MBN1200E17E

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

* 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.

MBN1200E17E

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
				1.7	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	Rise Time	t_r	µs	0.5	1.1	2.2	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 Time	t_{on}		1.0	2.0	4.0	
	Fall Time	t_f		0.5	1.0	2.0	
	Turn Off Time	t_{off}		1.0	2.1	4.2	
Peak Forward Voltage Drop		V_{FM}	V	-	1.8	-	IF=1,200A, V_{GE}=0V, Tj=25°C
				1.4	1.9	2.5	IF=1,200A, V_{GE}=0V, Tj=125°C
Reverse Recovery Time		t_{rr}	µs	0.3	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

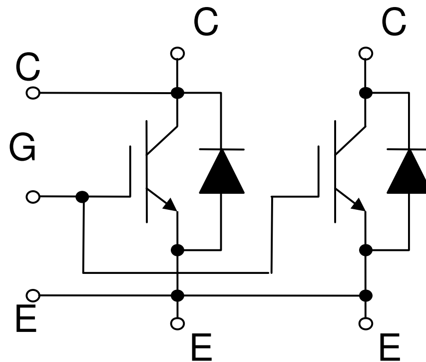
Item		Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Thermal Resistance	IGBT	Rth(j-c)	K/W	-	-	0.018	Junction to case
	FWD	Rth(j-c)		-	-	0.023	
Contact Thermal Impedance		Rth(c-f)	K/W	-	0.008	-	Case to fin. Thermal grease applied. Thickness 100µm, Thermal conductivity of grease: 1W/mK

