

# Dual N-channel MOSFET with schottky diode

ELM14912AA-N

## General description

ELM14912AA-N uses advanced trench technology to provide excellent  $R_{ds(on)}$  and low gate charge.

## Features

- |                            |                                 |                   |
|----------------------------|---------------------------------|-------------------|
| Q1                         | Q2                              | Schottky diode    |
| • $V_{ds}=30V$             | $V_{ds}=30V$                    | • $V_{ds}(V)=30V$ |
| • $I_d=8.5A$               | $I_d=7A$ ( $V_{gs}=10V$ )       | • $I_f=3A$        |
| • $R_{ds(on)} < 17m\Omega$ | $< 26m\Omega$ ( $V_{gs}=10V$ )  | • $V_f < 0.5V@1A$ |
| • $R_{ds(on)} < 25m\Omega$ | $< 31m\Omega$ ( $V_{gs}=4.5V$ ) |                   |

## Maximum absolute ratings

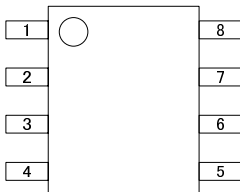
Parameter	Symbol	Max. Q1	Max. Q2	Max.Schottky	Unit	Note	
Drain-source voltage	$V_{ds}$	30	30		V		
Gate-source voltage	$V_{gs}$	$\pm 20$	$\pm 12$		V		
Continuous drain current	$I_d$	$T_a=25^\circ C$	8.5	7.0		A	1
		$T_a=70^\circ C$	6.8	6.4			
Pulsed drain current	$I_{dm}$	40	30		A	2	
Avalanche current	$I_{av}$	17	15		A	2	
Repetitive avalanche energy	$E_{av}$	43	34		mJ	2	
0.3mH Schottky reverse voltage	$V_{ka}$			30	V		
Continuous forward current	$I_f$	$T_a=25^\circ C$		3.0	A	1	
		$T_a=70^\circ C$		2.2			
Pulsed diode forward current	$I_{fm}$			20	A	2	
Power dissipation	$P_d$	$T_a=25^\circ C$	2.00	2.00	2.00	W	1
		$T_a=70^\circ C$	1.28	1.28	1.28		
Junction and storage temperature range	$T_j, T_{stg}$	-55 to 150	-55 to 150	-55 to 150	$^\circ C$		

## Thermal characteristics

Parameter (Q1,Q2)	Symbol	Typ.	Max.	Unit	Note
Maximum junction-to-ambient	$R\theta_{ja}$	48.0	62.5	$^\circ C/W$	1
Steady-state		74.0	110.0	$^\circ C/W$	
Maximum junction-to-lead	$R\theta_{jl}$	35.0	40.0	$^\circ C/W$	3
Parameter (Schottky)	Symbol	Typ.	Max.	Unit	Note
Maximum junction-to-ambient	$R\theta_{ja}$	47.5	62.5	$^\circ C/W$	1
Steady-state		71.0	110.0	$^\circ C/W$	
Maximum junction-to-lead	$R\theta_{jl}$	32.0	40.0	$^\circ C/W$	3

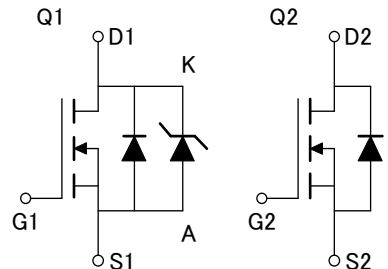
## Pin configuration

SOP-8 (TOP VIEW)



Pin No.	Pin name
1	DRAIN2
2	DRAIN2
3	GATE1
4	SOURCE1/ANODE
5	DRAIN1/SOURCE2/CATHODE
6	DRAIN1/SOURCE2/CATHODE
7	DRAIN1/SOURCE2/CATHODE
8	GATE2

## Circuit



# Dual N-channel MOSFET with schottky diode

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### ■ Electrical characteristics (Q1)

