

# FDG6332C

## 20V N & P-Channel PowerTrench® MOSFETs

### General Description

The N & P-Channel MOSFETs are produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize on-state resistance and yet maintain superior switching performance.

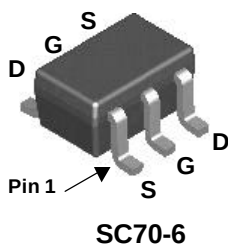
These devices have been designed to offer exceptional power dissipation in a very small footprint for applications where the bigger more expensive TSSOP-8 and SSOP-6 packages are impractical.

### Applications

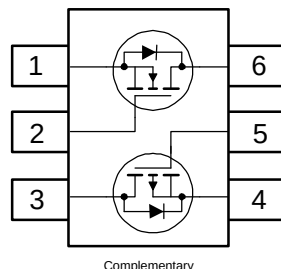
- DC/DC converter
- Load switch
- LCD display inverter

### Features

- **Q1** 0.7 A, 20V.  $R_{DS(ON)} = 300 \text{ m}\Omega @ V_{GS} = 4.5 \text{ V}$   
 $R_{DS(ON)} = 400 \text{ m}\Omega @ V_{GS} = 2.5 \text{ V}$
- **Q2** -0.6 A, -20V.  $R_{DS(ON)} = 420 \text{ m}\Omega @ V_{GS} = -4.5 \text{ V}$   
 $R_{DS(ON)} = 630 \text{ m}\Omega @ V_{GS} = -2.5 \text{ V}$
- Low gate charge
- High performance trench technology for extremely low  $R_{DS(ON)}$
- SC70-6 package: small footprint (51% smaller than SSOT-6); low profile (1mm thick)



SC70-6



Complementary

### Absolute Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol         | Parameter                                        | Q1          | Q2       | Units            |
|----------------|--------------------------------------------------|-------------|----------|------------------|
| $V_{DSS}$      | Drain-Source Voltage                             | 20          | -20      | V                |
| $V_{GSS}$      | Gate-Source Voltage                              | $\pm 12$    | $\pm 12$ | V                |
| $I_D$          | Drain Current – Continuous (Note 1)              | 0.7         | -0.6     | A                |
|                | – Pulsed                                         | 2.1         | -2       |                  |
| $P_D$          | Power Dissipation for Single Operation (Note 1)  | 0.3         |          | W                |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to +150 |          | $^\circ\text{C}$ |

### Thermal Characteristics

|                 |                                                  |     |                    |
|-----------------|--------------------------------------------------|-----|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1) | 415 | $^\circ\text{C/W}$ |
|-----------------|--------------------------------------------------|-----|--------------------|

### Package Marking and Ordering Information

| Device Marking | Device   | Reel Size | Tape width | Quantity   |
|----------------|----------|-----------|------------|------------|
| .32            | FDG6332C | 7"        | 8mm        | 3000 units |

