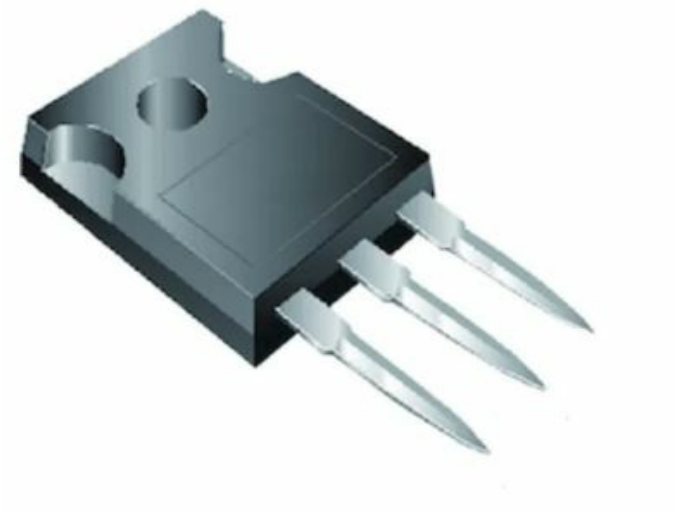
VISHAY EF Series Power MOSFET With Fast Body Diode Owner's Manual

Contents

VISHAY EF Series Power MOSFET With Fast Body Diode



Specifications

- **Product Name:** SiHB055N60EF
- **Brand:** Vishay Siliconix
- **Series:** EF Series Power MOSFET With Fast Body Diode
- **Package:** D2PAK (TO-263)
- **Channel Type:** N-Channel MOSFET
- **Drain-Source Voltage (VDS):** 650 VGS = 10 V
- **Single Pulse Avalanche Energy:** 95 mJ
- **Maximum Power Dissipation:** 29 W
- **Operating Junction and Storage Temperature Range:** -55°C to +150°C
- **Soldering Recommendations (Peak Temperature)**: 260°C for 10 seconds

Applications

The SiHB055N60EF MOSFET is suitable for various applications, including but not limited to:

- Power supplies
- Motor drives
- Inverters
- Switching regulators
- Industrial equipment

Ordering Information

To order the SiHB055N60EF, use the following part number:

- **Package:** D2PAK (TO-263)
- **Part Number:** SIHB055N60EF-GE3

Product Usage Instructions

Thermal Resistance Ratings

- **Maximum Junction-to-Ambient:** 62°C/W
- **Maximum Junction-to-Case (Drain):** 0.45°C/W

Static Parameters

- **Drain-Source Breakdown Voltage (VDS):** 600 V
- **Gate-Source Threshold Voltage (N) (VGS(th)):** 3 V
- Gate-Source Leakage (IGSS): –
- Zero Gate Voltage Drain Current (IDSS): –
- Drain-Source On-State Resistance (RDS(on)): –

Dynamic Parameters

- **Input Capacitance (Ciss):** 680 pF
- **Output Capacitance (Coss):** 63 pF
- **Reverse Transfer Capacitance (Crss):** 29 pF
- **Effective Output Capacitance, Energy-Related (Co(er)):** 15 pF
- **Effective Output Capacitance, Time Related (Co(tr)):** 39 pF
- **Total Gate Charge (Qg):** 89 nC
- **Gate-Source Charge (Qgs):** 56 nC
- **Gate-Drain Charge (Qgd):** 7 nC
- **Turn-On Delay Time (td(on)):** 0.8 ns
- **Rise Time (tr):** 13 ns
- **Turn-Off Delay Time (td(off)):** 1.1 ns
- **Fall Time (tf):** 46 ns
- **Gate Input Resistance (Rg):** 123 Ω

Drain-Source Body Diode Characteristics

- **Continuous Source-Drain Diode Current (IS):** 95 A
- **Pulsed Diode Forward Current (ISM):** 78 A
- **Diode Forward Voltage (VSD):** 1.2 V
- **Reverse Recovery Time (trr):** 312 ns
- **Reverse Recovery Charge (Qrr):** 2.2 µC
- **Reverse Recovery Current (IRRM):** –

PRODUCT SUMMARY		
V_{DS} (V) at T_J max.	650	
$R_{DS(on)}$ typ. (W) at 25 °C	V_{GS} = 10 V	0.048
Q_g max. (nC)	95	
Q_{gs} (nC)	29	
Q_{gd} (nC)	15	
Configuration	Single	

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
  - Motor drives
  - Battery chargers
  - Solar (PV inverters)

ORDERING INFORMATION	
Package	D2PAK (TO-263)
Lead (Pb)-free and halogen-free	SIHB055N60EF-GE3

