

## Description

The PNMDP650V4 is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in switching power supplies and adaptors.

### MOSFET Product Summary

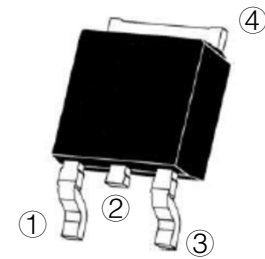
$V_{DS}(V)$	$R_{DS(on)}(\Omega)$	$I_D(A)$
650	2.6 @ $V_{GS} = 10V$	4.0

## Feature

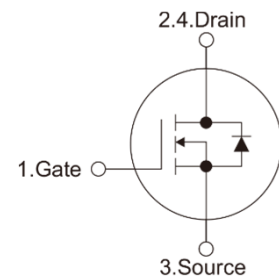
- Fast switching capability
- Avalanche energy tested
- Improved dv/dt capability, high ruggedness

## Mechanical data

- Case: TO-252
- Approx. Weight: 0.315g (0.011oz)
- Lead free finish, RoHS compliant
- Case Material: "Green" molding compound, UL flammability classification 94V-0, "Halogen-free".



**TO-252 (Top View)**



**Schematic diagram**

## Absolute maximum rating@25°C

Rating	Symbol	Value	Units
Drain-Source Voltage	$V_{DS}$	650	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	V
Drain Current-Continuous	$I_D$	$T_C=25^\circ C$	4.0
		$T_C=100^\circ C$	2.5
Pulsed Drain Current <sup>(2)</sup>	$I_{DM}$	16	A
Avalanche Energy, Single Pulsed <sup>(3)</sup>	$E_{AS}$	173	mJ
Peak Diode Recovery dv/dt <sup>(4)</sup>	dv/dt	2.1	V/ns
Maximum Power Dissipation	$P_D$	54	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 ~ +150	°C
Junction-to-Ambient	$R_{\theta JA}$	63	°C/W
Junction to Case	$R_{\theta JC}$	2.31	°C/W

## Electrical characteristics per line@25°C (unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	650	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 650V, V_{GS} = 0V$	-	-	1.0	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS} = \pm 30V, V_{DS} = 0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0	-	4.0	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 2.0A$	-	-	2.6	$\Omega$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 25V, V_{GS} = 0V,$ $f = 1.0MHz$	-	560	-	pF
Output Capacitance	$C_{oss}$		-	55	-	
Reverse Transfer Capacitance	$C_{rss}$		-	10	-	
<b>Switching Characteristics</b>						
Turn-on Delay Time <sup>5)</sup>	$t_{d(on)}$	$V_{DS} = 100V, V_{GS} = 10V,$ $I_D = 4.0A, R_G = 25\Omega^{5,6)}$	-	7.0	-	ns
Turn-on Rise Time	$t_r$		-	16	-	
Turn-Off Delay Time	$t_{d(off)}$		-	36	-	
Turn-Off Fall Time	$t_f$		-	22	-	
Total Gate Charge <sup>5)</sup>	$Q_g$	$V_{DS} = 520V, V_{GS} = 10V,$ $I_D = 4.0A, I_G = 1mA^{5,6)}$	-	13	-	nC
Gate-Source Charge	$Q_{gs}$		-	4.0	-	
Gate-Drain Charge	$Q_{gd}$		-	2.2	-	
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage <sup>5)</sup>	$V_{SD}$	$V_{GS} = 0V, I_S = 4.0A$	-	-	1.4	V
Diode Continuous Current	$I_S$		-	-	4.0	A
Diode Pulsed Current	$I_{SM}$		-	-	16	A
Reverse Recovery Time <sup>5)</sup>	$t_{rr}$	$V_{GS} = 0V, I_S = 4.0A,$ $di/dt = 100A/\mu s$	-	250	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	4.5	-	$\mu C$

## Notes:

1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Repetitive Rating: Pulse width limited by maximum junction temperature.
3.  $L = 30mH, I_{AS} = 3.4A, V_{DD} = 50V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$
4.  $I_{SD} \leq 4A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ C$
5. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .
6. Essentially independent of operating temperature.

