

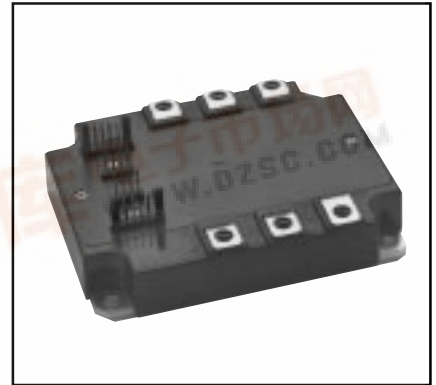
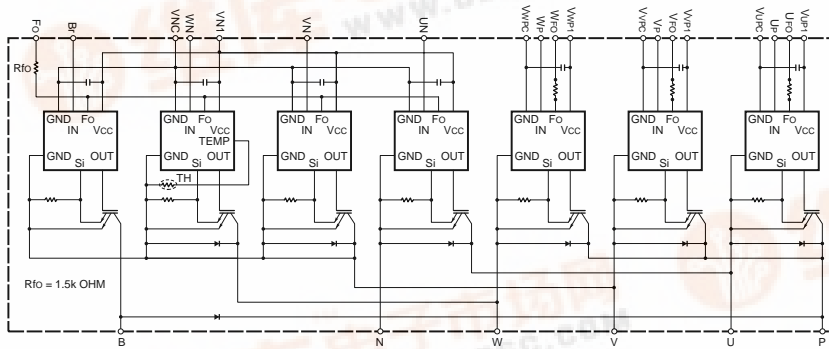
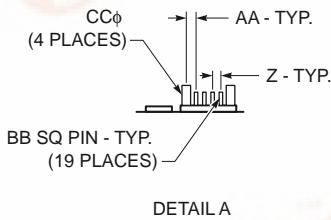
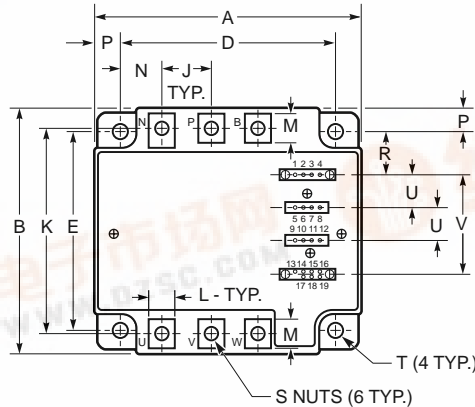
MITSUBISHI INTELLIGENT POWER MODULES

PM75RVA060

FLAT-BASE TYPE
INSULATED PACKAGE

TERMINAL CODE

- | | |
|----------|----------|
| 1. WFO | 11. UP |
| 2. VWPC | 12. VUP1 |
| 3. WP | 13. Br |
| 4. VWP1 | 14. Fo |
| 5. VFO | 15. VNC |
| 6. VVPC | 16. VN1 |
| 7. VP | 17. UN |
| 8. VVP1 | 18. VN |
| 9. UFO | 19. WN |
| 10. VUPC | |



Description:

Mitsubishi Intelligent Power Modules are isolated base modules designed for power switching applications operating at frequencies to 20kHz. Built-in control circuits provide optimum gate drive and protection for the IGBT and free-wheel diode power devices.

Features:

- Complete Output Power Circuit
- Gate Drive Circuit
- Protection Logic
 - Short Circuit
 - Over Temperature
 - Under Voltage

Applications:

- Inverters
- UPS
- Motion/Servo Control
- Power Supplies

Ordering Information:

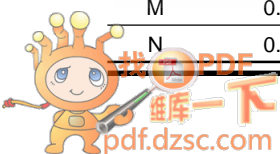
Example: Select the complete part number from the table below -i.e. PM75RVA060 is a 600V, 75 Ampere Intelligent Power Module.

