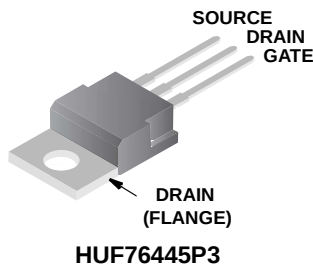


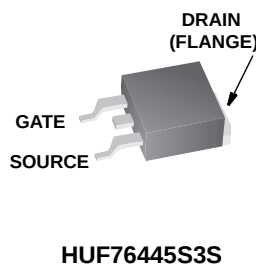
## 75A, 60V, 0.0075 Ohm, N-Channel, Logic Level UltraFET® Power MOSFET

### Packaging

JEDEC TO-220AB



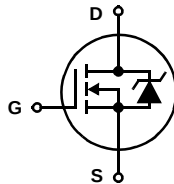
JEDEC TO-263AB



### Features

- Ultra Low On-Resistance
  - $r_{DS(ON)} = 0.0065\Omega$ ,  $V_{GS} = 10V$
  - $r_{DS(ON)} = 0.0075\Omega$ ,  $V_{GS} = 5V$
- Simulation Models
  - Temperature Compensated PSPICE® and SABER™ Electrical Models
  - Spice and SABER Thermal Impedance Models
  - [www.fairchildsemi.com](http://www.fairchildsemi.com)
- Peak Current vs Pulse Width Curve
- UIS Rating Curve
- Switching Time vs  $R_{GS}$  Curves

### Symbol



### Ordering Information

| PART NUMBER | PACKAGE  | BRAND  |
|-------------|----------|--------|
| HUF76445P3  | TO-220AB | 76445P |
| HUF76445S3S | TO-263AB | 76445S |

NOTE: When ordering, use the entire part number. Add the suffix T to obtain the variant in tape and reel, e.g., HUF76445S3ST.

### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ , Unless Otherwise Specified

|                                                                                 | HUF76445P3, HUF76445S3S | UNITS               |
|---------------------------------------------------------------------------------|-------------------------|---------------------|
| Drain to Source Voltage (Note 1) . . . . .                                      | 60                      | V                   |
| Drain to Gate Voltage ( $R_{GS} = 20k\Omega$ ) (Note 1) . . . . .               | 60                      | V                   |
| Gate to Source Voltage . . . . .                                                | $\pm 16$                | V                   |
| Drain Current                                                                   |                         |                     |
| Continuous ( $T_C = 25^\circ\text{C}$ , $V_{GS} = 5V$ ) . . . . .               | 75                      | A                   |
| Continuous ( $T_C = 25^\circ\text{C}$ , $V_{GS} = 10V$ ) (Figure 2) . . . . .   | 75                      | A                   |
| Continuous ( $T_C = 100^\circ\text{C}$ , $V_{GS} = 5V$ ) . . . . .              | 75                      | A                   |
| Continuous ( $T_C = 100^\circ\text{C}$ , $V_{GS} = 4.5V$ ) (Figure 2) . . . . . | 75                      | A                   |
| Pulsed Drain Current . . . . .                                                  | Figure 4                |                     |
| Pulsed Avalanche Rating . . . . .                                               | Figures 6, 17, 18       |                     |
| Power Dissipation . . . . .                                                     | 310                     | W                   |
| Derate Above $25^\circ\text{C}$ . . . . .                                       | 2.08                    | W/ $^\circ\text{C}$ |
| Operating and Storage Temperature. . . . .                                      | -55 to 175              | $^\circ\text{C}$    |
| Maximum Temperature for Soldering                                               |                         |                     |
| Leads at 0.063in (1.6mm) from Case for 10s. . . . .                             | 300                     | $^\circ\text{C}$    |
| Package Body for 10s, See Techbrief TB334. . . . .                              | 260                     | $^\circ\text{C}$    |

#### NOTES:

1.  $T_J = 25^\circ\text{C}$  to  $150^\circ\text{C}$ .

**CAUTION:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

Product reliability information can be found at <http://www.fairchildsemi.com/products/discrete/reliability/index.html>

For severe environments, see our Automotive HUFA series.

All Fairchild semiconductor products are manufactured, assembled and tested under ISO9000 and QS9000 quality systems certification.

