

7MBR150XNA065-50

IGBT Modules

Power Module(X series)
650V / 150A / PIM

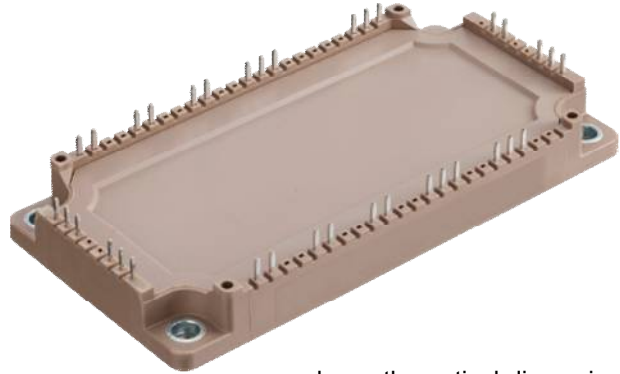
■ Features

- Low $V_{CE(sat)}$
- Compact Package
- P.C.Board Mount Module
- Converter Diode Bridge Dynamic Brake Circuit
- RoHS compliant Product

■ Applications

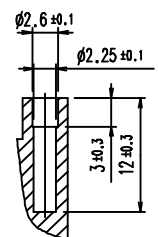
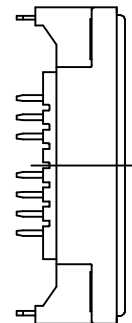
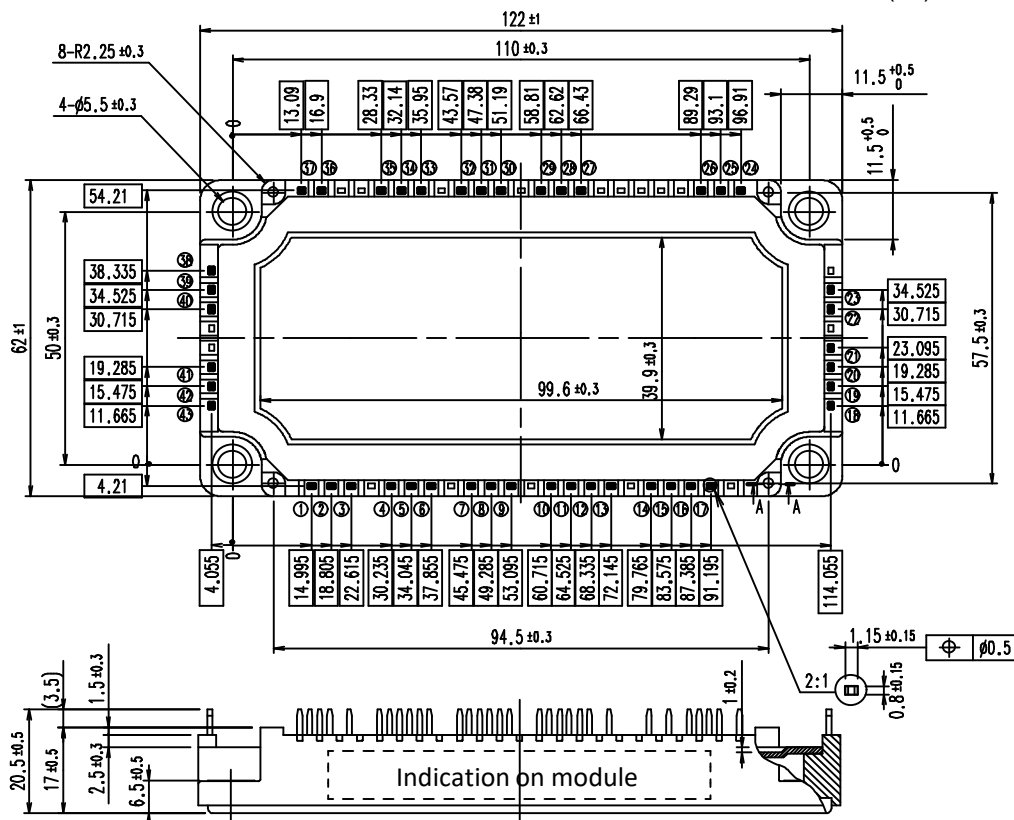
- Inverter for Motor Drive
- AC and DC Servo Drive Amplifier
- Uninterrupted Power Supply

■ Typical appearance



shows theoretical dimension.
() shows reference dimension.

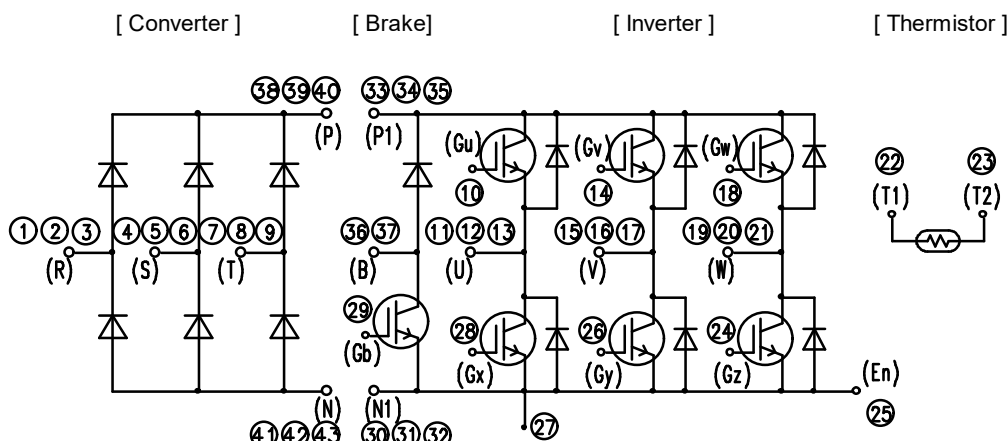
■ Outline drawing (Unit : mm)



Section A-A

Weight: 310 g (typ.)

