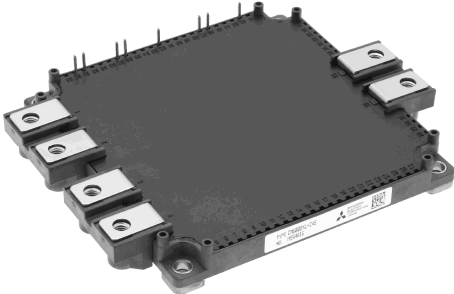


< IGBT MODULES >

CM1000DXL-24S

HIGH POWER SWITCHING USE
INSULATED TYPE



Dual switch (Half-Bridge)

Collector current I_C **900 A***
 Collector-emitter voltage V_{CES} **1200 V**
 Maximum junction temperature T_{jmax} **175 °C**

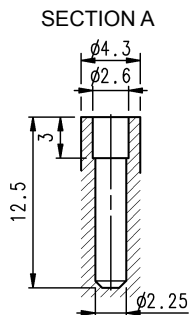
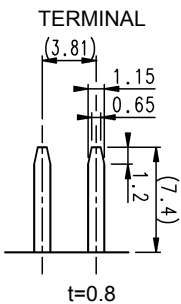
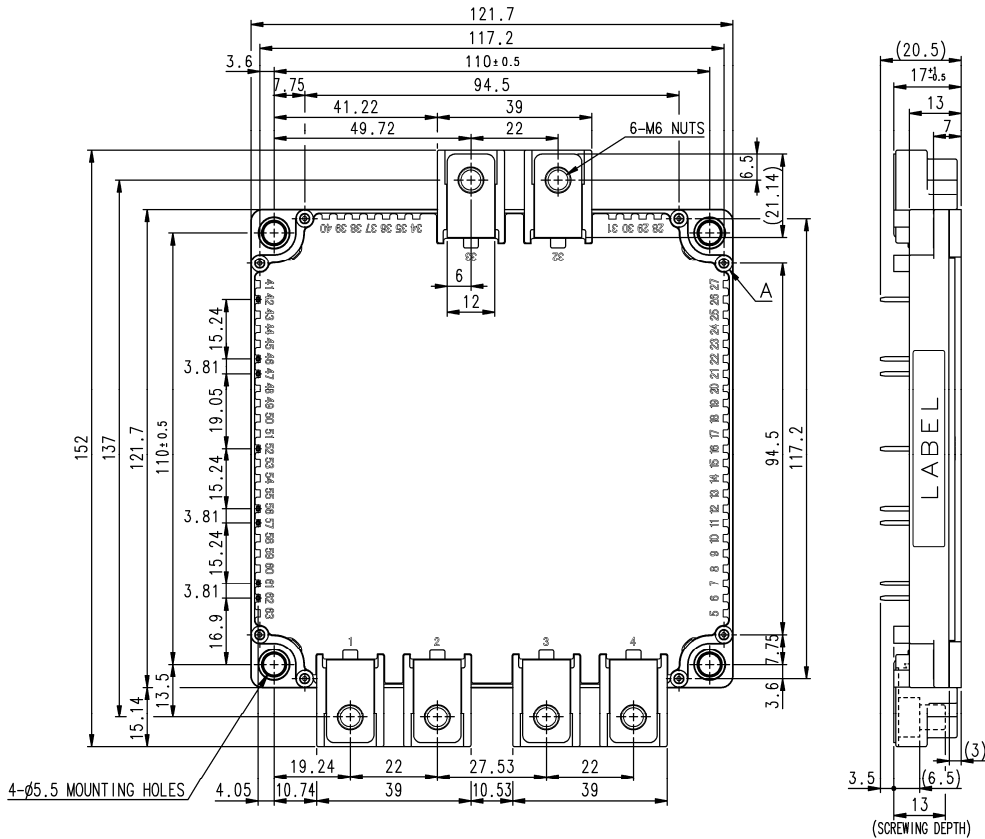
- Flat base Type
- Copper base plate (non-plating)
- Tin plating pin terminals
- RoHS Directive compliant
- Recognized under UL1557, File E323585

APPLICATION

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

OUTLINE DRAWING & INTERNAL CONNECTION

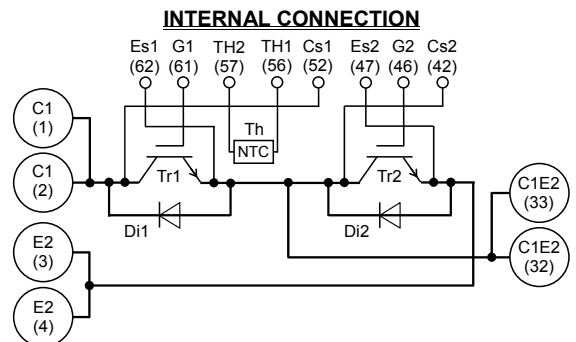
Dimension in mm



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 |

The tolerance of size between terminals is assumed to be ±0.4.



