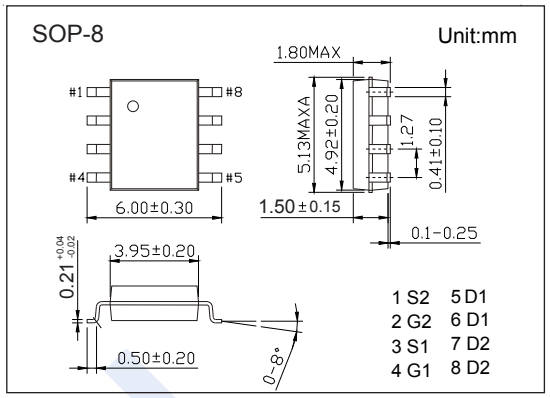
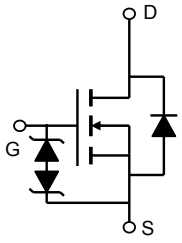
Complementary Trench MOSFET
AO4613-HF (KO4613-HF)

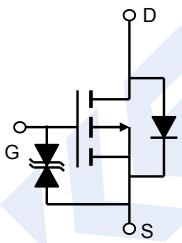


■ Features

- N-Channel :
  - $V_{DS\ (V)}$ = 30V
  - I_D = 7.2 A (V_{GS} = 10V)
  - $R_{DS(ON)}$ < 24mΩ (V_{GS} = 10V)
  - $R_{DS(ON)}$ < 40mΩ (V_{GS} = 4.5V)
- P-Channel :
  - $V_{DS\ (V)}$ = -30V
  - I_D = -6.1 A (V_{GS} = -10V)
  - $R_{DS(ON)}$ < 37mΩ (V_{GS} = -10V)
  - $R_{DS(ON)}$ < 60mΩ (V_{GS} = -4.5V)
- ESD Rating: 2KV HBM
- Pb−Free Package May be Available. The G−Suffix Denotes a Pb−Free Lead Finish



N-channel



P-channel

■ Absolute Maximum Ratings Ta = 25℃

Parameter		Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage		V_{DS}	30	-30	V
Gate-Source Voltage		V_{GS}	±20		
Continuous Drain Current	T_A=25℃	I_D	7.2	-6.1	A
	T_A=70℃		6.1	-5.1	
Pulsed Drain Current		I_{DM}	30	-30	
Avalanche Current		I_{AR}	15	20	
Repetitive Avalanche Energy	L=0.1mH	E_{AR}	11	20	
Power Dissipation	T_A=25℃	P_D	2		W
	T_A=70℃		1.44		
Thermal Resistance.Junction- to-Ambient	t ⩽ 10s	R_{thJA}	62.5		℃/W
	Steady-State		110		
Thermal Resistance.Junction- to-Lead		R_{thJL}	50		
Junction Temperature		T_J	150		℃
Storage Temperature Range		T_{stg}	-55 to 150		

Complementary Trench MOSFET
AO4613-HF (KO4613-HF)

■ N-Channel Electrical Characteristics Ta = 25℃

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	V_{DSS}	I_D=250μA, V_{GS}=0V	30			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=24V, V_{GS}=0V			1	uA
		V_{DS}=24V, V_{GS}=0V, T_J=55℃			5	
Gate-Body Leakage Current	I_{GSS}	V_{DS}=0V, V_{GS}=±12V			±10	uA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS} , I_D=250uA	1		3	V
Static Drain-Source On-Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=7.2A			24	mΩ
		V_{GS}=10V, I_D=7.2A T_J=125℃			35	
		V_{GS}=4.5V, I_D=4A			40	
On State Drain Current	$I_{D(ON)}$	V_{GS}=10V, V_{DS}=5V	20			A
Forward Transconductance	g_{FS}	V_{DS}=5V, I_D=7.2A	10	18		S
Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=15V, f=1MHz		522	630	pF
Output Capacitance	C_{oss}			110		
Reverse Transfer Capacitance	C_{rss}			75		
Gate Resistance	R_g	V_{GS}=0V, V_{DS}=0V, f=1MHz		2.1	3	Ω
Total Gate Charge (10V)	Q_g	V_{GS}=10V, V_{DS}=15V, I_D=7.2A		11	15	nC
Total Gate Charge (4.5V)				5.3	7	
Gate Source Charge	Q_{gs}			1.9		
Gate Drain Charge	Q_{gd}			4		
Turn-On DelayTime	$t_{d(on)}$	V_{GS}=10V, V_{DS}=15V, R_L=2.1Ω, R_{GEN}=3Ω		4.7	7	ns
Turn-On Rise Time	t_r			4.9	10	
Turn-Off DelayTime	$t_{d(off)}$			16.2	22	
Turn-Off Fall Time	t_f			3.5	7	
Body Diode Reverse Recovery Time	t_{rr}	I_F= 7.2A, dI/dt= 100A/us		15.7	20	
Body Diode Reverse Recovery Charge	Q_{rr}			7.9	10	nC
Maximum Body-Diode Continuous Current	I_S				3	A
Diode Forward Voltage	V_{SD}	I_S=1A,V_{GS}=0V			1	V

