Dual N-channel MOSFET with schottky diode

ELM14912AA-N

■General description

ELM14912AA-N uses advanced trench technology to provide excellent Rds(on) and low gate charge.

■Features

Q1	Q2	Schottky diode
• Vds=30V	Vds=30V	• Vds(V)=30V
• Id=8.5A	Id=7A (Vgs=10V)	• If=3A
• Rds(on) < 17mΩ	< 26mΩ (Vgs=10V)	• Vf < 0.5V@1A
• Rds(on) < 25mΩ	< 31mΩ (Vgs=4.5V)	

■Maximum absolute ratings

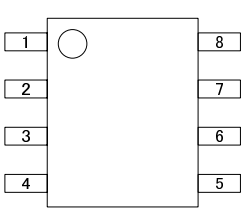
Parameter		Symbol	Max. Q1	Max. Q2	Max.Schottky	Unit	Note
Drain-source voltage		Vds	30	30		V	
Gate-source voltage		Vgs	±20	±12		V	
Continuous drain current	Ta=25℃	Id	8.5	7.0		A	1
	Ta=70℃		6.8	6.4			
Pulsed drain current		Idm	40	30		A	2
Avalanche current		Iav	17	15		A	2
Repetitive avalanche energy 0.3mH		Eav	43	34		mJ	2
Schottky reverse voltage		Vka			30	V	
Continuous forward current	Ta=25℃	If			3.0	A	1
	Ta=70℃				2.2		
Pulsed diode forward current		Ifm			20	A	2
Power dissipation	Ta=25℃	Pd	2.00	2.00	2.00	W	1
	Ta=70℃		1.28	1.28	1.28		
Junction and storage temperature range		Tj, Tstg	-55 to 150	-55 to 150	-55 to 150	℃	

■Thermal characteristics

Parameter (Q1,Q2)		Symbol	Typ.	Max.	Unit	Note
Maximum junction-to-ambient	t≤10s	Rθja	48.0	62.5	℃/W	1
Maximum junction-to-ambient	Steady-state		74.0	110.0	℃/W	
Maximum junction-to-lead	Steady-state	Rθjl	35.0	40.0	℃/W	3
Parameter (Schottky)		Symbol	Typ.	Max.	Unit	Note
Maximum junction-to-ambient	t≤10s	Rθja	47.5	62.5	℃/W	1
Maximum junction-to-ambient	Steady-state		71.0	110.0	℃/W	
Maximum junction-to-lead	Steady-state	Rθjl	32.0	40.0	℃/W	3

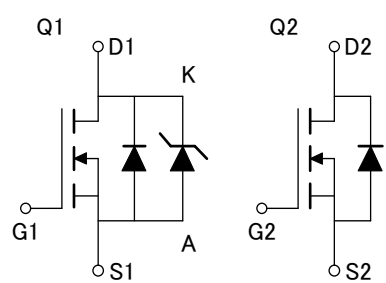
■Pin configuration

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



■Electrical characteristics (Q1)

