

TARGET SPECIFICATION (TENTATIVE)

Device Name : IGBT Module

 Type Name : 1MB11500UE-330-02

 Spec. No. : MT5F 21160

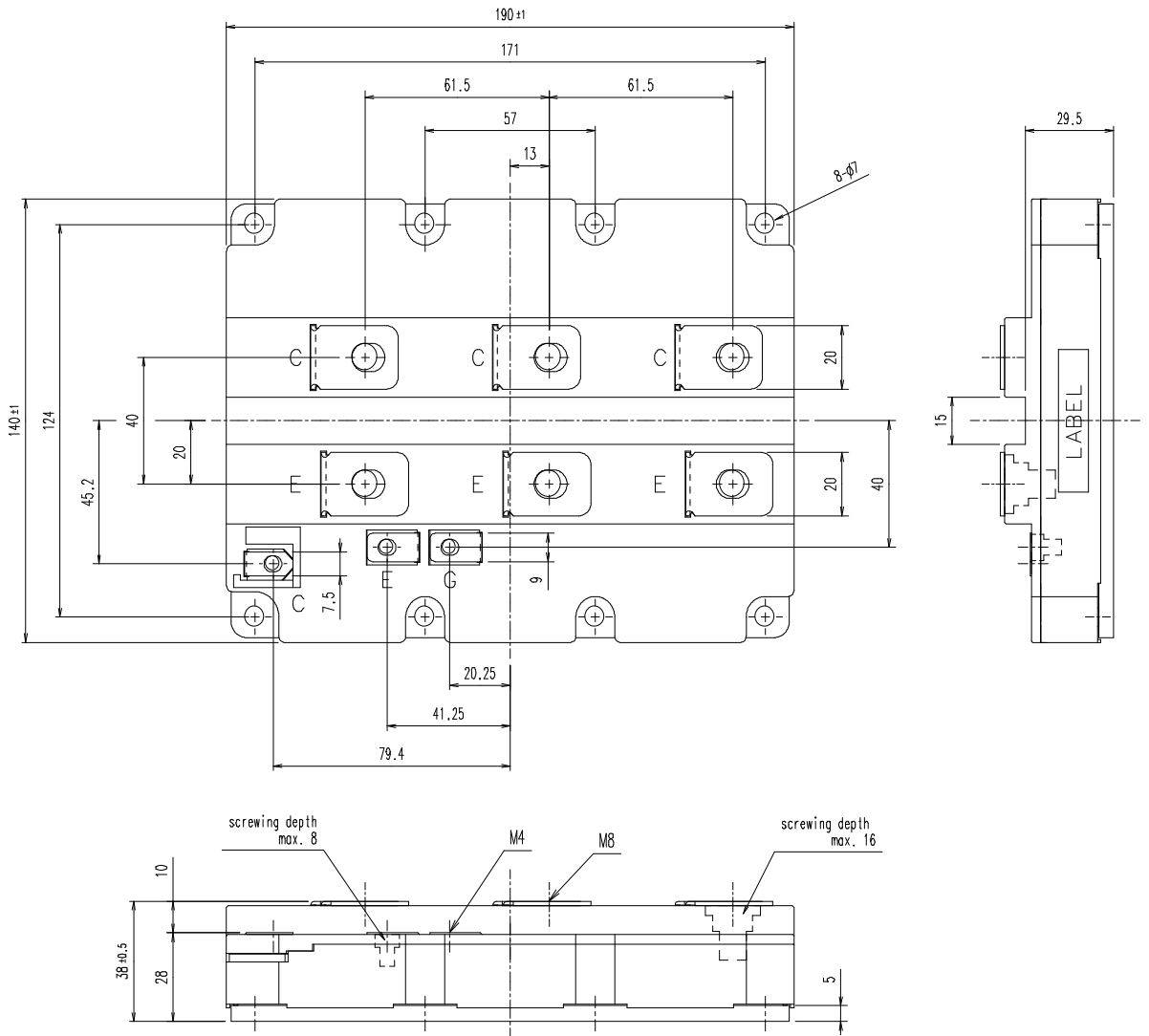
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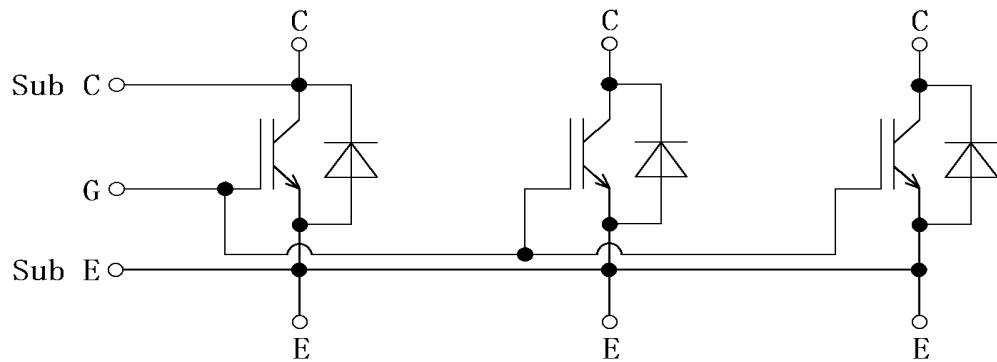
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| DRAWN | Dec.-10-'08 | K.Haraguchi | S.Igarashi | DWG.NO. MT5F21160 1 / 9 |
| CHECKED | Dec.-10-'08 | T.Koga | | |
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1MBI1500UE-330-02

