# 650V 75A CoolFAST™ 7 technology IGBT

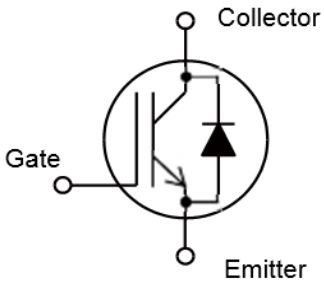
## Features:

- Low switching power loss
- Low switching surge and noise
- Advanced Fieldstop technology
- Low EMI
- Maximum junction temperature 175°C
- Qualified according to JEDEC for target applications
- Pb-free lead plating, halogen-free mold compound, RoHS compliant

G C E

## Applications:

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




## Key Performance and Package Parameters

| Type | $V_{CE}$ | $I_C$ | $V_{CEsat}$, $T_{vj}$=25°C | $T_{vjmax}$ | Marking | Package |
|---|---|---|---|---|---|---|
| EX75N65EF7 | 650V | 75A | 1.8V | 175°C | 75N65EF7 | TO247-3 |

## Maximum Ratings and Characteristics

## Absolute Maximum Ratings at $T_{vj}$= 25°C (unless otherwise specified)

| Items | Symbols | Value | Units |
|---|---|---|---|
| Collector-Emitter voltage | $V_{CES}$ | 650V | V |
| Gate-Emitter voltage | $V_{GES}$ | ±20 | V |
| DC Collector Current, limited by Tvjmax<br>Tc= 25°C<br>Tc= 100°C | $I_C$ | <br>115<br>75 | A |
| Pulsed Collector Current, tp limited by Tvjmax | $I_{CP}$ | 300 | A |
| Turn-Off Safe Operating Area<br>Vce≤ 650V, Tj≤ 175°C, tp=1μs | - | 300 | A |
| Diode Forward Current, limited by Tvjmax<br>Tc= 25°C<br>Tc= 100°C | $I_F$ | <br>115<br>75 | A |
| IGBT Max. Power Dissipation | $P_{D\_IGBT}$ | 420 | W |
| FWD Max. Power Dissipation | $P_{D\_FWD}$ | 375 | W |
| Operating Junction Temperature | $T_{vj}$ | -40 ~ +175 | °C |
| Storage Temperature | $T_{stg}$ | -55 ~ +175 | °C |

## Electrical characteristics at $T_{vj}$= 25°C (unless otherwise specified)

| Description | Symbols | Conditions | Characteristics | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| Collector-emitter breakdown voltage | $V_{(BR)CES}$ | $V_{GE}$=0V,$I_C$=0.50mA | 650V | - | - | V |
| Zero Gate Voltage Collector Current | $I_{CES}$ | $V_{CE}$= 650V, $V_{GE}$= 0V | - | - | 200 | μA |
| Gate-Emitter Leakage Current | $I_{GES}$ | $V_{CE}$= 0V, $V_{GE}$= ±20V | - | - | ±200 | nA |
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $V_{CE}$= $V_{GE}$, $I_C$= 250uA | 5.0 | 5.8 | 6.6 | V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE}$= 20V, $I_C$=75A<br>Tvj= 25°C<br>Tvj= 175°C | <br>-<br>- | <br>1.8<br>2.5 | <br>2.1<br> | V |
| Input Capacitance | $C_{ies}$ | $V_{CE}$= 25V, $V_{GE}$= 0V<br>f= 1MHz | - | 9600 | - | pF |
| Output Capacitance | $C_{oes}$ | | - | 310 | - | pF |
| Reverse Transfer Capacitance | $C_{res}$ | | - | 100 | - | pF |
| Gate Charge | $Q_G$ | $V_{CC}$= 520V,$I_C$= 75A, $V_{GE}$= 15V | - | 330 | - | nC |
| Forward Voltage Drop | $V_F$ | $I_F$= 75A<br>Tvj= 25°C<br>Tvj= 175°C | <br>-<br>- | <br>1.5<br>1.3 | <br>3.0<br> | V |

