

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
Stray inductance module	L _{SCE}	nH	-	8	-	
Thermal Impedance	IGBT	K/W	-	-	0.0072	Junction to case
	FWD		-	-	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.

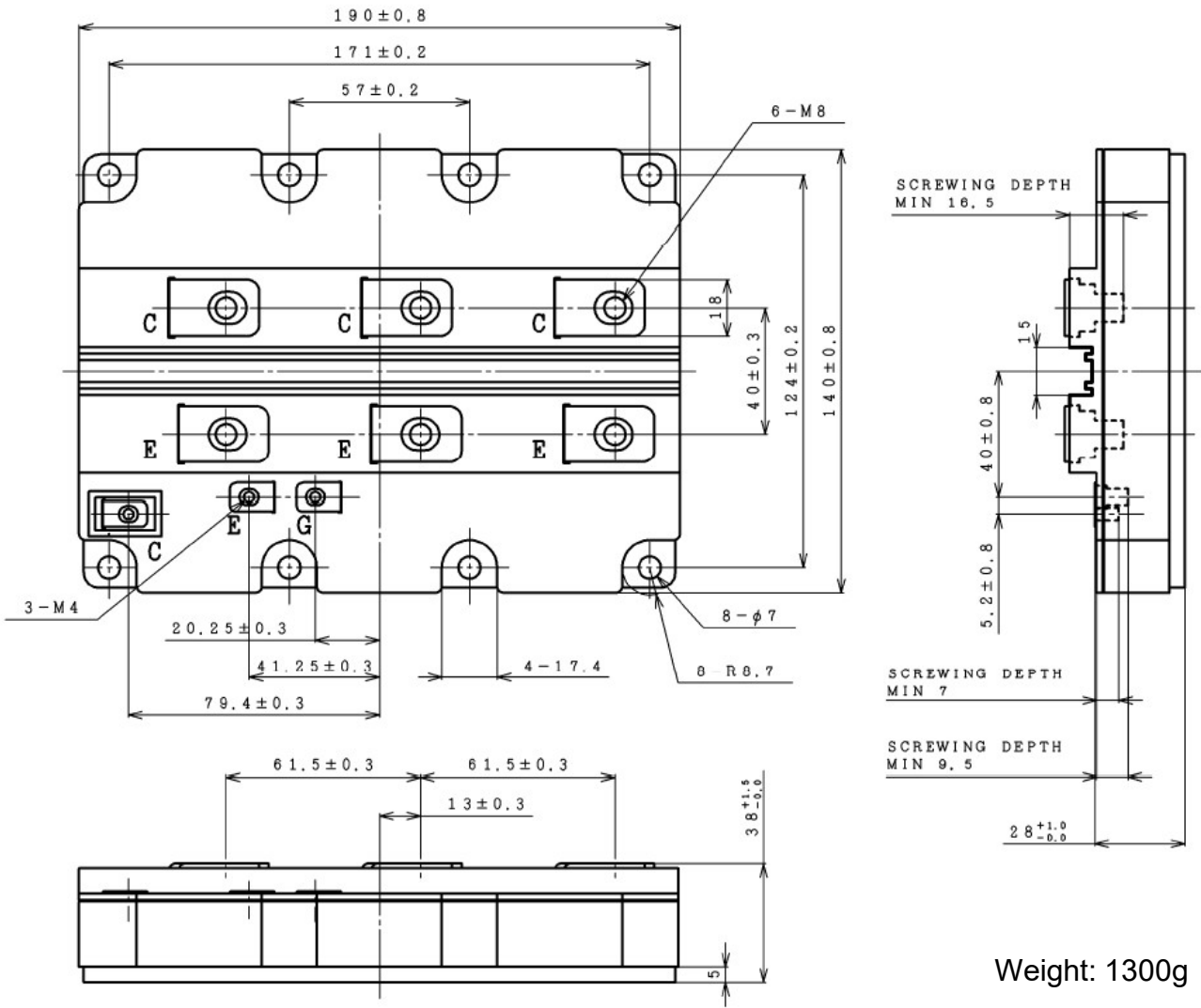
Please, determine the suitable R_G value by measuring switching behaviors.

- * 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.

