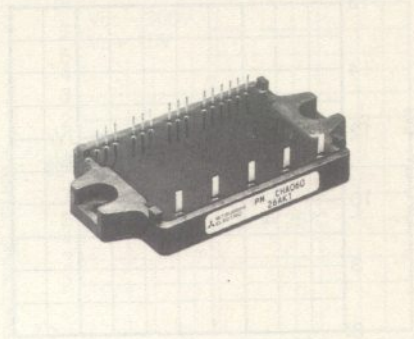


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FLAT-BASE TYPE
INSULATED PACKAGE

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- 3 ϕ 15A, 600V Current-sense IGBT type inverter
- Monolithic gate drive & protection logic
- Detection, protection & status indication circuits for over-current, short-circuit, over-temperature & under-voltage
- Acoustic noise-less 750W class inverter application
- UL Recognized

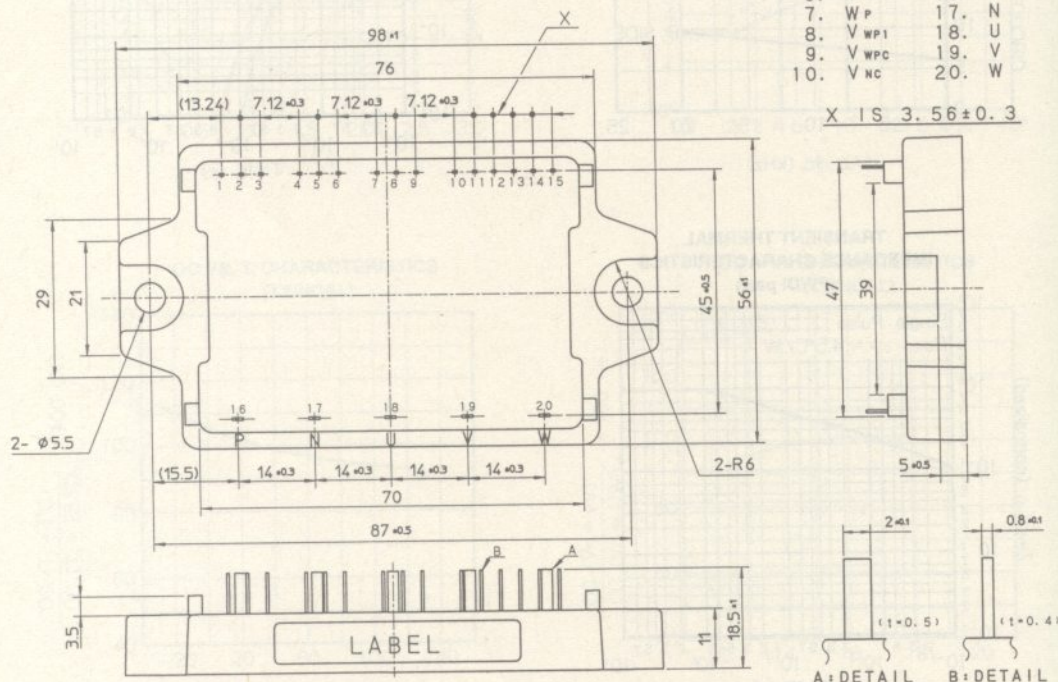
Yellow Card No. E80276 (N)
File No. E80271

