MBN1000E33E2

Silicon N-channel IGBT 3300V E2 version

FEATURES

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

ABSOLUTE MAXIMUM RATINGS (Tc=25ºC)

Item		Symbol	Unit	MBN1000E33E2
Collector Emitter Voltage		V_{CES}	V	3,300
Gate Emitter Voltage		V_{GES}	V	±20
Collector Current	DC	I_C	A	1,000 (Tc=95ºC)
	1ms	I_{Cp}		2,000
Forward Current	DC	I_F	A	1,000
	1ms	I_{FM}		2,000
Junction Temperature		T_j	ºC	-40 ~ +150
Storage Temperature		T_{stg}	ºC	-50 ~ +125
Isolation Voltage		V_{ISO}	V_{RMS}	6,000(AC 1 minute)
Screw Torque	Terminals (M4/M8)	-	N·m	2/15 (1)
	Mounting (M6)	-		6 (2)

Notes: (1) Recommended Value $1.8\pm0.2/15^{+0}_{-3}$N·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	-	-	8	V_{CE}=3,300V, V_{GE}=0V, Tj=25ºC
				-	14	40	V_{CE}=3,300V, V_{GE}=0V, Tj=125ºC
Gate Emitter Leakage Current		I_{GES}	nA	-500	-	+500	V_{GE}=±20V, V_{CE}=0V, Tj=25ºC
Collector Emitter Saturation Voltage		$V_{CE(sat)}$	V	2.5	2.95	3.5	I_C=1,000A, V_{GE}=15V, Tj=125ºC
				-	3.10	-	I_C=1,000A, V_{GE}=15V, Tj=150ºC
Gate Emitter Threshold Voltage		$V_{GE(TO)}$	V	5.5	6.5	7.5	V_{CE}=10V, I_C=1,000mA, Tj=25ºC
Input Capacitance		C_{ies}	nF	-	130	-	V_{CE}=10V, V_{GE}=0V, f=100kHz, Tj=25ºC
Internal Gate Resistance		Rge	Ω	-	1.5	-	V_{CE}=10V, V_{GE}=0V, f=100kHz, Tj=25ºC
Switching Times	Rise Time	t_r	μs	1.6	2.1	2.6	V_{CC}=1,650V, Ic=1,000A
	Turn On Time	t_{on}		1.9	3.0	3.4	L=120nH
	Fall Time	t_f		1.0	1.8	2.7	R_G=3.9Ω/3.9Ω, CGE=100nF (3)
	Turn Off Time	t_{off}		2.2	3.9	5.0	V_{GE}=±15V, Tj=125ºC
Peak Forward Voltage Drop		V_{FM}	V	2.2	2.5	3.0	IF=1,000A, V_{GE}=0V, Tj=125ºC
				-	2.5	-	IF=1,000A, V_{GE}=0V, Tj=150ºC
Reverse Recovery Time		t_{rr}	μs	0.2	0.8	1.2	Vcc=1,650V, IF=1,000A, L=120nH Tj=125ºC, R_G=3.9Ω/3.9Ω, CGE=100nF
Short Circuit Pulse Width		t_{sc}	μs	10	-	-	V_{CC}=2000V,Ls=130nH R_G(on/off)=3.9/39Ω, V_{GE}=±15V,Tj=125ºC
Turn On Loss		$E_{on(10\%)}$	J/P	-	2.0	2.4	Tj=125ºC
		$E_{on(full)}$		-	2.2	-	
				-	2.4	-	Tj=150ºC
Turn Off Loss		$E_{off(10\%)}$	J/P	-	1.4	1.8	Tj=125ºC
		$E_{off(full)}$		-	1.5	-	
				-	1.6	-	Tj=150ºC
Reverse Recovery Loss		$E_{rr(10\%)}$	J/P	-	1.0	1.3	Tj=125ºC
		$E_{rr(full)}$		-	1.2	-	
				-	1.4	-	Tj=150ºC
Stray inductance module		L_{SCE}	nH	-	18	-	

V_{CC}=1,650V, Ic= IF=1,000A, L=120nH, R_G=3.9Ω/3.9Ω, CGE=100nF (3) V_{GE}=±15V

Notes:(3) R_G and C_{GE} value are 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.

* 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.

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THERMAL CHARACTERISTICS

Item		Symbol	Unit	Min.	Typ.	Max.	Conditions
Thermal Impedance	IGBT	Rth(j-c)	K/W	-	-	0.012	Junction to case
	FWD	Rth(j-c)		-	-	0.024	
Contact Thermal Impedance		Rth(c-f)	K/W	-	0.007	-	Case to fin (λgrease=1W/(m·K), heat-sink flatness ≤ 50um)

