

Complementary MOSFET

ELM24604HA-S

General Description

ELM24604HA-S uses advanced trench technology to provide excellent $R_{ds(on)}$ and low gate charge.

Features

- | | |
|--|---|
| N-channel | P-channel |
| • $V_{ds}=40V$ | $V_{ds}=-40V$ |
| • $I_d=8A(V_{gs}=10V)$ | $I_d=-8A(V_{gs}=-10V)$ |
| • $R_{ds(on)} < 33m\Omega (V_{gs}=10V)$ | $R_{ds(on)} < 50m\Omega (V_{gs}=-10V)$ |
| • $R_{ds(on)} < 47m\Omega (V_{gs}=4.5V)$ | $R_{ds(on)} < 70m\Omega (V_{gs}=-4.5V)$ |

Maximum Absolute Ratings

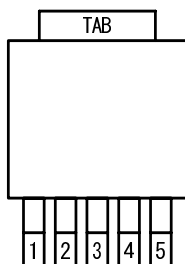
Parameter		Symbol	N-ch (Max.)	P-ch (Max.)	Unit	Note
Drain-source voltage		V_{ds}	40	-40	V	
Gate-source voltage		V_{gs}	± 20	± 20	V	
Continuous drain current	$T_c=25^\circ C$	I_d	8	-8	A	7
	$T_c=100^\circ C$		8	-8		
Pulsed drain current		I_{dm}	30	-30	A	3
Avalanche current		I_{ar}	8	-8	A	3
Repetitive avalanche energy $L=0.1mH$		E_{ar}	20	30	mJ	3
Power dissipation	$T_c=25^\circ C$	P_d	20	50	W	2
	$T_c=100^\circ C$		10	25		
Power dissipation	$T_a=25^\circ C$	P_{dsm}	2.0	2.5	W	1
	$T_a=70^\circ C$		1.3	1.6		
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	$t \leq 10s$	$R\theta_{ja}$	N-ch	17.4	30.0	$^\circ C/W$	1
	Steady-state			50.0	60.0	$^\circ C/W$	
Maximum junction-to-case	Steady-state	$R\theta_{jc}$		4.0	7.5	$^\circ C/W$	2
Maximum junction-to-ambient	$t \leq 10s$	$R\theta_{ja}$	P-ch	16.7	25.0	$^\circ C/W$	1
	Steady-state			40.0	50.0	$^\circ C/W$	
Maximum junction-to-case	Steady-state	$R\theta_{jc}$		2.5	3.0	$^\circ C/W$	2

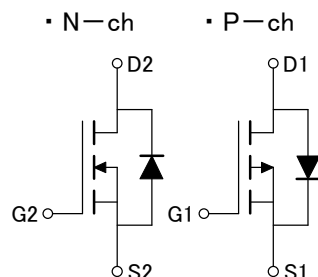
Pin Configuration

TO-252-5 (TOP VIEW)



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

Circuit



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■ Electrical Characteristics (N-ch)

T_a=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
STATIC PARAMETERS						
Drain-source breakdown voltage	BV _{dss}	I _d =10mA, V _{gs} =0V	40			V
Zero gate voltage drain current	I _{dss}	V _{ds} =32V V _{gs} =0V			1	μA
		T _j =55°C			5	
Gate-body leakage current	I _{gss}	V _{ds} =0V, V _{gs} =±20V			100	nA
Gate threshold voltage	V _{gs(th)}	V _{ds} =V _{gs} , I _d =250 μA	1.0	2.3	3.0	V
On state drain current	I _{d(on)}	V _{gs} =10V, V _{ds} =5V	30			A
Static drain-source on-resistance	R _{ds(on)}	V _{gs} =10V I _d =8A		25	33	mΩ
		T _j =125°C		39	52	
		V _{gs} =4.5V, I _d =6A		34	47	
Forward transconductance	G _{fs}	V _{ds} =5V, I _d =8A		25		S
Diode forward voltage	V _{sd}	I _s =1A, V _{gs} =0V		0.76	1.00	V
Max.body-diode continuous current	I _s				8	A
DYNAMIC PARAMETERS						
Input capacitance	C _{iss}			404		pF
Output capacitance	C _{oss}	V _{gs} =0V, V _{ds} =20V, f=1MHz		95		pF
Reverse transfer capacitance	C _{rss}			37		pF
Gate resistance	R _g	V _{gs} =0V, V _{ds} =0V, f=1MHz		2.7		Ω
SWITCHING PARAMETERS						
Total gate charge (10V)	Q _g	V _{gs} =10V, V _{ds} =20V, I _d =8A		9.2		nC
Total gate charge (4.5V)	Q _g			4.5		nC
Gate-source charge	Q _{gs}			1.6		nC
Gate-drain charge	Q _{gd}			2.6		nC
Turn-on delay time	t _{d(on)}			3.5		ns
Turn-on rise time	t _r	V _{gs} =10V, V _{ds} =20V		6.0		ns
Turn-off delay time	t _{d(off)}	R _l =2.5 Ω, R _{gen} =3 Ω		13.2		ns
Turn-off fall time	t _f			3.5		ns
Body-diode reverse recovery time	t _{rr}	I _f =8A, dI/dt=100A/μs		22.9		ns
Body-diode reverse recovery charge	Q _{rr}	I _f =8A, dI/dt=100A/μs		18.3		nC

