

MBN1200H45E2-H

Silicon N-channel IGBT 4500V E2 version

FEATURES

- * Low switching loss IGBT module.
- * Low noise due to ultra soft fast recovery diode.
- * High reliability, high durability module.
- * High thermal fatigue durability.
($\Delta T_c=70^\circ\text{C}$, $N>30,000$ cycles)
- * Isolated heat sink (terminal to base).

ABSOLUTE MAXIMUM RATINGS ($T_c=25^\circ\text{C}$)

Item	Symbol	Unit	MBN1200H45E2-H
Collector Emitter Voltage	V_{CES}	V	4,500
Gate Emitter Voltage	V_{GES}	V	± 20
Collector Current	DC	I_C	1,200 ($T_c=80^\circ\text{C}$)
	1ms	I_{CRM}	2,400
Forward Current	DC	I_F	1,200
	1ms	I_{FRM}	2,400
Operating Junction Temperature	$T_{vj\ op}$	$^\circ\text{C}$	-40 ~ +125
Maximum Junction Temperature	$T_{vj\ max}$	$^\circ\text{C}$	150 (1)
Storage Temperature	T_{stg}	$^\circ\text{C}$	-50 ~ +125 (2)
Isolation Voltage	V_{ISO}	V_{RMS}	10,200(AC 1 minute)
Screw Torque	Terminals (M4/M8)	-	2/10 (3)
	Mounting (M6)	-	6 (4)

Notes: (1) Regarding the condition of $T_{vj\ max}$ for each operation mode, please refer to LD-ES-130737.

(2) Terminal temperature shall not exceed the specified temperature in any operation.

(3) Recommended Value $1.8\pm 0.2/9\pm 1\text{N}\cdot\text{m}$ (4) Recommended Value $5.5\pm 0.5\text{N}\cdot\text{m}$

ELECTRICAL CHARACTERISTICS

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Collector Emitter Cut-Off Current	I_{CES}	mA	-	-	5	$V_{CE}=4,500\text{V}$, $V_{GE}=0\text{V}$, $T_{vj}=25^\circ\text{C}$
Gate Emitter Leakage Current	I_{GES}	nA	-500	-	+500	$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$, $T_{vj}=25^\circ\text{C}$
Collector Emitter Saturation Voltage	V_{CEsat}	V	3.5	4.2	4.7	$I_C=1,200\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=125^\circ\text{C}$
Gate Emitter Threshold Voltage	$V_{GE(th)}$	V	5.4	6.4	7.4	$V_{CE}=10\text{V}$, $I_C=1,200\text{mA}$, $T_{vj}=25^\circ\text{C}$
Input Capacitance	C_{ies}	nF	-	165	-	$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_{vj}=25^\circ\text{C}$
Internal Gate Resistance	$R_{G(int)}$	Ω	-	0.8	-	$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_{vj}=25^\circ\text{C}$
Turn On Delay Time	$t_{d(on)}$	μs	-	0.6	-	$V_{CC}=2,600\text{V}$, $I_C=1,200\text{A}$
Rise Time	t_r		1.0	2.1	4.2	$L_S=150\text{nH}$
Turn Off Delay Time	$t_{d(off)}$		-	2.4	-	$R_{G(on/off)}=3.3\Omega/3.3\Omega$ (5)
Fall Time	t_f		1.2	2.4	3.6	$V_{GE}=\pm 15\text{V}$, $T_{vj}=125^\circ\text{C}$
Forward Voltage Drop	V_F	V	3.0	3.7	4.2	$I_F=1,200\text{A}$, $V_{GE}=0\text{V}$, $T_{vj}=125^\circ\text{C}$
Reverse Recovery Time	t_{rr}	μs	0.3	0.7	1.4	$V_{CC}=2,600\text{V}$, $I_F=1,200\text{A}$, $L_S=150\text{nH}$ $T_{vj}=125^\circ\text{C}$
Turn On Loss	$E_{on(10\%)}$	J/P	-	3.2	4.8	$V_{CC}=2,600\text{V}$, $I_C=I_F=1,200\text{A}$, $L_S=150\text{nH}$ $R_{G(on/off)}=3.3\Omega/3.3\Omega$ (5) $V_{GE}=\pm 15\text{V}$, $T_{vj}=125^\circ\text{C}$
	$E_{on(full)}$		-	3.8	-	
Turn Off Loss	$E_{off(10\%)}$	J/P	-	3.2	4.8	
	$E_{off(full)}$		-	3.8	-	
Reverse Recovery Loss	$E_{rr(10\%)}$	J/P	-	2.5	3.7	
	$E_{rr(full)}$		-	2.8	-	
Partial discharge extinction voltage	V_e	V_{RMS}	3,500	-	-	$f=50\text{Hz}$, $Q_{PD}\leq 10\text{pC}$ (acc. to IEC 61287)
Stray inductance module	L_{SCE}	nH	-	14	-	
Thermal Impedance	IGBT	$R_{th(j-c)}$	-	-	0.0085	Junction to case
	FWD	$R_{th(j-c)}$	-	-	0.017	
Contact Thermal Impedance	$R_{th(c-f)}$	K/W	-	0.005	-	Case to fin ($\lambda_{grease}=1\text{W}/(\text{m}\cdot\text{K})$, heat-sink flatness $\leq 50\mu\text{m}$)

Notes: (5) R_G value is the test condition's value for evaluation of the switching times, not recommended value.Please, determine the suitable R_G value after the measurement of switching waveforms

(overshoot voltage, etc.) with appliance mounted.

