## Features

- High Speed Smooth Switching Device for Hard and Soft Switching
- $V_{ce(sat)}$ with Positive Temperature Coefficient
- High Ruggedness, Good Thermal Stability
- Very Tight Parameter Distribution
- Halogen Free. “Green” Device (Note 1)
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant ("P" Suffix Designates RoHS Compliant. See Ordering Information)

# Trench and Field Stop IGBT 1200V 40A

## Maximum Ratings

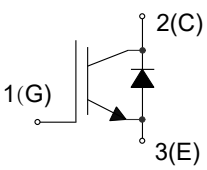
- Operating Junction Temperature Range : -40°C to +175°C
- Storage Temperature Range: -55°C to +150°C
- IGBT Thermal Resistance: 0.35°C/W Junction to Case
- Diode Thermal Resistance: 0.65°C/W Junction to Case
- Thermal Resistance: 40°C/W Junction to Ambient

| Parameter | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Collector-Emitter Voltage | | $V_{CE}$ | 1200 | V |
| DC Collector Current(2) | $T_C$=25°C | $I_C$ | 80 | A |
| | $T_C$=100°C | | 40 | |
| Pulsed Collector Current (3) | | $I_{C,pluse}$ | 160 | A |
| Diode Forward Current (2) | $T_C$=25°C | $I_F$ | 80 | A |
| | $T_C$=100°C | | 40 | |
| Diode Pulsed Current (3) | | $I_{F,pluse}$ | 160 | A |
| Gate-Emitter Voltage | | $V_{GE}$ | ±20 | V |
| Transient Gate-Emitter Voltage(4) | | | ±30 | |
| Short Circuit Withstand Time (5) $V_{GE}$=15V, $V_{CC}$=600V, $T_J$≤150°C | | $t_{SC}$ | 10 | μs |
| Power Dissipation | $T_C$=25°C | $P_D$ | 428 | W |
| | $T_C$=100°C | | 214 | |

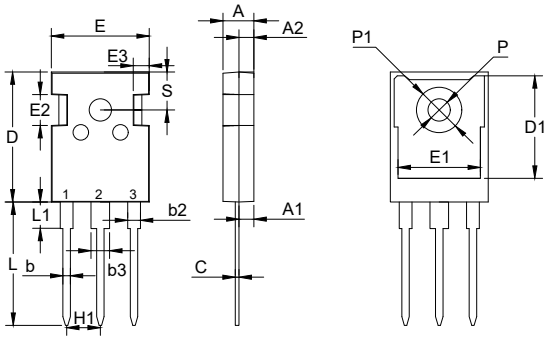
Note:

1. Halogen free "Green” products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
2. Limited by $T_{Jmax}$.
3. $T_p$ limited by $T_{Jmax}$.
4. $T_p$≤10us, Duty Cycle<1%
5. Allowed number of short circuits: <1000; time between short circuits: >1s.

## Internal Structure




## TO-247AB




| DIMENSIONS | | | | | |
|---|---|---|---|---|---|
| DIM | INCHES | | MM | | NOTE |
| | MIN | MAX | MIN | MAX | |
| A | 0.189 | 0.205 | 4.80 | 5.20 | |
| A1 | 0.087 | 0.103 | 2.21 | 2.61 | |
| A2 | 0.073 | 0.085 | 1.85 | 2.15 | |
| b | 0.039 | 0.055 | 1.00 | 1.40 | |
| b2 | 0.075 | 0.087 | 1.91 | 2.21 | |
| C | 0.020 | 0.028 | 0.50 | 0.70 | |
| D | 0.815 | 0.839 | 20.70 | 21.30 | |
| D1 | 0.640 | 0.663 | 16.25 | 16.85 | |
| E | 0.610 | 0.634 | 15.50 | 16.10 | |
| E1 | 0.512 | 0.535 | 13.00 | 13.60 | |
| E2 | 0.189 | 0.205 | 4.80 | 5.20 | |
| E3 | 0.091 | 0.106 | 2.30 | 2.70 | |
| L | 0.772 | 0.796 | 19.62 | 20.22 | |
| L1 | - | 0.169 | - | 4.30 | |
| P | 0.134 | 0.150 | 3.40 | 3.80 | Φ |
| P1 | | 0.287 | - | 7.30 | Φ |
| S | 0.242 | | 6.15 | | TYP |
| H1 | 0.214 | | 5.44 | | TYP |
| b3 | 0.110 | 0.126 | 2.80 | 3.20 | |

