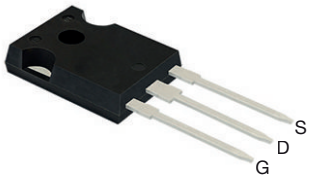
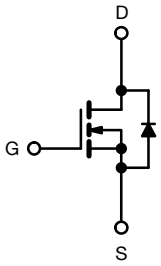
MaxSiC™ 1200 V N-Channel SiC MOSFET

TO-247AD 3L





N-Channel MOSFET

Marking Code: 120A250FW

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
- Industrial UPS
- Boost inverter
- 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	250
Q_g typ. (nC)	20	
I_D (A)	10.5	
C_{oss} (pF)	21.2	
P_D (W)	56	
Configuration	Single	

ORDERING INFORMATION	
Package	TO-247AD 3L
Lead (Pb)-free and halogen-free	MXP120A250FW-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	10.5	A
	T_C = 100 °C	I_D	6.7	
Pulsed drain current [b]		I_{DM}	21	
Short-circuit withstand time [c]		T_{SC}	3	µs
Maximum power dissipation	T_C = 25 °C	P_D	56	W
	T_C = 100 °C	P_D	22	
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

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum junction-to-ambient	R_{thJA}	-	40	°C/W
Maximum junction-to-case (drain)	R_{thJC}	-	2.24	

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 = 10 mA	-	3.1	-	V
		V_{DS} = V_{GS}, I_D = 10 mA, T_J = 150 °C	-	2.3	-	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 = 4 A	-	250	313	mΩ
		V_{GS} = 20 V, I_D = 4 A, T_J = 150 °C	-	383	479	
		V_{GS} = 18 V, I_D = 4 A	-	280	350	
		V_{GS} = 18 V, I_D = 4 A, T_J = 150 °C	-	400	500	
Dynamic						
Input capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 800 V, f = 1 MHz	-	447	-	pF
Output capacitance	C_{oss}		-	21.2	-	
Reverse transfer capacitance	C_{rss}		-	3.2	-	
Cross stored energy	E_{oss}		-	8.7	-	µJ
Total gate charge	Q_g	V_{GS} = 18 V, I_D = 4 A, V_{DS} = 800 V	-	20.3	-	nC
Gate-source charge	Q_{gs}		-	5.5	-	
Gate-drain charge	Q_{gd}		-	7.9	-	
Gate Resistance	R_g	V_{DS} = 0 V, f = 1 MHz	-	34	-	Ω
Switching Characteristics						
Turn-on delay time	$t_{d(on)}$	V_{GS} = -5 V ~ 18 V, I_D = 4 A, V_{DS} = 800 V, $R_{g(ext)}$ = 4.4 Ω	-	10	-	ns
Rise time	t_r		-	11.5	-	
Turn-off delay time	$t_{d(off)}$		-	9.5	-	
Fall time	t_f		-	15	-	
Turn-on switching energy	E_{on}		-	76	-	µJ
Turn-off switching energy	E_{off}		-	5	-	
Body Diode Ratings and Characteristic						
Forward diode voltage	V_{SD}	V_{GS} = -5 V, I_{SD} = 2 A, T_J = 25 °C	-	4.6	-	V
Continuous diode forward current	I_{SD}	V_{GS} = -5 V, T_J = 25 °C	-	-	7	A
Pulsed diode forward current	I_{SDM}		-	-	21	
Reverse recovery time	t_{rr}	V_{GS} = -5 V, I_{SD} = 4 A, V_R = 800 V, di/dt = 1000 A/µs	-	7.5	-	ns
Reverse recovery charge	Q_{rr}		-	12	-	nC
Reverse recovery current	I_{rrm}		-	2.8	-	A

