

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°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°C)
	1ms	I _{Cp}	3,000
Forward Current	DC	I _F	1,500
	1ms	I _{FM}	3,000
Junction Temperature	T _J	°C	-40 ~ +150
Storage Temperature	T _{stg}	°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 $1.8 \pm 0.2/15^{+0.3} N \cdot m$

(2) Recommended Value $5.5 \pm 0.5 N \cdot m$

ELECTRICAL CHARACTERISTICS

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Collector Emitter Cut-Off Current	I _{CES}	mA	-	-	12	V _{CE} =3,300V, V _{GE} =0V, T _J =25°C
Gate Emitter Leakage Current	I _{GES}	nA	-500	-	+500	V _{GE} =±20V, V _{CE} =0V, T _J =25°C
Collector Emitter Saturation Voltage	V _{CE(sat)}	V	-	2.45	-	I _C =1,500A, V _{GE} =15V, T _J =25°C
			2.80	3.20	3.80	I _C =1,500A, V _{GE} =15V, T _J =125°C
			-	3.60	-	I _C =1,500A, V _{GE} =15V, T _J =150°C
Gate Emitter Threshold Voltage	V _{GE(TO)}	V	5.5	6.3	7.5	V _{CE} =10V, I _C =1,500mA, T _J =25°C
Input Capacitance	C _{ies}	nF	-	195	-	V _{CE} =10V, V _{GE} =0V, f=100kHz, T _J =25°C
Internal Gate Resistance	R _{ge}	Ω	-	0.9	-	V _{CE} =10V, V _{GE} =0V, f=100kHz, T _J =25°C
Switching Times	Rise Time	t _r	1.6	2.1	2.8	V _{CC} =1,650V, I _C =1,500A
	Turn On Time	t _{on}	2.1	3.2	4.0	L=100nH
	Fall Time	t _f	1.1	2.1	3.3	R _G =2.7Ω/2.7Ω, C _{GE} =330nF (3)
	Turn Off Time	t _{off}	2.8	4.6	5.8	V _{GE} =±15V, T _J =125°C
Peak Forward Voltage Drop	V _{FM}	V	-	2.50	-	I _F =1,500A, V _{GE} =0V, T _J =25°C
			2.20	2.70	3.20	I _F =1,500A, V _{GE} =0V, T _J =125°C
			-	2.60	-	I _F =1,500A, V _{GE} =0V, T _J =150°C
Reverse Recovery Time	t _{rr}	μs	-	0.9	1.4	V _{CC} =1,650V, I _F =1,500A, L=100nH T _J =125°C
Short Circuit Pulse Width	t _{sc}	μs	10	-	-	V _{CC} =2000V, L _s =120nH R _G (on/off)=2.7/27Ω, V _{GE} =±15V, T _J =125°C
Turn On Loss	E _{on(10%)}	J/P	-	3.2	3.7	T _J =125°C
	E _{on(full)}		-	3.5	-	T _J =150°C
Turn Off Loss	E _{off(10%)}	J/P	-	2.1	2.8	T _J =125°C
	E _{off(full)}		-	2.65	-	T _J =150°C
			-	2.74	-	T _J =150°C
Reverse Recovery Loss	E _{rr(10%)}	J/P	-	1.5	2.0	T _J =125°C
	E _{rr(full)}		-	2.0	-	T _J =125°C
			-	2.5	-	T _J =150°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	$R_{th(c-f)}$	K/W	-	0.005	-	Case to fin ($\lambda_{grease}=1W/(m \cdot K)$, heat-sink flatness $\leq 50\mu m$)

