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Vishay Siliconix

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



TO-263
45
S
D G
Top View G

#### **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 www.vishay.com/doc?99912



PRODUCT SUMMARY				
V <sub>DS</sub> (V)	-40			
$R_{DS(on)}(\Omega)$ at $V_{GS} = -10 \text{ V}$	0.0085			
$R_{DS(on)}(\Omega)$ at $V_{GS} = -4.5 \text{ V}$	0.0105			
I <sub>D</sub> (A)	-50			
Configuration	Single			
Package	TO-263			

DS (V)	-40		G←→	
$R_{DS(on)}(\Omega)$ at $V_{GS} = -10 \text{ V}$	0.0085		<del>-</del>	' ★
$R_{DS(on)}(\Omega)$ at $V_{GS} = -4.5 \text{ V}$	0.0105		`_	
) (A)	-50			
Configuration	Single		P-Channel MOSFET	7
ackage	TO-263			D
	_			
ABSOLUTE MAXIMUM	<b>I RATINGS</b> ( $T_C = 25$ °C, unles	ss otherwise noted)		
ADAMETED		OVALDOL	1 18417	

ABSOLUTE MAXIMUM RATINGS	(1C = 25 °C, utiless			
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		$V_{DS}$	-40	V
Gate-source voltage		$V_{GS}$	± 20	V
Continuous drain current	T <sub>C</sub> = 25 °C <sup>a</sup>	1	-50	
Continuous drain current $T_C = 125  ^{\circ}C$		I <sub>D</sub>	-46	
Continuous source current (diode conduction	ı) <sup>a</sup>	Is	-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>	-35	
Single pulse avalanche energy	L=0.1 min	E <sub>AS</sub>	61	mJ
Maximum power dissipation <sup>b</sup>	T <sub>C</sub> = 25 °C	В	107	W
waximum power dissipation 5	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	$R_{thJA}$	40	°C/W		
Junction-to-case (drain)		R <sub>thJC</sub>	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							
Drain-source breakdown voltage	V <sub>DS</sub>	$V_{GS} = 0$ , $I_D = -250 \mu A$		-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	-1.5	-	-2.5	V
Gate-source leakage	I <sub>GSS</sub>	V <sub>DS</sub> =	0 V, V <sub>GS</sub> = ± 20 V	-	-	± 100	nA
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = -40 V	-	-	-1	
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = -40 V, T <sub>J</sub> = 125 °C	-	-	-50	μΑ
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = -40 V, T <sub>J</sub> = 175 °C	-	-	-250	
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>GS</sub> = -10 V	V <sub>DS</sub> ≤ -5 V	-50	-	-	Α
	, ,	V <sub>GS</sub> = -10 V	I <sub>D</sub> = -25 A	-	0.0070	0.0085	
During and the second	5	V <sub>GS</sub> = -10 V	I <sub>D</sub> = -25 A, T <sub>J</sub> = 125 °C	-	-	0.0110	Ω
Drain-source on-state resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = -10 V	I <sub>D</sub> = -25 A, T <sub>J</sub> = 175 °C	-	-	0.0131	
		V <sub>GS</sub> = -4.5 V	I <sub>D</sub> = -20 A	-	0.0086	0.0105	
Forward transconductance a	9fs	V <sub>DS</sub> =	-15 V, I <sub>D</sub> = -25 A	-	92	-	S
Dynamic b							
Input capacitance	C <sub>iss</sub>		V <sub>DS</sub> = -25 V, f = 1 MHz	-	7365	9950	pF
Output capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		-	576	800	
Reverse transfer capacitance	C <sub>rss</sub>			-	548	750	
Total gate charge <sup>c</sup>	Qg		V <sub>GS</sub> = -10 V V <sub>DS</sub> = -20 V, I <sub>D</sub> = -50 A		153	230	
Gate-source charge c	Q <sub>gs</sub>	V <sub>GS</sub> = -10 V			34	-	nC
Gate-drain charge <sup>c</sup>	Q <sub>gd</sub>			-	29	-	1
Gate resistance	$R_g$		f = 1 MHz	1.5	3.15	4.8	Ω
Turn-on delay time <sup>c</sup>	t <sub>d(on)</sub>	$V_{DD} = -20 \text{ V}, \text{ R}_{L} = 0.4 \Omega$ $I_{D} \cong -50 \text{ A}, \text{ V}_{GEN} = -10 \text{ V}, \text{ R}_{g} = 1 \Omega$		-	16	25	
Rise time <sup>c</sup>	t <sub>r</sub>			-	230	350	ns
Turn-off delay time c	t <sub>d(off)</sub>			-	103	160	
Fall time <sup>c</sup>	t <sub>f</sub>			-	153	250	
Source-Drain Diode Ratings and Charac	teristics <sup>b</sup>						
Pulsed current <sup>a</sup>	I <sub>SM</sub>			-	-	-200	Α
Forward voltage	$V_{SD}$	I <sub>F</sub> = -50 A, V <sub>GS</sub> = 0		-	-0.96	-1.5	V
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = -30 A, di/dt = 100 A/μs		-	56	120	ns
Body diode reverse recovery charge	Q <sub>rr</sub>			-	83	170	nC
Reverse recovery fall time	ta			-	34	-	
Reverse recovery rise time	t <sub>b</sub>			-	22	-	ns
Body diode peak reverse recovery current	I <sub>RM(REC)</sub>				-3.8	_	Α

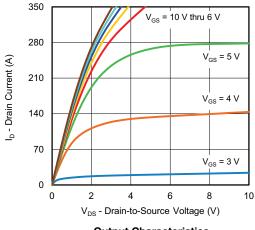
#### **Notes**

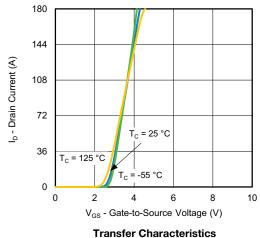
- a. Pulse test; pulse width  $\leq$  300  $\mu$ s, duty cycle  $\leq$  2 %
- b. Guaranteed by design, not subject to production testing
- c. Independent of operating temperature

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.

