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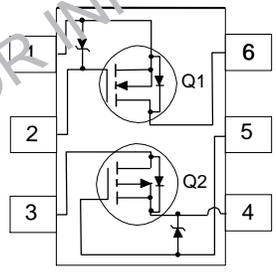
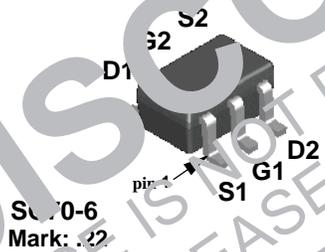
## FDG6322C Dual N & P Channel Digital FET

### General Description

These dual N & P-Channel logic level enhancement mode field effect transistors are produced using ON Semiconductor's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance. This device has been designed especially for low voltage applications as a replacement for bipolar digital transistors and small signal MOSFETs. Since bias resistors are not required, this dual digital FET can replace several different digital transistors, with different bias resistor values.

### Features

- N-Ch 0.22 A, 25 V,  $R_{DS(ON)} = 4.0 \Omega @ V_{GS} = 4.5 \text{ V}$ ,  
 $R_{DS(ON)} = 5.0 \Omega @ V_{GS} = 2.7 \text{ V}$ .
- P-Ch -0.41 A, -25V,  $R_{DS(ON)} = 1.1 \Omega @ V_{GS} = -4.5 \text{ V}$ ,  
 $R_{DS(ON)} = 1.5 \Omega @ V_{GS} = -2.7 \text{ V}$ .
- Very small package options SC70
- Very low level gate drive requirements allowing direct operation in 3 V circuits ( $V_{GS} = 1.5 \text{ V}$ ).
- Gate Source Zener for ESD ruggedness (>6kV Human Body Model).



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

| Symbol         | Parameter   | N-Channel  | P-Channel | Units            |
|----------------|---|------------|-----------|------------------|
| $V_{DS}$       | Drain-Source Voltage  | 25         | -25       | V                |
| $V_{GS}$       | Gate-Source Voltage   | 8          | -8        | V                |
| $I_D$          | Drain Current - Continuous  | 0.22       | -0.41     | A                |
|                | - Pulsed  | 0.65       | -1.2      |                  |
| $P_D$          | Maximum Power Dissipation (Note 1)  | 0.3        |           | W                |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range   | -55 to 150 |           | $^\circ\text{C}$ |
| ESD            | Electrostatic Discharge Rating MIL-STD-883D Human Body Model (100pf / 1500 Ohm) | 6          |           | kV               |

### THERMAL CHARACTERISTICS

|                 |   |     |                    |
|-----------------|---|-----|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note1) | 415 | $^\circ\text{C/W}$ |
|-----------------|---|-----|--------------------|

