

D Series Power MOSFET

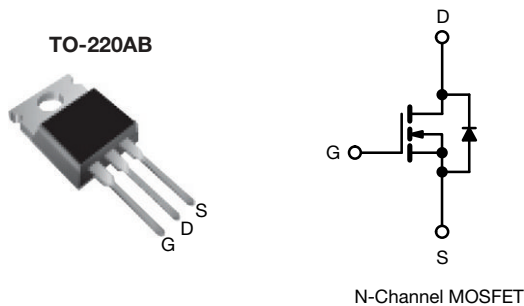
PRODUCT SUMMARY		
V_{DS} (V) at T_J max.	550	
$R_{DS(on)}$ max. (Ω) at 25 °C	$V_{GS} = 10$ V	1.5
Q_g max. (nC)	20	
Q_{gs} (nC)	3	
Q_{gd} (nC)	5	
Configuration	Single	

FEATURES

- Optimal design
 - Low area specific on-resistance
 - Low input capacitance (C_{iss})
 - Reduced capacitive switching losses
 - High body diode ruggedness
 - Avalanche energy rated (UIS)
- Optimal efficiency and operation
 - Low cost
 - Simple gate drive circuitry
 - Low figure-of-merit (FOM): $R_{on} \times Q_g$
 - Fast switching
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
Available



APPLICATIONS

- Consumer electronics
 - Displays (LCD or plasma TV)
- Server and telecom power supplies
 - SMPS
- Industrial
 - Welding
 - Induction heating
 - Motor drives
- Battery chargers


ORDERING INFORMATION	
Package	TO-220AB
Lead (Pb)-free	SiHP5N50D-E3
Lead (Pb)-free and Halogen-free	SiHP5N50D-GE3

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	
Gate-Source Voltage AC ($f > 1$ Hz)		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 ^a	I_{DM}	10	
Linear Derating Factor		0.83	W/°C
Single Pulse Avalanche Energy ^b	E_{AS}	28.8	mJ
Maximum Power Dissipation	P_D	104	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 ^d		24	
Soldering Recommendations (Peak temperature) ^c		0.28	
	for 10 s	300	°C

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, $L = 2.3$ mH, $R_g = 25$ Ω , $I_{AS} = 5$ A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, 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}	-	1.2	

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 $25\text{ }^\circ\text{C}$, $I_D = 250\text{ }\mu\text{A}$	-	0.58	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	3	-	5	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30\text{ V}$	-	-	± 100	nA
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	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}$	-	1.2	1.5	Ω
Forward Transconductance ^a	g_{fs}	$V_{DS} = 20\text{ V}, I_D = 2.5\text{ A}$	-	1.8	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 100\text{ V}, f = 1\text{ MHz}$	-	325	-	pF
Output Capacitance	C_{oss}		-	34	-	
Reverse Transfer Capacitance	C_{rss}		-	6	-	
Effective Output Capacitance, Energy Related ^b	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	-	31	-	
Effective Output Capacitance, Time Related ^c	$C_{o(tr)}$		-	41	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}, V_{DS} = 400\text{ V}$	-	10	20	nC
Gate-Source Charge	Q_{gs}		-	3	-	
Gate-Drain Charge	Q_{gd}		-	5	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 400\text{ V}, I_D = 2.5\text{ A}, R_g = 9.1\text{ }\Omega, V_{GS} = 10\text{ V}$	-	12	24	ns
Rise Time	t_r		-	11	22	
Turn-Off Delay Time	$t_{d(off)}$		-	14	28	
Fall Time	t_f		-	11	22	
Gate Input Resistance	R_g		$f = 1\text{ MHz}, \text{open drain}$	-	1.7	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse P - N junction diode 	-	-	5	A
Pulsed Diode Forward Current	I_{SM}		-	-	20	
Diode Forward Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 4\text{ A}, V_{GS} = 0\text{ V}$	-	-	1.2	V
Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 2.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_R = 20\text{ V}$	-	320	-	ns
Reverse Recovery Charge	Q_{rr}		-	1.2	-	μC
Reverse Recovery Current	I_{RRM}		-	8	-	A