< IGBT MODULES >

CM1000DXL-24S

HIGH POWER SWITCHING USE
INSULATED TYPE

MAXIMUM RATINGS (T_j=25 °C, unless otherwise specified)

INVERTER PART IGBT/DIODE

| Symbol | Item | Conditions | Rating | Unit |
|--------------------------|---------------------------|---------------------------------------|--------|------|
| V _{CEs} | Collector-emitter voltage | G-E short-circuited | 1200 | V |
| V _{GES} | Gate-emitter voltage | C-E short-circuited | ± 20 | V |
| I _C | Collector current | DC, T _C =124 °C (Note2, 4) | 900 * | A |
| I _{CM} | | (Note2) | 1000 | |
| I _{CRM} | | Pulse, Repetitive (Note3) | 2000 | |
| P _{tot} | Total power dissipation | T _C =25 °C (Note2, 4) | 7500 | W |
| I _E (Note1) | Emitter current | DC (Note2) | 900 * | A |
| I _{EM} (Note1) | | (Note2) | 1000 | |
| I _{ERM} (Note1) | | Pulse, Repetitive (Note3) | 2000 | |

MODULE

| Symbol | Item | Conditions | Rating | Unit |
|-------------------|--------------------------------|---|------------|------|
| V _{isol} | Isolation voltage | Terminals to base plate, RMS, f=60 Hz, AC 1 min | 2500 | V |
| T _{jmax} | Maximum junction temperature | Instantaneous event (overload) | 175 | °C |
| T _{Cmax} | Maximum case temperature | (Note4) | 125 | |
| T _{jop} | Operating junction temperature | Continuous operation (under switching) | -40 ~ +150 | °C |
| T _{stg} | Storage temperature | - | -40 ~ +125 | |

ELECTRICAL CHARACTERISTICS (T_j=25 °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 | µA | |
| V _{GE(th)} | Gate-emitter threshold voltage | I _C =100 mA, V _{CE} =10 V | 5.4 | 6.0 | 6.6 | V | |
| V _{CEsat} (Terminal) | Collector-emitter saturation voltage | I _C =1000 A, V _{GE} =15 V, Refer to the figure of test circuit (Note5) | T _j =25 °C | - | 1.85 | 2.30 | V |
| | | | T _j =125 °C | - | 2.05 | - | |
| | | | T _j =150 °C | - | 2.10 | - | |
| V _{CEsat} (Chip) | Collector-emitter saturation voltage | I _C =1000 A, V _{GE} =15 V, (Note5) | T _j =25 °C | - | 1.70 | 2.15 | V |
| | | | T _j =125 °C | - | 1.90 | - | |
| | | | T _j =150 °C | - | 1.95 | - | |
| C _{ies} | Input capacitance | V _{CE} =10 V, G-E short-circuited | - | - | 100 | nF | |
| C _{oes} | Output capacitance | | - | - | 20 | | |
| C _{res} | Reverse transfer capacitance | | - | - | 1.7 | | |
| Q _G | Gate charge | V _{CC} =600 V, I _C =1000 A, V _{GE} =15 V | - | 2300 | - | nC | |
| t _{d(on)} | Turn-on delay time | V _{CC} =600 V, I _C =1000 A, V _{GE} =±15 V, R _G =0 Ω, Inductive load | - | - | 800 | ns | |
| t _r | Rise time | | - | - | 200 | | |
| t _{d(off)} | Turn-off delay time | | - | - | 600 | | |
| t _f | Fall time | | - | - | 300 | | |
| V _{EC} (Note1) (Terminal) | Emitter-collector voltage | I _E =1000 A, G-E short-circuited, Refer to the figure of test circuit (Note5) | T _j =25 °C | - | 1.85 | 2.30 | V |
| | | | T _j =125 °C | - | 1.85 | - | |
| | | | T _j =150 °C | - | 1.85 | - | |
| V _{EC} (Note1) (Chip) | Emitter-collector voltage | I _E =1000 A, G-E short-circuited, (Note5) | T _j =25 °C | - | 1.70 | 2.15 | V |
| | | | T _j =125 °C | - | 1.70 | - | |
| | | | T _j =150 °C | - | 1.70 | - | |
| t _{rr} (Note1) | Reverse recovery time | V _{CC} =600 V, I _E =1000 A, V _{GE} =±15 V, | - | - | 300 | ns | |
| Q _{rr} (Note1) | Reverse recovery charge | R _G =0 Ω, Inductive load | - | 53.3 | - | µC | |

< IGBT MODULES >

CM1000DXL-24S

HIGH POWER SWITCHING USE
INSULATED TYPE

ELECTRICAL CHARACTERISTICS (cont.; T_j=25 °C, unless otherwise specified)

INVERTER PART IGBT/DIODE

| Symbol | Item | Conditions | Limits | | | Unit |
|-------------------------|-------------------------------------|--|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| E _{on} | Turn-on switching energy per pulse | V _{CC} =600 V, I _C =I _E =1000 A, | - | 45.6 | - | mJ |
| E _{off} | Turn-off switching energy per pulse | V _{GE} =±15 V, R _G =0 Ω, T _j =150 °C, | - | 97.1 | - | |
| E _{rr} (Note1) | Reverse recovery energy per pulse | Inductive load | - | 96.7 | - | mJ |
| R _{CC'+EE'} | Internal lead resistance | Main terminals-chip, per switch, T _C =25 °C (Note4) | - | - | 0.5 | mΩ |
| r _g | Internal gate resistance | Per switch | - | 2.0 | - | Ω |

NTC THERMISTOR PART

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

THERMAL RESISTANCE CHARACTERISTICS

| Symbol | Item | Conditions | Limits | | | Unit |
|-----------------------|----------------------------|---|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| R _{th(j-c)Q} | Thermal resistance | Junction to case, per Inverter IGBT (Note4) | - | - | 20 | K/kW |
| R _{th(j-c)D} | | Junction to case, per Inverter DIODE (Note4) | - | - | 38 | |
| R _{th(c-s)} | Contact thermal resistance | Case to heat sink, per 1 module, Thermal grease applied (Note4, 7) | - | 7 | - | K/kW |

