

# NTMFS4837N

## Power MOSFET

30 V, 74 A, Single N-Channel, SO-8FL

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- These are Pb-Free Devices

### Applications

- Refer to Application Note AND8195/D
- CPU Power Delivery
- DC-DC Converters
- Low Side Switching

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

| Parameter                                                                                                                                                               |                     |                            | Symbol         | Value       | Unit               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------|----------------|-------------|--------------------|
| Drain-to-Source Voltage                                                                                                                                                 |                     |                            | $V_{DSS}$      | 30          | V                  |
| Gate-to-Source Voltage                                                                                                                                                  |                     |                            | $V_{GS}$       | $\pm 20$    | V                  |
| Continuous Drain Current $R_{\theta JA}$ (Note 1)                                                                                                                       | Steady State        | $T_A = 25^{\circ}\text{C}$ | $I_D$          | 16          | A                  |
|                                                                                                                                                                         |                     | $T_A = 85^{\circ}\text{C}$ |                | 11.5        |                    |
| Power Dissipation $R_{\theta JA}$ (Note 1)                                                                                                                              |                     | $T_A = 25^{\circ}\text{C}$ | $P_D$          | 2.2         | W                  |
| Continuous Drain Current $R_{\theta JA}$ (Note 2)                                                                                                                       |                     | $T_A = 25^{\circ}\text{C}$ | ID             | 10          | A                  |
|                                                                                                                                                                         |                     | $T_A = 85^{\circ}\text{C}$ |                | 7           |                    |
| Power Dissipation $R_{\theta JA}$ (Note 2)                                                                                                                              |                     | $T_A = 25^{\circ}\text{C}$ | $P_D$          | 0.88        | W                  |
| Continuous Drain Current $R_{\theta JC}$ (Note 1)                                                                                                                       |                     | $T_C = 25^{\circ}\text{C}$ | $I_D$          | 74          | A                  |
|                                                                                                                                                                         |                     | $T_C = 85^{\circ}\text{C}$ |                | 53          |                    |
| Power Dissipation $R_{\theta JC}$ (Note 1)                                                                                                                              |                     | $T_C = 25^{\circ}\text{C}$ | $P_D$          | 47.2        | W                  |
| Pulsed Drain Current                                                                                                                                                    | $t_p=10\mu\text{s}$ | $T_A = 25^{\circ}\text{C}$ | $I_{DM}$       | 148         | A                  |
| Operating Junction and Storage Temperature                                                                                                                              |                     |                            | $T_J, T_{STG}$ | -55 to +150 | $^{\circ}\text{C}$ |
| Source Current (Body Diode)                                                                                                                                             |                     |                            | $I_S$          | 39          | A                  |
| Drain to Source $dV/dt$                                                                                                                                                 |                     |                            | $dV/dt$        | 6           | V/ns               |
| Single Pulse Drain-to-Source Avalanche Energy ( $V_{DD} = 30\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_L = 22\text{ A}_{pk}$ , $L = 1.0\text{ mH}$ , $R_G = 25\ \Omega$ ) |                     |                            | EAS            | 242         | mJ                 |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)                                                                                                       |                     |                            | $T_L$          | 260         | $^{\circ}\text{C}$ |

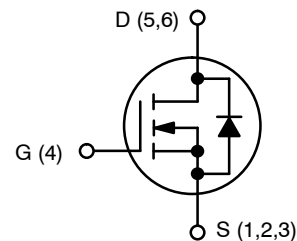
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



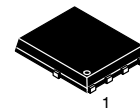
ON Semiconductor®

<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|---------------|--------------------------|-------------------|
| 30 V          | 5.0 m $\Omega$ @ 10 V    | 74 A              |
|               | 7.5 m $\Omega$ @ 4.5 V   |                   |

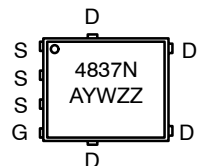


N-CHANNEL MOSFET



SO-8 FLAT LEAD  
CASE 488AA  
STYLE 1

### MARKING DIAGRAM



A = Assembly Location  
Y = Year  
W = Work Week  
ZZ = Lot Traceability

### ORDERING INFORMATION

| Device        | Package          | Shipping†          |
|---------------|------------------|--------------------|
| NTMFS4837NT1G | SO-8FL (Pb-Free) | 1500 / Tape & Reel |
| NTMFS4837NT3G | SO-8FL (Pb-Free) | 5000 / 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.

