Complementary MOSFET

ELM24603HA-S

■General Description

ELM24603HA-S uses advanced trench technology to provide excellent Rds(on) and low gate charge.

■Features

N-channel	P-channel
• Vds=60V	Vds=-60V
• Id=12A(Vgs=10V)	Id=-12A(Vgs=-10V)
• Rds(on) < 60mΩ(Vgs=10V)	Rds(on) < 115mΩ(Vgs=-10V)
• Rds(on) < 85mΩ(Vgs=4.5V)	Rds(on) < 150mΩ(Vgs=-4.5V)

■Maximum Absolute Ratings

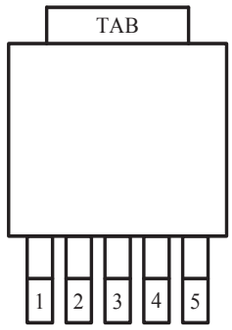
Parameter		Symbol	N-ch (Max.)	P-ch (Max.)	Unit	Note
Drain-source voltage		Vds	60	-60	V	
Gate-source voltage		Vgs	±20	±20	V	
Continuous drain current	Tc=25°C	Id	12	-12	A	7
	Tc=100°C		12	-10		
Pulsed drain current		Idm	30	-30	A	3
Avalanche current		Iar	12	-12	A	3
Repetitive avalanche energy	L=0.1mH	Ear	23	23	mJ	3
Power dissipation	Tc=25°C	Pd	20.0	37.5	W	2
	Tc=100°C		10.0	18.8		
Power dissipation	Ta=25°C	Pdsm	2.0	2.5	W	1
	Ta=70°C		1.3	1.6		
Junction and storage temperature range		Tj,Tstg	-55 to 150	-55 to 150	°C	

■Thermal Characteristics

Parameter		Symbol	Device	Typ.	Max.	Unit	Note
Maximum junction-to-ambient	t≤10s	Rθja	N-ch	17.4	30.0	°C/W	1
Maximum junction-to-ambient	Steady-state			50.0	60.0	°C/W	
Maximum junction-to-case	Steady-state	Rθjc		4.0	7.5	°C/W	2
Maximum junction-to-ambient	t≤10s	Rθja	P-ch	16.7	25.0	°C/W	1
Maximum junction-to-ambient	Steady-state			40.0	50.0	°C/W	
Maximum junction-to-case	Steady-state	Rθjc		2.5	4.0	°C/W	2

■Pin Configuration

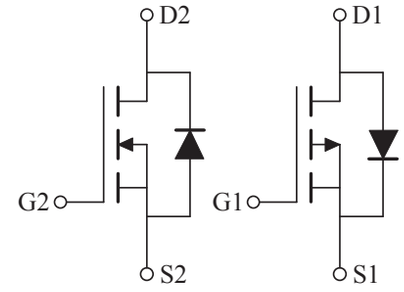
TO-252-5(TOP VIEW)



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

■Circuit

• N-ch • P-ch



■Electrical Characteristics (N-ch)

Ta=25°C

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
STATIC PARAMETERS							
Drain-source breakdown voltage	BVdss	Id=10mA, Vgs=0V		60			V
Zero gate voltage drain current	Idss	Vds=48V, Vgs=0V				1	μA
			Tj=55°C			5	
Gate-body leakage current	Igss	Vds=0V, Vgs=±20V				100	nA
Gate threshold voltage	Vgs(th)	Vds=Vgs, Id=250μA		1.0	2.4	3.0	V
On state drain current	Id(on)	Vgs=10V, Vds=5V		30			A
Static drain-source on-resistance	Rds(on)	Vgs=10V, Id=12A			47	60	mΩ
			Tj=125°C		85		
		Vgs=4.5V, Id=6A			67	85	
Forward transconductance	Gfs	Vds=5V, Id=12A			14		S
Diode forward voltage	Vsd	Is=1A, Vgs=0V			0.74	1.00	V
Max.body-diode continuous current	Is					12	A
DYNAMIC PARAMETERS							
Input capacitance	Ciss	Vgs=0V, Vds=30V, f=1MHz			450	540	pF
Output capacitance	Coss				61		pF
Reverse transfer capacitance	Crss				27		pF
Gate resistance	Rg	Vgs=0V, Vds=0V, f=1MHz			1.35	2.00	Ω
SWITCHING PARAMETERS							
Total gate charge (10V)	Qg	Vgs=10V, Vds=30V, Id=12A			7.5	10.0	nC
Total gate charge (4.5V)	Qg				3.8	5.0	nC
Gate-source charge	Qgs				1.2		nC
Gate-drain charge	Qgd				1.9		nC
Turn-on delay time	td(on)	Vgs=10V, Vds=30V Rl=2.5Ω, Rgen=3Ω			4.2		ns
Turn-on rise time	tr				3.4		ns
Turn-off delay time	td(off)				16.0		ns
Turn-off fall time	tf				2.0		ns
Body-diode reverse recovery time	trr	If=12A, dI/dt=100A/μs			27.6	35.0	ns
Body-diode reverse recovery charge	Qrr	If=12A, dI/dt=100A/μs			30.0		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°C. The power dissipation Pdsm is based on Rθja 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.
2. The power dissipation Pd is based on Tj(max.)=175°C, using junction-to-case thermal resistance, and is more useful setting the upper dissipation limit for cases where additional heartsinking is used.
3. The repetitive rating and the pulse width are limited by junction temperature Tj(max.)=175°C.
4. The Rθja is the sum of the thermal impedance from junction to case Rθjc and case to ambient.
5. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.
6. These curves are based on the junction-to-case thermal impedence which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of Tj(max.)=175°C.
7. The maximum current rating is limited by bond-wires.
8. These tests are performed with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with Ta=25°C. The SOA curve provides a single pulse rating.

