

# Single N-channel MOSFET

ELM13410CA-S

## General description

ELM13410CA-S uses advanced trench technology to provide excellent  $R_{ds(on)}$ , low gate charge and operation with gate voltages as low as 1.8V.

## Features

- $V_{ds}=30V$
- $I_d=5.8A$  ( $V_{gs}=10V$ )
- $R_{ds(on)} < 28m\Omega$  ( $V_{gs}=10V$ )
- $R_{ds(on)} < 33m\Omega$  ( $V_{gs}=4.5V$ )
- $R_{ds(on)} < 52m\Omega$  ( $V_{gs}=2.5V$ )
- $R_{ds(on)} < 70m\Omega$  ( $V_{gs}=1.8V$ )

## Maximum absolute ratings

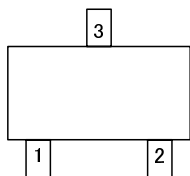
Parameter	Symbol	Limit	Unit	Note	
Drain-source voltage	$V_{ds}$	30	V		
Gate-source voltage	$V_{gs}$	$\pm 12$	V		
Continuous drain current	$I_d$	$T_a=25^\circ C$	5.8	A	1
		$T_a=70^\circ C$	4.9		
Pulsed drain current	$I_{dm}$	30	A	2	
Power dissipation	$P_d$	$T_a=25^\circ C$	1.4	W	1
		$T_a=70^\circ C$	1.0		
Junction and storage temperature range	$T_j, T_{stg}$	-55 to 150	$^\circ C$		

## Thermal characteristics

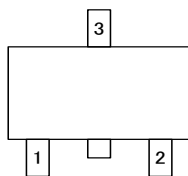
Parameter		Symbol	Typ.	Max.	Unit	Note
Maximum junction-to-ambient	$t \leq 10s$	$R\theta_{ja}$	65	90	$^\circ C/W$	1
Maximum junction-to-ambient	Steady-state		85	125	$^\circ C/W$	
Maximum junction-to-lead	Steady-state	$R\theta_{jl}$	43	60	$^\circ C/W$	3

## Pin configuration

SOT-23 (TOP VIEW)



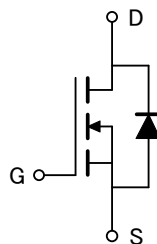
(Without extra bar)



(With extra bar)

Pin No.	Pin name
1	GATE
2	SOURCE
3	DRAIN

## Circuit



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### Electrical characteristics

T<sub>a</sub>=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
<b>STATIC PARAMETERS</b>						
Drain-source breakdown voltage	BV <sub>dss</sub>	I <sub>d</sub> =250 μA, V <sub>gs</sub> =0V	30			V
Zero gate voltage drain current	I <sub>dss</sub>	V <sub>ds</sub> =24V			1	μA
		V <sub>gs</sub> =0V		T <sub>j</sub> =55°C	5	
Gate-body leakage current	I <sub>gss</sub>	V <sub>ds</sub> =0V, V <sub>gs</sub> =±12V			100	nA
Gate threshold voltage	V <sub>gs(th)</sub>	V <sub>ds</sub> =V <sub>gs</sub> , I <sub>d</sub> =250 μA	0.5	0.8	1.0	V
On state drain current	I <sub>d(on)</sub>	V <sub>gs</sub> =4.5V, V <sub>ds</sub> =5V	30			A
Static drain-source on-resistance	R <sub>ds(on)</sub>	V <sub>gs</sub> =10V		23	28	mΩ
		I <sub>d</sub> =5.8A	T <sub>j</sub> =125°C	29	39	
		V <sub>gs</sub> =4.5V, I <sub>d</sub> =5A		26	33	mΩ
		V <sub>gs</sub> =2.5V, I <sub>d</sub> =4A		35	42	mΩ
		V <sub>gs</sub> =1.8V, I <sub>d</sub> =3A		54	72	mΩ
Forward transconductance	G <sub>fs</sub>	V <sub>ds</sub> =5V, I <sub>d</sub> =5A	12	17		S
Diode forward voltage	V <sub>sd</sub>	I <sub>s</sub> =1A, V <sub>gs</sub> =0V		0.66	1.00	V
Max. body-diode continuous current	I <sub>s</sub>				2.5	A
<b>DYNAMIC PARAMETERS</b>						
Input capacitance	C <sub>iss</sub>			767		pF
Output capacitance	C <sub>oss</sub>	V <sub>gs</sub> =0V, V <sub>ds</sub> =15V, f=1MHz		111		pF
Reverse transfer capacitance	C <sub>rss</sub>			82		pF
Gate resistance	R <sub>g</sub>	V <sub>gs</sub> =0V, V <sub>ds</sub> =0V, f=1MHz		1.3		Ω
<b>SWITCHING PARAMETERS</b>						
Total gate charge	Q <sub>g</sub>			10.0		nC
Gate-source charge	Q <sub>gs</sub>	V <sub>gs</sub> =4.5V, V <sub>ds</sub> =15V, I <sub>d</sub> =5.8A		1.2		nC
Gate-drain charge	Q <sub>gd</sub>			3.1		nC
Turn-on delay time	t <sub>d(on)</sub>			5.0		ns
Turn-on rise time	t <sub>r</sub>	V <sub>gs</sub> =10V, V <sub>ds</sub> =15V		5.5		ns
Turn-off delay time	t <sub>d(off)</sub>	R <sub>l</sub> =2.7 Ω, R <sub>gen</sub> =6 Ω		39.0		ns
Turn-off fall time	t <sub>f</sub>			4.7		ns
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>f</sub> =5A, dI/dt=100A/μs		15.0		ns
Body diode reverse recovery charge	Q <sub>rr</sub>	I <sub>f</sub> =5A, dI/dt=100A/μs		7.1		nC

