

E Series Power MOSFET

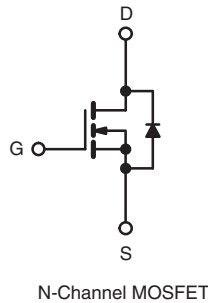
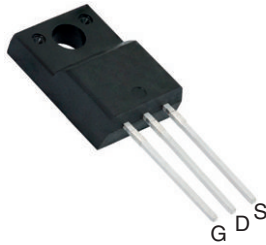
PRODUCT SUMMARY		
V_{DS} (V) at T_J max.	550	
$R_{DS(on)}$ max. at 25 °C (Ω)	$V_{GS} = 10$ V	0.380
Q_g max. (nC)	50	
Q_{gs} (nC)	6	
Q_{gd} (nC)	10	
Configuration	Single	

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


RoHS
COMPLIANT

Thin-Lead TO-220 FULLPAK



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)

ORDERING INFORMATION

Package	Thin-Lead TO-220 FULLPAK
Lead (Pb)-free	SiHA12N50E-E3

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}	± 30	
Continuous Drain Current ($T_J = 150$ °C) ^e	V_{GS} at 10 V	$T_C = 25$ °C	10.5
		$T_C = 100$ °C	6.6
Pulsed Drain Current ^a	I_{DM}	21	A
Linear Derating Factor		0.91	W/°C
Single Pulse Avalanche Energy ^b	E_{AS}	103	mJ
Maximum Power Dissipation	P_D	32	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 ^d		27	
Soldering Recommendations (Peak Temperature) ^c	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, $R_g = 25$ Ω , $I_{AS} = 2.7$ A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, starting $T_J = 25$ °C.
- Limited by maximum junction temperature.



THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	65	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	3.9	

SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
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/°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}	$V_{GS} = \pm 20\text{ V}$		-	-	± 100	nA
		$V_{GS} = \pm 30\text{ V}$		-	-	± 1	μA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$		-	-	1	μA
		$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	10	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 6\text{ A}$	-	0.330	0.380	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 30\text{ V}, I_D = 6\text{ A}$		-	3.1	-	S
Dynamic							
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 ^a	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$		-	45	-	pF
Effective Output Capacitance, Time Related ^b	$C_{o(tr)}$			-	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	-	Ω
Drain-Source Body Diode Characteristics							
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	-	μC
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)

