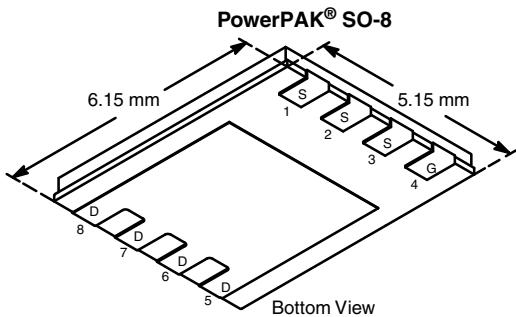


N-Channel 40 V (D-S) MOSFET

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω) Max.	I_D (A) ^a	Q_g (Typ.)
40	0.0038 at $V_{GS} = 10$ V	60	16.8 nC
	0.0053 at $V_{GS} = 4.5$ V	60	



Ordering Information:

SiR646DP-T1-GE3 (Lead (Pb)-free and Halogen-free)

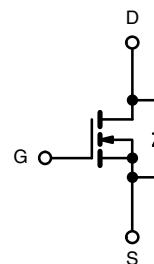
FEATURES

- TrenchFET® Power MOSFET
- 100 % R_g and UIS Tested
- Material categorization:
For definitions of compliance please see www.vishay.com/doc?99912



APPLICATIONS

- Synchronous Rectification
- DC/DC Converters
- DC/AC Inverters



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted)				
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	V_{DS}	40	V	
Gate-Source Voltage	V_{GS}	± 20		
Continuous Drain Current ($T_J = 150$ °C)	I_D	60^a	A	
		60^a		
		$27^{b,c}$		
		$21.6^{b,c}$		
Pulsed Drain Current ($t = 100$ µs)	I_{DM}	200		
Continuous Source-Drain Diode Current	I_S	49	A	
		$4.5^{b,c}$		
Single Pulse Avalanche Current	I_{AS}	30		
Single Pulse Avalanche Energy	E_{AS}	45	mJ	
Maximum Power Dissipation	P_D	54	W	
		34.7		
		$5^{b,c}$		
		$3.2^{b,c}$		
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 150	°C	
Soldering Recommendations (Peak Temperature) ^{d,e}		260		

THERMAL RESISTANCE RATINGS				
Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^{b,f}	R_{thJA}	20	25	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	1.8	2.3	

Notes:

- a. Package limited.
- b. Surface mounted on 1" x 1" FR4 board.
- c. $t = 10$ s.
- d. See solder profile (www.vishay.com/doc?73257). The PowerPAK SO-8 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.
- e. Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.
- f. Maximum under steady state conditions is 65 °C/W.

