

# Single P-channel MOSFET

ELM13413CA-S

## General description

ELM13413CA-S uses advanced trench technology to provide excellent  $R_{ds(on)}$ , low gate charge and low gate resistance.

## Features

- $V_{ds} = -20V$
- $I_d = -3A$  ( $V_{gs} = -4.5V$ )
- $R_{ds(on)} < 97m\Omega$  ( $V_{gs} = -4.5V$ )
- $R_{ds(on)} < 130m\Omega$  ( $V_{gs} = -2.5V$ )
- $R_{ds(on)} < 190m\Omega$  ( $V_{gs} = -1.8V$ )

## Maximum absolute ratings

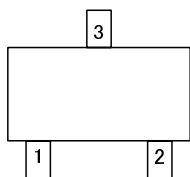
Parameter	Symbol	Limit	Unit	Note	
Drain-source voltage	$V_{ds}$	-20	V		
Gate-source voltage	$V_{gs}$	$\pm 8$	V		
Continuous drain current	$I_d$	$T_a = 25^\circ C$	-3.0	A	1
		$T_a = 70^\circ C$	-2.4		
Pulsed drain current	$I_{dm}$	-15	A	2	
Power dissipation	$P_d$	$T_a = 25^\circ C$	1.4	W	1
		$T_a = 70^\circ C$	0.9		
Junction and storage temperature range	$T_j, T_{stg}$	-55 to 150	$^\circ C$		

## Thermal characteristics

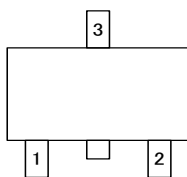
Parameter		Symbol	Typ.	Max.	Unit	Note
Maximum junction-to-ambient	$t \leq 10s$	$R\theta_{ja}$	70	90	$^\circ C/W$	1
Maximum junction-to-ambient	Steady-state		100	125	$^\circ C/W$	
Maximum junction-to-lead	Steady-state	$R\theta_{jl}$	63	80	$^\circ C/W$	3

## Pin configuration

SOT-23 (TOP VIEW)



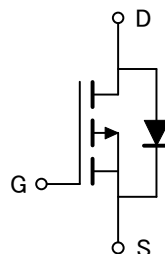
(Without extra bar)



(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
<b>STATIC PARAMETERS</b>						
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=±8V			±100	nA
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	-15			A
Static drain-source on-resistance	Rds(on)	Vgs=-4.5V		81	97	mΩ
		Id=-3A	Tj=125°C	111	135	
		Vgs=-2.5V, Id=-2.6A		108	130	
		Vgs=-1.8V, Id=-1A		146	190	mΩ
Forward transconductance	Gfs	Vds=-5V, Id=-3A	4	7		S
Diode forward voltage	Vsd	Is=-1A, Vgs=0V		-0.78	-1.00	V
Max. body-diode continuous current	Is				-2	A
<b>DYNAMIC PARAMETERS</b>						
Input capacitance	Ciss			540		pF
Output capacitance	Coss	Vgs=0V, Vds=-10V, f=1MHz		72		pF
Reverse transfer capacitance	Crss			49		pF
Gate resistance	Rg	Vgs=0V, Vds=0V, f=1MHz		12		Ω
<b>SWITCHING PARAMETERS</b>						
Total gate charge	Qg	Vgs=-4.5V, Vds=-10V		6.1		nC
Gate-source charge	Qgs	Id=-3A		0.6		nC
Gate-drain charge	Qgd			1.6		nC
Turn-on delay time	td(on)			10		ns
Turn-on rise time	tr	Vgs=-4.5V, Vds=-10V		12		ns
Turn-off delay time	td(off)	RI=3.3 Ω, Rgen=3 Ω		44		ns
Turn-off fall time	tf			22		ns
Body diode reverse recovery time	trr			21.0		ns
Body diode reverse recovery charge	Qrr	If=-3A, dl/dt=100A/μs		7.5		nC

#### NOTE :

1. The value of Rθja is measured with the device mounted on 1in<sup>2</sup> 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.
2. Repetitive rating, pulse width limited by junction temperature.
3. The Rθja is the sum of the thermal impedance from junction to lead Rθjl and lead to ambient.
4. The static characteristics in Figures 1 to 6 are obtained using 80μs pulses, duty cycle 0.5%max.
5. These tests are performed with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with Ta=25°C. The SOA curve provides a single pulse rating.