## Electrical Characteristics @ 25°C (Unless Otherwise Specified)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Static Characteristics** | | | | | | |
| Collector-Emitter Breakdown Voltage | $V_{(BR)CES}$ | $V_{GE}$=0V, $I_C$=250μA | 1200 | | | V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE}$=15V, $I_C$=40A, $T_J$=25℃ | | 1.85 | 2.30 | V |
| | | $V_{GE}$=15V, $I_C$=40A, $T_J$=125℃ | | 2.20 | | |
| | | $V_{GE}$=15V, $I_C$=40A, $T_J$=150℃ | | 2.30 | | |
| G-E Threshold Voltage | $V_{GE(th)}$ | $I_C$=250μA, $V_{CE}$=$V_{GE}$ | 5.1 | 5.8 | 6.4 | V |
| C-E Leakage Current | $I_{CES}$ | $V_{CE}$=1200V, $V_{GE}$=0V, $T_J$=25℃ | | | 0.25 | mA |
| | | $V_{CE}$=1200V, $V_{GE}$=0V, $T_J$=150℃ | | | 5 | |
| G-E Leakage Current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=±20V | | | 100 | nA |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | $C_{ies}$ | $V_{CE}$=25V,$V_{GE}$=0V,f=1MHz | | 4.2 | | nF |
| Reverse Transfer Capacitance | $C_{res}$ | | | 0.18 | | |
| Gate Charge | $Q_g$ | $V_{CC}$=960V,$I_C$=40A,$V_{GE}$=15V | | 0.33 | | uC |
| **IGBT Switching Characteristics** | | | | | | |
| Turn-On Delay Time | $td_{(on)}$ | $V_{CC}$=600V, $I_C$=40A, $V_{GE}$=-15/15V, $R_G$=12Ω,$T_J$=25℃ | | 45 | | ns |
| Rise Time | $t_r$ | | | 56 | | |
| Turn-Off Delay Time | $td_{(off)}$ | | | 180 | | |
| Fall Time | $t_f$ | | | 80 | | |
| Turn-On Energy | $E_{on}$ | | | 3.8 | | mJ |
| Turn-Off Energy | $E_{off}$ | | | 1.7 | | |
| Turn-On Delay Time | $td_{(on)}$ | $V_{CC}$=600V, $I_C$=40A, $V_{GE}$=-15/15V, $R_G$=12Ω,$T_J$=125℃ | | 50 | | ns |
| Rise Time | $t_r$ | | | 58 | | |
| Turn-Off Delay Time | $td_{(off)}$ | | | 240 | | |
| Fall Time | $t_f$ | | | 85 | | |
| Turn-On Energy | $E_{on}$ | | | 5.4 | | mJ |
| Turn-Off Energy | $E_{off}$ | | | 2.7 | | |
| Turn-On Delay Time | $td_{(on)}$ | $V_{CC}$=600V, $I_C$=40A, $V_{GE}$=-15/15V, $R_G$=12Ω,$T_J$=150℃ | | 53 | | ns |
| Rise Time | $t_r$ | | | 60 | | |
| Turn-Off Delay Time | $td_{(off)}$ | | | 260 | | |
| Fall Time | $t_f$ | | | 90 | | |
| Turn-On Energy | $E_{on}$ | | | 5.8 | | mJ |
| Turn-Off Energy | $E_{off}$ | | | 3.0 | | |

