

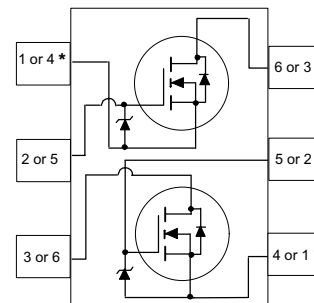
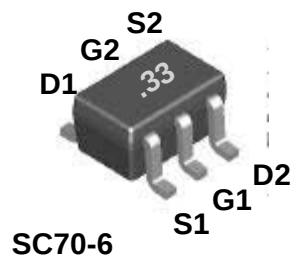
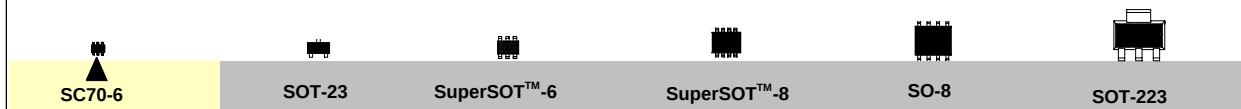
## FDG6313N Dual N-Channel, Digital FET

### General Description

These dual N-Channel logic level enhancement mode field effect transistors are produced using Fairchild'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.

### Features

- 25 V, 0.50 A continuous, 1.5 A peak.  
 $R_{DS(ON)} = 0.45 \Omega @ V_{GS} = 4.5 \text{ V}$ ,  
 $R_{DS(ON)} = 0.60 \Omega @ V_{GS} = 2.7 \text{ V}$ .
- Very low level gate drive requirements allowing direct operation in 3 V circuits ( $V_{GS(th)} < 1.5 \text{ V}$ ).
- Gate-Source Zener for ESD ruggedness (>6kV Human Body Model).
- Compact industry standard SC70-6 surface mount package.



\* The pinouts are symmetrical; pin 1 and 4 are interchangeable.  
Units inside the carrier can be of either orientation and will not affect the functionality of the device.

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

| Symbol         | Parameter                                                                                 | FDG6313N    | Units            |
|----------------|-------------------------------------------------------------------------------------------|-------------|------------------|
| $V_{DSS}$      | Drain-Source Voltage                                                                      | 25          | V                |
| $V_{GSS}$      | Gate-Source Voltage                                                                       | - 0.5 to +8 | V                |
| $I_D$          | Drain/Output Current<br>- Continuous<br>- Pulsed                                          | 0.5         | A                |
|                |                                                                                           | 1.5         |                  |
| $P_D$          | 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<br>Human Body Model (100 pF / 1500 $\Omega$ ) | 6.0         | kV               |