NOTE :

- The value of R_{θja} is measured with the device mounted on 1in² FR-4 board of 2oz. Copper, in still air environment with T_a=25°C. The power dissipation P_{dsm} is based on R_{θja} max. allowed junction temperature of 150°C. The value in any given applications depends on the user's specific board design, and the max. temperature of 175°C may be used if the PCB allows it.
- The power dissipation P_d is based on T_{j(max.)}=175°C, using junction-to-case thermal resistance, and is more useful setting the upper dissipation limit for cases where additional heatsinking is used.
- The repetitive rating and the pulse width are limited by junction temperature T_{j(max.)}=175°C.
- The R_{θja} is the sum of the thermal impedance from junction to case R_{θjc} and case to ambient.
- The static characteristics in Figures 1 to 6 are obtained using <300 μs pulses, duty cycle 0.5% max.
- These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T_{j(max.)}=175°C.
- The maximum current rating is limited by bond-wires.
- These tests are performed with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_a=25°C. The SOA curve provides a single pulse rating.

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Typical Electrical and Thermal Characteristics (N-ch)

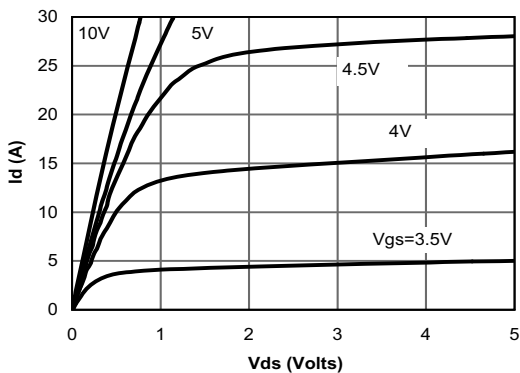


Fig 1: On-Region Characteristics

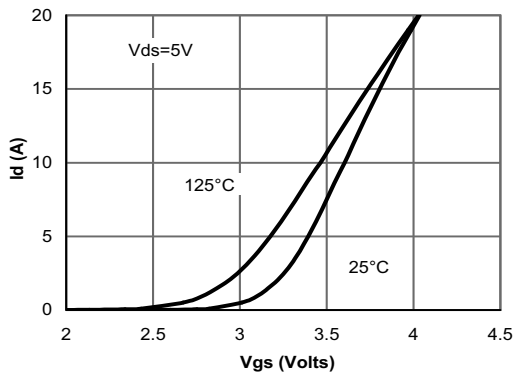


Figure 2: Transfer Characteristics

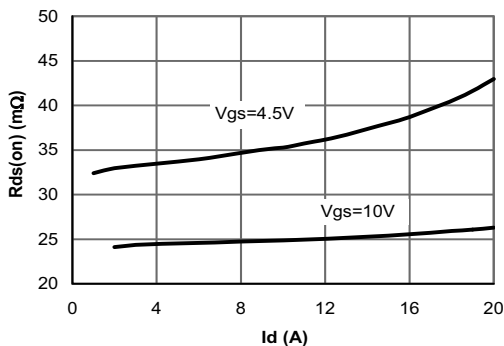


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

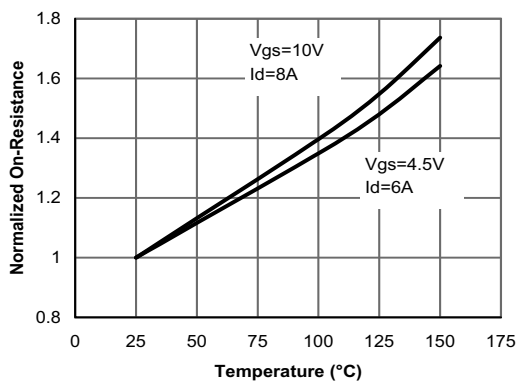


Figure 4: On-Resistance vs. Junction Temperature

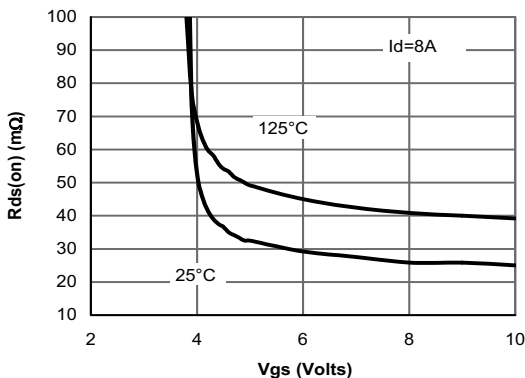


Figure 5: On-Resistance vs. Gate-Source Voltage

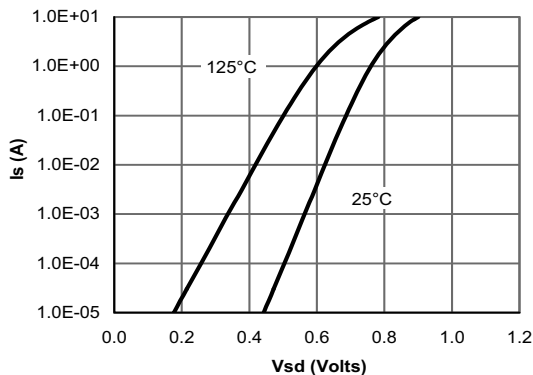


Figure 6: Body-Diode Characteristics

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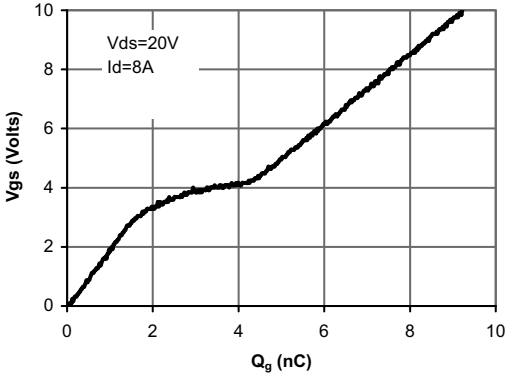