1. Outline Drawing (Unit : mm)



2. Equivalent circuit



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| Items | Symbols | Conditions | Maximum Ratings | Units | |
|---|-------------------------|-------------------------|-----------------|-------|-------------------|
| Collector-Emitter voltage | VCES | Tj = -40~150°C | 3300 | V | |
| Gate-Emitter voltage | VGES | | ±20 | V | |
| Collector current | Ic | Continuous | Tc=25°C | 3000 | A |
| | | | Tc=80°C | 1500 | |
| | Icp | 1ms | Tc=25°C | 6000 | |
| | | | Tc=80°C | 3000 | |
| | -Ic | | | 1500 | |
| -Ic pulse | 1ms | | 3000 | | |
| Collector Power Dissipation | Pc | 1 device | 15.6 | kW | |
| Junction temperature | Tj | | 150 | °C | |
| Operating temperature | Tj op | Industrial applications | 0~150 | | |
| | | Traction applications | -40~150 | | |
| Storage temperature | Tstg | | -40~150 | | |
| Isolation voltage *1 | Viso | AC : 1min. | 6.0 | kVAC | |
| Partial discharge Extinction voltage *2 | V _{PDoff} (Ve) | AC 50 or 60Hz, Q ≤ 10pC | 4.1 | kVAC | |
| DC stability for cosmic ray | VCED | Tj=25°C, 100FIT | 2100 | VDC | |
| FWD I2t *3 | I2t | Tj=125°C | t=100µs | TBD | kA ² s |
| | | | t=10ms | 700 | |
| | | | t=100ms | TBD | |
| Screw Torque(Mounting / M6) | *4 | — | 5.75 | Nm | |
| Screw Torque (Terminals) | M8 (Main C,E) | | *5 | | 10 |
| | M4 (G,sub C,E) | | *6 | | 2.1 |

- *1 All terminals should be connected together when isolation test will be done.
Isolation test of 5.0kVAC, 2min. and 4.3kV, 10min. will be done on the Type test.
- *2 This characteristics should be measured before isolation test.
V_{PDoff} will be not measured if V_{PDon} > 6.2kV on outgoing test.
- *3 Life time > 100 cycles (cycle interval > 1sec.)
- *4 Recommendable Value (M6) : 5±15% (4.25~5.75) Nm
- *5 Recommendable Value (M8) : 8~10 Nm
- *6 Recommendable Value (M4) : 2-10%,+5% (1.80~2.10) Nm

