# MBN800E33D

Silicon N-channel IGBT

## FEATURES

- High speed, low loss IGBT module.
- Low driving power due to low input capacitance MOS gate.
- Low noise due to ultra soft fast recovery diode.
- High reliability, high durability module.
- High thermal fatigue durability. (delta Tc=70°C, N>30,000cycles)
- Isolated heat sink (terminal to base).

## ABSOLUTE MAXIMUM RATINGS (Tc=25°C )

| Item | | Symbol | Unit | MBN800E33D |
|---|---|---|---|---|
| Collector Emitter Voltage | | $V_{CES}$ | V | 3,300 |
| Gate Emitter Voltage | | $V_{GES}$ | V | ±20 |
| Collector Current | DC | $I_C$ | A | 800 |
| | 1ms | $I_{Cp}$ | | 1,600 |
| Forward Current | DC | $I_F$ | A | 800 |
| | 1ms | $I_{FM}$ | | 1,600 |
| Junction Temperature | | $T_j$ | °C | -40 ~ +125 |
| Storage Temperature | | $T_{stg}$ | °C | -40 ~ +125 |
| Isolation Voltage | | $V_{ISO}$ | $V_{RMS}$ | 6,000(AC 1 minute) |
| Screw Torque | Terminals (M4/M8) | - | N·m | 2/15 (1) |
| | Mounting (M6) | - | | 6 (2) |

Notes: (1) Recommended Value $1.8\pm0.2/15^{+0}_{-3}$1N·m (2) Recommended Value 5.5±0.5N·m

## ELECTRICAL CHARACTERISTICS

| Item | | Symbol | Unit | Min. | Typ. | Max. | Test Conditions |
|---|---|---|---|---|---|---|---|
| Collector Emitter Cut-Off Current | | $I_{CES}$ | mA | - | - | 12.0 | $V_{CE}$=3,300V, $V_{GE}$=0V, Tj=25°C |
| | | | | - | 14 | 40 | $V_{CE}$=3,300V, $V_{GE}$=0V, Tj=125°C |
| Gate Emitter Leakage Current | | $I_{GES}$ | nA | -500 | - | +500 | $V_{GE}$=±20V, $V_{CE}$=0V, Tj=25°C |
| Collector Emitter Saturation Voltage | | $V_{CE(sat)}$ | V | 3.5 | 4.2 | 5.0 | $I_C$=800A, $V_{GE}$=15V, Tj=125°C |
| Gate Emitter Threshold Voltage | | $V_{GE(TO)}$ | V | 4.5 | 6.0 | 7.0 | $V_{CE}$=10V, $I_C$=800mA, Tj=25°C |
| Input Capacitance | | $C_{ies}$ | nF | - | 75 | - | $V_{CE}$=10V, $V_{GE}$=0V, f=100kHz, Tj=25°C |
| Internal Gate Resistance | | Rg(int) | Ω | - | 1.8 | - | $V_{CE}$=10V, $V_{GE}$=0V, f=100kHz, Tj=25°C |
| Switching Times | Rise Time | $t_r$ | μs | 1.0 | 1.9 | 3.1 | $V_{CC}$=1,650V, Ic=800A |
| | Turn On Time | $t_{on}$ | | 1.1 | 2.4 | 3.3 | L=120nH |
| | Fall Time | $t_f$ | | 0.4 | 1.0 | 2.5 | $R_G$=4.7Ω (3) |
| | Turn Off Time | $t_{off}$ | | 1.9 | 3.0 | 5.1 | $V_{GE}$=±15V, Tj=125°C |
| Peak Forward Voltage Drop | | $V_{FM}$ | V | 1.7 | 2.5 | 3.0 | IF=800A, $V_{GE}$=0V, Tj=125°C |
| Reverse Recovery Time | | $t_{rr}$ | μs | 0.3 | 0.6 | 1.1 | $V_{CC}$=1,650V, IF=800A, L=120nH Tj=125°C |
| Turn On Loss | | $E_{on(10\%)}$ | J/P | - | 1.2 | 1.6 | $V_{CC}$=1,650V, Ic=800A, L=120nH |
| Turn Off Loss | | $E_{off(10\%)}$ | J/P | - | 0.8 | 1.2 | $R_G$=4.7Ω (3) |
| Reverse Recovery Loss | | $E_{rr(10\%)}$ | J/P | - | 0.9 | 1.3 | $V_{GE}$=±15V, Tj=125°C |
| Stray inductance module | | $L_{SCE}$ | nH | - | 18 | - | |
| Thermal Impedance | IGBT | Rth(j-c) | K/W | - | - | 0.013 | Junction to case |
| | FWD | Rth(j-c) | | - | - | 0.026 | |
| Contact Thermal Impedance | | Rth(c-f) | K/W | - | 0.008 | - | Case to fin |

Notes:(3) $R_G$ value is a test condition value for evaluation, not recommended value.
Please, determine the suitable $R_G$ value by measuring switching behaviors.

* Please contact our representatives at order.
* For improvement, specifications are subject to change without notice.
* For actual application, please confirm this spec sheet is the newest revision.

