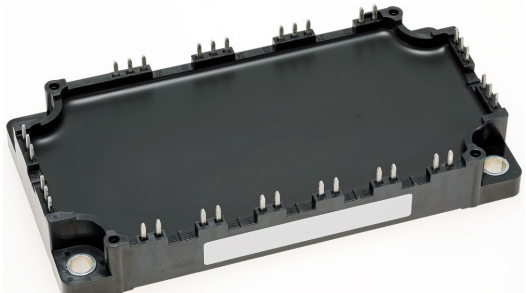



<IGBT Modules>

# CM150TX-34T/CM150TXP-34T

HIGH POWER SWITCHING USE  
INSULATED TYPE

|  |   |
|--|---|
|  <p>TX</p>                          | <p>Collector current <math>I_C</math> ..... <b>1 5 0 A</b><br/>           Collector-emitter voltage <math>V_{CES}</math> ..... <b>1 7 0 0 V</b><br/>           Maximum junction temperature <math>T_{vjmax}</math> ..... <b>1 7 5 °C</b></p> <ul style="list-style-type: none"> <li>• Flat base type</li> <li>• Copper base plate (Nickel-plating)</li> <li>• RoHS Directive compliant</li> <li>• Tin-plating pin terminals</li> </ul>      |
|  <p>TXP</p>                        | <p>Collector current <math>I_C</math> ..... <b>1 5 0 A</b><br/>           Collector-emitter voltage <math>V_{CES}</math> ..... <b>1 7 0 0 V</b><br/>           Maximum junction temperature <math>T_{vjmax}</math> ..... <b>1 7 5 °C</b></p> <ul style="list-style-type: none"> <li>• Flat base type</li> <li>• Copper base plate (Nickel-plating)</li> <li>• RoHS Directive compliant</li> <li>• Tin-plating pressfit terminals</li> </ul> |
| <p>sixpack (three-phase bridge) <span style="float: right;">•UL Recognized under UL1557, File No. E323585</span></p> |   |

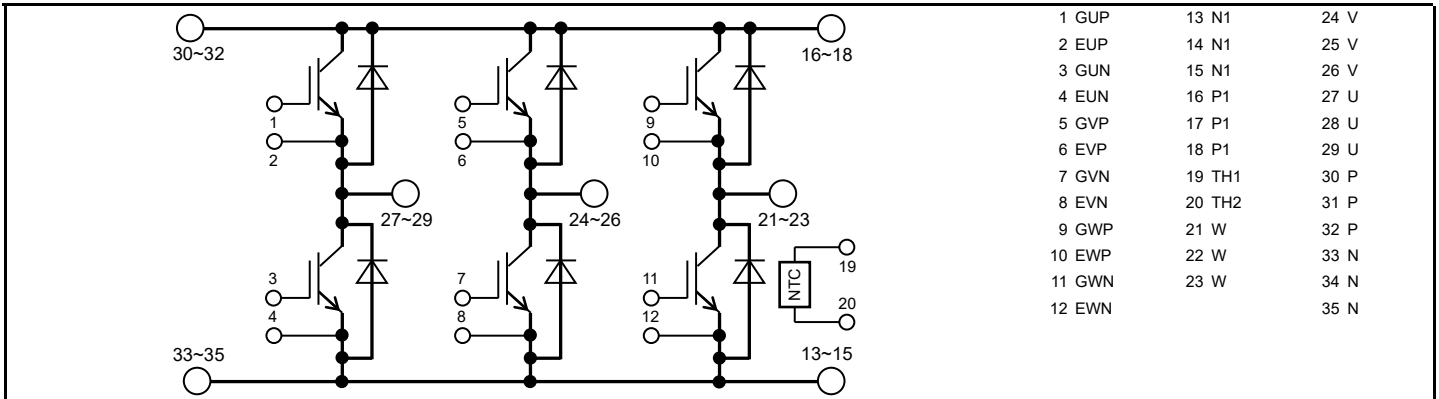
## APPLICATION

AC Motor Control, Motion/Servo Control, Power supply, etc.

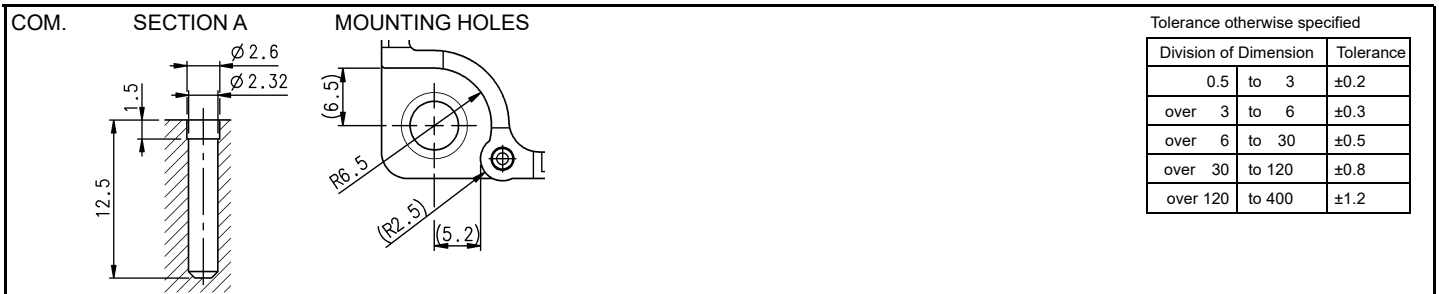
## OPTION (Below options are available.)

