



E502650

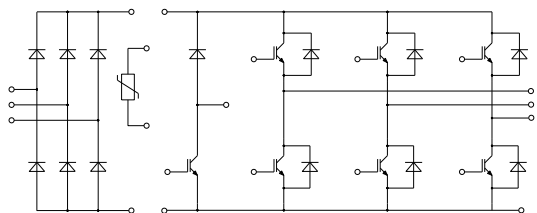
Features

- 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

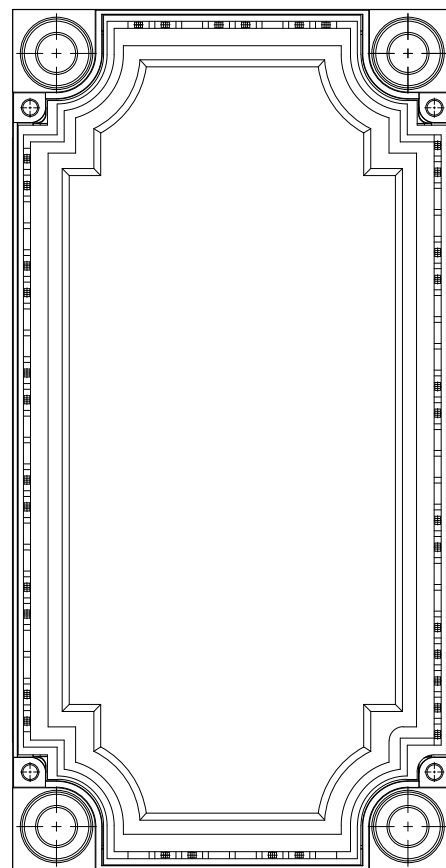
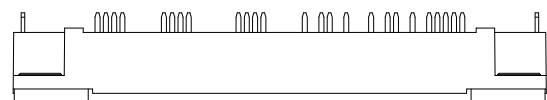
- Motor Drivers
- AC and DC Servo Drive Amplifier
- UPS (Uninterruptible Power Supplies)

Circuit Diagram



IGBT Modules 1200V 50A

E2A



● 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 | $T_C=80^{\circ}C, T_{vjmax}=175^{\circ}C$ | 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} | | | 4 | | 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 | | |
| 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 | | |
| Turn-Off Energy | E_{off} | | 5.8 | | | |
| SC Data | I_{SC} | $T_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C, V_{CC}=900V, V_{CEM} \leq 1200V$ | | 220 | | 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^2s |
| | | $V_R=0, t_p=10ms, T_{vj}=150^{\circ}C$ | 480 | A^2s |

Electrical Characteristics

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-------------------------------|-----------|---|-----|------|-----|---------|
| Forward Voltage | V_F | $I_F=50A, T_{vj}=25^{\circ}C$ | | 1.9 | 2.4 | V |
| | | $I_F=50A, T_{vj}=125^{\circ}C$ | | 1.9 | | V |
| | | $I_F=50A, T_{vj}=150^{\circ}C$ | | 1.95 | | 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 | $T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$ | 35 | A |
| Repetitive Peak Collector Current | I_{CRM} | $t_p=1ms$ | 70 | A |
| Gate-Emitter Voltage | V_{GES} | $T_{vj}=25^{\circ}C$ | ± 20 | V |
| Total Power Dissipation | P_{tot} | $T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$ | 227 | W |

Electrical Characteristics

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit | |
|--------------------------------------|---------------|--|-----|------|------|---------|----|
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $V_{GE}=V_{CE}, I_C=1.4mA, T_{vj}=25^{\circ}C$ | 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 | $V_{CE(sat)}$ | $I_C=35A, V_{GE}=15V, T_{vj}=25^{\circ}C$ | | 1.85 | 2.25 | V | |
| | | $I_C=35A, V_{GE}=15V, T_{vj}=125^{\circ}C$ | | 2.15 | | V | |
| | | $I_C=35A, V_{GE}=15V, T_{vj}=150^{\circ}C$ | | 2.25 | | V | |
| Gate Charge | Q_g | | | 0.27 | | μC | |
| Input Capacitance | C_{ies} | $V_{CE}=25V, V_{GE}=0V, f=1MHz$ | | 2 | | nF | |
| Reverse Transfer Capacitance | C_{res} | | | 0.07 | | | |
| Gate-Emitter leakage current | I_{GES} | $V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$ | | | 400 | nA | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CE}=600V, I_C=35A, V_{GE}=\pm 15V, R_G=12\Omega, T_{vj}=25^{\circ}C$ | | 25 | | ns | |
| Rise Time | t_r | | | 13 | | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 24 | | | |
| Fall Time | t_f | | | 115 | | | |
| Turn-On Energy | E_{on} | | | | 1.9 | | mJ |
| Turn-Off Energy | E_{off} | | | 2.0 | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CE}=600V, I_C=35A, V_{GE}=\pm 15V, R_G=12\Omega, T_{vj}=125^{\circ}C$ | | 25 | | ns | |
| Rise Time | t_r | | | 16 | | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 295 | | | |
| Fall Time | t_f | | | 170 | | | |
| Turn-On Energy | E_{on} | | | | 2.9 | | mJ |
| Turn-Off Energy | E_{off} | | | | 2.9 | | |
| SC Data | I_{SC} | $T_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C, V_{CC}=900V, V_{CEM} \leq 1200V$ | | 150 | | 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 | $V_R=0, t_p=10ms, T_{vj}=125^{\circ}C$ | 16 | A^2s |
| | | $V_R=0, t_p=10ms, T_{vj}=150^{\circ}C$ | 14 | |

