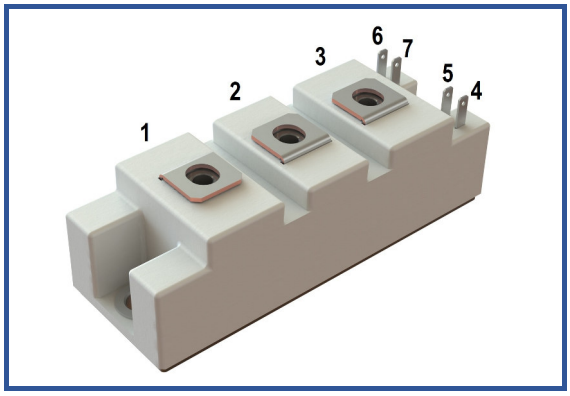
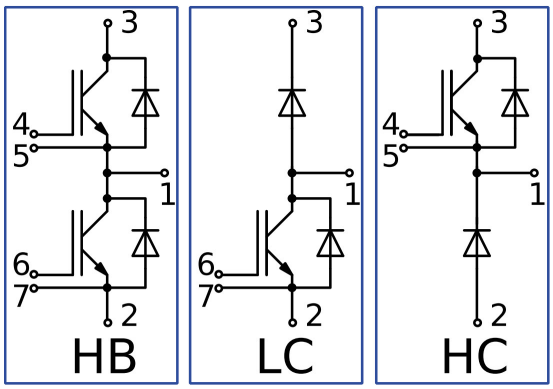
# MIFA-HB17FA-100N

IGBT module datasheet

## Industry standart 34mm IGBT module

**1700 V 100 A**




### Chip features

- IGBT chip
  - Trench FS — V-Series IGBT ( 6 th gen)
  - low $V_{CE(sat)}$ value
  - 10 µs short circuit of 150°C
  - square RBSOA of 2x$I_C$
  - low EMI
- FRD chip
  - fast and soft reverse recovery
  - low voltage drop

### Design features

- copper baseplate
- $Al_2O_3$ DBC substrate
- ultrasonically welded power terminals
- Improved thermal cycling
- RoHS compliant

### Typical application

- AC motor drivers
- solar inverter
- air conditioning
- high power converters and UPS

## Maximum rated values

| Definition | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| **IGBT** | | | | |
| Collector-Emitter voltage | $V_{CES}$ | $V_{GE}$ = 0. | 1700 | V |
| Collector current (nominal) | $I_{C\ nom}$ | | 100 | A |
| Collector current (maximum continuous) | $I_{C\ 25}$ | $T_{vj\ (max)}$ = 175°C; $T_c$ = 25°C. | 165 | A |
| | $I_{C\ 80}$ | $T_{vj\ (max)}$ = 175°C; $T_c$ = 80°C. | 126 | A |
| Repetitive peak collector current*1 | $I_{CRM}$ | $I_{CRM}$ = 3 x $I_{C\ nom}$; $t_p$ = 1 ms. | 300 | A |
| Short-circuit duration | $t_{psc}$ | $T_{vj}$ = 25°C; $V_{GE}$ = ±15 V; $V_{CE}$ = 1000 V; $R_{G\ on}$ = $R_{G\ off}$ = 2.2 Ω; $I_{Cmax}$ < 700 A. | 10 | µs |
| | | $T_{vj}$ = 150°C; $V_G$ = ±15 V; $V_{CE}$ = 1000V; $R_{G\ on}$ = $R_{G\ off}$ = 2.2 Ω; $I_{Cmax}$ < 680 A. | 10 | |
| Gate-Emitter voltage | $V_{GES}$ | | ±20 | V |
| Junction operating temperature | $T_{vj\ (op)}$ | | -40…+150 | °C |
| **Inverse diode \ Freewheeling diode** | | | | |
| Repetitive peak reverse voltage | $V_{RRM}$ | $V_{GE}$ = 0 V. | 1700 | V |
| Forward current (nominal) | $I_{F\ nom}$ | | 100 | A |
| Forward current (maximum continuous) | $I_{F\ 25}$ | $T_{vj\ (max)}$ = 175°C; $T_c$ = 25°C. | 125 | A |
| | $I_{F\ 80}$ | $T_{vj\ (max)}$ = 175°C; $T_c$ = 80°C. | 93 | A |
| Repetitive peak forward current*1 | $I_{FRM}$ | $I_{FRM}$ = 3 x $I_{F\ nom}$; $t_p$ = 1 ms. | 300 | A |
| Junction operating temperature | $T_{vj\ (op)}$ | | -40…+150 | °C |
| **Module** | | | | |
| Storage temperature | $T_{stg}$ | | -40…+50 | °C |
| Isolation voltage | $U_{isol}$ | AC sin 50 Hz; t = 1 min. | 4000 | V |

*1 Pulse width and repetition rate should be such that device junction temperature does not exceed maximum $T_{vj}$ rating.