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)					
PARAMETER			**SYMBOL**	**LIMIT**	**UNIT**
Drain-source voltage			VDS	600	V
Gate-source voltage			VGS	± 30	
Continuous drain current (T_J = 150 °C)	V_{GS} at 10 V	T_C = 25 °C	I_D	46	A
		T_C = 100 °C		29	
Pulsed drain current a			IDM	123	
Linear derating factor				2.2	W/°C
Single pulse avalanche energy b			EAS	286	mJ
Maximum power dissipation			P_D	278	W
Operating junction and storage temperature range			TJ, Tstg	-55 to +150	°C
Drain-source voltage slope	T_J = 125 °C		dV/dt	100	V/ns
Reverse diode dV/dt d				150	
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 TJ = 25 °C, L = 28.2 mH, Rg = 25 Ω, IAS = 4.5 A
- **c.** 1.6 mm from case
- **d**. ISD ≤ ID, dI/dt = 390 A/μs, starting TJ = 25 °C

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum junction-to-ambient	RthJA	–	62	°C/W
Maximum junction-to-case (drain)	RthJC	–	0.45	

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static						
Drain-source breakdown voltage	VDS	V_{GS} = 0 V, I_D = 250 μA	600	–	–	V
V_{DS} temperature coefficient	DV_{DS}/T_J	Reference to 25 °C, I_D = 30 mA	–	0.55	–	V/°C

Gate-source threshold voltage (N)	VGS(th)	V_{DS} = V_{GS}, I_D = 250 µA	3	–	5	V
Gate-source leakage	IGSS	V_{GS} = ± 20 V	–	–	± 10 0	nA
		V_{GS} = ± 30 V	–	–	± 1	µA
Zero gate voltage drain current	IDSS	V_{DS} = 480 V, V_{GS} = 0 V	–	–	1	µA
		V_{DS} = 480 V, V_{GS} = 0 V, T_J = 125 °C	–	–	2	mA
Drain-source on-state resistance	RDS(on)	V_{GS} = 10 V, I_D = 26.5 A	–	0.04 8	0.05 5	W
Forward transconductance	gfs	V_{DS} = 10 V, I_D = 26.5 A	–	23	–	S
Dynamic						
Input capacitance	Ciss	V_{GS} = 0 V, V_{DS} = 100 V, f = 1 MHz	–	3707	–	pF
Output capacitance	Coss		–	145	–	
Reverse transfer capacitance	Crss		–	5	–	
Effective output capacitance, energy related a	Co(er)	V_{DS} = 0 V to 480 V, V_{GS} = 0 V	–	110	–	
Effective output capacitance, tim e related b	Co(tr)		–	680	–	
Total gate charge	Q_g	V_{GS} = 10 V, I_D = 26.5 A, V_{DS} = 4 80 V	–	63	95	nC
Gate-source charge	Qgs		–	29	–	
Gate-drain charge	Qgd		–	15	–	
Turn-on delay time	td(on)	V_{DD} = 480 V, I_D = 26.5 A, V_{GS} = 10 V, R_g = 9.1 W	–	39	78	ns
Rise time	t_r		–	89	134	
Turn-off delay time	td(off)		–	56	84	
Fall time	t_f		–	7	14	
Gate input resistance	R_g	f = 1 MHz, open drain	0.4	0.8	1.6	W
Drain-Source Body Diode Characteristics						
Continuous source-drain diode c urrent	I_S	MOSFET symbol showing the integral reverse p – n junction diode	–	–	46	A
Pulsed diode forward current	ISM		–	–	123	
Diode forward voltage	VSD	T_J = 25 °C, I_S = 26.5 A, V_{GS} = 0 V	–	–	1.2	V

Reverse recovery time	trr	T_J = 25 °C, $I_F = I_S$ = 26.5 A, di/dt = 100 A/µs, V_R = 400 V	–	156	312	ns
Reverse recovery charge	Qrr		–	1.1	2.2	µC
Reverse recovery current	IRRM		–	13	–	A

TYPICAL CHARACTERISTICS

(25 °C, unless otherwise noted)