* 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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DEFINITION OF TEST CIRCUIT

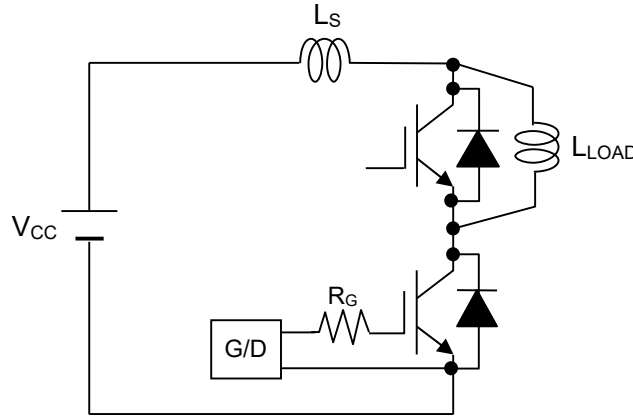


Fig.1 Switching test circuit

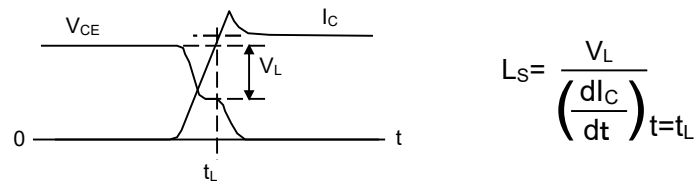


Fig.2 Definition of stray inductance

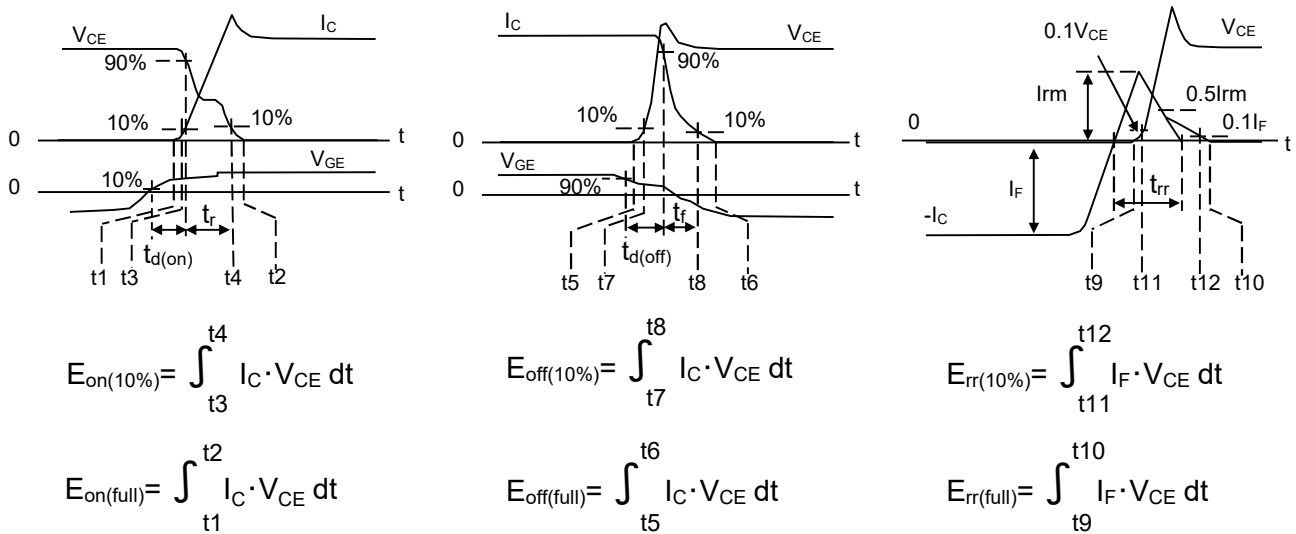
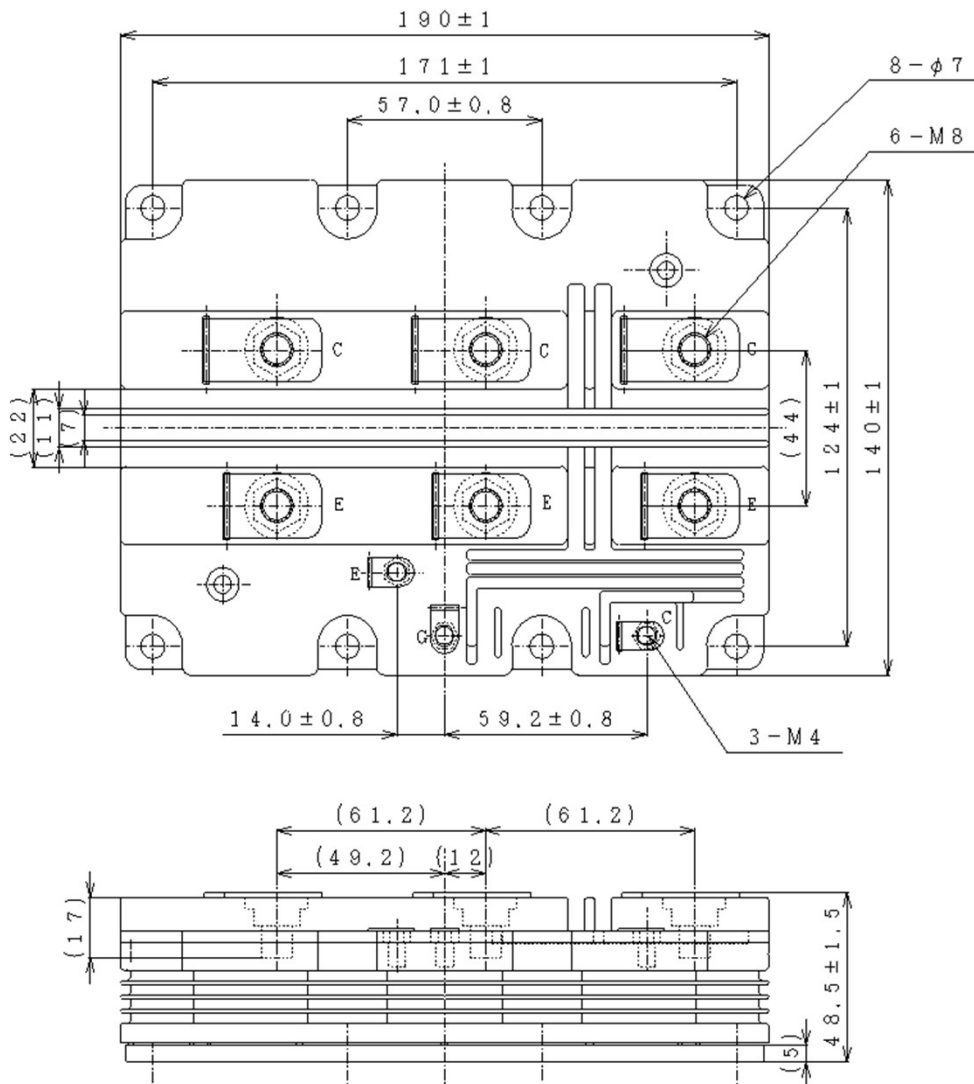