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

| Items | Symbols | Conditions | | | Characteristics | | | Units |
|---|-------------------------|---|---|----------|-----------------|------|------|-------|
| | | | | | min. | typ. | max. | |
| Zero gate voltage Collector current *1 | ICES | VGE=0V | VCE=3300V | Tj=-40°C | — | — | 1 | mA |
| | | | | Tj= 25°C | — | — | 1 | |
| | | | | Tj=125°C | | 6 | 25 | |
| | | | | Tj=150°C | | 38 | 150 | |
| | | VCE=2000V | Tj=125°C | — | 5 | 25 | | |
| | | | Tj=150°C | — | 30 | 125 | | |
| Gate-Emitter leakage current | IGES | VCE=0V,VGE=±20V | | | — | — | 6000 | nA |
| Gate-Emitter threshold voltage | VGE(th) | VCE=20V,Ic=1500mA | | | 5.5 | 6.5 | 7.5 | V |
| Collector-Emitter saturation voltage | VCE(sat) (terminal) | Ic=1500A | Tj= 25°C | — | 2.70 | TBD | V | |
| | | | Tj=125°C | — | 3.15 | | | |
| | | | Tj=150°C | — | 3.25 | | | |
| | VCE(sat) (chip) | | Tj= 25°C | — | 2.60 | TBD | | |
| | | | Tj=125°C | — | 3.05 | | | |
| | | | Tj=150°C | — | 3.15 | | | |
| Forward on voltage | VF (terminal) | Ic=1500A | Tj= 25°C | — | 2.80 | TBD | V | |
| | | | Tj=125°C | — | 2.95 | | | |
| | | | Tj=150°C | — | 2.85 | | | |
| | VF (chip) | | Tj= 25°C | — | 2.70 | TBD | | |
| | | | Tj=125°C | — | 2.85 | | | |
| | | | Tj=150°C | — | 2.75 | | | |
| Input capacitance | Cies | VCE=0V,VCE=10V,f=1MHz | | | — | 300 | — | nF |
| Turn-on time | ton | Tj= 25°C | Vcc=1800V Ic=1500A VGE=±15V RG=1 Ω Ls=150nH | — | — | TBD | ns | |
| | tr | | | — | — | TBD | | |
| Turn-off time | tr(i) | | | — | TBD | — | | |
| | toff | | | — | — | TBD | | |
| Reverse recovery time | trr | | | — | — | TBD | | |
| | trf | | | — | — | TBD | | |
| Reverse recovery current | Irp(RM) | — | TBD | TBD | A | | | |
| Reverse recovery charge | Qrr | — | TBD | TBD | μC | | | |
| Scatter range of reverse charge | ΔQrr | — | — | TBD | | | | |
| Switching Losses | Turn-on Losses | Eon | Tj=125°C | — | 2.7 | — | J | |
| | Turn-off Losses | Eoff | — | 2.50 | — | | | |
| | Reverse recovery Losses | Err | — | 1.70 | — | | | |
| Reverse recovery current | Irp(RM) | — | TBD | TBD | A | | | |
| Reverse recovery charge | Qrr | — | TBD | TBD | μC | | | |
| Scatter range of reverse charge | ΔQrr | — | — | TBD | | | | |
| Switching Losses | Turn-on Losses | Eon | Tj=150°C | — | 3.10 | — | J | |
| | Turn-off Losses | Eoff | — | 2.75 | — | | | |
| | Reverse recovery Losses | Err | — | 1.85 | — | | | |
| Maximum short circuit current | Icp | Tj=150°C,Vcc=2300V,Pw=10μs VGE=+16/-10V, +RG=1 Ω Ls=150nH,L(load)=20nH~3μH *2 | | | — | TBD | TBD | kA |
| Internal inductance | Ls C-E | Between main C-E terminals | | | — | 10 | TBD | nH |

*1 ICES should measured be after in out-going test .

*2 VCEP < 3300V,VGEP < 17V (by using Dynamic clump circuit)

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5. Thermal resistance characteristics *1

| Items | Symbols | Conditions | Characteristics | | | Units |
|-------------------------------------|----------|------------|-----------------|------|------|-------|
| | | | min. | typ. | max. | |
| Thermal resistance(1device) | Rth(j-c) | IGBT | — | TBD | 8.0 | °C/kW |
| | | FWD | — | TBD | 15.0 | |
| Contact Thermal resistance(1device) | Rth(c-f) | IGBT | — | 6.0 | — | |
| | | FWD | — | 12.0 | — | |

*1 This is the value which is defined mounting on the additional cooling fin with thermal compound(1W/m°C).

6. Mechanical Properties

| Items | Symbols | Conditions | Characteristics | | | Units |
|--|---------|---|-----------------|------|------|-------|
| | | | min. | typ. | max. | |
| Clearance distance | — | Terminals-base plate and collector-gate&emitter | 19.0 | — | — | mm |
| Creepage distance | — | | 32.0 | — | — | mm |
| Case material (Comparative tracking Index) | CTI | Insulator group I ,EN50124-1 | 600 | — | — | — |
| Air Gap *1 | — | | — | — | TDB | μ m |
| Mass | — | | — | 1.5 | — | kg |
| Fire load | — | | — | TBD | — | kJ |
| NFF16-101 Classification | — | Plastic case:II/F1 Epoxy resin:II/F1 | | | | |
| Base plate material | — | AlSiC | | | | |

*1 Gap should be measured between baseplate and an ideal plain clamping plate under center of substrate.
Mounting torque = 4.25Nm (M6)

7. Environmental Conditions

* The module will be operated according to the following environment conditions.