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# MBN800E33D

## DEFINITION OF TEST CIRCUIT

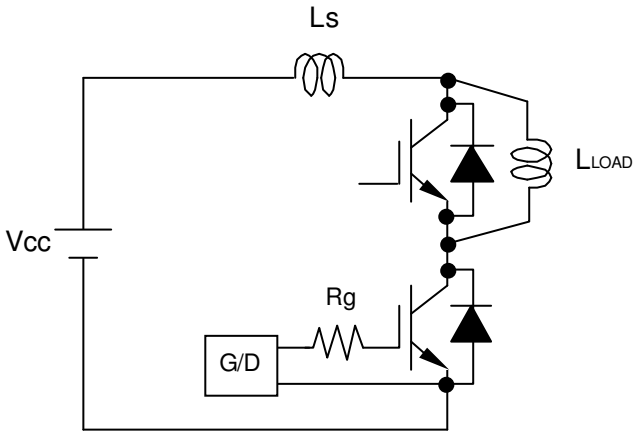
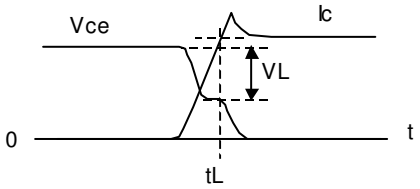
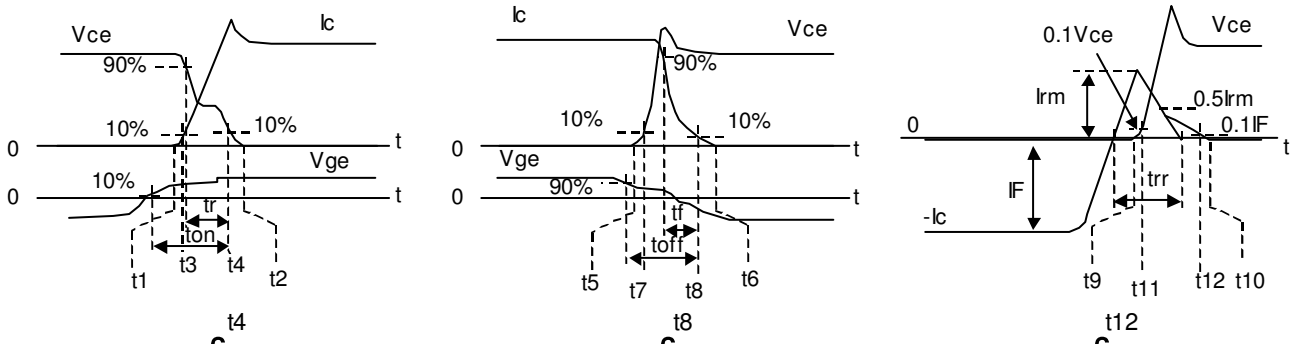



**Fig.1 Switching test circuit**




$$Ls = \frac{V_L}{\left(\frac{dIc}{dt}\right)_{t=tL}}$$

**Fig.2 Definition of Ls**




$$Eon(10\%) = \int_{t3}^{t4} Ic \cdot Vce\, dt \qquad Eoff(10\%) = \int_{t7}^{t8} Ic \cdot Vce\, dt \qquad Err(10\%) = \int_{t11}^{t12} IF \cdot Vce\, dt$$

$$Eon(Full) = \int_{t1}^{t2} Ic \cdot Vce\, dt \qquad Eoff(Full) = \int_{t5}^{t6} Ic \cdot Vce\, dt \qquad Err(Full) = \int_{t9}^{t10} IF \cdot Vce\, dt$$

