

### Product Summary

| $V_{(BR)CES}$ | $V_{CE(SAT)TYP}$ | $I_C(100^{\circ}C)$ |
|---------------|------------------|---------------------|
| 1200V         | 1.6V@15V         | 25A                 |

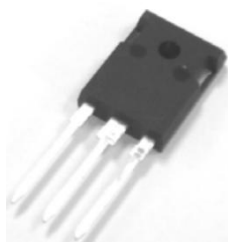
### Feature

- Low  $V_{CE(sat)}$  Trench-FS IGBT technology
- Maximum junction temperature  $175^{\circ}C$
- Positive temperature coefficient
- Including fast & soft recovery anti-parallel FWD
- High short circuit capability (10us)

### Application

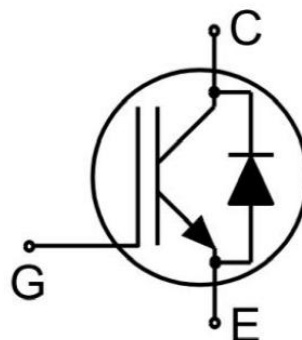
- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

### Package

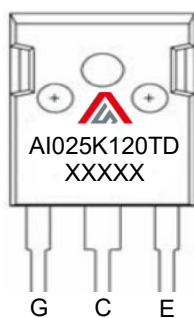


TO-247AB

### Circuit diagram



### Marking



### Absolute maximum ratings ( $T_C=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter                                                                                                 | Symbol                     | Value           | Unit                        |
|-----------------------------------------------------------------------------------------------------------|----------------------------|-----------------|-----------------------------|
| Collector-Emitter Voltage                                                                                 | $V_{CES}$                  | 1200            | V                           |
| Continuous Gate- Emitter Voltage                                                                          | $V_{GE}$                   | $\pm 20$        | V                           |
| Transient Gate-Emitter Voltage ( $t_p \leq 10\mu\text{s}, D < 0.01$ )                                     | $V_{GE}$                   | $\pm 30$        | V                           |
| Collector Current, limited by $T_{jmax}$                                                                  | $I_C$                      | 50              | A                           |
| Collector Current, limited by $T_{jmax}$ ( $T_C = 100^{\circ}\text{C}$ )                                  | $I_C(100^{\circ}\text{C})$ | 25              | A                           |
| Pulsed Collector Current, $t_p$ limited by $T_{jmax}$ ( $V_{GE} = 15\text{V}$ )                           | $I_{CM}$                   | 100             | A                           |
| Diode Continuous Forward Current, limited by $T_{jmax}$                                                   | $I_F$                      | 50              | A                           |
| Diode Continuous Forward Current, limited by $T_{jmax}$ ( $T_C = 100^{\circ}\text{C}$ )                   | $I_F(100^{\circ}\text{C})$ | 25              | A                           |
| Diode Pulsed Current, $t_p$ limited by $T_{jmax}$                                                         | $I_{Fpuls}$                | 100             | A                           |
| Turn off Safe Operating Area ( $V_{CE} \leq 1200\text{V}, T_J \leq 150^{\circ}\text{C}$ )                 | -                          | 100             | A                           |
| Short Circuit Withstand Time<br>( $V_{CE} \leq 1200\text{V}, V_{GE} = 15\text{V}, V_{CC} = 600\text{V}$ ) | $T_{SC}$                   | 10              | $\mu\text{s}$               |
| Power Dissipation ( $T_J = 175^{\circ}\text{C}$ )                                                         | $P_D$                      | 226             | W                           |
| Thermal Resistance, Junction to case for Diode                                                            | $R_{\theta JC}$            | 1.15            | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance, Junction to case for IGBT                                                             | $R_{\theta JC}$            | 0.65            | $^{\circ}\text{C}/\text{W}$ |
| Operating junction temperature range                                                                      | $T_J$                      | $-40 \sim +175$ | $^{\circ}\text{C}$          |
| Storage Temperature Range                                                                                 | $T_{STG}$                  | $-55 \sim +150$ | $^{\circ}\text{C}$          |

