

# 7MBR30XKC065-50

IGBT Modules

**Power Module(X series)**  
**650V / 30A / PIM**

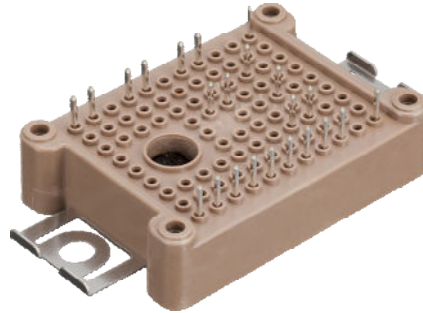
■ **Features**

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

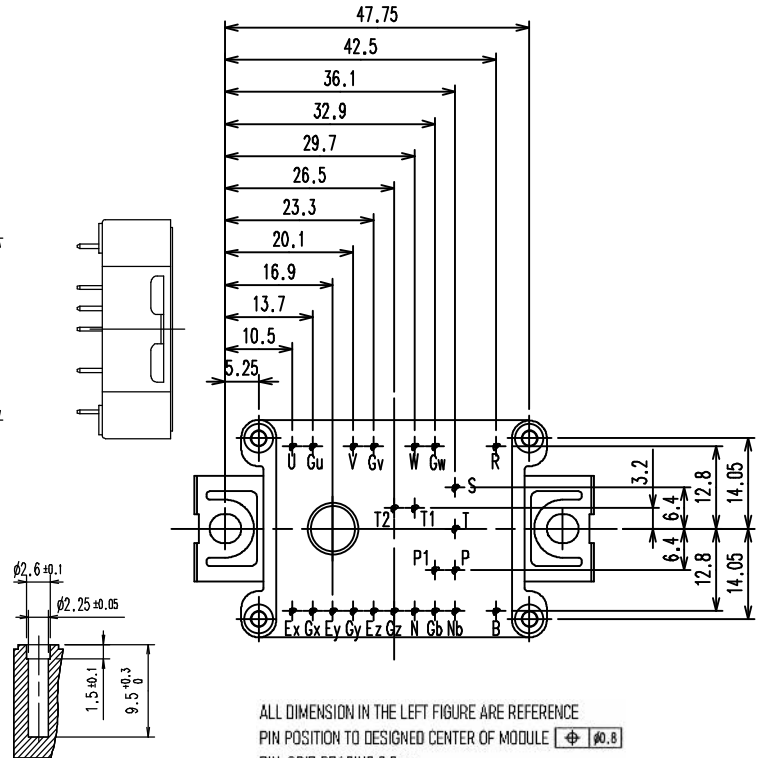
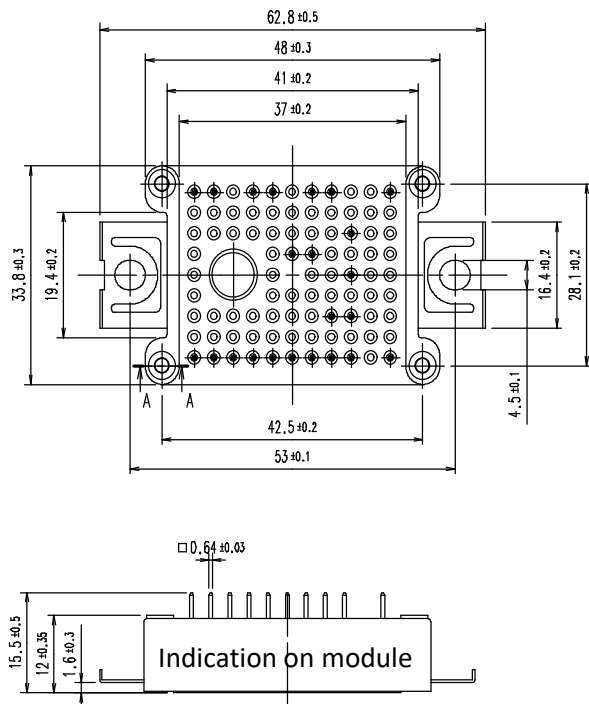
■ **Applications**

