

MBN1200E33E

Silicon N-channel IGBT 3300V E 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	MBN1200E33E
Collector Emitter Voltage	V _{CES}	V	3,300
Gate Emitter Voltage	V _{GES}	V	±20
Collector Current	DC	A	1,200
	1ms		2,400
Forward Current	DC	A	1,200
	1ms		2,400
Operating Junction Temperature	T _{vj op}	°C	-40 ~ +125
Storage Temperature	T _{stg}	°C	-50 ~ +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±0.2/15⁺⁰₋₃N·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	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 _{CESat}	V	3.0	3.5	4.2	I _C =1,200A, V _{GE} =15V, T _{vj} =125°C
Gate Emitter Threshold Voltage	V _{GE(th)}	V	4.5	6.0	7.0	V _{CE} =10V, I _C =1,200mA, T _{vj} =25°C
Input Capacitance	C _{ies}	nF	-	110	-	V _{CE} =10V, V _{GE} =0V, f=100kHz, T _{vj} =25°C
Internal Gate Resistance	R _{G(int)}	Ω	-	1.3	-	V _{CE} =10V, V _{GE} =0V, f=100kHz, T _{vj} =25°C
Turn On Delay Time	t _{d(on)}	μs	-	0.4	-	V _{CC} =1,650V, I _C =1,200A
Rise Time	t _r		1.1	2.1	3.1	L _S =100nH
Turn Off Delay Time	t _{d(off)}		-	2.0	-	R _G =3.9/3.9Ω (3)
Fall Time	t _f		1.3	2.2	3.1	V _{GE} =±15V, T _{vj} =125°C
Forward Voltage Drop	V _F	V	2.0	2.5	3.0	I _F =1,200A, V _{GE} =0V, T _{vj} =125°C
Reverse Recovery Time	t _{rr}	μs	0.2	0.7	1.2	V _{CC} =1,650V, I _F =1,200A, L _S =100nH T _{vj} =125°C
Turn On Loss	E _{on(10%)}	J/P	-	1.7	2.2	V _{CC} =1,650V, I _C =1,200A, L _S =100nH
Turn Off Loss	E _{off(10%)}	J/P	-	1.9	2.4	R _G =3.9/3.9Ω (3)
Reverse Recovery Loss	E _{rr(10%)}	J/P	-	1.6	2.1	V _{GE} =±15V, T _{vj} =125°C
Short Circuit Pulse Width	t _{sc}	μs	10	-	-	V _{CC} =2,000V, L _S =100nH R _{G(on/off)} =3.9/39Ω, V _{GE} =±15V, T _{vj} =125°C
Stray inductance module	L _{SCE}	nH	-	12	-	
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)}	-	0.006	-	Case to fin