T<sub>a</sub>=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
<b>STATIC PARAMETERS</b>						
Drain-source breakdown voltage	BV <sub>dss</sub>	I <sub>d</sub> =250 μA, V <sub>gs</sub> =0V	30			V
Zero gate voltage drain current (Set by Schottky leakage)	I <sub>dss</sub>	V <sub>r</sub> =30V		0.007	0.050	mA
		V <sub>r</sub> =30V, T <sub>j</sub> =125°C		3.2	10.0	
		V <sub>r</sub> =30V, T <sub>j</sub> =150°C		12.0	20.0	
Gate-body leakage current	I <sub>gss</sub>	V <sub>ds</sub> =0V, V <sub>gs</sub> =±20V			100	nA
Gate threshold voltage	V <sub>gs(th)</sub>	V <sub>ds</sub> =V <sub>gs</sub> , I <sub>d</sub> =250 μA	1.0	1.8	3.0	V
On state drain current	I <sub>d(on)</sub>	V <sub>gs</sub> =4.5V, V <sub>ds</sub> =5V	30			A
Static drain-source on-resistance	R <sub>ds(on)</sub>	V <sub>gs</sub> =10V		13.8	17.0	mΩ
		I <sub>d</sub> =8.5A	T <sub>j</sub> =125°C	20.0	24.0	
		V <sub>gs</sub> =4.5V, I <sub>d</sub> =7A		19.7	25.0	mΩ
Forward transconductance	G <sub>fs</sub>	V <sub>ds</sub> =5V, I <sub>d</sub> =8.5A		23		S
Diode+Schottky forward voltage	V <sub>sd</sub>	I <sub>s</sub> =1A		0.45	0.50	V
Max. body-diode+Schottky continuous current	I <sub>s</sub>				3.5	A
<b>DYNAMIC PARAMETERS</b>						
Input capacitance	C <sub>iss</sub>			971	1165	pF
Output capacitance (FET+Schottky)	C <sub>oss</sub>	V <sub>gs</sub> =0V, V <sub>ds</sub> =15V, f=1MHz		190		pF
Reverse transfer capacitance	C <sub>rss</sub>			110	154	pF
Gate resistance	R <sub>g</sub>	V <sub>gs</sub> =0V, V <sub>ds</sub> =0V, f=1MHz	0.35	0.70	0.85	Ω
<b>SWITCHING PARAMETERS</b>						
Total gate charge (10V)	Q <sub>g</sub>			19.20	23.00	nC
Total gate charge	Q <sub>g</sub>	V <sub>gs</sub> =10V, V <sub>ds</sub> =15V, I <sub>d</sub> =8.5A		9.36	11.20	nC
Gate-source charge	Q <sub>gs</sub>			2.60		nC
Gate-drain charge	Q <sub>gd</sub>			4.20		nC
Turn-on delay time	t <sub>d(on)</sub>			5.2	7.5	ns
Turn-on rise time	t <sub>r</sub>	V <sub>gs</sub> =10V, V <sub>ds</sub> =15V		4.4	6.5	ns
Turn-off delay time	t <sub>d(off)</sub>	R <sub>l</sub> =1.8 Ω, R <sub>gen</sub> =3 Ω		17.3	25.0	ns
Turn-off fall time	t <sub>f</sub>			3.3	5.0	ns
Body diode+Schottky reverse recovery time	t <sub>rr</sub>	I <sub>f</sub> =8.5A, dI/dt=100A/μs		19.3	23.0	ns
Body diode+Schottky reverse recovery charge	Q <sub>rr</sub>	I <sub>f</sub> =8.5A, dI/dt=100A/μs		9.4	11.0	nC