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

■ **Typical appearance**



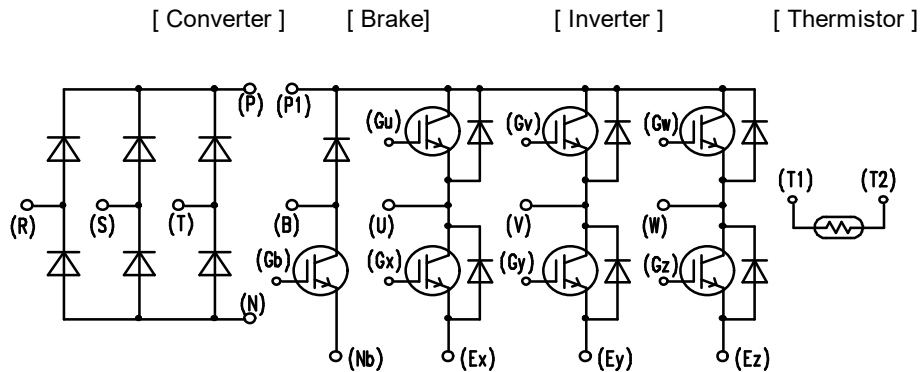
■ **Outline drawing ( Unit : mm )**



断面 A-A (1.5 : 1)  
SECTION A-A

Weight: 25 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, Gate-Emitter short-circuited	$V_{CES}$			650	V
	Gate-Emitter voltage, Collector-Emitter short-circuited	$V_{GES}$			$\pm 20$	V
	Collector current	$I_C$	Continuous	$T_c = 100^\circ\text{C}$	30	A
	Repetitive peak collector current	$I_{CRM}$	1ms		60	
	Forward current	$I_F$	Continuous		30	
	Repetitive peak forward current	$I_{FRM}$	1ms		60	
	Total power dissipation	$P_{tot}$	1 device		180	W
Brake IGBT	Collector-Emitter voltage, Gate-Emitter short-circuited	$V_{CES}$			650	V
	Gate-Emitter voltage, Collector-Emitter short-circuited	$V_{GES}$			$\pm 20$	V
	Collector current	$I_C$	Continuous	$T_c = 100^\circ\text{C}$	30	A
	Repetitive peak collector current	$I_{CRM}$	1ms		60	
Total power dissipation	$P_{tot}$	1 device		180	W	
Brake FWD	Forward current	$I_F$	Continuous		10	A
	Repetitive peak forward current	$I_{FRM}$	1ms		20	
	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	$T_c = 80^\circ\text{C}$	30	A
	Surge forward current (Non-Repetitive) (*1)	$I_{FSM}$	$t = 10\text{ms}$ , Half sine wave form	$T_{vj} = 25^\circ\text{C}$	390	A
				$T_{vj} = 150^\circ\text{C}$	340	
	$I^2t$ (Non-Repetitive) (*1)	$I^2t$		$T_{vj} = 25^\circ\text{C}$	760	$\text{A}^2\text{s}$
			$T_{vj} = 150^\circ\text{C}$	585		
Virtual junction temperature	$T_{vj}$	Inverter, Brake		175	$^\circ\text{C}$	
		Converter		150		
Operating virtual 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) between thermistor and others (*3)	$V_{isol}$	A.C. : 1min.		2500	Vrms
Screw torque	Mounting torque of screws to heat sink	$M_s$	M4		1.3 ~ 1.7	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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**IGBT Modules**
**■ Electrical characteristics ( at  $T_{vj} = 25^{\circ}\text{C}$  unless otherwise specified)**

Items	Symbols	Conditions	Characteristics			Units			
			min.	typ.	max.				
Collector-Emitter cut-off current, Gate-Emitter short-circuited	$I_{CES}$	$V_{GE} = 0\text{V}$ $V_{CE} = 650\text{V}$	-	-	50	$\mu\text{A}$			
Gate leakage current, Collector-Emitter short-circuited	$I_{GES}$	$V_{CE} = 0\text{V}$ $V_{GE} = +20/-20\text{V}$	-	-	100	nA			
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}$ $I_C = 30\text{mA}$	6.0	6.5	7.0	V			
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15\text{V}$ $I_C = 30\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.50	1.95	V		
			$T_{vj}=25^{\circ}\text{C}$	-	1.30	1.75			
	$T_{vj}=125^{\circ}\text{C}$		-	1.45	-				
	$T_{vj}=150^{\circ}\text{C}$		-	1.50	-				
	$T_{vj}=175^{\circ}\text{C}$		-	1.55	-				
Internal gate resistance	$r_g$	-	-	0	-	$\Omega$			
			Capacitance	$C_{ies}$	$V_{CE} = 10\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$	-	3.4	-	nF
						$C_{oes}$	-	0.13	
$C_{res}$	-	0.05					-		
Gate charge	$Q_G$	$V_{CC} = 300\text{V}$ $V_{GE} = -15 \rightarrow +15\text{V}$ $I_C = 30\text{A}$	-	240	-	nC			
Forward voltage	$V_F$ (terminal)	$I_F = 30\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	2.05	2.50	V		
			$T_{vj}=25^{\circ}\text{C}$	-	1.85	2.30			
	$T_{vj}=125^{\circ}\text{C}$		-	1.90	-				
	$T_{vj}=150^{\circ}\text{C}$		-	1.85	-				
	$T_{vj}=175^{\circ}\text{C}$		-	1.85	-				
Switching time (*1)	$t_{d(on)}$	$V_{CC} = 300\text{V}$ $I_C, I_F = 30\text{A}$ $L_s = 30\text{nH}$ $V_{GE} = +15/-15\text{V}$ $R_G = 15\ \Omega$	$T_{vj}=25^{\circ}\text{C}$	-	0.06	-	$\mu\text{s}$		
			$T_{vj}=125^{\circ}\text{C}$	-	0.06	-			
			$T_{vj}=150^{\circ}\text{C}$	-	0.06	-			
			$T_{vj}=175^{\circ}\text{C}$	-	0.06	-			
	$t_r$	$V_{CC} = 300\text{V}$ $I_C, I_F = 30\text{A}$ $L_s = 30\text{nH}$ $V_{GE} = +15/-15\text{V}$ $R_G = 15\ \Omega$	$T_{vj}=25^{\circ}\text{C}$	-	0.02	-			
			$T_{vj}=125^{\circ}\text{C}$	-	0.03	-			
			$T_{vj}=150^{\circ}\text{C}$	-	0.03	-			
			$T_{vj}=175^{\circ}\text{C}$	-	0.03	-			
	$t_{d(off)}$	$V_{CC} = 300\text{V}$ $I_C, I_F = 30\text{A}$ $L_s = 30\text{nH}$ $V_{GE} = +15/-15\text{V}$ $R_G = 15\ \Omega$	$T_{vj}=25^{\circ}\text{C}$	-	0.16	-			
			$T_{vj}=125^{\circ}\text{C}$	-	0.18	-			
			$T_{vj}=150^{\circ}\text{C}$	-	0.19	-			
			$T_{vj}=175^{\circ}\text{C}$	-	0.19	-			
	$t_f$	$V_{CC} = 300\text{V}$ $I_C, I_F = 30\text{A}$ $L_s = 30\text{nH}$ $V_{GE} = +15/-15\text{V}$ $R_G = 15\ \Omega$	$T_{vj}=25^{\circ}\text{C}$	-	0.04	-			
			$T_{vj}=125^{\circ}\text{C}$	-	0.04	-			
			$T_{vj}=150^{\circ}\text{C}$	-	0.04	-			
			$T_{vj}=175^{\circ}\text{C}$	-	0.04	-			
Reverse recovery time	$t_{rr}$	$V_{CC} = 300\text{V}$ $I_C, I_F = 30\text{A}$ $L_s = 30\text{nH}$ $V_{GE} = +15/-15\text{V}$ $R_G = 15\ \Omega$	$T_{vj}=25^{\circ}\text{C}$	-	0.07	-			
			$T_{vj}=125^{\circ}\text{C}$	-	0.11	-			
			$T_{vj}=150^{\circ}\text{C}$	-	0.12	-			
			$T_{vj}=175^{\circ}\text{C}$	-	0.14	-			

 (\*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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**IGBT Modules**