Ta=25℃

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
STATIC PARAMETERS						
Drain-source breakdown voltage	BVdss	Id=250μA, Vgs=0V	30			V
Zero gate voltage drain current (Set by Schottky leakage)	Idss	Vr=30V		0.007	0.050	mA
		Vr=30V, Tj=125℃		3.2	10.0	
		Vr=30V, Tj=150℃		12.0	20.0	
Gate-body leakage current	Igss	Vds=0V, Vgs=±20V			100	nA
Gate threshold voltage	Vgs(th)	Vds=Vgs, Id=250μA	1.0	1.8	3.0	V
On state drain current	Id(on)	Vgs=4.5V, Vds=5V	30			A
Static drain-source on-resistance	Rds(on)	Vgs=10V, Id=8.5A		13.8	17.0	mΩ
		Vgs=10V, Id=8.5A, Tj=125℃		20.0	24.0	
		Vgs=4.5V, Id=7A		19.7	25.0	mΩ
Forward transconductance	Gfs	Vds=5V, Id=8.5A		23		S
Diode+Schottky forward voltage	Vsd	Is=1A		0.45	0.50	V
Max. body-diode+Schottky continuous current	Is				3.5	A
DYNAMIC PARAMETERS						
Input capacitance	Ciss	Vgs=0V, Vds=15V, f=1MHz		971	1165	pF
Output capacitance (FET+Schottky)	Coss			190		pF
Reverse transfer capacitance	Crss			110	154	pF
Gate resistance	Rg	Vgs=0V, Vds=0V, f=1MHz	0.35	0.70	0.85	Ω
SWITCHING PARAMETERS						
Total gate charge (10V)	Qg	Vgs=10V, Vds=15V, Id=8.5A		19.20	23.00	nC
Total gate charge	Qg			9.36	11.20	nC
Gate-source charge	Qgs			2.60		nC
Gate-drain charge	Qgd			4.20		nC
Turn-on delay time	td(on)	Vgs=10V, Vds=15V, Rl=1.8Ω, Rgen=3Ω		5.2	7.5	ns
Turn-on rise time	tr			4.4	6.5	ns
Turn-off delay time	td(off)			17.3	25.0	ns
Turn-off fall time	tf			3.3	5.0	ns
Body diode+Schottky reverse recovery time	trr	If=8.5A, dI/dt=100A/μs		19.3	23.0	ns
Body diode+Schottky reverse recovery charge	Qrr	If=8.5A, dI/dt=100A/μs		9.4	11.0	nC

NOTE :

1. The value of Rθja is measured with the device mounted on 1in² FR-4 board of 2oz. Copper, in still air environment with Ta=25℃. The value in any given applications depends on the user's specific board design, The current rating is based on the t ≤ 10s themal 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 1in² FR-4 board with 2oz. Copper, in a still air environment with Ta=25℃. The SOA curve provides a single pulse rating.
6. 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.

■Typical electrical and thermal characteristics (Q1)

