

MBM250H33E3

Silicon N-channel IGBT 3300V E3 version

FEATURES

- * Soft switching behavior & low conduction loss:
Soft low-injection punch-through
High conductivity IGBT.
- * Low driving power due to low input capacitance MOS gate.
- * Low noise recovery: Ultra soft fast recovery diode.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C)

Item	Symbol	Unit	MBM250H33E3
Collector Emitter Voltage	V _{CES}	V	3,300
Gate Emitter Voltage	V _{GES}	V	±20
Collector Current	DC	I _C	250(T _C =95°C)
	1ms	I _{CRM}	500
Forward Current	DC	I _F	250
	1ms	I _{FRM}	500
Peak Forward Surge Current	IFSM	Ap	2,000
Junction Temperature	T _{vj}	°C	-40 ~ +150
Operating Junction Temperature	T _{vj op}	°C	-40 ~ +125
Case Temperature	T _C	°C	-40 ~ +125
Storage Temperature	T _{stg}	°C	-50 ~ +125
Isolation Voltage	V _{ISO}	V _{RMS}	7,700(AC 1 minute)
Screw Torque	Mounting (M6)	N·m	6 (1)

Notes: (1) 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	-	-	2	V _{CE} =3,300V, V _{GE} =0V, T _{vj} =25°C
Gate Emitter Leakage Current	I _{GES}	nA	-500	-	+500	V _{CE} =3,300V, V _{GE} =0V, T _{vj} =125°C
Collector Emitter Saturation Voltage	V _{CE(sat)}	V	-	2.65	-	I _C =250A, V _{GE} =15V, T _{vj} =25°C
			2.70	3.40	3.90	I _C =250A, V _{GE} =15V, T _{vj} =125°C
Gate Emitter Threshold Voltage	V _{GE(th)}	V	5.5	6.3	7.5	V _{CE} =10V, I _C =250mA, T _{vj} =25°C
Gate Charge	Q _g	uC	-	2.8	-	V _{CC} =1,800V, I _C =250A, V _{GE} =±15V
Input Capacitance	C _{ies}	nF	-	33	-	
Output Capacitance	C _{oes}	nF	-	3.3	-	V _{CE} =10V, V _{GE} =0V, f=100kHz, T _{vj} =25°C
Reverse transfer capacitance	C _{res}	nF	-	2.3	-	
Internal Gate Resistance	R _{G(int)}	Ω	-	5.4	-	V _{CE} =10V, V _{GE} =0V, f=100kHz, T _{vj} =25°C
Turn On Delay Time	t _{d(on)}	μs	-	0.7	-	V _{CC} =1,800V, I _C =250A
Rise Time	t _r		-	1.8	2.5	L _S =400nH
Turn Off Delay Time	t _{d(off)}		-	2.1	-	R _G =15/15Ω (2)
Fall Time	t _f		-	1.9	3.2	V _{GE} =±15V, T _{vj} =125°C
Forward Voltage Drop	V _F	V	2.3	2.9	3.3	I _F =250A, V _{GE} =0V, T _{vj} =125°C
Reverse Recovery Time	t _{rr}	μs	-	0.7	1.2	V _{CC} =1,800V, I _F =250A, L _S =100nH T _{vj} =125°C
Turn On Loss	E _{on(10%)}	J/P	-	0.43	0.58	V _{CC} =1,800V, I _C =250A, L _S =400nH
Turn Off Loss	E _{off(10%)}	J/P	-	0.37	0.50	R _G =15/15Ω (2)
Reverse Recovery Loss	E _{rr(10%)}	J/P	-	0.31	0.41	V _{GE} =±15V, T _{vj} =125°C
Partial discharge extinction voltage	V _e	V _{RMS}	3,500	-	-	f=50Hz, Q _{PD} ≤10pC(acc. to IEC 61287)
Stray inductance module	L _{SCE}	nH	-	140	-	Between C1- E2
Thermal Impedance	I _{GBT} R _{th(j-c)}	K/W	-	-	0.050	Junction to case
	FWD R _{th(j-c)}		-	-	0.100	
Contact Thermal Impedance	R _{th(c-f)}	K/W	-	0.032	-	Case to fin (par 1 arm)

Notes: (2) 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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MODULE MECHANICAL CHARACTERISTICS

Item		Unit	Characteristics	Conditions
Weight		g	840	
Creepage Distance	Between terminal	mm	51	C1 main - C2/E1 main C2/E1 main - E2 main
	Terminal-Base	mm	57	G1E1 - base
Clearance Distance	Between terminal	mm	20	C1 main - C2/E1 main C2/E1 main - E2 main
	Terminal-Base	mm	36	C1 aux - base
Resistance, Terminal-chip	$R_{CC'+EE'}$	mΩ	1.5	Terminal to chip
Comparative Tracking Index (CTI)			600	
Module base plate Material			Cu	
Baseplate Thickness		mm	5	
Insulation plate Material			AlN	
Terminal Surface treatment			Ni plating	
Case Material			Poly-Phenilene Sulfide	

