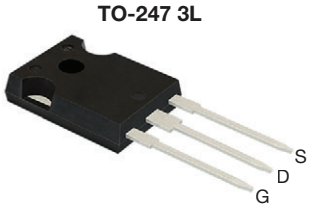
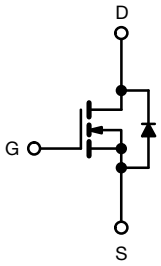
MaxSiC™ 1200 V N-Channel SiC MOSFET





N-Channel MOSFET

Marking Code: 120A080FW

FEATURES

- Fast switching speed
- Short circuit withstand time 3 µs
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- Charger
- Auxiliary motor drive
- DC/DC converter

PRODUCT SUMMARY		
V_{DS} (V) at T_J max.	1200	
$R_{DS(on)}$ typ. (mΩ) at 25 °C	V_{GS} = 20 V	80
Q_g typ. (nC)	47.3	
I_D (A)	29	
C_{oss} typ. (pF)	50	
P_D (W)	139	
Configuration	Single	

ORDERING INFORMATION	
Package	TO-247 3L
Lead (Pb)-free and halogen-free	MXP120A080FW-GE3

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

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage [a]		V_{DS}	1200	V
Gate-source voltage		V_{GS}	-10 / +22	
Recommended operation voltage of gate-source		V_{GSOP}	-5 / +20	
Continuous drain current	T_C = 25 °C	I_D	29	A
	T_C = 100 °C	I_D	18	
Pulsed drain current [b]		I_{DM}	58	
Short-circuit withstand time [c]		T_{SC}	3	µs
Maximum power dissipation	T_C = 25 °C	P_D	139	W
	T_C = 100 °C	P_D	56	
Operating junction and storage temperature range		T_J, T_{stg}	-55 to +150	°C
Soldering recommendations (peak temperature)	For 10 s		260	°C

Notes

a. T_J = 25 °C to 150 °C
b. Repetitive rating; pulse width limited by maximum junction temperature
c. Verified by the design / characterization

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum junction-to-ambient	R_{thJA}	-	40	°C/W
Maximum junction-to-case (drain)	R_{thJC}	-	0.9	

SPECIFICATIONS (T_J = 25 °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 = 1 mA	1200	-	-	V
Gate-source threshold voltage (N)	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 5 mA	-	2.69	-	V
		V_{DS} = V_{GS}, I_D = 5 mA, T_J = 150 °C	-	1.86	-	V
Gate-source leakage	I_{GSS}	V_{GS} = +22 V, V_{DS} = 0 V	-	-	100	nA
		V_{GS} = -10 V, V_{DS} = 0 V	-	-	-100	
Zero gate voltage drain current	I_{DSS}	V_{DS} = 960 V, V_{GS} = 0 V	-	-	10	µA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS} = 20 V, I_D = 20 A	-	80	100	mΩ
		V_{GS} = 20 V, I_D = 20 A, T_J = 150 °C	-	128	160	
		V_{GS} = 18 V, I_D = 20 A	-	95	119	
		V_{GS} = 18 V, I_D = 20 A, T_J = 150 °C	-	140	175	
Dynamic						
Input capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 800 V, f = 1 MHz	-	1156	-	pF
Output capacitance	C_{oss}		-	50	-	
Reverse transfer capacitance	C_{rss}		-	5	-	
Coss Stored Energy	E_{oss}		-	20	-	µJ
Total gate charge	Q_g	V_{GS} = 18 V, I_D = 20 A, V_{DS} = 800 V	-	47.3	-	nC
Gate-source charge	Q_{gs}		-	14.2	-	
Gate-drain charge	Q_{gd}		-	17.8	-	
Gate Resistance	R_g	V_{DS} = 0 V, f = 1 MHz	-	9.8	-	Ω
Switching Characteristics						
Turn-on delay time	$t_{d(on)}$	V_{GS} = -5 V ~ 18 V, I_D = 20 A, V_{DS} = 800 V, $R_{g(ext)}$ = 4.4 Ω	-	25.6	-	ns
Rise time	t_r		-	15.6	-	
Turn-off delay time	$t_{d(off)}$		-	16	-	
Fall time	t_f		-	9	-	
Turn-on switching energy	E_{on}		-	386	-	µJ
Turn-off switching energy	E_{off}		-	37	-	
Body Diode Ratings and Characteristic						
Forward diode voltage	V_{SD}	V_{GS} = -5 V, I_{SD} = 10 A, T_J = 25 °C	-	5.1	-	V
Continuous diode forward current	I_{SD}	V_{GS} = -5 V, T_J = 25 °C	-	-	21	A
Pulsed diode forward current	I_{SDM}		-	-	58	
Reverse recovery time	t_{rr}	V_{GS} = -5 V, I_{SD} = 20 A, V_R = 800 V, di/dt = 1000 A/µs	-	14	-	ns
Reverse recovery charge	Q_{rr}		-	35	-	nC
Reverse recovery current	I_{rrm}		-	4.5	-	A

