

## P-Channel 40 V (D-S) 175 °C MOSFET



### FEATURES

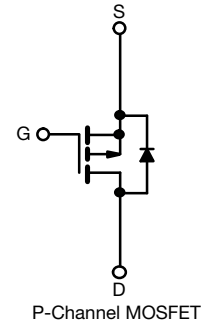
- TrenchFET® Gen IV p-channel power MOSFET
- Maximum 175 °C junction temperature
- 100 % R<sub>g</sub> and UIS tested
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### APPLICATIONS

- Motor drive control
- LED backlighting
- Load switch
- Industrial



PRODUCT SUMMARY	
V <sub>DS</sub> (V)	-40
R <sub>DS(on)</sub> max. (Ω) at V <sub>GS</sub> = 10 V	0.0120
R <sub>DS(on)</sub> max. (Ω) at V <sub>GS</sub> = 4.5 V	0.0175
Q <sub>g</sub> typ. (nC)	74.3
I <sub>D</sub> (A) <sup>d</sup>	-42
Configuration	Single

ORDERING INFORMATION	
Package	TO-252
Lead (Pb)-free and halogen-free	SUD40151EL-GE3

ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	V <sub>DS</sub>	-40	V
Gate-source voltage	V <sub>GS</sub>	± 20	
Continuous drain current	I <sub>D</sub>	T <sub>C</sub> = 25 °C	-42 <sup>d</sup>
		T <sub>C</sub> = 125 °C	-28.6
Pulsed drain current (t = 100 μs)	I <sub>DM</sub>	-100	A
Continuous source-drain diode current	I <sub>S</sub>	-41.7	
Single pulse avalanche current <sup>a</sup>	L = 0.1 mH	I <sub>AS</sub>	
Single pulse avalanche energy <sup>a</sup>		E <sub>AS</sub>	31.25
Maximum power dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	50 <sup>b</sup>
		T <sub>C</sub> = 125 °C	16.7 <sup>b</sup>
Operating junction and storage temperature range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C
Soldering recommendations (peak temperature) <sup>c</sup>		260	

THERMAL RESISTANCE RATINGS			
PARAMETER	SYMBOL	MAXIMUM	UNIT
Maximum junction-to-ambient (PCB mount) <sup>c</sup>	R <sub>thJA</sub>	60	°C/W
Maximum junction-to-case (drain)	Steady state	R <sub>thJC</sub>	

### Notes

- Duty cycle ≤ 1 %
- See SOA curve for voltage derating
- When mounted on 1" square PCB (FR4 material)
- Package limited