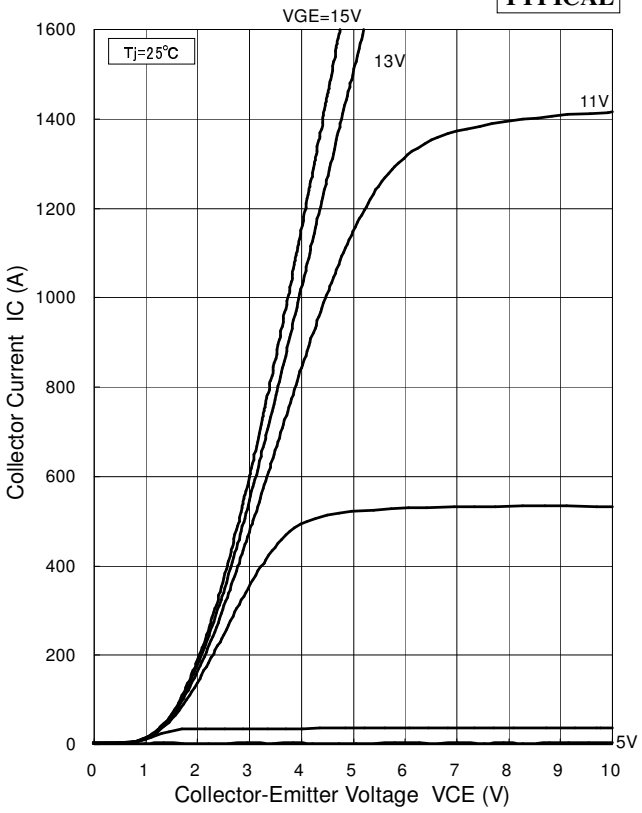
**Fig.3 Definition of switching loss**

# MBN800E33D

## CHARACTERISTICS CURVE

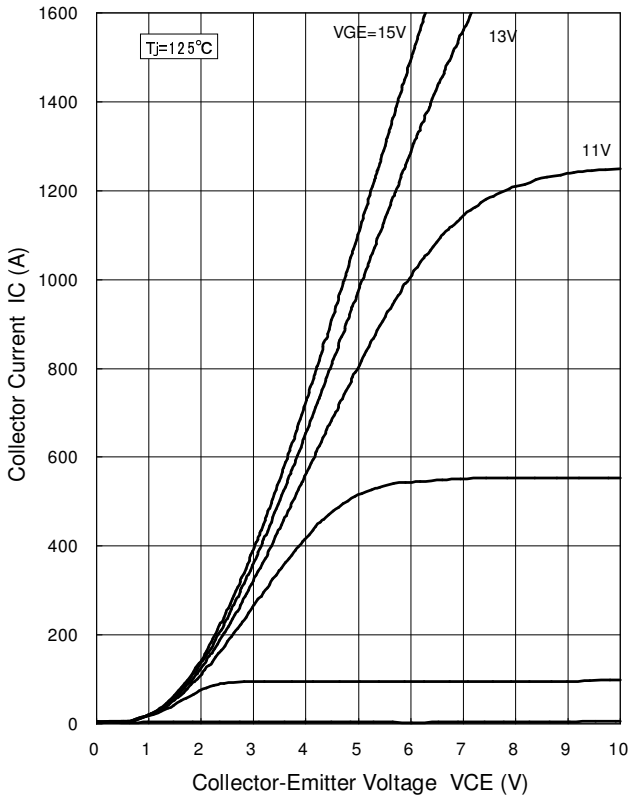
### STATIC CHARACTERISTICS

TYPICAL



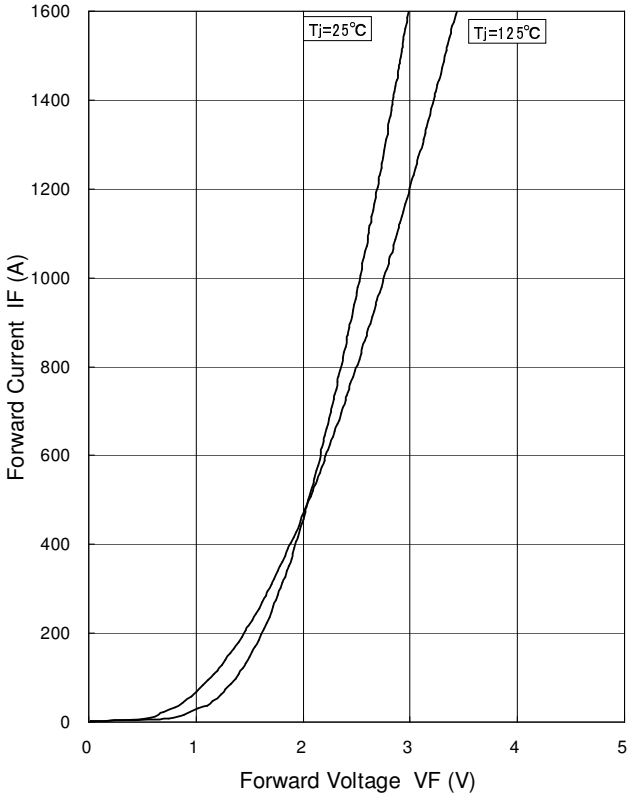

**Collector Current vs.Collector to Emitter Voltage**

TYPICAL




**Collector Current vs.Collector to Emitter Voltage**

TYPICAL



