

# 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	$\pm 20$
Collector Current	DC	$I_C$	1,200 ( $T_c=80^\circ\text{C}$ )
	1ms	$I_{CP}$	
Forward Current	DC	$I_F$	1,200
	1ms	$I_{FM}$	2,400
Junction Temperature	$T_j$	$^\circ\text{C}$	-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 definition 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	$V_{CE}=4,500\text{V}$ , $V_{GE}=0\text{V}$ , $T_j=25^\circ\text{C}$
Gate Emitter Leakage Current	$I_{GES}$	nA	-500	-	+500	$V_{GE}=\pm 20\text{V}$ , $V_{CE}=0\text{V}$ , $T_j=25^\circ\text{C}$
Collector Emitter Saturation Voltage	$V_{CE(sat)}$	V	3.5	4.2	4.7	$I_C=1200\text{A}$ , $V_{GE}=15\text{V}$ , $T_j=125^\circ\text{C}$
Gate Emitter Threshold Voltage	$V_{GE(TO)}$	V	5.4	6.4	7.4	$V_{CE}=10\text{V}$ , $I_C=1200\text{mA}$ , $T_j=25^\circ\text{C}$
Input Capacitance	$C_{ies}$	nF	-	165	-	$V_{CE}=10\text{V}$ , $V_{GE}=0\text{V}$ , $f=100\text{kHz}$ , $T_j=25^\circ\text{C}$
Internal Gate Resistance	$R_{ge}$	$\Omega$	-	0.8	-	$V_{CE}=10\text{V}$ , $V_{GE}=0\text{V}$ , $f=100\text{kHz}$ , $T_j=25^\circ\text{C}$
Switching Times	Rise Time	$t_r$	1.0	2.1	4.2	$V_{CC}=2,600\text{V}$ , $I_C=1200\text{A}$
	Turn On Time	$t_{on}$	1.3	2.7	5.4	$L_s=150\text{nH}$
	Fall Time	$t_f$	1.2	2.4	3.6	$R_g=3.3\Omega$ (5)
	Turn Off Time	$t_{off}$	2.4	4.8	7.2	$V_{GE}=\pm 15\text{V}$ , $T_j=125^\circ\text{C}$
Peak Forward Voltage Drop	$V_{FM}$	V	3.0	3.7	4.2	$I_F=1200\text{A}$ , $V_{GE}=0\text{V}$ , $T_j=125^\circ\text{C}$
Reverse Recovery Time	$t_{rr}$	$\mu\text{s}$	0.3	0.7	1.4	$V_{CC}=2600\text{V}$ , $I_F=1200\text{A}$ , $L_s=150\text{nH}$ , $T_j=125^\circ\text{C}$
Turn On Loss	$E_{on(10\%)}$	J/p	-	3.2	4.8	$V_{CC}=2600\text{V}$ , $I_C=I_F=1200\text{A}$ , $L_s=150\text{nH}$ , $R_g=3.3\Omega$ (5), $V_{GE}=\pm 15\text{V}$ , $T_j=125^\circ\text{C}$
	$E_{on(full)}$	J/p	-	3.8	-	
Turn Off Loss	$E_{off(10\%)}$	J/p	-	3.2	4.8	
	$E_{off(full)}$	J/p	-	3.8	-	
Reverse Recovery Loss	$E_{rr(10\%)}$	J/p	-	2.5	3.7	
	$E_{rr(full)}$	J/p	-	2.8	-	
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 $\leq 50\mu\text{m}$ )

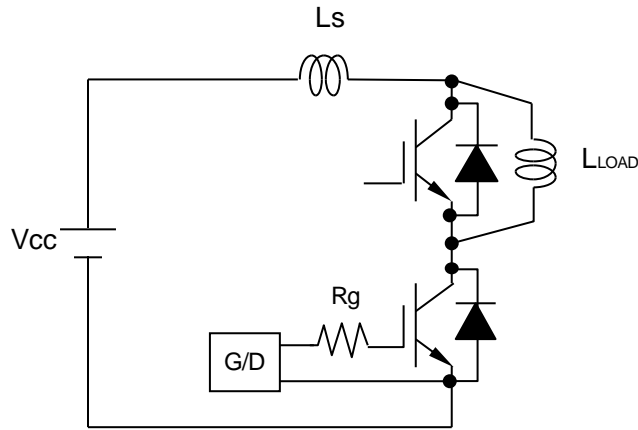
Notes:(5)  $R_g$  value is the test condition's value for evaluation of the switching times, not recommended value.

Please, determine the suitable  $R_g$  value after the measurement of switching waveforms (overshoot voltage, etc.) with appliance mounted.

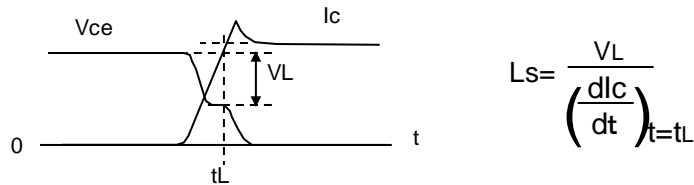
- \* Please contact our representatives at order.
- \* For improvement, specifications are subject to change without notice.
- \* For actual application, please confirm this spec sheet is the newest revision.

