

CM150DX-24A

HIGH POWER SWITCHING USE
INSULATED TYPE

CM150DX-24A

- 5th Generation NX series -



Dual (Half-Bridge)

Collector current I_C 150 A
 Collector-emitter voltage V_{CES} 1200 V
 Maximum junction temperature T_{jmax} ... 150 °C

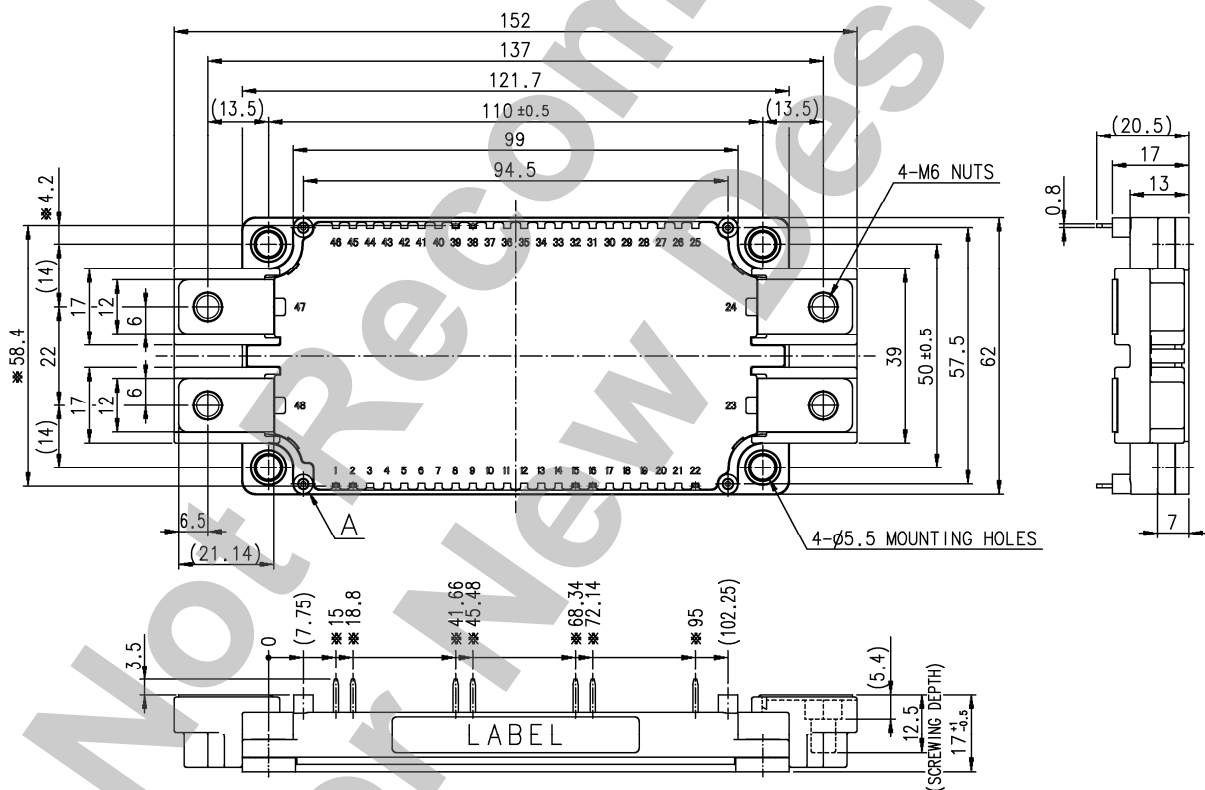
- Flat base Type
- Copper base plate (non-plating)
- RoHS Directive compliant
- UL Recognized under UL1557, File E323585

APPLICATION

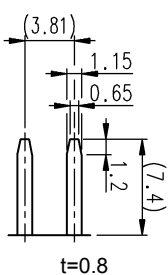
AC Motor Control, Motion/Servo Control, Power supply, etc.

OUTLINE DRAWING & INTERNAL CONNECTION

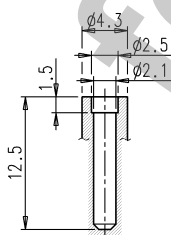
Dimension in mm



TERMINAL



SECTION A

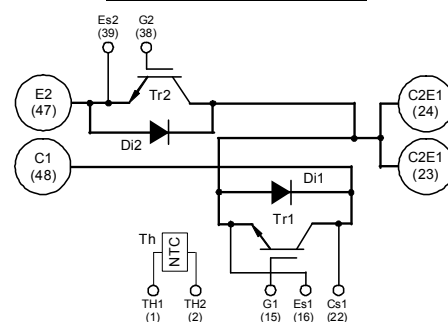


Tolerance otherwise specified

| 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 |

※: Dimensions with a
Tolerance of $\pm \square \square \square \square$

INTERNAL CONNECTION



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

INVERTER PART IGBT/FWDI

| 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, $T_C=91\text{ }^\circ\text{C}$ (Note.2, 4) | 150 | A |
| I_{CRM} | | Pulse, Repetitive (Note.3) | 300 | |
| P_{tot} | Total power dissipation | $T_C=25\text{ }^\circ\text{C}$ (Note.2, 4) | 960 | W |
| I_E (Note.1) | Emitter current | $T_C=25\text{ }^\circ\text{C}$ (Note.2, 4) | 150 | A |
| I_{ERM} (Note.1) | | Pulse, Repetitive (Note.3) | 300 | |

