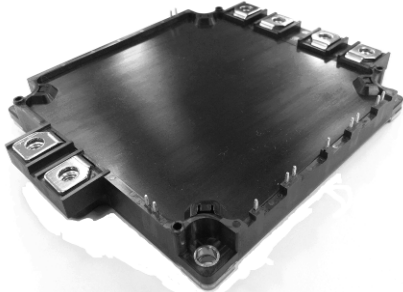


< IGBT MODULES >

# CM600DXL-34SA

HIGH POWER SWITCHING USE  
INSULATED TYPE



**Dual switch (Half-Bridge)**

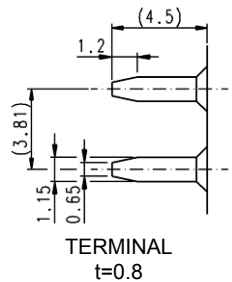
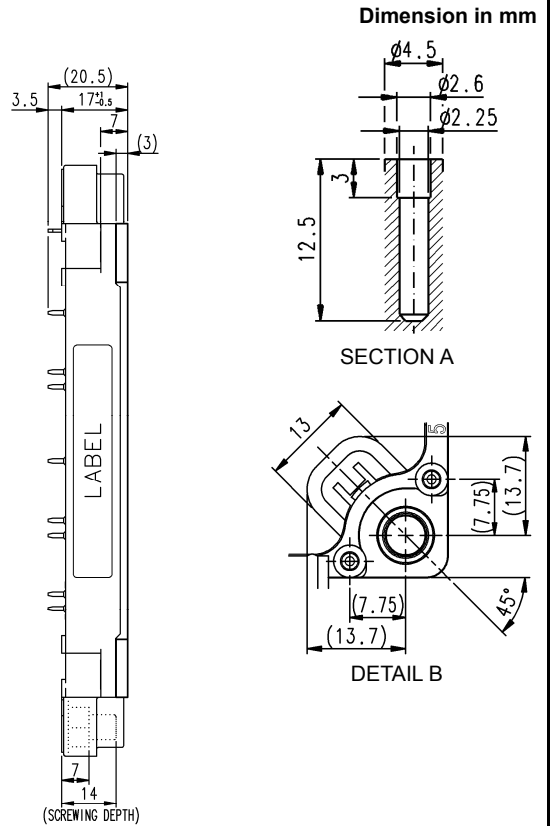
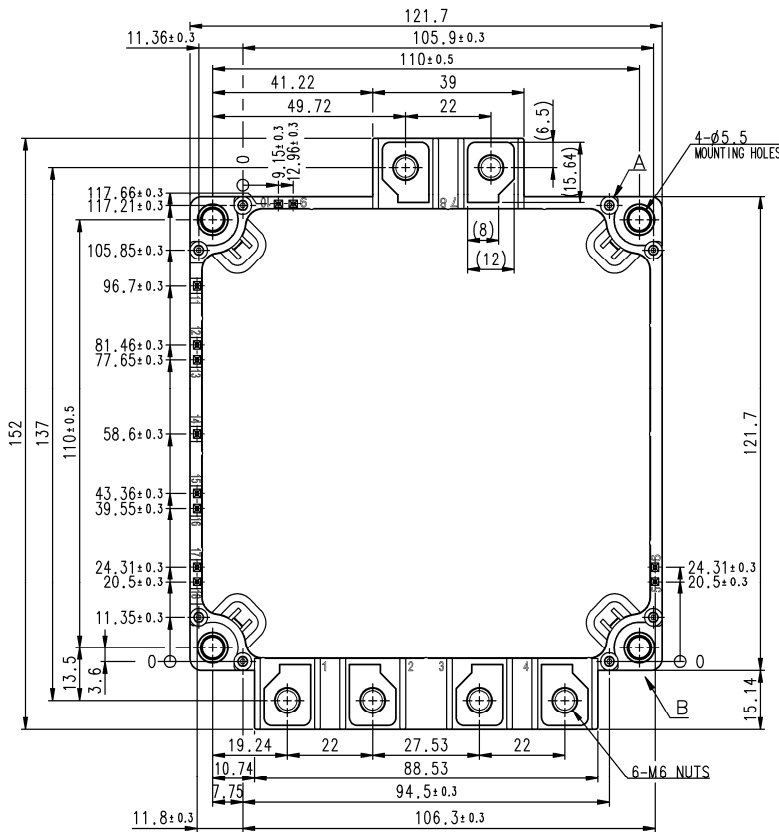
Collector current  $I_C$  ..... **600 A**  
 Collector-emitter voltage  $V_{CES}$  ..... **1700 V**  
 Maximum junction temperature  $T_{jmax}$  ..... **175 °C**

- Flat base Type
- Copper base plate (non-plating)
- Tin plating pin terminals
- RoHS Directive compliance
- Recognized under UL1557, File E323585

## APPLICATION

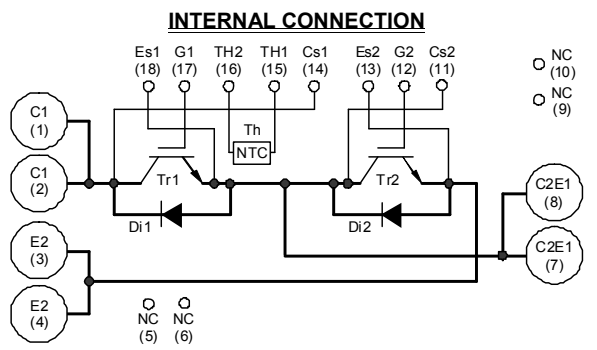
Wind power, AC Motor Control, Motion/Servo Control, Power supply, etc.

