

MBN3600E17F

Silicon N-channel IGBT 1700V F version

FEATURES

- * Soft switching behavior & low conduction loss :
Soft low-injection punch-through with
Advanced trench HiGT* (*High conductivity IGBT)
- * Low driving power:
Low input capacitance advanced trench gate.
- * Low noise recovery: Ultra soft fast recovery diode.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C)

Item	Symbol	Unit	MBN3600E17F
Collector Emitter Voltage	V _{CES}	V	1,700
Gate Emitter Voltage	V _{GES}	V	±20
Collector Current	DC	A	3,600
	1ms		7,200
Forward Current	DC	A	3,600
	1ms		7,200
Operating Junction Temperature	T _{vj op}	°C	-50 ~ +150
Storage Temperature	T _{stg}	°C	-55 ~ +125
Isolation Voltage	V _{ISO}	V _{RMS}	4,000(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	-	-	10	V _{CE} =1,700V, V _{GE} =0V, T _{vj} =25°C
Gate Emitter Leakage Current	I _{GES}	nA	-500	-	+500	V _{CE} =1,700V, V _{GE} =0V, T _{vj} =150°C
Collector Emitter Saturation Voltage	V _{CEsat}	V	-	2.4	2.8	V _{GE} =±20V, V _{CE} =0V, T _{vj} =25°C
Gate Emitter Threshold Voltage	V _{GE(th)}	V	4.1	5.5	7.1	I _C =3,600A, V _{GE} =15V, T _{vj} =150°C
Input Capacitance	C _{ies}	nF	-	177	-	V _{CE} =10V, I _C =360mA, 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	-	1.05	2.0	V _{CC} =900V, I _C =3,600A
Rise Time	t _r		-	0.35	0.8	L _S =55nH
Turn Off Delay Time	t _{d(off)}		-	1.7	3.4	R _{G(on/off)} =3.3/3.3Ω (3)
Fall Time	t _f		-	1.6	3.2	V _{GE} =±15V, T _{vj} =150°C
Peak Forward Voltage Drop	V _F	V	-	2.25	2.7	I _F =3,600A, V _{GE} =0V, T _{vj} =150°C
Reverse Recovery Time	t _{rr}	μs	-	0.8	1.6	V _{CC} =900V, I _F =3,600A, L _S =55nH T _{vj} =150°C
Turn On Loss	E _{on}	J/P	-	1.4	-	V _{CC} =900V, I _C =3,600A, L _S =55nH
Turn Off Loss	E _{off}	J/P	-	3.0	-	R _{G(on/off)} =3.3/3.3Ω (3)
Reverse Recovery Loss	E _{rr}	J/P	-	1.15	-	V _{GE} =±15V, T _{vj} =150°C
Short Circuit Pulse Width	t _{sc}	μs	10	-	-	V _{CC} =1,100V, L _S =55nH R _{G(on/off)} =3.3/15Ω, V _{GE} =±15V, T _{vj} =150°C
Stray inductance module	L _{SCE}	nH	-	8	-	
Thermal Impedance	IGBT R _{th(j-c)}	K/W	-	-	0.0072	Junction to case
	FWD R _{th(j-c)}		-	-	0.011	
Contact Thermal Impedance	R _{th(c-f)}	K/W	-	0.005	-	Case to fin

Notes: (3) R_G value is a test condition value for evaluation, not recommended value.

