

# Single N-channel MOSFET

ELM13404CA-S

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## General description

ELM13404CA-S uses advanced trench technology to provide excellent  $R_{ds(on)}$ , low gate charge and low gate resistance.

## Features

- $V_{ds}=30V$
- $I_d=5.8A$  ( $V_{gs}=10V$ )
- $R_{ds(on)} < 28m\Omega$  ( $V_{gs}=10V$ )
- $R_{ds(on)} < 43m\Omega$  ( $V_{gs}=4.5V$ )

## Maximum absolute ratings

Parameter	Symbol	Limit	Unit	Note	
Drain-source voltage	$V_{ds}$	30	V		
Gate-source voltage	$V_{gs}$	$\pm 20$	V		
Continuous drain current	$I_d$	$T_a=25^\circ C$	5.8	A	1
		$T_a=70^\circ C$	4.9		
Pulsed drain current	$I_{dm}$	20	A	2	
Power dissipation	$P_d$	$T_a=25^\circ C$	1.4	W	
		$T_a=70^\circ C$	1.0		
Junction and storage temperature range	$T_j, T_{stg}$	-55 to 150	$^\circ C$		

## Thermal characteristics

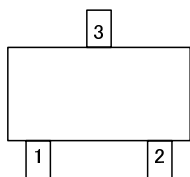
Parameter		Symbol	Typ.	Max.	Unit	Note
Maximum junction-to-ambient	$t \leq 10s$	$R\theta_{ja}$	65	90	$^\circ C/W$	1
Maximum junction-to-ambient	Steady-state		85	125	$^\circ C/W$	
Maximum junction-to-lead	Steady-state	$R\theta_{jl}$	43	60	$^\circ C/W$	3

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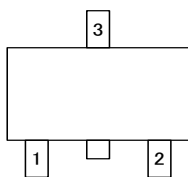
## Pin configuration

## Circuit

SOT-23 (TOP VIEW)

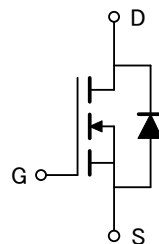


(Without extra bar)



(With extra bar)

Pin No.	Pin name
1	GATE
2	SOURCE
3	DRAIN



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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	30			V
Zero gate voltage drain current	Idss	Vds=30V Vgs=0V	Tj=55°C		1	μA
					5	
Gate-body leakage current	Igss	Vds=0V, Vgs=±20V			100	nA
Gate threshold voltage	Vgs(th)	Vds=Vgs, Id=250 μA	1.0	1.9	3.0	V
On state drain current	Id(on)	Vgs=4.5V, Vds=5V	20			A
Static drain-source on-resistance	Rds(on)	Vgs=10V Id=5.8A	Tj=125°C		22.5	28.0
					31.3	38.0
					34.5	43.0
Forward transconductance	Gfs	Vds=5V, Id=5.8A	10.0	14.5		S
Diode forward voltage	Vsd	Is=1A		0.76	1.00	V
Max. body-diode continuous current	Is				2.5	A
Pulsed body-diode current <sup>2</sup>	Is				20.0	A
<b>DYNAMIC PARAMETERS</b>						
Input capacitance	Ciss	Vgs=0V, Vds=15V, f=1MHz		680	820	pF
Output capacitance	Coss			102		pF
Reverse transfer capacitance	Crss			77	108	pF
Gate resistance	Rg	Vgs=0V, Vds=0V, f=1MHz	1.5	3.0	3.6	Ω
<b>SWITCHING PARAMETERS</b>						
Total gate charge (10V)	Qg	Vgs=10V, Vds=15V, Id=5.8A		13.88	17.00	nC
Total gate charge (4.5V)	Qg			6.78	8.10	nC
Gate-source charge	Qgs			1.80		nC
Gate-drain charge	Qgd			3.12		nC
Turn-on delay time	td(on)			4.6	6.5	ns
Turn-on rise time	tr	Vgs=10V, Vds=15V		3.8	5.7	ns
Turn-off delay time	td(off)	Rl=2.7 Ω, Rgen=3 Ω		20.9	30.0	ns
Turn-off fall time	tf			5.0	7.5	ns
Body diode reverse recovery time	trr	If=5.8A, dl/dt=100A/μs		16.1	21.0	ns
Body diode reverse recovery charge	Qrr	If=5.8A, dl/dt=100A/μs		7.4	10.0	nC

### NOTE :

- 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.
- 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 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.