## OUTLINE DRAWING & INTERNAL CONNECTION



Tolerance otherwise specified

| Division of Dimension | Tolerance |
|-----------------------|-----------|
| 0.5 to 3              | ±0.2      |
| over 3 to 6           | ±0.3      |
| over 6 to 30          | ±0.5      |
| over 30 to 120        | ±0.8      |
| over 120 to 400       | ±1.2      |



< IGBT MODULES >

CM600DXL-34SA

HIGH POWER SWITCHING USE  
INSULATED TYPE

MAXIMUM RATINGS ( $T_j=25\text{ }^\circ\text{C}$ , unless otherwise specified)

INVERTER PART IGBT/DIODE

| Symbol            | Item                      | Conditions                                     | Rating   | Unit |
|-------------------|---------------------------|--|----------|------|
| $V_{CES}$         | Collector-emitter voltage | G-E short-circuited                            | 1700     | V    |
| $V_{GES}$         | Gate-emitter voltage      | C-E short-circuited                            | $\pm 20$ | V    |
| $I_C$             | Collector current         | DC, $T_C=125\text{ }^\circ\text{C}$ (Note2, 4) | 600      | A    |
| $I_{CRM}$         |                           | Pulse, Repetitive (Note3)                      | 1200     |      |
| $P_{tot}$         | Total power dissipation   | $T_C=25\text{ }^\circ\text{C}$ (Note2, 4)      | 5760     | W    |
| $I_E$ (Note1)     | Emitter current           | DC (Note2)                                     | 600      | A    |
| $I_{ERM}$ (Note1) |                           | Pulse, Repetitive (Note3)                      | 1200     |      |

MODULE

| Symbol     | Item                           | Conditions                                      | Rating     | Unit             |
|------------|--------------------------------|---|------------|------------------|
| $V_{isol}$ | Isolation voltage              | Terminals to base plate, RMS, f=60 Hz, AC 1 min | 4000       | V                |
| $T_{jmax}$ | Maximum junction temperature   | Instantaneous event (overload)                  | 175        | $^\circ\text{C}$ |
| $T_{Cmax}$ | Maximum case temperature       | (Note4)   | 125        |                  |
| $T_{jop}$  | Operating junction temperature | Continuous operation (under switching)          | -40 ~ +150 | $^\circ\text{C}$ |
| $T_{stg}$  | Storage temperature            | -   | -40 ~ +125 |                  |

ELECTRICAL CHARACTERISTICS ( $T_j=25\text{ }^\circ\text{C}$ , unless otherwise specified)

INVERTER PART IGBT/DIODE

| Symbol                         | Item                                 | Conditions   | Limits                          |      |      | Unit          |   |
|--------------------------------|--------------------------------------|--|---------------------------------|------|------|---------------|---|
|                                |                                      |  | Min.                            | Typ. | Max. |               |   |
| $I_{CES}$                      | Collector-emitter cut-off current    | $V_{CE}=V_{CES}$ , G-E short-circuited   | -                               | -    | 1.0  | mA            |   |
| $I_{GES}$                      | Gate-emitter leakage current         | $V_{GE}=V_{GES}$ , C-E short-circuited   | -                               | -    | 0.5  | $\mu\text{A}$ |   |
| $V_{GE(th)}$                   | Gate-emitter threshold voltage       | $I_C=60\text{ mA}$ , $V_{CE}=10\text{ V}$  | 5.4                             | 6.0  | 6.6  | V             |   |
| $V_{Cesat}$<br>(Terminal)      | Collector-emitter saturation voltage | $I_C=600\text{ A}$ , $V_{GE}=15\text{ V}$ ,<br>Refer to the figure of test circuit.<br>(Note6)                     | $T_j=25\text{ }^\circ\text{C}$  | -    | 2.00 | 2.50          | V |
|                                |                                      |  | $T_j=125\text{ }^\circ\text{C}$ | -    | 2.20 | -             |   |
|                                |                                      |  | $T_j=150\text{ }^\circ\text{C}$ | -    | 2.25 | -             |   |
| $V_{Cesat}$<br>(Chip)          |                                      | $I_C=600\text{ A}$ ,<br>$V_{GE}=15\text{ V}$ ,<br>(Note6)  | $T_j=25\text{ }^\circ\text{C}$  | -    | 1.90 | 2.40          | V |
|                                |                                      |  | $T_j=125\text{ }^\circ\text{C}$ | -    | 2.10 | -             |   |
|                                |                                      |  | $T_j=150\text{ }^\circ\text{C}$ | -    | 2.15 | -             |   |
| $C_{ies}$                      | Input capacitance                    | $V_{CE}=10\text{ V}$ , G-E short-circuited   | -                               | -    | 158  | nF            |   |
| $C_{oes}$                      | Output capacitance                   |  | -                               | -    | 13   |               |   |
| $C_{res}$                      | Reverse transfer capacitance         |  | -                               | -    | 2.9  |               |   |
| $Q_G$                          | Gate charge                          | $V_{CC}=1000\text{ V}$ , $I_C=600\text{ A}$ , $V_{GE}=15\text{ V}$   | -                               | 3310 | -    | nC            |   |
| $t_{d(on)}$                    | Turn-on delay time                   | $V_{CC}=1000\text{ V}$ , $I_C=600\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ ,<br>$R_G=0\text{ }\Omega$ , Inductive load | -                               | -    | 900  | ns            |   |
| $t_r$                          | Rise time                            |  | -                               | -    | 150  |               |   |
| $t_{d(off)}$                   | Turn-off delay time                  |  | -                               | -    | 900  |               |   |
| $t_f$                          | Fall time                            |  | -                               | -    | 400  |               |   |
| $V_{EC}$ (Note1)<br>(Terminal) | Emitter-collector voltage            | $I_E=600\text{ A}$ , G-E short-circuited,<br>Refer to the figure of test circuit.<br>(Note6)                       | $T_j=25\text{ }^\circ\text{C}$  | -    | 4.1  | 5.3           | V |
|                                |                                      |  | $T_j=125\text{ }^\circ\text{C}$ | -    | 2.9  | -             |   |
|                                |                                      |  | $T_j=150\text{ }^\circ\text{C}$ | -    | 2.7  | -             |   |
| $V_{EC}$ (Note1)<br>(Chip)     |                                      | $I_E=600\text{ A}$ ,<br>G-E short-circuited,<br>(Note6)  | $T_j=25\text{ }^\circ\text{C}$  | -    | 4.0  | 5.2           | V |
|                                |                                      |  | $T_j=125\text{ }^\circ\text{C}$ | -    | 2.8  | -             |   |
|                                |                                      |  | $T_j=150\text{ }^\circ\text{C}$ | -    | 2.6  | -             |   |
| $t_{rr}$ (Note1)               | Reverse recovery time                | $V_{CC}=1000\text{ V}$ , $I_E=600\text{ A}$ , $V_{GE}=\pm 15\text{ V}$ ,<br>$R_G=0\text{ }\Omega$ , Inductive load | -                               | -    | 300  | ns            |   |
| $Q_{rr}$ (Note1)               | Reverse recovery charge              | $R_G=0\text{ }\Omega$ , Inductive load   | -                               | 23   | -    | $\mu\text{C}$ |   |
| $E_{on}$                       | Turn-on switching energy per pulse   | $V_{CC}=1000\text{ V}$ , $I_C=I_E=600\text{ A}$ ,  | -                               | 167  | -    | mJ            |   |
| $E_{off}$                      | Turn-off switching energy per pulse  | $V_{GE}=\pm 15\text{ V}$ , $R_G=0\text{ }\Omega$ , $T_j=150\text{ }^\circ\text{C}$ ,                               | -                               | 168  | -    |               |   |
| $E_{rr}$ (Note1)               | Reverse recovery energy per pulse    | Inductive load   | -                               | 106  | -    |               |   |
| $R_{CC+EE}$                    | Internal lead resistance             | Main terminals-chip, per switch,<br>$T_C=25\text{ }^\circ\text{C}$ (Note4)   | -                               | -    | 0.6  | m $\Omega$    |   |
| $r_g$                          | Internal gate resistance             | Per switch   | -                               | 2.4  | -    | $\Omega$      |   |