DEFINITION OF TEST CIRCUIT

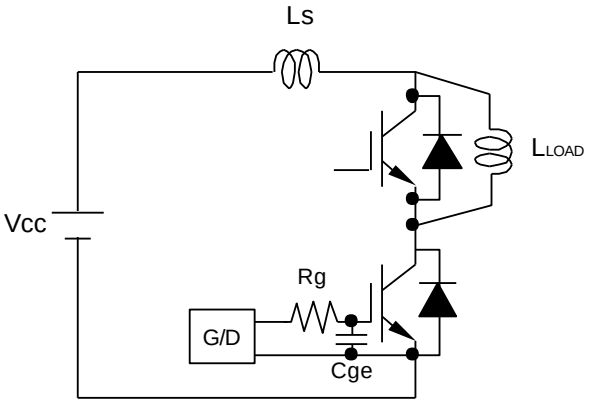
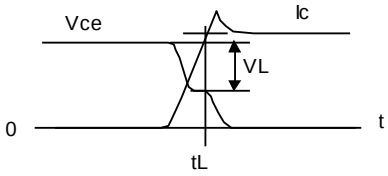
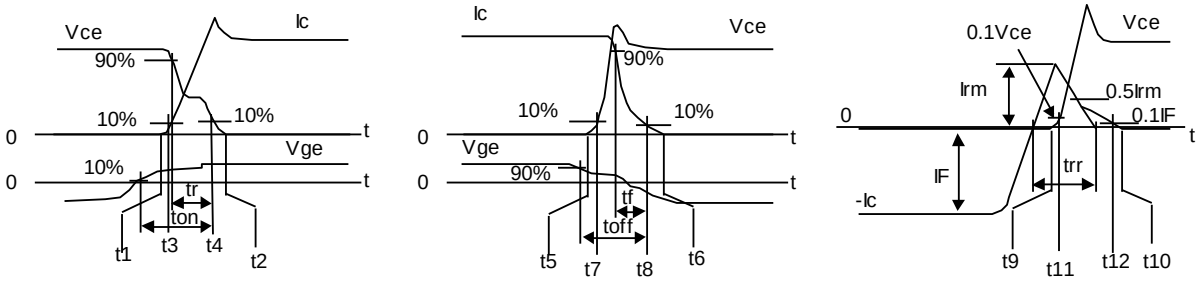


Fig.1 Switching test circuit



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

Fig.2 Definition of Ls



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

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

Fig.3 Definition of switching loss

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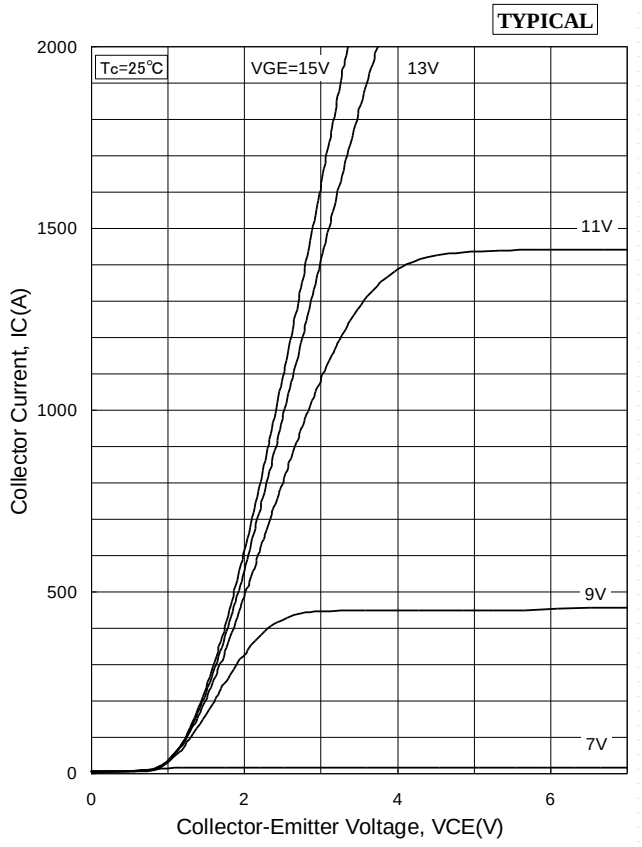
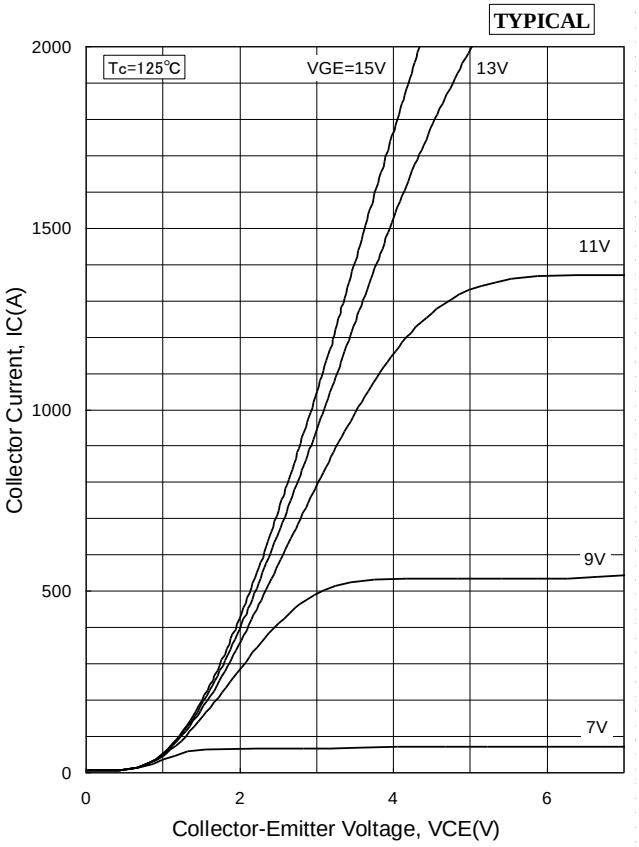
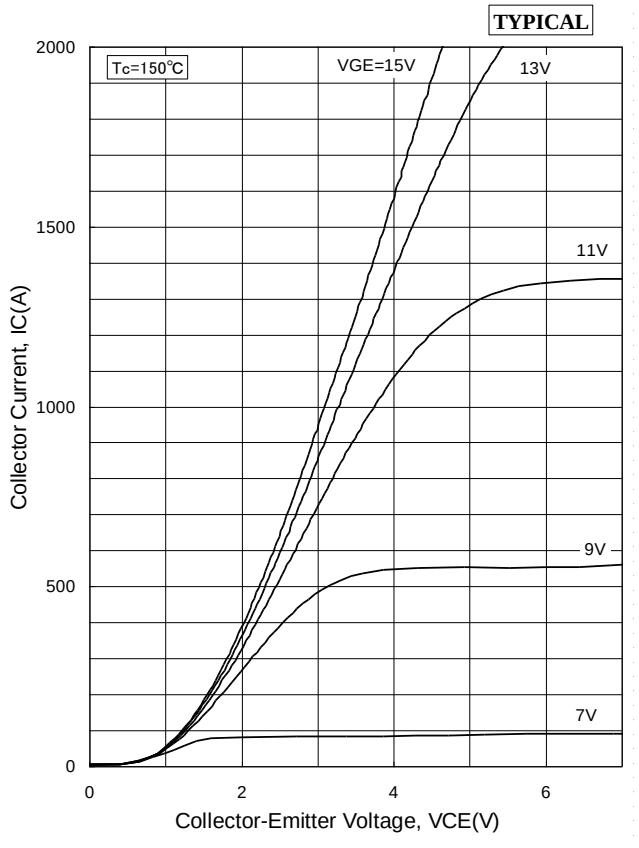
STATIC CHARACTERISTICS