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

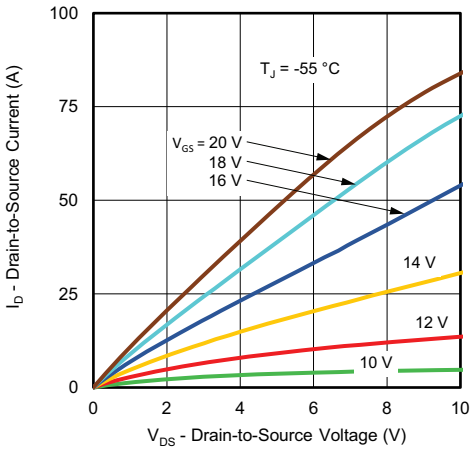


Fig. 1 - Typical Output Characteristics

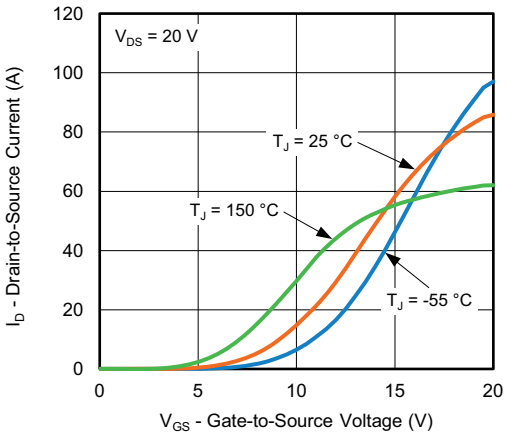


Fig. 4 - Typical Transfer Characteristics

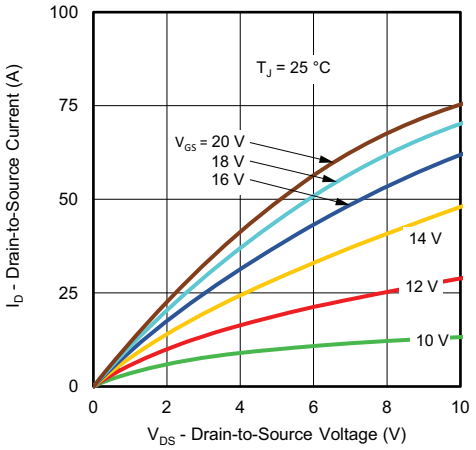


Fig. 2 - Typical Output Characteristics

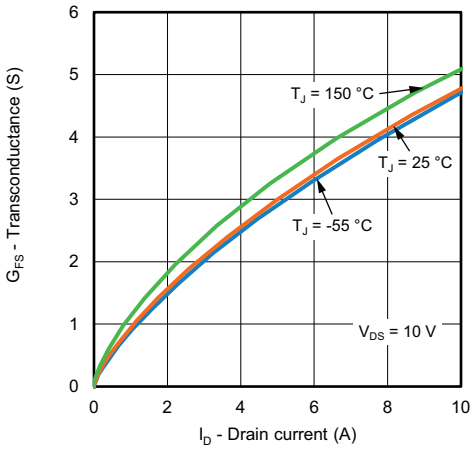


Fig. 5 - Forward Transconductance vs. Drain Current

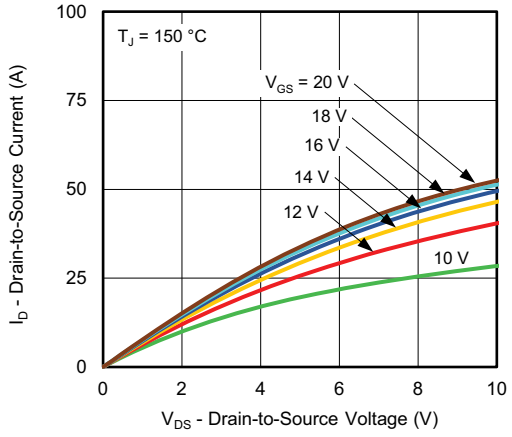


