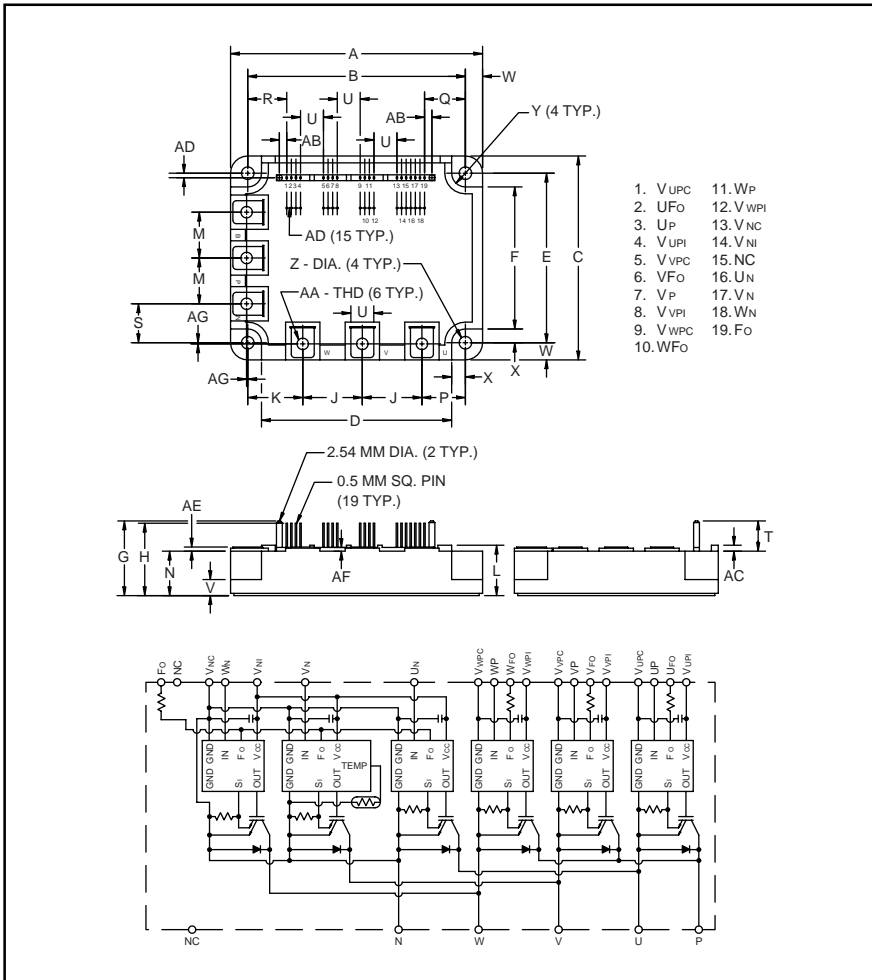


# PM100CSA060

FLAT-BASE TYPE  
INSULATED PACKAGE



- 1. V<sub>UPC</sub>
- 2. U<sub>Fo</sub>
- 3. U<sub>P</sub>
- 4. V<sub>UPI</sub>
- 5. V<sub>VPC</sub>
- 6. V<sub>Fo</sub>
- 7. V<sub>P</sub>
- 8. V<sub>VPI</sub>
- 9. V<sub>WPC</sub>
- 10. W<sub>Fo</sub>
- 11. W<sub>P</sub>
- 12. V<sub>WPI</sub>
- 13. V<sub>NC</sub>
- 14. V<sub>Ni</sub>
- 15. NC
- 16. UN
- 17. V<sub>N</sub>
- 18. W<sub>N</sub>
- 19. F<sub>o</sub>



**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. PM100CSA060 is a 600V, 100 Ampere Intelligent Power Module.

| Type | Current Rating<br>Amperes | V <sub>CES</sub><br>Volts (x 10) |
|------|---------------------------|----------------------------------|
| PM   | 100                       | 60                               |

**Outline Drawing and Circuit Diagram**

| Dimensions | Inches        | Millimeters    |
|------------|---------------|----------------|
| A          | 4.33±0.04     | 110.0±1.0      |
| B          | 3.74±0.02     | 95.0±0.5       |
| C          | 3.50±0.04     | 89.0±1.0       |
| D          | 3.27          | 83.0           |
| E          | 2.91±0.02     | 74.0±0.5       |
| F          | 2.44          | 62.0           |
| G          | 1.28          | 32.6           |
| H          | 1.24          | 31.6           |
| J          | 1.02          | 26.0           |
| K          | 0.94          | 24.0           |
| L          | 0.87 +0.06/-0 | 22.0 +1.5/-0.0 |
| M          | 0.79          | 20.0           |
| N          | 0.76          | 19.4           |
| P          | 0.75          | 19.0           |
| Q          | 0.708         | 17.98          |
| R          | 0.670         | 17.02          |

