

Complementary MOSFET

ELM4C3909FBA-S

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

General description

ELM4C3909FBA-S uses advanced trench technology to provide excellent $R_{ds(on)}$, low gate charge and low gate threshold voltage.

Features

- | N-channel | P-channel |
|---|---|
| • $V_{ds}=30V$ | • $V_{ds}=-30V$ |
| • $I_d=3.8A(V_{gs}=4.5V)$ | • $I_d=-2.3A(V_{gs}=-4.5V)$ |
| • $R_{ds(on)} = 60m\Omega(V_{gs}=10V)$ | • $R_{ds(on)} = 115m\Omega(V_{gs}=-10V)$ |
| • $R_{ds(on)} = 65m\Omega(V_{gs}=4.5V)$ | • $R_{ds(on)} = 145m\Omega(V_{gs}=-4.5V)$ |
| • $R_{ds(on)} = 85m\Omega(V_{gs}=2.5V)$ | • $R_{ds(on)} = 200m\Omega(V_{gs}=-2.5V)$ |

Maximum absolute ratings

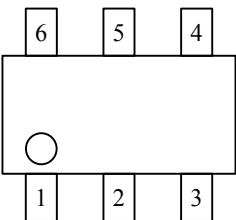
Parameter		Symbol	N-ch (Max.)	P-ch (Max.)	Unit	Note
Drain-source voltage		V_{ds}	30	-30	V	
Gate-source voltage		V_{gs}	± 12	± 12	V	
Continuous drain current ($V_{gs}=4.5V$)	$T_a=25^{\circ}C$	I_d	3.8	-2.3	A	1
	$T_a=70^{\circ}C$		3.0	-1.8		
Pulsed drain current		I_{dm}	16	-15	A	2
Total power dissipation	$T_c=25^{\circ}C$	P_d	1.1	1.1	W	3
Storage temperature range		T_{stg}	-55 to 150	-55 to 150	$^{\circ}C$	
Operating junction temperature range		T_j	-55 to 150	-55 to 150	$^{\circ}C$	

Thermal Characteristics

Parameter	Symbol	Typ.	Max.	Unit	Note
Thermal resistance junction-ambient	$R_{\theta ja}$	-	110	$^{\circ}C/W$	1
Thermal resistance junction-case	$R_{\theta jc}$	-	70	$^{\circ}C/W$	1

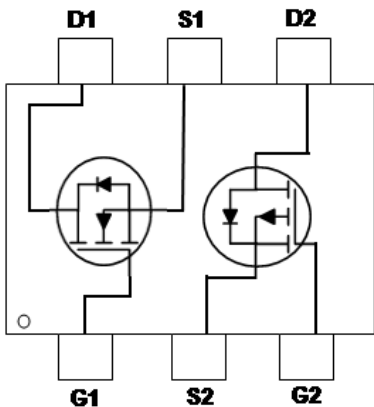
Pin configuration

TSOP-6(TOP VIEW)



Pin No.	Pin name
1	GATE1
2	SOURCE2
3	GATE2
4	DRAIN2
5	SOURCE1
6	DRAIN1

Circuit



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■Electrical characteristics (N-ch)