#### NOTE :

- The value of R<sub>θja</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board of 2oz. Copper, in still air environment with T<sub>a</sub>=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 R<sub>θja</sub> is the sum of the thermal impedance from junction to lead R<sub>θjl</sub> 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 T<sub>a</sub>=25°C. The SOA curve provides a single pulse rating.

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### Typical electrical and thermal characteristics

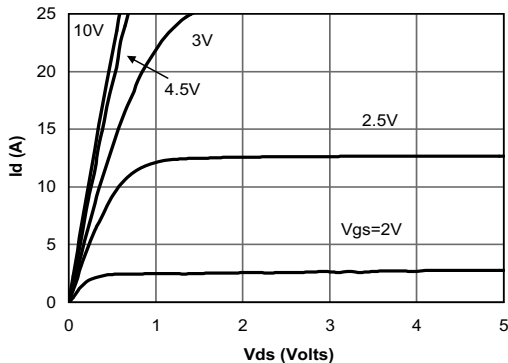


Fig 1: On-Region Characteristics

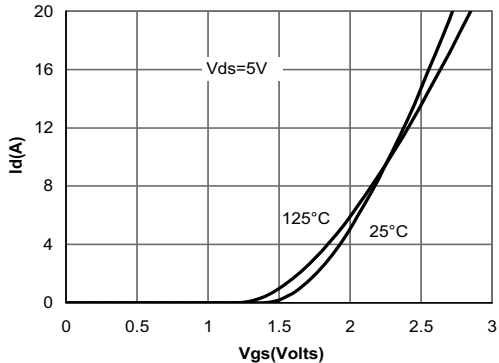


Figure 2: Transfer Characteristics

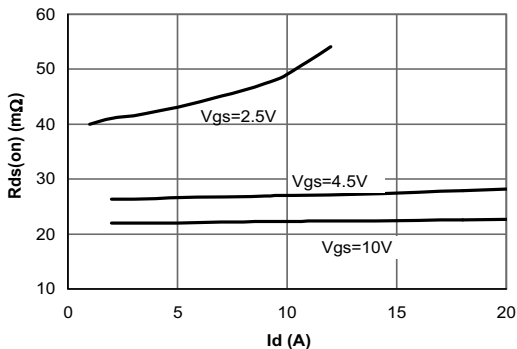


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