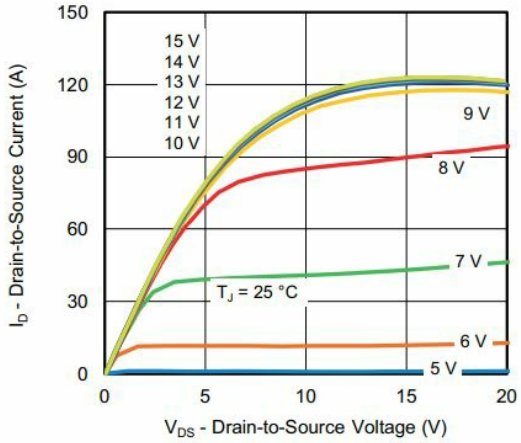


Fig. 1 - Typical Output Characteristics

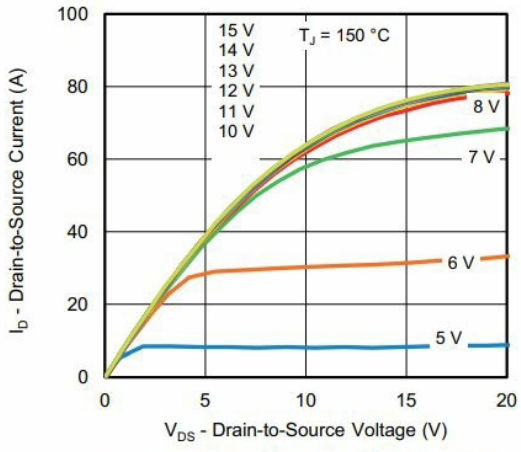


Fig. 2 - Typical Output Characteristics

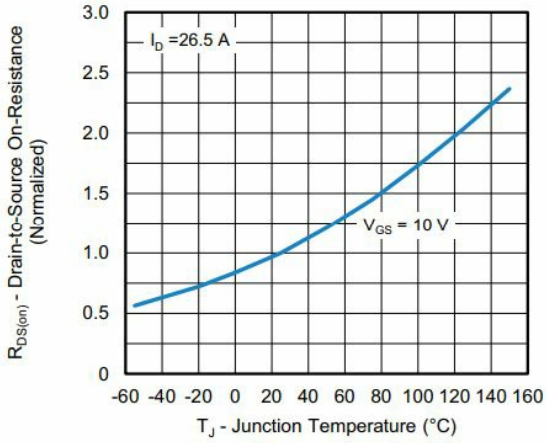


Fig. 4 - Normalized On-Resistance vs. Temperature

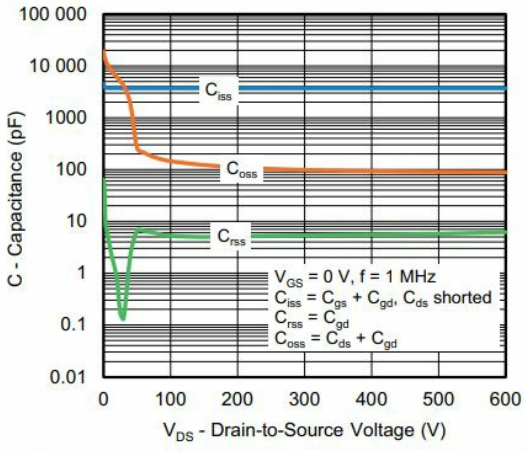
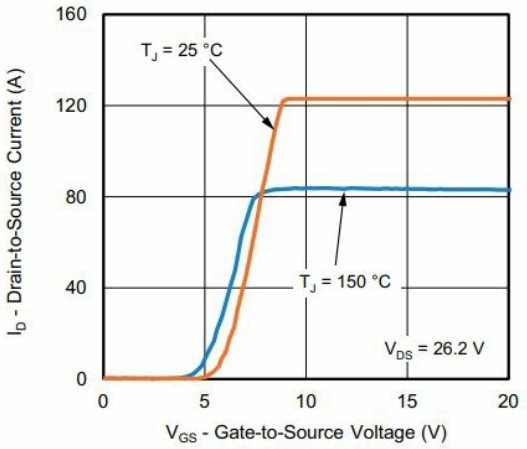


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage



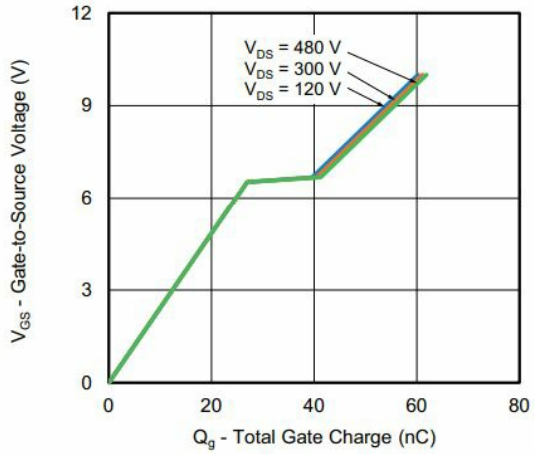
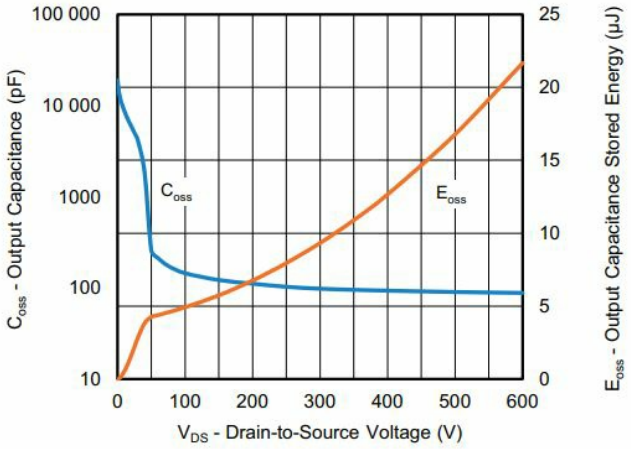


