

MBN2400F17F

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	MBN2400F17F
Collector Emitter Voltage	V_{CES}	V	1,700
Gate Emitter Voltage	V_{GES}	V	± 20
Collector Current	DC	A	2,400
	1ms		4,800
Forward Current	DC	A	2,400
	1ms		4,800
Junction Temperature	$T_{vj op}$	$^\circ\text{C}$	-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	-	-	7 100	$V_{CE}=1,700\text{V}$, $V_{GE}=0\text{V}$, $T_{vj}=25^\circ\text{C}$ $V_{CE}=1,700\text{V}$, $V_{GE}=0\text{V}$, $T_{vj}=150^\circ\text{C}$
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	-	$I_C=2,400\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=25^\circ\text{C}$
			-	2.3	-	$I_C=2,400\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=125^\circ\text{C}$
			-	2.4	2.6	$I_C=2,400\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=150^\circ\text{C}$
Gate Emitter Threshold Voltage	$V_{GE(th)}$	V	4.1	5.5	7.1	$V_{CE}=10\text{V}$, $I_C=240\text{mA}$, $T_{vj}=25^\circ\text{C}$
Input Capacitance	C_{ies}	nF	-	131	-	$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_{vj}=25^\circ\text{C}$
Internal Gate Resistance	$R_{G(int)}$	Ω	-	1.5	-	$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_{vj}=25^\circ\text{C}$
Turn On Delay Time	$t_{d(on)}$	μs	-	0.8	-	$V_{CC}=900\text{V}$, $I_C=2,400\text{A}$
Rise Time	t_r		-	0.2	-	$L_S=55\text{nH}$ (3)
Turn Off Delay Time	$t_{d(off)}$		-	1.7	-	$R_{G(on/off)}=3.3/3.3\Omega$ (3)
Fall Time	t_f		-	1.5	-	$V_{GE}=\pm 15\text{V}$, $T_{vj}=150^\circ\text{C}$
Forward Voltage Drop	V_F	V	-	2.0	-	$I_F=2,400\text{A}$, $V_{GE}=0\text{V}$, $T_{vj}=25^\circ\text{C}$
			-	2.2	-	$I_F=2,400\text{A}$, $V_{GE}=0\text{V}$, $T_{vj}=125^\circ\text{C}$
			-	2.25	2.7	$I_F=2,400\text{A}$, $V_{GE}=0\text{V}$, $T_{vj}=150^\circ\text{C}$
Reverse Recovery Time	t_{rr}	μs	-	0.85	-	$V_{CC}=900\text{V}$, $I_C=2,400\text{A}$
Turn On Loss	E_{on}	J/P	-	0.7	-	$L_S=55\text{nH}$ (3)
Turn Off Loss	E_{off}	J/P	-	2.0	-	$R_{G(on/off)}=3.3/3.3\Omega$ (3)
Reverse Recovery Loss	E_{rr}	J/P	-	0.8	-	$V_{GE}=\pm 15\text{V}$, $T_{vj}=150^\circ\text{C}$
Stray inductance module	L_{SCE}	nH	-	7	-	Collector Main to Emitter Main
Thermal Impedance	IGBT	$R_{th(j-c)}$	-	-	0.011	Junction to case
	FWD	$R_{th(j-c)}$	-	-	0.017	
Contact Thermal Impedance		$R_{th(c-f)}$	-	0.005	-	Case to fin