Type	Current Rating Amperes	V _{CES} Volts (x 10)
PM	75	60

Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	4.33	110.0
B	3.50	89.0
C	0.87 +0.04/-0.02	22.0 +1.0/-0.5
D	3.74±0.010	95.0±0.25
E	2.91±0.010	74.0±0.25
F	0.16	4.0
G	0.87	22.0
H	0.42	10.6
J	0.79	20.0
K	2.99±0.02	76.0±0.5
L	0.39	10.0
M	0.49	12.5
N	0.67	17.0

Dimensions	Inches	Millimeters
P	0.30	7.5
R	0.65	16.5
S	M5 Metric	M5
T	0.22 Dia.	Dia. 5.5
U	0.56±0.010	14.1±0.25
V	1.72±0.012	43.57±0.3
W	0.57±0.012	14.6±0.3
X	2.90	73.7
Y	0.78	19.7
Z	0.10±0.010	2.54±0.25
AA	1.37±0.010	3.49±0.25
BB	0.02 SQ	0.64 SQ
CC	0.12 +0.04/-0.02	3.0 +1.0/-0.5



PM75RVA060

**FLAT-BASE TYPE
INSULATED PACKAGE**

Absolute Maximum Ratings, $T_j = 25^\circ\text{C}$ unless otherwise specified

Ratings	Symbol	PM75RVA060	Units
Power Device Junction Temperature	T_j	-20 to 150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-40 to 125	$^\circ\text{C}$
Case Operating Temperature	T_C	-20 to 100	$^\circ\text{C}$
Mounting Torque, M5 Mounting Screws	—	2.5~3.5	N · m
Mounting Torque, M5 Main Terminal Screws	—	2.5~3.5	N · m
Module Weight (Typical)	—	560	Grams
Supply Voltage (Applied between P - N, Surge Value)	$V_{\text{CC(surge)}}$	500	Volts
Supply Voltage Protected by SC ($V_D = 13.5 \sim 16.5\text{V}$, Inverter Part, $T_j = 125^\circ\text{C}$ Start)	$V_{\text{CC(prot.)}}$	400	Volts
Isolation Voltage (Main Terminal to Baseplate, AC 1 min.)	V_{iso}	2500	Vrms

Control Sector

Supply Voltage (Applied between $V_{\text{UP1}}-V_{\text{UPC}}$, $V_{\text{VP1}}-V_{\text{VPC}}$, $V_{\text{WP1}}-V_{\text{WPC}}$, $V_{\text{N1}}-V_{\text{NC}}$)	V_D	20	Volts
Input Voltage (Applied between U_P-V_{UPC} , V_P-V_{VPC} , W_P-V_{WPC} , $U_N \cdot V_N \cdot W_N \cdot B_r-V_{\text{NC}}$)	V_{CIN}	20	Volts
Fault Output Supply Voltage (Applied between F_O-V_{NC} , $*F_O-V_{\text{PC}}$)	V_{FO}	20	Volts
Fault Output Current (Sink Current at U_{FO} , V_{FO} , W_{FO} and F_O Terminal)	I_{FO}	20	mA

IGBT Inverter Sector

Collector-Emitter Voltage ($V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$)	V_{CES}	600	Volts
Collector Current, ($T_C = 25^\circ\text{C}$)	I_C	75	Amperes
Peak Collector Current, ($T_C = 25^\circ\text{C}$)	I_{CP}	150	Amperes
Collector Dissipation ($T_C = 25^\circ\text{C}$)	P_C	284	Watts

Brake Sector

Collector-Emitter Voltage ($V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$)	V_{CES}	600	Volts
Collector Current, ($T_C = 25^\circ\text{C}$)	I_C	30	Amperes
Peak Collector Current, ($T_C = 25^\circ\text{C}$)	I_{CP}	60	Amperes
Collector Dissipation ($T_C = 25^\circ\text{C}$)	P_C	178	Watts
FWDi Forward Current ($T_C = 25^\circ\text{C}$)	I_F	30	Amperes
FWDi Rated DC Reverse Voltage ($T_C = 25^\circ\text{C}$)	$V_{\text{R(DC)}}$	600	Volts

