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# NDC7001C

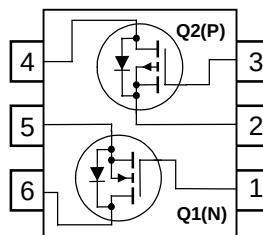
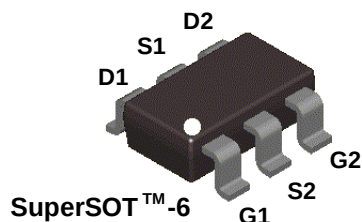
## Dual N & P-Channel Enhancement Mode Field Effect Transistor

### General Description

These dual N & P-Channel Enhancement Mode Field Effect Transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process has been designed to minimize on-state resistance, provide rugged and reliable performance and fast switching. These device is particularly suited for low voltage, low current, switching, and power supply applications.

### Features

- Q1** 0.51 A, 60V.  $R_{DS(ON)} = 2\ \Omega @ V_{GS} = 10\ V$   
 $R_{DS(ON)} = 4\ \Omega @ V_{GS} = 4.5\ V$
- Q2** -0.34 A, 60V.  $R_{DS(ON)} = 5\ \Omega @ V_{GS} = -10\ V$   
 $R_{DS(ON)} = 7.5\ \Omega @ V_{GS} = -4.5\ V$
- High saturation current
- High density cell design for low  $R_{DS(ON)}$
- Proprietary SuperSOT™ -6 package: design using copper lead frame for superior thermal and electrical capabilities



### Absolute Maximum Ratings

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

| Symbol                            | Parameter                                        | Q1          | Q2    | Units |
|-----------------------------------|--------------------------------------------------|-------------|-------|-------|
| V <sub>DSS</sub>                  | Drain-Source Voltage                             | 60          | −60   | V     |
| V <sub>GSS</sub>                  | Gate-Source Voltage                              | ±20         | ±20   |       |
| I <sub>D</sub>                    | Drain Current – Continuous (Note 1a)             | 0.51        | −0.34 | A     |
|                                   | – Pulsed                                         | 1.5         | −1    |       |
| P <sub>D</sub>                    | Power Dissipation for Single Operation (Note 1a) | 0.96        |       | W     |
|                                   | (Note 1b)                                        | 0.9         |       |       |
|                                   | (Note 1c)                                        | 0.7         |       |       |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Junction Temperature Range | −55 to +150 |       | °C    |

### Thermal Characteristics

|                 |                                                   |     |                    |
|-----------------|---------------------------------------------------|-----|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 130 | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Note 1)     | 60  |                    |

### Package Marking and Ordering Information

| Device Marking | Device   | Reel Size | Tape width | Quantity |
|----------------|----------|-----------|------------|----------|
| .01C           | NDC7001C | 7"        | 8mm        | 3000     |

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

| Symbol                               | Parameter                                 | Test Conditions                                                                                                             | Min                           | Typ       | Max     | Units                |
|--------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------|-----------|---------|----------------------|
| <b>Off Characteristics</b>           |                                           |                                                                                                                             |                               |           |         |                      |
| $BV_{DSS}$                           | Drain–Source Breakdown Voltage            | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$<br>$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$                 | <b>Q1</b> 60<br><b>Q2</b> -60 |           |         | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Ref. to $25^\circ\text{C}$<br>$I_D = -250\text{ }\mu\text{A}$ , Ref. to $25^\circ\text{C}$ | <b>Q1</b><br><b>Q2</b>        | 67<br>-57 |         | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$<br>$V_{DS} = -48\text{ V}, V_{GS} = 0\text{ V}$                                 | <b>Q1</b><br><b>Q2</b>        |           | 1<br>-1 | $\mu\text{A}$        |
| $I_{GSSF}$                           | Gate–Body Leakage, Forward                | $V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$                                                                                 | All                           |           | 100     | nA                   |
| $I_{GSSR}$                           | Gate–Body Leakage, Reverse                | $V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$                                                                                | All                           |           | -100    | nA                   |