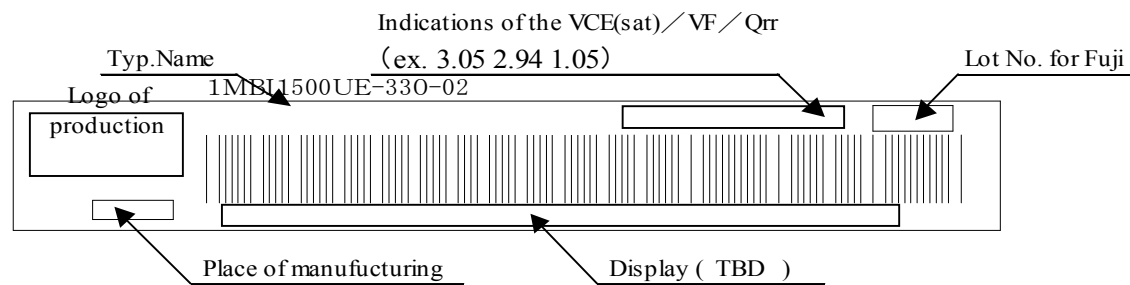
| Items | Class | Standard No. |
|-------------------------------|---|---------------|
| Climatic Conditions | Class : 5K2 (Tj=-40~150°C) | IEC60721-3-5 |
| Biological conditions | Class : 5B1 | |
| Chemically active substance | Class : 5C2 (no salt mist, no salt water) | |
| Mechanically active substance | Class : 5S2 | |
| Contaminating fluids | Class : 5F1 | |
| Pollution degree | PD2 | pr EN 50124-1 |

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8. Indication on module



For Indications of VCE(sat),VF,Qrr.

- VCE(sat) and VF are measured at terminal and at Tj=150°C. Unit is [V].
- Qrr is measured at conditions in "4.Electrical characteristics". Unit is [µC].

9.Applicable category

This specification is applied to IGBT Module named 1MBI1500UE-330-02 .

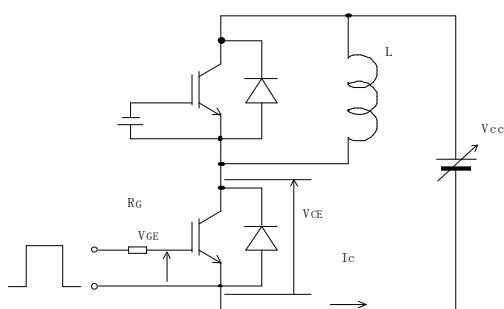
10.Storage and transportation notes

- The module should be stored at a standard temperature of 5 to 35°C and humidity of 45 to 75% .
- 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 transporting.

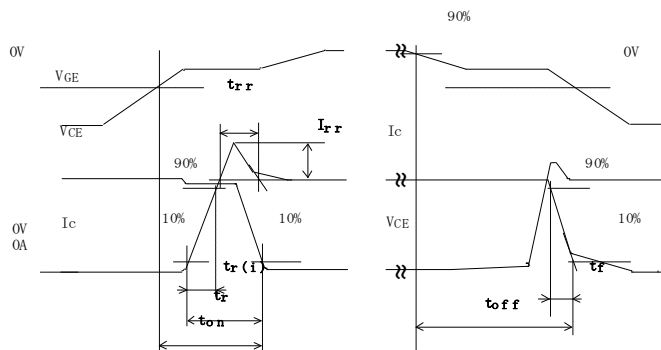
11.Definitions of switching time

*Ls=150nH

Test circuit



Definitions of switching time



12. Packing and Labeling

Display on the packing box

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

13. Type test items

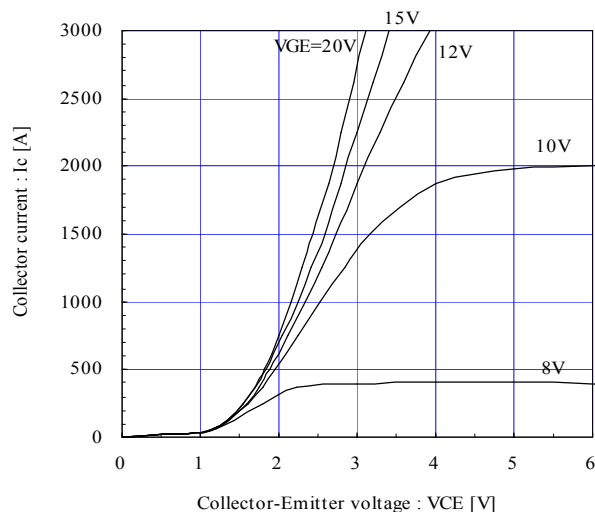
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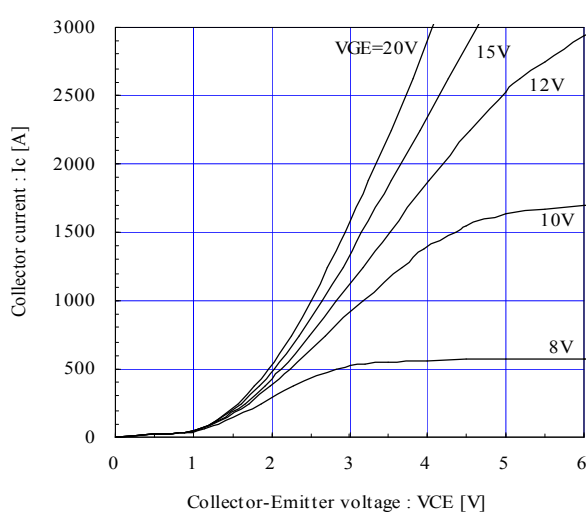
Collector current vs. Collector-Emitter voltage (typ.)

