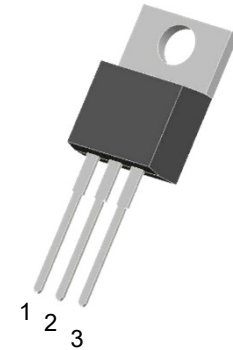


Description

The PNMTO650V4 is a high voltage 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 power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.


TO-220 (Top View)

MOSFET Product Summary

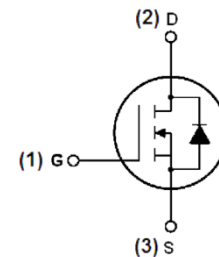
$V_{DS}(V)$	$R_{DS(on)}(\Omega)$	$I_D(A)$
650	2.4 @ $V_{GS} = 10V$	4

Feature

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

Mechanical Characteristics

- Case: TO-220-3L
- Approx. Weight: 2.0g (0.07oz)
- Lead free finish, RoHS compliant
- Case Material: “Green” molding compound, UL flammability classification 94V-0, “Halogen-free”.


Schematic diagram

Absolute maximum rating@25°C

Rating	Symbol	Value	Units
Drain-Source Voltage	V_{DSS}	650	V
Gate-Source Voltage	V_{GSS}	±30	V
Drain Current-Continuous	I_D	Tc=25°C	4.0
		Tc=100°C	2.5
Pulsed Drain Current ²⁾	I_{DM}	16	A
Avalanche Energy Single Pulsed ³⁾	E_{AS}	173	mJ
Peak Diode Recovery dv/dt ⁴⁾	dv/dt	2.1	V/ns
Maximum Power Dissipation	P_D	109	W
Thermal Resistance , Junction-case	$R_{\theta JC}$	1.17	°C/W
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$	62.5	°C/W
Junction and Storage Temperature Range	T_J, T_{STG}	-55~+150	°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 = 100mH, $I_{AS} = 4.1A$, $V_{DD} = 50V$, $R_G = 25 \Omega$, Starting $T_J = 25^\circ C$

4. $I_{SD} \leq 10A$, $di/dt \leq 200A/\mu s$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ C$

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
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	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS} = \pm 30V, V_{DS} = 0V$	-	-	± 100	nA
On Characteristics						
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	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 2A$	-	2.4	2.6	Ω
Dynamic Characteristics						
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}		-	5.0	-	
Switching Characteristics						
Total Gate Charge ¹⁾	Q_g	$V_{DS} = 520V, V_{GS} = 10V$ $I_D = 4A, I_G = 1mA^{1)2)}$	-	13	-	nC
Gate-Source Charge	Q_{gs}		-	3.0	-	
Gate-Drain Charge	Q_{gd}		-	2.2	-	
Turn-on Delay Time ¹⁾	$t_{d(on)}$	$V_{DD} = 325V, V_{GS} = 10V,$ $I_D = 4A, R_G = 25\Omega^{1)2)}$	-	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	-	
Drain-Source Diode Characteristics						
Diode Forward Current	I_{SD}		-	-	4.0	A
Pulsed Drain-Source Current	I_{SM}		-	-	16	A
Diode Forward Voltage ¹⁾	V_{SD}	$V_{GS} = 0V, I_S = 4A$	-	-	1.4	V
Reverse Recovery Time ¹⁾	t_{rr}	$V_{GS} = 0V, I_S = 4A,$ $di/dt = 100A/\mu s$	-	250	-	nS
Reverse Recovery Charge	Q_{rr}		-	4.5	-	μC

Notes:

1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.
2. Essentially independent of operating temperature.

