

MBM400E33D-MFR

Silicon N-channel IGBT 3300V D-MF version

FEATURES

- * Ultra High speed, low loss IGBT module.
- * Low driving power due to low input capacitance MOS gate.
- * High reliability, high durability module.
- * High thermal fatigue durability.
($\Delta T_c=70K$, $N>30,000$ cycles)
- * Suitable for kHz order switching

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

Item	Symbol	Unit	MBM400E33D-MFR
Collector Emitter Voltage	V_{CES}	V	3,300
Gate Emitter Voltage	V_{GES}	V	± 20
Collector Current	DC	I_C	400
	1ms	I_{Cp}	800
Forward Current	DC	I_F	400
	1ms	I_{FM}	800
Junction Temperature	T_j	$^\circ C$	-40 ~ +125
Storage Temperature	T_{stg}	$^\circ C$	-40 ~ +125
Isolation Voltage	V_{ISO}	V_{RMS}	6,000(AC 1 minute)
Screw Torque	Terminals (M4/M8)	-	2/10 (1)
	Mounting (M6)	-	6 (2)

Notes: (1) Recommended Value $1.8\pm 0.2/9\pm 1N\cdot m$ (2) Recommended Value $5.5\pm 0.5N\cdot m$

ELECTRICAL CHARACTERISTICS

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions	
Collector Emitter Cut-Off Current	I_{CES}	mA	-	-	12	$V_{CE}=3,300V, V_{GE}=0V, T_j=25^\circ C$	
			-	20	60	$V_{CE}=3,300V, V_{GE}=0V, T_j=125^\circ C$	
Gate Emitter Leakage Current	I_{GES}	nA	-500	-	+500	$V_{GE}=\pm 20V, V_{CE}=0V, T_j=25^\circ C$	
Collector Emitter Saturation Voltage	$V_{CE(sat)}$	V	4.4	5.0	5.6	$I_C=400A, V_{GE}=15V, T_j=125^\circ C$	
Gate Emitter Threshold Voltage	$V_{GE(TO)}$	V	5.0	6.0	7.0	$V_{CE}=10V, I_C=400mA, T_j=25^\circ C$	
Input Capacitance	C_{ies}	nF	-	37	-	$V_{CE}=10V, V_{GE}=0V, f=100kHz, T_j=25^\circ C$	
Internal Gate Resistance	R_{ge}	Ω	-	3.6	-	$V_{CE}=10V, V_{GE}=0V, f=100kHz, T_j=25^\circ C$	
Switching Times	Rise Time	t_r	-	1.5	-	$V_{CC}=1,650V, I_C=400A$	
	Turn On Time	t_{on}	-	1.9	-	$L=150nH$	
	Fall Time	t_f	-	0.8	-	$R_G(\text{on/off})=10\Omega/10\Omega$ (3)	
	Turn Off Time	t_{off}	-	2.4	-	$V_{GE}=\pm 15V, T_j=125^\circ C$	
Peak Forward Voltage Drop	V_{FM}	V	2.8	3.6	4.4	$I_F=400A, V_{GE}=0V, T_j=125^\circ C$	
Reverse Recovery Time	t_{rr}	μs	-	0.36	-	$V_{CC}=1,650V, I_C=400A, L=150nH$	
Turn On Loss	$E_{on(10\%)}$	J/P	-	0.55	-	$R_G(\text{on/off})=10\Omega/10\Omega$ (3)	
Turn Off Loss	$E_{off(10\%)}$	J/P	-	0.28	-	$V_{GE}=\pm 15V, T_j=125^\circ C$	
Reverse Recovery Loss	$E_{rr(10\%)}$	J/P	-	0.23	-		
Stray inductance module	L_{SCE}	nH	-	36	-	Collector-main to Emitter-main	
Thermal Impedance	IGBT	$R_{th(j-c)}$	K/W	-	-	0.026	Junction to case (per arm)
	FWD	$R_{th(j-c)}$		-	-	0.052	
Contact Thermal Impedance		$R_{th(c-f)}$	K/W	-	0.008	-	Case to fin (per module, $\lambda_{grease}=1W/(m\cdot K)$, heat-sink flatness $\leq 50\mu m$)

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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Definition of test circuit