Fig.3 Definition of switching loss

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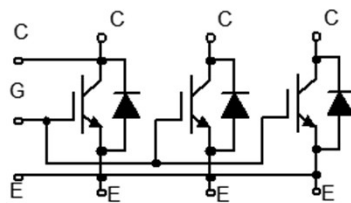
OUTLINE DRAWING

Unit in mm

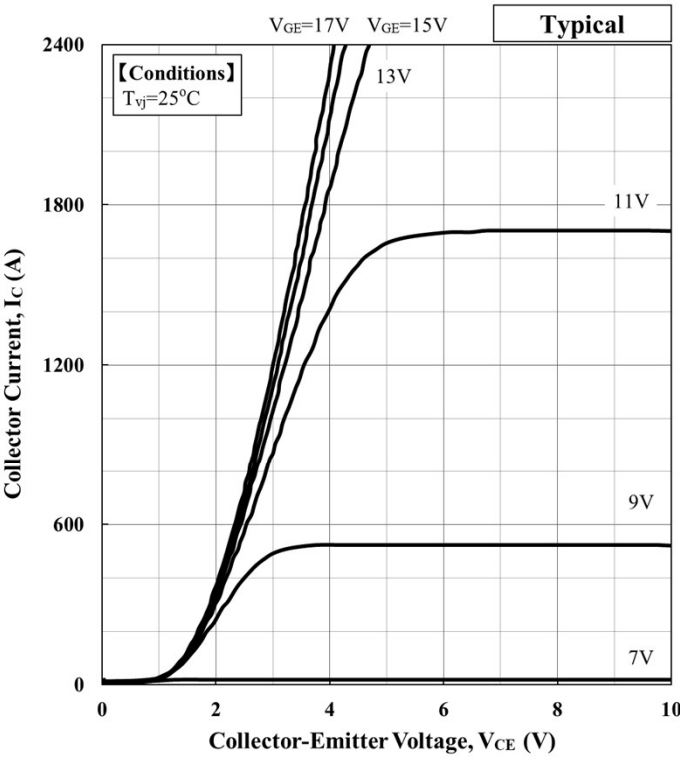


Weight: 1,550g

CIRCUIT DIAGRAM

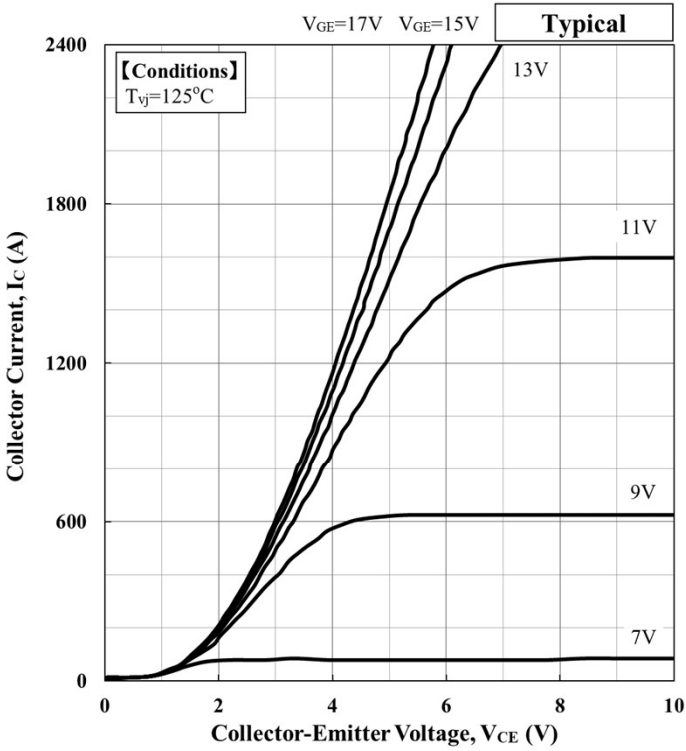


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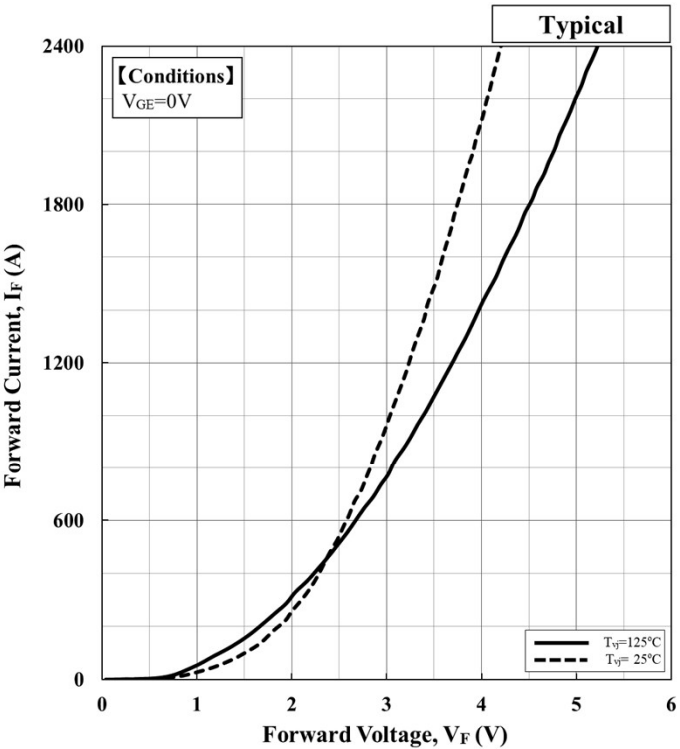
$V_{CE}(sat)[V] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$					
Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
25	15	1.32E-10	-6.89E-07	2.13E-03	1.30E+00