# MBN1200H45E2-H

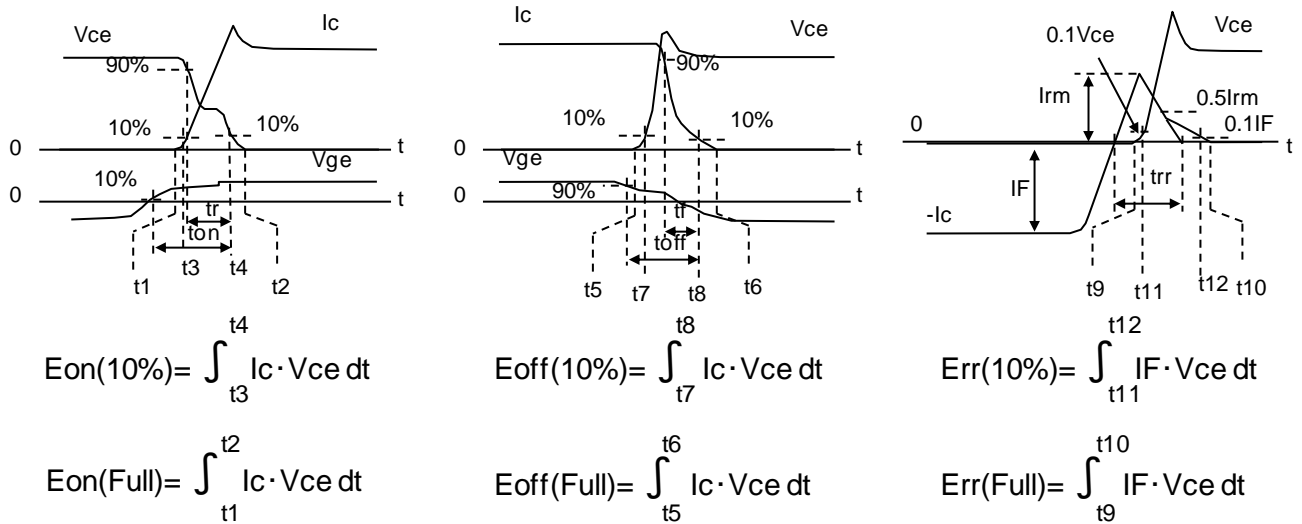
## DEFINITION OF TEST CIRCUIT



**Fig.1 Switching test circuit**



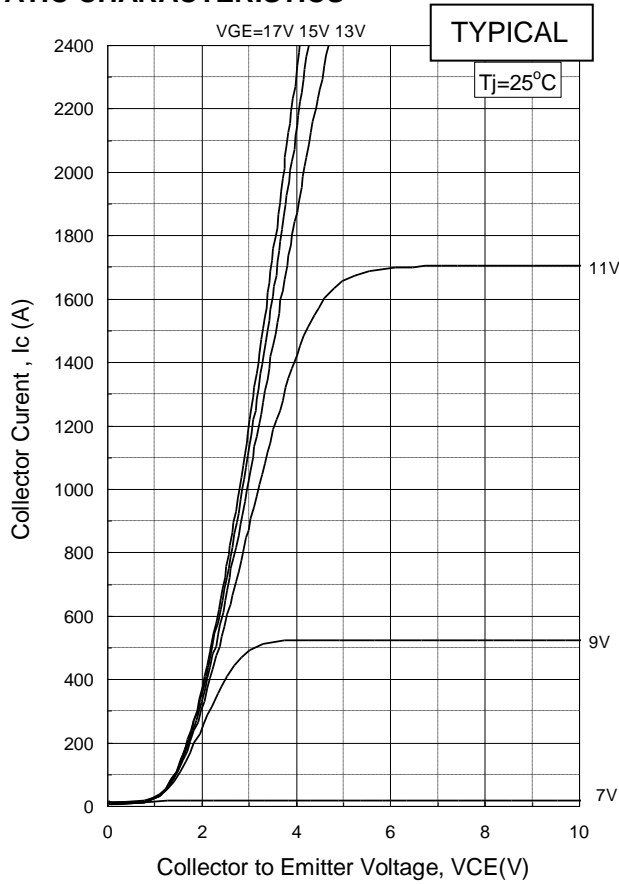
**Fig.2 Definition of Ls**



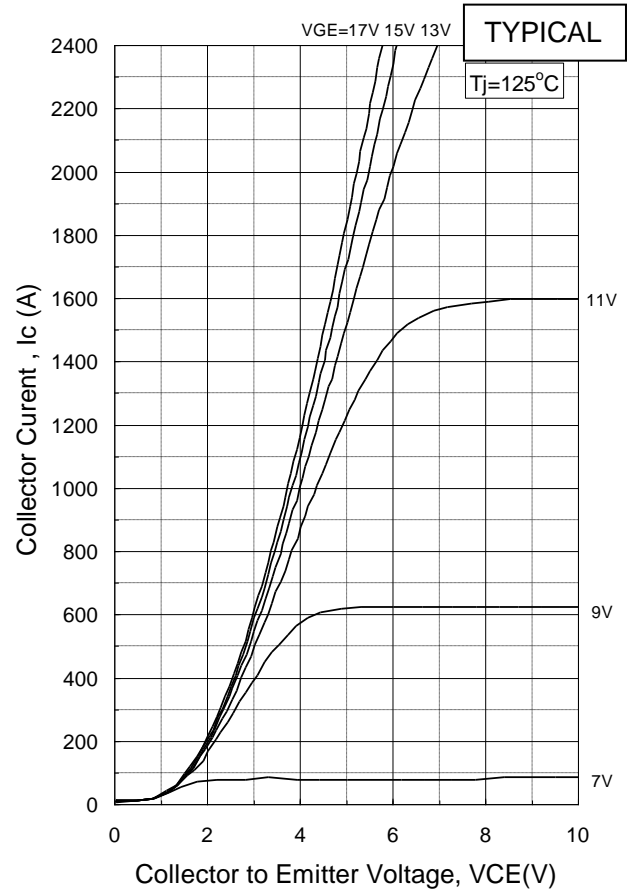
