

MBN1600F17F

Silicon N-channel IGBT 1700V F version

FEATURES

- * Soft switching behavior, low switching loss & low conduction loss :
Soft low-injection punch-through with trench gate IGBT
- * Low driving power due to low input capacitance advanced trench MOS gate.
- * Ultra soft fast recovery diode.
- * High current rate package.
- * Low $R_{th(j-c)}$ & low stray inductance.
- * RoHS
- * High thermal fatigue durability

ABSOLUTE MAXIMUM RATINGS ($T_C=25^{\circ}\text{C}$)

Item	Symbol	Unit	MBN1600F17F
Collector Emitter Voltage	V_{CES}	V	1,700
Gate Emitter Voltage	V_{GES}	V	± 20
Collector Current	DC	A	1,600
	1ms		3,200
Forward Current	DC	A	1,600
	1ms		3,200
Operating Junction Temperature	$T_{vj\text{ op}}$	$^{\circ}\text{C}$	-50 ~ +150
Storage Temperature	T_{stg}	$^{\circ}\text{C}$	-50 ~ +150
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 $1.8 \pm 0.2 / 15^{+0}_{-3} \text{N} \cdot \text{m}$ (2) 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	$V_{CE}=1,700\text{V}$, $V_{GE}=0\text{V}$, $T_{vj}=25^{\circ}\text{C}$
Gate Emitter Leakage Current	I_{GES}	nA	-500	-	+500	$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$, $T_{vj}=25^{\circ}\text{C}$
Collector Emitter Saturation Voltage	$V_{CE(sat)}$	V	-	2.0	-	$I_C=1,600\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=25^{\circ}\text{C}$
			-	2.3	-	$I_C=1,600\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=125^{\circ}\text{C}$
			-	2.4	2.6	$I_C=1,600\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=150^{\circ}\text{C}$
Gate Emitter Threshold Voltage	$V_{GE(th)}$	V	4.1	5.5	7.1	$V_{CE}=10\text{V}$, $I_C=160\text{mA}$, $T_{vj}=25^{\circ}\text{C}$
Input Capacitance	C_{ies}	nF	-	87	-	$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_{vj}=25^{\circ}\text{C}$
Internal Gate Resistance	$R_{G(int)}$	Ω	-	2.25	-	$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_{vj}=25^{\circ}\text{C}$
Turn On Delay Time	$t_{d(on)}$	μs	-	0.7	-	$V_{CC}=900\text{V}$, $I_C=1,600\text{A}$
Rise Time	t_r		-	0.2	-	$L_S=65\text{nH}$ (3)
Turn Off Delay Time	$t_{d(off)}$		-	1.5	-	$R_{G(on/off)}=4.7/4.7\Omega$ (3)
Fall Time	t_f		-	1.5	-	$V_{GE}=\pm 15\text{V}$, $T_{vj}=150^{\circ}\text{C}$
Peak Forward Voltage Drop	V_F	V	-	2.0	-	$I_F=1,600\text{A}$, $V_{GE}=0\text{V}$, $T_{vj}=25^{\circ}\text{C}$
			-	2.2	-	$I_F=1,600\text{A}$, $V_{GE}=0\text{V}$, $T_{vj}=125^{\circ}\text{C}$
			-	2.25	2.7	$I_F=1,600\text{A}$, $V_{GE}=0\text{V}$, $T_{vj}=150^{\circ}\text{C}$
Reverse Recovery Time	t_{rr}	μs	-	0.75	-	$V_{CC}=900\text{V}$, $I_C=1,600\text{A}$
Turn On Loss	E_{on}	J/P	-	0.47	-	$L_S=65\text{nH}$ (3)
Turn Off Loss	E_{off}	J/P	-	1.25	-	$R_{G(on/off)}=4.7/4.7\Omega$ (3)
Reverse Recovery Loss	E_{rr}	J/P	-	0.55	-	$V_{GE}=\pm 15\text{V}$, $T_{vj}=150^{\circ}\text{C}$
Stray inductance module	L_{SCE}	nH	-	10	-	Collector Main to Emitter Main
Thermal Impedance	IGBT	$R_{th(j-c)}$	K/W	-	0.0165	Junction to case
	FWD	$R_{th(j-c)}$		-	0.0255	
Contact Thermal Impedance		$R_{th(c-f)}$	K/W	-	0.008	Case to fin

