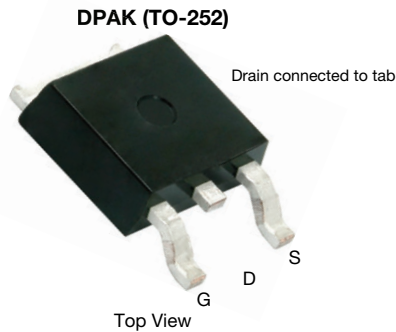
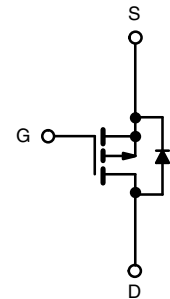


## P-Channel 40 V (D-S), 175 °C MOSFET



### FEATURES

- TrenchFET® power MOSFETs
- 175 °C junction temperature
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT


P-Channel MOSFET

### PRODUCT SUMMARY

$V_{DS}$ (V)	-40
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -10$ V	0.0094
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -4.5$ V	0.0145
$I_D$ (A) <sup>d</sup>	-50
Configuration	Single

### ORDERING INFORMATION

Package	DPAK (TO-252)
Lead (Pb)-free	SUD50P04-09L-E3

### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	$V_{DS}$	-40	V
Gate-source voltage	$V_{GS}$	$\pm 20$	
Continuous drain current ( $T_J = 175$ °C)	$I_D$	$T_C = 25$ °C	-50 <sup>d</sup>
		$T_C = 125$ °C	-50 <sup>d</sup>
Pulsed drain current	$I_{DM}$	-100	A
Avalanche current	$I_{AS}$	-50	
Single avalanche energy <sup>a</sup>	$E_{AS}$	125	mJ
Power dissipation	$P_D$	$T_C = 25$ °C	136 <sup>c</sup>
		$T_A = 25$ °C	3 <sup>b, c</sup>
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to +175	°C

### THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYPICAL	MAXIMUM	UNIT
Junction-to-ambient <sup>b</sup>	$R_{thJA}$	$t \leq 10$ s	15	°C/W
		Steady state	40	
Junction-to-case	$R_{thJC}$	0.82	1.1	

#### Notes

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



SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = -250 μA	-40	-	-	V
Gate threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA	-1	-	-3	
Gate-body leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V	-	-	± 100	nA
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = -32 V, V <sub>GS</sub> = 0 V	-	-	-1	μA
		V <sub>DS</sub> = -32 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C	-	-	-50	
		V <sub>DS</sub> = -32 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175 °C	-	-	-150	
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = -5 V, V <sub>GS</sub> = -10 V	-50	-	-	A
Drain-source on-state resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = -10 V, I <sub>D</sub> = -24 A	-	0.0075	0.0094	Ω
		V <sub>GS</sub> = -10 V, I <sub>D</sub> = -50 A, T <sub>J</sub> = 125 °C	-	-	0.0140	
		V <sub>GS</sub> = -10 V, I <sub>D</sub> = -50 A, T <sub>J</sub> = 175 °C	-	-	0.0170	
		V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -18 A	-	0.0115	0.0145	
Forward transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = -5 V, I <sub>D</sub> = -24 A	-	73	-	S
<b>Dynamic <sup>b</sup></b>						
Input capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = -25 V, f = 1 MHz	-	4800	-	pF
Output capacitance	C <sub>OSS</sub>		-	700	-	
Reverse transfer capacitance	C <sub>RSS</sub>		-	550	-	
Total gate charge <sup>c</sup>	Q <sub>g</sub>	V <sub>DS</sub> = -20 V, V <sub>GS</sub> = -10 V, I <sub>D</sub> = -50 A	-	102	150	nC
Gate-source charge <sup>c</sup>	Q <sub>gs</sub>		-	18.5	-	
Gate-drain charge <sup>c</sup>	Q <sub>gd</sub>		-	27	-	
Turn-on delay time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = -20 V, R <sub>L</sub> = 0.4 Ω I <sub>D</sub> ≅ -50 A, V <sub>GEN</sub> = -10 V, R <sub>g</sub> = 6 Ω	-	10	15	ns
Rise time <sup>c</sup>	t <sub>r</sub>		-	60	90	
Turn-off delay time <sup>c</sup>	t <sub>d(off)</sub>		-	145	220	
Fall time <sup>c</sup>	t <sub>f</sub>		-	140	220	
<b>Source Drain-Diode Ratings and Characteristics <sup>b</sup> (T<sub>C</sub> = 25 °C)</b>						
Continuous current	I <sub>S</sub>		-	-	-50	A
Pulsed current	I <sub>SM</sub>		-	-	-100	
Forward voltage <sup>a</sup>	V <sub>SD</sub>	I <sub>F</sub> = -50 A, V <sub>GS</sub> = 0 V	-	-1	-1.5	V
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = -50 A, di/dt = 100 A/μs	-	55	85	ns

