

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

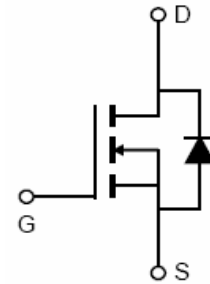
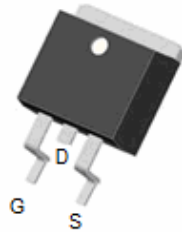
General Features

- $V_{DS} = 120V, I_D = 150A$
 $R_{DS(on)} = 3.5m\Omega$, typical (TO-220) @ $V_{GS} = 10V$
 $R_{DS(on)} = 3.3m\Omega$, typical (TO-263) @ $V_{GS} = 10V$
- 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-220



TO-263



Schematic Diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VCRRP040N12	VCRRP040N12	TO-220	-	-	-
VCRRP040N12D	VCRRP040N12D	TO-263	-	-	-

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}	± 20	V
Drain Current-Continuous	I_D	150	A
Drain Current-Continuous ($T_C = 100^\circ C$)	$I_D(100^\circ C)$	108	A
Pulsed Drain Current	I_{DM}	600	A
Maximum Power Dissipation	P_D	245	W
Derating factor		1.63	W/ $^\circ C$
Single pulse avalanche energy ^(Note 5)	E_{AS}	1345	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 175	$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Case ^(Note 2)	$R_{\theta JC}$	0.61	$^{\circ}\text{C}/\text{W}$
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Electrical Characteristics ($T_C=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	
Off Characteristics							
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	μA	
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA	
On Characteristics ^(Note 3)							
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	3.0	4.0	V	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=75A$	TO-220	-	3.5	4.0	m Ω
			TO-263		3.3	4.0	m Ω
Forward Transconductance	g_{FS}	$V_{DS}=5V, I_D=75A$	85	-	-	S	
Dynamic Characteristics ^(Note 4)							
Input Capacitance	C_{iss}	$V_{DS}=60V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	8760	-	PF	
Output Capacitance	C_{oss}		-	620	-	PF	
Reverse Transfer Capacitance	C_{rss}		-	70	-	PF	
Switching Characteristics ^(Note 4)							
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=60V, I_D=75A$ $V_{GS}=10V, R_G=1.6\Omega$	-	25	-	nS	
Turn-on Rise Time	t_r		-	15	-	nS	
Turn-Off Delay Time	$t_{d(off)}$		-	52	-	nS	
Turn-Off Fall Time	t_f		-	17	-	nS	
Total Gate Charge	Q_g	$V_{DS}=60V, I_D=75A,$ $V_{GS}=10V$	-	152	-	nC	
Gate-Source Charge	Q_{gs}		-	40		nC	
Gate-Drain Charge	Q_{gd}		-	47		nC	
Drain-Source Diode Characteristics							
Diode Forward Voltage ^(Note 3)	V_{SD}	$V_{GS}=0V, I_S=75A$	-		1.2	V	
Diode Forward Current ^(Note 2)	I_S		-	-	150	A	
Reverse Recovery Time	t_{rr}	$T_J = 25^{\circ}\text{C}, I_F = 75A$ $di/dt = 100A/\mu s$ ^(Note 3)	-	74	-	nS	
Reverse Recovery Charge	Q_{rr}		-	164	-	nC	

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production
5. EAS condition : $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