Figure 7: Gate-Charge Characteristics

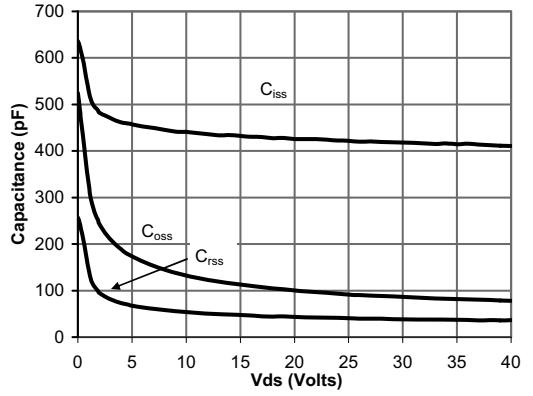


Figure 8: Capacitance Characteristics

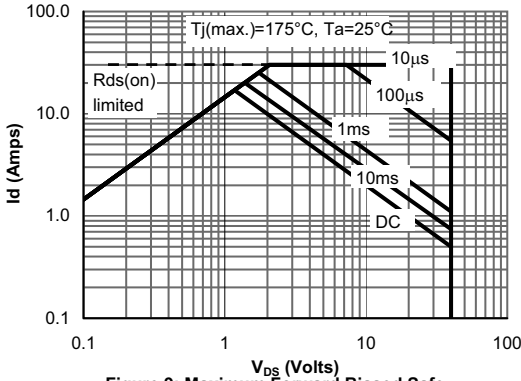


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

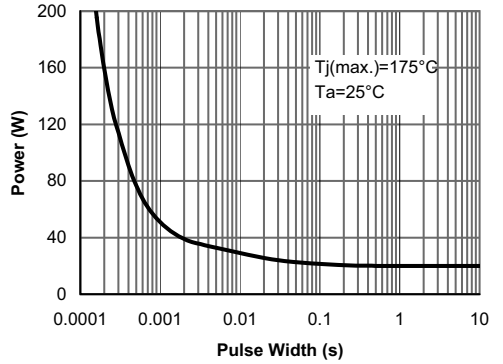


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

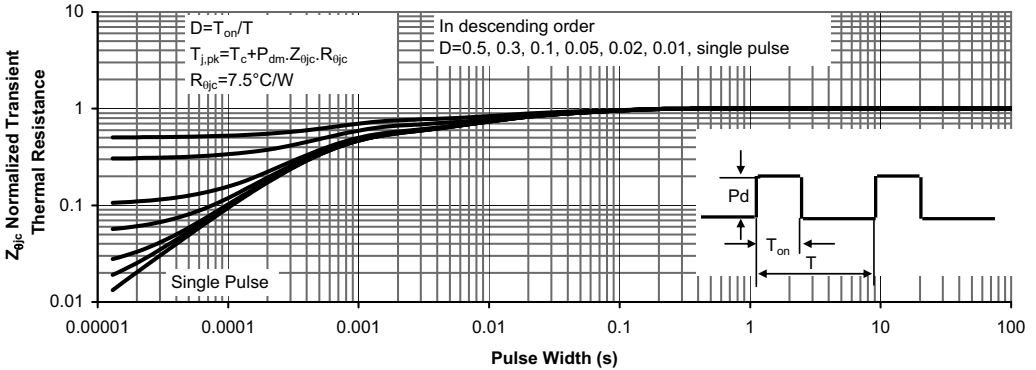


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

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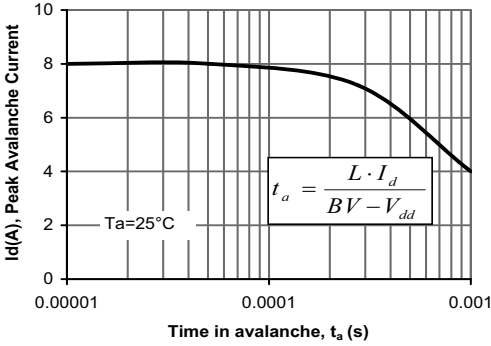


Figure 12: Single Pulse Avalanche capability

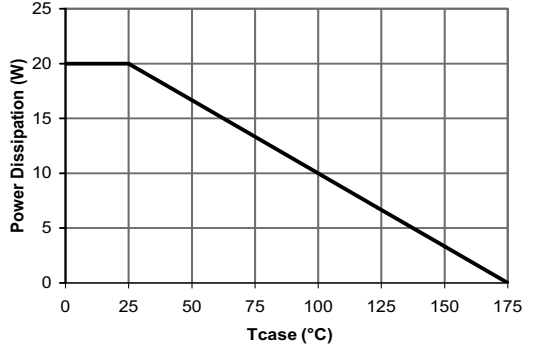


Figure 13: Power De-rating (Note B)

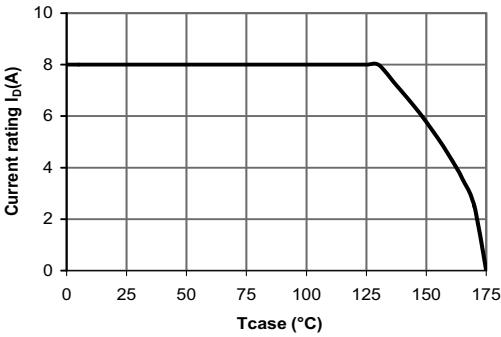


Figure 14: Current De-rating (Note B)

