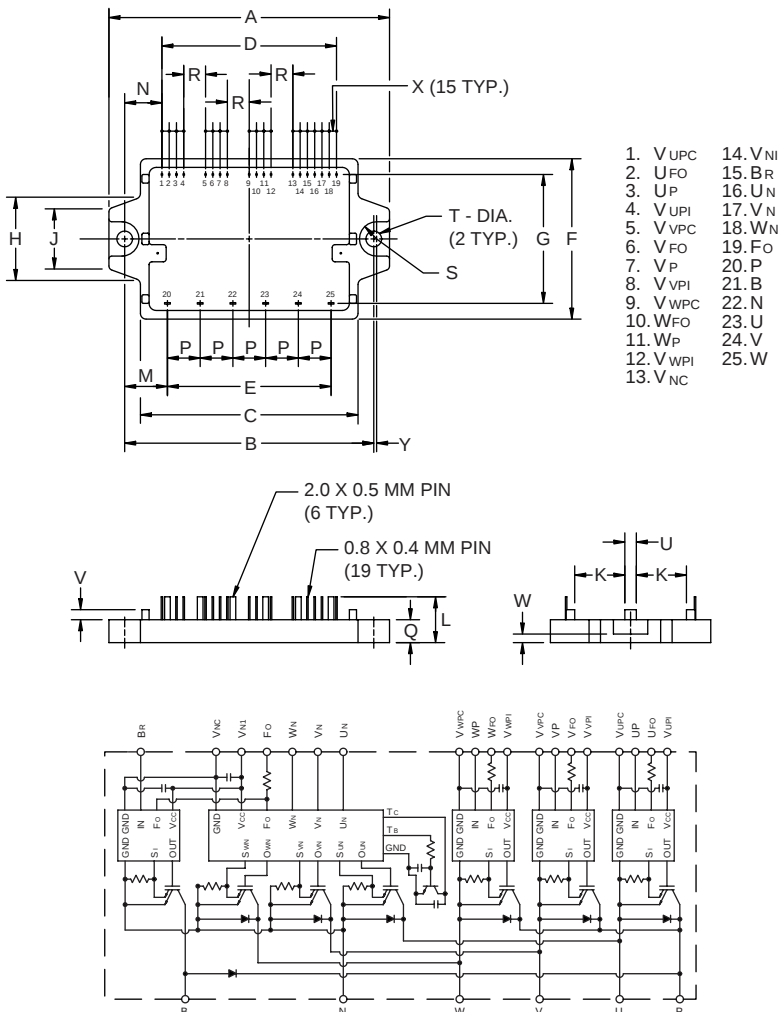


# PM30RSF060

FLAT-BASE TYPE  
INSULATED PACKAGE



## 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 Current
  - 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. PM30RSF060 is a 600V, 30 Ampere Intelligent Power Module.

| Type | Current Rating<br>Amperes | $V_{CES}$<br>Volts (x 10) |
|------|---------------------------|---------------------------|
| PM   | 30                        | 60                        |

## Outline Drawing and Circuit Diagram

| Dimensions | Inches     | Millimeters |
|------------|------------|-------------|
| A          | 3.86±0.04  | 98.0±1.0    |
| B          | 3.42±0.02  | 87.0±0.5    |
| C          | 2.99       | 76.0        |
| D          | 2.400±0.03 | 60.96±0.8   |
| E          | 2.250±0.03 | 57.15±0.8   |
| F          | 2.20±0.04  | 56.0±1.0    |
| G          | 1.77±0.03  | 45.0±0.8    |
| H          | 1.14       | 29.0        |
| J          | 0.83       | 21.0        |
| K          | 0.69       | 17.5        |
| L          | 0.71±0.04  | 18.0±1.0    |
| M          | 0.588      | 14.925      |

| Dimensions | Inches      | Millimeters |
|------------|-------------|-------------|
| N          | 0.512       | 13.02       |
| P          | 0.450±0.012 | 11.43±0.3   |
| Q          | 0.31±0.02   | 8.0±0.5     |
| R          | 0.300       | 7.62        |
| S          | 0.24 Rad.   | Rad. 6.0    |
| T          | 0.22 Dia.   | Dia. 5.5    |
| U          | 0.16        | 4.0         |
| V          | 0.14        | 3.5         |
| W          | 0.12±0.02   | 3.0±0.5     |
| X          | 0.100±0.012 | 2.54±0.3    |
| Y          | 0.04        | 1.0         |

