MBN1200E17E

TARGET SPECIFICATION

Silicon N-channel IGBT 1700V E version

1. FEATURES

- Soft switching behavior & low conduction loss: Soft low-injection punch-through with trench gate IGBT.
- Low driving power: Low input capacitance advanced trench gate.
- Low noise recovery: Ultra soft fast recovery diode.
- High thermal fatigue durability:(delta Tc=70K, N＞30,000cycles)
- AlSiC base-plate/AlN substrate.

2. ABSOLUTE MAXIMUM RATINGS (Tc=25°C)

Item			Symbol	Unit	MBN1200E17E
Collector Emitter Voltage			V_{CES}	V	1,700
Gate Emitter Voltage			V_{GES}	V	±20
Collector Current	DC		I_C	A	1,200
	1ms		I_{Cp}		2,400
Forward Current	DC		I_F	A	1,200
	1ms		I_{FM}		2,400
Total Power dissipation			Ptot	kW	5.5
Junction Temperature			T_j	°C	-40 ~ +125
Storage Temperature			Tstg	°C	-40 ~ +125
Isolation Voltage			V_{ISO}	V_{RMS}	4,000 (AC 1 minute)
Screw Torque	Terminals	(M4)	-	N·m	2 (1)
		(M8)	-		15 (1)
	Mounting	(M6)	-		5 (2)

Notes: (1) Recommended Value $2.0^{+0.1}_{-0.2}$ / 15^{+0}_{-3}N·m

(2) Recommended Value 5.0±1N·m

3. ELECTRIC 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, Tj=25°C
				-	14	35	V_{CE}=1,700V, V_{GE}=0V, Tj=125°C
Gate Emitter Leakage Current		I_{GES}	nA	-500	-	+500	V_{GE}=±20V, V_{CE}=0V, Tj=25°C
Collector Emitter Saturation Voltage		V_{CE}(sat)	V	-	2.0	-	I_C=1,200A, V_{GE}=15V, Tj=25°C
				-	2.2	2.7	I_C=1,200A, V_{GE}=15V, Tj=125°C
Gate Emitter Threshold Voltage		V_{GE}(TO)	V	5.0	6.5	8.0	V_{CE}=10V, I_C=120mA, Tj=25°C
Input Capacitance		C_{ies}	nF	-	100	-	V_{CE}=10V, V_{GE}=0V f=100kHz, Tj=25°C
Reverse transfer Capacitance		C_{res}	nF	-	6	-	
Output Capacitance		C_{oes}	nF	-	11	-	
Total Gate Charge		Q_G	μC	-	7	-	V_{GE}=±15V, Vcc=900V, Ic=1,200A
Turn-on Gate Charge		QG(on)	μC	-	3.3	-	V_{GE}=-15V→0V, Vcc=900V, Ic=1,200A
				-	4.3	-	V_{GE}=-15V→8V, Vcc=900V, Ic=1,200A
Internal Gate Resistance (Tentative)		Rge(int)	Ω	-	2.0	-	V_{CE}=10V, V_{GE}=0V, f=100kHz, Tj=25°C
Switching Times	Turn on delay Time	$t_{d(on)}$	μs	-	0.9	1.8	V_{CC}=900V, Ic=1,200A L=100nH R_G(on/off)=6.8/1.5Ω (3) V_{GE}=±15V, Tj=125°C
	Rise Time	t_r		-	1.1	2.2	
	Turn On Time	t_{on}		-	2.0	4.0	
	Turn off delay Time	$t_{d(off)}$			1.1	2.2	
	Fall Time	t_f		-	1.0	2.0	
	Turn Off Time	t_{off}		-	2.1	4.2	
Peak Forward Voltage Drop		V_{FM}	V	-	1.8	-	Ic=1,200A, V_{GE}=0V, Tj=25°C
				-	1.9	2.5	Ic=1,200A, V_{GE}=0V, Tj=125°C
Reverse Recovery Time		t_{rr}	μs	-	0.7	1.4	V_{CC}=900V, Ic=1,200A L=100nH R_G(on/off)=6.8/1.5Ω (3) V_{GE}=±15V, Tj=125°C
Turn On Loss		$E_{on(10\%)}$	J/P	-	0.28	0.42	
		$E_{on(Full)}$	J/P	-	0.36	(0.54)	
Turn Off Loss		$E_{off(10\%)}$	J/P	-	0.8	1.2	
		$E_{off(Full)}$	J/P	-	0.9	(1.35)	
Reverse Recovery Loss		$E_{rr(10\%)}$	J/P	-	0.4	0.6	
		$E_{rr(Full)}$	J/P	-	0.5	(0.75)	
Reverse Recovery Peak Current		IRRM	A	-	1000	-	
RBSOA		Ic	A	2400	-	-	V_{CC}=1100V,L=100nH,R_G(on/off)=6.8/1.5Ω(3) V_{GE}=±15V, Tj=125°C
Recovery SOA		I_F	A	2400	-	-	
I^2t value		I^2t	kA^2s	-	450	-	$T_{j,start}$=125 °C, 10ms, V_R=0V
Partial Discharge Extinction Voltage		V_{PDoff}	V_{RMS}	1.3	-	-	Q=10pC, 50Hz,

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.

