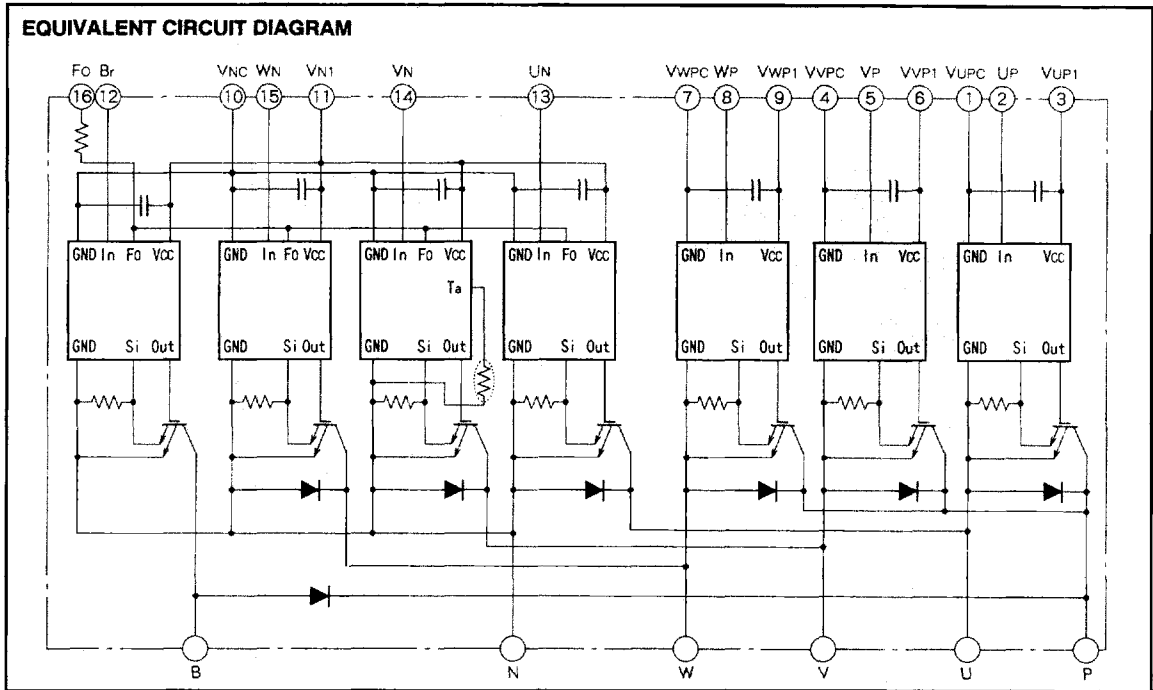


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FLAT-BASE TYPE
INSULATED PACKAGE



MAXIMUM RATINGS ($T_j = 25^\circ\text{C}$, unless otherwise noted)
INVERTER PART

Symbol	Parameter	Conditions	Ratings	Unit
Vcc	Supply voltage	Applied between : P-N	900	V
Vcc(surge)	Supply voltage (surge)	Applied between : P-N, surge value	1000	V
Vces	Collector-emitter voltage		1200	V
$\pm I_c$	Collector current	$T_c = 25^\circ\text{C}$	15	A
$\pm I_{cP}$	Collector current (peak)	$T_c = 25^\circ\text{C}$	30	A
Pc	Collector dissipation	$T_c = 25^\circ\text{C}$	96	W
Tj	Junction temperature		-20~+150	$^\circ\text{C}$

BRAKE PART

Symbol	Parameter	Conditions	Ratings	Unit
Vcc	Supply voltage	Applied between : P-N	900	V
Vcc(surge)	Supply voltage (surge)	Applied between : P-N, surge value	1000	V
Vces	Collector-emitter voltage		1200	V
Ic	Collector current	$T_c = 25^\circ\text{C}$	10	A
IcP	Collector current (peak)	$T_c = 25^\circ\text{C}$	20	A
Pc	Collector dissipation	$T_c = 25^\circ\text{C}$	38	W
V _{R(DC)}	FWDi rating DC reverse voltage	$T_c = 25^\circ\text{C}$	1200	V
I _F	FWDi forward current	$T_c = 25^\circ\text{C}$	10	A
Tj	Junction temperature		-20~+150	$^\circ\text{C}$

