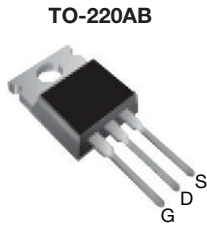


## E Series Power MOSFET



N-Channel MOSFET

### FEATURES

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



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

### APPLICATIONS

- Computing
  - PC silver box / ATX power supplies
- Lighting
  - Two stage LED lighting
- Consumer electronics
- Applications using hard switched topologies
  - Power factor correction (PFC)
  - Two switch forward converter
  - Flyback converter
- Switch mode power supplies (SMPS)

### PRODUCT SUMMARY

$V_{DS}$ (V) at $T_J$ max.	550	
$R_{DS(on)}$ max. at 25 °C ( $\Omega$ )	$V_{GS} = 10$ V	0.243
$Q_g$ max. (nC)	66	
$Q_{gs}$ (nC)	8	
$Q_{gd}$ (nC)	14	
Configuration	Single	

### ORDERING INFORMATION

Package	TO-220AB
Lead (Pb)-free and halogen-free	SiHP15N50E-BE3 <sup>a</sup>
	SiHP15N50E-GE3

#### Note

a. "-BE3" denotes alternate manufacturing location


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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	500	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	
Continuous Drain Current ( $T_J = 150$ °C)	$V_{GS}$ at 10 V	$T_C = 25$ °C	14.5
		$T_C = 100$ °C	9.2
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	28	A
Linear Derating Factor		1.25	W/°C
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	136	mJ
Maximum Power Dissipation	$P_D$	156	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	°C
Drain-Source Voltage Slope	$dV/dt$	$V_{DS} = 0$ V to 80 % $V_{DS}$	70
Reverse Diode $dV/dt$ <sup>d</sup>		27	
Soldering Recommendations (Peak Temperature) <sup>c</sup>	for 10 s	300	°C

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 50$  V, starting  $T_J = 25$  °C,  $L = 28.2$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 3.1$  A
- 1.6 mm from case
- $I_{SD} \leq I_D$ ,  $dI/dt = 100$  A/ $\mu$ s, starting  $T_J = 25$  °C

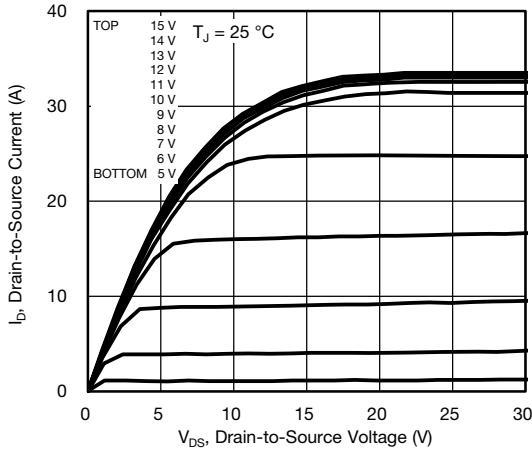
THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	$R_{thJA}$	-	62	°C/W
Maximum junction-to-case (drain)	$R_{thJC}$	-	0.8	