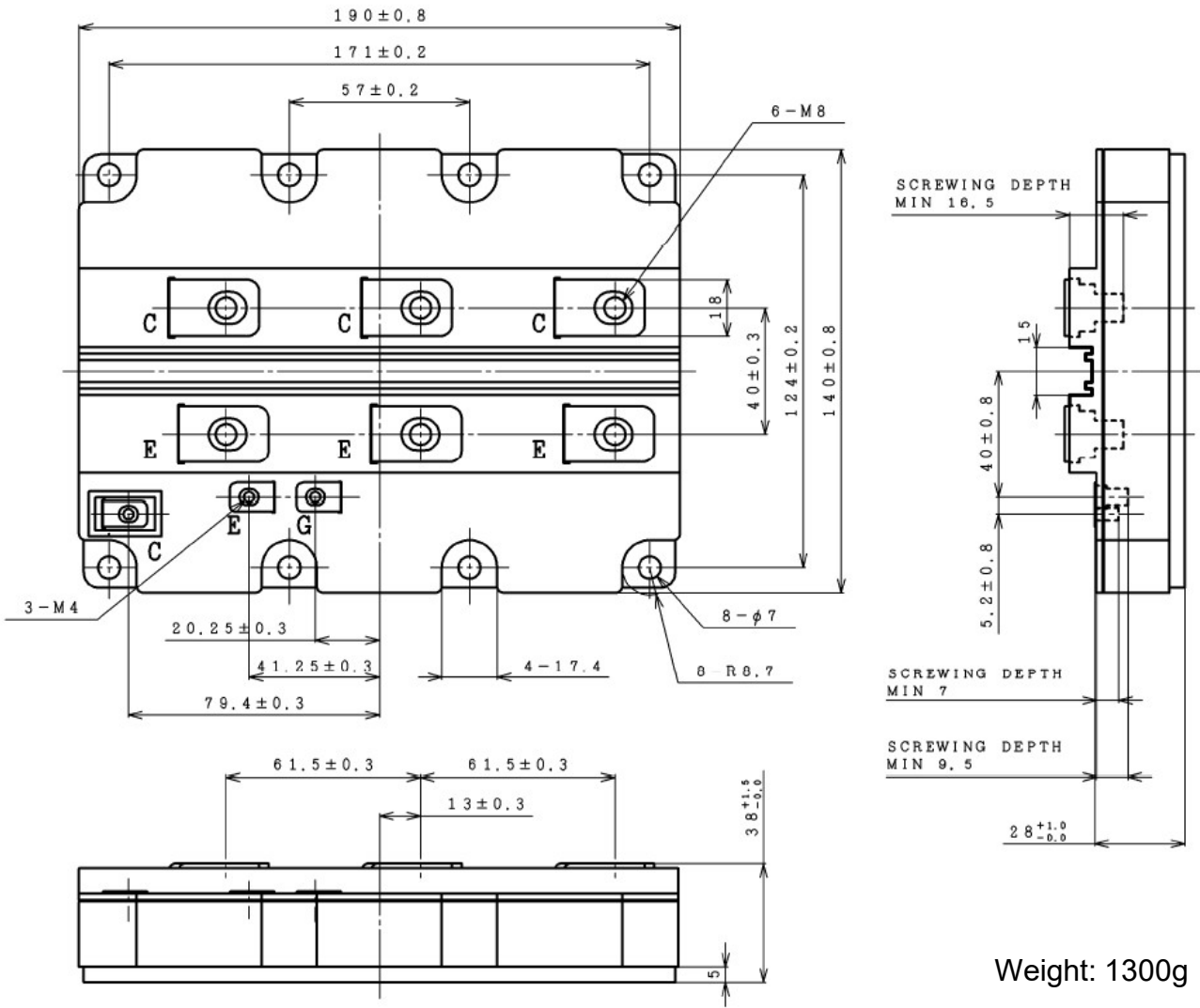
Please, determine the suitable R_G value by measuring switching behaviors.

- * 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.
- * ELECTRICAL CHARACTERISTIC items shown in above table are according to IEC 60747-2 and IEC 60747-9.

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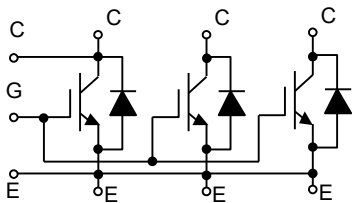
OUTLINE DRAWING