MECHANICAL CHARACTERISTICS

| Symbol | Item | Conditions | Limits | | | Unit |
|----------------|------------------------|---------------------------------|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| M _t | Mounting torque | Main terminals M 6 screw | 3.5 | 4.0 | 4.5 | N·m |
| M _s | | Mounting to heat sink M 5 screw | 2.5 | 3.0 | 3.5 | |
| m | mass | - | - | 690 | - | g |
| d _s | Creepage distance | Terminal to terminal | 13.69 | - | - | mm |
| | | Terminal to base plate | 15.7 | - | - | |
| d _a | Clearance | Terminal to terminal | 13.69 | - | - | mm |
| | | Terminal to base plate | 14.88 | - | - | |
| e _c | 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_j) should not increase beyond T_{jmax} rating.
- Pulse width and repetition rate should be such that the device junction temperature (T_j) dose not exceed T_{jmax} rating.
- Case temperature (T_C) and heat sink temperature (T_s) 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.

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

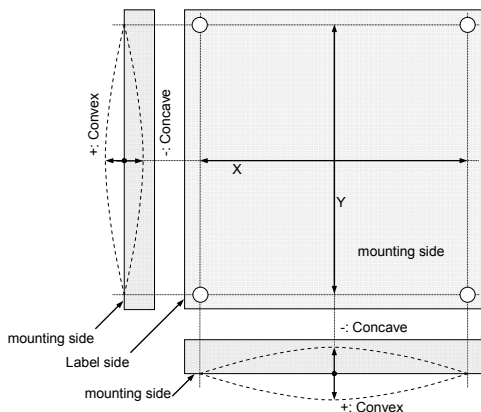
R₂₅: resistance at absolute temperature T₂₅ [K]; T₂₅=25 [°C]+273.15=298.15 [K]

R₅₀: resistance at absolute temperature T₅₀ [K]; T₅₀=50 [°C]+273.15=323.15 [K]

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

< IGBT MODULES >
CM1000DXL-24S
HIGH POWER SWITCHING USE
INSULATED TYPE

Note8. Base plate (mounting side) flatness measurement points (X, Y) are as follows of the following figure.



9. Use the following screws when mounting the printed circuit board (PCB) on the stand offs.

" $\phi 2.6 \times 10$ or $\phi 2.6 \times 12$ B1 tapping screw"

The length of the screw depends on thickness ($t1.6 \sim t2.0$) of the PCB.

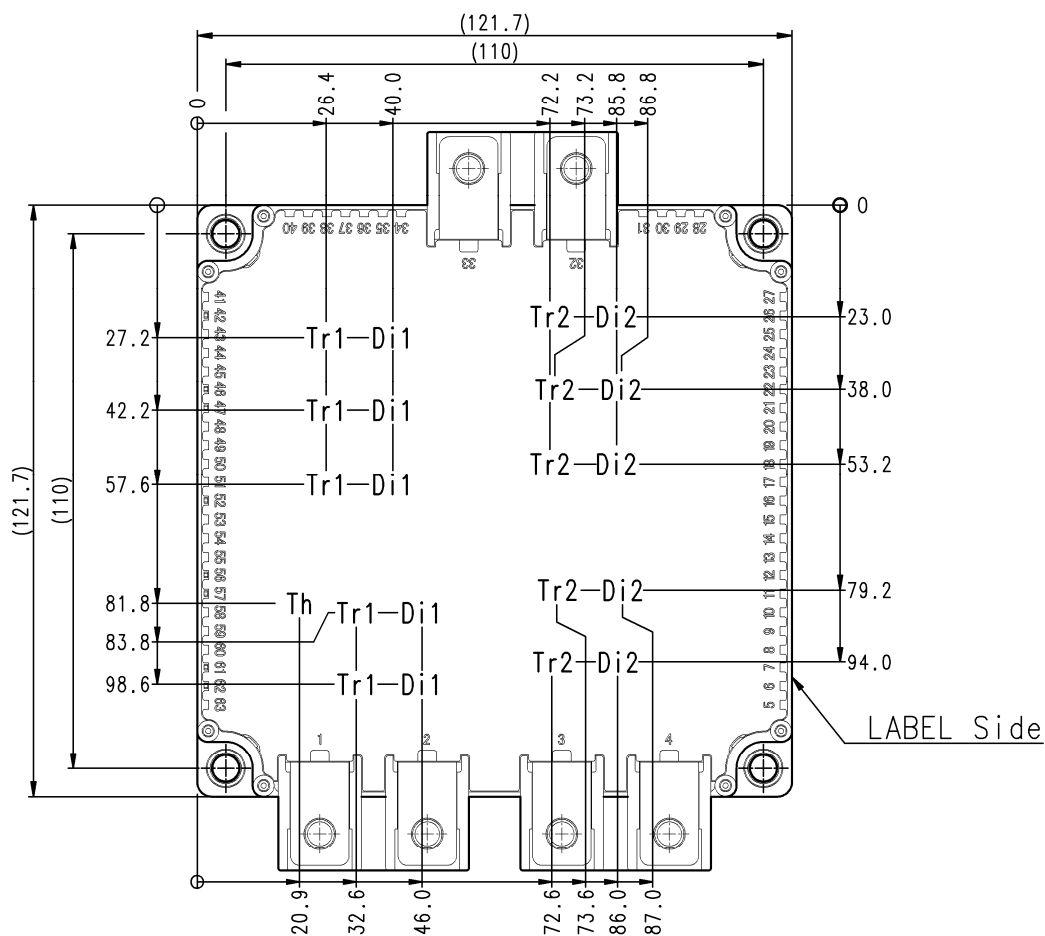
*: DC current rating is limited by power terminals.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Item | Conditions | Limits | | | Unit |
|------------|-------------------------------|------------------------------|--------|------|------|----------|
| | | | Min. | Typ. | Max. | |
| V_{CC} | (DC) Supply voltage | Applied across C1-E2 | - | 600 | 850 | 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 | - | 5.1 | Ω |

