

## PHW50NQ15T-VB Datasheet

### N-Channel 150 V (D-S) MOSFET

#### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ ) MAX.	$I_D$ (A)	$Q_g$ (TYP.)
150	0.012 at $V_{GS} = 10$ V	150	113 nC
	0.014 at $V_{GS} = 7.5$ V	135	

#### FEATURES

- Thunder power MOSFET
- Maximum 175 °C junction temperature
- 100 %  $R_g$  and UIS tested

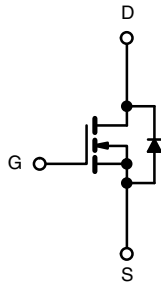


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

TO-247



Top View



N-Channel MOSFET

#### APPLICATIONS

- Power supplies:
  - Uninterruptible power supplies
  - AC/DC switch-mode power supplies
  - Lighting
- Synchronous rectification
- DC/DC converter
- Motor drive switch
- DC/AC inverter
- Solar micro inverter
- Class D audio amplifier

#### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V <sub>DS</sub>	150	V
Gate-Source Voltage		V <sub>GS</sub>	± 20	
Continuous Drain Current (T <sub>J</sub> = 150 °C)	T <sub>C</sub> = 25 °C	I <sub>D</sub>	150	A
	T <sub>C</sub> = 125 °C		60	
Pulsed Drain Current (t = 100 μs)		I <sub>DM</sub>	300	
Avalanche Current	L = 0.1 mH	I <sub>AS</sub>	60	
Single Avalanche Energy <sup>a</sup>		E <sub>AS</sub>	180	mJ
Maximum Power Dissipation <sup>a</sup>	T <sub>C</sub> = 25 °C	P <sub>D</sub>	375 <sup>b</sup>	W
	T <sub>C</sub> = 125 °C		125 <sup>b</sup>	
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C

#### THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	LIMIT	UNIT
Junction-to-Ambient (PCB Mount) <sup>c</sup>	$R_{thJA}$	40	°C/W
Junction-to-Case (Drain)	$R_{thJC}$	0.4	

#### Notes

- Duty cycle  $\leq 1$  %.
- See SOA curve for voltage derating.
- When mounted on 1" square PCB (FR4 material).

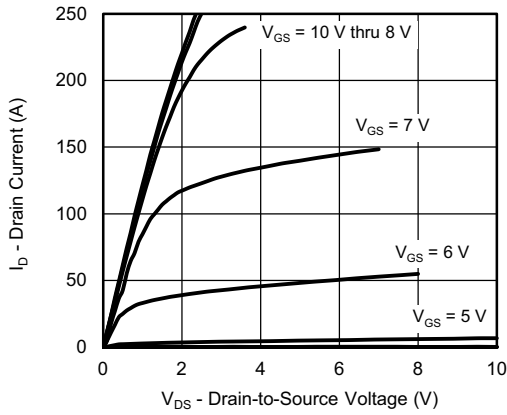
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	150	-	-	V
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	2	-	5	
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V	-	-	± 250	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 150 V, V <sub>GS</sub> = 0 V	-	-	1	μA
		V <sub>DS</sub> = 150 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C	-	-	100	
		V <sub>DS</sub> = 150 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175 °C	-	-	2	mA
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 10 V, V <sub>GS</sub> = 10 V	50	-	-	A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A	-	0.012	-	Ω
		V <sub>GS</sub> = 7.5 V, I <sub>D</sub> = 20 A	-	0.014	-	
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 20 A	-	52	-	S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 75 V, f = 1 MHz	-	6200	-	pF
Output Capacitance	C <sub>oss</sub>		-	535	-	
Reverse Transfer Capacitance	C <sub>rss</sub>		-	26	-	
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>DS</sub> = 75 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 30 A	-	113	-	nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>		-	19.5	-	
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>		-	20.5	-	
Gate Resistance	R <sub>g</sub>	f = 1 MHz	1.5	3	5	Ω
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = 75 V, R <sub>L</sub> = 1.25 Ω I <sub>D</sub> ≅ 60 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω	-	15	30	ns
Rise Time <sup>c</sup>	t <sub>r</sub>		-	114	220	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>		-	28	56	
Fall Time <sup>c</sup>	t <sub>f</sub>		-	8	16	
Drain-Source Body Diode Ratings and Characteristics <sup>b</sup> (T <sub>C</sub> = 25 °C)						
Pulsed Current (t = 100 μs)	I <sub>SM</sub>		-	-	200	A
Forward Voltage <sup>a</sup>	V <sub>SD</sub>	I <sub>F</sub> = 30 A, V <sub>GS</sub> = 0 V	-	0.73	1.2	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 30 A, di/dt = 100 A/μs	-	60	120	ns
Peak Reverse Recovery Charge	I <sub>RM(REC)</sub>		-	10	20	A
Reverse Recovery Charge	Q <sub>rr</sub>		-	0.5	1	μC

