

## VCRR P-Channel Super Trench Power MOSFET

### Description

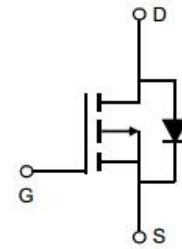
The VCRRP40PT15D uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(on)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

### General Features

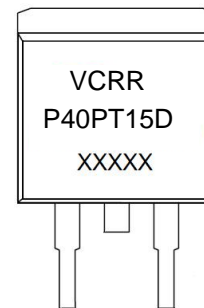
- $V_{DS} = -40V, I_D = -150A$   
 $R_{DS(on)} = 2.8m\Omega$  (typical) @  $V_{GS} = -10V$   
 $R_{DS(on)} = 3.8m\Omega$  (typical) @  $V_{GS} = -4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

### Application

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



Schematic Diagram



Marking and pin assignment



TO-263-2L top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VCRRP40PT15D		TO-263-2L	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	-150	A
Drain Current-Continuous( $T_C = 100^\circ\text{C}$ )	$I_D(100^\circ\text{C})$	-120	A
Pulsed Drain Current	$I_{DM}$	-600	A
Maximum Power Dissipation	$P_D$	250	W
Derating factor		1.67	W/°C
Single pulse avalanche energy <sup>(Note 1)</sup>	$E_{AS}$	1345	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	°C

## Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.6	$^{\circ}C/W$
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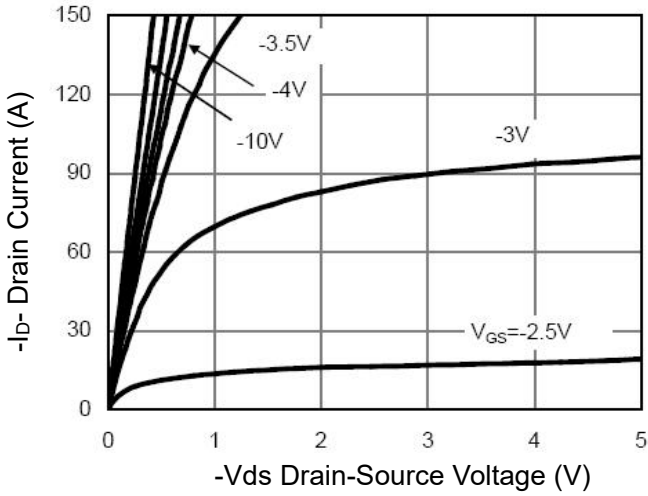
## Electrical Characteristics ( $T_c=25^{\circ}C$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-40		-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=-40V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.0	-1.6	-2.5	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=-10V, I_D=-75A$	-	2.8	3.4	m $\Omega$
		$V_{GS}=-4.5V, I_D=-75A$	-	3.8	4.6	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=-5V, I_D=-75A$	-	30	-	S
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=-20V, V_{GS}=0V,$ $F=1.0MHz$	-	8940	-	PF
Output Capacitance	$C_{oss}$		-	1900	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	45	-	PF
<b>Switching Characteristics</b> (Note 2)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-20V, I_D=-75A$ $V_{GS}=-10V, R_G=1.6\Omega$	-	18	-	nS
Turn-on Rise Time	$t_r$		-	13	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	90	-	nS
Turn-Off Fall Time	$t_f$		-	15	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=-20V, I_D=-75A,$ $V_{GS}=-10V$	-	104.4	-	nC
Gate-Source Charge	$Q_{gs}$		-	20.8	-	nC
Gate-Drain Charge	$Q_{gd}$		-	13.5	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=-75A$	-		-1.2	V
Diode Forward Current	$I_S$		-	-	-150	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}C, I_F = -75A$	-		35	nS
Reverse Recovery Charge	$Q_{rr}$	$di/dt = 100A/\mu s$	-		85	nC