Items	Symbols	Conditions	Characteristics			Units	
			min.	typ.	max.		
Inverter Switching loss (per pulse)	$E_{on}$	$V_{CC} = 300V$ $I_C, I_F = 30A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 15\Omega$	$T_{vj}=25^\circ C$	-	0.44	-	mJ
			$T_{vj}=125^\circ C$	-	0.63	-	
			$T_{vj}=150^\circ C$	-	0.71	-	
			$T_{vj}=175^\circ C$	-	0.78	-	
	$E_{off}$	$V_{CC} = 300V$ $I_C, I_F = 30A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 15\Omega$	$T_{vj}=25^\circ C$	-	0.82	-	
			$T_{vj}=125^\circ C$	-	1.04	-	
			$T_{vj}=150^\circ C$	-	1.12	-	
			$T_{vj}=175^\circ C$	-	1.15	-	
	$E_{rr}$	$V_{CC} = 300V$ $I_C, I_F = 30A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 15\Omega$	$T_{vj}=25^\circ C$	-	0.24	-	
			$T_{vj}=125^\circ C$	-	0.38	-	
			$T_{vj}=150^\circ C$	-	0.42	-	
			$T_{vj}=175^\circ C$	-	0.50	-	
Collector-Emitter cut-off current, Gate-Emitter short-circuited	$I_{CES}$	$V_{GE} = 0V$ $V_{CE} = 650V$	-	-	50	$\mu A$	
Gate leakage current, Collector-Emitter short-circuited	$I_{GES}$	$V_{CE} = 0V, \quad V_{GE} = +20/-20V$	-	-	100	nA	
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 30A$	$T_{vj}=25^\circ C$	-	1.50	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	-	
Internal gate resistance	$r_g$	-	$T_{vj}=25^\circ C$	-	0	-	$\Omega$
			$T_{vj}=125^\circ C$	-	0.06	-	
			$T_{vj}=150^\circ C$	-	0.06	-	
			$T_{vj}=175^\circ C$	-	0.06	-	
Brake Switching time (*1)	$t_{d(on)}$	$V_{CC} = 300V$ $I_C = 30A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 15\Omega$	$T_{vj}=25^\circ C$	-	0.06	-	$\mu s$
			$T_{vj}=125^\circ C$	-	0.06	-	
			$T_{vj}=150^\circ C$	-	0.06	-	
			$T_{vj}=175^\circ C$	-	0.06	-	
	$t_r$	$V_{CC} = 300V$ $I_C = 30A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 15\Omega$	$T_{vj}=25^\circ C$	-	0.02	-	
			$T_{vj}=125^\circ C$	-	0.03	-	
			$T_{vj}=150^\circ C$	-	0.03	-	
			$T_{vj}=175^\circ C$	-	0.03	-	
	$t_{d(off)}$	$V_{CC} = 300V$ $I_C = 30A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 15\Omega$	$T_{vj}=25^\circ C$	-	0.16	-	
			$T_{vj}=125^\circ C$	-	0.18	-	
			$T_{vj}=150^\circ C$	-	0.19	-	
			$T_{vj}=175^\circ C$	-	0.19	-	
	$t_f$	$V_{CC} = 300V$ $I_C = 30A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 15\Omega$	$T_{vj}=25^\circ C$	-	0.04	-	
			$T_{vj}=125^\circ C$	-	0.04	-	
			$T_{vj}=150^\circ C$	-	0.04	-	
			$T_{vj}=175^\circ C$	-	0.04	-	
Reverse current	$I_{RRM}$	$V_R = 650V$	-	-	50	$\mu A$	
Forward voltage	$V_F$ (terminal)	$I_F = 10A$	$T_{vj}=25^\circ C$	-	1.75	2.20	V
			$T_{vj}=125^\circ C$	-	1.55	2.00	
	$V_F$ (chip)	$I_F = 10A$	$T_{vj}=125^\circ C$	-	1.50	-	
			$T_{vj}=150^\circ C$	-	1.50	-	
Thermistor Converter	$R$	$T = 25^\circ C$ $T = 100^\circ C$	$T_{vj}=25^\circ C$	-	5000	-	$\Omega$
			$T_{vj}=125^\circ C$	-	495	520	
			$T_{vj}=150^\circ C$	-	495	520	
			$T_{vj}=175^\circ C$	-	495	520	
Reverse current	$I_{RRM}$	$V_R = 800V$	-	-	50	$\mu A$	
			-	-	50	$\mu A$	
Continuous (direct) forward voltage	$V_{FM}$	$I_F = 30A$	terminal	-	1.25	1.70	V
			chip	-	1.05	1.50	
Resistance	$R$	$T = 25^\circ C$ $T = 100^\circ C$	-	5000	-	$\Omega$	
B value	$B$	$T = 25/50^\circ C$	3305	3375	3450	K	

 (\*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 junction to case (1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.82	K/W
		Inverter FWD	-	-	1.50	
		Brake IGBT	-	-	0.82	
		Brake FWD	-	-	1.92	
		Converter Diode	-	-	0.75	
Thermal resistance case to heat sink(*1) (1 device)	$R_{th(c-f)}$	Inverter IGBT	-	0.75	-	
		Inverter FWD	-	0.92	-	
		Brake IGBT	-	0.78	-	
		Brake FWD	-	0.80	-	
		Converter Diode	-	0.79	-	

(\*1) This is the value which is defined mounting on the additional cooling fin with 1 W/(m·K) thermal grease.

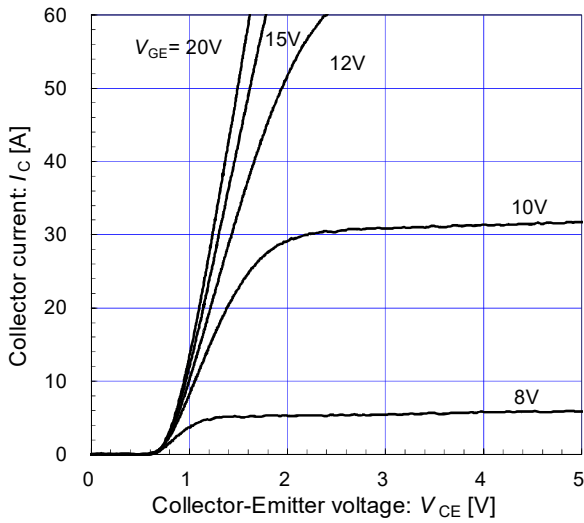
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IGBT Modules

[ Inverter ]

