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 Tc=70K, N>30,000cycles)
AlSiC base-plate/AlN substrate

ABSOLUTE MAXIMUM RATINGS (Tc=25ºC)

Item		Symbol	Unit	MBN1500E33E3
Collector Emitter Voltage		V_{CES}	V	3,300
Gate Emitter Voltage		V_{GES}	V	±20
Collector Current	DC	I_C	A	1,500 (Tc=95 ºC)
	1ms	I_{Cp}		3,000
Forward Current	DC	I_F	A	1,500
	1ms	I_{FM}		3,000
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	-	-	12	V_{CE}=3,300V, V_{GE}=0V, Tj=25ºC
			-	20	60	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	-	2.45	-	I_C=1,500A, V_{GE}=15V, Tj=25ºC
			2.80	3.20	3.80	I_C=1,500A, V_{GE}=15V, Tj=125ºC
			-	3.60	-	I_C=1,500A, V_{GE}=15V, Tj=150ºC
Gate Emitter Threshold Voltage	$V_{GE(TO)}$	V	5.5	6.3	7.5	V_{CE}=10V, I_C=1,500mA, Tj=25ºC
Input Capacitance	C_{ies}	nF	-	195	-	V_{CE}=10V, V_{GE}=0V, f=100kHz, Tj=25ºC
Internal Gate Resistance	Rge	Ω	-	0.9	-	V_{CE}=10V, V_{GE}=0V, f=100kHz, Tj=25ºC
Rise Time	t_r	μs	1.6	2.1	2.8	V_{CC}=1,650V, Ic=1,500A
Turn On Delay Time	$t_{d(on)}$		-	1.1	-	L=100nH
Fall Time	t_f		1.1	2.1	3.3	R_G=2.7Ω/2.7Ω, CGE=330nF (3)
Turn Off Delay Time	$t_{d(off)}$		-	2.5	-	V_{GE}=±15V, Tj=125ºC
Forward Voltage Drop	V_{FM}	V	-	2.50	-	IF=1,500A, V_{GE}=0V, Tj=25ºC
			2.20	2.70	3.20	IF=1,500A, V_{GE}=0V, Tj=125ºC
			-	2.60	-	IF=1,500A, V_{GE}=0V, Tj=150ºC
Reverse Recovery Time	t_{rr}	μs	-	0.9	1.4	Vcc=1,650V, IF=1,500A, L=100nH Tj=125ºC
Short Circuit Pulse Width	t_{sc}	μs	10	-	-	V_{CC}=2000V,Ls=120nH R_G(on/off)=2.7/27Ω, V_{GE}=±15V,Tj=125ºC
Turn On Loss	$E_{on(10\%)}$	J/P	-	3.2	3.7	Tj=125ºC
	$E_{on(full)}$		-	3.5	-	
			-	4.0	-	Tj=150ºC
Turn Off Loss	$E_{off(10\%)}$	J/P	-	2.1	2.8	Tj=125ºC
	$E_{off(full)}$		-	2.65	-	
			-	2.74	-	Tj=150ºC
Reverse Recovery Loss	$E_{rr(10\%)}$	J/P	-	1.5	2.0	Tj=125ºC
	$E_{rr(full)}$		-	2.0	-	
			-	2.5	-	Tj=150ºC

V_{CC}=1,650V, Ic=1,500A, L=100nH, R_G=2.7Ω/2.7Ω, CGE=330nF (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	-	-	0.0078	Junction to case
	FWD	Rth(j-c)		-	-	0.0156	
Contact Thermal Impedance		Rth(c-f)	K/W	-	0.005	-	Case to fin (λgrease=1W/(m·K), heat-sink flatness ≤50um)

