## 30V N-Channel MOSFET

### PRODUCT SUMMARY

| | |
|---|---|
| $V_{DS}$ | 30V |
| $I_D$ (at $V_{GS}$=10V) | 40A |
| $R_{DS(ON)}$ (at $V_{GS}$=10V) | < 4.5mΩ |
| $R_{DS(ON)}$ (at $V_{GS}$ = 4.5V) | < 5.3mΩ |

100% UIS Tested
100% $R_g$ Tested

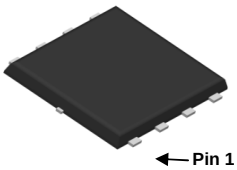
- Trench Power αMOS Technology
- Low $R_{DS(ON)}$
- Low Gate Charge
- High Current Capability
- RoHS and Halogen-Free Compliant

### Applications

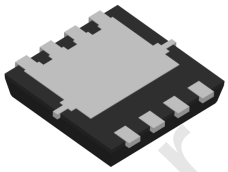
- DC/DC Converters in Computing
- Isolated DC/DC Converters in Telecom and Industrial

DFN 3x3_EP

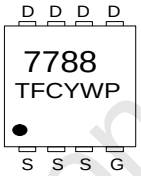
Top View



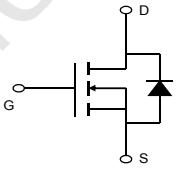

Bottom View



Top View




Equivalent Circuit




Y :year code W :week code

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| 7788 | 7788 | PDFN3x3-8 | Ø330mm | 12mm | 4000 units |

**Absolute Maximum Ratings $T_A$=25°C unless otherwise noted**

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 30 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±12 | V |
| Continuous Drain Current [G] | $T_C$=25°C | $I_D$ | 40 | A |
| Pulsed Drain Current [C] | | $I_{DM}$ | 150 | |
| Continuous Drain Current | $T_A$=25°C | $I_{DSM}$ | 20 | A |
| | $T_A$=70°C | | 16 | |
| Avalanche Current [C] | | $I_{AS}$, $I_{AR}$ | 35 | A |
| Avalanche energy L=0.1mH [C] | | $E_{AS}$, $E_{AR}$ | 61 | mJ |
| Power Dissipation [B] | $T_C$=25°C | $P_D$ | 36 | W |
| Power Dissipation [A] | $T_A$=25°C | $P_{DSM}$ | 3.1 | W |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | °C |

**Thermal Characteristics**

| Parameter | | Symbol | Typ | Max | Units |
|---|---|---|---|---|---|
| Maximum Junction-to-Ambient [A] | t ≤ 10s | $R_{\theta JA}$ | 30 | 40 | °C/W |
| Maximum Junction-to-Ambient [A D] | Steady-State | | 60 | 75 | °C/W |
| Maximum Junction-to-Case | Steady-State | $R_{\theta JC}$ | 2.8 | 3.4 | °C/W |

**Electrical Characteristics ($T_J$=25°C unless otherwise noted)**

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **STATIC PARAMETERS** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $I_D$=10mA, $V_{GS}$=0V | 30 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=30V, $V_{GS}$=0V | | | 0.5 | uA |
| $I_{GSS}$ | Gate-Body leakage current | $V_{DS}$=0V, $V_{GS}$= ±12V | | | 100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$ $I_D$=250μA | 1.2 | 1.6 | 2 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS}$=10V, $V_{DS}$=5V | 150 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=20A | | 4.5 | 5.5 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=20A | | 6.5 | 7.5 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=5V, $I_D$=20A | | 115 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=1A,$V_{GS}$=0V | | 0.4 | 0.7 | V |
| $I_S$ | Maximum Body-Diode Continuous Current [G] | | | | 40 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=15V, f=1MHz | 2730 | 3415 | 4100 | pF |
| $C_{oss}$ | Output Capacitance | | 240 | 340 | 440 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | 140 | 232 | 325 | pF |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | 0.6 | 1.2 | 1.8 | Ω |
| **SWITCHING PARAMETERS** | | | | | | |
| $Q_g$(4.5V) | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=15V, ID=20A | 19 | 24 | 29 | nC |
| $Q_{gs}$ | Gate Source Charge | | | 6.6 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 10 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=15V, $R_L$=0.75Ω, $R_{GEN}$=3Ω | | 9 | | ns |
| $t_r$ | Turn-On Rise Time | | | 4.5 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 47 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 5.5 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=20A, dI/dt=500A/μs | 8 | 10 | 12 | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=20A, dI/dt=500A/μs | 12 | 15 | 18 | nC |

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in $^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$ =25°C. The Power dissipation $P_{DSM}$ is based on $R_{\theta JA}$ t ≤ 10s value and the maximum allowed junction temperature of 150°C. The value in any given application depends on the user's specific board design, and the maximum temperature of 150°C may be used if the PCB allows it.