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

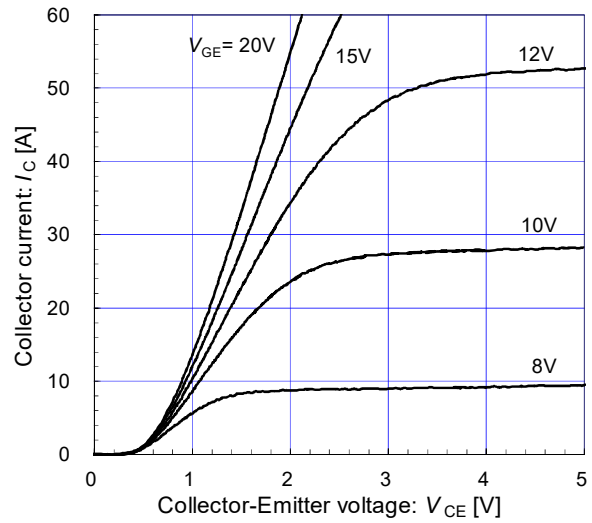
$T_{vj} = 25^{\circ}\text{C}$  / chip



[ Inverter ]

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

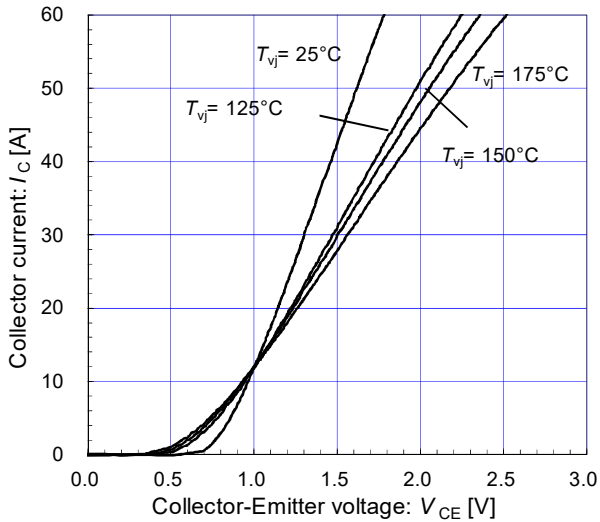
$T_{vj} = 175^{\circ}\text{C}$  / chip



[ Inverter ]

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

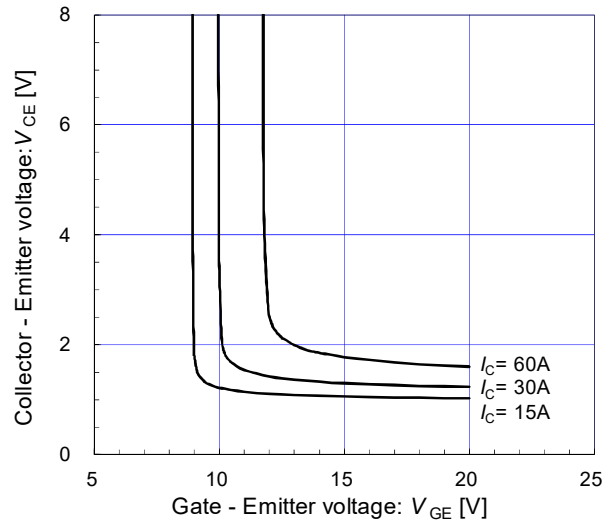
$V_{GE} = 15\text{V}$  / chip



[ Inverter ]

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

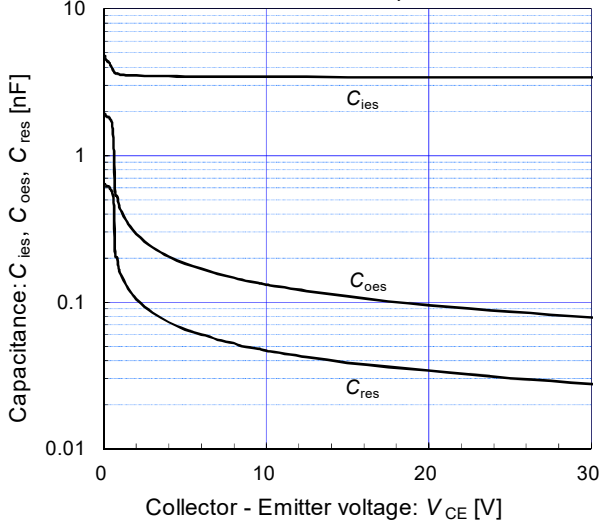
$T_{vj} = 25^{\circ}\text{C}$  / chip



[ Inverter ]

Capacitance vs. Collector-Emittor voltage (typ.)

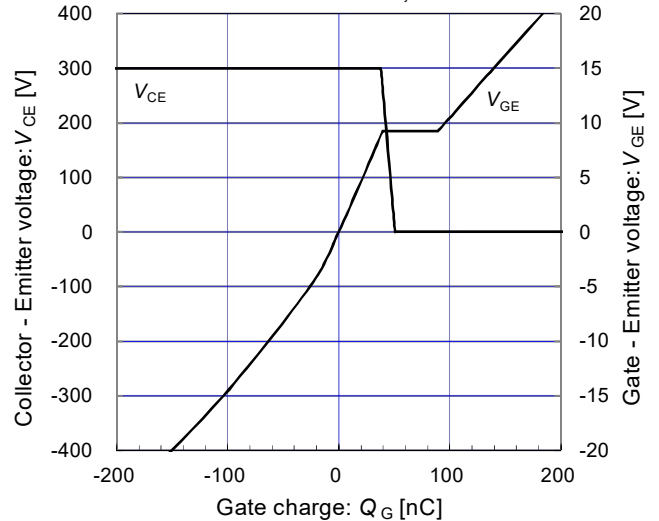
$V_{GE} = 0\text{V}$ ,  $f = 1\text{MHz}$ ,  $T_{vj} = 25^{\circ}\text{C}$



[ Inverter ]