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

■ Marking

Marking	4613 KA**** F

Complementary Trench MOSFET
AO4613-HF (KO4613-HF)

■ P-Channel Electrical Characteristics Ta = 25℃

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	V_{DSS}	I_D=-250μA, V_{GS}=0V	-30			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=-24V, V_{GS}=0V			-1	uA
		V_{DS}=-24V, V_{GS}=0V, T_J=55℃			-5	
Gate-Body leakage current	I_{GSS}	V_{DS}=0V, V_{GS}=±12V			±10	uA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS} , I_D=-250μA	-1		-3	V
Static Drain-Source On-Resistance	$R_{DS(ON)}$	V_{GS}=-10V, I_D=-6.1A			37	mΩ
		V_{GS}=-10V, I_D=-6.1A T_J=125℃			48	
		V_{GS}=-4.5V, I_D=-4A			60	
On state drain current	$I_{D(ON)}$	V_{GS}=-10V, V_{DS}=-5V	-30			A
Forward Transconductance	g_{FS}	V_{DS}=-5V, I_D=-6.1A		12.5		S
Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=-15V, f=1MHz		1040	1250	pF
Output Capacitance	C_{oss}			179		
Reverse Transfer Capacitance	C_{rss}			134		
Gate resistance	R_g	V_{GS}=0V, V_{DS}=0V, f=1MHz		5	10	Ω
Total Gate Charge (10V)	Q_g	V_{GS}=-10V, V_{DS}=-15V, I_D=-6.1A		16.8	22	nC
Total Gate Charge (4.5V)				8.7	12	
Gate Source Charge	Q_{gs}			3.4		
Gate Drain Charge	Q_{gd}			5		
Turn-On DelayTime	$t_{d(on)}$	V_{GS}=-10V, V_{DS}=-15V, R_L=2.5Ω, R_{GEN}=3Ω		9	12	ns
Turn-On Rise Time	t_r			5.7	11	
Turn-Off DelayTime	$t_{d(off)}$			22.7	30	
Turn-Off Fall Time	t_f			10.2	20	
Body Diode Reverse Recovery Time	t_{rr}	I_F=-6.1A, dI/dt=100A/us		21.7	27	
Body Diode Reverse Recovery Charge	Q_{rr}			13.6	18	nC
Maximum Body-Diode Continuous Current	I_S				-3	A
Diode Forward Voltage	V_{SD}	I_S=-1A,V_{GS}=0V			-1	V

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

Complementary Trench MOSFET
AO4613-HF (KO4613-HF)

