

TRA1565SL1、TRP1565SL1、TRB1565SL1、TRD1565SL1 系列是 15A, 650V 高可靠性 IGBT 晶体管, 具有低的导通损耗和开关损耗等特点。该产品可应用于 UPS、PFC、电机控制等领域。

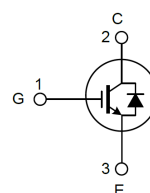
#### 主要特征:

- 15A, 650V,  $V_{CE(sat)}=1.8V @I_C=15A$
- 饱和压降为正温度系数, 易于并联使用
- 低导通损耗
- 内置快恢复二极管
- 高可靠性及热稳定性, 良好的参数一致性

#### 产品规格分类:

| 型号 #       | 打标名称       | 封装      |
|------------|------------|---------|
| TRA1565SL1 | TRA1565SL1 | TO-220F |
| TRP1565SL1 | TRP1565SL1 | TO-220  |
| TRB1565SL1 | TRB1565SL1 | TO-263  |
| TRD1565SL1 | TRD1565SL1 | TO-252  |

#### 封装符号:



#### 极限参数 (除非另有说明, $T_A = 25^\circ C$ ):

| 符号          | 参数   | 参数范围     | 单位      |
|-------------|--|----------|---------|
| $V_{CE}$    | 集电极-发射极电压  | 650      | V       |
| $V_{GE}$    | 栅极-发射极电压   | $\pm 20$ | V       |
| $I_C$       | 集电极电流 ( $T_C=25^\circ C$ )                               | 30       | A       |
|             | 集电极电流 ( $T_C=100^\circ C$ )                              | 15       | A       |
| $I_{Cpuls}$ | 集电极脉冲电流  | 45       | A       |
| $I_F$       | 二极管正向电流 ( $T_C=25^\circ C$ )                             | 30       | A       |
|             | 二极管正向电流 ( $T_C=100^\circ C$ )                            | 15       | A       |
| $I_{Fpuls}$ | 二极管脉冲电流  | 45       | A       |
| $t_{sc}$    | 短路耐受时间 $V_{CE} \leq 300V, V_{GE} = 15V$ , 间隔时间 $\geq 1s$ | 5        | $\mu s$ |
| $P_{tot}$   | 耗散功率 ( $T_C=25^\circ C$ ) ~ TO-220F                      | 40       | W       |

|                    |   |         |                    |
|--------------------|---|---------|--------------------|
|                    | 耗散功率 ( $T_C=100^{\circ}\text{C}$ ) ~ TO-220F        | 16      | W                  |
| $P_{\text{tot}}$   | 耗散功率 ( $T_C=25^{\circ}\text{C}$ ) ~ TO-220/ TO-263  | 105     | W                  |
|                    | 耗散功率 ( $T_C=100^{\circ}\text{C}$ ) ~ TO-220/ TO-263 | 52.5    | W                  |
| $P_{\text{tot}}$   | 耗散功率 ( $T_C=25^{\circ}\text{C}$ ) ~ TO-252          | 250     | W                  |
|                    | 耗散功率 ( $T_C=100^{\circ}\text{C}$ ) ~ TO-252         | 125     | W                  |
| $T_J$              | 最高结温  | -55~175 | $^{\circ}\text{C}$ |
| $T_{\text{STG}}$   | 存储温度  | -55~175 | $^{\circ}\text{C}$ |
| $R_{\text{thjc}}$  | IGBT芯片至管壳热阻 TO-220F                                 | 3.1     | K/W                |
|                    | IGBT芯片至管壳热阻 TO-220/ TO-263                          | 0.88    | K/W                |
|                    | IGBT芯片至管壳热阻 TO-252                                  | 0.6     | K/W                |
| $R_{\text{thjcD}}$ | 体二极管芯片至管壳热阻 TO-220F                                 | 4.9     | K/W                |
|                    | 体二极管芯片至管壳热阻 TO-220/ TO-263                          | 1.89    | K/W                |
|                    | 体二极管芯片至管壳热阻 TO-252                                  | 2.0     | K/W                |
| $R_{\text{thjA}}$  | 结到空气热阻 TO-220F                                      | 62.5    | K/W                |
|                    | 结到空气热阻 TO-220/ TO-263                               | 62      | K/W                |
|                    | 结到空气热阻 TO-252                                       | 75      | K/W                |