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	30	-	-	V	
Static drain-source on-resistance	R _{ds(on)}	V _{gs} =10V, I _d =3.4A	-	52	60	mΩ	2
		V _{gs} =4.5V, I _d =3.0A	-	57	65		
		V _{gs} =2.5V, I _d =2.0A	-	70	85		
Gate threshold voltage	V _{gs(th)}	V _{gs} =V _{ds} , I _d =250μA	0.4	-	1.2	V	
Drain-source leakage current	I _{dss}	V _{ds} =24V, V _{gs} =0V	-	-	1	μA	
		V _{ds} =24V, V _{gs} =0V, T _j =55°C	-	-	5		
Gate-source leakage current	I _{gss}	V _{gs} =±12V, V _{ds} =0V	-	-	±100	nA	
Forward transconductance	G _{fs}	V _{ds} =5V, I _d =3.4A	-	6	-	S	
Continuous source current	I _s	V _{gs} =V _{ds} =0V, Force current	-	-	3.8	A	1, 4
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	-	662	-	pF	
Output capacitance	C _{oss}		-	52	-	pF	
Reverse transfer capacitance	C _{rss}		-	45	-	pF	
SWITCHING PARAMETERS							
Total gate charge (4.5V)	Q _g	V _{ds} =15V, V _{gs} =4.5V I _d =3A		8.4	-	nC	