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

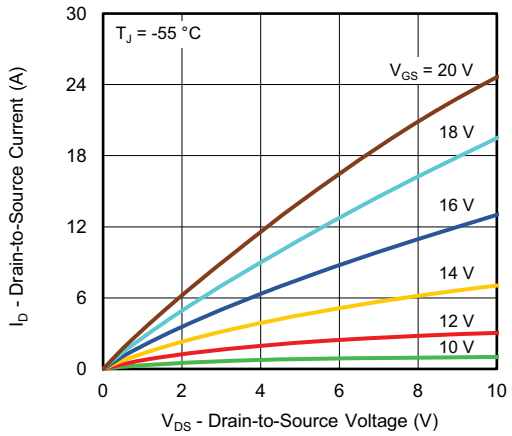


Fig. 1 - Typical Output Characteristics

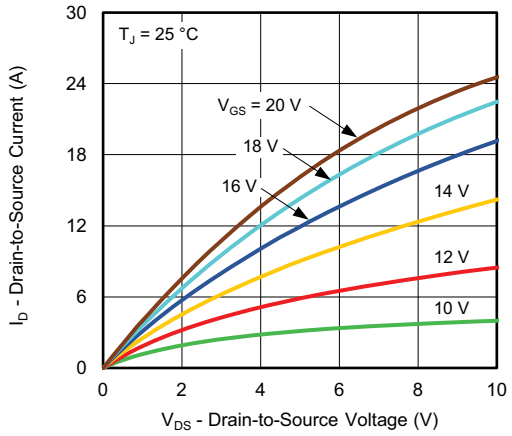


Fig. 2 - Typical Output Characteristics

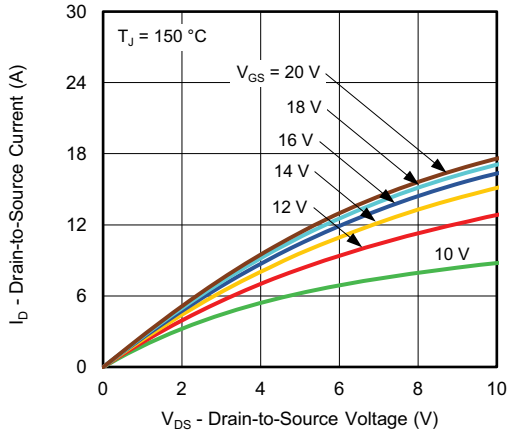


Fig. 3 - Typical Output Characteristics

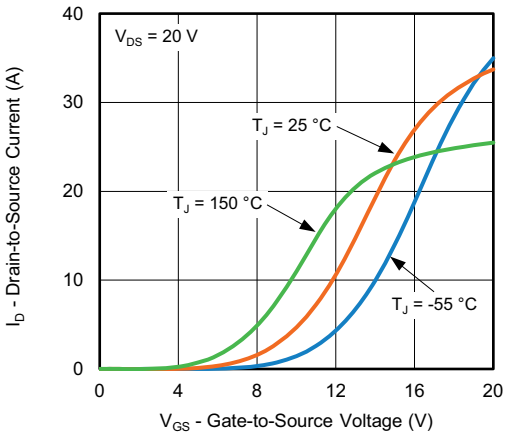


Fig. 4 - Typical Transfer Characteristics

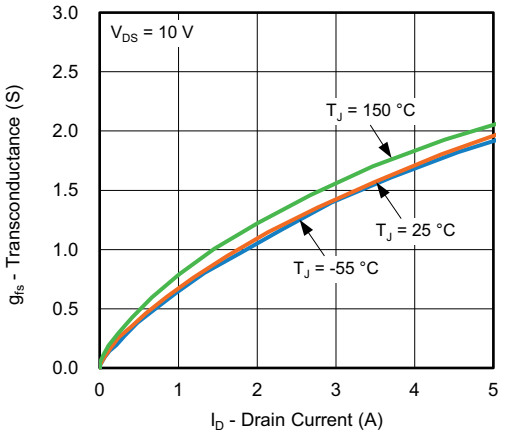


Fig. 5 - Forward Transconductance vs. Drain Current