Notes: (3) 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

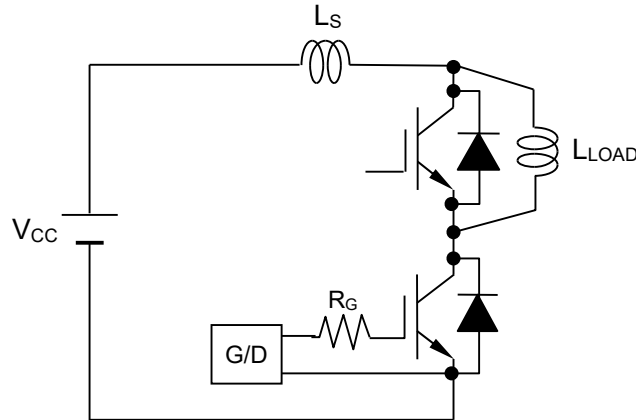


Fig.1 Switching test circuit

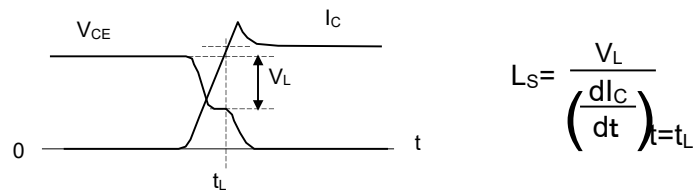


Fig.2 Definition of stray inductance

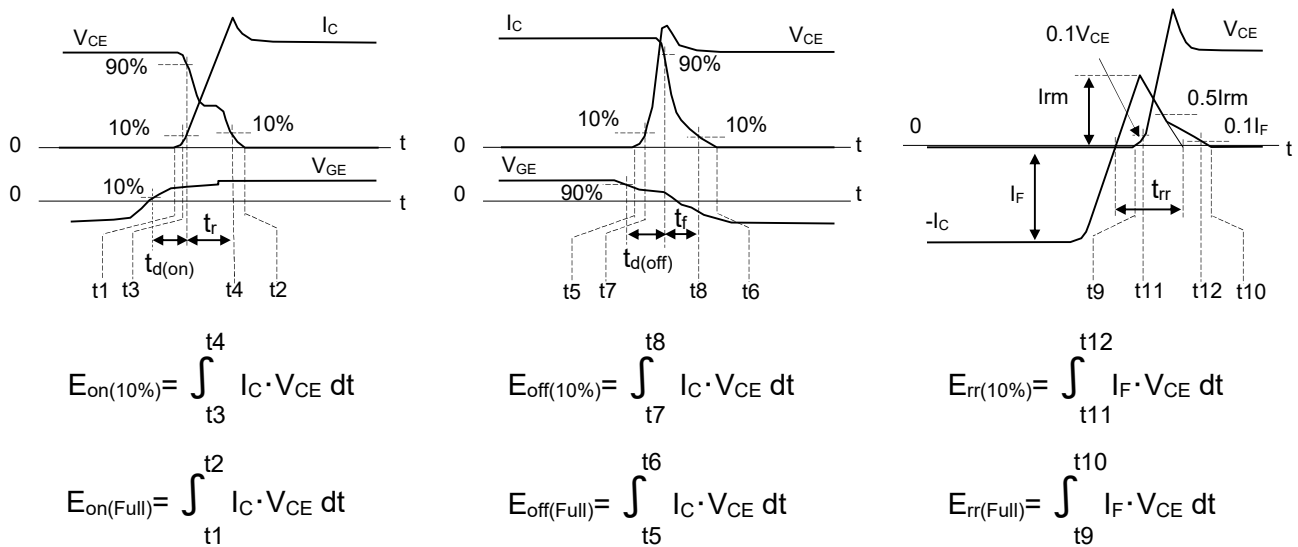
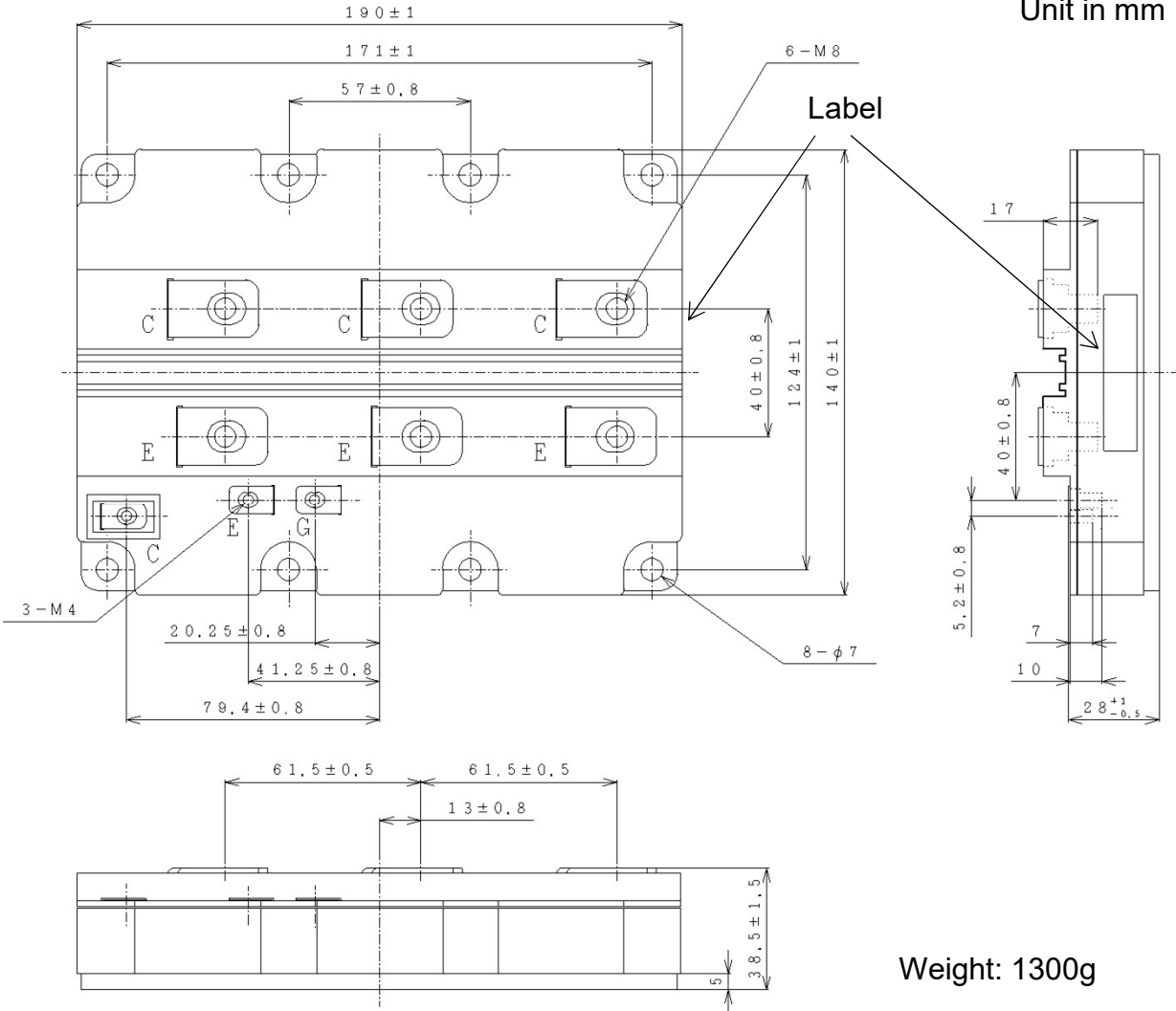