APPLICATION

General purpose inverter, servo drives and other motor controls

OUTLINE DRAWING

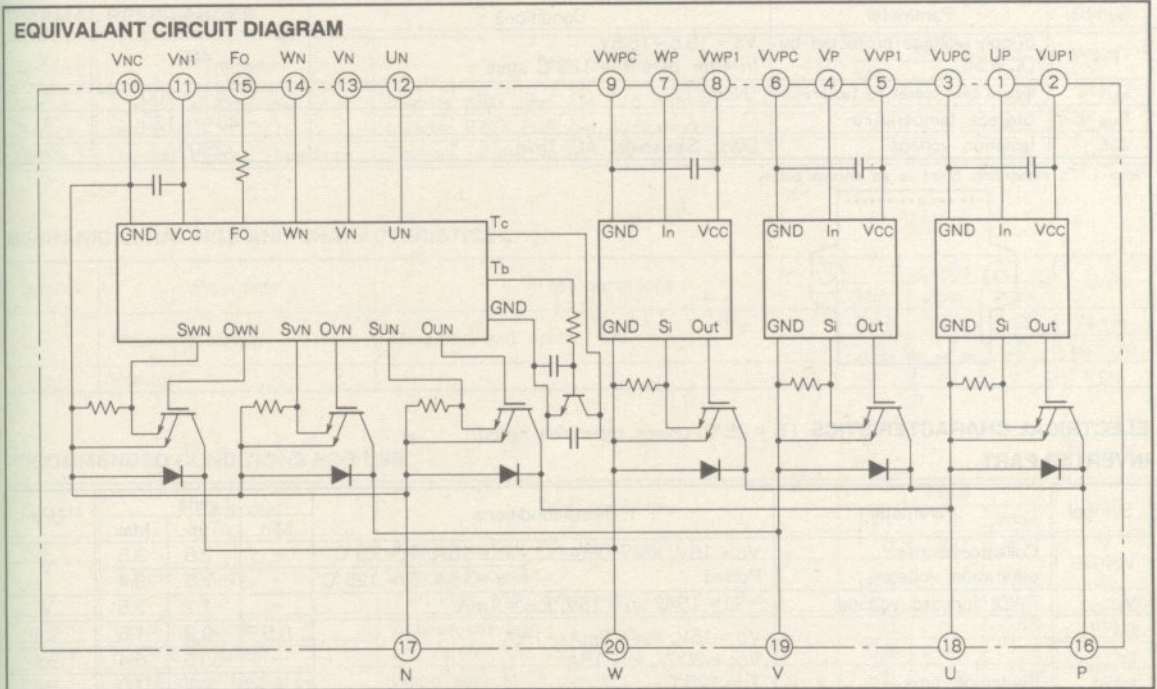
Dimensions in mm



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EQUIVALENT CIRCUIT DIAGRAM



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

INVERTER PART

Symbol	Parameter	Conditions	Ratings	Unit
V_{cc}	Supply voltage	Applied between : P-N	450	V
$V_{cc}(\text{surge})$	Supply voltage (surge)	Applied between : P-N, surge value	500	V
V_{CES}	Collector-emitter voltage		600	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
P_c	Collector dissipation	$T_c = 25^\circ\text{C}$	43	W
T_j	Junction temperature		$-20 \sim +150$	$^\circ\text{C}$

CONTROL PART

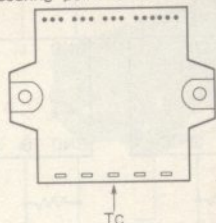
Symbol	Parameter	Conditions	Ratings	Unit
V_o	Supply voltage	Applied between : $V_{UP1}-V_{UPC}, V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}, V_{NI}-V_{NC}$	20	V
I_{cIN}	Input current	Applied between :	20	mA
V_{cIN}	Input voltage	$U_P, V_P, W_P, U_N, V_N, W_N$	20	V
V_{Fo}	Fault output supply voltage	Applied between : $Fo-V_{NC}$	20	V
I_{Fo}	Fault output current	Sink current of Fo terminal	20	mA

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TOTAL SYSTEM

Symbol	Parameter	Conditions	Ratings	Unit
$V_{CC(prot)}$	Supply voltage protected by OC & SC	$V_D = 13.5 \sim 16.5V$ Inverter part $T_j = 125^\circ C$ start	400	V
T_c	Module case operating temperature	(Note 1)	$-20 \sim +100$	$^\circ C$
T_{stg}	Storage temperature		$-40 \sim +125$	$^\circ C$
V_{iso}	Isolation voltage	60Hz, Sinusoidal, AC, 1min	2500	V_{rms}

Note 1. T_c measuring point is as shown belowELECTRICAL CHARACTERISTICS ($T_j = 25^\circ C$, unless otherwise noted)

INVERTER PART

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_D = 15V, I_{CIN} = 0mA$ Pulsed	—	2.6	3.5	V
V_{EC}	FWDi forward voltage	$I_c = 15A, T_j = 25^\circ C$ $I_c = 15A, T_j = 125^\circ C$	—	2.5	3.4	V
t_{on}	Switching time	$-I_c = 15A, V_D = 15V, I_{CIN} = 1mA$	—	1.7	2.5	V
t_{rr}		$V_D = 15V, I_{CIN} = 0mA \leftrightarrow 1mA$	0.5	0.9	1.5	μs
$t_{c(on)}$		$V_{CC} = 300V, I_c = 15A$	—	0.15	0.4	μs
t_{off}		$T_j = 125^\circ C$ (Per 1 arm)	—	0.3	1.0	μs
$t_{c(off)}$		Inductive Load	—	1.5	2.5	μs
I_{CES}	Collector-emitter cutoff current	$V_{CE} = V_{CES}$	—	—	1	mA
		$T_j = 125^\circ C$	—	—	10	mA