## Electrical Characteristics @ 25°C (Unless Otherwise Specified)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Diode Characteristics** | | | | | | |
| Diode Forward Voltage | $V_F$ | $V_{GE}$=0V, $I_F$=40A, $T_J$=25℃ | | 2.0 | | V |
| | | $V_{GE}$=0V, $I_F$=40A, $T_J$=125℃ | | 1.8 | | |
| | | $V_{GE}$=0V, $I_F$=40A, $T_J$=150℃ | | 1.7 | | |
| Reverse Recovery Current | $I_{rr}$ | $V_R$=600V, $I_F$=40A, $di_F/dt$=-450A/μs, $T_J$=25℃ | | 21 | | A |
| Reverse Recovery Charge | $Q_{rr}$ | | | 2.4 | | μC |
| Reverse Recovery Energy | $E_{rec}$ | | | 1.0 | | mJ |
| Reverse Recovery Current | $I_{rr}$ | $V_R$=600V, $I_F$=40A, $di_F/dt$=-450A/μs, $T_J$=125℃ | | 25 | | A |
| Reverse Recovery Charge | $Q_{rr}$ | | | 4.8 | | μC |
| Reverse Recovery Energy | $E_{rec}$ | | | 1.95 | | mJ |
| Reverse Recovery Current | $I_{rr}$ | $V_R$=600V, $I_F$=40A, $di_F/dt$=-450A/μs, $T_J$=150℃ | | 28 | | A |
| Reverse Recovery Charge | $Q_{rr}$ | | | 5.4 | | μC |
| Reverse Recovery Energy | $E_{rec}$ | | | 2.25 | | mJ |

## Curve Characteristics

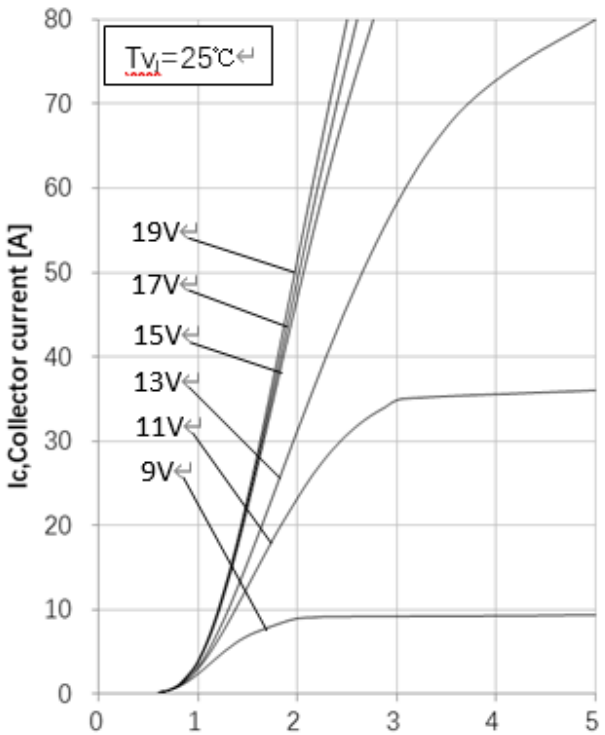


Fig1. Typical output characteristic

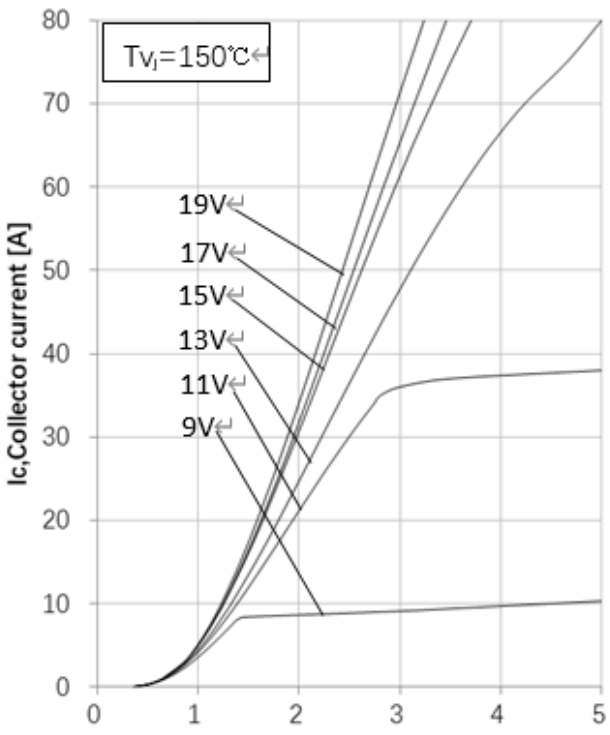


Fig2. Typical output characteristic (Tj=150c)

