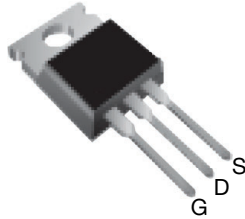


## E Series Power MOSFET

**TO-220AB**


N-Channel MOSFET

### FEATURES

- Low figure-of-merit (FOM)  $R_{on} \times Q_g$
- Low effective capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- Ultra low gate charge ( $Q_g$ )
- Avalanche energy rated (UIS)
- Integrated Zener diode ESD protection
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
 COMPLIANT  
 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
  - Renewable energy

### PRODUCT SUMMARY

$V_{DS}$ (V) at $T_J$ max.	850	
$R_{DS(on)}$ typ. ( $\Omega$ ) at 25 °C	$V_{GS} = 10$ V	0.391
$Q_g$ max. (nC)	42	
$Q_{gs}$ (nC)	6	
$Q_{gd}$ (nC)	12	
Configuration	Single	

### ORDERING INFORMATION

Package	TO-220AB
Lead (Pb)-free and halogen-free	SiHP11N80AE-GE3


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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	$V_{DS}$	800	V
Gate-source voltage	$V_{GS}$	$\pm 30$	
Continuous drain current ( $T_J = 150$ °C)	$V_{GS}$ at 10 V	$T_C = 25$ °C	A
		$T_C = 100$ °C	
Pulsed drain current <sup>a</sup>	$I_{DM}$	22	
Linear derating factor		0.6	W/°C
Single pulse avalanche energy <sup>b</sup>	$E_{AS}$	88	mJ
Maximum power dissipation	$P_D$	78	W
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to +150	°C
Drain-source voltage slope	$dv/dt$	$T_J = 125$ °C	V/ns
Reverse diode $dv/dt$ <sup>d</sup>		2	
Soldering recommendations (peak temperature) <sup>c</sup>	For 10 s	260	°C

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 140$  V, starting  $T_J = 25$  °C,  $L = 28.2$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 2.5$  A
- 1.6 mm from case
- $I_{SD} \leq I_D$ ,  $di/dt = 100$  A/ $\mu$ s, starting  $T_J = 25$  °C

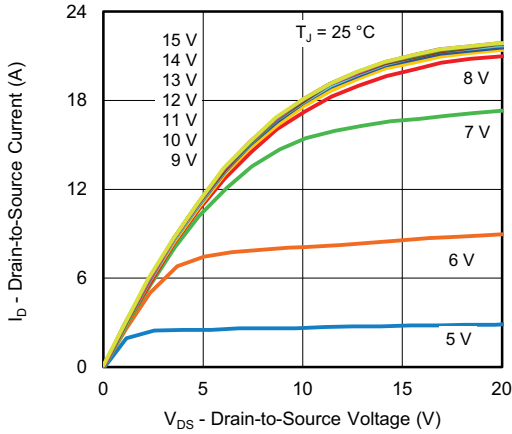
<b>THERMAL RESISTANCE RATINGS</b>				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	$R_{thJA}$	-	62	°C/W
Maximum junction-to-case (drain)	$R_{thJC}$	-	1.6	

<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		800	-	-	V
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$		-	0.8	-	V/ $^\circ\text{C}$
Gate-source threshold voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2	-	4	V
Gate-source leakage	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$		-	-	$\pm 10$	$\mu\text{A}$
		$V_{GS} = \pm 30\text{ V}$		-	-	$\pm 50$	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}$		-	-	1	$\mu\text{A}$
		$V_{DS} = 640\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	10	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 5.5\text{ A}$	-	0.391	0.450	$\Omega$
Forward transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 30\text{ V}, I_D = 5.5\text{ A}$		-	2.9	-	S
<b>Dynamic</b>							
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{ V},$ $V_{DS} = 100\text{ V},$ $f = 1\text{ MHz}$		-	804	-	pF
Output capacitance	$C_{oss}$			-	34	-	
Reverse transfer capacitance	$C_{rss}$			-	5	-	
Effective output capacitance, energy related <sup>a</sup>	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 480\text{ V}, V_{GS} = 0\text{ V}$		-	27	-	pF
Effective output capacitance, time related <sup>b</sup>	$C_{o(tr)}$			-	162	-	
Total gate charge	$Q_g$	$V_{GS} = 10\text{ V}$	$I_D = 5.5\text{ A}, V_{DS} = 640\text{ V}$	-	28	42	nC
Gate-source charge	$Q_{gs}$			-	6	-	
Gate-drain charge	$Q_{gd}$			-	12	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 640\text{ V}, I_D = 5.5\text{ A},$ $V_{GS} = 10\text{ V}, R_g = 9.1\text{ }\Omega$		-	13	26	ns
Rise time	$t_r$			-	15	30	
Turn-off delay time	$t_{d(off)}$			-	25	50	
Fall time	$t_f$			-	27	54	
Gate input resistance	$R_g$	$f = 1\text{ MHz}, \text{ open drain}$		0.7	1.5	3	$\Omega$
<b>Drain-Source Body Diode Characteristics</b>							
Continuous source-drain diode current	$I_S$	MOSFET symbol showing the integral reverse p-n junction diode 		-	-	8	A
Pulsed diode forward current	$I_{SM}$			-	-	22	
Diode forward voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = 5.5\text{ A}, V_{GS} = 0\text{ V}$		-	-	1.2	V
Reverse recovery time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 5.5\text{ A},$ $di/dt = 100\text{ A}/\mu\text{s}, V_R = 25\text{ V}$		-	278	556	ns
Reverse recovery charge	$Q_{rr}$			-	2.9	5.8	$\mu\text{C}$
Reverse recovery current	$I_{RRM}$			-	17	-	A