表 1: 极限参数

#### 电气参数(除非另有说明, $T_A = 25^{\circ}\text{C}$ ):

| 符号                   | 参数      | 最小  | 典型  | 最大        | 单位            | 测试条件   |
|----------------------|---------|-----|-----|-----------|---------------|--|
| $B_{\text{VCEs}}$    | 集射极击穿电压 | 650 | --- | ---       | V             | $V_{\text{GE}}=0\text{V}, I_{\text{C}}=100\mu\text{A}$     |
| $I_{\text{CES}}$     | 集射漏电流   | --- | --- | 200       | $\mu\text{A}$ | $V_{\text{CE}}=650\text{V}, V_{\text{GE}}=0\text{V}$       |
| $I_{\text{GES}}$     | 栅射漏电流   | --- | --- | $\pm 400$ | nA            | $V_{\text{GE}}=20\text{V}, V_{\text{CE}}=0\text{V}$        |
| $V_{\text{GE(th)}}$  | 栅极开启电压  | 4.0 | 6.0 | 7.0       | V             | $I_{\text{C}}=250\mu\text{A}, V_{\text{CE}}=V_{\text{GE}}$ |
| $V_{\text{CE(sat)}}$ | 导通饱和压降  | --- | 1.6 | 2.0       | V             | $I_{\text{C}}=15\text{A}, V_{\text{GE}}=15\text{V}$        |

|                            |        |     |     |     |    |   |
|----------------------------|--------|-----|-----|-----|----|---|
| <b>V<sub>CE(sat)</sub></b> |        | --- | 2.1 | --- | V  | I <sub>C</sub> = 15A, V <sub>GE</sub> = 15V,<br>T <sub>C</sub> = 125°C    |
| <b>C<sub>ies</sub></b>     | 输入电容   | --- | 900 | --- | pF | V <sub>CE</sub> = 30V<br>V <sub>GE</sub> = 0V<br>f = 1MHz                 |
| <b>C<sub>oes</sub></b>     | 输出电容   | --- | 50  | --- | pF |   |
| <b>C<sub>res</sub></b>     | 反向传输电容 | --- | 20  | --- | pF |   |
| <b>Q<sub>g</sub></b>       | 栅电荷    | --- | 61  | --- | nC | V <sub>CE</sub> = 400V,<br>I <sub>C</sub> = 15A,<br>V <sub>GE</sub> = 15V |
| <b>Q<sub>ge</sub></b>      | 发射极栅电荷 | --- | 5.3 | --- | nC |   |
| <b>Q<sub>gc</sub></b>      | 集电极栅电荷 | --- | 31  | --- | nC |   |

表 2: 电气参数

### FRD 电气参数 (除非另有说明, T<sub>A</sub> = 25°C):

|                       |                                 |     |     |     |    |  |
|-----------------------|---------------------------------|-----|-----|-----|----|--|
| <b>V<sub>F</sub></b>  | 二极管正向压降(T <sub>C</sub> = 25°C)  | --- | --- | 2.0 | V  | I <sub>F</sub> = 15A                                     |
|                       | 二极管正向压降(T <sub>C</sub> = 125°C) | --- | 1.5 | --- | V  | I <sub>F</sub> = 15A                                     |
| <b>T<sub>rr</sub></b> | 二极管反向恢复时间                       | --- | 32  | --- | ns | I <sub>ES</sub> = 15A,<br>dI <sub>ES</sub> /dt = 200A/μs |
| <b>Q<sub>rr</sub></b> | 二极管反向恢复电荷                       | --- | 74  | --- | nC | I <sub>ES</sub> = 15A,<br>dI <sub>ES</sub> /dt = 200A/μs |