## Characteristics

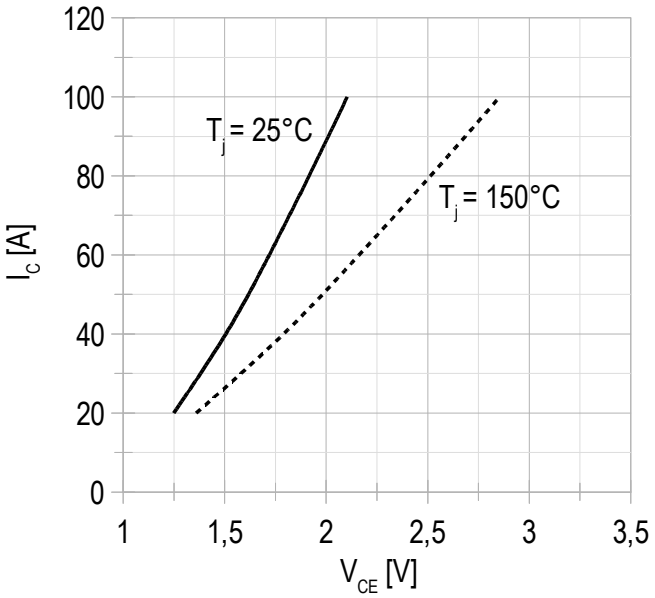
| Definition | Symbol | Conditions | | Value min. | Value typ. | Value max. | Unit. |
|---|---|---|---|---|---|---|---|
| **IGBT** | | | | | | | |
| Collector-Emitter saturation voltage | $V_{CEsat}$ | $V_{GE}$ = +15 V; $I_C$ = 100 A; $t_u$ = 1000 µs. | $T_{vj}$ = 25°C | 2.08 | 2.11 | 2.47 | V |
| | | | $T_{vj}$ = 150°C | 2.66 | 2.72 | 2.92 | V |
| Gate-Emitter threshold voltage | $V_{GE(th)}$ | $I_C$ = 4 mA; $V_{CE}$ = $V_{GE}$; $T_{vj}$ = 25°C; $t_u$ = 2 ms. | | 5.28 | 5.60 | 6.35 | V |
| Collector-Emitter cut-off current | $I_{CES}$ | $V_{CE}$ = 1700 V; $t_u$ = 50 ms; $V_{GE}$ = 0. | $T_{vj}$ = 25°C | 4.10 | 4.71 | 150 | µA |
| | | | $T_{vj}$ = 150°C | 0.55 | 0.67 | 1.00 | mA |
| Gate-Emitter leakage current | $I_{GES}$ | $V_{CE}$ = 0; $V_{GE}$ = ±20 V; $T_{vj}$ = 25°C; $t_u$ = 30 ms. | | 9.14 | 16.2 | 250 | nA |
| Input capacitance | $C_{ies}$ | $V_{CE}$ = 10 V; $V_{GE}$ = 0 V; f = 1 MHz; $T_{vj}$ = 25°C. | | - | 7.50 | - | nF |
| Output capacipance | $C_{oes}$ | | | - | 0.40 | - | nF |
| Reverse transfer capacitance | $C_{res}$ | | | - | 0.50 | - | nF |
| Total gate charge | $Q_G$ | $I_C$ = 100 A; $V_{CE}$ = 850 V; $V_{GE}$ = - 8÷15 V. | | - | 1197 | 1271 | nC |
| Internal gate resistance | $R_{Gint}$ | $T_{vj}$ = 25°C. | | - | 10.0 | - | Ω |
| Turn-on delay time | $t_{d(on)}$ | $V_{CE}$ = 850 V; $V_{GE}$ = ±15 V; $I_{C\,max}$ = 100 A; $R_G$ = 2.2 Ω; L = 300 µH. | $T_{vj}$ = 25°C | 356 | 362 | 425 | ns |
| | | | $T_{vj}$ = 150°C | 408 | 415 | 478 | |
| Rise time | $t_{ri}$ | | $T_{vj}$ = 25°C | 35.0 | 36.5 | 42.0 | ns |
| | | | $T_{vj}$ = 150°C | 41.0 | 42.0 | 50.0 | |
| Turn-on energy | $E_{on}$ | | $T_{vj}$ = 25°C | 11.5 | 12.9 | 16.0 | mJ |
| | | | $T_{vj}$ = 150°C | 20.1 | 21.8 | 26.0 | |
| Turn-off delay time | $t_{d(off)}$ | | $T_{vj}$ = 25°C | 400 | 407 | 467 | ns |
| | | | $T_{vj}$ = 150°C | 468 | 481 | 552 | |
| Fall time | $t_{fi}$ | | $T_{vj}$ = 25°C | 535 | 567 | 714 | ns |
| | | | $T_{vj}$ = 150°C | 796 | 843 | 1057 | |
| Turn-off energy | $E_{off}$ | | $T_{vj}$ = 25°C | 18.3 | 19.6 | 25.0 | mJ |
| | | | $T_{vj}$ = 150°C | 26.4 | 28.6 | 36.0 | |
| Collector-emitter threshold voltage | $V_{CE0}$ | $V_{GE}$ = +15 V; $T_{vj}$ = 150°C; $I_{CE1}$ = 25 A; $I_{CE2}$ = 100 A; $t_u$ = 1000 µs. | | 1.04 | 1.06 | 1.10 | V |
| On-State slope resistance (IGBT) | $r_{CE0}$ | | | 16.3 | 16.7 | 18.0 | mΩ |
| Thermal resistance junction to case | $R_{th(j-c)}$ | DC; $I_{CE}$ = 100±10 A; $I_{test}$ = 0.5 A; $V_{GE}$ = +15 V. | | - | 0.209 | 0.223 | K/W |
| **Inverse diode \ Freewheeling diode** | | | | | | | |
| Forward voltage drop | $V_F$ | $I_F$ = 100 A; $V_{GE}$ = 0; $t_u$ = 1000 µs. | $T_{vj}$ = 25°C | 1.72 | 1.76 | 2.22 | V |
| | | | $T_{vj}$ = 150°C | 1.89 | 1.95 | 1.98 | V |
| Reverse recovery time | $t_{rr}$ | $V_{GE}$ = ±15 V; $V_{CE}$ = 850 V; $I_{C\,max}$ = 100 A; $R_{G\,on}$ = 2.2 Ω; L = 300 µH. | $T_{vj}$ = 25°C | 432 | 523 | 630 | ns |
| | | | $T_{vj}$ = 150°C | 850 | 931 | 1120 | ns |
| Repetitive peak reverse current | $I_{RRM}$ | | $T_{vj}$ = 25°C | 133 | 138 | 165 | A |
| | | | $T_{vj}$ = 150°C | 148 | 152 | 180 | A |
| Reverse recovered charge | $Q_{rr}$ | | $T_{vj}$ = 25°C | 19.3 | 21.1 | 25.0 | µC |
| | | | $T_{vj}$ = 150°C | 35.0 | 37.4 | 44.0 | µC |
| Reverse recovery energy | $E_{rec}$ | | $T_{vj}$ = 25°C | 11.2 | 12.9 | 16.0 | mJ |
| | | | $T_{vj}$ = 150°C | 20.6 | 22.7 | 28.0 | mJ |
| Threshold voltage | $V_{(T0)}$ | $T_{vj}$ = 150°C; $V_{GE}$ = 0; $I_{CE1}$ = 25 A; $I_{CE2}$ = 100 A; $t_u$ = 1000 µs | | 0.89 | 0.90 | 0.95 | V |
| Forward slope resistance | $r_T$ | | | 10.0 | 10.5 | 11.6 | mΩ |
| Thermal resistance junction to case | $R_{th(JC-D)}$ | DC; $I_{CE}$ = 80±10 A; $I_{test}$ = 0.5 A; $V_{GE}$ = +15 V. | | - | 0.452 | 0.500 | K/W |