**On Characteristics** (Note 2)

|                                        |                                                |           |                                                                                                                                                                           |     |                   |                |                      |
|----------------------------------------|------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------|----------------|----------------------|
| $V_{GS(th)}$                           | Gate Threshold Voltage                         | <b>Q1</b> | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$                                                                                                                           | 1   | 2.1               | 2.5            | V                    |
|                                        |                                                | <b>Q2</b> | $V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$                                                                                                                          | -1  | -1.9              | -3.5           |                      |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | <b>Q1</b> | $I_D = 250\text{ }\mu\text{A}$ , Referenced. to $25^\circ\text{C}$                                                                                                        |     | -3.8              |                | mV/ $^\circ\text{C}$ |
|                                        |                                                | <b>Q2</b> | $I_D = -250\text{ }\mu\text{A}$ , Ref. to $25^\circ\text{C}$                                                                                                              |     | 3.2               |                |                      |
| $R_{DS(on)}$                           | Static Drain–Source On–Resistance              | <b>Q1</b> | $V_{GS} = 10\text{ V}, I_D = 0.51\text{ A}$                                                                                                                               |     | 1                 | 2              | $\Omega$             |
|                                        |                                                |           | $V_{GS} = 4.5\text{ V}, I_D = 0.35\text{ A}$                                                                                                                              |     | 2                 | 4              |                      |
|                                        |                                                |           | $V_{GS} = 10\text{ V}, I_D = 0.51\text{ A}, T_J = 125^\circ\text{C}$                                                                                                      |     | 1.7               | 3.5            |                      |
|                                        |                                                | <b>Q2</b> | $V_{GS} = -10\text{ V}, I_D = -0.34\text{ A}$<br>$V_{GS} = -4.5\text{ V}, I_D = -0.25\text{ A}$<br>$V_{GS} = -10\text{ V}, I_D = -0.34\text{ A}, T_J = 125^\circ\text{C}$ |     | 1.2<br>1.5<br>1.9 | 5<br>7.5<br>10 |                      |
| $I_{D(on)}$                            | On-State Drain Current                         | <b>Q1</b> | $V_{GS} = 10\text{ V}, V_{DS} = 10\text{ V}$                                                                                                                              | 1.5 |                   |                | A                    |
|                                        |                                                | <b>Q2</b> | $V_{GS} = -10\text{ V}, V_{DS} = -10\text{ V}$                                                                                                                            | -1  |                   |                |                      |
| $g_{FS}$                               | Forward Transconductance                       | <b>Q1</b> | $V_{DS} = 10\text{ V}, I_D = 0.51\text{ A}$                                                                                                                               |     | 380               |                | mS                   |
|                                        |                                                | <b>Q2</b> | $V_{DS} = -10\text{ V}, I_D = -0.34\text{ A}$                                                                                                                             |     | 700               |                |                      |

**Dynamic Characteristics**

|           |                              |           |                                              |  |      |  |          |
|-----------|------------------------------|-----------|----------------------------------------------|--|------|--|----------|
| $C_{iss}$ | Input Capacitance            | <b>Q1</b> | For <b>Q1</b> :                              |  | 20   |  | pF       |
|           |                              | <b>Q2</b> | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}$  |  | 66   |  |          |
| $C_{oss}$ | Output Capacitance           | <b>Q1</b> | $f = 1.0\text{ MHz}$                         |  | 11   |  | pF       |
|           |                              | <b>Q2</b> | For <b>Q2</b> :                              |  | 13   |  |          |
| $C_{rss}$ | Reverse Transfer Capacitance | <b>Q1</b> | $V_{DS} = -25\text{ V}, V_{GS} = 0\text{ V}$ |  | 4.3  |  | pF       |
|           |                              | <b>Q2</b> | $f = 1.0\text{ MHz}$                         |  | 6    |  |          |
| $R_G$     | Gate Resistance              | <b>Q1</b> | $V_{GS} = 15\text{ mV}, f = 1.0\text{ MHz}$  |  | 11.2 |  | $\Omega$ |
|           |                              | <b>Q2</b> |                                              |  | 11.2 |  |          |