MODULE

| Symbol | Item | Conditions | Rating | Unit |
|------------|--------------------------------|---|------------|------------------|
| T_{jmax} | Maximum junction temperature | - | 150 | $^\circ\text{C}$ |
| T_{Cmax} | Maximum case temperature | (Note.2) | 125 | |
| T_{jop} | Operating junction temperature | - | -40 ~ +150 | $^\circ\text{C}$ |
| T_{stg} | Storage temperature | - | -40 ~ +125 | |
| V_{isol} | Isolation voltage | Terminals to base plate, RMS, $f=60\text{ Hz}$, AC 1 min | 2500 | V |

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

INVERTER PART IGBT/FWDI

| Symbol | Item | Conditions | Limits | | | Unit | |
|------------------------------|--------------------------------------|--|---------------------------------|------|------|---------------|---|
| | | | Min. | Typ. | Max. | | |
| I_{CES} | Collector-emitter cut-off current | $V_{CE}=V_{CES}$, G-E short-circuited | - | - | 1 | 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 | $I_C=15\text{ mA}$, $V_{CE}=10\text{ V}$ | 6 | 7 | 8 | V | |
| V_{CESat} (Terminal) | Collector-emitter saturation voltage | $I_C=150\text{ A}$ (Note.5), $V_{GE}=15\text{ V}$ | $T_j=25\text{ }^\circ\text{C}$ | - | 2.0 | 2.6 | V |
| | | | $T_j=125\text{ }^\circ\text{C}$ | - | 2.2 | - | |
| V_{CESat} (Chip) | Collector-emitter saturation voltage | $I_C=150\text{ A}$, $V_{GE}=15\text{ V}$ (Note.5) | - | 1.9 | - | V | |
| C_{ies} | Input capacitance | $V_{CE}=10\text{ V}$, G-E short-circuited | - | - | 23 | nF | |
| C_{oes} | Output capacitance | | - | - | 2.0 | | |
| C_{res} | Reverse transfer capacitance | | - | - | 0.45 | | |
| Q_G | Gate charge | $V_{CC}=600\text{ V}$, $I_C=150\text{ A}$, $V_{GE}=15\text{ V}$ | - | 675 | - | nC | |
| $t_{d(on)}$ | Turn-on delay time | $V_{CC}=600\text{ V}$, $I_C=150\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.2\text{ }\Omega$, Inductive load | - | - | 130 | ns | |
| t_r | Rise time | | - | - | 100 | | |
| $t_{d(off)}$ | Turn-off delay time | | - | - | 450 | | |
| t_f | Fall time | | - | - | 600 | | |
| V_{EC} (Note.1) (Terminal) | Emitter-collector voltage | $I_E=150\text{ A}$ (Note.5), G-E short-circuited | $T_j=25\text{ }^\circ\text{C}$ | - | 2.6 | 3.4 | V |
| | | | $T_j=125\text{ }^\circ\text{C}$ | - | 2.16 | - | |
| V_{EC} (Note.1) (Chip) | Emitter-collector voltage | $I_E=150\text{ A}$, G-E short-circuited (Note.5) | - | 2.5 | - | V | |
| t_{rr} (Note.1) | Reverse recovery time | $V_{CC}=600\text{ V}$, $I_E=150\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.2\text{ }\Omega$, Inductive load | - | - | 150 | ns | |
| Q_{rr} (Note.1) | Reverse recovery charge | | - | 6.0 | - | μC | |
| E_{on} | Turn-on switching energy per pulse | $V_{CC}=600\text{ V}$, $I_C=I_E=150\text{ A}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.2\text{ }\Omega$, $T_j=125\text{ }^\circ\text{C}$, | - | 7.0 | - | mJ | |
| E_{off} | Turn-off switching energy per pulse | Inductive load | - | 15 | - | | |
| E_{rr} (Note.1) | Reverse recovery energy per pulse | | - | 15 | - | mJ | |
| R_{CC+EE} | Internal lead resistance | Main terminals-chip, per switch, $T_C=25\text{ }^\circ\text{C}$ (Note.2) | - | 1.6 | - | m Ω | |
| r_g | Internal gate resistance | Per switch, $T_C=25\text{ }^\circ\text{C}$ (Note.2) | - | 0 | - | Ω | |

