

Descriptions

This is 650V 6A Trench FS Technology IGBT in a TO-252 Plastic Package.

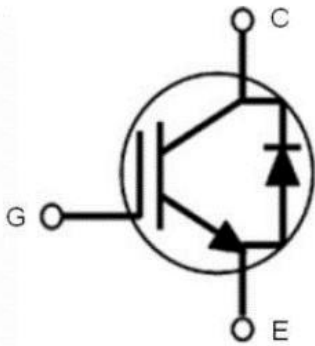
Features

- High efficient turn-on di/dt controllability
- Low VCE(sat) enable high efficiencies
- Low Turn-off switching loss
- Very Good EMI and High Short-Circuit Ruggedness

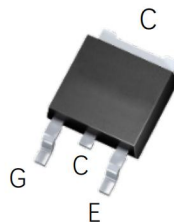
Applications

- Motor Drives
- Home Appliance Applications
- Fan, Pumps, Vacuum Cleaner
- Other Hard Switching Applications

Equivalent Circuit & Pinning



TO-252



Marking

See Marking Instructions

Maximum Ratings

| | | | | |
|--|---------------|--|----------|----------------------|
| Collector to Emitter Voltage | V_{CES} | | 650 | V |
| Gate to Emitter Voltage | V_{GES} | | ±30 | V |
| Collector Current | I_C | $T_C=25^{\circ}\text{C}$ $T_C=10^{\circ}\text{C}$ | 12 6 | A |
| Pulsed Collector Current | I_{CM} | Pulse width limited by T_{Jmax} | 35 | A |
| Diode Continuous Forward Current | I_F | $T_C=100^{\circ}\text{C}$ | 6 | A |
| Maximum Power Dissipation | P_D | $T_C=25^{\circ}\text{C}$ $T_C=10^{\circ}\text{C}$ | 69 28 | W |
| Operating Junction Temperature Range | T_J | | -55~+175 | $^{\circ}\text{C}$ |
| Storage Temperature Range | T_{STG} | | -55~+150 | $^{\circ}\text{C}$ |
| Thermal Resistance, Junction to case for IGBT | $R_{th(J-C)}$ | | 1.8 | $^{\circ}\text{C/W}$ |
| Thermal Resistance, Junction to case for Diode | $R_{th(J-C)}$ | | 2.2 | $^{\circ}\text{C/W}$ |
| Thermal Resistance, Junction to Ambient | $R_{th(J-A)}$ | | 60 | $^{\circ}\text{C/W}$ |

Electrical Characteristics (T_J = 25°C, unless otherwise noted)

| | | | | MIN | TYP | Max |
|---|----------------------|--|---|------|----------------------|-----------|
| Collector to Emitter Breakdown Voltage | BV _{CES} | I _C =250μA, V _{GE} =0V | T _J =25°C | 650 | | V |
| Collector to Emitter Saturation Voltage | V _{CE(sat)} | I _C =6A V _{GE} =15V I _C =6A V _{GE} =15V | T _J =25°C T _J =150°C | | 1.7 2 1.8 7 | 1.98 V |
| Gate Threshold Voltage | V _{GE(th)} | I _C =1mA, V _{CE} =5V | T _J =25°C | 4.5 | 5.76 | 6.5 V |
| Zero Gate Voltage Collector current | I _{CES} | V _{CE} =V _{CES} , V _{GS} =0V | T _J =25°C | | | 10 μA |
| Gate to Emitter Leakage Current | I _{GES} | V _{GE} =V _{GES} , V _{CE} =0V | T _J =25°C | | | ±100 nA |
| Input Capacitance | C _{ies} | f=1MHz, V _{CE} =25V, V _{GE} =0V | T _J =25°C | | 243 | pF |
| Output Capacitance | C _{oes} | | | | 36 | |
| Reverse Transfer Capacitance | C _{res} | | | | 22 | |
| Gate to Emitter Charge | Q _{ge} | | | | 3.2 | |
| Gate to Collector Charge | Q _{gc} | V _{CC} =520V, I _C =6A, V _{GE} =15V | T _J =25°C | | 3.5 | nC |
| Total Gate Charge | Q _g | | | | 10 | |
| Short Circuit Withstand Time | t _{sc} | V _{CC} =400V, V _{GE} =15V | T _J =25°C | | | 5 μs |
| Turn-on Delay Time | t _{d(on)} | V _{CC} =400V, I _C =6A, V _{GE} =15V, R _G =60Ω | T _J =25°C | | 6 | ns |
| | | | T _J =175°C | | 8 | |
| Rising Time | t _r | | T _J =25°C | | 21 | ns |
| | | | T _J =175°C | | 27 | |
| Turn-off Delay Time | t _{d(off)} | | T _J =25°C | | 39 | ns |
| | | | T _J =175°C | | 57 | |
| Falling Time | t _f | | T _J =25°C | | 121 | ns |
| | | | T _J =175°C | | 180 | |
| Turn-on Switching Loss | E _{on} | | T _J =25°C | | 0.09 | mJ |
| | | | T _J =175°C | | 0.11 | |
| Turn-off Switching Loss | E _{off} | | T _J =25°C | | 0.13 | mJ |
| | | | T _J =175°C | | 0.19 | |
| Total Switching Energy | E _{total} | T _J =25°C | | 0.22 | mJ | |
| | | T _J =175°C | | 0.3 | | |

