 5 | ( 0 : 1 ) |
| Environment Tests | 1 | High Temperature Storage | Storage temp. : 125±5 ℃<br>Test duration : 1000hr. | Test Method 201 | 5 | ( 0 : 1 ) |
| | 2 | Low Temperature Storage | Storage temp. : -40±5 ℃<br>Test duration : 1000hr. | Test Method 202 | 5 | ( 0 : 1 ) |
| | 3 | Temperature Humidity Storage | Storage temp. : 85±2 ℃<br>Relative humidity : 85±5%<br>Test duration : 1000hr. | Test Method 103 Test code C | 5 | ( 0 : 1 ) |
| | 4 | Unsaturated Pressurized Vapor | Test temp. : 120±2 ℃<br>Test humidity : 85±5%<br>Test duration : 96hr. | Test Method 103 Test code E | 5 | ( 0 : 1 ) |
| | 5 | Temperature Cycle | Test temp. : Low temp. -40±5 ℃<br>High temp. 125 ±5 ℃<br>RT 5 ~ 35 ℃<br>Dwell time : High ~ RT ~ Low ~ RT<br>1hr. 0.5hr. 1hr. 0.5hr.<br>Number of cycles : 100 cycles | Test Method 105 | 5 | ( 0 : 1 ) |
| | 6 | Thermal Shock | Test temp. : High temp. 100 $^{+0}_{-5}$ ℃<br>Low temp. 0 $^{+5}_{-0}$ ℃<br>Used liquid : Water with ice and boiling water<br>Dipping time : 5 min. par each temp.<br>Transfer time : 10 sec.<br>Number of cycles : 10 cycles | Test Method 307 method Ⅰ Condition code A | 5 | ( 0 : 1 ) |

## Reliability Test Items

| Test categories | | Test items | Test methods and conditions | Reference norms EIAJ ED-4701 (Aug.-2001 edition) | Number of sample | Acceptance number |
|---|---|---|---|---|---|---|
| Endurance Tests | 1 | High temperature Reverse Bias (for Collector-Emitter) | Test temp. : Ta = 125±5 ℃ (Tj ≦ 150 ℃)<br>Bias Voltage : VC = 0.8×VCES<br>Bias Method : Applied DC voltage to C-E VGE = 0V<br>Test duration : 1000hr. | Test Method 101 | 5 | ( 0 : 1 ) |
| | 2 | High temperature Bias (for gate) | Test temp. : Ta = 125±5 ℃ (Tj ≦ 150 ℃)<br>Bias Voltage : VC = VGE = +20V or -20V<br>Bias Method : Applied DC voltage to G-E VCE = 0V<br>Test duration : 1000hr. | Test Method 101 | 5 | ( 0 : 1 ) |
| | 3 | Intermitted Operating Life (Power cycle) ( for IGBT ) | ON time : 2 sec.<br>OFF time : 18 sec.<br>Test temp. : Δ Tj=100±5 deg Tj ≦ 150 ℃, Ta=25±5 ℃<br>Number of cycles : 15000 cycles | Test Method 106 | 5 | ( 0 : 1 ) |

## Failure Criteria

| Item | Characteristic | | Symbol | Failure criteria Lower limit | Failure criteria Upper limit | Unit | Note |
|---|---|---|---|---|---|---|---|
| Electrical characteristic | Leakage current | | ICES | - | USL×2 | mA | |
| | | | ±IGES | - | USL×2 | μA | |
| | Gate threshold voltage | | VGE(th) | LSL×0.8 | USL×1.2 | mA | |
| | Saturation voltage | | VCE(sat) | - | USL×1.2 | V | |
| | Forward voltage | | VF | - | USL×1.2 | V | |
| | Thermal resistance | IGBT | Δ VGE or Δ VCE | - | USL×1.2 | mV | |
| | | FWD | Δ VF | - | USL×1.2 | mV | |
| | Isolation voltage | | Viso | Broken insulation | | - | |
| Visual inspection | Visual inspection ┌ Peeling ┤ Plating └ and the others | | - | The visual sample | | - | |

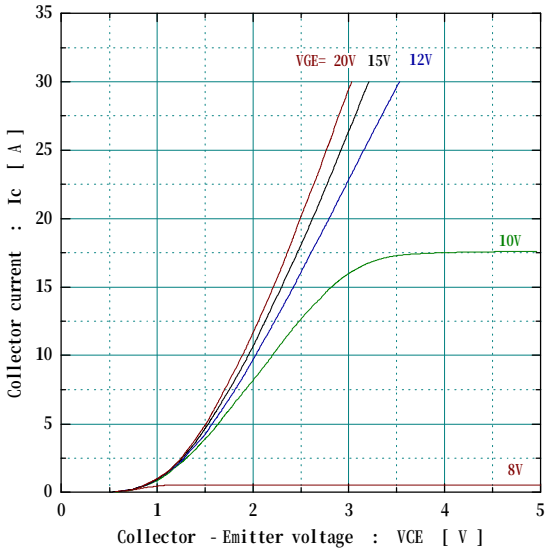
LSL : Lower specified limit.
USL : Upper specified limit.

