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# FCP16N60N / FCPF16N60NT

## N 沟道 SupreMOS® MOSFET 600 V, 16 A, 199 mΩ

### 特性

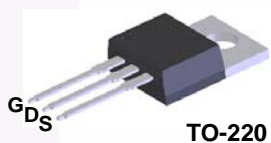
- $R_{DS(on)} = 170 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 8 \text{ A}$
- 超低栅极电荷 (典型值  $Q_g = 40.2 \text{ nC}$ )
- 低有效输出电容 (典型值  $C_{oss(eff.)} = 176 \text{ pF}$ )
- 100% 经过雪崩测试
- 符合 RoHS 标准

### 应用

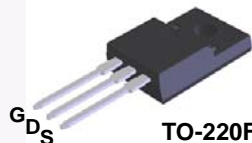
- LCD/LED/PDP 电视
- 照明
- 太阳能逆变器
- AC-DC 电源

### 说明

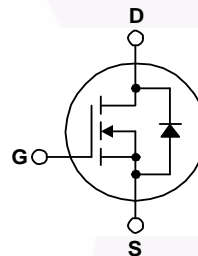
SupreMOS® MOSFET 是飞兆半导体的下一代高压超级结 (SJ) 技术, 该技术采用区别于传统 SJ MOSFET 产品的深沟槽填充工艺。这项先进技术和精密的工艺控制提供了最低的  $R_{sp}$  on-resistance (导通电阻规格), 卓越的开关性能和耐用性。SupreMOS MOSFET 产品非常适合高频开关电源转换器应用, 如功率因数校正 (PFC)、服务器 / 电信电源、平板电视电源、ATX 电源及工业电源应用。



TO-220



TO-220F



绝对最大额定值针对  $T_C = 25^\circ\text{C}$  除非另有说明。

符号	参数	FCP16N60N	FCPF16N60NT	单位
$V_{DSS}$	漏极-源极电压	600		V
$V_{GSS}$	栅极-源极电压	$\pm 30$		V
$I_D$	漏极电流	- 连续 ( $T_C = 25^\circ\text{C}$ )	16.0	16.0*
		- 连续 ( $T_C = 100^\circ\text{C}$ )	10.1	10.1*
$I_{DM}$	漏极电流 (注 1)	48.0	48.0*	A
$E_{AS}$	单脉冲雪崩能量 (注 2)	355		mJ
$I_{AR}$	雪崩电流 (注 1)	5.3		A
$E_{AR}$	重复雪崩能量 (注 1)	1.34		mJ
dv/dt	MOSFET dv/dt	100		V/ns
	二极管恢复 dv/dt 峰值 (注 3)	20		V/ns
$P_D$	功耗	( $T_C = 25^\circ\text{C}$ )	134.4	35.7
		- 超过 $25^\circ\text{C}$ 时降额	1.08	0.29
$T_J, T_{STG}$	工作和存储温度范围	-55 至 +150		$^\circ\text{C}$
$T_L$	用于焊接的最大引脚温度, 距离外壳 1/8", 持续 5 秒	300		$^\circ\text{C}$

\* 漏极电流受限于最大结温

### 热性能

符号	参数	FCP16N60N	FCPF16N60NT	单位
$R_{\theta JC}$	结至外壳热阻最大值	0.93	3.5	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	结至环境热阻最大值	62.5	62.5	

## 封装标识与订购信息

器件编号	顶标	封装	包装方法	卷尺寸	带宽	数量
FCP16N60N	FCP16N60N	TO-220	塑料管	不适用	不适用	50 单元
FCPF16N60NT	FCPF16N60NT	TO-220F	塑料管	不适用	不适用	50 单元

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
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## 关断特性

$BV_{DSS}$	漏极-源极击穿电压	$I_D = 1\text{ mA}, V_{GS} = 0\text{ V}, T_C = 25^\circ\text{C}$	600	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	击穿电压温度系数	$I_D = 1\text{ mA}$ , 参考 $25^\circ\text{C}$	-	0.73	-	V/ $^\circ\text{C}$
$I_{DSS}$	零栅极电压漏极电流	$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}$	-	-	10	$\mu\text{A}$
		$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_C = 125^\circ\text{C}$	-	-	100	
$I_{GSS}$	栅极-体漏电流	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$	-	-	$\pm 100$	nA