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage



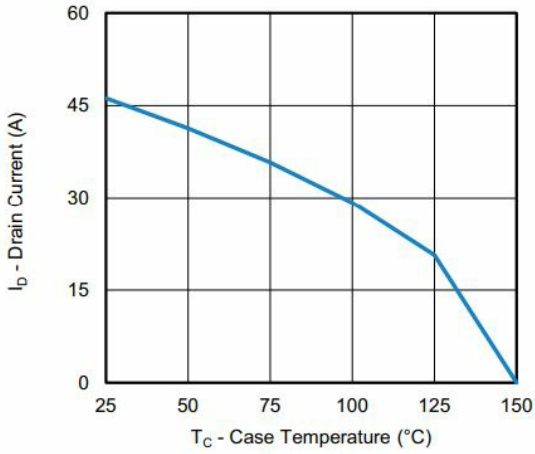


Fig. 10 - Maximum Drain Current vs. Case Temperature

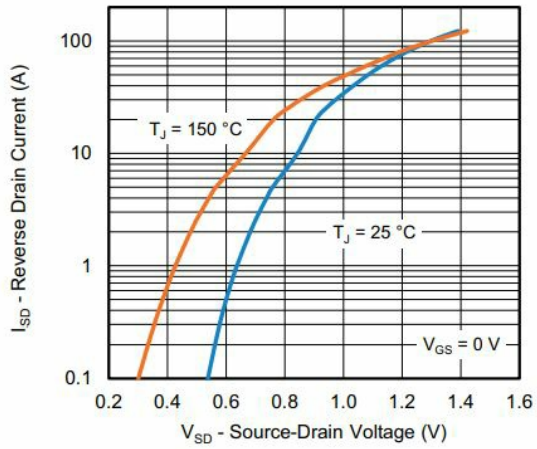


Fig. 8 - Typical Source-Drain Diode Forward Voltage

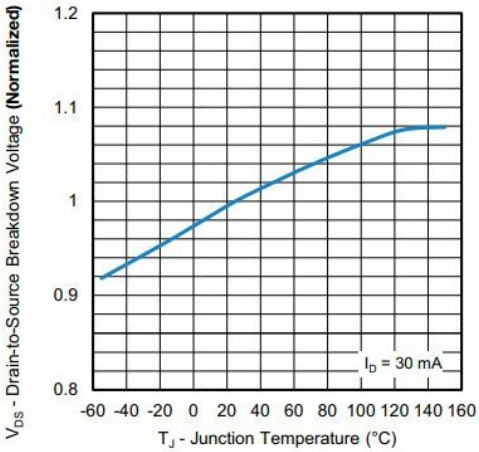


Fig. 11 - Temperature vs. Drain-to-Source Voltage

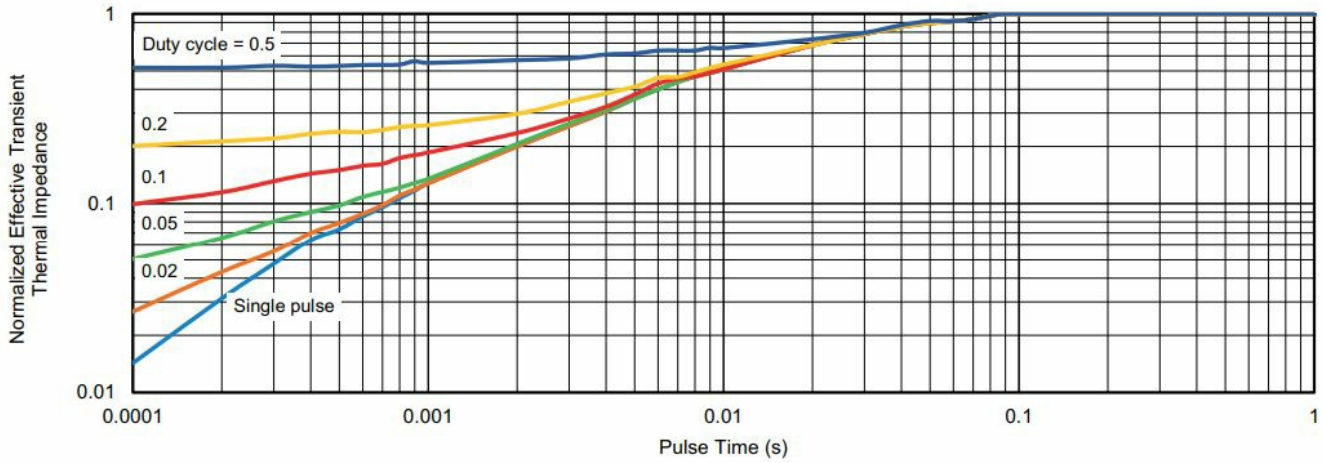


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

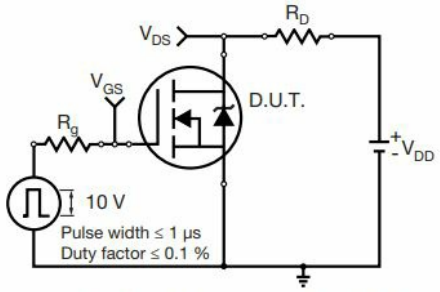


Fig. 13 - Switching Time Test Circuit