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## THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter                                   | Symbol          | Value | Unit |
|---------------------------------------------|-----------------|-------|------|
| Junction-to-Case (Drain)                    | $R_{\theta JC}$ | 2.65  | °C/W |
| Junction-to-Ambient – Steady State (Note 1) | $R_{\theta JA}$ | 56.75 |      |
| Junction-to-Ambient – Steady State (Note 2) | $R_{\theta JA}$ | 142.2 |      |

1. Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.
2. Surface-mounted on FR4 board using the minimum recommended pad size.

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

| Parameter                                                 | Symbol            | Test Condition                                      | Min                       | Typ | Max       | Unit          |
|-----------------------------------------------------------|-------------------|-----------------------------------------------------|---------------------------|-----|-----------|---------------|
| <b>OFF CHARACTERISTICS</b>                                |                   |                                                     |                           |     |           |               |
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 30                        |     |           | V             |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ |                                                     |                           | 25  |           | mV/°C         |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$         | $T_J = 25^\circ\text{C}$  |     | 1         | $\mu\text{A}$ |
|                                                           |                   |                                                     | $T_J = 125^\circ\text{C}$ |     | 10        |               |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$     |                           |     | $\pm 100$ | nA            |

## ON CHARACTERISTICS (Note 3)

|                                            |                  |                                                 |                     |     |     |            |
|--------------------------------------------|------------------|-------------------------------------------------|---------------------|-----|-----|------------|
| Gate Threshold Voltage                     | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$ | 1.5                 |     | 2.5 | V          |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |                                                 |                     | 5.7 |     | mV/°C      |
| Drain-to-Source On Resistance              | $R_{DS(on)}$     | $V_{GS} = 10\text{ V to } 11.5\text{ V}$        | $I_D = 30\text{ A}$ |     | 3.5 | m $\Omega$ |
|                                            |                  |                                                 | $I_D = 15\text{ A}$ |     | 3.5 |            |
|                                            |                  | $V_{GS} = 4.5\text{ V}$                         | $I_D = 30\text{ A}$ |     | 5.9 |            |
|                                            |                  |                                                 | $I_D = 15\text{ A}$ |     | 5.9 |            |
| Forward Transconductance                   | $g_{FS}$         | $V_{DS} = 15\text{ V}, I_D = 15\text{ A}$       |                     | 15  |     | S          |

## CHARGES AND CAPACITANCES

|                              |              |                                                                   |  |      |    |    |
|------------------------------|--------------|-------------------------------------------------------------------|--|------|----|----|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 12\text{ V}$     |  | 2048 |    | pF |
| Output Capacitance           | $C_{OSS}$    |                                                                   |  | 444  |    |    |
| Reverse Transfer Capacitance | $C_{RSS}$    |                                                                   |  | 239  |    |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$  |  | 14.2 | 22 | nC |
| Threshold Gate Charge        | $Q_{G(TH)}$  |                                                                   |  | 2.98 |    |    |
| Gate-to-Source Charge        | $Q_{GS}$     |                                                                   |  | 5.7  |    |    |
| Gate-to-Drain Charge         | $Q_{GD}$     |                                                                   |  | 6.7  |    |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 11.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 15\text{ A}$ |  | 34.2 |    | nC |

## SWITCHING CHARACTERISTICS (Note 4)

|                     |              |                                                                                            |  |      |  |    |
|---------------------|--------------|--------------------------------------------------------------------------------------------|--|------|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\text{ }\Omega$  |  | 14.2 |  | ns |
| Rise Time           | $t_r$        |                                                                                            |  | 55   |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |                                                                                            |  | 19   |  |    |
| Fall Time           | $t_f$        |                                                                                            |  | 10   |  |    |
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = 11.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\text{ }\Omega$ |  | 8.5  |  | ns |
| Rise Time           | $t_r$        |                                                                                            |  | 25.6 |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |                                                                                            |  | 25.2 |  |    |
| Fall Time           | $t_f$        |                                                                                            |  | 9.2  |  |    |

3. Pulse Test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
4. Switching characteristics are independent of operating junction temperatures.

