

# 2MSI300VAH-120C-53

SiC Hybrid Modules

Power Module (V-series IGBT & SiC SBD Hybrid type)  
1200V / 300A / 2-in-1 package

■ Features

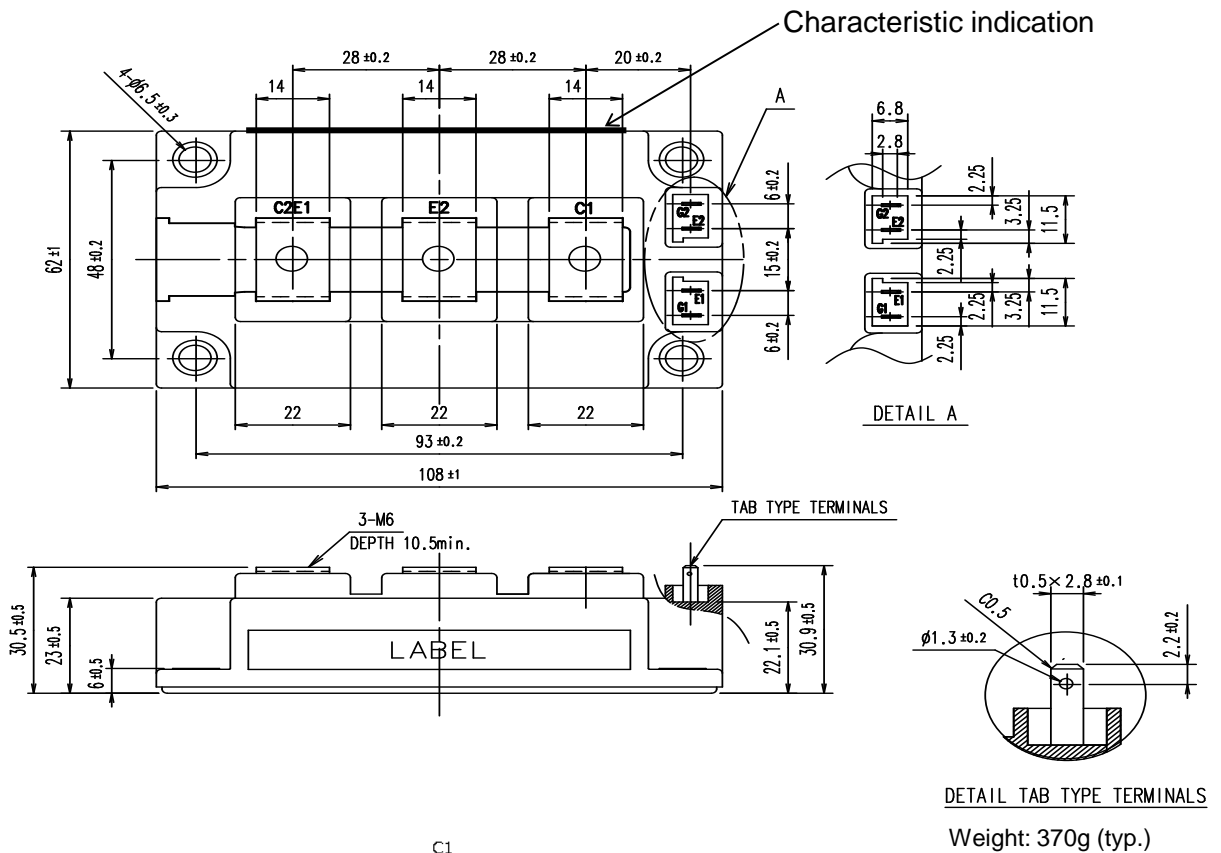
- High speed switching
- Voltage drive
- Low switching loss
- Low inductance module structure

■ Applications

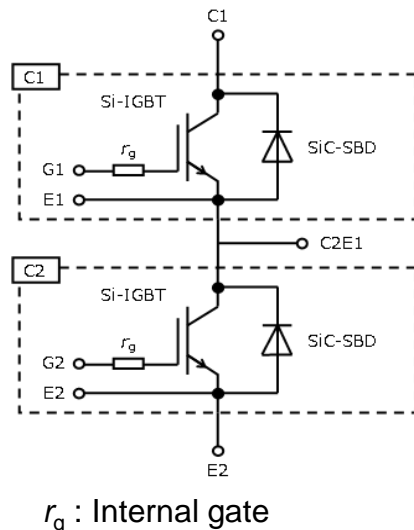
- Inverter for Motor Drive
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply
- Active Front End



