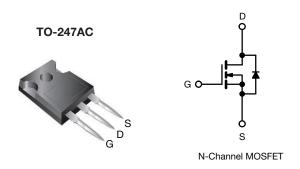
SiHG052N60EF

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Vishay Siliconix

EF Series Power MOSFET With Fast Body Diode



PRODUCT SUMMARY		
V _{DS} (V) at T _J max.	65	50
R _{DS(on)} typ. (Ω) at 25 °C	$V_{GS} = 10 V$	0.045
Q _g max. (nC)	1(01
Q _{gs} (nC)	24	
Q _{gd} (nC)	2	2
Configuration	Sin	gle

FEATURES

- 4th generation E series technology
- Low figure-of-merit (FOM) Ron x Qg
- Low effective capacitance (Co(er))
- · Reduced switching and conduction losses
- Avalanche energy rated (UIS)
- · Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

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)

ORDERING INFORMATION	
Package	TO-247AC
Lead (Pb)-free and halogen-free	SiHG052N60EF-GE3

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			V _{DS}	600	v
Gate-source voltage			V _{GS}	± 30	v
Continuous drain current ($T_{,1} = 150 \ ^{\circ}C$)	V _{GS} at 10 V	T _C = 25 °C T _C = 100 °C	I.	48	
Continuous drain current $(1) = 150^{\circ}$ C)	VGS at TO V	T _C = 100 °C	ID	31	А
Pulsed drain current ^a			I _{DM}	148	
Linear derating factor				2.2	W/°C
Single pulse avalanche energy ^b			E _{AS}	353	mJ
Maximum power dissipation			PD	278	W
Operating junction and storage temperature range			T _J , T _{stg}	-55 to +150	°C
Drain-source voltage slope $T_J = 125 \text{ °C}$.1. (.1)	100	1//20	
Reverse diode dv/dt d			dv/dt	50	V/ns
Soldering recommendations (peak temperature) ^c	For	10 s		260	°C