# PM30RSF060

FLAT-BASE TYPE  
INSULATED PACKAGE

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

|                                                                                                                  | Symbol                 | Ratings     | Units            |
|------------------------------------------------------------------------------------------------------------------|------------------------|-------------|------------------|
| Power Device Junction Temperature                                                                                | $T_j$                  | -20 to 150  | $^\circ\text{C}$ |
| Storage Temperature                                                                                              | $T_{\text{stg}}$       | -40 to 125  | $^\circ\text{C}$ |
| Case Operating Temperature                                                                                       | $T_C$                  | -20 to 100  | $^\circ\text{C}$ |
| Mounting Torque, M5 Mounting Screws                                                                              | —                      | 1.47 ~ 1.96 | N · m            |
| Module Weight (Typical)                                                                                          | —                      | 80          | Grams            |
| Supply Voltage Protected by OC and SC ( $V_D = 13.5 - 16.5\text{V}$ , Inverter Part, $T_j = 125^\circ\text{C}$ ) | $V_{\text{CC(prot.)}}$ | 400         | Volts            |
| Isolation Voltage (Main Terminal to Baseplate, AC 1 min.)                                                        | $V_{\text{iso}}$       | 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 $U_P-V_{\text{UPC}}$ , $V_P-V_{\text{VPC}}$ , $W_P-V_{\text{WPC}}$ , $U_N \cdot V_N \cdot W_N-V_{\text{NC}}$ )                         | $V_{\text{CIN}}$ | 20 | Volts |
| Fault Output Supply Voltage (Applied between $U_{\text{FO}}-V_{\text{UPC}}$ , $V_{\text{FO}}-V_{\text{VPC}}$ , $W_{\text{FO}}-V_{\text{WPC}}$ , $F_O-V_{\text{NC}}$ ) | $V_{\text{FO}}$  | 20 | Volts |
| Fault Output Current (Sink Current of $U_{\text{FO}}$ , $V_{\text{FO}}$ , $W_{\text{FO}}$ and $F_O$ Terminal)                                                         | $I_{\text{FO}}$  | 20 | mA    |

## IGBT Inverter Sector

|                                                                                  |                        |     |         |
|----------------------------------------------------------------------------------|------------------------|-----|---------|
| Collector-Emitter Voltage ( $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ ) | $V_{\text{CES}}$       | 600 | Volts   |
| Collector Current, $\pm$                                                         | $I_C$                  | 30  | Amperes |
| Peak Collector Current, $\pm$                                                    | $I_{\text{CP}}$        | 60  | Amperes |
| Supply Voltage (Applied between P - N)                                           | $V_{\text{CC}}$        | 450 | Volts   |
| Supply Voltage, Surge (Applied between P - N)                                    | $V_{\text{CC(surge)}}$ | 500 | Volts   |
| Collector Dissipation                                                            | $P_C$                  | 83  | Watts   |

## Brake Sector

|                                                                                  |                        |     |         |
|----------------------------------------------------------------------------------|------------------------|-----|---------|
| Collector-Emitter Voltage ( $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ ) | $V_{\text{CES}}$       | 600 | Volts   |
| Collector Current, ( $T_C = 25^\circ\text{C}$ )                                  | $I_C$                  | 10  | Amperes |
| Peak Collector Current, ( $T_C = 25^\circ\text{C}$ )                             | $I_{\text{CP}}$        | 20  | Amperes |
| Supply Voltage (Applied between P - N)                                           | $V_{\text{CC}}$        | 450 | Volts   |
| Supply Voltage, Surge (Applied between P - N)                                    | $V_{\text{CC(surge)}}$ | 500 | Volts   |
| Collector Dissipation                                                            | $P_C$                  | 39  | Watts   |
| Diode Forward Current                                                            | $I_F$                  | 10  | Amperes |
| Diode DC Reverse Voltage                                                         | $V_{\text{R(DC)}}$     | 600 | Volts   |