### Electrical characteristics of the IGBT ( $T_J=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter                            | Symbol        | Test Condition                                                       | Min. | Typ. | Max. | Unit    |
|--------------------------------------|---------------|----------------------------------------------------------------------|------|------|------|---------|
| Static Characteristics               |               |                                                                      |      |      |      |         |
| Collector-Emitter Breakdown Voltage  | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=250\mu A$                                            | 1200 |      |      | V       |
| Collector-Emitter Leakage Current    | $I_{CES}$     | $V_{GE}=0V, V_{CE}=1200V$                                            |      |      | 0.25 | mA      |
|                                      |               | $V_{GE}=0V, V_{CE}=1200V, T_J=150^{\circ}C$                          |      |      | 5    |         |
| Gate to Emitter Leakage Current      | $I_{GES}$     | $V_{GE}=\pm 20V, V_{CE}=0V$                                          |      |      | 100  | nA      |
| Gate Threshold Voltage               | $V_{GE(th)}$  | $V_{GE}=V_{CE}, I_C=1mA$                                             | 5.2  | 5.8  | 6.5  | V       |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE}=15V, I_C=25A$                                                |      | 1.6  | 2.1  | V       |
|                                      |               | $V_{GE}=15V, I_C=25A, T_J=125^{\circ}C$                              |      | 1.9  |      |         |
|                                      |               | $V_{GE}=15V, I_C=25A, T_J=150^{\circ}C$                              |      | 2    |      |         |
| Dynamic characteristics              |               |                                                                      |      |      |      |         |
| Input Capacitance                    | $C_{ies}$     | $V_{CE}=25V, V_{GE}=0V, f=1MHz$                                      |      | 2.69 |      | nF      |
| Reverse Transfer Capacitance         | $C_{res}$     |                                                                      |      | 0.03 |      |         |
| Total Gate Charge                    | $Q_g$         | $V_{CC}=600V, V_{GE}=15V, I_C=25A$                                   |      | 0.19 |      | $\mu C$ |
| Short Circuit Collector Current      | $I_{SC}$      | $V_{GE}=15V, t_{SC}\leq 10us, V_{CC}=600V$<br>$T_J\leq 150^{\circ}C$ |      | 120  |      | A       |
| Turn-on delay time                   | $t_{d(on)}$   | $V_{CC}=600V, V_{GE}=-5V\sim 15V$<br>$I_C=25A, R_G=20\Omega$         |      | 75   |      | nS      |
| Turn-on rise time                    | $t_r$         |                                                                      |      | 70   |      |         |
| Turn-off delay time                  | $t_{d(off)}$  |                                                                      |      | 223  |      |         |
| Turn-off fall time                   | $t_f$         |                                                                      |      | 216  |      |         |
| Turn-On Switching Loss               | $E_{on}$      |                                                                      |      | 1.8  |      | mJ      |
| Turn-Off Switching Loss              | $E_{off}$     |                                                                      |      | 1.7  |      |         |

| Parameter                      | Symbol       | Test Condition                                                                               | Min. | Typ. | Max. | Unit |
|--------------------------------|--------------|----------------------------------------------------------------------------------------------|------|------|------|------|
| <b>Dynamic characteristics</b> |              |                                                                                              |      |      |      |      |
| Turn-on delay time             | $t_{d(on)}$  | $V_{CC} = 600V, V_{GE} = -5V \sim 15V$<br>$I_C = 25A, R_G = 20\Omega$<br>$T_J = 125^\circ C$ |      | 72   |      | nS   |
| Turn-on rise time              | $t_r$        |                                                                                              |      | 70   |      |      |
| Turn-off delay time            | $t_{d(off)}$ |                                                                                              |      | 251  |      |      |
| Turn-off fall time             | $t_f$        |                                                                                              |      | 304  |      |      |
| Turn-On Switching Loss         | $E_{on}$     |                                                                                              |      | 1.9  |      | mJ   |
| Turn-Off Switching Loss        | $E_{off}$    |                                                                                              |      | 2.2  |      |      |
| Turn-on delay time             | $t_{d(on)}$  | $V_{CC} = 600V, V_{GE} = -5V \sim 15V$<br>$I_C = 25A, R_G = 20\Omega$<br>$T_J = 150^\circ C$ |      | 71   |      | nS   |
| Turn-on rise time              | $t_r$        |                                                                                              |      | 70   |      |      |
| Turn-off delay time            | $t_{d(off)}$ |                                                                                              |      | 264  |      |      |
| Turn-off fall time             | $t_f$        |                                                                                              |      | 342  |      |      |
| Turn-On Switching Loss         | $E_{on}$     |                                                                                              |      | 2    |      | mJ   |
| Turn-Off Switching Loss        | $E_{off}$    |                                                                                              |      | 2.4  |      |      |