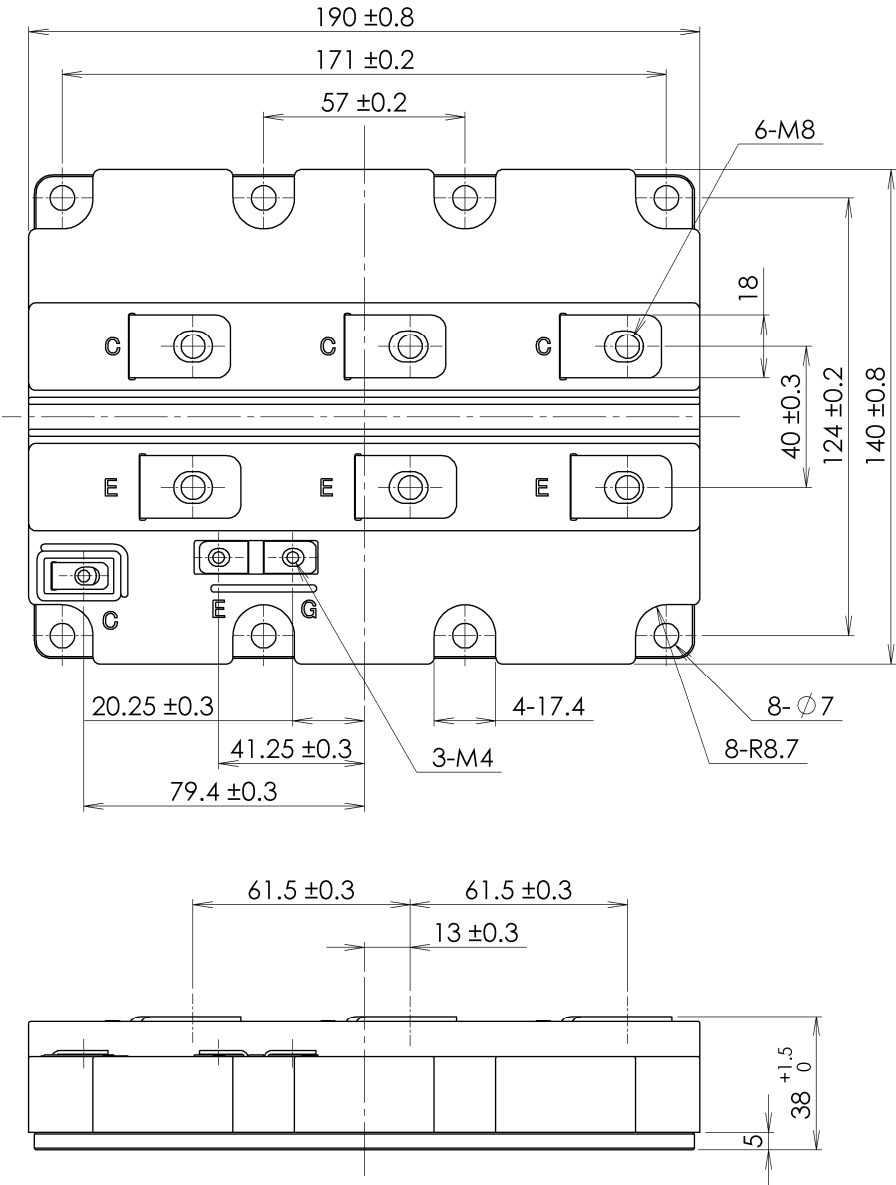
Notes:(3) L_S and R_G are the test condition's values for evaluation of the switching times, not recommended value.

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.

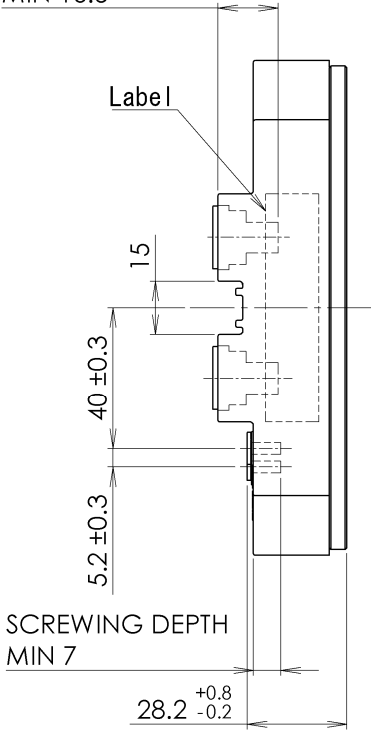
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OUTLINE DRAWING