# PM30RSF060

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            |
|-----------------------------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------------------|
| <b>Control Sector</b>                   |                             |                                                                                                                                                        |      |      |      |                  |
| Over Current Trip Level Inverter Part   | OC                          | $-20^\circ\text{C} \leq T \leq 125^\circ\text{C}$ , $V_D = 15\text{V}$                                                                                 | 39   | 53   | —    | Amperes          |
| Over Current Trip Level Brake Part      |                             |                                                                                                                                                        | 12   | 18   | —    | Amperes          |
| Short Circuit Trip Level Inverter Part  | SC                          | $-20^\circ\text{C} \leq T \leq 125^\circ\text{C}$ , $V_D = 15\text{V}$                                                                                 | —    | 80   | —    | Amperes          |
| Short Circuit Trip Level Brake Part     |                             |                                                                                                                                                        | —    | 27   | —    | Amperes          |
| Over Current Delay Time                 | $t_{\text{off}}(\text{OC})$ | $V_D = 15\text{V}$                                                                                                                                     | —    | 10   | —    | $\mu\text{s}$    |
| Over Temperature Protection             | OT                          | Trip Level                                                                                                                                             | 100  | 110  | 120  | $^\circ\text{C}$ |
|                                         | $\text{OT}_r$               | Reset Level                                                                                                                                            | —    | 90   | —    | $^\circ\text{C}$ |
| Supply Circuit Under Voltage Protection | UV                          | Trip Level                                                                                                                                             | 11.5 | 12.0 | 12.5 | Volts            |
|                                         | $\text{UV}_r$               | Reset Level                                                                                                                                            | —    | 12.5 | —    | Volts            |
| Supply Voltage                          | $V_D$                       | Applied between $V_{\text{UP1}}-V_{\text{UPC}}$ ,<br>$V_{\text{VP1}}-V_{\text{VPC}}$ , $V_{\text{WP1}}-V_{\text{WPC}}$ , $V_{\text{N1}}-V_{\text{NC}}$ | 13.5 | 15   | 16.5 | Volts            |
| Circuit Current                         | $I_D$                       | $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{\text{N1}}-V_{\text{NC}}$                                                                     | —    | 25   | 30   | mA               |
|                                         |                             | $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{\text{XP1}}-V_{\text{XPC}}$                                                                   | —    | 7    | 10   | mA               |
| Input ON Threshold Voltage              | $V_{\text{th(on)}}$         | Applied between                                                                                                                                        | 1.2  | 1.5  | 1.8  | Volts            |
| Input OFF Threshold Voltage             | $V_{\text{th(off)}}$        | $U_P-V_{\text{UPC}}$ , $V_P-V_{\text{VPC}}$ , $W_P-V_{\text{WPC}}$ ,<br>$U_N \cdot V_N \cdot W_N \cdot B_r-V_{\text{NC}}$                              | 1.7  | 2.0  | 2.3  | Volts            |
| PWM Input Frequency                     | $f_{\text{PWM}}$            | 3- $\phi$ Sinusoidal                                                                                                                                   | —    | 15   | 20   | kHz              |
| 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        | $t_{\text{FO}}$             | $V_D = 15\text{V}$                                                                                                                                     | 1.0  | 1.8  | —    | ms               |

