# KSN3636X

## N&P-Channel complementary Power MOSFET

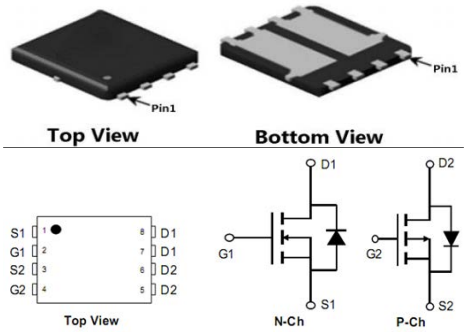
## General Description

The KSN3636X is the high performance complementary N-ch and P-ch MOSFET with high cell density, whichprovide excellent $R_{DSON}$ and gate charge for most of the synchronous buck converter applications .

## Product Summary

| | $V_{DS}$ (V) | $R_{DS(on)}$ (mΩ) | $I_D$ (A) |
|---|---|---|---|
| N-ch | 30 | 19 at $V_{GS}$ = 10 V | 36 |
| | | 27 at $V_{GS}$ = 4.5 V | 28 |
| P-ch | -30 | 23 at $V_{GS}$ = 10 V | -32 |
| | | 31 at $V_{GS}$ = 4.5 V | -26 |

## PDFN5*6 Pin Configuration




## Features

- High density cell design for ultra low $R_{ds}$on
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

## Applications

- H-bridge
- Inverters

## Absolute Maximum Ratings Tc=25℃ unless otherwise noted

| Symbol | Parameter | N-ch Rating | P-ch Rating | Units |
|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 30 | -30 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | ±20 | V |
| $I_D$ | Drain Current – Continuous ($T_C$=25℃) | 36 | -32 | A |
| | Drain Current – Continuous ($T_C$=100℃) | 18 | -16 | A |
| $I_{DM}$ | Drain Current – Pulsed[1] | 102 | -93 | A |
| $P_D$ | Power Dissipation ($T_C$=25℃) | 30 | | W |
| | Power Dissipation ($T_C$=100℃) | 0.8 | | W/℃ |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | | ℃ |

## Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | --- | 62 | ℃/W |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case | --- | 1.2 | ℃/W |

## N-Channel Electrical Characteristics (TJ=25 ℃, unless otherwisenoted)

### Off Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=250uA | 30 | --- | --- | V |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=15V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=15V , $V_{GS}$=0V , $T_J$=125℃ | --- | --- | 10 | uA |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±10V , $V_{DS}$=0V | --- | --- | ±100 | nA |

### On Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V , $I_D$=7.0A | --- | 19 | 23 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=5.0A | --- | 27 | 32 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 0.6 | 1.2 | 1.8 | V |
| gfs | Forward Transconductance | $V_{DS}$=10V , $I_S$=4.5A | --- | 16 | --- | S |

### Dynamic and switching Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge[2,3] | $V_{DS}$=10V , $V_{GS}$=4.5V , $I_D$=5A | --- | 14 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge[2,3] | | --- | 6 | --- | |
| $Q_{gd}$ | Gate-Drain Charge[2,3] | | --- | 3.5 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time[2,3] | $V_{DS}$=10V, $R_L$=2.5Ω $V_{GS}$=4.5V,$R_G$=3Ω | --- | 8.5 | --- | ns |
| $T_r$ | Rise Time[2,3] | | --- | 23 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time[2,3] | | --- | 37 | --- | |
| $T_f$ | Fall Time[2,3] | | --- | 6.3 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=15V , $V_{GS}$=0V , F=1MHz | --- | 568 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 125 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 52 | --- | |

### Drain-Source Diode Characteristics and Maximum Ratings

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current | $V_G$=$V_D$=0V , Force Current | --- | --- | 25 | A |
| $I_{SM}$ | Pulsed Source Current | | --- | --- | 60 | A |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$=0V , $I_S$=1A , $T_J$=25℃ | --- | --- | 1.2 | V |