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## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|-----------|--------|----------------|-----|-----|-----|------|
|-----------|--------|----------------|-----|-----|-----|------|

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |          |                                                                                       |                           |      |     |    |
|-------------------------|----------|---------------------------------------------------------------------------------------|---------------------------|------|-----|----|
| Forward Diode Voltage   | $V_{SD}$ | $V_{GS} = 0\text{ V}$ ,<br>$I_S = 30\text{ A}$                                        | $T_J = 25^\circ\text{C}$  | 0.85 | 1.2 | V  |
|                         |          |                                                                                       | $T_J = 125^\circ\text{C}$ | 0.72 |     |    |
| Reverse Recovery Time   | $t_{RR}$ | $V_{GS} = 0\text{ V}$ , $dI_S/dt = 100\text{ A}/\mu\text{s}$ ,<br>$I_S = 30\text{ A}$ |                           | 24   |     | ns |
| Charge Time             | $t_a$    |                                                                                       |                           | 13   |     |    |
| Discharge Time          | $t_b$    |                                                                                       |                           | 11   |     |    |
| Reverse Recovery Charge | $Q_{RR}$ |                                                                                       |                           | 14   |     | nC |

### PACKAGE PARASITIC VALUES

|                   |       |                          |       |  |          |
|-------------------|-------|--------------------------|-------|--|----------|
| Source Inductance | $L_S$ | $T_A = 25^\circ\text{C}$ | 0.93  |  | nH       |
| Drain Inductance  | $L_D$ |                          | 0.005 |  |          |
| Gate Inductance   | $L_G$ |                          | 1.84  |  |          |
| Gate Resistance   | $R_G$ |                          | 2.8   |  | $\Omega$ |

- Pulse Test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Switching characteristics are independent of operating junction temperatures.

