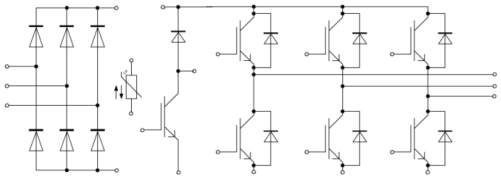
佳恩半导体
JIAENSEMI

# JNG15T120PE1S1

## IGBT 15A 1200V PIM module

### Features
- Trench+ Field Stop Technology / 沟槽栅/场终止工艺
- Low VCEsat / 低饱和压降/
- Low Switching Losses / 低开关损耗
- Positive Temperature Coefficient / 正温度系数

### Applications
- Motor Drives / 电机传动
- Auxiliary Inverters / 辅助逆变器
- Frequency Coverters / 变频器

### Absolute Maximum Ratings Tj = 25°C unless otherwise noted

| IGBT-Inverter/ IGBT-逆变器 | | | | |
|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Value | Unit |
| $V_{CES}$ | Collector-emitter voltage<br>集电极-发射极电压 | $T_{vj}$=25℃ | 1200 | V |
| $I_{C\ nom}$ | Continuous DC collector current<br>连续集电极直流电流 | $T_C$=100℃,$T_{vj\ max}$=175℃ | 15 | A |
| $I_{CRM}$ | Repetitive peak collector current<br>集电极重复峰值电流 | $T_P$=1ms | 30 | A |
| $V_{GES}$ | Gate-emitter peak voltage<br>栅极-发射极峰值电压 | | ±20 | V |
| **Diode-Inverter/二极管-逆变器** | | | | |
| $V_{RRM}$ | Repetitive peak reverse voltage<br>反向重复峰值电压 | $T_{vj}$=25oC | 1200 | V |
| $I_F$ | Continuous DC forward current<br>连续正向直流电流 | | 15 | A |
| $I_{FRM}$ | Repetitive peak forward current | $T_P$=1ms | 30 | A |

### Characteristic Values

| IGBT-Inverter/ IGBT-逆变器 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
| $V_{CE\ sat}$ | Collector-emitter voltage<br>集电极-发射极饱和电压 | $I_C$=15A,<br>$V_{GE}$=15V | $T_{vj}$=25℃ | | 2.02 | | V |
| | | | $T_{vj}$=125℃ | | 2.27 | | |
| | | | $T_{vj}$=150℃ | | 2.31 | | |
| $V_{GEth}$ | Gate threshold voltage<br>栅极阈值电压 | $I_C$=0.48mA,<br>$V_{CE}$=$V_{GE}$ | $T_{vj}$=25℃ | | 5.7 | | V |
| $I_{GES}$ | Gate-emitter leakage current<br>栅极-发射极漏电流 | $V_{GE}$=20V,<br>$V_{CE}$=0V | $T_{vj}$=25℃ | | | 100 | nA |
| $I_{CES}$ | Collector-emitter leakage current<br>集电极-发射极截止电流 | $V_{CE}$=1200V,<br>$V_{GE}$=0V | $T_{vj}$=25℃ | | | 1 | mA |
| $R_{Gint}$ | Internal gate resistor<br>内部栅极电阻 | | $T_{vj}$=25℃ | | / | | Ω |

