

IPD60R600E6-VB Datasheet

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

PRODUCT SUMMARY		
V <sub>DS</sub> (V) at T <sub>J</sub> max.	650	
R <sub>DS(on)</sub> at 25 °C (Ω)	V <sub>GS</sub> = 10 V	0.50
Q <sub>g</sub> max. (nC)	25	
Q <sub>gs</sub> (nC)	2.0	
Q <sub>gd</sub> (nC)	2.7	
Configuration	Single	

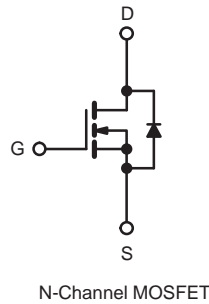
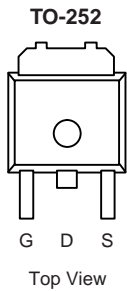
FEATURES

- Low figure-of-merit (FOM) R<sub>on</sub> × Q<sub>g</sub>
- Low input capacitance (C<sub>iss</sub>)
- Reduced switching and conduction losses
- Ultra low gate charge (Q<sub>g</sub>)
- 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

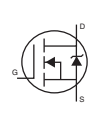


ABSOLUTE MAXIMUM RATINGS (T <sub>C</sub> = 25 °C, unless otherwise noted)				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	V <sub>DS</sub>	650	V	
Gate-Source Voltage	V <sub>GS</sub>	± 30		
Continuous Drain Current (T <sub>J</sub> = 150 °C)	V <sub>GS</sub> at 10 V	T <sub>C</sub> = 25 °C	9	A
		T <sub>C</sub> = 100 °C	6	
Pulsed Drain Current <sup>a</sup>	I <sub>DM</sub>	21		
Linear Derating Factor		1.5	W/°C	
Single Pulse Avalanche Energy <sup>b</sup>	E <sub>AS</sub>	86	mJ	
Maximum Power Dissipation	P <sub>D</sub>	83	W	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C	
Drain-Source Voltage Slope	dV/dt	T <sub>J</sub> = 125 °C	50	V/ns
Reverse Diode dV/dt <sup>d</sup>		4.5		
Soldering Recommendations (Peak Temperature) <sup>c</sup>	for 10 s	300	°C	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- V<sub>DD</sub> = 50 V, starting T<sub>J</sub> = 25 °C, L = 28.2 mH, R<sub>g</sub> = 25 Ω, I<sub>AS</sub> = 3.5 A.
- 1.6 mm from case.
- I<sub>SD</sub> ≤ I<sub>D</sub>, dI/dt = 100 A/μs, starting T<sub>J</sub> = 25 °C.

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	63	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	0.6	

SPECIFICATIONS ( $T_J = 25\text{ °C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		650	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ °C}$ , $I_D = 1\text{ mA}$		-	0.65	-	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	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100$	nA
		$V_{GS} = \pm 30\text{ V}$		-	-	$\pm 1$	$\mu\text{A}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$		-	-	1	$\mu\text{A}$
		$V_{DS} = 520\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ °C}$		-	-	10	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 4\text{ A}$	-	0.50	-	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 30\text{ V}, I_D = 4\text{ A}$		-	16	-	S
<b>Dynamic</b>							
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 100\text{ V}, f = 1\text{ MHz}$		-	360	-	pF
Output Capacitance	$C_{oss}$			-	25	-	
Reverse Transfer Capacitance	$C_{rss}$			-	12	-	
Effective Output Capacitance, Energy Related <sup>a</sup>	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 520\text{ V}, V_{GS} = 0\text{ V}$		-	45	-	
Effective Output Capacitance, Time Related <sup>b</sup>	$C_{o(tr)}$			-	62	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}$	$I_D = 4\text{ A}, V_{DS} = 520\text{ V}$	-	25	-	nC
Gate-Source Charge	$Q_{gs}$			-	2.0	-	
Gate-Drain Charge	$Q_{gd}$			-	2.7	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 520\text{ V}, I_D = 4\text{ A}, V_{GS} = 10\text{ V}, R_g = 9.1\text{ }\Omega$		-	25	-	ns
Rise Time	$t_r$			-	55	-	
Turn-Off Delay Time	$t_{d(off)}$			-	70	-	
Fall Time	$t_f$			-	40	-	
Gate Input Resistance	$R_g$	$f = 1\text{ MHz}, \text{open drain}$		-	3.5	-	$\Omega$
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	7	A
Pulsed Diode Forward Current	$I_{SM}$			-	-	18	
Diode Forward Voltage	$V_{SD}$	$T_J = 25\text{ °C}, I_S = 4\text{ A}, V_{GS} = 0\text{ V}$		-	-	1.5	V
Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ °C}, I_F = I_S = 4\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, V_R = 400\text{ V}$		-	190	-	ns
Reverse Recovery Charge	$Q_{rr}$			-	2.3	-	$\mu\text{C}$
Reverse Recovery Current	$I_{RRM}$			-	10	-	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