■ N-Channel Typical Characterisitics

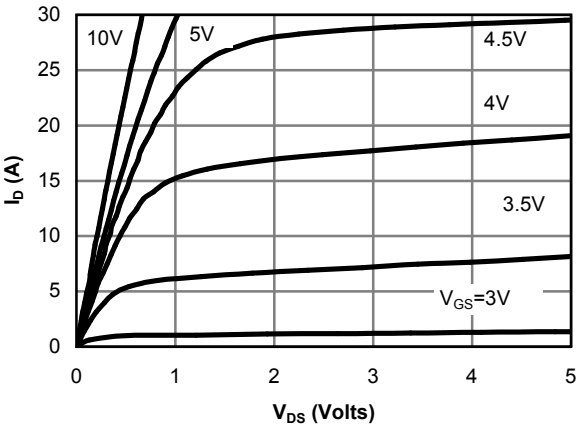


Fig 1: On-Region Characteristics

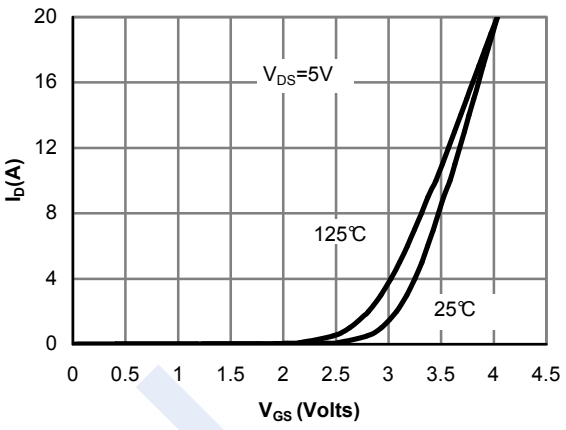


Figure 2: Transfer Characteristics

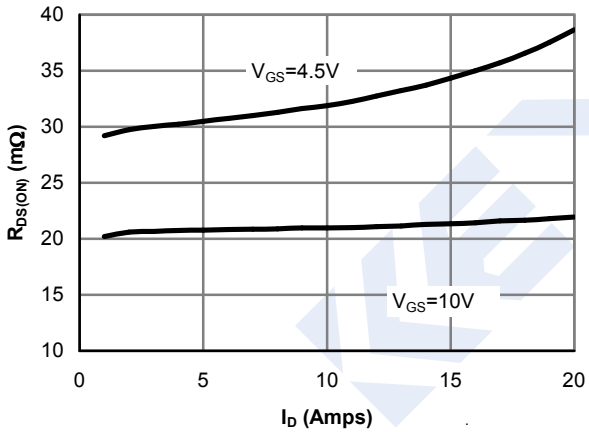


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

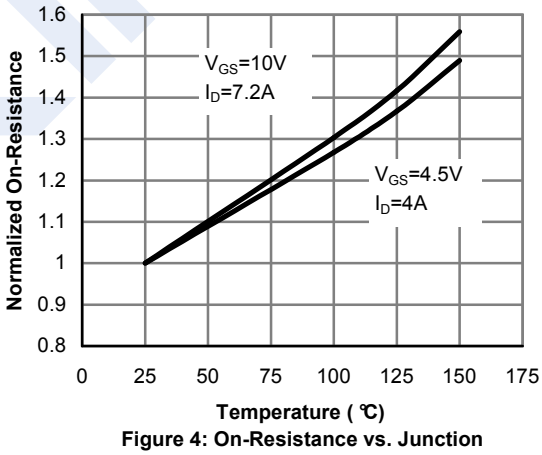


Figure 4: On-Resistance vs. Junction Temperature

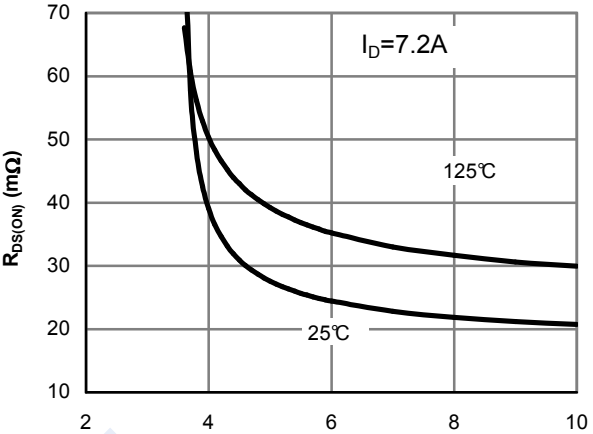


Figure 5: On-Resistance vs. Gate-Source Voltage

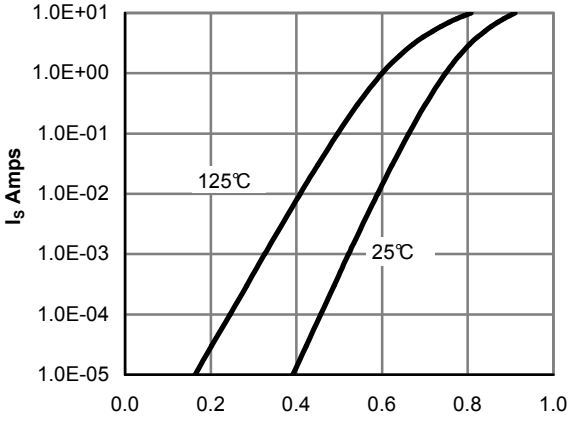


Figure 6: Body diode characteristics

Complementary Trench MOSFET
AO4613-HF (KO4613-HF)

