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2015 年 4 月

# FDPF041N06BL1

## N 沟道 SuperFET® II MOSFET

60 V, 77 A, 4.1 mΩ

### 特性

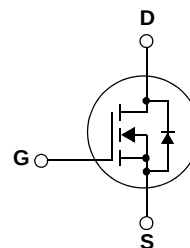
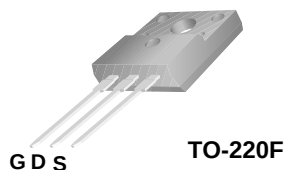
- $R_{DS(on)} = 3.5 \text{ m}\Omega$  (典型值) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 77 \text{ A}$
- 低 FOM  $R_{DS(on)} \cdot Q_G$
- 低反向恢复电荷,  $Q_{rr}$
- 软反向恢复体二极管
- 可实现高效同步整流
- 快速开关速度
- 100% 经过 UIL 测试
- 符合 RoHS 标准

### 描述

此 N- 沟道 MOSFET 采用 飞兆半导体® 先进的 Power Trench® 工艺生产, 这一先进工艺是专为最大限度地降低通态电阻并保持卓越开关性能而定制的。

### 应用

- 用于 ATX/ 服务器 / 电信 PSU 的同步整流
- 电池保护电路
- 电机驱动和不间断电源
- 可再生系统



### MOSFET 最大额定值 $T_C = 25^\circ\text{C}$ 除非另有说明 \*

| 符号             | 参数                             | FDPF041N06BL1                           | 单位                 |
|----------------|--------------------------------|-----------------------------------------|--------------------|
| $V_{DSS}$      | 漏极-源极电压                        | 60                                      | V                  |
| $V_{GSS}$      | 栅极-源极电压                        | $\pm 20$                                | V                  |
| $I_D$          | 漏极电流                           | - 连续 ( $T_C = 25^\circ\text{C}$ , 硅限制)  | A                  |
|                |                                | - 连续 ( $T_C = 100^\circ\text{C}$ , 硅限制) |                    |
| $I_{DM}$       | 漏极电流                           | - 脉冲 (注 1)                              | A                  |
| $E_{AS}$       | 单脉冲雪崩能量                        | (注 2)                                   | mJ                 |
| $dv/dt$        | 二极管恢复 $dv/dt$ 峰值               | (注 3)                                   | V/ns               |
| $P_D$          | 功耗                             | ( $T_C = 25^\circ\text{C}$ )            | W                  |
|                |                                | - 高于 $25^\circ\text{C}$ 的功耗系数           | $^\circ\text{C/W}$ |
| $T_J, T_{STG}$ | 工作和存储温度范围                      | -55 至 +175                              | $^\circ\text{C}$   |
| $T_L$          | 用于焊接的最高引脚温度, 距离外壳 1/8", 持续 5 秒 | 300                                     | $^\circ\text{C}$   |

### 热性能

| 符号              | 参数        | FDPF041N06BL1 | 单位                 |
|-----------------|-----------|---------------|--------------------|
| $R_{\theta JC}$ | 结至外壳热阻最大值 | 3.4           | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | 结至环境热阻最大值 | 62.5          |                    |

## 封装标识与订购信息

| 器件标识          | 器件            | 封装      | 包装类型 | 数量 |
|---------------|---------------|---------|------|----|
| FDPF041N06BL1 | FDPF041N06BL1 | TO-220F | 塑料管  | 50 |

电气特性  $T_C = 25^\circ\text{C}$  除非另有说明

| 符号 | 参数 | 测试条件 | 最小值 | 典型值 | 最大值 | 单位 |
|----|----|------|-----|-----|-----|----|
|----|----|------|-----|-----|-----|----|

## 关断特性

|                                      |           |                                                      |    |      |           |                           |
|--------------------------------------|-----------|------------------------------------------------------|----|------|-----------|---------------------------|
| $BV_{DSS}$                           | 漏极-源极击穿电压 | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$    | 60 | -    | -         | V                         |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | 击穿电压温度系数  | $I_D = 250\ \mu\text{A}$ , 参考 $25^\circ\text{C}$     | -  | 0.03 | -         | $\text{V}/^\circ\text{C}$ |
| $I_{DSS}$                            | 零栅极电压漏极电流 | $V_{DS} = 48\ \text{V}$ , $V_{GS} = 0\ \text{V}$     | -  | -    | 1         | $\mu\text{A}$             |
| $I_{GSS}$                            | 栅极-体漏电流   | $V_{GS} = \pm 20\ \text{V}$ , $V_{DS} = 0\ \text{V}$ | -  | -    | $\pm 100$ | nA                        |