# PM30RSF060

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 Cutoff Current             | $I_{CES}$     | $V_{CE} = V_{CES}, T_j = 25^\circ\text{C}$                                                                                          | —   | —    | 1.0 | mA            |
|                                      |               | $V_{CE} = V_{CES}, T_j = 125^\circ\text{C}$                                                                                         | —   | —    | 10  | mA            |
| Diode Forward Voltage                | $V_{EC}$      | $-I_C = 30\text{A}, V_D = 15\text{V}, V_{CIN} = 15\text{V}$                                                                         | —   | 2.5  | 3.5 | Volts         |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 30\text{A}$                                                                           | —   | 1.8  | 2.5 | Volts         |
|                                      |               | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 30\text{A}, T_j = 125^\circ\text{C}$                                                  | —   | 1.9  | 2.6 | Volts         |
| Inductive Load Switching Times       | $t_{on}$      | $V_D = 15\text{V}, V_{CIN} = 0 \leftrightarrow 15\text{V}$<br>$V_{CC} = 300\text{V}, I_C = 30\text{A}$<br>$T_j = 125^\circ\text{C}$ | 0.3 | 0.6  | 1.5 | $\mu\text{s}$ |
|                                      | $t_{rr}$      |                                                                                                                                     | —   | 0.12 | 0.3 | $\mu\text{s}$ |
|                                      | $t_{C(on)}$   |                                                                                                                                     | —   | 0.3  | 1.0 | $\mu\text{s}$ |
|                                      | $t_{off}$     |                                                                                                                                     | —   | 2.0  | 2.8 | $\mu\text{s}$ |
|                                      | $t_{C(off)}$  |                                                                                                                                     | —   | 0.6  | 1.5 | $\mu\text{s}$ |

### Brake Sector

|                                      |               |                                                                                    |   |     |     |       |
|--------------------------------------|---------------|------------------------------------------------------------------------------------|---|-----|-----|-------|
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 10\text{A}, T_j = 25^\circ\text{C}$  | — | 2.6 | 3.5 | Volts |
|                                      |               | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 10\text{A}, T_j = 125^\circ\text{C}$ | — | 2.9 | 4.0 | Volts |
| Diode Forward Voltage                | $V_{FM}$      | $I_F = 10\text{A}$                                                                 | — | 1.5 | 2.5 | Volts |
| Collector Cutoff Current             | $I_{CES}$     | $V_{CE} = V_{CES}, T_j = 25^\circ\text{C}$                                         | — | —   | 1   | mA    |
|                                      |               | $V_{CE} = V_{CES}, T_j = 125^\circ\text{C}$                                        | — | —   | 10  | mA    |

# PM30RSF060

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                                | —    | —    | 1.5   | °C/Watt |
|                                     | $R_{th(j-c)F}$ | Each Inverter FWDi                                | —    | —    | 3.0   | °C/Watt |
|                                     | $R_{th(j-c)Q}$ | Brake IGBT                                        | —    | —    | 3.2   | °C/Watt |
|                                     | $R_{th(j-c)F}$ | Brake FWDi                                        | —    | —    | 4.5   | °C/Watt |
| Contact Thermal Resistance          | $R_{th(c-f)}$  | Case to Fin Per Module,<br>Thermal Grease Applied | —    | —    | 0.067 | °C/Watt |

## Recommended Conditions for Use

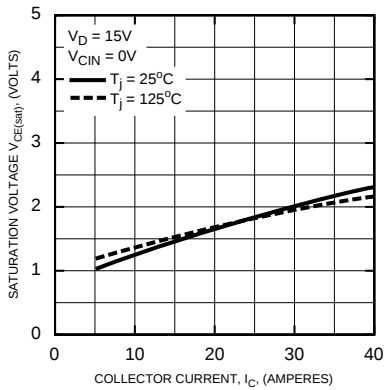
| Characteristic      | Symbol         | Condition                                                                                                      | Value          | Units   |
|---------------------|----------------|----------------------------------------------------------------------------------------------------------------|----------------|---------|
| Supply Voltage      | $V_{CC}$       | Applied across P-N Terminals                                                                                   | 0 ~ 400        | Volts   |
|                     | $V_D$          | Applied between $V_{UP1}$ - $V_{UPC}$ ,<br>$V_{N1}$ - $V_{NC}$ , $V_{VP1}$ - $V_{VPC}$ , $V_{WP1}$ - $V_{WPC}$ | $15 \pm 1.5$   | Volts   |
| Input ON Voltage    | $V_{CIN(on)}$  | Applied between                                                                                                | 0 ~ 0.8        | Volts   |
| Input OFF Voltage   | $V_{CIN(off)}$ | $U_P$ - $V_{UPC}$ , $V_P$ - $V_{VPC}$ , $W_P$ - $V_{WPC}$ ,<br>$U_N$ · $V_N$ · $W_N$ · $B_r$ - $V_{NC}$        | $4.0 \sim V_D$ | Volts   |
| PWM Input Frequency | $f_{PWM}$      | Using Application Circuit                                                                                      | 5 ~ 20         | kHz     |
| Minimum Dead Time   | $t_{dead}$     | Input Signal                                                                                                   | $\geq 2.5$     | $\mu s$ |

