

PHP101NQ04T-VB Datasheet N-Channel 40-V (D-S) MOSFET

PRODUCT SUMMARY		
V_{DS}	40	V
$R_{DS(on)}$ $V_{GS} = 10\text{ V}$	6	m Ω
I_D	110	A
Configuration	Single	

FEATURES

- TrenchFET[®] Power MOSFET
- 100 % R_g and UIS Tested

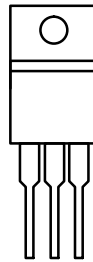


RoHS
COMPLIANT

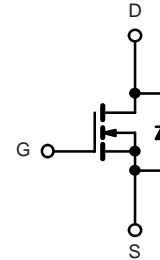
APPLICATIONS

- Synchronous Rectification
- Power Supplies

TO-220AB



G D S
Top View



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted				
Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V_{DS}	40	V
Gate-Source Voltage		V_{GS}	± 20	
Continuous Drain Current ($T_J = 175\text{ }^\circ\text{C}$)	$T_C = 25\text{ }^\circ\text{C}$	I_D	110 ^{a, c}	A
	$T_C = 70\text{ }^\circ\text{C}$		90 ^c	
	$T_A = 25\text{ }^\circ\text{C}$		31 ^b	
	$T_A = 70\text{ }^\circ\text{C}$		25 ^b	
Pulsed Drain Current		I_{DM}	270	
Avalanche Current Pulse	L = 0.1 mH	I_{AS}	85	
Single Pulse Avalanche Energy		E_{AS}	320	V
Continuous Source-Drain Diode Current	$T_C = 25\text{ }^\circ\text{C}$	I_S	110 ^{a, c}	A
	$T_A = 25\text{ }^\circ\text{C}$		2.6 ^b	
Maximum Power Dissipation	$T_C = 25\text{ }^\circ\text{C}$	P_D	312 ^a	W
	$T_C = 70\text{ }^\circ\text{C}$		200	
	$T_A = 25\text{ }^\circ\text{C}$		3.13 ^b	
	$T_A = 70\text{ }^\circ\text{C}$		2.0 ^b	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150	$^\circ\text{C}$

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^b	Steady State	R_{thJA}	32	40	$^\circ\text{C/W}$
Maximum Junction-to-Case	Steady State	R_{thJC}	0.33	0.4	

Notes:

a. Based on $T_C = 25\text{ }^\circ\text{C}$.

b. Surface Mounted on 1" x 1" FR4 board.

c. Calculated based on maximum junction temperature. Package limitation current is 110 A.

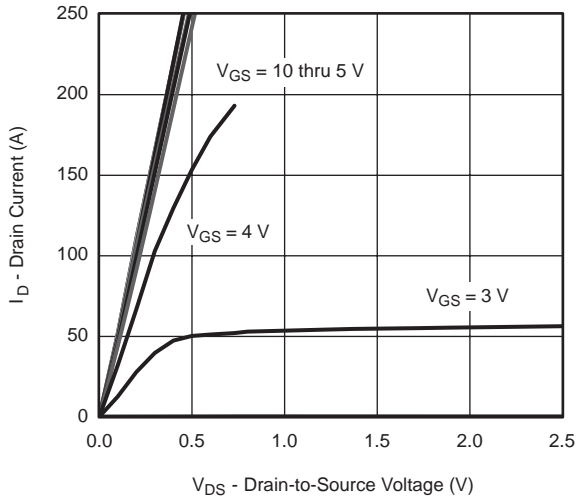
SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted							
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	40			V	
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		41		mV/ $^\circ\text{C}$	
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			- 8			
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.2		2.5	V	
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$			1	μA	
		$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			10		
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	120			A	
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 30\text{ A}$		6		m Ω	
		$V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$		7			
Forward Transconductance ^a	g_{fs}	$V_{DS} = 15\text{ V}, I_D = 30\text{ A}$		180		S	
Dynamic^b							
Input Capacitance	C_{iss}	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		2900		pF	
Output Capacitance	C_{oss}			750			
Reverse Transfer Capacitance	C_{rss}			310			
Total Gate Charge	Q_g	$V_{DS} = 20\text{ V}, V_{GS} = 10\text{ V}, I_D = 20\text{ A}$		130		nC	
Gate-Source Charge	Q_{gs}			20			
Gate-Drain Charge	Q_{gd}			32			
Gate Resistance	R_g	$f = 1\text{ MHz}$		0.85	1.3	Ω	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 20\text{ V}, R_L = 1.0\text{ }\Omega$ $I_D \cong 20\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		20	30	ns	
Rise Time	t_r			11	17		
Turn-Off Delay Time	$t_{d(off)}$			77	115		
Fall Time	t_f			10	15		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 20\text{ V}, R_L = 1.0\text{ }\Omega$ $I_D \cong 20\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		102	155		
Rise Time	t_r			62	95		
Turn-Off Delay Time	$t_{d(off)}$			180	270		
Fall Time	t_f			60	90		
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^\circ\text{C}$			110	A	
Pulse Diode Forward Current ^a	I_{SM}				200		
Body Diode Voltage	V_{SD}	$I_S = 20\text{ A}$		0.8	1.2	V	
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 20\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		50	75	ns	
Body Diode Reverse Recovery Charge	Q_{rr}				70	105	nC
Reverse Recovery Fall Time	t_a				30		ns
Reverse Recovery Rise Time	t_b				20		