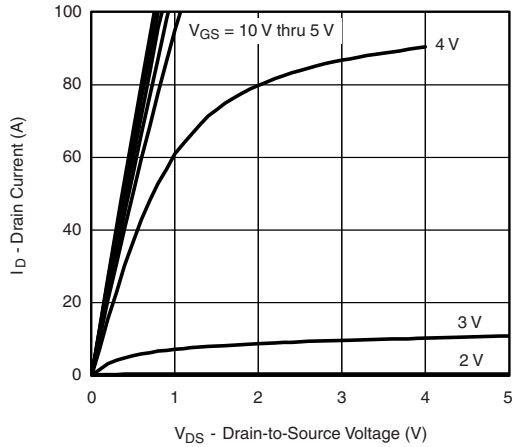
**Notes**

- a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2%
- a. Guaranteed by design, not subject to production testing
- b. Independent of operating temperature

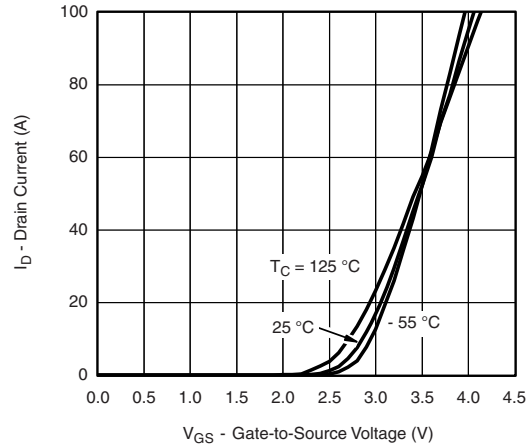
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



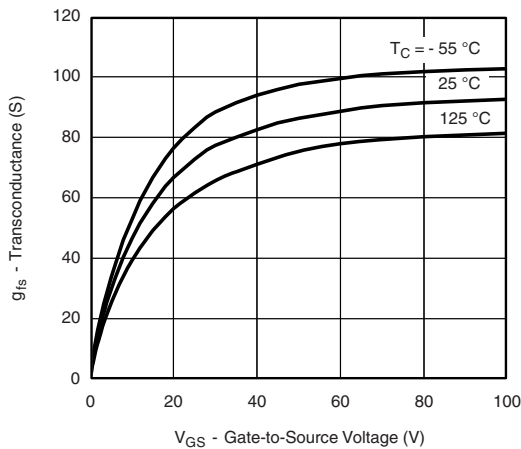
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



