# IGBT Modules

## H-Bridge

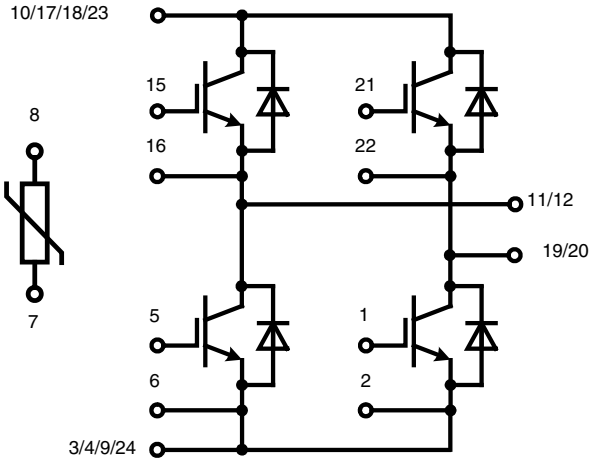
## Trench IGBT

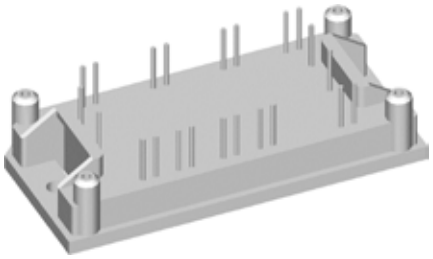
$I_{C25}$ = 89 A
$V_{CES}$ = 600 V
$V_{CE(sat)\ typ.}$ = 1.8 V

Preliminary data

**Part name** (Marking on product)

MKI 80-06T6K



**Features:**

- Trench IGBT technology
- Low saturation voltage
- Low switching losses
- Square RBSOA, no latch up
- High short circuit capability
- Positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- Ultra fast free wheeling diodes
- Solderable pins for PCB mounting
- Space saving
- Reduced protection circuits

**Application:**

- AC motor control
- AC servo and robot drives
- Power supplies

**Package:**

- Industry standard E1-pack
- Designed for wave soldering
- With copper base plate

## IGBTs

| Symbol | Definitions | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{CES}$ | *collector emitter voltage* | | $T_{VJ}$ = 25°C to 150°C | | | 600 | V |
| $V_{GES}$ | *max. DC gate voltage* | continuous | | | | ±20 | V |
| $V_{GEM}$ | *max. transient collector gate voltage* | transient | | | | ±30 | V |
| $I_{C25}$ | *collector current* | | $T_C$ = 25°C | | | 89 | A |
| $I_{C80}$ | | | $T_C$ = 80°C | | | 67 | A |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25°C | | | 210 | W |
| $V_{CE(sat)}$ | *collector emitter saturation voltage* | $I_C$ = 75 A; $V_{GE}$ = 15 V | $T_{VJ}$ = 25°C | | 1.8 | 2.3 | V |
| | | | $T_{VJ}$ = 125°C | | 2.1 | | V |
| $V_{GE(th)}$ | *gate emitter threshold voltage* | $I_C$ = 1.2 mA; $V_{GE}$ = $V_{CE}$ | $T_{VJ}$ = 25°C | 5 | | 6.5 | V |
| $I_{CES}$ | *collector emitter leakage current* | $V_{CE}$ = $V_{CES}$; $V_{GE}$ = 0 V | $T_{VJ}$ = 25°C | | | 0.5 | mA |
| | | | $T_{VJ}$ = 125°C | | 1 | | mA |
| $I_{GES}$ | *gate emitter leakage current* | $V_{CE}$ = 0 V; $V_{GE}$ = ±20 V | | | | 400 | nA |
| $C_{ies}$ | *input capacitance* | $V_{CE}$ = 25 V; $V_{GE}$ = 0 V; f = 1 MHz | | | 4620 | | pF |
| $Q_{G(on)}$ | *total gate charge* | $V_{CE}$ = 480 V; $V_{GE}$ = 15 V; $I_C$ = 75 A | | | 470 | | nC |
| $t_{d(on)}$ | *turn-on delay time* | inductive load | $T_{VJ}$ = 125°C | | 30 | | ns |
| $t_r$ | *current rise time* | $V_{CE}$ = 300 V; $I_C$ = 75 A | | | 20 | | ns |
| $t_{d(off)}$ | *turn-off delay time* | $V_{GE}$ = ±15 V; $R_G$ = 5.1 Ω | | | 250 | | ns |
| $t_f$ | *current fall time* | | | | 70 | | ns |
| $E_{on}$ | *turn-on energy per pulse* | | | | 2.5 | | mJ |
| $E_{off}$ | *turn-off energy per pulse* | | | | 2.8 | | mJ |
| $I_{CM}$ | *reverse bias safe operating area* | RBSOA; $V_{GE}$ = ±15 V; $R_G$ = 5.1 Ω; L = 100 µH | | | 150 | | A |
| $V_{CEK}$ | | clamped inductive load; | $T_{VJ}$ = 125°C | | 0.9x | $V_{CES}$ | |
| $t_{SC}$ (SCSOA) | *short circuit safe operating area* | $V_{CE}$ = 480 V; $V_{GE}$ = ±15 V; $R_G$ = 5.1 Ω; non-repetitive | $T_{VJ}$ = 125°C | | 6 | | µs |
| $R_{thJC}$ | *thermal resistance junction to case* | (per IGBT) | | | | 0.6 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | (per IGBT) | | | 0.2 | | K/W |