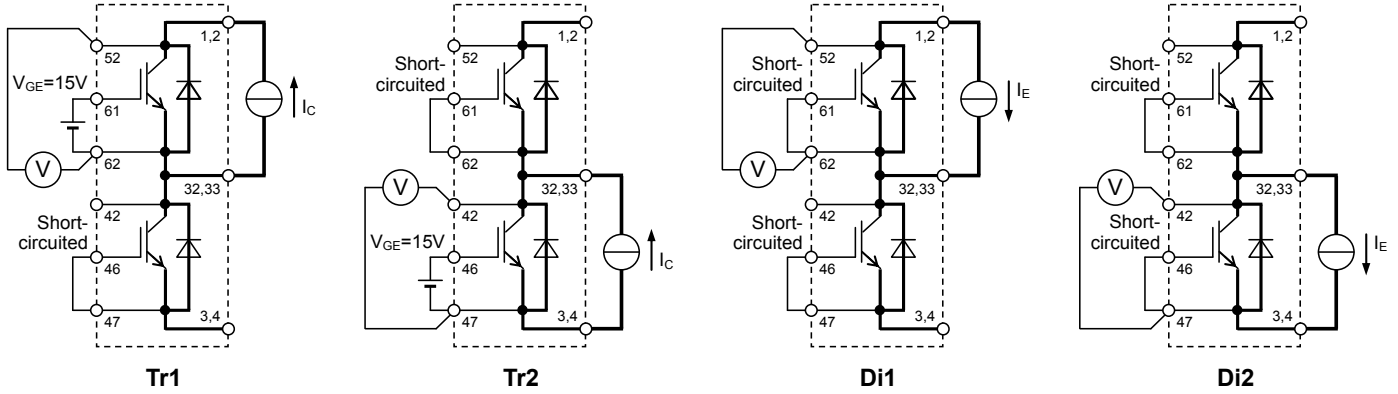
CHIP LOCATION (Top view)

Dimension in mm, tolerance: ± 1 mm



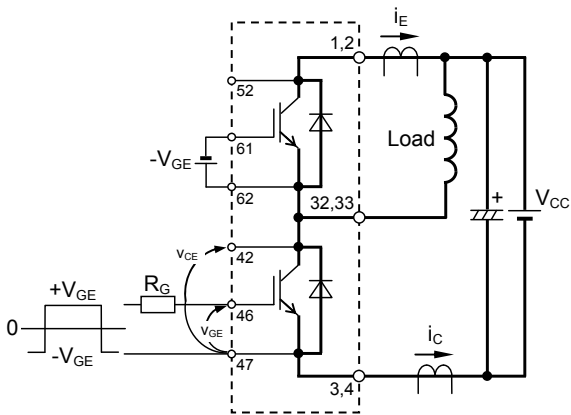
Tr1/Tr2: IGBT, Di1/Di2: DIODE, Th: NTC thermistor

TEST CIRCUIT AND WAVEFORMS

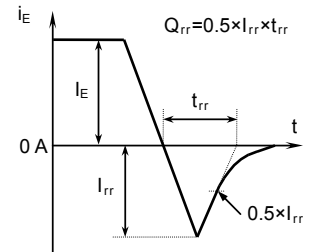
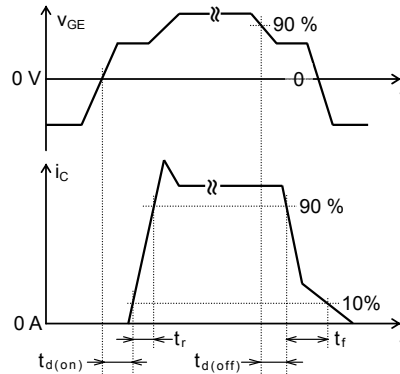


V_{CEsat} test circuit

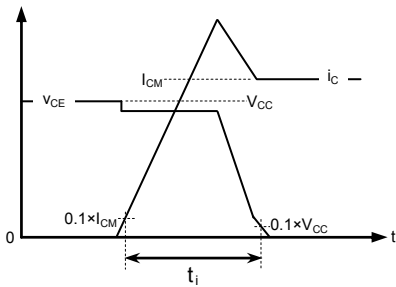
V_{EC} test circuit



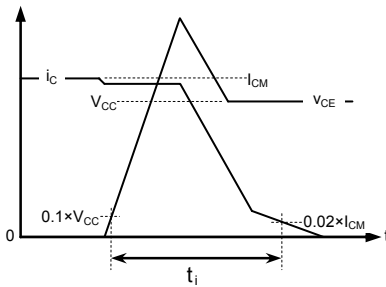
Switching characteristics test circuit and waveforms



