

# Complementary MOSFET

## ELM16601EA-S

### ■ General Description

ELM16601EA-S uses advanced trench technology to provide excellent  $R_{ds(on)}$  and low gate charge.

### ■ Features

- |  |   |
|--|---|
| N-channel                                | P-channel                               |
| • $V_{ds}=30V$                           | $V_{ds}=-30V$                           |
| • $I_d=3.4A(V_{gs}=10V)$                 | $I_d=-2.3A(V_{gs}=-10V)$                |
| • $R_{ds(on)} < 60m\Omega(V_{gs}=10V)$   | $R_{ds(on)} < 135m\Omega(V_{gs}=-10V)$  |
| • $R_{ds(on)} < 75m\Omega(V_{gs}=4.5V)$  | $R_{ds(on)} < 185m\Omega(V_{gs}=-4.5V)$ |
| • $R_{ds(on)} < 115m\Omega(V_{gs}=2.5V)$ | $R_{ds(on)} < 265m\Omega(V_{gs}=-2.5V)$ |

### ■ Maximum Absolute Ratings

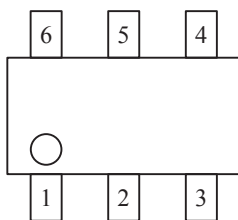
Parameter	Symbol	N-ch (Max.)	P-ch (Max.)	Unit	Note
Drain-source voltage	$V_{ds}$	30	-30	V	
Gate-source voltage	$V_{gs}$	$\pm 12$	$\pm 12$	V	
Continuous drain current	$I_d$	$T_a=25^\circ C$	-2.3	A	1
		$T_a=70^\circ C$	-1.8		
Pulsed drain current	$I_{dm}$	30	-30	A	2
Power dissipation	$P_d$	$T_a=25^\circ C$	1.15	W	
		$T_a=70^\circ C$	0.73		
Junction and storage temperature range	$T_j, T_{stg}$	-55 to 150	-55 to 150	$^\circ C$	

### ■ Thermal Characteristics

Parameter	Symbol	Device	Typ.	Max.	Unit	Note	
Maximum junction-to-ambient	$R_{\theta ja}$	N-ch	78	110	$^\circ C/W$	1	
Maximum junction-to-ambient			Steady-state	106	150		$^\circ C/W$
Maximum junction-to-lead			Steady-state	$R_{\theta jl}$	64		80
Maximum junction-to-ambient	$R_{\theta ja}$	P-ch	78	110	$^\circ C/W$	1	
Maximum junction-to-ambient			Steady-state	106	150		$^\circ C/W$
Maximum junction-to-lead			Steady-state	$R_{\theta jl}$	64		80

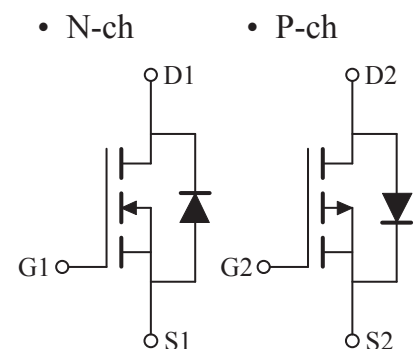
### ■ Pin configuration

SOT-26(TOP VIEW)



Pin No.	Pin name
1	GATE1
2	SOURCE2
3	GATE2
4	DRAIN2
5	SOURCE1
6	DRAIN1

### ■ Circuit



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### ■ Electrical Characteristics (N-ch)