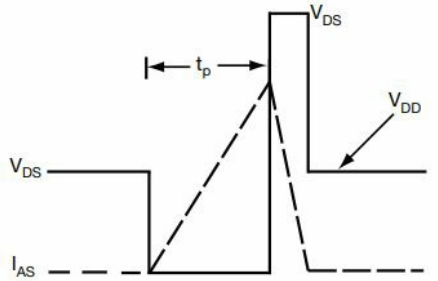


Fig. 16 - Unclamped Inductive Waveforms

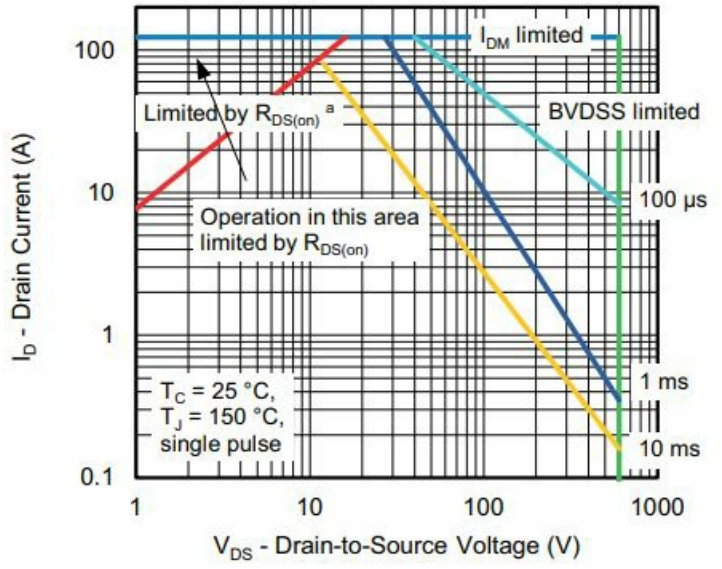


Fig. 13 - Switching Time Test Circuit

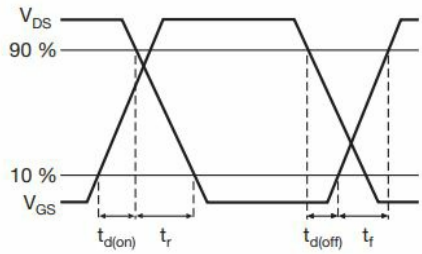


Fig. 14 - Switching Time Waveforms

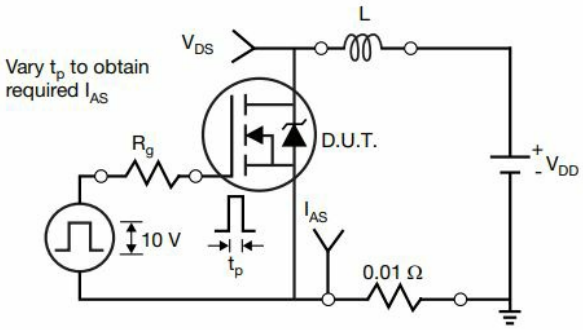


Fig. 15 - Unclamped Inductive Test Circuit

Fig. 16 - Unclamped Inductive Waveforms

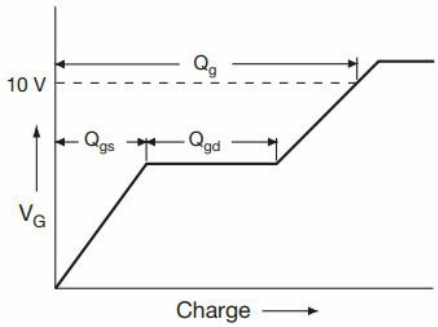


Fig. 17 - Basic Gate Charge Waveform

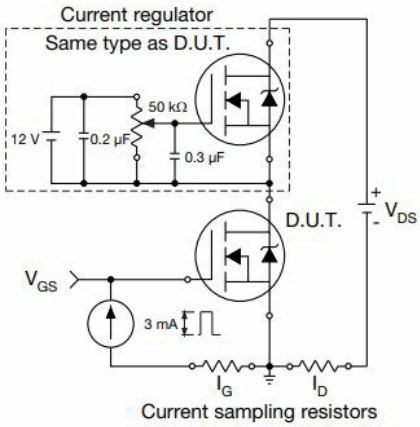
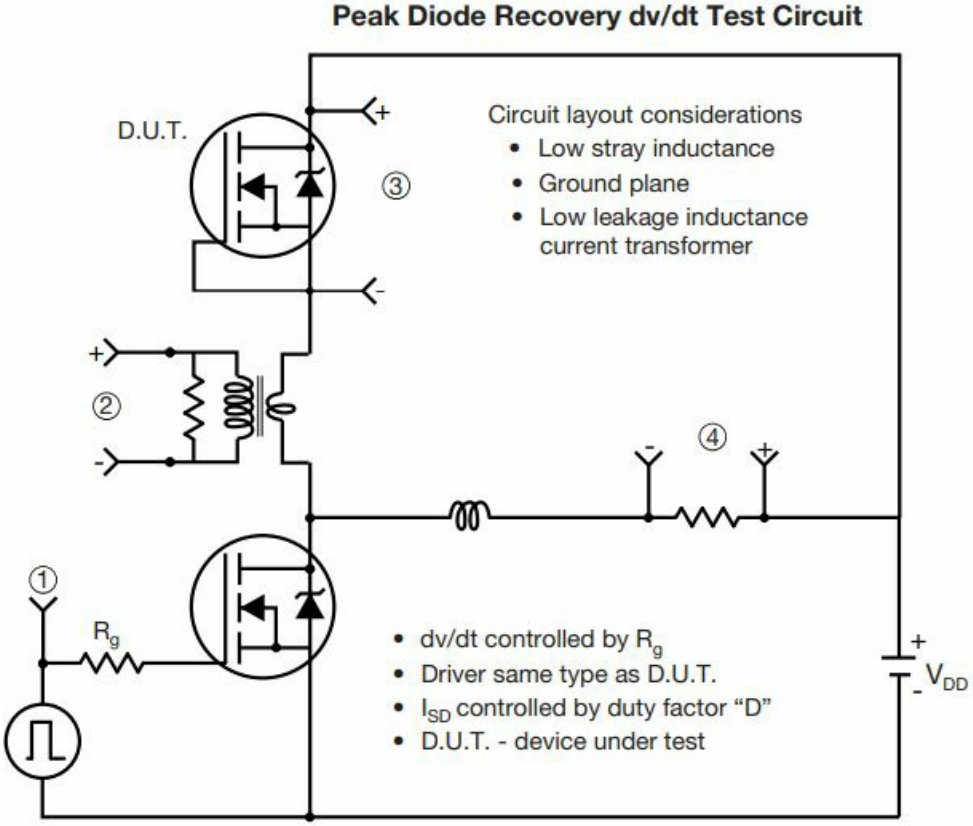