### THERMAL CHARACTERISTICS

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

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

| Symbol                                                 | Parameter                               | Conditions                                                                                               | Min  | Typ  | Max  | Units         |
|--------------------------------------------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| OFF CHARACTERISTICS                                    |                                         |                                                                                                          |      |      |      |               |
| $BV_{DSS}$                                             | Drain-Source Breakdown Voltage          | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                   | 25   |      |      | V             |
| $\Delta BV_{DSS}/\Delta T_J$                           | Breakdown Voltage Temp. Coefficient     | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^{\circ}\text{C}$                                      |      | 26   |      | mV/°C         |
| $I_{DSS}$                                              | Zero Gate Voltage Drain Current         | $V_{DS} = 20\text{ V}$ , $V_{GS} = 0\text{ V}$                                                           |      |      | 1    | $\mu\text{A}$ |
|                                                        |                                         | $T_J = 55^{\circ}\text{C}$                                                                               |      |      | 10   | $\mu\text{A}$ |
| $I_{GSS}$                                              | Gate - Body Leakage Current             | $V_{GS} = 8\text{ V}$ , $V_{DS} = 0\text{ V}$                                                            |      |      | 100  | nA            |
| ON CHARACTERISTICS (Note 2)                            |                                         |                                                                                                          |      |      |      |               |
| $V_{GS(th)}$                                           | Gate Threshold Voltage                  | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                                       | 0.65 | 0.8  | 1.5  | V             |
| $\Delta V_{GS(th)}/\Delta T_J$                         | Gate Threshold Voltage Temp.Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^{\circ}\text{C}$                                      |      | -2.6 |      | mV/°C         |
| $R_{DS(on)}$                                           | Static Drain-Source On-Resistance       | $V_{GS} = 4.5\text{ V}$ , $I_D = 0.5\text{ A}$                                                           |      | 0.34 | 0.45 | $\Omega$      |
|                                                        |                                         | $T_J = 125^{\circ}\text{C}$                                                                              |      | 0.55 | 0.77 |               |
|                                                        |                                         | $V_{GS} = 2.7\text{ V}$ , $I_D = 0.2\text{ A}$                                                           |      | 0.44 | 0.6  |               |
| $I_{D(on)}$                                            | On-State Drain Current                  | $V_{GS} = 2.7\text{ V}$ , $V_{DS} = 5\text{ V}$                                                          | 0.5  |      |      | A             |
| $g_{FS}$                                               | Forward Transconductance                | $V_{DS} = 5\text{ V}$ , $I_D = 0.5\text{ A}$                                                             |      | 1.45 |      | S             |
| DYNAMIC CHARACTERISTICS                                |                                         |                                                                                                          |      |      |      |               |
| $C_{iss}$                                              | Input Capacitance                       | $V_{DS} = 10\text{ V}$ , $V_{GS} = 0\text{ V}$ ,<br>$f = 1.0\text{ MHz}$                                 |      | 50   |      | pF            |
| $C_{oss}$                                              | Output Capacitance                      |                                                                                                          |      | 28   |      | pF            |
| $C_{rss}$                                              | Reverse Transfer Capacitance            |                                                                                                          |      | 9    |      | pF            |
| SWITCHING CHARACTERISTICS (Note 2)                     |                                         |                                                                                                          |      |      |      |               |
| $t_{D(on)}$                                            | Turn - On Delay Time                    | $V_{DD} = 5\text{ V}$ , $I_D = 0.5\text{ A}$ ,<br>$V_{GS} = 4.5\text{ V}$ , $R_{GEN} = 50\text{ }\Omega$ |      | 3    | 6    | ns            |
| $t_r$                                                  | Turn - On Rise Time                     |                                                                                                          |      | 8.5  | 18   | ns            |
| $t_{D(off)}$                                           | Turn - Off Delay Time                   |                                                                                                          |      | 17   | 30   | ns            |
| $t_f$                                                  | Turn - Off Fall Time                    |                                                                                                          |      | 13   | 25   | ns            |
| $Q_g$                                                  | Total Gate Charge                       | $V_{DS} = 5\text{ V}$ , $I_D = 0.5\text{ A}$ ,<br>$V_{GS} = 4.5\text{ V}$                                |      | 1.64 | 2.3  | nC            |
| $Q_{gs}$                                               | Gate-Source Charge                      |                                                                                                          |      | 0.38 |      | nC            |
| $Q_{gd}$                                               | Gate-Drain Charge                       |                                                                                                          |      | 0.45 |      | nC            |
| DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS |                                         |                                                                                                          |      |      |      |               |
| $I_S$                                                  | Maximum Continuous Source Current       |                                                                                                          |      |      | 0.25 | A             |
| $V_{SD}$                                               | Drain-Source Diode Forward Voltage      | $V_{GS} = 0\text{ V}$ , $I_S = 0.25\text{ A}$ (Note 2)                                                   |      | 0.8  | 1.2  | V             |

Notes:

- $R_{\theta JA}$  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.  $R_{\theta JA} = 415^{\circ}\text{C/W}$  on minimum pad mounting on FR-4 board in still air.
- Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

## Typical Electrical Characteristics

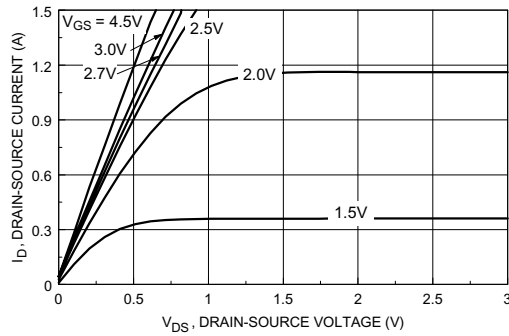


Figure 1. On-Region Characteristics.