MBN1200E17E

5. MODULE MECHANICAL 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

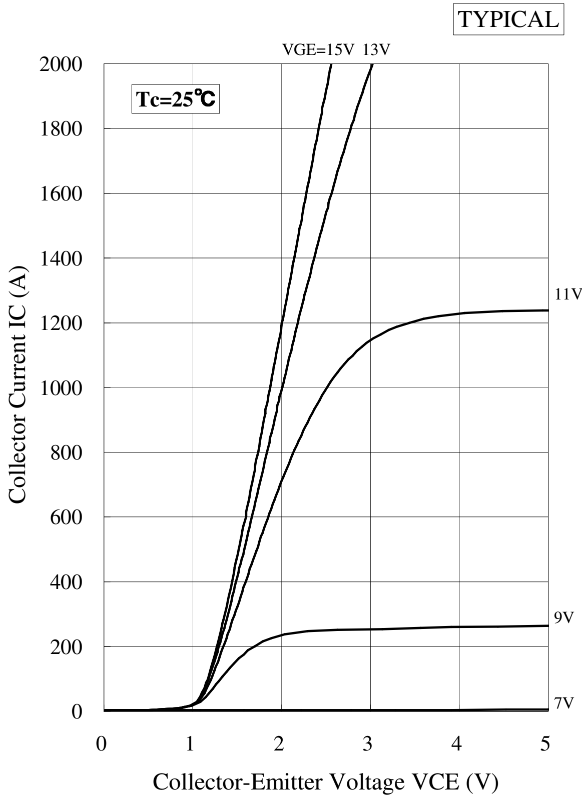


CIRCUIT DIAGRAM

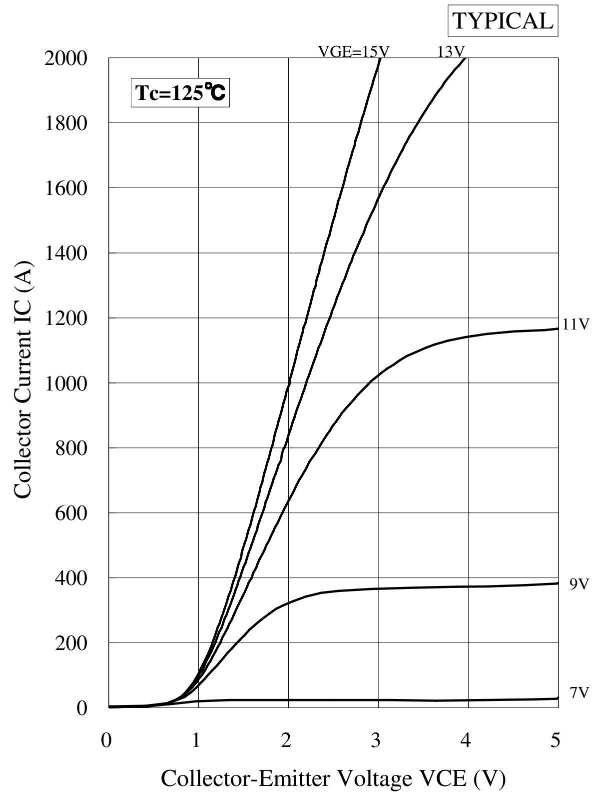
MBN1200E17E

7. CHARACTERISTICS CURVE

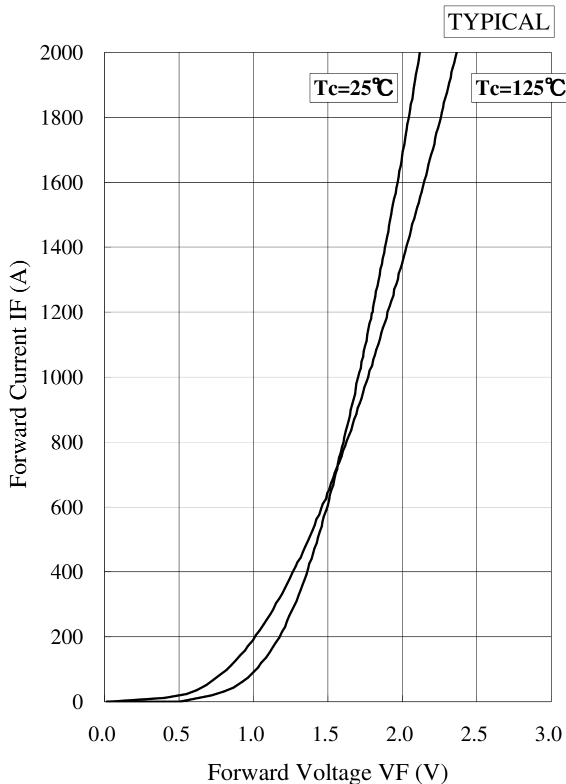
7.1 STATIC CHARACTERISTICS



Collector Current vs. Collector to Emitter Voltage

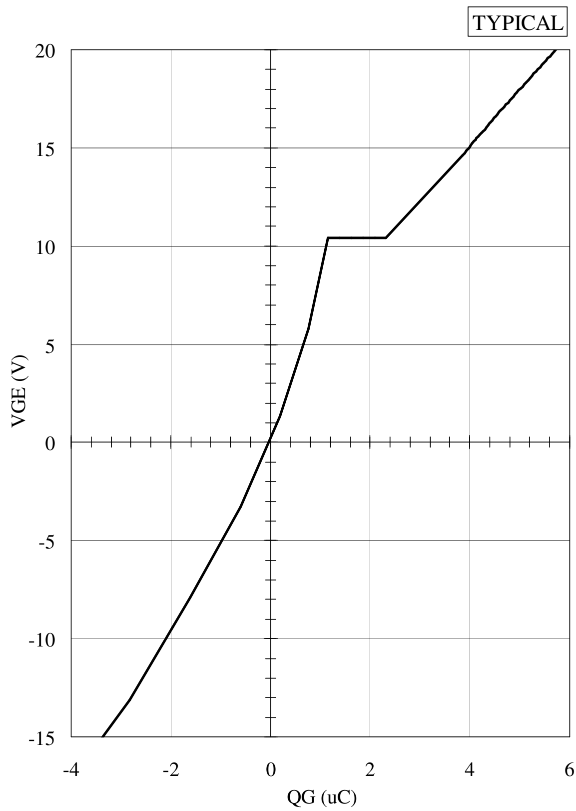


Collector Current vs. Collector to Emitter Voltage

