

## QIAOXIN N-Channel Super Trench II Power MOSFET

### Description

The series of devices uses **Super Trench II** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

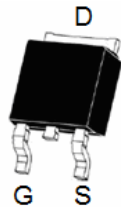
### Application

- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

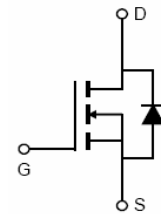
### General Features

- $V_{DS} = 120V, I_D = 60A$   
 $R_{DS(ON)} = 11m\Omega$ , typical @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 14m\Omega$ , typical @  $V_{GS} = 4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating

**TO-252**



**Top View**



**Schematic Diagram**

### Package Marking and Ordering Information

Device Marking	Device	Device Package
VCRR12N12AK		TO-252-2L

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	120	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	60	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	42	A
Pulsed Drain Current	$I_{DM}$	240	A
Maximum Power Dissipation	$P_D$	90	W
Derating factor		0.6	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 4)</sup>	$E_{AS}$	231	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.67	$^\circ C/W$
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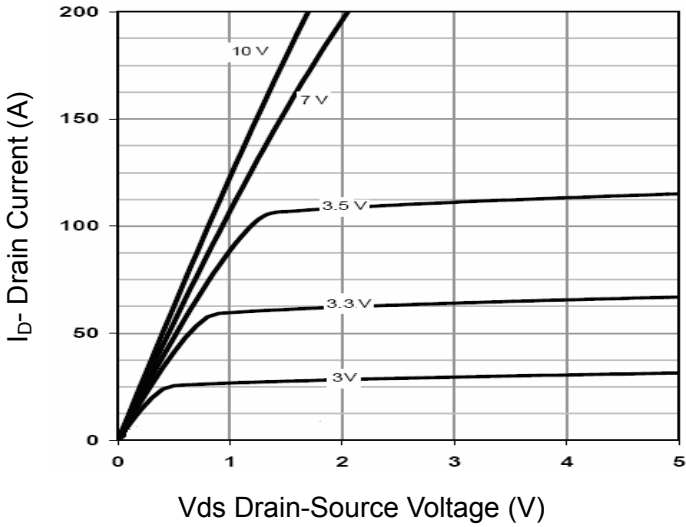
### Electrical Characteristics ( $T_C=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	120		-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=120V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.1	1.7	2.5	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=30A$	-	11	12	m $\Omega$
		$V_{GS}=4.5V, I_D=30A$	-	14	15.5	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=30A$		60	-	S
<b>Dynamic Characteristics</b> (Note 3)						
Input Capacitance	$C_{iss}$	$V_{DS}=60V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	2800	-	pF
Output Capacitance	$C_{oss}$		-	180	-	pF
Reverse Transfer Capacitance	$C_{rss}$		-	20	-	pF
<b>Switching Characteristics</b> (Note 3)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=60V, I_D=30A$ $V_{GS}=10V, R_G=1.6\Omega$	-	13	-	nS
Turn-on Rise Time	$t_r$		-	10	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	30	-	nS
Turn-Off Fall Time	$t_f$		-	8	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=60V, I_D=30A,$ $V_{GS}=10V$	-	56	-	nC
Gate-Source Charge	$Q_{gs}$		-	12.5	-	nC
Gate-Drain Charge	$Q_{gd}$		-	14	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 2)	$V_{SD}$	$V_{GS}=0V, I_S=30A$	-	-	1.2	V
Diode Forward Current	$I_S$		-	-	60	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}\text{C}, I_F = 30A$ $di/dt = 100A/\mu s$ (Note 3)	-	60	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	106	-	nC