# PM30RSF060

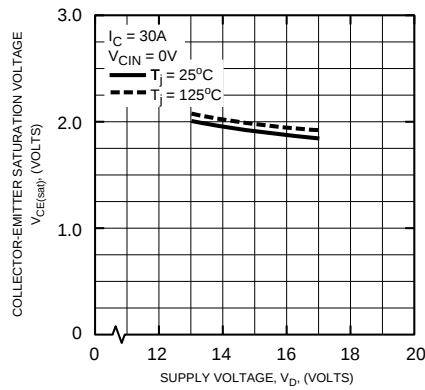
FLAT-BASE TYPE  
INSULATED PACKAGE

## Inverter Part

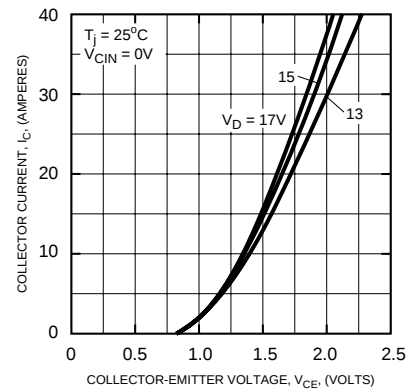
**SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



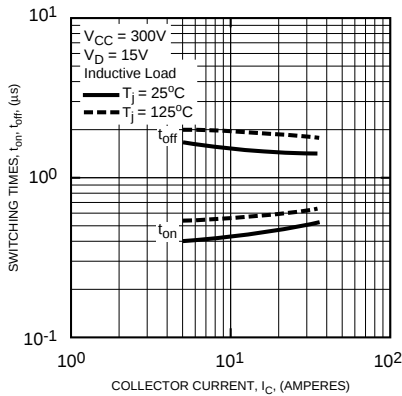
**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



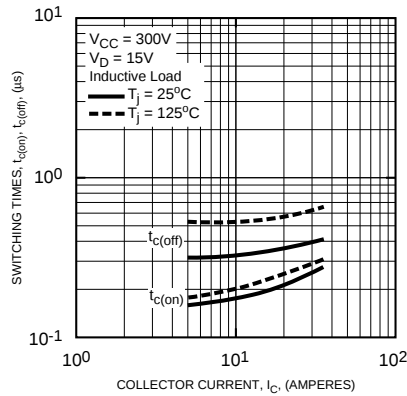
**OUTPUT CHARACTERISTICS (TYPICAL)**



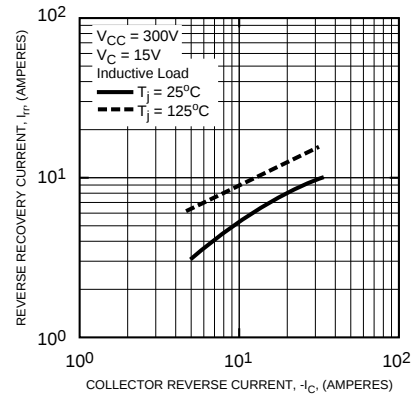
**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



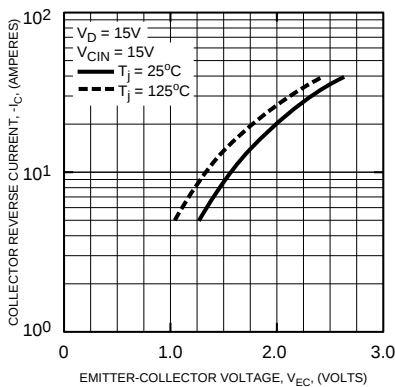
**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



