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Vishay Siliconix

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



Marking Code: 9Vxxx

PRODUCT SUMMARY					
V _{DS} (V)	-60				
$R_{DS(on)}(\Omega)$ at $V_{GS} = -10 \text{ V}$	0.170				
$R_{DS(on)}(\Omega)$ at $V_{GS} = -4.5 \text{ V}$	0.230				
I _D (A)	-2.8				
Configuration	Single				

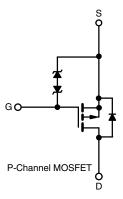
FEATURES

- TrenchFET® power MOSFET
- Typical ESD protection: 800 V
- AEC-Q101 qualified
- 100 % R_a and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



HALOGEN

FREE



ORDERING INFORMATION					
Package	SOT-23				
Lead (Pb)-free and halogen-free	SQ2361CEES (for detailed order number please see www.vishay.com/doc?79771)				

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		V_{DS}	-60	W
Gate-source voltage		V _{GS}	± 20	V
Continuous drain current	T _C = 25 °C	- I _D	-2.8	
	T _C = 125 °C		-1.6	
Continuous source current (diode conduction)		Is	-2.5	Α
Pulsed drain current ^a		I _{DM}	-11	
Single pulse avalanche current	1 0.1 ml l	I _{AS}	-13	
Single pulse avalanche energy	L = 0.1 mH	E _{AS}	8.4	mJ
Manian and a second distriction	T _C = 25 °C	D	2	W
Maximum power dissipation	T _C = 125 °C	P_{D}	0.67	VV
Operating junction and storage temperature	e range	T _J , T _{stg}	-55 to +175	°C

THERMAL RESISTANCE RATINGS					
PARAMETER		SYMBOL	LIMIT	UNIT	
Junction-to-ambient	PCB mount b	R _{thJA}	175	°C/W	
Junction-to-foot (drain)		R _{thJF}	75]	

Notes

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

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PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static		•					<u>I</u>
Drain-source breakdown voltage	V_{DS}	$V_{GS} = 0 \text{ V}, I_{D} = -250 \mu\text{A}$		-60	-	-	V
Gate-source threshold voltage	V _{GS(th)}	$V_{DS} = V_{GS}, I_D = -250 \mu A$		-1.5	-	-2.5	V
Cata acurea lagkaga	I _{GSS}	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$		-	-	± 30	mA
Gate-source leakage		$V_{DS} = 0 \text{ V}, V_{GS} = \pm 8 \text{ V}$		-	-	± 2	
		V _{GS} = 0 V	V _{DS} = -60 V	-	=.	-1	- μA
Zero gate voltage drain current	I _{DSS}	$V_{GS} = 0 V$	V _{DS} = -60 V, T _J = 125 °C	-	-	-50	
		V _{GS} = 0 V	V _{DS} = -60 V, T _J = 175 °C	-	-	-150	
On-state drain current ^a	I _{D(on)}	V _{GS} = -10 V	V _{DS} ≤ -5 V	-10	-	-	Α
		V _{GS} = -10 V	I _D = -2.4 A	-	0.130	0.170	Ω
Drain course on state resistance 3	В	V _{GS} = -10 V	I _D = -2.4 A, T _J = 125 °C	-	-	0.300	
Drain-source on-state resistance ^a	R _{DS(on)}	V _{GS} = -10 V	I _D = -2.4 A, T _J = 175 °C	-	-	0.315	
		V _{GS} = -4.5 V	I _D = -1.8 A	-	0.180	0.230	
Forward transconductance b	9 _{fs}	V _{DS} :	= -10 V, I _D = -2 A	-	5	-	S
Dynamic ^b							
Input capacitance	C _{iss}			-	415	620	
Output capacitance	C _{oss}	$V_{GS} = 0 V$	V _{DS} = -30 V, f = 1 MHz	-	55	80	pF
Reverse transfer capacitance	C _{rss}			-	32	45	
Total gate charge c	Qg			-	10	15	
Gate-source charge ^c	Q _{gs}	V _{GS} = -10 V	$V_{DS} = -30 \text{ V}, I_{D} = -6 \text{ A}$	-	1.5	-	nC
Gate-drain charge ^c	Q _{gd}]		-	5	-	
Gate resistance	R _g		f = 1 MHz		4.3	6.45	Ω
Turn-on delay time ^c	t _{d(on)}			-	9	12	
Rise time ^c	t _r	V _{DD} =	V_{DD} = -30 V, R_L = 20 Ω		9	12	- ns
Turn-off delay time ^c	t _{d(off)}	$I_D \cong -1.5$ A, $V_{GEN} = -10$ V, $R_g = 1$ Ω		-	24	30	
Fall time ^c	t _f			-	4	6	
Source-Drain Diode Ratings and Charact	eristics ^b						
Pulsed current ^a	I _{SM}			-	-	-11	Α
Forward voltage	V _{SD}	I _F = -1.5 A, V _{GS} = 0 V		-	-0.8	-1.2	V
Body diode reverse recovery time	t _{rr}			-	23	46	ns
Body diode reverse recovery charge	Q_{rr}	I _F = -1.5 A, di/dt = 100 A/μs		-	25	50	nC
Reverse recovery fall time	t _a			-	20	-	
Reverse recovery rise time	t _b			-	3	-	ns
Body diode peak reverse recovery current	I _{RM(REC)}			-	-2.9	-	Α

