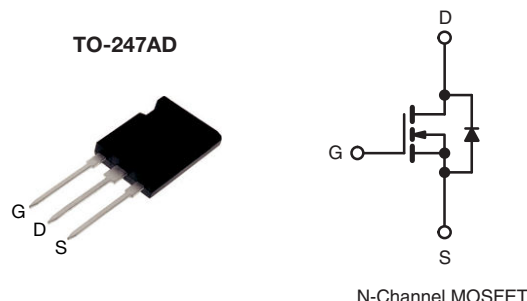


E Series Power MOSFET with Fast Body Diode

PRODUCT SUMMARY		
V_{DS} (V) at T_J max.	650	
$R_{DS(on)}$ max. at 25 °C (Ω)	$V_{GS} = 10$ V	0.067
Q_g max. (nC)	225	
Q_{gs} (nC)	31	
Q_{gd} (nC)	63	
Configuration	Single	



FEATURES

- Fast Body Diode MOSFET Using E Series Technology
- Reduced t_{rr} , Q_{rr} , and I_{RRM}
- Low Figure-of-Merit (FOM) $R_{on} \times Q_g$
- Low Input Capacitance (C_{iss})
- Low switching losses due to reduced Q_{rr}
- Ultra Low Gate Charge (Q_g)
- Avalanche Energy Rated (UIS)
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
Available

APPLICATIONS

- Telecommunications
 - Server and Telecom Power Supplies
- Lighting
 - High-Intensity Lighting (HID)
 - Light Emitting Diodes (LEDs)
- Consumer and Computing
 - ATX Power Supplies
- Industrial
 - Welding
 - Battery Chargers
- Renewable Energy
 - Solar (PV Inverters)
- Switching Mode Power Supplies (SMPS)
 - LLC
 - Phase Shifted Bridge (ZVS)
 - 3-level Inverter
 - AC/DC Bridge

ORDERING INFORMATION	
Package	TO-247AD
Lead (Pb)-free and Halogen-free	SiHW47N60EF-GE3

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	V_{DS}	600	V	
Gate-Source Voltage		± 20		
Gate-Source Voltage AC ($f > 1$ Hz)		30		
Continuous Drain Current ($T_J = 150$ °C)	I_D	47	A	
		29		
Pulsed Drain Current ^a	I_{DM}	138		
Linear Derating Factor		3	W/°C	
Single Pulse Avalanche Energy ^b	E_{AS}	1500	mJ	
Maximum Power Dissipation	P_D	379	W	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150	°C	
Drain-Source Voltage Slope	dV/dt	37	V/ns	
Reverse Diode dV/dt ^d		9.7		
Soldering Recommendations (Peak Temperature) ^c		300	°C	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DS} = 50$ V, starting $T_J = 25$ °C, $L = 73.5$ mH, $R_g = 25$ Ω , $I_{AS} = 6.4$ A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, starting $T_J = 25$ °C.

