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Vishay Siliconix

# P-Channel 20 V (D-S) MOSFET



PRODUCT SUMMARY					
V <sub>DS</sub> (V)	-20				
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS}$ = -4.5 V	0.0140				
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS}$ = -2.5 V	0.0200				
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -1.8 \text{ V}$	0.0300				
Q <sub>g</sub> typ. (nC)	39				
I <sub>D</sub> (A)	-15.4 <sup>e</sup>				
Configuration	Single				

#### **FEATURES**

- TrenchFET® Gen III p-channel power MOSFET
- 1.8 V rated R<sub>DS(on)</sub>
- 100% R<sub>q</sub> tested
- Material categorization: for definitions of compliance please see www.vishav.com/doc?99912

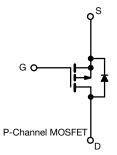


RoHS COMPLIANT

HALOGEN FREE

#### **APPLICATIONS**

- Adapter switch
- · Load switch
- DC/DC converters
- High speed switching
- Power management in
- battery-operated, mobile and wearable devices



ORDERING INFORMATION					
Package	SO-8				
Lead (Pb)-free and halogen-free Si4403DDY-T1-GE3					
<b>ABSOLUTE MAXIMUM RATINGS</b> (T <sub>A</sub> = 25 °C, unless otherwise noted)					

ABSOLUTE MAXIMUM RATING	<b>15</b> $(1_A = 25  {}^{\circ}\text{C}, \text{U})$	niess otnerw	rise notea)	
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		$V_{DS}$	-20	V
Gate-source voltage		$V_{GS}$	± 8	v
Continuous drain current (T <sub>J</sub> = 150 °C)	T <sub>C</sub> = 25 °C		-15.4 <sup>e</sup>	
	T <sub>C</sub> = 70 °C	1 , [	-12.3	
	T <sub>A</sub> =25 °C	l <sub>D</sub>	-10.9 <sup>b, c</sup>	
	T <sub>A</sub> = 70 °C	1 [	-8.7 b, c	Α
Pulsed drain current (t = 100 µs)		I <sub>DM</sub>	-32 <sup>a</sup>	
Continuous source-drain diode current	T <sub>C</sub> = 25 °C		-4.2	
	T <sub>A</sub> = 70 °C	l <sub>S</sub>	-2 <sup>b, c</sup>	
Maximum power dissipation	T <sub>C</sub> = 25 °C		5	
	T <sub>C</sub> = 70 °C	1 _ [	3.2	
	T <sub>A</sub> = 25 °C	P <sub>D</sub>	2.4 b, c	W
	T <sub>A</sub> = 70 °C	1 [	1.5 <sup>b, c</sup>	
Operating junction and storage temperature range		T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	
Soldering recommendations (peak temperature)			260	°C

THERMAL RESISTANCE RATINGS							
PARAMETER	SYMBOL	TYPICAL	MAXIMUM	UNIT			
Maximum junction-to-ambient b, d	t ≤ 10 s	R <sub>thJA</sub>	41	52	°C/W		
Maximum junction-to-foot (drain)	Steady state	R <sub>thJF</sub>	20	25	J C/VV		

#### Notes

- a. Package limited
- b. Surface mounted on 1" x 1" FR4 board
- c. t = 10 s
- d. Maximum under steady state conditions is 100 °C/W
- e.  $T_C = 25$  °C