■ Equivalent circuit



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IGBT Modules
■ Maximum ratings (at $T_c = 25^\circ\text{C}$ unless otherwise specified)

Items		Symbols	Conditions		Maximum ratings	Units	
Inverter	Collector-Emitter voltage	V_{CES}			650	V	
	Gate-Emitter voltage	V_{GES}			±20	V	
	Collector current	I_C	Continuous	$T_c=80^{\circ}\text{C}$	150	A	
		I_C pulse	1ms		300		
	Forward current	I_F	Continuous		150		
		I_F pulse	1ms		300		
Collector power dissipation		P_C	1 device		450	W	
Brake IGBT	Collector-Emitter voltage	V_{CES}			650	V	
	Gate-Emitter voltage	V_{GES}			±20	V	
	Collector current	I_C	Continuous	$T_c=80^{\circ}\text{C}$	75	A	
		I_C pulse	1ms		150		
	Collector power dissipation		P_C	1 device		270	W
Brake FWD	Forward current	I_F	Continuous		50	A	
		I_{FRM}	1ms		100		
	Repetitive peak reverse voltage		V_{RRM}			650	V
Converter	Repetitive peak reverse voltage		V_{RRM}			800	V
	Average output current	I_O	Three-phase full wave rectified current	$T_c=80^{\circ}\text{C}$	150	A	
	Surge current (Non-Repetitive) (*1)	I_{FSM}	$t=10\text{ms}$, Half sine wave form	$T_{vj}=25^{\circ}\text{C}$	1440	A	
		$T_{vj}=150^{\circ}\text{C}$		1260			
	I^2t (Non-Repetitive) (*1)	I^2t		$T_{vj}=25^{\circ}\text{C}$	10400	A ² s	
		$T_{vj}=150^{\circ}\text{C}$	8000				
Junction temperature		T_{vj}	Inverter, Brake		175	°C	
			Converter		150		
Operating junction temperature (under switching conditions)		T_{vjop}	Inverter, Brake		175		
			Converter		150		
Case temperature		T_c			125		
Storage temperature		T_{stg}			-40 ~ 125		
Isolation voltage	between terminals and copper base (*2)	V_{isol}	A.C. : 1min.		2500	Vrms	
	between thermistor and others (*3)						
Screw torque	Mounting torque of screws to heat sink	M_5	M5		2.5~6.0	N·m	

(*1) T_{vj} : Temperature at test start.

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

(*3) Two thermistor terminals should be connected together, other terminals should be connected together and shorted to base plate during the test.

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■ Electrical characteristics (at $T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

Items	Symbols	Conditions		Characteristics			Units	
				min.	typ.	max.		
Inverter	Zero Gate voltage collector current	I_{CES}	$V_{GE} = 0V$ $V_{CE} = 650V$		-	-	50	μA
	Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0V \quad V_{GE} = +20/-20V$		-	-	100	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V$ $I_C = 150mA$		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 150A$	$T_{Vj}=25^{\circ}C$	-	1.65	2.10	V
		$V_{CE(sat)}$ (chip)		$T_{Vj}=25^{\circ}C$	-	1.30	1.75	
				$T_{Vj}=125^{\circ}C$	-	1.45	-	
				$T_{Vj}=150^{\circ}C$	-	1.50	-	
				$T_{Vj}=175^{\circ}C$	-	1.55	-	
	Internal Gate resistance	r_g	-		-	4.5	-	Ω
	Capacitance	C_{ies}	$V_{CE} = 10V, V_{GE}=0V, f = 1MHz$		-	17.2	-	nF
		C_{oes}			-	0.66	-	
		C_{res}			-	0.23	-	
	Gate charge	Q_G	$V_{CC} = 300V \quad V_{GE}=-15 \rightarrow +15V$ $I_C = 150A$		-	1200	-	nC
	Forward voltage	V_F (terminal)	$I_F = 150A$	$T_{Vj}=25^{\circ}C$	-	1.90	2.35	V
		V_F (chip)		$T_{Vj}=25^{\circ}C$	-	1.55	2.00	
				$T_{Vj}=125^{\circ}C$	-	1.50	-	
				$T_{Vj}=150^{\circ}C$	-	1.50	-	
				$T_{Vj}=175^{\circ}C$	-	1.45	-	
	Switching time (*1)	$t_{d(on)}$	$V_{CC} = 300V$ $I_C, I_F = 150A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 18\Omega$	$T_{Vj}=25^{\circ}C$	-	0.48	-	μs
				$T_{Vj}=125^{\circ}C$	-	0.52	-	
				$T_{Vj}=150^{\circ}C$	-	0.54	-	
$T_{Vj}=175^{\circ}C$				-	0.52	-		
t_r		$V_{CC} = 300V$ $I_C, I_F = 150A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 18\Omega$	$T_{Vj}=25^{\circ}C$	-	0.12	-		
			$T_{Vj}=125^{\circ}C$	-	0.16	-		
			$T_{Vj}=150^{\circ}C$	-	0.16	-		
			$T_{Vj}=175^{\circ}C$	-	0.18	-		
$t_{d(off)}$		$V_{CC} = 300V$ $I_C, I_F = 150A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 18\Omega$	$T_{Vj}=25^{\circ}C$	-	0.54	-		
			$T_{Vj}=125^{\circ}C$	-	0.58	-		
			$T_{Vj}=150^{\circ}C$	-	0.59	-		
			$T_{Vj}=175^{\circ}C$	-	0.60	-		
t_f		$V_{CC} = 300V$ $I_C, I_F = 150A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 18\Omega$	$T_{Vj}=25^{\circ}C$	-	0.05	-		
			$T_{Vj}=125^{\circ}C$	-	0.05	-		
			$T_{Vj}=150^{\circ}C$	-	0.06	-		
			$T_{Vj}=175^{\circ}C$	-	0.06	-		
Reverse recovery time	t_{rr}	$V_{CC} = 300V$ $I_C, I_F = 150A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 18\Omega$	$T_{Vj}=25^{\circ}C$	-	0.11	-		
			$T_{Vj}=125^{\circ}C$	-	0.23	-		
			$T_{Vj}=150^{\circ}C$	-	0.24	-		
			$T_{Vj}=175^{\circ}C$	-	0.30	-		