- PC-TIM (Phase Change Thermal Interface Material) pre-apply

## INTERNAL CONNECTION



## OUTLINE DRAWING

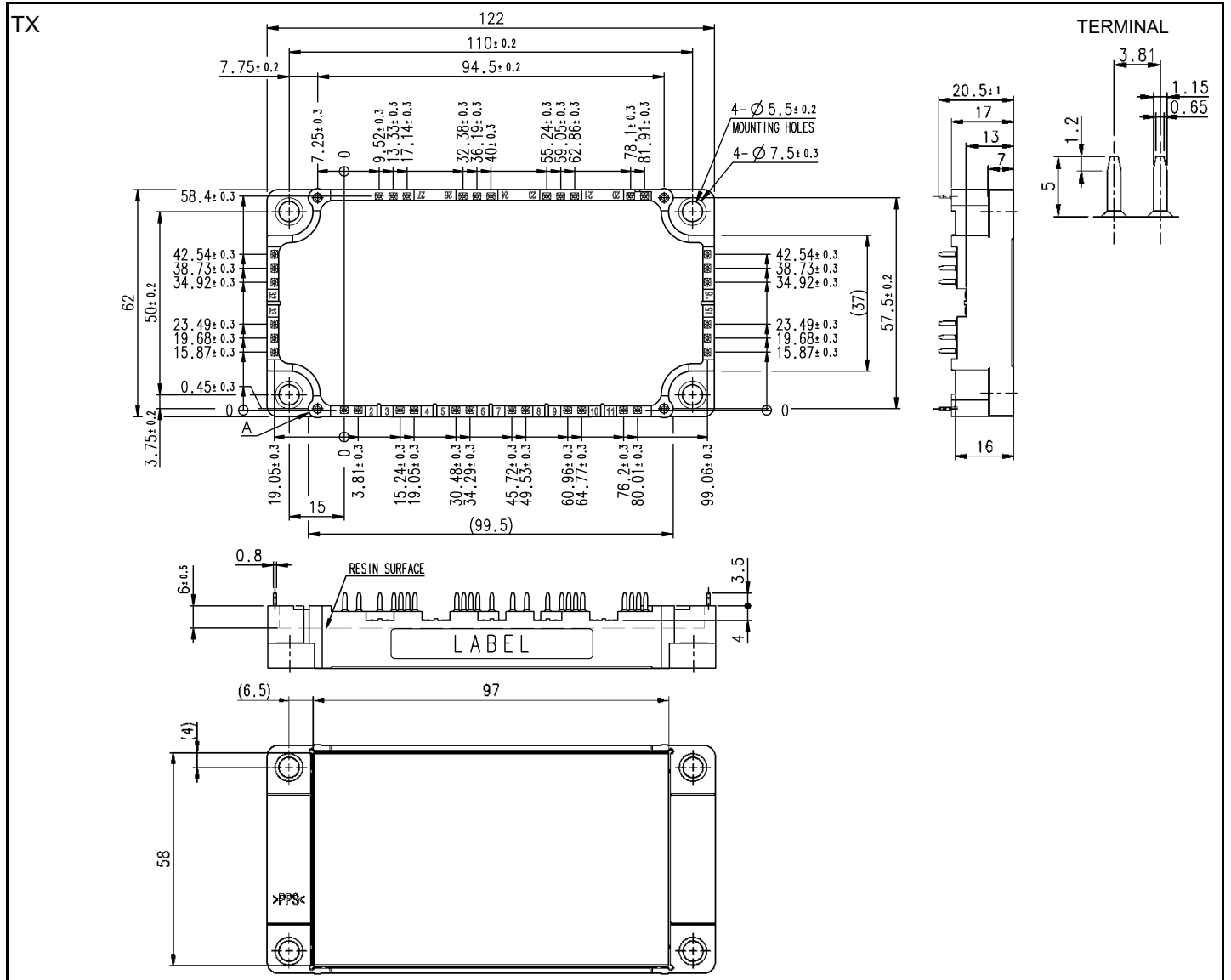


# CM150TX-34T/CM150TXP-34T

HIGH POWER SWITCHING USE  
INSULATED TYPE

## OUTLINE DRAWING

Dimension in mm

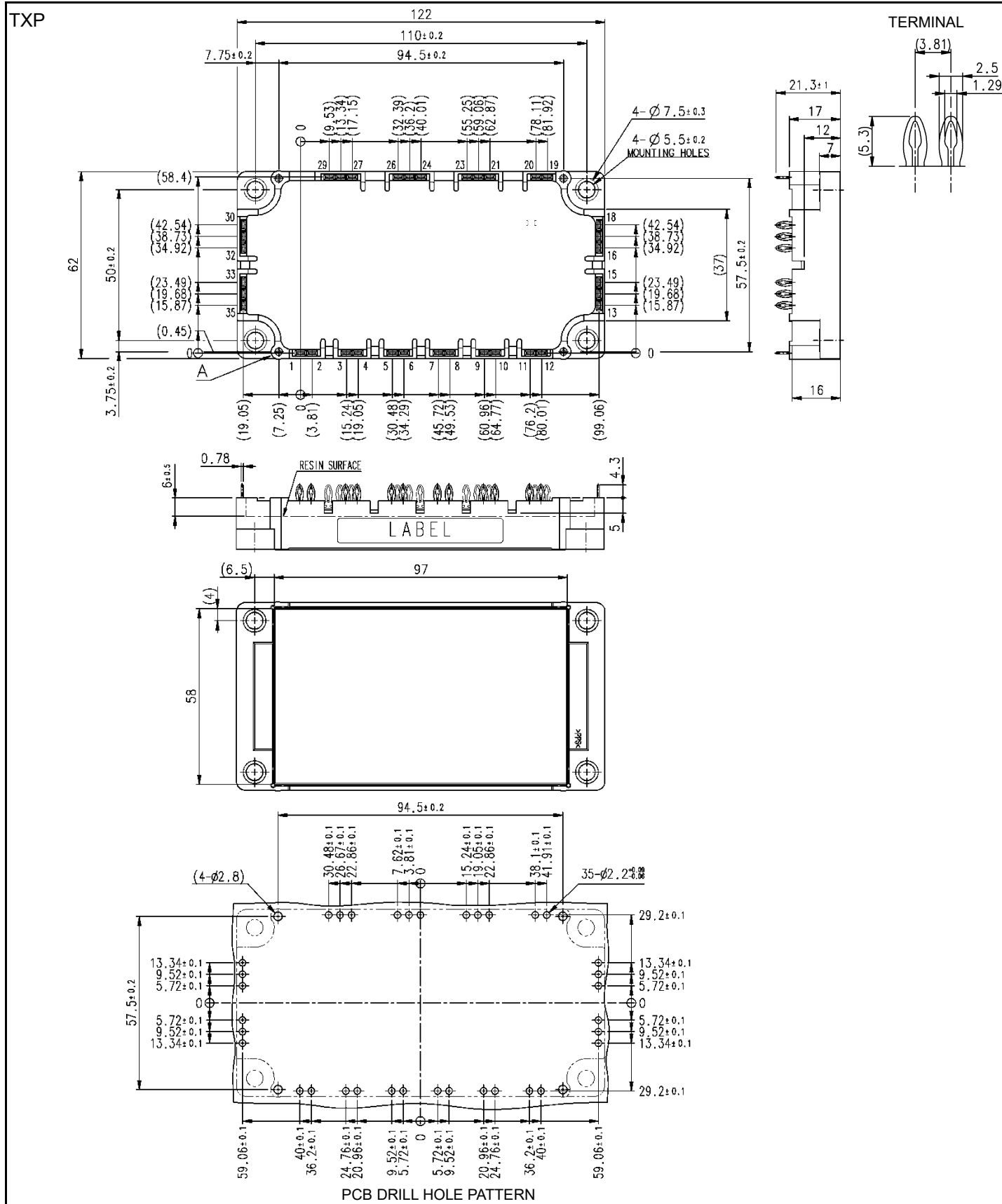


# CM150TX-34T/CM150TXP-34T

HIGH POWER SWITCHING USE  
INSULATED TYPE

## OUTLINE DRAWING

Dimension in mm



# CM150TX-34T/CM150TXP-34T

HIGH POWER SWITCHING USE  
INSULATED TYPE

## MAXIMUM RATINGS (T<sub>vj</sub>=25 °C, unless otherwise specified)

### INVERTER PART IGBT/FWD

| Symbol                   | Item                      | Conditions                           | Rating | Unit |
|--------------------------|---------------------------|--------------------------------------|--------|------|
| V <sub>CEs</sub>         | Collector-emitter voltage | G-E short-circuited                  | 1700   | V    |
| V <sub>GES</sub>         | Gate-emitter voltage      | C-E short-circuited                  | ± 20   | V    |
| I <sub>C</sub>           | Collector current         | DC, T <sub>C</sub> =84 °C (Note2, 4) | 150    | A    |
| I <sub>CRM</sub>         |                           | Pulse, Repetitive (Note3)            | 300    |      |
| P <sub>tot</sub>         | Total power dissipation   | T <sub>C</sub> =25 °C (Note2, 4)     | 740    | W    |
| I <sub>E</sub> (Note1)   | Emitter current           | DC (Note2)                           | 150    | A    |
| I <sub>ERM</sub> (Note1) |                           | Pulse, Repetitive (Note3)            | 300    |      |

### MODULE

| Symbol             | Item                           | Conditions                                      | Rating     | Unit |
|--------------------|--------------------------------|---|------------|------|
| V <sub>isol</sub>  | Isolation voltage              | Terminals to base plate, RMS, f=60 Hz, AC 1 min | 4000       | V    |
| T <sub>vjmax</sub> | Maximum junction temperature   | Instantaneous event (overload) (Note9)          | 175        | °C   |
| T <sub>Cmax</sub>  | Maximum case temperature       | (Note4, 9)                                      | 125        |      |
| T <sub>vjop</sub>  | Operating junction temperature | Continuous operation (under switching) (Note9)  | -40 ~ +150 | °C   |
| T <sub>stg</sub>   | Storage temperature            | -   | -40 ~ +125 |      |

