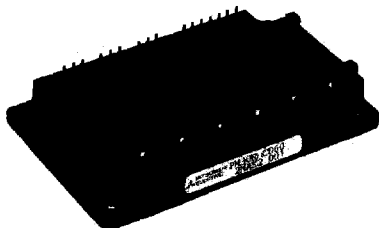


# PM30RMC060

FLAT-BASE TYPE  
INSULATED PACKAGE

PM30RMC060



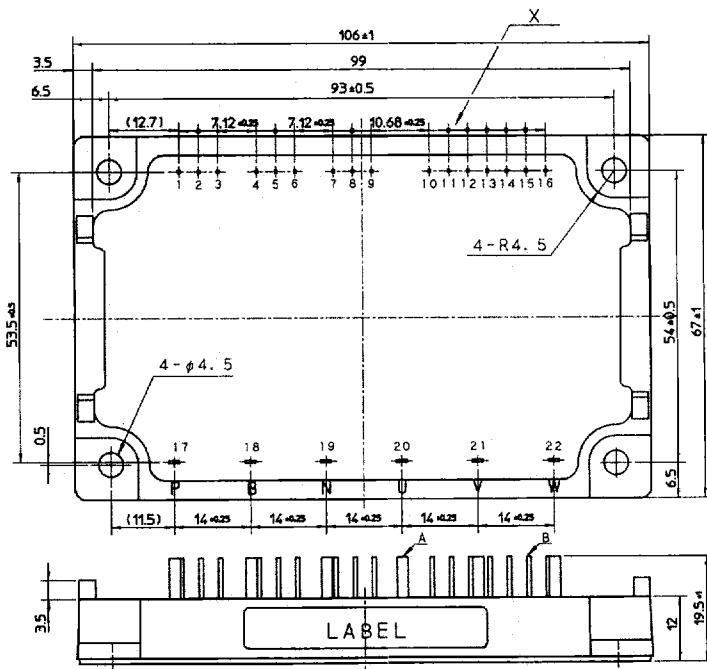
- 3  $\phi$  30A, 600V Current-sense IGBT type inverter
- Monolithic gate drive & protection logic
- Detection, protection & status indication circuits for over-current, short-circuit, over-temperature & under-voltage
- Acoustic noise-less 2.2kW class inverter application

## APPLICATION

General Purpose Inverter, Servo drives and other motor controls

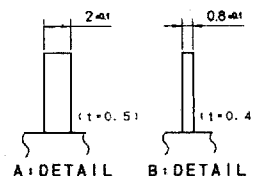
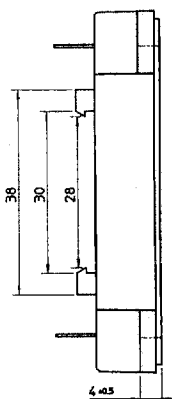
## OUTLINE DRAWING