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

NTC THERMISTOR PART

| Symbol | Item | Conditions | Limits | | | Unit |
|----------------------|-------------------------|---|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| R ₂₅ | Zero-power resistance | T _C =25 °C (Note.2) | 4.85 | 5.00 | 5.15 | kΩ |
| ΔR/R | Deviation of resistance | T _C =100 °C, R ₁₀₀ =493 Ω | -7.3 | - | +7.8 | % |
| B _(25/50) | B-constant | Approximate by equation (Note.6) | - | 3375 | - | K |
| P ₂₅ | Power dissipation | T _C =25 °C (Note.2) | - | - | 10 | mW |

THERMAL RESISTANCE CHARACTERISTICS

| Symbol | Item | Conditions | Limits | | | Unit |
|-----------------------|-------------------------------------|--|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| R _{th(j-c)Q} | Thermal resistance (Note.2) | Junction to case, per Inverter IGBT | - | - | 0.13 | K/W |
| R _{th(j-c)D} | | Junction to case, per Inverter FWDi | - | - | 0.23 | K/W |
| R _{th(c-s)} | Contact thermal resistance (Note.2) | Case to heat sink, per 1 module, Thermal grease applied (Note.7) | - | 15 | - | 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 | |
| d _s | Creepage distance | Terminal to terminal | 11.55 | - | - | mm |
| | | Terminal to base plate | 12.32 | - | - | |
| d _a | Clearance | Terminal to terminal | 10.00 | - | - | mm |
| | | Terminal to base plate | 10.85 | - | - | |
| m | Weight | - | - | 330 | - | g |
| e _c | Flatness of base plate | On the centerline X, Y (Note.8) | ±0 | - | +100 | μm |

Note.1: Represent ratings and characteristics of the anti-parallel, emitter-collector free wheeling diode (FWDi).

Note.2: 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.
The heat sink thermal resistance should measure just under the chips.

Note.3: Pulse width and repetition rate should be such that the device junction temperature (T_j) dose not exceed T_{jmax} rating.

Note.4: Junction temperature (T_j) should not increase beyond T_{jmax} rating.

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

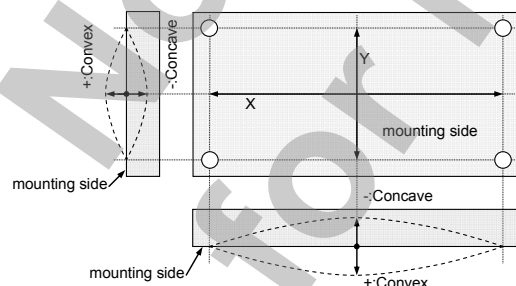
Note.6: $B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$

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]

Note.7: Typical value is measured by using thermally conductive grease of λ=0.9 W/(m·K).

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



Note.9: JAPAN Electronics and Information Technology Industries Association (JEITA) standard,

"ED-4701/300: Environmental and endurance test methods for semiconductor devices (Stress test I)".

