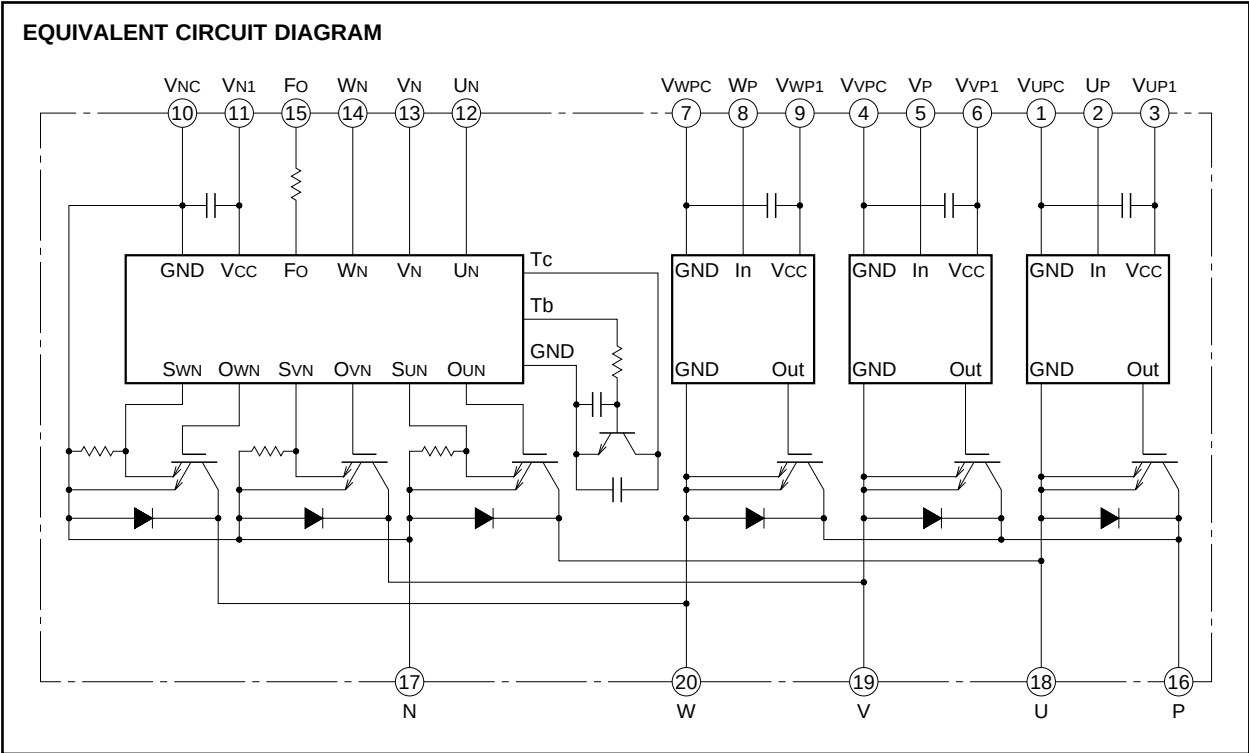




# PM15CTM060

FLAT-BASE TYPE  
INSULATED PACKAGE



**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> = 0mA | 600         | V    |
| ±I <sub>C</sub>  | Collector current         | T <sub>c</sub> = 25°C                        | 15          | A    |
| ±I <sub>CP</sub> | Collector current (peak)  | T <sub>c</sub> = 25°C                        | 30          | A    |
| P <sub>C</sub>   | Collector dissipation     | T <sub>c</sub> = 25°C                        | 43          | 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>VP1</sub> -V <sub>VP1</sub><br>V <sub>WP1</sub> -V <sub>WP1</sub> , V <sub>N1</sub> -V <sub>N1</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>VP1</sub> , W <sub>P</sub> -V <sub>WP1</sub> , U <sub>N</sub> ·<br>V <sub>N</sub> · W <sub>N</sub> -V <sub>N1</sub> | 20      | mA   |
| V <sub>FO</sub>  | Fault output supply voltage | Applied between : F <sub>O</sub> -V <sub>N1</sub>                                                                                                                                               | 20      | V    |
| I <sub>FO</sub>  | Fault output current        | Sink current of F <sub>O</sub> terminal                                                                                                                                                         | 20      | mA   |

