



IGBT Modules

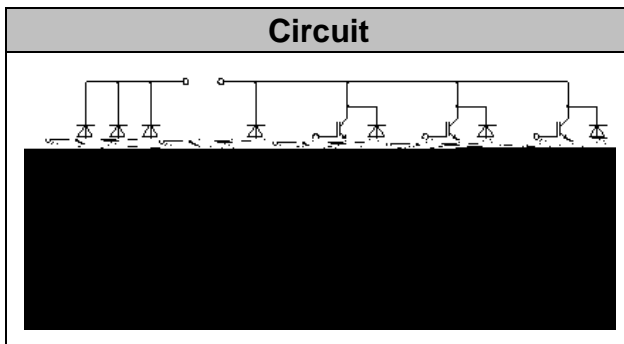
| | |
|------------------------|-------|
| V_{CES} | 1200V |
| I_C | 15A |

Applications

- Motor Drivers
- AC and DC servo drive amplifier
- UPS (Uninterruptible Power Supplies)

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(10us)
- Isolated heatsink using DBC technology
- Maximum junction temperature 175



IGBT- inverter

Absolute Maximum Ratings

| Parameter | Symbol | Conditions | Value | Unit |
|-----------------------------------|-----------|-----------------------------------|----------|------|
| Collector-Emitter Voltage | V_{CES} | $V_{GE}=0V, I_C = 1mA, T_{vj}=25$ | 1200 | V |
| Continuous Collector Current | I_C | $T_c=100, T_{vjmax}=175$ | 15 | A |
| Repetitive Peak Collector Current | I_{CRM} | $tp=1ms$ | 30 | A |
| Gate-Emitter Voltage | V_{GES} | $T_{vj}=25$ | ± 20 | V |
| Total Power Dissipation | P_{tot} | $T_c=25$ $T_{vjmax}=175$ | 155 | W |



IGBT- inverter Characteristic values

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---------------|--|-------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Gate-emitter Threshold Voltage | $V_{GE(th)}$ | $V_{GE}=V_{CE}, I_C =0.5mA, T_{vj}=25$ | 5.2 | 6.0 | 6.8 | V |
| Collector-Emitter Cut-off Current | I_{CES} | $V_{CE}=1200V, V_{GE}=0V, T_{vj}=25$ | | | 1.0 | mA |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C=15A, V_{GE}=15V, T_{vj}=25$ | | 1.80 | 2.20 | V |
| | | $I_C=15A, V_{GE}=15V, T_{vj}=125$ | | 2.10 | | |
| | | $I_C=15A, V_{GE}=15V, T_{vj}=150$ | | 2.20 | | |
| Gate Charge | Q_G | | | 0.15 | | uC |
| Input Capacitance | C_{ies} | $V_{CE}=25V, V_{GE}=0V,$ | | 1.1 | | nF |
| Reverse Transfer Capacitance | C_{res} | $f=1MHz, T_{vj}=25$ | | 0.04 | | nF |
| Gate-Emitter leakage current | I_{GES} | $V_{CE}=0V, V_{GE}=20V, T_{vj}=25$ | | | 400 | nA |
| Turn-on Delay Time | $t_{d(on)}$ | $I_C =15A$ $V_{CE} = 600V$ $V_{GE} = \pm 15V$ $R_G=39$ $T_{vj}=25$ | | 90 | | ns |
| Rise Time | t_r | | | 64 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | | | 180 | | ns |
| Fall Time | t_f | | | 135 | | ns |
| Energy Dissipation During Turn-on Time | E_{on} | | | 1.42 | | mJ |
| Energy Dissipation During Turn-off Time | E_{off} | | | 0.78 | | mJ |
| Turn-on Delay Time | $t_{d(on)}$ | | | 95 | | ns |
| Rise Time | t_r | | | 70 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | | | 260 | | ns |
| Fall Time | t_f | | | 180 | | ns |
| Energy Dissipation During Turn-on Time | E_{on} | $T_{vj}=125$ | | 1.85 | | mJ |
| Energy Dissipation During Turn-off Time | E_{off} | | | 1.13 | | mJ |
| SC Data | I_{sc} | $T_p, 10\mu s, V_{GE}=15V, T_{vj}=150$, $V_{cc}=900V, V_{CEM} 1200V$ | | 90 | | A |