CM150DX-24A

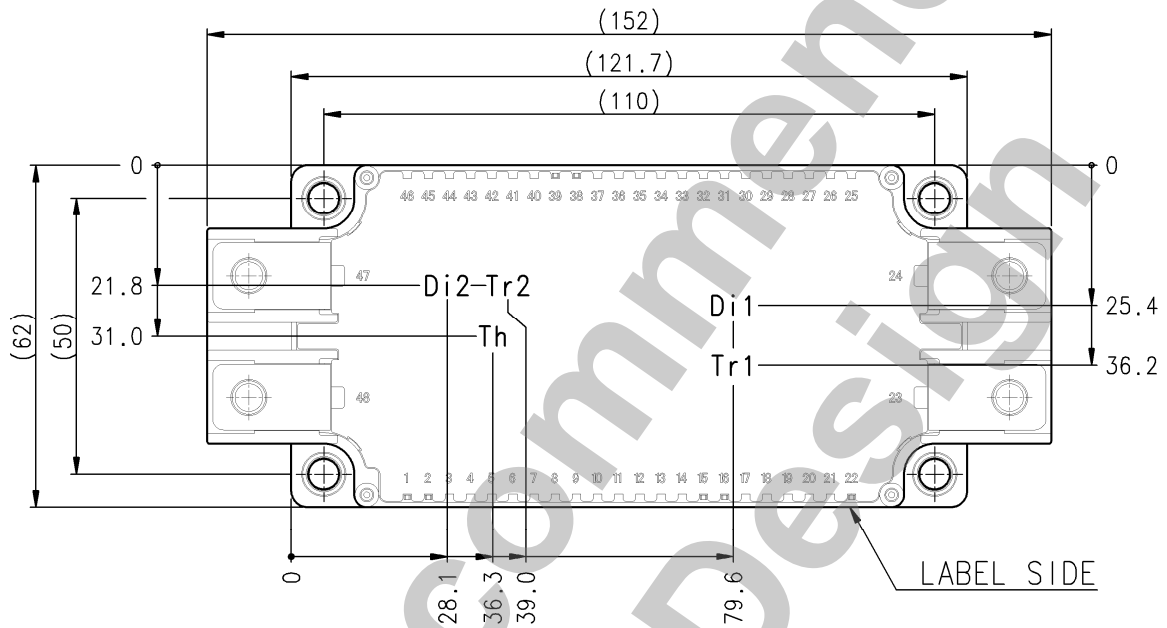
HIGH POWER SWITCHING USE
INSULATED TYPE

RECOMMENDED OPERATING CONDITIONS ($T_a=25\text{ }^\circ\text{C}$)

| Symbol | Item | Conditions | Limits | | | Unit |
|------------|-------------------------------|------------------------------|--------|------|------|----------|
| | | | Min. | Typ. | Max. | |
| V_{CC} | (DC) Supply voltage | Applied across C1-E2 | - | 600 | 800 | 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 | 2.0 | - | 21 | Ω |

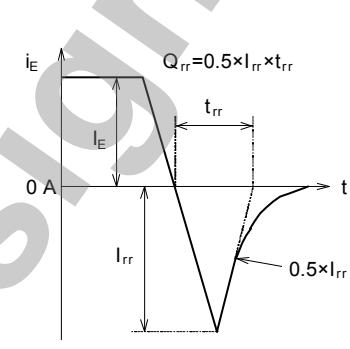
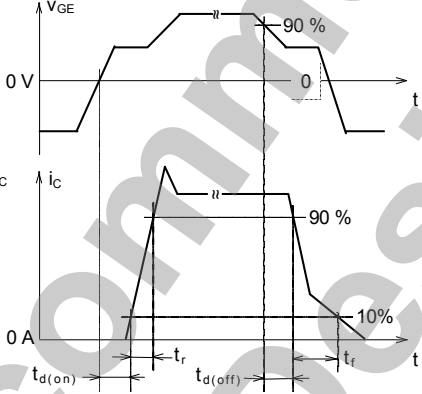
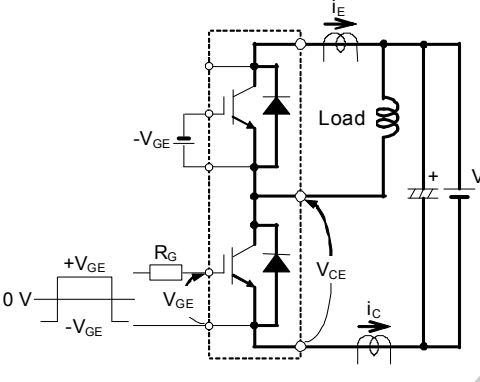
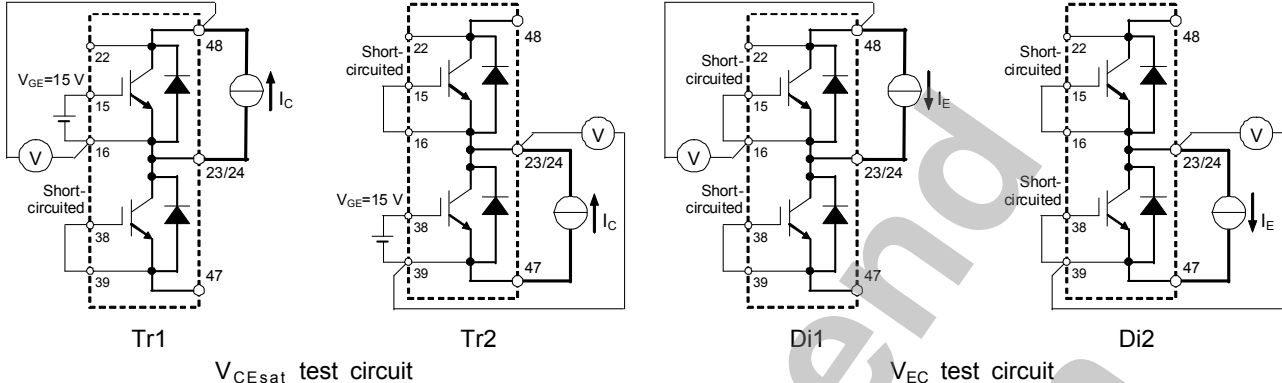
CHIP LOCATION (Top view)