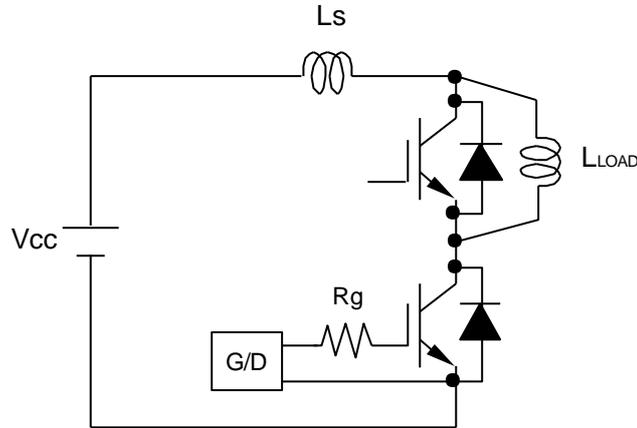


Fig.1 Switching test circuit

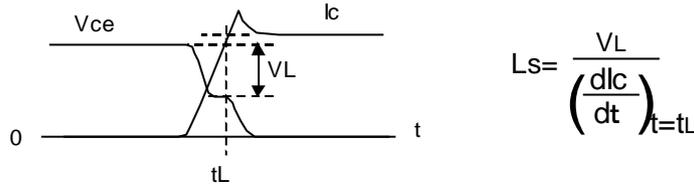


Fig.2 Definition of Ls

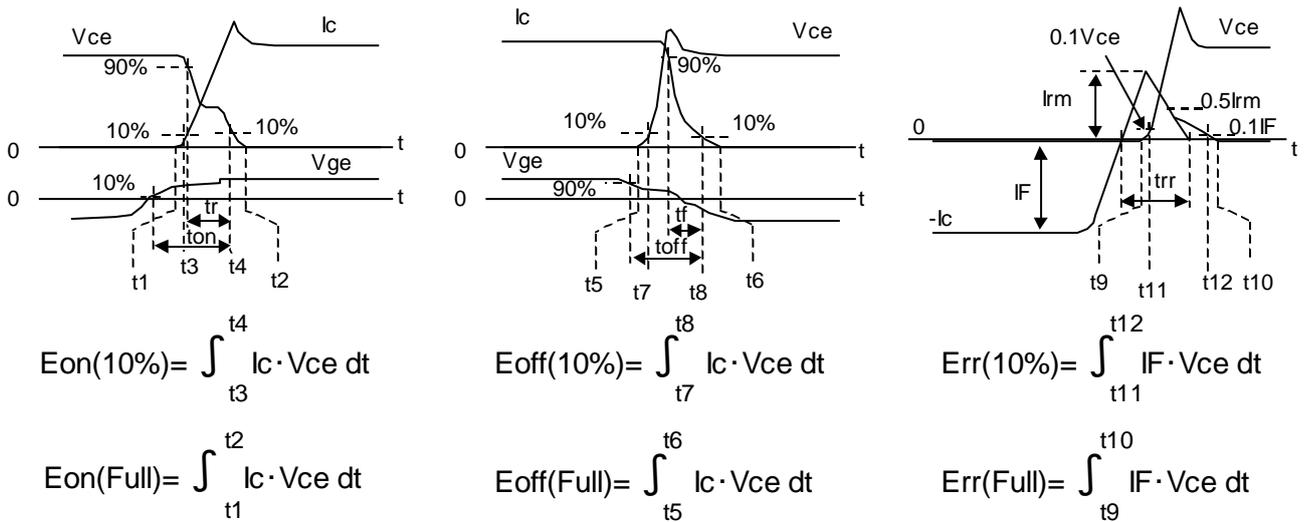
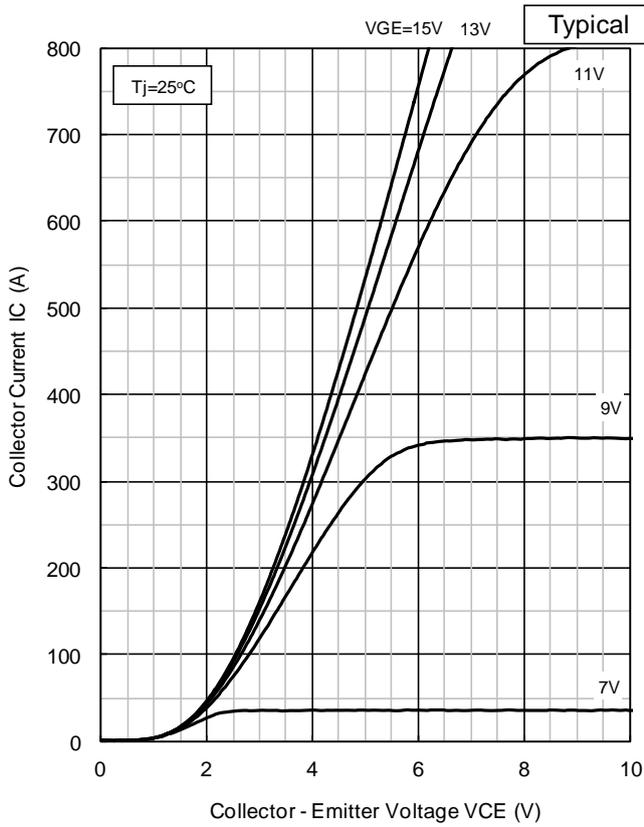