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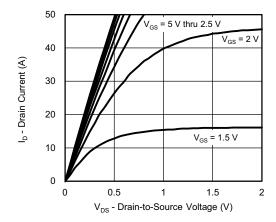
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT	
Static				l.			
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0 \text{ V}, I_D = -250 \mu\text{A}$	-20	-	-	V	
V <sub>DS</sub> temperature coefficient	$\Delta V_{DS}/T_{J}$		-	-12.5	-	mV/°C	
V <sub>GS(th)</sub> temperature coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>	$I_D = -250  \mu A$	-	26.5	-		
Gate-source threshold voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}, I_{D} = -250 \mu A$	-0.4	-	-1	V	
Gate-source leakage	I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 8 \text{ V}$	-	-	± 100	nA	
		V <sub>DS</sub> = -20 V, V <sub>GS</sub> = 0 V	-	-	-1		
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = -20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C	-	-	-10	μΑ	
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	$V_{DS} \le -5 \text{ V}, V_{GS} = 0 \text{ V}$	-5	-	-	Α	
	2(0.1)	V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -9 A	-	0.0105	0.0140		
Drain-source on-state resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -6 A	-	0.0140	0.0200	Ω	
	20(01)	$V_{GS} = -1.8 \text{ V}, I_D = -3 \text{ A}$	-	0.0190	0.0300		
Forward transconductance a	g <sub>fs</sub>	$V_{DS} = -10 \text{ V}, I_D = -9 \text{ A}$	-	45	-	S	
Dynamic <sup>b</sup>	313	20 1 7 2	<u> </u>				
Input capacitance	C <sub>iss</sub>		T -	3250	_		
Output capacitance	Coss	$V_{DS} = -10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	_	340	-	pF	
Reverse transfer capacitance	C <sub>rss</sub>	150 17 140 17, 1	_	325	_	Pi	
Total gate charge	0	V <sub>DS</sub> = -10 V, V <sub>GS</sub> = -8 V, I <sub>D</sub> = -5 A	_	66	99		
		$V_{DS} = -10 \text{ V}, V_{GS} = -4.5 \text{ V}, I_{D} = -5 \text{ A}$	_	39	59	1	
Gate-source charge	Q <sub>qs</sub>		_	3.7	-	nC	
Gate-drain charge	Q <sub>ad</sub>	$V_{DS} = -10 \text{ V}, V_{GS} = -4.5 \text{ V}, I_D = -5 \text{ A}$	_	7.9	_		
Gate resistance	R <sub>a</sub>	f = 1 MHz	0.7	3.7	7.4	Ω	
Turn-on delay time	t <sub>d(on)</sub>		-	21	40		
Rise time	t <sub>r</sub>	$V_{DD}$ = -10 V, $R_L$ = 2 $\Omega$ , $I_D \cong$ -5 A,	_	25	50		
Turn-off delay time	t <sub>d(off)</sub>	$V_{GEN} = -4.5 \text{ V}, R_{a} = 1 \Omega$	_	70	140		
Fall time	t <sub>f</sub>	3	_	24	50		
Turn-on delay time	t <sub>d(on)</sub>		-	9	20	ns	
Rise time	t <sub>r</sub>	$V_{DD}$ = -10 V, $R_L$ = 2 $\Omega$ , $I_D \cong$ -5 A,	_	18	35		
Turn-off delay time	t <sub>d(off)</sub>	$V_{GEN} = -8 \text{ V}, R_q = 1 \Omega$	_	74	150		
Fall time	t <sub>f</sub>	3	_	20	40		
Drain-Source Body Diode Characteristi						<u> </u>	
Continuous source-drain diode current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	_	_	-5.2		
Pulse diode forward current	I <sub>SM</sub>	-0 20 0	_	-	-32	Α	
Body diode voltage	V <sub>SD</sub>	I <sub>S</sub> = -5 A, V <sub>GS</sub> = 0 V	_	-0.8	-1.2	V	
Body diode reverse recovery time	t <sub>rr</sub>	15 - 071, 165 - 01	_	31	60	ns	
Body diode reverse recovery time	Q <sub>rr</sub>		_	20	40	nC	
Reverse recovery fall time	<del> </del>	$I_F = -5$ A, $dI/dt = 100$ A/ $\mu$ s, $T_J = 25$ °C	_	12	-	110	
neverse recovery fall tillle	ta		_	14	ı -	ns	

#### **Notes**

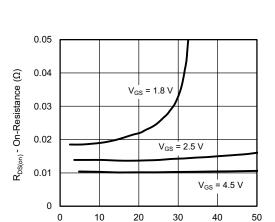
- a. Pulse test; pulse width  $\leq 300~\mu s,$  duty cycle  $\leq 2~\%$
- b. Guaranteed by design, not subject to production testing

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.



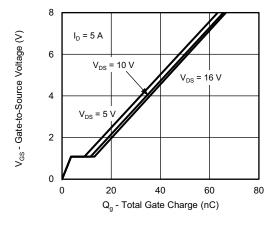


#### **Output Characteristics**

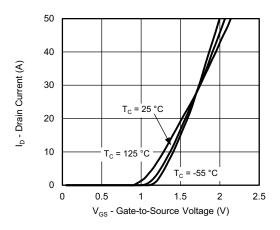


On-Resistance vs. Drain Current and Gate Voltage

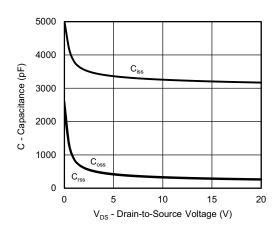
I<sub>D</sub> - Drain Current (A)



