

## E Series Power MOSFET

PRODUCT SUMMARY	
$V_{DS}$ (V) at $T_J$ max.	550
$R_{DS(on)}$ max. at 25 °C ( $\Omega$ )	$V_{GS} = 10\text{ V}$   0.380
$Q_g$ max. (nC)	50
$Q_{gs}$ (nC)	6
$Q_{gd}$ (nC)	10
Configuration	Single

### 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)

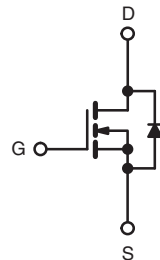
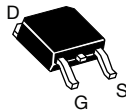


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### 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)

**DPAK**  
**(TO-252)**



N-Channel MOSFET


ORDERING INFORMATION	
Package	DPAK (TO-252)
Lead (Pb)-free and Halogen-free	SiHD12N50E-GE3

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25\text{ °C}$ , unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	500	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Gate-Source Voltage AC ( $f > 1\text{ Hz}$ )		30	
Continuous Drain Current ( $T_J = 150\text{ °C}$ )	$V_{GS}$ at 10 V	$T_C = 25\text{ °C}$	10.5
		$T_C = 100\text{ °C}$	
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	21	A
Linear Derating Factor		0.91	W/°C
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	103	mJ
Maximum Power Dissipation	$P_D$	114	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	°C
Drain-Source Voltage Slope	$V_{DS} = 0\text{ V to } 80\% V_{DS}$	70	V/ns
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.
- $V_{DD} = 50\text{ V}$ , starting  $T_J = 25\text{ °C}$ ,  $L = 28.2\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 2.7\text{ A}$ .
- 1.6 mm from case.
- $I_{SD} \leq I_D$ ,  $dI/dt = 100\text{ A}/\mu\text{s}$ , starting  $T_J = 25\text{ °C}$ .

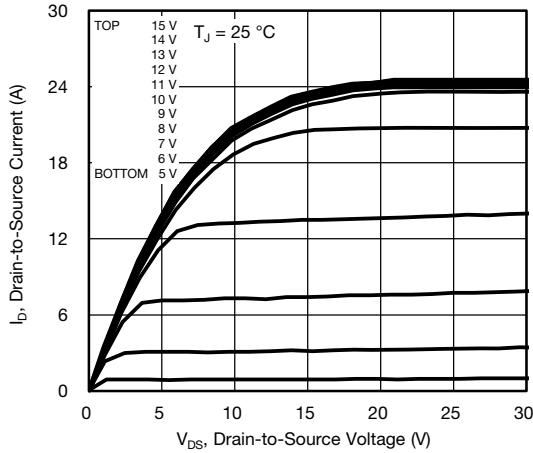
THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	62	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	1.1	

<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	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	500	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}, I_D = 1\text{ mA}$	-	0.60	-	$V/^\circ\text{C}$
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
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	10	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 6\text{ A}$	-	0.330	0.380	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 30\text{ V}, I_D = 6\text{ A}$	-	3.1	-	S
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 100\text{ V}, f = 1\text{ MHz}$	-	886	-	pF
Output Capacitance	$C_{oss}$		-	52	-	
Reverse Transfer Capacitance	$C_{rss}$		-	6	-	
Effective Output Capacitance, Energy Related <sup>a</sup>	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	-	45	-	pF
Effective Output Capacitance, Time Related <sup>b</sup>	$C_{o(tr)}$		-	131	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}, I_D = 6\text{ A}, V_{DS} = 400\text{ V}$	-	25	50	nC
Gate-Source Charge	$Q_{gs}$		-	6	-	
Gate-Drain Charge	$Q_{gd}$		-	10	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 400\text{ V}, I_D = 6\text{ A}, V_{GS} = 10\text{ V}, R_g = 9.1\text{ }\Omega$	-	13	26	ns
Rise Time	$t_r$		-	16	32	
Turn-Off Delay Time	$t_{d(off)}$		-	29	58	
Fall Time	$t_f$		-	12	24	
Gate Input Resistance	$R_g$	$f = 1\text{ MHz}, \text{open drain}$	-	0.92	-	$\Omega$
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	10.5	A
Pulsed Diode Forward Current	$I_{SM}$		-	-	21	
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	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 6\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_R = 25\text{ V}$	-	244	-	ns
Reverse Recovery Charge	$Q_{rr}$		-	2.5	-	$\mu\text{C}$
Reverse Recovery Current	$I_{RRM}$		-	19	-	A