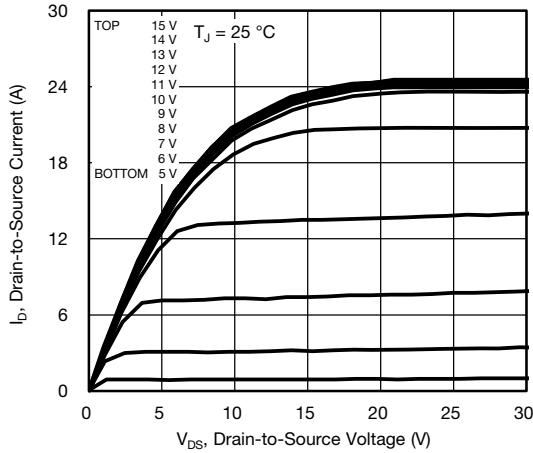


Fig. 1 - Typical Output Characteristics

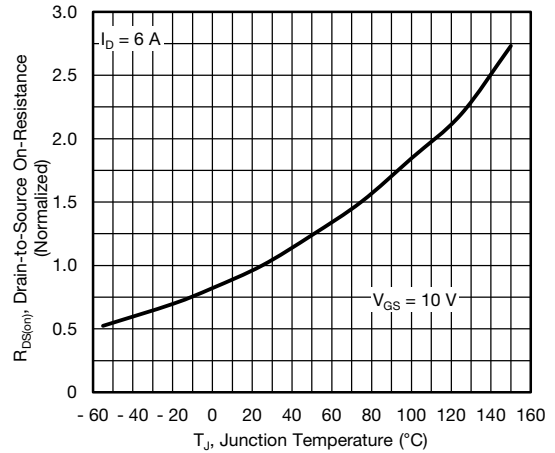


Fig. 4 - Normalized On-Resistance vs. Temperature

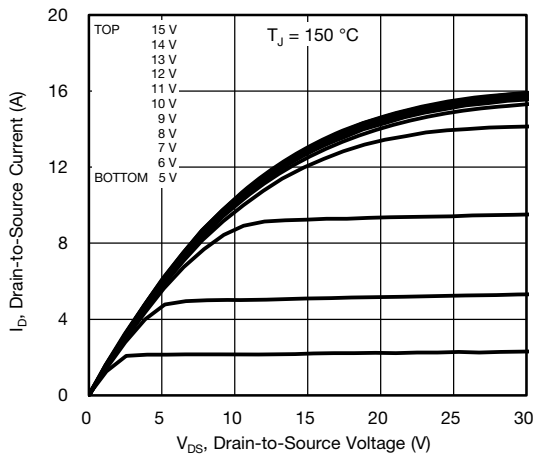


Fig. 2 - Typical Output Characteristics

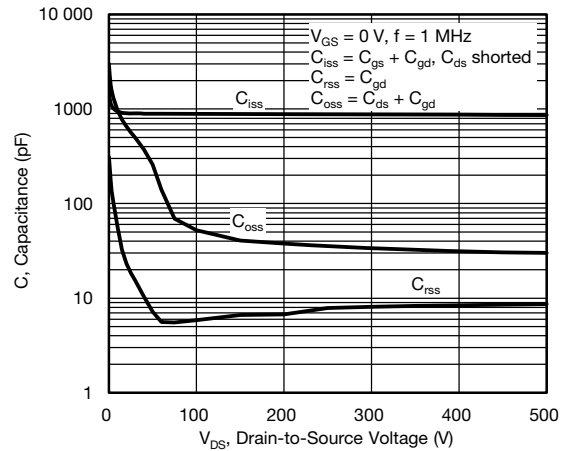


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

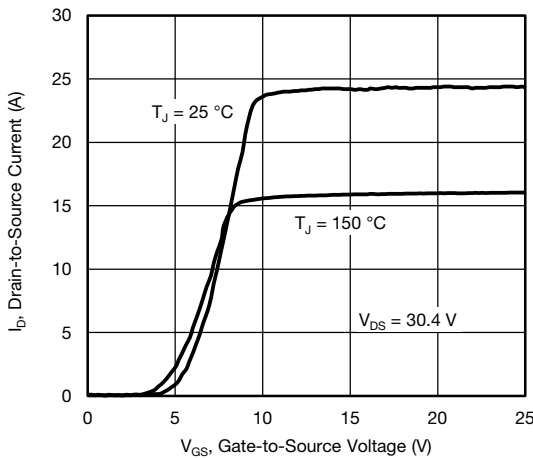


Fig. 3 - Typical Transfer Characteristics

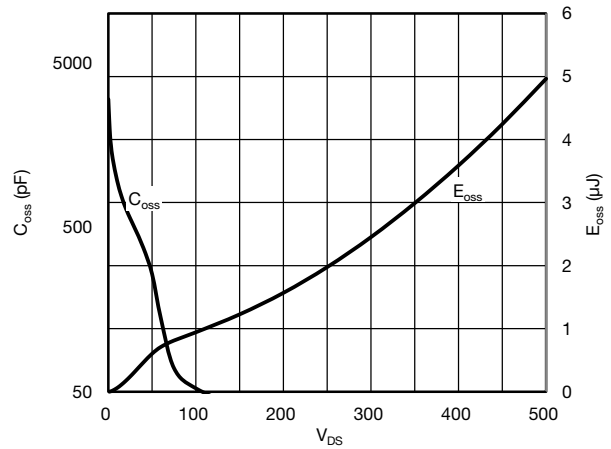


Fig. 6 - C_{OSS} and E_{OSS} vs. V_{DS}



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



Fig. 10 - Maximum Drain Current vs. Case Temperature

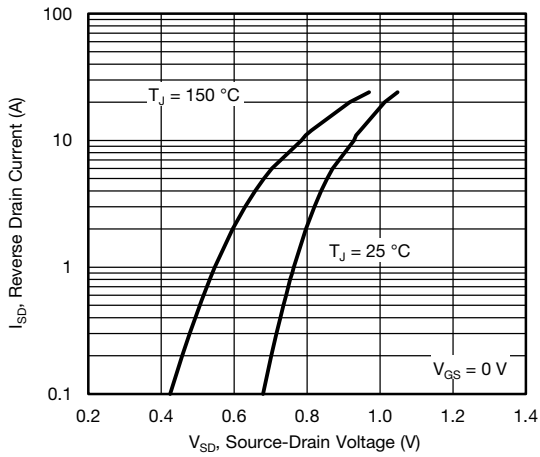


Fig. 8 - Typical Source-Drain Diode Forward Voltage