Note Each parameter measurement read-outs shall be made after stabilizing the components at room ambient for 2 hours minimum, 24 hours maximum after removal from the tests. And in case of the wetting tests, for example, moisture resistance tests, each component shall be made wipe or dry completely before the measurement.

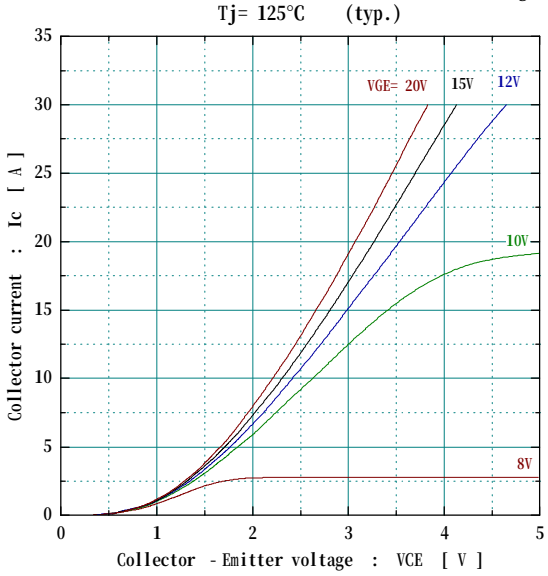
# Reliability Test Results

| Test categories | | Test items | Reference norms EIAJ ED-4701 (Aug.-2001 edition) | Number of test sample | Number of failure sample |
|---|---|---|---|---|---|
| Mechanical Tests | 1 | Terminal Strength (Pull test) | Test Method 401 Method Ⅰ | 5 | 0 |
| | 2 | Mounting Strength | Test Method 402 method Ⅱ | 5 | 0 |
| | 3 | Vibration | Test Method 403 Condition code B | 5 | 0 |
| | 4 | Shock | Test Method 404 Condition code B | 5 | 0 |
| | 5 | Solderability | Test Method 303 | 5 | 0 |
| | 6 | Resistance to Soldering Heat | Test Method 302 Condition code A | 5 | 0 |
| Environment Tests | 1 | High Temperature Storage | Test Method 201 | 5 | 0 |
| | 2 | Low Temperature Storage | Test Method 202 | 5 | 0 |
| | 3 | Temperature Humidity Storage | Test Method 103 Test code C | 5 | 0 |
| | 4 | Unsaturated Pressurized Vapor | Test Method 103 Test code E | 5 | 0 |
| | 5 | Temperature Cycle | Test Method 105 | 5 | 0 |
| | 6 | Thermal Shock | Test Method 307 method Ⅰ Condition code A | 5 | 0 |
| Endurance Tests | 1 | High temperature Reverse Bias ( for Collector-Emitter) | Test Method 101 | 5 | 0 |
| | 2 | High temperature Bias ( for gate ) | Test Method 101 | 5 | 0 |
| | 3 | Intermitted Operating Life (Power cycling) ( for IGBT ) | Test Method 106 | 5 | 0 |

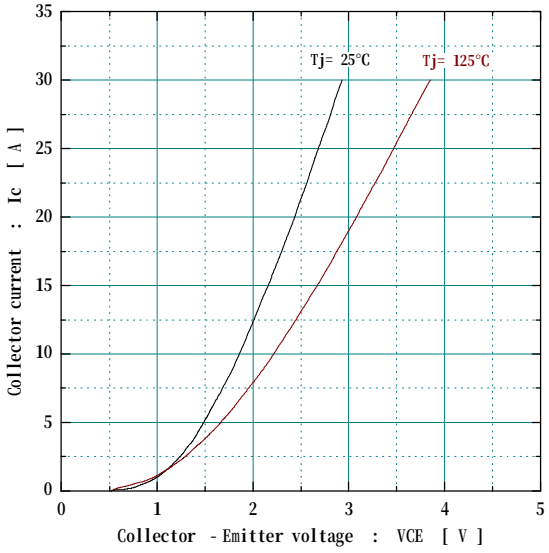
Collector current vs. Collector-Emitter voltage
Tj= 25°C (typ.)