Notes:

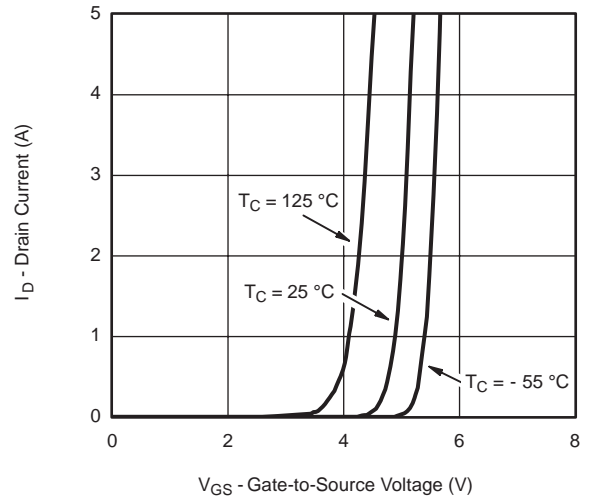
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
- b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

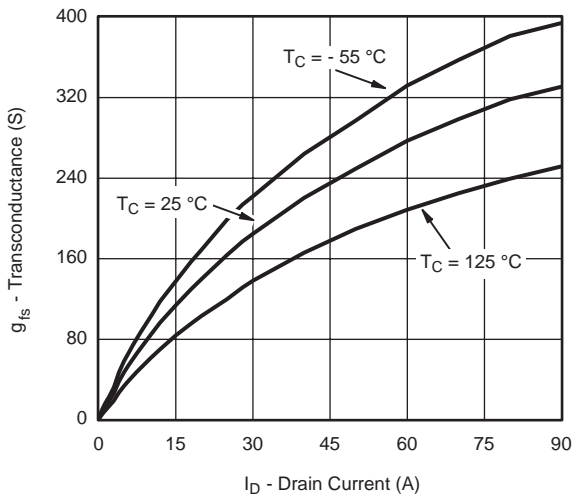
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