Fig. 3 - Typical Output Characteristics

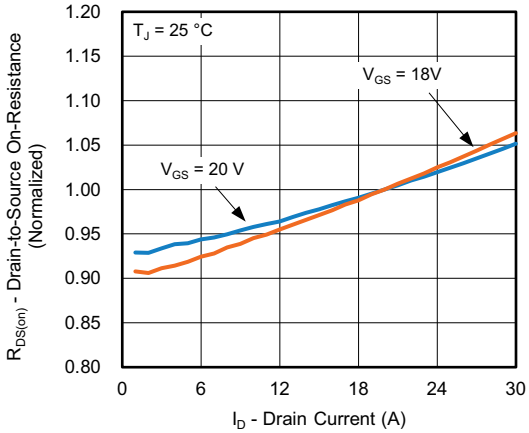


Fig. 6 - Normalized On-Resistance vs. Drain Current

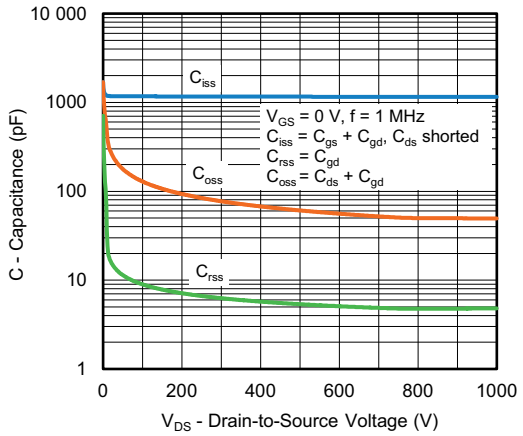


Fig. 7 - Typical Capacitance vs. Drain-to-Source Voltage

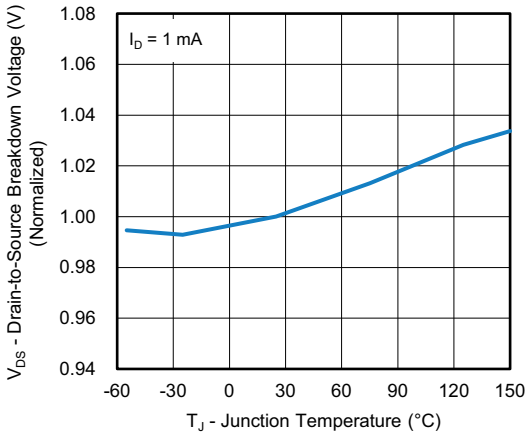


Fig. 10 - Drain-to-Source Voltage vs. Temperature

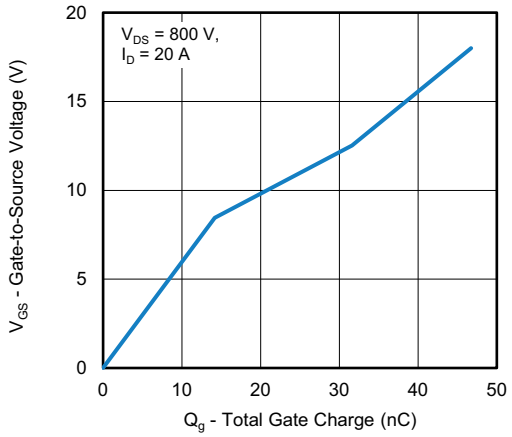


Fig. 8 - Typical Gate Charge vs. Gate-to-Source Voltage

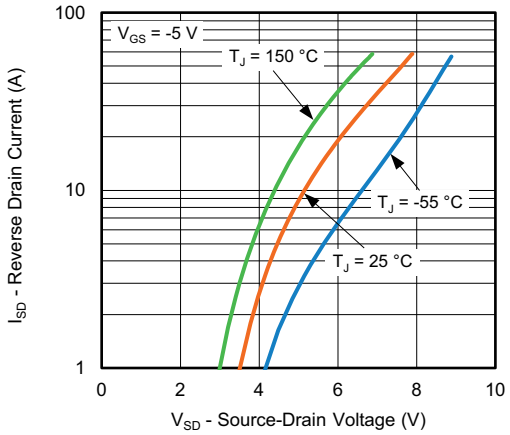