MBN3600E17F

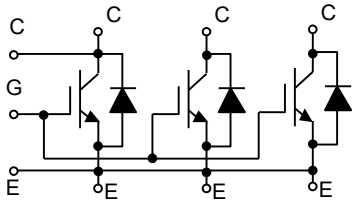
OUTLINE DRAWING

Unit in mm

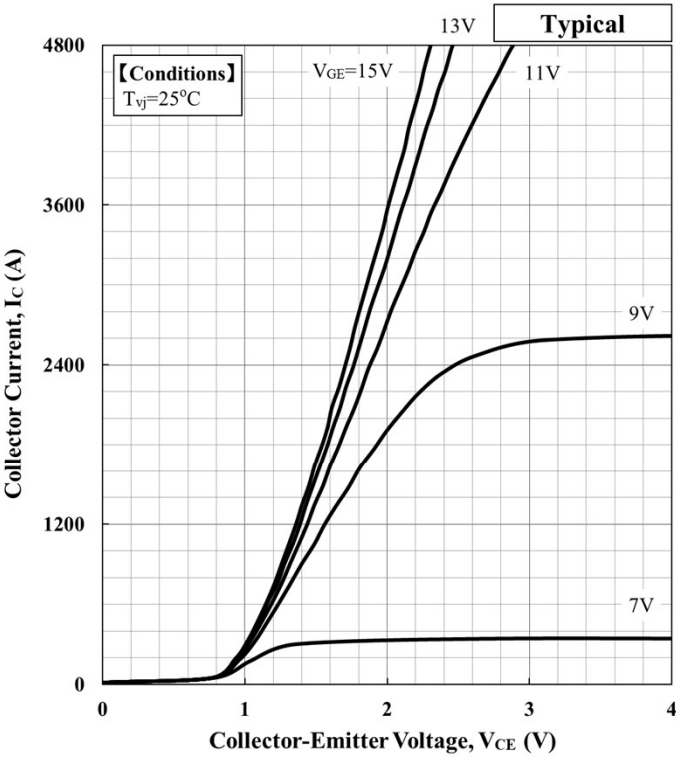


Weight: 1300g

CIRCUIT DIAGRAM

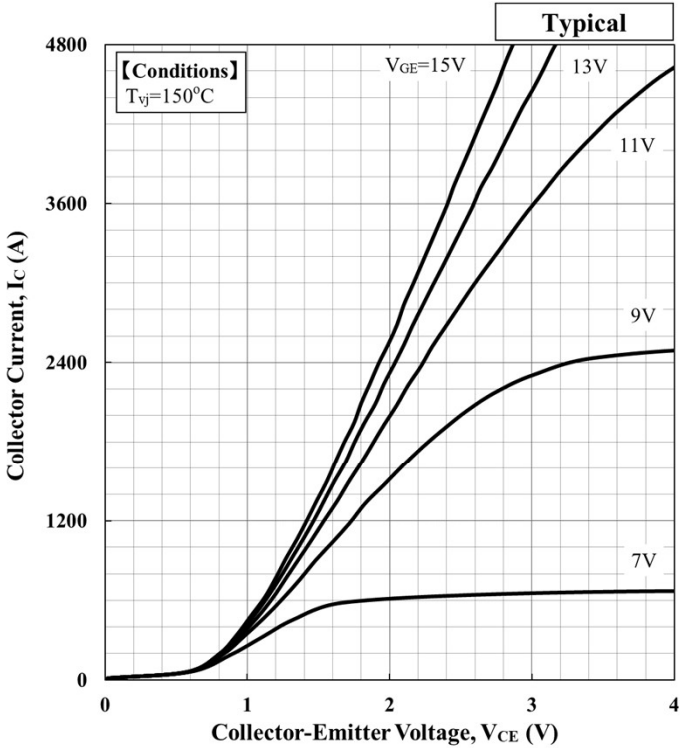


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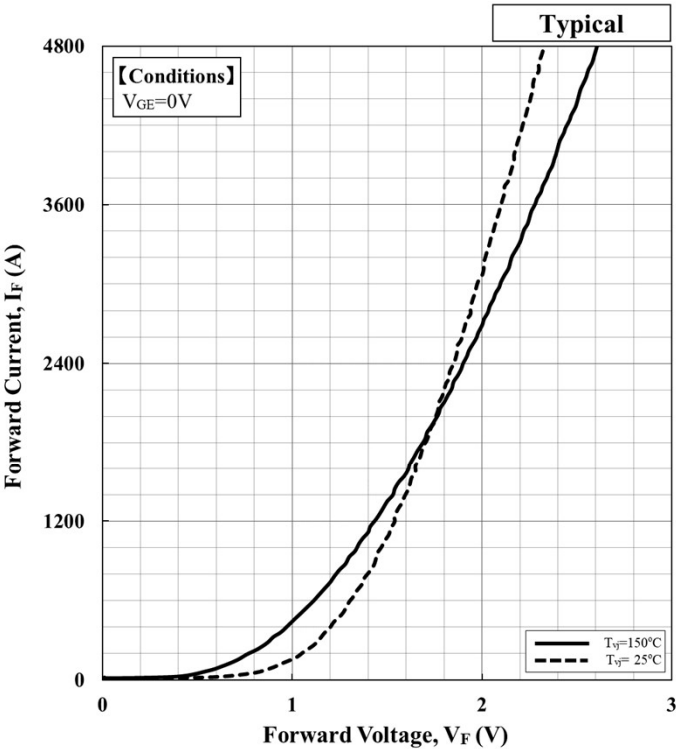
$V_{CE(sat)}[V] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$					
Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
25	15	3.32.E-12	-4.14.E-08	4.12.E-04	9.09.E-01

