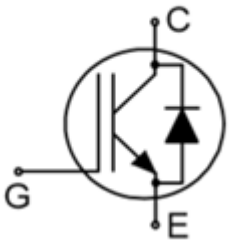
# Trench Field-Stop Technology IGBT




## Features

- 1200V, 40A
- $V_{CE(sat)(typ.)}$ =2.25V@$V_{GE}$=15V, $I_C$=40A
- Low Switching Losses
- $V_{CE(sat)}$ with Positive Temperature Coefficient
- Pb-free Lead Plating; RoHS Compliant

## Applications

- Uninterrupted Power Supply
- Motor Drives

| Order codes | $V_{CE}$ | $I_C$ | $V_{CEsat}$, $T_{vj}$=25℃ | $T_{vjmax}$ | Marking | Package |
|---|---|---|---|---|---|---|
| XD040H120AT2S3 | 1200V | 40A | 2.25V | 150℃ | D40H120AT2 | TO247-3 |

## Absolute Maximum Ratings

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | 1200 | V |
| $V_{GES}$ | Gate-Emitter Voltage | ±20 | V |
| $I_C$ | Continuous Collector Current ($T_C$=25℃) | 40 | A |
| | Continuous Collector Current ($T_C$=100℃) | 20 | A |
| $I_{CRM}$ | Repetitive peak collector current | 80 | A |
| $I_F$ | Diode Continuous Forward Current ($T_C$=25℃) | 40 | A |
| | Diode Continuous Forward Current ($T_C$=100℃) | 20 | A |
| $I_{FM}$ | Diode Maximum Forward Current (Note 1) | 80 | A |
| $R_{Gint}$ | Internal Gate Resistor | 3.5 | Ω |
| $t_{sc}$ | Short Circuit Withstand Time | 10 | us |
| $P_{tot}$ | Total Power Dissipation ($T_C$=25℃) | 577 | W |
| $T_J$ | Operating Junction Temperature Range | -40 to 175 | ℃ |
| $T_{STG}$ | Storage Temperature Range | -40 to 125 | ℃ |

## Thermal Data

| Symbol | Parameter | Max. | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case for IGBT | 0.26 | ℃/W |

## Electrical Characteristics ($T_C$=25℃ unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{CES}$ | Collector-Emitter Breakdown Voltage | $V_{GE}$=0V, $I_C$=500uA | 1200 | --- | --- | V |
| $I_{CES}$ | Collector-Emitter Leakage Current | $V_{CE}$=1200V, $V_{GE}$=0V | --- | --- | 1 | mA |
| $I_{GES}$ | Gate Leakage Current, Forward | $V_{GE}$=20V, $V_{CE}$=0V | --- | --- | 450 | nA |
| | Gate Leakage Current, Reverse | $V_{GE}$=-20V, $V_{CE}$=0V | --- | --- | -450 | nA |
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{GE}$=$V_{CE}$, $I_C$=1mA | 6.1 | 6.6 | 7.3 | V |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE}$=15V, $I_C$=40A | --- | 2.25 | --- | V |
| $Q_G$ | Total Gate Charge | $V_{GE}$=15V | --- | 285 | --- | nC |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CC}$=600V<br>$V_{GE}$=±15V<br>$I_C$=40A<br>$R_G$=4.7Ω<br>Inductive Load<br>$T_C$=25℃ | --- | 73 | --- | ns |
| $t_r$ | Turn-on Rise Time | | --- | 175 | --- | ns |
| $t_{d(off)}$ | Turn-off Delay Time | | --- | 53.5 | --- | ns |
| $t_f$ | Turn-off Fall Time | | --- | 113.5 | --- | ns |
| $E_{on}$ | Turn-on Switching Loss | | --- | 4.82 | --- | mJ |
| $E_{off}$ | Turn-off Switching Loss | | --- | 1.85 | --- | mJ |
| $E_{ts}$ | Total Switching Loss | | --- | 4.00 | --- | mJ |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=25V<br>$V_{GE}$=0V<br>f =1MHz | --- | 2.7 | --- | nF |
| $C_{oes}$ | Output Capacitance | | --- | 0.18 | --- | nF |
| $C_{res}$ | Reverse Transfer Capacitance | | --- | 0.12 | --- | nF |
| $I_{SC}$ | SC data | $V_{GE}$≤15V，$V_{CC}$=800V<br>$V_{CEmax}$=$V_{CES}$-$L_{sCE}$ • di/dt<br>Tp≤10uS | --- | 108 | --- | A |

## Diode Characteristics ( $T_C$=25℃ unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_F$ | Diode Forward Voltage | $I_F$=40A | --- | 1.84 | --- | V |
| $I_{RM}$ | Peak reverse recovery current | $V_R$=600V<br>$I_F$=40A<br>$V_{GE}$=-15V | --- | 17.6 | --- | A |
| $Q_r$ | Recovered charge | | --- | 3.7 | --- | uC |
| $E_{rec}$ | Reverse recovery energy | | --- | 1.37 | --- | mJ |

