2MSI400VAE-170-53

SiC Hybrid Modules

Power Module (V-series IGBT&SiC SBD Hybrid type)
1700V / 400A / 2-in-1 package

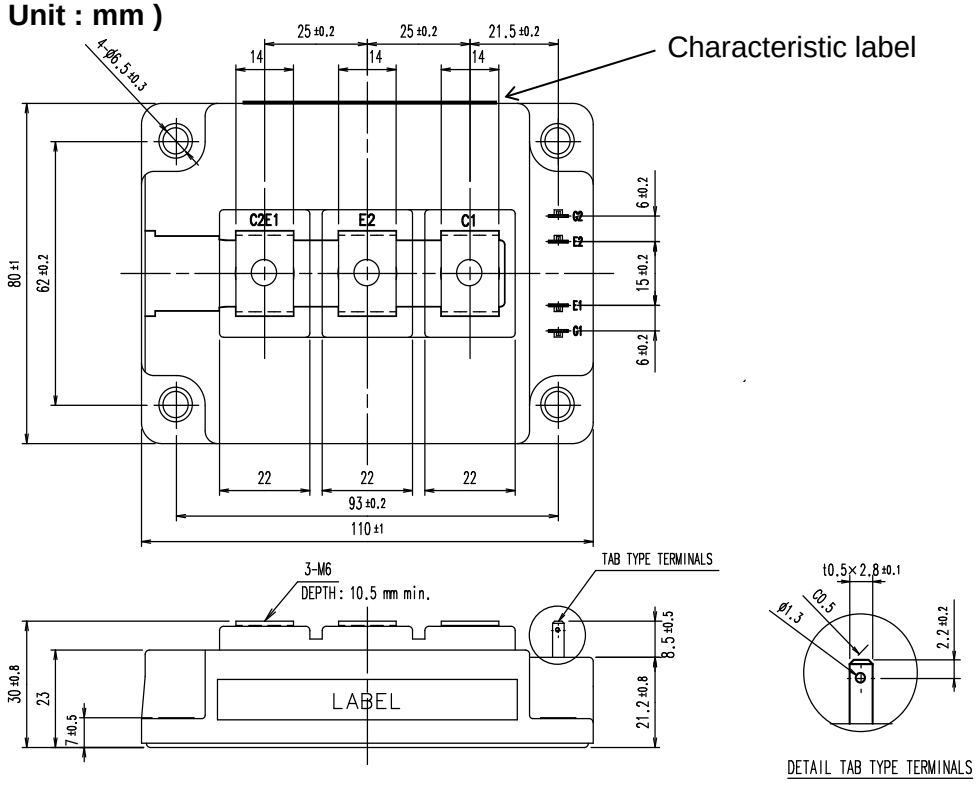
■ Features

High speed switching
Voltage drive
Low switching loss
Low Inductance module structure

■ Applications

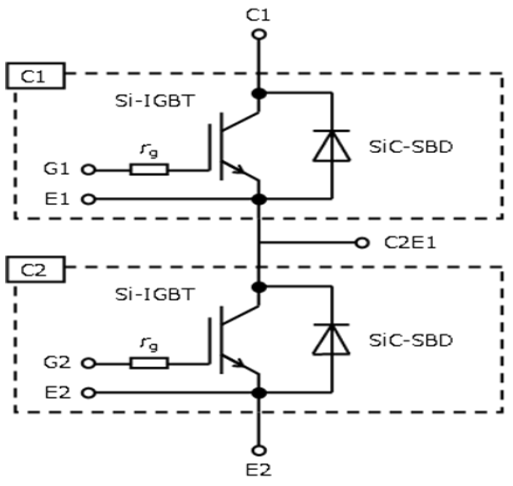
Inverter for Motor Drive
AC and DC Servo Drive Amplifier
Uninterruptible Power Supply
Active Front End

■ Outline drawing (Unit : mm)



Weight: 470g (typ.)