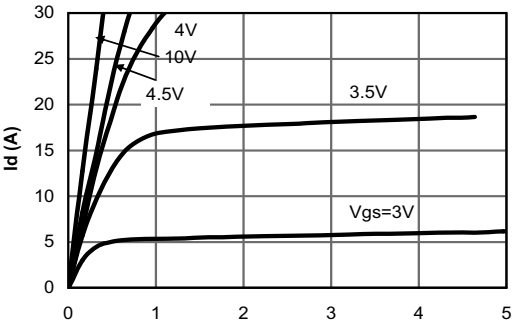


Fig 1: On-Region Characteristics

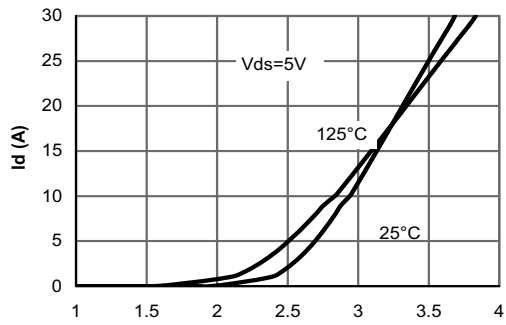


Figure 2: Transfer Characteristics

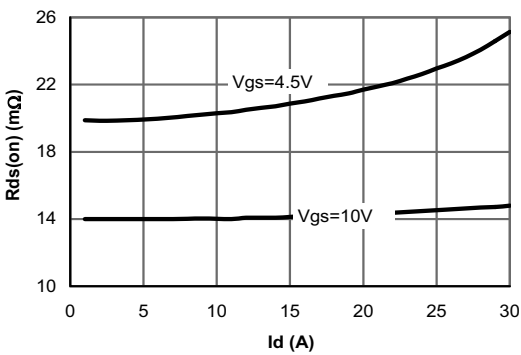


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

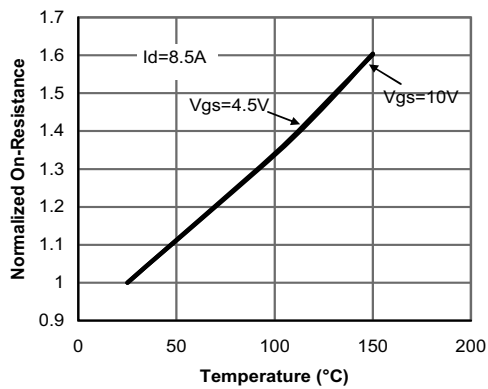


Figure 4: On resistance vs. Junction Temperature

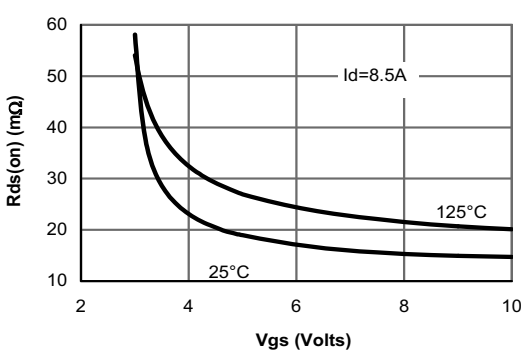


Figure 5: On resistance vs. Gate-Source Voltage

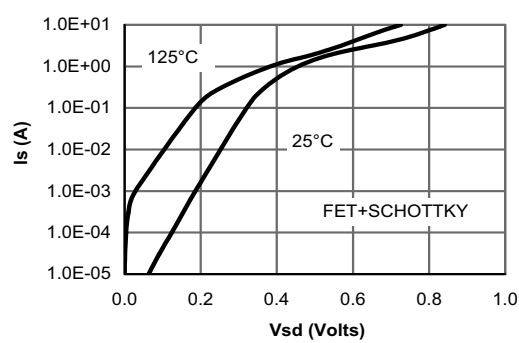


Figure 6: Body-Diode Characteristics (Note 6)

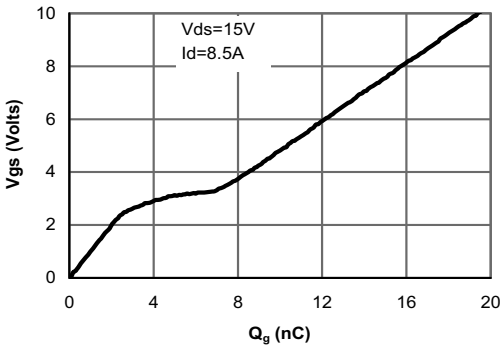


Figure 7: Gate-Charge Characteristics

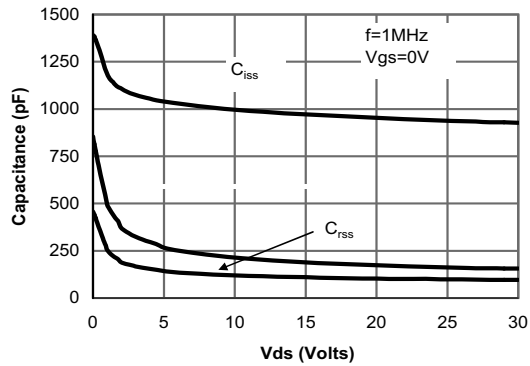


Figure 8: Capacitance Characteristics

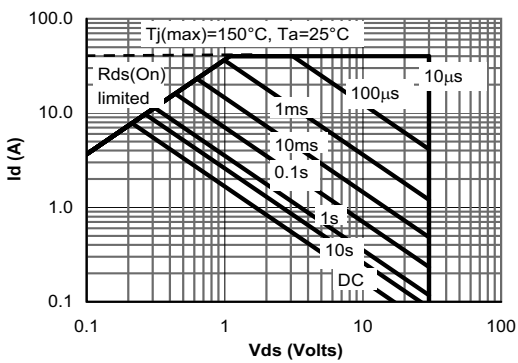


Figure 9: Maximum Forward Biased Safe Operating Area (Note 5)

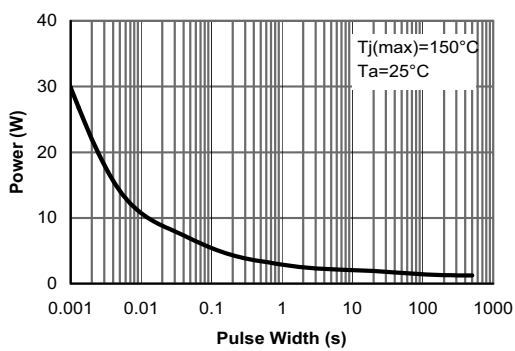


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note 5)