**Switching Characteristics** (Note 2)

|              |                     |           |                                                    |  |     |     |    |
|--------------|---------------------|-----------|----------------------------------------------------|--|-----|-----|----|
| $t_{d(on)}$  | Turn–On Delay Time  | <b>Q1</b> | For <b>Q1</b> :                                    |  | 2.8 | 5.6 | ns |
|              |                     | <b>Q2</b> | $V_{DS} = 25\text{ V}, I_{DS} = 1\text{ A}$        |  | 3.2 | 6.4 |    |
| $t_r$        | Turn–On Rise Time   | <b>Q1</b> | $V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$  |  | 8   | 16  | ns |
|              |                     | <b>Q2</b> | For <b>Q2</b> :                                    |  | 10  | 20  |    |
| $t_{d(off)}$ | Turn–Off Delay Time | <b>Q1</b> | $V_{DS} = -25\text{ V}, I_{DS} = -1\text{ A}$      |  | 14  | 26  | ns |
|              |                     | <b>Q2</b> | $V_{GS} = -10\text{ V}, R_{GEN} = 6\text{ }\Omega$ |  | 8   | 16  |    |
| $t_f$        | Turn–Off Fall Time  | <b>Q1</b> |                                                    |  | 4   | 8   | ns |
|              |                     | <b>Q2</b> |                                                    |  | 1   | 2   |    |
| $Q_g$        | Total Gate Charge   | <b>Q1</b> | For <b>Q1</b> :                                    |  | 1.1 | 1.5 | nC |
|              |                     | <b>Q2</b> | $V_{DS} = 25\text{ V}, I_{DS} = 0.51\text{ A}$     |  | 1.6 | 2.2 |    |
| $Q_{gs}$     | Gate–Source Charge  | <b>Q1</b> | $V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$  |  | 0.2 |     | nC |
|              |                     | <b>Q2</b> | For <b>Q2</b> :                                    |  | 0.3 |     |    |
| $Q_{gd}$     | Gate–Drain Charge   | <b>Q1</b> | $V_{DS} = -25\text{ V}, I_{DS} = -0.35\text{ A}$   |  | 0.4 |     | nC |
|              |                     | <b>Q2</b> | $V_{GS} = -10\text{ V}, R_{GEN} = 6\text{ }\Omega$ |  | 0.3 |     |    |

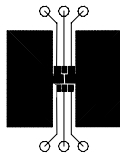
## Electrical Characteristics

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

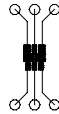
| Symbol                                                        | Parameter                                             | Test Conditions | Min                                                        | Typ  | Max   | Units |
|---------------------------------------------------------------|-------------------------------------------------------|-----------------|------------------------------------------------------------|------|-------|-------|
| <b>Drain–Source Diode Characteristics and Maximum Ratings</b> |                                                       |                 |                                                            |      |       |       |
| $I_S$                                                         | Maximum Continuous Drain–Source Diode Forward Current | Q1              |                                                            |      | 0.51  | A     |
|                                                               |                                                       | Q2              |                                                            |      | –0.34 |       |
| $V_{SD}$                                                      | Drain–Source Diode Forward Voltage                    | Q1              | $V_{GS} = 0\text{ V}, I_S = 0.51\text{ A}$ (Note 2)        | 0.8  | 1.2   | V     |
|                                                               |                                                       | Q2              | $V_{GS} = 0\text{ V}, I_S = -0.34\text{ A}$ (Note 2)       | –0.8 | –1.4  |       |
| $t_{rr}$                                                      | Diode Reverse Recovery Time                           | Q1              | $I_F = 0.51\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}$  | 18   |       | nS    |
|                                                               |                                                       | Q2              | $I_F = -0.34\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}$ | 16   |       |       |
| $Q_{rr}$                                                      | Diode Reverse Recovery Charge                         | Q1              | $I_F = 0.51\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}$  | 16   |       | nC    |
|                                                               |                                                       | Q2              | $I_F = -0.34\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}$ | 11   |       |       |

### Notes:

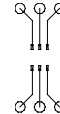
1.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $130^\circ\text{C/W}$  when mounted on a  $0.125\text{ in}^2$  pad of 2 oz. copper.



b)  $140^\circ\text{C/W}$  when mounted on a  $0.005\text{ in}^2$  pad of 2 oz. copper



c)  $180^\circ\text{C/W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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

## Typical Characteristics: N-Channel

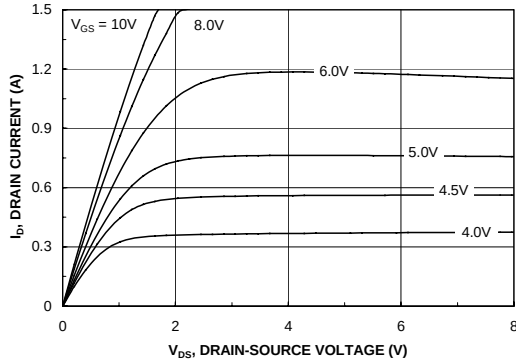


Figure 1. On-Region Characteristics.