■ Outline drawing ( Unit : mm )



■ Equivalent Circuit



# 2MSI300VAH-120C-53

**SiC Hybrid Modules**
**■ Absolute Maximum Ratings (at  $T_c = 25^\circ\text{C}$  unless otherwise specified)**

Items	Symbols	Conditions	Maximum Ratings	Units	
Collector-Emitter voltage	$V_{CES}$		1200	V	
Gate-Emitter voltage	$V_{GES}$		$\pm 20$	V	
Collector current	$I_C$	Continuous	$T_c = 100^\circ\text{C}$	300	A
			$T_c = 25^\circ\text{C}$	360	
	$I_C$ pulse	1 msec	600		
Forward current	$I_F$	Continuous	300		
			$I_F$ pulse	1 msec	600
Collector power dissipation	$P_c$	1 device	1600	W	
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 voltage	between terminal and copper base (*1)	$V_{iso}$	AC: 1 min.	2500	Vrms
Screw Mounting (*2)		-	6.0	N m	
Torque Terminals (*3)		-	5.0		

(\*1) (\*1) All terminals should be connected together during the test.

(\*2) (\*2) Recommendable Value : 3.0-6.0 Nm (M5 or M6)

(\*3) (\*3) Recommendable Value : 2.5-5.0 Nm (M6)

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**SiC Hybrid Modules**
**■ Electrical characteristics (at  $T_{vj}= 25^{\circ}\text{C}$  unless otherwise specified)**
**NOTICE:**

The external gate resistance ( $R_{G(on)}$ ) 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  $R_G$  value shown in below or more.

Items	Symbols	Conditions	Characteristics			Units	
			min.	typ.	max.		
Zero gate voltage Collector current	$I_{CES}$	$V_{GE} = 0 \text{ V}, V_{CE} = 1200 \text{ V}$	-	-	4	mA	
Gate-Emitter leakage current	$I_{GES}$	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$	-	-	400	nA	
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20 \text{ V}, I_C = 300 \text{ mA}$	6.0	6.5	7.0	V	
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15 \text{ V}, I_C = 300 \text{ A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.95	2.40	V
			$T_{vj}=125^{\circ}\text{C}$	-	2.25	-	
			$T_{vj}=150^{\circ}\text{C}$	-	2.30	-	
	$V_{CE(sat)}$ (chip)	$V_{GE} = 15 \text{ V}, I_C = 300 \text{ A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.75	2.10	
$T_{vj}=125^{\circ}\text{C}$			-	2.05	-		
Internal gate resistance	$r_{g(int)}$	-	-	5.0	-	$\Omega$	
Input capacitance	$C_{ies}$	$V_{CE}= 10 \text{ V}, V_{GE}= 0 \text{ V}, f=100 \text{ kHz}$	-	22.1	-	nF	
Turn-on time	$t_{on}$	$V_{CC} = 600 \text{ V}, I_C = 300 \text{ A}, V_{GE} = \pm 15 \text{ V}, R_G = 0.22 \Omega,$	-	815	-	nsec	
	$t_r$		-	245	-		
	$t_{r(i)}$		-	85	-		
Turn-off time	$t_{off}$	$T_{vj} = 150^{\circ}\text{C}, L_s = 60\text{nH}$	-	835	-	nsec	
	$t_f$		-	85	-		
Forward on voltage	$V_F$ (terminal)	$V_{GE} = 0 \text{ V}, I_F = 300 \text{ A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.55	1.80	V
			$T_{vj}=125^{\circ}\text{C}$	-	1.85	-	
			$T_{vj}=150^{\circ}\text{C}$	-	2.00	-	
	$V_F$ (chip)	$V_{GE} = 0 \text{ V}, I_F = 300 \text{ A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.35	1.60	
$T_{vj}=125^{\circ}\text{C}$			-	1.65	-		
Reverse recovery time	$t_{rr}$	$I_F = 300\text{A}$	-	45.0	-	nsec	

