

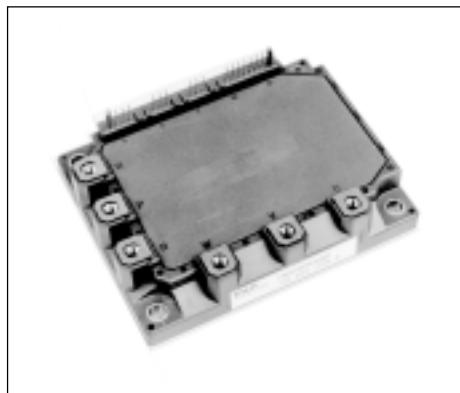
7MBP50RA060

IGBT-IPM R series

600V / 50A 7 in one-package

■ Features

- Temperature protection provided by directly detecting the junction temperature of the IGBTs
- Low power loss and soft switching
- Compatible with existing IPM-N series packages
- High performance and high reliability IGBT with overheating protection
- Higher reliability because of a big decrease in number of parts in built-in control circuit



■ Maximum ratings and characteristics

● Absolute maximum ratings(at Tc=25°C unless otherwise specified)

Item	Symbol	Rating		Unit
		Min.	Max.	
DC bus voltage	Vdc	0	450	V
DC bus voltage (surge)	Vdc(surge)	0	500	V
DC bus voltage (short operating)	Vsc	200	400	V
Collector-Emitter voltage	Vces	0	600	V
DB Reverse voltage	Vr	0	600	V
INV	Collector current DC	Ic	-	50 A
	1ms	Icp	-	100 A
	DC	-Ic	-	50 A
Collector power dissipation	Pc	-	198	W
DB	Collector current DC	Ic	-	30 A
	1ms	Icp	-	60 A
Forward current of Diode	If	-	30	A
Collector power dissipation	Pc	-	120	W
Junction temperature	Tj	-	150	°C
Input voltage of power supply for Pre-Driver	Vcc *1	0	20	V
Input signal voltage	Vin *2	0	Vz	V
Input signal current	Iin	-	1	mA
Alarm signal voltage	Valm *3	0	Vcc	V
Alarm signal current	Ialm *4	-	15	mA
Storage temperature	Tstg	-40	125	°C
Operating case temperature	T _{op}	-20	100	°C
Isolating voltage (Case-Terminal)	Viso *5	-	AC2.5	kV
Screw torque	Mounting (M5)	-	3.5 *6	N·m
	Terminal (M5)	-	3.5 *6	N·m

*1 Apply Vcc between terminal No. 3 and 1, 6 and 4, 9 and 7, 11 and 10.

*2 Apply Vin between terminal No. 2 and 1, 5 and 4, 8 and 7, 12,13,14,15 and 10.

*3 Apply VALM between terminal No. 16 and 10.

*4 Apply IALM to terminal No. 16.

*5 50Hz/60Hz sine wave 1 minute.

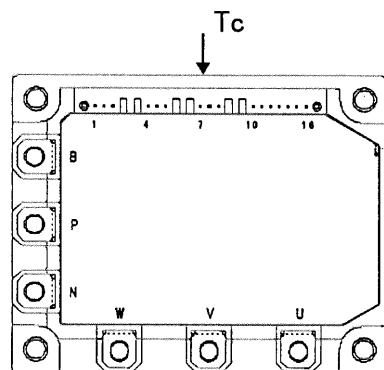


Fig.1 Measurement of case temperature

● Electrical characteristics of power circuit (at Tc=Tj=25°C, Vcc=15V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
INV	Ices	Vce=600V input terminal open	-	-	1.0	mA
	Vce(sat)	Ic=50A	-	-	2.8	V
	Vf	-Ic=50A	-	-	3.0	V
DB	Ices	Vce=600V input terminal open	-	-	1.0	mA
	Vce(sat)	Ic=30A	-	-	2.8	V
	Vf	-Ic=30A	-	-	3.3	V