Collector Current vs. Collector Emitter Voltage



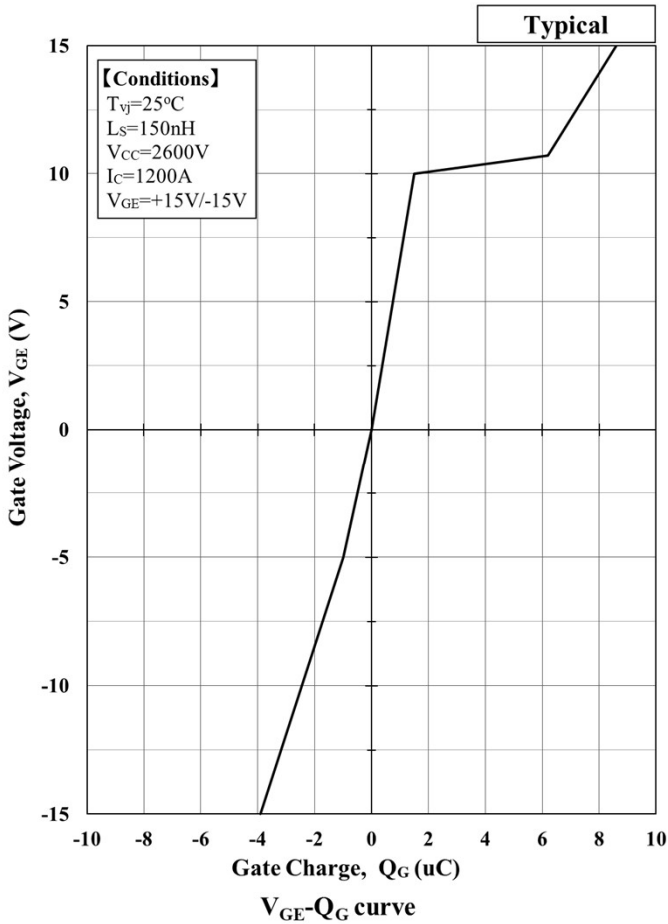
$V_{CE}(sat)[V] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$					
Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
125	15	2.21E-10	-1.12E-06	3.41E-03	1.35E+00

Collector Current vs. Collector Emitter Voltage

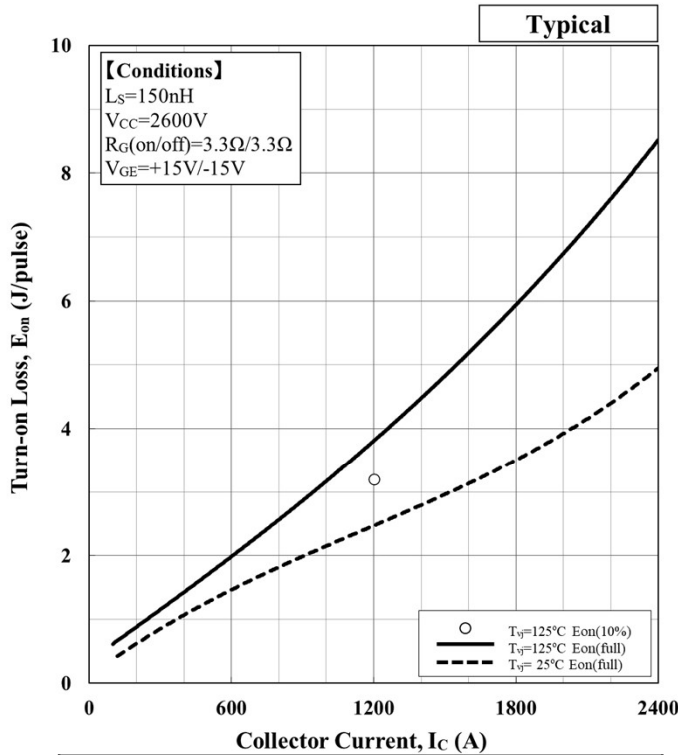


$V_F[V] = a_3 \cdot I_F ^3 + a_2 \cdot I_F ^2 + a_1 \cdot I_F + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	1.81E-10	-9.62E-07	2.44E-03	1.40E+00
125	1.89E-10	-1.06E-06	3.20E-03	1.07E+00

