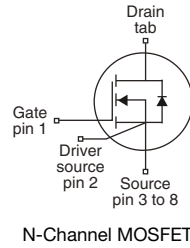


## E Series Power MOSFET



### FEATURES

- 4<sup>th</sup> generation E series technology
- Low figure-of-merit (FOM)  $R_{on} \times Q_g$
- Low effective capacitance ( $C_{o(er)}$ )
- Reduced switching and conduction losses
- Avalanche energy rated (UIS)
- Kelvin connection for reduced gate noise
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

### 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)

### PRODUCT SUMMARY

$V_{DS}$ (V) at $T_J$ max.	700	
$R_{DS(on)}$ typ. ( $\Omega$ ) at 25 °C	$V_{GS} = 10$ V	0.106
$Q_g$ max. (nC)	57	
$Q_{gs}$ (nC)	15	
$Q_{gd}$ (nC)	14	
Configuration	Single	

### ORDERING INFORMATION

Package	PowerPAK 10 x 12
Lead (Pb)-free and halogen-free	SiHK125N65E-T1-GE3

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

PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-source voltage	$V_{DS}$	650	V	
Gate-source voltage	$V_{GS}$	$\pm 30$		
Continuous drain current ( $T_J = 150$ °C)	$V_{GS}$ at 10 V	$T_C = 25$ °C	25	A
		$T_C = 100$ °C	16	
Pulsed drain current <sup>a</sup>	$I_{DM}$	60		
Linear derating factor		1.38	W/°C	
Single pulse avalanche energy <sup>b</sup>	$E_{AS}$	81	mJ	
Maximum power dissipation	$P_D$	174	W	
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to +150	°C	
Drain-source voltage slope	dv/dt	100	V/ns	
Reverse diode dv/dt <sup>c</sup>		7.1		

#### Notes


- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 140$  V, starting  $T_J = 25$  °C,  $L = 28.2$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 2.4$  A
- $I_{SD} \leq I_D$ , di/dt = 100 A/ $\mu$ s, starting  $T_J = 25$  °C



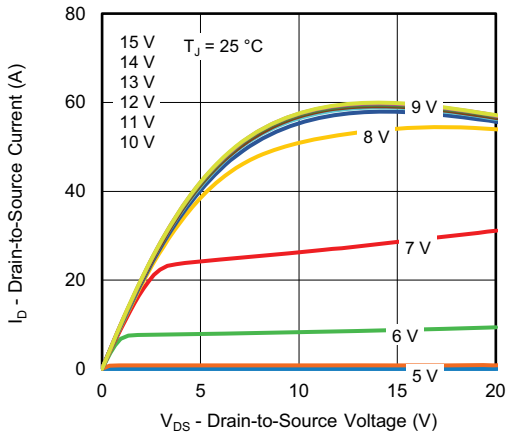
THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	$R_{thJA}$	-	42	°C/W
Maximum junction-to-case (drain)	$R_{thJC}$	-	0.72	

