

## FDP603AL / FDB603AL

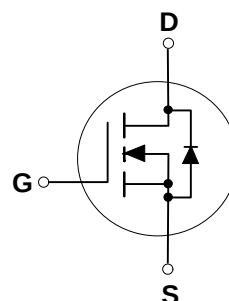
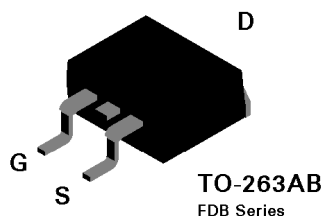
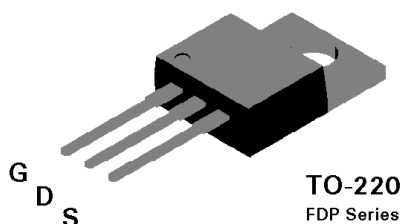
### N-Channel Logic Level Enhancement Mode Field Effect Transistor

#### General Description

These N-Channel logic level enhancement mode power 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. These devices are particularly suited for low voltage applications such as DC/DC converters and high efficiency switching circuits where fast switching, low in-line power loss, and resistance to transients are needed.

#### Features

- 33 A, 30 V.  $R_{DS(ON)} = 0.022 \Omega @ V_{GS}=10 \text{ V}$   
 $R_{DS(ON)} = 0.036 \Omega @ V_{GS}=4.5 \text{ V}$ .
- Critical DC electrical parameters specified at elevated temperature.
- Rugged internal source-drain diode can eliminate the need for an external Zener diode transient suppressor.
- High density cell design for extremely low  $R_{DS(ON)}$ .
- 175°C maximum junction temperature rating.



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

| Symbol         | Parameter                                                                     | FDP603AL   | FDB603AL   | Units               |
|----------------|-------------------------------------------------------------------------------|------------|------------|---------------------|
| $V_{DS}$       | Drain-Source Voltage                                                          | 30         | 30         | V                   |
| $V_{GS}$       | Gate-Source Voltage - Continuous                                              | $\pm 20$   | $\pm 20$   | V                   |
| $I_D$          | Drain Current - Continuous                                                    | 33         | 33         | A                   |
|                | - Pulsed (Note 1)                                                             | 100        | 100        |                     |
| $P_D$          | Total Power Dissipation @ $T_c = 25^\circ\text{C}$                            | 50         | 50         | W                   |
|                | Derate above $25^\circ\text{C}$                                               | 0.33       | 0.33       | W/ $^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range                                       | -65 to 175 | -65 to 175 | $^\circ\text{C}$    |
| $T_L$          | Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds | 275        | 275        | $^\circ\text{C}$    |

#### THERMAL CHARACTERISTICS

|                 |                                         |      |                    |
|-----------------|-----------------------------------------|------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | 3    | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 62.5 | $^\circ\text{C/W}$ |

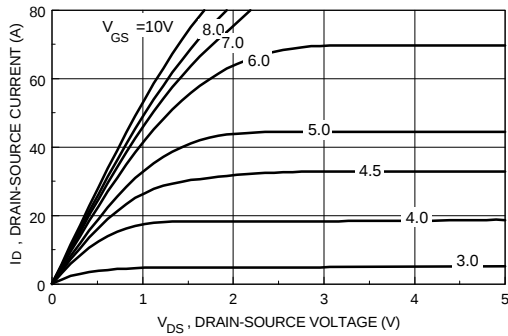
**Electrical Characteristics**  $T_c = 25^\circ\text{C}$  unless otherwise noted)