Collector Current vs. Collector Emitter Voltage



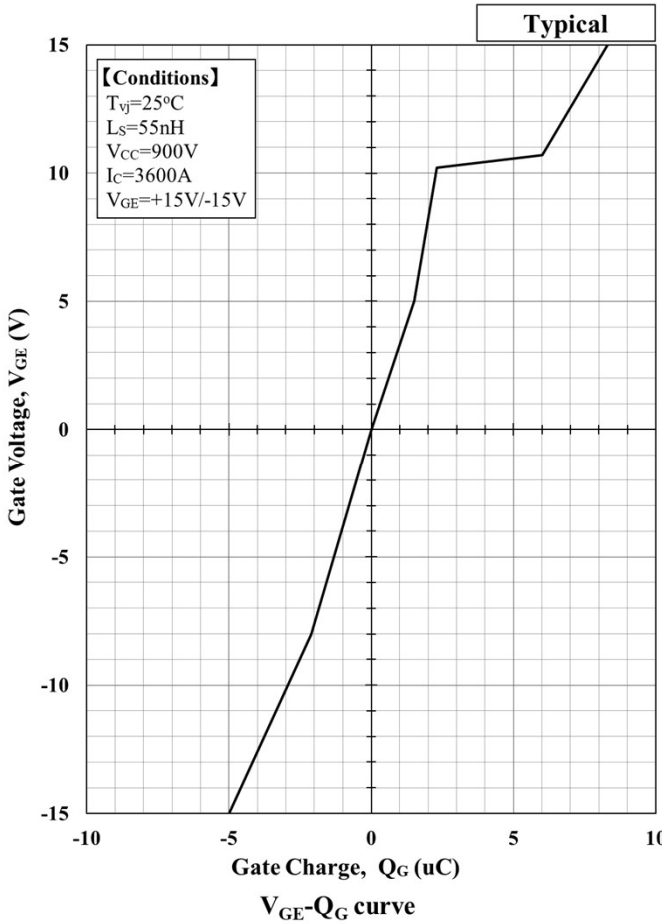
$V_{CE(sat)}[V] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$					
Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
150	15	5.12.E-12	-5.86.E-08	6.02.E-04	7.58.E-01

Collector Current vs. Collector Emitter Voltage

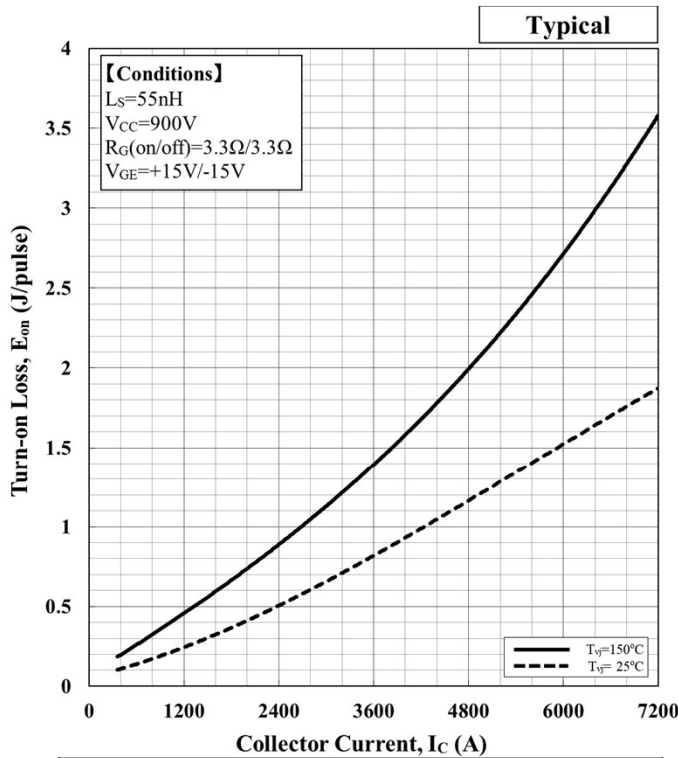


$V_F[V] = a_3 \cdot I_F ^3 + a_2 \cdot I_F ^2 + a_1 \cdot I_F + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	4.96.E-12	-6.54.E-08	4.64.E-04	1.05.E+00
150	6.11.E-12	-8.46.E-08	6.51.E-04	7.50.E-01