Diode-inverter Absolute Maximum Ratings

| Parameter | Symbol | Conditions | Value | Unit |
|---------------------------------|-----------|-------------------------------|-------|--------|
| Repetitive Peak Reverse Voltage | V_{RRM} | $T_{vj}=25$ | 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 | $V_R=0, t_p=10ms, T_{vj}=125$ | 16.0 | A^2s |
| | | $V_R=0, t_p=10ms, T_{vj}=150$ | 14.0 | |

Characteristic values

| Parameter | Symbol | Conditions | Value | | | Unit |
|-------------------------------|-----------|-------------------------------------|-------|------|------|---------|
| | | | Min. | Typ. | Max. | |
| Forward Voltage | V_F | $I_F=15A, T_{vj}=25$ | | 2.00 | 2.65 | V |
| | | $I_F=15A, T_{vj}=125$ | | 2.10 | | |
| | | $I_F=15A, T_{vj}=150$ | | 2.10 | | |
| Recovered Charge | Q_{rr} | $I_F=15A$ | | 1.20 | | μC |
| Peak Reverse Recovery Current | I_{rr} | $V_R=600V$ $-di_F/dt=600A/\mu s$ | | 13.0 | | A |
| Reverse Recovery Energy | E_{rec} | $T_{vj}=25$ | | 0.37 | | mJ |
| Recovered Charge | Q_{rr} | $I_F=15A$ | | 2.05 | | μC |
| Peak Reverse Recovery Current | I_{rr} | $V_R=600V$ $-di_F/dt=600A/\mu s$ | | 12.0 | | A |
| Reverse Recovery Energy | E_{rec} | $T_{vj}=125$ | | 0.68 | | mJ |



IGBT-brake-chopper Absolute Maximum Ratings

| Parameter | Symbol | Conditions | Value | Unit |
|-----------------------------------|-----------|---------------------------------|----------|------|
| Collector-Emitter Voltage | V_{CES} | $V_{GE}=0V, I_C=1mA, T_{vj}=25$ | 1200 | V |
| Continuous Collector Current | I_C | $T_c=100, T_{vjmax}=175$ | 15 | A |
| Repetitive Peak Collector Current | I_{CRM} | $tp=1ms$ | 30 | A |
| Gate-Emitter Voltage | V_{GES} | $T_{vj}=25$ | ± 20 | V |
| Total Power Dissipation | P_{tot} | $T_c=25, T_{vjmax}=175$ | 155 | W |

Characteristic values

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---------------|---|-------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Gate-emitter Threshold Voltage | $V_{GE(th)}$ | $V_{GE}=V_{CE}, I_C=0.5mA, T_{vj}=25$ | 5.2 | 6.0 | 6.8 | V |
| Collector-Emitter Cut-off Current | I_{CES} | $V_{CE}=1200V, V_{GE}=0V, T_{vj}=25$ | | | 1.0 | mA |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C=15A, V_{GE}=15V, T_{vj}=25$ | | 1.85 | 2.25 | V |
| | | $I_C=15A, V_{GE}=15V, T_{vj}=125$ | | 2.15 | | |
| | | $I_C=15A, V_{GE}=15V, T_{vj}=150$ | | 2.25 | | |
| Gate Charge | Q_G | | | 0.09 | | uC |
| Input Capacitance | C_{ies} | $V_{CE}=25V, V_{GE}=0V,$ | | 1.35 | | nF |
| Reverse Transfer Capacitance | C_{res} | $f=1MHz, T_{vj}=25$ | | 0.08 | | nF |
| Gate-Emitter leakage current | I_{GES} | $V_{CE}=0V, V_{GE}=20V, T_{vj}=25$ | | | 400 | nA |
| Turn-on Delay Time | $t_{d(on)}$ | $I_C=15A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=39$ $T_{vj}=25$ | | 46 | | ns |
| Rise Time | t_r | | | 45 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | | | 182 | | ns |
| Fall Time | t_f | | | 168 | | ns |
| Energy Dissipation During Turn-on Time | E_{on} | | | 0.92 | | mJ |
| Energy Dissipation During Turn-off Time | E_{off} | | | 0.56 | | mJ |