DEFINITION OF TEST CIRCUIT

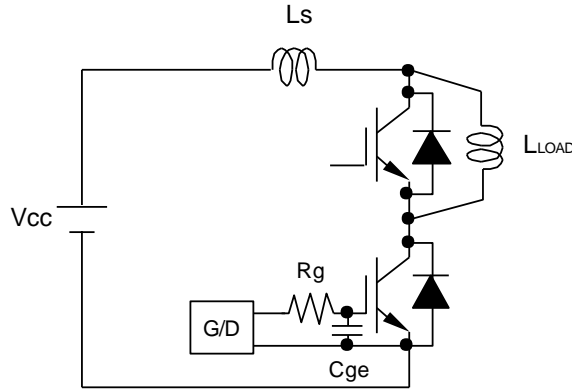


Fig.1 Switching test circuit

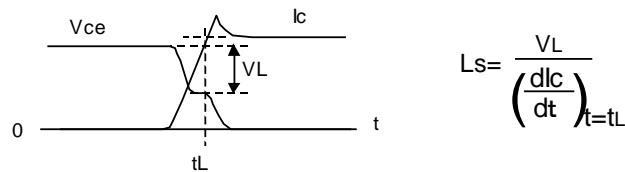


Fig.2 Definition of stray inductance

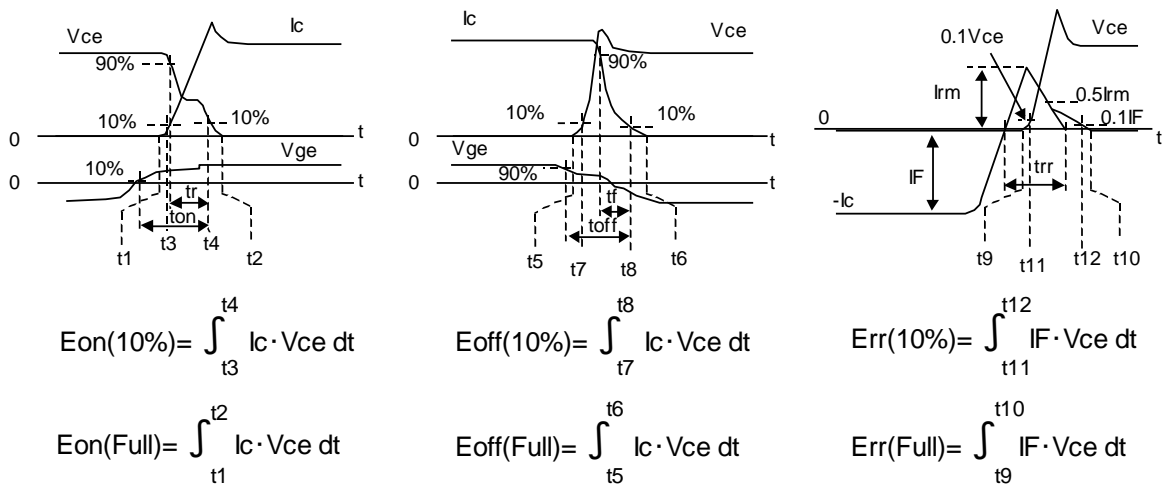
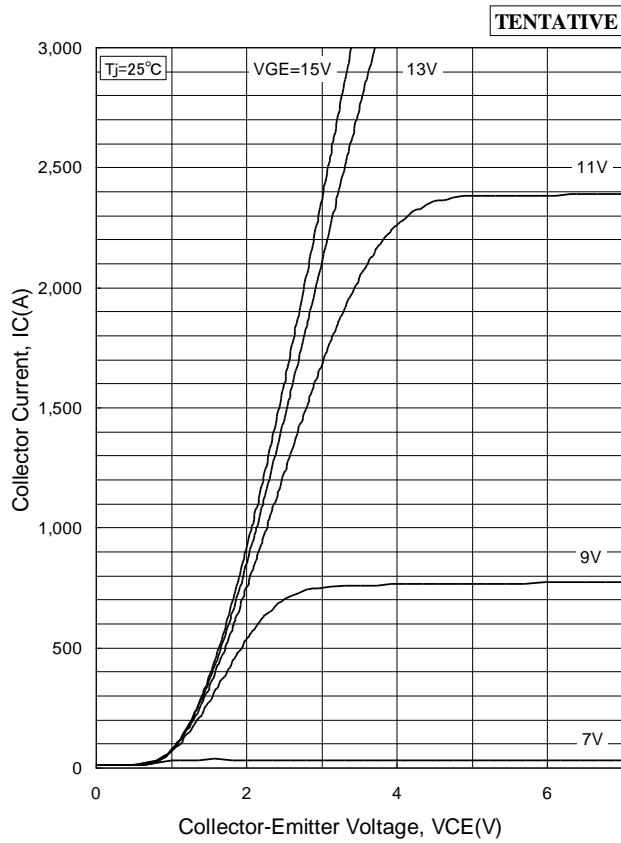