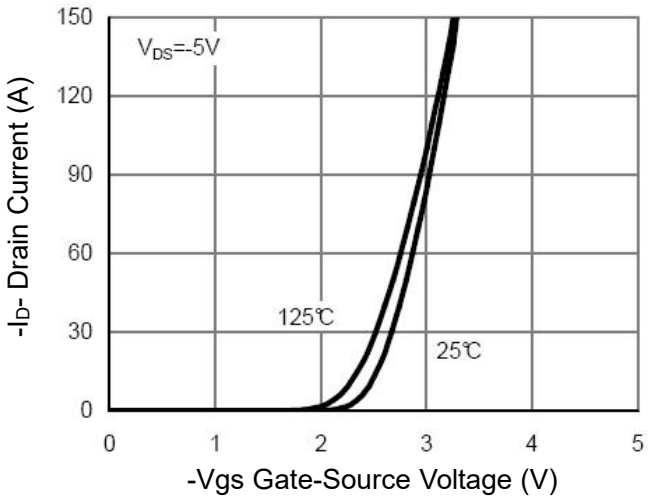
### Notes:

- EAS condition :  $T_J=25^{\circ}C, V_{DD}=-20V, V_G=-10V, L=0.5mH, R_G=25\Omega$
- Guaranteed by design, not subject to production
- These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of  $T_J(MAX)=175^{\circ}C$ . The SOA curve provides a single pulse rating.

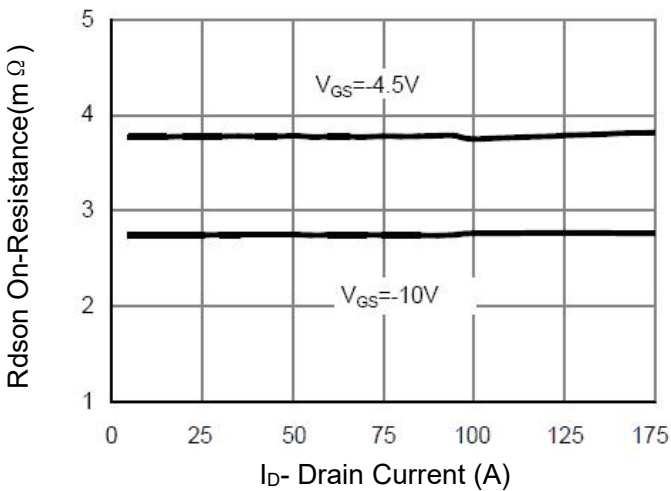
**Typical Electrical and Thermal Characteristics**



