



AO3705
P-Channel Enhancement Mode Field Effect Transistor
with Schottky Diode

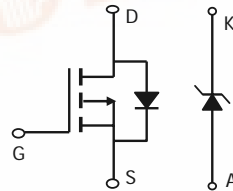
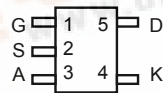
General Description

The AO3705/L uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge. A Schottky diode is provided to facilitate the implementation of a bidirectional blocking switch, or for buck convertor applications.
 AO3705 and AO3705L are electrically identical.
 -RoHs Complaint
 -AO3705L is Halogen Free

Features

V_{DS} (V) = -20V
 I_D = -3.2A (V_{GS} = -4.5V)
 $R_{DS(ON)} < 70m\Omega$ (V_{GS} = -4.5V)
 $R_{DS(ON)} < 90m\Omega$ (V_{GS} = -2.5V)
 $R_{DS(ON)} < 110m\Omega$ (V_{GS} = -1.8V)
 $R_{DS(ON)} < 130m\Omega$ (V_{GS} = -1.5V)
SCHOTTKY
 V_{DS} (V) = 20V, I_F = 1A, $V_F < 0.45V@1A$

SOT-23-5
 Top View



Absolute Maximum Ratings $T_A=25^\circ C$ unless otherwise noted

Parameter	Symbol	MOSFET	Schottky	Units
Drain-Source Voltage	V_{DS}	-20		V
Gate-Source Voltage	V_{GS}	± 8		V
Continuous Drain Current ^A	I_D	$T_A=25^\circ C$	-3.2	A
		$T_A=70^\circ C$	-2.5	
Pulsed Drain Current ^B	I_{DM}	-25		
Schottky reverse voltage	V_{KA}		20	V
Continuous Forward Current ^A	I_F	$T_A=25^\circ C$	1	A
		$T_A=70^\circ C$	0.5	
Pulsed Forward Current ^B	I_{FM}		10	
Power Dissipation	P_D	$T_A=25^\circ C$	1.15	W
		$T_A=70^\circ C$	0.7	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150		$^\circ C$

Parameter: Thermal Characteristics MOSFET		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	80.3	110	$^\circ C/W$
Maximum Junction-to-Ambient ^A	Steady-State		117	150	
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	43	80	
Thermal Characteristics Schottky					
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	153	190	$^\circ C/W$
Maximum Junction-to-Ambient ^A	Steady-State		173	220	
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	103	140	



Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D=-250\mu\text{A}$, $V_{GS}=0\text{V}$	-20			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-20\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1 -5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}$, $V_{GS}=\pm 8\text{V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$	-0.5	-0.65	-1	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-4.5\text{V}$, $V_{DS}=-5\text{V}$	-25			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-4.5\text{V}$, $I_D=-3.2\text{A}$ $T_J=125^\circ\text{C}$		56 80	70 100	$\text{m}\Omega$
		$V_{GS}=-2.5\text{V}$, $I_D=-2.8\text{A}$		70	90	$\text{m}\Omega$
		$V_{GS}=-1.8\text{V}$, $I_D=-2\text{A}$		85	110	$\text{m}\Omega$
		$V_{GS}=-1.5\text{V}$, $I_D=-0.5\text{A}$		100	130	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}$, $I_D=-3.2\text{A}$		15		S
V_{SD}	Diode Forward Voltage	$I_S=-1\text{A}$, $V_{GS}=0\text{V}$		-0.7	-1	V
I_S	Maximum Body-Diode Continuous Current				-1.2	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=-10\text{V}$, $f=1\text{MHz}$		560	745	pF
C_{oss}	Output Capacitance			80		pF
C_{rss}	Reverse Transfer Capacitance			70		pF
R_g	Gate resistance	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$		15	23	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=-4.5\text{V}$, $V_{DS}=-10\text{V}$, $I_D=-3.2\text{A}$		8.5	11	nC
Q_{gs}	Gate Source Charge			1.2		nC
Q_{gd}	Gate Drain Charge			2.1		nC
$t_{D(on)}$	Turn-On Delay Time	$V_{GS}=-4.5\text{V}$, $V_{DS}=-10\text{V}$, $R_L=3\Omega$, $R_{GEN}=6\Omega$		7.2		ns
t_r	Turn-On Rise Time			36		ns
$t_{D(off)}$	Turn-Off Delay Time			53		ns
t_f	Turn-Off Fall Time			56		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=-3.2\text{A}$, $di/dt=100\text{A}/\mu\text{s}$		37	49	ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-3.2\text{A}$, $di/dt=100\text{A}/\mu\text{s}$		27		nC
SCHOTTKY PARAMETERS						
V_F	Forward Voltage Drop	$I_F=1\text{A}$		0.4	0.45	V
I_{rm}	Maximum reverse leakage current	$V_R=16\text{V}$			0.1	mA
		$V_R=16\text{V}$, $T_J=125^\circ\text{C}$			20	
C_T	Junction Capacitance	$V_R=10\text{V}$		44		pF
t_{rr}	Schottky Reverse Recovery Time	$I_F=1\text{A}$, $di/dt=100\text{A}/\mu\text{s}$		11	14	ns
Q_{rr}	Schottky Reverse Recovery Charge	$I_F=1\text{A}$, $di/dt=100\text{A}/\mu\text{s}$		2.5		nC

