

Vishay Siliconix

# Automotive N-Channel 100 V (D-S) 175 °C MOSFET

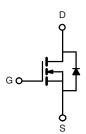
PRODUCT SUMMARY					
V <sub>DS</sub> (V)	100				
$R_{DS(on)} (\Omega)$ at $V_{GS} = 10 V$	0.025				
$R_{DS(on)} (\Omega)$ at $V_{GS} = 4.5 V$	0.029				
I <sub>D</sub> (A)	40				
Configuration	Single				
Package	TO-252				



#### **FEATURES**

- TrenchFET<sup>®</sup> power MOSFET
- · Package with low thermal resistance
- 100 %  $\rm R_g$  and UIS tested
- AEC-Q101 qualified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912





N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS	(T <sub>C</sub> = 25 °C, unless	s otherwise noted	)	
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage		V <sub>DS</sub>	100	V
Gate-Source Voltage		V <sub>GS</sub>	± 20	v
Continuous Drain Current	$T_C = 25 \ ^\circ C \ ^a$	- I <sub>D</sub>	40	
Continuous Drain Current	T <sub>C</sub> = 125 °C		26	
Continuous Source Current (Diode Conductio	n) <sup>a</sup>	I <sub>S</sub>	40	A
Pulsed Drain Current <sup>b</sup>		I <sub>DM</sub>	160	
Single Pulse Avalanche Current L = 0.1 mH		I <sub>AS</sub>	40	
Single Pulse Avalanche Energy		E <sub>AS</sub>	80	mJ
Maximum Power Dissipation <sup>b</sup>	T <sub>C</sub> = 25 °C	Pn	136	W
	T <sub>C</sub> = 125 °C	гD	45	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>c</sup>	R <sub>thJA</sub>	50	°C/W
Junction-to-Case (Drain)		R <sub>thJC</sub>	1.1	0/10

Notes

a. Package limited.

b. Pulse test; pulse width  $\leq 300~\mu s,~duty~cycle \leq 2~\%.$ 

c. When mounted on 1" square PCB (FR4 material).



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PARAMETER	SYMBOL	TES	MIN.	TYP.	MAX.	UNIT		
Static								
Drain-Source Breakdown Voltage	V <sub>DS</sub>	$V_{GS} = 0 V, I_D = 250 \mu A$		100	-	-	v	
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =	= V <sub>GS</sub> , I <sub>D</sub> = 250 μΑ	1.5	-	2.5	v	
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> =	$0 V, V_{GS} = \pm 20 V$	-	-	± 100	nA	
		$V_{GS} = 0 V$	V <sub>DS</sub> = 100 V	-	-	1.0		
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	$V_{GS} = 0 V$	V <sub>DS</sub> = 100 V, T <sub>J</sub> = 125 °C	-	-	50	μA	
		$V_{GS} = 0 V$	V <sub>DS</sub> = 100 V, T <sub>J</sub> = 175 °C	-	-	250	1	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>GS</sub> = 10 V	$V_{DS} \ge 5 V$	50	-	-	Α	
		$V_{GS} = 10 V$	I <sub>D</sub> = 40 A	-	0.019	0.025	Ω	
Drain-Source On-State Resistance <sup>a</sup>	Б	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 40 A, T <sub>J</sub> = 125 °C	-	-	0.050		
Drain-Source On-State Resistance ~	R <sub>DS(on)</sub>	$V_{GS} = 10 V$	I <sub>D</sub> = 40 A, T <sub>J</sub> = 175 °C	-	-	0.063		
		$V_{GS} = 4.5 V$	I <sub>D</sub> = 20 A	-	0.021	0.029		
Forward Transconductance <sup>b</sup>	<b>g</b> fs	V <sub>DS</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 40 A		73	-	S	
Dynamic <sup>b</sup>								
Input Capacitance	C <sub>iss</sub>			-	2703	3380	pF	
Output Capacitance	C <sub>oss</sub>	$V_{GS} = 0 V$	V <sub>DS</sub> = 25 V, f = 1 MHz	-	312	390		
Reverse Transfer Capacitance	C <sub>rss</sub>			-	127	160		
Total Gate Charge <sup>c</sup>	Qg			-	46	70		
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>	$V_{GS} = 10 \text{ V}$	$V_{DS} = 50 \text{ V}, I_D = 40 \text{ A}$	-	8.2	-	nC	
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			-	13	-		
Gate Resistance	Rg	f = 1 MHz		0.9	1.8	3.1	Ω	
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>			-	11	17		
Rise Time <sup>c</sup>	t <sub>r</sub>	$\label{eq:VDD} \begin{array}{l} V_{DD} = 50 \text{ V}, \text{ R}_L = 1.25 \ \Omega \\ I_D \cong 40 \text{ A}, \text{ V}_{GEN} = 10 \text{ V}, \text{ R}_g = 1 \ \Omega \end{array}$		-	11	17	ns	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			-	27	41		
Fall Time <sup>c</sup>	t <sub>f</sub>			-	6	9	]	
Source-Drain Diode Ratings and Chara	acteristics <sup>b</sup>							
Pulsed Current <sup>a</sup>	I <sub>SM</sub>			-	-	160	Α	
Forward Voltage	V <sub>SD</sub>	$I_{\rm F} = 40 \text{ A}, V_{\rm GS} = 0 \text{ V}$		-	0.9	1.5	V	