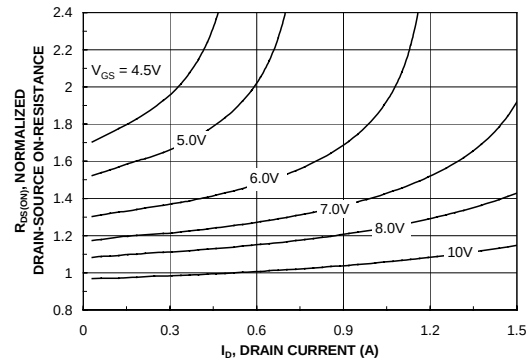


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

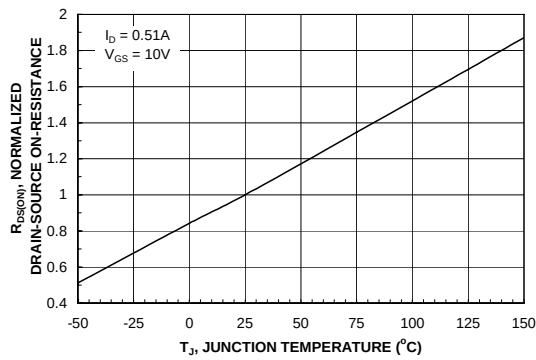


Figure 3. On-Resistance Variation with Temperature.

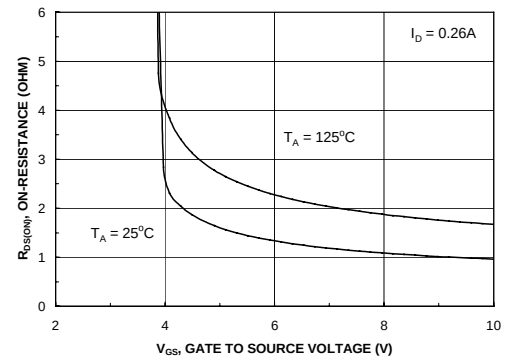


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

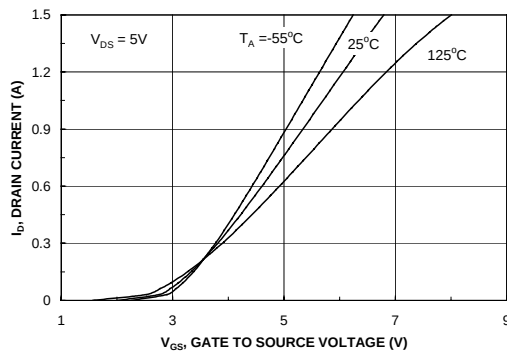


Figure 5. Transfer Characteristics.

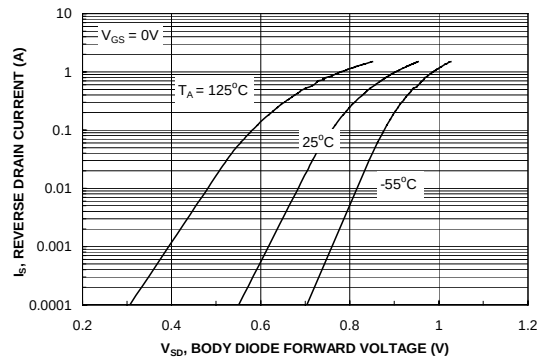


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

# Typical Characteristics: N-Channel (continued)

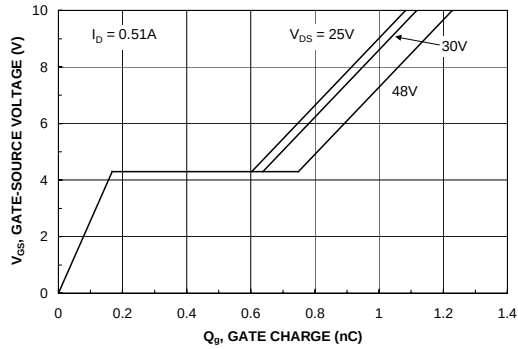


Figure 7. Gate Charge Characteristics.