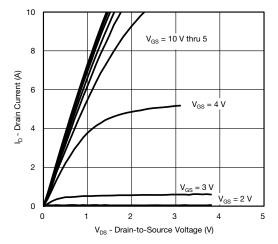
Notes

- 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

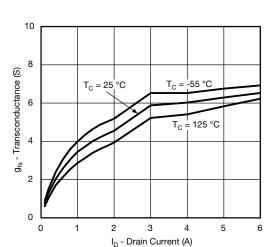
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



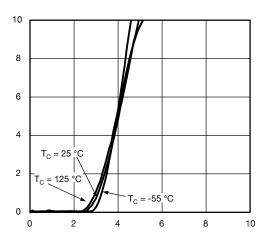
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



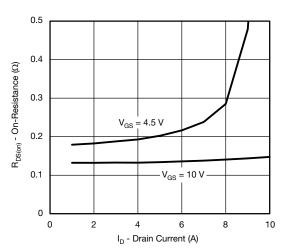
Output Characteristics



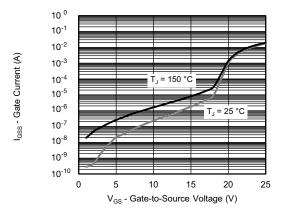
Transconductance



Transfer Characteristics



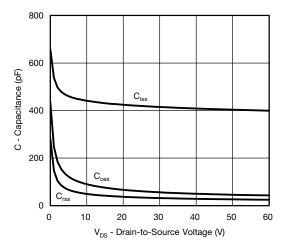
On-Resistance vs. Drain Current



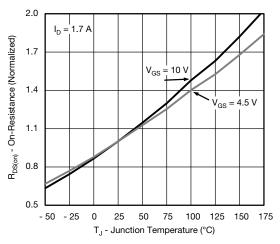
Gate Current vs. Gate-Source Voltage



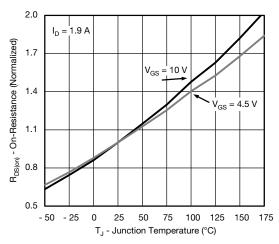
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