## ELECTRICAL CHARACTERISTICS (T<sub>vj</sub>=25 °C, unless otherwise specified)

### INVERTER PART IGBT/FWD

| Symbol                                | Item                                 | Conditions   | Limits                  |      |      | Unit |   |
|---------------------------------------|--------------------------------------|--|-------------------------|------|------|------|---|
|                                       |                                      |  | Min.                    | Typ. | Max. |      |   |
| I <sub>CEs</sub>                      | Collector-emitter cut-off current    | V <sub>CE</sub> =V <sub>CEs</sub> , G-E short-circuited  | -                       | -    | 1.0  | mA   |   |
| I <sub>GES</sub>                      | Gate-emitter leakage current         | V <sub>GE</sub> =V <sub>GES</sub> , C-E short-circuited  | -                       | -    | 0.5  | µA   |   |
| V <sub>GE(th)</sub>                   | Gate-emitter threshold voltage       | I <sub>C</sub> =15 mA, V <sub>CE</sub> =10 V   | 5.4                     | 6.0  | 6.6  | V    |   |
| V <sub>CEsat</sub><br>(Terminal)      | Collector-emitter saturation voltage | I <sub>C</sub> =150 A, V <sub>GE</sub> =15 V,<br>Refer to the figure of test circuit<br>(Note5)                | T <sub>vj</sub> =25 °C  | -    | 2.00 | 2.40 | V |
|                                       |                                      |  | T <sub>vj</sub> =125 °C | -    | 2.40 | -    |   |
|                                       |                                      |  | T <sub>vj</sub> =150 °C | -    | 2.50 | -    |   |
| V <sub>CEsat</sub><br>(Chip)          | Collector-emitter saturation voltage | I <sub>C</sub> =150 A,<br>V <sub>GE</sub> =15 V,<br>(Note5)  | T <sub>vj</sub> =25 °C  | -    | 1.95 | 2.35 | V |
|                                       |                                      |  | T <sub>vj</sub> =125 °C | -    | 2.35 | -    |   |
|                                       |                                      |  | T <sub>vj</sub> =150 °C | -    | 2.45 | -    |   |
| C <sub>ies</sub>                      | Input capacitance                    | V <sub>CE</sub> =10 V, G-E short-circuited   | -                       | -    | 40   | nF   |   |
| C <sub>oes</sub>                      | Output capacitance                   |  | -                       | -    | 1.1  |      |   |
| C <sub>res</sub>                      | Reverse transfer capacitance         |  | -                       | -    | 0.4  |      |   |
| Q <sub>G</sub>                        | Gate charge                          | V <sub>CC</sub> =1000 V, I <sub>C</sub> =150 A, V <sub>GE</sub> =15 V  | -                       | 1.18 | -    | µC   |   |
| t <sub>d(on)</sub>                    | Turn-on delay time                   | V <sub>CC</sub> =1000 V, I <sub>C</sub> =150 A, V <sub>GE</sub> =±15 V,<br>R <sub>G</sub> =0 Ω, Inductive load | -                       | -    | 800  | ns   |   |
| t <sub>r</sub>                        | Rise time                            |  | -                       | -    | 200  |      |   |
| t <sub>d(off)</sub>                   | Turn-off delay time                  |  | -                       | -    | 800  |      |   |
| t <sub>f</sub>                        | Fall time                            |  | -                       | -    | 600  |      |   |
| V <sub>EC</sub> (Note1)<br>(Terminal) | Emitter-collector voltage            | I <sub>E</sub> =150 A, G-E short-circuited,<br>Refer to the figure of test circuit<br>(Note5)                  | T <sub>vj</sub> =25 °C  | -    | 2.70 | 3.30 | V |
|                                       |                                      |  | T <sub>vj</sub> =125 °C | -    | 2.90 | -    |   |
|                                       |                                      |  | T <sub>vj</sub> =150 °C | -    | 2.90 | -    |   |
| V <sub>EC</sub> (Note1)<br>(Chip)     | Emitter-collector voltage            | I <sub>E</sub> =150 A,<br>G-E short-circuited,<br>(Note5)  | T <sub>vj</sub> =25 °C  | -    | 2.65 | 3.25 | V |
|                                       |                                      |  | T <sub>vj</sub> =125 °C | -    | 2.75 | -    |   |
|                                       |                                      |  | T <sub>vj</sub> =150 °C | -    | 2.75 | -    |   |
| t <sub>rr</sub> (Note1)               | Reverse recovery time                | V <sub>CC</sub> =1000 V, I <sub>E</sub> =150 A, V <sub>GE</sub> =±15 V,<br>R <sub>G</sub> =0 Ω, Inductive load | -                       | -    | 300  | ns   |   |
| Q <sub>rr</sub> (Note1)               | Reverse recovery charge              | R <sub>G</sub> =0 Ω, Inductive load  | -                       | 5.6  | -    | µC   |   |
| E <sub>on</sub>                       | Turn-on switching energy per pulse   | V <sub>CC</sub> =1000 V, I <sub>C</sub> =I <sub>E</sub> =150 A,  | -                       | 48.7 | -    | mJ   |   |
| E <sub>off</sub>                      | Turn-off switching energy per pulse  | V <sub>GE</sub> =±15 V, R <sub>G</sub> =0 Ω, T <sub>vj</sub> =150 °C,  | -                       | 40.9 | -    |      |   |
| E <sub>rr</sub> (Note1)               | Reverse recovery energy per pulse    | Inductive load   | -                       | 15.5 | -    | mJ   |   |
| R <sub>CC'+EE'</sub>                  | Internal lead resistance             | Main terminals-chip, per switch, T <sub>C</sub> =25 °C (Note4)   | -                       | 1.8  | -    | mΩ   |   |
| r <sub>g</sub>                        | Internal gate resistance             | Per switch   | -                       | 5.0  | -    | Ω    |   |

# CM150TX-34T/CM150TXP-34T

HIGH POWER SWITCHING USE  
INSULATED TYPE

## ELECTRICAL CHARACTERISTICS (cont.; T<sub>vj</sub>=25 °C, unless otherwise specified)

### NTC THERMISTOR PART

| Symbol               | Item                    | Conditions  | Limits |      |      | Unit |
|----------------------|-------------------------|---|--------|------|------|------|
|                      |                         |   | Min.   | Typ. | Max. |      |
| R <sub>25</sub>      | Zero-power resistance   | T <sub>C</sub> =25 °C (Note4)                           | 4.85   | 5.00 | 5.15 | kΩ   |
| ΔR/R                 | Deviation of resistance | R <sub>100</sub> =493 Ω, T <sub>C</sub> =100 °C (Note4) | -7.3   | -    | +7.8 | %    |
| B <sub>(25/50)</sub> | B-constant              | Approximate by equation (Note6)                         | -      | 3375 | -    | K    |
| P <sub>25</sub>      | Power dissipation       | T <sub>C</sub> =25 °C (Note4)                           | -      | -    | 10   | mW   |

### THERMAL RESISTANCE CHARACTERISTICS

| Symbol                | Item                       | Conditions  | Limits |      |      | Unit |
|-----------------------|----------------------------|---|--------|------|------|------|
|                       |                            |   | Min.   | Typ. | Max. |      |
| R <sub>th(j-c)Q</sub> | Thermal resistance         | Junction to case, per Inverter IGBT (Note4)                           | -      | -    | 202  | K/kW |
| R <sub>th(j-c)D</sub> |                            | Junction to case, per Inverter FWD (Note4)                            | -      | -    | 312  |      |
| R <sub>th(c-s)</sub>  | Contact thermal resistance | Case to heat sink, per 1 module, Thermal grease applied (Note4, 7, 9) | -      | 11.5 | -    | K/kW |

### MECHANICAL CHARACTERISTICS

| Symbol         | Item                   | Conditions                         | Limits                 |      |      | Unit |    |
|----------------|------------------------|------------------------------------|------------------------|------|------|------|----|
|                |                        |                                    | Min.                   | Typ. | Max. |      |    |
| M <sub>s</sub> | Mounting torque        | Mounting to heat sink<br>M 5 screw | 2.5                    | 3.0  | 3.5  | N·m  |    |
| d <sub>s</sub> | Creepage distance      | Solder pin type (TX)               | Terminal to terminal   | 16.4 | -    | -    | mm |
|                |                        |                                    | Terminal to base plate | 18.5 | -    | -    |    |
|                |                        | Pressfit pin type (TXP)            | Terminal to terminal   | 19.0 | -    | -    | mm |
|                |                        |                                    | Terminal to base plate | 18.6 | -    | -    |    |
| d <sub>a</sub> | Clearance              | Solder pin type (TX)               | Terminal to terminal   | 10.2 | -    | -    | mm |
|                |                        |                                    | Terminal to base plate | 9.0  | -    | -    |    |
|                |                        | Pressfit pin type (TXP)            | Terminal to terminal   | 8.9  | -    | -    | mm |
|                |                        |                                    | Terminal to base plate | 9.0  | -    | -    |    |
| e <sub>c</sub> | Flatness of base plate | On the centerline X, Y (Note8)     | ±0                     | -    | +200 | μm   |    |
| m              | mass                   | -                                  | -                      | 270  | -    | g    |    |

\*. This product is compliant with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) directive 2011/65/EU and (EU) 2015/863.

Note1. Represent ratings and characteristics of the anti-parallel, emitter-collector free-wheeling diode (FWD).