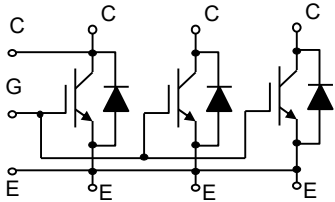
Fig.3 Definition of switching loss

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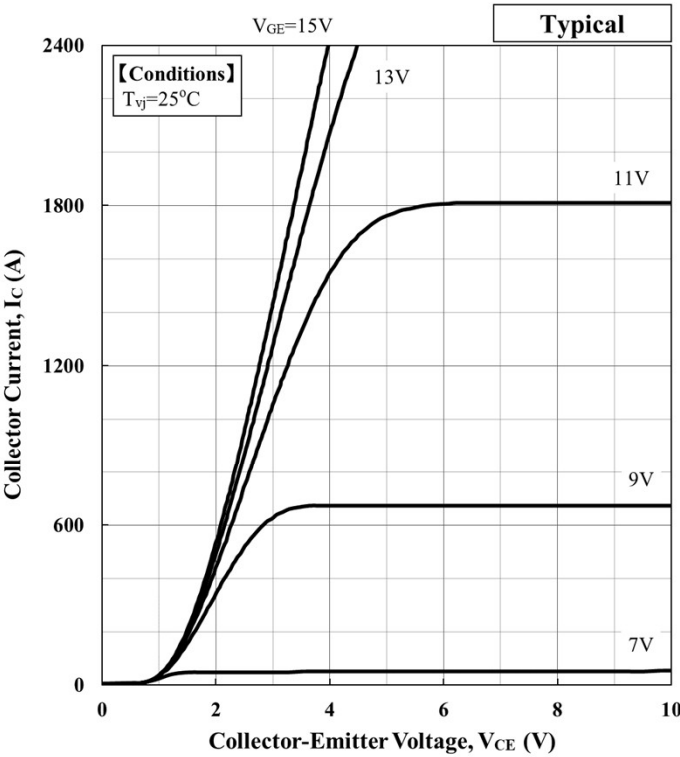
OUTLINE DRAWING



CIRCUIT DIAGRAM



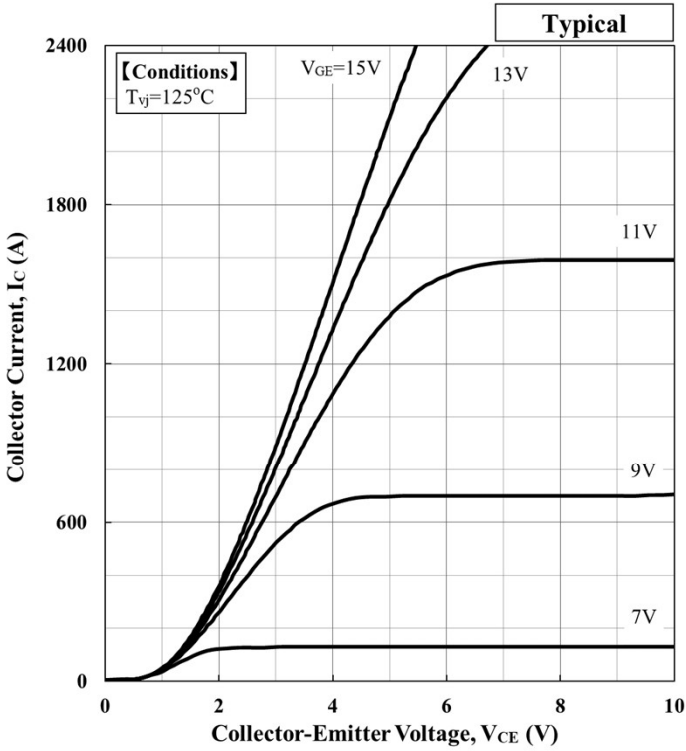
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$$V_{CE}(sat)[V] = a_3 \cdot |I_C|^3 + a_2 \cdot |I_C|^2 + a_1 \cdot |I_C| + a_0$$

Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
25	15	1.03.E-10	-5.18.E-07	1.83.E-03	1.14.E+00

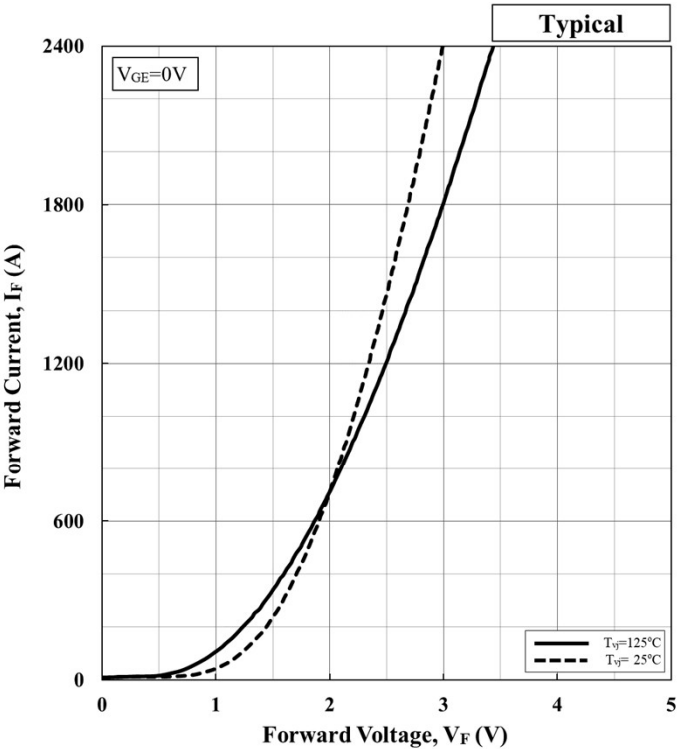
Collector Current vs. Collector Emitter Voltage



$$V_{CE}(sat)[V] = a_3 \cdot |I_C|^3 + a_2 \cdot |I_C|^2 + a_1 \cdot |I_C| + a_0$$

Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
125	15	1.70.E-10	-7.77.E-07	2.72.E-03	1.08.E+00

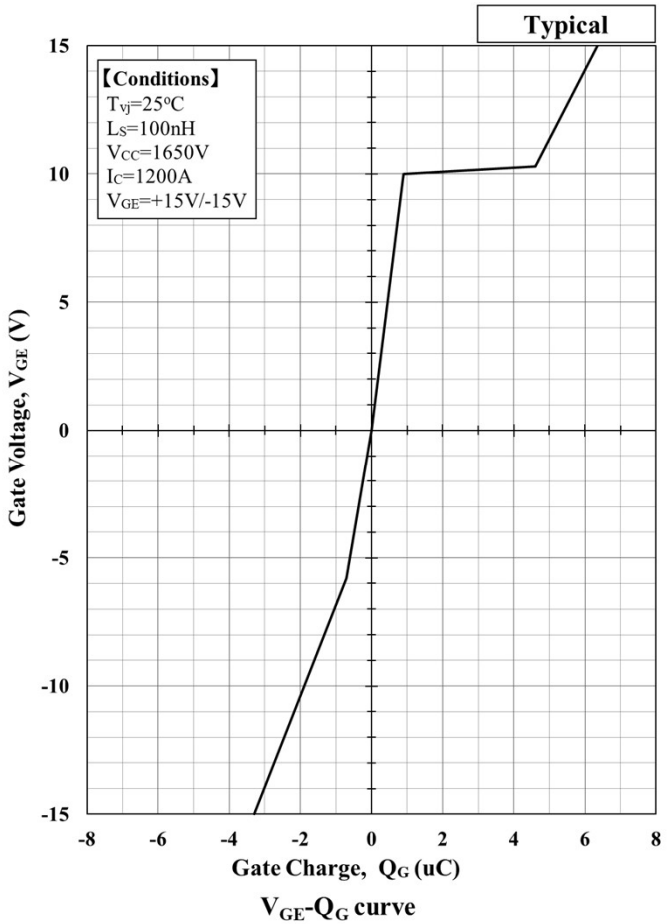
Collector Current vs. Collector Emitter Voltage



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

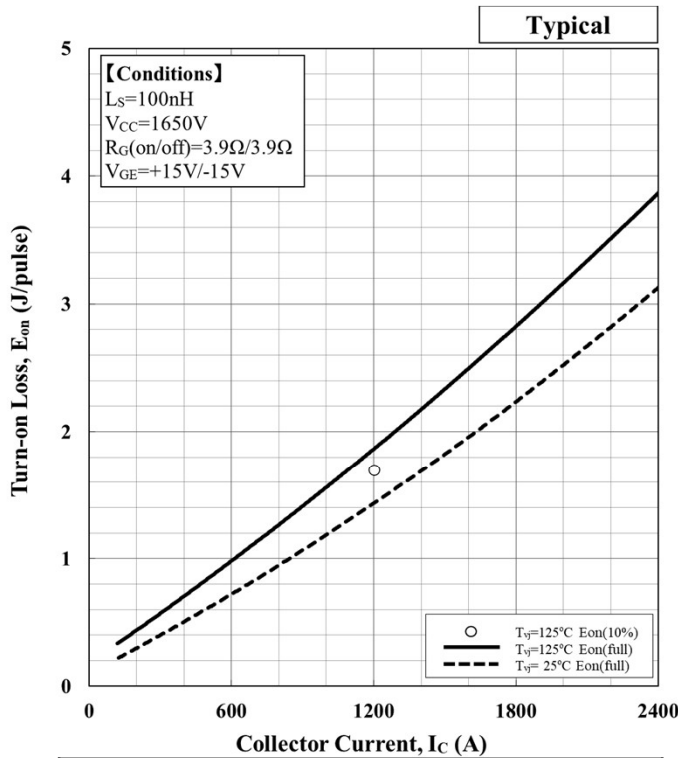
Temp.[°C]	a_3	a_2	a_1	a_0
25	1.13.E-10	-5.95.E-07	1.55.E-03	1.15.E+00
125	1.33.E-10	-7.18.E-07	2.04.E-03	8.61.E-01