## Switching Characteristics at $T_{vj}$= 25°C

| Description | Symbols | Conditions | Characteristics | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| **IGBT Characteristics** | | | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CC}$= 400V<br>$I_C$= 75A<br>$V_{GE}$= 15V<br>$R_G$= 10Ω<br>Inductive load | - | 80 | - | ns |
| Rise Time | $t_r$ | | - | 33 | - | ns |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 150 | - | ns |
| Fall Time | $t_f$ | | - | 85 | - | ns |
| Turn-On Energy | $E_{on}$ | | - | 0.7 | - | mJ |
| Turn-Off Energy | $E_{off}$ | | - | 0.97 | - | mJ |
| Total switching energy | $E_{ts}$ | | - | 1.67 | - | mJ |
| **Diode Characteristics** | | | | | | |
| Diode Reverse Recovery Time | $t_{rr}$ | $V_{CC}$= 400V<br>$I_F$= 75A<br>$di_F/dt$= 500A/μs | - | 107 | - | ns |
| Diode Reverse Recovery Charge | $Q_{rr}$ | | - | 1.1 | - | μC |
| Diode peak reverse recovery current | Irrm | | - | 17.1 | - | A |

## Switching Characteristics $T_{vj}$= 175°C

| Description | Symbols | Conditions | Characteristics | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| **IGBT Characteristics** | | | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CC}$= 400V<br>$I_C$= 75A<br>$V_{GE}$= 15V<br>$R_G$= 10Ω<br>Inductive load | - | 74 | - | ns |
| Rise Time | $t_r$ | | - | 34 | - | ns |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 160 | - | ns |
| Fall Time | $t_f$ | | - | 110 | - | ns |
| Turn-On Energy | $E_{on}$ | | - | 1.17 | - | mJ |
| Turn-Off Energy | $E_{off}$ | | - | 1.30 | - | mJ |
| Total switching energy | $E_{ts}$ | | - | 2.47 | - | mJ |
| **Diode Characteristics** | | | | | | |
| Diode Reverse Recovery Time | $t_{rr}$ | $V_{CC}$= 400V<br>$I_F$= 75A<br>$di_F/dt$= 500A/μs | - | 194 | - | ns |
| Diode Reverse Recovery Charge | $Q_{rr}$ | | - | 5.2 | - | μC |
| Diode peak reverse recovery current | Irrm | | - | 49.3 | - | A |

## Thermal resistance

| Items | Symbols | Characteristics | | | Unit |
|---|---|---|---|---|---|
| | | Min | Typ | Max | |
| Thermal Resistance, Junction-Ambient | $R_{th(j-a)}$ | - | - | 50 | °C /W |
| Thermal Resistance, IGBT Junction to Case | $R_{th(j-c)}$ | - | - | 0.35 | |
| Thermal Resistance, Diodes Junction to Case | $R_{th(j-c)}$ | - | - | 0.4 | |