Unit in mm

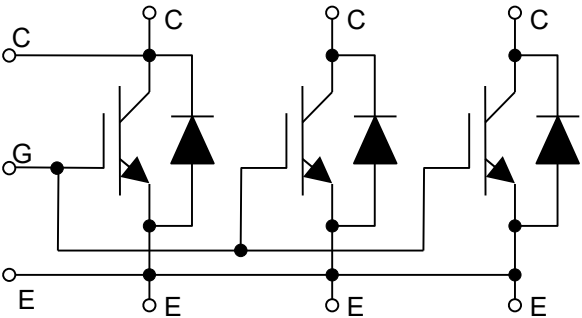
SCREWING DEPTH
MIN 16.5



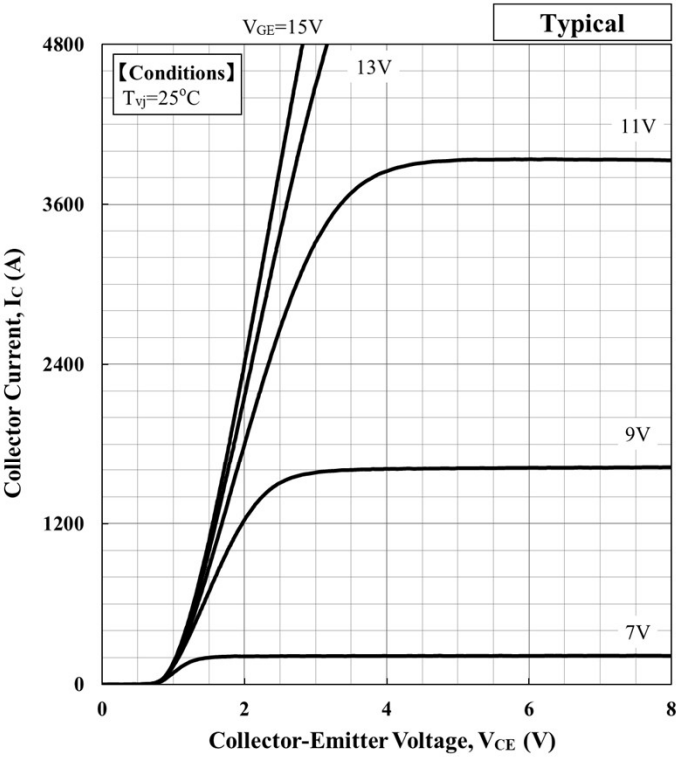
SCREWING DEPTH
MIN 7

Weight : 1,300g

CIRCUIT DIAGRAM

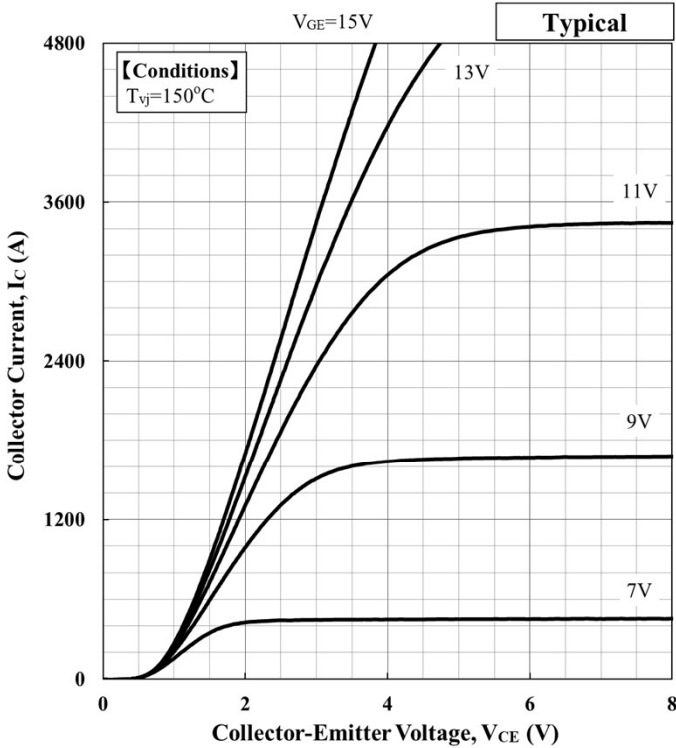


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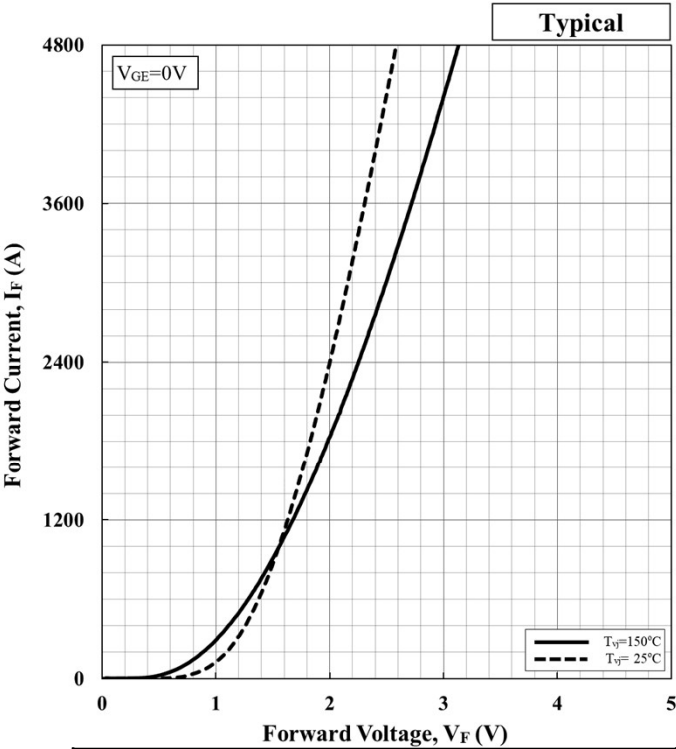
$V_{CE}(sat)[V] = a_3 \cdot I_C ^3 + a_2 \cdot I_C ^2 + a_1 \cdot I_C + a_0$					
Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
25	15	8.16.E-12	-7.88.E-08	5.80.E-04	9.51.E-01