## 导通特性

|              |             |                                                |   |     |     |                  |
|--------------|-------------|------------------------------------------------|---|-----|-----|------------------|
| $V_{GS(th)}$ | 栅极阈值电压      | $V_{GS} = V_{DS}$ , $I_D = 250\ \mu\text{A}$   | 2 | -   | 4   | V                |
| $R_{DS(on)}$ | 漏极至源极静态导通电阻 | $V_{GS} = 10\ \text{V}$ , $I_D = 77\ \text{A}$ | - | 3.5 | 4.1 | $\text{m}\Omega$ |
| $g_{FS}$     | 正向跨导        | $V_{DS} = 10\ \text{V}$ , $I_D = 77\ \text{A}$ | - | 125 | -   | S                |

## 动态特性

|               |              |                                                                            |   |      |      |    |
|---------------|--------------|----------------------------------------------------------------------------|---|------|------|----|
| $C_{iss}$     | 输入电容         | $V_{DS} = 30\ \text{V}$ , $V_{GS} = 0\ \text{V}$<br>$f = 1\ \text{MHz}$    | - | 4280 | 5690 | pF |
| $C_{oss}$     | 输出电容         |                                                                            | - | 1050 | 1400 | pF |
| $C_{rss}$     | 反向传输电容       |                                                                            | - | 23   | -    | pF |
| $C_{oss(er)}$ | 能量相关输出电容     | $V_{DS} = 30\ \text{V}$ , $V_{GS} = 0\ \text{V}$                           | - | 1787 | -    | pF |
| $Q_{g(tot)}$  | 10 V 的栅极电荷总量 | $V_{DS} = 30\ \text{V}$ , $I_D = 100\ \text{A}$<br>$V_{GS} = 10\ \text{V}$ | - | 53   | 69   | nC |
| $Q_{gs}$      | 栅极-源极栅极电荷    |                                                                            | - | 23   | -    | nC |
| $Q_{gd}$      | 栅极-漏极“米勒”电荷  |                                                                            | - | 8    | -    | nC |
| $V_{plateau}$ | 栅极平台电压       | (注 4)                                                                      | - | 5.7  | -    | V  |
| $Q_{sync}$    | 总栅极电荷同步      | $V_{DS} = 0\ \text{V}$ , $I_D = 50\ \text{A}$ (注 5)                        | - | 48.6 | -    | nC |
| $Q_{oss}$     | 输出电荷         | $V_{DS} = 30\ \text{V}$ , $V_{GS} = 0\ \text{V}$                           | - | 63.8 | -    | nC |

## 开关特性

|              |              |                                                                                                               |   |     |    |          |
|--------------|--------------|---------------------------------------------------------------------------------------------------------------|---|-----|----|----------|
| $t_{d(on)}$  | 导通延迟时间       | $V_{DD} = 30\ \text{V}$ , $I_D = 100\ \text{A}$<br>$V_{GS} = 10\ \text{V}$ , $R_{GEN} = 4.7\ \Omega$<br>(注 4) | - | 29  | 68 | ns       |
| $t_r$        | 开通上升时间       |                                                                                                               | - | 22  | 54 | ns       |
| $t_{d(off)}$ | 关断延迟时间       |                                                                                                               | - | 38  | 86 | ns       |
| $t_f$        | 关断下降时间       |                                                                                                               | - | 11  | 32 | ns       |
| ESR          | 等效串联电阻 (G-S) | $f = 1\ \text{MHz}$                                                                                           | - | 0.8 | -  | $\Omega$ |

## 漏极-源极二极管特性

|                 |                  |                                                |   |    |      |    |
|-----------------|------------------|------------------------------------------------|---|----|------|----|
| I <sub>S</sub>  | 漏极－源极二极管最大正向连续电流 |                                                | - | -  | 77   | A  |
| I <sub>SM</sub> | 漏极－源极二极管最大正向脉冲电流 |                                                | - | -  | 308  | A  |
| V <sub>SD</sub> | 漏极－源极二极管正向电压     | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 77 A  | - | -  | 1.25 | V  |
| t <sub>rr</sub> | 反向恢复时间           | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 100 A | - | 65 | -    | ns |
| Q <sub>rr</sub> | 反向恢复电荷           | dI <sub>F</sub> /dt = 100 A/μs                 | - | 63 | -    | nC |

## 注:

1. 重复额定值: 脉冲宽度受限于最大结温
2.  $L = 3\ \text{mH}$ ,  $I_{AS} = 15.6\ \text{A}$ , 开始于  $T_J = 25^\circ$
3.  $I_{SD} \leq 100\ \text{A}$ ,  $di/dt \leq 200\ \text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , 开始于  $T_J = 25^\circ\text{C}$
4. 本质上独立于操作温度的典型特性
5. 见第 8 页测试电路