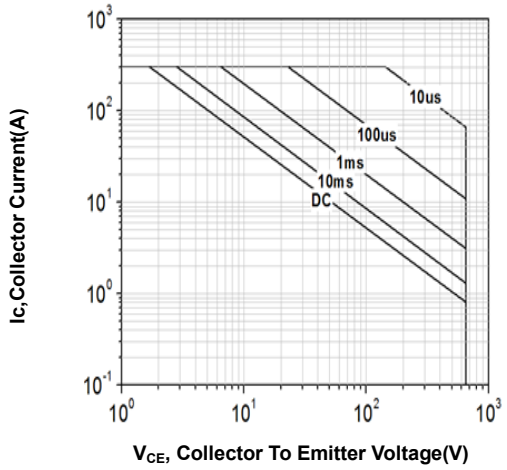



**Figure 1. Forward bias safe operating area**
(D=0, Tc=25℃, Tvj≤175℃; VGE=15V)

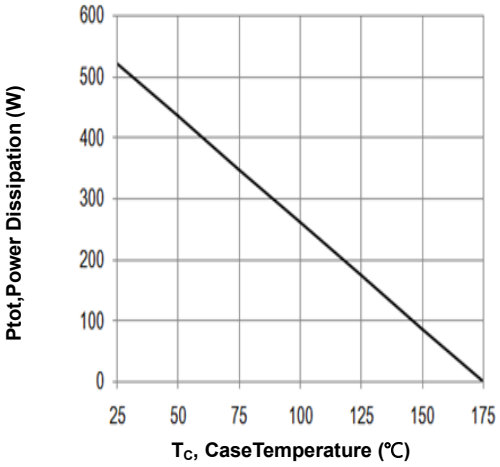



**Figure 2. Power dissipation vs. case temperature**
(Tvj≤175℃)

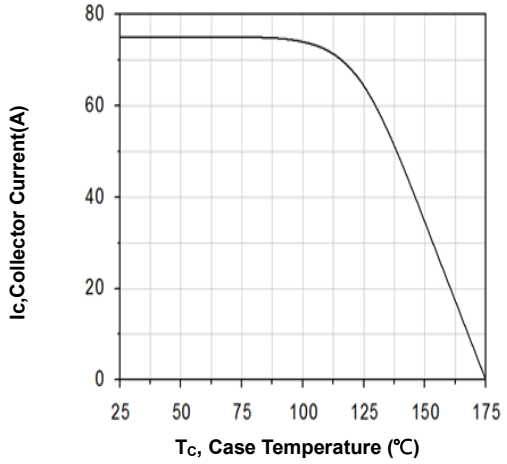



**Figure 3. Collector current vs. case temperature**
(VGE≤15V, Tvj≤175℃)

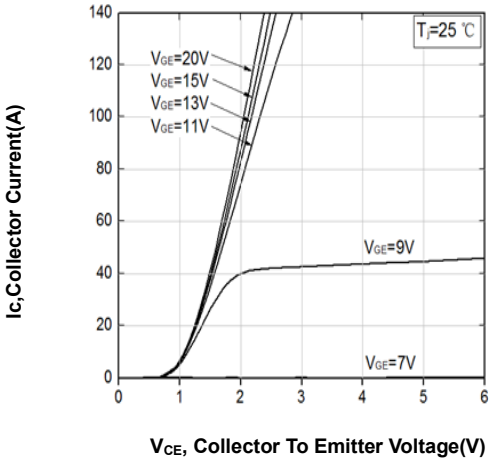



**Figure 4. Typical output characteristic**
(Tvj=25℃)

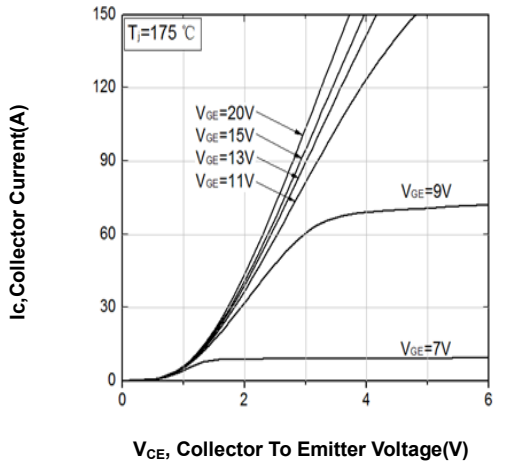



**Figure 5. Typical output characteristic**
(Tvj=175℃)

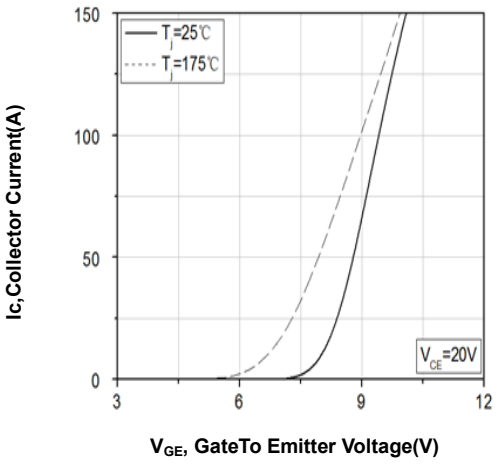



