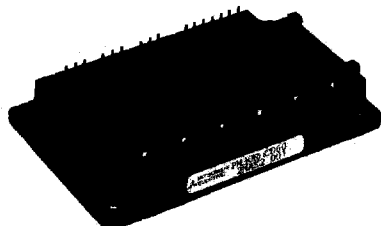


PM30RMC060

FLAT-BASE TYPE
INSULATED PACKAGE

PM30RMC060



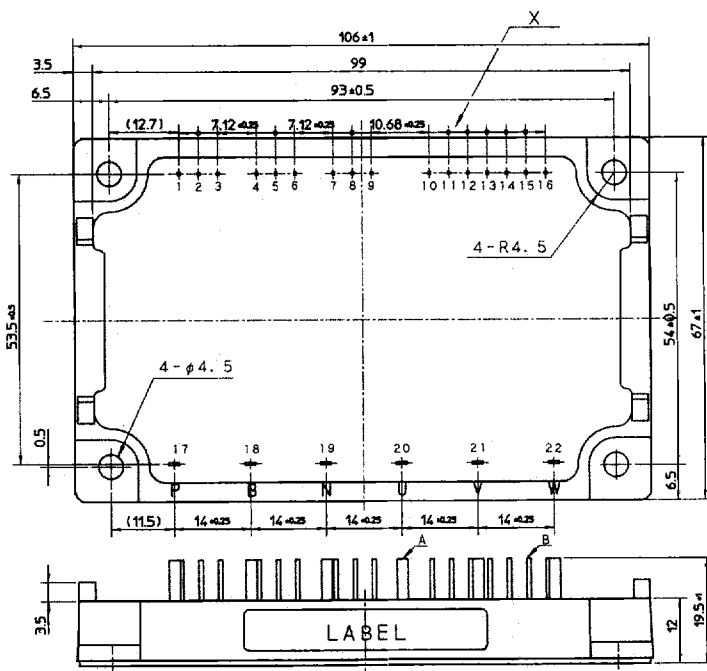
- 3 ϕ 30A, 600V Current-sense IGBT type inverter
- Monolithic gate drive & protection logic
- Detection, protection & status indication circuits for over-current, short-circuit, over-temperature & under-voltage
- Acoustic noise-less 2.2kW class inverter application

APPLICATION

General Purpose Inverter, Servo drives and other motor controls

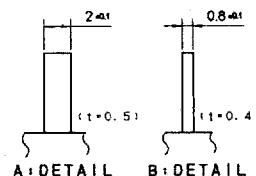
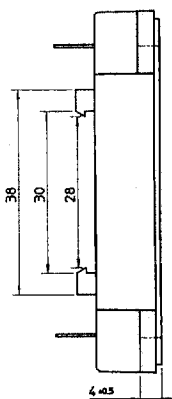
OUTLINE DRAWING

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_{up1}	9. V_{wp1}	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_{vp1}	12. NC	18. B.	

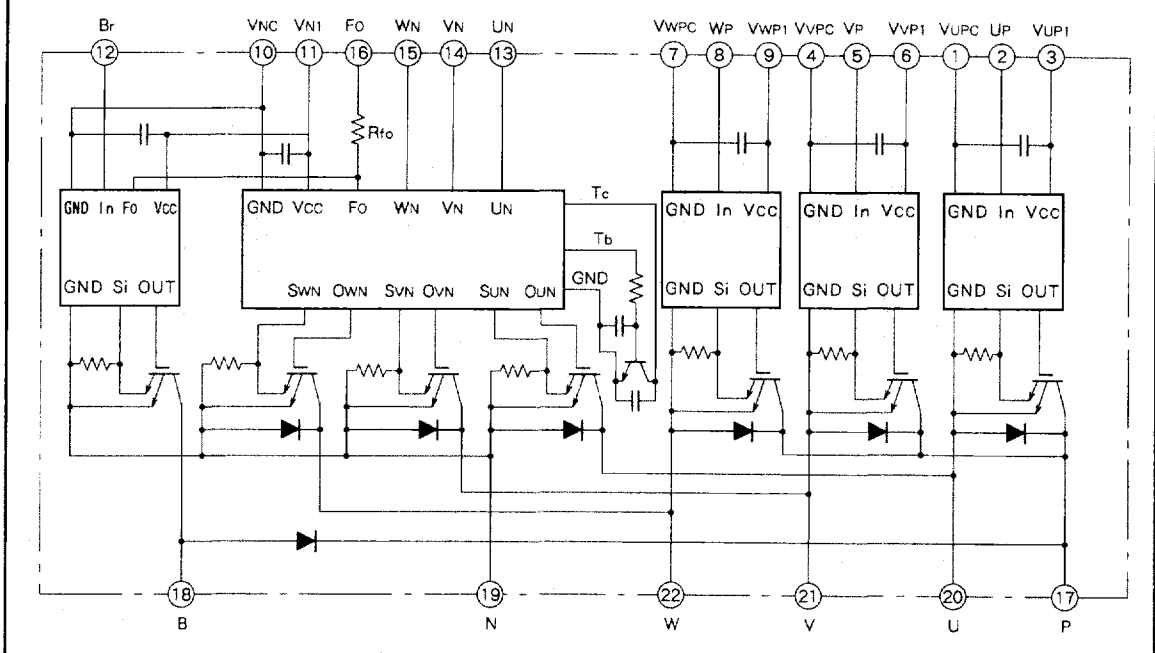
X IS 3.56±0.25.



