AP6601
30V Complementary MOSFET

- **General Description**

AP6601 combines advanced MOSFET technology with a low resistance package to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs form a high-speed power inverter, which is suitable for a wide variety of applications.

- **Applications**

- Synchronous DC–DC conversion circuits
- Load/Power management of portable devices

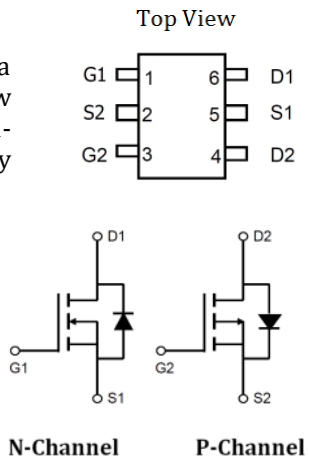
- **Product Summary**

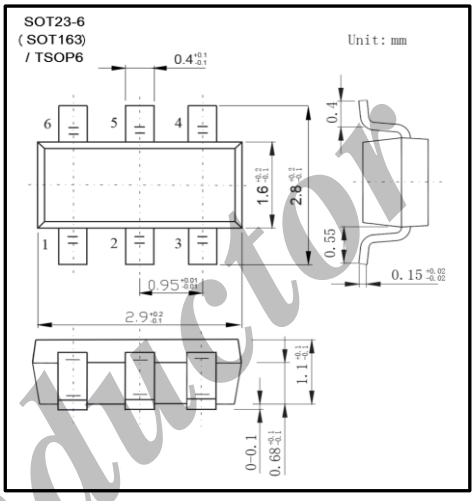
N-Channel

V_{DS}	30V
I_D (at V_{GS} = 10V)	3.4A
$R_{DS(ON)}$ (at V_{GS} = 10V)	< 60mΩ
$R_{DS(ON)}$ (at V_{GS} = 4.5V)	< 70mΩ
$R_{DS(ON)}$ (at V_{GS} = 2.5V)	< 90mΩ

P-Channel

V_{DS}	-30V
I_D (at V_{GS} = -10V)	-2.3A
$R_{DS(ON)}$ (at V_{GS} = -10V)	< 115mΩ
$R_{DS(ON)}$ (at V_{GS} = -4.5V)	< 150mΩ
$R_{DS(ON)}$ (at V_{GS} = -2.5V)	< 200mΩ





Pb-Free

RoHS COMPLIANT

- **Absolute Maximum Ratings Ta = 25°C**

Parameter		Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage		V_{DS}	30	-30	V
Gate-Source Voltage		V_{GS}	±12		V
Continuous Drain Current	Ta = 25°C	I_D	3.4	-2.3	A
	Ta = 70°C		2.7	-1.8	
Pulsed Drain Current		I_{DM}	20	-15	
Power Dissipation	Ta = 25°C	P_D	1.15		W
	Ta = 70°C		0.73		
Junction Temperature		T_J	150		°C
Storage Temperature Range		T_{STG}	-55 to 150		
Thermal Characteristics					
Thermal Resistance. Junction-to-Ambient	t ≤ 10s	$R_{\theta JA}$	110		°C/W
	Steady State		150		
Thermal Resistance. Junction-to-Lead		$R_{\theta JL}$	80		