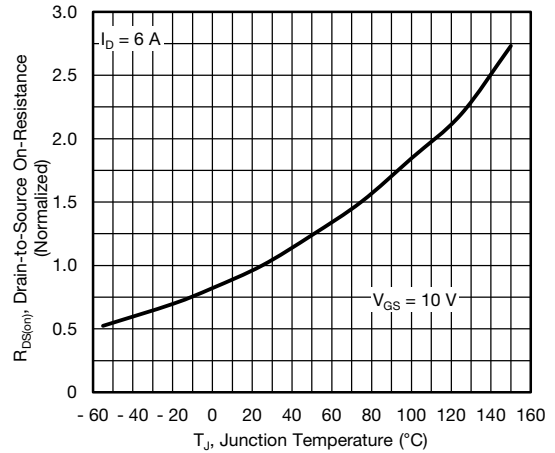
**Notes**

- 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 %  $V_{DSS}$ .

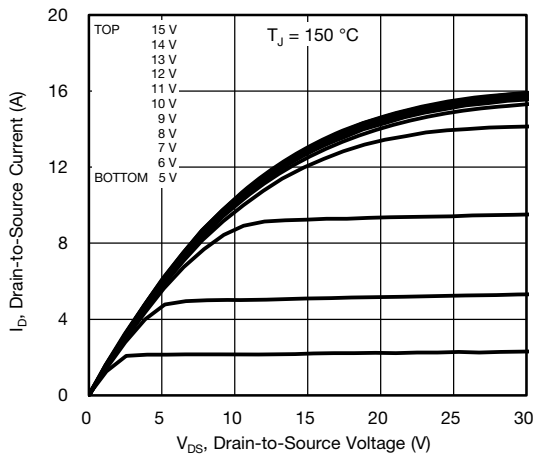
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



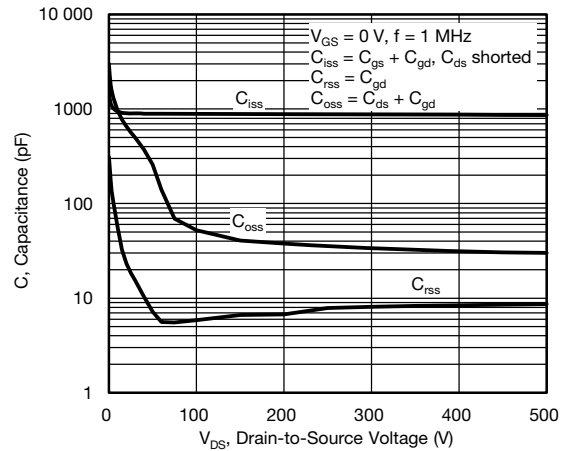
**Fig. 1 - Typical Output Characteristics**



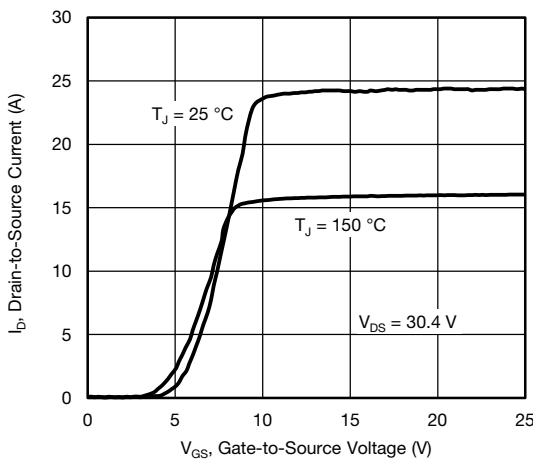
**Fig. 4 - Normalized On-Resistance vs. Temperature**



