MLSQ4612A

60V N-Channel and P-Channel MOSFET

Features

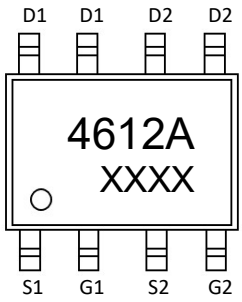
- High power and current handing capability
- Lead free product is acquired
- Surface mount package

Application

- Battery protection
- Load switch
- Power management

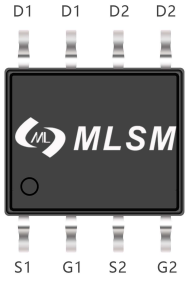
Product Summary

V_{DS}	$R_{DS(ON)}$ MAX	I_D MAX
60V	56mΩ@10V	4.5A
	77mΩ@4.5V	
-60V	105mΩ@-10V	-3.2A
	135mΩ@-4.5V	

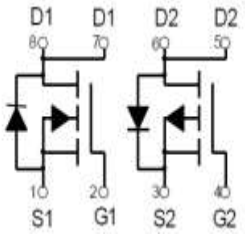


4612A : Device code
XXXX : Code

Marking and pin assignment



SOP-8 top view



Schematic diagram

Pb-Free RoHS Halogen-Free

Absolute Maximum Ratings (TA=25℃unless otherwise noted)

Symbol	Parameter		N-Channel	P-Channel	Unit
Common Ratings (TC=25°C Unless Otherwise Noted)					
V_{DS}	Drain-Source Breakdown Voltage		60	-60	V
V_{GS}	Gate-Source Voltage		±20	±20	V
T_J	Maximum Junction Temperature		150	150	°C
T_{STG}	Storage Temperature Range		-55 to 150	-55 to 150	°C
I_S	Diode Continuous Forward Current	Tc=25°C	4.5	-3.2	A
Mounted on Large Heat Sink					
I_{DM}	Pulse Drain Current Tested	Tc=25°C	20	-20	A
I_D	Continuous Drain Current	Tc=25°C	4.5	-3.2	A
P_D	Maximum Power Dissipation	Tc=25°C	2	2	W
$R_{\theta JA}$	Thermal Resistance Junction-Ambient		62.5	62.5	°C/W

Ordering Information (Example)

Type	Package	Marking	Minimum Package(pcs)	Inner Box Quantity(pcs)	Outer Carton Quantity(pcs)	Delivery Mode
MLSQ4612A	SOP-8	4612A	3,000	6,000	42,000	13"reel

N-Ch Electrical Characteristics (TJ=25℃ unless otherwise noted)						
Symbol	**Parameter**	**Condition**	**Min**	**Typ**	**Max**	**Unit**
Static Electrical Characteristics @ TJ = 25°C (unless otherwise stated)						
$BV_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=250μA	60	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=60V, V_{GS}=0V	--	--	1	μA
I_{GSS}	Gate-Body Leakage Current	V_{GS}=±20V, V_{DS}=0V	--	--	±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=250μA	1.0	1.5	3.0	V
$R_{DS(on)}$	Drain-Source On-State Resistance	V_{GS}=10V, I_D=4.5A	--	46	56	mΩ
		V_{GS}=4.5V, I_D=3.0A	--	64	77	mΩ
Dynamic Electrical Characteristics @ TJ = 25°C (unless otherwise stated)						
C_{ISS}	Input Capacitance	V_{DS}=30V, V_{GS}=0V, f=1MHz	--	450	--	pF
C_{OSS}	Output Capacitance		--	60	--	pF
C_{RSS}	Reverse Transfer Capacitance		--	25	--	pF
Switching Characteristics						
Q_g	Total Gate Charge	V_{DD}=30V, I_D=4.5A, V_{GS}=10V	--	8.5	--	nC
Q_{gs}	Gate Source Charge		--	4.3	--	nC
Q_{gd}	Gate Drain Charge		--	2.2	--	nC
$t_{d(on)}$	Turn-on Delay Time	V_{DD}=30V, I_D=4.5A, V_{GS}=10V, R_G=3Ω	--	4.7	--	nS
t_r	Turn-on Rise Time		--	2.3	--	nS
$t_{d(off)}$	Turn-Off Delay Time		--	15.7	--	nS
t_f	Turn-Off Fall Time		--	19	--	nS
Source- Drain Diode Characteristics						
V_{SD}	Forward on voltage	Tj=25℃, Is=4.5A	--	--	1.2	V