$T_j = 25^\circ\text{C} / \text{chip}$



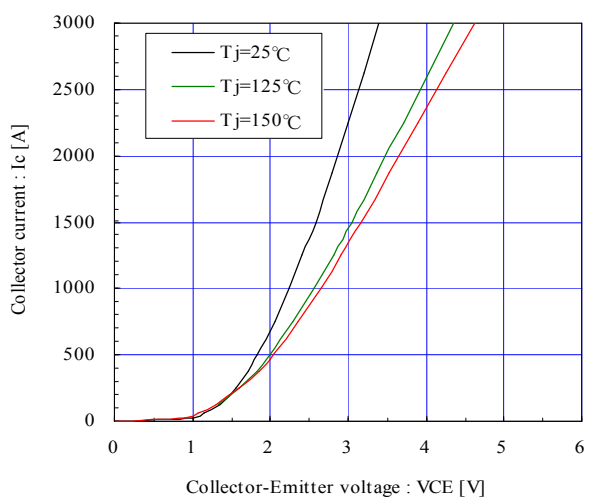
Collector current vs. Collector-Emitter voltage (typ.)

$T_j = 150^\circ\text{C} / \text{chip}$



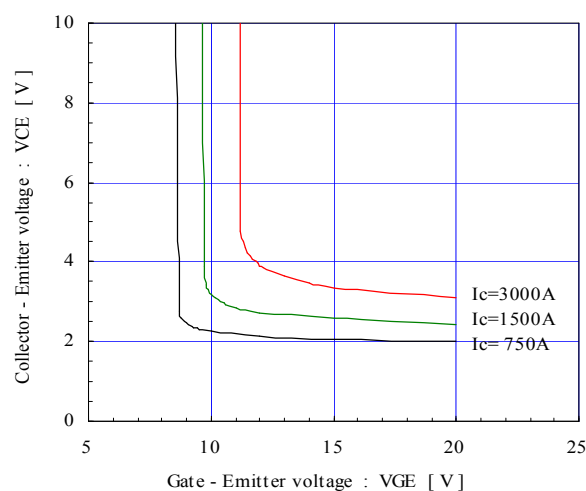
Collector current vs. Collector-Emitter voltage (typ.)

$V_{GE} = 15\text{V} / \text{chip}$



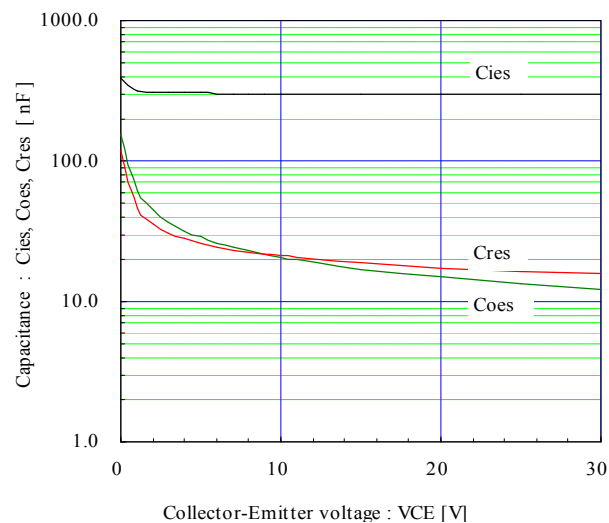
Collector-Emitter voltage vs. Gate-Emmitter voltage (typ.)

$T_j = 25^\circ\text{C} / \text{chip}$



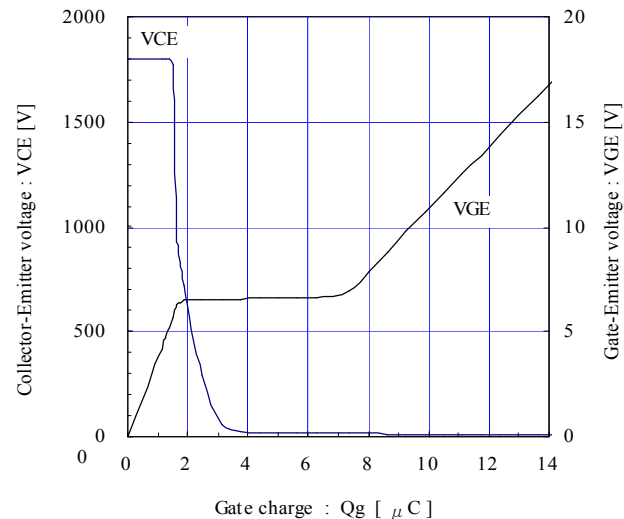
Capacitance vs. Collector-Emitter voltage (typ.)

