

MBN1500E33E3

Silicon N-channel IGBT 3300V E3 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:
($\Delta T_c=70K$, $N>30,000$ cycles)
AlSiC base-plate/AlN substrate

ABSOLUTE MAXIMUM RATINGS ($T_c=25^\circ\text{C}$)

Item	Symbol	Unit	MBN1500E33E3
Collector Emitter Voltage	V_{CES}	V	3,300
Gate Emitter Voltage	V_{GES}	V	± 20
Collector Current	DC	I_C	1,500 ($T_c=95^\circ\text{C}$)
	1ms	I_{Cp}	
Forward Current	DC	I_F	1,500
	1ms	I_{FM}	3,000
Junction Temperature	T_j	$^\circ\text{C}$	-40 ~ +150
Storage Temperature	T_{stg}	$^\circ\text{C}$	-50 ~ +125
Isolation Voltage	V_{ISO}	V_{RMS}	6,000(AC 1 minute)
Screw Torque	Terminals (M4/M8)	-	2/15 (1)
	Mounting (M6)	-	6 (2)

Notes: (1) Recommended Value $1.8\pm 0.2/15^{+0}_{-3}$ N·m

(2) Recommended Value 5.5 ± 0.5 N·m

ELECTRICAL CHARACTERISTICS

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions	
Collector Emitter Cut-Off Current	I_{CES}	mA	-	-	12	$V_{CE}=3,300\text{V}$, $V_{GE}=0\text{V}$, $T_j=25^\circ\text{C}$	
Gate Emitter Leakage Current	I_{GES}	nA	-500	-	+500	$V_{CE}=3,300\text{V}$, $V_{GE}=0\text{V}$, $T_j=125^\circ\text{C}$ $V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$, $T_j=25^\circ\text{C}$	
Collector Emitter Saturation Voltage	$V_{CE(sat)}$	V	-	2.45	-	$I_C=1,500\text{A}$, $V_{GE}=15\text{V}$, $T_j=25^\circ\text{C}$	
			2.80	3.20	3.80	$I_C=1,500\text{A}$, $V_{GE}=15\text{V}$, $T_j=125^\circ\text{C}$	
			-	3.60	-	$I_C=1,500\text{A}$, $V_{GE}=15\text{V}$, $T_j=150^\circ\text{C}$	
Gate Emitter Threshold Voltage	$V_{GE(TH)}$	V	5.5	6.3	7.5	$V_{CE}=10\text{V}$, $I_C=1,500\text{mA}$, $T_j=25^\circ\text{C}$	
Input Capacitance	C_{ies}	nF	-	195	-	$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_j=25^\circ\text{C}$	
Internal Gate Resistance	R_{ge}	Ω	-	0.9	-	$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_j=25^\circ\text{C}$	
Switching Times	Rise Time	t_r	μs	1.6	2.1	2.8	$V_{CC}=1,650\text{V}$, $I_C=1,500\text{A}$ $L=100\text{nH}$ $R_G=2.7\Omega/2.7\Omega$, $C_{GE}=330\text{nF}$ (3) $V_{GE}=\pm 15\text{V}$, $T_j=125^\circ\text{C}$
	Turn On Time	t_{on}		2.1	3.2	4.0	
	Fall Time	t_f		1.1	2.1	3.3	
	Turn Off Time	t_{off}		2.8	4.6	5.8	
Peak Forward Voltage Drop	V_{FM}	V	-	2.50	-	$I_F=1,500\text{A}$, $V_{GE}=0\text{V}$, $T_j=25^\circ\text{C}$	
			2.20	2.70	3.20	$I_F=1,500\text{A}$, $V_{GE}=0\text{V}$, $T_j=125^\circ\text{C}$	
			-	2.60	-	$I_F=1,500\text{A}$, $V_{GE}=0\text{V}$, $T_j=150^\circ\text{C}$	
Reverse Recovery Time	t_{rr}	μs	-	0.9	1.4	$V_{CC}=1,650\text{V}$, $I_F=1,500\text{A}$, $L=100\text{nH}$ $T_j=125^\circ\text{C}$	
Turn On Loss	$E_{on(10\%)}$	J/P	-	3.2	3.7	$T_j=125^\circ\text{C}$	
	$E_{on(full)}$		-	3.5	-		$T_j=150^\circ\text{C}$
Turn Off Loss	$E_{off(10\%)}$	J/P	-	2.1	2.8	$V_{CC}=1,650\text{V}$, $I_C=1,500\text{A}$, $L=100\text{nH}$, $R_G=2.7\Omega/2.7\Omega$, $C_{GE}=330\text{nF}$ (3) $V_{GE}=\pm 15\text{V}$	
	$E_{off(full)}$		-	2.65	-		$T_j=125^\circ\text{C}$
	$E_{off(full)}$		-	2.74	-		$T_j=150^\circ\text{C}$
Reverse Recovery Loss	$E_{rr(10\%)}$	J/P	-	1.5	2.0	$T_j=125^\circ\text{C}$	
	$E_{rr(full)}$		-	2.0	-		$T_j=150^\circ\text{C}$
	$E_{rr(full)}$		-	2.5	-		$T_j=150^\circ\text{C}$