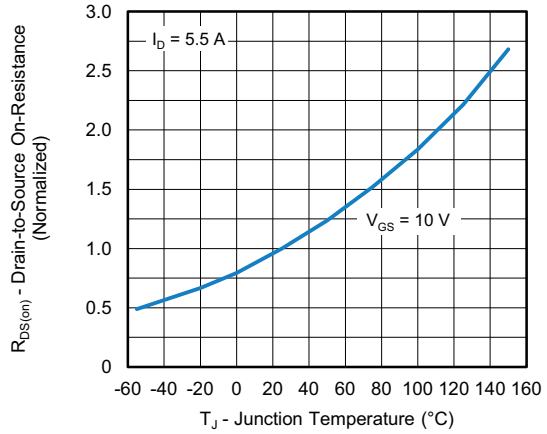
**Notes**

- a.  $C_{oss(er)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 V to 480 V  $V_{DSS}$   
 b.  $C_{oss(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 V to 480 V  $V_{DSS}$

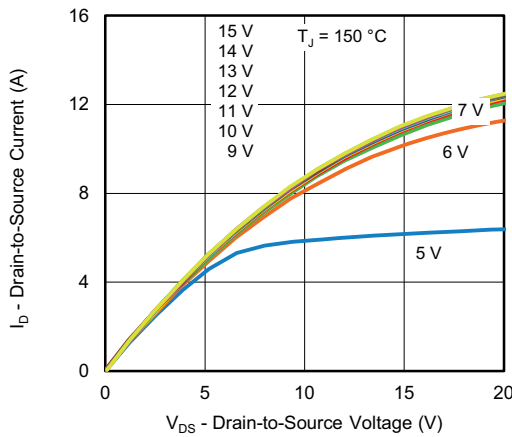
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



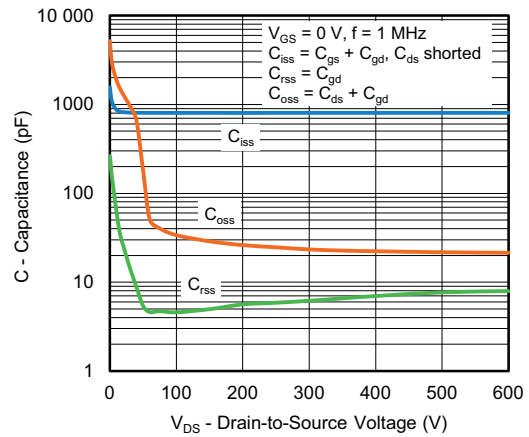
**Fig. 1 - Typical Output Characteristics**



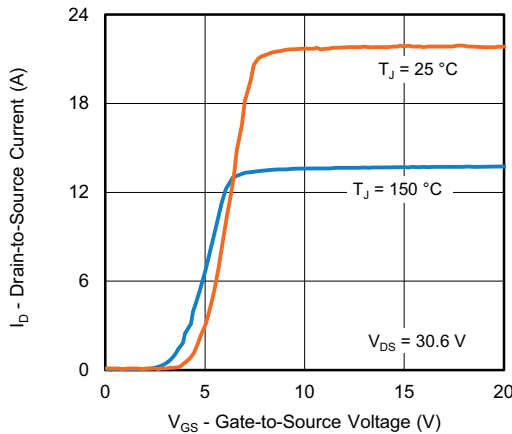
**Fig. 4 - Normalized On-Resistance vs. Temperature**