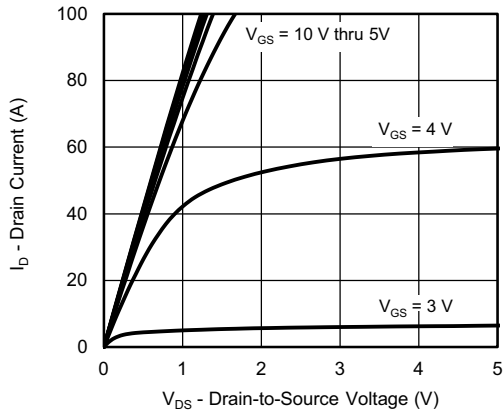
SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$	-40	-	-	V
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$	-1.5	-	-2.5	V
Gate-source leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$	-	-	250	nA
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = -40\text{ V}$ , $V_{GS} = 0\text{ V}$	-	-	-1	$\mu\text{A}$
		$V_{DS} = -40\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$	-	-	-150	$\mu\text{A}$
		$V_{DS} = -40\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 175\text{ }^\circ\text{C}$	-	-	-5	mA
On-state drain current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq -10\text{ V}$ , $V_{GS} = -10\text{ V}$	-30	-	-	A
Drain-source on-state resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$ , $I_D = -17.5\text{ A}$	-	0.0100	0.0120	$\Omega$
		$V_{GS} = -4.5\text{ V}$ , $I_D = -14.5\text{ A}$	-	0.0135	0.0175	$\Omega$
Forward transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -10\text{ V}$ , $I_D = -17.5\text{ A}$	-	70	-	S
<b>Dynamic <sup>b</sup></b>						
Input capacitance	$C_{iss}$	$V_{DS} = -20\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$	-	5340	-	pF
Output capacitance	$C_{oss}$		-	335	-	
Reverse transfer capacitance	$C_{rss}$		-	303	-	
Total gate charge	$Q_g$	$V_{DS} = -20\text{ V}$ , $V_{GS} = -10\text{ V}$ , $I_D = -17.5\text{ A}$	-	74.3	112	nC
Gate-source charge	$Q_{gs}$		-	12.7	-	
Gate-drain charge	$Q_{gd}$		-	11.1	-	
Gate resistance	$R_g$	$f = 1\text{ MHz}$	0.86	4.3	8.6	$\Omega$
Turn-on delay time	$t_{d(on)}$	$V_{DD} = -20\text{ V}$ , $R_L = 1.4\text{ }\Omega$ , $I_D \cong -14\text{ A}$ , $V_{GEN} = -10\text{ V}$ , $R_g = 1\text{ }\Omega$	-	15	30	ns
Rise time	$t_r$		-	10	20	
Turn-off delay time	$t_{d(off)}$		-	75	113	
Fall time	$t_f$		-	75	113	
<b>Drain-Source Body Diode Characteristics</b>						
Pulse diode forward current ( $t = 100\text{ }\mu\text{s}$ )	$I_{SM}$		-	-	-42	A
Body diode voltage	$V_{SD}$	$I_F = -14\text{ A}$ , $V_{GS} = 0\text{ V}$	-	-0.85	-1.5	V
Body diode reverse recovery time	$t_{rr}$	$I_F = -14\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$	-	30	45	ns
Body diode reverse recovery charge	$Q_{rr}$		-	0.02	0.04	$\mu\text{C}$
Reverse recovery fall time	$t_a$		-	15.3	-	ns
Reverse recovery rise time	$t_b$		-	14.7	-	
Body diode peak reverse recovery charge	$I_{RM(REC)}$			-	-	2.8

**Notes**

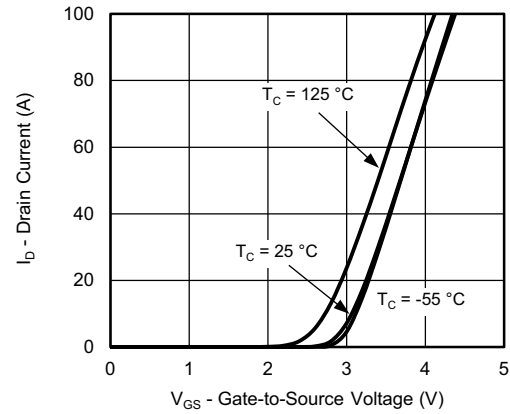
- Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$
- Guaranteed by design, not subject to production testing
- Independent of operating temperature

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.

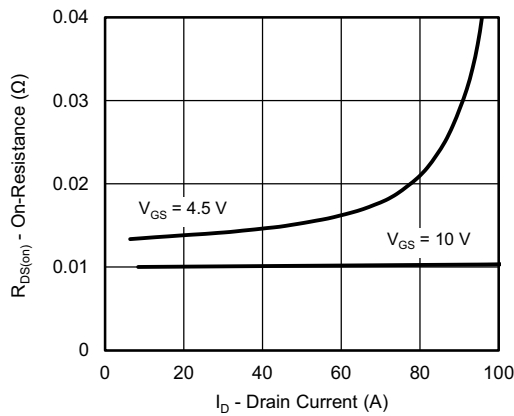
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