## Typical Characteristics

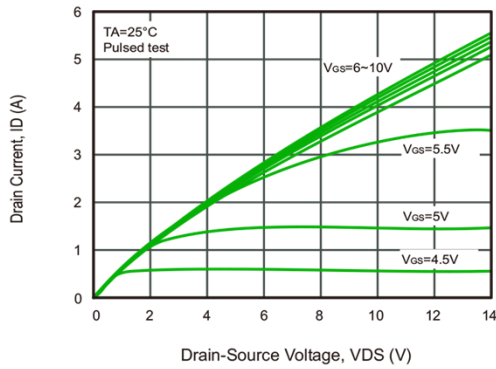


Fig.1 Drain Current vs. Gate-Source Voltage

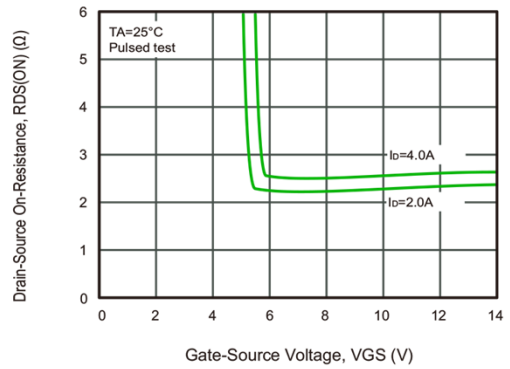


Fig.2 Drain-Source On-Resistance vs. Gate-Source Voltage

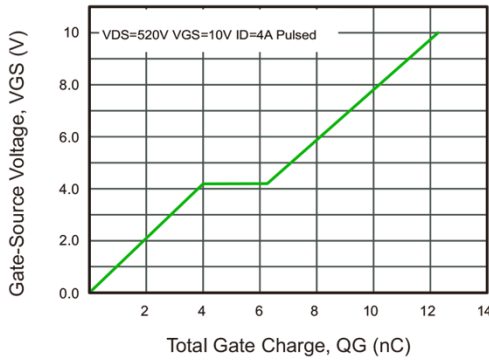


Fig.3 Gate Charge Characteristics

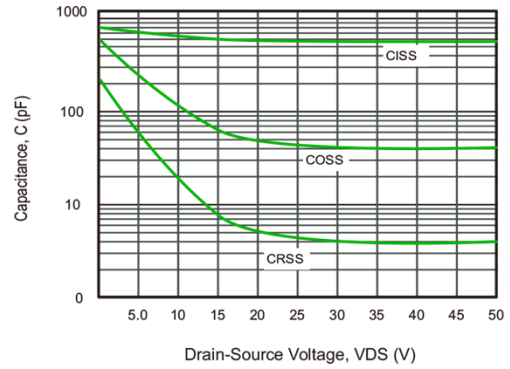


Fig.4 Capacitance Characteristics

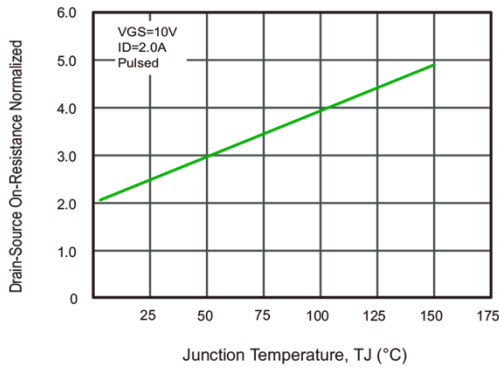


Fig.5 Drain-Source On-Resistance vs. Junction Temperature

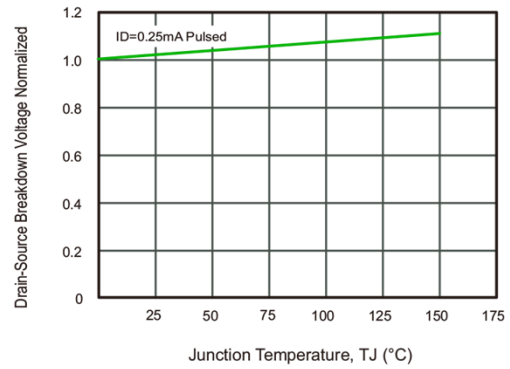


Fig.6 Breakdown Voltage vs. Junction Temperature

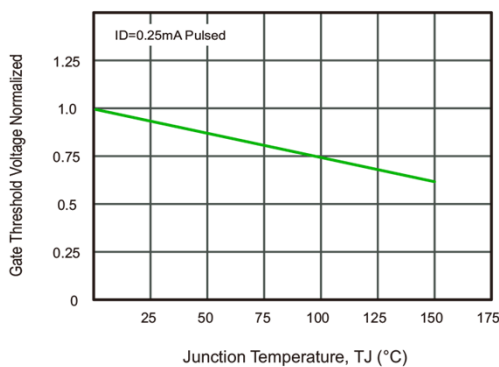