$V_{GE} = 0\text{V}, f = 1\text{MHz}, T_j = 25^\circ\text{C}$



Dynamic Gate charge (typ.)

$V_{CC} = 1800\text{V}, I_c = 1500\text{A}, T_j = 25^\circ\text{C}$



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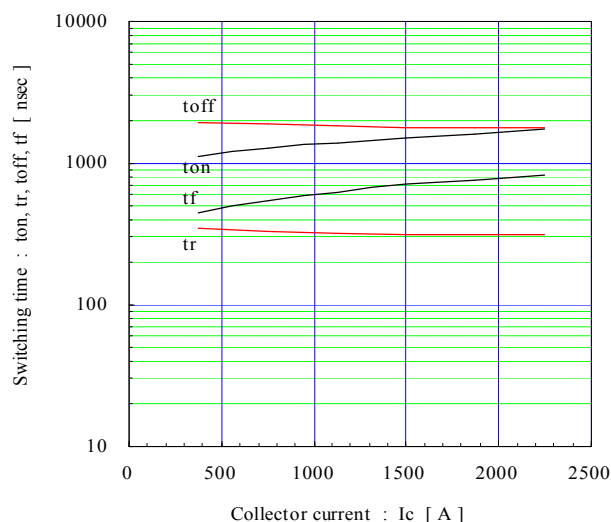
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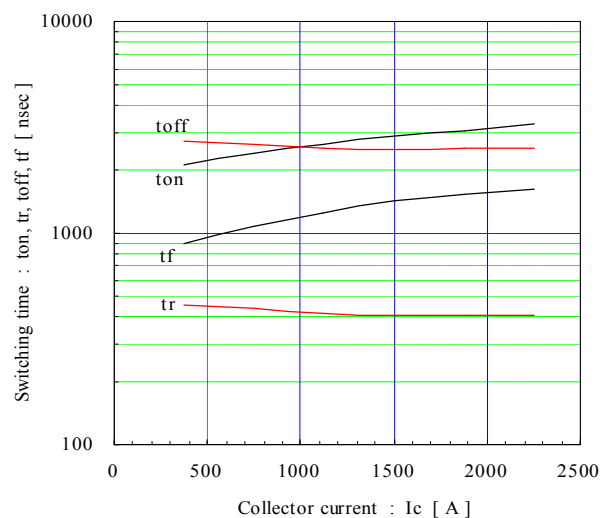
Switching time vs. Collector current (typ.)

Vcc=1800V, VGE=±15V, Rg=1Ω, Tj= 25°C



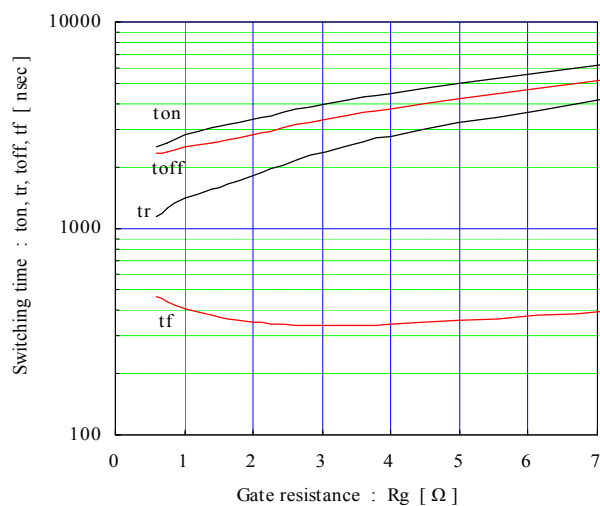
Switching time vs. Collector current (typ.)

Vcc=1800V, VGE=±15V, Rg=1Ω, Tj=150°C



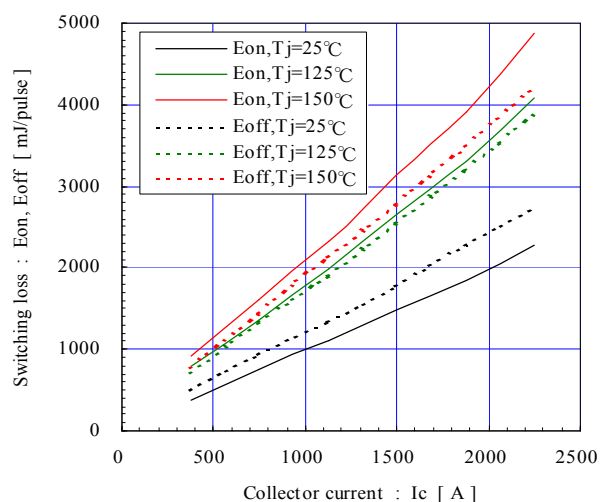
Switching time vs. Gate resistance (typ.)