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DEFINITION OF TEST CIRCUIT

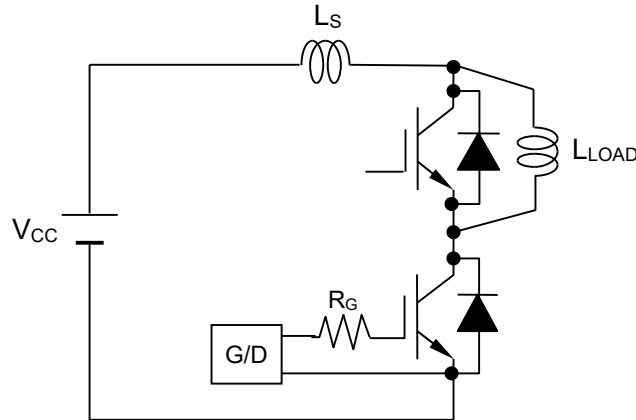


Fig.1 Switching test circuit

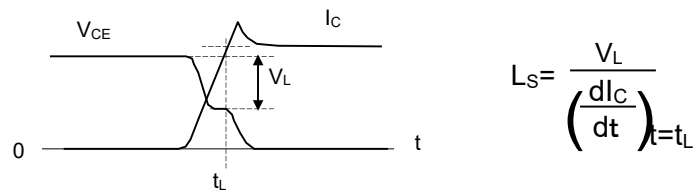


Fig.2 Definition of stray inductance

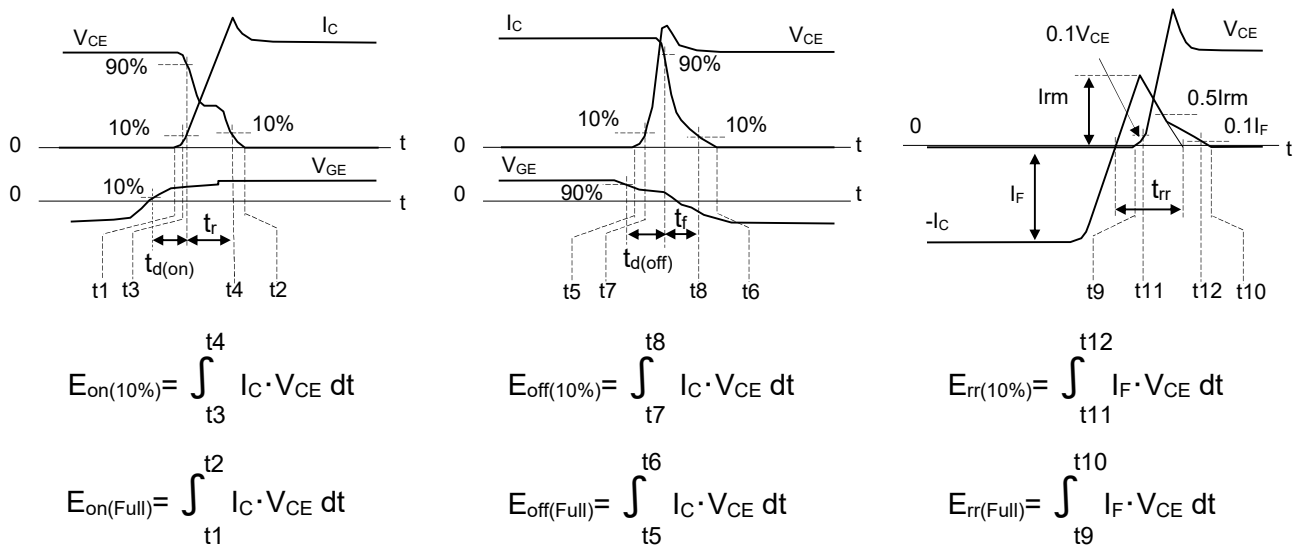
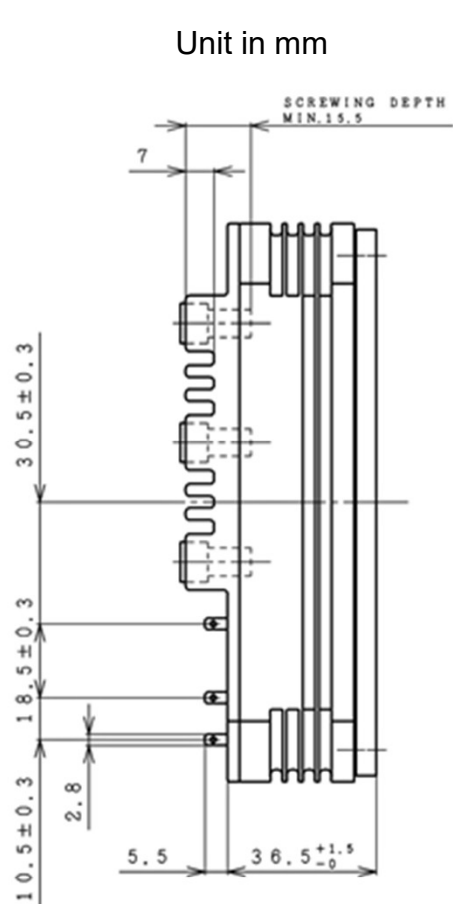


Fig.3 Definition of switching loss

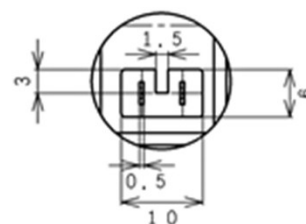
OUTLINE DRAWING



Unit in mm

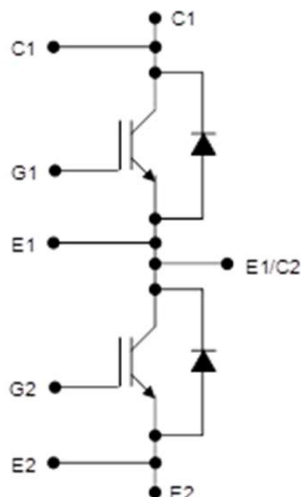
SCREWING DEPTH
MIN.15.5

A (2 : 1)