# 典型性能特征

图 1. 导通区域特性

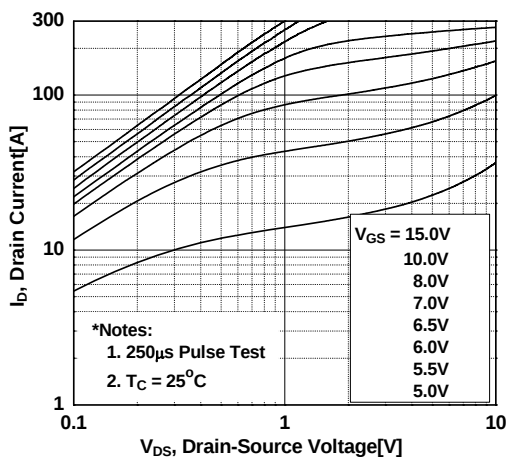


图 2. 传输特性

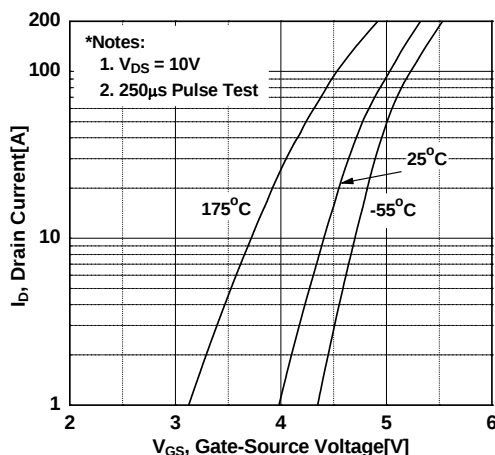


图 3. 导通电阻变化与漏极电流和栅极电压的关系

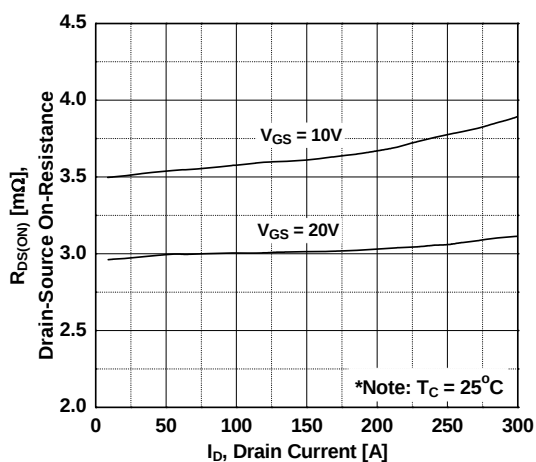


图 4. 体二极管正向电压变化与源极电流的关系和温度的关系

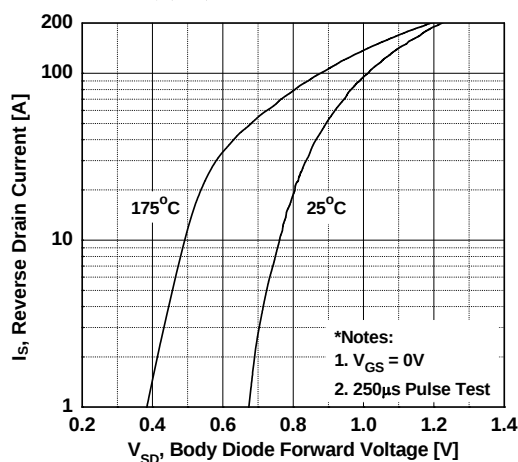


图 5. 电容特性

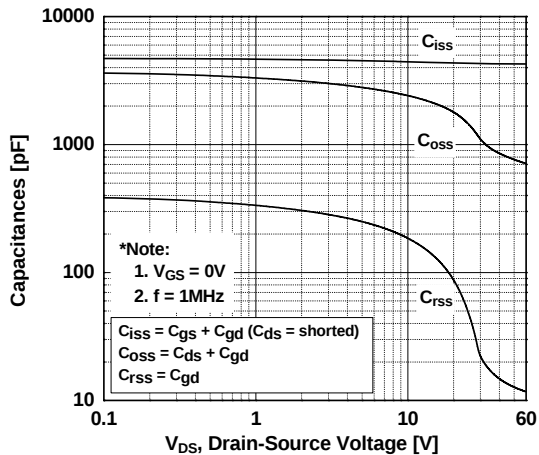
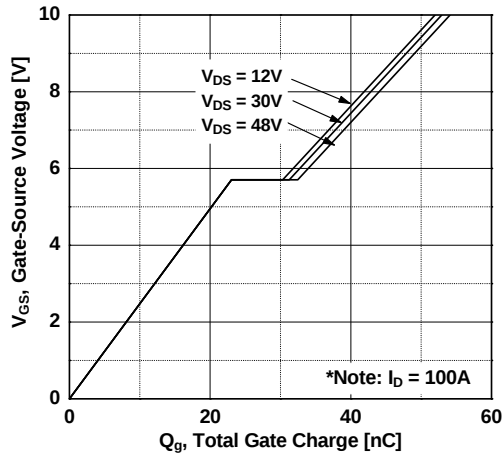