# HUF76445P3, HUF76445S3S

## Electrical Specifications $T_C = 25^{\circ}\text{C}$ , Unless Otherwise Specified

| PARAMETER                                         | SYMBOL              | TEST CONDITIONS                                                                                                         | MIN                                                                                                    | TYP    | MAX    | UNITS            |    |
|---------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|--------|--------|------------------|----|
| OFF STATE SPECIFICATIONS                          |                     |                                                                                                                         |                                                                                                        |        |        |                  |    |
| Drain to Source Breakdown Voltage                 | BV <sub>DSS</sub>   | I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V (Figure 12)                                                                | 60                                                                                                     | -      | -      | V                |    |
|                                                   |                     | I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V , T <sub>C</sub> = -40 <sup>0</sup> C (Figure 12)                          | 55                                                                                                     | -      | -      | V                |    |
| Zero Gate Voltage Drain Current                   | I <sub>DSS</sub>    | V <sub>DS</sub> = 55V, V <sub>GS</sub> = 0V                                                                             | -                                                                                                      | -      | 1      | μA               |    |
|                                                   |                     | V <sub>DS</sub> = 50V, V <sub>GS</sub> = 0V, T <sub>C</sub> = 150 <sup>0</sup> C                                        | -                                                                                                      | -      | 250    | μA               |    |
| Gate to Source Leakage Current                    | I <sub>GSS</sub>    | V <sub>GS</sub> = ±16V                                                                                                  | -                                                                                                      | -      | ±100   | nA               |    |
| ON STATE SPECIFICATIONS                           |                     |                                                                                                                         |                                                                                                        |        |        |                  |    |
| Gate to Source Threshold Voltage                  | V <sub>GS(TH)</sub> | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250μA (Figure 11)                                                  | 1                                                                                                      | -      | 3      | V                |    |
| Drain to Source On Resistance                     | r <sub>DS(ON)</sub> | I <sub>D</sub> = 75A, V <sub>GS</sub> = 10V (Figures 9, 10)                                                             | -                                                                                                      | 0.0054 | 0.0065 | Ω                |    |
|                                                   |                     | I <sub>D</sub> = 75A, V <sub>GS</sub> = 5V (Figure 9)                                                                   | -                                                                                                      | 0.0063 | 0.0075 | Ω                |    |
|                                                   |                     | I <sub>D</sub> = 75A, V <sub>GS</sub> = 4.5V (Figure 9)                                                                 | -                                                                                                      | 0.0066 | 0.008  | Ω                |    |
| THERMAL SPECIFICATIONS                            |                     |                                                                                                                         |                                                                                                        |        |        |                  |    |
| Thermal Resistance Junction to Case               | R <sub>θJC</sub>    | TO-220 and TO-263                                                                                                       | -                                                                                                      | -      | 0.48   | <sup>0</sup> C/W |    |
| Thermal Resistance Junction to Ambient            | R <sub>θJA</sub>    |                                                                                                                         | -                                                                                                      | -      | 62     | <sup>0</sup> C/W |    |
| SWITCHING SPECIFICATIONS (V <sub>GS</sub> = 4.5V) |                     |                                                                                                                         |                                                                                                        |        |        |                  |    |
| Turn-On Time                                      | t <sub>ON</sub>     | V <sub>DD</sub> = 30V, I <sub>D</sub> = 75A<br>V <sub>GS</sub> = 4.5V, R <sub>GS</sub> = 2.2Ω<br>(Figures 15, 21, 22)   | -                                                                                                      | -      | 515    | ns               |    |
| Turn-On Delay Time                                | t <sub>d(ON)</sub>  |                                                                                                                         | -                                                                                                      | 18     | -      | ns               |    |
| Rise Time                                         | t <sub>r</sub>      |                                                                                                                         | -                                                                                                      | 325    | -      | ns               |    |
| Turn-Off Delay Time                               | t <sub>d(OFF)</sub> |                                                                                                                         | -                                                                                                      | 39     | -      | ns               |    |
| Fall Time                                         | t <sub>f</sub>      |                                                                                                                         | -                                                                                                      | 135    | -      | ns               |    |
| Turn-Off Time                                     | t <sub>OFF</sub>    |                                                                                                                         | -                                                                                                      | -      | 260    | ns               |    |
| SWITCHING SPECIFICATIONS (V <sub>GS</sub> = 10V)  |                     |                                                                                                                         |                                                                                                        |        |        |                  |    |
| Turn-On Time                                      | t <sub>ON</sub>     | V <sub>DD</sub> = 30V, I <sub>D</sub> = 75A<br>V <sub>GS</sub> = 10V,<br>R <sub>GS</sub> = 2.4Ω<br>(Figures 16, 21, 22) | -                                                                                                      | -      | 205    | ns               |    |
| Turn-On Delay Time                                | t <sub>d(ON)</sub>  |                                                                                                                         | -                                                                                                      | 12     | -      | ns               |    |
| Rise Time                                         | t <sub>r</sub>      |                                                                                                                         | -                                                                                                      | 126    | -      | ns               |    |
| Turn-Off Delay Time                               | t <sub>d(OFF)</sub> |                                                                                                                         | -                                                                                                      | 62     | -      | ns               |    |
| Fall Time                                         | t <sub>f</sub>      |                                                                                                                         | -                                                                                                      | 135    | -      | ns               |    |
| Turn-Off Time                                     | t <sub>OFF</sub>    |                                                                                                                         | -                                                                                                      | -      | 295    | ns               |    |
| GATE CHARGE SPECIFICATIONS                        |                     |                                                                                                                         |                                                                                                        |        |        |                  |    |
| Total Gate Charge                                 | Q <sub>g(TOT)</sub> | V <sub>GS</sub> = 0V to 10V                                                                                             | V <sub>DD</sub> = 30V,<br>I <sub>D</sub> = 75A,<br>I <sub>g(REF)</sub> = 1.0mA<br>(Figures 14, 19, 20) | -      | 124    | 150              | nC |
| Gate Charge at 5V                                 | Q <sub>g(5)</sub>   | V <sub>GS</sub> = 0V to 5V                                                                                              |                                                                                                        | -      | 68     | 81               | nC |
| Threshold Gate Charge                             | Q <sub>g(TH)</sub>  | V <sub>GS</sub> = 0V to 1V                                                                                              |                                                                                                        | -      | 5      | 6                | nC |
| Gate to Source Gate Charge                        | Q <sub>gs</sub>     |                                                                                                                         |                                                                                                        | -      | 14     | -                | nC |
| Gate to Drain “Miller” Charge                     | Q <sub>gd</sub>     |                                                                                                                         |                                                                                                        | -      | 30     | -                | nC |
| CAPACITANCE SPECIFICATIONS                        |                     |                                                                                                                         |                                                                                                        |        |        |                  |    |
| Input Capacitance                                 | C <sub>ISS</sub>    | V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V,<br>f = 1MHz<br>(Figure 13)                                                 | -                                                                                                      | 4965   | -      | pF               |    |
| Output Capacitance                                | C <sub>OSS</sub>    |                                                                                                                         | -                                                                                                      | 1250   | -      | pF               |    |
| Reverse Transfer Capacitance                      | C <sub>RSS</sub>    |                                                                                                                         | -                                                                                                      | 150    | -      | pF               |    |