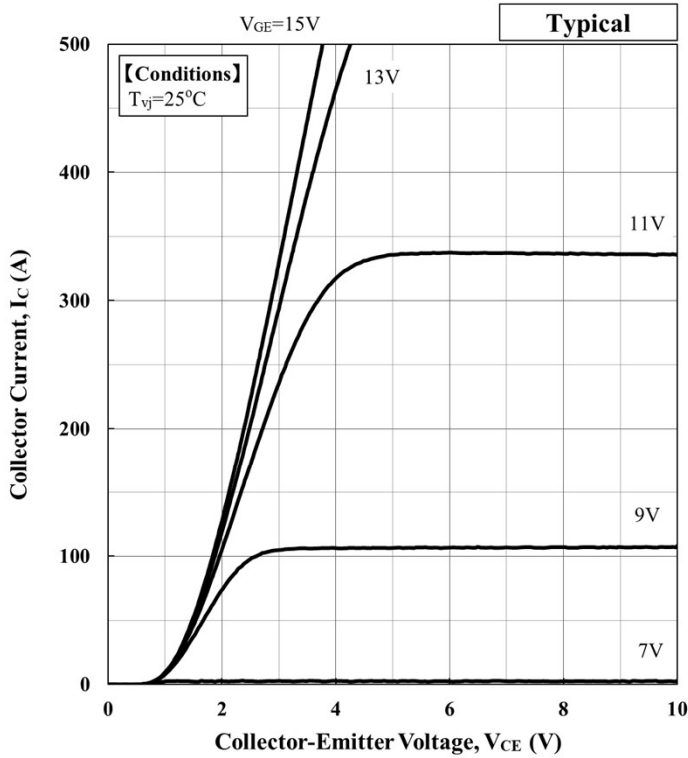


Weight: 840g

CIRCUIT DIAGRAM

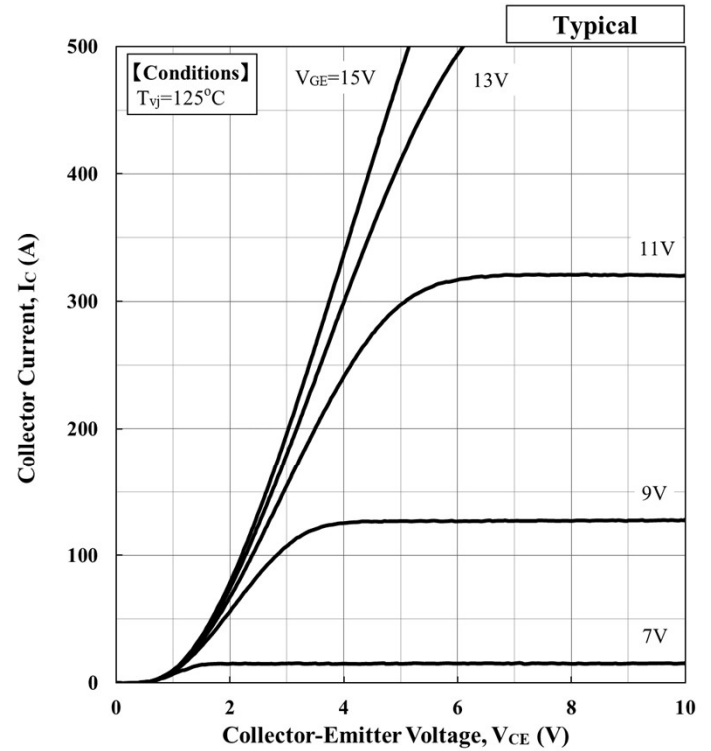


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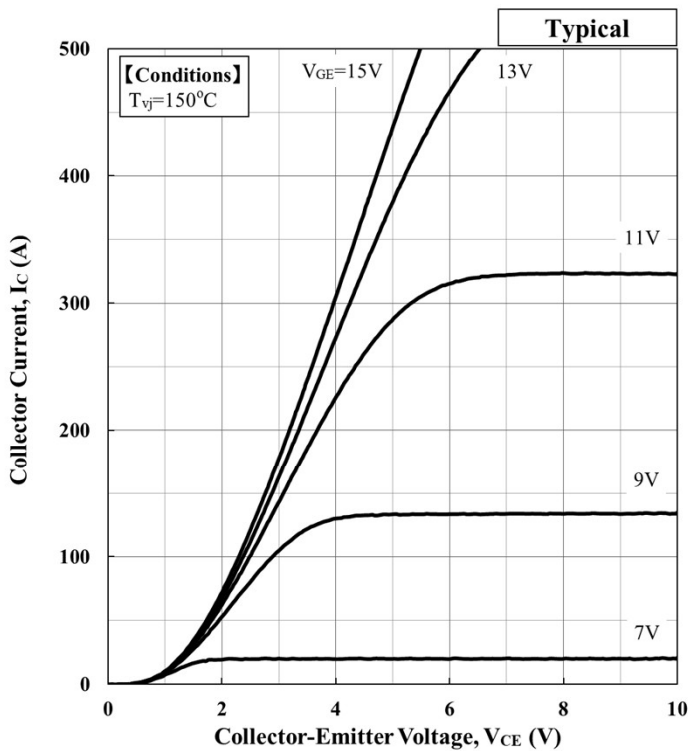
$V_{CE}(sat)[V] = a_3 \cdot I_C ^3 + a_2 \cdot I_C ^2 + a_1 \cdot I_C + a_0$					
Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
25	15	7.92E-09	-9.63E-06	8.20E-03	1.07E+00