● Electrical characteristics of control circuit(at $T_c=T_j=25^\circ C$, $V_{cc}=15V$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power supply current of P-line side Pre-driver(one unit)	I_{ccp}	$f_{sw}=0$ to 15kHz $T_c=-20$ to $100^\circ C$ *7	3	-	18	mA
Power supply current of N-line side three Pre-driver	I_{ccn}	$f_{sw}=0$ to 15kHz $T_c=-20$ to $100^\circ C$ *7	10	-	65	mA
Input signal threshold voltage (on/off)	$V_{in(th)}$	ON	1.00	1.35	1.70	V
		OFF	1.25	1.60	1.95	V
Input zener voltage	V_z	$R_{in}=20k\ \text{ohm}$	-	8.0	-	V
Over heating protection temperature level	T_{COH}	$V_{DC}=0V$, $I_c=0A$, Case temperature Fig.1	110	-	125	°C
Hysteresis	T_{CH}		-	20	-	°C
IGBT chips over heating protection temperature level	T_{JOH}	surface of IGBT chips	150	-	-	°C
Hysteresis	T_{JH}		-	20	-	°C
Collector current protection level	INV	I_{oc} $T_j=125^\circ C$ Collector current	75	-	-	A
	DB	I_{oc} $T_j=125^\circ C$ Collector current	45	-	-	A
Over current protection delay time	t_{DOC}	$T_j=25^\circ C$ Fig.2	-	10	-	μs
Under voltage protection level	V_{UV}		11.0	-	12.5	V
Hysteresis	V_H		0.2	-	-	V
Alarm signal hold time	t_{ALM}		1.5	2	-	ms
SC protection delay time	t_{SC}	$T_j=25^\circ C$ Fig.3	-	-	12	μs
Limiting resistor for alarm	R_{ALM}		1425	1500	1575	ohm

*7 Switching frequency of IPM

● Dynamic characteristics(at $T_c=T_j=125^\circ C$, $V_{cc}=15V$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Switching time (IGBT)	t_{on}	$I_C=50A$, $V_{DC}=300V$	0.3	-	-	μs
	t_{off}		-	-	3.6	μs
Switching time (FWD)	t_{trr}	$I_F=50A$, $V_{DC}=300V$	-	-	0.4	μs

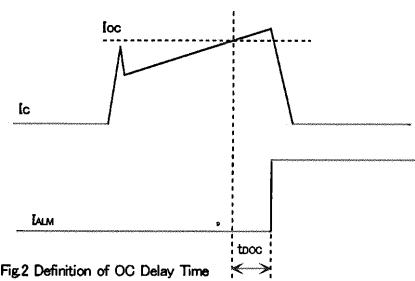


Fig.2 Definition of OC Delay Time

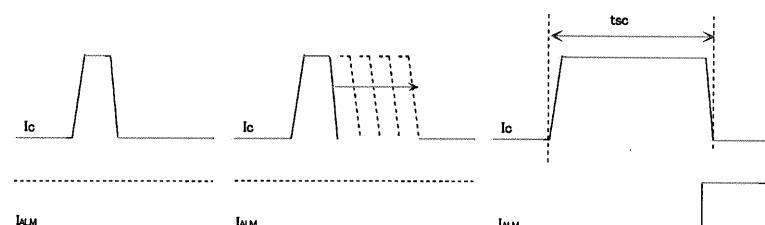


Fig.3 Definition of tsc

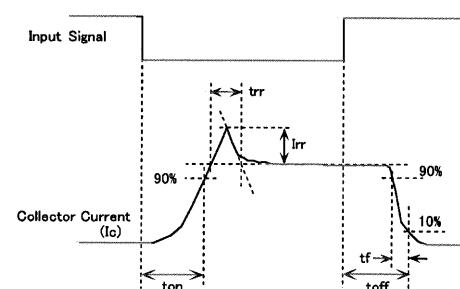


Fig.4 Definition of Switching Time

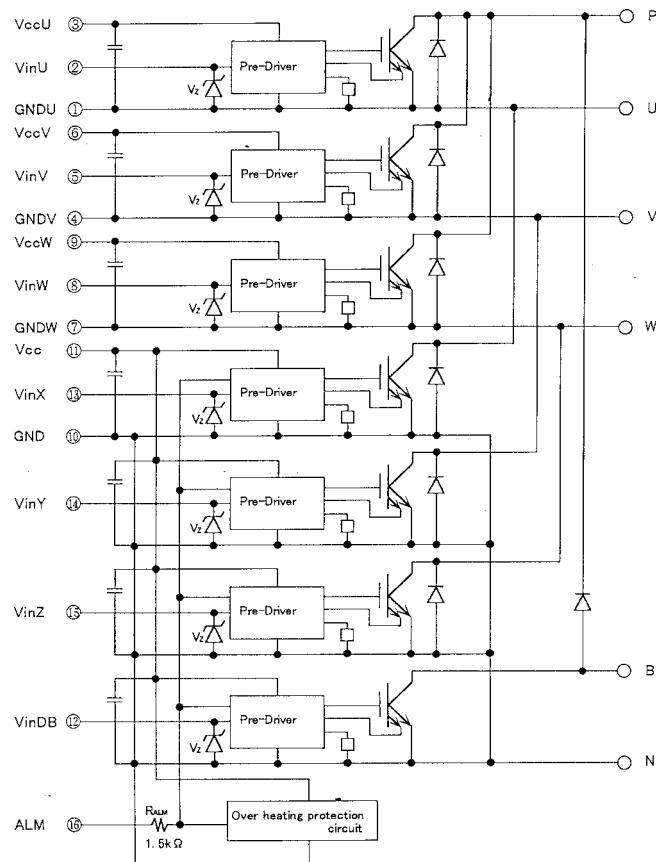
● Thermal characteristics($T_c=25^\circ C$)

