

Single P-channel MOSFET

ELM13415CA-S

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General description

ELM13415CA-S uses advanced trench technology to provide excellent $R_{ds(on)}$, low gate charge and low gate resistance. Internal ESD protection is included.

Features

- $V_{ds} = -20V$
- $I_d = -4A$ ($V_{gs} = -4.5V$)
- $R_{ds(on)} < 43m\Omega$ ($V_{gs} = -4.5V$)
- $R_{ds(on)} < 54m\Omega$ ($V_{gs} = -2.5V$)
- $R_{ds(on)} < 73m\Omega$ ($V_{gs} = -1.8V$)
- ESD Rating : 3000V HBM

Maximum absolute ratings

Parameter	Symbol	Limit	Unit	Note	
Drain-source voltage	V_{ds}	-20	V		
Gate-source voltage	V_{gs}	± 8	V		
Continuous drain current	I_d	$T_a = 25^\circ C$	-4.0	A	1
		$T_a = 70^\circ C$	-3.5		
Pulsed drain current	I_{dm}	-30	A	2	
Power dissipation	P_d	$T_a = 25^\circ C$	1.4	W	1
		$T_a = 70^\circ C$	0.9		
Junction and storage temperature range	T_j, T_{stg}	-55 to 150	$^\circ C$		

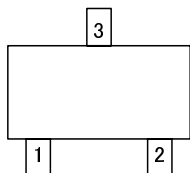
Thermal characteristics

Parameter		Symbol	Typ.	Max.	Unit	Note
Maximum junction-to-ambient	$t \leq 10s$	$R\theta_{ja}$	65	90	$^\circ C/W$	1
Maximum junction-to-ambient	Steady-state		85	125	$^\circ C/W$	
Maximum junction-to-lead	Steady-state	$R\theta_{jl}$	43	60	$^\circ C/W$	3

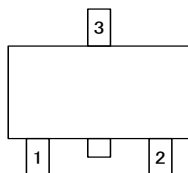
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Pin configuration

SOT-23 (TOP VIEW)



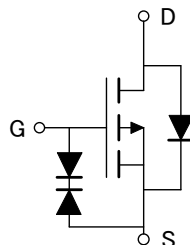
(Without extra bar)



(With extra bar)

Pin No.	Pin name
1	GATE
2	SOURCE
3	DRAIN

Circuit



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Electrical characteristics

Ta=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
STATIC PARAMETERS						
Drain-source breakdown voltage	BVdss	Id=-250 μA, Vgs=0V	-20			V
Zero gate voltage drain current	Idss	Vds=-16V			-1	μA
		Vgs=0V		Tj=55°C	-5	
Gate-body leakage current	Igss	Vds=0V, Vgs=±4.5V			±1	μA
		Vds=0V, Vgs=±8V			±10	μA
Gate threshold voltage	Vgs(th)	Vds=Vgs, Id=-250 μA	-0.30	-0.55	-1.00	V
On state drain current	Id(on)	Vgs=-4.5V, Vds=-5V	-25			A
Static drain-source on-resistance	Rds(on)	Vgs=-4.5V		35	43	mΩ
		Id=-4A	Tj=125°C	48	60	
		Vgs=-2.5V, Id=-4A		45	54	mΩ
		Vgs=-1.8V, Id=-2A		56	73	mΩ
Forward transconductance	Gfs	Vds=-5V, Id=-4A	8	16		S
Diode forward voltage	Vsd	Is=-1A, Vgs=0V		-0.78	-1.00	V
Max. body-diode continuous current	Is				-2.2	A
DYNAMIC PARAMETERS						
Input capacitance	Ciss			1450		pF
Output capacitance	Coss	Vgs=0V, Vds=-10V, f=1MHz		205		pF
Reverse transfer capacitance	Crss			160		pF
Gate resistance	Rg	Vgs=0V, Vds=0V, f=1MHz		6.5		Ω
SWITCHING PARAMETERS						
Total gate charge	Qg	Vgs=-4.5V, Vds=-10V		17.2		nC
Gate-source charge	Qgs	Id=-4A		1.3		nC
Gate-drain charge	Qgd		4.5		nC	
Turn-on delay time	td(on)			9.5		ns
Turn-on rise time	tr	Vgs=-4.5V, Vds=-10V		17.0		ns
Turn-off delay time	td(off)	RI=2.5 Ω, Rgen=3 Ω		94.0		ns
Turn-off fall time	tf			35.0		ns
Body diode reverse recovery time	trr	If=-4A, di/dt=100A/μs		31.0		ns
Body diode reverse recovery charge	Qrr	If=-4A, di/dt=100A/μs		13.8		nC