CONTROL PART

Symbol	Parameter	Conditions	Ratings	Unit
V _D	Supply voltage	Applied between : V _{UP1} -V _{UPC} , V _{VP1} -V _{WPC} , V _{WN1} -V _{VNC}	20	V
V _{DIN}	Input voltage	Applied between : U _P -U _{PC} , V _P -V _{PC} , W _P -W _{PC} , U _N · V _N · W _N · B _P -V _{NC}	20	V
V _{FO}	Fault output supply voltage	Applied between, F _o -V _{NC}	20	V
I _{FO}	Fault output current	Sink current of F _o terminal	20	mA

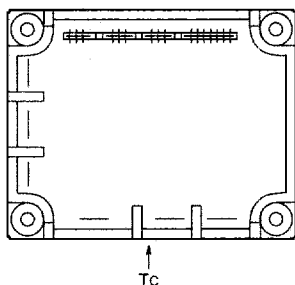
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**FLAT-BASE TYPE
INSULATED PACKAGE**

TOTAL SYSTEM

Symbol	Parameter	Conditions	Ratings	Unit
V _{CC(PROT)}	Supply voltage protected by OC & SC	V _D = 13.5~16.5V Inverter part, T _j = 125 °C start	800	V
T _C	Module case operating temperature	(Note 1)	- 20 ~ + 100	°C
T _{stg}	Storage temperature	-	- 40 ~ + 125	°C
V _{iso}	Isolation voltage	60Hz, Sinusoidal, AC, 1min	2500	Vrms

Note 1. T_C measuring point is as shown below



ELECTRICAL CHARACTERISTICS (T_j = 25 °C, unless otherwise noted)
INVERTER PART

Symbol	Parameter	Test conditions	Limits			Unit	
			Min	Typ	Max		
V _{CE(sat)}	Collector-emitter saturation voltage	V _D = 15V, V _{CIN} = 0V Pulsed	ic = 15A, T _j = 25 °C ic = 15A, T _j = 125 °C	-	2.8 2.5	3.8 3.5	V
V _{EC}	FWDi forward voltage	- ic = 15A, V _D = 15V, V _{CIN} = 15V	-	1.9	3.0	V	
t _{on}	Switching time	V _D = 15V, V _{CIN} = 0V ↔ 15V V _{CC} = 600V, I _c = 15A T _j = 125 °C (Per 1 arm) Inductive load	-	0.5	1.0	2.5	μs
t _{rr}			-	0.3	0.6	μs	
t _{c(on)}			-	0.5	1.5	μs	
t _{off}			-	2.1	3.5	μs	
t _{c(off)}			-	0.6	1.2	μs	
I _{CES}	Collector-emitter cutoff current	V _{CE} = V _{CEs}	T _j = 25 °C T _j = 125 °C	-	-	1 10	mA

BRAKE PART

Symbol	Parameter	Test conditions	Limits			Unit	
			Min	Typ	Max		
V _{CE(sat)}	Collector-emitter saturation voltage	V _D = 15V, V _{CIN} = 0V Pulsed	ic = 10A, T _j = 25 °C ic = 10A, T _j = 125 °C	-	2.8 2.5	3.8 3.5	V
V _{EC}	FWDi forward voltage	- ic = 10A, V _D = 15V, V _{CIN} = 15V	-	1.9	3.0	V	
I _{CES}	Collector-emitter cutoff current	V _{CE} = V _{CEs}	T _j = 25 °C T _j = 125 °C	-	-	1 10	mA

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FLAT-BASE TYPE
INSULATED PACKAGE