**Electrical Characteristics** $T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol                                 | Parameter                                      | Test Conditions                                                                                                                                                                                                                 |                                                                                                                                                                                                                                     | Min       | Typ               | Max               | Units |    |
|----------------------------------------|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------|-------------------|-------|----|
| Off Characteristics                    |                                                |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                     |           |                   |                   |       |    |
| BV <sub>DSS</sub>                      | Drain–Source Breakdown Voltage                 | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA<br>V <sub>GS</sub> = 0 V, I <sub>D</sub> = –250 μA                                                                                                                               | Q1<br>Q2                                                                                                                                                                                                                            | 20<br>–20 |                   |                   | V     |    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$   | Breakdown Voltage Temperature Coefficient      | I <sub>D</sub> = 250 μA, Ref. to 25°C<br>I <sub>D</sub> = –250 μA, Ref. to 25°C                                                                                                                                                 | Q1<br>Q2                                                                                                                                                                                                                            |           | 14<br>–14         |                   | mV/°C |    |
| I <sub>DSS</sub>                       | Zero Gate Voltage Drain Current                | V <sub>DS</sub> = 16 V, V <sub>GS</sub> = 0 V<br>V <sub>DS</sub> = –16 V, V <sub>GS</sub> = 0 V                                                                                                                                 | Q1<br>Q2                                                                                                                                                                                                                            |           |                   | 1<br>–1           | μA    |    |
| I <sub>GSSF</sub> / I <sub>GSSR</sub>  | Gate–Body Leakage, Forward                     | V <sub>GS</sub> = ± 12 V, V <sub>DS</sub> = 0 V                                                                                                                                                                                 |                                                                                                                                                                                                                                     |           |                   | ±100              | nA    |    |
| I <sub>GSSF</sub> / I <sub>GSSR</sub>  | Gate–Body Leakage, Reverse                     | V <sub>GS</sub> = ± 12V, V <sub>DS</sub> = 0 V                                                                                                                                                                                  |                                                                                                                                                                                                                                     |           |                   | ±100              | nA    |    |
| On Characteristics (Note 2)            |                                                |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                     |           |                   |                   |       |    |
| V <sub>GS(th)</sub>                    | Gate Threshold Voltage                         | Q1 V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                                                                                                                                  |                                                                                                                                                                                                                                     | 0.6       | 1.1               | 1.5               | V     |    |
|                                        |                                                | Q2 V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = –250 μA                                                                                                                                                                 |                                                                                                                                                                                                                                     | –0.6      | –1.2              | –1.5              |       |    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | I <sub>D</sub> = 250 μA, Ref. To 25°C<br>I <sub>D</sub> = –250 μA, Ref. to 25°C                                                                                                                                                 | Q1<br>Q2                                                                                                                                                                                                                            |           | –2.8<br>3         |                   | mV/°C |    |
| R <sub>DS(on)</sub>                    | Static Drain–Source On–Resistance              | Q1 V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 0.7 A<br>V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 0.6 A<br>V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 0.7A, T <sub>J</sub> = 125°C                                                 |                                                                                                                                                                                                                                     |           | 180<br>293<br>247 | 300<br>400<br>442 | mΩ    |    |
|                                        |                                                | Q2 V <sub>GS</sub> = –4.5 V, I <sub>D</sub> = –0.6 A<br>V <sub>GS</sub> = –2.5 V, I <sub>D</sub> = –0.5 A<br>V <sub>GS</sub> = –4.5 V, I <sub>D</sub> = –0.6 A, T <sub>J</sub> = 125°C                                          |                                                                                                                                                                                                                                     |           | 300<br>470<br>400 | 420<br>630<br>700 |       |    |
| g <sub>FS</sub>                        | Forward Transconductance                       | Q1 V <sub>DS</sub> = 5 V I <sub>D</sub> = 0.7 A                                                                                                                                                                                 |                                                                                                                                                                                                                                     |           | 2.8               |                   | S     |    |
|                                        |                                                | Q2 V <sub>DS</sub> = –5 V I <sub>D</sub> = –0.6A                                                                                                                                                                                |                                                                                                                                                                                                                                     |           | 1.8               |                   |       |    |
| I <sub>D(on)</sub>                     | On–State Drain Current                         | Q1 V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 5 V                                                                                                                                                                               |                                                                                                                                                                                                                                     | 1         |                   |                   | A     |    |
|                                        |                                                | Q2 V <sub>GS</sub> = –4.5 V, V <sub>DS</sub> = –5 V                                                                                                                                                                             |                                                                                                                                                                                                                                     | –2        |                   |                   |       |    |
