

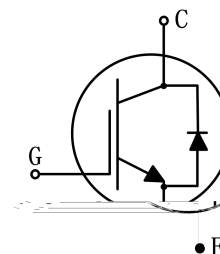
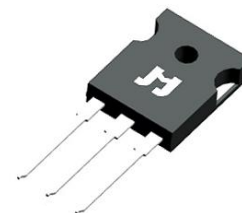
## 1200V 40A Trench and Field Stop IGBT

JJT40N120HE

- $V_{CE}=1200V$
- $I_C=40A@T_C=100$
- $V_{CE(sat)}=1.9V$

TO-247

- Trench and field-stop technology
- High speed switching
- Low collector to emitter saturation voltage
- Easy parallel switching capability
- High ruggedness performance
- RoHS compliant



- Welding machines
- UPS
- Solar inverters

| Type        | Marking  | Package | Packaging Method |
|-------------|----------|---------|------------------|
| JJT40N120HE | T40120HE | TO-247  | Tube             |



| $V_{CES}$ | Collector-emitter voltage                                    | 1200        | V |
|-----------|--------------------------------------------------------------|-------------|---|
| $V_{GES}$ | Gate-emitter voltage                                         | $\pm 20$    | V |
| $I_C$     | Continuous collector current ( $T_C=25^\circ\text{C}$ )      | 80          | A |
|           | Continuous collector current ( $T_C=100^\circ\text{C}$ )     | 40          | A |
| $I_{CM}$  | Pulsed collector current, $t_p$ limited by $T_{vjmax}$       | 160         | A |
| $I_F$     | Diode continuous forward current ( $T_C=100^\circ\text{C}$ ) | 40          | A |
| $I_{FM}$  | Diode maximum current, $t_p$ limited by $T_{vjmax}$          | 160         | A |
| $P_{tot}$ | Power dissipation ( $T_C=25^\circ\text{C}$ )                 | 395         | W |
|           | Power dissipation ( $T_C=100^\circ\text{C}$ )                | 197         | W |
| $T_{vj}$  | Operating junction temperature range                         | -40 to +175 |   |
| $T_{stg}$ | Storage temperature range                                    | -55 to +150 |   |

| $R_{th(j-c)}$ | Thermal resistance, junction to case for IGBT  | - | 0.38 | K/ W |
|---------------|------------------------------------------------|---|------|------|
| $R_{th(j-c)}$ | Thermal resistance, junction to case for Diode | - | 0.65 | K/ W |
| $R_{th(j-a)}$ | Thermal resistance, junction to ambient        | - | 40   | K/ W |



( $T_{vj}=25$  unless otherwise specified)

## Static characteristics

| $BV_{CES}$    | Collector-emitter breakdown voltage  | $V_{GE}=0V, I_C=250\text{ A}$     | 1200 | -   | -    | V  |
|---------------|--------------------------------------|-----------------------------------|------|-----|------|----|
| $I_{CES}$     | Collector-emitter leakage current    | $V_{CE}=1200V, V_{GE}=0V$         | -    | -   | 100  | A  |
| $I_{GES}$     | Gate leakage current, forward        | $V_{GE}=20V, V_{CE}=0V$           | -    | -   | 100  | nA |
|               | Gate leakage current, reverse        | $V_{GE}=-20V, V_{CE}=0V$          | -    | -   | -100 | nA |
| $V_{GE(th)}$  | Gate-emitter threshold voltage       | $V_{GE}=V_{CE}, I_C=1mA$          | 5.0  | 6.0 | 7.0  | V  |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_{GE}=15\text{ V}, I_C=40A$     | -    | 1.9 | -    | V  |
|               |                                      | $V_{GE}=15V, I_C=40A, T_{vj}=175$ | -    | 2.2 | -    | V  |

## Dynamic characteristics

| $C_{ies}$ | Input capacitance            | $V_{CE}=30V$<br>$V_{GE}=0V$<br>$f=1MHz$    | - | 9900 | - | pF |
|-----------|------------------------------|--------------------------------------------|---|------|---|----|
| $C_{oes}$ | Output capacitance           |                                            | - | 189  | - | pF |
| $C_{res}$ | Reverse transfer capacitance |                                            | - | 40   | - | pF |
| $Q_g$     | Total gate charge            | $V_{CC}=960V$<br>$V_{GE}=15V$<br>$I_C=40A$ | - | 263  | - | nC |