表 3: FRD 电气参数

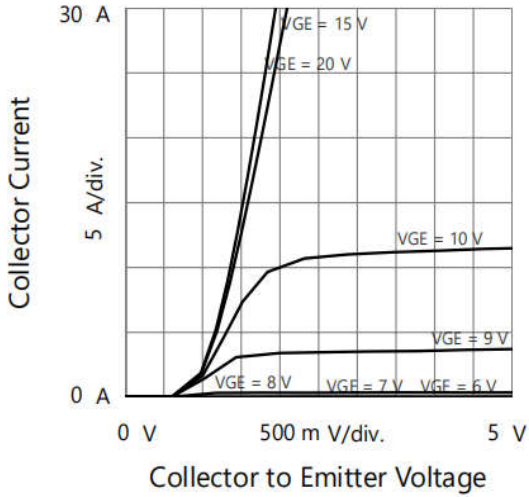
### 开关特性参数 (除非另有说明, T<sub>A</sub> = 25°C):

|                        |        |     |      |     |    |   |
|------------------------|--------|-----|------|-----|----|---|
| <b>t<sub>on</sub></b>  | 开通延时   | --- | 40   | --- | ns | V <sub>CE</sub> = 400V<br>I <sub>C</sub> = 15A<br>R <sub>g</sub> = 10Ω<br>V <sub>GE</sub> = 15V<br>感性负载 |
| <b>t<sub>off</sub></b> | 关断延时   | --- | 70   | --- | ns |   |
| <b>T<sub>r</sub></b>   | 开启上升时间 | --- | 35   | --- | ns |   |
| <b>T<sub>f</sub></b>   | 关断下降时间 | --- | 30   | --- | ns |   |
| <b>E<sub>on</sub></b>  | 导通损耗   | --- | 0.54 | --- | mJ |   |
| <b>E<sub>off</sub></b> | 关断损耗   | --- | 0.45 | --- | mJ |   |
| <b>E<sub>st</sub></b>  | 开关损耗   | --- | 0.99 | --- | mJ |   |

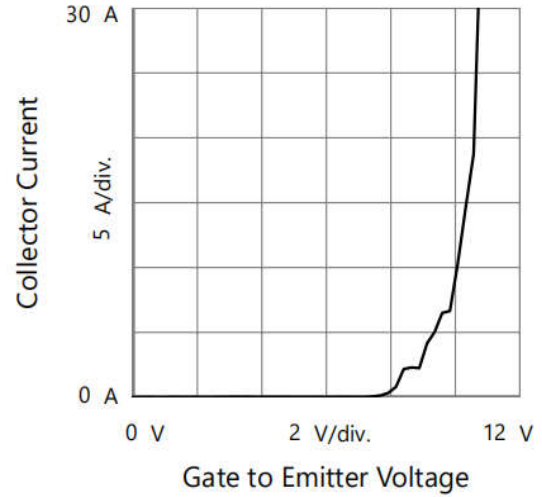
表 4: 开关特性参数

典型特性曲线图(除非另有说明,  $T_A = 25^\circ\text{C}$ ):