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	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$	500	-	-	V	
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$	-	0.62	-	V/°C	
Gate-source threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	2.0	-	4.0	V	
Gate-source leakage	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$	-	-	$\pm 100$	nA	
		$V_{GS} = \pm 30\text{ V}$	-	-	$\pm 1$	$\mu\text{A}$	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 500\text{ V}$ , $V_{GS} = 0\text{ V}$	-	-	10	$\mu\text{A}$	
		$V_{DS} = 400\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$	-	-	25		
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$   $I_D = 7.5\text{ A}$	-	0.243	0.280	$\Omega$	
Forward transconductance	$g_{fs}$	$V_{DS} = 30\text{ V}$ , $I_D = 7.5\text{ A}$	-	3.9	-	S	
<b>Dynamic</b>							
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$ , $V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$	-	1162	-	pF	
Output capacitance	$C_{oss}$		-	51	-		
Reverse transfer capacitance	$C_{rss}$		-	7	-		
Effective output capacitance, energy related <sup>a</sup>	$C_{o(er)}$		$V_{DS} = 0\text{ V to } 400\text{ V}$ , $V_{GS} = 0\text{ V}$	-	55		-
Effective output capacitance, time related <sup>b</sup>	$C_{o(tr)}$			-	164		-
Total gate charge	$Q_g$	$V_{GS} = 10\text{ V}$   $I_D = 7.5\text{ A}$ , $V_{DS} = 400\text{ V}$	-	33	66	nC	
Gate-source charge	$Q_{gs}$		-	8	-		
Gate-drain charge	$Q_{gd}$		-	14	-		
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 400\text{ V}$ , $I_D = 12\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_g = 9.1\text{ }\Omega$	-	15	30	ns	
Rise time	$t_r$		-	24	48		
Turn-off delay time	$t_{d(off)}$		-	34	68		
Fall time	$t_f$		-	18	36		
Gate input resistance	$R_g$	$f = 1\text{ MHz}$ , open drain	-	0.85	-	$\Omega$	
<b>Drain-Source Body Diode Characteristics</b>							
Continuous source-drain diode current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	14.5	A	
Pulsed diode forward current	$I_{SM}$		-	-	28		
Diode forward voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_S = 7.5\text{ A}$ , $V_{GS} = 0\text{ V}$	-	-	1.2	V	
Reverse recovery time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_F = I_S = 7.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 25\text{ V}$	-	265	-	ns	
Reverse recovery charge	$Q_{rr}$		-	3.2	-	$\mu\text{C}$	
Reverse recovery current	$I_{RRM}$		-	23	-	A	

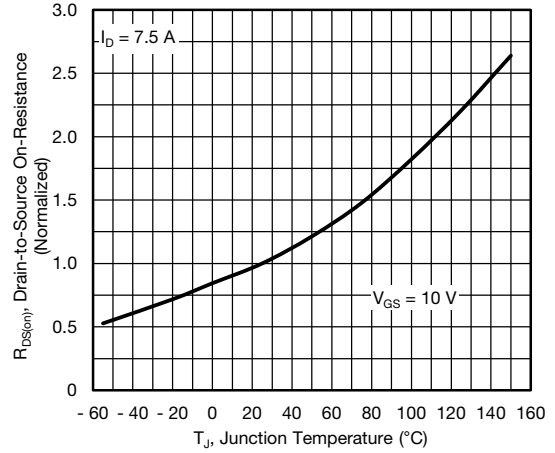
**Notes**

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

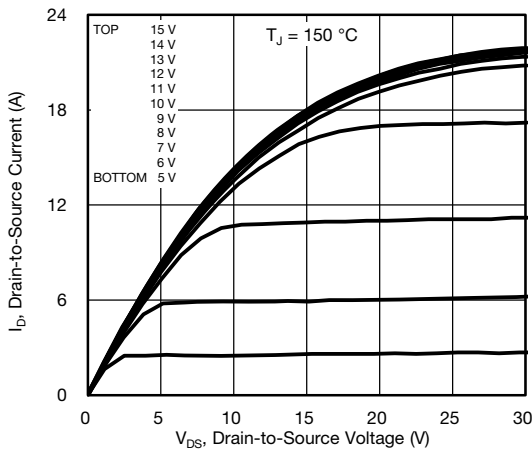
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