Gate-source charge	Q _{gs}			1.6	-	nC	
Gate-drain charge	Q _{gd}			1.8	-	nC	
Turn-on delay time	t _{d(on)}	V _{dd} =10V, V _{gs} =4.5V R _{gen} =3.3Ω, I _d =3A		3.2	-	ns	
Turn-on rise time	t _r			41.8	-	ns	
Turn-off delay time	t _{d(off)}			21.2	-	ns	
Turn-off fall time	t _f			6.4	-	ns	

NOTE :

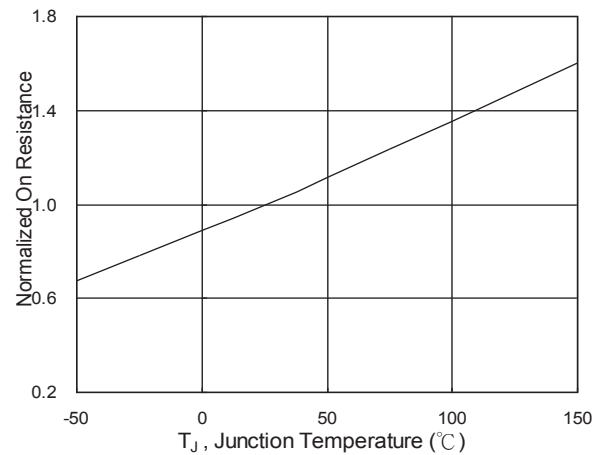
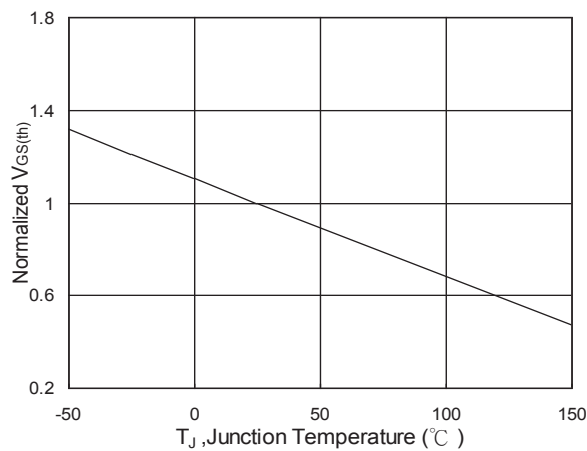
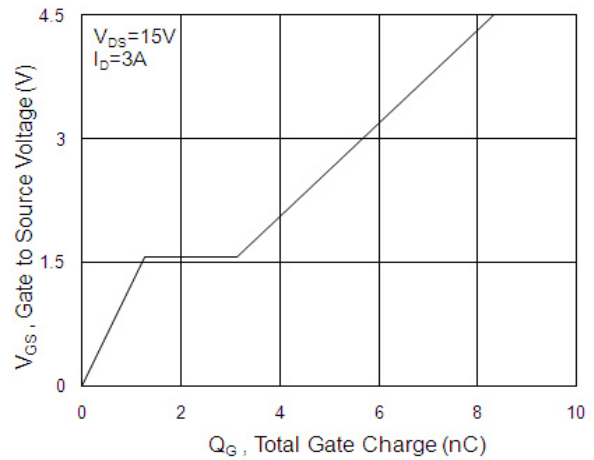
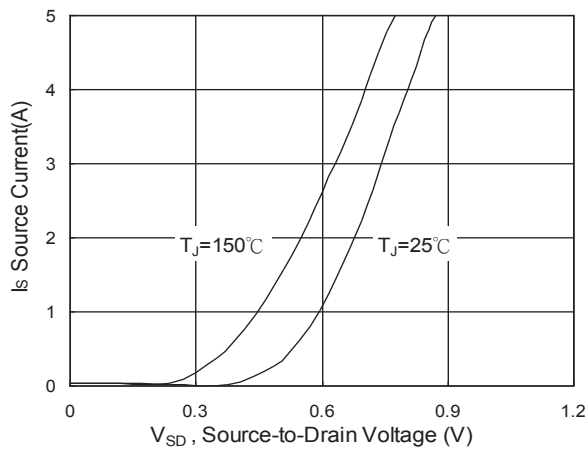
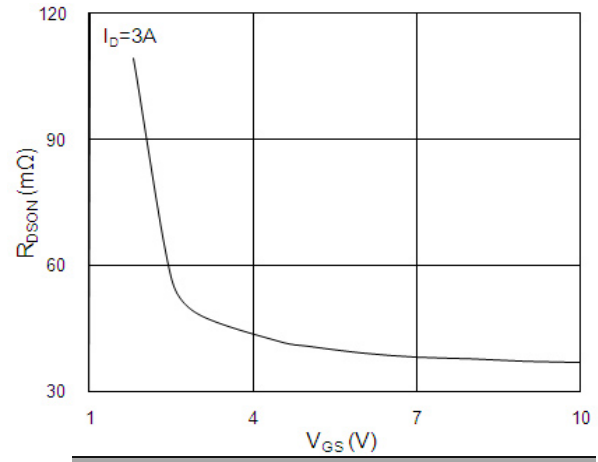
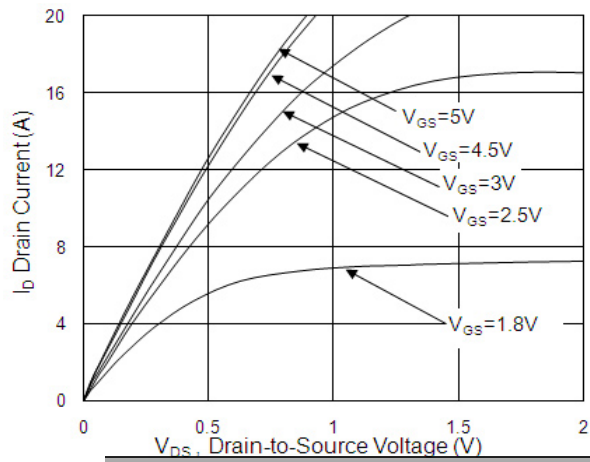
1. The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
2. The data tested by pulsed, pulse width ≤ 300μs and duty cycle ≤ 2%.
3. The power dissipation is limited by 150°C junction temperature.
4. The data is theoretically the same as I_d and I_{dm}, in real applications, should be limited by total power dissipation.