**Fig.3 Definition of switching loss**

# MBN1200H45E2-H

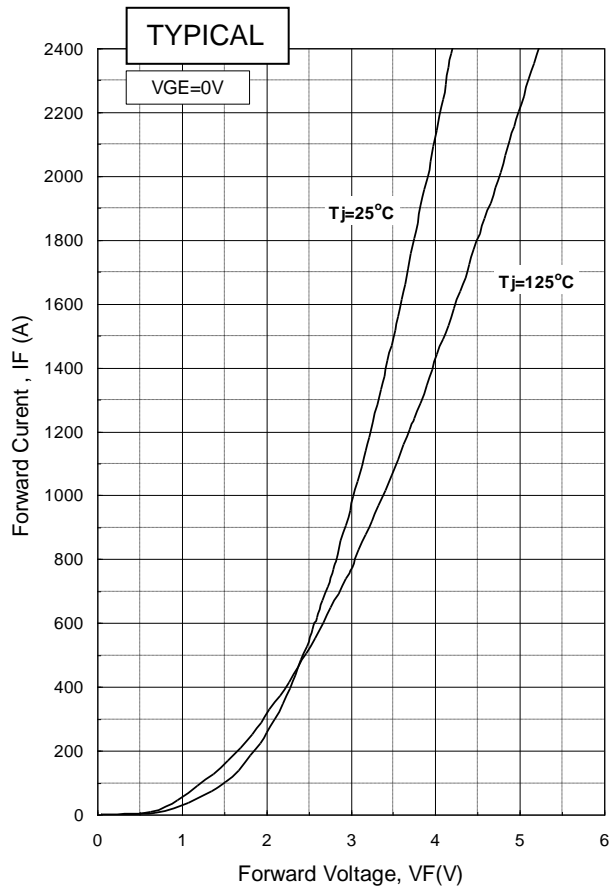
## STATIC CHARACTERISTICS



I<sub>c</sub> vs. V<sub>CE</sub>(T<sub>j</sub>=25°C)



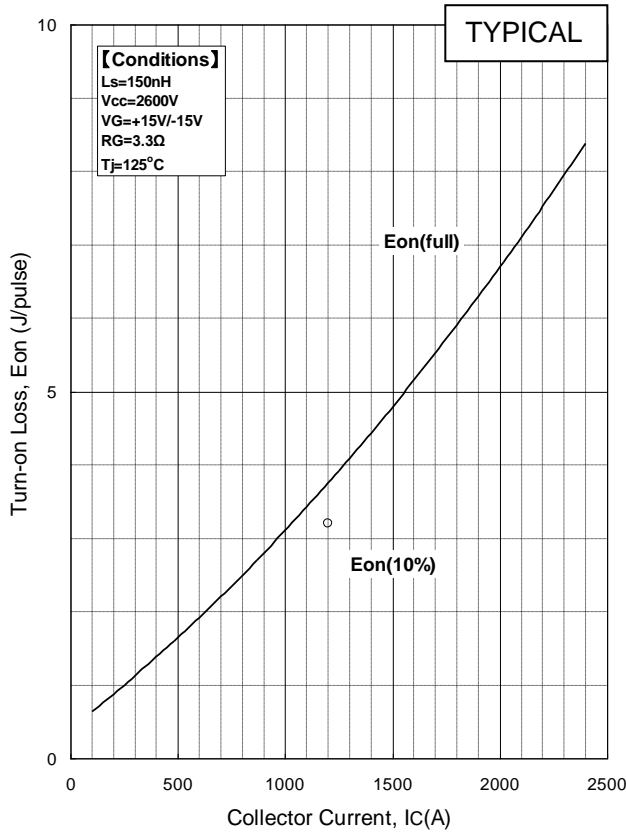
I<sub>c</sub> vs. V<sub>CE</sub>(T<sub>j</sub>=125°C)