Electrical Characteristics of Diode

| | | | MIN | TYP | Max | |
|-------------------------------------|----------|--------------------|--------------------|------|------|---------|
| Diode Forward Voltage | V_F | $I_F=6A$ | $T_J=25^{\circ}C$ | 1.95 | 2.25 | V |
| | | | $T_J=150^{\circ}C$ | 1.75 | | |
| Diode Peak Reverse Recovery Current | I_{RM} | $I_F=6A$ | $T_J=25^{\circ}C$ | 4.9 | | A |
| | | | $T_J=175^{\circ}C$ | 6.5 | | |
| Diode Reverse Recovery Time | t_{rr} | $di/dt=200A/\mu s$ | $T_J=25^{\circ}C$ | 91 | | ns |
| | | | $T_J=175^{\circ}C$ | 122 | | |
| Diode Reverse Recovery Charge | Q_{rr} | $V_{CC}=400V$ | $T_J=25^{\circ}C$ | 0.25 | | μC |
| | | | $T_J=175^{\circ}C$ | 0.44 | | |

Typical Performance

Fig.1 Typical Output Characteristics ($T_J=25^\circ\text{C}$)

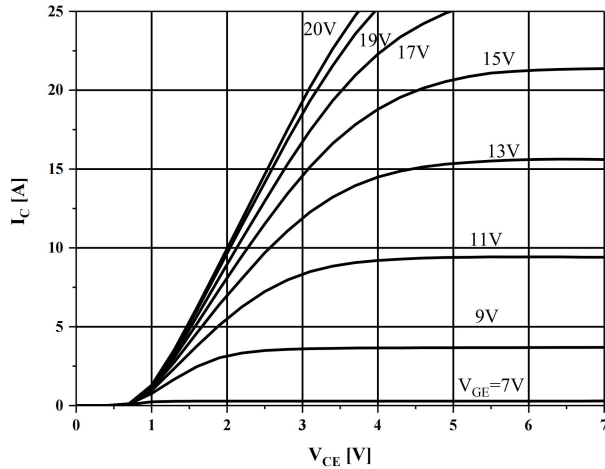


Fig.2 Typical Output Characteristics ($T_J=175^\circ\text{C}$)

