

Single N-channel MOSFET

ELM4N6014FRA-S

<https://www.elm-tech.com>

■ General description

ELM4N6014FRA-S uses advanced trench technology to provide excellent $R_{ds(on)}$, low gate charge and low gate threshold voltage.

■ Features

- $V_{ds}=60V$
- $I_d=5A$
- $R_{ds(on)} = 50m\Omega$ ($V_{gs}=10V$)
- $R_{ds(on)} = 60m\Omega$ ($V_{gs}=4.5V$)

■ Maximum absolute ratings

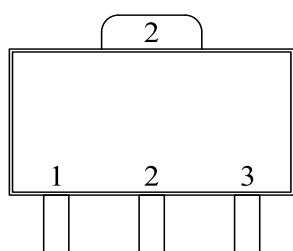
Parameter	Symbol	Limit	Unit	Note
Drain-source voltage	V_{ds}	60	V	
Gate-source voltage	V_{gs}	± 20	V	
Continuous drain current ($V_{gs}=10V$)	$T_a=25^\circ C$	5.0	A	1
	$T_a=70^\circ C$	3.5		
Pulsed drain current	I_{dm}	20	A	2
Single pulse avalanche energy	EAS	22	mJ	3
Avalanche current	I_{as}	21	A	
Total power dissipation	$T_a=25^\circ C$	2	W	4
Storage temperature range	T_{stg}	-55 to 150	$^\circ C$	
Operating junction temperature range	T_j	-55 to 150	$^\circ C$	

■ Thermal characteristics

Parameter	Symbol	Typ.	Max.	Unit	Note
Thermal resistance junction-ambient	$R_{\theta ja}$	--	62.5	$^\circ C/W$	1

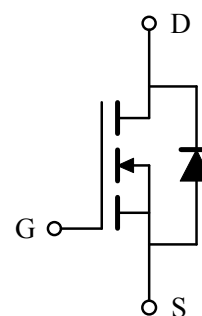
■ Pin configuration

SOT-89(TOP VIEW)



Pin No.	Pin name
1	GATE
2	DRAIN
3	SOURCE

■ Circuit



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■Electrical characteristics

T_j=25°C. Unless otherwise noted.

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
STATIC PARAMETERS							
Drain-source breakdown voltage	BV _{dss}	V _{gs} =0V, I _d =250μA	60	--	--	V	
Static drain-source on-resistance	R _{ds(on)}	V _{gs} =10V, I _d =4A	--	40	50	mΩ	2
		V _{gs} =4.5V, I _d =3A	--	45	60		
Gate threshold voltage	V _{gs(th)}	V _{gs} =V _{ds} , I _d =250μA	1.0	--	2.5	V	
Drain-source leakage current	I _{dss}	V _{ds} =48V, V _{gs} =0V	--	--	1	μA	
		V _{ds} =48V, V _{gs} =0V, T _j =55°C	--	--	5		
Gate-source leakage current	I _{gss}	V _{gs} =±20V, V _{ds} =0V	--	--	±100	nA	
Forward transconductance	G _{fs}	V _{ds} =5V, I _d =4A	--	28.3	--	S	
Continuous source current	I _s	V _{gs} =V _{ds} =0V, Force current	--	--	5	A	1, 5
Diode forward voltage	V _{sd}	V _{gs} =0V, I _s =1A	--	--	1.2	V	2
DYNAMIC PARAMETERS							
Input capacitance	C _{iss}	V _{ds} =15V, V _{gs} =0V, f=1MHz	--	1027	--	pF	
Output capacitance	C _{oss}		--	65	--	pF	
Reverse transfer capacitance	C _{rss}		--	46	--	pF	
SWITCHING PARAMETERS							
Total gate charge (10V)	Q _g	V _{ds} =48V, V _{gs} =10V, I _d =4A	--	19.0	--	nC	
Gate-source charge	Q _{gs}		--	2.6	--	nC	
Gate-drain charge	Q _{gd}		--	4.1	--	nC	
Turn-on delay time	t _{d(on)}	V _{dd} =30V, V _{gs} =10V R _{gen} =3.3Ω, I _d =4A	--	3	--	ns	
Turn-on rise time	t _r		--	34	--	ns	
Turn-off delay time	t _{d(off)}		--	23	--	ns	
Turn-off fall time	t _f		--	6	--	ns	
Reverse recovery time	t _{rr}	I _f =4A, di/dt=100A/μs	--	12.1	--	nS	
Reverse recovery charge	Q _{rr}		--	6.7	--	nC	