### Electrical characteristics of the Diode ( $T_J = 25^\circ C$ unless otherwise noted)

| Parameter                | Symbol    | Test Condition                                                          | Min. | Typ. | Max. | Unit |
|--------------------------|-----------|-------------------------------------------------------------------------|------|------|------|------|
| Diode Forward Voltage    | $V_F$     | $I_F = 25A$                                                             |      | 2.15 | 2.75 | V    |
|                          |           | $I_F = 25A, T_J = 125^\circ C$                                          |      | 1.95 |      |      |
|                          |           | $I_F = 25A, T_J = 150^\circ C$                                          |      | 1.85 |      |      |
| Reverse Recovery Current | $I_{rrm}$ | $V_R = 600V, I_F = 25A$<br>$di/dt = -300A/\mu s$                        |      | 9    |      | A    |
| Reverse Recovery Charge  | $Q_{rr}$  |                                                                         |      | 0.95 |      | uC   |
| Reverse Recovery Time    | $T_{rr}$  |                                                                         |      | 175  |      | nS   |
| Reverse Recovery Energy  | $E_{rec}$ |                                                                         |      | 0.3  |      | mJ   |
| Reverse Recovery Current | $I_{rrm}$ | $V_R = 600V, I_F = 25A$<br>$di/dt = -300A/\mu s$<br>$T_J = 125^\circ C$ |      | 14   |      | A    |
| Reverse Recovery Charge  | $Q_{rr}$  |                                                                         |      | 2.10 |      | uC   |
| Reverse Recovery Time    | $T_{rr}$  |                                                                         |      | 250  |      | nS   |
| Reverse Recovery Energy  | $E_{rec}$ |                                                                         |      | 0.75 |      | mJ   |
| Reverse Recovery Current | $I_{rrm}$ | $V_R = 600V, I_F = 25A$<br>$di/dt = -300A/\mu s$<br>$T_J = 150^\circ C$ |      | 16   |      | A    |
| Reverse Recovery Charge  | $Q_{rr}$  |                                                                         |      | 2.60 |      | uC   |
| Reverse Recovery Time    | $T_{rr}$  |                                                                         |      | 280  |      | nS   |
| Reverse Recovery Energy  | $E_{rec}$ |                                                                         |      | 0.95 |      | mJ   |

### Typical Characteristics

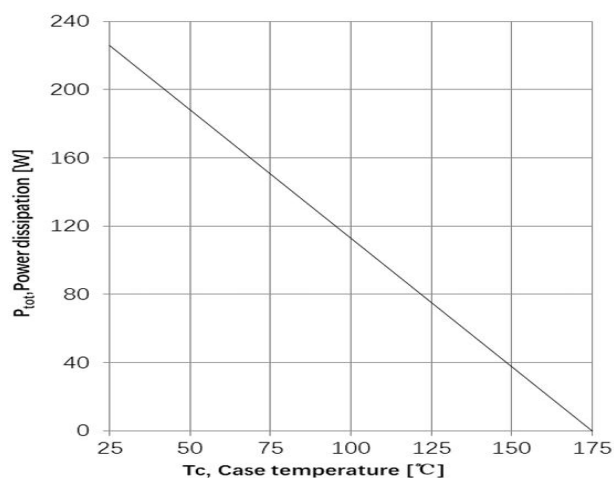


Fig1. Power dissipation as a function of case temperature ( $T_j < 175^\circ\text{C}$ )

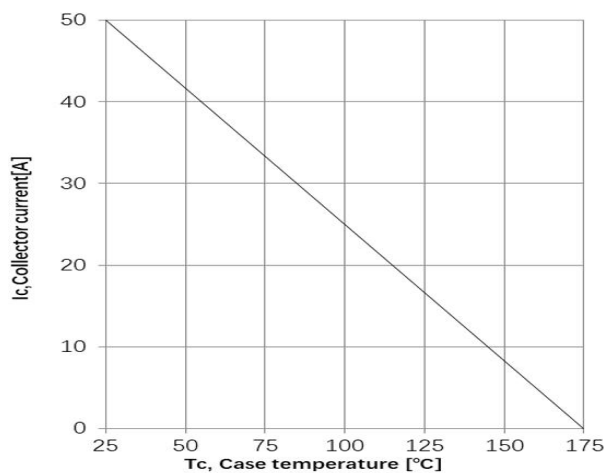


Fig2. Collector current as a function of case temperature ( $V_{ge} > 15\text{V}$ ,  $T_j < 175^\circ\text{C}$ )

