

# N-Channel 60 V (D-S), 175 °C MOSFET, Logic Level

## PRODUCT SUMMARY

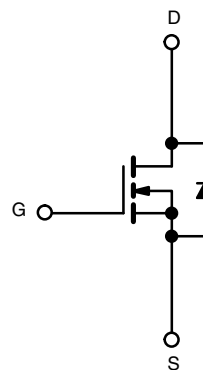
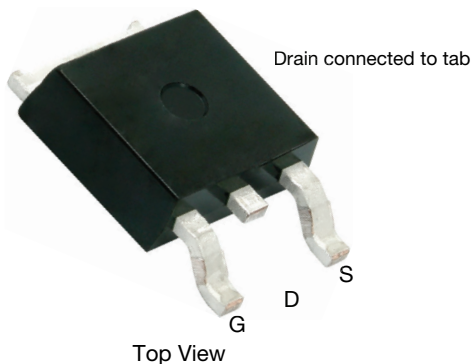
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_d$ (A) <sup>a</sup>
60	0.031 at $V_{GS} = 10$ V	23
	0.045 at $V_{GS} = 4.5$ V	19.5

## FEATURES

- TrenchFET® power MOSFET
- 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

## TO-252



N-Channel MOSFET

## Ordering Information:

SUD23N06-31L-E3 (lead (Pb)-free)

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

PARAMETER	SYMBOL	LIMIT	UNIT
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current ( $T_J = 175$ °C) <sup>b</sup>	$I_D$	23	A
		16.5	
Pulsed Drain Current	$I_{DM}$	50	
Continuous Source Current (Diode Conduction)	$I_S$	23	
Avalanche Current	$I_{AS}$	20	
Single Avalanche Energy (Duty Cycle $\leq 1$ %)	$E_{AS}$	20	mJ
Maximum Power Dissipation	$P_D$	37.5	W
		3 <sup>a</sup>	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +175	°C

## THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum Junction-to-Ambient <sup>a</sup>	$R_{thJA}$	18	22	°C/W
		40	50	
Maximum Junction-to-Case	$R_{thJC}$	3.2	4	

## Note

a. Surface mounted on 1" x 1" FR4 board.



SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP. <sup>a</sup>	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	60	-	-	V
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1	2	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> = 60 V, V <sub>GS</sub> = 0 V	-	-	1	μA
		V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C	-	-	50	
		V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175 °C	-	-	250	
On-State Drain Current <sup>b</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>b</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 15 A	-	0.025	0.031	Ω
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 15 A, T <sub>J</sub> = 125 °C	-	-	0.055	
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 15 A, T <sub>J</sub> = 175 °C	-	-	0.069	
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 A	-	0.037	0.045	
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 15 A	-	20	-	S
Dynamic <sup>a</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1 MHz	-	670	-	pF
Output Capacitance	C <sub>oss</sub>		-	140	-	
Reverse Transfer Capacitance	C <sub>rss</sub>		-	60	-	
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 23 A	-	11	17	nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>		-	3	-	
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>		-	3	-	
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = 30 V, R <sub>L</sub> = 1.3 Ω I <sub>D</sub> ≅ 23 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 2.5 Ω	-	8	15	ns
Rise Time <sup>c</sup>	t <sub>r</sub>		-	15	25	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>		-	30	45	
Fall Time <sup>c</sup>	t <sub>f</sub>		-	25	40	
Source-Drain Diode Ratings and Characteristics (T <sub>C</sub> = 25 °C)						
Pulsed Current	I <sub>SM</sub>		-	-	50	A
Diode Forward Voltage	V <sub>SD</sub>	I <sub>F</sub> = 15 A, V <sub>GS</sub> = 0 V	-	1	1.5	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 15 A, dI/dt = 100 A/μs	-	30	60	ns