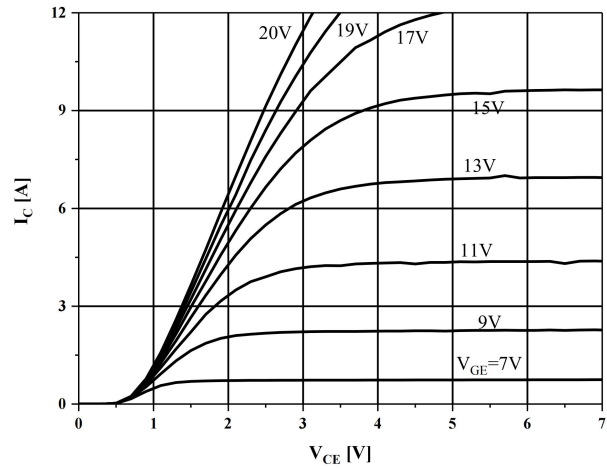


Fig.3 Transfer Characteristic

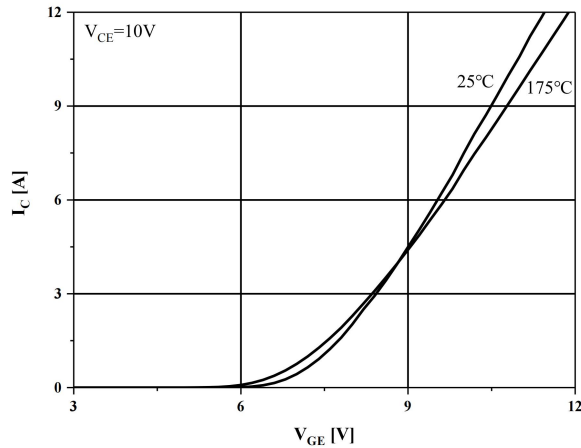


Fig.4 Diode Characteristic

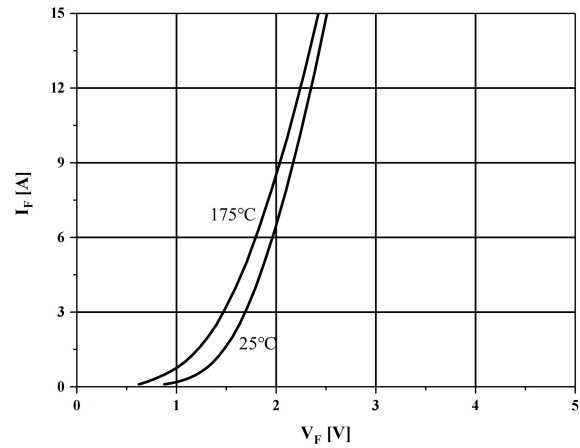


Fig.5 Collector-Emitter Saturation Voltage vs Junction Temperature

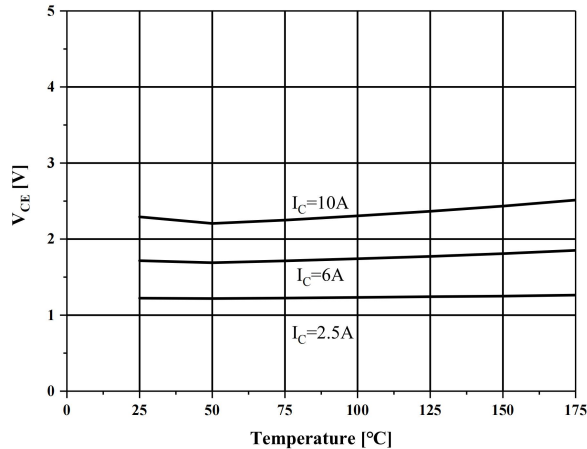
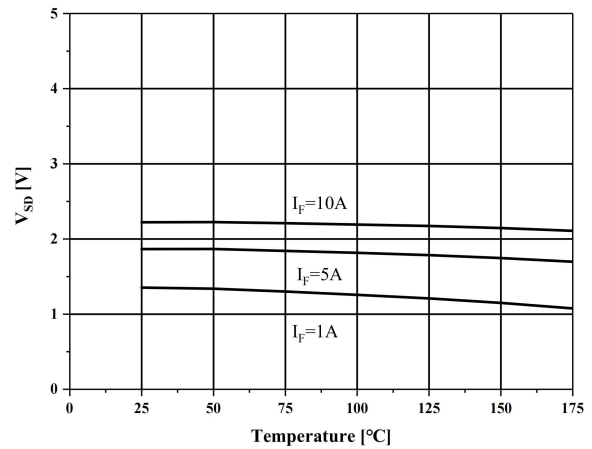