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	$R_{th(j-c)}$	-	-	0.0078	Junction to case
	FWD	$R_{th(j-c)}$	-	-	0.0156	
Contact Thermal Impedance		$R_{th(c-f)}$	-	0.005	-	Case to fin ($\lambda_{grease}=1W/(m \cdot K)$, heat-sink flatness $\leq 50\mu m$)

DEFINITION OF TEST CIRCUIT

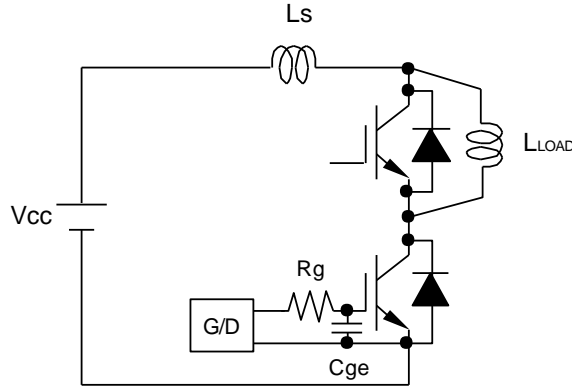


Fig.1 Switching test circuit

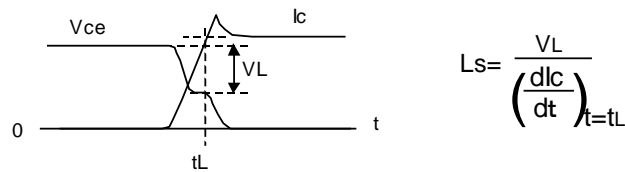


Fig.2 Definition of stray inductance

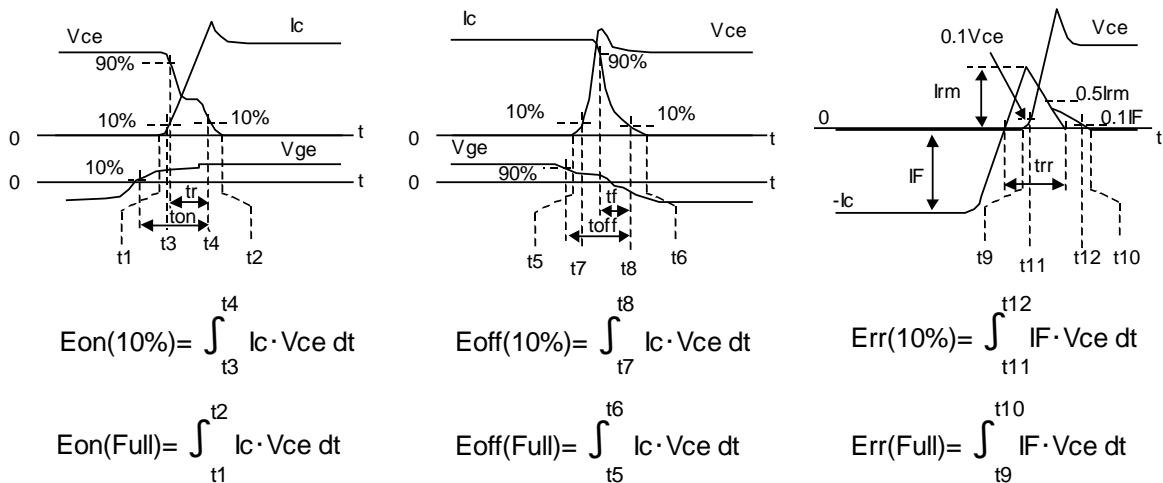
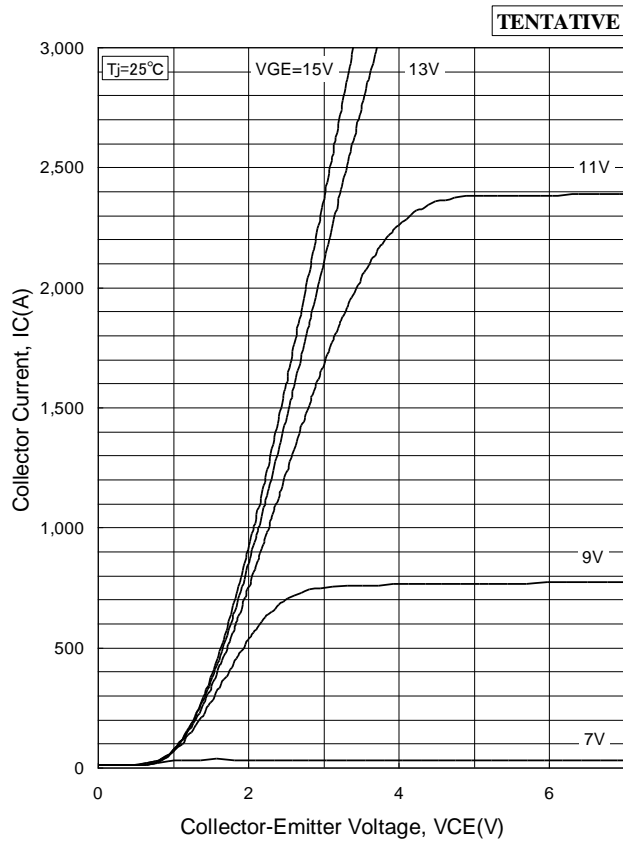


