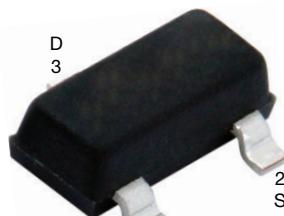


# Automotive N-Channel 60 V (D-S) 175 °C MOSFET

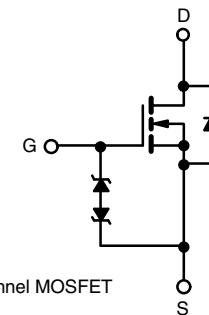
**SOT-23 (TO-236)**


Top View

**FEATURES**

- TrenchFET® power MOSFET
- AEC-Q101 qualified
- 100 % R<sub>g</sub> and UIS tested
- Typical ESD protection 800 V
- 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)	60
R <sub>DS(on)</sub> (Ω) at V <sub>GS</sub> = 1.5 V	0.245
I <sub>D</sub> (A)	4
Configuration	Single
Package	SOT-23

Marking code: 9JXXX

**ABSOLUTE MAXIMUM RATINGS** (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 <sub>GS</sub>	± 8	
Continuous drain current	I <sub>D</sub>	2	A
		1.3	
Continuous source current (diode conduction)	I <sub>S</sub>	2	
Pulsed drain current <sup>a</sup>	I <sub>DM</sub>	8	
Single pulse avalanche current	I <sub>AS</sub>	5	mJ
Single pulse avalanche energy	E <sub>AS</sub>	1.25	
Maximum power dissipation <sup>a</sup>	P <sub>D</sub>	3	W
		1	
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	R <sub>thJA</sub>	166	°C/W
Junction-to-foot (drain)	R <sub>thJF</sub>	50	

**Notes**

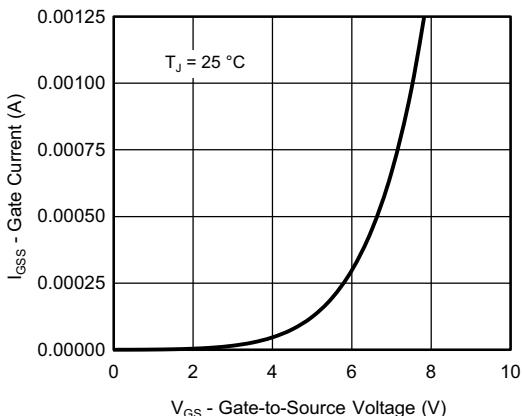
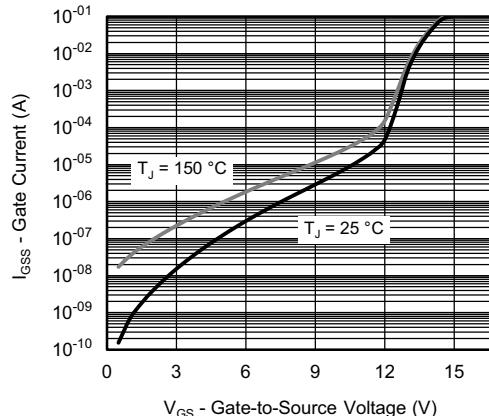
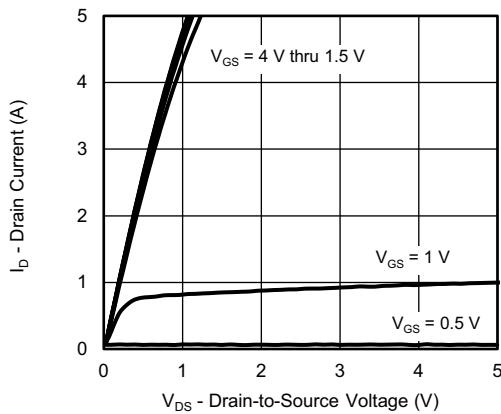
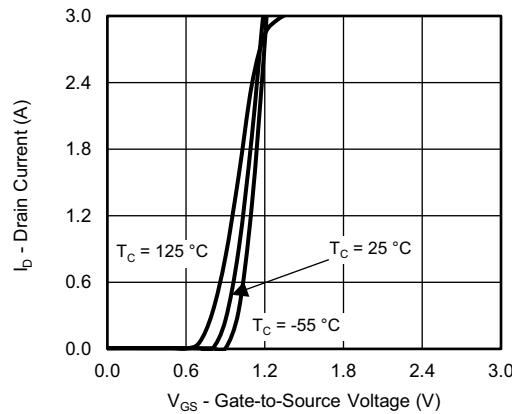
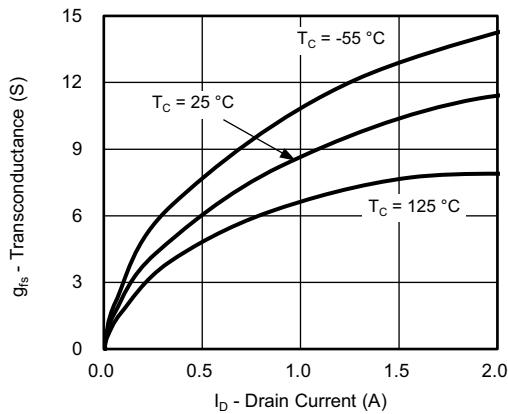
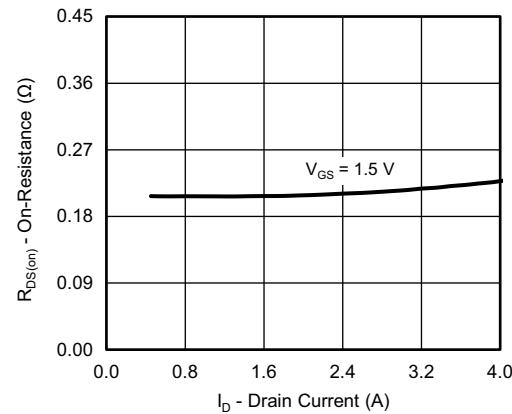
- a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %  
b. When mounted on 1" square PCB (FR4 material)

