# IGBT
## 650 V, 150 A
## Half-Bridge IGBT Module
## 34MM
## QX150HB065C2

The QX150HB065C2 is a 650 V / 150 A IGBT half-bridge power module with ultra-low conduction loss and short-circuit ruggedness. It is intended for applications including motor drives and solar-energy systems.

### Features

- Low VCE(sat) trench IGBT technology
- VCE(sat) with positive temperature coefficient
- Maximum junction temperature 175 °C
- Low-inductance case
- Isolated copper baseplate using DBC technology

### Typical Applications

- Solar-energy applications
- Inverters for motor drives
- Uninterruptible power supplies
- Hybrid and electric vehicles

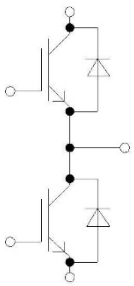
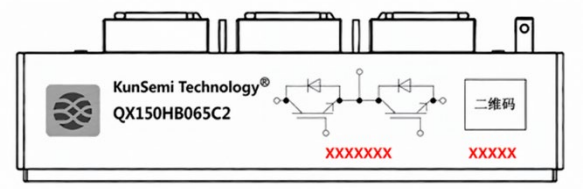


**Figure 1. Equivalent Schematic**



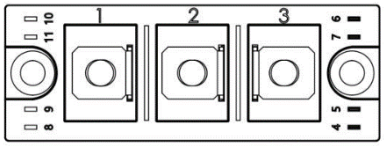
**95.00 × 34.00 × 27.50**

### MARKING DIAGRAM




QX150HB065C2 = Device Code
XXXXXXX = Year, week and batch Code
XXXXX = Flow code

### PIN ASSIGNMENTS




### ORDERING INFORMATION

| Device | Package |
|---|---|
| QX150HB065C2 | 34MM |

### PIN DESCRIPTION

| Pin | Name | Description |
|---|---|---|
| 1 | OUT | Center Point of Half Bridge |
| 2 | DC− | DC Negative Bus Connection |
| 3 | DC+ | DC Positive Bus Connection |
| 4 | G1 | T1 Gate |
| 5 | S1 | T1 Emitter |
| 6 | G2 | T2 Gate |
| 7 | S2 | T2 Emitter |

# ELECTRICAL CHARACTERISTICS

## Absolute Maximum Ratings

| Parameter | Test Conditions | Symbol | Maximum Ratings | Unit |
|---|---|---|---|---|
| Collector-emitter voltage | — | $V_{CES}$ | 650 | V |
| Gate-emitter voltage | — | $V_{GES}$ | ±20 | V |
| Collector current | $T_j$=100 °C | $I_C$ | 150 | A |
| Pulsed collector current | $t_p$=1 ms | $I_{CM}$ | 300 | A |
| Maximum power dissipation | $T_j$=175 °C | $P_D$ | 1170 | W |
| Repetitive peak reverse voltage | — | $V_{RRM}$ | 650 | V |
| Diode continuous forward current | — | $I_F$ | 150 | A |
| Diode maximum forward current | $t_p$=1 ms | $I_{FM}$ | 300 | A |
| Maximum junction temperature | — | $T_{jmax}$ | 175 | °C |
| Operating junction temperature | — | $T_{jop}$ | −40 to +150 | °C |
| Storage temperature range | — | $T_{STG}$ | −40 to +125 | °C |
| Isolation voltage RMS | f=50 Hz; t=1 min | $V_{ISO}$ | 2500 | V |

## IGBT ELECTRICAL CHARACTERISTICS

| Characteristic | Test Conditions | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Collector-emitter saturation voltage | $I_C$=150 A; $V_{GE}$=15 V | $T_j$=25 °C | $V_{CE(sat)}$ | — | 1.59 | 2.15 | V |
| | | $T_j$=125 °C | | — | 1.84 | — | |
| | | $T_j$=150 °C | | — | 1.91 | — | |
| Gate-emitter threshold voltage | $I_C$=1.5 mA; $V_{CE}$=$V_{GE}$; $T_j$=25 °C | | $V_{GE(th)}$ | — | 5.73 | — | V |
| Collector cut-off current | $V_{CE}$=$V_{CES}$; $V_{GE}$=0 V; $T_j$=25 °C | | $I_{CES}$ | — | — | 10 | µA |
| Gate-emitter leakage current | $V_{GE}$=$V_{GES}$; $V_{CE}$=0 V; $T_j$=25 °C | | $I_{GES}$ | — | — | 100 | nA |
| Internal gate resistance | — | | $R_{Gint}$ | — | 2.76 | — | Ω |
| Input capacitance | $V_{CE}$=25 V; f=100 kHz; $V_{GE}$=0 V | | $C_{ies}$ | — | 9.38 | — | nF |
| Reverse transfer capacitance | $V_{CE}$=25 V; f=100 kHz; $V_{GE}$=0 V | | $C_{res}$ | — | 0.12 | — | nF |
| Gate charge | $V_{GE}$=−15…+15 V | | $Q_G$ | — | 0.47 | — | µC |