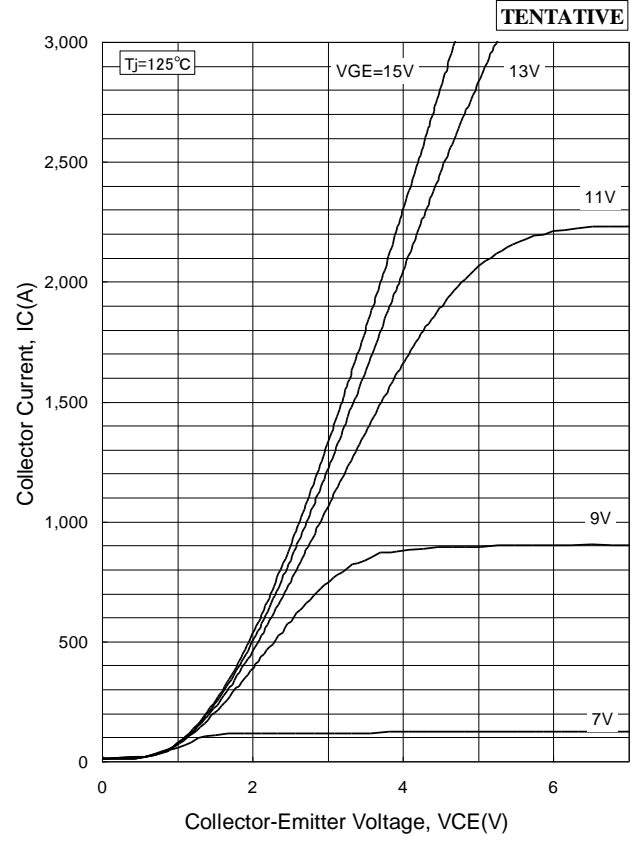
Fig.3 Definition of switching loss

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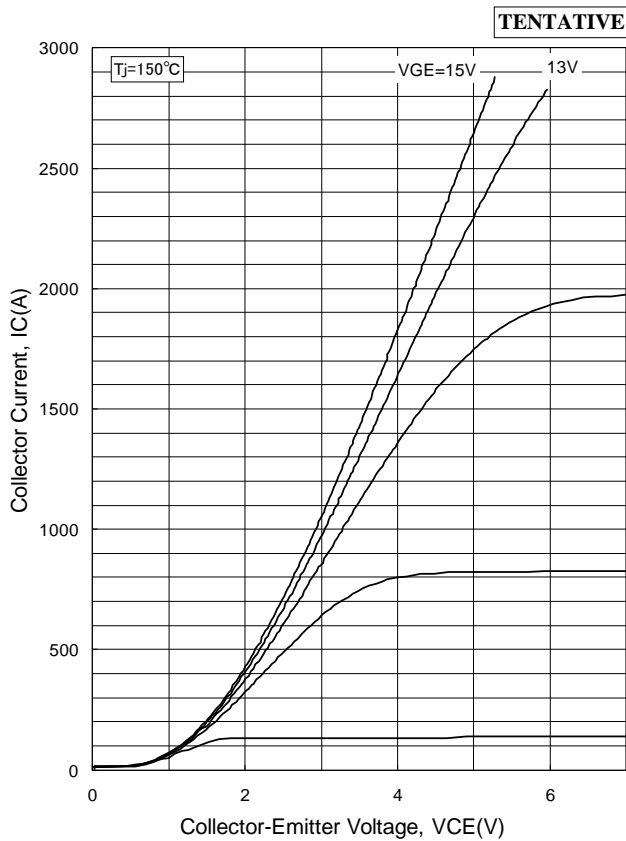
STATIC CHARACTERISTICS



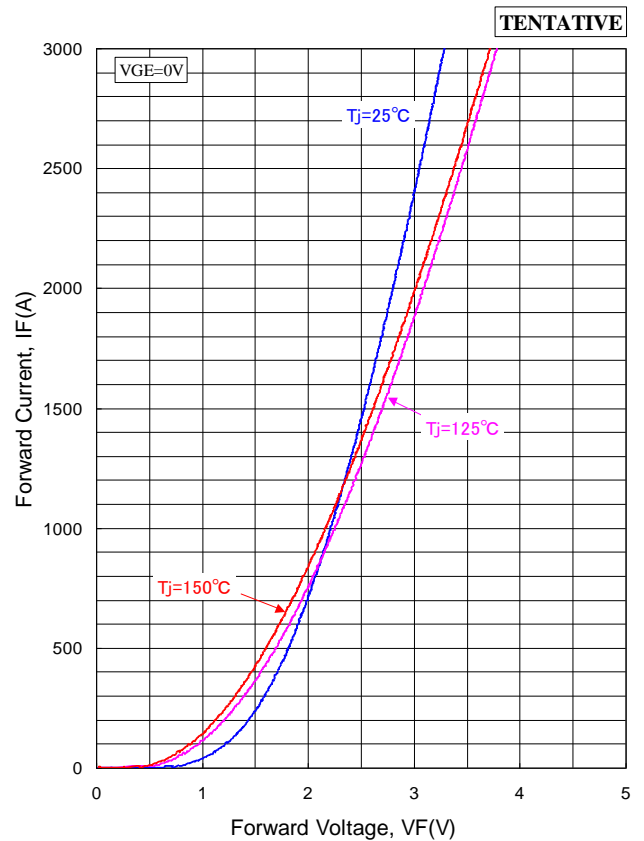
Collector Current vs. Collector to Emitter Voltage