Typical Electrical and Thermal Characteristics

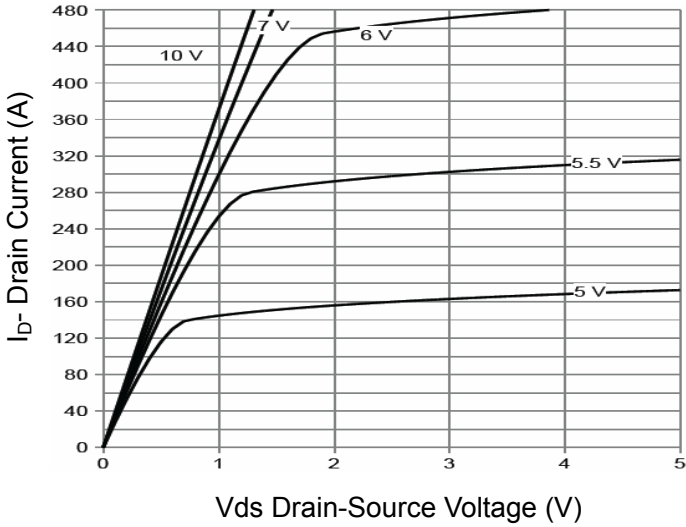


Figure 1 Output Characteristics

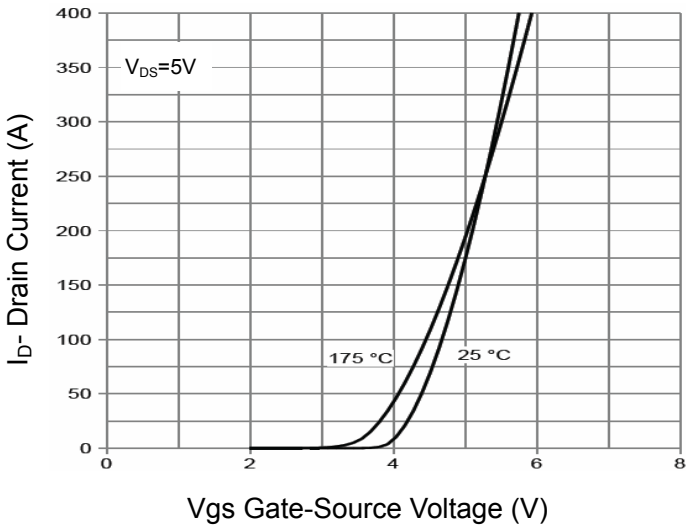


Figure 2 Transfer Characteristics

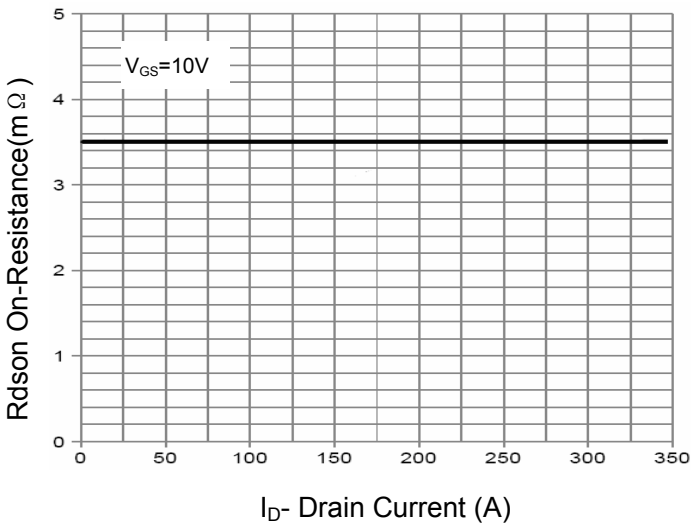


Figure 3 Rdson- Drain Current