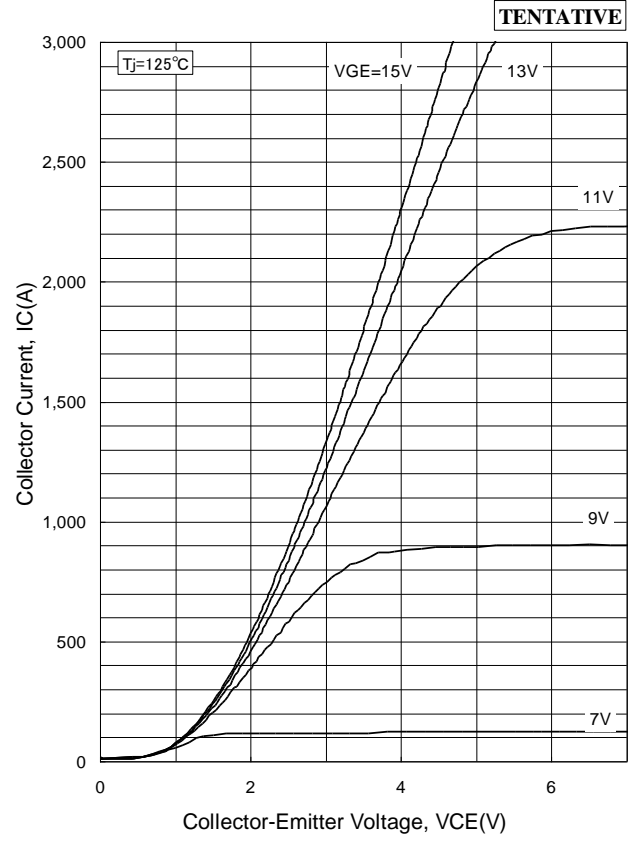
Fig.3 Definition of switching loss

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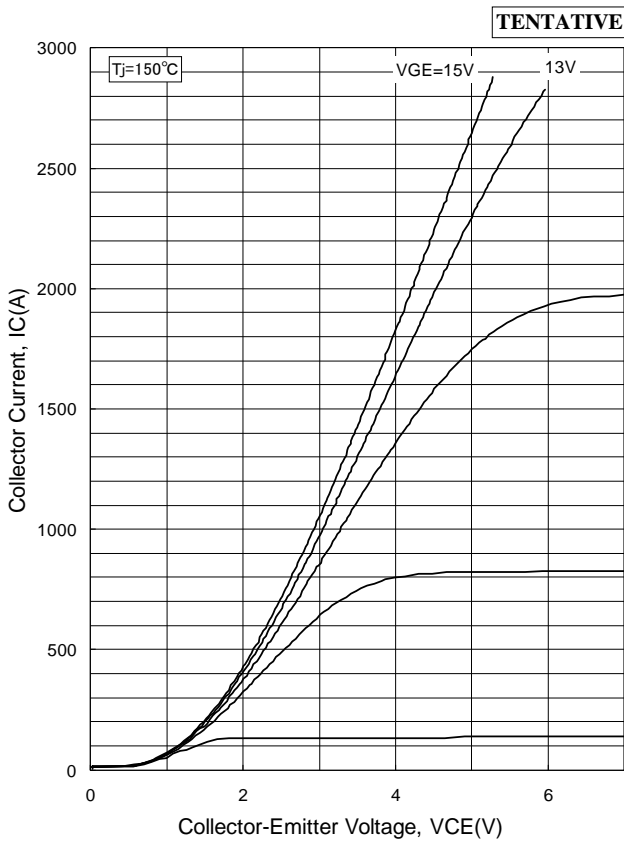
STATIC CHARACTERISTICS



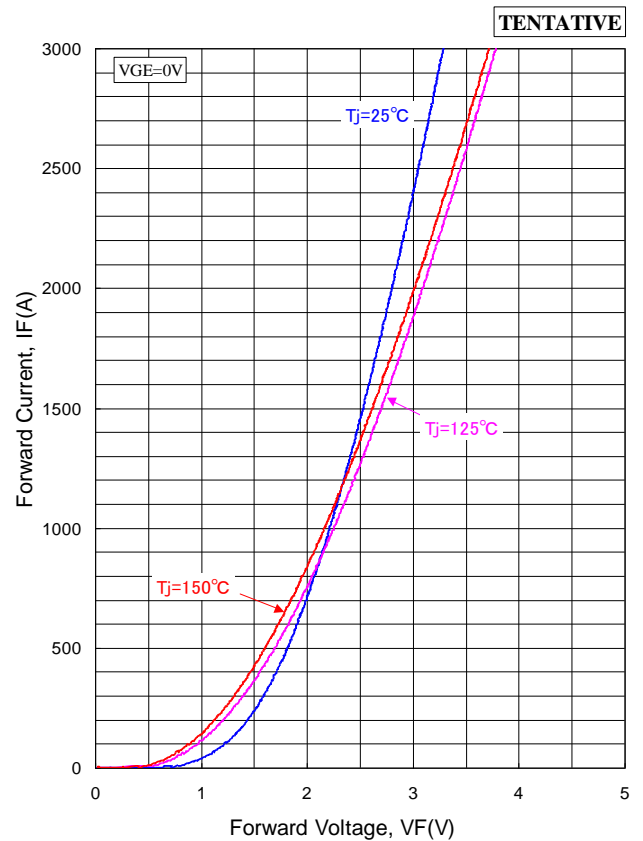
Collector Current vs. Collector to Emmitter Voltage



