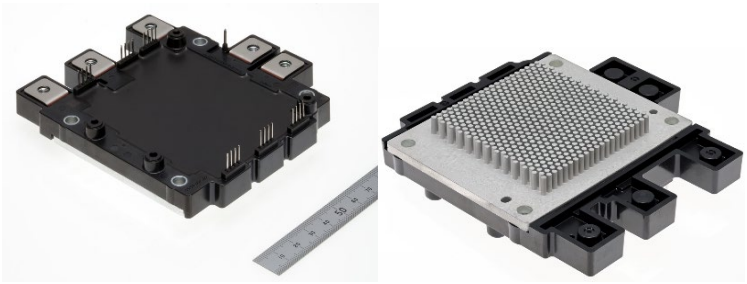
<IGBT Modules>

CT700CJ1A060-A

HIGH POWER SWITCHING USE
INSULATED TYPE



Collector current I_C	**700** A
Collector-emitter voltage V_{CES}	**650** V

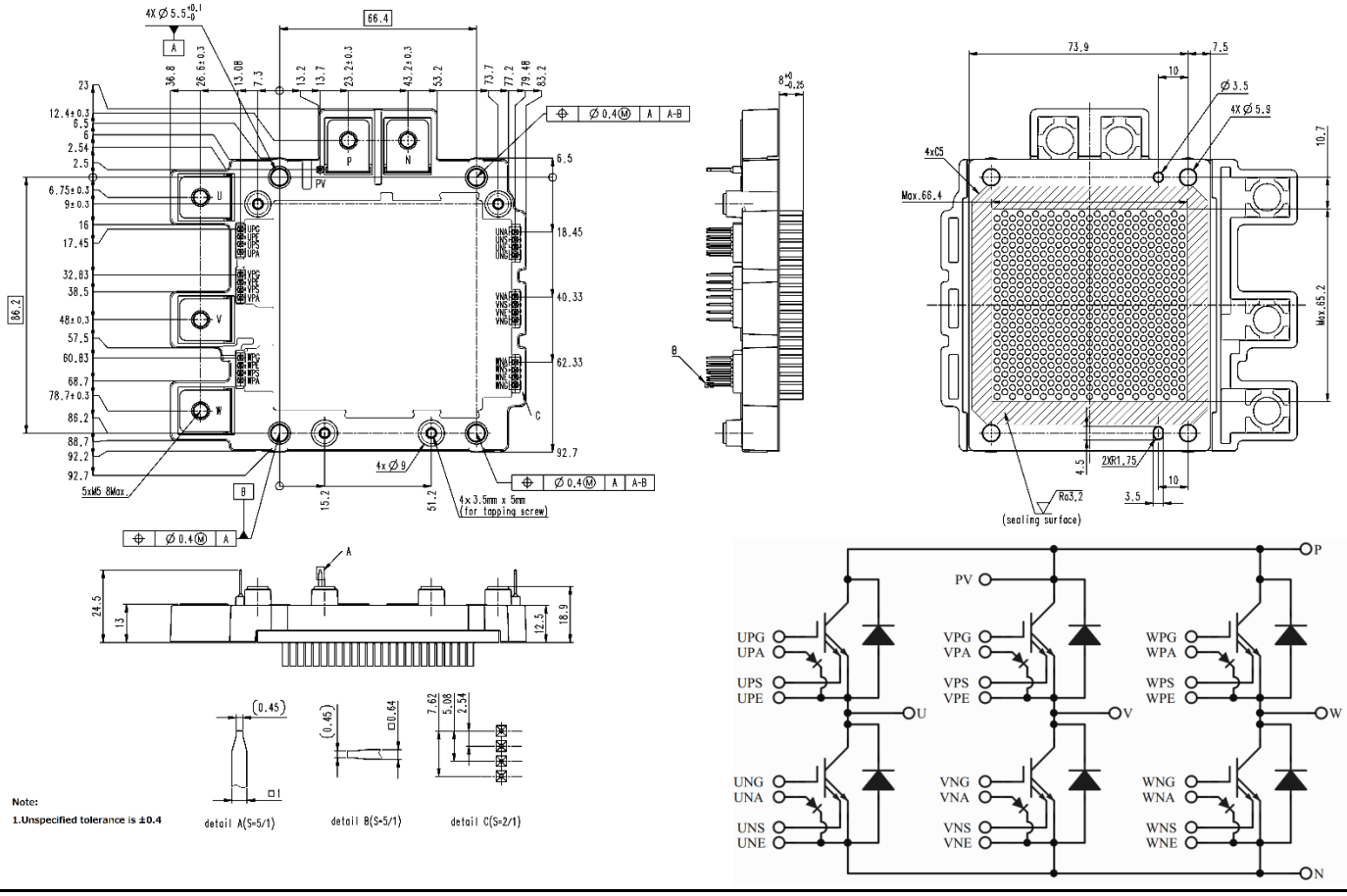
- ●High-Reliability DLB structure*Note
- ●Direct cooling package with cooling fin
- ●Compact, light-weight, high-power-density module
- ●6-Elements package (6-in-1, insulated type)
- ●Low internal impedance package
- ●Low-loss CSTBT™ chip technology*Note
- ●Built-in on-chip temperature sensor
- ●Built-in on-chip current sensor for SC protection
- ●Compliant with RoHS directive 2011/65/EU
- ●High strength material(Al)