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature

b. V_{DD} = 120 V, starting T_J = 25 °C, L = 28.2 mH, R_g = 25 Ω , I_{AS} = 5 A

c. 1.6 mm from case

d. $I_{SD} \leq I_D$, di/dt = 240 A/µs, starting T_J = 25 °C

1



COMPLIANT

HALOGEN

FREE



THERMAL RESISTANCE RAT	INGS							
PARAMETER	SYMBOL	TYP.		MAX.			UNIT	
Maximum junction-to-ambient	R _{thJA}	-		40			°C / M	
Maximum junction-to-case (drain)	R _{thJC}	-		0.45			°C/W	
SPECIFICATIONS (T _J = 25 $^{\circ}$ C, t	unless otherwi	se noted)						
PARAMETER	SYMBOL	TES	T CONDIT	IONS	MIN.	TYP.	MAX.	UNIT
Static								
Drain-source breakdown voltage	V _{DS}	V _{GS} =	= 0 V, I _D = 2	250 µA	600	-	-	V
V _{DS} temperature coefficient	$\Delta V_{DS}/T_{J}$	Referenc	e to 25 °C,	$I_D = 1 \text{ mA}$	-	0.61	-	V/°C
Gate-source threshold voltage (N)	V _{GS(th)}	V _{DS} =	· V _{GS} , I _D = 2	250 µA	3.0	-	5.0	V
	1	$V_{GS} = \pm 20 V$		-	-	± 100	nA	
Gate-source leakage	I _{GSS}	, v	V _{GS} = ± 30	V	-	-	± 1	μA
Zous anto usltana dusia sumant	1	V _{DS} =	480 V, V _G	_S = 0 V	-	-	1	μA
Zero gate voltage drain current	IDSS	V _{DS} = 480 V	, V _{GS} = 0 V	′, T _J = 125 °C	-	-	2	mA
Drain-source on-state resistance	R _{DS(on)}	V _{GS} = 10 V	١	₀ = 23 A	-	0.045	0.052	Ω
Forward transconductance a	9 _{fs}	V _{DS}	= 30 V, I _D =	= 23 A	-	11	-	S
Dynamic					•		•	
Input capacitance	C _{iss}		V _{GS} = 0 V		-	3380	-	
Output capacitance	C _{oss}	V _{DS} = 100 V,		-	158	-	1	
Reverse transfer capacitance	C _{rss}		f = 1 MHz	:	-	6	-	
Effective output capacitance, energy related ^a	C _{o(er)}	N 01	(1. 400.)/	N 0.V	-	116	-	pF
Effective output capacitance, time related ^b	C _{o(tr)}	$V_{\rm DS} = 0$	/ to 480 V,	V _{GS} = 0 V	-	715	-	
Total gate charge	Qg				-	67	101	
Gate-source charge	Q _{gs}	V _{GS} = 10 V	I _D = 23	A, V _{DS} = 480 V	-	24	-	nC
Gate-drain charge	Q _{gd}				-	22	-	
Turn-on delay time	t _{d(on)}				-	31	62	
Rise time	t _r	- VDD =	480 V, I _D	= 23 A.	-	80	160	
Turn-off delay time	t _{d(off)}		= 10 V, R _g =		-	68	136	ns
Fall time	t _f				-	50	100	
Gate input resistance	R _g	f = 1	MHz, oper	n drain	0.4	0.8	1.6	Ω
Drain-Source Body Diode Characterist								
Continuous source-drain diode current	۱ _S	MOSFET sym showing the	bol		-	-	48	_
Pulsed diode forward current	I _{SM}	integral revers p - n junction			-	-	148	A
Diode forward voltage	V _{SD}	T _J = 25 °C	C, I _S = 23 A	, V _{GS} = 0 V	-	-	1.2	V
Reverse recovery time	t _{rr}				- 1	148	296	ns
Reverse recovery charge	Q _{rr}		$5 ^{\circ}\text{C}, I_{\text{F}} = I_{\text{S}}$		-	1.1	1.2	μC
Reverse recovery current	I _{RRM}	ai/at = 1	00 A/µs, V	_R = 400 v	-	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)

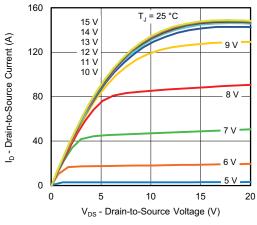


Fig. 1 - Typical Output Characteristics

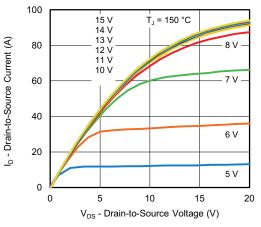


Fig. 2 - Typical Output Characteristics

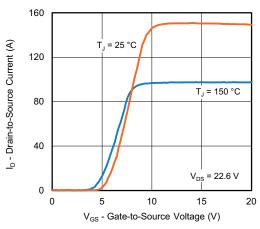


Fig. 3 - Typical Transfer Characteristics

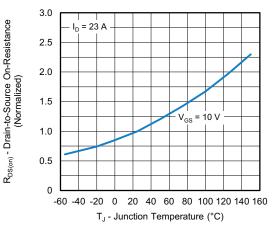


Fig. 4 - Normalized On-Resistance vs. Temperature

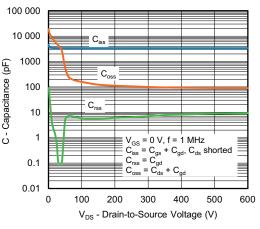
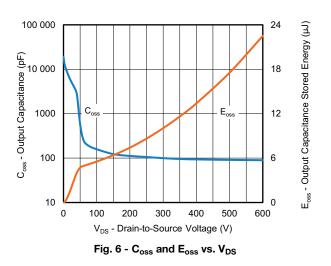


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage



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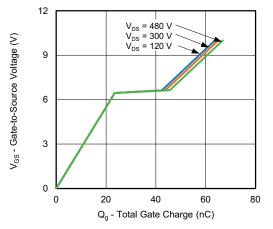


