

## Silicon Field Stop(FS) Planar IGBT

### Description

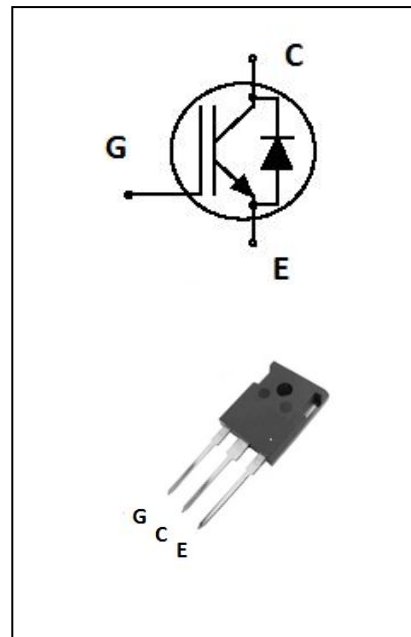
The THG40N120FQK is use advanced field stop(FS) technology. The 1200V FS IGBT offers superior conduction and switching performances.

### General Features

- 1200V Breakdown Voltage
- Low saturation voltage:  $V_{CE(sat)}$ , typ=2.0V  
@  $I_C=40A$  and  $T_C=25^\circ C$
- FS Planar Technology, Positive temperature coefficient
- High speed switch & Low power loss

### Application

- Solar Converters
- Welding Converters
- UPS



### Electrical Characteristics @ $T_C=25^\circ C$ (unless otherwise specified)

#### a) Limited Parameters:

| Symbol    | Parameter                                            | Value       | Units      |
|-----------|------------------------------------------------------|-------------|------------|
| $V_{CES}$ | Collector-Emitter Voltage                            | 1200        | V          |
| $V_{GES}$ | Gate-Emitter Voltage                                 | +/-30       | V          |
| $I_C$     | Collector Current                                    | 65          | A          |
|           | Collector Current @ $T_C=100^\circ C$                | 40          | A          |
| $I_{CM}$  | Pulsed Collector Current                             | 130         | A          |
| $I_F$     | Diode Continuous Forward Current @ $T_C=100^\circ C$ | 20          | A          |
| $I_{FM}$  | Diode Maximum Forward Current                        | 100         | A          |
| $P_D$     | Total Dissipation at                                 | 280         | W          |
|           | Total Dissipation at @ $T_C=100^\circ C$             | 110         |            |
|           | Total Dissipation at @ $T_a=25^\circ C$              | 3.125       |            |
| $T_j$     | Operating Junction and Storage Temperature Range     | -55 to +175 | $^\circ C$ |
| $T_L$     | Max Temperature For Soldering                        | 270         | $^\circ C$ |

**b) Electrical Parameters:**

| Symbol        | Parameter                            | Test Conditions                             | Min  | Typ  | Max  | Unit    |
|---------------|--------------------------------------|---------------------------------------------|------|------|------|---------|
| $V_{CES}$     | Collector-Emitter Voltage            | $V_{GE}=0V, I_{CE}=250\mu A$                | 1200 |      |      | V       |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE}=15V, I_C=40A$                       |      | 2.0  | 2.5  | V       |
| $V_{GE(th)}$  | Gated Threshold Voltage              | $V_{CE}=V_{GE}, I_C=1mA$                    | 4.8  | 5.3  | 6.0  | V       |
| $I_{CES}$     | Collector-Emitter Leakage Current    | $V_{GE}=0V, V_{CE}=1200V$                   |      |      | 20   | $\mu A$ |
| $I_{GES(F)}$  | Gate to Emitter Forward Leakage      | $V_{GE}=+30V,$                              |      |      | 800  | nA      |
| $I_{GES(R)}$  | Gate to Emitter Reverse Leakage      | $V_{GE}=-30V,$                              |      |      | -800 | nA      |
| $C_{ies}$     | Input Capacitance                    | $V_{GE}=0V,$<br>$V_{CE}=25V,$<br>$f=1.0MHz$ |      | 3750 |      | nF      |
| $C_{oes}$     | Output Capacitance                   |                                             |      | 200  |      | pF      |
| $C_{res}$     | Reverse Transfer Capacitance         |                                             |      | 51   |      | pF      |
| $Q_g$         | Total Gate Charge                    | $V_{CE}=600V, I_C=40A, V_{GE}=15V$          |      | 220  |      | nC      |

