MBN500H65E2

Silicon N-channel IGBT 6500V E2 version

FEATURES

- Low driving power due to low input capacitance MOS gate.
- Low noise due to ultra soft fast recovery diode.
- High reliability, high durability module.
- High thermal fatigue durability.
  (delta Tc=70°C, N>30,000cycles)
- Isolated head sink (terminal to base).

ABSOLUTE MAXIMUM RATINGS (Tc=25ºC)

Item		Symbol	Unit	MBN500H65E2
Collector Emitter Voltage	Tj=125 ºC	V_{CES}	V	6,500
	Tj=25 ºC			6,500
	Tj=-40 ºC			6,000
Gate Emitter Voltage		V_{GES}	V	±20
Collector Current	DC	I_C	A	500 (Tc=80 ºC)
	1ms	I_{Cp}		1,000
Forward Current	DC	I_F	A	500
	1ms	I_{FM}		1,000
Junction Temperature		T_j	ºC	-40 ~ +125
Storage Temperature		T_{stg}	ºC	-50 ~ +125
Isolation Voltage		V_{ISO}	V_{RMS}	10,200 (AC 1 minute)
Screw Torque	Terminals (M4/M8)	-	N·m	2/10 (1)
	Mounting (M6)	-		6 (2)

Notes: (1) Recommended Value 1.8±0.2/9±1N·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	-	-	17	V_{CE}=6,500V, V_{GE}=0V, Tj=25ºC
				-	17	67	V_{CE}=6,500V, 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	-	3.2	-	I_C=500A, V_{GE}=15V, Tj=25ºC
				3.4	4.3	5.2	I_C=500A, V_{GE}=15V, Tj=125ºC
Gate Emitter Threshold Voltage		$V_{GE(TO)}$	V	5.8	6.3	6.8	V_{CE}=10V, I_C=500mA, Tj=25ºC
Input Capacitance		C_{ies}	nF	-	87	-	V_{CE}=10V,V_{GE}=0V, f=100kHz, Tj=25ºC
Internal Gate Resistance		R_{ge}	Ω	-	1.1	-	V_{CE}=10V,V_{GE}=0V, f=100kHz, Tj=25ºC
Switching Times	Rise Time	t_r	μs	2.2	3.2	4.8	V_{CC}=3,600V, Ic=500A Ls=210nH R_G=12Ω (3) V_{GE}=+/-15V, Tj=125ºC
	Turn On Time	t_{on}		2.7	3.9	5.9	
	Fall Time	t_f		2.2	3.1	4.7	
	Turn Off Time	t_{off}		4.5	6.4	9.6	
Peak Forward Voltage Drop		V_{FM}	V	-	3.6	-	IF=500A, V_{GE}=0V, Tj=25ºC
				3.5	3.9	4.4	IF=500A, V_{GE}=0V, Tj=125ºC
Reverse Recovery Time		t_{rr}	μs	-	0.8	1.6	Vcc=3,600V, IF=500A, Ls=210nH Tj=125ºC
Short Circuit Pulse Width		t_{sc}	μs	10	-	-	V_{CC}=4500V,Ls=210nH R_G(on/off)=12/120Ω, V_{GE}=±15V,Tj=25ºC
Turn On Loss		$E_{on(10\%)}$	J/p	-	3.3	4.3	V_{CC}=3600V, Ic= IF=500A, Ls=210nH R_G= 12Ω (3) V_{GE}=+/-15V, Tj=125ºC
		$E_{on(full)}$		-	3.7	-	
Turn Off Loss		$E_{off(10\%)}$	J/ p	-	2.6	3.4	
		$E_{off(full)}$		-	2.8	-	
Reverse Recovery Loss		$E_{rr(10\%)}$	J/ p	-	1.4	1.8	
		$E_{rr(full)}$		-	1.5	-	

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.

* 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	-	-	0.0135	Junction to case
	FWD	Rth(j-c)		-	-	0.027	
Contact Thermal Impedance		Rth(c-f)	K/W	-	0.007	-	Case to fin (λgrease=1W/(m・K), heat-sink flatness ≤50um)

MODULE MECHANICAL CHARACTERISTICS

Item		Unit	Characteristics	Conditions
Weight		g	1,050	
Stray inductance in module	LS(CM-EM)	nH	21	Collector-main to Emitter-main
Comparative Tracking Index	(CTI)		600	
Module base plate Material			Al-SiC	
Baseplate Thickness		mm	5	
Insulation plate Material			Al N	
Terminal Surface treatment			Ni plating	
Case Material			Poly-Phenilene Sulfide	
Fire and Smoke Category			I2 / F3	NFF 16-102

