

Single N-channel MOSFET

ELM4N6004FDA-N

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

■ General description

ELM4N6004FDA-N uses advanced trench technology to provide excellent $R_{ds(on)}$, low gate charge and low gate threshold voltage.

■ Features

- $V_{ds}=60V$
- $I_d=23A$ ($V_{gs}=10V$)
- $R_{ds(on)} = 30m\Omega$ ($V_{gs}=10V$)
- $R_{ds(on)} = 38m\Omega$ ($V_{gs}=4.5V$)

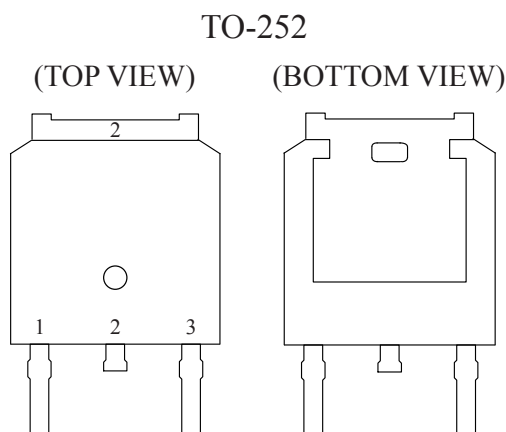
■ Maximum absolute ratings

Parameter	Symbol	Limit	Unit	Note	
Drain-source voltage	V_{ds}	60	V		
Gate-source voltage	V_{gs}	± 20	V		
Continuous drain current ($V_{gs}=10V$)	I_d	$T_c=25^\circ C$	23.0	A	1
		$T_c=100^\circ C$	15.0		
		$T_a=25^\circ C$	5.6		
		$T_a=70^\circ C$	4.5		
Pulsed drain current	I_{dm}	46	A	2	
Single pulsed avalanche energy	E_{as}	25.5	mJ	3	
Avalanche current	I_{as}	22.6	A		
Total power dissipation	P_d	$T_c=25^\circ C$	34.7	W	4
		$T_a=25^\circ C$	2.0		
Storage temperature range	T_{stg}	-55 to 150	$^\circ C$		
Operating junction temperature range	T_j	-55 to 150	$^\circ C$		

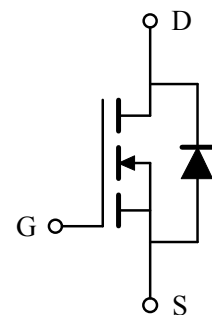
■ Thermal characteristics

Parameter	Symbol	Typ.	Max.	Unit	Note
Thermal resistance junction-ambient	$R_{\theta ja}$	--	62.0	$^\circ C/W$	1
Thermal resistance junction-case	$R_{\theta jc}$	--	3.6	$^\circ C/W$	1

■ Pin configuration



■ 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	
BV _{dss} Temperature coefficient	$\frac{\Delta BV_{dss}}{\Delta T_j}$	Reference to 25°C, I _d =1mA	--	0.063	--	V/°C	
Static drain-source on-resistance	R _{ds(on)}	V _{gs} =10V, I _d =15A	--	25	30	mΩ	2
		V _{gs} =4.5V, I _d =10A	--	30	38		
Gate threshold voltage	V _{gs(th)}	V _{gs} =V _{ds} , I _d =250μA	1.2	--	2.5	V	
V _{gs(th)} Temperature coefficient	ΔV _{gs(th)}		--	-5.24	--	mV/°C	
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 =15A	--	17	--	S	
Continuous source current	I _s	V _{gs} =V _{ds} =0V, Force current	--	--	23	A	1, 5
Pulsed source current	I _{sm}		--	--	46	A	2, 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	--	1378	--	pF	
Output capacitance	C _{oss}		--	86	--	pF	
Reverse transfer capacitance	C _{rss}		--	64	--	pF	
Gate resistance	R _g	V _{ds} =0V, V _{gs} =0V, f=1MHz	--	3.2	--	Ω	
SWITCHING PARAMETERS							
Total gate charge (4.5V)	Q _g	V _{ds} =48V, V _{gs} =4.5V, I _d =12A	--	12.6	--	nC	
Gate-source charge	Q _{gs}		--	3.2	--	nC	
Gate-drain charge	Q _{gd}		--	6.3	--	nC	
Turn-on delay time	t _{d(on)}	V _{dd} =30V, V _{gs} =10V R _{gen} =3.3Ω, I _d =10A	--	8.0	--	ns	
Turn-on rise time	t _r		--	14.2	--	ns	
Turn-off delay time	t _{d(off)}		--	24.4	--	ns	
Turn-off fall time	t _f		--	4.6	--	ns	