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

| Symbol                             | Parameter                                | Conditions  | Type      | Min   | Typ  | Max  | Units                |
|------------------------------------|--|---|-----------|-------|------|------|----------------------|
| <b>OFF CHARACTERISTICS</b>         |  |   |           |       |      |      |                      |
| $BV_{DSS}$                         | Drain-Source Breakdown Voltage           | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$                               | N-Ch      | 25    |      |      | V                    |
|                                    |  | $V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$                              | P-Ch      | -25   |      |      |                      |
| $\Delta BV_{DSS}/\Delta T_J$       | Breakdown Voltage Temp. Coefficient      | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25\text{ }^\circ\text{C}$         | N-Ch      |       | 25   |      | mV/ $^\circ\text{C}$ |
|                                    |  | $I_D = -250\text{ }\mu\text{A}$ , Referenced to $25\text{ }^\circ\text{C}$        | P-Ch      |       | -22  |      |                      |
| $I_{DSS}$                          | Zero Gate Voltage Drain Current          | $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V},$<br>$T_J = 55\text{ }^\circ\text{C}$  | N-Ch      |       |      | 1    | $\mu\text{A}$        |
|                                    |  |   |           |       |      | 10   |                      |
| $I_{DSS}$                          | Zero Gate Voltage Drain Current          | $V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V},$<br>$T_J = 55\text{ }^\circ\text{C}$ | P-Ch      |       |      | -1   | $\mu\text{A}$        |
|                                    |  |   |           |       |      | -10  |                      |
| $I_{GSS}$                          | Gate - Body Leakage Current              | $V_{GS} = 8\text{ V}, V_{DS} = 0\text{ V}$  | N-Ch      |       |      | 00   | nA                   |
|                                    |  | $V_{GS} = -8\text{ V}, V_{DS} = 0\text{ V}$                                       | P-Ch      |       |      | 100  |                      |
| <b>ON CHARACTERISTICS</b> (Note 2) |  |   |           |       |      |      |                      |
| $V_{GS(th)}$                       | Gate Threshold Voltage                   | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$                                   | N-Ch      | 0.5   | 0.85 | 1.5  | V                    |
|                                    |  | $V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$                                  | P-Ch      | -0.65 | 0.52 | -1.5 |                      |
| $\Delta V_{GS(th)}/\Delta T_J$     | Gate Threshold Voltage Temp. Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25\text{ }^\circ\text{C}$         | N-Ch      |       | -2.1 |      | mV/ $^\circ\text{C}$ |
|                                    |  | $I_D = -250\text{ }\mu\text{A}$ , Referenced to $25\text{ }^\circ\text{C}$        | P-Ch      |       | 2.1  |      |                      |
| $R_{DS(on)}$                       | Static Drain-Source On-Resistance        | $V_{GS} = 4.5\text{ V}, I_D = 0.22\text{ A}$<br>$T_J = 125\text{ }^\circ\text{C}$ | N-Ch      |       | 2.5  | 4    | $\Omega$             |
|                                    |  |   |           |       | 5.3  | 7    |                      |
|                                    |  | $V_{GS} = 2.7\text{ V}, I_D = 0.19\text{ A}$<br>$T_J = 125\text{ }^\circ\text{C}$ | N-Ch      |       | 3.7  | 5    |                      |
|                                    |  |   | P-Ch      |       | 0.85 | 1.1  |                      |
| $I_{D(on)}$                        | On-State Drain Current                   | $V_{GS} = 4.5\text{ V}, V_{DS} = 5\text{ V}$                                      | N-Ch      | 0.22  |      |      | A                    |
|                                    |  | $V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$                                    | P-Ch      | -0.41 |      |      |                      |
| $g_{FS}$                           | Forward Transconductance                 | $V_{GS} = 5\text{ V}, I_D = 0.22\text{ A}$  | N-Ch      |       | 0.2  |      | S                    |
|                                    |  | $V_{GS} = -5\text{ V}, I_D = 0.5\text{ A}$  | P-Ch      |       | 0.9  |      |                      |
| <b>DYNAMIC CHARACTERISTICS</b>     |  |   |           |       |      |      |                      |
| $C_{iss}$                          | Input Capacitance                        | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$              | N-Channel |       | 9.5  |      | pF                   |
|                                    |  |   |           |       | 62   |      |                      |
| $C_{oss}$                          | Output Capacitance                       | $f = 1.0\text{ MHz}$  | N-Channel |       | 6    |      |                      |
|                                    |  |   | P-Channel |       | 34   |      |                      |
| $C_{rss}$                          | Reverse Transfer Capacitance             | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$             | N-Ch      |       | 1.3  |      |                      |
|                                    |  |   | P-Ch      |       | 10   |      |                      |