## Typical Characteristics

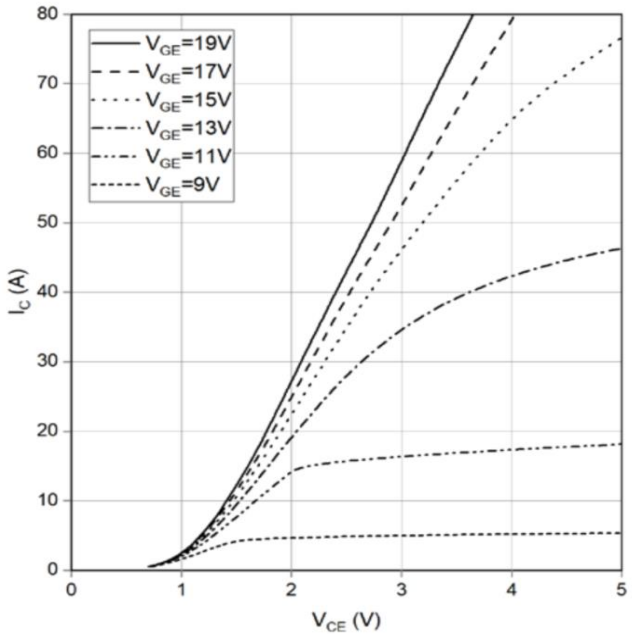



**Fig. 1 Typical IGBT Output Characteristics at $T_J$=150℃**

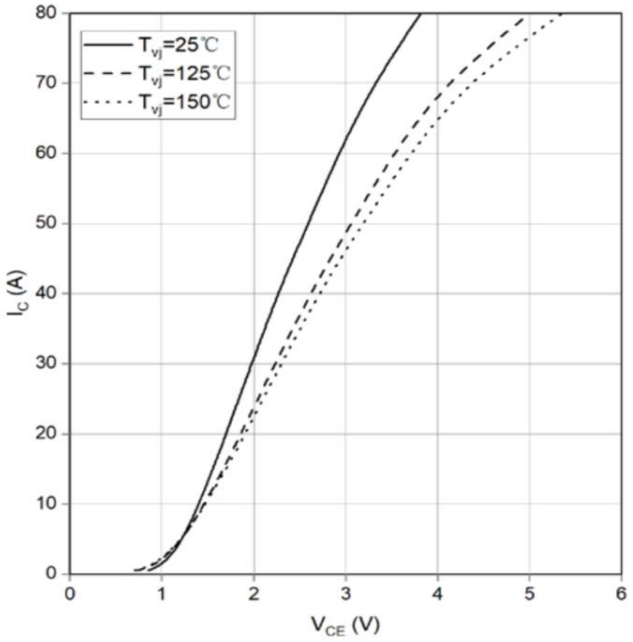



**Fig. 2 Typical Transfer Characteristics at $V_{GE}$=15V**

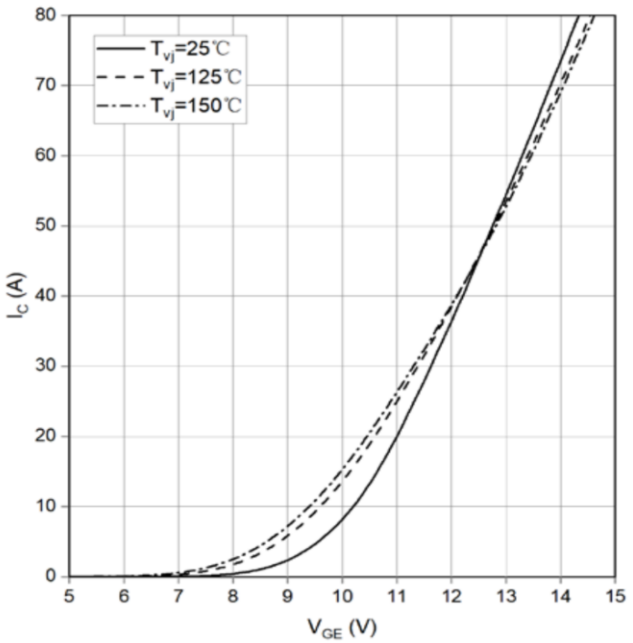



**Fig. 3 Typical Transfer Characteristics at $V_{CE}$=15V**

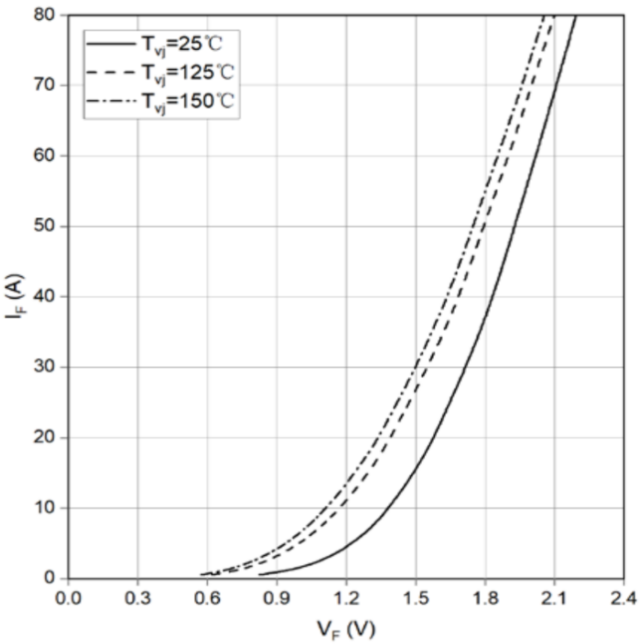



**Fig. 4 Forward characteristic of Diode-Inverter**

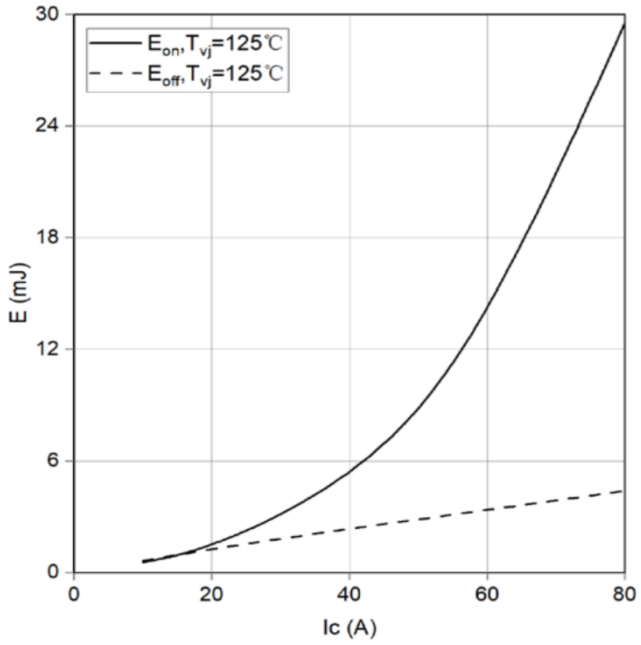