■ Equivalent Circuit



r_g : Internal gate resistance

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■ Absolute Maximum Ratings (at T_c= 25°C unless otherwise specified)

Items		Symbols	Conditions		Maximum Ratings	Units
Collector-Emitter voltage		V_{CES}			1700	V
Gate-Emitter voltage		V_{GES}			±20	V
Collector current		I_C	Continuous	T_c = 100°C	400	A
				T_c = 25°C	520	
		I_C pulse	1ms		800	
		$-I_C$			400	
		$-I_C$ pulse	1ms		800	
Collector power dissipation		P_C	1 device		4540	W
I^2t (*1)		I^2t	1 device V_{CE}=0V,t_w=10ms	T_{vj}=125°C	14.2	kA^2s
				T_{vj}=150°C	11.8	
Junction temperature		T_{vj}			175	°C
Operating junction temperature (under switching conditions)		T_{vjop}			150	
Case temperature		T_C			125	
Storage temperature		T_{stg}			-40 ~ 125	
Isolation	between terminal and copper base (*2)	V_{iso}	AC: 1min.		4000	VAC
Screw Torque	Mounting (*3)	-			6.0	N m
	Terminals (*4)	-			5.0	

(*1) Non-repetitive
(*2) All terminals should be connected together during the test.
(*3) Recommendable Value : 3.0-6.0 Nm (M5 or M6)
(*4) Recommendable Value : 2.5-5.0 Nm (M6)

■ Electrical characteristics (at T_{vj}= 25°C unless otherwise specified)

NOTICE:
The external gate resistance ($R_{G(on)}$, $R_{G(off)}$) shown in below is one of our recommend value for the purpose of minimum switching loss. However the optimum R_G depends on circuit configuration and/or environment. We recommend that the R_G has to be carefully chosen based on consideration if IGBT module matches design criteria, for example, switching loss, EMC/EMI, spike voltage, surge current and no unexpected oscillation and so on. Especially, we recommend to choose $R_{G(on)}$ value shown in below or more.

Items	Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Zero gate voltage Collector current	I_{CES}	V_{GE} = 0 V, V_{CE} = 1700 V		-	-	10.0	mA
Gate-Emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V		-	-	800	nA
Gate-Emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 20 V, I_C = 400 mA		6.0	6.5	7.0	V
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	V_{GE} = 15 V, I_C = 400 A	T_{vj} = 25°C	-	2.15	2.60	V
			T_{vj} = 125°C	-	2.55	-	
			T_{vj} = 150°C	-	2.60	-	
	$V_{CE(sat)}$ (chip)	V_{GE} = 15 V, I_C = 400 A	T_{vj} = 25°C	-	2.00	2.25	
			T_{vj} = 125°C	-	2.40	-	
			T_{vj} = 150°C	-	2.45	-	
Internal gate resistance	$r_{g(int)}$	-		-	5.6	-	Ω
Input capacitance	C_{ies}	V_{CE} = 10 V, V_{GE} = 0 V, f = 100kHz		-	38	-	nF
Turn-on time	t_{on}	V_{cc} = 900V, I_c = 400A, V_{GE} = ±15V, $R_{G(on)}$ = 1Ω, $R_{G(off)}$ = 0.5Ω, T_{vj} = 125°C, L_s = 30nH		-	1050	-	nsec
	t_r			-	450	-	
	$t_{r(i)}$			-	-	-	
Turn-off time	t_{off}			-	1950	-	
	t_f			-	90	-	
Forward on voltage	V_F (terminal)	V_{GE} = 0 V, I_F = 400 A	T_{vj} = 25°C	-	1.70	2.15	V
			T_{vj} = 125°C	-	2.25	-	
			T_{vj} = 150°C	-	2.45	-	
	V_F (chip)	V_{GE} = 0 V, I_F = 400 A	T_{vj} = 25°C	-	1.60	1.90	
			T_{vj} = 125°C	-	2.15	-	
			T_{vj} = 150°C		2.35	-	
Reverse recovery time	t_{rr}	I_F = 400A		-	45		nsec

5. Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics min.	Characteristics typ.	Characteristics max.	Units
Thermal resistance(1device)	$R_{th(j-c)}$	IGBT	-	-	0.033	°C/W
		FWD(SiC-SBD)	-	-	0.070	
Contact thermal resistance (1device) (*1)	$R_{th(c-f)}$	with Thermal Compound	-	0.0125	-	

(*1) This is the value which is defined mounting on the additional cooling fin with thermal compound.