*Note DLB: Direct-Lead-Bonding (Wire-bond-Less power contacts); CSTBT™: Carrier Stored Trench Gate Bipolar Transistor

APPLICATION

EV/HEV and High Reliability Inverter

PACKAGE OUTLINES & CIRCUIT DIAGRAM Unit : mm



CT700CJ1A060-A

HIGH POWER SWITCHING USE
INSULATED TYPE

ABSOLUTE MAXIMUM RATINGS (T_{vj} = 25°C, unless otherwise noted)

Symbol	Item	Conditions	Ratings	Unit
V_{CES}	Collector-emitter voltage	-40°C ≤ T_{vj} < 25°C, V_{GE} = 0V	650	V
		25°C ≤ T_{vj} ≤ 150 °C, V_{GE} = 0V	714	V
		25°C ≤ T_{vj} ≤ 150 °C, V_{GE} = 0V (Non-repetition of abnormal operation)	750	V
V_{GES}	Gate-emitter voltage	V_{GE} = 0V	±20	V
I_C	Collector current	T_W = 25°C	700	A
I_{CRM}	Peak collector current	T_W = 25°C, Repetitive, pulse(Note 1)	1400	A
I_E	Emitter current	T_W = 25°C	700	A
I_{ERM}	Peak emitter current	T_W = 25°C, Repetitive, pulse(Note 1)	1400	A
P_{tot}	Maximum collector dissipation	T_W = 25°C, T_{vj} =175°C	773	W
T_{vj}	Junction temperature	Repetition	-40 ~ +150	°C
		Non-repetition, Accumulated time 100hour	+150 ~ +175	°C
T_{stg}	Storage temperature	—	-40 ~ +125	°C
V_{isol}	Isolation voltage	Main terminals to base plate, AC 1 minute, 60Hz	2500	Vrms

MECHANICAL RATINGS

Symbol	Item	Conditions		Limits			Unit
				Min.	Typ.	Max.	
—	Tightening torque strength	Main terminal screw : M5	Torque coefficient =0.32	2.8	3.2	6.0	Nm
		Mounting screw : M5		2.8	3.2	6.0	Nm
—	Weight	Typical value		—	340	—	g

ELECTRICAL CHARACTERISTICS (T_{vj} = 25°C, unless otherwise noted)

Symbol	Item	Conditions			Limits			Unit
					Min.	Typ.	Max.	
I_{CES}	Collector cut-off current	V_{CE} = V_{CES}, V_{GE} = 0V			—	—	1	mA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C = 70mA, V_{CE} = 10V			5.5	6.5	7.5	V
I_{GES}	Gate leakage current	V_{GE} = V_{GES}			—	—	15	µA
V_{CEsat}	Collector-emitter saturation voltage	I_C = 700A, V_{GE} = 15V	T_{vj} = 25°C	Main terminal	—	1.60	1.89	V
				Chip	—	1.25	—	V
			T_{vj}=125°C	Main terminal	—	1.70	2.01	V
				Chip	—	1.25	—	V
V_{EC}	Emitter-collector voltage	I_E = 700A, V_{GE} = 0V, T_{vj} = 25°C		Main terminal	—	1.60	1.89	V
				Chip	—	1.45	—	V
C_{ies}	Input capacitance	V_{CE} = 10V, V_{GE} = 0V, T_{vj} = 25°C			—	57	—	nF
C_{oes}	Output capacitance				—	7.7	—	nF
C_{res}	Reverse transfer capacitance				—	1.0	—	nF
V_F	On-chip temperature-sense diode voltage	I_F = 200µA			2.65	2.75	2.85	V
		I_F = 200µA, T_{vj} = 125°C			1.98	2.08	2.18	V
$t_{d(on)}$	Turn-on delay time	V_{CC} = 350V, I_C = I_E = 700A, V_{GE} = 15V, T_{vj} = 125°C, $R_{G(on)}$ = 3.6Ω (dI_C/dt≒4.5kA/µs), $R_{G(off)}$ = 4.7Ω (dI_C/dt≒4.0kA/µs), Ls=15nH, Inductive load switching operation. Note) see switching measurement circuit on page6			—	0.25	—	µs
t_r	Turn-on rise time				—	0.16	—	µs
E_{on}	Turn-on loss				—	34.4	—	mJ/p
$t_{d(off)}$	Turn-off delay time				—	1.00	—	µs
t_f	Turn-off fall time				—	0.22	—	µs
E_{off}	Turn-off loss				—	56.8	—	mJ/p
t_{rr}	Reverse-recovery time				—	0.26	—	µs
Q_{rr}	Reverse-recovery charge				—	50.3	—	µC
E_{rr}	Reverse-recovery loss				—	15.9	—	mJ/p