| Dimensions | Inches    | Millimeters |
|------------|-----------|-------------|
| S          | 0.67      | 17.0        |
| T          | 0.52      | 13.2        |
| U          | 0.39      | 10.0        |
| V          | 0.27      | 7.0         |
| W          | 0.30      | 7.5         |
| X          | 0.24      | 6.0         |
| Y          | 0.24 Rad. | Rad. 6.0    |
| Z          | 0.22 Dia. | Dia. 5.5    |
| AA         | Metric M5 | M5          |
| AB         | 0.127     | 3.22        |
| AC         | 0.10      | 2.6         |
| AD         | 0.08      | 2.0         |
| AE         | 0.07      | 1.8         |
| AF         | 0.06      | 1.6         |
| AG         | 0.02±0.01 | 0.5±0.3     |

# PM100CSA060

FLAT-BASE TYPE  
INSULATED PACKAGE

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

| Ratings  | Symbol                 | PM100CSA060 | 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            |
| Mounting Torque, M5 Main Terminal Screws   | —                      | 1.47 ~ 1.96 | N · m            |
| Module Weight (Typical)  | —                      | 550         | Grams            |
| Supply Voltage Protected by OC and SC ( $V_D = 13.5 - 16.5\text{V}$ , Inverter Part) | $V_{\text{CC(prot.)}}$ | 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, $\pm$   | $I_C$                  | 100 | Amperes |
| Peak Collector Current, $\pm$  | $I_{\text{CP}}$        | 200 | 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  | $P_C$                  | 403 | Watts   |

**PM100CSA060**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                          | $-20^\circ\text{C} \leq T \leq 125^\circ\text{C}$ , $V_D = 15\text{V}$   | 158  | 240  | —    | Amperes          |
| Short Circuit Trip Level Inverter Part  | SC                          | $-20^\circ\text{C} \leq T \leq 125^\circ\text{C}$ , $V_D = 15\text{V}$   | —    | 360  | —    | 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   | 111  | 118  | 125  | $^\circ\text{C}$ |
|   | $\text{OT}_r$               | Reset Level  | —    | 100  | —    | $^\circ\text{C}$ |
| 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 $V_{\text{UP}1}\text{-}V_{\text{UPC}}$ ,<br>$V_{\text{VP}1}\text{-}V_{\text{VPC}}$ , $V_{\text{WP}1}\text{-}V_{\text{WPC}}$ , $V_{\text{N}1}\text{-}V_{\text{NC}}$ | 13.5 | 15   | 16.5 | Volts            |
| Circuit Current                         | $I_D$                       | $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{\text{N}1}\text{-}V_{\text{NC}}$  | —    | 40   | 55   | mA               |
|   |                             | $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{\text{XP}1}\text{-}V_{\text{XPC}}$  | —    | 13   | 18   | mA               |
| Input ON Threshold Voltage              | $V_{\text{th}}(\text{on})$  | Applied between  | 1.2  | 1.5  | 1.8  | Volts            |
| Input OFF Threshold Voltage             | $V_{\text{th}}(\text{off})$ | $U_P\text{-}V_{\text{UPC}}$ , $V_P\text{-}V_{\text{VPC}}$ , $W_P\text{-}V_{\text{WPC}}$ ,<br>$U_N \cdot V_N \cdot W_N\text{-}V_{\text{NC}}$  | 1.7  | 2.0  | 2.3  | Volts            |
| PWM Input Frequency                     | $f_{\text{PWM}}$            | 3- $\phi$ Sinusoidal   | —    | 15   | 20   | kHz              |
| Fault Output Current                    | $I_{\text{FO}}(\text{H})$   | $V_D = 15\text{V}$ , $V_{\text{FO}} = 15\text{V}$  | —    | —    | 0.01 | mA               |
|   | $I_{\text{FO}}(\text{L})$   | $V_D = 15\text{V}$ , $V_{\text{FO}} = 15\text{V}$  | —    | 10   | 15   | mA               |
| Minimum Fault Output Pulse Width        | $t_{\text{FO}}$             | $V_D = 15\text{V}$   | 1.0  | 1.8  | —    | ms               |