Typical Characteristics

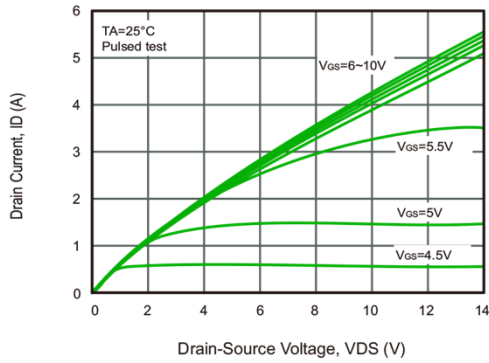


Fig.1 Drain Current vs. Gate-Source Voltage

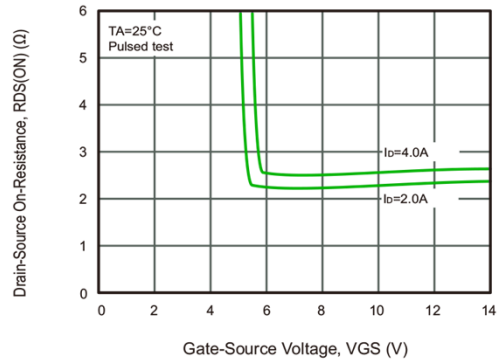


Fig.2 Drain-Source On-Resistance vs. Gate-Source Voltage

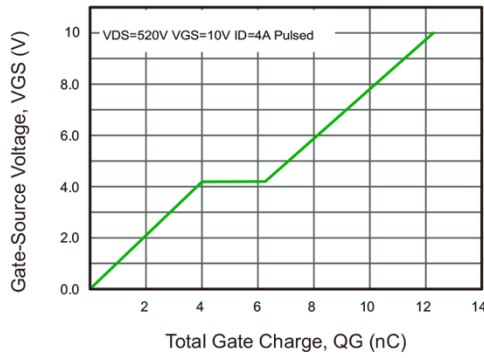


Fig.3 Gate Charge Characteristics

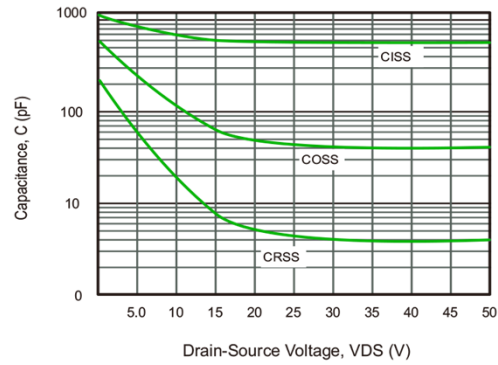


Fig.4 Capacitance Characteristics

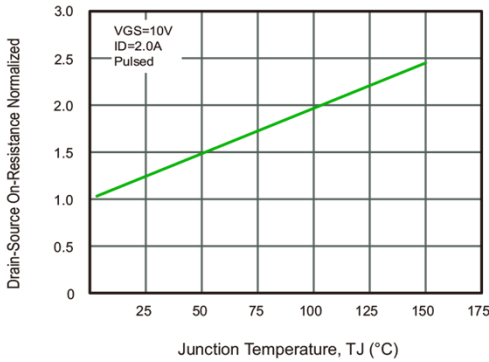


Fig.5 Drain-Source On-Resistance vs. Junction Temperature

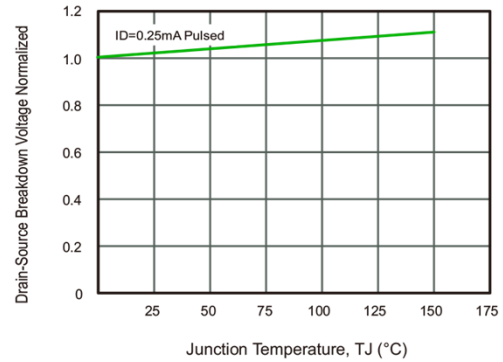


Fig.6 Breakdown Voltage vs. Junction Temperature