Dimensions in mm

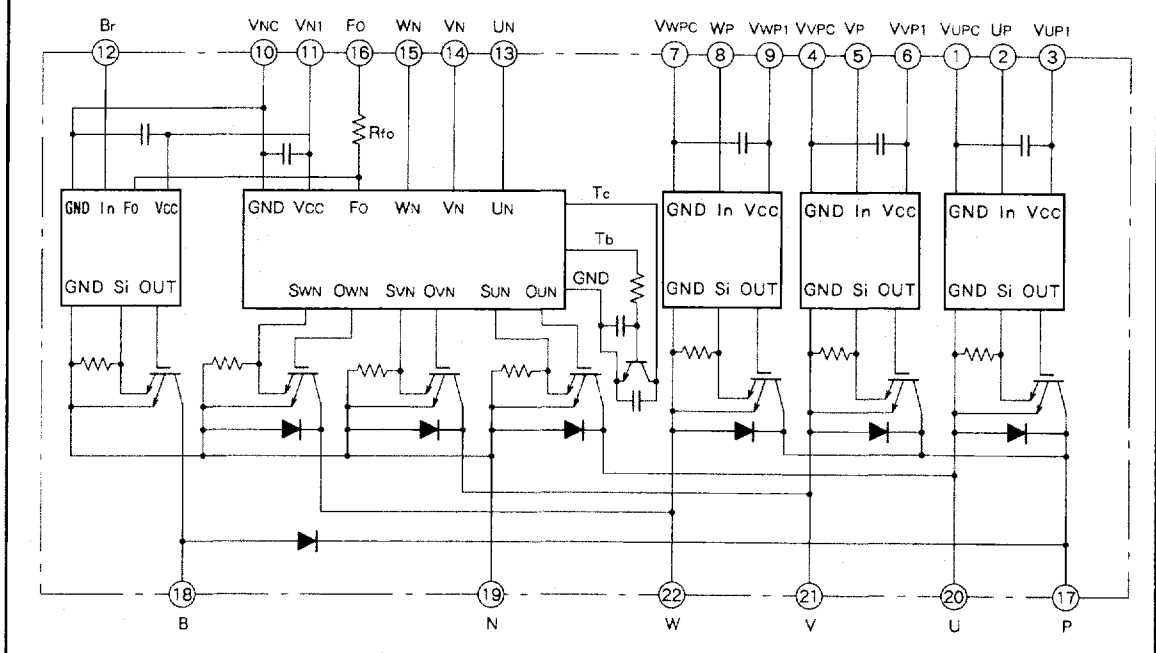


- |              |              |                    |       |
|--------------|--------------|--------------------|-------|
| 1. $V_{epc}$ | 7. $V_{epc}$ | 13. $U_N$          | 19. N |
| 2. $U_p$     | 8. $W_p$     | 14. $V_N$          | 20. U |
| 3. $V_{ep1}$ | 9. $V_{ep1}$ | 15. $W_N$          | 21. V |
| 4. $V_{epc}$ | 10. $V_{nc}$ | 16. $F_0$          | 22. W |
| 5. $V_p$     | 11. $V_{n1}$ | 17. P              |       |
| 6. $V_{ep1}$ | 12. NC       | 18. B <sub>r</sub> |       |

X IS 3.56±0.25.



### EQUIVALENT CIRCUIT DIAGRAM



### MAXIMUM RATINGS (T<sub>j</sub> = 25 °C, unless otherwise noted)

#### INVERTER PART

Symbol	Parameter	Conditions	Ratings	Unit
V <sub>cc</sub>	Supply voltage	Applied between : P-N	450	V
V <sub>cc(surge)</sub>	Supply voltage (surge)	Applied between : P-N, surge value	500	V
V <sub>CEs</sub>	Collector-emitter voltage		600	V
± I <sub>c</sub>	Collector current	T <sub>c</sub> = 25 °C	30	A
± I <sub>CP</sub>	Collector current (peak)	T <sub>c</sub> = 25 °C	60	A
P <sub>c</sub>	Collector dissipation	T <sub>c</sub> = 25 °C	96	W
T <sub>j</sub>	Junction temperature		- 20 ~ + 150	°C

#### BRAKE PART

Symbol	Parameter	Conditions	Ratings	Unit
V <sub>cc</sub>	Supply voltage	Applied between : P-N	450	V
V <sub>cc(surge)</sub>	Supply voltage (surge)	Applied between : P-N, surge value	500	V
V <sub>CEs</sub>	Collector-emitter voltage		600	V
I <sub>c</sub>	Collector current	T <sub>c</sub> = 25 °C	10	A
I <sub>CP</sub>	Collector current (peak)	T <sub>c</sub> = 25 °C	20	A
P <sub>c</sub>	Collector dissipation	T <sub>c</sub> = 25 °C	41	W
V <sub>R(DC)</sub>	FWDi rating DC reverse voltage	T <sub>c</sub> = 25 °C	600	V
I <sub>F</sub>	FWDi forward current	T <sub>c</sub> = 25 °C	10	A
T <sub>j</sub>	Junction temperature		- 20 ~ + 150	°C