**Notes**

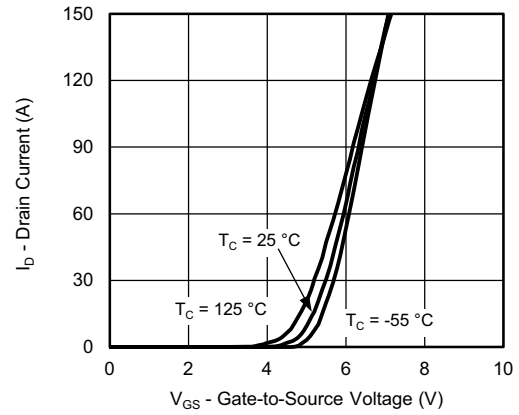
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
b. Guaranteed by design, not subject to production testing.  
c. Independent of operating temperature.

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.

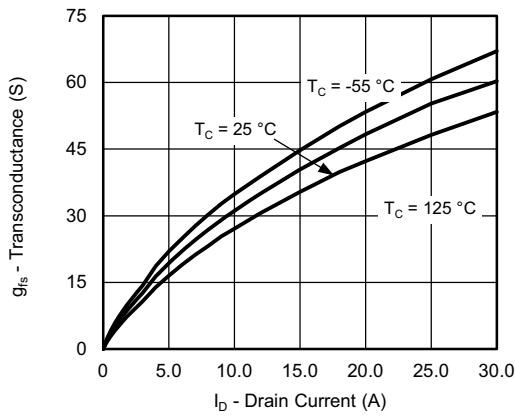
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)