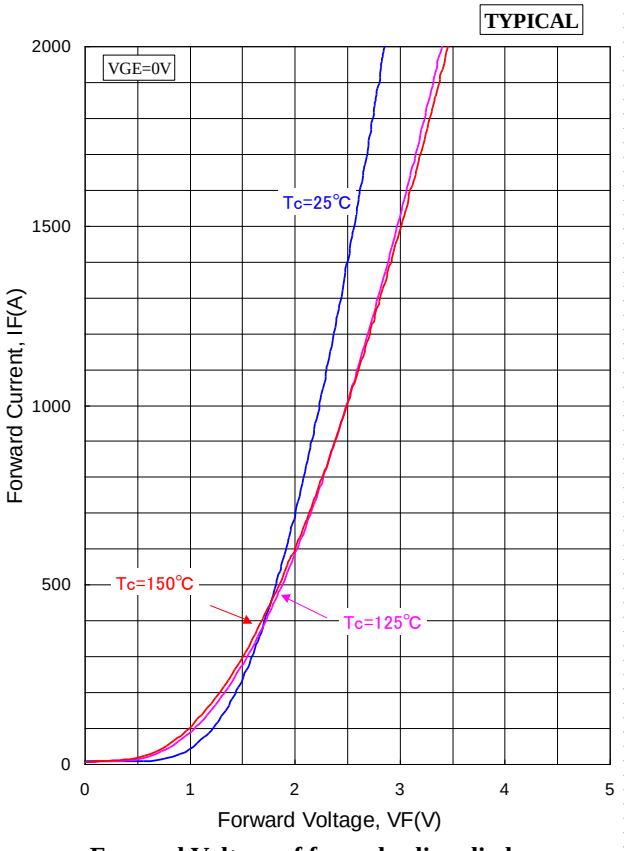
Collecter Current vs. Collector to Emitter Voltage