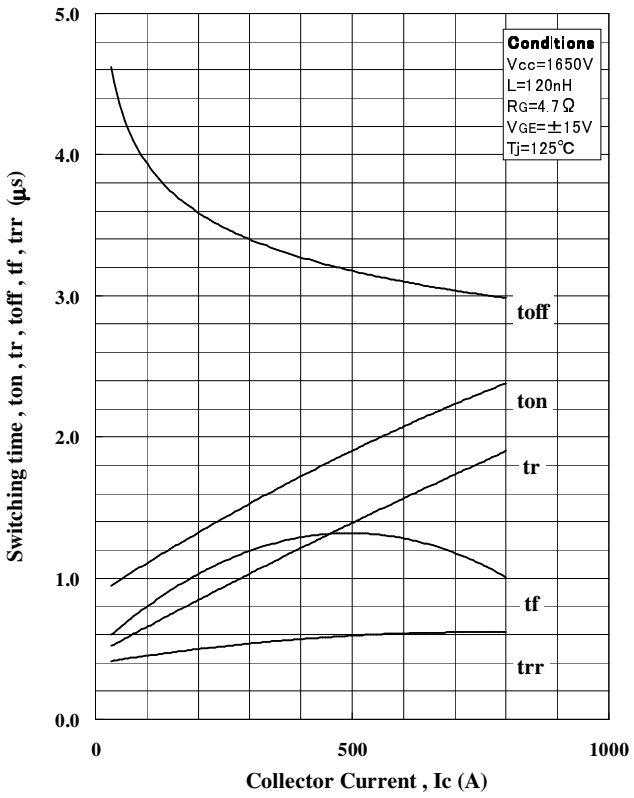

**Forward Voltage of free-wheeling diode**

# MBN800E33D

## DYNAMIC CHARACTERISTICS

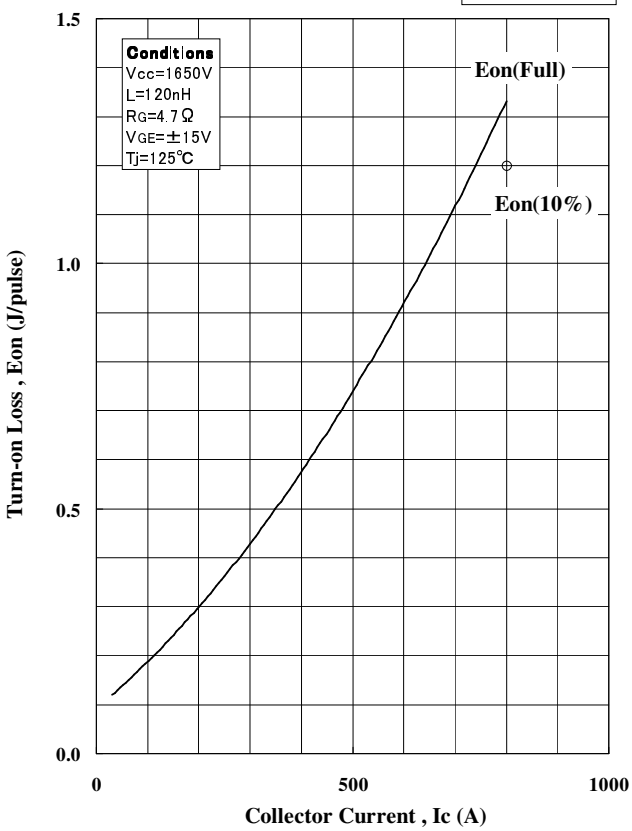
### DEPENDENCE OF CURRENT

TYPICAL



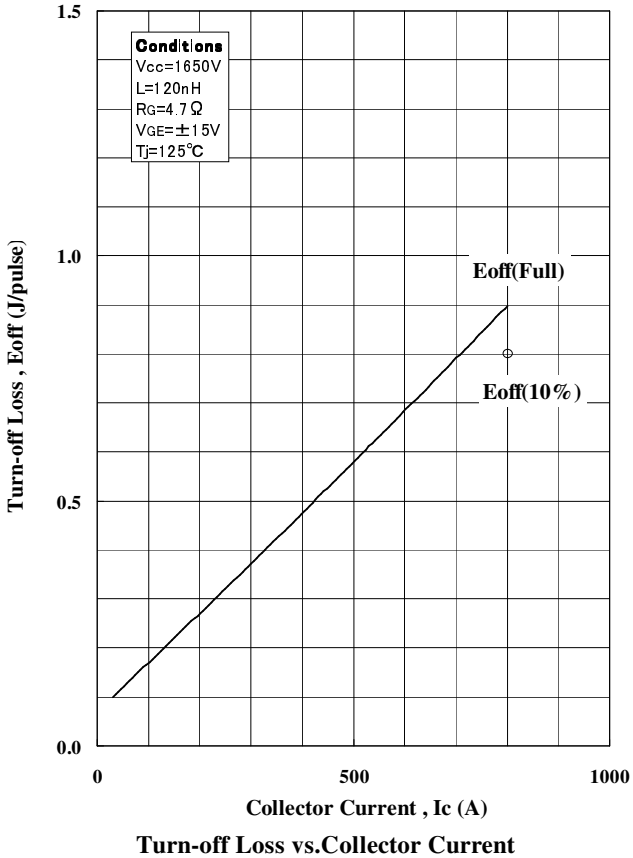

Turn-on Loss vs.Collector Current

TYPICAL



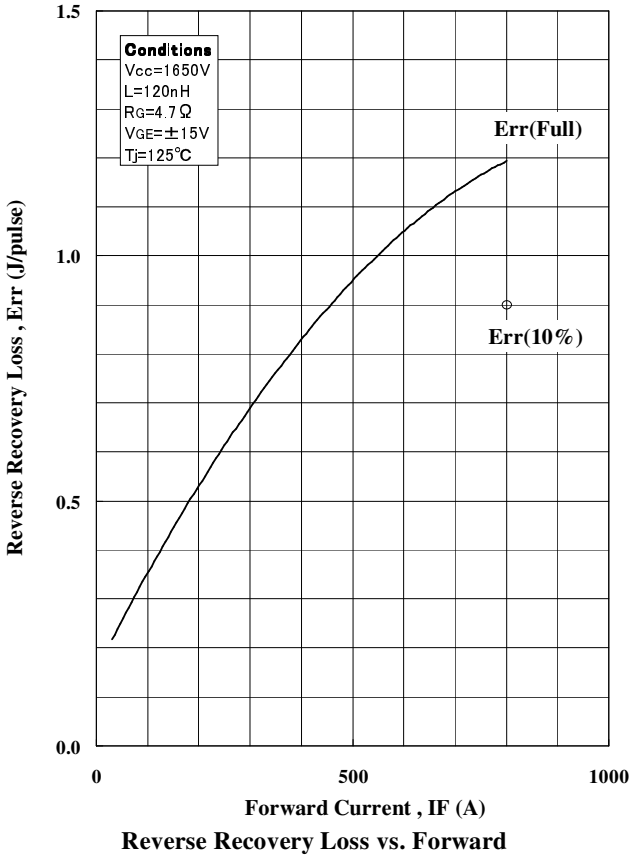