Fig. 18 - Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



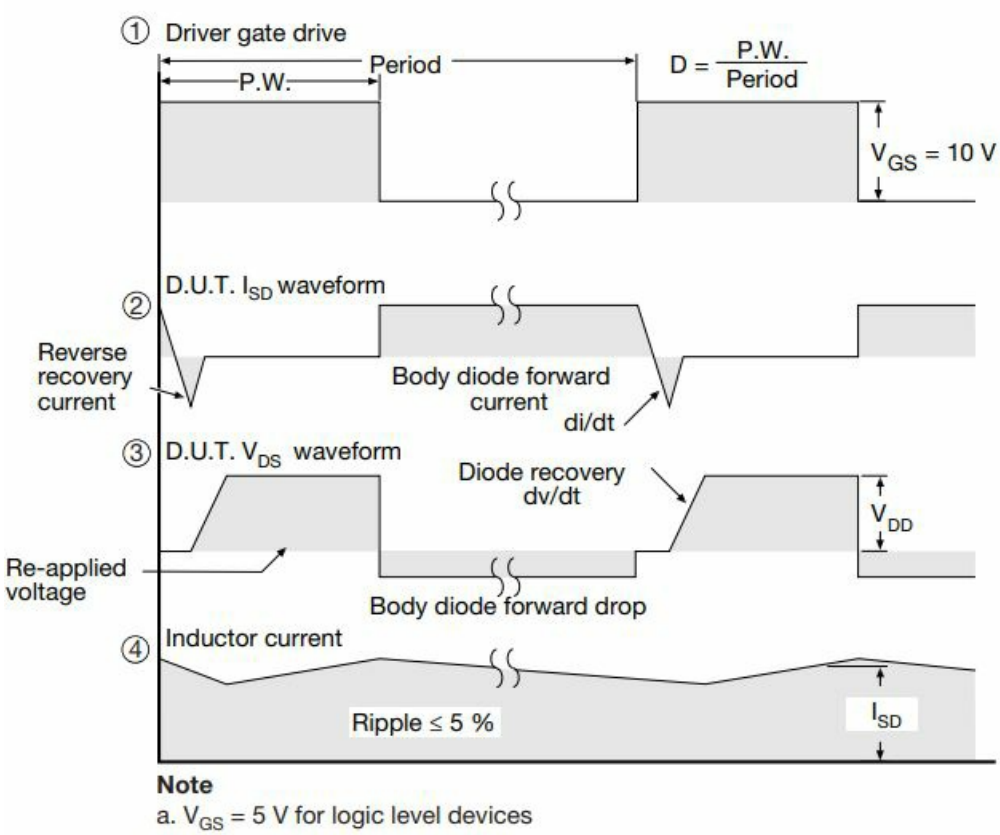


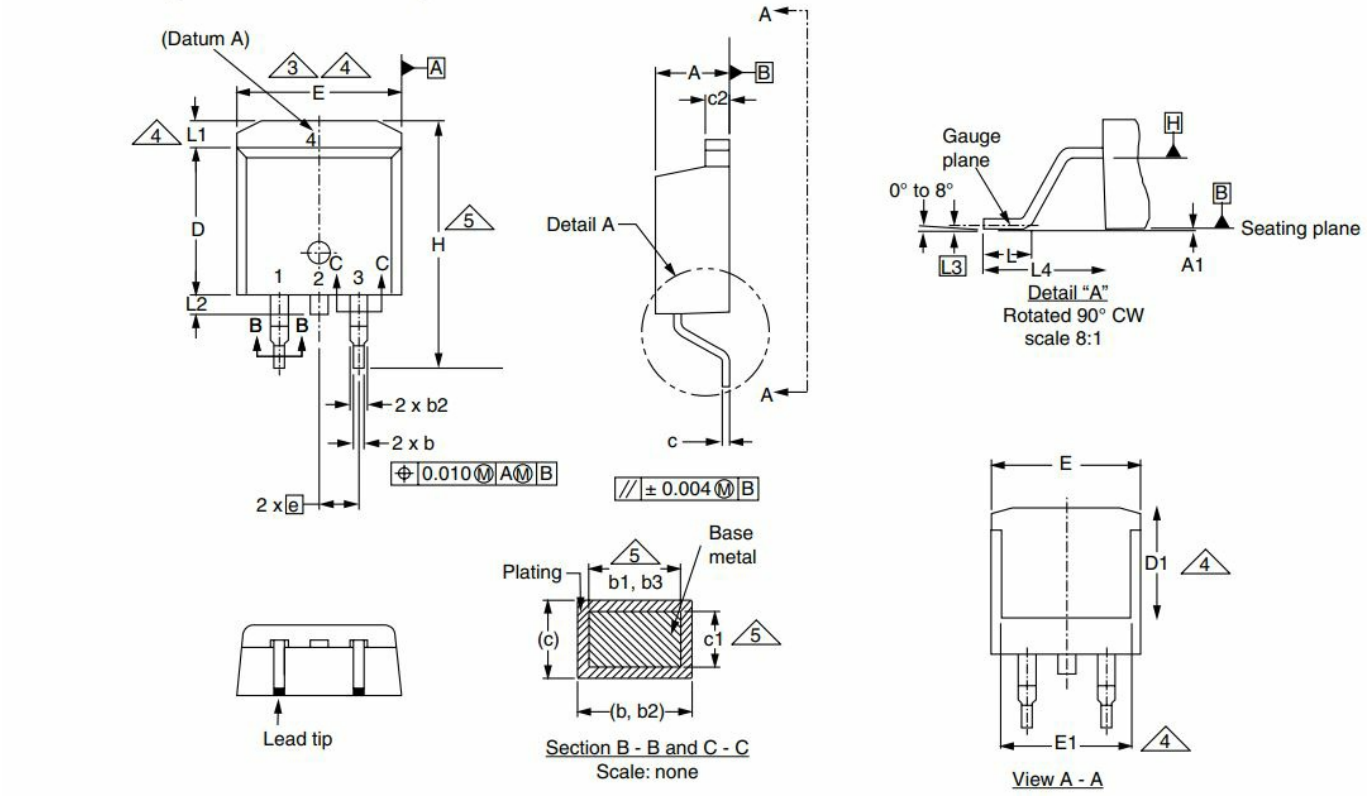
Fig. 19 - For N-Channel

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?92420.

Package Information

TO-263AB (HIGH VOLTAGE)

TO-263AB (HIGH VOLTAGE)



	MILLIMETERS		INCHES	
DIM.	**MIN.**	**MAX.**	**MIN.**	**MAX.**
A	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
b1	0.51	0.89	0.020	0.035
b2	1.14	1.78	0.045	0.070
b3	1.14	1.73	0.045	0.068
c	0.38	0.74	0.015	0.029
c1	0.38	0.58	0.015	0.023
c2	1.14	1.65	0.045	0.065
D	8.38	9.65	0.330	0.380

	MILLIMETERS		INCHES	
DIM.	**MIN.**	**MAX.**	**MIN.**	**MAX.**
D1	6.86	–	0.270	–
E	9.65	10.67	0.380	0.420
E1	6.22	–	0.245	–
e	2.54 BSC		0.100 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	–	1.65	–	0.066
L2	–	1.78	–	0.070
L3	0.25 BSC		0.010 BSC	
L4	4.78	5.28	0.188	0.208