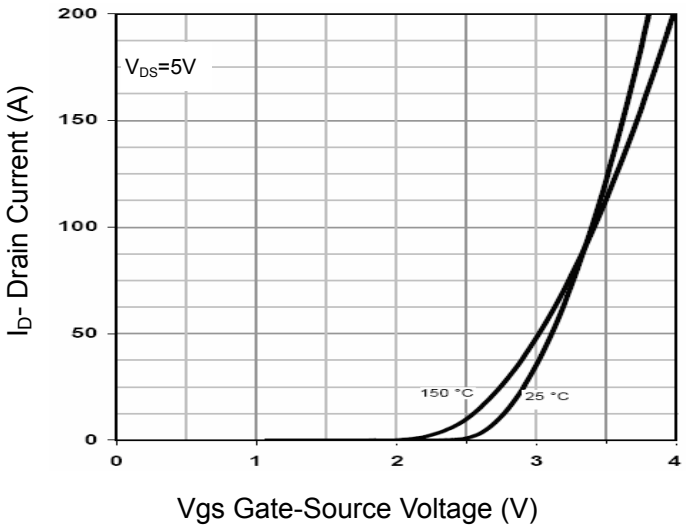
#### Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
3. Guaranteed by design, not subject to production
4. EAS condition :  $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.25\text{mH}, R_g=25\Omega$

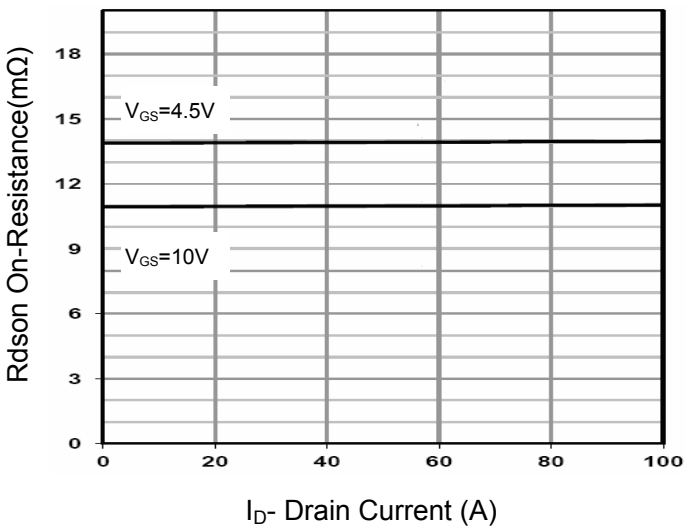
**Typical Electrical and Thermal Characteristics**