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $C_{oss(er)}$ 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)

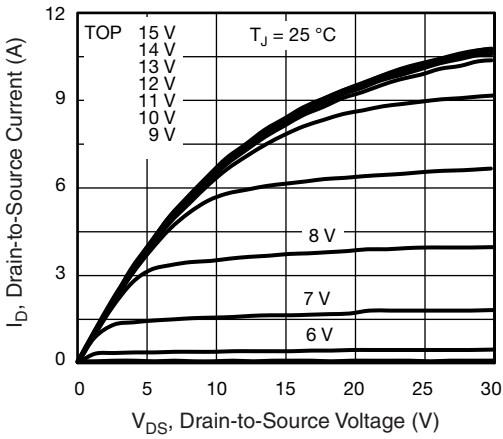


Fig. 1 - Typical Output Characteristics

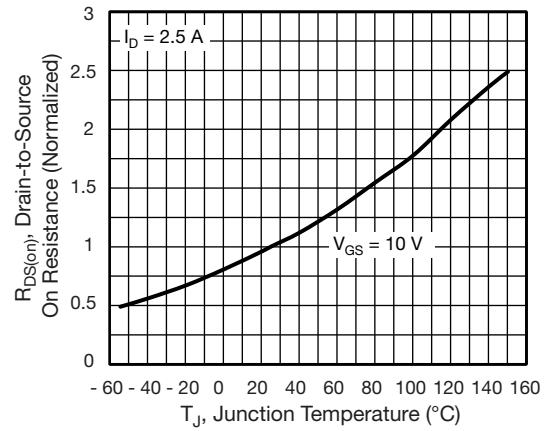


Fig. 4 - Normalized On-Resistance vs. Temperature

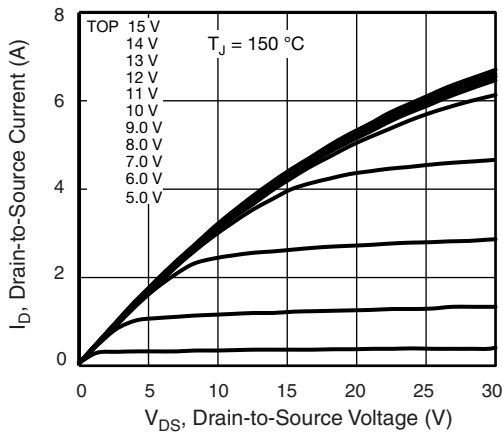


Fig. 2 - Typical Output Characteristics

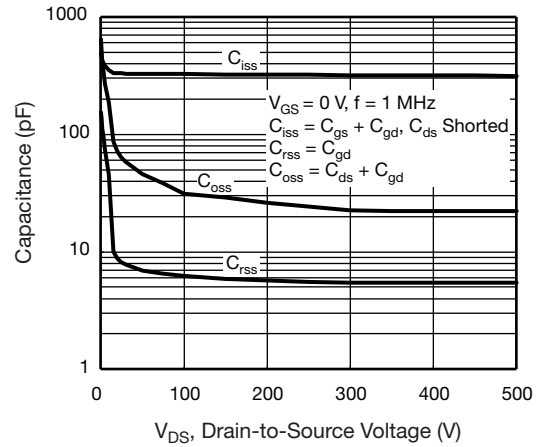


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

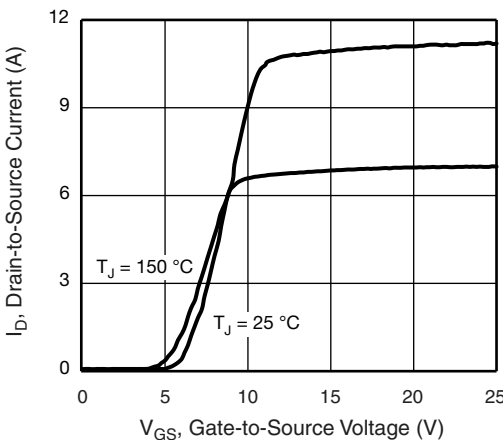


Fig. 3 - Typical Transfer Characteristics

