

MITSUBISHI IGBT MODULES

CM100MX-12A

HIGH POWER SWITCHING USE

CM100MX-12A

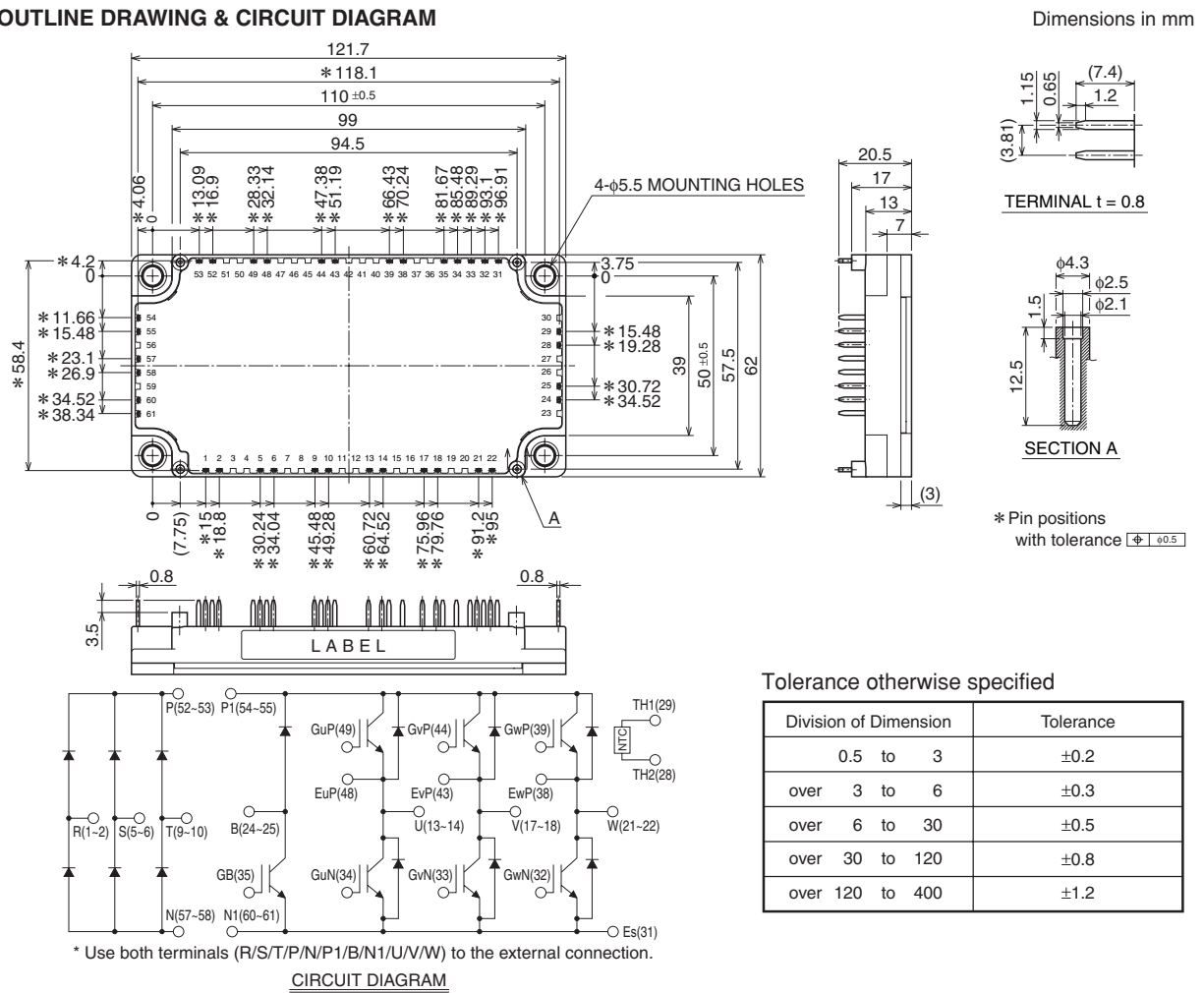


- Ic 100A
- VCES 600V
- CIB (3-phase Converter + 3-phase Inverter + Brake)
- Flatbase Type / Insulated Package / Copper base plate
- RoHS Directive compliant