■ N-Channel Typical Characterisitics

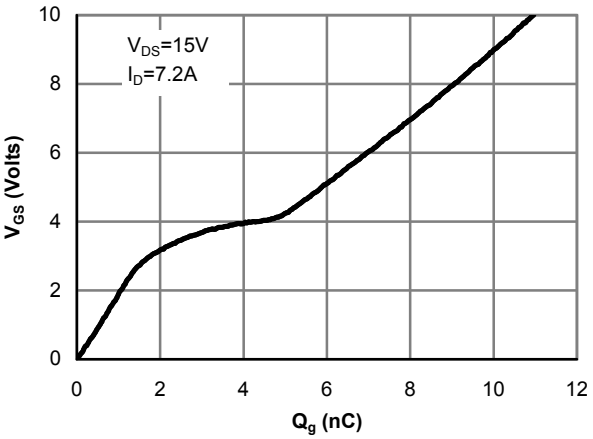


Figure 7: Gate-Charge characteristics

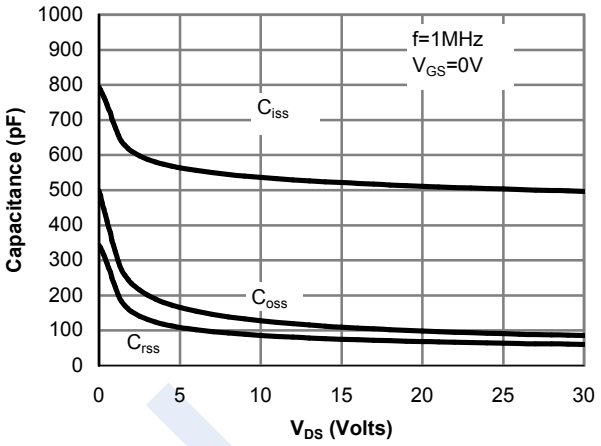


Figure 8: Capacitance Characteristics

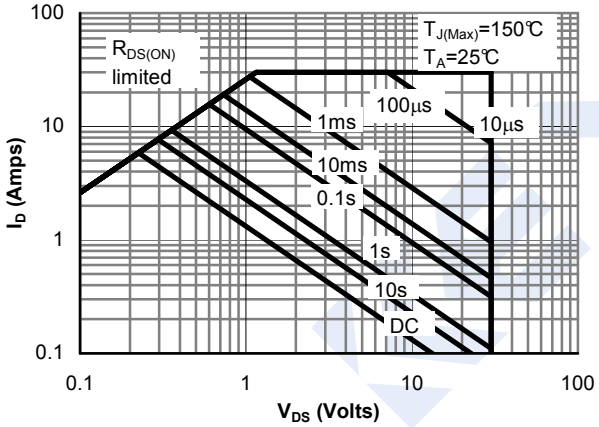


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

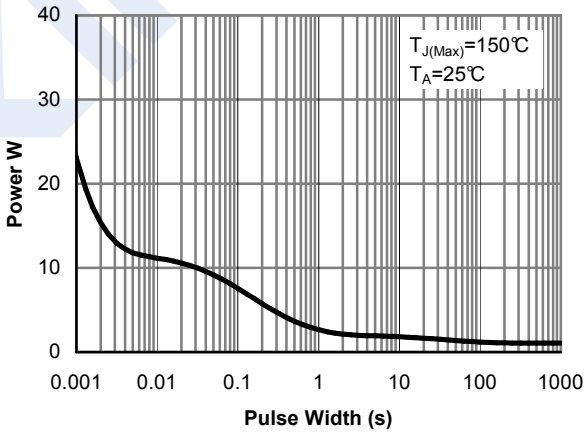


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

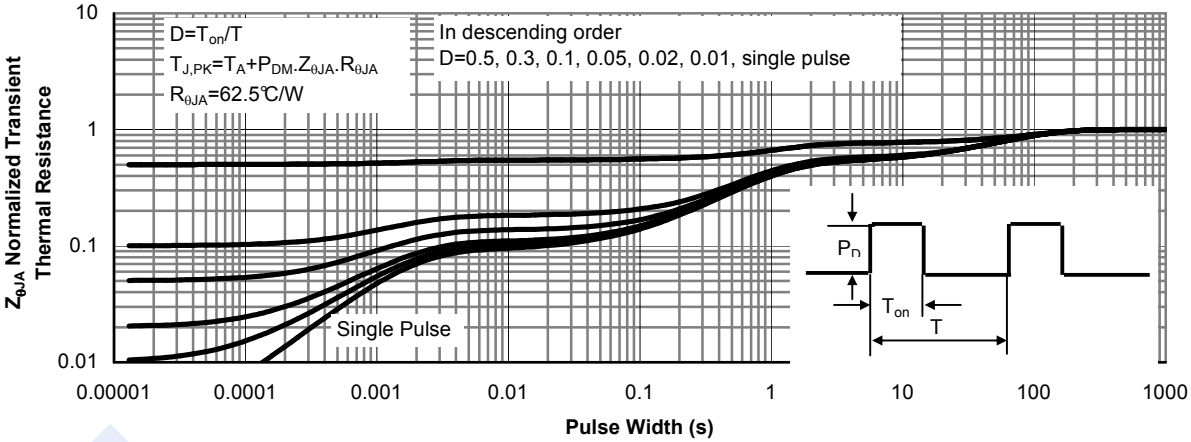


Figure 11: Normalized Maximum Transient Thermal Impedance

Complementary Trench MOSFET
AO4613-HF (KO4613-HF)