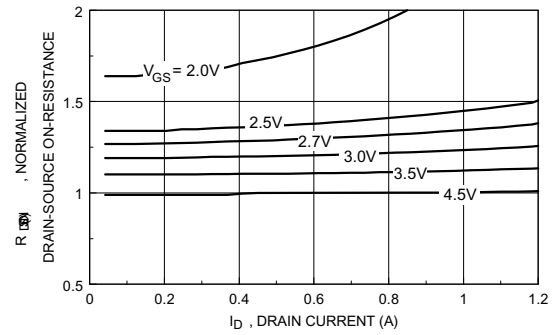


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

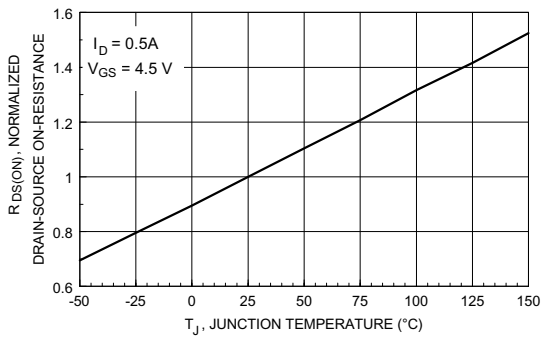


Figure 3. On-Resistance Variation with Temperature.

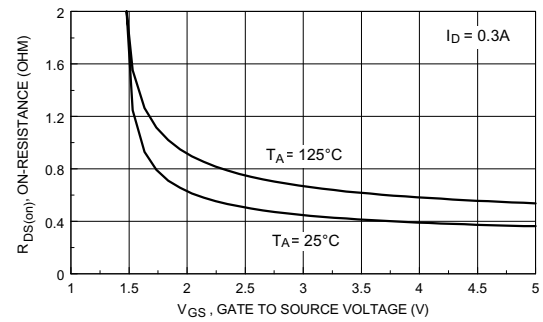


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

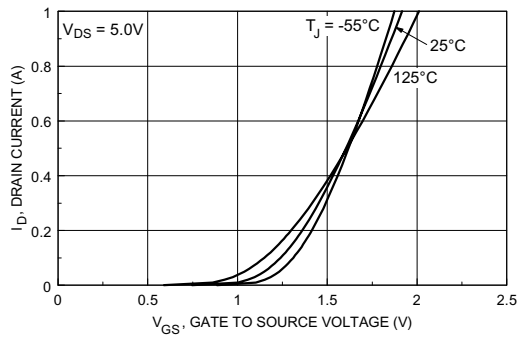


Figure 5. Transfer Characteristics.

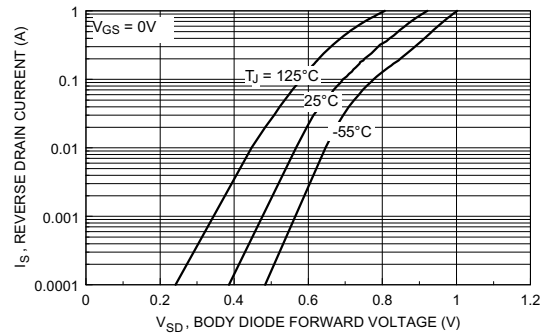


Figure 6 . Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Electrical Characteristics (continued)

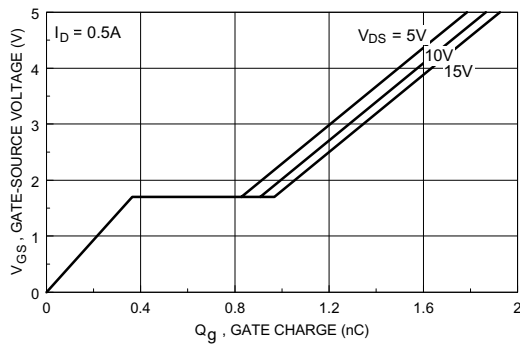


Figure 7. Gate Charge Characteristics.