| Symbol       | Parameter           | Test Conditions                                      | Min | Typ | Max | Unit |
|--------------|---------------------|------------------------------------------------------|-----|-----|-----|------|
| $t_{d(on)}$  | Turn-on Delay Time  | $V_{CE}=600V, I_C=40A$<br>$V_{GE}=15V, R_G=10\Omega$ |     | 60  |     | nS   |
| $t_r$        | Rise Time           |                                                      |     | 140 |     | nS   |
| $t_{d(off)}$ | Turn-off Delay Time |                                                      |     | 320 |     | nS   |
| $t_f$        | Fall Time           |                                                      |     | 251 |     | nS   |

| Symbol                                             | Parameter                        | Test Conditions                                             | Min | Typ  | Max  | Unit |
|----------------------------------------------------|----------------------------------|-------------------------------------------------------------|-----|------|------|------|
| I <sub>F</sub>                                     | Diode Continuous Forward Current | TC=100°C                                                    |     | 40   |      | A    |
| I <sub>FM</sub>                                    | Diode Maximum Forward Current    | TC=100°C                                                    |     | 200  |      | A    |
| V <sub>F</sub>                                     | Diode Forward Voltage            | I <sub>F</sub> =20A                                         |     | 1.75 | 2.15 | V    |
| t <sub>rr</sub>                                    | Reverse Recovery Time            | T <sub>J</sub> =25 °C ,I <sub>F</sub> =20A<br>di/dt=200A/us |     | 95   |      | nS   |
| Q <sub>rr</sub>                                    | Reverse Recovery Charge          |                                                             |     | 1.1  |      | uC   |
| *Pulse Test: Pulse Width <= 300μs, Duty Cycle< =2% |                                  |                                                             |     |      |      |      |

| Symbol          | Parameter                                      | Typ | MAX   | Units        |
|-----------------|------------------------------------------------|-----|-------|--------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to case for IGBT  | --  | 0.446 | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction to case for Diode | --  | 1.25  | $^\circ C/W$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient        | --  | 40    | $^\circ C/W$ |