DEFINITION OF TEST CIRCUIT

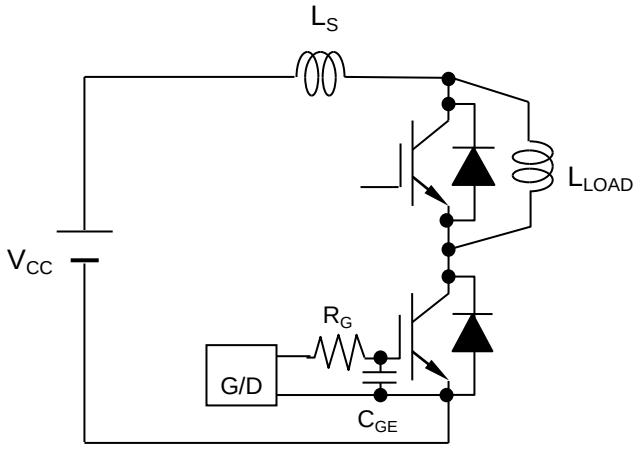
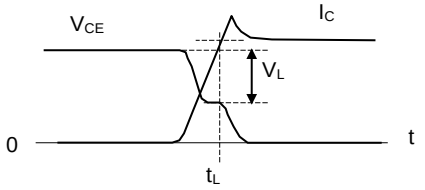
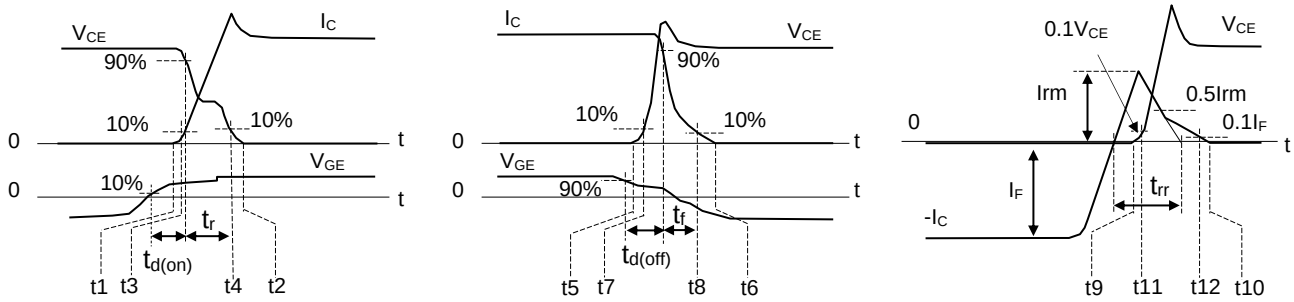


Fig.1 Switching test circuit



$$L_S = \frac{V_L}{\left(\frac{dI_C}{dt}\right)_{t=t_L}}$$

Fig.2 Definition of stray inductance



$$E_{on(10\%)} = \int_{t3}^{t4} I_C \cdot V_{CE}\, dt \qquad E_{off(10\%)} = \int_{t7}^{t8} I_C \cdot V_{CE}\, dt \qquad E_{rr(10\%)} = \int_{t11}^{t12} I_F \cdot V_{CE}\, dt$$

$$E_{on(Full)} = \int_{t1}^{t2} I_C \cdot V_{CE}\, dt \qquad E_{off(Full)} = \int_{t5}^{t6} I_C \cdot V_{CE}\, dt \qquad E_{rr(Full)} = \int_{t9}^{t10} I_F \cdot V_{CE}\, dt$$

