

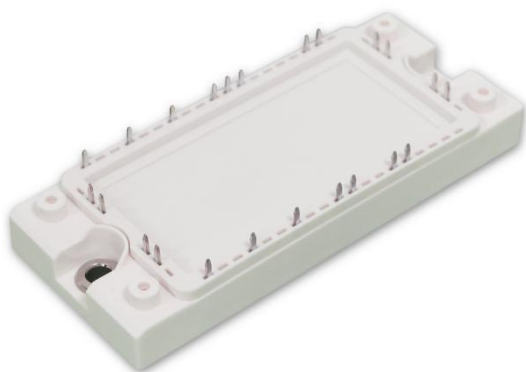
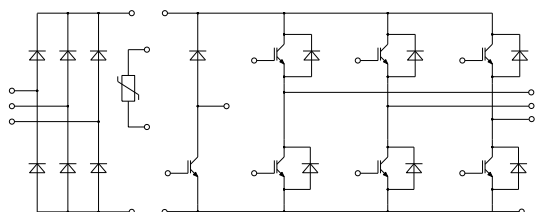
Features

- Low Switching Losses
- Low $V_{ce(sat)}$ with Positive Temperature Coefficient
- Including Fast & Soft Recovery Anti-parallel FWD
- Low Inductance Case
- High Short Circuit Capability(10 μ s)
- Maximum Junction Temperature 175°C
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant ("P" Suffix Designates RoHS Compliant. See Ordering Information)

Applications

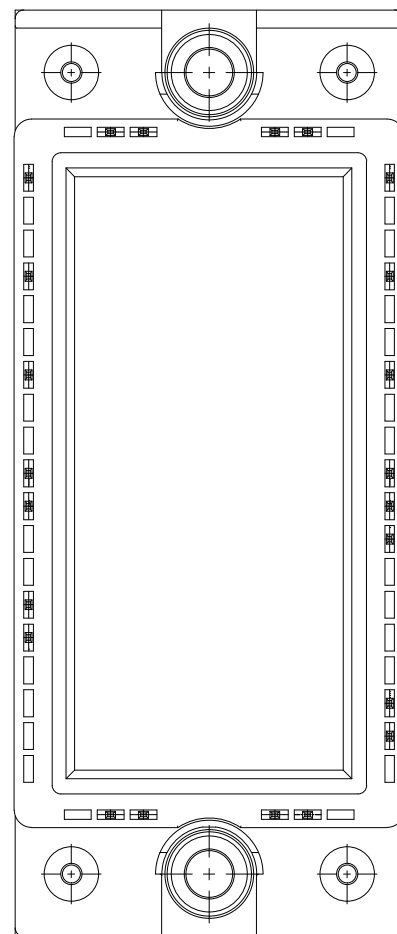
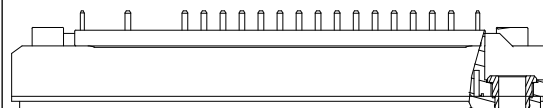
- Motor Drivers
- AC and DC Servo Drive Amplifier
- UPS (Uninterruptible Power Supplies)

Circuit Diagram



IGBT Modules 1200V 50A

E1A



● IGBT- Inverter

Maximum Ratings

| Parameter | Symbol | Test Conditions | Rating | Unit |
|-----------------------------------|-----------|--|----------|------|
| Collector-Emitter Voltage | V_{CES} | $V_{GE}=0V, I_C=1mA, T_{vj}=25^{\circ}C$ | 1200 | V |
| Continuous Collector Current | I_C | $T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$ | 50 | A |
| Repetitive Peak Collector Current | I_{CRM} | $t_p=1ms$ | 100 | A |
| Gate-Emitter Voltage | V_{GES} | $T_{vj}=25^{\circ}C$ | ± 20 | V |
| Total Power Dissipation | P_{tot} | $T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$ | 288 | W |

