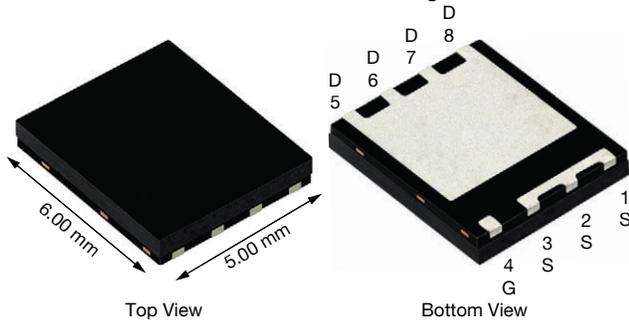
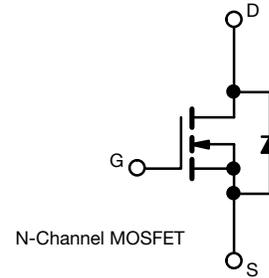


# Automotive N-Channel 40 V (D-S) 175 °C MOSFET

**PowerPAK® SO-8SW Single**

**FEATURES**

- TrenchFET® Gen IV power MOSFET
- AEC-Q101 qualified
- 100 % R<sub>g</sub> and UIS tested
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

AUTOMOTIVE GRADE


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


PRODUCT SUMMARY	
V <sub>DS</sub> (V)	40
R <sub>DS(on)</sub> (Ω) at V <sub>GS</sub> = 10 V	0.0006
R <sub>DS(on)</sub> (Ω) at V <sub>GS</sub> = 4.5 V	0.00087
I <sub>D</sub> (A) <sup>e</sup>	504
Configuration	Single

ORDERING INFORMATION	
Package	PowerPAK® SO-8SW
Lead (Pb)-free and halogen-free	SQRS140ELP (for detailed order number please see <a href="http://www.vishay.com/doc?79771">www.vishay.com/doc?79771</a> )

ABSOLUTE MAXIMUM RATINGS (T <sub>C</sub> = 25 °C, unless otherwise noted)					
PARAMETER	SYMBOL	LIMIT	UNIT		
Drain-source voltage	V <sub>DS</sub>	40	V		
Gate-source voltage	V <sub>GS</sub>	± 20			
Continuous drain current <sup>e</sup>	I <sub>D</sub>	T <sub>C</sub> = 25 °C	504	A	
		T <sub>C</sub> = 125 °C	291		
Continuous source current (diode conduction)	I <sub>S</sub>	242	mJ		
Pulsed drain current <sup>a, e</sup>	I <sub>DM</sub>	1342			
Single pulse avalanche current	L = 0.1 mH	I <sub>AS</sub>	68		
Single pulse avalanche energy		E <sub>AS</sub>	234		
Maximum power dissipation <sup>a</sup>	T <sub>C</sub> = 25 °C	P <sub>D</sub>	266	W	
			T <sub>C</sub> = 125 °C		88
Operating junction and storage temperature range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C		
Soldering recommendations (peak temperature) <sup>c</sup>		260			

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	LIMIT	UNIT	
Junction-to-ambient	PCB mount <sup>b</sup>	R <sub>thJA</sub>	42	°C/W
Junction-to-case (drain) <sup>d</sup>		R <sub>thJC</sub>	0.56	

**Notes**

- Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %
- When mounted on 1" square PCB (FR4 material)
- See solder profile ([www.vishay.com/doc?73257](http://www.vishay.com/doc?73257)). 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
- As per on JESD51-14
- Values based on R<sub>thJC</sub> and T<sub>C</sub> of 25 °C. Actual values achievable will be dependent on the thermal characteristics of the complete system