PM30RMC060

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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
$V_{cc(surge)}$	Supply voltage (surge)	Applied between : P-N, surge value	500	V
V_{CES}	Collector-emitter voltage		600	V
$\pm I_c$	Collector current	$T_c = 25^\circ\text{C}$	30	A
$\pm I_{CP}$	Collector current (peak)	$T_c = 25^\circ\text{C}$	60	A
P_c	Collector dissipation	$T_c = 25^\circ\text{C}$	96	W
T_j	Junction temperature		$-20 \sim +150$	$^\circ\text{C}$

BRAKE PART

Symbol	Parameter	Conditions	Ratings	Unit
V_{cc}	Supply voltage	Applied between : P-N	450	V
$V_{cc(surge)}$	Supply voltage (surge)	Applied between : P-N, surge value	500	V
V_{CES}	Collector-emitter voltage		600	V
I_c	Collector current	$T_c = 25^\circ\text{C}$	10	A
I_{CP}	Collector current (peak)	$T_c = 25^\circ\text{C}$	20	A
P_c	Collector dissipation	$T_c = 25^\circ\text{C}$	41	W
$V_{R(DC)}$	FWDi rating DC reverse voltage	$T_c = 25^\circ\text{C}$	600	V
I_F	FWDi forward current	$T_c = 25^\circ\text{C}$	10	A
T_j	Junction temperature		$-20 \sim +150$	$^\circ\text{C}$

CONTROL PART

Symbol	Parameter	Conditions	Ratings	Unit
V_o	Supply voltage	Applied between : $V_{UP1}-V_{UPC}, V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}, V_{N1}-V_{NC}$	20	V
V_{oIN}	Input voltage	Applied between : $U_P-U_{PC}, V_P-V_{PC}, W_P-W_{PC}, U_N, V_N, W_N, B-V_{NC}$	20	mA
V_{Fo}	Fault output supply voltage	Applied between : F_o -GND	20	V
I_{Fo}	Fault output current	Sink current of F_o terminal	20	mA

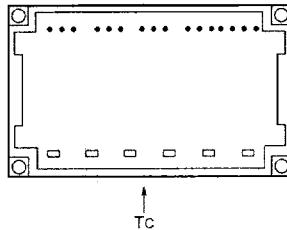
PM30RMC060

FLAT-BASE TYPE
INSULATED PACKAGE

TOTAL SYSTEM

Symbol	Parameter	Conditions	Ratings	Unit
$V_{CC(Prot)}$	Supply voltage protected by OC & SC	$V_D = 13.5 \sim 16.5V$ 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	μs
t_{rr}			—	0.15	0.4	μs
$t_{c(on)}$			—	0.4	1.2	μs
t_{off}			—	2.5	3.3	μs
$t_{c(off)}$			—	0.6	1.2	μs
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	