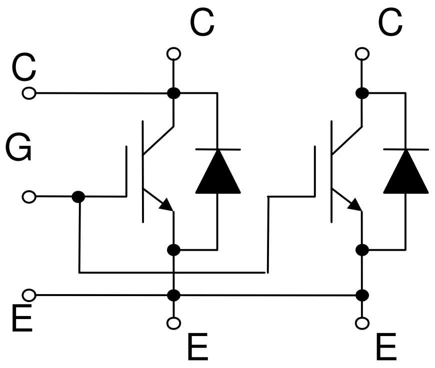
4. THERMAL CHARACTERISTICS

Item		Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Thermal Resistance	IGBT	Rth(j-c)	K/W	-	-	0.018	Junction to case
	FWD	Rth(j-c)		-	-	0.023	
Contact Thermal Impedance		Rth(c-f)	K/W	-	0.008	-	Case to fin. Thermal grease applied. Thickness 100μm, Thermal conductivity of grease: 1W/mK

5. MODULE MECHNICAL CHARACTERISTICS

Item		Unit	Characteristics	Conditions
Weight		g	900	
Creeping Distance	Between terminal	mm	49	
	Terminal-Base	mm	33	
Clearance Distance	Between terminal	mm	22	
	Terminal-Base	mm	25	
Stray inductance in module	LS(CM-EM)	nH	18	Collector-main to Emitter-main
	LS(ES-EM)		5.7	Emitter-sense to Emitter-main
	LS(CM-CS)		9.6	Collector-main to Collector sense
Terminal Resistance	$R_{Terminal}$	mΩ	0.14	Collector-main to Emitter-main
Comparative Tracking Index	(CTI)		600	
Module base plate Material			Al-SiC	
Baseplate Thickness		mm	5	
Insulation Material			Al N	
Terminal Surface treatment			Ni plating	
Case Material			Poly-Phenilene Sulfide	
Fire and Smoke Category			I2 / F3	NFF 16-102

