



## ■ Applications

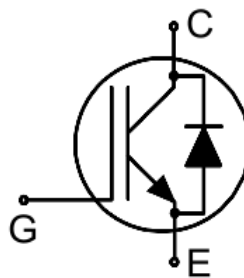
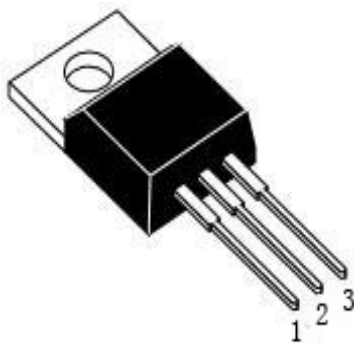
- Industrial UPS
- Welding machine
- Solar converters
- Energy Storage
- Mid to high range switching frequency converters

## ■ Features

- Low switching power loss
- Low switching surge and noise
- Advanced Fieldstop technology
- Low EMI
- Short circuit withstand time – 5uS
- Qualified according to JEDEC for target applications
- RoHS and Halogen-Free Compliant

## ■ Product Summary

|                        |     |   |
|------------------------|-----|---|
| $V_{CES}$              | 650 | V |
| $I_C$                  | 15  | A |
| $V_{CE(sat)}, Typ@15V$ | 1.7 | V |

**TO-220**

Gate: 1  
Collector: 2  
Emitter: 3

| Marking      | Package | Packaging | Min. package quantity |
|--------------|---------|-----------|-----------------------|
| MCB15N065T4F | TO-220  | Tube      | 1000                  |





### ■ Absolute Maximum Ratings (Tc=25°C unless otherwise noted)

| Parameter                                                                            | Symbol         | Ratings  | Unit |
|--------------------------------------------------------------------------------------|----------------|----------|------|
| Collector-emitter Voltage                                                            | $V_{CES}$      | 650      | V    |
| DC collector current, limited by $T_{jmax}$<br>TC=25°C<br>TC=100°C                   | $I_C$          | 30<br>15 | A    |
| Pulsed collector current, tp limited by $T_{jmax}$                                   | $I_{C\ Pulse}$ | 45       | A    |
| Diode forward current, limited by $T_{jmax}$<br>TC=25°C<br>TC=100°C                  | $I_F$          | 30<br>15 | A    |
| Diode Pulsed current, tp limited by $T_{jmax}$                                       | $I_{F\ Pulse}$ | 40       | A    |
| Continuous Gate-emitter voltage                                                      | $V_{GE}$       | ±20      | V    |
| Short circuit withstand time<br>$V_{GE}=15V, V_{CC} \leq 400V, T_j \leq 150^\circ C$ | $t_{SC}$       | 5        | μs   |
| Power Dissipation (TC=25°C)                                                          | $P_D$          | 125      | W    |
| Junction Temperature                                                                 | $T_j$          | 150      | °C   |
| Storage Temperature                                                                  | $T_{STG}$      | -55-150  | °C   |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

### ■ Thermal Characteristics

| Parameter                      | Symbol          | Max | Unit |
|--------------------------------|-----------------|-----|------|
| IGBT Maximum Junction-to-Case  | $R_{\theta JC}$ | 1   | °C/W |
| Diode Maximum Junction-to-Case | $R_{\theta JC}$ | 2   | °C/W |
| Maximum Junction-to-Ambient    | $R_{\theta JA}$ | 60  | °C/W |

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.