## IGBT SWITCHING CHARACTERISTICS

| Characteristic | Test Conditions | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Turn-on delay time | $V_{CC}$=300 V; $I_C$=150 A; $R_G$=2.2 Ω; $V_{GE}$=±15 V; $L_S$=16 µH | $T_j$=25 °C | $t_{d(on)}$ | — | 70.4 | — | ns |
| | | $T_j$=125 °C | | — | 89.9 | — | |
| | | $T_j$=150 °C | | — | 97.9 | — | |
| Rise time | | $T_j$=25 °C | $t_r$ | — | 23.3 | — | ns |
| | | $T_j$=125 °C | | — | 24.1 | — | |
| | | $T_j$=150 °C | | — | 24.5 | — | |
| Turn-off delay time | | $T_j$=25 °C | $t_{d(off)}$ | — | 85.4 | — | ns |
| | | $T_j$=125 °C | | — | 101.1 | — | |
| | | $T_j$=150 °C | | — | 111.7 | — | |
| Fall time | | $T_j$=25 °C | $t_f$ | — | 60.8 | — | ns |
| | | $T_j$=125 °C | | — | 80.9 | — | |
| | | $T_j$=150 °C | | — | 97.9 | — | |
| Turn-on switching loss | | $T_j$=25 °C | $E_{on}$ | — | 1.1 | — | mJ |
| | | $T_j$=125 °C | | — | 1.8 | — | |
| | | $T_j$=150 °C | | — | 2.3 | — | |
| Turn-off switching loss | | $T_j$=25 °C | $E_{off}$ | — | 2.3 | — | mJ |
| | | $T_j$=125 °C | | — | 2.7 | — | |
| | | $T_j$=150 °C | | — | 2.9 | — | |

## DIODE ELECTRICAL CHARACTERISTICS

| Characteristic | Test Conditions | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Diode forward voltage | $I_F$=150 A; $V_{GE}$=0 V | $T_j$=25 °C | $V_F$ | — | 1.33 | 2.15 | V |
| | | $T_j$=125 °C | | — | 1.17 | — | |
| | | $T_j$=150 °C | | — | 1.12 | — | |
| Recovered charge | $V_{CC}$=300 V; $I_F$=150 A; $V_{GE}$=−15 V | −di/dt=5900 A/μs; $T_j$=25 °C | $Q_r$ | — | 9.9 | — | μC |
| | | −di/dt=5310 A/μs; $T_j$=125 °C | | — | 18.1 | — | |
| | | −di/dt=5270 A/μs; $T_j$=150 °C | | — | 20.3 | — | |
| Peak reverse recovery current | | −di/dt=5900 A/μs; $T_j$=25 °C | $I_{RM}$ | — | 240.2 | — | A |
| | | −di/dt=5310 A/μs; $T_j$=125 °C | | — | 310.5 | — | |
| | | −di/dt=5270 A/μs; $T_j$=150 °C | | — | 314.1 | — | |
| Reverse recovery energy | | −di/dt=5900 A/μs; $T_j$=25 °C | $E_{rec}$ | — | 2.9 | — | mJ |
| | | −di/dt=5310 A/μs; $T_j$=125 °C | | — | 4.9 | — | |
| | | −di/dt=5270 A/μs; $T_j$=150 °C | | — | 5.8 | — | |

## MODULE CHARACTERISTICS

| Characteristic | Test Conditions | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Stray inductance | — | $L_{CE}$ | — | 30 | — | nH |
| Module lead resistance, terminal to chip | — | $R_{CC'+EE'}$ | — | 0.65 | — | mΩ |
| Junction-to-case thermal resistance, per IGBT | — | $R_{thJC}$ | — | — | 0.128 | K/W |
| Junction-to-case thermal resistance, per diode | — | $R_{thJC}$ | — | — | 0.333 | K/W |
| Case-to-heatsink thermal resistance, per IGBT | — | $R_{thCH}$ | — | 0.170 | — | K/W |
| Case-to-heatsink thermal resistance, per diode | — | $R_{thCH}$ | — | 0.157 | — | K/W |
| Case-to-heatsink thermal resistance, per module | — | $R_{thCH}$ | — | 0.041 | — | K/W |
| Terminal connection torque | Screw M5 | M | 2.5 | 3.0 | 5.0 | N·m |
| Mounting torque | Screw M6 | M | 2.5 | 3.0 | 5.0 | N·m |
| Weight of module | — | G | — | 155 | — | g |