Item	Symbol	Typ.	Max.	Unit
Junction to Case thermal resistance	INV IGBT	$R_{th(j-c)}$	-	0.63 °C/W
	FWD	$R_{th(j-c)}$	-	1.33 °C/W
	DB IGBT	$R_{th(j-c)}$	-	1.04 °C/W
Case to fin thermal resistance with compound	$R_{th(c-f)}$	0.05	-	°C/W

● Recommendable value

Item	Symbol	Min.	Typ.	Max.	Unit
DC bus voltage	V_{DC}	200	-	400	V
Operating power supply voltage range of Pre-driver	V_{cc}	13.5	15	16.5	V
Switching frequency of IPM	f_{sw}	1	-	20	kHz
Screw torque	Mounting (M5)	-	2.5	-	N·m
	Terminal (M5)	-	2.5	-	N·m

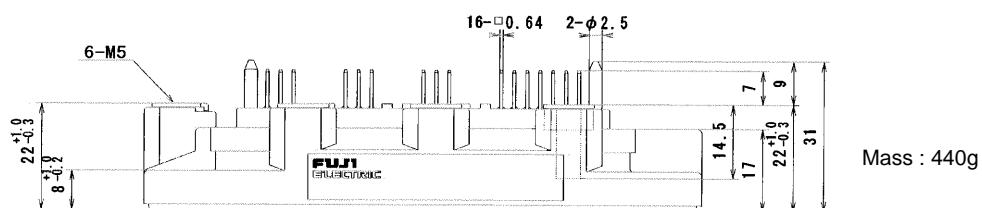
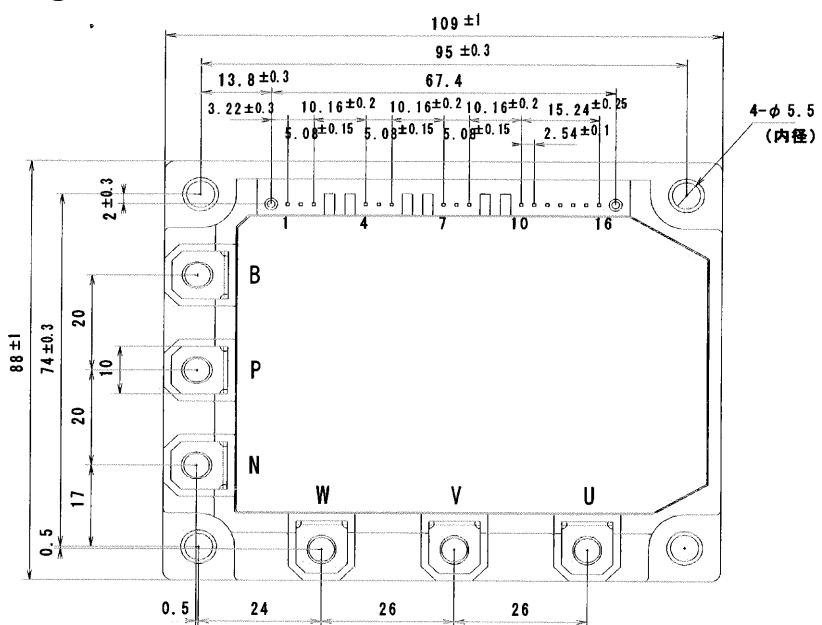
■ Block diagram