Collector Current vs. Collector to Emitter Voltage



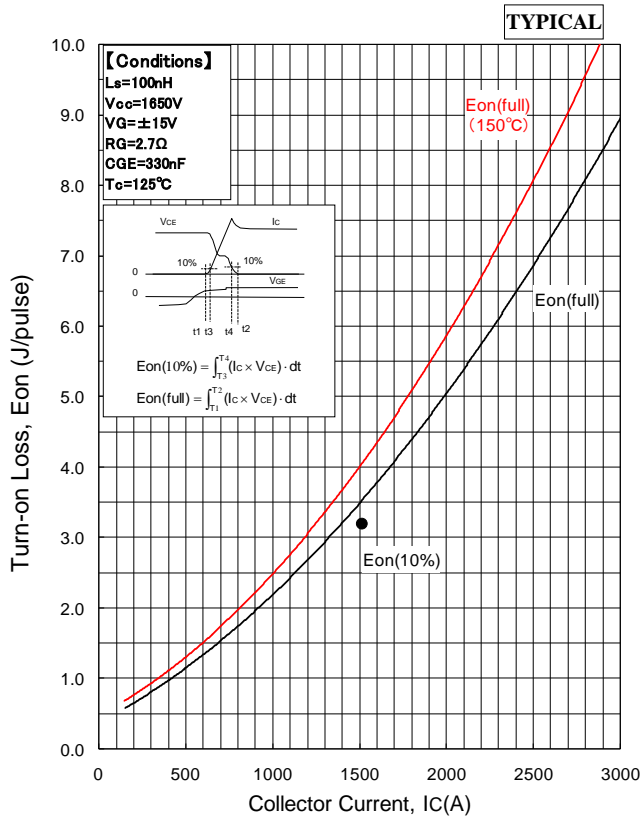
Collector Current vs. Collector to Emitter Voltage



