

## IPW65R090CFD7-VB Datasheet

## N-Channel 650V (D-S) Super Junction Power MOSFET

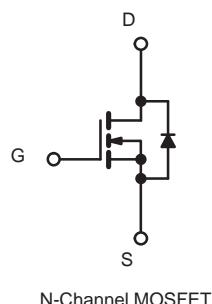
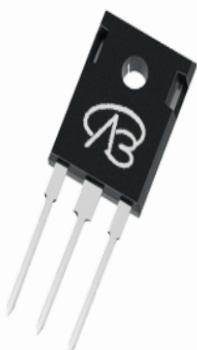
PRODUCT SUMMARY		
$V_{DS}$ (V) at $T_J$ max.		650
$R_{DS(on)}$ at 25 °C (Ω)	$V_{GS} = 10$ V	0.075

## FEATURES

- Low figure-of-merit (FOM)  $R_{on} \times Q_g$
- Low input capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- Ultra low gate charge ( $Q_g$ )
- Avalanche energy rated (UIS)



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Top View

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		$V_{DS}$	650	V
Gate-Source Voltage		$V_{GS}$	$\pm 30$	
Continuous Drain Current ( $T_J = 150$ °C)	$V_{GS}$ at 10 V	$I_D$	36	A
			22	
Pulsed Drain Current <sup>a</sup>		$I_{DM}$	108	
Linear Derating Factor			1.67	W/°C
Single Pulse Avalanche Energy <sup>b</sup>		$E_{AS}$	1400	mJ
Maximum Power Dissipation		$P_D$	210	W
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	-55 to +150	°C
Drain-Source Voltage Slope	$T_J = 125$ °C	$dV/dt$	50	V/ns
Reverse Diode $dV/dt$ <sup>d</sup>			15	
Soldering Recommendations (Peak Temperature) <sup>c</sup>	for 10 s		260	°C

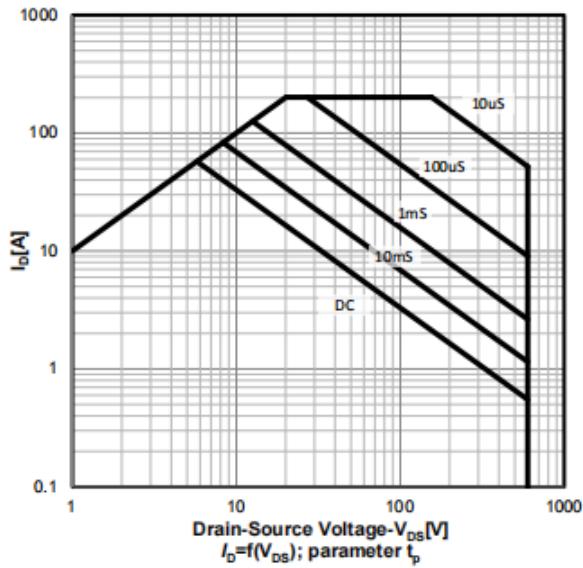
## Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 100$  V, starting  $T_J = 25$  °C,  $L = 30\text{mH}$ ,  $R_g = 25$  Ω,  $I_{AS} = 13$  A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$ ,  $dI/dt = 100$  A/μs, starting  $T_J = 25$  °C.