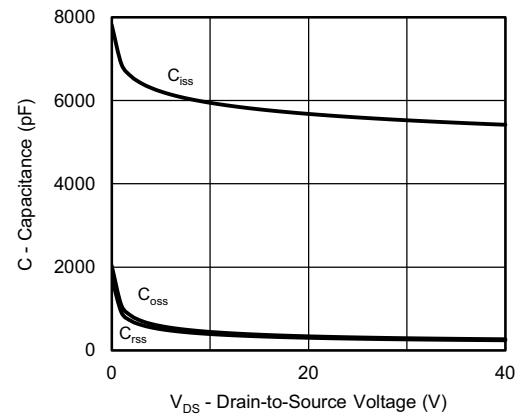
**Output Characteristics**



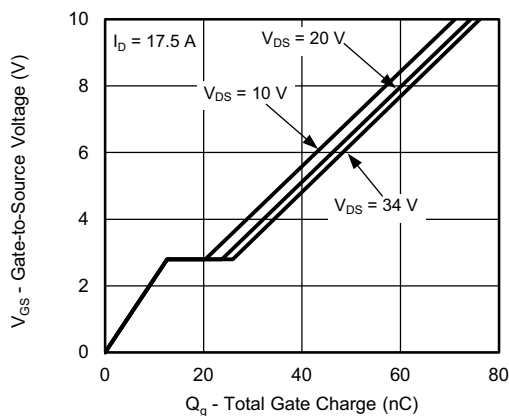
**Transfer Characteristics**



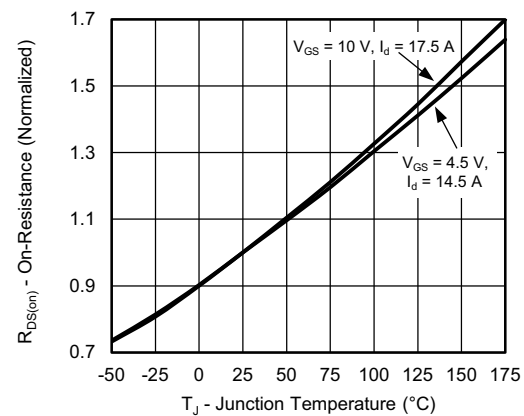
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**

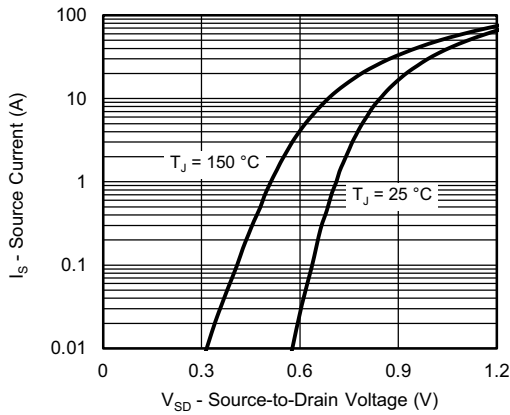


**Gate Charge**

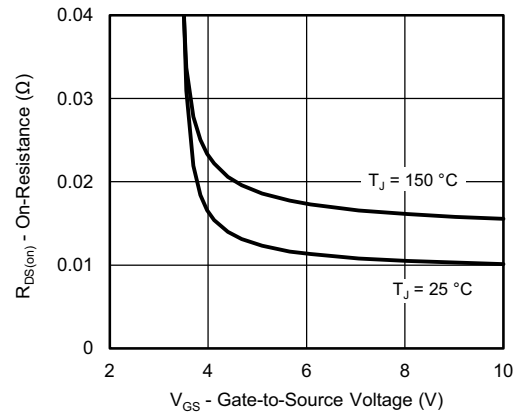


**On-Resistance vs. Junction Temperature**

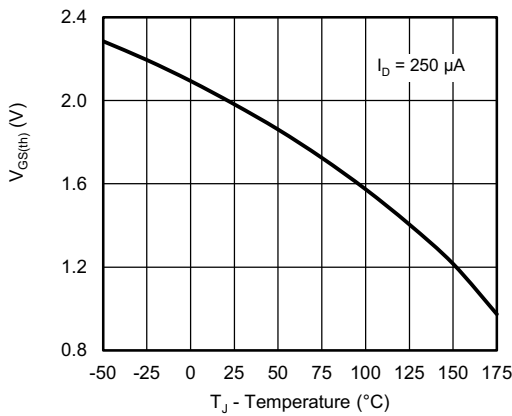
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