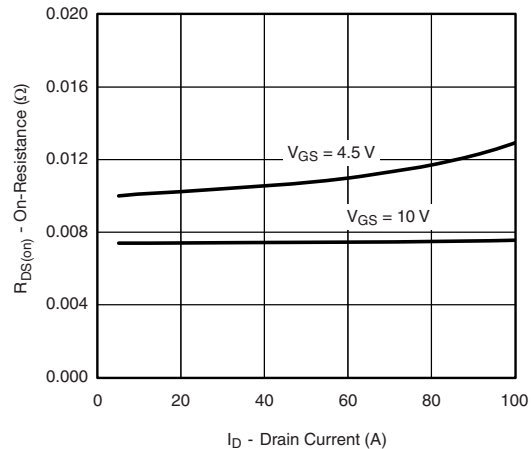
Output Characteristics



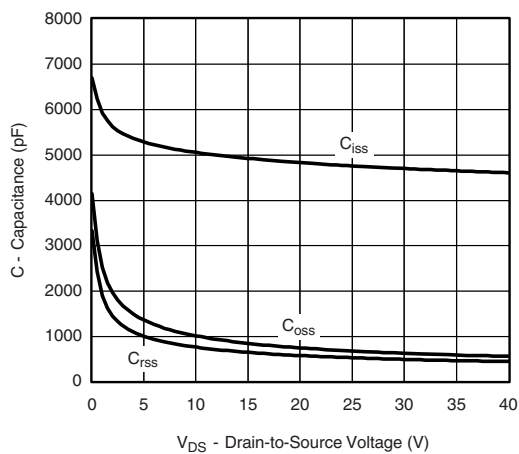
Transfer Characteristics



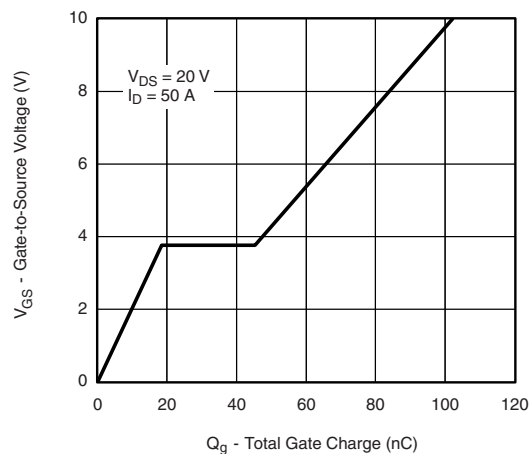
Transconductance



On-Resistance vs. Drain Current



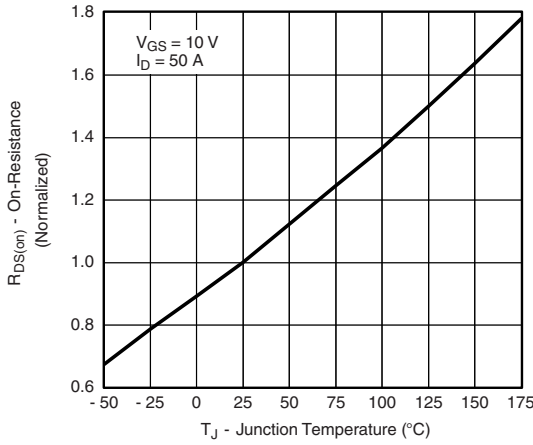
Capacitance



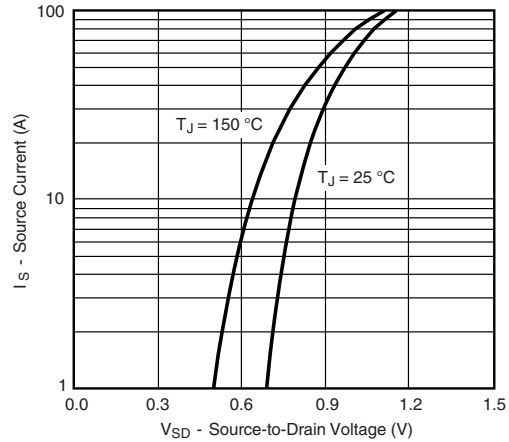
Gate Charge



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

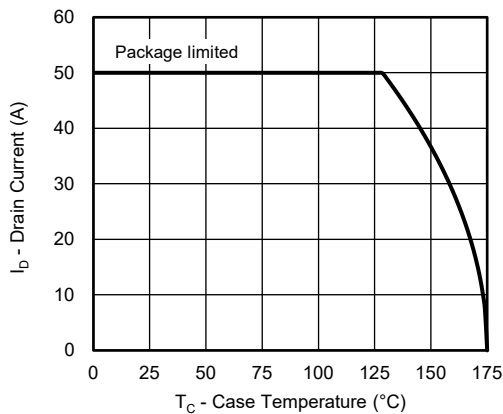


On-Resistance vs. Junction Temperature

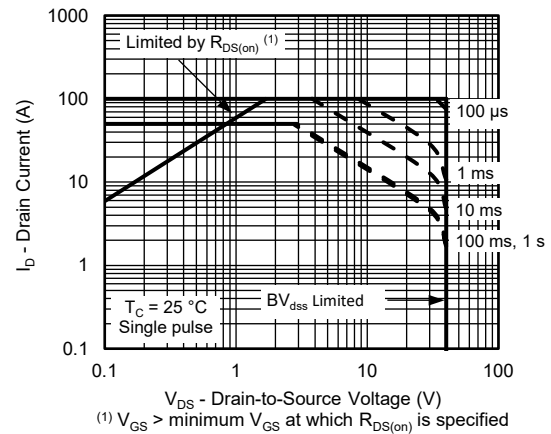


Source-Drain Diode Forward Voltage

THERMAL RATINGS

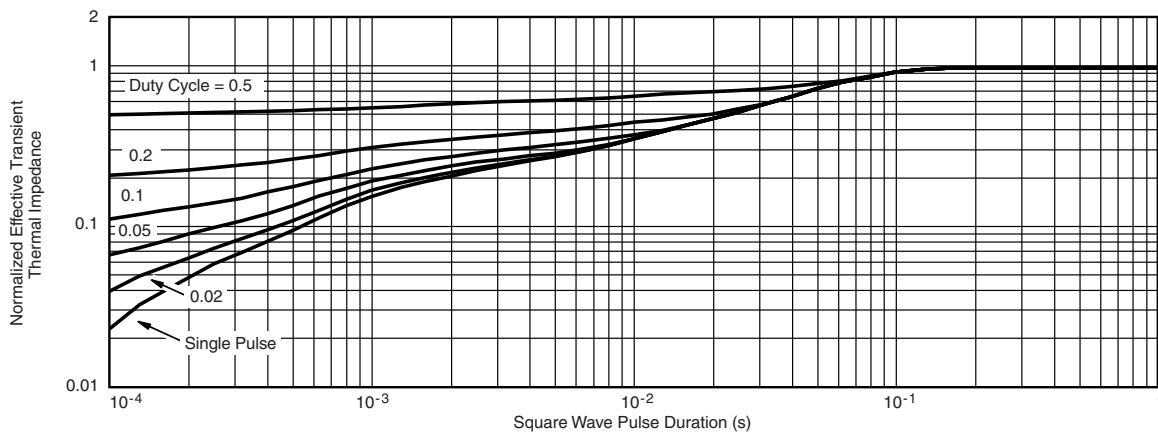