- Junction temperature (T<sub>vj</sub>) should not increase beyond T<sub>vjmax</sub> rating.
- Pulse width and repetition rate should be such that the device junction temperature (T<sub>vj</sub>) dose not exceed T<sub>vjmax</sub> rating.
- Case temperature (T<sub>C</sub>) and heat sink temperature (T<sub>S</sub>) are defined on the each surface (mounting side) of base plate and heat sink just under the chips. Refer to the figure of chip location.

5. Pulse width and repetition rate should be such as to cause negligible temperature rise. Refer to the figure of test circuit.

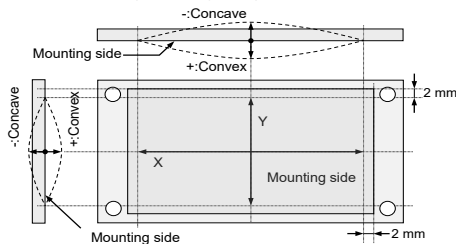
$$6. B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$$

R<sub>25</sub>: resistance at absolute temperature T<sub>25</sub> [K]; T<sub>25</sub>=25 [°C]+273.15=298.15 [K]

R<sub>50</sub>: resistance at absolute temperature T<sub>50</sub> [K]; T<sub>50</sub>=50 [°C]+273.15=323.15 [K]

7. Reference value. Thermally conductive grease of thermal conductivity λ=0.9 W/(m·K) and thickness D<sub>(c-s)</sub>=50 μm.

8. The base plate (mounting side) flatness measurement points (X, Y) are shown in the following figure.



9. Long term performance related to thermal conductive grease (including but not limited to aspects such as the increase of thermal resistance due to pumping out, etc.) should be verified under user's specific application conditions. Each temperature condition (T<sub>vjmax</sub>, T<sub>vjop</sub>, T<sub>Cmax</sub>) must be maintained below the maximum rated temperature throughout consideration of the temperature rise even for long term usage.

**CM150TX-34T/CM150TXP-34T**

HIGH POWER SWITCHING USE

INSULATED TYPE

Note10. Use the following screws when mounting the printed circuit board (PCB) on the standoffs.

PCB thickness : t1.6

| Type                 | Manufacturer | Size               | Tightening torque (N·m) | Recommended tightening method  |
|----------------------|--------------|--------------------|-------------------------|--|
| (1) PT®              | EJOT         | K25×8              | 0.55 ± 0.055            | by handwork (equivalent to 30 rpm<br>by mechanical screw driver)<br>~ 600 rpm (by mechanical screw driver) |
| (2) PT®              |              | K25×10             | 0.75 ± 0.075            |  |
| (3) DELTA PT®        |              | 25×8               | 0.55 ± 0.055            |  |
| (4) DELTA PT®        |              | 25×10              | 0.75 ± 0.075            |  |
| (5) B1 tapping screw | -            | φ2.6×10<br>φ2.6×12 | 0.75 ± 0.075            |  |

**RECOMMENDED OPERATING CONDITIONS**

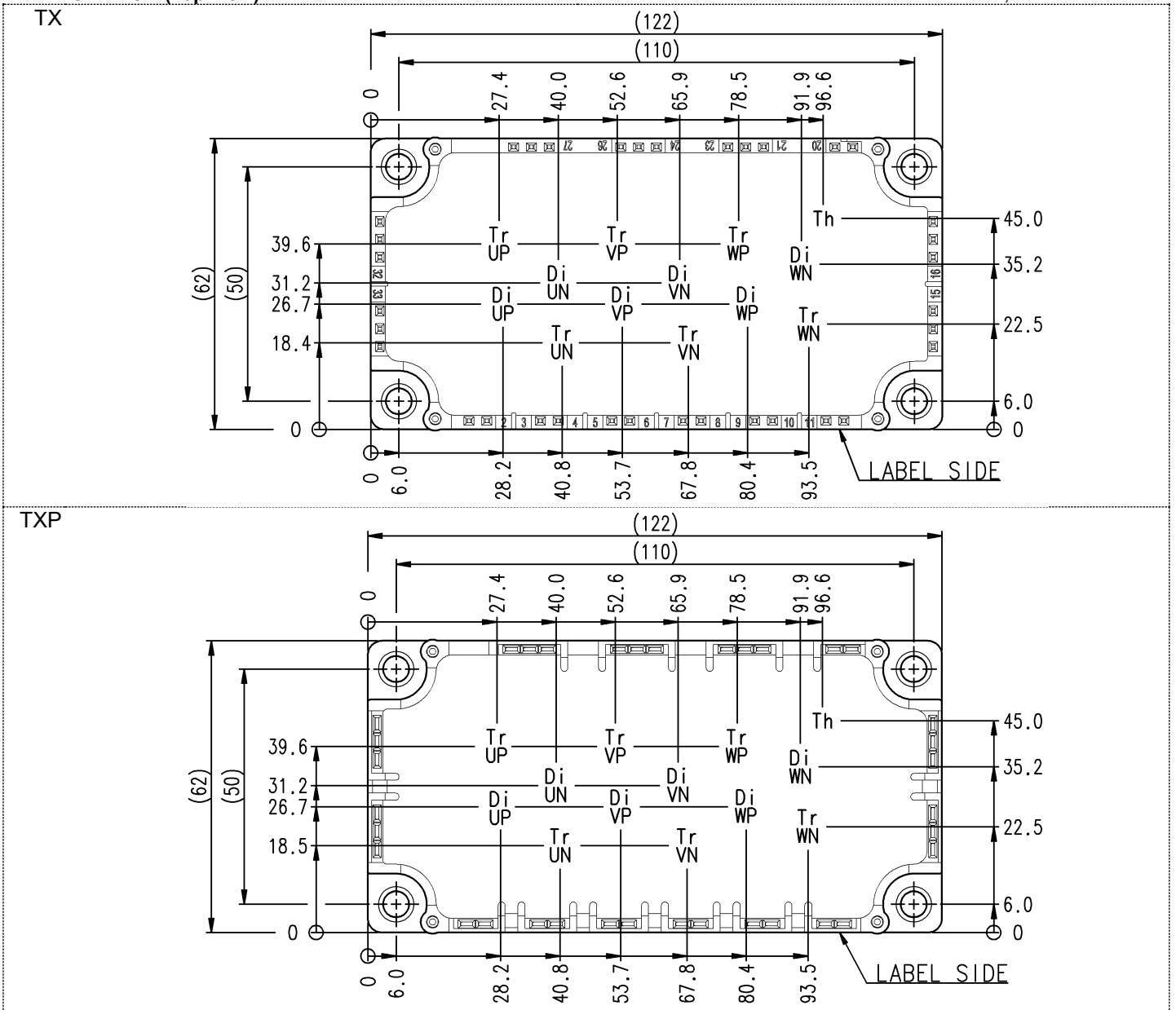
| Symbol     | Item                          | Conditions   | Limits |      |      | Unit     |
|------------|-------------------------------|--|--------|------|------|----------|
|            |                               |  | Min.   | Typ. | Max. |          |
| $V_{CC}$   | (DC) Supply voltage           | Applied across P-N terminals                       | -      | 1000 | 1200 | V        |
| $V_{GEon}$ | Gate (-emitter drive) voltage | Applied across G*P-E*P/G*N-E*N terminals (*=U,V,W) | 13.5   | 15.0 | 16.5 | V        |
| $R_G$      | External gate resistance      | Per switch   | 0      | -    | 56   | $\Omega$ |