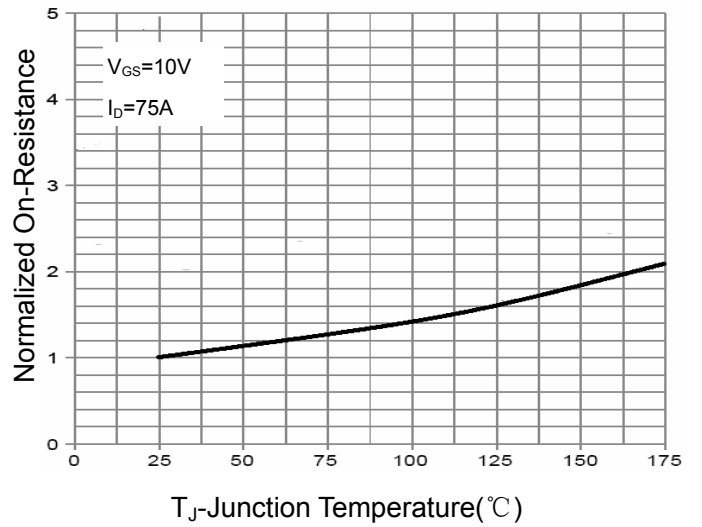


Figure 4 Rdson-Junction Temperature

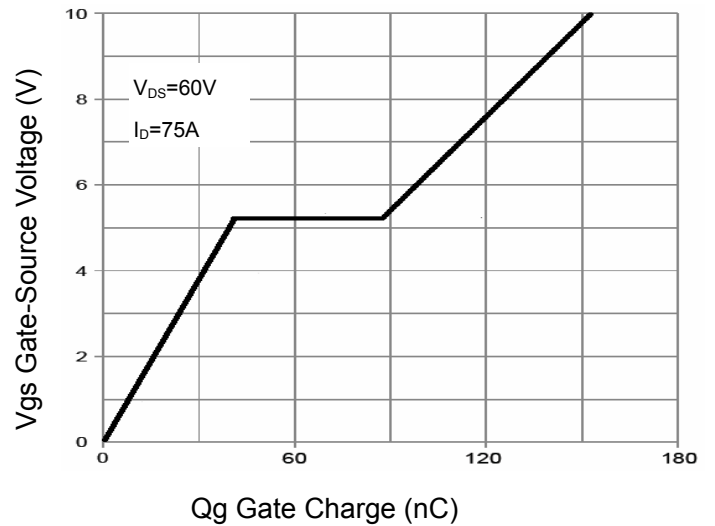


Figure 5 Gate Charge

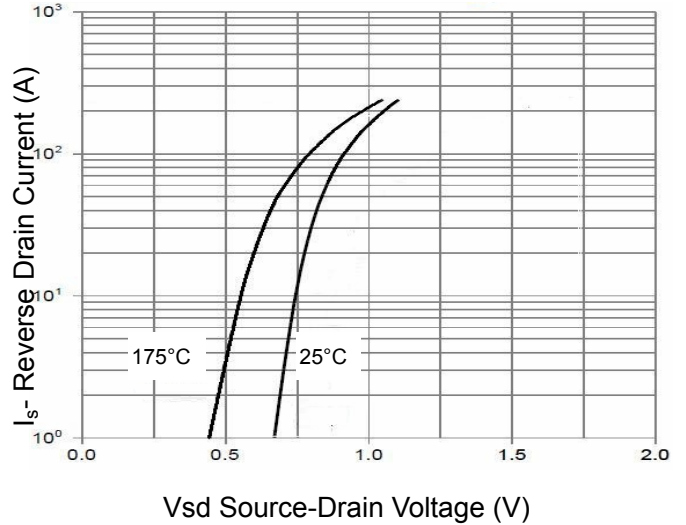
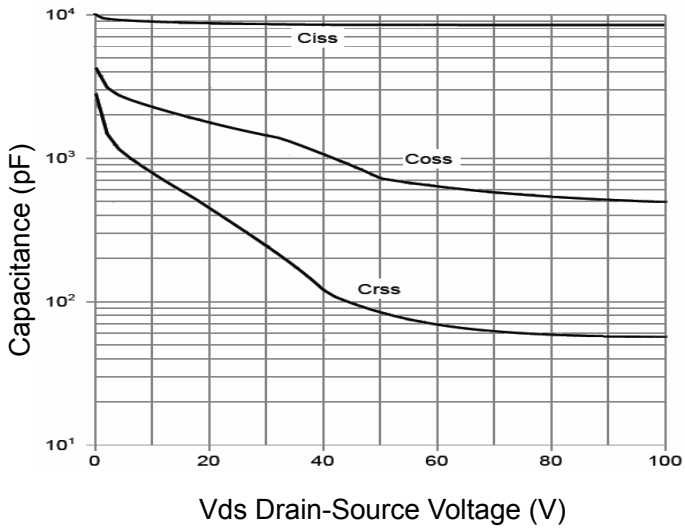
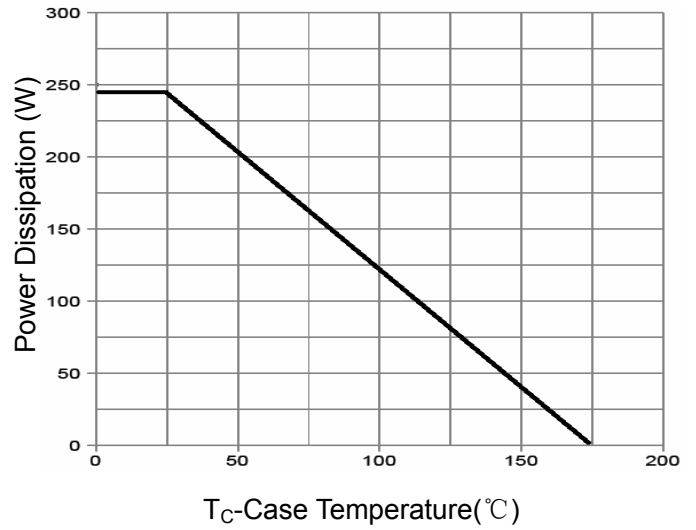