图 6. 栅极电荷特性



## 典型性能特征 (接上页)

图 7. 击穿电压变化与温度的关系

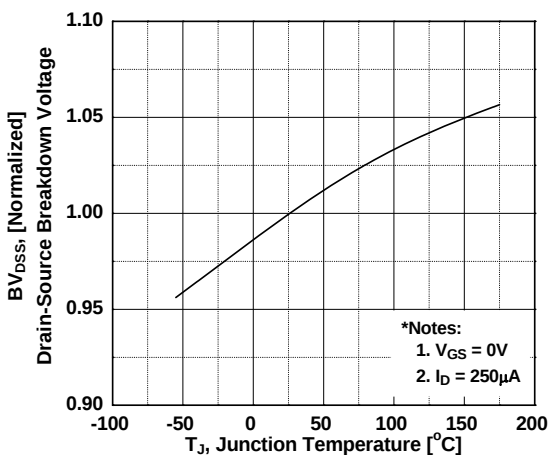


图 8. 导通电阻变化与温度的关系

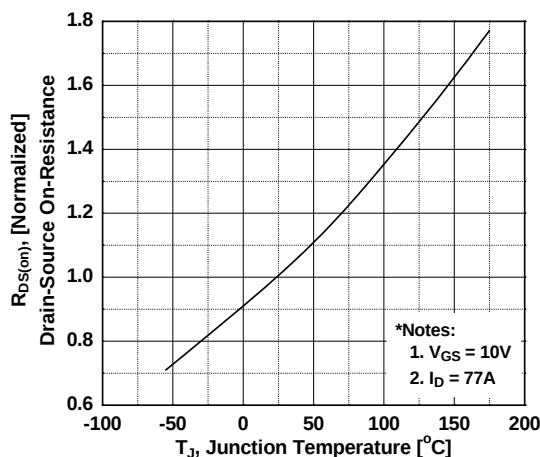


图 9. 最大安全工作区与壳温的关系

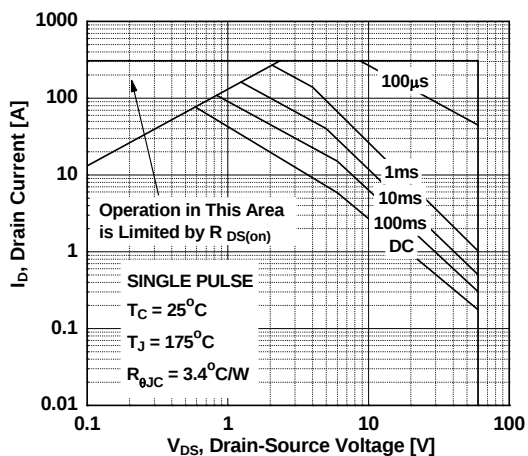