### Typical electrical and thermal characteristics

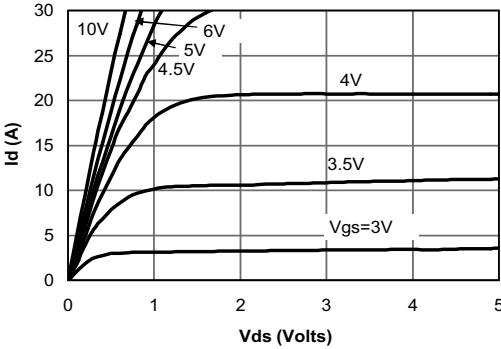


Fig 1: On-Region Characteristics

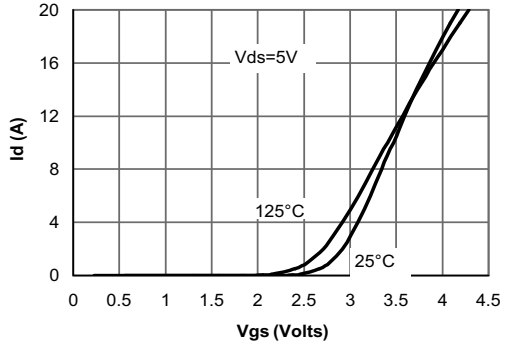


Figure 2: Transfer Characteristics

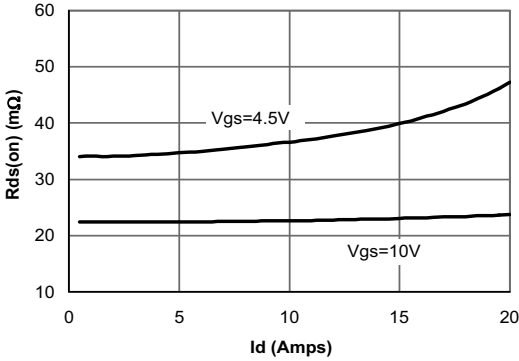


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

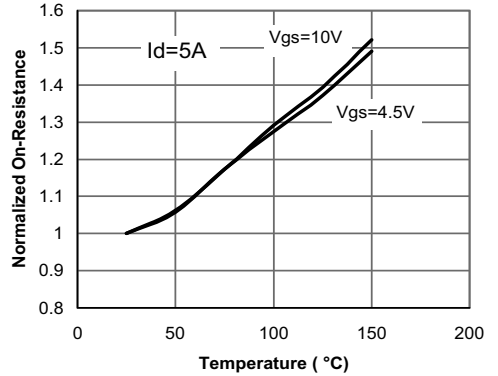


Figure 4: On-Resistance vs. Junction Temperature

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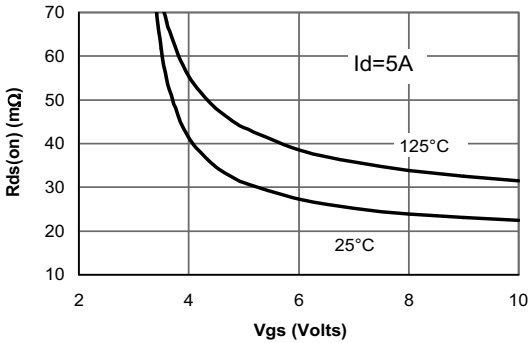


