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Vishay Siliconix

# Automotive N-Channel 60 V (D-S) 175 °C MOSFET



PRODUCT SUMMARY					
V <sub>DS</sub> (V)	60				
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 10 \text{ V}$	0.0040				
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 4.5 \text{ V}$	0.0052				
I <sub>D</sub> (A)	100				
Configuration	Single				
Package	TO-252				

#### **FEATURES**

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



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G <sub>O</sub>	
N-Channel MOSFET	) S

<b>ABSOLUTE MAXIMUM RATINGS</b> (T <sub>C</sub> = 25 °C, unless otherwise noted)					
PARAMETER		SYMBOL	LIMIT	UNIT	
Drain-source voltage		V <sub>DS</sub>	60	V	
Gate-source voltage		$V_{GS}$	± 20	V	
Continuous drain current	$T_C = 25$ °C <sup>a</sup>	1	100		
	T <sub>C</sub> = 125 °C	- I <sub>D</sub>	68		
Continuous source current (diode conduction) <sup>a</sup>		I <sub>S</sub>	97	Α	
Pulsed drain current <sup>b</sup>		I <sub>DM</sub>	320		
Single pulse avalanche current	L = 0.1 mH	I <sub>AS</sub>	48		
Single pulse avalanche energy	L=0.11IIII	E <sub>AS</sub>	115	mJ	
Maximum power dissipation <sup>b</sup>	T <sub>C</sub> = 25 °C	D	107	W	
	T <sub>C</sub> = 125 °C	$P_{D}$	35	, 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 c	$R_{thJA}$	50	°C/W	
Junction-to-case (drain)	ction-to-case (drain)		1.4	C/VV	

#### 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	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static		•				<u> </u>	I
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$		60	-	-	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	V
Gate-source leakage	I <sub>GSS</sub>	V <sub>DS</sub> =	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$		-	± 100	nA
		$V_{GS} = 0 V$	V <sub>DS</sub> = 60 V -		-	1	
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 60 V, T <sub>J</sub> = 125 °C	-	-	50	μA
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 60 V, T <sub>J</sub> = 175 °C	-	-	300	μΑ
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>GS</sub> = 10 V	$V_{DS} \ge 5 \text{ V}$	100	-	-	Α
		V <sub>GS</sub> = 10 V	I <sub>D</sub> = 20 A	-	0.0033	0.0040	
During and a state of the second	5	V <sub>GS</sub> = 4.5 V	I <sub>D</sub> = 15 A	-	0.0042	0.0052	Ω
Drain-source on-state resistance a	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 20 A, T <sub>J</sub> = 125 °C	-	-	0.0064	
			I <sub>D</sub> = 20 A, T <sub>J</sub> = 175 °C	-	-	0.0077	
Forward transconductance b	9 <sub>fs</sub>	V <sub>DS</sub>	= 15 V, I <sub>D</sub> = 20 A	-	97	-	S
Dynamic <sup>b</sup>							
Input capacitance	C <sub>iss</sub>			-	4425	6100	
Output capacitance	C <sub>oss</sub>	$V_{GS} = 0 V$	V <sub>DS</sub> = 25 V, f = 1 MHz	-	1989	2800	рF
Reverse transfer capacitance	C <sub>rss</sub>			1	67	95	
Total gate charge <sup>c</sup>	Qq			1	60	90	
Gate-source charge c	Q <sub>gs</sub>	V <sub>GS</sub> = 10 V	$V = V_{DS} = 30 \text{ V}, I_{D} = 50 \text{ A}$		16.3	-	nC
Gate-drain charge <sup>c</sup>	Q <sub>gd</sub>	1		-	4.8	-	
Gate resistance	$R_g$	f = 1 MHz		0.6	1.24	1.9	Ω
Turn-on delay time c	t <sub>d(on)</sub>				15	25	
Rise time <sup>c</sup>	t <sub>r</sub>	$V_{DD}$ = 30 V, $R_L$ = 0.6 $\Omega$ $I_D \cong$ 50 A, $V_{GEN}$ = 10 V, $R_g$ = 1 $\Omega$		1	7	15	
Turn-off delay time <sup>c</sup>	t <sub>d(off)</sub>			-	33	50	ns
Fall time <sup>c</sup>	t <sub>f</sub>			-	7	15	
Source-Drain Diode Ratings and Chara	cteristics b						
Pulsed current <sup>a</sup>	I <sub>SM</sub>			-	-	320	Α
Forward voltage	V <sub>SD</sub>	I <sub>F</sub> = 25 A, V <sub>GS</sub> = 0 V		-	0.81	1.5	V
Body diode reverse recovery time	t <sub>rr</sub>	l <sub>F</sub> = 30 A, di/dt = 100 A/μs		-	42	85	ns
Body diode reverse recovery charge	$Q_{rr}$			-	34	70	nC
Reverse recovery fall time	ta			-	15	-	
Reverse recovery rise time	t <sub>b</sub>			-	27	-	ns
Body diode peak reverse recovery current	I <sub>RM(REC)</sub>	†		-	-1.45	-	Α

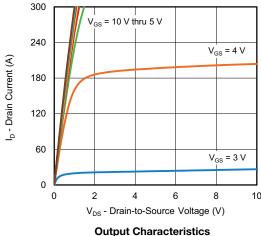
#### **Notes**

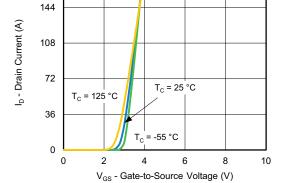
- a. Pulse test; pulse width  $\leq$  300  $\mu$ s, duty cycle  $\leq$  2 %
- b. Guaranteed by design, not subject to production testing
- c. Independent of operating temperature

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.