(*1) Turn on time (t_{on}) = $t_{d(on)} + t_r$, Turn off time (t_{off}) = $t_{d(off)} + t_f$

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Items		Symbols	Conditions		Characteristics			Units
					min.	typ.	max.	
Inverter	Switching loss (per pulse)	E_{on}	$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	5.94	-	mJ
			$I_C, I_F = 150A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	8.59	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	9.46	-	
			$R_G = 18\ \Omega$	$T_{vj}=175^{\circ}C$	-	10.27	-	
		E_{off}	$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	4.86	-	
			$I_C, I_F = 150A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	6.19	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	6.48	-	
			$R_G = 18\ \Omega$	$T_{vj}=175^{\circ}C$	-	6.81	-	
		E_{rr}	$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	0.64	-	
			$I_C, I_F = 150A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.90	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	1.12	-	
			$R_G = 18\ \Omega$	$T_{vj}=175^{\circ}C$	-	1.24	-	
Zero Gate voltage collector current	I_{CES}	$V_{GE} = 0V$ $V_{CE} = 650V$		-	-	50	μA	
Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0V, \ V_{GE} = +20/-20V$		-	-	100	nA	
Brake	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 75A$	$T_{vj}=25^{\circ}C$	-	1.45	1.95	V
		$V_{CE(sat)}$ (chip)	$T_{vj}=25^{\circ}C$	-	1.30	1.75		
			$T_{vj}=125^{\circ}C$	-	1.45	-		
			$T_{vj}=150^{\circ}C$	-	1.50	-		
			$T_{vj}=175^{\circ}C$	-	1.55	-		
	Internal Gate resistance	r_g	-		-	0	-	Ω
	Switching time (*1)	$t_{d(on)}$	$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	0.35	-	μs
			$I_C = 75A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.34	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	0.36	-	
			$R_G = 43\ \Omega$	$T_{vj}=175^{\circ}C$	-	0.34	-	
t_r		$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	0.12	-		
		$I_C = 75A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.14	-		
		$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	0.16	-		
		$R_G = 43\ \Omega$	$T_{vj}=175^{\circ}C$	-	0.15	-		
$t_{d(off)}$		$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	0.47	-		
		$I_C = 75A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.52	-		
		$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	0.52	-		
		$R_G = 43\ \Omega$	$T_{vj}=175^{\circ}C$	-	0.53	-		
t_f		$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	0.04	-		
		$I_C = 75A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.05	-		
		$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	0.04	-		
		$R_G = 43\ \Omega$	$T_{vj}=175^{\circ}C$	-	0.04	-		
Reverse current	I_{RRM}	$V_R = 650V$		-	-	50	μA	
Forward voltage	V_F (terminal)	$I_F = 50A$	$T_{vj}=25^{\circ}C$	-	1.70	2.20	V	
	V_F (chip)	$I_F = 50A$	$T_{vj}=25^{\circ}C$	-	1.55	2.00		
		$T_{vj}=125^{\circ}C$	-	1.50	-			
		$T_{vj}=150^{\circ}C$	-	1.50	-			
		$T_{vj}=175^{\circ}C$	-	1.45	-			
Converter	Reverse current	I_{RRM}	$V_R = 800V$		-	-	50	μA
Forward voltage	V_{FM}		terminal	-	1.45	1.90	V	
			chip	-	1.10	1.55		
Thermistor	Resistance	R	$T = 25^{\circ}C$		-	5000	-	Ω
			$T = 100^{\circ}C$		465	495	520	
	B value	B	$T = 25/ 50^{\circ}C$			3305	3375	3450

(*1) Turn on time (t_{on}) = $t_{d(on)} + t_r$, Turn off time (t_{off}) = $t_{d(off)} + t_f$

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NOTICE:

The external gate resistance (R_G) shown above is one of our recommended 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.

■ Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.33	°C/W
		Inverter FWD	-	-	0.43	
		Brake IGBT	-	-	0.55	
		Brake FWD	-	-	0.86	
		Converter Diode	-	-	0.36	
Contact thermal resistance (1 IGBT+1 FWD) (*1)	$R_{th(c-f)}$	with 1 W/(m·K) thermal grease	-	0.05	-	

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

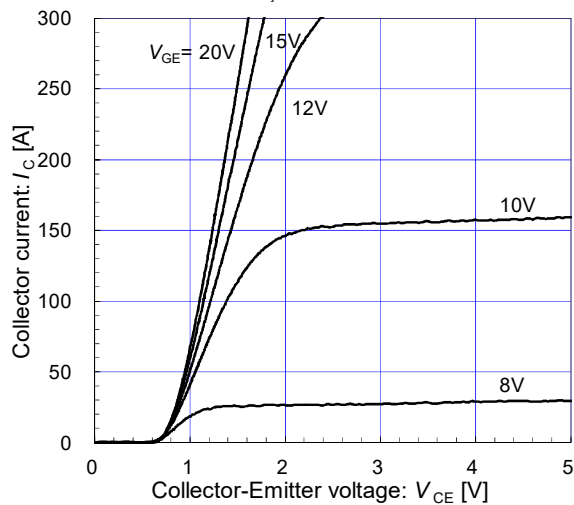
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IGBT Modules

[Inverter]

Collector current vs. Collector-Emittor voltage (typ.)