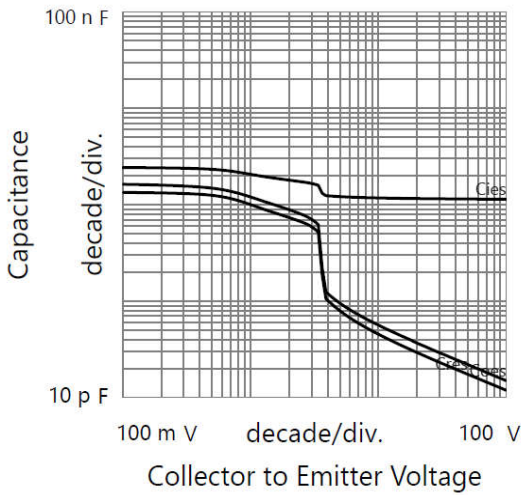
Output Characteristics



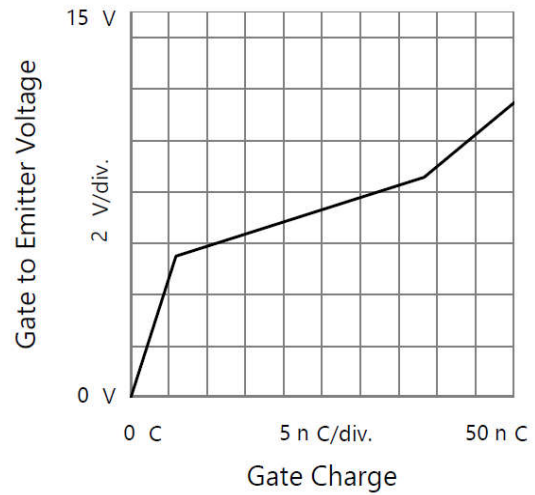
Transfer Characteristics



Capacitances

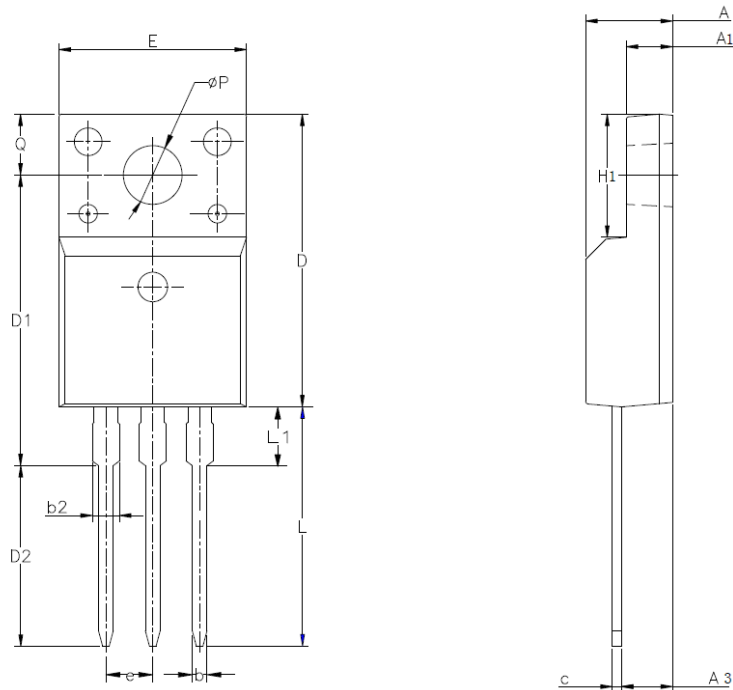


Gate Charge



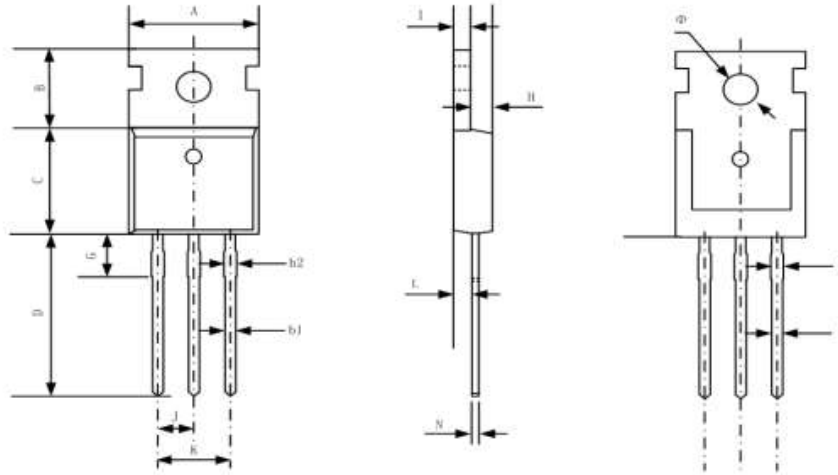
#### 封装信息:

#### TO-220F 封装尺寸图:



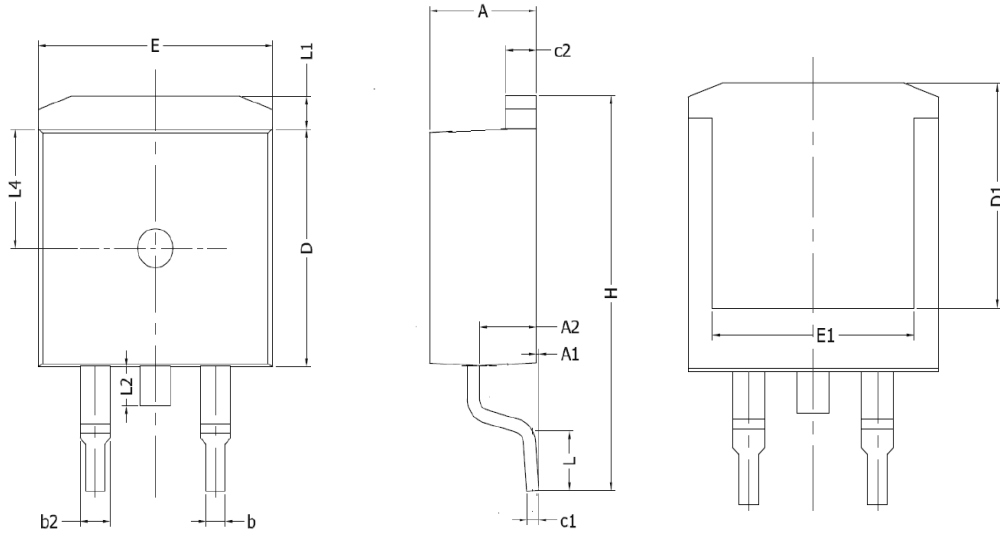
| SYMBOL   | MIN     | NOM   | MAX   |
|----------|---------|-------|-------|
| A        | 4.42    | 4.70  | 5.02  |
| A1       | 2.30    | 2.54  | 2.80  |
| A3       | 2.50    | 2.76  | 3.10  |
| b        | 0.70    | 0.80  | 0.90  |
| b2       | —       | —     | 1.47  |
| c        | 0.35    | 0.50  | 0.65  |
| D        | 15.25   | 15.87 | 16.25 |
| D1       | 15.30   | 15.75 | 16.30 |
| D2       | 9.30    | 9.80  | 10.30 |
| E        | 9.73    | 10.16 | 10.36 |
| e        | 2.54BCS |       |       |
| H1       | 6.40    | 6.68  | 7.00  |
| L        | 12.48   | 12.98 | 13.48 |
| L1       | /       | /     | 3.50  |
| $\phi P$ | 3.00    | 3.18  | 3.40  |
| Q        | 3.05    | 3.30  | 3.55  |

TO-220 封装尺寸图:



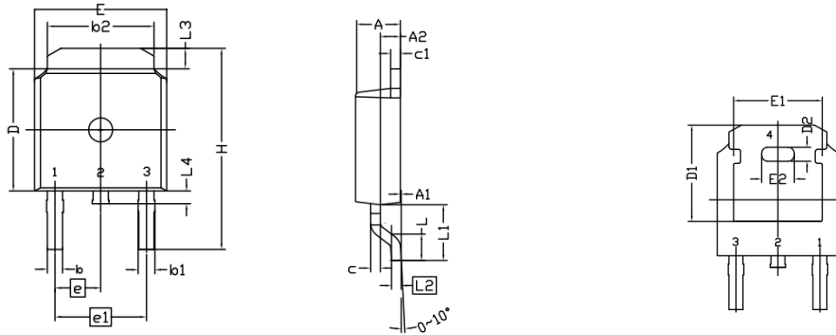
| Symbol | Dimensions in Millimeters |       | Dimensions in Inches |      |
|--------|---------------------------|-------|----------------------|------|
|        | Min.                      | Max.  | Min.                 | Max. |
| A      | 9.70                      | 10.20 | 0.38                 | 0.40 |
| B      | 6.30                      | 6.70  | 0.25                 | 0.26 |
| C      | 9.00                      | 9.47  | 0.35                 | 0.37 |
| D      | 12.78                     | 13.38 | 0.50                 | 0.53 |
| G      | 2.65 REF                  |       | 0.104 REF            |      |
| H      | 3.00                      | 3.40  | 0.12                 | 0.13 |
| I      | 1.25                      | 1.40  | 0.05                 | 0.06 |
| J      | 2.40                      | 2.70  | 0.09                 | 0.11 |
| K      | 5.00                      | 5.15  | 0.20                 | 0.20 |
| L      | 2.20                      | 2.60  | 0.09                 | 0.10 |
| M      | 1.25                      | 1.45  | 0.05                 | 0.06 |
| N      | 0.45                      | 0.60  | 0.02                 | 0.02 |
| O      | 0.70                      | 0.90  | 0.03                 | 0.04 |
| ⌀      | 3.6 REF                   |       | 0.142 REF            |      |

TO-263 封装尺寸图:



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |      |
|--------|---------------------------|-------|----------------------|------|
|        | Min.                      | Max.  | Min.                 | Max. |
| A      | 4.40                      | 4.60  | 0.17                 | 0.18 |
| A1     | 0.00                      | 0.25  | 0.00                 | 0.01 |
| A2     | 2.20                      | 2.60  | 0.09                 | 0.10 |
| b      | 0.76                      | 0.89  | 0.03                 | 0.04 |
| b2     | 1.23                      | 1.37  | 0.05                 | 0.05 |
| C      | 0.47                      | 0.60  | 0.02                 | 0.02 |
| c1     | 0.46                      | 0.56  | 0.02                 | 0.02 |
| c2     | 1.25                      | 1.35  | 0.05                 | 0.05 |
| D      | 0.91                      | 0.93  | 0.04                 | 0.04 |
| D1     | 8.00                      | -     | 0.31                 | -    |
| E      | 9.80                      | 10.00 | 0.39                 | 0.39 |
| E1     | 7.80                      | -     | 0.31                 | -    |
| e      | 2.54BSC                   |       | 0.10BSC              |      |
| H      | 14.90                     | 15.70 | 0.59                 | 0.62 |
| L      | 2.00                      | 2.60  | 0.08                 | 0.10 |
| L1     | 1.17                      | 1.40  | 0.05                 | 0.06 |
| L2     | -                         | 1.75  | -                    | 0.07 |
| L4     | 4.60REF                   |       | 0.18REF              |      |

#### TO-252 封装尺寸图:



| SYMBOL | DIMENSION IN MILLIMETERS |        |        | DIMENSIONS IN INCHES |       |       |
|--------|--------------------------|--------|--------|----------------------|-------|-------|
|        | MIN.                     | NOM.   | MAX.   | MIN.                 | NOM.  | MAX.  |
| A      | 2.184                    | 2.286  | 2.388  | 0.086                | 0.090 | 0.094 |
| A1     | 0.000                    | ----   | 0.127  | 0.000                | ----  | 0.005 |
| A2     | 0.889                    | 1.041  | 1.143  | 0.035                | 0.041 | 0.045 |
| b      | 0.635                    | 0.762  | 0.889  | 0.025                | 0.030 | 0.035 |
| b1     | 0.762                    | 0.840  | 1.143  | 0.030                | 0.033 | 0.045 |
| b2     | 4.953                    | 5.340  | 5.461  | 0.195                | 0.210 | 0.215 |
| c      | 0.450                    | 0.508  | 0.610  | 0.018                | 0.020 | 0.024 |
| c1     | 0.450                    | 0.508  | 0.610  | 0.018                | 0.020 | 0.024 |
| D      | 5.969                    | 6.096  | 6.223  | 0.235                | 0.240 | 0.245 |
| D1     | 5.210                    | 5.249  | 5.380  | 0.205                | 0.207 | 0.212 |
| D2     | 0.662                    | 0.762  | 0.862  | 0.026                | 0.030 | 0.034 |
| E      | 6.350                    | 6.604  | 6.731  | 0.250                | 0.260 | 0.265 |
| E1     | 4.318                    | 4.826  | 4.901  | 0.170                | 0.190 | 0.193 |
| E2     | 1.678                    | 1.778  | 1.878  | 0.066                | 0.070 | 0.074 |
| e      | 2.286 BSC                |        |        | 0.090 BSC            |       |       |
| e1     | 4.572 BSC                |        |        | 0.180 BSC            |       |       |
| H      | 9.398                    | 10.033 | 10.414 | 0.370                | 0.395 | 0.410 |
| L      | 1.270                    | 1.520  | 2.032  | 0.050                | 0.060 | 0.080 |
| L1     | 2.921 REF.               |        |        | 0.115REF.            |       |       |
| L2     | 0.408                    | 0.508  | 0.608  | 0.016                | 0.020 | 0.024 |
| L3     | 0.889                    | 1.016  | 1.270  | 0.035                | 0.040 | 0.050 |
| L4     | 0.635                    | ----   | 1.016  | 0.025                | ----  | 0.040 |



**版本记录**

| 日期         | 版本  | 更改内容                          |
|------------|-----|-------------------------------|
| 2021.10.20 | 0.0 | 初稿                            |
| 2022.01.06 | 0.1 | 部分优化                          |
| 2022.04.07 | 0.2 | 修改部分参数                        |
| 2022.04.21 | 0.3 | 添加 TO-252 封装及参数               |
| 2022.06.09 | 0.4 | 添加 TO-220、TO-263 封装尺寸以及部份参数更新 |