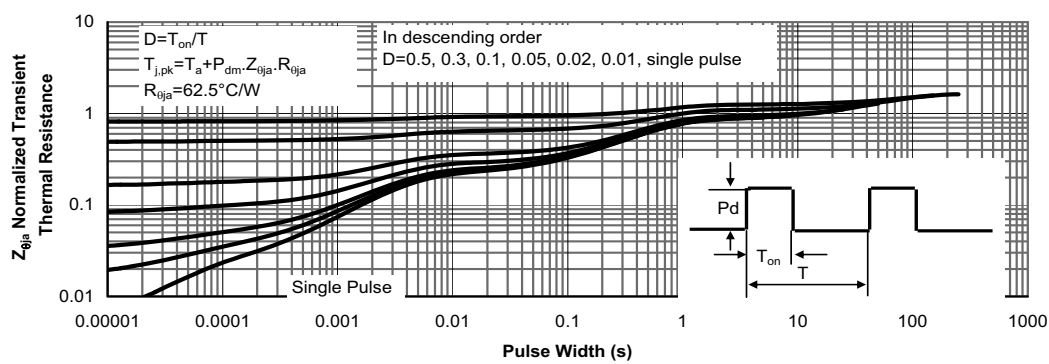


Figure 11: Normalized Maximum Transient Thermal Impedance

■Electrical characteristics (Q2)

Ta=25℃

Parameter	Symbol	Condition		Min.	Typ.	Max.	Unit
STATIC PARAMETERS							
Drain-source breakdown voltage	BVdss	Id=250μA, Vgs=0V		30			V
Zero gate voltage drain current	Idss	Vds=30V, Vgs=0V				1	μA
			Tj=55℃			5	
Gate-body leakage current	Igss	Vds=0V, Vgs=±12V				100	nA
Gate threshold voltage	Vgs(th)	Vds=Vgs, Id=250μA		1.0	1.5	2.0	V
On state drain current	Id(on)	Vgs=4.5V, Vds=5V		25			A
Static drain-source on-resistance	Rds(on)	Vgs=10V, Id=7A			20.0	26.0	mΩ
			Tj=125℃		31.6	38.0	
		Vgs=4.5V, Id=6A			24.3	31.0	mΩ
Forward transconductance	Gfs	Vds=5V, Id=7A			22		S
Diode forward voltage	Vsd	Is=1A			0.78	1.00	V
Max. body-diode continuous current	Is					3	A
DYNAMIC PARAMETERS							
Input capacitance	Ciss	Vgs=0V, Vds=15V, f=1MHz			590	710	pF
Output capacitance	Coss				162		pF
Reverse transfer capacitance	Crss				40	56	pF
Gate resistance	Rg	Vgs=0V, Vds=0V, f=1MHz		0.20	0.45	0.60	Ω
SWITCHING PARAMETERS							
Total gate charge	Qg	Vgs=4.5V, Vds=15V, Id=7A			6.04	7.30	nC
Gate-source charge	Qgs				1.46		nC
Gate-drain charge	Qgd				2.56		nC
Turn-on delay time	td(on)	Vgs=10V, Vds=15V, Rl=2.2Ω, Rgen=3Ω			3.7	5.5	ns
Turn-on rise time	tr				3.5	5.5	ns
Turn-off delay time	td(off)				14.9	22.0	ns
Turn-off fall time	tf				2.5	4.0	ns
Body diode reverse recovery time	trr	If=7A, dI/dt=100A/μs			21.2	26.0	ns
Body diode reverse recovery charge	Qrr	If=7A, dI/dt=100A/μs			14.2	21.0	nC

NOTE :

1. The value of Rθja is measured with the device mounted on 1in² FR-4 board of 2oz. Copper, in still air environment with Ta=25℃. The value in any given applications depends on the user's specific board design, The current rating is based on the t ≤ 10s themal 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 1in² FR-4 board with 2oz. Copper, in a still air environment with Ta=25℃. The SOA curve provides a single pulse rating.

