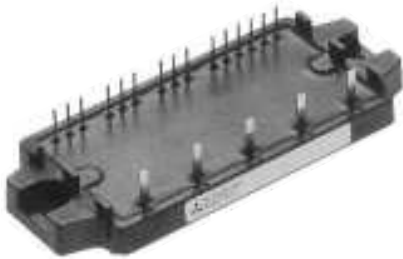


# PM20CTM060

FLAT-BASE TYPE  
INSULATED PACKAGE

## PM20CTM060



- 600V, 20A Current-sense 6kHz IGBT type inverter
- Built in IGBT gate drive circuit
- Built in Fault OC, SC, OT & UV protection Fault output
- 1.5kW class inverter application
- UL Recognized

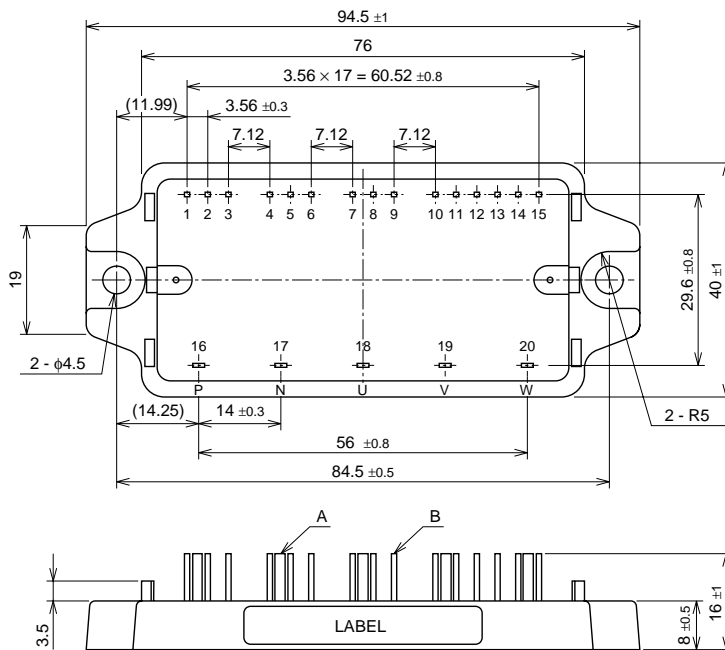
Yellow Card No. E80276 (N)  
File No. E80271