Fig.7 Gate Threshold Voltage vs. Junction Temperature

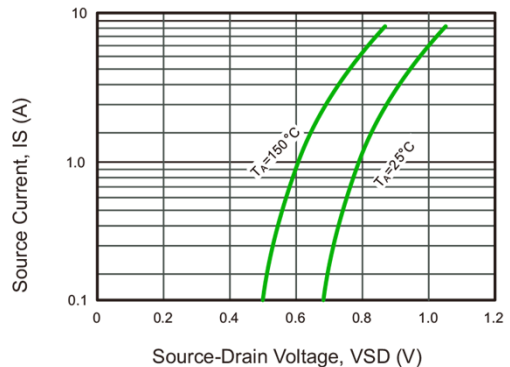


Fig.8 Source Current vs. Source-Drain Voltage

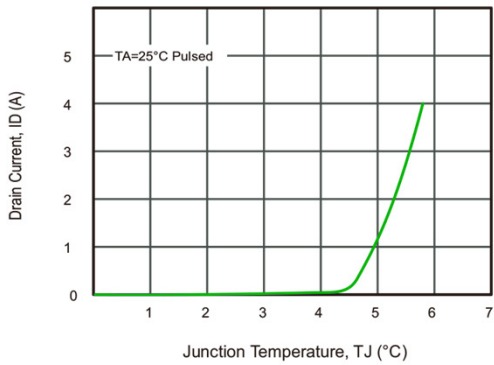


Fig.9 Drain Current vs. Gate-Source Voltage

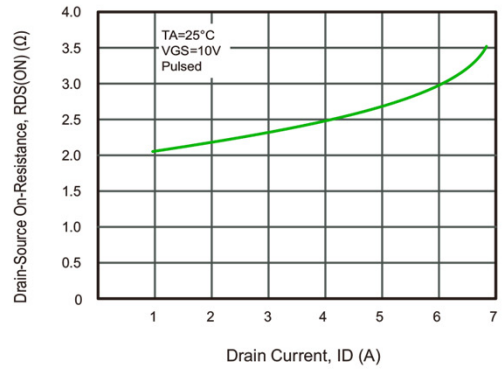


Fig.10 Drain-Source On-Resistance vs. Drain Current

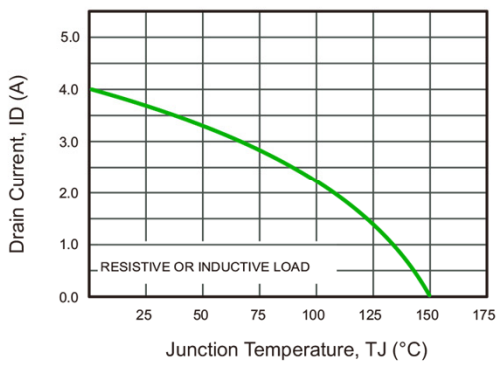


Fig.11 Drain Current vs. Junction Temperature

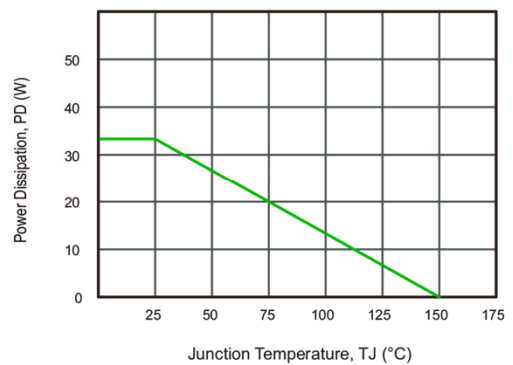


Fig.12 Power Dissipation vs. Junction Temperature

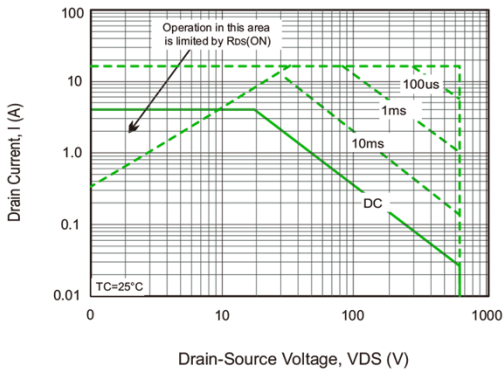
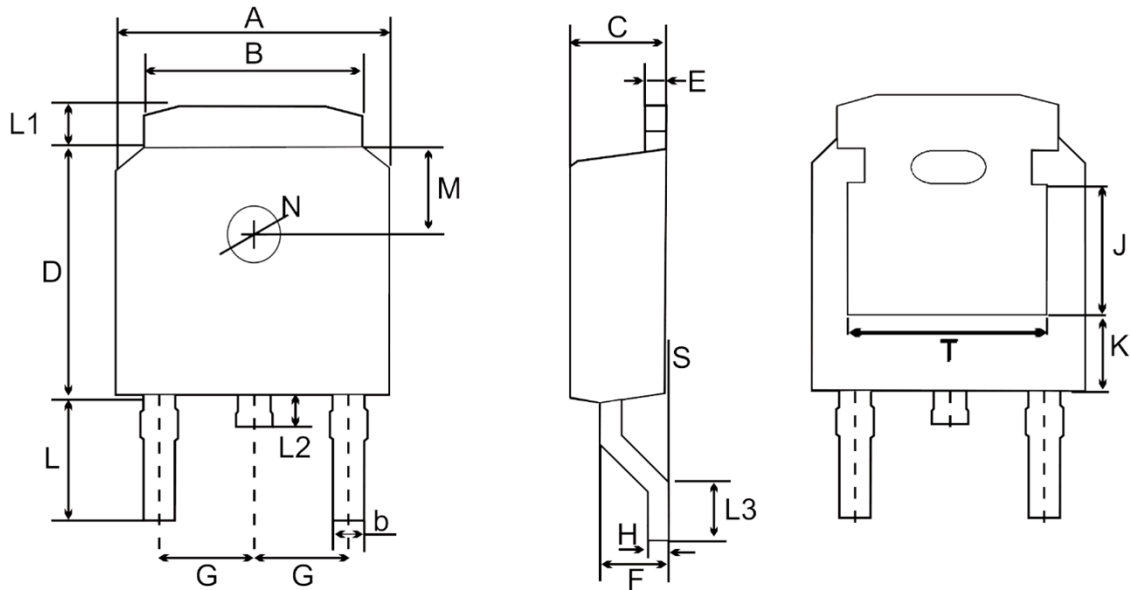



Fig.13 Safe Operating Area

## Product dimension (TO-252)



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	6.30	6.70	0.248	0.264
B	5.10	5.50	0.201	0.217
b	0.30	0.80	0.012	0.031
C	2.10	2.50	0.083	0.098
D	5.90	6.30	0.232	0.248
E	0.40	0.60	0.016	0.024
F	1.30	1.80	0.051	0.071
G	2.29 Typ.		0.090 Typ.	
H	0.45	0.55	0.018	0.022
L	2.70	3.10	0.106	0.122
L1	0.80	1.20	0.031	0.047
L2	0.60	1.00	0.024	0.039
L3	1.00	1.75	0.039	0.069
S	0.00	0.23	0.000	0.009
M	1.80 Typ.		0.071 Typ.	
N	1.30 Typ.		0.051 Typ.	
J	3.16 Ref.		0.124 Ref.	
K	1.80 Ref.		0.071 Ref.	
T	4.83 Ref.		0.190 Ref.	


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