Fig. 11 - Typical Source-Drain Diode Forward Voltage

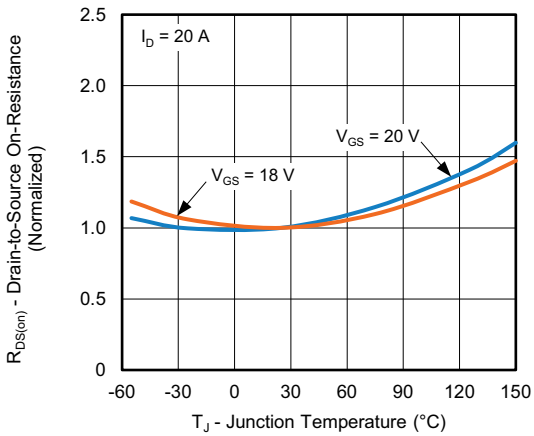


Fig. 9 - Normalized On-Resistance vs. Temperature

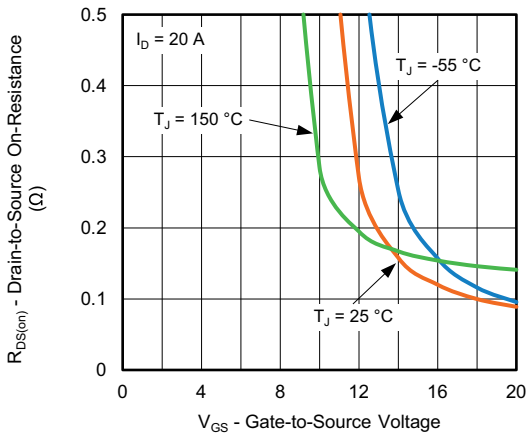


Fig. 12 - On-Resistance vs. Gate-to-Source Voltage

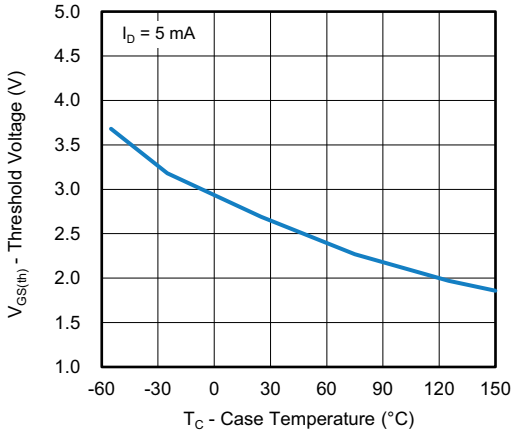


Fig. 13 - Threshold Voltage vs. Case Temperature

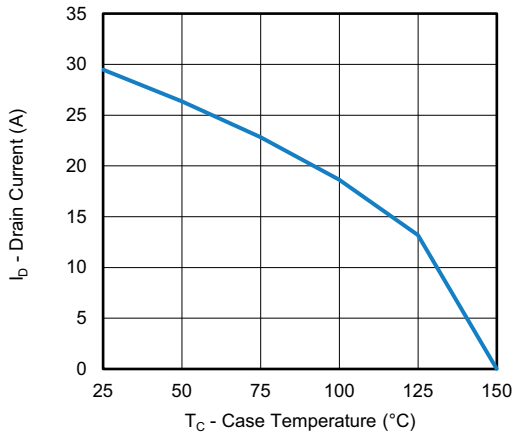


Fig. 14 - Drain Current vs. Case Temperature

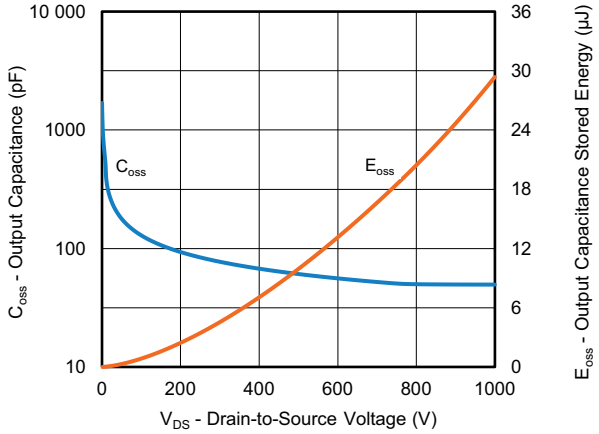


