

Features

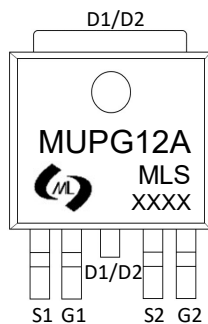
- High power and current handing capability
- Lead free product is acquired
- Surface mount package

Application

- Battery protection
- Load switch
- Power management

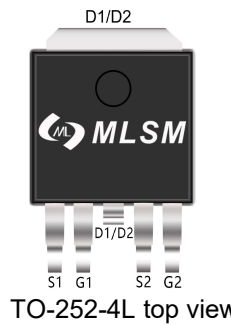
Product Summary

V_{DS}	$R_{DS(ON)}$ MAX	I_D MAX
60V	65mΩ@10V	12A
	85mΩ@4.5V	
-60V	100mΩ@-10V	-12A
	150mΩ@-4.5V	

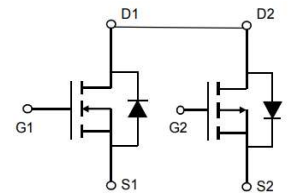


MUPG12A: Device code
XXXX: Code

Marking and pin assignment



TO-252-4L top view



Schematic diagram



Pb-Free



Halogen-Free

Absolute Maximum Ratings (TA=25°C 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	12	-12	A
	$T_c=25^\circ\text{C}$			

Mounted on Large Heat Sink

I_{DM}	Pulse Drain Current Tested	$T_c=25^\circ\text{C}$	48	-48	A
I_D	Continuous Drain Current	$T_c=25^\circ\text{C}$	12	-12	A
P_D	Maximum Power Dissipation	$T_c=25^\circ\text{C}$	35	35	W
$R_{\theta JA}$	Thermal Resistance Junction-Ambient		83	83	°C/W

Ordering Information (Example)