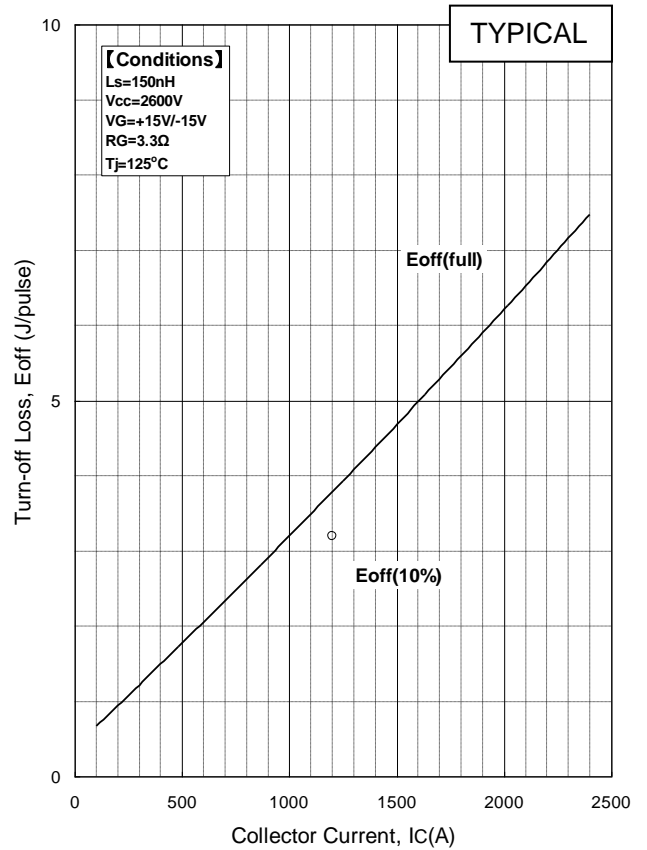
I<sub>F</sub> vs. V<sub>F</sub>

# MBN1200H45E2-H

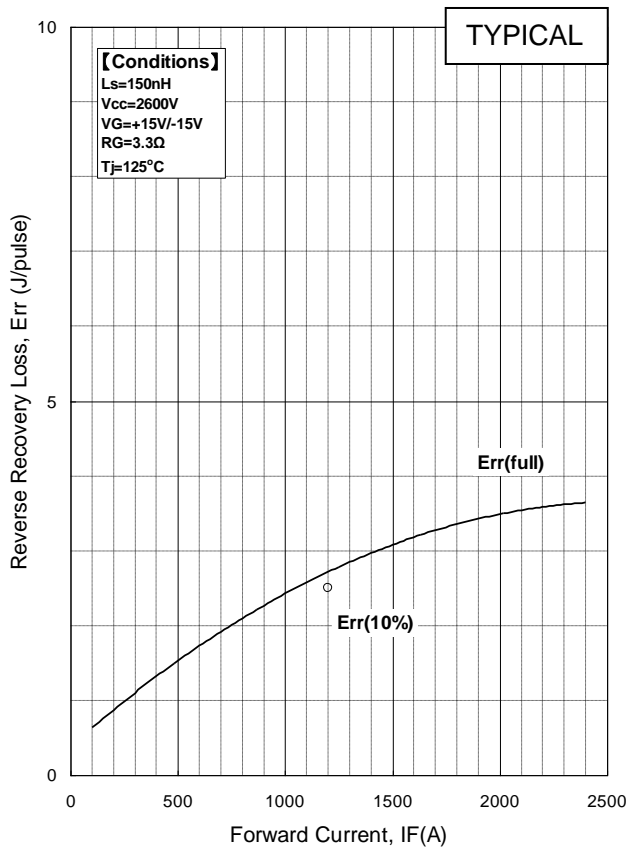
## DYNAMIC CHARACTERISTICS



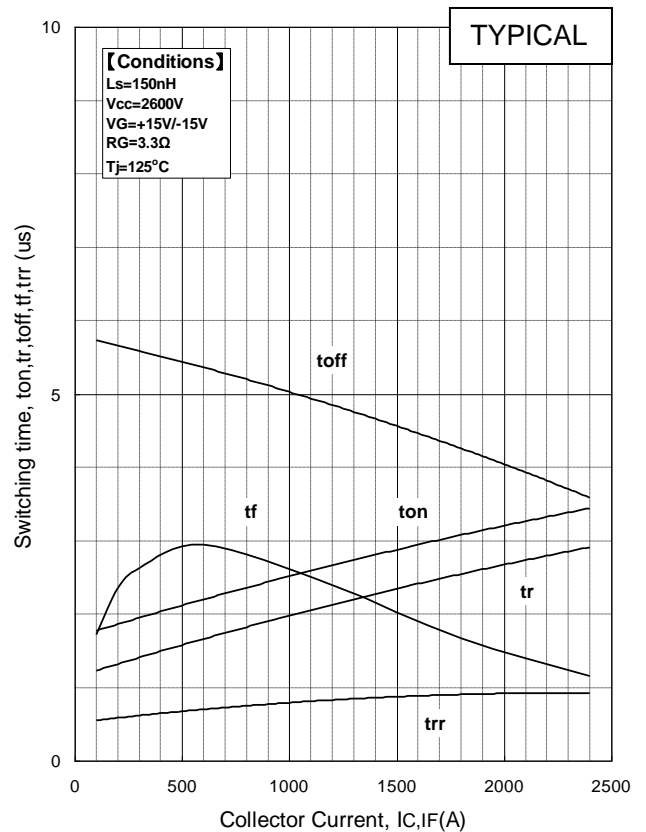
Turn-on loss vs. Collector current



Turn-off loss vs. Collector current



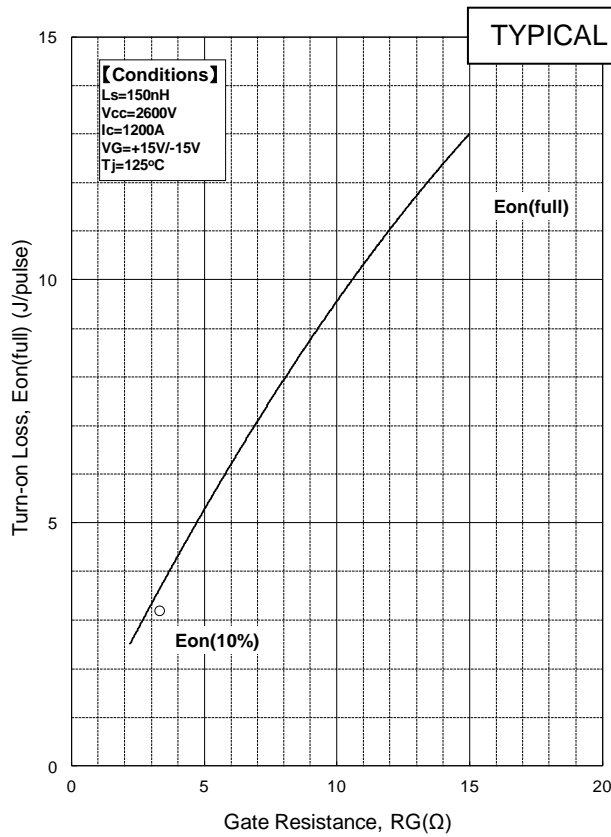