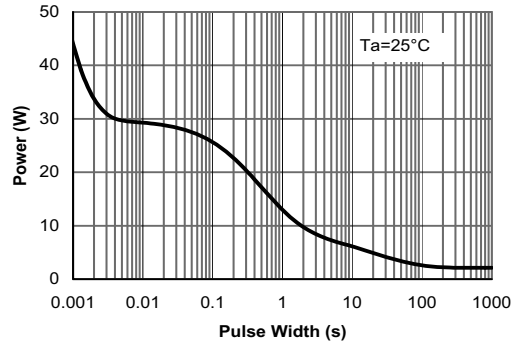


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

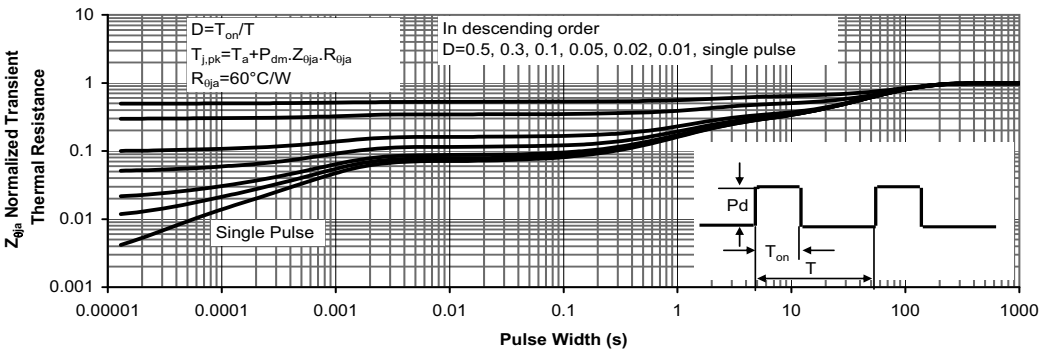


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

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Electrical Characteristics (P-ch)

T_a=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
STATIC PARAMETERS						
Drain-source breakdown voltage	BV _{dss}	I _d =-10mA, V _{gs} =0V	-40			V
Zero gate voltage drain current	I _{dss}	V _d =-32V V _{gs} =0V			-1	μA
		T _j =55°C			-5	
Gate-body leakage current	I _{gss}	V _d =0V, V _{gs} =±20V			±100	nA
Gate threshold voltage	V _{gs(th)}	V _d =V _{gs} , I _d =-250μA	-1.0	-1.8	-3.0	V
On state drain current	I _{d(on)}	V _{gs} =-10V, V _d =-5V	-30			A
Static drain-source on-resistance	R _{d(s on)}	V _{gs} =-10V I _d =-8A		41	50	mΩ
		T _j =125°C		62		
		V _{gs} =-4.5V, I _d =-4A		57	70	mΩ
Forward transconductance	G _{fs}	V _d =-5V, I _d =-8A		16		S
Diode forward voltage	V _{sd}	I _s =-1A, V _{gs} =0V		-0.75	-1.00	V
Max. body-diode continuous current	I _s				-8	A
DYNAMIC PARAMETERS						
Input capacitance	C _{iss}	V _{gs} =0V, V _d =-20V, f=1MHz		657		pF
Output capacitance	C _{oss}			143		pF
Reverse transfer capacitance	C _{rss}			63		pF
Gate resistance	R _g			6.5		Ω
SWITCHING PARAMETERS						
Total gate charge (10V)	Q _g	V _{gs} =-10V, V _d =-20V		14.1		nC
Total gate charge (4.5V)	Q _g			7.0		nC
Gate-source charge	Q _{gs}	I _d =-8A		2.2		nC
Gate-drain charge	Q _{gd}			4.1		nC
Turn-on delay time	t _{d(on)}	V _{gs} =-10V, V _d =-20V R _f =2.5Ω, R _{gen} =3Ω		8.0		ns
Turn-on rise time	t _r			12.2		ns
Turn-off delay time	t _{d(off)}			24.0		ns
Turn-off fall time	t _f			12.5		ns
Body diode reverse recovery time	t _{rr}	I _f =-8A, dI/dt=100A/μs		23.2		ns
Body diode reverse recovery charge	Q _{rr}	I _f =-8A, dI/dt=100A/μs		18.2		nC

NOTE :

- The value of R_{θja} is measured with the device mounted on 1in² FR-4 board of 2oz. Copper, in still air environment with T_a=25°C. The power dissipation P_{dsm} is based on R_{θja} max. allowed junction temperature of 150°C. The value in any given applications depends on the user's specific board design, and the max. temperature of 175°C may be used if the PCB allows it.
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- These tests are performed with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_a=25°C. The SOA curve provides a single pulse rating.