■Typical Electrical and Thermal Characteristics (N-ch)

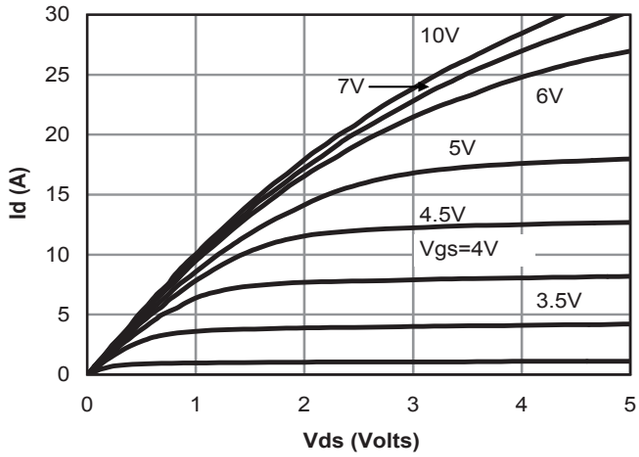


Fig 1: On-Region Characteristics

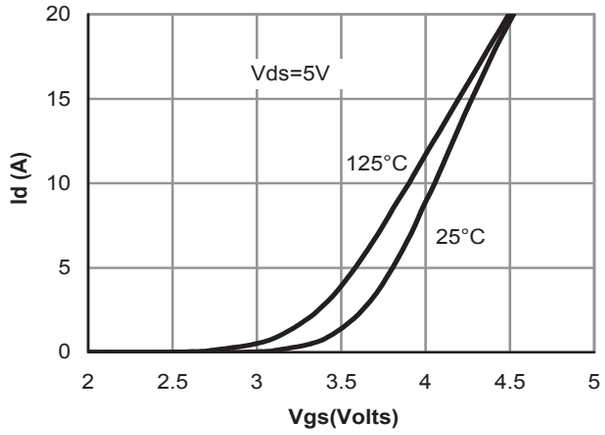


Figure 2: Transfer Characteristics

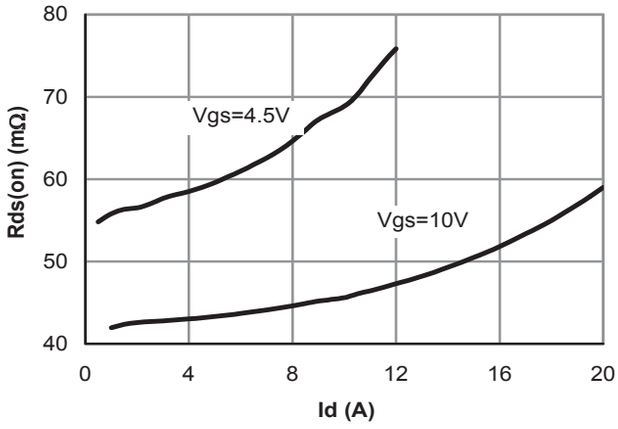


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

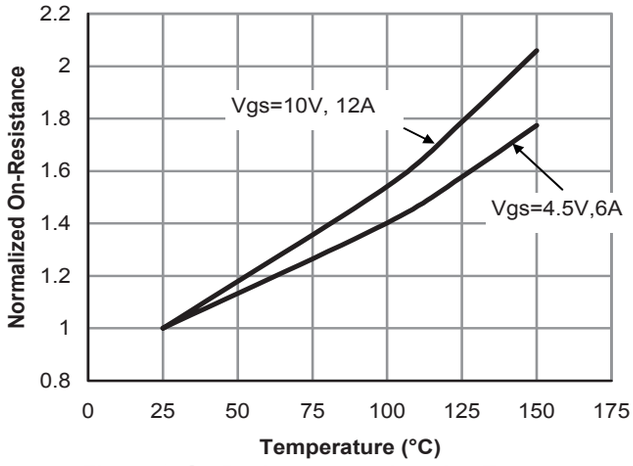


Figure 4: On-Resistance vs. Junction Temperature

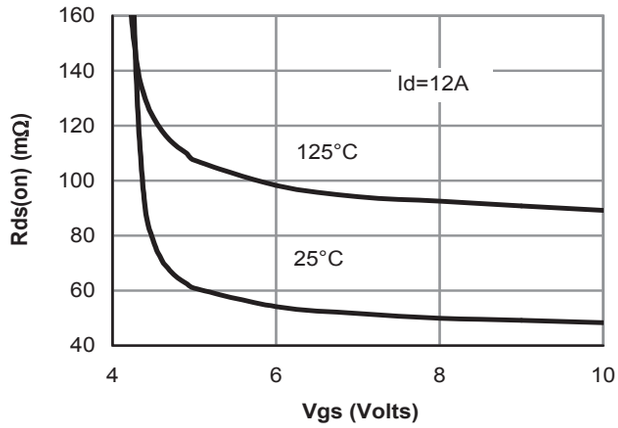