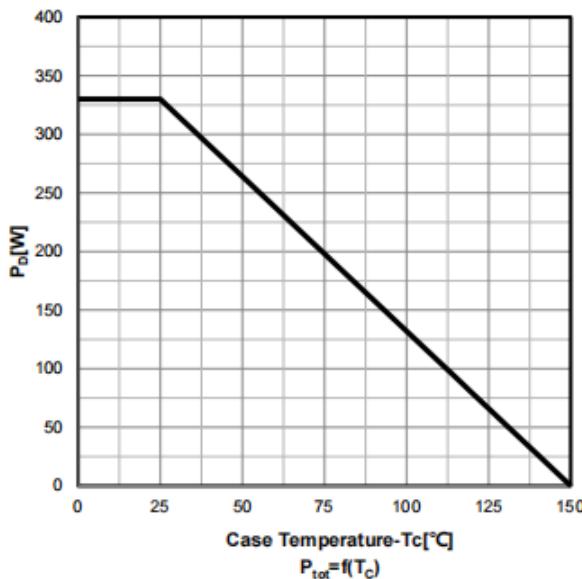
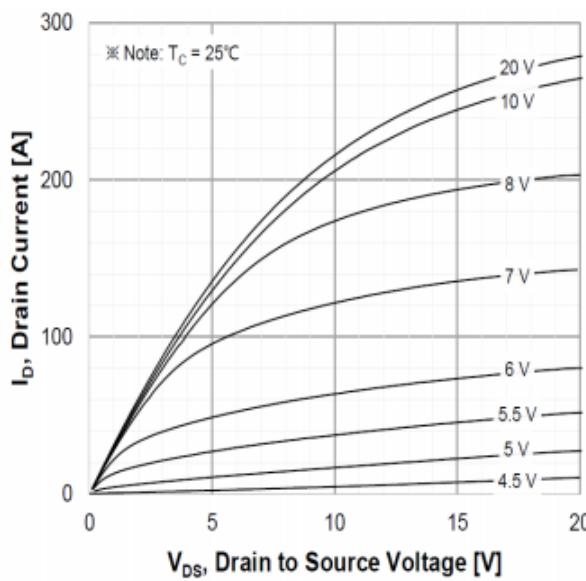
THERMAL RESISTANCE RATINGS							
PARAMETER	SYMBOL	TYP.	MAX.	UNIT			
Maximum Junction-to-Ambient	$R_{thJA}$	-	62	$^{\circ}\text{C}/\text{W}$			
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	0 . 3 8				
SPECIFICATIONS ( $T_J = 25^{\circ}\text{C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	
Static							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0 \text{ V}$ , $I_D = 1 \text{ mA}$		650	-	-	
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25^{\circ}\text{C}$ , $I_D = 1 \text{ mA}$		-	0.70	-	
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$		2.5	-	4.5	
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 20 \text{ V}$		-	-	$\pm 100$	
		$V_{GS} = \pm 30 \text{ V}$		-	-	$\pm 1$	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 650 \text{ V}$ , $V_{GS} = 0 \text{ V}$		-	-	1	
		$V_{DS} = 520 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $T_J = 125^{\circ}\text{C}$		-	-	100	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10 \text{ V}$	$I_D = 12 \text{ A}$	-	0.075	-	
Forward Transconductance	$g_{fs}$	$V_{DS} = 30 \text{ V}$ , $I_D = 12 \text{ A}$		-	5.6	-	
Dynamic							
Input Capacitance	$C_{iss}$	$V_{GS} = 0 \text{ V}$ , $V_{DS} = 100 \text{ V}$ , $f = 1 \text{ MHz}$		-	3900	-	
Output Capacitance	$C_{oss}$			-	330	-	
Reverse Transfer Capacitance	$C_{rss}$			-	4	-	
Effective Output Capacitance, Energy Related <sup>a</sup>	$C_{o(er)}$	$V_{DS} = 0 \text{ V}$ to $520 \text{ V}$ , $V_{GS} = 0 \text{ V}$		-	63	-	
Effective Output Capacitance, Time Related <sup>b</sup>	$C_{o(tr)}$			-	213	-	
Total Gate Charge	$Q_g$			-	60	-	
Gate-Source Charge	$Q_{gs}$	$V_{GS} = 10 \text{ V}$	$I_D = 20 \text{ A}$ , $V_{DS} = 520 \text{ V}$	-	39	-	
Gate-Drain Charge	$Q_{gd}$			-	4.7	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 520 \text{ V}$ , $I_D = 20 \text{ A}$ , $V_{GS} = 10 \text{ V}$ , $R_g = 9.1 \Omega$		-	18	25	
Rise Time	$t_r$			-	24	55	
Turn-Off Delay Time	$t_{d(off)}$			-	8.0	-	
Fall Time	$t_f$			-	1.2	-	
Gate Input Resistance	$R_g$	$f = 1 \text{ MHz}$ , open drain		-	0.8	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode		-	-	36	
Pulsed Diode Forward Current	$I_{SM}$			-	-	108	
Diode Forward Voltage	$V_{SD}$	$T_J = 25^{\circ}\text{C}$ , $I_S = 8 \text{ A}$ , $V_{GS} = 0 \text{ V}$		-	-	1.5	
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}\text{C}$ , $I_F = I_S = 8 \text{ A}$ , $dl/dt = 100 \text{ A}/\mu\text{s}$ , $V_R = 400 \text{ V}$		-	520	-	
Reverse Recovery Charge	$Q_{rr}$			-	5.8	-	
Reverse Recovery Current	$I_{RRM}$			-	4.5	-	