Recovery loss vs. Forward current



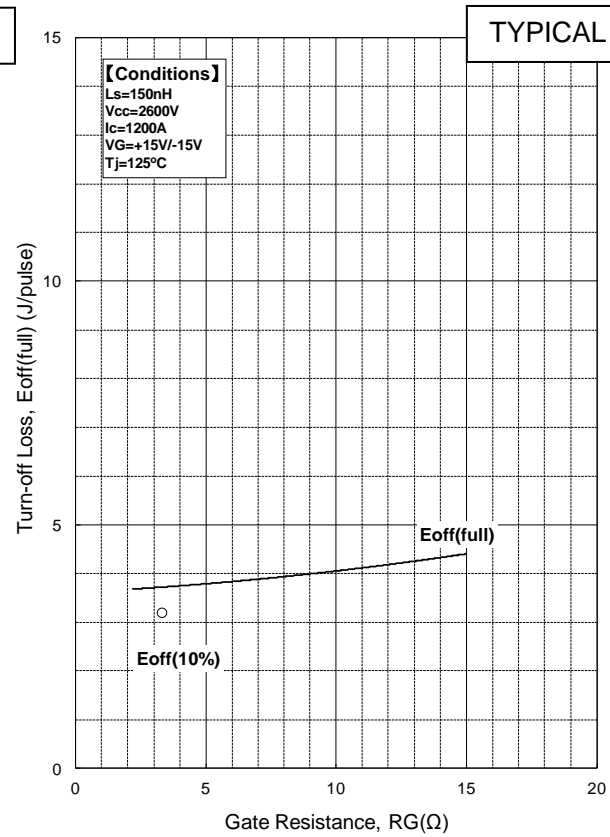
Switching time vs. Collector current

# MBN1200H45E2-H

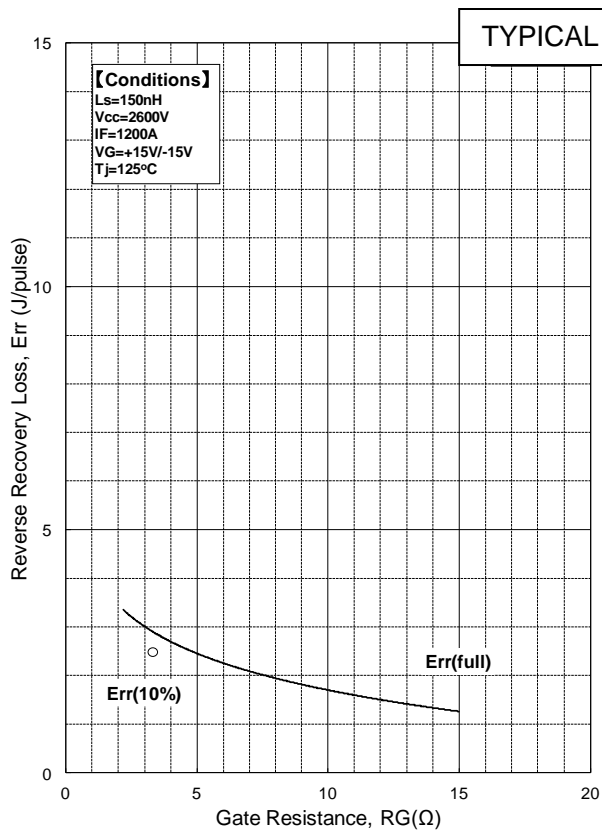
## DYNAMIC CHARACTERISTICS



Turn-on loss vs. Gate Resistance

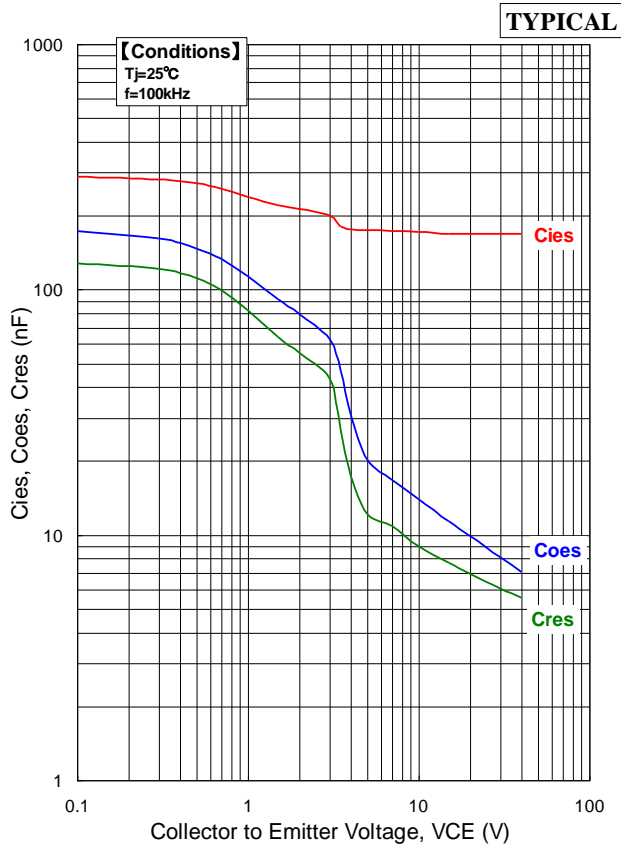


Turn-off loss vs. Gate Resistance