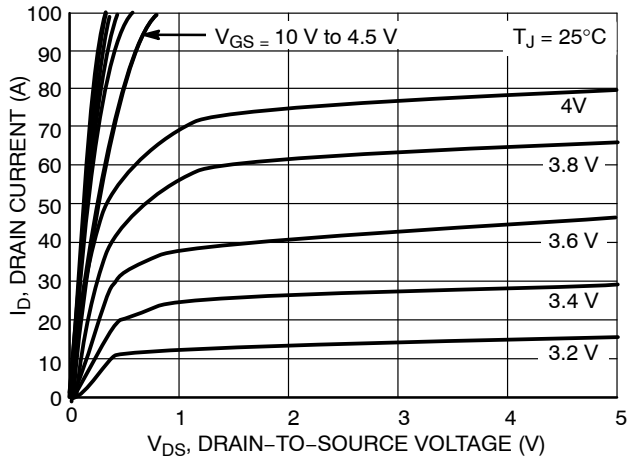


Figure 1. On-Region Characteristics

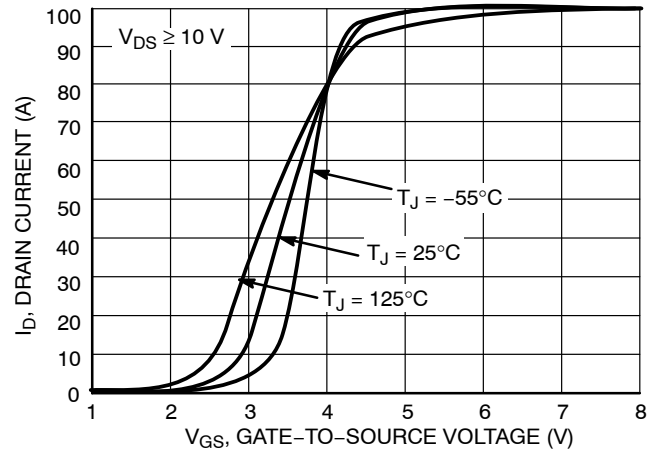


Figure 2. Transfer Characteristics

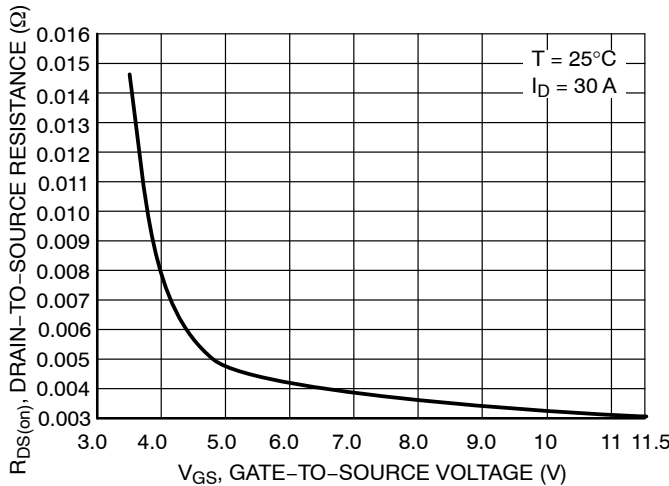


Figure 3. On-Resistance vs.  $V_{GS}$

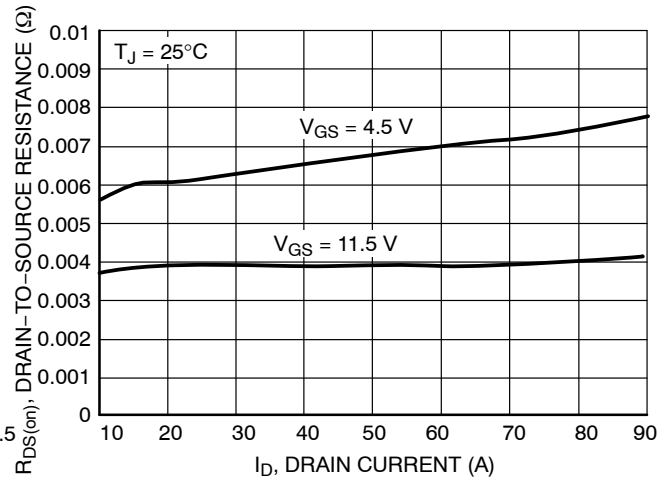


Figure 4. On-Resistance vs. Drain Current & Gate Voltage

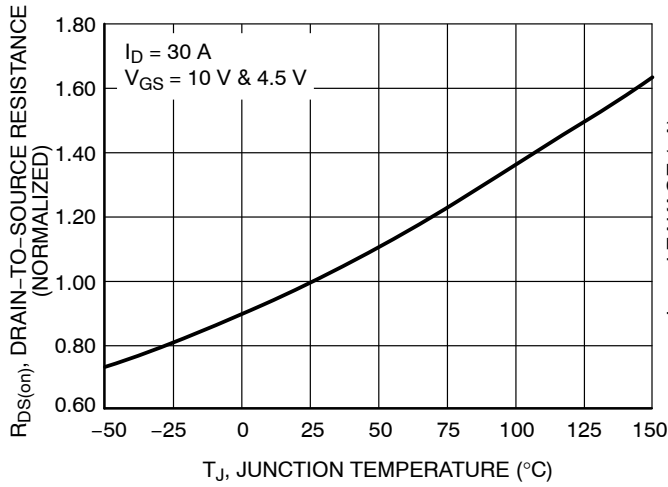


Figure 5. On-Resistance Variation with Temperature

