



N 沟道增强型场效应晶体管  
N-CHANNEL MOSFET  
FHP12N65W/FHF12N65W

主要参数 MAIN CHARACTERISTICS

|                        |       |
|------------------------|-------|
| ID                     | 12A   |
| VDSS                   | 650V  |
| Rdson-typ ( @Vgs=10V ) | 0.58Ω |
| Qg-typ                 | 33nC  |

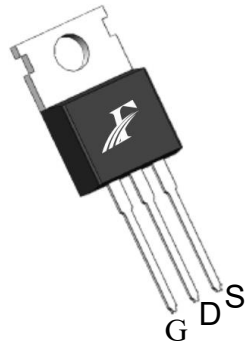
用途 APPLICATIONS

|        |                                            |
|--------|--------------------------------------------|
| 高频开关电源 | High efficiency switch mode power supplies |
|--------|--------------------------------------------|

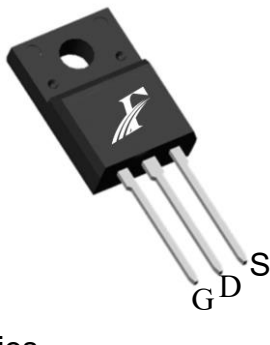
产品特性 FEATURES

|                    |                           |
|--------------------|---------------------------|
| 低栅极电荷              | Low gate charge           |
| 低 Crss (典型值 4.0pF) | Low Crss (typical 4.0pF ) |
| 开关速度快              | Fast switching            |
| 100%经过雪崩测试         | 100% avalanche tested     |
| 100%经过热阻测试         | 100% DVDS tested          |
| 100%经过 RG 测试       | 100% Rg tested            |
| 高抗 dv/dt 能力        | Improved dv/dt capability |
| RoHS 产品            | RoHS product              |

封装形式 Package

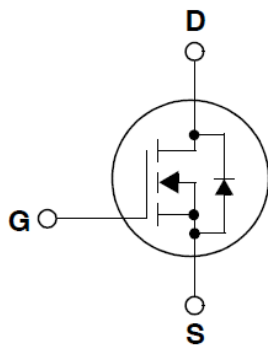


TO-220  
FHP series



TO-220F  
FHF series

等效电路 Equivalent Circuit



绝对最大额定值 ABSOLUTE RATINGS (Tc=25℃)

| 项目<br>Parameter                                             | 符号<br>Symbol      | 数值<br>Value     |           | 单位<br>Unit |
|-------------------------------------------------------------|-------------------|-----------------|-----------|------------|
|                                                             |                   | FHP12N65W       | FHF12N65W |            |
| 最高漏极—源极直流电压<br>Drain-Source Voltage                         | Vds               | 650             |           | V          |
| 连续漏极电流*<br>Drain Current -continuous *                      | Id (Tc=25℃)       | 12              |           | A          |
|                                                             | Id (Tc=100℃)      | 7.2             |           | A          |
| 最大脉冲漏极电流 (注 1)<br>Drain Current – pulse (note 1)            | IDM               | 48              |           | A          |
| 最高栅源电压<br>Gate-Source Voltage                               | VGS               | ±30             |           | V          |
| 单脉冲雪崩能量 (注 2)<br>Single Pulsed Avalanche Energy (note 2)    | EAS               | 180             |           | mJ         |
| 雪崩电流 (注 1)<br>Avalanche Current (note 1)                    | IAR               | 6               |           | A          |
| 重复雪崩能量 (注 1)<br>Repetitive Avalanche Current (note 1)       | EAR               | 4               |           | mJ         |
| 二极管反向恢复最大电压变化速率 (注 3)<br>Peak Diode Recovery dv/dt (note 3) | dv/dt             | 5.0             |           | V/ns       |
| 耗散功率<br>Power Dissipation                                   | Pd (TC=25℃)       | 180             | 50        | W          |
|                                                             | -Derate above 25℃ | 1.45            | 0.4       | W/℃        |
| 最高结温及存储温度<br>Operating and Storage Temperature Range        | TJ, TSTG          | 150, -55 to 150 |           | ℃          |
| 引线最高焊接温度<br>Maximum Lead Temperature for Soldering Purposes | TL                | 300             |           | ℃          |