Collector Current vs. Collector Emitter Voltage



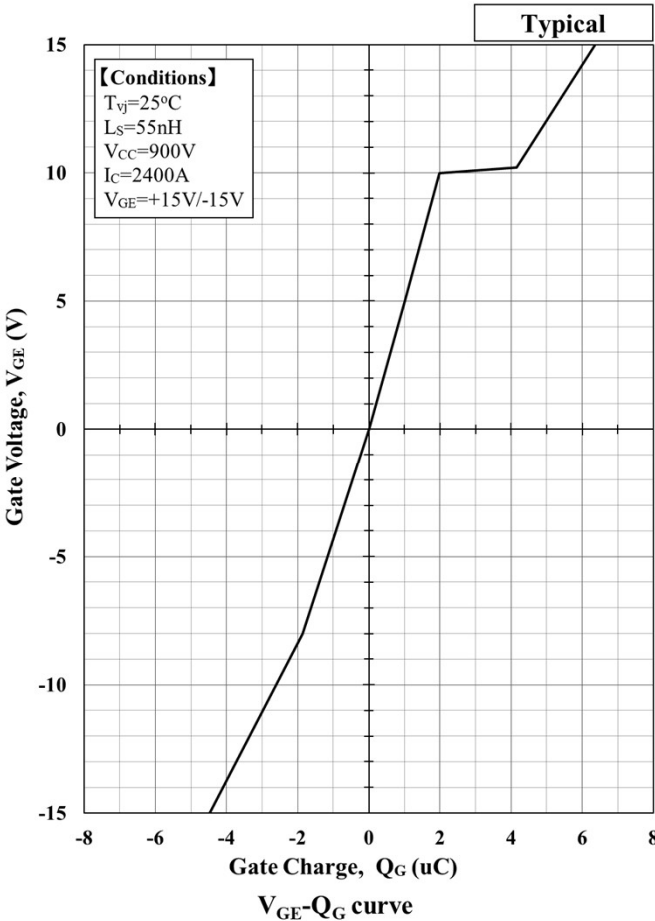
$V_{CE}(sat)[V] = a_3 \cdot I_C ^3 + a_2 \cdot I_C ^2 + a_1 \cdot I_C + a_0$					
Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
150	15	1.27.E-11	-1.07.E-07	8.57.E-04	7.94.E-01

Collector Current vs. Collector Emitter Voltage

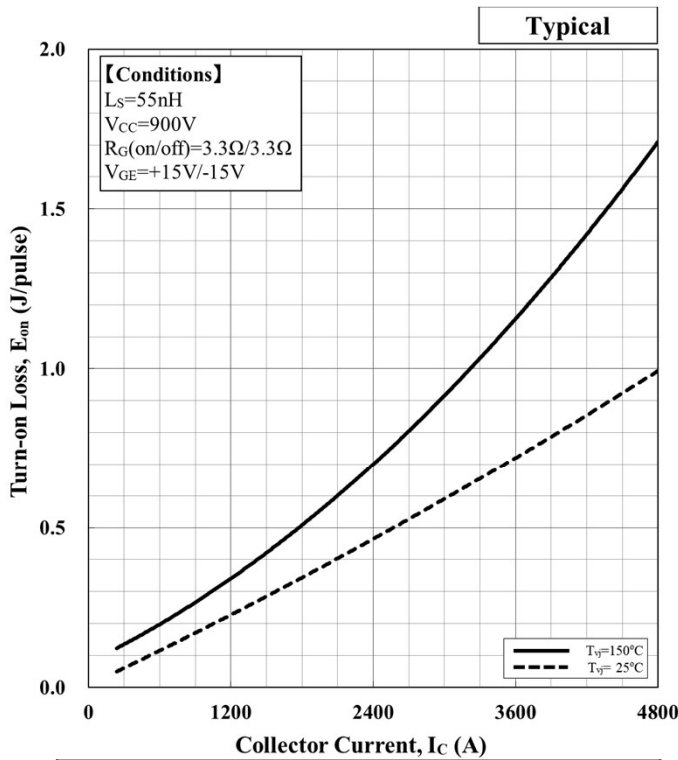


$V_F[V] = a_3 \cdot I_F ^3 + a_2 \cdot I_F ^2 + a_1 \cdot I_F + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	9.71.E-12	-1.02.E-07	5.92.E-04	1.04.E+00
150	1.34.E-11	-1.48.E-07	8.94.E-04	7.83.E-01