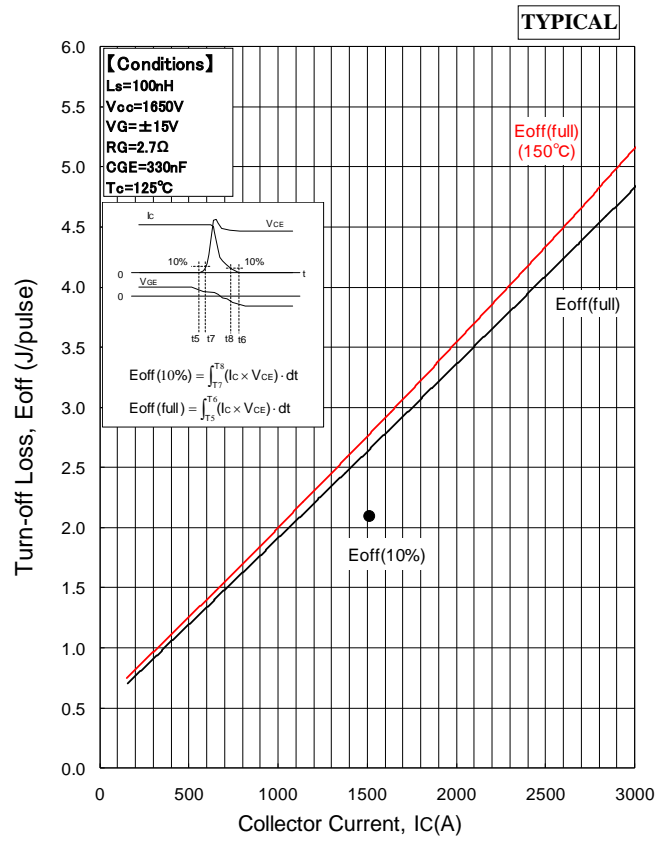
Forward Voltage of free-wheeling diode

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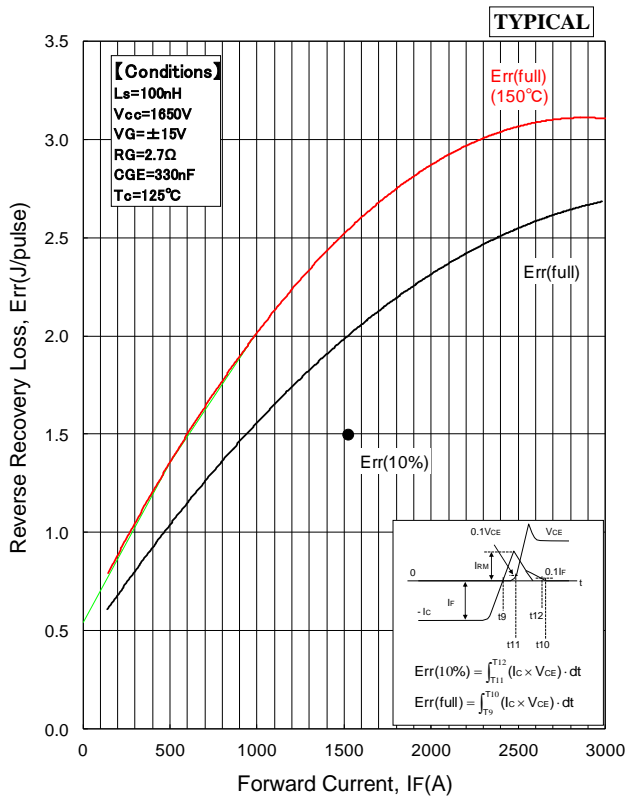
DYNAMIC CHARACTERISTICS



