

IPA70R360P7S-VB Datasheet

N-Channel 700V (D-S) Super Junction Power MOSFET

PRODUCT SUMMARY	
V_{DS} (V) at T_J max.	700
$R_{DS(on)}$ at 25 °C (Ω)	$V_{GS} = 10\text{ V}$ 0.34
Q_g max. (nC)	96
Q_{gs} (nC)	11
Q_{gd} (nC)	21
Configuration	Single

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)

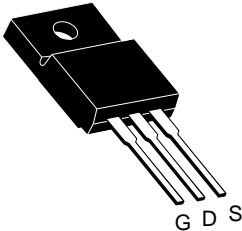
APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
 - High-intensity discharge (HID)
 - Fluorescent ballast lighting
- Industrial
 - Welding
 - Induction heating
 - Motor drives
 - Battery chargers
 - Renewable energy
 - Solar (PV inverters)

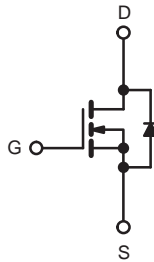


Available
RoHS*
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HALOGEN
FREE
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TO-220 FULLPAK



Top View




N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted)				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	V_{DS}	700	V	
Gate-Source Voltage	V_{GS}	± 30		
Continuous Drain Current ($T_J = 150\text{ }^\circ\text{C}$)	V_{GS} at 10 V	$T_C = 25\text{ }^\circ\text{C}$	15	A
		$T_C = 100\text{ }^\circ\text{C}$	10	
Pulsed Drain Current ^a	I_{DM}	38		
Linear Derating Factor		1.4	W/ $^\circ\text{C}$	
Single Pulse Avalanche Energy ^b	E_{AS}	286	mJ	
Maximum Power Dissipation	P_D	34	W	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$	
Drain-Source Voltage Slope	dV/dt	$T_J = 125\text{ }^\circ\text{C}$	37	V/ns
Reverse Diode dV/dt ^d		23		
Soldering Recommendations (Peak Temperature) ^c	for 10 s	300	$^\circ\text{C}$	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50\text{ V}$, starting $T_J = 25\text{ }^\circ\text{C}$, $L = 28.2\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 4.5\text{ A}$.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100\text{ A}/\mu\text{s}$, starting $T_J = 25\text{ }^\circ\text{C}$.

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	62	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.7	

SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		700	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}, I_D = 1\text{ mA}$		-	0.75	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2	-	4	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$		-	-	± 100	nA
		$V_{GS} = \pm 30\text{ V}$		-	-	± 1	μA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 700\text{ V}, V_{GS} = 0\text{ V}$		-	-	1	μA
		$V_{DS} = 520\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	10	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 8\text{ A}$	-	0.34	-	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 30\text{ V}, I_D = 8\text{ A}$		-	5.6	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 100\text{ V}, f = 1\text{ MHz}$		-	1640	-	pF
Output Capacitance	C_{oss}			-	80	-	
Reverse Transfer Capacitance	C_{rss}			-	4	-	
Effective Output Capacitance, Energy Related ^a	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 520\text{ V}, V_{GS} = 0\text{ V}$		-	63	-	
Effective Output Capacitance, Time Related ^b	$C_{o(tr)}$			-	213	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 8\text{ A}, V_{DS} = 520\text{ V}$	-	48	96	nC
Gate-Source Charge	Q_{gs}			-	11	-	
Gate-Drain Charge	Q_{gd}			-	21	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 520\text{ V}, I_D = 8\text{ A}, V_{GS} = 10\text{ V}, R_g = 9.1\text{ }\Omega$		-	18	36	ns
Rise Time	t_r			-	24	48	
Turn-Off Delay Time	$t_{d(off)}$			-	48	96	
Fall Time	t_f			-	25	50	
Gate Input Resistance	R_g	$f = 1\text{ MHz}, \text{open drain}$		-	0.8	-	Ω
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	15	A
Pulsed Diode Forward Current	I_{SM}			-	-	38	
Diode Forward Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 8\text{ A}, V_{GS} = 0\text{ V}$		-	-	1.2	V
Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 8\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_R = 400\text{ V}$		-	325	-	ns
Reverse Recovery Charge	Q_{rr}			-	4.6	-	μC
Reverse Recovery Current	I_{RRM}			-	20	-	A

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} .