## APPLICATION

Air conditioner, motor control

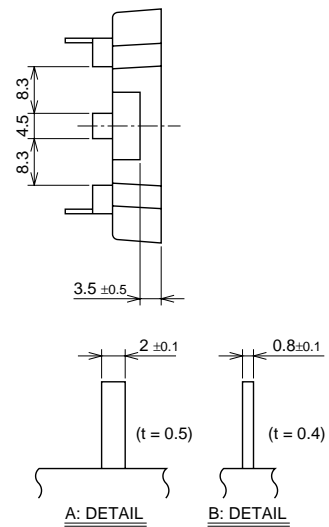
## OUTLINE DRAWING

Dimensions in mm



### A - B: TERMINAL NAME

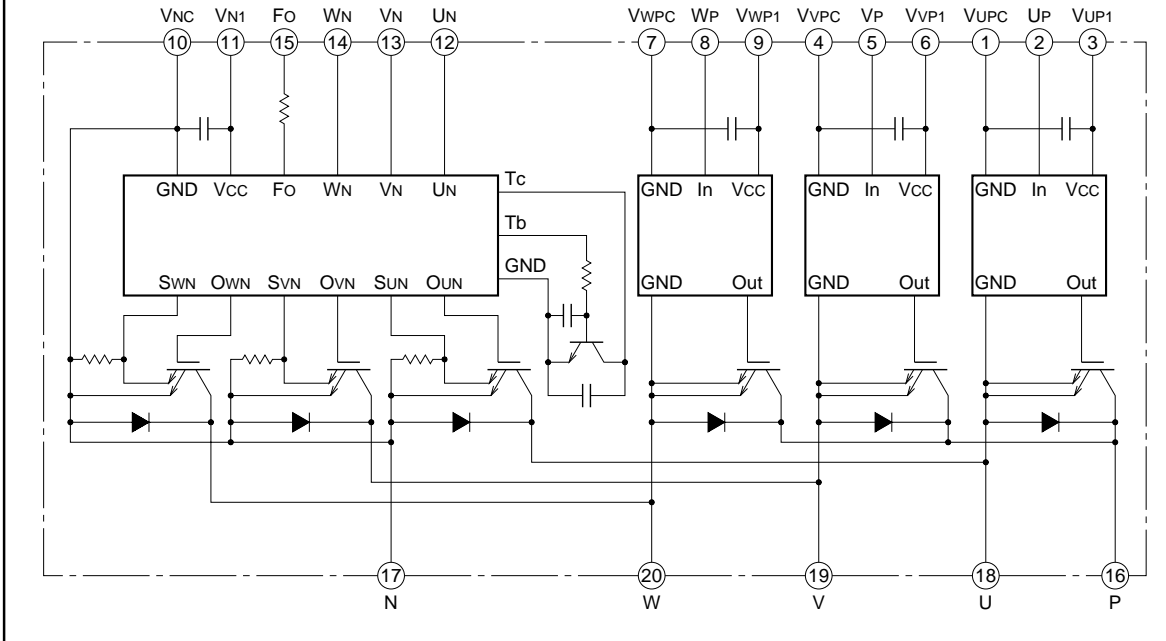
|         |         |
|---------|---------|
| 1. VUPC | 11. VN1 |
| 2. UP   | 12. UN  |
| 3. VUP1 | 13. VN  |
| 4. VVPC | 14. WN  |
| 5. VP   | 15. FO  |
| 6. VVP1 | 16. P   |
| 7. VWPC | 17. N   |
| 8. WP   | 18. U   |
| 9. VWP1 | 19. V   |
| 10. VNC | 20. W   |



**PM20CTM060**

FLAT-BASE TYPE  
INSULATED PACKAGE

**EQUIVALENT CIRCUIT DIAGRAM**



**MAXIMUM RATINGS** (T<sub>j</sub> = 25°C, unless otherwise noted)

**INVERTER PART**

| Symbol           | Parameter                 | Conditions                                    | Ratings     | Unit |
|------------------|---------------------------|---|-------------|------|
| V <sub>CES</sub> | Collector-emitter voltage | V <sub>D</sub> = 15V, I <sub>CIN</sub> = 10mA | 600         | V    |
| ±I <sub>C</sub>  | Collector current         | T <sub>C</sub> = 25°C                         | 20          | A    |
| ±I <sub>CP</sub> | Collector current (peak)  | T <sub>C</sub> = 25°C                         | 40          | A    |
| P <sub>C</sub>   | Collector dissipation     | T <sub>C</sub> = 25°C                         | 56          | W    |
| T <sub>j</sub>   | Junction temperature      |   | -20 ~ +125* | °C   |

\* maximum instantaneous T<sub>j</sub> ≤ 150°C

**CONTROL PART**

| Symbol           | Parameter                   | Conditions  | Ratings | Unit |
|------------------|-----------------------------|---|---------|------|
| V <sub>D</sub>   | Supply voltage              | Applied between : V <sub>UP1</sub> -V <sub>UPC</sub> , V <sub>V1</sub> -V <sub>VPC</sub><br>V <sub>WP1</sub> -V <sub>WP</sub> , V <sub>N1</sub> -V <sub>N</sub> | 20      | V    |
| I <sub>CIN</sub> | Input current               | Applied between : U <sub>P</sub> -V <sub>UPC</sub> , V <sub>P</sub> -V <sub>VPC</sub> , U <sub>N</sub> ·<br>V <sub>N</sub> · W <sub>N</sub> -V <sub>N</sub>     | 20      | mA   |
| V <sub>FO</sub>  | Fault output supply voltage | Applied between : F <sub>O</sub> -V <sub>N</sub>  | 20      | V    |
| I <sub>FO</sub>  | Fault output current        | Sink current of F <sub>O</sub> terminal   | 20      | mA   |

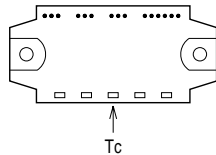
**PM20CTM060**

**FLAT-BASE TYPE  
INSULATED PACKAGE**

**TOTAL SYSTEM**

| Symbol           | Parameter                           | Conditions   | Ratings    | Unit             |
|------------------|-------------------------------------|--|------------|------------------|
| VCC(PROT)        | Supply voltage protected by OC & SC | V <sub>D</sub> = 13.5 ~ 16.5V, Inverter part, T <sub>j</sub> = 125°C start | 400        | V                |
| VCC              | Supply voltage                      | Applied between : P-N, operating time                                      | 450        | V                |
| VCC(surge)       | Supply voltage (surge)              | Applied between : P-N, surge and non-operating time                        | 500        | V                |
| T <sub>C</sub>   | Module case operating temperature   | (Note 1)   | -20 ~ +100 | °C               |
| T <sub>stg</sub> | Storage temperature                 |  | -40 ~ +125 | °C               |
| V <sub>iso</sub> | Isolation voltage                   | 60Hz, sinusoidal, AC · 1 min   | 2500       | V <sub>rms</sub> |

Note 1 : T<sub>C</sub> measuring point is as shown below.