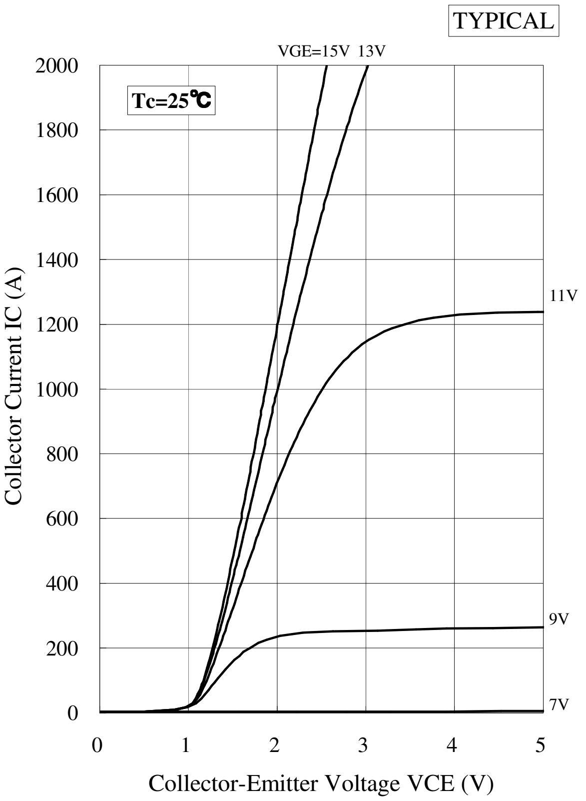
6. CIRCUIT DIAGRAM



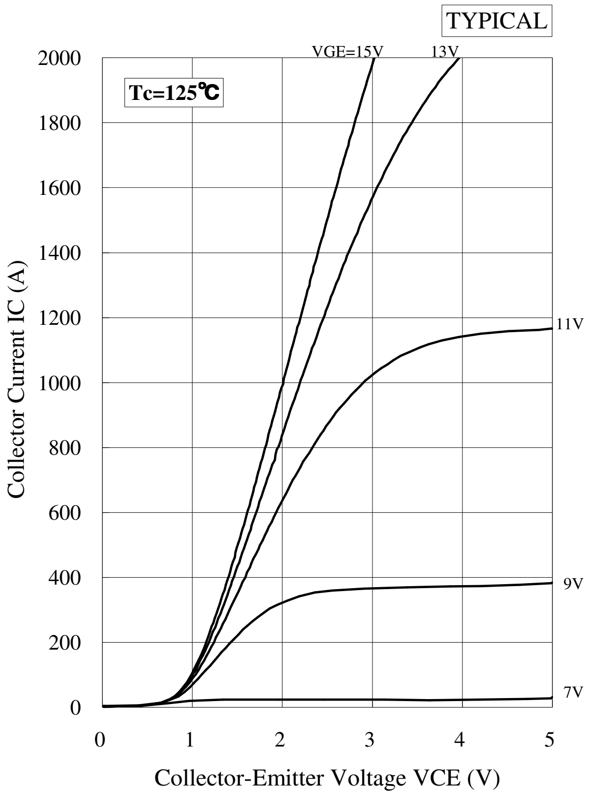
CIRCUIT DIAGRAM

7. CHARACTERISTICS CURVE

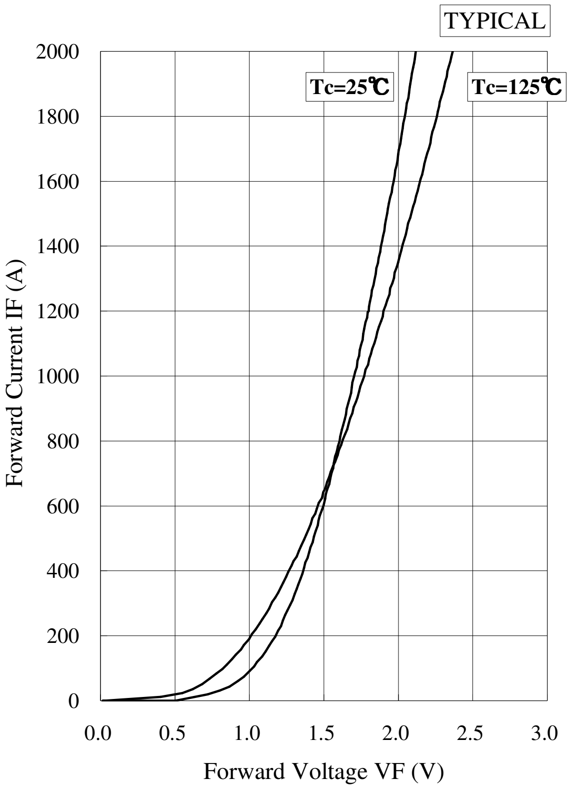
7.1 STATIC CHARACTERISTICS



Collector Current vs. Collector to Emitter Voltage



Collector Current vs. Collector to Emitter Voltage



Forward Voltage of free-wheeling diode

MBN1200E17E

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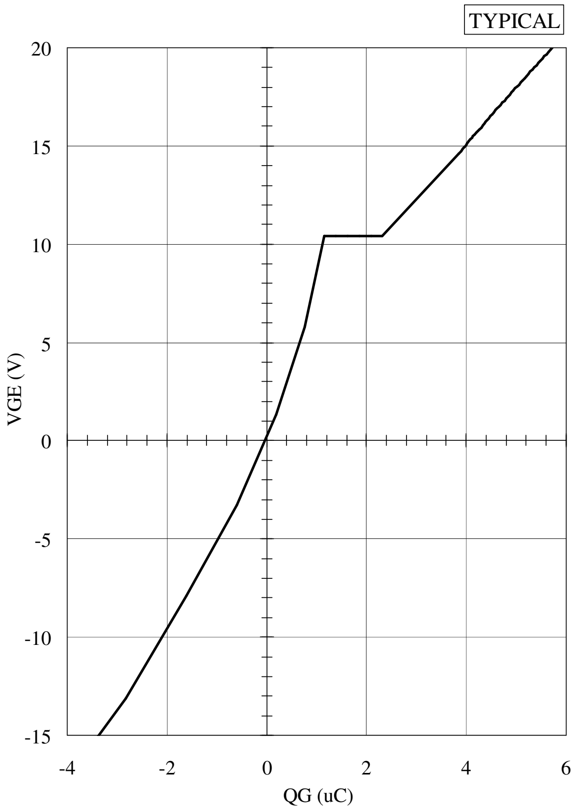
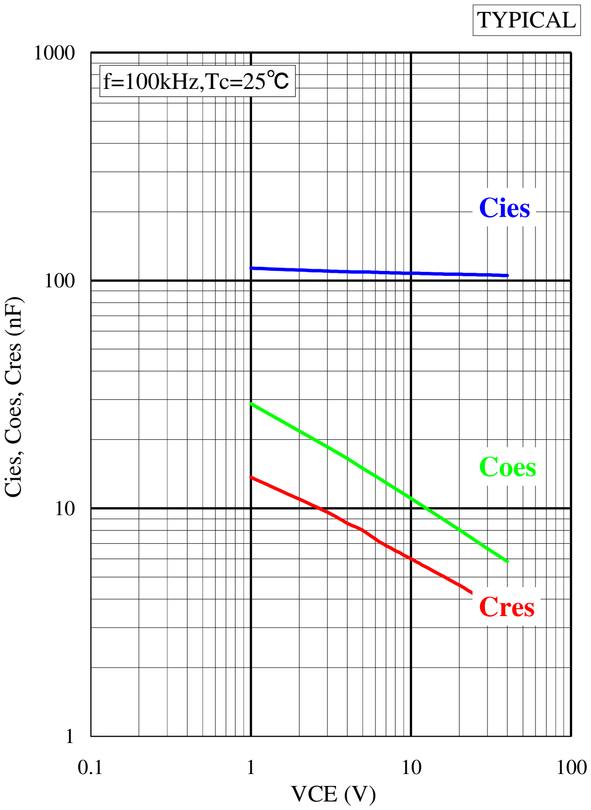