Collector Current vs. Collector to Emmitter Voltage



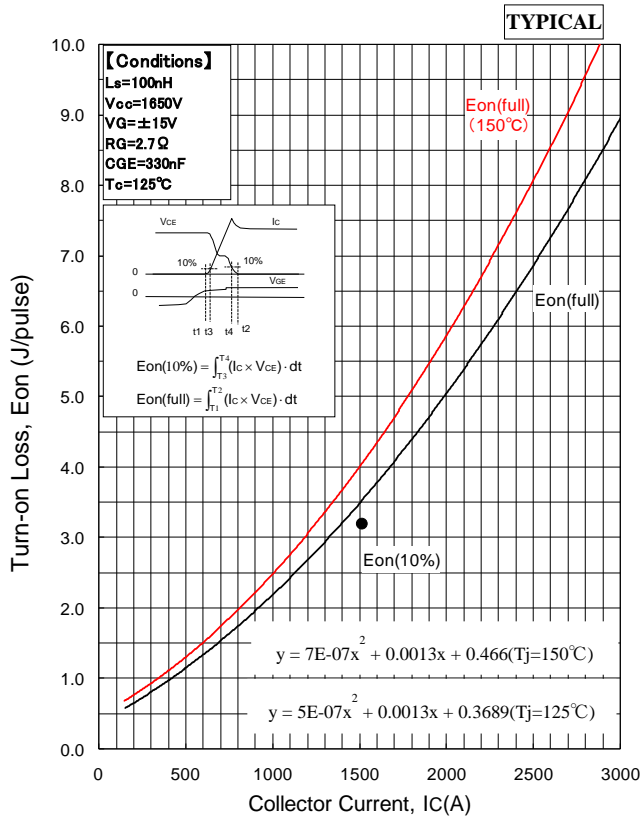
Collector Current vs. Collector to Emmitter Voltage



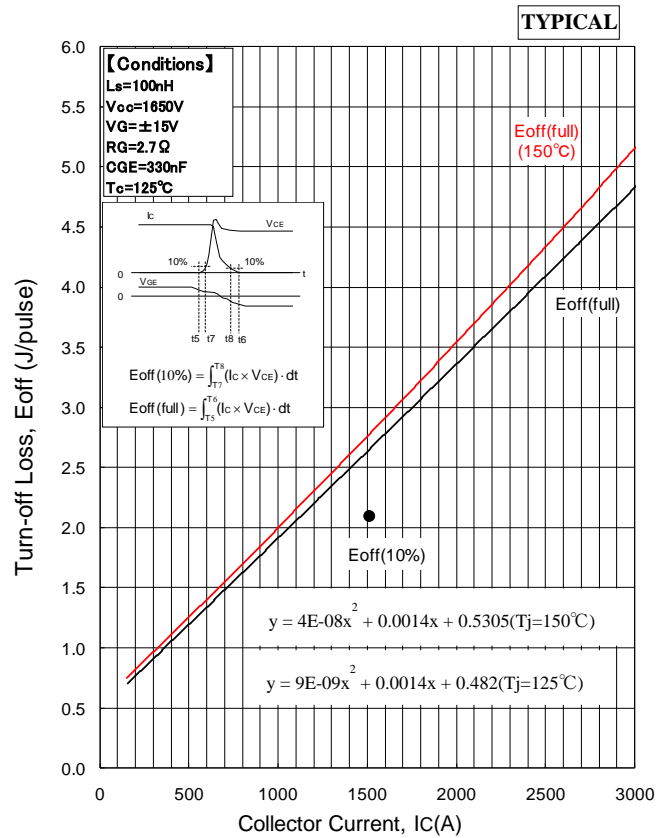
Forward Voltage of free-wheeling diode

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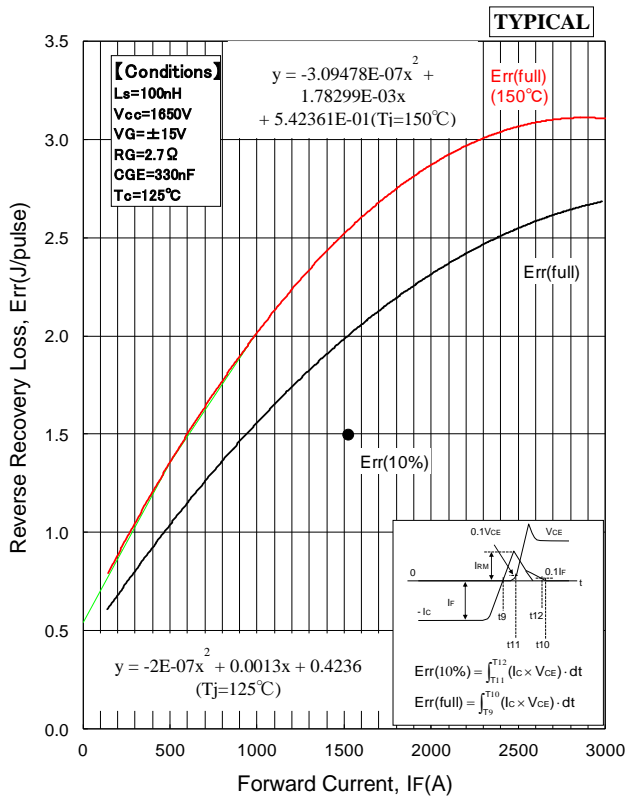
DYNAMIC CHARACTERISTICS