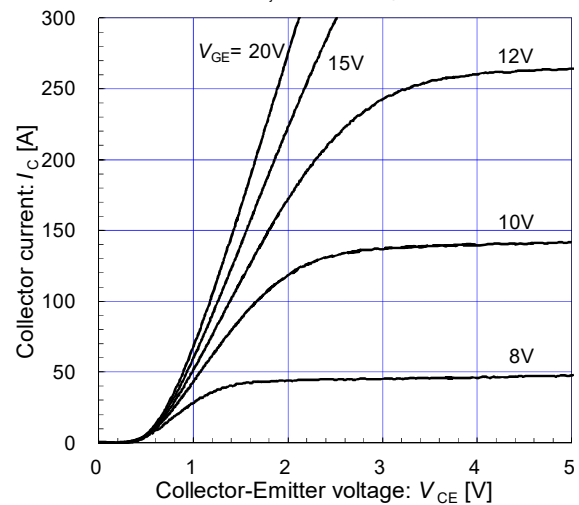
$T_{vj} = 25^\circ\text{C}$ / chip



[Inverter]

Collector current vs. Collector-Emittor voltage (typ.)

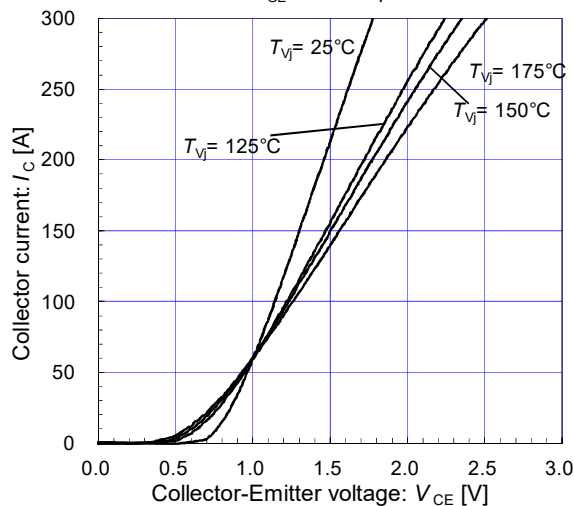
$T_{vj} = 175^\circ\text{C}$ / chip



[Inverter]

Collector current vs. Collector-Emittor voltage (typ.)

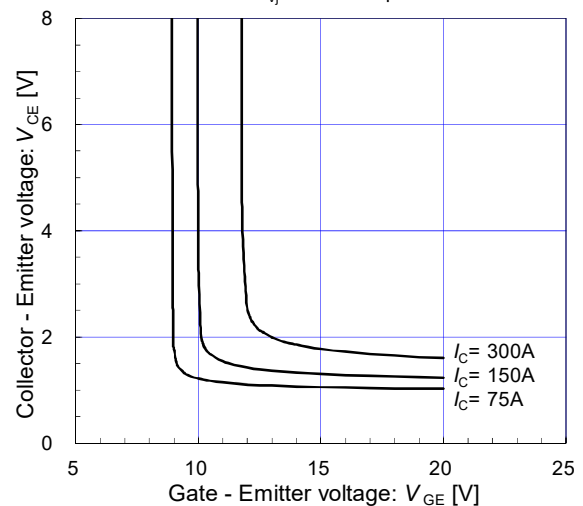
$V_{GE} = 15\text{V}$ / chip



[Inverter]

Collector-Emittor voltage vs. Gate-Emittor voltage (typ.)

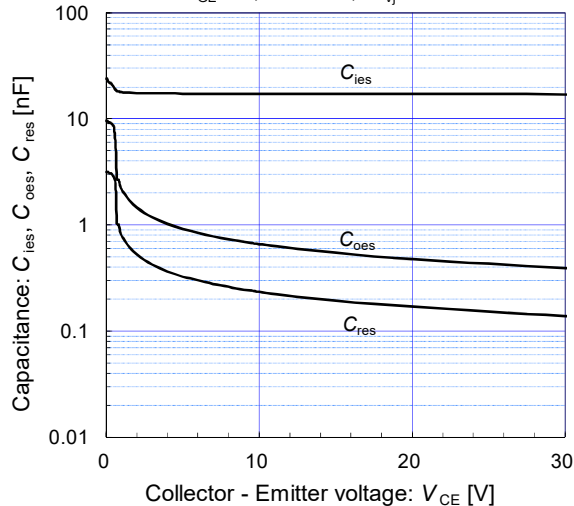
$T_{vj} = 25^\circ\text{C}$ / chip



[Inverter]

Capacitance vs. Collector-Emittor voltage (typ.)

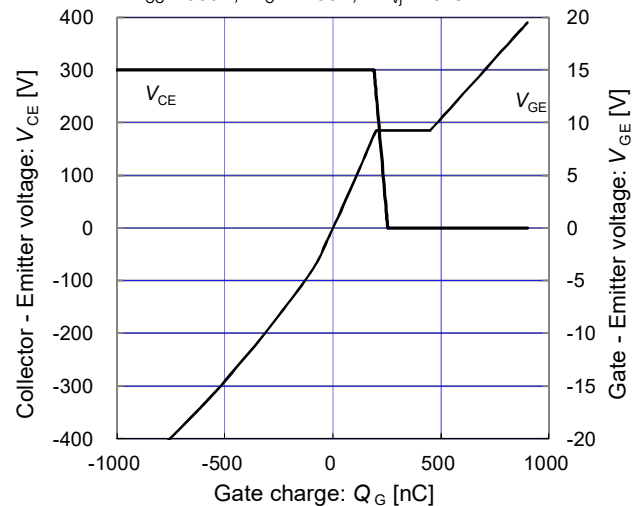
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_{vj} = 25^\circ\text{C}$



[Inverter]