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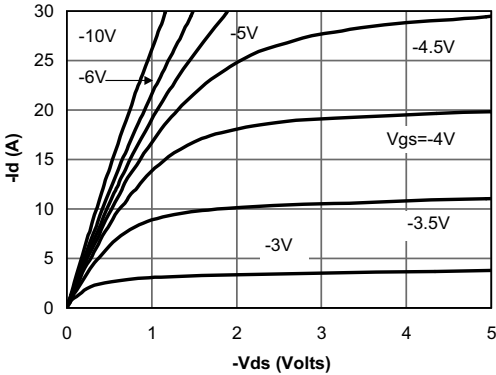


Fig 1: On-Region Characteristics

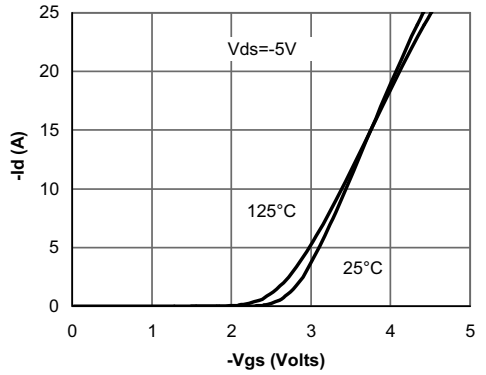


Figure 2: Transfer Characteristics

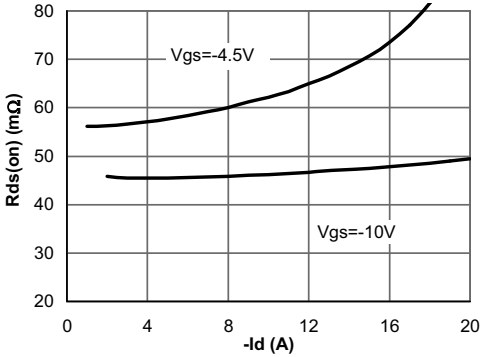


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

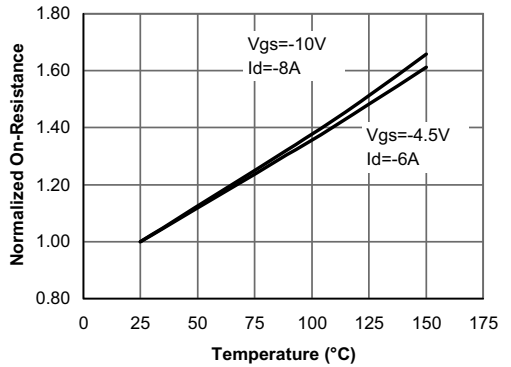


Figure 4: On-Resistance vs. Junction Temperature

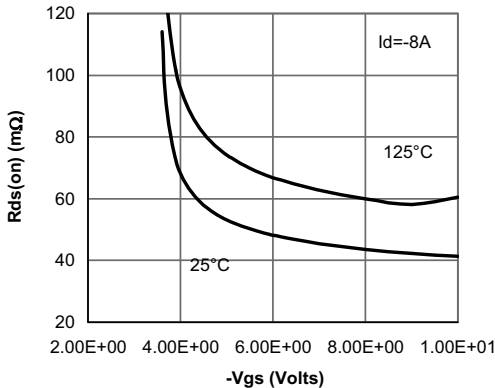


Figure 5: On-Resistance vs. Gate-Source Voltage

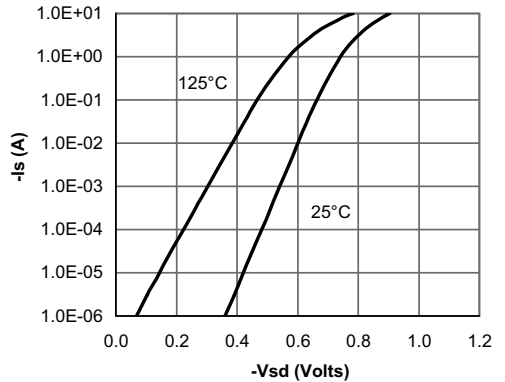


Figure 6: Body-Diode Characteristics

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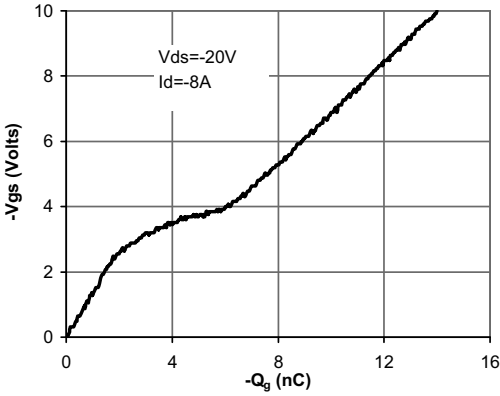