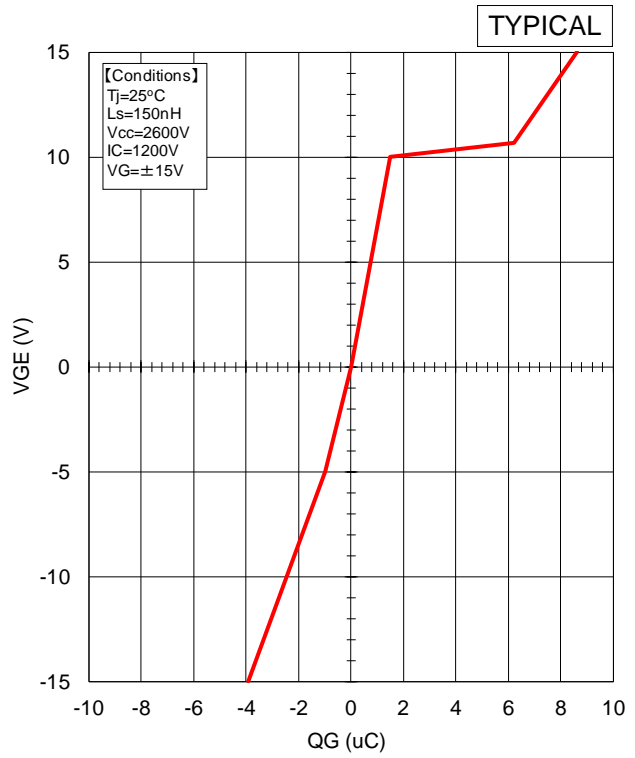


Recovery loss vs. Gate Resistance

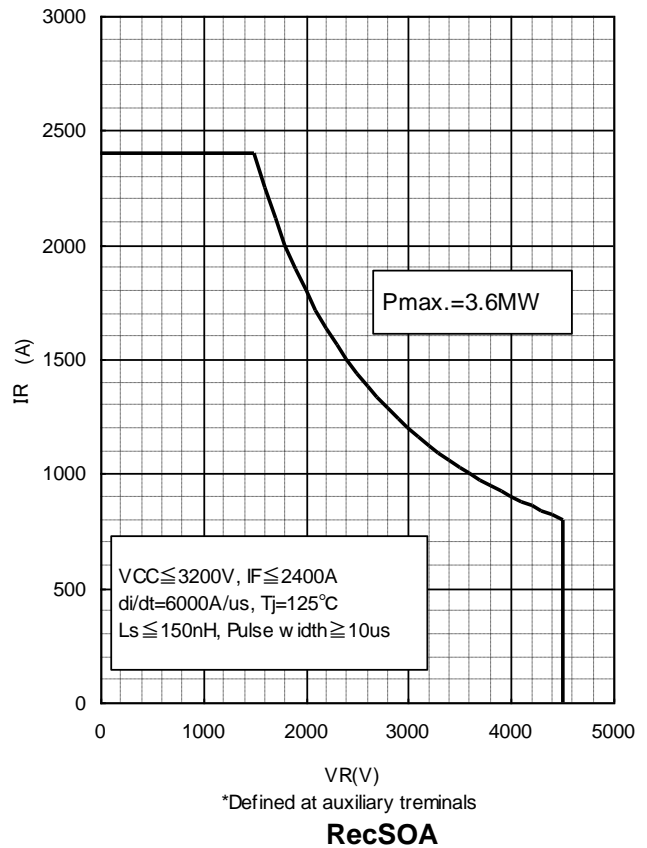
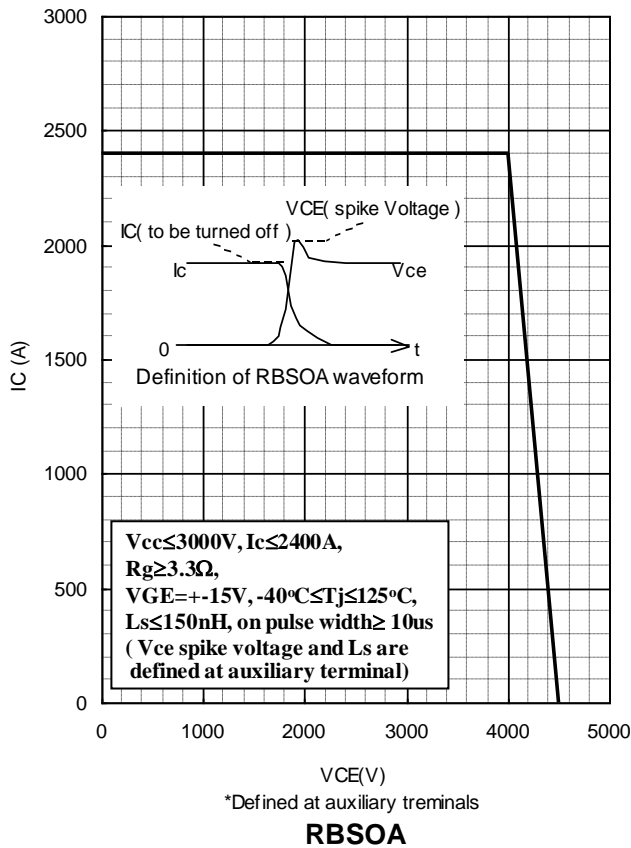
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**Cies, Coes, Cres - VCE**

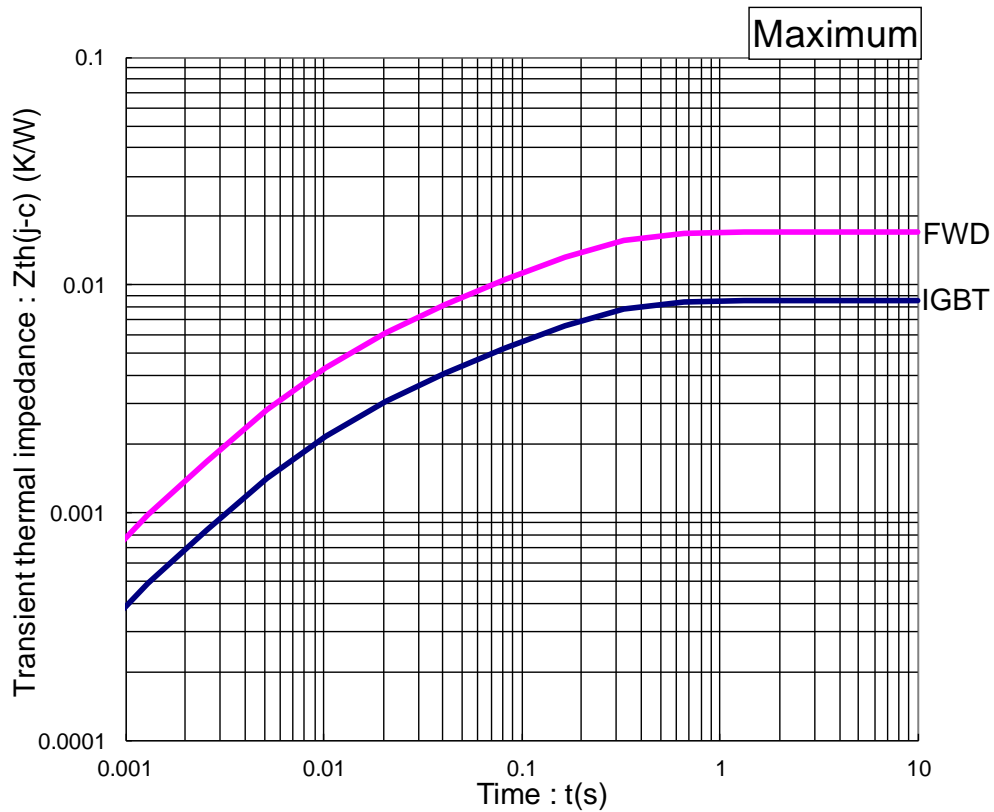


**QG - VGE**



# MBN1200H45E2-H

## TRANSIENT THERMAL IMPEDANCE



Transient Thermal Impedance Curve

### Curve Approximation Model

$$\sum r_{th}[n] * (1 - \exp(-t/r_{th}[n]))$$

n	1	2	3	4	Unit
$\tau_{th}[n]$	1.63E-01	2.71E-02	6.12E-03	8.66E-04	sec
$r_{th}[n,IGBT]$	5.24E-03	1.61E-03	1.56E-03	8.64E-05	K/W
$r_{th}[n,Diode]$	1.05E-02	3.18E-03	3.13E-03	1.71E-04	K/W