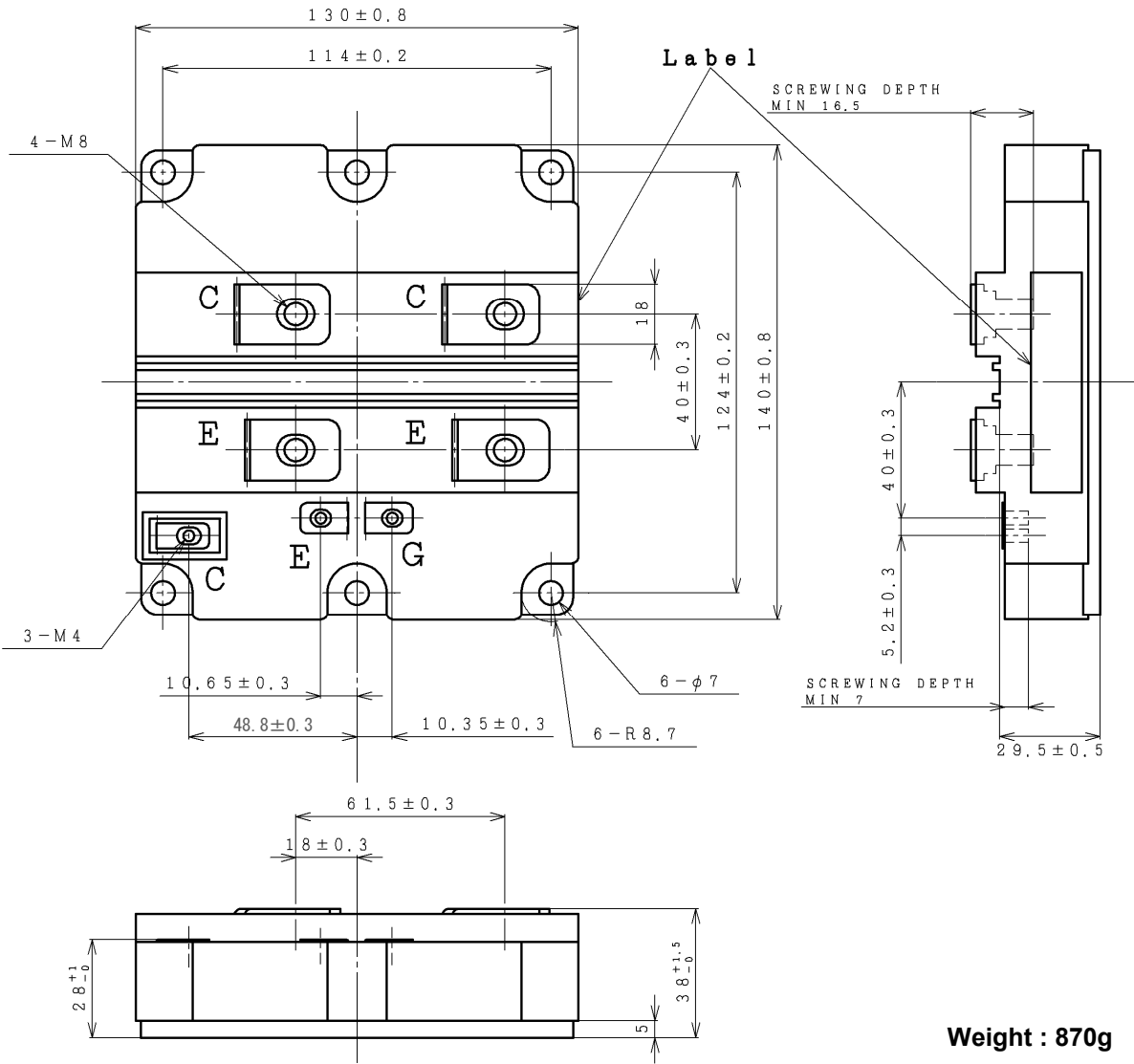
Notes:(3) L_S and R_G are the test condition's values for evaluation of the switching times, not recommended value.Please, determine the suitable R_G value after the measurement of switching waveforms (overshoot voltage, etc.) with appliance mounted.

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

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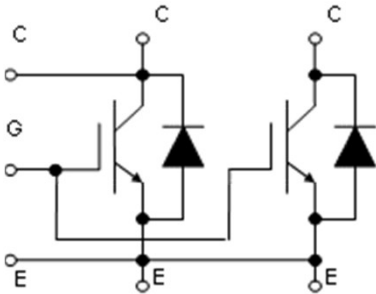
OUTLINE DRAWING

