Description

The XXW60P04 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

TO252-2L

## General Features

V_{DS} = -40V I_D =60 A

$R_{DS(ON)}$ < 13mΩ @ V_{GS}=10V

Application

Battery protection

Load switch

Uninterruptible power supply
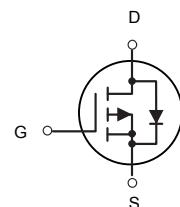
P-Channel MOSFET

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

| Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	-40	V
V_{GS}	Gate-Source Voltage	±20	V
I_D@T_C=25℃	Continuous Drain Current, V_{GS} @ -10V[1]	-60	A
I_D@T_C=100℃	Continuous Drain Current, V_{GS} @ -10V[1]	-32	A
I_D@T_A=25℃	Continuous Drain Current, V_{GS} @ -10V[1]	-10	A
I_D@T_A=70℃	Continuous Drain Current, V_{GS} @ -10V[1]	-8	A
I_{DM}	Pulsed Drain Current[2]	-105	A
EAS	Single Pulse Avalanche Energy[3]	146	mJ
I_{AS}	Avalanche Current	-54	A
P_D@T_C=25℃	Total Power Dissipation[4]	52.1	W
P_D@T_A=25℃	Total Power Dissipation[4]	2	W
T_{STG}	Storage Temperature Range	-55 to 150	℃
T_J	Operating Junction Temperature Range	-55 to 150	℃
$R_{θJA}$	Thermal Resistance Junction-Ambient [1]	62	℃/W
$R_{θJC}$	Thermal Resistance Junction-Case[1]	2.4	℃/W

## Electrical Characteristics (T$_J$=25 ℃, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV$_{DSS}$	Drain-Source Breakdown Voltage	V$_{GS}$=0V , I$_D$=-250uA	-40	---	---	V
△BV$_{DSS}$/△T$_J$	BV$_{DSS}$ Temperature Coefficient	Reference to 25℃ , I$_D$=-1mA	---	-0.023	---	V/℃
R$_{DS(ON)}$	Static Drain-Source On-Resistance[2]	V$_{GS}$=-10V , I$_D$=-18A	---	10.5	13	mΩ
		V$_{GS}$=-4.5V , I$_D$=-12A	---	15	20	
V$_{GS(th)}$	Gate Threshold Voltage		-1.0	-1.6	-2.5	V
△V$_{GS(th)}$	V$_{GS(th)}$ Temperature Coefficient	V$_{GS}$=V$_{DS}$, I$_D$ =-250uA	---	4.74	---	mV/℃
I$_{DSS}$	Drain-Source Leakage Current	V$_{DS}$=-32V , V$_{GS}$=0V , T$_J$=25℃	---	---	1	uA
		V$_{DS}$=-32V , V$_{GS}$=0V , T$_J$=55℃	---	---	5	
I$_{GSS}$	Gate-Source Leakage Current	V$_{GS}$=±20V , V$_{DS}$=0V	---	---	±100	nA
gfs	Forward Transconductance	V$_{DS}$=-5V , I$_D$=-18A	---	24	---	S
R$_g$	Gate Resistance	V$_{DS}$=0V , V$_{GS}$=0V , f=1MHz	---	7	14	
Q$_g$	Total Gate Charge (-4.5V)	V$_{DS}$=-20V , V$_{GS}$=-4.5V , I$_D$=-12A	---	27.9	---	nC
Q$_{gs}$	Gate-Source Charge		---	7.7	---	
Q$_{gd}$	Gate-Drain Charge		---	7.5	---	
T$_{d(on)}$	Turn-On Delay Time	V$_{DD}$=-15V , V$_{GS}$=-10V , R$_G$=3.3 , I$_D$=-1A	---	40	---	ns
T$_r$	Rise Time		---	35.2	---	
T$_{d(off)}$	Turn-Off Delay Time		---	100	---	
T$_f$	Fall Time		---	9.6	---	
C$_{iss}$	Input Capacitance	V$_{DS}$=-15V , V$_{GS}$=0V , f=1MHz	---	3500	---	pF
C$_{oss}$	Output Capacitance		---	323	---	
C$_{rss}$	Reverse Transfer Capacitance		---	222	---	
I$_S$	Continuous Source Current[1,5]	V$_G$=V$_D$=0V , Force Current	---	---	-52	A
I$_{SM}$	Pulsed Source Current[2,5]		---	---	-105	A
V$_{SD}$	Diode Forward Voltage[2]	V$_{GS}$=0V , I$_S$=-1A , T$_J$=25℃	---	---	-1	V