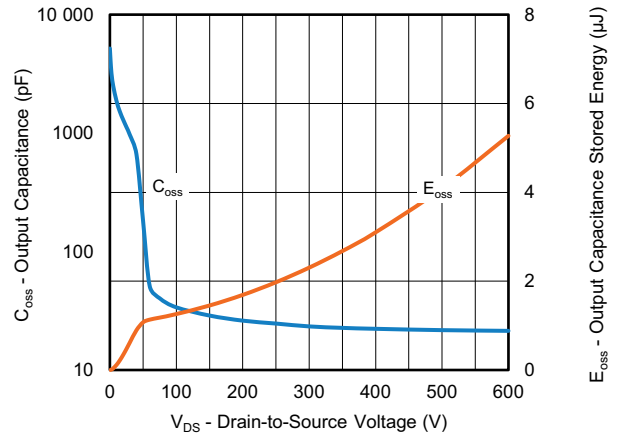
**Fig. 2 - Typical Output Characteristics**



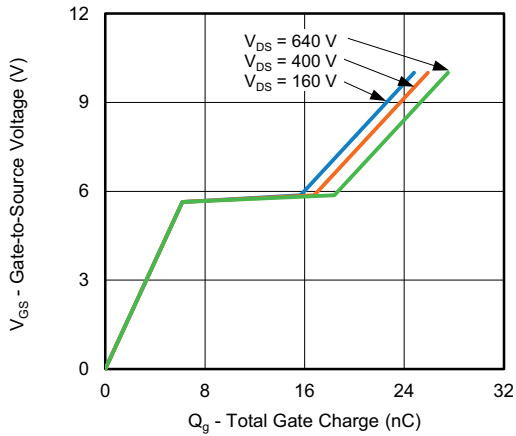
**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**



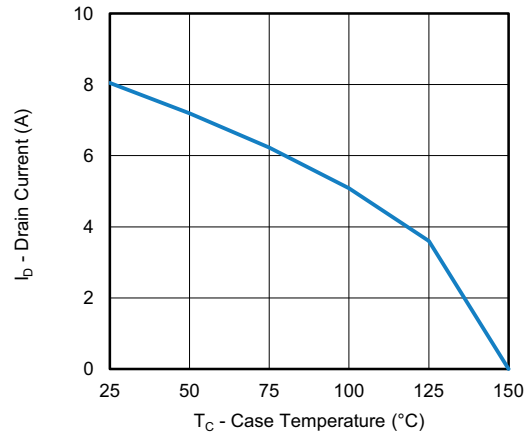
**Fig. 3 - Typical Transfer Characteristics**



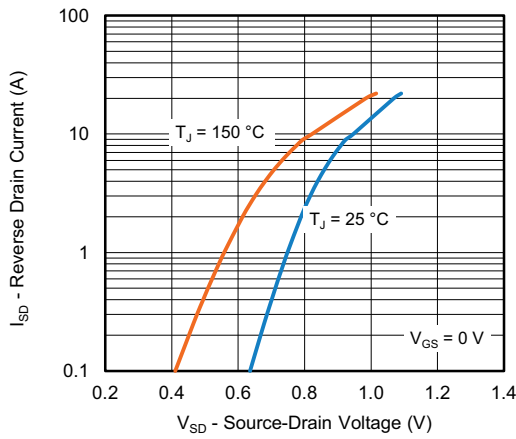
**Fig. 6 -  $C_{oss}$  and  $E_{oss}$  vs.  $V_{DS}$**



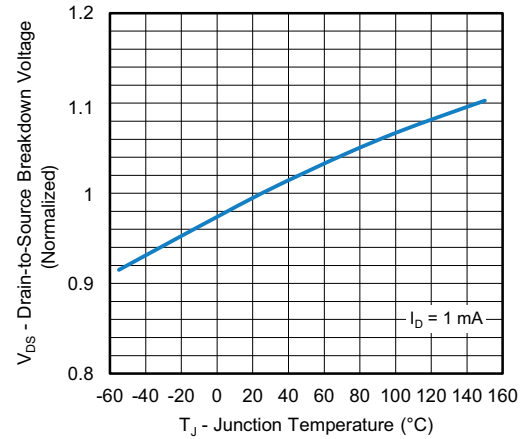
**Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage**