Electrical Characteristics

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit | |
|--------------------------------------|---------------|--|-----|------|-----|----------|----|
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $V_{GE}=V_{CE}, I_C=1.7mA, T_{vj}=25^{\circ}C$ | 5.2 | 5.8 | 6.4 | V | |
| Collector-Emitter Cut-off Current | I_{CES} | $V_{CE}=1200V, V_{GE}=0V, T_{vj}=25^{\circ}C$ | | | 1 | mA | |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C=50A, V_{GE}=15V, T_{vj}=25^{\circ}C$ | | 1.9 | 2.3 | V | |
| | | $I_C=50A, V_{GE}=15V, T_{vj}=125^{\circ}C$ | | 2.2 | | V | |
| | | $I_C=50A, V_{GE}=15V, T_{vj}=150^{\circ}C$ | | 2.3 | | V | |
| Gate Charge | Q_g | | | 0.35 | | μC | |
| Input Capacitance | C_{ies} | $V_{CE}=25V, V_{GE}=0V, f=1MHz$ | | 2.6 | | nF | |
| Reverse Transfer Capacitance | C_{res} | | | 0.1 | | | |
| Internal Gate Resistance | R_{gint} | | | 5 | | Ω | |
| Gate-Emitter leakage current | I_{GES} | $V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$ | | | 400 | nA | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CE}=600V, I_C=50A, V_{GE}=\pm 15V, R_G=15\Omega, T_{vj}=25^{\circ}C$ | | 168 | | ns | |
| Rise Time | t_r | | | 34 | | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 320 | | | |
| Fall Time | t_f | | | 78 | | | |
| Turn-On Energy | E_{on} | | | 5.42 | | | mJ |
| Turn-Off Energy | E_{off} | | | 4.15 | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CE}=600V, I_C=50A, V_{GE}=\pm 15V, R_G=15\Omega, T_{vj}=125^{\circ}C$ | | 175 | | ns | |
| Rise Time | t_r | | | 42 | | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 426 | | | |
| Fall Time | t_f | | | 148 | | | |
| Turn-On Energy | E_{on} | | | 7.26 | | | mJ |
| Turn-Off Energy | E_{off} | | | 5.8 | | | |
| SC Data | I_{SC} | $T_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C, V_{CC}=900V, V_{CEM} \leq 1200V$ | | 260 | | A | |

● Diode- Inverter

Maximum Ratings

| Parameter | Symbol | Test Conditions | Rating | Unit |
|---------------------------------|-----------|--|--------|------------------|
| Repetitive Peak Reverse Voltage | V_{RRM} | $T_{vj}=25^{\circ}C$ | 1200 | V |
| Continuous DC Forward Current | I_F | | 50 | A |
| Repetitive Peak Forward Current | I_{FRM} | $t_p=1ms$ | 100 | A |
| I^2t -value | I^2t | $V_R=0, t_p=10ms, T_{vj}=125^{\circ}C$ | 560 | A ² s |
| | | $V_R=0, t_p=10ms, T_{vj}=150^{\circ}C$ | 480 | |

Electrical Characteristics

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-------------------------------|-----------|---|-----|------|-----|---------|
| Forward Voltage | V_F | $I_F=50A, T_{vj}=25^{\circ}C$ | | 2.1 | 2.5 | V |
| | | $I_F=50A, T_{vj}=125^{\circ}C$ | | 2.15 | | V |
| | | $I_F=50A, T_{vj}=150^{\circ}C$ | | 2.15 | | V |
| Recovered Charge | Q_{rr} | $I_F=50A, V_R=600V,$ $-di_F/dt=1500A/\mu s, T_{vj}=25^{\circ}C$ | | 5.8 | | μC |
| Peak Reverse Recovery Current | I_{rr} | | | 56 | | A |
| Reverse Recovery Energy | E_{rec} | | | 1.85 | | mJ |
| Recovered Charge | Q_{rr} | $I_F=50A, V_R=600V,$ $-di_F/dt=1500A/\mu s, T_{vj}=125^{\circ}C$ | | 9.1 | | μC |
| Peak Reverse Recovery Current | I_{rr} | | | 58 | | A |
| Reverse Recovery Energy | E_{rec} | | | 3.3 | | mJ |

● IGBT- Brake-chopper

Maximum Ratings

| Parameter | Symbol | Test Conditions | Rating | Unit |
|-----------------------------------|-----------|--|----------|------|
| Collector-Emitter Voltage | V_{CES} | $V_{GE}=0V, I_C=1mA, T_{vj}=25^{\circ}C$ | 1200 | V |
| Continuous Collector Current | I_C | $T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$ | 25 | A |
| Repetitive Peak Collector Current | I_{CRM} | $t_p=1ms$ | 50 | A |
| Gate-Emitter Voltage | V_{GES} | $T_{vj}=25^{\circ}C$ | ± 20 | V |
| Total Power Dissipation | P_{tot} | $T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$ | 166 | W |