**Notes**

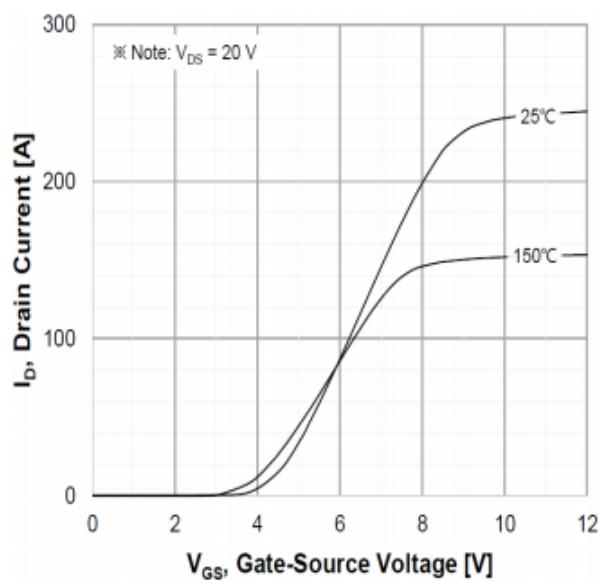
a.  $C_{oss(er)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$ .  
 b.  $C_{oss(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$ .

Safe operating area  $T_C=25\text{ }^\circ\text{C}$   
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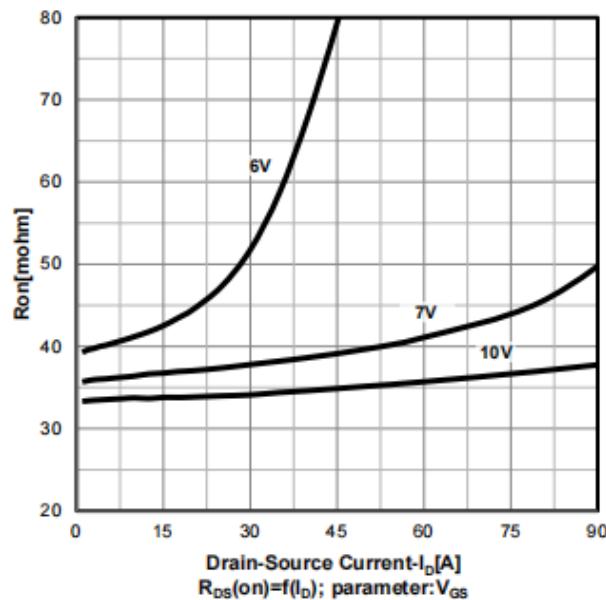
Power dissipation