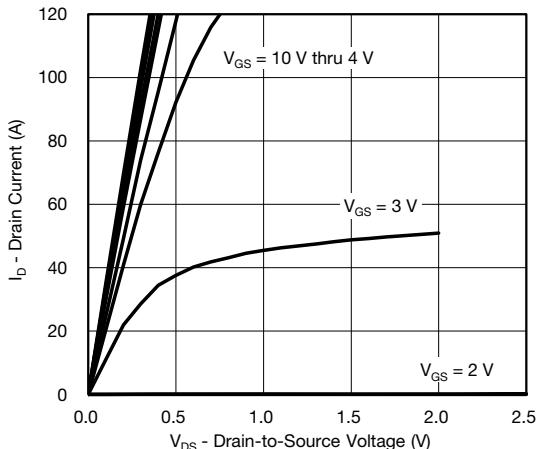
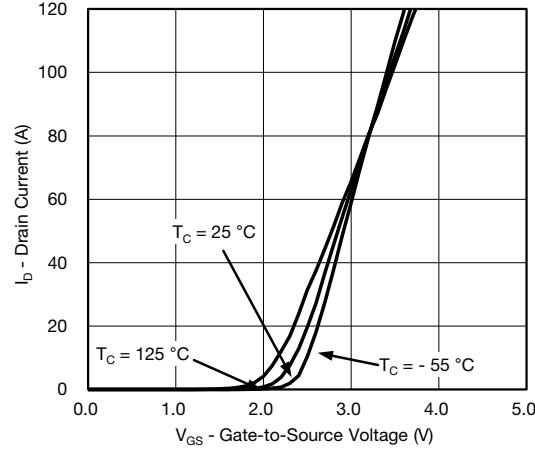
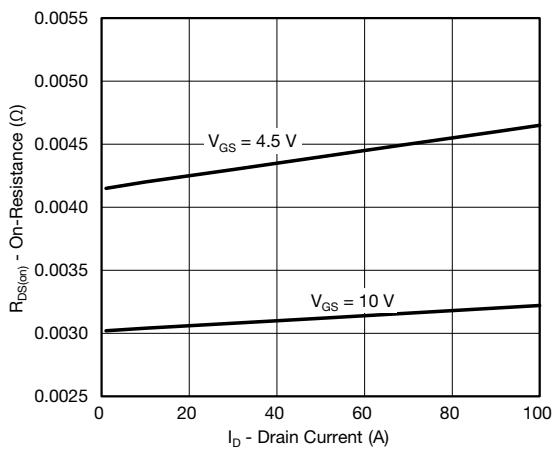
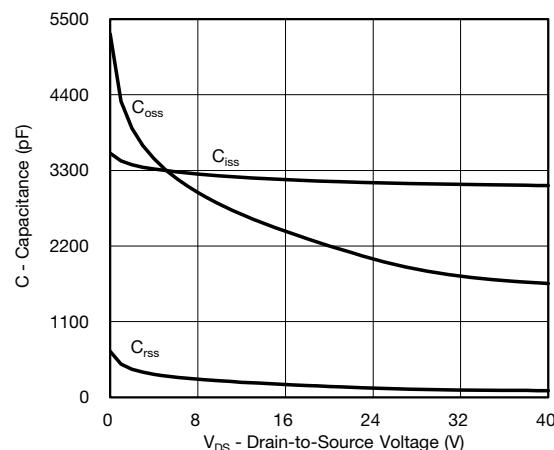
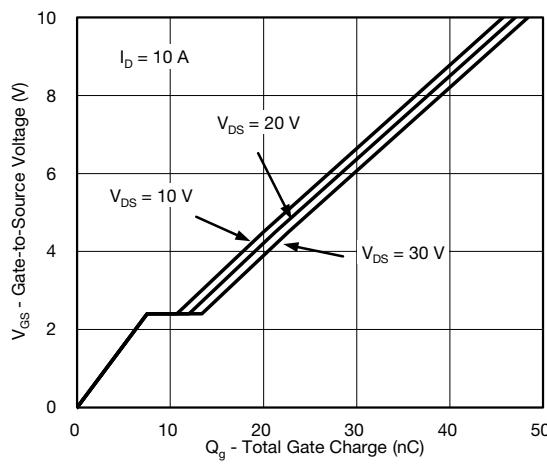
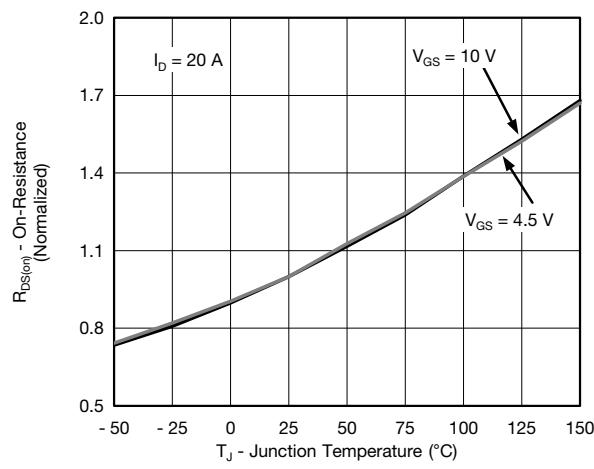
SPECIFICATIONS ($T_J = 25^\circ\text{C}$, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0 \text{ V}$, $I_D = 250 \mu\text{A}$	40			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250 \mu\text{A}$		24		mV°C
$V_{GS(\text{th})}$ Temperature Coefficient	$\Delta V_{GS(\text{th})}/T_J$			- 4.8		
Gate-Source Threshold Voltage	$V_{GS(\text{th})}$	$V_{DS} = V_{GS}$, $I_D = 250 \mu\text{A}$	1		2.2	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
		$V_{DS} = 40 \text{ V}$, $V_{GS} = 0 \text{ V}$, $T_J = 55^\circ\text{C}$			10	
On-State Drain Current ^a	$I_{D(\text{on})}$	$V_{DS} \geq 5 \text{ V}$, $V_{GS} = 10 \text{ V}$	50			A
Drain-Source On-State Resistance ^a	$R_{DS(\text{on})}$	$V_{GS} = 10 \text{ V}$, $I_D = 20 \text{ A}$		0.0031	0.0038	Ω
		$V_{GS} = 4.5 \text{ V}$, $I_D = 10 \text{ A}$		0.0042	0.0053	
Forward Transconductance ^a	g_{fs}	$V_{DS} = 10 \text{ V}$, $I_D = 20 \text{ A}$		71		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = 20 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$		2230		pF
Output Capacitance	C_{oss}			1850		
Reverse Transfer Capacitance	C_{rss}			121		
Total Gate Charge	Q_g	$V_{DS} = 20 \text{ V}$, $V_{GS} = 10 \text{ V}$, $I_D = 10 \text{ A}$		34	51	nC
				16.8	26	
Gate-Source Charge	Q_{gs}	$V_{DS} = 20 \text{ V}$, $V_{GS} = 4.5 \text{ V}$, $I_D = 10 \text{ A}$		5.3		nC
Gate-Drain Charge	Q_{gd}			4.7		
Output Charge	Q_{oss}	$V_{DS} = 20 \text{ V}$, $V_{GS} = 0 \text{ V}$		46.5	70	
Gate Resistance	R_g	$f = 1 \text{ MHz}$	0.2	0.6	1.2	Ω
Turn-On Delay Time	$t_{d(\text{on})}$	$V_{DD} = 20 \text{ V}$, $R_L = 2 \Omega$ $I_D \geq 10 \text{ A}$, $V_{GEN} = 10 \text{ V}$, $R_g = 1 \Omega$		10	20	ns
Rise Time	t_r			11	22	
Turn-Off Delay Time	$t_{d(\text{off})}$			22	44	
Fall Time	t_f			9	18	
Turn-On Delay Time	$t_{d(\text{on})}$			21	40	
Rise Time	t_r			66	120	
Turn-Off Delay Time	$t_{d(\text{off})}$	$V_{DD} = 20 \text{ V}$, $R_L = 2 \Omega$ $I_D \geq 10 \text{ A}$, $V_{GEN} = 4.5 \text{ V}$, $R_g = 1 \Omega$		21	40	ns
Fall Time	t_f			11	22	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25^\circ\text{C}$			49	A
Pulse Diode Forward Current ($t_p = 100 \mu\text{s}$)	I_{SM}				100	
Body Diode Voltage	V_{SD}	$I_S = 5 \text{ A}$		0.74	1.1	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 10 \text{ A}$, $dl/dt = 100 \text{ A}/\mu\text{s}$, $T_J = 25^\circ\text{C}$		49	95	ns
Body Diode Reverse Recovery Charge	Q_{rr}			40	80	
Reverse Recovery Fall Time	t_a			19		ns
Reverse Recovery Rise Time	t_b			30		