Electrical Characteristics

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit | | |
|--------------------------------------|---------------|---|--|------|-----|---------|----|---|
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $V_{GE}=V_{CE}, I_C=0.8mA, T_{vj}=25^{\circ}C$ | 5.2 | 6.0 | 6.8 | V | | |
| Collector-Emitter Cut-off Current | I_{CES} | $V_{CE}=1200V, V_{GE}=0V, T_{vj}=25^{\circ}C$ | | | 1 | mA | | |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C=25A, V_{GE}=15V, T_{vj}=25^{\circ}C$ | | 1.9 | 2.3 | V | | |
| | | $I_C=25A, V_{GE}=15V, T_{vj}=125^{\circ}C$ | | 2.2 | | V | | |
| | | $I_C=25A, V_{GE}=15V, T_{vj}=150^{\circ}C$ | | 2.3 | | V | | |
| Gate Charge | Q_g | | | 0.24 | | μC | | |
| Input Capacitance | C_{ies} | $V_{CE}=25V, V_{GE}=0V, f=1MHz$ | | 1.6 | | nF | | |
| Reverse Transfer Capacitance | C_{res} | | | 0.07 | | | | |
| Gate-Emitter leakage current | I_{GES} | $V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$ | | | 100 | nA | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CE}=600V, I_C=25A, V_{GE}=\pm 15V, R_G=18\Omega, T_{vj}=25^{\circ}C$ | | 175 | | ns | | |
| Rise Time | t_r | | | 38 | | | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 420 | | | | |
| Fall Time | t_f | | | 65 | | | | |
| Turn-On Energy | E_{on} | | | 1.95 | | | mJ | |
| Turn-Off Energy | E_{off} | | | 1.2 | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CE}=600V, I_C=25A, V_{GE}=\pm 15V, R_G=18\Omega, T_{vj}=125^{\circ}C$ | | 185 | | ns | | |
| Rise Time | t_r | | | 43 | | | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 510 | | | | |
| Fall Time | t_f | | | 120 | | | | |
| Turn-On Energy | E_{on} | | | 2.6 | | | mJ | |
| Turn-Off Energy | E_{off} | | | 2.0 | | | | |
| SC Data | I_{SC} | | $T_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C, V_{CC}=900V, V_{CEM} \leq 1200V$ | | 135 | | | A |

● Diode- Brake-chopper

Maximum Ratings

| Parameter | Symbol | Test Conditions | Rating | Unit |
|---------------------------------|-----------|--|--------|--------|
| Repetitive Peak Reverse Voltage | V_{RRM} | $T_{vj}=25^{\circ}C$ | 1200 | V |
| Continuous DC Forward Current | I_F | | 15 | A |
| Repetitive Peak Forward Current | I_{FRM} | $t_p=1ms$ | 30 | A |
| I^2t -value | I^2t | $V_R=0, t_p=10ms, T_{vj}=125^{\circ}C$ | 48 | A^2s |
| | | $V_R=0, t_p=10ms, T_{vj}=150^{\circ}C$ | 42 | |

Electrical Characteristics

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-------------------------------|-----------|--|-----|-----|-----|---------|
| Forward Voltage | V_F | $I_F=15A, T_{vj}=25^{\circ}C$ | | 2 | | V |
| | | $I_F=15A, T_{vj}=125^{\circ}C$ | | 2.1 | | V |
| | | $I_F=15A, T_{vj}=150^{\circ}C$ | | 2.1 | | V |
| Recovered Charge | Q_{rr} | $I_F=15A, V_R=600V,$ $-di_F/dt=550A/\mu s, T_{vj}=25^{\circ}C$ | | 1.1 | | μC |
| Peak Reverse Recovery Current | I_{rr} | | | 12 | | A |
| Reverse Recovery Energy | E_{rec} | | | 0.3 | | mJ |
| Recovered Charge | Q_{rr} | $I_F=15A, V_R=600V,$ $-di_F/dt=550A/\mu s, T_{vj}=125^{\circ}C$ | | 1.9 | | μC |
| Peak Reverse Recovery Current | I_{rr} | | | 14 | | A |
| Reverse Recovery Energy | E_{rec} | | | 0.6 | | mJ |

● Diode- Rectifier

Maximum Ratings

| Parameter | Symbol | Test Conditions | Rating | Unit |
|--|-------------|--|--------|----------------------|
| Repetitive Peak Reverse Voltage | V_{RRM} | $T_j=25^{\circ}\text{C}$ | 1600 | V |
| Average On-state Current 50/60Hz, sine wave | $I_{F(AV)}$ | $T_C=100^{\circ}\text{C}$ | 65 | A |
| Maximum RMS Current at Rectifier Output | I_{RMSM} | $T_C=100^{\circ}\text{C}$ | 110 | A |
| Surge Forward Current | I_{FSM} | $V_R=0, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$ | 850 | A |
| I^2t -value | I^2t | $V_R=0, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$ | 3610 | A^2s |

Electrical Characteristics

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-----------------------|--------|---|-----|-----|-----|------|
| Diode Forward Voltage | V_F | $I_F=50\text{A}, T_j=150^{\circ}\text{C}$ | | 1 | | V |
| Reverse Current | I_r | $T_j=125^{\circ}\text{C}, V_R=1600\text{V}$ | | | 1.5 | mA |

● NTC-Thermistor

Electrical Characteristics

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-------------------|--------------|---|-----|------|-----|------------|
| Rated Resistance | R_{25} | | | 5 | | k Ω |
| Deviation of R100 | $\Delta R/R$ | $T_C=100, R_{100}=493.3\Omega$ | -5 | | 5 | % |
| Power Dissipation | P_{25} | | | | 20 | mW |
| B-value | $B_{25/50}$ | $R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$ | | 3375 | | K |