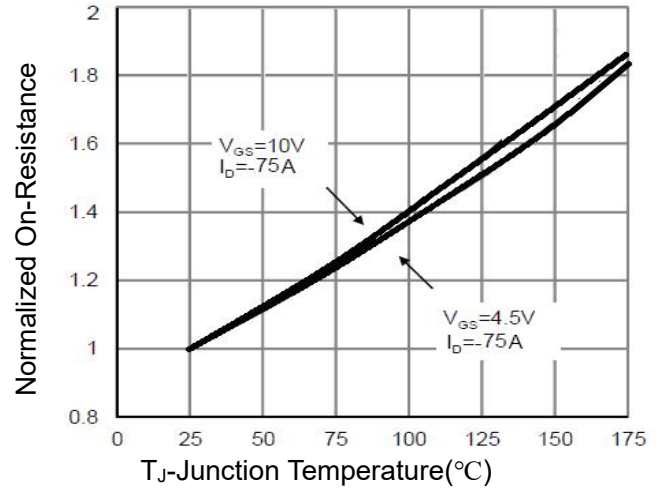
**Figure 1 Output Characteristics**



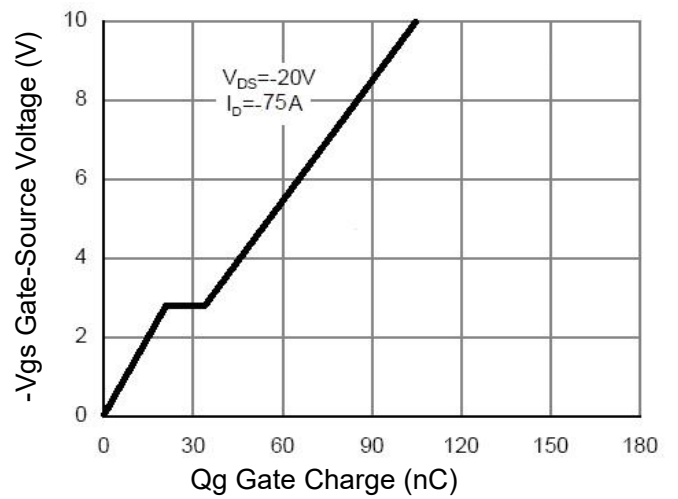
**Figure 2 Transfer Characteristics**



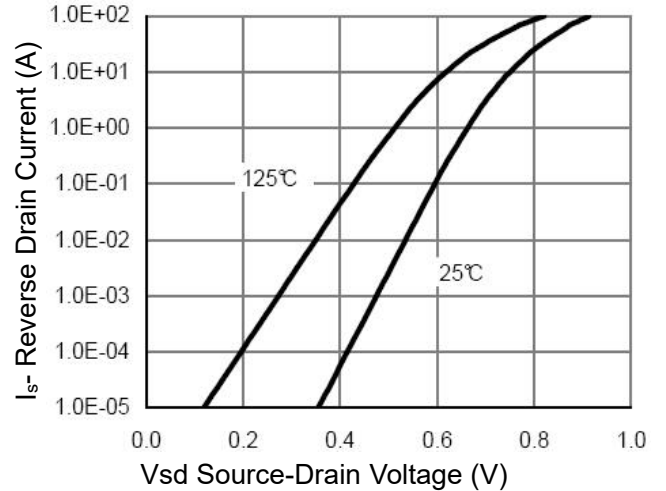
**Figure 3  $R_{Dson}$ - Drain Current**



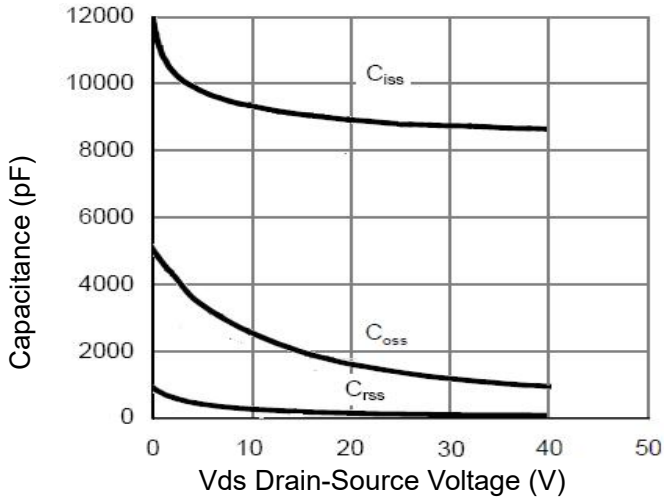
**Figure 4  $R_{Dson}$ -Junction Temperature**