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Fig. 1 - Typical Output Characteristics

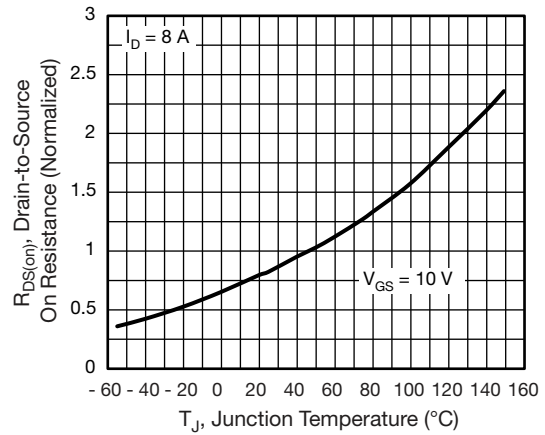


Fig. 4 - Normalized On-Resistance vs. Temperature

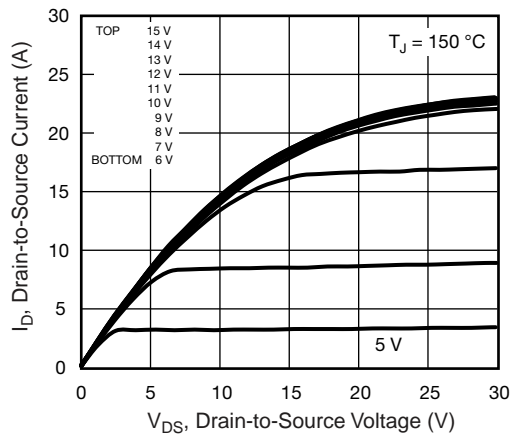


Fig. 2 - Typical Output Characteristics

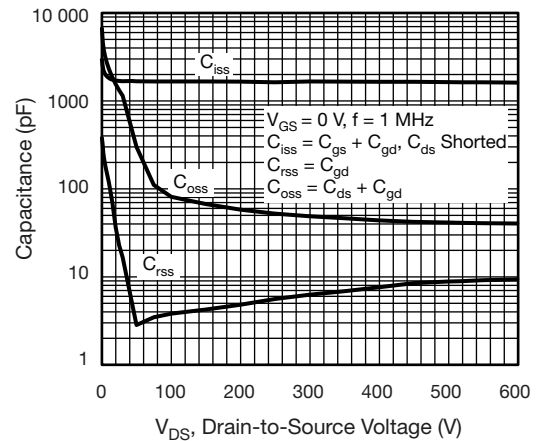


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

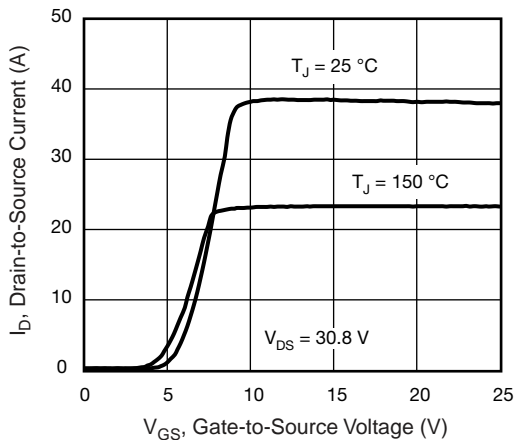


Fig. 3 - Typical Transfer Characteristics