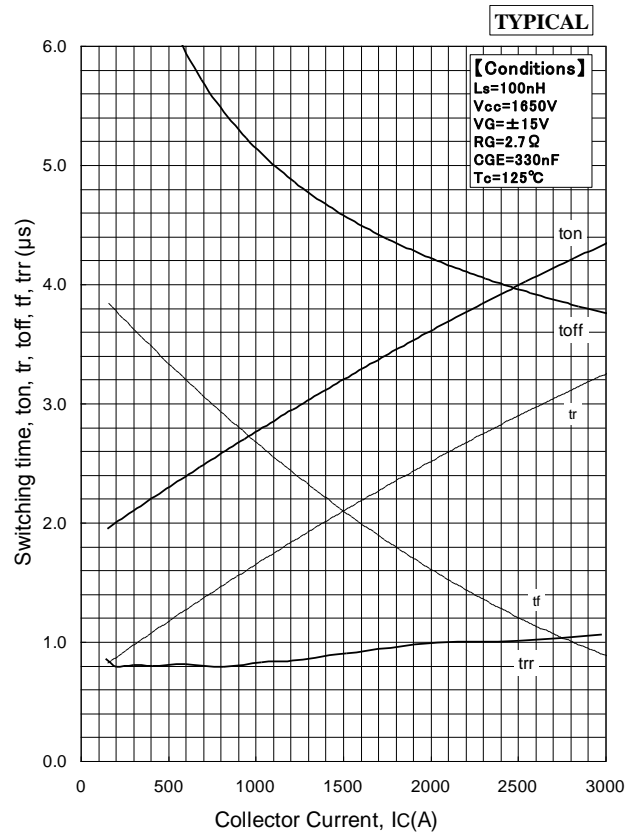
Turn-on Loss vs. Collector Current



Turn-off Loss vs. Collector Current

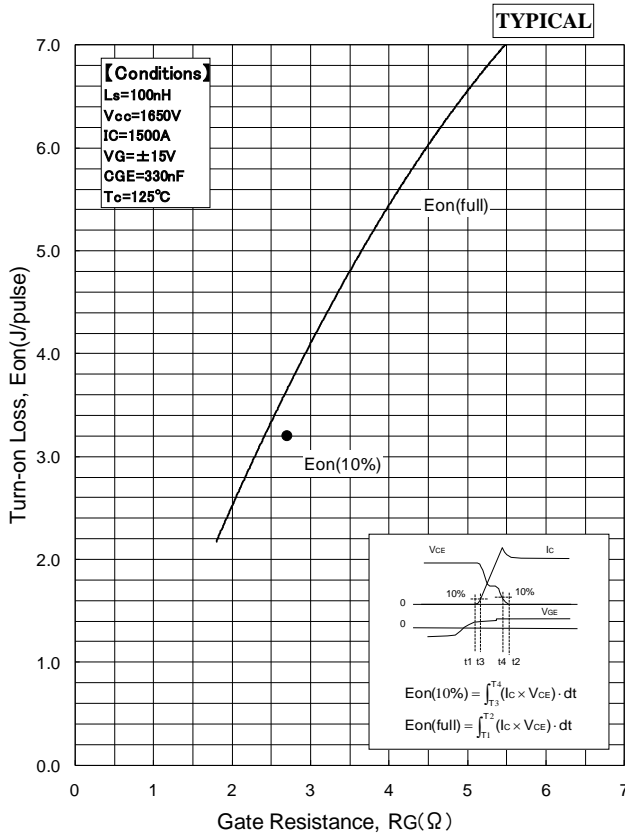


Recovery Loss vs. Forward Current

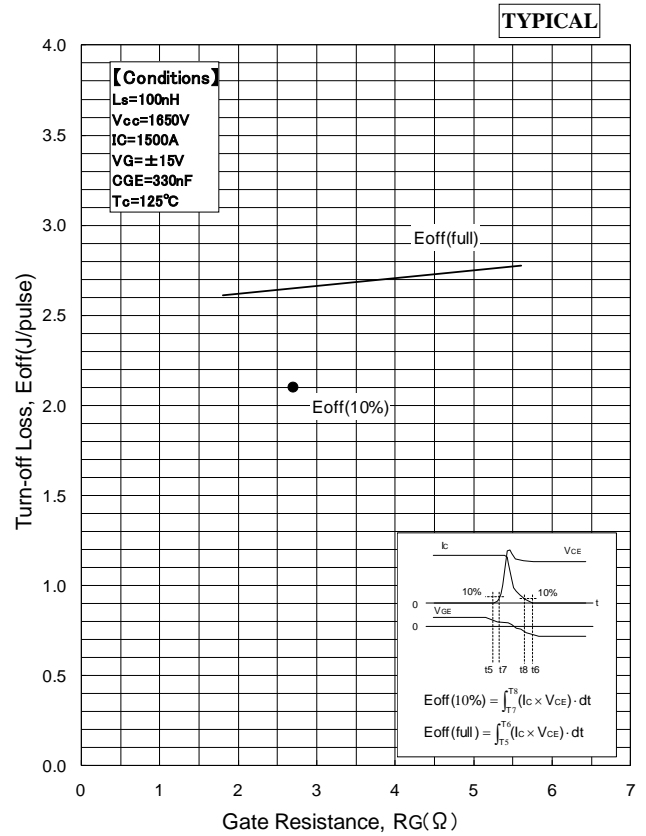


Switching time vs. Collector current