Ta=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>STATIC PARAMETERS</b>						
Drain-source breakdown voltage	BVdss	Id=250μA, Vgs=0V	30			V
Zero gate voltage drain current	Idss	Vds=24V, Vgs=0V			1	μA
			Tj=55°C		5	
Gate-body leakage current	Igss	Vds=0V, Vgs=±12V			100	nA
Gate threshold voltage	Vgs(th)	Vds=Vgs, Id=250μA	0.6	1.0	1.4	V
On state drain current	Id(on)	Vgs=4.5V, Vds=5V	10			A
Static drain-source on-resistance	Rds(on)	Vgs=10V, Id=3A		50	60	mΩ
			Tj=125°C		75	
			Vgs=4.5V, Id=3A		60	
		Vgs=2.5V, Id=2A		88	115	
Forward transconductance	Gfs	Vds=5V, Id=3A		7.8		S
Diode forward voltage	Vsd	Is=1A, Vgs=0V		0.8	1.0	V
Max.body-diode continuous current	Is				1.5	A
<b>DYNAMIC PARAMETERS</b>						
Input capacitance	Ciss			390.0		pF
Output capacitance	Coss	Vgs=0V, Vds=15V, f=1MHz		54.5		pF
Reverse transfer capacitance	Crss			41.0		pF
Gate resistance	Rg	Vgs=0V, Vds=0V, f=1MHz		3		Ω
<b>SWITCHING PARAMETERS</b>						
Total gate charge	Qg			4.34		nC
Gate-source charge	Qgs	Vgs=4.5V, Vds=15V, Id=3A		1.38		nC
Gate-drain charge	Qgd			0.60		nC
Turn-on delay time	td(on)			4		ns
Turn-on rise time	tr	Vgs=10V, Vds=15V		2		ns
Turn-off delay time	td(off)	RI=5Ω, Rgen=6Ω		22		ns
Turn-off fall time	tf			3		ns
Body-diode reverse recovery time	trr	If=3A, dl/dt=100A/μs		11.0		ns
Body-diode reverse recovery charge	Qrr	If=3A, dl/dt=100A/μs		5.5		nC

#### NOTE :

1. The value of Rθja is measured with the device mounted on 1in<sup>2</sup> FR-4 board of 2oz. Copper, in still air environment with Ta=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 Rθja is the sum of the thermal impedance from junction to lead Rθjl 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 Ta=25°C. The SOA curve provides a single pulse rating.

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### ■ Typical Electrical and Thermal Characteristics (N-ch)