B. The power dissipation $P_D$ is based on $T_{J(MAX)}$=150°C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150°C. Ratings are based on low frequency and duty cycles to keep initial $T_J$ =25°C.

D. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to case $R_{\theta JC}$ and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300 μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedence which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$=150°C. The SOA curve provides a single pulse rating.

G. The maximum current rating is package limited.

H. These tests are performed with the device mounted on 1 in $^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25°C.

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

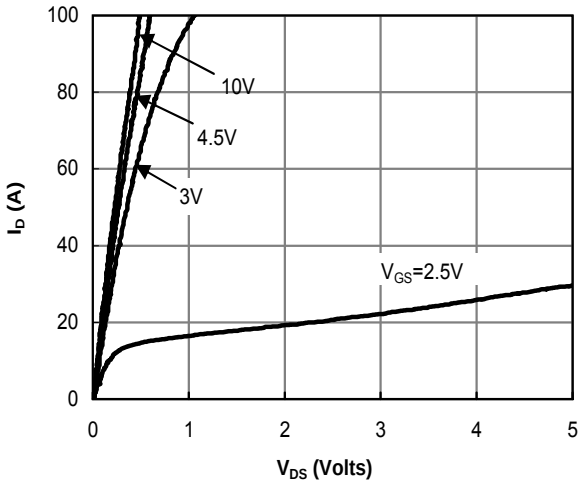



Fig 1: On-Region Characteristics (Note E)

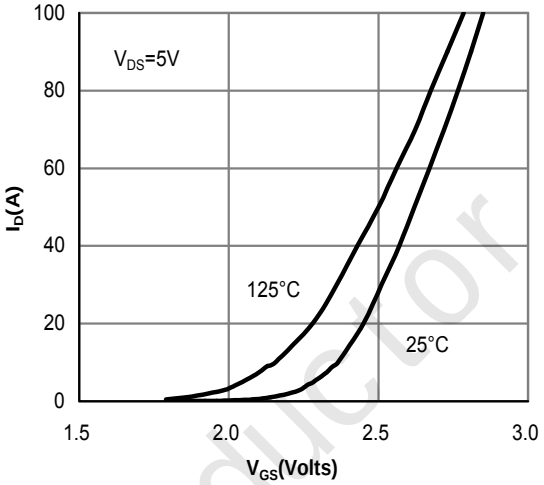



Figure 2: Transfer Characteristics (Note E)

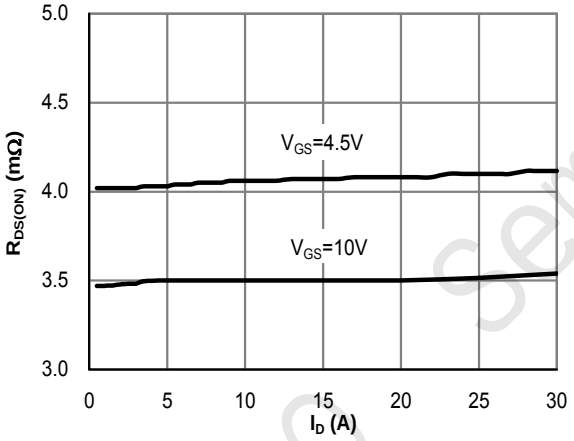



Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

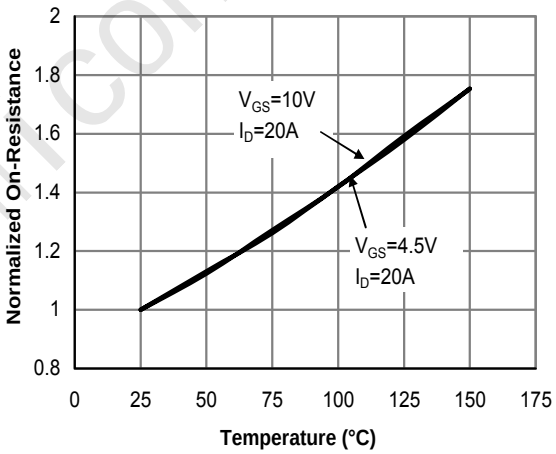



Figure 4: On-Resistance vs. Junction Temperature (Note E)