图 10. 最大漏极电流

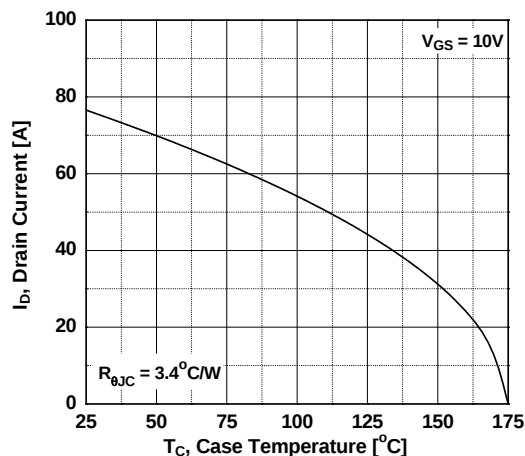


图 11. Eoss 与漏源极电压的关系

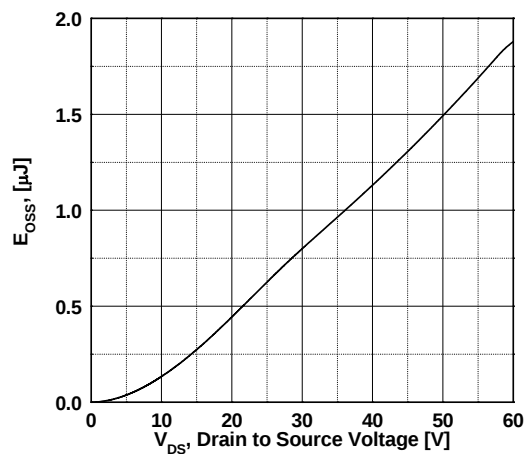
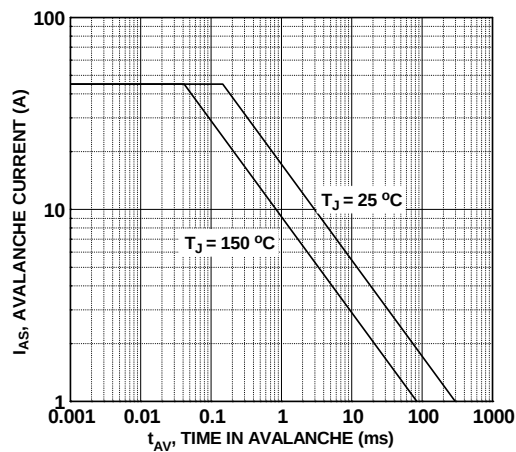
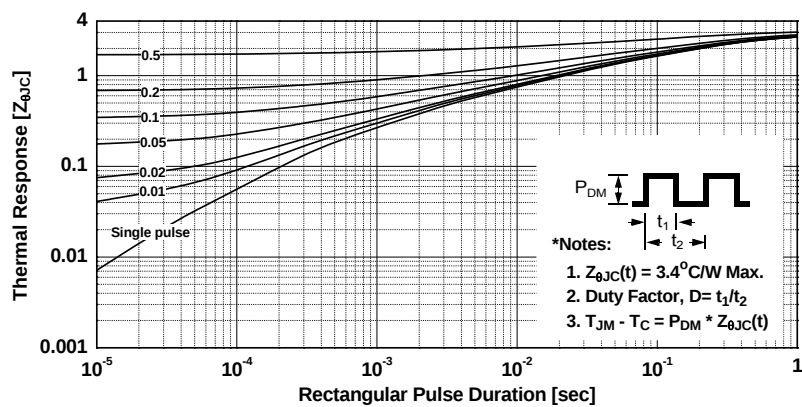