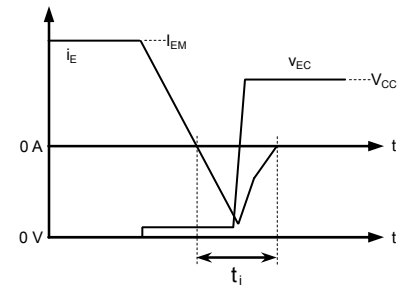
t_{rr}, Q_{rr} test waveform



IGBT Turn-on switching energy



IGBT Turn-off switching energy



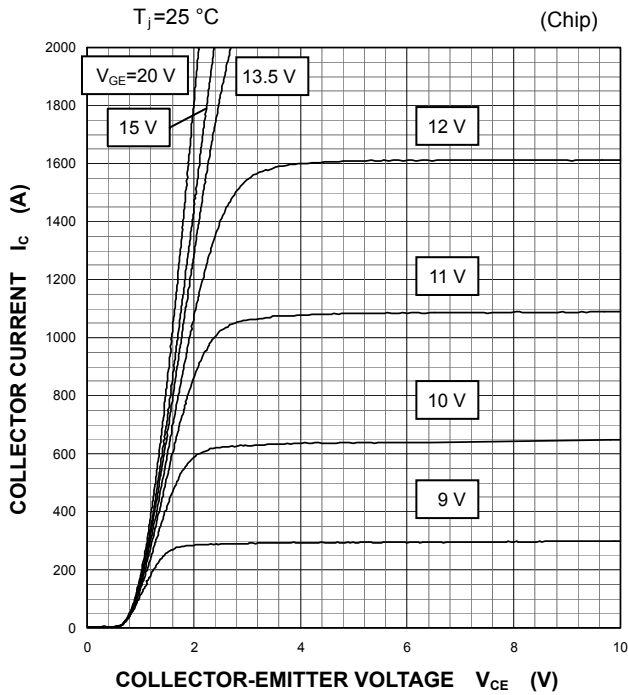
FWDi Reverse recovery energy

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

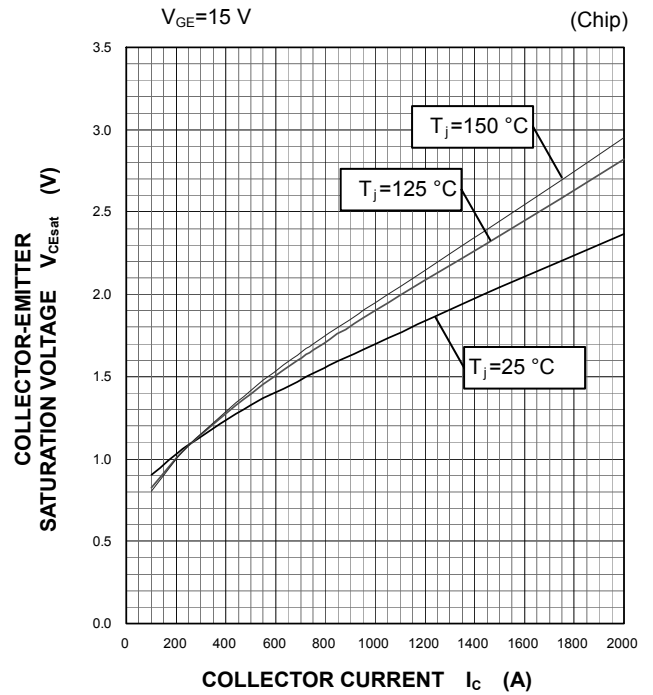
PERFORMANCE CURVES

INVERTER PART

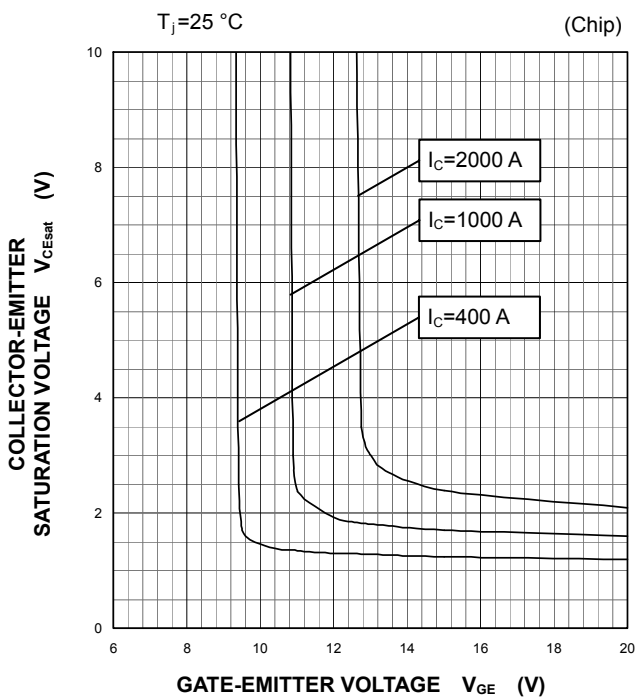
OUTPUT CHARACTERISTICS
(TYPICAL)