Turn-on Loss vs.Collector Current

TYPICAL




Turn-off Loss vs.Collector Current

TYPICAL




Reverse Recovery Loss vs. Forward

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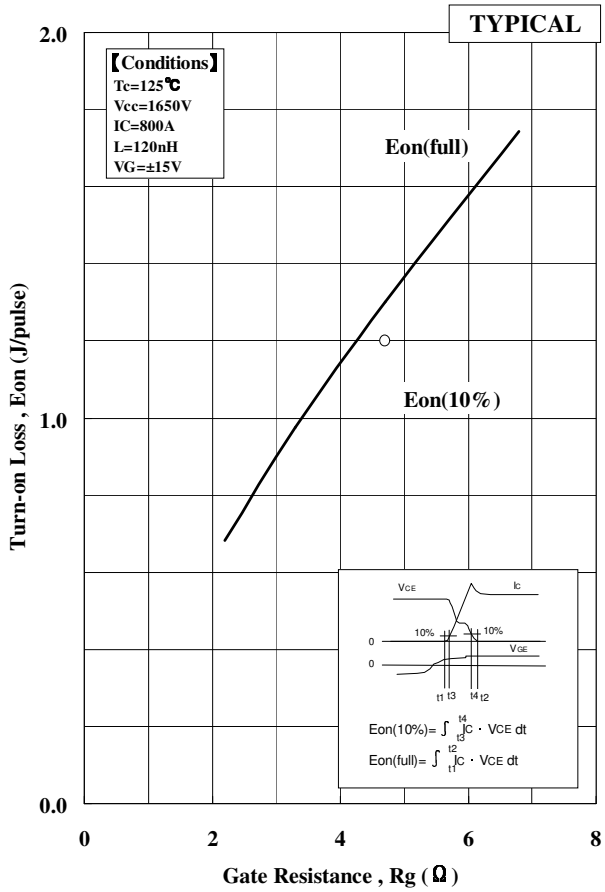
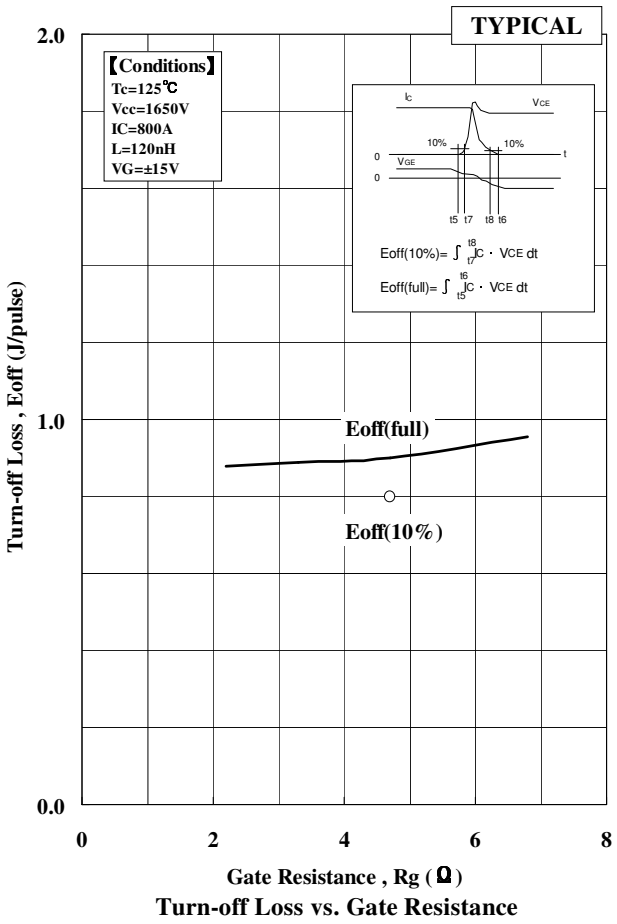
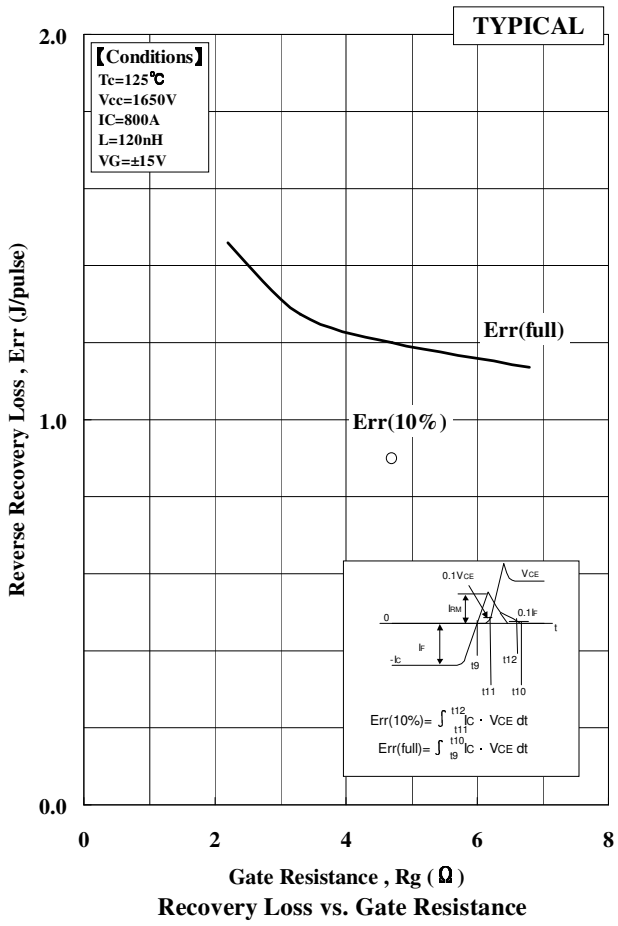
## DEPENDENCE OF RG