APPLICATION

General purpose Inverters, Servo Amplifiers

OUTLINE DRAWING & CIRCUIT DIAGRAM



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HIGH POWER SWITCHING USE

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

INVERTER PART

| Symbol | Parameter | Conditions | Rating | Unit |
|---------------------------|---------------------------------------|-------------------------------------|--------|------|
| V _{CES} | Collector-emitter voltage | G-E Short | 600 | V |
| V _{GES} | Gate-emitter voltage | C-E Short | ±20 | |
| I _C | Collector current | DC, T _c = 75°C (Note. 1) | 100 | A |
| I _{CRM} | | Pulse (Note. 4) | 200 | |
| P _{tot} | Maximum collector dissipation | T _c = 25°C (Note. 1, 5) | 400 | W |
| I _E (Note.3) | Emitter current | T _c = 25°C (Note. 1) | 100 | A |
| I _{ERM} (Note.3) | (Free wheeling diode forward current) | Pulse (Note. 4) | 150 | |

BRAKE PART

| Symbol | Parameter | Conditions | Rating | Unit |
|---------------------------|---------------------------------|-------------------------------------|--------|------|
| V _{CES} | Collector-emitter voltage | G-E Short | 600 | V |
| V _{GES} | Gate-emitter voltage | C-E Short | ±20 | |
| I _C | Collector current | DC, T _c = 97°C (Note. 1) | 50 | A |
| I _{CRM} | | Pulse (Note. 4) | 100 | |
| P _{tot} | Maximum collector dissipation | T _c = 25°C (Note. 1, 5) | 280 | W |
| V _{RRM} (Note.3) | Repetitive peak reverse voltage | | 600 | V |
| I _F (Note.3) | Forward current | T _c = 25°C (Note. 1) | 50 | A |
| I _{FRM} (Note.3) | | Pulse (Note. 4) | 100 | |

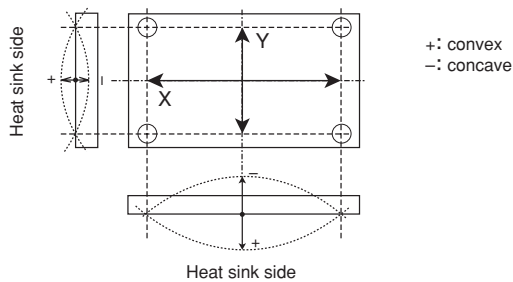
CONVERTER PART

| Symbol | Parameter | Conditions | Rating | Unit |
|------------------|---------------------------------|---|--------|------------------|
| V _{RRM} | Repetitive peak reverse voltage | | 800 | V |
| E _a | Recommended AC input voltage | | 220 | V |
| I _o | DC output current | 3-phase full wave rectifying, T _c = 125°C (Note. 1) | 100 | A |
| I _{FSM} | Surge forward current | The sine half wave 1 cycle peak value, f = 60Hz, non-repetitive | 1000 | |
| i ² t | Current square time | Value for one cycle of surge current | 4160 | A ² s |

MODULE

| Symbol | Parameter | Conditions | Rating | Unit |
|-------------------|----------------------|--|------------|------|
| T _j | Junction temperature | | -40 ~ +150 | °C |
| T _{stg} | Storage temperature | | -40 ~ +125 | |
| V _{isol} | Isolation voltage | Terminals to base plate, f = 60Hz, AC 1 min, RMS | 2500 | V |
| — | Base plate flatness | On the centerline X, Y (Note. 8) | ±0 ~ +100 | μm |
| — | Mounting torque | Mounting M5 screw | 2.5 ~ 3.5 | N·m |
| — | Weight | (Typical) | 270 | g |

Note. 8: The base plate flatness measurement points are in the following figure.