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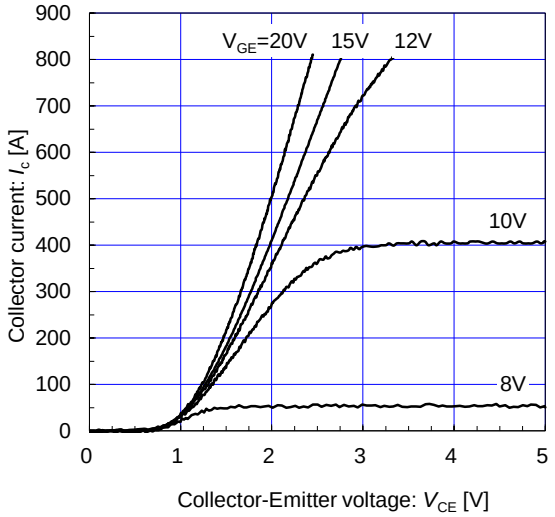
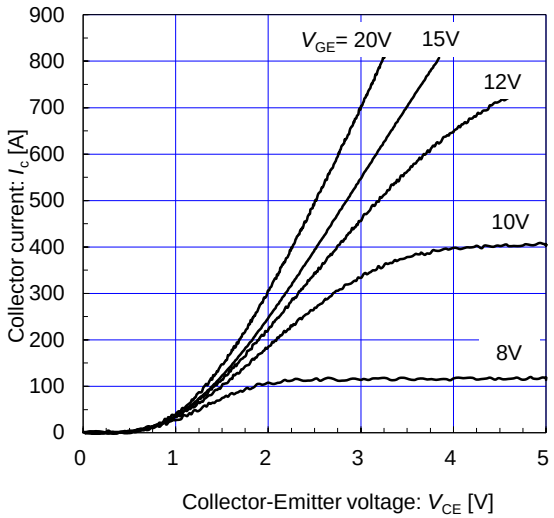
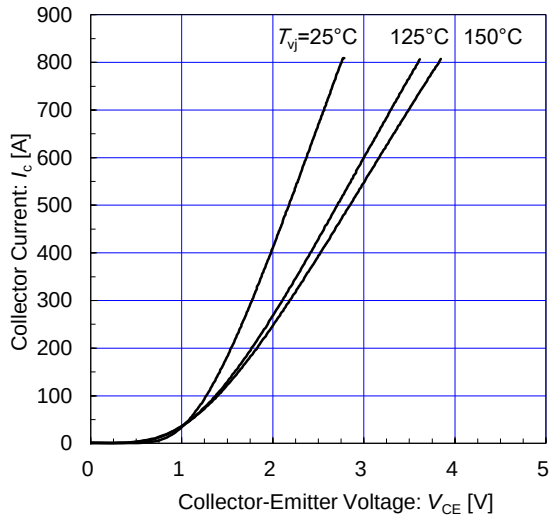
Collector current vs. Collector-Emitter voltage
T_{vj}= 25°C / chip



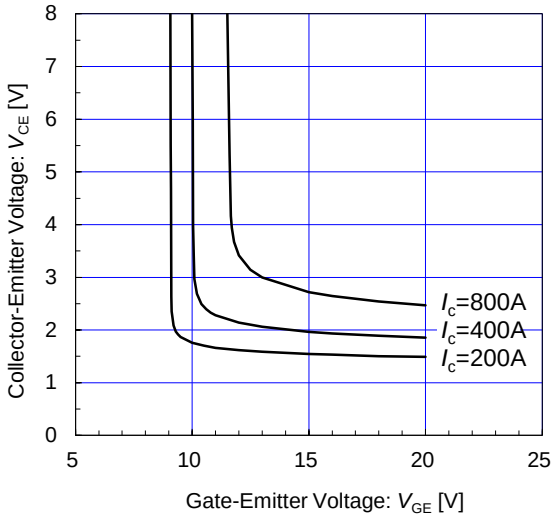
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj}= 150°C / chip



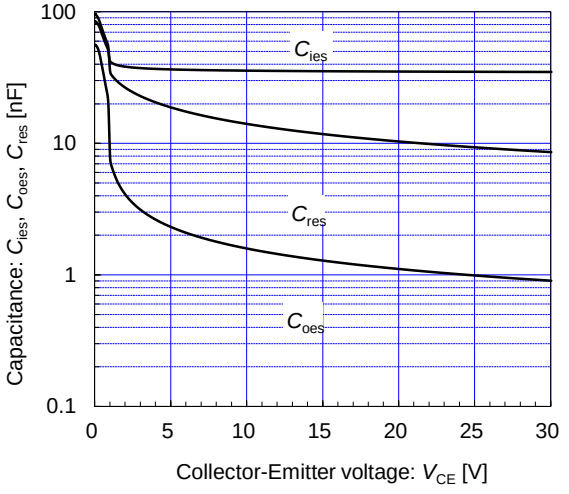
Collector current vs. Collector-Emitter voltage
V_{GE}= 15V / chip