Turn-off Loss vs. Gate Resistance




Recovery Loss vs. Gate Resistance

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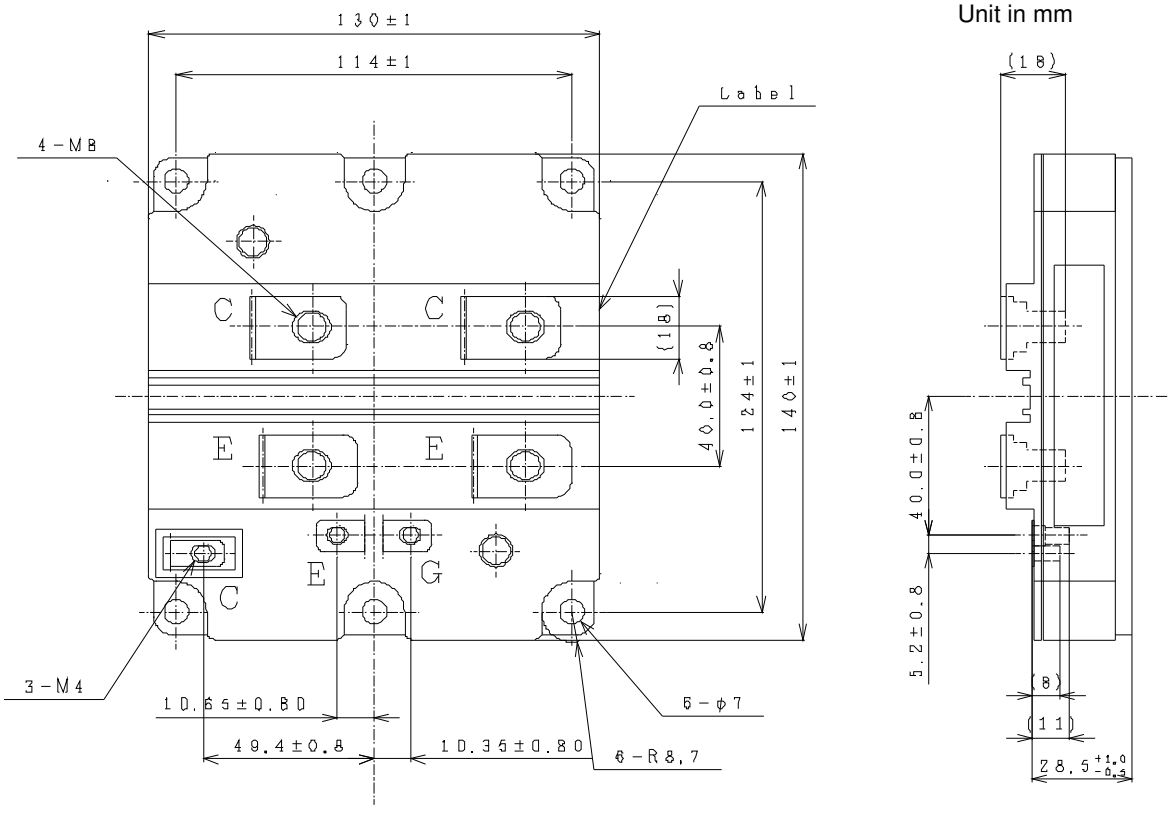
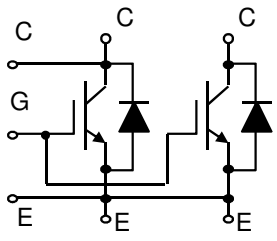
## OUTLINE DRAWINGS