## Switching characteristics

| $t_{d(on)}$  | Turn-on delay time     | $V_{CC}=600V$<br>$V_{GE}=0/15V$<br>$I_C=40A$<br>$R_G=10\Omega$<br>Inductive load                 | - | 85  | - | ns |
|--------------|------------------------|--------------------------------------------------------------------------------------------------|---|-----|---|----|
| $t_r$        | Rise time              |                                                                                                  | - | 76  | - | ns |
| $t_{d(off)}$ | Turn-off delay time    |                                                                                                  | - | 307 | - | ns |
| $t_f$        | Fall time              |                                                                                                  | - | 69  | - | ns |
| $E_{on}$     | Turn-on energy         |                                                                                                  | - | 2.5 | - | mJ |
| $E_{off}$    | Turn-off energy        |                                                                                                  | - | 1.4 | - | mJ |
| $E_{ts}$     | Total switching energy |                                                                                                  | - | 3.9 | - | mJ |
| $t_{d(on)}$  | Turn-on delay time     | $V_{CC}=600V$<br>$V_{GE}=0/15V$<br>$I_C=40A$<br>$R_G=10\Omega$<br>Inductive load<br>$T_{vj}=175$ | - | 76  | - | ns |
| $t_r$        | Rise time              |                                                                                                  | - | 75  | - | ns |
| $t_{d(off)}$ | Turn-off delay time    |                                                                                                  | - | 360 | - | ns |
| $t_f$        | Fall time              |                                                                                                  | - | 149 | - | ns |
| $E_{on}$     | Turn-on energy         |                                                                                                  | - | 2.9 | - | mJ |
| $E_{off}$    | Turn-off energy        |                                                                                                  | - | 2.6 | - | mJ |
| $E_{ts}$     | Total switching energy |                                                                                                  | - | 5.5 | - | mJ |



( $T_{vj}=25$  unless otherwise specified)

| $V_F$     | Diode forward voltage               | $I_F=40A$                                                   | - | 2.0  | - | V  |
|-----------|-------------------------------------|-------------------------------------------------------------|---|------|---|----|
|           |                                     | $I_F=40A \quad T_{vj}=175$                                  | - | 1.6  | - | V  |
| $t_{rr}$  | Diode reverse recovery time         | $V_R=600V$<br>$I_F=40A$<br>$di_F/dt=-750A/$                 | - | 175  | - | ns |
| $I_{rrm}$ | Diode peak reverse recovery current |                                                             | - | 24   | - | A  |
| $Q_{rr}$  | Diode reverse recovery charge       |                                                             | - | 2000 | - | nC |
| $t_{rr}$  | Diode reverse recovery time         | $V_R=600V$<br>$I_F=40A$<br>$di_F/dt=-750A/$<br>$T_{vj}=175$ | - | 285  | - | ns |
| $I_{rrm}$ | Diode peak reverse recovery current |                                                             | - | 37   | - | A  |
| $Q_{rr}$  | Diode reverse recovery charge       |                                                             | - | 5500 | - | nC |

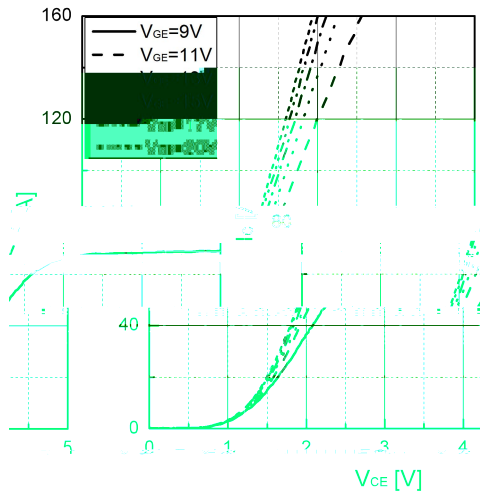


Fig 1. Typical output characteristic ( $T_{vj}=25^{\circ}\text{C}$ )

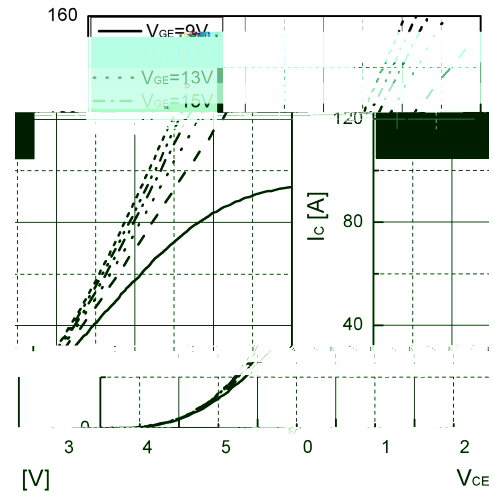


Fig 2. Typical output characteristic ( $T_{vj}=175^{\circ}\text{C}$ )