| |
|----|
| ns |
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| Unit |
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Diode-Rectifier Absolute Maximum Ratings

| Parameter | Symbol | Conditions | Value | Unit |
|--|-------------|---------------------------|-------|------------------|
| Repetitive Peak Reverse Voltage | V_{RRM} | $T_j=25$ | 1600 | V |
| Average output Current 50/60Hz, sine wave | $I_{F(AV)}$ | $T_c=100$ | 20 | A |
| Maximum RMS Current at Rectifier Output | I_{RMSM} | $T_c=100$ | 40 | A |
| Surge Forward Current | I_{FSM} | $V_R=0, t_p=10ms, T_j=45$ | 270 | A |
| I^2t -value | I^2t | $V_R=0, t_p=10ms, T_j=45$ | 360 | A ² s |

Characteristic values

| Parameter | Symbol | Conditions | Value | | | Unit |
|-----------------------|--------|----------------------|-------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Diode Forward Voltage | V_F | $I_F=15A, T_j=150$ | | 0.96 | | V |
| Reverse Current | I_R | $T_j=150, V_R=1600V$ | | | 1.0 | mA |

NTC-Thermistor Characteristic values

| Parameter | Symbol | Conditions | Value | | | Unit |
|-------------------|-------------|--|-------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Rated Resistance | R_{25} | | | 5.0 | | k |
| Deviation of R100 | R/R | $T_c=100, R_{100}=493.3$ | -5 | | 5 | % |
| Power Dissipation | P_{25} | | | | 20.0 | mW |
| B-value | $B_{25/50}$ | $R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$ | | 3375 | | K |