CONTROL PART

Symbol	Parameter	Test conditions	Limits			Unit	
			Min	Typ	Max		
V _D	Supply voltage	Applied between : V _{UP1} -V _{UPC} , V _{VP1} -V _{VPc} , V _{WP1} -V _{WPC} , V _{N1} -V _{NC}	13.5	15	16.5	V	
I _D	Circuit current	V _D = 15V, V _{CIN} = 15V V _{N1} -V _{NC} V _{XP1} -V _{XPC}	-	80	120	mA	
			-	25	35		
V _{CIN(ON)}	Input on threshold voltage	Applied between :	1.2	1.5	1.8	V	
V _{CIN(OFF)}	Input off threshold voltage	U _P -V _{UPC} , V _P -V _{VPc} , W _P -V _{WPC} , U _N · V _N · W _N · B _r -V _{NC}	1.7	2.0	2.3	V	
f _{PWM}	PWM input frequency	3 φ sinusoidal	-	15	20	kHz	
t _{dead}	Arm shoot-through blocking time	For each pulse input Using application circuit opto-coupler's input signal I _F = 12mA	3.0	-	-	μs	
			5.0	-	-		
OC	Over current trip level	- 20°C ≤ T _J ≤ 125°C	Inverter part	22	44	-	A
		V _D = 15V	Brake part	15	30	-	
SC	Short circuit trip level	- 20°C ≤ T _J ≤ 125°C	Inverter part	42	84	-	A
		V _D = 15V	Brake part	-	70	-	
t _{off(oc)}	Over current delay time	V _D = 15V	-	10	-	μs	
OT	Over temperature protection	Trip level	Base-plate	111	118	125	°C
		Reset level	Temperature detection	-	100	-	°C
UV	Supply circuit under voltage protection	Trip level		11.5	12.0	12.5	V
		Reset level		-	12.5	-	V
I _{FO(H)}	Fault output current (Note 2)	V _D = 15V, V _{FO} = 15V		-	-	0.01	mA
I _{FO(L)}				-	10	15	mA
t _{FO}	Minimum fault output pulse width (Note 2)	V _D = 15V	1.0	2.0	-	ms	

Note 2. Fault output is given only when the internal OC, SC, OT & UV protections schemes of any lower arm device operate to protect the device. For each upper arm device, the internal OC, SC & UV protection schemes are provided to protect the device but, no fault output is given.

THERMAL RESISTANCES

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
R _{th(j-c)Q}	Junction-to-case thermal resistances	Inverter IGBT part, per 1/6 module	-	-	1.3	°C/W
R _{th(j-c)F}		Inverter FWDi part, per 1/6 module	-	-	4.0	°C/W
R _{th(j-c)Q}		Brake IGBT	-	-	3.3	°C/W
R _{th(j-c)F}		Brake FWDi	-	-	4.0	°C/W
R _{th(c-f)}		Contact thermal resistance	Thermal grease applied, per 1/6 module	-	-	0.25

MECHANICAL RATINGS AND CHARACTERISTICS

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
-	Mounting torque	Mounting part screw : M4	0.98	1.18	1.47	N · m
-	Weight	-	10	12	15	kg · cm
-			-	330	-	g

RECOMMENDED CONDITIONS FOR USE

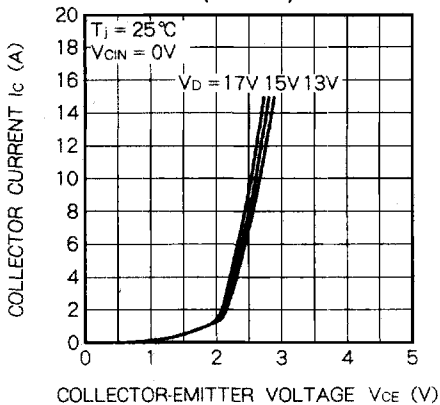
Symbol	Parameter	Test conditions	Value			Unit
			Min	Typ	Max	
V _{CC}	Supply voltage	Applied across P-N terminals	0	600	800	V
V _D		Applied between : V _{UP1} -V _{UPC} , V _{VP1} -V _{VPc} , V _{WP1} -V _{WPC} , V _{N1} -V _{NC}	13.5	15	16.5	V
V _{CIN(ON)}	Input on voltage	Applied between :	0	-	0.8	V
V _{CIN(OFF)}	Input off voltage	U _P -U _{PC} , V _P -V _{PC} , W _P -W _{PC} , U _N · V _N · W _N · B _r -V _{NC}	12	-	V _D	V
f _{PWM}	PWM Input frequency	Using application circuit	5	15	20	kHz
t _{dead}	Arm shoot-through blocking time	Using application circuit opto-coupler's input signal	5	-	-	μs