Fig.3 Definition of switching loss

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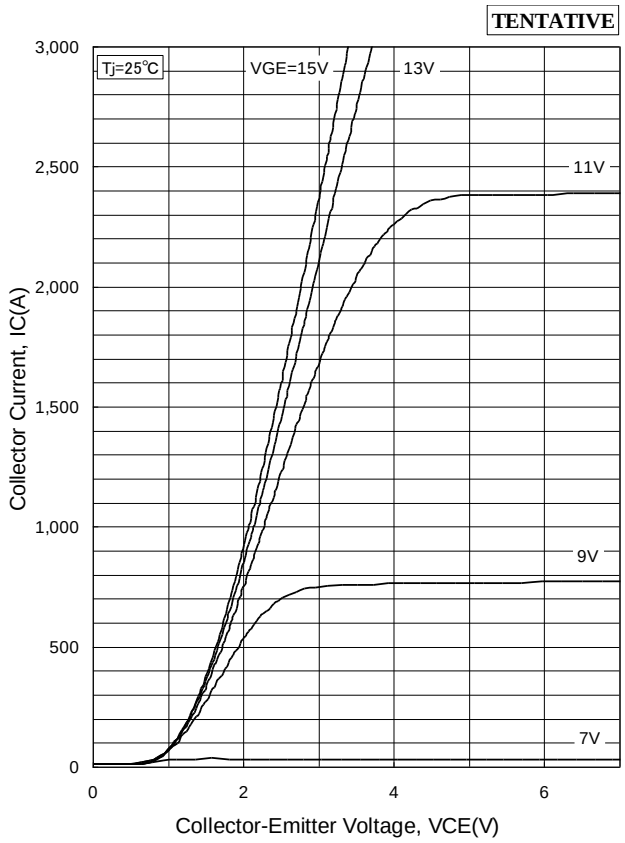
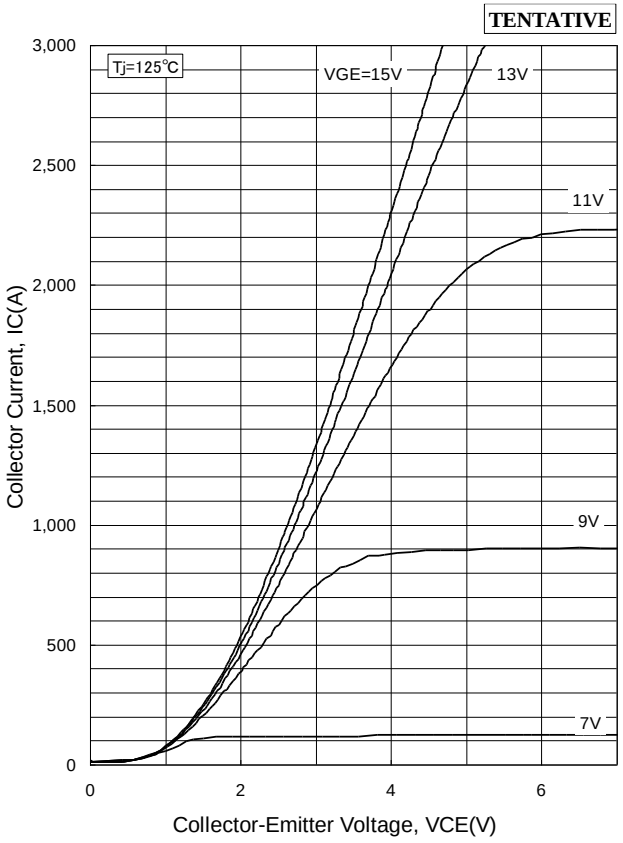
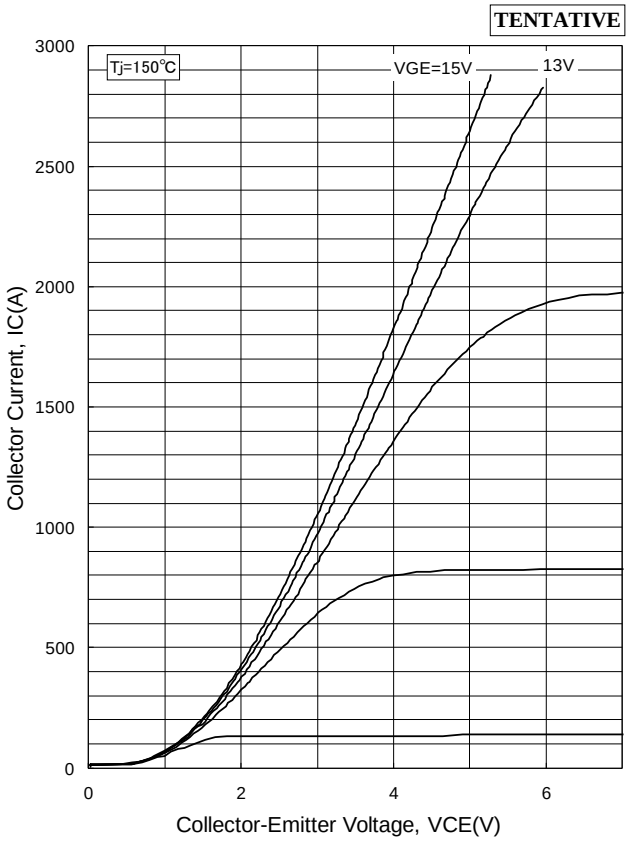
STATIC CHARACTERISTICS



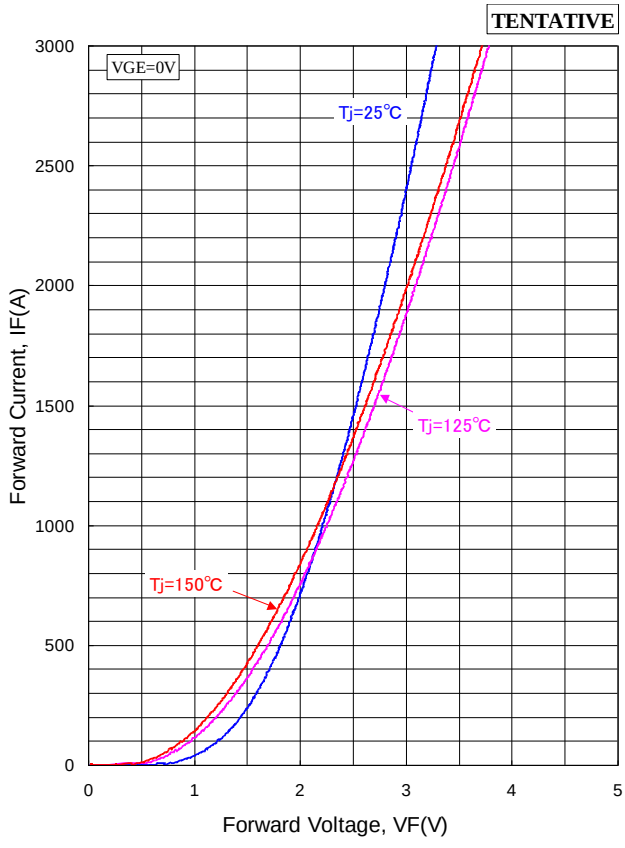
Collecter Current vs. Collector to Emitter Voltage