**PM100CSA060**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>IGBT Inverter Sector</b>          |               |  |      |      |      |               |
| 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                | $V_{EC}$      | $-I_C = 100\text{A}, V_D = 15\text{V}, V_{CIN} = 15\text{V}$                             | —    | 2.2  | 3.3  | Volts         |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 100\text{A}$                               | —    | 1.8  | 2.7  | Volts         |
|                                      |               | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 100\text{A},$<br>$T_j = 125^\circ\text{C}$ | —    | 1.75 | 2.63 | Volts         |
| Inductive Load Switching Times       | $t_{on}$      |  | 0.4  | 0.8  | 2.0  | $\mu\text{s}$ |
|                                      | $t_{rr}$      | $V_D = 15\text{V}, V_{CIN} = 0 \leftrightarrow 15\text{V}$                               | —    | 0.15 | 0.3  | $\mu\text{s}$ |
|                                      | $t_{C(on)}$   | $V_{CC} = 300\text{V}, I_C = 100\text{A}$  | —    | 0.4  | 1.0  | $\mu\text{s}$ |
|                                      | $t_{off}$     | $T_j = 125^\circ\text{C}$  | —    | 2.0  | 2.9  | $\mu\text{s}$ |
|                                      | $t_{C(off)}$  |  | —    | 0.6  | 1.2  | $\mu\text{s}$ |

**Control Sector****Thermal Characteristics**

| Characteristic                      | Symbol         | Condition   | Min. | Typ. | Max.  | Units                 |
|-------------------------------------|----------------|---|------|------|-------|-----------------------|
| Junction to Case Thermal Resistance | $R_{th(j-c)Q}$ | Each IGBT   | —    | —    | 0.31  | $^\circ\text{C/Watt}$ |
|                                     | $R_{th(j-c)F}$ | Each FWDi   | —    | —    | 0.7   | $^\circ\text{C/Watt}$ |
| Contact Thermal Resistance          | $R_{th(c-f)}$  | Case to Fin Per Module,<br>Thermal Grease Applied | —    | —    | 0.027 | $^\circ\text{C/Watt}$ |

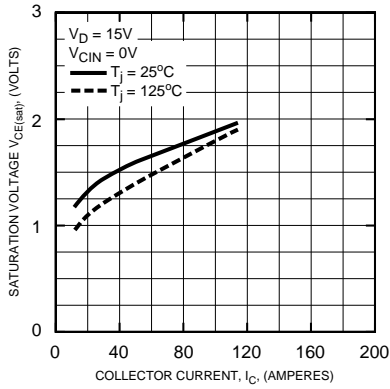
**Recommended Conditions for Use**

| 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>$U_N \cdot V_N \cdot W_N-V_{NC}$            | $4.0 \sim V_D$ | Volts         |
| PWM Input Frequency | $f_{PWM}$      | Using Application Circuit   | 5 ~ 20         | kHz           |
| Minimum Dead Time   | $t_{dead}$     | Input Signal  | $\geq 2.5$     | $\mu\text{s}$ |

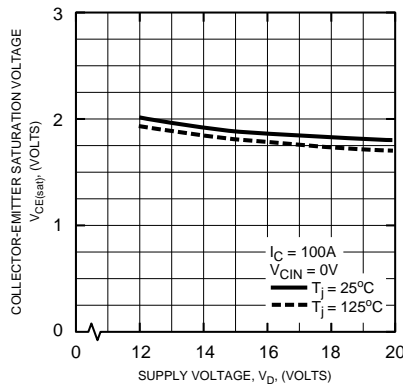
# PM100CSA060

FLAT-BASE TYPE  
INSULATED PACKAGE

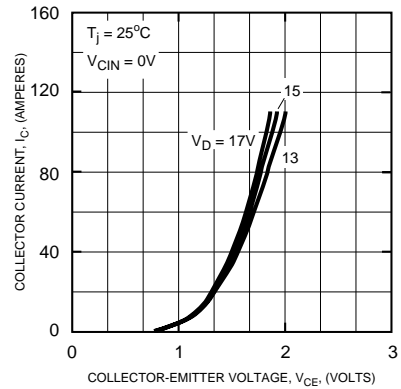
**SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



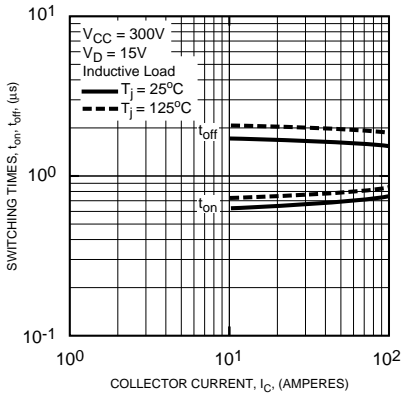
**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