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $C_{ies}$ | Input capacitance<br>输入电容 | f=1 MHz，<br>$V_{CE}$=25V，<br>$V_{GE}$=0V | $T_{vj}$=25℃ | | 1509 | | pF |
| $C_{oes}$ | Output capacitance<br>输出电容 | | | | 85 | | |
| $C_{res}$ | Reverse transfer capacitance<br>反向传输电容 | | | | 36 | | |
| $R_{thJC}$ | Thermal resistance，junction to case<br>结-外壳热阻 | Per IGBT | | | | 1.15 | K/W |
| $T_{vj\ op}$ | Temperature under switching conditions<br>在开关状态下温度 | | | -40 | | 150 | ℃ |
| $I_{SC}$ | Short circuit current<br>短路电流 | $V_{GE}$≤15V，<br>$V_{CC}$=800V<br>$V_{CEmax}$=$V_{CES}$-$L_{SCE}$·di/dt | $T_P$≤10μs<br>$T_{vj}$=150℃ | | 67 | | A |
| $T_{don}$ | Turn-on delay time<br>开通延迟时间 | $I_C$=15A，<br>$V_{CE}$=600V<br>$V_{GE}$=±15V<br>$R_{Gon}$=39Ω，<br>$R_{Goff}$=39Ω<br>电感负载<br>（Inductive load） | $T_{vj}$=25℃ | | 39 | | ns |
| | | | $T_{vj}$=125℃ | | 37 | | |
| | | | $T_{vj}$=150℃ | | 37 | | |
| $T_{doff}$ | Turn-off delay time<br>关断延迟时间 | | $T_{vj}$=25℃ | | 241 | | ns |
| | | | $T_{vj}$=125℃ | | 274 | | |
| | | | $T_{vj}$=150℃ | | 292 | | |
| $T_r$ | Turn-on rise time<br>开通上升时间 | | $T_{vj}$=25℃ | | 43 | | ns |
| | | | $T_{vj}$=125℃ | | 36 | | |
| | | | $T_{vj}$=150℃ | | 32 | | |
| $T_f$ | Turn-off fall time<br>关断下降时间 | | $T_{vj}$=25℃ | | 187 | | ns |
| | | | $T_{vj}$=125℃ | | 221 | | |
| | | | $T_{vj}$=150℃ | | 287 | | |
| $E_{on}$ | Turn-on switching loss per pulse<br>开通损耗（每脉冲） | | $T_{vj}$=25℃ | | 1.26 | | mJ |
| | | | $T_{vj}$=125℃ | | 1.80 | | |
| | | | $T_{vj}$=150℃ | | 2.20 | | |
| $E_{off}$ | Turn-off energy loss per pulse<br>关断损耗（每脉冲） | | $T_{vj}$=25℃ | | 0.69 | | mJ |
| | | | $T_{vj}$=125℃ | | 1.01 | | |
| | | | $T_{vj}$=150℃ | | 1.14 | | |

**Diode-Inverter/二极管-逆变器**

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_F$ | Forward voltage<br>正向电压 | $I_F$=15A，$V_{GE}$=0V | $T_{vj}$=25℃ | | 1.89 | | V |
| | | | $T_{vj}$=125℃ | | 1.55 | | |
| | | | $T_{vj}$=150℃ | | 1.47 | | |
| $I_{RM}$ | Peak reverse recovery current<br>反向恢复峰值电流 | $I_F$=15A，<br>$V_R$=600V<br>$V_{GE}$=-15V | $T_{vj}$=25℃ | | 9 | | A |
| | | | $T_{vj}$=125℃ | | 24 | | |
| | | | $T_{vj}$=150℃ | | 28 | | |
| $Q_{rr}$ | Diode reverse recovery charge<br>恢复电荷 | | $T_{vj}$=25℃ | | 1.05 | | μC |
| | | | $T_{vj}$=125℃ | | 2.21 | | |
| | | | $T_{vj}$=150℃ | | 3.03 | | |
| $E_{rec}$ | Reverse recovery energy<br>反向恢复损耗（每脉冲） | | $T_{vj}$=25℃ | | 0.26 | | mJ |
| | | | $T_{vj}$=125℃ | | 0.51 | | |
| | | | $T_{vj}$=150℃ | | 0.72 | | |
| $R_{thJC}$ | Thermal resistance，junction to case<br>结-外壳热阻 | Per diode | | | | 1.3 | K/W |
| $T_{vj\ op}$ | Temperature under switching conditions<br>在开关状态下温度 | | | -40 | | 150 | ℃ |