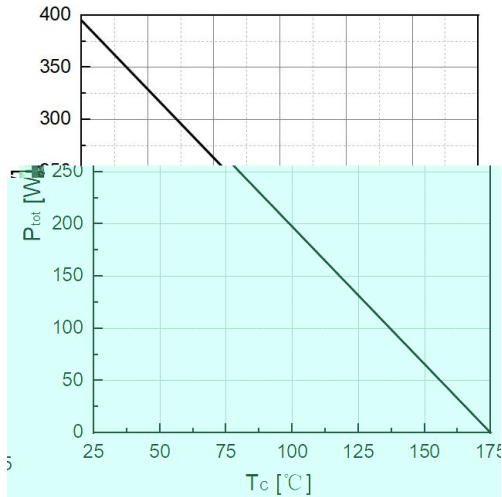


Fig 3. Power dissipation as a function of  $T_c$

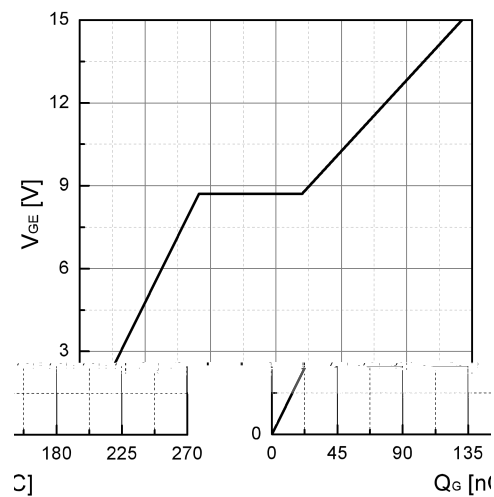


Fig 4. Typical Gate charge

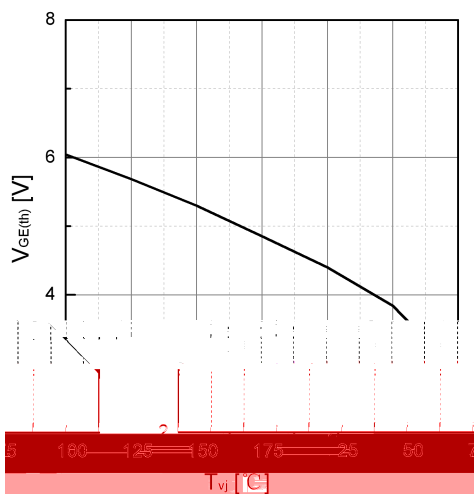


Fig 5. Typical  $V_{GE(th)}$  as a function of  $T_{vj}$   
( $I_c=1\text{mA}$ )