**ELECTRICAL CHARACTERISTICS** (T<sub>j</sub> = 25°C, unless otherwise noted)

**INVERTER PART**

| Symbol              | Parameter                            | Test conditions   | Limits |      |      | Unit |
|---------------------|--------------------------------------|---|--------|------|------|------|
|                     |                                      |   | Min.   | Typ. | Max. |      |
| VCE(sat)            | Collector-emitter saturation voltage | V <sub>D</sub> = 15V, I <sub>CIN</sub> = 10mA   | —      | 1.8  | 2.6  | V    |
|                     |                                      | I <sub>C</sub> = 20A, T <sub>j</sub> = 25°C<br>I <sub>C</sub> = 20A, T <sub>j</sub> = 125°C   | —      | 2.0  | 3.0  |      |
| VEC                 | FWDi forward voltage                 | -I <sub>C</sub> = 20A, V <sub>D</sub> = 15V, I <sub>CIN</sub> = 0mA   | —      | 2.5  | 3.5  | V    |
| t <sub>on</sub>     | Switching time                       | V <sub>D</sub> = 15V, I <sub>CIN</sub> = 0mA ↔ 10mA<br>V <sub>CC</sub> = 300V, I <sub>C</sub> = 20A<br>T <sub>j</sub> = 125°C<br>(Per 1 arm) Inductive Load | 0.5    | 1.0  | 2.0  | μs   |
| t <sub>rr</sub>     |                                      |   | —      | 0.1  | —    | μs   |
| t <sub>c(on)</sub>  |                                      |   | —      | 0.2  | 0.8  | μs   |
| t <sub>off</sub>    |                                      |   | —      | 2.5  | 3.5  | μs   |
| t <sub>c(off)</sub> |                                      |   | —      | 0.9  | 2.0  | μs   |
| ICES                | Collector-emitter cutoff current     | V <sub>CE</sub> = V <sub>CEs</sub> , I <sub>CIN</sub> = 0mA   | —      | —    | 1    | mA   |
|                     |                                      | T <sub>j</sub> = 25°C<br>T <sub>j</sub> = 125°C   | —      | —    | 10   |      |

**CONTROL PART**

| Symbol               | Parameter                                 | Test conditions   | Limits      |      |      | Unit |    |
|----------------------|---|---|-------------|------|------|------|----|
|                      |   |   | Min.        | Typ. | Max. |      |    |
| I <sub>D</sub>       | Circuit current                           | V <sub>D</sub> = 15V, I <sub>CIN</sub> = 0mA  | —           | 25   | 35   | mA   |    |
|                      |   | V <sub>N1</sub> -V <sub>Nc</sub><br>V <sub>xP1</sub> -V <sub>xPc</sub>  | —           | 5    | 10   |      |    |
| I <sub>th(ON)</sub>  | Input on threshold current                | Applied between : U <sub>P</sub> -V <sub>UPC</sub> , V <sub>P</sub> -V <sub>VPC</sub> , W <sub>P</sub> -V <sub>WPC</sub><br>U <sub>N</sub> · V <sub>N</sub> · W <sub>N</sub> -V <sub>Nc</sub> | 1           | 3    | 5    | mA   |    |
| I <sub>th(OFF)</sub> | Input off threshold current               |   | 1           | 3    | 5    |      |    |
| OC                   | Over current trip level                   | -20°C ≤ T <sub>j</sub> ≤ 125°C, V <sub>D</sub> = 15V (only N side)  | 28          | 34   | —    | A    |    |
| SC                   | Short circuit trip level                  | -20°C ≤ T <sub>j</sub> ≤ 125°C, V <sub>D</sub> = 15V (only N side)  | —           | 51   | —    | A    |    |
| t <sub>off(OC)</sub> | Over current delay time                   | V <sub>D</sub> = 15V  | —           | 10   | —    | μs   |    |
| OT                   | Over temperature protection               | Base-plate<br>Temperature detection, V <sub>D</sub> = 15V   | Trip level  | 100  | 110  | 120  | °C |
| OT <sub>r</sub>      |   |   | Reset level | —    | 90   | —    |    |
| UV                   | Supply circuit under voltage protection   | -20°C ≤ T <sub>j</sub> ≤ 125°C (only N side)  | Trip level  | 11.5 | 12.0 | 12.5 | V  |
| UV <sub>r</sub>      |   |   | Reset level | —    | 12.5 | —    |    |
| I <sub>FO(H)</sub>   | Fault output current (Note 2)             | V <sub>D</sub> = 15V, V <sub>FO</sub> = 15V   | —           | —    | 0.01 | mA   |    |
| I <sub>FO(L)</sub>   |   |   | —           | 10   | 15   |      |    |
| t <sub>FO</sub>      | Minimum fault output pulse width (Note 2) | V <sub>D</sub> = 15V  | 1.0         | 1.8  | —    | ms   |    |