## Source to Drain Diode Specifications

| PARAMETER                     | SYMBOL   | TEST CONDITIONS                                                | MIN | TYP | MAX  | UNITS |
|-------------------------------|----------|----------------------------------------------------------------|-----|-----|------|-------|
| Source to Drain Diode Voltage | $V_{SD}$ | $I_{SD} = 75\text{A}$                                          | -   | -   | 1.25 | V     |
|                               |          | $I_{SD} = 35\text{A}$                                          | -   | -   | 1.00 | V     |
| Reverse Recovery Time         | $t_{rr}$ | $I_{SD} = 75\text{A}$ , $dI_{SD}/dt = 100\text{A}/\mu\text{s}$ | -   | -   | 100  | ns    |
| Reverse Recovered Charge      | $Q_{RR}$ | $I_{SD} = 75\text{A}$ , $dI_{SD}/dt = 100\text{A}/\mu\text{s}$ | -   | -   | 260  | nC    |

## Typical Performance Curves

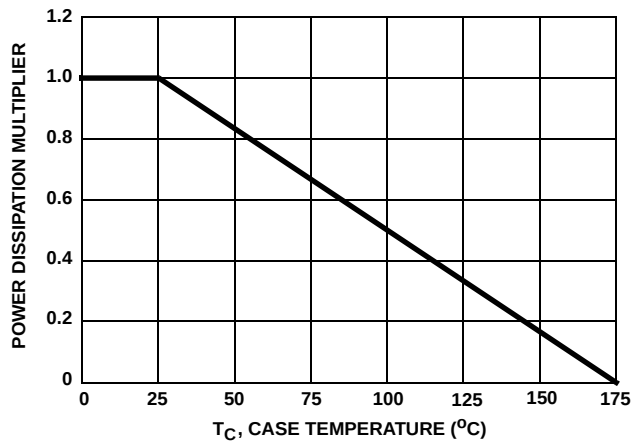


FIGURE 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

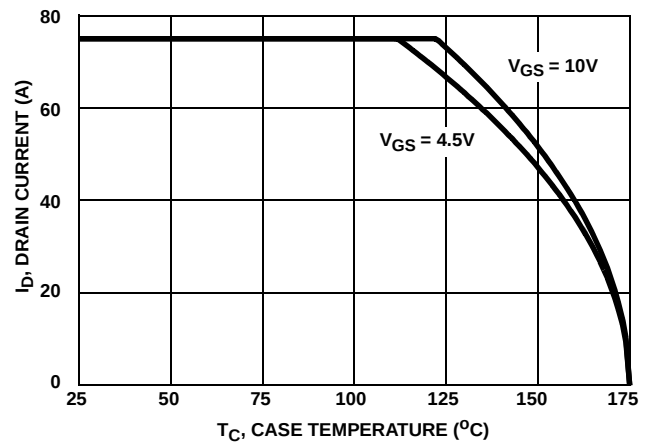


FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE

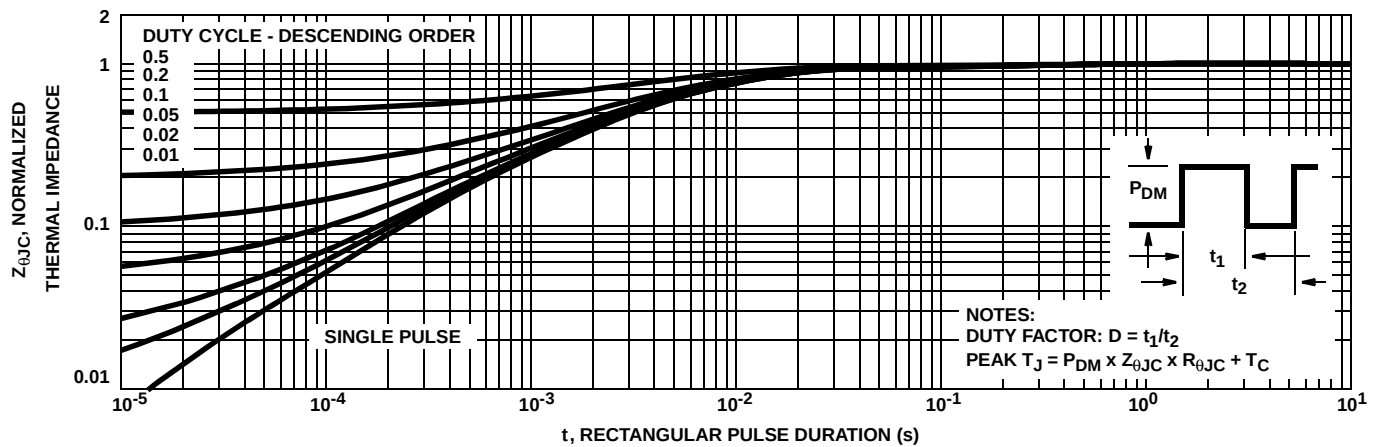


FIGURE 3. NORMALIZED MAXIMUM TRANSIENT THERMAL IMPEDANCE

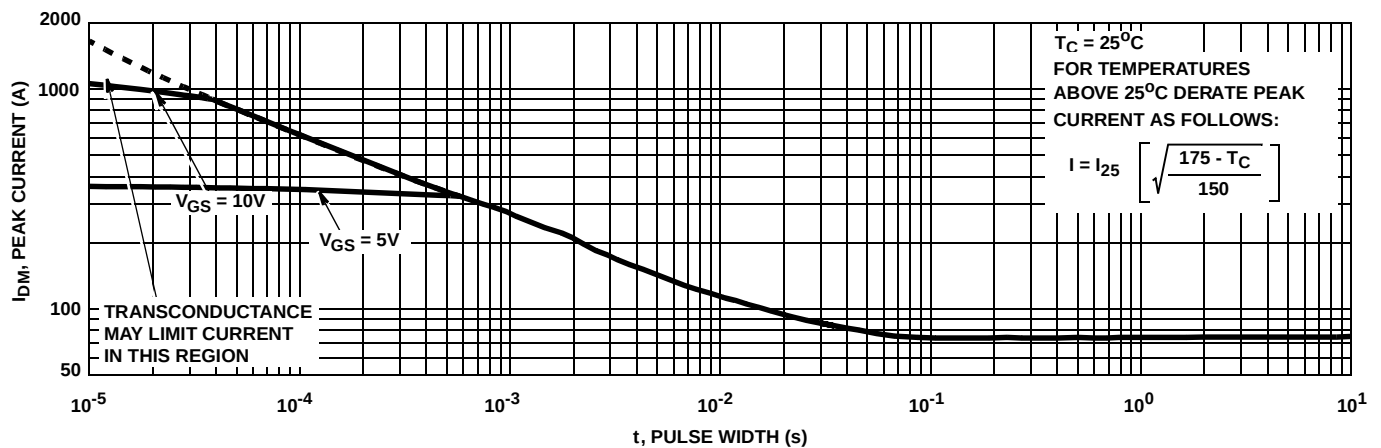


FIGURE 4. PEAK CURRENT CAPABILITY

Typical Performance Curves (Continued)

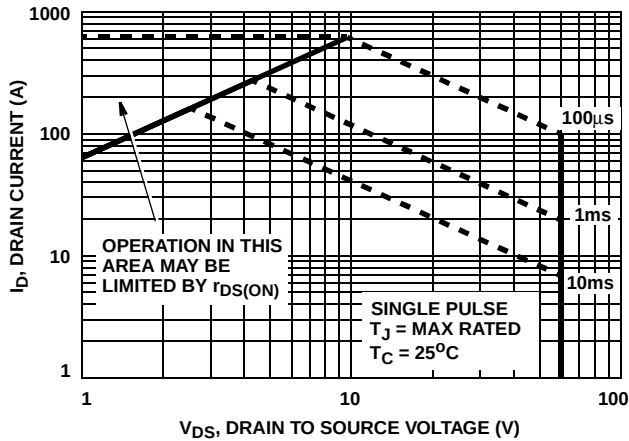
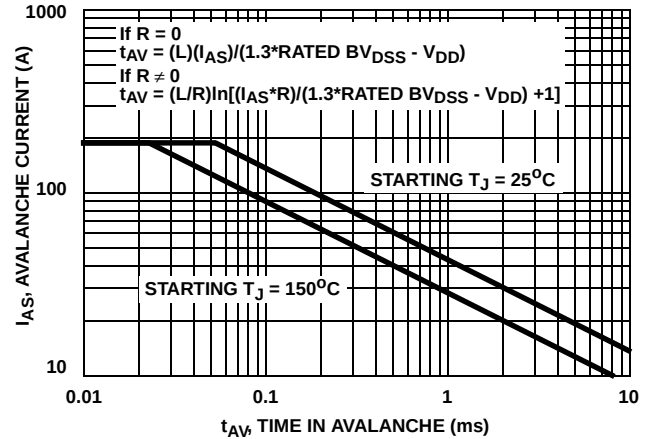