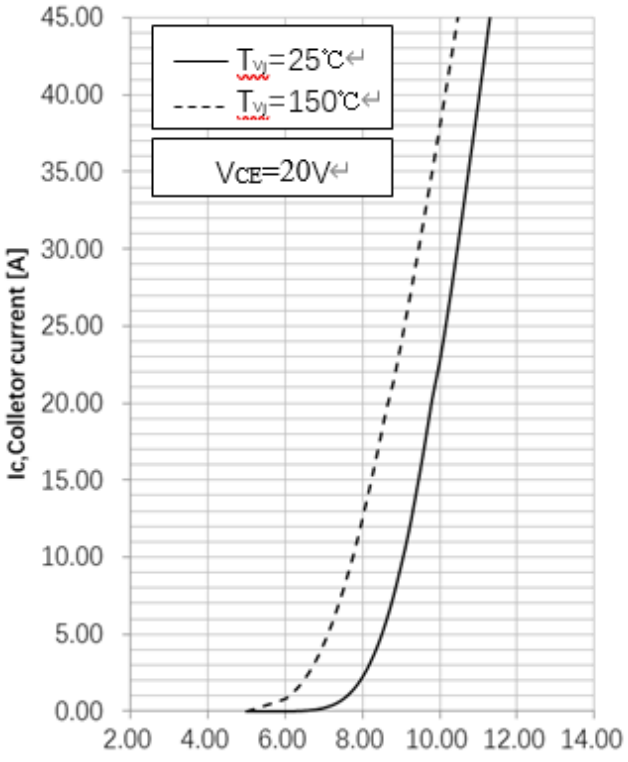


Fig3. Typical transfer characteristic

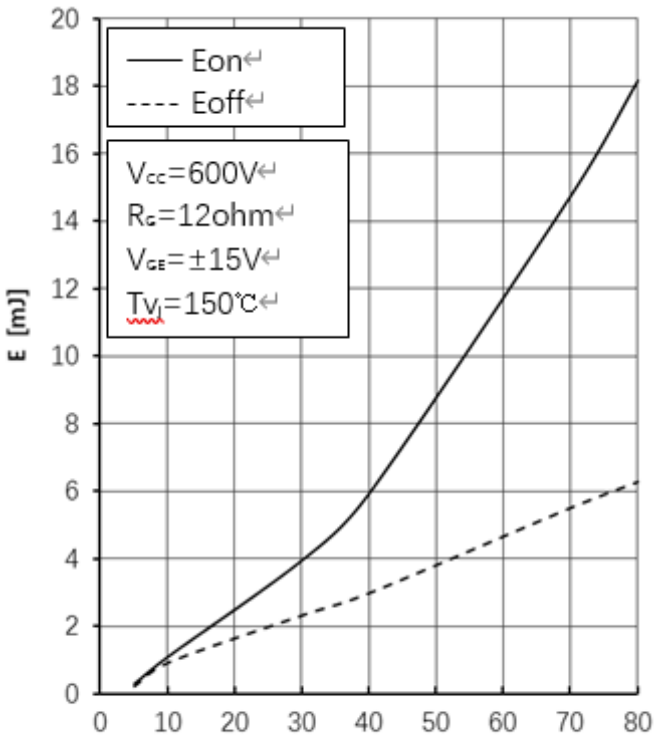


Fig4.IGBT Switching Loss vs.Ic

## Curve Characteristics