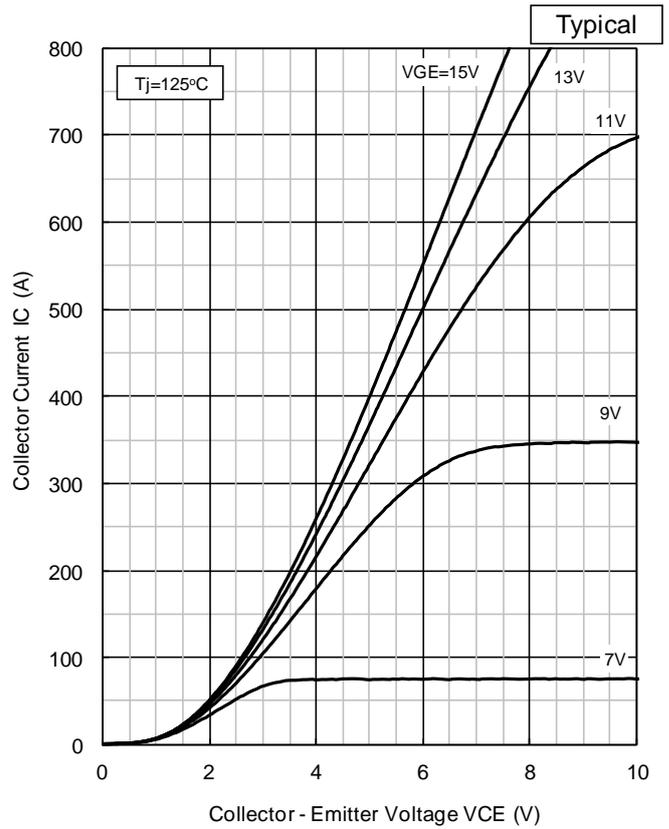
Fig.3 Definition of switching loss

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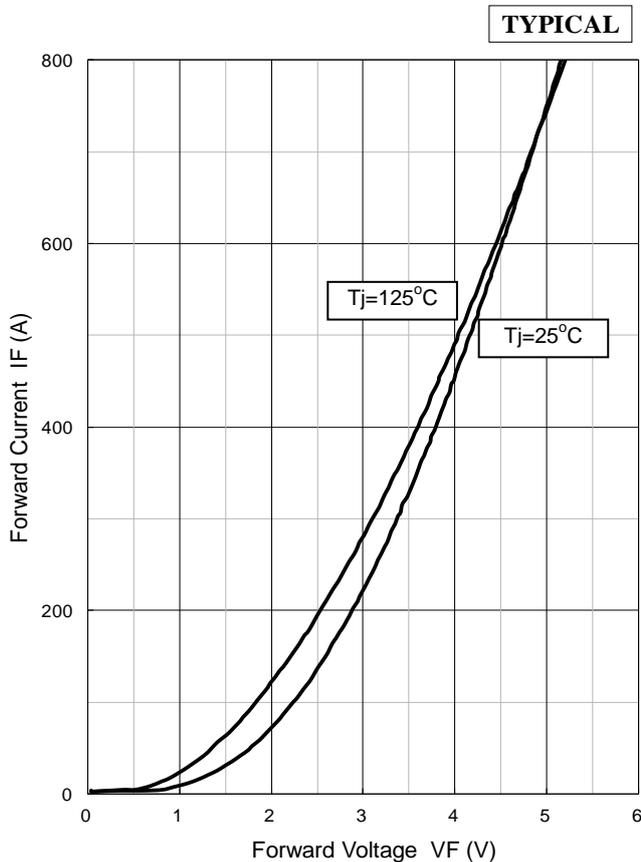
Static characteristics



IC vs. VCE (Tj=25°C)



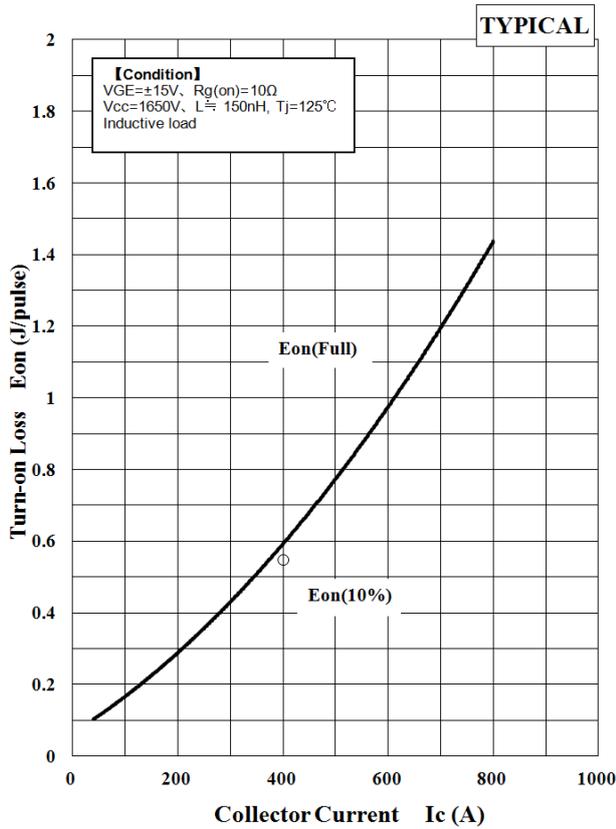
IC vs. VCE (Tj=125°C)