Figure 5: On-Resistance vs. Gate-Source Voltage

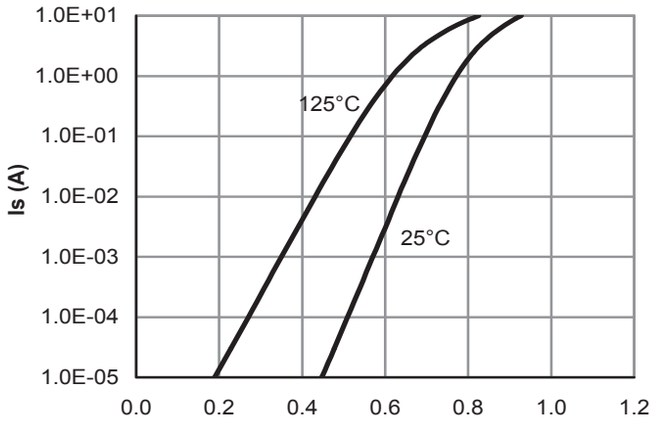


Figure 6: Body-Diode Characteristics

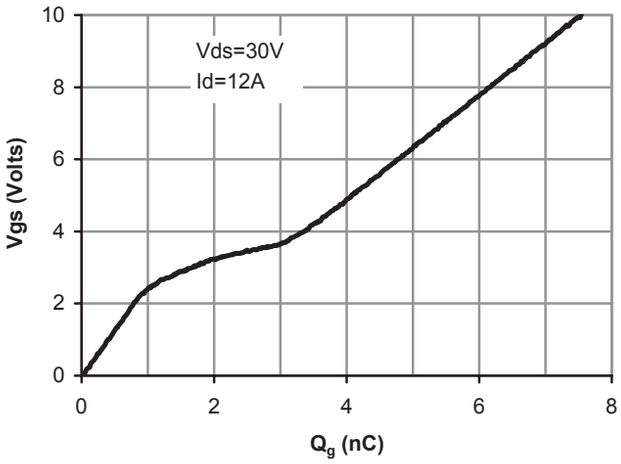


Figure 7: Gate-Charge Characteristics

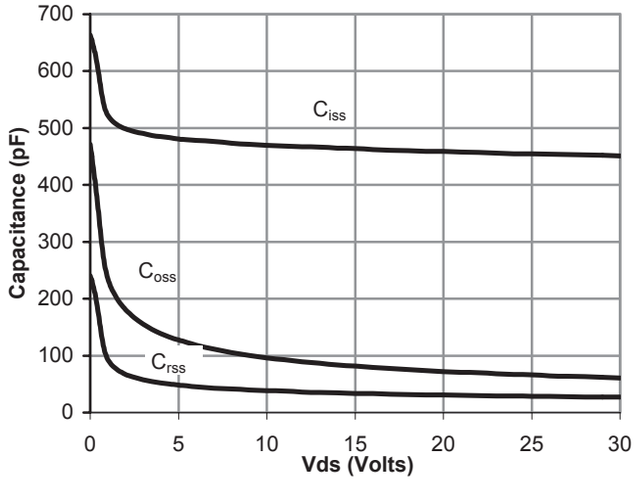


Figure 8: Capacitance Characteristics

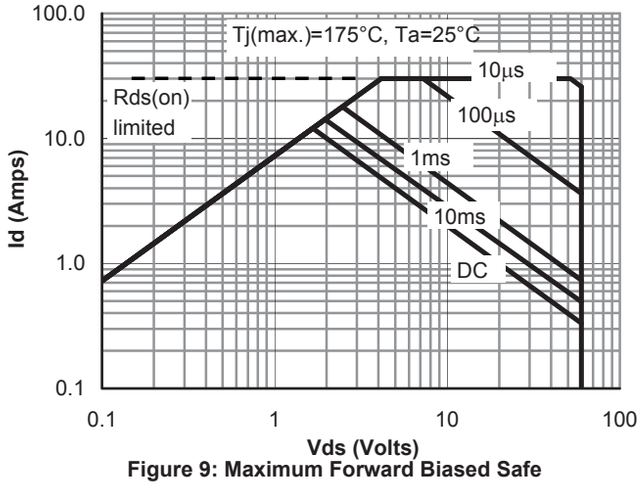


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