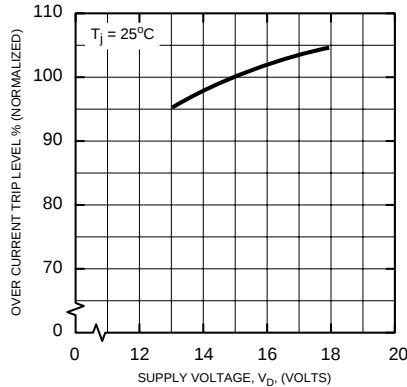
**REVERSE RECOVERY CURRENT VS. COLLECTOR CURRENT (TYPICAL)**



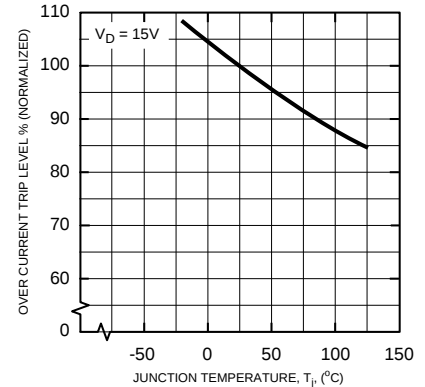
**DIODE FORWARD CHARACTERISTICS**



**OVER CURRENT TRIP LEVEL VS. SUPPLY VOLTAGE (TYPICAL)**



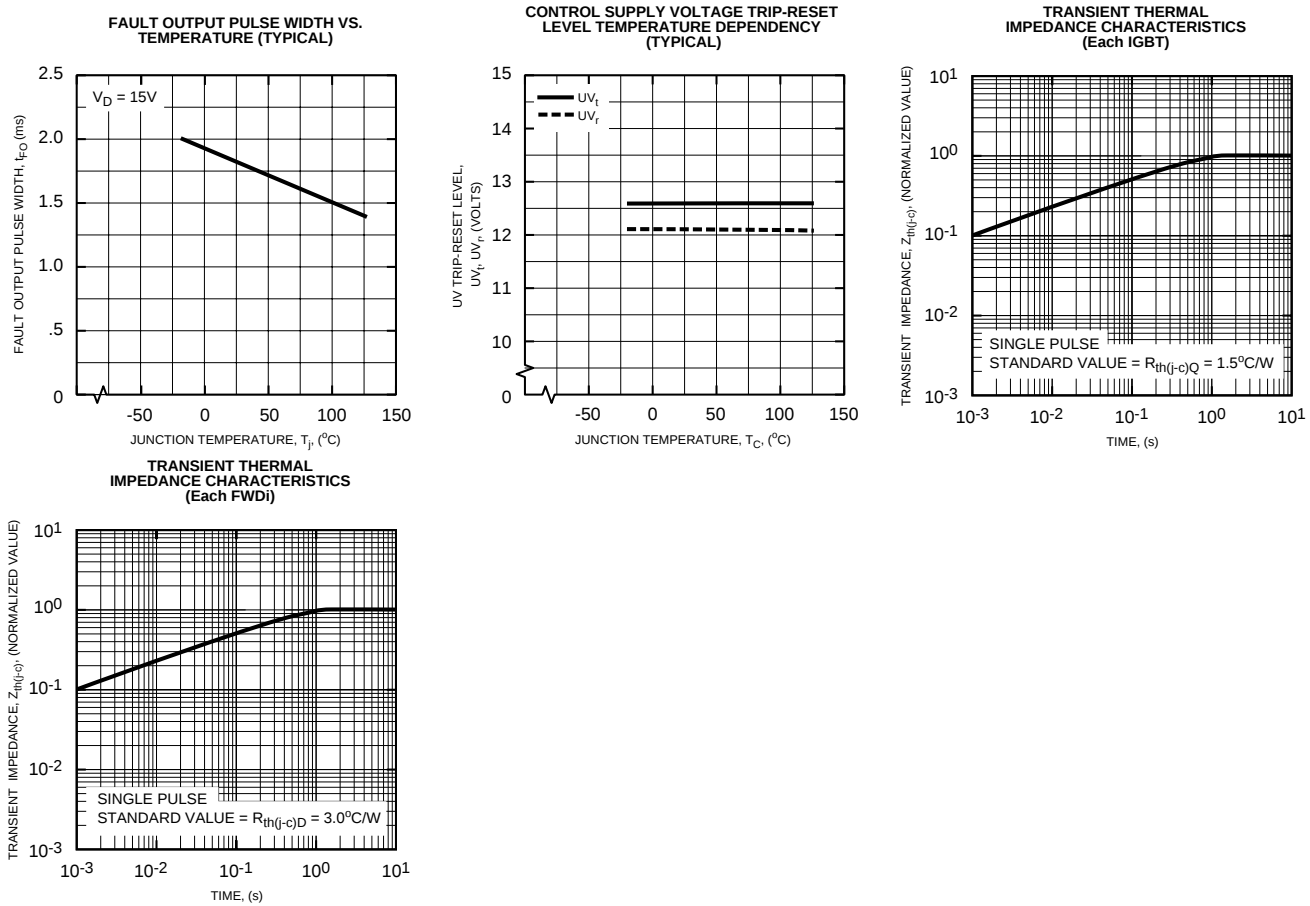
**OVER CURRENT TRIP LEVEL VS. TEMPERATURE (TYPICAL)**



PM30RSF060

FLAT-BASE TYPE  
INSULATED PACKAGE

Inverter Part

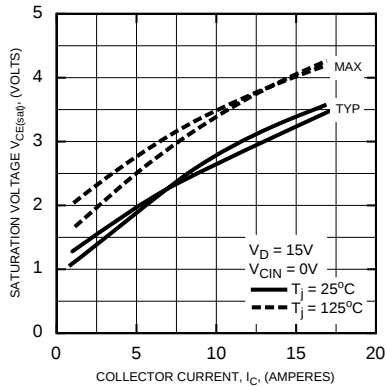


# PM30RSF060

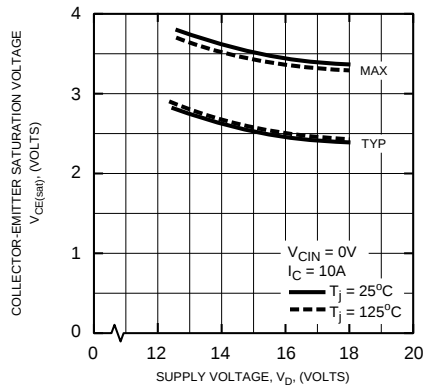