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 ≤ 300μs and 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}=22.6A.
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

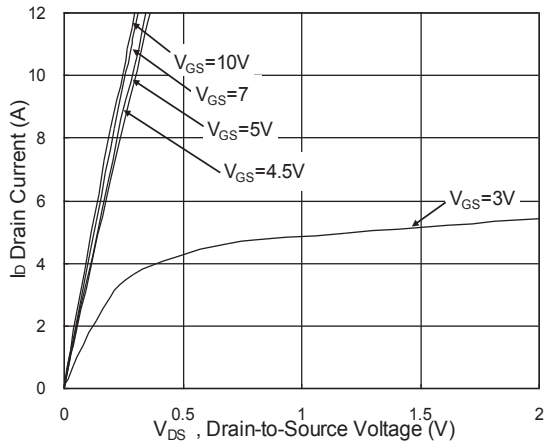


Fig.1 Typical Output Characteristics

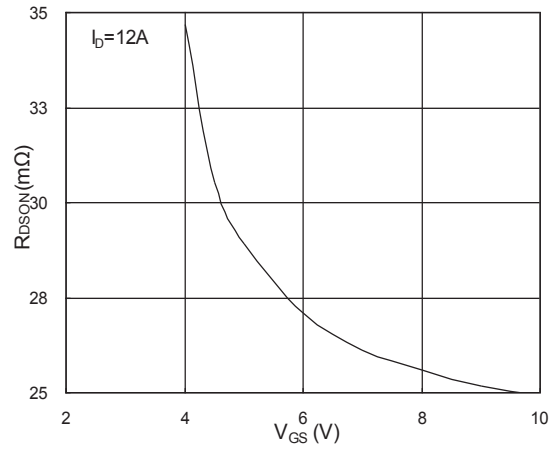


Fig.2 On-Resistance v.s Gate-Source

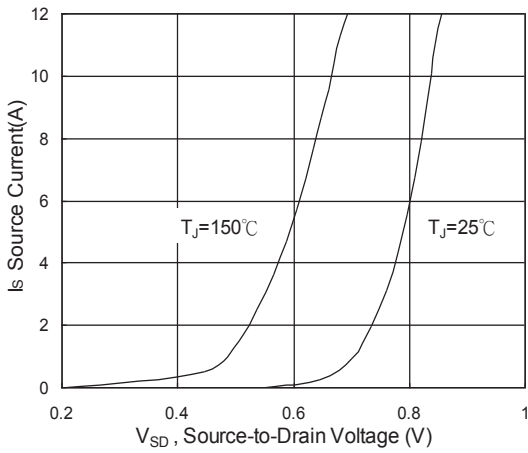


Fig.3 Forward Characteristics of Reverse

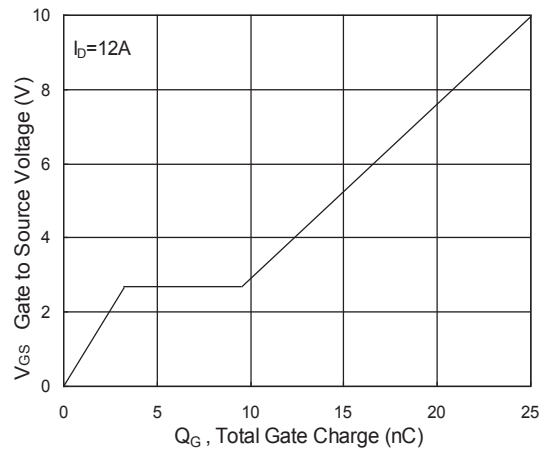


Fig.4 Gate-Charge Characteristics

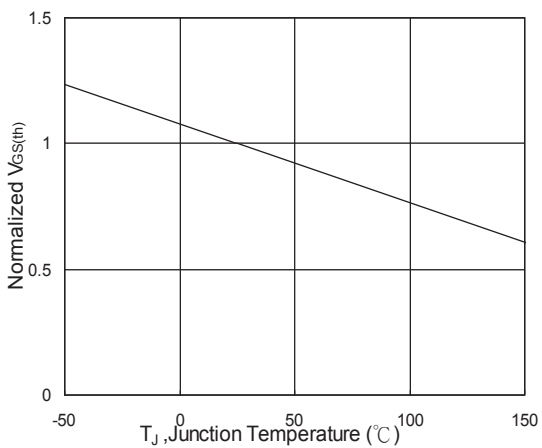


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

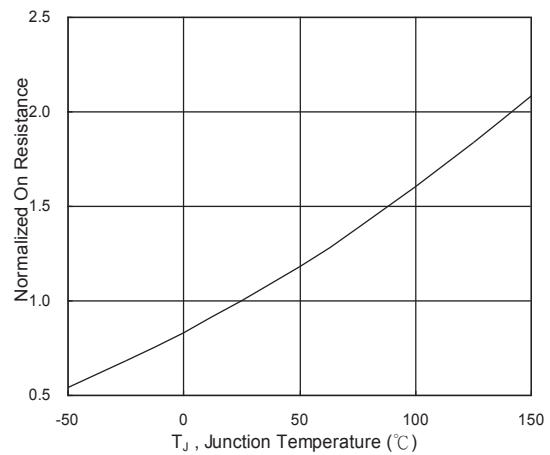


Fig.6 Normalized $R_{DS(on)}$ v.s T_J

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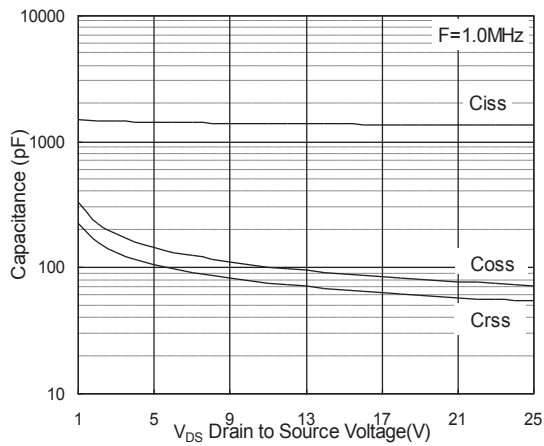