- **Electrical Characteristics Ta = 25°C (N-Channel)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Static Parameters						
Drain-Source Breakdown Voltage	V_{DSS}	I_D=250μA, V_{GS}=0V	30			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=30V, V_{GS}=0V			1	μA
		V_{DS}=30V, V_{GS}=0V, T_J=55°C			5	
Gate-Body Leakage Current	I_{GSS}	V_{DS}=0V, V_{GS}=±12V			±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=250μA	0.5		1.5	V
On-State Drain Current	$I_{D(ON)}$	V_{GS}=10V, V_{DS}=5V	20			A
Static Drain-Source On-Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=3.4A			60	mΩ
		V_{GS}=10V, I_D=3.4A, T_J=125°C			88	
		V_{GS}=4.5V, I_D=3A			70	
		V_{GS}=2.5V, I_D=2A			90	
Forward Transconductance	g_{FS}	V_{DS}=5V, I_D=3.4A		14		S
Diode Forward Voltage	V_{SD}	I_S=1A, V_{GS}=0V			1	V
Maximum Body-Diode Continuous Current	I_S				1.5	A
Dynamic Parameters						
Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=15V, f=1MHz	182		285	pF
Output Capacitance	C_{oss}		25		45	
Reverse Transfer Capacitance	C_{rss}		10		25	
Gate Resistance	R_g	V_{GS}=0V, V_{DS}=0V, f=1MHz	0.9		2.7	Ω
Switching Parameters						
Total Gate Charge (10V)	Q_g	V_{GS}=10V, V_{DS}=15V, I_D=3.4A		10	12	nC
Total Gate Charge (4.5V)				4.7	6	
Gate Source Charge	Q_{gs}			0.95		
Gate Drain Charge	Q_{gd}			1.6		
Turn-On Delay Time	$t_{D(on)}$	V_{GS}=10V, V_{DS}=15V, R_L=4.4Ω, R_{GEN}=3Ω		3.5		ns
Turn-On Rise Time	t_r			1.5		
Turn-Off Delay Time	$t_{D(off)}$			17.5		
Turn-Off Fall Time	t_f			2.5		
Body Diode Reverse Recovery Time	t_{rr}	I_F=3.4A, d_i/d_t=100A/μs			12	
Body Diode Reverse Recovery Charge	Q_{rr}				4	nC

- **Electrical Characteristics Ta = 25°C (P-Channel)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Static Parameters						
Drain-Source Breakdown Voltage	V_{DSS}	I_D=-250µA, V_{GS}=0V	-30			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=-30V, V_{GS}=0V			-1	µA
		V_{DS}=-30V, V_{GS}=0V, T_J=55°C			-5	
Gate-Body Leakage Current	I_{GSS}	V_{DS}=0V, V_{GS}=±12V			±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=-250µA	-0.6		-1.4	V
On-State Drain Current	$I_{D(ON)}$	V_{GS}=-10V, V_{DS}=-5V	-15			A
Static Drain-Source On-Resistance	$R_{DS(ON)}$	V_{GS}=-10V, I_D=-2.3A			115	mΩ
		V_{GS}=-10V, I_D=-2.3A, T_J=125°C			200	
		V_{GS}=-4.5V, I_D=-2A			150	
		V_{GS}=-2.5V, I_D=-1A			200	
Forward Transconductance	g_{FS}	V_{DS}=-5V, I_D=-2.3A		8		S
Diode Forward Voltage	V_{SD}	I_S=-1A, V_{GS}=0V			-1	V
Maximum Body-Diode Continuous Current	I_S				-1.5	A
Dynamic Parameters						
Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=-15V, f=1MHz	205		315	pF
Output Capacitance	C_{oss}		25		50	
Reverse Transfer Capacitance	C_{rss}		10		30	
Gate Resistance	R_g	V_{GS}=0V, V_{DS}=0V, f=1MHz	4		12	Ω
Switching Parameters						
Total Gate Charge (10V)	Q_g	V_{GS}=-10V, V_{DS}=-15V, I_D=-2.3A	4.5		7	nC
Total Gate Charge (4.5V)			2		4	
Gate Source Charge	Q_{gs}			0.7		
Gate Drain Charge	Q_{gd}			1		
Turn-On Delay Time	$t_{D(on)}$	V_{GS}=-10V, V_{DS}=-15V, R_L=6Ω, R_{GEN}=3Ω		6		ns
Turn-On Rise Time	t_r			3.5		
Turn-Off Delay Time	$t_{D(off)}$			20		
Turn-Off Fall Time	t_f			5		
Body Diode Reverse Recovery Time	t_{rr}	I_F=-2.3A, d_i/d_t=100A/µs			15	
Body Diode Reverse Recovery Charge	Q_{rr}				6	nC