| Dynamic Characteristics                |                                                |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                     |           |                   |                   |       |    |
| C <sub>iss</sub>                       | Input Capacitance                              | Q1 V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1.0MHz                                                                                                                                                                    |                                                                                                                                                                                                                                     |           | 113               |                   | pF    |    |
|                                        |                                                | Q2 V <sub>DS</sub> = –10 V, V <sub>GS</sub> = 0 V, f = 1.0MHz                                                                                                                                                                   |                                                                                                                                                                                                                                     |           | 114               |                   |       |    |
| C <sub>oss</sub>                       | Output Capacitance                             | Q1 V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1.0MHz                                                                                                                                                                    |                                                                                                                                                                                                                                     |           | 34                |                   | pF    |    |
|                                        |                                                | Q2 V <sub>DS</sub> = –10 V, V <sub>GS</sub> = 0 V, f = 1.0MHz                                                                                                                                                                   |                                                                                                                                                                                                                                     |           | 24                |                   |       |    |
| C <sub>rss</sub>                       | Reverse Transfer Capacitance                   | Q1 V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1.0MHz                                                                                                                                                                    |                                                                                                                                                                                                                                     |           | 16                |                   | pF    |    |
|                                        |                                                | Q2 V <sub>DS</sub> = –10 V, V <sub>GS</sub> = 0 V, f = 1.0MHz                                                                                                                                                                   |                                                                                                                                                                                                                                     |           | 9                 |                   |       |    |
| Switching Characteristics (Note 2)     |                                                |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                     |           |                   |                   |       |    |
| t <sub>d(on)</sub>                     | Turn–On Delay Time                             | For Q1:<br>V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 A<br>V <sub>GS</sub> = 4.5 V, R <sub>GEN</sub> = 6 Ω<br><br>For Q2:<br>V <sub>DS</sub> = –10 V, I <sub>D</sub> = –1 A<br>V <sub>GS</sub> = –4.5 V, R <sub>GEN</sub> = 6 Ω |                                                                                                                                                                                                                                     |           | 5                 | 10                | ns    |    |
|                                        |                                                |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                     |           | 5.5               | 11                |       |    |
| t <sub>r</sub>                         | Turn–On Rise Time                              |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                     |           |                   | 7                 | 15    | ns |
|                                        |                                                |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                     |           |                   | 14                | 25    |    |
| t <sub>d(off)</sub>                    | Turn–Off Delay Time                            |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                     |           |                   | 9                 | 18    | ns |
|                                        |                                                |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                     |           |                   | 6                 | 12    |    |
| t <sub>f</sub>                         | Turn–Off Fall Time                             |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                     |           |                   | 1.5               | 3     | ns |
|                                        |                                                |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                     |           |                   | 1.7               | 3.4   |    |
| Q <sub>g</sub>                         | Total Gate Charge                              | Q1                                                                                                                                                                                                                              | For Q1:<br>V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.7 A<br>V <sub>GS</sub> = 4.5 V, R <sub>GEN</sub> = 6 Ω<br><br>For Q2:<br>V <sub>DS</sub> = –10 V, I <sub>D</sub> = –0.6 A<br>V <sub>GS</sub> = –4.5 V, R <sub>GEN</sub> = 6 Ω |           | 1.1               | 1.5               | nC    |    |
|                                        |                                                | Q2                                                                                                                                                                                                                              |                                                                                                                                                                                                                                     |           | 1.4               | 2                 |       |    |
| Q <sub>gs</sub>                        | Gate–Source Charge                             | Q1                                                                                                                                                                                                                              |                                                                                                                                                                                                                                     |           | 0.24              |                   | nC    |    |
|                                        |                                                | Q2                                                                                                                                                                                                                              |                                                                                                                                                                                                                                     |           | 0.3               |                   |       |    |
| Q <sub>gd</sub>                        | Gate–Drain Charge                              | Q1                                                                                                                                                                                                                              |                                                                                                                                                                                                                                     |           | 0.3               |                   | nC    |    |
|                                        |                                                | Q2                                                                                                                                                                                                                              |                                                                                                                                                                                                                                     |           | 0.4               |                   |       |    |