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

INVERTER PART

| Symbol | Parameter | Conditions | Limits | | | Unit | |
|--------------|---|--|------------------------|------|------|------|-----|
| | | | Min. | Typ. | Max. | | |
| ICES | Collector cut-off current | VCE = VCES, G-E Short | — | — | 1 | mA | |
| VGE(th) | Gate-emitter threshold voltage | IC = 10mA, VCE = 10V | 5 | 6 | 7 | V | |
| IGES | Gate-emitter leakage current | VGE = VGES, C-E Short | — | — | 0.5 | μA | |
| VCEsat | Collector-emitter saturation voltage | IC = 100A, VGE = 15V (Note. 6) | T _j = 25°C | — | 1.7 | 2.1 | V |
| | | | T _j = 125°C | — | 1.9 | — | |
| | | IC = 100A, VGE = 15V | Chip | — | 1.6 | — | |
| Cies | Input capacitance | VCE = 10V, G-E Short (Note. 6) | — | — | 13.3 | nF | |
| Coes | Output capacitance | | — | — | 1.4 | | |
| Cres | Reverse transfer capacitance | | — | — | 0.45 | | |
| QG | Gate charge | VCC = 300V, IC = 100A, VGE = 15V | — | 270 | — | nC | |
| td(on) | Turn-on delay time | VCC = 300V, IC = 100A, VGE = ±15V, RG = 6.2Ω, Inductive load | — | — | 100 | ns | |
| tr | Rise time | | — | — | 100 | | |
| td(off) | Turn-off delay time | | — | — | 300 | | |
| tf | Fall time | | — | — | 600 | | |
| trr (Note.3) | Reverse recovery time | | (IE = 100A) | — | — | | 200 |
| Qrr (Note.3) | Reverse recovery charge | | — | 3.6 | — | μC | |
| VEC(Note.3) | Emitter-collector voltage | IE = 100A, G-E Short (Note. 6) | T _j = 25°C | — | 2.0 | 2.8 | V |
| | | | T _j = 125°C | — | 1.95 | — | |
| | | IE = 100A, G-E Short | Chip | — | 1.9 | — | |
| Rth(j-c)Q | Thermal resistance (Junction to case) (Note. 1) | per IGBT | — | — | 0.31 | K/W | |
| Rth(j-c)D | | per free wheeling diode | — | — | 0.59 | | |
| rg | Internal gate resistance | Tc = 25°C, per switch | — | 0 | — | Ω | |
| RG | External gate resistance | | 6 | — | 62 | | |

BRAKE PART

| Symbol | Parameter | Conditions | Limits | | | Unit | |
|--------------|---|-----------------------------------|------------------------|------|------|------|---|
| | | | Min. | Typ. | Max. | | |
| ICES | Collector cut-off current | VCE = VCES, G-E Short | — | — | 1 | mA | |
| VGE(th) | Gate-emitter threshold voltage | IC = 5mA, VCE = 10V | 5 | 6 | 7 | V | |
| IGES | Gate-emitter leakage current | VGE = VGES, C-E Short | — | — | 0.5 | μA | |
| VCEsat | Collector-emitter saturation voltage | IC = 50A, VGE = 15V (Note. 6) | T _j = 25°C | — | 1.7 | 2.1 | V |
| | | | T _j = 125°C | — | 1.9 | — | |
| | | IC = 50A, VGE = 15V | Chip | — | 1.6 | — | |
| Cies | Input capacitance | VCE = 10V, G-E Short (Note. 6) | — | — | 9.3 | nF | |
| Coes | Output capacitance | | — | — | 1.0 | | |
| Cres | Reverse transfer capacitance | | — | — | 0.3 | | |
| QG | Gate charge | VCC = 300V, IC = 50A, VGE = 15V | — | 200 | — | nC | |
| IRRM(Note.3) | Repetitive peak reverse current | VR = VRRM | — | — | 1 | mA | |
| VF(Note.3) | Forward voltage | IF = 50A (Note. 6) | T _j = 25°C | — | 2.0 | 2.8 | V |
| | | | T _j = 125°C | — | 1.95 | — | |
| | | IF = 50A | Chip | — | 1.9 | — | |
| Rth(j-c)Q | Thermal resistance (Junction to case) (Note. 1) | per IGBT | — | — | 0.44 | K/W | |
| Rth(j-c)D | | per Clamp diode | — | — | 0.85 | | |
| rg | Internal gate resistance | Tc = 25°C | — | 0 | — | Ω | |
| RG | External gate resistance | | 13 | — | 125 | | |