## N-Channel Typical Electrical and Thermal Characteristics (Curves)

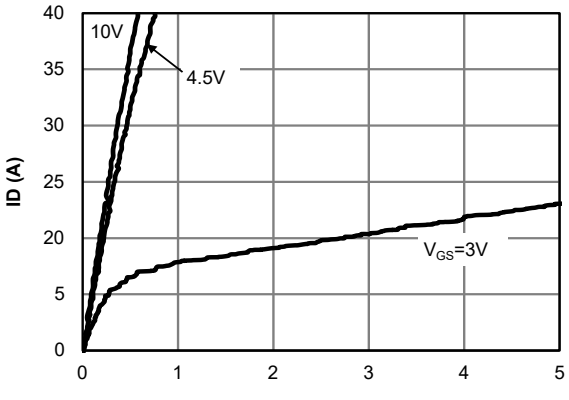



Figure 1: On-Region Characteristics

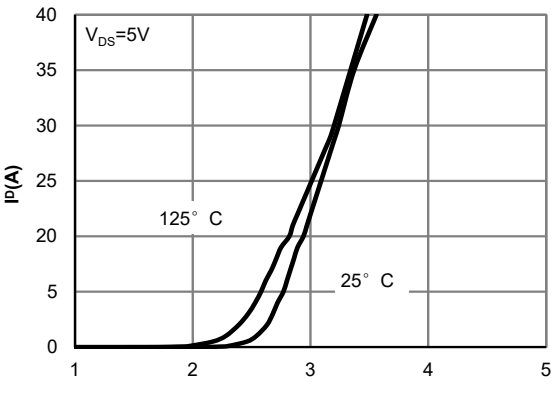



Figure 2: Transfer Characteristics

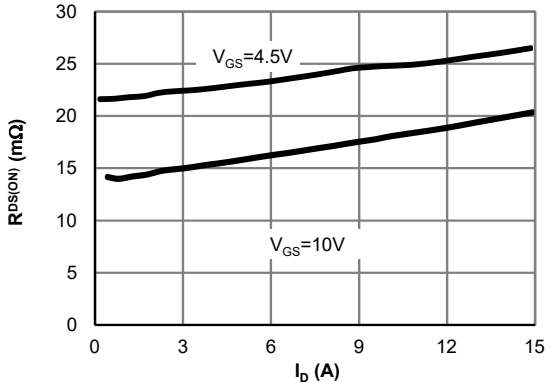



Figure 3: On-Resistance vs. Drain Current and Gate Voltage

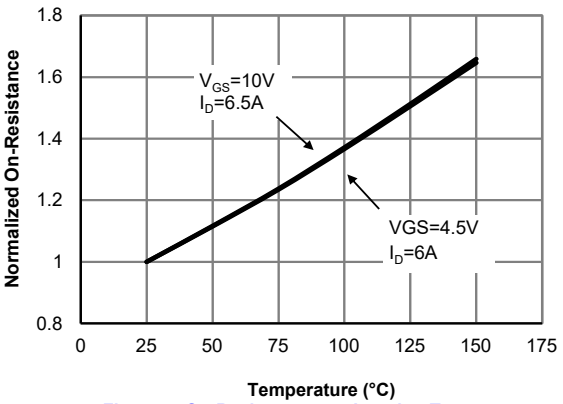



Figure 4: On-Resistance vs. Junction Temperature

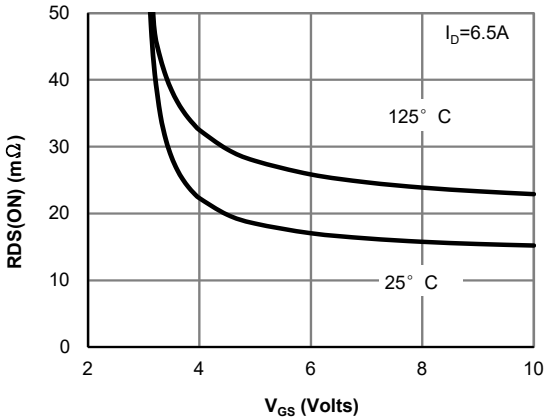



Figure 5: On-Resistance vs. Gate-Source Voltage

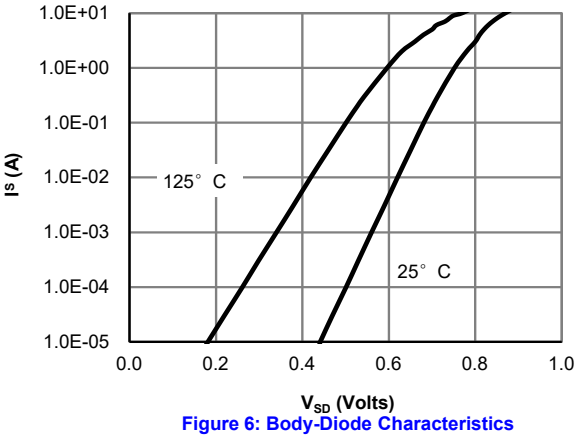



Figure 6: Body-Diode Characteristics

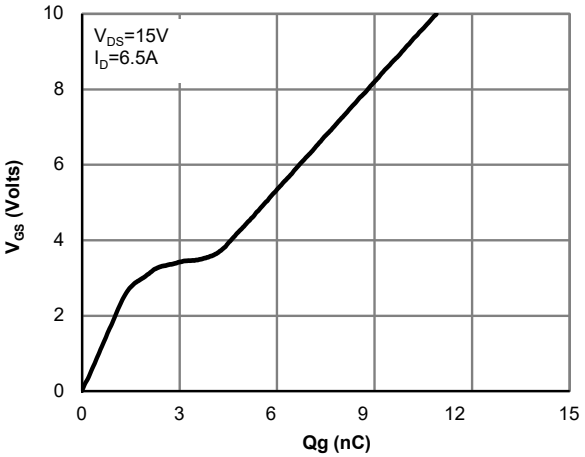



Figure 7: Gate-Charge Characteristics

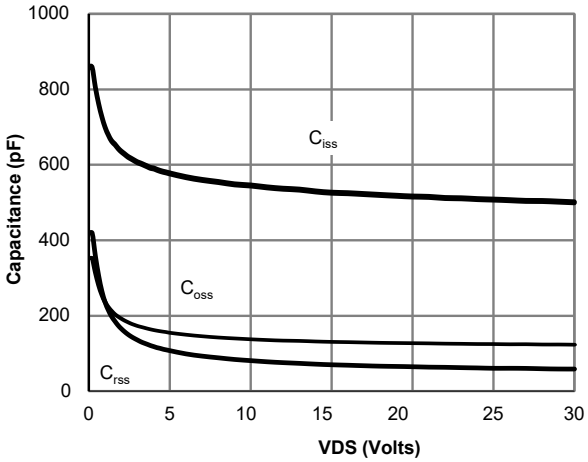



Figure 8: Capacitance Characteristics

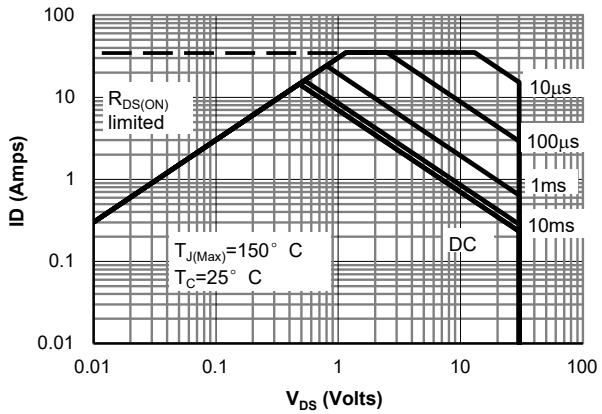



Figure 9: Maximum Forward Biased SafeOperating Area

