

FDP6670AL/FDB6670AL

N-Channel Logic Level PowerTrench[®] MOSFET

General Description

This N-Channel Logic Level MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

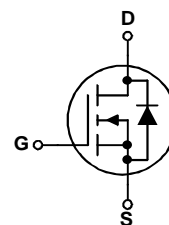
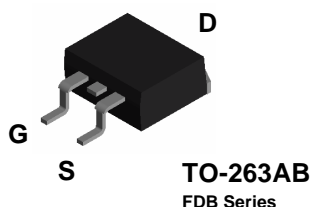
These MOSFETs feature faster switching and lower gate charge than other MOSFETs with comparable $R_{DS(ON)}$ specifications.

The result is a MOSFET that is easy and safer to drive (even at very high frequencies), and DC/DC power supply designs with higher overall efficiency.

It has been optimized for low gate charge, low $R_{DS(ON)}$ and fast switching speed.

Features

- 80 A, 30 V $R_{DS(ON)} = 6.5 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$
 $R_{DS(ON)} = 8.5 \text{ m}\Omega @ V_{GS} = 4.5 \text{ V}$
- Critical DC electrical parameters specified at elevated temperature
- High performance trench technology for extremely low $R_{DS(ON)}$
- 175°C maximum junction temperature rating



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

| Symbol | Parameter | Ratings | Units |
|----------------|---|-------------|------------------|
| V_{DSS} | Drain-Source Voltage | 30 | V |
| V_{GSS} | Gate-Source Voltage | ± 20 | V |
| I_D | Drain Current – Continuous (Note 1) | 80 | A |
| | – Pulsed (Note 1) | 240 | |
| P_D | Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C | 68 | W |
| | | 0.45 | |
| T_J, T_{STG} | Operating and Storage Junction Temperature Range | -65 to +175 | $^\circ\text{C}$ |

Thermal Characteristics

| | | | |
|-----------------|---|------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | 2.2 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 62.5 | $^\circ\text{C/W}$ |

Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape width | Quantity |
|----------------|-----------|-----------|------------|-----------|
| FDB6670AL | FDB6670AL | 13" | 24mm | 800 units |
| FDP6670AL | FDP6670AL | Tube | n/a | 45 |

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

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

Drain-Source Avalanche Ratings (Note 1)

| | | | | | | |
|-----------|--|---|--|--|-----|----|
| W_{DSS} | Single Pulse Drain-Source Avalanche Energy | $V_{DD} = 15\text{ V}, I_D = 80\text{ A}$ | | | 114 | mJ |
| I_{AR} | Maximum Drain-Source Avalanche Current | | | | 80 | A |

Off Characteristics

| | | | | | | |
|--------------------------------------|---|---|----|----|-----------|----------------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$ | 30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$, Referenced to 25°C | | 24 | | mV/ $^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$ | | | 1 | μA |
| I_{GSS} | Gate-Body Leakage | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$ | | | ± 100 | nA |

On Characteristics (Note 2)

| | | | | | | |
|--|--|---|----|-------------------|-------------------|----------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$ | 1 | 1.9 | 3 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$, Referenced to 25°C | | -5 | | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}, I_D = 40\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 37\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 40\text{ A}, T_J = 125^\circ\text{C}$ | | 5.2 6.5 7.2 | 6.5 8.5 9.7 | m Ω |
| $I_{D(on)}$ | On-State Drain Current | $V_{GS} = 10\text{ V}, V_{DS} = 10\text{ V}$ | 80 | | | A |
| g_{FS} | Forward Transconductance | $V_{DS} = 10\text{ V}, I_D = 40\text{ A}$ | | 115 | | S |

Dynamic Characteristics

| | | | | | | |
|-----------|------------------------------|--|--|------|--|----------|
| C_{iss} | Input Capacitance | $V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$ | | 2440 | | pF |
| C_{oss} | Output Capacitance | | | 580 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 250 | | pF |
| R_G | Gate Resistance | $V_{GS} = 15\text{ mV}, f = 1.0\text{ MHz}$ | | 1.4 | | Ω |

Switching Characteristics (Note 2)

| | | | | | | |
|--------------|---------------------|--|--|----|----|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 10\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$ | | 13 | 23 | ns |
| t_r | Turn-On Rise Time | | | 13 | 23 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 42 | 68 | ns |
| t_f | Turn-Off Fall Time | | | 15 | 27 | ns |
| Q_g | Total Gate Charge | $V_{DS} = 15\text{ V}, I_D = 40\text{ A},$ $V_{GS} = 5\text{ V}$ | | 24 | 33 | nC |
| Q_{gs} | Gate-Source Charge | | | 7 | | nC |
| Q_{gd} | Gate-Drain Charge | | | 9 | | nC |