Forward Voltage of free-wheeling diode

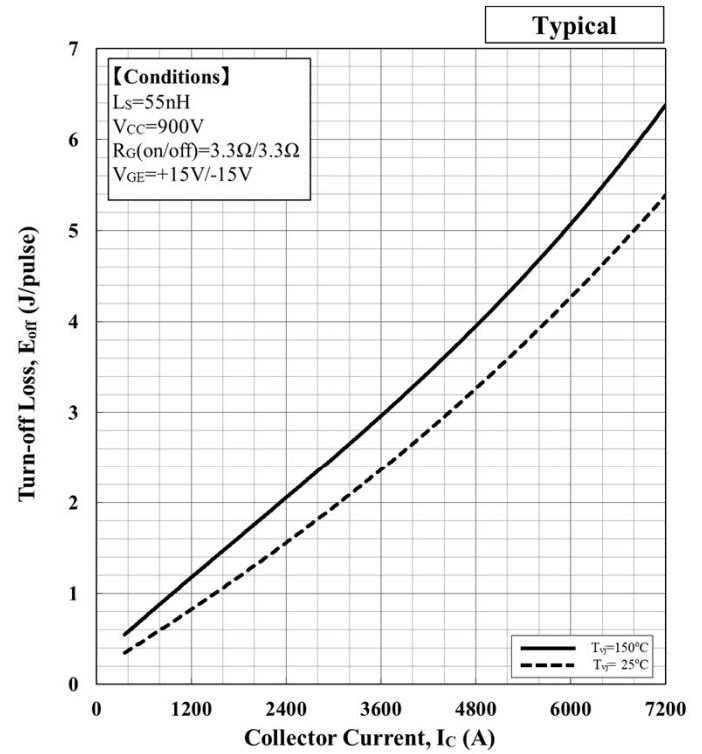


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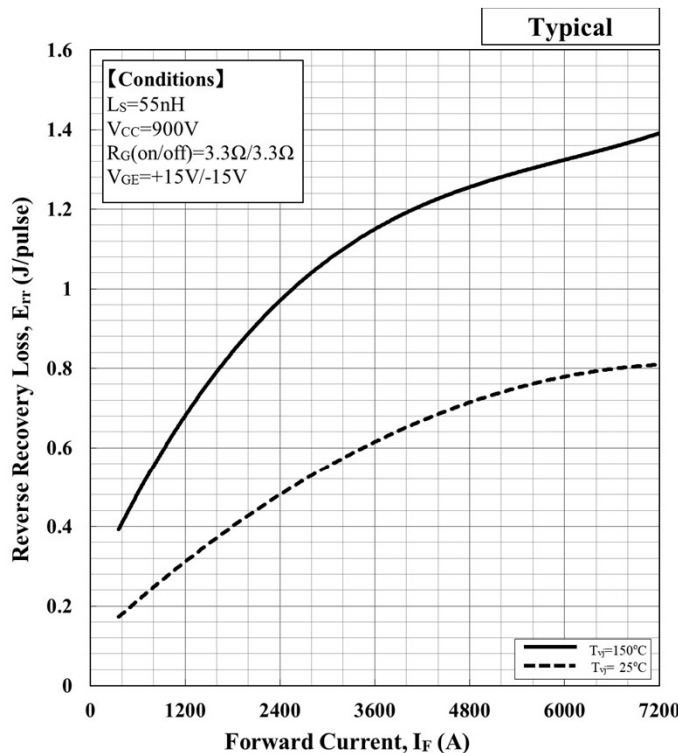
$E [J] = a_3 \cdot I_C ^3 + a_2 \cdot I_C ^2 + a_1 \cdot I_C + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	-	1.01E-08	1.86E-04	2.17E-02
150	-	3.49E-08	2.29E-04	1.14E-01

Turn-on loss vs. Collector current



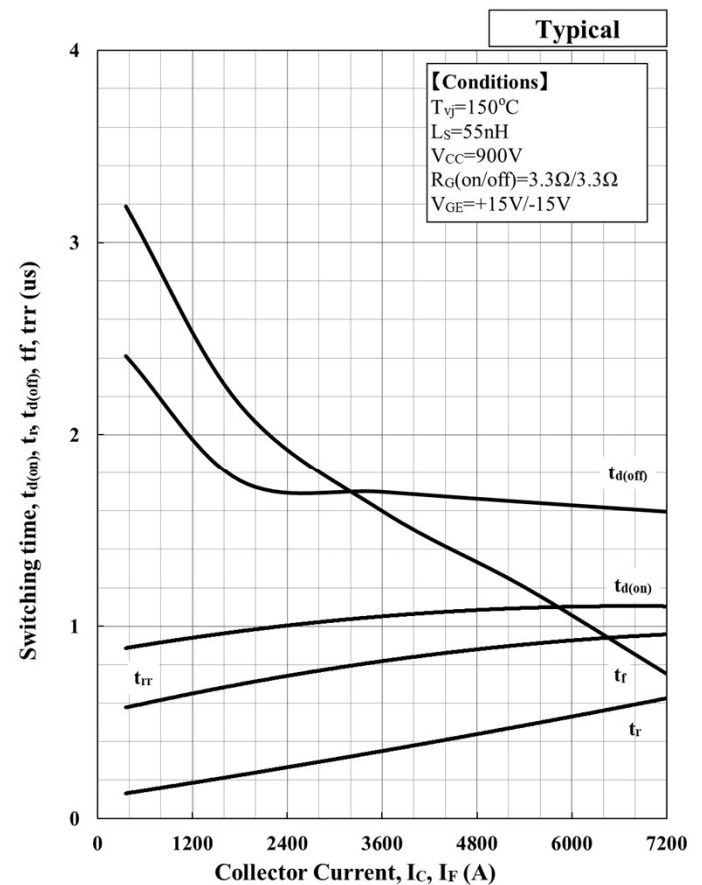
$E [J] = a_3 \cdot I_C ^3 + a_2 \cdot I_C ^2 + a_1 \cdot I_C + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	1.38E-12	1.62E-08	5.39E-04	1.53E-01
150	5.14E-12	-2.77E-08	7.81E-04	2.71E-01