Pre-drivers include following functions

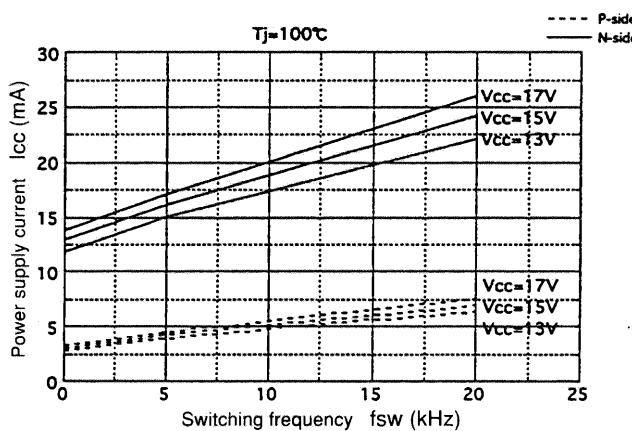
- Short circuit protection circuit
- Amplifier for driver
- Undervoltage protection circuit
- Over current protection circuit
- IGBT chip over heating protection

■ Outline drawings, mm

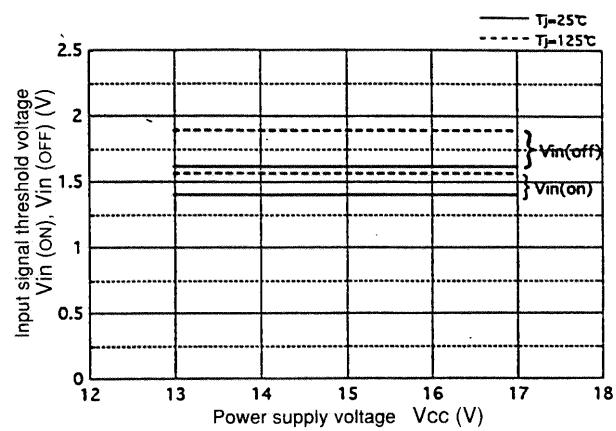


■ Characteristics (Representative)

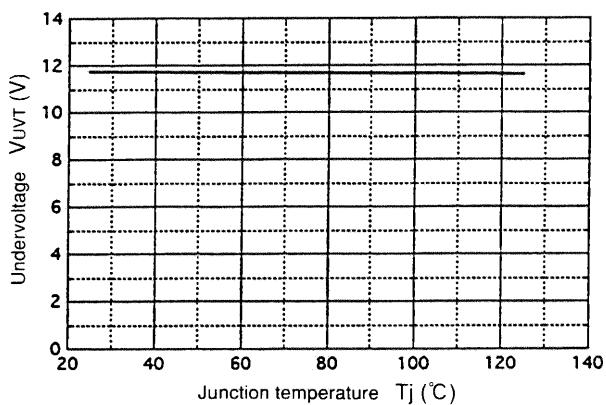
● Control Circuit



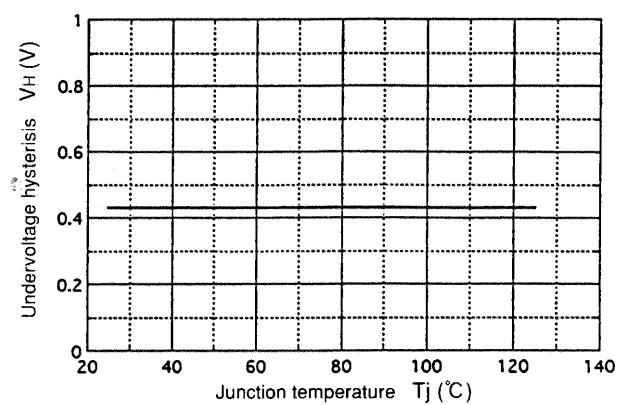
電源電流—スイッチング周波数特性
Power supply current vs. Switching frequency



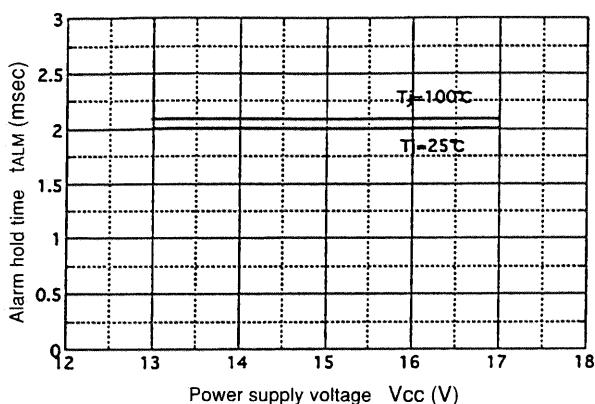
入力しきい値電圧—電源電圧特性
Input signal threshold voltage
vs. Power supply voltage