| Symbol                                  | Parameter                                             | Conditions                                                                                            | Min | Typ   | Max   | Unit                 |
|-----------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-----|-------|-------|----------------------|
| DRAIN-SOURCE AVALANCHE RATINGS (Note 1) |                                                       |                                                                                                       |     |       |       |                      |
| $W_{DSS}$                               | Single Pulse Drain-Source Avalanche Energy            | $V_{DD} = 15\text{ V}$ , $I_D = 12\text{ A}$                                                          |     |       | 100   | mJ                   |
| $I_{AR}$                                | Maximum Drain-Source Avalanche Current                |                                                                                                       |     |       | 12    | A                    |
| OFF CHARACTERISTICS                     |                                                       |                                                                                                       |     |       |       |                      |
| $BV_{DSS}$                              | Drain-Source Breakdown Voltage                        | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                | 30  |       |       | V                    |
| $\Delta BV_{DSS}/\Delta T_J$            | Breakdown Voltage Temp. Coefficient                   | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25\text{ }^\circ\text{C}$                             |     | 32    |       | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                               | Zero Gate Voltage Drain Current                       | $V_{DS} = 24\text{ V}$ , $V_{GS} = 0\text{ V}$                                                        |     |       | 10    | $\mu\text{A}$        |
| $I_{GSSF}$                              | Gate - Body Leakage, Forward                          | $V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$                                                        |     |       | 100   | nA                   |
| $I_{GSSR}$                              | Gate - Body Leakage, Reverse                          | $V_{GS} = -20\text{ V}$ , $V_{DS} = 0\text{ V}$                                                       |     |       | -100  | nA                   |
| ON CHARACTERISTICS (Note 1)             |                                                       |                                                                                                       |     |       |       |                      |
| $V_{GS(th)}$                            | Gate Threshold Voltage                                | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                                    | 1   | 1.8   | 3     | V                    |
| $\Delta V_{GS(th)}/\Delta T_J$          | Gate Threshold Voltage Temp.Coefficient               | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25\text{ }^\circ\text{C}$                             |     | -4.5  |       | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$                            | Static Drain-Source On-Resistance                     | $V_{GS} = 10\text{ V}$ , $I_D = 25\text{ A}$                                                          |     | 0.018 | 0.022 | $\Omega$             |
|                                         |                                                       | $T_J = 125\text{ }^\circ\text{C}$                                                                     |     | 0.026 | 0.035 |                      |
|                                         |                                                       | $V_{GS} = 4.5\text{ V}$ , $I_D = 10\text{ A}$                                                         |     | 0.03  | 0.036 |                      |
| $I_{D(on)}$                             | On-State Drain Current                                | $V_{GS} = 10\text{ V}$ , $V_{DS} = 10\text{ V}$                                                       | 60  |       |       | A                    |
| $I_{D(on)}$                             | On-State Drain Current                                | $V_{GS} = 4.5\text{ V}$ , $V_{DS} = 10\text{ V}$                                                      | 15  |       |       | A                    |
| $g_{FS}$                                | Forward Transconductance                              | $V_{DS} = 10\text{ V}$ , $I_D = 25\text{ A}$                                                          |     | 24    |       | S                    |
| DYNAMIC CHARACTERISTICS                 |                                                       |                                                                                                       |     |       |       |                      |
| $C_{iss}$                               | Input Capacitance                                     | $V_{DS} = 15\text{ V}$ , $V_{GS} = 0\text{ V}$ ,<br>$f = 1.0\text{ MHz}$                              |     | 670   |       | pF                   |
| $C_{oss}$                               | Output Capacitance                                    |                                                                                                       |     | 345   |       | pF                   |
| $C_{rss}$                               | Reverse Transfer Capacitance                          |                                                                                                       |     | 95    |       | pF                   |
| SWITCHING CHARACTERISTICS (Note 1)      |                                                       |                                                                                                       |     |       |       |                      |
| $t_{D(on)}$                             | Turn - On Delay Time                                  | $V_{DD} = 15\text{ V}$ , $I_D = 25\text{ A}$<br>$V_{GS} = 10\text{ V}$ , $R_{GEN} = 24\text{ }\Omega$ |     | 8     | 16    | nS                   |
| $t_r$                                   | Turn - On Rise Time                                   |                                                                                                       |     | 102   | 140   | nS                   |
| $t_{D(off)}$                            | Turn - Off Delay Time                                 |                                                                                                       |     | 20    | 36    | nS                   |
| $t_f$                                   | Turn - Off Fall Time                                  |                                                                                                       |     | 80    | 115   | nS                   |
| $Q_{gi}$                                | Total Gate Charge                                     | $V_{DS} = 10\text{ V}$<br>$I_D = 25\text{ A}$ , $V_{GS} = 10\text{ V}$                                |     | 19    | 26    | nC                   |
| $Q_{gis}$                               | Gate-Source Charge                                    |                                                                                                       |     | 3.5   |       | nC                   |
| $Q_{gfd}$                               | Gate-Drain Charge                                     |                                                                                                       |     | 5.5   |       | nC                   |
| DRAIN-SOURCE DIODE CHARACTERISTICS      |                                                       |                                                                                                       |     |       |       |                      |
| $I_S$                                   | Maximum Continuous Drain-Source Diode Forward Current |                                                                                                       |     |       | 25    | A                    |
| $V_{SD}$                                | Drain-Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}$ , $I_S = 25\text{ A}$ (Note 1)                                                  |     | 1     | 1.3   | V                    |
|                                         |                                                       | $T_J = 125^\circ\text{C}$                                                                             |     | 0.85  | 1.1   |                      |

