# NVTFS5C670NL

## MOSFET − Power, Single N-Channel

### 60 V, 6.8 mΩ, 70 A

**Features**

- Small Footprint (3.3 x 3.3 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- NVTFS5C670NLWF − Wettable Flanks Product
- AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free and are RoHS Compliant

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise noted)

| Parameter | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain−to−Source Voltage | | | $V_{DSS}$ | 60 | V |
| Gate−to−Source Voltage | | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current $R_{\theta JC}$ (Notes 1, 2, 3, 4) | Steady State | $T_C$ = 25°C | $I_D$ | 70 | A |
| | | $T_C$ = 100°C | | 49 | |
| Power Dissipation $R_{\theta JC}$ (Notes 1, 2, 3) | | $T_C$ = 25°C | $P_D$ | 63 | W |
| | | $T_C$ = 100°C | | 31 | |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1 & 3, 4) | Steady State | $T_A$ = 25°C | $I_D$ | 16 | A |
| | | $T_A$ = 100°C | | 11 | |
| Power Dissipation $R_{\theta JA}$ (Notes 1, 3) | | $T_A$ = 25°C | $P_D$ | 3.2 | W |
| | | $T_A$ = 100°C | | 1.6 | |
| Pulsed Drain Current | $T_A$ = 25°C, $t_p$ = 10 μs | | $I_{DM}$ | 440 | A |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{stg}$ | −55 to +175 | °C |
| Source Current (Body Diode) | | | $I_S$ | 68 | A |
| Single Pulse Drain−to−Source Avalanche Energy ($I_{L(pk)}$ = 3.6 A) | | | $E_{AS}$ | 166 | mJ |
| Lead Temperature for Soldering Purposes (1/8″ from case for 10 s) | | | $T_L$ | 260 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**THERMAL RESISTANCE MAXIMUM RATINGS** (Note 1)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction−to−Case − Steady State (Note 3) | $R_{\theta JC}$ | 2.4 | °C/W |
| Junction−to−Ambient − Steady State (Note 3) | $R_{\theta JA}$ | 47 | |

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Psi (Ψ) is used as required per JESD51−12 for packages in which substantially less than 100% of the heat flows to single case surface.
3. Surface−mounted on FR4 board using a 650 $mm^2$, 2 oz. Cu pad.
4. Continuous DC current rating. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

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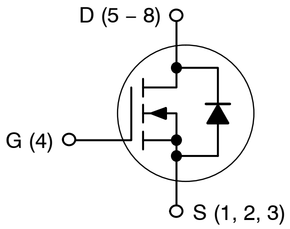
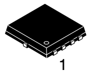
| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|---|---|---|
| 60 V | 6.8 mΩ @ 10 V | 70 A |
| | 10 mΩ @ 4.5 V | |