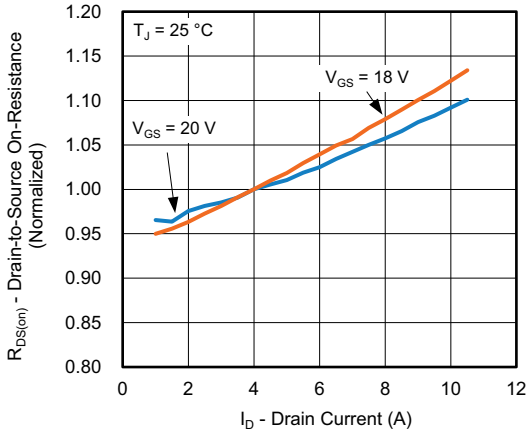


Fig. 6 - Normalized On-Resistance vs. Drain Current

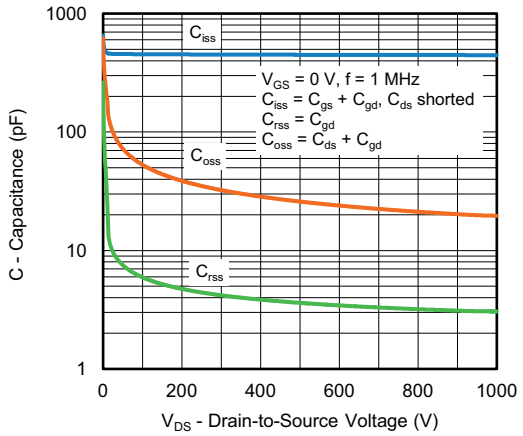


Fig. 7 - Typical Capacitance vs. Drain-to-Source Voltage

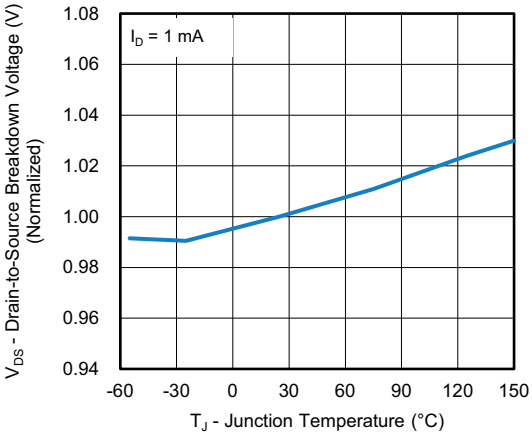


Fig. 10 - Drain-to-Source Voltage vs. Temperature

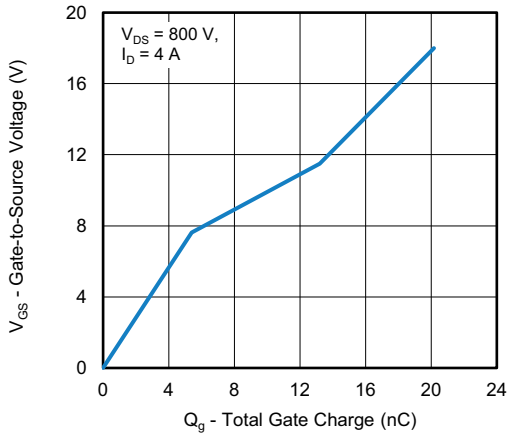


Fig. 8 - Typical Gate Charge vs. Gate-to-Source Voltage

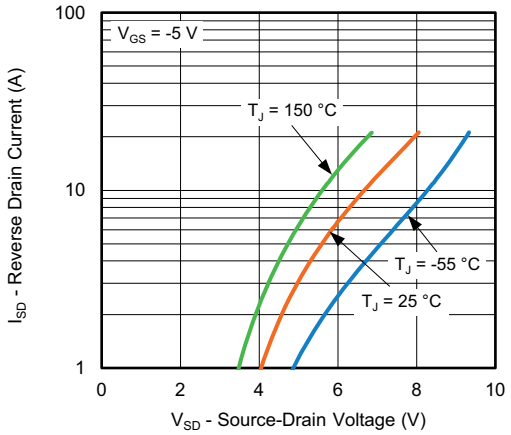