# CM150TX-34T/CM150TXP-34T

HIGH POWER SWITCHING USE  
INSULATED TYPE

## CHIP LOCATION (Top view)

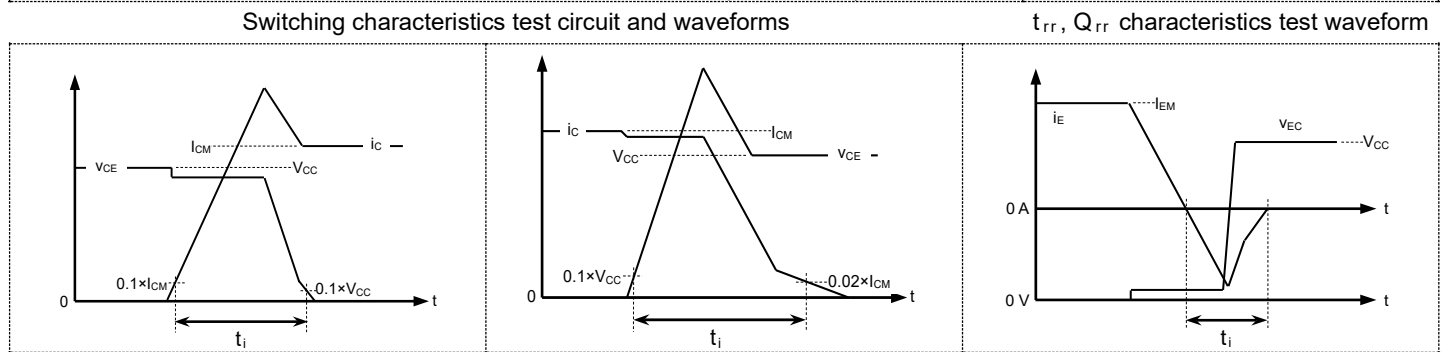
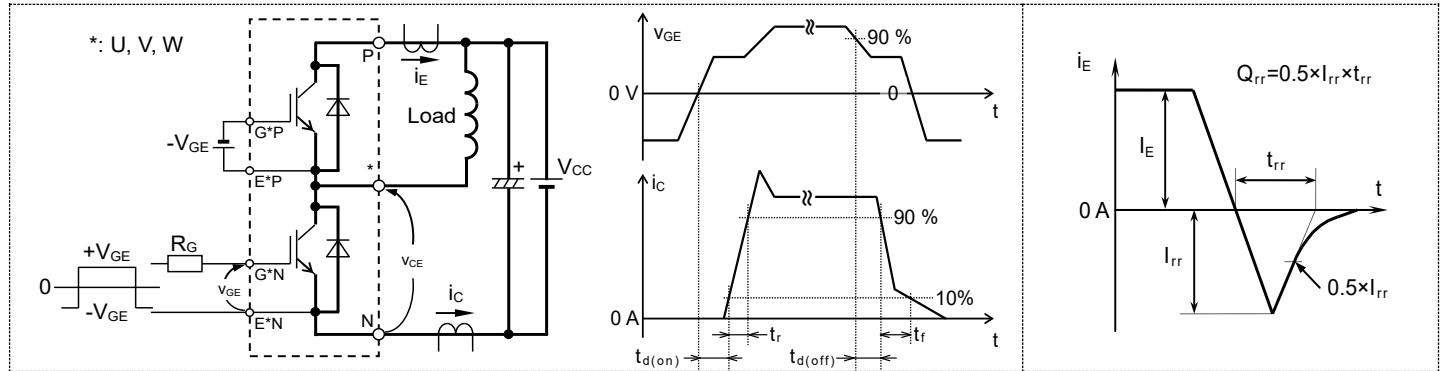
Dimension in mm, tolerance:  $\pm 1$  mm



# CM150TX-34T/CM150TXP-34T

HIGH POWER SWITCHING USE  
INSULATED TYPE

## TEST CIRCUIT AND WAVEFORMS



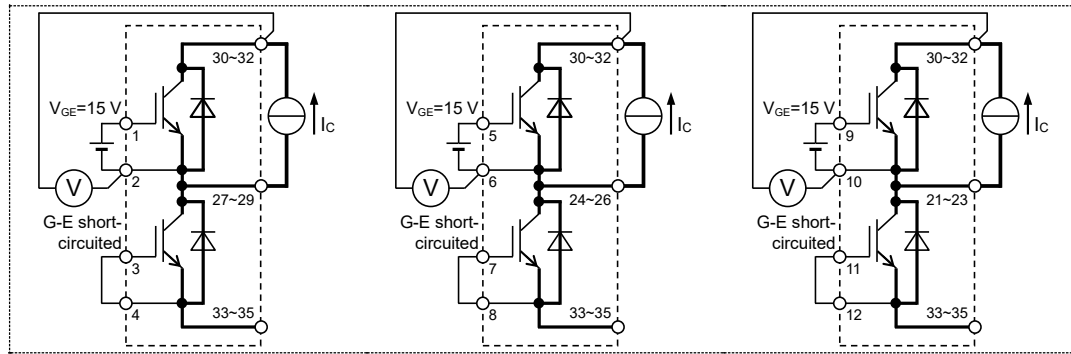
Switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)



# CM150TX-34T/CM150TXP-34T

HIGH POWER SWITCHING USE  
INSULATED TYPE

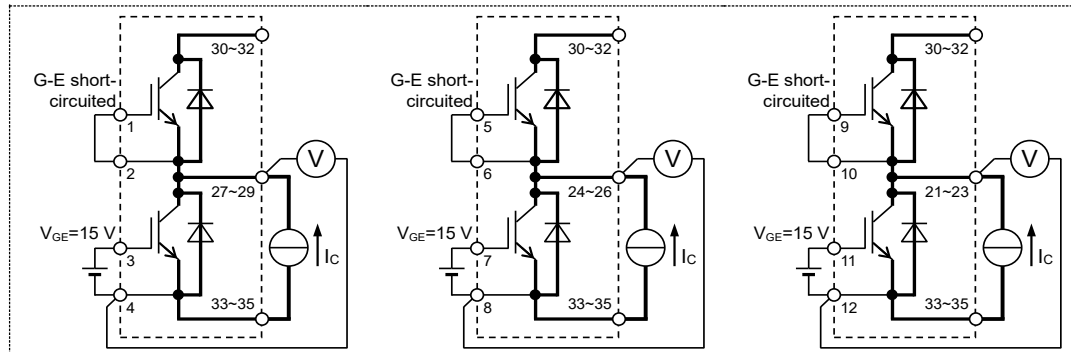
## TEST CIRCUIT



TrUP

TrVP

TrWP



TrUN

TrVN

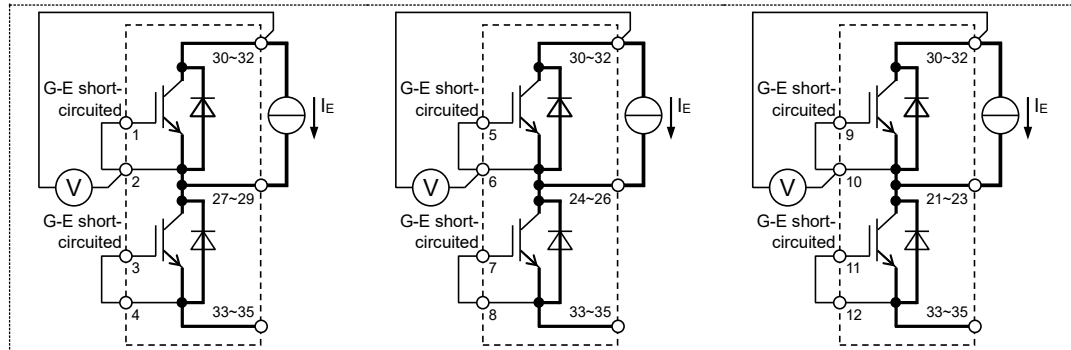
TrWN

Gate-emitter GVP-EVP, GVN-EVN,  
short-circuited GWP-EWP, GWN-EWN

Gate-emitter GUP-EUP, GUN-EUN,  
short-circuited GWP-EWP, GWN-EWN

Gate-emitter GUP-EUP, GUN-EUN,  
short-circuited GVP-EVP, GVN-EVN

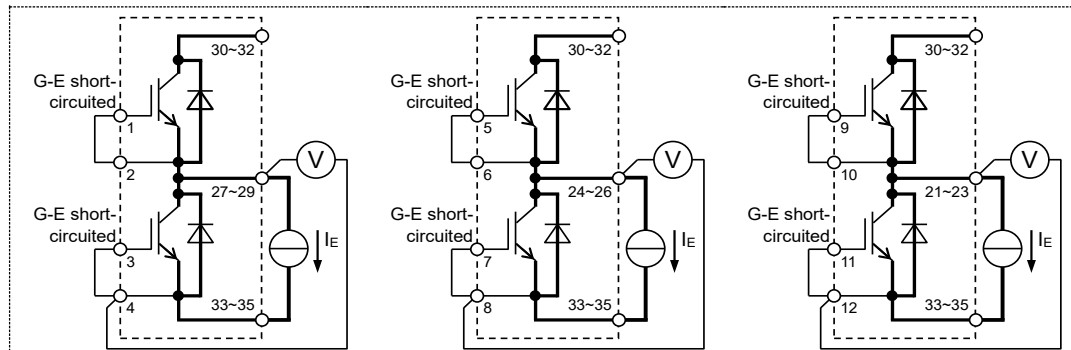
### $V_{CEsat}$ characteristics test circuit