< IGBT MODULES >

CM600DXL-34SA

HIGH POWER SWITCHING USE  
INSULATED TYPE

ELECTRICAL CHARACTERISTICS (cont.; T<sub>j</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 IGBT (Note4)                                    | -      | -    | 26   | K/kW |
| R <sub>th(j-c)D</sub> |                            | Junction to case, per DIODE (Note4)                                   | -      | -    | 39   |      |
| R <sub>th(c-s)</sub>  | Contact thermal resistance | Case to heat sink, per 1 module,<br>Thermal grease applied (Note4, 7) | -      | 7    | -    | K/kW |

MECHANICAL CHARACTERISTICS

| Symbol         | Item                   | Conditions                      | Limits |      |      | Unit |
|----------------|------------------------|---------------------------------|--------|------|------|------|
|                |                        |                                 | Min.   | Typ. | Max. |      |
| M <sub>t</sub> | Mounting torque        | Main terminals M 6 screw        | 3.5    | 4.0  | 4.5  | N·m  |
| M <sub>s</sub> |                        | Mounting to heat sink M 5 screw | 2.5    | 3.0  | 3.5  |      |
| d <sub>s</sub> | Creepage distance      | Terminal to terminal            | 22.5   | -    | -    | mm   |
|                |                        | Terminal to base plate          | 16.8   | -    | -    |      |
| d <sub>a</sub> | Clearance              | Terminal to terminal            | 15.5   | -    | -    | mm   |
|                |                        | Terminal to base plate          | 11.3   | -    | -    |      |
| m              | mass                   | -                               | -      | 690  | -    | g    |
| e <sub>c</sub> | Flatness of base plate | On the centerline X, Y (Note8)  | ± 0    | -    | +100 | μm   |

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

- Junction temperature (T<sub>j</sub>) should not increase beyond T<sub>jmax</sub> rating.
- Pulse width and repetition rate should be such that the device junction temperature (T<sub>j</sub>) dose not exceed T<sub>jmax</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.
- Pulse width and repetition rate should be such as to cause negligible temperature rise.

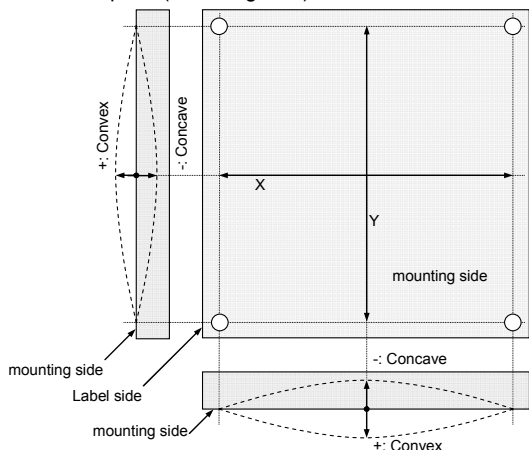
$$6. B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right),$$

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. Typical value is measured by using thermally conductive grease of λ=0.9 W/(m·K).

8. The base plate (mounting side) flatness measurement points (X, Y) are as follows of the following figure.



- Use the following screws when mounting the printed circuit board (PCB) on the stand offs.  
"φ2.6×10 or φ2.6×12 self tapping screw"  
The length of the screw depends on the thickness (t1.6~t2.0) of the PCB.

