# KSD3020

## N&P-Channel complementary Power MOSFET

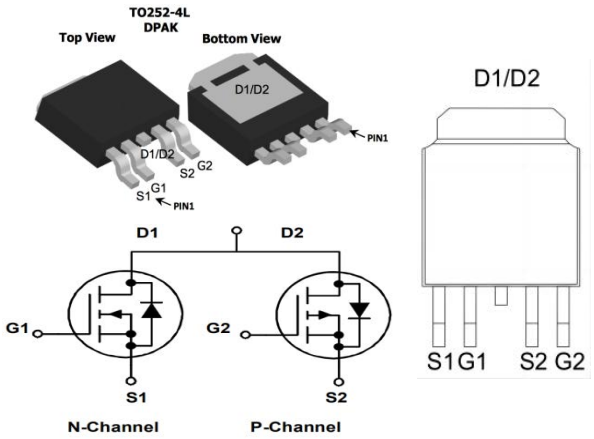
## General Description

The KSD3020 uses advanced trench technology and design to provide excellent $R_{DS}(ON)$ with low gate charge. It can be used in a widevariety of applications.

## Product Summary

| | $V_{DS}$ (V) | $R_{DS(on)}$ (mΩ) | $I_D$ (A) |
|---|---|---|---|
| N-ch | 30 | 10 at VGS = 10 V | 25 |
| | | 12 at VGS = 4.5 V | 19 |
| P-ch | -30 | 22 at VGS = 10 V | -20 |
| | | 32 at VGS = 4.5 V | -16 |

## TO-252 Pin Configuration




## Features

- High density cell design for ultra low $R_{dson}$
- 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
- DC Motor for BLDC Applications.

## Absolute Maximum Ratings $T_C$=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℃) | 25 | -20 | A |
| | Drain Current – Continuous ($T_C$=100℃) | 19 | -16 | A |
| $I_{DM}$ | Drain Current – Pulsed[1] | 60 | -50 | A |
| $P_D$ | Power Dissipation ($T_C$=25℃) | 22 | | W |
| | Power Dissipation ($T_C$=100℃) | 1.5 | | 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 | --- | 1.5 | ℃/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 | $V_{DS}$=30V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=30V , $V_{GS}$=0V , $T_J$=125℃ | --- | --- | 10 | uA |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |

### On Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V , $I_D$=10A | --- | 10 | 12 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=8A | --- | 12 | 15 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.0 | 1.5 | 2 | V |
| gfs | Forward Transconductance | $V_{DS}$=10V , $I_S$=5A | --- | 20 | --- | S |

### Dynamic and switching Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge[2,3] | $V_{DS}$=15V , $V_{GS}$=10V , $I_D$=6A | --- | 12 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge[2,3] | | --- | 4 | --- | |
| $Q_{gd}$ | Gate-Drain Charge[2,3] | | --- | 3 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time[2,3] | $V_{DS}$=15V, $R_L$=2.5Ω $V_{GS}$=10V,$R_G$=3Ω | --- | 7 | --- | ns |
| $T_r$ | Rise Time[2,3] | | --- | 15 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time[2,3] | | --- | 30 | --- | |
| $T_f$ | Fall Time[2,3] | | --- | 9 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=15V , $V_{GS}$=0V , F=1MHz | --- | 774 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 205 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 125 | --- | |

### 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 | | --- | --- | 40 | 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)

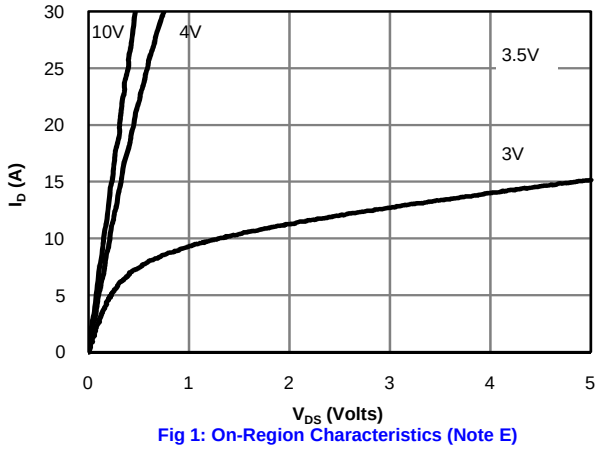



Fig 1: On-Region Characteristics (Note E)