**THERMAL RESISTANCE RATINGS**

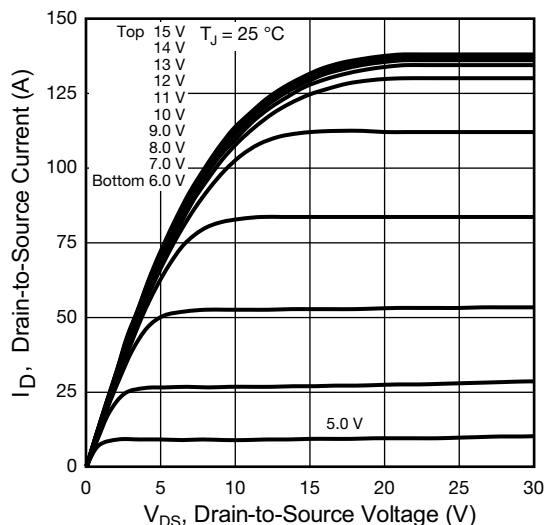
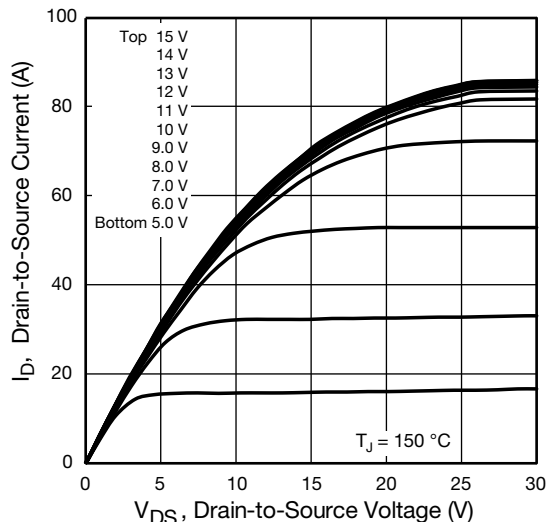
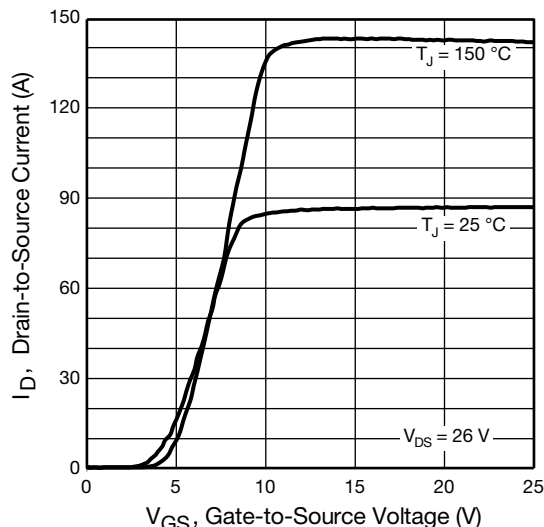
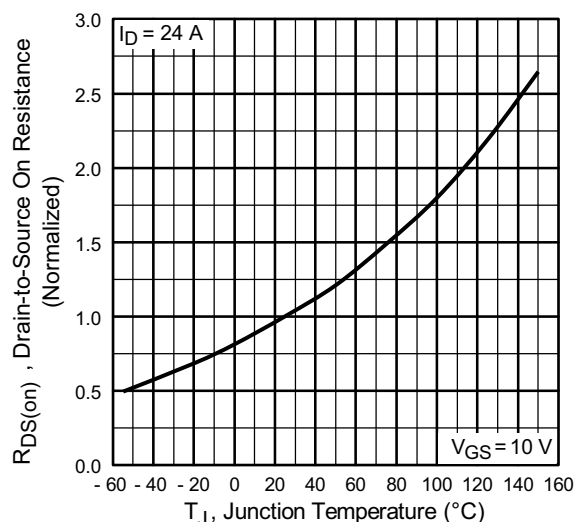
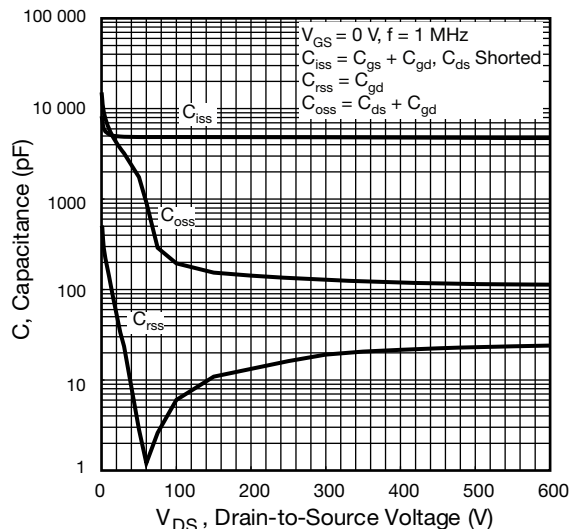
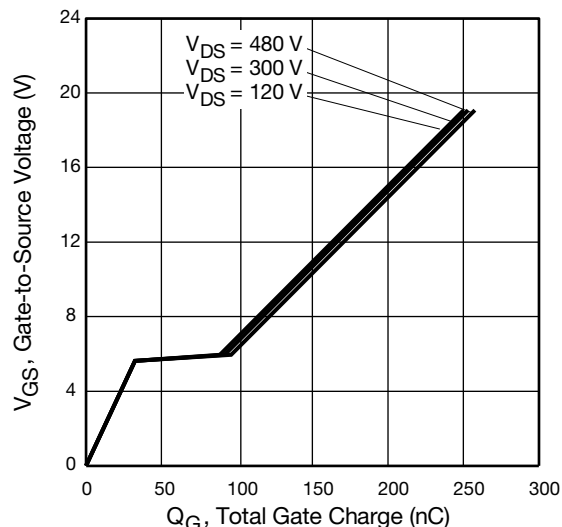
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	40	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.33	