Forward Voltage of free-wheeling diode

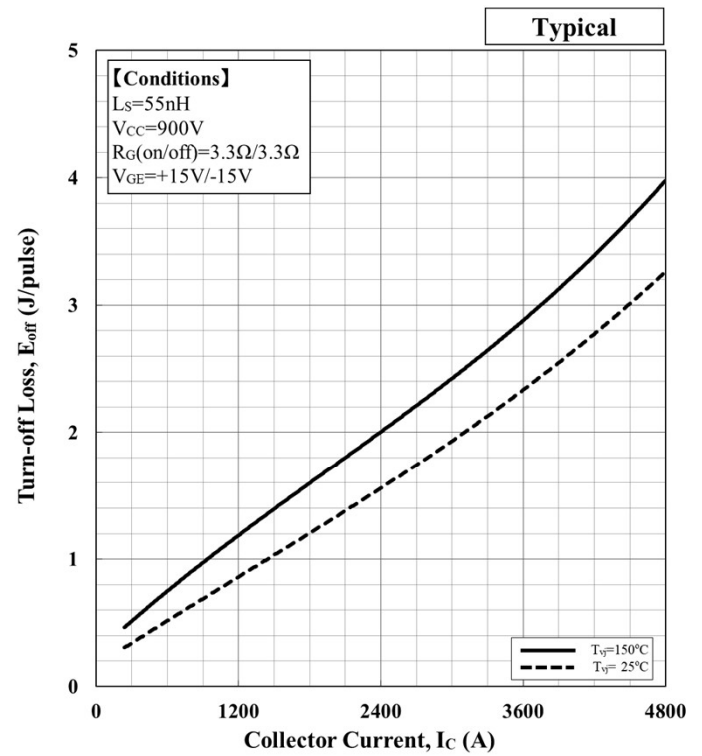


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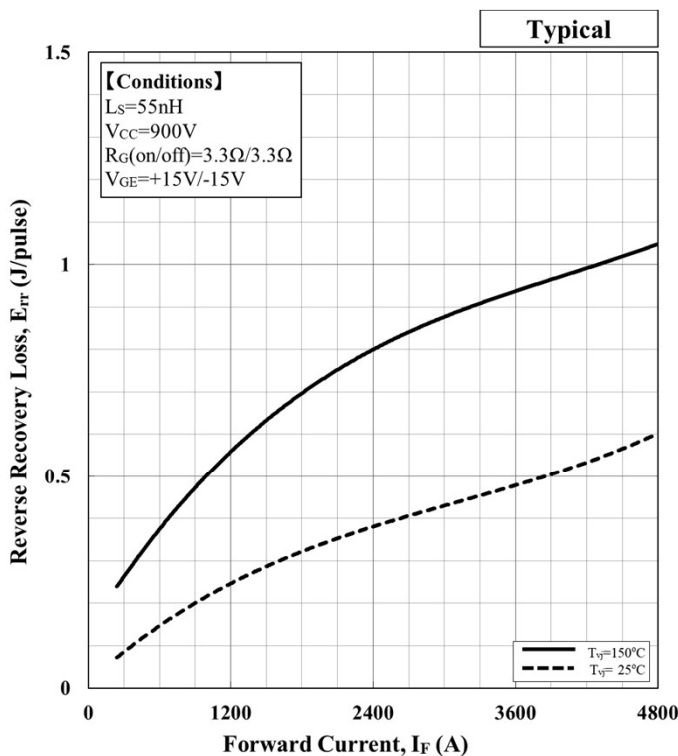
$E [J] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	-	6.23E-09	1.75E-04	7.91E-03
150	-	3.38E-08	1.78E-04	7.88E-02

Turn-on loss vs. Collector current



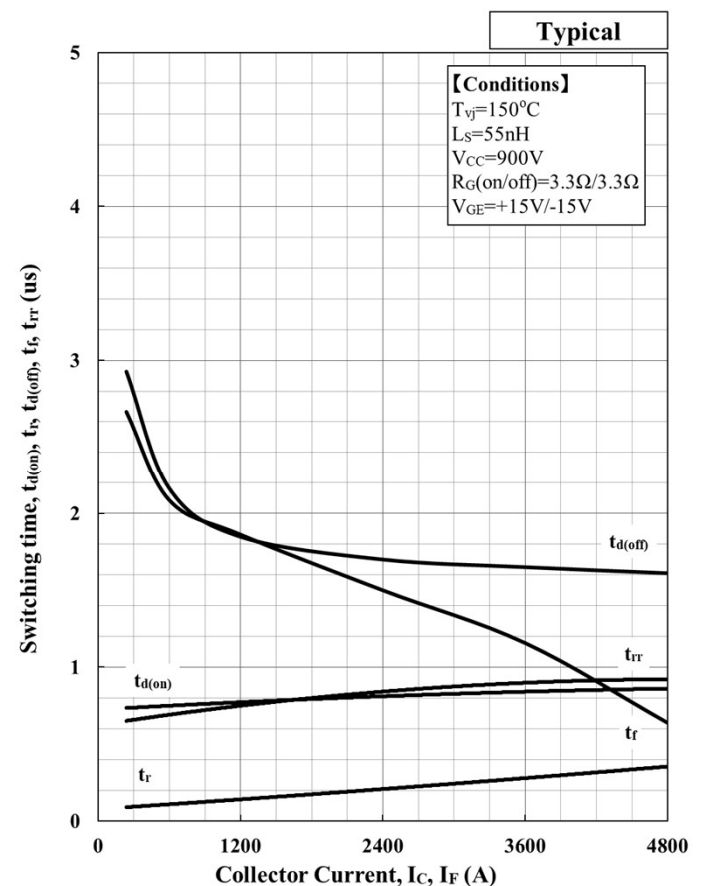
$E [J] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	7.32E-12	-2.61E-08	6.03E-04	1.62E-01
150	1.58E-11	-9.38E-08	8.59E-04	2.64E-01