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DEFINITION OF TEST CIRCUIT

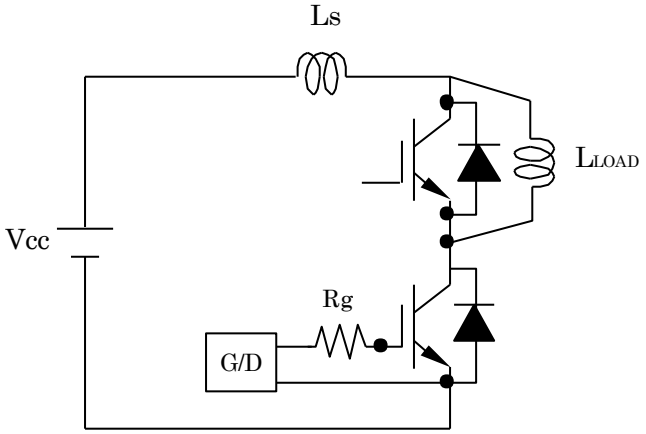
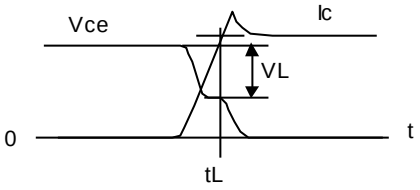
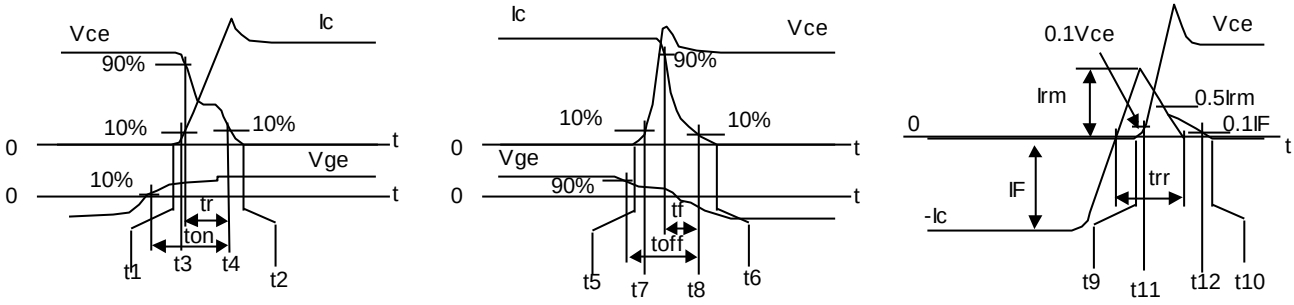


Fig.1 Switching test circuit



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