Electrical Characteristics

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-------------------------------|-----------|--|-----|-----|-----|---------|
| Forward Voltage | V_F | $I_F=15A, T_{vj}=25^{\circ}C$ | | 2.0 | 2.4 | 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

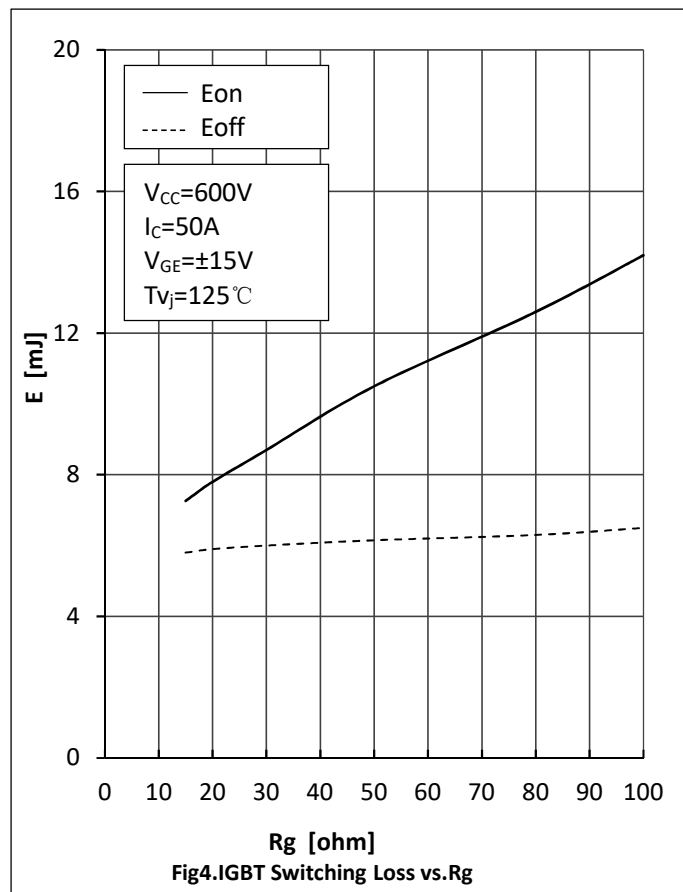
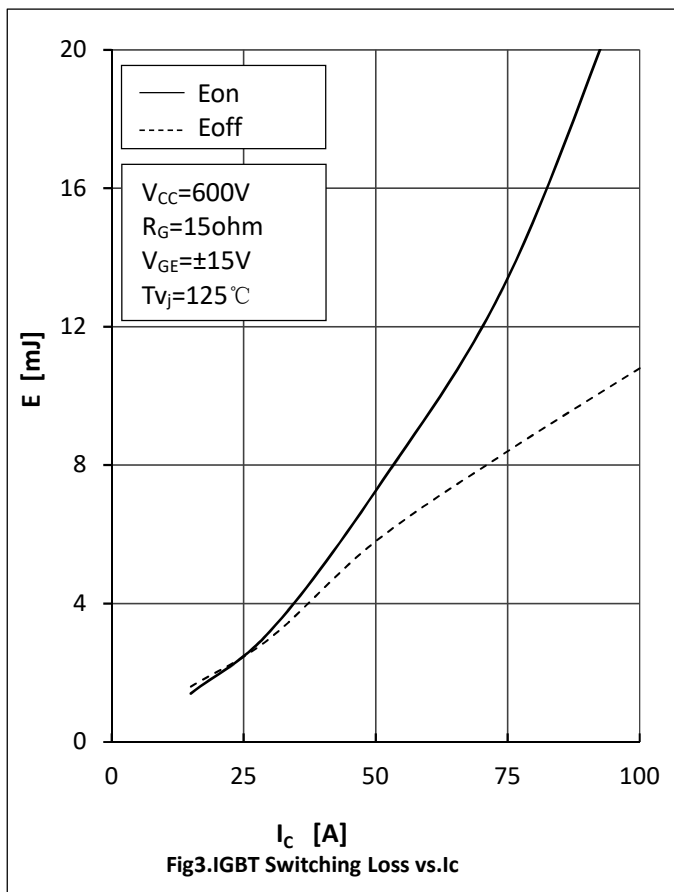
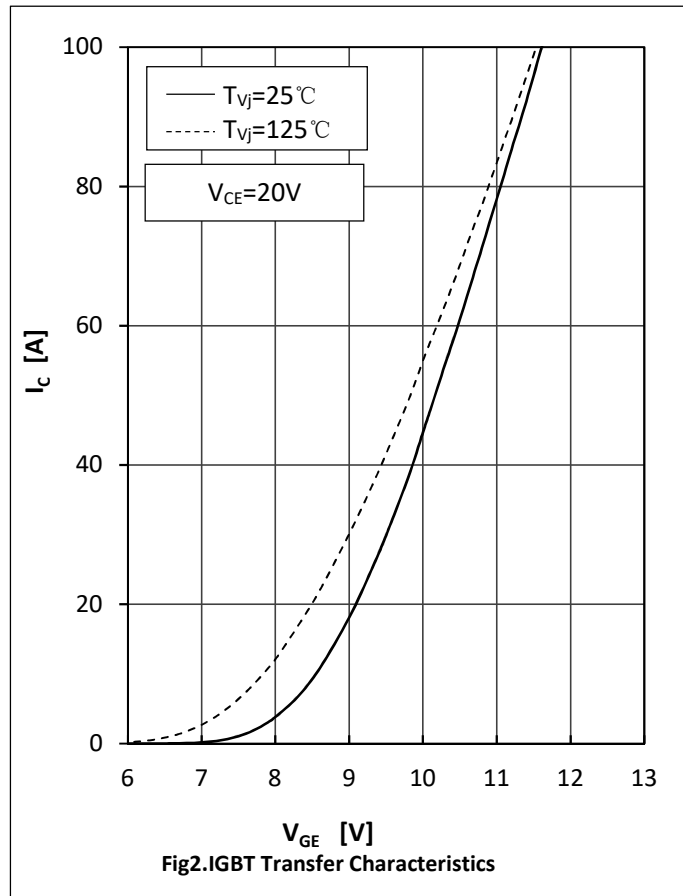
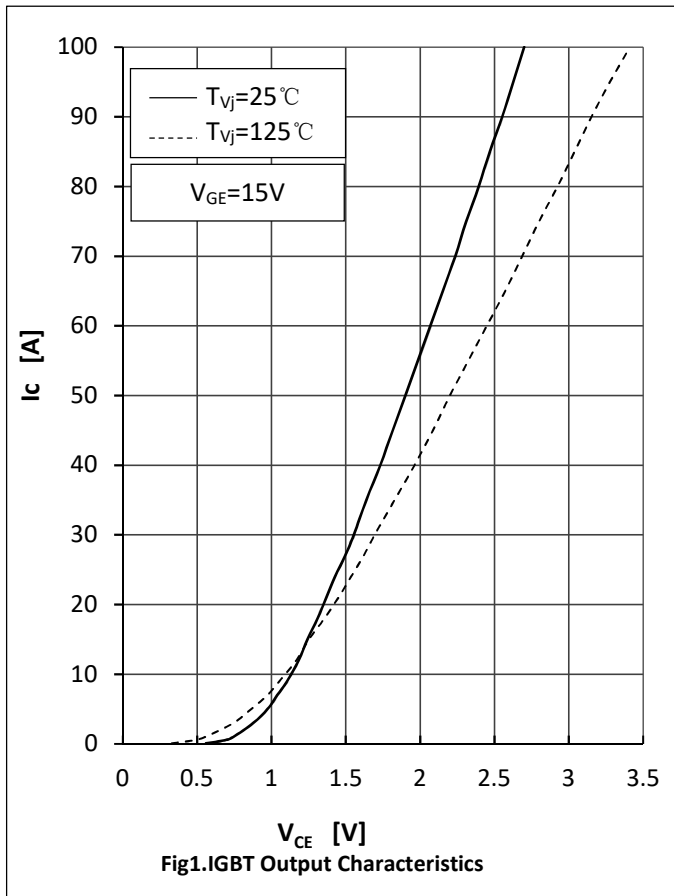
Electrical Characteristics