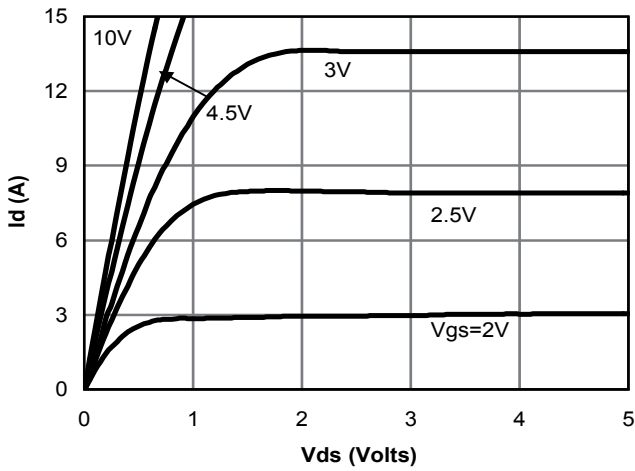


Fig 1: On-Region Characteristics

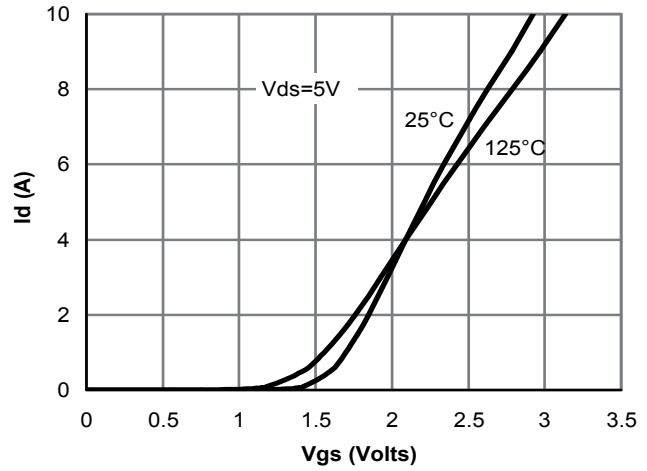


Figure 2: Transfer Characteristics

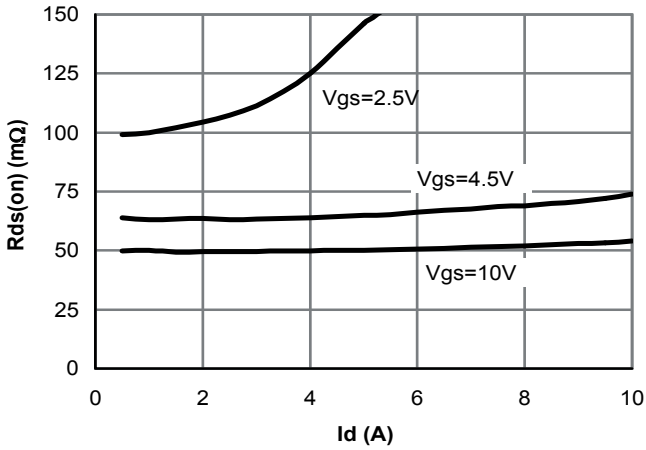


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

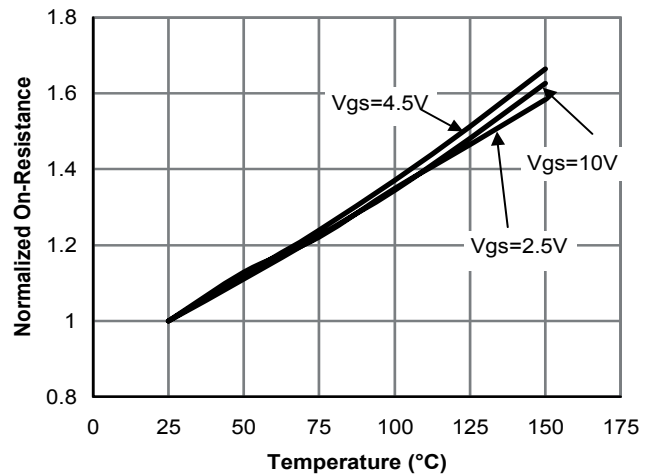