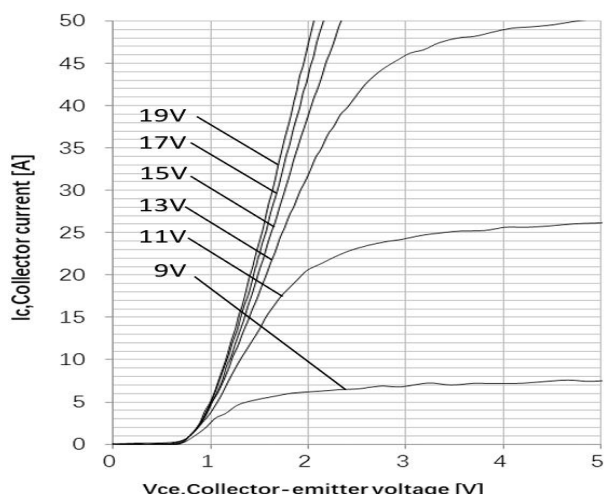


Fig3. Typical output characteristic ( $T_j = 25^\circ\text{C}$ )

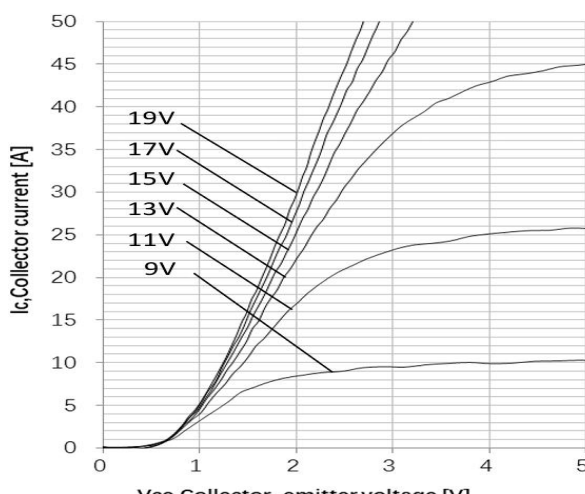


Fig4. Typical output characteristic ( $T_j = 150^\circ\text{C}$ )

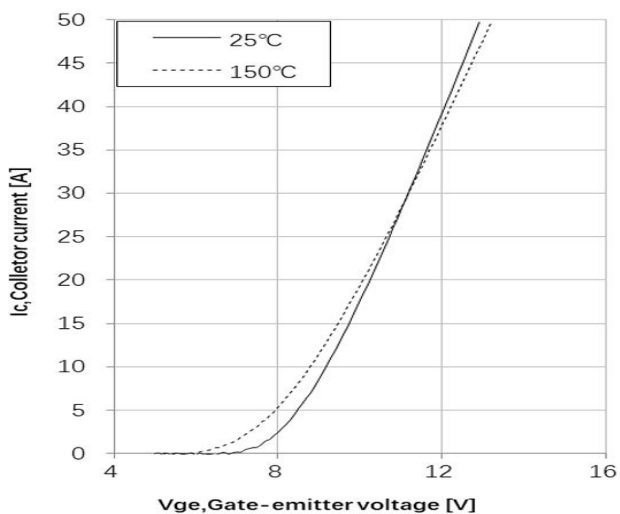


Fig5. Typical transfer characteristic ( $V_{ce} = 20\text{V}$ )