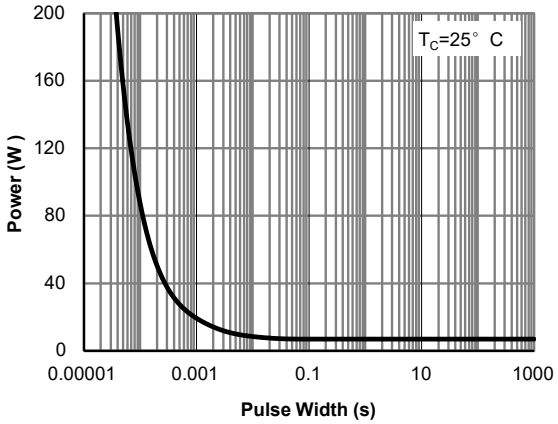



Figure 10: Single Pulse Power Rating Junction-to-Case

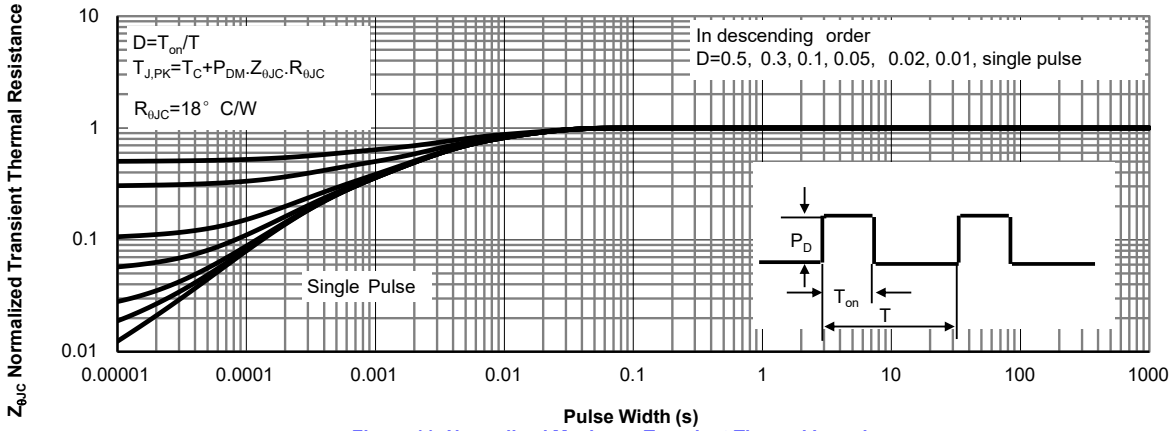



Figure 11: Normalized Maximum Transient Thermal Impedance

## P-Channel Electrical Characteristics ($T_J$=25 ℃, unless otherwisenoted)

### Off Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=-250uA | -30 | --- | --- | V |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=-15V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | -1 | uA |
| | | $V_{DS}$=-15V , $V_{GS}$=0V , $T_J$=125℃ | --- | --- | -10 | uA |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±10V , $V_{DS}$=0V | --- | --- | ±100 | nA |

### On Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=-10V , $I_D$=-7.0A | --- | 23 | 28 | mΩ |
| | | $V_{GS}$=-4.5V , $I_D$=-5.0A | --- | 31 | 37 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | -0.6 | -1.2 | -1.8 | V |
| gfs | Forward Transconductance | $V_{DS}$=-10V , $I_S$=-4.5A | --- | 20 | --- | S |

### Dynamic and switching Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge | $V_{DS}$=-15V , $V_{GS}$=-10V , $I_D$=-6A | --- | 12 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 3.7 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 4.3 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DS}$=-15V, $R_L$=2.5Ω $V_{GS}$=-10V,$R_G$=3Ω | --- | 4.6 | --- | ns |
| $T_r$ | Rise Time | | --- | 15 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 24 | --- | |
| $T_f$ | Fall Time | | --- | 6.8 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=-15V , $V_{GS}$=0V , F=1MHz | --- | 683 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 147 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 86 | --- | |