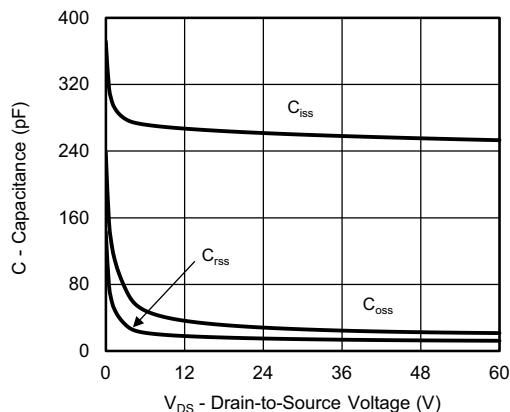
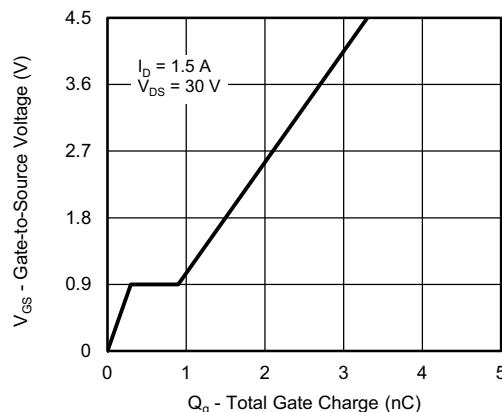
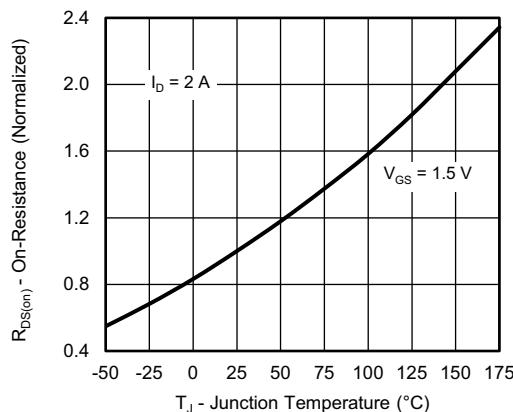
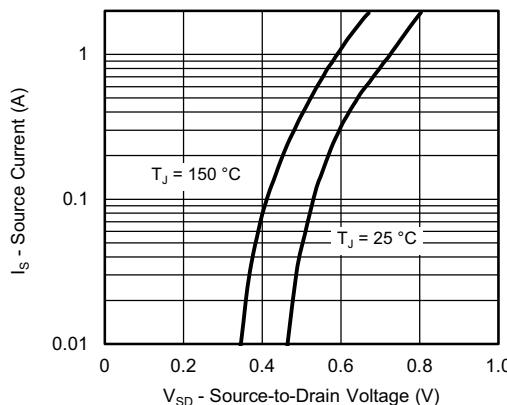
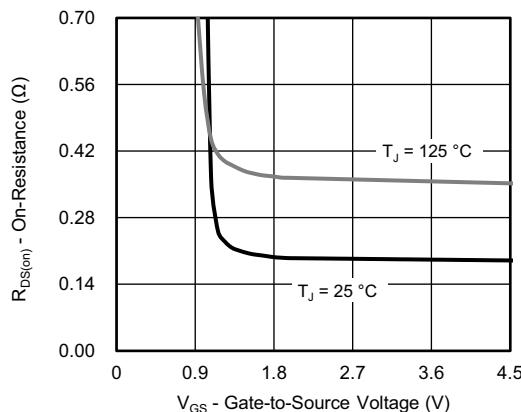
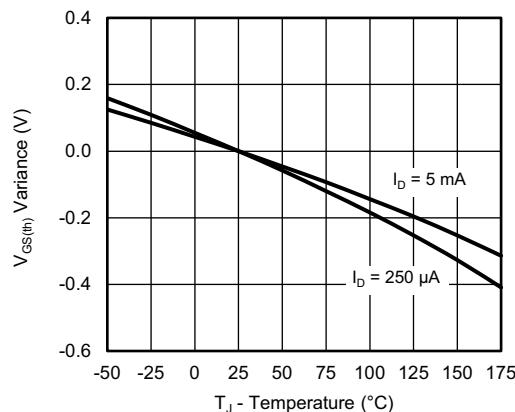
<b>SPECIFICATIONS</b> ( $T_C = 25^\circ\text{C}$ , unless otherwise noted)								
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT	
<b>Static</b>								
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0$ , $I_D = 250 \mu\text{A}$		60	-	-	V	
Gate-source threshold voltage	$V_{GS(\text{th})}$	$V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$		0.46	0.6	1		
Gate-source leakage	$I_{GSS}$	$V_{DS} = 0 \text{ V}$ , $V_{GS} = \pm 3 \text{ V}$		-	-	$\pm 100$	nA	
		$V_{DS} = 0 \text{ V}$ , $V_{GS} = \pm 8 \text{ V}$		-	-	$\pm 5.5$		
Zero gate voltage drain current	$I_{DSS}$	$V_{GS} = 0 \text{ V}$	$V_{DS} = 60 \text{ V}$	-	-	1		
		$V_{GS} = 0 \text{ V}$	$V_{DS} = 60 \text{ V}$ , $T_J = 125^\circ\text{C}$	-	-	50	$\mu\text{A}$	
		$V_{GS} = 0 \text{ V}$	$V_{DS} = 60 \text{ V}$ , $T_J = 175^\circ\text{C}$	-	-	150		
On-state drain current <sup>a</sup>	$I_{D(\text{on})}$	$V_{GS} = 4.5 \text{ V}$	$V_{DS} \geq 5 \text{ V}$	2	-	-	A	
Drain-source on-state resistance <sup>a</sup>	$R_{DS(\text{on})}$	$V_{GS} = 4.5 \text{ V}$	$I_D = 2 \text{ A}$ , $T_J = 25^\circ\text{C}$	-	0.190	0.240		