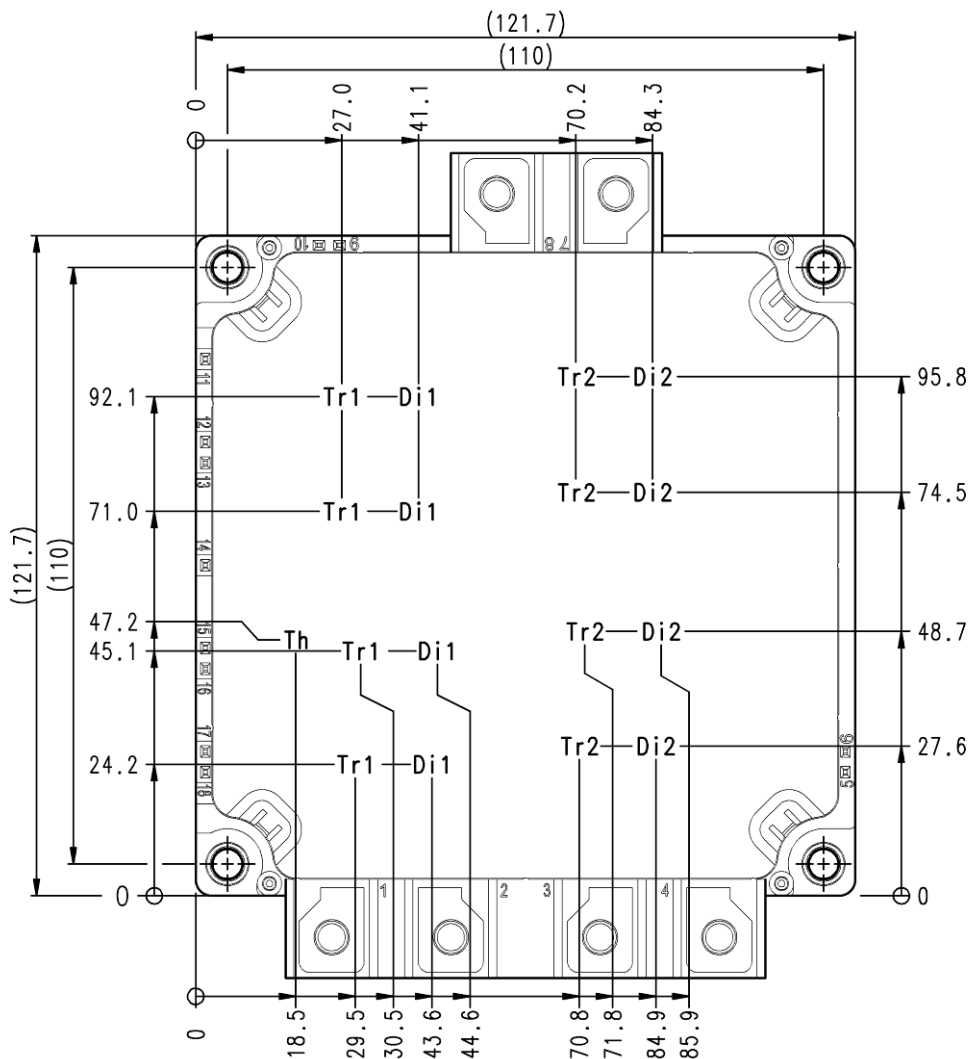
< IGBT MODULES >  
**CM600DXL-34SA**  
 HIGH POWER SWITCHING USE  
 INSULATED TYPE

**RECOMMENDED OPERATING CONDITIONS**

| Symbol     | Item                          | Conditions                   | Limits |      |      | Unit     |
|------------|-------------------------------|------------------------------|--------|------|------|----------|
|            |                               |                              | Min.   | Typ. | Max. |          |
| $V_{CC}$   | (DC) Supply voltage           | Applied across C1-E2         | -      | 1000 | 1200 | V        |
| $V_{GEon}$ | Gate (-emitter drive) voltage | Applied across G1-Es1/G2-Es2 | 13.5   | 15.0 | 16.5 | V        |
| $R_G$      | External gate resistance      | Per switch                   | 0      | -    | 13   | $\Omega$ |