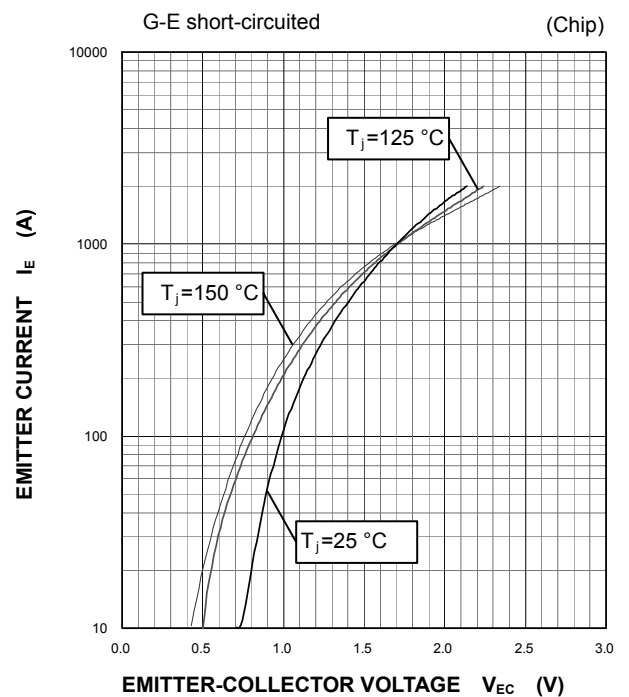
COLLECTOR-EMITTER SATURATION
VOLTAGE CHARACTERISTICS
(TYPICAL)



COLLECTOR-EMITTER SATURATION
VOLTAGE CHARACTERISTICS
(TYPICAL)



FREE WHEELING DIODE
FORWARD CHARACTERISTICS
(TYPICAL)



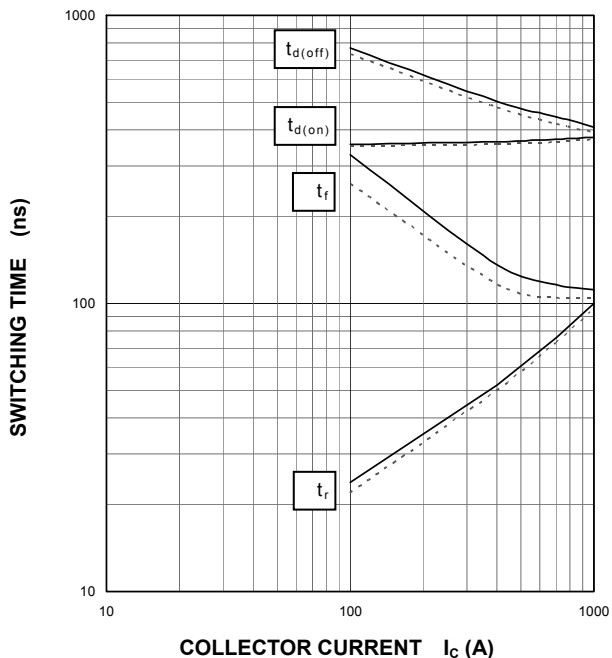
PERFORMANCE CURVES

INVERTER PART

HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$, INDUCTIVE LOAD

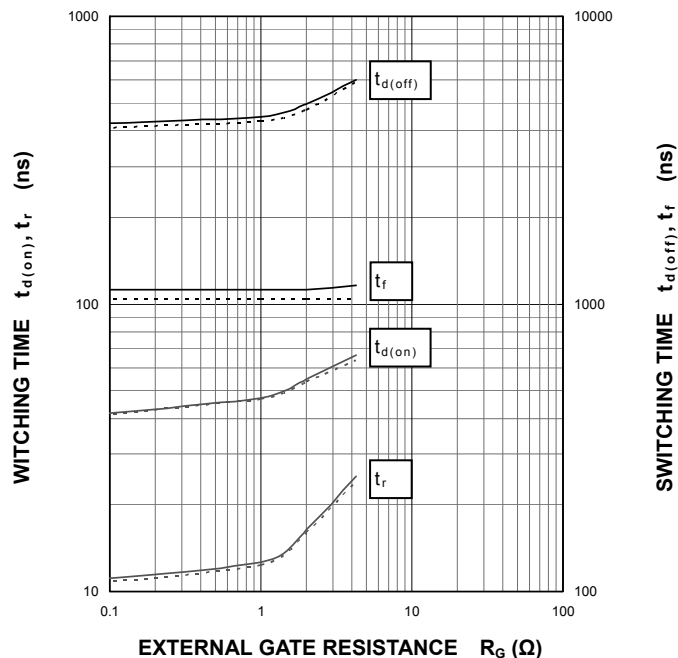
————: $T_j=150\text{ }^\circ\text{C}$, - - - - -: $T_j=125\text{ }^\circ\text{C}$



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $I_c=1000\text{ A}$, $V_{GE}=\pm 15\text{ V}$, INDUCTIVE LOAD