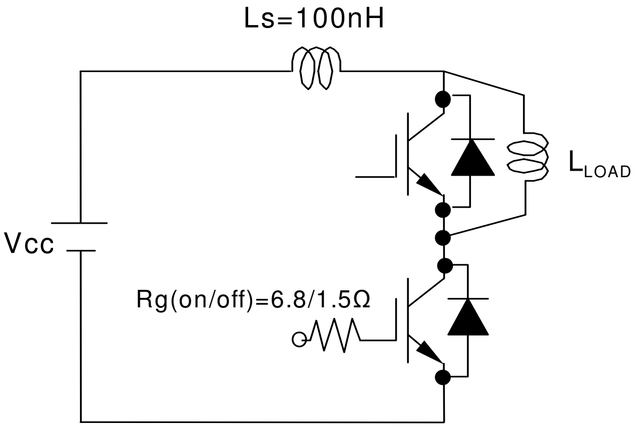
QG-VGE curve

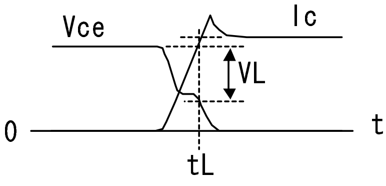


Cies, Coes, Cres vs. Vce

7.2 DYNAMIC CHARACTERISTICS

7.2.1 CIRCUIT

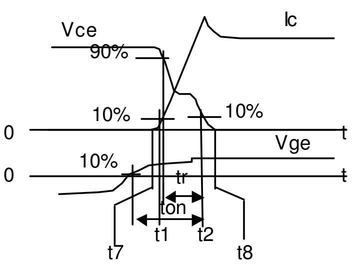


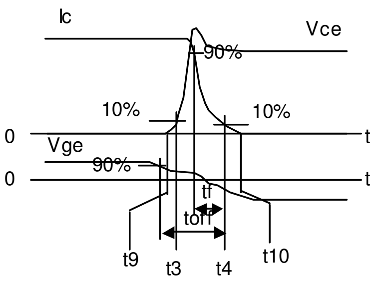


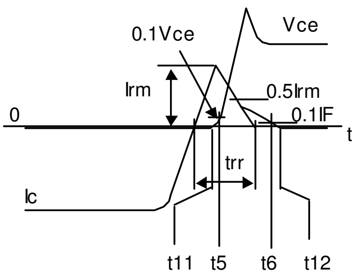
$$Ls=\frac{VL}{\left(\frac{dIc}{dt}\right)_{t=tL}}$$

