Complementary MOSFET

ELM4C3909FBA-S

■General description

ELM4C3909FBA-S uses advanced trench technology to provide excellent Rds(on), low gate charge and low gate threshold voltage.

■Features

N-channel

- Vds=30V
- Id=3.8A(Vgs=4.5V)
- Rds(on) = 60mΩ(Vgs=10V)
- Rds(on) = 65mΩ(Vgs=4.5V)
- Rds(on) = 85mΩ(Vgs=2.5V)

P-channel

- Vds=-30V
- Id=-2.3A(Vgs=-4.5V)
- Rds(on) = 115mΩ(Vgs=-10V)
- Rds(on) = 145mΩ(Vgs=-4.5V)
- Rds(on) = 200mΩ(Vgs=-2.5V)

■Maximum absolute ratings

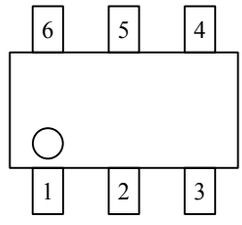
Parameter		Symbol	N-ch (Max.)	P-ch (Max.)	Unit	Note
Drain-source voltage		Vds	30	-30	V	
Gate-source voltage		Vgs	±12	±12	V	
Continuous drain current (Vgs=4.5)	Ta=25°C	Id	3.8	-2.3	A	1
	Ta=70°C		3.0	-1.8		
Pulsed drain current		Idm	16	-15	A	2
Total power dissipation	Tc=25°C	Pd	1.1	1.1	W	3
Storage temperature range		Tstg	-55 to 150	-55 to 150	°C	
Operating junction temperature range		Tj	-55 to 150	-55 to 150	°C	

■Thermal Characteristics

Parameter	Symbol	Typ.	Max.	Unit	Note
Thermal resistance junction-ambient	Rθja	-	110	°C/W	1
Thermal resistance junction-case	Rθjc	-	70	°C/W	1

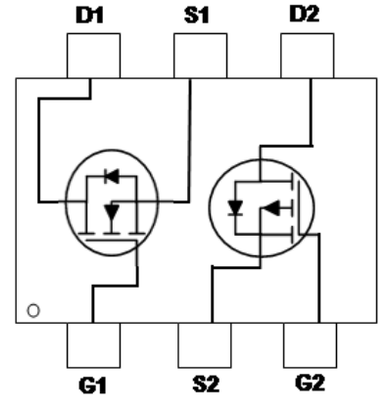
■Pin configuration

TSOP-6(TOP VIEW)



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

■Circuit



■Electrical characteristics (N-ch)

Tj=25°C. Unless otherwise noted.

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
STATIC PARAMETERS							
Drain-source breakdown voltage	BVdss	Vgs=0V, Id=250μA	30	-	-	V	
Static drain-source on-resistance	Rds(on)	Vgs=10V, Id=3.4A	-	52	60	mΩ	2
		Vgs=4.5V, Id=3.0A	-	57	65		
		Vgs=2.5V, Id=2.0A	-	70	85		
Gate threshold voltage	Vgs(th)	Vgs=Vds, Id=250μA	0.4	-	1.2	V	
Drain-source leakage current	Idss	Vds=24V, Vgs=0V	-	-	1	μA	
		Vds=24V, Vgs=0V, Tj=55°C	-	-	5		
Gate-source leakage current	Igss	Vgs=±12V, Vds=0V	-	-	±100	nA	
Forward transconductance	Gfs	Vds=5V, Id=3.4A	-	6	-	S	
Continuous source current	Is	Vgs=Vds=0V, Force current	-	-	3.8	A	1, 4
Diode forward voltage	Vsd	Vgs=0V, Is=1A	-	-	1.2	V	2
DYNAMIC PARAMETERS							
Input capacitance	Ciss	Vds=15V, Vgs=0V, f=1MHz	-	662	-	pF	
Output capacitance	Coss		-	52	-	pF	
Reverse transfer capacitance	Crss		-	45	-	pF	
SWITCHING PARAMETERS							
Total gate charge (4.5V)	Qg	Vds=15V, Vgs=4.5V Id=3A		8.4	-	nC	
Gate-source charge	Qgs			1.6	-	nC	
Gate-drain charge	Qgd			1.8	-	nC	
Turn-on delay time	td(on)	Vds=10V, Vgs=4.5V Rgen=3.3Ω, Id=3A		3.2	-	ns	
Turn-on rise time	tr			41.8	-	ns	
Turn-off delay time	td(off)			21.2	-	ns	
Turn-off fall time	tf			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 Id and Idm, in real applications, should be limited by total power dissipation.