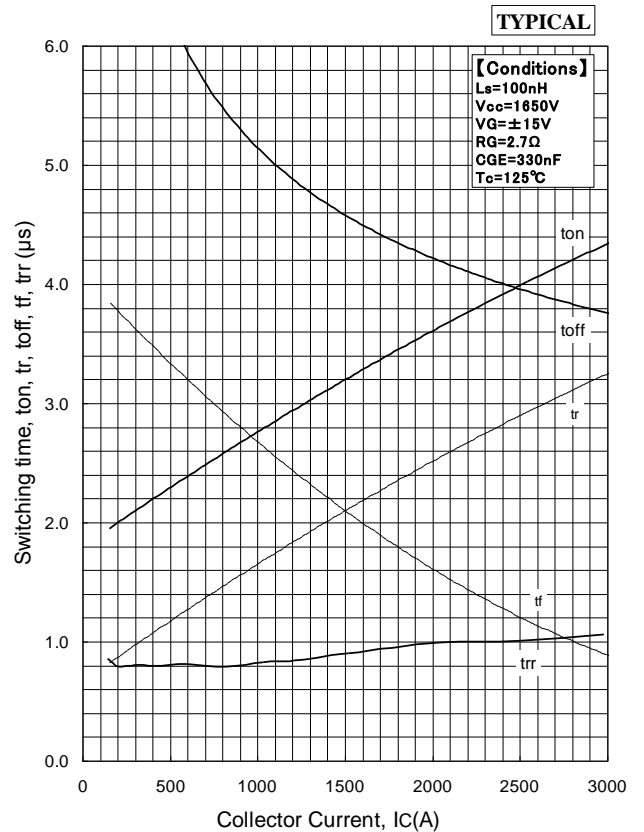
Turn-on Loss vs. Collector Current



Turn-off Loss vs. Collector Current

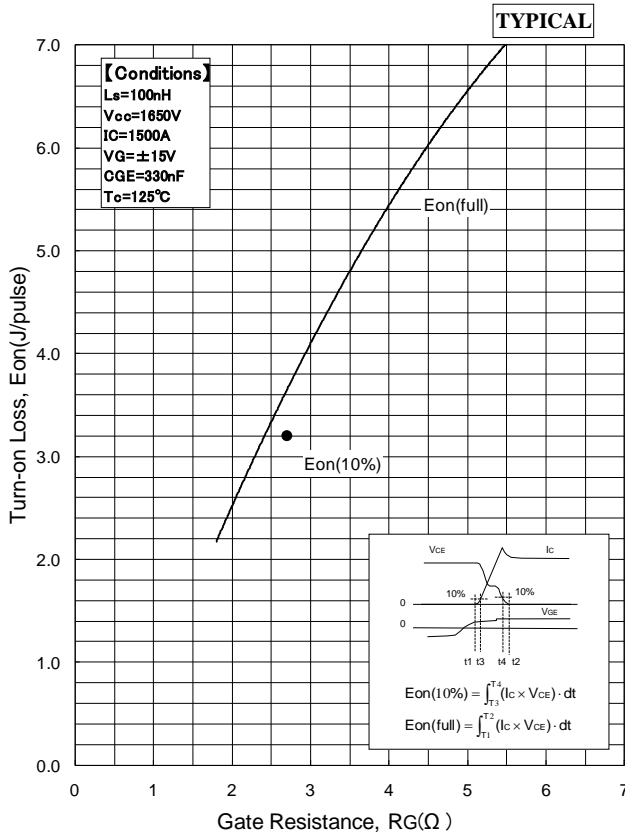


Recovery Loss vs. Forward Current

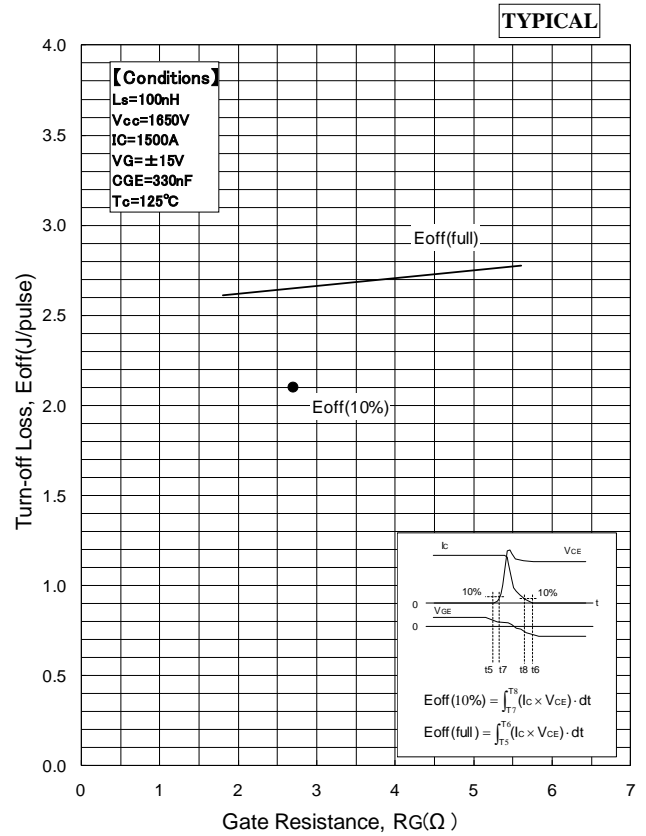


Switching time vs. Collector current