Collecter Current vs. Collector to Emitter Voltage



Collecter Current vs. Collector to Emitter Voltage



Forward Voltage of free-wheeling diode

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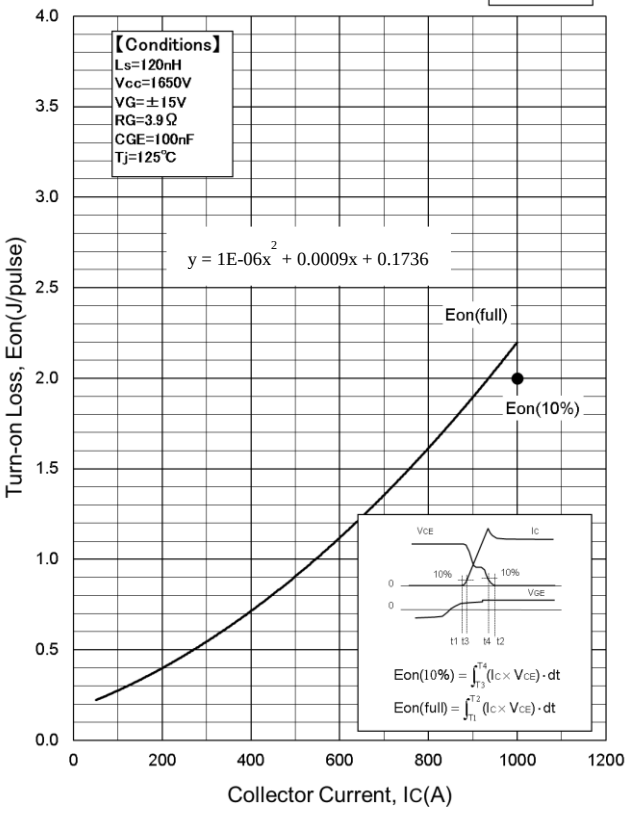
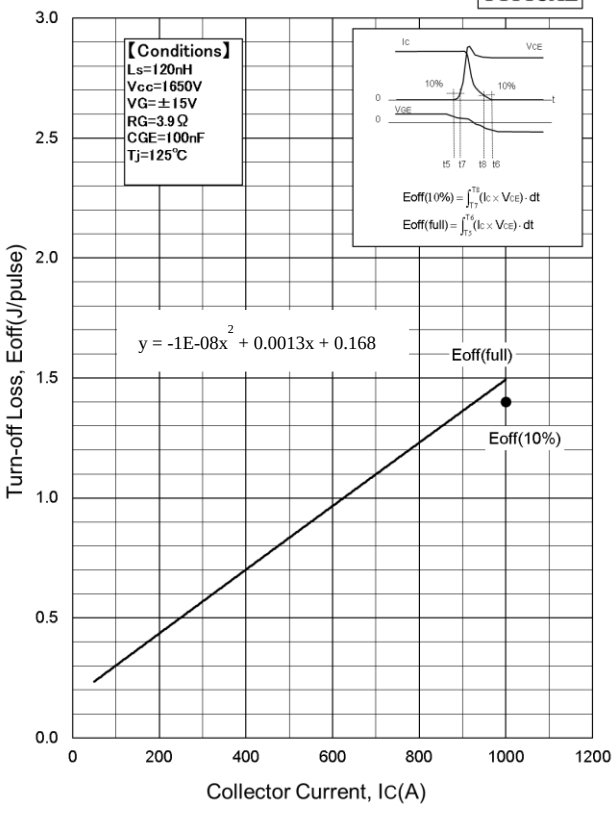
DYNAMIC CHARACTERISTICS