Unit in mm

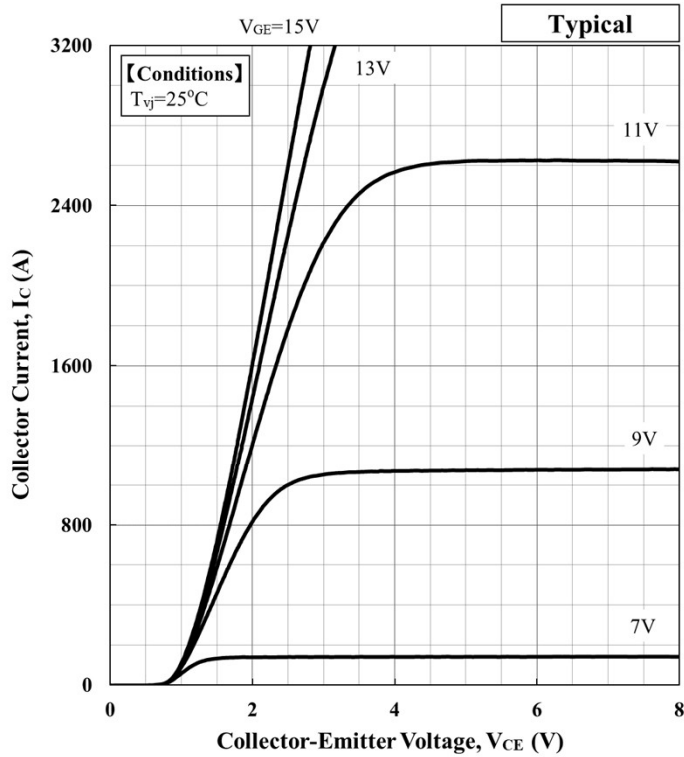


Weight : 870g

CIRCUIT DIAGRAM

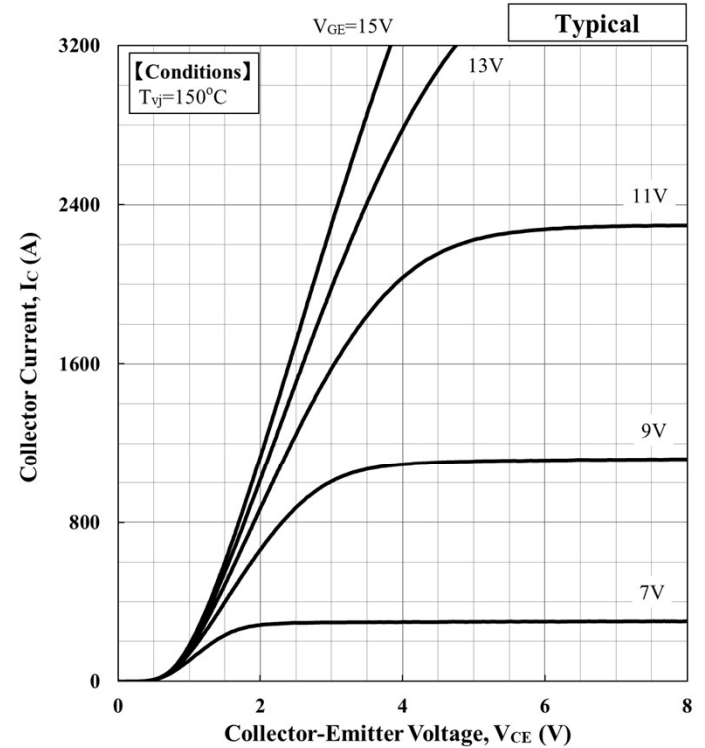


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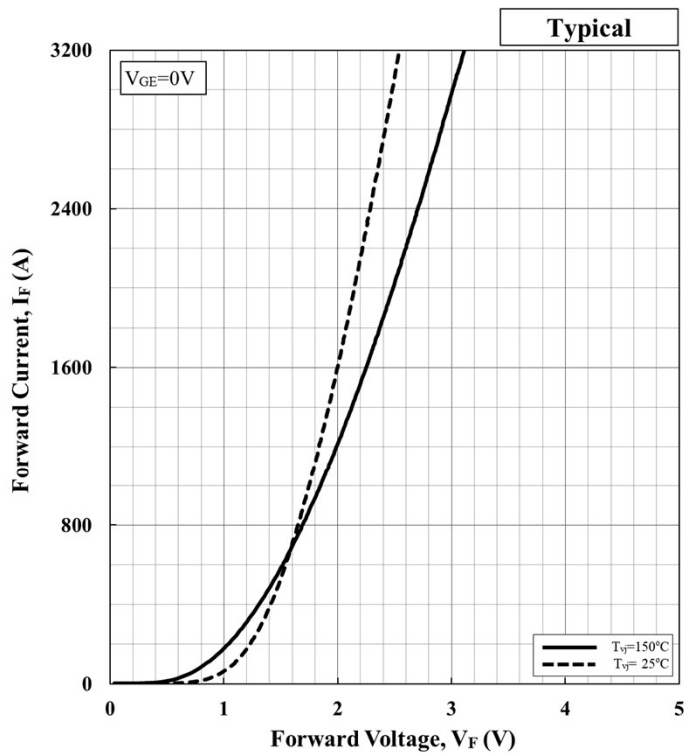
$V_{CE}(sat)[V] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$					
Temp.[$^{\circ}\text{C}$]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
25	15	2.84.E-11	-1.82.E-07	8.78.E-04	9.47.E-01

Collector Current vs. Collector Emitter Voltage



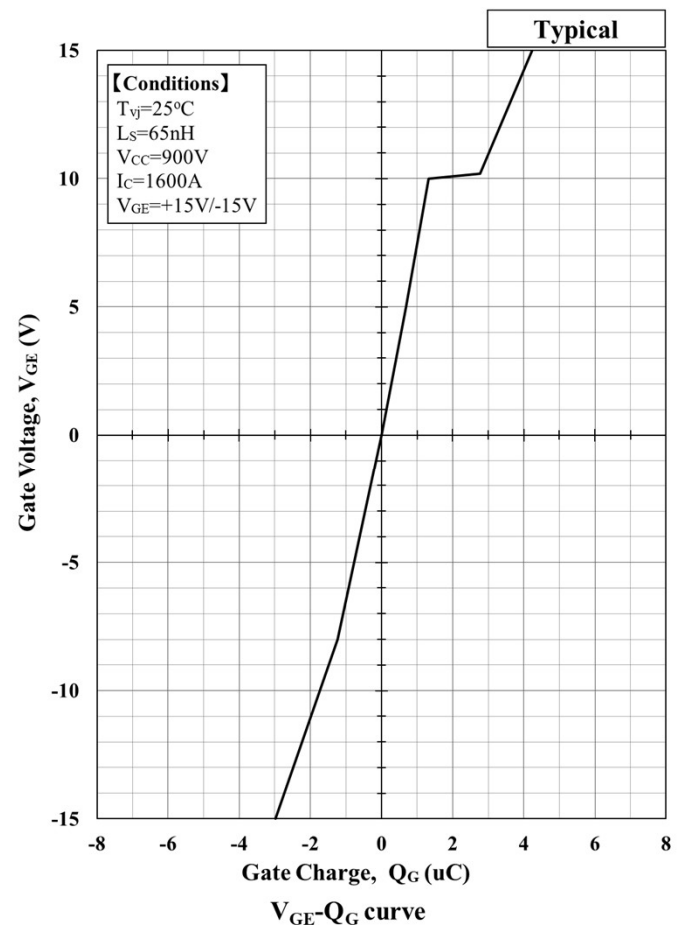
$V_{CE}(sat)[V] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$					
Temp.[$^{\circ}\text{C}$]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
150	15	4.40.E-11	-2.48.E-07	1.30.E-03	7.90.E-01

