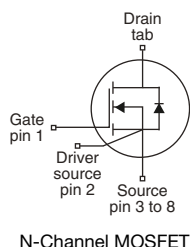


EF Series Power MOSFET with Fast Body Diode



FEATURES

- 5th generation EF 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)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

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.	650	
$R_{DS(on)}$ typ. (Ω) at 25 °C	$V_{GS} = 10$ V	0.039
Q_g max. (nC)	153	
Q_{gs} (nC)	32	
Q_{gd} (nC)	35	
Configuration	Single	

ORDERING INFORMATION

Package	PowerPAK 10 x 12
Lead (Pb)-free and halogen-free	SiHK039N60AEFT1GE3

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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	V_{DS}	600	V
Gate-source voltage	V_{GS}	± 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}	172	
Linear derating factor		2.9	W/°C
Single pulse avalanche energy ^b	E_{AS}	311	mJ
Maximum power dissipation	P_D	368	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			

Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 120$ V, starting $T_J = 25$ °C, $L = 28.2$ mH, $R_g = 25$ Ω , $I_{AS} = 4.7$ 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**

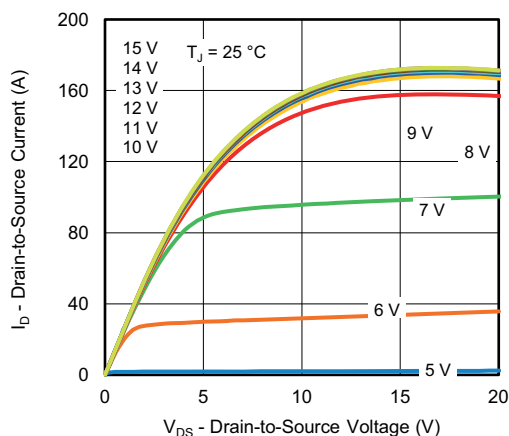
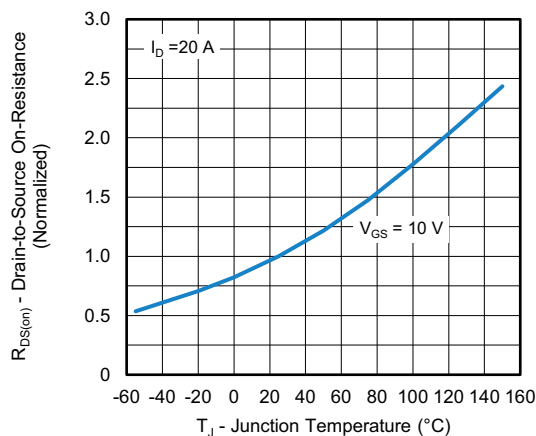
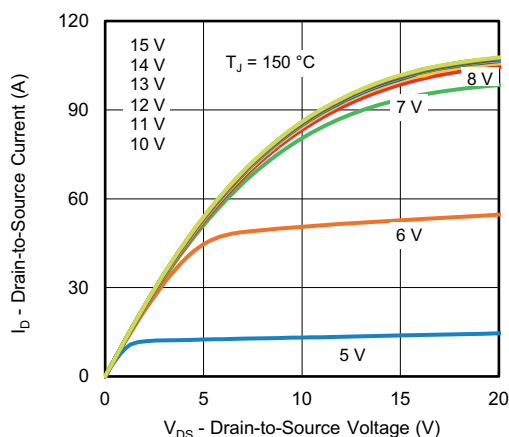
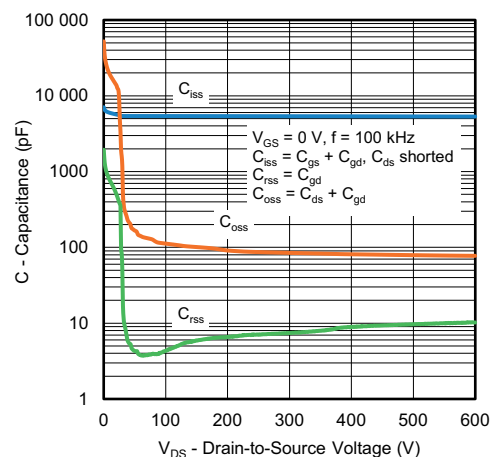
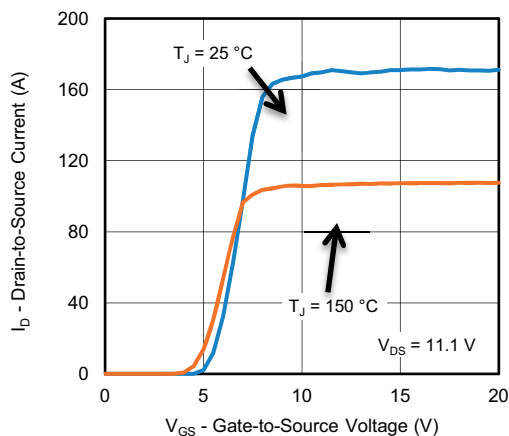
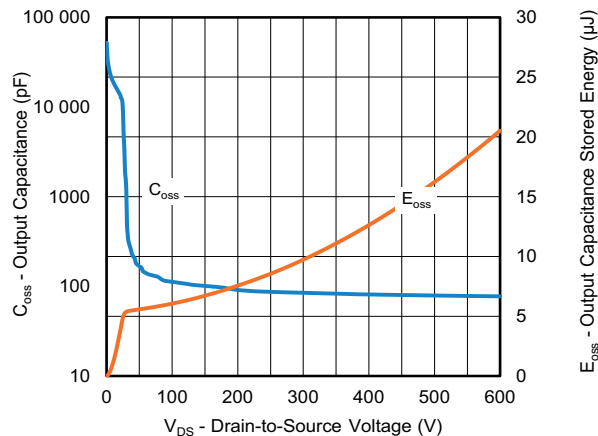
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	R_{thJA}	-	50 ^a	°C/W
Maximum junction-to-case (drain)	R_{thJC}	-	0.34	