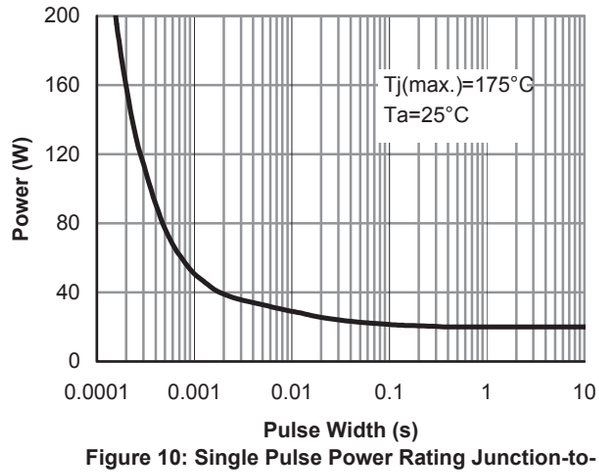


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

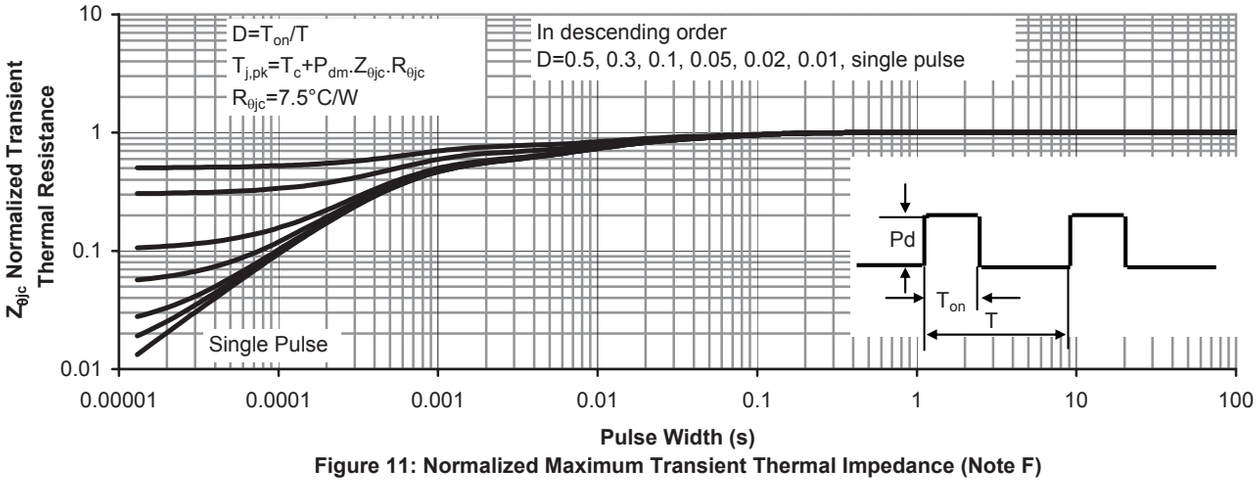


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

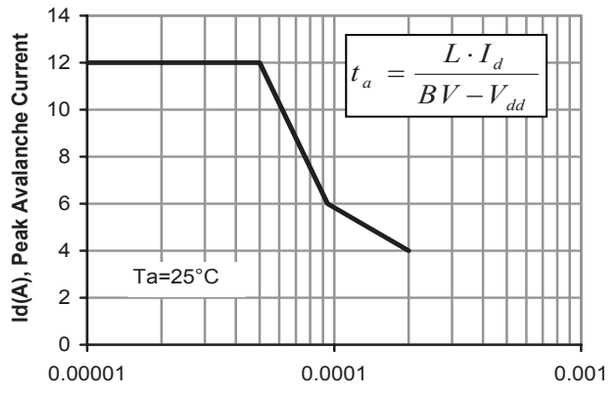


Figure 12: Single Pulse Avalanche capability

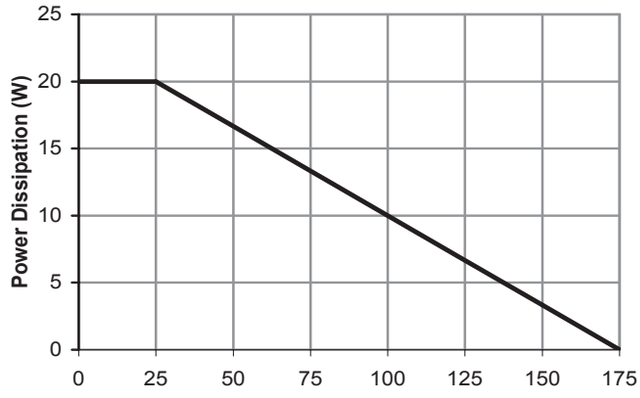


Figure 13: Power De-rating (Note B)

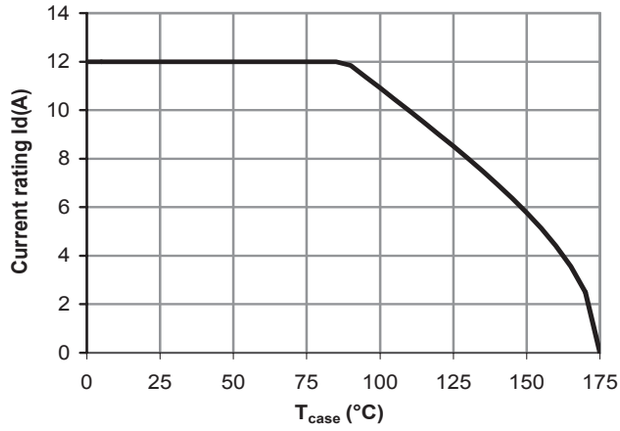


Figure 14: Current De-rating (Note B)