● Module Characteristics($T_C=25^\circ\text{C}$ unless otherwise specified)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|--|------------------------|-------------------------------------|------|------|------|------------------|
| Isolation voltage | V_{isol} | $t=1\text{min}, f=50\text{Hz}$ | 2500 | | | V |
| Maximum Junction Temperature | T_{jmax} | Inverter, brake | | | 175 | $^\circ\text{C}$ |
| | | rectifier | | | 150 | |
| Operating Junction Temperature | $T_{\text{vj op}}$ | | -40 | | 150 | $^\circ\text{C}$ |
| Operating Junction Temperature | T_{stg} | | -40 | | 125 | $^\circ\text{C}$ |
| Stray Inductance | L_{CE} | | | 60 | | nH |
| Module Lead Resistance , Terminal to Chip | $R_{\text{cc'+EE'}}$ | TC=25 $^\circ\text{C}$, per switch | | 4 | | m Ω |
| | $R_{\text{AA'+CC'}}$ | | | 3 | | |
| Thermal Resistance Junction to Case | $R_{\theta\text{j c}}$ | per IGBT-inverter | | | 0.52 | K/W |
| | | per Diode-inverter | | | 0.81 | |
| | | per IGBT-brake-chopper | | | 0.90 | |
| | | per Diode-chopper | | | 1.5 | |
| | | per Diode-rectifier | | | 0.75 | |
| Thermal Resistance Case to Sink | $R_{\theta\text{cs}}$ | per IGBT-inverter | | 0.31 | | K/W |
| | | per Diode-inverter | | 0.48 | | |
| | | per IGBT-brake-chopper | | 0.33 | | |
| | | per Diode-chopper | | 0.7 | | |
| | | per Diode-rectifier | | 0.36 | | |
| | | per Module | | 0.02 | | |
| Module-to-Sink Torque | M_{S} | | 3 | | 6 | N·m |
| Weight of Module | G | | | 180 | | g |