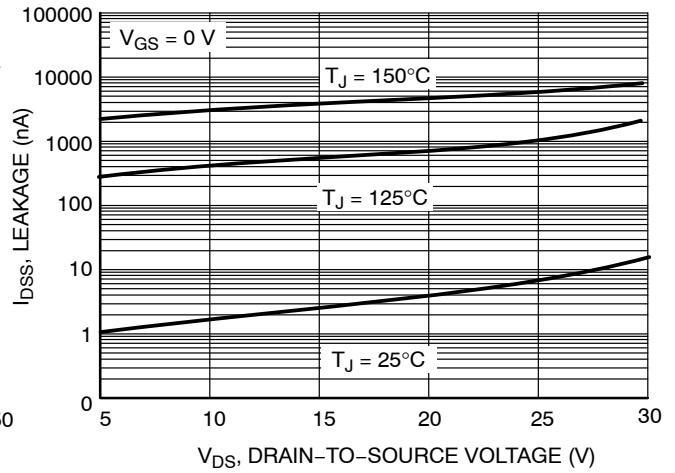


Figure 6. Drain-to-Source Leakage Current vs. Voltage

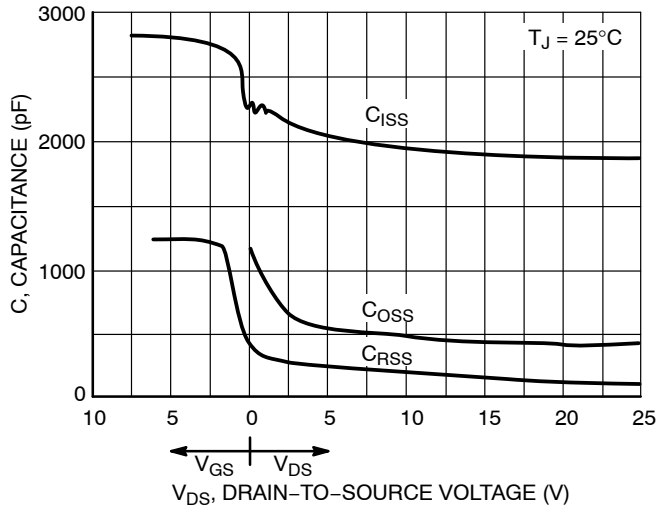


Figure 7. Capacitance Variation

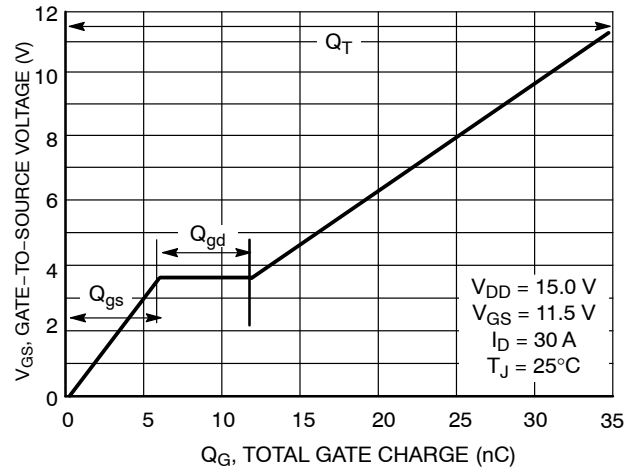


Figure 8. Gate-to-Source & Drain-to-Source Voltage vs. Total Charge

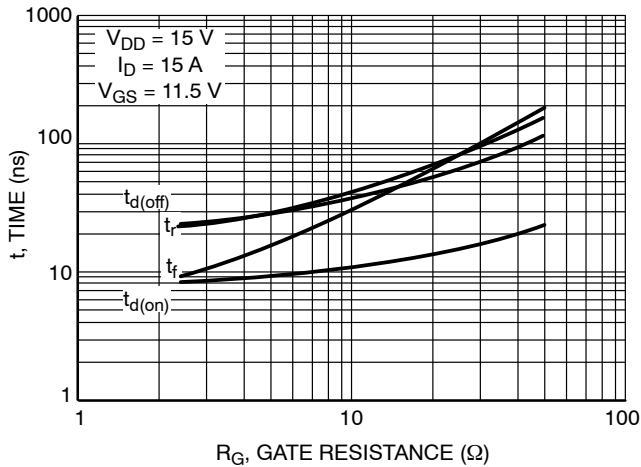


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