Collecter Current vs. Collector to Emitter Voltage



Collecter Current vs. Collector to Emitter Voltage



Forward Voltage of free-wheeling diode

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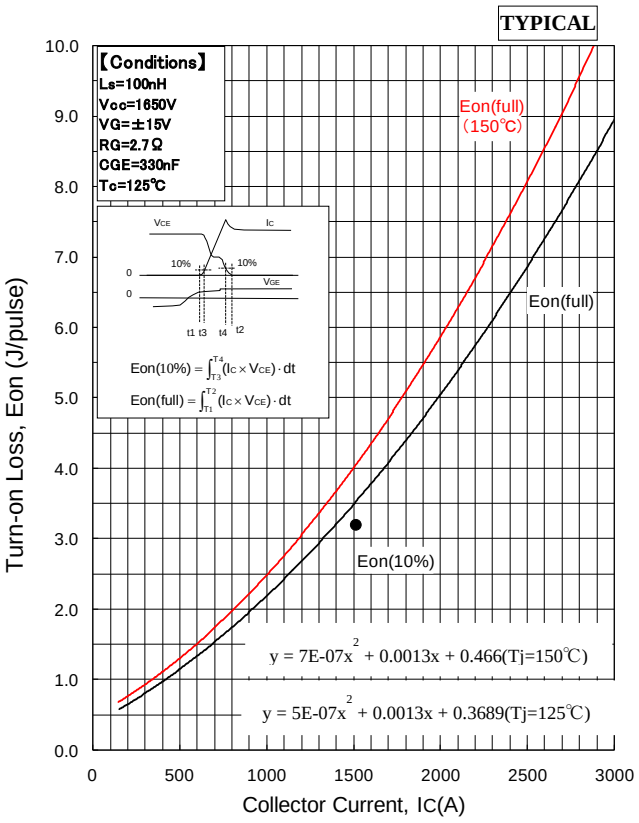
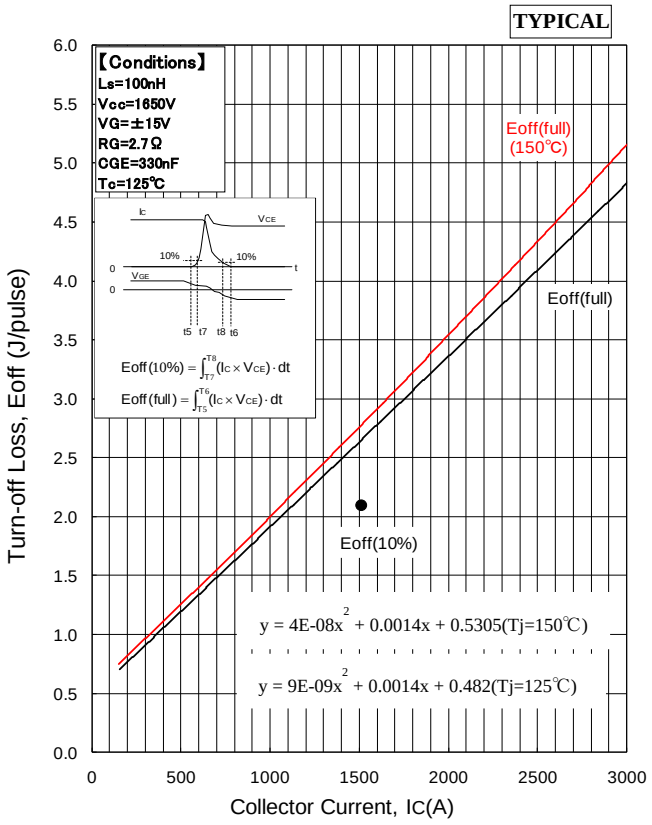
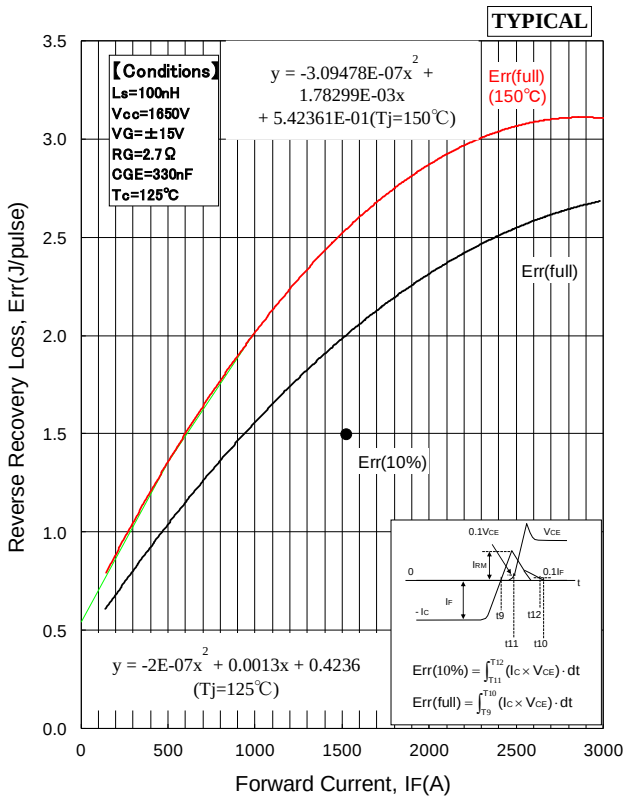
DYNAMIC CHARACTERISTICS