\*漏极电流由最高结温限制

\*Drain current limited by maximum junction temperature

电特性 ELECTRICAL CHARACTERISTICS

| 项目<br>Parameter                                                       | 符号<br>Symbol                         | 测试条件<br>Tests conditions                                                                                     | 最小<br>Min | 典型<br>Typ | 最大<br>Max | 单位<br>Units |
|-----------------------------------------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|-------------|
| 关态特性 Off –Characteristics                                             |                                      |                                                                                                              |           |           |           |             |
| 漏－源击穿电压 Drain-Source Voltage                                          | BV <sub>DSS</sub>                    | I <sub>D</sub> =250μA, V <sub>GS</sub> =0V                                                                   | 650       | -         | -         | V           |
| 击穿电压温度特性 Breakdown Voltage Temperature Coefficient                    | ΔBV <sub>DSS</sub> /Δ T <sub>J</sub> | I <sub>D</sub> =250μA, referenced to 25℃                                                                     | -         | 0.65      | -         | V/℃         |
| 零栅压下漏极漏电流<br>Zero Gate Voltage Drain Current                          | I <sub>DSS</sub>                     | V <sub>DS</sub> =650V,V <sub>GS</sub> =0V, T <sub>C</sub> =25℃                                               | -         | -         | 1         | μA          |
|                                                                       |                                      | V <sub>DS</sub> =520V, T <sub>C</sub> =125℃                                                                  | -         | -         | 10        | μA          |
| 栅极体漏电流<br>Gate-body leakage current                                   | I <sub>GSS</sub> (F/R)               | V <sub>DS</sub> =0V, V <sub>GS</sub> =±30V                                                                   | -         | -         | ±100      | nA          |
| 通态特性 On-Characteristics                                               |                                      |                                                                                                              |           |           |           |             |
| 阈值电压<br>Gate Threshold Voltage                                        | V <sub>GS(th)</sub>                  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =250μA                                                    | 2.0       | -         | 4.0       | V           |
| 静态导通电阻<br>Static Drain-Source On-Resistance                           | R <sub>DS(ON)</sub>                  | V <sub>GS</sub> =10V , I <sub>D</sub> =6A                                                                    | -         | 0.58      | 0.70      | Ω           |
| 正向跨导<br>Forward Transconductance                                      | g <sub>fs</sub>                      | V <sub>DS</sub> = 20V, I <sub>D</sub> =6A (note 4)                                                           | -         | 12        | -         | S           |
| 动态特性 Dynamic Characteristics                                          |                                      |                                                                                                              |           |           |           |             |
| 栅电阻<br>Gate Resistance                                                | R <sub>g</sub>                       | f=1.0MHz,V <sub>DS</sub> OPEN                                                                                | -         | 2.0       | -         | Ω           |
| 输入电容<br>Input capacitance                                             | C <sub>iss</sub>                     | V <sub>DS</sub> =25V,<br>V <sub>GS</sub> =0V,<br>f=1.0MHz                                                    | -         | 2100      | -         | pF          |
| 输出电容<br>Output capacitance                                            | C <sub>oss</sub>                     |                                                                                                              | -         | 160       | -         |             |
| 反向传输电容<br>Reverse transfer capacitance                                | C <sub>rss</sub>                     |                                                                                                              | -         | 4.0       | -         |             |
| 开关特性 Switching Characteristics                                        |                                      |                                                                                                              |           |           |           |             |
| 延迟时间<br>Turn-On delay time                                            | t <sub>d(on)</sub>                   | V <sub>DS</sub> =325V,<br>I <sub>D</sub> =12A,<br>R <sub>G</sub> =25Ω<br>V <sub>GS</sub> =10V<br>(note 4, 5) | -         | 33        | -         | ns          |
| 上升时间<br>Turn-On rise time                                             | t <sub>r</sub>                       |                                                                                                              | -         | 82        | -         | ns          |
| 延迟时间<br>Turn-Off delay time                                           | t <sub>d(off)</sub>                  |                                                                                                              | -         | 72        | -         | ns          |
| 下降时间<br>Turn-Off Fall time                                            | t <sub>f</sub>                       |                                                                                                              | -         | 53        | -         | ns          |
| 栅极电荷总量<br>Total Gate Charge                                           | Q <sub>g</sub>                       | V <sub>DS</sub> =520V ,<br>I <sub>D</sub> =12A ,<br>V <sub>GS</sub> =10V<br>(note 4, 5)                      | -         | 33        | -         | nC          |
| 栅－源电荷<br>Gate-Source charge                                           | Q <sub>gs</sub>                      |                                                                                                              | -         | 10        | -         | nC          |
| 栅－漏电荷<br>Gate-Drain charge                                            | Q <sub>gd</sub>                      |                                                                                                              | -         | 20.5      | -         | nC          |
| 漏－源二极管特性及最大额定值 Drain-Source Diode Characteristics and Maximum Ratings |                                      |                                                                                                              |           |           |           |             |
| 正向最大连续电流<br>Maximum Continuous Drain -Source Diode Forward Current    | I <sub>S</sub>                       |                                                                                                              | -         | -         | 12        | A           |
| 正向最大脉冲电流<br>Maximum Pulsed Drain-Source Diode Forward Current         | I <sub>SM</sub>                      |                                                                                                              | -         | -         | 48        | A           |
| 正向压降<br>Drain-Source Diode Forward Voltage                            | V <sub>SD</sub>                      | V <sub>GS</sub> =0V, I <sub>S</sub> =12A                                                                     | -         | -         | 1.2       | V           |
| 反向恢复时间<br>Reverse recovery time                                       | t <sub>rr</sub>                      | V <sub>GS</sub> =0V, I <sub>S</sub> =12A ,dI <sub>F</sub> /dt=100A/μs<br>(note 4)                            | -         | 509       | -         | ns          |
| 反向恢复电荷<br>Reverse recovery charge                                     | Q <sub>rr</sub>                      |                                                                                                              | -         | 4261      | -         | nC          |