Unit in mm

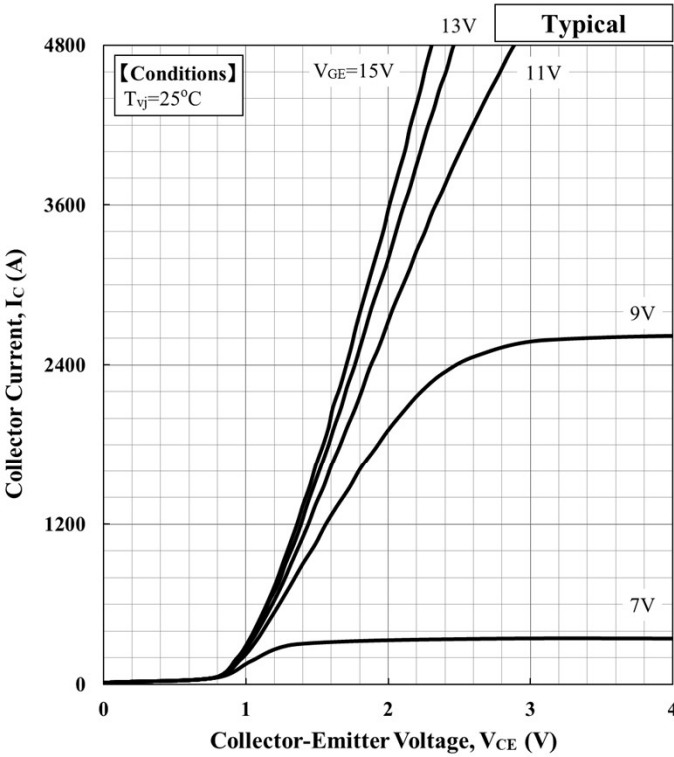


Weight: 1300g

CIRCUIT DIAGRAM

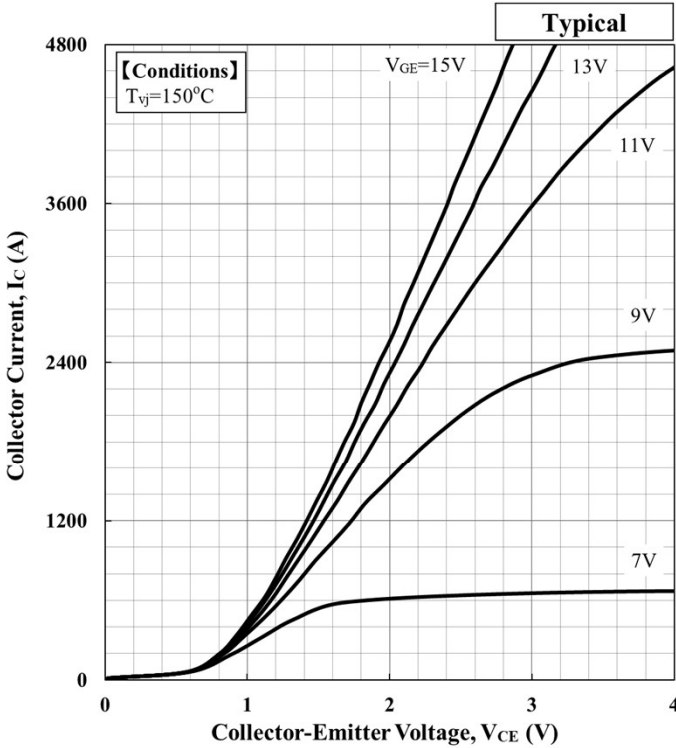


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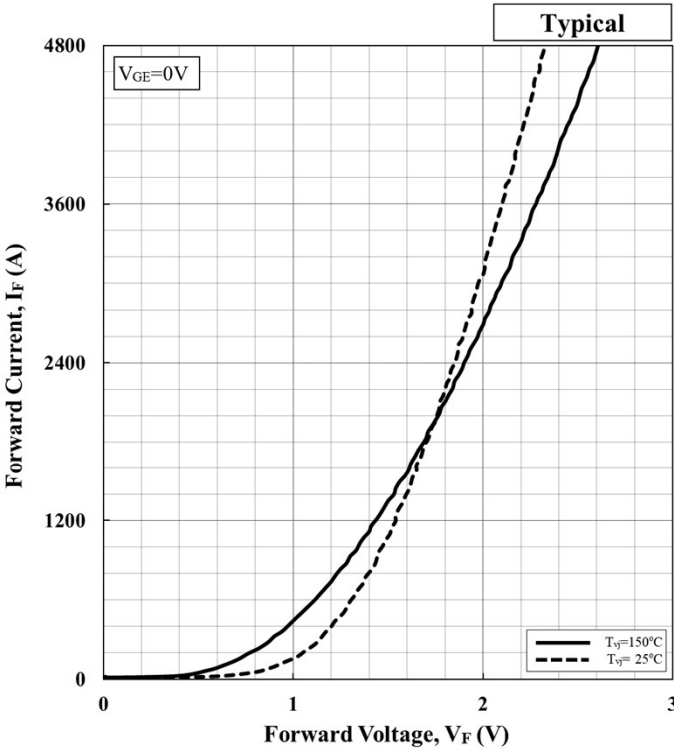
$V_{CE}(sat)[V] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$					
Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
25	15	3.32.E-12	-4.14.E-08	4.12.E-04	9.09.E-01

Collector Current vs. Collector Emitter Voltage



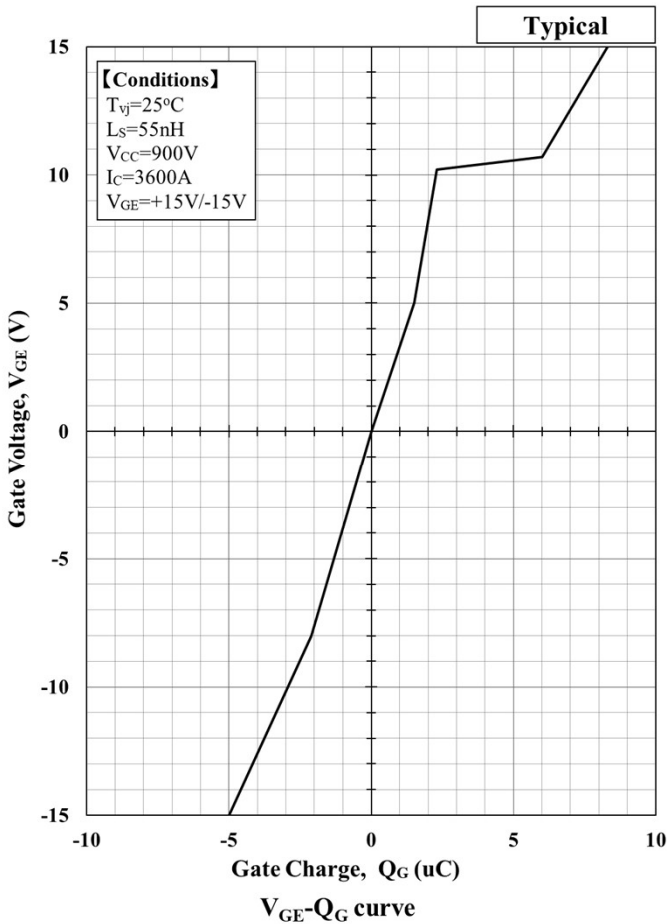
$V_{CE}(sat)[V] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$					
Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
150	15	5.12.E-12	-5.86.E-08	6.02.E-04	7.58.E-01