**Note**

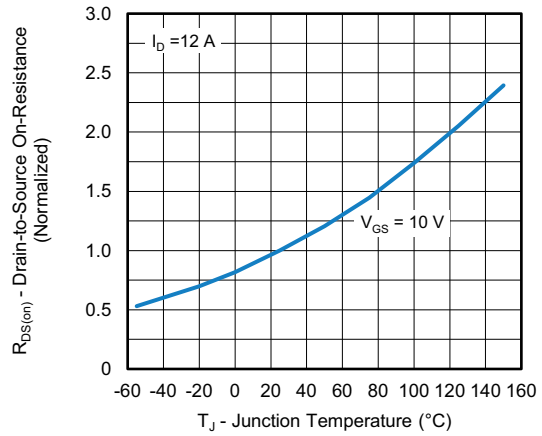
a. When mounted on 1 " x 1 " FR4 board

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	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		650	-	-	V
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}, I_D = 1\text{ mA}$		-	0.61	-	V/°C
Gate-source threshold voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		3.0	-	5.0	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	$I_{DSS}$	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$		-	-	1	$\mu\text{A}$
		$V_{DS} = 520\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	10	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 12\text{ A}$	-	0.106	0.120	$\Omega$
Forward transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 8\text{ V}, I_D = 12\text{ A}$		-	11	-	S
<b>Dynamic</b>							
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 100\text{ V}, f = 100\text{ kHz}$		-	1938	-	pF
Output capacitance	$C_{oss}$			-	71	-	
Reverse transfer capacitance	$C_{rss}$			-	2	-	
Effective output capacitance, energy related <sup>a</sup>	$C_{o(er)}$			-	81	-	
Effective output capacitance, time related <sup>b</sup>	$C_{o(tr)}$	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$		-	546	-	
Total gate charge	$Q_g$	$V_{GS} = 10\text{ V}$	$I_D = 12\text{ A}, V_{DS} = 520\text{ V}$	-	38	57	nC
Gate-source charge	$Q_{gs}$			-	15	-	
Gate-drain charge	$Q_{gd}$			-	14	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 520\text{ V}, I_D = 12\text{ A}, V_{GS} = 10\text{ V}, R_g = 9.1\text{ }\Omega$		-	26	52	ns
Rise time	$t_r$			-	59	118	
Turn-off delay time	$t_{d(off)}$			-	46	92	
Fall time	$t_f$			-	26	52	
Gate input resistance	$R_g$	$f = 1\text{ MHz}$		0.4	0.8	1.6	$\Omega$
<b>Drain-Source Body Diode Characteristics</b>							
Continuous source-drain diode current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	25	A
Pulsed diode forward current	$I_{SM}$			-	-	60	
Diode forward voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = 12\text{ A}, V_{GS} = 0\text{ V}$		-	-	1.2	V
Reverse recovery time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 12\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_R = 25\text{ V}$		-	345	690	ns
Reverse recovery charge	$Q_{rr}$			-	4.4	8.8	$\mu\text{C}$
Reverse recovery current	$I_{RRM}$			-	22	-	A

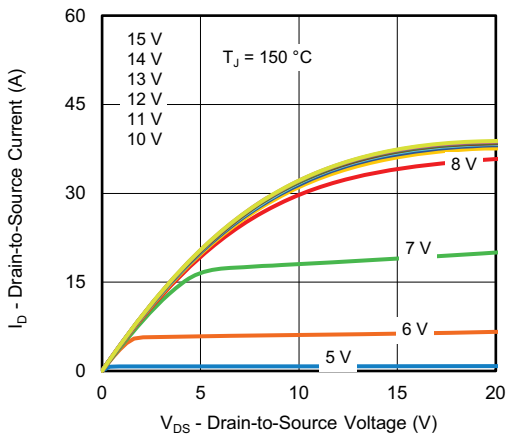
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



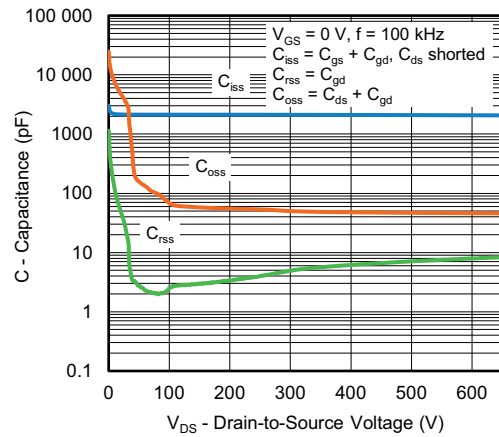
**Fig. 1 - Typical Output Characteristics**



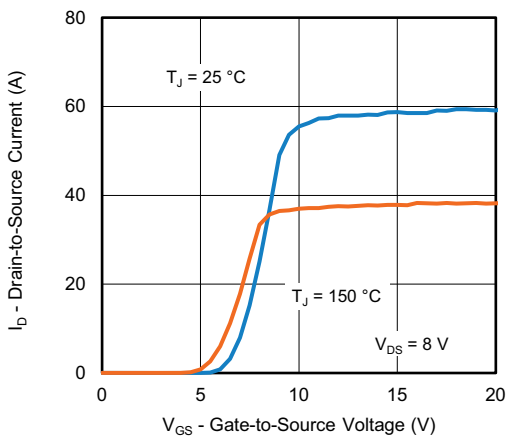
**Fig. 4 - Normalized On-Resistance vs. Temperature**