# ■ Electrical Characteristics (Tc=25°C unless otherwise noted)

| Parameter                                                            | Symbol               | Test Condition                                                     |          | Min  | Typ  | Max  | Unit |
|----------------------------------------------------------------------|----------------------|--------------------------------------------------------------------|----------|------|------|------|------|
| Static Characteristics                                               |                      |                                                                    |          |      |      |      |      |
| Collector-emitter breakdown voltage                                  | BV <sub>CES</sub>    | V <sub>GE</sub> =0V,I <sub>C</sub> =250uA                          |          | 650  | -    | -    | V    |
| Zero gate voltage collector current                                  | I <sub>CES</sub>     | VCE=650V,VGE=0V                                                    |          | -    | -    | 200  | uA   |
| Gate-emitter leakage current                                         | I <sub>GES</sub>     | V <sub>GE</sub> =±20V,V <sub>CE</sub> =0V                          |          | -    | -    | ±100 | nA   |
| Gate-emitter threshold voltage                                       | V <sub>GE(TH)</sub>  | V <sub>CE</sub> =V <sub>GE</sub> ,I <sub>C</sub> =250uA            |          | 4..2 | 5..2 | 6.2  | V    |
| Collector-emitter saturation voltage                                 | V <sub>CE(sat)</sub> | V <sub>GE</sub> =15V,I <sub>C</sub> =15A                           |          | -    | 1.7  | 2.4  | V    |
|                                                                      |                      |                                                                    | Tj=150°C | -    | 2.2  | -    | V    |
| Diode forward voltage                                                | V <sub>F</sub>       | I <sub>F</sub> =15A                                                |          | -    | 1.4  | 1.9  | V    |
|                                                                      |                      |                                                                    | Tj=150°C | -    | 1.1  | -    | V    |
| Dynamic Characteristics                                              |                      |                                                                    |          |      |      |      |      |
| Input Capacitance                                                    | C <sub>ies</sub>     | V <sub>CE</sub> =25V,V <sub>GE</sub> =0V,<br>f=1.0MHz              |          | -    | 878  | -    | pF   |
| Output Capacitance                                                   | C <sub>oes</sub>     |                                                                    |          | -    | 42   | -    | pF   |
| Reverse Transfer Capacitance                                         | C <sub>res</sub>     |                                                                    |          | -    | 14   | -    | pF   |
| Integrated gate resistor                                             | R <sub>Gint</sub>    |                                                                    |          | -    | 2.7  | -    | Ω    |
| Total Gate Charge                                                    | Q <sub>g</sub>       | V <sub>CC</sub> =400V,I <sub>C</sub> =15A,<br>V <sub>GE</sub> =15V |          | -    | 42   | -    | nC   |
| Gate-to-emitter charge                                               | Q <sub>ge</sub>      |                                                                    |          | -    | 8    | -    | nC   |
| Gate-to-collector charge                                             | Q <sub>gc</sub>      |                                                                    |          | -    | 23   | -    | nC   |
| Internal emitter inductance<br>measured 5mm (0.197 in.) from<br>case | L <sub>E</sub>       |                                                                    |          | -    | 7    | -    | nH   |





### ■ Switching Characteristic, Inductive Load, at $T_J=25^{\circ}\text{C}$

| Parameter                      | Symbol              | Test Condition                                                                                                    | Min | Typ  | Max | Unit |
|--------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------|-----|------|-----|------|
| IGBT Switching Characteristics |                     |                                                                                                                   |     |      |     |      |
| Turn-On Delay Time             | t <sub>d(on)</sub>  | V <sub>CC</sub> = 400V<br>I <sub>C</sub> = 15A<br>V <sub>GE</sub> = 15V<br>R <sub>G</sub> = 10Ω<br>Inductive load | -   | 15   | -   | ns   |
| Turn-On Rise Time              | t <sub>r</sub>      |                                                                                                                   | -   | 45   | -   | ns   |
| Turn-Off Delay Time            | t <sub>d(off)</sub> |                                                                                                                   | -   | 30   | -   | ns   |
| Turn-Off Rise Time             | t <sub>f</sub>      |                                                                                                                   | -   | 135  | -   | ns   |
| Turn-on energy                 | E <sub>on</sub>     |                                                                                                                   | -   | 0.7  | -   | mJ   |
| Turn-off energy                | E <sub>off</sub>    |                                                                                                                   | -   | 0.2  | -   | mJ   |
| Diode Characteristics          |                     |                                                                                                                   |     |      |     |      |
| Reverse Recovery Time          | t <sub>rr</sub>     | V <sub>R</sub> =400V,I <sub>F</sub> =15A,<br>di/dt=200A/us                                                        | -   | 62   | -   | ns   |
| Reverse Recovery Charge        | Q <sub>rr</sub>     |                                                                                                                   | -   | 0.22 | -   | μC   |
| Peak Reverse Recovery Current  | I <sub>rrm</sub>    |                                                                                                                   | -   | 7    | -   | A    |

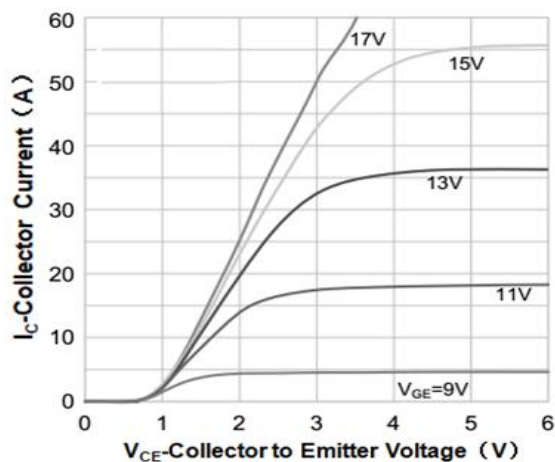
### ■ Switching Characteristic, Inductive Load, at $T_J=150^{\circ}\text{C}$