PM75RVA060

**FLAT-BASE TYPE
INSULATED PACKAGE**

Electrical and Mechanical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Control Sector						
Over Current Trip Level Brake Part	OC	$-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $V_D = 15\text{V}$	39	—	—	Amperes
Short Circuit Trip Level Inverter Part	SC	$-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $V_D = 15\text{V}$	115	—	—	Amperes
Short Circuit Trip Level Brake Part			—	94	—	Amperes
Short Circuit Current Shut-off Time	$t_{\text{off(SC)}}$	$V_D = 15\text{V}$	—	10	—	μs
Over Temperature Protection	OT	Trip Level	100	110	120	$^\circ\text{C}$
($V_D = 15\text{V}$, Lower Arm)	OT_r	Reset Level	85	95	105	$^\circ\text{C}$
Supply Circuit Under Voltage Protection	UV	Trip Level	11.5	12.0	12.5	Volts
($-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$)	UV_r	Reset Level	—	12.5	—	Volts
Circuit Current	I_D	$V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$, $V_{\text{N1}}-V_{\text{NC}}$	—	44	60	mA
		$V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$, $V_{\text{XP1}}-V_{\text{XPC}}$	—	13	18	mA
Input ON Threshold Voltage	$V_{\text{th(on)}}$	Applied between U_P-V_{UPC} , V_P-V_{VPC} ,	1.2	1.5	1.8	Volts
Input OFF Threshold Voltage	$V_{\text{th(off)}}$	W_P-V_{WPC} , $U_N \cdot V_N \cdot W_N \cdot B_r-V_{\text{NC}}$	1.7	2.0	2.3	Volts
Fault Output Current	$I_{\text{FO(H)}}$	$V_D = 15\text{V}$, $V_{\text{FO}} = 15\text{V}^*$	—	—	0.01	mA
	$I_{\text{FO(L)}}$	$V_D = 15\text{V}$, $V_{\text{FO}} = 15\text{V}^*$	—	10	15	mA
Minimum Fault Output Pulse Width	t_{FO}	$V_D = 15\text{V}^*$	1.0	1.8	—	ms

* Fault output is given only when the internal SC, OT, and UV protections circuits of either an upper-arm or a lower-arm device operate to protect it.

PM75RVA060

**FLAT-BASE TYPE
INSULATED PACKAGE**

Electrical and Mechanical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
-----------------	--------	-----------------	------	------	------	-------

IGBT Inverter Sector

Collector-Emitter Cutoff Current	I_{CES}	$V_{CE} = V_{CES}, V_D = 15\text{V}, T_j = 25^\circ\text{C}$	—	—	1.0	mA
		$V_{CE} = V_{CES}, V_D = 15\text{V}, T_j = 125^\circ\text{C}$	—	—	10.0	mA
FWDi Forward Voltage	V_{EC}	$-I_C = 75\text{A}, V_D = 15\text{V}, V_{CIN} = 15\text{V}$	—	2.20	3.30	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 75\text{A},$ Pulsed, $T_j = 25^\circ\text{C}$	—	2.35	2.80	Volts
		$V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 75\text{A},$ Pulsed, $T_j = 125^\circ\text{C}$	—	2.55	3.05	Volts
Inductive Load Switching Times (Upper-Lower Arm)	t_{on}		0.4	0.8	2.1	μs
	t_{rr}	$V_D = 15\text{V}, V_{CIN} = 0\text{V} \leftrightarrow 15\text{V}$	—	0.2	0.3	μs
	$t_{C(on)}$	$V_{CC} = 300\text{V}, I_C = 75\text{A},$	—	0.3	1.1	μs
	t_{off}	$T_j = 125^\circ\text{C}$	—	1.8	2.9	μs
	$t_{C(off)}$		—	0.6	1.2	μs

Brake Sector

Collector-Emitter Cutoff Current	I_{CES}	$V_{CE} = V_{CES}, V_D = 15\text{V}, T_j = 25^\circ\text{C}$	—	—	1.0	mA
		$V_{CE} = V_{CES}, V_D = 15\text{V}, T_j = 125^\circ\text{C}$	—	—	10.0	mA
FWDi Forward Voltage	V_{FM}	$I_F = 30\text{A}$	—	2.20	3.30	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 30\text{A},$ Pulsed, $T_j = 25^\circ\text{C}$	—	2.35	2.80	Volts
		$V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 30\text{A},$ Pulsed, $T_j = 125^\circ\text{C}$	—	2.55	3.05	Volts

PM75RVA060

**FLAT-BASE TYPE
INSULATED PACKAGE**

Thermal Characteristics

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	Each Inverter IGBT	—	—	0.44	°C/Watt
	$R_{th(j-c)F}$	Each Inverter FWDi	—	—	1.00	°C/Watt
	$R_{th(j-c)Q}$	Each Brake IGBT	—	—	0.70	°C/Watt
	$R_{th(j-c)F}$	Each Brake FWDi	—	—	1.50	°C/Watt
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Fin Per Module, Thermal Grease Applied	—	—	0.027	°C/Watt