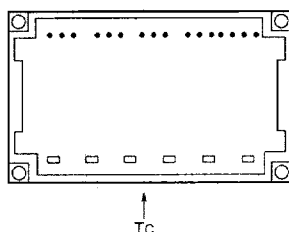
#### CONTROL PART

Symbol	Parameter	Conditions	Ratings	Unit
V <sub>o</sub>	Supply voltage	Applied between : VUPI-VUPC, VVPI-VVPC, VWPI-VWPC, VN1-VNC	20	V
V <sub>oIN</sub>	Input voltage	Applied between : UP-UPC, VP-VPC, WP-WPC, UN, VN, WN, Br-VNC	20	mA
V <sub>Fo</sub>	Fault output supply voltage	Applied between : Fo-GND	20	V
I <sub>Fo</sub>	Fault output current	Sink current of Fo terminal	20	mA

### 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	2000	$V_{rms}$

Note 1.  $T_C$  measuring point is as shown below



### ELECTRICAL 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	$V_D = 15V, V_{CIN} = 15V$ Pulsed	—	2.7	3.5	V
		$I_C = 30A, T_j = 125^\circ C$	—	2.5	3.4	
$V_{EC}$	FWDi forward voltage	$-I_C = 30A, V_D = 15V, V_{CIN} = 15V$	—	1.7	2.5	V
$t_{on}$	Switching time	$V_D = 15V, V_{CIN} = 15V \leftrightarrow 0V$ $V_{CC} = 300V, I_C = 30A$ $T_j = 125^\circ C$ (Per 1 arm) Inductive Load	0.3	0.8	1.5	$\mu s$
$t_{rr}$			—	0.15	0.4	$\mu s$
$t_{c(on)}$			—	0.4	1.2	$\mu s$
$t_{off}$			—	2.5	3.3	$\mu s$
$t_{c(off)}$			—	0.6	1.2	$\mu s$
$I_{CES}$	Collector-emitter cutoff current	$V_{CE} = V_{CES}$	—	—	1	mA
		$T_j = 125^\circ C$	—	—	10	

#### 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	—	2.6	3.5	V
		$I_C = 10A, T_j = 125^\circ C$	—	2.9	4.0	
$V_{EC}$	FWDi forward voltage	$-I_C = 10A, V_D = 15V, V_{CIN} = 15V$	—	1.6	2.2	V
$I_{CES}$	Collector-emitter cutoff current	$V_{CE} = V_{CES}$	—	—	1	mA
		$T_j = 125^\circ C$	—	—	10	