FLAT-BASE TYPE  
INSULATED PACKAGE

## Brake Part

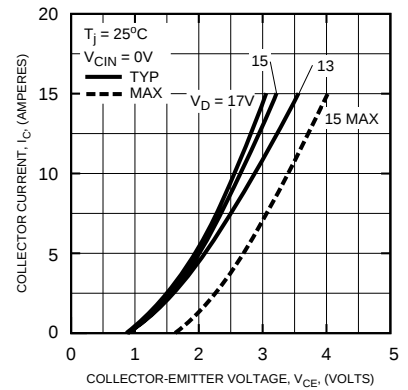
SATURATION VOLTAGE  
CHARACTERISTICS (TYPICAL)



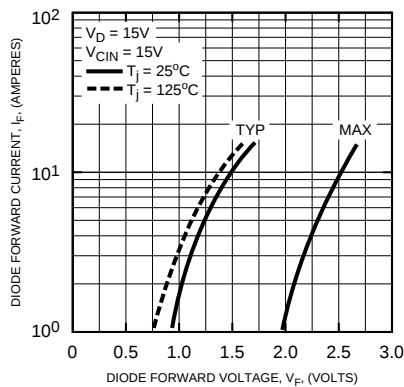
COLLECTOR-EMITTER SATURATION  
VOLTAGE CHARACTERISTICS (TYPICAL)



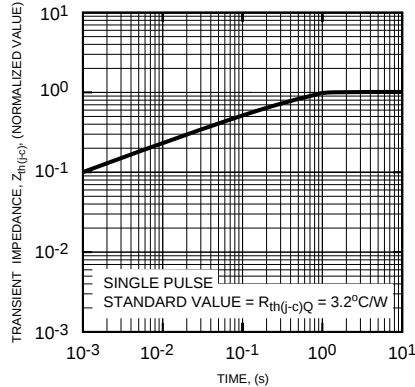
OUTPUT CHARACTERISTICS  
(TYPICAL)



DIODE FORWARD CHARACTERISTICS



TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(IGBT)



TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(FWDi)