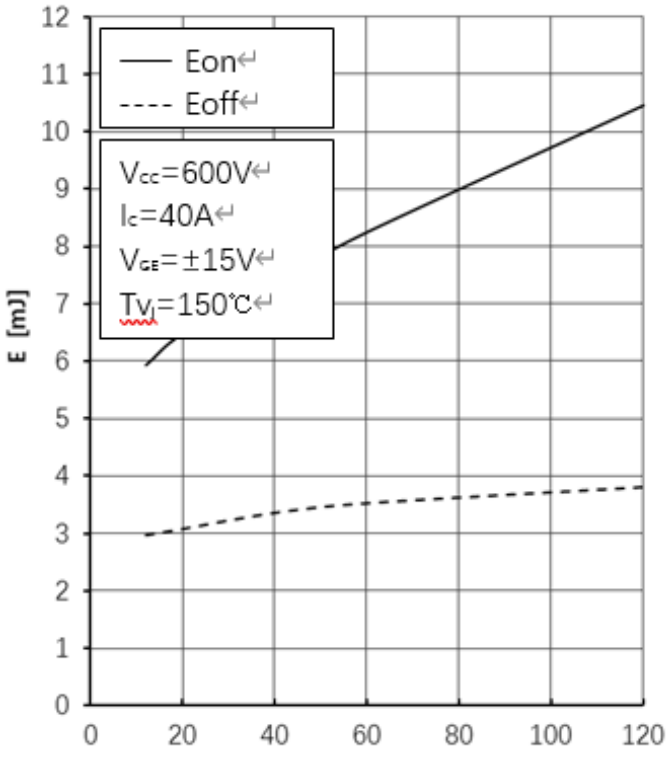



Fig5.IGBT Switching Loss vs.Rg

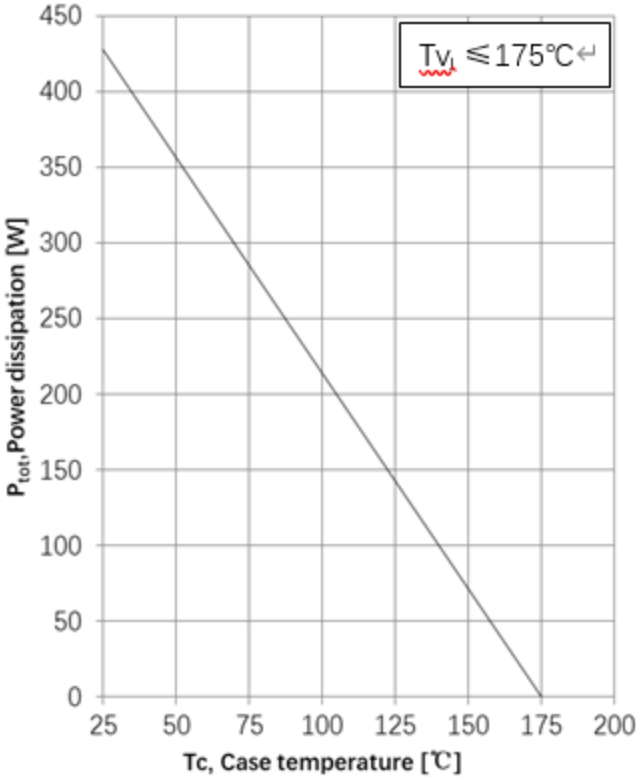



Fig6. Power dissipation as a function of case temperature (Tj＜175℃)