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## Typical electrical and thermal characteristics

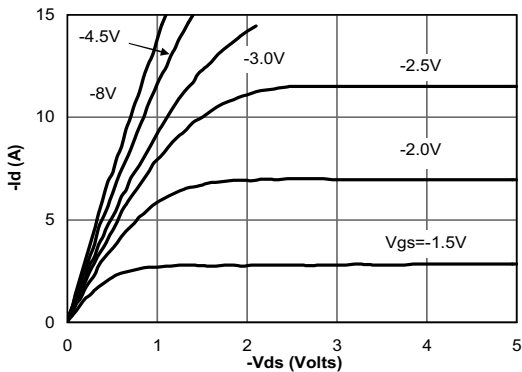


Figure 1: On-Region Characteristics

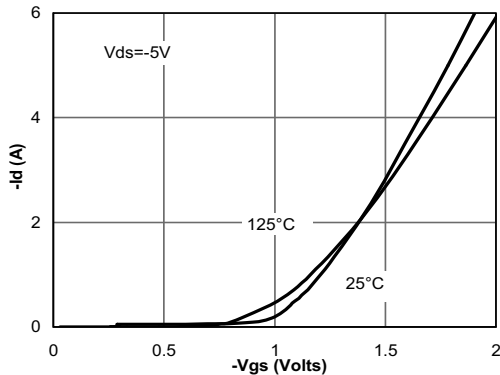


Figure 2: Transfer Characteristics

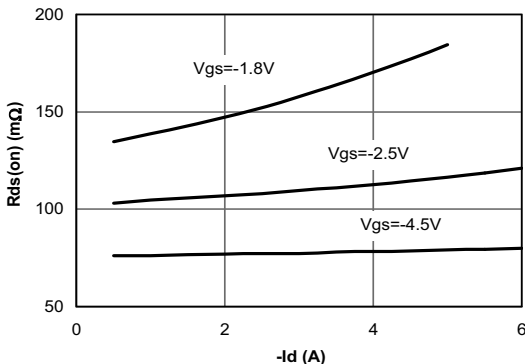


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

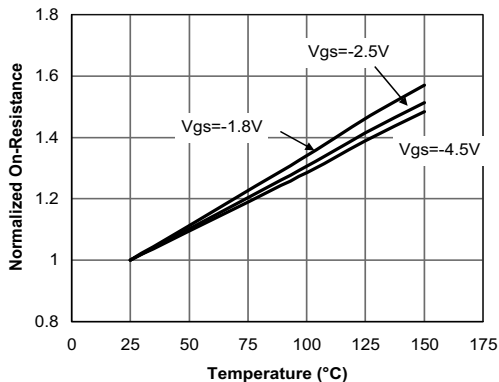


Figure 4: On-Resistance vs. Junction Temperature

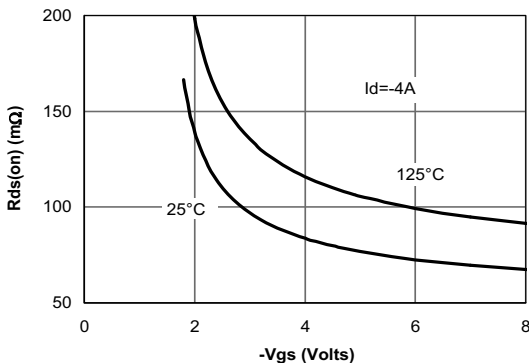


Figure 5: On-Resistance vs. Gate-Source Voltage

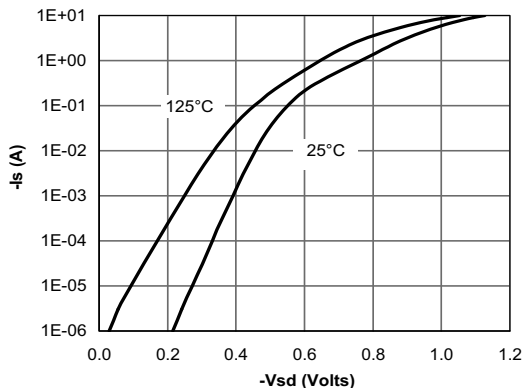