Turn-off loss vs. Collector current



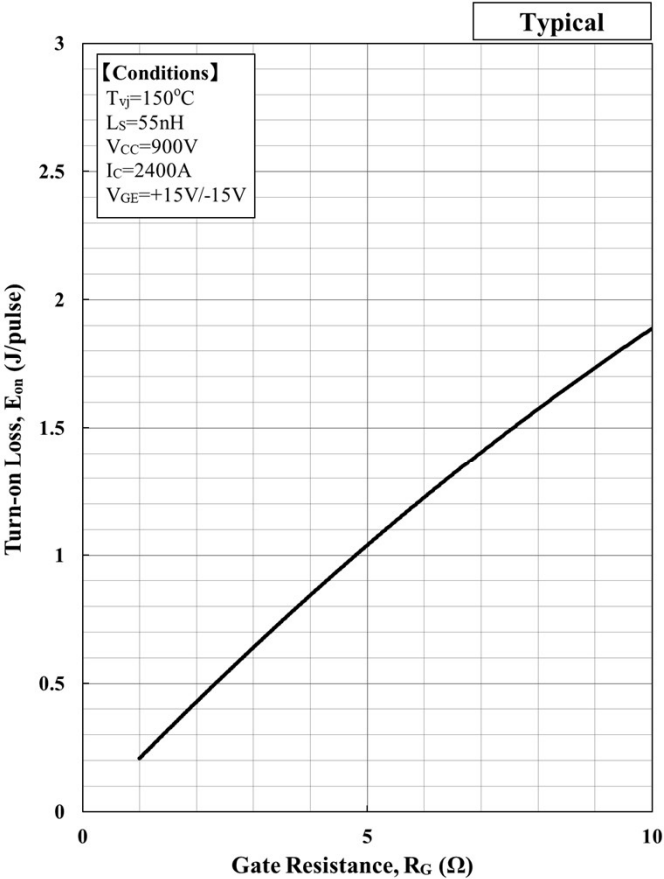
$E [J] = a_3 \cdot I_F ^3 + a_2 \cdot I_F ^2 + a_1 \cdot I_F + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	5.96E-12	-5.55E-08	2.51E-04	1.46E-02
150	7.44E-12	-8.96E-08	4.49E-04	1.36E-01

Recovery loss vs. Forward current

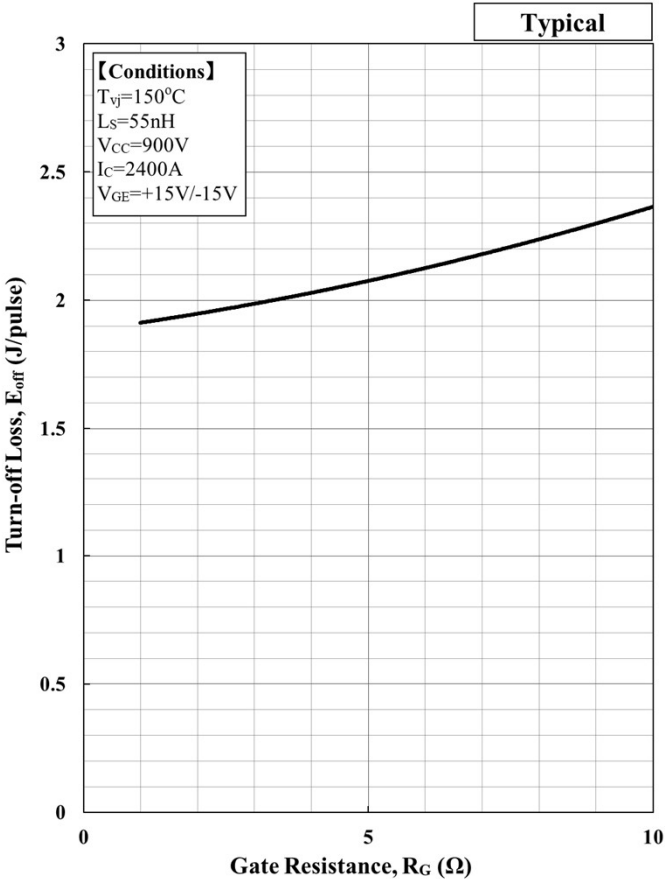


Switching time vs. Collector Current

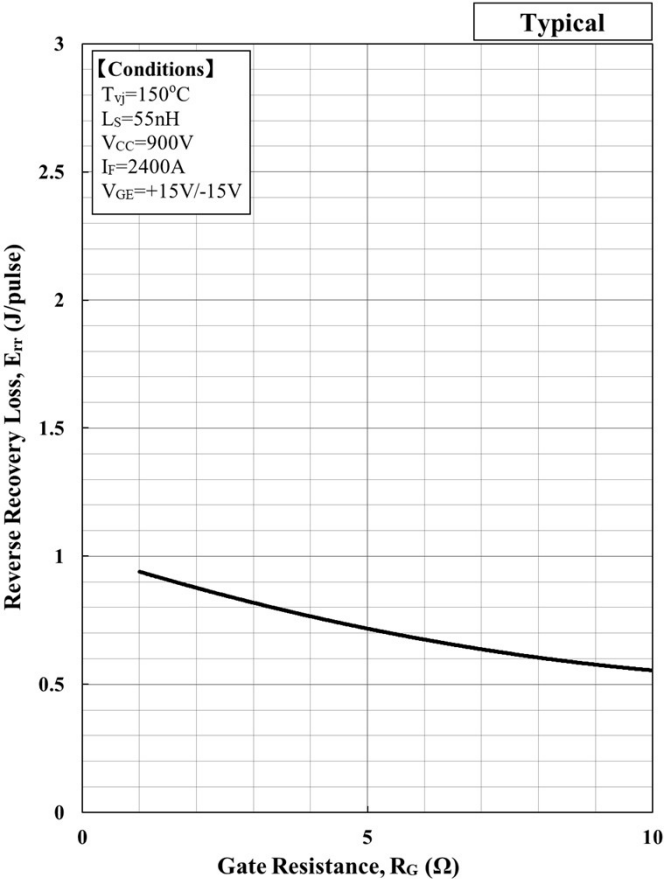
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Turn-on loss vs. Gate Resistance