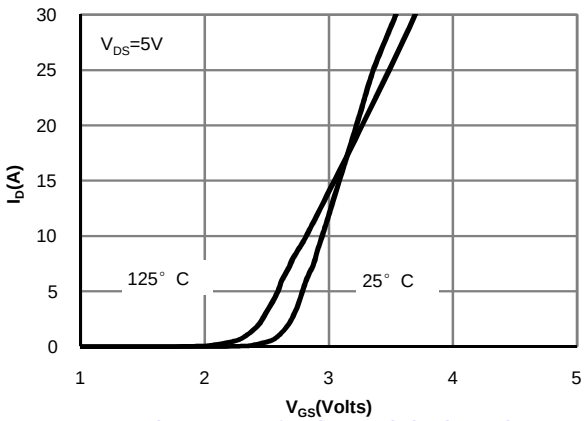



Figure 2: Transfer Characteristics (Note E)

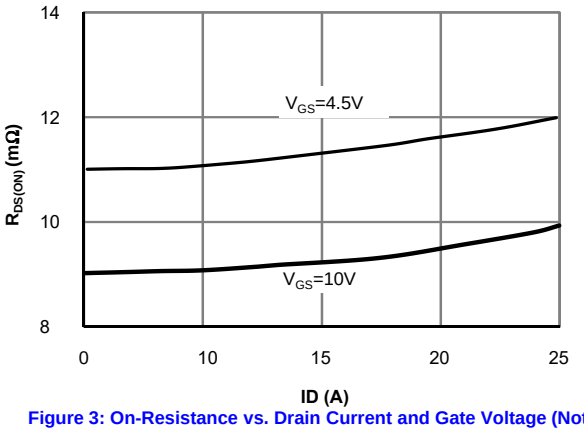



Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

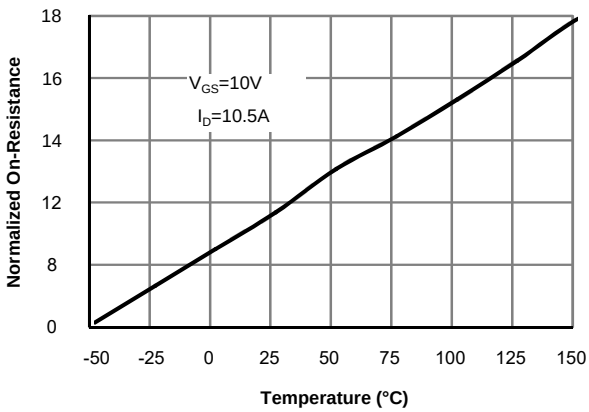



Figure 4: On-Resistance vs. Junction Temperature (NoteE)

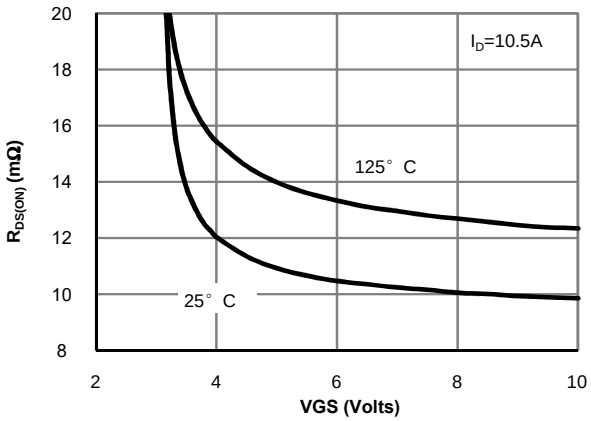



Figure 5: On-Resistance vs. Gate-Source Voltage(Note E)

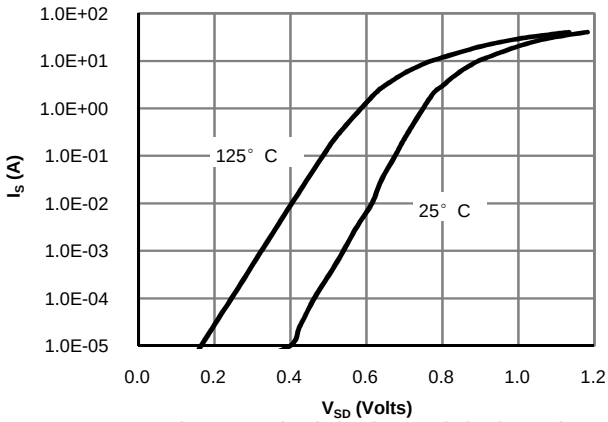



Figure 6: Body-Diode Characteristics (Note E)