### Drain-Source Diode Characteristics and Maximum Ratings

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current | $V_G$=$V_D$=0V , Force Current | --- | --- | -20 | A |
| $I_{SM}$ | Pulsed Source Current | | --- | --- | -55 | A |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$=0V , $I_S$=-1A , $T_J$=25℃ | --- | --- | -1.2 | V |

Note :

**1.** Repetitive Rating: Pulse width limited by maximum junction temperature.
**2.** Surface Mounted on FR4 Board, t ≤ 10 sec.
**3.** Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
**4.** Guaranteed by design, not subject to production
**5.** $E_{AS}$ condition: Tj=25℃,$V_{DD}$=-15V,$V_G$=-10V,L=0.5mH,Rg=25Ω,$I_{AS}$=-26A

## P-Channel Typical Electrical and Thermal Characteristics (Curves)

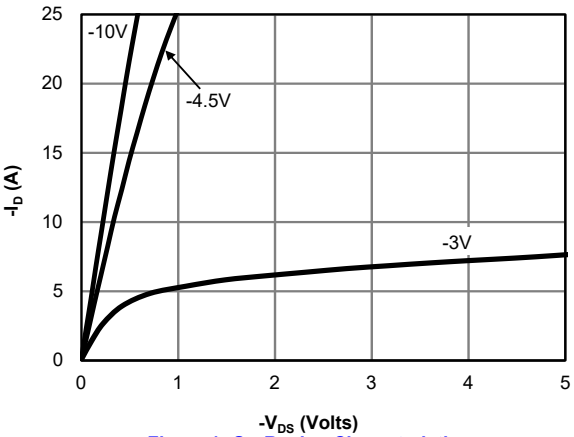