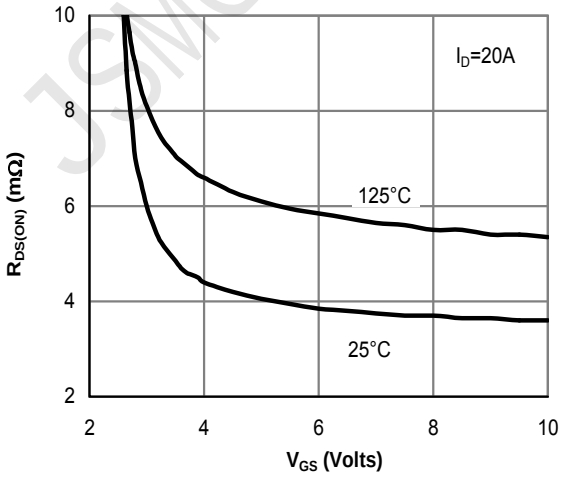



Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

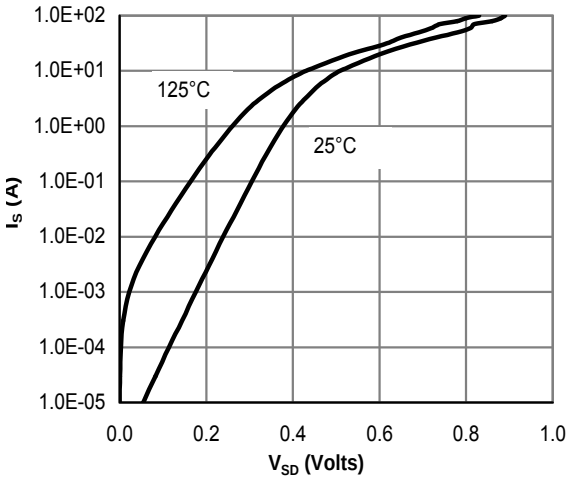



Figure 6: Body-Diode Characteristics (Note E)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