		$V_{GS} = 4.5 \text{ V}$	$I_D = 2 \text{ A}$ , $T_J = 125^\circ\text{C}$	-	-	0.460	$\Omega$	
		$V_{GS} = 4.5 \text{ V}$	$I_D = 2 \text{ A}$ , $T_J = 175^\circ\text{C}$	-	-	0.600		
		$V_{GS} = 1.5 \text{ V}$	$I_D = 2 \text{ A}$	-	0.195	0.245		
Forward transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = -15 \text{ V}$ , $I_D = 1 \text{ A}$		-	8.8	-	S	
<b>Dynamic<sup>b</sup></b>								
Input capacitance	$C_{iss}$	$V_{GS} = 0 \text{ V}$	$V_{DS} = 25 \text{ V}$ , $f = 1 \text{ MHz}$	-	263	330		
Output capacitance	$C_{oss}$			-	28	35	pF	
Reverse transfer capacitance	$C_{rss}$			-	15	19		
Total gate charge <sup>c</sup>	$Q_g$	$V_{GS} = 4.5 \text{ V}$	$V_{DS} = 30 \text{ V}$ , $I_D = 1.5 \text{ A}$	-	2	2.5		
Gate-source charge <sup>c</sup>	$Q_{gs}$			-	0.3	-	nC	
Gate-drain charge <sup>c</sup>	$Q_{gd}$			-	0.6	-		
Gate resistance	$R_g$	$f = 1 \text{ MHz}$		2.5	4.1	6.6	$\Omega$	
Turn-on delay time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = 30 \text{ V}$ , $R_L = 15 \Omega$ $I_D \geq 1.5 \text{ A}$ , $V_{GEN} = 10 \text{ V}$ , $R_g = 1 \Omega$		-	6	7.2		
Rise time <sup>c</sup>	$t_r$			-	11	14		
Turn-off delay time <sup>c</sup>	$t_{d(off)}$			-	26	32	ns	
Fall time <sup>c</sup>	$t_f$			-	13	16		
<b>Source-Drain Diode Ratings and Characteristics<sup>b</sup></b>								
Pulsed current <sup>a</sup>	$I_{SM}$			-	-	8	A	
Forward voltage	$V_{SD}$	$I_F = 2 \text{ A}$ , $V_{GS} = 0$		-	0.8	1.2	V	