SPECIFICATIONS (T <sub>C</sub> = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA		40	-	-	V
Gate-source threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA		1.2	1.7	2.2	
Gate-source leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V		-	-	± 100	nA
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 40 V	-	-	1	μA
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 40 V, T <sub>J</sub> = 125 °C	-	-	50	
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 40 V, T <sub>J</sub> = 175 °C	-	-	250	
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>GS</sub> = 10 V	V <sub>DS</sub> ≥ 5 V	30	-	-	A
Drain-source on-state resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 15 A	-	0.00048	0.0006	Ω
		V <sub>GS</sub> = 10 V	I <sub>D</sub> = 15 A, T <sub>J</sub> = 125 °C	-	-	0.00088	
		V <sub>GS</sub> = 10 V	I <sub>D</sub> = 15 A, T <sub>J</sub> = 175 °C	-	-	0.0011	
		V <sub>GS</sub> = 4.5 V	I <sub>D</sub> = 15 A	-	0.00066	0.00087	
Forward transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 40 A		-	160	-	S
<b>Dynamic<sup>b</sup></b>							
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 25 V, f = 1 MHz	-	10998	15398	pF
Output capacitance	C <sub>oss</sub>			-	3045	4263	
Reverse transfer capacitance	C <sub>rss</sub>			-	282	395	
Total gate charge <sup>c</sup>	Q <sub>g</sub>	V <sub>GS</sub> = 10 V	V <sub>DS</sub> = 20 V, I <sub>D</sub> = 15 A	-	196	294	nC
Gate-source charge <sup>c</sup>	Q <sub>gs</sub>			-	33	-	
Gate-drain charge <sup>c</sup>	Q <sub>gd</sub>			-	33	-	
Gate resistance	R <sub>g</sub>	f = 1 MHz		0.6	1.2	1.8	Ω
Turn-on delay time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, R <sub>L</sub> = 1.33 Ω I <sub>D</sub> ≅ 15 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω		-	20	30	ns
Rise time <sup>c</sup>	t <sub>r</sub>			-	20	30	
Turn-off delay time <sup>c</sup>	t <sub>d(off)</sub>			-	78	117	
Fall time <sup>c</sup>	t <sub>f</sub>			-	21	32	
<b>Source-Drain Diode Ratings and Characteristics<sup>b</sup></b>							
Pulsed current <sup>a</sup>	I <sub>SM</sub>			-	-	480	A
Forward voltage	V <sub>SD</sub>	I <sub>F</sub> = 15 A, V <sub>GS</sub> = 0 V		-	-	1.1	V
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 40 A, di/dt = 100 A/μs		-	78	156	ns
Body diode reverse recovery charge	Q <sub>rr</sub>			-	122	224	nC
Reverse recovery fall time	t <sub>a</sub>			-	36	-	ns
Reverse recovery rise time	t <sub>b</sub>			-	42	-	
Body diode peak reverse recovery current	I <sub>RM(REC)</sub>					-	2.7

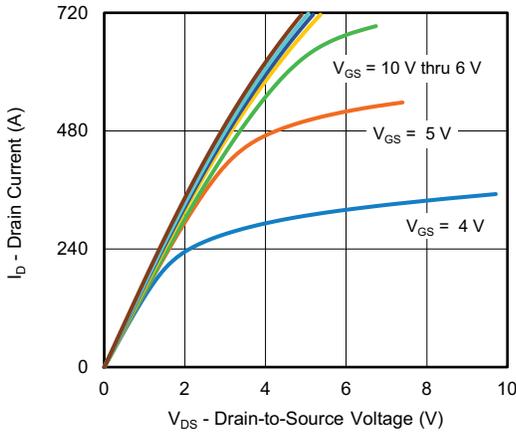
**Notes**

- a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %  
b. Guaranteed by design, not subject to production testing  
c. Independent of operating temperature

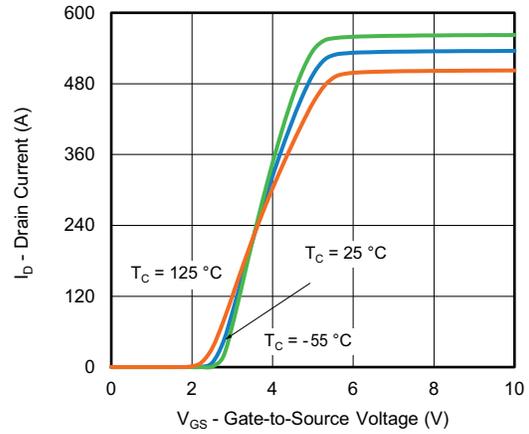
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