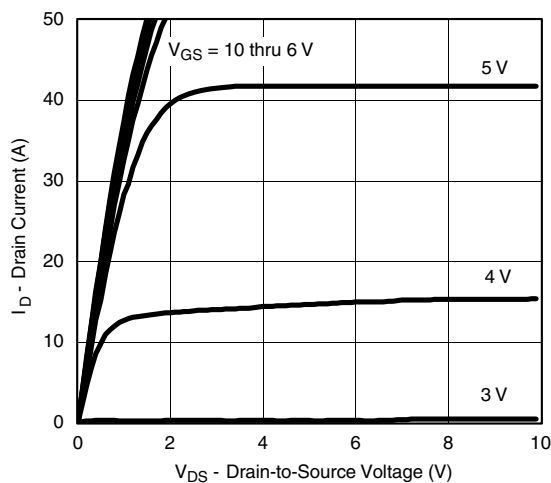
**Notes**

- a. For design aid only; not subject to production testing.  
b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
c. Independent of operating temperature.

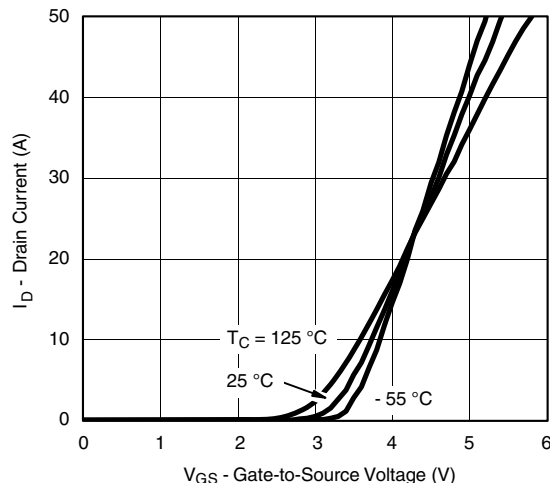
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



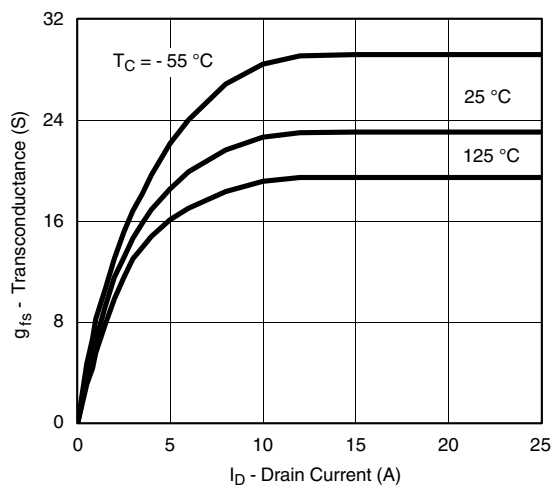
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