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

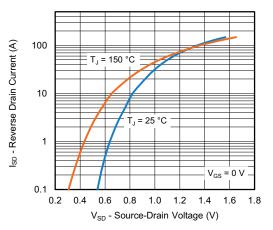


Fig. 8 - Typical Source-Drain Diode Forward Voltage

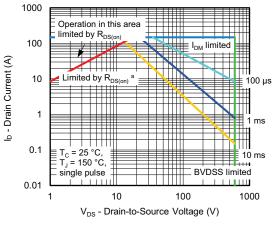


Fig. 9 - Maximum Safe Operating Area

Note

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

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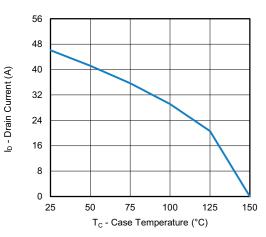


Fig. 10 - Maximum Drain Current vs. Case Temperature

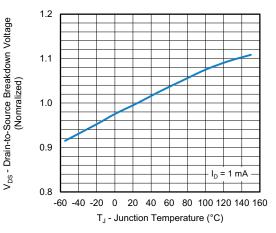
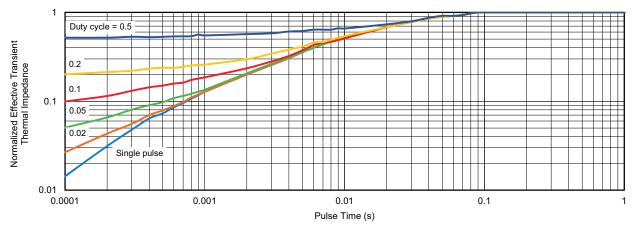


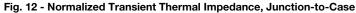
Fig. 11 - Temperature vs. Drain-to-Source Voltage



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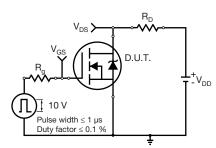


Fig. 13 - Switching Time Test Circuit

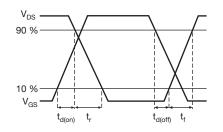


Fig. 14 - Switching Time Waveforms

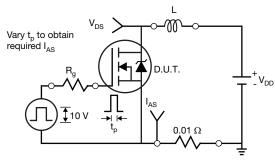


Fig. 15 - Unclamped Inductive Test Circuit

DS V_{DD} V_{DS} I_{AS}

Fig. 16 - Unclamped Inductive Waveforms

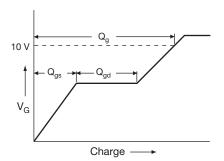


Fig. 17 - Basic Gate Charge Waveform

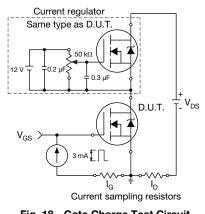


Fig. 18 - Gate Charge Test Circuit

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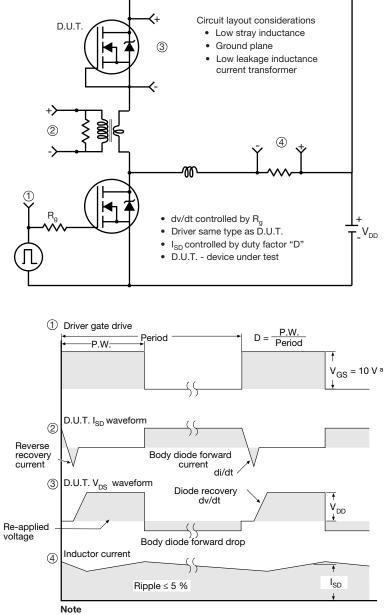
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Peak Diode Recovery dv/dt Test Circuit



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

Fig. 19 - For N-Channel

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TO-247AC (High Voltage)