Note :
1.The data tested by surface mounted on a 1 inch[2] FR-4 board with 2OZ copper.
2.The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%
3.The EAS data shows Max. rating . The test condition is V$_{DD}$=-25V,V$_{GS}$=-10V,L=0.1mH,I$_{AS}$=-54A
4.The power dissipation is limited by 150℃ 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.

Typical Characteristics
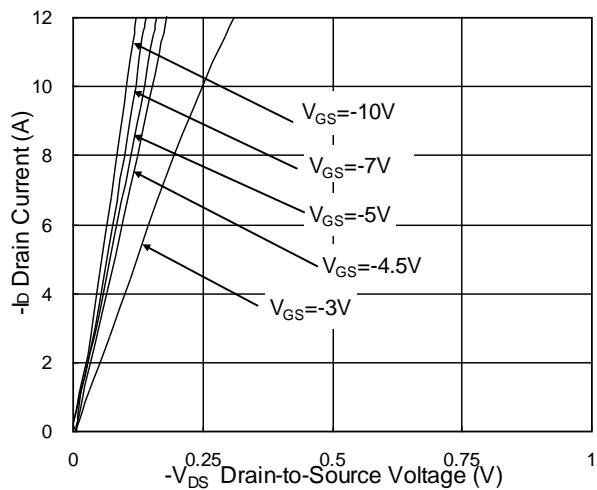
Fig.1 Typical Output Characteristics
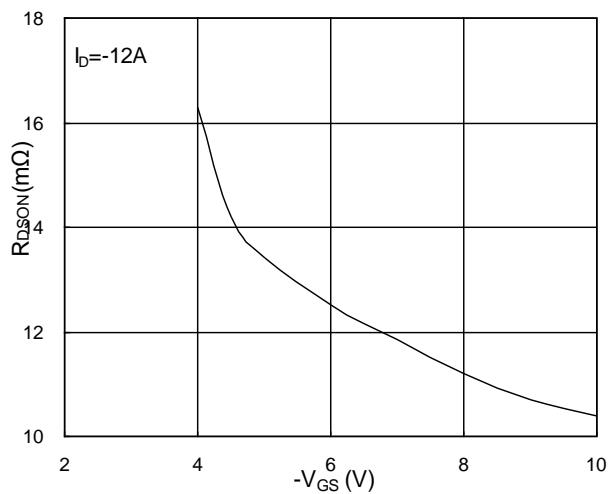
Fig.2 On-Resistance v.s Gate-Source
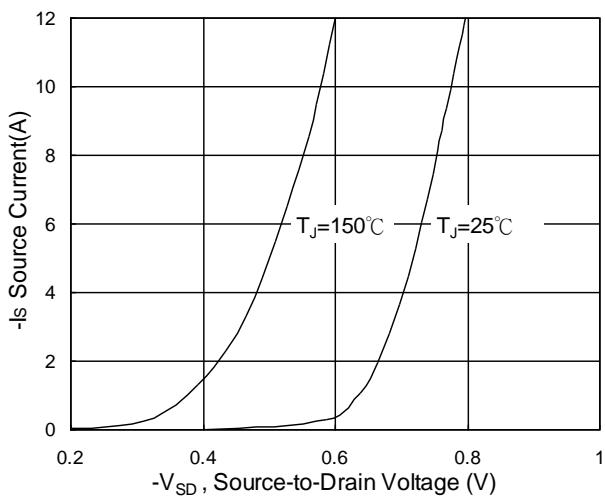
Fig.3 Forward Characteristics Of Reverse
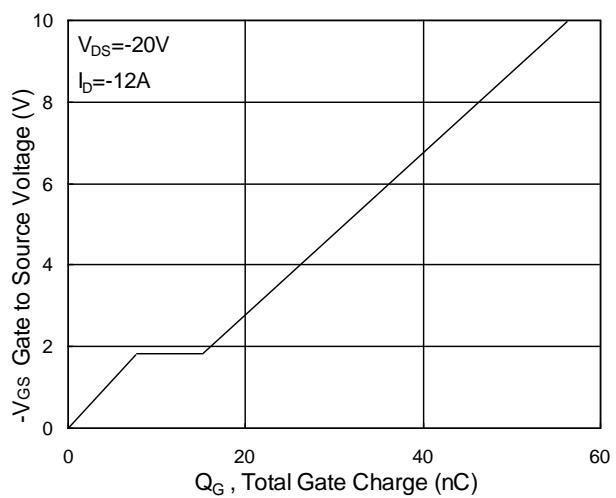
Fig.4 Gate-Charge Characteristics
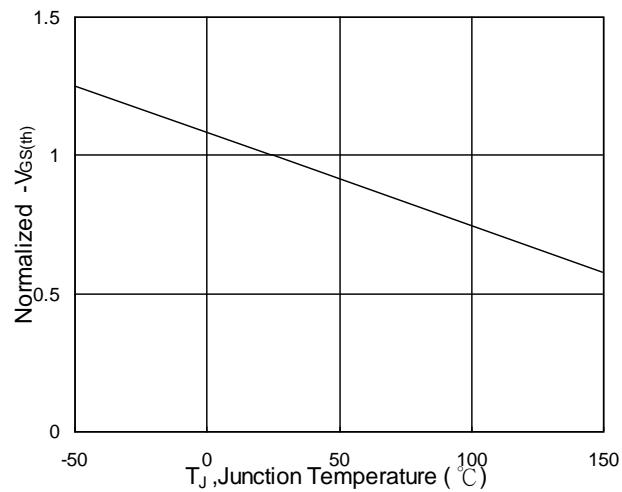
Fig.5 Normalized $V_{GS(th)}$ v.s T_J