Dimension in mm, tolerance: $\pm 1\text{ mm}$



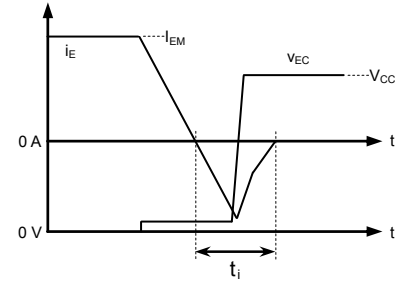
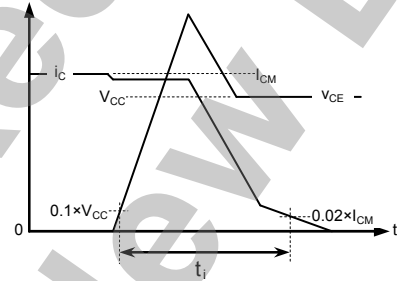
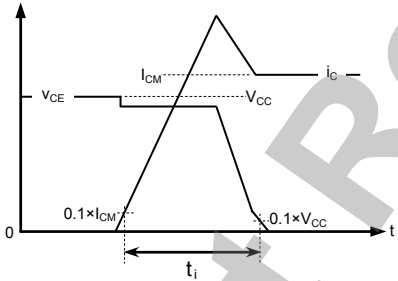
Tr1/Tr2: IGBT, Di1/Di2: FWDi, Th: NTC thermistor. Each mark points the center position of each chip.