Max. Avalanche and Drain Current vs. Case Temperature



(1)  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

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# TO-252AA Case Outline

## VERSION 1: FACILITY CODE = Y



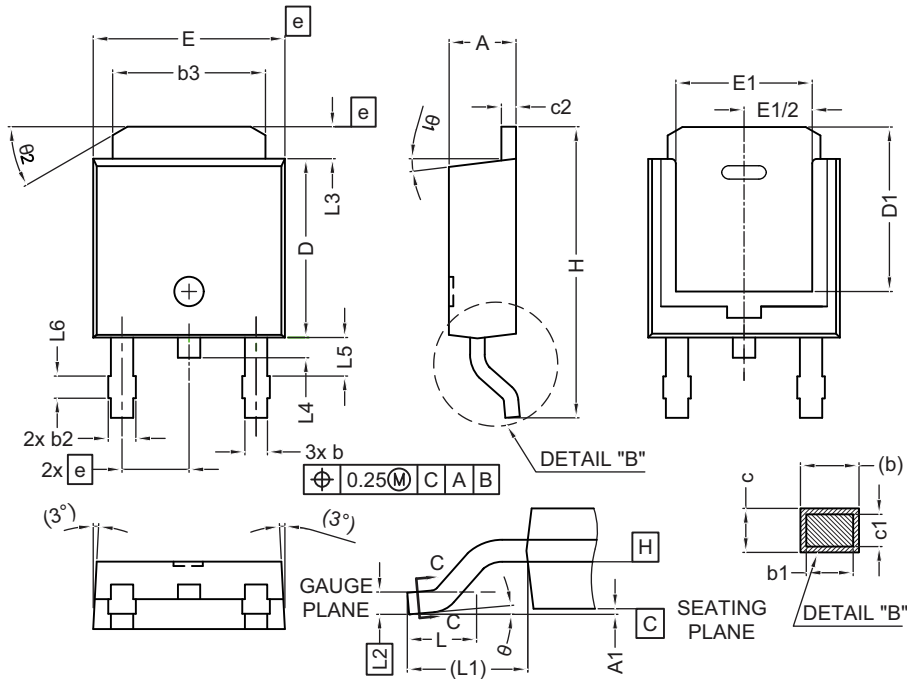
DIM.	MILLIMETERS	
	MIN.	MAX.
A	2.18	2.38
A1	-	0.127
b	0.64	0.88
b2	0.76	1.14
b3	4.95	5.46
C	0.46	0.61
C2	0.46	0.89
D	5.97	6.22
D1	4.10	-
E	6.35	6.73
E1	4.32	-
H	9.40	10.41
e	2.28 BSC	
e1	4.56 BSC	
L	1.40	1.78
L3	0.89	1.27
L4	-	1.02
L5	1.01	1.52

### 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)

[Return to Index](#)



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