**5. Thermal resistance characteristics**

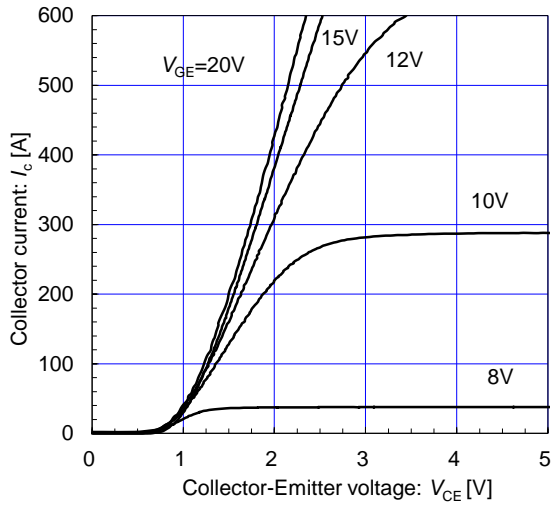
Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance(1 device)	$R_{th(j-c)}$	IGBT	-	-	0.093	$^{\circ}\text{C/W}$
		FWD	-	-	0.102	
Contact thermal resistance (1 device) (*1)	$R_{th(c-f)}$	with Thermal Compound	-	0.0125	-	

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

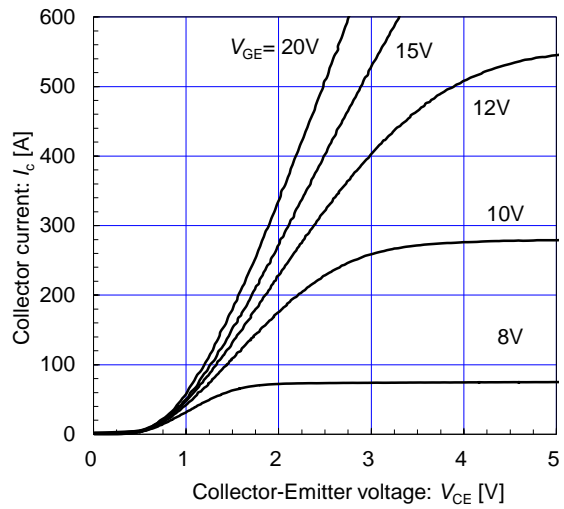
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SiC Hybrid Modules

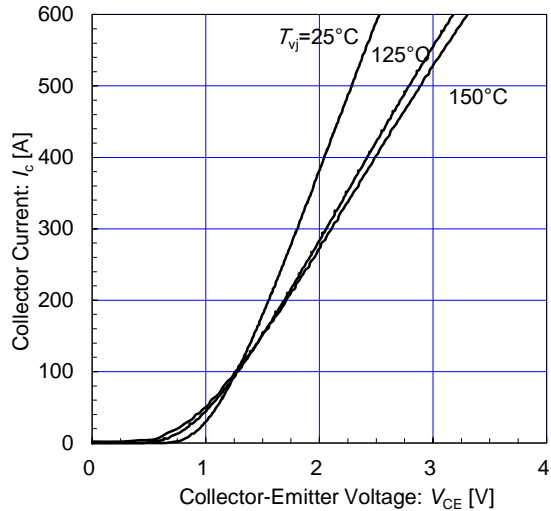
Collector current vs. Collector-Emitter voltage  
 $T_{vj} = 25^{\circ}\text{C} / \text{chip}$