Collector Current vs. Collector Emitter Voltage



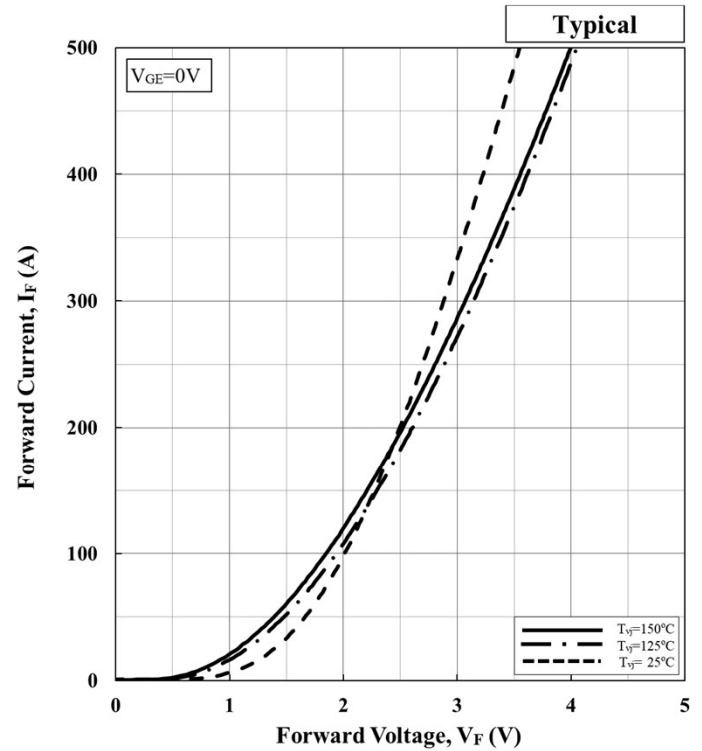
$V_{CE}(sat)[V] = a_3 \cdot I_C ^3 + a_2 \cdot I_C ^2 + a_1 \cdot I_C + a_0$					
Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
125	15	1.66E-08	-1.78E-05	1.29E-02	1.05E+00

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
150	15	1.75E-08	-1.85E-05	1.37E-02	1.06E+00

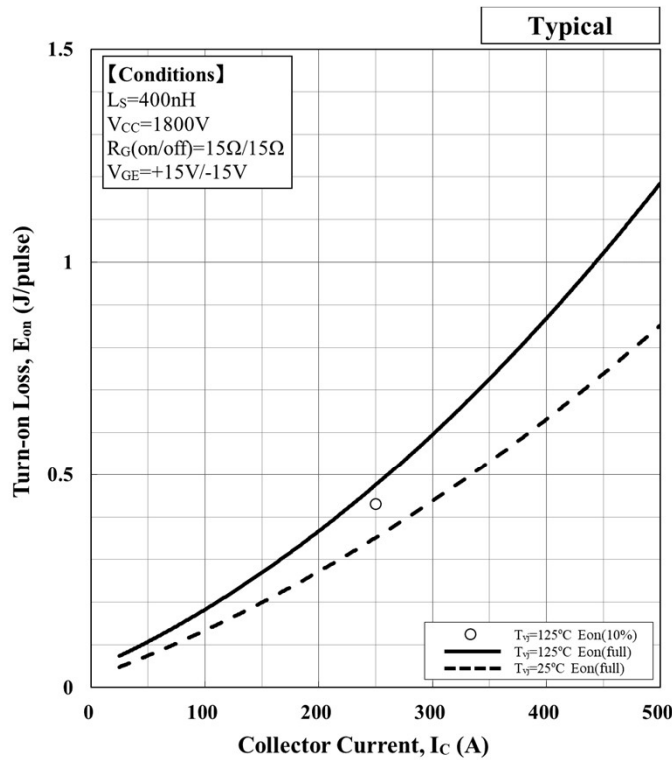
Collector Current vs. Collector Emitter Voltage



$V_F[V] = a_3 \cdot I_F ^3 + a_2 \cdot I_F ^2 + a_1 \cdot I_F + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	1.33E-08	-1.49E-05	8.75E-03	1.25E+00
125	1.58E-08	-1.82E-05	1.14E-02	9.41E-01
150	1.51E-08	-1.76E-05	1.13E-02	8.50E-01