■Typical electrical and thermal characteristics (N-ch)

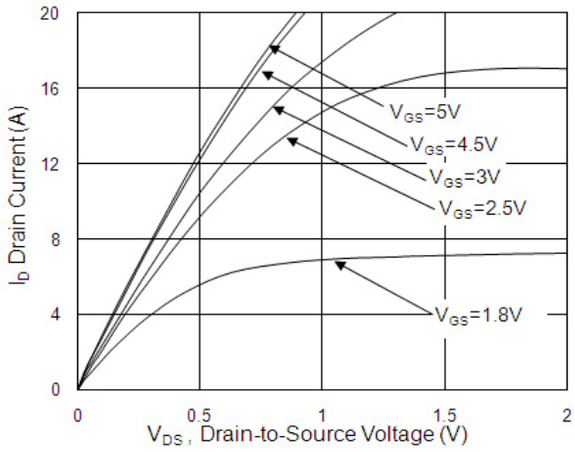


Fig.1 Typical Output Characteristics

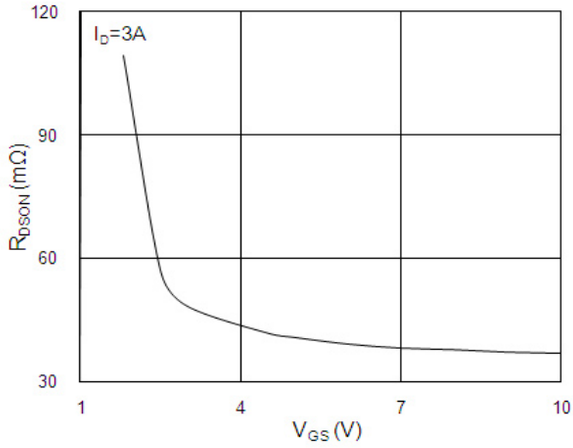


Fig.2 On-Resistance vs. Gate-Source

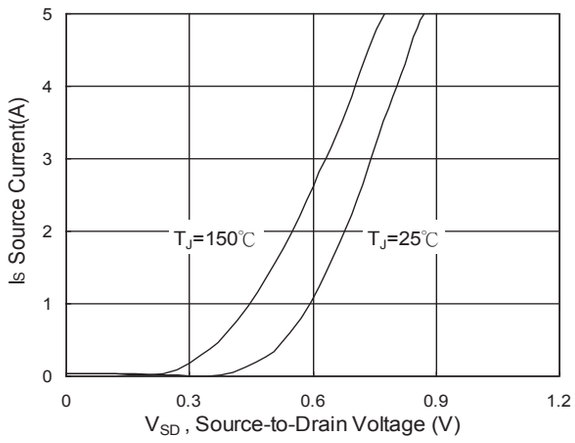


Fig.3 Forward Characteristics of Reverse

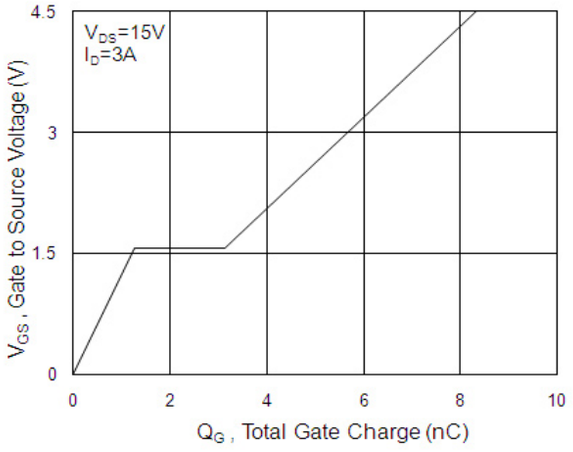


Fig.4 Gate-Charge Characteristics

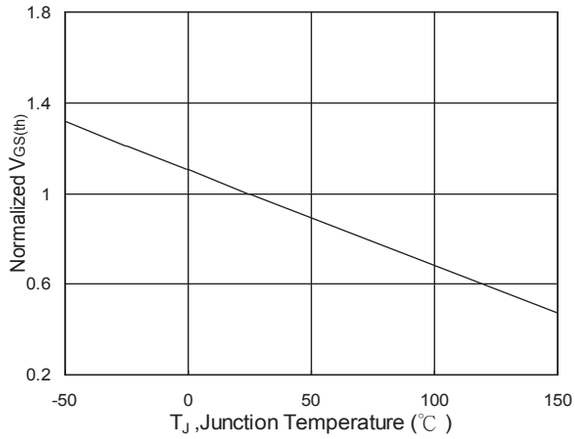


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

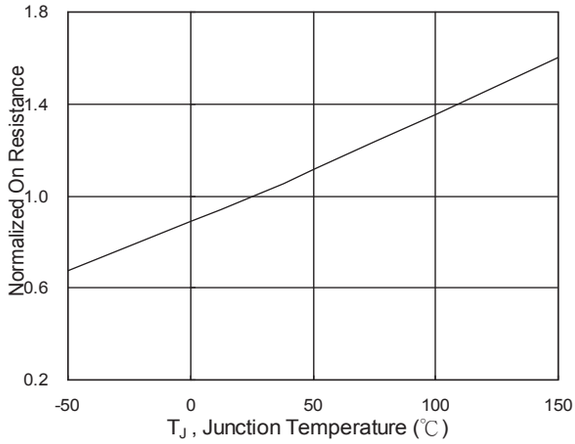


Fig.6 Normalized R_{DSON} vs. T_J

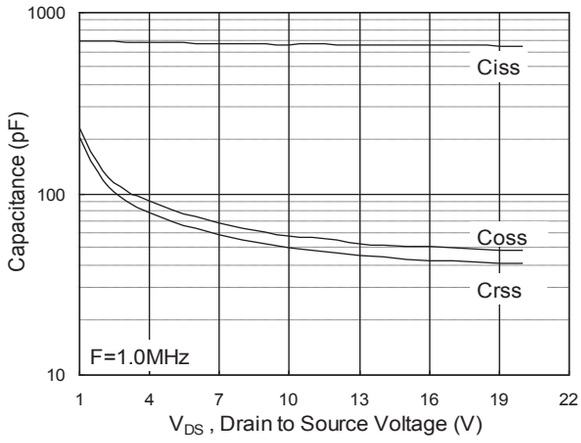


Fig.7 Capacitance

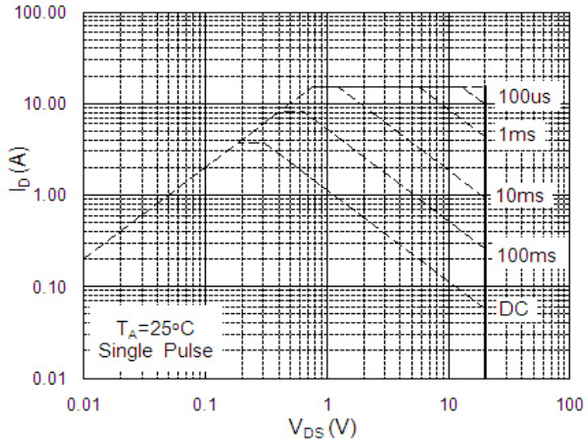


Fig.8 Safe Operating Area

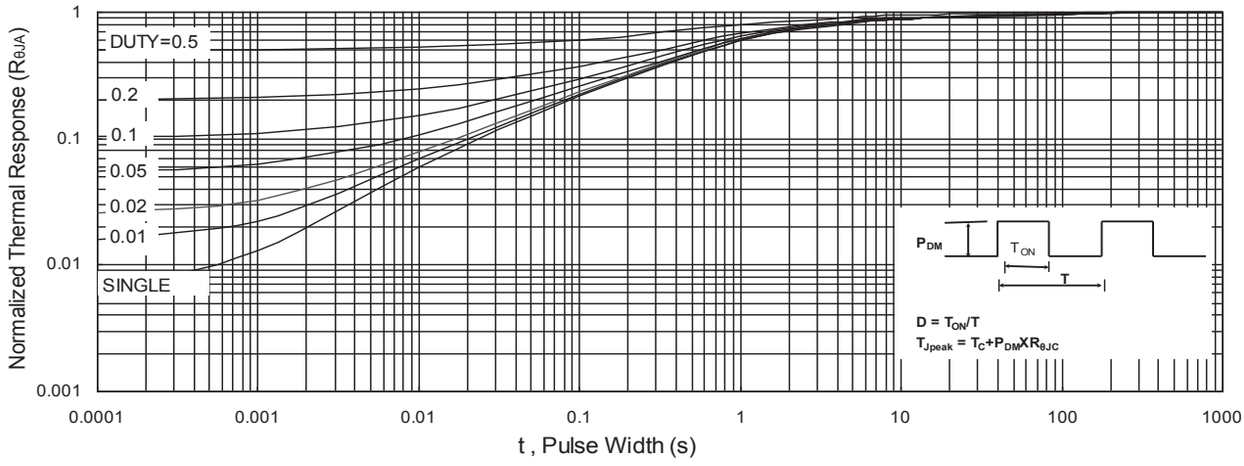


Fig.9 Normalized Maximum Transient Thermal Impedance