Forward Voltage of free-wheeling diode



V_{GE} - Q_G curve

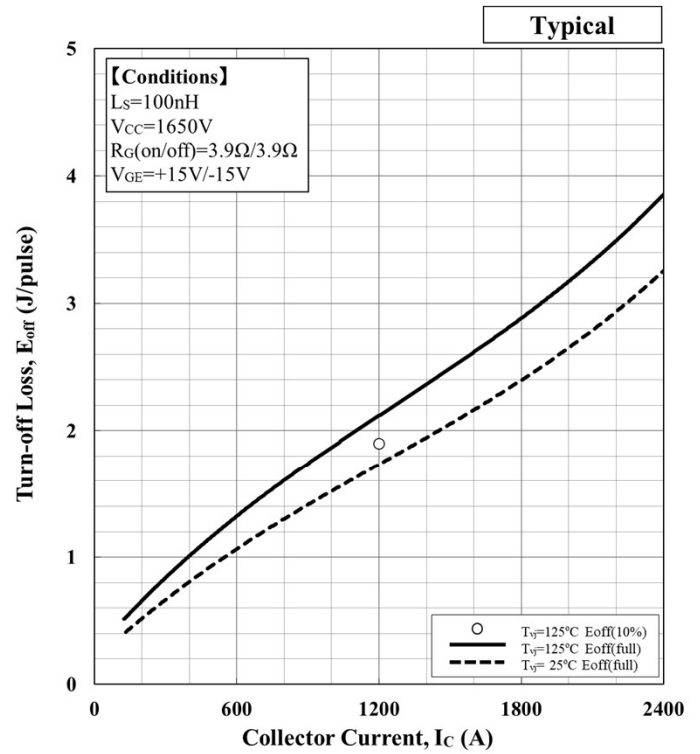
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$$E [J] = a_3 \cdot |I_c|^3 + a_2 \cdot |I_c|^2 + a_1 \cdot |I_c| + a_0$$

Temp.[°C]	a_3	a_2	a_1	a_0
25	-	1.26E-07	9.59E-04	1.01E-01
125	-	1.12E-07	1.27E-03	1.80E-01

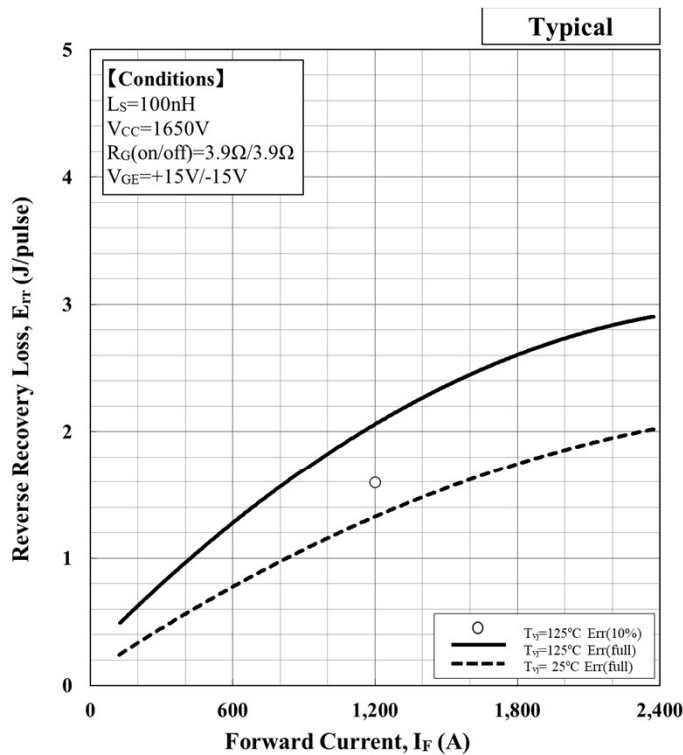
Turn-on loss vs. Collector current



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

Temp.[°C]	a_3	a_2	a_1	a_0
25	1.55E-10	-5.66E-07	1.74E-03	1.90E-01
125	1.83E-10	-7.03E-07	2.13E-03	2.58E-01