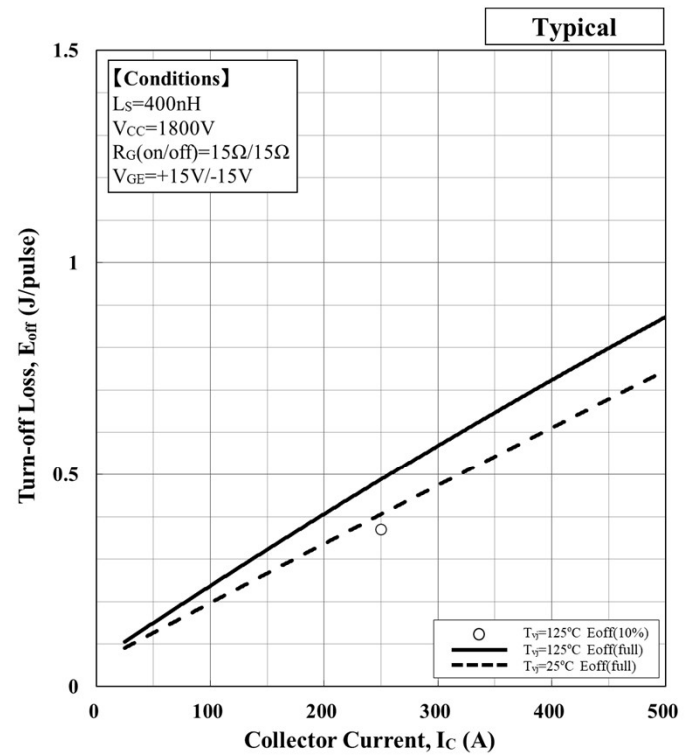
Forward Voltage of free-wheeling diode

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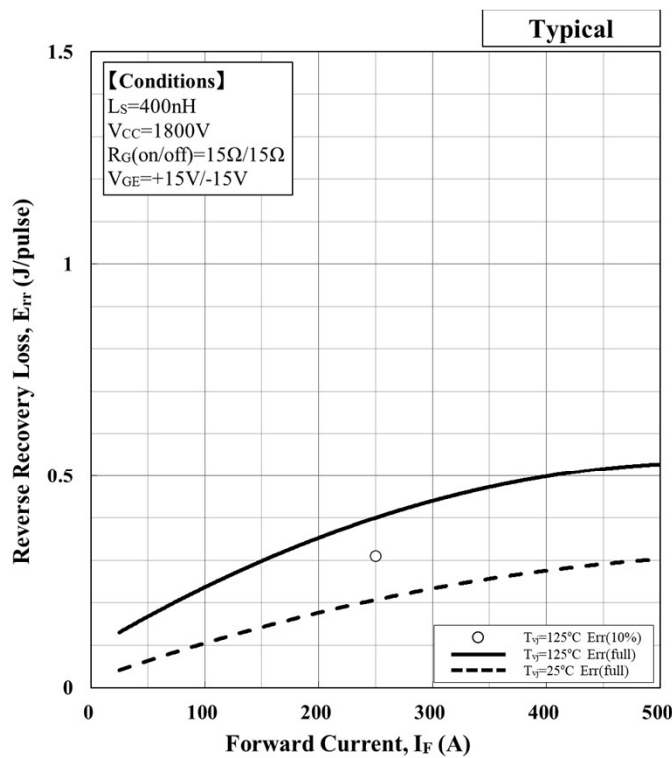
$E [J] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	-	1.38E-06	9.70E-04	2.31E-02
125	-	2.22E-06	1.18E-03	4.33E-02

Turn-on loss vs. Collector current



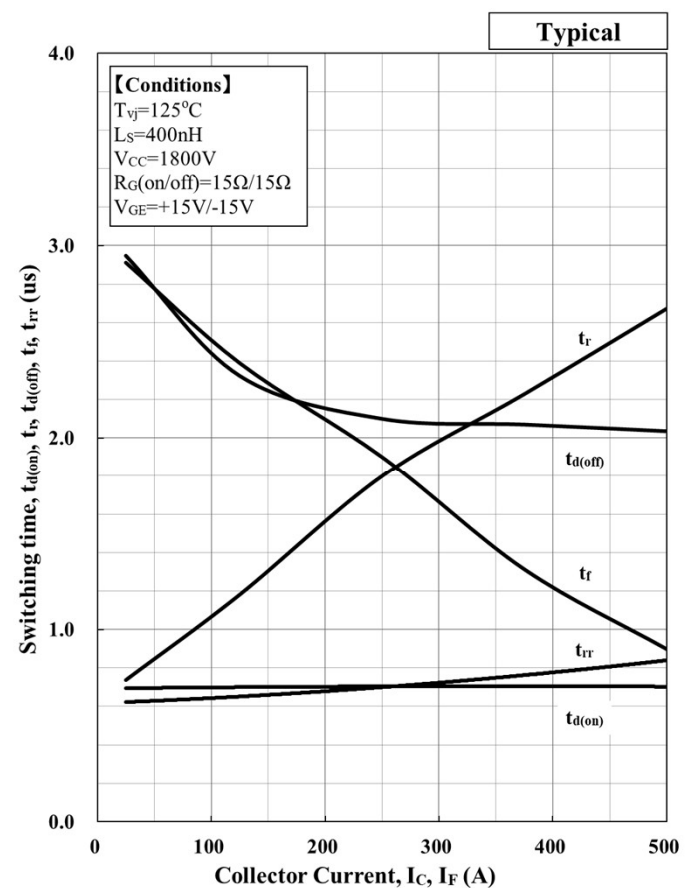
$E [J] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	-	-7.01E-08	1.42E-03	5.58E-02
125	-	-3.45E-07	1.80E-03	6.09E-02