■ P-Channel Typical Characterisitics

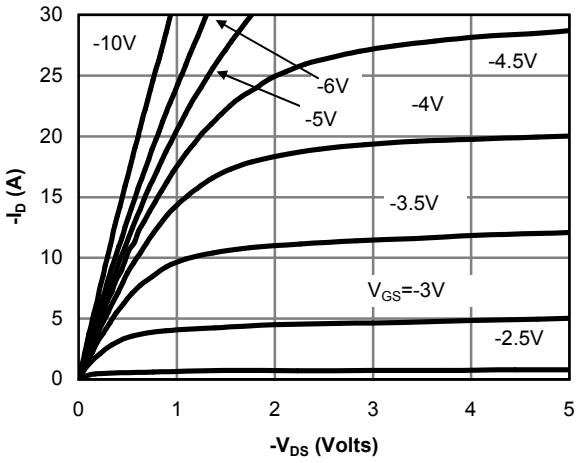


Fig 1: On-Region Characteristics

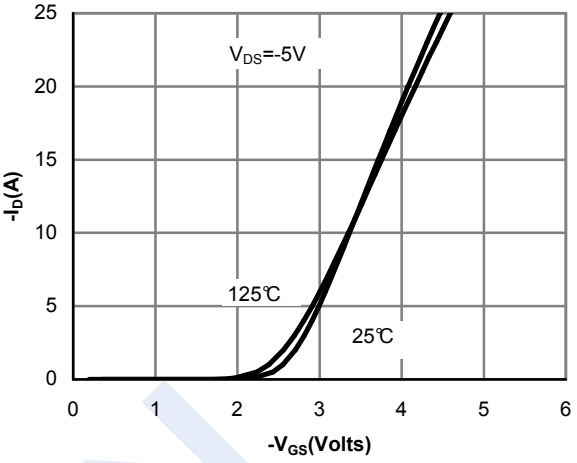


Figure 2: Transfer Characteristics

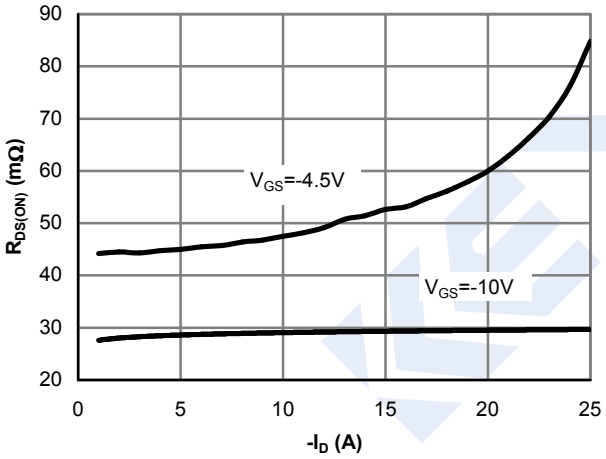


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