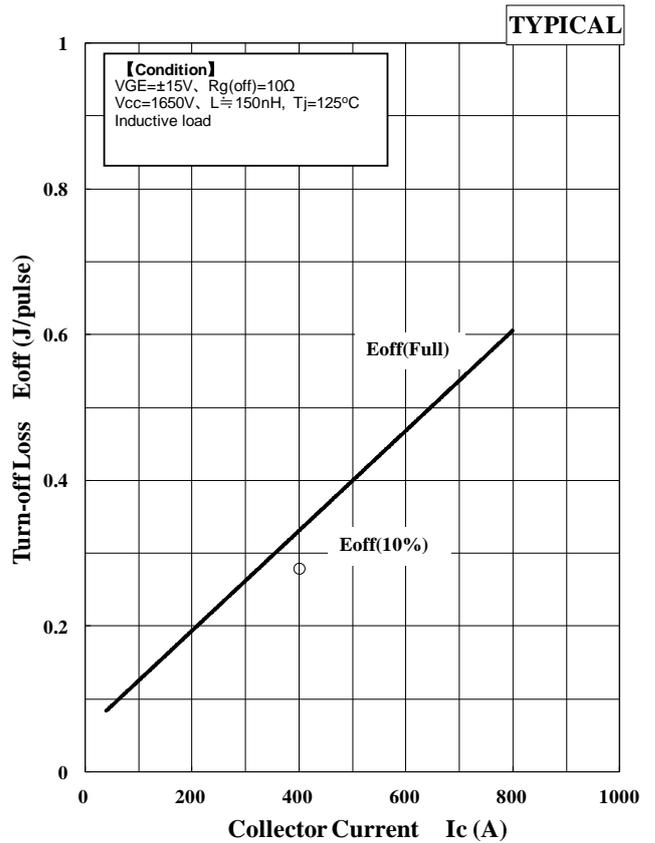
Forward Voltage of free-wheeling diode

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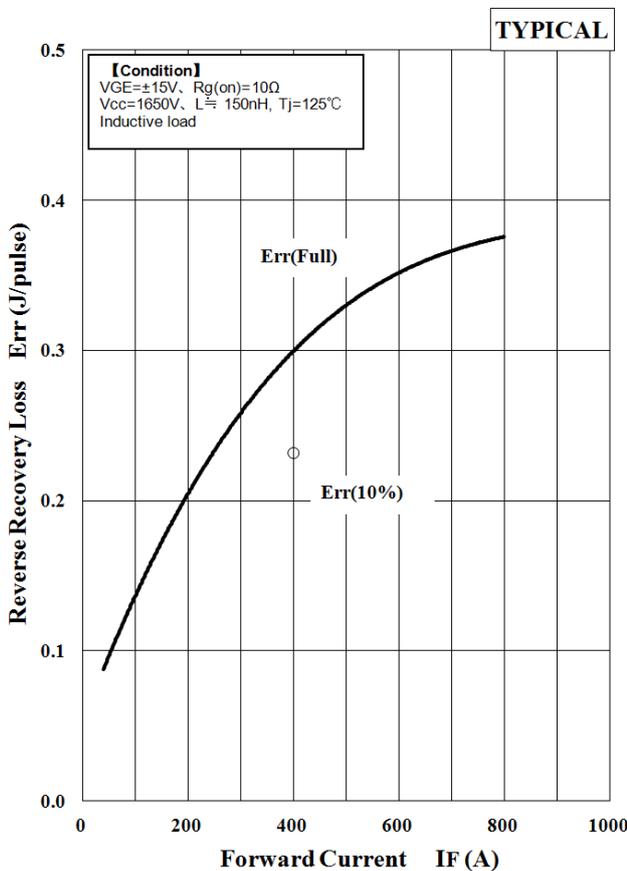
Dynamic characteristics