## CONTROL PART

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V <sub>D</sub>	Supply voltage	Applied between : V <sub>UP1</sub> -V <sub>UPC</sub> , V <sub>VP1</sub> -V <sub>VPC</sub> , V <sub>WP1</sub> -V <sub>WPC</sub> , V <sub>N1</sub> -V <sub>NPC</sub>	13.5	15	16.5	V
I <sub>D</sub>	Circuit current	V <sub>D</sub> = 15V, V <sub>CIN</sub> = 1mA	—	23	30	mA
		V <sub>N1</sub> -V <sub>NPC</sub> V <sub>XP1</sub> -V <sub>XPC</sub>	—	7	10	
V <sub>CIN(ON)</sub>	Input on threshold voltage	Applied between :	1.2	1.5	1.8	V
V <sub>CIN(OFF)</sub>	Input off threshold voltage	U <sub>P</sub> -V <sub>UPC</sub> , V <sub>P</sub> -V <sub>VPC</sub> , W <sub>P</sub> -V <sub>WPC</sub> , U <sub>N</sub> , V <sub>N</sub> , W <sub>N</sub> , Br-V <sub>NPC</sub>	1.7	2.0	2.3	V
f <sub>PWM</sub>	PWM input frequency	3 φ sinusoidal	—	15	20	kHz
t <sub>dead</sub>	Arm shoot-through blocking time	For each pulse input, U <sub>P</sub> -U <sub>N</sub> , V <sub>P</sub> -V <sub>N</sub> , W <sub>P</sub> -W <sub>N</sub>	3.0	—	—	μs
		Using application circuit Opto-coupler's input signal I <sub>F</sub> = 12mA	5.0	—	—	
OC	Over current trip level	- 20°C ≤ T <sub>J</sub> ≤ 125°C, V <sub>D</sub> = 15V	Inverter part 39	53	—	A
			Brake part 12	18	—	
SC	Short circuit trip level	- 20°C ≤ T <sub>J</sub> ≤ 125°C, V <sub>D</sub> = 15V	Inverter part —	80	—	A
			Brake part —	27	—	
t <sub>off(OC)</sub>	Over current delay time	V <sub>D</sub> = 15V	—	10	—	μs
OT	Over temperature protection	Base-plate	100	110	120	°C
OT <sub>r</sub>	Reset level	Temperature detection	—	90	—	°C
UV	Supply circuit under voltage protection	Trip level	11.5	12.0	12.5	V
UV <sub>r</sub>	Reset level		—	12.5	—	V
I <sub>FO(H)</sub>	Fault output current	V <sub>D</sub> = 15V, V <sub>FO</sub> = 15V	—	—	0.01	mA
I <sub>FO(L)</sub>	(Note 2)		—	10	15	mA
t <sub>FO</sub>	Minimum fault output pulse width	Using application circuit opto-coupler's input signal, V <sub>D</sub> = 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.

## THERMAL RESISTANCES

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
R <sub>th(j-c)Q</sub>	Junction-to-case thermal resistances	Inverter IGBT part, per 1/6 module	—	—	1.3	°C/W
R <sub>th(j-c)F</sub>		Inverter FWDi part, per 1/6 module	—	—	3.0	°C/W
R <sub>th(j-c)Q</sub>		Brake IGBT part	—	—	3.0	°C/W
R <sub>th(j-c)F</sub>		Brake FWDi part	—	—	4.5	°C/W
R <sub>th(c-f)</sub>	Contact thermal resistance	Thermal grease applied, per 1/6 module	—	—	0.3	°C/W