**CHIP LOCATION (Top view)**

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



Tr1/Tr2: IGBT, Di1/Di2: DIODE, Th: NTC thermistor

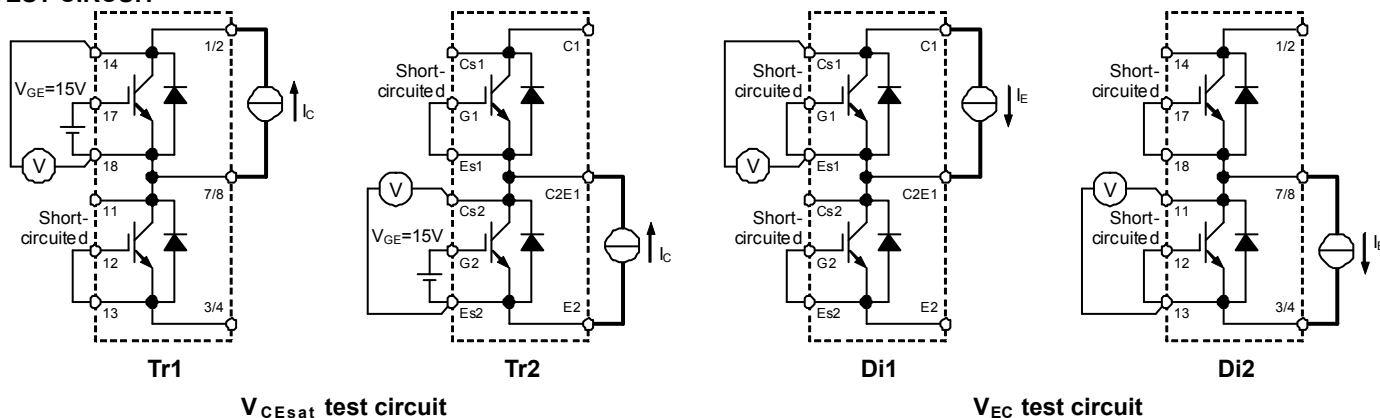
< IGBT MODULES >

CM600DXL-34SA

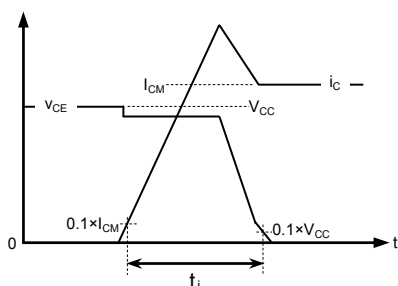
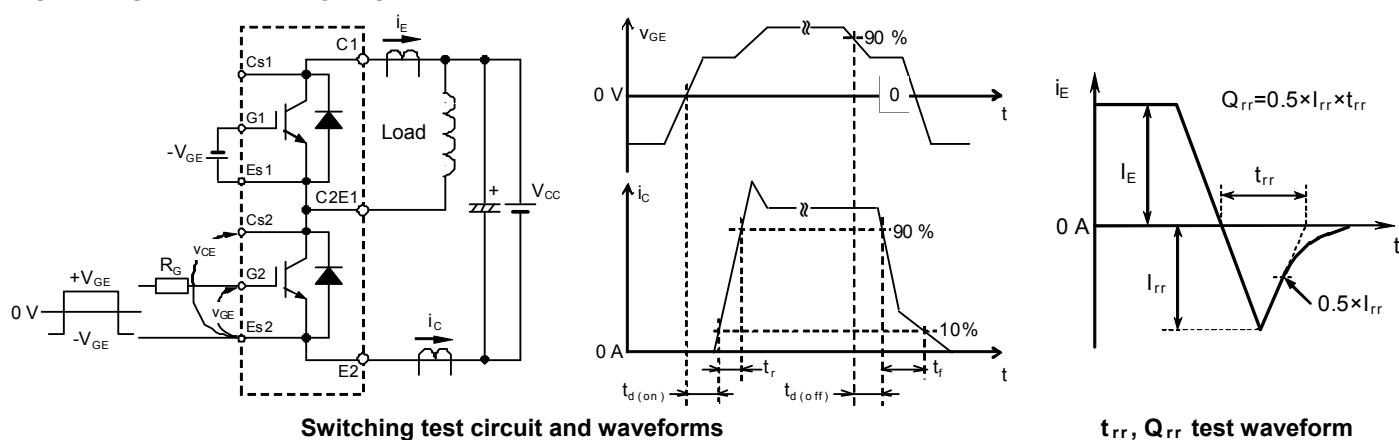
HIGH POWER SWITCHING USE

INSULATED TYPE

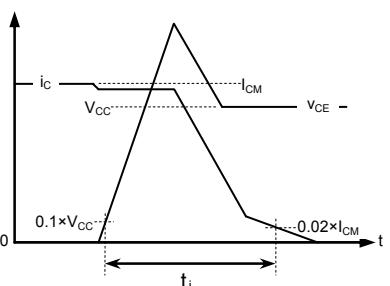
TEST CIRCUIT



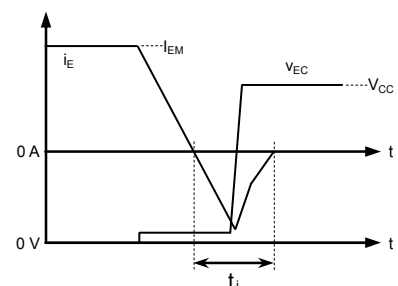
TEST CIRCUIT AND WAVEFORMS



**IGBT Turn-on switching energy**



**IGBT Turn-off switching energy**



**DIODE Reverse recovery energy**

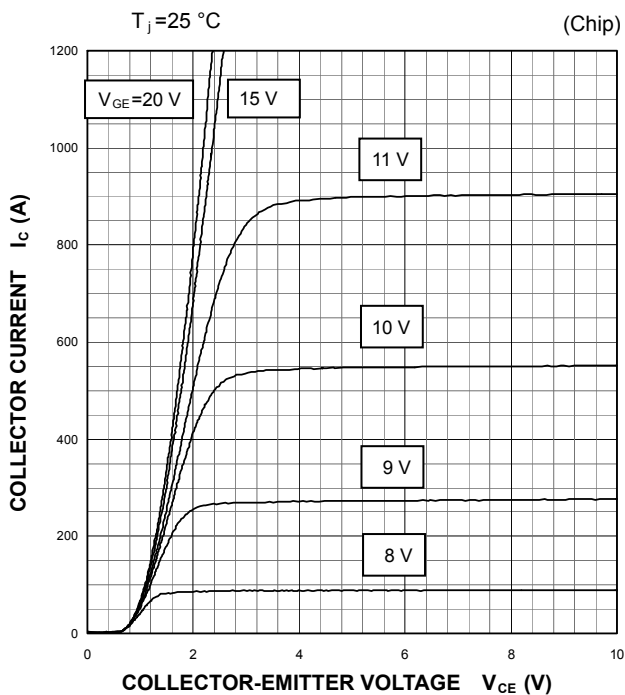
Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