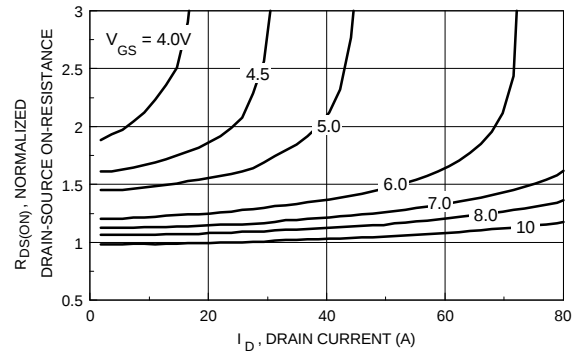
Note

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

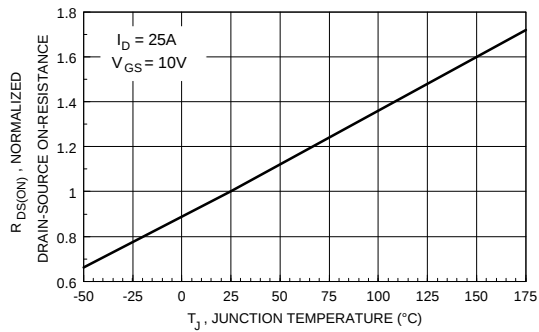
## Typical Electrical Characteristics



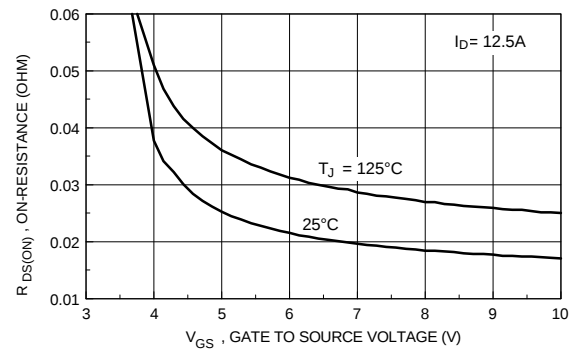
**Figure 1. On-Region Characteristics.**



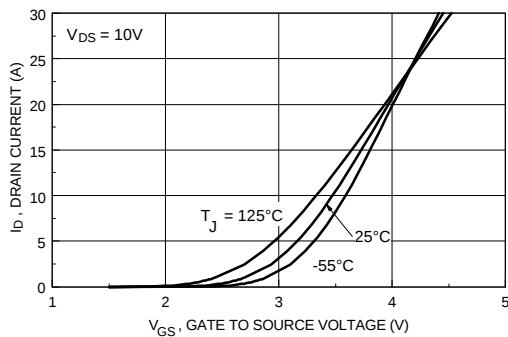
**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.**



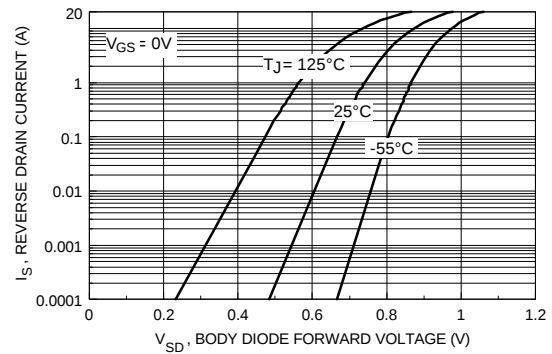
**Figure 3. On-Resistance Variation with Temperature.**



**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)

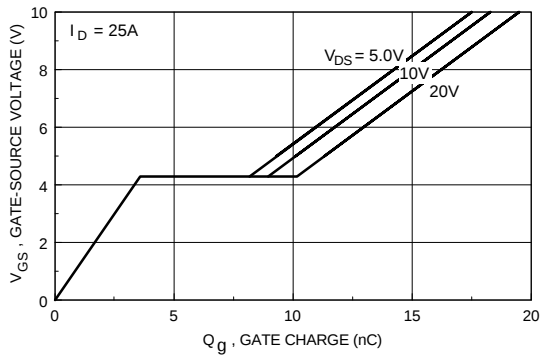


Figure 7. Gate Charge Characteristics.