## 导通特性

$V_{GS(th)}$	栅极阈值电压	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	2.0	-	4.0	V
$R_{DS(on)}$	漏极至源极静态导通电阻	$V_{GS} = 10\text{ V}, I_D = 8\text{ A}$	-	0.170	0.199	$\Omega$
$g_{FS}$	正向跨导	$V_{DS} = 40\text{ V}, I_D = 8\text{ A}$	-	13	-	S

## 动态特性

$C_{iss}$	输入电容	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	1630	2170	pF
$C_{oss}$	输出电容		-	70	95	pF
$C_{rss}$	反向传输电容		-	5	10	pF
$C_{oss}$	输出电容	$V_{DS} = 380\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	40	60	pF
$C_{oss(eff.)}$	有效输出电容	$V_{DS} = 0\text{ V}$ 至 $480\text{ V}, V_{GS} = 0\text{ V}$	-	176	-	pF
$Q_g(\text{tot})$	10 V 的栅极电荷总量	$V_{DS} = 380\text{ V}, I_D = 8\text{ A}, V_{GS} = 10\text{ V}$ (说明 4)	-	40.2	52.3	nC
$Q_{gs}$	栅极-源极栅极电荷		-	6.7	-	nC
$Q_{gd}$	栅极-漏极“密勒”电荷		-	12.9	-	nC
ESR	等效串联电阻 (G-S)	$f = 1\text{ MHz}$	-	2.9	-	$\Omega$

## 开关特性

$t_{d(on)}$	导通延迟时间	$V_{DD} = 380\text{ V}, I_D = 8\text{ A}, V_{GS} = 10\text{ V}, R_G = 4.7\ \Omega$ (说明 4)	-	15.8	41.6	ns
$t_r$	开通上升时间		-	15.5	41.0	ns
$t_{d(off)}$	关断延迟时间		-	60.3	130.6	ns
$t_f$	关断下降时间		-	20.2	50.4	ns

## 漏极-源极二极管特性

$I_S$	漏极-源极二极管最大正向连续电流	-	-	16	A	
$I_{SM}$	漏极-源极二极管最大正向脉冲电流	-	-	48	A	
$V_{SD}$	漏极-源极二极管正向电压	$V_{GS} = 0\text{ V}, I_{SD} = 8\text{ A}$	-	-	1.2	V
$t_{rr}$	反向恢复时间	$V_{GS} = 0\text{ V}, I_{SD} = 8\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}$	-	319	-	ns
$Q_{rr}$	反向恢复电荷		-	4.4	-	$\mu\text{C}$

注意：

1. 重复额定值：脉冲宽度受限于最大结温。
2.  $I_{AS} = 5.3\text{ A}, R_G = 25\ \Omega$ , 启动  $T_J = 25^\circ\text{C}$ 。
3.  $I_{SD} \leq 16\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} = 380\text{ V}$ , 启动  $T_J = 25^\circ\text{C}$ 。
4. 本质上独立于工作温度的典型特性。