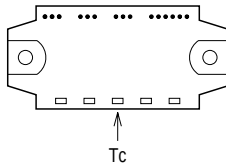
# PM15CTM060

FLAT-BASE TYPE  
INSULATED PACKAGE

## TOTAL SYSTEM

| Symbol                 | Parameter                           | Conditions                                                                 | Ratings    | Unit             |
|------------------------|-------------------------------------|----------------------------------------------------------------------------|------------|------------------|
| V <sub>CC(Prot)</sub>  | 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                |
| V <sub>CC</sub>        | Supply voltage                      | Applied between : P-N, operating time                                      | 450        | V                |
| V <sub>CC(surge)</sub> | 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. |      |
| V <sub>CE(sat)</sub> | Collector-emitter saturation voltage | V <sub>D</sub> = 15V, I <sub>CIN</sub> = 10mA                                                                                                             | —      | 1.8  | 2.6  | V    |
|                      |                                      | I <sub>C</sub> = 15A, T <sub>j</sub> = 125°C                                                                                                              |        | 2.0  | 3.0  |      |
| V <sub>EC</sub>      | FWDi forward voltage                 | -I <sub>C</sub> = 15A, V <sub>D</sub> = 15V, I <sub>CIN</sub> = 0mA                                                                                       | —      | 2.0  | 3.0  | 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> = 15A<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   |
| I <sub>CES</sub>     | Collector-emitter cutoff current     | V <sub>CE</sub> = V <sub>CES</sub> , I <sub>CIN</sub> = 0mA                                                                                               | —      | —    | 1    | mA   |
|                      |                                      | 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>N2</sub><br>V <sub>XP1</sub> -V <sub>XP2</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> | 1      | 3    | 5    | mA   |
| I <sub>th(OFF)</sub> | Input off threshold current               | U <sub>N</sub> · V <sub>N</sub> · W <sub>N</sub> -V <sub>N2</sub>                                                        | 1      | 3    | 5    | mA   |
| OC                   | Over current trip level                   | -20°C ≤ T <sub>j</sub> ≤ 125°C, V <sub>D</sub> = 15V (only N side)                                                       | 18     | 23   | —    | A    |
| SC                   | Short circuit trip level                  | -20°C ≤ T <sub>j</sub> ≤ 125°C, V <sub>D</sub> = 15V (only N side)                                                       | —      | 34.5 | —    | A    |
| t <sub>off(OC)</sub> | Over current delay time                   | V <sub>D</sub> = 15V                                                                                                     | —      | 10   | —    | μs   |
| OT                   | Over temperature protection               | Base-plate                                                                                                               | 100    | 110  | 120  | °C   |
| OT <sub>r</sub>      |                                           | Temperature detection, V <sub>D</sub> = 15V                                                                              |        | 90   | —    |      |
| UV                   | Supply circuit under voltage protection   | -20°C ≤ T <sub>j</sub> ≤ 125°C                                                                                           | 11.5   | 12.0 | 12.5 | V    |
| UV <sub>r</sub>      |                                           |                                                                                                                          |        | 12.5 | —    | V    |
| 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   | mA   |
| 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)

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## THERMAL RESISTANCES

| Symbol                | Parameter                            | Test conditions                                     | Limits |      |      | Unit   |
|-----------------------|--------------------------------------|-----------------------------------------------------|--------|------|------|--------|
|                       |                                      |                                                     | Min.   | Tye. | Max. |        |
| R <sub>th(j-c)Q</sub> | Junction to case thermal resistances | Inverter IGBT part, per 1/6 module                  | —      | —    | 2.9  | °C / W |
| R <sub>th(j-c)F</sub> |                                      | Inverter FWDi part, per 1/6 module                  | —      | —    | 4.5  | °C / W |
| R <sub>th(c-f)</sub>  | 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          |                     | 10     | 12   | 15   | kg·cm |
| —      |                 |                     | —      | 60   | —    | g     |

## RECOMMENDED CONDITIONS FOR USE

| Symbol                | Parameter                       | Test conditions                                                                                                                                                               | Ratings  | Unit |
|-----------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|
| V <sub>CC</sub>       | Supply voltage                  | Applied between : P-N                                                                                                                                                         | ≤ 400    | V    |
| V <sub>D</sub>        |                                 | Applied between : V <sub>UP1</sub> -V <sub>UPC</sub> , V <sub>VP1</sub> -V <sub>VPC</sub><br>V <sub>WP1</sub> -V <sub>WPC</sub> , V <sub>UN1</sub> -V <sub>UNC</sub> (Note 3) | 15 ± 1.5 | V    |
| I <sub>CIN(ON)</sub>  | Input on current                | Applied between : UP, VP, WP, UN, VN, WN                                                                                                                                      | ≥ 5      | mA   |
| I <sub>CIN(OFF)</sub> | Input off current               |                                                                                                                                                                               | ≤ 1      | mA   |
| f <sub>PWM</sub>      | PWM input frequency             | Using application circuit Opto-coupler's input signal                                                                                                                         | ≤ 8      | kHz  |
| t <sub>dead</sub>     | Arm shoot-through blocking time | Using application circuit Opto-coupler's input signal                                                                                                                         | ≥ 3      | μs   |