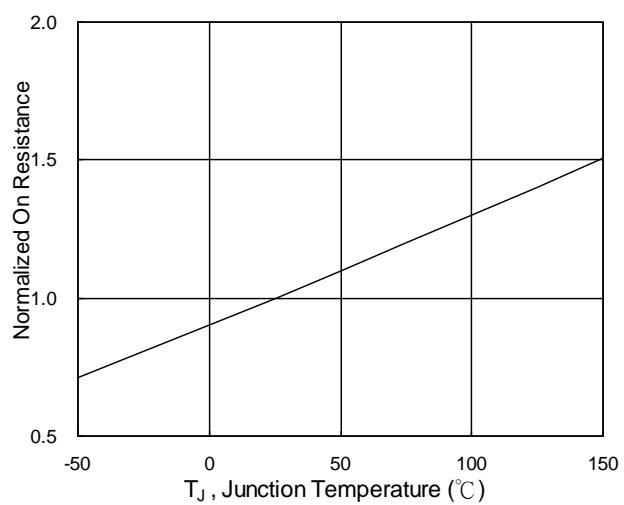
Fig.6 Normalized R_{DSON} v.s T_J
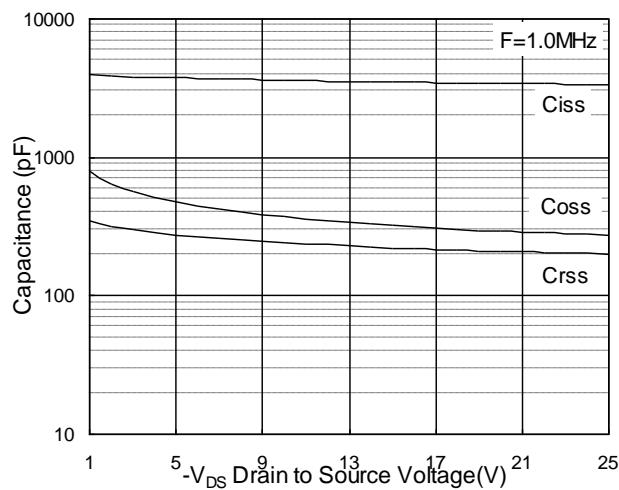
Fig.7 Capacitance
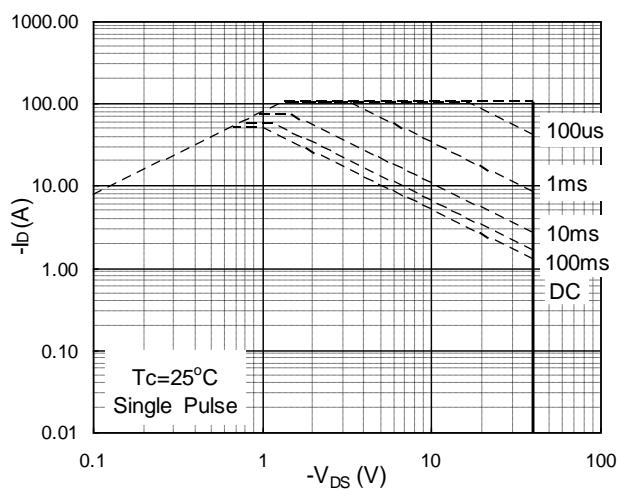
Fig.8 Safe Operating Area
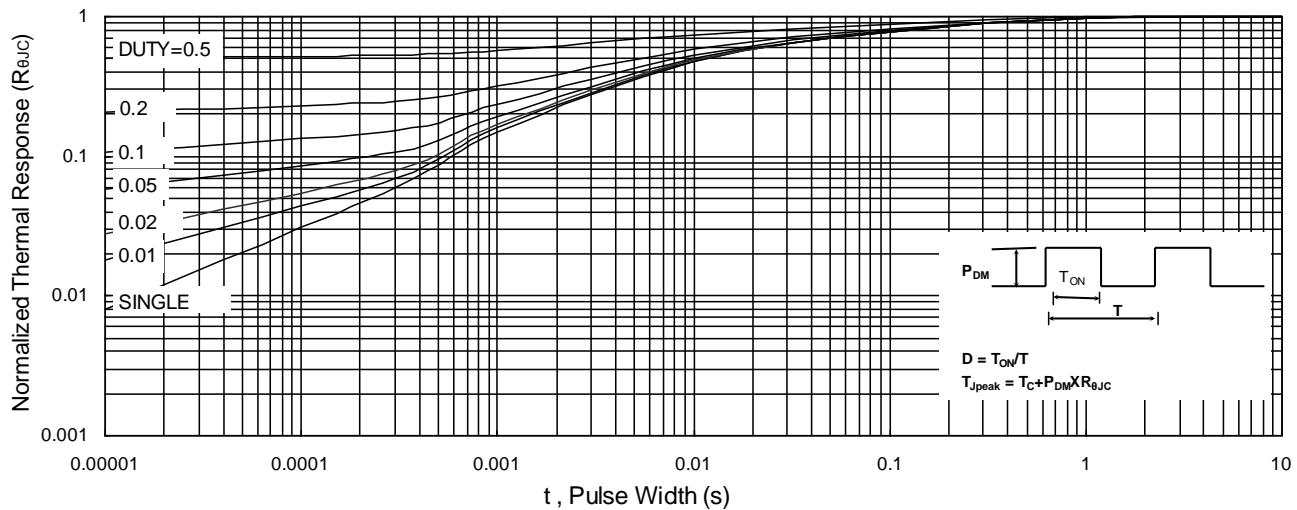
Fig.9 Normalized Maximum Transient Thermal Impedance
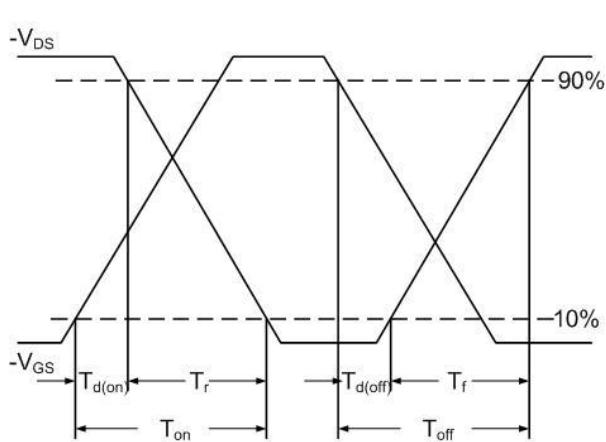
Fig.10 Switching Time Waveform