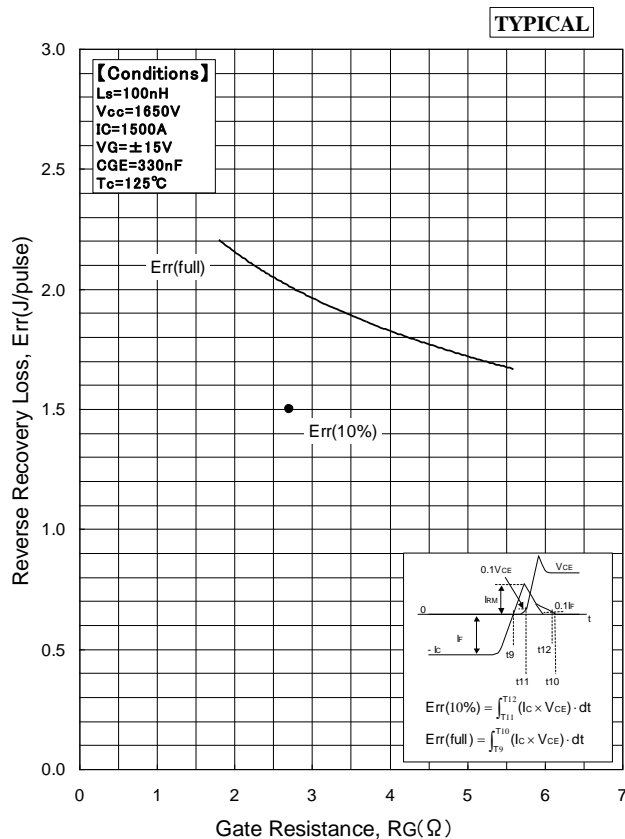
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Turn-on Loss vs. Gate Resistance



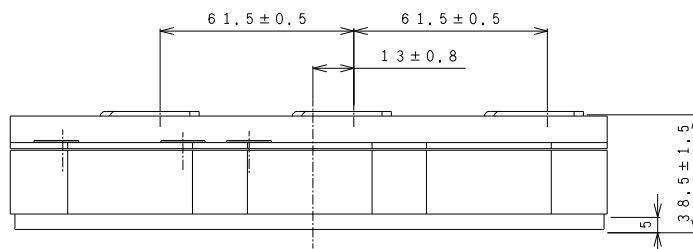
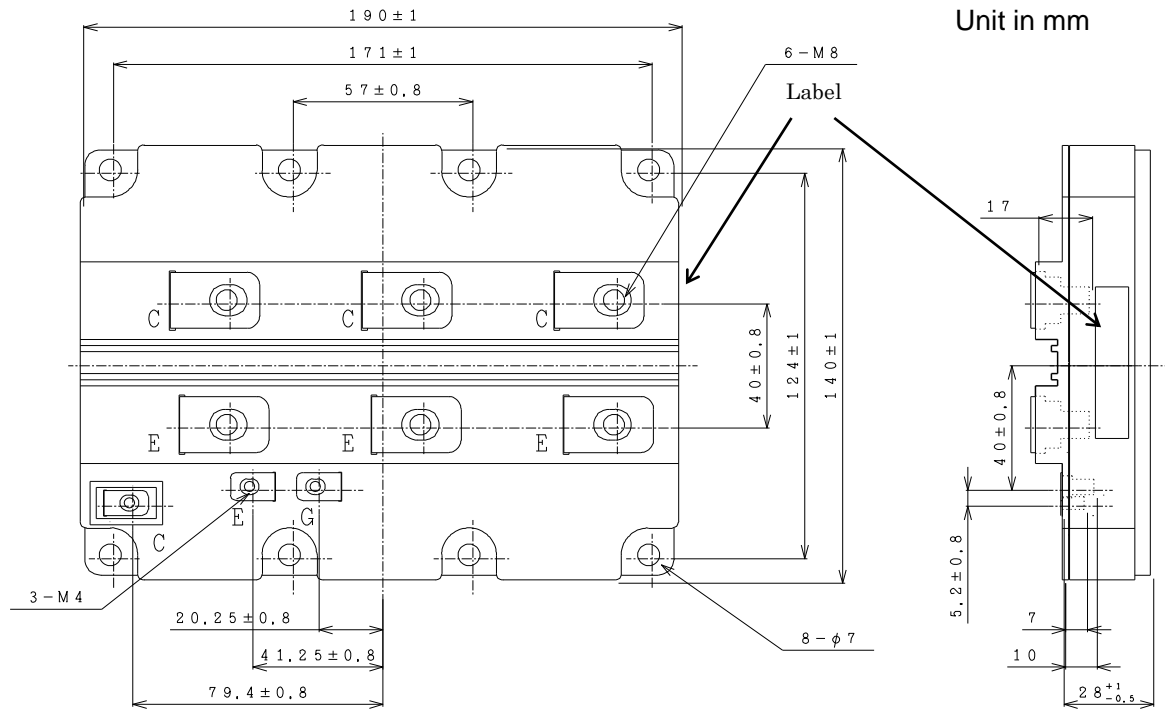
Turn-off Loss vs. Gate Resistance