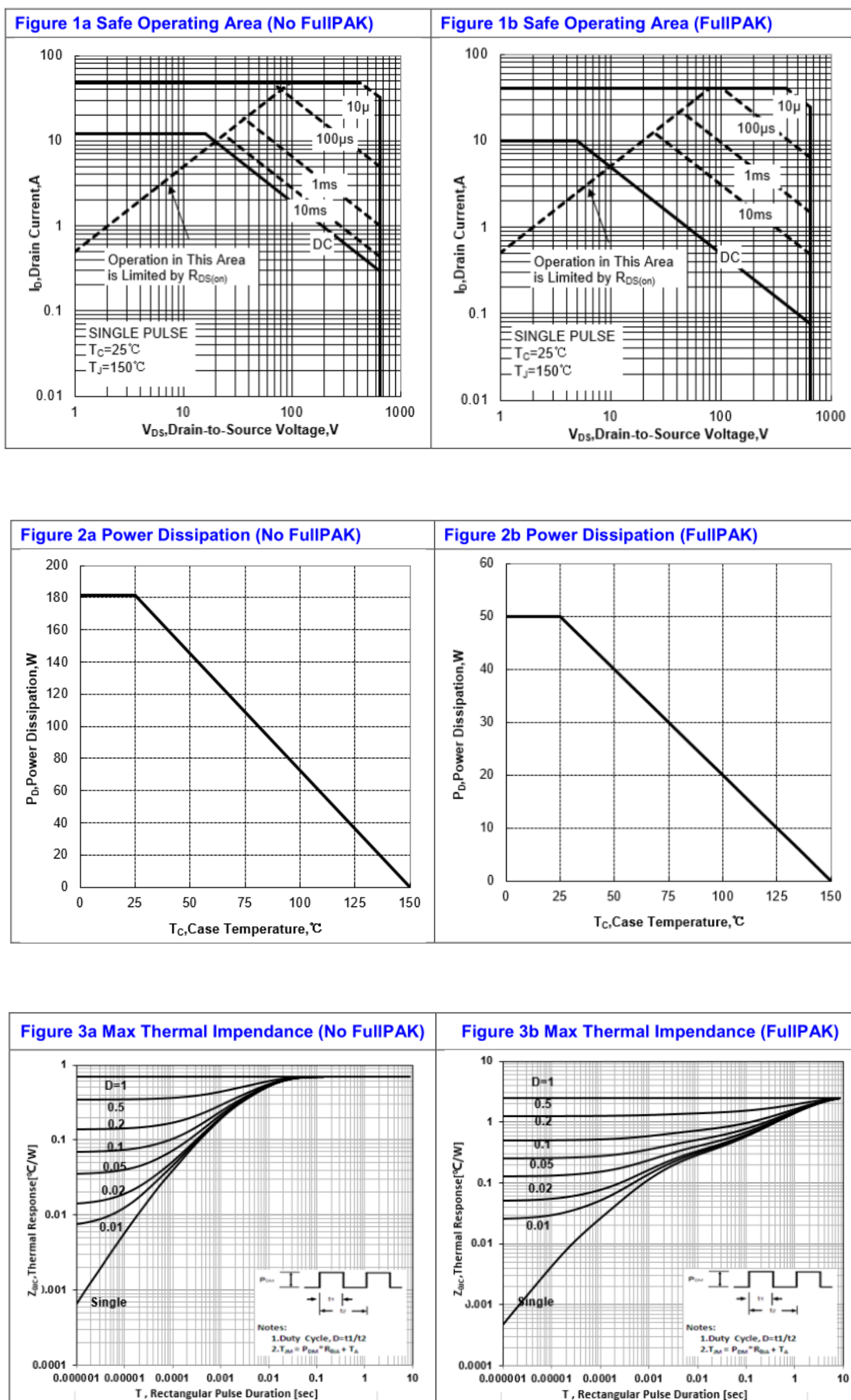
热特性 THERMAL CHARACTERISTIC

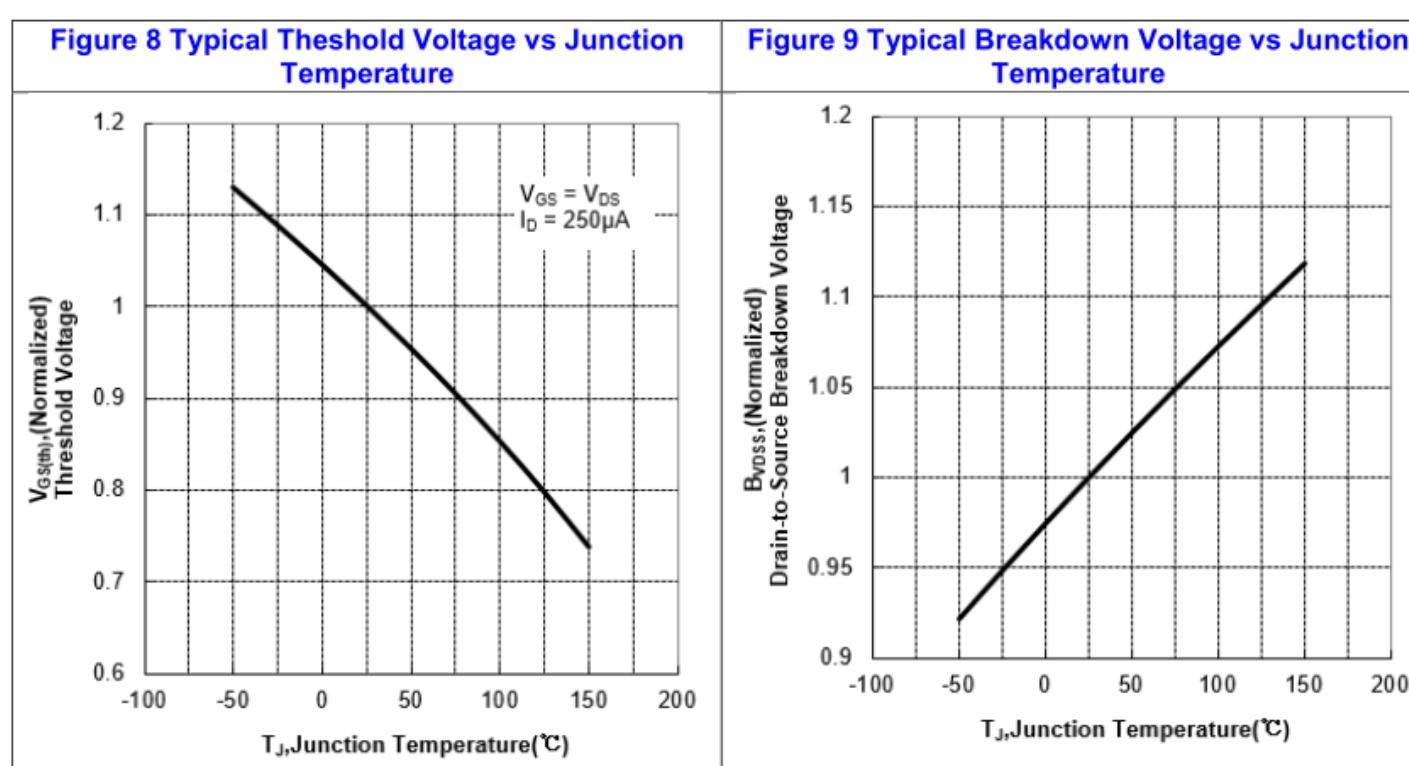
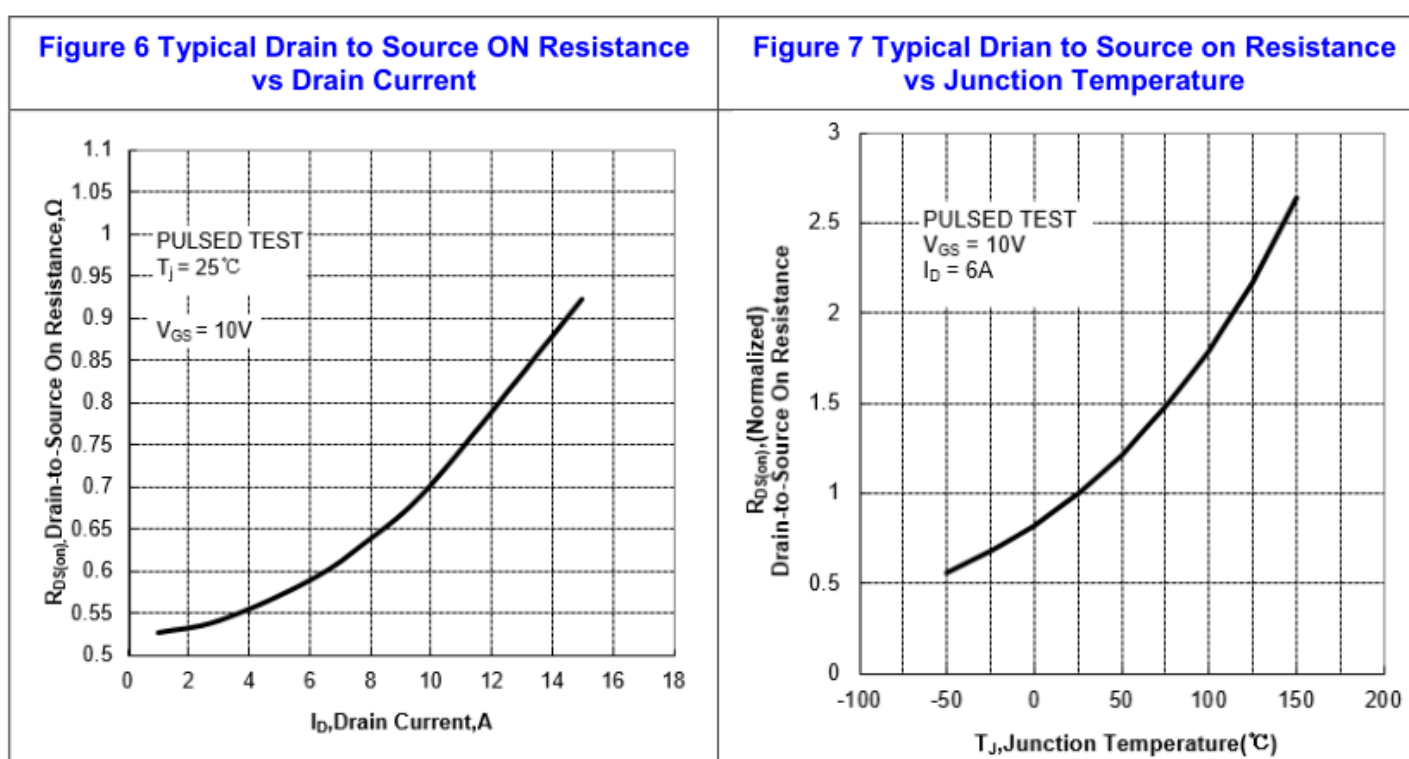
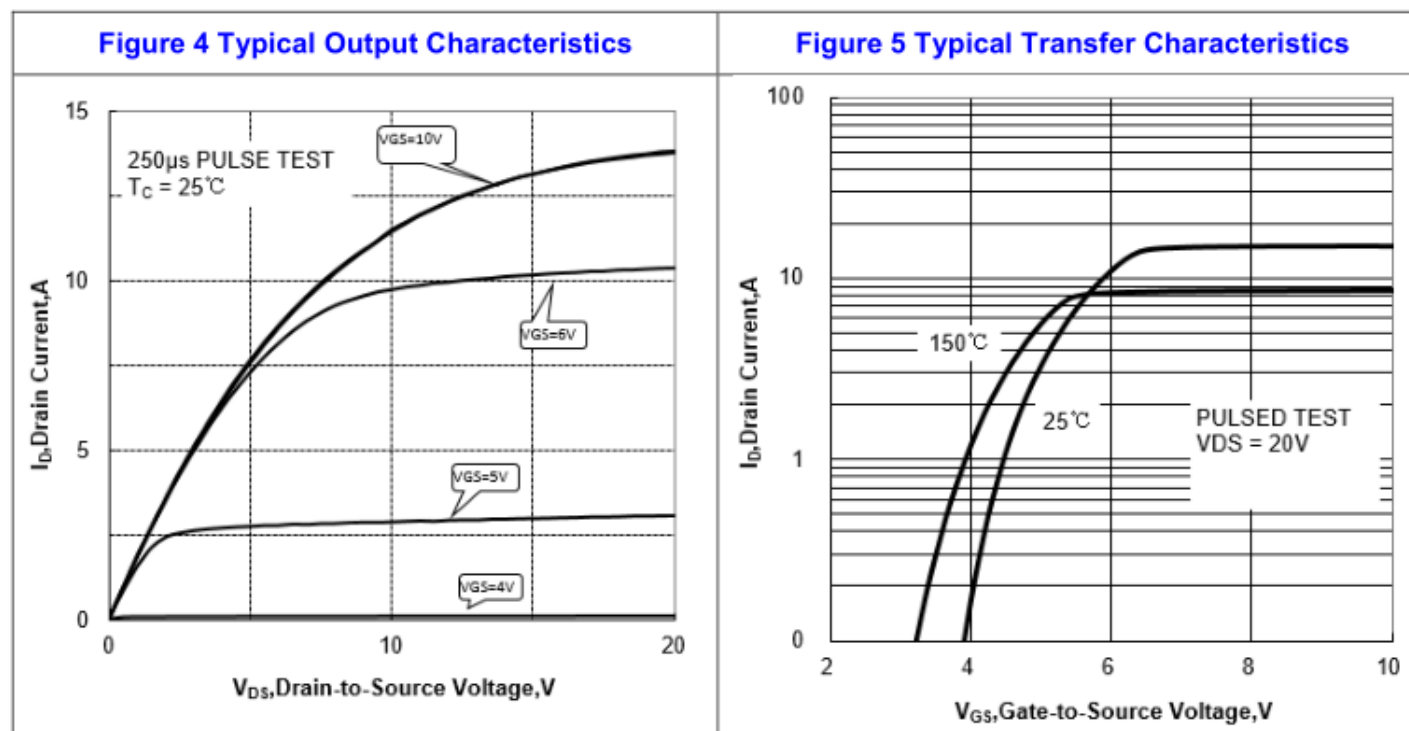
| 项目<br>Parameter                                    | 符号<br>Symbol | FHP12N65W | FHF12N65W | 单位<br>Unit |
|----------------------------------------------------|--------------|-----------|-----------|------------|
| 结到管壳的热阻<br>Thermal Resistance, Junction to Case    | Rth(j-c)     | 0.69      | 2.5       | ℃/W        |
| 结到环境的热阻<br>Thermal Resistance, Junction to Ambient | Rth(j-A)     | 62.5      | 62.5      | ℃/W        |