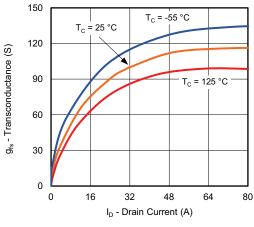


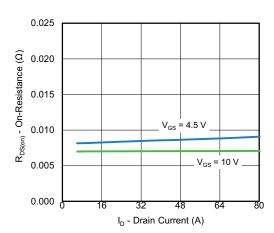
# **TYPICAL CHARACTERISTICS** (T<sub>A</sub> = 25 °C, unless otherwise noted)



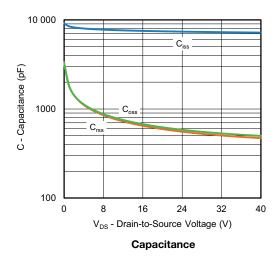


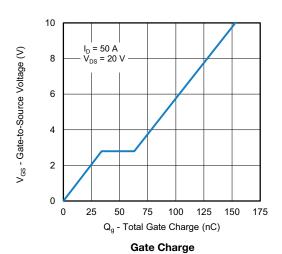
### Output Characteristics





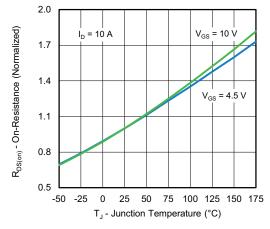
Transconductance On-Resistance vs. Drain Current



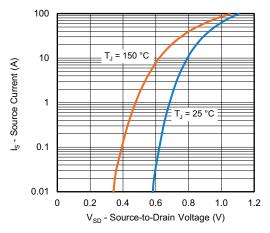




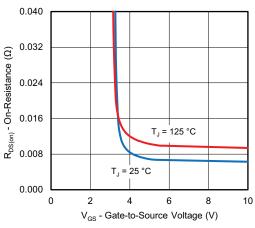
# **TYPICAL CHARACTERISTICS** (T<sub>A</sub> = 25 °C, unless otherwise noted)



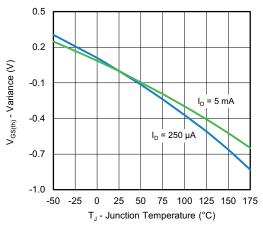
On-Resistance vs. Junction Temperature



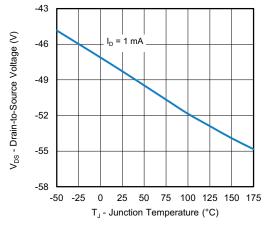
**Source Drain Diode Forward Voltage** 



On-Resistance vs. Gate-to-Source Voltage



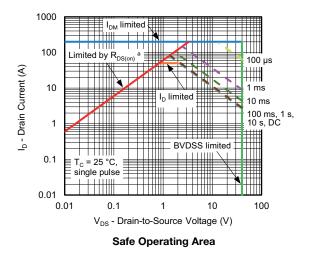
Threshold Voltage



Drain Source Breakdown vs. Junction Temperature

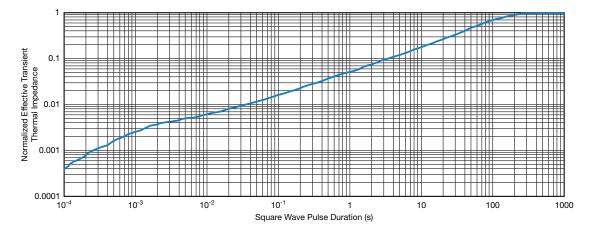


# **THERMAL RATINGS** ( $T_A = 25$ °C, unless otherwise noted)



#### Note

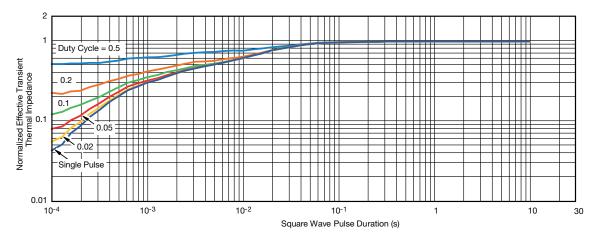
a.  $V_{GS} > \mbox{minimum} \ V_{GS}$  at which  $R_{DS(on)}$  is specified



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

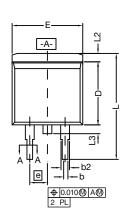
- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction to Ambient (25 °C)
  - Normalized Transient Thermal Impedance Junction to Case (25  $^{\circ}\text{C})$

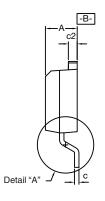
are given for general guidelines only to enable the user to get a "ball park" indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit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

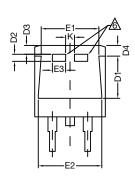
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# TO-263 (D<sup>2</sup>PAK): 3-LEAD

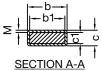








DETAIL A (ROTATED 90°)



_   <del>  -</del> b1 <del></del>    , , ,	
≥ <del>                                    </del>	- -

- 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	
C	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		0.254	BSC	
М		-	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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