Recommended Conditions for Use

Characteristic	Symbol	Condition	Value	Units
Supply Voltage	V_{CC}	Applied across P-N Terminals	≤ 400	Volts
	$V_{CE(surge)}$	Applied across C-E Terminals	≤ 500	Volts
	V_D	Applied between $V_{UP1}-V_{UPC}^*$, $V_{VP1}-V_{VPC}^*$, $V_{WP1}-V_{WPC}^*$, $V_{N1}-V_{NC}^*$	15 ± 1.5	Volts
Input ON Voltage	$V_{CIN(on)}$	Applied between	≤ 0.8	Volts
Input OFF Voltage	$V_{CIN(off)}$	U_P-V_{UPC} , V_P-V_{VPC} , W_P-V_{WPC} , $U_N \cdot V_N \cdot W_N \cdot B_I-V_{NC}$	≥ 4.0	Volts
Arm Shoot-Through Blocking Time	t_{dead}	For IPM's each Input Signal	≥ 2.5	μs

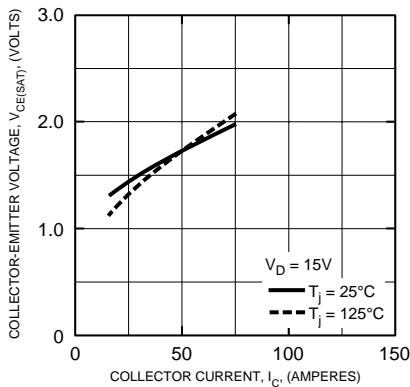
* With ripple satisfying the following conditions, dv/dt swing $\leq 5V/\mu s$, Variation $\leq 2V$ peak to peak.

PM75RVA060

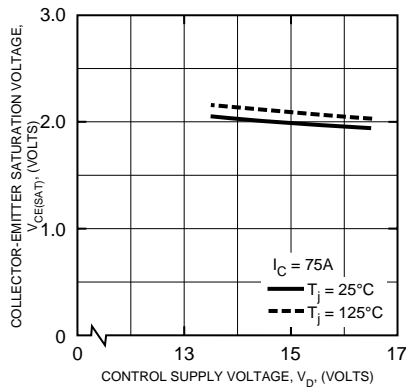
FLAT-BASE TYPE
INSULATED PACKAGE

Inverter Part

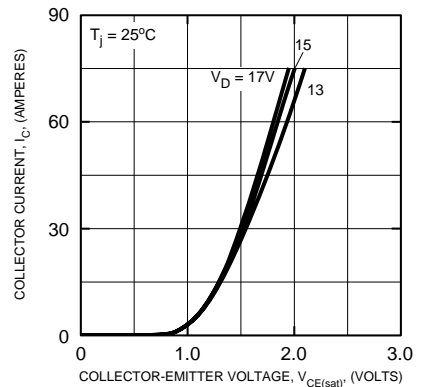
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



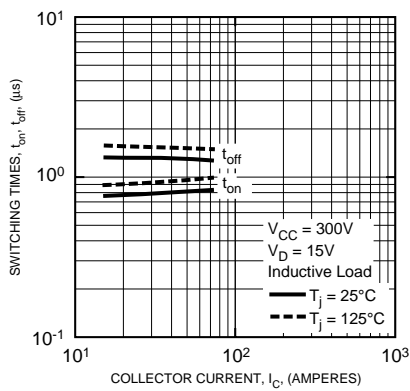
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



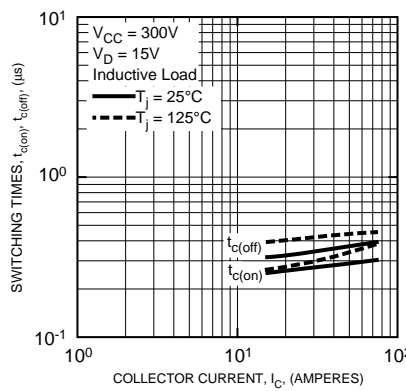
OUTPUT CHARACTERISTICS (TYPICAL)



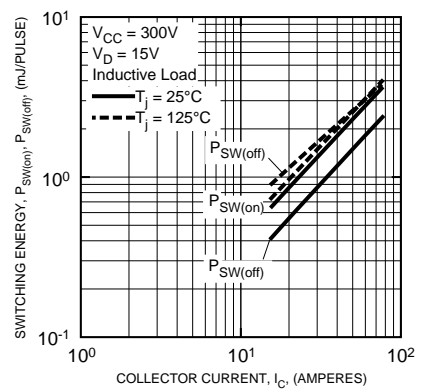
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