THERMAL RESISTANCES

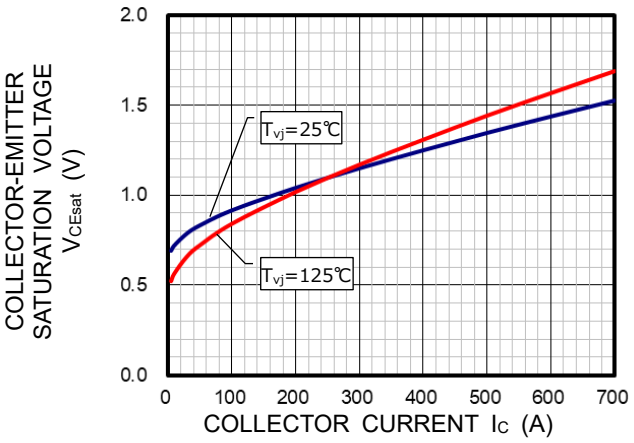
Symbol	Item	Conditions		Limits			Unit
				Min.	Typ.	Max.	
$R_{th(j-w)Q}$	Junction-water thermal resistance	IGBT part (1/6 module)	50% LLC : Flow rate:10L/min	—	0.164	0.194	K/W
$R_{th(j-w)D}$		FWD part (1/6 module)		—	0.180	0.212	K/W

Note1 : Pulse width and repetition rate should be such that the device junction temperature (T_{vj}) dose not exceed maximum ratings.

PERFORMANCE CURVES

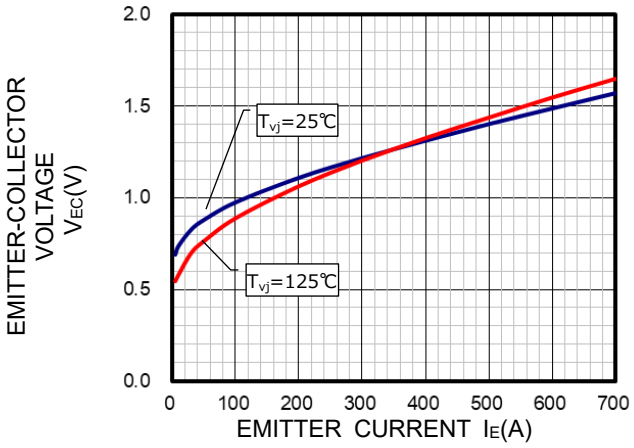
COLLECTOR-EMITTER SATURATION CHARACTERISTICS (Representative Example:Main terminal)

V_{GE}=15V



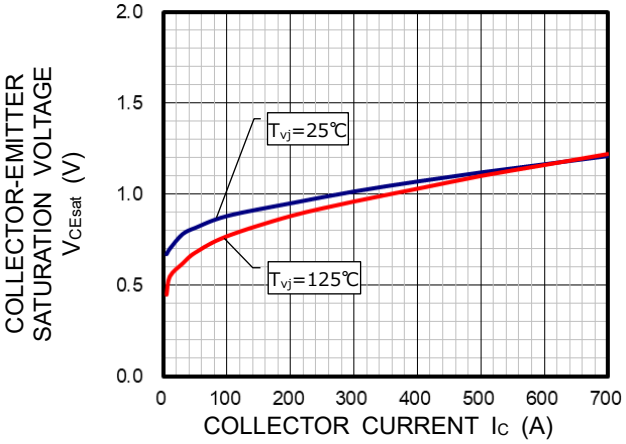
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (Representative Example:Main terminal)