VERSION 1: FACILITY CODE = 9





Section C--C, D--D, E--E

	MILLIN	IETERS	
DIM.	MIN.	MAX.	NOTES
А	4.83	5.21	
A1	2.29	2.55	
A2	1.50	2.49	
b	1.12	1.33	
b1	1.12	1.28	
b2	1.91	2.39	6
b3	1.91	2.34	
b4	2.87	3.22	6, 8
b5	2.87	3.18	
С	0.55	0.69	6
c1	0.55	0.65	
D	20.40	20.70	4

	MILLIN	IETERS	
DIM.	MIN.	MAX.	NOTES
D1	16.25	16.85	5
D2	0.56	0.76	
E	15.50	15.87	4
E1	13.46	14.16	5
E2	4.52	5.49	3
е	5.44	BSC	
L	14.90	15.40	
L1	3.96	4.16	6
ØP	3.56	3.65	7
Ø P1	7.19) ref.	
Q	5.31	5.69	
S	5.54	5.74	

Notes

- ⁽¹⁾ Package reference: JEDEC[®] TO247, variation AC
- (2) All dimensions are in mm
- ⁽³⁾ Slot required, notch may be rounded
- ⁽⁴⁾ Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm per side. These dimensions are measured at the outermost extremes of the plastic body
- ⁽⁵⁾ Thermal pad contour optional with dimensions D1 and E1
- (6) Lead finish uncontrolled in L1
- (7) Ø P to have a maximum draft angle of 1.5° to the top of the part with a maximum hole diameter of 3.91 mm
- (8) Dimension b2 and b4 does not include dambar protrusion. Allowable dambar protrusion shall be 0.1 mm total in excess of b2 and b4 dimension at maximum material condition

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VERSION 2: FACILITY CODE = Y



	MILLIN	IETERS	
DIM.	MIN.	MAX.	NOTES
A	4.58	5.31	
A1	2.21	2.59	
A2	1.17	2.49	
b	0.99	1.40	
b1	0.99	1.35	
b2	1.53	2.39	
b3	1.65	2.37	
b4	2.42	3.43	
b5	2.59	3.38	
с	0.38	0.86	
c1	0.38	0.76	
D	19.71	20.82	
D1	13.08	-	

	MILLIN	IETERS	
DIM.	MIN.	MAX.	NOTES
D2	0.51	1.30	
E	15.29	15.87	
E1	13.72	-	
е	5.46	BSC	
Øk	0.2	254	
L	14.20	16.25	
L1	3.71	4.29	
ØΡ	3.51	3.66	
Ø P1	-	7.39	
Q	5.31	5.69	
R	4.52	5.49	
S	5.51	BSC	

Notes

- ⁽¹⁾ Dimensioning and tolerancing per ASME Y14.5M-1994
- ⁽²⁾ Contour of slot optional
- (3) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- ⁽⁴⁾ Thermal pad contour optional with dimensions D1 and E1
- ⁽⁵⁾ Lead finish uncontrolled in L1
- ⁽⁶⁾ Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- ⁽⁷⁾ Outline conforms to JEDEC outline TO-247 with exception of dimension c



VERSION 3: FACILITY CODE = N



MILLIME	IETERS		MILLIMETERS		
DIM.	MIN.	MAX.	DIM.	MIN.	MAX.
А	4.65	5.31	D2	0.51	1.35
A1	2.21	2.59	E	15.29	15.87
A2	1.17	1.37	E1	13.46	-
b	0.99	1.40	е	5.46	BSC
b1	0.99	1.35	k	0.:	254
b2	1.65	2.39	L	14.20	16.10
b3	1.65	2.34	L1	3.71	4.29
b4	2.59	3.43	N	7.62	BSC
b5	2.59	3.38	Р	3.56	3.66
С	0.38	0.89	P1	-	7.39
c1	0.38	0.84	Q	5.31	5.69
D	19.71	20.70	R	4.52	5.49
D1	13.08	-	S	5.51	BSC

Notes

⁽¹⁾ Dimensioning and tolerancing per ASME Y14.5M-1994

⁽²⁾ Contour of slot optional

(3) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body

⁽⁴⁾ Thermal pad contour optional with dimensions D1 and E1

⁽⁵⁾ Lead finish uncontrolled in L1

⁽⁶⁾ Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")



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