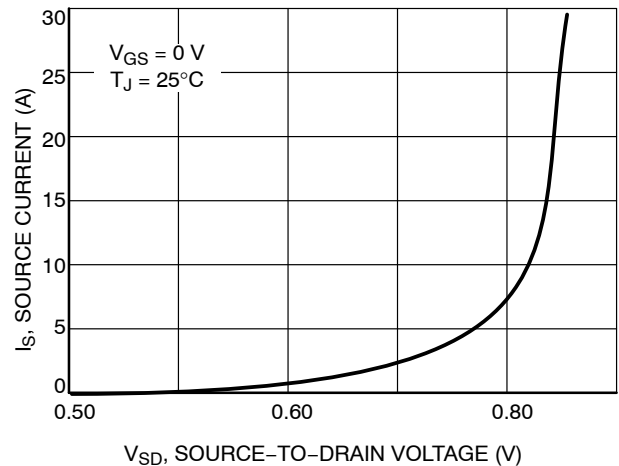
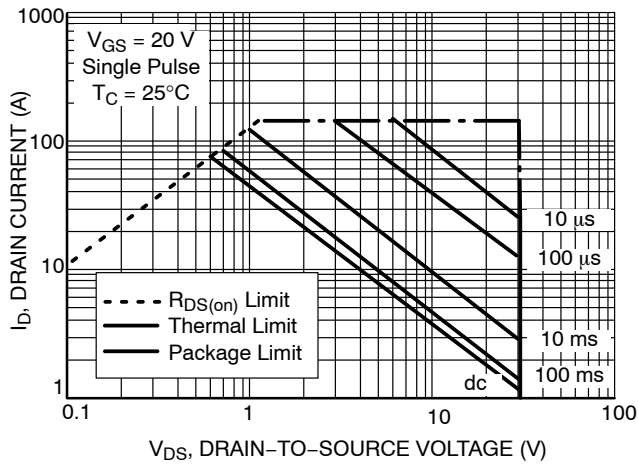
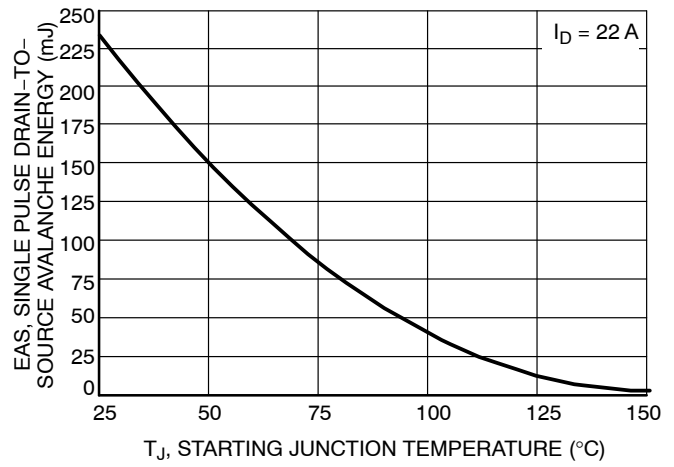


Figure 10. Diode Forward Voltage vs. Current

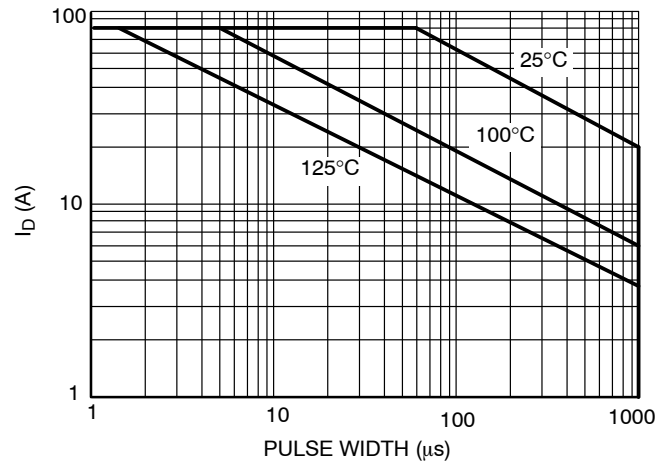
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**Figure 11. Maximum Rated Forward-Biased Safe Operating Range**



**Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature**



**Figure 13. EAS vs. Pulse Width**