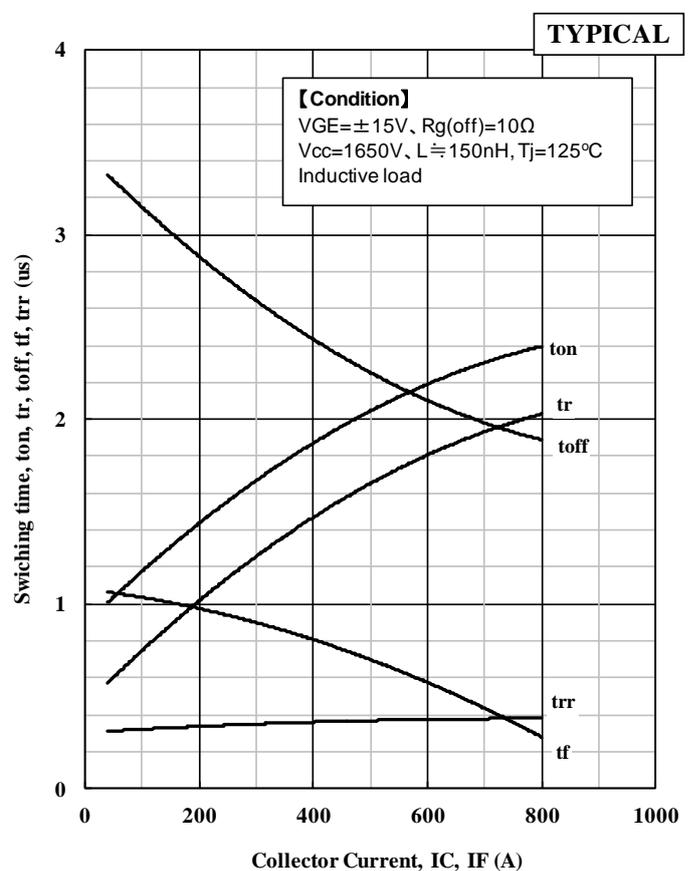
Turn-on Loss vs. Collector Current



Turn-off Loss vs. Collector Current

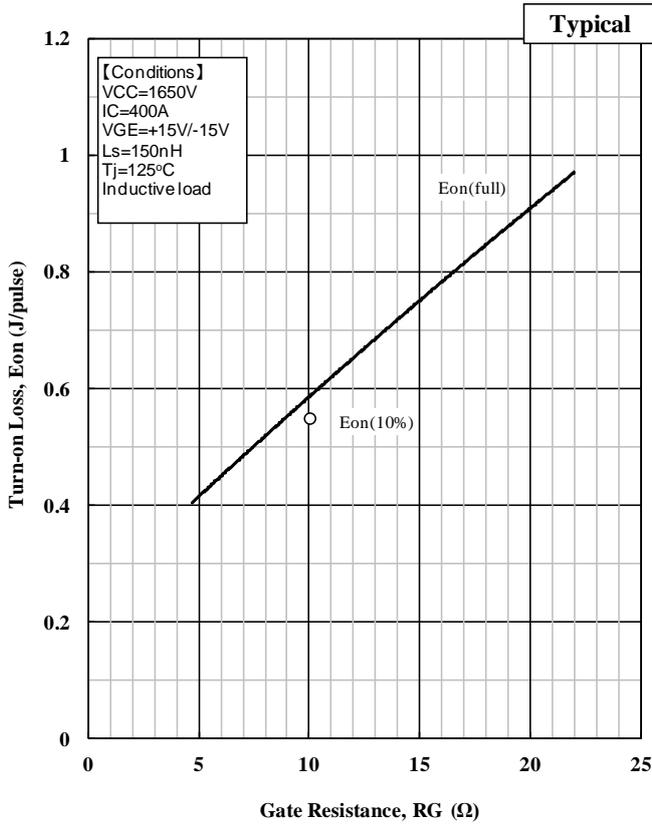


Recovery Loss vs. Forward Current

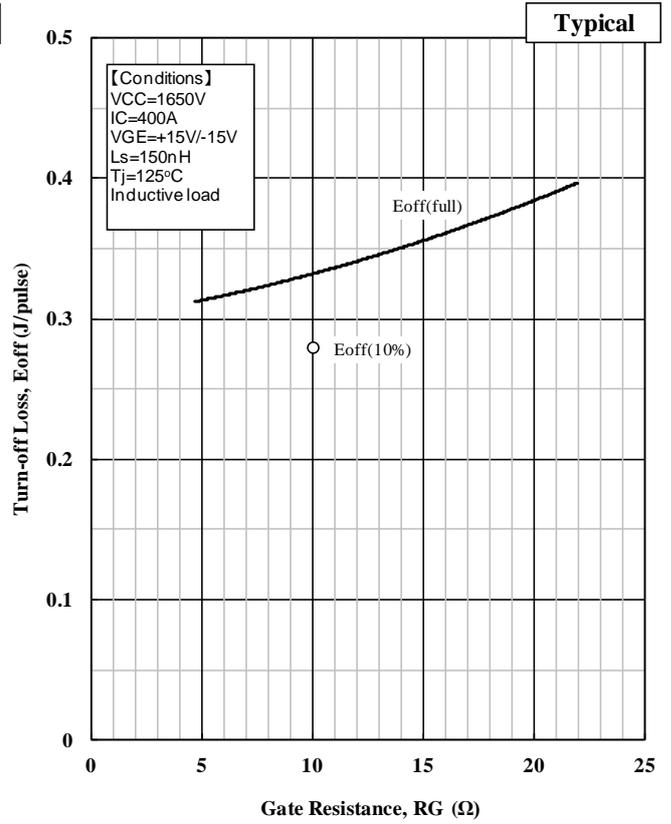


Switching time vs. Collector current

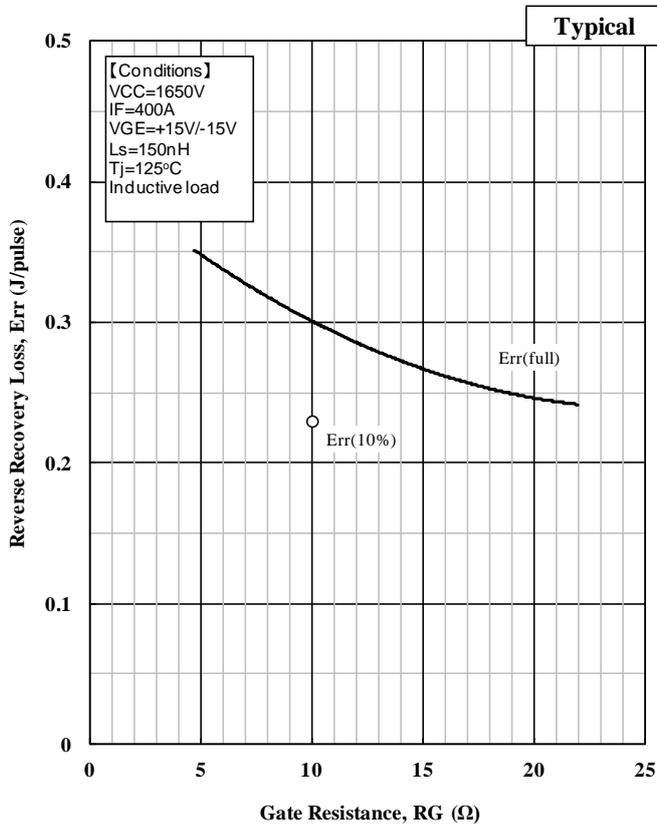
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Turn-on loss vs. Gate Resistance