**Figure 6. Typical transfer characteristic**
(VCE=20V)

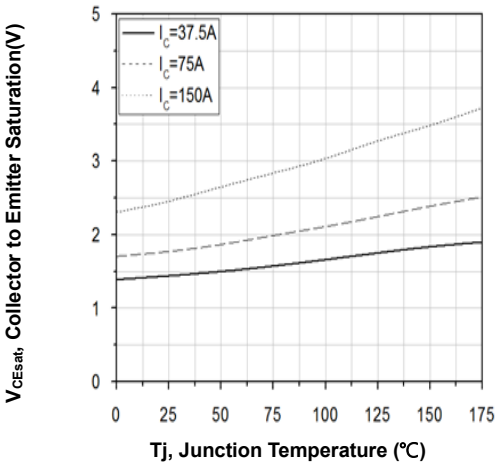



**Figure 7. Typical collector-emitter saturation voltage vs. Tvj**(VGE=20V)

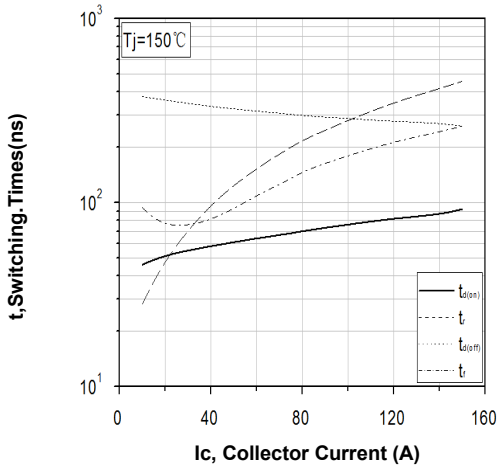



**Figure 8. Typical switching times vs. collector current** (Ind. load, Tvj=150℃, VCE=400V, VGE=15/0V, Rg=12Ω)

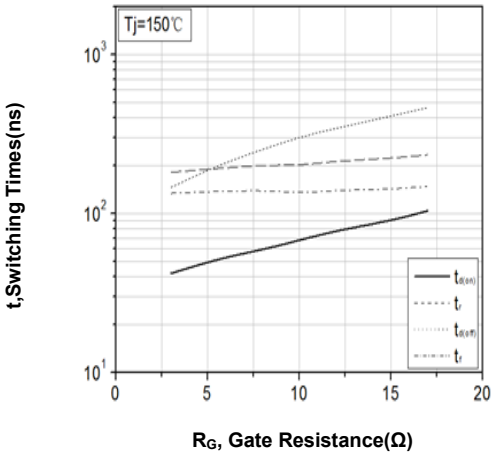



**Figure 9. Typical switching times vs. gate resistor**
(Ind. Load, Tvj=150℃, VCE=400V, VGE=15/0V, IC=75A)

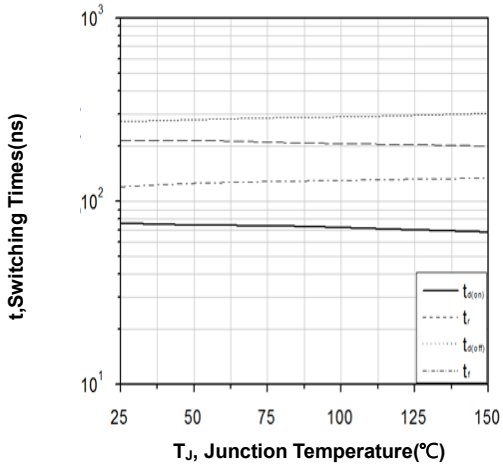