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$. The value in any given application depends on the user's specific board design. The current rating is based on the $t \leq 10\text{s}$ thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C: The $R_{\theta JA}$ is the sum of the thermal impedance from junction to lead $R_{\theta JL}$ and lead to ambient.

D: The static characteristics in Figures 1 to 6 are obtained using $<300\mu\text{s}$ pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$. The SOA curve provides a single pulse rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

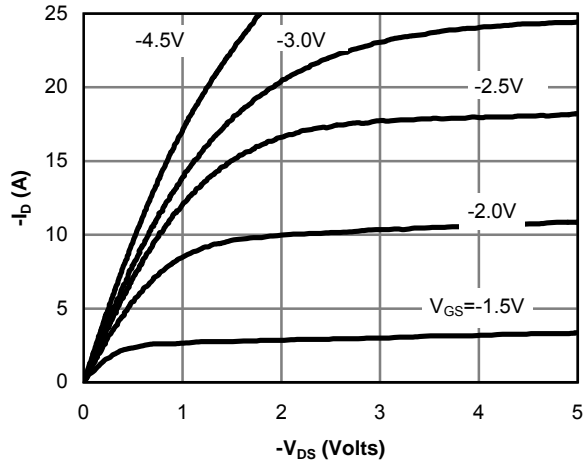


Figure 1: On-Region Characteristics

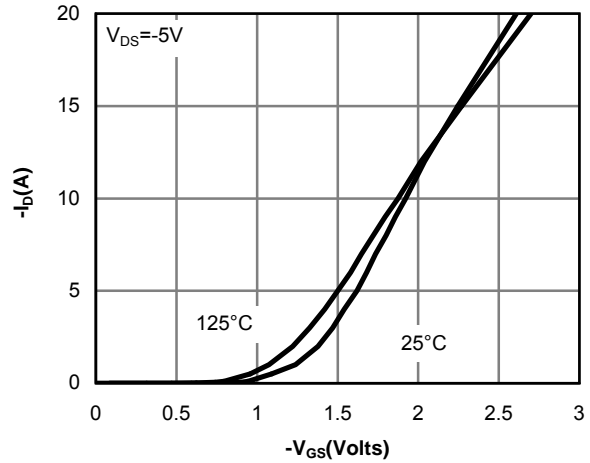


Figure 2: Transfer Characteristics

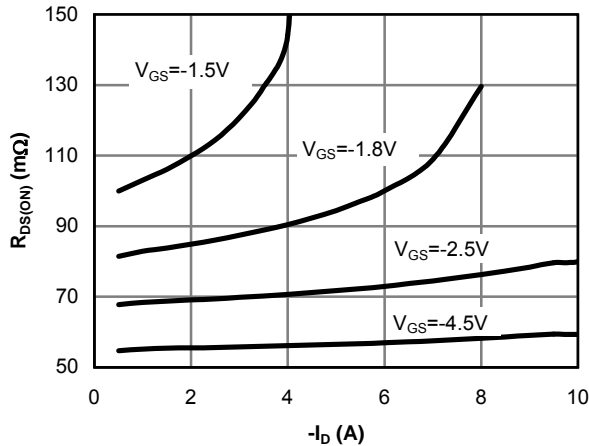


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

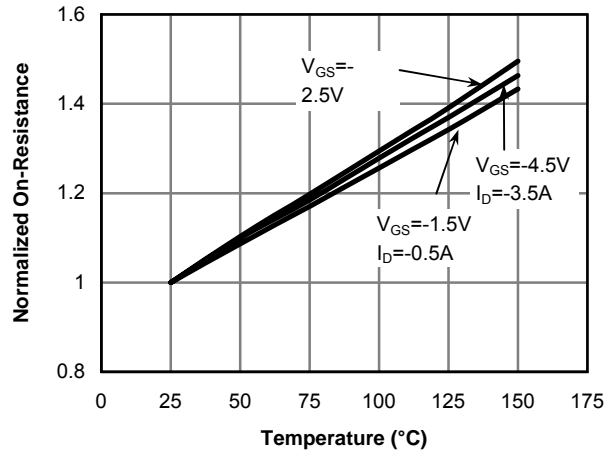


Figure 4: On-Resistance vs. Junction Temperature

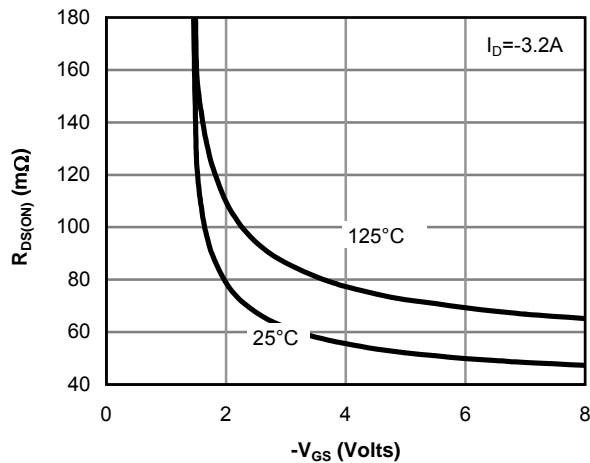


Figure 5: On-Resistance vs. Gate-Source Voltage