- **Ordering Information**

Ordering Part Number	Package	MOQ
AP6601	SOT23-6 (SOT163) / TSOP6	3,000 pcs / reel

- **Typical Electrical and Thermal Characteristics (N-Channel)**

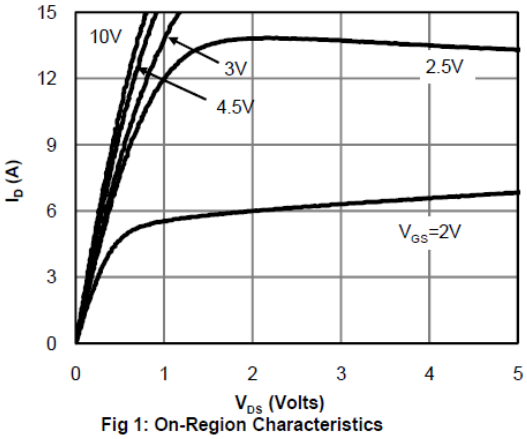


Fig 1: On-Region Characteristics

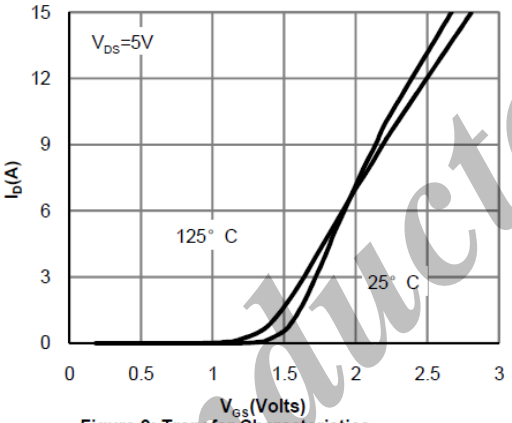


Figure 2: Transfer Characteristics

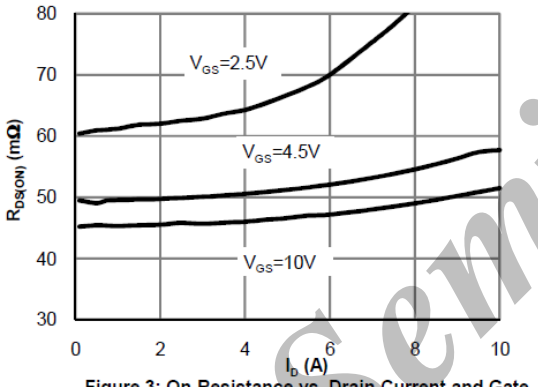


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

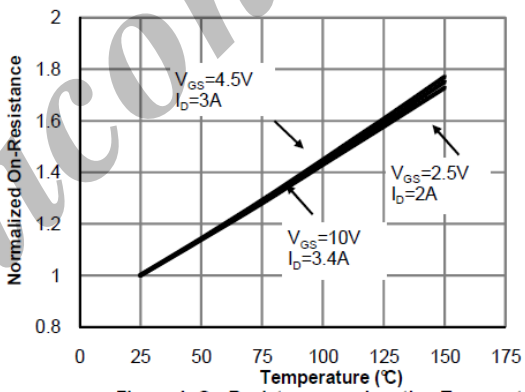


Figure 4: On-Resistance vs. Junction Temperature