典型性能特征

图 1. 导通区域特性

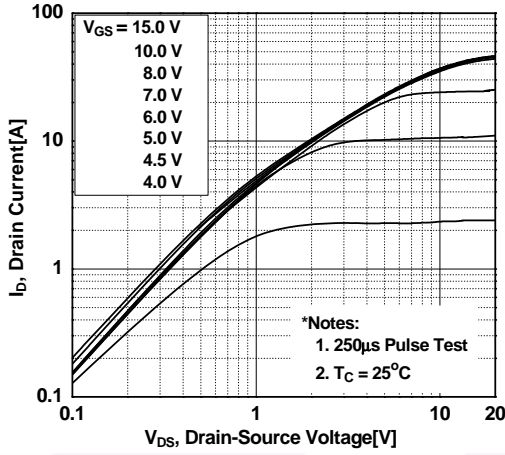


图 2. 传输特性

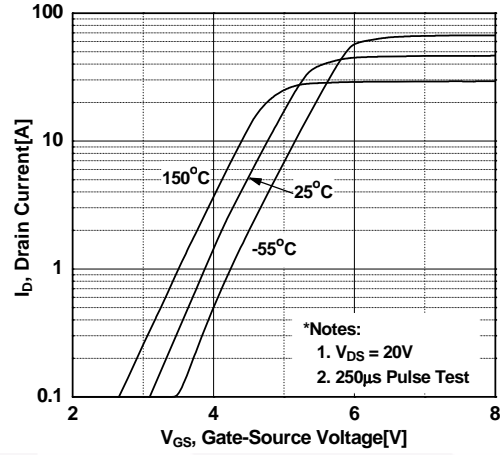


图 3. 导通电阻变化与漏极电流和栅极电压

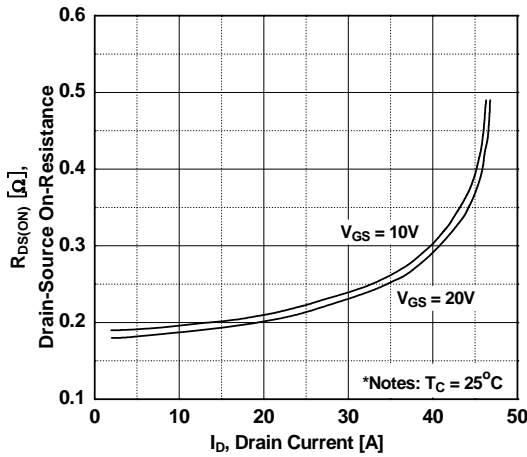


图 4. 体二极管正向电压变化与源极电流和温度

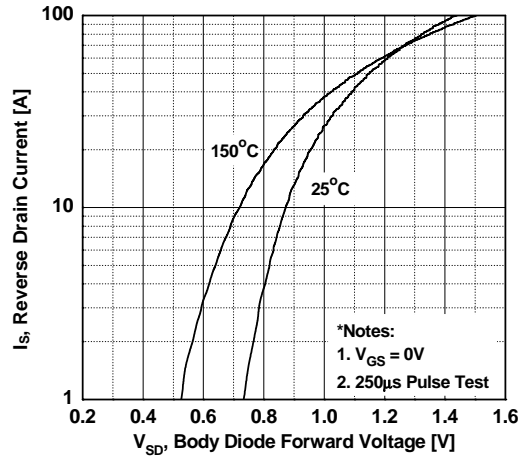


图 5. 电容特性

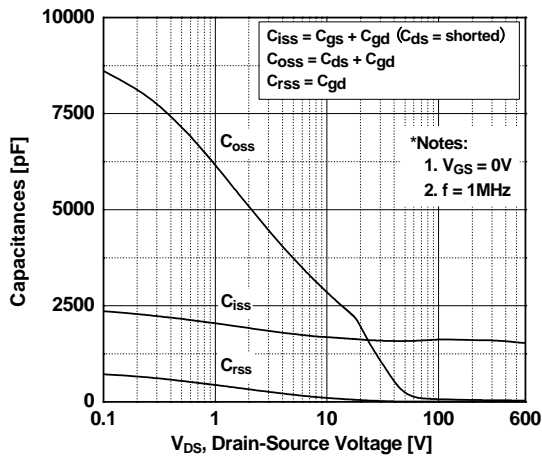
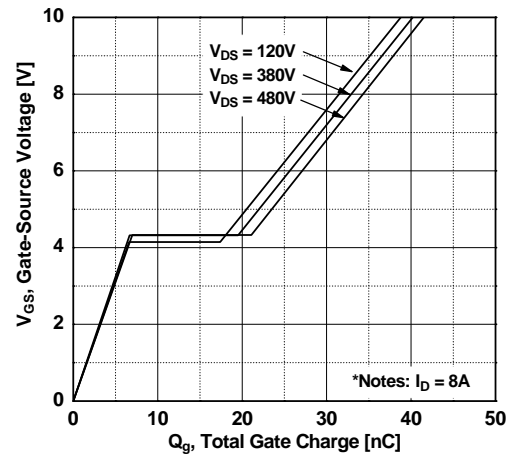


图 6. 栅极电荷



典型性能特征 (接上页)