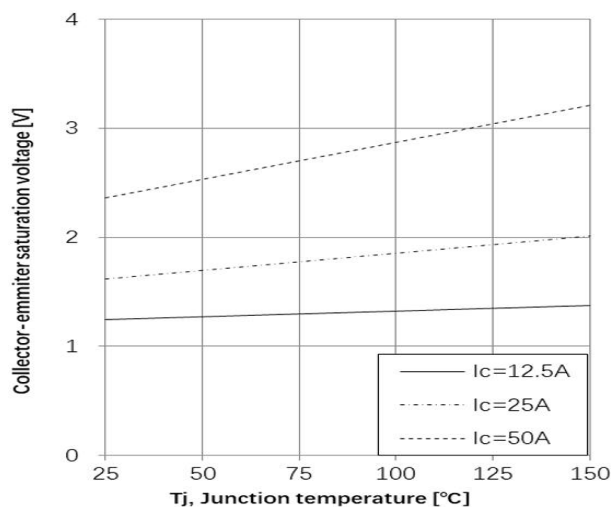
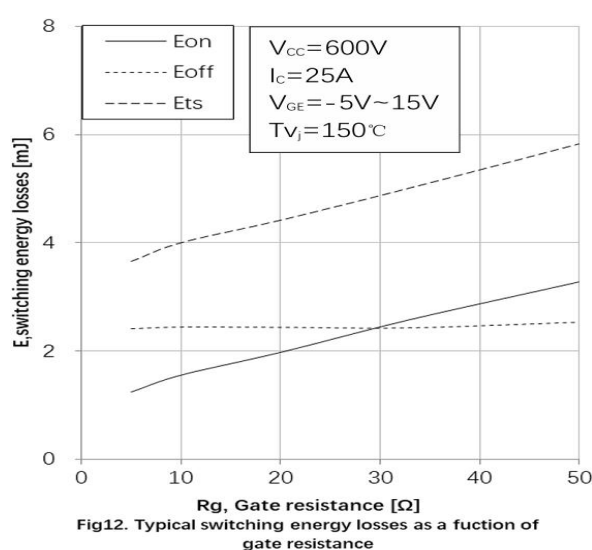
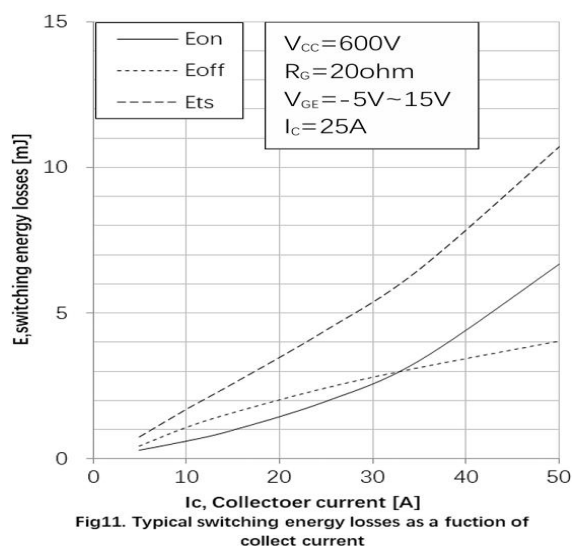
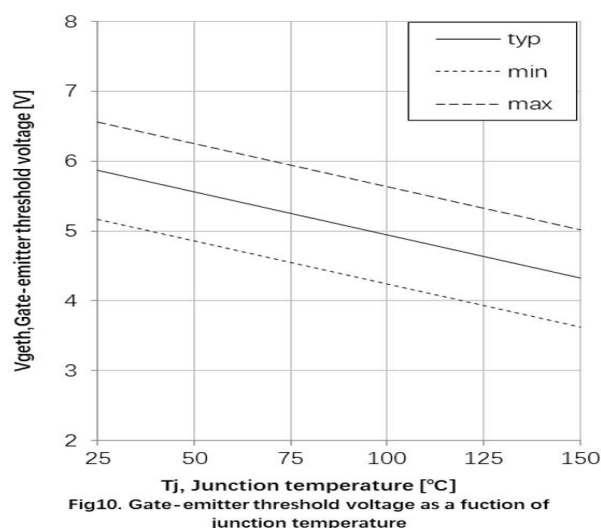