Definitions of Ls

7.2.2 WAVEFORM DEFINITION



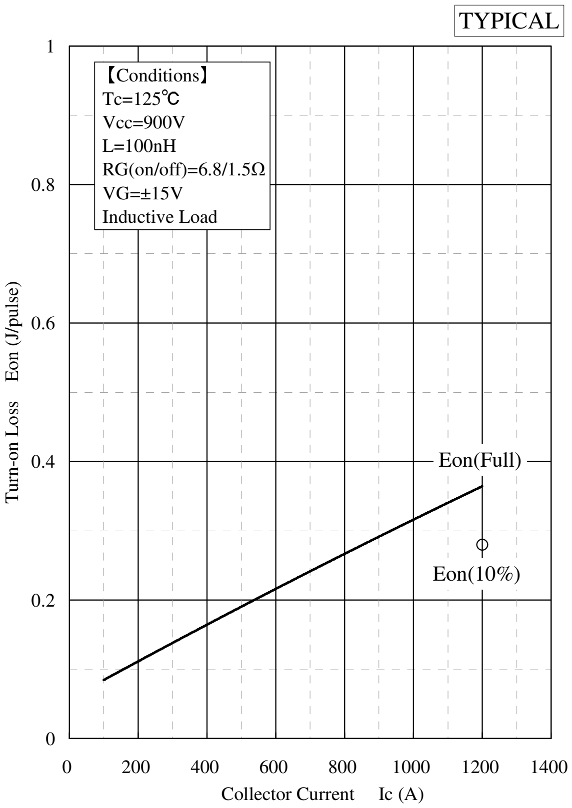




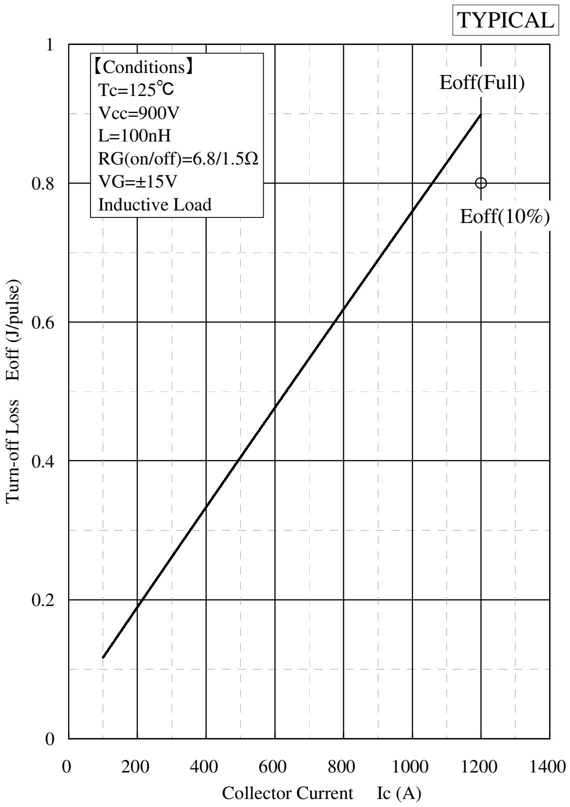
$$Eon(10\%)=\int_{t1}^{t2} Ic\cdot Vce\ dt \qquad Eoff(10\%)=\int_{t3}^{t4} Ic\cdot Vce\ dt \qquad Err(10\%)=\int_{t5}^{t6} IF\cdot Vce\ dt$$

$$Eon(Full)=\int_{t7}^{t8} Ic\cdot Vce\ dt \qquad Eoff(Full)=\int_{t9}^{t10} Ic\cdot Vce\ dt \qquad Err(Full)=\int_{t11}^{t12} IF\cdot Vce\ dt$$