Collector Current vs. Collector Emitter Voltage

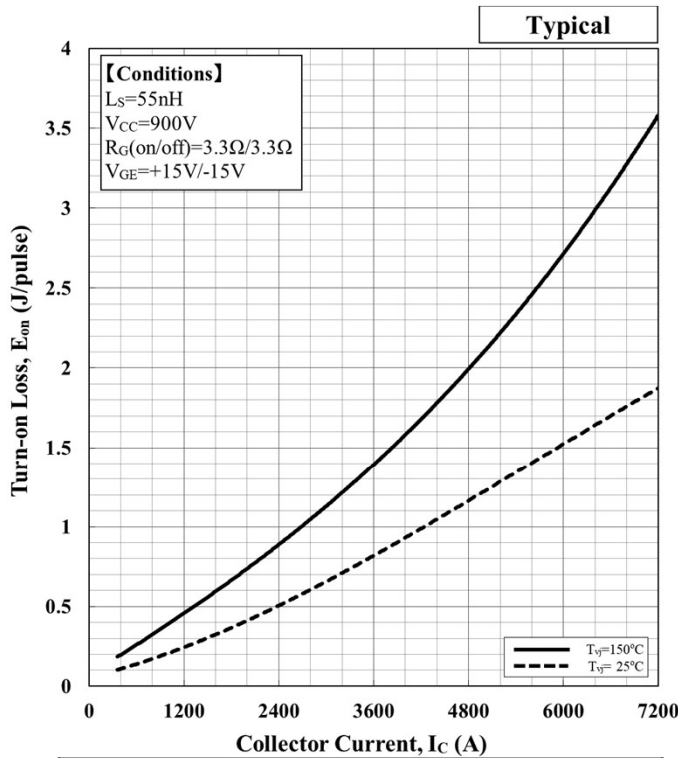


$V_F[V] = a_3 \cdot I_F ^3 + a_2 \cdot I_F ^2 + a_1 \cdot I_F + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	4.96.E-12	-6.54.E-08	4.64.E-04	1.05.E+00
150	6.11.E-12	-8.46.E-08	6.51.E-04	7.50.E-01

Forward Voltage of free-wheeling diode

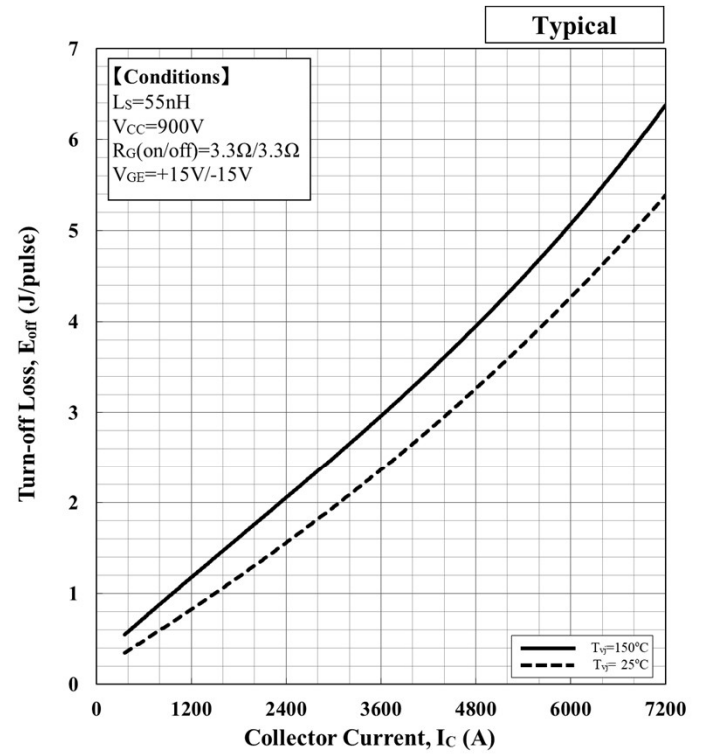


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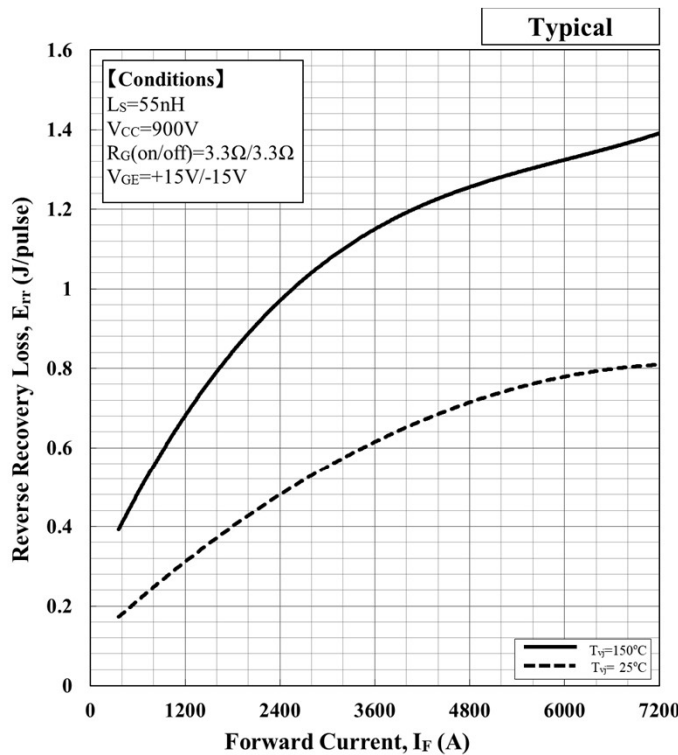
$E [J] = a_3 \cdot I_C ^3 + a_2 \cdot I_C ^2 + a_1 \cdot I_C + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	-	1.01E-08	1.86E-04	2.17E-02
150	-	3.49E-08	2.29E-04	1.14E-01