Figure 5: On-Resistance vs. Gate-Source Voltage

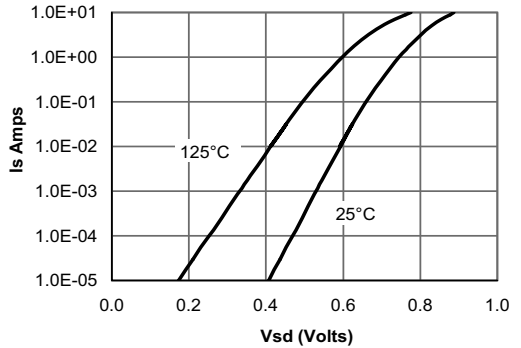


Figure 6: Body diode characteristics

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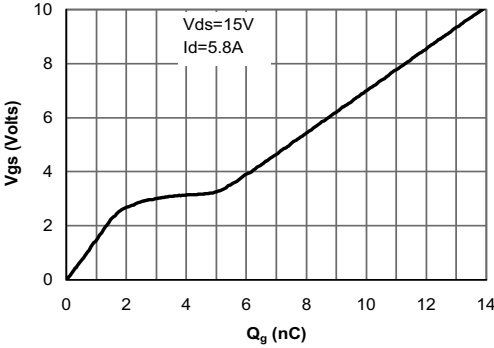


Figure 7: Gate-Charge characteristics

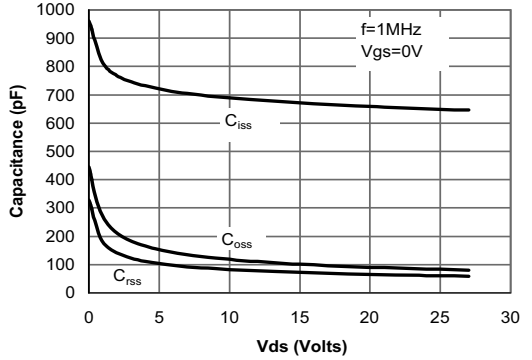


Figure 8: Capacitance Characteristics

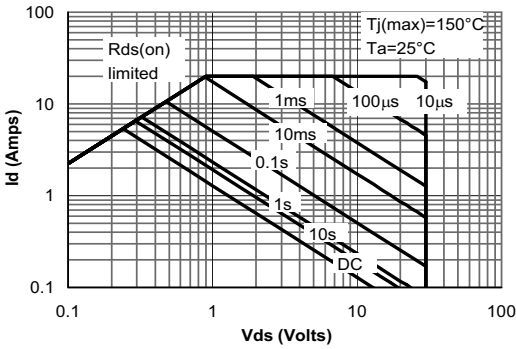


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

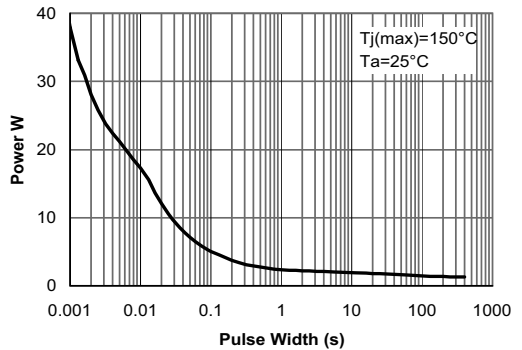


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

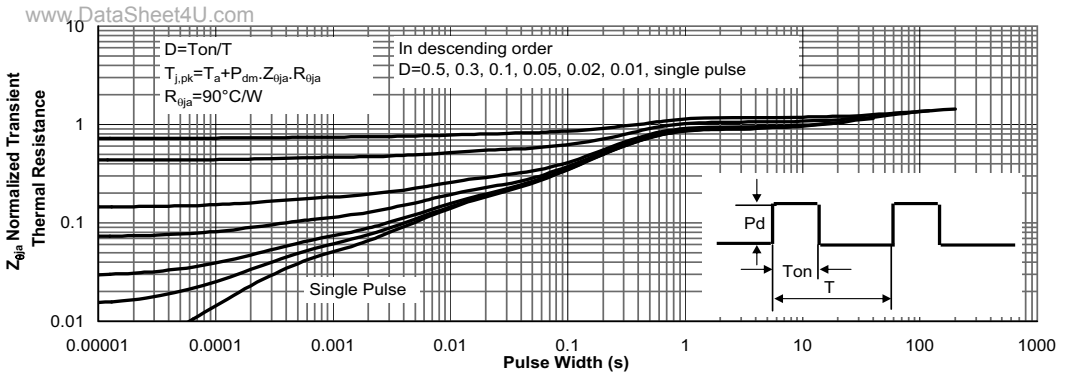


Figure 11: Normalized Maximum Transient Thermal Impedance