## Electrical Characteristics (continued)

### SWITCHING CHARACTERISTICS (Note 2)

| Symbol       | Parameter             | Conditions  | Type | Min | Typ  | Max | Units |
|--------------|-----------------------|---|------|-----|------|-----|-------|
| $t_{D(on)}$  | Turn - On Delay Time  | N-Channel<br>$V_{DD} = 5\text{ V}, I_D = 0.5\text{ A},$                   | N-Ch |     | 5    | 10  | nS    |
|              |                       |   | P-Ch |     | 7    | 15  |       |
| $t_r$        | Turn - On Rise Time   | $V_{GS} = 4.5\text{ V}, R_{GEN} = 50\ \Omega$                             | N-Ch |     | 4.5  | 10  | nS    |
|              |                       |   | P-Ch |     | 8    | 16  |       |
| $t_{D(off)}$ | Turn - Off Delay Time | P-Channel<br>$V_{DD} = -5\text{ V}, I_D = -0.5\text{ A},$                 | N-Ch |     | 4    | 8   | nS    |
|              |                       |   | P-Ch |     | 55   | 80  |       |
| $t_f$        | Turn - Off Fall Time  | $V_{GS} = -4.5\text{ V}, R_{GEN} = 50\ \Omega$                            | N-Ch |     | 3.2  | 7   | nS    |
|              |                       |   | P-Ch |     | 35   | 60  |       |
| $Q_g$        | Total Gate Charge     | N-Channel<br>$V_{DS} = 5\text{ V}, I_D = 0.22\text{ A},$                  | N-Ch |     | 0.29 | 0.4 | nC    |
|              |                       |   | P-Ch |     | 1    | 1.5 |       |
| $Q_{gs}$     | Gate-Source Charge    | $V_{GS} = 4.5\text{ V}$   | N-Ch |     | 0.12 |     | nC    |
|              |                       |   | P-Ch |     | 0.31 |     |       |
| $Q_{gd}$     | Gate-Drain Charge     | $V_{DS} = -5\text{ V}, I_D = -0.41\text{ A},$<br>$V_{GS} = -4.5\text{ V}$ | N-Ch |     | 0.03 |     | nC    |
|              |                       |   | P-Ch |     | 0.29 |     |       |

### DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

|          |   |  |      |  |       |      |   |
|----------|---|--|------|--|-------|------|---|
| $I_S$    | Maximum Continuous Drain-Source Diode Forward Current | $V_{GS} = 0\text{ V}, I_S = 0.5\text{ A}$ (Note 2) | N-Ch |  | 0.25  |      | A |
|          |   |  | P-Ch |  |       | 0.25 |   |
| $V_{SD}$ | Drain-Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_S = 0.5\text{ A}$ (Note 2) | N-Ch |  | 0.8   | 1.2  | V |
|          |   |  | P-Ch |  | -0.85 | -1.2 |   |

Notes:

- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistances, 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.  $R_{\theta JA}$  is  $5^\circ\text{C/W}$  on minimum mounting pad on FR-4 board in still air.
- Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty  $\leq 2.0\%$ .

## Typical Electrical Characteristics: N-Channel

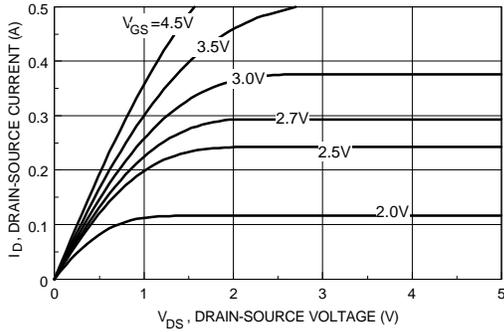


Figure 1. On-Region Characteristics.

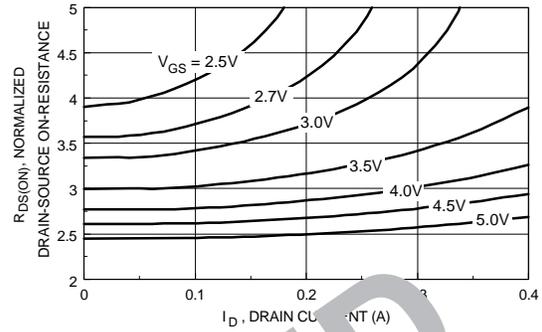


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

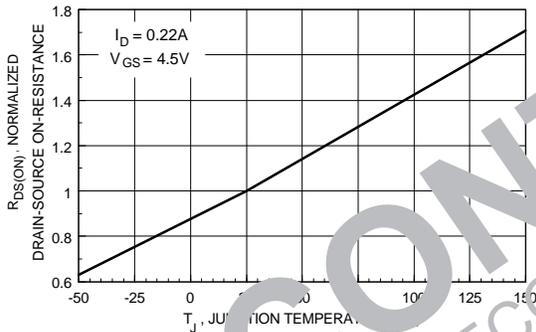


Figure 3. On-Resistance Variation with Temperature.