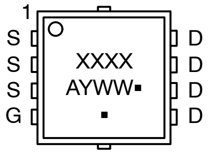
**N−Channel**





**WDFN8**
**(μ8FL)**
**CASE 511AB**

**MARKING DIAGRAM**



XXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

**ORDERING INFORMATION**

See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

**August, 2019 − Rev. 2**

## ELECTRICAL CHARACTERISTICS ($T_J$ = 25°C unless otherwise specified)

| Parameter | Symbol | Test Condition | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain–to–Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 μA | | 60 | | | V |
| Drain–to–Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | | 27 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V,<br>$V_{DS}$ = 60 V | $T_J$ = 25°C | | | 10 | μA |
| | | | $T_J$ = 125°C | | | 250 | |
| Gate–to–Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = 20 V | | | | 100 | nA |
| **ON CHARACTERISTICS** (Note 5) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 50 μA | | 1.2 | | 2.0 | V |
| Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | | −4.7 | | mV/°C |
| Drain–to–Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V | $I_D$ = 35 A | | 5.6 | 6.8 | mΩ |
| | | $V_{GS}$ = 4.5 V | $I_D$ = 35 A | | 8.0 | 10 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 15 V, $I_D$ = 35 A | | | 82 | | S |
| **CHARGES AND CAPACITANCES** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1 MHz, $V_{DS}$ = 25 V | | | 1400 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 690 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 15 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 48 V; $I_D$ = 35 A | | | 9.0 | | nC |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 48 V; $I_D$ = 35 A | | | 20 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 48 V; $I_D$ = 35 A | | | 2.5 | | nC |
| Gate–to–Source Charge | $Q_{GS}$ | | | | 4.5 | | |
| Gate–to–Drain Charge | $Q_{GD}$ | | | | 2.0 | | |
| Plateau Voltage | $V_{GP}$ | | | | 3.1 | | V |
| **SWITCHING CHARACTERISTICS** (Note 6) | | | | | | | |
| Turn–On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 48 V,<br>$I_D$ = 35 A, $R_G$ = 2.5 Ω | | | 11 | | ns |
| Rise Time | $t_r$ | | | | 60 | | |
| Turn–Off Delay Time | $t_{d(OFF)}$ | | | | 15 | | |
| Fall Time | $t_f$ | | | | 4 | | |
| **DRAIN–SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V,<br>$I_S$ = 35 A | $T_J$ = 25°C | | 0.9 | 1.2 | V |
| | | | $T_J$ = 125°C | | 0.8 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, $dI_S/d_t$ = 100 A/μs,<br>$I_S$ = 35 A | | | 34 | | ns |
| Charge Time | $t_a$ | | | | 17 | | |
| Discharge Time | $t_b$ | | | | 17 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 19 | | nC |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

5. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.