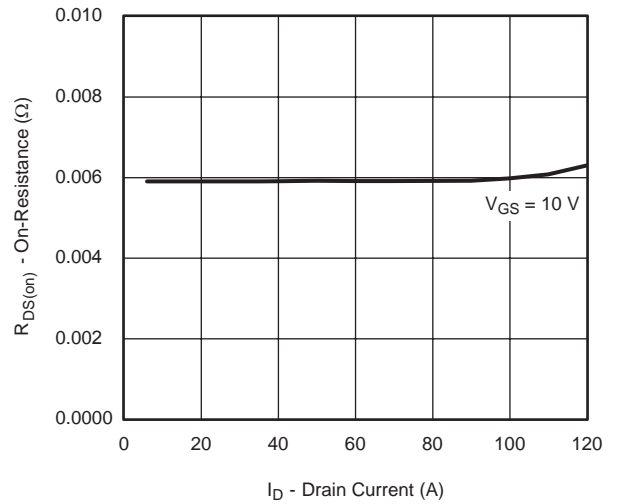
Output Characteristics



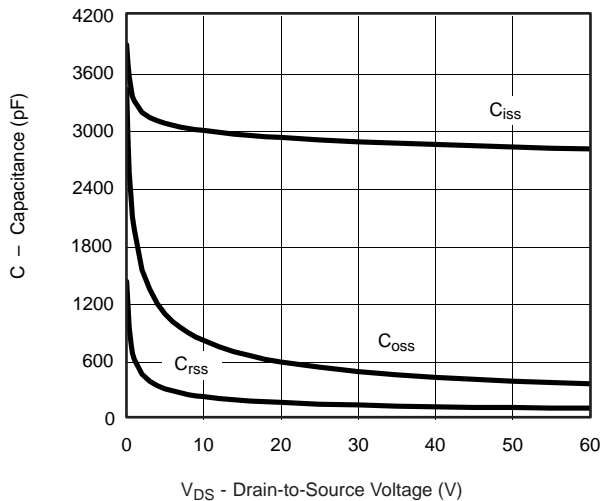
Transfer Characteristics



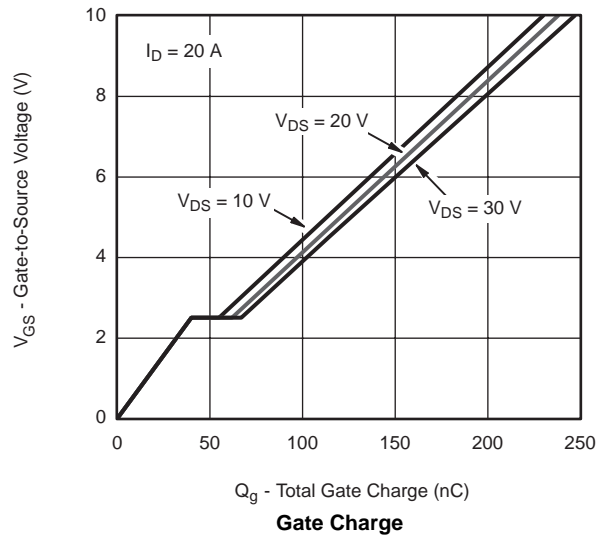
Transconductance



On-Resistance vs. Drain Current



Capacitance

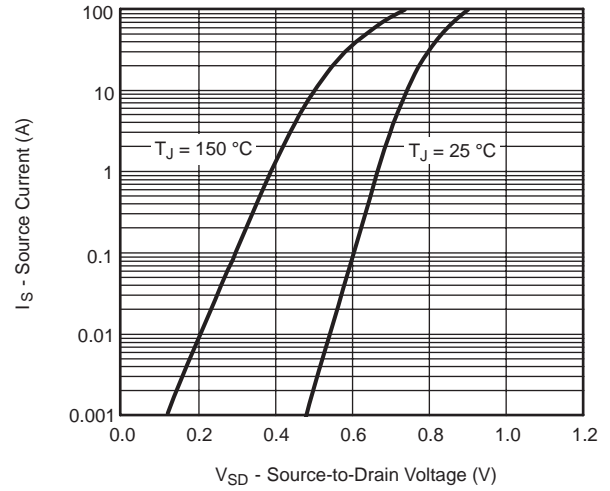


Gate Charge

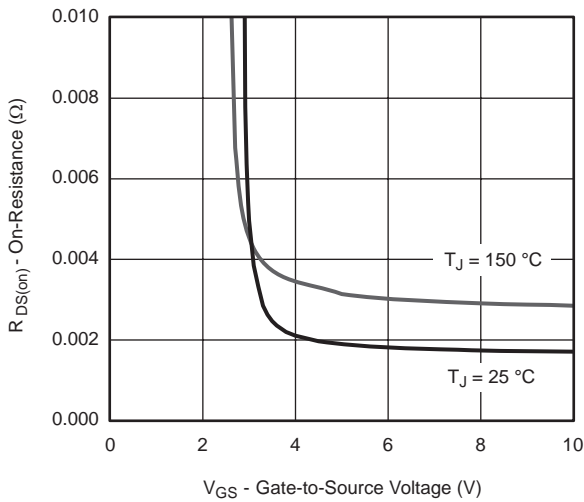
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