#### NOTE :

- The value of R<sub>θja</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board of 2oz. Copper, in still air environment with T<sub>a</sub>=25°C. The value in any given applications depends on the user's specific board design, The current rating is based on the t ≤ 10s thermal resistance rating.
- Repetitive rating, pulse width limited by junction temperature.
- The R<sub>θja</sub> is the sum of the thermal impedance from junction to lead R<sub>θjl</sub> and lead to ambient.
- The static characteristics in Figures 1 to 6 are obtained using 80μs pulses, duty cycle 0.5%max.
- These tests are performed with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>a</sub>=25°C. The SOA curve provides a single pulse rating.
- The Schottky appears in parallel with the MOSFET body diode, even though it is a separate chip. Therefore, we provide the net forward drop, capacitance and recovery characteristics of the MOSFET and Schottky. However, the thermal resistance is specified for each chip separately.

# Dual N-channel MOSFET with schottky diode

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## Typical electrical and thermal characteristics (Q1)

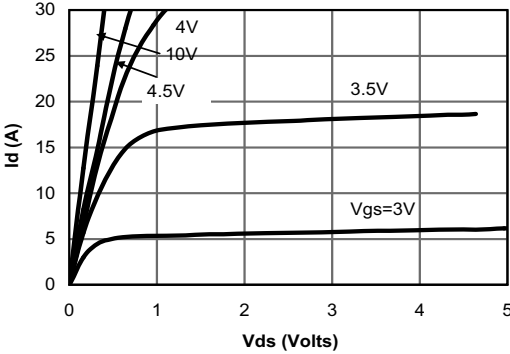


Figure 1: On-Region Characteristics

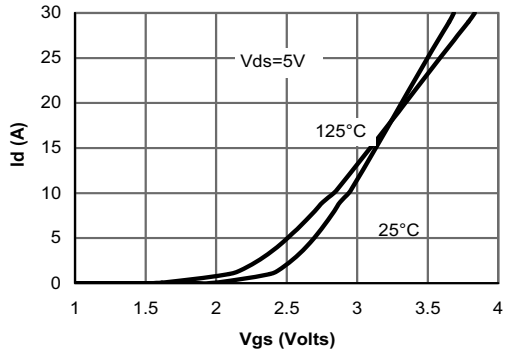


Figure 2: Transfer Characteristics

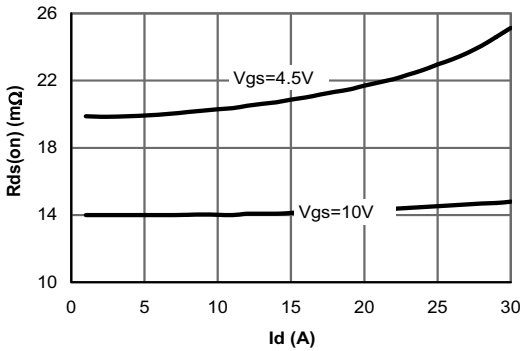


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

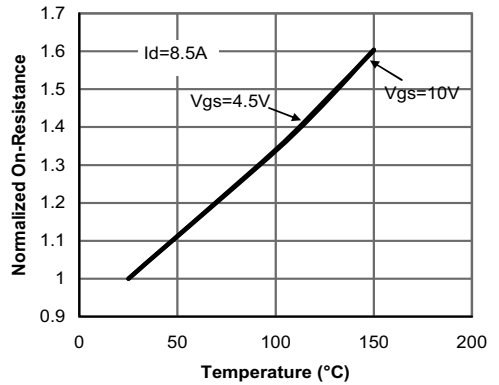


Figure 4: On resistance vs. Junction Temperature

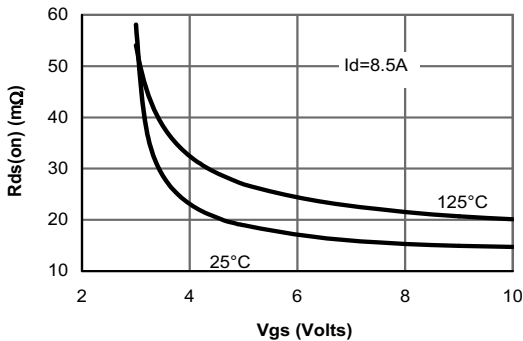


Figure 5: On resistance vs. Gate-Source Voltage

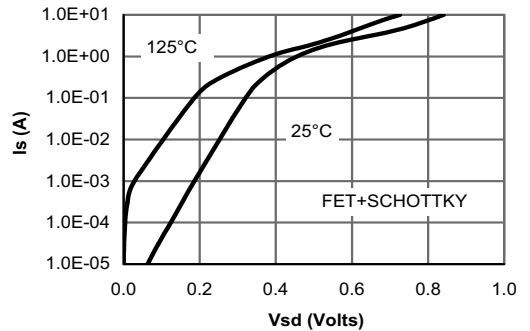


Figure 6: Body-Diode Characteristics (Note 6)

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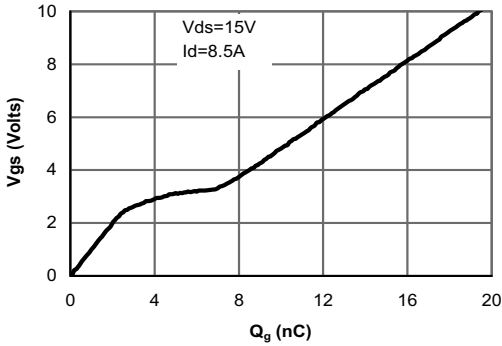


Figure 7: Gate-Charge Characteristics

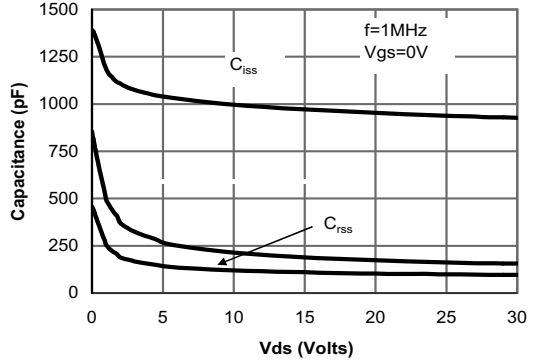


Figure 8: Capacitance Characteristics

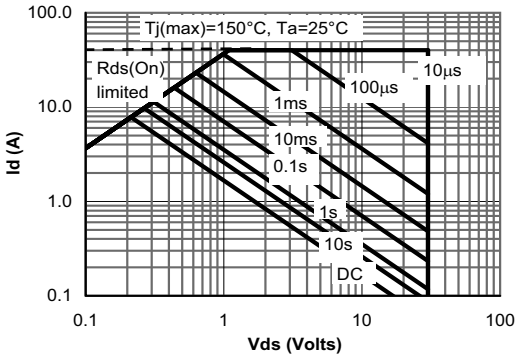


Figure 9: Maximum Forward Biased Safe Operating Area (Note 5)

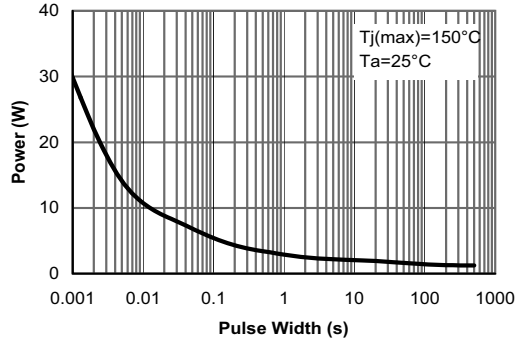


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note 5)



Figure 11: Normalized Maximum Transient Thermal Impedance

# Dual N-channel MOSFET with schottky diode

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### ■ Electrical characteristics (Q2)