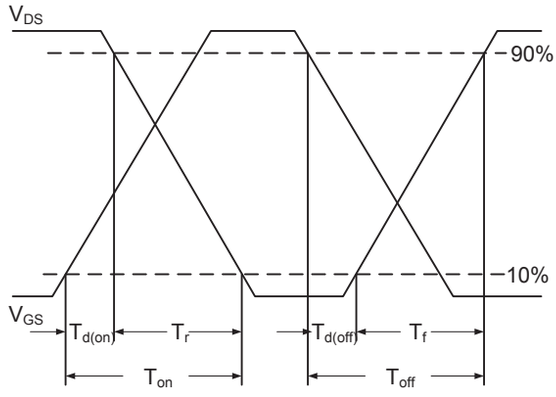


Fig.10 Switching Time Waveform

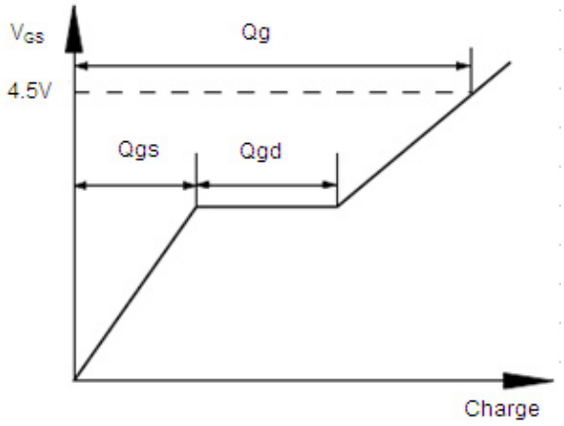


Fig.11 Gate Charge Waveform

■Electrical Characteristics (P-ch)

Tj=25°C. Unless otherwise noted.

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
STATIC PARAMETERS							
Drain-source breakdown voltage	BVdss	Vgs=0V, Id=-250μA	-30	-	-	V	
Static drain-source on-resistance	Rds(on)	Vgs=-10V, Id=-2.3A	-	85	115	mΩ	2
		Vgs=-4.5V, Id=-2.0A	-	105	145		
		Vgs=-2.5V, Id=-1.0A	-	145	200		
Gate threshold voltage	Vgs(th)	Vgs=Vds, Id=-250μA	-0.4	-	-1.2	V	
Drain-source leakage current	Idss	Vds=-24V, Vgs=0V	-	-	-1	μA	
		Vds=-24V, Vgs=0V, Tj=55°C	-	-	-5		
Gate-source leakage current	Igss	Vgs=±12V, Vds=0V	-	-	±100	nA	
Forward transconductance	Gfs	Vds=-5V, Id=-2.3A	-	5.3	-	S	
Continuous source current	Is	Vgs=Vds=0V, Force current	-	-	-2.3	A	1, 4
Diode forward voltage	Vsd	Vgs=0V, Is=-1A	-	-	-1.2	V	2
DYNAMIC PARAMETERS							
Input capacitance	Ciss	Vds=-15V, Vgs=0V, f=1MHz	-	710	-	pF	
Output capacitance	Coss		-	79	-	pF	
Reverse transfer capacitance	Crss		-	57	-	pF	
SWITCHING PARAMETERS							
Total gate charge (-4.5V)	Qg	Vds=-15V, Vgs=-4.5V Id=-2A	-	8.1	-	nC	
Gate-source charge	Qgs		-	1.2	-	nC	
Gate-drain charge	Qgd		-	2.1	-	nC	
Turn-on delay time	td(on)	Vds=-10V, Vgs=-4.5V Rgen=3.3Ω, Id=-2A	-	4.0	-	ns	
Turn-on rise time	tr		-	33.2	-	ns	
Turn-off delay time	td(off)		-	26.0	-	ns	
Turn-off fall time	tf		-	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 Id and Idm, in real applications, should be limited by total power dissipation.