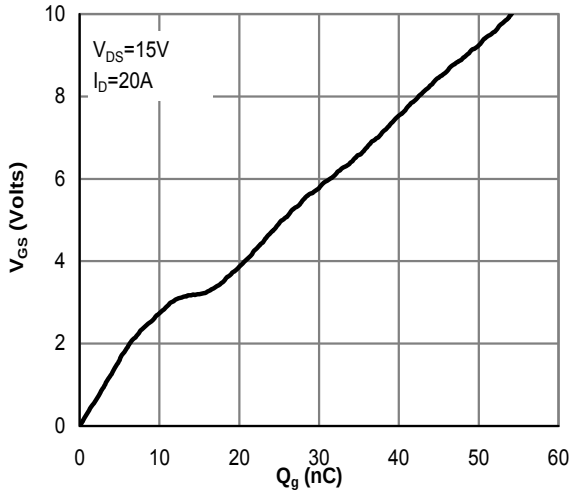



Figure 7: Gate-Charge Characteristics

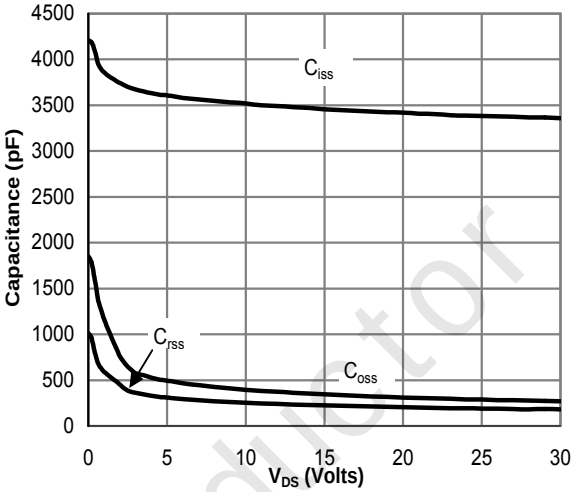



Figure 8: Capacitance Characteristics

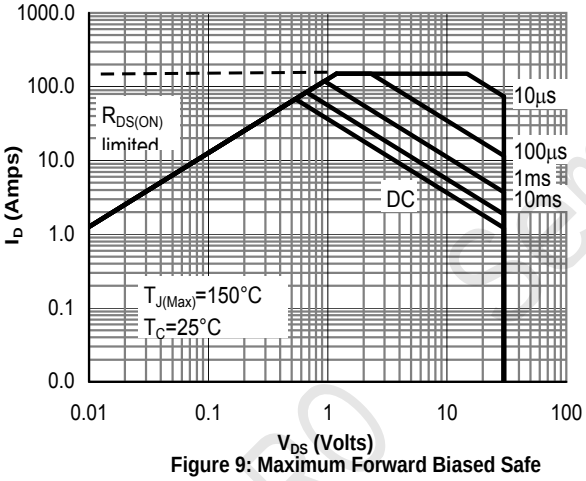



Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

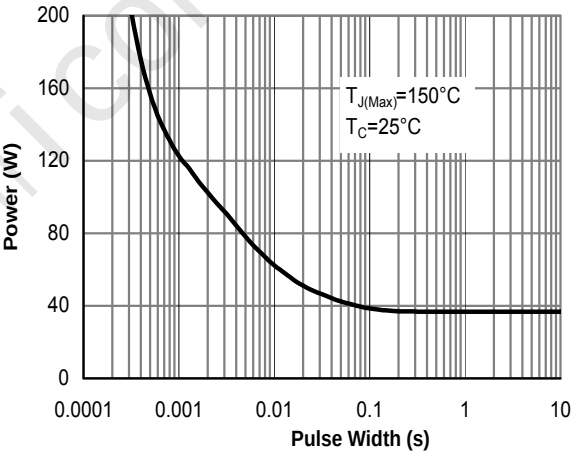



Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

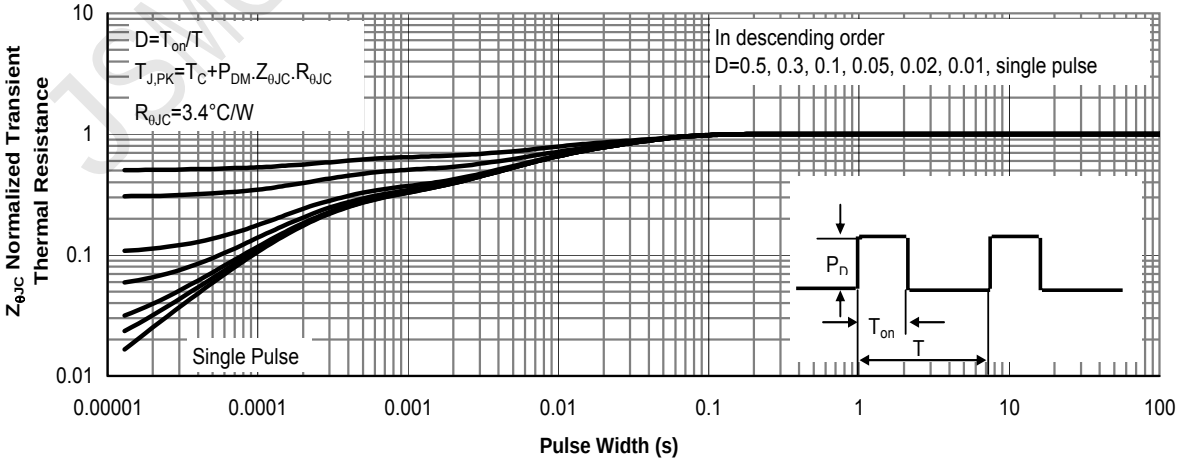



Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

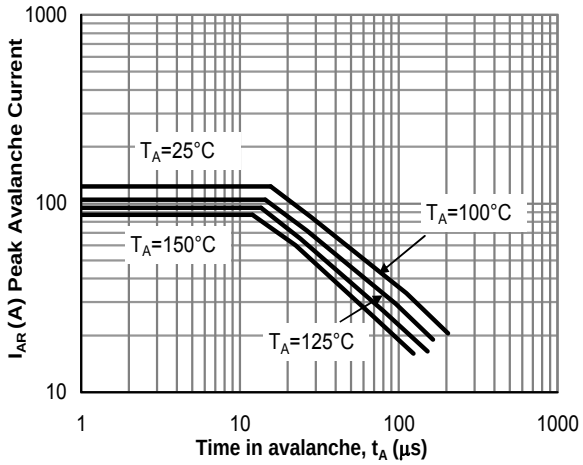



Figure 12: Single Pulse Avalanche capability (Note C)