T<sub>a</sub>=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
<b>STATIC PARAMETERS</b>						
Drain-source breakdown voltage	BV <sub>dss</sub>	I <sub>d</sub> =250 μA, V <sub>gs</sub> =0V	30			V
Zero gate voltage drain current	I <sub>dss</sub>	V <sub>ds</sub> =30V			1	μA
		V <sub>gs</sub> =0V			5	
Gate-body leakage current	I <sub>gss</sub>	V <sub>ds</sub> =0V, V <sub>gs</sub> =±12V			100	nA
Gate threshold voltage	V <sub>gs(th)</sub>	V <sub>ds</sub> =V <sub>gs</sub> , I <sub>d</sub> =250 μA	1.0	1.5	2.0	V
On state drain current	I <sub>d(on)</sub>	V <sub>gs</sub> =4.5V, V <sub>ds</sub> =5V	25			A
Static drain-source on-resistance	R <sub>ds(on)</sub>	V <sub>gs</sub> =10V			20.0	mΩ
		I <sub>d</sub> =7A			31.6	
			T <sub>j</sub> =125°C		38.0	
		V <sub>gs</sub> =4.5V, I <sub>d</sub> =6A			24.3	mΩ
Forward transconductance	G <sub>fs</sub>	V <sub>ds</sub> =5V, I <sub>d</sub> =7A		22		S
Diode forward voltage	V <sub>sd</sub>	I <sub>s</sub> =1A		0.78	1.00	V
Max. body-diode continuous current	I <sub>s</sub>				3	A
<b>DYNAMIC PARAMETERS</b>						
Input capacitance	C <sub>iss</sub>			590	710	pF
Output capacitance	C <sub>oss</sub>	V <sub>gs</sub> =0V, V <sub>ds</sub> =15V, f=1MHz		162		pF
Reverse transfer capacitance	C <sub>rss</sub>			40	56	pF
Gate resistance	R <sub>g</sub>	V <sub>gs</sub> =0V, V <sub>ds</sub> =0V, f=1MHz	0.20	0.45	0.60	Ω
<b>SWITCHING PARAMETERS</b>						
Total gate charge	Q <sub>g</sub>			6.04	7.30	nC
Gate-source charge	Q <sub>gs</sub>	V <sub>gs</sub> =4.5V, V <sub>ds</sub> =15V, I <sub>d</sub> =7A		1.46		nC
Gate-drain charge	Q <sub>gd</sub>			2.56		nC
Turn-on delay time	t <sub>d(on)</sub>			3.7	5.5	ns
Turn-on rise time	t <sub>r</sub>	V <sub>gs</sub> =10V, V <sub>ds</sub> =15V		3.5	5.5	ns
Turn-off delay time	t <sub>d(off)</sub>	R <sub>l</sub> =2.2 Ω, R <sub>gen</sub> =3 Ω		14.9	22.0	ns
Turn-off fall time	t <sub>f</sub>			2.5	4.0	ns
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>f</sub> =7A, dI/dt=100A/μs		21.2	26.0	ns
Body diode reverse recovery charge	Q <sub>rr</sub>	I <sub>f</sub> =7A, dI/dt=100A/μs		14.2	21.0	nC

#### NOTE :

1. The value of R<sub>θja</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board of 2oz. Copper, in still air environment with T<sub>a</sub>=25°C. The value in any given applications depends on the user's specific board design. The current rating is based on the t ≤ 10s thermal resistance rating.
2. Repetitive rating, pulse width limited by junction temperature.
3. The R<sub>θja</sub> is the sum of the thermal impedance from junction to lead R<sub>θjl</sub> and lead to ambient.
4. The static characteristics in Figures 1 to 6 are obtained using 80μs pulses, duty cycle 0.5%max.
5. These tests are performed with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>a</sub>=25°C. The SOA curve provides a single pulse rating.