NOTE :

- 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 value in any given applications depends on the user's specific board design. The current rating is based on the t ≤ 10s thermal resistance rating.
- Repetitive rating, pulse width limited by junction temperature.
- The Rθja is the sum of the thermal impedance from junction to lead Rθjl and lead to ambient.
- The static characteristics in Figures 1 to 6 are obtained using 80μs pulses, duty cycle 0.5%max.
- 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

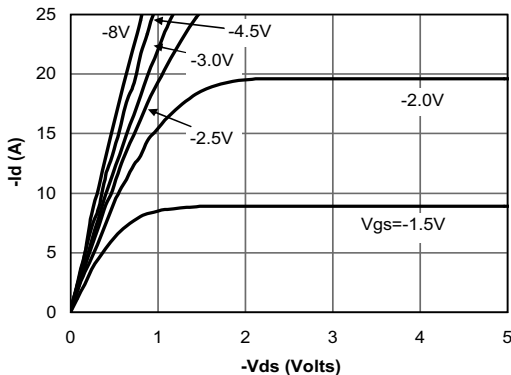


Figure 1: On-Region Characteristics

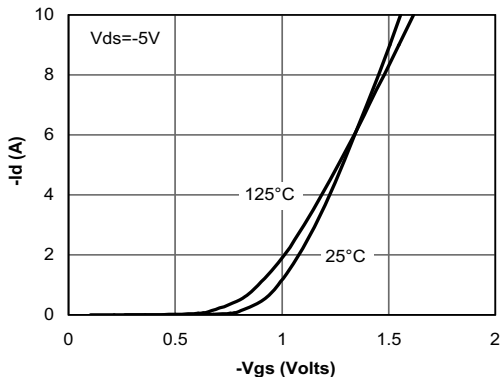


Figure 2: Transfer Characteristics

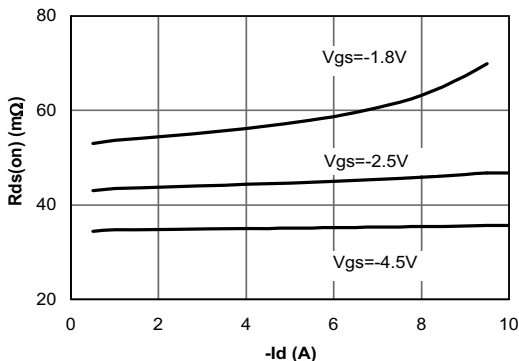


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

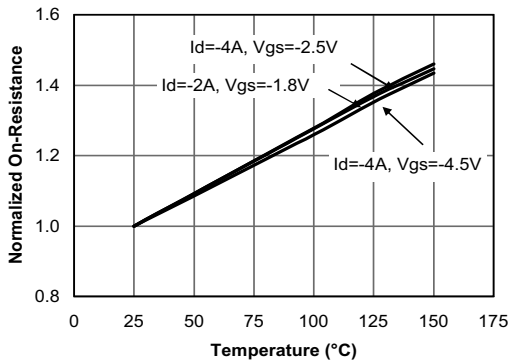


Figure 4: On-Resistance vs. Junction Temperature

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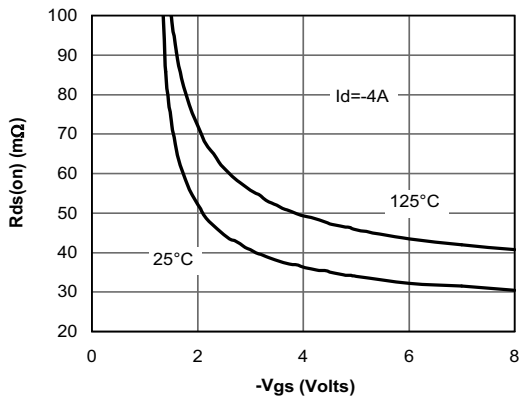