Curve Characteristics

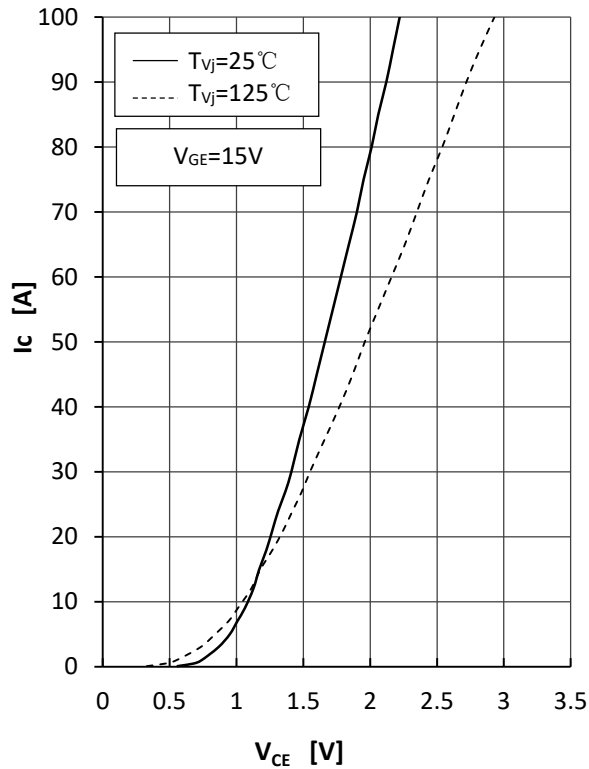


Fig1.IGBT Output Characteristics

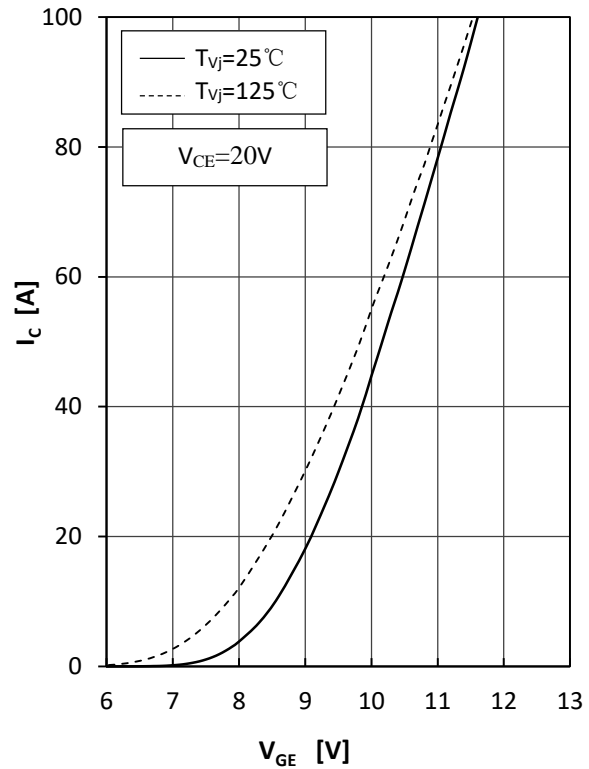


Fig2.IGBT Transfer Characteristics

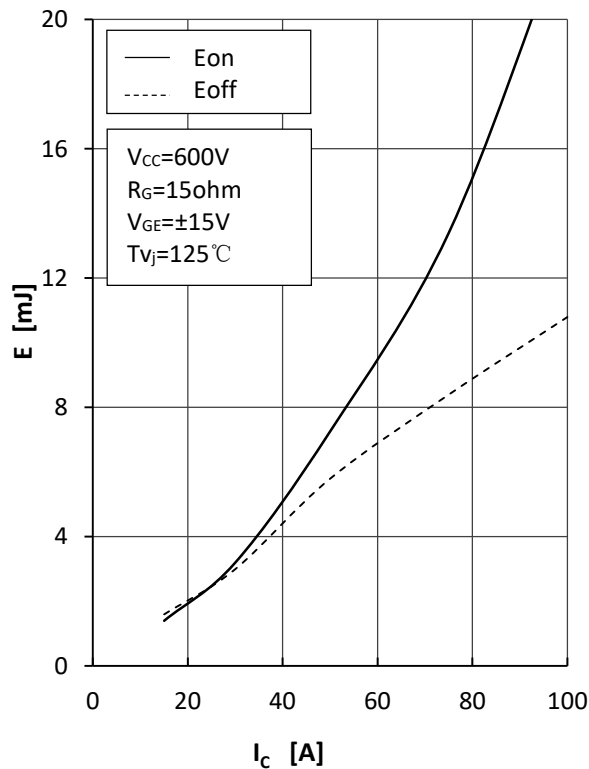