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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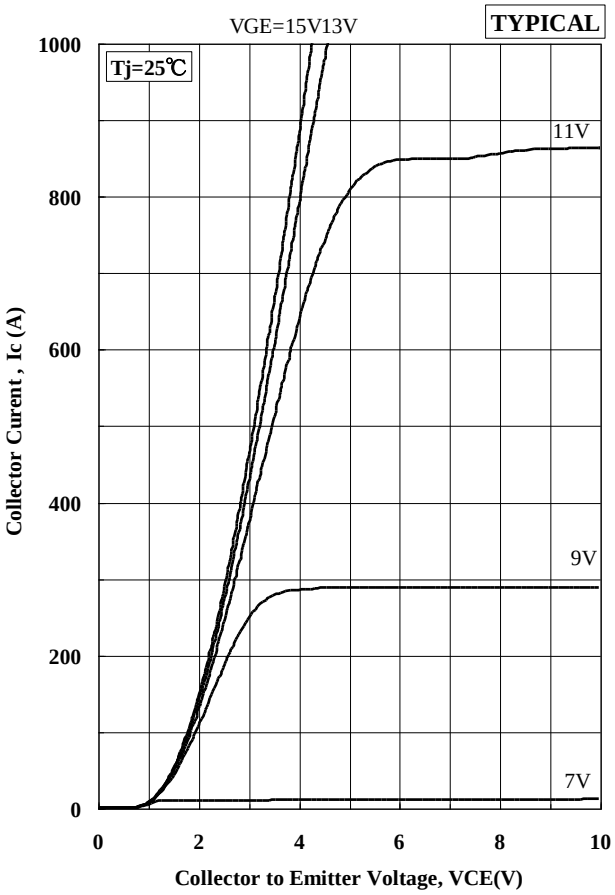
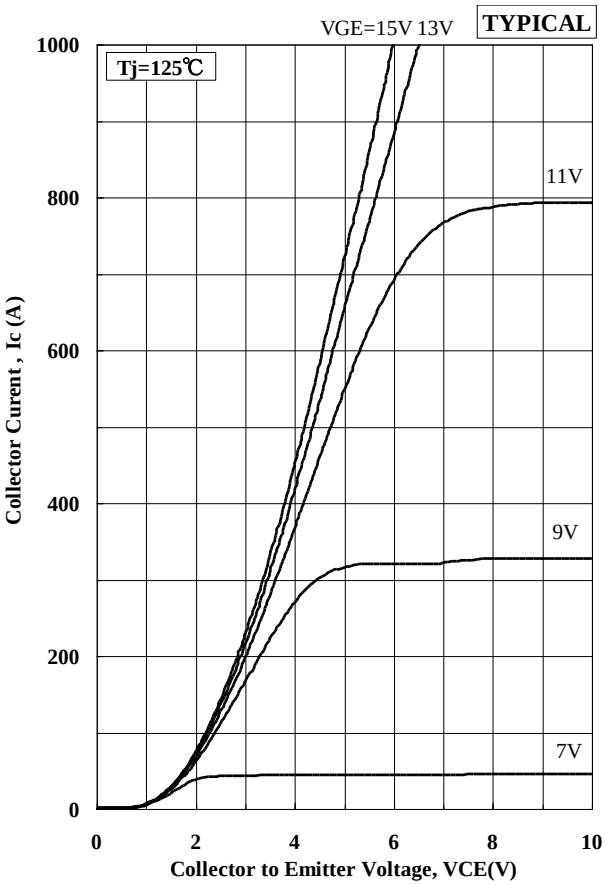
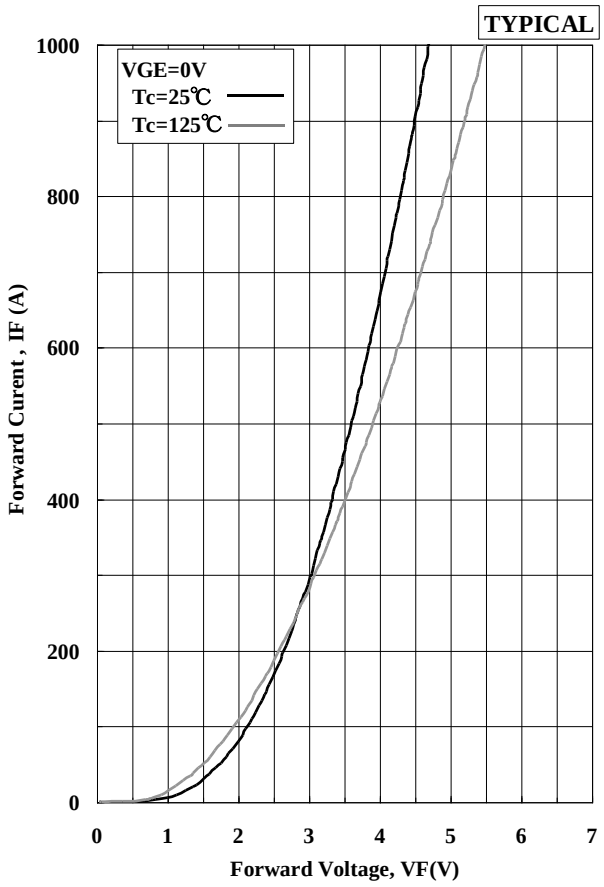
STATIC CHARACTERISTICS