Figure 1: On-Region Characteristics

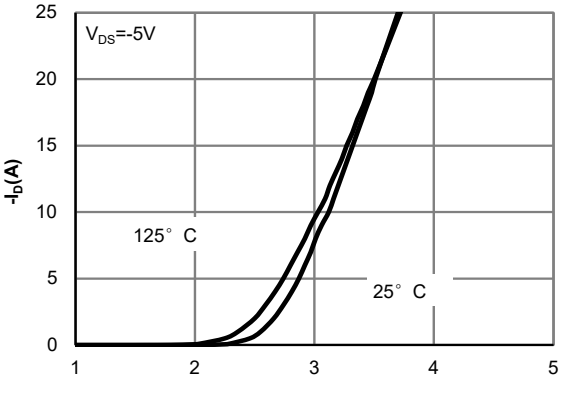



Figure 2: Transfer Characteristics

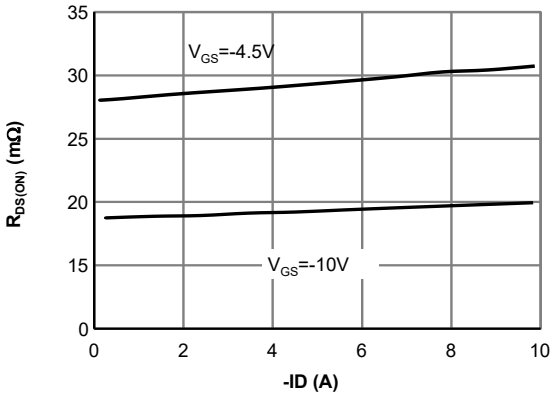



Figure 3: On-Resistance vs. Drain Current and Gate Voltage

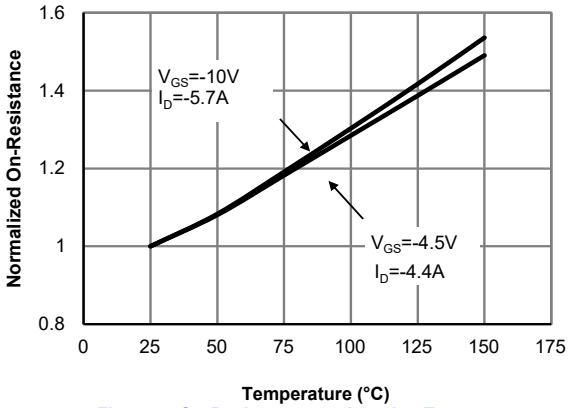



Figure 4: On-Resistance vs. Junction Temperature

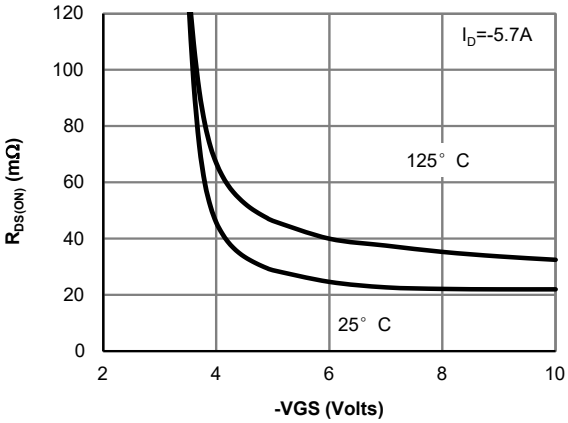



Figure 5: On-Resistance vs. Gate-Source Voltage

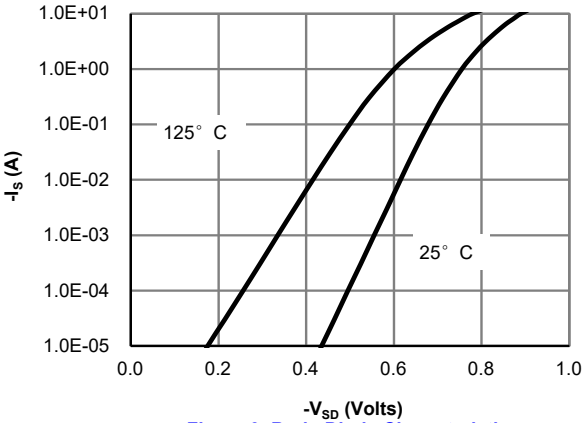



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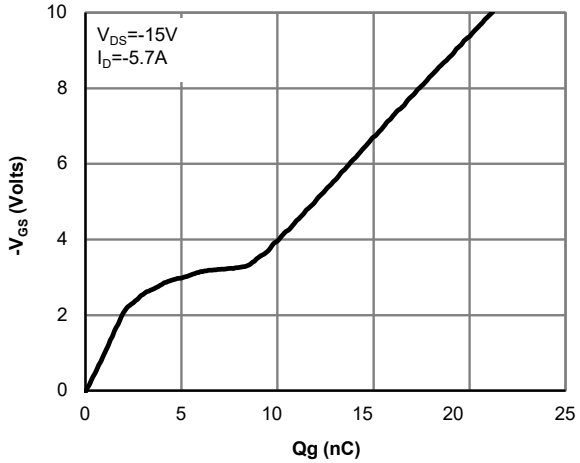



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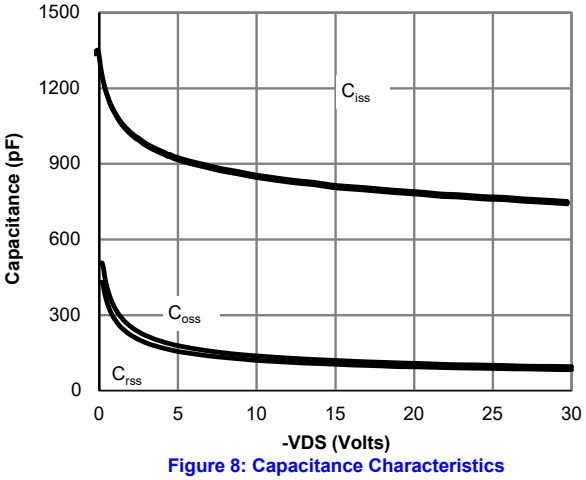