■Typical electrical and thermal characteristics (P-ch)

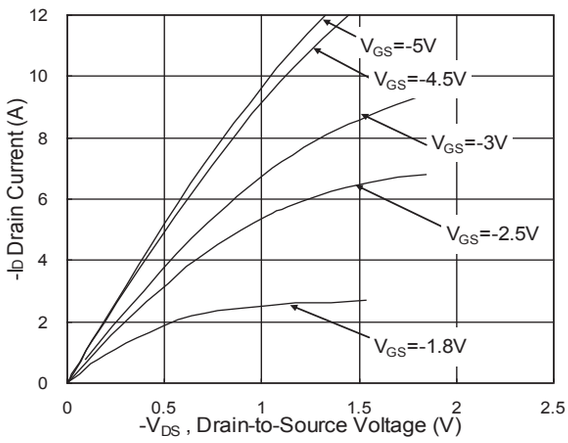


Fig.1 Typical Output Characteristics

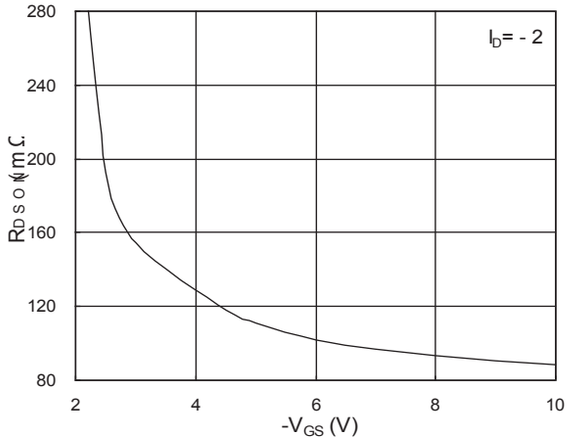


Fig.2 On-Resistance vs. Gate-Source

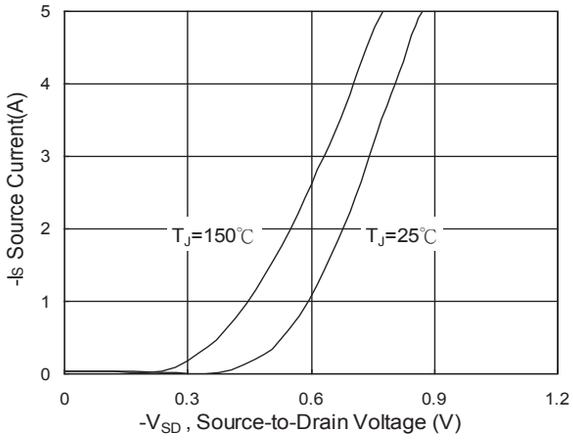


Fig.3 Forward Characteristics of Reverse

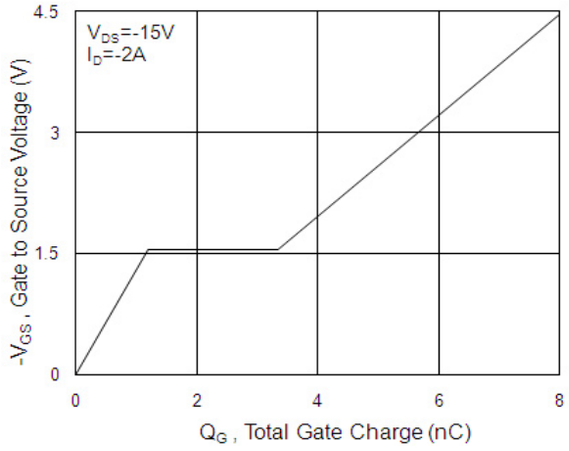