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-------------------|--------------|---|-----|------|-----|------------------|
| Rated Resistance | R_{25} | | | 5 | | $\text{k}\Omega$ |
| 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 |

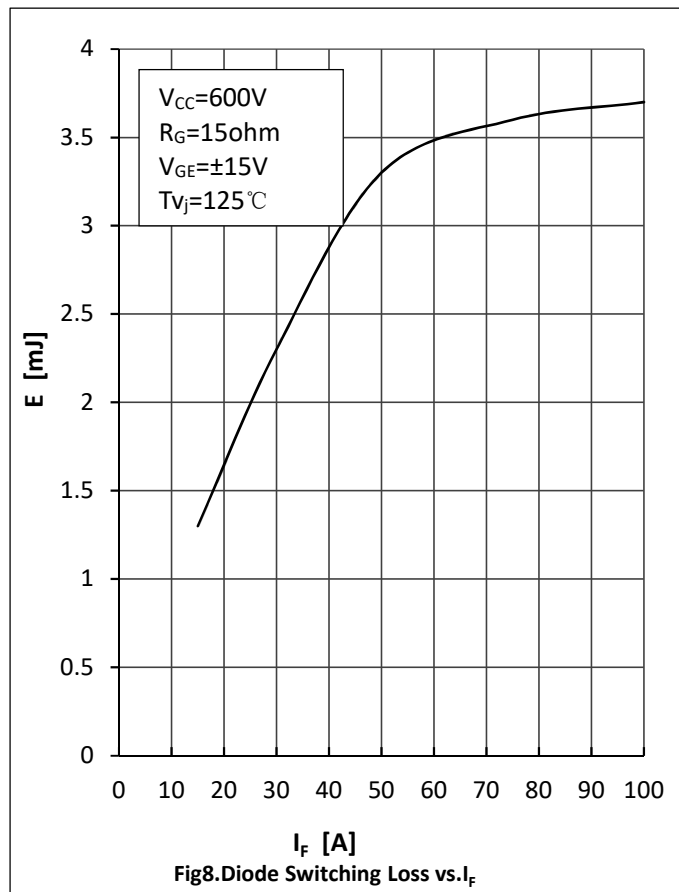
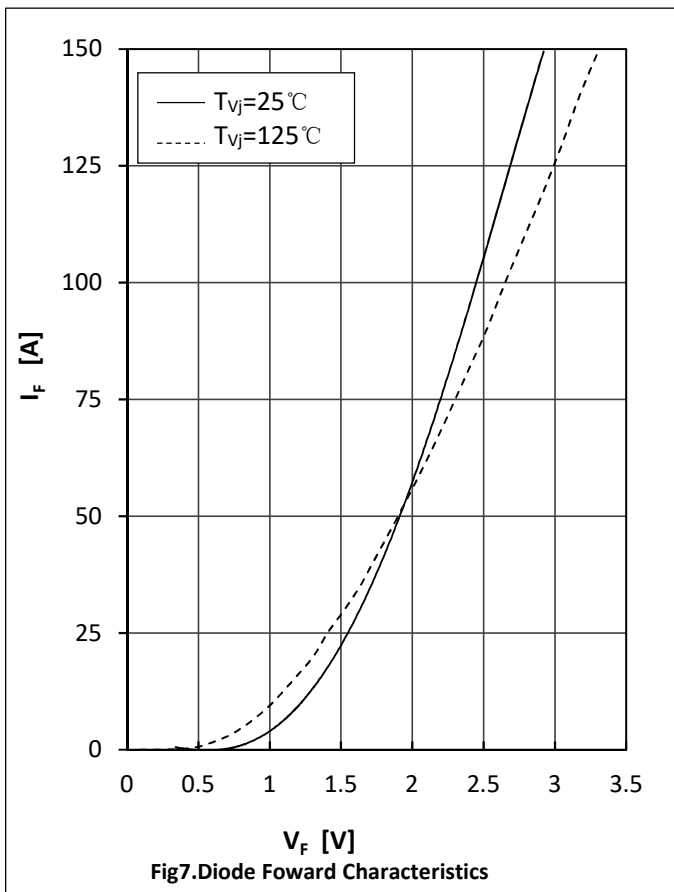
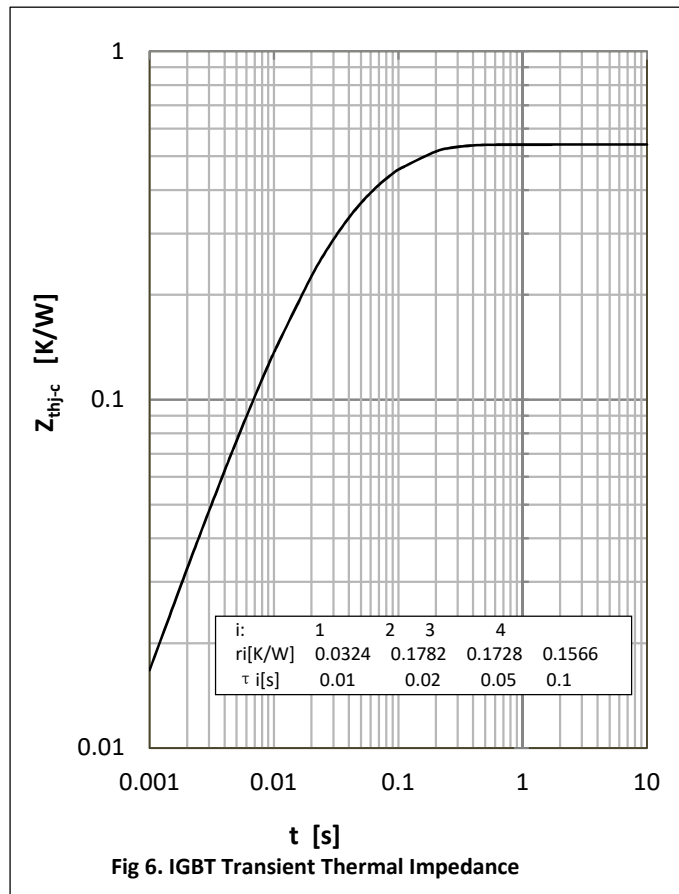
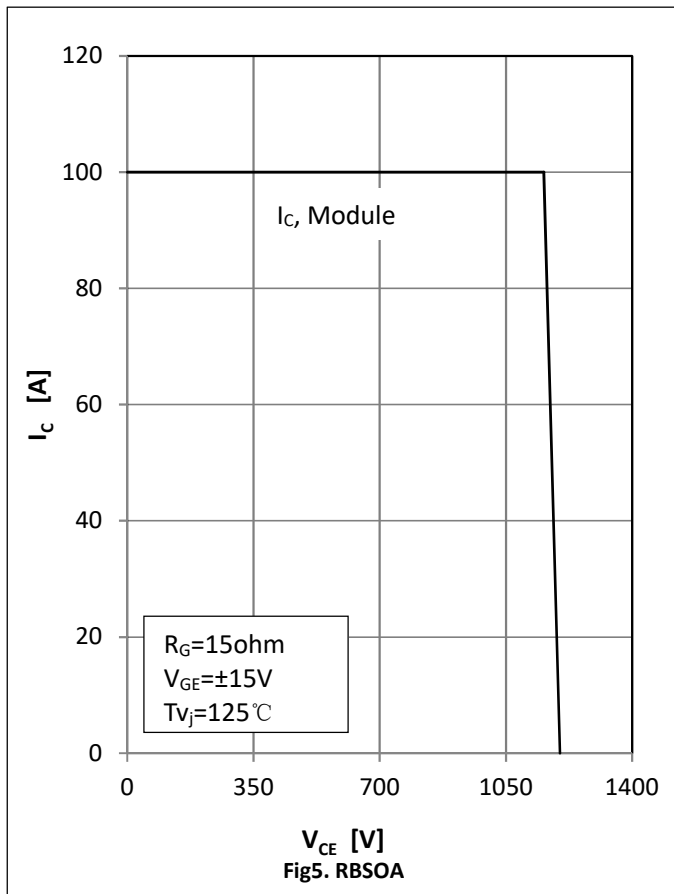
● Module Characteristics($T_C=25^\circ\text{C}$ unless otherwise specified)