## Maximum Rated Values

| IGBT-Brake/ IGBT-制动器 | | | | |
|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Value | Unit |
| $V_{CES}$ | Collector-emitter voltage<br>集电极-发射极电压 | $T_{vj}$=25℃ | 1200 | V |
| $I_C$ | Continuous DC collector current<br>连续集电极直流电流 | $T_C$=100℃,$T_{vj\ max}$=175℃ | 15 | A |
| $I_{CRM}$ | Repetitive peak collector current<br>集电极重复峰值电流 | $T_P$=1ms | 30 | A |
| $V_{GES}$ | Gate-emitter peak voltage<br>栅极-发射极峰值电压 | | ±20 | V |
| **Diode-Inverter/ 二极管-逆变器** | | | | |
| $V_{RRM}$ | Repetitive peak reverse voltage<br>反向重复峰值电压 | $T_{vj}$=25oC | 1200 | V |
| $I_F$ | Continuous DC forward current<br>连续正向直流电流 | | 15 | A |
| $I_{FRM}$ | Repetitive peak forward current<br>正向重复峰值电流 | $T_P$=1ms | 30 | A |

## Characteristic Values

| IGBT-Brake/ IGBT-制动器 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
| $V_{CE.sat}$ | Collector-emitter voltage<br>集电极-发射极饱和电压 | $I_C$=15A，$V_{GE}$=15V | $T_{vj}$=25℃ | | 2.04 | | V |
| | | | $T_{vj}$=125℃ | | 2.27 | | |
| | | | $T_{vj}$=150℃ | | 2.30 | | |
| $V_{GEth}$ | Gate threshold voltage<br>栅极阈值电压 | $I_C$=0.48mA，$V_{CE}$=$V_{GE}$ | Tvj=25℃ | | 5.7 | | V |
| $I_{GES}$ | Gate-emitter leakage current<br>栅极-发射极漏电流 | $V_{GE}$=20V，$V_{CE}$=0V | Tvj=25℃ | | | 100 | nA |
| $I_{CES}$ | Collector-emitter leakage current<br>集电极-发射极截止电流 | $V_{CE}$=1200V，$V_{GE}$=0V | Tvj=25℃ | | | 1 | mA |
| $R_{Gint}$ | Internal gate resistor<br>内部栅极电阻 | | Tvj=25℃ | | / | | Ω |
| $C_{ies}$ | Input capacitance<br>输入电容 | f=1 MHz，$V_{CE}$=25V，$V_{GE}$=0V | Tvj=25℃ | | 1505 | | pF |
| $C_{oes}$ | Output capacitance<br>输出电容 | | | | 85 | | |
| $C_{res}$ | Reverse transfer capacitance<br>反向传输电容 | | | | 34 | | |
| $I_{SC}$ | Short circuit current<br>短路电流 | $V_{GE}$≤15V，$V_{CC}$=800V<br>$V_{CEmax}$=$V_{CES}$-$L_{SCE}$·di/dt | TP≤10μs<br>Tvj=150℃ | | 67 | | A |
| $T_{don}$ | Turn-on delay time<br>开通延迟时间 | $I_C$=15A，$V_{CE}$=600V<br>$V_{GE}$=±15V<br>$R_{Gon}$=39Ω，$R_{Goff}$=39Ω<br>电感负载（Inductive load） | $T_{vj}$=25℃ | | 43 | | ns |
| | | | $T_{vj}$=125℃ | | 40 | | |
| | | | $T_{vj}$=150℃ | | 38 | | |
| $T_{doff}$ | Turn-off delay time<br>关断延迟时间 | | $T_{vj}$=25℃ | | 268 | | ns |
| | | | $T_{vj}$=125℃ | | 297 | | |
| | | | $T_{vj}$=150℃ | | 303 | | |
| $T_r$ | Turn-on rise time<br>开通上升时间 | | $T_{vj}$=25℃ | | 44 | | ns |
| | | | $T_{vj}$=125℃ | | 35 | | |
| | | | $T_{vj}$=150℃ | | 37 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $T_f$ | Turn-off fall time<br>关断下降时间 | | $T_{vj}$=25℃ | | 120 | | ns |
| | | | $T_{vj}$=125℃ | | 213 | | |
| | | | $T_{vj}$=150℃ | | 219 | | |
| $E_{on}$ | Turn-on switching loss per pulse<br>开通损耗（每脉冲） | | $T_{vj}$=25℃ | | 1.16 | | ns |
| | | | $T_{vj}$=125℃ | | 1.97 | | |
| | | | $T_{vj}$=150℃ | | 2.25 | | |
| $E_{off}$ | Turn-off energy loss per pulse<br>关断损耗（每脉冲） | | $T_{vj}$=25℃ | | 0.61 | | ns |
| | | | $T_{vj}$=125℃ | | 1.02 | | |
| | | | $T_{vj}$=150℃ | | 1.14 | | |
| $T_{vj\ op}$ | Temperature under switching conditions<br>在开关状态下温度 | | | -40 | | 150 | ℃ |