Figure 7: Gate-Charge Characteristics

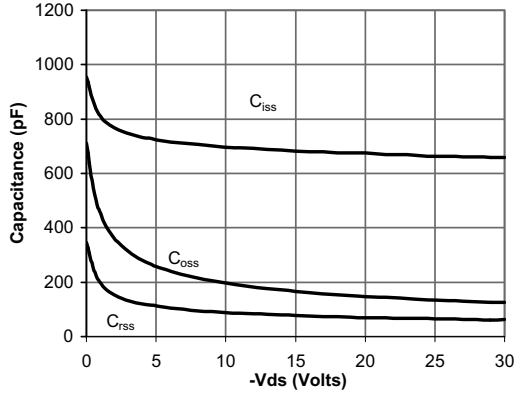


Figure 8: Capacitance Characteristics

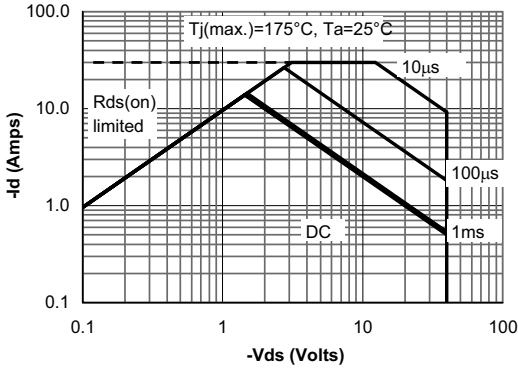


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

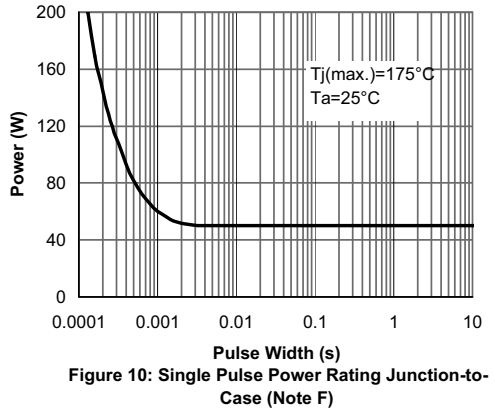


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

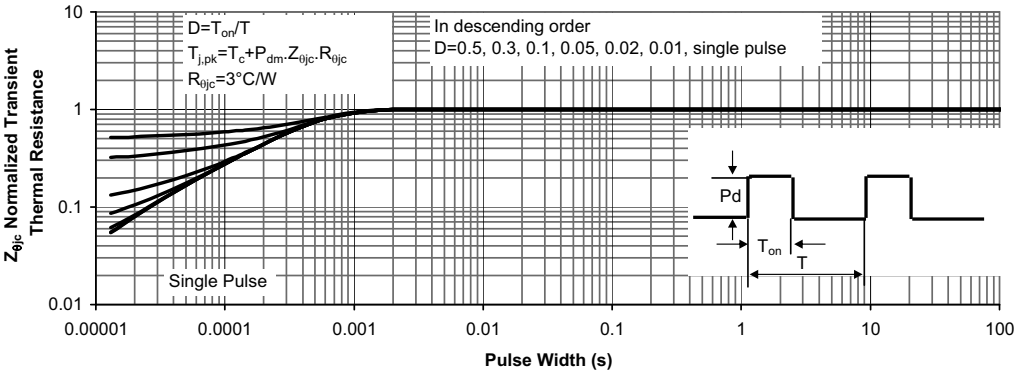


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

