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Vishay Siliconix

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



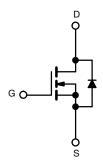
PRODUCT SUMMARY				
V <sub>DS</sub> (V)	40			
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 10 \text{ V}$	0.0080			
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 4.5 \text{ V}$	0.0110			
I <sub>D</sub> (A)	19			
Configuration	Single			

### **FEATURES**

- TrenchFET® power MOSFET
- AEC-Q101 qualified
- 100 % R<sub>q</sub> and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912







N-Channel MOSFET

ORDERING INFORMATION	
Package	SO-8
Lead (Pb)-free and halogen-free	SQ4050EY (for detailed order number please see <a href="https://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		$V_{DS}$	40	V		
Gate-source voltage		$V_{GS}$	± 20	V		
Continuous drain current	T <sub>C</sub> = 25 °C	- I <sub>D</sub>	19			
	T <sub>C</sub> = 125 °C		11			
Continuous source current (diode conduction)		I <sub>S</sub>	5.5	Α		
Pulsed drain current <sup>a</sup>		I <sub>DM</sub>	75			
Single pulse avalanche current	L = 0.1 mH	I <sub>AS</sub>	34			
Single pulse avalanche energy	L = 0.1 IIII	E <sub>AS</sub>	58	mJ		
Maximum power dissipation <sup>a</sup>	T <sub>C</sub> = 25 °C	В	6	W		
	T <sub>C</sub> = 125 °C	P <sub>D</sub>	2	VV		
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>b</sup>	$R_{thJA}$	85	°C/W
Junction-to-foot (drain)		$R_{thJF}$	25	C/VV

#### Notes

- a. Pulse test; pulse width  $\leq$  300  $\mu$ s, duty cycle  $\leq$  2 %
- b. When mounted on 1" square PCB (FR4 material)



# Vishay Siliconix

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-source breakdown voltage	V <sub>DS</sub>	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$		40	-	-	V
Gate-source threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =	$V_{DS} = V_{GS}, I_{D} = 250 \mu\text{A}$		2.0	2.5	
Gate-source leakage	I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$		-	-	± 100	nA
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 40 V	-	-	1	
Zero gate voltage drain current	I <sub>DSS</sub>	$V_{GS} = 0 V$	V <sub>DS</sub> = 40 V, T <sub>J</sub> = 125 °C	-	-	50	μΑ
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 40 V, T <sub>J</sub> = 175 °C	-	-	150	
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>GS</sub> = 10 V	$V_{DS} \ge 5 \text{ V}$	30	-	-	Α
		V <sub>GS</sub> = 10 V	I <sub>D</sub> = 10 A	-	0.0063	0.0080	
Dunius and an atota unninternal a	Б	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 10 A, T <sub>C</sub> = 125 °C	-	-	0.0120	
Drain-source on-state resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 10 A, T <sub>C</sub> = 175 °C	-	-	0.0150	Ω
		V <sub>GS</sub> = 4.5 V	I <sub>D</sub> = 9 A	-	0.0090	0.0110	1
Forward transconductance b	9fs	V <sub>DS</sub>	= 15 V, I <sub>D</sub> = 10 A	-	51	-	S
Dynamic <sup>b</sup>							
Input capacitance	C <sub>iss</sub>			-	1925	2406	pF
Output capacitance	C <sub>oss</sub>	$V_{GS} = 0 V$	V <sub>DS</sub> = 20 V, f = 1 MHz	-	300	375	
Reverse transfer capacitance	C <sub>rss</sub>			-	120	150	
Total gate charge <sup>c</sup>	Qg			-	34	51	
Gate-source charge c	Q <sub>gs</sub>	V <sub>GS</sub> = 10 V	$V_{DS} = 20 \text{ V}, I_D = 14 \text{ A}$	-	6.1	-	nC
Gate-drain charge <sup>c</sup>	Q <sub>gd</sub>	1		-	5.6	-	
Gate resistance	R <sub>g</sub>	f = 1 MHz		0.2	0.8	1.2	Ω
Turn-on delay time <sup>c</sup>	t <sub>d(on)</sub>			-	16	24	
Rise time <sup>c</sup>	t <sub>r</sub>	$V_{DD} = 20 \text{ V, } R_L = 20 \Omega$ $I_D \cong 1 \text{ A, } V_{GEN} = 10 \text{ V, } R_g = 6 \Omega$		-	9.3	14	ns
Turn-off delay time <sup>c</sup>	t <sub>d(off)</sub>			-	33.5	50	
Fall time <sup>c</sup>	t <sub>f</sub>			-	9.6	14.5	
Source-Drain Diode Ratings and Chai	acteristics b				•		
Pulsed current a	I <sub>SM</sub>			-	-	75	Α
Forward voltage	$V_{SD}$	$I_F = 3.5 \text{ A}, V_{GS} = 0$		_	0.75	1.1	V