Turn-on loss vs. Collector current



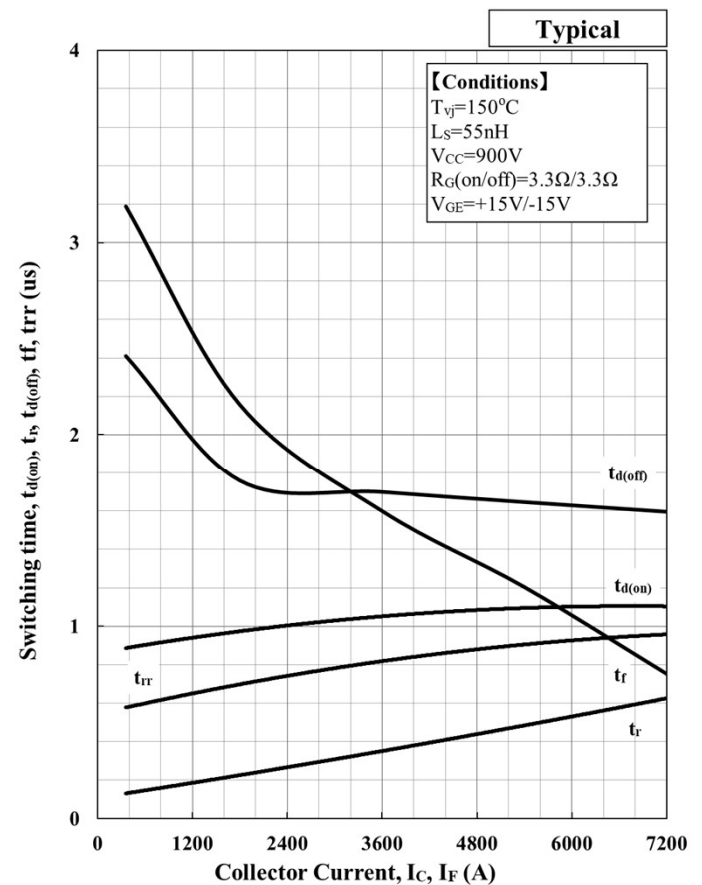
$E [J] = a_3 \cdot I_C ^3 + a_2 \cdot I_C ^2 + a_1 \cdot I_C + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	1.38E-12	1.62E-08	5.39E-04	1.53E-01
150	5.14E-12	-2.77E-08	7.81E-04	2.71E-01