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■ Typical electrical and thermal characteristics (N-ch)



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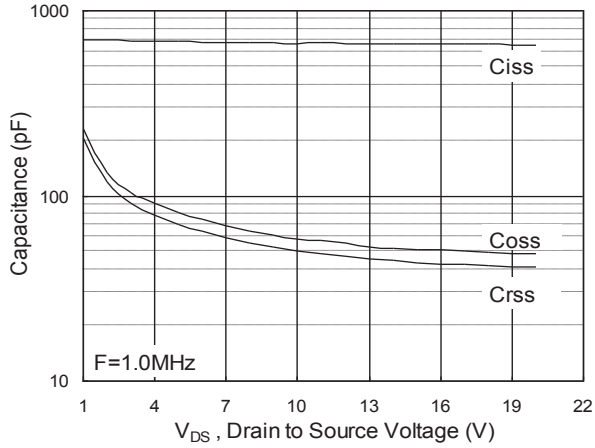


Fig.7 Capacitance

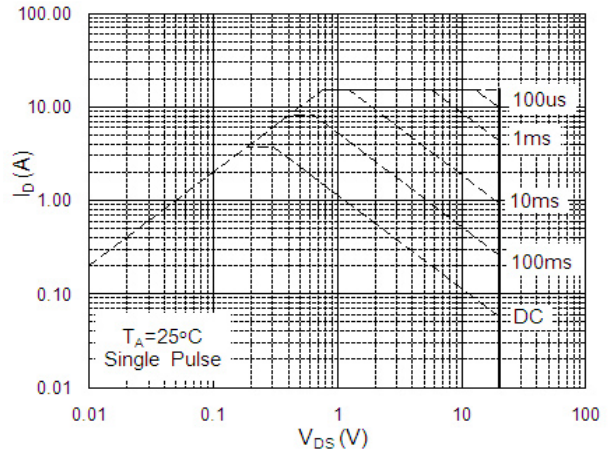


Fig.8 Safe Operating Area

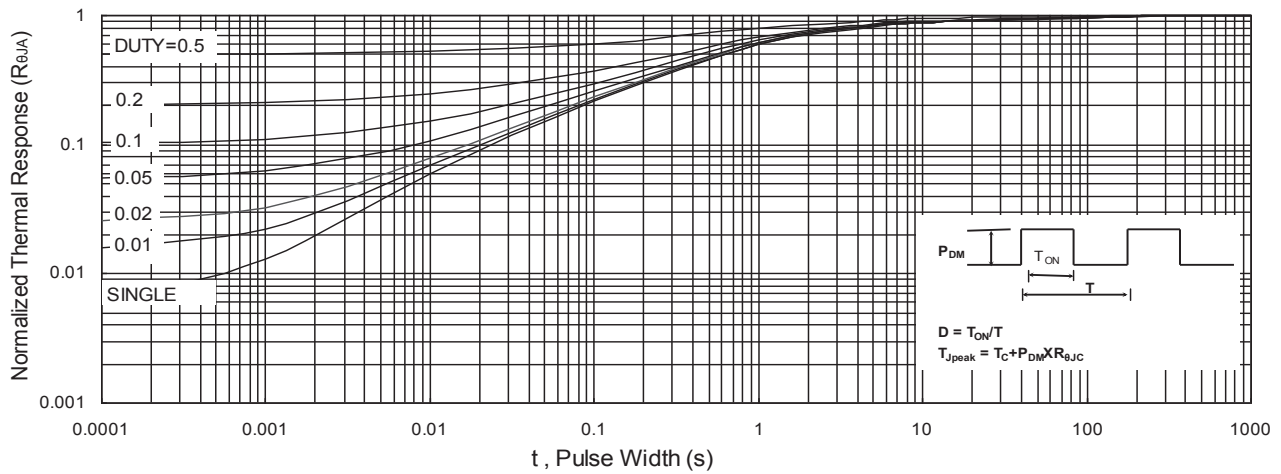


Fig.9 Normalized Maximum Transient Thermal Impedance

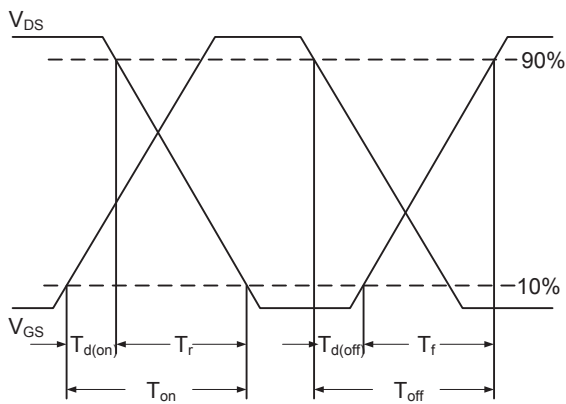


Fig.10 Switching Time Waveform

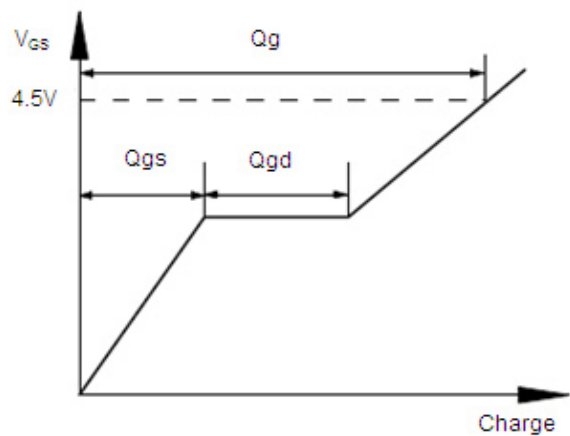


Fig.11 Gate Charge Waveform

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■Electrical Characteristics (P-ch)