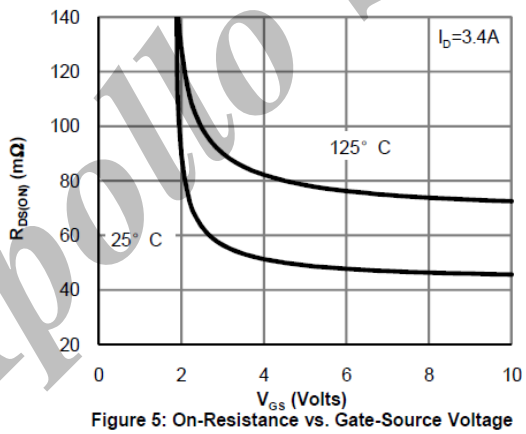


Figure 5: On-Resistance vs. Gate-Source Voltage

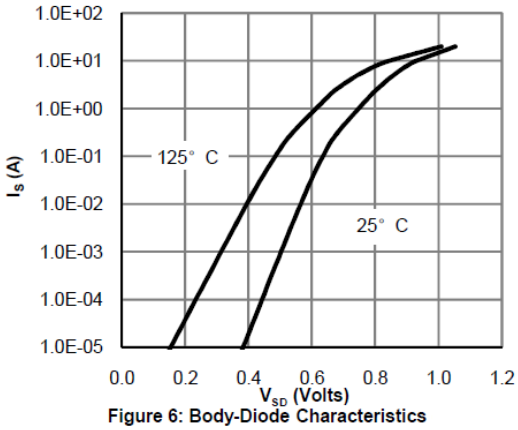


Figure 6: Body-Diode Characteristics

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

- **Typical Electrical and Thermal Characteristics (N-Channel)**

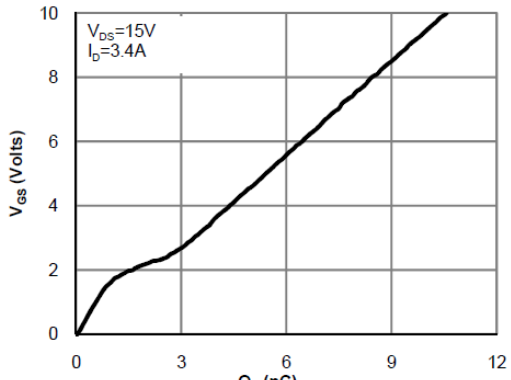


Figure 7: Gate-Charge Characteristics

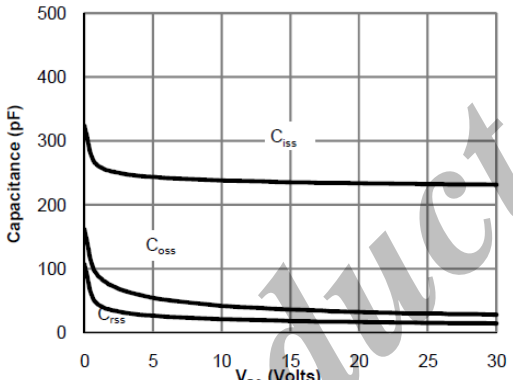


Figure 8: Capacitance Characteristics

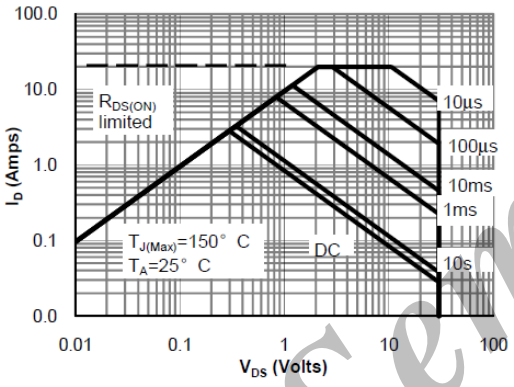