Fig. 11 - Typical Source-Drain Diode Forward Voltage

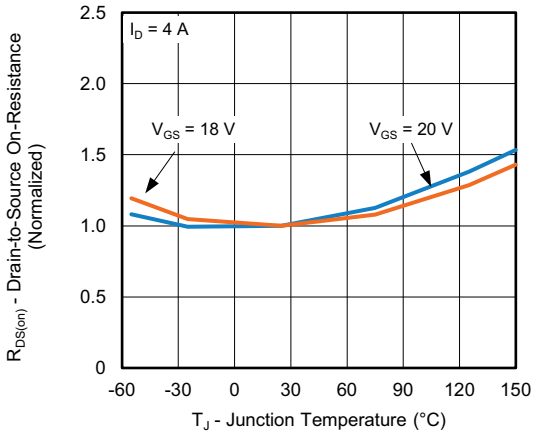


Fig. 9 - Normalized On-Resistance vs. Temperature

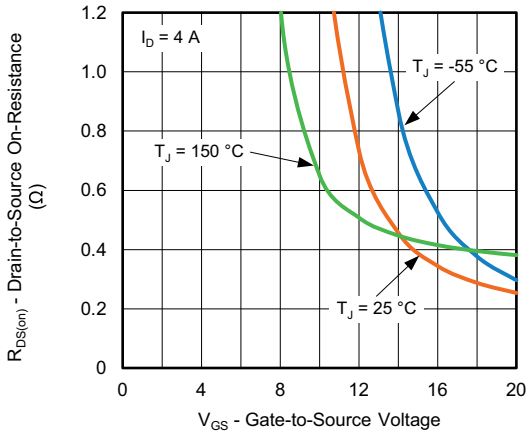


Fig. 12 - On-Resistance vs. Gate-to-Source Voltage

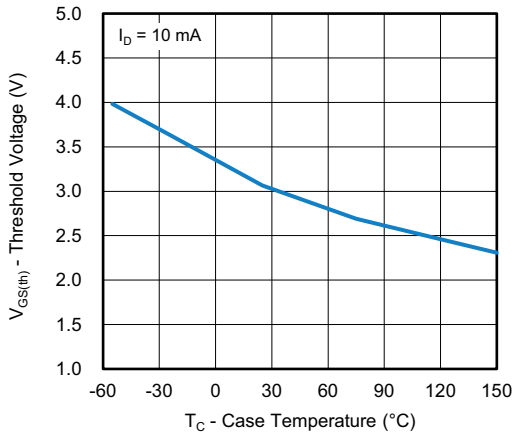


Fig. 13 - Threshold Voltage vs. Case Temperature

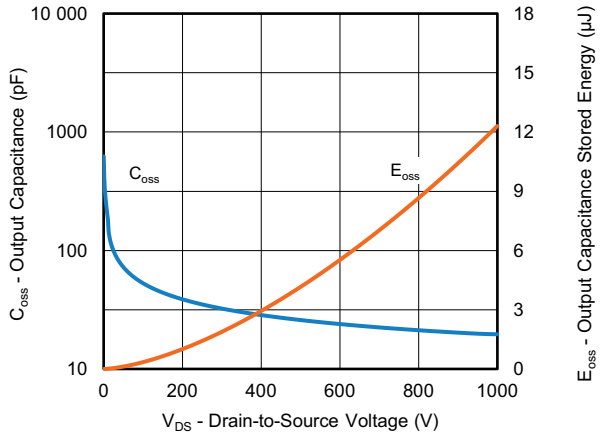


Fig. 15 - Output Capacitance and its Stored Energy vs. Drain-to-Source Voltage