PM30RMC060

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 _{NPC}	13.5	15	16.5	V
I _D	Circuit current	V _D = 15V, V _{CIN} = 1mA	—	23	30	mA
		V _{N1} -V _{NPC} V _{XP1} -V _{XPC}	—	7	10	
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 , Br-V _{NPC}	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, U _P -U _N , V _P -V _N , W _P -W _N	3.0	—	—	μs
		Using application circuit Opto-coupler's input signal I _F = 12mA	5.0	—	—	
OC	Over current trip level	- 20°C ≤ T _J ≤ 125°C, V _D = 15V	39	53	—	A
		Inverter part Brake part	12	18	—	
SC	Short circuit trip level	- 20°C ≤ T _J ≤ 125°C, V _D = 15V	—	80	—	A
		Inverter part Brake part	—	27	—	
t _{off(OC)}	Over current delay time	V _D = 15V	—	10	—	μs
OT	Over temperature protection	Base-plate	100	110	120	°C
OT _r	Reset level	Temperature detection	—	90	—	°C
UV	Supply circuit under voltage protection	Trip level	11.5	12.0	12.5	V
UV _r	Reset level	Reset level	—	12.5	—	V
I _{FO(H)}	Fault output current	V _D = 15V, V _{FO} = 15V	—	—	0.01	mA
I _{FO(L)}	(Note 2)	(Note 2)	—	10	15	mA
t _{FO}	Minimum fault output pulse width	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.

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	—	—	3.0	°C/W
R _{th(j-c)Q}		Brake IGBT part	—	—	3.0	°C/W
R _{th(j-c)F}		Brake FWDi part	—	—	4.5	°C/W
R _{th(c-f)}	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

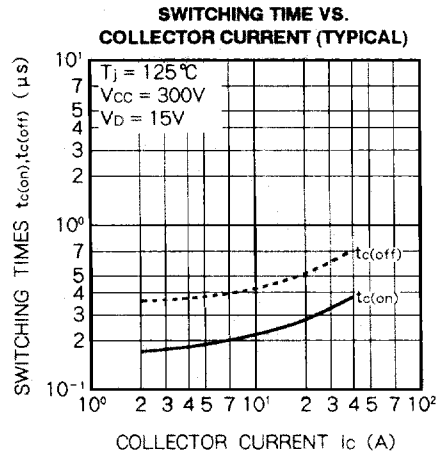
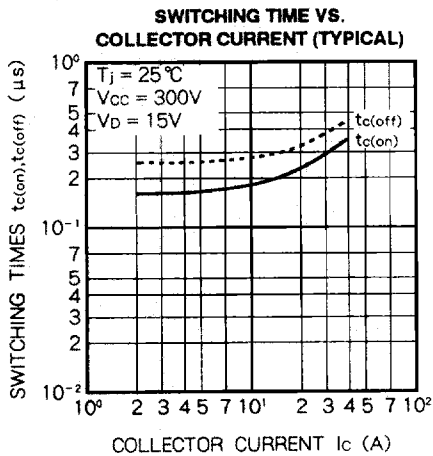
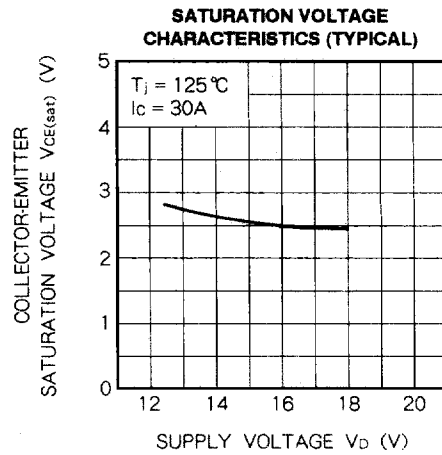
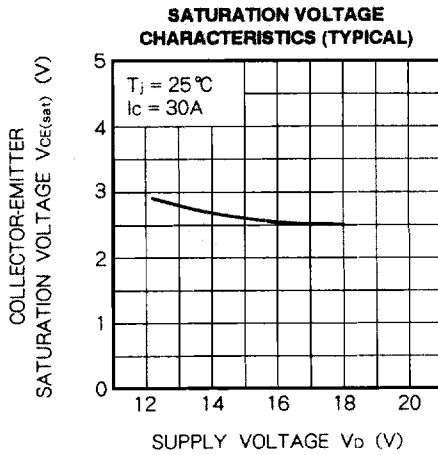
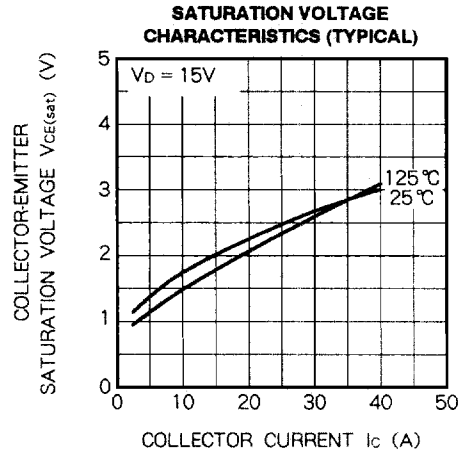
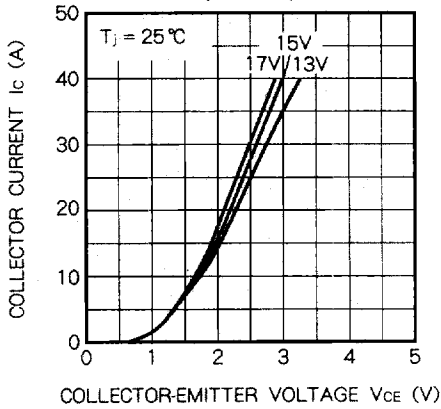
RECOMMENDED CONDITIONS FOR USE