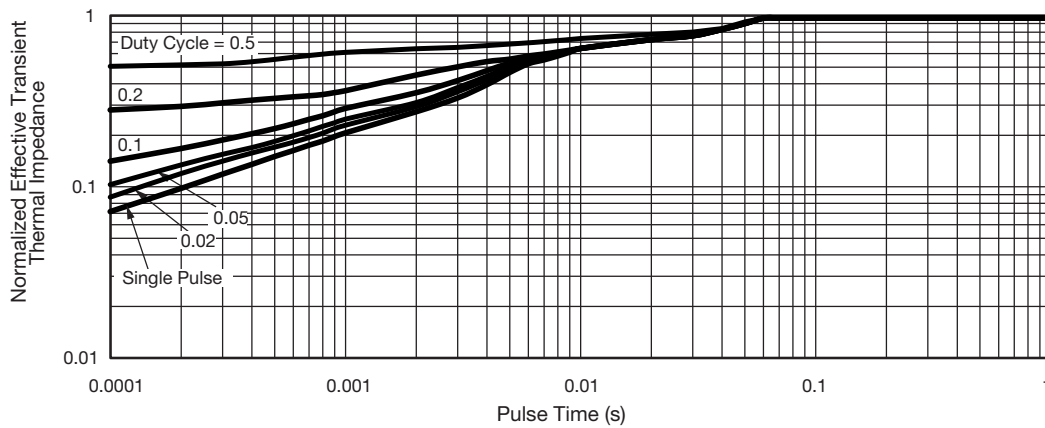


Fig. 11 - Normalized Thermal Transient Impedance, Junction-to-Case



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**

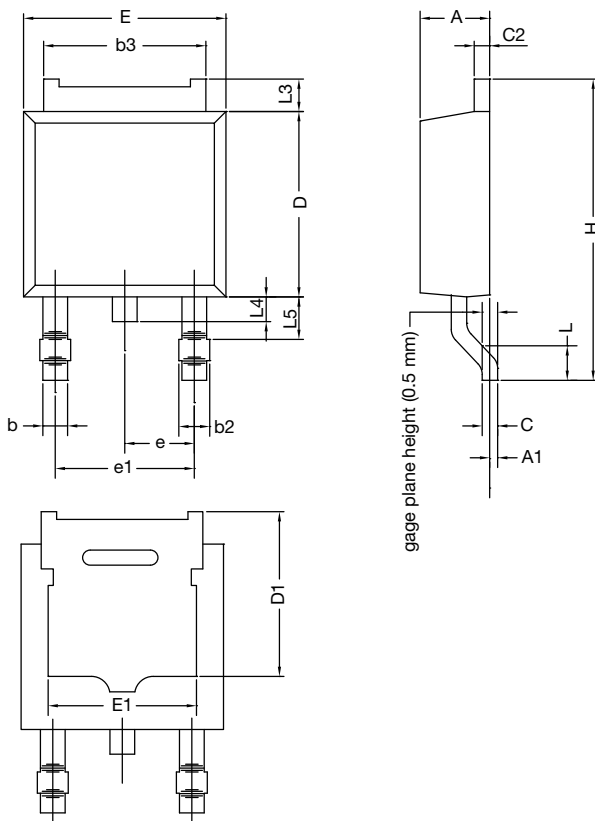


**Note**

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

**Fig. 18 - For N-Channel**

## TO-252AA CASE OUTLINE



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.38	0.086	0.094
A1	-	0.127	-	0.005
b	0.64	0.88	0.025	0.035
b2	0.76	1.14	0.030	0.045
b3	4.95	5.46	0.195	0.215
C	0.46	0.61	0.018	0.024
C2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	5.21	-	0.205	-
E	6.35	6.73	0.250	0.265
E1	4.32	-	0.170	-
H	9.40	10.41	0.370	0.410
e	2.28 BSC		0.090 BSC	
e1	4.56 BSC		0.180 BSC	
L	1.40	1.78	0.055	0.070
L3	0.89	1.27	0.035	0.050
L4	-	1.02	-	0.040
L5	1.14	1.52	0.045	0.060
ECN: X12-0247-Rev. M, 24-Dec-12 DWG: 5347				

**Note**

- Dimension L3 is for reference only.

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