| Module | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pin resistance | $R_{Pxy}$ | $T_{vj}$ = 25°C. | $R_{P12}$ | - | 0.47 | 0.50 | mΩ |
| | | | $R_{P13}$ | - | 0.66 | 0.66 | |
| Parasitic inductance between terminals | $L_{Pxy}$ | $T_{vj}$ = 25°C; f = 1 MHz. | $L_{P12}$ | - | 34.5 | 35.0 | nH |
| | | | $L_{P13}$ | - | 52.3 | 60.0 | |
| Thermal resistance case to heatsink | $R_{thCH}$ | per module | | - | 0.02 | 0.04 | K/W |
| Mounting torque for screws to heatsink | $M_s$ | to heatsink M6 | | 3 | - | 5 | N*m |
| Mounting torque for terminal screws | $M_t$ | to terminals M5 | | 2.25 | 2.50 | 2.75 | N*m |
| Weight | W | | | - | 153 | 170 | g |

## Notes:

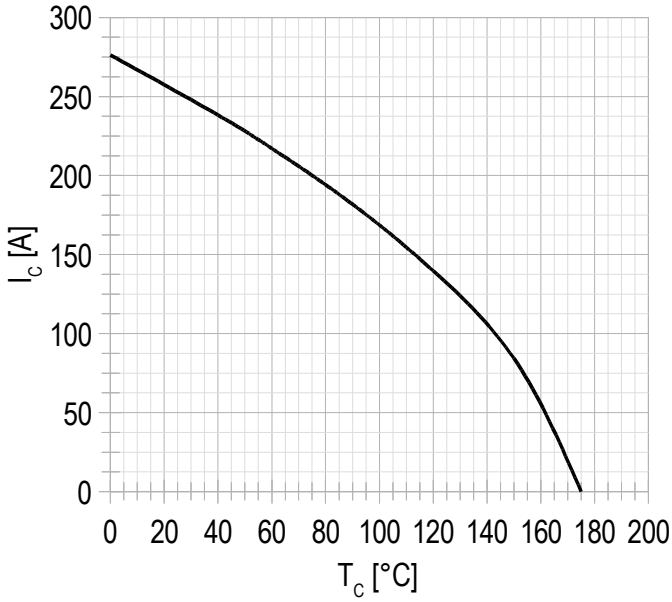
- Insulating material operating temperature 125°C max;
- Case temperature 125°C max;
- The recommended operating junction temperature $T_{vj\ op}$ = - 40 ÷ +150°C.

## Chart 1 – typ. output characteristic, IGBT.



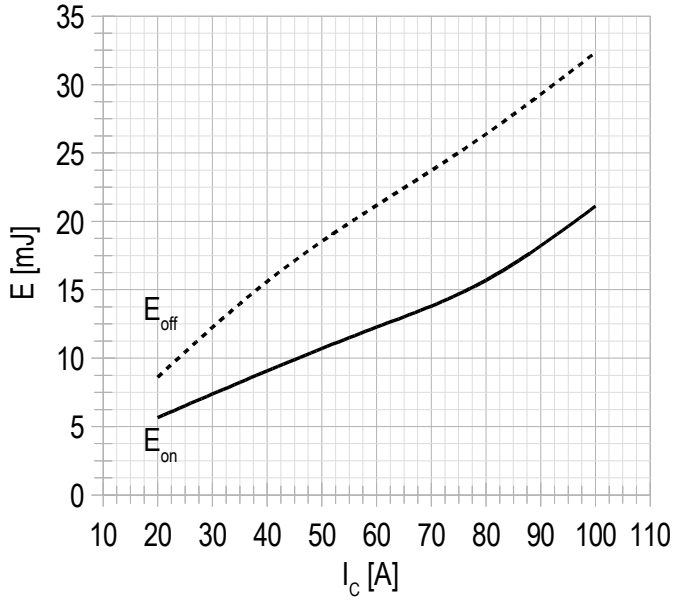

$V_{GE}$ = +15 V.