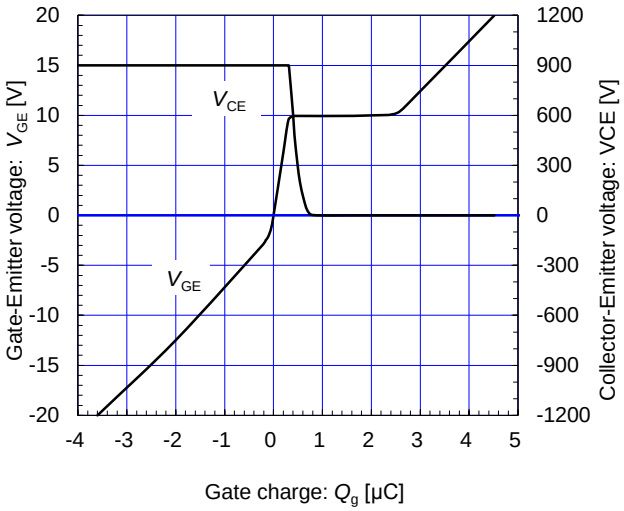
Collector-Emitter voltage vs. Gate-Emitter voltage
T_{vj}= 25°C / chip



Capacitance vs. Collector-Emitter Voltage (typ.)
V_{GE} = 0 V, f = 100kHz, T_{vj} = 25°C



Dynamic Gate Charge (typ.)
V_{CC} = 900 V, I_C = 400 A, T_{vj} = 25°C



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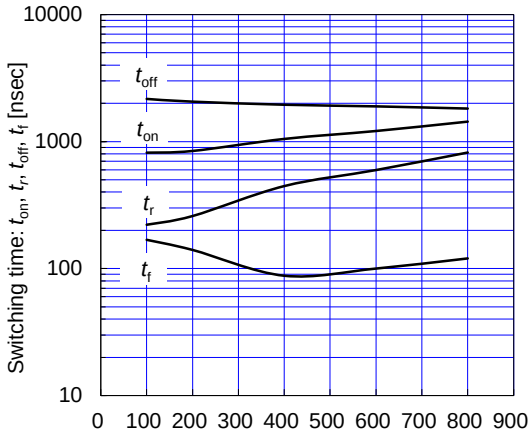
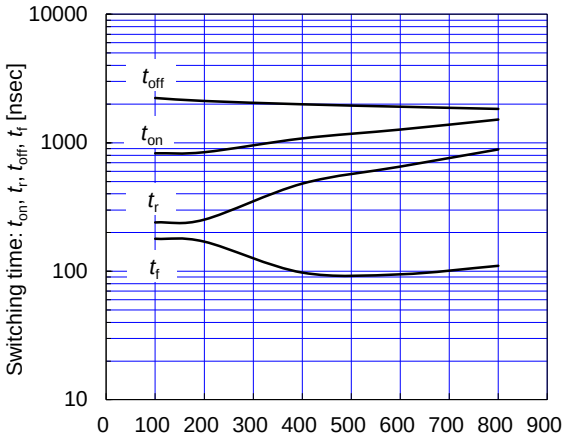
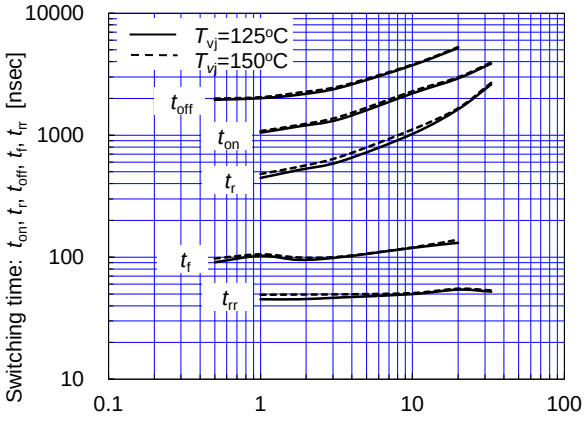
Switching time vs. Collector current (typ.)
V_{CC} = 900 V, V_{GE} = ±15 V, $R_{G(on)}$ = 1 Ω, $R_{G(off)}$ = 0.5 Ω, T_{vj} = 125°C