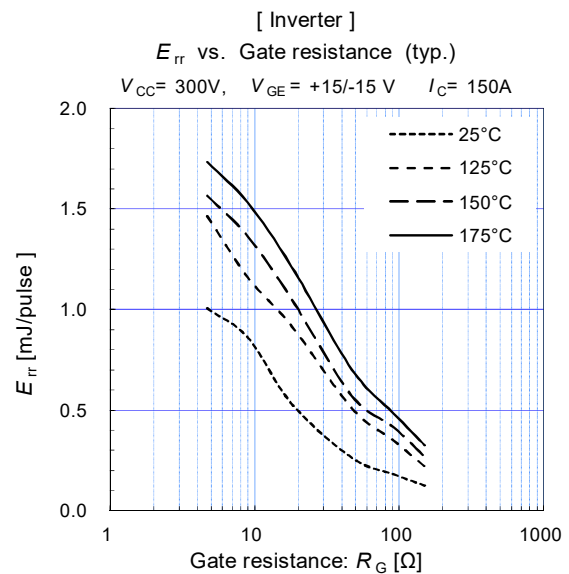
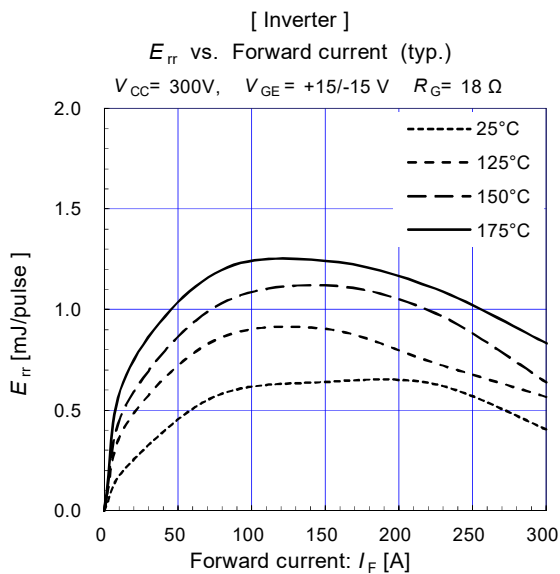
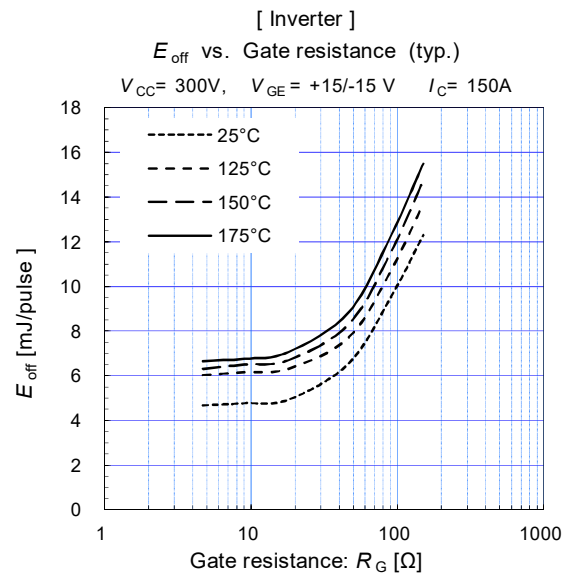
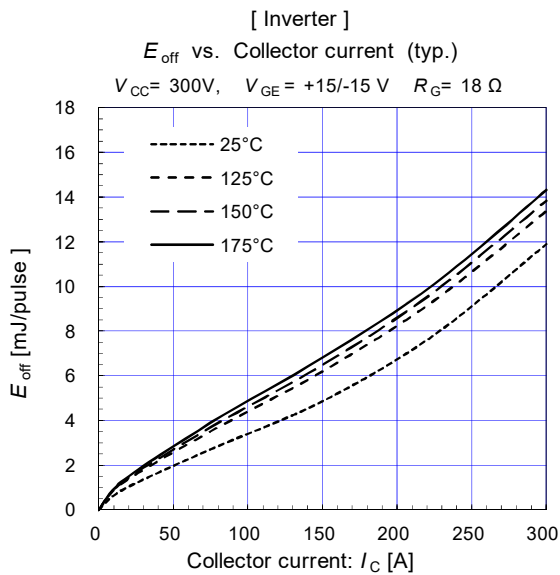
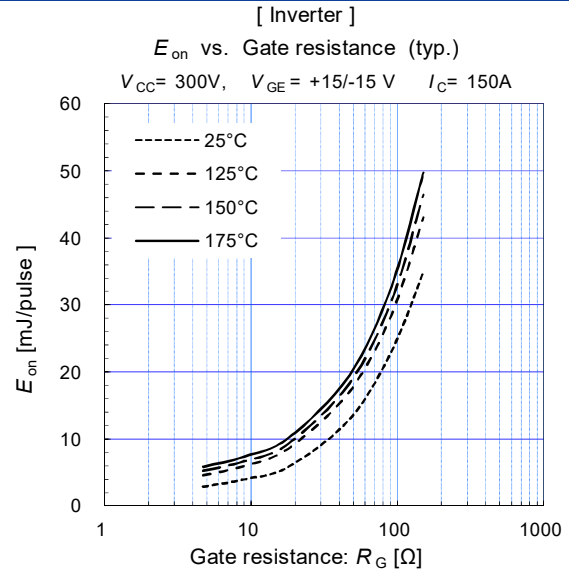
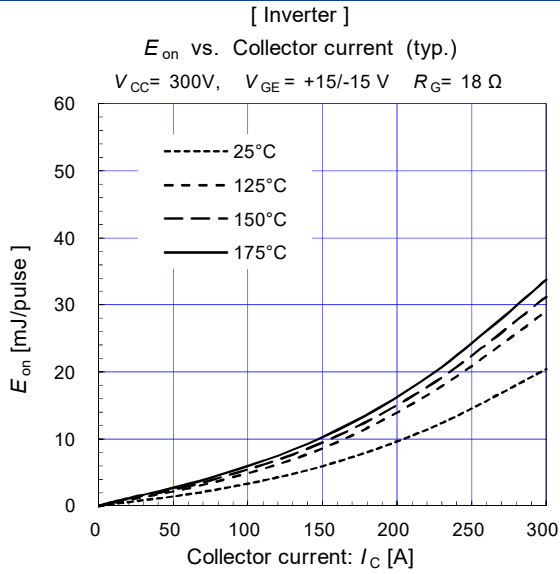
Dynamic Gate charge (typ.)