$$EAS= \frac{1}{2} L \times (-I_{AS}^2) \times \frac{-BV_{DSS}}{-BV_{DSS}-(-V_{DD})}$$
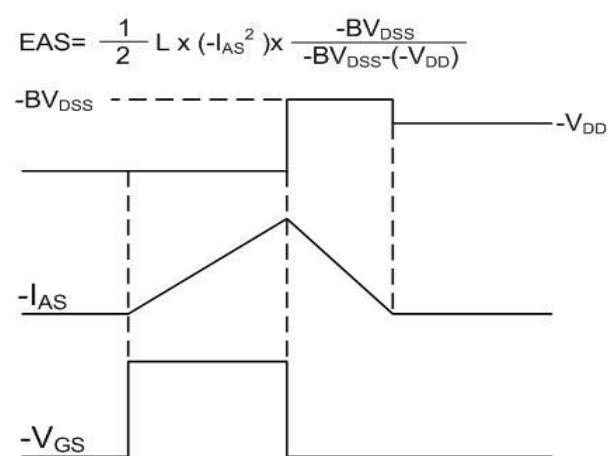
Fig.11 Unclamped Inductive Waveform

TO252-2L Package Information
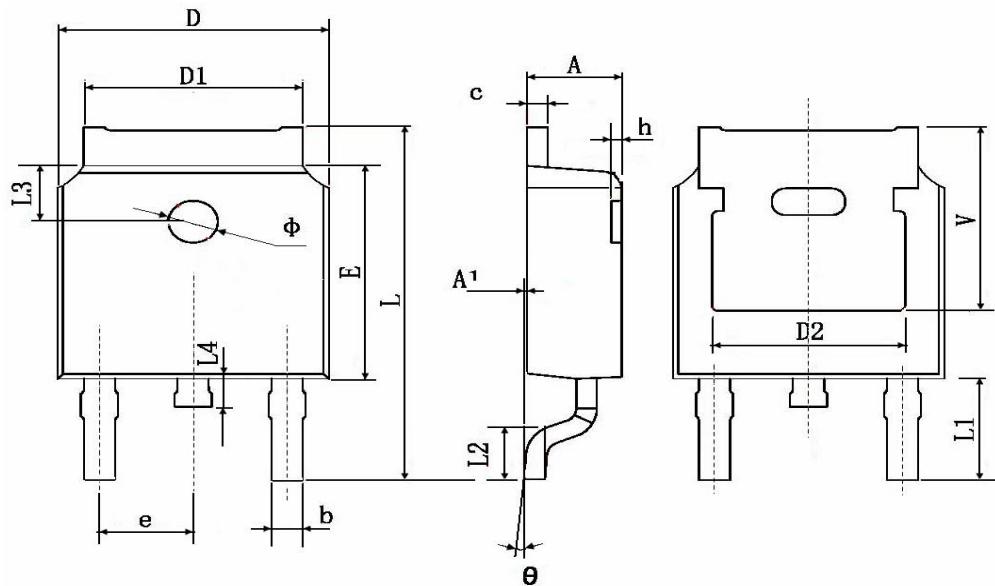
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	