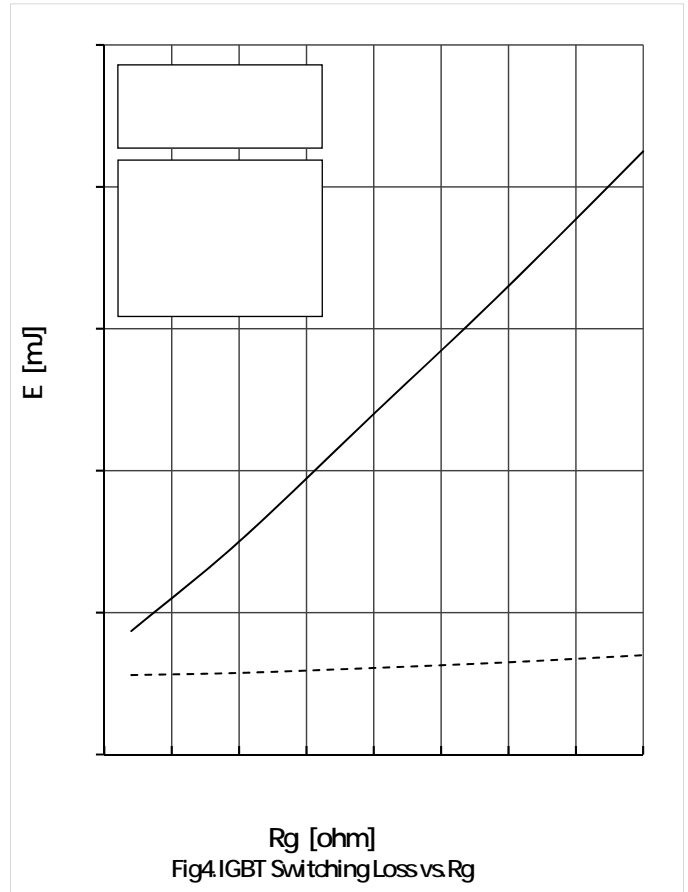
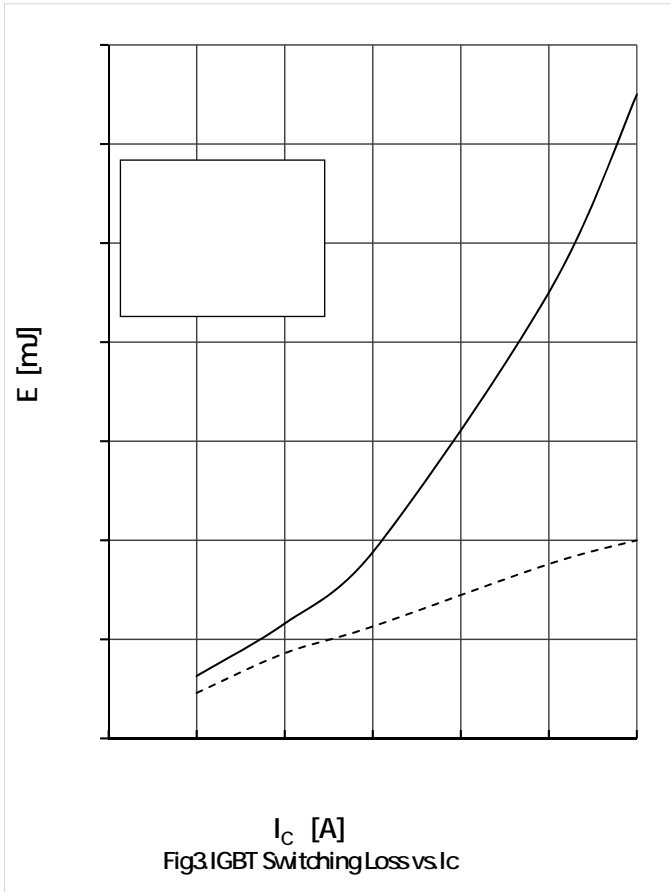
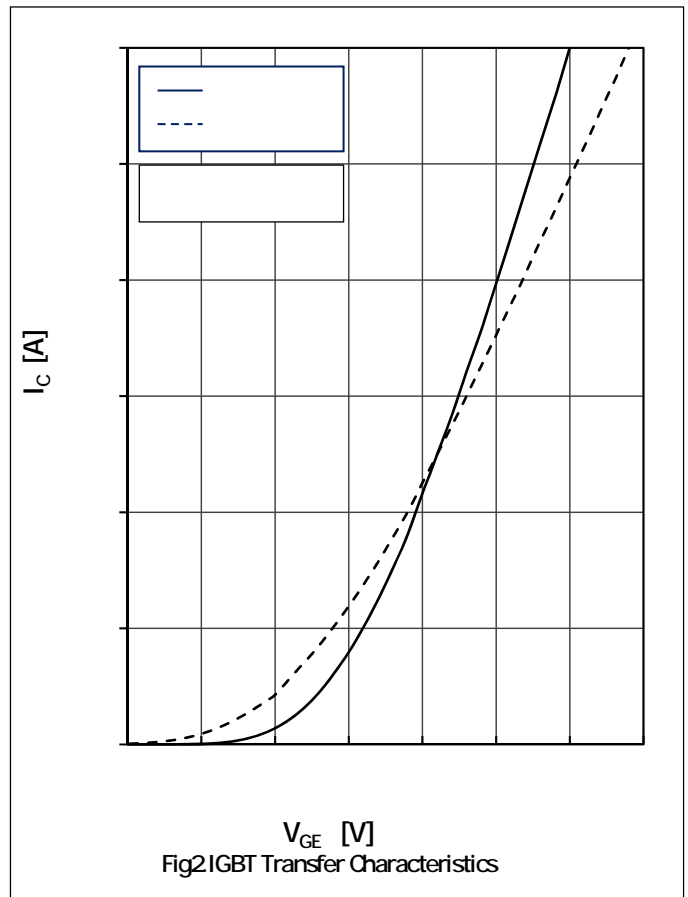
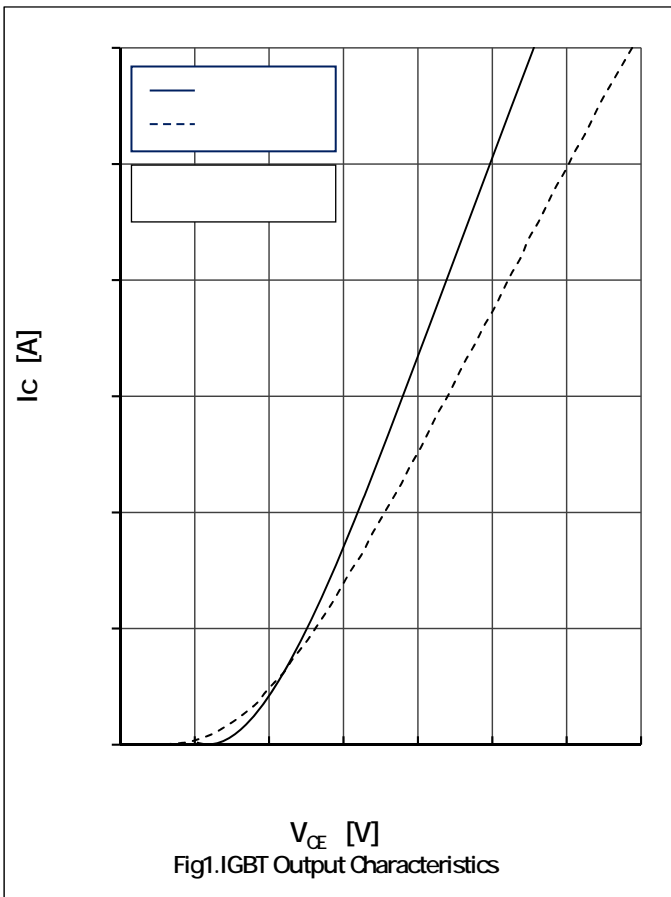