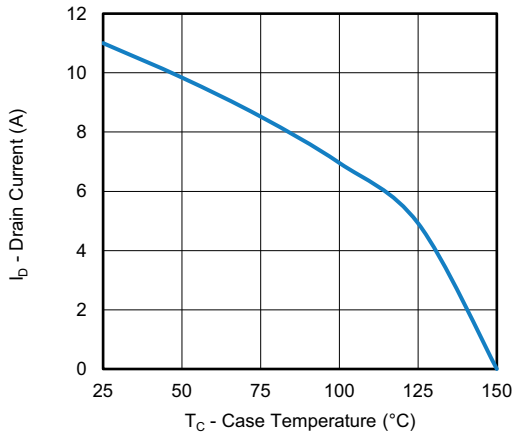


Fig. 14 - Drain Current vs. Case Temperature

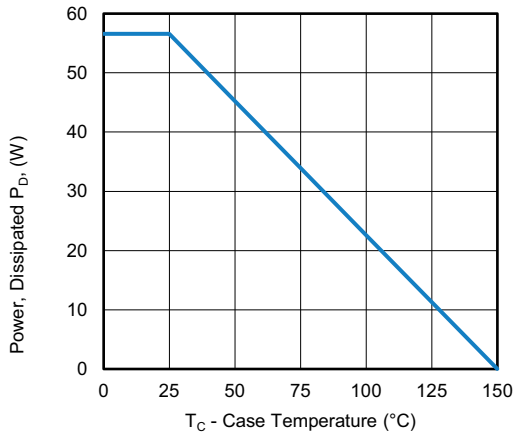


Fig. 16 - Power, Dissipated P_D vs. Case Temperature

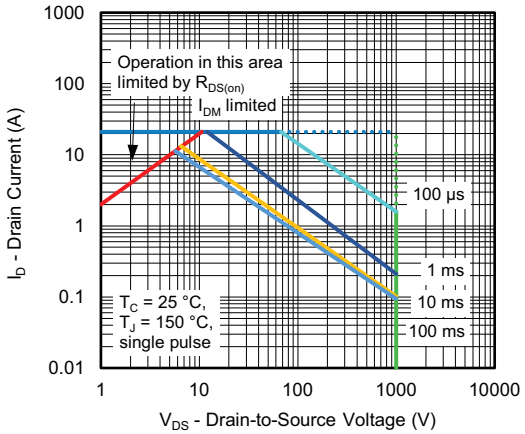


Fig. 17 - Safe Operating Area

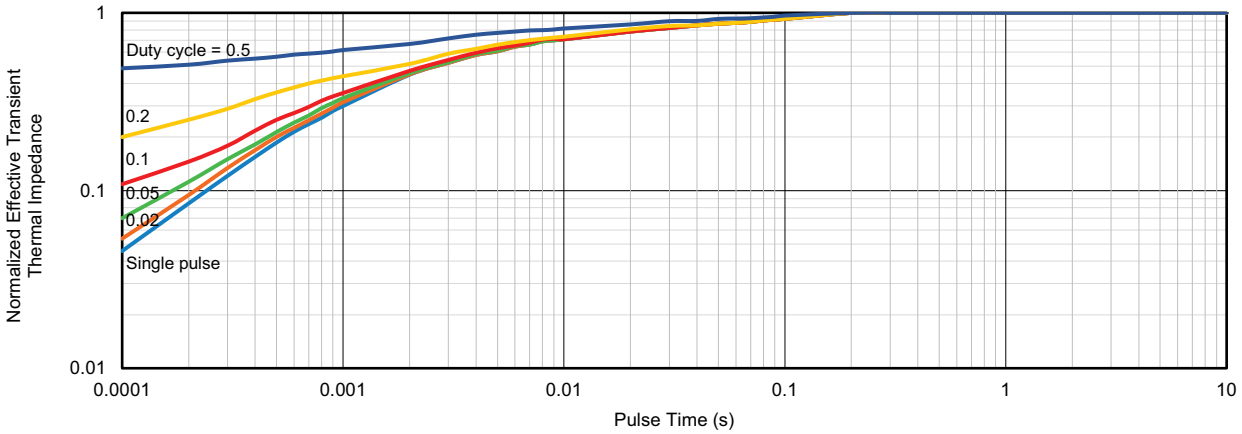


Fig. 18 - Normalized Effective Transient Thermal Impedance

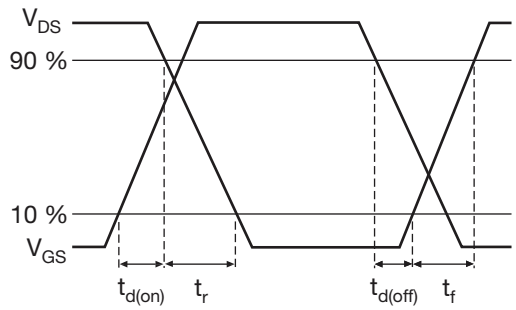


Fig. 19 - Waveforms of Switching Time

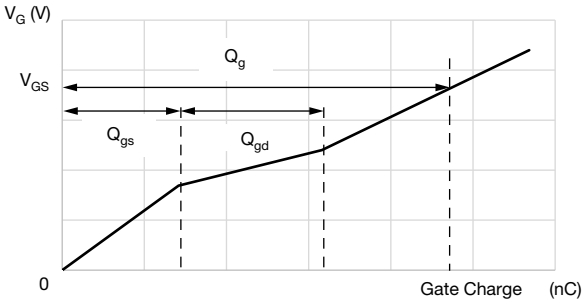