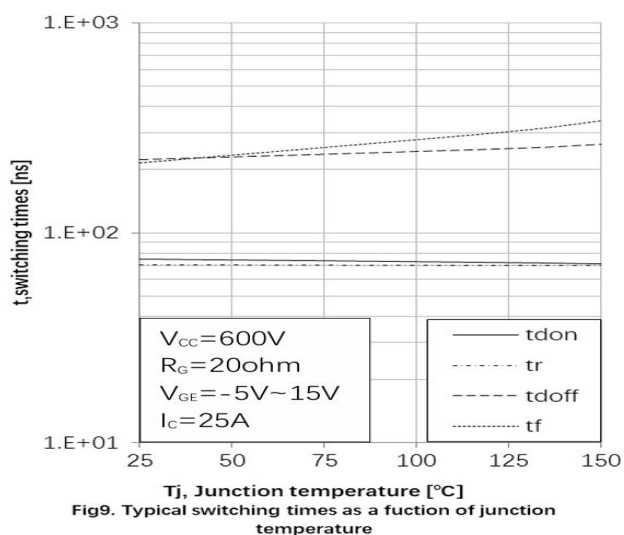
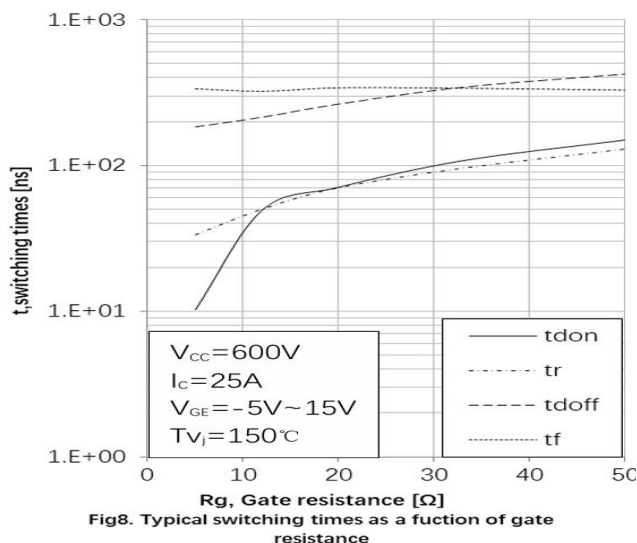
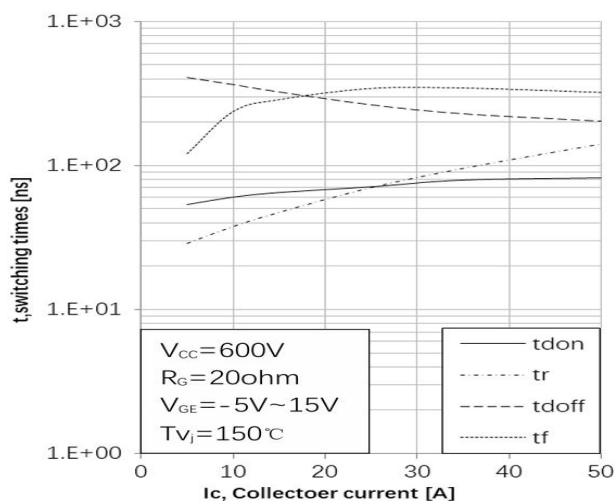
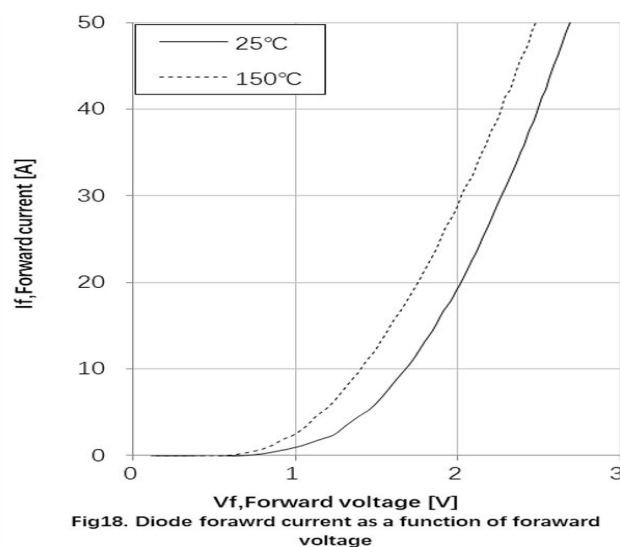
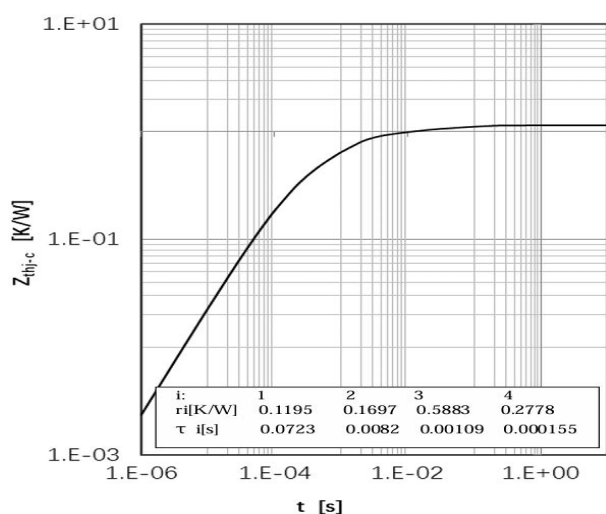