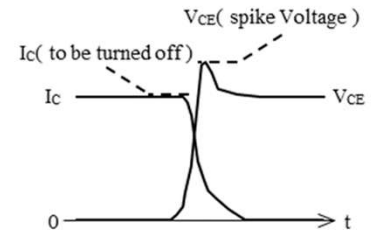
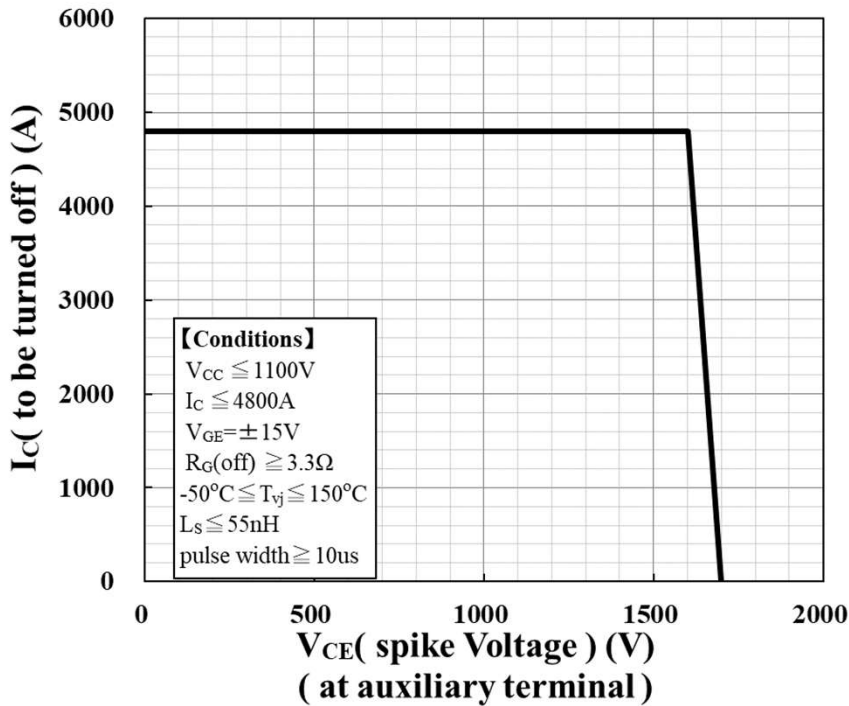


Turn-off loss vs. Gate Resistance



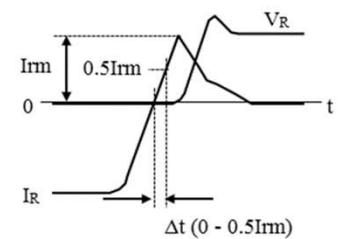
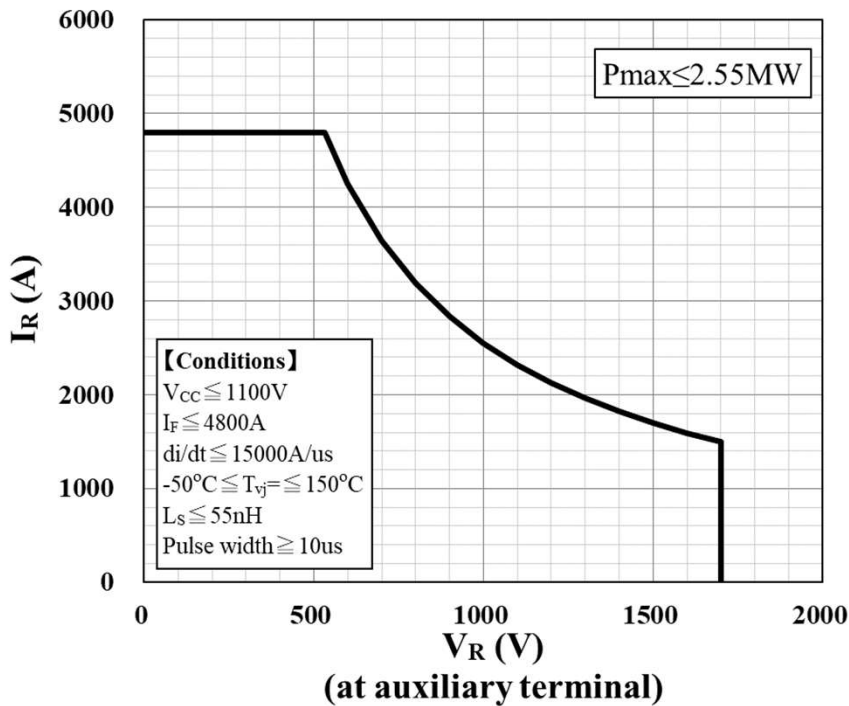
Recovery loss vs. Gate Resistance