Fig3.IGBT Switching Loss vs.Ic

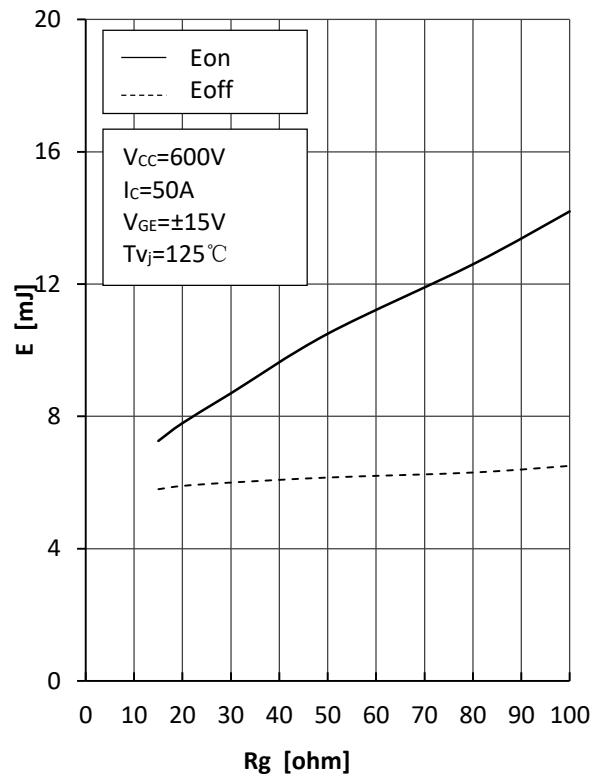
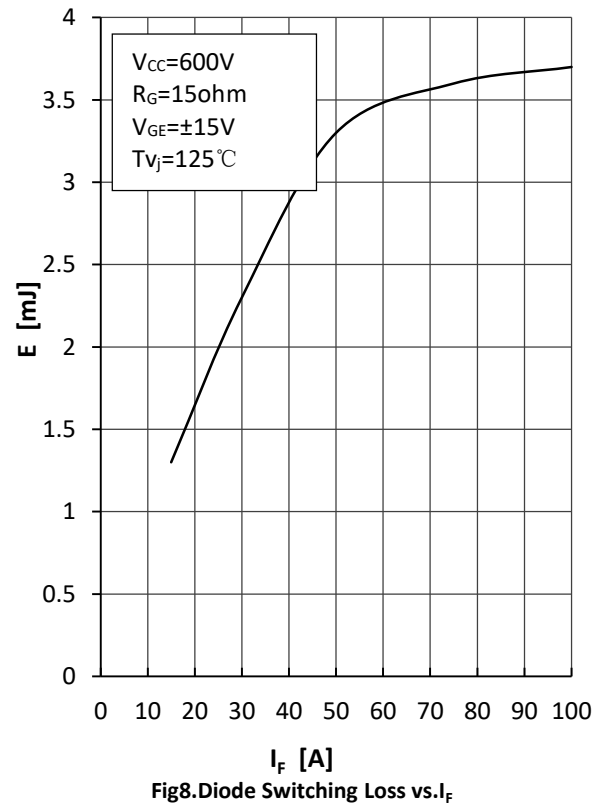
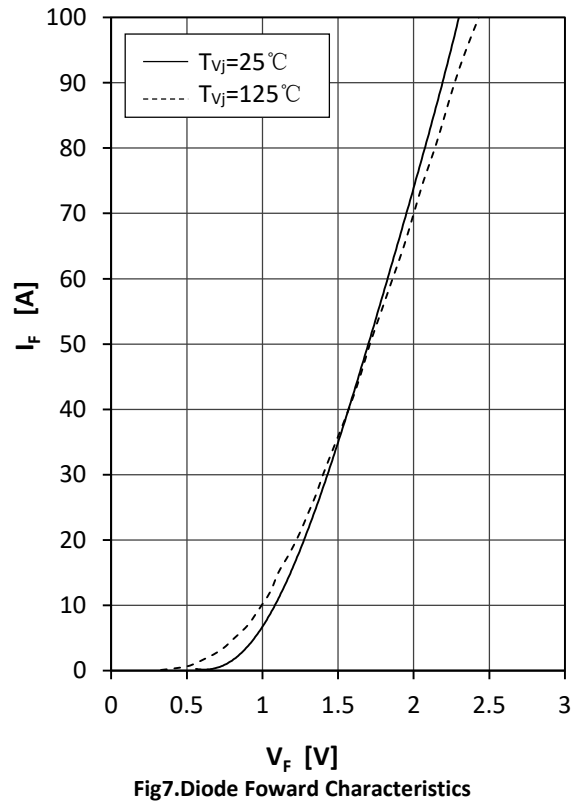
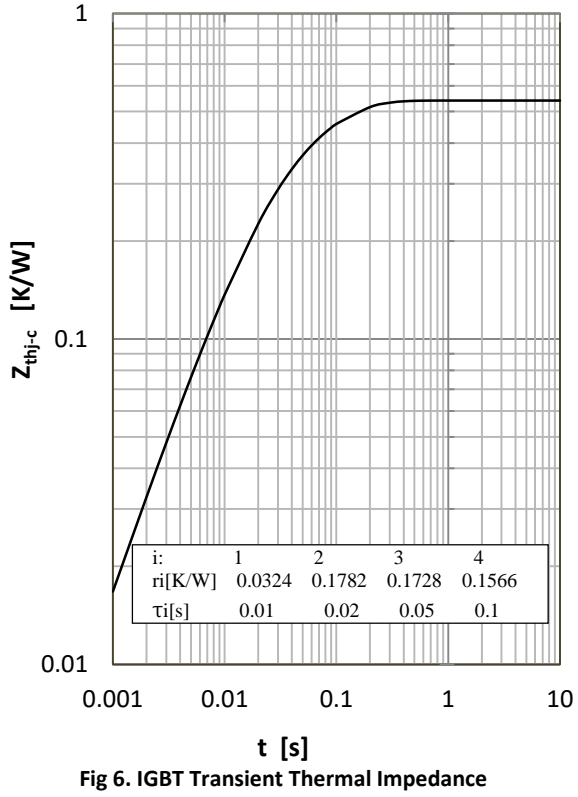
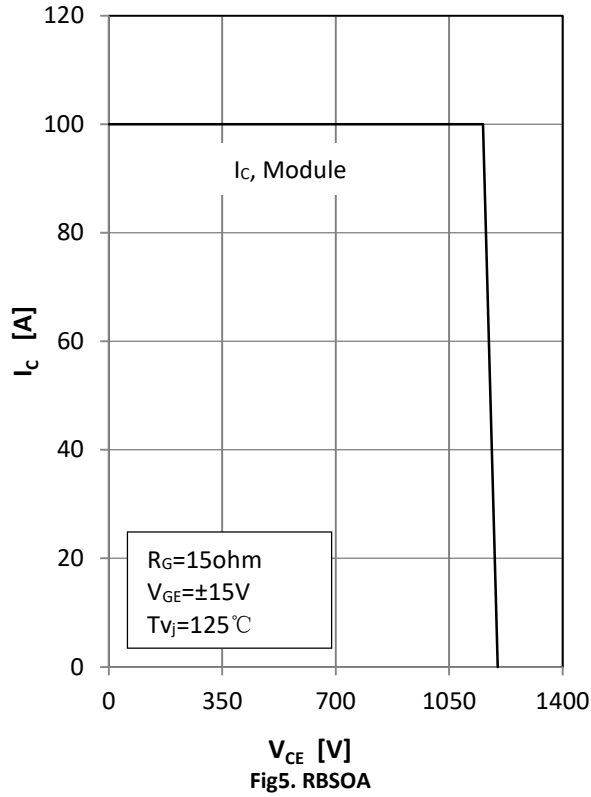