Fig. 15 - Output Capacitances and its Stored Energy vs. Drain-to-Source Voltage

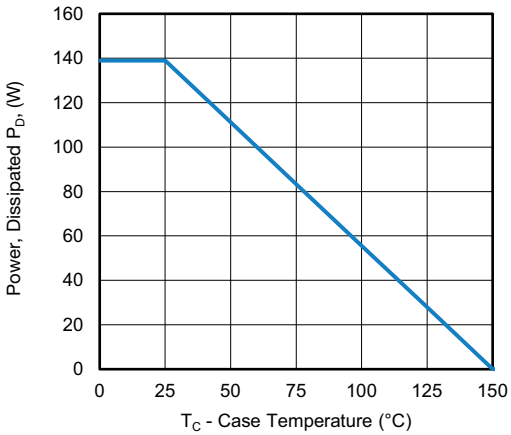


Fig. 16 - Power, Dissipated P_D vs. Case Temperature

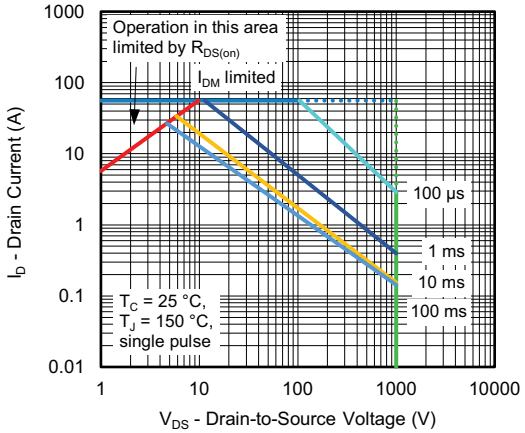


Fig. 17 - Safe Operating Area

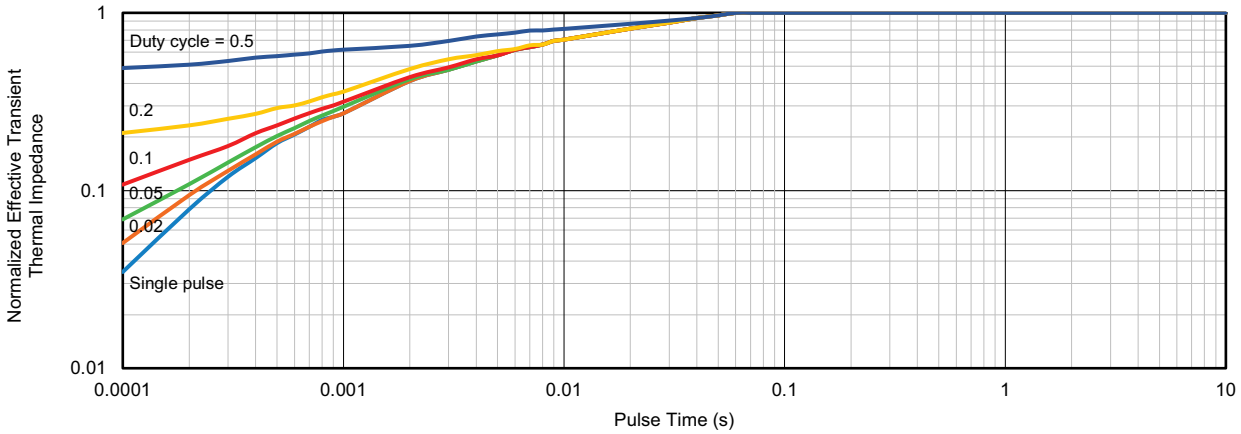


Fig. 18 - Normalized Effective Transient Thermal Impedance

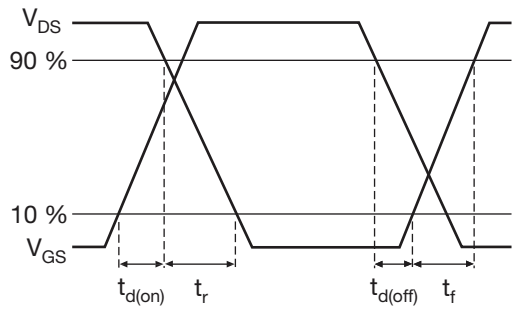


Fig. 19 - Waveforms of Switching Time