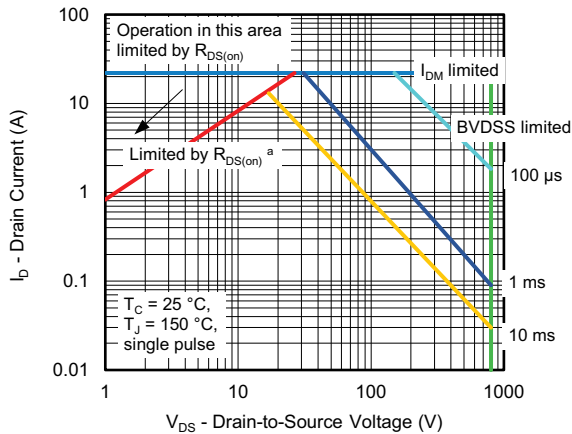
**Fig. 10 - Maximum Drain Current vs. Case Temperature**



**Fig. 8 - Typical Source-Drain Diode Forward Voltage**



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



**Fig. 9 - Maximum Safe Operating Area**

**Note**

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

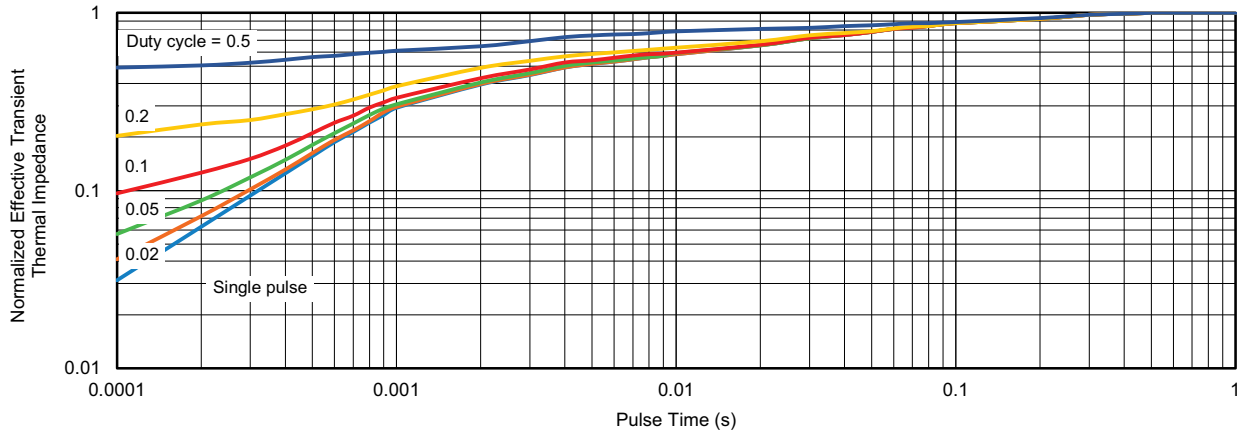


Fig. 12 - Normalized Transient Thermal Impedance, Junction-to-Case



Fig. 13 - Switching Time Test Circuit



Fig. 16 - Unclamped Inductive Waveforms



Fig. 14 - Switching Time Waveforms



Fig. 17 - Basic Gate Charge Waveform



Fig. 15 - Unclamped Inductive Test Circuit

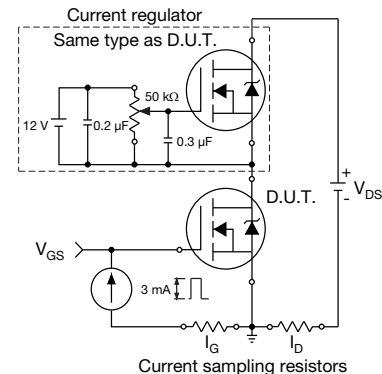


Fig. 18 - Gate Charge Test Circuit



**Note**  
 a.  $V_{GS} = 5 V$  for logic level devices

**Fig. 19 - For N-Channel**

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# TO-220-1



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.24	4.65	0.167	0.183
b	0.69	1.02	0.027	0.040
b(1)	1.14	1.78	0.045	0.070
c	0.36	0.61	0.014	0.024
D	14.33	15.85	0.564	0.624
E	9.96	10.52	0.392	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.10	6.71	0.240	0.264
J(1)	2.41	2.92	0.095	0.115
L	13.36	14.40	0.526	0.567
L(1)	3.33	4.04	0.131	0.159
Ø P	3.53	3.94	0.139	0.155
Q	2.54	3.00	0.100	0.118

ECN: E21-0621-Rev. D, 04-Nov-2021  
DWG: 6031

**Note**

- M\* = 0.052 inches to 0.064 inches (dimension including protrusion), heatsink hole for HVM



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