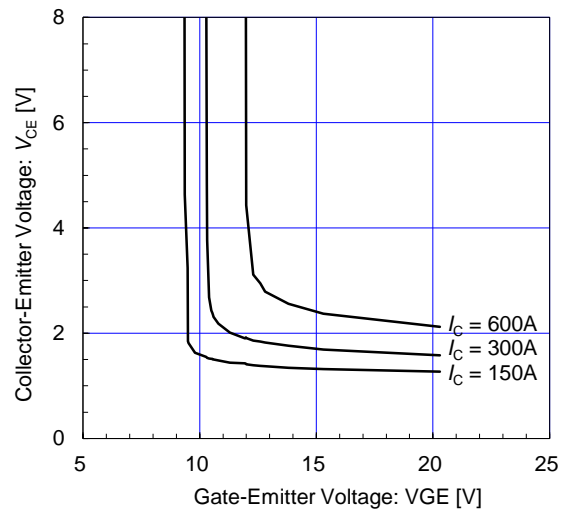
Collector current vs. Collector-Emitter voltage (typ.)  
 $T_{vj} = 150^{\circ}\text{C} / \text{chip}$



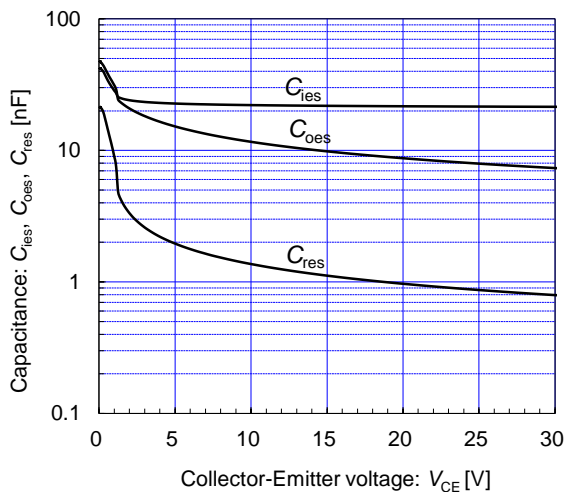
Collector current vs. Collector-Emitter voltage  
 $V_{GE} = 15\text{V} / \text{chip}$



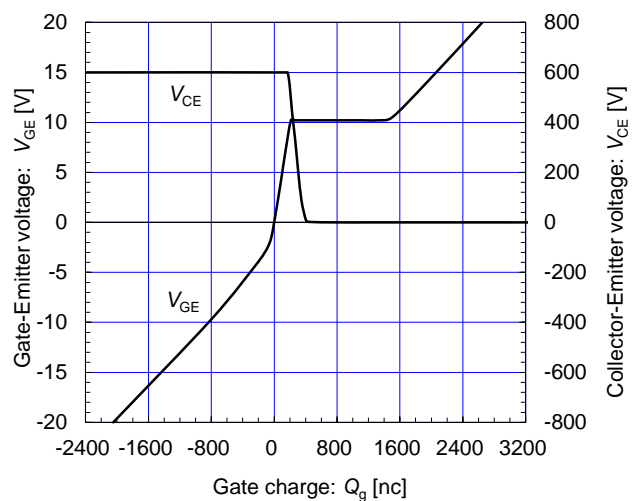
Collector-Emitter voltage vs. Gate-Emitter voltage  
 $T_{vj} = 25^{\circ}\text{C} / \text{chip}$



Gate Capacitance vs. Collector-Emitter Voltage  
 $V_{GE} = 0\text{V}, f = 100\text{kHz}, T_{vj} = 25^{\circ}\text{C}$



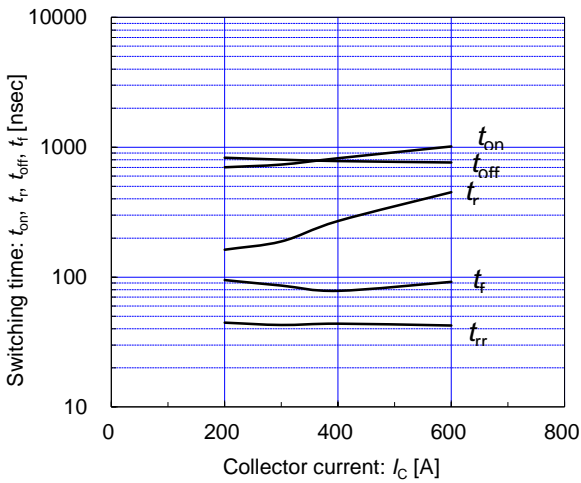
Dynamic Gate Charge (typ.)  
 $V_{CC} = 600\text{V}, I_C = 300\text{A}, T_{vj} = 25^{\circ}\text{C}$