V_{GE}=0V



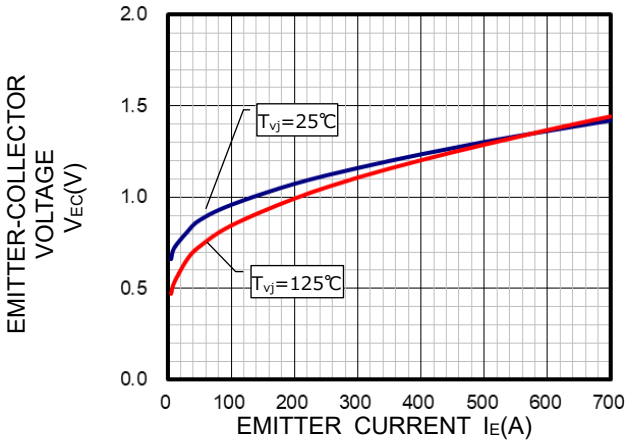
COLLECTOR-EMITTER SATURATION CHARACTERISTICS (Representative Example:Chip)

V_{GE}=15V



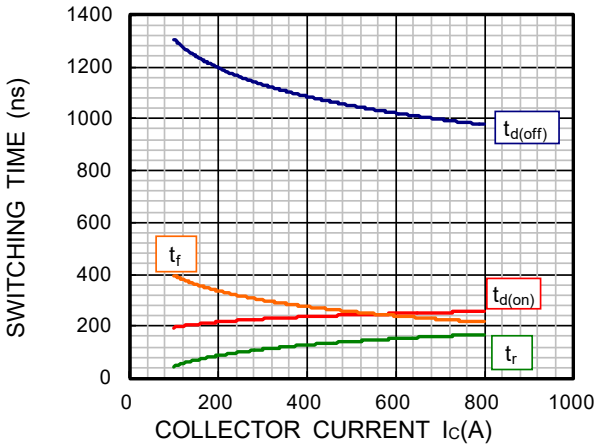
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (Representative Example:Chip)

V_{GE}=0V



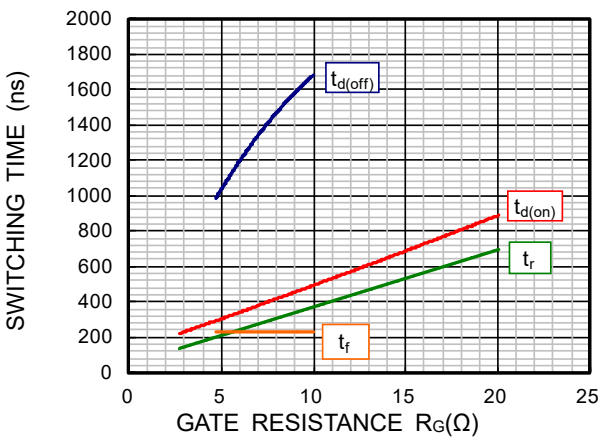
SWITCHING CHARACTERISTICS (Representative Example)

V_{CC}=350V, V_{GE}=15V, $R_{G(on)}$=3.6Ω, $R_{G(off)}$=4.7Ω,
T_{vj}=125°C, Ls=15nH, Inductive load

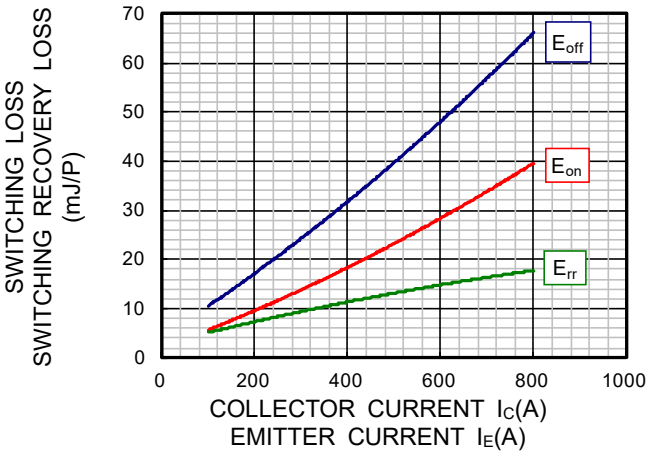


SWITCHING CHARACTERISTICS (Representative Example)