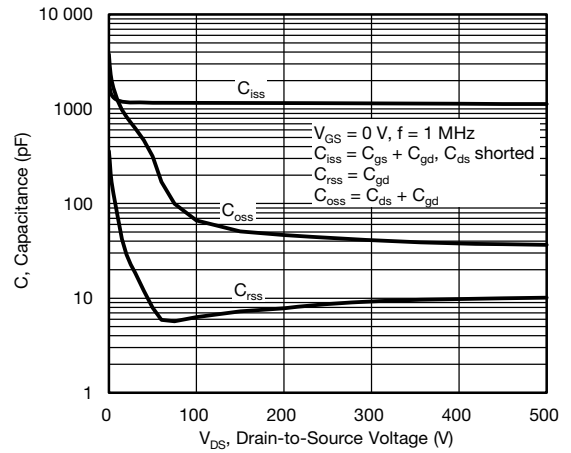
**Fig. 1 - Typical Output Characteristics**



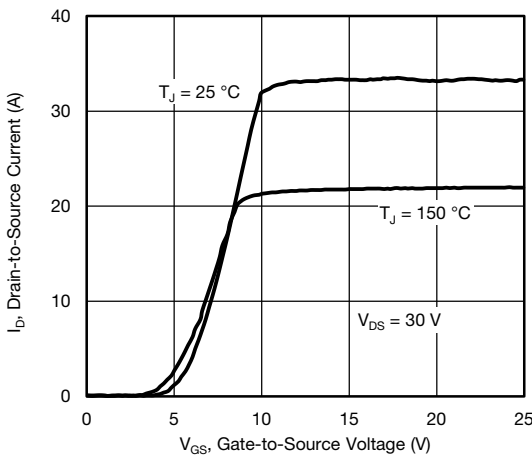
**Fig. 4 - Normalized On-Resistance vs. Temperature**



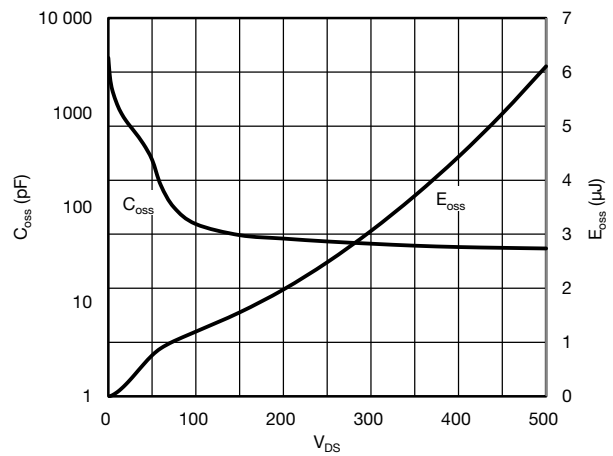
**Fig. 2 - Typical Output Characteristics**



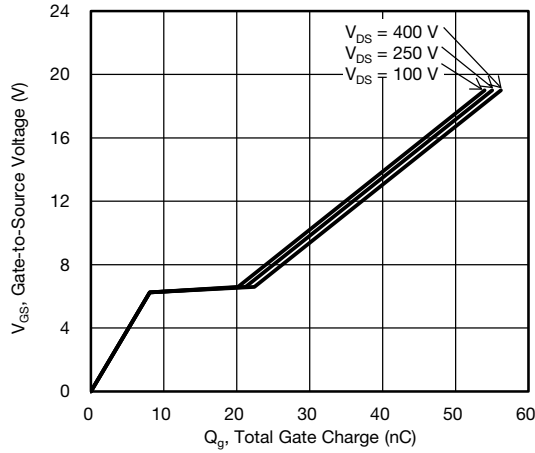
**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**



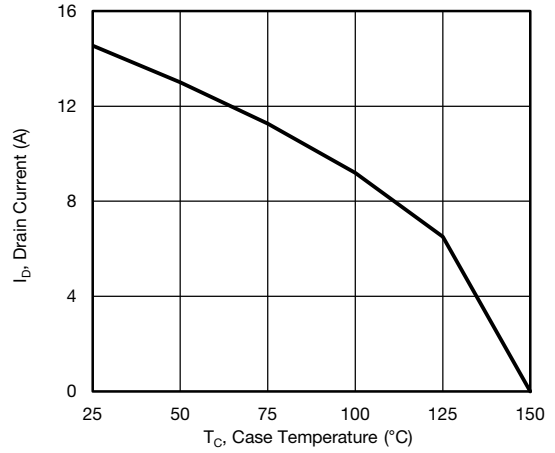
**Fig. 3 - Typical Transfer Characteristics**