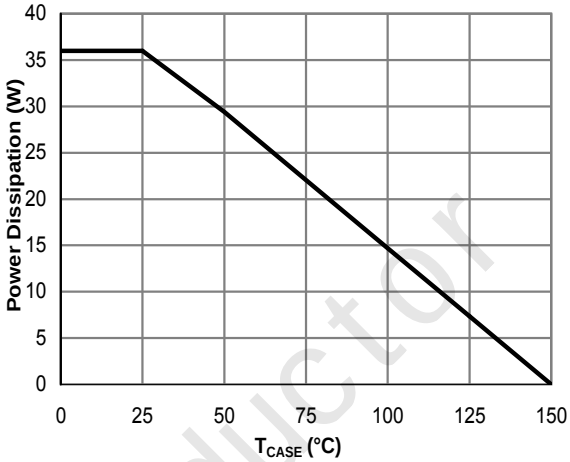



Figure 13: Power De-rating (Note F)

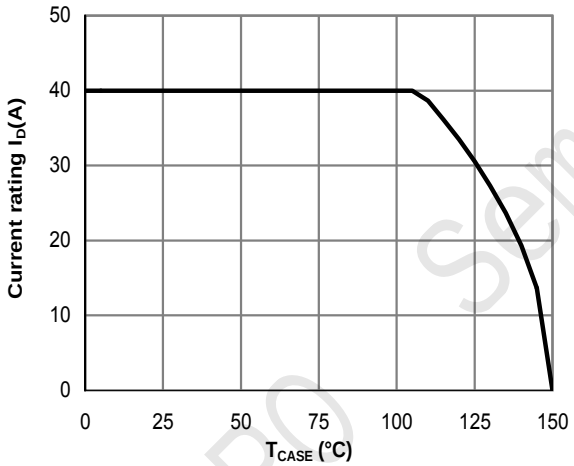



Figure 14: Current De-rating (Note F)