Turn-off loss vs. Collector current



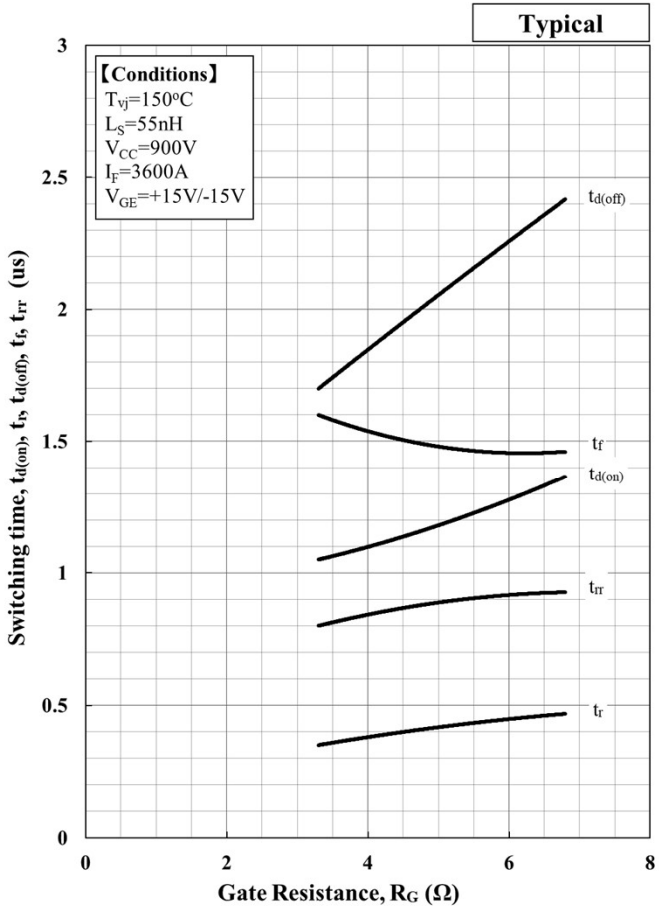
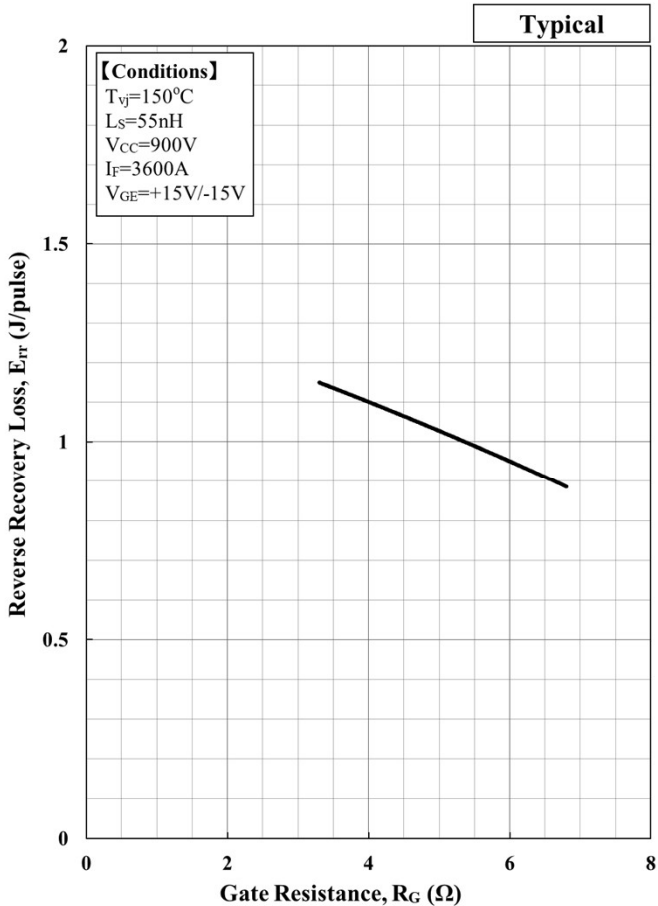
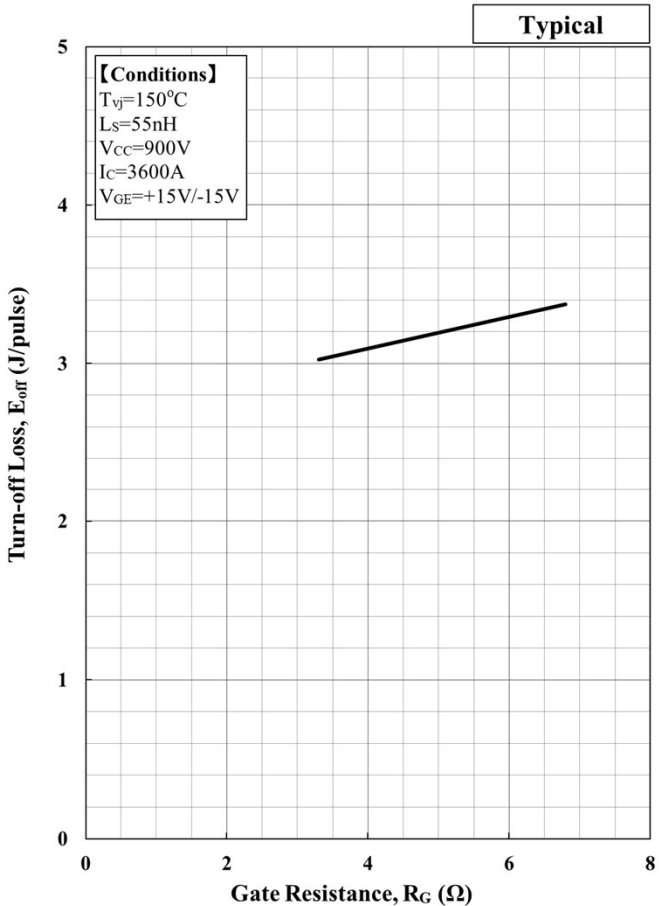
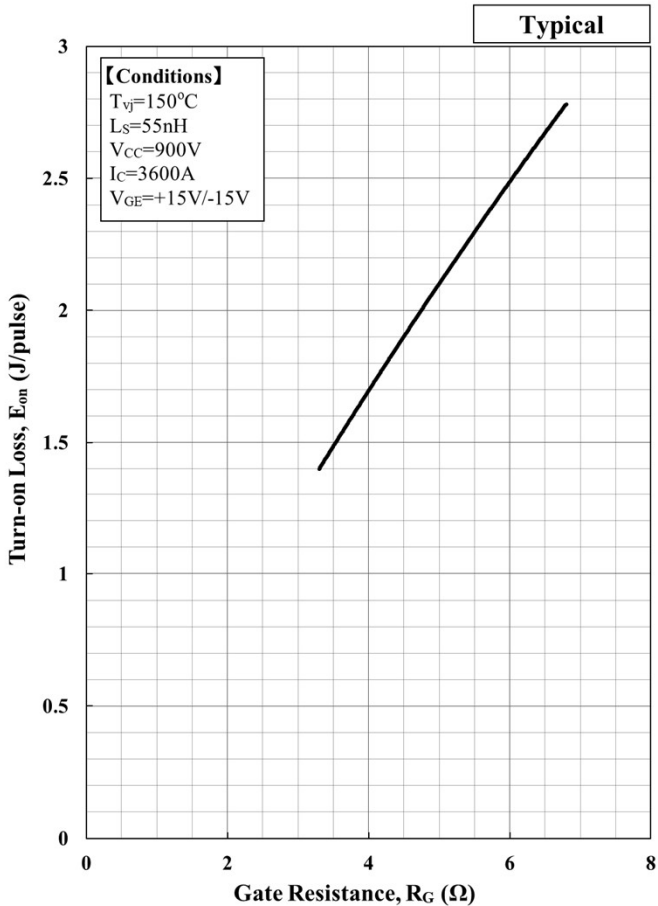
$E [J] = a_3 \cdot I_F ^3 + a_2 \cdot I_F ^2 + a_1 \cdot I_F + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	2.32E-12	-3.85E-08	2.62E-04	6.75E-02
150	3.49E-12	-6.33E-08	4.34E-04	2.45E-01