< IGBT MODULES >  
**CM600DXL-34SA**  
 HIGH POWER SWITCHING USE  
 INSULATED TYPE

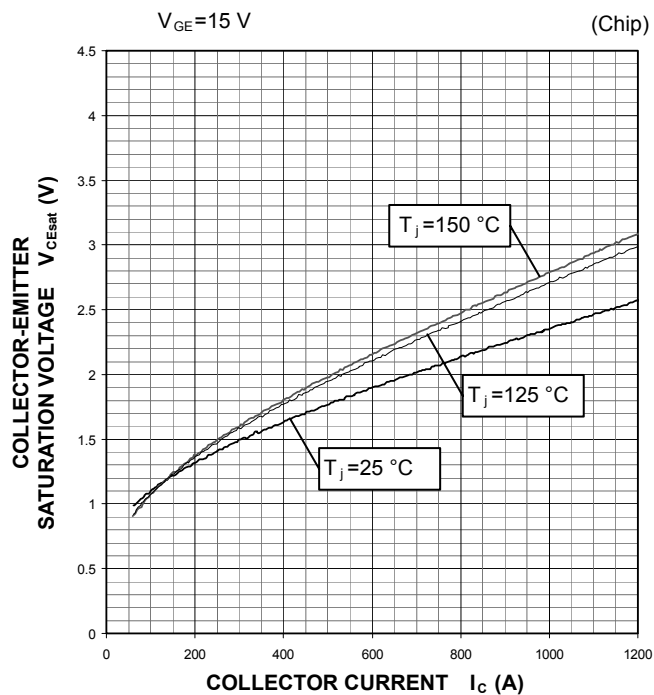
PERFORMANCE CURVES

INVERTER PART

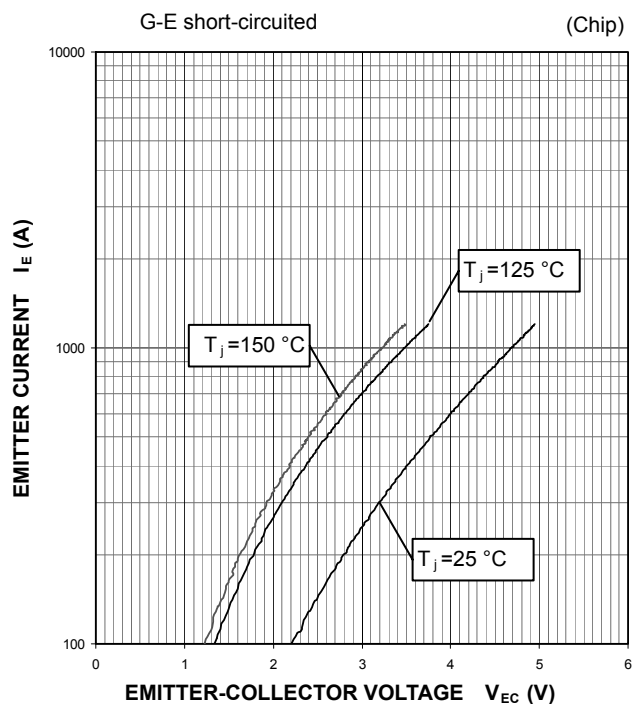
OUTPUT CHARACTERISTICS  
 (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE  
 CHARACTERISTICS  
 (TYPICAL)



FREE WHEELING DIODE  
 FORWARD CHARACTERISTICS  
 (TYPICAL)



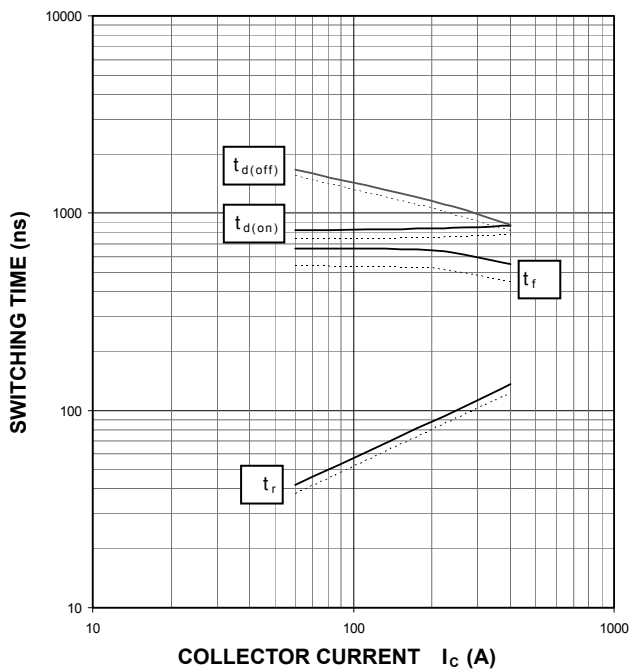
< IGBT MODULES >  
**CM600DXL-34SA**  
 HIGH POWER SWITCHING USE  
 INSULATED TYPE

PERFORMANCE CURVES

INVERTER PART

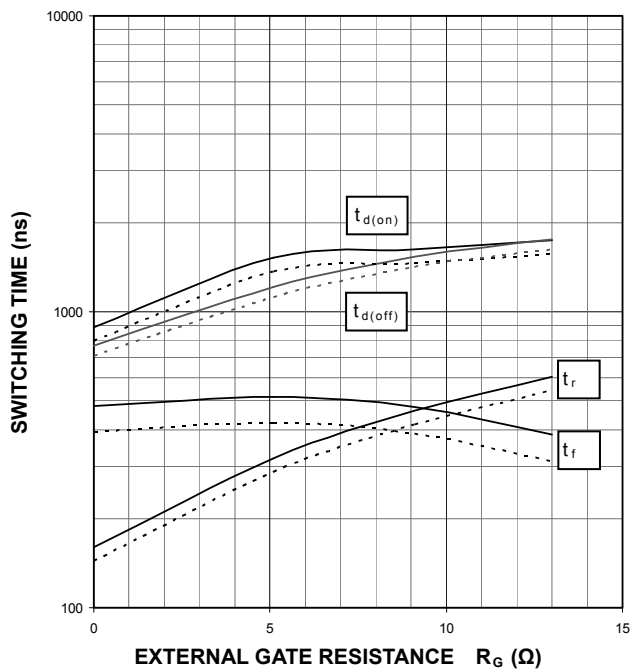
HALF-BRIDGE  
 SWITCHING CHARACTERISTICS  
 (TYPICAL)