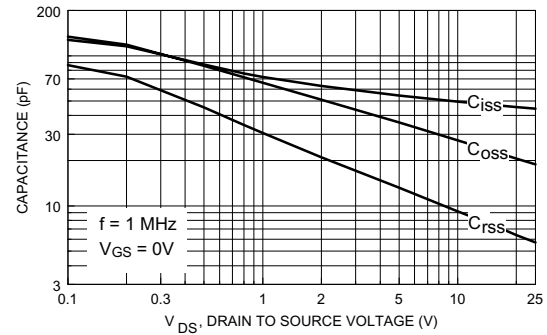


Figure 8. Capacitance Characteristics.

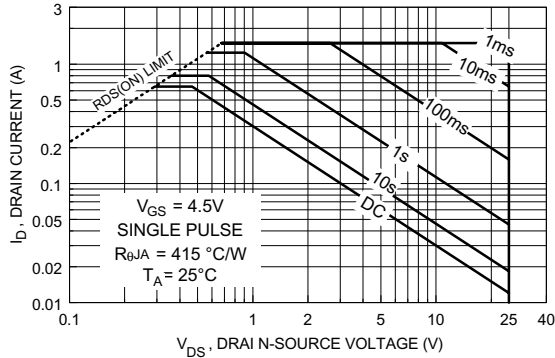


Figure 9. Maximum Safe Operating Area.

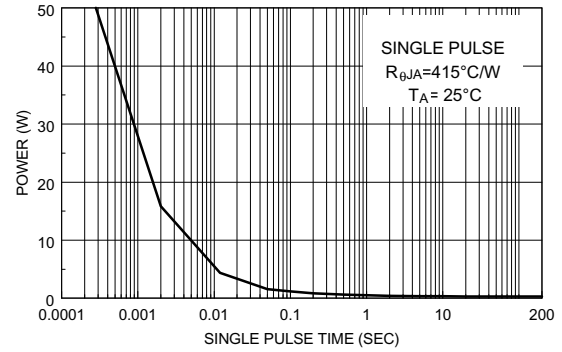


Figure 10. Single Pulse Maximum Power Dissipation.

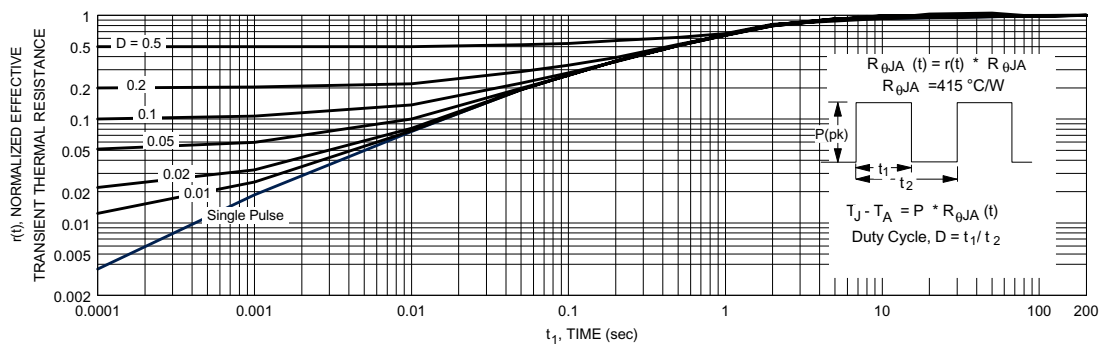


Figure 11. Transient Thermal Response Curve.

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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