Turn-off loss vs. Collector current



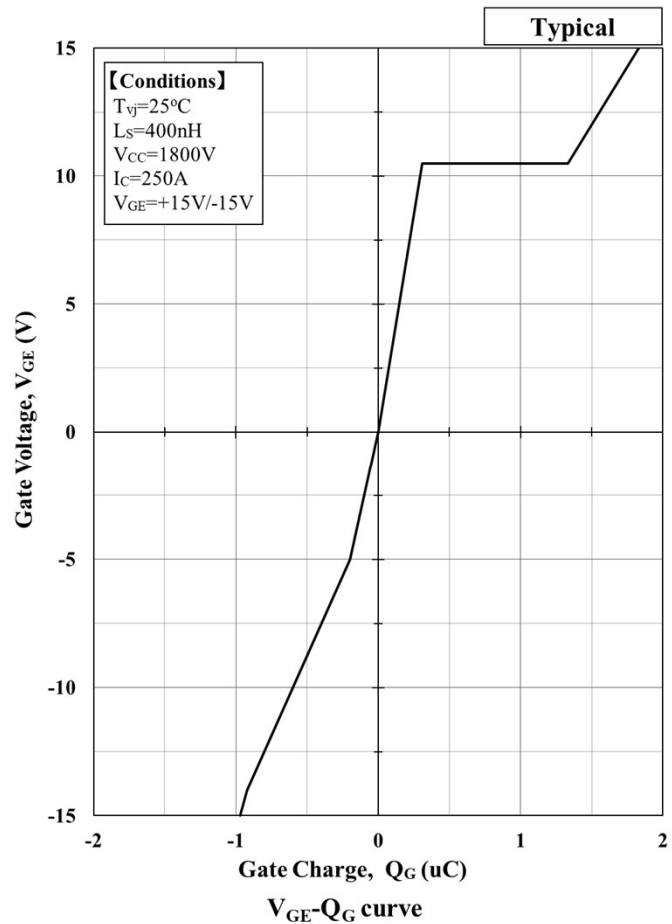
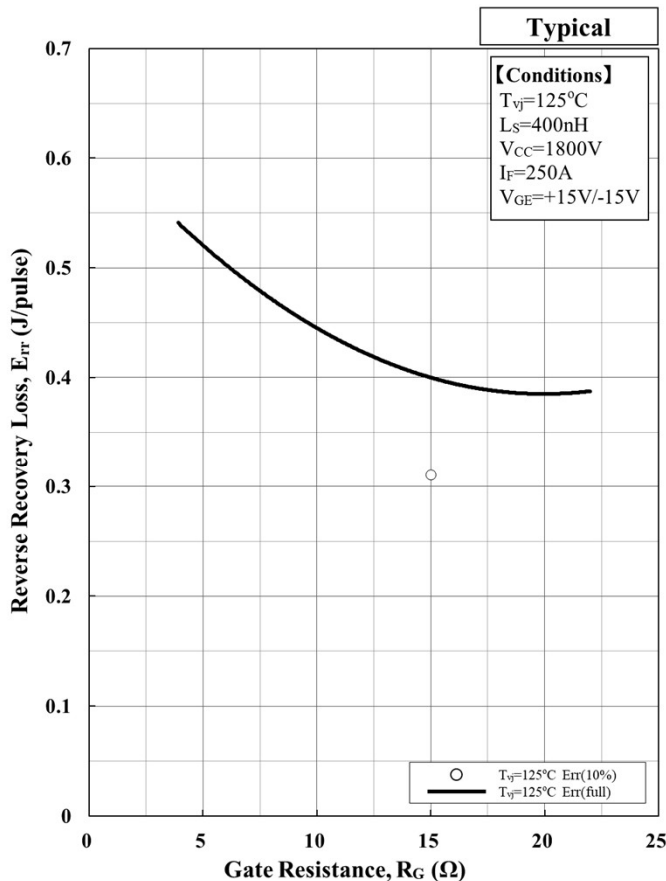
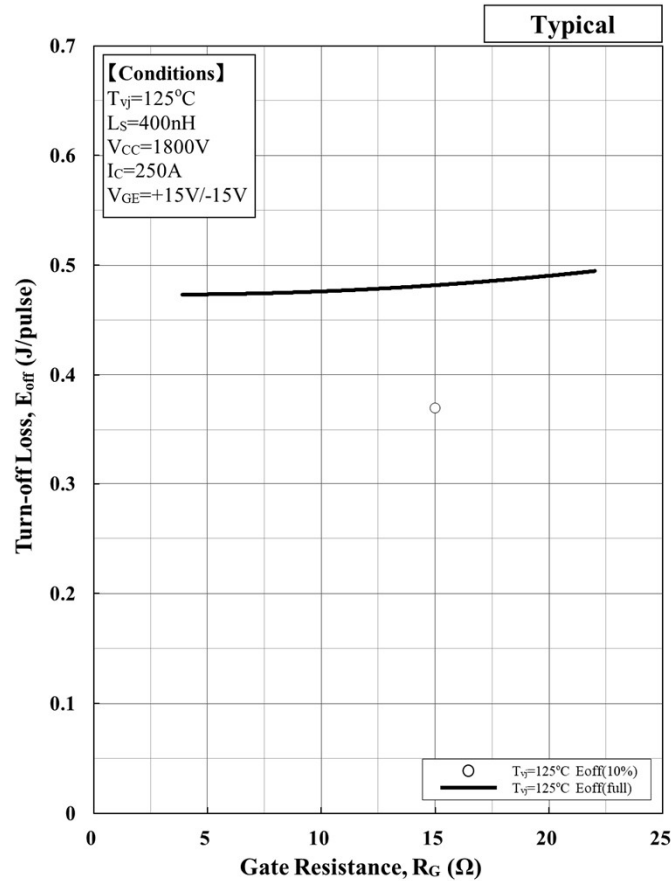
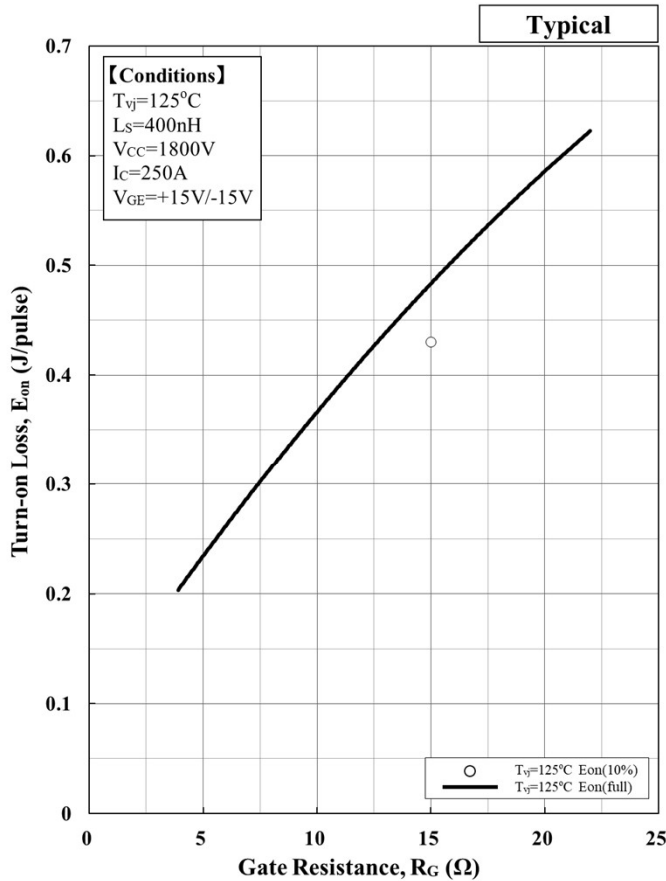
$E [J] = a_3 \cdot I_F ^3 + a_2 \cdot I_F ^2 + a_1 \cdot I_F + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	-	-7.40E-07	9.39E-04	1.82E-02
125	-	-1.45E-06	1.60E-03	9.12E-02