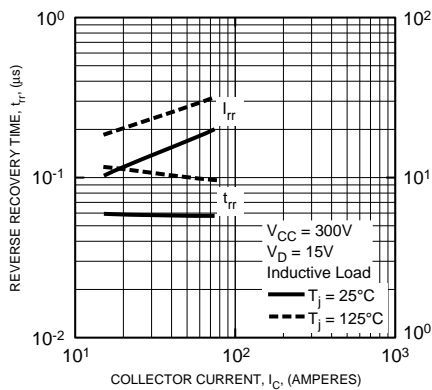
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



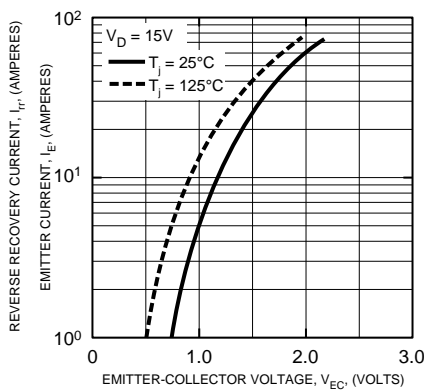
SWITCHING LOSS CHARACTERISTICS (TYPICAL)



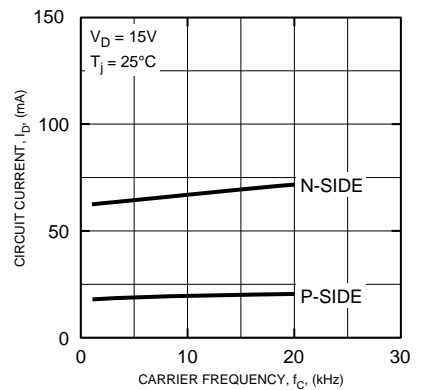
FWDI REVERSE RECOVERY CURRENT VS. COLLECTOR CURRENT (TYPICAL)



DIODE FORWARD CHARACTERISTICS



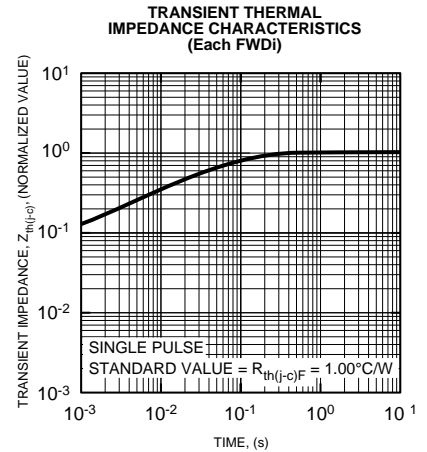
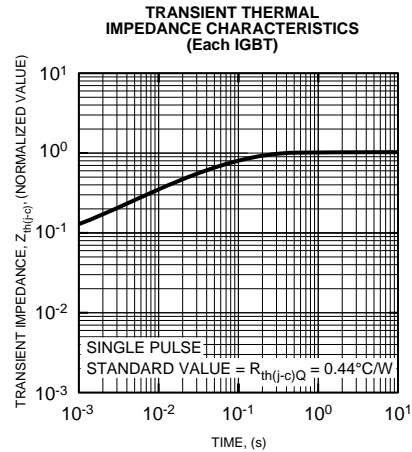
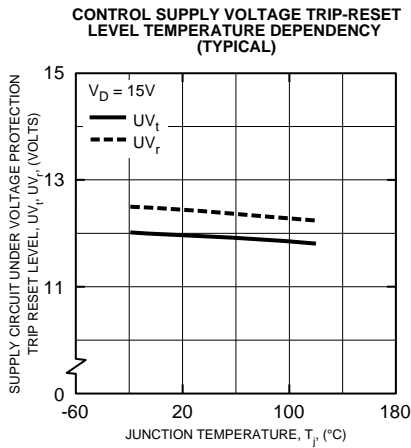
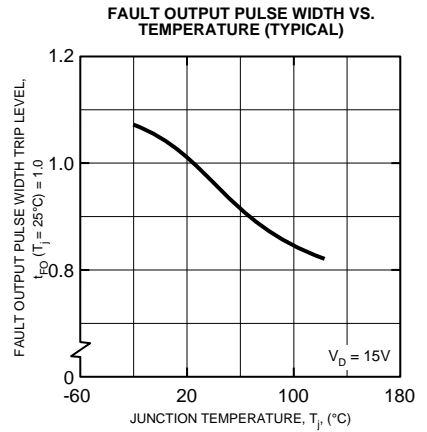
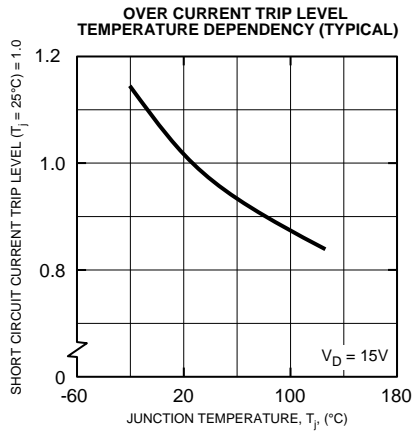
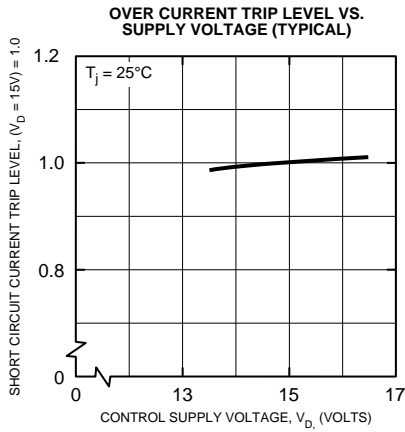
CIRCUIT CURRENT VS. CARRIER FREQUENCY