Collector Current vs. Collector Emitter Voltage

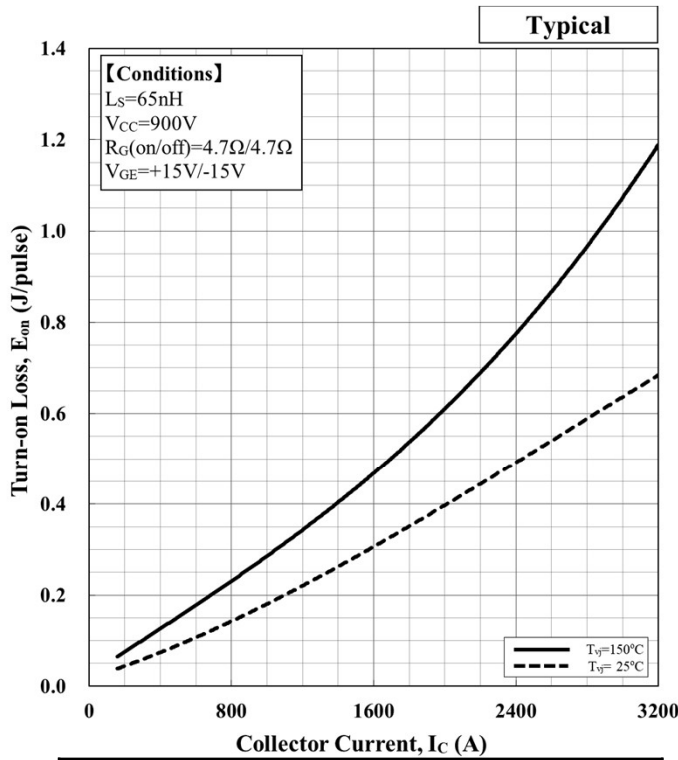


$V_F[V] = a_3 \cdot I_F ^3 + a_2 \cdot I_F ^2 + a_1 \cdot I_F + a_0$				
Temp.[$^{\circ}\text{C}$]	a_3	a_2	a_1	a_0
25	3.11.E-11	-2.27.E-07	8.66.E-04	1.08.E+00
150	5.16.E-11	-3.65.E-07	1.37.E-03	7.92.E-01