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



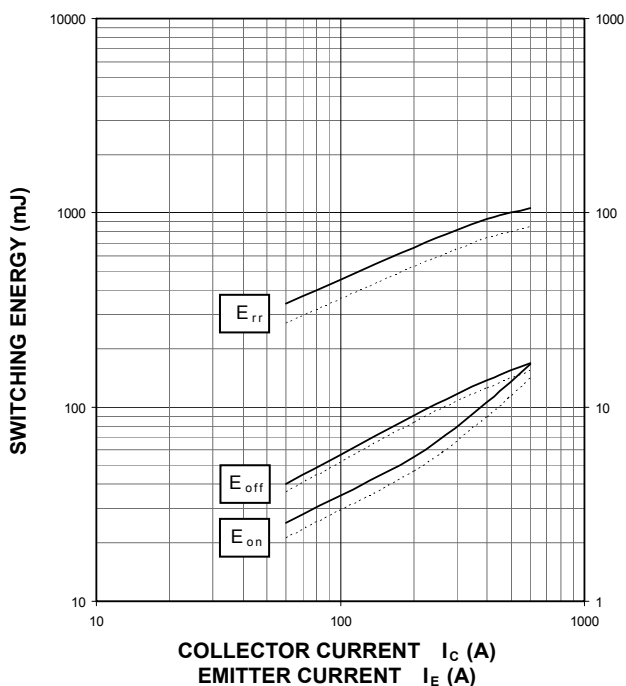
HALF-BRIDGE  
 SWITCHING CHARACTERISTICS  
 (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $I_C=600\text{ A}$ , INDUCTIVE LOAD  
 —:  $T_j=150\text{ }^\circ\text{C}$ , - - - -:  $T_j=125\text{ }^\circ\text{C}$



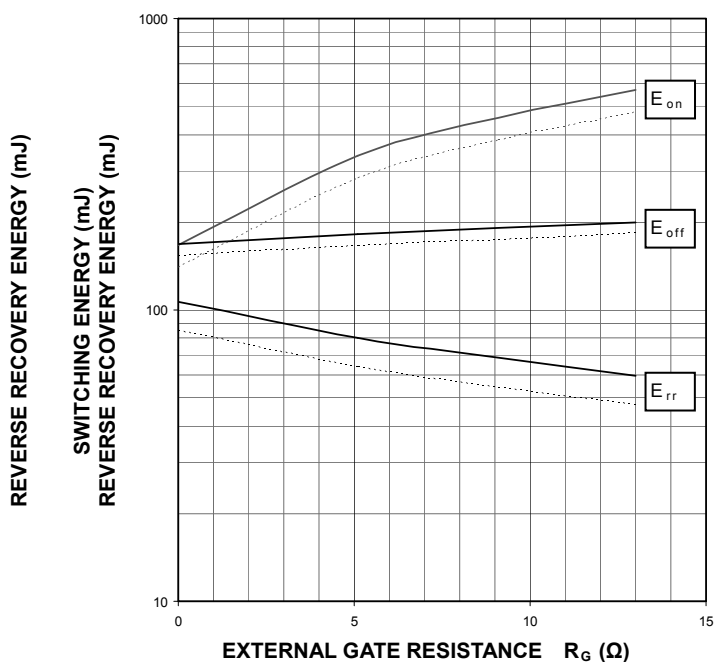
HALF-BRIDGE  
 SWITCHING CHARACTERISTICS  
 (TYPICAL)

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



HALF-BRIDGE  
 SWITCHING CHARACTERISTICS  
 (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $V_{GE}=\pm 15\text{ V}$ ,  $I_C=600\text{ A}$ ,  
 INDUCTIVE LOAD, PER PULSE  
 —:  $T_j=150\text{ }^\circ\text{C}$ , - - - -:  $T_j=125\text{ }^\circ\text{C}$



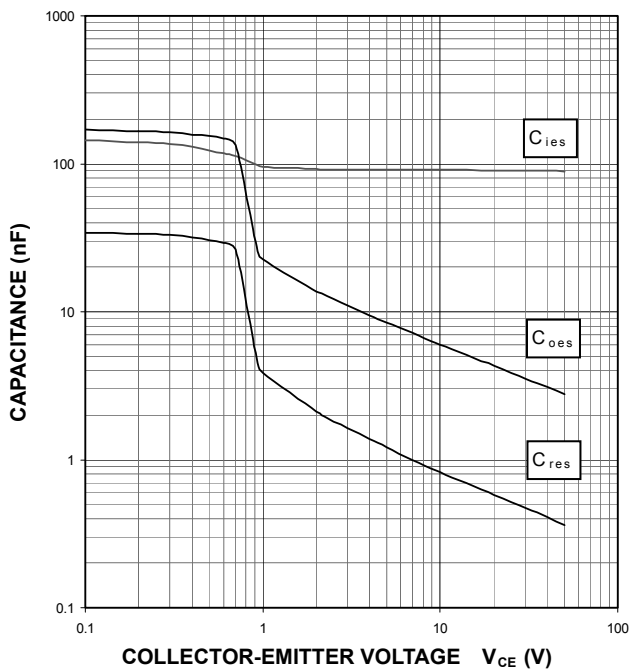
< IGBT MODULES >  
**CM600DXL-34SA**  
 HIGH POWER SWITCHING USE  
 INSULATED TYPE

**PERFORMANCE CURVES**

**INVERTER PART**

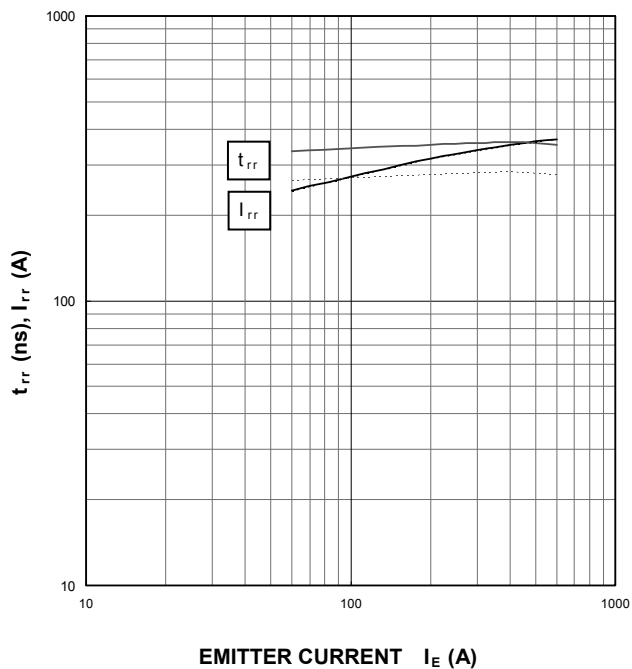
**CAPACITANCE CHARACTERISTICS**  
 (TYPICAL)