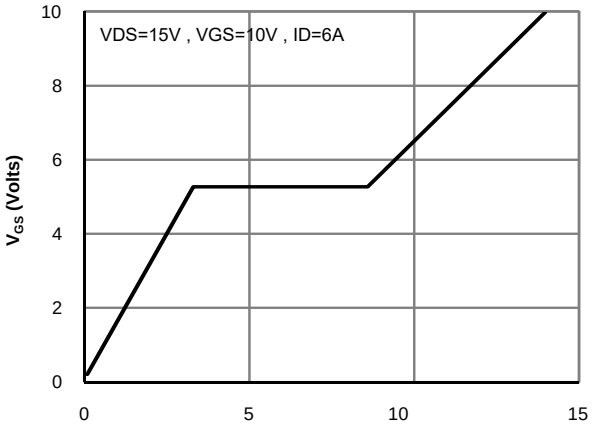



Figure 7: Gate-Charge Characteristics

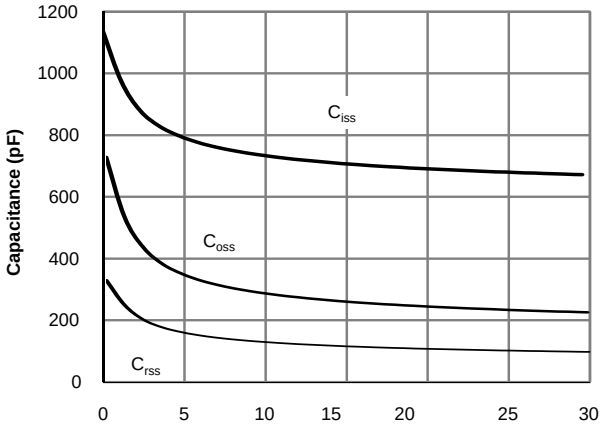



Figure 8: Capacitance Characteristics

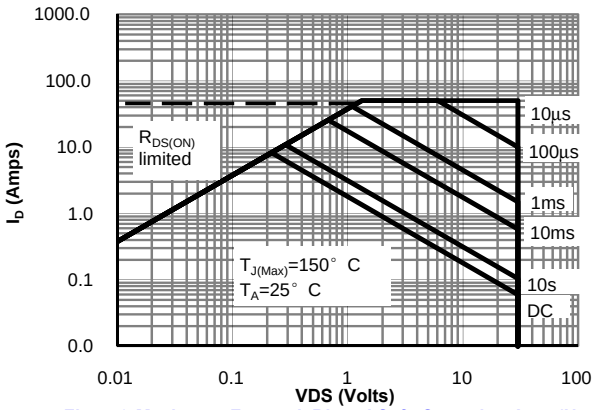



Figure9:Maximum Forward Biased Safe Operating Area (Note F)

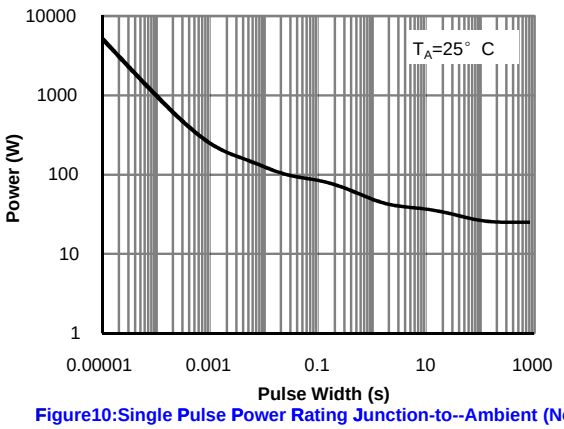



Figure10:Single Pulse Power Rating Junction-to--Ambient (Note F)