Unit in mm




Weight: 900(g)




**Circuit diagram**

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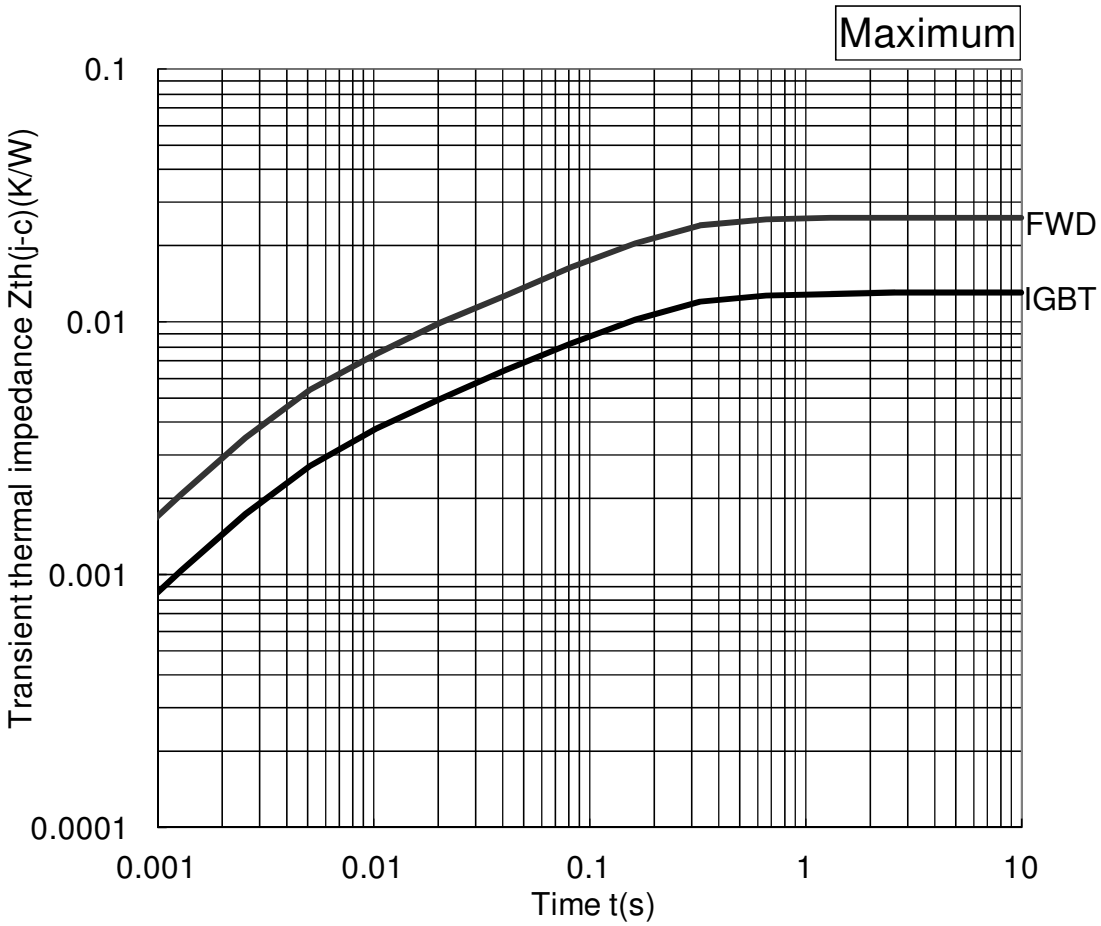
**TRANSIENT THERMAL IMPEDANCE**




Transient Thermal Impedance Curve

**Material declaration**

Please note the following materials are contained in the product, in order to keep characteristic and reliability level.