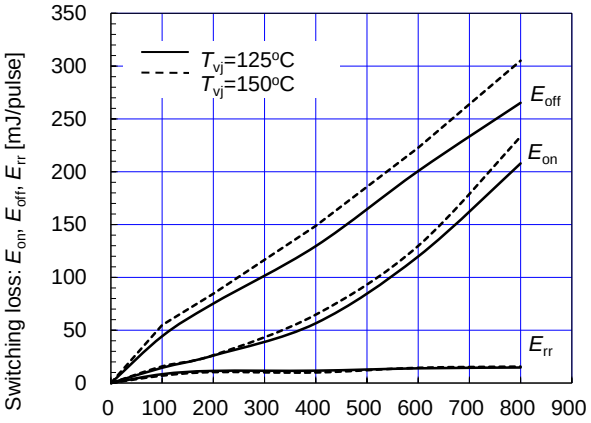
Switching time vs. Collector current (typ.)
V_{CC} = 900 V, V_{GE} = ±15 V, $R_{G(on)}$ = 1 Ω, $R_{G(off)}$ = 0.5 Ω, T_{vj} = 150°C



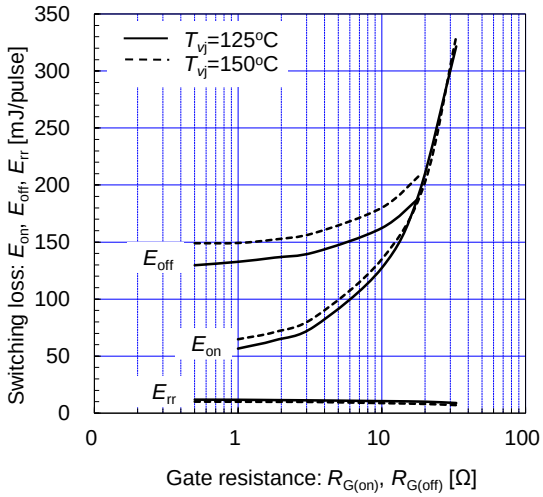
Switching time vs. Gate resistance (typ.)
V_{CC} = 900 V, I_C = I_F = 400 A, V_{GE} = ±15 V



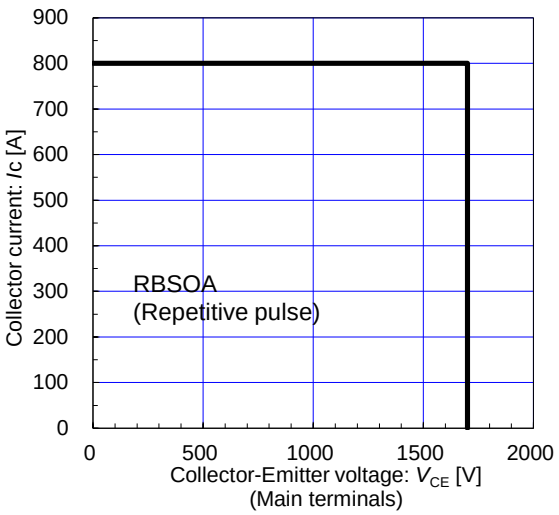
Switching loss vs. Collector current (typ.)
V_{CC} = 900 V, V_{GE} = ±15 V, $R_{G(on)}$ = 1 Ω, $R_{G(off)}$ = 0.5 Ω



Switching loss vs. Gate resistance (typ.)
V_{CC} = 900 V, I_C = I_F = 400 A, V_{GE} = ±15 V



Reverse bias safe operating area (max.)
V_{GE} = ±15 V , $R_{G(off)}$ = 0.5 Ω , T_{vj} = 150°C