## Chart 2 – typ. rated current vs temperature.



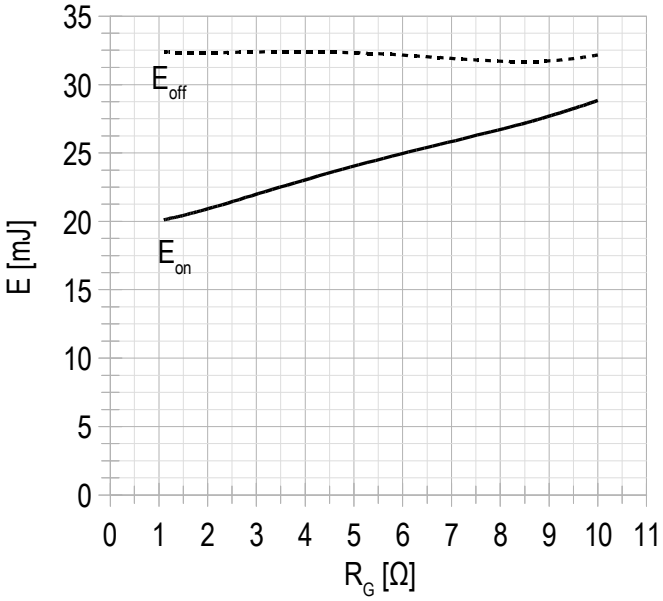

DC;
$V_{GE}$ = +15 V;
$T_{vj\ (max)}$ = 150°C.

## Chart 3 – typ. turn-on/-off energy vs rated current, IGBT.



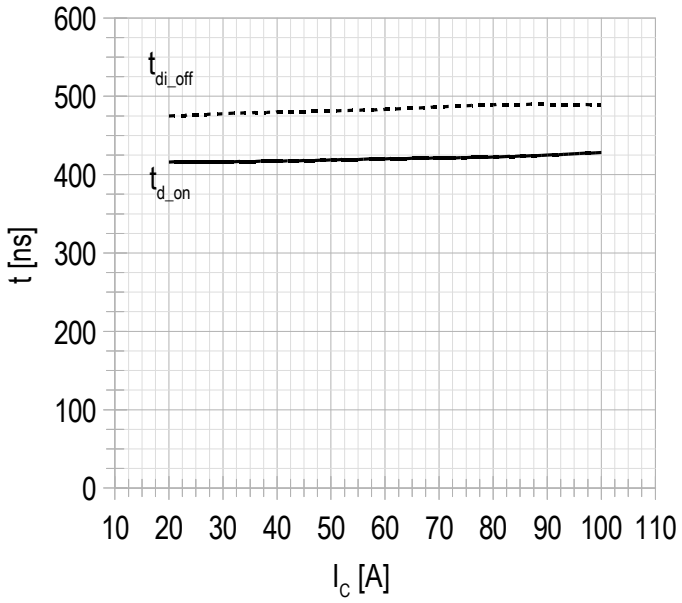

$V_{CE}$ = 850 V;
$V_{GE}$ = ±15 V;
$R_G$ = 2.2 Ω;
L = 300 µH;
$T_{vj\ (max)}$ = 150°C.

## Chart 4 – typ. turn-on/-off energy vs gate resistance, IGBT.



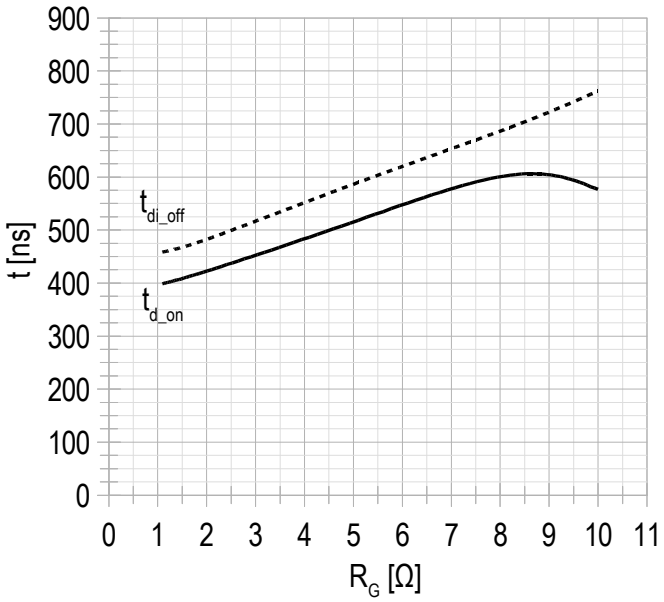

$V_{CE}$ = 850 V;
$V_{GE}$ = ±15 V;
$I_{C\ max}$ = 100 A;
L = 300 µH;
$T_{vj\ (max)}$ = 150°C.