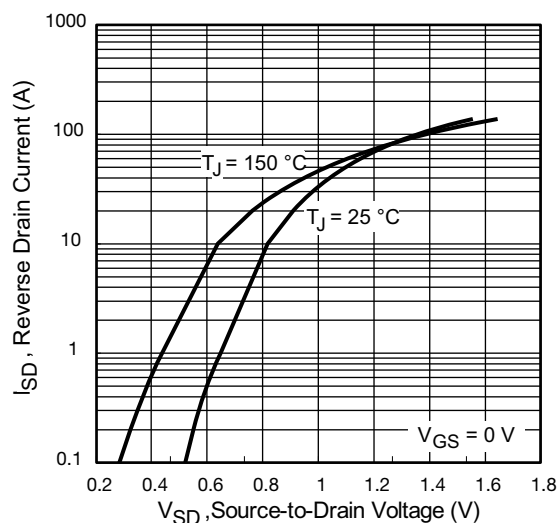
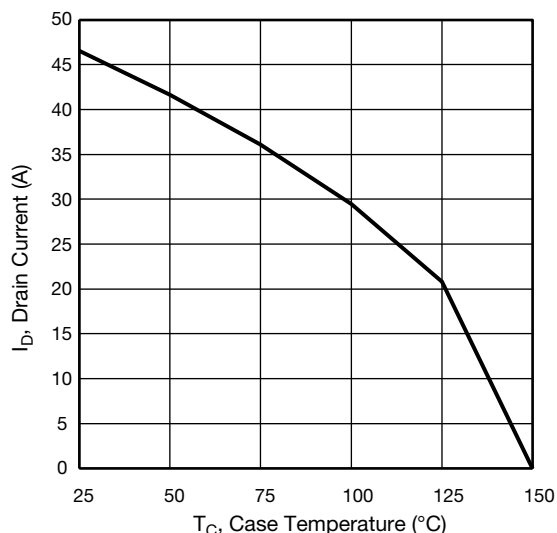
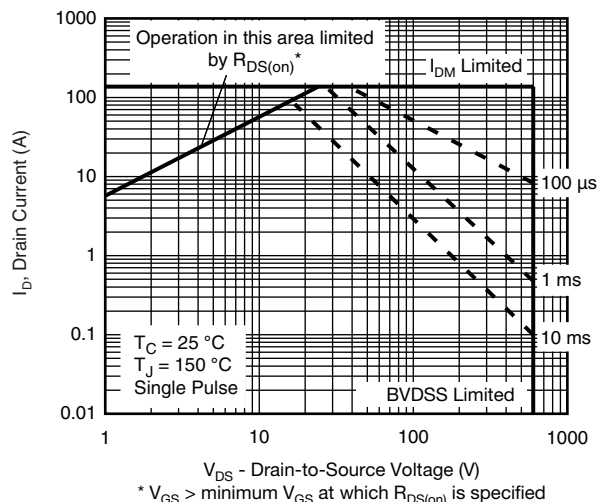