| 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} | | | | 175 | $^\circ\text{C}$ |
| 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 | $R_{\text{CC'+EE'}}$ | $T_C=25^\circ\text{C}$, per switch | | 4 | | m Ω |
| | $R_{\text{AA'+CC'}}$ | | | 3 | | |
| Thermal Resistance Junction to Case | $R_{\theta\text{jc}}$ | per IGBT-inverter | | | 0.52 | K/W |
| | | per Diode-inverter | | | 0.81 | |
| | | per IGBT-brake-chopper | | | 0.66 | |
| | | per Diode-chopper | | | 1.5 | |
| | | per Diode-rectifier | | | 0.64 | |
| Thermal Resistance Case to Sink | $R_{\theta\text{cs}}$ | per IGBT-inverter | | 0.29 | | K/W |
| | | per Diode-inverter | | 0.44 | | |
| | | per IGBT-brake-chopper | | 0.36 | | |
| | | per Diode-chopper | | 0.33 | | |
| | | per Diode-rectifier | | 0.70 | | |
| | | per Module | | 0.009 | | |
| Module-to-Sink Torque | M_S | | 3 | | 6 | N·m |
| Weight of Module | G | | | 300 | | g |

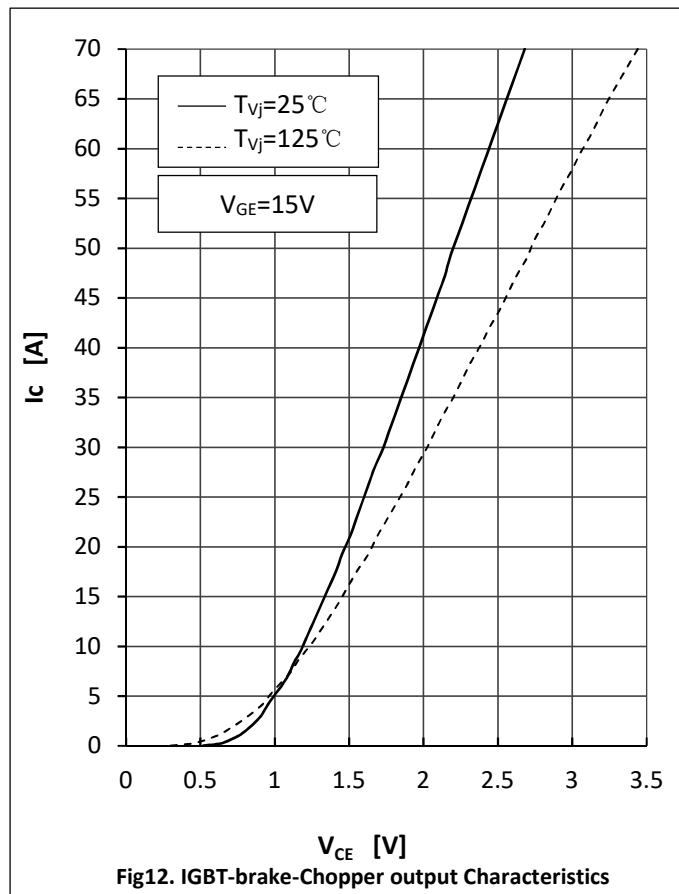
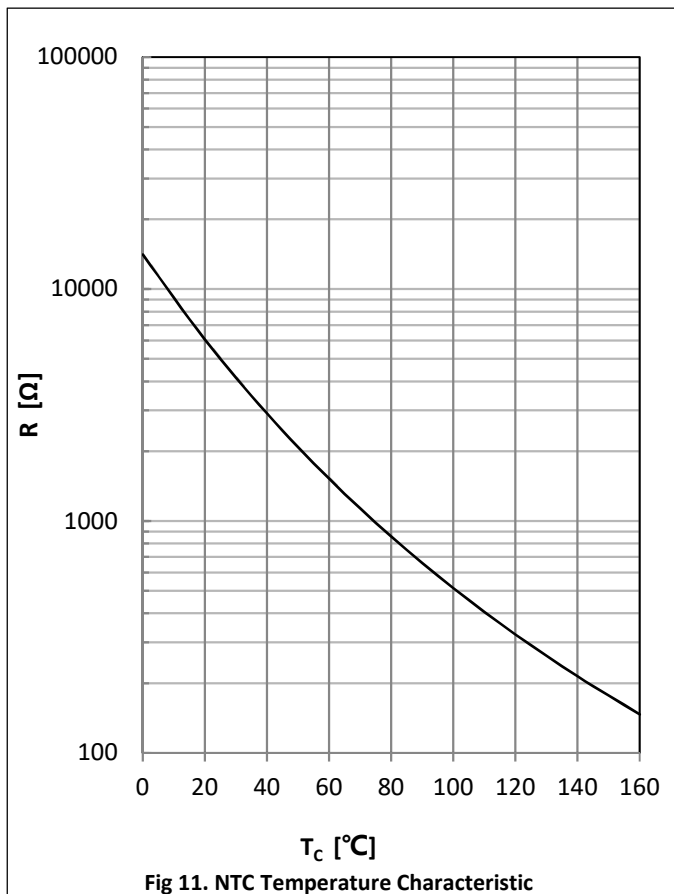
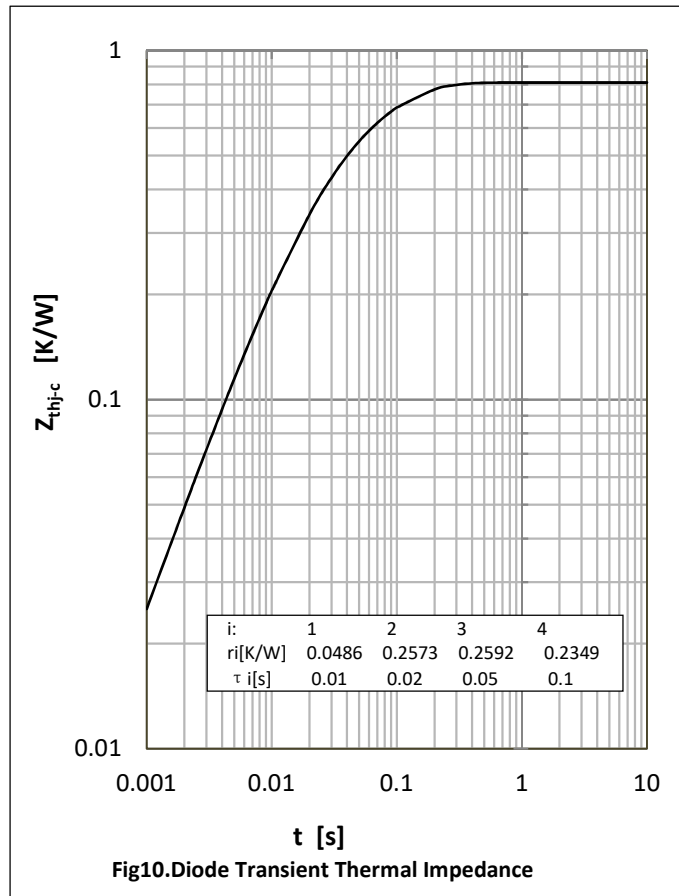
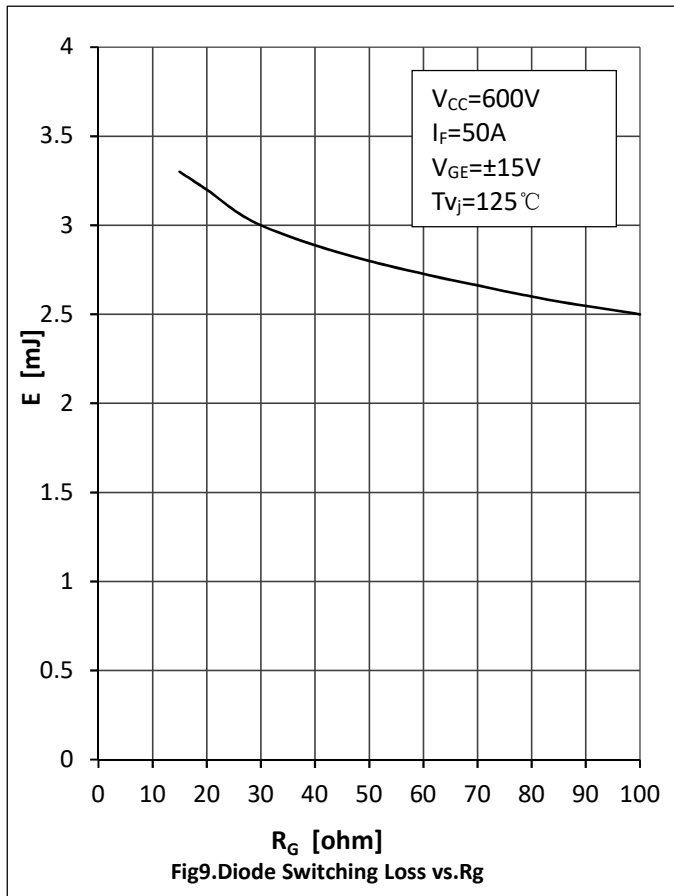
Curve Characteristics