G-E short-circuited,  $T_j=25\text{ }^\circ\text{C}$



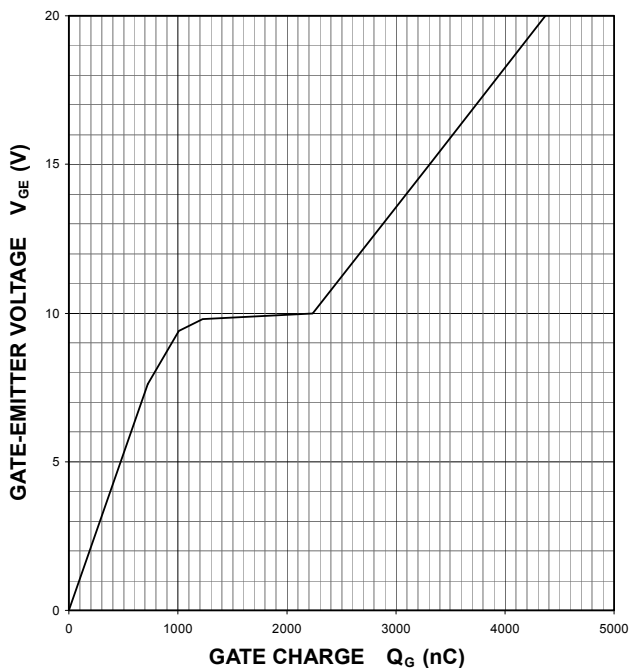
**FREE WHEELING DIODE**  
**REVERSE RECOVERY CHARACTERISTICS**  
 (TYPICAL)

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



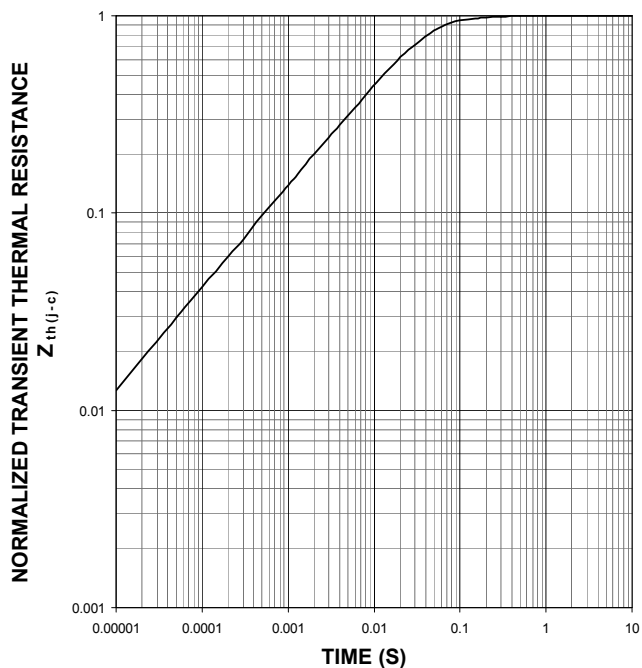
**GATE CHARGE CHARACTERISTICS**  
 (TYPICAL)

$V_{CC}=1000\text{ V}$ ,  $I_C=600\text{ A}$ ,  $T_j=25\text{ }^\circ\text{C}$



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS**  
 (MAXIMUM)

Single pulse,  $T_C=25\text{ }^\circ\text{C}$   
 $R_{th(j-c)Q}=26\text{ K/kW}$ ,  $R_{th(j-c)D}=39\text{ K/kW}$





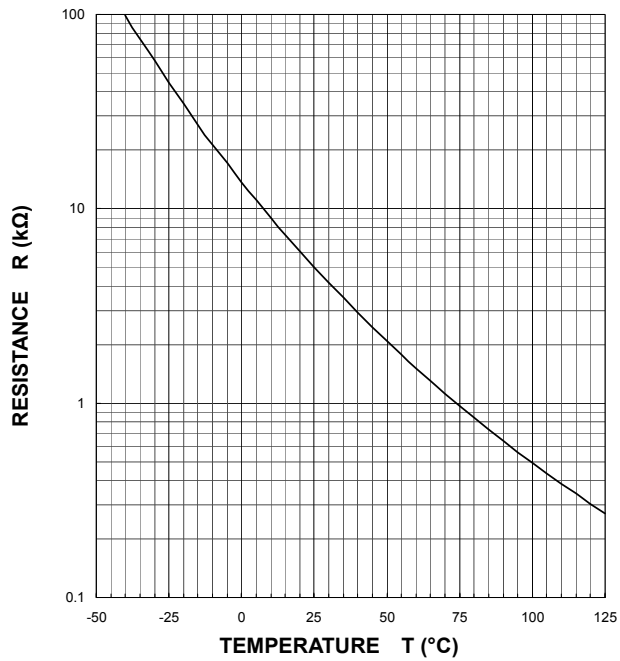
< IGBT MODULES >  
CM600DXL-34SA  
HIGH POWER SWITCHING USE  
INSULATED TYPE

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PERFORMANCE CURVES

NTC thermistor part

TEMPERATURE CHARACTERISTICS  
(TYPICAL)



### **Keep safety first in your circuit designs!**

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