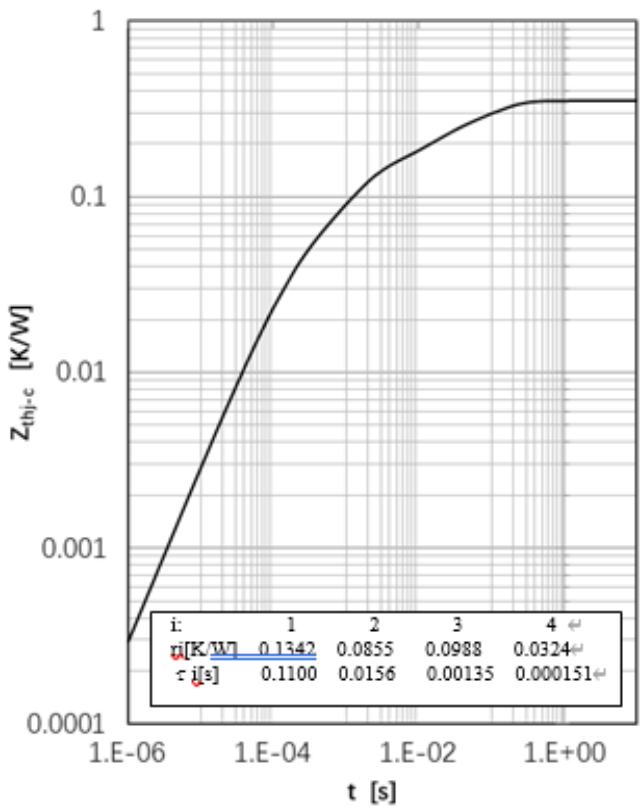



Fig 7. IGBT Transient Thermal Impedance

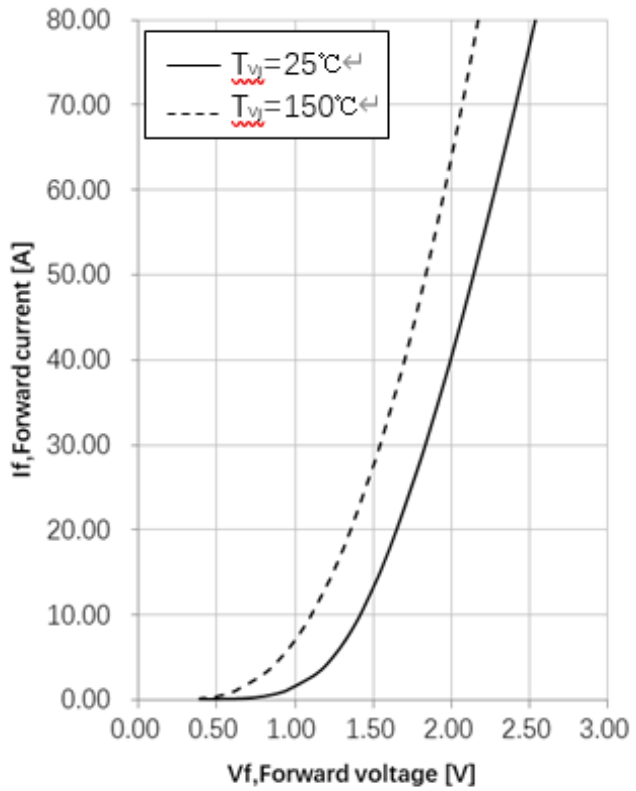



Fig8. diode forawrd current as a function of foraward voltage

## Curve Characteristics

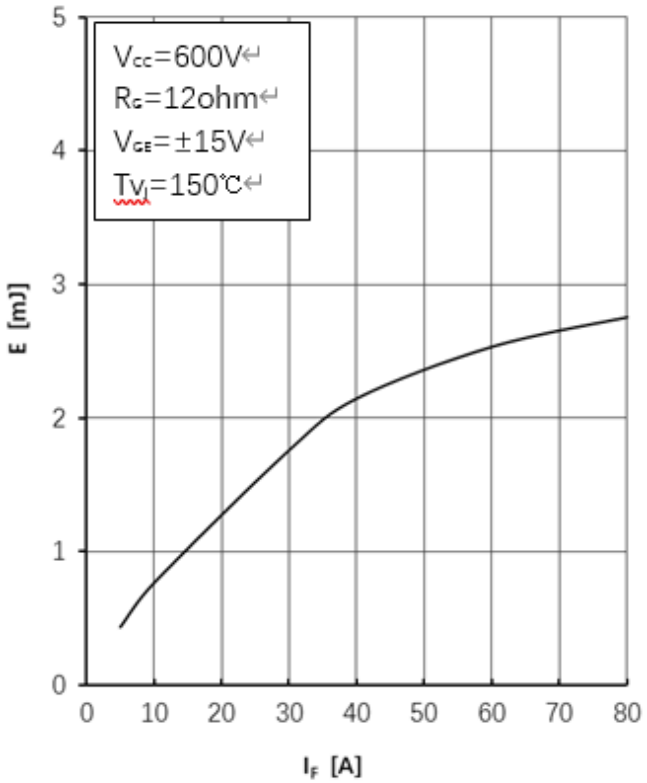



Fig9.Diode Switching Loss(Erec) vs.$I_F$