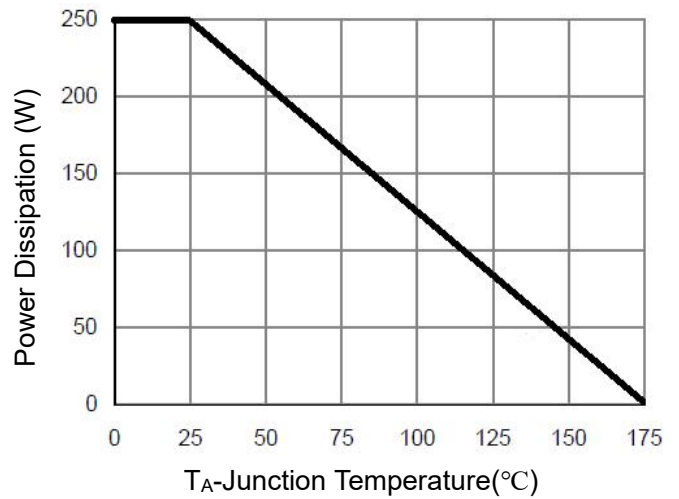
**Figure 5 Gate Charge**



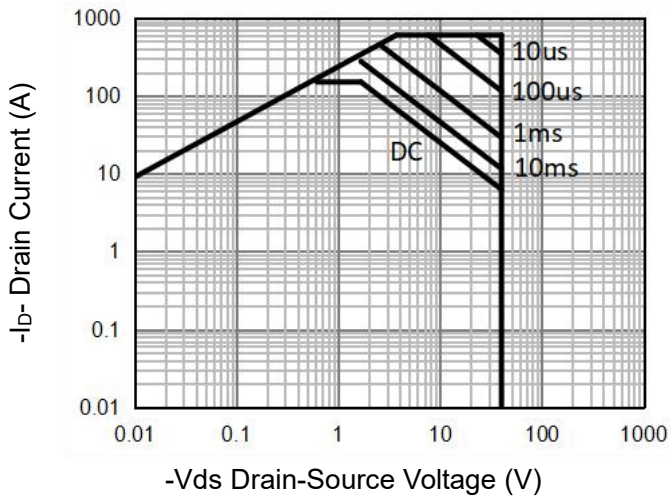
**Figure 6 Source- Drain Diode Forward**



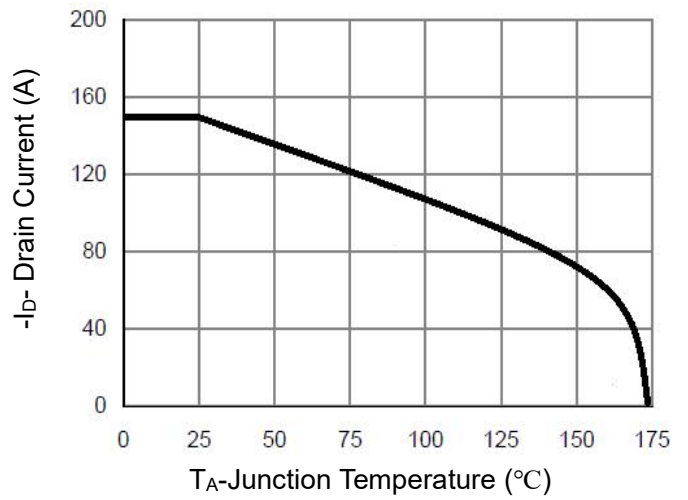
**Figure 7 Capacitance vs Vds**



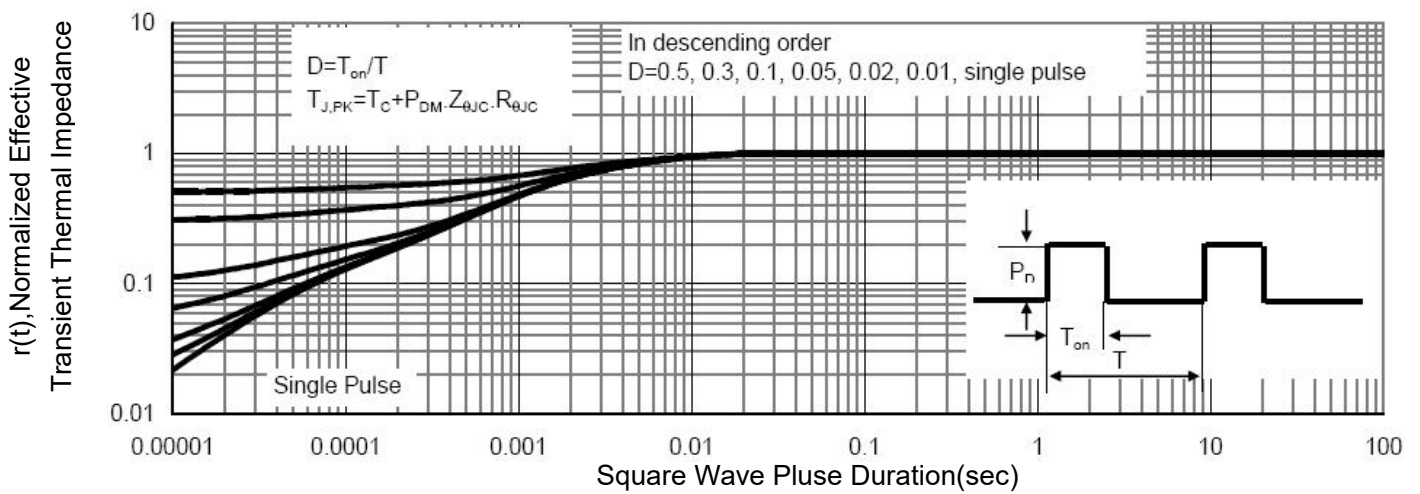
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area** (Note 3)