TEST CIRCUIT AND WAVEFORMS



Switching characteristics test circuit and waveforms

t_{rr} , Q_{rr} test waveform



IGBT Turn-on switching energy

IGBT Turn-off switching energy

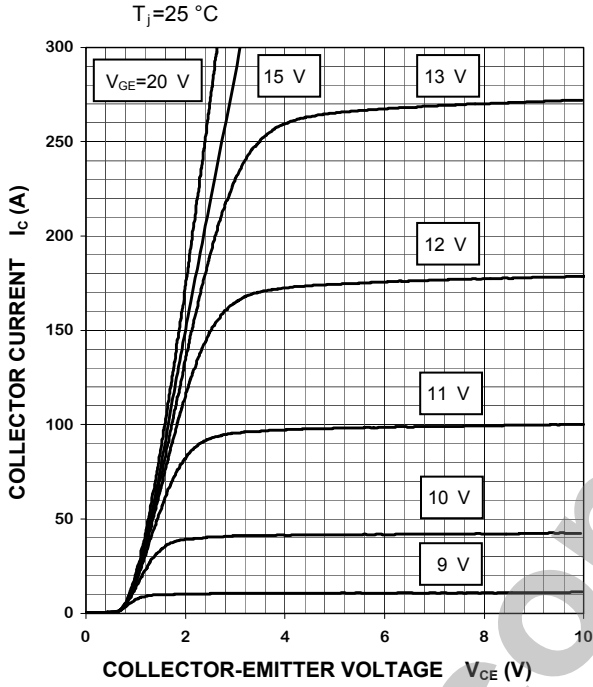
FWDi Reverse recovery energy

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

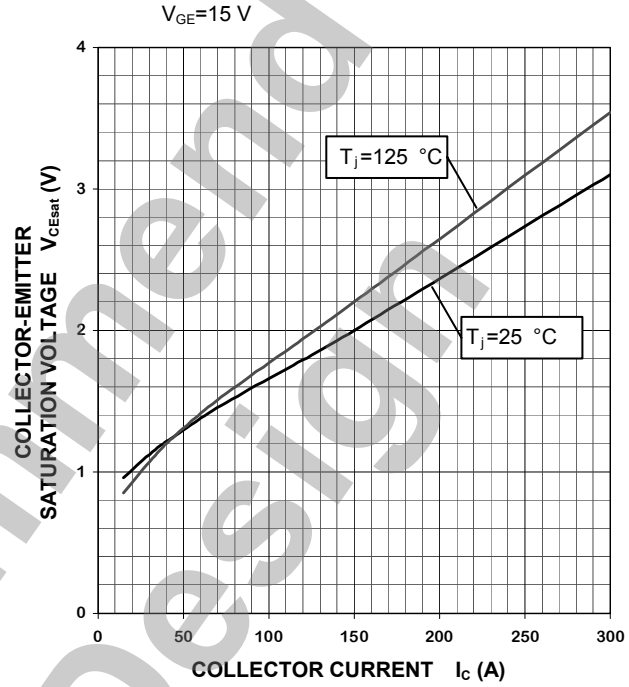
PERFORMANCE CURVES

INVERTER PART

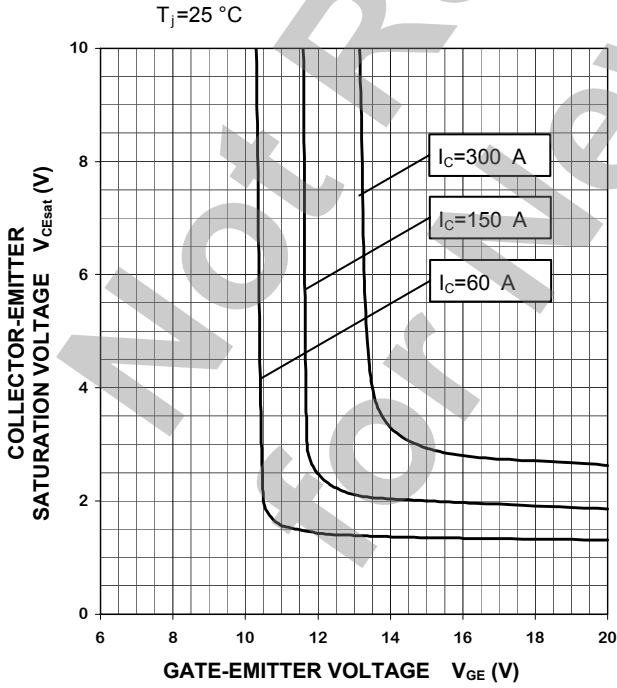
OUTPUT CHARACTERISTICS (TYPICAL)



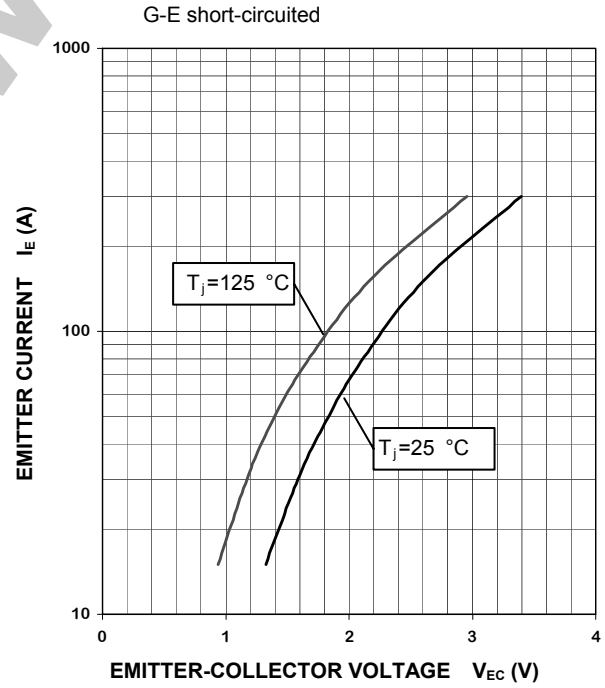
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE WHEELING DIODE FORWARD CHARACTERISTICS (TYPICAL)

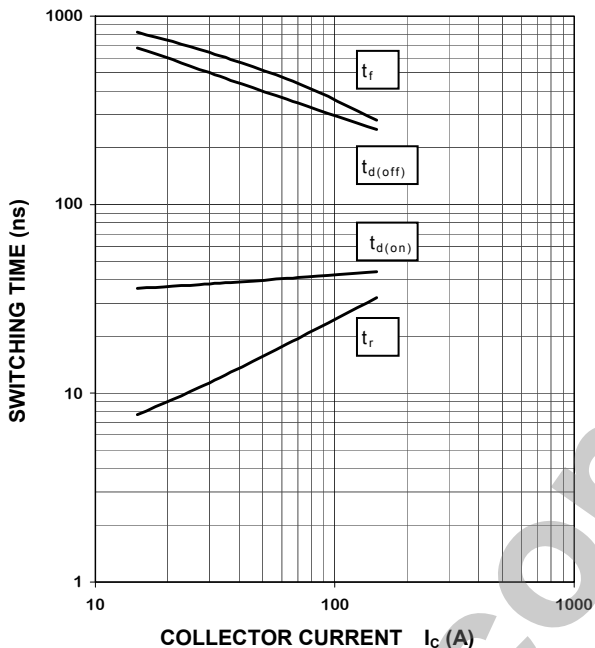


CM150DX-24A

HIGH POWER SWITCHING USE
INSULATED TYPE

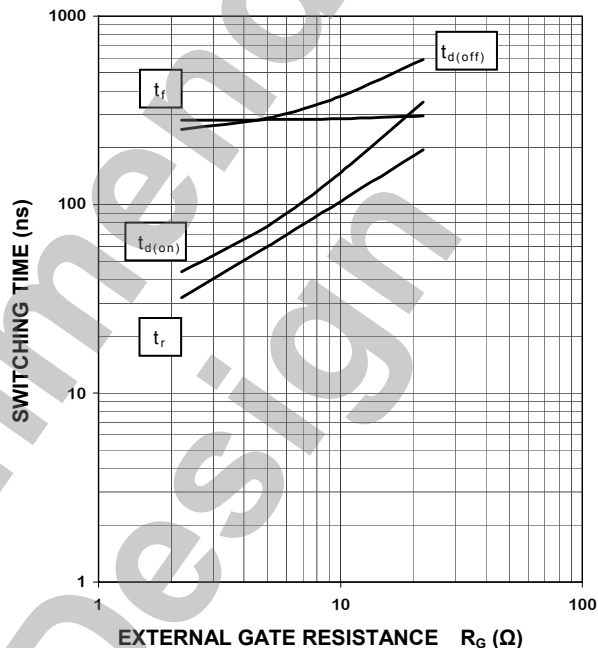
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.2\ \Omega$,
INDUCTIVE LOAD, $T_j=125\text{ }^\circ\text{C}$