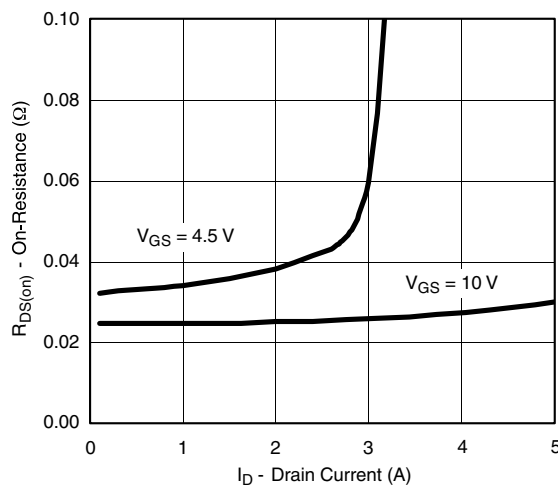
**Output Characteristics**



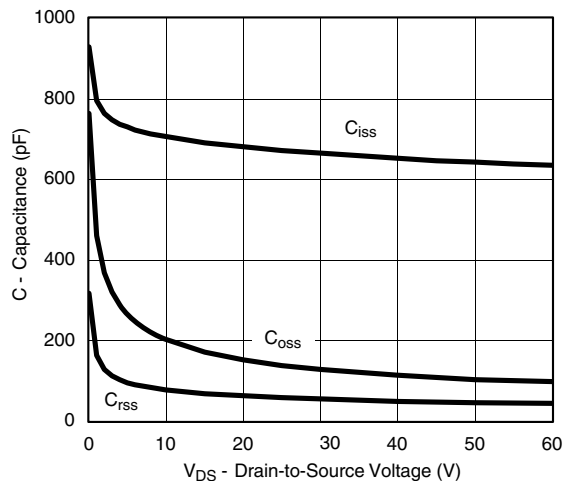
**Transfer Characteristics**



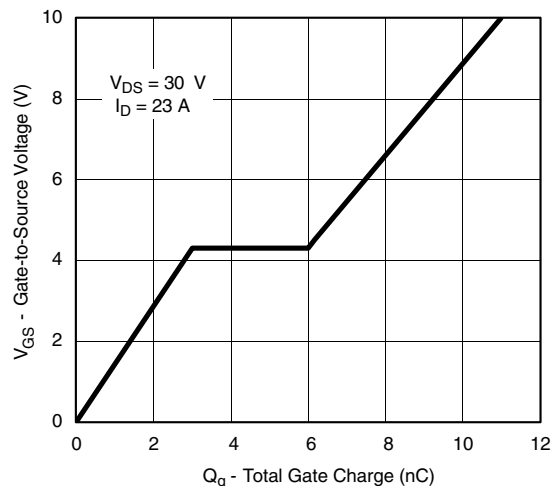
**Transconductance**



**On-Resistance vs. Drain Current**



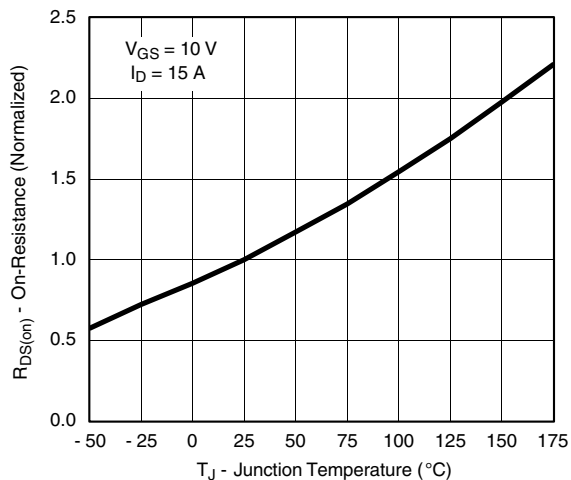
**Capacitance**



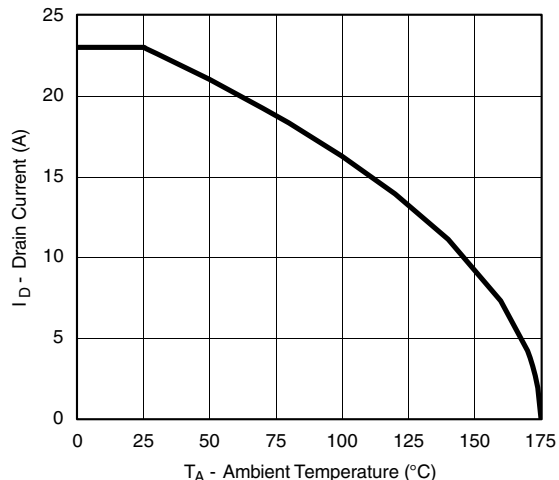
**Gate Charge**



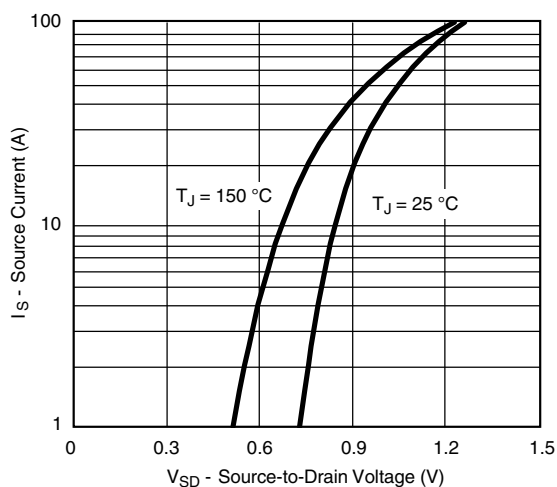
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