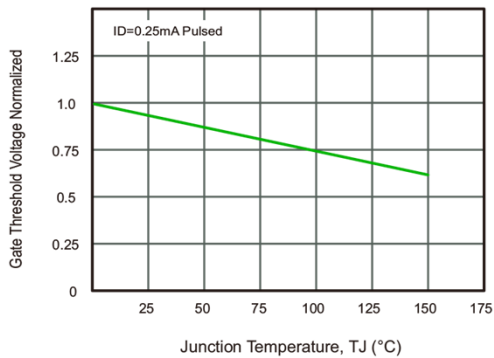


Fig.7 Gate Threshold Voltage vs. Junction Temperature

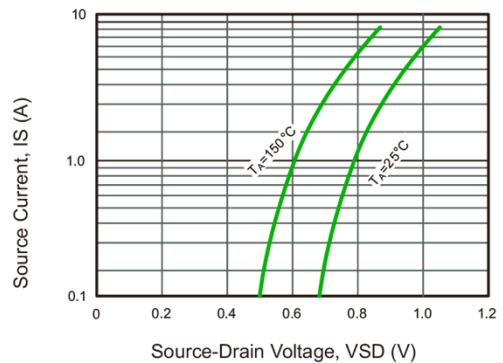


Fig.8 Source Current vs. Source-Drain Voltage

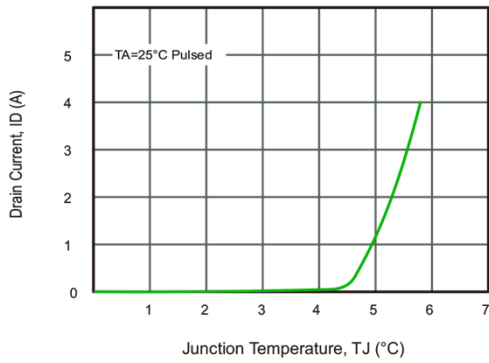


Fig.9 Drain Current vs. Gate-Source Voltage

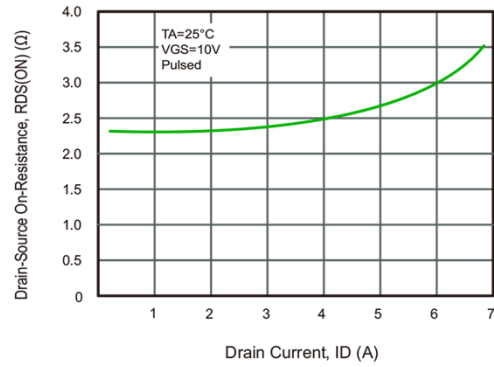


Fig.10 Drain-Source On-Resistance vs. Drain Current

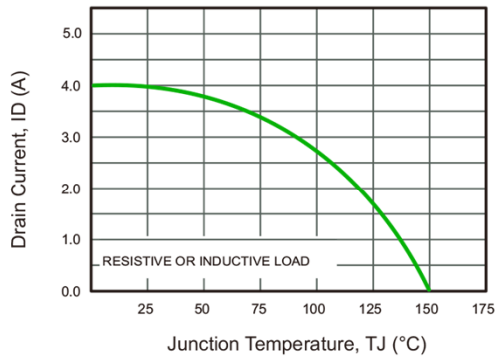


Fig.11 Drain Current vs. Junction Temperature

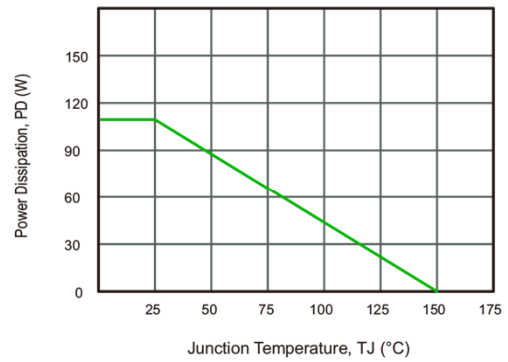


Fig.12 Power Dissipation vs. Junction Temperature

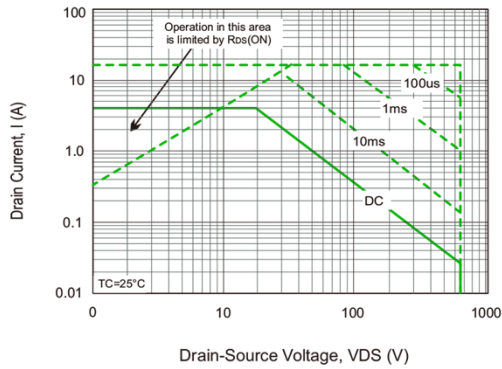