Forward Voltage of free-wheeling diode

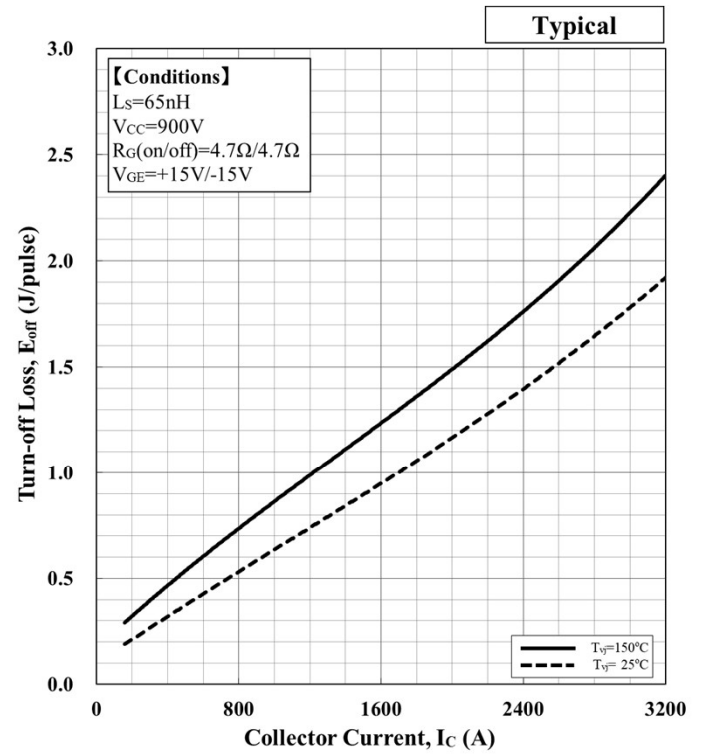


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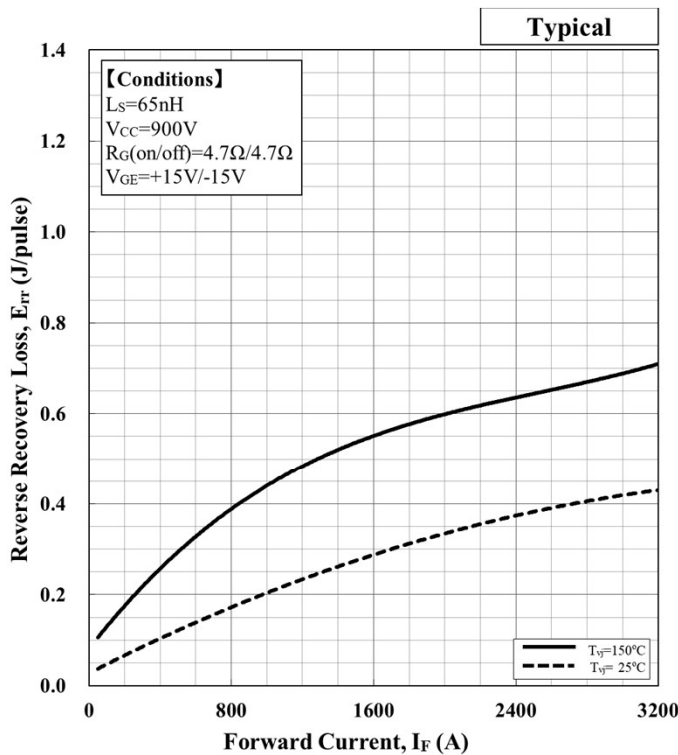
$E [J] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	-	1.60E-08	1.61E-04	8.71E-03
150	-	5.76E-08	1.71E-04	4.60E-02

Turn-on loss vs. Collector current



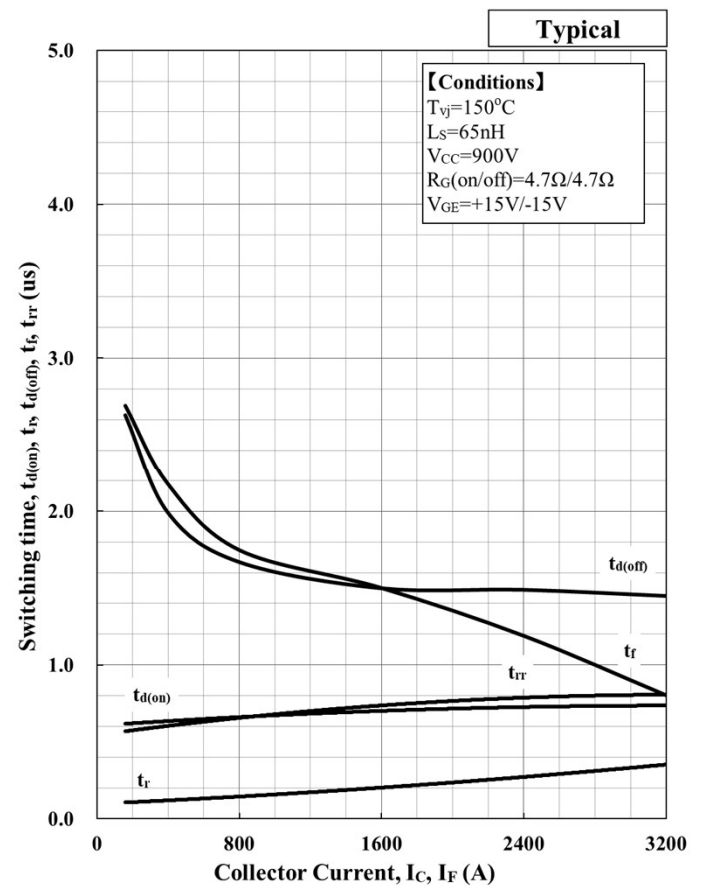
$E [J] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	1.46E-11	-4.61E-08	5.67E-04	9.95E-02
150	2.95E-11	-1.22E-07	7.87E-04	1.69E-01