Forward Voltage of free-wheeling diode



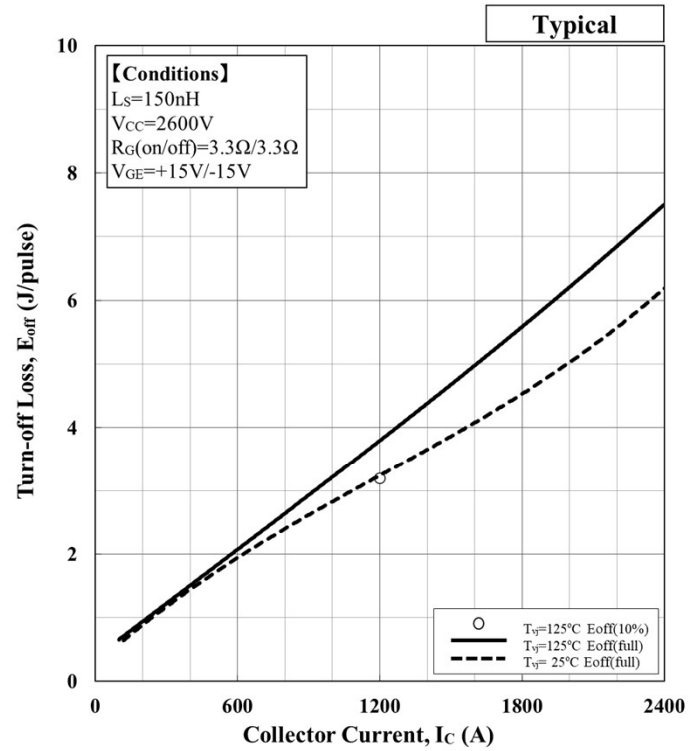
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$$E [J] = a_3 \cdot |I_c|^3 + a_2 \cdot |I_c|^2 + a_1 \cdot |I_c| + a_0$$

Temp.[°C]	a_3	a_2	a_1	a_0
25	2.93E-10	-1.02E-06	2.77E-03	1.06E-01
125	9.93E-11	7.82E-08	2.64E-03	3.51E-01

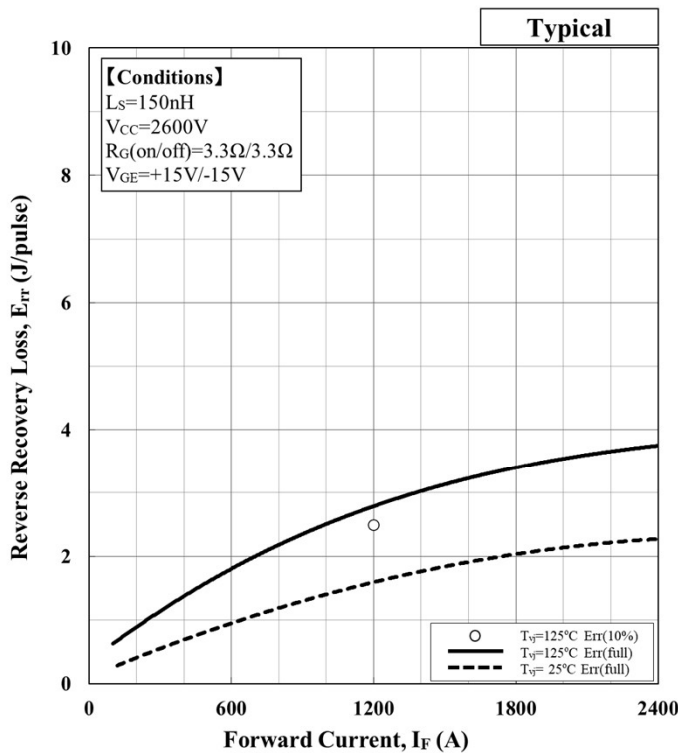
Turn-on loss vs. Collector current



$$E [J] = a_3 \cdot |I_c|^3 + a_2 \cdot |I_c|^2 + a_1 \cdot |I_c| + a_0$$

Temp.[°C]	a_3	a_2	a_1	a_0
25	2.90E-10	-1.06E-06	3.33E-03	2.60E-01
125	4.15E-11	-4.93E-08	2.85E-03	3.73E-01