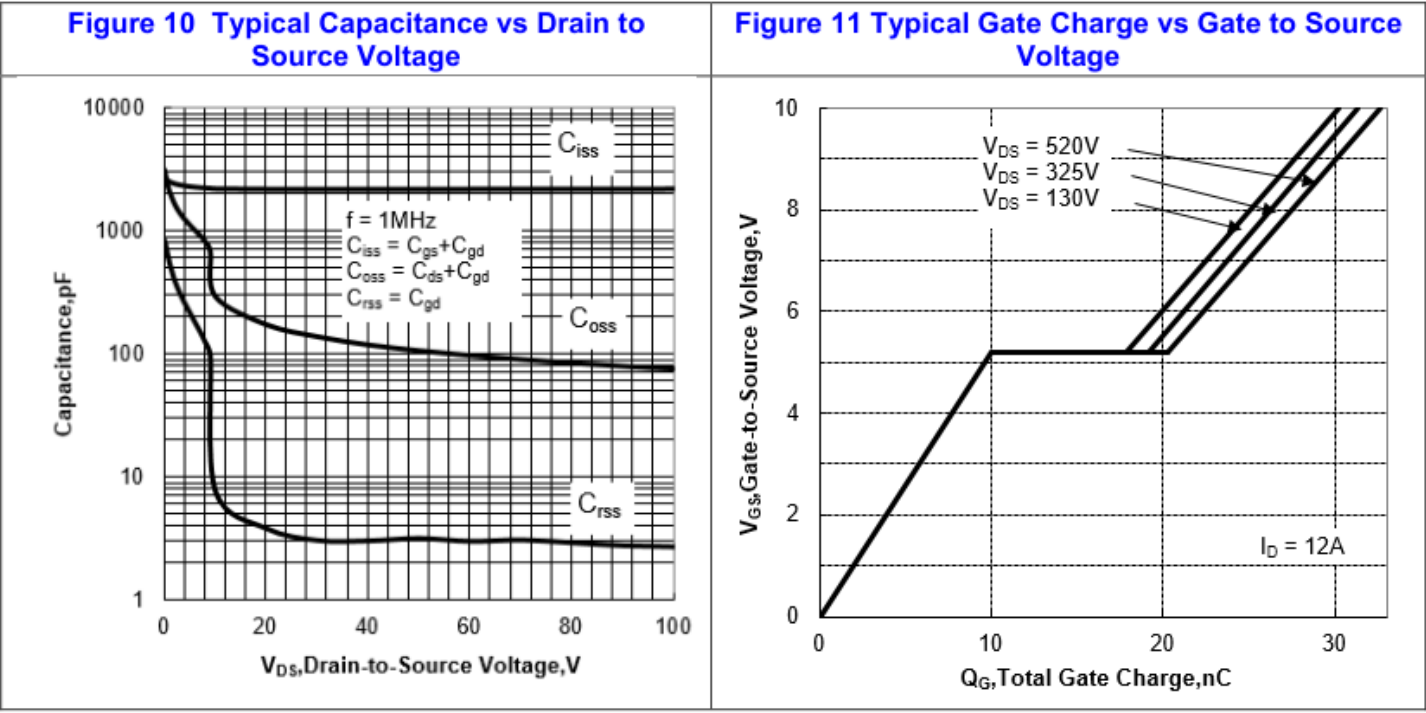
注释：  
1：脉冲宽度由最高结温限制  
2：L=10mH, IAS=6A, VDS=50V, RG=25 Ω,起始结温 TJ=25℃  
3：ISD ≤12A,di/dt ≤100A/μs,VDD≤BV<sub>DSS</sub>,起始结温 TJ=25℃  
4：脉冲测试：脉冲宽度 ≤300μs,占空比≤2%  
5：基本与工作温度无关

Notes:  
1: Pulse width limited by maximum junction temperature  
2: L=10mH, IAS=6A, VDS=50V, RG=25 Ω ,Start TJ=25℃;  
3: ISD ≤12A,di/dt ≤100A/μs,VDD≤BV<sub>DSS</sub>, Starting TJ=25℃  
4: Pulse Test: Pulse Width ≤300μs,Duty Cycle≤2%  
5: Essentially independent of operating temperature