## Chart 5 – typ. switching times vs rated current, IGBT.



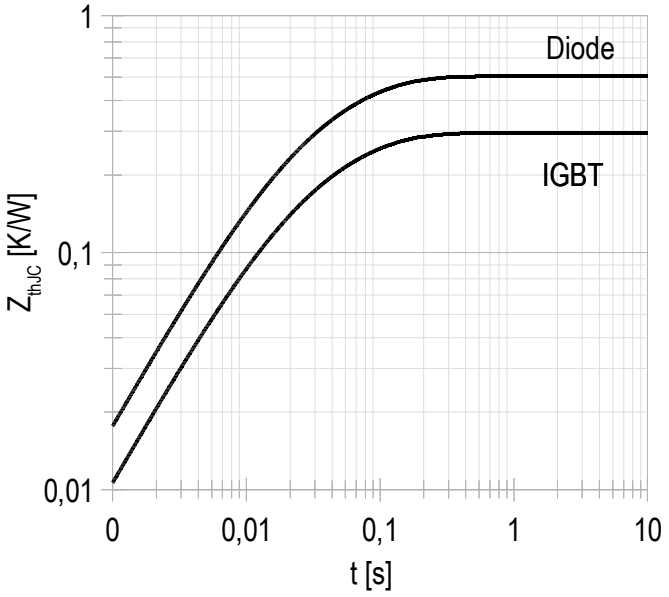

$V_{CE}$ = 850 V;
$V_{GE}$ = ±15 V;
$R_G$ = 2.2 Ω;
L = 300 µH;
$T_{vj\ (max)}$ = 150°C.

## Chart 6 – typ. switching times vs gate resistance, IGBT.



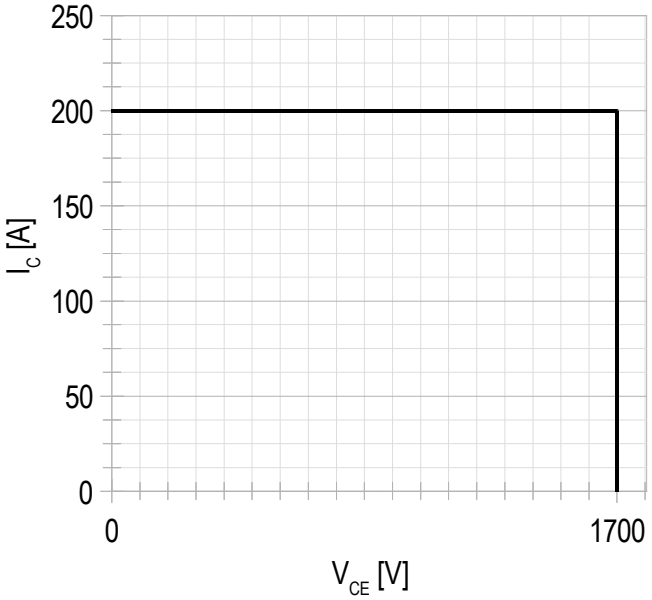

$V_{CE}$ = 850 V;
$V_{GE}$ = ±15 V;
$I_{C\ max}$ = 100 A;
L = 300 µH;
$T_{vj\ (max)}$ = 150°C.

## Chart 7 – max. transient thermal impedance.



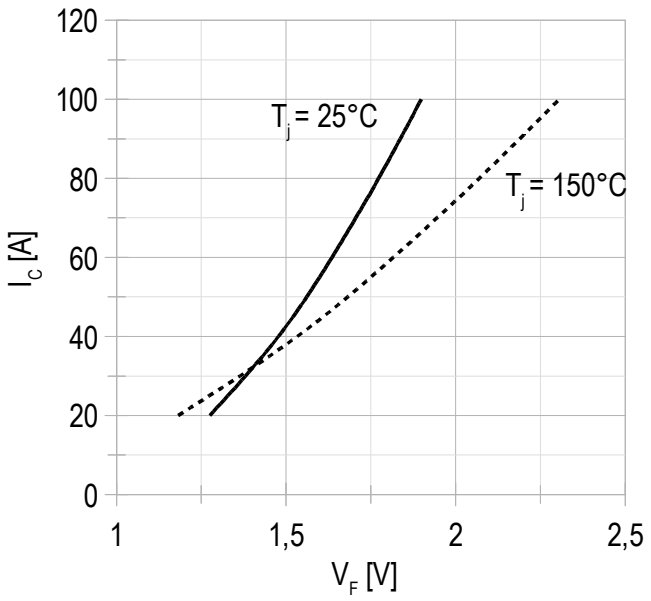

Single pulse;
$V_{GE}$ = +15 V.

## Chart 8 – RBSOA.



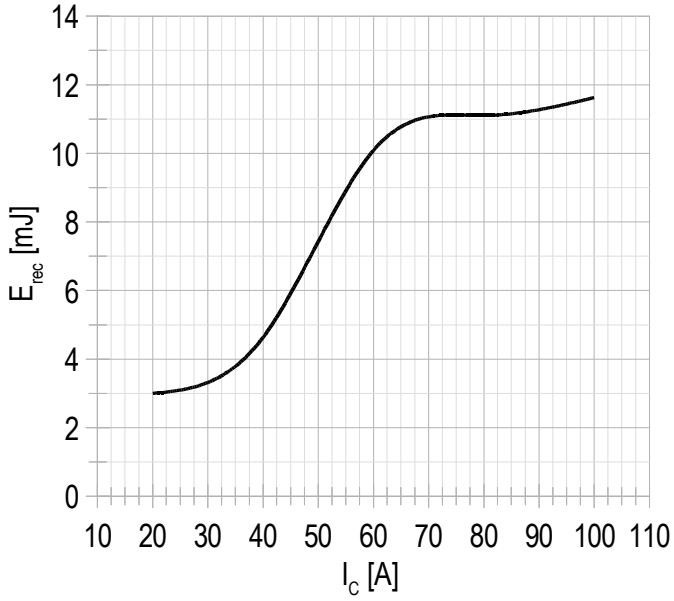

$V_{CE\ max}$ = 1700 V;
$V_{GE}$ = ±15 V;
$I_{C\ max}$ = 2*$I_{C\ nom}$;
$R_G$ = 2.2 Ω;
L = 300 µH.