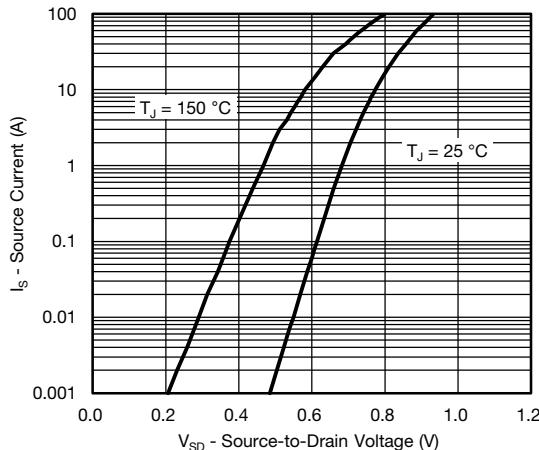
Notes:

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

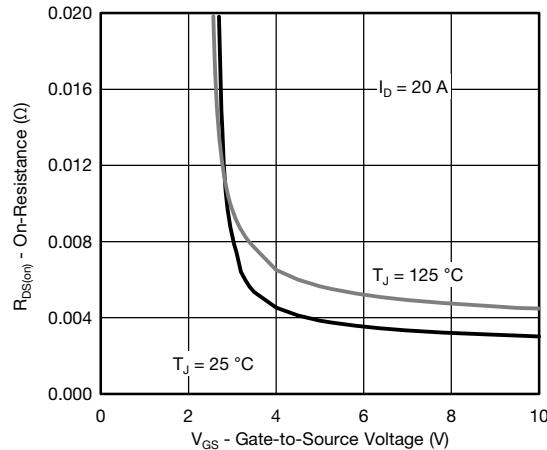
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Output Characteristics