## Typical Performance Characteristics

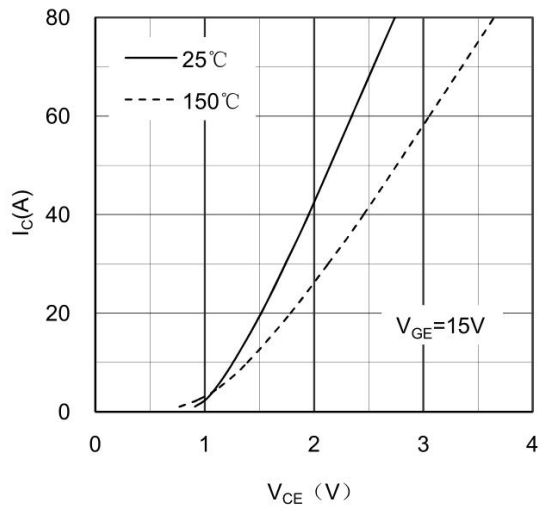


Figure 1. Typical Output Characteristics IGBT

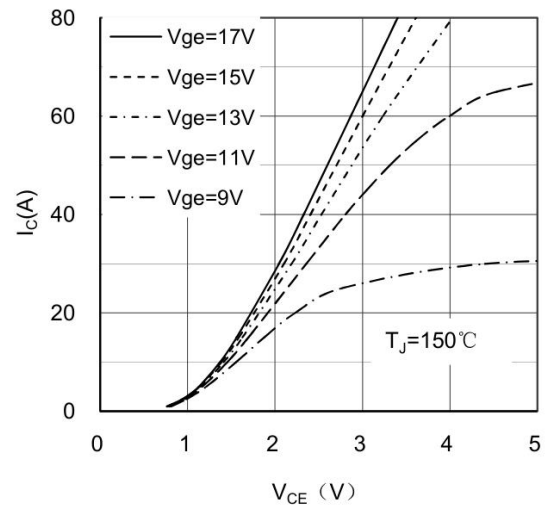


Figure 2. Typical Output Characteristics IGBT

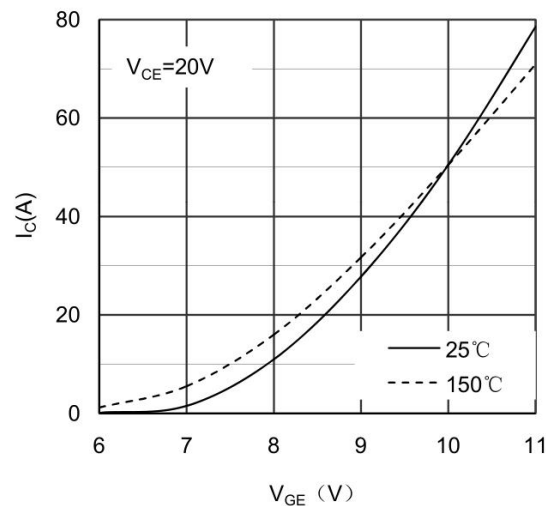


Figure 3. Typical Transfer characteristics IGBT

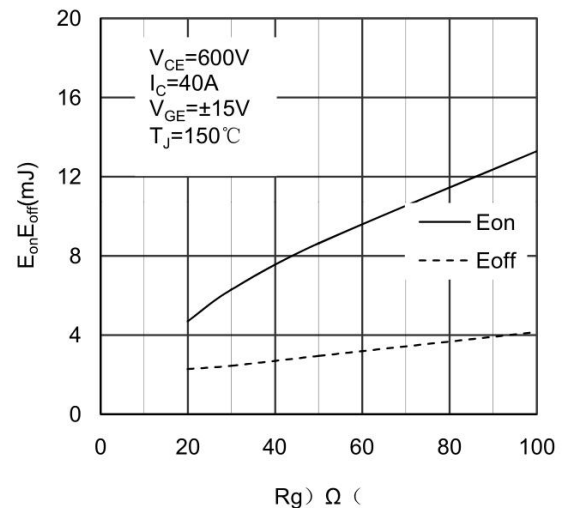


Figure 4. Switching Energy vs Gate Resistor IGBT

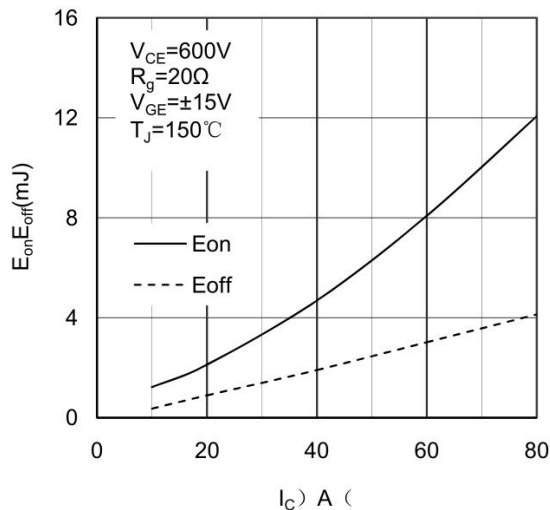


Figure 5. Switching Energy vs Collector Current IGBT

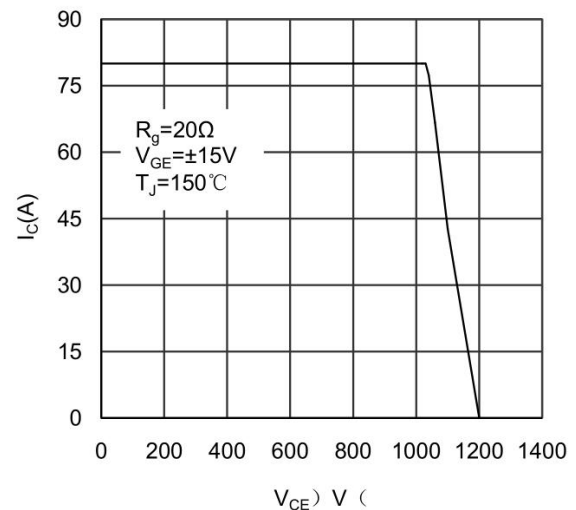


Figure 6. Reverse Biased Safe Operating Area IGBT

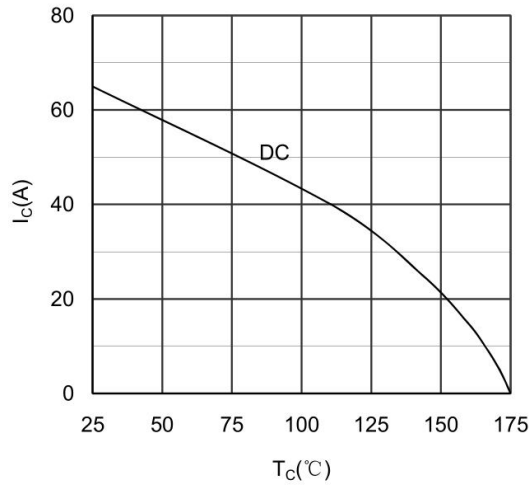


Figure 7. Collector Current vs Case temperature IGBT

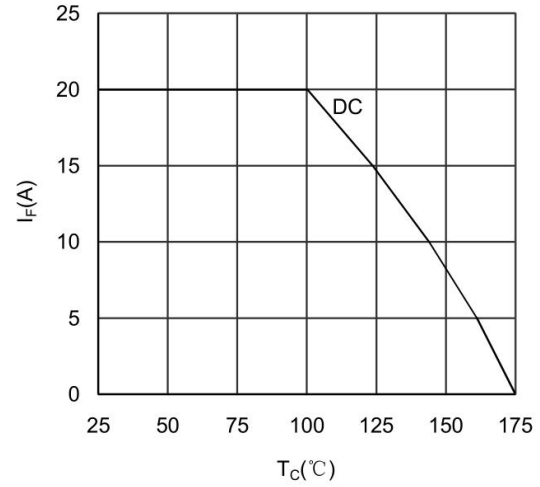