**Electrical Characteristics** $T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol                                                        | Parameter                                             | Test Conditions | Min                                                  | Typ   | Max   | Units |
|---------------------------------------------------------------|-------------------------------------------------------|-----------------|------------------------------------------------------|-------|-------|-------|
| <b>Drain–Source Diode Characteristics and Maximum Ratings</b> |                                                       |                 |                                                      |       |       |       |
| $I_S$                                                         | Maximum Continuous Drain–Source Diode Forward Current | Q1              |                                                      |       | 0.25  | A     |
|                                                               |                                                       | Q2              |                                                      |       | –0.25 |       |
| $V_{SD}$                                                      | Drain–Source Diode Forward Voltage                    | Q1              | $V_{GS} = 0\text{ V}, I_S = 0.25\text{ A}$ (Note 2)  | 0.74  | 1.2   | V     |
|                                                               |                                                       | Q2              | $V_{GS} = 0\text{ V}, I_S = -0.25\text{ A}$ (Note 2) | –0.77 | –1.2  |       |

**Notes:**

1.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.  $R_{\theta JA} = 415^\circ\text{C/W}$  when mounted on a minimum pad of FR-4 PCB in a still air environment.

2. Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty Cycle < 2.0%

## Typical Characteristics: N-Channel

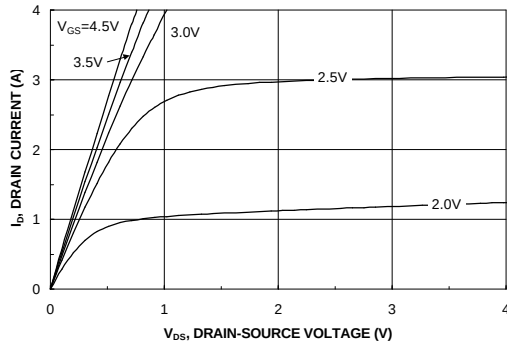


Figure 1. On-Region Characteristics.

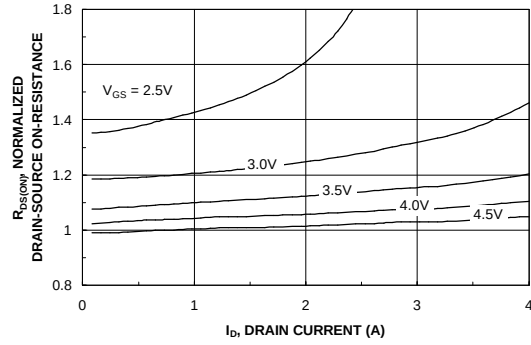


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

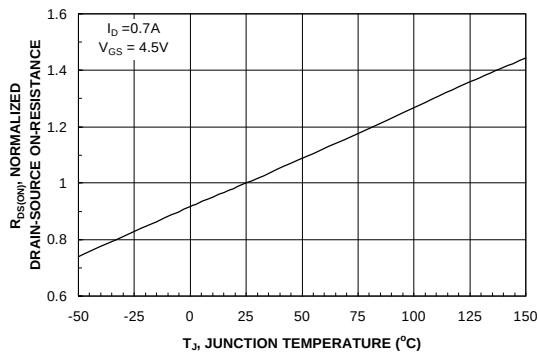


Figure 3. On-Resistance Variation with Temperature.

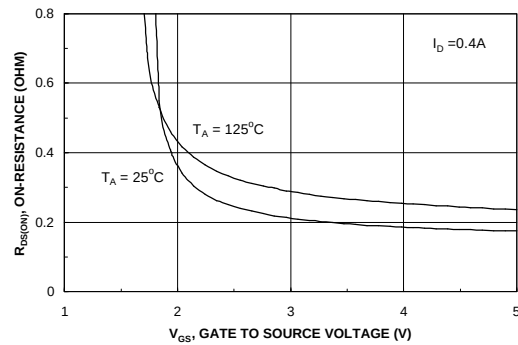


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

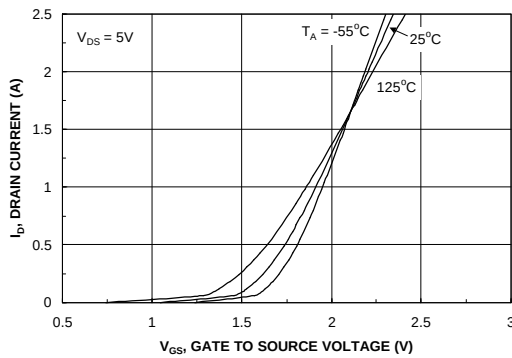


Figure 5. Transfer Characteristics.

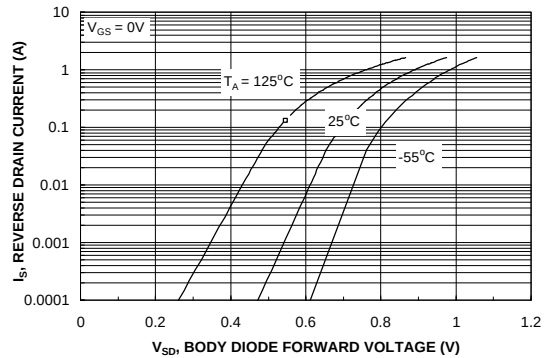


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics: N-Channel

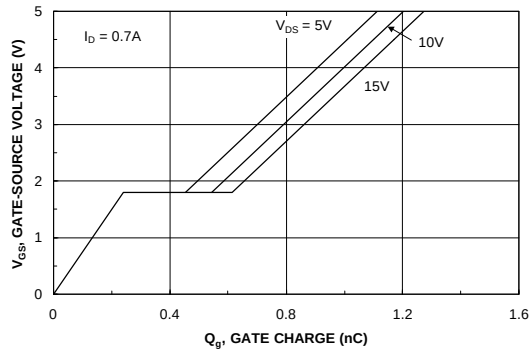


Figure 7. Gate Charge Characteristics.