Figure 9: Maximum Forward Biased Safe Operating Area

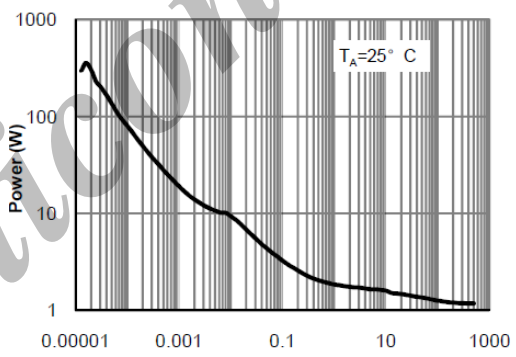


Figure 10: Single Pulse Power Rating Junction-to-Ambient

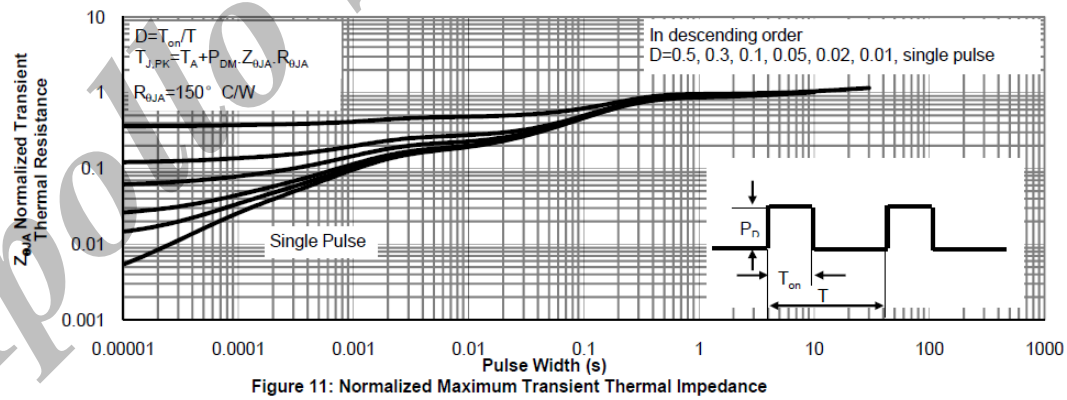


Figure 11: Normalized Maximum Transient Thermal Impedance

Note 2: The curves in Figure 9 to 11 are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in² FR-4 board with 2oz. copper, assuming a maximum junction temperature of $T_{J(MAX)}$=150°C . The SOA curve provides a single pulse rating.