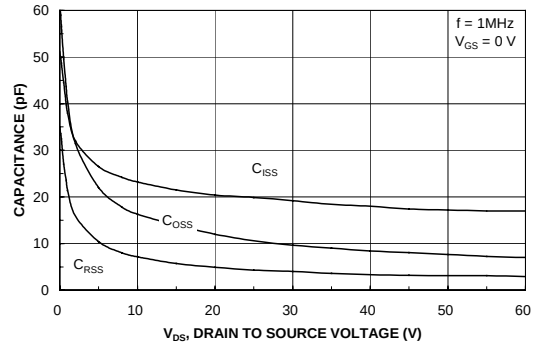


Figure 8. Capacitance Characteristics.

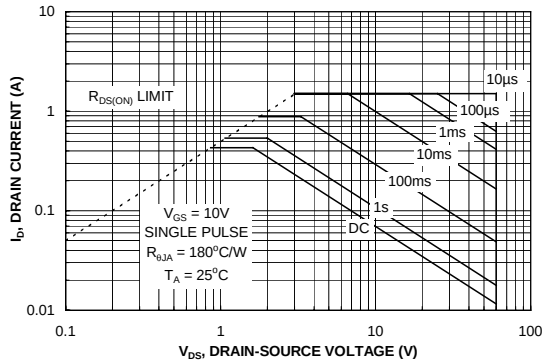


Figure 9. Maximum Safe Operating Area.

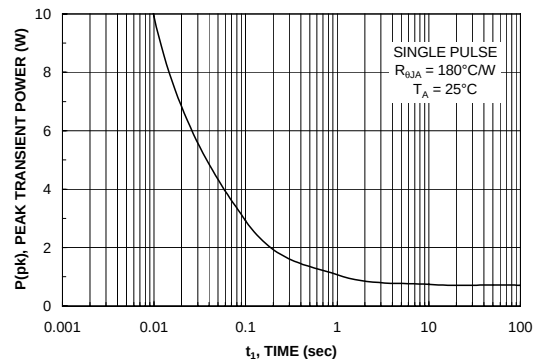


Figure 10. Single Pulse Maximum Power Dissipation.

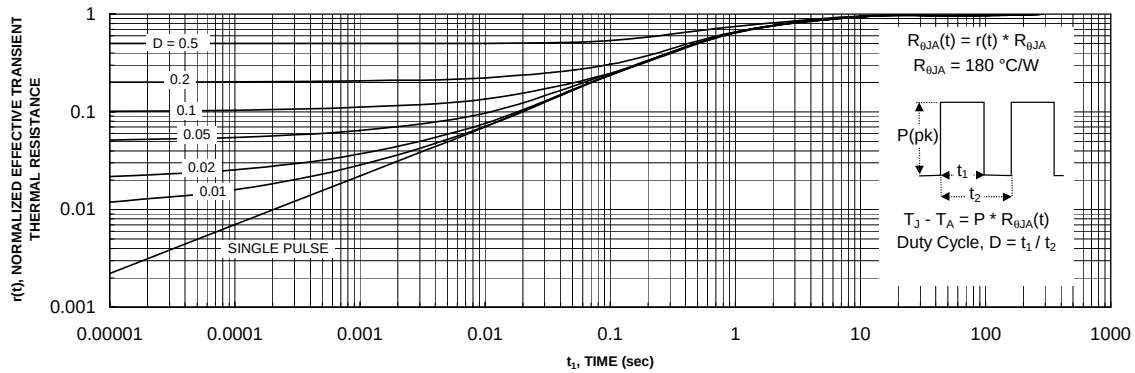


Figure 21. Transient Thermal Response Curve.

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

## Typical Characteristics: P-Channel

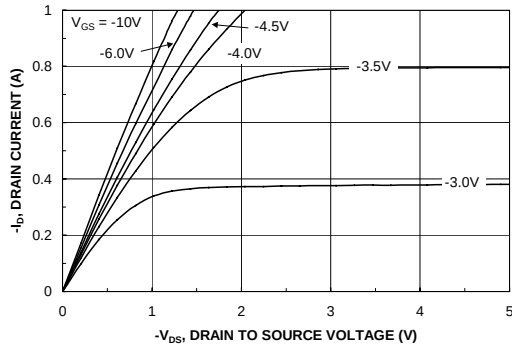


Figure 11. On-Region Characteristics.