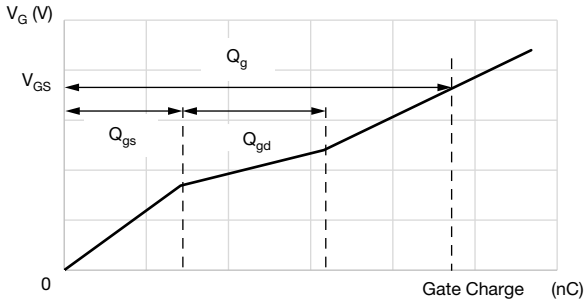


Fig. 22 - Waveforms for Gate Charge

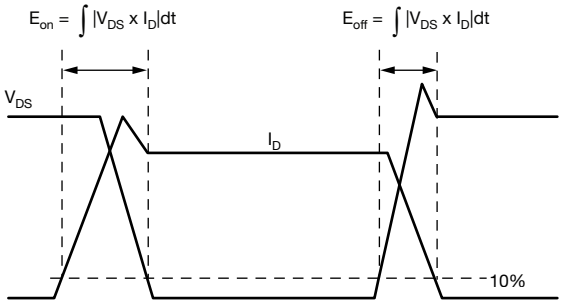


Fig. 20 - Waveforms for Switching Energy

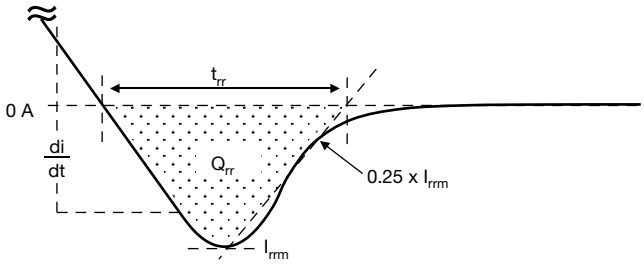


Fig. 23 - Waveforms for Reverse Recovery

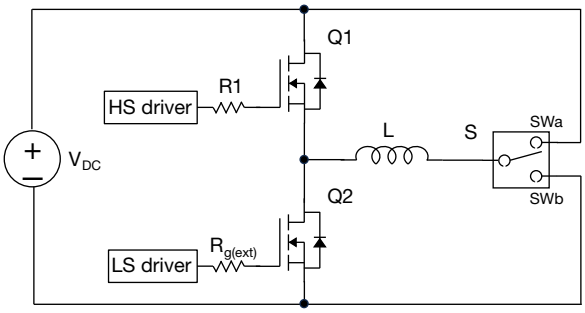
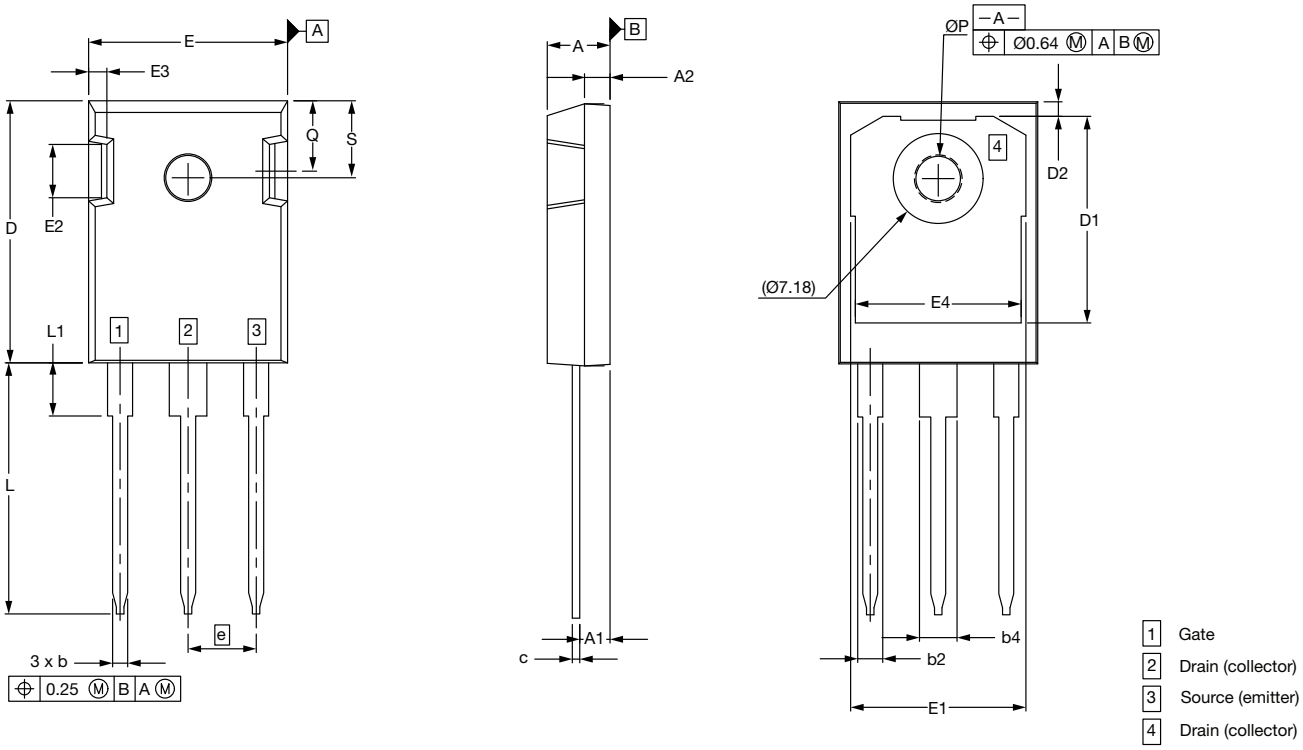


Fig. 21 - Switching and Reverse Diode Characteristics Measurement Circuit

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?92811.