Fig.6 Diode Forward Voltage vs. Junction Temperature



Typical Performance

Fig.7 Gate-Charge Characteristics

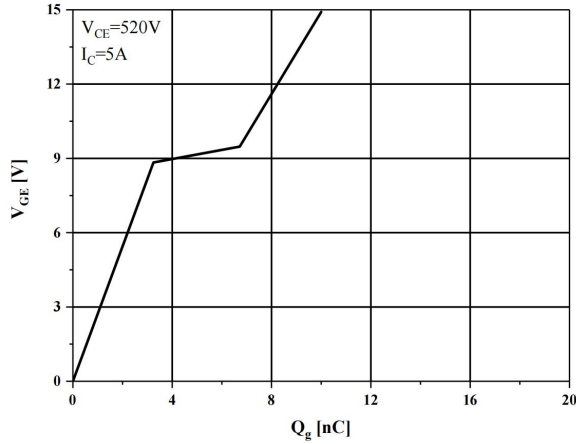


Fig.8 Capacitance Characteristics

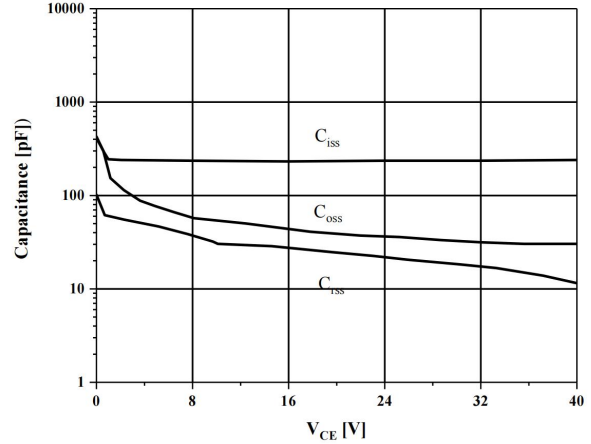


Fig.9 Power Dissipation as Function of Case

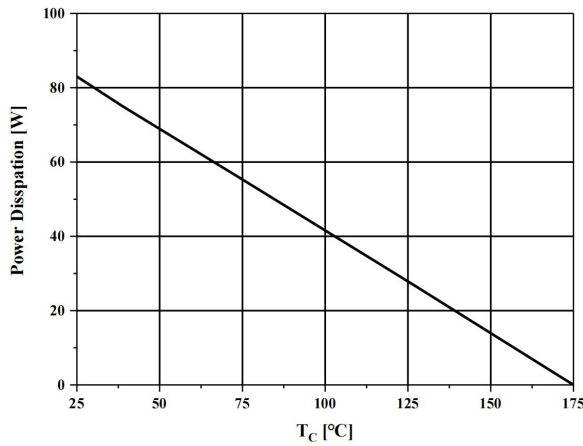


Fig.10 Current De-rating

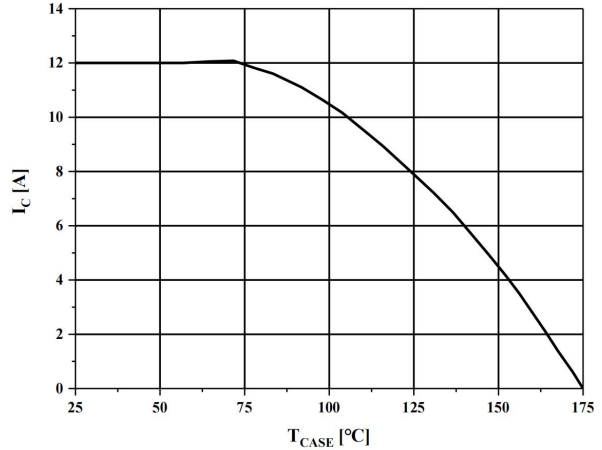


Fig.11 Diode Reverse Leakage Current vs. Junction Temperature

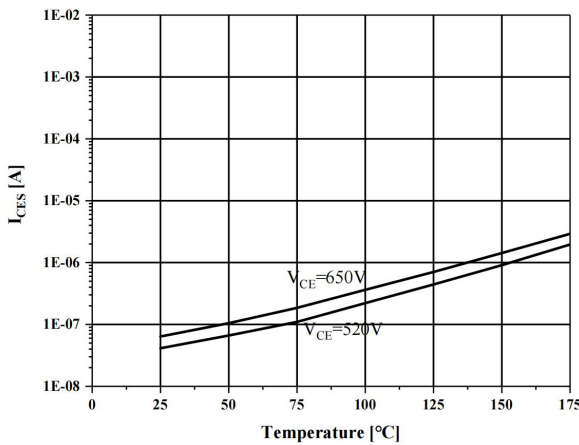
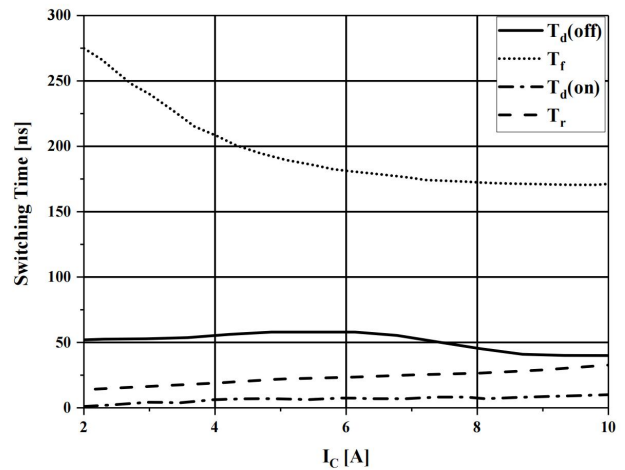


Fig.12 Switching Time vs. I_C (T_J=175°C, V_GE=15V, V_CE=400V, R_g=60Ω)