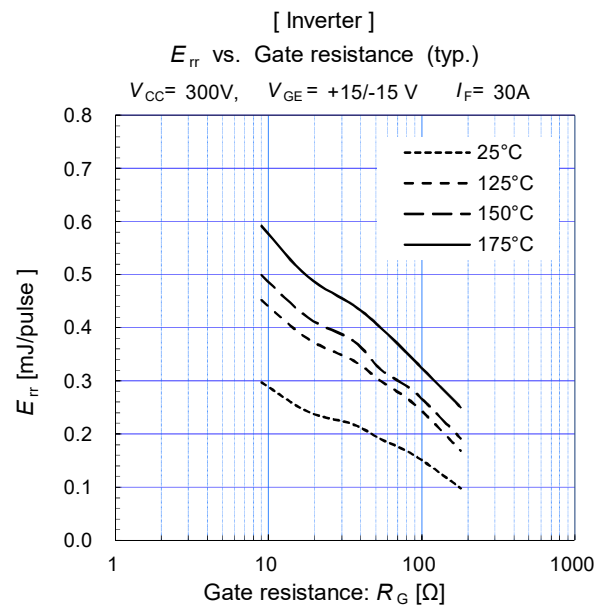
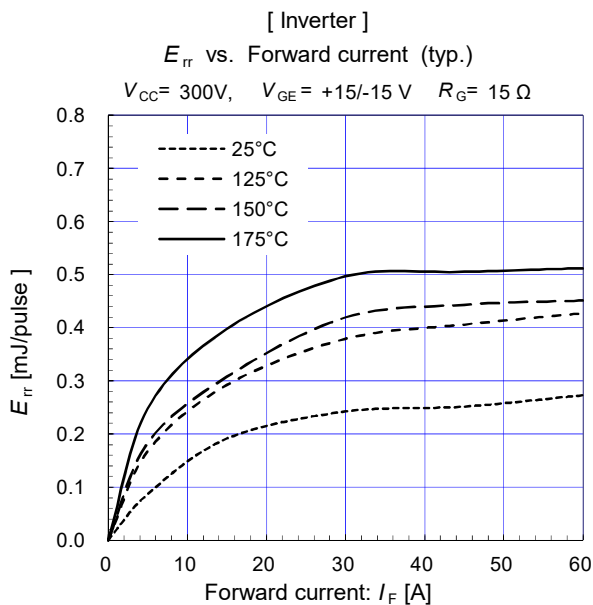
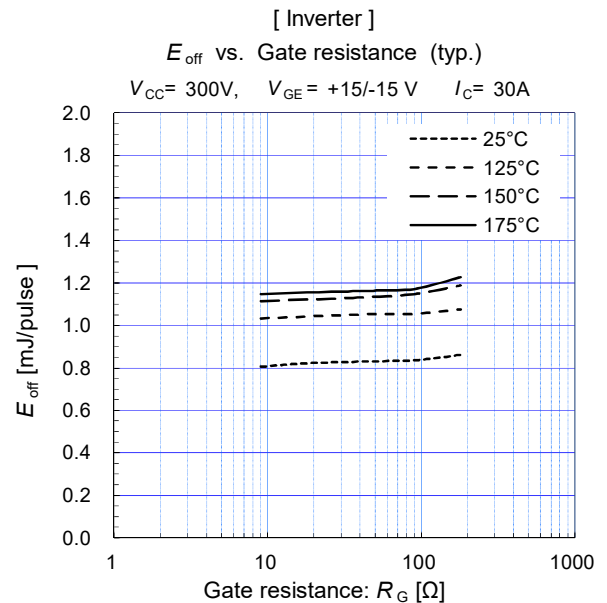
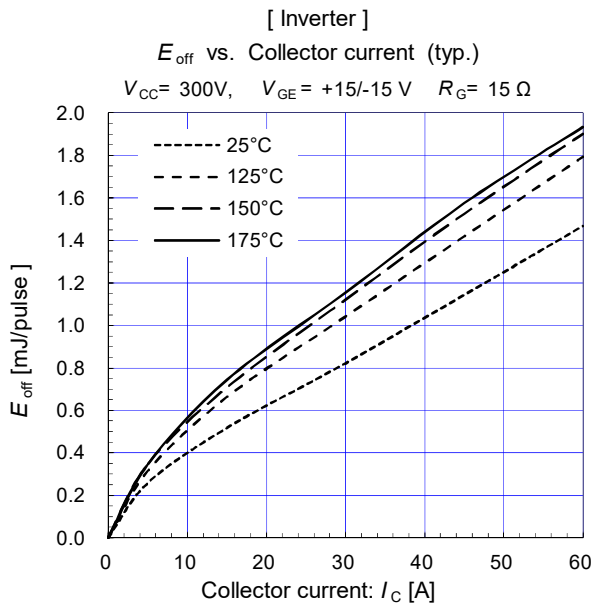
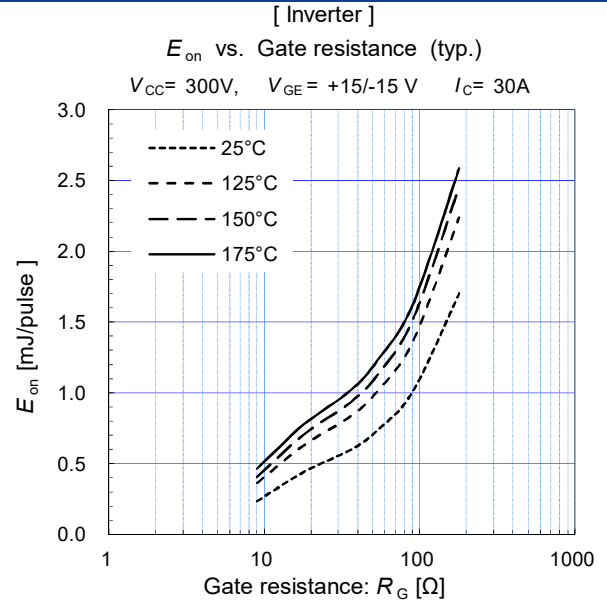
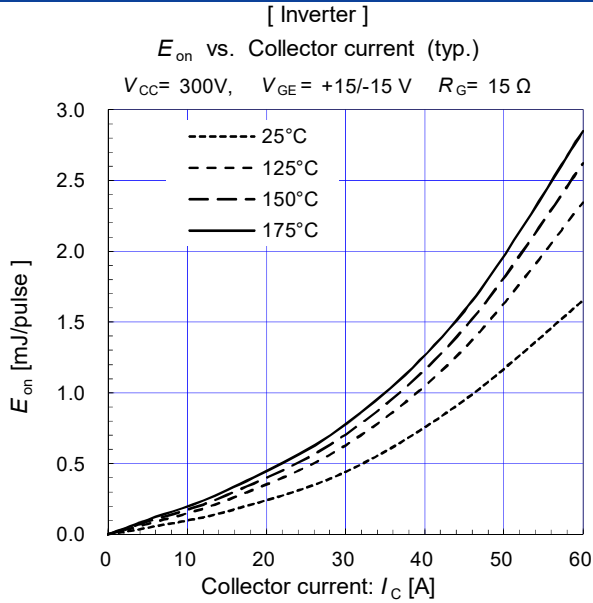
Dynamic gate charge (typ.)