Fig. 22 - Waveforms for Gate Charge

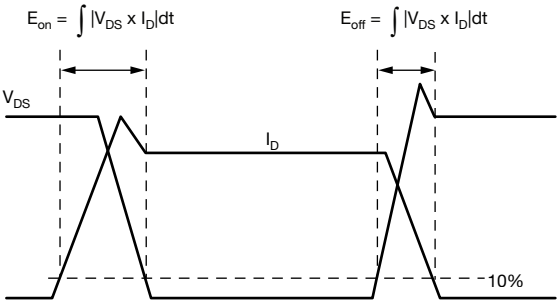


Fig. 20 - Waveforms for Switching Energy

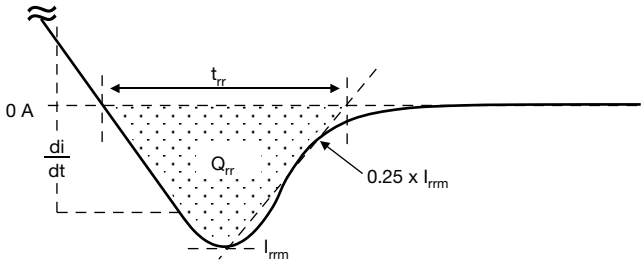


Fig. 23 - Waveforms for Reverse Recovery

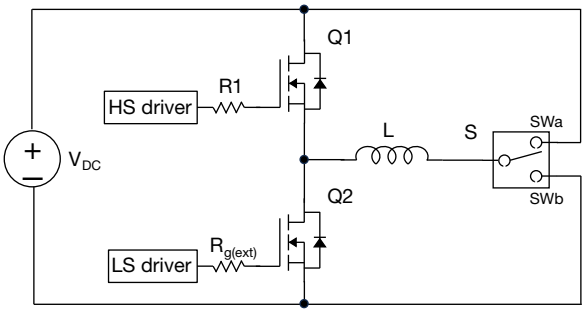


Fig. 21 - Switching and Reverse Diode Characteristics Measurement Circuit

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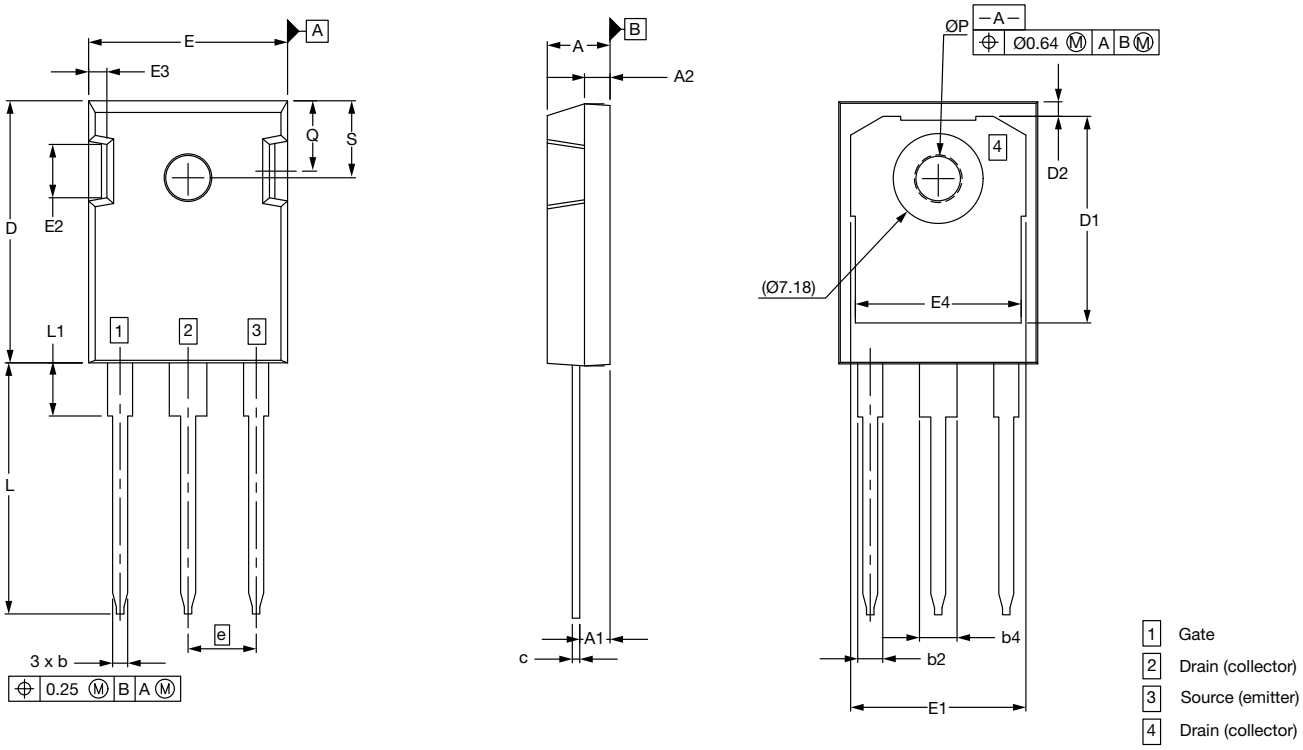
Case Outline for TO-247AD 3L