Figure 4: On-Resistance vs. Junction Temperature

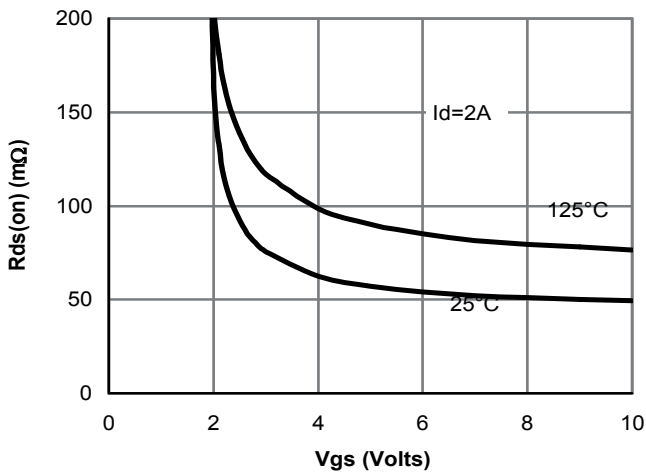


Figure 5: On-Resistance vs. Gate-Source Voltage

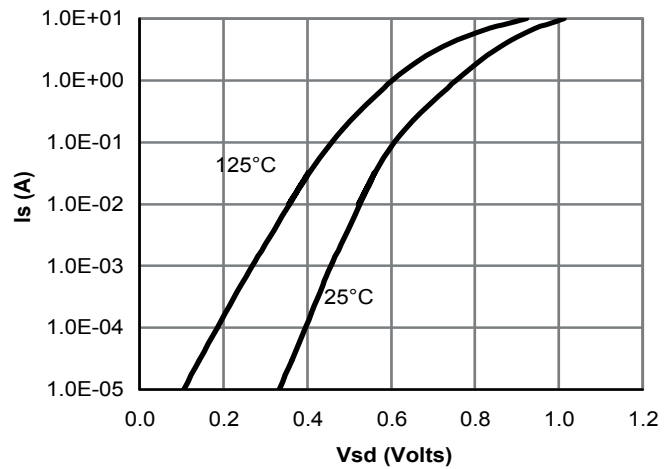


Figure 6: Body-Diode Characteristics

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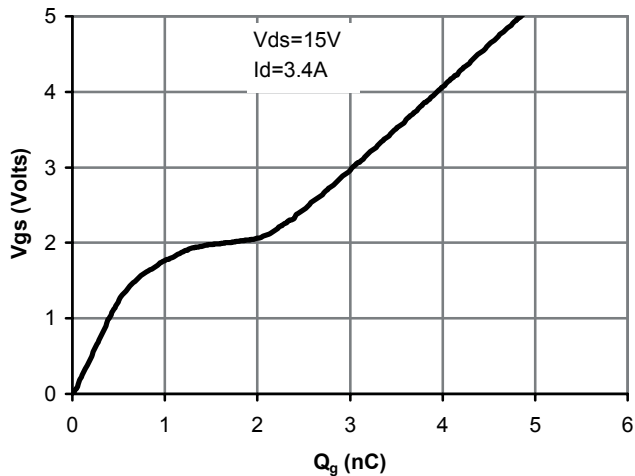