TYPICAL



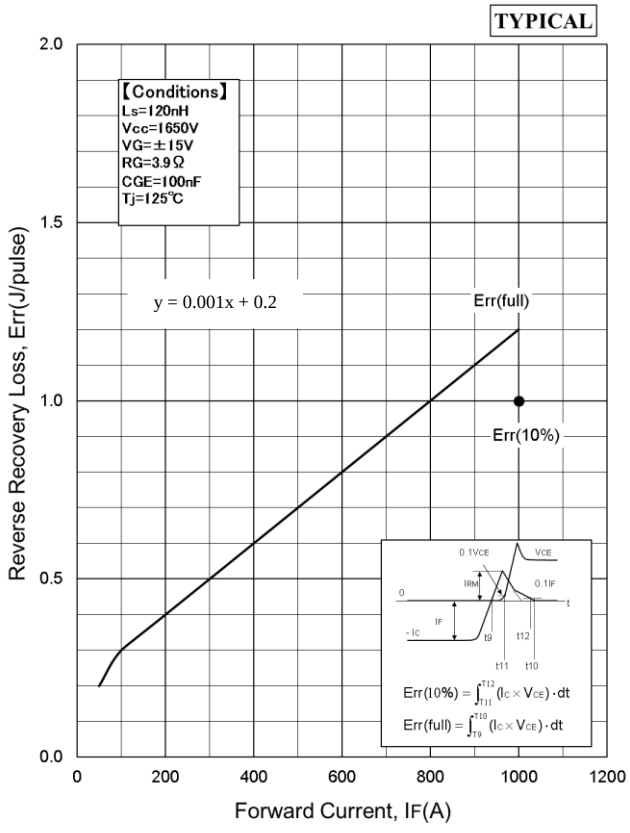
Turn-on Loss vs. Collector Current

TYPICAL



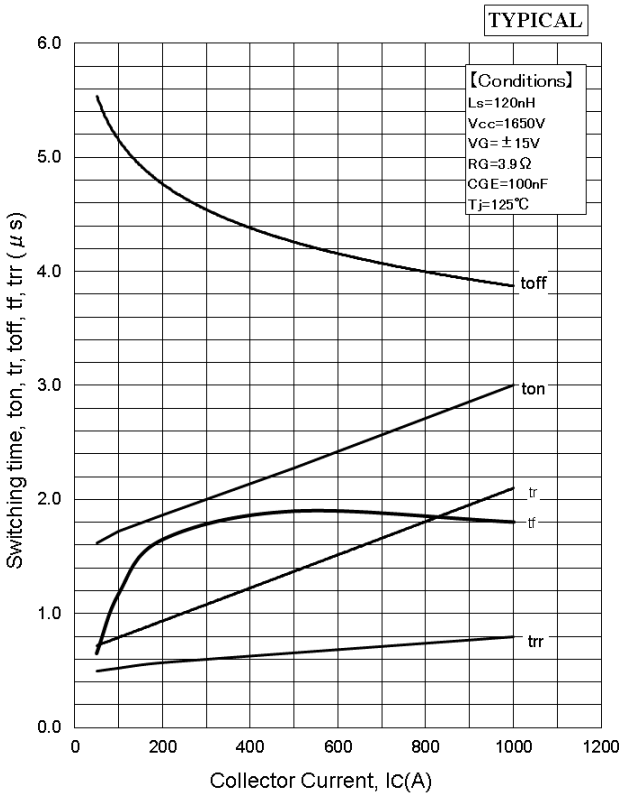
Turn-off Loss vs. Collector Current

TYPICAL



Recovery Loss vs. Forward Current

TYPICAL



Switching time vs. Collector current

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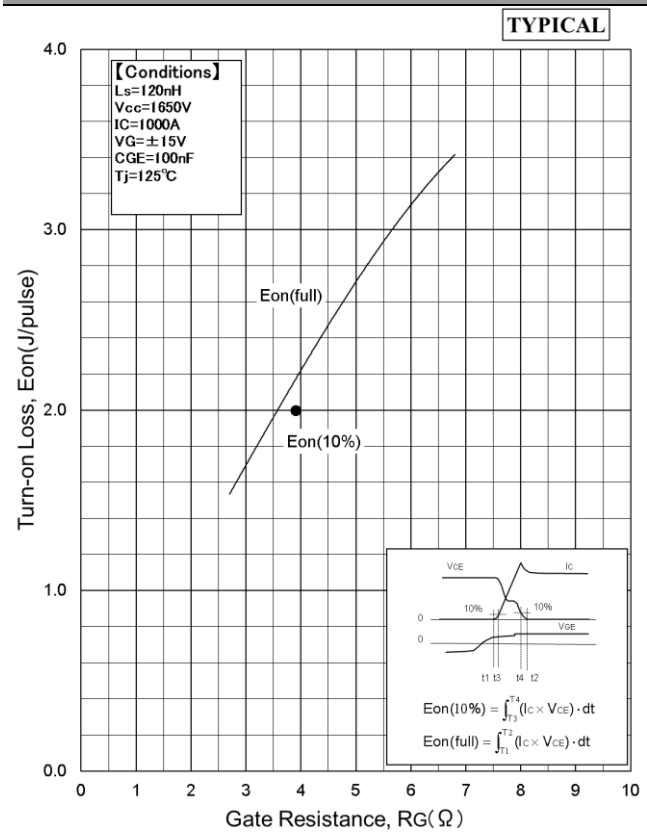
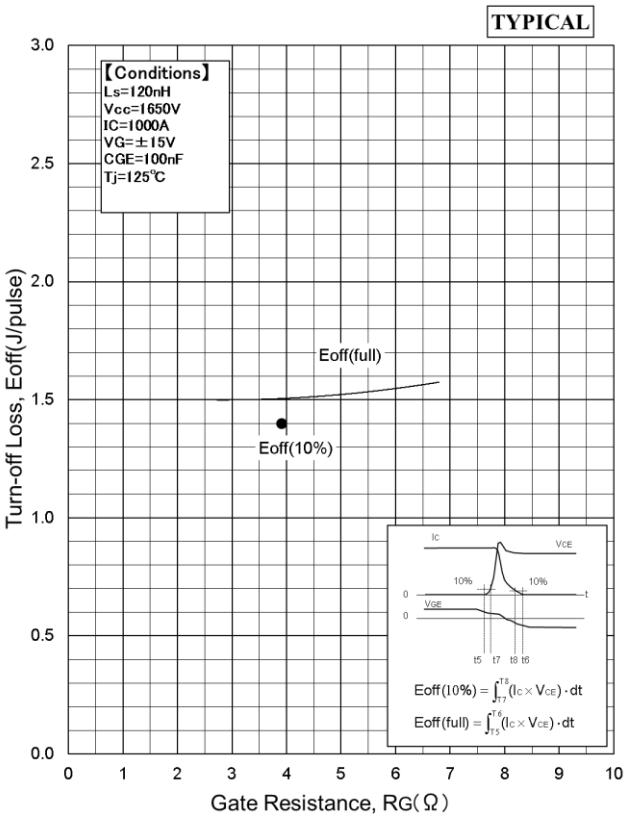
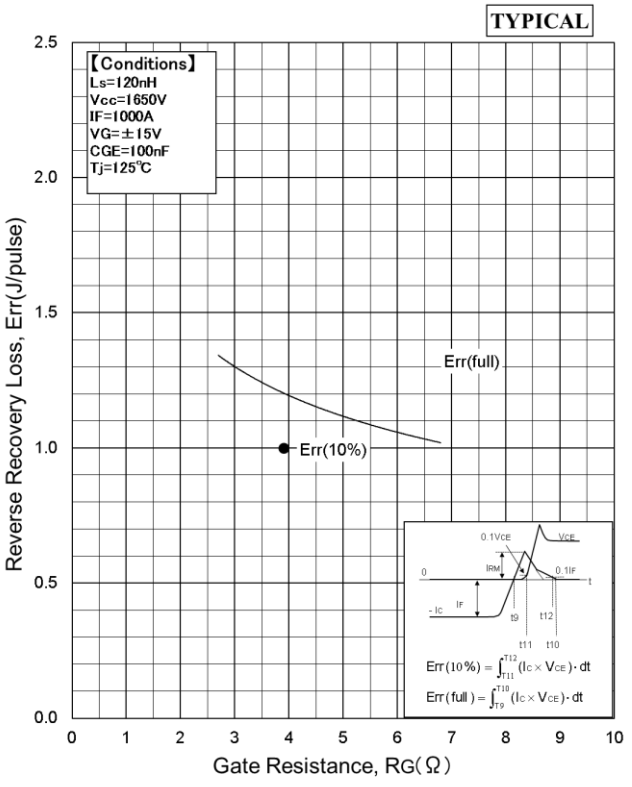