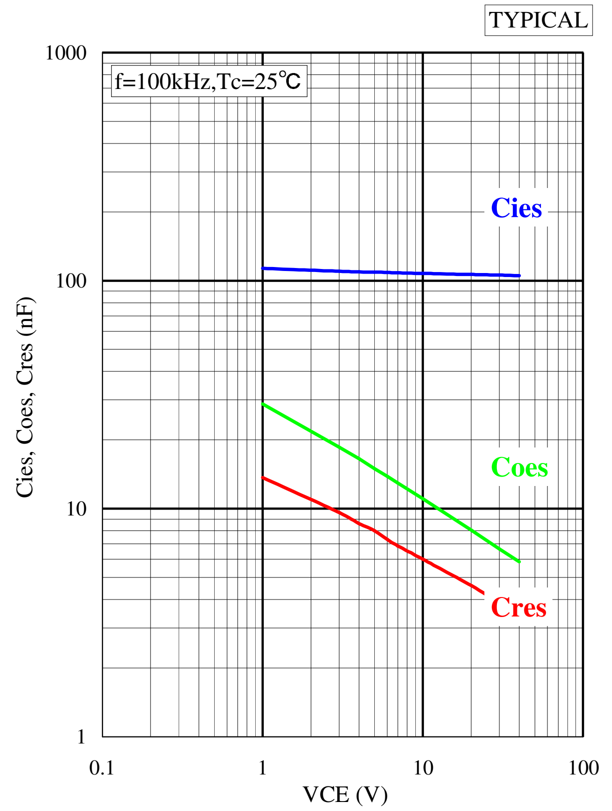


Forward Voltage of free-wheeling diode

MBN1200E17E



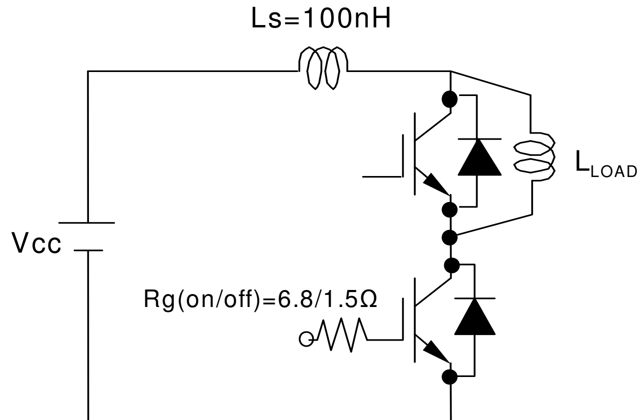
QG-VGE curve

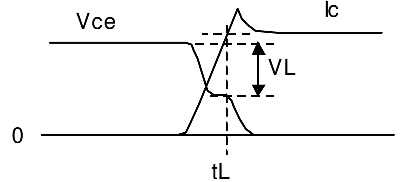


Cies, Coes, Cres vs. Vce

7.2 DYNAMIC CHARACTERISTICS

7.2.1 CIRCUIT

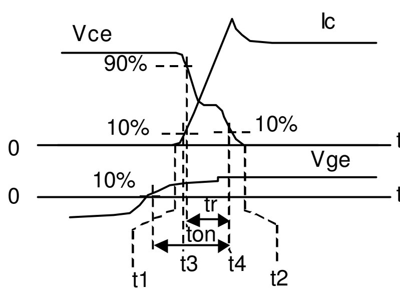


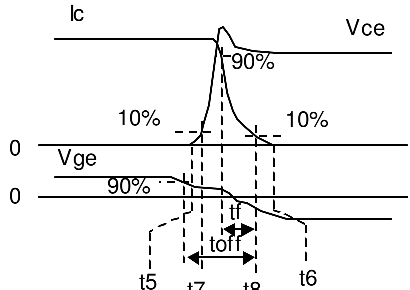


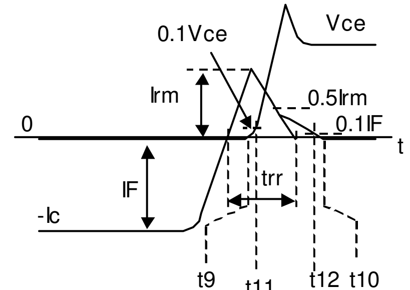
$$Ls = \frac{V_L}{\left(\frac{dIc}{dt}\right)_{t=t_L}}$$