Figure 7: Gate-Charge Characteristics

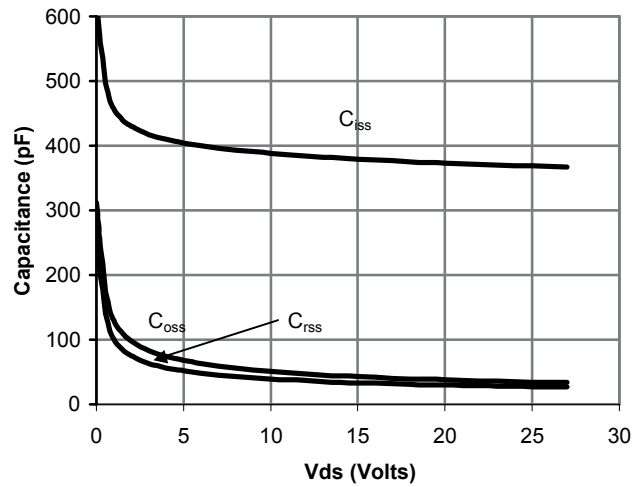


Figure 8: Capacitance Characteristics

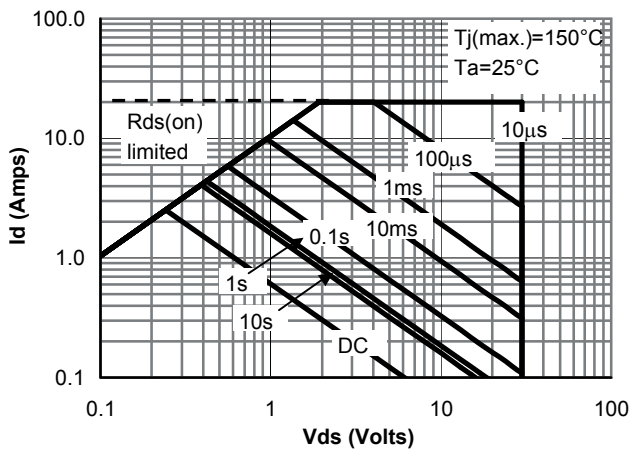


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

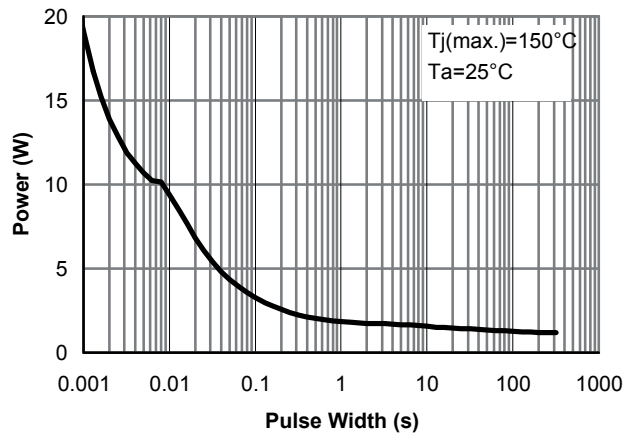


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

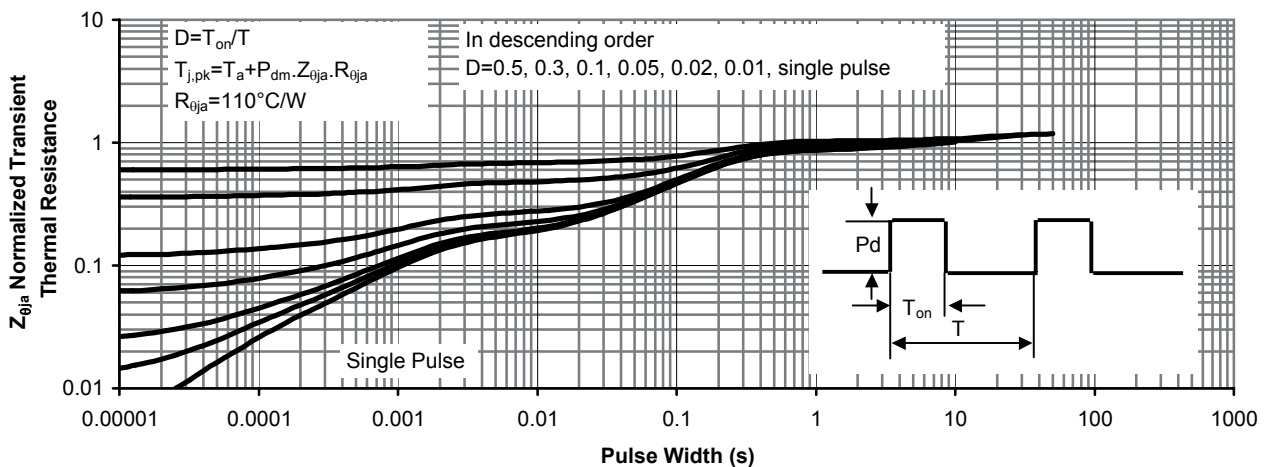


Figure 11: Normalized Maximum Transient Thermal Impedance

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### ■ Electrical Characteristics (P-ch)

Ta=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>STATIC PARAMETERS</b>						
Drain-source breakdown voltage	BVdss	Id=-250μA, Vgs=0V	-30			V
Zero gate voltage drain current	Idss	Vds=-24V, Vgs=0V			-1	μA
		Tj=55°C			-5	
Gate-body leakage current	Igss	Vds=0V, Vgs=±12V			±100	nA
Gate threshold voltage	Vgs(th)	Vds=Vgs, Id=-250μA	-0.6	-1.0	-1.4	V
On state drain current	Id(on)	Vgs=-4.5V, Vds=-5V	-10			A
Static drain-source on-resistance	Rds(on)	Vgs=-10V, Id=-2.3A		107	135	mΩ
		Tj=125°C				
		Vgs=-4.5V, Id=-2A		135	185	
		Vgs=-2.5V, Id=-1A		195	265	mΩ
Forward transconductance	Gfs	Vds=-5V, Id=-2.3A		8		S
Diode forward voltage	Vsd	Is=-1A, Vgs=0V		-0.85	-1.00	V
Max. body-diode continuous current	Is				-1.35	A
<b>DYNAMIC PARAMETERS</b>						
Input capacitance	Ciss			409		pF
Output capacitance	Coss	Vgs=0V, Vds=-15V, f=1MHz		55		pF
Reverse transfer capacitance	Crss			42		pF
Gate resistance	Rg	Vgs=0V, Vds=0V, f=1MHz		12		Ω
<b>SWITCHING PARAMETERS</b>						
Total gate charge	Qg	Vgs=-4.5V, Vds=-15V Id=-2.5A		4.80		nC
Gate-source charge	Qgs			1.34		nC
Gate-drain charge	Qgd			0.72		nC
Turn-on delay time	td(on)	Vgs=-10V, Vds=-15V Rl=6Ω, Rgen=6Ω		13		ns
Turn-on rise time	tr			10		ns
Turn-off delay time	td(off)			28		ns
Turn-off fall time	tf			13		ns
Body diode reverse recovery time	trr	If=-2.5A, dl/dt=100A/μs		26.0		ns
Body diode reverse recovery charge	Qrr	If=-2.5A, dl/dt=100A/μs		15.6		nC