■Typical electrical and thermal characteristics (Q2)

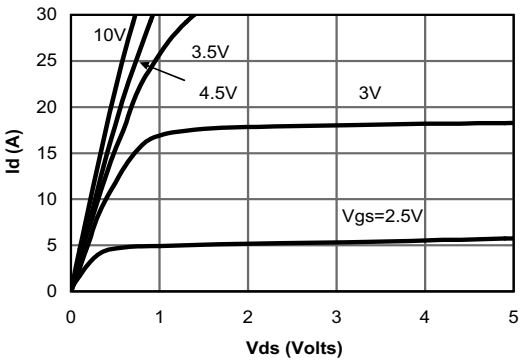


Fig 1: On-Region Characteristics

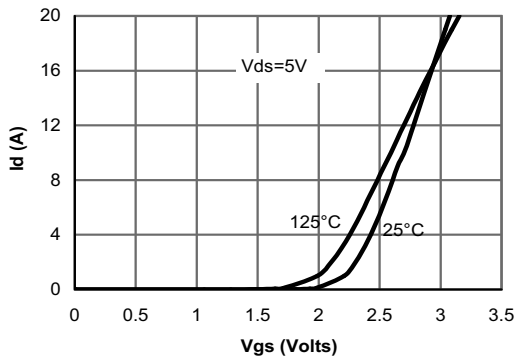


Figure 2: Transfer Characteristics

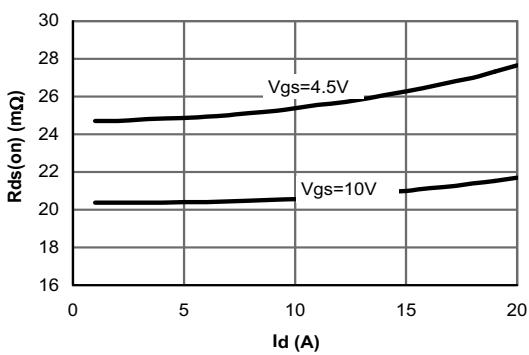


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

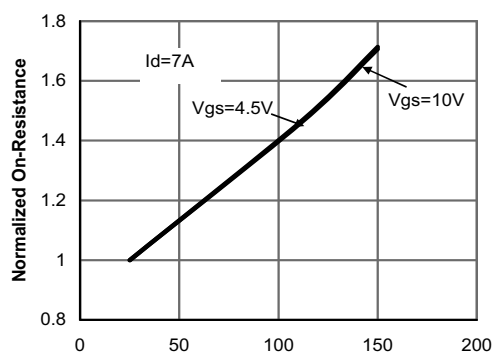


Figure 4: On resistance vs. Junction Temperature

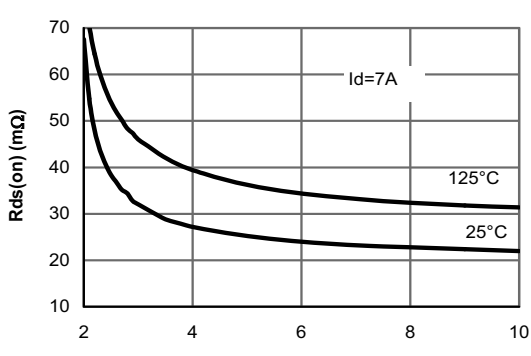


Figure 5: On resistance vs. Gate-Source Voltage

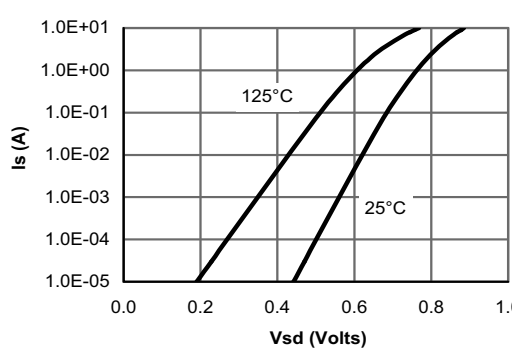