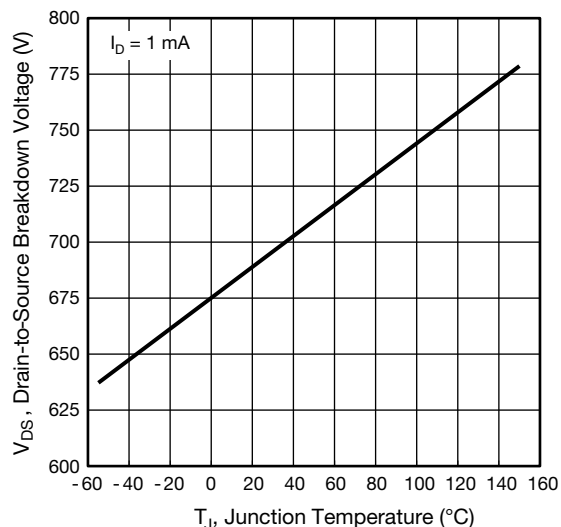
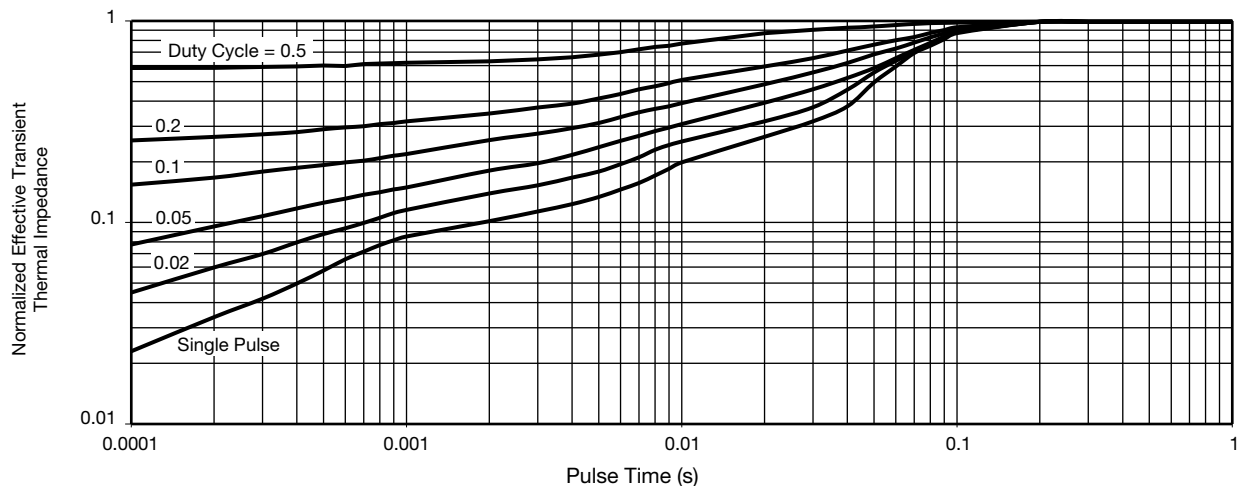
SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