Typical Performance

Fig.13 Switching Time vs. R_g
($T_J=175^\circ\text{C}, V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C=6\text{A}$)

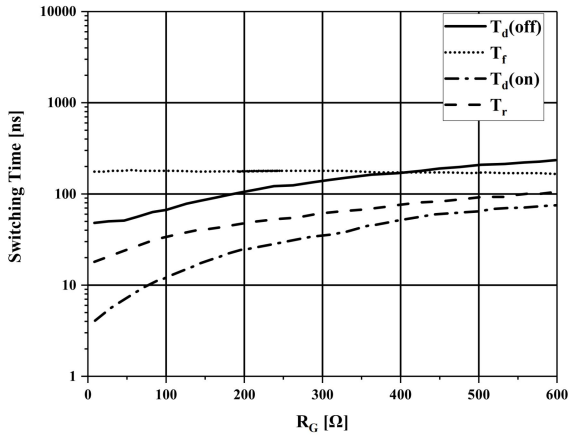


Fig.14 Switching Time vs. Junction Temperature
($V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C=6\text{A}, R_g=60\Omega$)

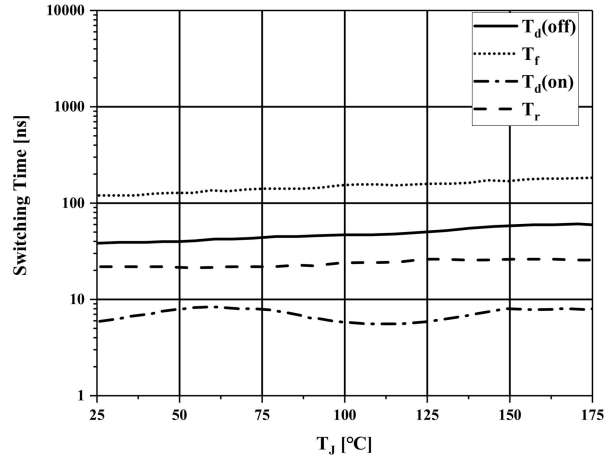


Fig.15 V_{GEth} vs. Junction Temperature

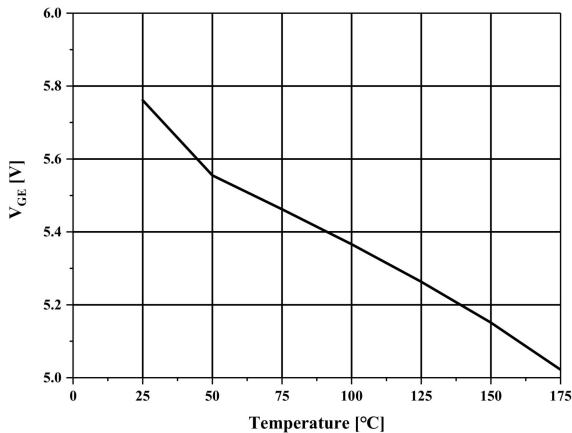


Fig.16 Switching Loss vs. I_C

($T_J=175^\circ\text{C}, V_{GE}=15\text{V}, V_{CE}=400\text{V}, R_g=60\Omega$)