图 12. 非箝位电感开关能力

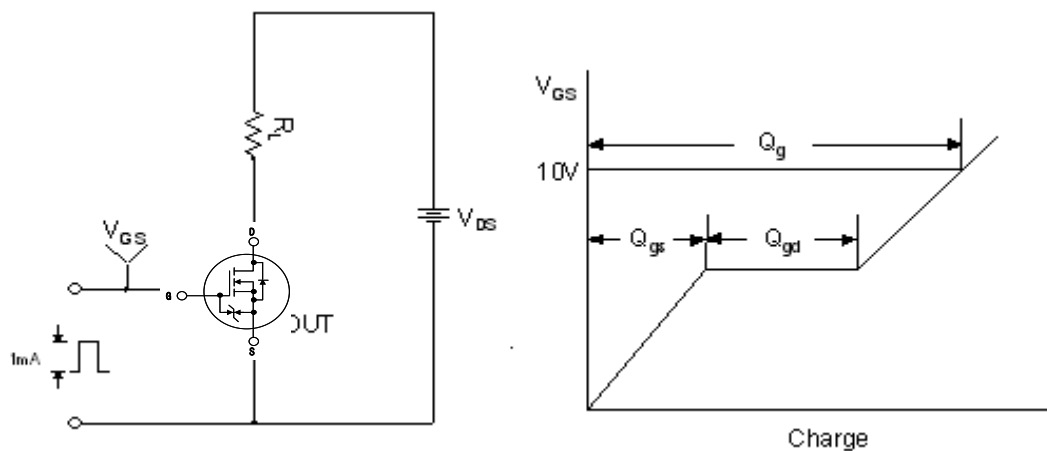


## 典型性能特征 (接上页)

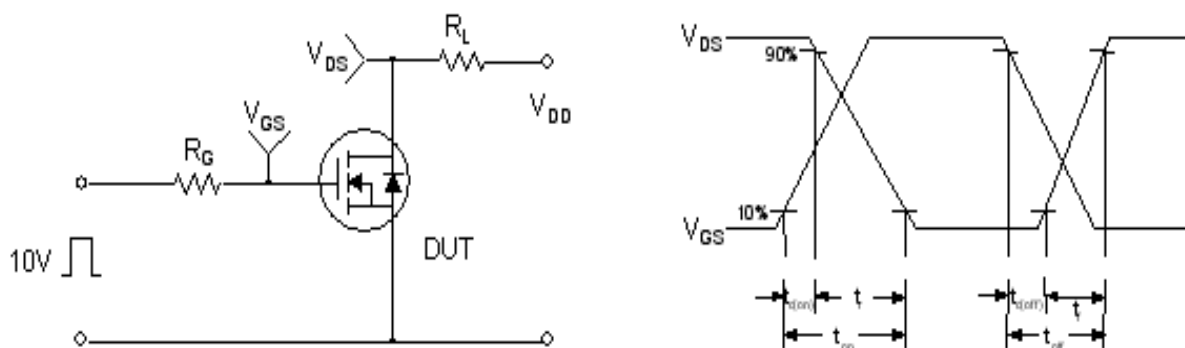
图 13. 瞬态热响应曲线



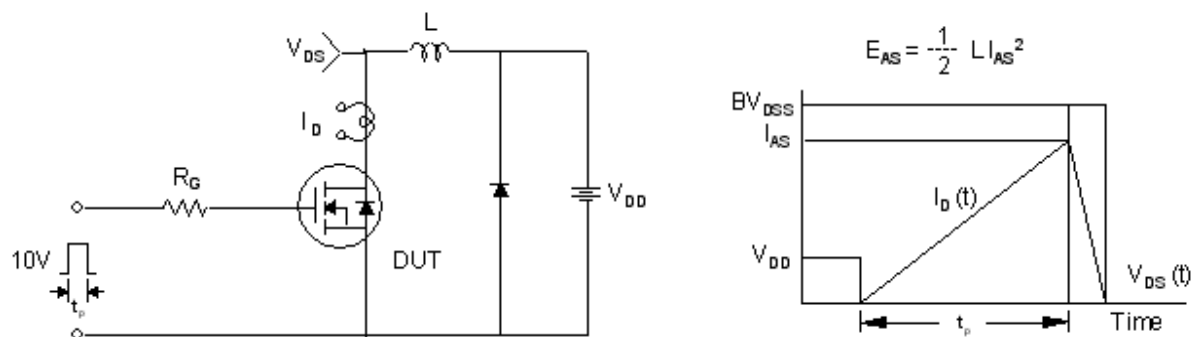