Fig4.IGBT Switching Loss vs.Rg

Curve Characteristics



Curve Characteristics

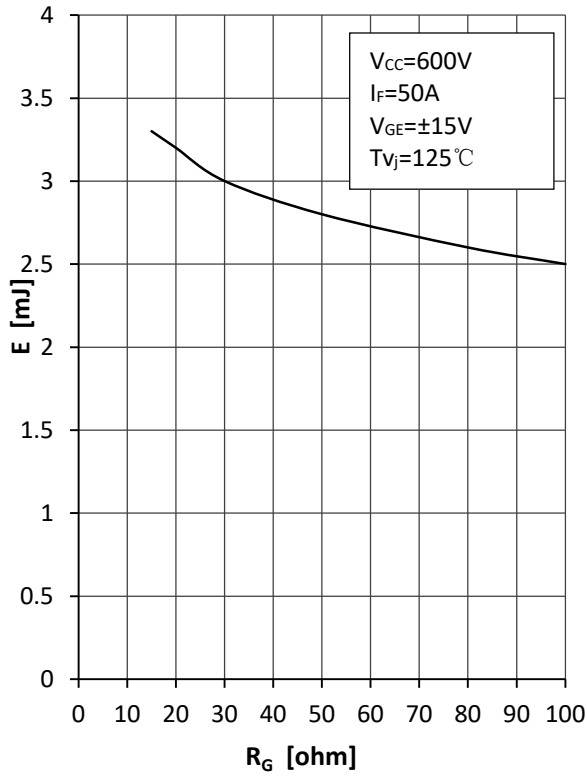


Fig9.Diode Switching Loss vs.Rg

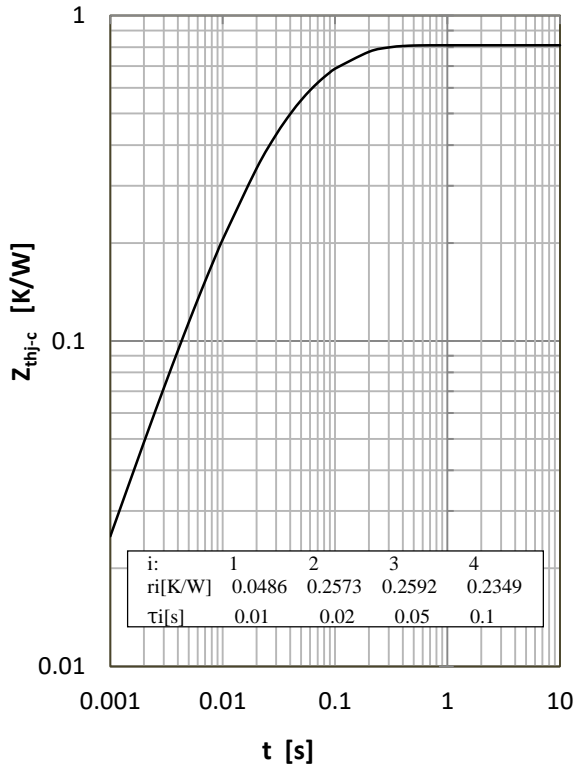


Fig10.Diode Transient Thermal Impedance

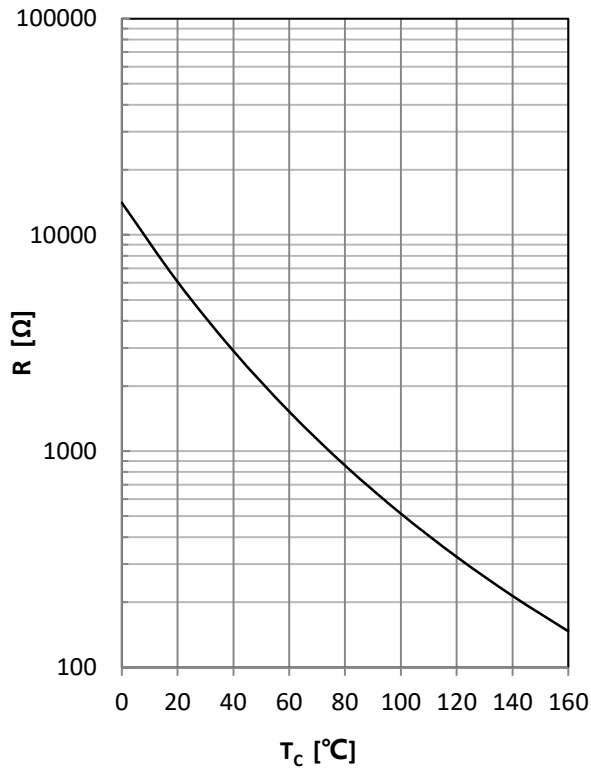
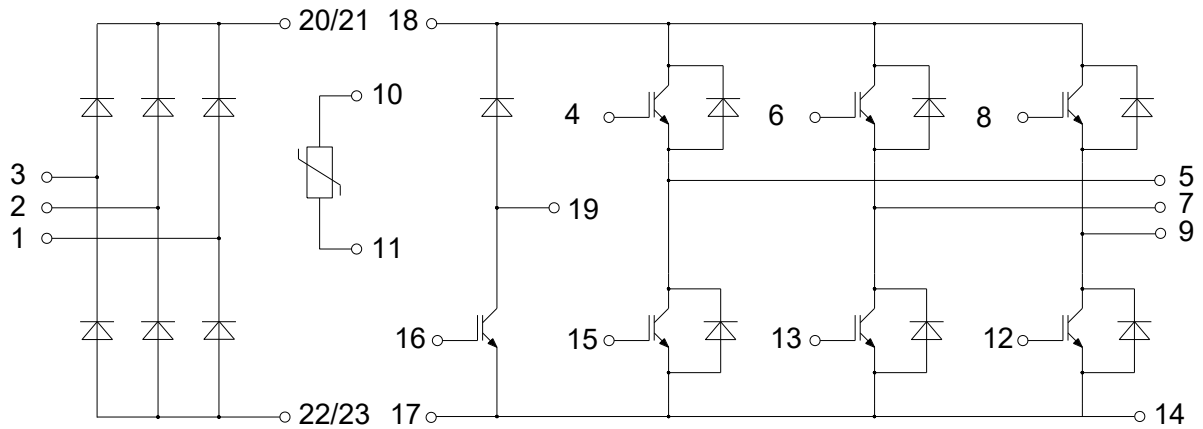