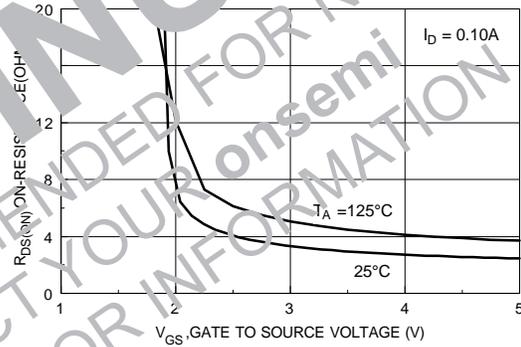


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

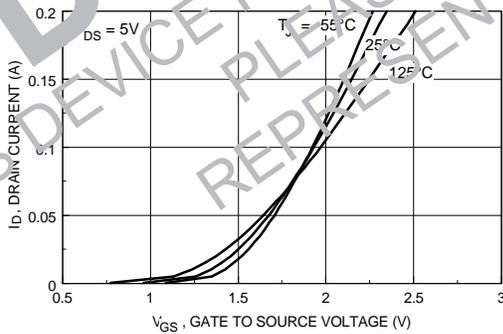


Figure 5. Transfer Characteristics.

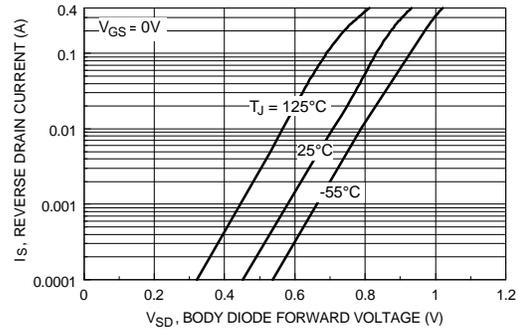


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Electrical Characteristics: N-Channel (continued)

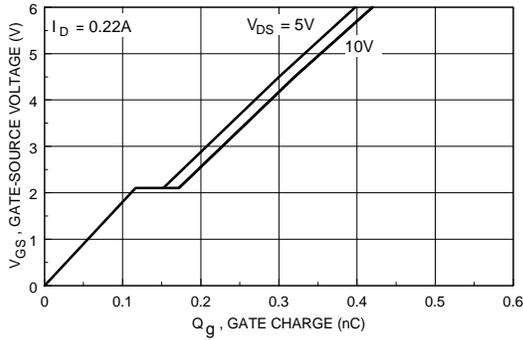


Figure 7. Gate Charge Characteristics.

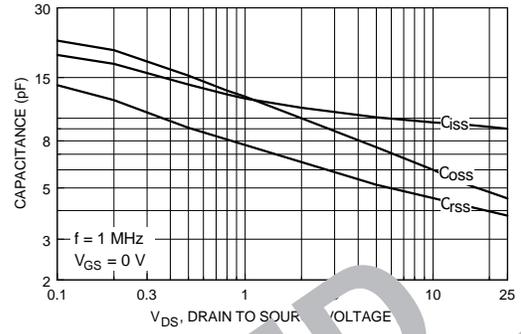


Figure 8. Capacitance Characteristics.

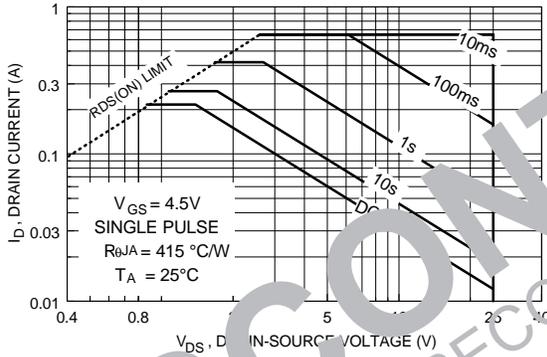


Figure 9. Maximum Safe Operating Area.

