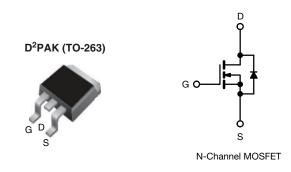
Vishay Siliconix

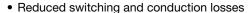
# **E Series Power MOSFET**



PRODUCT SUMMARY					
V <sub>DS</sub> (V) at T <sub>J</sub> max. 850					
R <sub>DS(on)</sub> typ. (Ω) at 25 °C	0.205				
Q <sub>g</sub> max. (nC)	7	72			
Q <sub>gs</sub> (nC)	(	9			
Q <sub>gd</sub> (nC)	22				
Configuration	Single				

#### **FEATURES**

- Low figure-of-merit (FOM) Ron x Qa
- Low effective capacitance (Co(er))



Avalanche energy rated (UIS)

 Material categorization: for definitions of compliance please see <a href="https://www.vishay.com/doc?99912"><u>www.vishay.com/doc?99912</u></a>



#### HALOGEN FREE

#### **APPLICATIONS**

- · Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
  - High-intensity discharge (HID)
  - Fluorescent ballast lighting
- Industrial
  - Welding
  - Induction heating
  - Motor drives
  - Battery chargers
  - Solar (PV inverters)

ORDERING INFORMATION				
Package	D2PAK (TO-263)			
Lead (Pb)-free and halogen-free	SiHB21N80AE-GE3			

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			V <sub>DS</sub>	800	V
Gate-source voltage			$V_{GS}$	± 30	7 v
Continuous drain current (T, = 150 °C)	V <sub>GS</sub> at 10 V	$T_C = 25 ^{\circ}C$ $T_C = 100 ^{\circ}C$	- I <sub>D</sub>	17.4	А
Continuous drain current (1) = 150 °C)	V <sub>GS</sub> at 10 V	T <sub>C</sub> = 100 °C		11	
Pulsed drain current <sup>a</sup>			I <sub>DM</sub>	38	
Linear derating factor				1.4	W/°C
Single pulse avalanche energy b			E <sub>AS</sub>	127	mJ
Maximum power dissipation			$P_{D}$	179	W
Operating junction and storage temperature range			T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C
Drain-source voltage slope $T_J = 125 ^{\circ}\text{C}$			dv/dt	70	\//no
Reverse diode dv/dt <sup>d</sup>			uv/at	39	- V/ns
Soldering recommendations (peak temperature) c For 10 s				260	°C

#### Notos

- a. Repetitive rating; pulse width limited by maximum junction temperature
- b.  $V_{DD}$  = 140 V, starting  $T_J$  = 25 °C, L = 28.2 mH,  $R_q$  = 25  $\Omega$ ,  $I_{AS}$  = 1.5 A
- c. 1.6 mm from case
- d.  $I_{SD} \le I_D$ , di/dt = 100 A/ $\mu$ s, starting  $T_J = 25$  °C



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THERMAL RESISTANCE RATINGS					
PARAMETER	SYMBOL	TYP.	MAX.	UNIT	
Maximum junction-to-ambient	R <sub>thJA</sub>	-	62	°C/W	
Maximum junction-to-case (drain)	R <sub>thJC</sub>	-	0.7	C/ VV	