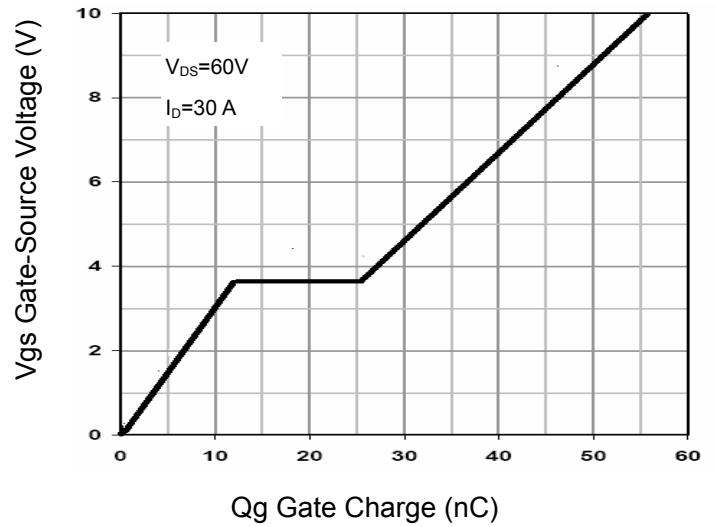
**Figure 1 Output Characteristics**



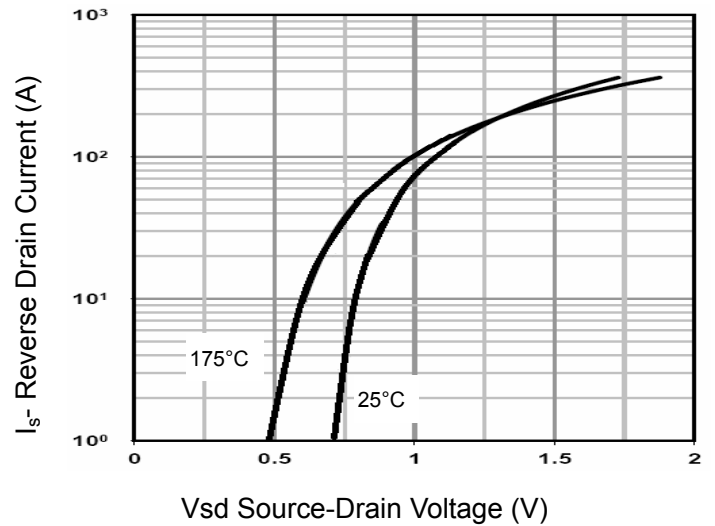
**Figure 2 Transfer Characteristics**



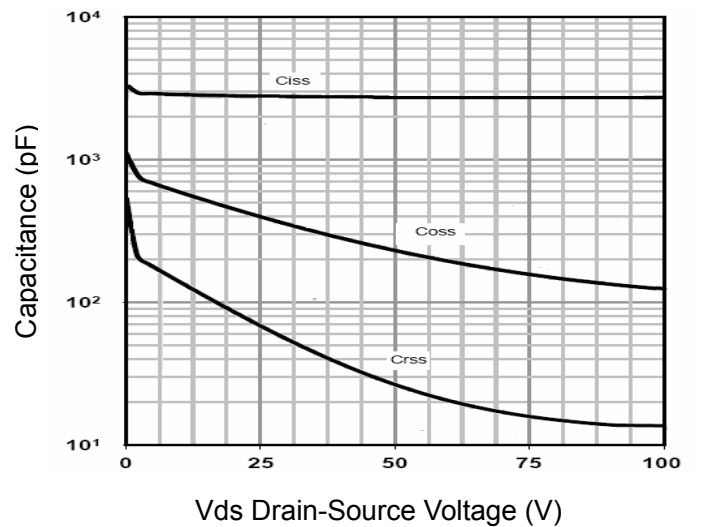
**Figure 3 Rdson- Drain Current**



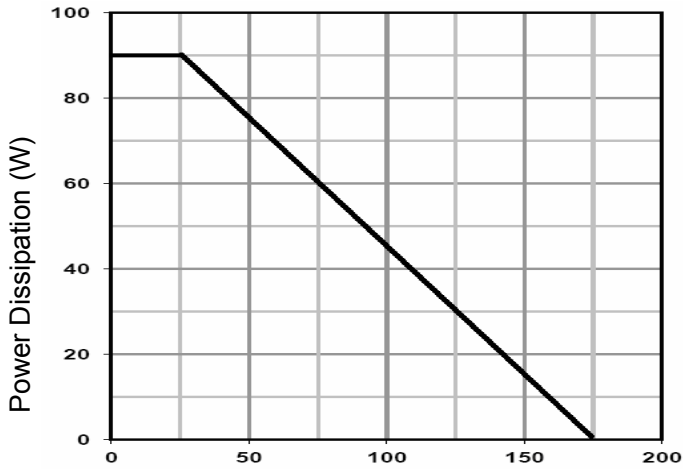
**Figure 4 Gate Charge**



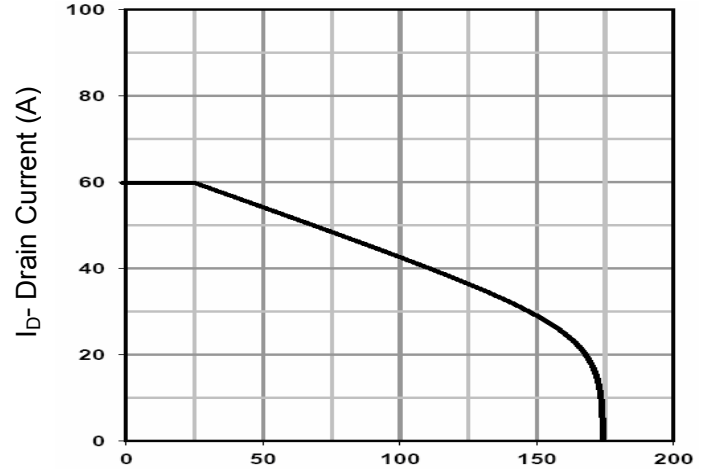