CONVERTER PART

| Symbol | Parameter | Conditions | Limits | | | Unit |
|----------|---|-----------------------------------|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| IRRM | Repetitive peak reverse current | VR = VRRM, T _j = 150°C | — | — | 20 | mA |
| VF | Forward voltage | IF = 100A | — | 1.2 | 1.6 | V |
| Rth(j-c) | Thermal resistance (Junction to case) (Note. 1) | per Diode | — | — | 0.24 | K/W |

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NTC THERMISTOR PART

| Symbol | Parameter | Conditions | Limits | | | Unit |
|----------|-------------------------|-----------------------------------|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| R25 | Zero power resistance | Tc = 25°C | 4.85 | 5.00 | 5.15 | kΩ |
| ΔR/R | Deviation of resistance | Tc = 100°C, R100 = 493Ω | -7.3 | — | +7.8 | % |
| B(25/50) | B constant | Approximate by equation (Note. 7) | — | 3375 | — | K |
| P25 | Power dissipation | Tc = 25°C | — | — | 10 | mW |

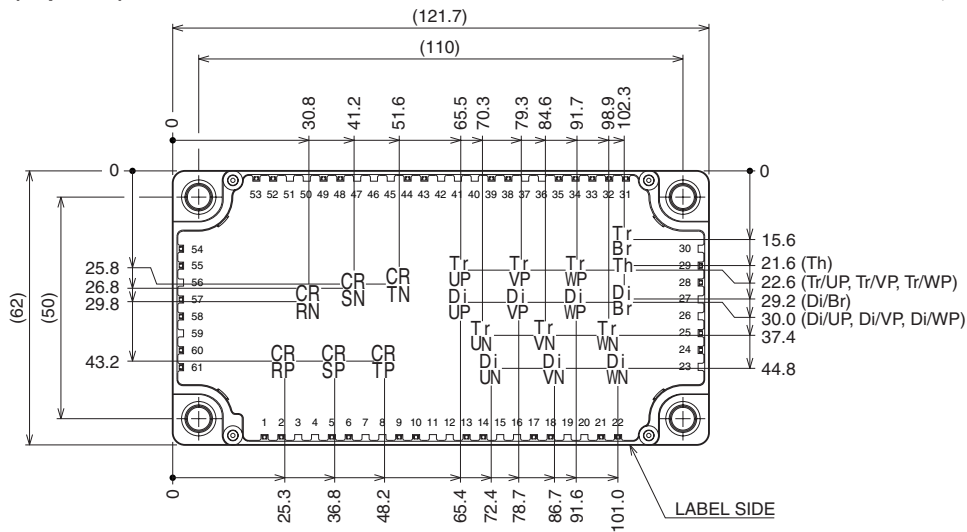
MODULE

| Symbol | Parameter | Conditions | Limits | | | Unit |
|----------|--|---|--------|-------|------|------|
| | | | Min. | Typ. | Max. | |
| Rth(c-s) | Contact thermal resistance (Case to heat sink) (Note. 1) | Thermal grease applied per 1 module (Note. 2) | — | 0.015 | — | K/W |

- Note. 1: Case temperature (Tc), heat sink temperature (Ts) measured point is just under the chips. (Refer to the figure of the chip location.)
 2: Typical value is measured by using thermally conductive grease of λ = 0.9W/(m·K).
 3: IE, IERM, VEC, tr, Qrr and Err represent ratings and characteristics of the anti-parallel, emitter-collector free wheeling diode (FWDi).
 IF, IFRM, VF, VRRM and IRRM represent ratings and characteristics of the Clamp diode of Brake part.
 4: Pulse width and repetition rate should be such that the device junction temperature (Tj) dose not exceed Tjmax rating.
 5: Junction temperature (Tj) should not increase beyond 150°C.
 6: Pulse width and repetition rate should be such as to cause negligible temperature rise. (Refer to the figure of the test circuit for VCEsat and VEC)
 7: $B(25/50) = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$
 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]

Chip Location (Top view)