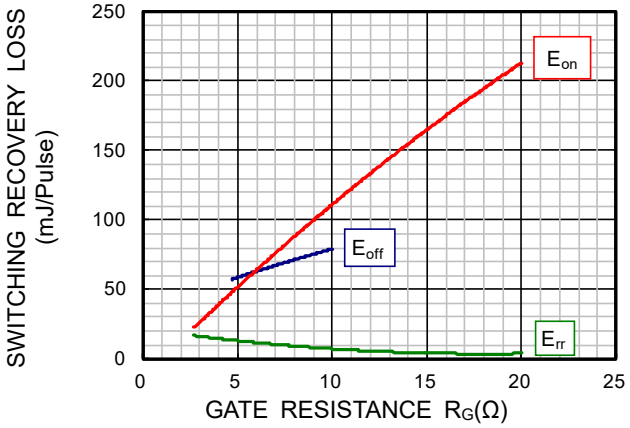
V_{CC}=350V, I_C=700A, V_{GE}=15V,
T_{vj}=125°C, Ls=15nH, Inductive load



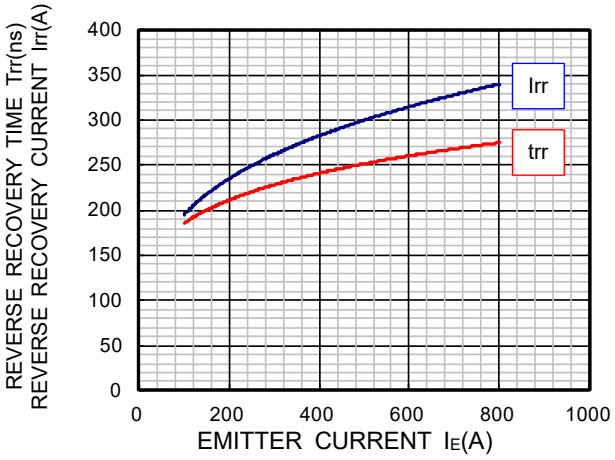
SWITCHING CHARACTERISTICS
(Representative Example)
V_{CC}=350V, V_{GE}=15V, $R_{G(on)}$=3.6Ω, $R_{G(off)}$=4.7Ω,
T_{vj}=125°C, Ls=15nH, Inductive load



SWITCHING CHARACTERISTICS
(Representative Example)
V_{CC}=350V, I_C=I_E=700A, V_{GE}=15V,
T_{vj}=125°C, Ls=15nH, Inductive load

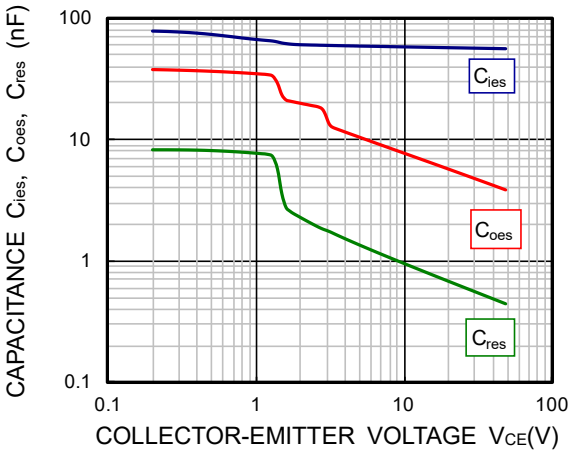


FREE-WHEEL DIODE REVERSE RECOVERY CHARACTERISTICS
(Representative Example)
V_{CC}=350V, V_{GE}=15V, $R_{G(on)}$=3.6Ω
T_{vj}=125°C, Ls=15nH, Inductive load

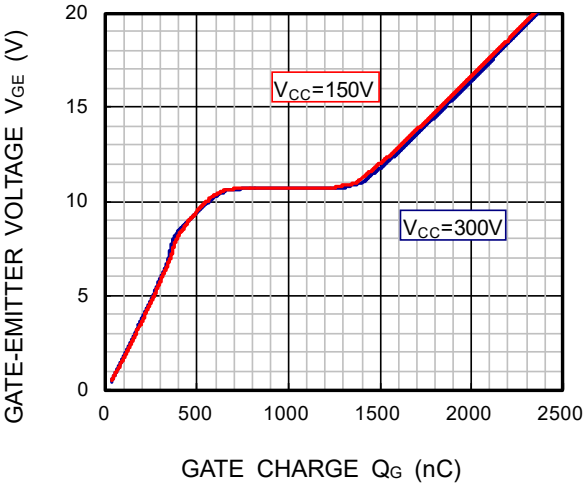


CAPACITANCE-vs.-VCE CHARACTERISTICS
(Representative Example)