**Diode-Brake/二极管-制动器**

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_F$ | Forward voltage<br>正向电压 | $I_F$=15A，$V_{GE}$=0V | $T_{vj}$=25℃ | | 2.09 | | V |
| | | | $T_{vj}$=125℃ | | 1.65 | | |
| | | | $T_{vj}$=150℃ | | 1.56 | | |
| $I_{RM}$ | Peak reverse recovery current<br>反向恢复峰值电流 | $I_F$=15A，$V_R$=600V<br>$V_{GE}$=-15V | $T_{vj}$=25℃ | | 6 | | A |
| | | | $T_{vj}$=125℃ | | 10 | | |
| | | | $T_{vj}$=150℃ | | 12 | | |
| $Q_{rr}$ | Diode reverse recovery charge<br>恢复电荷 | | $T_{vj}$=25℃ | | 0.8 | | μC |
| | | | $T_{vj}$=125℃ | | 1.77 | | |
| | | | $T_{vj}$=150℃ | | 2.02 | | |
| $E_{rec}$ | Reverse recovery energy<br>反向恢复损耗（每脉冲） | | $T_{vj}$=25℃ | | 0.24 | | mJ |
| | | | $T_{vj}$=125℃ | | 0.51 | | |
| | | | $T_{vj}$=150℃ | | 0.61 | | |
| $T_{vj\ op}$ | Temperature under switching conditions<br>在开关状态下温度 | | | -40 | | 150 | ℃ |

## Maximum Rated Values

**Diode-Rectifier/二极管-整流器**

| Symbol | Parameter | Test Conditions | Value | Unit |
|---|---|---|---|---|
| $V_{RRM}$ | Repetitive peak reverse voltage<br>反向重复峰值电压 | $T_{vj}$=25℃ | 1600 | V |
| $I_{F(AV)}$ | forward average current<br>正向平均电流 | | 16 | A |
| $I_{FSM}$ | Repetitive peak collector current<br>正向浪涌电流 | $T_P$=10ms，sin 180°,$T_{vj}$=25℃ | 250 | A |
| $I^2t$ | $I^2t$ -value<br>$I^2t$-值 | $T_P$=10ms，sin 180°,$T_{vj}$=25℃ | 180 | $A^2s$ |

## Characteristic Values

**Diode-Brake/二极管-制动器**

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_F$ | Forward voltage<br>正向电压 | $I_F$=15A，$V_{GE}$=0V | $T_{vj}$=25℃ | | 0.95 | | V |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $I_R$ | Recovered Charge<br>反向漏电流 | $V_R=V_{RRM}$ | $T_{vj}$=25℃ | | | 5 | uA |
| | | | $T_{vj}$=150℃ | | | 1 | mA |
| $T_{vj\ op}$ | Temperature under switching conditions<br>在开关状态下温度 | | | -40 | | 150 | ℃ |