**Fig. 5 Typical Energy Loss vs. Ic at $T_C$=25℃, $V_{CE}$=600V, $V_{GE}$=15V, Rg=4.7Ω**

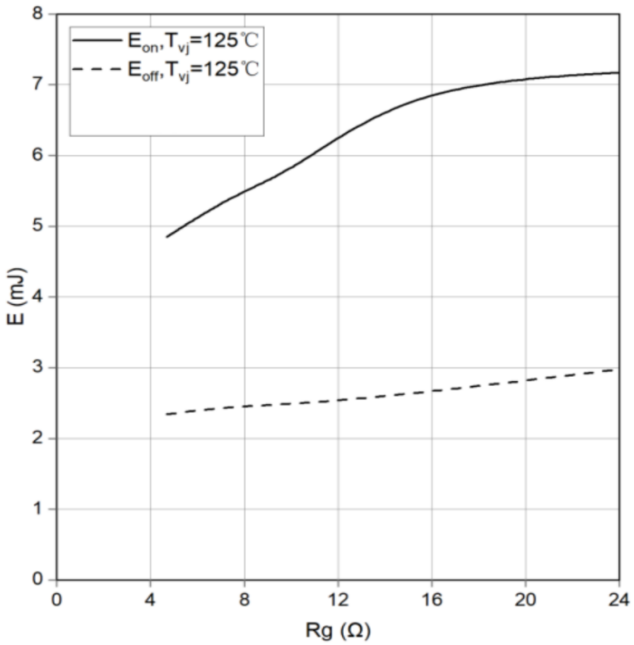



**Fig. 6 Typical Switching Time vs. Rg at $T_C$=25℃, $V_{CE}$=600V, $V_{GE}$=15V, $I_C$=40A**

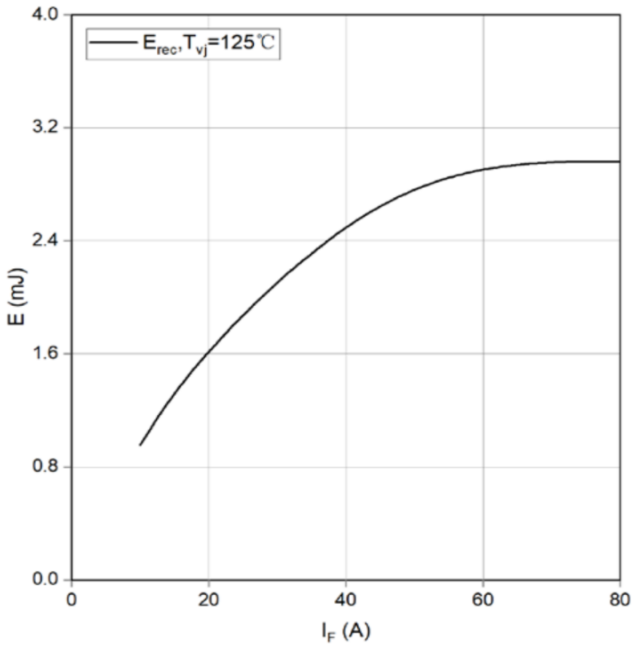



**Fig. 7 Typical Diode Energy Loss vs. Ic at $V_{CC}$=600V and Rg=4.7Ω**

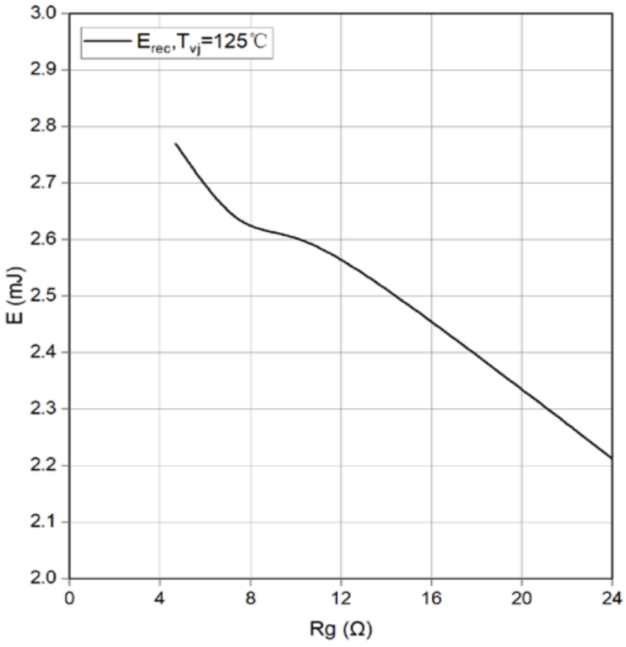
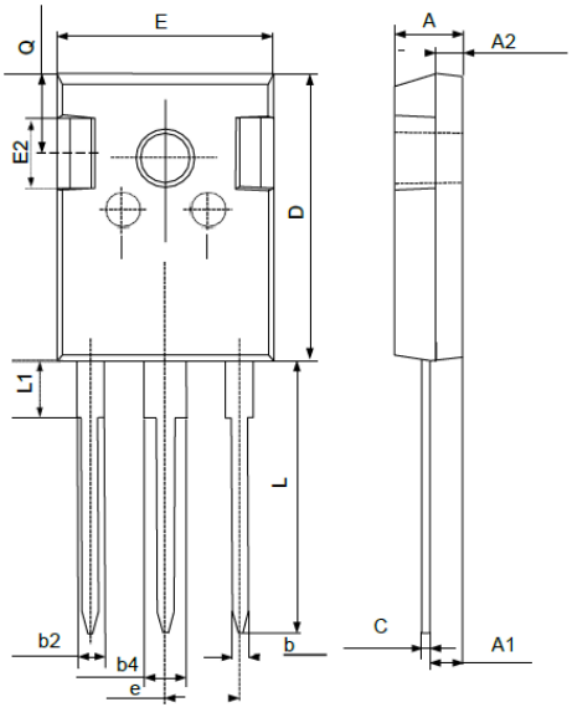



**Fig. 8 Typical Diode Energy Loss vs. Rg at $V_{CC}$=600V and $I_F$=40A**

## Package Information

TO-247




| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 4.80 | 5.00 | 5.20 |
| A1 | 2.21 | 2.41 | 2.59 |
| A2 | 1.85 | 2.00 | 2.15 |
| b | 1.11 | --- | 1.36 |
| b2 | 1.91 | --- | 2.25 |
| b4 | 2.91 | --- | 3.25 |
| c | 0.51 | --- | 0.75 |
| D | 20.80 | 21.00 | 21.30 |
| E | 15.50 | 15.80 | 16.10 |
| E2 | 4.40 | 5.00 | 5.20 |
| e | | 5.44 BSC | |
| L | 19.72 | 19.92 | 20.22 |
| L1 | --- | --- | 4.30 |
| Q | 5.60 | 5.80 | 6.00 |