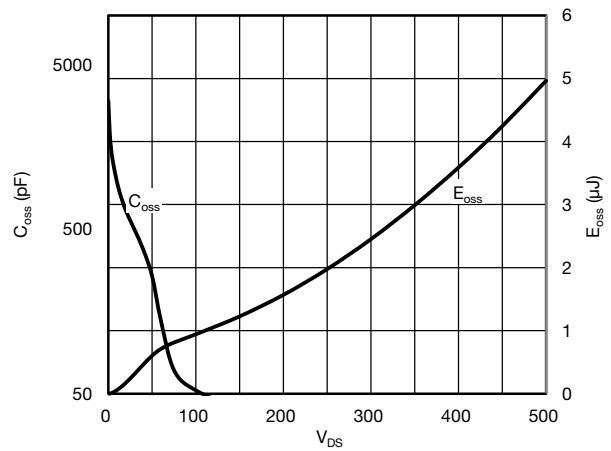
**Fig. 2 - Typical Output Characteristics**



**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

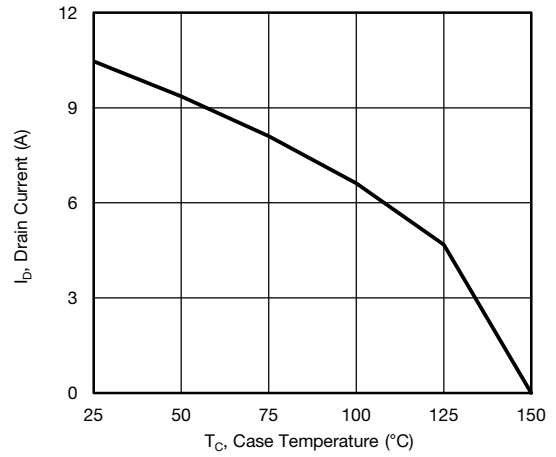


Fig. 10 - Maximum Drain Current vs. Case Temperature



Fig. 8 - Typical Source-Drain Diode Forward Voltage

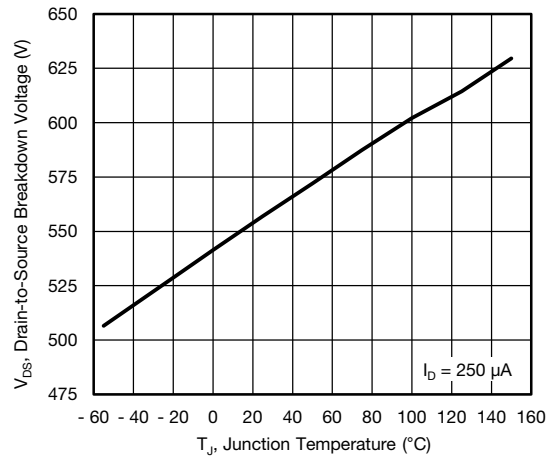


Fig. 11 - Temperature vs. Drain-to-Source Voltage

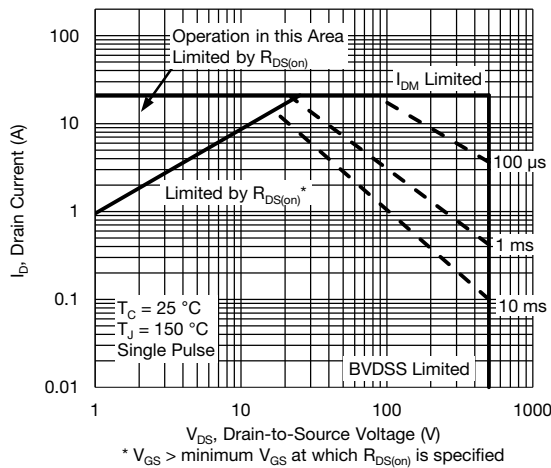
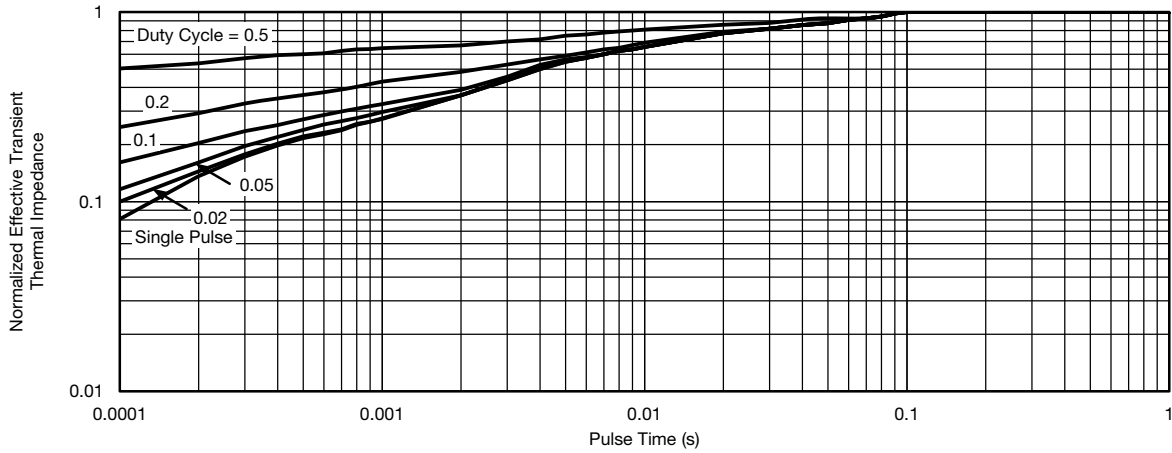
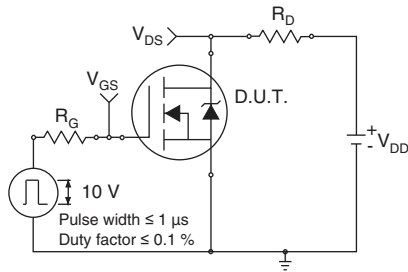


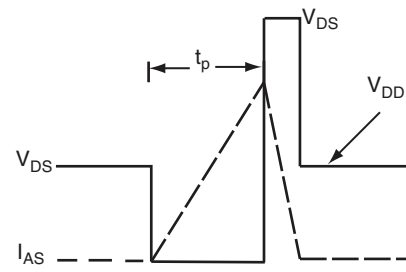
Fig. 9 - Maximum Safe Operating Area



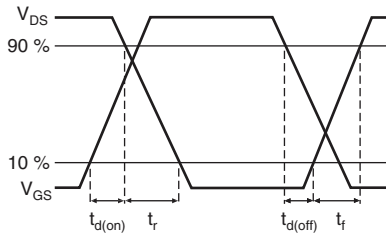
**Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case**



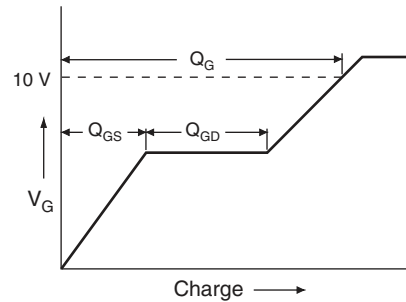
**Fig. 13 - Switching Time Test Circuit**



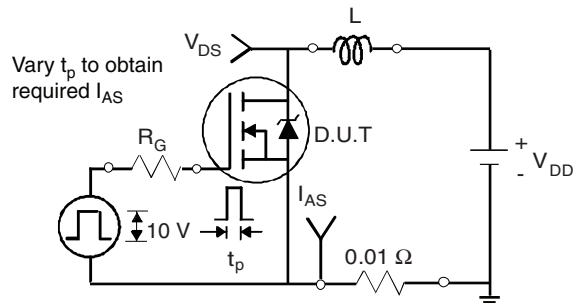
**Fig. 16 - Unclamped Inductive Waveforms**



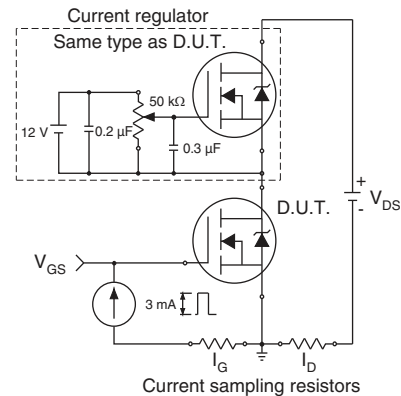
**Fig. 14 - Switching Time Waveforms**



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



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



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



**Note**

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

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

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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А