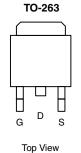


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Vishay Siliconix

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

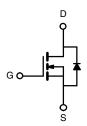
PRODUCT SUMMARY					
V <sub>DS</sub> (V)	40				
$R_{DS(on)}(\Omega)$ at $V_{GS} = 10 \text{ V}$	0.0041				
I <sub>D</sub> (A)	50				
Configuration	Single				



#### **FEATURES**

- TrenchFET® Power MOSFET
- Package with Low Thermal Resistance
- AEC-Q101 Qualified<sup>d</sup>
- 100 % R<sub>g</sub> and UIS Tested
- Material categorization:
  For definitions of compliance please see <a href="https://www.vishay.com/doc?99912">www.vishay.com/doc?99912</a>





N-Channel MOSFET

ORDERING INFORMATION				
Package	TO-263			
Lead (Pb)-free and Halogen-free	SQM50N04-4m1-GE3			

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 <sub>GS</sub>	± 20	V		
Continuous Drain Currenta	T <sub>C</sub> = 25 °C	1	50			
Continuous Drain Current	T <sub>C</sub> = 125 °C	I <sub>D</sub>	50			
Continuous Source Current (Diode Conduct	I <sub>S</sub>	50	Α			
Pulsed Drain Current <sup>b</sup>	I <sub>DM</sub>	200				
Single Pulse Avalanche Current	L = 0.1 mH	I <sub>AS</sub>	60			
Single Pulse Avalanche Energy	L = 0.1 min	E <sub>AS</sub>	180	mJ		
Maximum Dawar Dissinationh	T <sub>C</sub> = 25 °C	D	150	W		
Maximum Power Dissipation <sup>b</sup>	T <sub>C</sub> = 125 °C	P <sub>D</sub>	50	VV		
Operating Junction and Storage Temperatu	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 <sub>thJC</sub>	1	C/VV			

#### Notes

- a. Package limited.
- b. Pulse test; pulse width  $\leq$  300 µs, duty cycle  $\leq$  2 %.
- c. When mounted on 1" square PCB (FR-4 material).
- d. Parametric verification ongoing.



# Vishay Siliconix

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT	
Static				l			·	
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 <sub>GS</sub> , I <sub>D</sub> = 250 μA	2.5	3.0	3.5	ľ	
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> =	$0 \text{ V}, \text{ V}_{GS} = \pm 20 \text{ V}$	-	-	± 100	nA	
		$V_{GS} = 0 V$	V <sub>DS</sub> = 40 V	-	-	1		
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	$V_{GS} = 0 V$	$V_{DS} = 40 \text{ V}, T_{J} = 125 ^{\circ}\text{C}$	-	-	50	μA	
		$V_{GS} = 0 V$	V <sub>DS</sub> = 40 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 <sub>GS</sub> = 10 V	I <sub>D</sub> = 30 A	-	0.0030	0.0041	Ω	
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 30 A, T <sub>J</sub> = 125 °C	-	-	0.0068		
		V <sub>GS</sub> = 10 V	I <sub>D</sub> = 30 A, T <sub>J</sub> = 175 °C	-	-	0.0082		
Forward Transconductance <sup>b</sup>	9 <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 30 A		-	200	-	S	
Dynamic <sup>b</sup>								
Input Capacitance	C <sub>iss</sub>			-	5372	6715		
Output Capacitance	C <sub>oss</sub>	$V_{GS} = 0 V$	$V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}$	-	512	640	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	1		-	256	320		
Total Gate Charge <sup>c</sup>	Qg			-	70	105		
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>	V <sub>GS</sub> = 10 V	$V_{DS} = 20 \text{ V}, I_D = 50 \text{ A}$	-	16	-	nC	
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>	1	1		12.6	-		
Gate Resistance	$R_g$		f = 1 MHz		1.86	2.8	Ω	
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>				12	18		
Rise Time <sup>c</sup>	t <sub>r</sub>	$V_{DD} = 20 \text{ V}, \text{ R}_L = 0.4 \Omega$ $I_D \cong 50 \text{ A}, \text{ V}_{GEN} = 10 \text{ V}, \text{ R}_g = 1 \Omega$		-	5	8	ns	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			-	35	53		
Fall Time <sup>c</sup>	t <sub>f</sub>			-	9	14		
Source-Drain Diode Ratings and Char-	acteristics <sup>b</sup>	•						
Pulsed Current <sup>a</sup>	I <sub>SM</sub>			-	-	200	Α	
Forward Voltage	V <sub>SD</sub>	I <sub>F</sub> = 50 A, V <sub>GS</sub> = 0 V		-	0.86	1.5	V	
<u> </u>	1	1 . , 40						

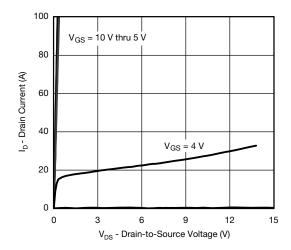
#### Notes

- 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.