DiUP

DiVP

DiWP



DiUN

DiVN

DiWN

Gate-emitter GVP-EVP, GVN-EVN,  
short-circuited GWP-EWP, GWN-EWN

Gate-emitter GUP-EUP, GUN-EUN,  
short-circuited GWP-EWP, GWN-EWN

Gate-emitter GUP-EUP, GUN-EUN,  
short-circuited GVP-EVP, GVN-EVN

### $V_{EC}$ characteristics test circuit

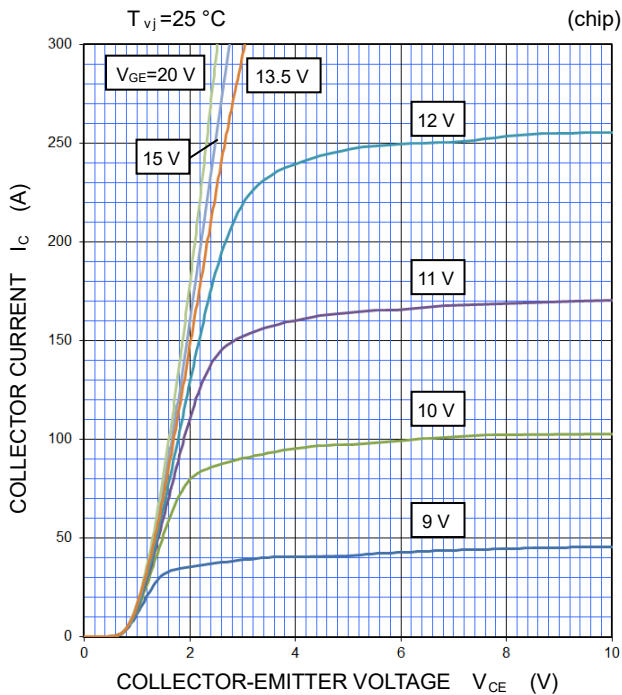
# CM150TX-34T/CM150TXP-34T

HIGH POWER SWITCHING USE  
INSULATED TYPE

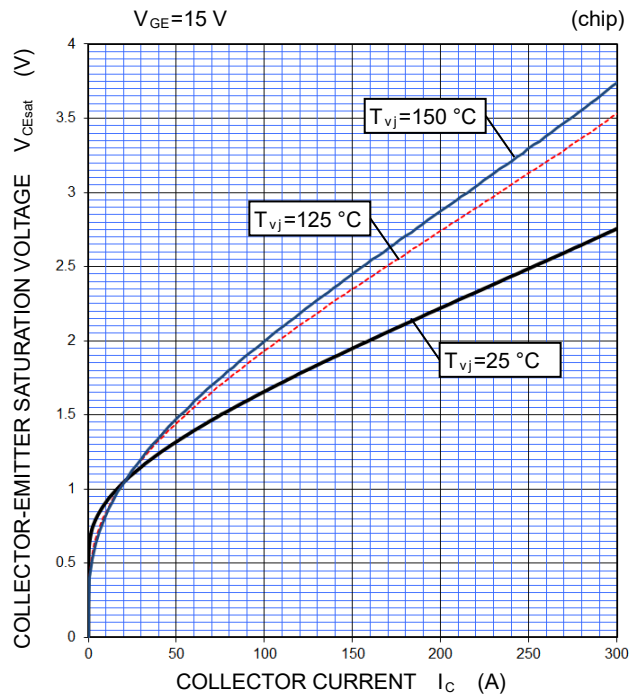
## PERFORMANCE CURVES

### INVERTER PART

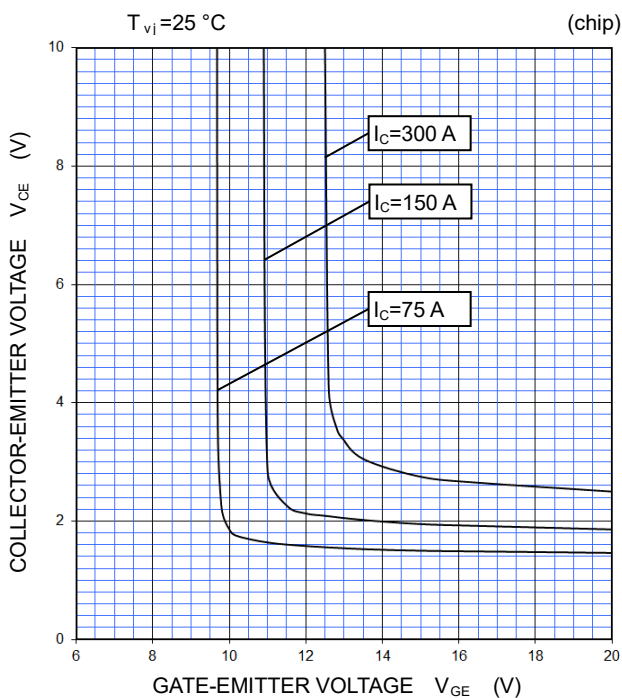
**OUTPUT CHARACTERISTICS  
(TYPICAL)**



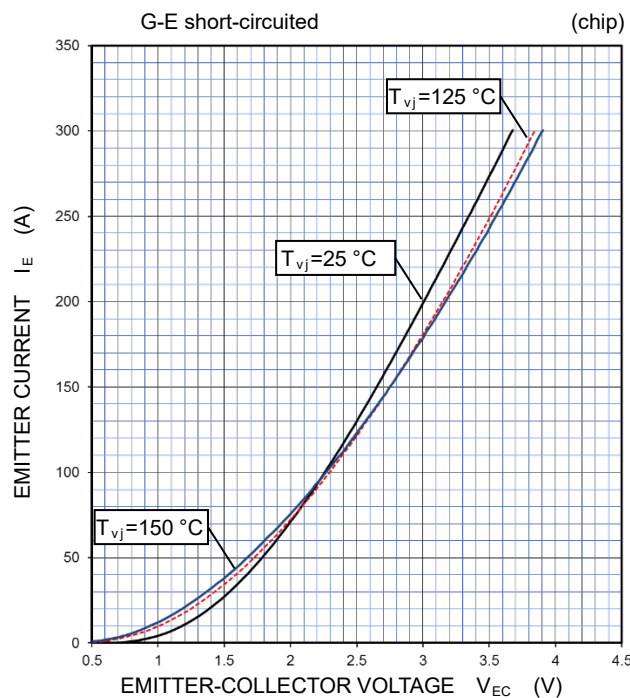
**COLLECTOR-EMITTER SATURATION VOLTAGE  
CHARACTERISTICS  
(TYPICAL)**



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



**FREE WHEELING DIODE  
FORWARD CHARACTERISTICS  
(TYPICAL)**



# CM150TX-34T/CM150TXP-34T

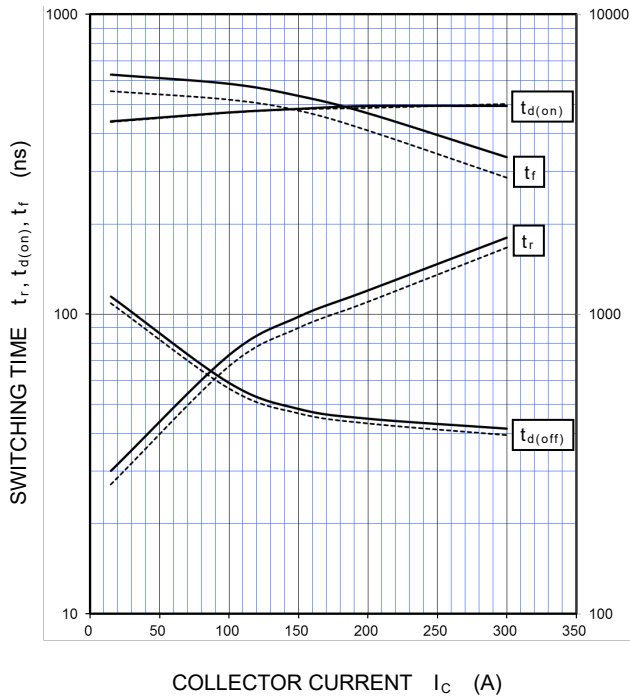
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### INVERTER PART