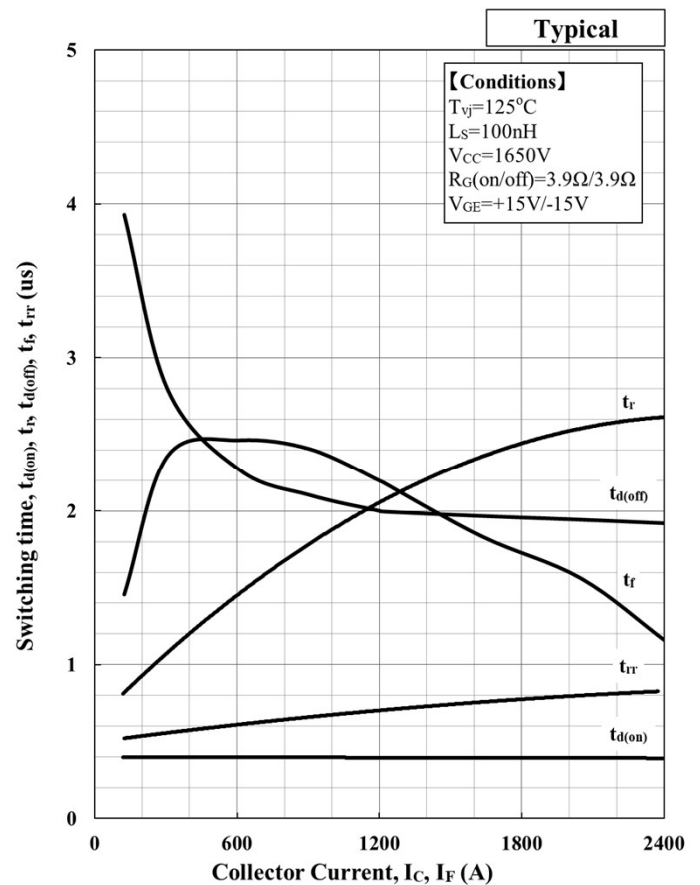
Turn-off loss vs. Collector current



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

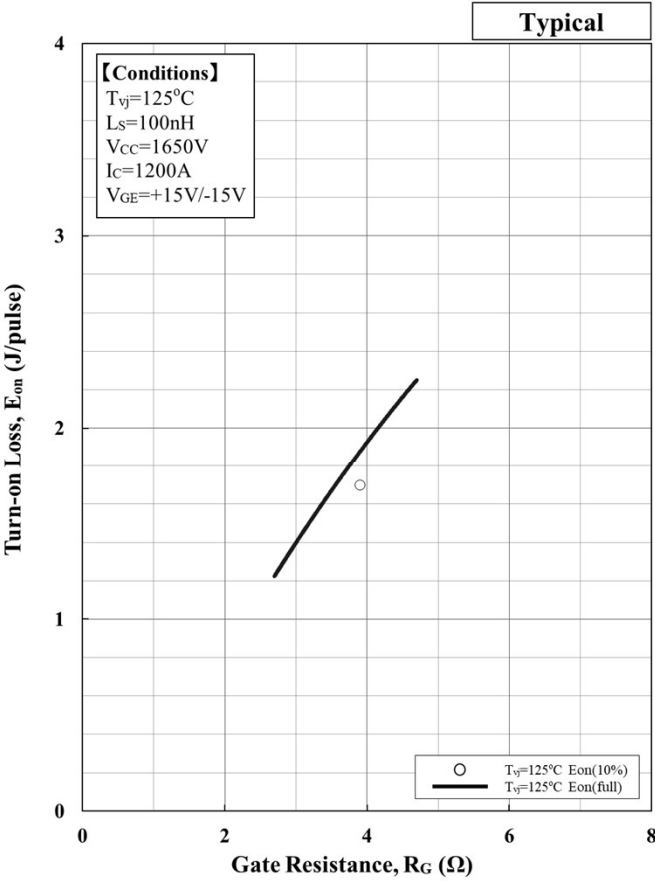
Temp.[°C]	a_3	a_2	a_1	a_0
25	-	-1.85E-07	1.25E-03	9.06E-02
125	-	-3.28E-07	1.89E-03	2.60E-01

Recovery loss vs. Forward current

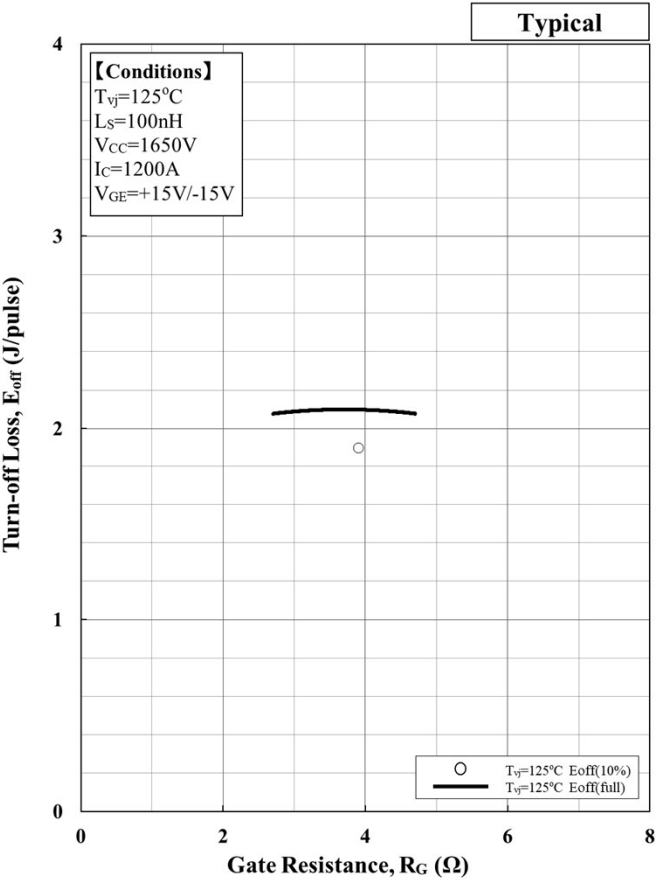


Switching time vs. Collector Current

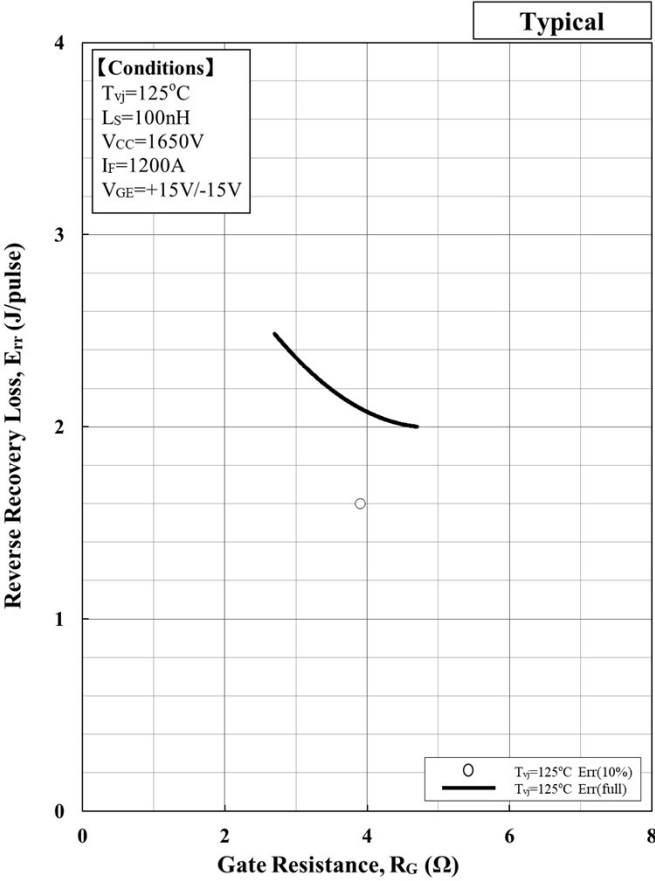
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Turn-on loss vs. Gate Resistance