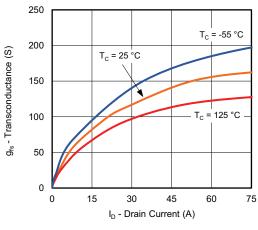
## **TYPICAL CHARACTERISTICS** (T<sub>A</sub> = 25 °C, unless otherwise noted)

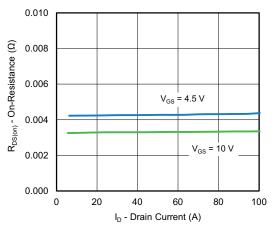




180

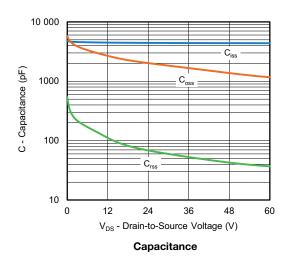


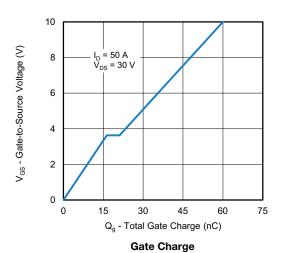




**Transconductance** 

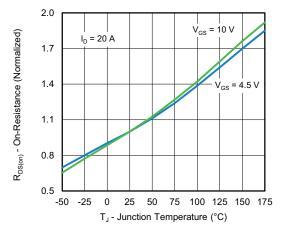
On-Resistance vs. Drain Current



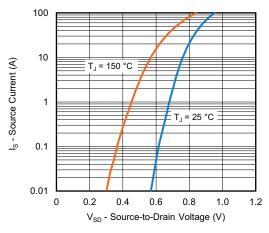




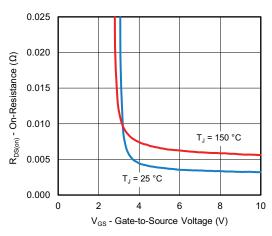
### **TYPICAL CHARACTERISTICS** (T<sub>A</sub> = 25 °C, unless otherwise noted)



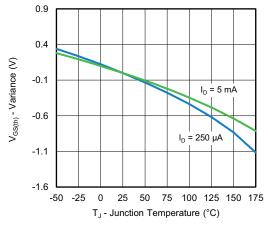
On-Resistance vs. Junction Temperature



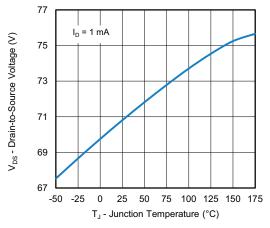
**Source Drain Diode Forward Voltage** 



On-Resistance vs. Gate-to-Source Voltage



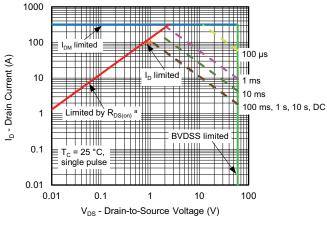
**Threshold Voltage** 



**Drain Source Breakdown vs. Junction Temperature** 



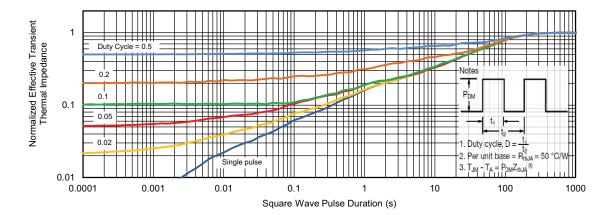
## **THERMAL RATINGS** ( $T_A = 25$ °C, unless otherwise noted)



#### Safe Operating Area

#### Note

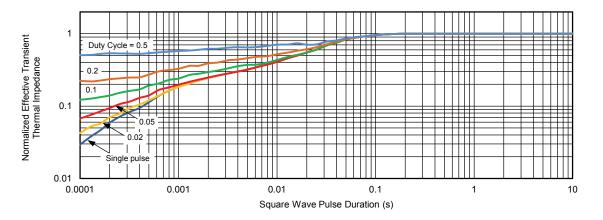
a.  $V_{GS}$  > minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified



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 °C)

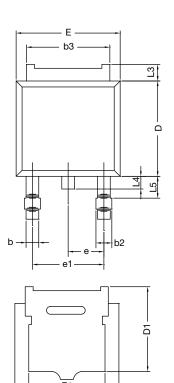
are given for general guidelines only to enable the user to get a "ball park" indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit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

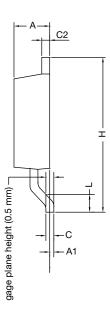
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## **TO-252AA Case Outline**





	MILLIN	METERS	INC	HES	
DIM.	MIN.	MAX.	MIN.	MAX.	
Α	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 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					

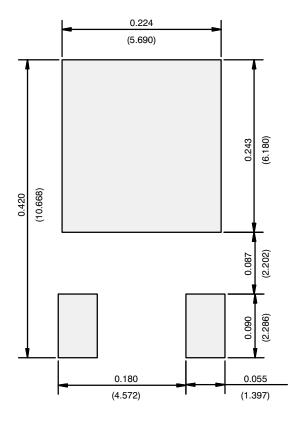
#### DWG: 6019

Note

• Dimension L3 is for reference only.



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



Recommended Minimum Pads Dimensions in Inches/(mm)

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APPLICATION NOTE



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