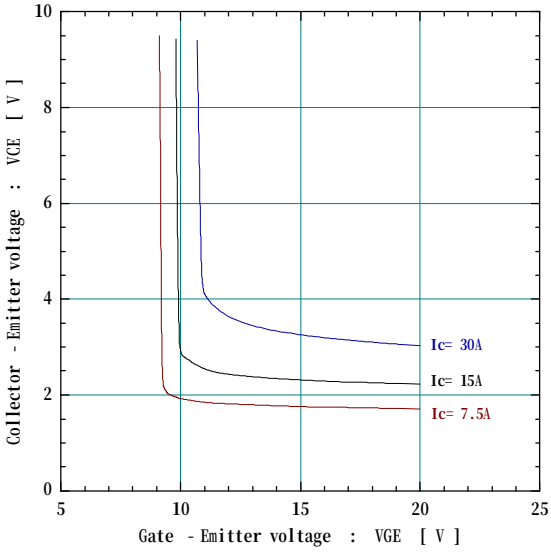

Collector current vs. Collector-Emitter voltage
Tj= 125°C (typ.)



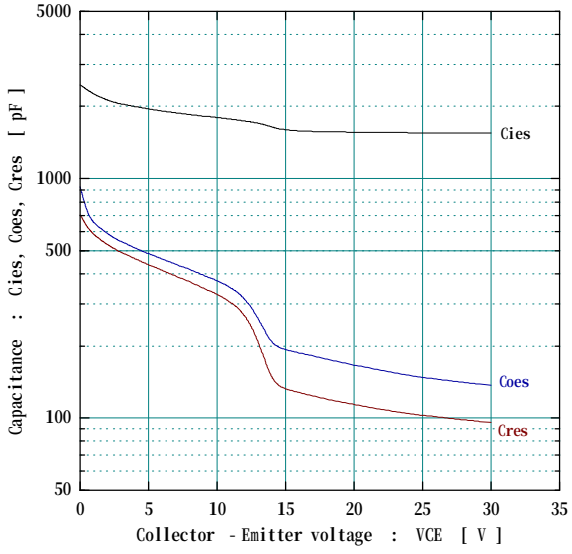

Collector current vs. Collector-Emitter voltage
VGE=15V (typ.)



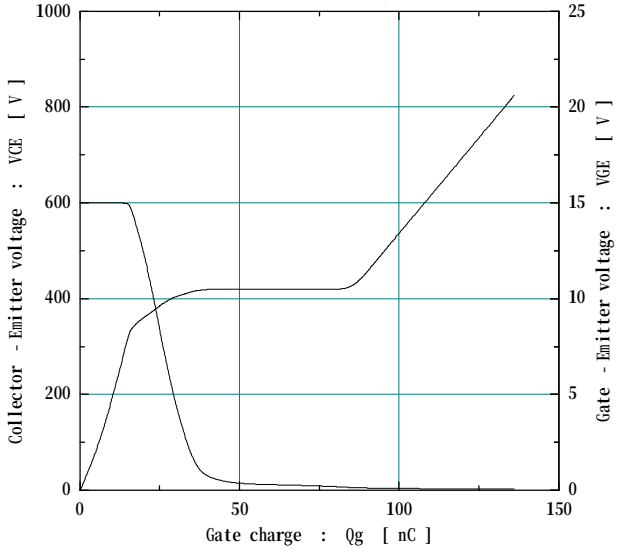

Collector-Emitter voltage vs. Gate-Emitter voltage
Tj= 25°C (typ.)