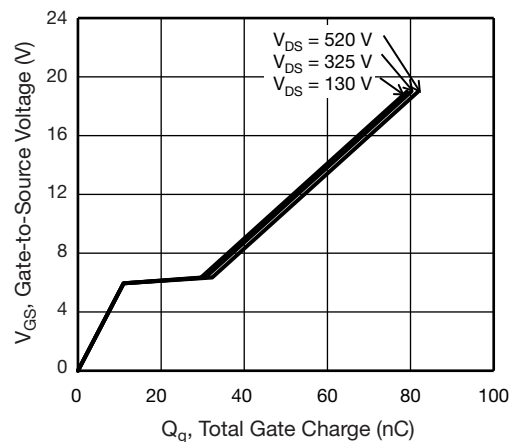


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage



Fig. 7 - Typical Source-Drain Diode Forward Voltage

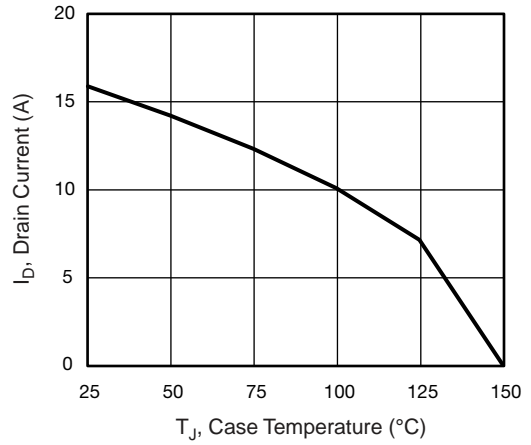


Fig. 9 - Maximum Drain Current vs. Case Temperature

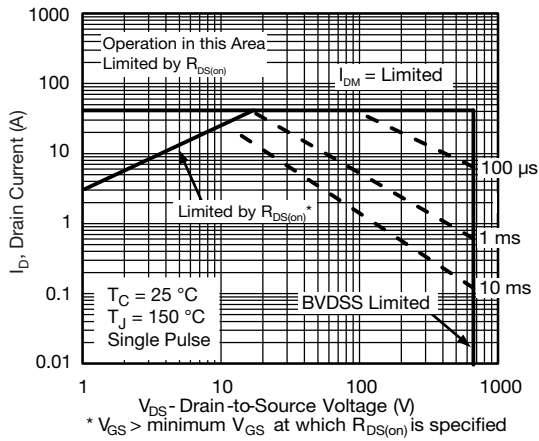


Fig. 8 - Maximum Safe Operating Area



Fig. 10 - Temperature vs. Drain-to-Source Voltage



Fig. 11 - Normalized Thermal Transient Impedance, Junction-to-Case