Figure 6: Body-Diode Characteristics

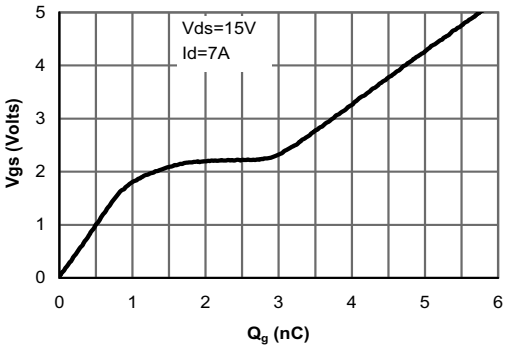


Figure 7: Gate-Charge Characteristics

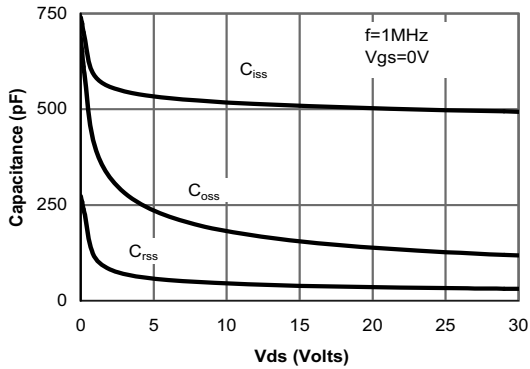


Figure 8: Capacitance Characteristics

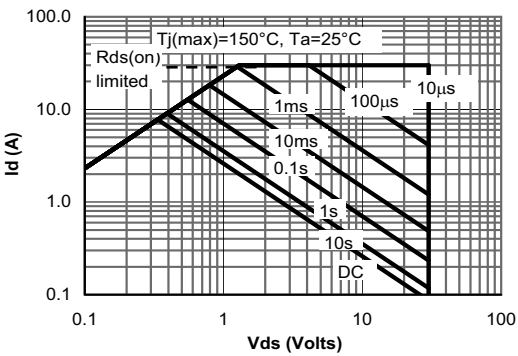


Figure 9: Maximum Forward Biased Safe Operating Area (Note 5)

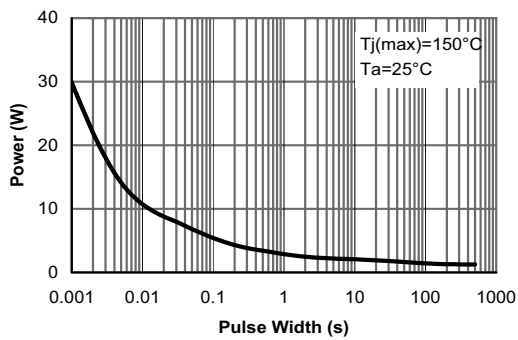


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note 5)

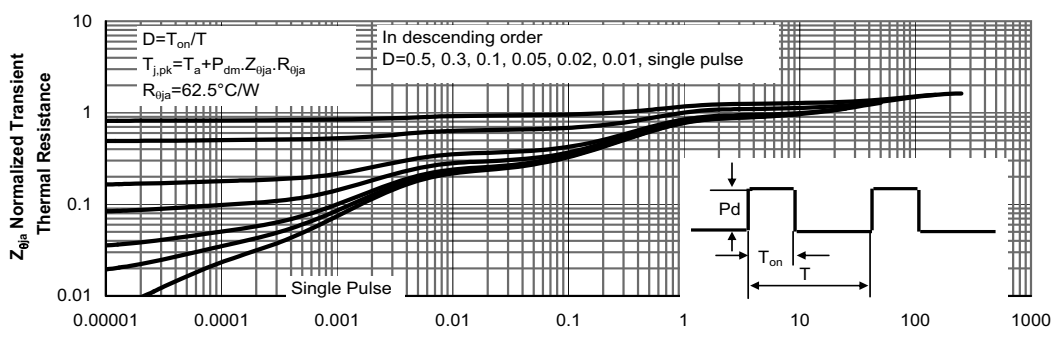


Figure 11: Normalized Maximum Transient Thermal Impedance