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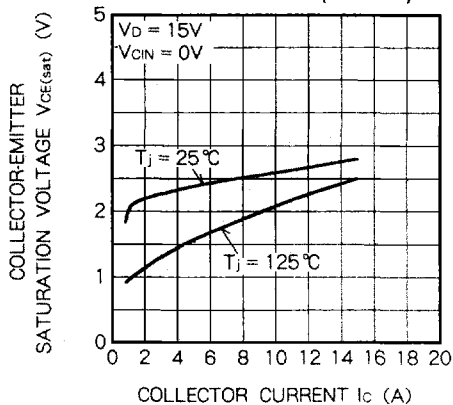
**FLAT-BASE TYPE
INSULATED PACKAGE**

PERFORMANCE CURVES (INVERTER PART)

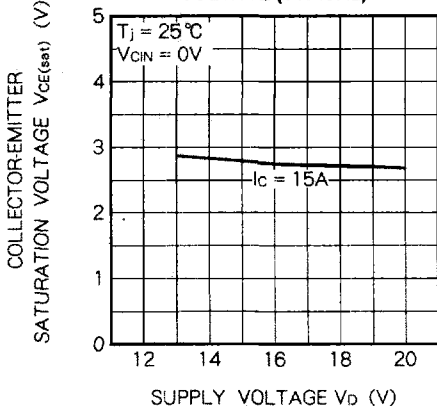
OUTPUT CHARACTERISTICS (TYPICAL)



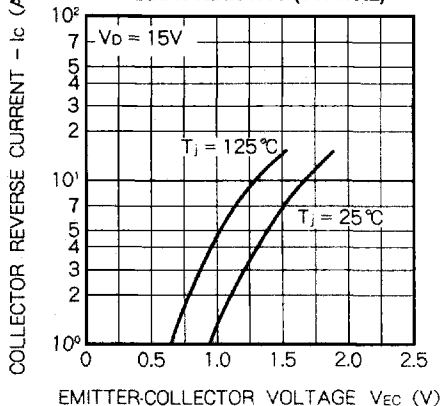
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



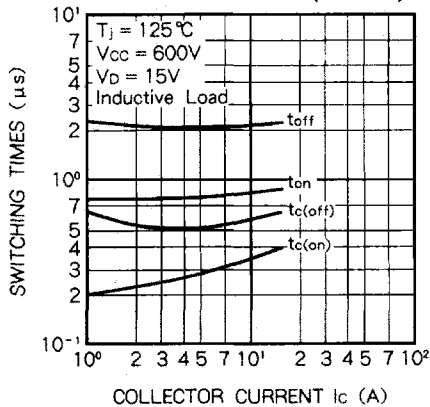
COLLECTOR-EMITTER SATURATION VOLTAGE (TYPICAL)



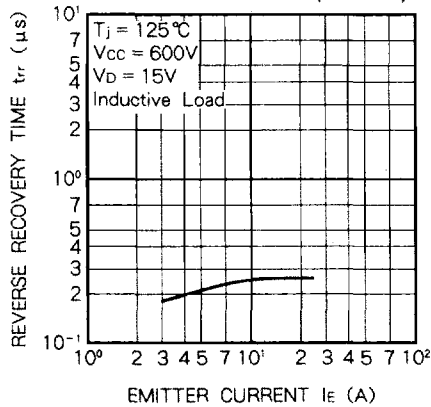
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