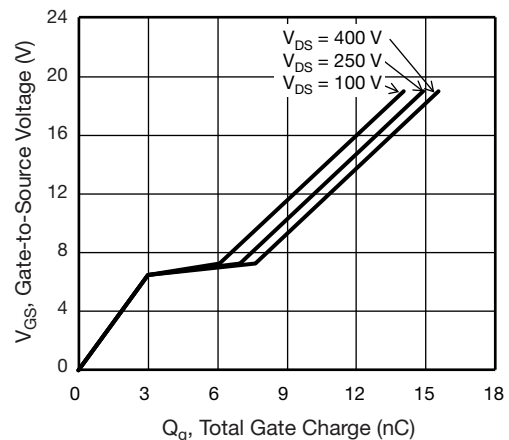


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

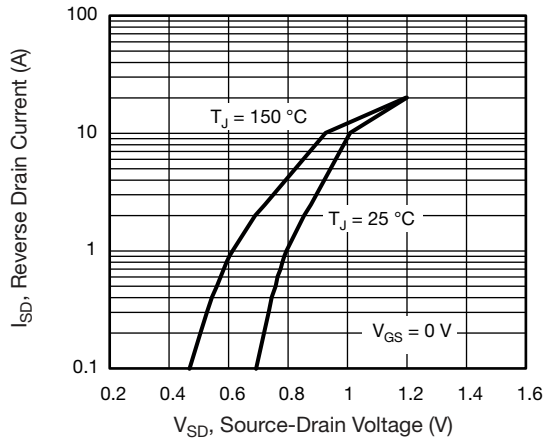


Fig. 7 - Typical Source-Drain Diode Forward Voltage

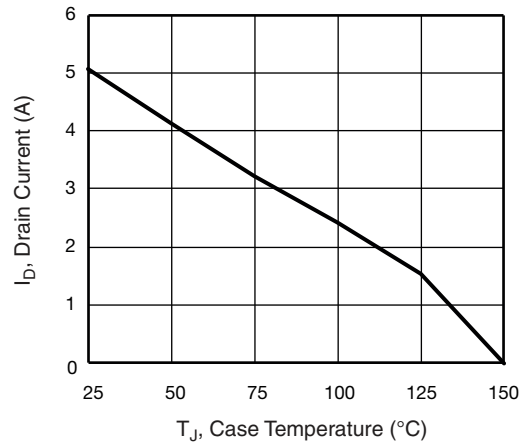


Fig. 9 - Maximum Drain Current vs. Case Temperature

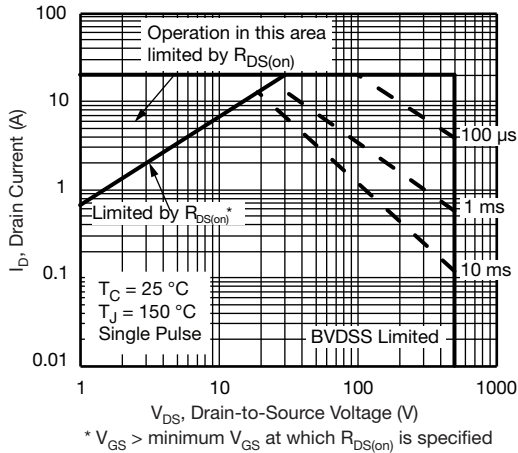


Fig. 8 - Maximum Safe Operating Area

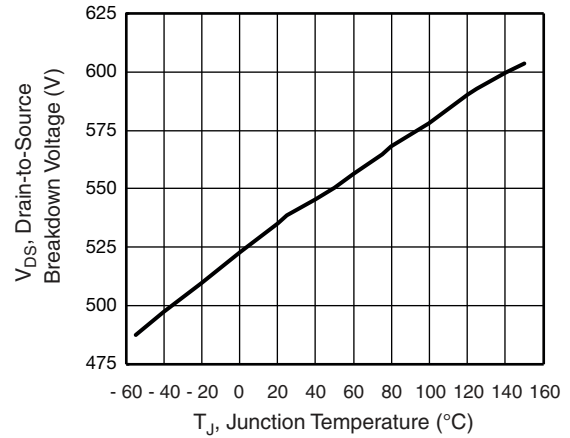


Fig. 10 - Typical Drain-to-Source Voltage vs. Temperature

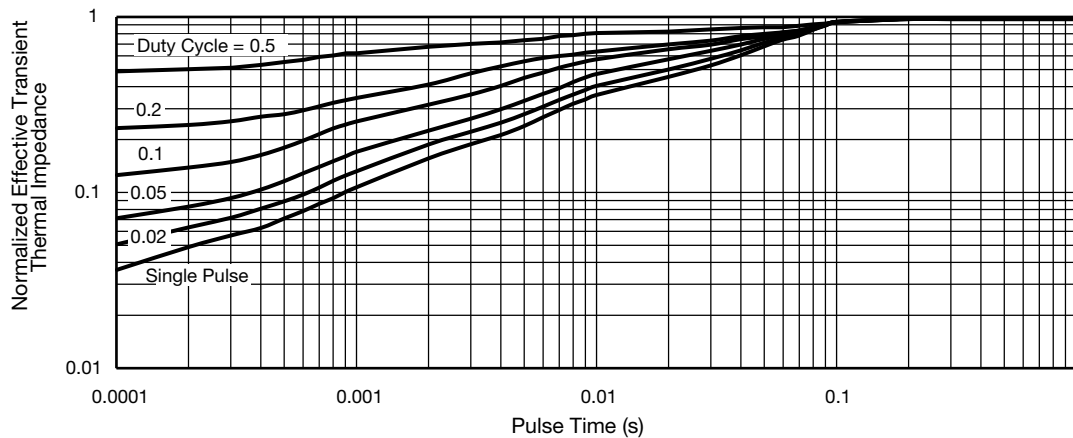


Fig. 11 - Normalized Thermal Transient Impedance, Junction-to-Case