#### NOTE :

1. The value of Rθja is measured with the device mounted on 1in<sup>2</sup> FR-4 board of 2oz. Copper, in still air environment with Ta=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.
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4. The static characteristics in Figures 1 to 6 are obtained using 80μs pulses, duty cycle 0.5%max.
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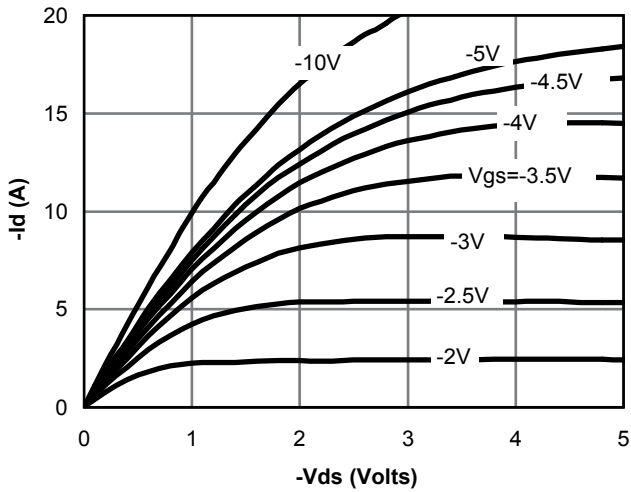


Fig 1: On-Region Characteristics

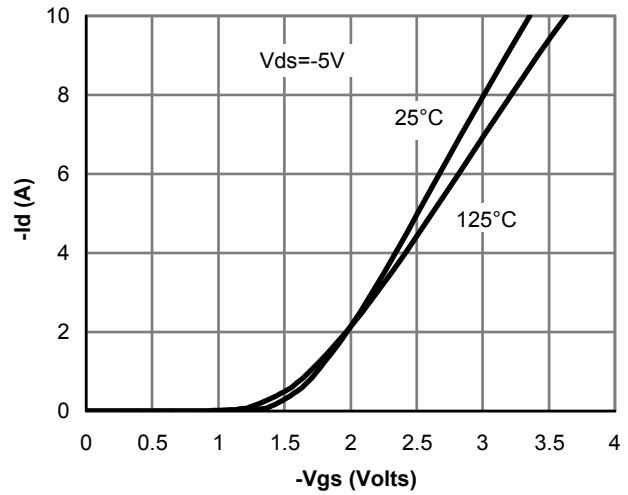


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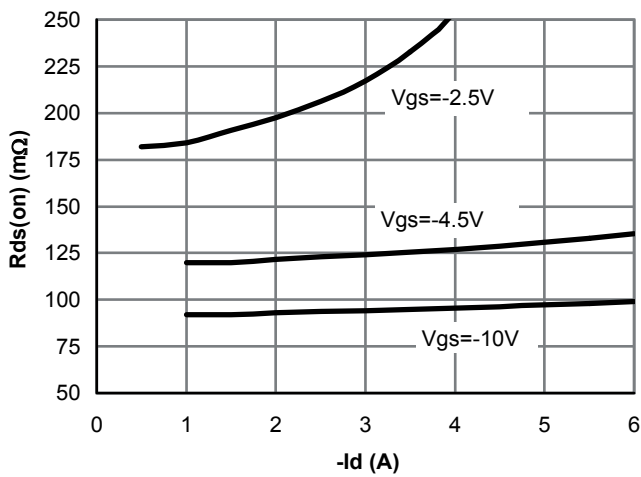


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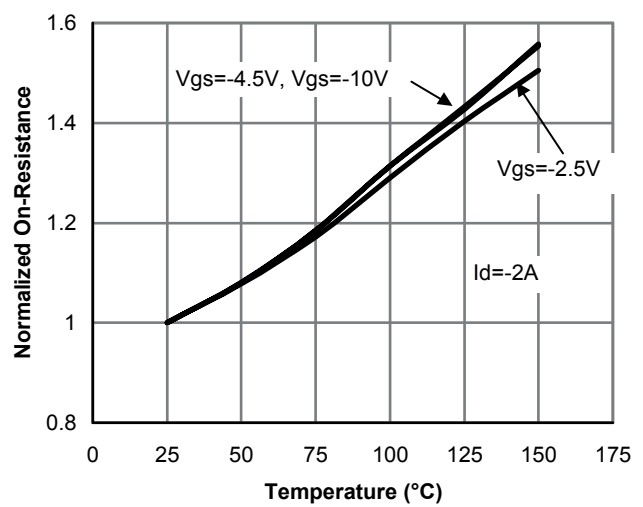