Note :

1. The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
2. The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%.
3. The EAS data shows Max. rating . The test condition is V_{dd}=25V, V_{gs}=10V, L=0.1mH, I_{as}=21A.
4. The power dissipation is limited by 150°C junction temperature.
5. The data is theoretically the same as I_d and I_{dm}, in real applications, should be limited by total power dissipation.

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■ Typical characteristics

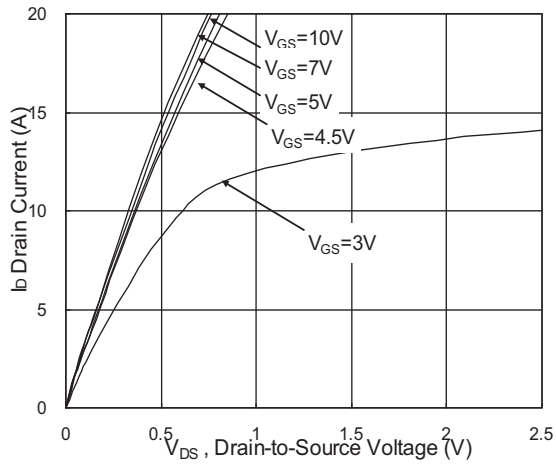


Fig.1 Typical Output Characteristics

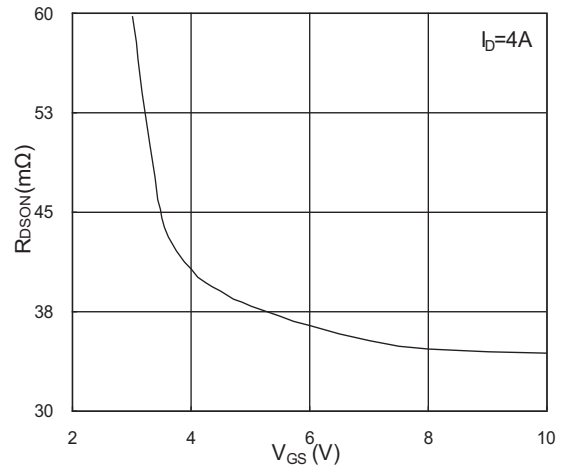


Fig.2 On-Resistance vs G-S Voltage

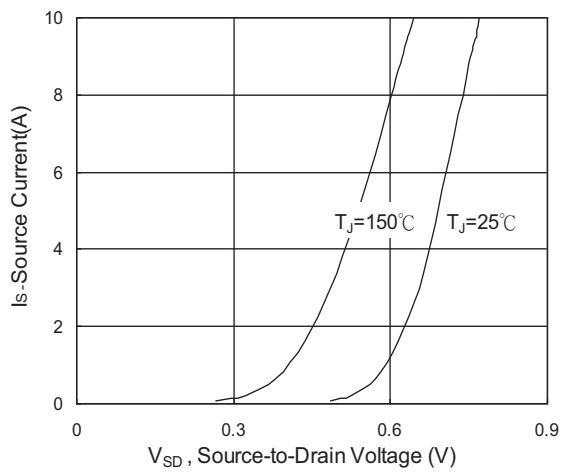


Fig.3 Source Drain Forward Characteristics

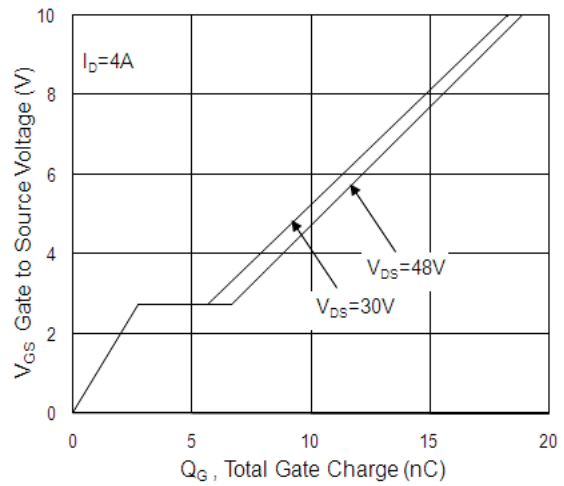


Fig.4 Gate-Charge Characteristics

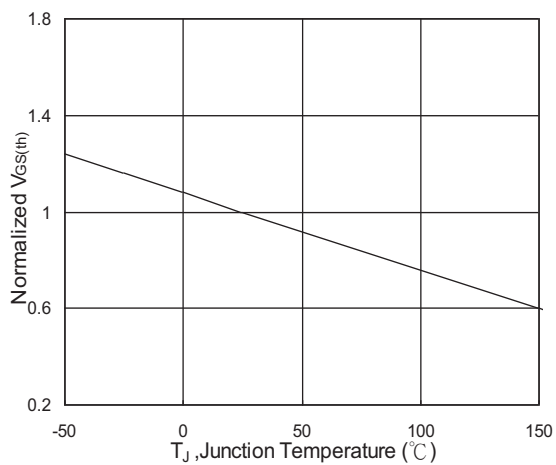


Fig.5 Normalized $V_{GS(th)}$ vs T_J

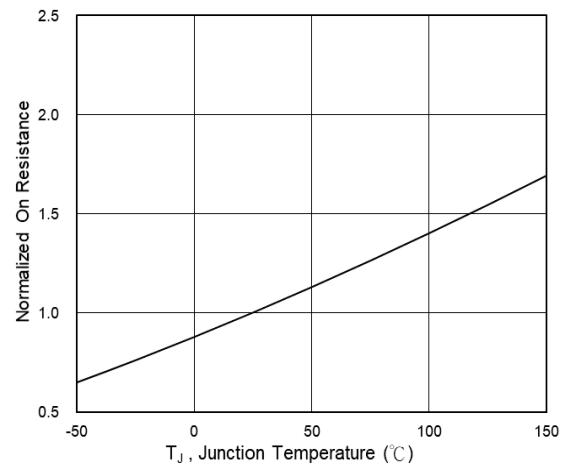


Fig.6 Normalized $R_{DS(on)}$ vs T_J

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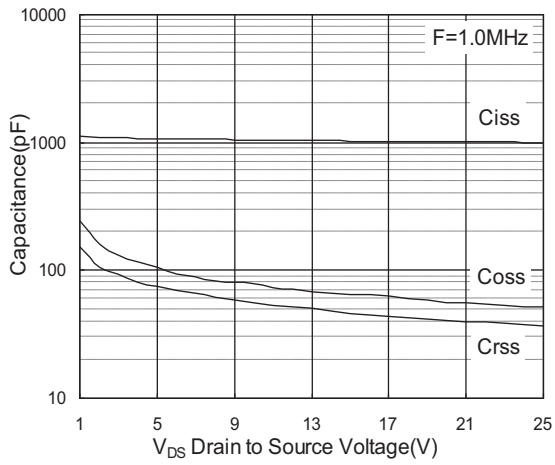