## Characteristic Values

| NTC-Thermistor/负温度系数热敏电阻 | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
| $R_{25}$ | Rated resistance<br>额定电阻值 | $T_C$=25℃ | | 5.00 | | KΩ |
| Δ R/R | Deviation of R100<br>R100偏差 | $T_C$=100℃，$R_{100}$=480Ω | -5 | | 5 | % |
| $P_{25}$ | Power dissipation<br>耗散功率 | $T_C$=25℃ | | 50 | | mW |
| $B_{25/50}$ | B-value<br>B-值 | $B=[(T_a*T_b)/(T_b-T_a)]*\ln(R_a/R_b)$<br>$T_b$=50℃±0.01℃ | | 3380 | | K |

| Module/模块 | | | | | | |
|---|---|---|---|---|---|---|
| Symbol | Parameter | Test Conditions | Value | | | Unit |
| $V_{ISOL}$ | Isolation test voltage<br>绝缘测试电压 | RMS，f=50Hz，t=1min | 3 | | | KV |
| | Internal isolation<br>内部绝缘 | basicinsulation(class1,IEC61140) | $Al_2O_3$ | | | |
| | Creepage distance<br>爬电距离 | Terminal to heatsink<br>端子-散热器 | 11.8 | | | mm |
| | | Terminal to terminal<br>端子-端子 | 6 | | | mm |
| | Clearance<br>电气间隙 | Terminal to heatsink<br>端子-散热器 | 10.2 | | | mm |
| | | Terminal to terminal<br>端子-端子 | 5.1 | | | mm |
| | | | Min. | Typ. | Max. | |
| $L_{sCE}$ | Stray inductance module<br>杂散电感，模块 | | | 30 | | nH |
| $R_{CC'+EE'}$ | Module lead resistance，terminals-chip<br>模块引线电阻，端子-芯片 | $T_C$=25℃ Per switch | | 8.0 | | mΩ |
| $T_{stg}$ | Storage temperature<br>储存温度 | | -40 | | 125 | ℃ |
| G | Weight<br>重量 | | | 23.8 | | g |