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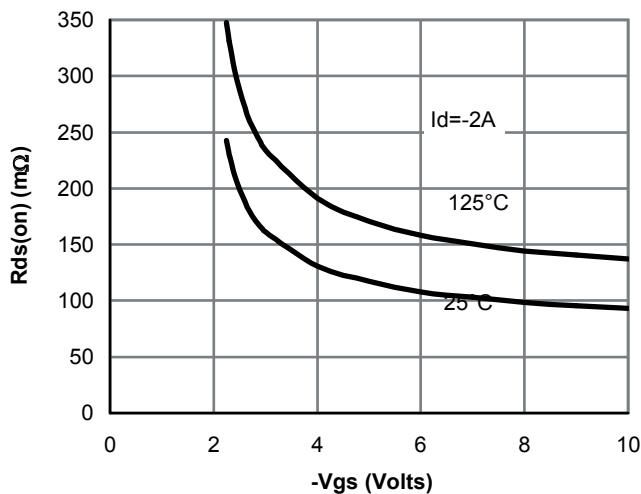


Figure 5: On-Resistance vs. Gate-Source Voltage

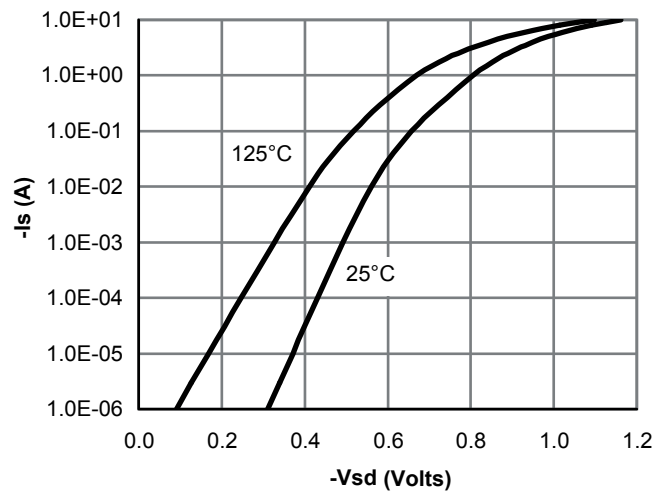


Figure 6: Body-Diode Characteristics

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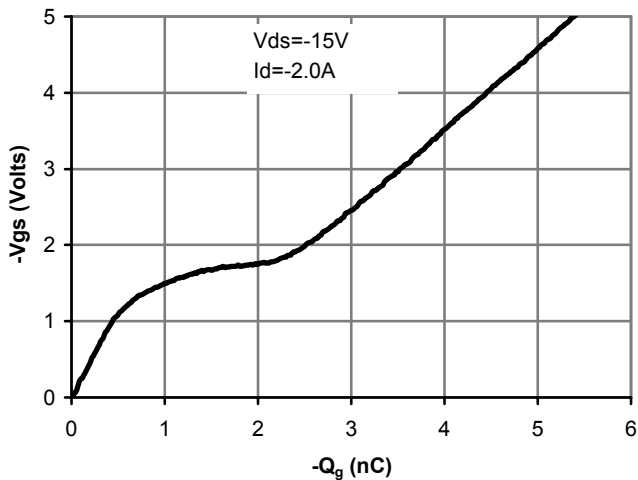