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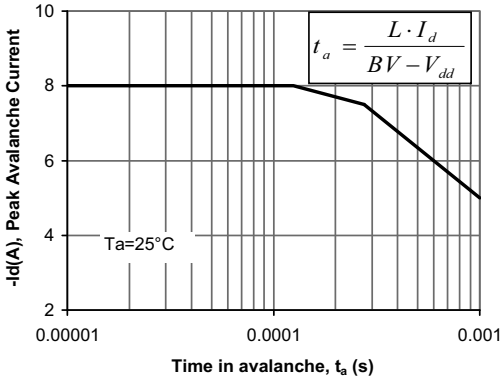


Figure 12: Single Pulse Avalanche capability

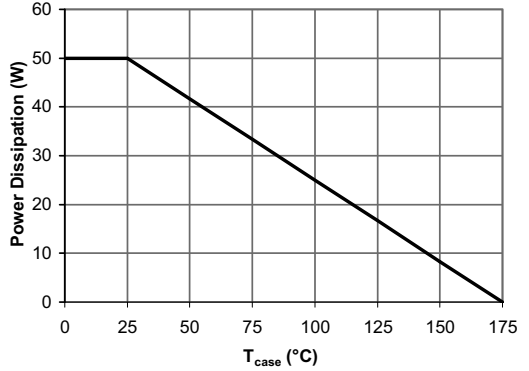


Figure 13: Power De-rating (Note B)

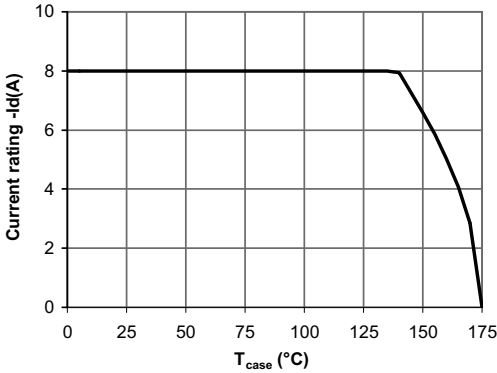


Figure 14: Current De-rating (Note B)

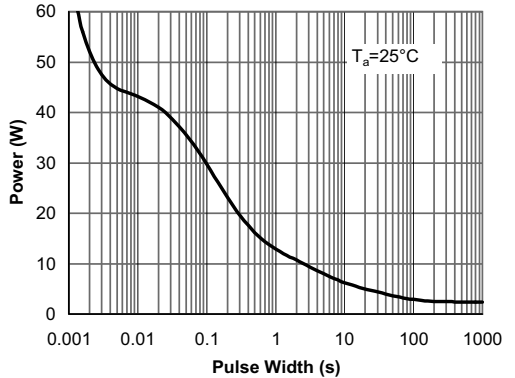


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

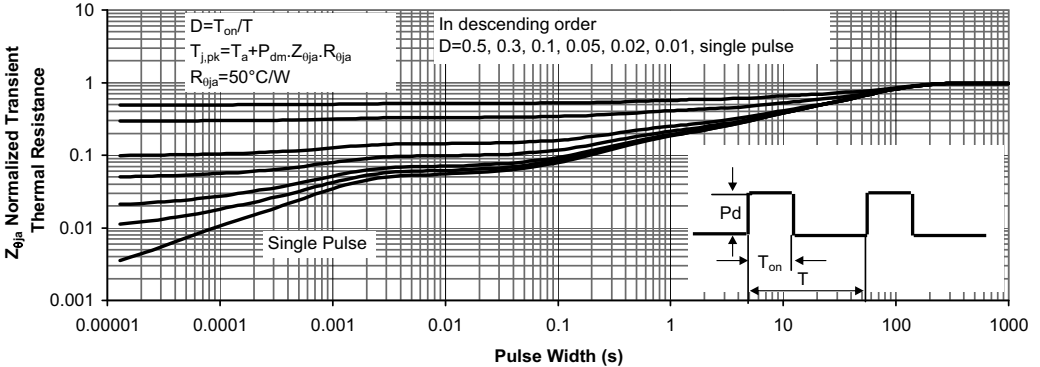


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