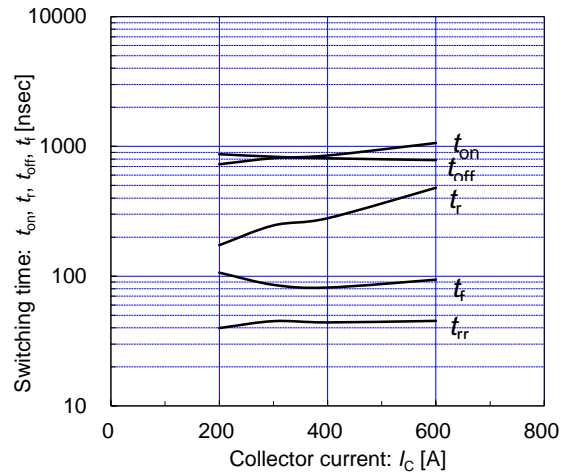
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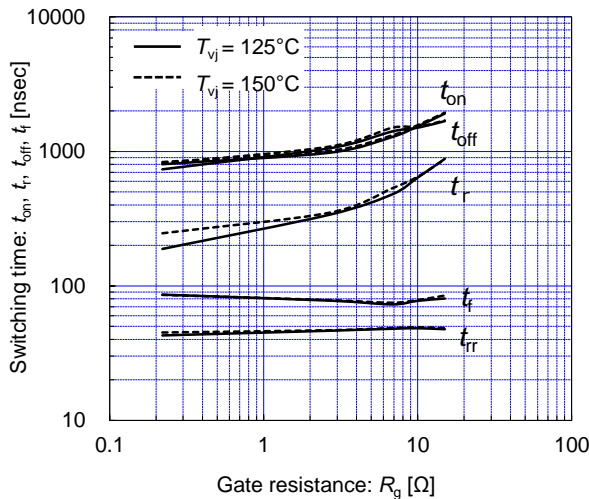
Switching time vs. Collector current (typ.)  
 $V_{CC} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 0.22\ \Omega$ ,  $T_{vj} = 125^\circ\text{C}$



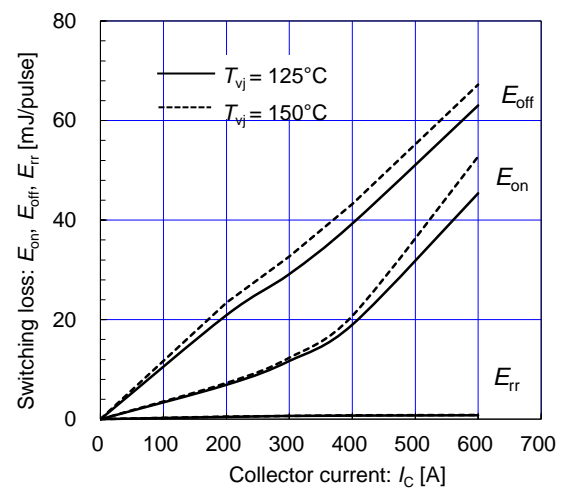
Switching time vs. Collector current (typ.)  
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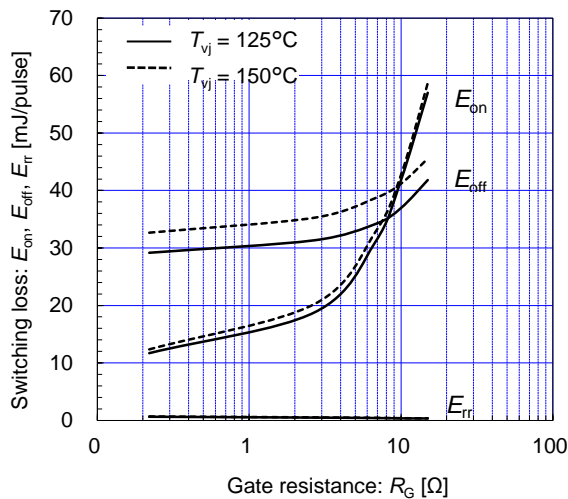
Switching time vs. Gate resistance (typ.)  
 $V_{CC} = 600\text{ V}$ ,  $I_C = 300\text{ A}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $T_{vj} = 125, 150^\circ\text{C}$