Tj=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	-30	-	-	V	
Static drain-source on-resistance	R _{ds(on)}	V _{gs} =-10V, I _d =-2.3A	-	85	115	mΩ	2
		V _{gs} =-4.5V, I _d =-2.0A	-	105	145		
		V _{gs} =-2.5V, I _d =-1.0A	-	145	200		
Gate threshold voltage	V _{gs(th)}	V _{gs} =V _{ds} , I _d =-250μA	-0.4	-	-1.2	V	
Drain-source leakage current	I _{dss}	V _{ds} =-24V, V _{gs} =0V	-	-	-1	μA	
		V _{ds} =-24V, V _{gs} =0V, T _j =55°C	-	-	-5		
Gate-source leakage current	I _{gss}	V _{gs} =±12V, V _{ds} =0V	-	-	±100	nA	
Forward transconductance	G _{fs}	V _{ds} =-5V, I _d =-2.3A	-	5.3	-	S	
Continuous source current	I _s	V _{gs} =V _{ds} =0V, Force current	-	-	-2.3	A	1, 4
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	-	710	-	pF	
Output capacitance	C _{oss}		-	79	-	pF	
Reverse transfer capacitance	C _{rss}		-	57	-	pF	
SWITCHING PARAMETERS							
Total gate charge (-4.5V)	Q _g	V _{ds} =-15V, V _{gs} =-4.5V I _d =-2A	-	8.1	-	nC	
Gate-source charge	Q _{gs}		-	1.2	-	nC	
Gate-drain charge	Q _{gd}		-	2.1	-	nC	
Turn-on delay time	t _{d(on)}	V _{dd} =-10V, V _{gs} =-4.5V R _{gen} =3.3Ω, I _d =-2A	-	4.0	-	ns	
Turn-on rise time	t _r		-	33.2	-	ns	
Turn-off delay time	t _{d(off)}		-	26.0	-	ns	
Turn-off fall time	t _f		-	11.6	-	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 power dissipation is limited by 150°C junction temperature.
4. 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 electrical and thermal characteristics (P-ch)