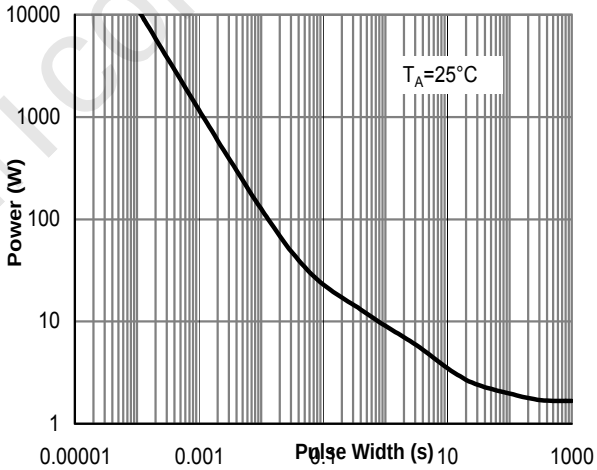



Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

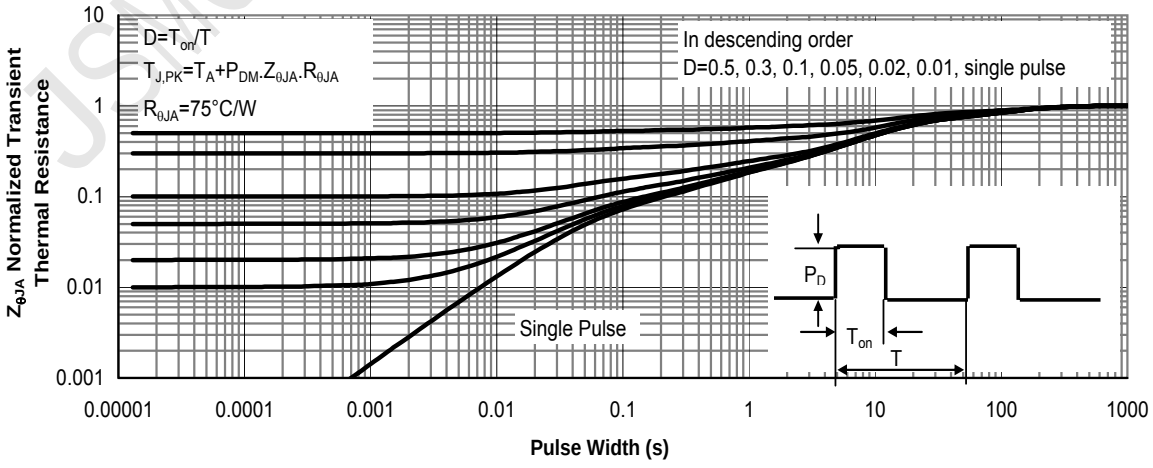



Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

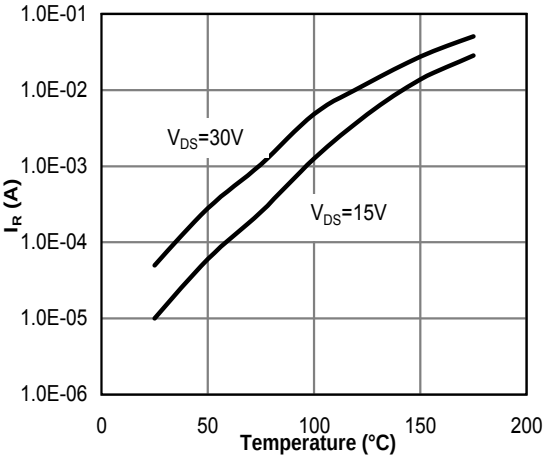



Figure 17: Diode Reverse Leakage Current vs. Junction Temperature

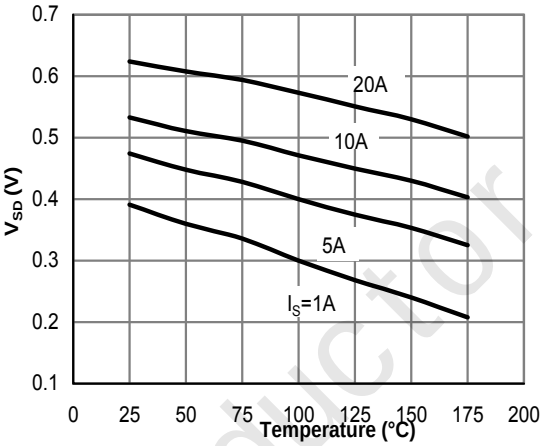



Figure 18: Diode Forward voltage vs. Junction Temperature

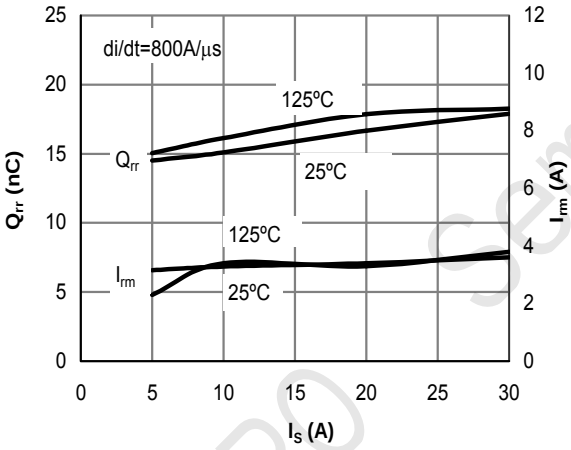