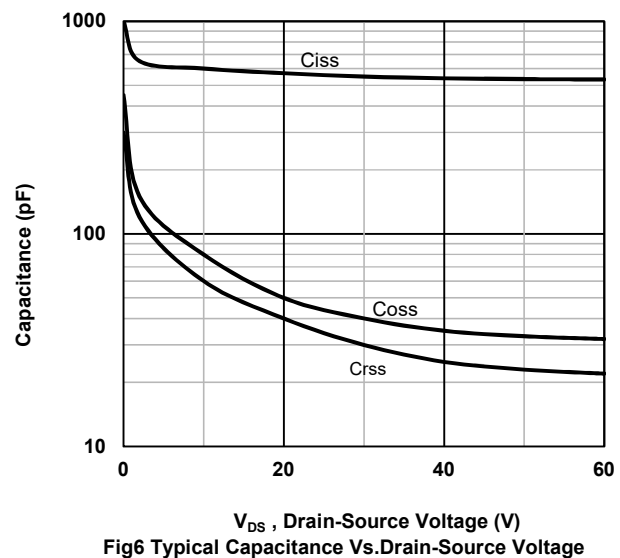
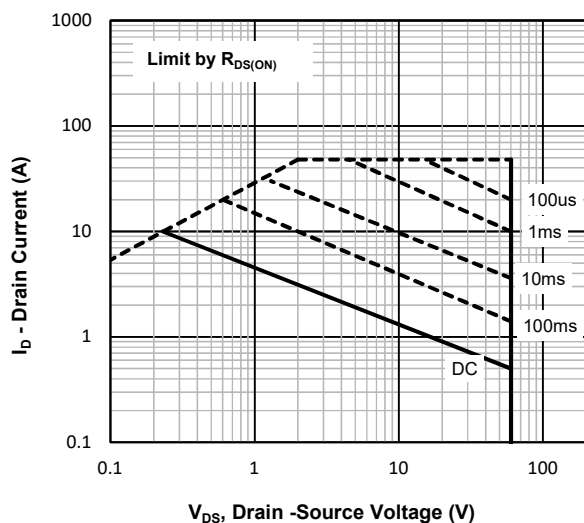
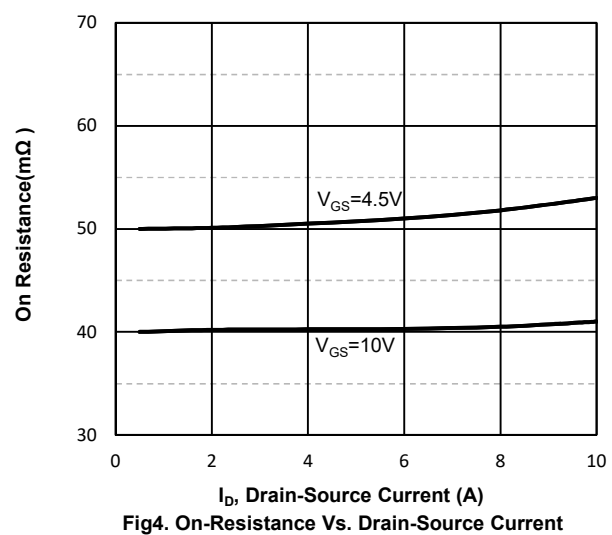
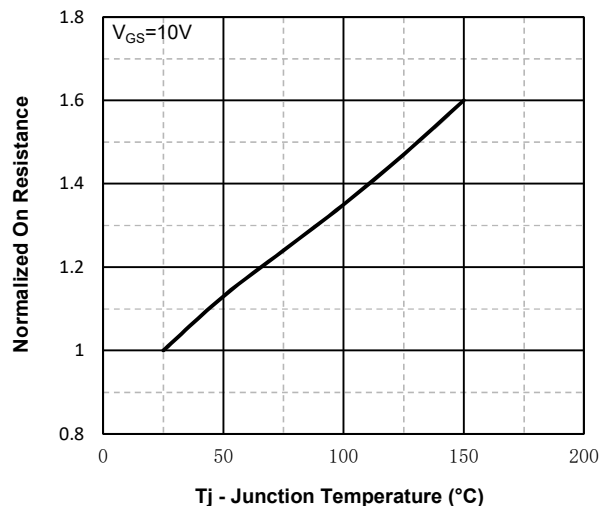
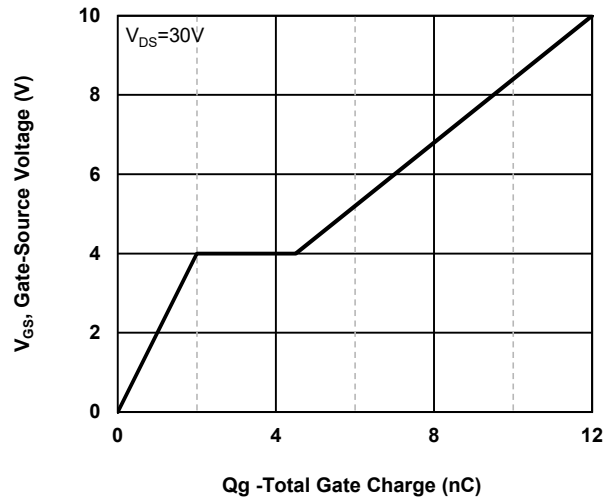
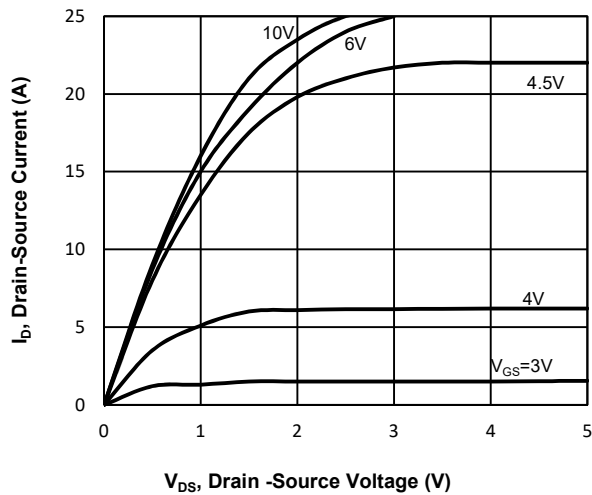
Type	Package	Marking	Minimum Package(pcs)	Inner Box Quantity(pcs)	Outer Carton Quantity(pcs)	Delivery Mode
MUPG12A	TO-252-4L	MUPG12A	2,500	5,000	35,000	13"reel