Fig. 12 - Switching Time Test Circuit



Fig. 16 - Basic Gate Charge Waveform



Fig. 13 - Switching Time Waveforms

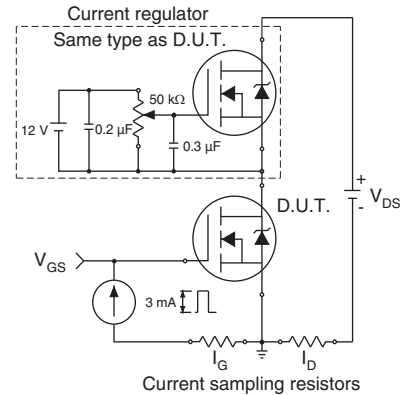


Fig. 17 - Gate Charge Test Circuit

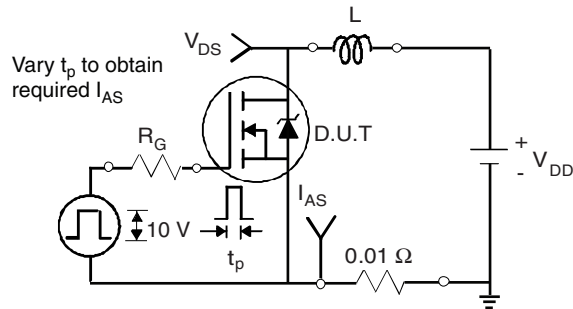


Fig. 14 - Unclamped Inductive Test Circuit

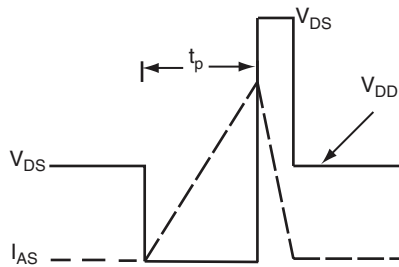
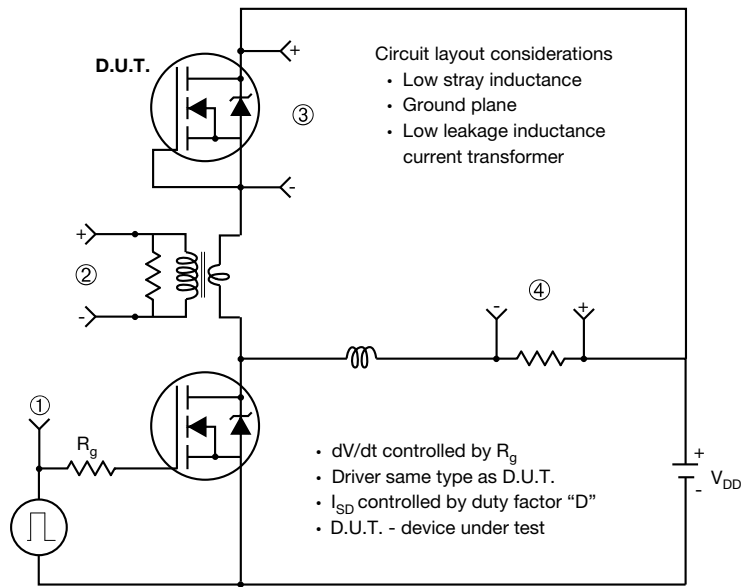


Fig. 15 - Unclamped Inductive Waveforms

Peak Diode Recovery dV/dt Test Circuit



Note

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

Fig. 18 - For N-Channel