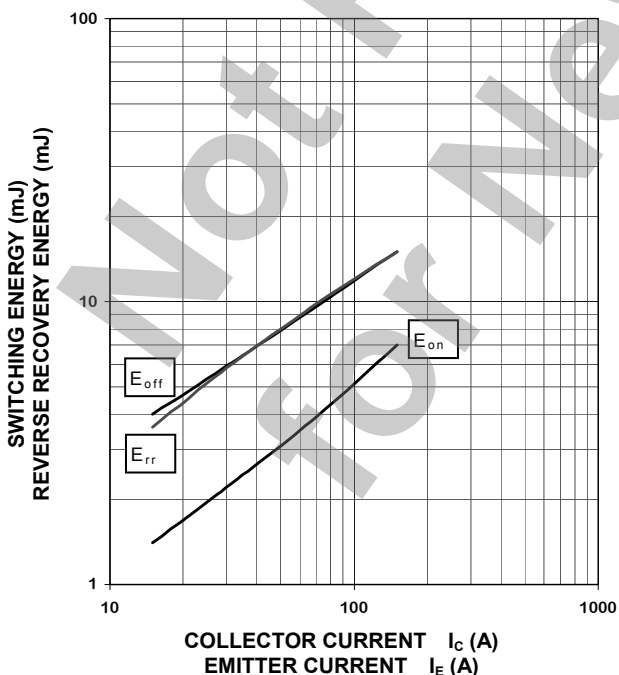
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

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



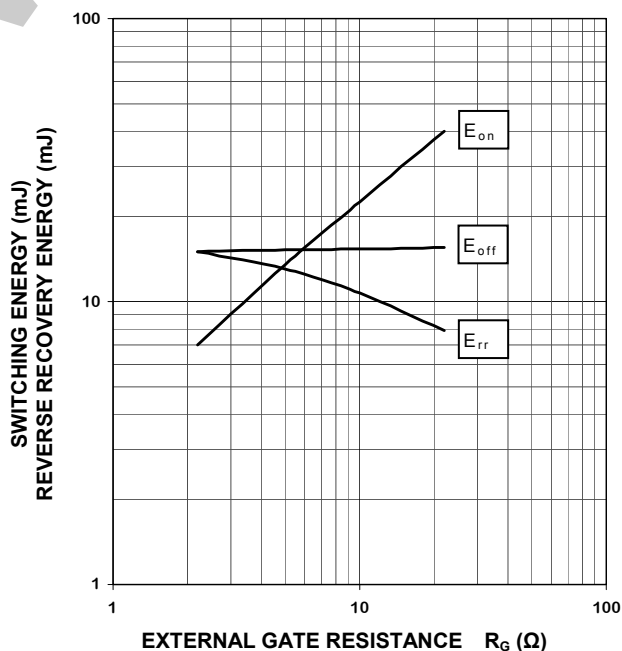
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

$V_{CC}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$, $R_G=2.2\ \Omega$,
INDUCTIVE LOAD, PER PULSE, $T_j=125\text{ }^\circ\text{C}$