$V_{CC} = 300\text{V}$ ,  $I_C = 30\text{A}$ ,  $T_{vj} = 25^{\circ}\text{C}$



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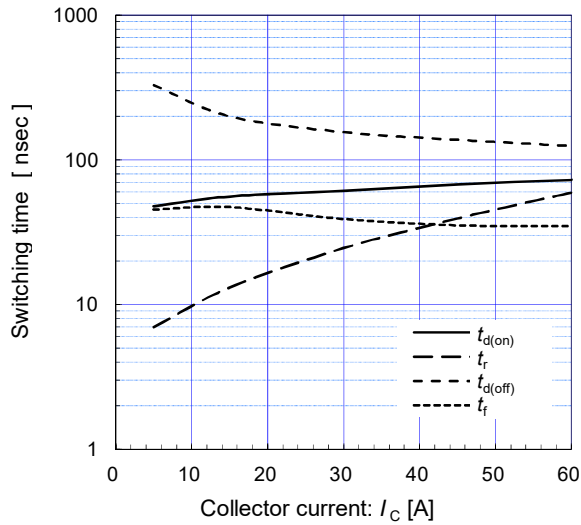
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IGBT Modules

[ Inverter ]

Switching time vs. Collector current (typ.)

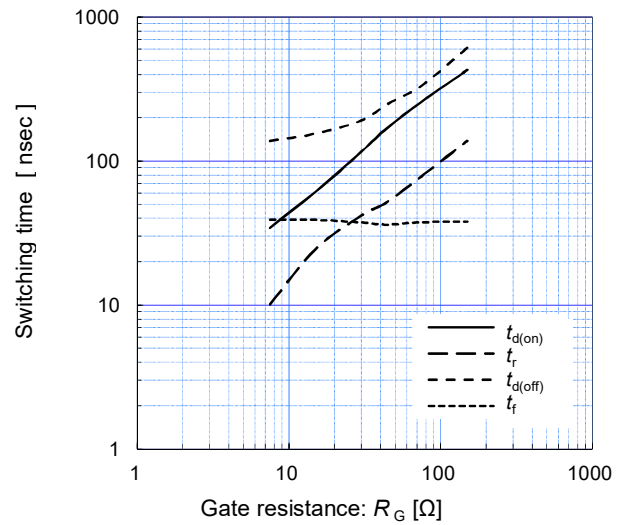
$V_{CC}=300V, R_G=15\Omega, V_{GE}=+15/-15V, T_{vj}=25^\circ C$



[ Inverter ]

Switching time vs. Gate resistance (typ.)

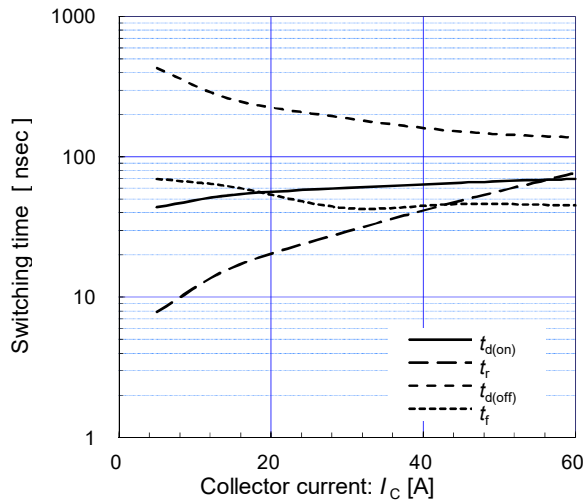
$V_{CC}=300V, I_C=30A, V_{GE}=+15/-15V, T_{vj}=25^\circ C$



[ Inverter ]

Switching time vs. Collector current (typ.)

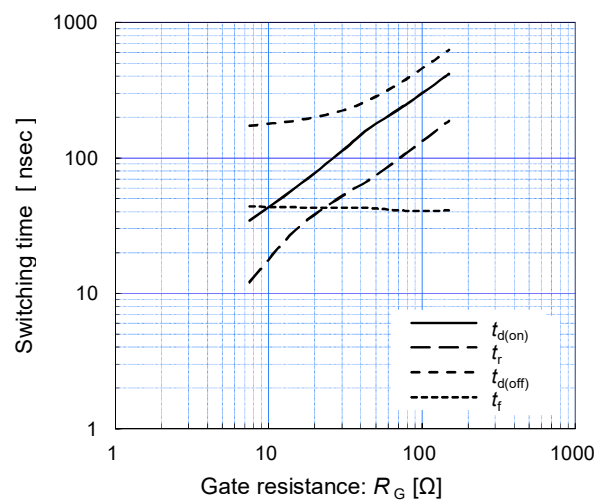
$V_{CC}=300V, R_G=15\Omega, V_{GE}=+15/-15V, T_{vj}=175^\circ C$



[ Inverter ]

Switching time vs. Gate resistance (typ.)

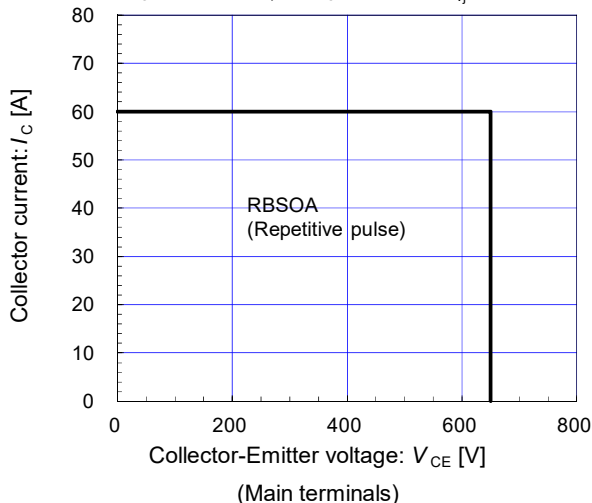
$V_{CC}=300V, I_C=30A, V_{GE}=+15/-15V, T_{vj}=175^\circ C$



[ Inverter ]