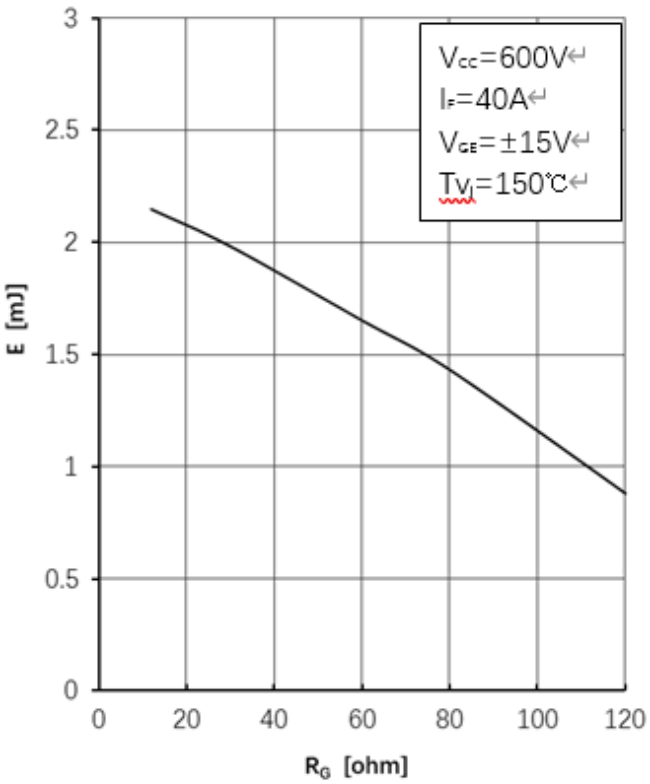



Fig10.Diode Switching Loss(Erec) vs.Rg

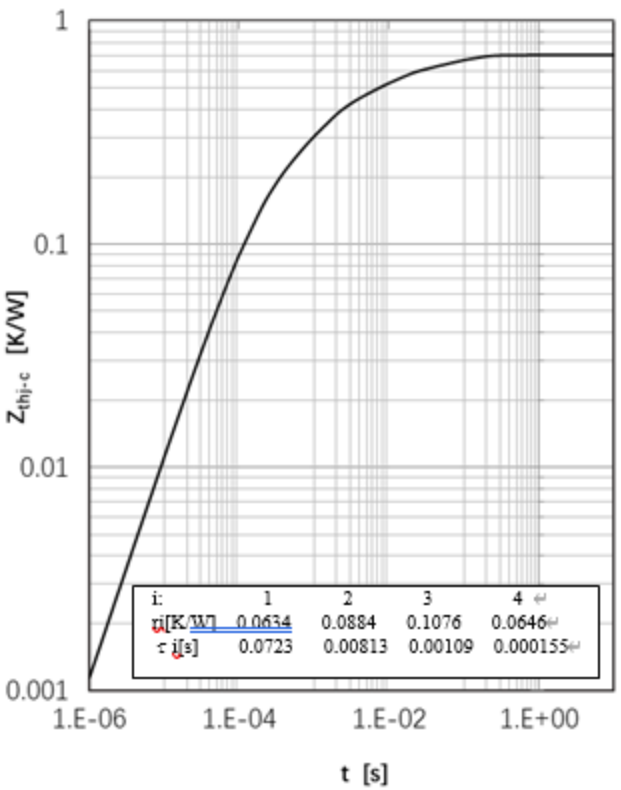



Fig11.Diode Transient Thermal Impedance

## Ordering Information

| Device | Packing |
|---|---|
| Part Number-BP | Tube: 30pcs/Tube, 1800pcs/Ctn |

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