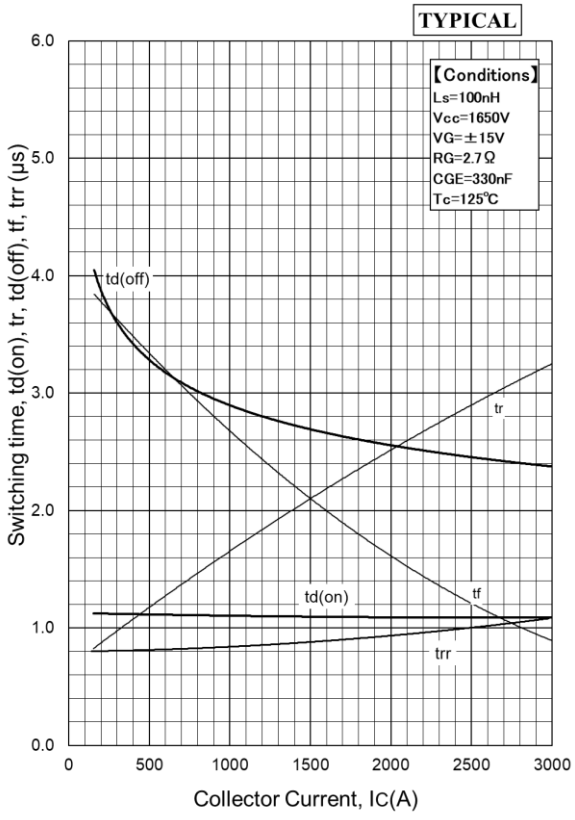
Turn-on Loss vs. Collector Current



Turn-off Loss vs. Collector Current



Recovery Loss vs. Forward Current



Switching time vs. Collector current

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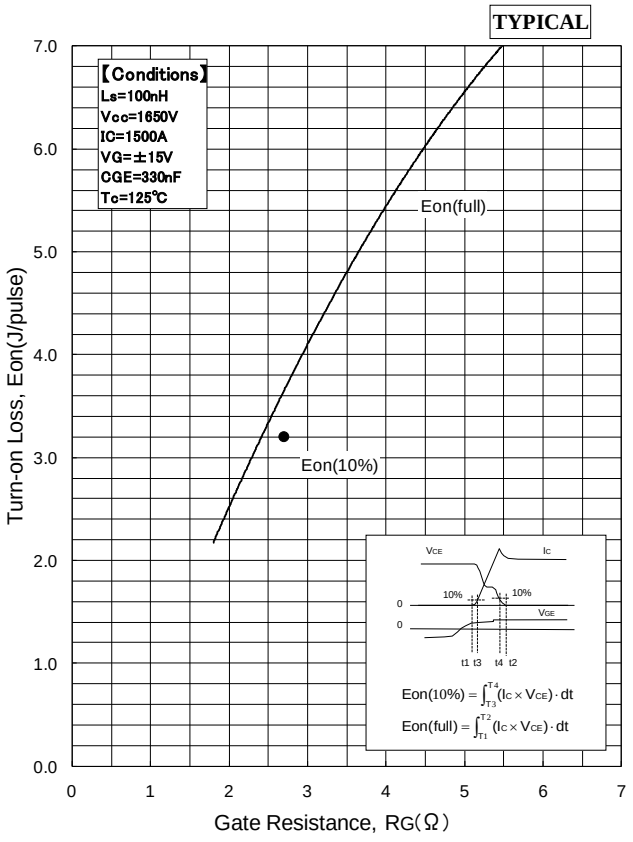
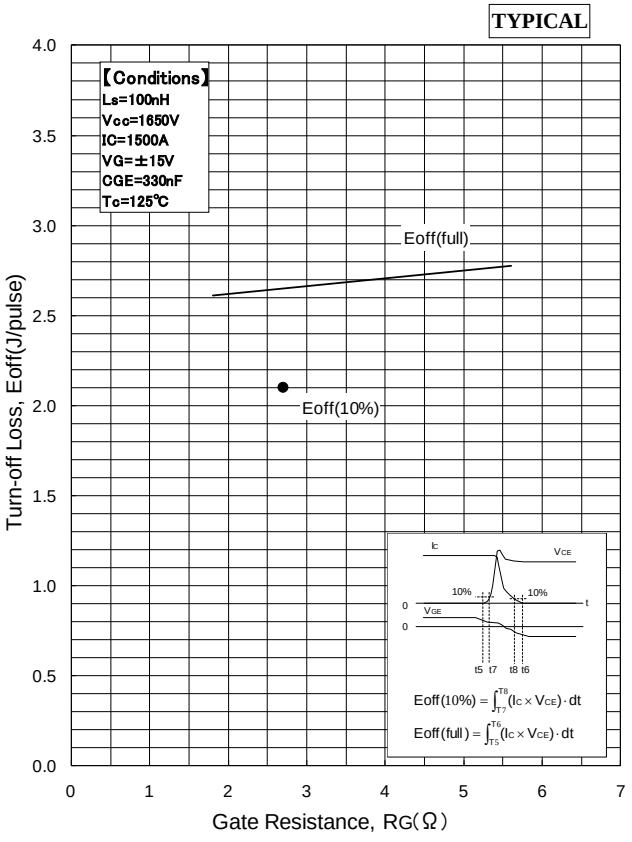
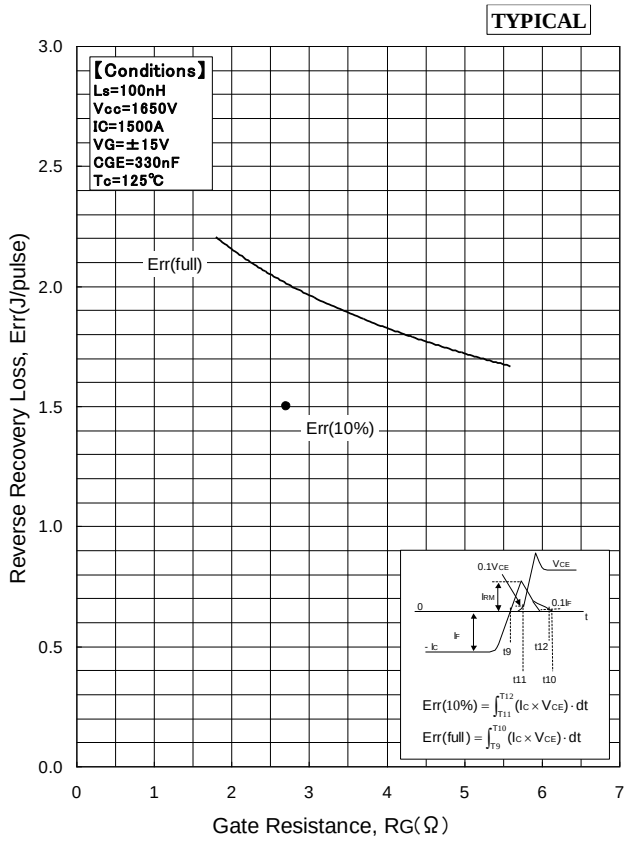