Collector Current vs.Collector to Emitter Voltage



Collector Current vs.Collector to Emitter Voltage



Forward Voltage of free-wheeling diode

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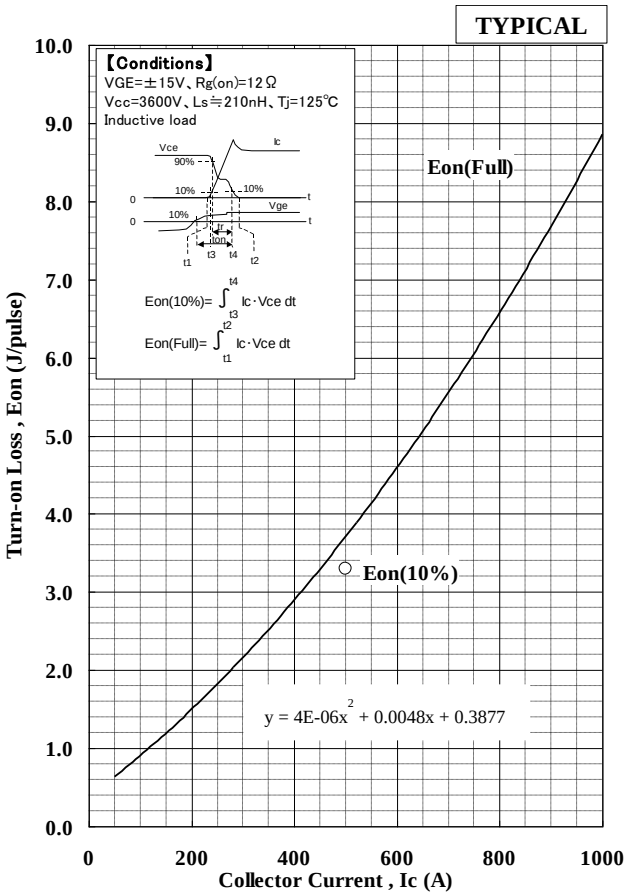
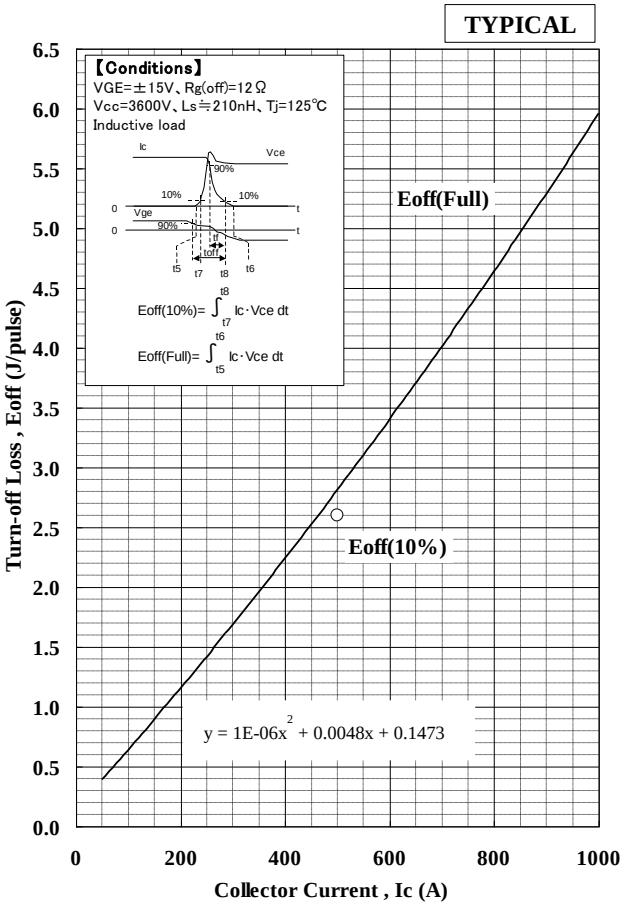
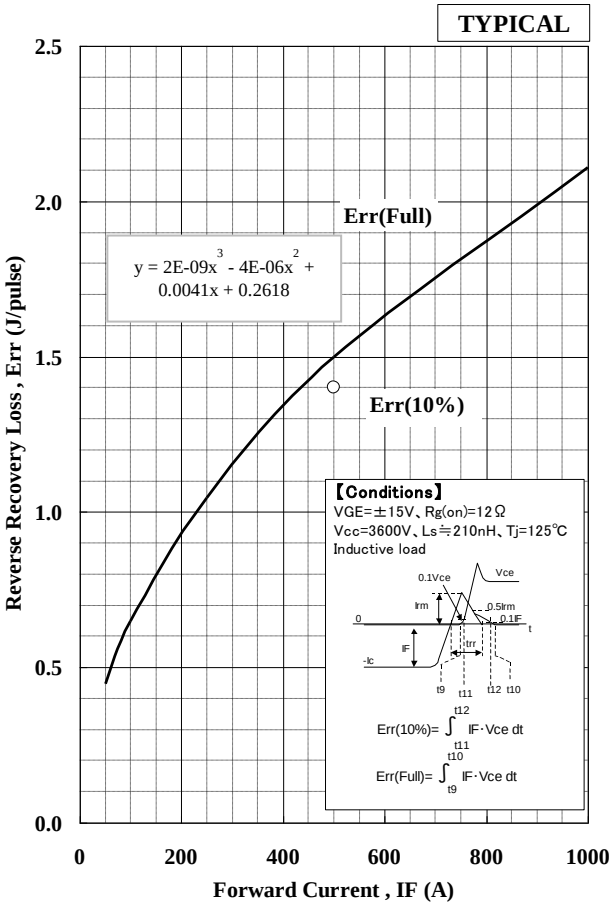
DYNAMIC CHARACTERISTICS