图 7. 击穿电压变化与温度

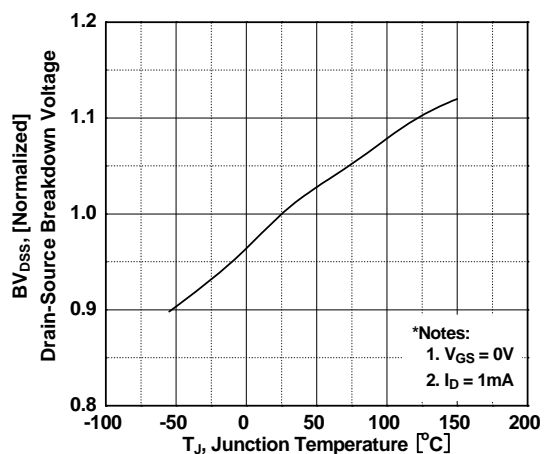


图 8. 导通电阻变化与温度

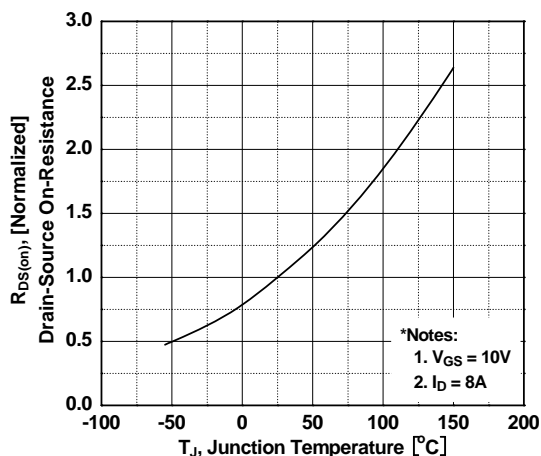


图 9. 最大安全工作区用于 FCP16N60N

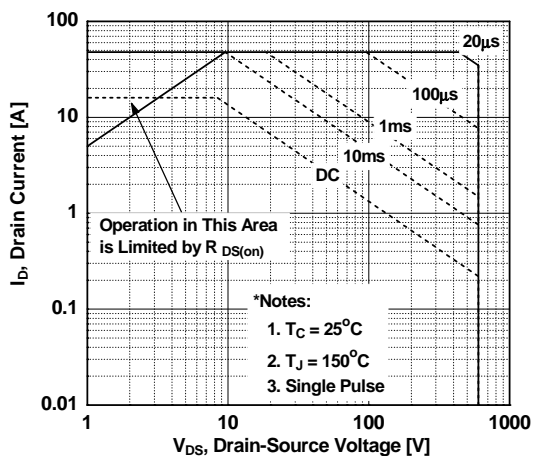


图 10. 最大安全操作区用于 FCPF16N60NT

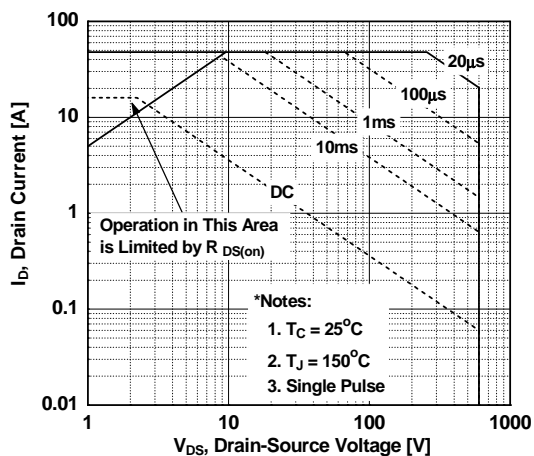
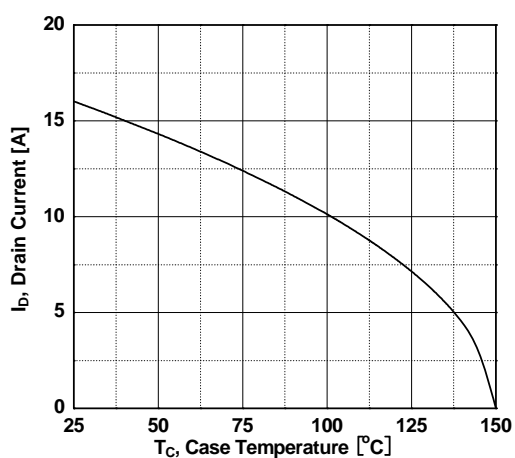


图 11. 最大漏极电流与壳体温度



典型性能特征 (接上页)