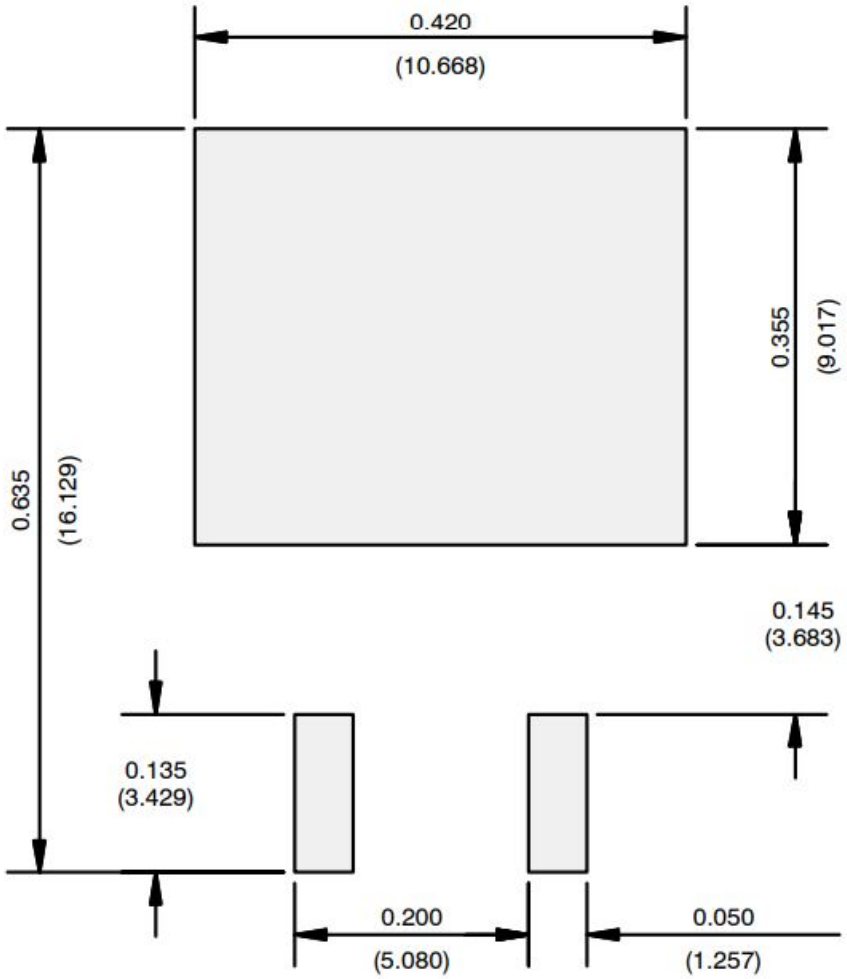
ECN: S-82110-Rev. A, 15-Sep-08 DWG: 5970

Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimetres (inches).
3. Dimensions D and E do not include mould flash. Mould flash shall not exceed 0.127 mm (0.005″) per side. These dimensions are measured at the utmost extremes of the plastic body at datum A.
4. Thermal PAD contour is optional within dimensions E, L1, D1 and E1.

5. Dimensions b1 and c1 apply to base metal only.
6. Datum A and B to be determined at datum plane H.
7. Outline conforms to JEDEC outline to TO-263AB.

RECOMMENDED MINIMUM PADS FOR D2PAK: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

Recommended Minimum Pads Dimensions in Inches/(mm)

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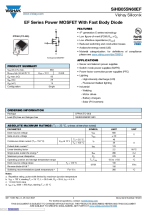
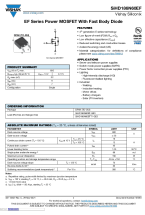
FAQ

Frequently Asked Questions

- What is the maximum junction-to-ambient thermal resistance?
- The maximum junction-to-ambient thermal resistance is 62°C/W.
- What is the drain-source breakdown voltage?
- The drain-source breakdown voltage is 600 V.
- What is the gate-source threshold voltage?
- The gate-source threshold voltage is 3 V.
- What is the maximum continuous source-drain diode current?
- The maximum continuous source-drain diode current is 95 A.
- For technical questions, contact: **hvm@vishay.com**

Documents / Resources

	VISHAY EF Series Power MOSFET With Fast Body Diode [pdf] Owner's Manual SIHB055N60EF, EF Series Power MOSFET With Fast Body Diode, EF Series, Power MOSFET With Fast Body Diode, MOSFET With Fast Body Diode, Fast Body Diode, Body Diode, Diode
	VISHAY EF Series Power MOSFET With Fast Body Diode [pdf] Owner's Manual SiHD186N60EF-GE3, SiHD186N60EFT1-GE3, EF Series Power MOSFET With Fast Body Diode, EF Series, Power MOSFET With Fast Body Diode, MOSFET With Fast Body Diode, Fast Body Diode, Body Diode, Diode

References

- applications.no
- vishay.com/doc?91000
- SiHD186N60EF MOSFETs | Vishay
- SiHB055N60EF MOSFETs | Vishay
- User Manual