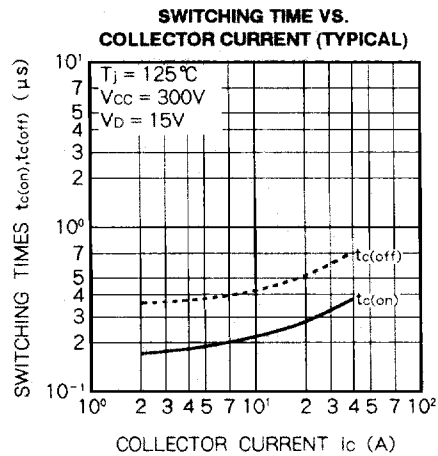
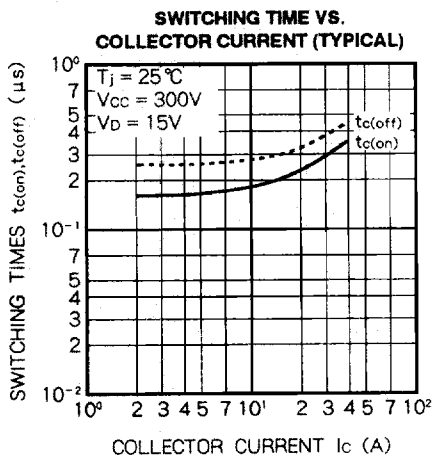
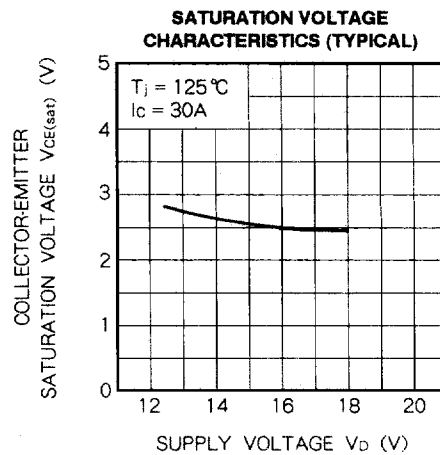
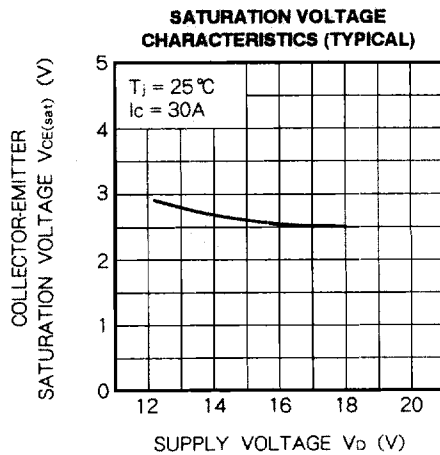
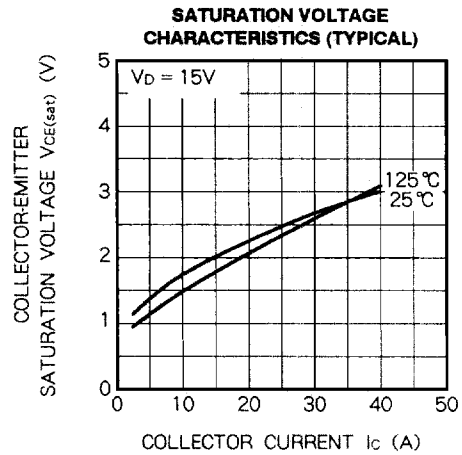
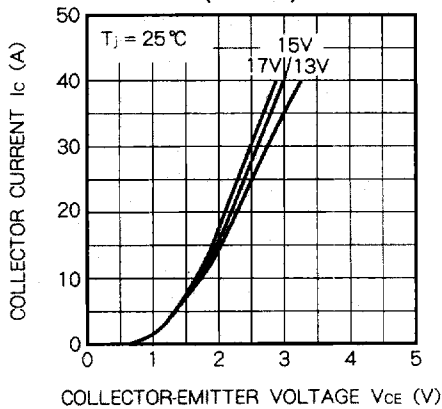
## MECHANICAL RATINGS AND CHARACTERISTICS