## TYPICAL CHARACTERISTICS

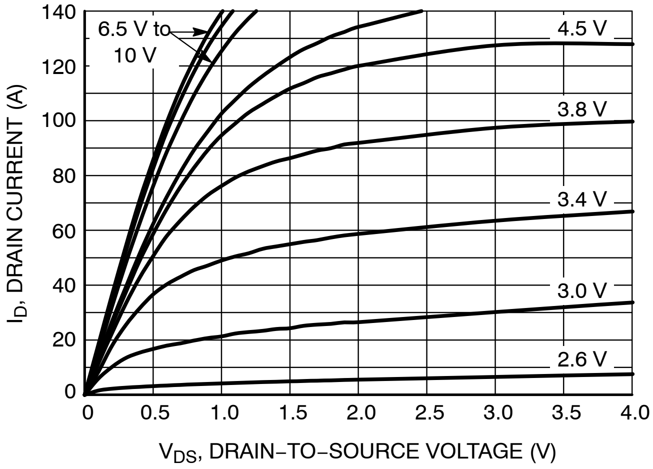


**Figure 1. On−Region Characteristics**

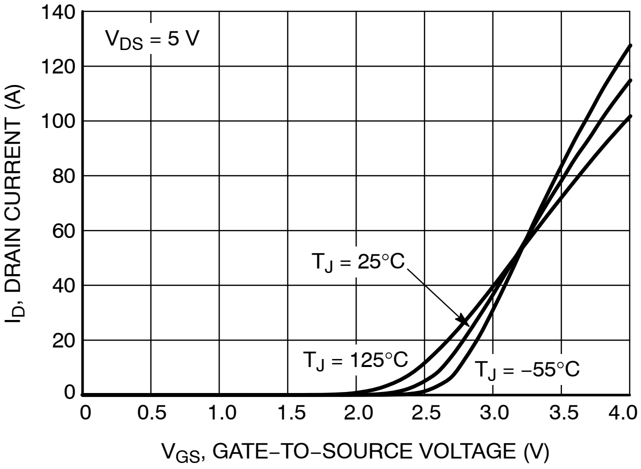


**Figure 2. Transfer Characteristics**

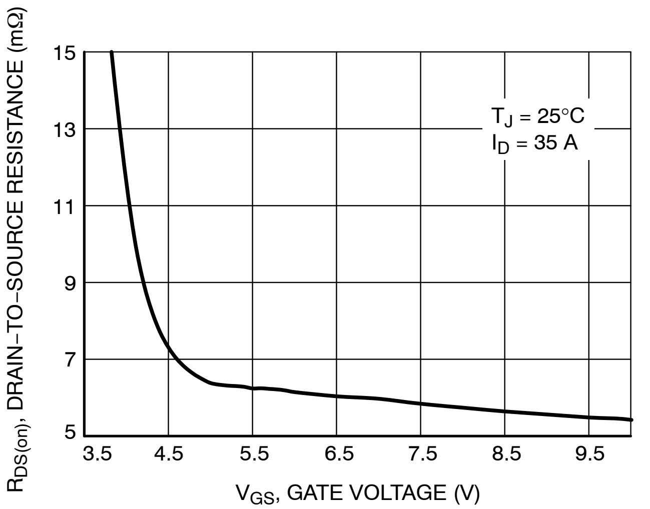


**Figure 3. On−Resistance vs. Gate−to−Source Voltage**

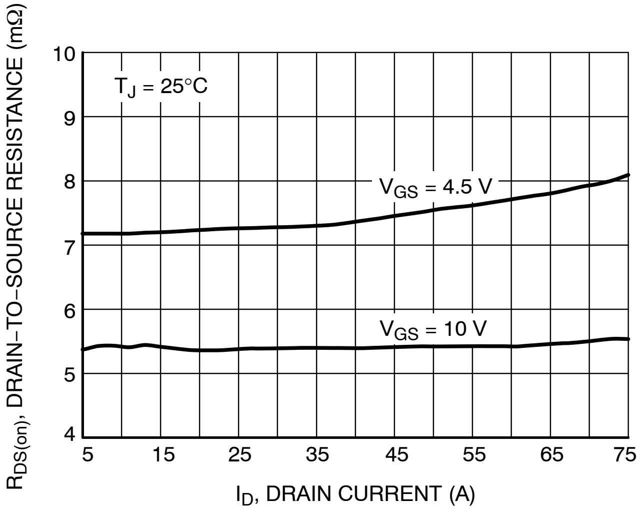


**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**

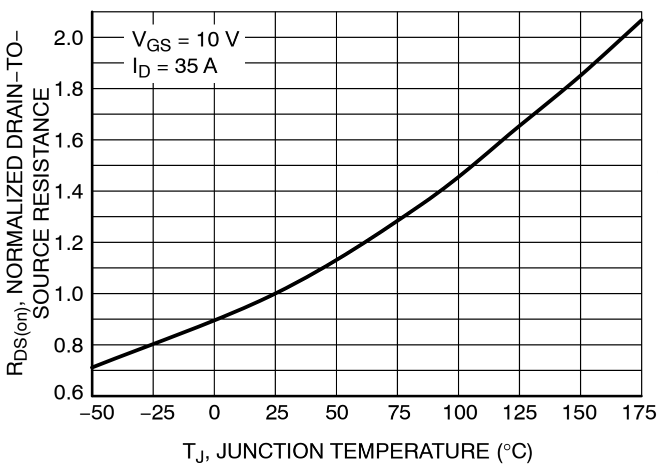


**Figure 5. On−Resistance Variation with Temperature**

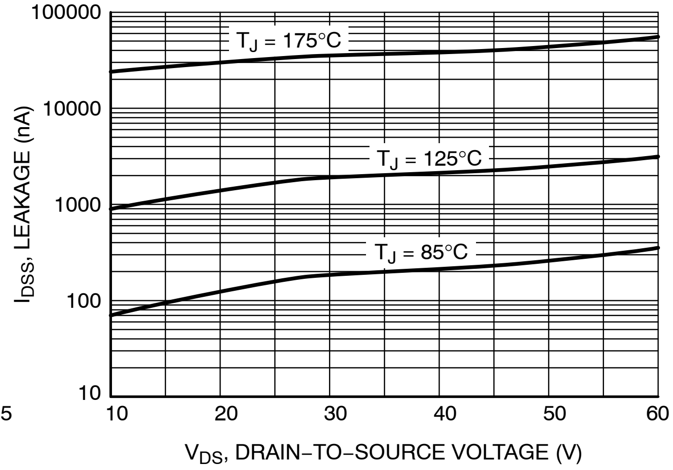