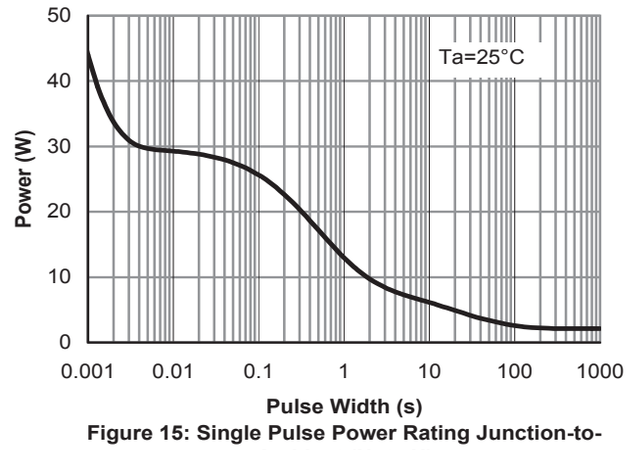


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

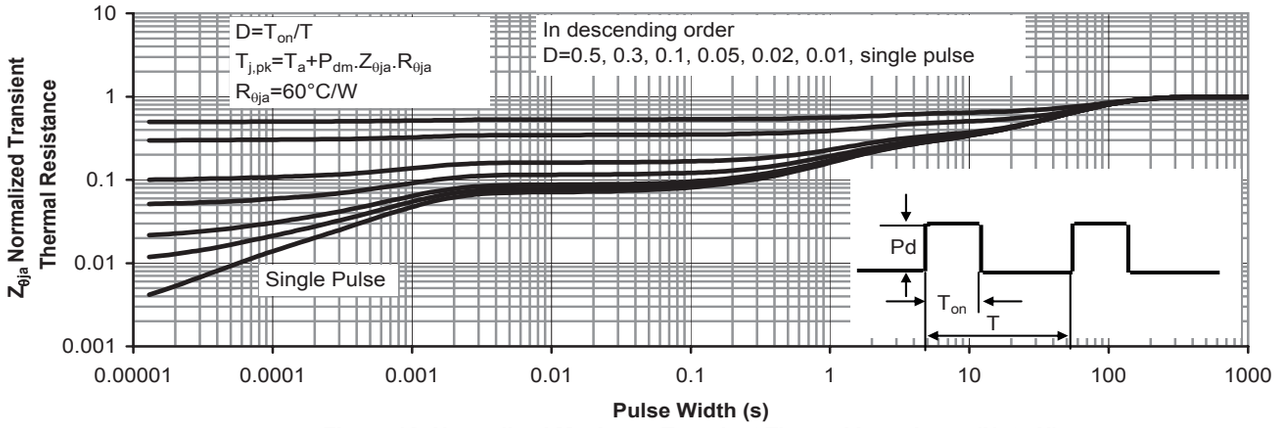


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

■Electrical Characteristics (P-ch)

Ta=25°C

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
STATIC PARAMETERS							
Drain-source breakdown voltage	BVdss	Id=-250μA, Vgs=0V		-60			V
Zero gate voltage drain current	Idss	Vds=-48V, Vgs=0V			-0.003	-1.000	μA
			Tj=55°C			-5.000	
Gate-body leakage current	Igss	Vds=0V, Vgs=±20V				±100	nA
Gate threshold voltage	Vgs(th)	Vds=Vgs, Id=-250μA		-1.5	-2.1	-3.0	V
On state drain current	Id(on)	Vgs=-10V, Vds=-5V		-30			A
Static drain-source on-resistance	Rds(on)	Vgs=-10V, Id=-12A			91	115	mΩ
			Tj=125°C		150		
		Vgs=-4.5V, Id=-6A			114	150	mΩ
Forward transconductance	Gfs	Vds=-5V, Id=-12A			12.8		S
Diode forward voltage	Vsd	Is=-1A, Vgs=0V			-0.76	-1.00	V
Max. body-diode continuous current	Is					-12	A
DYNAMIC PARAMETERS							
Input capacitance	Ciss	Vgs=0V, Vds=-30V, f=1MHz			987	1185	pF
Output capacitance	Coss				114		pF
Reverse transfer capacitance	Crss				46		pF
Gate resistance	Rg	Vgs=0V, Vds=0V, f=1MHz			7	10	Ω
SWITCHING PARAMETERS							
Total gate charge (10V)	Qg	Vgs=-10V, Vds=-30V, Id=-12A			15.8	20.0	nC
Total gate charge (4.5V)	Qg				7.4	9.0	nC
Gate-source charge	Qgs				3.0		nC
Gate-drain charge	Qgd				3.5		nC
Turn-on delay time	td(on)	Vgs=-10V, Vds=-30V, Rl=2.5Ω, Rgen=3Ω			9		ns
Turn-on rise time	tr				10		ns
Turn-off delay time	td(off)				25		ns
Turn-off fall time	tf				11		ns
Body diode reverse recovery time	trr	If=-12A, dl/dt=100A/μs			27.5	35.0	ns
Body diode reverse recovery charge	Qrr	If=-12A, dl/dt=100A/μs			30.0		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°C. The power dissipation Pdsm is based on Rθja 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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3. The repetitive rating and the pulse width are limited by junction temperature Tj(max.)=175°C.
4. The Rθja is the sum of the thermal impedance from junction to case Rθjc and case to ambient.
5. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.
6. These curves are based on the junction-to-case thermal impedence which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of Tj(max.)=175°C.
7. The maximum current rating is limited by bond-wires.
8. These tests are performed with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with Ta=25°C. The SOA curve provides a single pulse rating.

■Typical Electrical and Thermal Characteristics (P-ch)