Vcc=1800V, Ic=1500A, VGE=±15V, Tj= 150°C



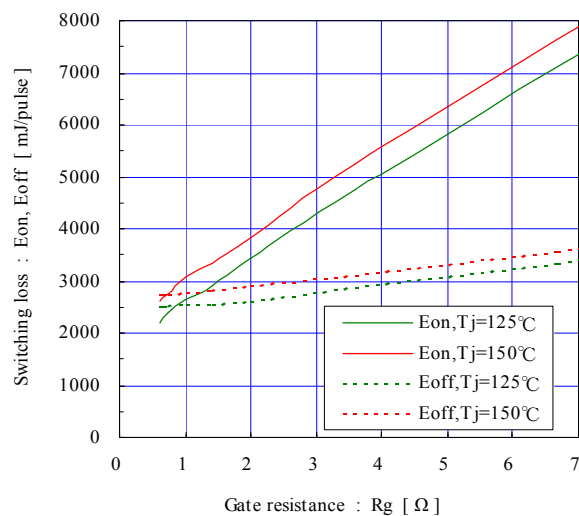
Switching loss vs. Collector current (typ.)

Vcc=1800V, VGE=±15V, Rg=1Ω, Ls=150nH



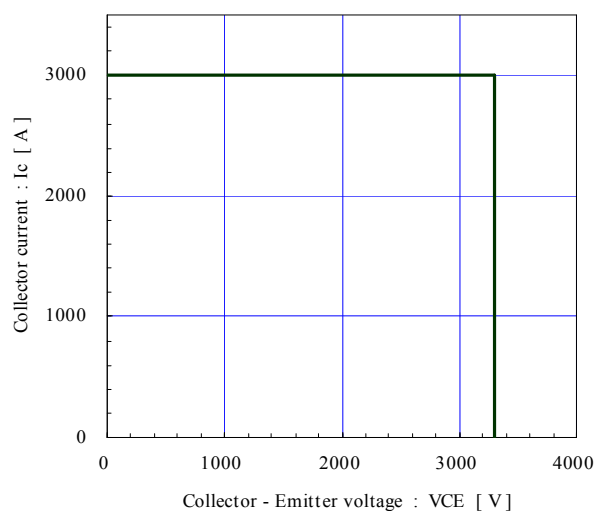
Switching loss vs. Gate resistance (typ.)

Vcc=1800V, Ic=1500A, VGE=±15V, Ls=150nH



Reverse bias safe operating area (max.)

+VGE=15V, -VGE ≤ 15V, RG ≥ 1Ω, Tj=150°C



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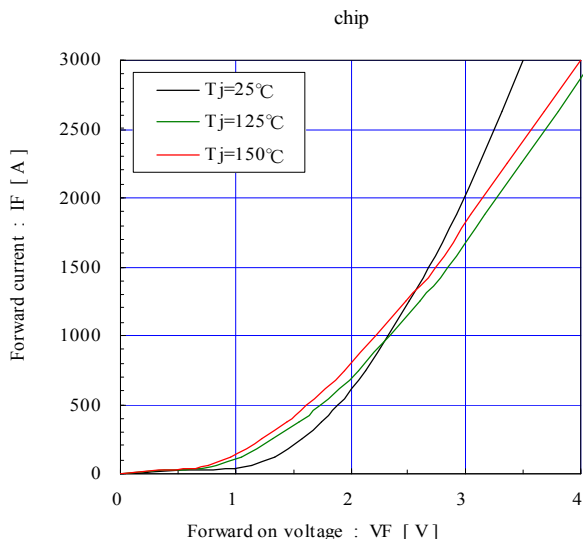
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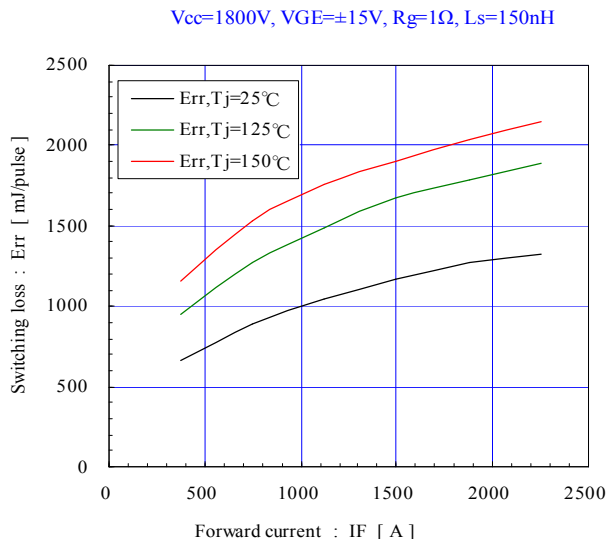
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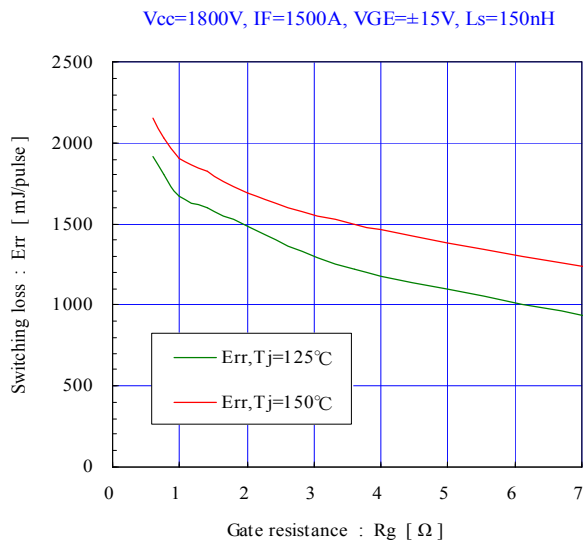
Forward current vs. Forward on voltage (typ.)