| Material | Contained part |
|---|---|
| Lead (Pb) and its compounds | Solder |

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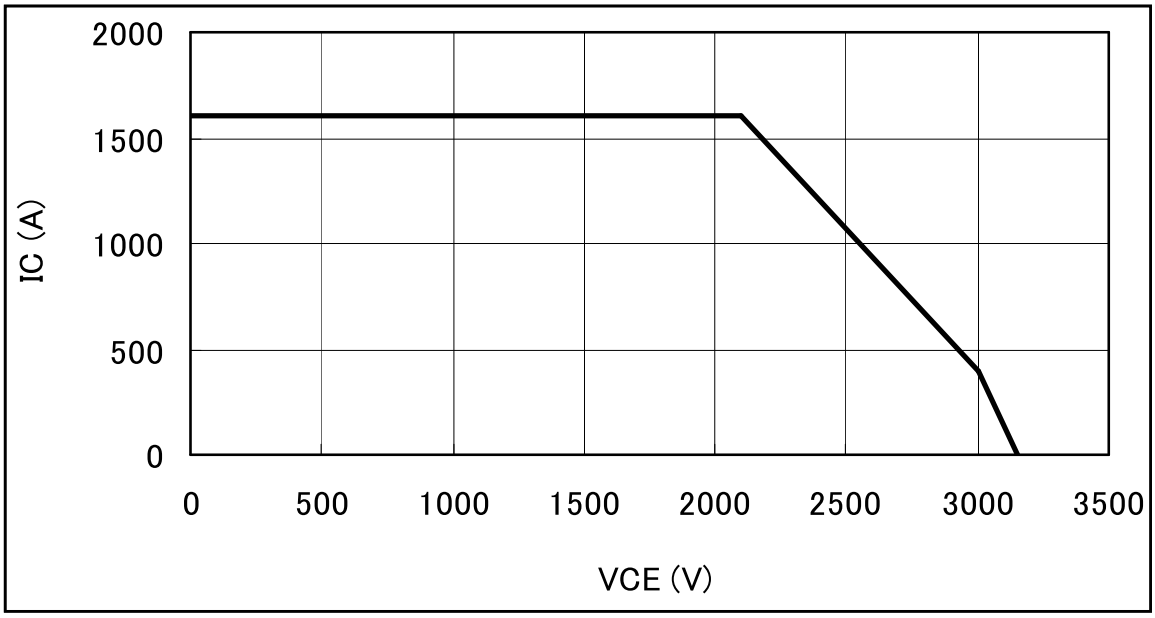
**SOA**

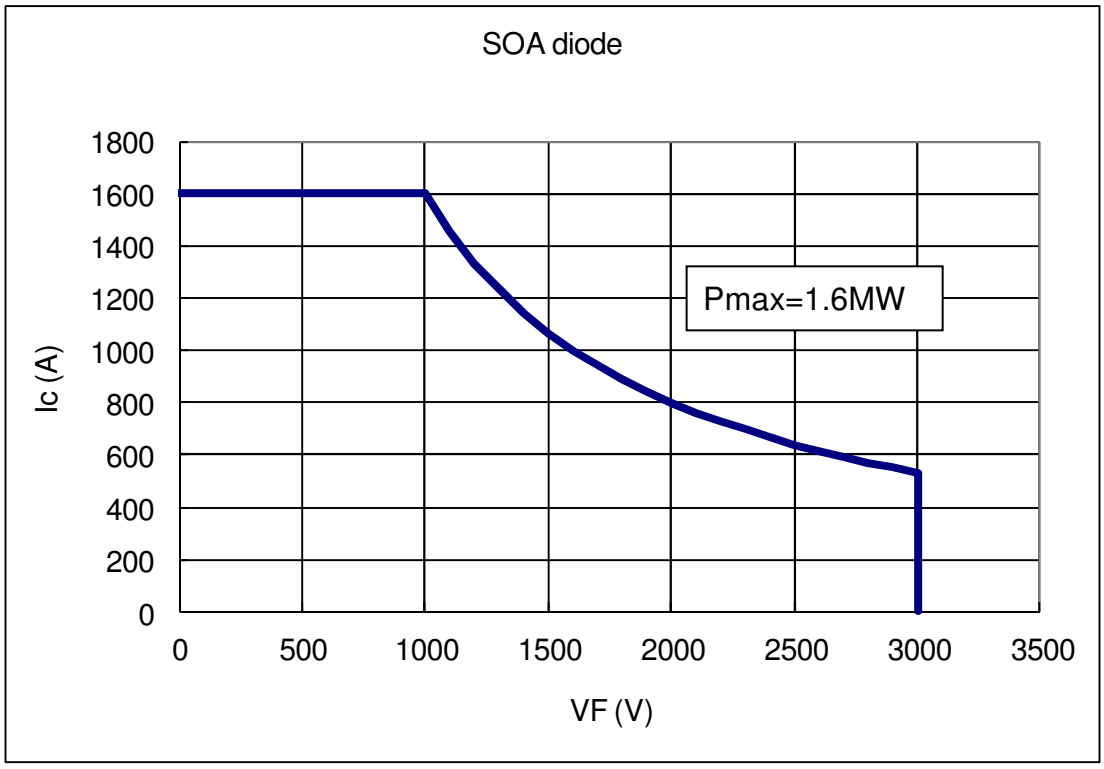
**RBSOA**




RBSOA diagram

RBSOA
Hitachi routine test conditions
Tj=125°C, Vcc=2000V, Ic=1600A, Ls=120nH, VGE=±15V, RG=4.7Ω
(Measured at auxiliary terminal)

**Recovery SOA**




RecSOA diagram

RecSOA
Hitachi routine test conditions
Tj=125°C, Vcc=2000V, IF=1600A, Ls=120nH, VGE=±15V, RG=4.7Ω
(Measured at auxiliary terminal)

# MBN800E33D

## HITACHI POWER SEMICONDUCTORS

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