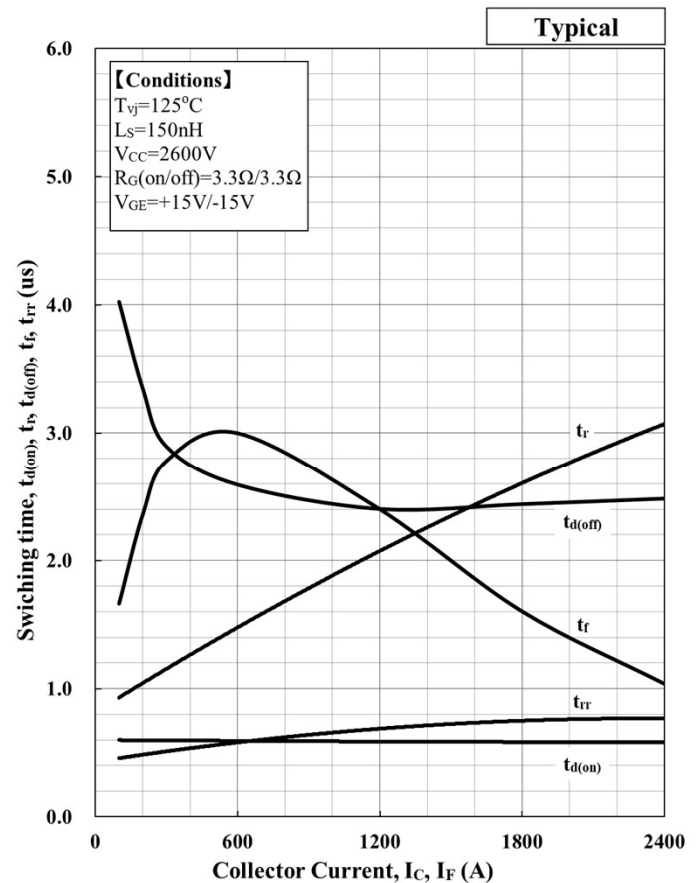
Turn-off loss vs. Collector current



$$E [J] = a_3 \cdot |I_F|^3 + a_2 \cdot |I_F|^2 + a_1 \cdot |I_F| + a_0$$

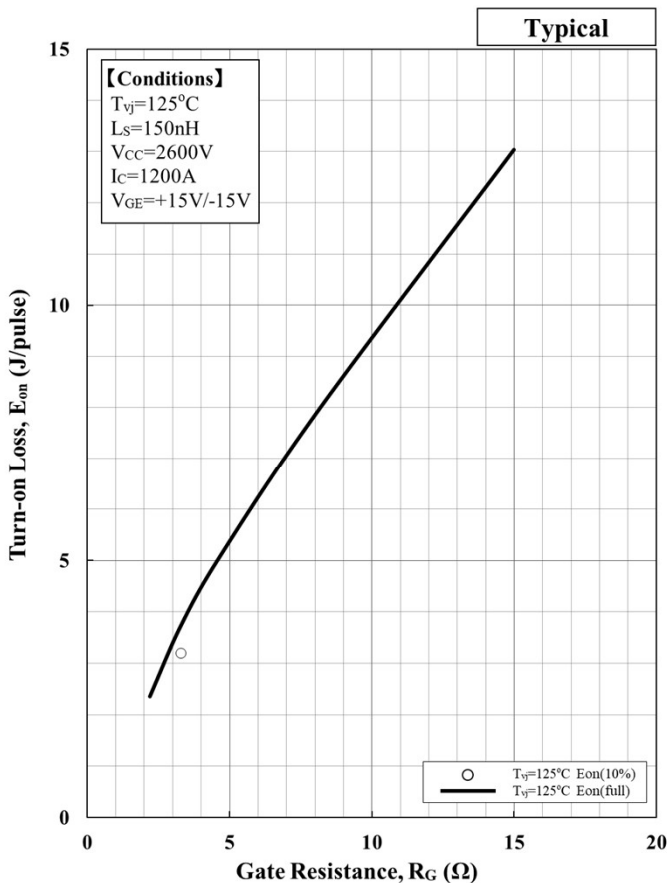
Temp.[°C]	a_3	a_2	a_1	a_0
25	-	-2.82E-07	1.58E-03	1.01E-01
125	8.10E-11	-8.06E-07	2.89E-03	3.44E-01

Recovery loss vs. Forward current

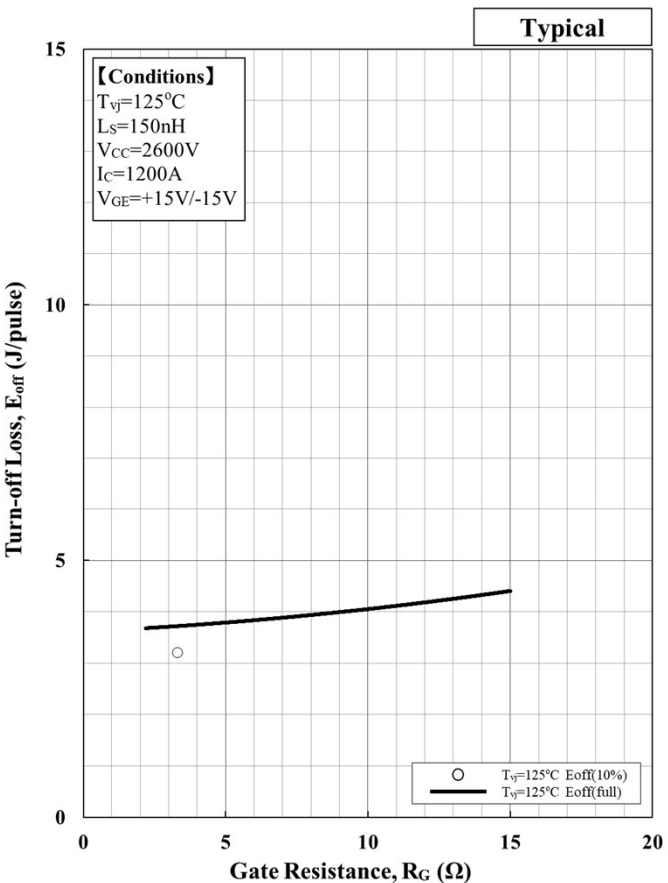


Switching time vs. Collector Current

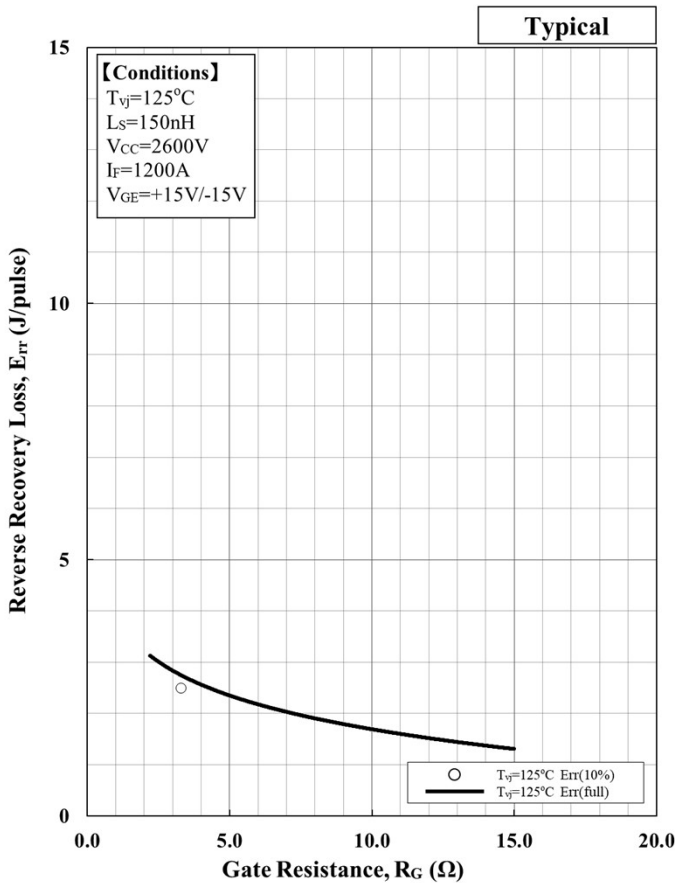
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Turn-on loss vs. Gate Resistance