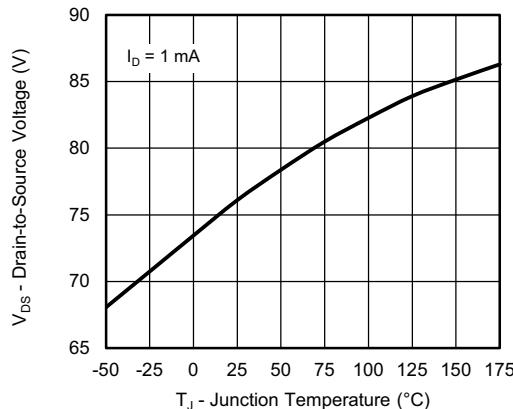
**Notes**

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

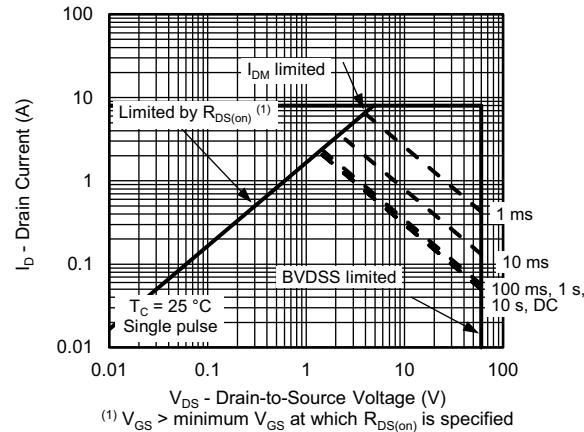
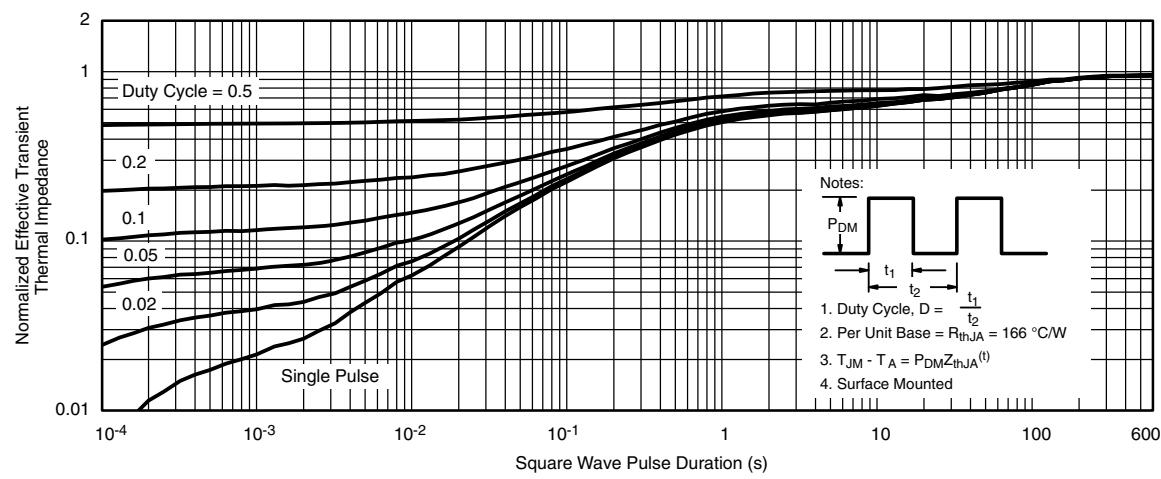
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

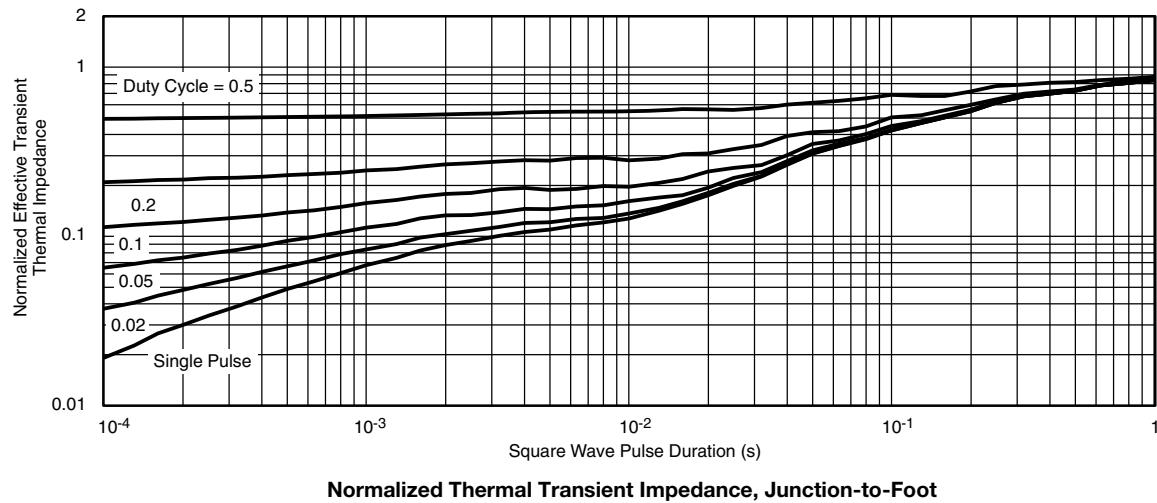
**TYPICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

**Gate Current vs. Gate-Source Voltage**

**Gate Current vs. Gate-Source Voltage**

**Output Characteristics**

**Transfer Characteristics**

**Transconductance**

**On-Resistance vs. Drain Current**

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

**Capacitance**

**Gate Charge**

**On-Resistance vs. Junction Temperature**

**Source-Drain Diode Forward Voltage**

**On-Resistance vs. Gate-Source Voltage**

**Threshold Voltage**

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


Drain-Source Breakdown vs. Junction Temperature


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


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

**Normalized Thermal Transient Impedance, Junction-to-Foot**
**Note**

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

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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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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