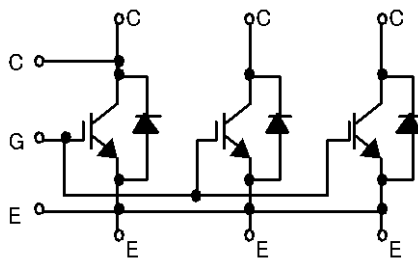
Recovery Loss vs. Gate Resistance

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OUTLINE DRAWINGS



Weight: 1300(g)

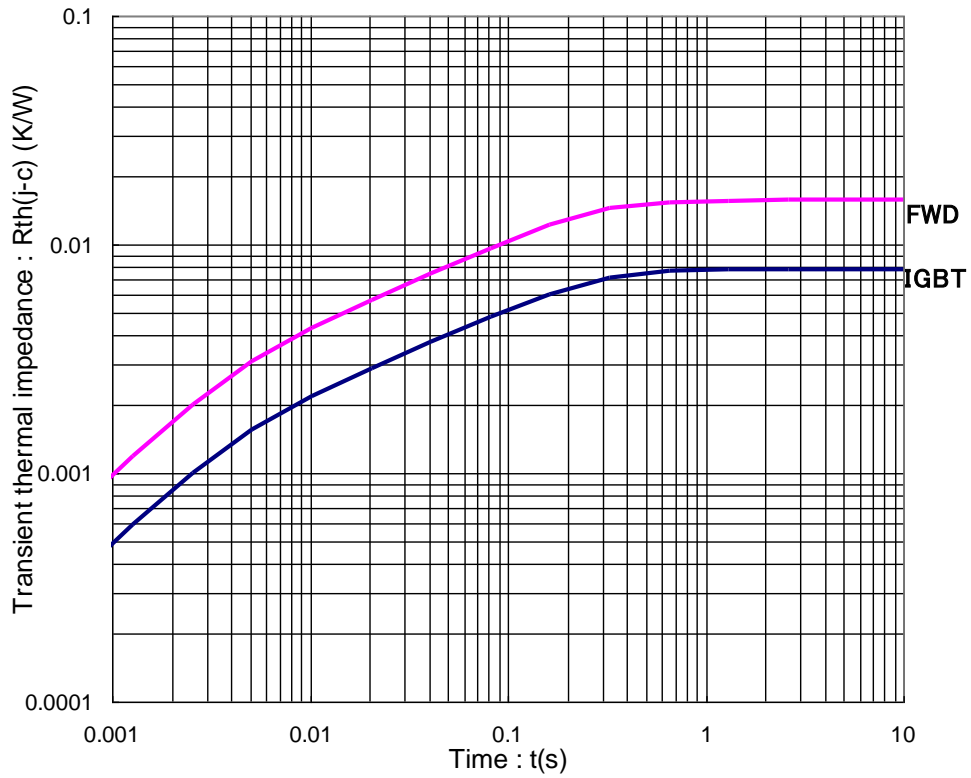


Circuit diagram

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TRANSIENT THERMAL IMPEDANCE

Maximum



Transient Thermal Impedance Curve

Curve approximation model

$$Z_{th} = \sum r_{th}[n] * (1 - \exp(-t/r_{th}[n]))$$

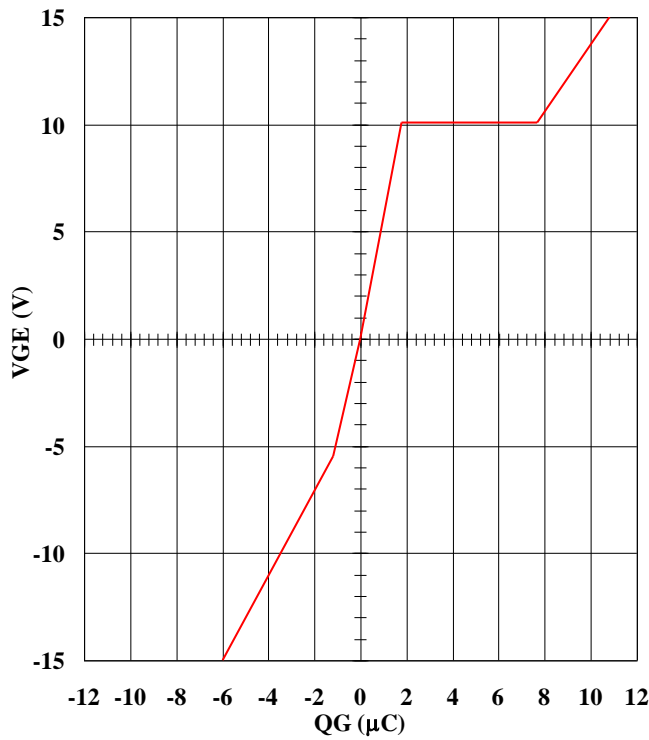
n	1	2	3	4	Unit
$\tau_{th}[n]$	1.60E-01	2.77E-02	4.10E-03	8.06E-04	sec
$r_{th}[n,IGBT]$	4.84E-03	1.41E-03	1.39E-03	1.63E-04	K/W
$r_{th}[n,Diode]$	9.62E-03	2.94E-03	2.70E-03	3.38E-04	K/W

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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