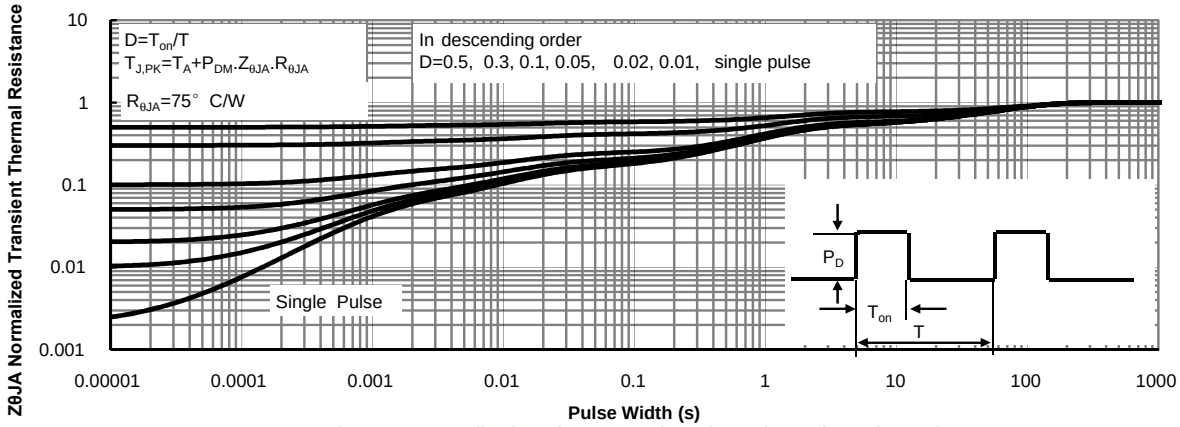



Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

## N&P-Channel complementary Power MOSFET

### P-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 | $V_{DS}$=-30V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | -1 | uA |
| | | $V_{DS}$=-30V , $V_{GS}$=0V , $T_J$=125℃ | --- | --- | -10 | uA |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |

### On Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=-10V , $I_D$=-10A | --- | 22 | 27 | mΩ |
| | | $V_{GS}$=-4.5V , $I_D$=-10A | --- | 32 | 38 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | -1.0 | -1.5 | -2 | V |
| gfs | Forward Transconductance | $V_{DS}$=-5V , $I_S$=-10A | --- | 20 | --- | S |

### Dynamic and switching Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge | $V_{DS}$=-15V , $V_{GS}$=-10V , $I_D$=-6A | --- | 20 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 4.8 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 6.2 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DS}$=-15V, $R_L$=2.5Ω<br>$V_{GS}$=-10V,$R_G$=3Ω | --- | 11 | --- | ns |
| $T_r$ | Rise Time | | --- | 40 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 28 | --- | |
| $T_f$ | Fall Time | | --- | 33 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=-15V , $V_{GS}$=0V , F=1MHz | --- | 618 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 180 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 125 | --- | |

### 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 | --- | --- | -16 | A |
| $I_{SM}$ | Pulsed Source Current | | --- | --- | -30 | 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)

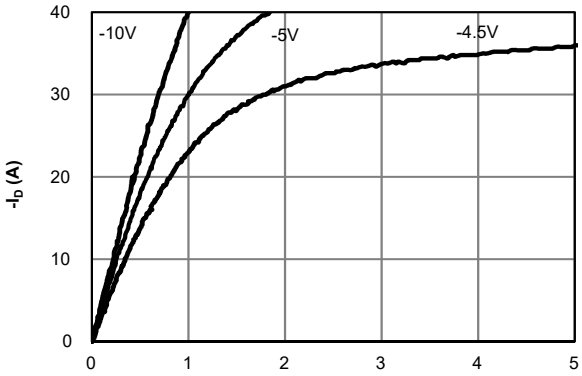



Figure 1: On-Region Characteristics (Note E)

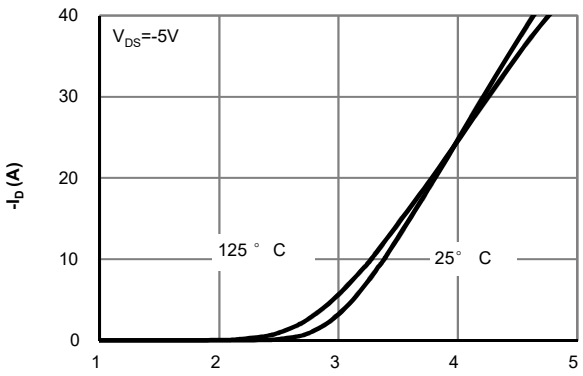



Figure 2: Transfer Characteristics (Note E)