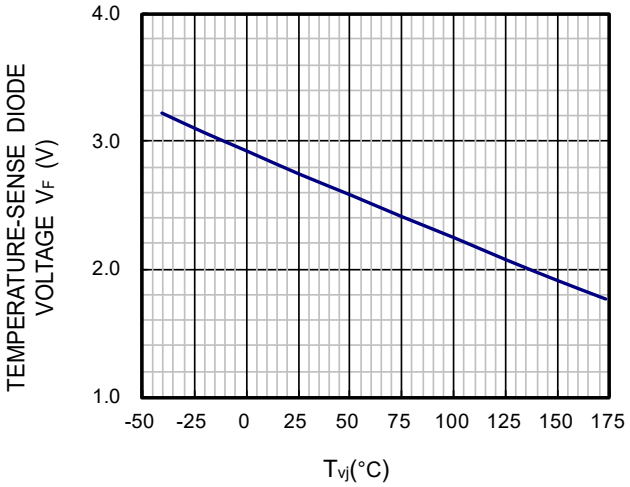
T_{vj}=25°C



GATE CHARGE CHARACTERISTICS
(Representative Example)
I_C=700A, T_{vj}=25°C

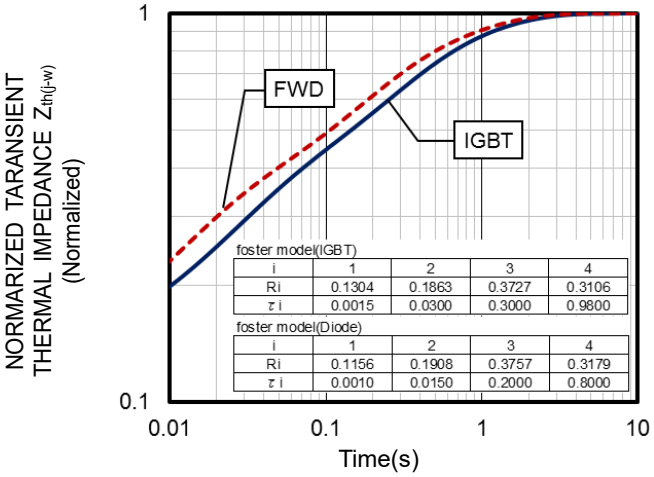


ON-CHIP TEMPERATURE-SENSE DIODE CHARACTERISTICS
(Representative Example)
I_F=200μA



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (Representative Example)

IGBT part:Per unit base=$R_{th(j-w)Q}$=0.164K/W
FWD part:Per unit base=$R_{th(j-w)D}$=0.180K/W



foster model(IGBT)

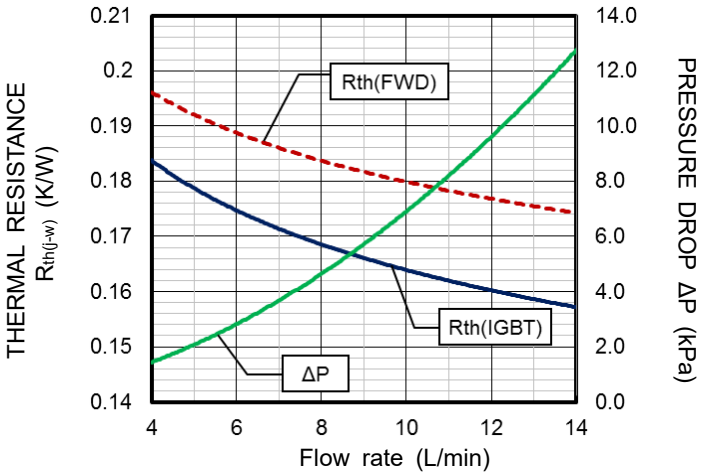
i	1	2	3	4
Ri	0.1304	0.1863	0.3727	0.3106
τ i	0.0015	0.0300	0.3000	0.9800

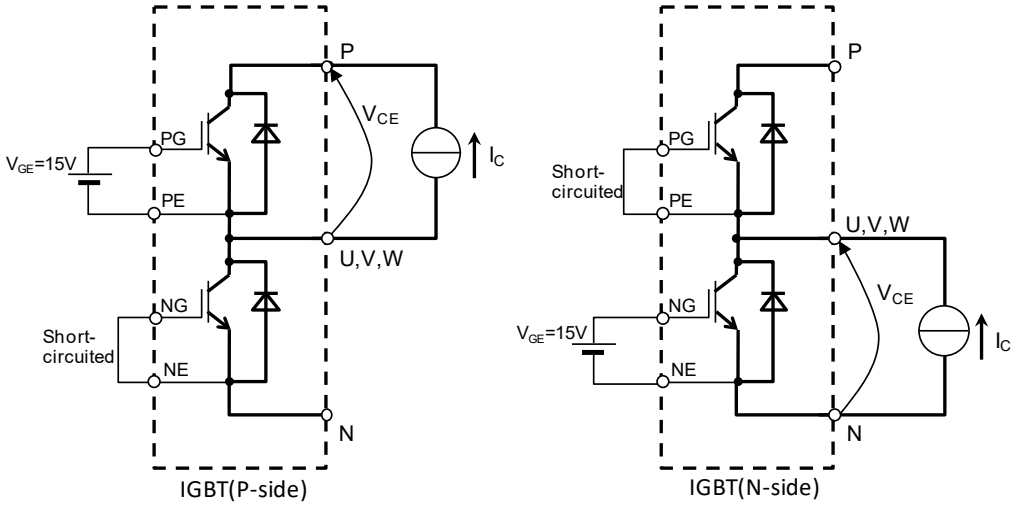
foster model(Diode)