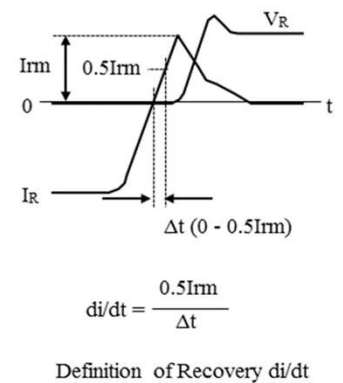
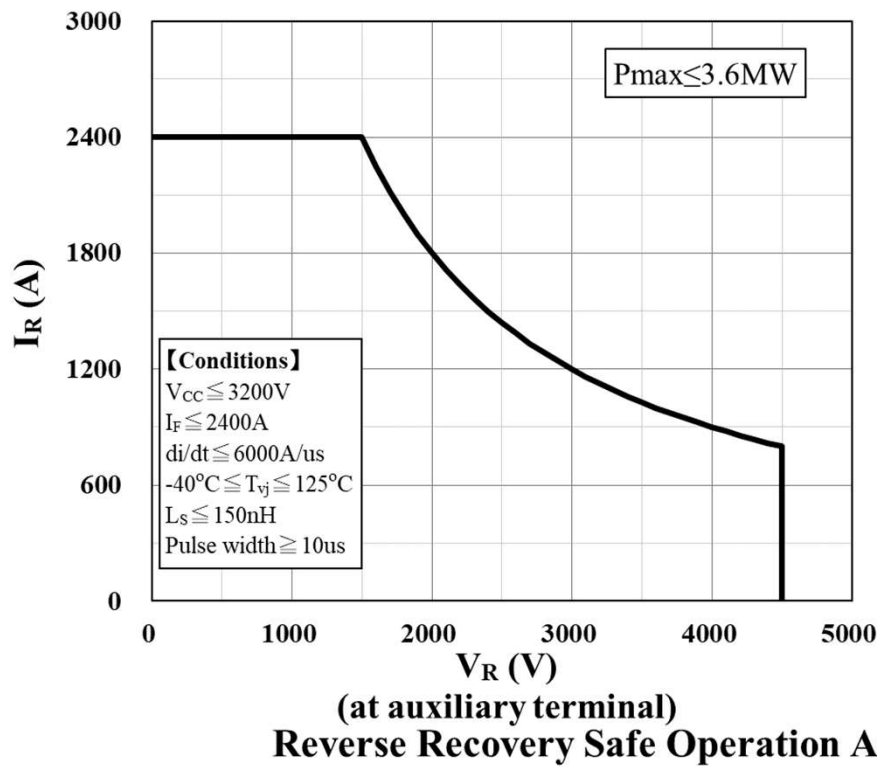
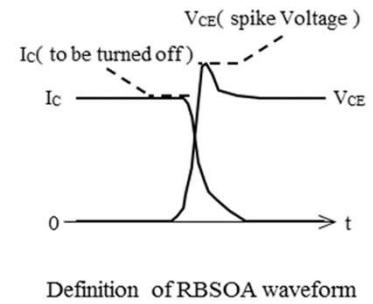
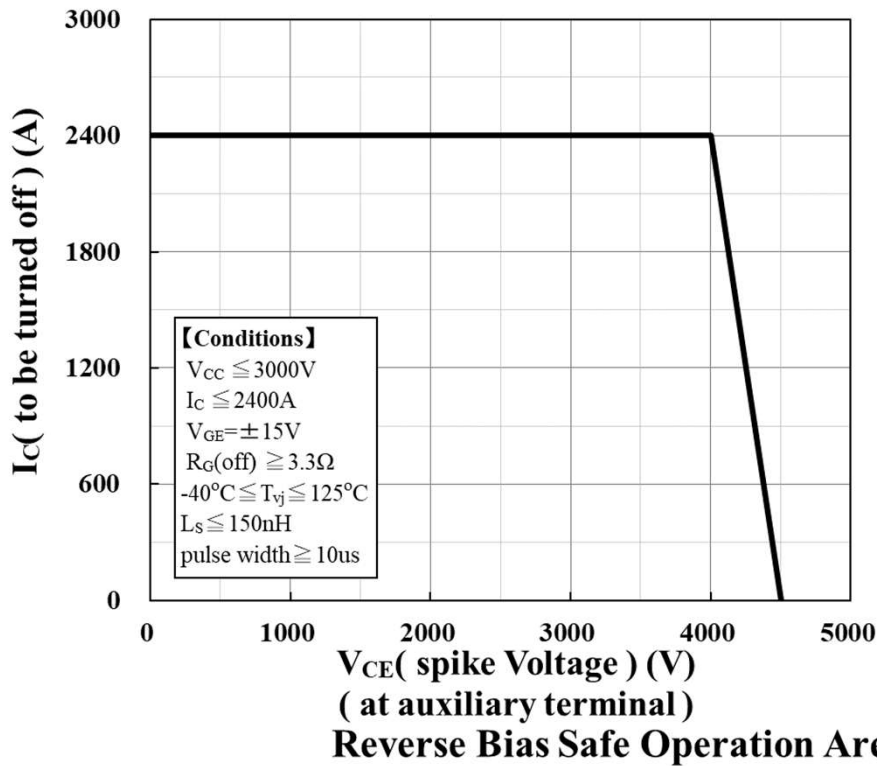