Turn-on Loss vs. Gate Resistance



Turn-off Loss vs. Gate Resistance



Recovery Loss vs. Gate Resistance

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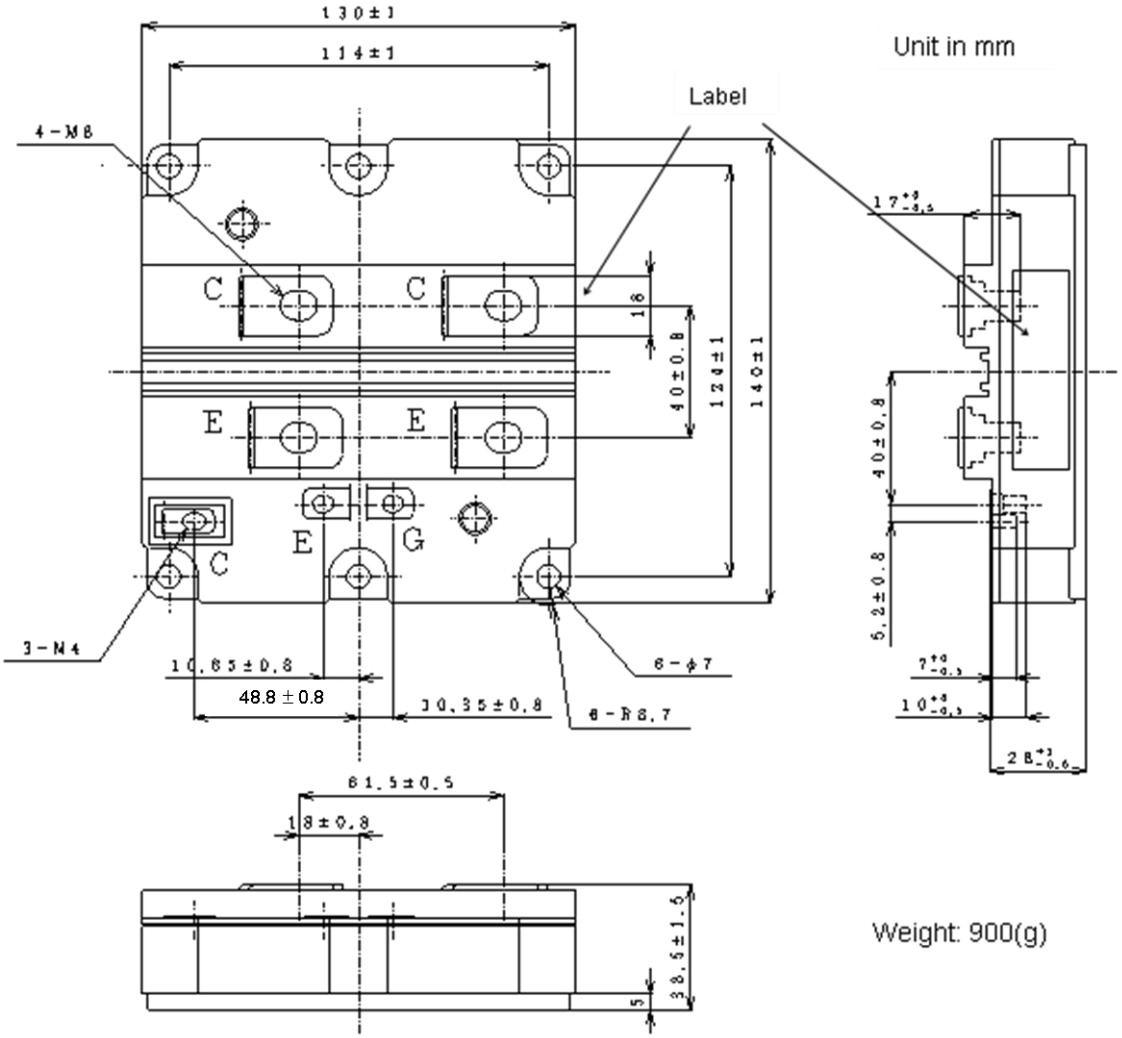
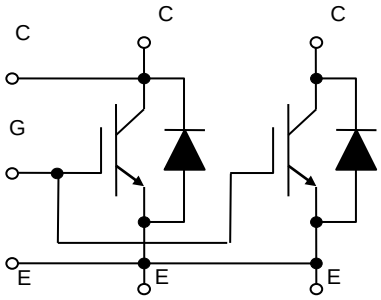
OUTLINE DRAWINGS