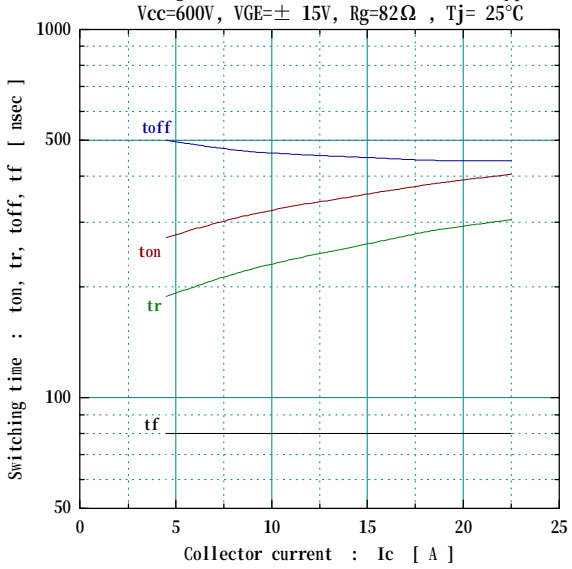

Capacitance vs. Collector-Emitter voltage (typ.)
VGE=0V, f= 1MHz, Tj= 25°C



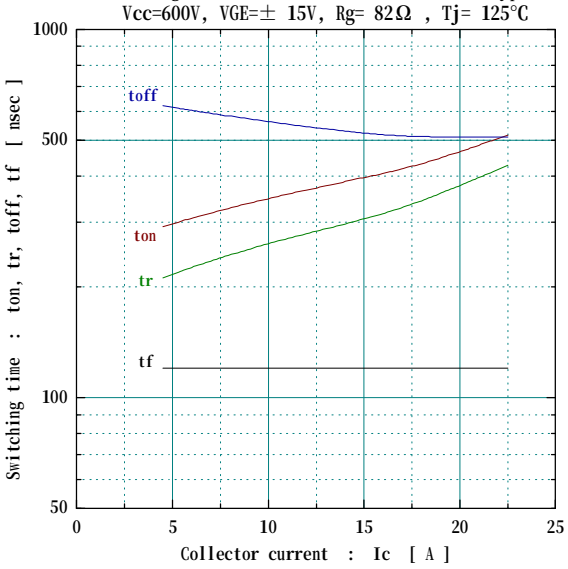

Dynamic Gate charge (typ.)
Vcc=600V, Ic=15A, Tj= 25°C



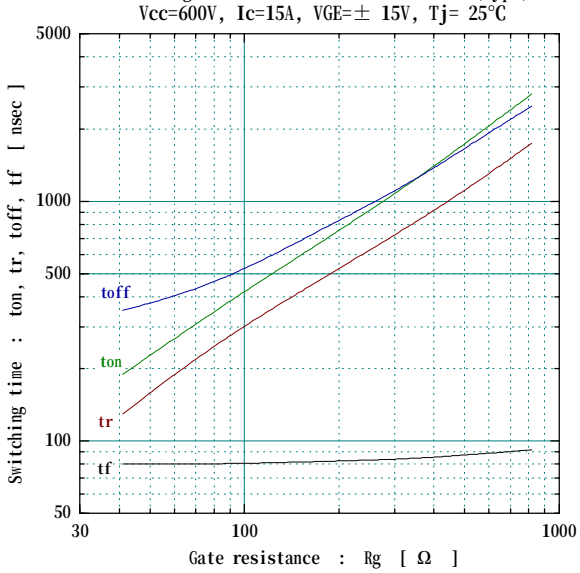
Switching time vs. Collector current (typ.)
Vcc=600V, VGE=± 15V, Rg=82Ω , Tj= 25°C



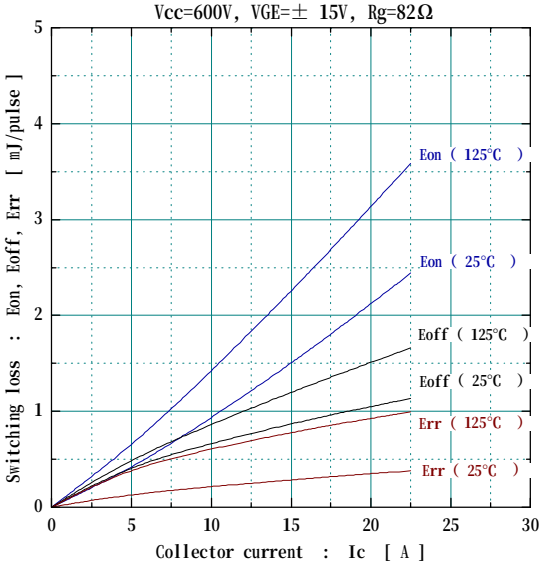

Switching time vs. Collector current (typ.)
Vcc=600V, VGE=± 15V, Rg= 82Ω , Tj= 125°C