FIGURE 5. FORWARD BIAS SAFE OPERATING AREA



NOTE: Refer to Fairchild Application Notes AN9321 and AN9322.

FIGURE 6. UNCLAMPED INDUCTIVE SWITCHING CAPABILITY

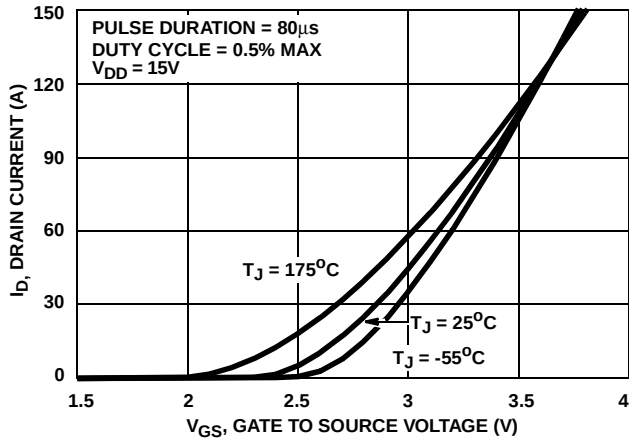


FIGURE 7. TRANSFER CHARACTERISTICS

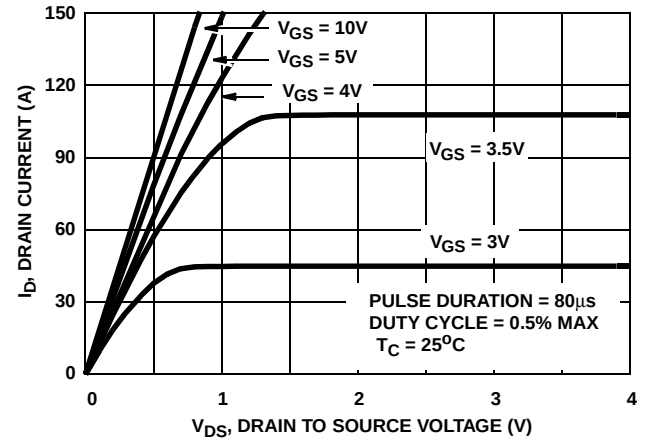


FIGURE 8. SATURATION CHARACTERISTICS

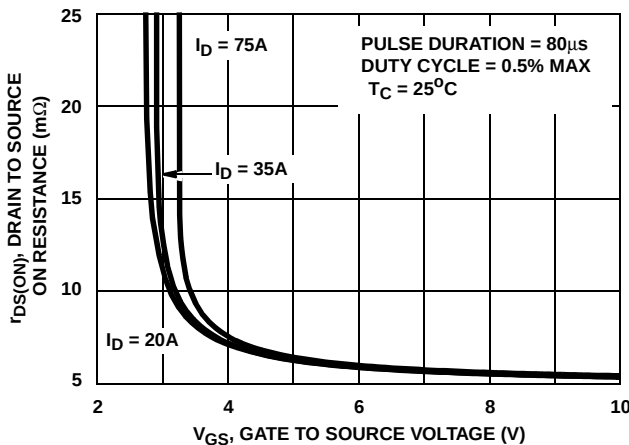


FIGURE 9. DRAIN TO SOURCE ON RESISTANCE vs. GATE VOLTAGE AND DRAIN CURRENT

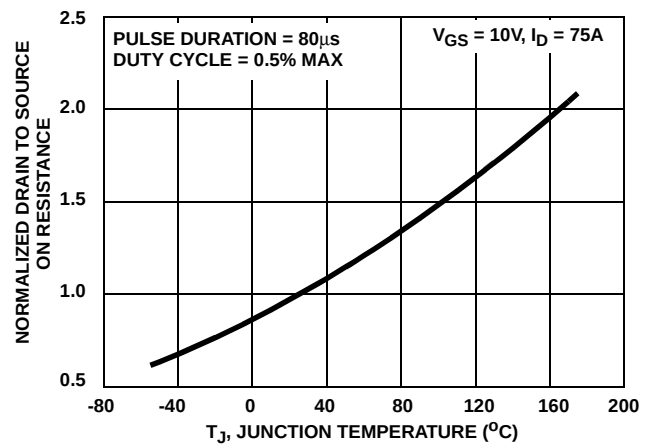


FIGURE 10. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs. JUNCTION TEMPERATURE