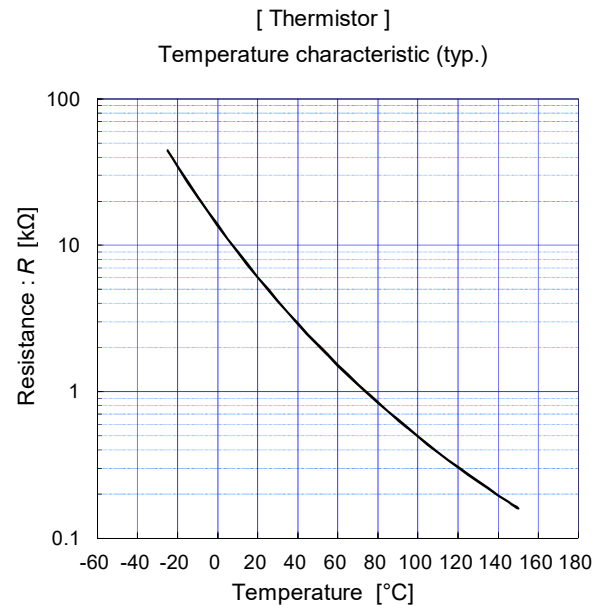
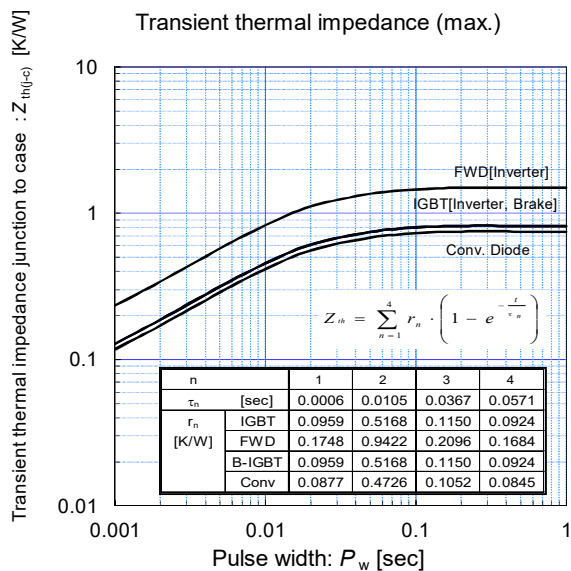
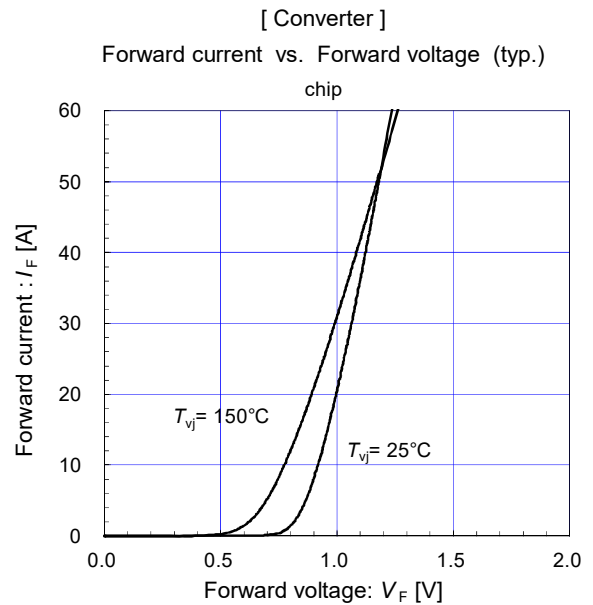
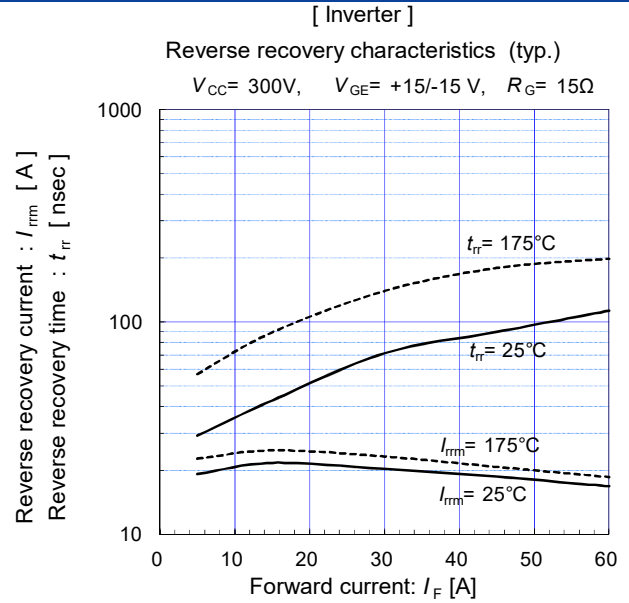
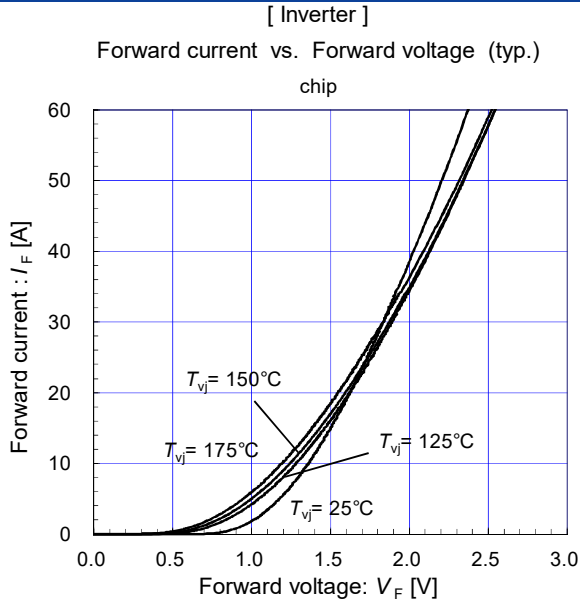
Reverse bias safe operating area (max.)