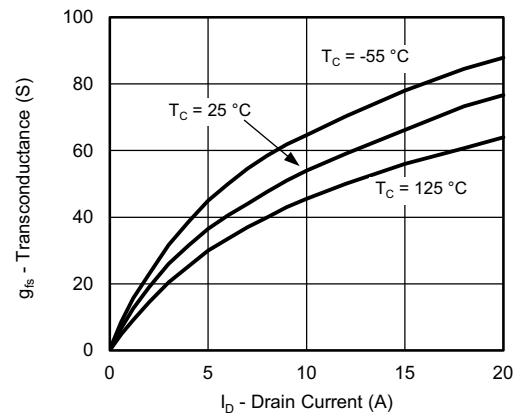
**Source-Drain Diode Forward Voltage**



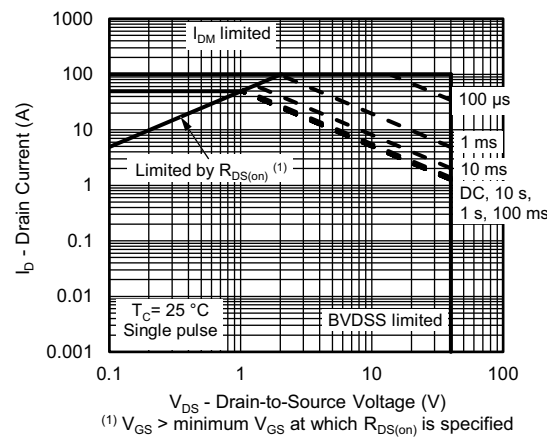
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



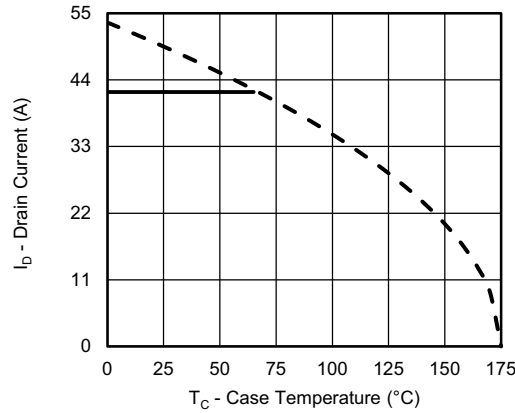
**Transconductance**



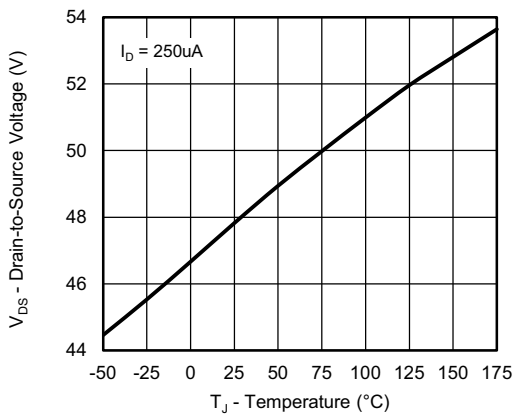
**Safe Operating Area, Junction-to-Ambient**



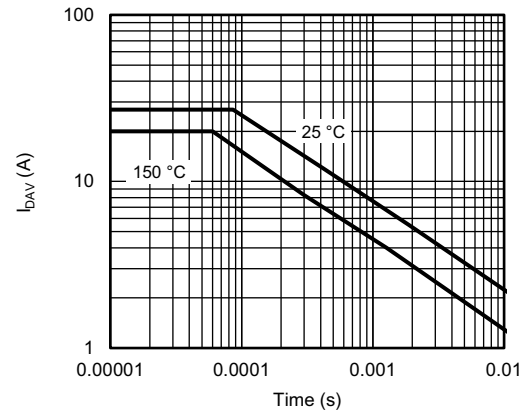
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating <sup>a</sup>