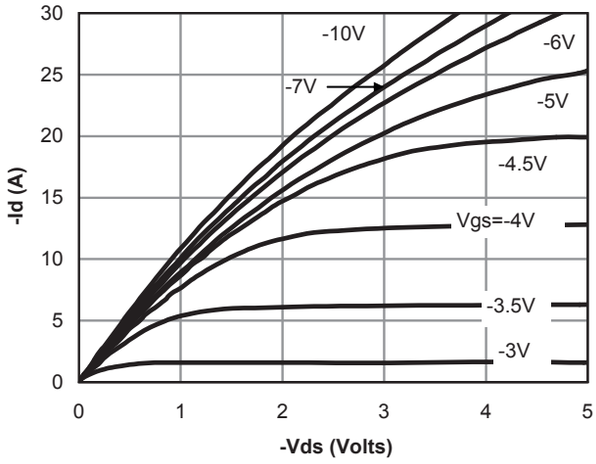

Fig 1: On-Region Characteristics

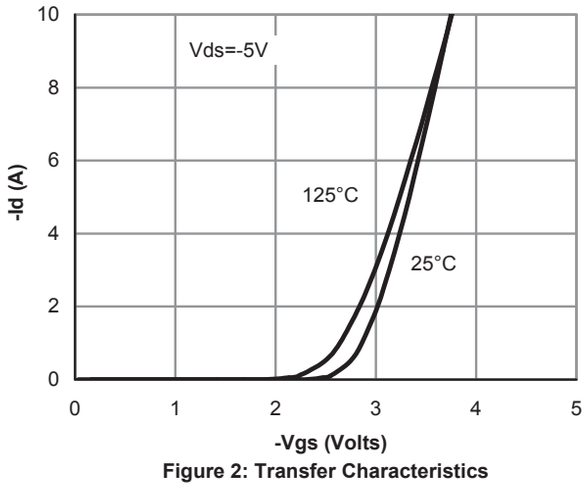

Figure 2: Transfer Characteristics

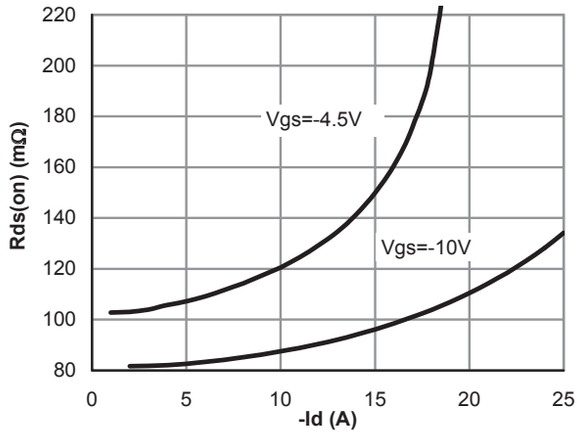

Figure 3: On-Resistance vs. Drain Current and Gate Voltage

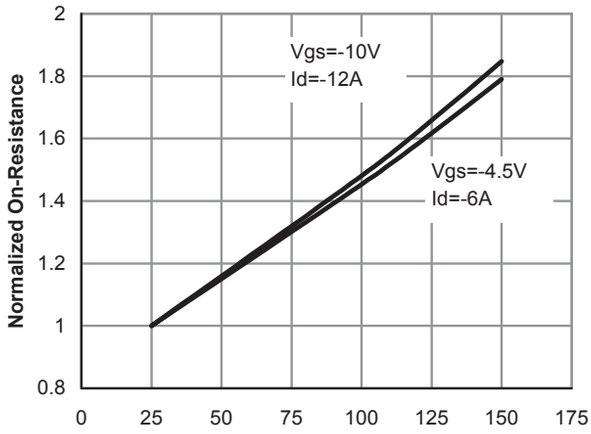

Figure 4: On-Resistance vs. Junction Temperature

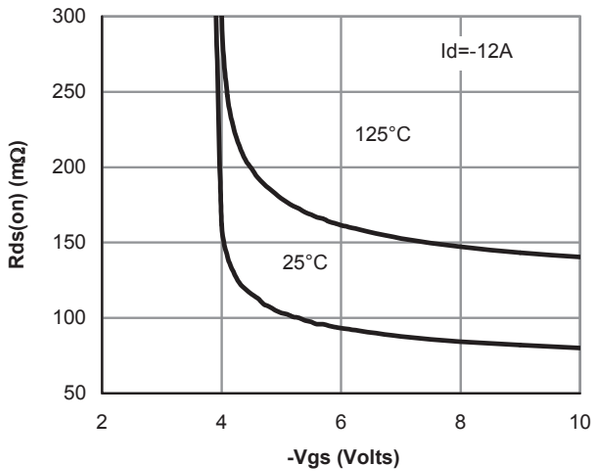

Figure 5: On-Resistance vs. Gate-Source Voltage

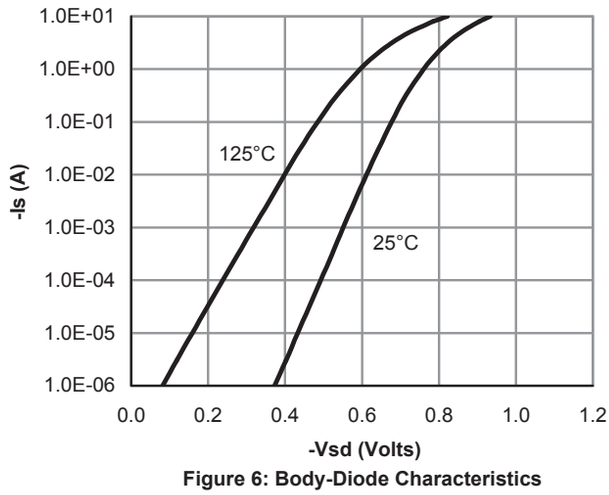