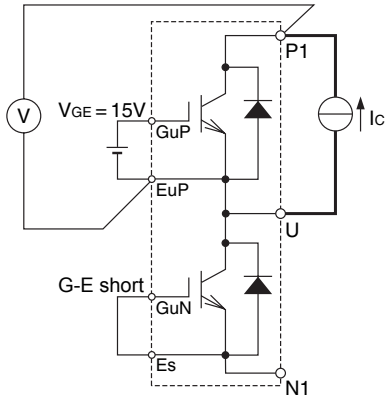
Dimensions in mm (tolerance: ±1mm)



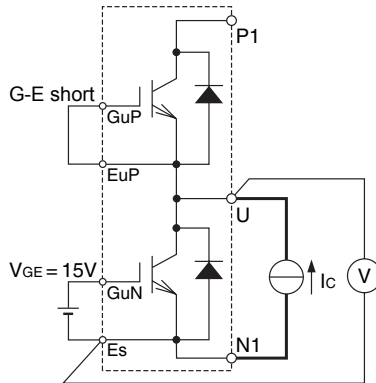
Each mark points the center position of each chip. Tr**: IGBT, Di**: FWDi (DiBr: Clamp diode), CR**: Converter diode, Th: NTC thermistor

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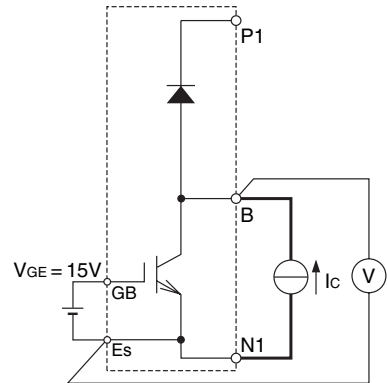
HIGH POWER SWITCHING USE



P side Inverter part Tr
(example of U arm)
G-E short
(GvP-EvP, GwP-EwP, GvN-E•, GwN-E•, GB-Es) (GvP-EvP, GwP-EwP, GvN-Es, GwN-Es, GB-Es)

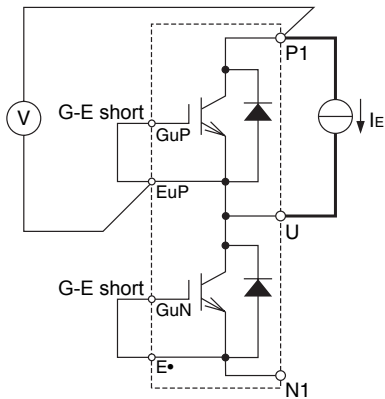


N side Inverter part Tr
(example of U arm)
G-E short

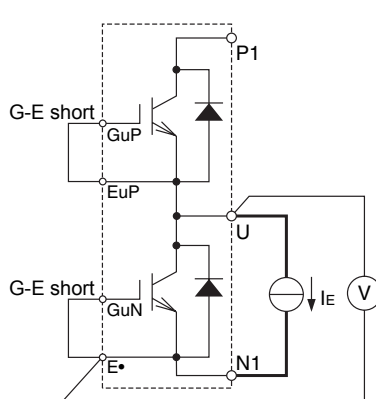


Br Tr
G-E short
(GuP-EuP, GvP-EvP, GwP-EwP, GuN-Es, GvN-Es, GwN-Es)

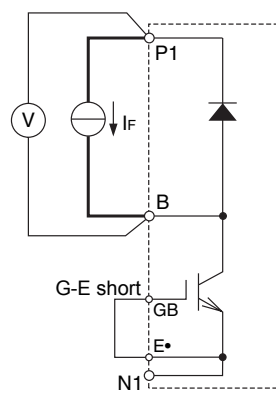
VCEsat test circuit



P side Inverter part Di
(example of U arm)
G-E short
(GvP-EvP, GwP-EwP, GvN-E•, GwN-E•, GB-E•) (GvP-EvP, GwP-EwP, GvN-E•, GwN-E•, GB-E•)