Case Outline for TO-247AD 3L

FACILITY CODE: N

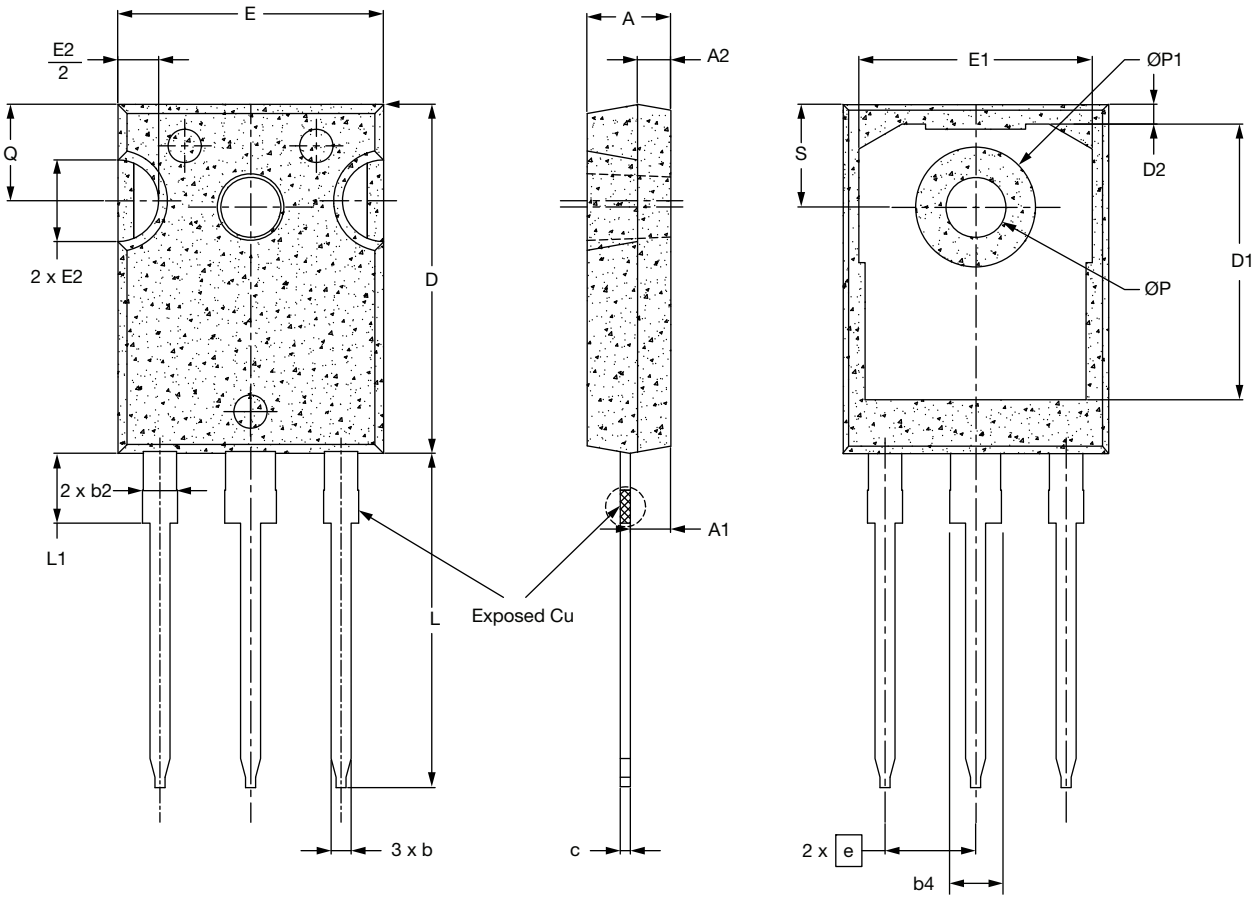


DIM.	MILLIMETERS	
	MIN.	MAX.
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b	1.07	1.33
b2	1.91	2.41
b4	2.87	3.38
c	0.55	0.68
D	20.80	21.10
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	5.44 BSC.	
N	3	
L	19.81	20.32
L1	4.10	4.40
ØP	3.51	3.65
Q	5.49	6.00
S	6.04	6.30

Notes

- All metal surfaces: tin plated (MATTE), except area of cut
- Dimensioning and toleranceing confirm to ASME Y14.5M-1994
- All dimensions are in millimeters
- This drawing will meet all dimensions requirement of JEDEC outlines TO-247 AD
- Dimension b2 and b4 does not include dambar protrusion

FACILITY CODE: 9



DIM.	MILLIMETERS		
	MIN.	NOM.	MAX.
A	4.83	5.02	5.21
A1	2.29	2.41	2.55
A2	1.50	2.00	2.49
b	1.12	1.20	1.33
b2 (1)	1.91	2.00	2.39
b4 (1)	2.87	3.00	3.22
c	0.55	0.60	0.69
D (2)	20.80	20.95	21.10
D1 (3)	16.25	16.55	17.65
D2	0.51	1.19	1.35
E (2)	15.75	15.94	16.13
E1 (3)	13.46	14.02	14.16
E2	4.32	4.91	5.49
e	5.44 BSC.		
L	19.81	20.07	20.32
L1 (4)	4.10	4.19	4.40
ØP (5)	3.56	3.61	3.65
ØP1	7.19 ref.		
Q	5.39	5.79	6.20
S	6.04	6.17	6.30
ECN: E24-0303-Rev. B, 19-Aug-2024 DWG: 6118			

Notes

- Package reference: JEDEC TO-247, variation AD
- All dimensions are in mm
- Slot required, notch may be rounded

(1) Dimension b2 and b4 does not include dambar protrusion

(2) Dimension D and E do not include mold flash

(3) Thermal pad contour optional within dimension D1 and E1

(4) Lead Finish Uncontrolled In L1

(5) ØP to have a draft angle of 1.5 ° ref. to the top of the part with hole diameter of 3.91mm

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.