Definition of Ls

7.2.2 WAVEFORM DEFINITION







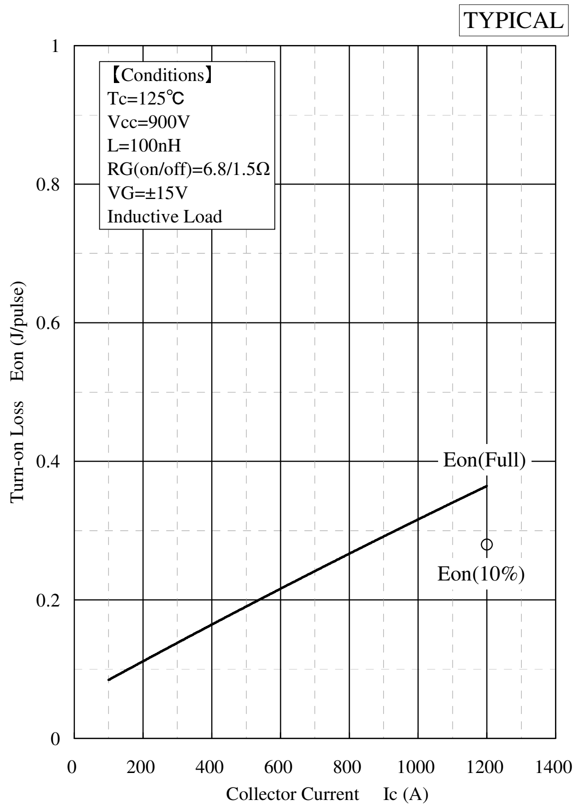
$$Eon(10\%) = \int_{t3}^{t4} Ic \cdot Vce \, dt \qquad Eoff(10\%) = \int_{t7}^{t8} Ic \cdot Vce \, dt \qquad Err(10\%) = \int_{t11}^{t12} IF \cdot Vce \, dt$$

$$Eon(Full) = \int_{t1}^{t2} Ic \cdot Vce \, dt \qquad Eoff(Full) = \int_{t5}^{t6} Ic \cdot Vce \, dt \qquad Err(Full) = \int_{t9}^{t10} IF \cdot Vce \, dt$$