Turn-on Loss vs. Gate Resistance



Turn-off Loss vs. Gate Resistance



Recovery Loss vs. Gate Resistance

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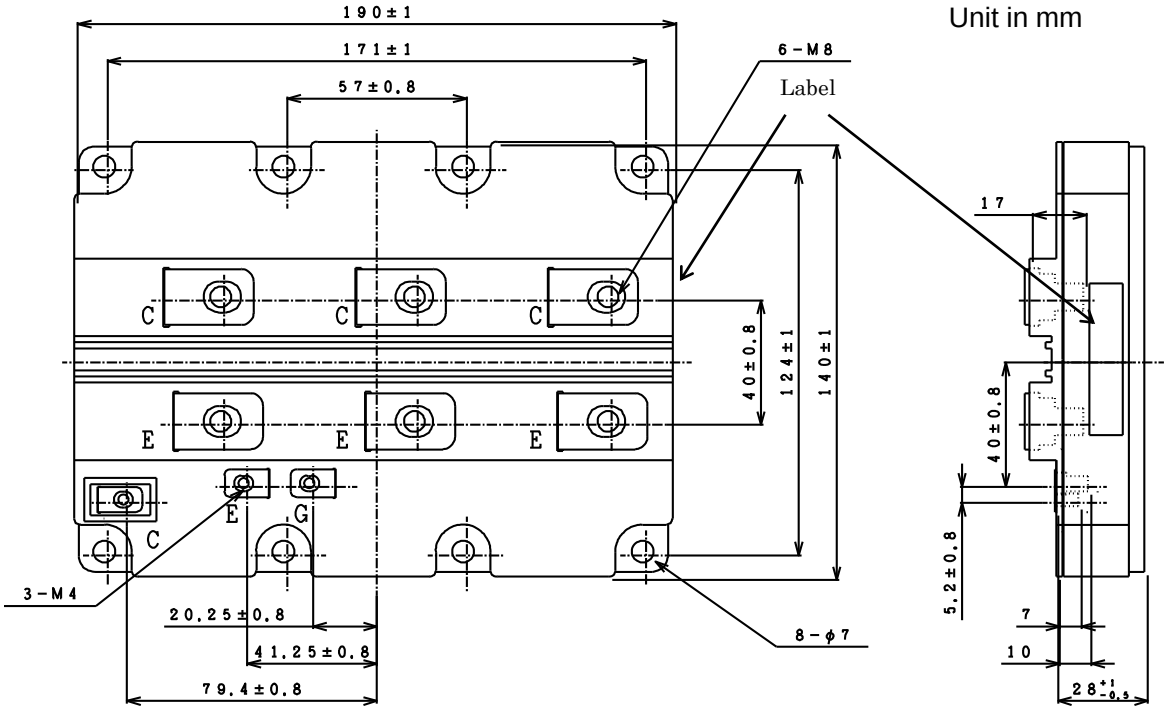
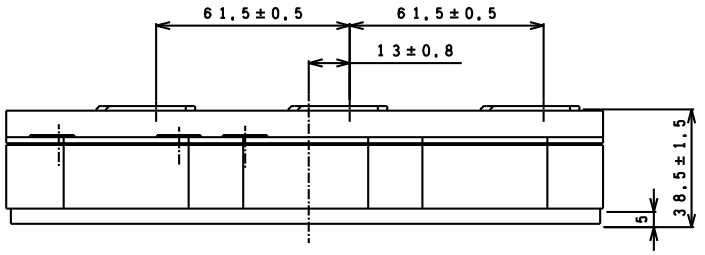
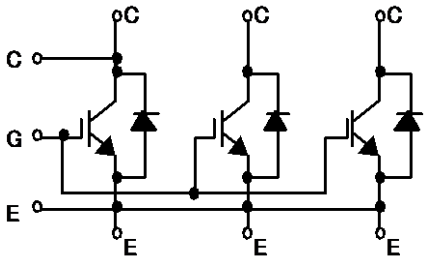
OUTLINE DRAWINGS