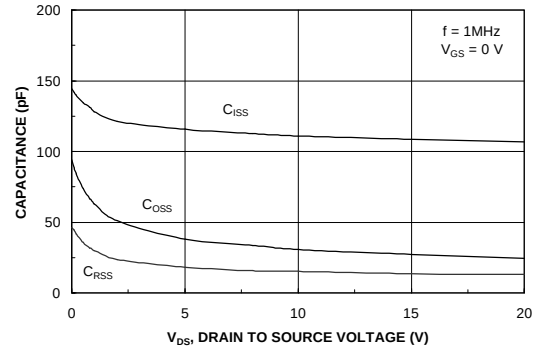


Figure 8. Capacitance Characteristics.

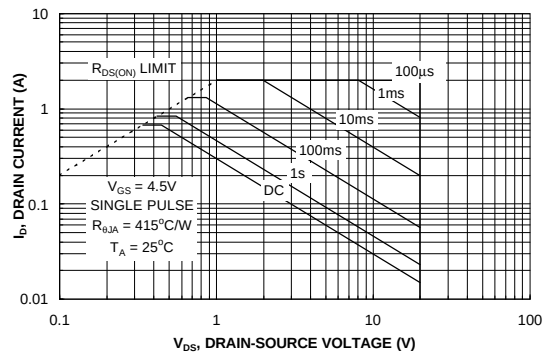


Figure 9. Maximum Safe Operating Area.

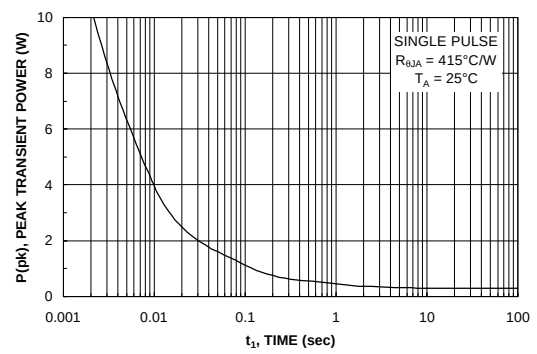


Figure 10. Single Pulse Maximum Power Dissipation.

## Typical Characteristics: P-Channel

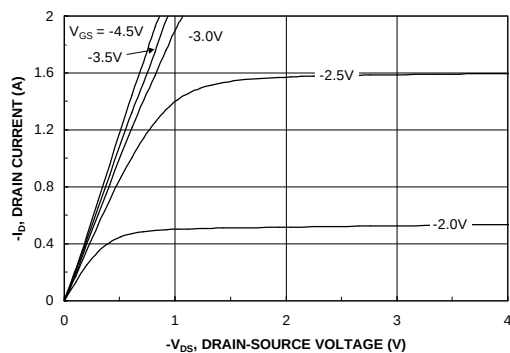


Figure 11. On-Region Characteristics.

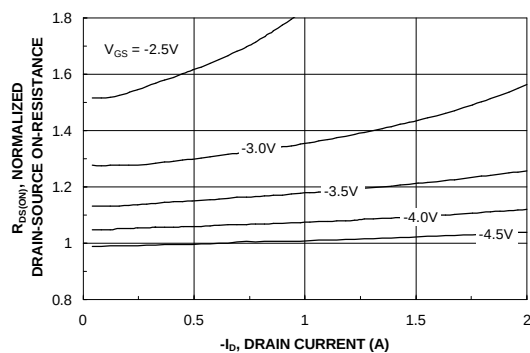


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

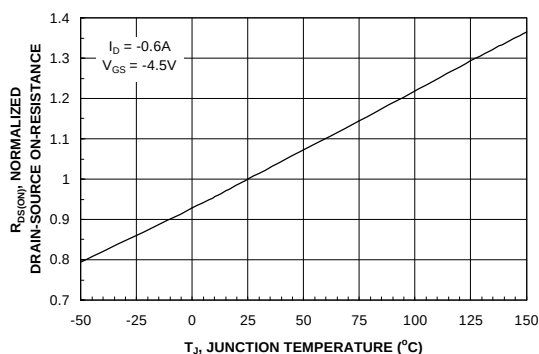


Figure 13. On-Resistance Variation with Temperature.