Typ. output characteristics  $T_J=25\text{ }^\circ\text{C}$ 

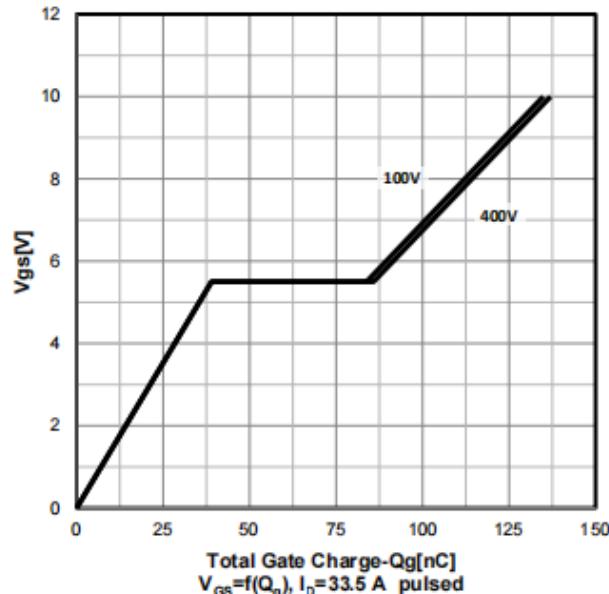
Transfer characteristics



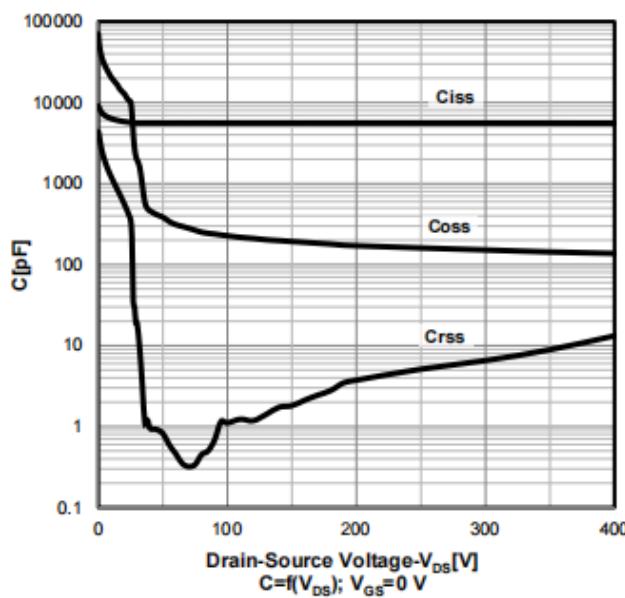
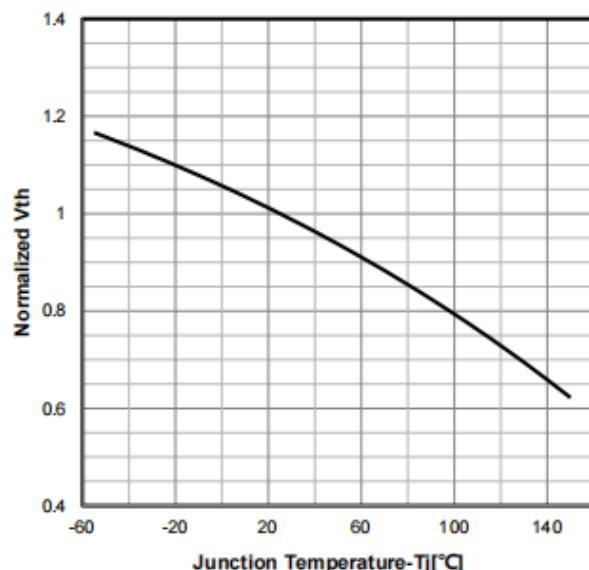
Typ. drain-source on-state resistance