Turn-off loss vs. Collector current



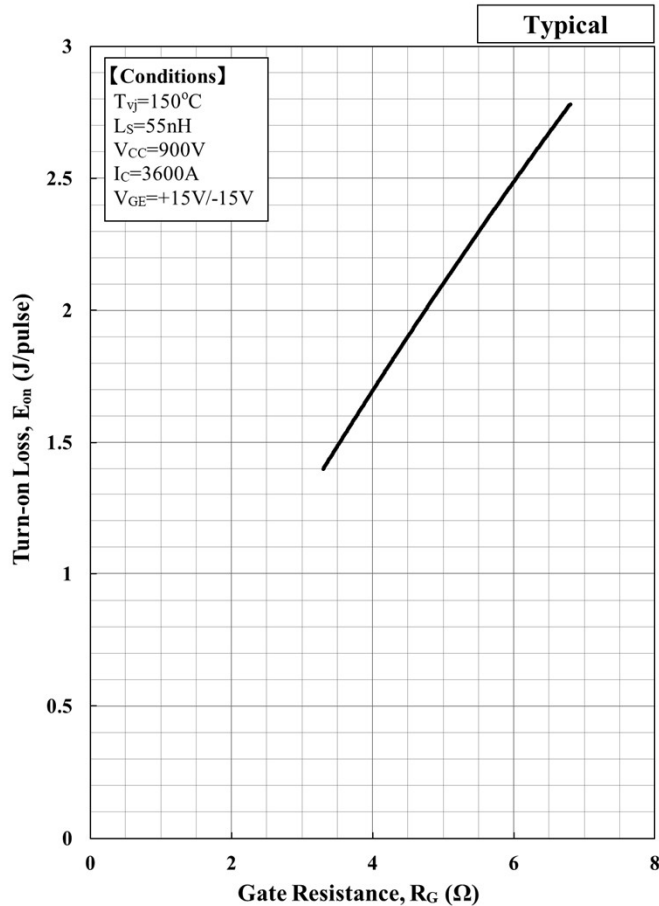
$E [J] = a_3 \cdot I_F ^3 + a_2 \cdot I_F ^2 + a_1 \cdot I_F + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	2.32E-12	-3.85E-08	2.62E-04	6.75E-02
150	3.49E-12	-6.33E-08	4.34E-04	2.45E-01