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	$V_D = 15V, I_{CIN} = 1mA$	—	25	40	mA
$I_{CIN(ON)}$	Input on threshold current	$V_{N1}-V_{NC}$	—	7	12	mA
$I_{CIN(OFF)}$	Input off threshold current	$V_{XP1}-V_{XPC}$	—	—	—	—
f_{PWM}	PWM input frequency	Applied between : $U_P-V_{UPC}, V_P-V_{VPC}, W_P-V_{WPC}, U_N, V_N, W_N-V_{NC}$	0.1	0.22	0.5	mA
t_{dead}	Arm shoot-through blocking time	3 ϕ sinusoidal	0.1	0.22	0.5	mA
		For each pulse input $U_P-U_N, V_P-V_N, W_P-W_N$	—	15	20	kHz
		Using application circuit opto-coupler's input signal $I_F = 12mA$	2.0	—	—	μs
OC	Over current trip level		5.0	—	—	μs
SC	Short circuit trip level	$-20^\circ C \leq T_j \leq 125^\circ C, V_D = 15V$	18	26	—	A
$t_{off(oc)}$	Over current delay time	$-20^\circ C \leq T_j \leq 125^\circ C, V_D = 15V$	—	39	—	A
OT	Over temperature	$V_D = 15V$	—	10	—	μs
OTr	Over temperature protection	Base-plate	100	110	120	$^\circ C$
UV	Supply circuit under voltage protection	Temperature detection, $V_D = 15V$	—	90	—	$^\circ C$
UVr	Supply circuit under voltage protection	$T_j \leq 125^\circ C$	11.5	12.0	12.5	V
$I_{FO(H)}$	Fault output current (Note 2)		—	12.5	—	V
$I_{FO(L)}$		$V_D = 15V, V_{FO} = 15V$	—	—	0.01	mA
			—	10	15	mA
t_{FO}	Minimum fault output pulse width (Note 2)	$V_D = 15V$	20	40	60	μs
		Using application circuit opto-coupler's input signal $V_D = 15V$	25	100	—	μs

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.

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THERMAL RESISTANCES

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$R_{th(j-c)}$	Junction-to-case thermal resistances	Inverter IGBT part, per 1/6 module	—	—	2.9	°C/W
$R_{th(j-c)F}$		Inverter FWDi part, per 1/6 module	—	—	4.5	°C/W
$R_{th(c-f)}$	Contact thermal resistance	Thermal grease applied, per 1/6 module	—	—	0.4	°C/W

MECHANICAL RATINGS AND CHARACTERISTICS

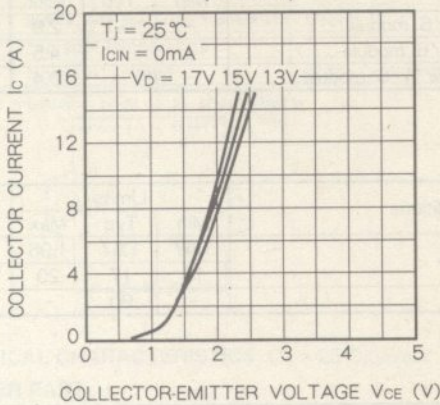
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
—	Mounting torque	Mounting part screw : M5	1.47	1.67	1.96	N · m
—	Weight	—	15	17	20	kg · cm
—	Weight	—	—	90	—	g

RECOMMENDED CONDITIONS FOR USE

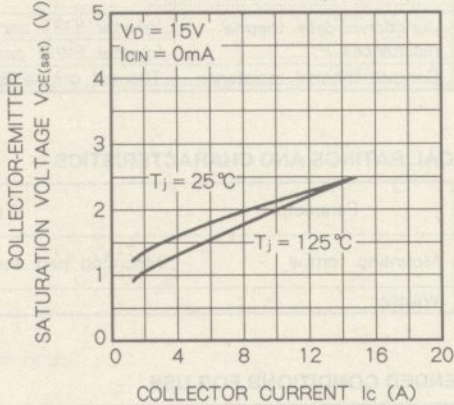
Symbol	Parameter	Test conditions	Value			Unit
			Min	Typ	Max	
V_{cc}	Supply voltage	Applied across P-N terminals	0	300	400	V
V_D		Applied between : $V_{UP1-V_{UPC}}$, $V_{VP1-V_{VPC}}$, $V_{WP1-V_{WPC}}$, $V_{N1-V_{NC}}$	13.5	15	16.5	V
$I_{CIN(ON)}$	Input on current	Applied between : U_P , V_P , W_P , U_N , V_N , W_N	0	—	0.05	mA
$I_{CIN(OFF)}$	Input off current		0.5	—	2	mA
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	5.0	—	—	μs

PERFORMANCE CURVES

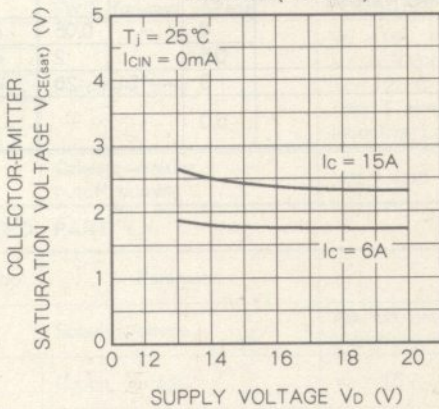
OUTPUT CHARACTERISTICS
(TYPICAL)