Turn-off loss vs. Gate Resistance

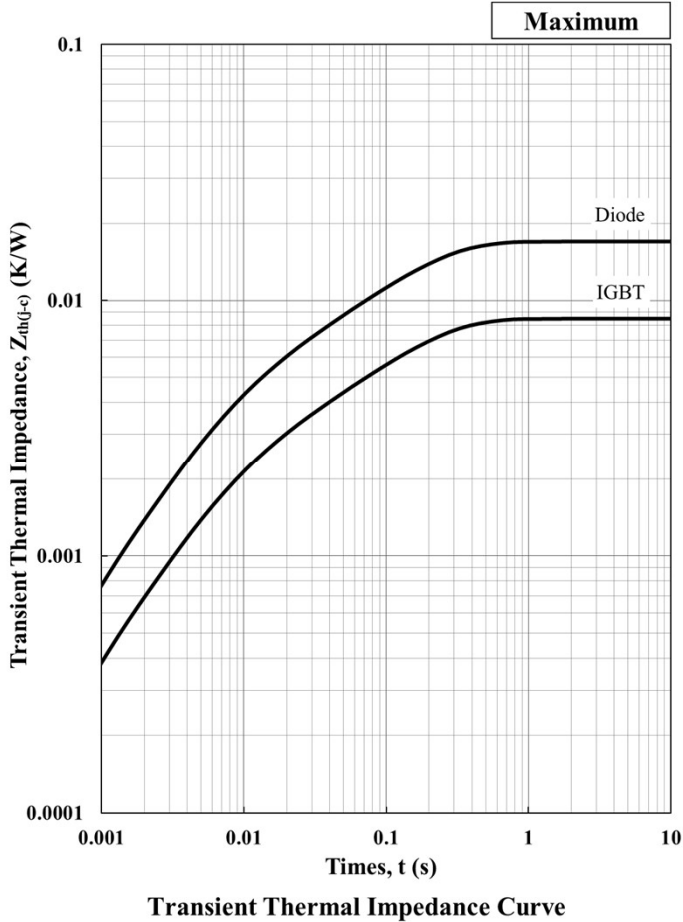
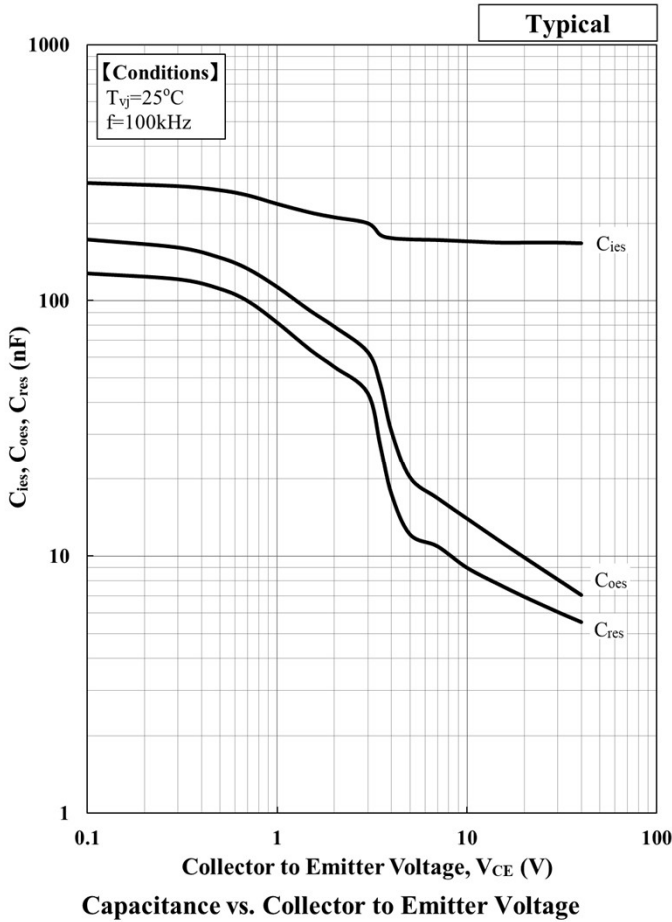


Reverse Recovery loss vs. Gate Resistance

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Foster model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	5.25E-03	1.61E-03	1.56E-03	8.65E-05	[K/W]
C th, IGBT [n]	3.11E+01	1.69E+01	3.93E+00	1.00E+01	[J/K]
R th, Diode [n]	1.05E-02	3.18E-03	3.14E-03	1.71E-04	[K/W]
C th, Diode [n]	1.55E+01	8.52E+00	1.95E+00	5.06E+00	[J/K]

Cauer model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	1.25E-03	1.71E-03	2.64E-03	2.91E-03	[K/W]
C th, IGBT [n]	2.24E+00	1.54E+00	1.23E+01	3.39E+01	[J/K]
R th, Diode [n]	2.51E-03	3.39E-03	5.27E-03	5.82E-03	[K/W]
C th, Diode [n]	1.12E+00	7.64E-01	6.19E+00	1.69E+01	[J/K]

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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Minebea POWER SEMICONDUCTORS

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8. For handling other than described in this manual, follow the handling instructions (IGBT-HI-00002).

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