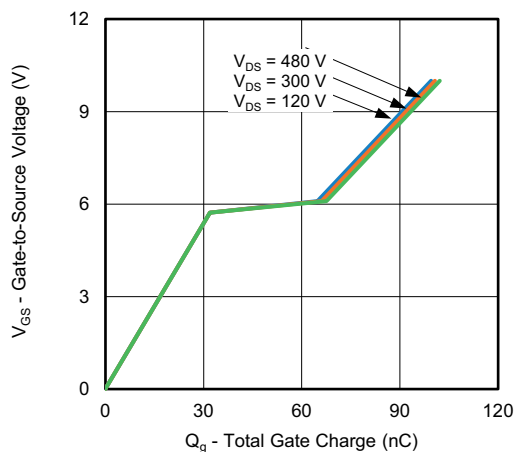
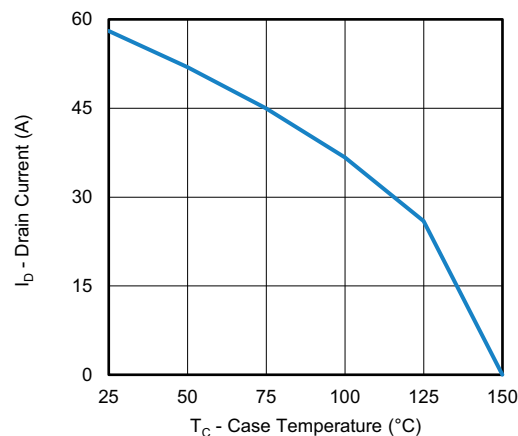
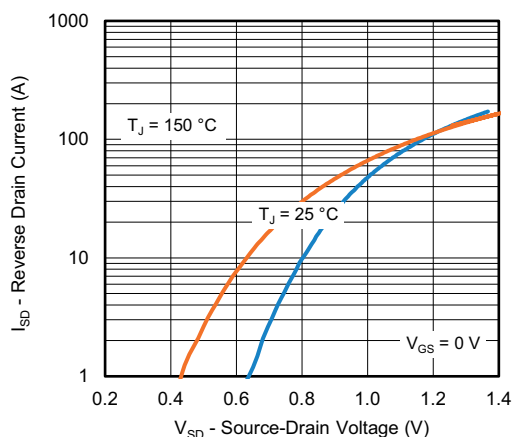
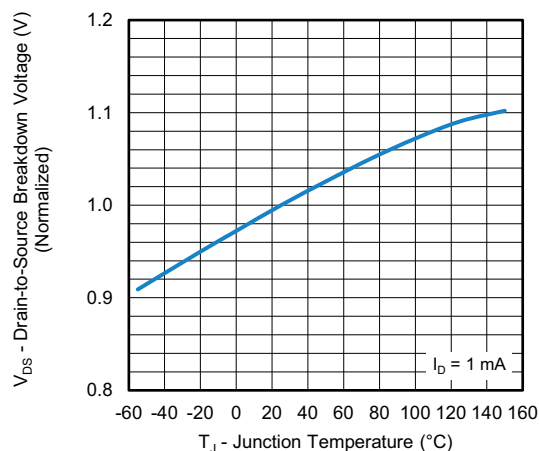
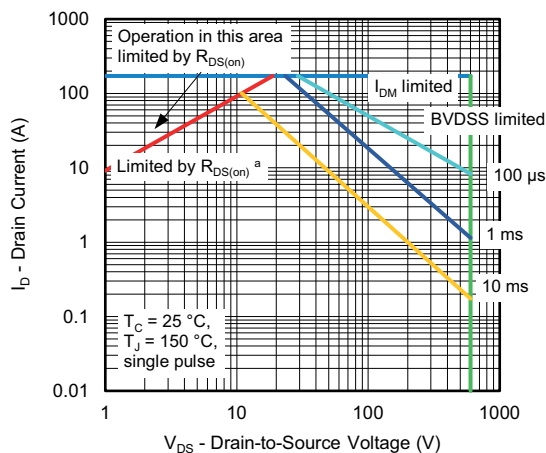
SPECIFICATIONS ($T_J = 25\text{ °C}$, unless otherwise noted)