Fig 11. NTC Temperature Characteristic

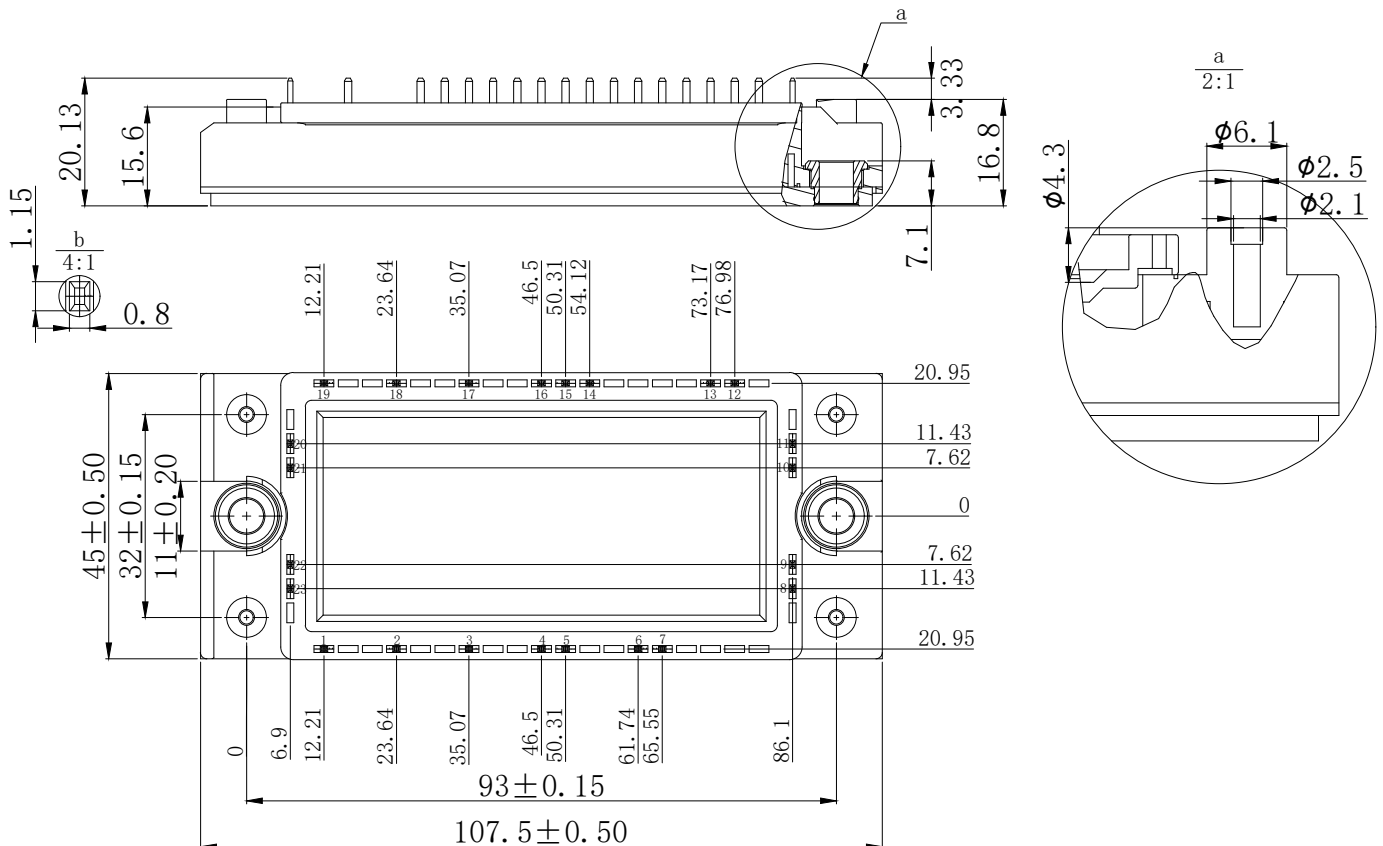
Circuit Diagram



Package Dimensions

E1A

Dimensions in mm



Ordering Information

| Device | Packing |
|----------------|-----------------------------|
| Part Number-BP | Bulk: 10pcs/Box ; 70pcs/Ctn |

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