Note 2 : Fault output is given only when the internal OC, SC, OT & UV protection. (only N side)  
 Fault output of OC, SC protection given pulse.  
 Fault output of OT, UV protection given pulse while over level. (OT is only N side)

**PM20CTM060**

**FLAT-BASE TYPE  
INSULATED PACKAGE**

**THERMAL RESISTANCES**

| Symbol    | Parameter                  | Test conditions                                     | Limits |      |      | Unit   |
|-----------|----------------------------|---|--------|------|------|--------|
|           |                            |   | Min.   | Tye. | Max. |        |
| Rth(j-c)Q | Junction to case           | Inverter IGBT part, per 1/6 module                  | —      | —    | 2.0  | °C / W |
| Rth(j-c)F | thermal resistances        | Inverter FWDi part, per 1/6 module                  | —      | —    | 4.5  | °C / W |
| Rth(c-f)  | Contact thermal resistance | Case to fin, thermal grease applied, per 1/6 module | —      | —    | 0.4  | °C / W |

**MECHANICAL RATINGS AND CHARACTERISTICS**

| Symbol | Parameter       | Test conditions     | Limits |      |      | Unit |
|--------|-----------------|---------------------|--------|------|------|------|
|        |                 |                     | Min.   | Tye. | Max. |      |
| —      | Mounting torque | Mounting screw : M4 | 0.98   | 1.18 | 1.47 | N·m  |
| —      | Weight          |                     | —      | 60   | —    | g    |

**RECOMMENDED CONDITIONS FOR USE**

| Symbol    | Parameter                       | Test conditions   | Ratings  | Unit |
|-----------|---------------------------------|---|----------|------|
| VCC       | Supply voltage                  | Applied between : P-N   | ≤ 400    | V    |
| Vd        |                                 | Applied between : VUP1-VUPC, VVP1-VVPC<br>VWP1-VWPC, VN1-VNC (Note 3) | 15 ± 1.5 | V    |
| ICIN(ON)  | Input on current                | Applied between : UP, VP, WP, UN, VN, WN                              | ≥ 5      | mA   |
| ICIN(OFF) | Input off current               |   | ≤ 1      | mA   |
| fPWM      | PWM input frequency             | Using application circuit Opto-coupler's input signal                 | ≤ 8      | kHz  |
| tdead     | Arm shoot-through blocking time | Using application circuit Opto-coupler's input signal                 | ≥ 3      | μs   |

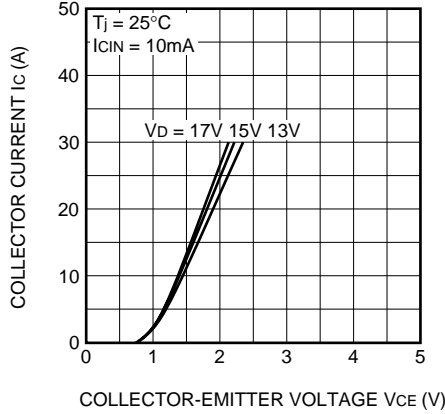
Note 3 : Permissible ripple value :  $dv/dt \leq \pm 5V/\mu s$ ,  $V_{ripple} \leq 2VP-P$