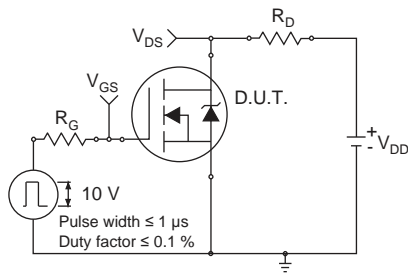


Fig. 12 - Switching Time Test Circuit

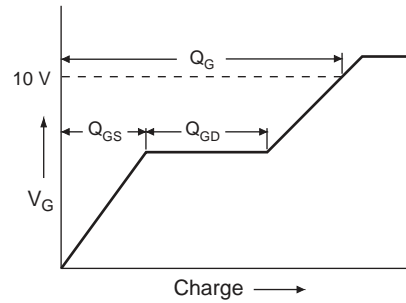


Fig. 16 - Basic Gate Charge Waveform

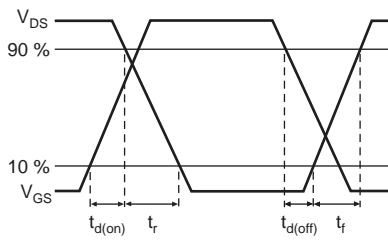


Fig. 13 - Switching Time Waveforms

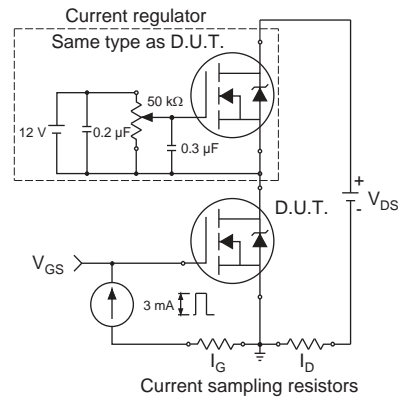


Fig. 17 - Gate Charge Test Circuit

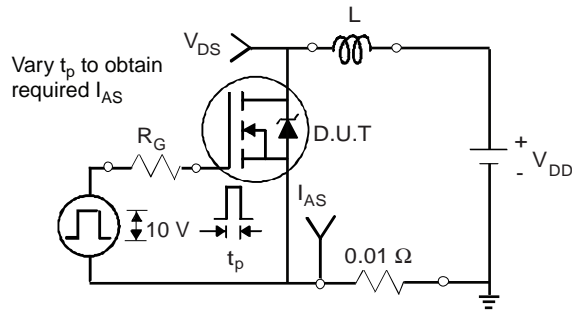
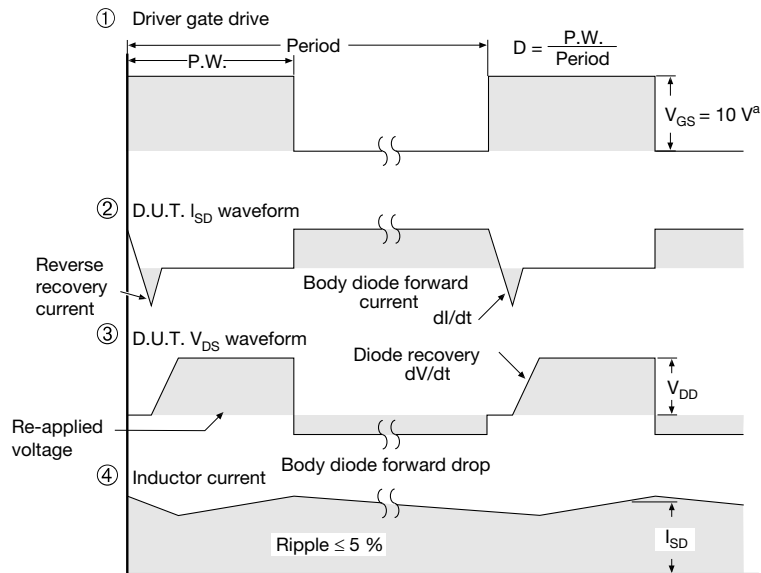
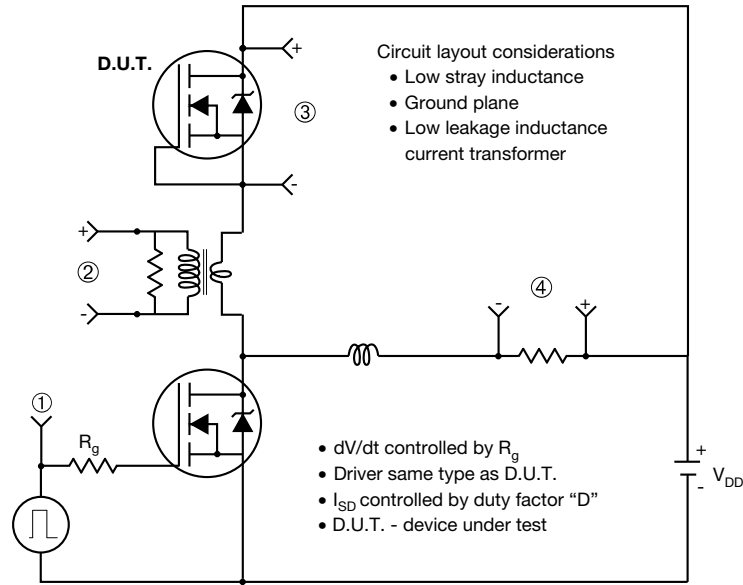