| Parameter                      | Symbol              | Test Condition                                                                                                    | Min | Typ  | Max | Unit |
|--------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------|-----|------|-----|------|
| IGBT Switching Characteristics |                     |                                                                                                                   |     |      |     |      |
| Turn-On Delay Time             | t <sub>d(on)</sub>  | V <sub>CC</sub> = 400V<br>I <sub>C</sub> = 15A<br>V <sub>GE</sub> = 15V<br>R <sub>G</sub> = 10Ω<br>Inductive load | -   | 17   | -   | ns   |
| Turn-On Rise Time              | t <sub>r</sub>      |                                                                                                                   | -   | 43   | -   | ns   |
| Turn-Off Delay Time            | t <sub>d(off)</sub> |                                                                                                                   | -   | 27   | -   | ns   |
| Turn-Off Rise Time             | t <sub>f</sub>      |                                                                                                                   | -   | 137  | -   | ns   |
| Turn-on energy                 | E <sub>on</sub>     |                                                                                                                   | -   | 1    | -   | mJ   |
| Turn-off energy                | E <sub>off</sub>    |                                                                                                                   | -   | 0.37 | -   | mJ   |
| Diode Characteristics          |                     |                                                                                                                   |     |      |     |      |
| Reverse Recovery Time          | t <sub>rr</sub>     | V <sub>R</sub> =400V,I <sub>F</sub> =15A,<br>di/dt=200A/us                                                        | -   | 100  | -   | ns   |
| Reverse Recovery Charge        | Q <sub>rr</sub>     |                                                                                                                   | -   | 0.55 | -   | μC   |
| Peak Reverse Recovery Current  | I <sub>rrm</sub>    |                                                                                                                   | -   | 11   | -   | A    |