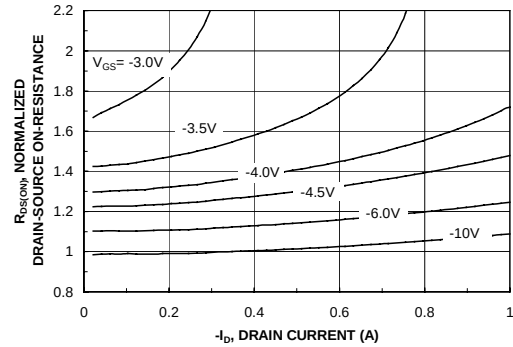


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

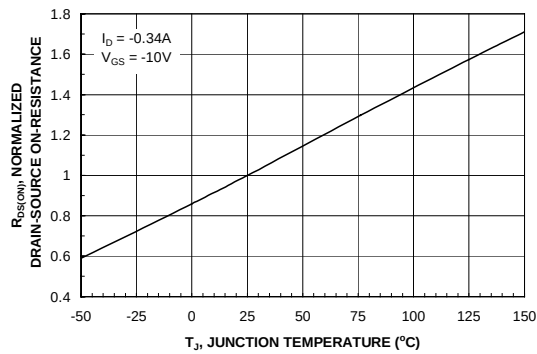


Figure 13. On-Resistance Variation with Temperature.

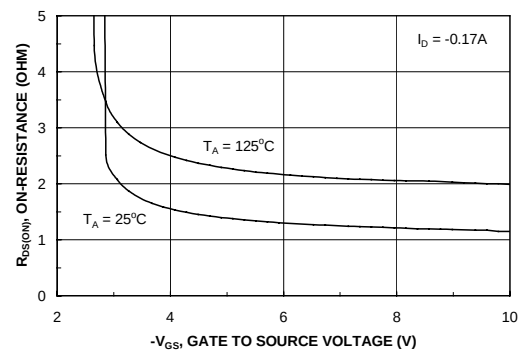


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

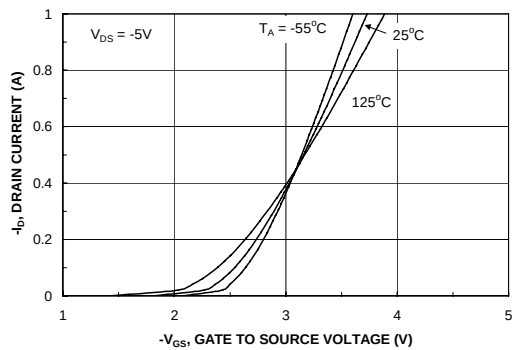


Figure 15. Transfer Characteristics.

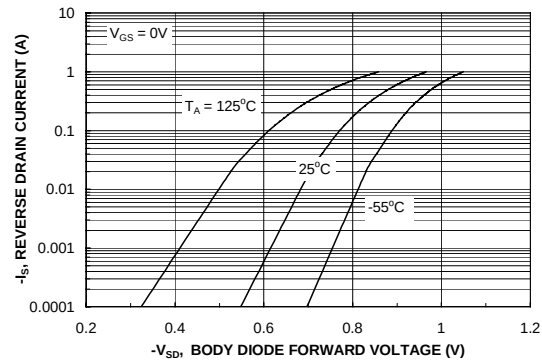


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics: P-Channel (continued)

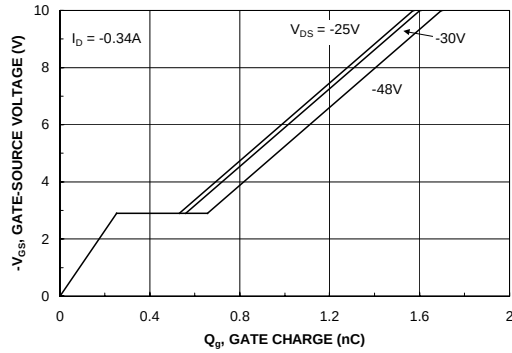


Figure 17. Gate Charge Characteristics.

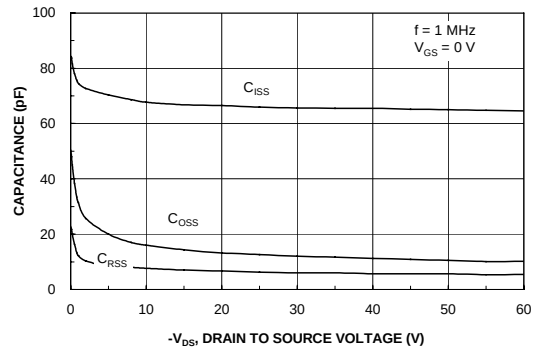


Figure 18. Capacitance Characteristics.