## Typical Performance

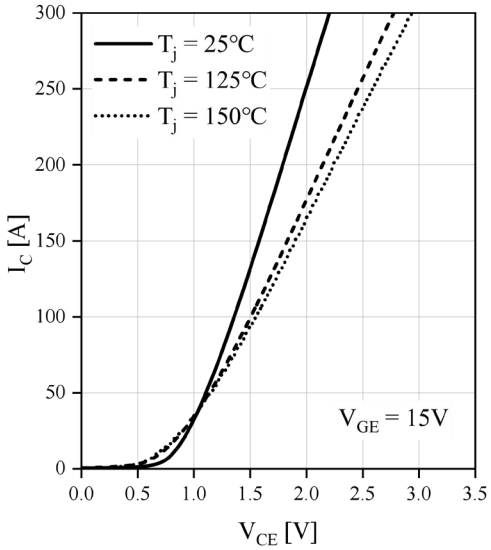



Figure 1. IGBT Output Characteristics

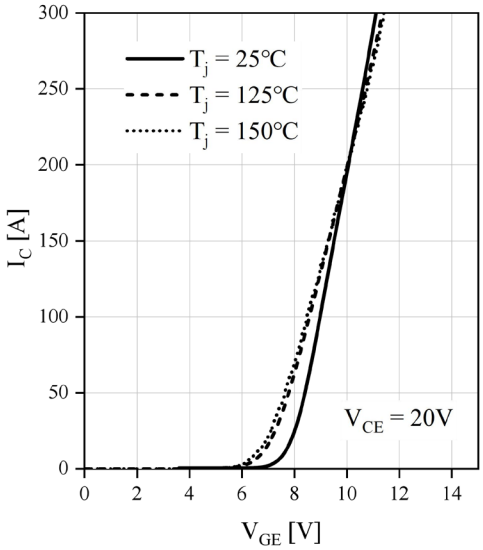



Figure 2. IGBT Transfer Characteristics

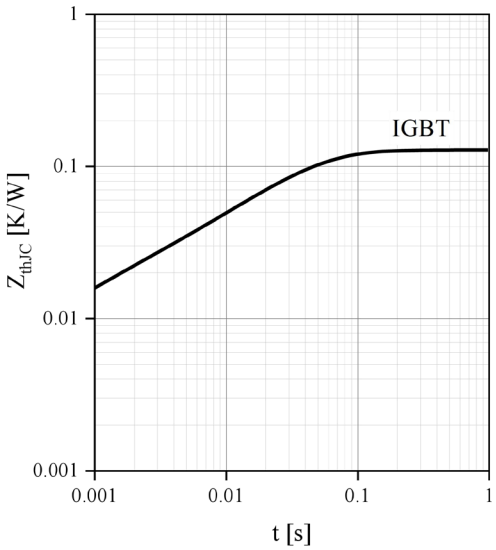



Figure 3. IGBT Transient Thermal Impedance

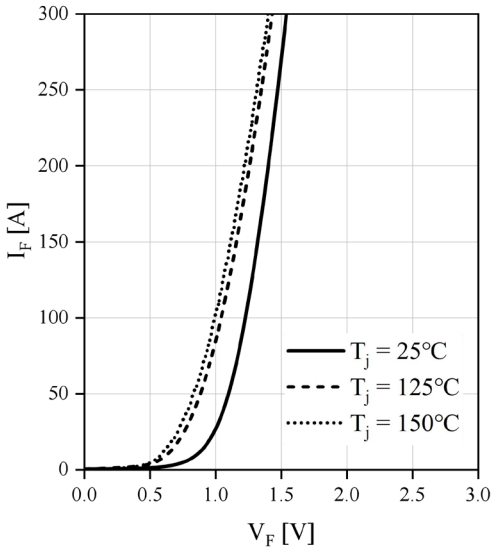



Figure 4. Diode Forward Characteristics