Turn-off loss vs. Collector current



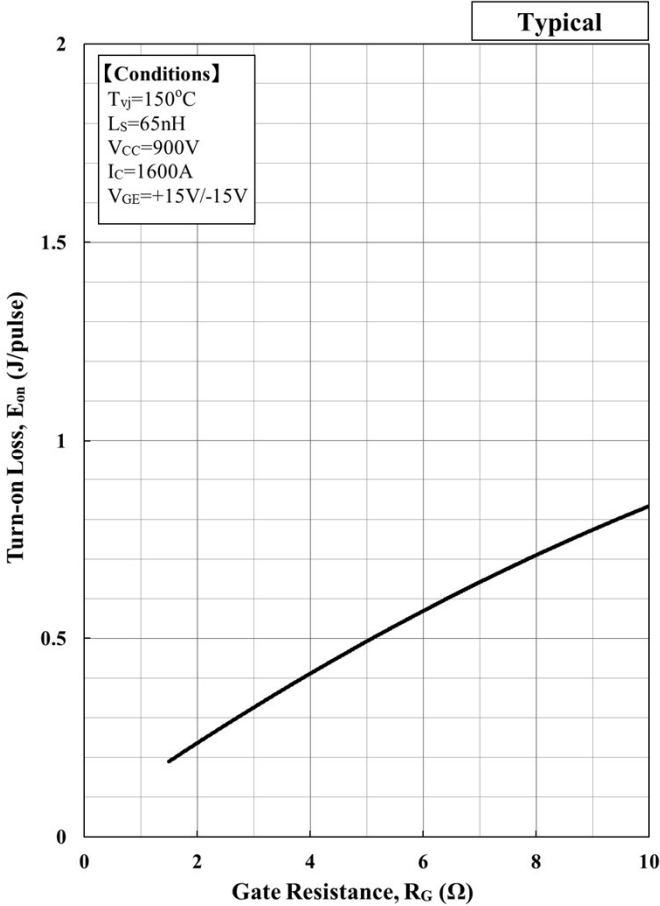
$E [J] = a_3 \cdot I_F ^3 + a_2 \cdot I_F ^2 + a_1 \cdot I_F + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	1.89E-11	-1.15E-07	3.10E-04	7.77E-03
150	2.18E-11	-1.66E-07	5.03E-04	8.14E-02

Recovery loss vs. Forward current

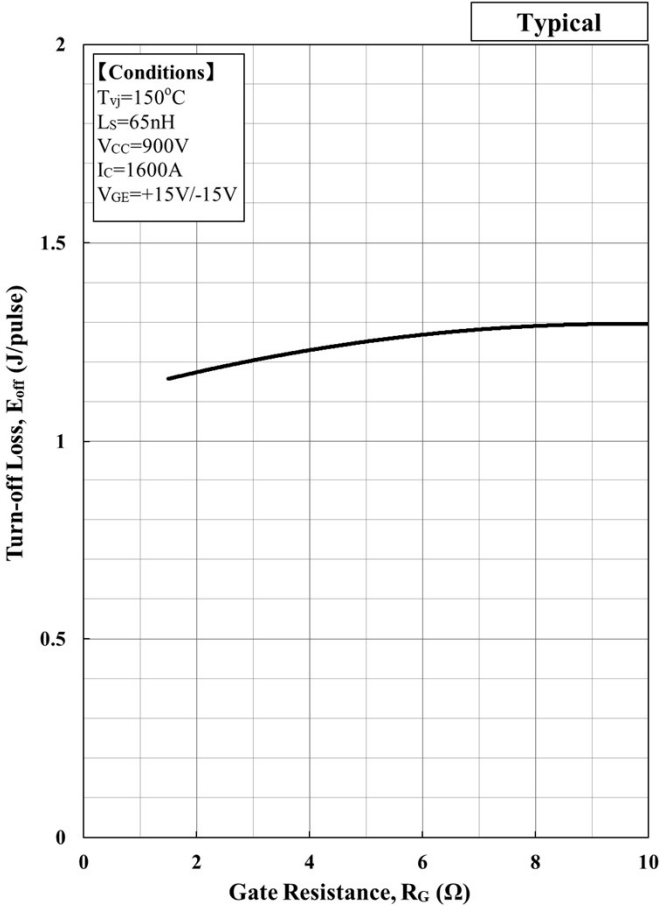


Switching time vs. Collector Current

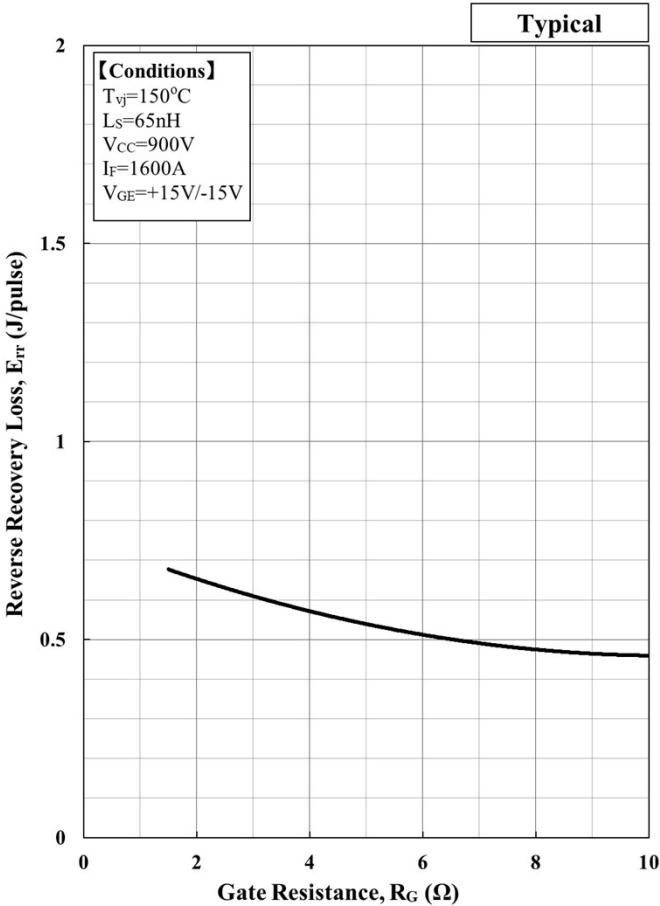
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Turn-on loss vs. Gate Resistance