## Diodes

| Symbol | Definitions | Conditions | | Maximum Ratings | |
|---|---|---|---|---|---|
| $V_{RRM}$ | *max. repetitive reverse voltage* | | | 600 | V |
| $I_{F25}$ | *forward current* | | $T_C$ = 25°C | 105 | A |
| $I_{F80}$ | | | $T_C$ = 80°C | 67 | A |

| Symbol | Conditions | | Characteristic Values min. | typ. | max. | |
|---|---|---|---|---|---|---|
| $V_F$ | *forward voltage* | $I_F$ = 75 A | $T_{VJ}$ = 25°C | 1.8 | 2.2 | V |
| | | | $T_{VJ}$ = 125°C | 1.6 | | V |
| $I_{RM}$ | *max. reverse recovery current* | $V_R$ = 300 V; $I_F$ = 75 A | | 36 | | A |
| $t_{rr}$ | *reverse recovery time* | $di_F/dt$ = -600 A/µs | $T_{VJ}$ = 100°C | 100 | | ns |
| $R_{thJC}$ | *thermal resistance junction to case* | (per diode) | $T_{VJ}$ = 25°C | | 0.65 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | (per diode) | | 0.25 | | K/W |

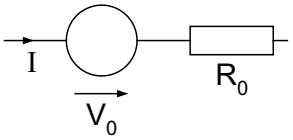
## Temperature Sensor NTC

| Symbol | Definitions | Conditions | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| $R_{25}$ | *resistance* | $T_C$ = 25°C | 4.45 | 4.7 | 5.0 | kΩ |
| $B_{25/85}$ | | | | 3510 | | K |

## Module

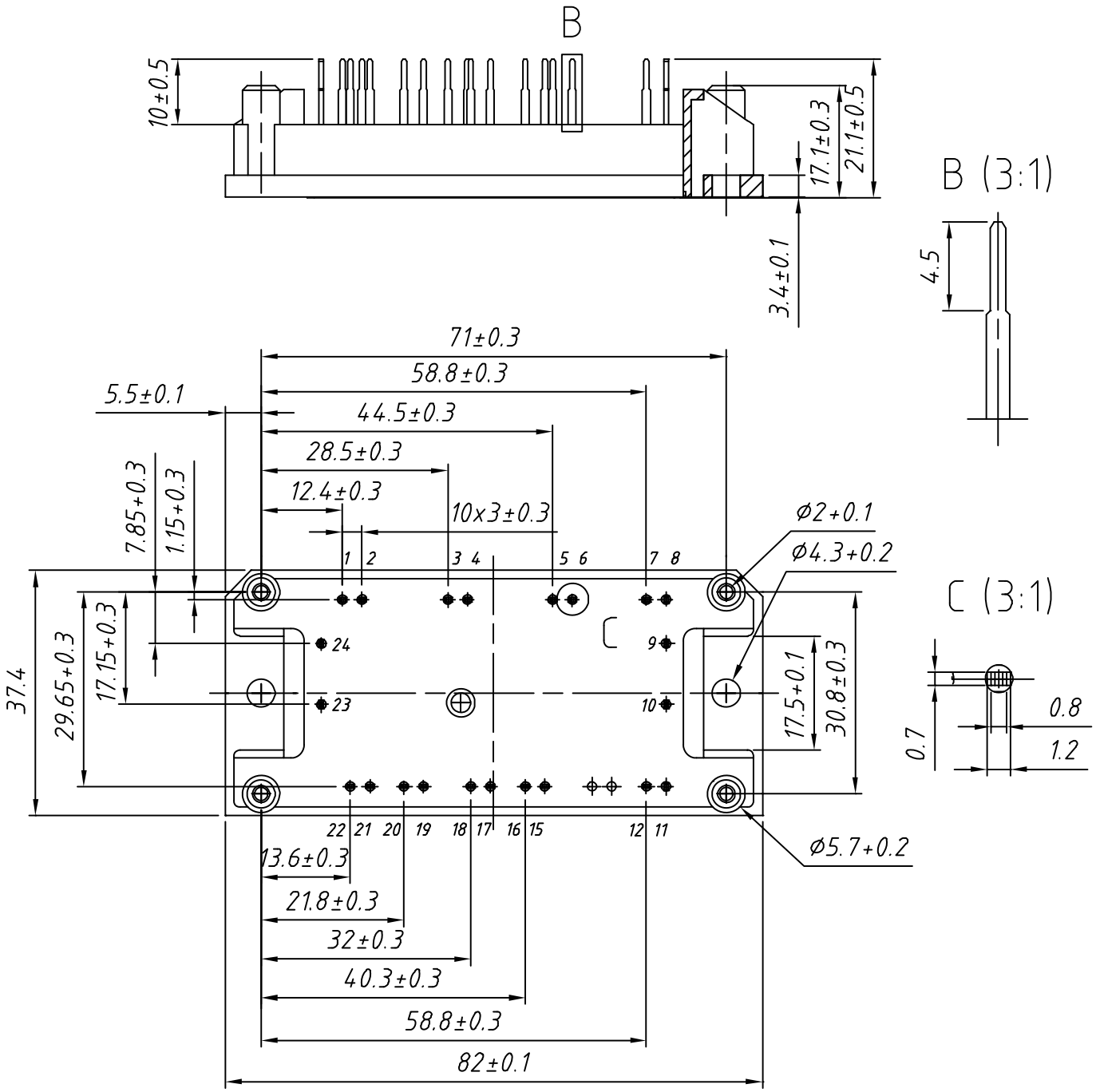
| Symbol | Definitions | Conditions | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| $T_{VJ}$ | *operating temperature* | | -40 | | 125 | °C |
| $T_{VJM}$ | *max. virtual junction temperature* | | | | 175 | °C |
| $T_{stg}$ | *storage temperature* | | -40 | | 125 | °C |
| $V_{ISOL}$ | *isolation voltage* | $I_{ISOL} \leq$ 1 mA; 50/60 Hz | | | 2500 | V~ |
| $M_d$ | *mounting torque* | (M4) | 2.0 | | 2.2 | Nm |
| $d_S$ | *creep distance on surface* | | 12.7 | | | mm |
| $d_A$ | *strike distance through air* | | 12.7 | | | mm |
| **Weight** | | | | 40 | | g |