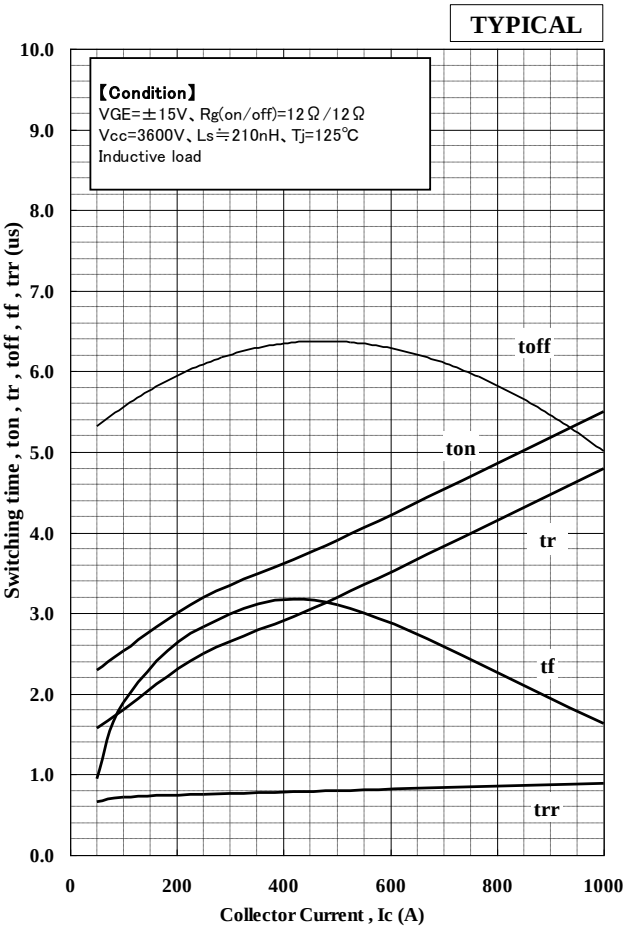
Turn-on Loss vs. Collector Current



Turn-off Loss vs.Collector Current



Recovery Loss vs. Forward Current



Switching time vs. Collector current

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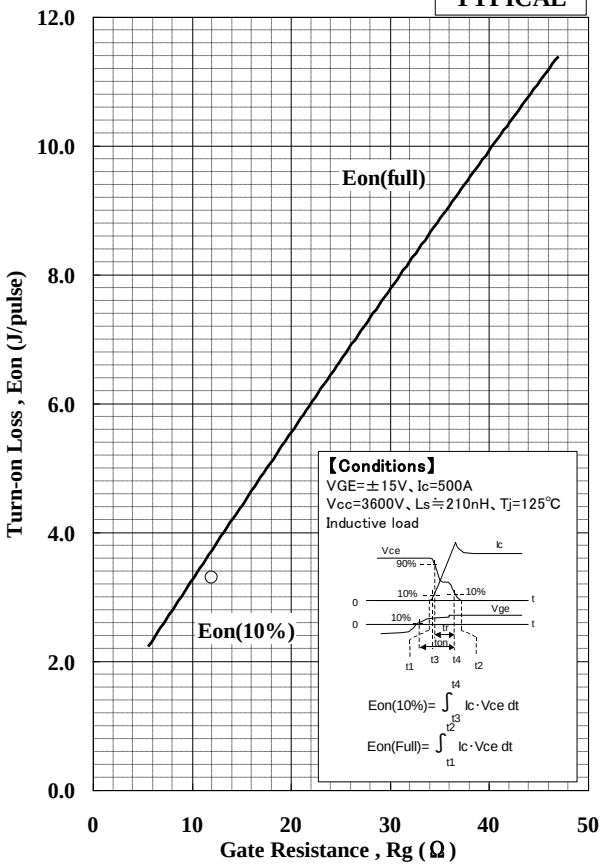
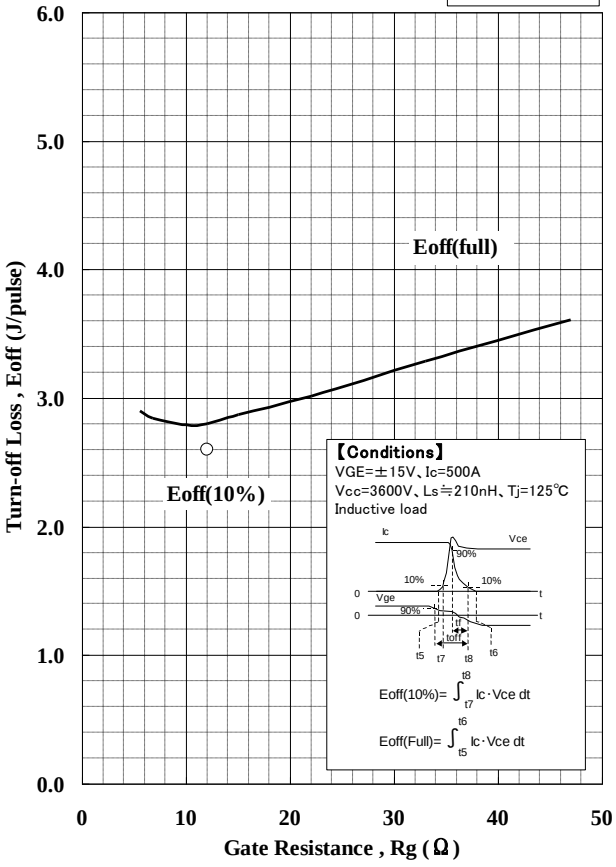
TYPICAL