Fig.4 Gate-Charge Characteristics

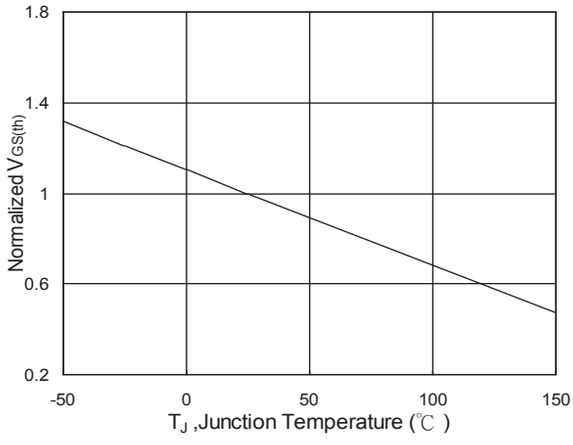


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

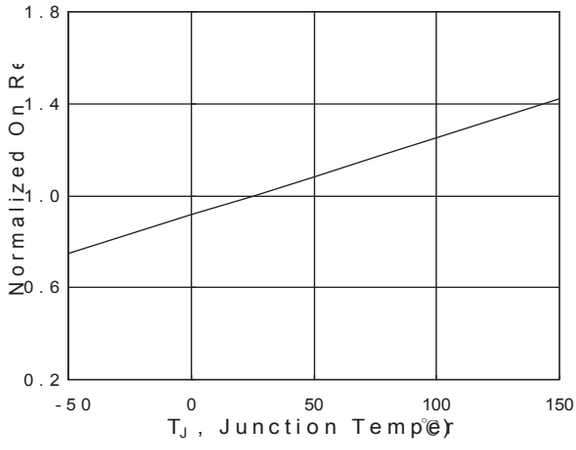


Fig.6 Normalized R_{DSON} vs. T_J

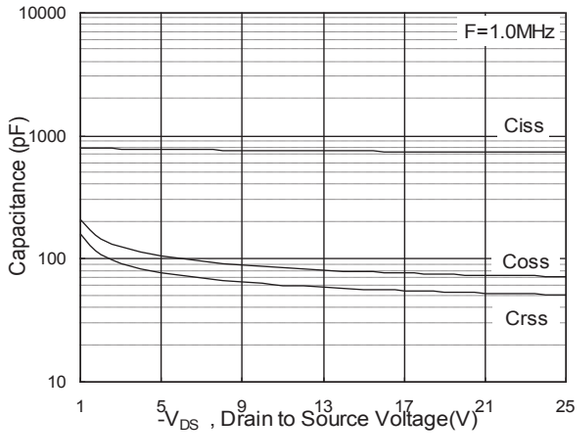


Fig.7 Capacitance

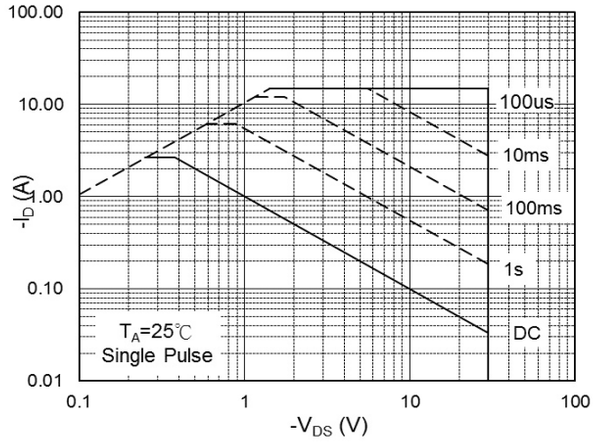


Fig.8 Safe Operating Area

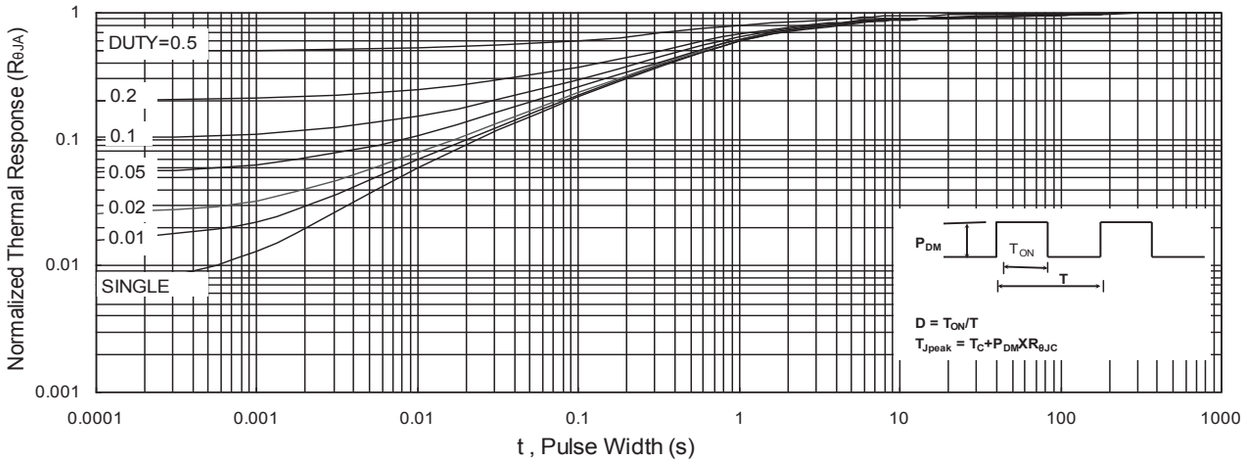