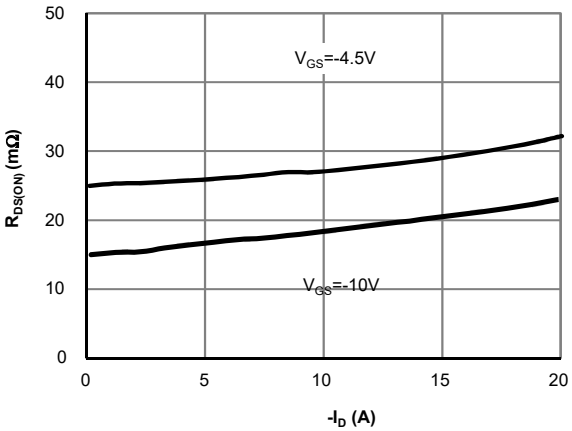



Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

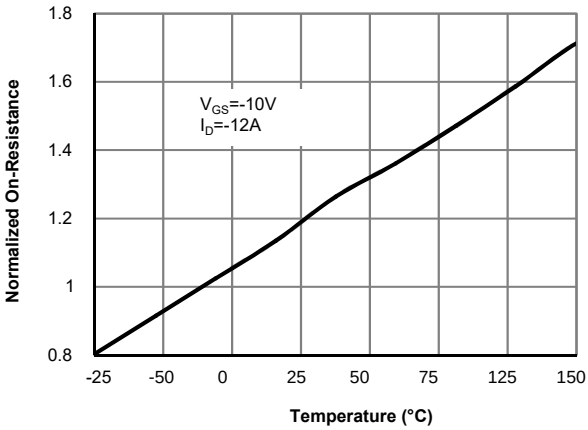



Figure 4: On-Resistance vs. Junction Temperature (Note E)

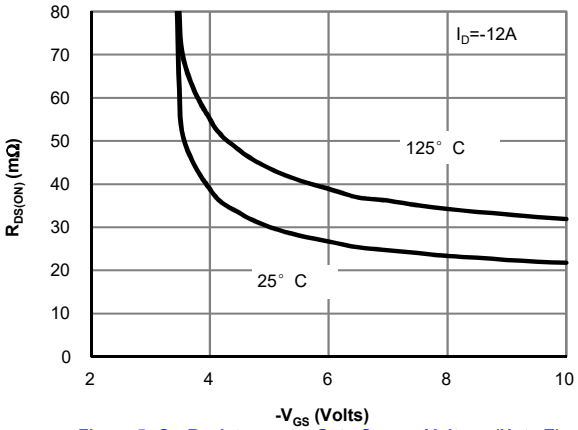



Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

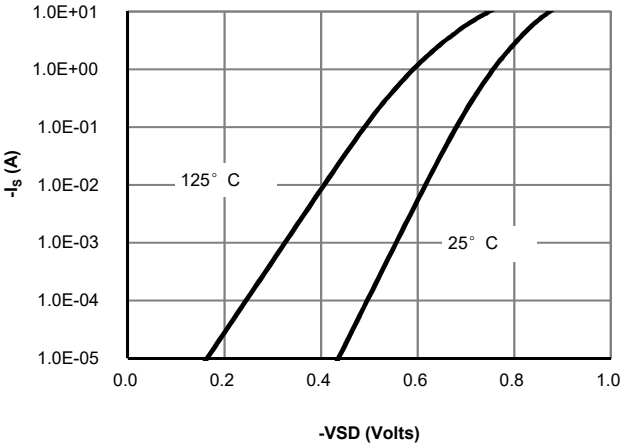



Figure 6: Body-Diode Characteristics (Note E)