P-Ch Electrical Characteristics (TJ=25℃ unless otherwise noted)						
Symbol	**Parameter**	**Condition**	**Min**	**Typ**	**Max**	**Unit**
Static Electrical Characteristics @ TJ = 25°C (unless otherwise stated)						
$BV_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=-250μA	-60	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=-60V, V_{GS}=0V	--	--	-1	μA
I_{GSS}	Gate-Body Leakage Current	V_{GS}=±20V, V_{DS}=0V	--	--	±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=-250μA	-1.0	-1.8	-3.0	V
$R_{DS(on)}$	Drain-Source On-State Resistance	V_{GS}=-10V, I_D=-3.2A	--	84	105	mΩ
		V_{GS}=-4.5V, I_D=-2.8A	--	106	135	mΩ
Dynamic Electrical Characteristics @ TJ = 25°C (unless otherwise stated)						
C_{ISS}	Input Capacitance	V_{DS}=-30V, V_{GS}=0V, f=1MHz	--	930	--	pF
C_{OSS}	Output Capacitance		--	85	--	pF
C_{RSS}	Reverse Transfer Capacitance		--	35	--	pF
Switching Characteristics						
Q_g	Total Gate Charge	V_{DS}=-30V, I_D=-3.2A, V_{GS}=-10V	--	16	--	nC
Q_{gs}	Gate Source Charge		--	2.5	--	nC
Q_{gd}	Gate Drain Charge		--	3.2	--	nC
$t_{d(on)}$	Turn-on Delay Time	V_{DD}=-30V, I_D=-3.2A, V_{GS}=-10V, R_G=3.3Ω	--	8	--	nS
t_r	Turn-on Rise Time		--	3.8	--	nS
$t_{d(off)}$	Turn-Off Delay Time		--	31.5	--	nS
t_f	Turn-Off Fall Time		--	7.5	--	nS
Source- Drain Diode Characteristics						
V_{SD}	Forward on voltage	Tj=25℃, Is=-3.2A	--	--	-1.2	V