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
—			—	120	—	g

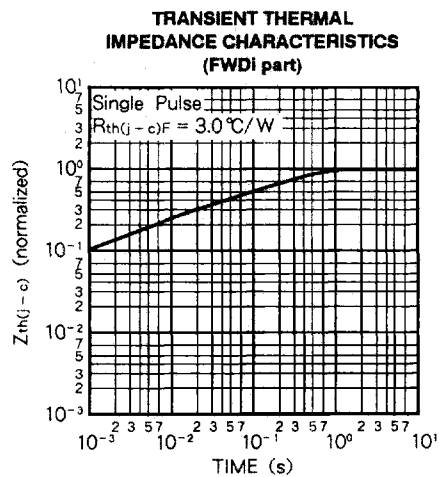
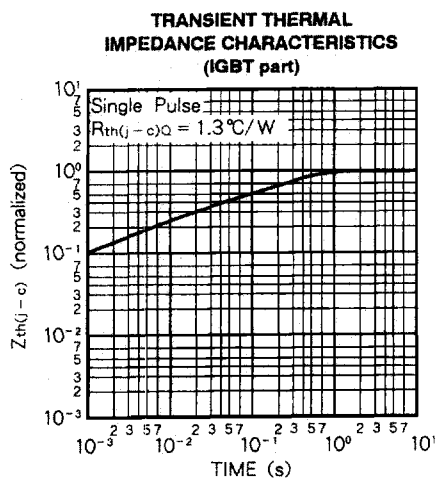
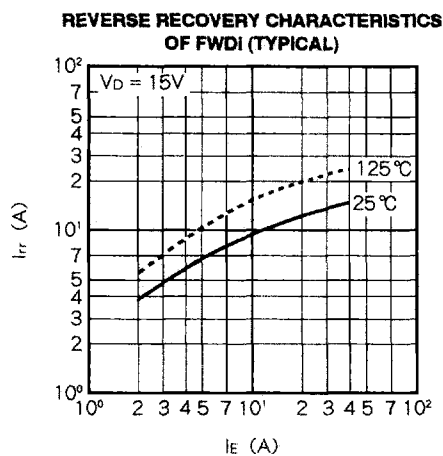
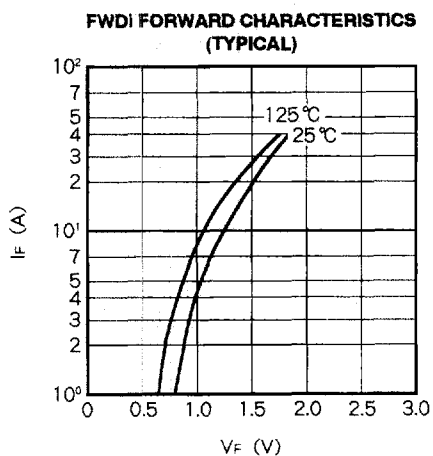
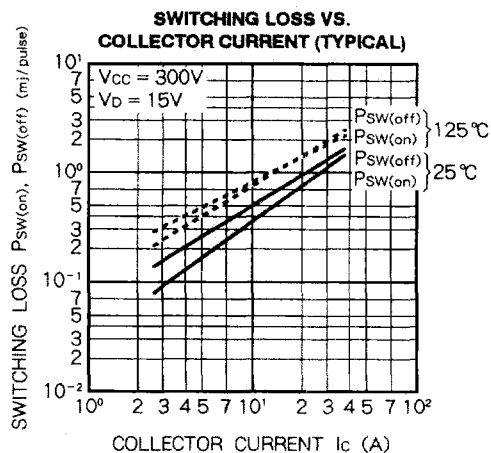
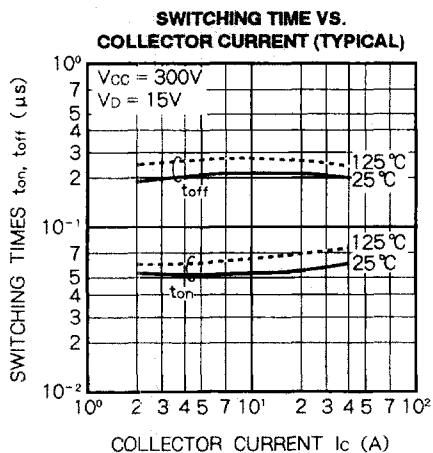
## RECOMMENDED CONDITIONS FOR USE

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V <sub>CC</sub>	Supply voltage	Applied across P-N terminals	0	300	400	V
V <sub>D</sub>		Applied between : V <sub>UP1</sub> -V <sub>UPC</sub> , V <sub>VP1</sub> -V <sub>VPC</sub> , V <sub>WP1</sub> -V <sub>WPC</sub> , V <sub>N1</sub> -V <sub>NPC</sub>	13.5	15	16.5	V
V <sub>CIN(ON)</sub>	Input on voltage	Applied between :	0	—	0.8	V
V <sub>CIN(OFF)</sub>	Input off voltage	U <sub>P</sub> -V <sub>UPC</sub> , V <sub>P</sub> -V <sub>VPC</sub> , W <sub>P</sub> -V <sub>WPC</sub> , U <sub>N</sub> , V <sub>N</sub> , W <sub>N</sub> , Br-V <sub>NPC</sub>	4	—	V <sub>D</sub>	V
f <sub>PWM</sub>	PWM input frequency	Using application circuit	5	15	20	kHz
t <sub>dead</sub>	Arm shoot-through blocking time	Using application circuit Opto-coupler's input signal	5.0	—	—	μs