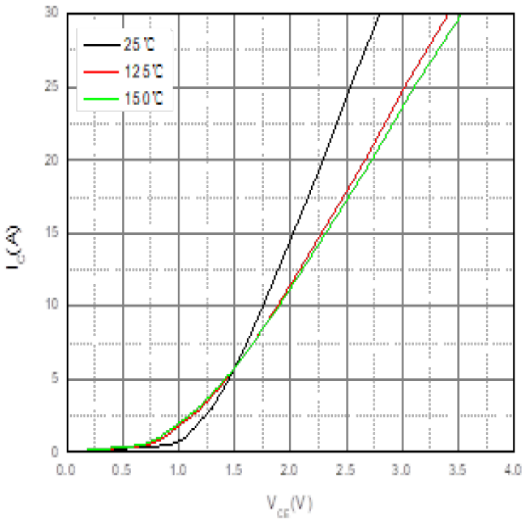



Figure.1 Output characteristic IGBT-Inverter（Typical）

$I_C$=f（$V_{CE}$）$V_{GE}$=15V

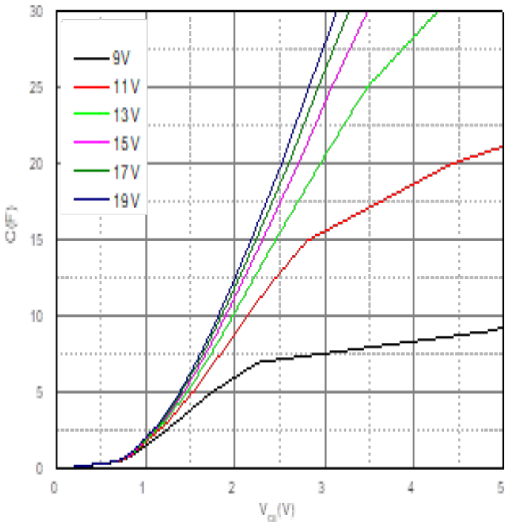



Figure.2 Output characteristic IGBT-Inverter（Typical）

$I_C$=f（$V_{CE}$） $T_{vj}$=150℃

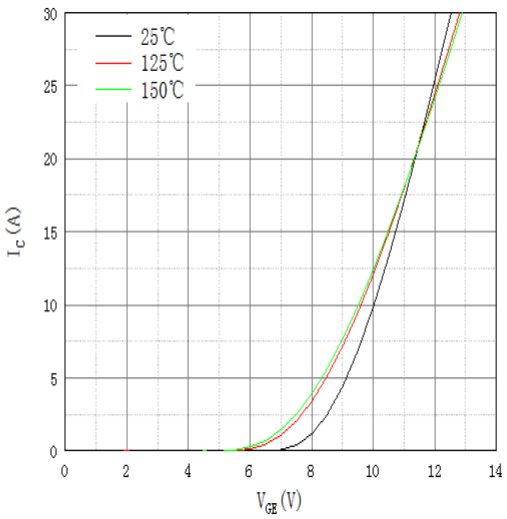



Figure.3 Transfer characteristic IGBT-Inverter（Typical）

$I_C$=f（$V_{GE}$）$V_{CE}$=20V

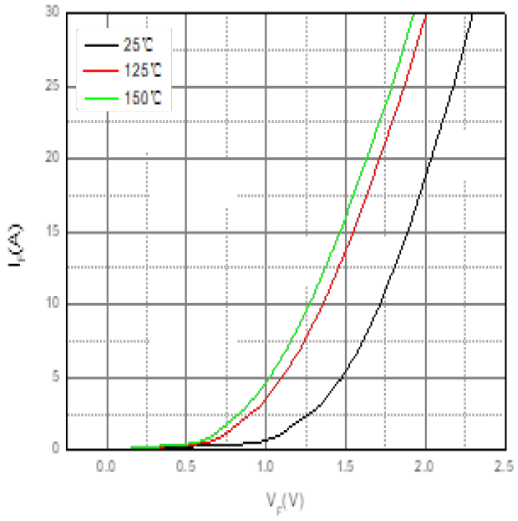



Figure.4 Forward characteristic of Diode-Inverter（Typical）

$I_F$=f（$V_F$）

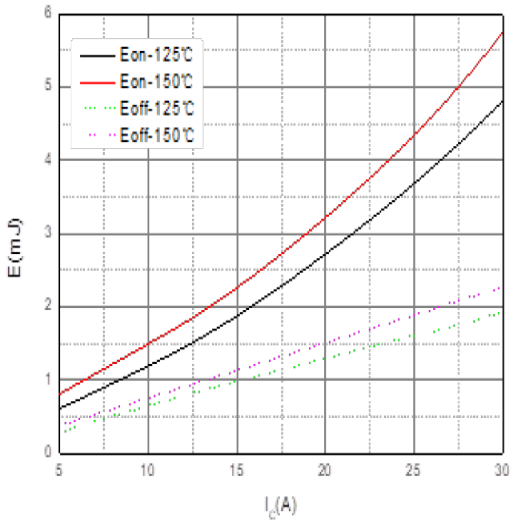