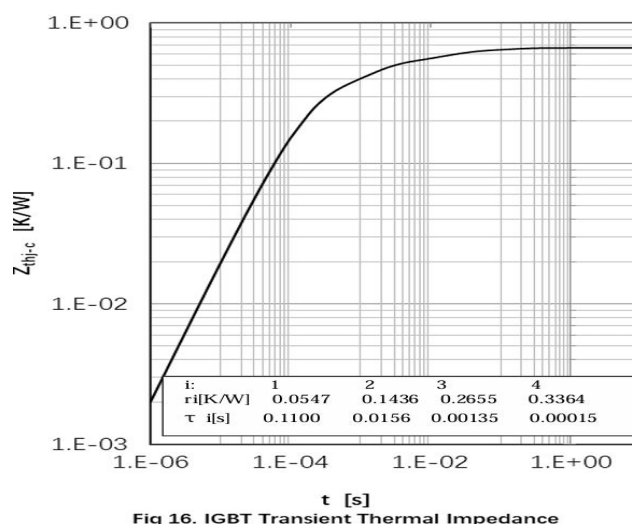
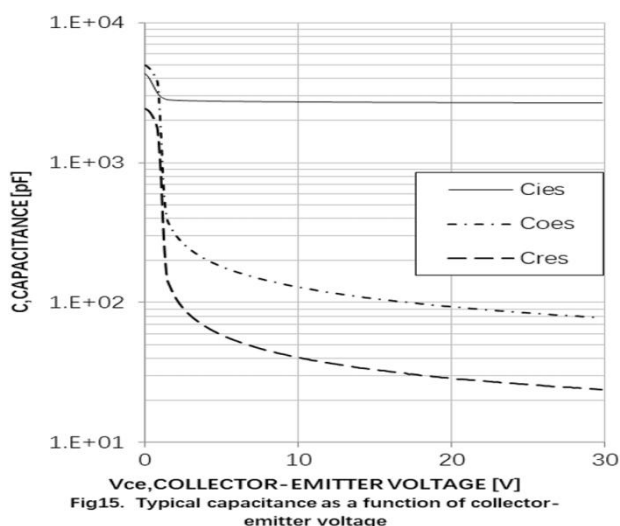
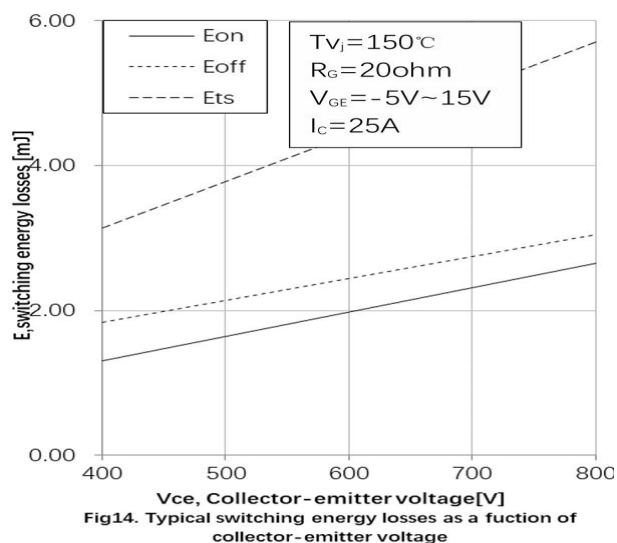
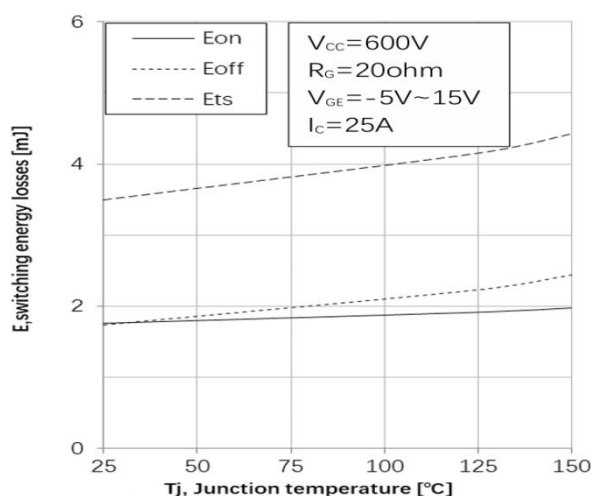