栅极电荷测试电路与波形



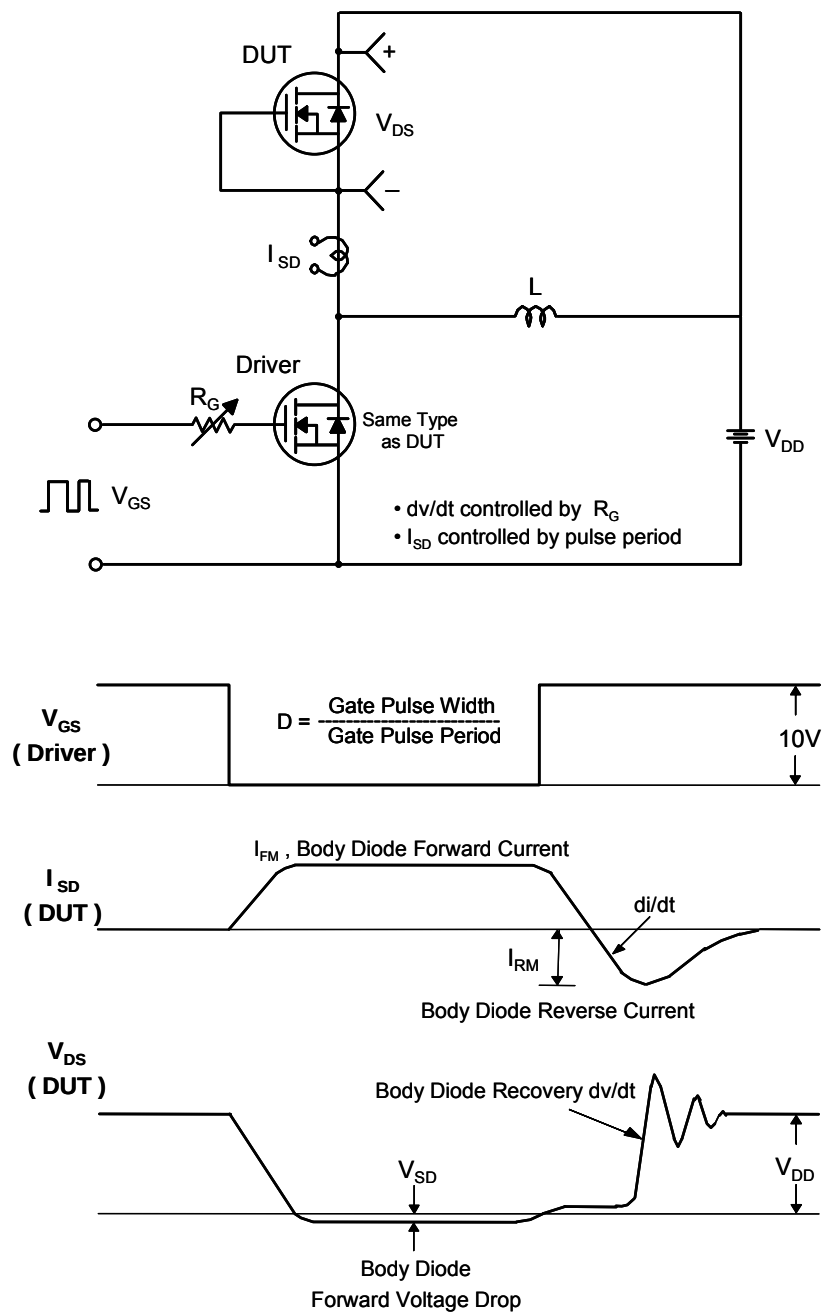
阻性开关测试电路与波形



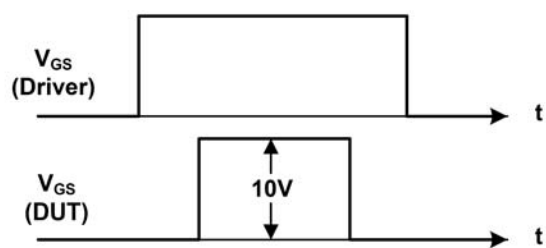
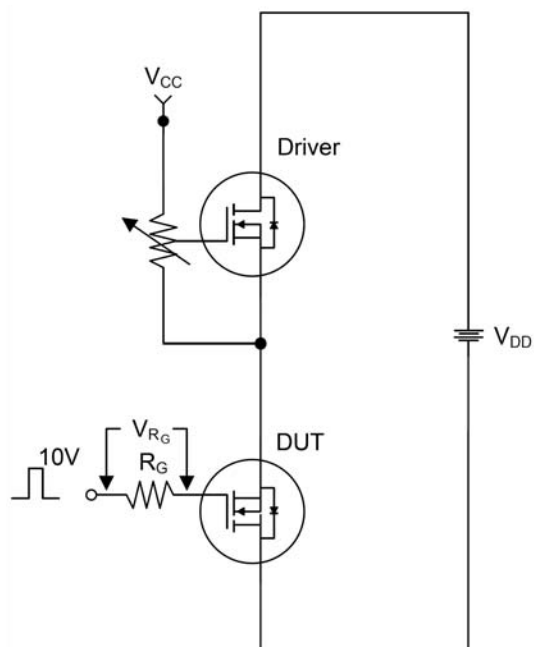
非箝位感性开关测试电路与波形