Figure 7: Gate-Charge Characteristics

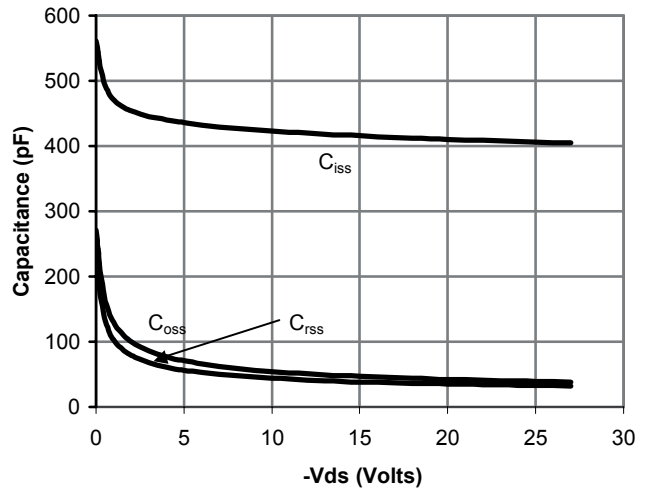


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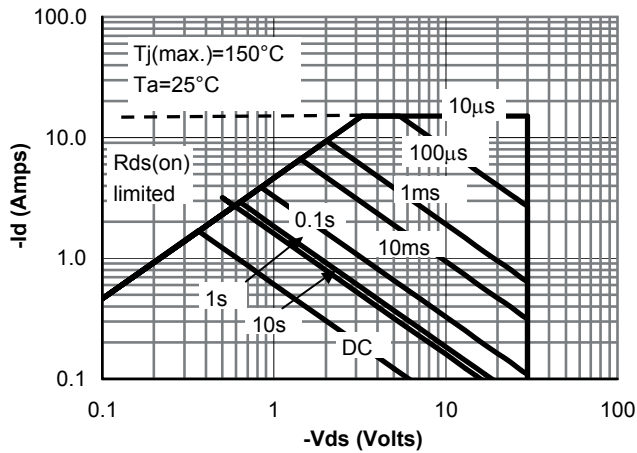


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

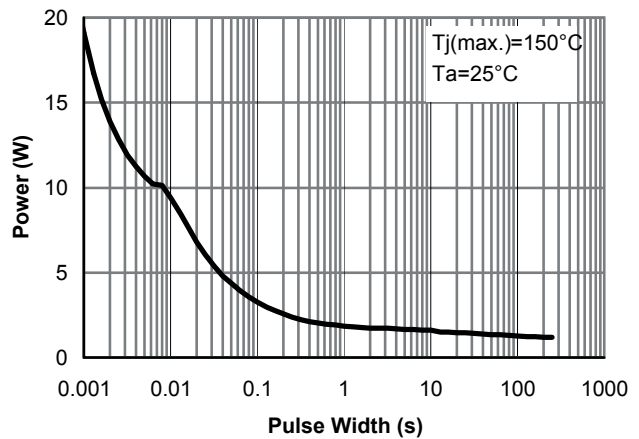


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

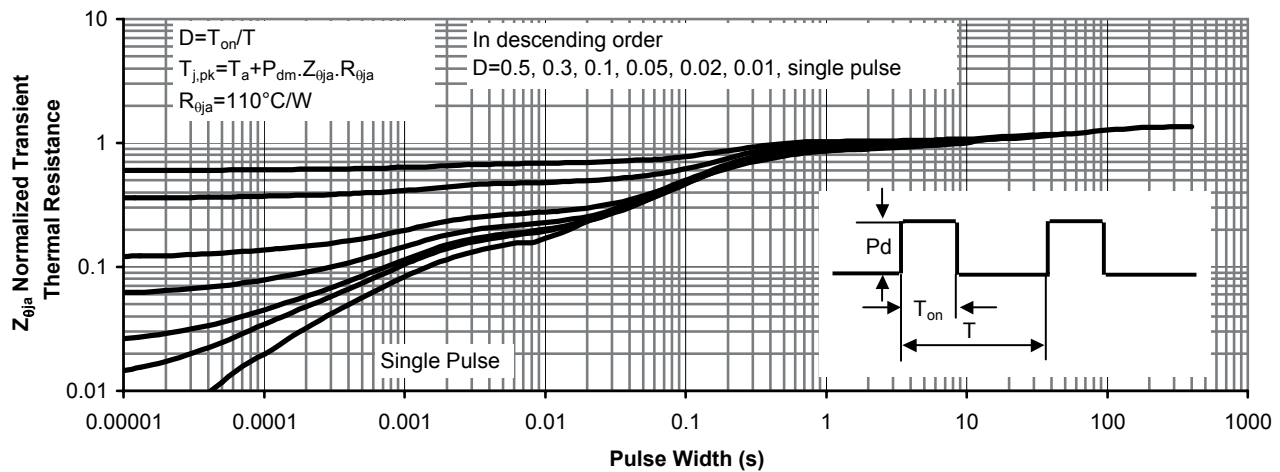


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