Recovery loss vs. Forward current

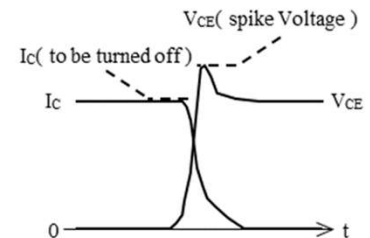
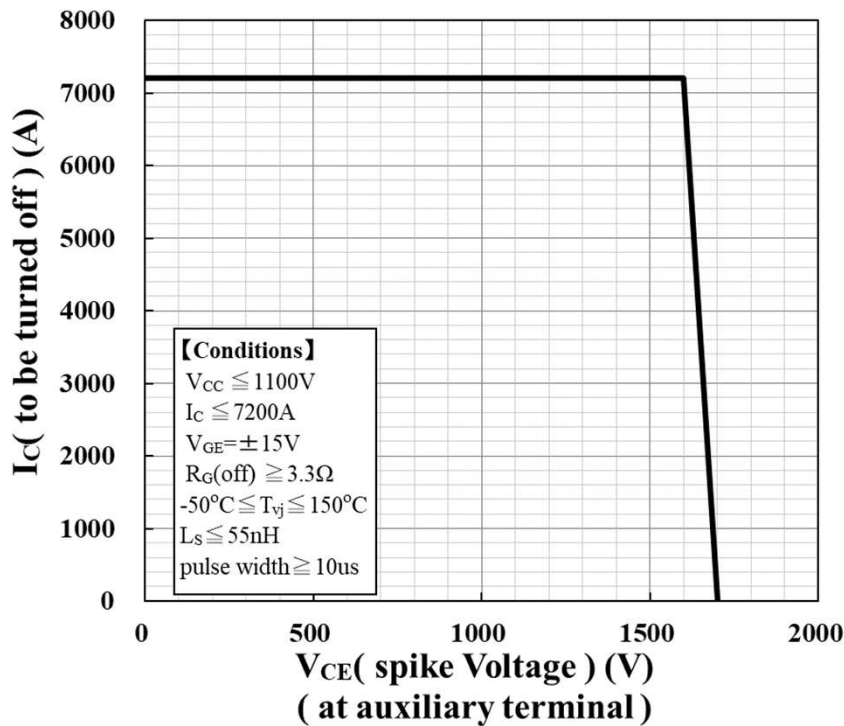


Switching time vs. Collector Current

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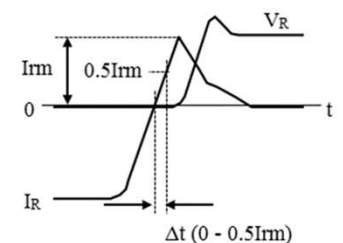
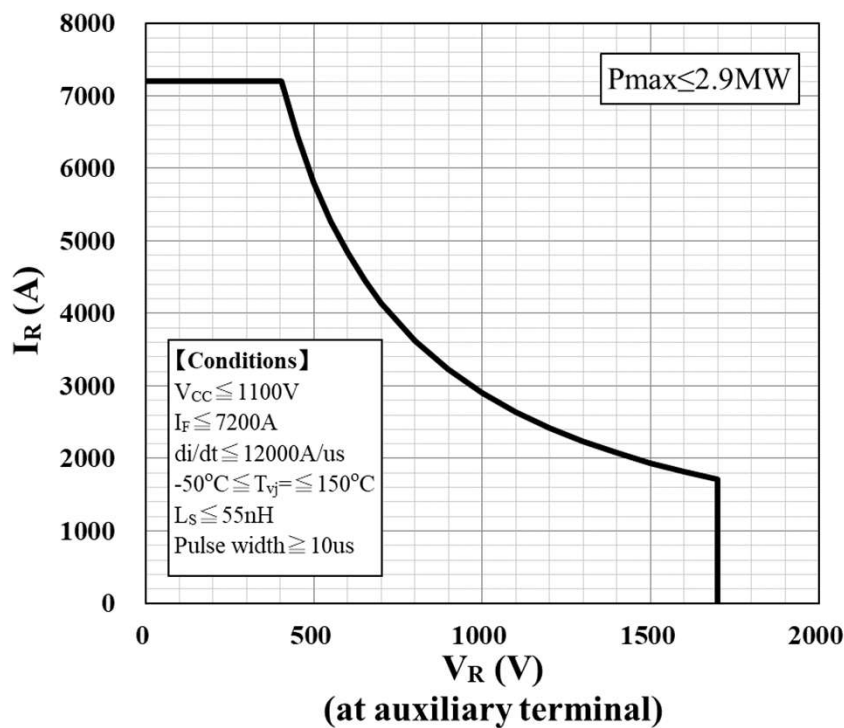


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Definition of RBSOA waveform

Reverse Bias Safe Operation Area (RBSOA)