## 特性曲线 (ELECTRICAL CHARACTERISTICS (curves))

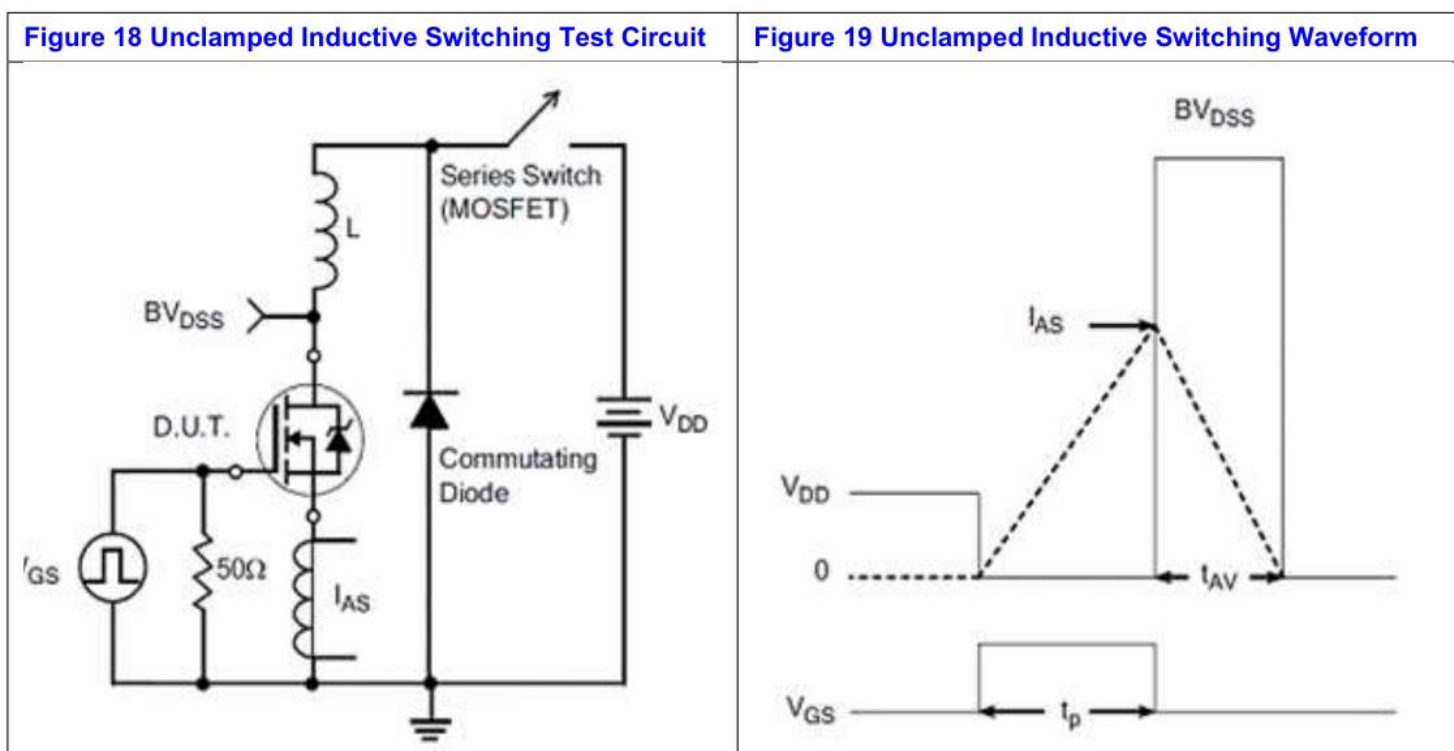




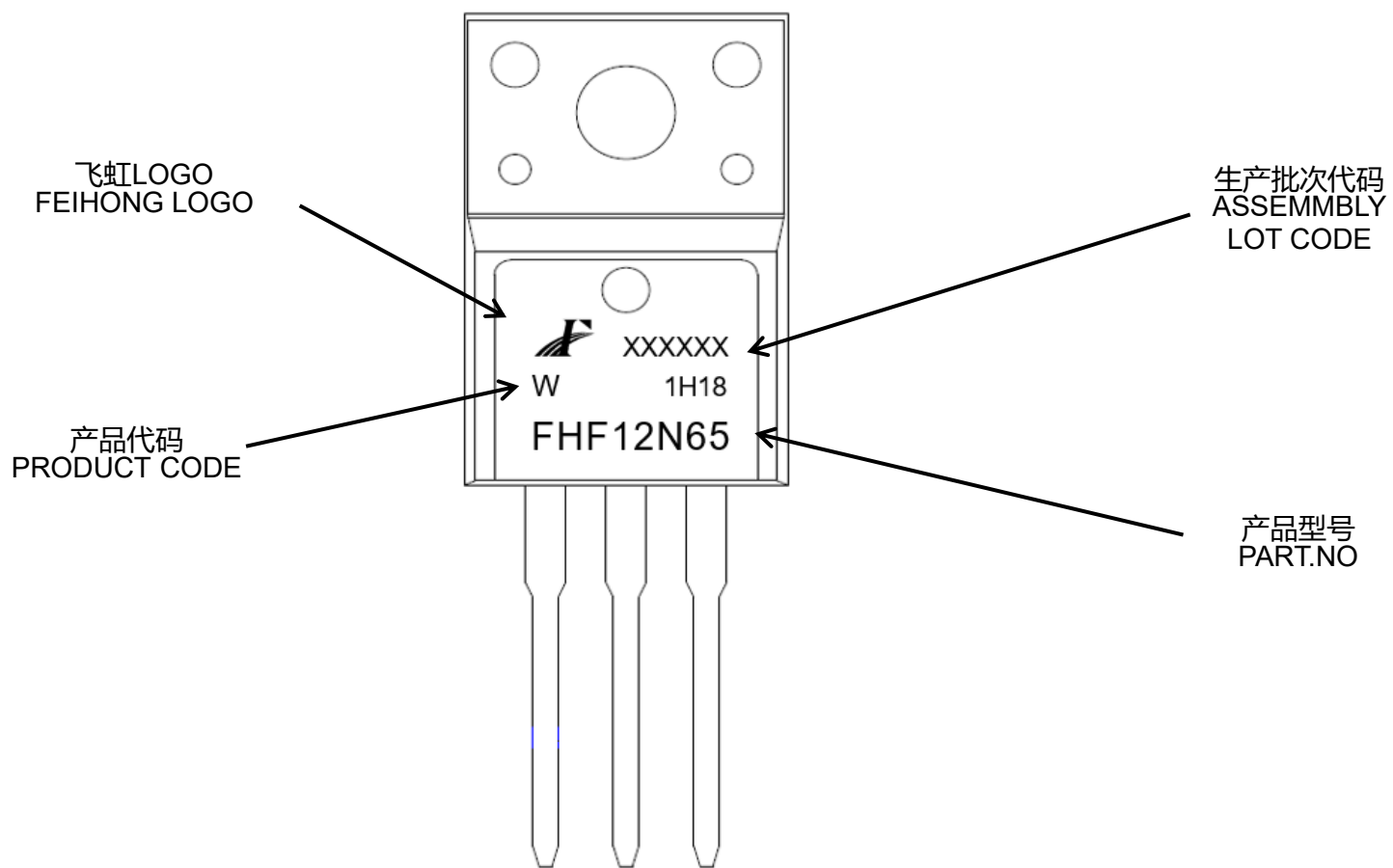
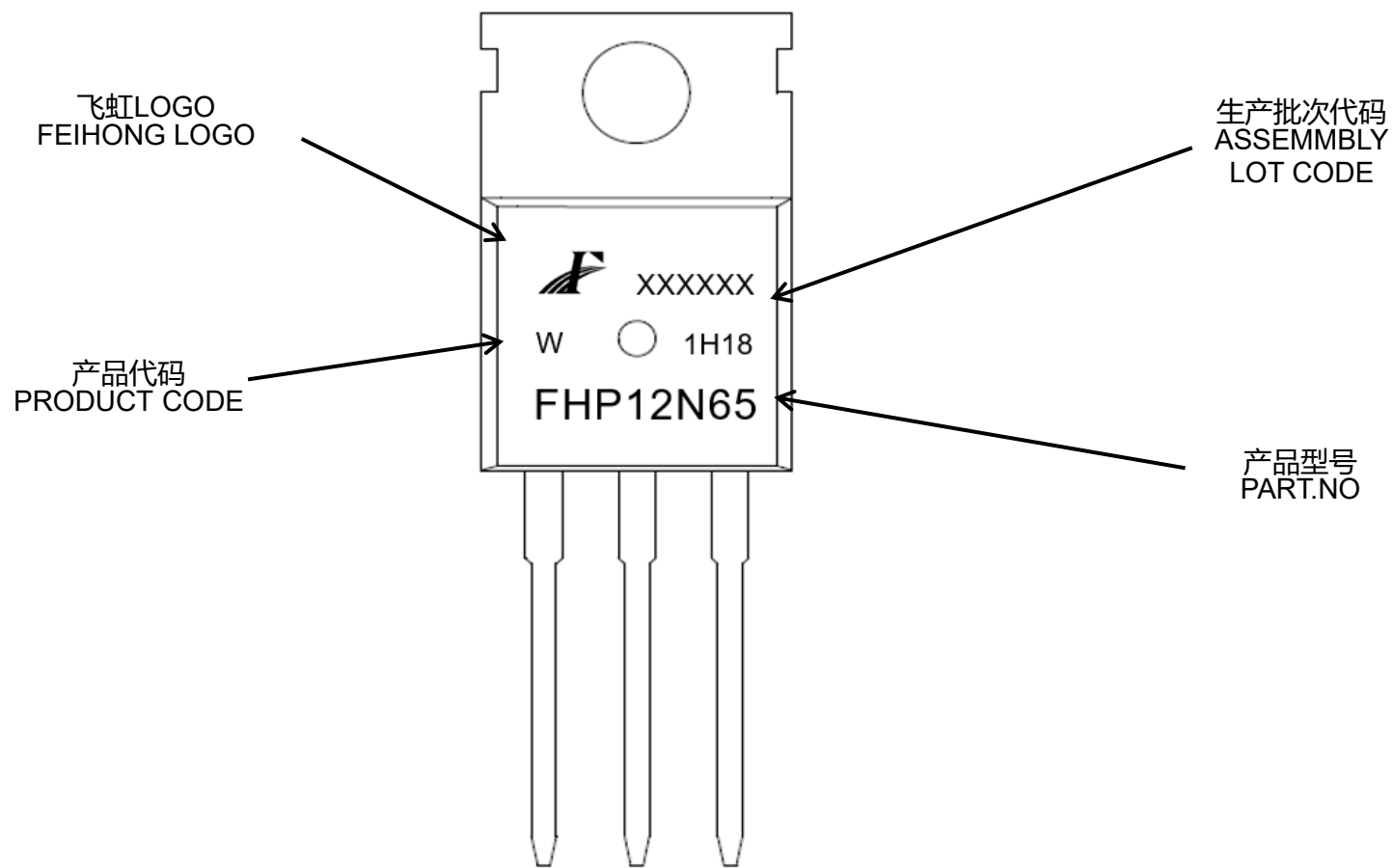