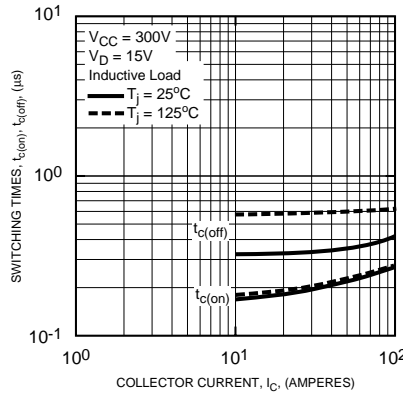
**OUTPUT CHARACTERISTICS (TYPICAL)**



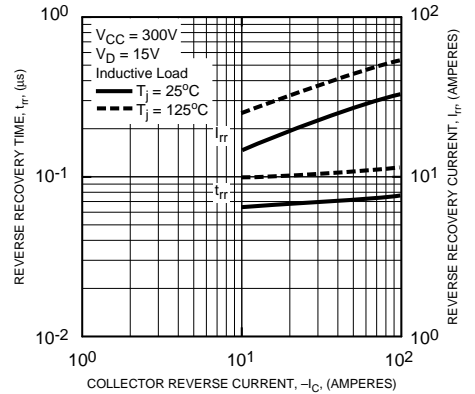
**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



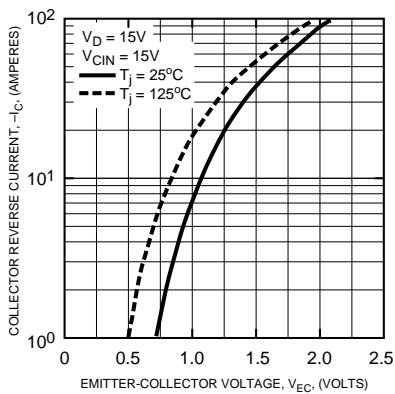
**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



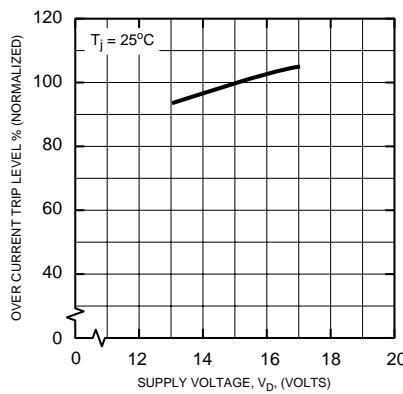
**REVERSE RECOVERY CURRENT VS. COLLECTOR CURRENT (TYPICAL)**



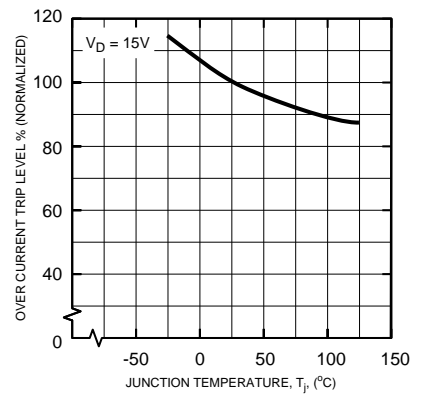
**DIODE FORWARD CHARACTERISTICS**



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



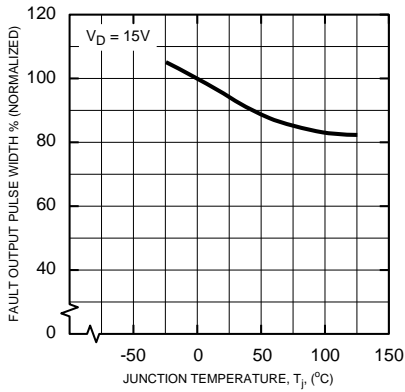
**OVER CURRENT TRIP LEVEL TEMPERATURE DEPENDENCY (TYPICAL)**



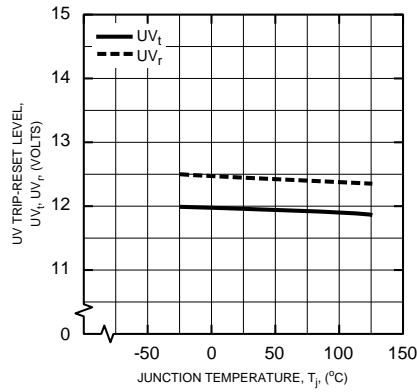
# PM100CSA060

FLAT-BASE TYPE  
INSULATED PACKAGE

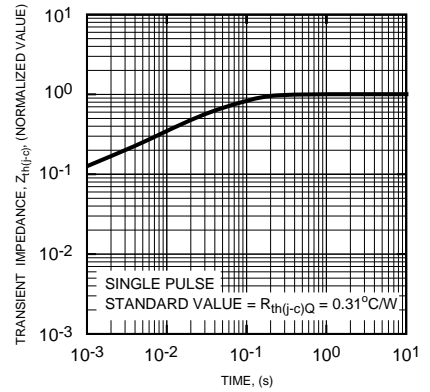
**FAULT OUTPUT PULSE WIDTH VS. TEMPERATURE (TYPICAL)**



**CONTROL SUPPLY VOLTAGE TRIP-RESET LEVEL TEMPERATURE DEPENDENCY (TYPICAL)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (Each IGBT)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (Each FWDi)**