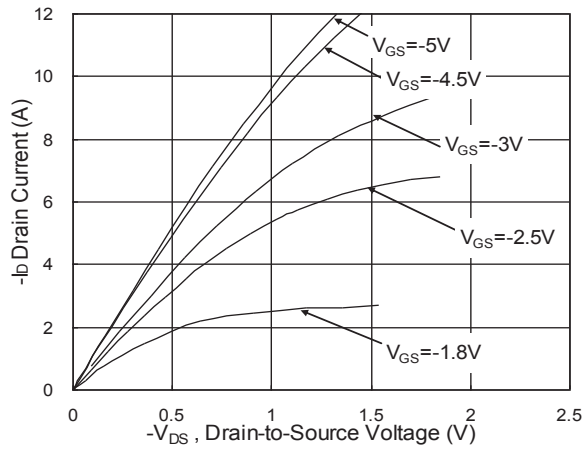


Fig.1 Typical Output Characteristics

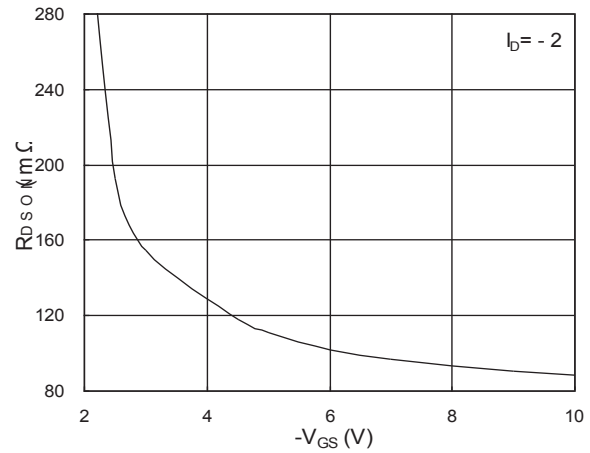


Fig.2 On-Resistance vs. Gate-Source

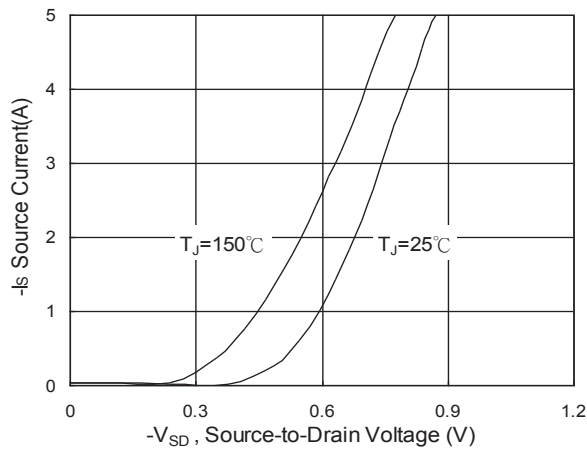


Fig.3 Forward Characteristics of Reverse

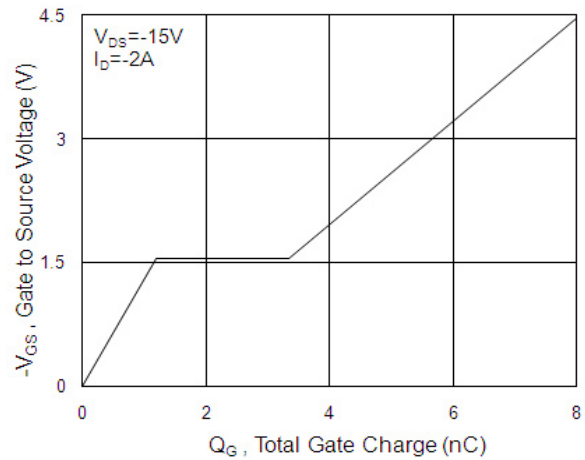


Fig.4 Gate-Charge Characteristics

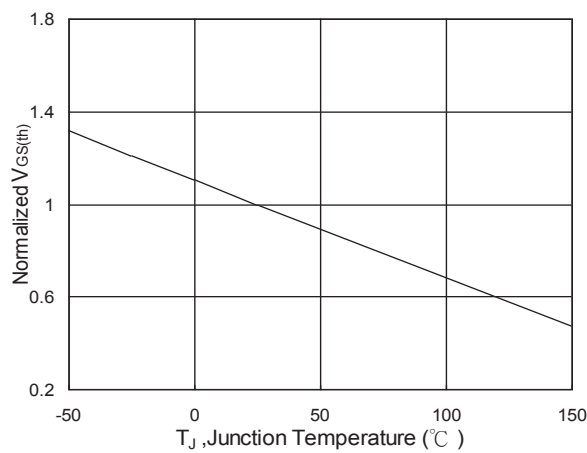


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

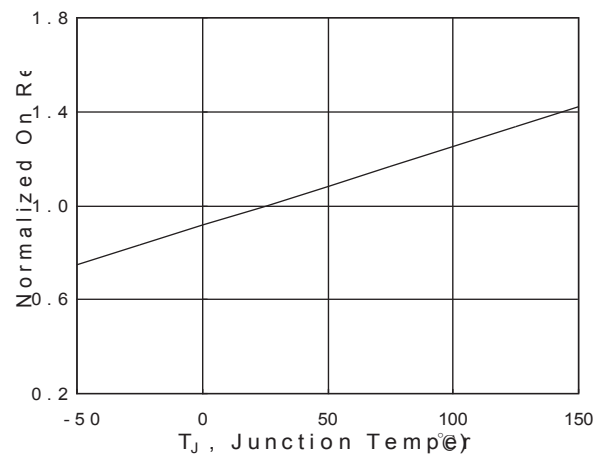


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

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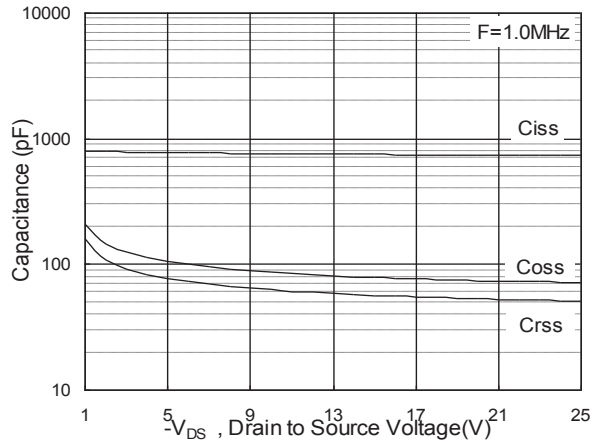