i	1	2	3	4
Ri	0.1156	0.1908	0.3757	0.3179
τ i	0.0010	0.0150	0.2000	0.8000

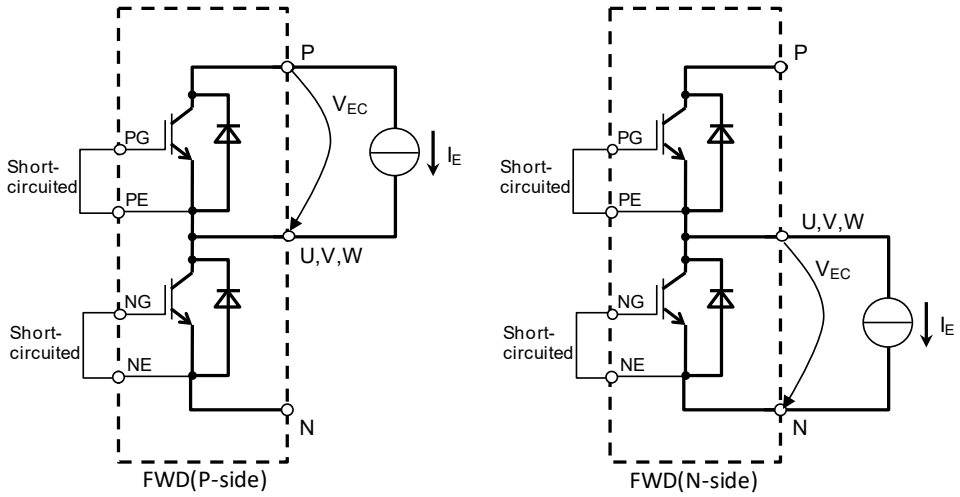
THERMAL RESISTANCE, PRESSURE DROP CHARACTERISTICS (Representative Example)

Tw=60°C, 50%LLC
cooling jacket(J1WJB)