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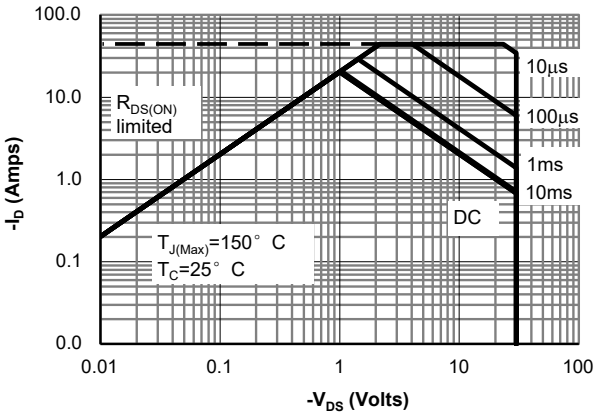



Figure 9: Maximum Forward Biased Safe Operating Area

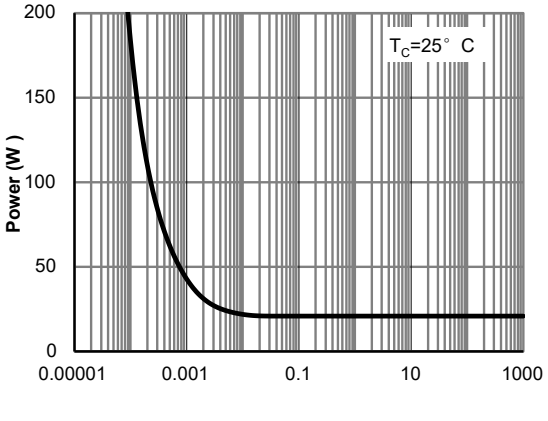



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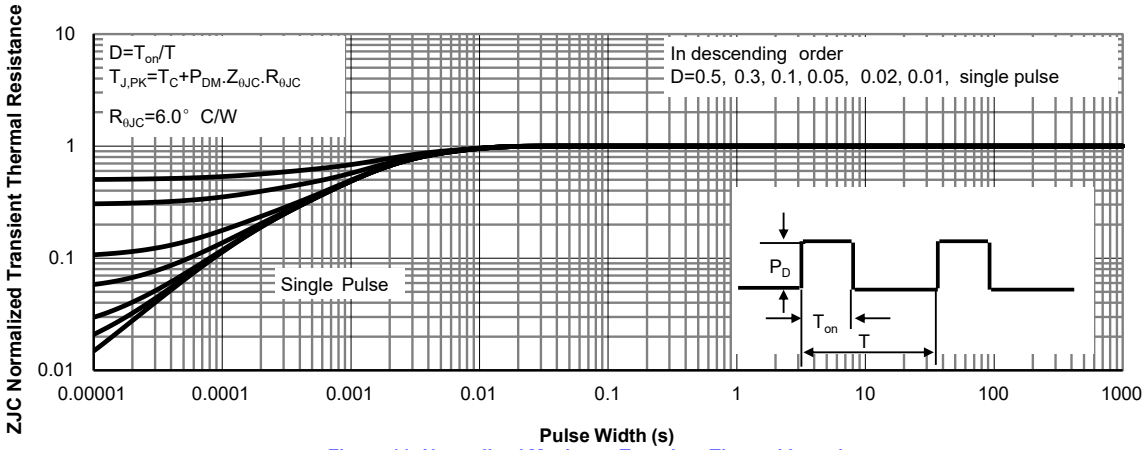



Figure 11: Normalized Maximum Transient Thermal Impedance

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