### Chart 9 – typ. output characteristic, FRD.



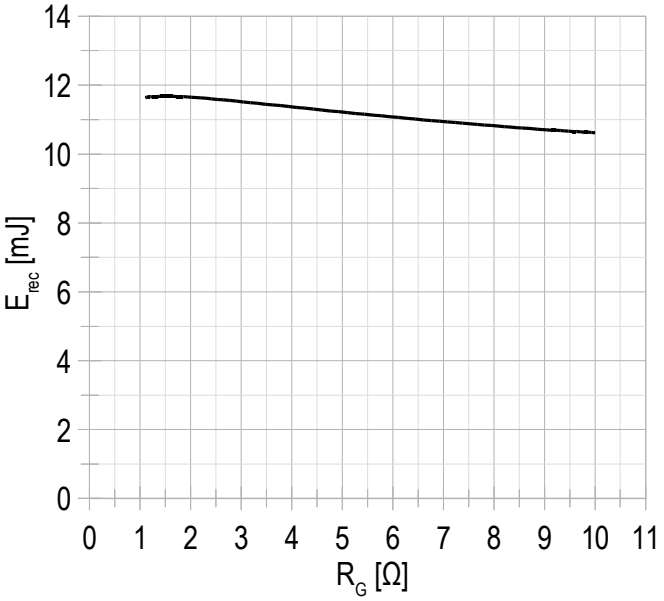

$V_{GE}$ = +15 V.

### Chart 10 – typ. switching losses vs rated current, FRD.



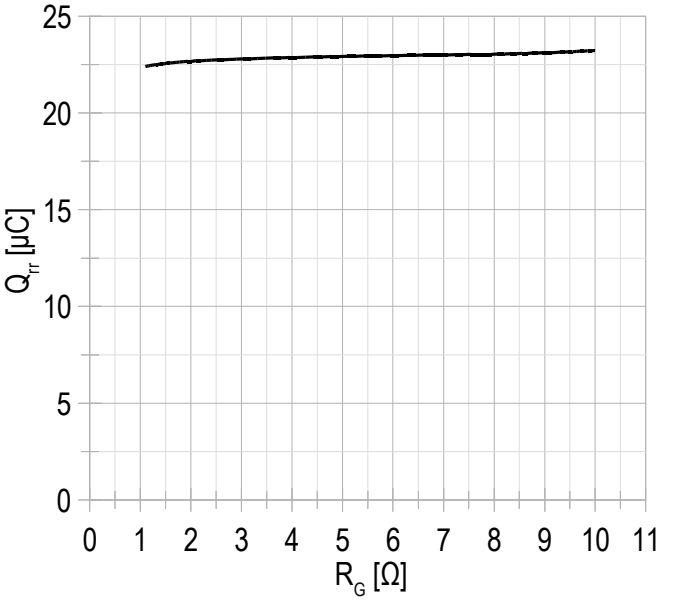

$V_{GE}$ = ±15 V;
$V_{CE}$ = 850 V;
L = 300 µH;
$R_{G\ on}$ = 2.2 Ω;
$T_{vj\ (max)}$ = 150°C.

### Chart 11 – typ. switching losses vs gate resistance, FRD.



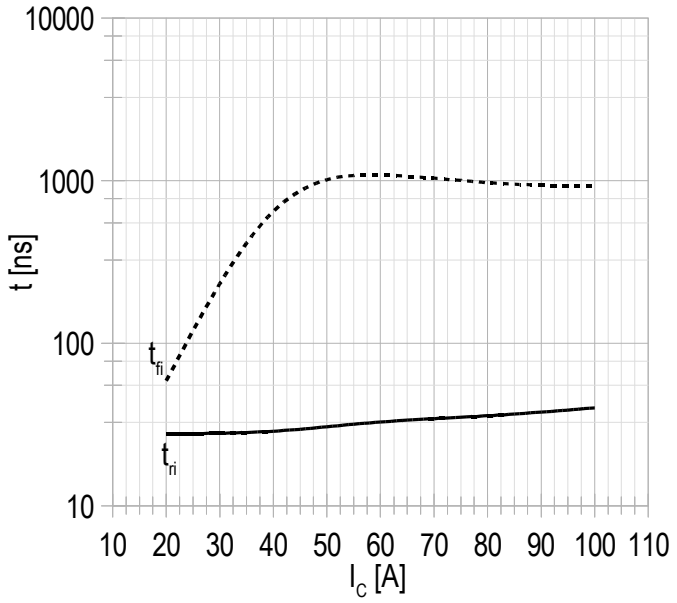

$V_{GE}$ = ±15 V;
$V_{CE}$ = 850 V;
$I_{C\ max}$ = 100 A;
L = 300 µH;
$T_{vj\ (max)}$ = 150°C.

