

FDP5690/FDB5690

60V N-Channel PowerTrench™ MOSFET

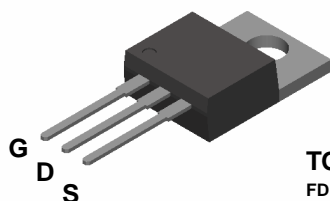
General Description

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

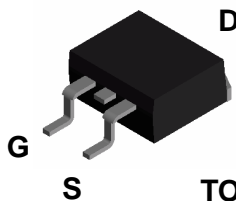
These MOSFETs feature faster switching and lower gate charge than other MOSFETs with comparable $R_{DS(on)}$ specifications resulting in DC/DC power supply designs with higher overall efficiency.

Features

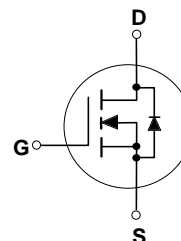
- 32 A, 60 V. $R_{DS(on)} = 0.027 \Omega @ V_{GS} = 10 \text{ V}$
 $R_{DS(on)} = 0.032 \Omega @ V_{GS} = 6 \text{ V}$.
- Critical DC electrical parameters specified at elevated temperature.
- Rugged internal source-drain diode can eliminate the need for an external Zener diode transient suppressor.
- High performance trench technology for extremely low $R_{DS(on)}$.
- 175°C maximum junction temperature rating.



TO-220
FDP Series



TO-263AB
FDB Series



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

| Symbol | Parameter | FDP5690 | FDB5690 | Units |
|----------------|--|-------------|---------|---------------------|
| V_{DSS} | Drain-Source Voltage | 60 | | V |
| V_{GSS} | Gate-Source Voltage | ± 20 | | V |
| I_D | Maximum Drain Current - Continuous - Pulsed | 32 | | A |
| | | 100 | | |
| P_D | Total Power Dissipation @ $T_C = 25^\circ\text{C}$ | 58 | | W |
| | Derate above 25°C | 0.4 | | W/ $^\circ\text{C}$ |
| 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 | 2.6 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 62.5 | $^\circ\text{C/W}$ |

Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape Width | Quantity |
|----------------|---------|-----------|------------|----------|
| FDB5690 | FDB5690 | 13" | 24mm | 800 |
| FDP5690 | FDP5690 | Tube | N/A | 45 |

Electrical Characteristics

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

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

Drain-Source Avalanche Ratings (Note1)

| | | | | | | |
|-----------|--|---|--|--|----|----|
| W_{DSS} | Single Pulse Drain-Source Avalanche Energy | $V_{DD} = 30\text{ V}, I_D = 32\text{ A}$ | | | 80 | mJ |
| I_{AR} | Maximum Drain-Source Avalanche Current | | | | 32 | A |

Off Characteristics

| | | | | | | |
|--------------------------------------|---|---|----|----|------|----------------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$ | 60 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$, Referenced to 25°C | | 61 | | mV/ $^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$ | | | 1 | μA |
| I_{GSSF} | Gate-Body Leakage Current, Forward | $V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$ | | | 100 | nA |
| I_{GSSR} | Gate-Body Leakage Current, Reverse | $V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$ | | | -100 | nA |

On Characteristics (Note 1)

| | | | | | | |
|--|--|---|----|-------------------------|-------------------------|----------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$ | 2 | 2.4 | 4 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$, Referenced to 25°C | | -6.4 | | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}, I_D = 16\text{ A}$, $V_{GS} = 10\text{ V}, I_D = 16\text{ A}, T_J = 125^\circ\text{C}$ $V_{GS} = 6\text{ V}, I_D = 15\text{ A}$ | | 0.021 0.042 0.024 | 0.027 0.055 0.032 | Ω |
| $I_{D(on)}$ | On-State Drain Current | $V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$ | 50 | | | A |
| g_{FS} | Forward Transconductance | $V_{DS} = 5\text{ V}, I_D = 16\text{ A}$ | | 32 | | S |

Dynamic Characteristics

| | | | | | | |
|-----------|------------------------------|---|--|------|--|----|
| C_{iss} | Input Capacitance | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$ | | 1120 | | pF |
| C_{oss} | Output Capacitance | | | 160 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 80 | | pF |

Switching Characteristics (Note 1)

| | | | | | | |
|--------------|---------------------|---|--|-----|----|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 30\text{ V}, I_D = 1\text{ A}$, $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$ | | 10 | 18 | ns |
| t_r | Turn-On Rise Time | | | 9 | 18 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 24 | 39 | ns |
| t_f | Turn-Off Fall Time | | | 10 | 18 | ns |
| Q_g | Total Gate Charge | $V_{DS} = 15\text{ V}$, $I_D = 16\text{ A}, V_{GS} = 10\text{ V}$ | | 23 | 33 | nC |
| Q_{gs} | Gate-Source Charge | | | 3.9 | | nC |
| Q_{gd} | Gate-Drain Charge | | | 6.8 | | nC |