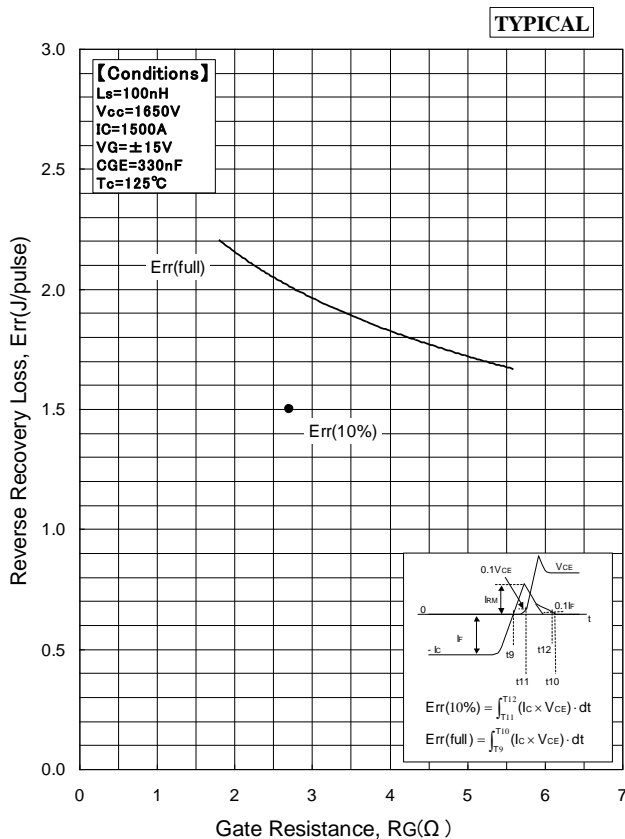
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Turn-on Loss vs. Gate Resistance



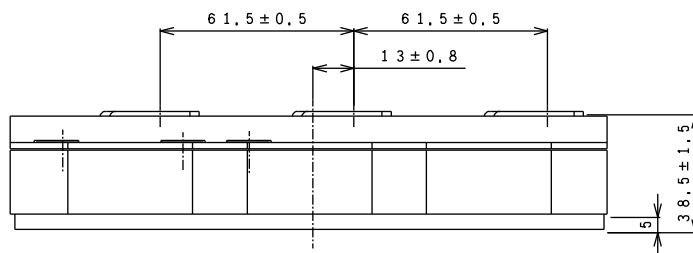
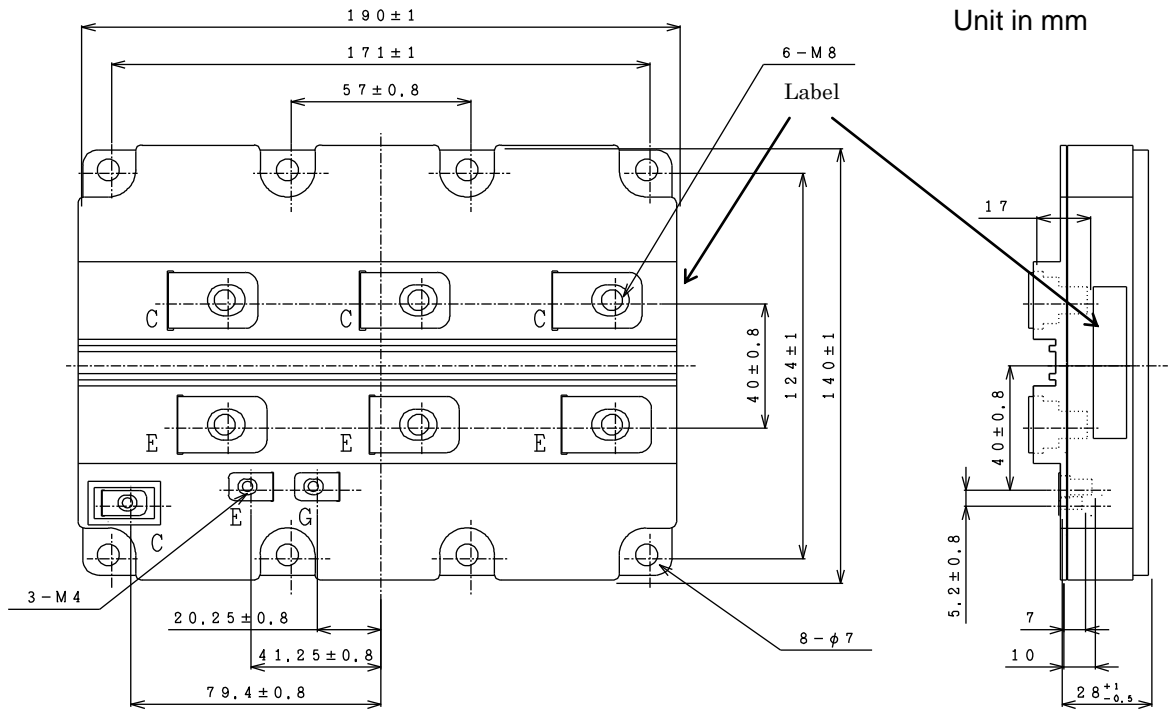
Turn-off Loss vs. Gate Resistance