Figure 6: Body-Diode Characteristics

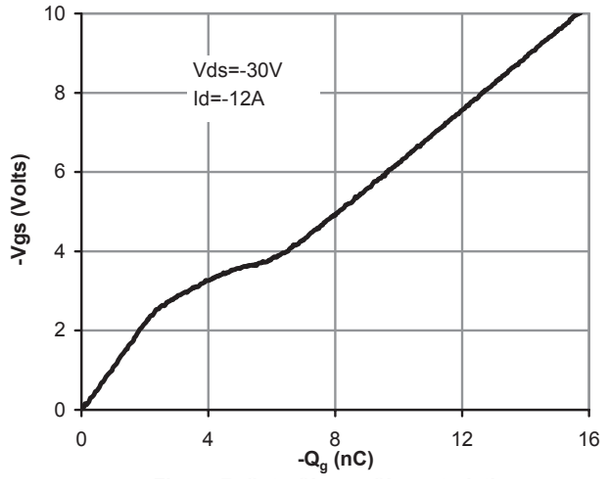

Figure 7: Gate-Charge Characteristics

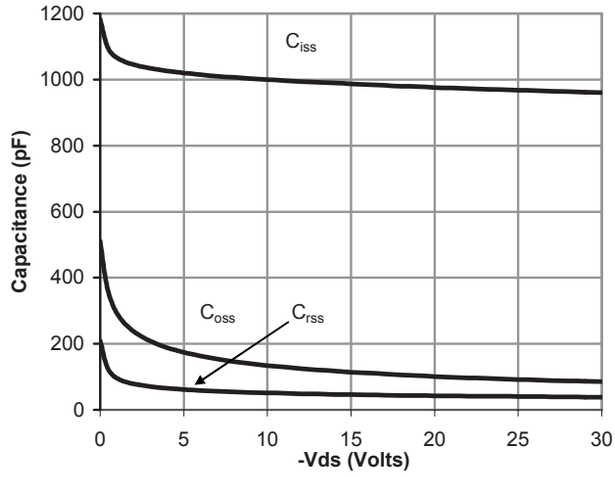

Figure 8: Capacitance Characteristics

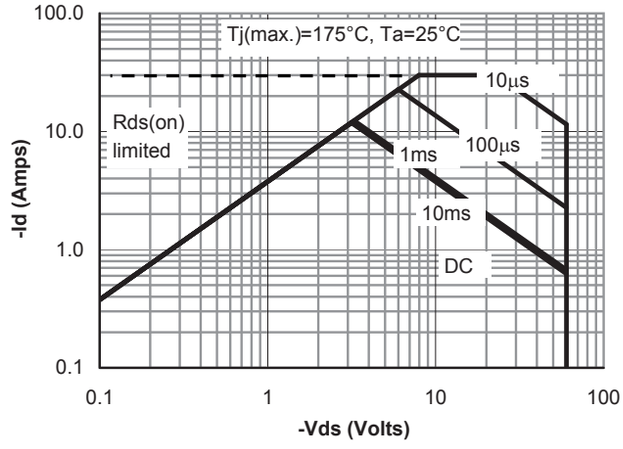

Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

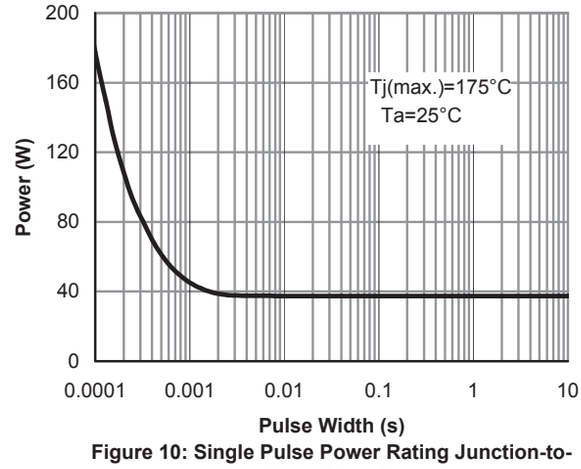

Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

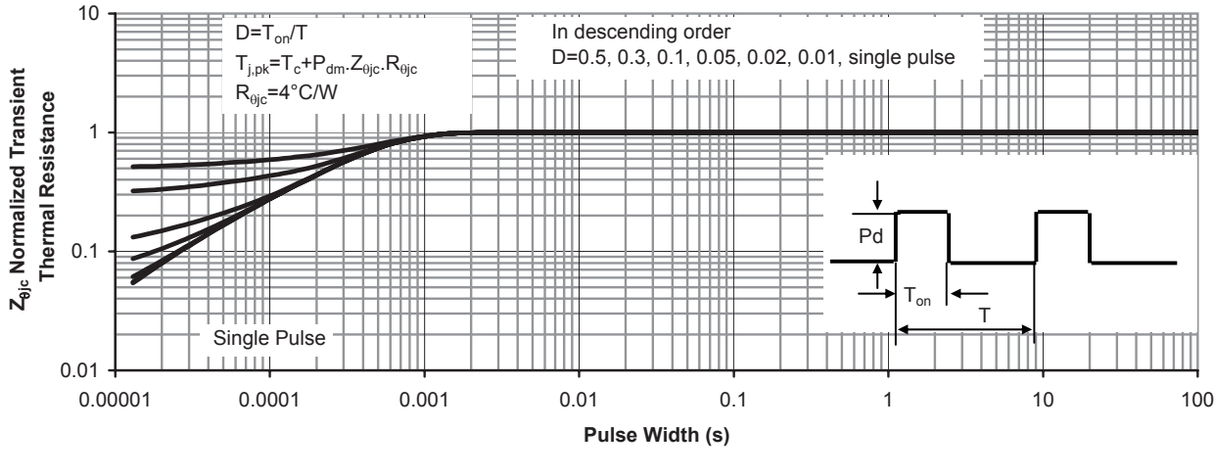

Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

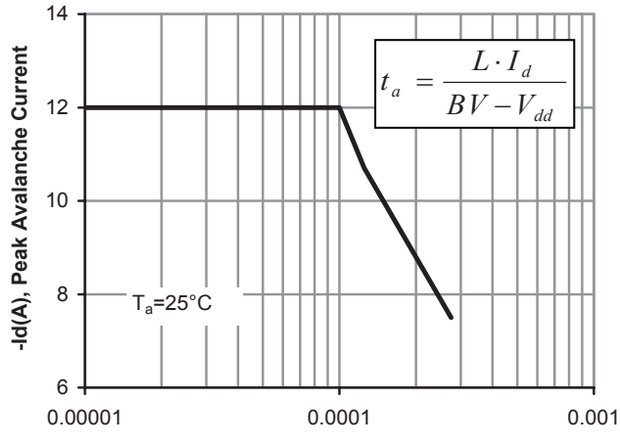

Figure 12: Single Pulse Avalanche capability

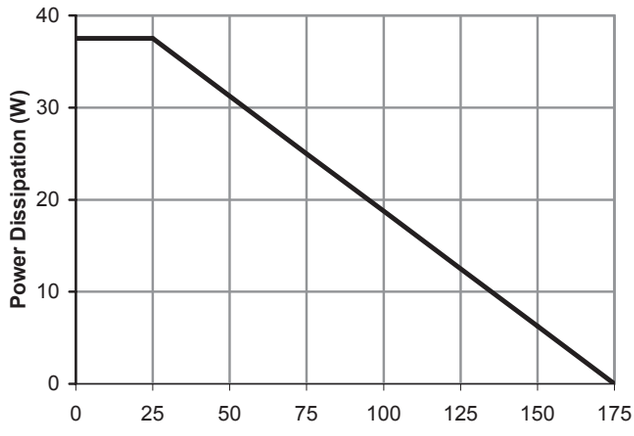

Figure 13: Power De-rating (Note B)

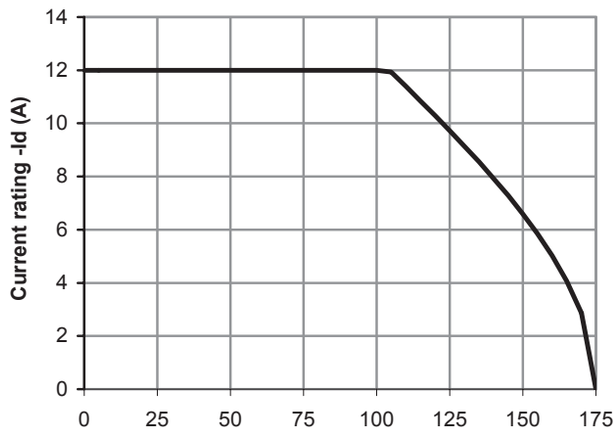

Figure 14: Current De-rating (Note B)

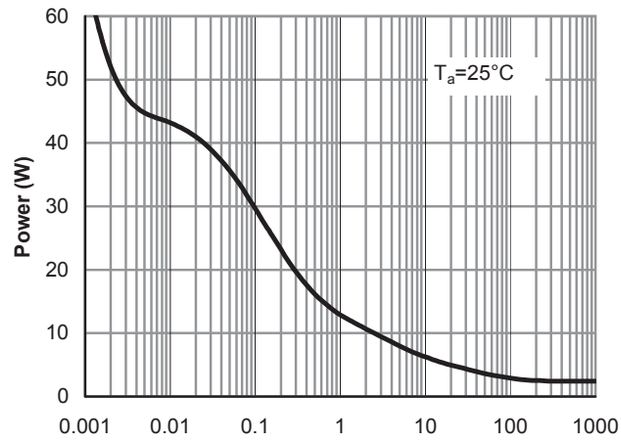

Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

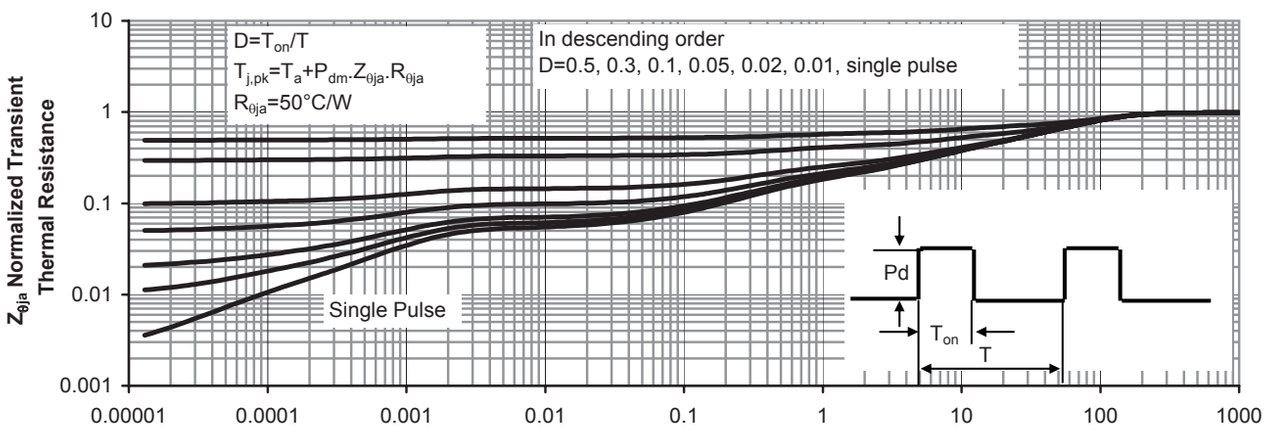

Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)