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



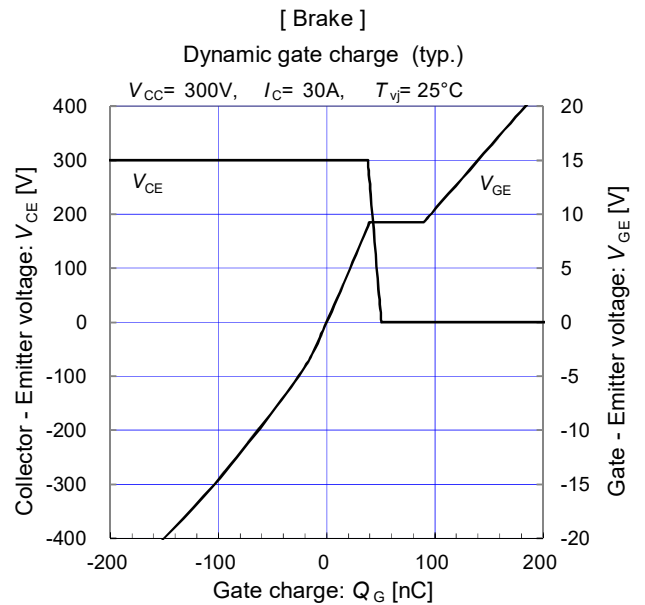
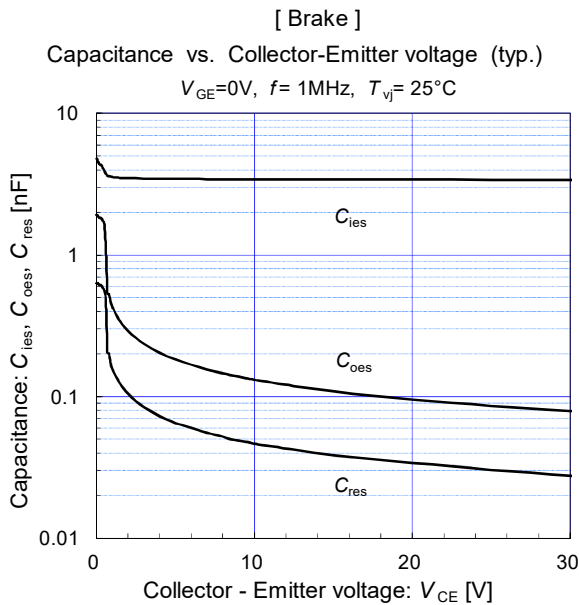
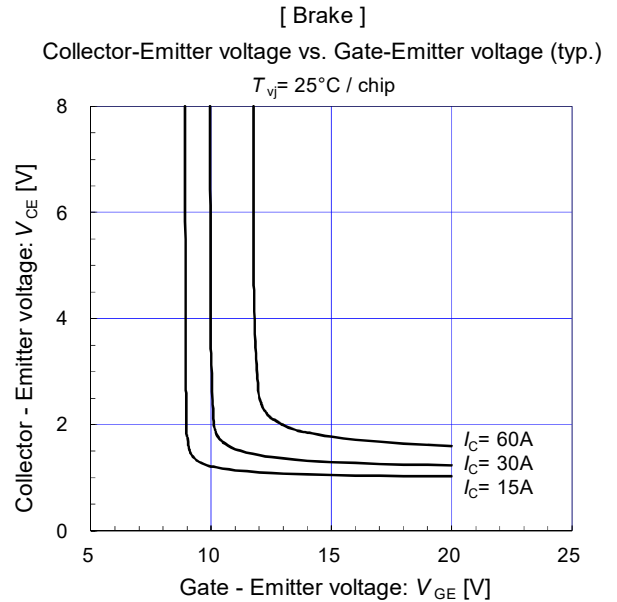
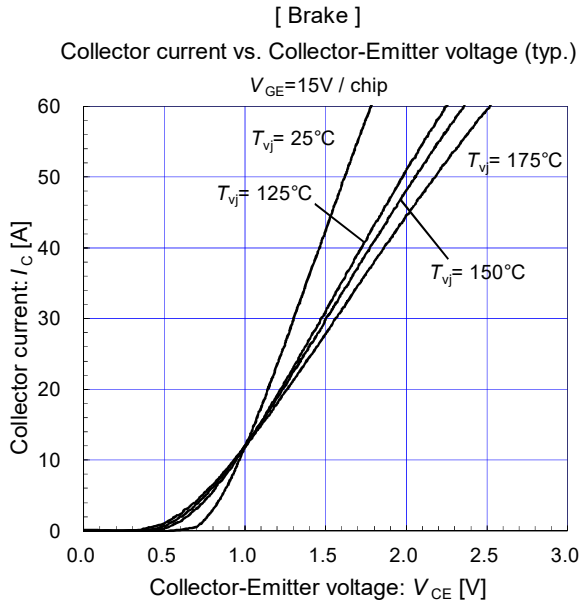
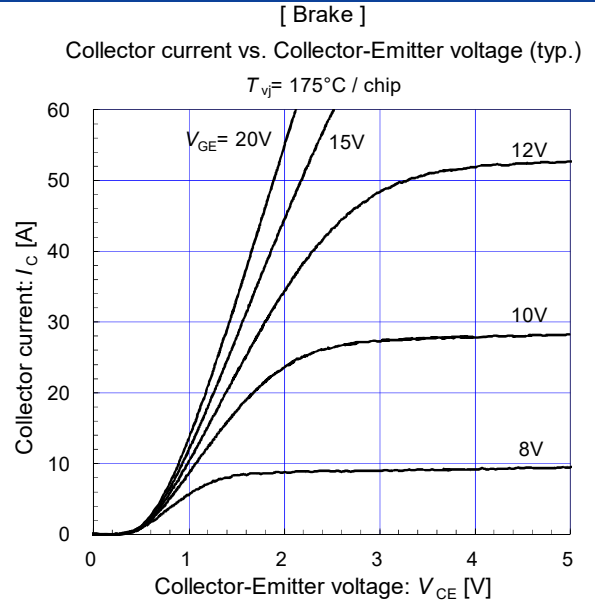
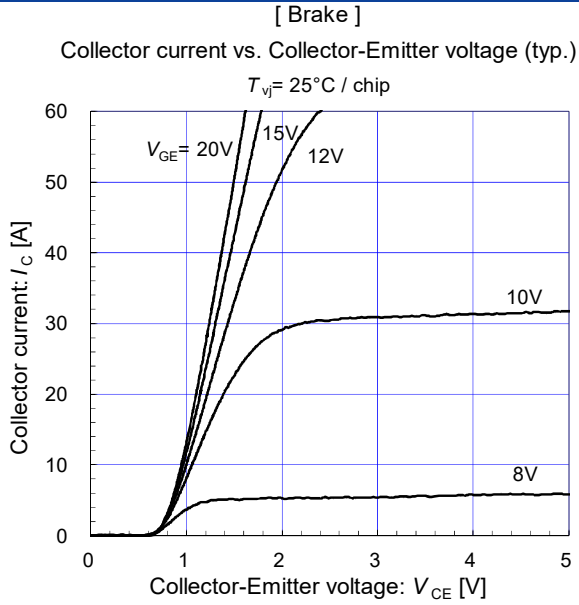
# 7MBR30XKC065-50

IGBT Modules



# 7MBR30XKC065-50

**IGBT Modules**



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## IGBT Modules

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