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		-	0.63	-	V/°C
Gate-source threshold voltage (N)	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		3.0	-	5.0	V
Gate-source leakage	I _{GSS}	V _{GS} = ± 30 V		-	-	± 100	nA
Zero gate voltage drain current	I _{DSS}	V _{DS} = 480 V, V _{GS} = 0 V		-	-	1	μA
		V _{DS} = 480 V, V _{GS} = 0 V, T _J = 125 °C		-	-	10	mA
Drain-source on-state resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 20 A	-	0.039	0.0448	Ω
Forward transconductance ^a	g _{fs}	V _{DS} = 30 V, I _D = 20 A		-	18	-	S
Dynamic							
Input capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 100 V, f = 100 KHz		-	5409	-	pF
Output capacitance	C _{oss}			-	116	-	
Reverse transfer capacitance	C _{rss}			-	4	-	
Effective output capacitance, energy related ^a	C _{o(er)}	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		-	158	-	
Effective output capacitance, time related ^b	C _{o(tr)}			-	1365	-	
Total gate charge	Q _g	V _{GS} = 10 V	I _D = 20 A, V _{DS} = 480 V	-	102	153	nC
Gate-source charge	Q _{gs}			-	32	-	
Gate-drain charge	Q _{gd}			-	35	-	
Turn-on delay time	t _{d(on)}	V _{DD} = 480 V, I _D = 20 A, V _{GS} = 10 V, R _g = 9.1 Ω		-	42	84	ns
Rise time	t _r			-	65	98	
Turn-off delay time	t _{d(off)}			-	150	225	
Fall time	t _f			-	46	92	
Gate input resistance	R _g	f = 1 MHz		2	4	8	Ω
Drain-Source Body Diode Characteristics							
Continuous source-drain diode current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	58	A
Pulsed diode forward current	I _{SM}			-	-	172	
Diode forward voltage	V _{SD}	T _J = 25 °C, I _S = 20 A, V _{GS} = 0 V		-	-	1.2	V
Reverse recovery time	t _{rr}	T _J = 25 °C, I _F = I _S = 20 A, di/dt = 100 A/μs, V _R = 400 V		-	145	290	ns
Reverse recovery charge	Q _{rr}			-	1.1	2.2	μC
Reverse recovery current	I _{RRM}			-	15	-	A