Typical Performance Curves (Continued)

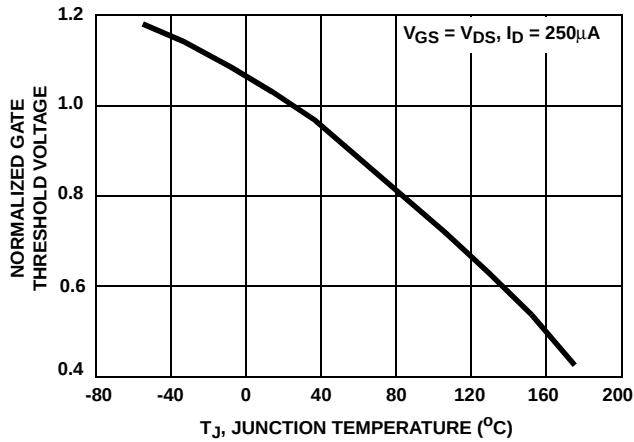


FIGURE 11. NORMALIZED GATE THRESHOLD VOLTAGE vs JUNCTION TEMPERATURE

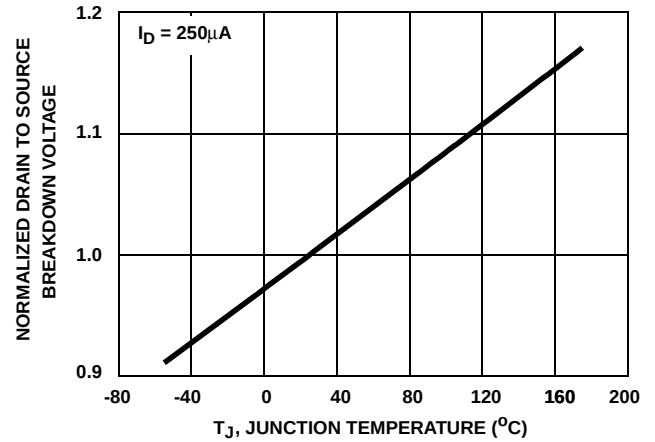


FIGURE 12. NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE

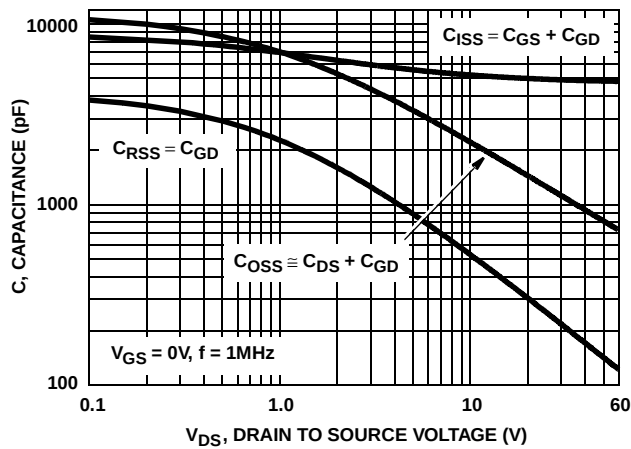
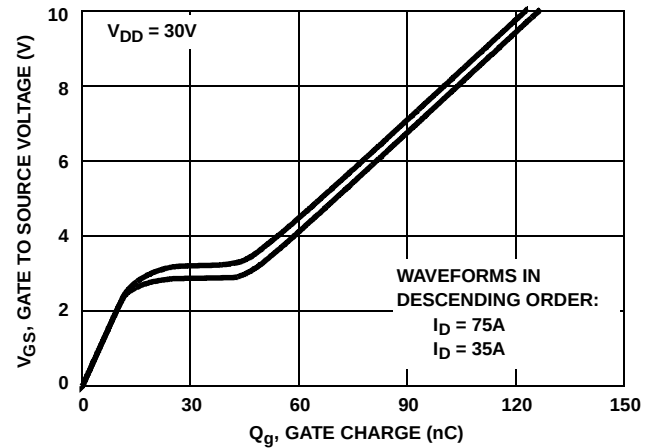


FIGURE 13. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE



NOTE: Refer to Fairchild Application Notes AN7254 and AN7260.