Fig.9 Normalized Maximum Transient Thermal Impedance

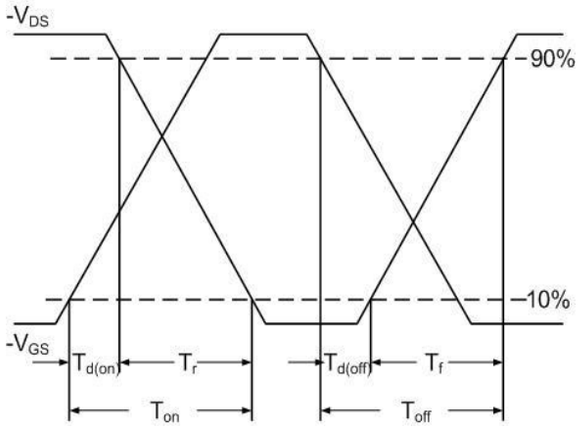


Fig.10 Switching Time Waveform

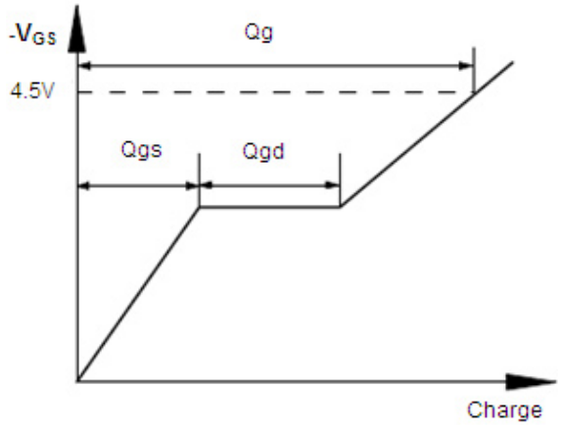
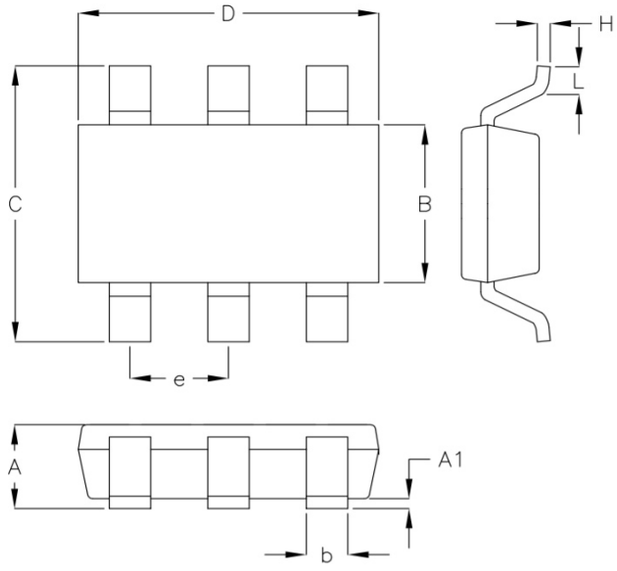


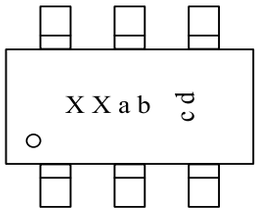
Fig.11 Gate Charge Waveform

■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)