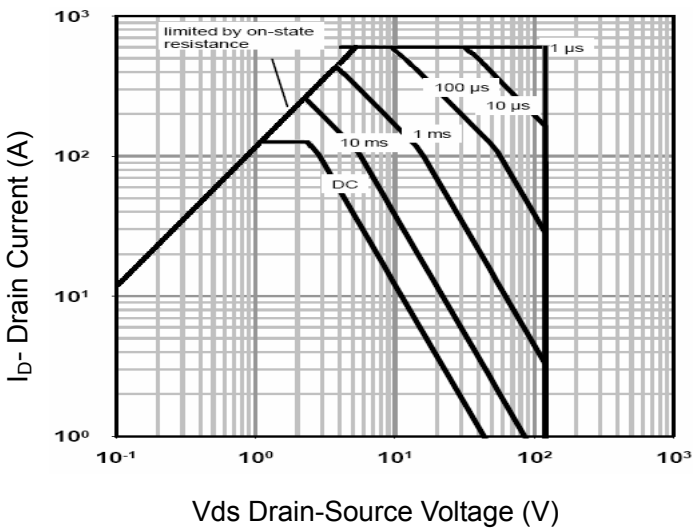
Figure 6 Source- Drain Diode Forward



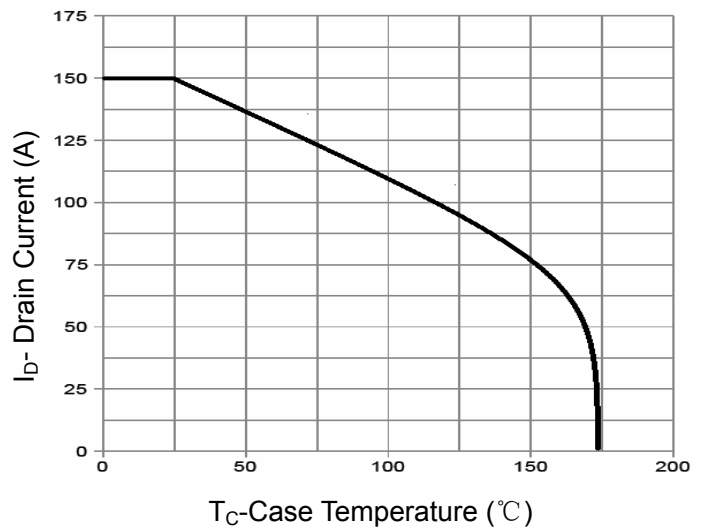
Vds Drain-Source Voltage (V)
Figure 7 Capacitance vs Vds