Recovery loss vs. Forward current

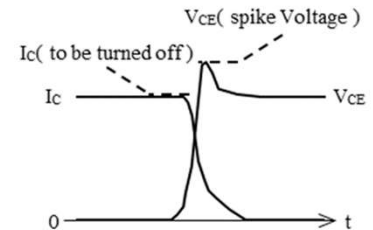
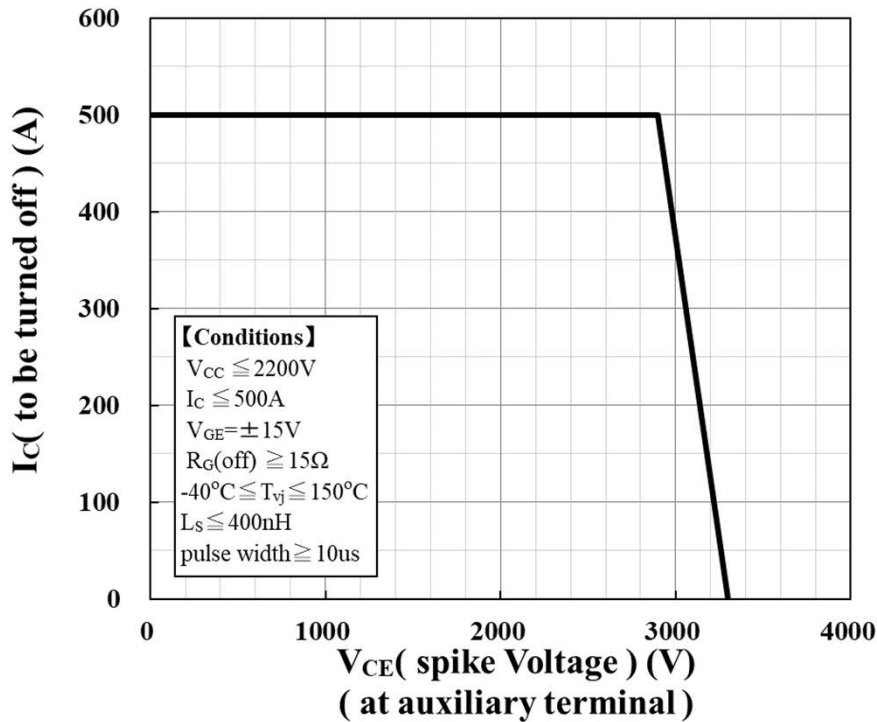


Switching time vs. Collector Current

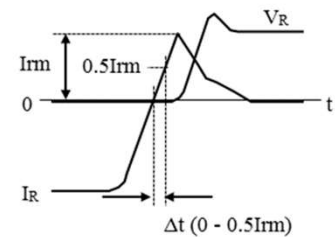
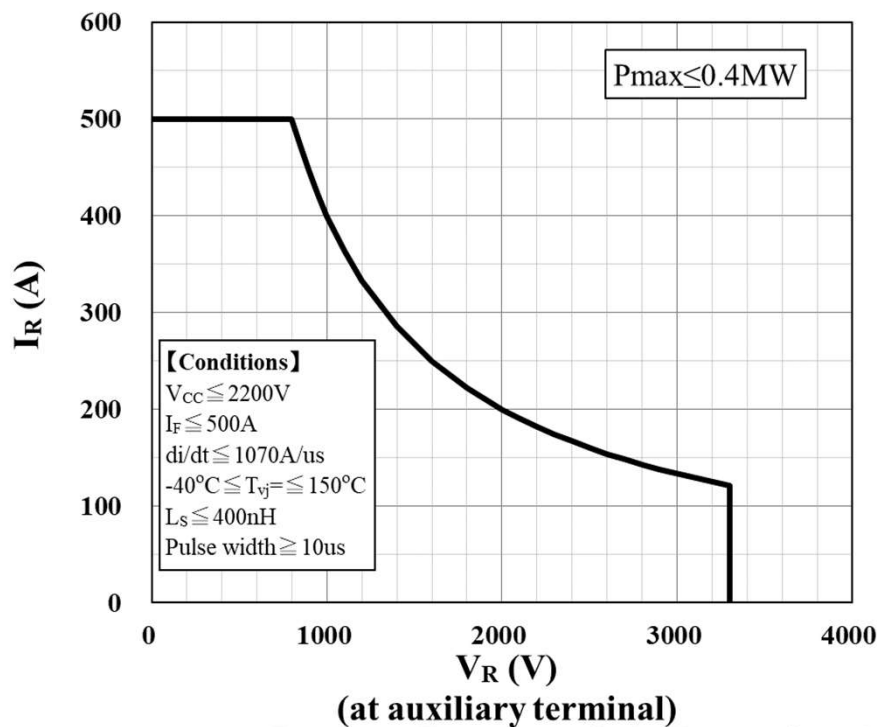
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Definition of RBSOA waveform