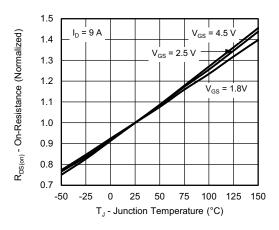
**Gate Charge** 



**Transfer Characteristics** 

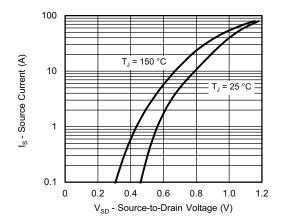


Capacitance

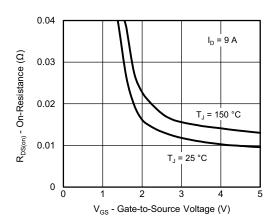


On-Resistance vs. Junction Temperature

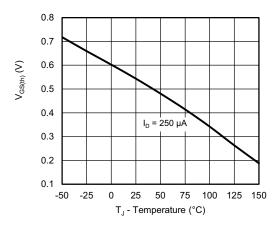




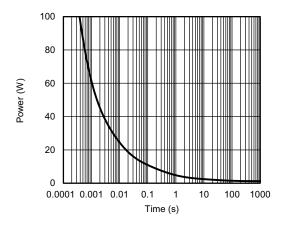
Source-Drain Diode Forward Voltage



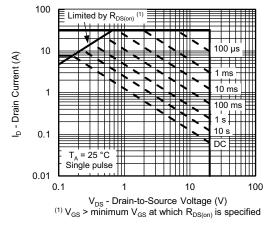
On-Resistance vs. Gate-to-Source Voltage



**Threshold Voltage** 

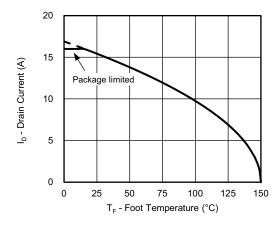


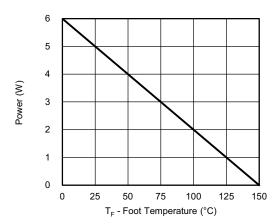
Single Pulse Power, Junction-to-Ambient



Safe Operating Area, Junction-to-Ambient







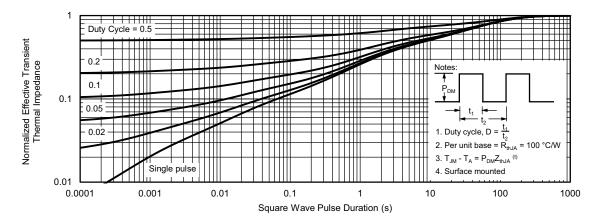
Current Derating a

Power, Junction-to-Foot

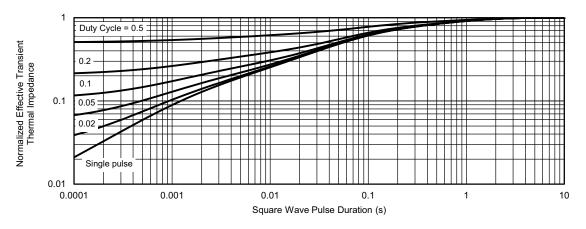
#### Note

a. The power dissipation P<sub>D</sub> is based on T<sub>J</sub> max. = 25 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.





Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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SOIC (NARROW): 8-LEAD JEDEC Part Number: MS-012







	MILLIMETERS		INC	HES	
DIM	Min	Max	Min	Max	
Α	1.35	1.75	0.053	0.069	
A <sub>1</sub>	0.10	0.20	0.004	0.008	
В	0.35	0.51	0.014	0.020	
С	0.19	0.25	0.0075	0.010	
D	4.80	5.00	0.189	0.196	
Е	3.80	4.00	0.150	0.157	
е	1.27	BSC	0.050 BSC		
Н	5.80	6.20	0.228	0.244	
h	0.25	0.50	0.010	0.020	
L	0.50	0.93	0.020	0.037	
q	0°	8°	0°	8°	
S	0.44	0.64	0.018	0.026	
ECN: C-06527-Rev. I. 11-Sep-06					

DWG: 5498

Document Number: 71192 www.vishay.com 11-Sep-06



## **RECOMMENDED MINIMUM PADS FOR SO-8**



Recommended Minimum Pads Dimensions in Inches/(mm)

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