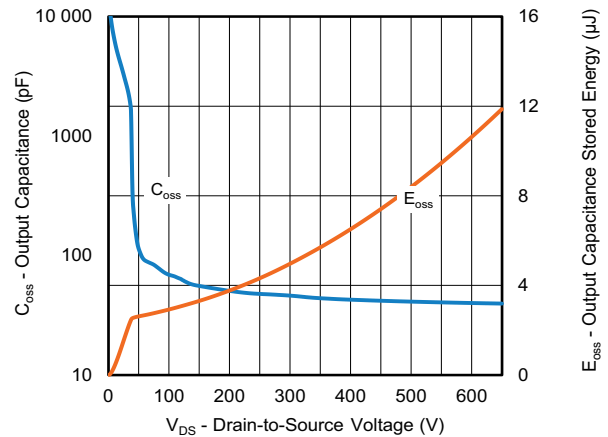
**Fig. 2 - Typical Output Characteristics**



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



**Fig. 3 - Typical Transfer Characteristics**



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

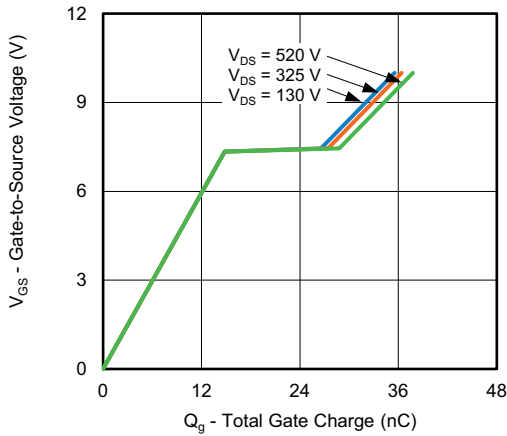


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

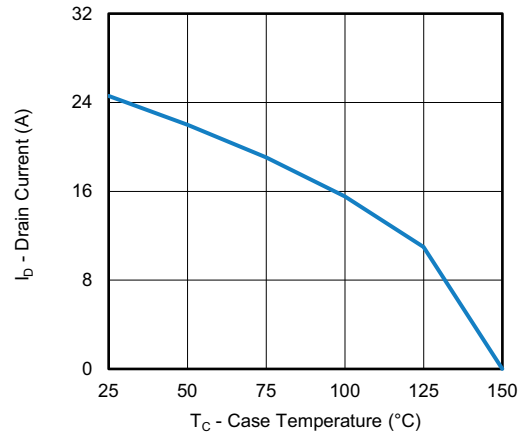


Fig. 10 - Maximum Drain Current vs. Case Temperature

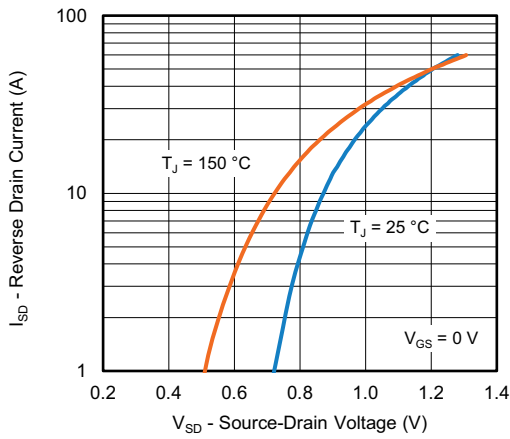


Fig. 8 - Typical Source-Drain Diode Forward Voltage