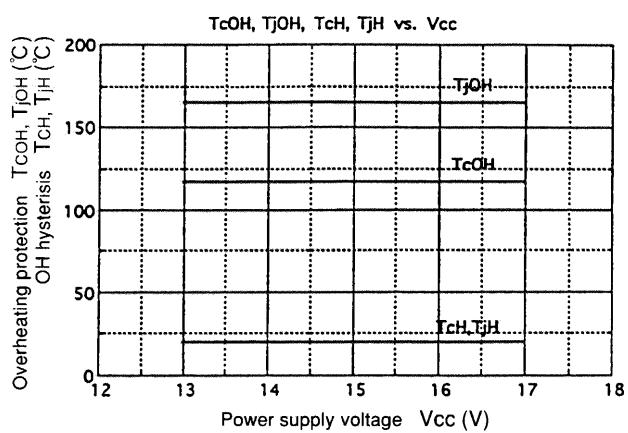
制御電源電圧低下保護レベル—接合部温度特性
Undervoltage vs. Junction temperature



電圧低下保護ヒステリシス—接合部温度特性
Undervoltage hysteresis vs. Junction temperature

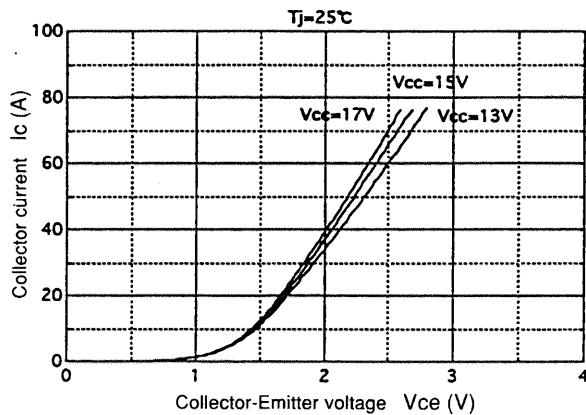


アラーム出力保持時間—電源電圧特性
Alarm hold time vs. Power supply voltage

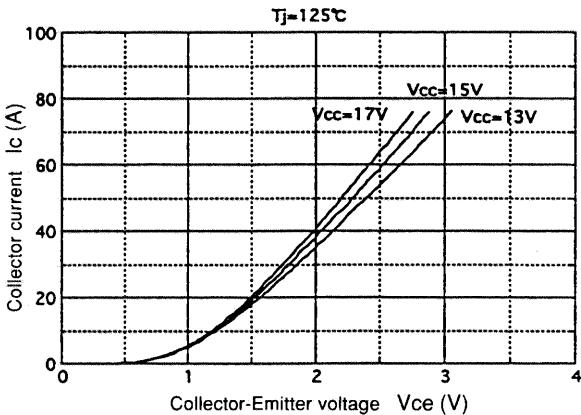


過熱保護動作温度—電源電圧特性
Overheating characteristics $T_{COH}, T_{JOH}, T_{ch}, T_{JH}$ vs. V_{cc}

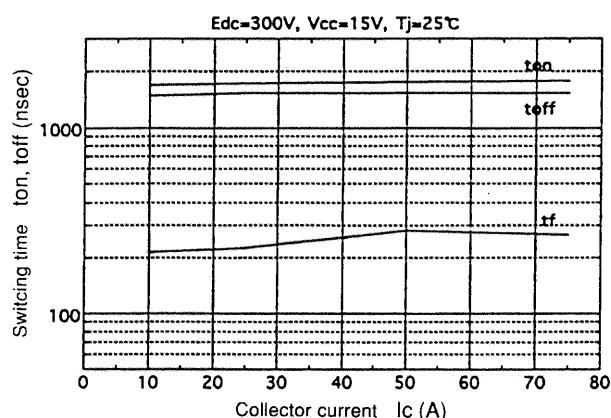
● Inverter



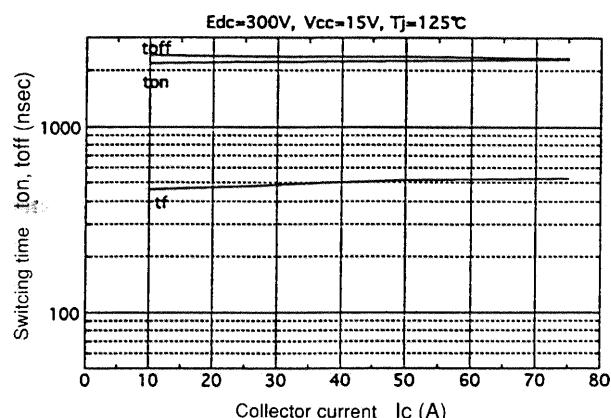
コレクタ電流—コレクタ・エミッタ間電圧特性
Collector current vs. Collector-Emitter voltage