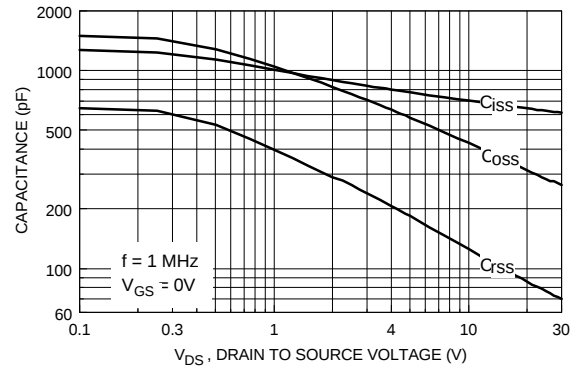


Figure 8. Capacitance Characteristics.

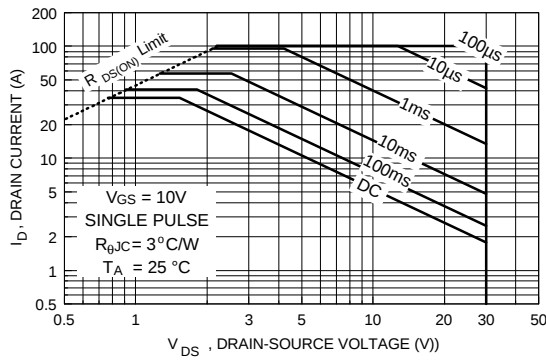


Figure 9. Maximum Safe Operating Area.

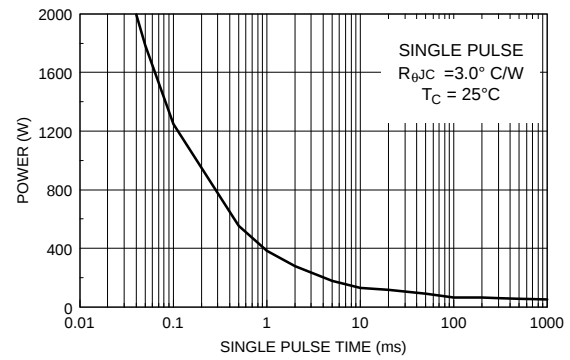


Figure 10. Single Pulse Maximum Power Dissipation.

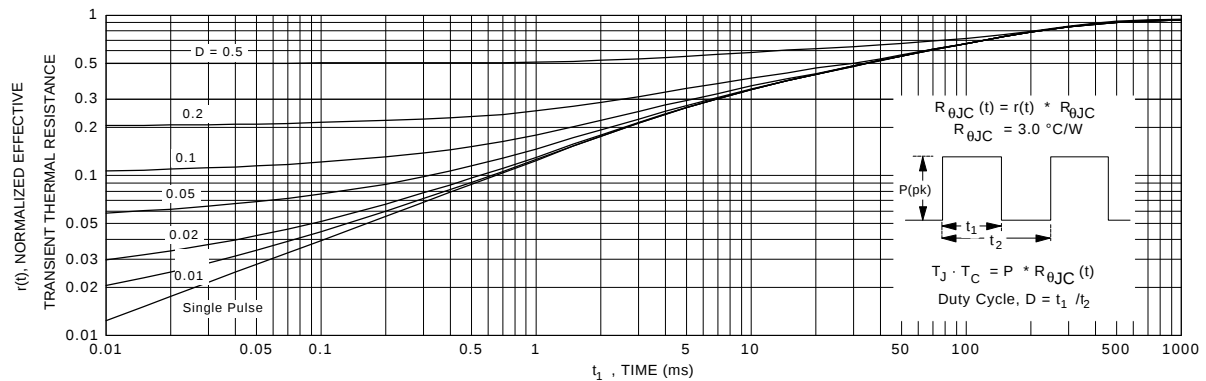


Figure 11. Transient Thermal Response Curve.

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