Figure 5: On-Resistance vs. Gate-Source Voltage

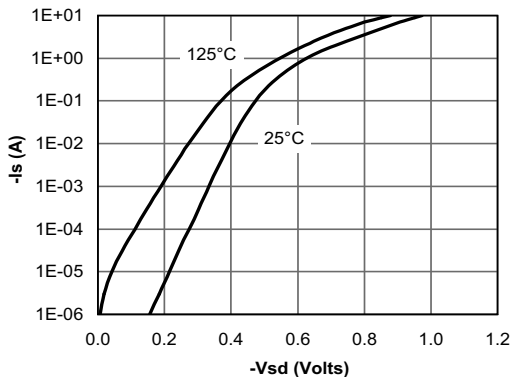


Figure 6: Body-Diode Characteristics

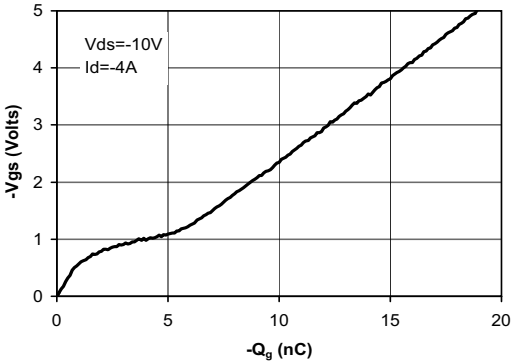


Figure 7: Gate-Charge Characteristics

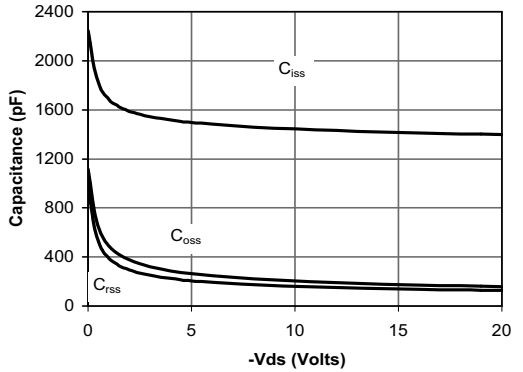


Figure 8: Capacitance Characteristics

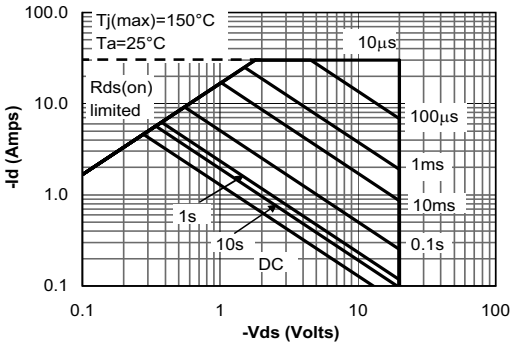


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

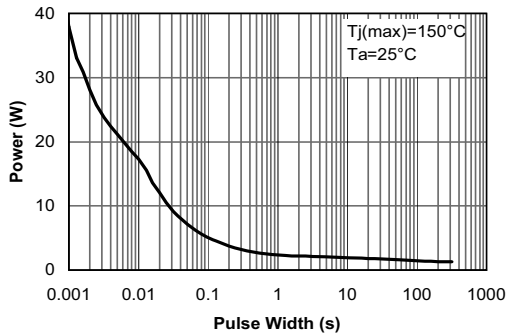


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

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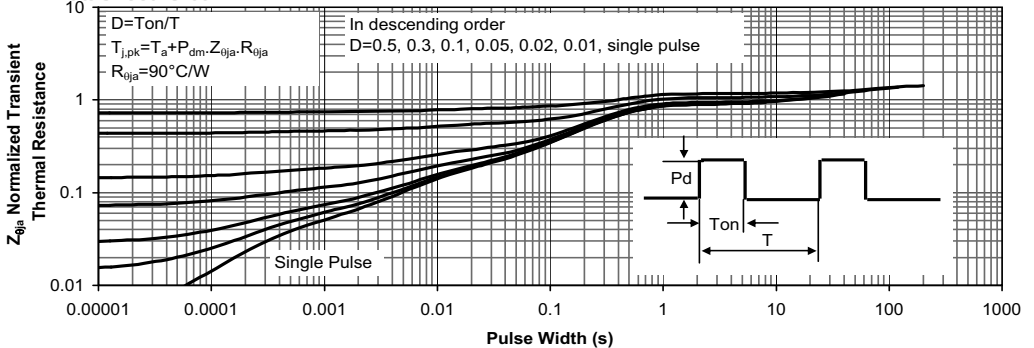


Figure 11: Normalized Maximum Transient Thermal Impedance