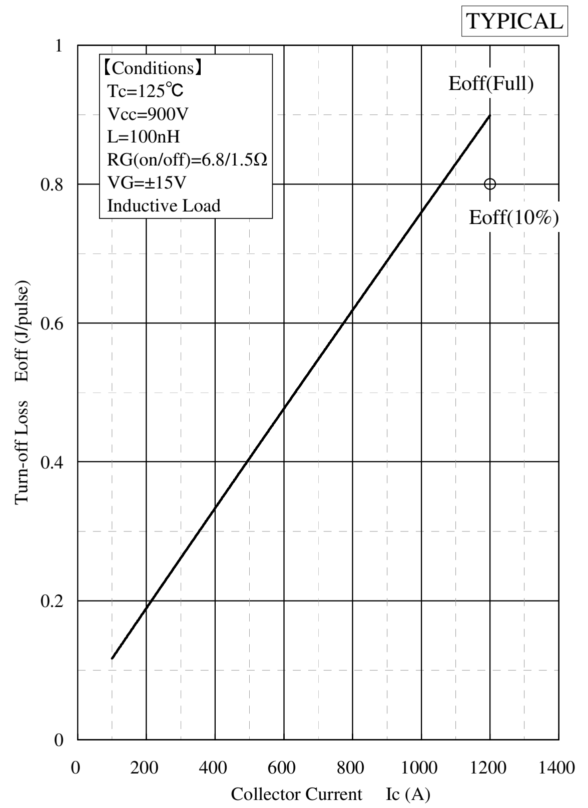
Definition of switching loss

MBN1200E17E

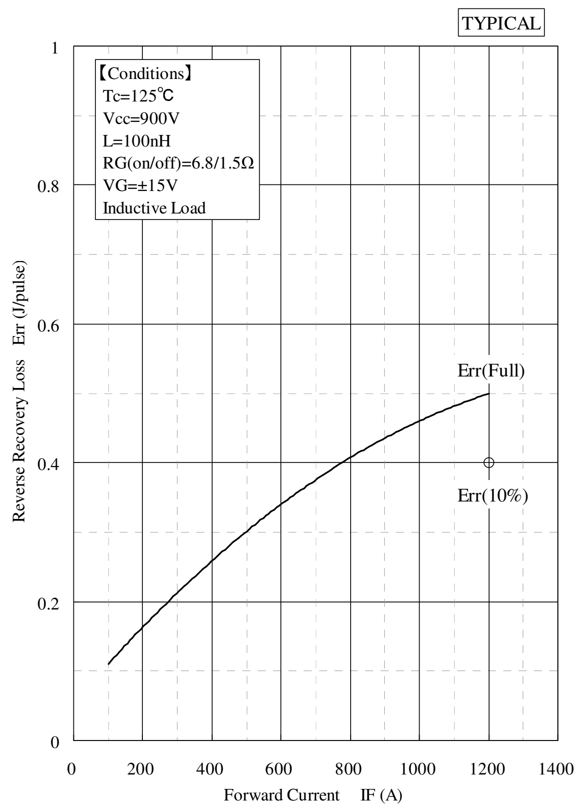
7.2.3 DEPENDENCE OF CURRENT



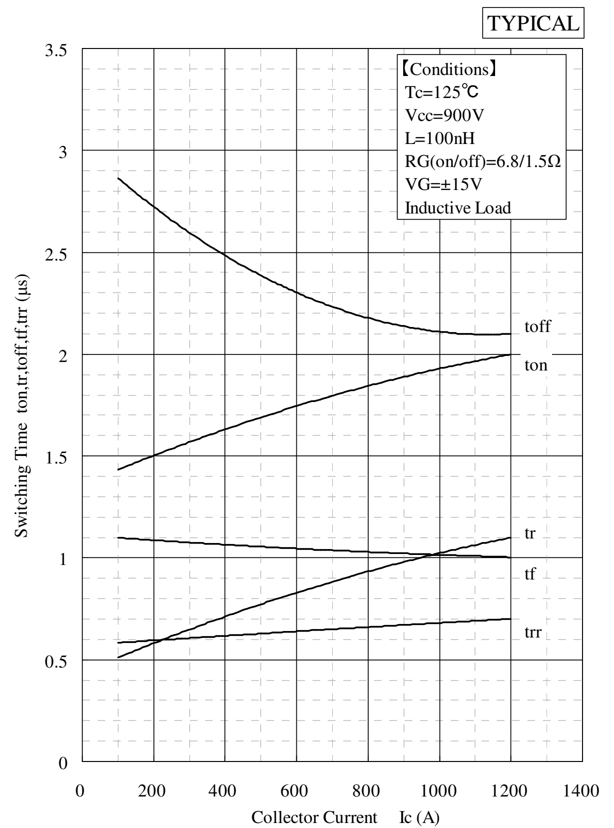
Turn-on Loss vs. Collector Current



Turn-off Loss vs. Collector Current



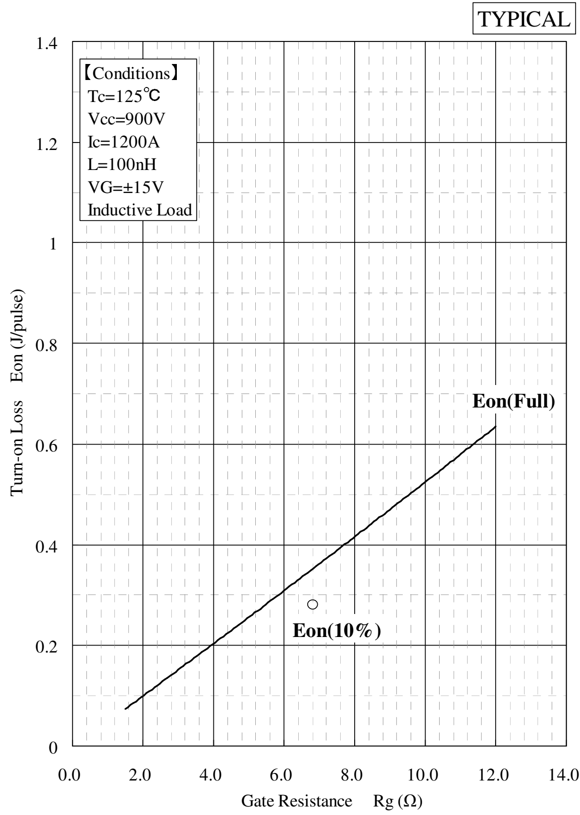
Reverse Recovery Loss vs. Forward Current