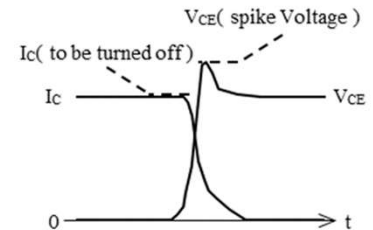
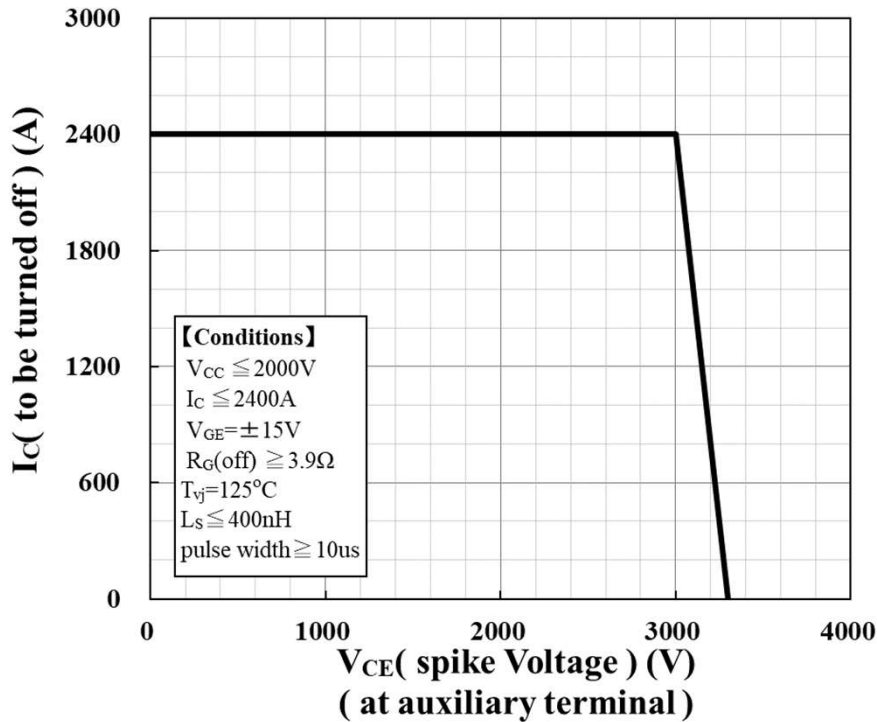


Turn-off loss vs. Gate Resistance

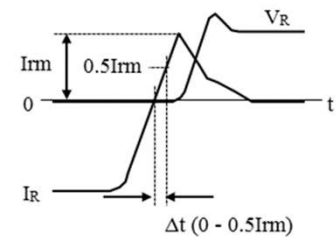
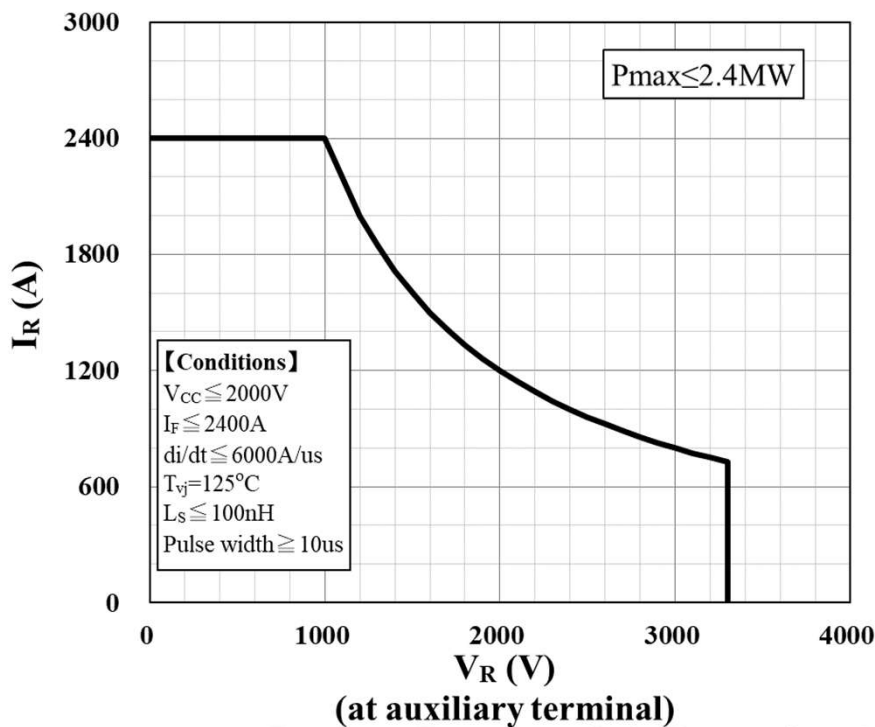