T_C-Case Temperature(°C)
Figure 9 Power De-rating



Vds Drain-Source Voltage (V)
Figure 8 Safe Operation Area



T_C-Case Temperature (°C)
Figure 10 Current De-rating

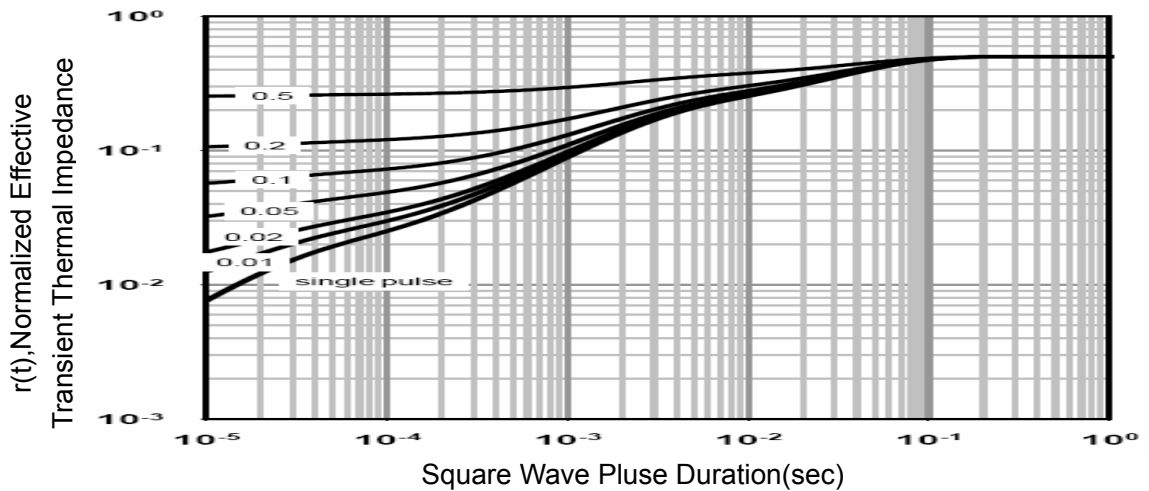


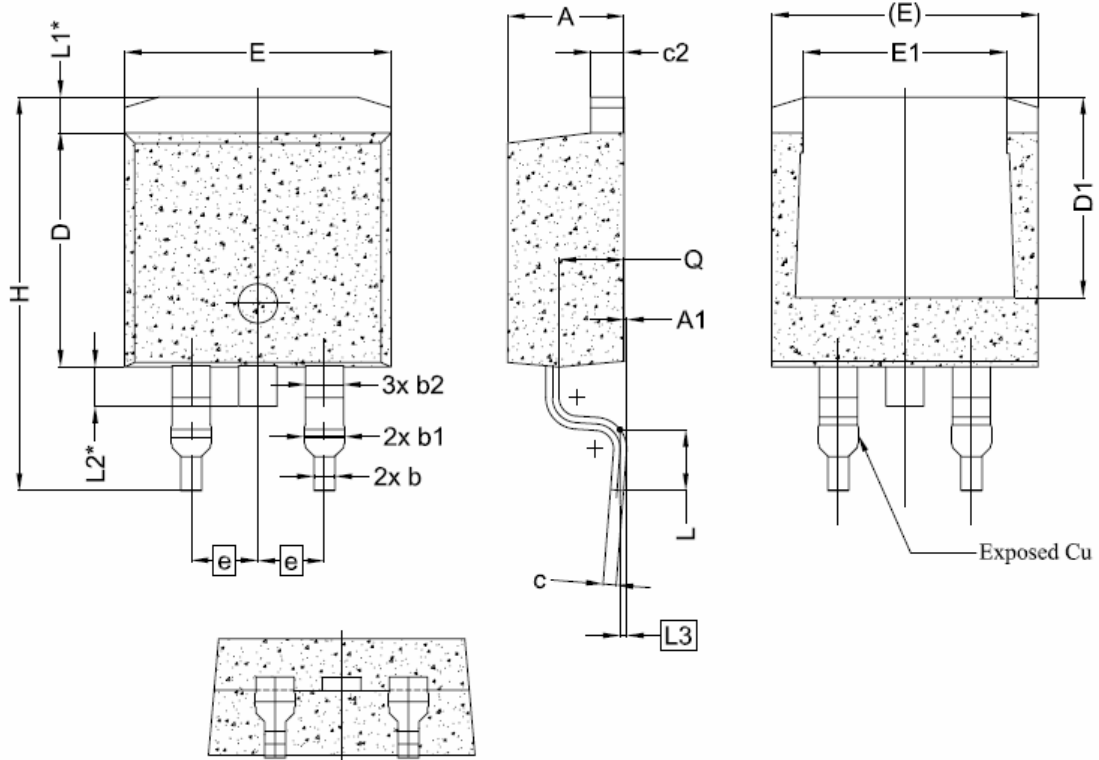
Figure 11 Normalized Maximum Transient Thermal Impedance

TO-220-3L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.9500	9.750	0.352	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.900	13.400	0.508	0.528
L1	2.850	3.250	0.112	0.128
V	6.900 REF.		0.276 REF.	
Φ	3.400	3.800	0.134	0.150

TO-263-2L Package Information



Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	4.24	4.44	4.64
A1	0.00	0.10	0.25
b	0.70	0.80	0.90
b1	1.20	1.55	1.75
b2	1.20	1.45	1.70
c	0.40	0.50	0.60
c2	1.15	1.27	1.40
D	8.82	8.92	9.02
D1	6.86	7.65	-
E	9.96	10.16	10.36
E1	6.89	7.77	7.89
e	2.54BSC		
H	14.61	15.00	15.88
L	1.78	2.32	2.79
L1	1.36 REF.		
L2	1.50 REF.		
L3	0.25 BSC		
Q	2.30	2.48	2.70

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