Drain-Source Diode Characteristics and Maximum Ratings

| | | | | | | |
|----------|--|---|--|------|-----|---|
| I_S | Maximum Continuous Drain-Source Diode Forward Current (Note 1) | | | | 32 | A |
| V_{SD} | Drain-Source Diode Forward Voltage | $V_{GS} = 0\text{ V}, I_S = 16\text{ A}$ (Note 1) | | 0.92 | 1.2 | V |

Note:

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

Typical Characteristics

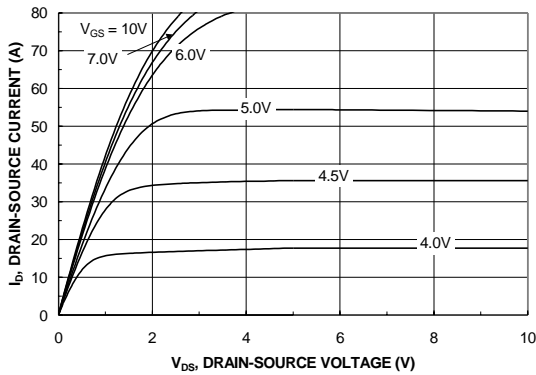


Figure 1. On-Region Characteristics.

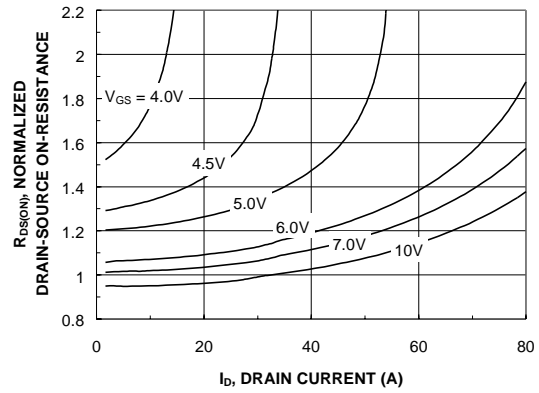


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

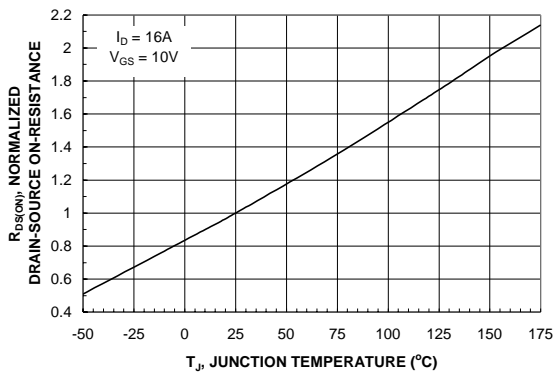


Figure 3. On-Resistance Variation with Temperature.

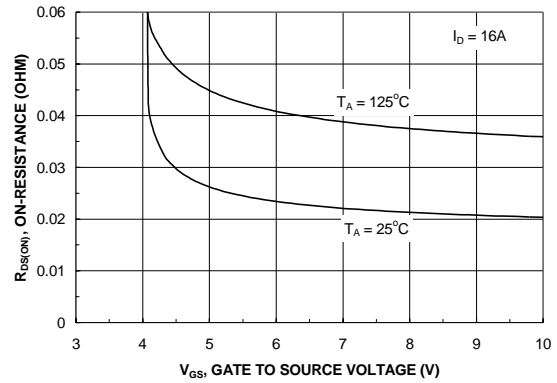


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

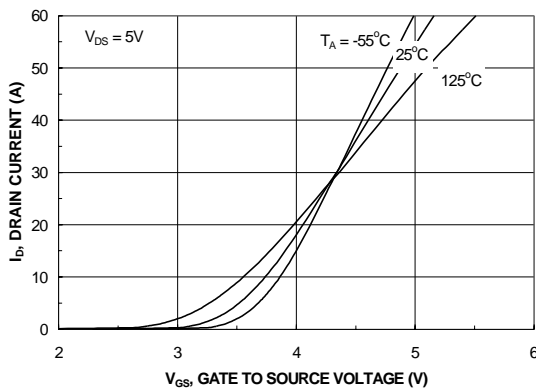


Figure 5. Transfer Characteristics.