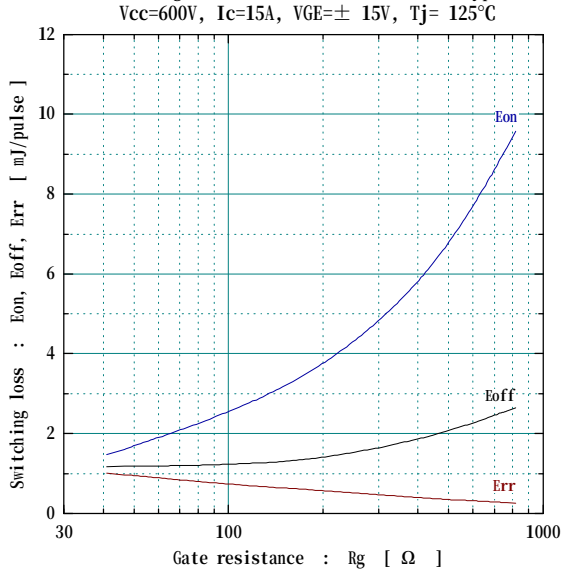

Switching time vs. Gate resistance (typ.)
Vcc=600V, Ic=15A, VGE=± 15V, Tj= 25°C



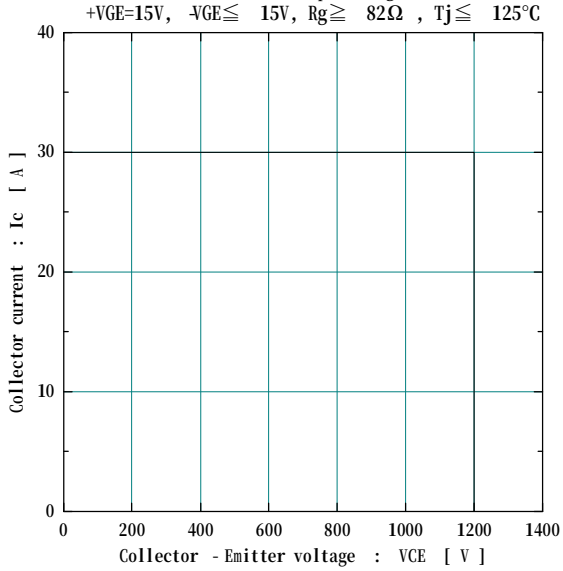

Switching loss vs. Collector current (typ.)
Vcc=600V, VGE=± 15V, Rg=82Ω



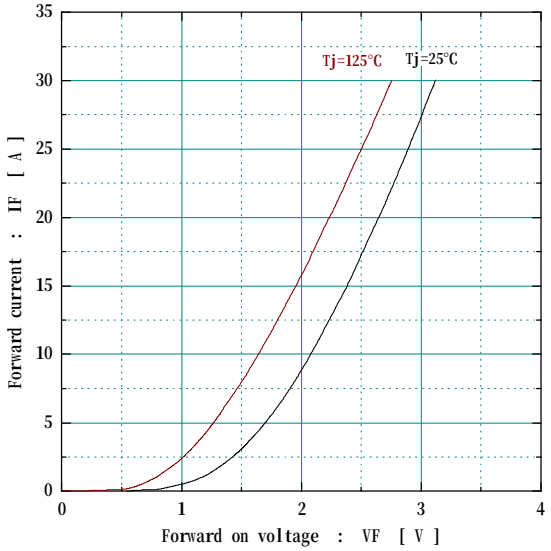

Switching loss vs. Gate resistance (typ.)
Vcc=600V, Ic=15A, VGE=± 15V, Tj= 125°C



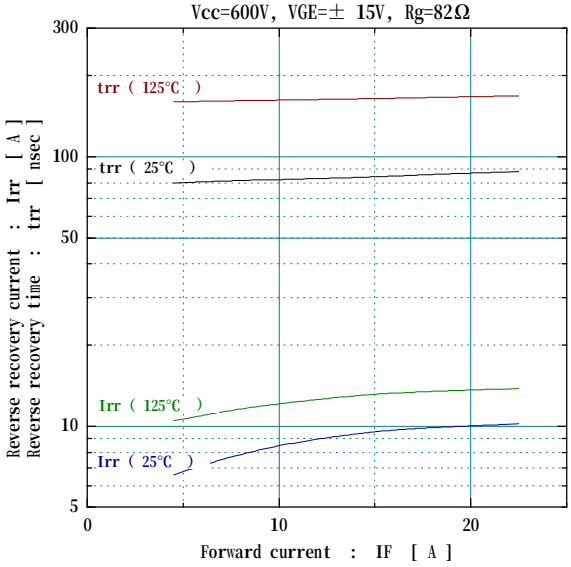

Reverse bias safe operating area
+VGE=15V, -VGE≦ 15V, Rg≧ 82Ω , Tj≦ 125°C



Forward current vs. Forward on voltage (typ.)




Reverse recovery characteristics (typ.)
Vcc=600V, VGE=± 15V, Rg=82Ω




Transient thermal resistance