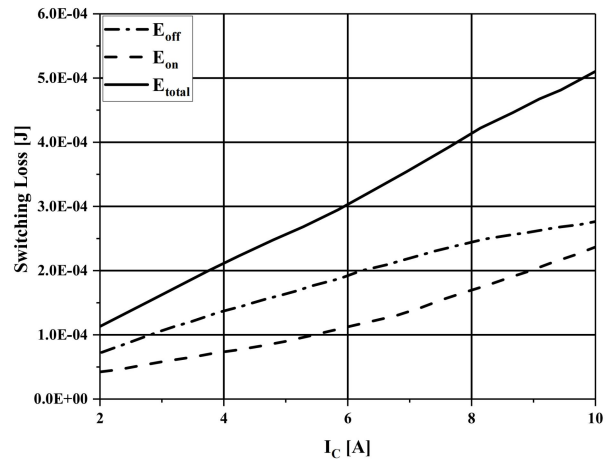


Fig.17 Switching Loss vs. R_g
($T_J=175^\circ\text{C}, V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C=6\text{A}$)

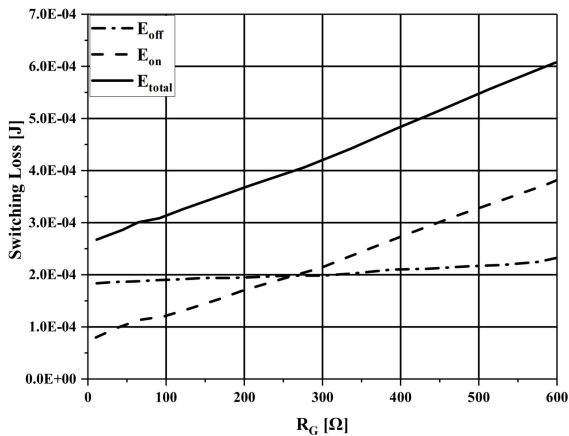
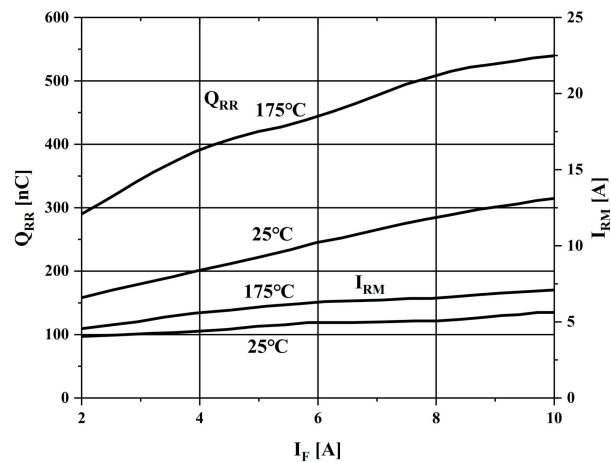


Fig.18 Diode Reverse Recovery Charge and Peak Current vs. Conduction Forward Current
($V_{GE}=15\text{V}, V_{CE}=400\text{V}, di/dt=200\text{A/us}$)