Drain Source Breakdown vs. Junction Temperature



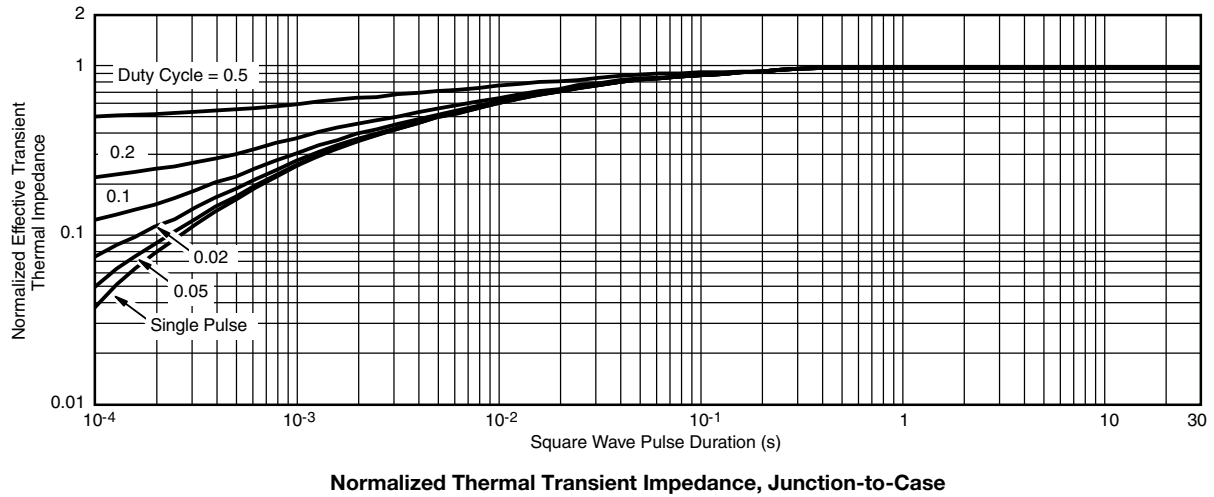
$I_{DAV}$  vs. Time

Note

- a. The power dissipation  $P_D$  is based on  $T_J$  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



**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



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# TO-252AA Case Outline

## VERSION 1: FACILITY CODE = Y



MILLIMETERS		
DIM.	MIN.	MAX.
A	2.18	2.38
A1	-	0.127
b	0.64	0.88
b2	0.76	1.14
b3	4.95	5.46
C	0.46	0.61
C2	0.46	0.89
D	5.97	6.22
D1	4.10	-
E	6.35	6.73
E1	4.32	-
H	9.40	10.41
e	2.28 BSC	
e1	4.56 BSC	
L	1.40	1.78
L3	0.89	1.27
L4	-	1.02
L5	1.01	1.52

### Note

- Dimension L3 is for reference only



VERSION 2: FACILITY CODE = N



MILLIMETERS		
DIM.	MIN.	MAX.
A	2.18	2.39
A1	-	0.13
b	0.65	0.89
b1	0.64	0.79
b2	0.76	1.13
b3	4.95	5.46
c	0.46	0.61
c1	0.41	0.56
c2	0.46	0.60
D	5.97	6.22
D1	5.21	-
E	6.35	6.73
E1	4.32	-
e	2.29 BSC	
H	9.94	10.34

MILLIMETERS		
DIM.	MIN.	MAX.
L	1.50	1.78
L1	2.74 ref.	
L2	0.51 BSC	
L3	0.89	1.27
L4	-	1.02
L5	1.14	1.49
L6	0.65	0.85
θ	0°	10°
θ1	0°	15°
θ2	25°	35°

Notes

- Dimensioning and tolerance confirm to ASME Y14.5M-1994
- All dimensions are in millimeters. Angles are in degrees
- Heat sink side flash is max. 0.8 mm
- Radius on terminal is optional

ECN: E19-0649-Rev. Q, 16-Dec-2019  
 DWG: 5347



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



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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