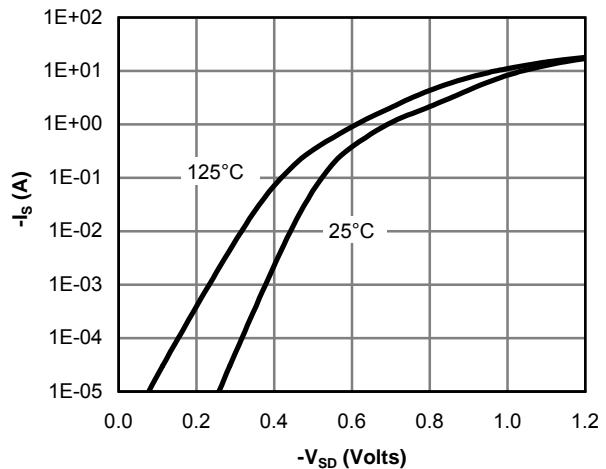


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

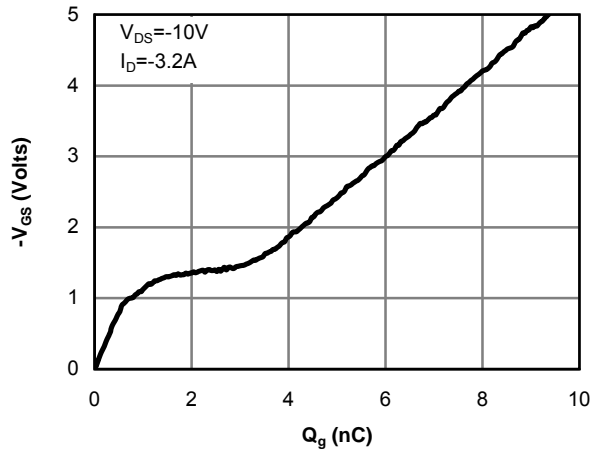


Figure 7: Gate-Charge Characteristics

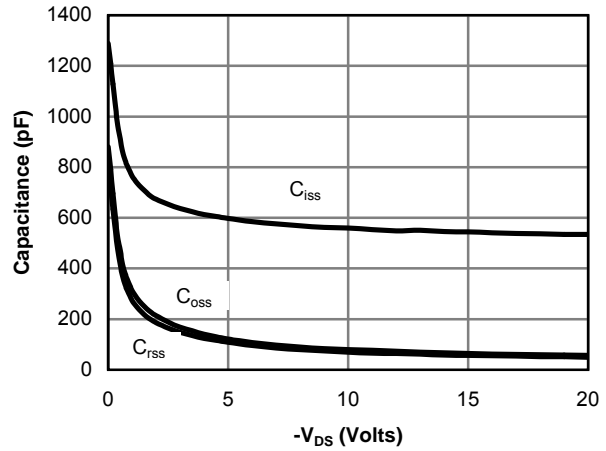


Figure 8: Capacitance Characteristics

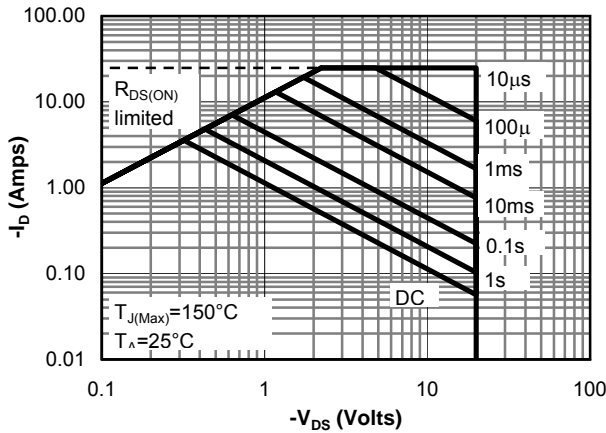


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

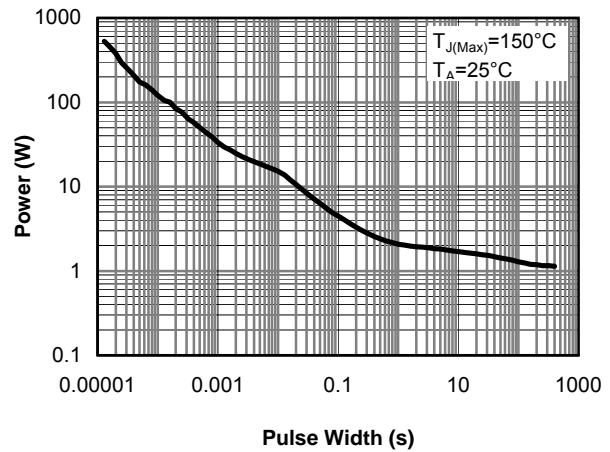


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

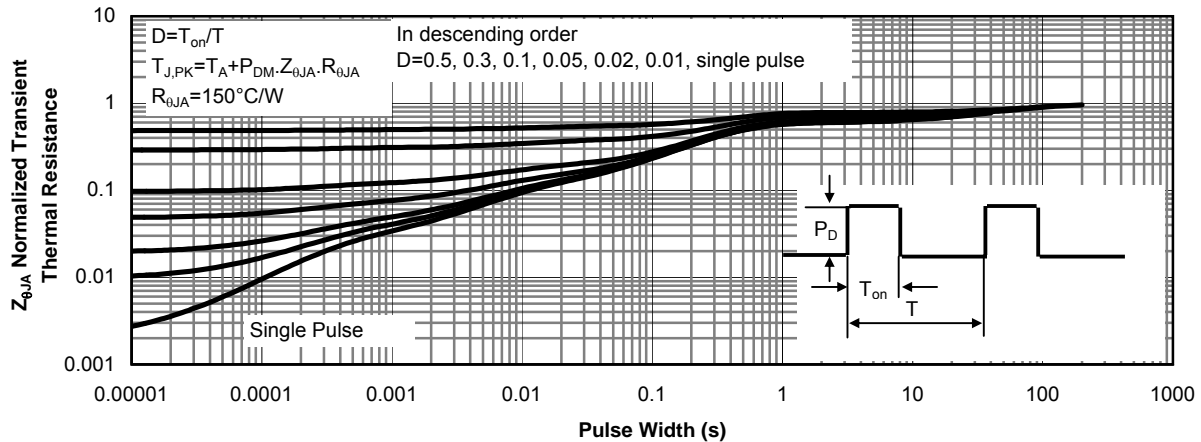


Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: SCHOTTKY