**PM20CTM060**

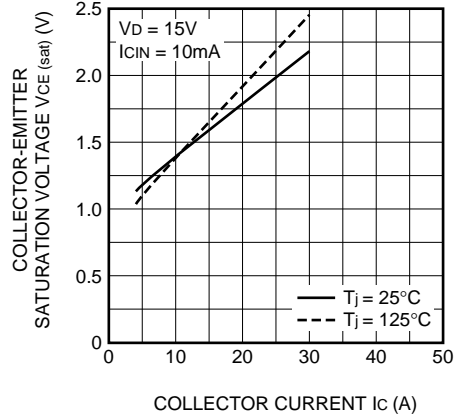
FLAT-BASE TYPE  
INSULATED PACKAGE

PERFORMANCE CURVES

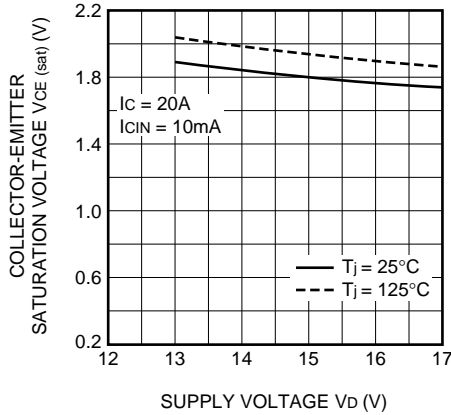
OUTPUT CHARACTERISTICS  
(TYPICAL)



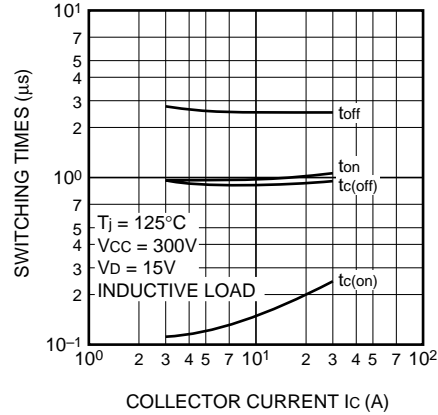
COLLECTOR-EMITTER SATURATION  
VOLTAGE CHARACTERISTICS  
(TYPICAL)



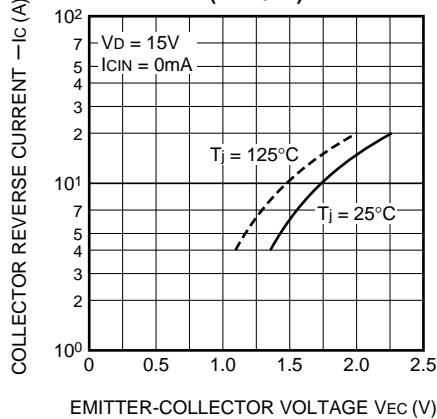
COLLECTOR-EMITTER SATURATION  
VOLTAGE VS. SUPPLY VOLTAGE  
(TYPICAL)



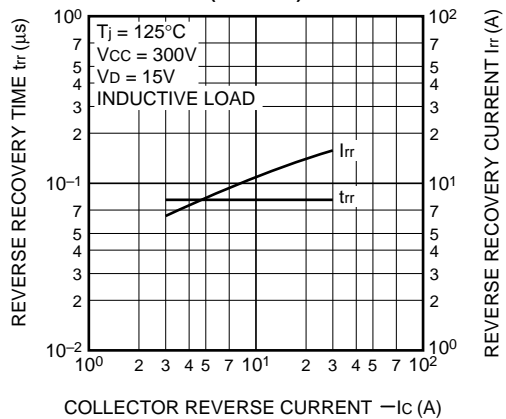
SWITCHING TIME VS.  
COLLECTOR CURRENT  
(TYPICAL)



FREE-WHEEL DIODE FORWARD  
CHARACTERISTICS  
(TYPICAL)



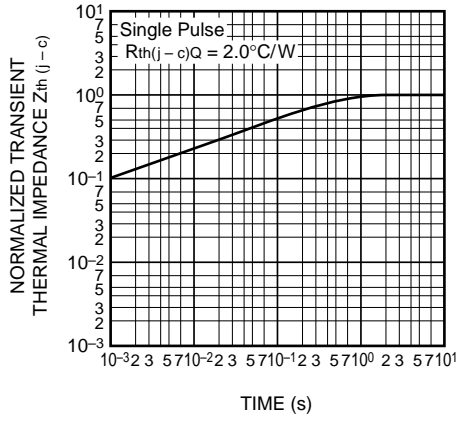
REVERSE RECOVERY CHARACTERISTICS  
OF FREE-WHEEL DIODE  
(TYPICAL)



**PM20CTM060**

FLAT-BASE TYPE  
INSULATED PACKAGE

**TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(IGBT per 1 element)**



**TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(FWDi per 1 element)**