**Figure 5 Source- Drain Diode Forward**



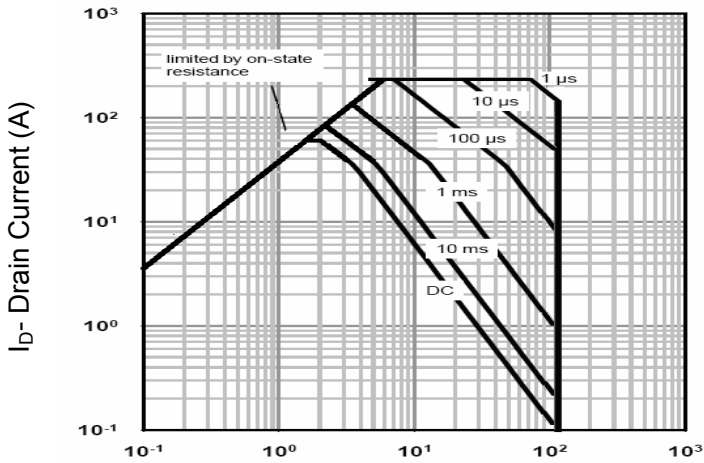
**Figure 6 Capacitance vs Vds**



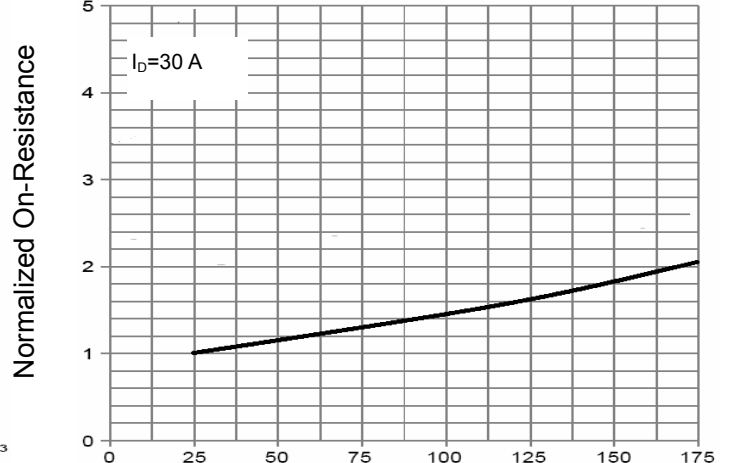
T<sub>J</sub>-Junction Temperature(°C)  
**Figure 7 Power De-rating**



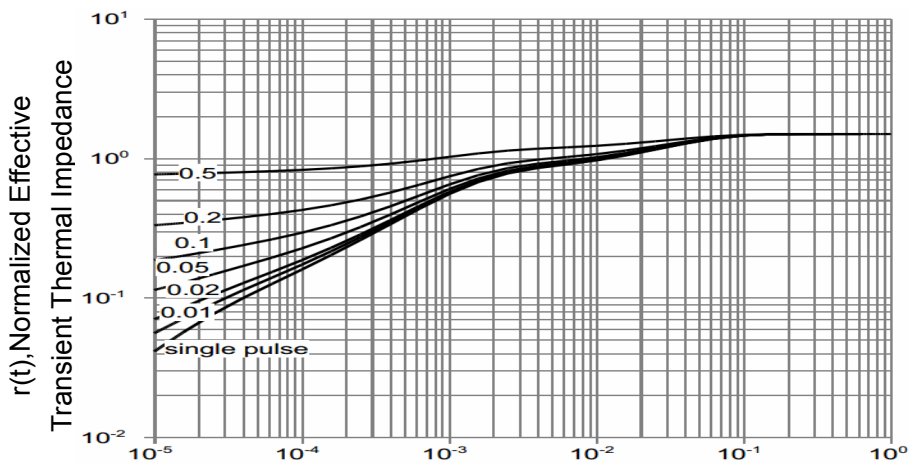
T<sub>J</sub>-Junction Temperature (°C)  
**Figure 9 Current De-rating**