Reverse Recovery loss vs. Gate Resistance

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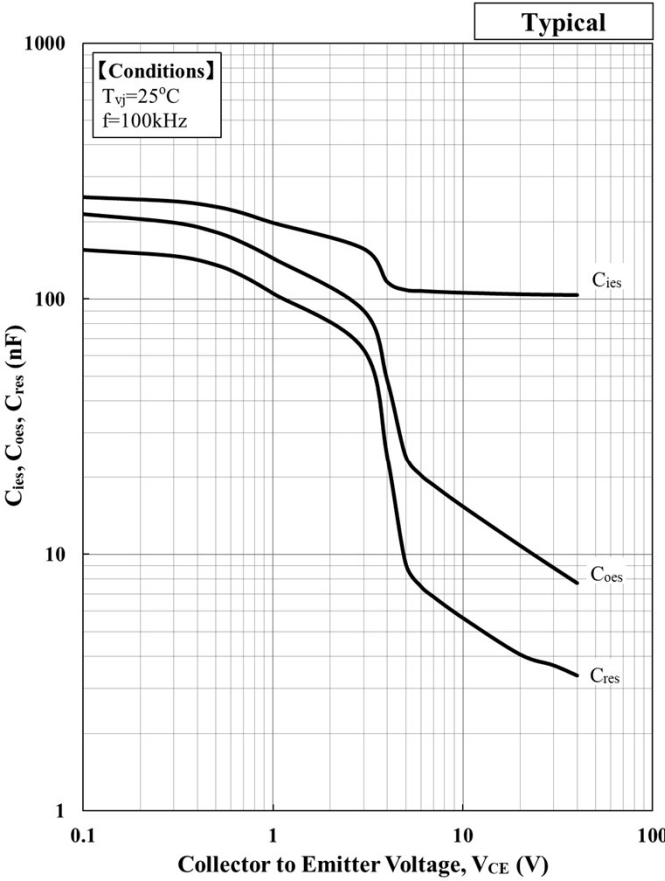
Definition of RBSOA waveform



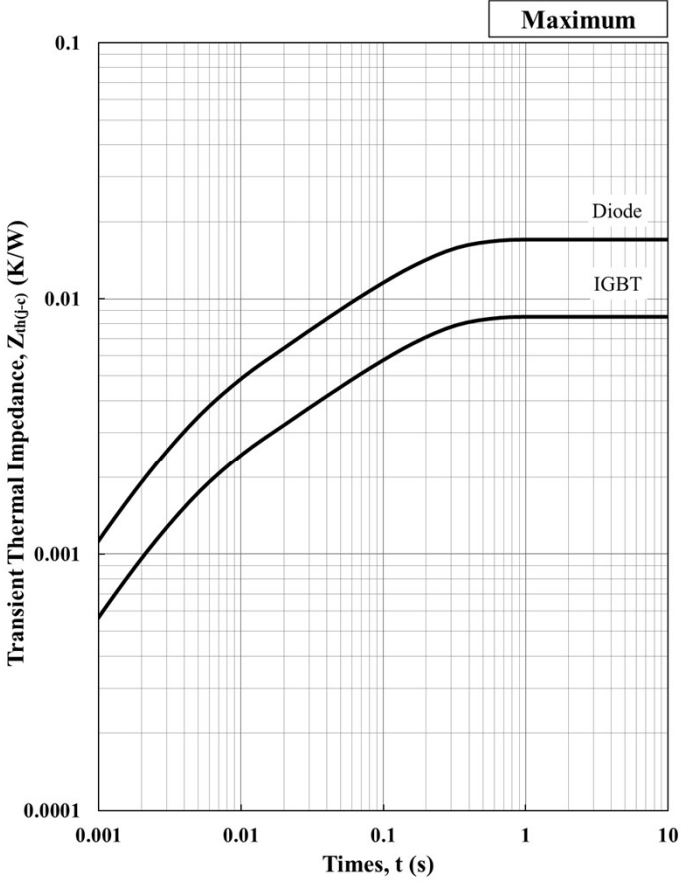
$$\frac{di}{dt} = \frac{0.5I_{rm}}{\Delta t}$$

Definition of Recovery di/dt

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Capacitance vs. Collector to Emitter Voltage



Transient Thermal Impedance Curve

Foster model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	5.24E-03	1.54E-03	1.57E-03	1.45E-04	[K/W]
C th, IGBT [n]	2.89E+01	1.62E+01	2.45E+00	4.55E+00	[J/K]
R th, Diode [n]	1.04E-02	3.19E-03	3.08E-03	2.99E-04	[K/W]
C th, Diode [n]	1.45E+01	7.81E+00	1.25E+00	2.21E+00	[J/K]

Cauer model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	1.19E-03	1.43E-03	2.83E-03	3.05E-03	[K/W]
C th, IGBT [n]	1.38E+00	1.42E+00	1.07E+01	3.14E+01	[J/K]
R th, Diode [n]	2.34E-03	2.88E-03	5.68E-03	6.10E-03	[K/W]
C th, Diode [n]	6.91E-01	7.19E-01	5.21E+00	1.59E+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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