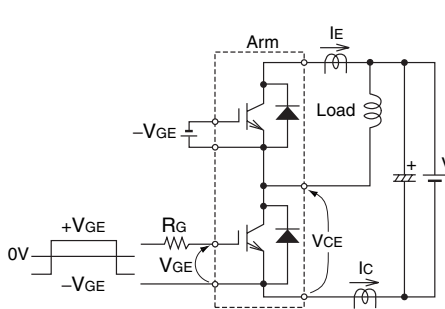


N side Inverter part Di
(example of U arm)
G-E short

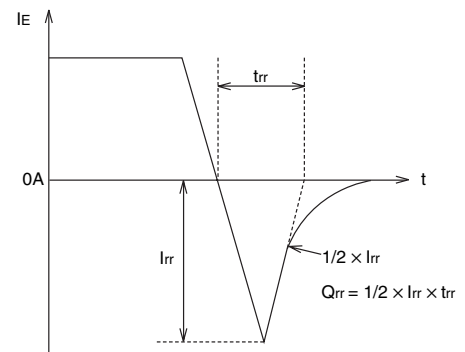
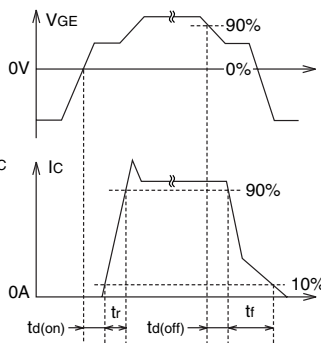


Br Di
G-E short
(GuP-EuP, GvP-EvP, GwP-EwP, GuN-E•, GvN-E•, GwN-E•)

Vec/Vf test circuit



Switching time test circuit and waveforms

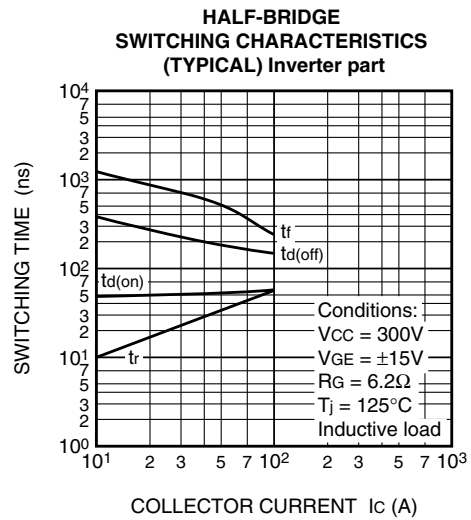
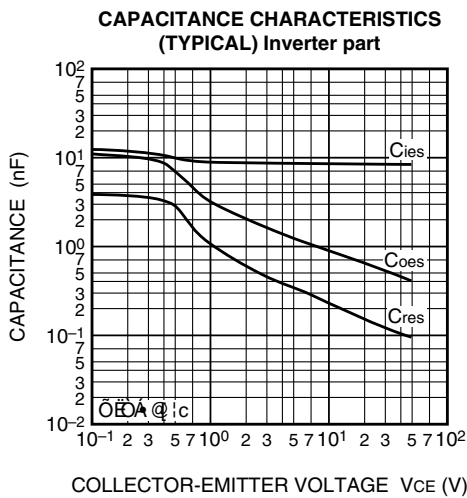
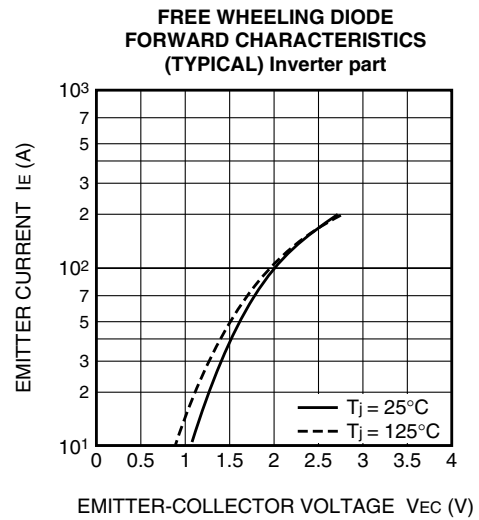
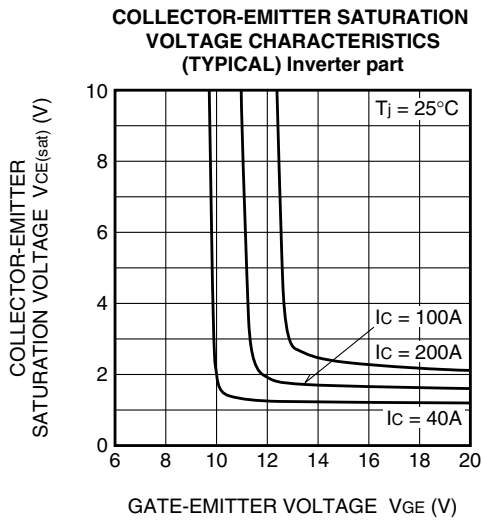
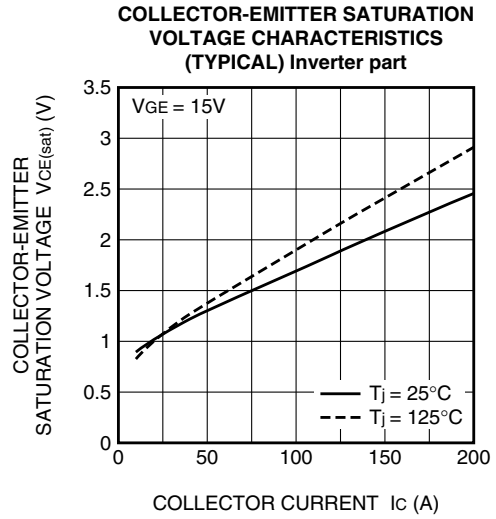
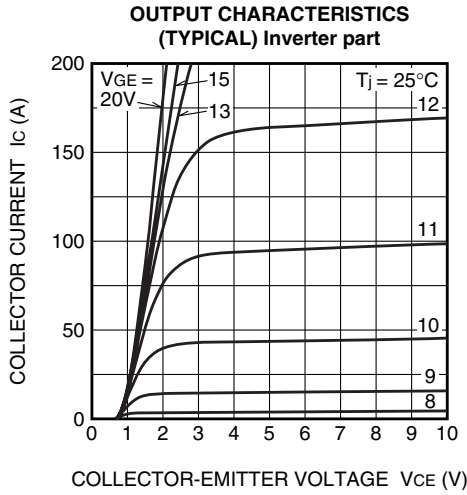