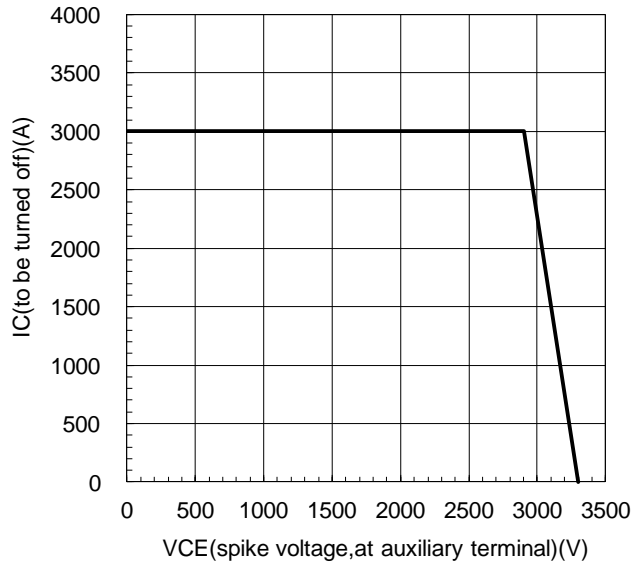
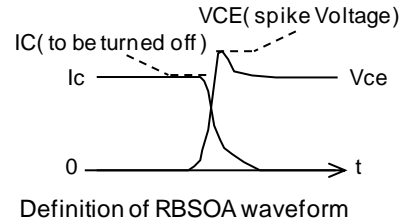
Please note the following materials are contained in the product, in order to keep characteristic and reliability level.

Material	Contained part
Lead (Pb) and its compounds	Solder

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RBSOA

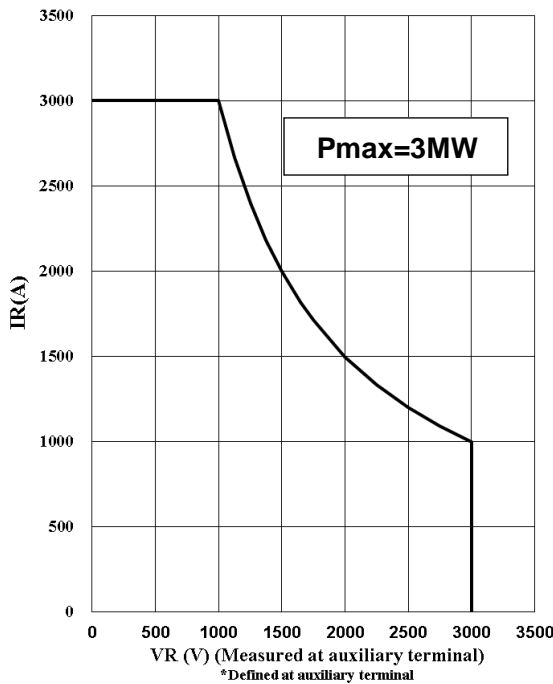
Conditions: $V_{cc} \leq 2200V$, $I_c \leq 3000A$,
 $R_g \geq 2.7\Omega$, $C_{GE} \geq 330nF$
 $V_{GE} = \pm 15V$, $-40^\circ C \leq T_j \leq 150^\circ C$,
 $L_s \leq 100nH$, on pulse width $\geq 10\mu s$
 (Vce spike voltage and L_s are defined at auxiliary terminal)



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

Notices

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