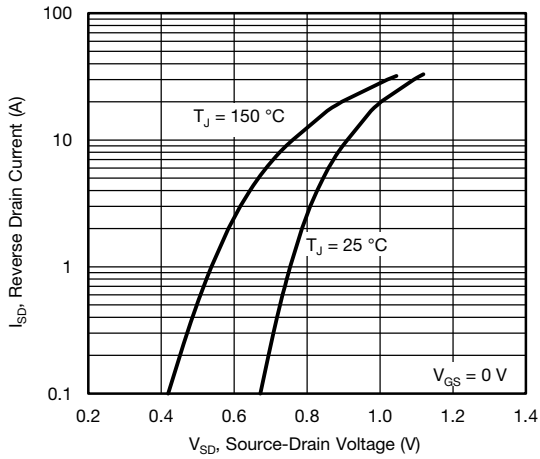
**Fig. 6 - C<sub>oss</sub> and E<sub>oss</sub> vs. V<sub>DS</sub>**



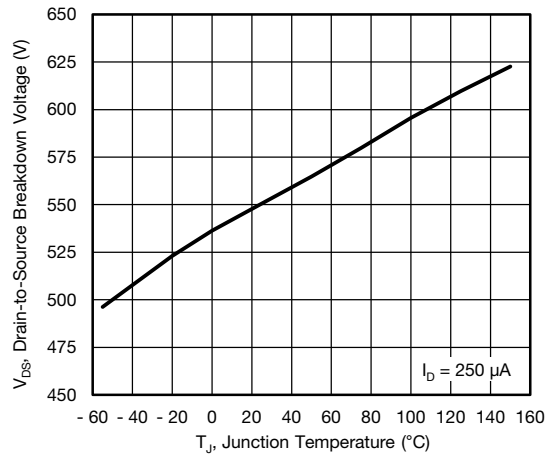
**Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage**



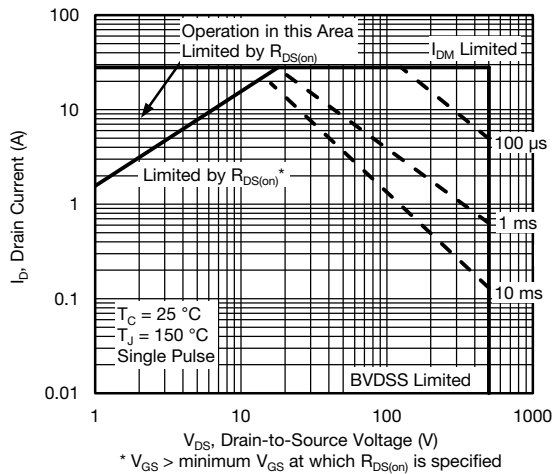
**Fig. 10 - Maximum Drain Current vs. Case Temperature**