Fig.7 Capacitance

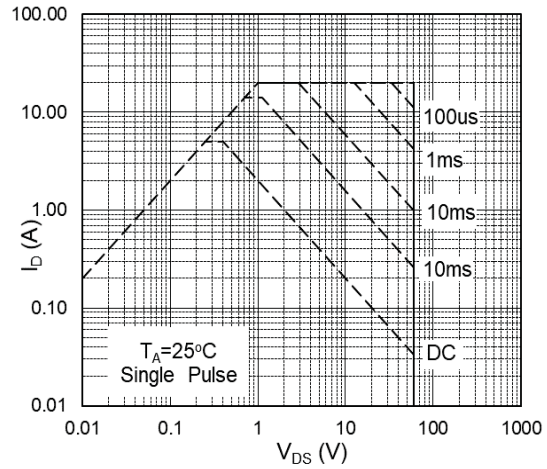


Fig.8 Safe Operating Area

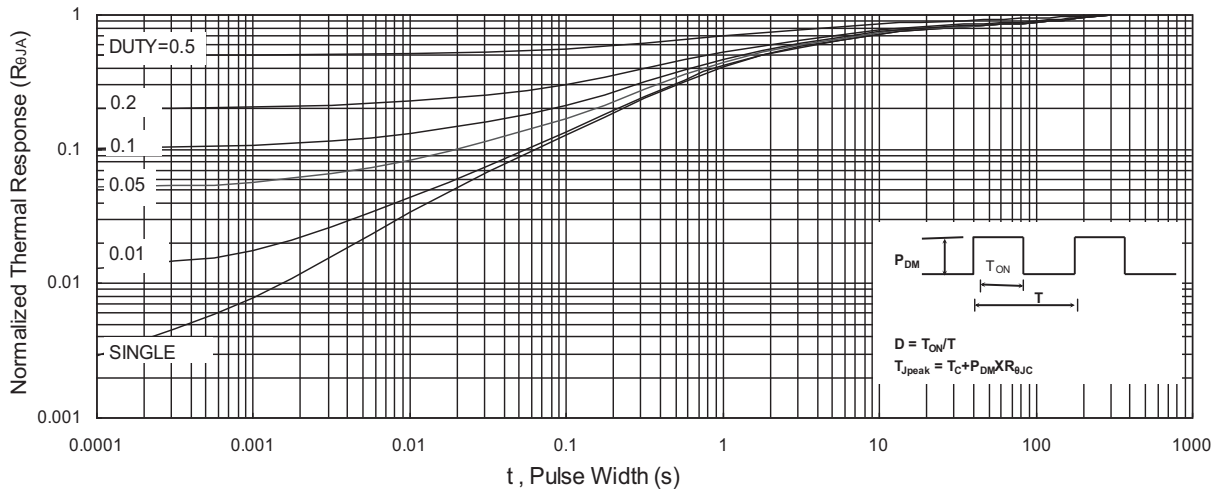


Fig.9 Normalized Maximum Transient Thermal Impedance

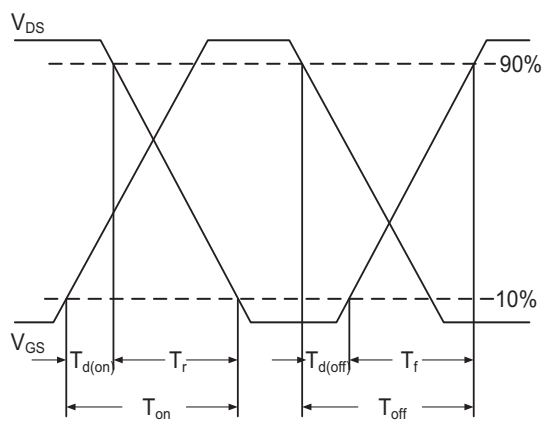


Fig.10 Switching Time Waveform

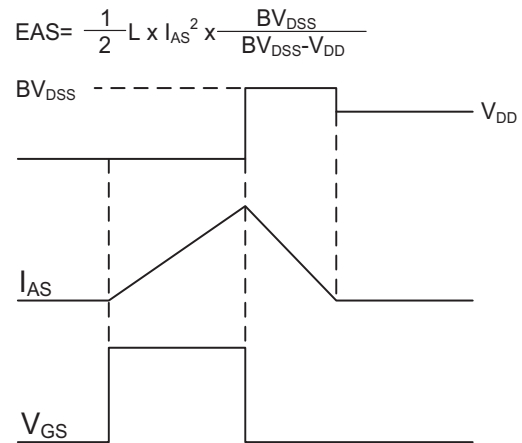


Fig.11 Unclamped Inductive Switching Waveform

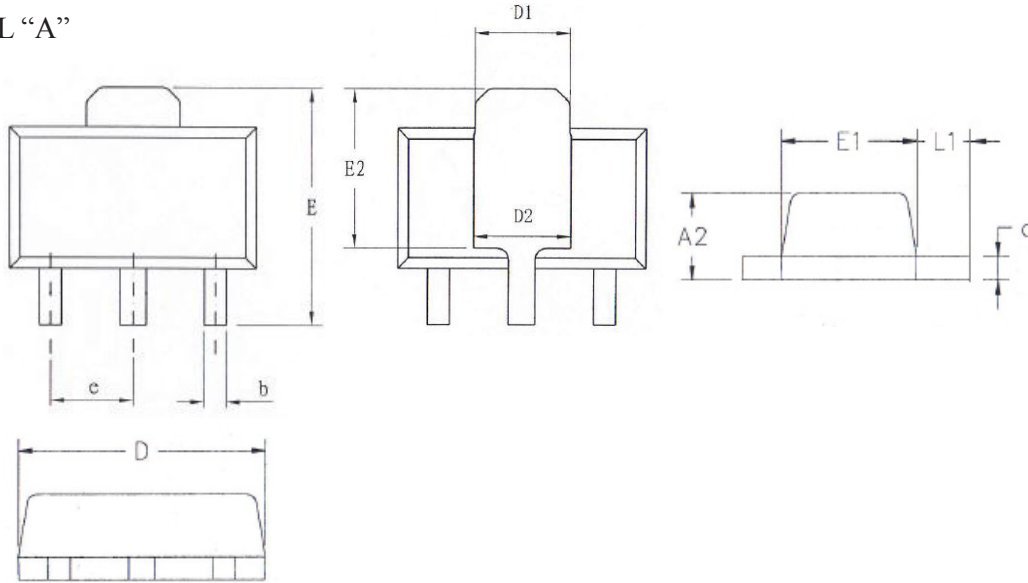
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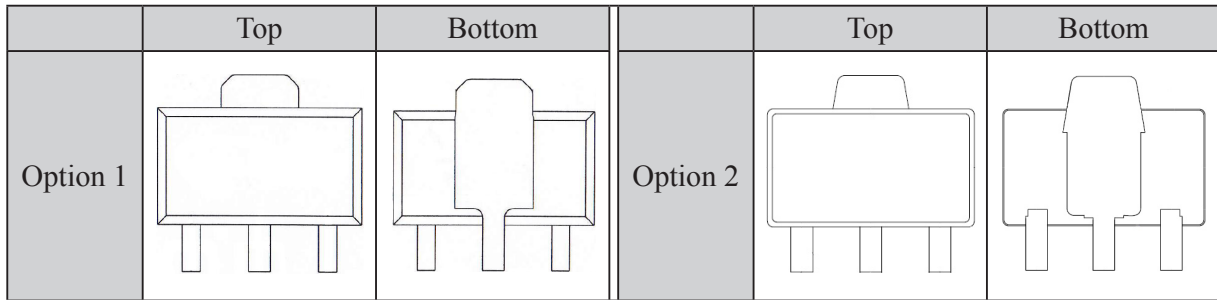
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■SOT-89 dimension (1,000pcs/reel)

SEE DETAIL "A"

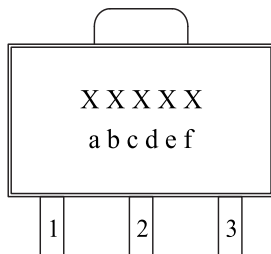


Detail "A"



Symbols	Millimeters		Inches		Symbols	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A2	1.40	1.60	0.055	0.063	E	3.95	4.25	0.156	0.167
b	0.38	0.56	0.015	0.022	E1	2.40	2.60	0.094	0.102
c	0.35	0.44	0.014	0.017	E2	2.84 Ref		0.112 Ref	
D	4.40	4.60	0.173	0.181	e	1.50 BSC		0.059 BSC	
D1	1.62	1.83	0.064	0.072	L1	0.81	1.20	0.032	0.047
D2	1.75 Ref		0.069 Ref						

■Marking



Symbols	Content
xxxxx	Product code
a	Yearly code : 2019=K, 2020=L, 2021=M....
b, c	Weekly code : 01 to 53
d, e	Sequence : 01 to 99 or 0A to 0Z
f	Assembly code : A to Z (I, O excepted)