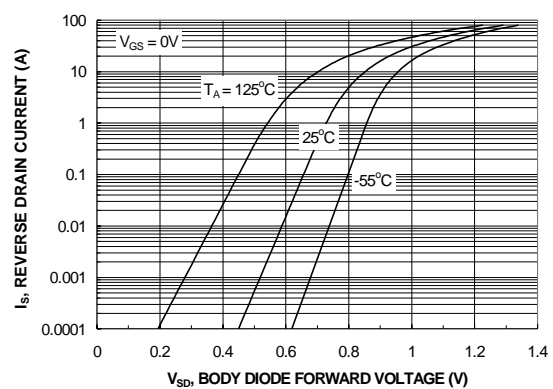


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

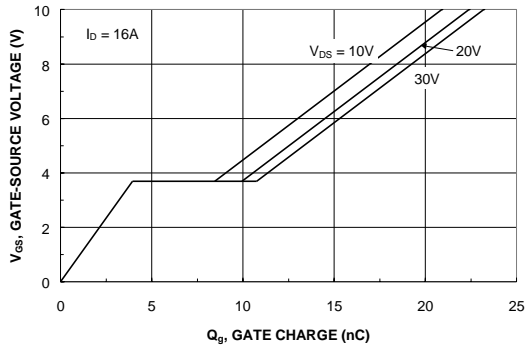


Figure 7. Gate-Charge Characteristics.

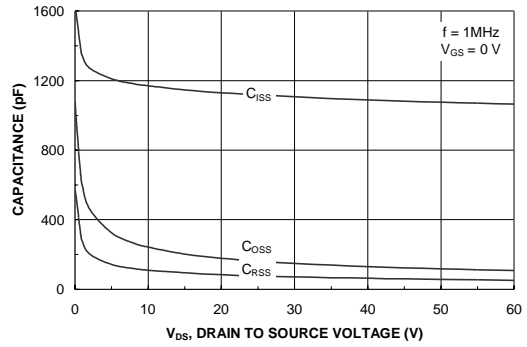


Figure 8. Capacitance Characteristics.

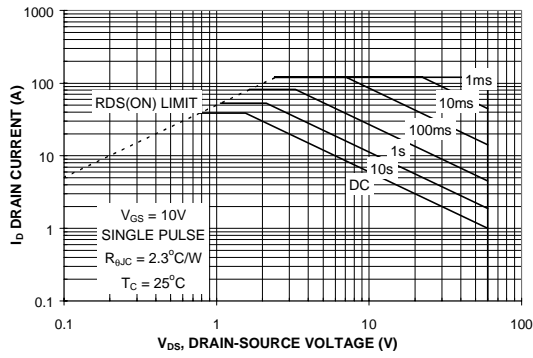


Figure 9. Maximum Safe Operating Area.

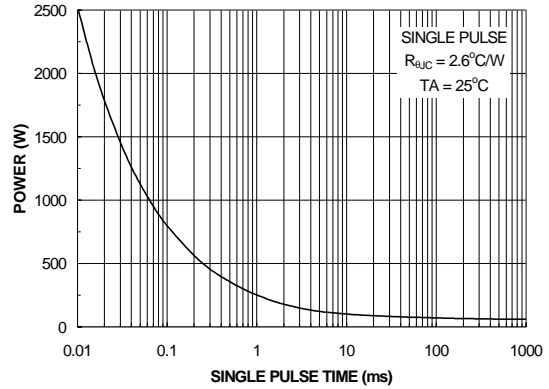


Figure 10. Single Pulse Maximum Power Dissipation.

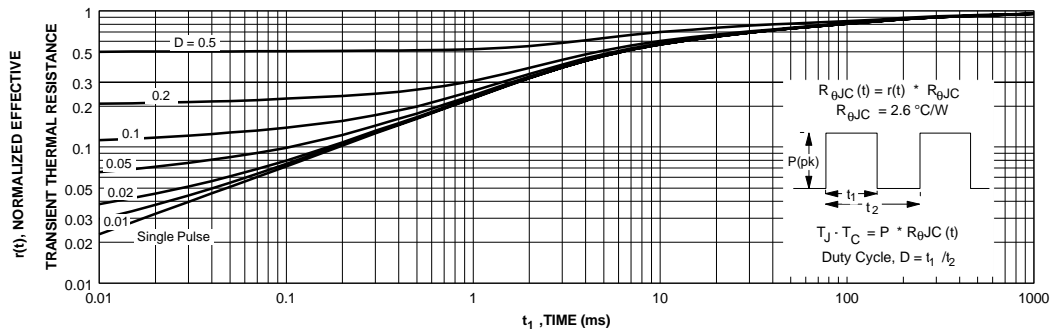


Figure 11. Transient Thermal Response Curve.

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