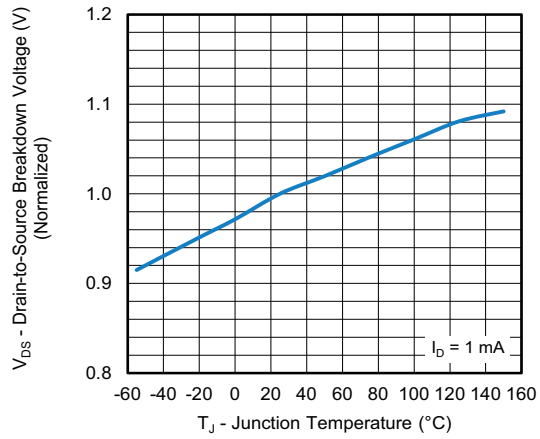


Fig. 11 - Temperature vs. Drain-to-Source Voltage

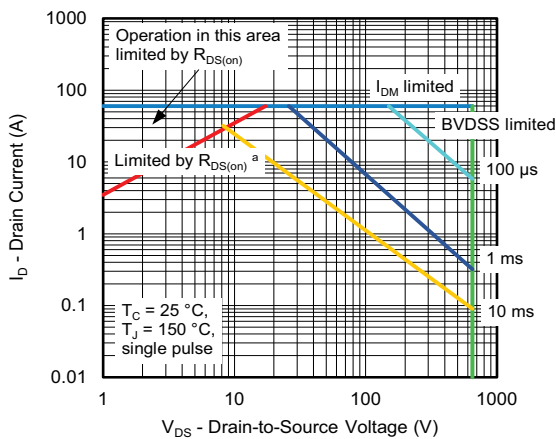


Fig. 9 - Maximum Safe Operating Area

**Note**

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

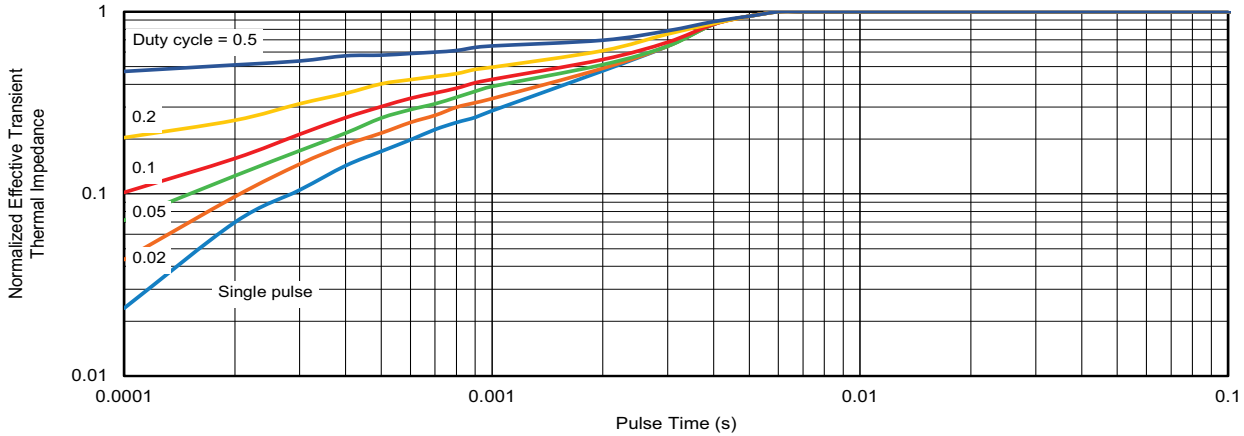


Fig. 12 - Normalized Transient Thermal Impedance, Junction-to-Case

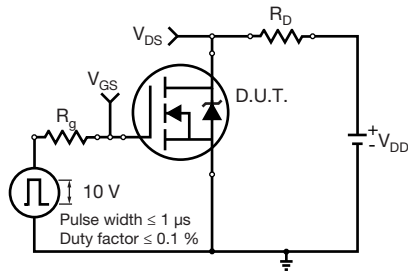


Fig. 13 - Switching Time Test Circuit

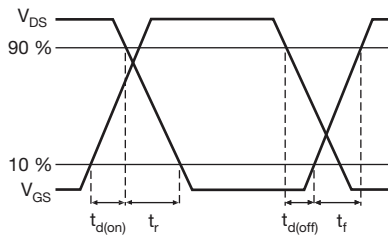


Fig. 14 - Switching Time Waveforms