PERFORMANCE CURVES (INVERTER PART)  
OUTPUT CHARACTERISTICS  
(TYPICAL)

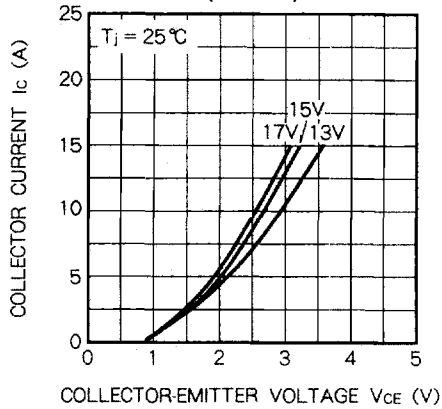


### (INVERTER PART)

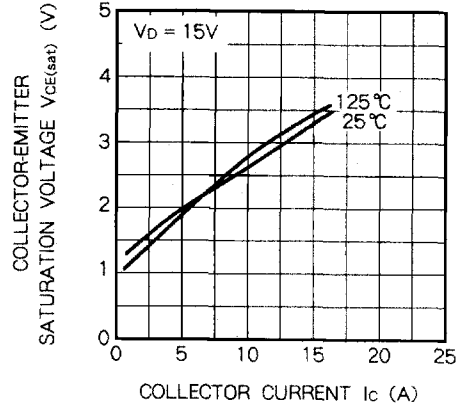


### PERFORMANCE CURVES (BRAKE PART)

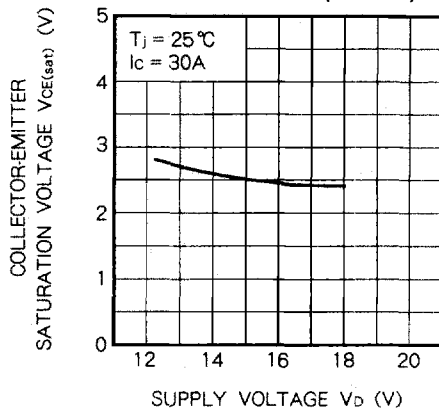
OUTPUT CHARACTERISTICS  
(TYPICAL)



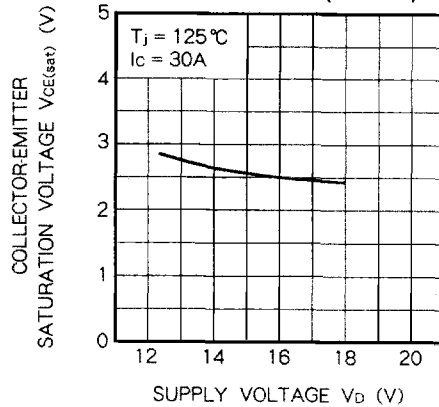
SATURATION VOLTAGE  
CHARACTERISTICS (TYPICAL)



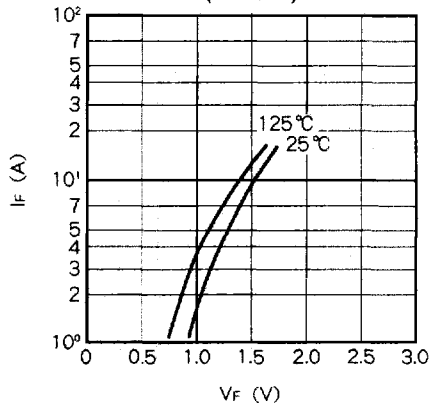
SATURATION VOLTAGE  
CHARACTERISTICS (TYPICAL)



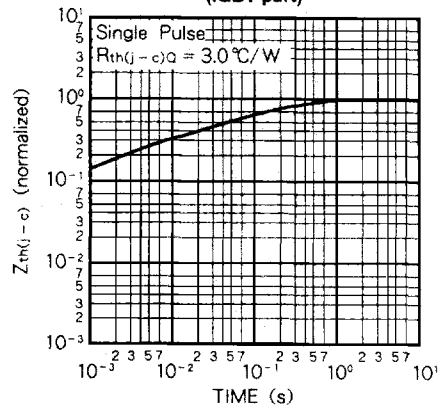
SATURATION VOLTAGE  
CHARACTERISTICS (TYPICAL)