Drain-Source Diode Characteristics and Maximum Ratings

| | | | | | | |
|----------|---|--|--|-----|-----|----|
| I_S | Maximum Continuous Drain-Source Diode Forward Current | | | | 80 | A |
| V_{SD} | Drain-Source Diode Forward Voltage | $V_{GS} = 0\text{ V}, I_S = 40\text{ A}$ (Note 1) | | 0.9 | 1.3 | V |
| t_{rr} | Diode Reverse Recovery Time | $I_F = 40\text{ A},$ $dI_F/dt = 100\text{ A}/\mu\text{s}$ | | 34 | | nS |
| Q_{rr} | Diode Reverse Recovery Charge | | | 24 | | nC |

Notes:

1. Pulse Test: Pulse Width < 300 μs , Duty Cycle < 2.0%

Typical Characteristics

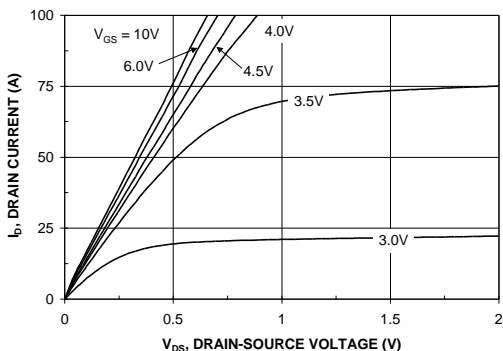


Figure 1. On-Region Characteristics.

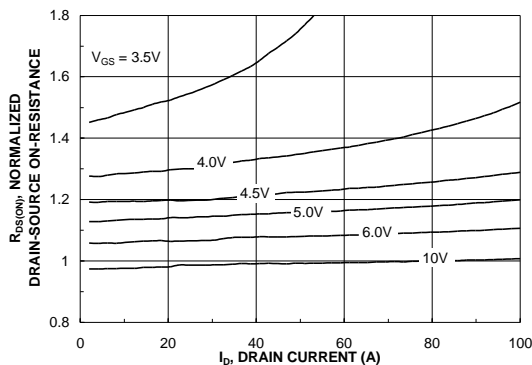


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

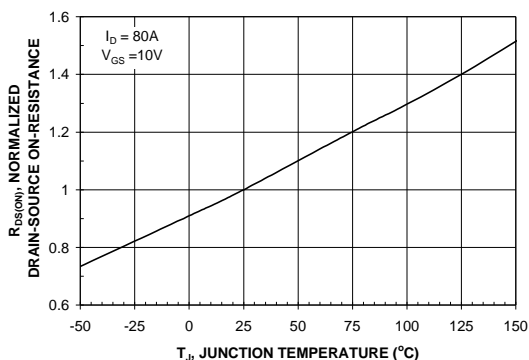


Figure 3. On-Resistance Variation with Temperature.

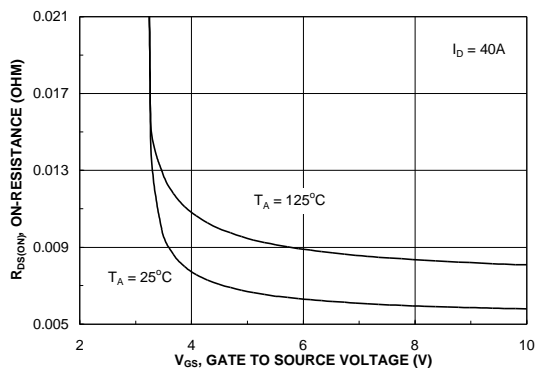


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

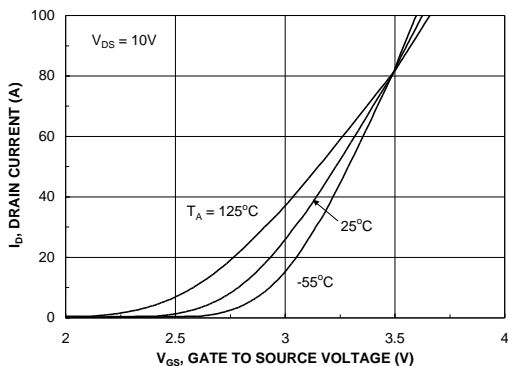


Figure 5. Transfer Characteristics.