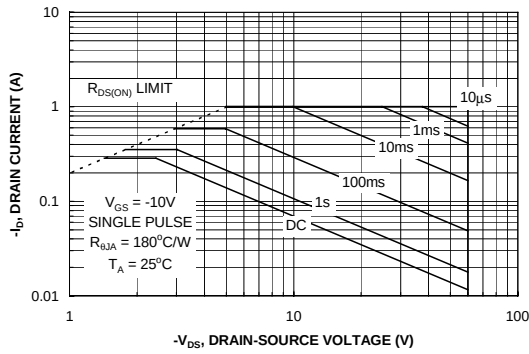


Figure 19. Maximum Safe Operating Area.

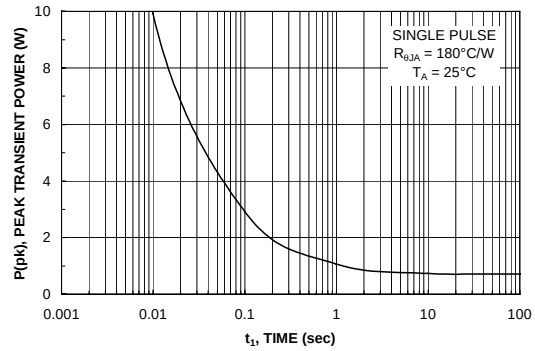


Figure 20. Single Pulse Maximum Power Dissipation.

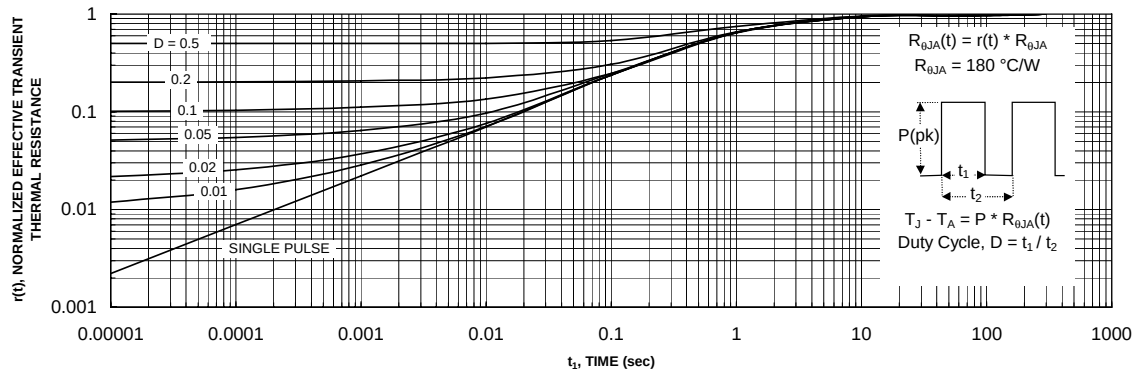


Figure 21. Transient Thermal Response Curve.

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



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| Bottomless <sup>TM</sup>          | FAST <sup>r</sup> <sup>TM</sup>  | OPTOLOGIC <sup>®</sup>           | SMART START <sup>TM</sup>    | UltraFET <sup>®</sup> |
| CoolFET <sup>TM</sup>             | FRFET <sup>TM</sup>              | OPTOPLANAR <sup>TM</sup>         | SPM <sup>TM</sup>            | VCX <sup>TM</sup>     |
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| EcoSPARK <sup>TM</sup>            | I <sup>2</sup> C <sup>TM</sup>   | PowerTrench <sup>®</sup>         | SuperSOT <sup>TM</sup> -6    |                       |
| E <sup>2</sup> CMOS <sup>TM</sup> | ISOPLANAR <sup>TM</sup>          | QFET <sup>TM</sup>               | SuperSOT <sup>TM</sup> -8    |                       |
| EnSigna <sup>TM</sup>             | LittleFET <sup>TM</sup>          | QS <sup>TM</sup>                 | SyncFET <sup>TM</sup>        |                       |
| FACT <sup>TM</sup>                | MicroFET <sup>TM</sup>           | QT Optoelectronics <sup>TM</sup> | TinyLogic <sup>TM</sup>      |                       |
| FACT Quiet Series <sup>TM</sup>   | MicroPak <sup>TM</sup>           | Quiet Series <sup>TM</sup>       | TruTranslation <sup>TM</sup> |                       |

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