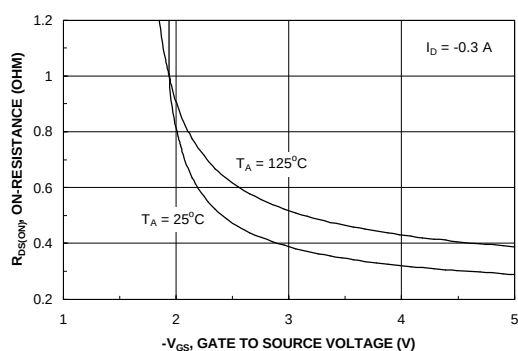


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

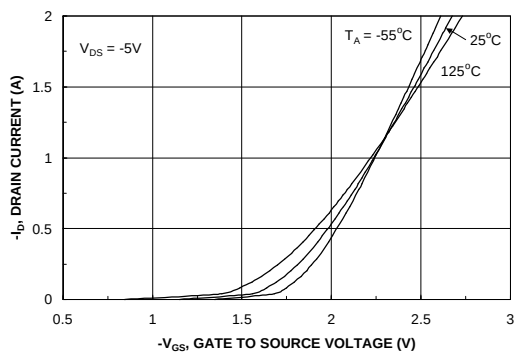


Figure 15. Transfer Characteristics.

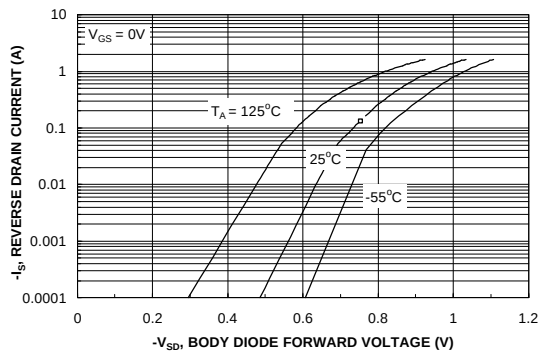


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics: P-Channel

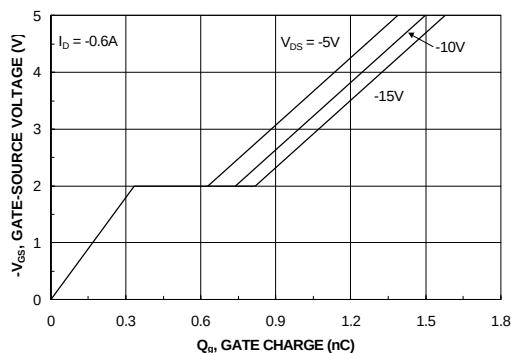


Figure 17. Gate Charge Characteristics.

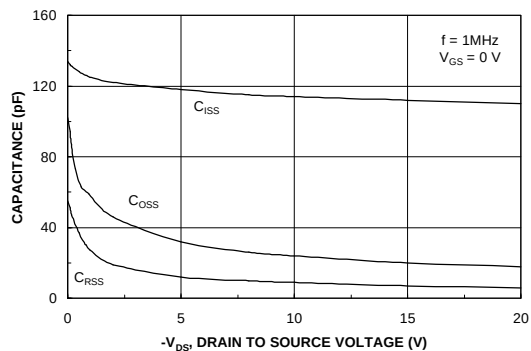


Figure 18. Capacitance Characteristics.