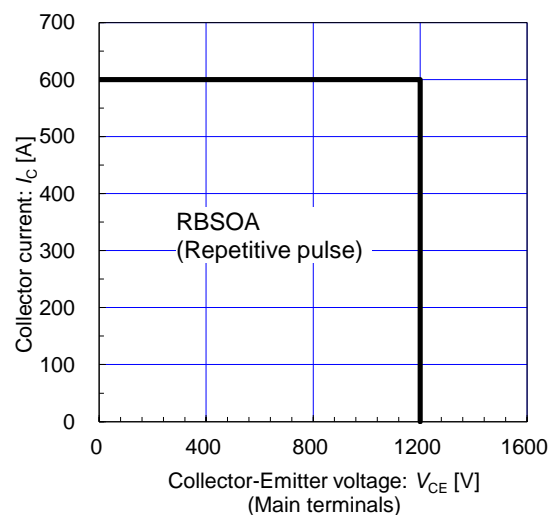
Switching loss vs. Collector current (typ.)  
 $V_{CC} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 0.22\ \Omega$ ,  $T_{vj} = 125, 150^\circ\text{C}$



Switching loss vs. Gate resistance (typ.)  
 $V_{CC} = 600\text{ V}$ ,  $I_C = 300\text{ A}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $T_{vj} = 125, 150^\circ\text{C}$



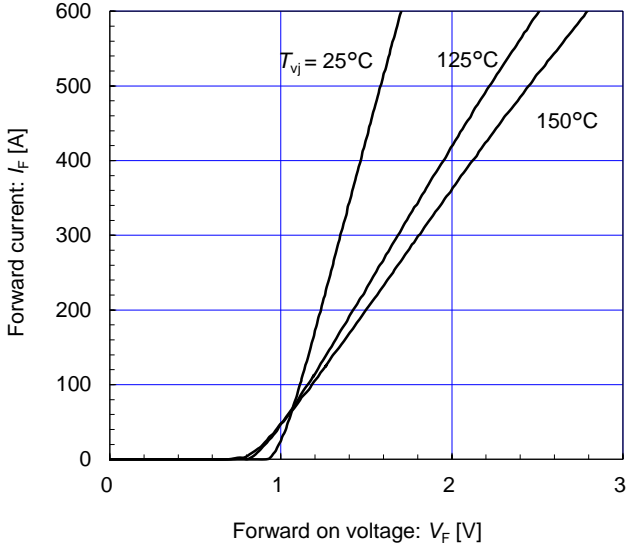
Reverse bias safe operating area (max.)  
 $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 0.22\ \Omega$ ,  $T_{vj} = 150^\circ\text{C}$



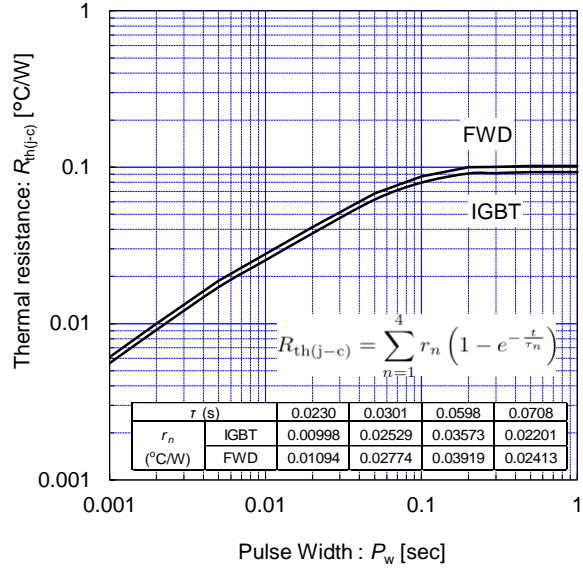
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Forward Current vs. Forward Voltage (typ.)  
chip



Transient Thermal Resistance (max.)



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