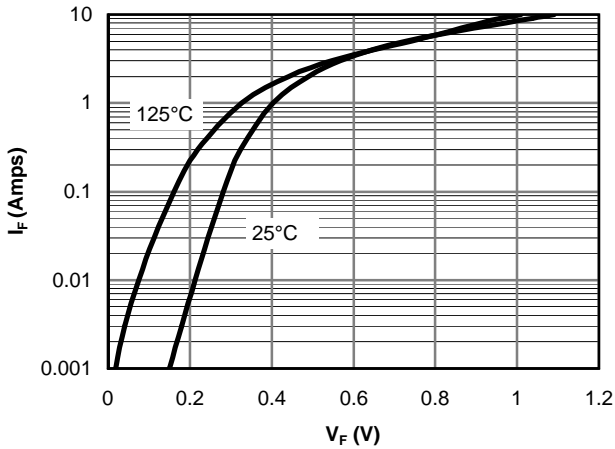


Figure 12: Schottky Forward Characteristics

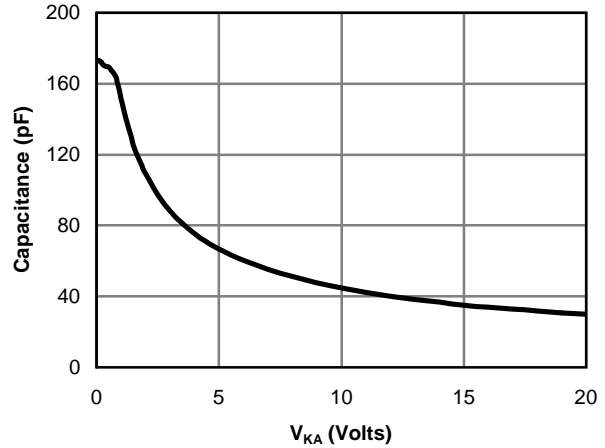


Figure 13: Schottky Capacitance Characteristics

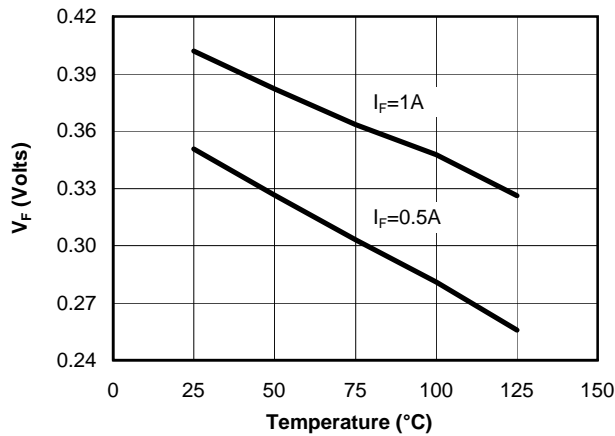


Figure 14: Schottky Forward Drop vs. Junction Temperature

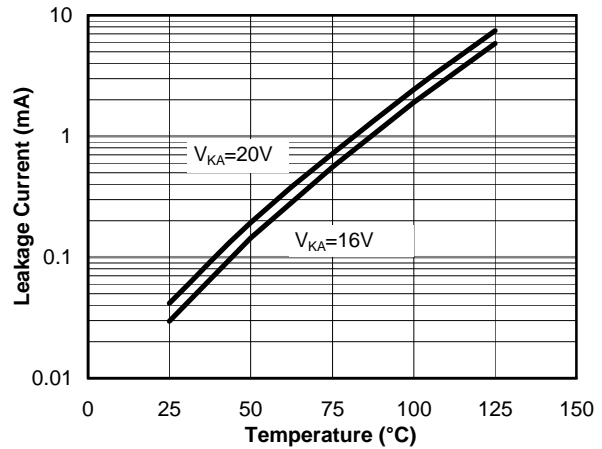


Figure 15: Schottky Leakage Current vs. Junction Temperature

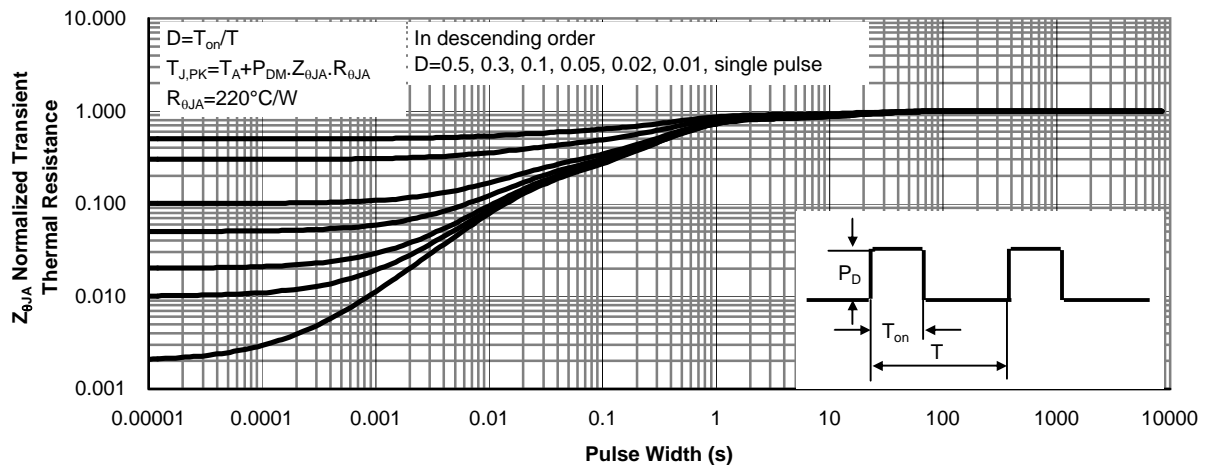


Figure 16: Schottky Normalized Maximum Transient Thermal Impedance