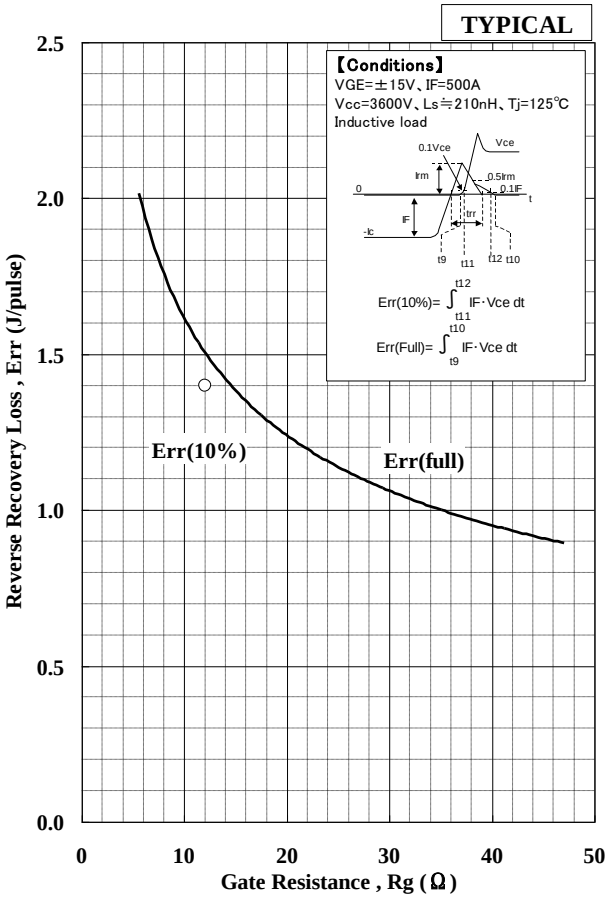
Turn-on Loss vs. Gate Resistance

TYPICAL



Turn-off Loss vs. Gate Resistance

TYPICAL



Recovery Loss vs. Gate Resistance

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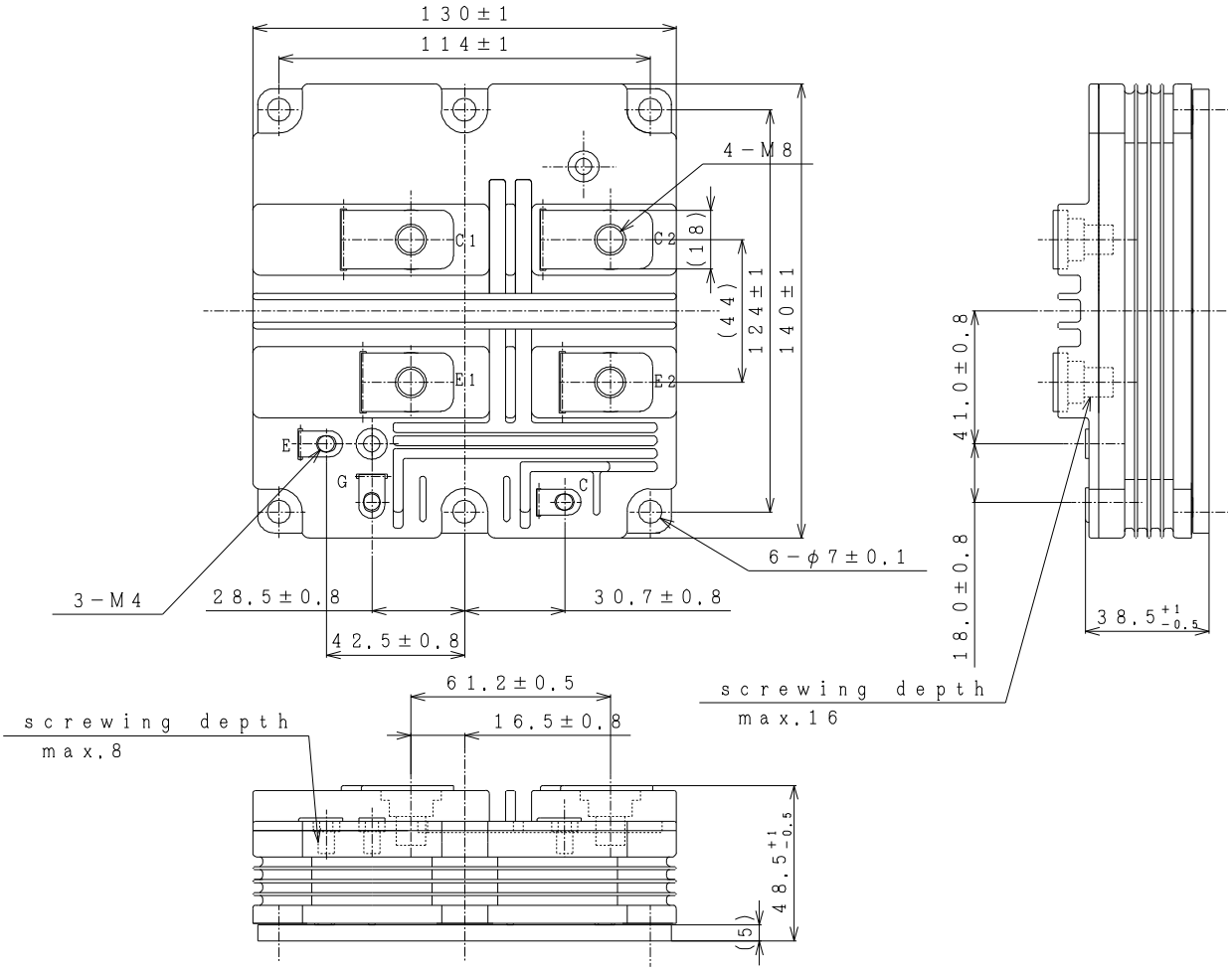
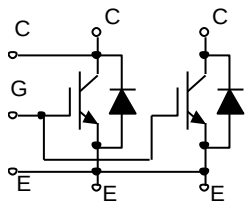
PACKAGE OUTLINE DRAWING