N-Channel Typical Operating Characteristics

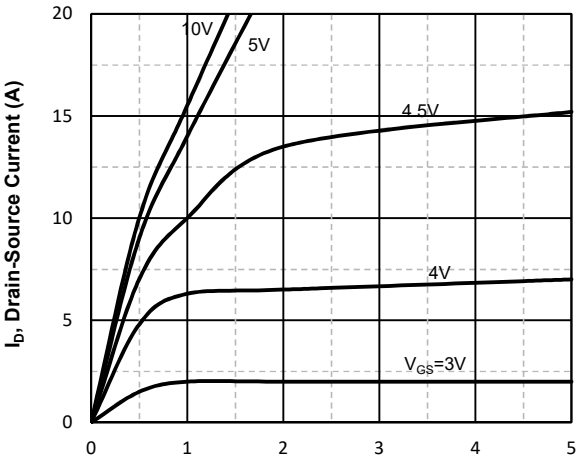


Fig1. Typical Output Characteristics

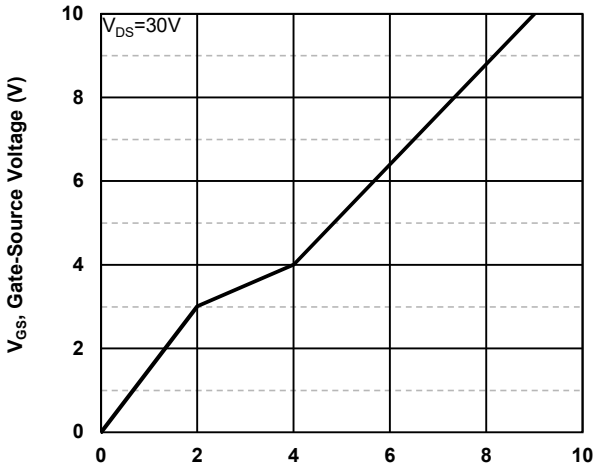


Fig2. Typical Gate Charge Vs.Gate-Source Voltage

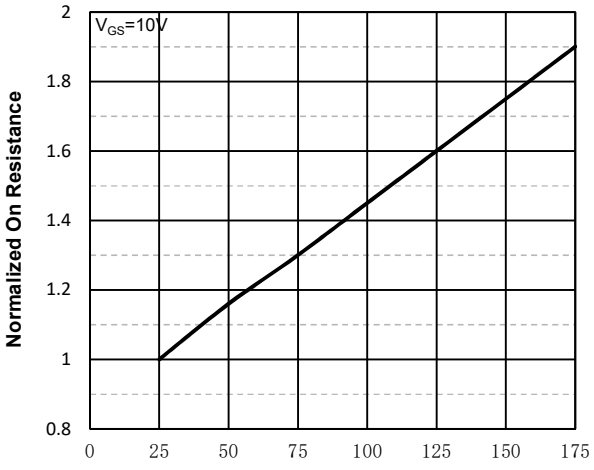


Fig3. Normalized On-Resistance Vs. Temperature

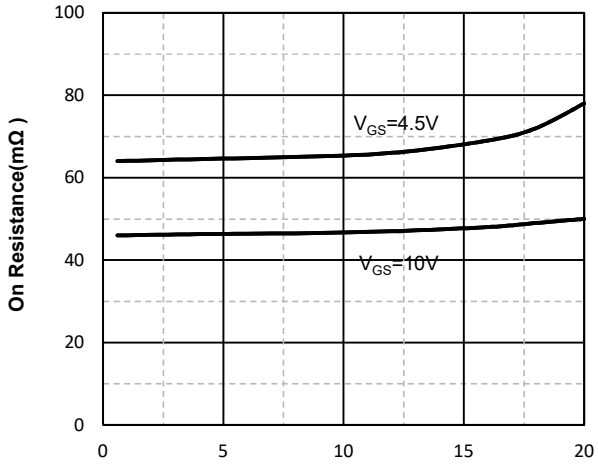


Fig4. On-Resistance Vs. Drain-Source Current

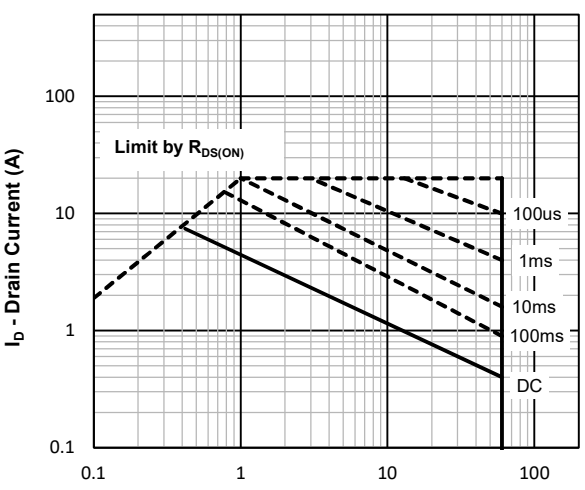


Fig5. Maximum Safe Operating Area

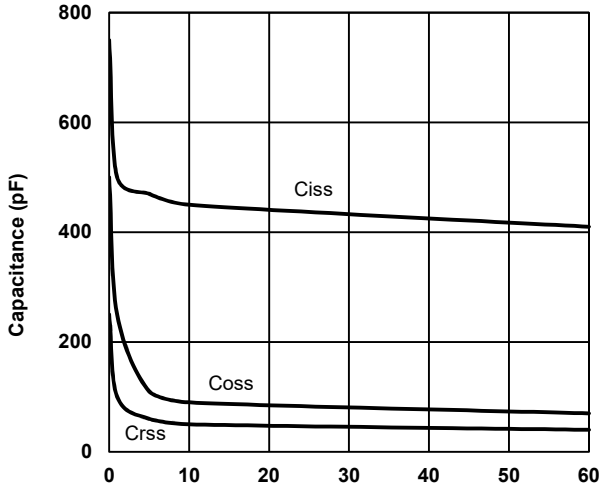