## Typical Performance

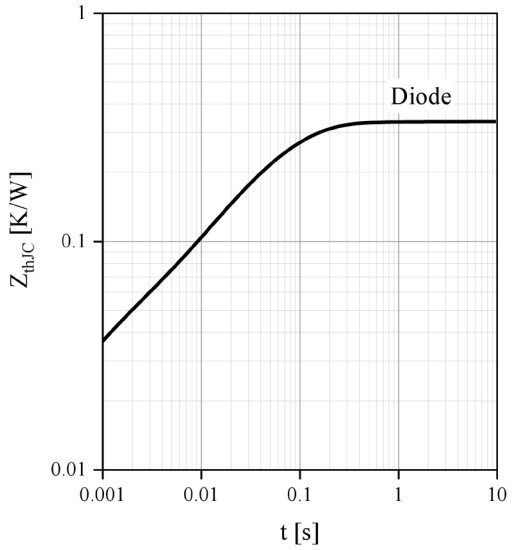



Figure 5. Diode Transient Thermal Impedance

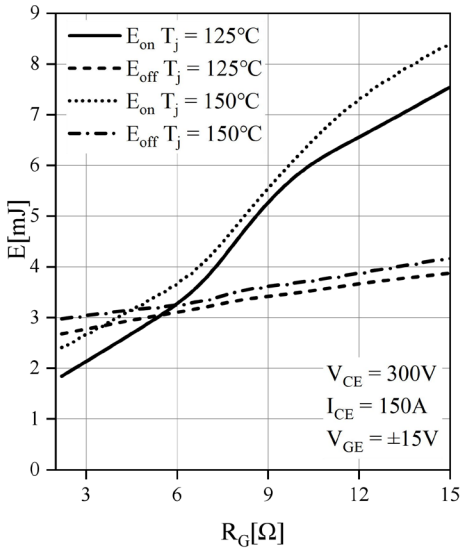



Figure 6. IGBT Switching Loss vs. RG

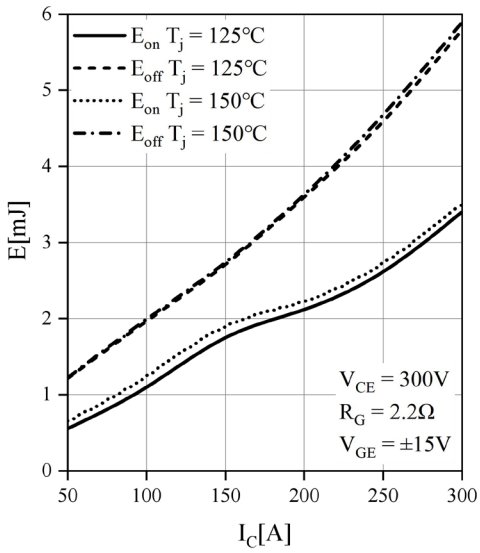



Figure 7. IGBT Switching Loss vs. IC

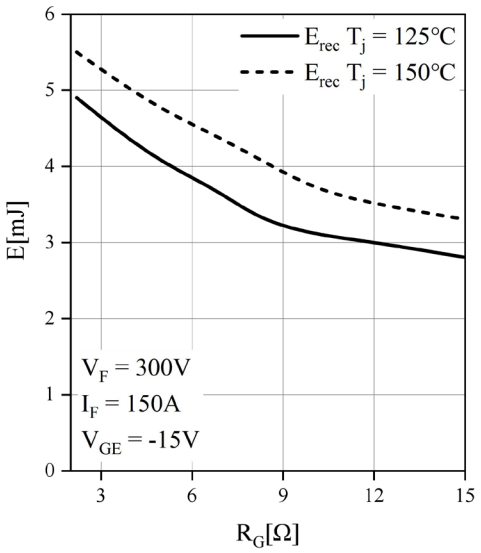



Figure 8. Diode Switching Loss vs. RG