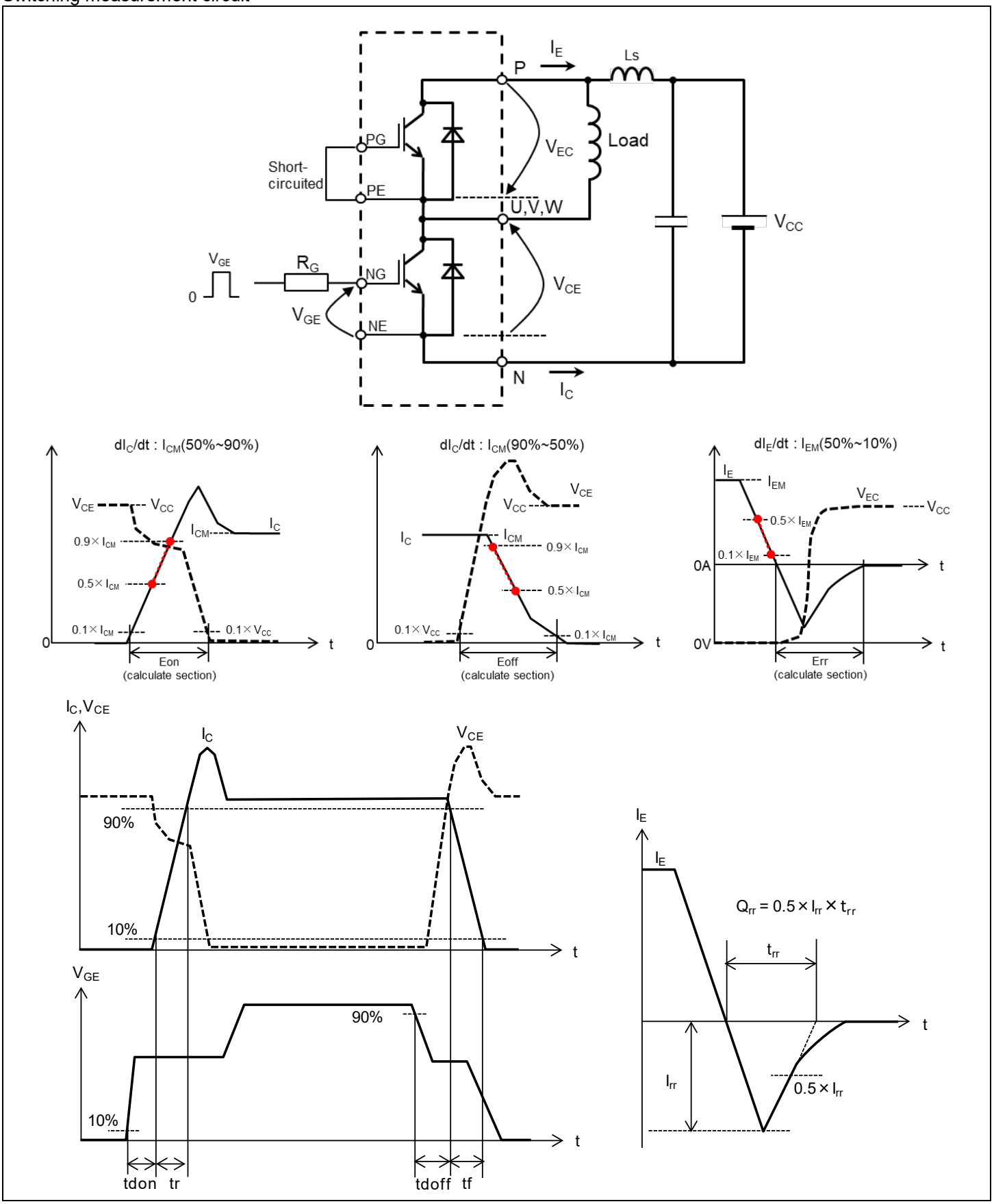


V_{CEsat} Measurement circuit (Main terminal)



V_{EC} Measurement circuit (Main terminal)

Switching measurement circuit



Correct and Safety Use of Power Module

Unsuitable operation (such as electrical, mechanical stress and so on) may lead to damage of power modules.
Please pay attention to the following descriptions and use Mitsubishi Electric's IGBT modules according to the guidance.

⚠ CAUTION	
During Transit	(1) Keep shipping cartons right side up. If stress is applied by either placing a carton upside down or by leaning a box against something, terminals can be bent and/or resin packages can be damaged. (2) Tossing or dropping of a carton may damage devices inside. (3) If a device gets wet with water, malfunctioning and failure may result. Special care should be taken during rain or snow to prevent the devices from getting wet.
Storage	The temperature and humidity of the storage place should be 5~35°C and 45~75% respectively. The performance and reliability of devices may be jeopardized if devices are stored in an environment far above or below the range indicated above.
Prolonged Storage	When storing devices more than one year, dehumidifying measures should be provided for the storage place. When using devices after a long period of storage, make sure to check the exterior of the devices is free from scratches, dirt, rust, and so on.
Operating Environment	Devices should not be exposed to water, organic solvents, corrosive gases, explosive gases, fine particles, or corrosive agents, since any of those can lead to a serious accident.
Flame Resistance	Although the epoxy resin is in conformity with UL 94-V0 standards, it should be noted that those are not non-flammable.
Anti-electrostatic Measures	Following precautions should be taken for MOS-gated devices to prevent static buildup which could damage the devices. (1) Precautions against the device rupture caused by static electricity Static electricity of human bodies and cartons and/or excessive voltage applied across the gate to emitter may damage and rupture devices. Sense-emitter and temperature-sensor are also vulnerable to excessive voltage. The basis of anti-electrostatic is suppression of build-up and quick dissipation of the charged electricity. ① Containers that are susceptible to static electricity should not be used for transit or for storage. ② Signal terminals to emitter should be always shorted with a carbon cloth or the like until right before a module is used. Never touch the signal terminals with bare hands. ③ Always ground the equipment and your body during installation (after removing a carbon cloth or the like. It is advisable to cover the workstation and its surrounding floor with conductive mats and ground them. ④ It should be noted that devices may get damaged by the static electricity charged to a printed circuit board if the signal terminals to emitter of the circuit board are open. ⑤ Use soldering irons with grounded tips. (2) Precautions when the signal terminals to emitter are open ① Voltage should not be applied across the collector to emitter when the signal terminals to emitter are open. ② The signal terminals to emitter should be shorted before removing a device from a unit.

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