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V _{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 _{NPC}	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 -V _{UPC} , V _P -V _{VPC} , W _P -V _{WPC} , U _N , V _N , W _N , Br-V _{NPC}	4	—	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	5.0	—	—	μs

PM30RMC060

FLAT-BASE TYPE
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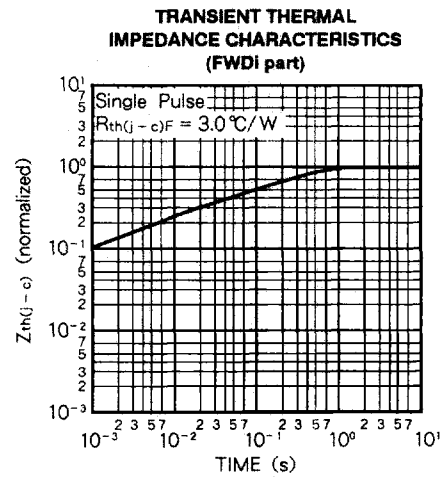
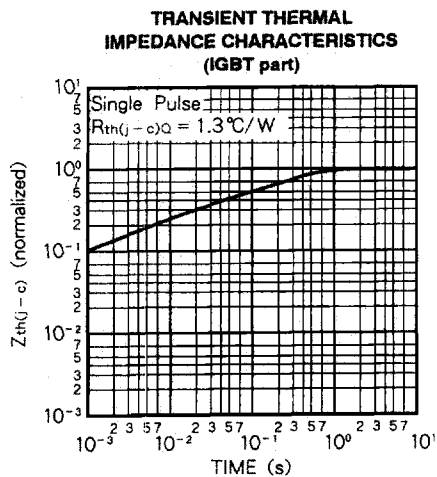
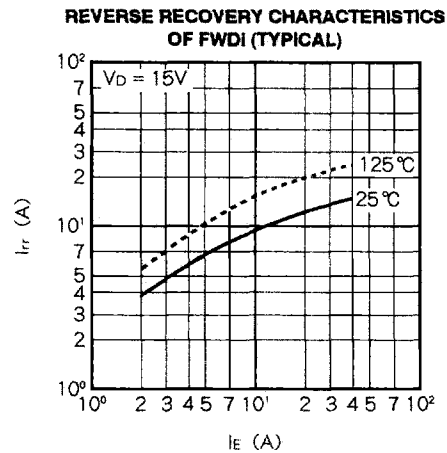
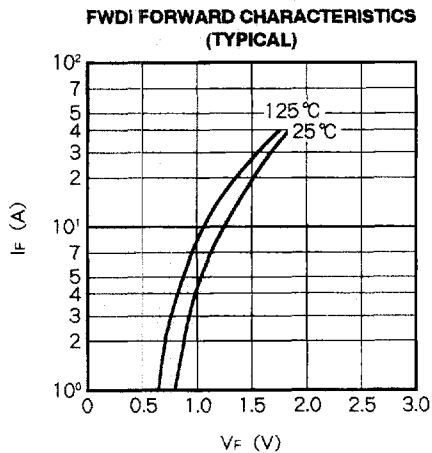
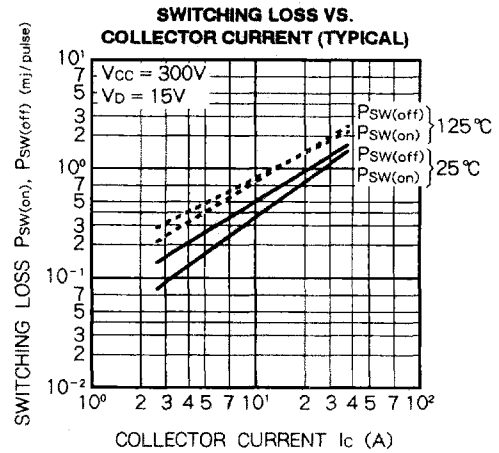
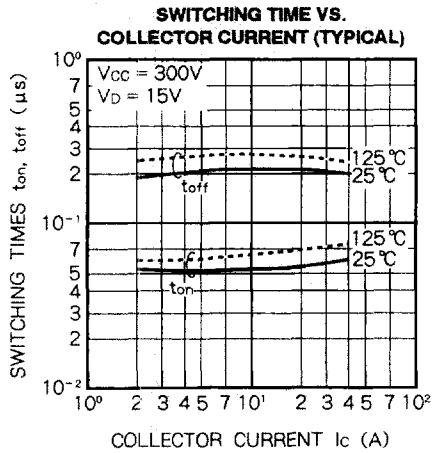
PERFORMANCE CURVES (INVERTER PART)
OUTPUT CHARACTERISTICS
(TYPICAL)