$V_{CC} = 300\text{V}$, $I_c = 150\text{A}$, $T_{vj} = 25^\circ\text{C}$



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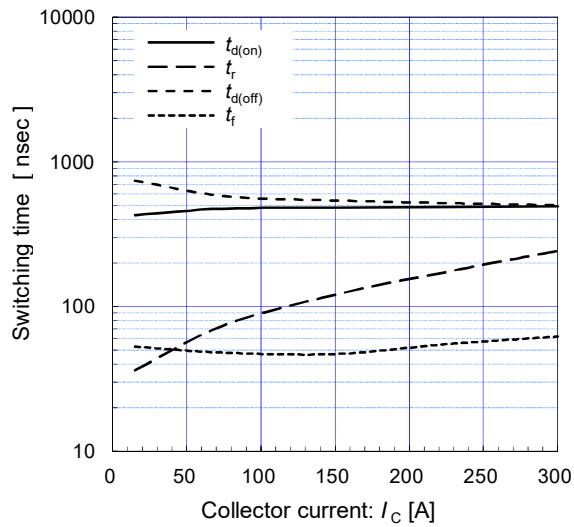
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IGBT Modules

[Inverter]

Switching time vs. Collector current (typ.)

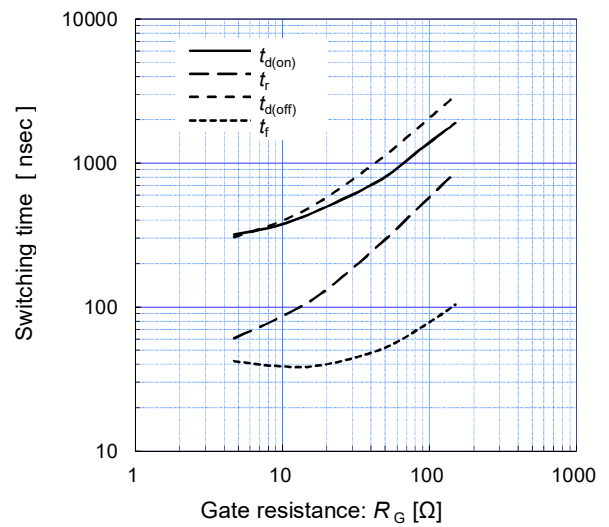
$V_{CC} = 300V$, $R_G = 18\Omega$ $V_{GE} = +15/-15V$, $T_{Vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

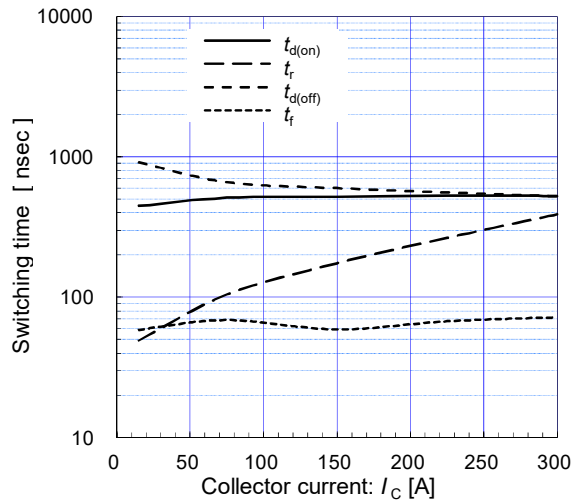
$V_{CC} = 300V$, $I_C = 150A$, $V_{GE} = +15/-15V$, $T_{Vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

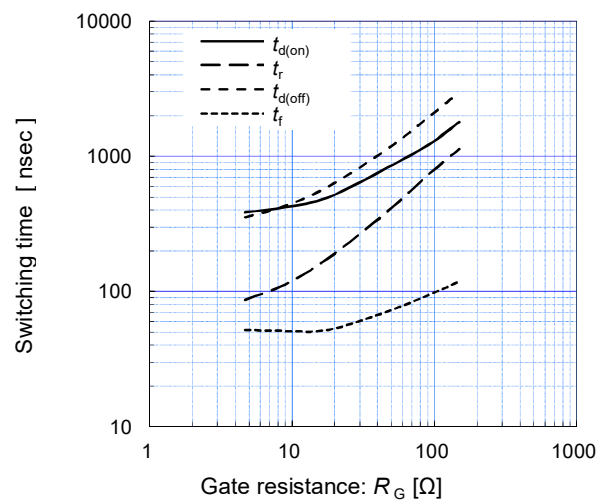
$V_{CC} = 300V$, $R_G = 18\Omega$ $V_{GE} = +15/-15V$, $T_{Vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

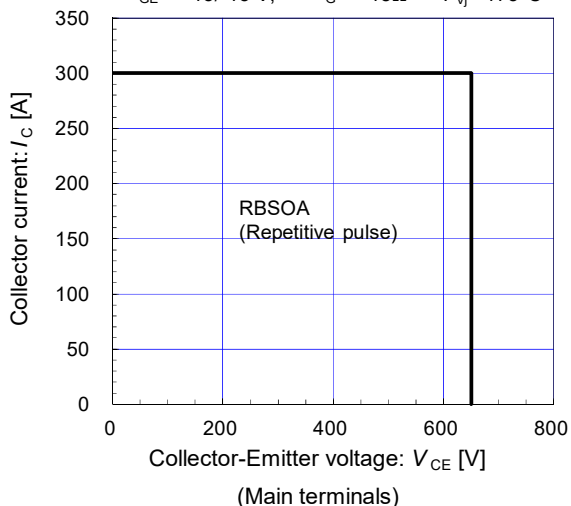
$V_{CC} = 300V$, $I_C = 150A$, $V_{GE} = +15/-15V$, $T_{Vj} = 175^\circ C$



[Inverter]