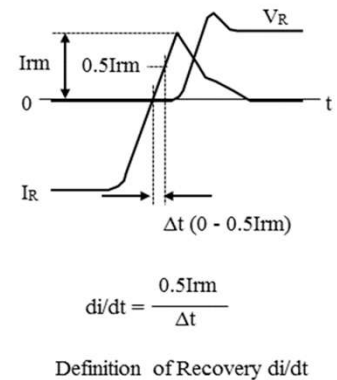
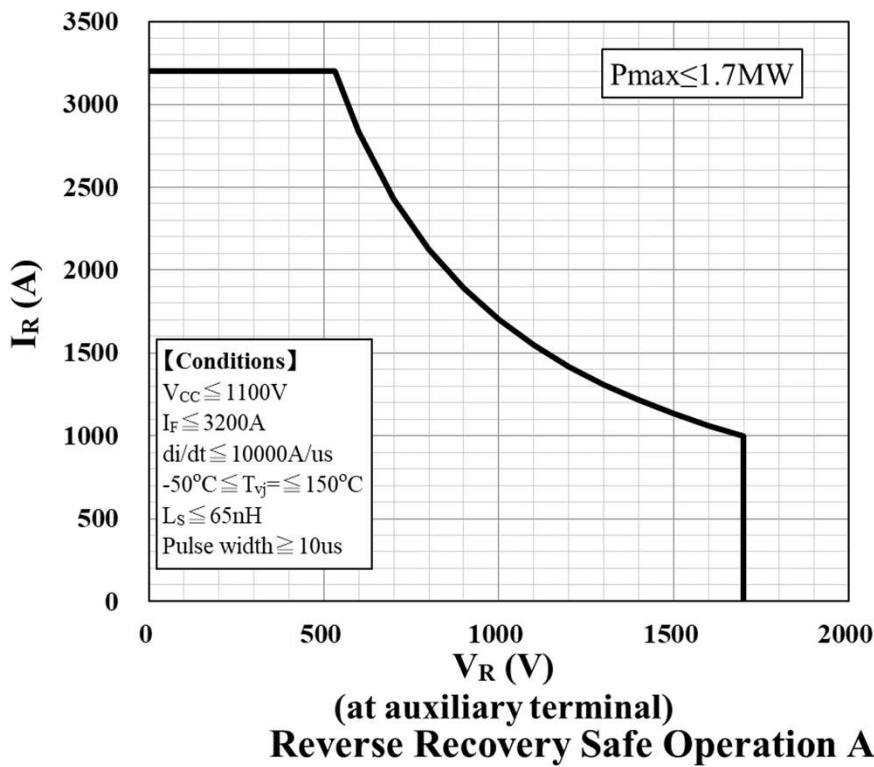
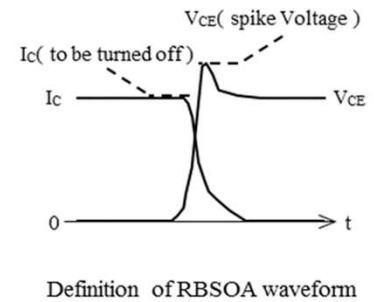
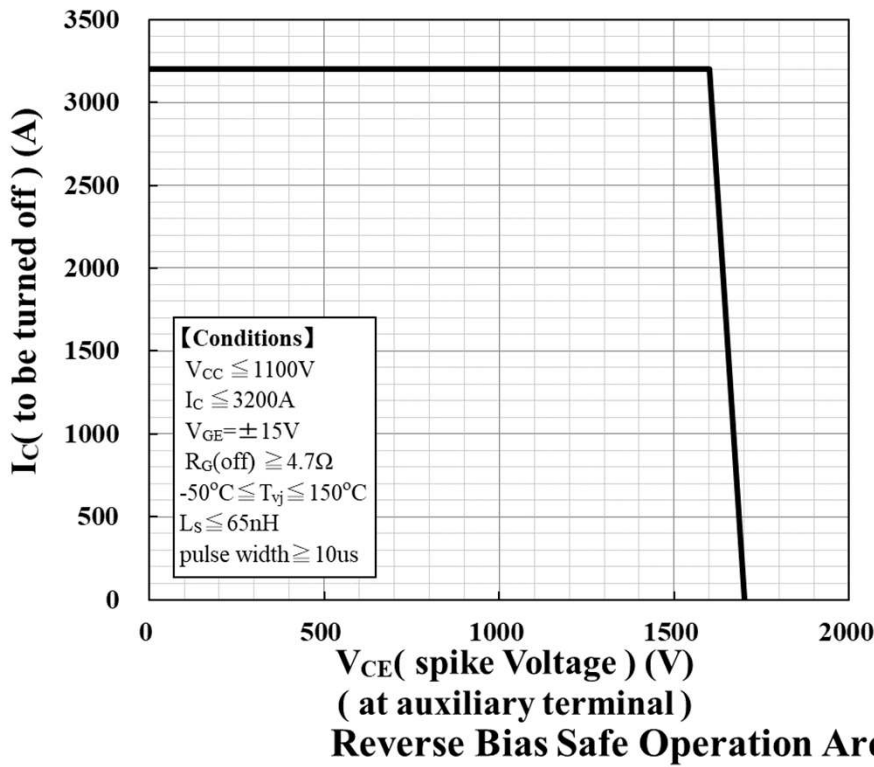