- **Typical Electrical and Thermal Characteristics (P-Channel)**

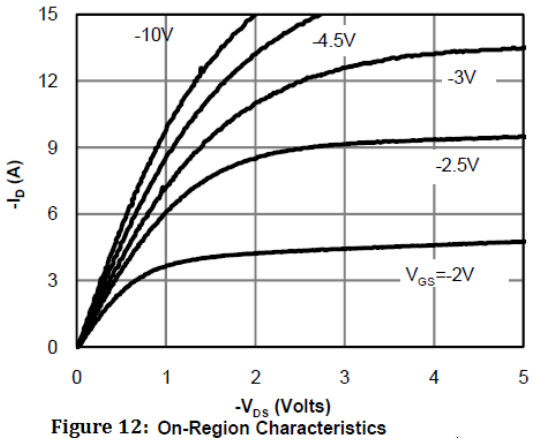


Figure 12: On-Region Characteristics

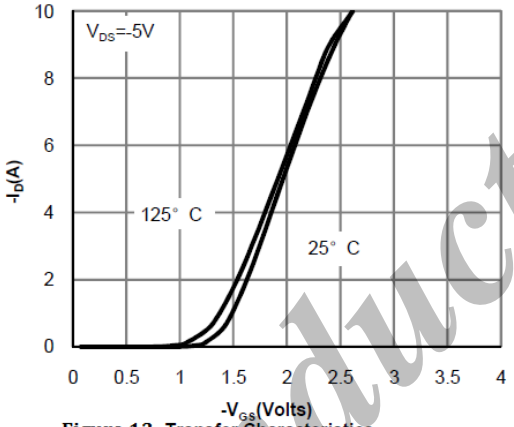


Figure 13: Transfer Characteristics

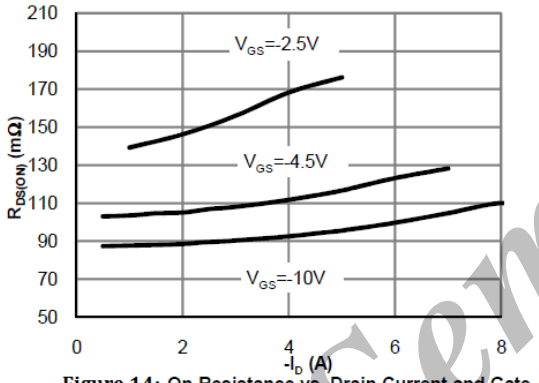


Figure 14: On-Resistance vs. Drain Current and Gate Voltage

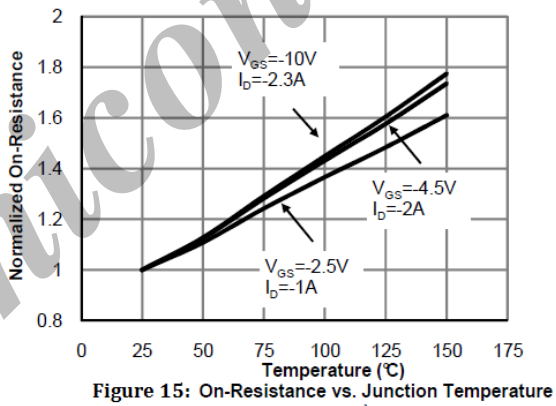


Figure 15: On-Resistance vs. Junction Temperature

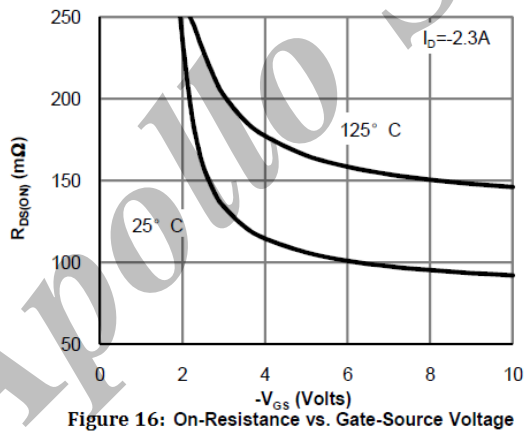


Figure 16: On-Resistance vs. Gate-Source Voltage

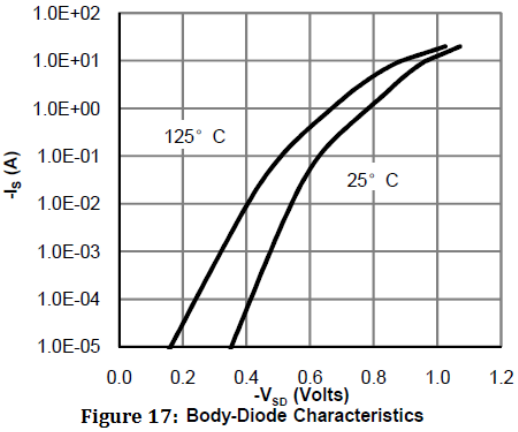


Figure 17: Body-Diode Characteristics

Note 3: The static characteristics in Figure 12 to 17 are obtained using <300μA pulses, duty cycle 0.5% max.