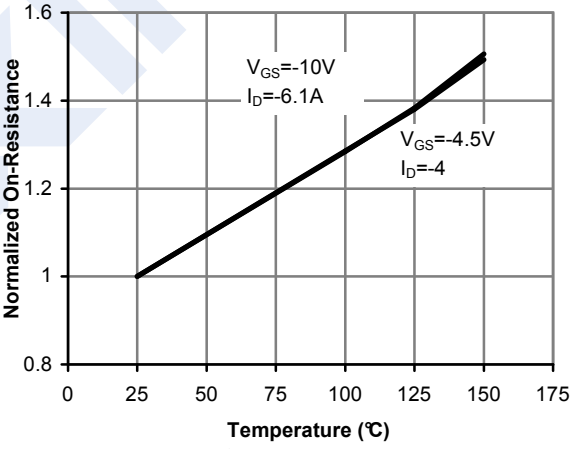


Figure 4: On-Resistance vs. Junction Temperature

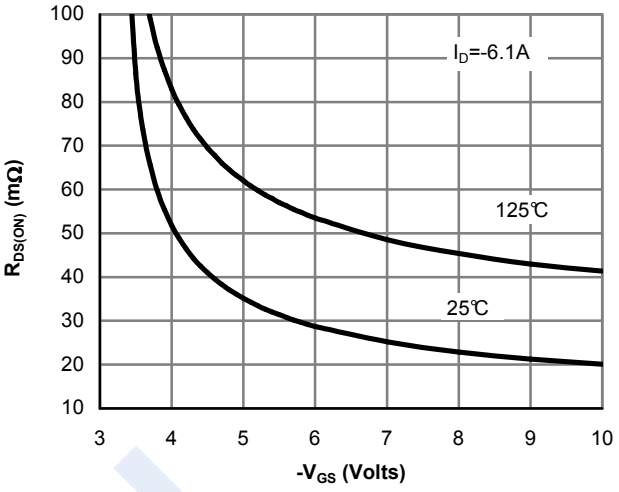


Figure 5: On-Resistance vs. Gate-Source Voltage

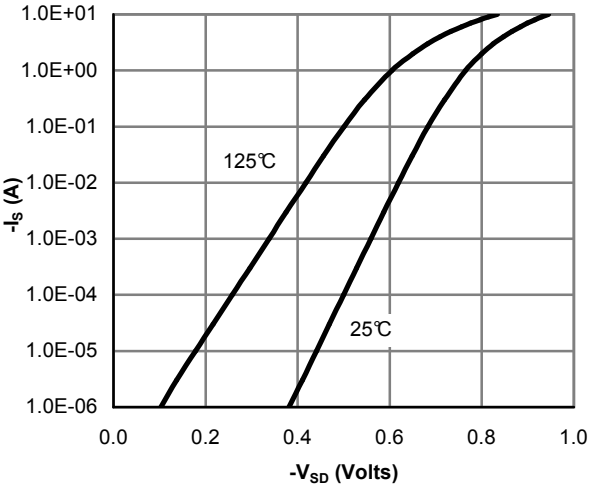


Figure 6: Body-Diode Characteristics

Complementary Trench MOSFET
AO4613-HF (KO4613-HF)