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-source breakdown voltage	V <sub>DS</sub>	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$		800	-	-	V
V <sub>DS</sub> temperature coefficient	$\Delta V_{DS}/T_{J}$	Referenc	e to 25 °C, I <sub>D</sub> = 1 mA	-	0.8	-	V/°C
Gate-source threshold voltage (N)	V <sub>GS(th)</sub>	V <sub>DS</sub> =	· V <sub>GS</sub> , I <sub>D</sub> = 250 μA	2.0	-	4.0	V
Cata assuma laglanda	I <sub>GSS</sub>	V <sub>GS</sub> = ± 20 V		-	-	± 100	nA
Gate-source leakage		,	$V_{GS} = \pm 30 \text{ V}$	-	-	± 1	μΑ
Zoro goto voltago droip ourrent		V <sub>DS</sub> =	$V_{DS} = 800 \text{ V}, V_{GS} = 0 \text{ V}$		-	1	
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 640 V	, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C	-	-	10	μA
Drain-source on-state resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 11 A	-	0.205	0.235	Ω
Forward transconductance a	9 <sub>fs</sub>	V <sub>DS</sub>	= 30 V, I <sub>D</sub> = 3 A	-	4.0	-	S
Dynamic							
Input capacitance	C <sub>iss</sub>		$V_{GS} = 0 V$ ,		1388	-	
Output capacitance	C <sub>oss</sub>	Ţ ,	$V_{DS} = 100 \text{ V},$	-	53	-	
Reverse transfer capacitance	C <sub>rss</sub>	f = 1 MHz		-	5	-	pF
Effective output capacitance, energy related <sup>a</sup>	C <sub>o(er)</sub>	V <sub>DS</sub> = 0 V to 480 V, V <sub>GS</sub> = 0 V		-	43	-	
Effective output capacitance, time related <sup>b</sup>	$C_{o(tr)}$			-	276	-	
Total gate charge	Qg				48	72	
Gate-source charge	$Q_{gs}$	$V_{GS} = 10 \text{ V}$ $I_D = 11 \text{ A}, V_{DS} = 640 \text{ V}$		-	9	-	nC
Gate-drain charge	$Q_gd$			-	22	-	
Turn-on delay time	$t_{d(on)}$			-	21	42	
Rise time	t <sub>r</sub>	$V_{DD} = 640 \text{ V}, I_D = 11 \text{ A},$		-	38	76	ns
Turn-off delay time	$t_{d(off)}$	V <sub>GS</sub> =	$V_{GS} = 10 \text{ V}, R_g = 20 \Omega$		71	107	
Fall time	t <sub>f</sub>	1		-	76	114	
Gate input resistance	$R_{g}$	f = 1 MHz, open drain		0.2	0.55	1.1	Ω
<b>Drain-Source Body Diode Characteristic</b>	s						
Continuous source-drain diode current	I <sub>S</sub>	MOSFET symbol showing the integral reverse p - n junction diode		-	-	17.4	
Pulsed diode forward current	I <sub>SM</sub>			-	-	38	A
Diode forward voltage	V <sub>SD</sub>	T <sub>J</sub> = 25 °C, I <sub>S</sub> = 11 A, V <sub>GS</sub> = 0 V		-	-	1.2	V
Reverse recovery time	t <sub>rr</sub>			-	400	800	ns
Reverse recovery charge	Q <sub>rr</sub>	$T_J = 25 \text{ °C}, I_F = I_S = 11 \text{ A},$ $di/dt = 100 \text{ A/}\mu\text{s}, V_R = 25 \text{ V}$		-	5	10	μC
Reverse recovery current	I <sub>RRM</sub>			-	20	-	A

#### Notes

- a.  $C_{oss(er)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$
- b.  $C_{oss(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$