N-CH Electrical Characteristics (TJ=25°C 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 =12A	–	40	60	mΩ
		V _{GS} =4.5V, I _D =6A	–	50	85	mΩ
Dynamic Electrical Characteristics @ TJ = 25°C (unless otherwise stated)						
C _{ISS}	Input Capacitance	V _{DS} =30V, V _{GS} =0V, f=1MHz	–	550	–	pF
C _{OSS}	Output Capacitance		–	43	–	pF
C _{RSS}	Reverse Transfer Capacitance		–	35	–	pF
Switching Characteristics						
Q _g	Total Gate Charge	V _{DS} =30V, I _D =6A, V _{GS} =10V	–	11.5	–	nC
Q _{gs}	Gate Source Charge		–	1.7	–	nC
Q _{gd}	Gate Drain Charge		–	2.5	–	nC
t _{d(on)}	Turn-on Delay Time	V _{DD} =30V, I _D =6A, V _{GS} =10V, R _G =2.3Ω	–	6	–	nS
t _r	Turn-on Rise Time		–	11	–	nS
t _{d(off)}	Turn-Off Delay Time		–	18	–	nS
t _f	Turn-Off Fall Time		–	10	–	nS
Source- Drain Diode Characteristics						
V _{SD}	Forward on voltage	Tj=25°C, Is=6A	–	–	1.2	V

P-CH Electrical Characteristics (TJ=25℃ unless otherwise noted)						
Symbol	Parameter	Condition	Min	Typ	Max	Unit
Static Electrical Characteristics @ TJ = 25℃ (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	-1.5	-1.7	-3.0	V
R _{DS(on)}	Drain-Source On-State Resistance	V _{GS} =-10V, I _D =-12A	--	80	100	mΩ
		V _{GS} =-4.5V, I _D =-6A	--	100	150	mΩ
Dynamic Electrical Characteristics @ TJ = 25℃ (unless otherwise stated)						
C _{ISS}	Input Capacitance	V _{DS} =-30V, V _{GS} =0V, f=1MHz	--	900	--	pF
C _{OSS}	Output Capacitance		--	112	--	pF
C _{RSS}	Reverse Transfer Capacitance		--	40	--	pF
Switching Characteristics						
Q _g	Total Gate Charge	V _{DS} =-30V, I _D =-6A, V _{GS} =-10V	--	17.5	--	nC
Q _{gs}	Gate Source Charge		--	3	--	nC
Q _{gd}	Gate Drain Charge		--	3.5	--	nC
t _{d(on)}	Turn-on Delay Time	V _{DS} =-30V, R _L =6Ω, V _{GS} =-10V, R _G =3Ω	--	8	--	nS
t _r	Turn-on Rise Time		--	5	--	nS
t _{d(off)}	Turn-Off Delay Time		--	33	--	nS
t _f	Turn-Off Fall Time		--	8	--	nS
Source- Drain Diode Characteristics						
V _{SD}	Forward on voltage	TJ=25℃, I _S =-6A	--	--	-1.2	V