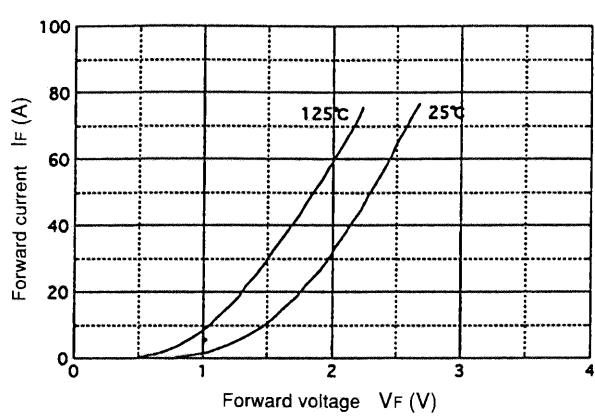
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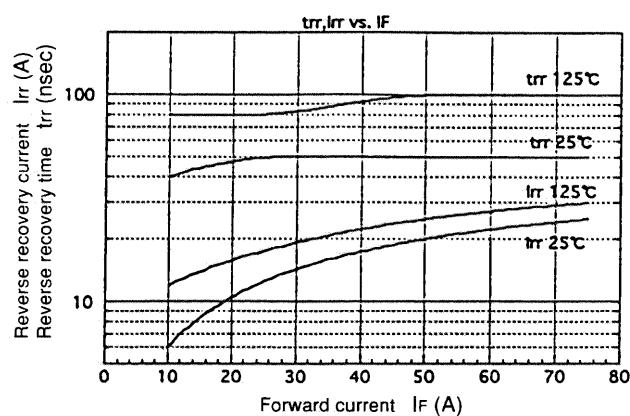
スイッチング時間—コレクタ電流特性
Switching time vs. Collector current



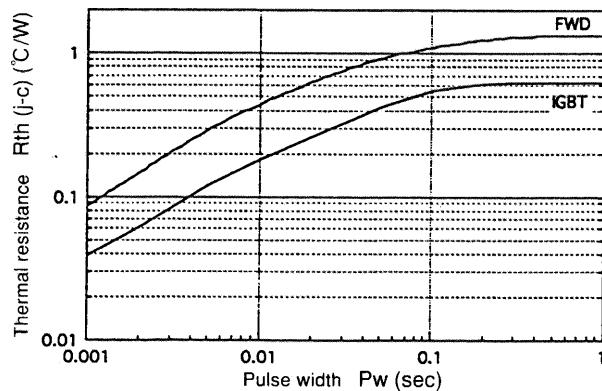
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Switching time vs. Collector current



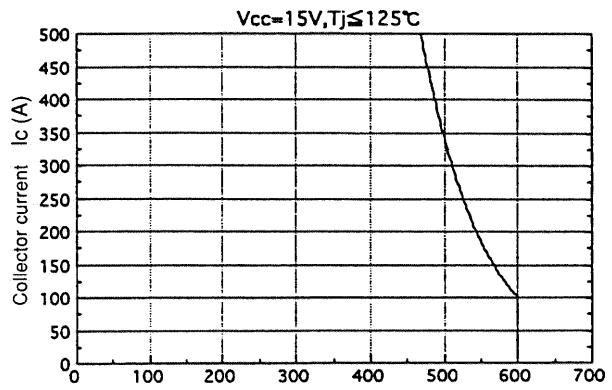
順電流—順電圧特性
Forward current vs. Forward voltage



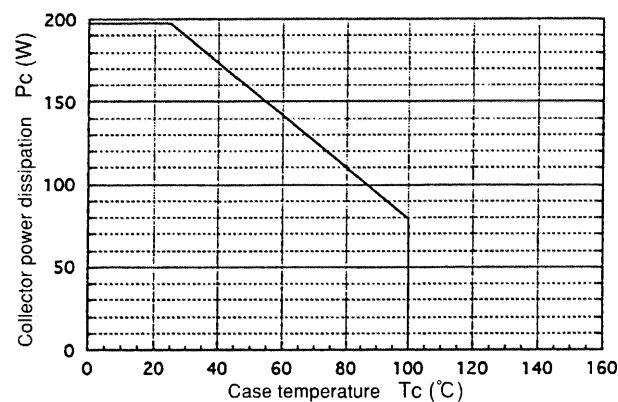
逆回復時間、逆回復電流—逆回復特性
Reverse recovery characteristics t_{rr}, I_{rr} vs. I_F