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

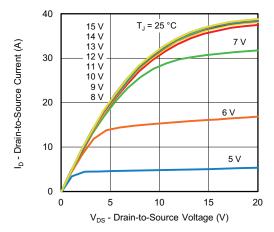


Fig. 1 - Typical Output Characteristics

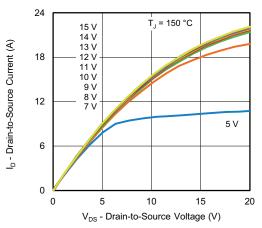


Fig. 2 - Typical Output Characteristics

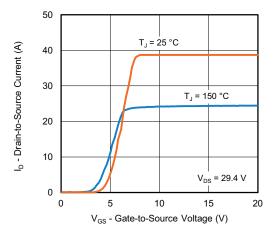


Fig. 3 - Typical Transfer Characteristics

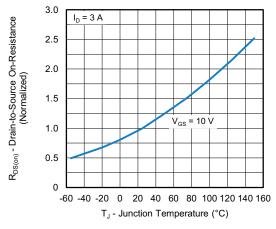


Fig. 4 - Normalized On-Resistance vs. Temperature

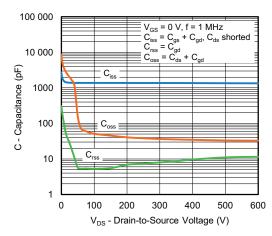


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

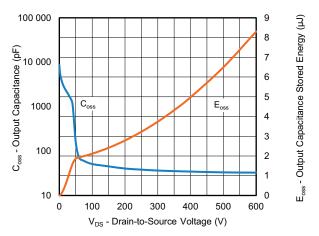


Fig. 6 - Coss and Eoss vs. VDS



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

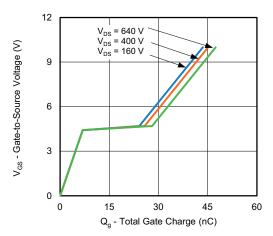


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

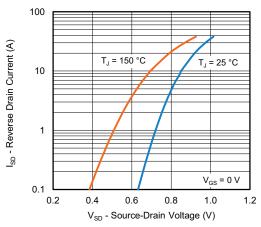


Fig. 8 - Typical Source-Drain Diode Forward Voltage

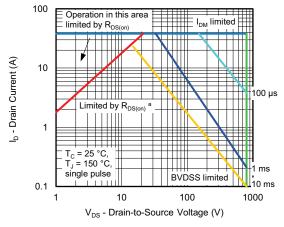


Fig. 9 - Maximum Safe Operating Area



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

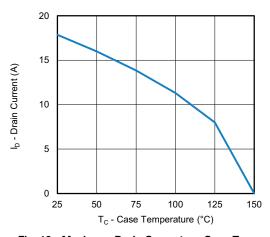


Fig. 10 - Maximum Drain Current vs. Case Temperature

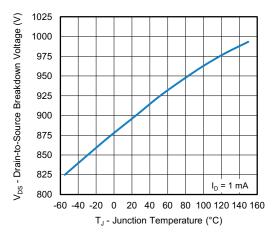


Fig. 11 - Temperature vs. Drain-to-Source Voltage



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

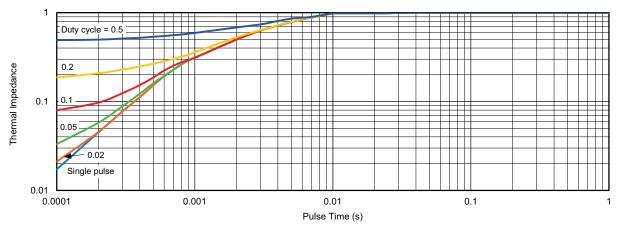


Fig. 12 - Normalized Transient Thermal Impedance, Junction-to-Case

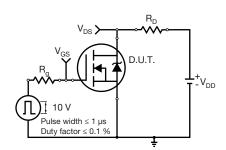


Fig. 13 - Switching Time Test Circuit

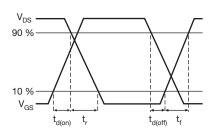


Fig. 14 - Switching Time Waveforms

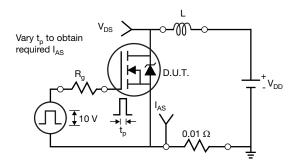


Fig. 15 - Unclamped Inductive Test Circuit

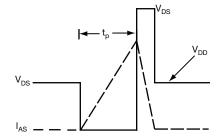


Fig. 16 - Unclamped Inductive Waveforms

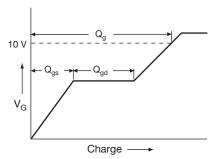


Fig. 17 - Basic Gate Charge Waveform