Figure.5 Switching losses IGBT-Inverter（Typical）

$E_{on}$=f（$I_C$），$E_{off}$=f（$I_C$）

$V_{CE}$=600V， $R_{Gon}$=39Ω，$R_{Goff}$=39Ω，$V_{GE}$=±15V

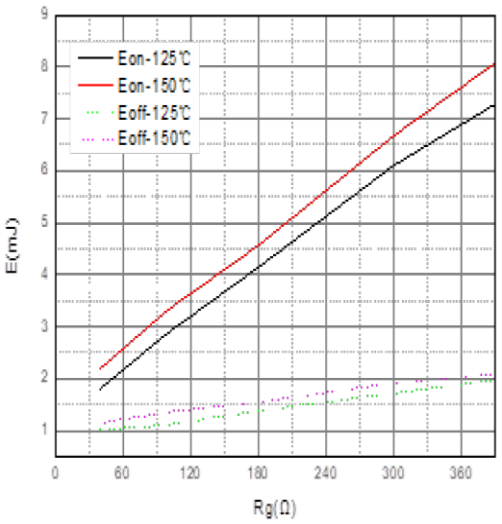



Figure.6 Switching losses IGBT-Inverter（Typical）

$E_{on}$=f（$R_G$），$E_{off}$=f（$R_G$）

$V_{CE}$=600V， $I_C$=15A，$V_{GE}$=±15V

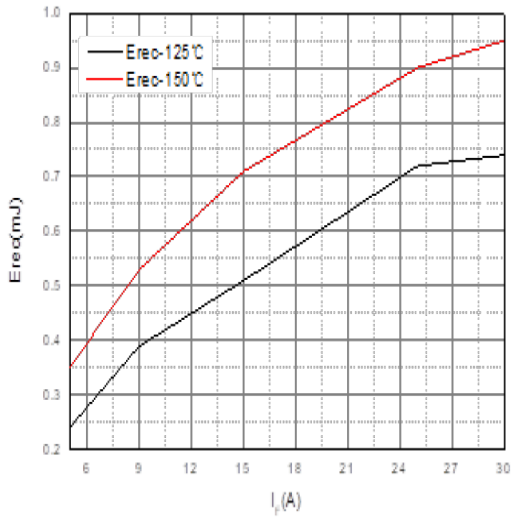



Figure.7 Switching losses Diode-Inverter（Typical）

$E_{rec}$=f（$I_F$）$V_{CE}$=600V，$R_{Gon}$=39Ω

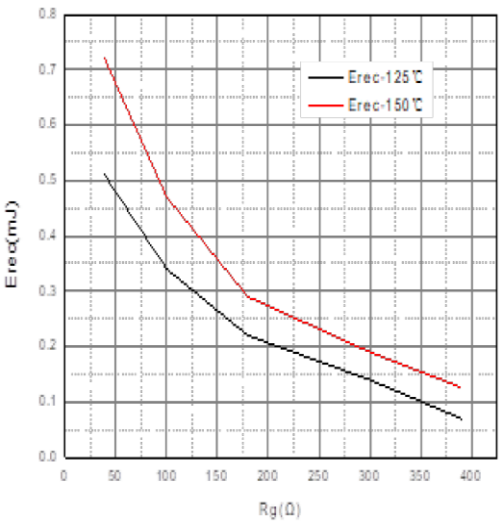



Figure.8 Switching losses Diode-Inverter（Typical）