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Definition of RBSOA waveform

Reverse Bias Safe Operation Area (RBSOA)

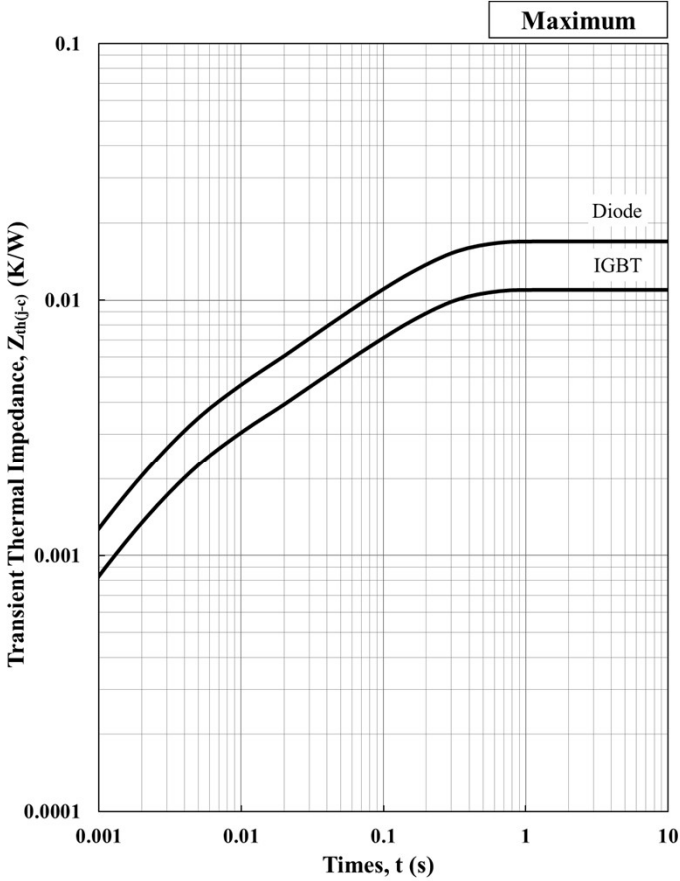
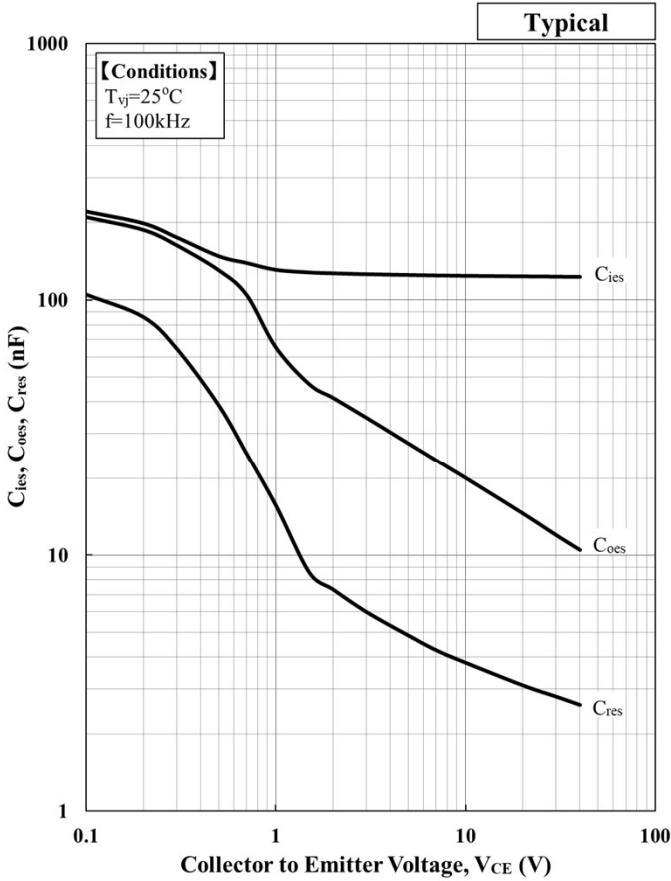


$$di/dt = \frac{0.5I_{rm}}{\Delta t}$$

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]	7.08E-03	1.83E-03	1.84E-03	2.53E-04	[K/W]
C th, IGBT [n]	2.29E+01	1.34E+01	1.70E+00	2.15E+00	[J/K]
R th, Diode [n]	1.09E-02	2.99E-03	2.75E-03	4.03E-04	[K/W]
C th, Diode [n]	1.49E+01	8.20E+00	1.13E+00	1.35E+00	[J/K]

Cauer model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	1.31E-03	1.67E-03	3.64E-03	4.37E-03	[K/W]
C th, IGBT [n]	8.52E-01	1.14E+00	8.42E+00	2.35E+01	[J/K]
R th, Diode [n]	1.99E-03	2.60E-03	5.67E-03	6.75E-03	[K/W]
C th, Diode [n]	5.51E-01	7.59E-01	5.25E+00	1.55E+01	[J/K]

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