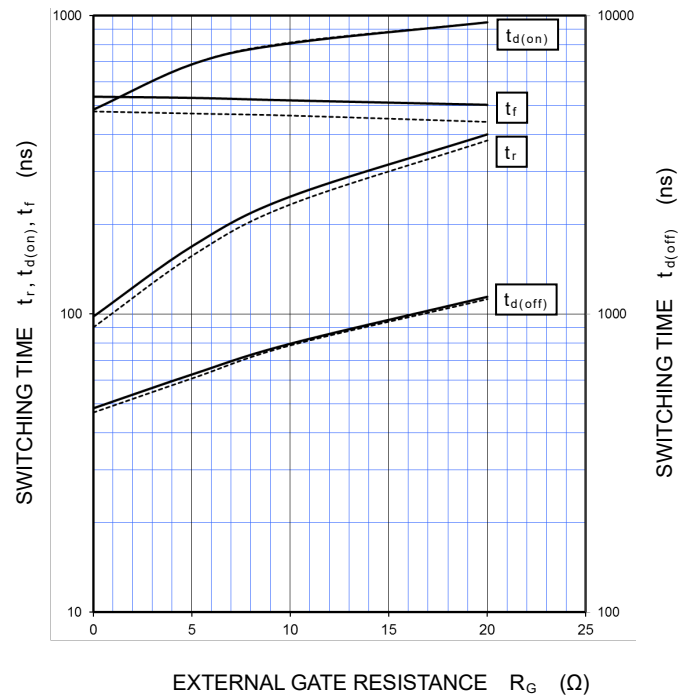
#### HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $R_G=0\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



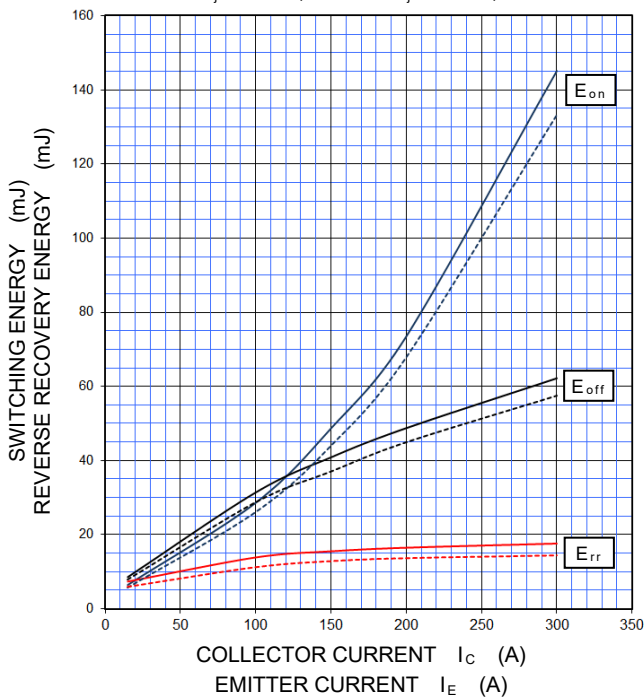
#### HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $I_C=150\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$



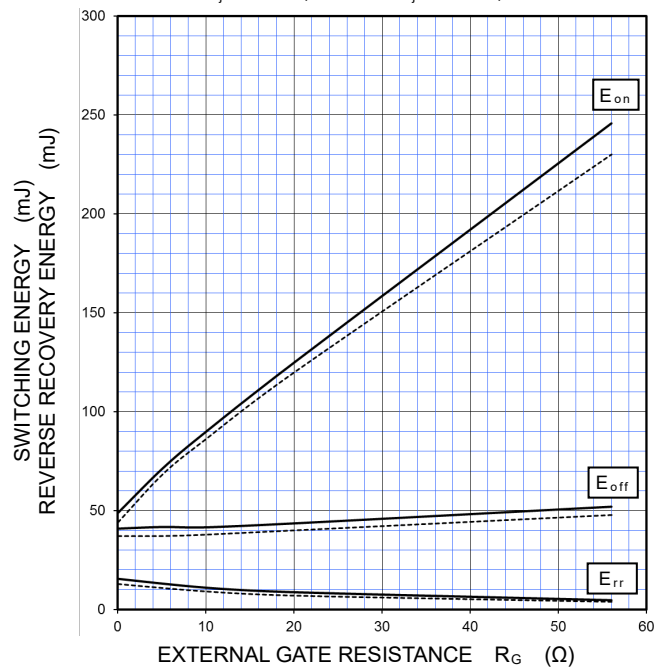
#### HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $R_G=0\ \Omega$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD,  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$ , PER PULSE



#### HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $I_C/I_E=150\text{ A}$ ,  $V_{GE}=\pm 15\text{ V}$ , INDUCTIVE LOAD,  
 —:  $T_{vj}=150\text{ }^\circ\text{C}$ , - - - -:  $T_{vj}=125\text{ }^\circ\text{C}$ , PER PULSE