### Chart 12 – typ. reverse recovered charge vs gate resistance, FRD.



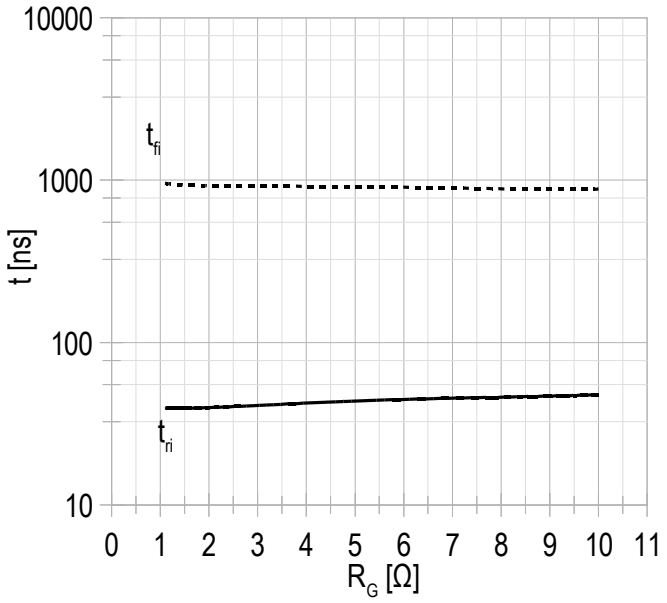

$V_{GE}$ = ±15 V;
$V_{CE}$ = 850 V;
$I_{C\ max}$ = 100 A;
L = 300 µH;
$T_{vj\ (max)}$ = 150°C.

## Chart 13 – typ. switching times vs rated current, FRD.



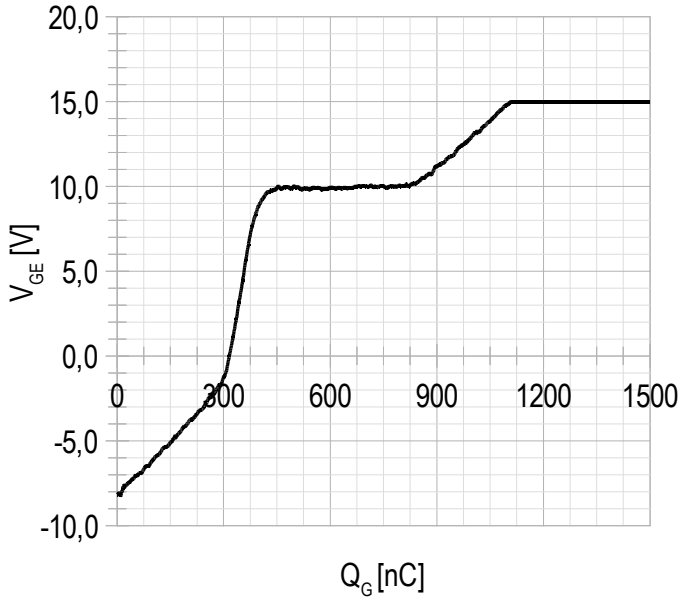

$V_{CE}$ = 850 V;
$V_{GE}$ = ±15 V;
$R_G$ = 2.2 Ω;
L = 300 µH.
$T_{vj\ (max)}$ = 150°C.

## Chart 14 – typ. switching times vs gate resistance, FRD.



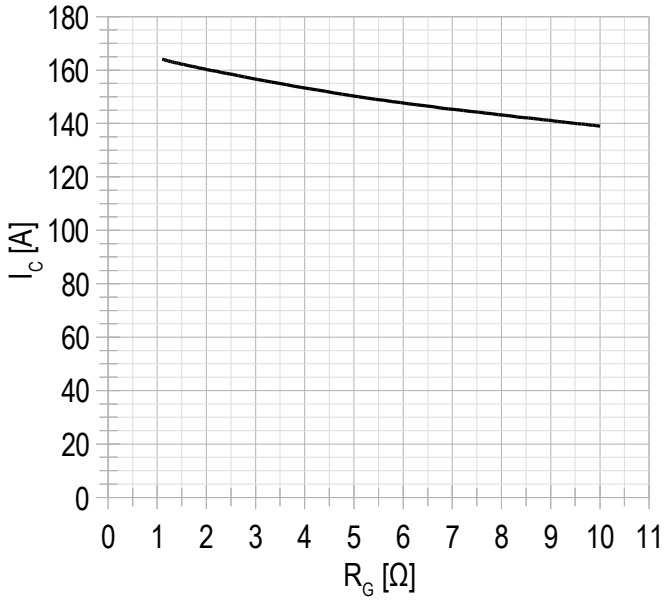

$V_{CE}$ = 850 V;
$V_{GE}$ = ±15 V;
$I_{C\ max}$ = 100 A;
L = 300 µH.
$T_{vj\ (max)}$ = 150°C.

## Chart 15 – typ. gate charge characteristic.



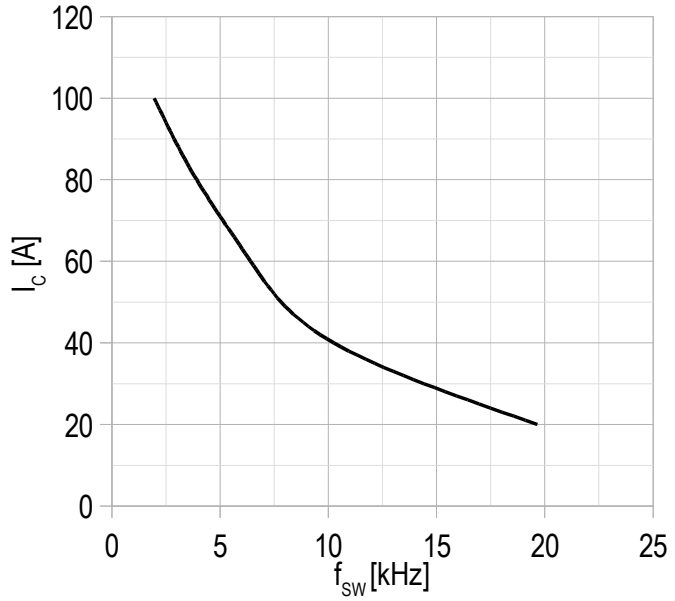

$I_C$ = 100 A;
$V_{CE}$ = 850 V;
$V_{GE}$ = - 8÷15 V.