**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

## TYPICAL CHARACTERISTICS

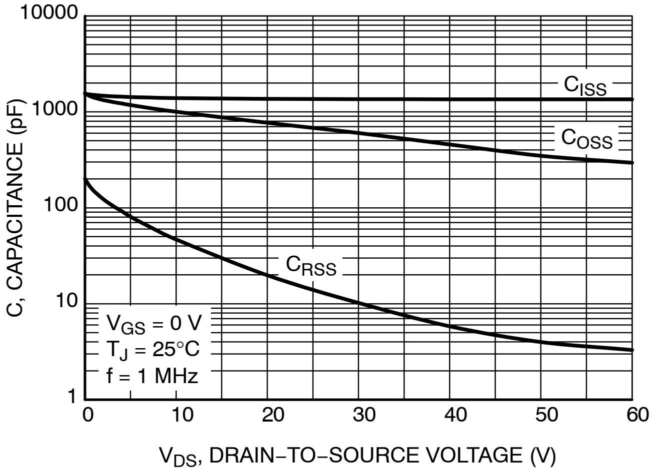


**Figure 7. Capacitance Variation**

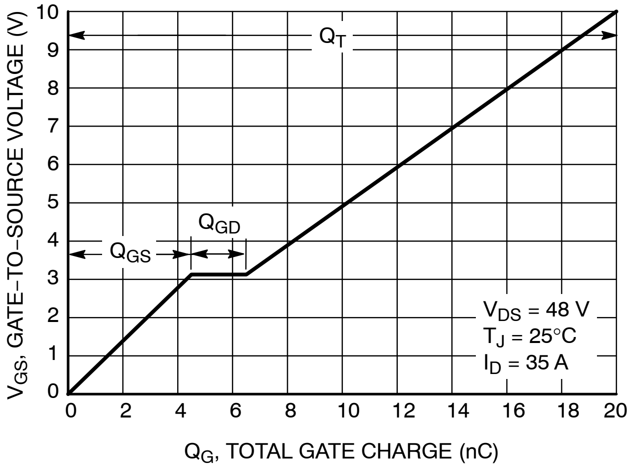


**Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge**

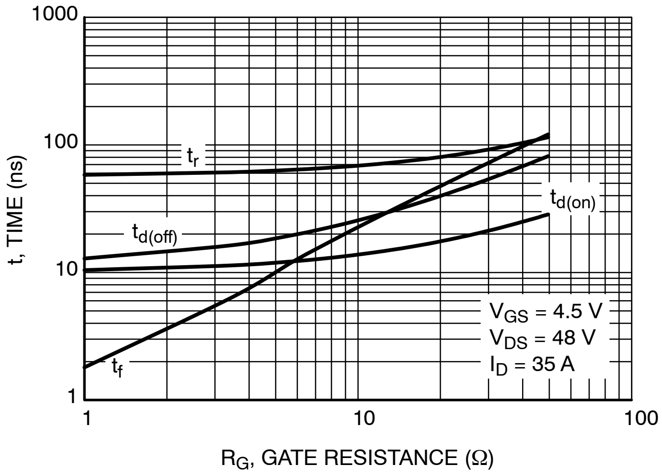


**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

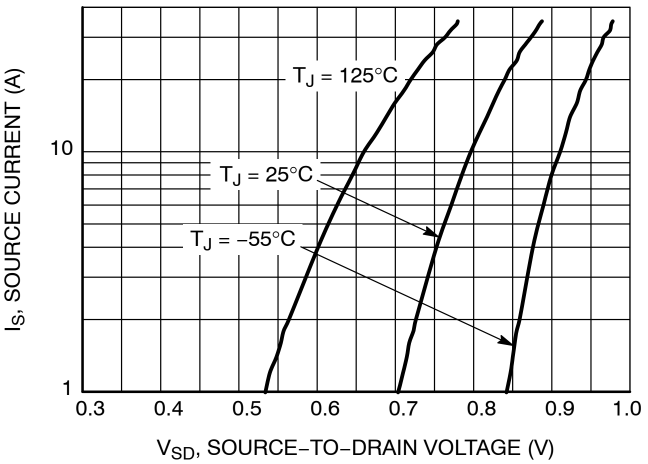


**Figure 10. Diode Forward Voltage vs. Current**

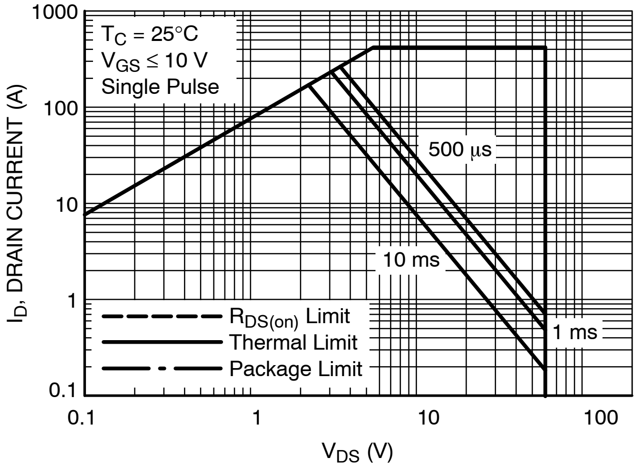