FACILITY CODE: N

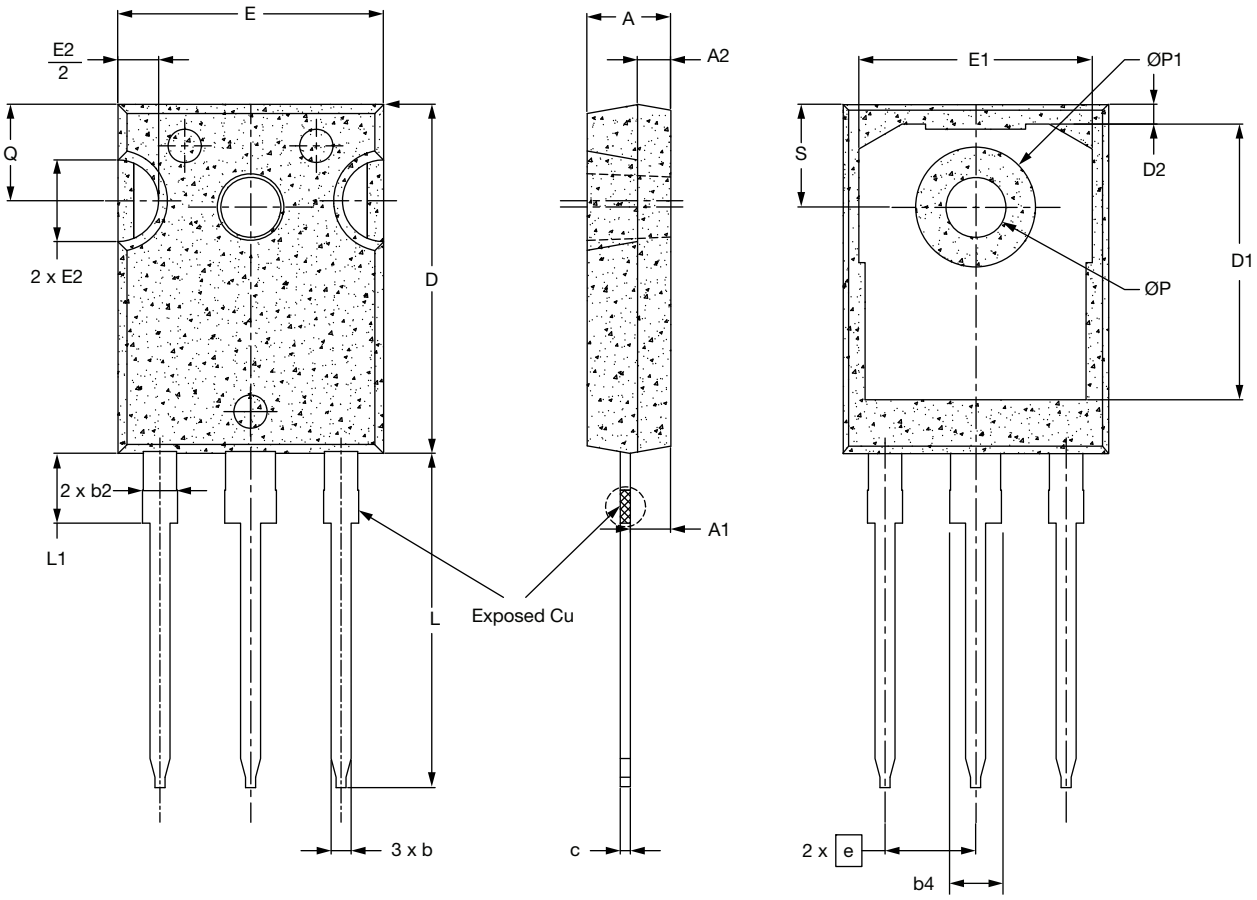


DIM.	MILLIMETERS	
	MIN.	MAX.
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b	1.07	1.33
b2	1.91	2.41
b4	2.87	3.38
c	0.55	0.68
D	20.80	21.10
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	5.44 BSC.	
N	3	
L	19.81	20.32
L1	4.10	4.40
ØP	3.51	3.65
Q	5.49	6.00
S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

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