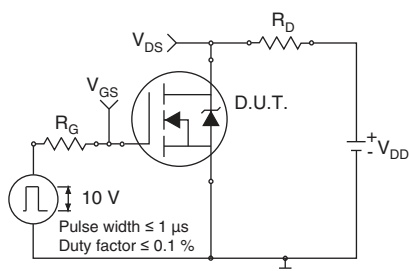
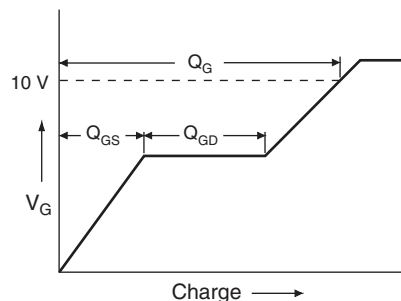
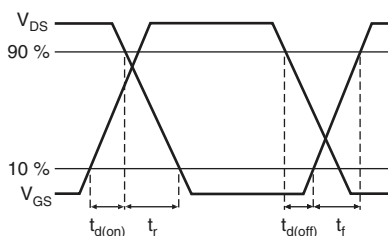
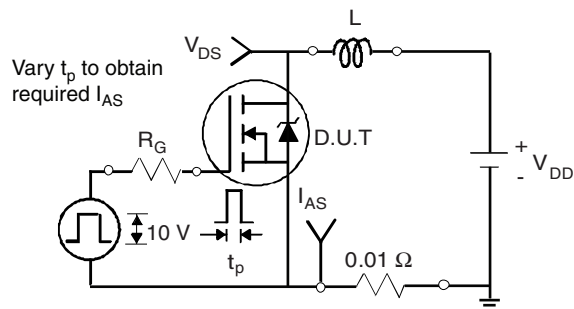
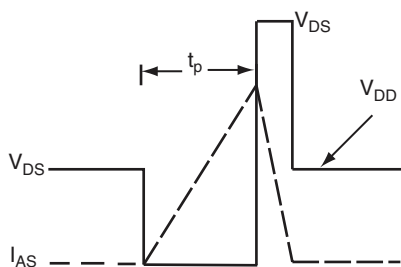
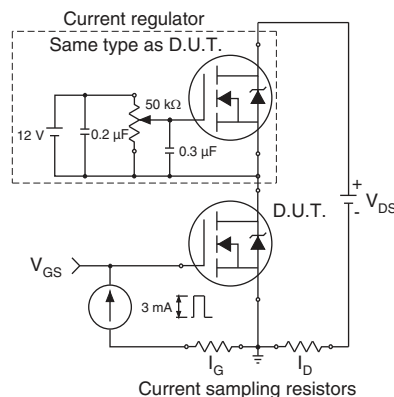
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		600	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-		-	V/°C
Gate-Source Threshold Voltage (N)	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		2.0	-	4.0	V
Gate-Source Leakage	I _{GSS}	V _{GS} = ± 20 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 600 V, V _{GS} = 0 V		-	-	1	μA
		V _{DS} = 480 V, V _{GS} = 0 V, T _J = 125 °C		-	-	500	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 24 A	-	0.056	0.067	Ω
Forward Transconductance	g _{fs}	V _{DS} = 30 V, I _D = 24 A		-	17	-	S
Dynamic							
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 100 V, f = 1 MHz		-	4854	-	pF
Output Capacitance	C _{oss}			-	195	-	
Reverse Transfer Capacitance	C _{rss}			-	6	-	
Effective Output Capacitance, Energy Related ^a	C _{o(er)}	V _{DS} = 0 V to 480 V, V _{GS} = 0 V		-	208	-	
Effective Output Capacitance, Time Related ^b	C _{o(tr)}			-	651	-	
Total Gate Charge	Q _g	V _{GS} = 10 V	I _D = 24 A, V _{DS} = 480 V	-	150	225	nC
Gate-Source Charge	Q _{gs}			-	31	-	
Gate-Drain Charge	Q _{gd}			-	63	-	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 480 V, I _D = 24 A, V _{GS} = 10 V, R _g = 4.4 Ω		-	30	60	ns
Rise Time	t _r			-	61	92	
Turn-Off Delay Time	t _{d(off)}			-	94	141	
Fall Time	t _f			-	58	87	
Gate Input Resistance	R _g	f = 1 MHz, open drain		-	0.67	-	Ω
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	24	A
Pulsed Diode Forward Current	I _{SM}			-	-	138	
Diode Forward Voltage	V _{SD}	T _J = 25 °C, I _S = 24 A, V _{GS} = 0 V		-	0.9	1.2	V
Body Diode Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = I _S = 24 A, dI/dt = 100 A/μs, V _R = 25 V		-	168	336	ns
Body Diode Reverse Recovery Charge	Q _{rr}			-	1.2	2.4	μC
Reverse Recovery Current	I _{RRM}			-	14	-	A