Recovery loss vs. Forward current

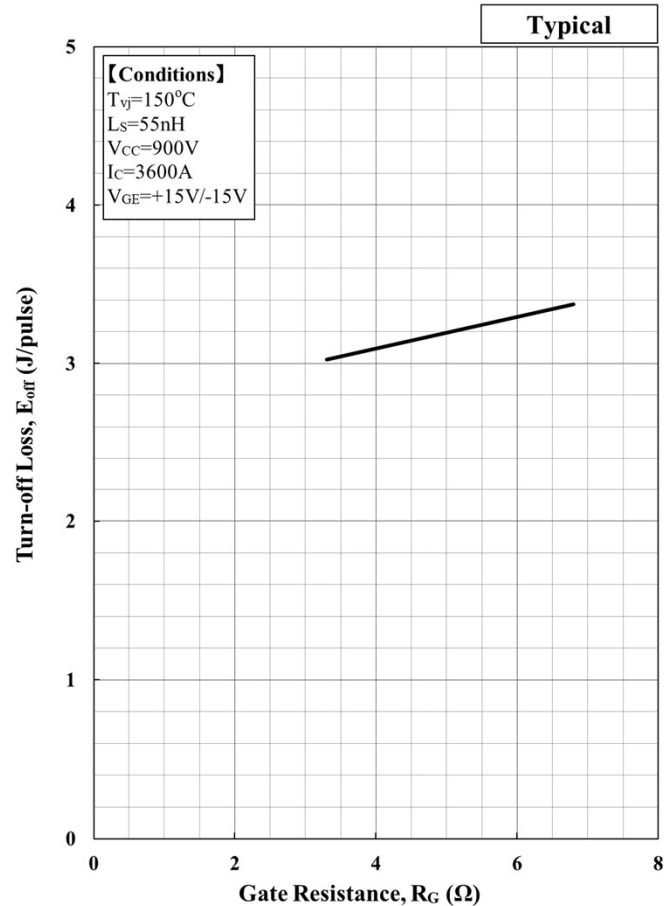


Switching time vs. Collector Current

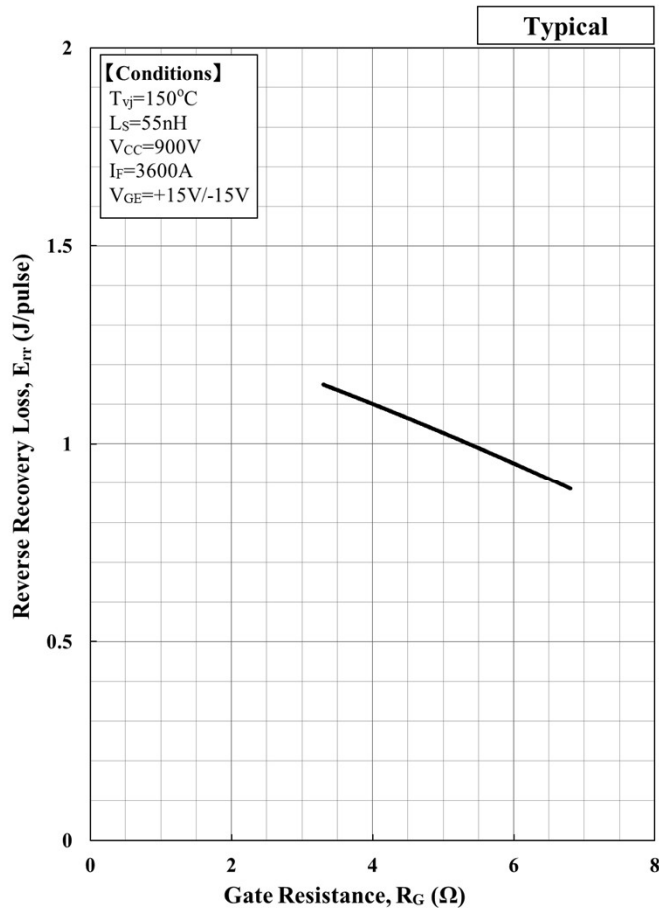
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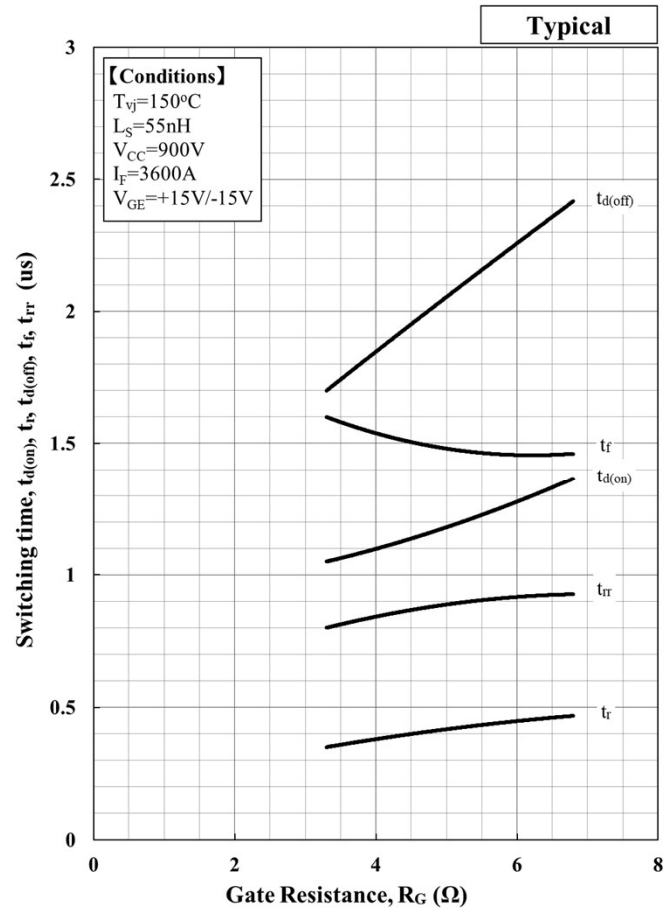
Turn-on loss vs. Gate Resistance