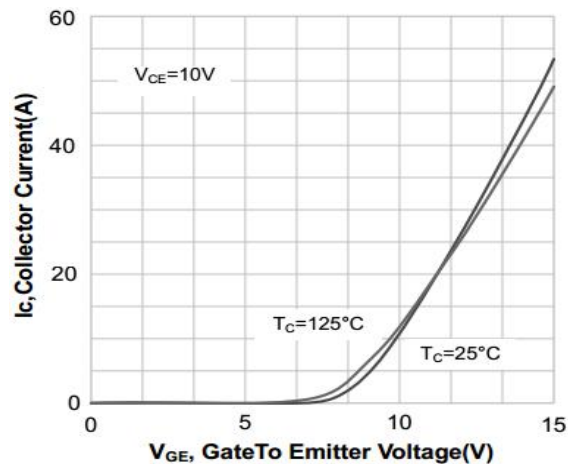




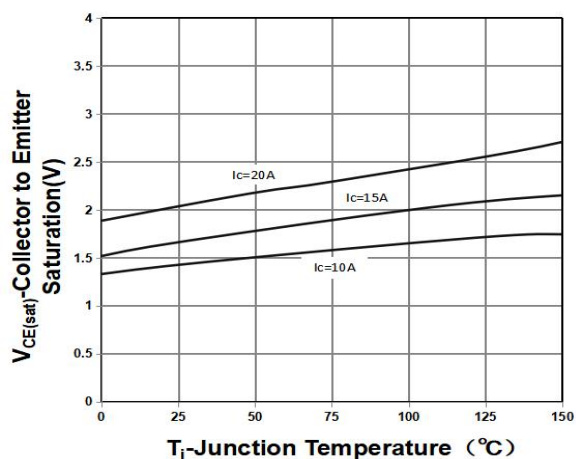
## ■ Characteristics Curves



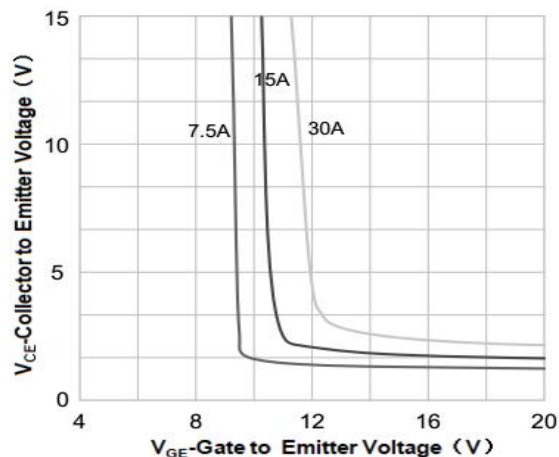
Output Characteristcs



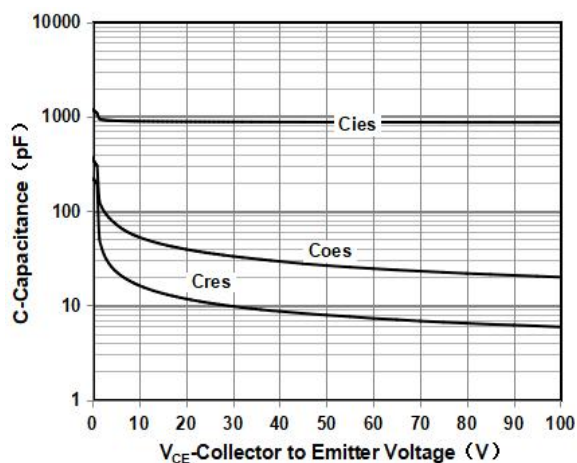
Transfer Characteristcs



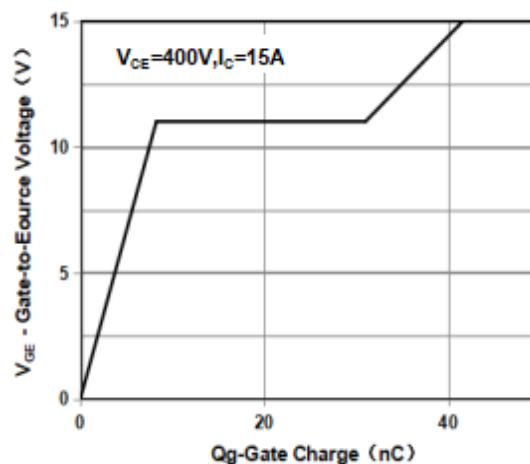
Typical collector-emitter saturation voltage as a function of junction temperature



Saturation Voltage vs.  $V_{GE}$

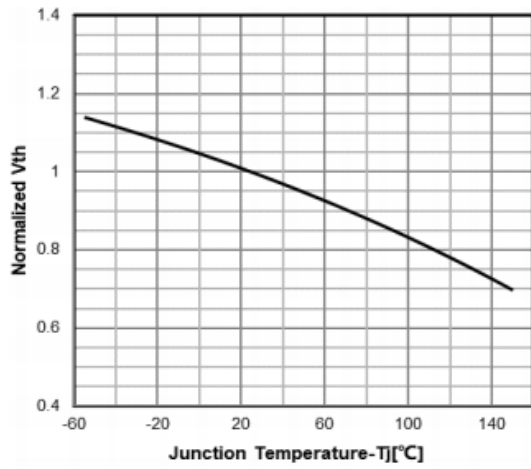


Capacitance

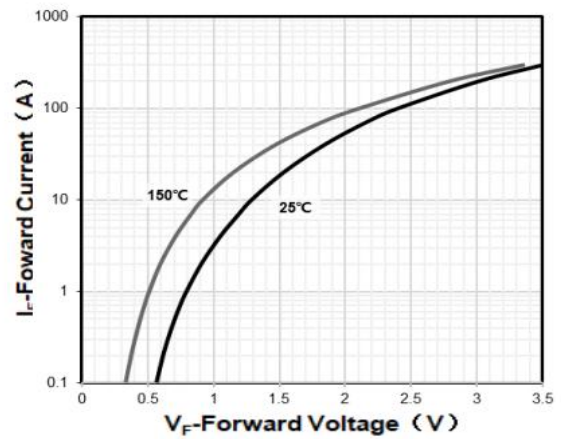


Typical gate charge





Gate-emitter threshold voltage as a function of junction temperature



Typ. diode forward current as a function of forward voltage

Note : The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.





■ TO-220 Package Dimensions

Unit: mm

| Symbol | Min   | Nom | Max   | Symbol | Min   | Nom  | Max   |
|--------|-------|-----|-------|--------|-------|------|-------|
| A      | 4.00  |     | 4.80  | e      | 2.44  | 2.54 | 2.64  |
| B      | 1.20  |     | 1.40  | F      | 1.10  |      | 1.40  |
| B1     | 1.00  |     | 1.40  | L      | 12.50 |      | 14.50 |
| b1     | 0.75  |     | 0.95  | L1     | 3.00  | 3.50 | 4.00  |
| c      | 0.40  |     | 0.55  | ΦP     | 3.70  | 3.80 | 3.90  |
| D      | 15.00 |     | 16.50 | Q      | 2.50  |      | 3.00  |
| D1     | 5.90  |     | 6.90  | Q1     | 2.00  |      | 2.90  |
| E      | 9.90  |     | 10.70 | Y      | 8.02  | 8.12 | 8.22  |