Unit in mm





Weight: 1300(g)



Circuit diagram

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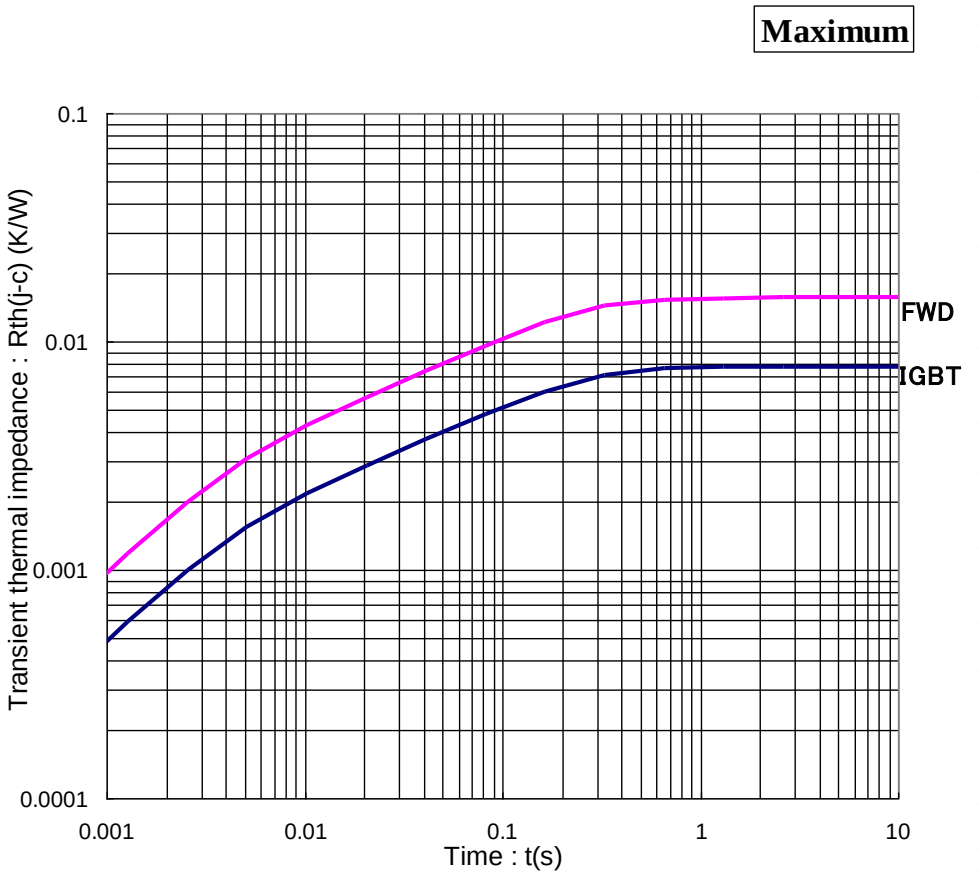
TRANSIENT THERMAL IMPEDANCE



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	2.77E-02	4.10E-03	8.06E-04	sec
rth[n,IGBT]	4.84E-03	1.41E-03	1.39E-03	1.63E-04	K/W
rth[n,Diode]	9.62E-03	2.94E-03	2.70E-03	3.38E-04	K/W