PM30RMC060

FLAT-BASE TYPE
INSULATED PACKAGE

(INVERTER PART)

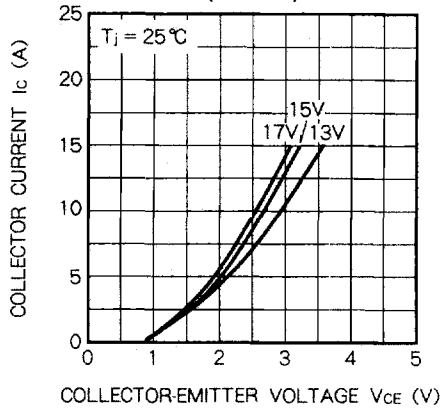


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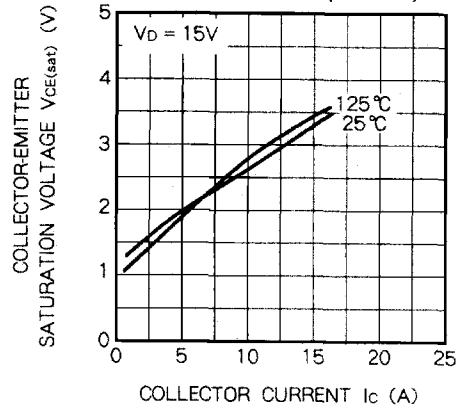
FLAT-BASE TYPE
INSULATED PACKAGE

PERFORMANCE CURVES (BRAKE PART)

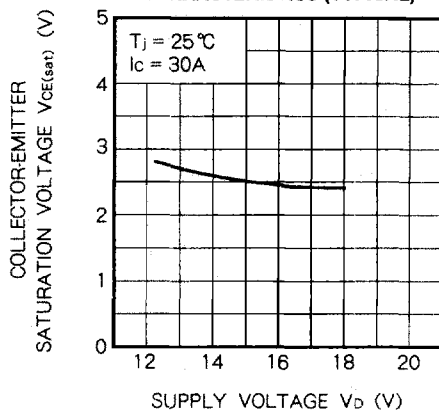
OUTPUT CHARACTERISTICS
(TYPICAL)



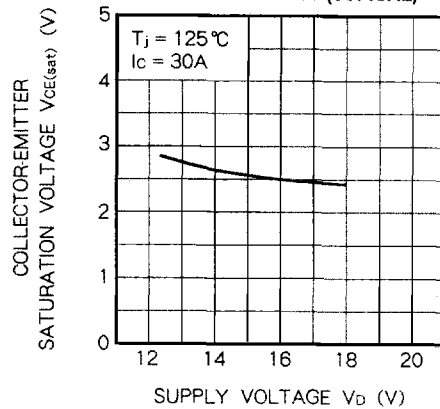
SATURATION VOLTAGE
CHARACTERISTICS (TYPICAL)



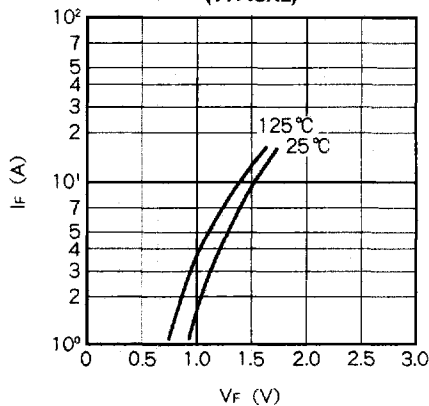
SATURATION VOLTAGE
CHARACTERISTICS (TYPICAL)