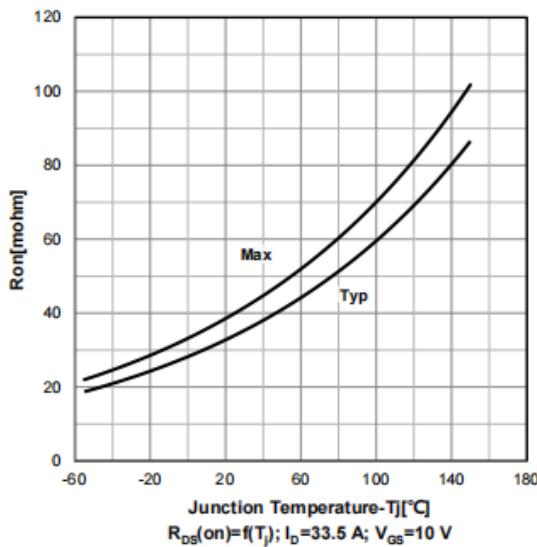
Typ. gate charge characteristics



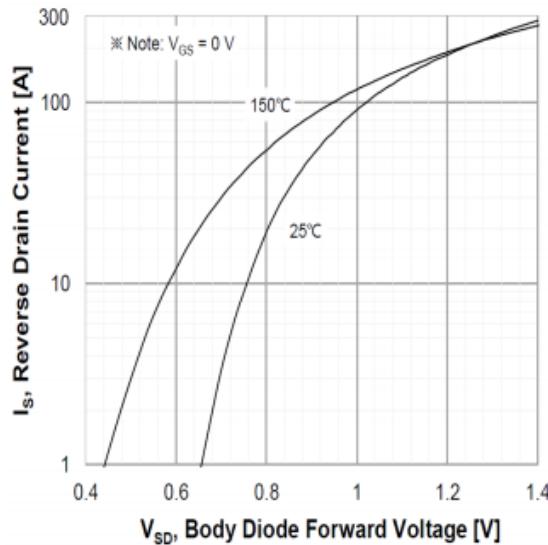
Typ. capacitances

Normalized  $V_{GS(th)}$  characteristics

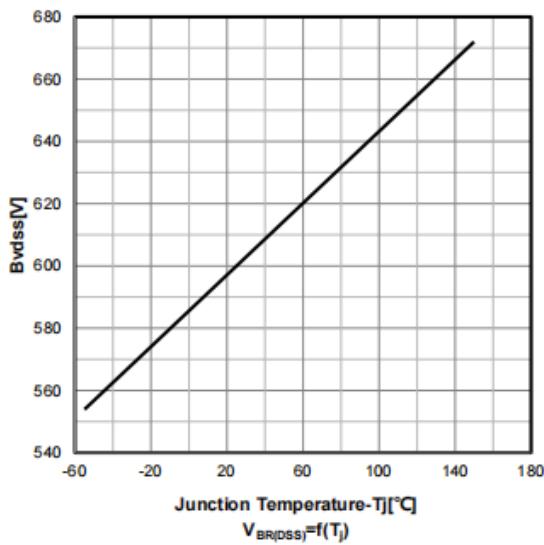
On-resistance vs temperature



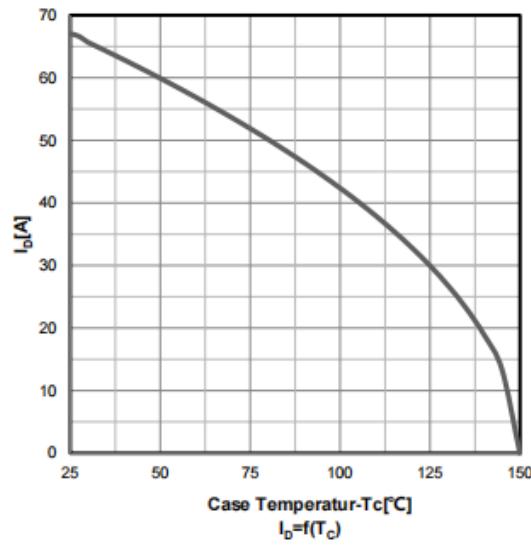
Forward characteristics of reverse diode



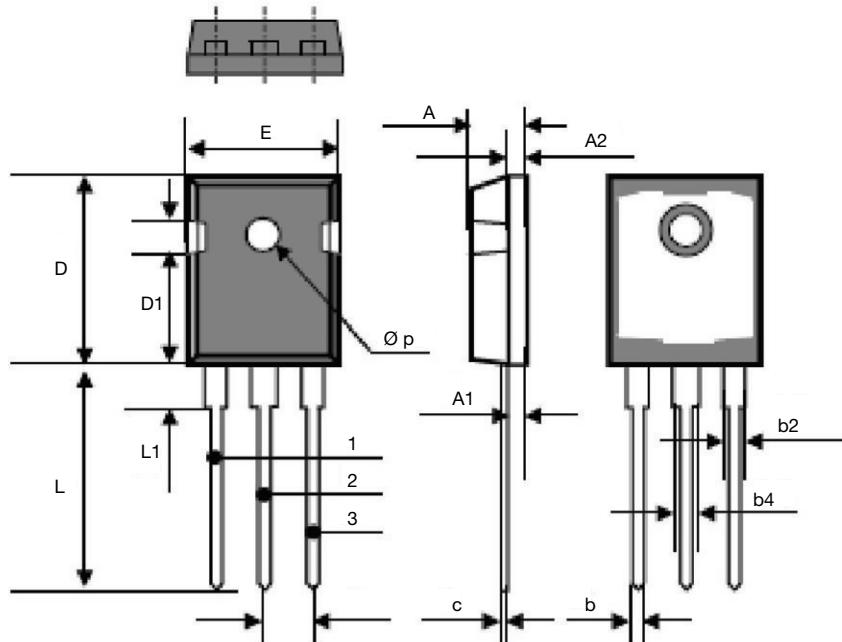
Drain-source breakdown voltage



Drain current vs temperature



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DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.70	5.31	0.185	0.209
A1	2.21	2.59	0.087	0.102
A2	1.50	2.49	0.059	0.098
b	0.99	1.40	0.039	0.055
b2	1.65	2.41	0.065	0.095
b4	2.59	3.43	0.102	0.135
c	0.61 BSC		0.024 BSC	
D	20.80	21.46	0.819	0.845
D1	3.68	5.49	0.145	0.216
(e)	5.46 BSC		0.215 BSC	
E	15.49	16.26	0.610	0.640
L	19.81	20.32	0.780	0.800
L1	4.06	4.50	0.160	0.177
Ø p	3.51	3.66	0.138	0.144

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