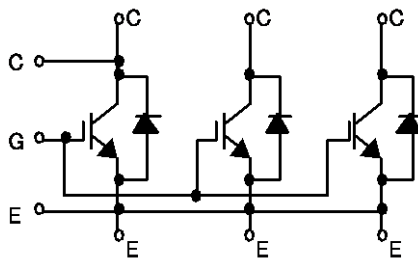
Recovery Loss vs. Gate Resistance

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OUTLINE DRAWINGS



Weight: 1300(g)

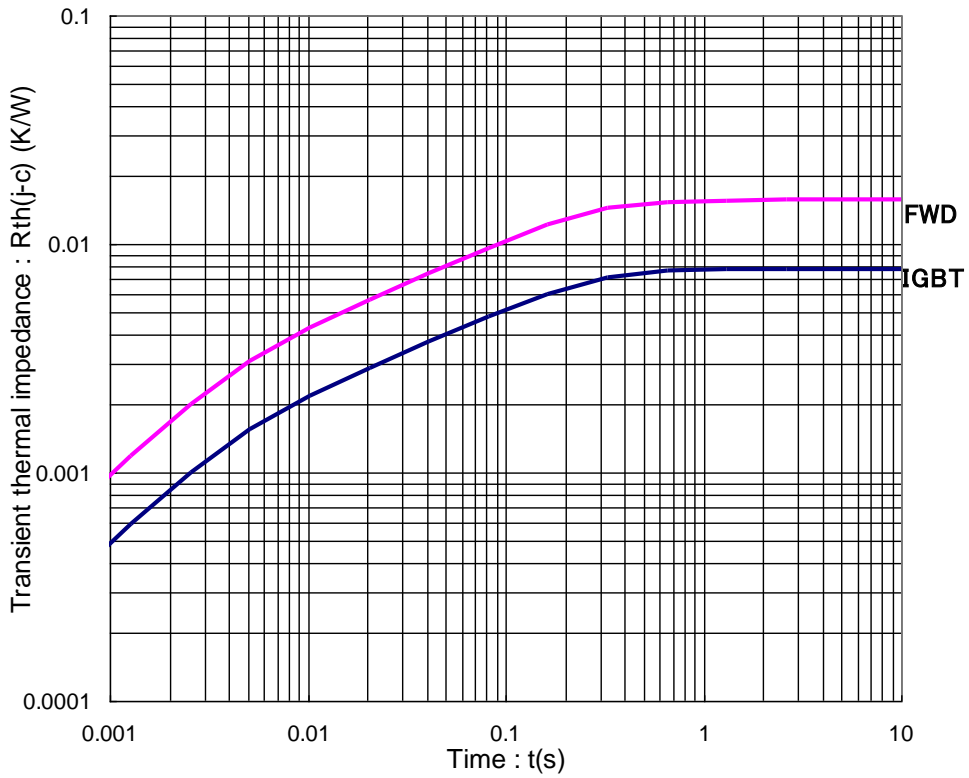


Circuit diagram

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TRANSIENT THERMAL IMPEDANCE

Maximum



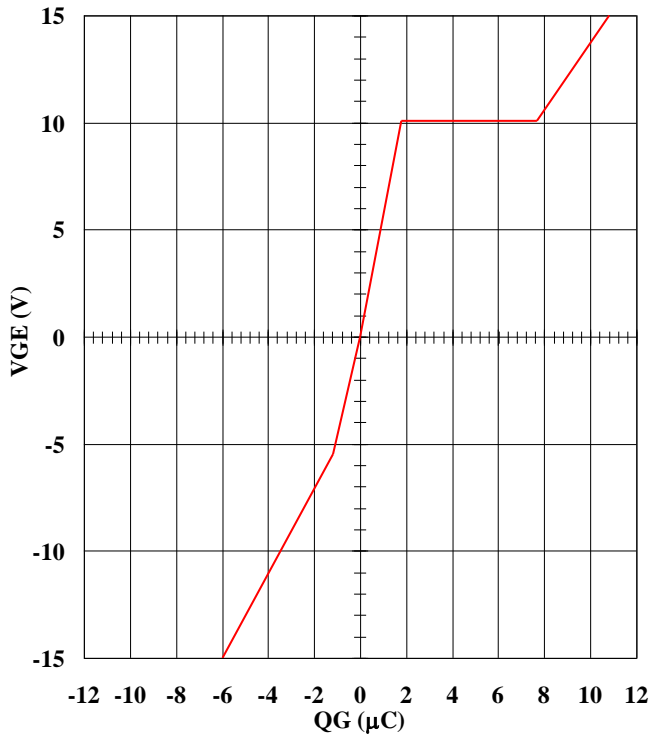
Transient Thermal Impedance Curve

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QG-VG CURVE

TYPICAL

Conditions: $L_s=100\text{nH}$, $V_{CC}=1650\text{V}$, $I_C=1500\text{A}$,
 $V_{GE}=\pm 15\text{V}$, $T_j=25^\circ\text{C}$



QG-VGE curve

Material declaration

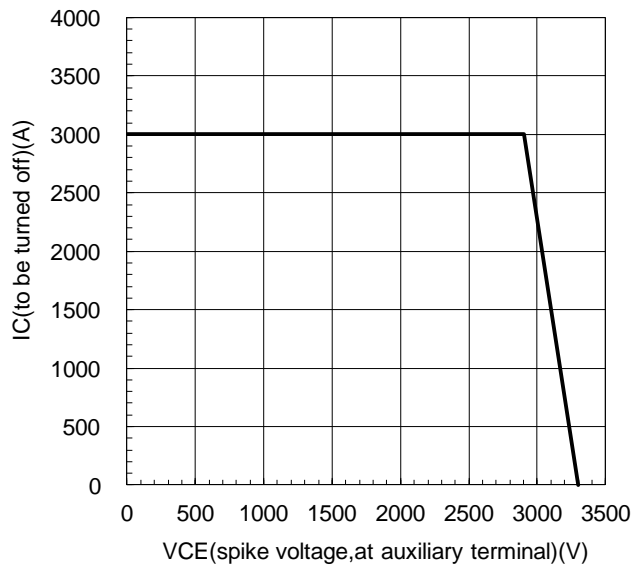
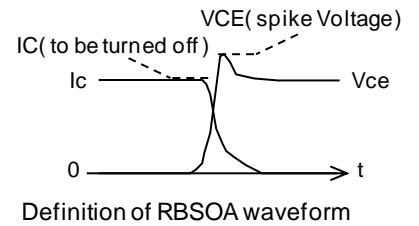
Please note the following materials are contained in the product, in order to keep characteristic and reliability level.

Material	Contained part
Lead (Pb) and its compounds	Solder

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RBSOA

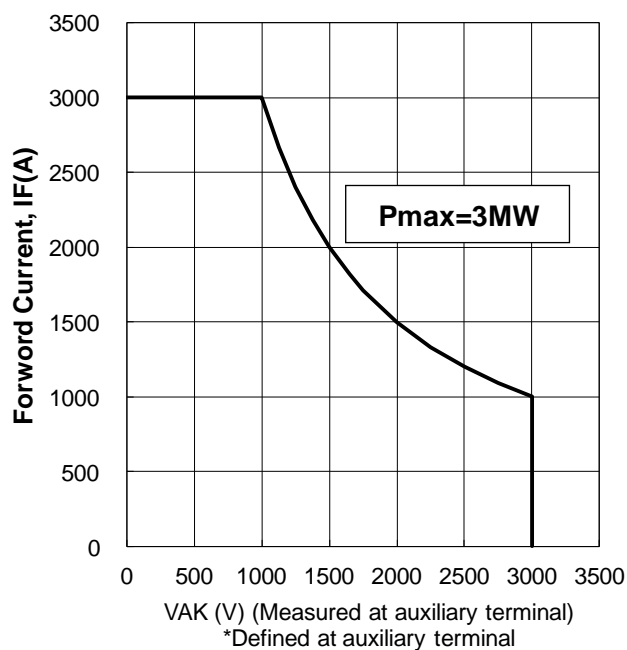
Conditions: $V_{cc} \leq 2200V$, $I_c \leq 3000A$,
 $R_g \geq 2.7\Omega$, $C_{GE} \geq 330nF$
 $V_{GE} = \pm 15V$, $-40^\circ C \leq T_j \leq 150^\circ C$,
 $L_s \leq 100nH$, on pulse width $\geq 10\mu s$
 (Vce spike voltage and L_s are defined at auxiliary terminal)



Reverse bias safe operation area (RBSOA)

RecSOA

Conditions: $V_{cc} \leq 2000V$, $di/dt \leq 6,400A/\mu s$,
 $T_j = 150^\circ C$, $L_s \leq 100nH$



Reverse recovery operation area(RecSOA)

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HITACHI POWER SEMICONDUCTORS

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