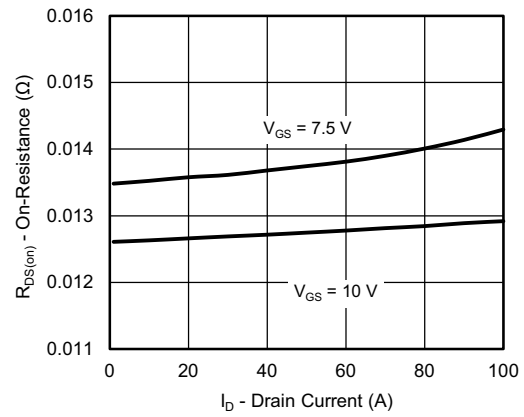
**Output Characteristics**



**Transfer Characteristics**



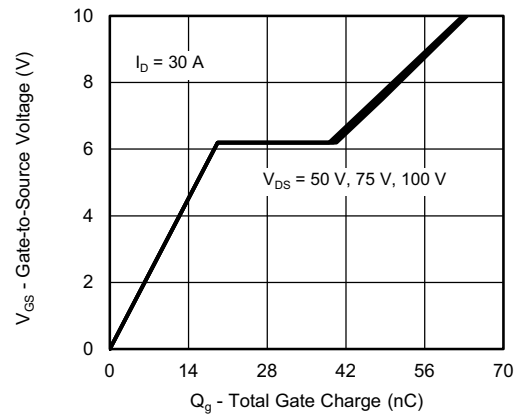
**Transconductance**



**On-Resistance vs. Drain Current**



**Capacitance**



**Gate Charge**

**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)



**On-Resistance vs. Junction Temperature**



**Threshold Voltage**



**On-Resistance vs. Gate-to-Source Voltage**



**Drain Source Breakdown vs. Junction Temperature**



**Source Drain Diode Forward Voltage**



**Current De-Rating**

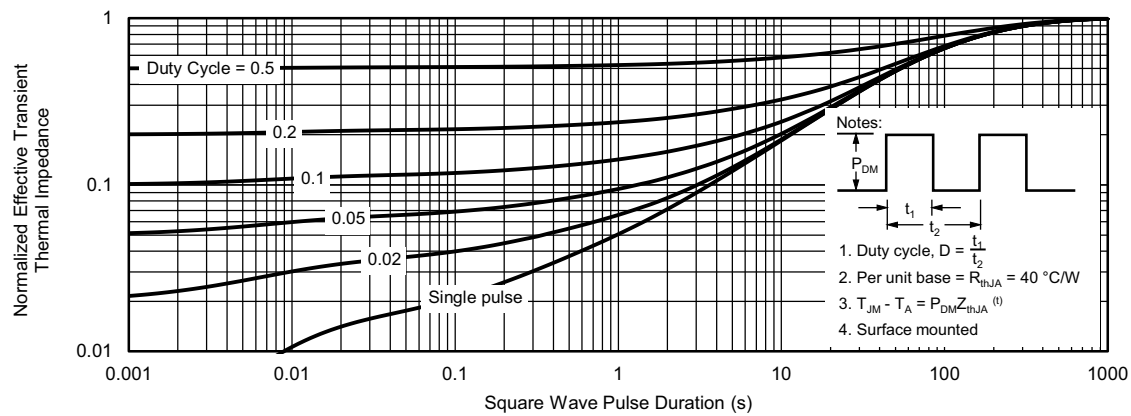
**THERMAL RATINGS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)



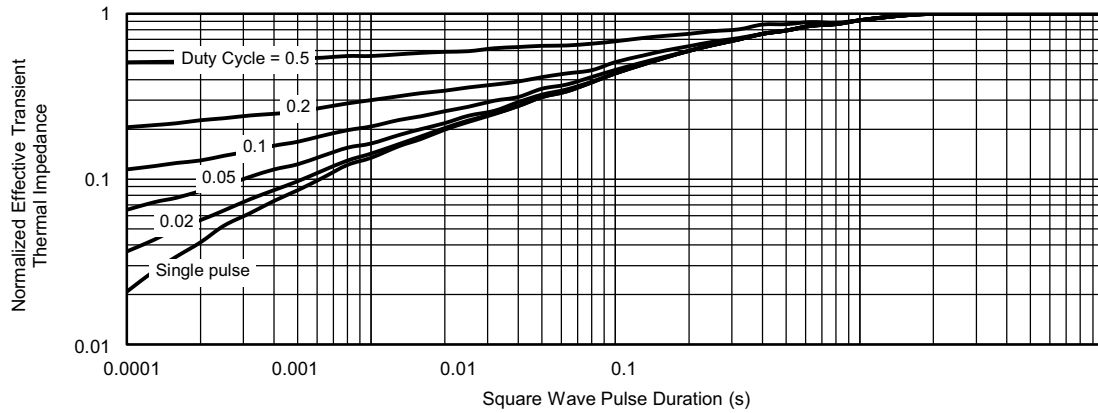
**Safe Operating Area**



**$I_{DAV}$  vs. Time**



**Normalized Thermal Transient Impedance, Junction-to-Ambient**

**THERMAL RATINGS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)


**Normalized Thermal Transient Impedance, Junction-to-Case**

**Note**

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction to Ambient ( $25\text{ }^{\circ}\text{C}$ )
  - Normalized Transient Thermal Impedance Junction to Case ( $25\text{ }^{\circ}\text{C}$ )
 are given for general guidelines only to enable the user to get a "ball park" indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

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DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.70	5.31	0.185	0.209
A1	2.21	2.59	0.087	0.102
A2	1.50	2.49	0.059	0.098
b	0.99	1.40	0.039	0.055
b2	1.65	2.41	0.065	0.095
b4	2.59	3.43	0.102	0.135
c	0.61 BSC		0.024 BSC	
D	20.80	21.46	0.819	0.845
D1	3.68	5.49	0.145	0.216
(e)	5.46 BSC		0.215 BSC	
E	15.49	16.26	0.610	0.640
L	19.81	20.32	0.780	0.800
L1	4.06	4.50	0.160	0.177
$\varnothing p$	3.51	3.66	0.138	0.144

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