Turn-off loss vs. Gate Resistance

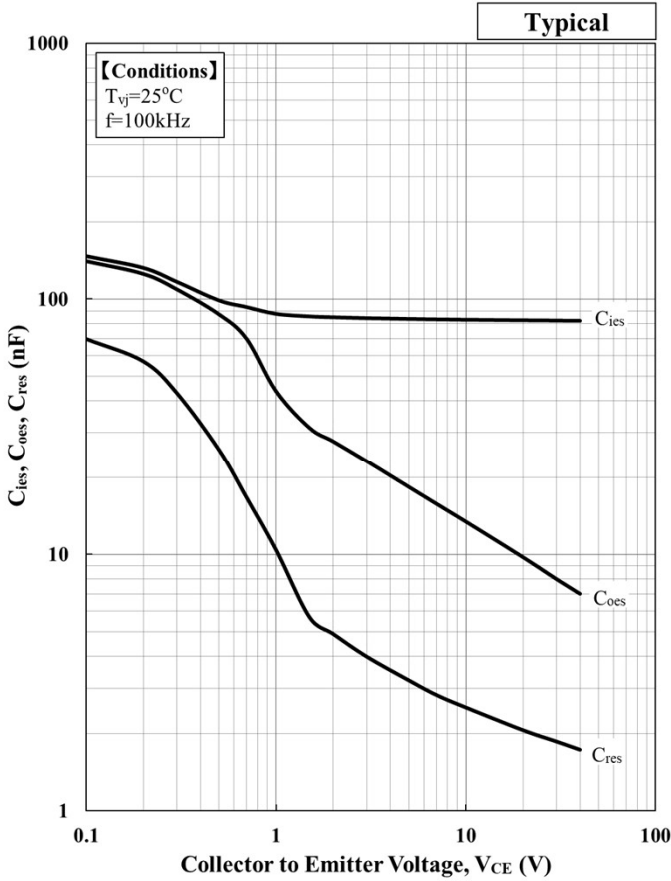


Recovery loss vs. Gate Resistance

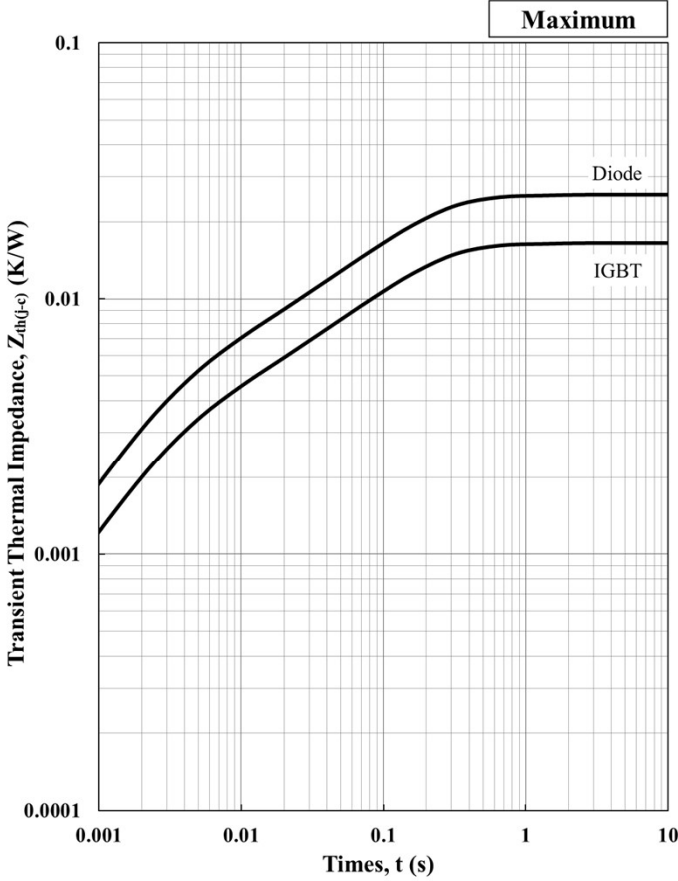
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Capacitance vs. Collector to Emitter Voltage



Transient Thermal Impedance Curve

Foster model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	1.06E-02	2.75E-03	2.75E-03	3.80E-04	[K/W]
C th, IGBT [n]	1.53E+01	8.90E+00	1.13E+00	1.43E+00	[J/K]
R th, Diode [n]	1.63E-02	4.48E-03	4.13E-03	6.04E-04	[K/W]
C th, Diode [n]	9.96E+00	5.47E+00	7.55E-01	9.00E-01	[J/K]

Cauer model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	1.97E-03	2.51E-03	5.47E-03	6.55E-03	[K/W]
C th, IGBT [n]	5.68E-01	7.62E-01	5.61E+00	1.56E+01	[J/K]
R th, Diode [n]	2.99E-03	3.90E-03	8.50E-03	1.01E-02	[K/W]
C th, Diode [n]	3.68E-01	5.06E-01	3.50E+00	1.03E+01	[J/K]

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