FIGURE 14. GATE CHARGE WAVEFORMS FOR CONSTANT GATE CURRENT

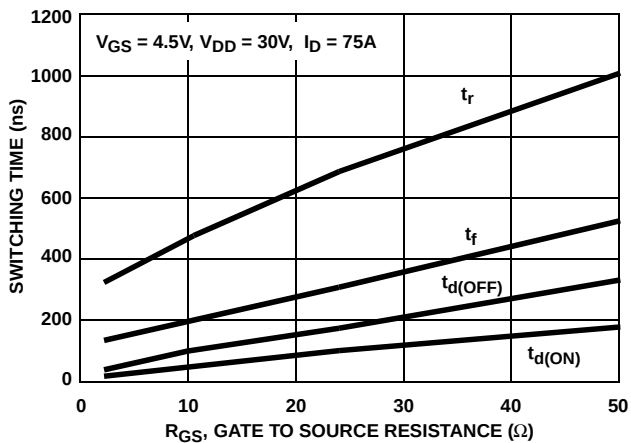


FIGURE 15. SWITCHING TIME vs GATE RESISTANCE

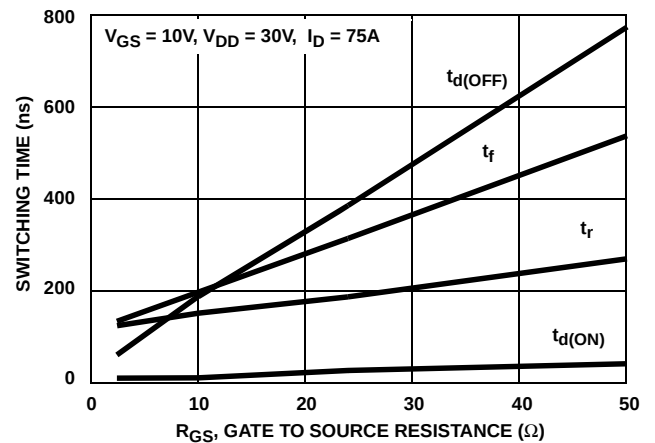


FIGURE 16. SWITCHING TIME vs GATE RESISTANCE

# Test Circuits and Waveforms

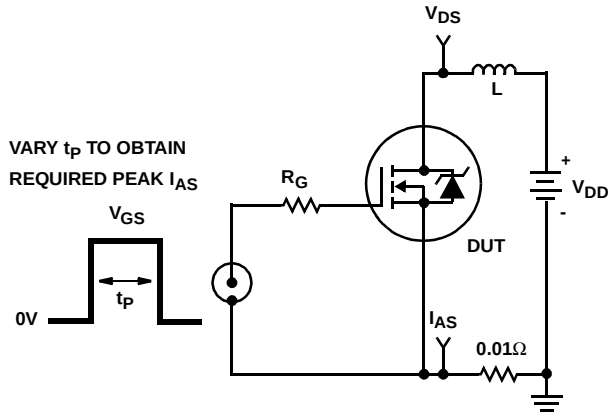


FIGURE 17. UNCLAMPED ENERGY TEST CIRCUIT

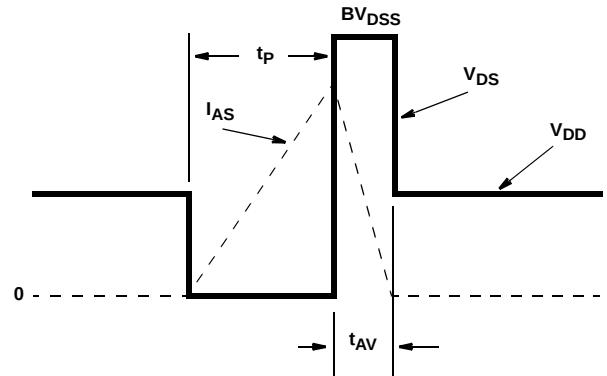


FIGURE 18. UNCLAMPED ENERGY WAVEFORMS

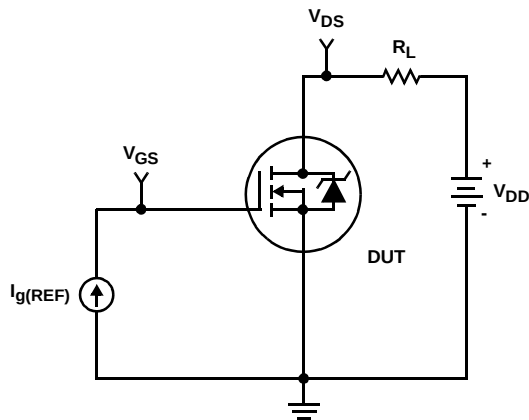


FIGURE 19. GATE CHARGE TEST CIRCUIT



FIGURE 20. GATE CHARGE WAVEFORMS



FIGURE 21. SWITCHING TIME TEST CIRCUIT

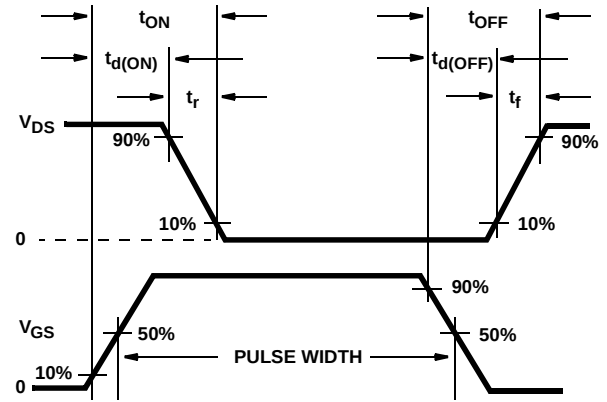


FIGURE 22. SWITCHING TIME WAVEFORM





## SPICE Thermal Model

REV 8 April 1999

HUF76445T

CTHERM1 th 6 6.45e-3  
 CHERM2 6 5 3.00e-2  
 CHERM3 5 4 1.40e-2  
 CHERM4 4 3 1.65e-2  
 CHERM5 3 2 4.85e-2  
 CHERM6 2 tl 12.55