Fig6. Typical collector-emitter saturation voltage as a function of junction temperature ( $V_{ge} = 15\text{V}$ )

### Typical Characteristics



### Typical Characteristics



## Typical Characteristics

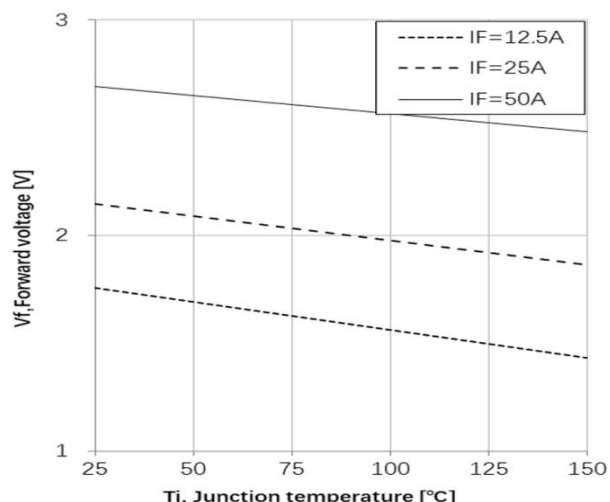
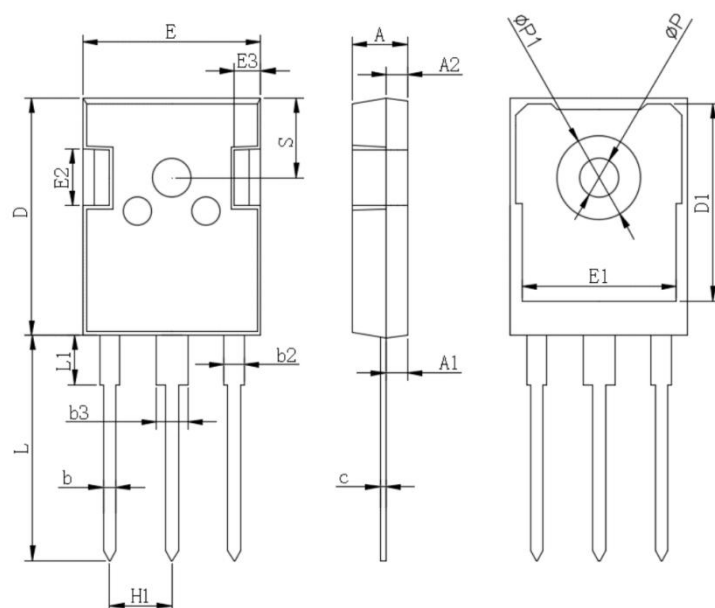


Fig19. Diode forward voltage as a function of junction temperature

### TO-247AB Package Information



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 4.800                     | 5.200  | 0.189                | 0.205 |
| A1     | 2.210                     | 2.610  | 0.087                | 0.103 |
| A2     | 1.850                     | 2.150  | 0.073                | 0.085 |
| b      | 1.000                     | 1.400  | 0.039                | 0.055 |
| b2     | 1.910                     | 2.210  | 0.075                | 0.087 |
| b3     | 2.800                     | 3.200  | 0.110                | 0.126 |
| C      | 0.500                     | 0.700  | 0.020                | 0.028 |
| D      | 20.700                    | 21.300 | 0.815                | 0.839 |
| D1     | 16.250                    | 16.850 | 0.640                | 0.663 |
| E      | 15.500                    | 16.100 | 0.610                | 0.634 |
| E1     | 13.000                    | 13.600 | 0.512                | 0.535 |
| E2     | 4.800                     | 5.200  | 0.189                | 0.205 |
| E3     | 2.300                     | 2.700  | 0.091                | 0.106 |
| L      | 19.620                    | 20.220 | 0.772                | 0.796 |
| L1     | -                         | 4.300  | -                    | 0.169 |
| Φ P    | 3.400                     | 3.800  | 0.134                | 0.150 |
| Φ P1   | -                         | 7.300  | -                    | 0.287 |
| S      | 6.150 TYP.                |        | 0.242 TYP.           |       |
| H1     | 5.440 TYP.                |        | 0.214 TYP.           |       |