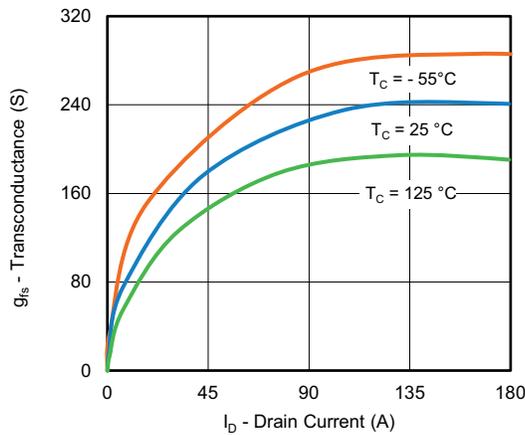
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



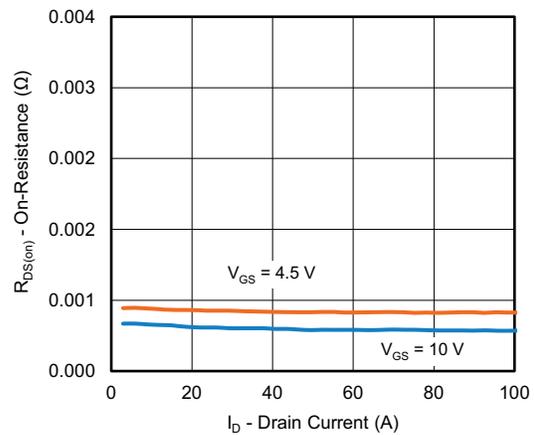
**Output Characteristics**



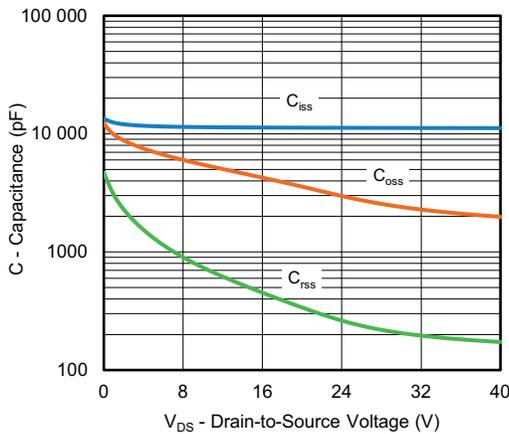
**Transfer Characteristics**



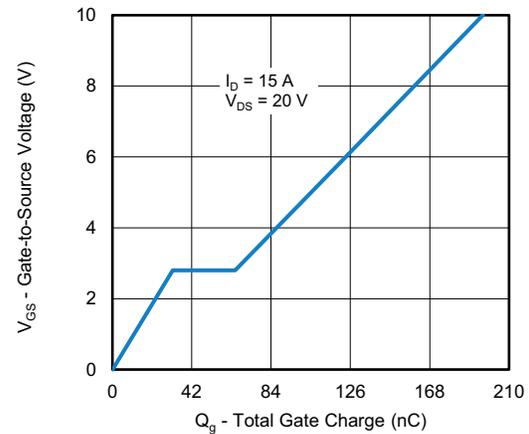
**Transconductance**



**On-Resistance vs. Drain Current**



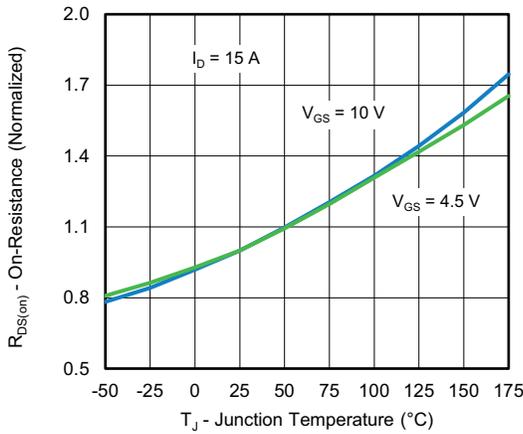