## Equivalent Circuits for Simulation




| Symbol | Definitions | Conditions | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| $V_0$ | *IGBT* | $T_{VJ}$ = 125°C | | 0.9 | | V |
| $R_0$ | | | | 14.3 | | mΩ |
| $V_0$ | *free wheeling diode* | $T_{VJ}$ = 125°C | | 1.25 | | V |
| $R_0$ | | | | 3 | | mΩ |

**Outline Drawing** Dimensions in mm (1 mm = 0.0394“)




**Product Marking**

| Ordering | Part Name | Marking on Product | Delivering Mode | Base Qty | Ordering Code |
|---|---|---|---|---|---|
| Standard | MKI 80-06T6K | MKI80-06T6K | Box | 10 | 504061 |

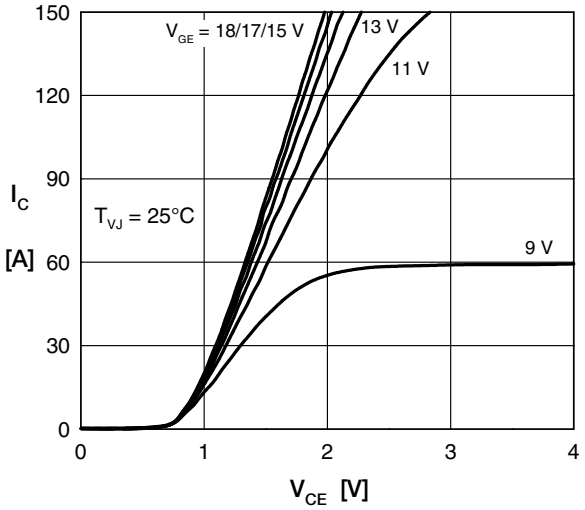



Fig. 1 Typical output characteristics

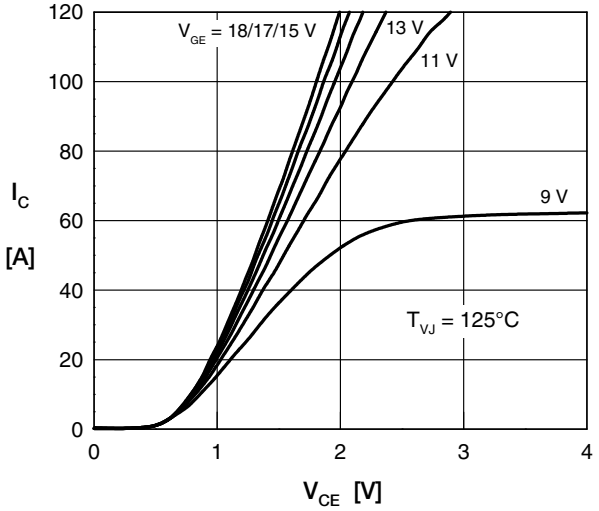



Fig. 2 Typical output characteristics

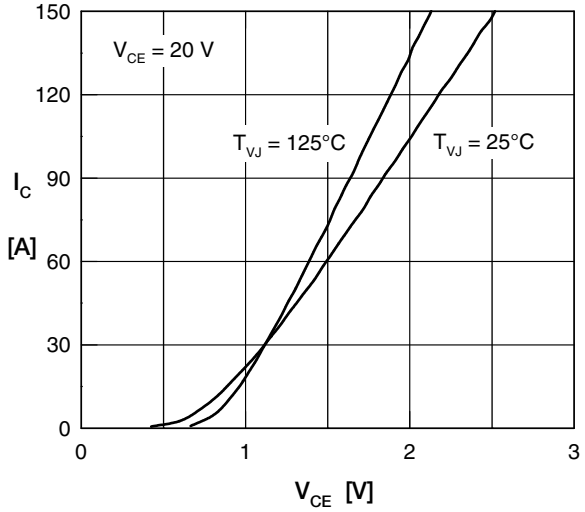



Fig. 3 Typical output characteristics

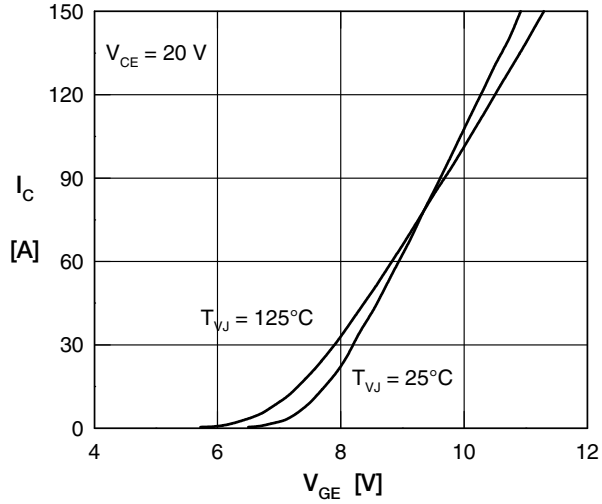



Fig. 4 Typical transfer characteristics

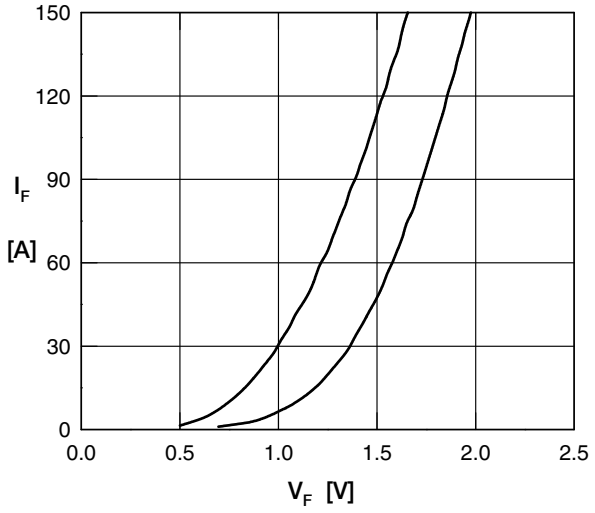



Fig. 5 Typical forward characteristics FWD

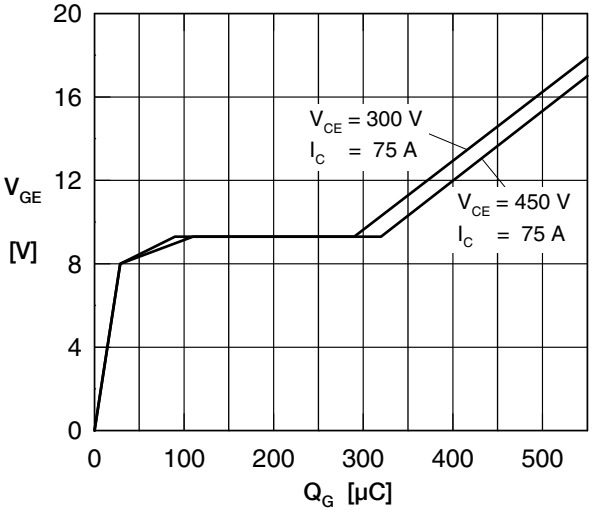



Fig. 6 Typical turn-on gate charge