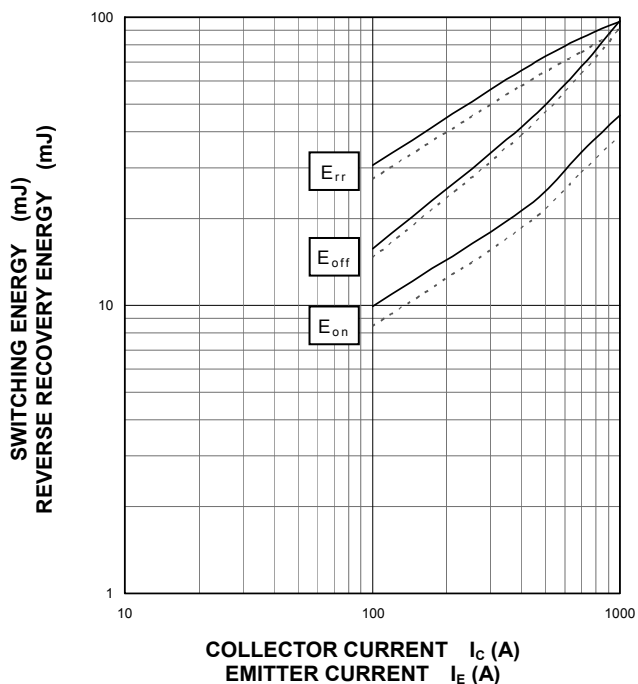
————: $T_j=150\text{ }^\circ\text{C}$, - - - - -: $T_j=125\text{ }^\circ\text{C}$



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$,
INDUCTIVE LOAD, PER PULSE

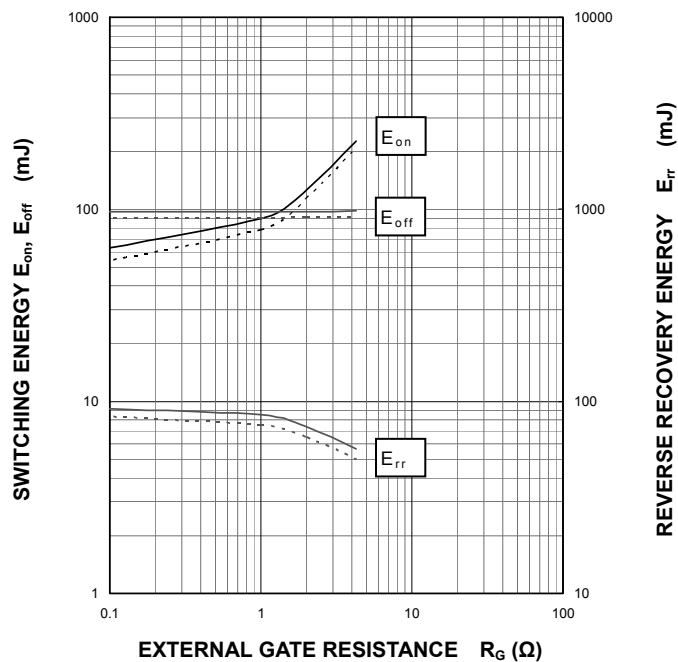
————: $T_j=150\text{ }^\circ\text{C}$, - - - - -: $T_j=125\text{ }^\circ\text{C}$



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)

$V_{CC}=600\text{ V}$, $I_c/I_E=1000\text{ A}$, $V_{GE}=\pm 15\text{ V}$,
INDUCTIVE LOAD, PER PULSE

————: $T_j=150\text{ }^\circ\text{C}$, - - - - -: $T_j=125\text{ }^\circ\text{C}$



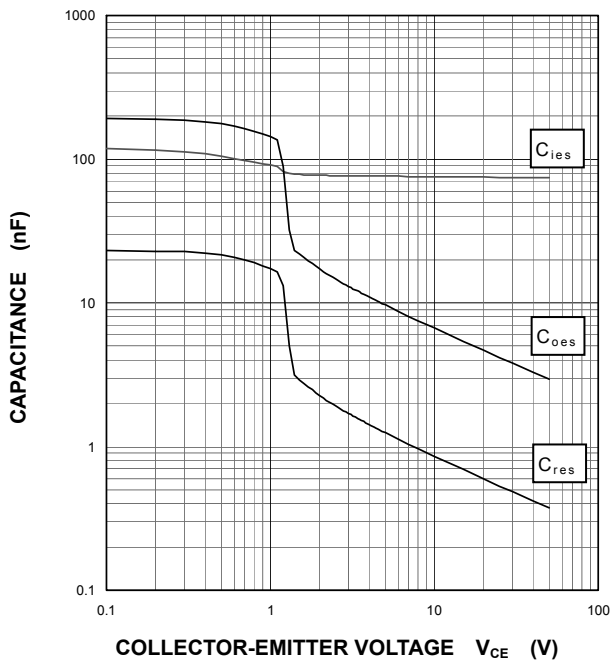
< IGBT MODULES >
CM1000DXL-24S
 HIGH POWER SWITCHING USE
 INSULATED TYPE

PERFORMANCE CURVES

INVERTER PART

CAPACITANCE CHARACTERISTICS (TYPICAL)

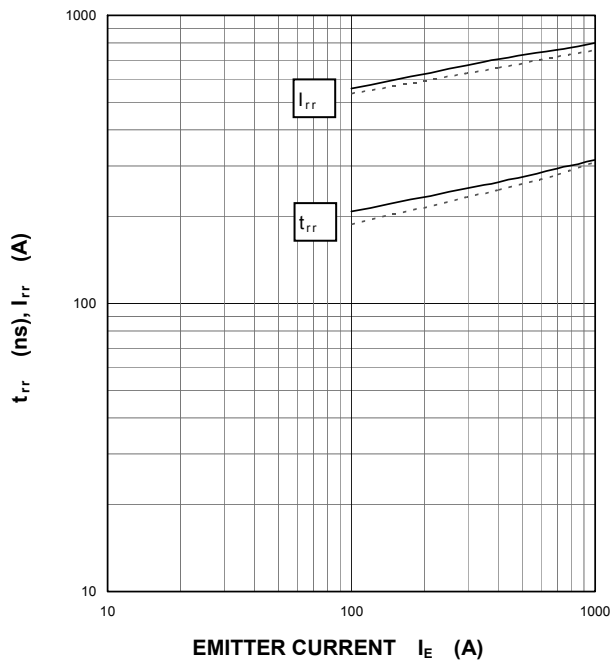
G-E short-circuited, $T_j=25^\circ\text{C}$



FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

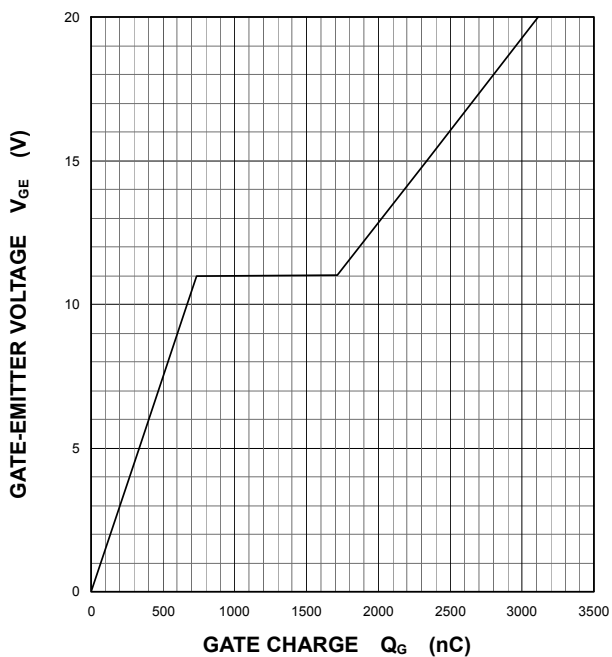
$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=0\ \Omega$, INDUCTIVE LOAD

—: $T_j=150^\circ\text{C}$, - - - -: $T_j=125^\circ\text{C}$



GATE CHARGE CHARACTERISTICS (TYPICAL)

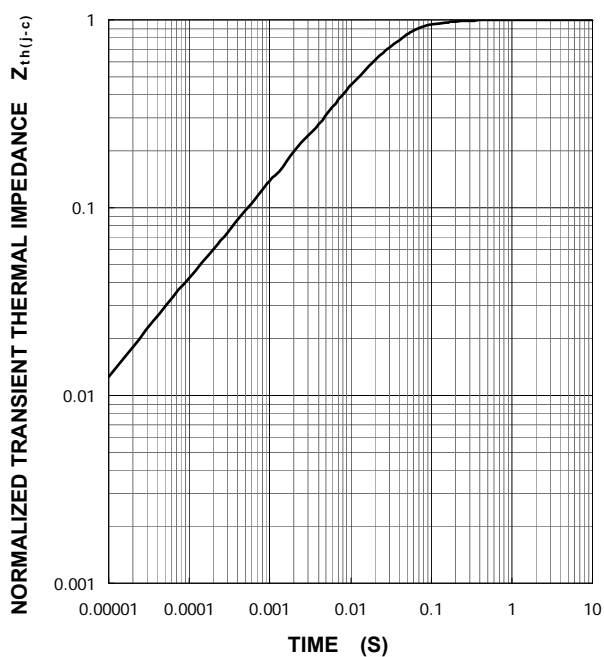
$V_{CC}=600\text{ V}$, $I_C=1000\text{ A}$, $T_j=25^\circ\text{C}$



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)

Single pulse, $T_C=25^\circ\text{C}$

$R_{th(j-c)Q}=20\text{ K/kW}$, $R_{th(j-c)D}=38\text{ K/kW}$

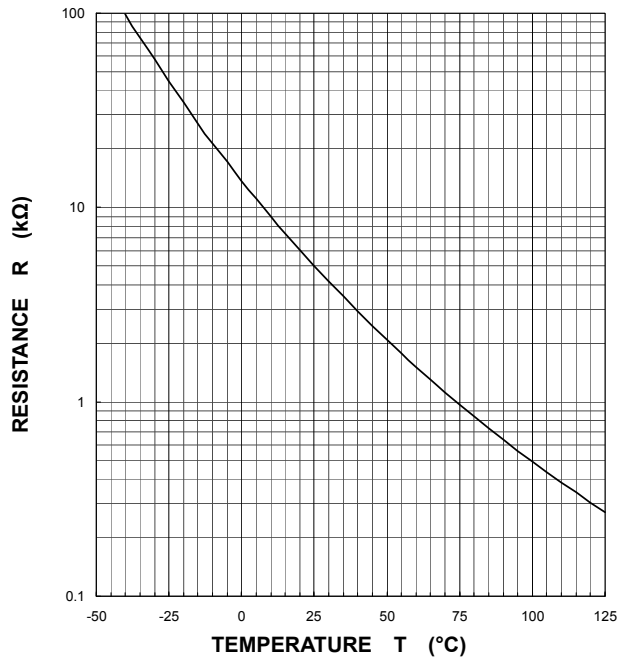


< IGBT MODULES >
CM1000DXL-24S
HIGH POWER SWITCHING USE
INSULATED TYPE

PERFORMANCE CURVES

NTC thermistor part

TEMPERATURE CHARACTERISTICS
(TYPICAL)



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