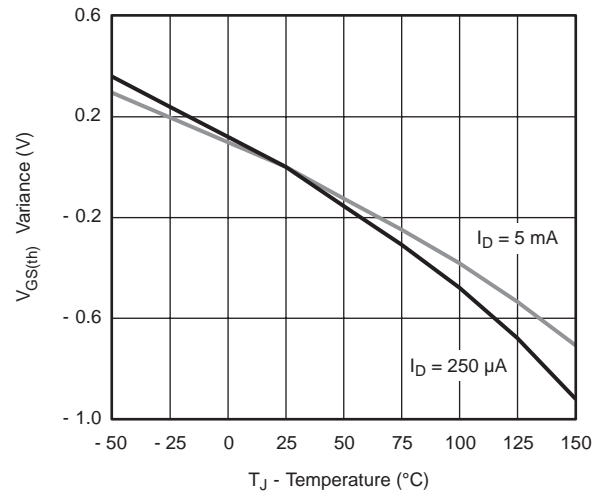
On-Resistance vs. Junction Temperature



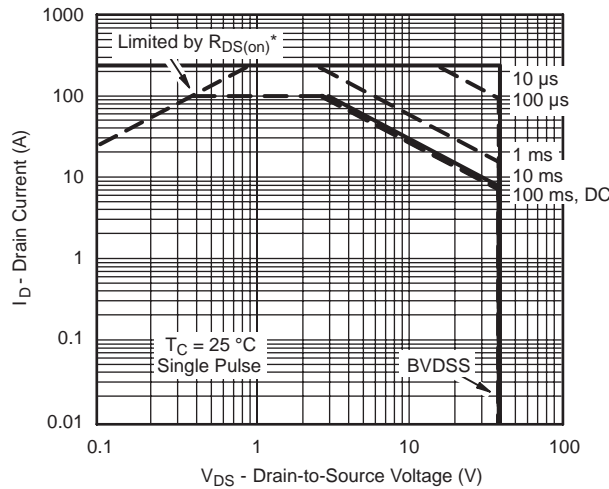
Forward Diode Voltage vs. Temperature



On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



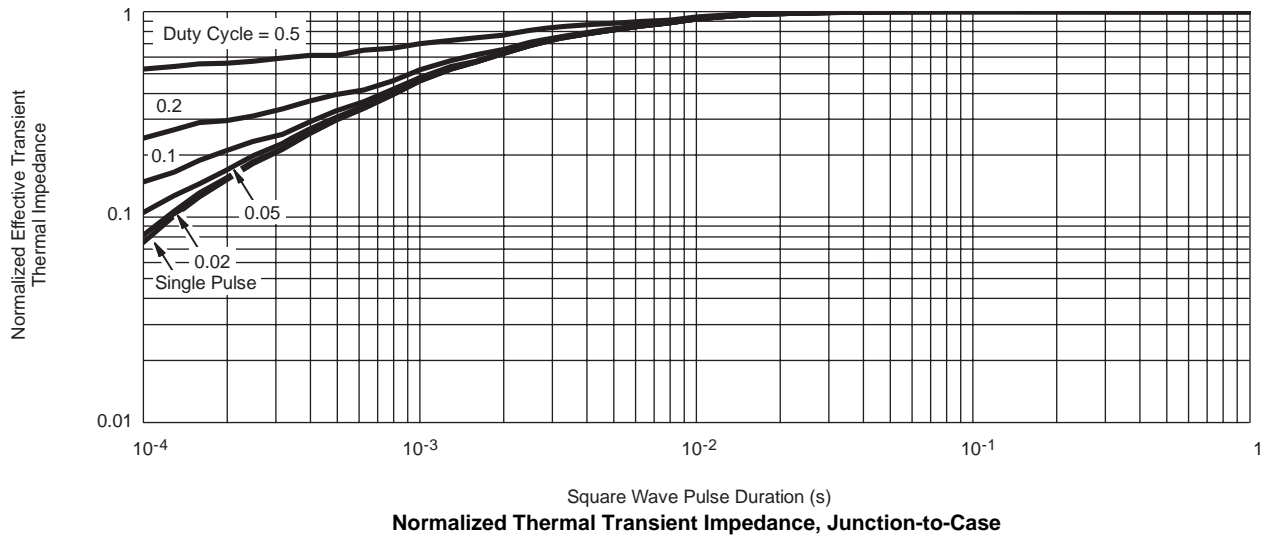
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

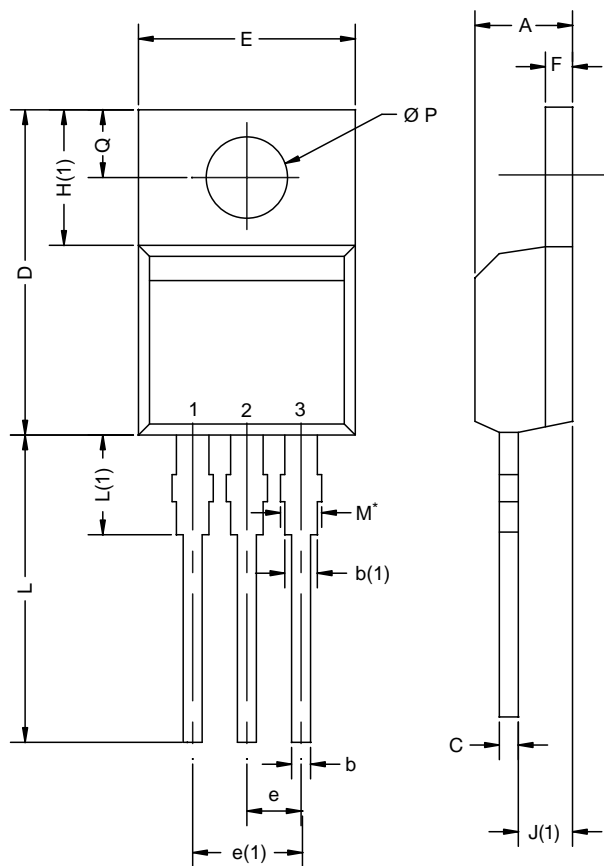
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



* The power dissipation P_D is based on $T_{J(max)} = 150\text{ °C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



TO-220AB



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
Ø P	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118

ECN: X12-0208-Rev. N, 08-Oct-12
DWG: 5471

Notes

* M = 1.32 mm to 1.62 mm (dimension including protrusion)
Heatsink hole for HVM

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