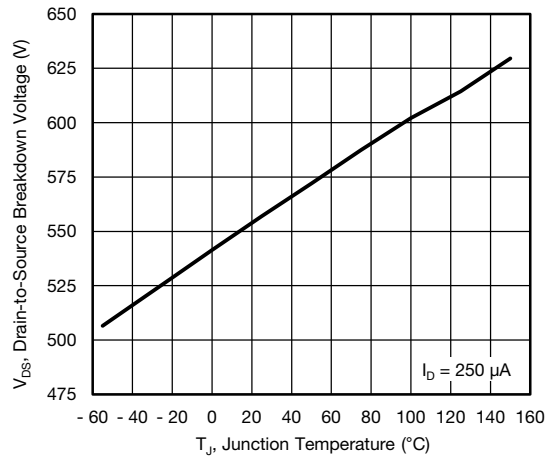


Fig. 11 - Temperature vs. Drain-to-Source Voltage

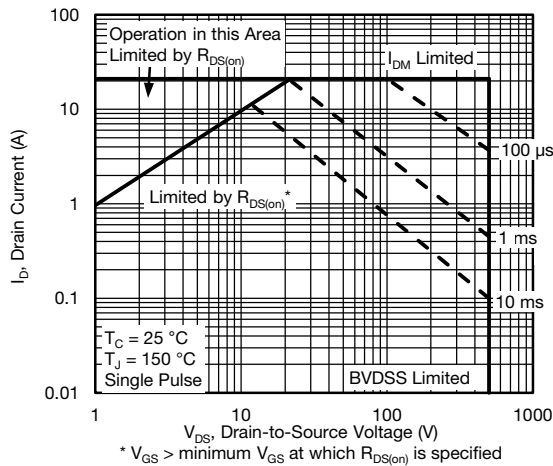


Fig. 9 - Maximum Safe Operating Area

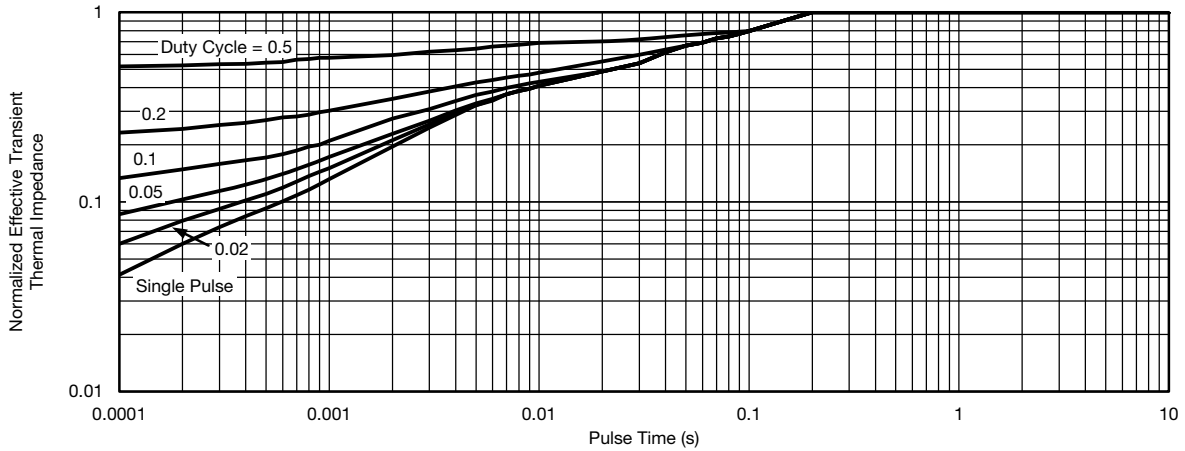


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case



Fig. 13 - Switching Time Test Circuit



Fig. 16 - Unclamped Inductive Waveforms

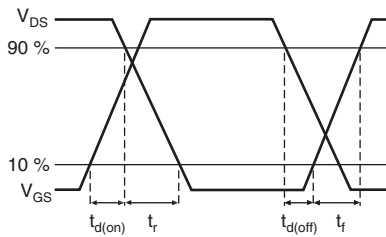


Fig. 14 - Switching Time Waveforms

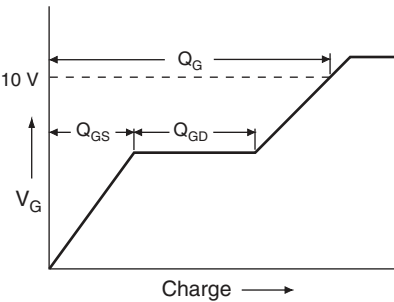


Fig. 17 - Basic Gate Charge Waveform

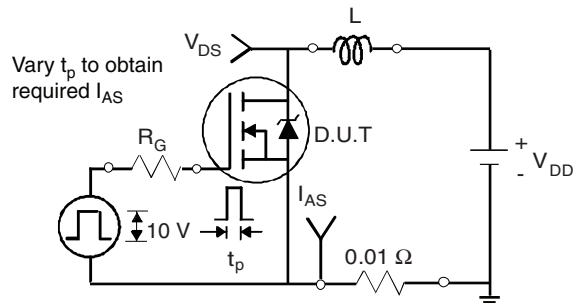


Fig. 15 - Unclamped Inductive Test Circuit

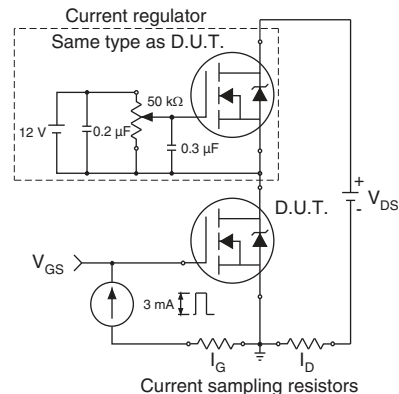


Fig. 18 - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note

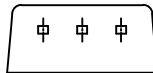