**Capacitance**



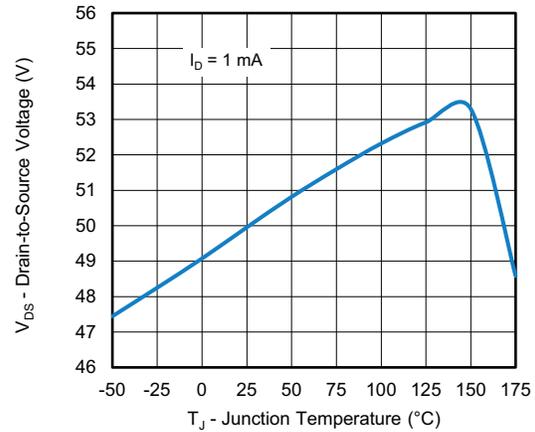
**Gate Charge**



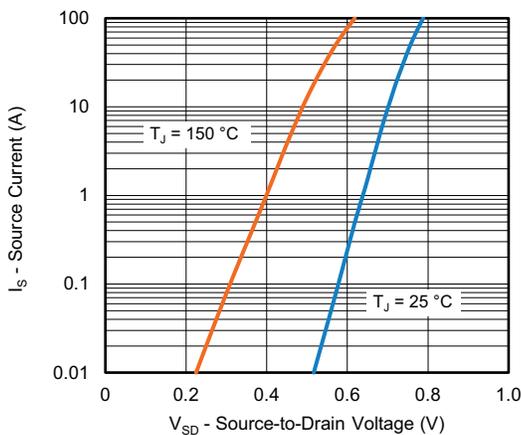
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise noted)



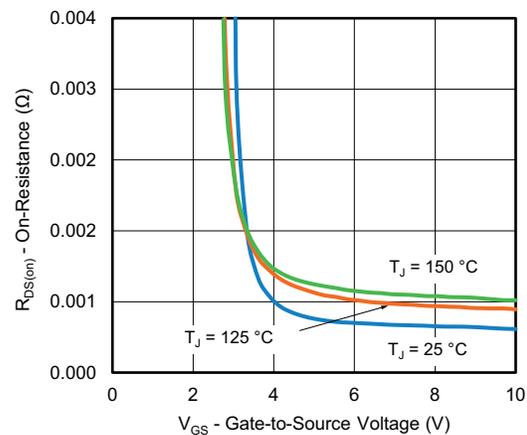
On-Resistance vs. Junction Temperature



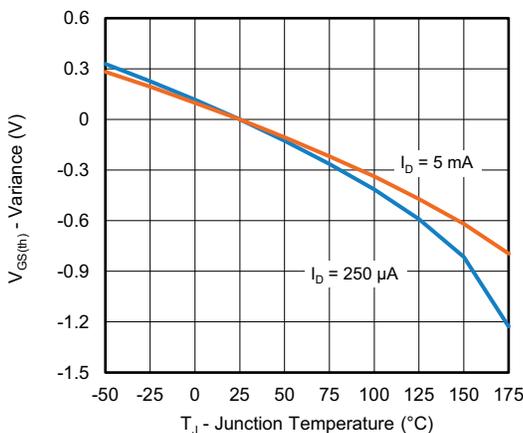
Drain Source Breakdown vs. Junction Temperature