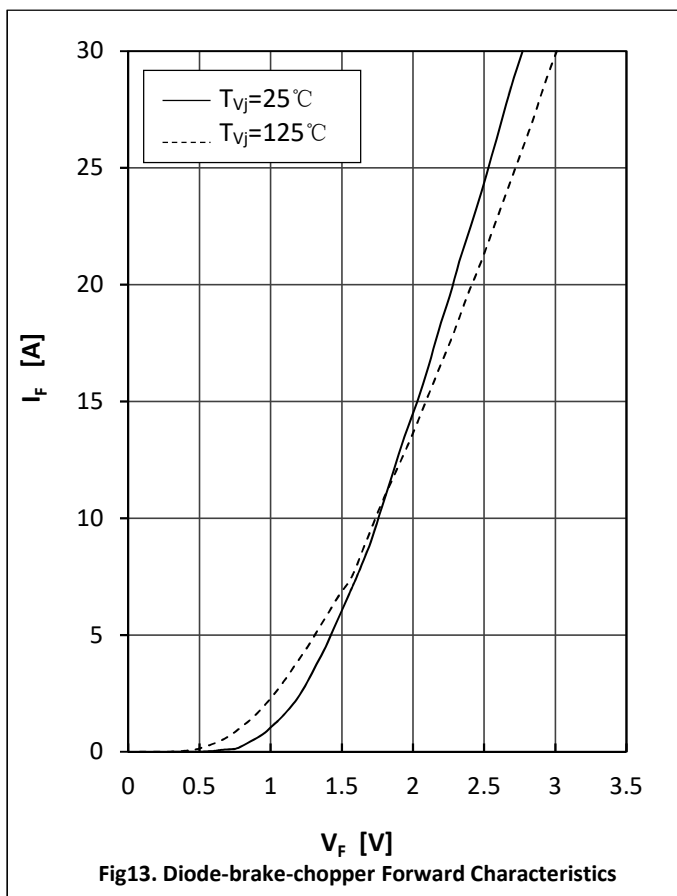
Curve Characteristics



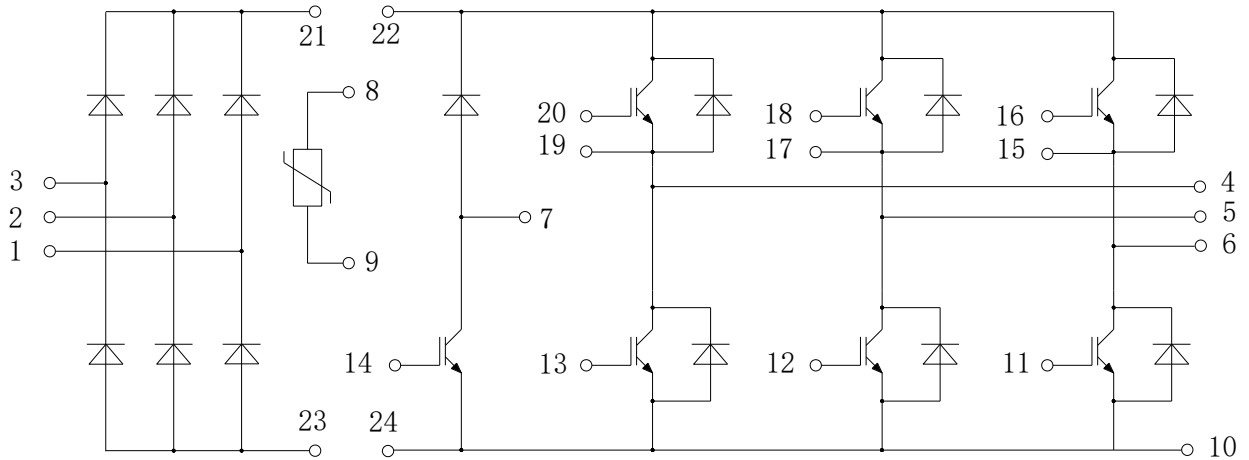
Curve Characteristics



Curve Characteristics



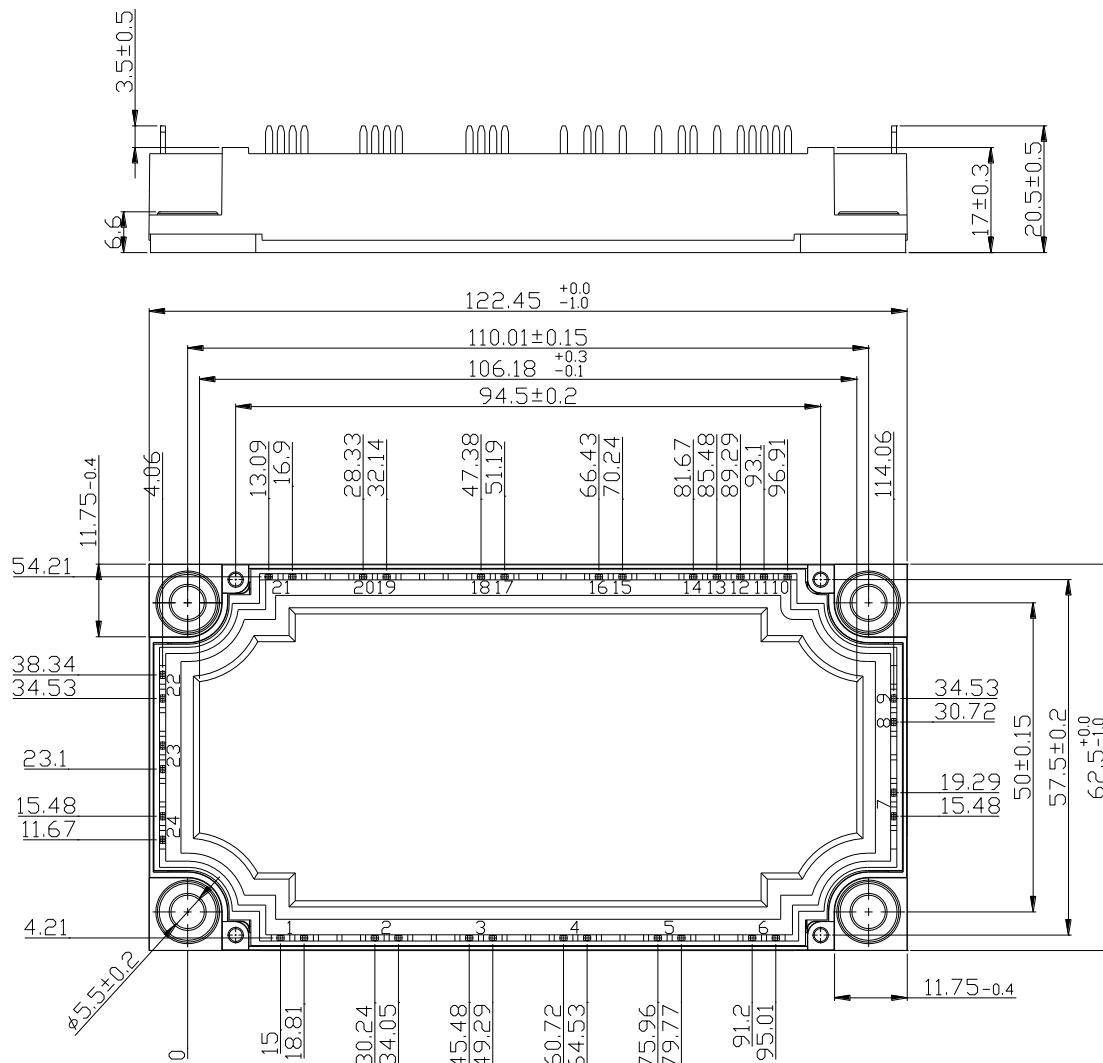
Circuit Diagram



Package Dimensions

Dimensions in mm

E2A



Ordering Information

| Device | Packing |
|----------------|----------------------------|
| Part Number-BP | Bulk: 6pcs/Box ; 42pcs/Ctn |

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