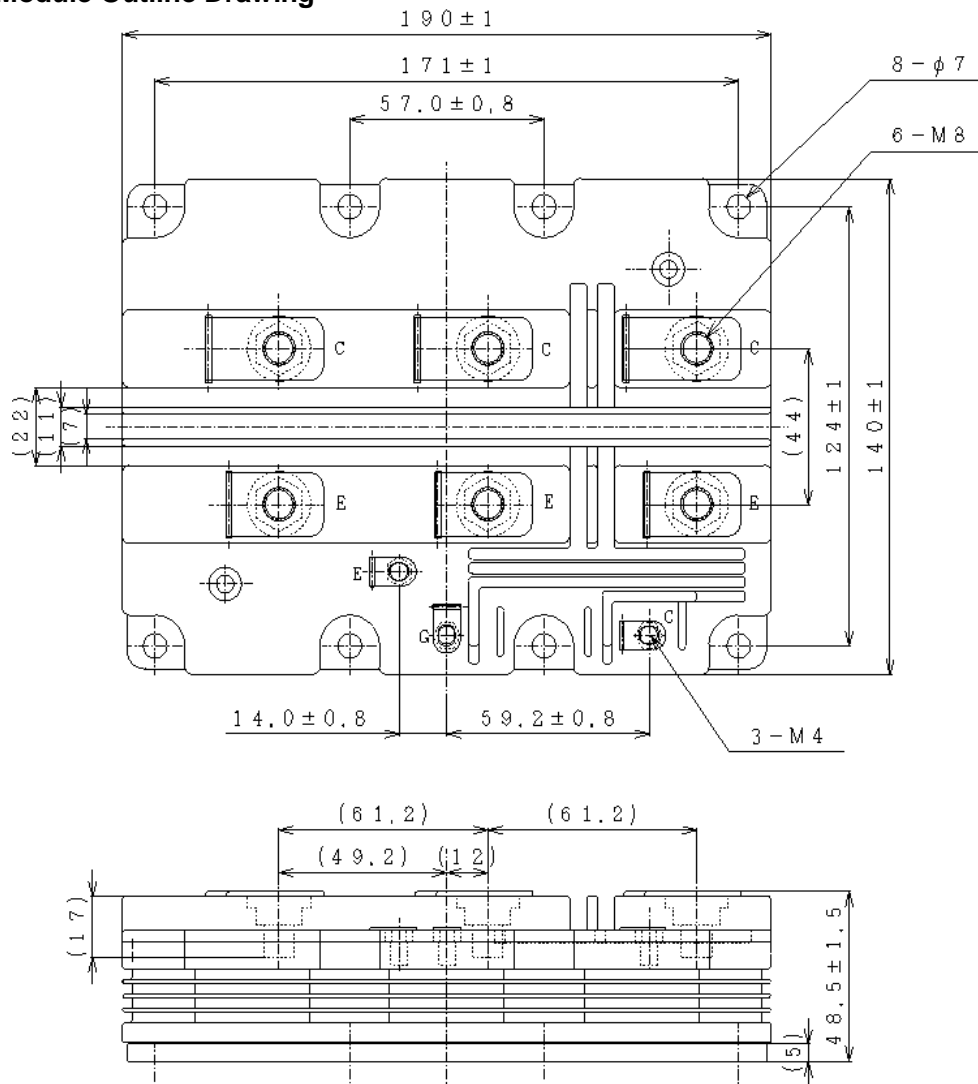
### Material declaration

Please note that following materials are contained in the product In order to keep characteristics and reliability level.

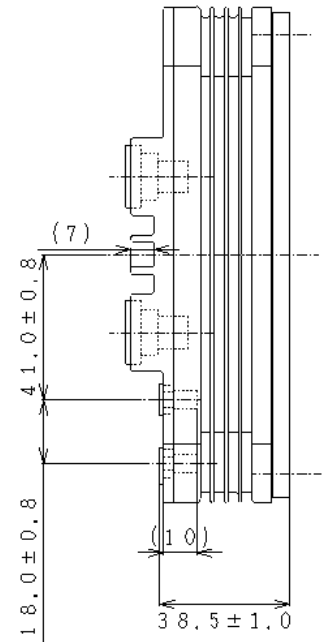
Material	Contained part
Lead (Pb) and its compounds	Solder

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## Module Outline Drawing

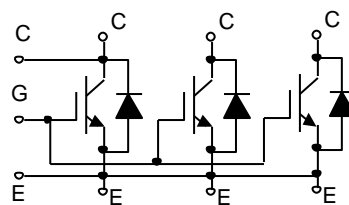


Unit: mm



Weight: 1550(g)

## CIRCUIT DIAGRAM



TERMINALS



# MBN1200H45E2-H

## HITACHI POWER SEMICONDUCTORS

### Notices

1. The information given herein, including the specifications and dimensions, is subject to change without prior notice to improve product characteristics. Before ordering, purchasers are advised to contact Hitachi sales department for the latest version of this data sheets.
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