trr, Qrr test waveform

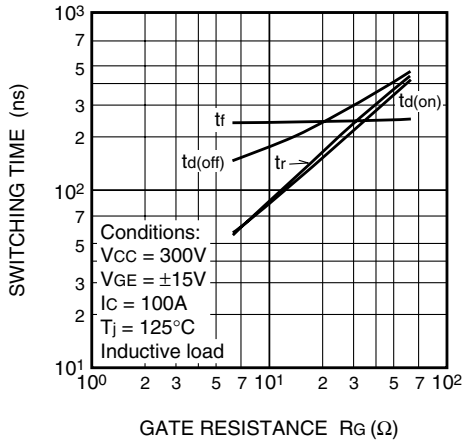
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HIGH POWER SWITCHING USE

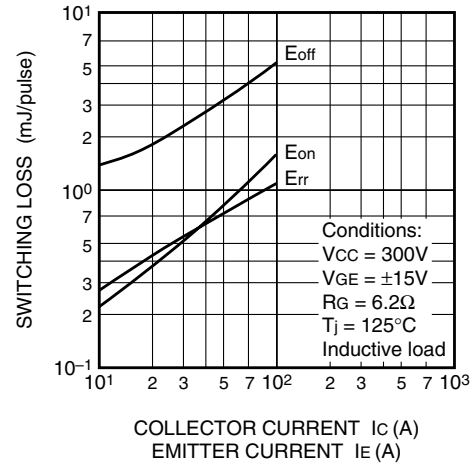
PERFORMANCE CURVES



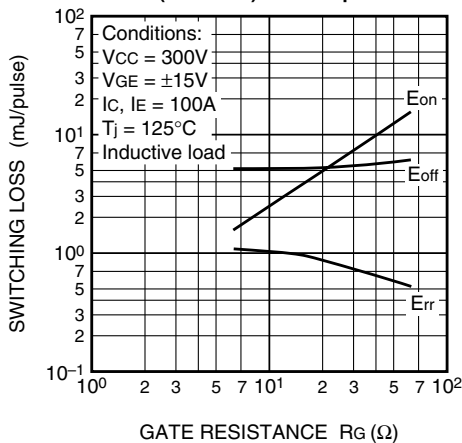
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL) Inverter part