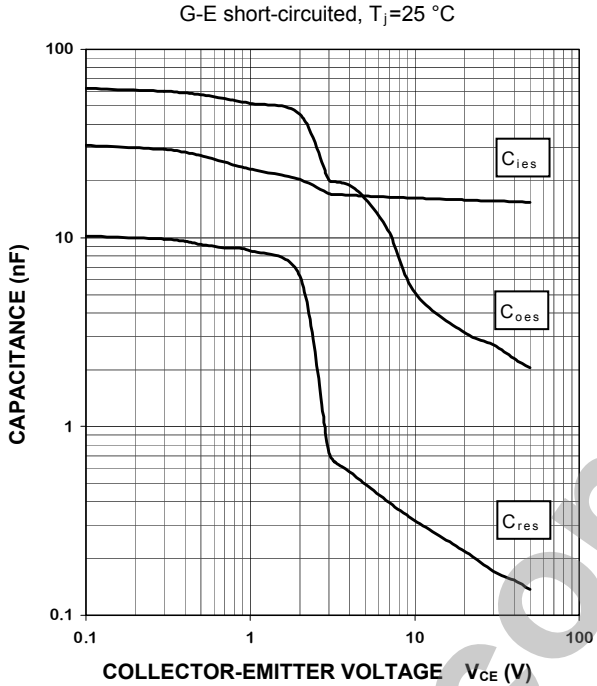


HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

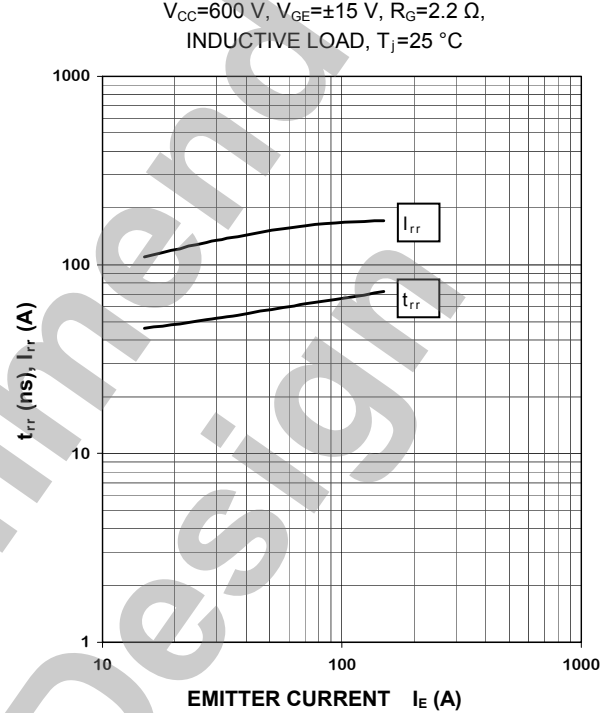
$V_{CC}=600\text{ V}$, $I_C/I_E=150\text{ A}$, $V_{GE}=\pm 15\text{ V}$,
INDUCTIVE LOAD, PER PULSE, $T_j=125\text{ }^\circ\text{C}$



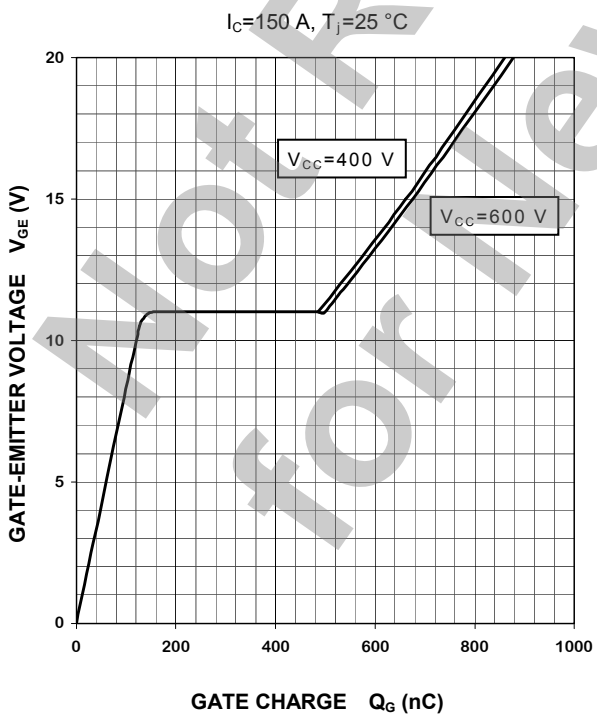
CAPACITANCE CHARACTERISTICS (TYPICAL)



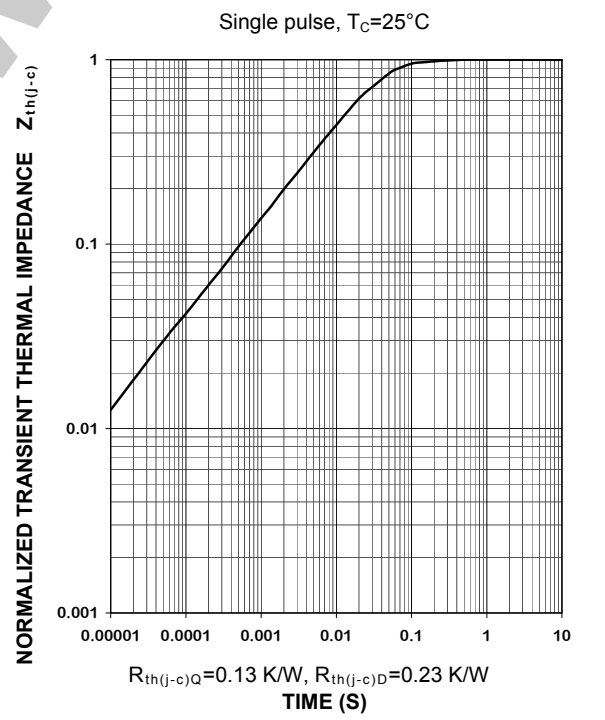
FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



GATE CHARGE CHARACTERISTICS (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)



Keep safety first in your circuit designs!

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