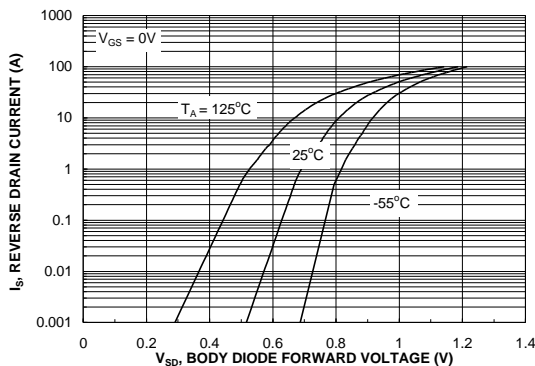


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

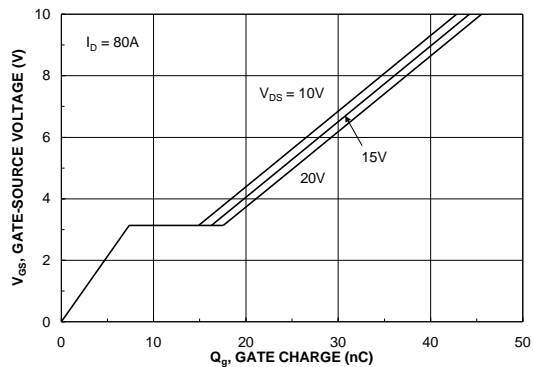


Figure 7. Gate Charge Characteristics.

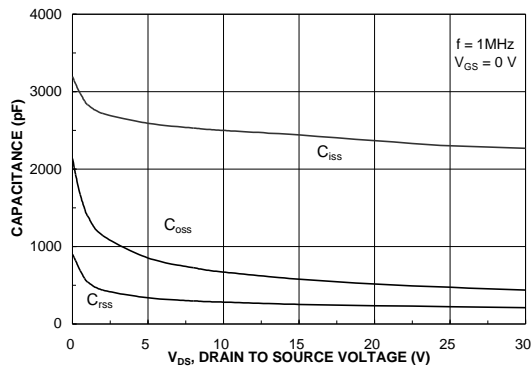


Figure 8. Capacitance Characteristics.

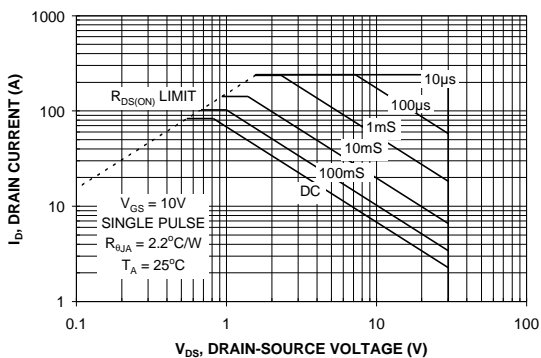


Figure 9. Maximum Safe Operating Area.

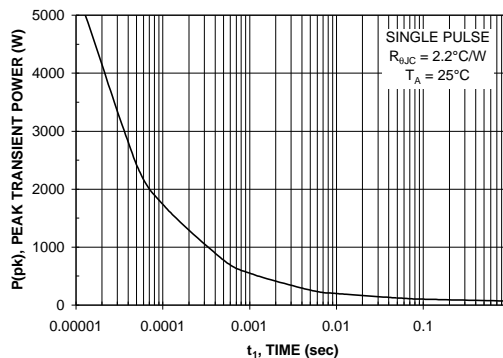


Figure 10. Single Pulse Maximum Power Dissipation.

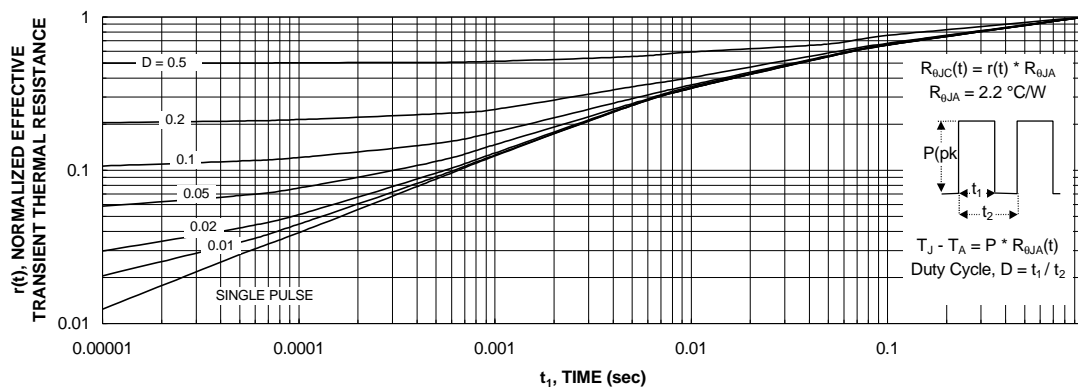


Figure 11. Transient Thermal Response Curve.

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Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: org@eplast1.ru

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.