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## Typical electrical and thermal characteristics (Q2)

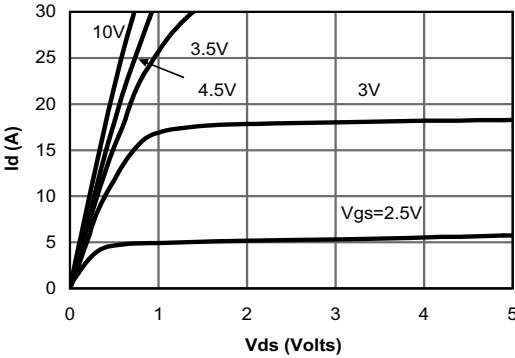


Fig 1: On-Region Characteristics

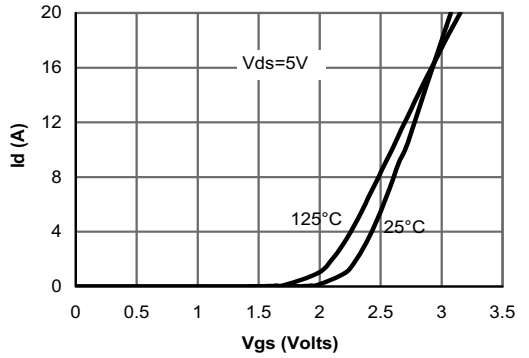


Figure 2: Transfer Characteristics

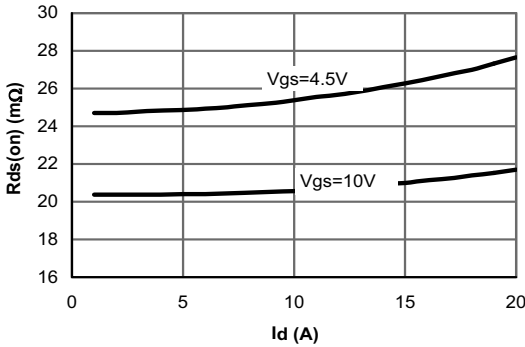


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

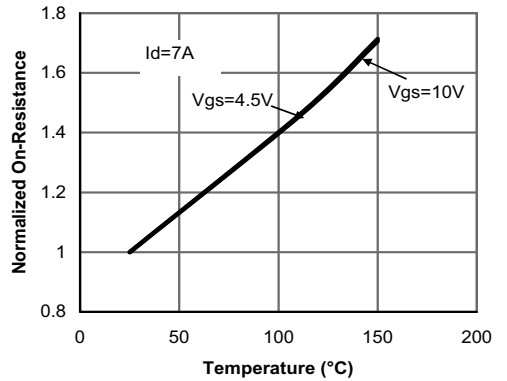


Figure 4: On resistance vs. Junction Temperature

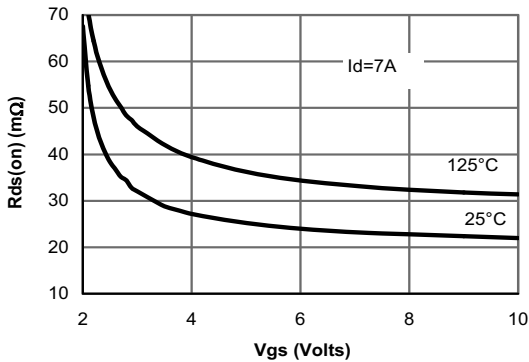


Figure 5: On resistance vs. Gate-Source Voltage

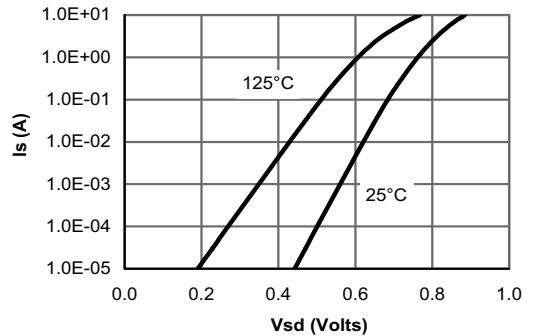


Figure 6: Body-Diode Characteristics

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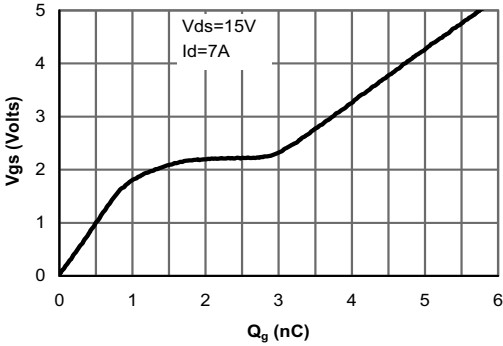