Fig.7 Capacitance

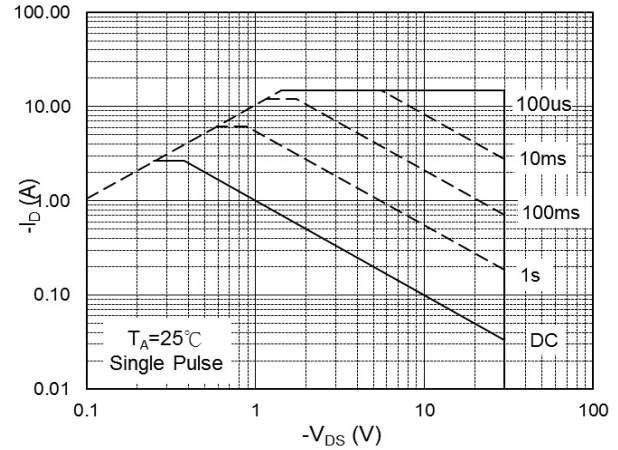


Fig.8 Safe Operating Area

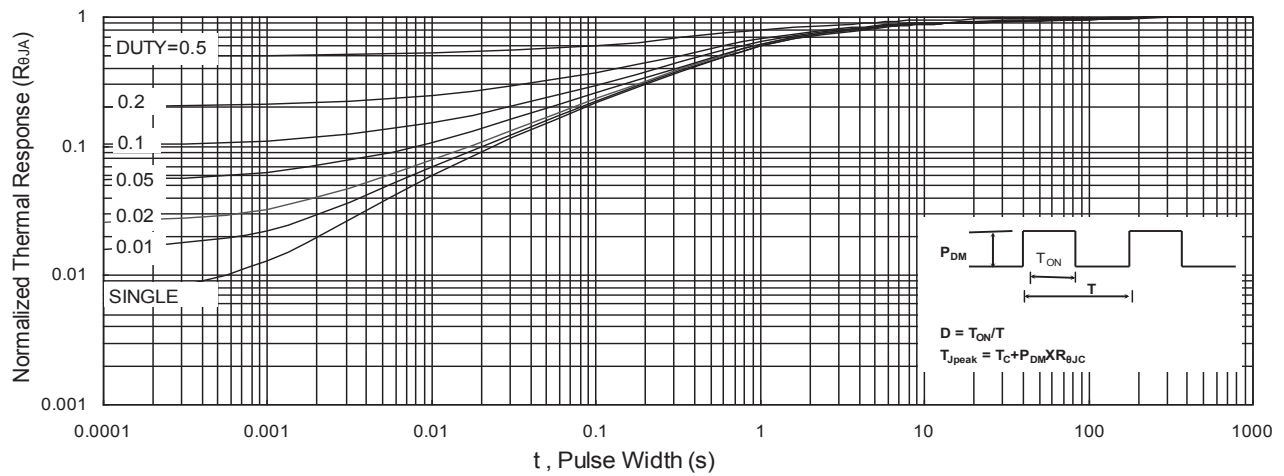


Fig.9 Normalized Maximum Transient Thermal Impedance

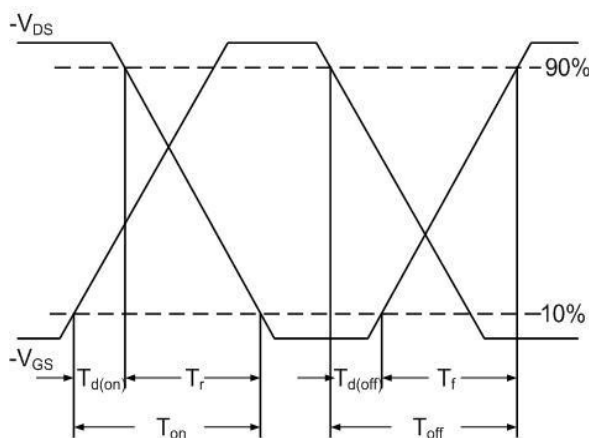


Fig.10 Switching Time Waveform

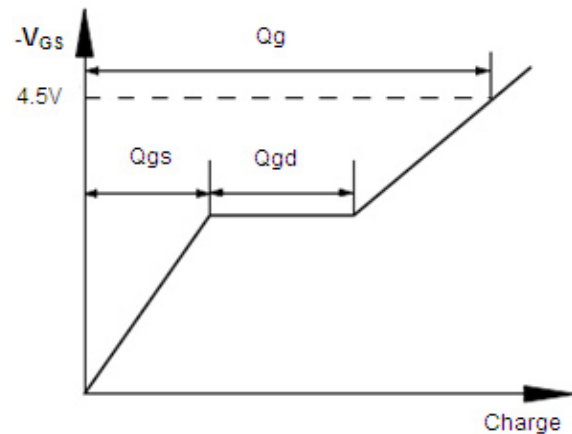


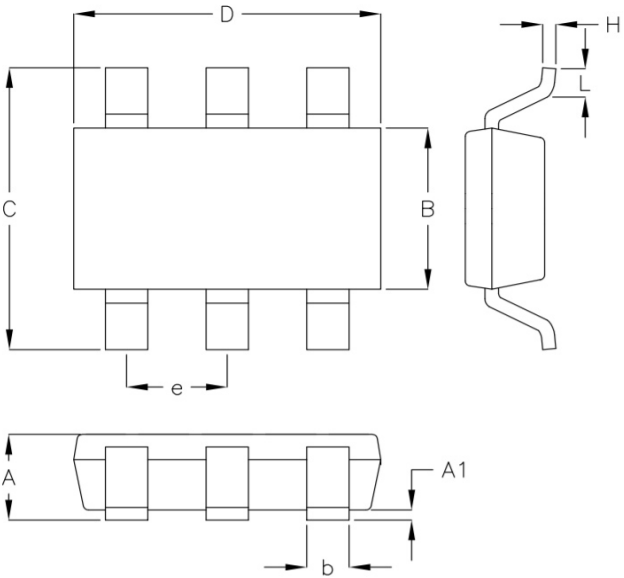
Fig.11 Gate Charge Waveform

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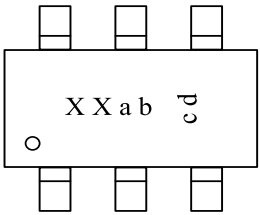
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■TSOP-6 dimension (3,000pcs/reel)



Symbols	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.70	0.90	0.028	0.035
A1	0.00	0.10	0.000	0.004
B	1.50	1.70	0.059	0.067
b	0.35	0.50	0.014	0.020
C	2.60	3.00	0.102	0.119
D	2.80	3.02	0.110	0.119
e	0.90	1.00	0.035	0.039
H	0.08	0.20	0.003	0.008
L	0.30	0.60	0.012	0.024

■Marking



Symbols	Content
x x	Product code
a	Yearly code : 2019=9, 2020=A, 2021=B, 2022=C.....
b	Weekly code : A to Z, a to z (53 weeks in total)
c	Sequence : 1 to 9 or A to Z
d	Assembly code : A to Z (I, O excepted)