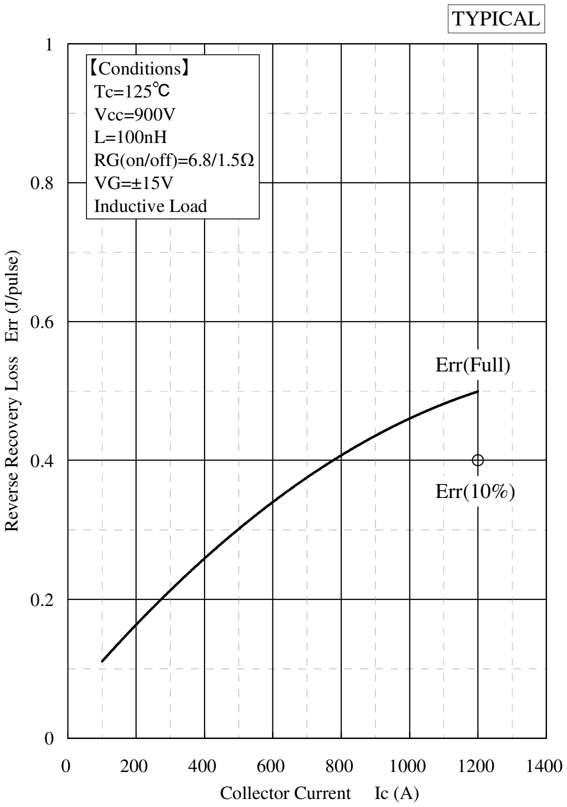
7.2.3 DEPENDENCE OF CURRENT



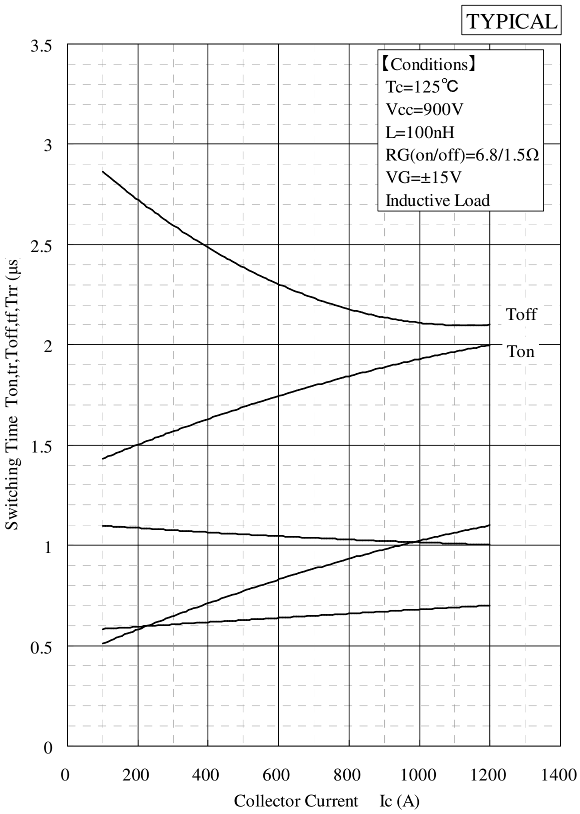
Turn-on Loss vs. Collector Current



Turn-off Loss vs. Collector Current

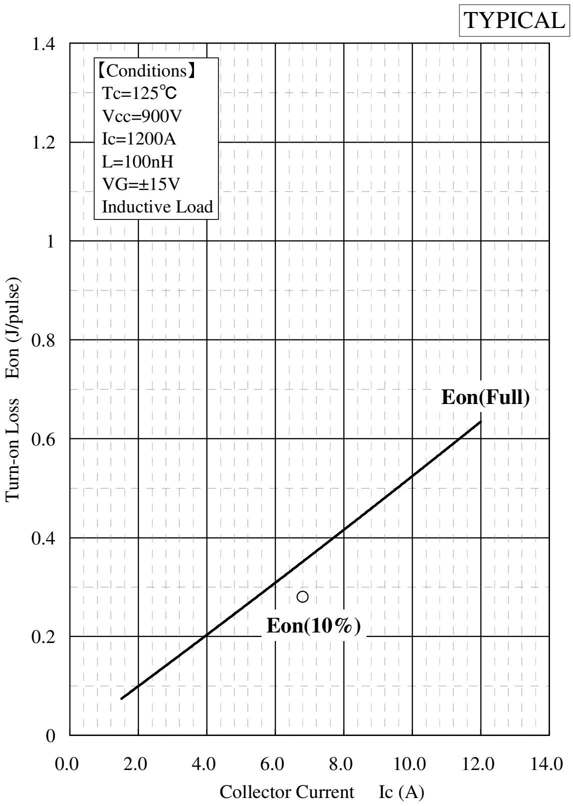


Reverse Recovery Loss vs. Collector Current

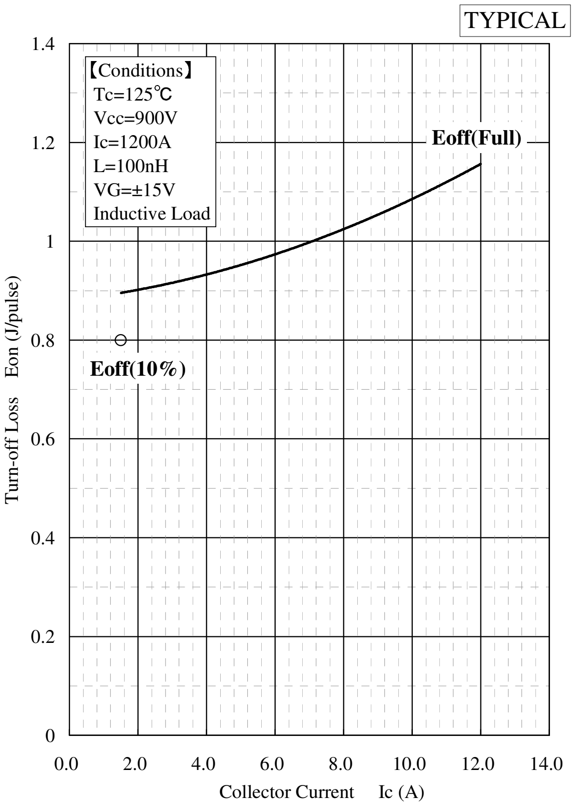


Switching Time vs. Collector Current

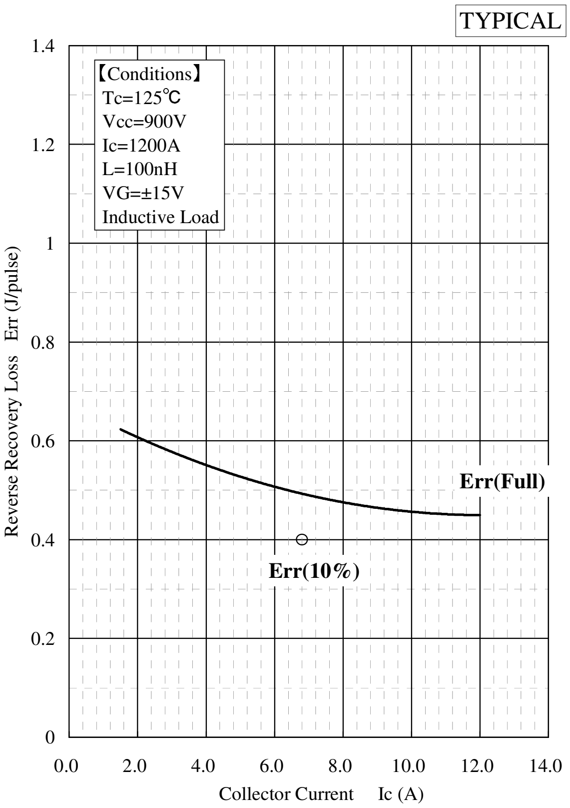
7.2.4 DEPENDENCE OF RG



Turn-on Loss vs. Gate Resistance