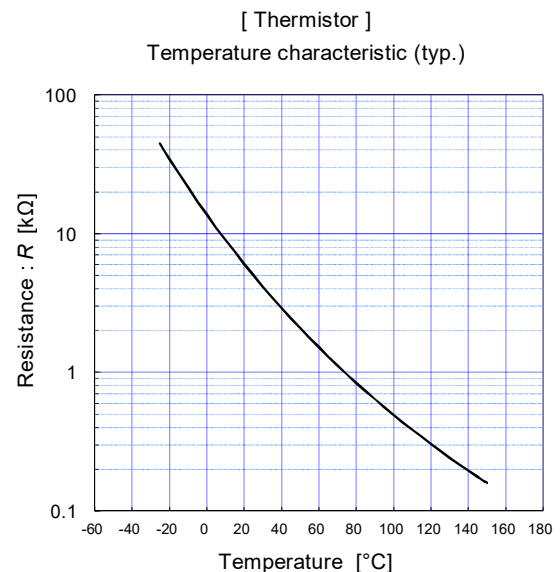
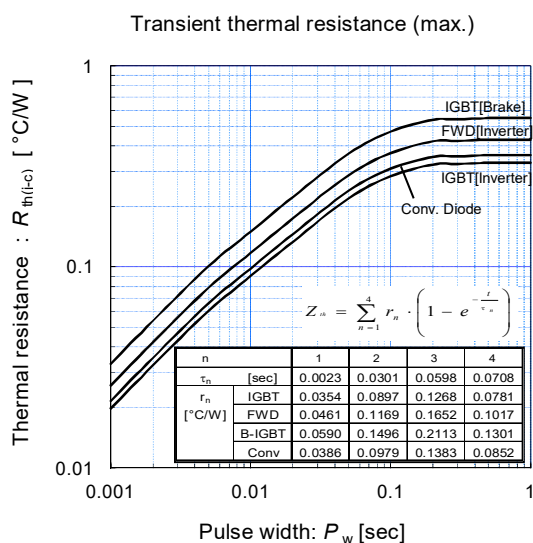
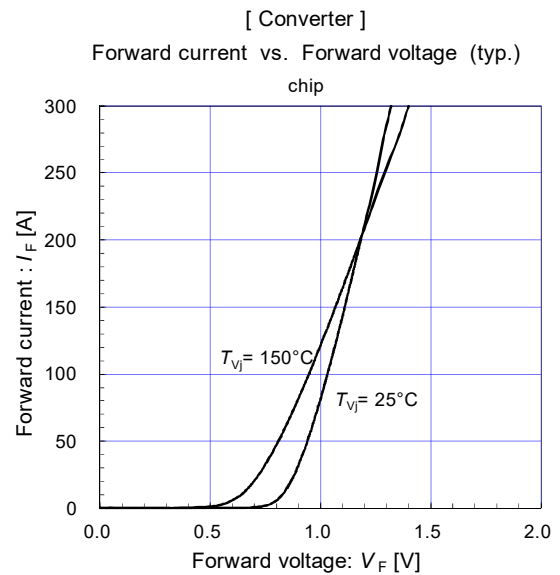
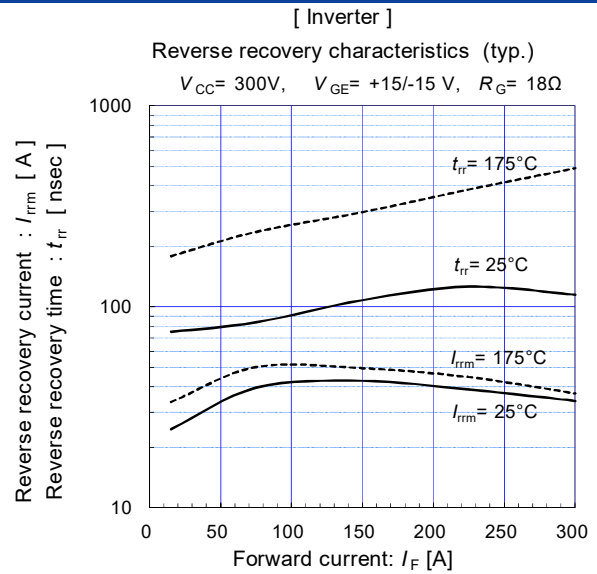
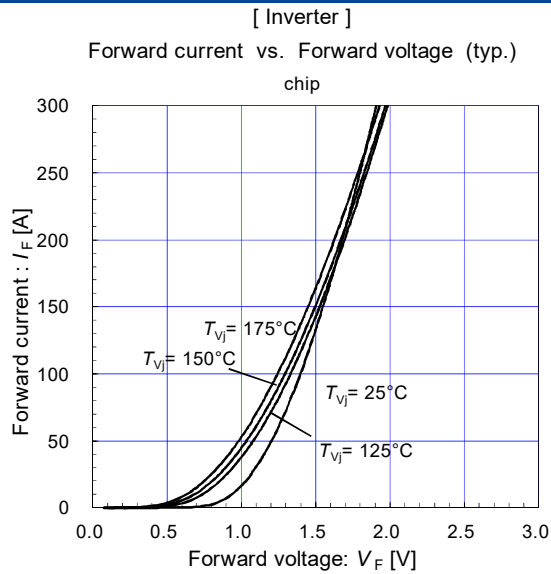
Reverse bias safe operating area (max.)