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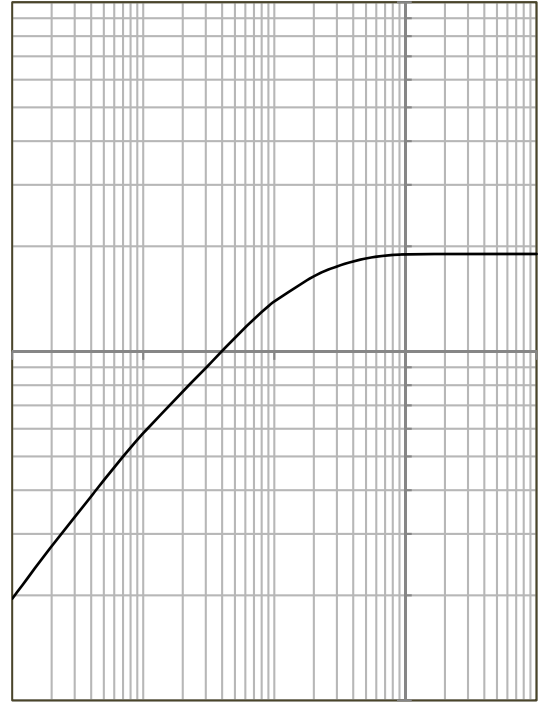
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Module Characteristics $T_C=25^\circ\text{C}$ unless otherwise specified

| Parameter | Symbol | Conditions | Value | | | Unit |
|--|-----------------------------|-------------------------------------|-------|-------|------|------|
| | | | Min. | Typ. | Max. | |
| Isolation voltage | V_{isol} | $t=1\text{min}, f=50\text{Hz}$ | 2500 | | | V |
| Maximum Junction Temperature | T_{Jmax} | | | | 175 | |
| Operating Junction Temperature | $T_{\text{vj op}}$ | | -40 | | 150 | |
| Storage Temperature | T_{stg} | | -40 | | 125 | |
| Stray-inductance-module | L_{SCE} | | | 30 | | nH |
| Module lead resistance, terminals-chip | $R_{\text{CC}'+\text{EE}'}$ | $T_C=25^\circ\text{C}$, per switch | | 8.00 | | m |
| | $R_{\text{AA}'+\text{CC}'}$ | | | 6.00 | | |
| Thermal Resistance Junction-to Case | R_{JC} | per IGBT-inverter | | 0.95 | 1.05 | K/W |
| | | per Diode-inverter | | 1.30 | 1.45 | |
| | | per IGBT-brake-copper | | 0.95 | 1.05 | |
| | | per Diode-chopper | | 1.75 | 1.90 | |
| | | per Diode-rectifier | | 1.03 | 1.13 | |
| Thermal Resistance Case-to Sink | R_{CS} | per IGBT-inverter | | 0.95 | | K/W |
| | | per Diode-inverter | | 1.05 | | |
| | | per IGBT-brake-copper | | 0.95 | | |
| | | per Diode-chopper | | 1.30 | | |
| | | per Diode-rectifier | | 1.17 | | |
| | | per Module | | 0.058 | | |
| Mounting Force Per Clamp | F | | 20 | | 50 | N |
| Weight of Module | G | | | 25 | | g |