Transfer Characteristics

On-Resistance vs. Drain Current

Capacitance

Gate Charge

On-Resistance vs. Junction Temperature

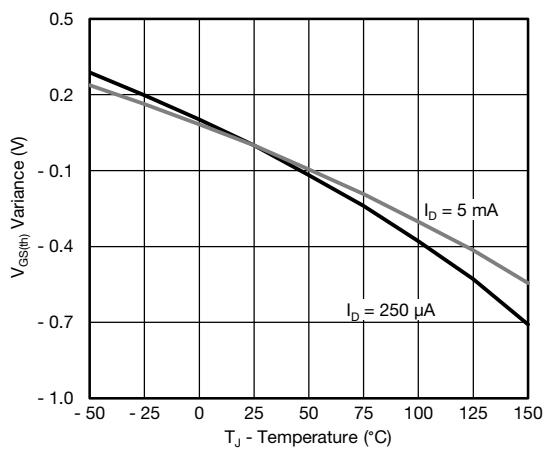
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



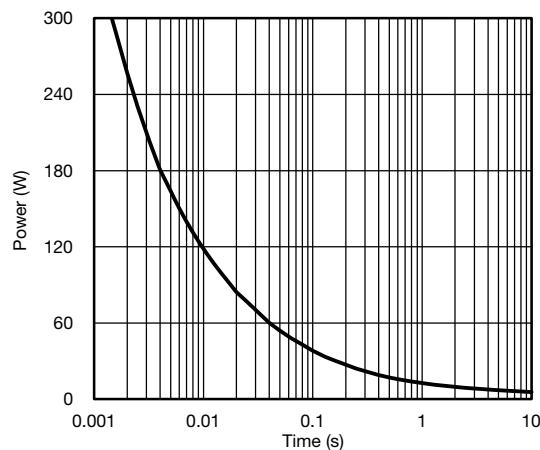
Source-Drain Diode Forward Voltage



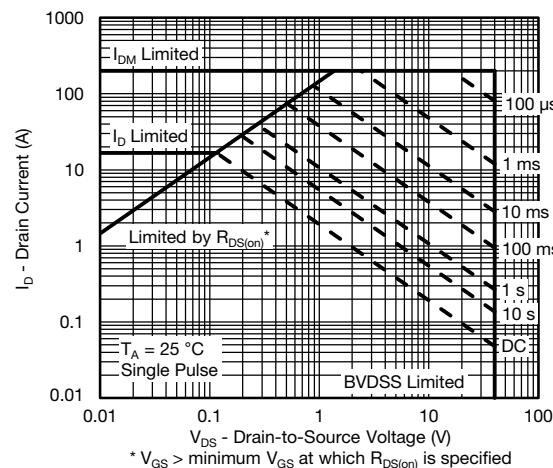
On-Resistance vs. Gate-to-Source Voltage



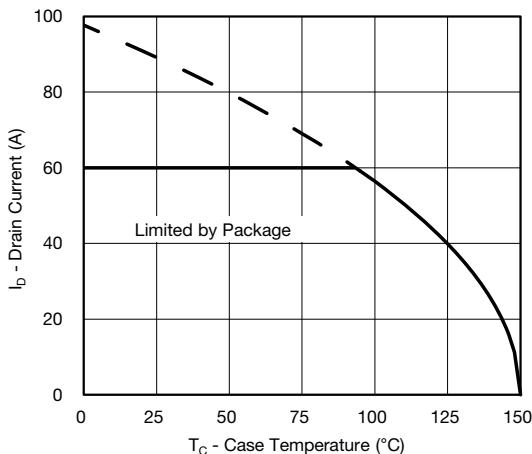
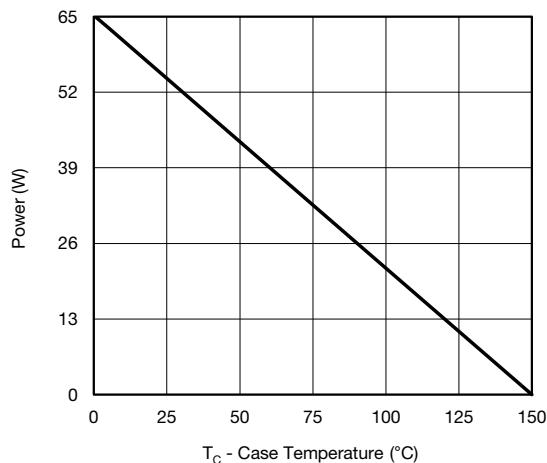
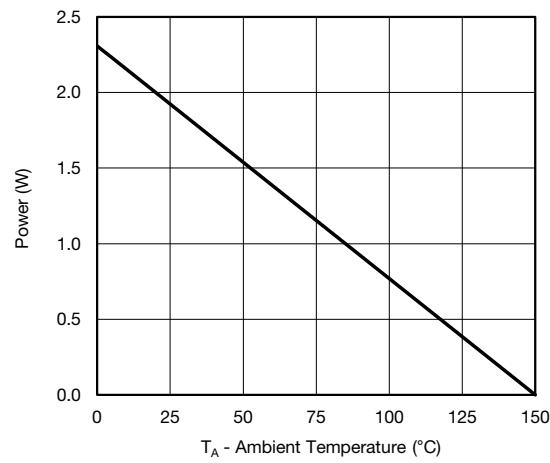
Threshold Voltage