- **Typical Electrical and Thermal Characteristics (P-Channel)**

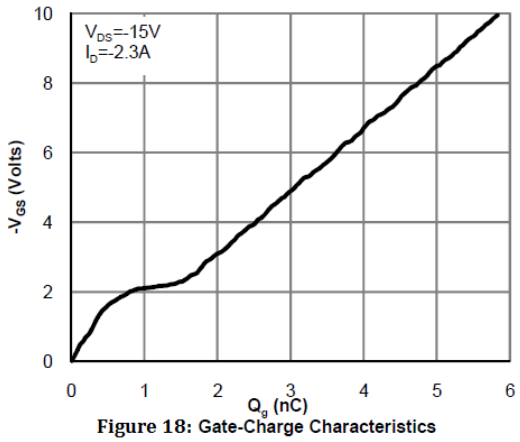


Figure 18: Gate-Charge Characteristics

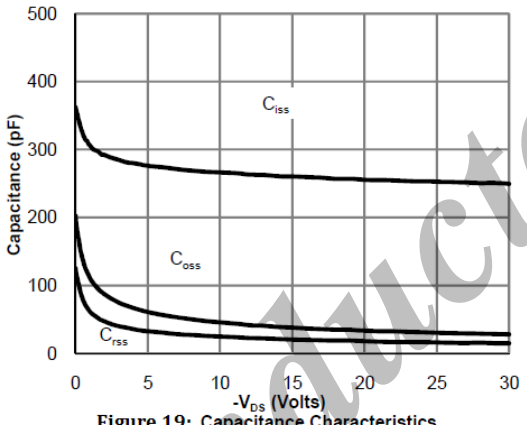


Figure 19: Capacitance Characteristics

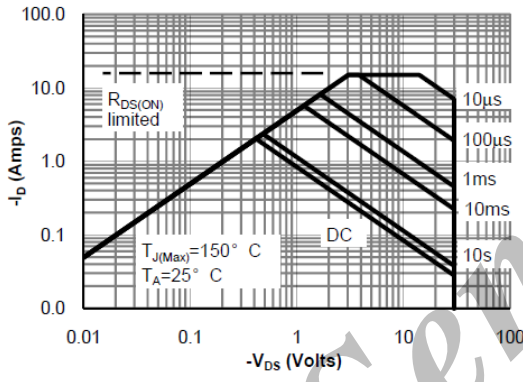


Figure 20: Maximum Forward Biased Safe Operating Area

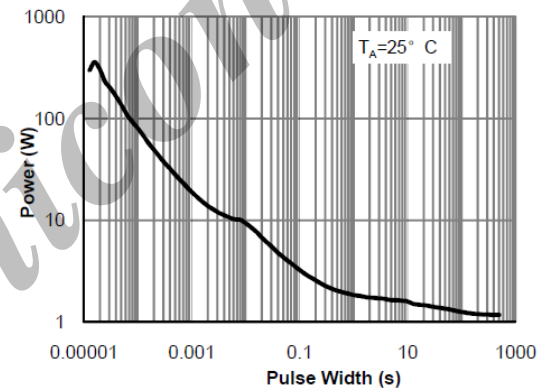


Figure 21: Single Pulse Power Rating Junction-to-Ambient

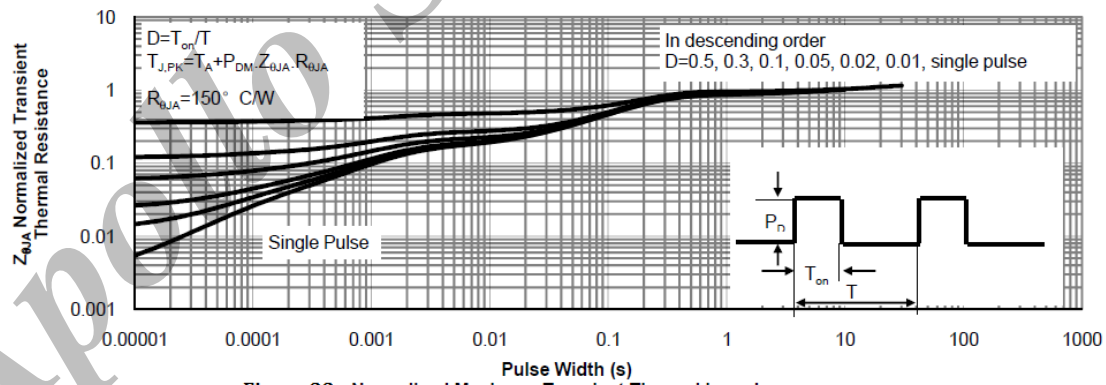


Figure 22: Normalized Maximum Transient Thermal Impedance

Note 4: The curves in Figure 20 to 22 are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in² FR-4 board with 2oz. copper, assuming a maximum junction temperature of $T_{J(MAX)}$=150°C . The SOA curve provides a single pulse rating.

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