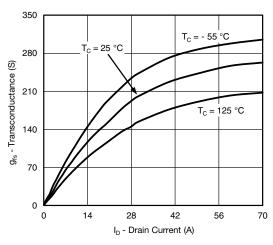
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



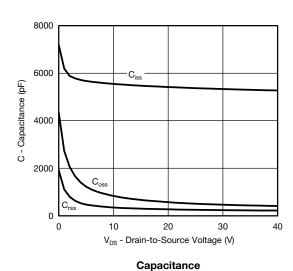
# **TYPICAL CHARACTERISTICS** (T<sub>A</sub> = 25 °C, unless otherwise noted)



### **Output Characteristics**



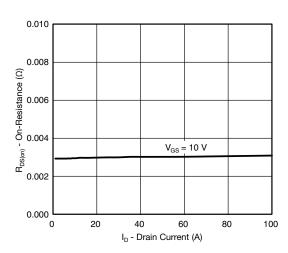
#### Transconductance



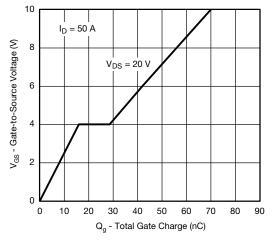
100 80 (c) T<sub>C</sub> = 25 °C 20 T<sub>C</sub> = 125 °C T<sub>C</sub> = -55 °C 0 2 4 6 8 10

#### **Transfer Characteristics**

V<sub>GS</sub> - Gate-to-Source Voltage (V)



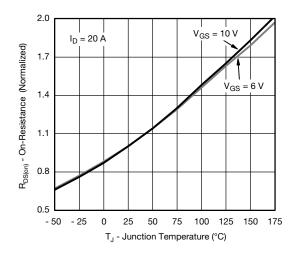
On-Resistance vs. Drain Current



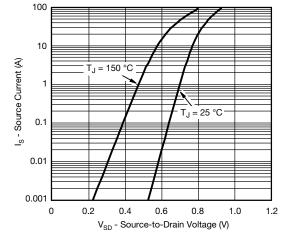
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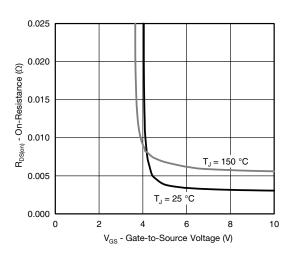
# **TYPICAL CHARACTERISTICS** (T<sub>A</sub> = 25 °C, unless otherwise noted)



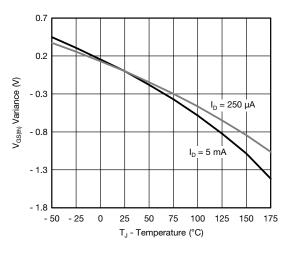
#### On-Resistance vs. Junction Temperature



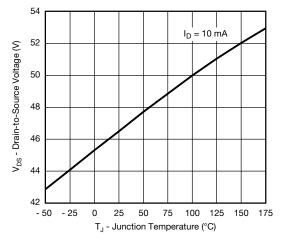
Source Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



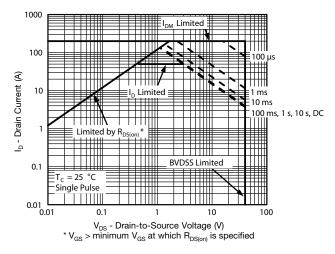
Threshold Voltage



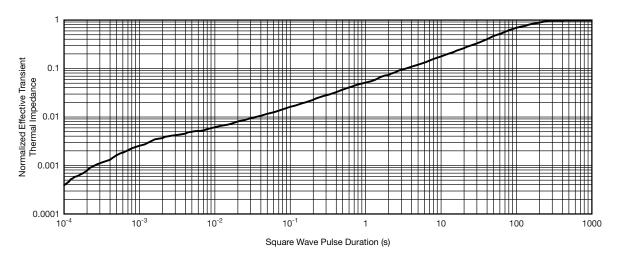
Drain Source Breakdown vs. Junction Temperature