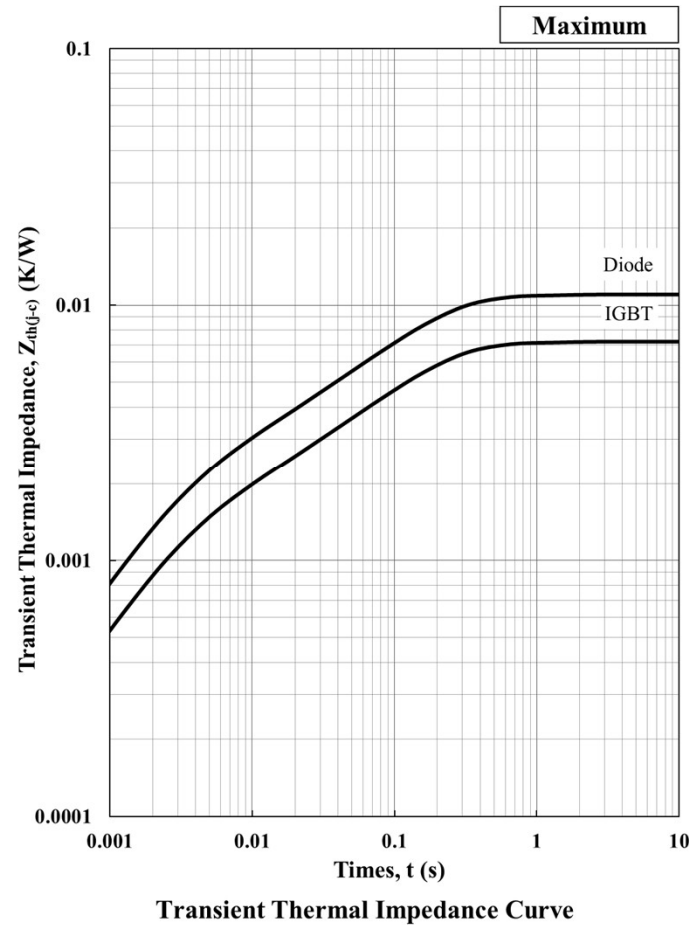
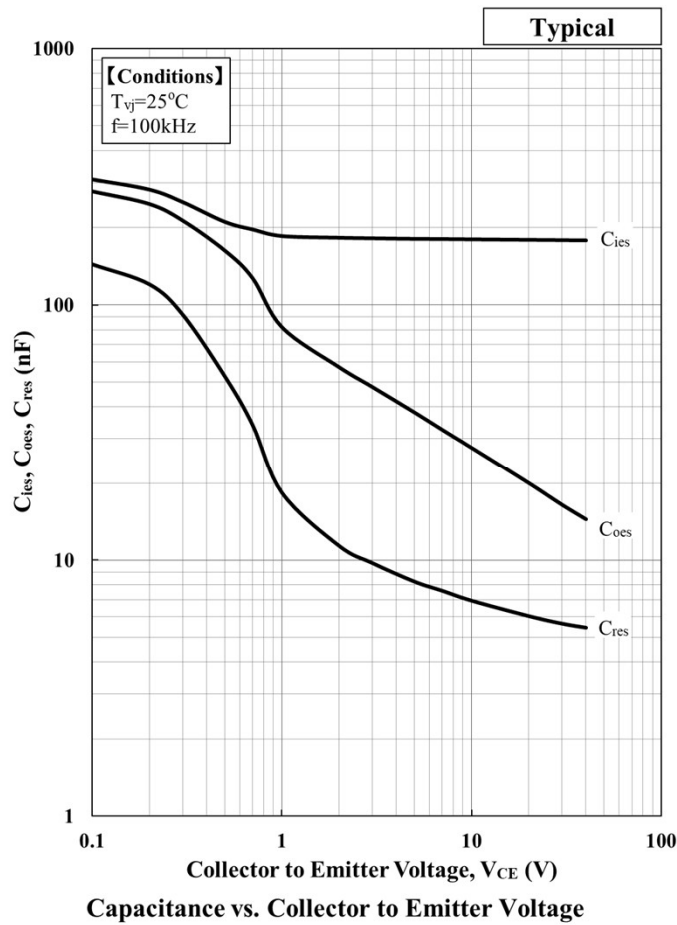


$$\frac{di}{dt} = \frac{0.5I_{rm}}{\Delta t}$$

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	Unit
R th, IGBT [n]	4.63E-03	1.20E-03	1.20E-03	1.66E-04	[K/W]
C th, IGBT [n]	3.50E+01	2.04E+01	2.59E+00	3.28E+00	[J/K]
R th, Diode [n]	7.02E-03	1.93E-03	1.78E-03	2.61E-04	[K/W]
C th, Diode [n]	2.31E+01	1.27E+01	1.75E+00	2.09E+00	[J/K]

Cauer model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	8.60E-04	1.09E-03	2.39E-03	2.86E-03	[K/W]
C th, IGBT [n]	1.30E+00	1.75E+00	1.29E+01	3.58E+01	[J/K]
R th, Diode [n]	1.29E-03	1.68E-03	3.66E-03	4.36E-03	[K/W]
C th, Diode [n]	8.53E-01	1.17E+00	8.12E+00	2.39E+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

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.
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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.
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