Turn-off loss vs. Gate Resistance

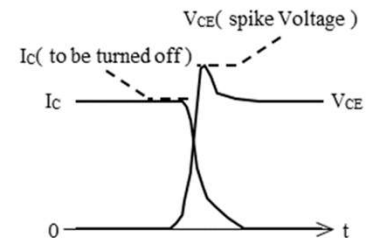
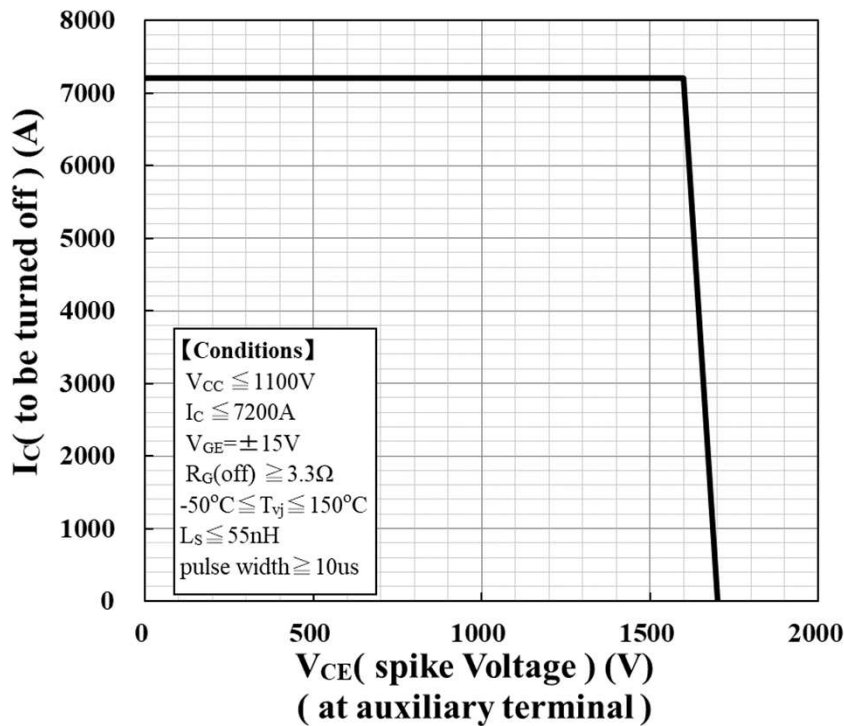


Recovery loss vs. Gate Resistance



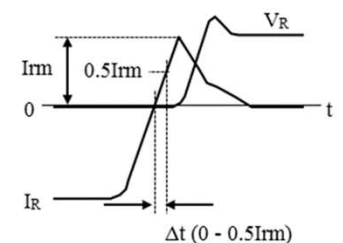
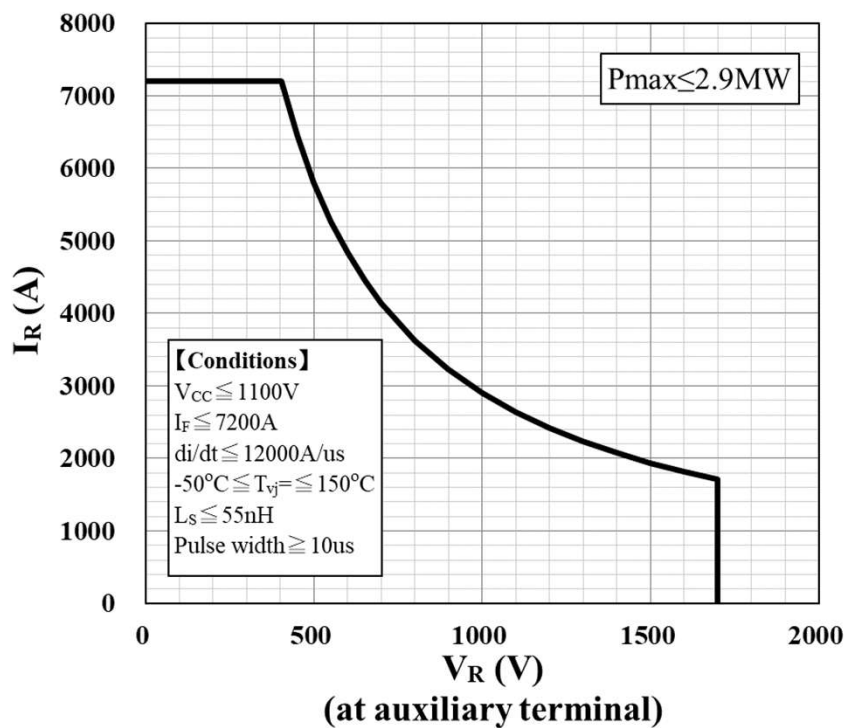
Switching time vs. Gate Resistance