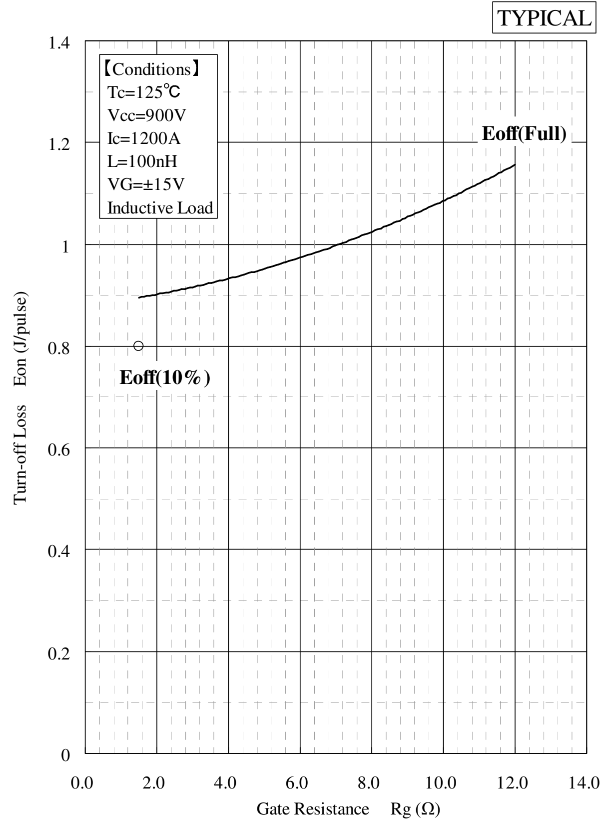
Switching Time vs. Collector Current

MBN1200E17E

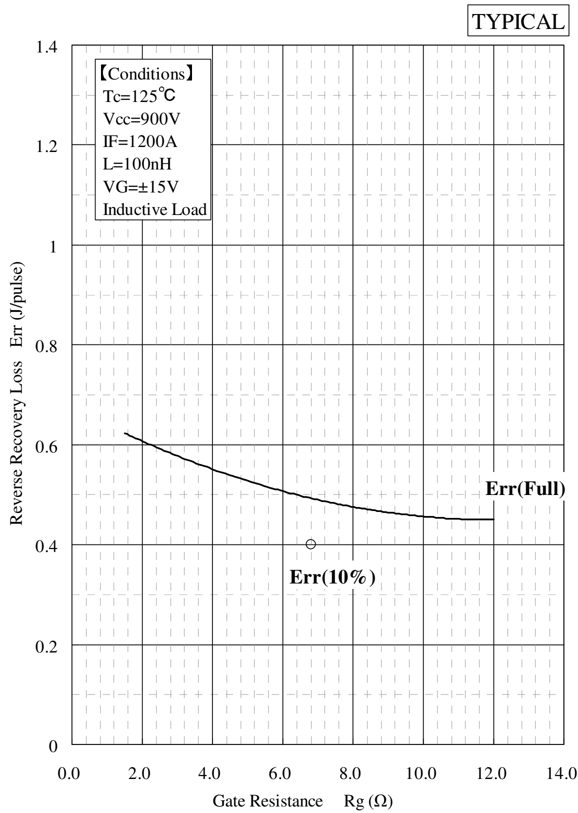
7.2.4 DEPENDENCE OF RG



Turn-on Loss vs. Gate Resistance



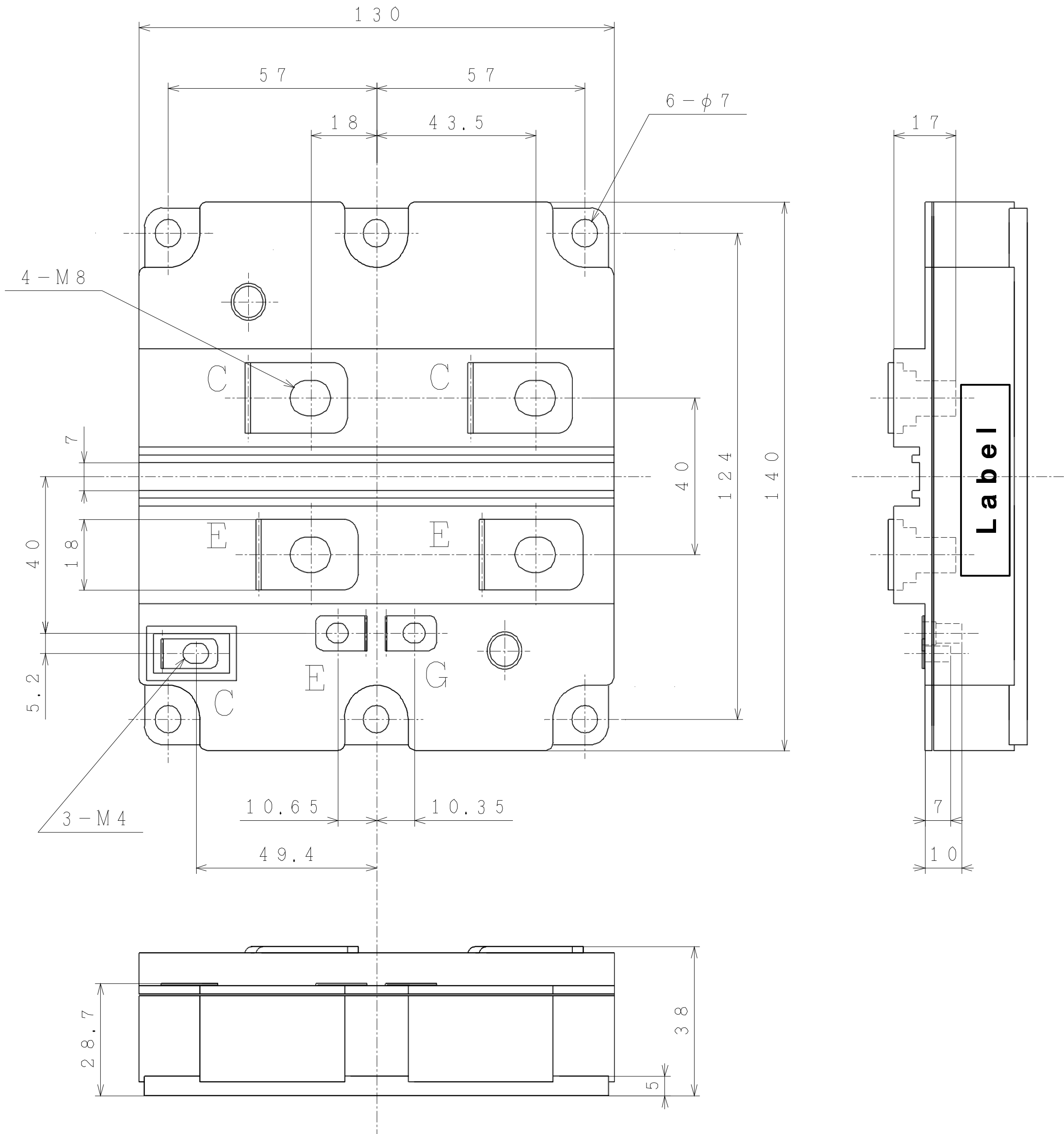
Turn-off Loss vs. Gate Resistance



Reverse Recovery Loss vs. Gate Resistance

MBN1200E17E

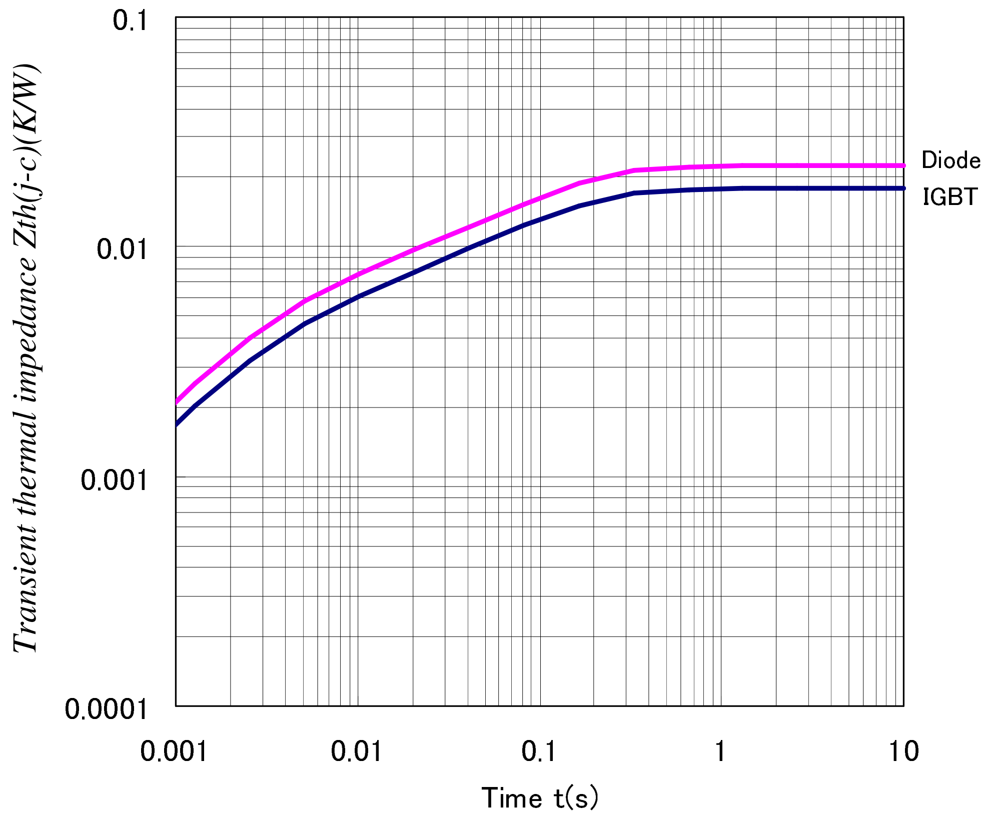
8. PACKAGE OUTLINE DRAWING



MBN1200E17E

9. Thermal Impedance

9.1 TRANSIENT THERMAL IMPEDANCE



Transient Thermal Impedance Curve *(Maximum Value)*

10. Negative environmental impact material

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
Arsenic and its compounds	Si chip

HITACHI POWER SEMICONDUCTORS

Notices

1. The information given herein, including the specifications and dimensions, is subject to change without prior notice to improve product characteristics. Before ordering, purchasers are advised to contact Hitachi sales department for the latest version of this data sheets.
2. Please be sure to read "Precautions for Safe Use and Notices" in the individual brochure before use.