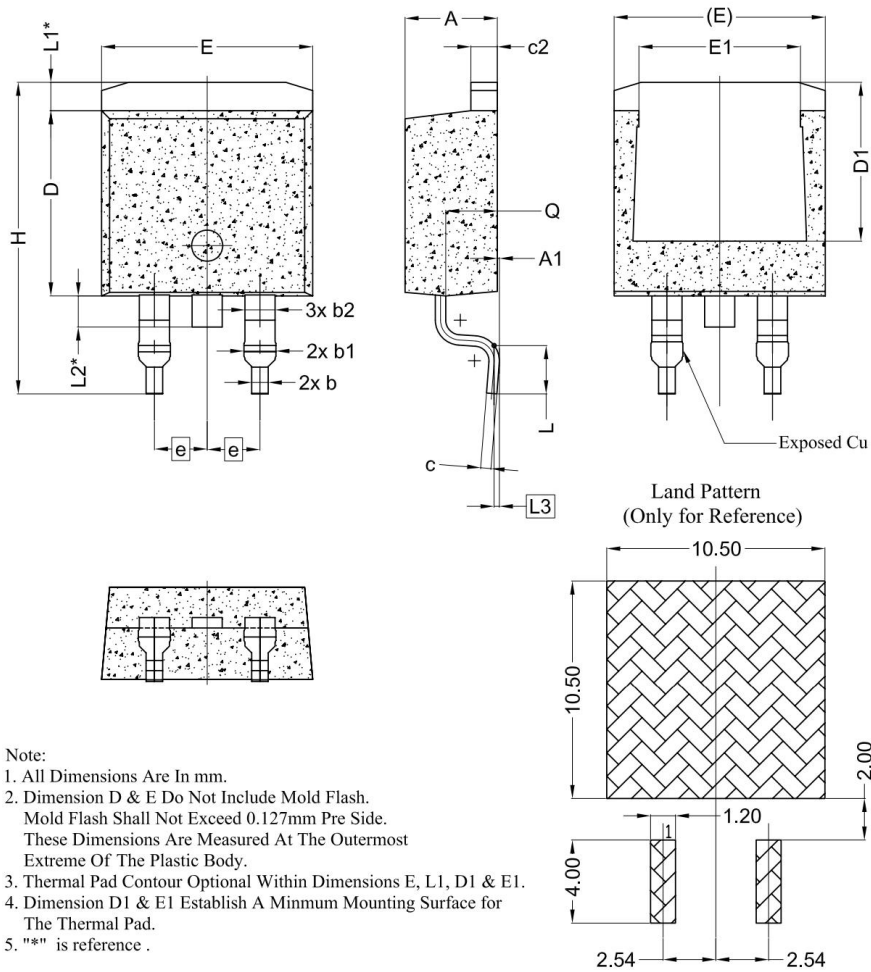


**Figure 10 Current De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## TO-263-2L Package Information



**Note:**

1. All Dimensions Are In mm.
2. Dimension D & E Do Not Include Mold Flash.  
Mold Flash Shall Not Exceed 0.127mm Pre Side.  
These Dimensions Are Measured At The Outermost Extreme Of The Plastic Body.
3. Thermal Pad Contour Optional Within Dimensions E, L1, D1 & E1.
4. Dimension D1 & E1 Establish A Minmum Mounting Surface for The Thermal Pad.
5. "\*" is reference .

SYMBOL	DIMENSIONS		
	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	2.54 BSC		
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

### **Attention**

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