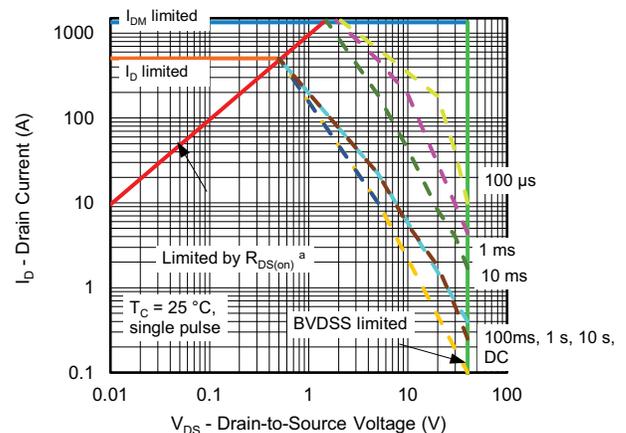
Source Drain Diode Forward Voltage



On-Resistance vs. Gate to Source Voltage



Threshold Voltage



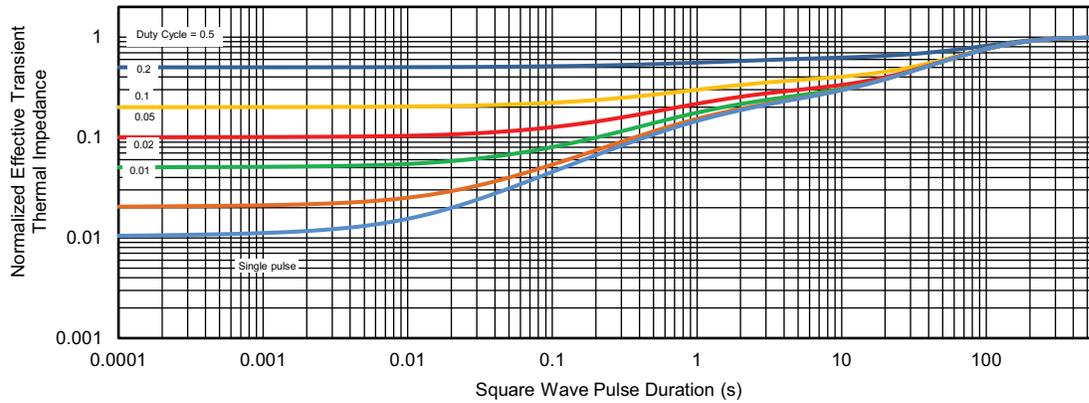
Safe Operating Area

Note

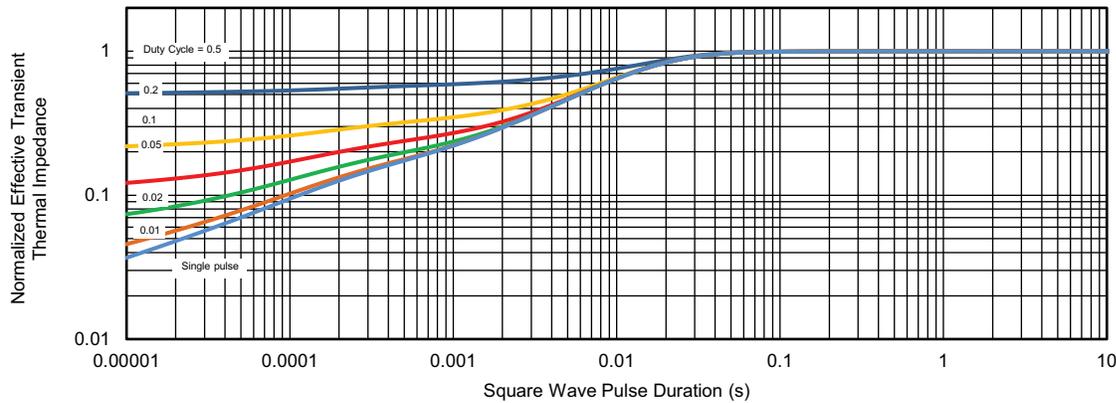
a. V<sub>GS</sub> > minimum V<sub>GS</sub> at which R<sub>DS(on)</sub> is specified



TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

Note

- The characteristics shown in the two graphs
    - Normalized Transient Thermal Impedance Junction-to-Ambient (25 °C)
    - Normalized Transient Thermal Impedance Junction-to-Case (25 °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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