REVERSE RECOVERY CHARACTERISTICS OF FREE-WHEEL DIODE (TYPICAL)

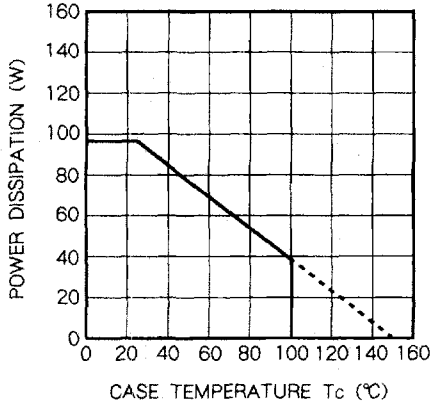


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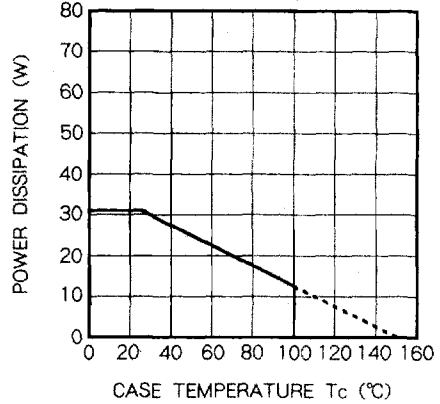
FLAT-BASE TYPE
INSULATED PACKAGE

(INVERTER PART)

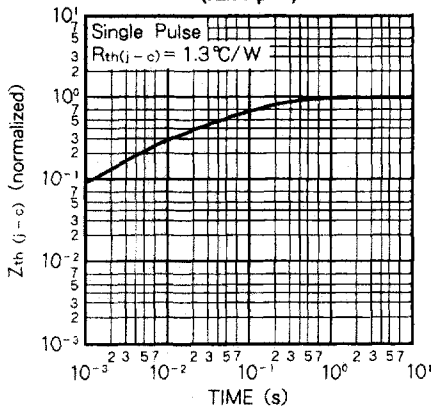
POWER DISSIPATION DERATING CURVE
(Per IGBT element)



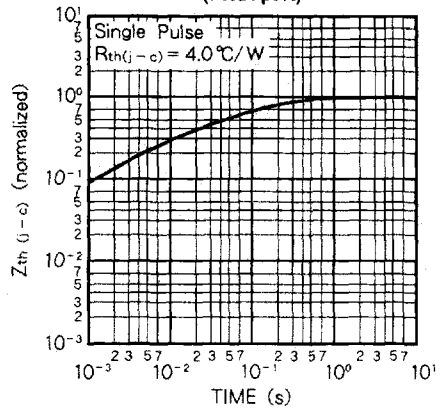
POWER DISSIPATION DERATING CURVE
(Per FWDi element)



TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS
(IGBT part)



TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS
(FWDi part)

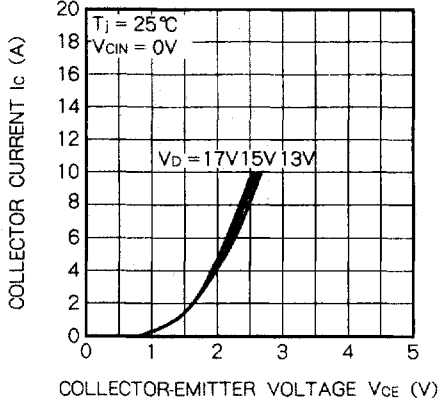


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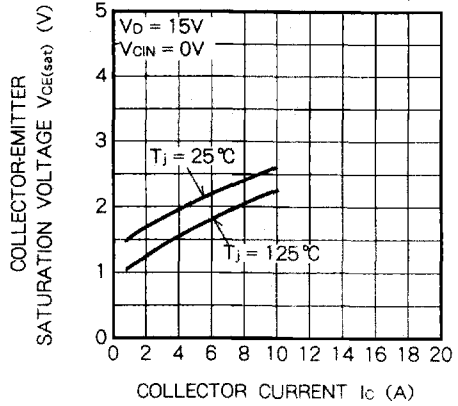
FLAT-BASE TYPE
INSULATED PACKAGE