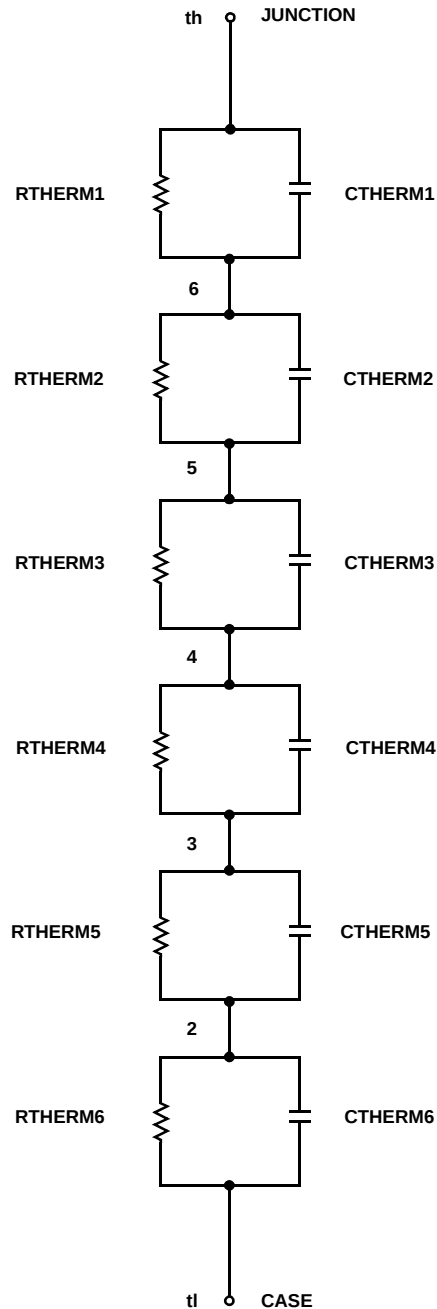
RHERM1 th 6 3.24e-3  
 RHERM2 6 5 8.08e-3  
 RHERM3 5 4 2.28e-2  
 RHERM4 4 3 1.28e-1  
 RHERM5 3 2 1.93e-1  
 RHERM6 2 tl 2.56e-2

## SABER Thermal Model

SABER thermal model HUF76445T

```
template thermal_model th tl
thermal_c th, tl
{
    ctherm.therm1 th 6 = 6.45e-3
    ctherm.therm2 6 5 = 3.00e-2
    ctherm.therm3 5 4 = 1.40e-2
    ctherm.therm4 4 3 = 1.65e-2
    ctherm.therm5 3 2 = 4.85e-2
    ctherm.therm6 2 tl = 12.55

    rtherm.rtherm1 th 6 = 3.24e-3
    rtherm.rtherm2 6 5 = 8.08e-3
    rtherm.rtherm3 5 4 = 2.28e-2
    rtherm.rtherm4 4 3 = 1.28e-1
    rtherm.rtherm5 3 2 = 1.93e-1
    rtherm.rtherm6 2 tl = 2.56e-2
}
```



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|                      |                     |                              |                       |      |
|----------------------|---------------------|------------------------------|-----------------------|------|
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| Bottomless™          | FAST <sup>r</sup> ™ | OPTOPLANAR™                  | STAR*POWER™           |      |
| CoolFET™             | FRFET™              | PACMAN™                      | Stealth™              |      |
| CROSSVOLT™           | GlobalOptoisolator™ | POP™                         | SuperSOT™-3           |      |
| DenseTrench™         | GTO™                | Power247™                    | SuperSOT™-6           |      |
| DOME™                | HiSeC™              | PowerTrench <sup>®</sup>     | SuperSOT™-8           |      |
| EcoSPARK™            | ISOPLANAR™          | QFET™                        | SyncFET™              |      |
| E <sup>2</sup> CMOS™ | LittleFET™          | QS™                          | TinyLogic™            |      |
| EnSigna™             | MicroFET™           | QT Optoelectronics™          | TruTranslation™       |      |
| FACT™                | MicroPak™           | Quiet Series™                | UHC™                  |      |
| FACT Quiet Series™   | MICROWIRE™          | SILENT SWITCHER <sup>®</sup> | UltraFET <sup>®</sup> |      |

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

| Datasheet Identification | Product Status         | Definition                                                                                                                                                                                                            |
|--------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Advance Information      | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.                                                                                    |
| Preliminary              | First Production       | This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design. |
| No Identification Needed | Full Production        | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.                                                       |
| Obsolete                 | Not In Production      | This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.                                                   |