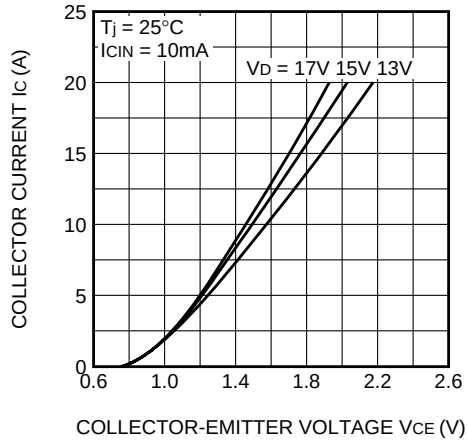
Note 3 : Permissible ripple value : dv/dt ≤ ±5V/μs, V<sub>ripple</sub> ≤ 2V<sub>P-P</sub>

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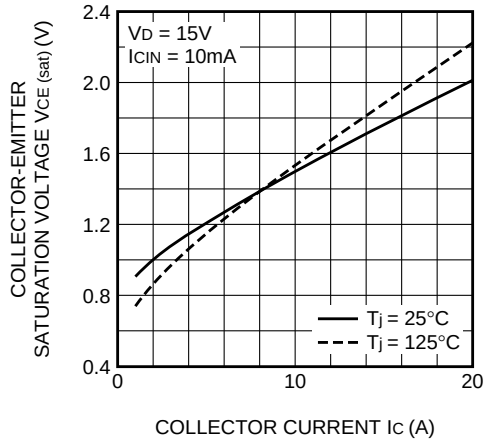
FLAT-BASE TYPE  
INSULATED PACKAGE

## PERFORMANCE CURVES

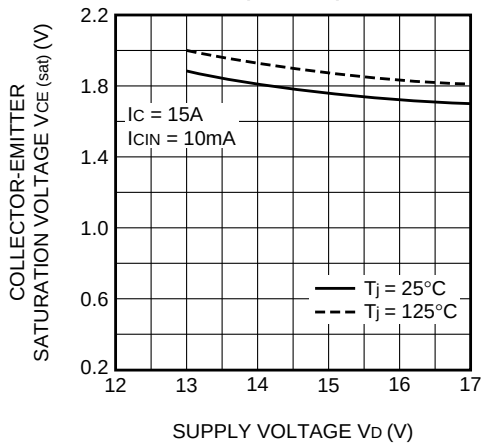
OUTPUT CHARACTERISTICS  
(TYPICAL)



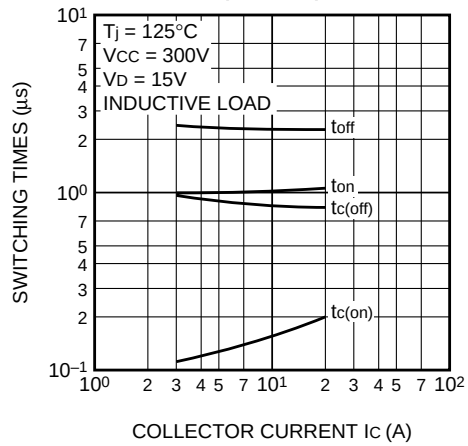
COLLECTOR-EMITTER SATURATION  
VOLTAGE CHARACTERISTICS  
(TYPICAL)



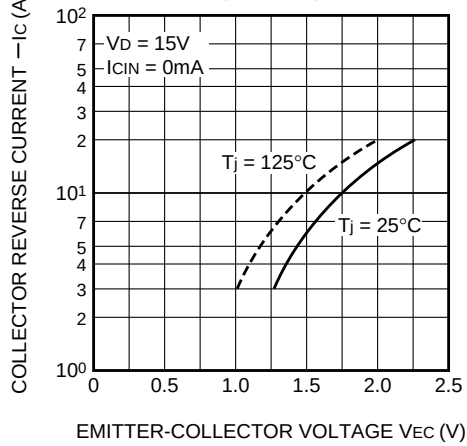
COLLECTOR-EMITTER SATURATION  
VOLTAGE VS. SUPPLY VOLTAGE  
(TYPICAL)



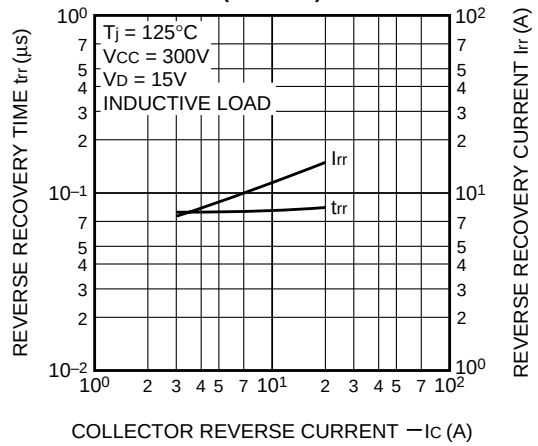
SWITCHING TIME VS.  
COLLECTOR CURRENT  
(TYPICAL)



FREE-WHEEL DIODE FORWARD  
CHARACTERISTICS  
(TYPICAL)



REVERSE RECOVERY CHARACTERISTICS  
OF FREE-WHEEL DIODE  
(TYPICAL)



PM15CTM060

FLAT-BASE TYPE  
INSULATED PACKAGE