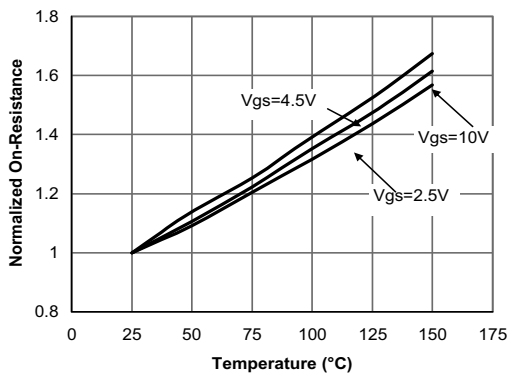


Figure 4: On-Resistance vs. Junction Temperature

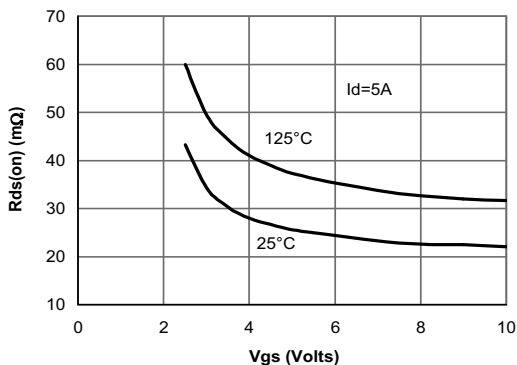


Figure 5: On-Resistance vs. Gate-Source Voltage

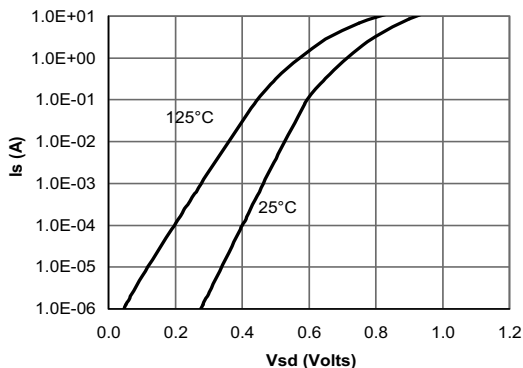


Figure 6: Body-Diode Characteristics

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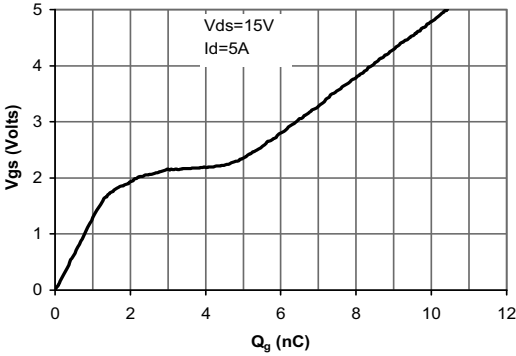


Figure 7: Gate-Charge Characteristics

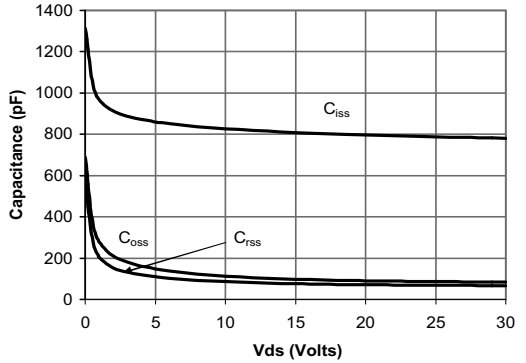


Figure 8: Capacitance Characteristics

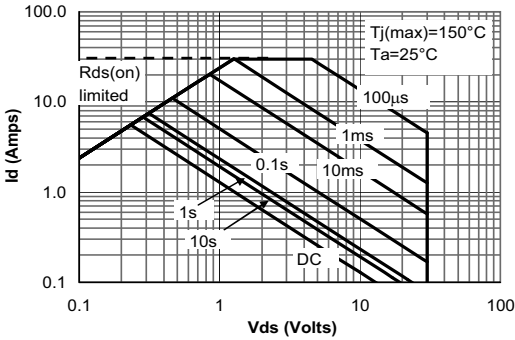


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

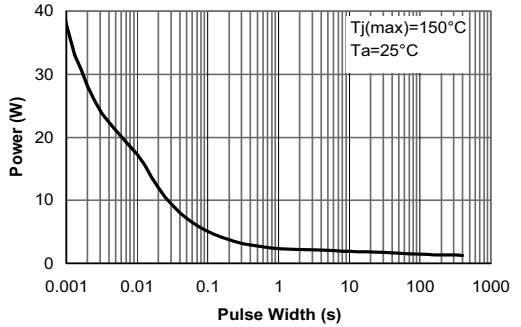


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

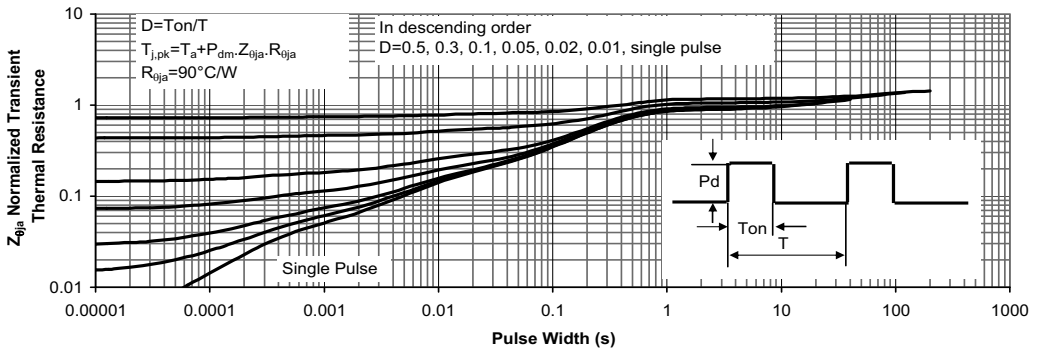


Figure 11: Normalized Maximum Transient Thermal Impedance