Notes

a. Pulse test; pulse width  $\leq$  300 µs, 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.

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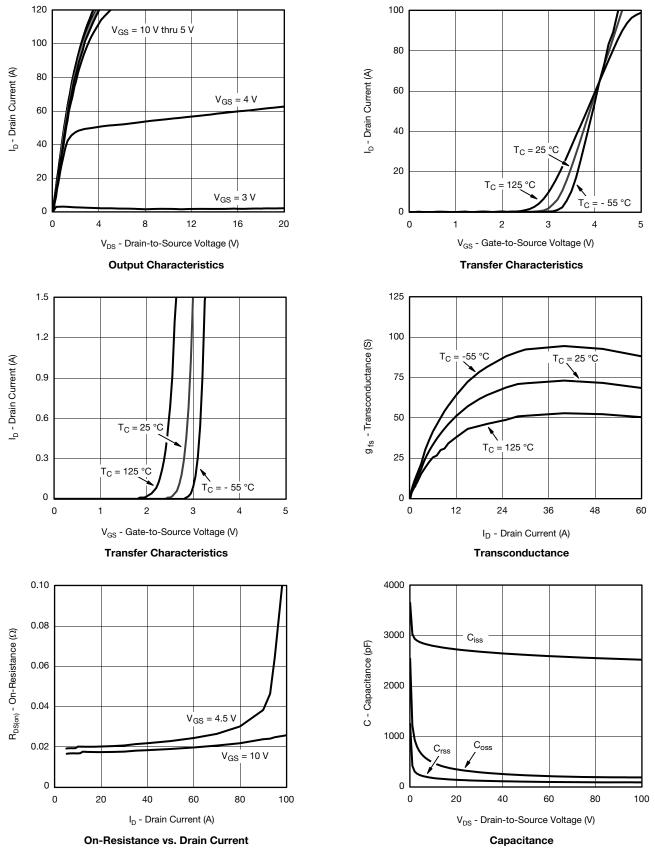
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SQD40N10-25

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



S15-1873-Rev. E, 10-Aug-15

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Document Number: 69064

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2.5  $I_D = 40 \text{ Å}$ 2.1

1.7

1.3

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10

8

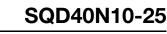
6

4

 $I_D = 40$  A

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

 $V_{DS} = 50 V$ 



V<sub>GS</sub> = 10 V

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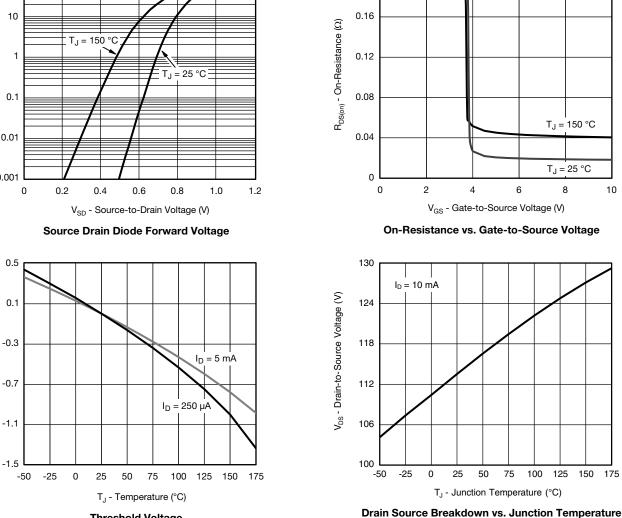
175