Fig6 Typical Capacitance Vs.Drain-Source Voltage

P-Channel Typical Operating Characteristics

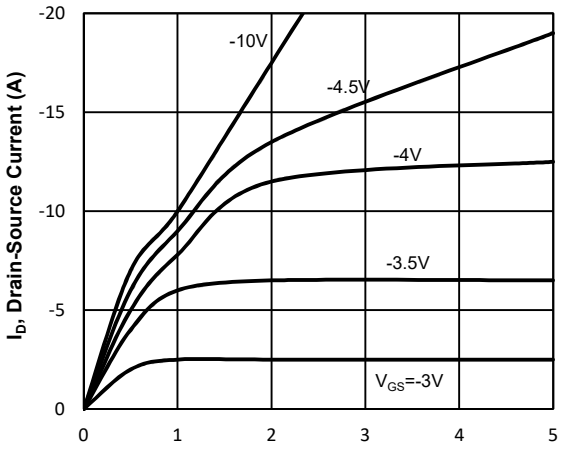


Fig7. Typical Output Characteristics

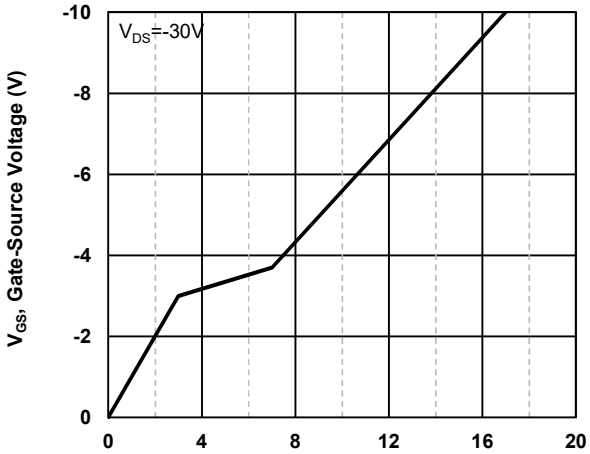


Fig8. Typical Gate Charge Vs.Gate-Source Voltage

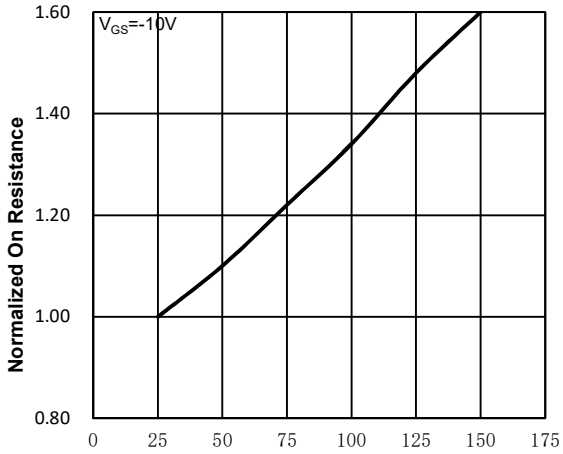


Fig9. Normalized On-Resistance Vs. Temperature

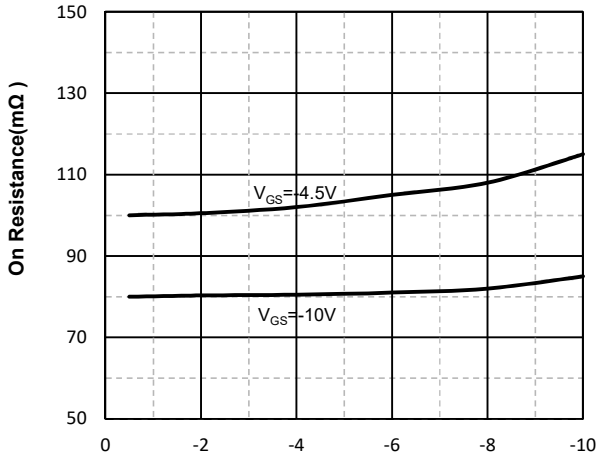


Fig10. On-Resistance Vs. Drain-Source Current

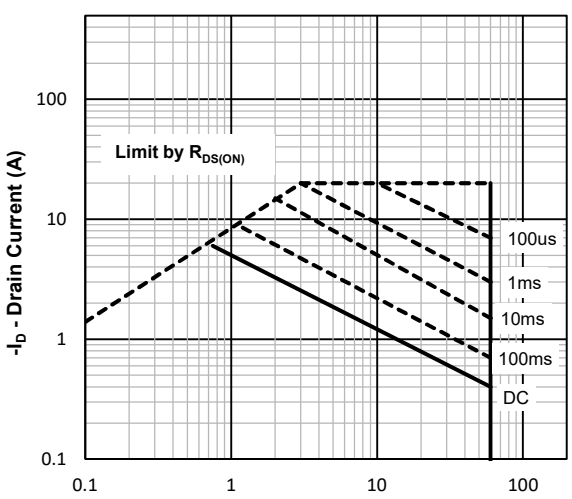


Fig11. Maximum Safe Operating Area