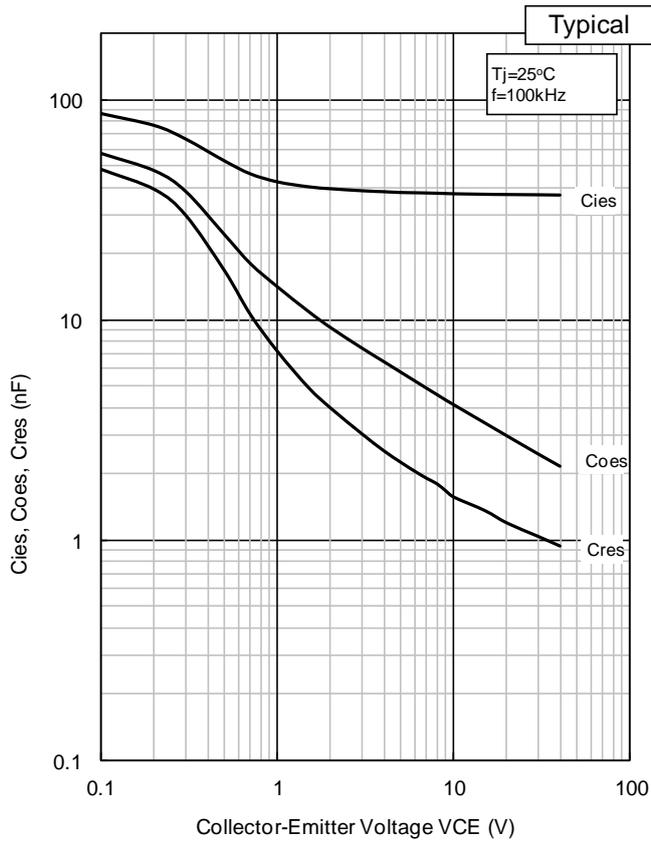
Turn-off loss vs. Gate Resistance



Recovery loss vs. Gate Resistance

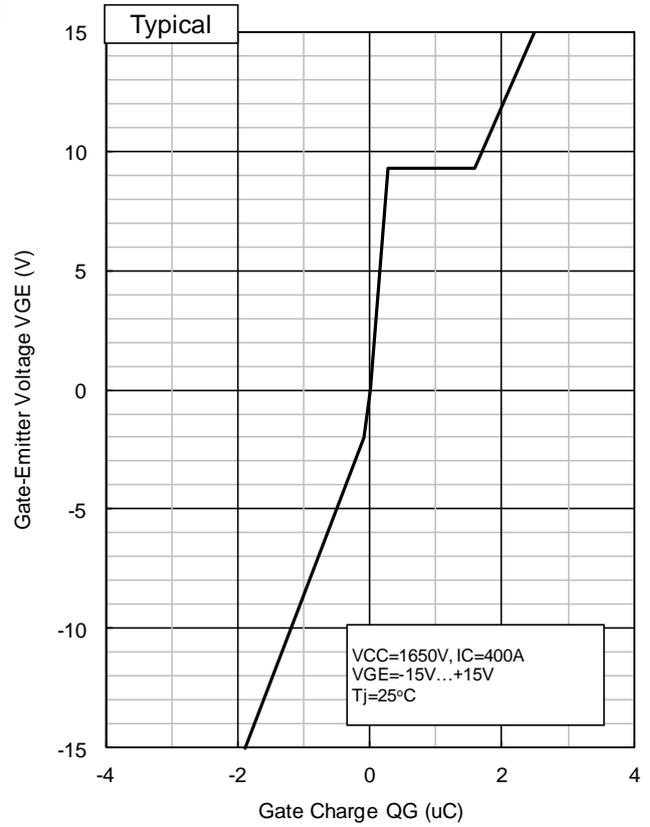
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Capacitance vs. Collector to Emitter Voltage