$Z_{thj,s}$ [K/W]

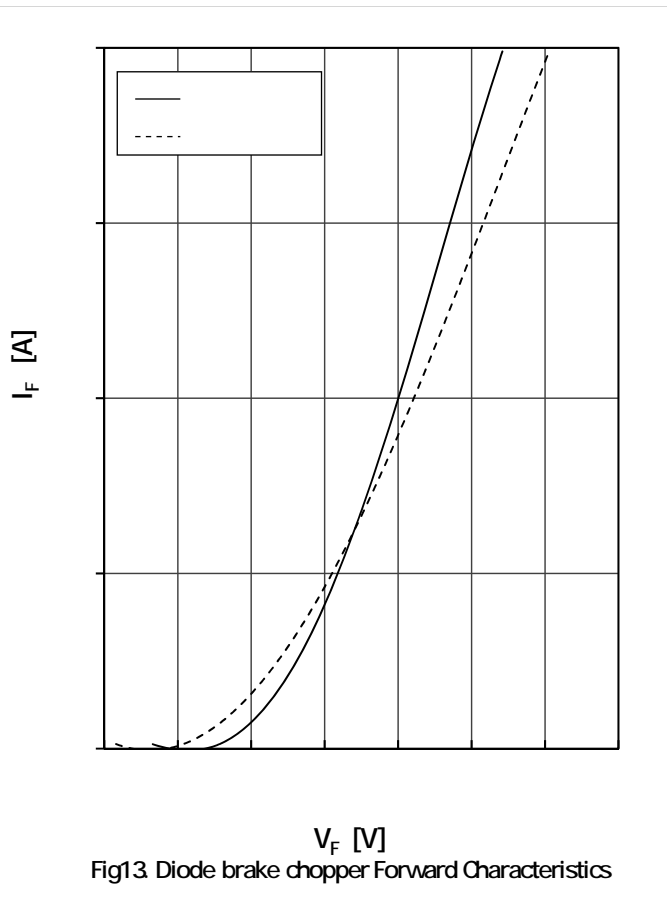


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Fig 6 IGBT Transient Thermal Impedance



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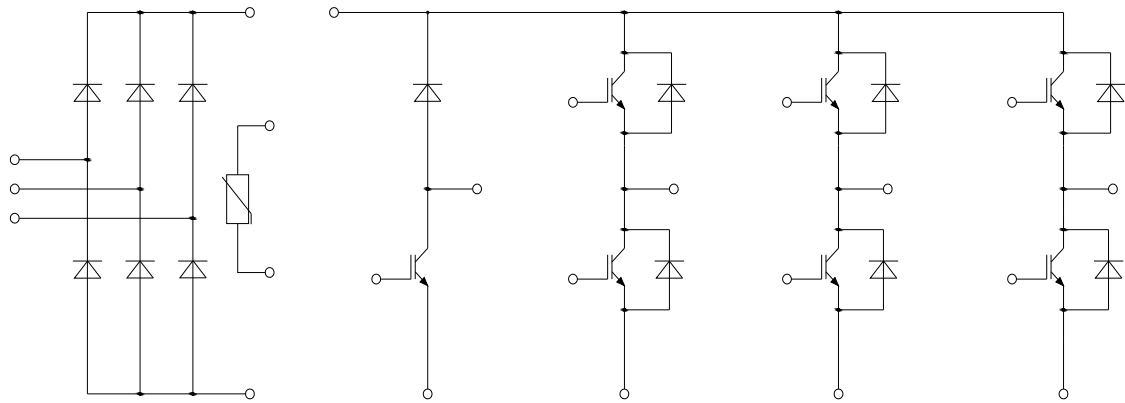




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Circuit Diagram



Package Dimensions