Fig.7 Capacitance

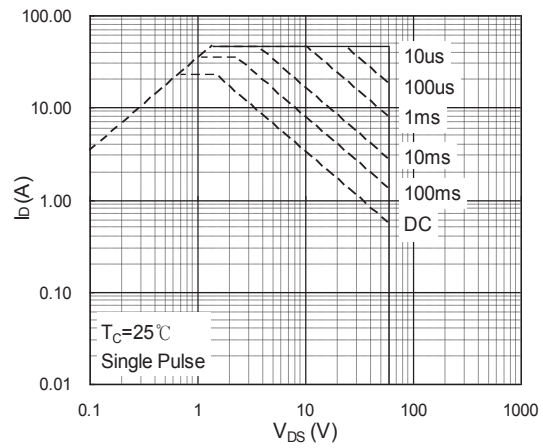


Fig.8 Safe Operating Area

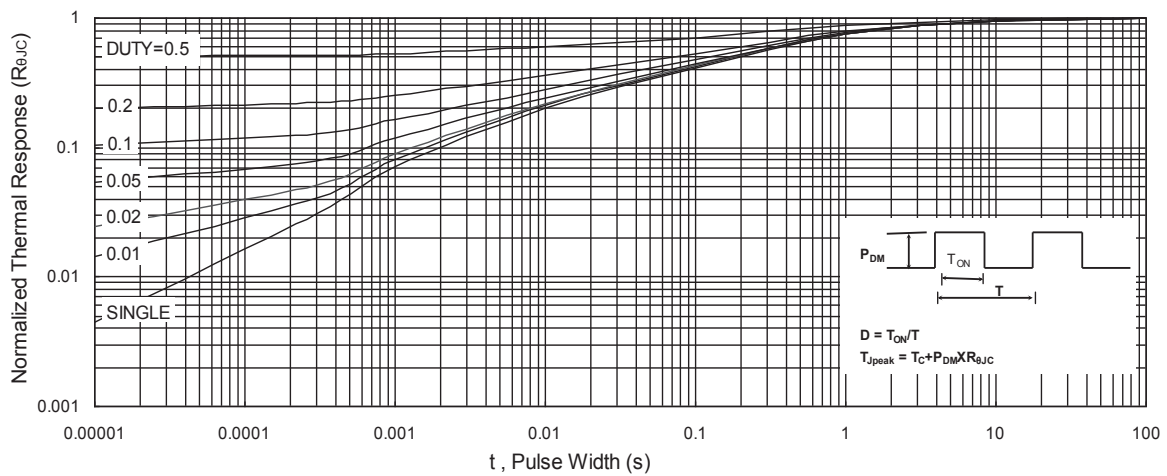


Fig.9 Normalized Maximum Transient Thermal Impedance

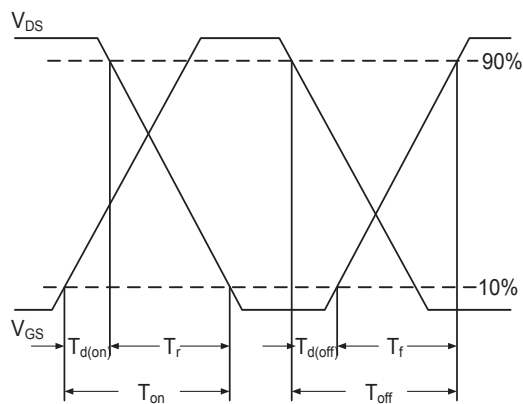


Fig.10 Switching Time Waveform

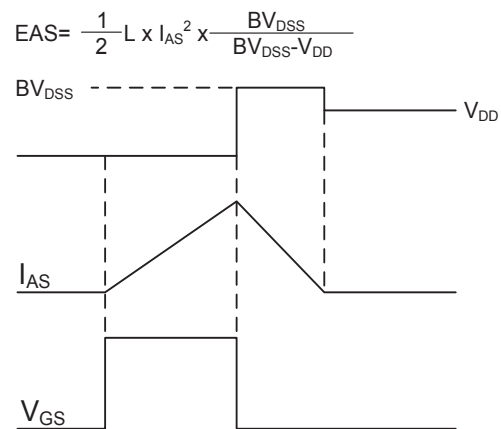


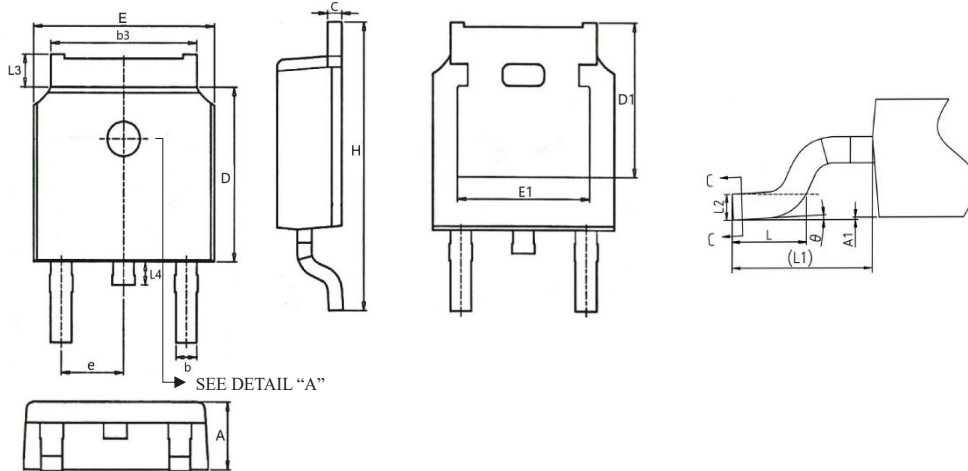
Fig.11 Unclamped Inductive Waveform

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TO-252 dimension (2,500pcs/reel)

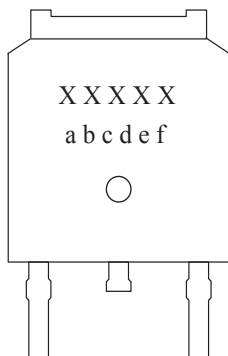


Detail "A"

	Top	Bottom		Top	Bottom
Option 1			Option 3		
Option 2			Option 4		

Symbols	Millimeters		Inches		Symbols	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	2.18	2.40	0.086	0.094	e	2.29 BSC		0.090 BSC	
A1	0.00	0.20	0.000	0.008	H	9.40	10.50	0.370	0.413
b	0.64	0.90	0.025	0.035	L	1.27	2.03	0.050	0.080
b3	4.95	5.50	0.195	0.217	L1	2.90 REF		0.114 REF	
c	0.43	0.61	0.017	0.024	L2	0.51 BSC		0.020 BSC	
D	5.90	6.30	0.232	0.248	L3	0.88	1.28	0.035	0.050
D1	5.30 REF		0.209 REF		L4	0.50	1.02	0.020	0.040
E	6.35	6.80	0.250	0.268	θ	0°	10°	0°	10°
E1	4.32	4.95	0.170	0.195					

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)