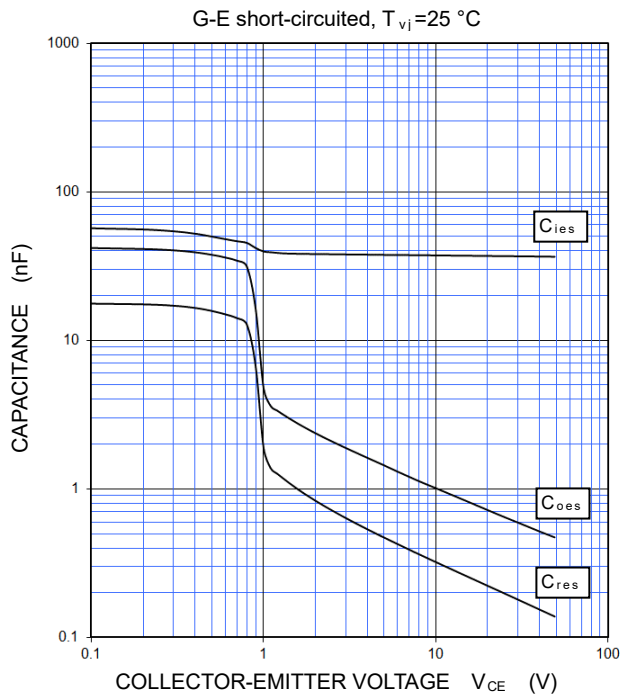
# CM150TX-34T/CM150TXP-34T

HIGH POWER SWITCHING USE  
INSULATED TYPE

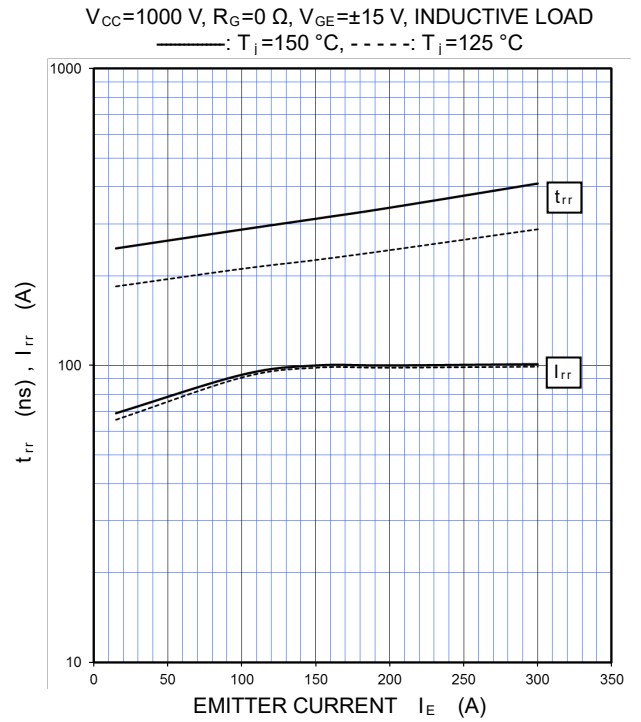
## PERFORMANCE CURVES

### INVERTER PART

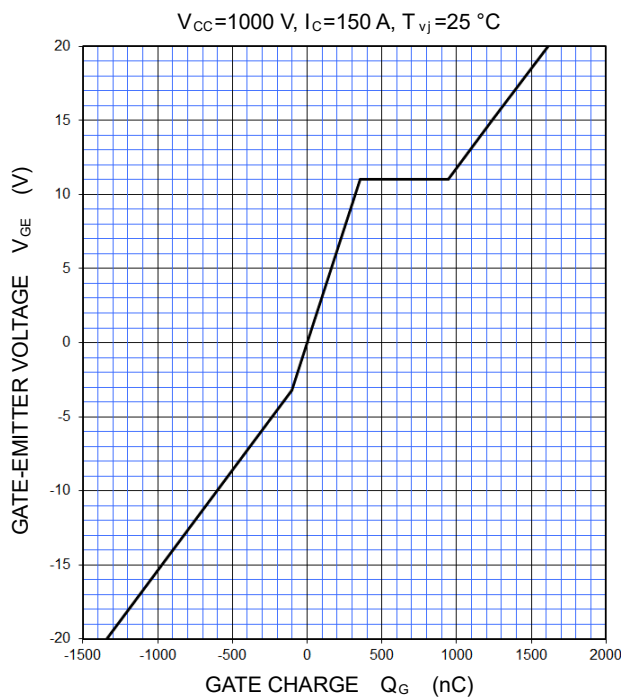
**CAPACITANCE CHARACTERISTICS (TYPICAL)**



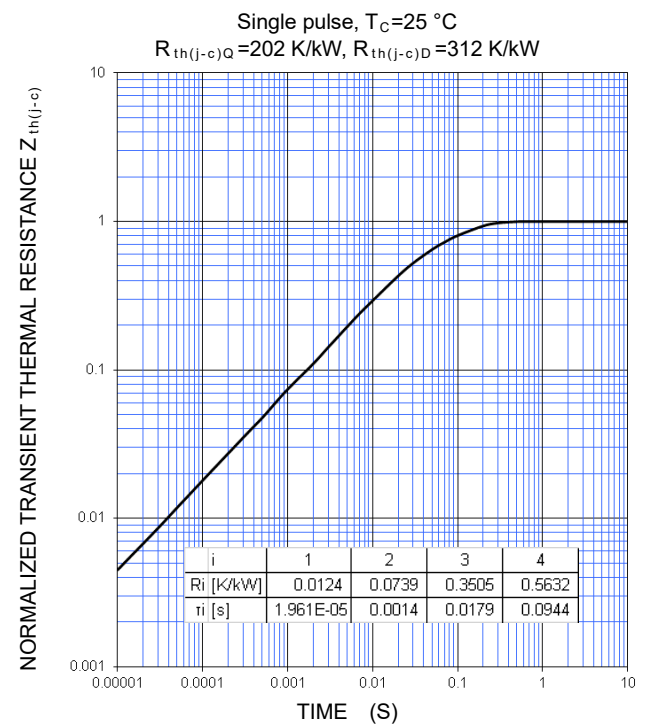
**FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



**GATE CHARGE CHARACTERISTICS (TYPICAL)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)**



# CM150TX-34T/CM150TXP-34T

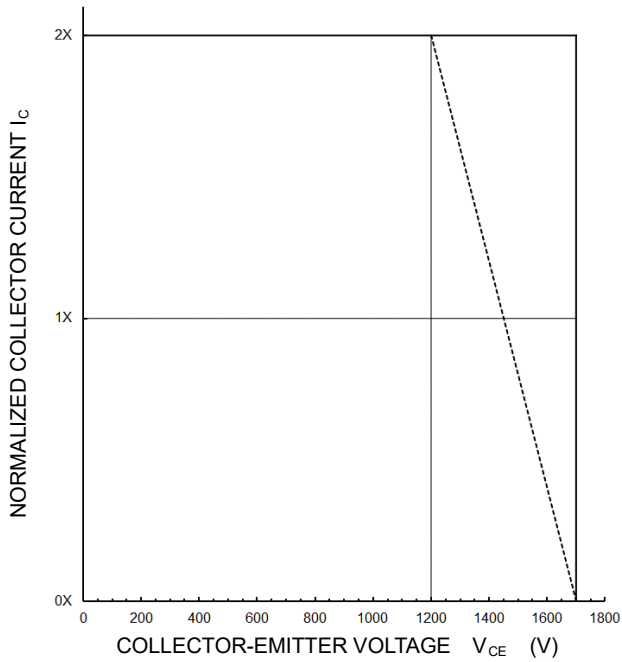
HIGH POWER SWITCHING USE  
INSULATED TYPE

## PERFORMANCE CURVES

### INVERTER PART

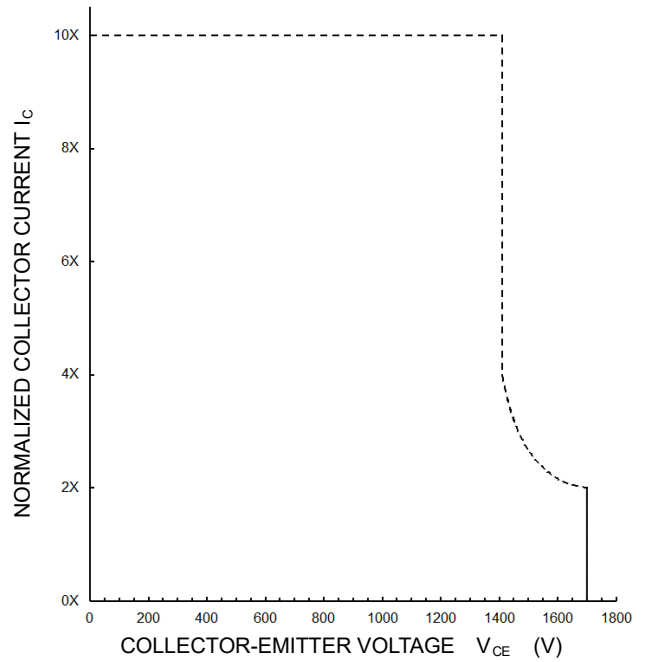
**TURN-OFF SWITCHING SAFE OPERATING AREA  
(REVERSE BIAS SAFE OPERATING AREA)  
(MAXIMUM)**

$V_{CC} \leq 1200 \text{ V}$ ,  $R_G = 0 \sim 56 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
 —:  $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$  (Normal load operations  
 (Continuous))  
 - - - - :  $T_{vj} = 175 \text{ }^\circ\text{C}$  (Unusual load operations (Limited period))



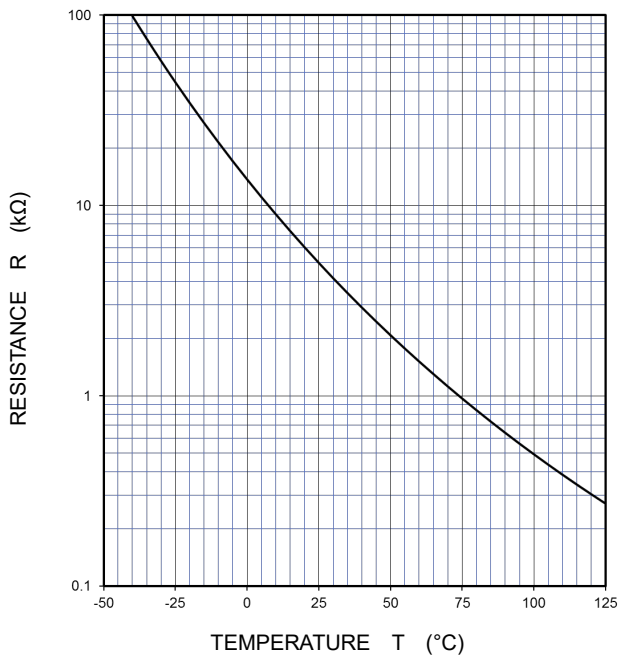
**SHORT-CIRCUIT SAFE OPERATING AREA  
(MAXIMUM)**

$V_{CC} \leq 1200 \text{ V}$ ,  $R_G = 0 \sim 56 \ \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  
 $T_{vj} = 25 \sim 150 \text{ }^\circ\text{C}$ ,  $t_w \leq 8 \ \mu\text{s}$ , Non-Repetitive



### NTC thermistor part

**TEMPERATURE CHARACTERISTICS  
(TYPICAL)**



Note: The characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

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# CM150TX-34T/CM150TXP-34T

HIGH POWER SWITCHING USE  
INSULATED TYPE

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