**Figure 10. Typical switching times vs. Tvj**
(Ind. Load, VCE=400V, VGE=15/0V, IC=75A, Rg=10Ω)

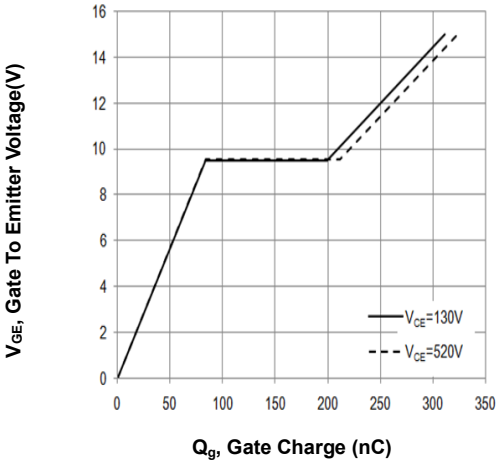



**Figure 11. Typical gate charge**
(IC=75A)

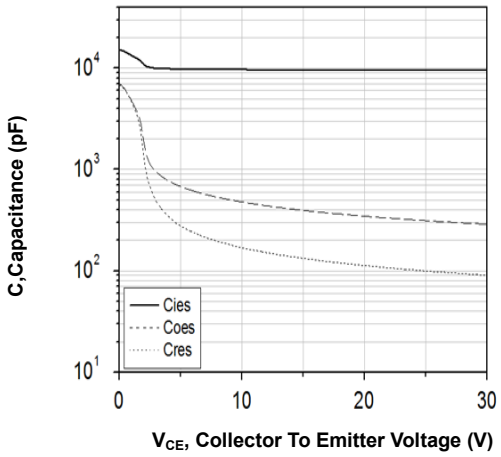



**Figure 12. Typical capacitance vs. collector-emitter voltage** (VGE=0V, f=1MHz)

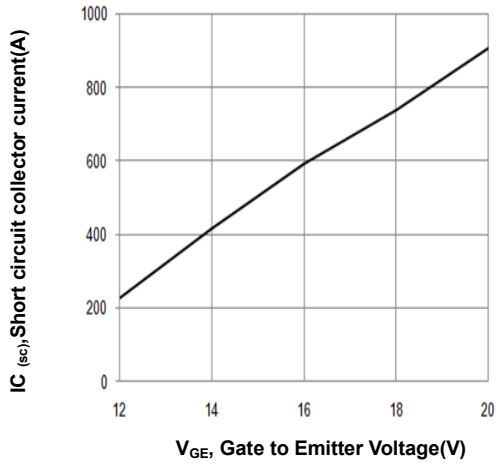



**Figure 13. Typical short circuit collector current vs. gate-emitter voltage** (VCE≤400V start at Tvj=25℃)

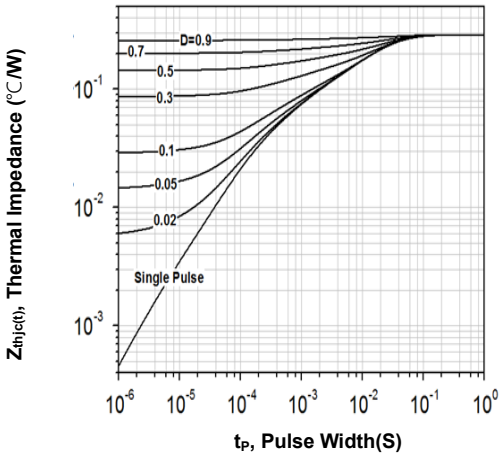



**Figure 14. IGBT transient thermal impedance** (D=tp/T)

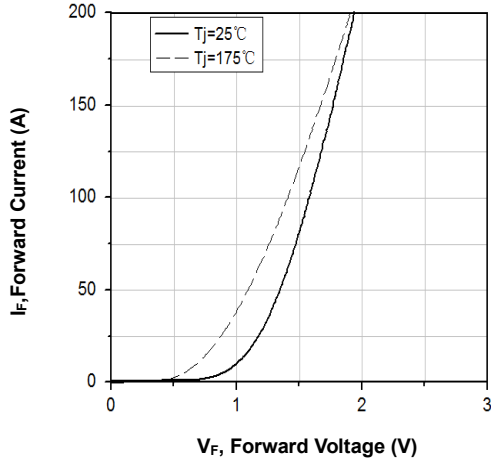