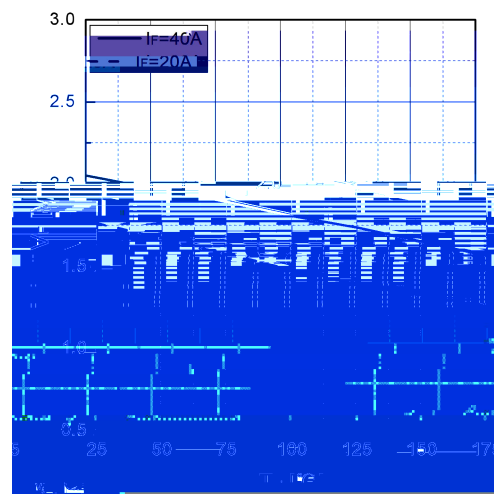


Fig 6. Typical  $V_F$  as a function of  $T_{vj}$

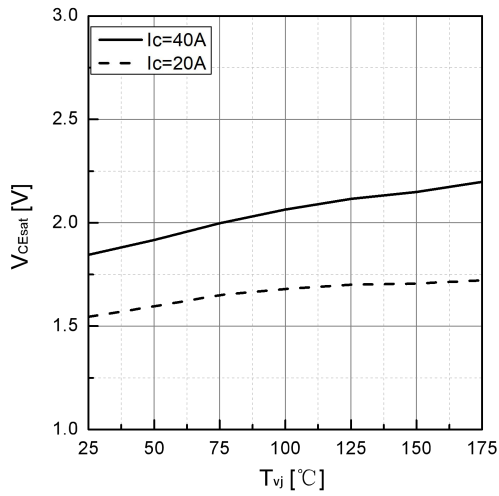


Fig 7. Typical  $V_{CEsat}$  as a function of  $T_{vj}$

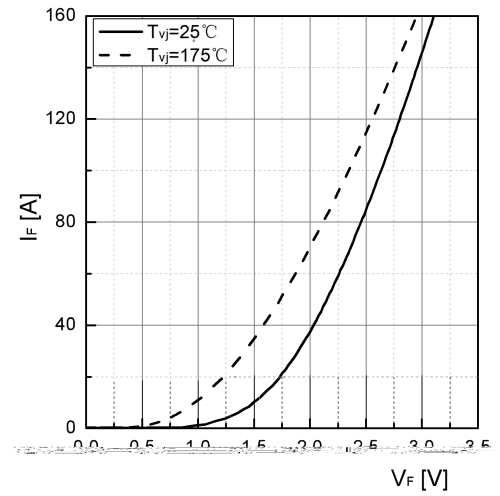


Fig 8. Typical  $I_F$  as a function of  $V_F$

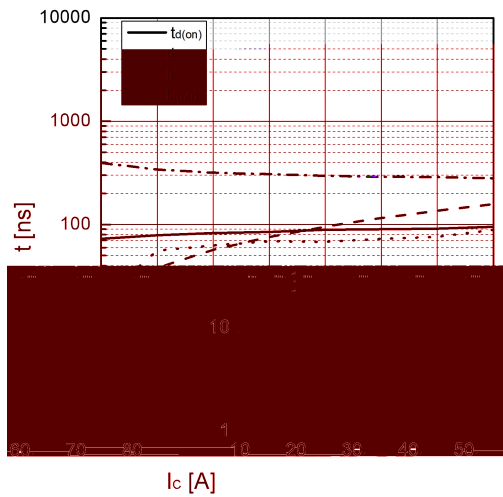


Fig 9. Typical switching time as a function of  $I_c$

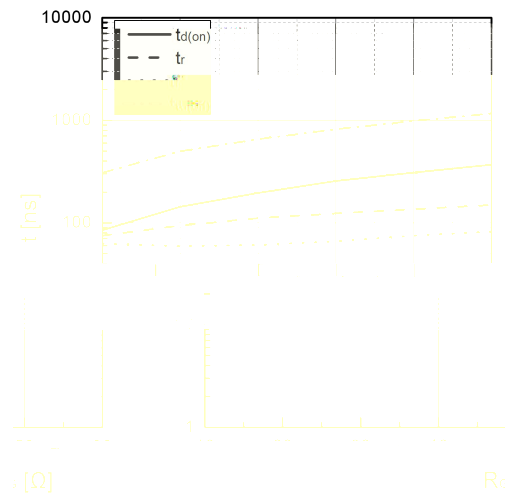


Fig 10. Typical switching times as a function of  $R_G$

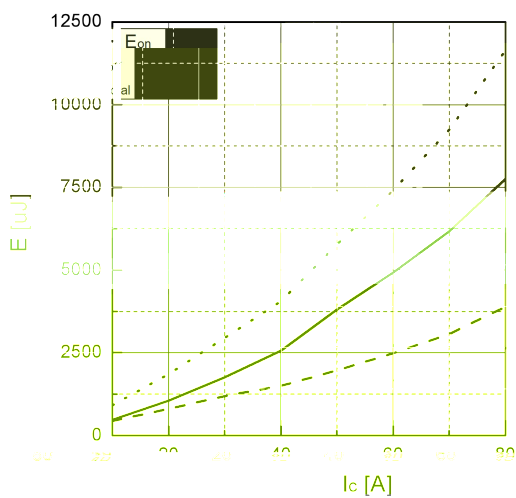


Fig 11. Typical switching energy losses as a function of  $I_c$

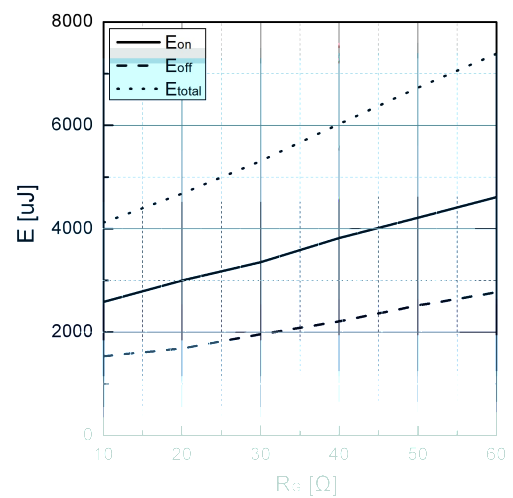


Fig 12. Typical switching energy losses as a function of  $R_G$

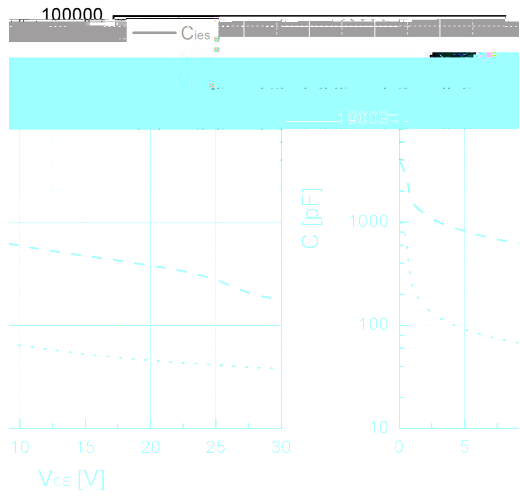


Fig 13. Typical capacitance as a function of  $V_{CE}$   
( $f=1\text{MHz}$ ,  $V_{GE}=0\text{V}$ )

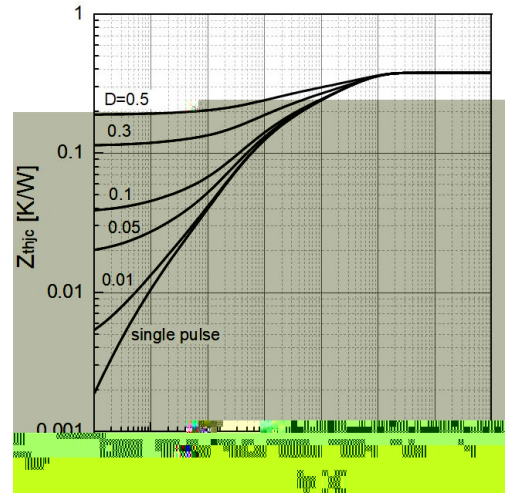
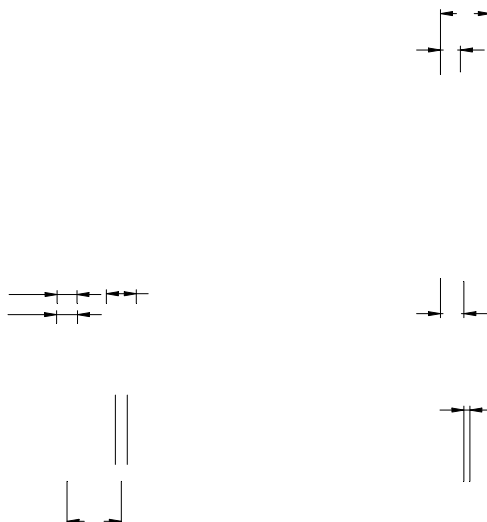


Fig 14. Transient thermal impedance of IGBT



TO-247



| Ref. | Dimensions  |       |       |        |       |       |
|------|-------------|-------|-------|--------|-------|-------|
|      | Millimeters |       |       | Inches |       |       |
|      | Min.        | Typ.  | Max.  | Min.   | Typ.  | Max.  |