Unit: mm





Circuit diagram

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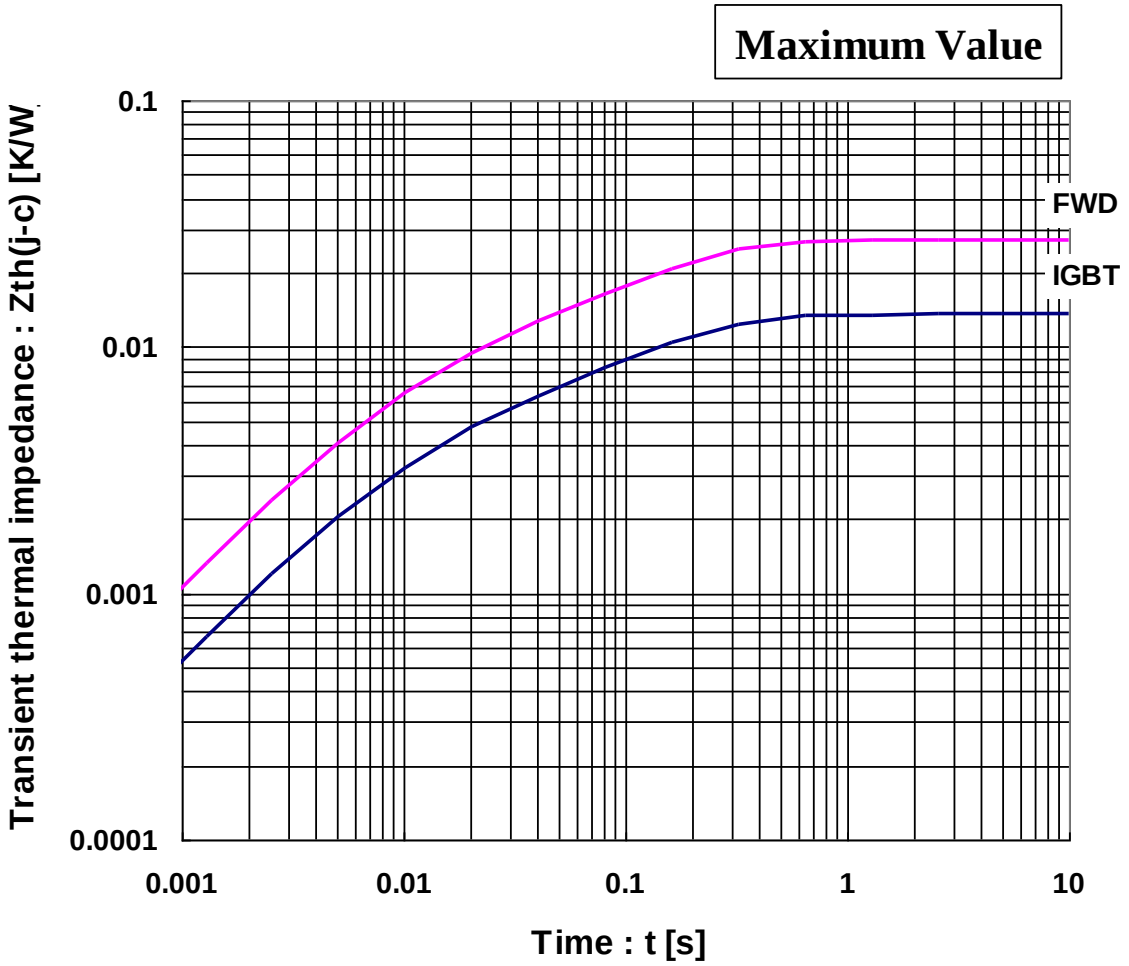
TRANSIENT THERMAL IMPEDANCE



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]	1.64E-01	2.89E-02	7.02E-03	9.42E-04	sec
rth[n,IGBT]	8.36E-03	2.59E-03	2.43E-03	1.04E-04	K/W
rth[n,Diode]	1.67E-02	5.25E-03	4.81E-03	2.13E-04	K/W