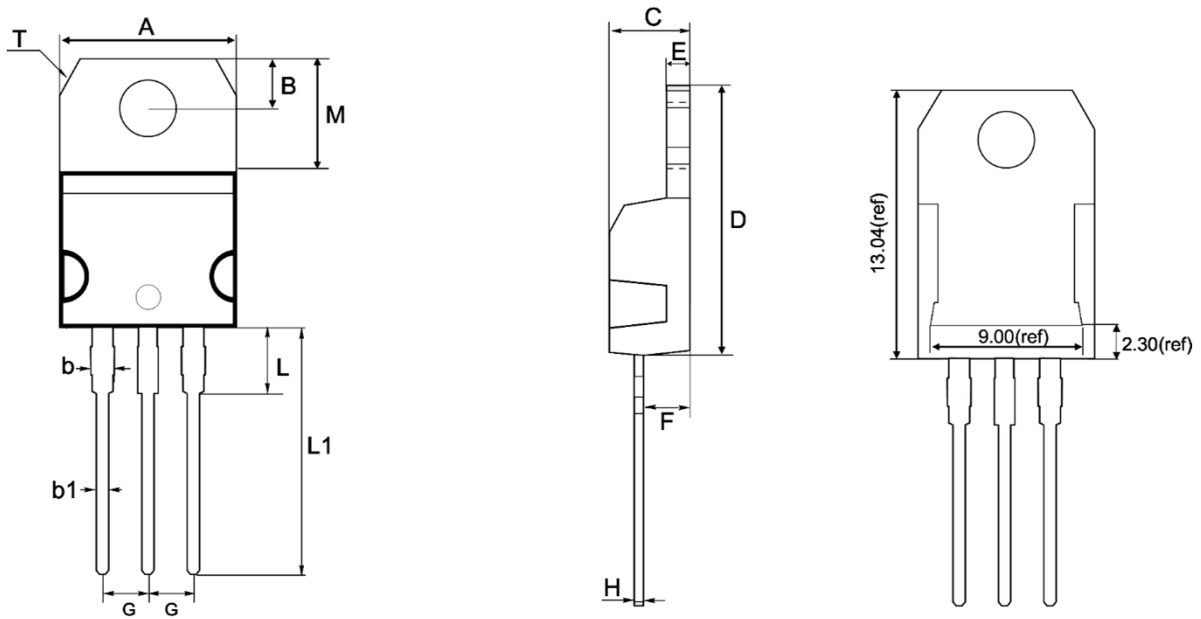



Fig.13 Safe Operating Area

Product dimension (TO-220-3L)



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	10.08	10.28	0.397	0.405
B	2.64	2.84	0.104	0.112
b	1.18	1.48	0.046	0.058
b1	0.70	0.90	0.028	0.035
C	4.25	4.65	0.167	0.183
D	15.14	15.54	0.596	0.612
E	1.17	1.37	0.046	0.054
F	2.39	2.79	0.094	0.110
G	2.44	2.64	0.096	0.104
H	0.40	0.60	0.016	0.024
L	3.48	3.88	0.137	0.153
L1	12.73	13.13	0.501	0.517
M	5.99	6.39	0.236	0.252
N	3.82 Typ.		0.150 Typ.	
T	1.19 Typ.		0.047 Typ.	


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