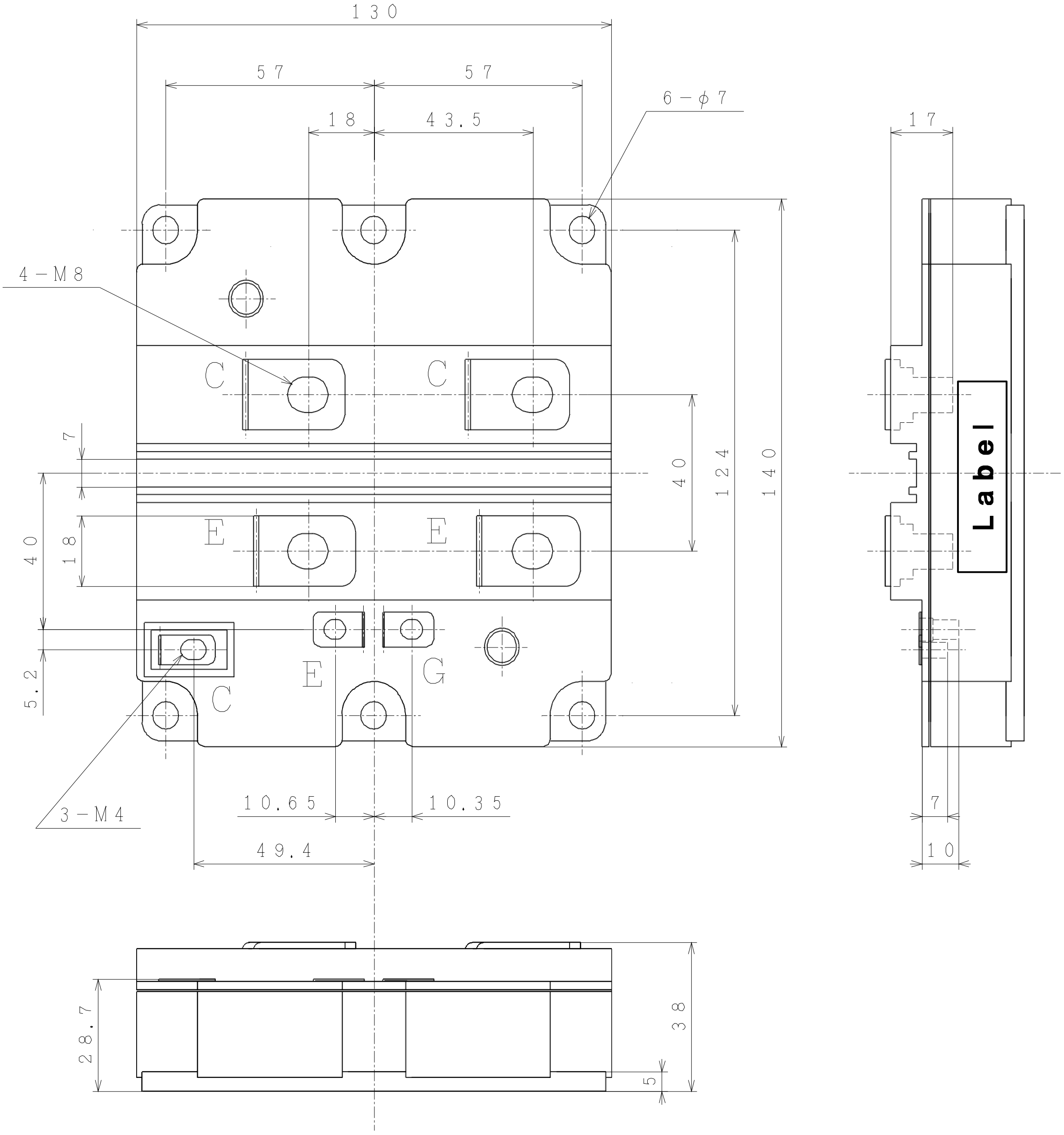


Turn-off Loss vs. Gate Resistance



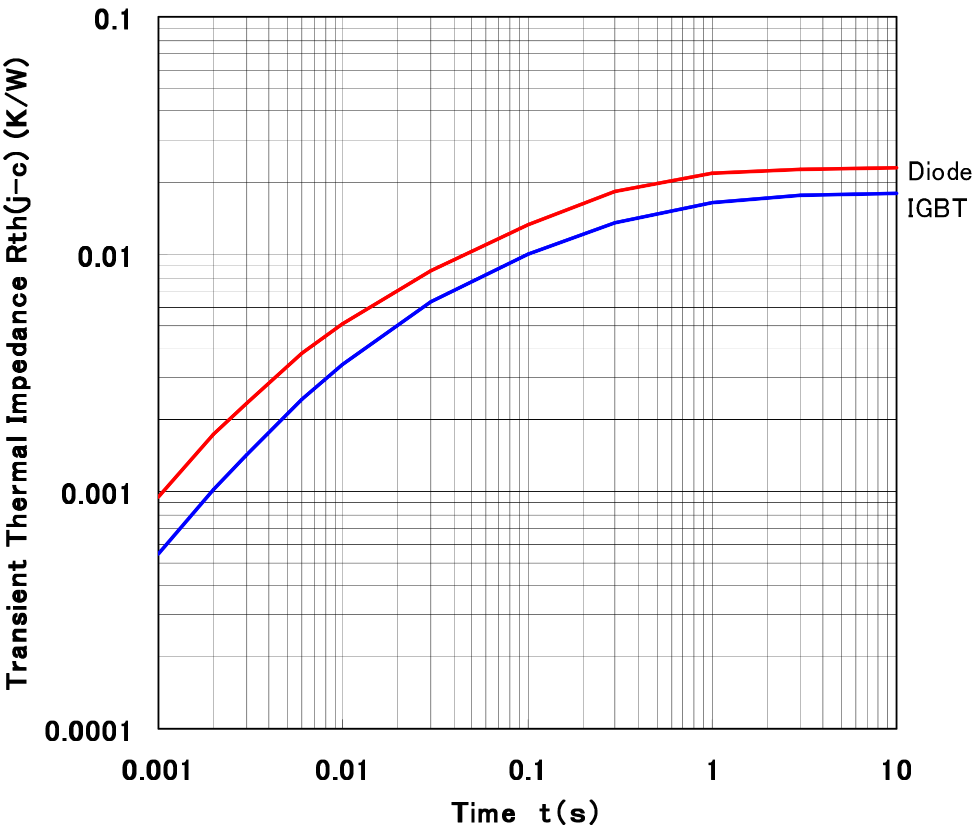
Reverse Recovery Loss vs. Gate Resistance

8. PACKAGE OUTLINE DRAWING



9. Thermal Impedance

9.1 TRANSIENT THERMAL IMPEDANCE



9.2 Curve approximation model

Following expressions approximates the transient thermal impedance curves.

Please note that the expressions are the curve fitted value, and there is no physical meaning in this expression. The expressions are applicable under following condition only.

Condition 1: Time is more than t (1)/e

Condition 2: No heat sink model is considered.

$$Z_{th(j-c)} = \Sigma z_{th(n)} \cdot [1-\exp\{-t/\tau_{th(n)}\}] \qquad (1)$$

n (IGBT)		1	2	3	4	5	6
Z th(n,IGBT)	(K/kW)	0.6	2.2	3.2	3.9	4.5	3.6
τ th(n,IGBT)	(s)	0.003	0.01	0.03	0.1	0.3	1
n (Diode)		1	2	3	4	5	6
Z th(n,Diode)	(K/kW)	1.9	2.4	3.0	6.6	6.3	2.8
τ th(n,Diode)	(s)	0.003	0.01	0.03	0.1	0.3	1

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