Figure 6: Body-Diode Characteristics

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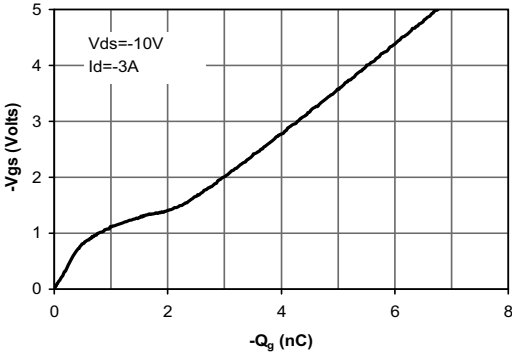


Figure 7: Gate-Charge Characteristics

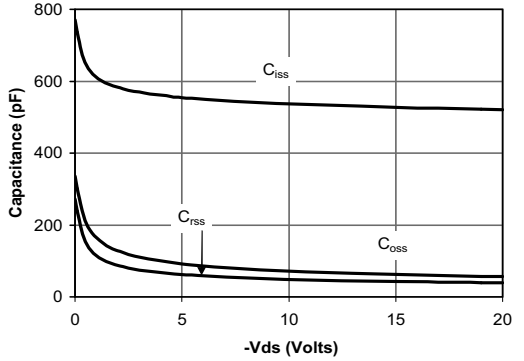


Figure 8: Capacitance Characteristics

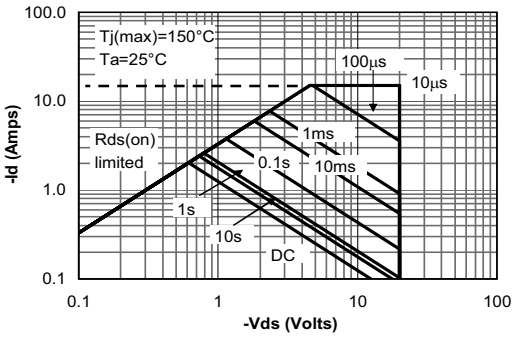


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

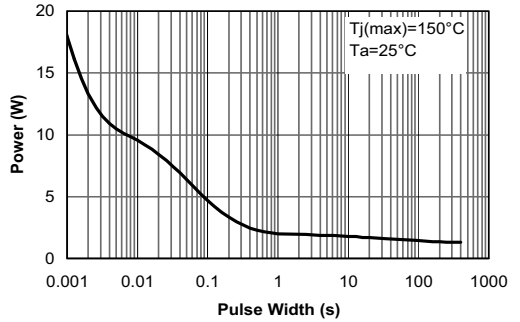


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

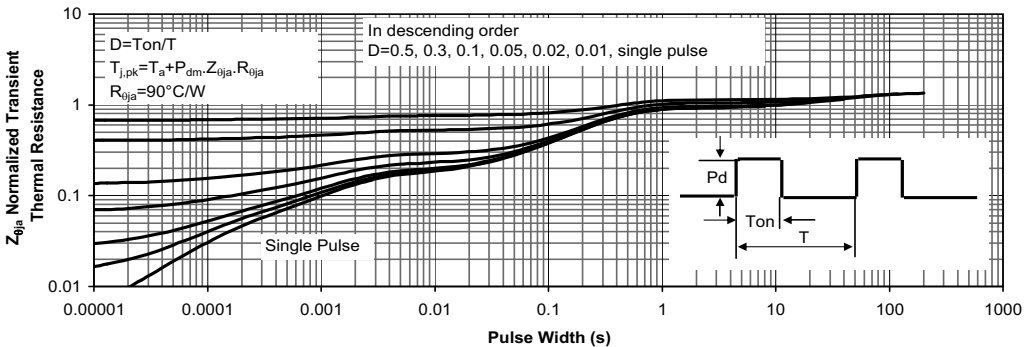


Figure 11: Normalized Maximum Transient Thermal Impedance