## Typical Performance

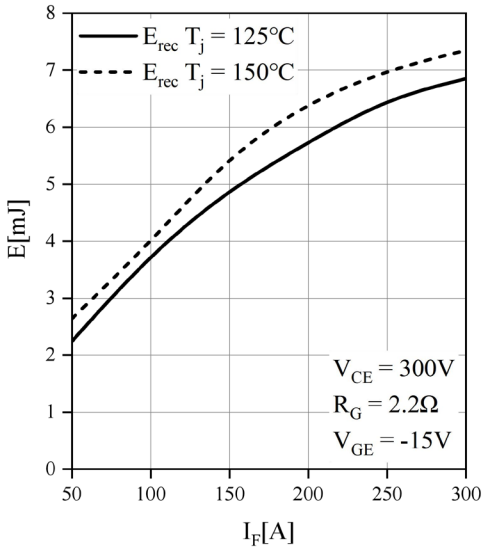



Figure 9. Diode Switching Loss vs. IF

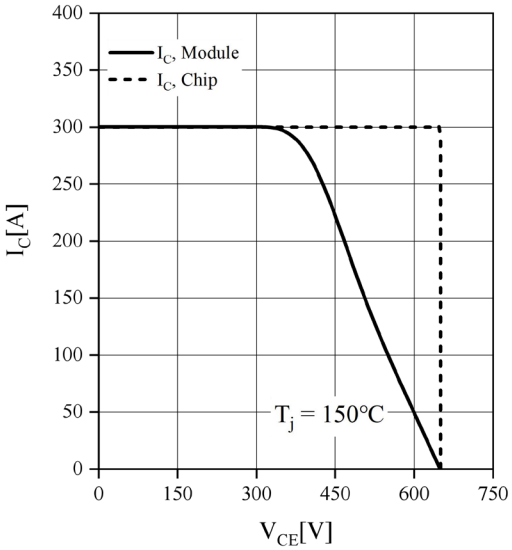
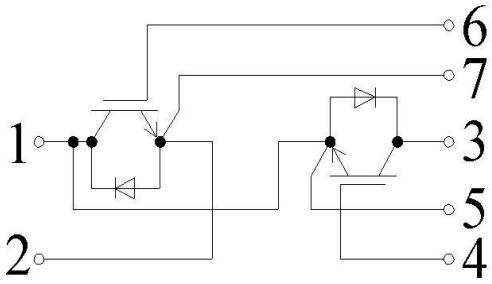
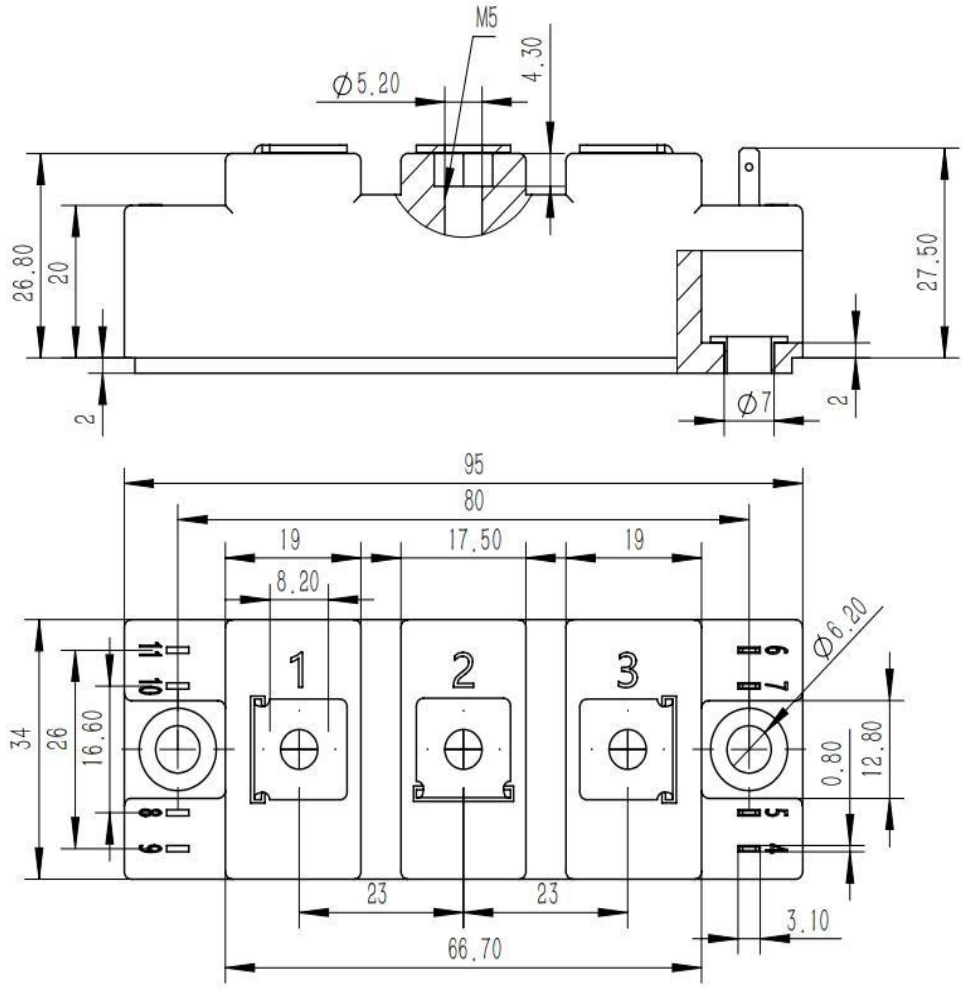



Figure 10. Reverse Bias Safe Operating Area

## Circuit Schematic




## Package Dimensions




UNIT:mm