图 12. 用于 FCP16N60N 的瞬态热响应曲线

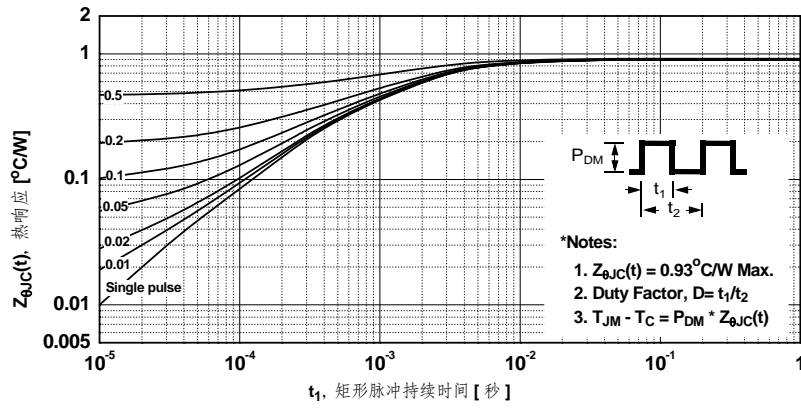
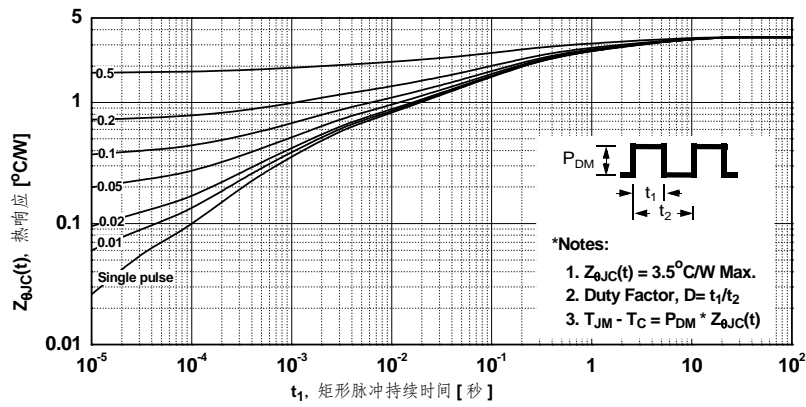