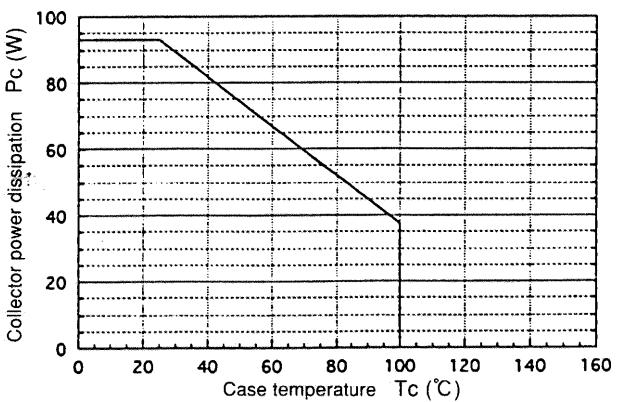
過渡熱抵抗特性
Transient thermal resistance



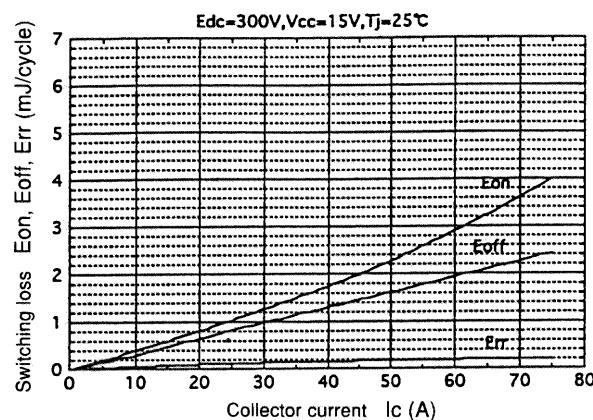
逆バイアス安全動作領域
Reverse biased safe operating area



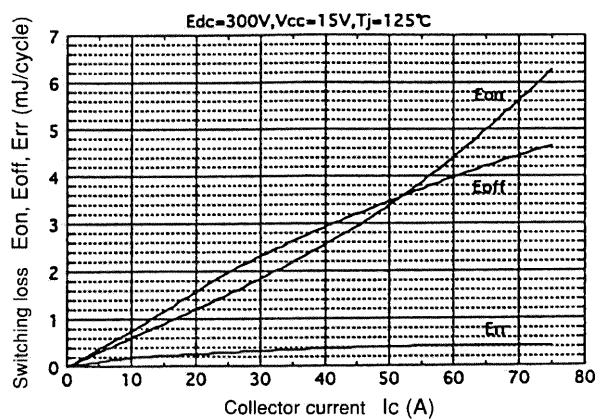
IGBT 電力低減特性 (1 チップ)
Power derating for IGBT (per device)



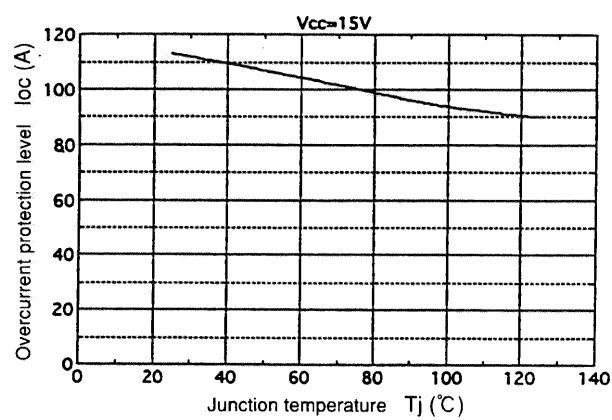
FWD 電力低減特性 (1 チップ)
Power derating for FWD (per device)



スイッチング損失—コレクタ電流特性
Switching loss vs. Collector current



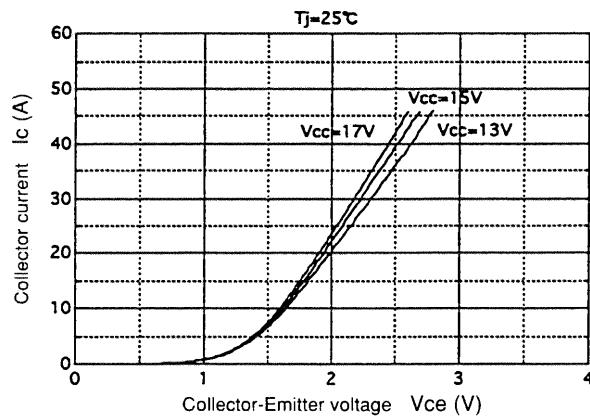
スイッチング損失—コレクタ電流特性
Switching loss vs. Collector current