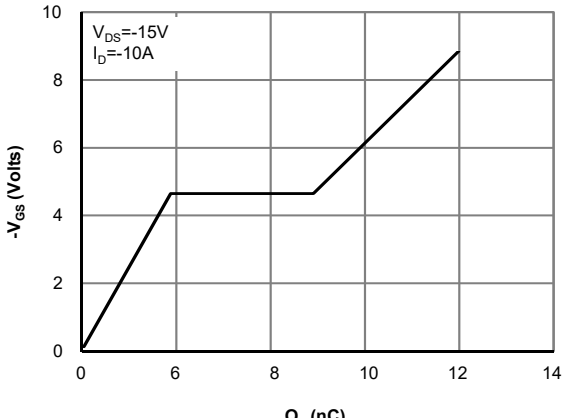



Figure 7: Gate-Charge Characteristics

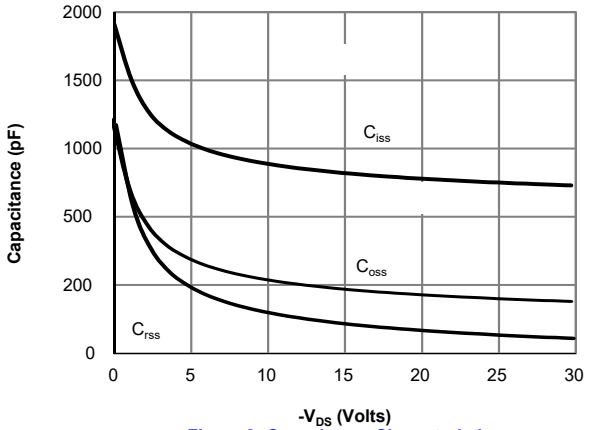



Figure 8: Capacitance Characteristics

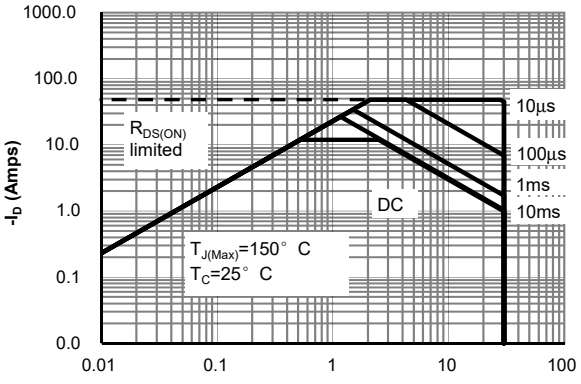



Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

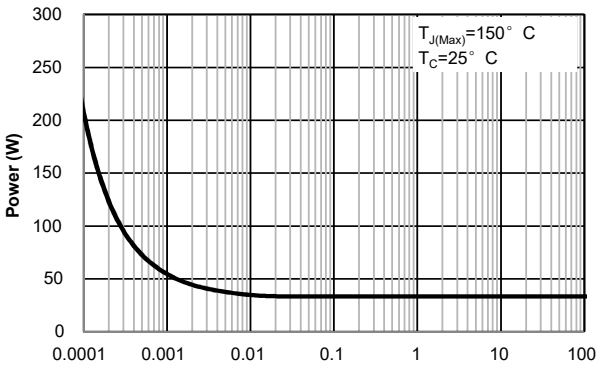



Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

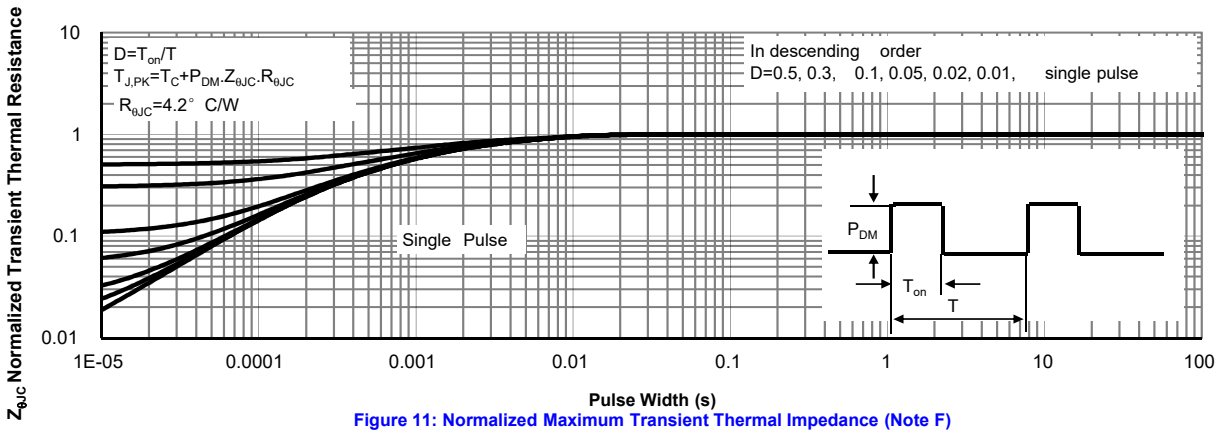



Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

# Disclaimer

1. Any and all Korsun Semiconductor products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your Korsun Semiconductor representative nearest you before using any Korsun Semiconductor products described or contained herein in such applications.

2.Korsun Semiconductor assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all Korsun Semiconductor products described or contained herein.

3. Specifications of any and all Korsun Semiconductor products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.

4. Korsun Semiconductor CO.,LTD. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.

5.In the event that any or all Korsun Semiconductor products(including technical data, services described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.

6. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of Korsun Semiconductor CO.,LTD.

7. Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production. Korsun Semiconductor believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

8. Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the Korsun Semiconductor product that you intend to use.

9. This catalog provides information as of Sep.2010. Specifications and information herein are subject to change without notice.