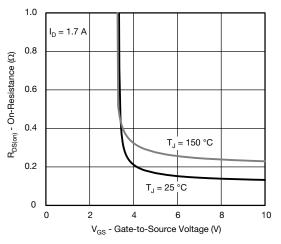
Capacitance



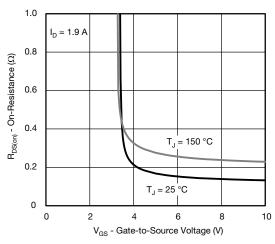
On-Resistance vs. Junction Temperature



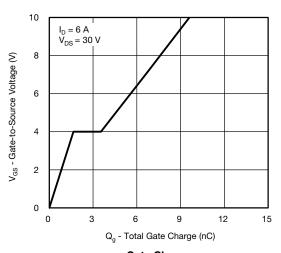
On-Resistance vs. Junction Temperature



On-Resistance vs. Gate-Source Voltage



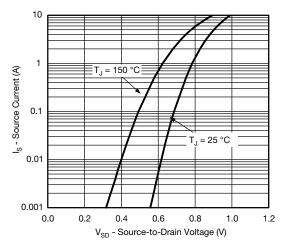
On-Resistance vs. Gate-Source Voltage



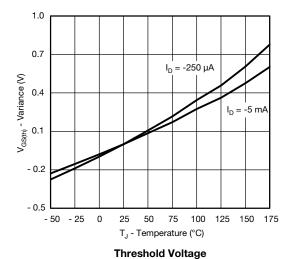
150 175



TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



Source-Drain Diode Forward Voltage



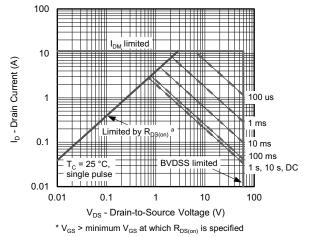
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- 55

- 50 - 25

T_J - Junction Temperature (°C) **Drain Source Breakdown vs. Junction Temperature**

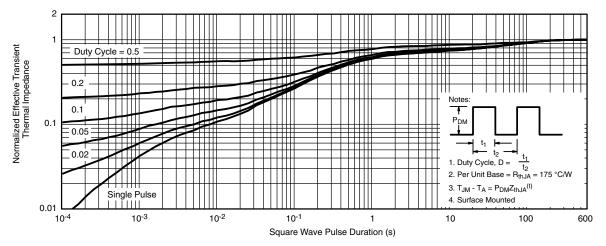
50 75 100 125



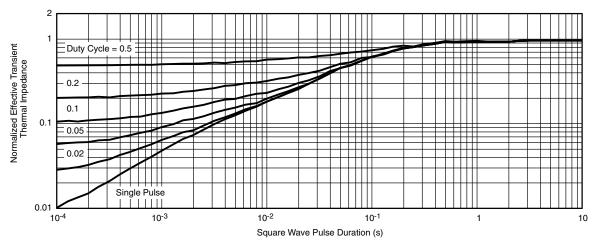
Safe Operating Area



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



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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

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 www.vishay.com/ppg?62349.

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SOT-23 (TO-236): 3-LEAD







Dim	MILLI	METERS	INCHES		
	Min	Max	Min	Max	
Α	0.89	1.12	0.035	0.044	
A ₁	0.01	0.10	0.0004	0.004	
A ₂	0.88	1.02	0.0346	0.040	
b	0.35	0.50	0.014	0.020	
С	0.085	0.18	0.003	0.007	
D	2.80	3.04	0.110	0.120	
E	2.10	2.64	0.083	0.104	
E ₁	1.20	1.40	0.047	0.055	
е	0.95 BSC		0.0374 Ref		
e ₁	1.90 BSC		0.0748 Ref		
L	0.40	0.60	0.016	0.024	
L ₁	0.64 Ref		0.025 Ref		
S	0.50 Ref		0.020 Ref		
q	3°	8°	3°	8°	
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RECOMMENDED MINIMUM PADS FOR SOT-23



Recommended Minimum Pads Dimensions in Inches/(mm)

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APPLICATION NOTE



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