Notes

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

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

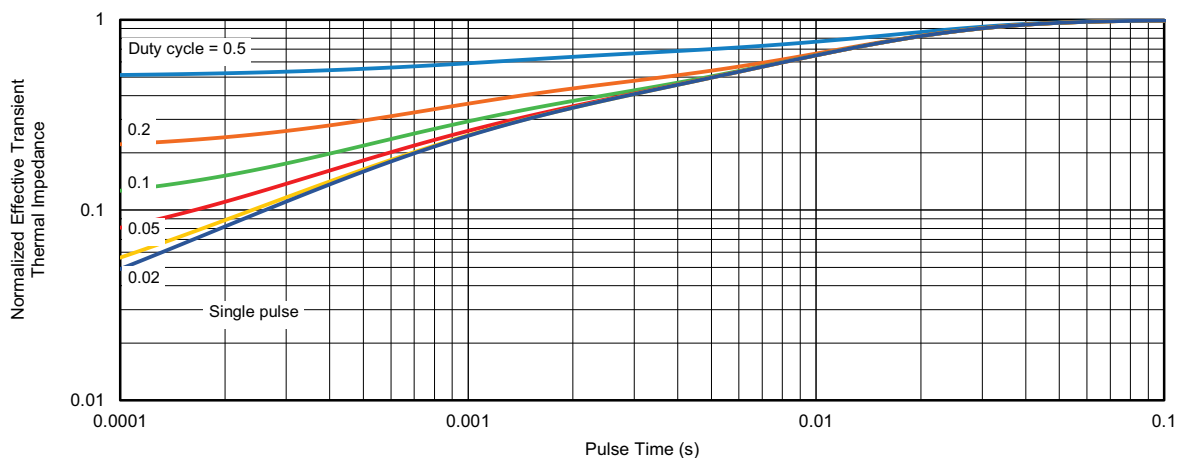
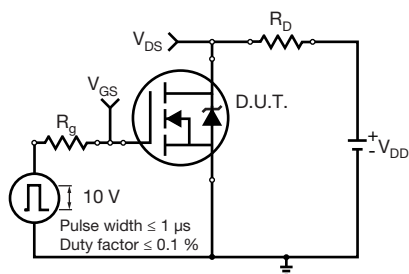
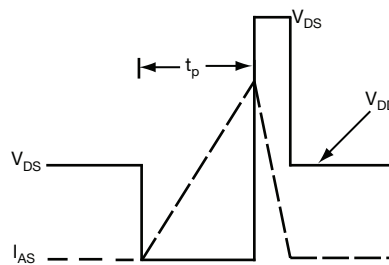
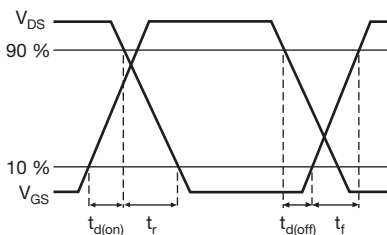
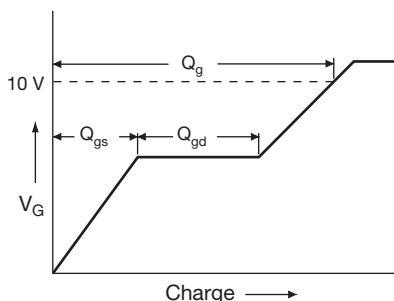
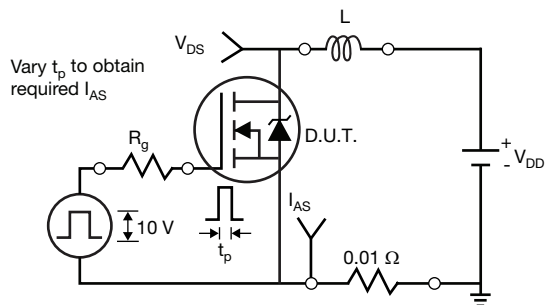
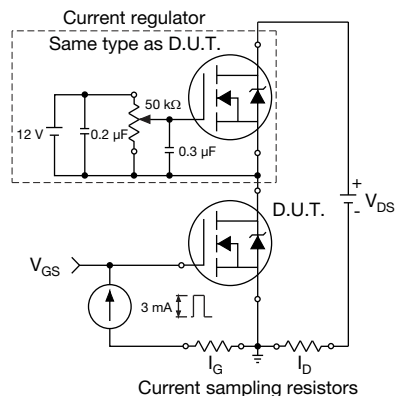

Fig. 12 - Normalized Transient Thermal Impedance, Junction-to-Case

Fig. 13 - Switching Time Test Circuit

Fig. 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



Fig. 19 - For N-Channel

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