Figure 8. Forward current vs Case temperature Diode

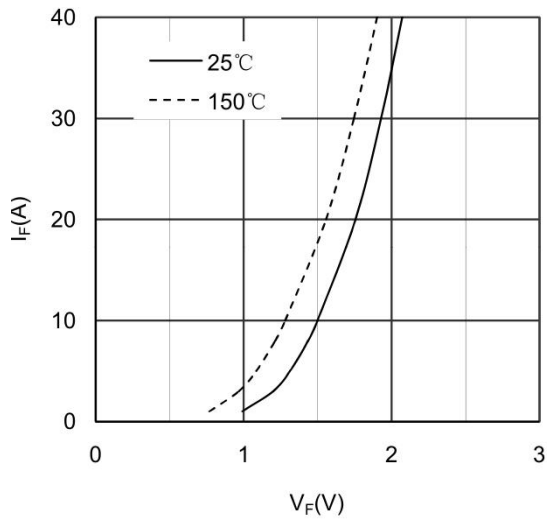


Figure 9. Diode Forward Characteristics Diode

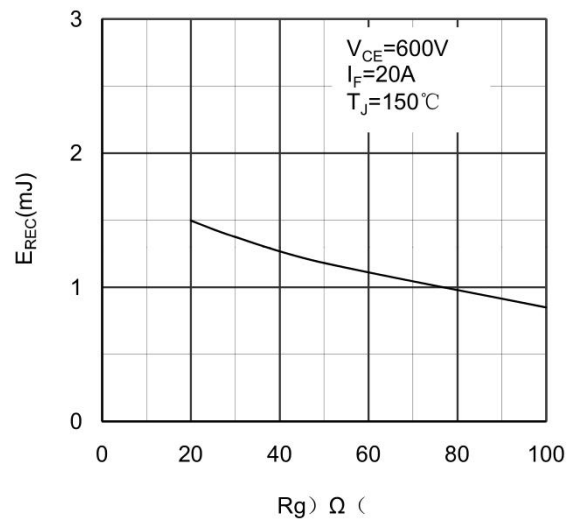


Figure 10. Switching Energy vs Gate Resistor Diode

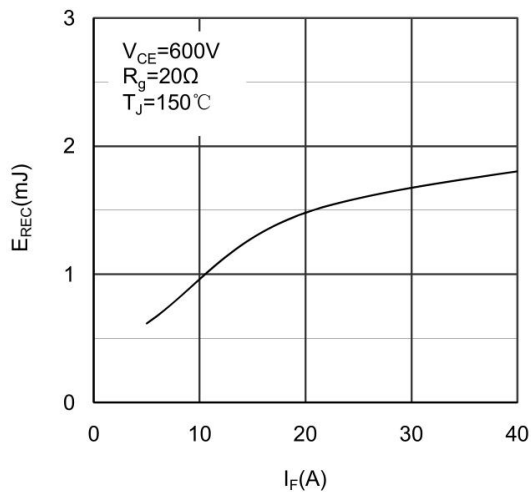


Figure 11. Switching Energy vs Forward Current Diode

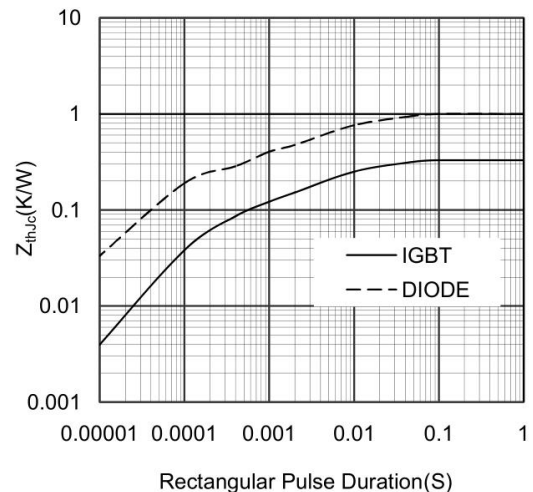
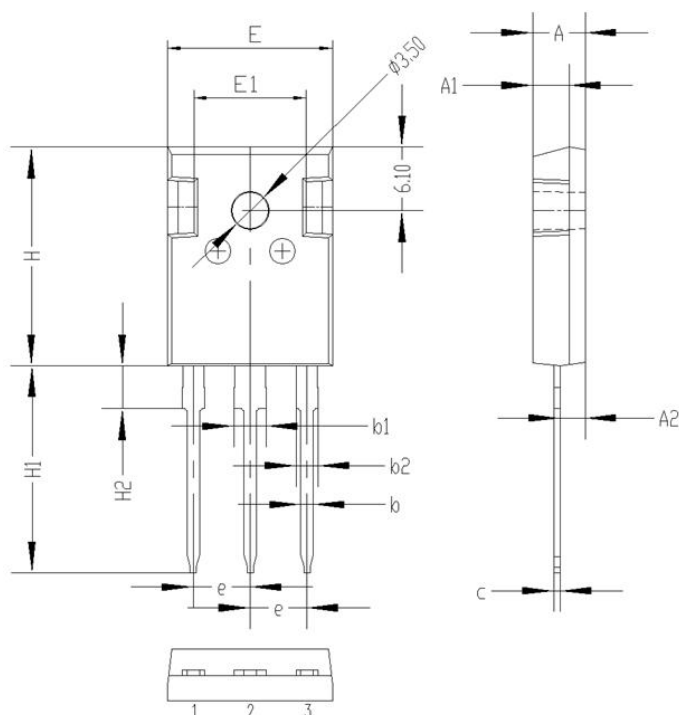


Figure 12. Transient Thermal Impedance of Diode and IGBT

## Package Information

### TO-247 PACKAGE



| Symbol   | Dimensions(millimeters) |       |
|----------|-------------------------|-------|
|          | Min.                    | Max.  |
| A        | 4.80                    | 5.20  |
| A1       | 3.30                    | 3.70  |
| A2       | 2.10                    | 2.50  |
| b        | 1.00                    | 1.40  |
| b1       | 2.90                    | 3.30  |
| b2       | 1.90                    | 2.30  |
| c        | 0.40                    | 0.80  |
| e        | 5.25                    | 5.65  |
| E        | 15.6                    | 16.0  |
| E1       | 10.6                    | 11.00 |
| H        | 20.8                    | 21.2  |
| H1       | 19.4                    | 20.4  |
| H2       | 3.90                    | 4.30  |
| G        | 5.90                    | 6.30  |
| $\Phi P$ | 3.30                    | 3.70  |

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