Circuit diagram

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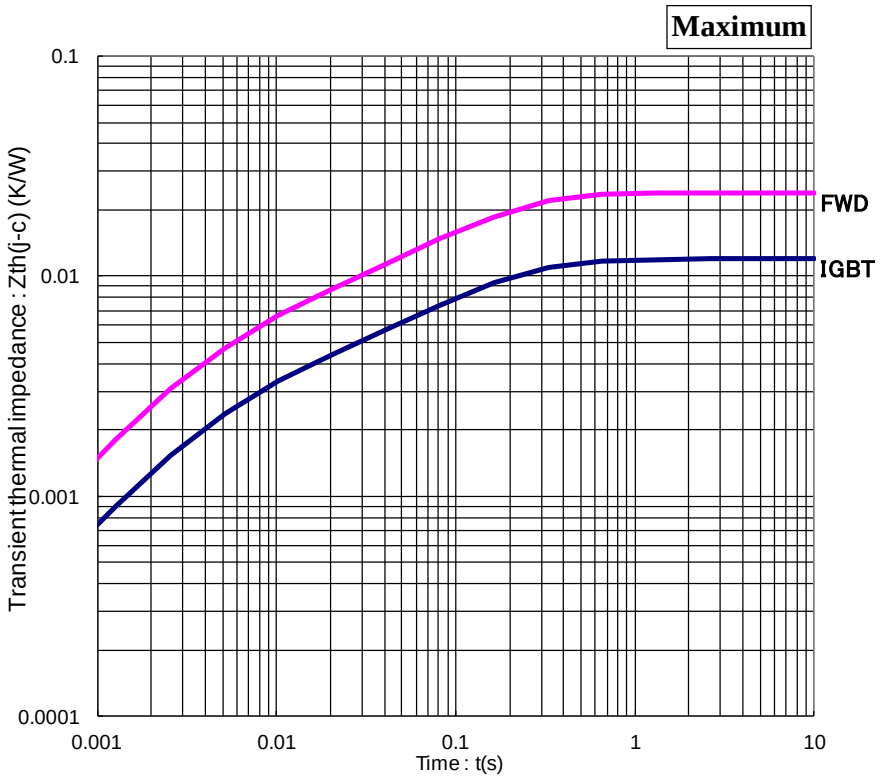
TRANSIENT THERMAL IMPEDANCE



Transient Thermal Impedance Curve

Curve approximation model
Zth = Σ rth[n]*(1-exp(-t/τth[n]))

n	1	2	3	4	Unit
τ th[n]	1.60E-01	2.74E-02	4.04E-03	7.37E-04	sec
rth[n,IGBT]	7.46E-03	2.17E-03	2.16E-03	2.21E-04	K/W
rth[n,Diode]	1.48E-02	4.47E-03	4.24E-03	4.53E-04	K/W