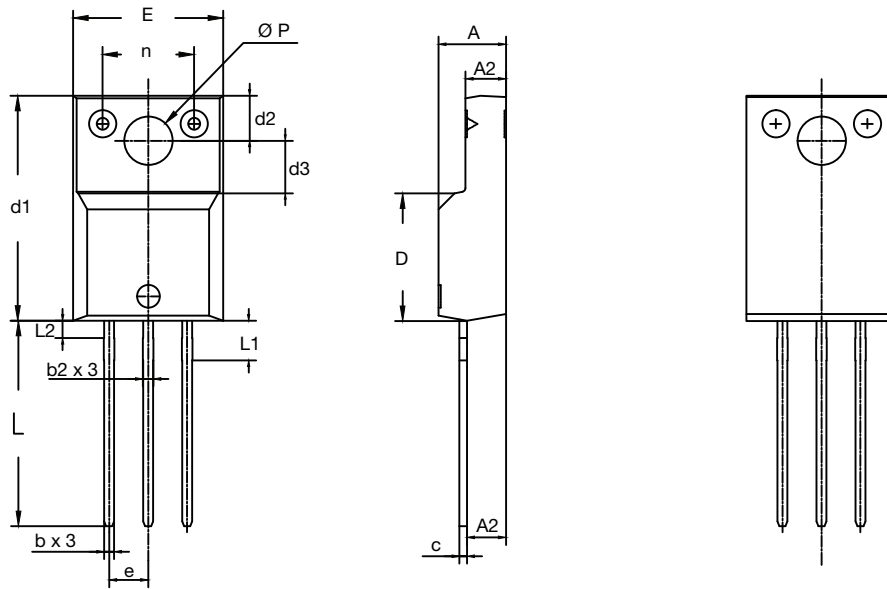
a. $V_{GS} = 5 V$ for logic level devices

Fig. 19 - For N-Channel

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TO-220 FULLPAK Thin Lead



SYMBOL	DIMENSIONS			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.30	4.70	0.169	0.185
A1	2.50	2.90	0.098	0.114
A2	2.50	2.70	0.098	0.106
b	0.60	0.80	0.024	0.031
b2	0.60	0.90	0.024	0.035
c	-	0.60	-	0.024
D	8.30	8.70	0.327	0.342
d1	14.70	15.30	0.579	0.602
d2	2.90	3.10	0.114	0.122
d3	3.40	3.60	0.134	0.142
E	9.70	10.30	0.382	0.406
e	2.50	2.70	0.098	0.106
L	13.40	13.80	0.528	0.543
L1	2.50	2.80	0.098	0.110
L2	-	1.20	-	0.047
n	6.05	6.15	0.238	0.242
Ø P	3.00	3.40	0.118	0.134

ECN: X15-0319-Rev. B, 12-Oct-15
DWG: 6021



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