Single Pulse Power, Junction-to-Ambient

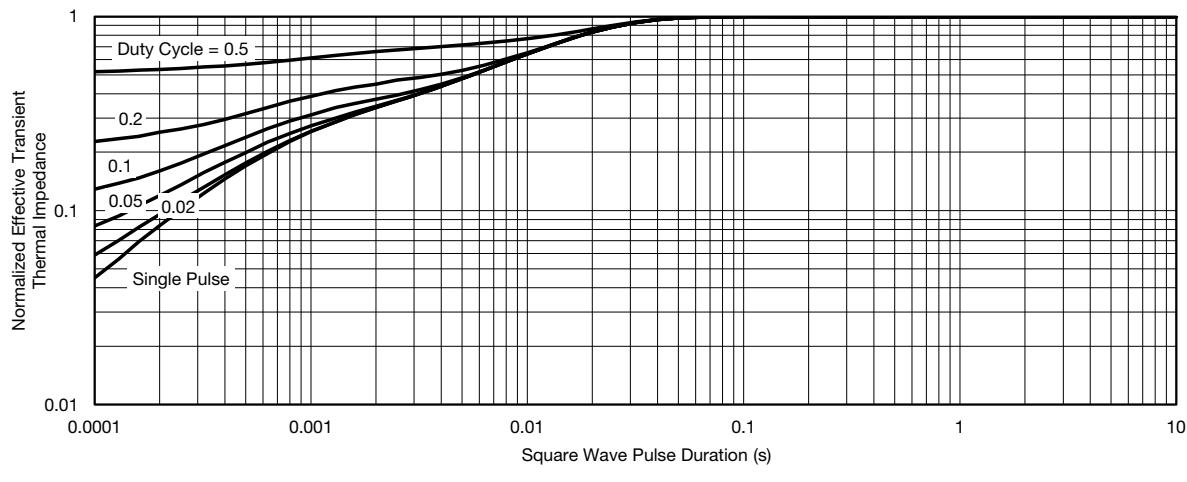
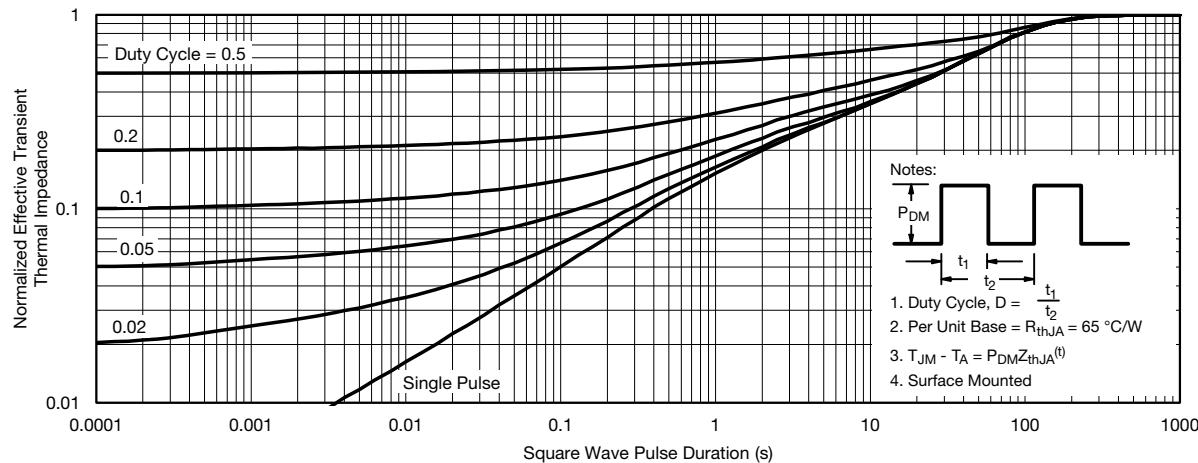


Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Current Derating*

Power, Junction-to-Case

Power, Junction-to-Ambient

* The power dissipation P_D is based on $T_{J(max.)} = 150$ °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.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



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