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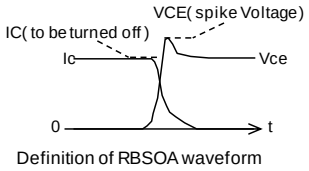
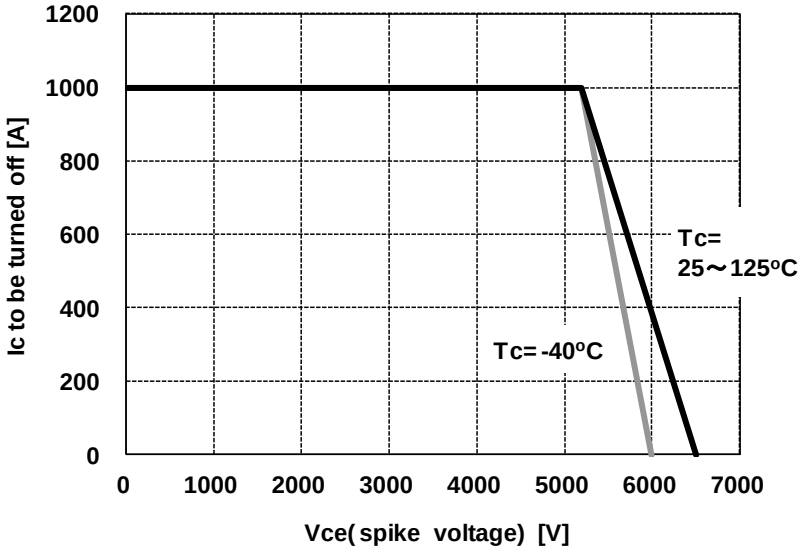
RBSOA

Conditions: Ls≤210nH, Vcc≤4400V,
Ic≤1000A, VGE=±15V,
Rg(on/off)≥12/12Ω, -40°C≤Tc≤125°C
on pulse width ≥ 20us
(Vce spike voltage and Ls are defined at auxiliary terminal)



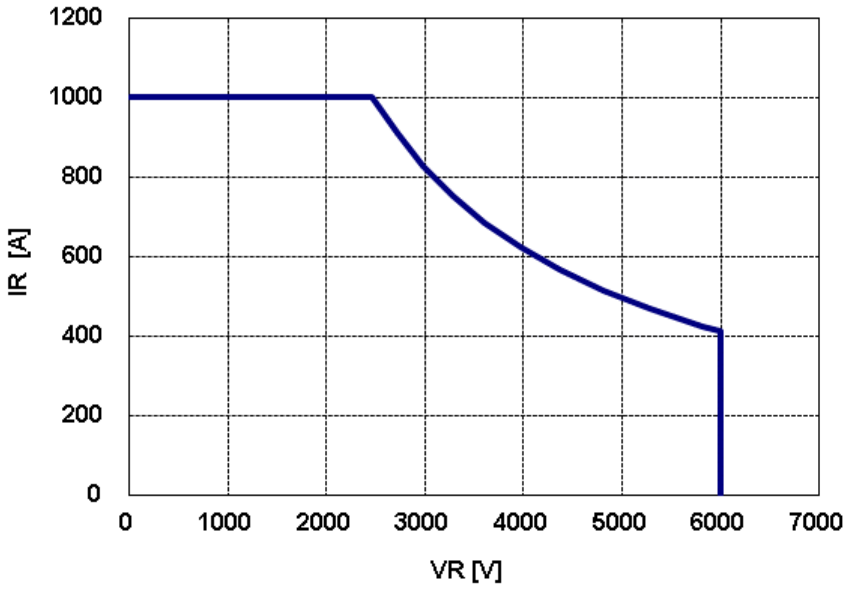
Definition of RBSOA waveform



Reverse bias safe operation area (RBSOA)

Recovery SOA

Conditions:
Ls≤210nH, Vcc≤4400V, IR≤1000A, VGE=-15V,
Rg(on) of across IGBT ≥12Ω, VGE of across IGBT = ±15V,
-40°C≤Tc≤125°C, VR defined at auxiliary terminal
Conduction pulse width of diode ≥30μs



RecSOA

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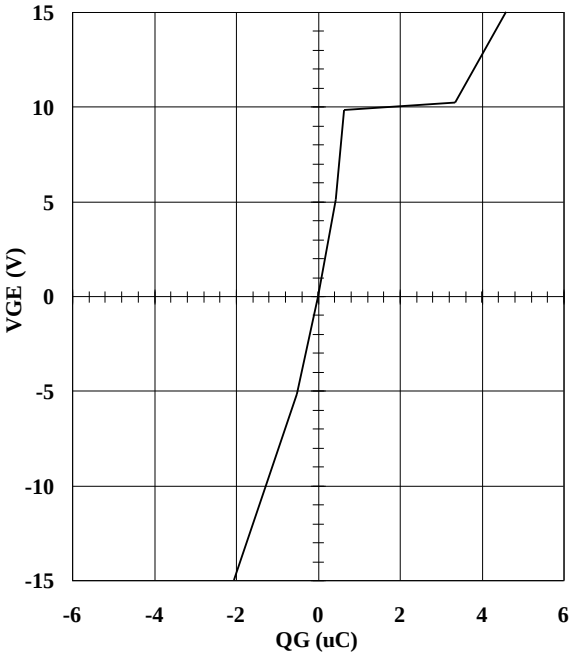
QG-VGE Curve

TYPICAL

Conditions: Ls=300nH,VCC=3600V,VGE=+/-15V,
RG(on/off)=68Ω/12Ω,Tj=25°C,



QG-VGE curve

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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HITACHI POWER SEMICONDUCTORS

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