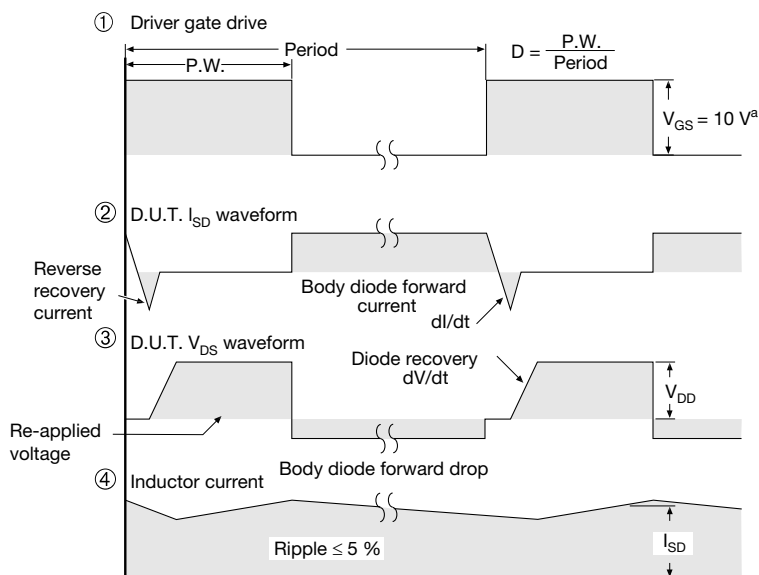
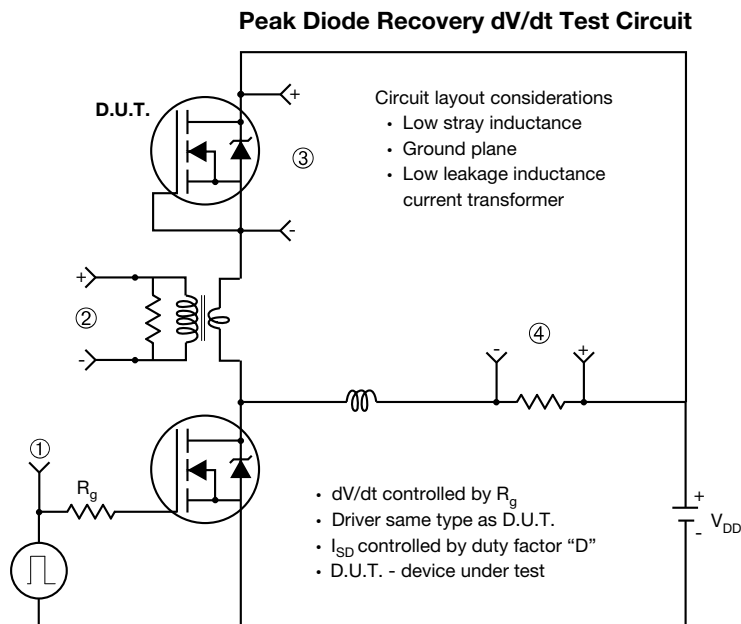
Notes

- 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, $T_C = 25\text{ °C}$

Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ °C}$

Fig. 3 - Typical Transfer Characteristics

Fig. 4 - Normalized On-Resistance vs. Temperature

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

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 - Temperature vs. Drain-to-Source Voltage

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. 14 - Unclamped Inductive Test Circuit

Fig. 15 - Unclamped Inductive Waveforms

Fig. 17 - Gate Charge Test Circuit


Note

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

Fig. 18 - For N-Channel

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