二极管恢复 dv/dt 峰值测试电路与波形



总栅极电荷同步测试电路与波形



$$Q_{sync} = \frac{1}{R_G} \cdot \int V_{R_G}(t) dt$$

## 机械尺寸

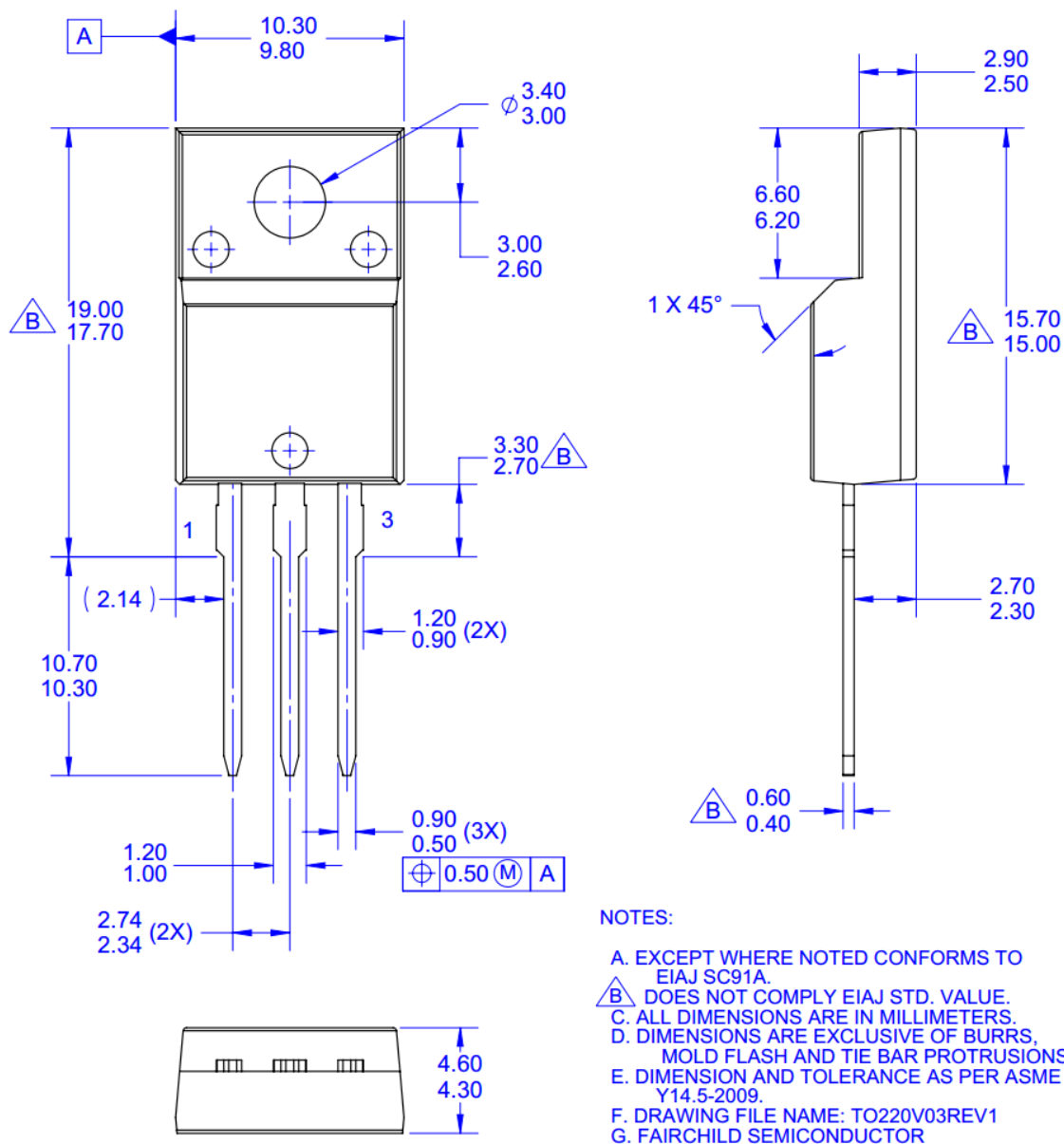


图 17. TO220 模塑 3 引脚 Full Pack, EIAJ SC91, Takcheong

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\* 前 / 后侧隔离电压: AC 2500V

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| Awinda®                                                                           | FRFET®                              | PowerTrench®                | TinyBoost®       |
| AX-CAP®*                                                                          | Global Power ResourceSM             | PowerXS™                    | TinyBuck®        |
| BitSiC™                                                                           | GreenBridge™                        | Programmable Active Droop™  | TinyCalc™        |
| Build it Now™                                                                     | Green FPS™                          | QFET®                       | TinyLogic®       |
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| CorePOWER™                                                                        | Gmax™                               | Quiet Series™               | TinyPower™       |
| CROSSVOLT™                                                                        | GTO™                                | RapidConfigure™             | TinyPWM™         |
| CTL™                                                                              | IntelliMAX™                         | SignalWise™                 | TinyWire™        |
| Current Transfer Logic™                                                           | ISOPLANAR™                          | SmartMax™                   | TranSiC™         |
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| Dual Cool™                                                                        | and Better™                         | Solutions for Your Success™ | TRUECURRENT®*    |
| EcoSPARK®                                                                         | MegaBuck™                           | SPM®                        | µSerDes™         |
| EfficientMax™                                                                     | MICROCOUPLER™                       | STEALTH™                    | UHC®             |
| ESBC™                                                                             | MicroFET™                           | SuperFET®                   | Ultra FRFET™     |
|  | MicroPak™                           | SuperSOT™-3                 | UnifET™          |
| Fairchild®                                                                        | MicroPak2™                          | SuperSOT™-6                 | VCX™             |
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| FACT®                                                                             | MotionGrid®                         | SyncFET™                    | XS™              |
| FAST®                                                                             | MTI®                                | Sync-Lock™                  | Xsens™           |
| FastvCore™                                                                        | MTx®                                |                             | 仙童™              |
| FETBench™                                                                         | MVN®                                |                             |                  |
| FPS™                                                                              | mWSaver®                            |                             |                  |
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- 关键器件是指生命支持设备或系统中，由于该器件的失效会导致整个生命支持设备或系统的失效，或是影响其安全性及使用效果。

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## 产品状态定义

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