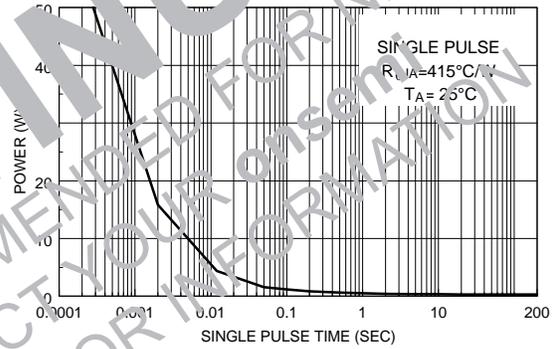


Figure 10. Single Pulse Maximum Power Dissipation.

## Typical Electrical Characteristics: P-Channel

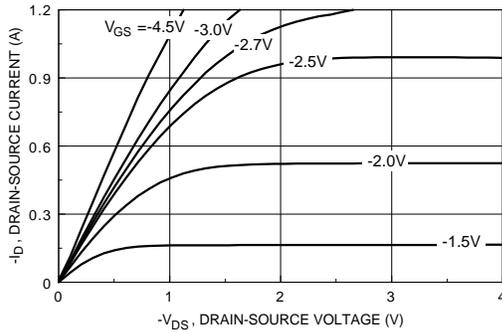


Figure 11. On-Region Characteristics.

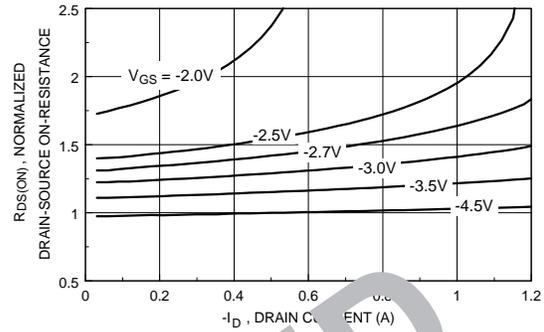


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

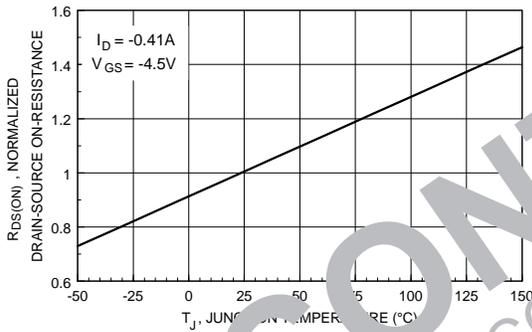


Figure 13. On-Resistance Variation with Temperature.

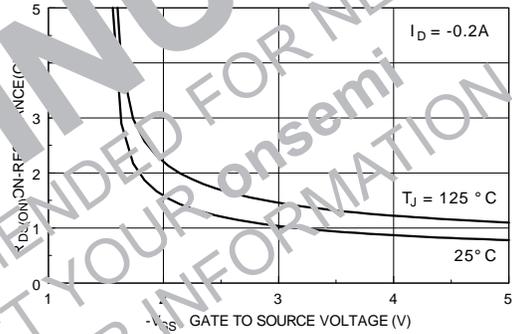


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

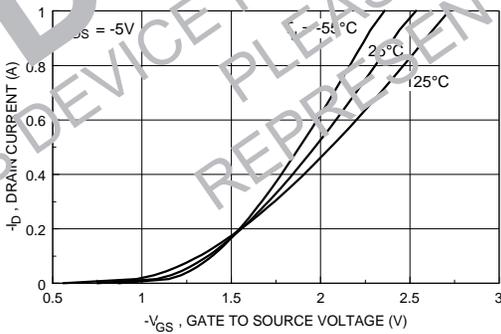


Figure 15. Transfer Characteristics.