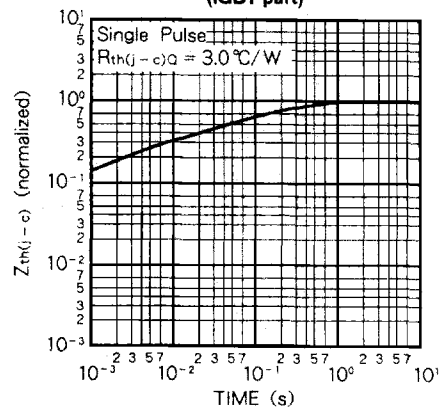
SATURATION VOLTAGE
CHARACTERISTICS (TYPICAL)



FWDI FORWARD CHARACTERISTICS
(TYPICAL)



TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS
(IGBT part)

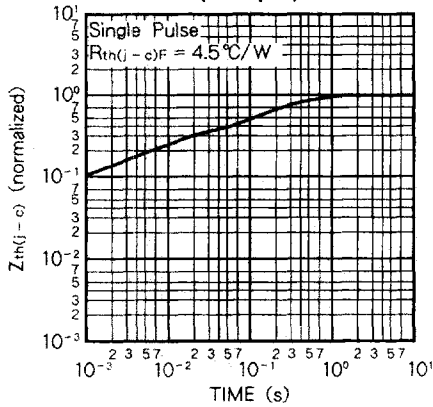


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FLAT-BASE TYPE
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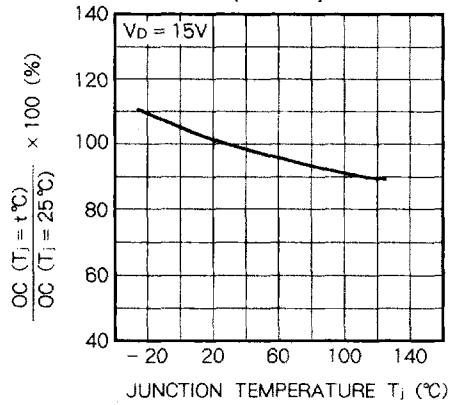
(BRAKE PART)

TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (FWDI part)

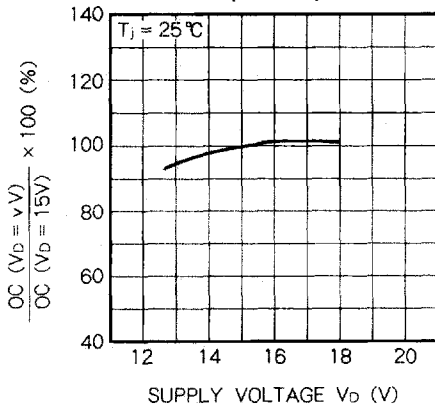


(CONTROL PART)

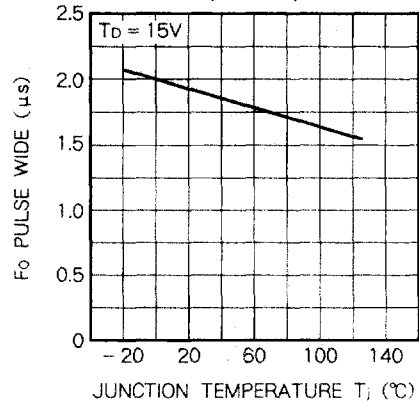
OC VS. T_j CHARACTERISTICS (TYPICAL)



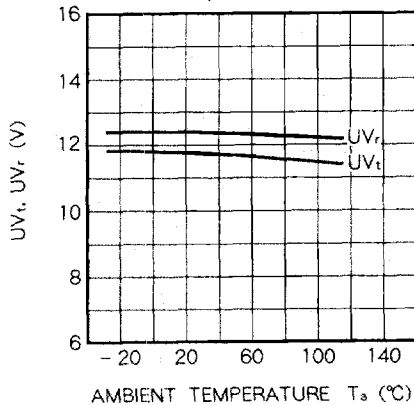
OC VS. V_D CHARACTERISTICS (TYPICAL)



F_o PULSE WIDTH VS. T_j CHARACTERISTICS (TYPICAL)



UV_t, UV_r VS. T_a CHARACTERISTICS (TYPICAL)



I_D VS. f_c CHARACTERISTICS (TYPICAL)