**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

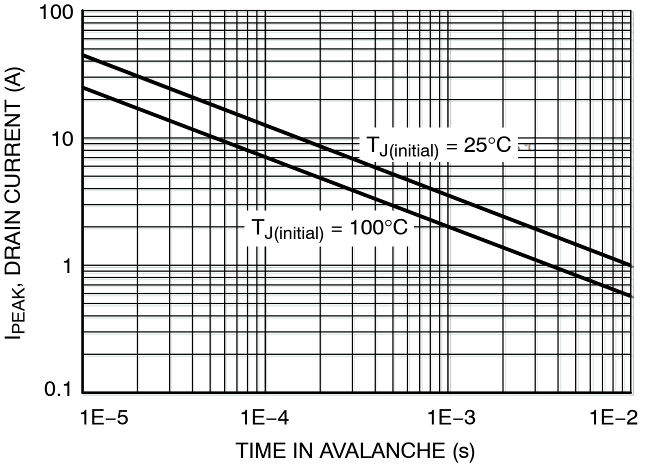


**Figure 12. Maximum Drain Current vs. Time in Avalanche**

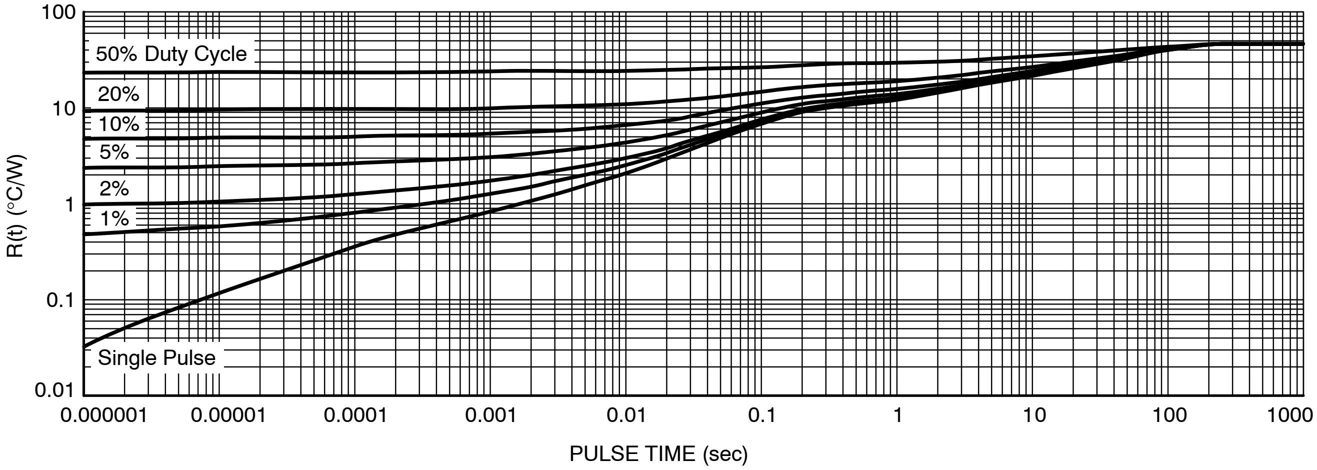


Figure 13. Thermal Characteristics

## DEVICE ORDERING INFORMATION

| Device | Marking | Package | Shipping† |
|---|---|---|---|
| NVTFS5C670NLTAG | 670L | WDFN8<br>(Pb−Free) | 1500 / Tape & Reel |
| NVTFS5C670NLWFTAG | 70LW | WDFN8<br>(Pb−Free, Wettable Flanks) | 1500 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.