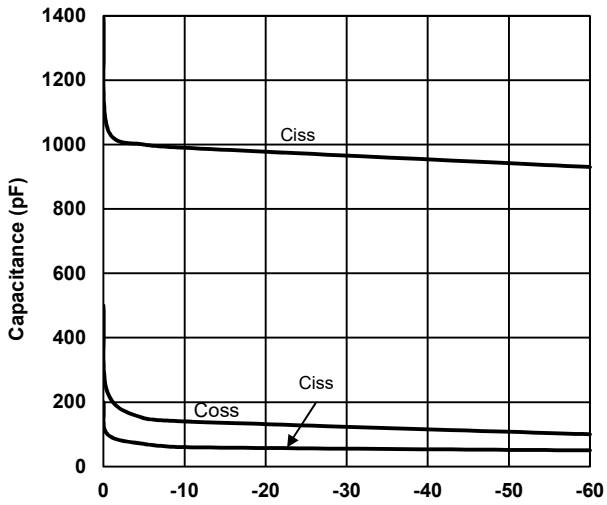
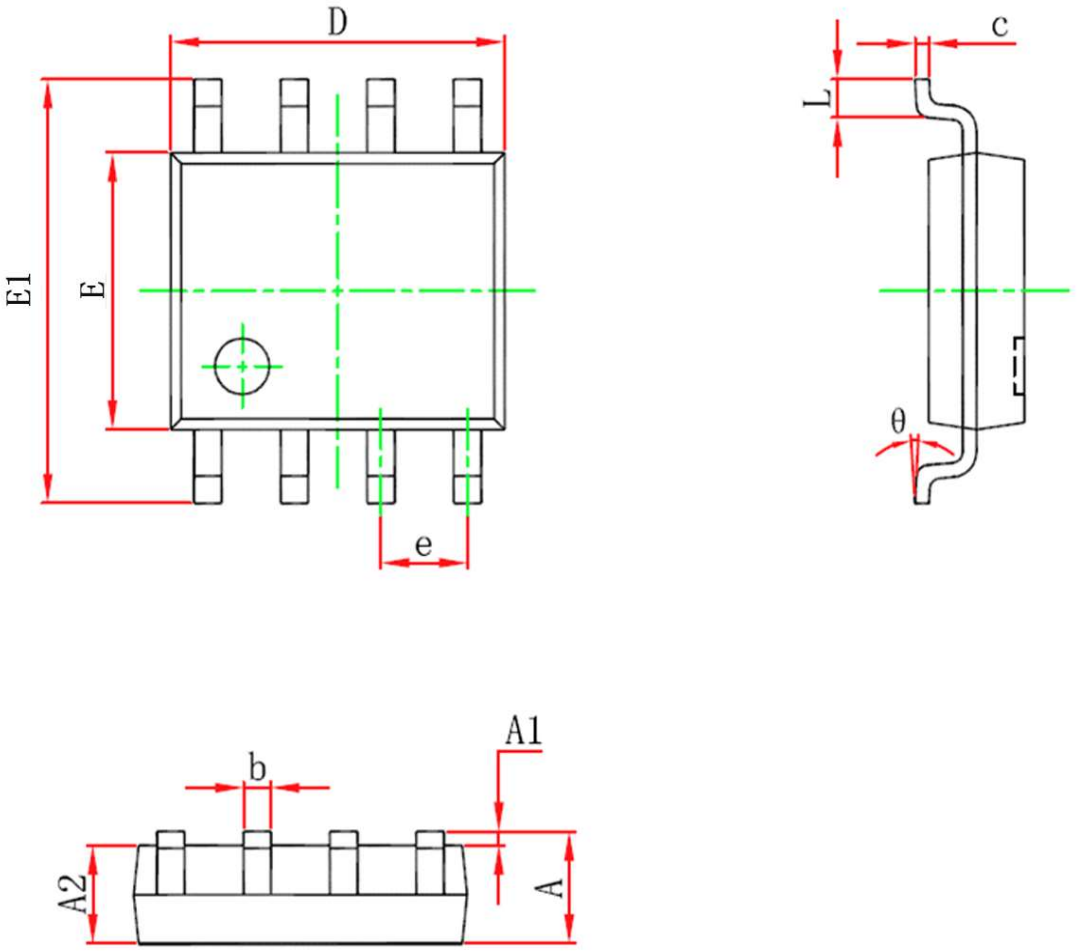


Fig12 Typical Capacitance Vs.Drain-Source Voltage

SOP-8 Package information



Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	1.450	1.750	0.057	0.068
A1	0.100	0.250	0.003	0.009
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.012	0.020
c	0.170	0.250	0.006	0.009
D	4.700	5.100	0.185	0.200
e	1.270(BSC)		0.050(BSC)	
E	3.800	4.000	0.149	0.157
E1	5.800	6.200	0.228	0.244
L	0.400	1.270	0.015	0.050
θ	0°	8°	0°	8°