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

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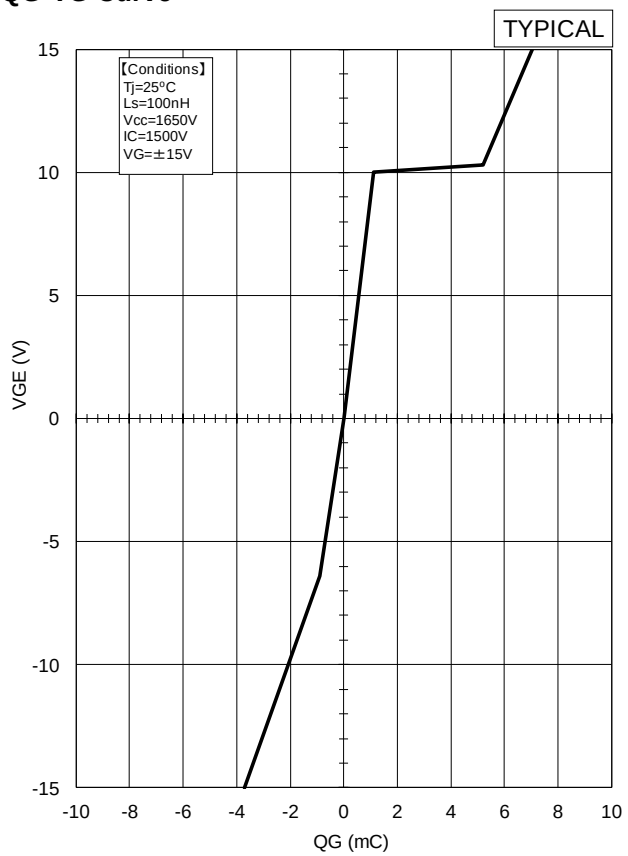
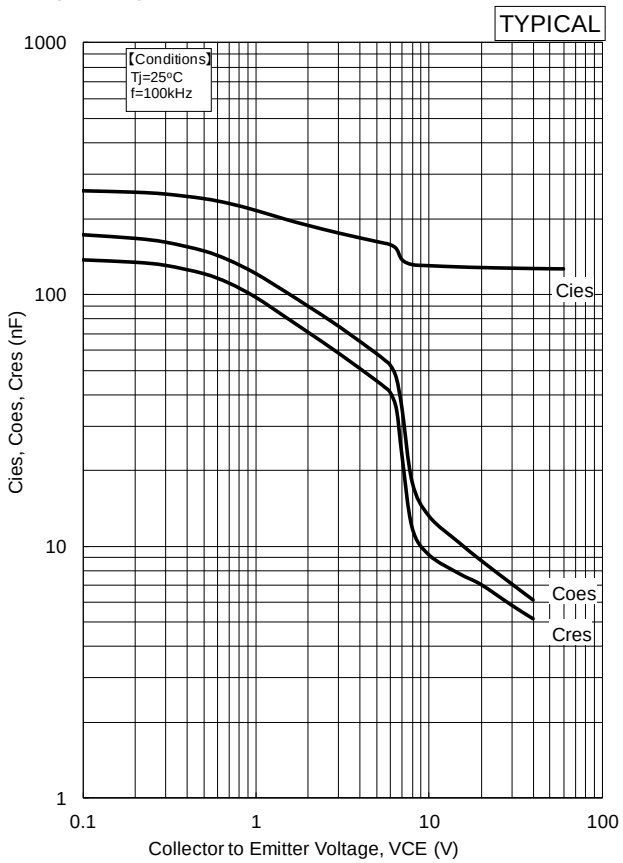
QG-VG Curve



QG-VGE curve

Cies, Coes, Cres Curve



Capacitance vs. Collector to Emitter Voltage

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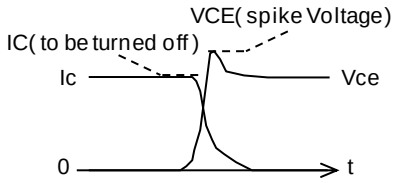
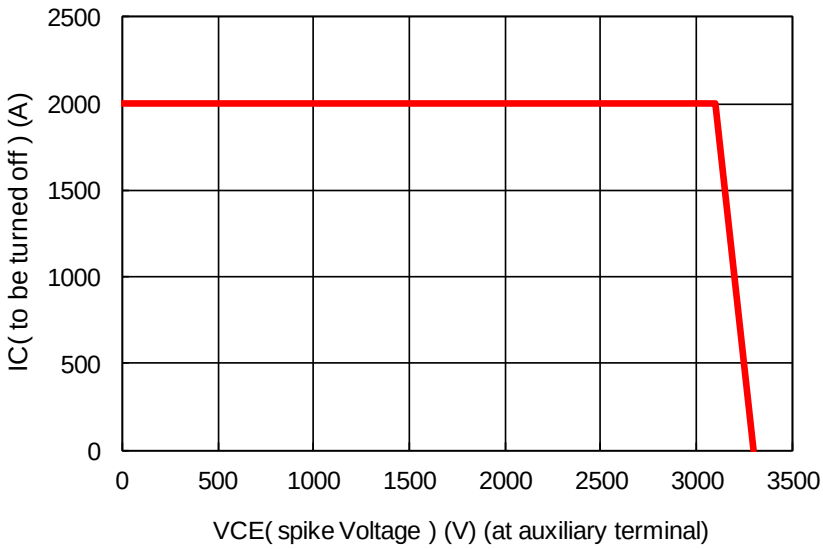
RBSOA

Conditions: Vcc≤2200V, Ic≤2000A,
Rg≥3.9Ω, Cge≥100nF,
VGE=±15V, -40°C≤Tj≤150°C,
Ls≤120nH, on pulse width≥ 10us
(Vce spike voltage and Ls are defined at auxiliary terminal)



Definition of RBSOA waveform



Reverse bias safe operation area (RBSOA)

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HITACHI POWER SEMICONDUCTORS

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