$V_{GE} = +15/-15V$, $R_G \geq 18\Omega$ $T_{Vj} = 175^\circ C$



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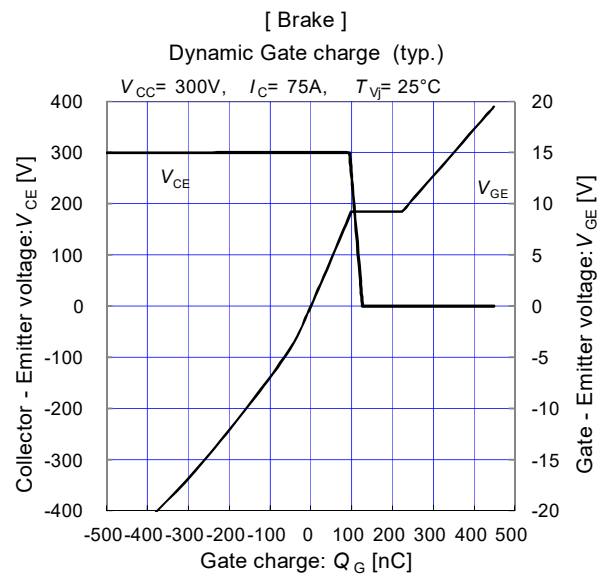
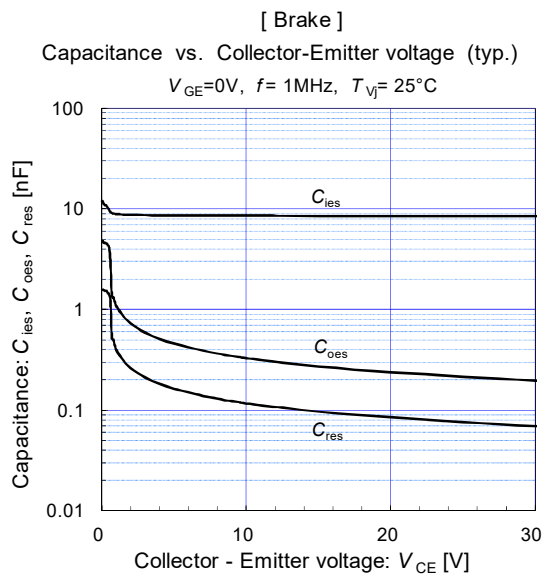
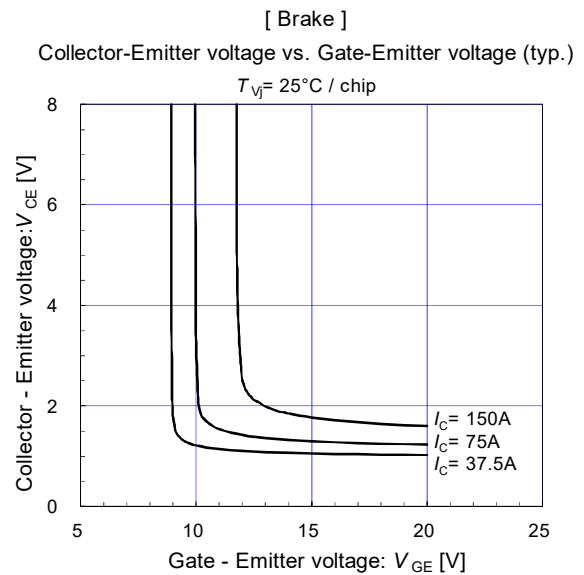
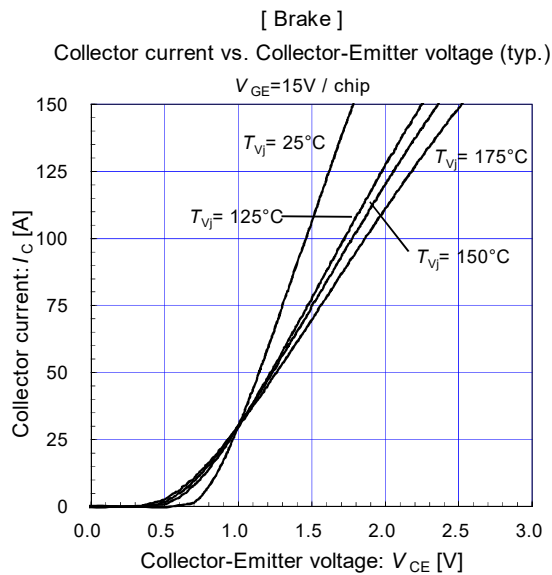
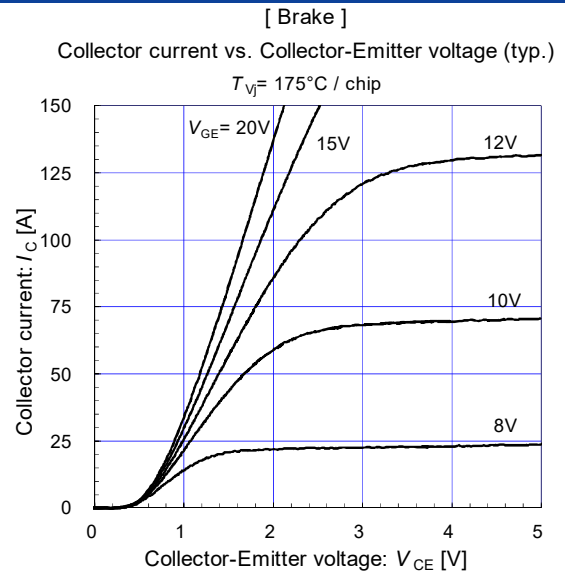
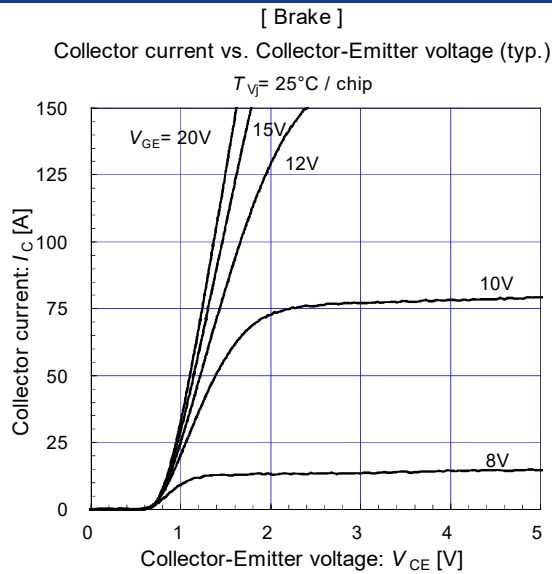


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IGBT Modules



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