N-Channel Typical Operating Characteristics



P-Channel Typical Operating Characteristics

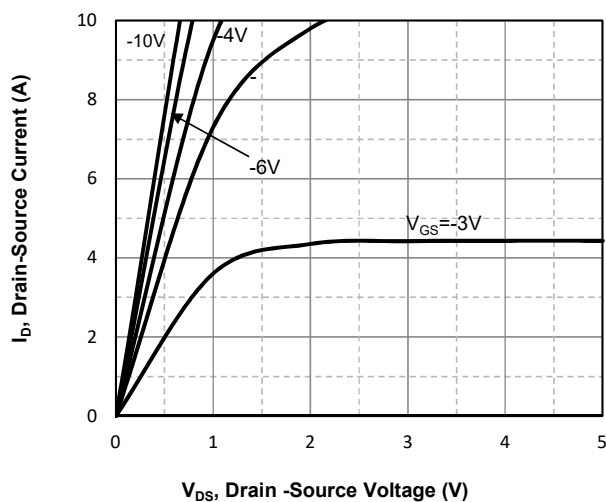


Fig7. Typical Output Characteristics

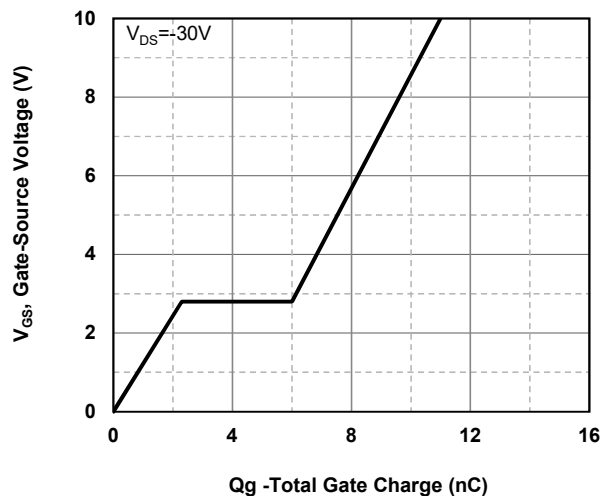


Fig8. Typical Gate Charge Vs. Gate-Source Voltage

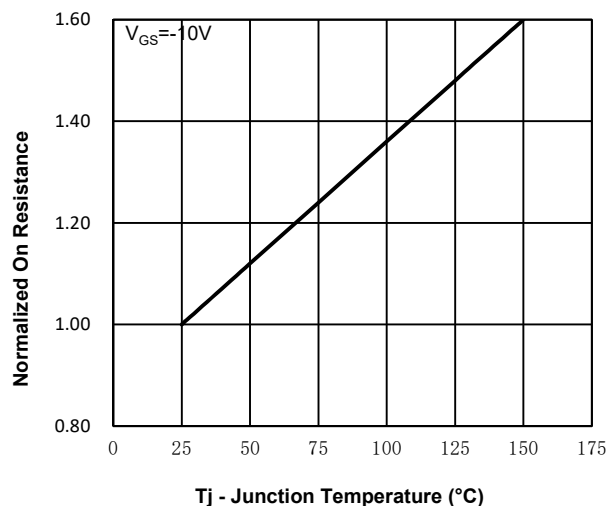


Fig9. Normalized On-Resistance Vs. Temperature

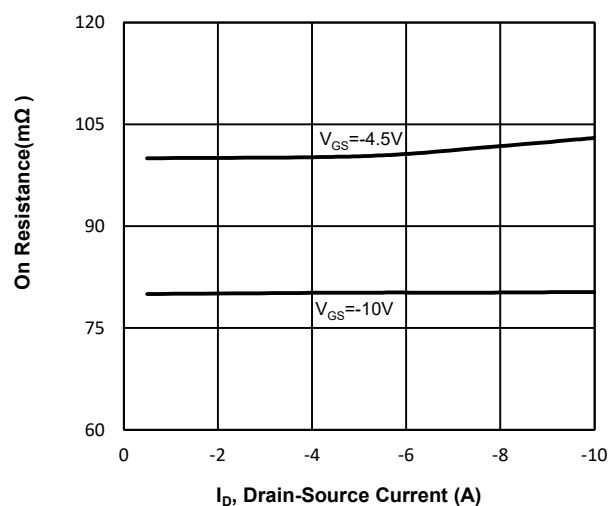


Fig10. On-Resistance Vs. Drain-Source Current

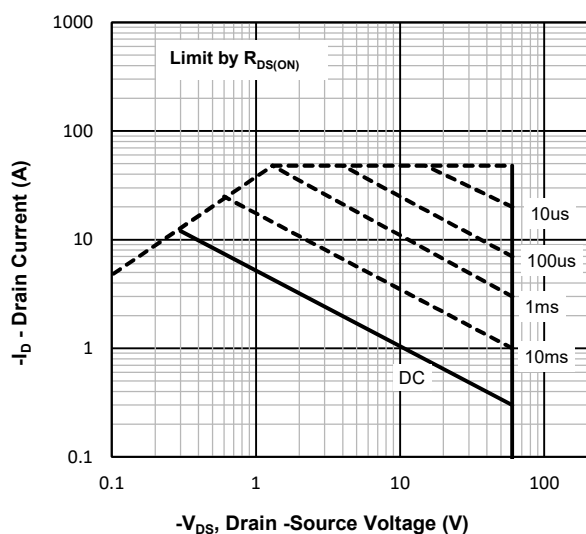


Fig11. Maximum Safe Operating Area

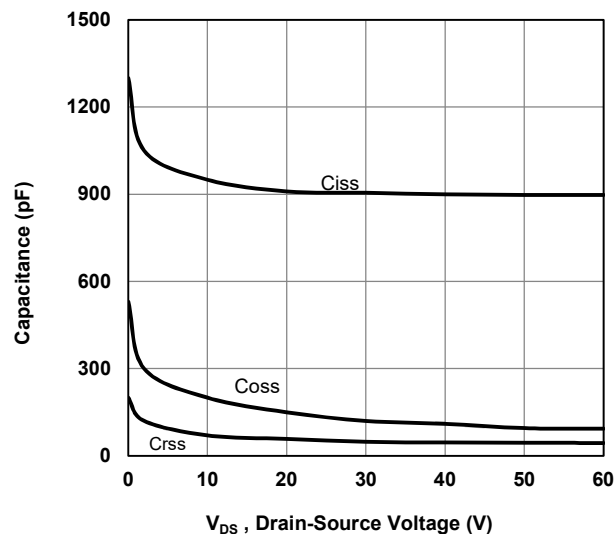
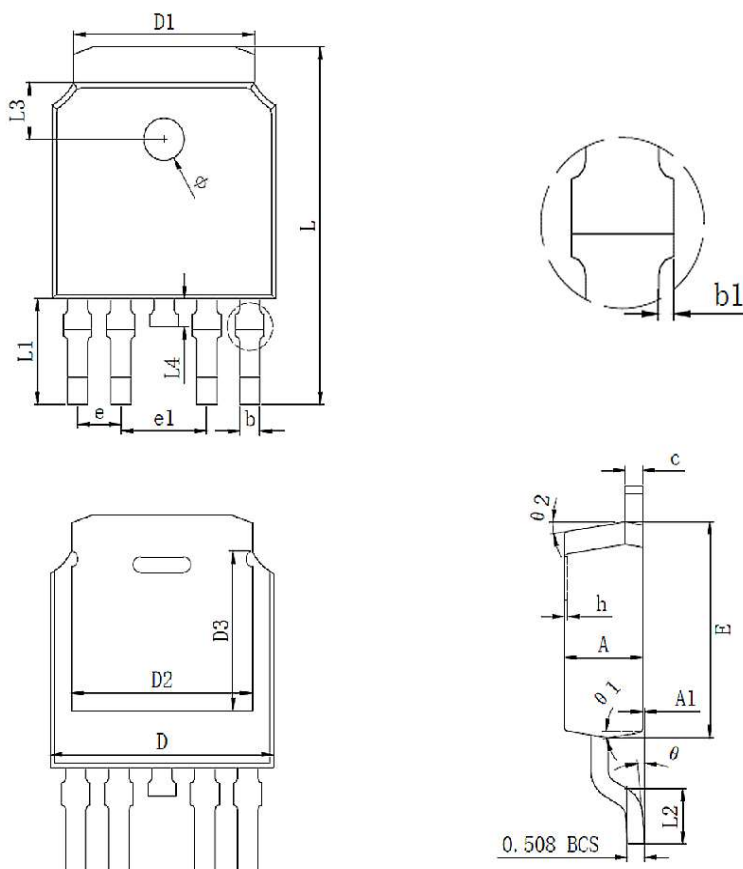


Fig12 Typical Capacitance Vs. Drain-Source Voltage

TO-252-4L Package information



Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.550	0.650	0.022	0.026
b1	0.000	0.120	0.000	0.005
b2	0.250	0.350	0.010	0.014
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.334(REF)		0.210(REF)	
D2	5.346(REF)		0.210(REF)	
D3	4.490(REF)		0.177(REF)	
E	6.000	6.200	0.236	0.244
e	1.270(TYP)		0.050(TYP)	
e1	2.540(TYP)		0.100(TYP)	
h	0.000	0.200	0.000	0.008
L	9.900	10.300	0.390	0.406
L1	2.988(REF)		0.117(REF)	
L2	1.400	1.700	0.055	0.067
L3	1.600(REF)		0.063(REF)	
L4	0.700	0.900	0.028	0.035
ϕ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
$\theta 1$	9°(TYP)		9°(TYP)	
$\theta 2$	9°(TYP)		9°(TYP)	