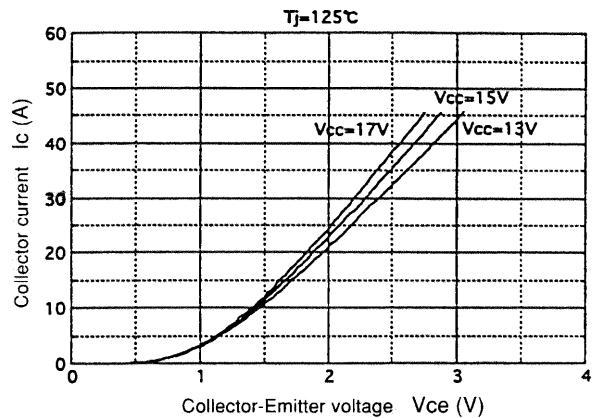
過電流保護—接合部温度特性

Overcurrent protection vs. Junction temperature

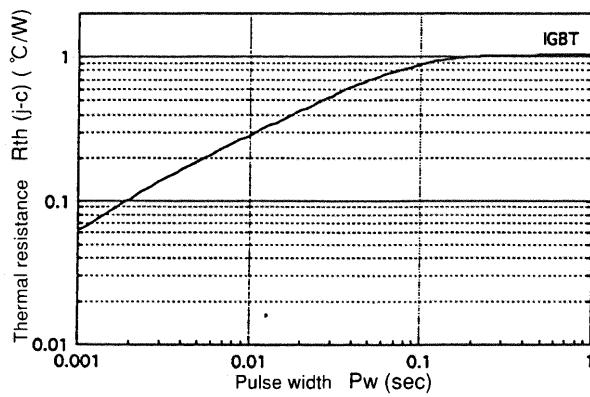
● Brake



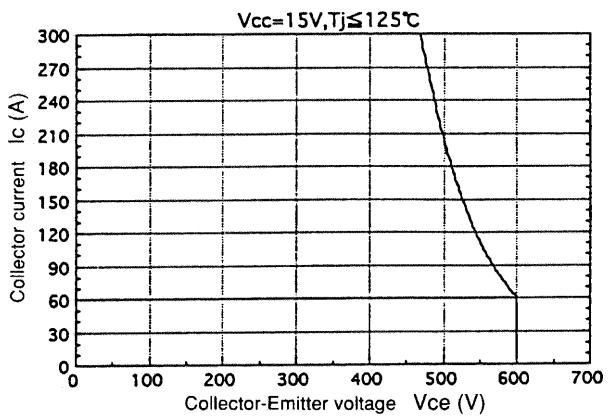
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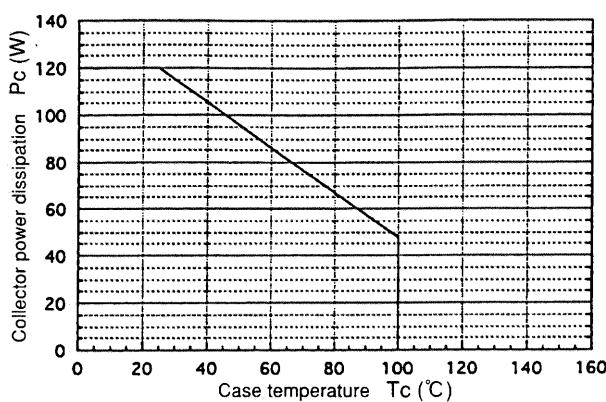
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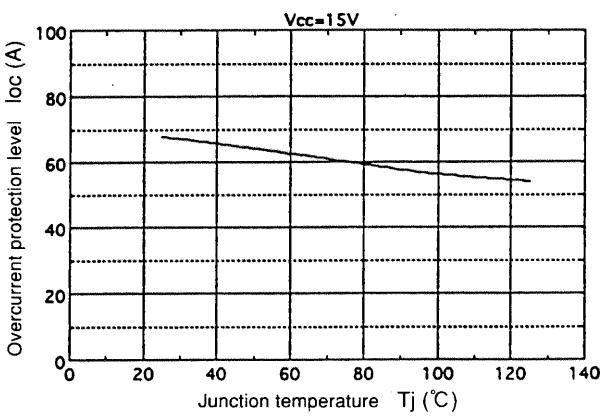
過渡熱抵抗特性
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