Typical Performance

Fig.19 Transient Thermal Impedance for IGBT

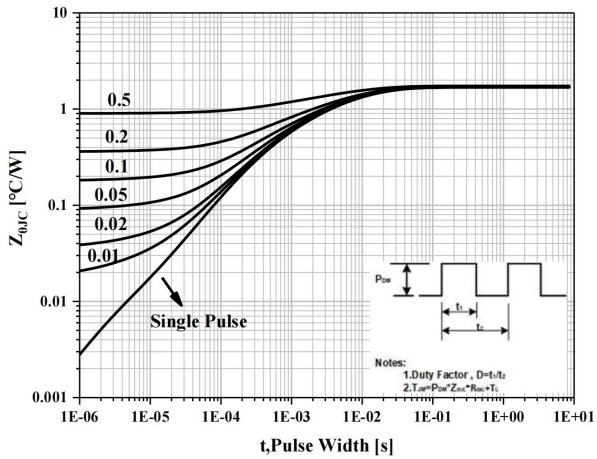


Fig.20 Transient Thermal Impedance for Diode

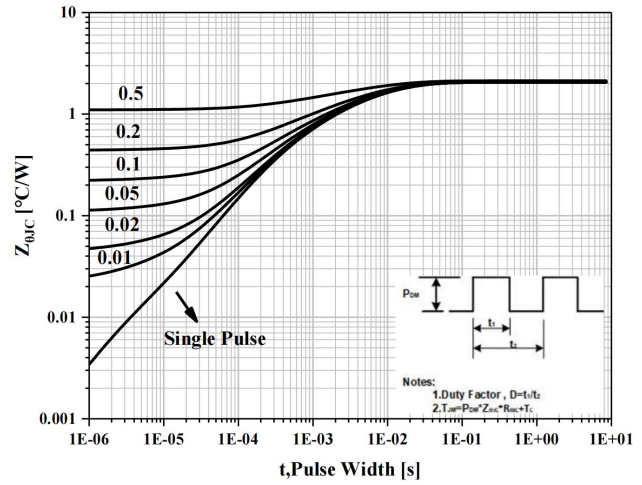
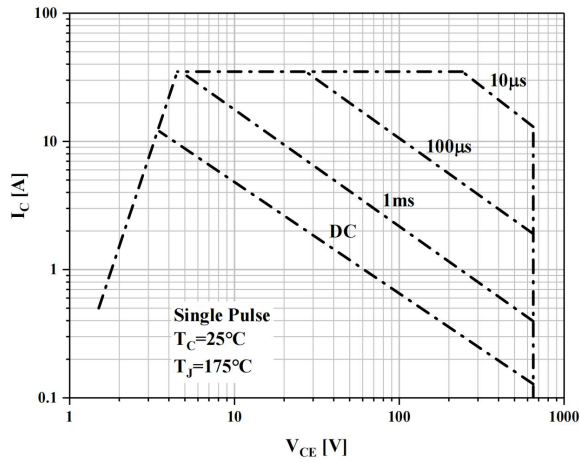


Fig.21 Forward Bias Safe Operating Area



Marking Information



Note:

COT: Company

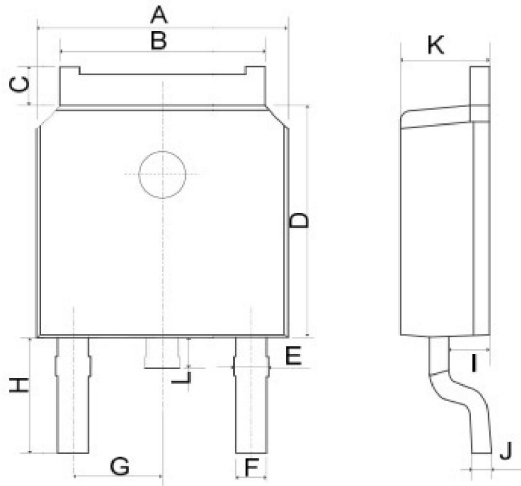
GB6N65: Product Type.

*****: *: Inner Code * : Year Code **: Week Code **: Lot Code

Ordering Information

| Part | Package | Marking | Packing method |
|------------|---------|---------|----------------|
| CTGB6N65DP | TO-252 | 6N65 | Tube |

Mechanical Dimensions for TO-252



COMMON DIMENSIONS

| SYMBOL | MM | |
|--------|---------|------|
| | MIN | MAX |
| A | 6.40 | 6.80 |
| B | 5.13 | 5.50 |
| C | 0.88 | 1.28 |
| D | 5.90 | 6.22 |
| E | 0.68 | 1.10 |
| F | 0.68 | 0.91 |
| G | 2.29REF | |
| H | 2.90REF | |
| I | 0.85 | 1.17 |
| J | 0.51REF | |
| K | 2.10 | 2.50 |
| L | 0.40 | 1.00 |