## Chart 16 – typ. reverse recovery current vs gate resistance FRD.



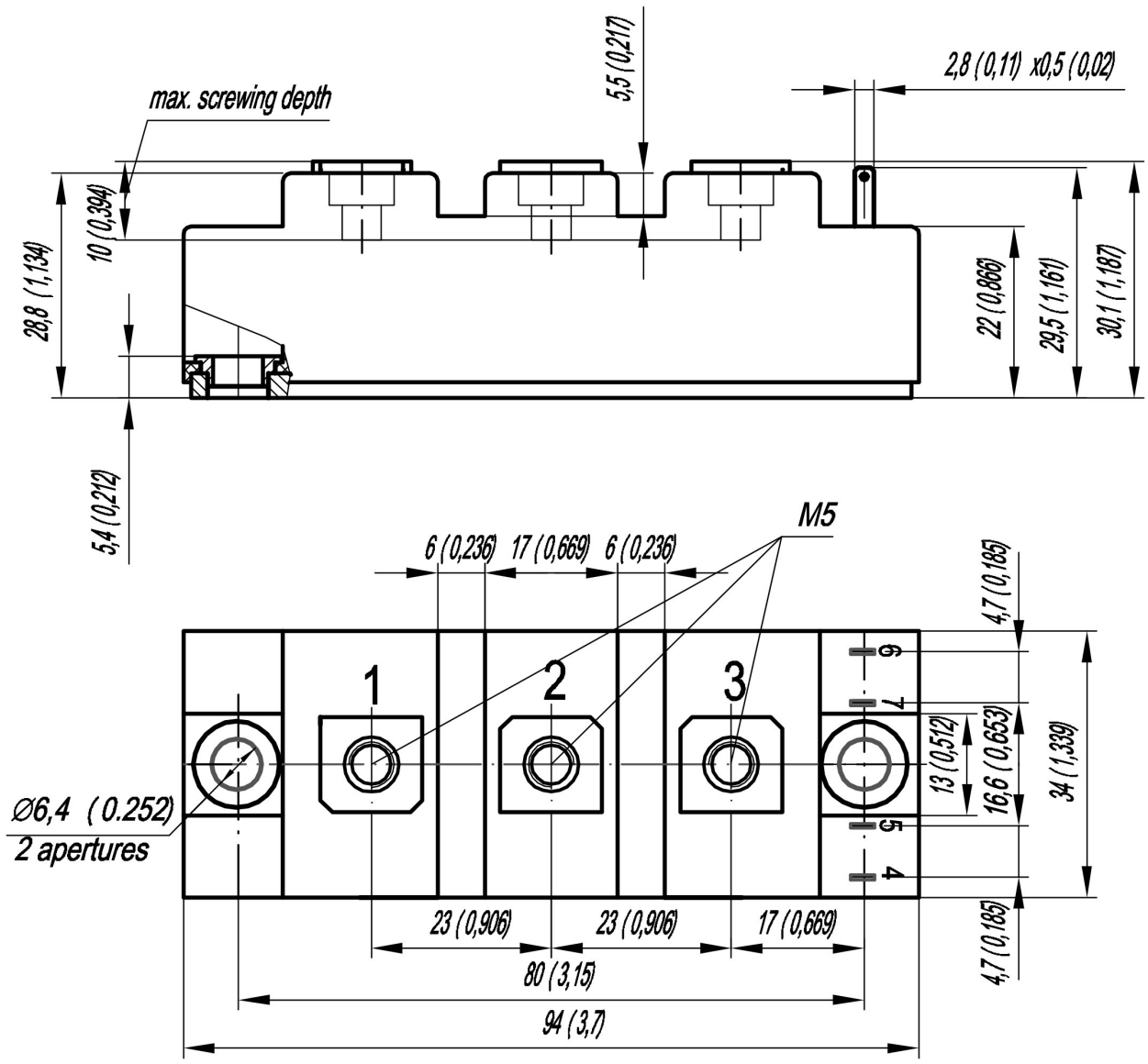

$V_{CE}$ = 850 V;
$V_{GE}$ = ±15 V;
L = 300 µH.
$T_{vj\ (max)}$ = 150°C.

**Chart 17 – typ. rated current vs frequency.**




Duty cycle 50%

## **Overall dimensions**: Package type – FA




## Part numbering guide

| MIFA | - | HB | 17 | AA | - | 100 | N | |
|---|---|---|---|---|---|---|---|---|
| MIFA | | | | | | | | IGBT module package type: FA |
| | | HB | | | | | | 2 switches as Half-Bridge |
| | | HC | | | | | | 1 switch as High-Side chopper |
| | | LC | | | | | | 1 switch as Low-Side chopper |
| | | | 17 | | | | | Voltage rating ($V_{CES}$/100) |
| | | | | AA | | | | IGBT+FRD chipset modification |
| | | | | | | 100 | | Current Rating |
| | | | | | | | N | Climatic version: normal climate |