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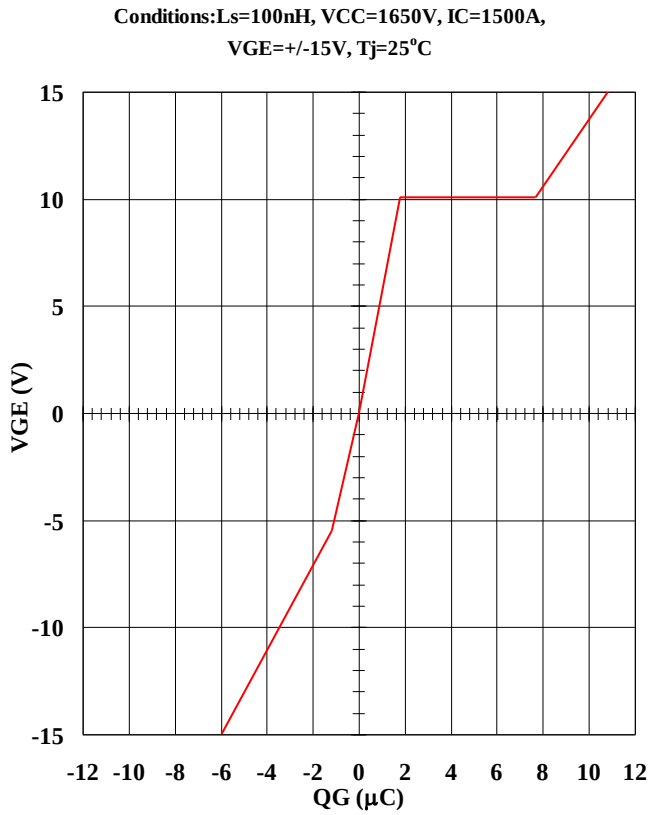
QG-VG CURVE

TYPICAL



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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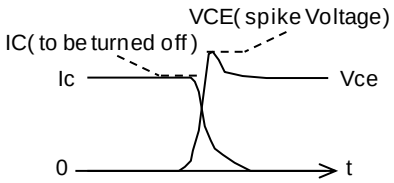
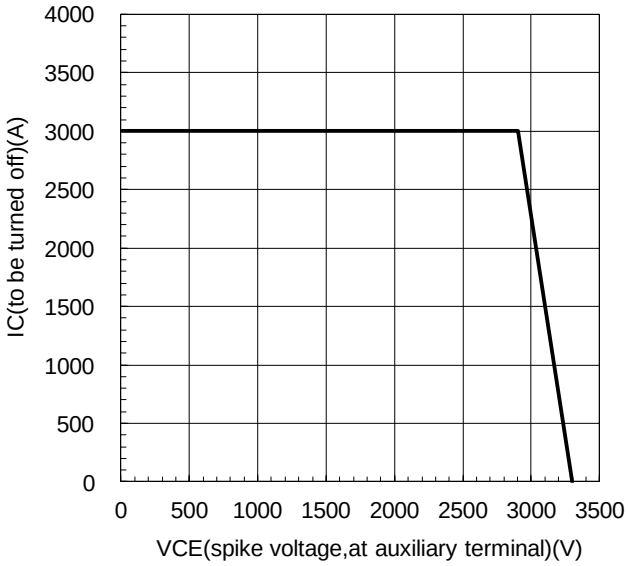
RBSOA

Conditions: Vcc≤2200V, Ic≤3000A,
Rg≥2.7Ω, CGE≥330nF
VGE=±15V, -40°C≤Tj≤150°C,
Ls≤100nH, on pulse width≥ 10us
(Vce spike voltage and Ls are defined at auxiliary terminal)



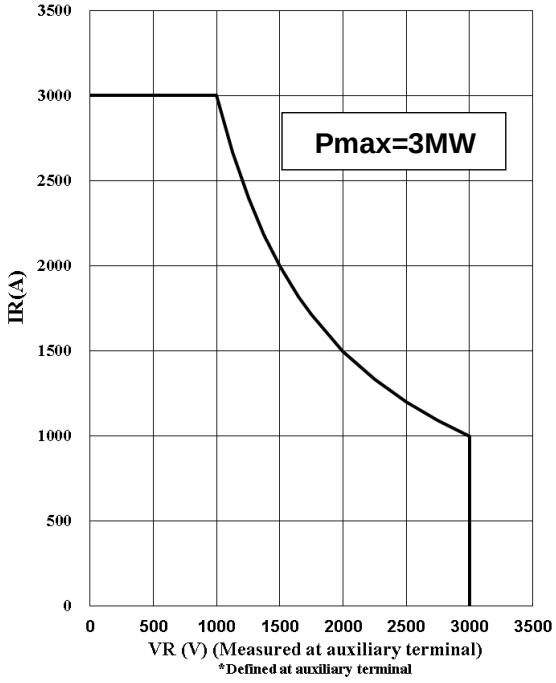
Definition of RBSOA waveform



Reverse bias safe operation area (RBSOA)

RecSOA

Conditions: Vcc≤2000V, di/dt≤6,400A/us,
Tj=150°C, Ls≤100nH



Reverse recovery operation area(RecSOA)

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