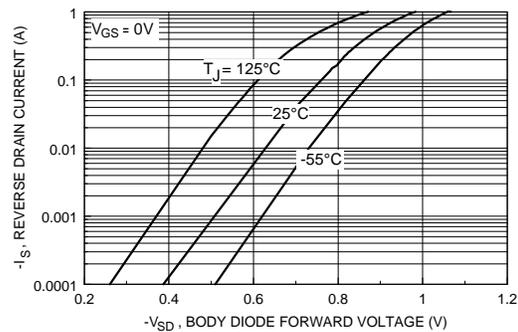


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Electrical Characteristics: P-Channel (continued)

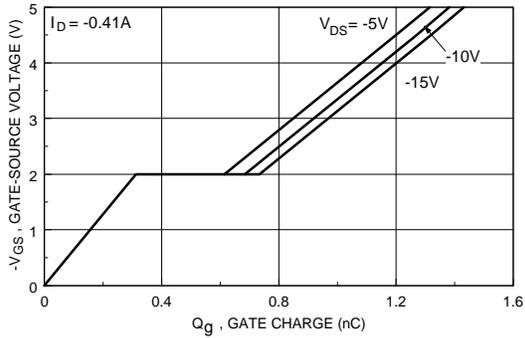


Figure 17. Gate Charge Characteristics.

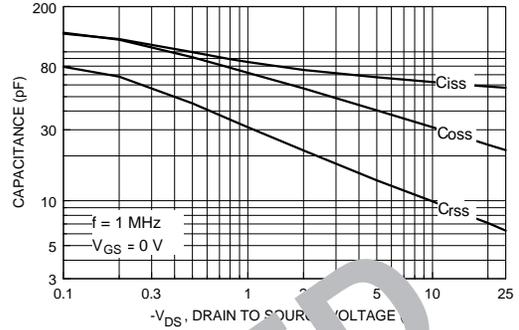


Figure 18. Capacitance Characteristics.

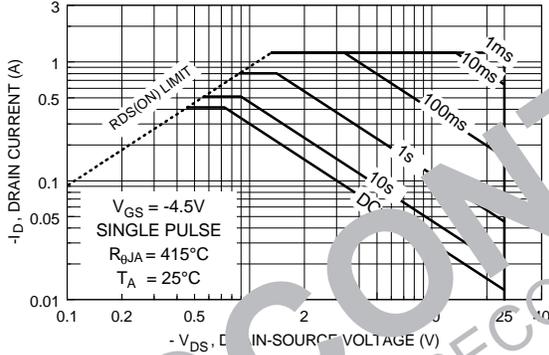


Figure 19. Maximum Safe Operating Area.

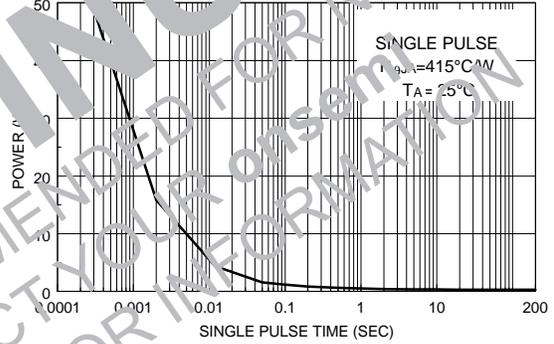
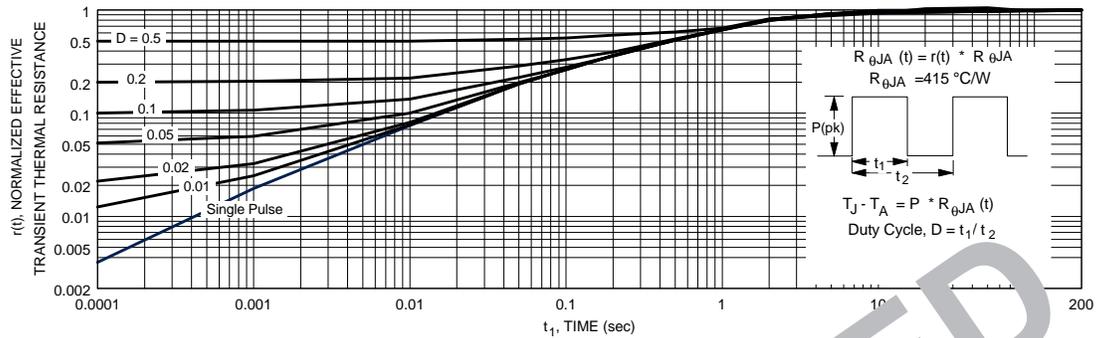


Figure 20. Single Pulse Maximum Power Dissipation.

## Typical Thermal Characteristics: N & P-Channel (continued)



**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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