Figure 19: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current

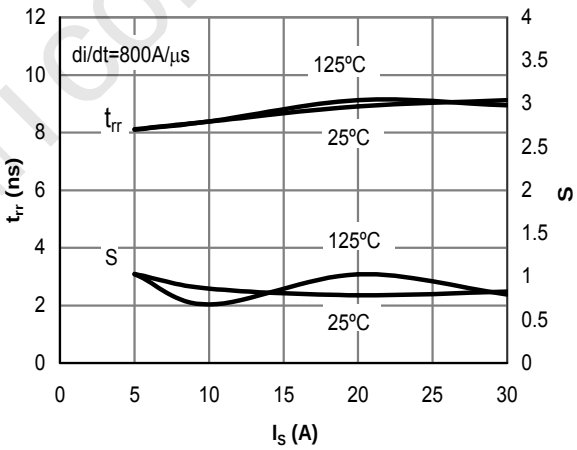



Figure 20: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current

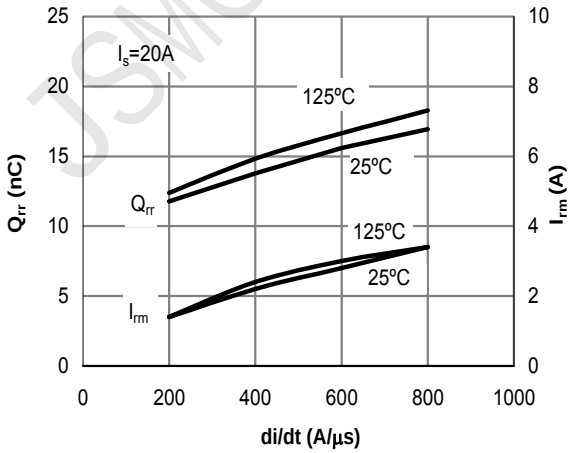



Figure 21: Diode Reverse Recovery Charge and Peak Current vs. di/dt

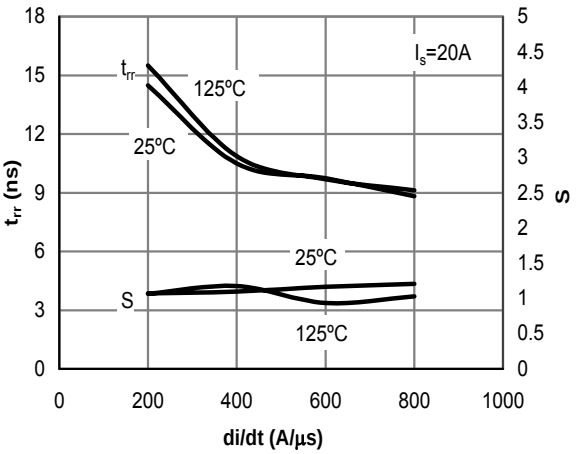
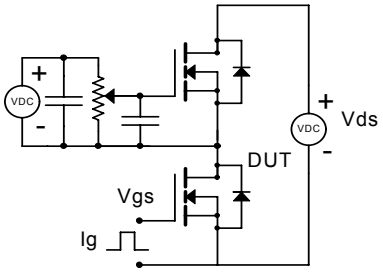
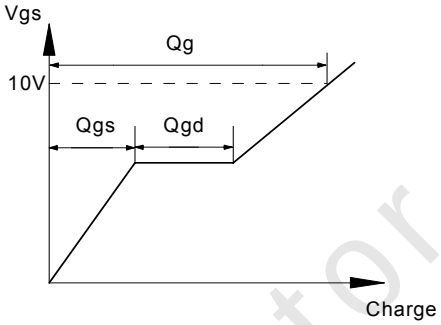