PM75RVA060

FLAT-BASE TYPE
INSULATED PACKAGE

Inverter Part

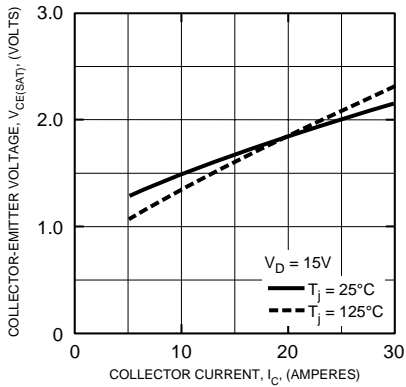


PM75RVA060

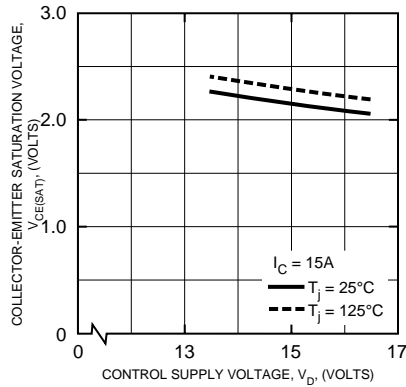
FLAT-BASE TYPE
INSULATED PACKAGE

Brake Part

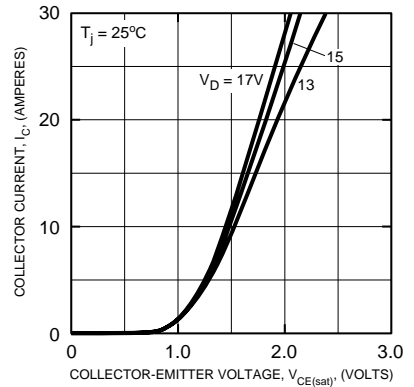
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



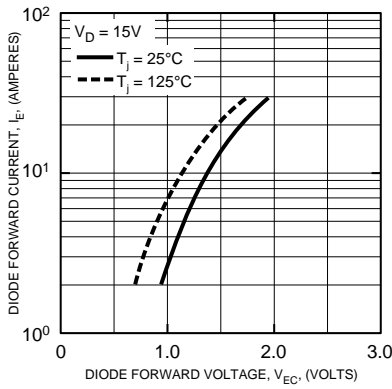
COLLECTOR-EMITTER SATURATON VOLTAGE CHARACTERISTICS (TYPICAL)



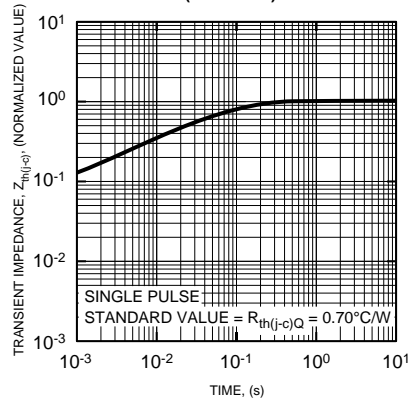
OUTPUT CHARACTERISTICS (TYPICAL)



DIODE FORWARD CHARACTERISTICS



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (Each IGBT)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (Each FWDI)