Figure 7: Gate-Charge Characteristics

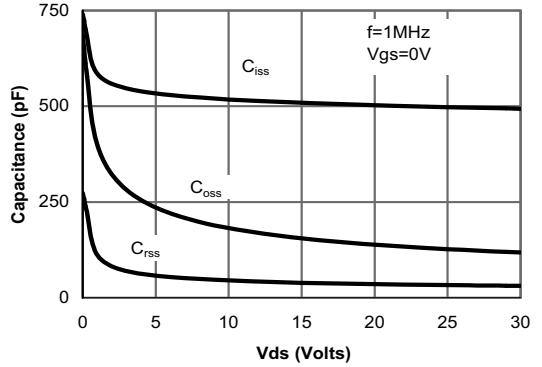


Figure 8: Capacitance Characteristics

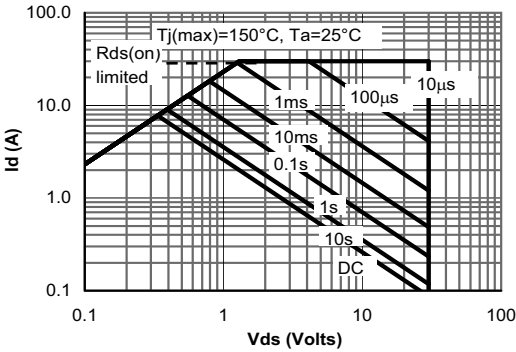


Figure 9: Maximum Forward Biased Safe Operating Area (Note 5)

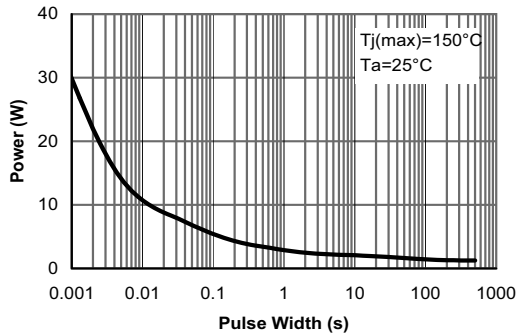


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note 5)

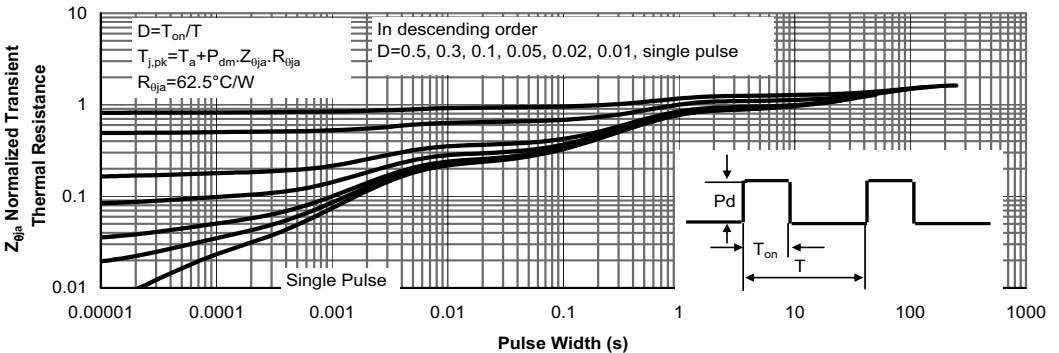


Figure 11: Normalized Maximum Transient Thermal Impedance