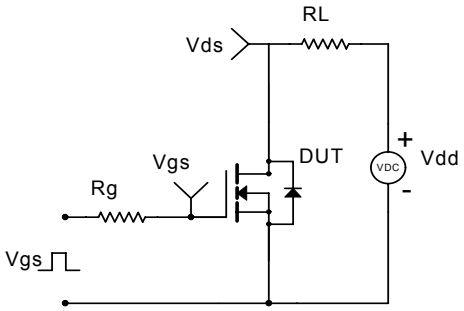

Figure 22: Diode Reverse Recovery Time and Softness Factor vs. di/dt

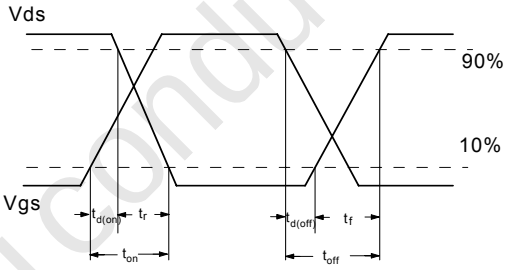
## Gate Charge Test Circuit & Waveform



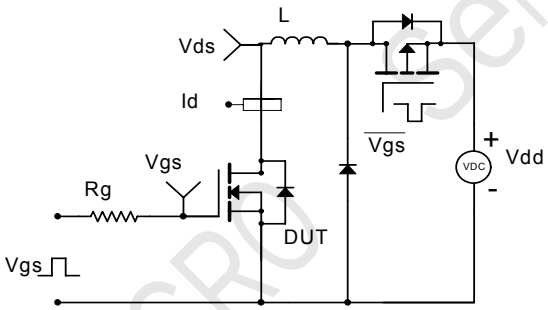



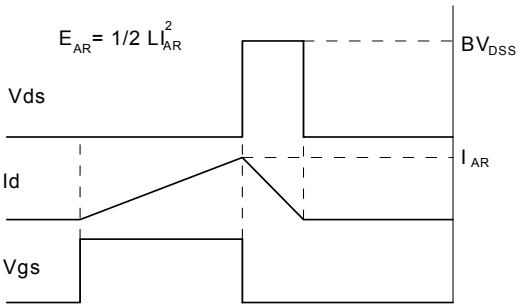

## Resistive Switching Test Circuit & Waveforms



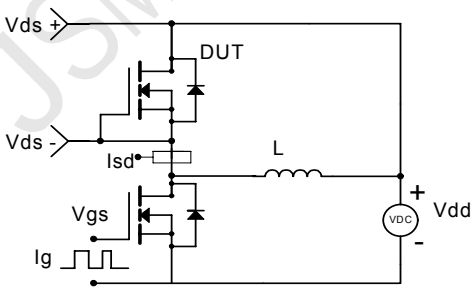



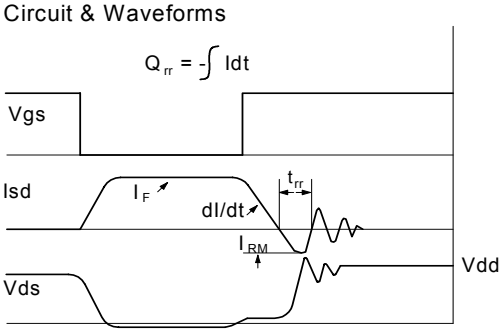

## Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



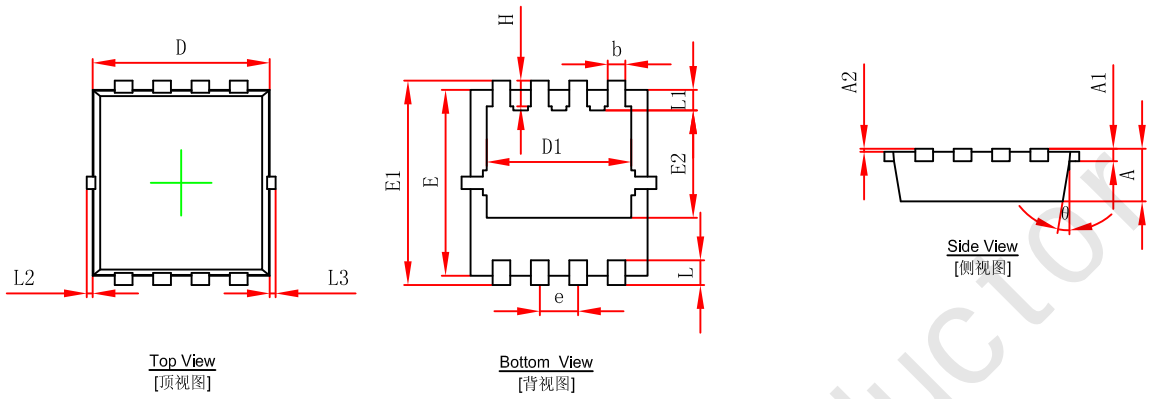




## Diode Recovery Test Circuit & Waveforms



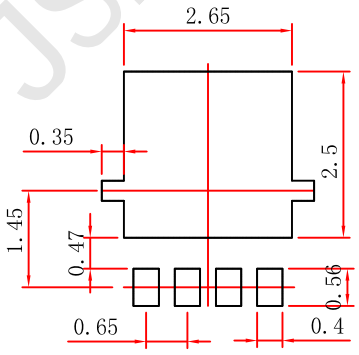



## PDFN 3x3-8L Package Outline Dimensions




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 0.650 | 0.850 | 0.026 | 0.033 |
| A1 | 0.152 REF. | | 0.006 REF. | |
| A2 | 0~0.05 | | 0~0.002 | |
| D | 2.900 | 3.100 | 0.114 | 0.122 |
| D1 | 2.300 | 2.600 | 0.091 | 0.102 |
| E | 2.900 | 3.100 | 0.114 | 0.122 |
| E1 | 3.150 | 3.450 | 0.124 | 0.136 |
| E2 | 1.535 | 1.935 | 0.060 | 0.076 |
| b | 0.200 | 0.400 | 0.008 | 0.016 |
| e | 0.550 | 0.750 | 0.022 | 0.030 |
| L | 0.300 | 0.500 | 0.012 | 0.020 |
| L1 | 0.180 | 0.480 | 0.007 | 0.019 |
| L2 | 0~0.100 | | 0~0.004 | |
| L3 | 0~0.100 | | 0~0.004 | |
| H | 0.315 | 0.515 | 0.012 | 0.020 |
| θ | 9° | 13° | 9° | 13° |

## PDFNWB3.3x3.3-8L Suggested Pad Layout




Note:
1.Controlling dimension:in millimeters.
2.General tolerance:±0.05mm.
3.The pad layout is for reference purposes only.

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