图 13. 用于 FCPF16N60NT 的瞬态热响应曲线



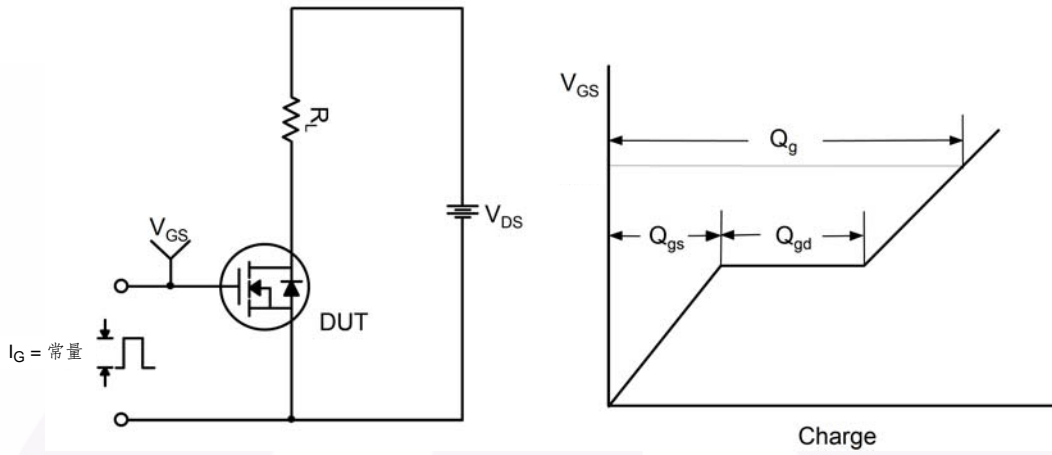


图 14. 栅极电荷测试电路与波形

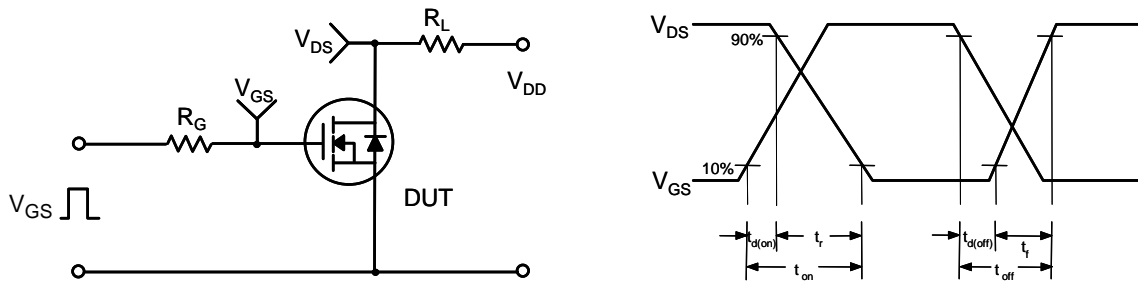


图 15. 阻性开关测试电路与波形

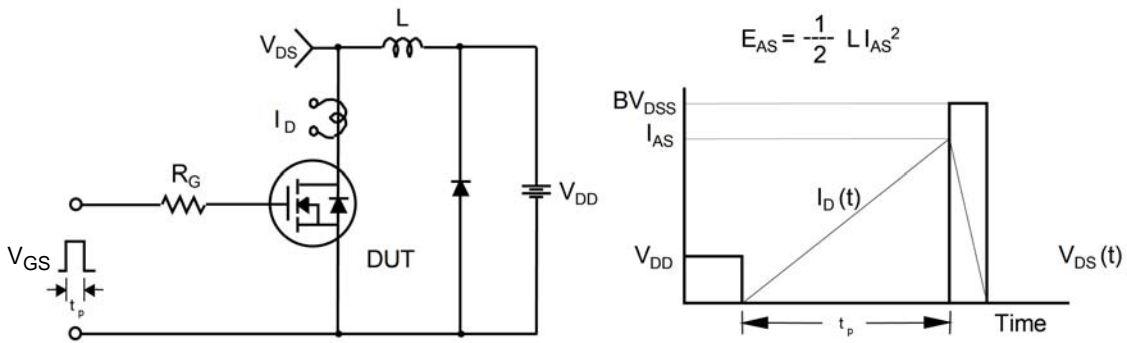


图 16. 非箝位感性开关测试电路与波形

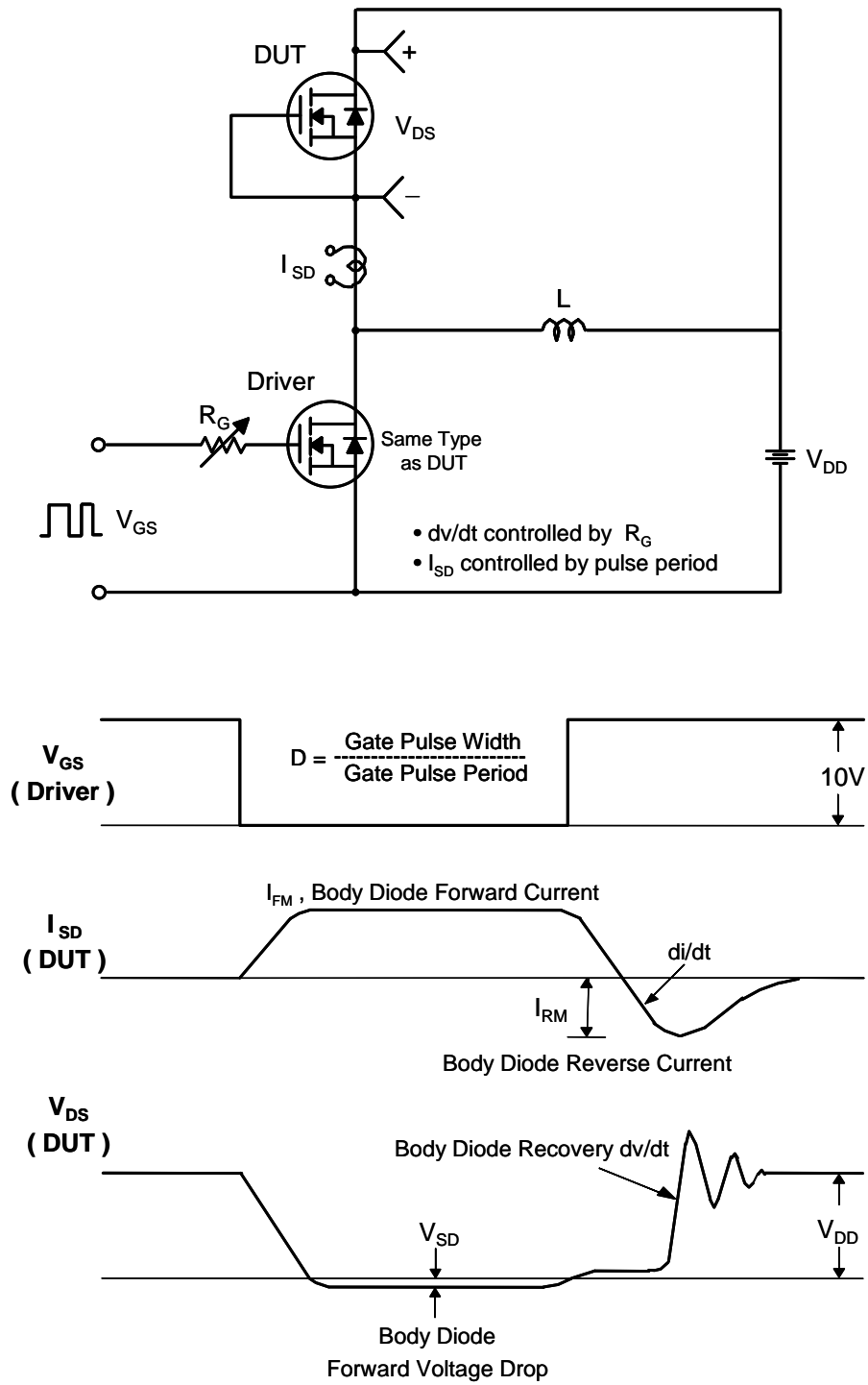
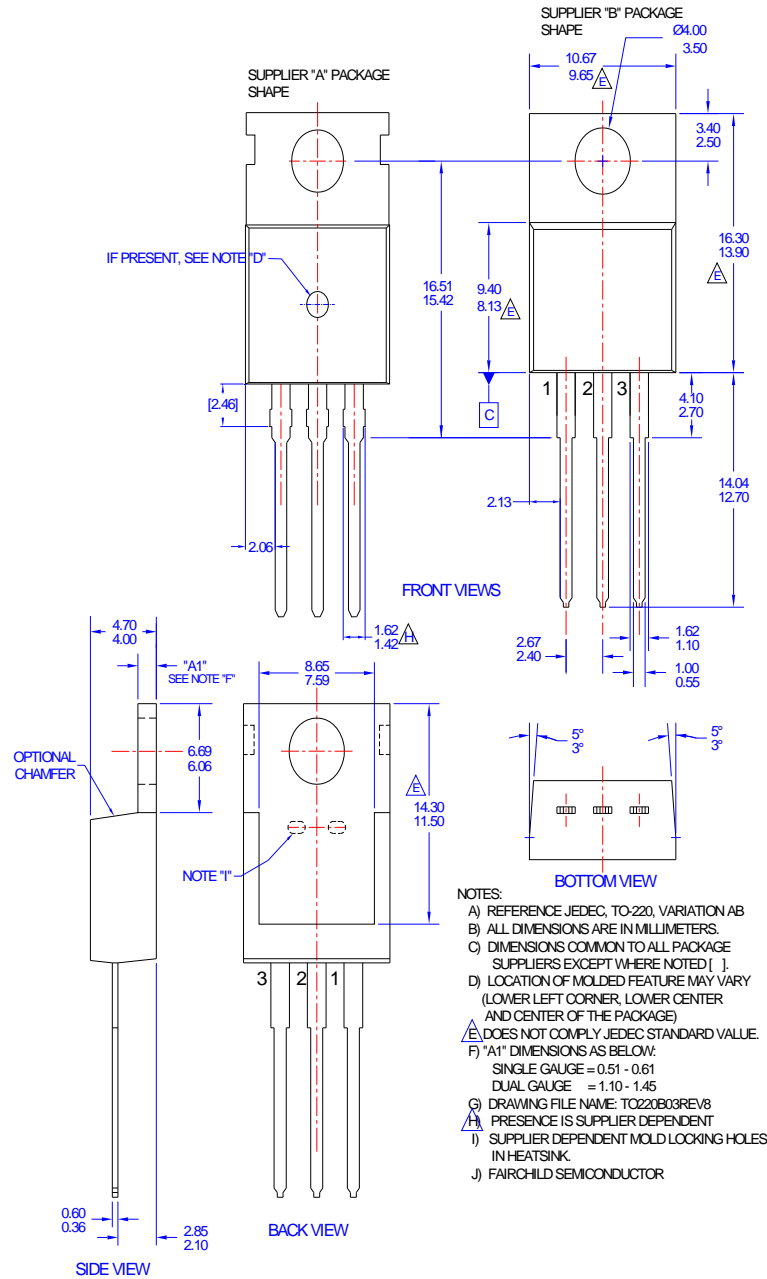


图 17. 二极管恢复  $dv/dt$  峰值测试电路与波形



机械尺寸



- NOTES:
- A) REFERENCE JEDEC, TO-220, VARIATION AB
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
  - D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
  - E) DOES NOT COMPLY JEDEC STANDARD VALUE.
  - F) \*A1\* DIMENSIONS AS BELOW:  
 SINGLE GAUGE = 0.51 - 0.61  
 DUAL GAUGE = 1.10 - 1.45
  - G) DRAWING FILE NAME: TO220B03REV8
  - H) PRESENCE IS SUPPLIER DEPENDENT
  - I) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.
  - J) FAIRCHILD SEMICONDUCTOR