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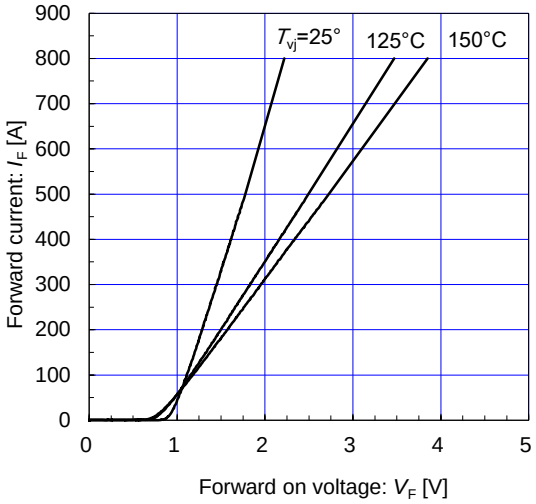
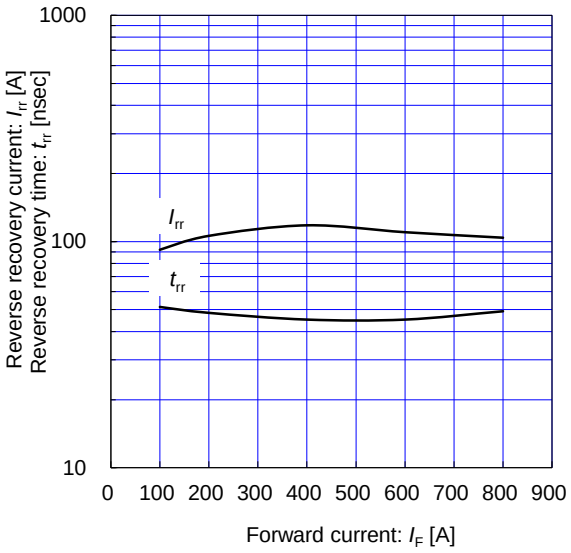
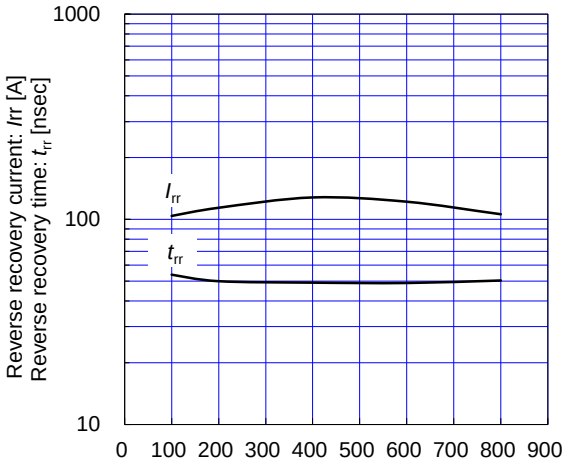
Forward Current vs. Forward Voltage (typ.)
chip



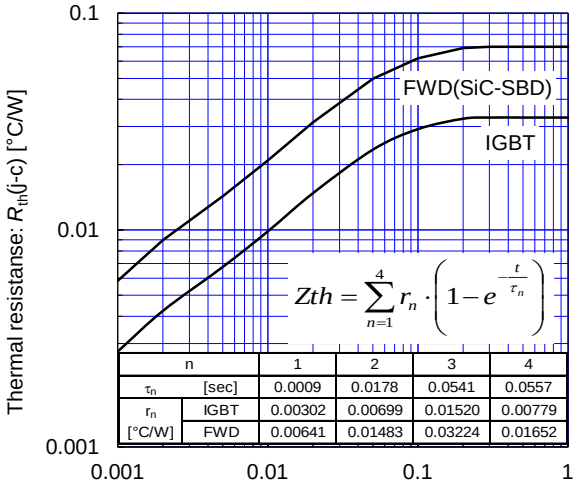
Reverse Recovery Characteristics (typ.)
V_{cc} = 900V, V_{GE} = ±15V, $R_{G(on)}$= 1Ω, T_{vj} = 125°C



Reverse Recovery Characteristics (typ.)
V_{cc} = 900V, V_{GE} = ±15V, $R_{G(on)}$ = 1Ω, T_{vj} = 150°C



Transient Thermal Resistance (max.)



n		1	2	3	4
τ_n	[sec]	0.0009	0.0178	0.0541	0.0557
r_n	IGBT	0.00302	0.00699	0.01520	0.00779
[°C/W]	FWD	0.00641	0.01483	0.03224	0.01652

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