FWDI FORWARD CHARACTERISTICS  
(TYPICAL)

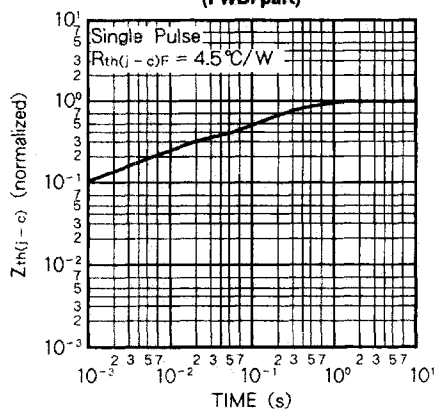


TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(IGBT part)



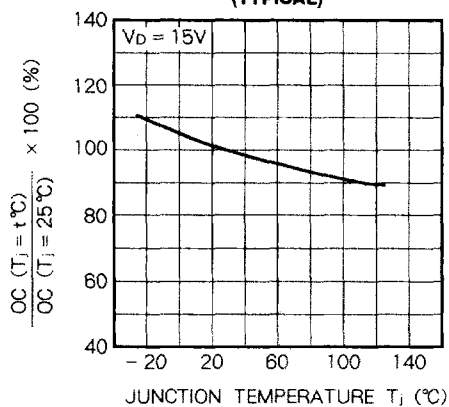
(BRAKE PART)

TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(FWDI part)

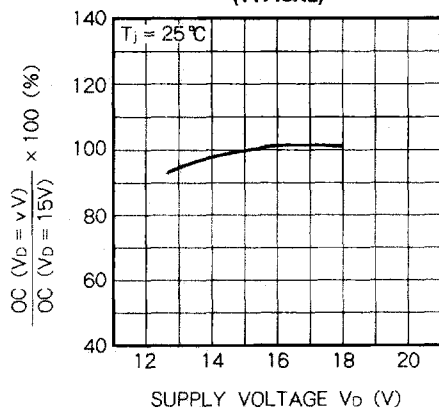


(CONTROL PART)

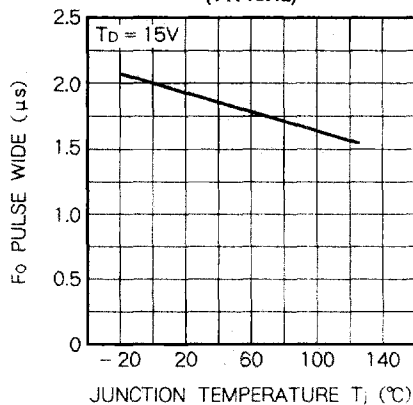
OC VS.  $T_j$  CHARACTERISTICS  
(TYPICAL)



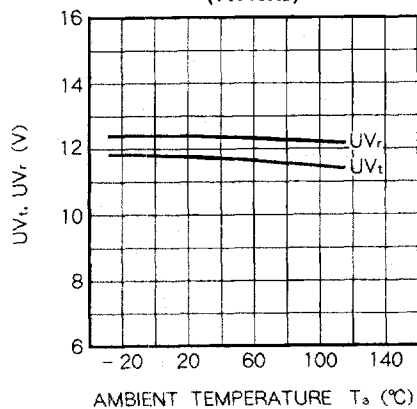
OC VS.  $V_D$  CHARACTERISTICS  
(TYPICAL)



F<sub>0</sub> PULSE WIDTH VS.  $T_j$  CHARACTERISTICS  
(TYPICAL)



$UV_i$ ,  $UV_r$  VS.  $T_a$  CHARACTERISTICS  
(TYPICAL)



$I_D$  VS.  $f_c$  CHARACTERISTICS  
(TYPICAL)