$E_{rec}$=f（$R_G$）$V_{CE}$=600V，$I_F$=15A

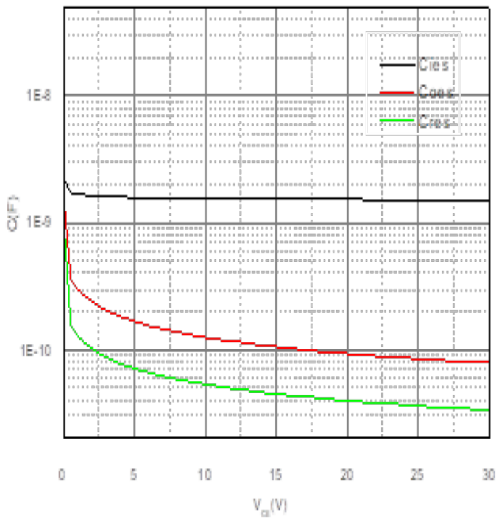



Figure.9 Capacitance characteristic

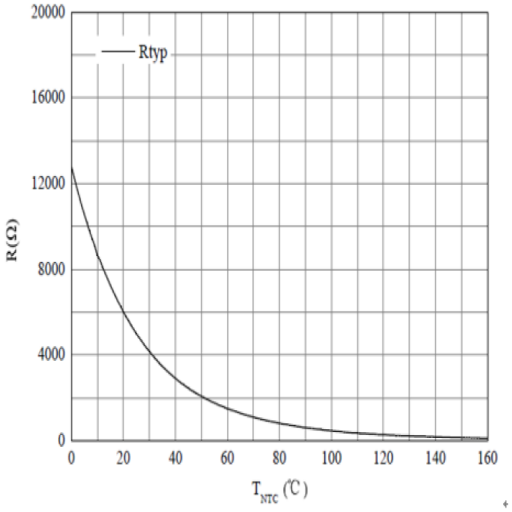
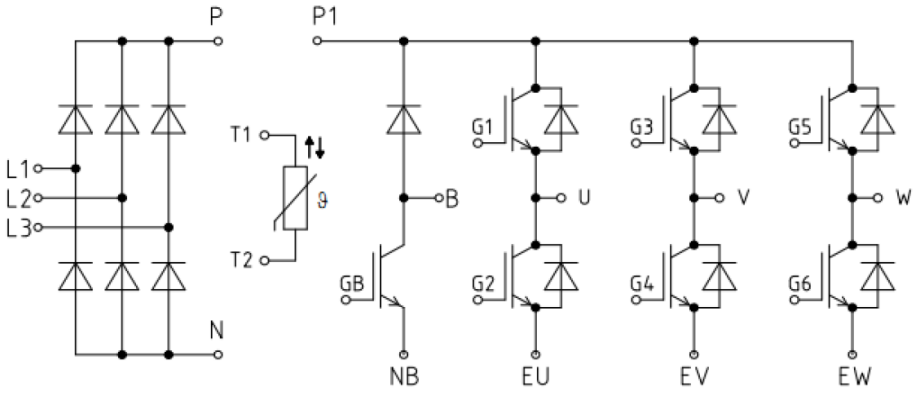
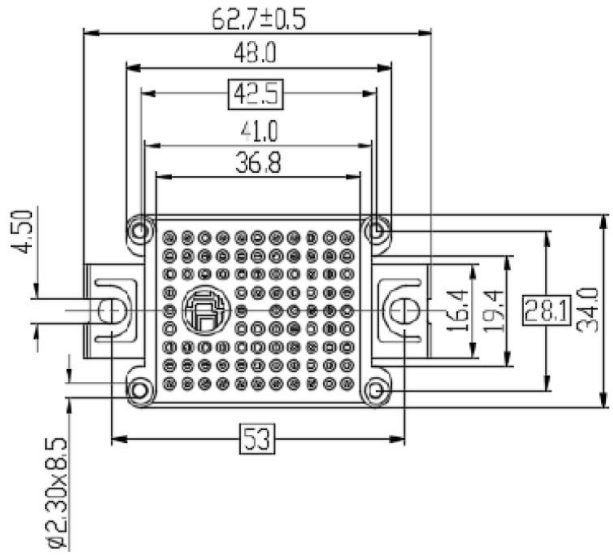


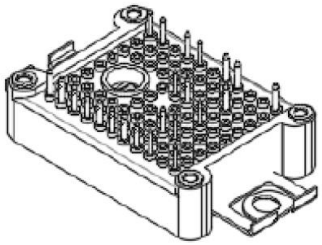

Figure.10 NTC-Themistor-temperature characteristic

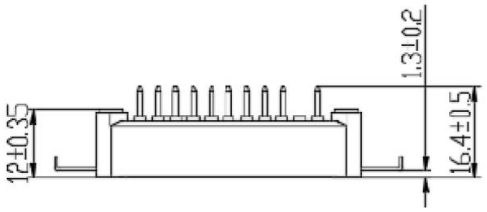
**Circuit diagram**

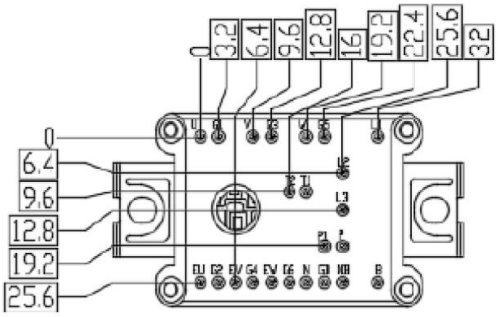



**Package outlines**





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