MBN3600E17F



Definition of RBSOA waveform

Reverse Bias Safe Operation Area (RBSOA)

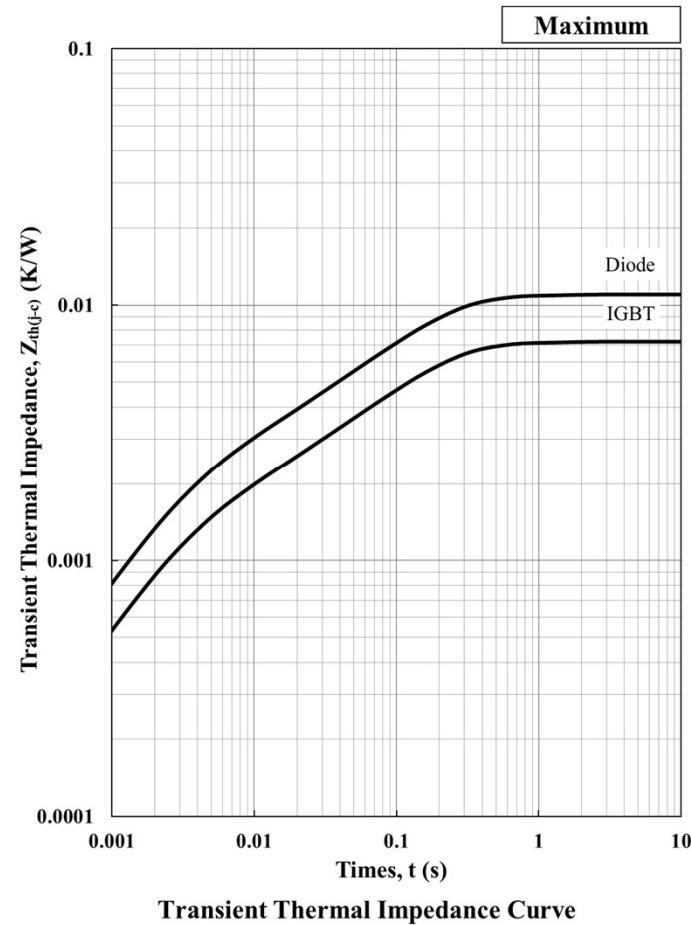
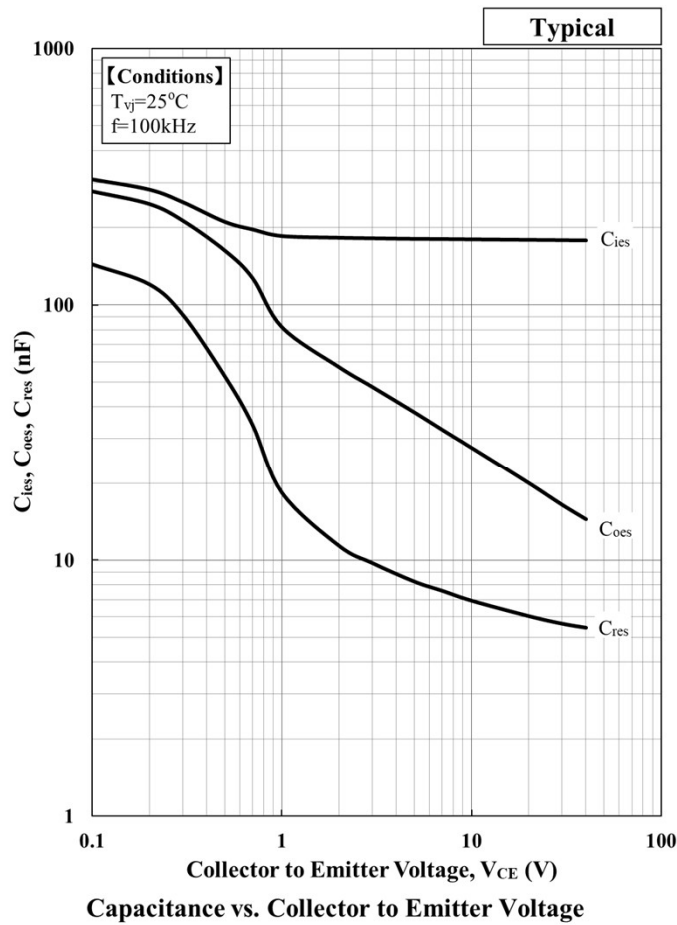


$$\frac{di}{dt} = \frac{0.5I_{rm}}{\Delta t}$$

Definition of Recovery di/dt

Reverse Recovery Safe Operation Area (RRSOA)

MBN3600E17F



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

MBN3600E17F

Minebea POWER SEMICONDUCTORS

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5. A semi-processed article is done now using solder which contains lead inside the semiconductor devices. There is possibility of the regulation substance depend on the applied models, so please check before using.
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