| A    | 15.50       | 15.80 | 16.10 | 0.610  | 0.622 | 0.634 |
| B    | 20.80       | 21.00 | 21.20 | 0.819  | 0.827 | 0.835 |
| C    | 19.70       | 20.00 | 20.30 | 0.776  | 0.787 | 0.799 |
| D    | 1.80        | 2.00  | 2.20  | 0.071  | 0.079 | 0.087 |
| E    | 1.90        | 2.10  | 2.30  | 0.075  | 0.083 | 0.091 |
| F    | 1.00        | 1.20  | 1.40  | 0.039  | 0.047 | 0.055 |
| G    | 5.25        | -     | 5.65  | 0.207  | -     | 0.222 |
| H    | 4.80        | 5.00  | 5.20  | 0.189  | 0.197 | 0.205 |
| J    | 1.90        | 2.00  | 2.10  | 0.075  | 0.079 | 0.083 |
| K    | 2.20        | 2.35  | 2.50  | 0.087  | 0.093 | 0.098 |
| L    | 0.41        | 0.60  | 0.79  | 0.016  | 0.024 | 0.031 |
| M    | 2.80        | 3.00  | 3.20  | 0.110  | 0.118 | 0.126 |
| N    | 2.90        | 3.10  | 3.30  | 0.114  | 0.122 | 0.130 |



| Date       | Revision | Changes                   |
|------------|----------|---------------------------|
| 2023-12-12 | Rev. 1.0 | Release of the datasheet. |
| 2024-04-03 | Rev. 1.1 | Update                    |
| 2024-05-17 | Rev. 1.2 | Update                    |
| 2026-06-25 | Rev 1.3  | Update thermal            |

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