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TO-220-1

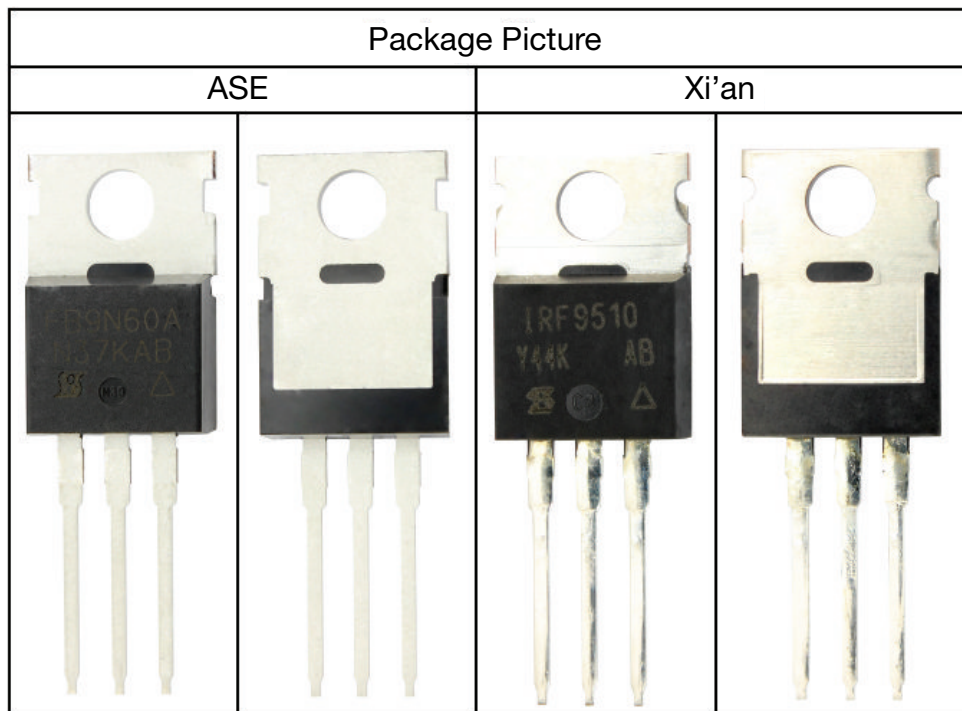


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.24	4.65	0.167	0.183
b	0.69	1.02	0.027	0.040
b(1)	1.14	1.78	0.045	0.070
c	0.36	0.61	0.014	0.024
D	14.33	15.85	0.564	0.624
E	9.96	10.52	0.392	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.10	6.71	0.240	0.264
J(1)	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: X15-0364-Rev. C, 14-Dec-15
DWG: 6031

Note

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





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