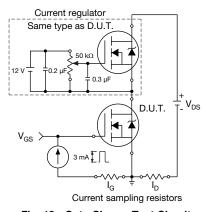
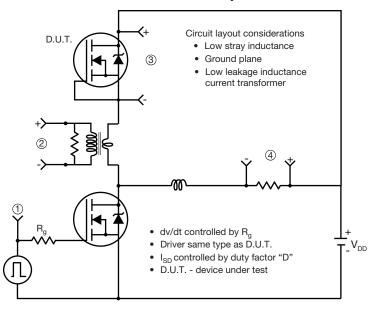


Fig. 18 - Gate Charge Test Circuit



### Peak Diode Recovery dv/dt Test Circuit



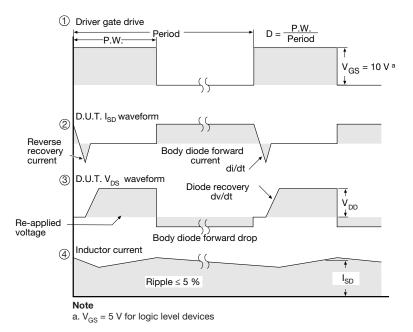


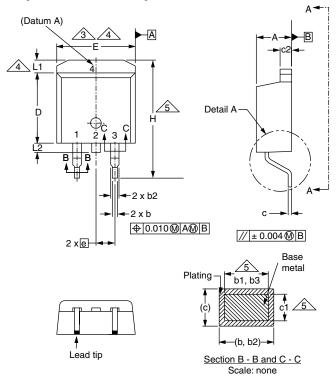
Fig. 19 - For N-Channel

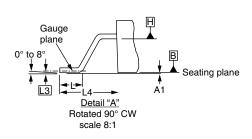
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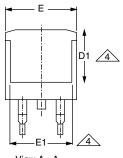




### **TO-263AB (HIGH VOLTAGE)**







View A - A

	MILLIMETERS		INC	HES
DIM.	MIN.	MAX.	MIN.	MAX.
Α	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
b1	0.51	0.89	0.020	0.035
b2	1.14	1.78	0.045	0.070
b3	1.14	1.73	0.045	0.068
С	0.38	0.74	0.015	0.029
c1	0.38	0.58	0.015	0.023
c2	1.14	1.65	0.045	0.065
D	8.38	9.65	0.330	0.380

	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
D1	6.86	-	0.270	-
Е	9.65	10.67	0.380	0.420
E1	6.22	-	0.245	i
е	2.54 BSC		0.100 BSC	
Н	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	-	1.65	ı	0.066
L2	-	1.78	-	0.070
L3	0.25 BSC		0.010 BSC	
L4	4.78	5.28	0.188	0.208

ECN: S-82110-Rev. A, 15-Sep-08

DWG: 5970

### Notes

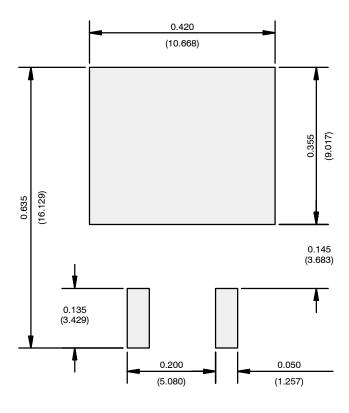
- 1. Dimensioning and tolerancing per ASME Y14.5M-1994.
- 2. Dimensions are shown in millimeters (inches).
- 3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body at datum A.
- 4. Thermal PAD contour optional within dimension E, L1, D1 and E1.
- 5. Dimension b1 and c1 apply to base metal only.
- 6. Datum A and B to be determined at datum plane H.
- 7. Outline conforms to JEDEC outline to TO-263AB.

Document Number: 91364 www.vishay.com Revision: 15-Sep-08





### RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead



Recommended Minimum Pads Dimensions in Inches/(mm)

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