■ P-Channel Typical Characterisitics

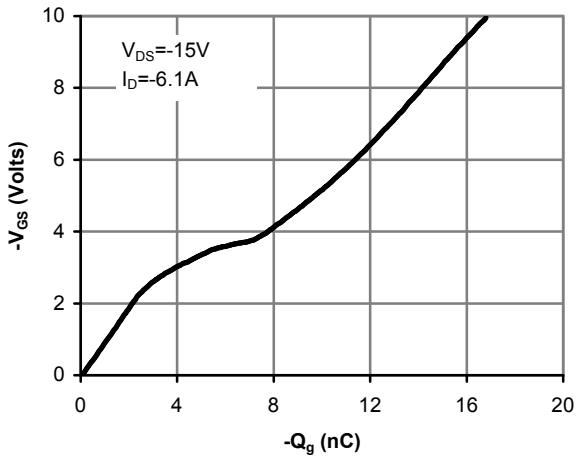


Figure 7: Gate-Charge Characteristics

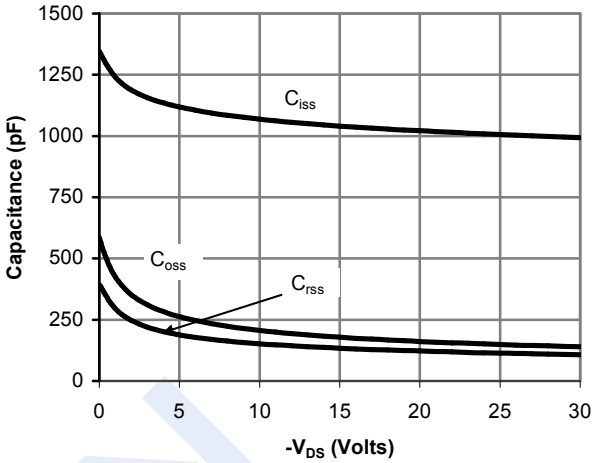


Figure 8: Capacitance Characteristics

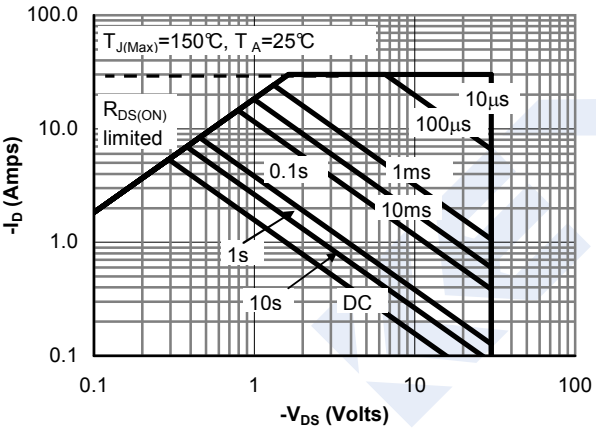


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

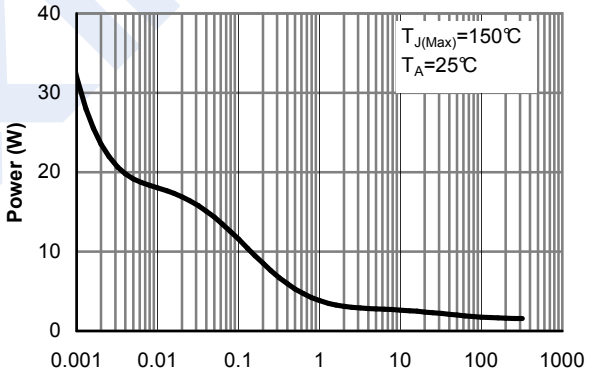


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

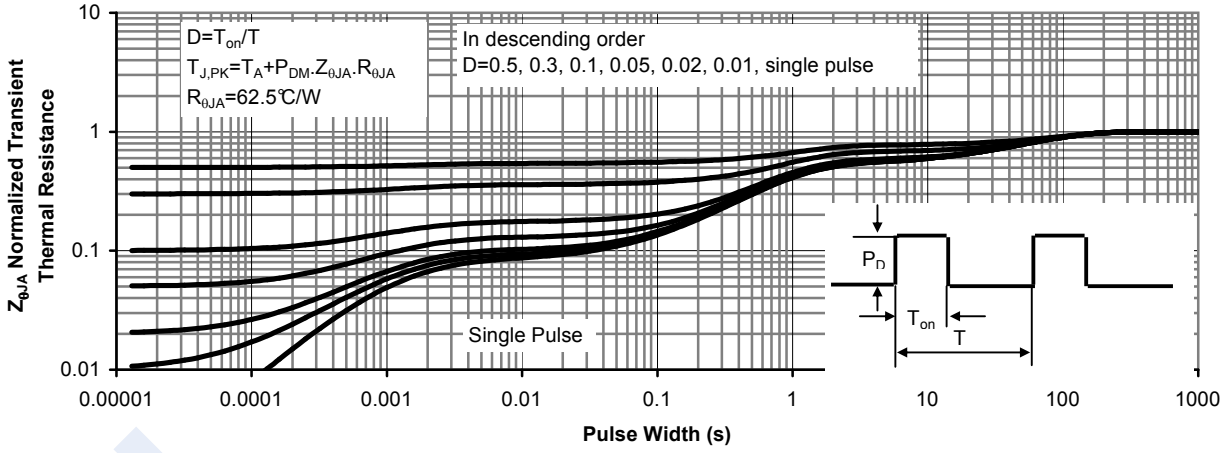


Figure 11: Normalized Maximum Transient Thermal Impedance