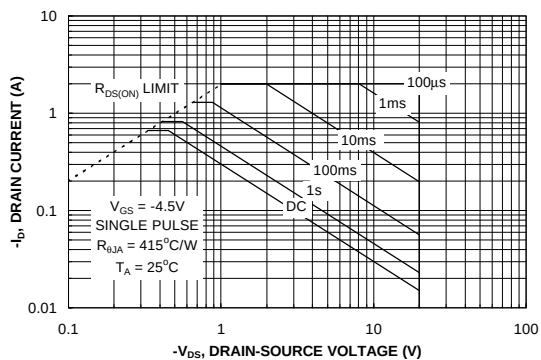


Figure 19. Maximum Safe Operating Area.

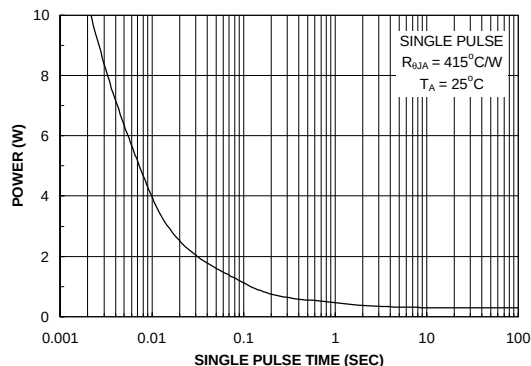


Figure 20. Single Pulse Maximum Power Dissipation.

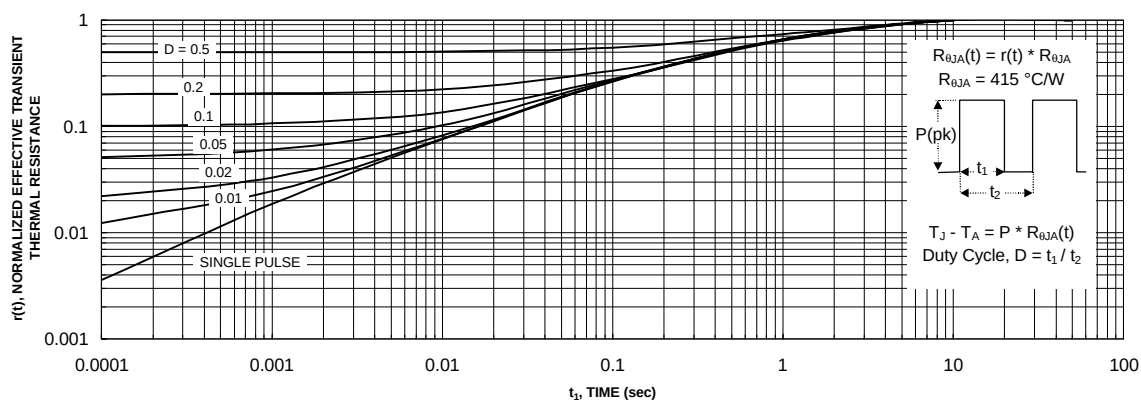


Figure 21. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1.  
Transient thermal response will change depending on the circuit board design.

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|                                      |                     |               |                     |                 |
|--------------------------------------|---------------------|---------------|---------------------|-----------------|
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| ActiveArray™                         | FAST®               | MICROCOUPLER™ | PowerTrench®        | SuperSOT™-8     |
| Bottomless™                          | FASTr™              | MicroFET™     | QFET®               | SyncFET™        |
| CoolFET™                             | FRFET™              | MicroPak™     | QS™                 | TinyLogic®      |
| CROSSVOLT™                           | GlobalOptoisolator™ | MICROWIRE™    | QT Optoelectronics™ | TINYOPTO™       |
| DOME™                                | GTO™                | MSX™          | Quiet Series™       | TruTranslation™ |
| EcoSPARK™                            | HiSeC™              | MSXPro™       | RapidConfigure™     | UHC™            |
| E <sup>2</sup> CMOS™                 | I <sup>2</sup> C™   | OCX™          | RapidConnect™       | UltraFET®       |
| EnSigna™                             | ImpliedDisconnect™  | OCXPro™       | SILENT SWITCHER®    | VCX™            |
| FACT™                                | ISOPPLANAR™         | OPTOLOGIC®    | SMART START™        |                 |
| Across the board. Around the world.™ | OPTOPLANAR™         | SPM™          |                     |                 |
| The Power Franchise™                 | PACMAN™             | Stealth™      |                     |                 |
| Programmable Active Droop™           | POP™                | SuperSOT™-3   |                     |                 |

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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. |
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