V<sub>ds</sub> Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**

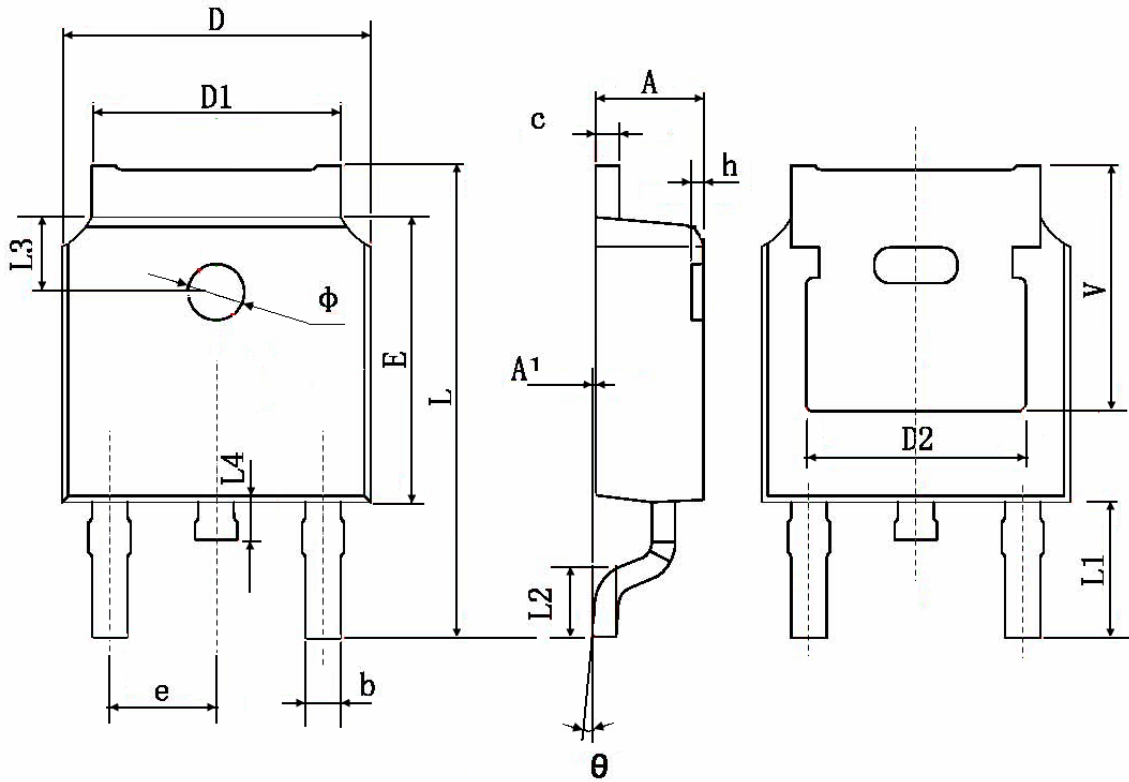


T<sub>J</sub>-Junction Temperature(°C)  
**Figure 10 Rdson-Junction Temperature**



Square Wave Pluse Duration(sec)

**TO-252-2L 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	4.83 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
phi	1.100	1.300	0.043	0.051
theta	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	

## Attention

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