PERFORMANCE CURVES (BRAKE PART)

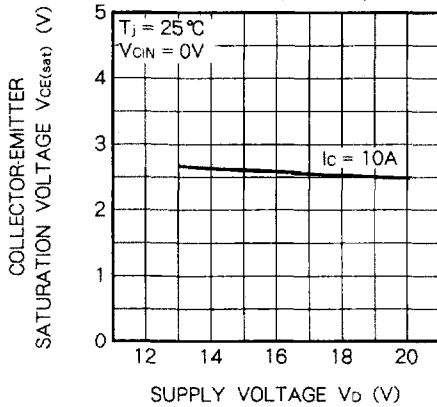
OUTPUT CHARACTERISTICS (TYPICAL)



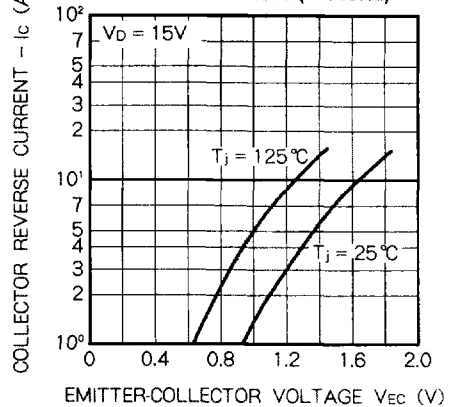
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



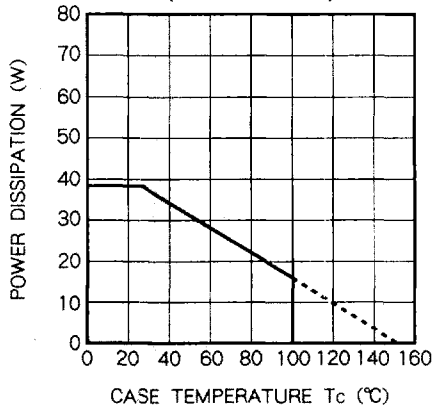
COLLECTOR-EMITTER SATURATION VOLTAGE (TYPICAL)



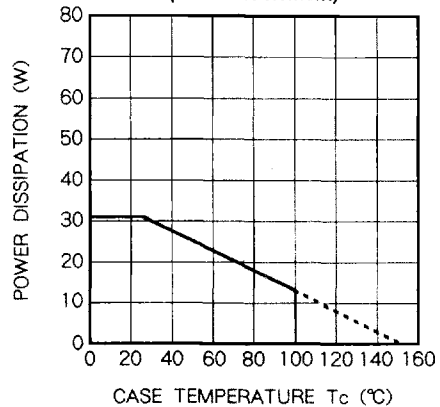
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



POWER DISSIPATION DERATING CURVE (Per IGBT element)



POWER DISSIPATION DERATING CURVE (Per FWDi element)

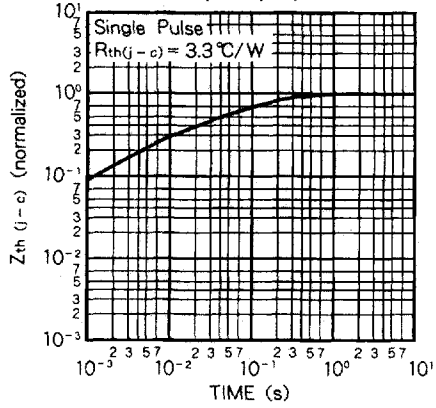


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FLAT-BASE TYPE
INSULATED PACKAGE

(BRAKE PART)

TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS
(IGBT part)



TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS
(FWDi part)