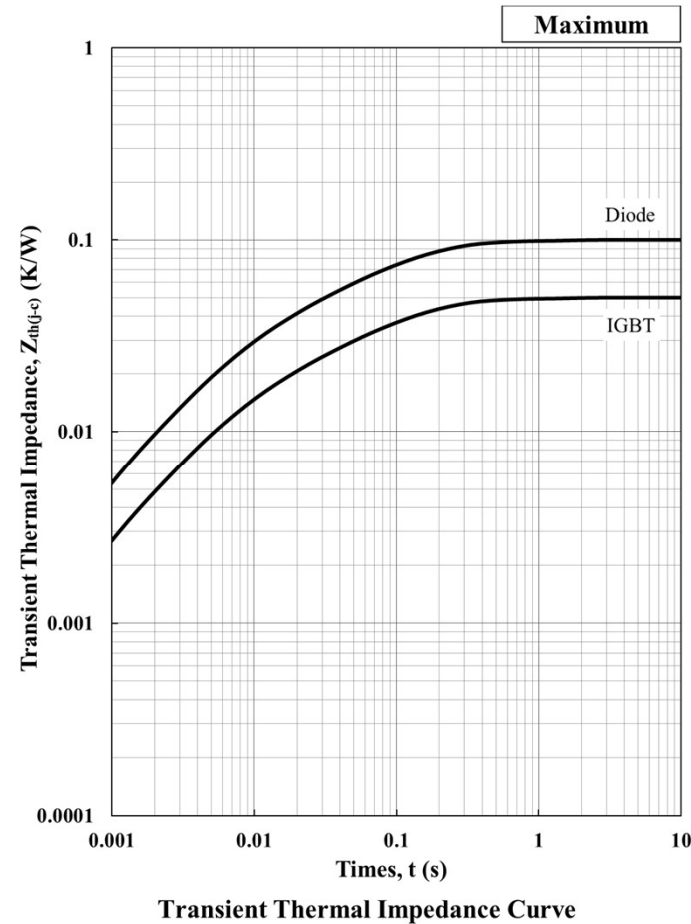
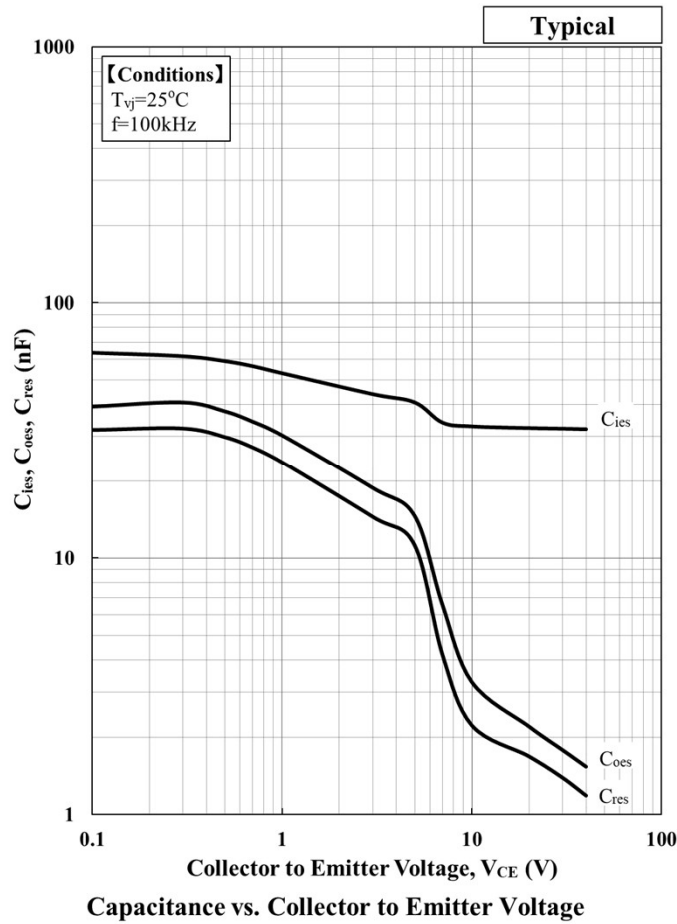


$$\frac{di}{dt} = \frac{0.5I_{rm}}{\Delta t}$$

Definition of Recovery di/dt

Reverse Recovery Safe Operation Area (RRSOA)

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Foster model lumped circuit constant

n	1	2	3	4
R th, IGBT [n]	9.27E-03	2.52E-02	1.32E-02	2.35E-03
C th, IGBT [n]	2.94E+01	2.87E+00	6.79E-01	8.61E-01
R th, Diode [n]	1.83E-02	5.07E-02	2.61E-02	4.89E-03
C th, Diode [n]	1.49E+01	1.42E+00	3.45E-01	4.13E-01

Cauer model lumped circuit constant

n	1	2	3	4
R th, IGBT [n]	1.22E-02	1.20E-02	2.13E-02	4.47E-03
C th, IGBT [n]	3.32E-01	5.09E-01	2.70E+00	5.60E+01
R th, Diode [n]	2.42E-02	2.42E-02	4.27E-02	8.84E-03
C th, Diode [n]	1.64E-01	2.59E-01	1.34E+00	2.84E+01

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

Notices

1. Since mishandling of semiconductor devices may cause malfunctions, please be sure to read "Precautions for Safe Use and Notices" in the individual brochure before use.
2. When designing an electronic circuit using semiconductor devices, please do not exceed the absolute maximum rating specified for the device under any external fluctuations. And for pulse applications, please also do not exceed the "Safe Operating Area (SOA)".
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6. This specification is a material for component selection, which describes specifications of power semiconductor devices (hereinafter referred to as products), characteristic charts, and external dimension drawings.
7. 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 with Minebea power semiconductor sales department for the latest version of this data sheets.
8. For handling other than described in this manual, follow the handling instructions (IGBT-HI-00002).

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