150

8

10

#### R<sub>DS(on)</sub> - On-Resistance (Normalized) V<sub>GS</sub> - Gate-to-Source Voltage (V) 0.9 2 0 0.5 -25 0 50 75 10 -50 25 100 125 0 20 30 40 50 T<sub>.1</sub> - Junction Temperature (°C) Q<sub>a</sub> - Total Gate Charge (nC) **On-Resistance vs. Junction Temperature** Gate Charge 100 0.20 0.16 10 $R_{DS(on)}$ - On-Resistance ( $\Omega$ ) I<sub>S</sub> - Source Current (A) T<sub>J</sub> = 150 °C 1 0.12 ТJ = 25 °C = 0.1 0.08 0.04 0.01 0 0.001 2 6 0 0.2 0.4 0.6 0.8 1.0 1.2 0 4 V<sub>SD</sub> - Source-to-Drain Voltage (V) Source Drain Diode Forward Voltage 0.5 130 $I_D = 10 \text{ mA}$ 0.1 124 V<sub>GS(th)</sub> Variance (V) -0.3 118



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**Threshold Voltage** 

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150 175

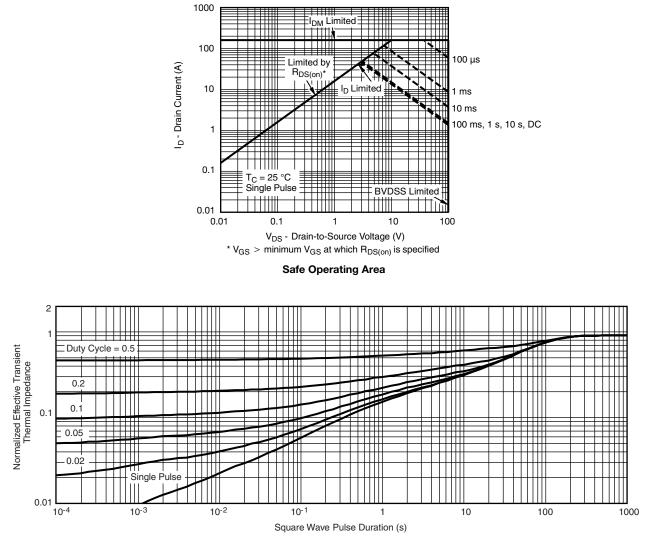
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#### **THERMAL RATINGS** (T<sub>A</sub> = 25 °C, unless otherwise noted)



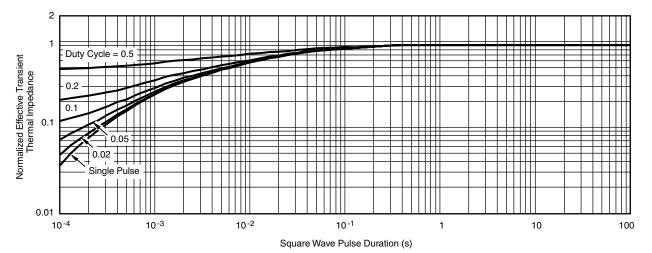
Normalized Thermal Transient Impedance, Junction-to-Ambient



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



Normalized Thermal Transient Impedance, Junction-to-Case

#### Note

S15-1873-Rev. E, 10-Aug-15

- 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.

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see <a href="http://www.vishay.com/ppg?69064">www.vishay.com/ppg?69064</a>.

<sup>•</sup> The characteristics shown in the two graphs



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REVISION HISTORY <sup>a</sup>			
REVISION	DATE	DESCRIPTION OF CHANGE	
E	04-Aug-15	Revised R <sub>g</sub> minimum limit	

Note

a. As of April 2014



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## **DPAK / TO-252 and Reverse DPAK**

Ordering codes for the SQ rugged series power MOSFETs in the DPAK / TO-252 and Reverse DPAK packages:

DATASHEET PART NUMBER	OLD ORDERING CODE a	NEW ORDERING CODE
SQD07N25-350H	SQD07N25-350H-GE3	SQD07N25-350H_GE3
SQD100N02-3m5L	-	SQD100N02-3m5L_GE3
SQD100N03-3m2L	SQD100N03-3M2L-GE3	SQD100N03-3M2L_GE3
SQD100N03-3m4	SQD100N03-3M4-GE3	SQD100N03-3M4_GE3
SQD100N04-3m6	SQD100N04-3M6-GE3	SQD100N04-3M6_GE3
SQD100N04-3m6L	SQD100N04-3M6L-GE3	SQD100N04-3M6L_GE3
SQD10N30-330H	SQD10N30-330H-GE3	SQD10N30-330H_GE3
SQD15N06-42L	SQD15N06-42L-GE3	SQD15N06-42L_GE3
SQD19P06-60L	SQD19P06-60L-GE3	SQD19P06-60L_GE3
SQD23N06-31L	SQD23N06-31L-GE3	SQD23N06-31L_GE3
SQD25N06-22L	SQD25N06-22L-GE3	SQD25N06-22L_GE3
SQD25N15-52	SQD25N15-52-GE3	SQD25N15-52_GE3
SQD30N05-20L	SQD30N05-20L-GE3	SQD30N05-20L_GE3
SQD40N06-14L	SQD40N06-14L-GE3	SQD40N06-14L_GE3
SQD40N10-25	SQD40N10-25-GE3	SQD40N10-25_GE3
SQD40P10-40L	SQD40P10-40L-GE3	SQD40P10-40L_GE3
SQD45P03-12	SQD45P03-12-GE3	SQD45P03-12_GE3
SQD50N04-5m6	SQD50N04-5M6-GE3	SQD50N04-5M6_GE3
SQD50N04-5m6L	-	SQD50N04-5m6L_GE3
SQD50N05-11L	SQD50N05-11L-GE3	SQD50N05-11L_GE3
SQD50N06-09L	SQD50N06-09L-GE3	SQD50N06-09L_GE3
SQD50N10-8m9L	SQD50N10-8M9L-GE3	SQD50N10-8M9L_GE3
SQD50P03-07	SQD50P03-07-GE3	SQD50P03-07_GE3
SQD50P04-13L	SQD50P04-13L-GE3	SQD50P04-13L_GE3
SQD50P04-09L	SQD50P04-09L-GE3	SQD50P04-09L_GE3
SQD50P06-15L	SQD50P06-15L-GE3	SQD50P06-15L_GE3
SQD50P08-25L	SQD50P08-25L-GE3	SQD50P08-25L_GE3
SQD50P08-28	SQD50P08-28-GE3	SQD50P08-28_GE3
SQD70140EL	-	SQD70140EL_GE3
SQD90P04-9m4L	SQD90P04-9M4L-GE3	SQD90P04-9M4L_GE3
SQD97N06-6m3L	SQD97N06-6M3L-GE3	SQD97N06-6M3L_GE3
SQR40N10-25	SQR40N10-25-GE3	SQR40N10-25_GE3
SQR50N04-3m8	SQR50N04-3M8-GE3	SQR50N04-3M8 GE3

Note

a. Old ordering code is obsolete and no longer valid for new orders





Е b3 Ľ Δ ŝ b2 e1 Б E1

# C2 т gage plane height (0.5 mm)

-C

- A1

**TO-252AA** Case Outline

	MILLIN	<b>IETERS</b>	INCHES		
DIM.	MIN. MAX.		MIN.	MAX.	
А	2.18	2.38	0.086	0.094	
A1	-	0.127	-	0.005	
b	0.64	0.88	0.025	0.035	
b2	0.76	1.14	0.030	0.045	
b3	4.95	5.46	0.195	0.215	
С	0.46	0.61	0.018	0.024	
C2	0.46	0.89	0.018	0.035	
D	5.97	6.22	0.235	0.245	
D1	4.10	-	0.161	-	
Е	6.35	6.73	0.250	0.265	
E1	4.32	-	0.170	-	
Н	9.40	10.41	0.370	0.410	
е	2.28 BSC 0.090 BSC				
e1	4.56	4.56 BSC		0.180 BSC	
L	1.40	1.78	0.055	0.070	
L3	0.89	1.27	0.035	0.050	
L4	-	1.02	-	0.040	
L5	1.01	1.52	0.040	0.060	
ECN: T13-0592-Rev. A, 02-Sep-13 DWG: 6019					

Note

• Dimension L3 is for reference only.





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#### **RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)**



Recommended Minimum Pads Dimensions in Inches/(mm)

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