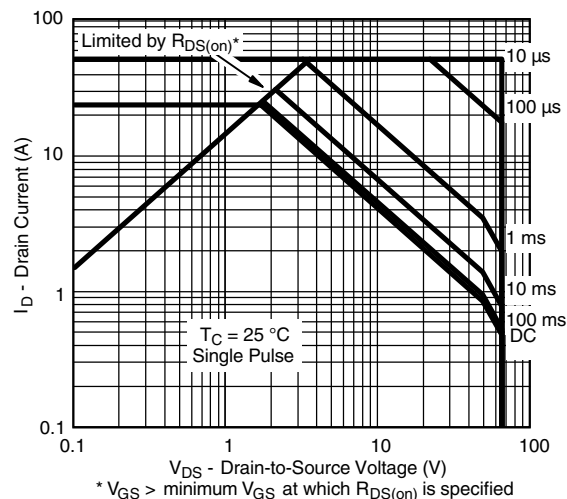
**On-Resistance vs. Junction Temperature**



**Maximum Drain Current vs. Ambient Temperature**



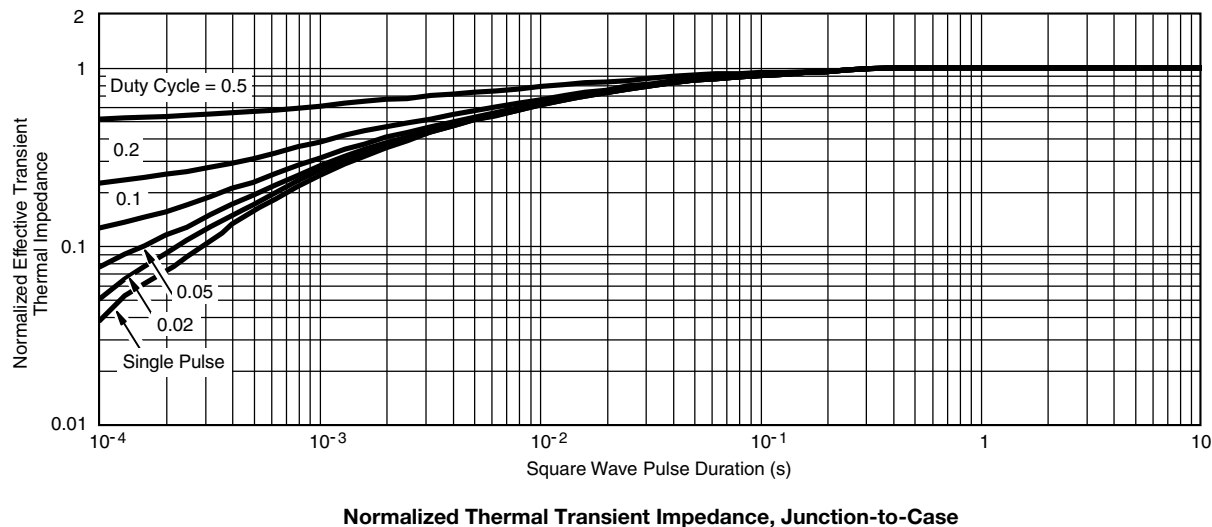
**Source-Drain Diode Forward Voltage**



**Safe Operating Area**



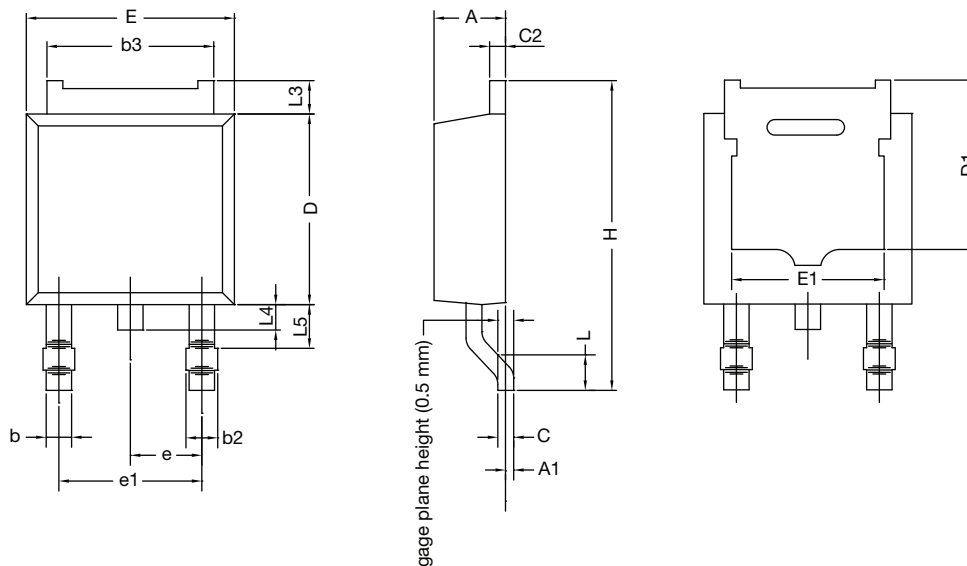
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



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## TO-252AA Case Outline

### VERSION 1: FACILITY CODE = Y



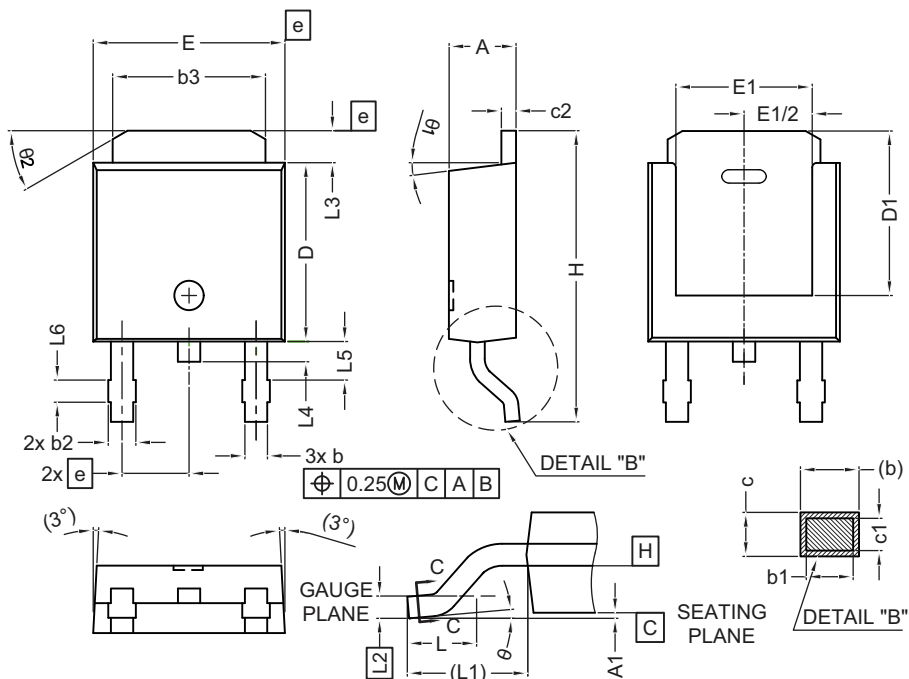
MILLIMETERS		
DIM.	MIN.	MAX.
A	2.18	2.38
A1	-	0.127
b	0.64	0.88
b2	0.76	1.14
b3	4.95	5.46
C	0.46	0.61
C2	0.46	0.89
D	5.97	6.22
D1	4.10	-
E	6.35	6.73
E1	4.32	-
H	9.40	10.41
e	2.28 BSC	
e1	4.56 BSC	
L	1.40	1.78
L3	0.89	1.27
L4	-	1.02
L5	1.01	1.52

#### Note

- Dimension L3 is for reference only



## VERSION 2: FACILITY CODE = N



DIM.	MILLIMETERS	
	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

DIM.	MILLIMETERS	
	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: E22-0399-Rev. R, 03-Oct-2022  
DWG: 5347

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



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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