图 18. TO-220, 模塑, 3 引脚, Jedec 变体 AB

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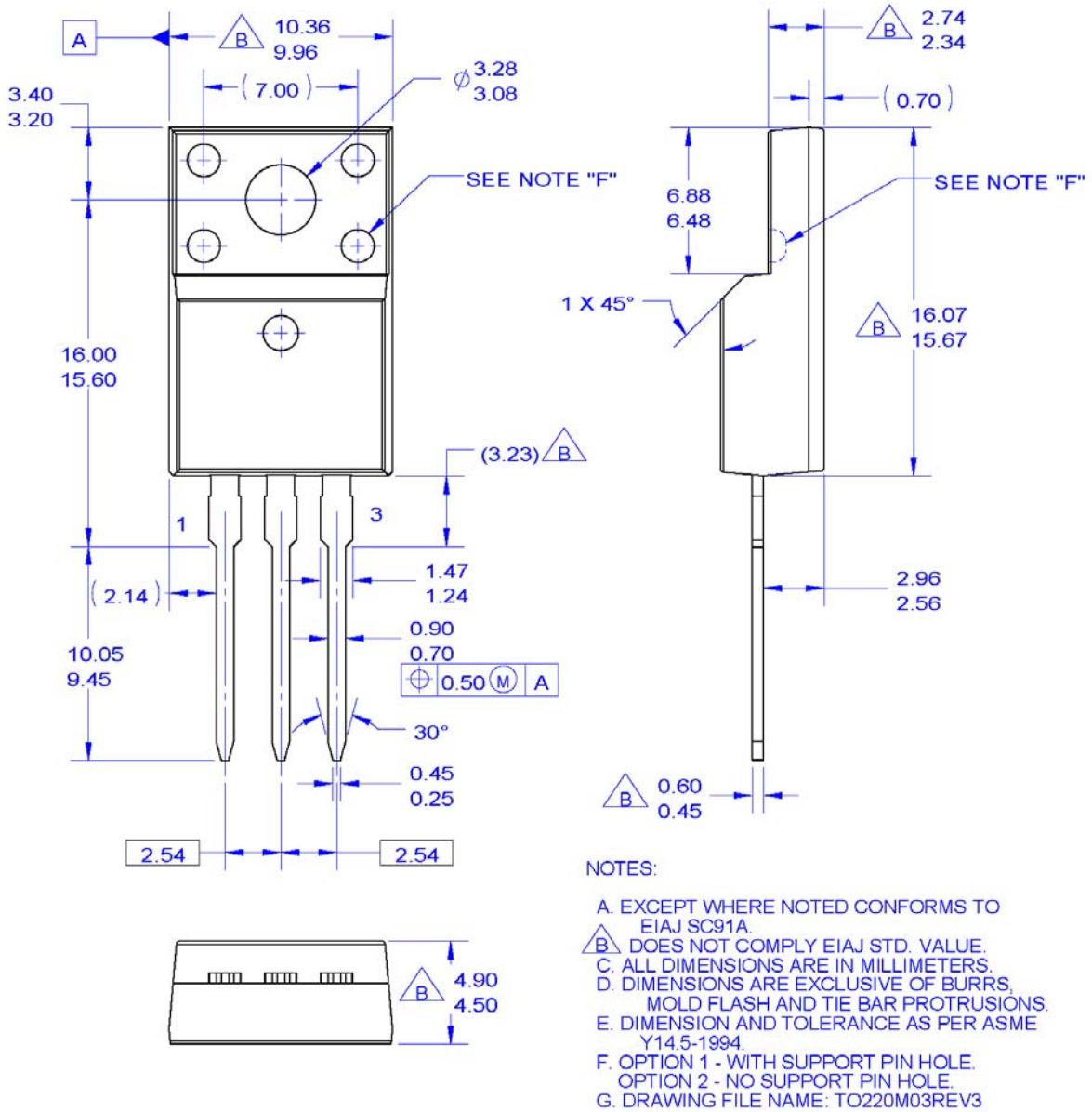


图 19. TO220, 模塑, 3 引脚, 全封装, EIAJ SC91, 直引脚

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|                          | QFET®   |                  |
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|                          | SignalWise™                                     |                  |
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|                          | SmartMax™                                       |                  |
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|                          | SPM®  |                  |
|                          | STEALTH™  |                  |
|                          | SuperFET®                                       |                  |
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