Cies, Coes, Cres - VCE

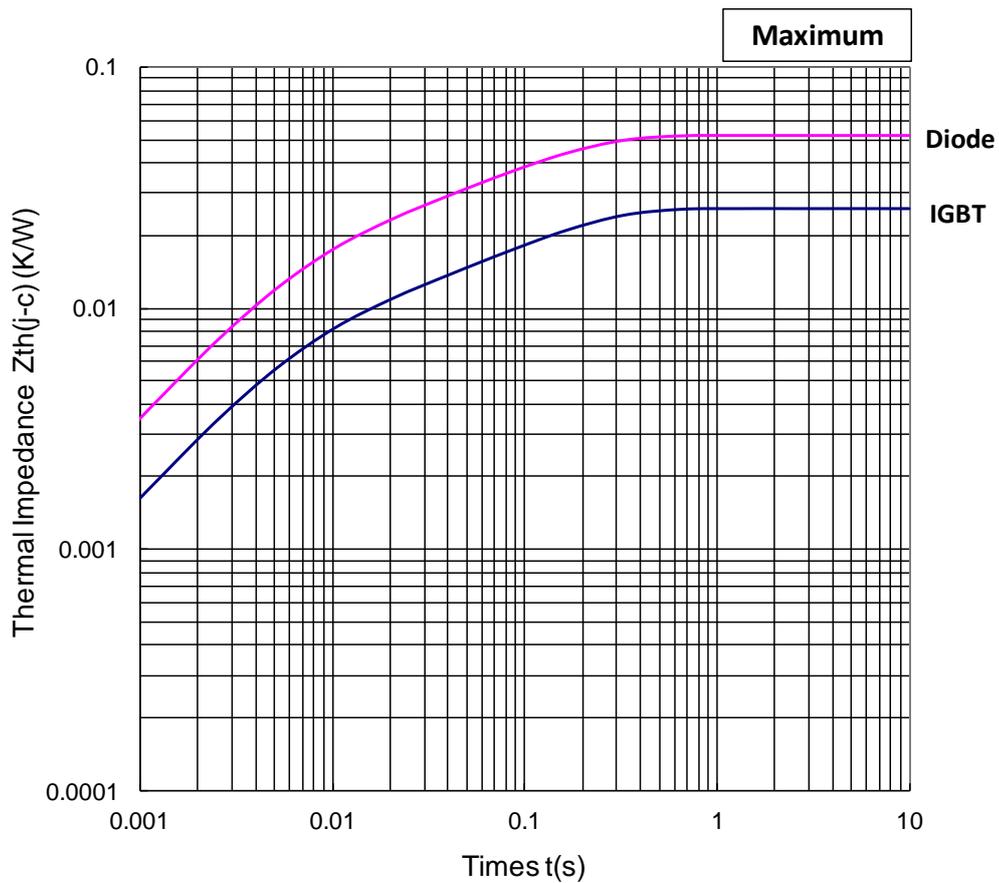
QG-VGE CURVE



QG - VGE

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TRANSIENT THERMAL IMPEDANCE



Transient Thermal Impedance Curve

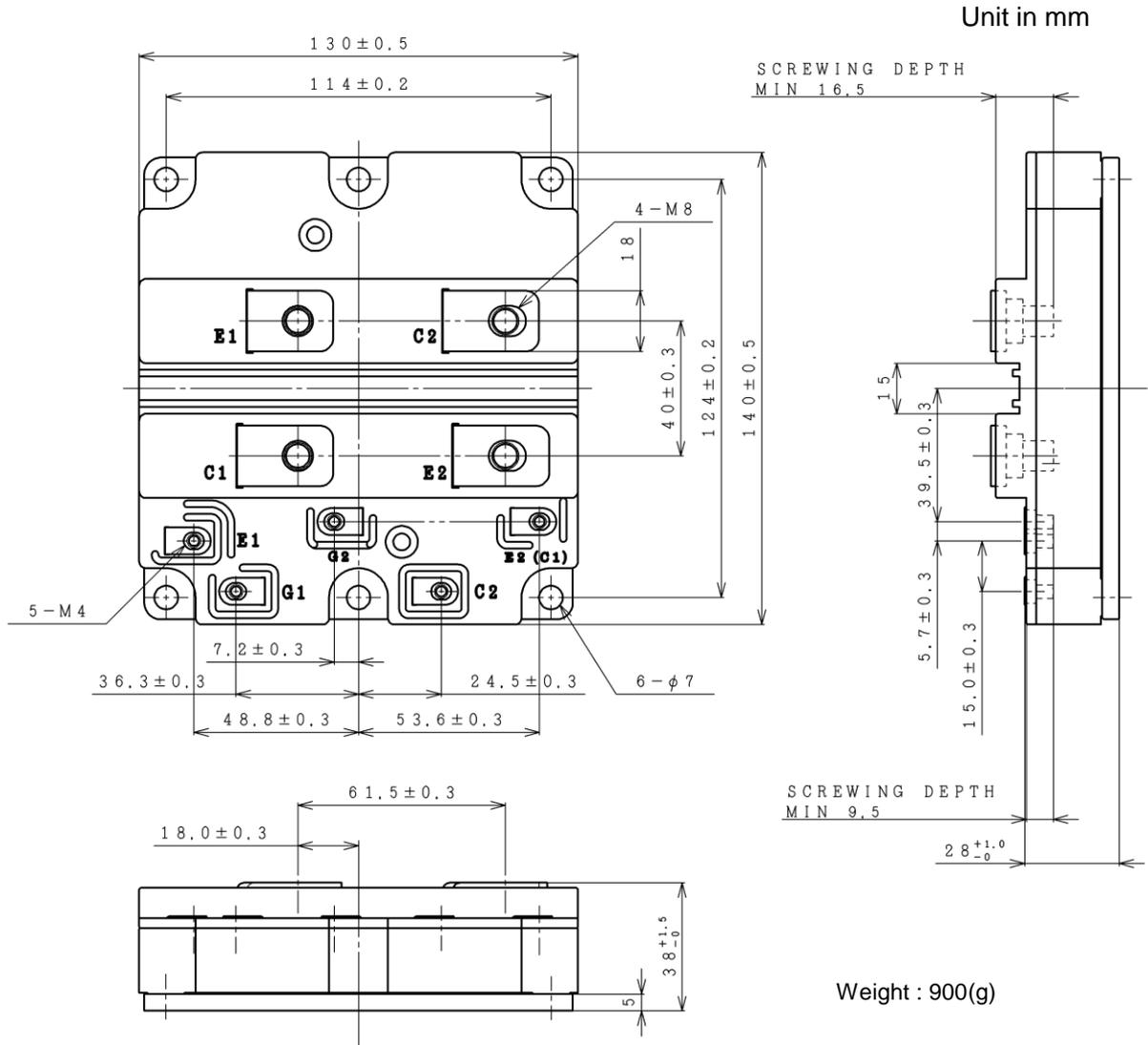
Curve approximation model

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

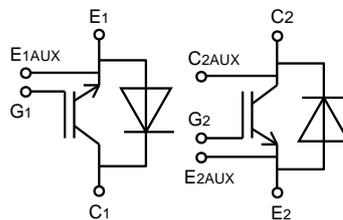
n	1	2	3	4	Unit
$\tau_{th[n]}$	1.39E-01	1.36E-02	3.61E-03	2.38E-04	sec
$r_{th[n,IGBT]}$	1.58E-02	5.95E-03	4.16E-03	1.00E-04	K/W
$r_{th[n,Diode]}$	2.94E-02	1.38E-02	8.55E-03	2.20E-04	K/W

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OUTLINE DRAWINGS



CIRCUIT DIAGRAM



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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1. The information given herein, including the specifications and dimensions, is subject to change without prior notice to improve product characteristics. Before ordering, purchasers are advised to contact Hitachi sales department for the latest version of this data sheets.
2. Please be sure to read "Precautions for Safe Use and Notices" in the individual brochure before use.
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