**Figure 15. Typical diode forward current vs. forward voltage**

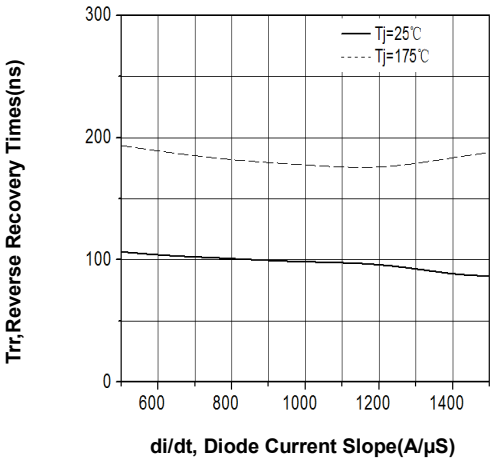



**Figure 16. Typical reverse recovery time vs. diode current slope** (VR=400V)

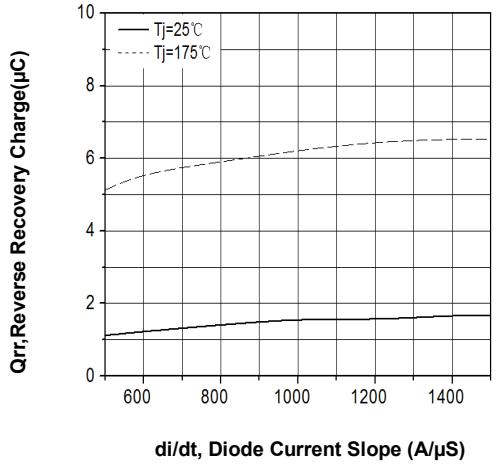



**Figure 17. Typical reverse recovery charge vs. diode current slope** (VR=400V)

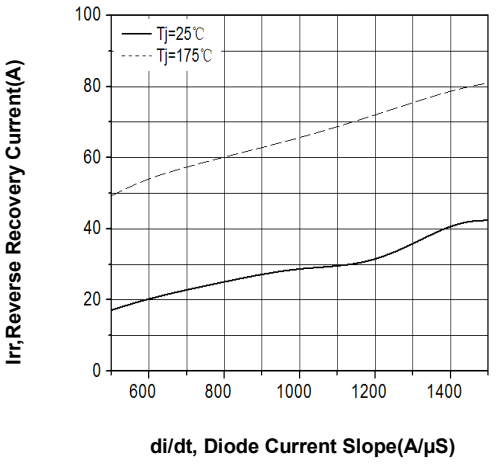
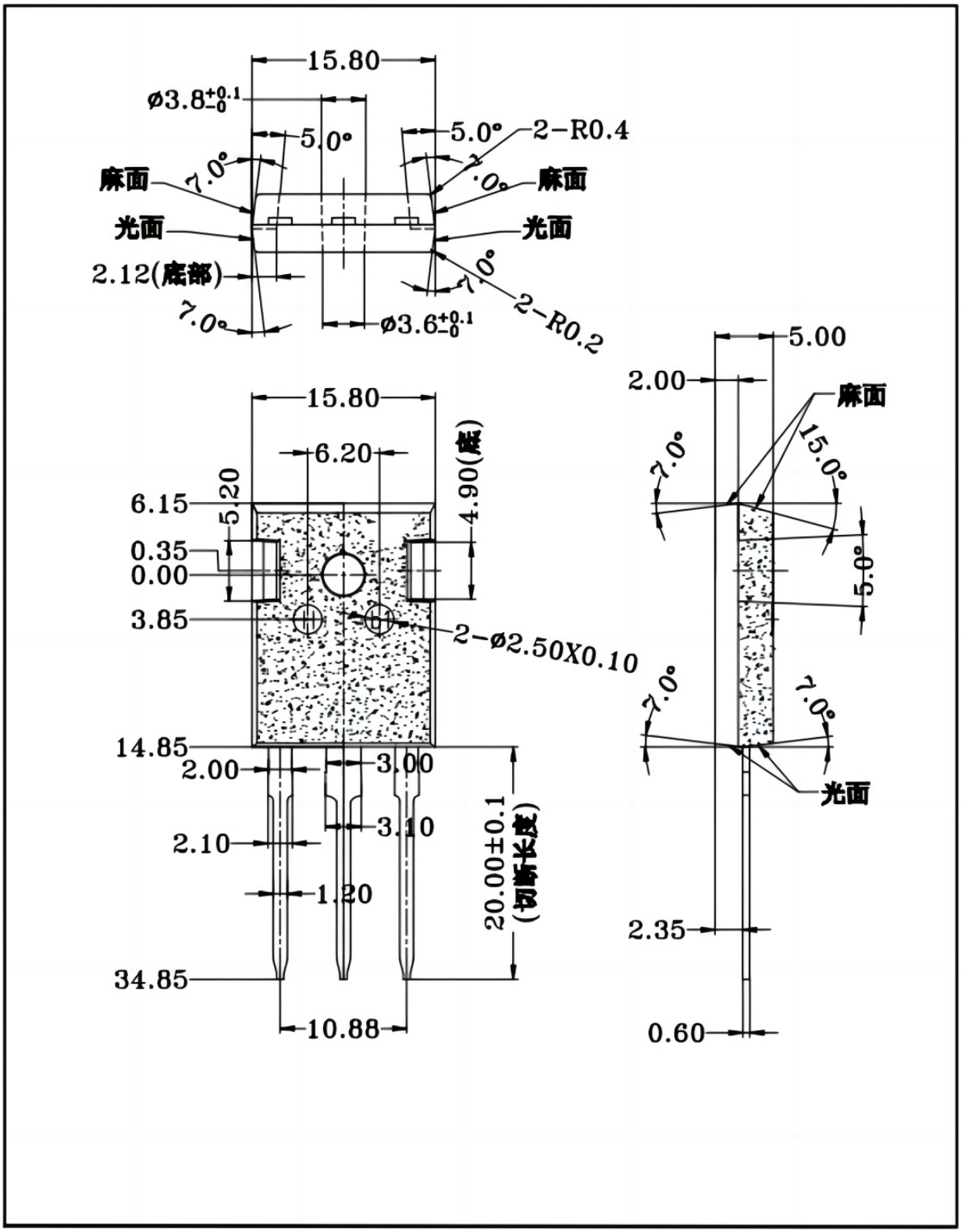



**Figure 18. Typical reverse recovery current vs. diode current slope** (VR=400V)

## TO247-3 PackageOutline



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