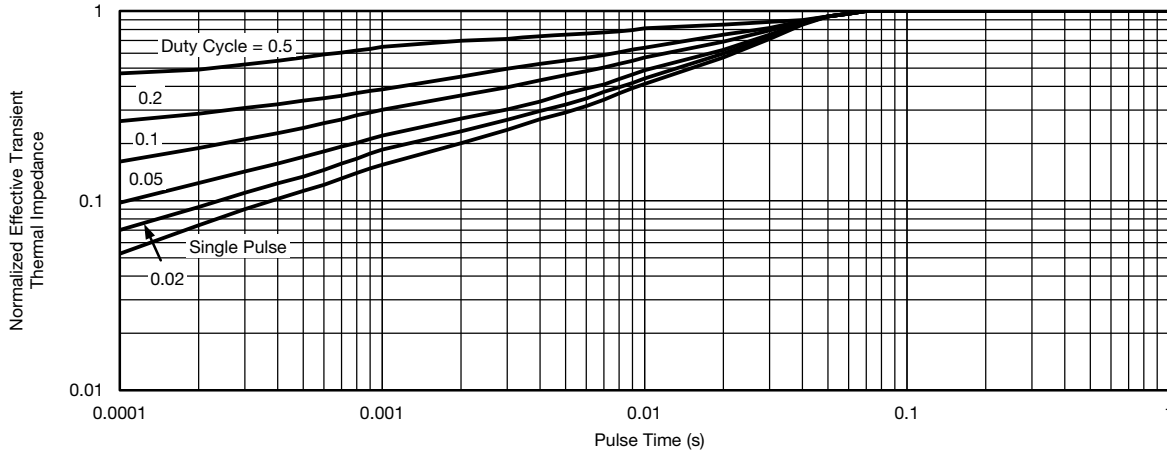
**Fig. 8 - Typical Source-Drain Diode Forward Voltage**



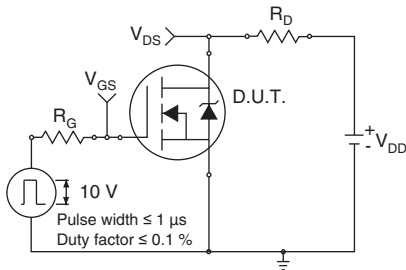
**Fig. 11 - Temperature vs. Drain-to-Source Voltage**



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



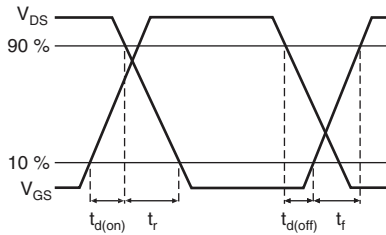
**Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case**



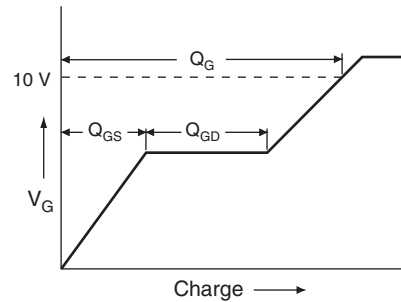
**Fig. 13 - Switching Time Test Circuit**



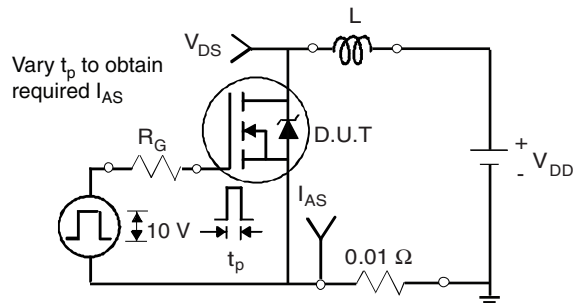
**Fig. 16 - Unclamped Inductive Waveforms**



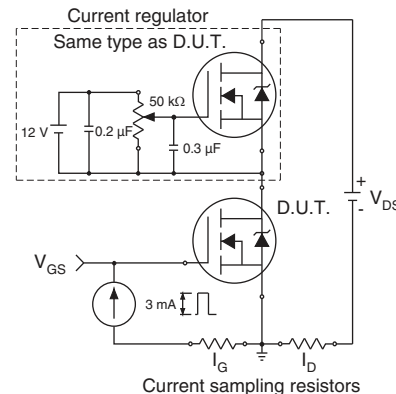
**Fig. 14 - Switching Time Waveforms**



**Fig. 17 - Basic Gate Charge Waveform**



**Fig. 15 - Unclamped Inductive Test Circuit**



**Fig. 18 - Gate Charge Test Circuit**

Peak Diode Recovery dV/dt Test Circuit



Note

a.  $V_{GS} = 5\text{ V}$  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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