Fig. 14 - Unclamped Inductive Test Circuit



Fig. 15 - Unclamped Inductive Waveforms

Peak Diode Recovery dV/dt Test Circuit

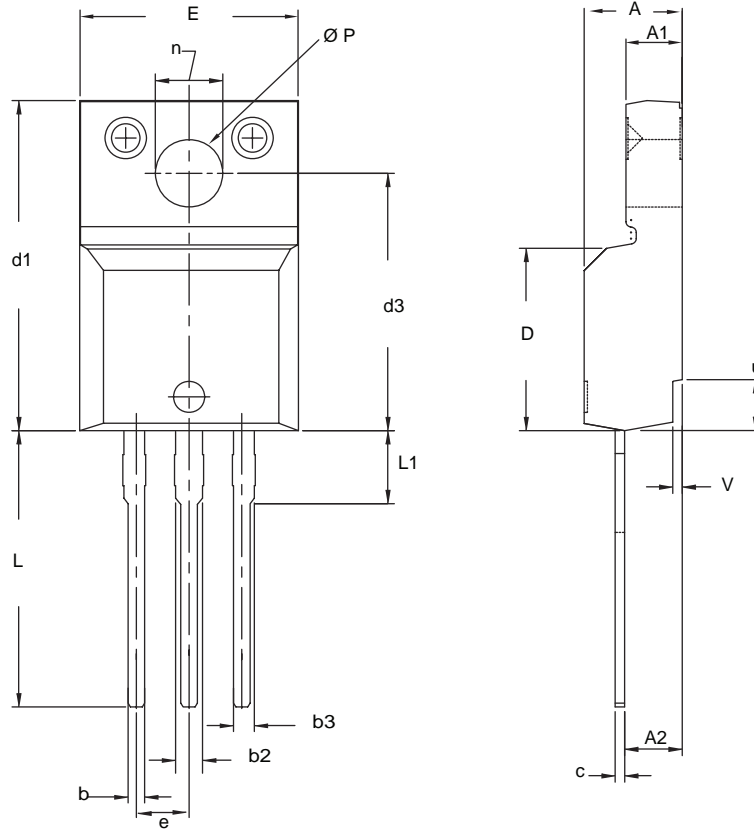


Note

a. $V_{GS} = 5 V$ for logic level devices

Fig. 18 - For N-Channel

TO-220 FULLPAK (HIGH VOLTAGE)



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.570	4.830	0.180	0.190
A1	2.570	2.830	0.101	0.111
A2	2.510	2.850	0.099	0.112
b	0.622	0.890	0.024	0.035
b2	1.229	1.400	0.048	0.055
b3	1.229	1.400	0.048	0.055
c	0.440	0.629	0.017	0.025
D	8.650	9.800	0.341	0.386
d1	15.88	16.120	0.622	0.635
d3	12.300	12.920	0.484	0.509
E	10.360	10.630	0.408	0.419
e	2.54 BSC		0.100 BSC	
L	13.200	13.730	0.520	0.541
L1	3.100	3.500	0.122	0.138
n	6.050	6.150	0.238	0.242
Ø P	3.050	3.450	0.120	0.136
u	2.400	2.500	0.094	0.098
v	0.400	0.500	0.016	0.020

ECN: X09-0126-Rev. B, 26-Oct-09
DWG: 5972

Notes

1. To be used only for process drawing.
2. These dimensions apply to all TO-220, FULLPAK leadframe versions 3 leads.
3. All critical dimensions should C meet $C_{pk} > 1.33$.
4. All dimensions include burrs and plating thickness.
5. No chipping or package damage.

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