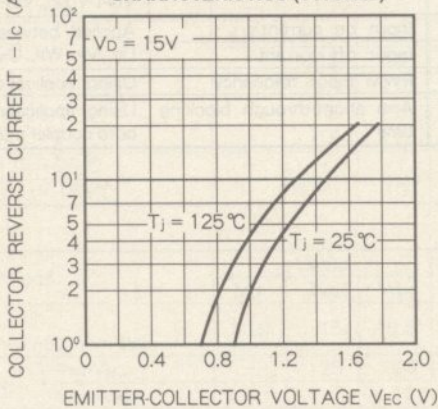
SATURATION VOLTAGE
CHARACTERISTICS (TYPICAL)



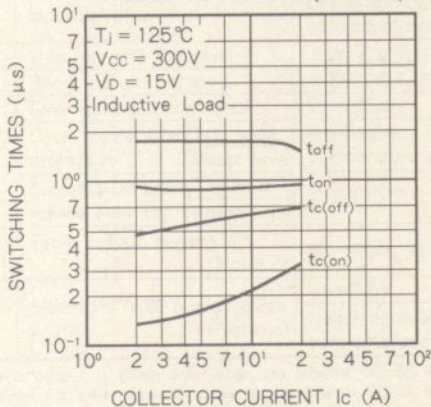
COLLECTOR-EMITTER SATURATION
VOLTAGE (TYPICAL)



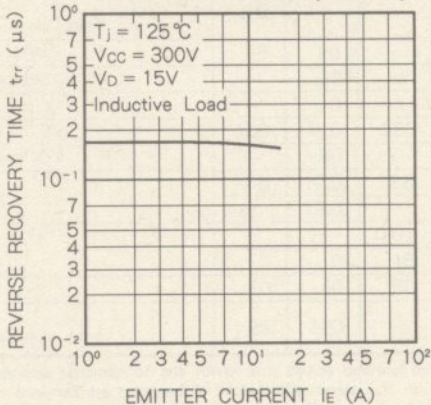
FREE-WHEEL DIODE FORWARD
CHARACTERISTICS (TYPICAL)



SWITCHING TIME VS.
COLLECTOR CURRENT (TYPICAL)



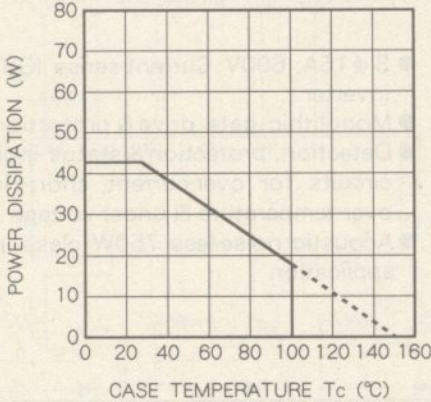
REVERSE RECOVERY CHARACTERISTICS
OF FREE-WHEEL DIODE (TYPICAL)



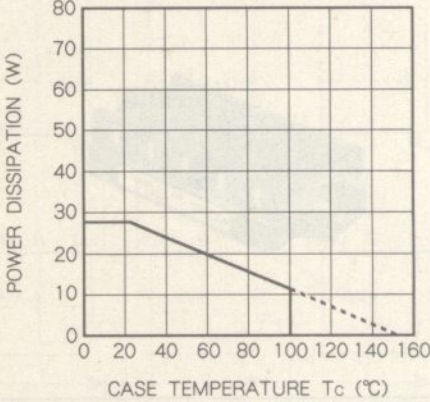
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FLAT-BASE TYPE
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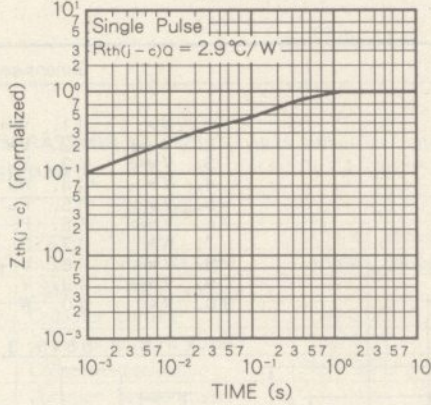
POWER DISSIPATION DERATING CURVE
(Per IGBT element)



POWER DISSIPATION DERATING CURVE
(Per FWDi element)



TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS
(IGBT part)



TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS
(FWDi part)