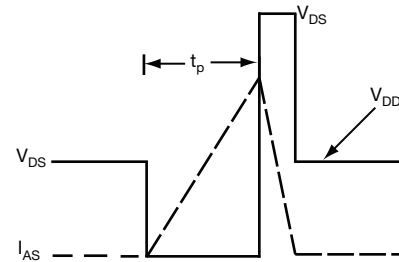


Fig. 16 - Unclamped Inductive Waveforms

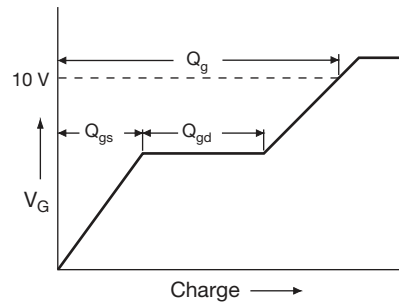


Fig. 17 - Basic Gate Charge Waveform

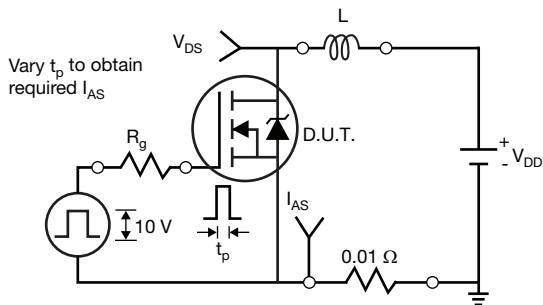


Fig. 15 - Unclamped Inductive Test Circuit

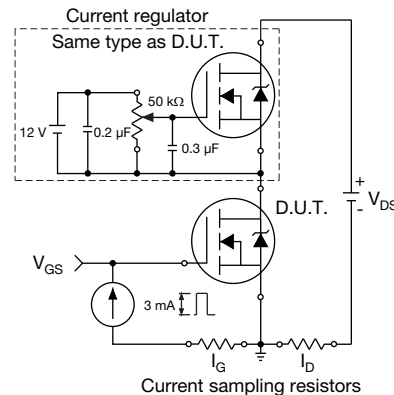
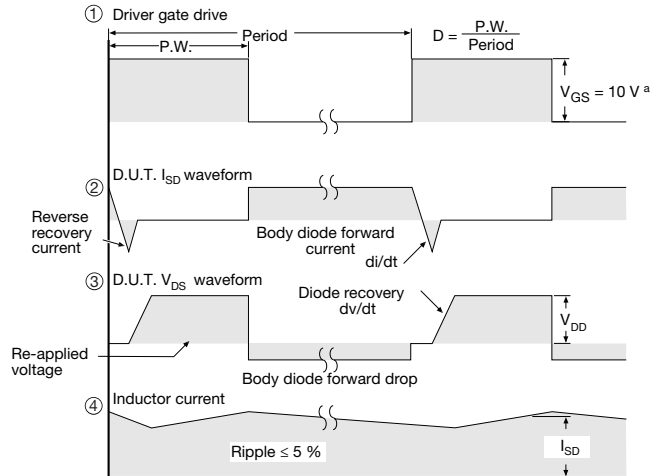
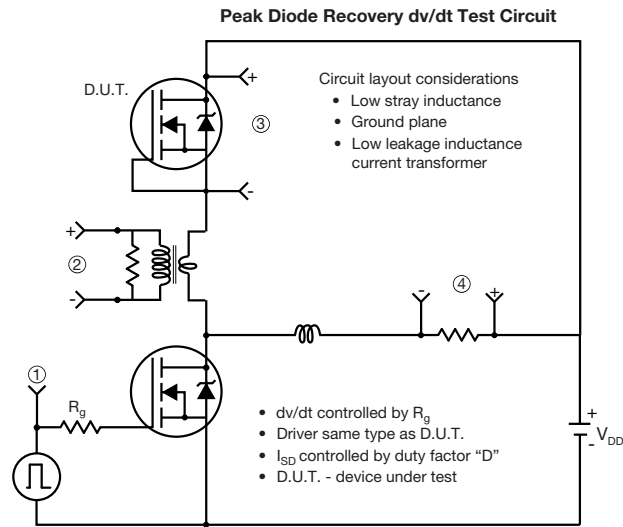


Fig. 18 - Gate Charge Test Circuit



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

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