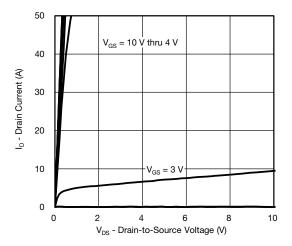
### Notes

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

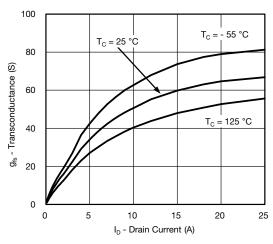
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



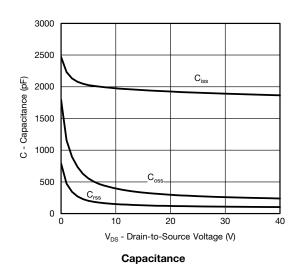
## **TYPICAL CHARACTERISTICS** (T<sub>A</sub> = 25 °C, unless otherwise noted)

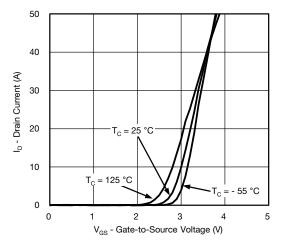


### **Output Characteristics**

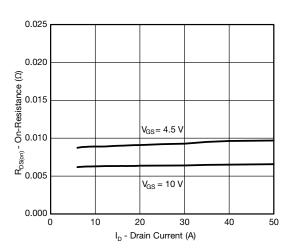


### Transconductance

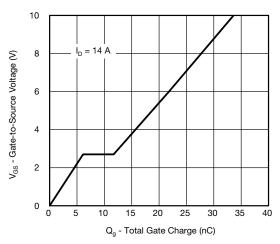




### **Transfer Characteristics**

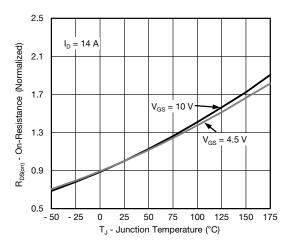


### **On-Resistance vs. Drain Current**

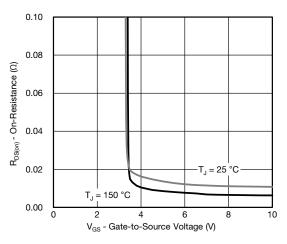




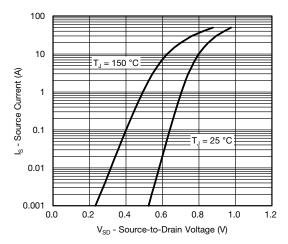
## TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise noted)



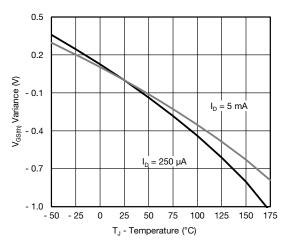
### On-Resistance vs. Junction Temperature



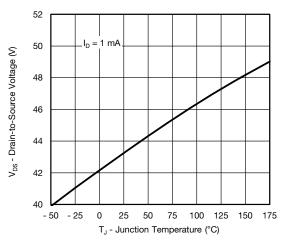
On-Resistance vs. Gate-to-Source Voltage



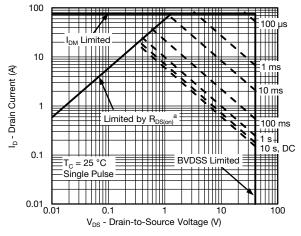
**Source Drain Diode Forward Voltage** 



### **Threshold Voltage**



**Drain Source Breakdown vs. Junction Temperature** 



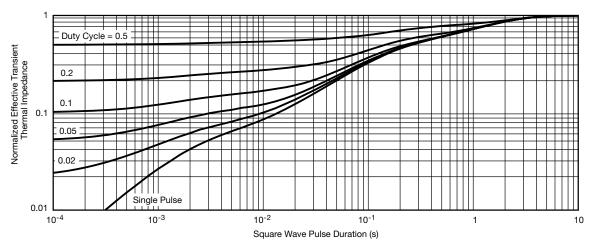
Safe Operating Area

### Note

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



### THERMAL RATINGS (T<sub>A</sub> = 25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient

#### Note

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient (25 °C)
  - Normalized Transient Thermal Impedance Junction-to-Foot (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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SOIC (NARROW): 8-LEAD JEDEC Part Number: MS-012







	MILLIM	IETERS	INCHES		
DIM	Min	Max	Min	Max	
Α	1.35	1.75	0.053	0.069	
A <sub>1</sub>	0.10	0.20	0.004	0.008	
В	0.35	0.51	0.014	0.020	
С	0.19	0.25	0.0075	0.010	
D	4.80	5.00	0.189	0.196	
Е	3.80	4.00	0.150	0.157	
е	1.27 BSC		0.050 BSC		
Н	5.80	6.20	0.228	0.244	
h	0.25	0.50	0.010	0.020	
L	0.50	0.93	0.020	0.037	
q	0°	8°	0°	8°	
S	0.44	0.64	0.018	0.026	
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DWG: 5498

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### **RECOMMENDED MINIMUM PADS FOR SO-8**



Recommended Minimum Pads Dimensions in Inches/(mm)

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