# Test Circuit and Waveform

|                                                             |                                                         |
|-------------------------------------------------------------|---------------------------------------------------------|
| <p><b>Figure 12 Gate Charge Test Circuit</b></p>            | <p><b>Figure 13 Gate Charge Waveforms</b></p>           |
| <p><b>Figure 14 Resistive Switching Test Circuit</b></p>    | <p><b>Figure 15 Resistive Switching Waveforms</b></p>   |
| <p><b>Figure 16 Diode Reverse Recovery Test Circuit</b></p> | <p><b>Figure 17 Diode Reverse Recovery Waveform</b></p> |



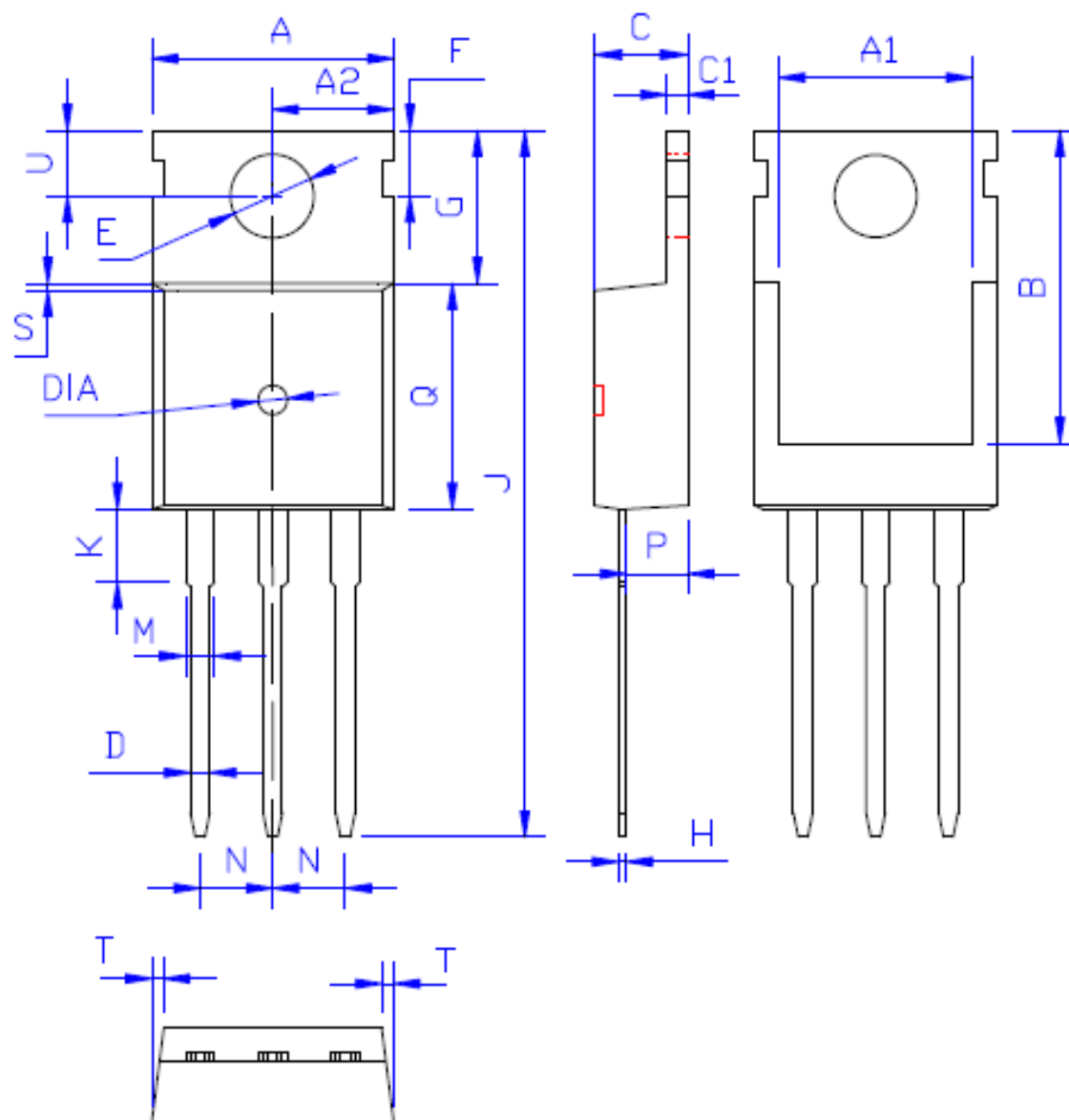
印记 Marking:



外形尺寸:

Package Dimension:

## TO-220



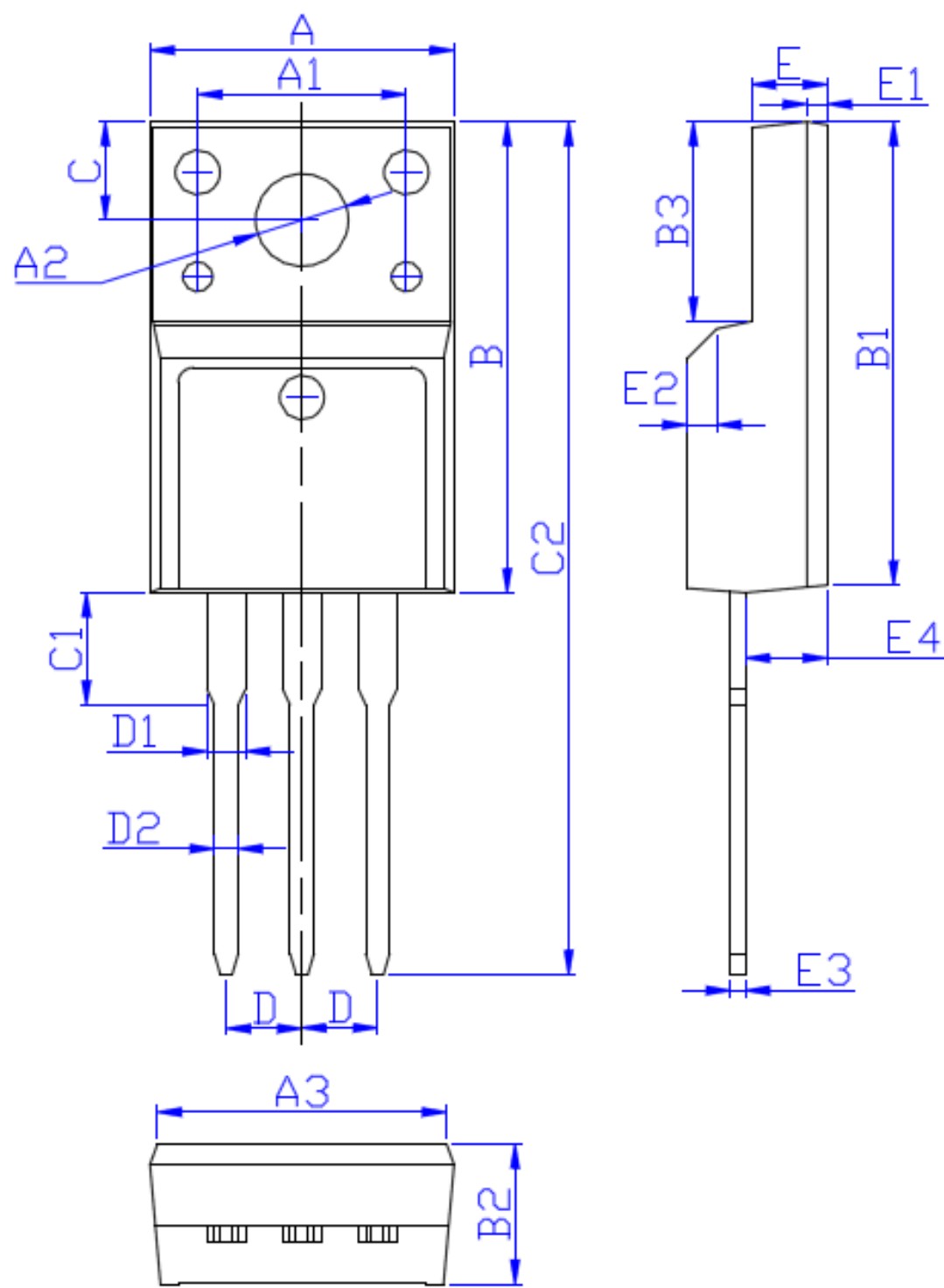
| DIM | MILLIMETERS                     |
|-----|---------------------------------|
| A   | $10.00 \pm 0.30$                |
| A1  | $8.00 \pm 0.30$                 |
| A2  | $5.00 \pm 0.30$                 |
| B   | $13.20 \pm 0.40$                |
| C   | $4.50 \pm 0.20$                 |
| C1  | $1.30 \pm 0.20$                 |
| D   | $0.80 \pm 0.20$                 |
| E   | $3.60 \pm 0.20$                 |
| F   | $3.00 \pm 0.30$                 |
| G   | $6.60 \pm 0.40$                 |
| H   | $0.50 \pm 0.20$                 |
| J   | $28.88 \pm 0.50$                |
| K   | $3.00 \pm 0.30$                 |
| M   | $1.30 \pm 0.30$                 |
| N   | Typical 2.54                    |
| P   | $2.40 \pm 0.40$                 |
| Q   | $9.20 \pm 0.40$                 |
| S   | $0.25 \pm 0.15$                 |
| T   | $0.25 \pm 0.15$                 |
| U   | $2.80 \pm 0.30$                 |
| DIA | 宽 $1.50 \pm 0.10$<br>深 0.50 MAX |

(Unit: mm)

外形尺寸:

Package Dimension:

TO-220F



| DIM | MILLIMETERS  |
|-----|--------------|
| A   | 10.16±0.30   |
| A1  | 7.00±0.20    |
| A2  | 3.12±0.20    |
| A3  | 9.70±0.30    |
| B   | 15.90±0.50   |
| B1  | 15.60±0.50   |
| B2  | 4.70±0.30    |
| B3  | 6.70±0.30    |
| C   | 3.30±0.25    |
| C1  | 3.25±0.30    |
| C2  | 28.70±0.50   |
| D   | Typical 2.54 |
| D1  | 1.47 (MAX)   |
| D2  | 0.80±0.20    |
| E   | 2.55±0.25    |
| E1  | 0.70±0.25    |
| E2  | 1.0×45°      |
| E3  | 0.50±0.20    |
| E4  | 2.75±0.30    |

(Unit:mm)