3. In cases where extremely high reliability is required (such as use in nuclear power control, aerospace and aviation, traffic equipment, life-support-related medical equipment, fuel control equipment and various kinds of safety equipment), safety should be ensured by using semiconductor devices that feature assured safety or by means of users' fail-safe precautions or other arrangement. Or consult Hitachi's sales department staff.
4. In no event shall Hitachi be liable for any damages that may result from an accident or any other cause during operation of the user's units according to this data sheets. Hitachi assumes no responsibility for any intellectual property claims or any other problems that may result from applications of information, products or circuits described in this data sheets.
5. In no event shall Hitachi be liable for any failure in a semiconductor device or any secondary damage resulting from use at a value exceeding the absolute maximum rating.
6. No license is granted by this data sheets under any patents or other rights of any third party or Hitachi Power Semiconductor Device, Ltd.
7. This data sheets may not be reproduced or duplicated, in any form, in whole or in part, without the expressed written permission of Hitachi Power Semiconductor Device, Ltd.
8. The products (technologies) described in this data sheets are not to be provided to any party whose purpose in their application will hinder maintenance of international peace and safety not are they to be applied to that purpose by their direct purchasers or any third party. When exporting these products (technologies), the necessary procedures are to be taken in accordance with related laws and regulations.

- For inquiries relating to the products, please contact nearest overseas representatives that is located "Inquiry" portion on the top page of a home page.

Hitachi power semiconductor home page address http://www.hitachi-power-semiconductor-device.co.jp/en/

HITACHI
Inspire the Next