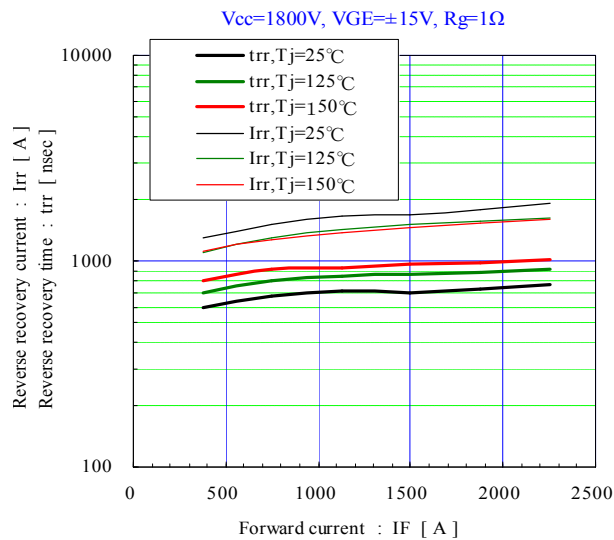
Switching loss vs. Collector current (typ.)



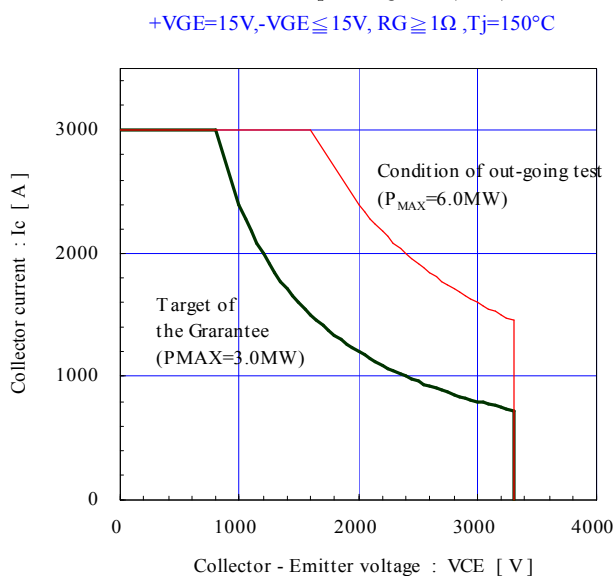
Switching loss vs. Gate resistance (typ.)



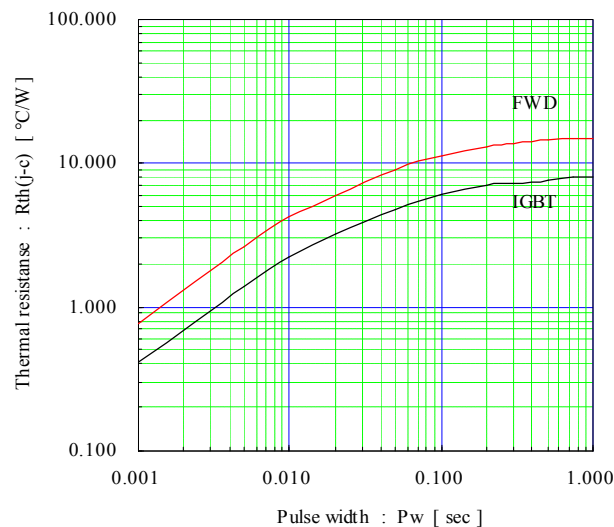
Reverse recovery characteristics (typ.)



Diode safe operating area (max.)



Transient thermal resistance (max.)



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