# **THERMAL RATINGS** ( $T_A = 25$ °C, unless otherwise noted)



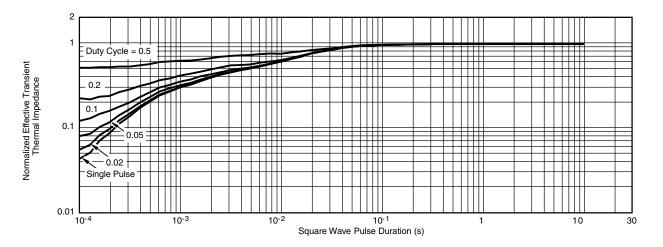
#### Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Ambient



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



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

#### Note

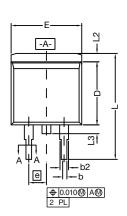
- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient (25 °C)
  - Normalized Transient Thermal Impedance Junction-to-Case (25  $^{\circ}\text{C})$

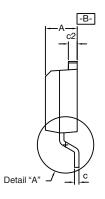
are given for general guidelines only to enable the user to get a "ball park" indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit 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.

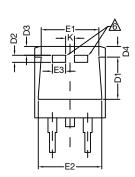
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# TO-263 (D<sup>2</sup>PAK): 3-LEAD

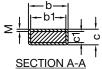








DETAIL A (ROTATED 90°)



⋝:	,	 	b— b1–		ļ	ļ
2:	П				5	ပ
	SE	СТ	ION	ΙΔ.	- 1 - Δ	Ŧ

- 1. Plane B includes maximum features of heat sink tab and plastic.
- 2. No more than 25 % of L1 can fall above seating plane by max. 8 mils.
- 3. Pin-to-pin coplanarity max. 4 mils.
- 4. \*: Thin lead is for SUB, SYB. Thick lead is for SUM, SYM, SQM.
- 5. Use inches as the primary measurement.

6 This feature is for thick lead.

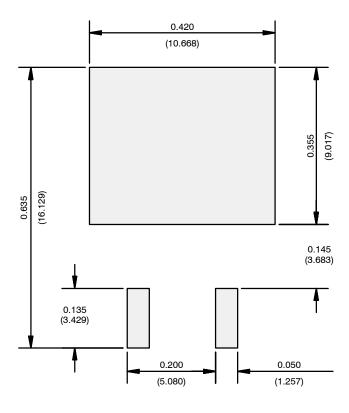
		INCHES		MILLIMETERS		
	DIM.	MIN.	MAX.	MIN.	MAX.	
Α		0.160	0.190	4.064	4.826	
	b	0.020	0.039	0.508	0.990	
	b1	0.020	0.035	0.508	0.889	
	b2	0.045	0.055	1.143	1.397	
c*	Thin lead	0.013	0.018	0.330	0.457	
	Thick lead	0.023	0.028	0.584	0.711	
c1	Thin lead	0.013	0.017	0.330	0.431	
CI	Thick lead	0.023	0.027	0.584	0.685	
	c2	0.045	0.055	1.143	1.397	
	D	0.340	0.380	8.636	9.652	
	D1	0.220	0.240	5.588	6.096	
	D2	0.038	0.042	0.965	1.067	
D3		0.045	0.055	1.143	1.397	
D4		0.044	0.052	1.118	1.321	
	Е	0.380	0.410	9.652	10.414	
	E1	0.245	-	6.223	-	
	E2	0.355	0.375	9.017	9.525	
	E3	0.072	0.078	1.829	1.981	
	е	0.100	BSC	2.54 BSC		
	K	0.045	0.055	1.143	1.397	
	L	0.575	0.625	14.605	15.875	
L1		0.090	0.110	2.286	2.794	
L2		0.040	0.055	1.016	1.397	
L3		0.050	0.070	1.270	1.778	
	L4 0.010 BSC		BSC	0.254 BSC		
M		- 0.002		-	0.050	
ECN: T13-0707-Rev. K, 30-Sep-13						

DWG: 5843





# RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead



Recommended Minimum Pads Dimensions in Inches/(mm)

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Revision: 02-Oct-12 Document Number: 91000