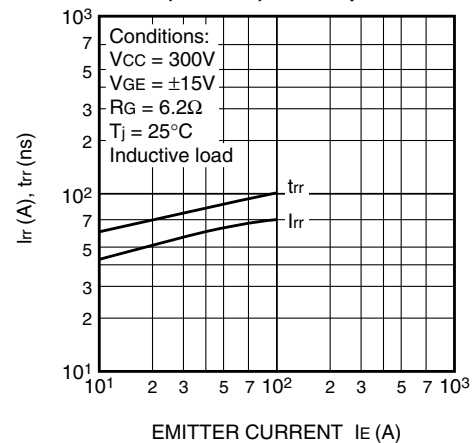
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL) Inverter part



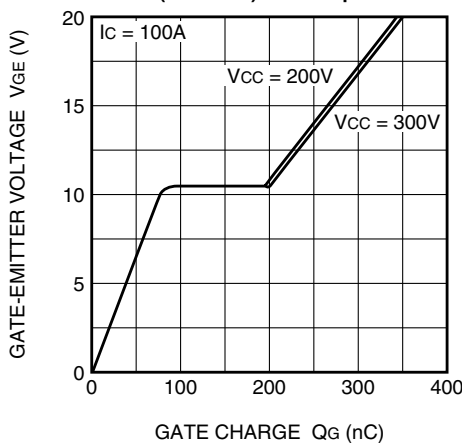
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL) Inverter part



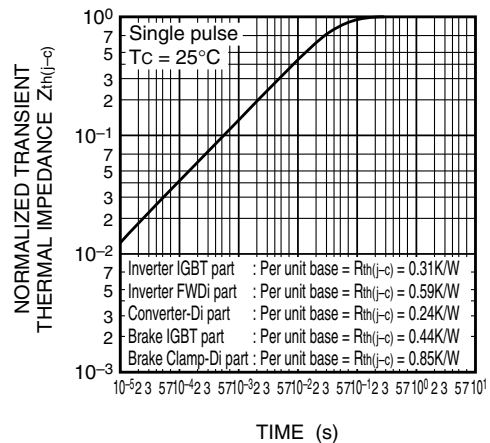
REVERSE RECOVERY CHARACTERISTICS OF FREE WHEELING DIODE (TYPICAL) Inverter part



GATE CHARGE CHARACTERISTICS (TYPICAL) Inverter part



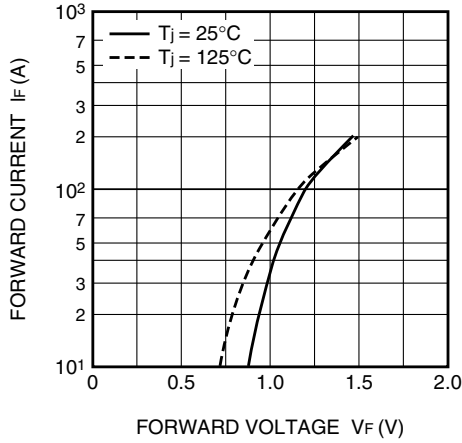
TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS



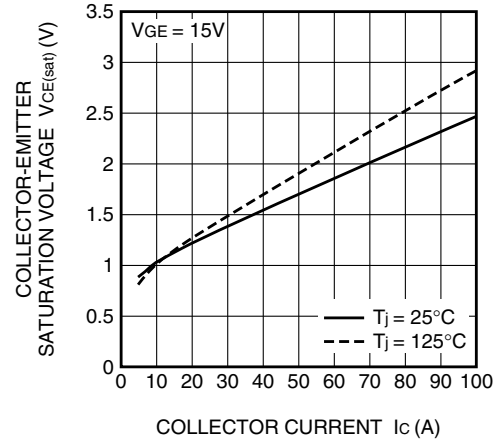
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HIGH POWER SWITCHING USE

**RECTIFIER DIODE
FORWARD CHARACTERISTICS
(TYPICAL) Converter part**



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



**CLAMP DIODE
FORWARD CHARACTERISTICS
(TYPICAL) Brake part**

