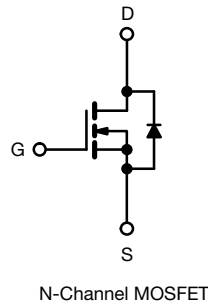


MaxSiC[®] 1200 V N-Channel SiC MOSFET



Marking Code: Q120A045SW

FEATURES

- AEC-Q101 qualified
- Fast switching speed
- Short circuit withstand time 3 μ s
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Automotive on board charger
- Automotive DC/DC converter for EV/HEV
- Auxiliary drives

PRODUCT SUMMARY	
V_{DS} (V) at T_J max.	1200
$R_{DS(on)}$ typ. ($m\Omega$) at 25 °C	$V_{GS} = 18$ V 45
Q_g typ. (nC)	84
I_D (A)	51
C_{oss} typ. (pF)	98
P_D (W)	254
Configuration	Single

ORDERING INFORMATION	
Package	TO-247AD 3L
Lead (Pb)-free and halogen-free	MXPQ120A045SW-GE3

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	V_{DS}	1200	V
Gate-source voltage	V_{GS}	-10 / +22	
Recommended operation voltage of gate-source	V_{GSOP}	-5 to -3 / +18	
Continuous drain current	I_D	51	A
Pulsed drain current ^a			
Short-circuit withstand time ^b	T_{SC}	3	μ s
Maximum power dissipation	P_D	254	W
Operating junction and storage temperature range	T_J, T_{stg}	-55 to +175	°C
Soldering recommendations (peak temperature)	For 10 s	260	°C
Single pulse avalanche energy ^c			

Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{GS} = 18$ V, $V_{DS} = 800$ V, $R_{g(ext)} = 20$ Ω , verified by the design / characterization
- $T_J = 25$ °C, $V_{DD} = 120$ V, $L = 1$ mH, $V_{GS} = 18$ V, $I_{AS} = 20$ A



THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	R_{thJA}	-	40	°C/W
Maximum junction-to-case (drain)	R_{thJC}	-	0.59	

SPECIFICATIONS ($T_J = 25\text{ °C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT	
Static							
Drain-source breakdown voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	1200	-	-	V	
Gate-source threshold voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 5\text{ mA}$	-	2.8	-	V	
		$V_{DS} = V_{GS}, I_D = 5\text{ mA}, T_J = 175\text{ °C}$	-	1.9	-	V	
Gate-source leakage	I_{GSS}	$V_{GS} = 22\text{ V}, V_{DS} = 0\text{ V}$	-	-	100	nA	
		$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$	-	-	-100		
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$	-	-	10	μA	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 15\text{ V}, I_D = 26\text{ A}$	-	60	75	mΩ	
		$V_{GS} = 18\text{ V}, I_D = 26\text{ A}$	-	45	56		
		$V_{GS} = 18\text{ V}, I_D = 26\text{ A}, T_J = 175\text{ °C}$	-	82	-		
Transconductance	g_{fs}	$V_{DS} = 10\text{ V}, I_D = 26\text{ A}$	-	10	-	S	
Dynamic							
Input capacitance	C_{iss}	$V_{GS} = 0\text{ V},$ $V_{DS} = 800\text{ V},$ $f = 100\text{ KHz}$	-	2530	-	pF	
Output capacitance	C_{oss}		-	98	-		
Reverse transfer capacitance	C_{rss}		-	4	-		
C_{oss} stored energy	E_{oss}		-	41	-		μJ
Total gate charge	Q_g	$V_{GS} = -5 \sim 18\text{ V}, I_D = 26\text{ A}, V_{DS} = 800\text{ V}$	-	84	-	nC	
Gate-source charge	Q_{gs}		-	23	-		
Gate-drain charge	Q_{gd}		-	23	-		
Gate Resistance	R_g	$V_{DS} = 0\text{ V}, f = 1\text{ MHz}$	-	2.5	-	Ω	
Switching Characteristics							
Turn-on delay time	$t_{d(on)}$	$V_{GS} = -5 \sim 18\text{ V}, I_D = 26\text{ A},$ $V_{DS} = 800\text{ V}, R_{g(ext)} = 4.4\text{ Ω}$	$T_J = 25\text{ °C}$	-	34	-	ns
			$T_J = 175\text{ °C}$	-	31	-	
Rise time	t_r		$T_J = 25\text{ °C}$	-	16	-	
			$T_J = 175\text{ °C}$	-	13	-	
Turn-off delay time	$t_{d(off)}$		$T_J = 25\text{ °C}$	-	26	-	
			$T_J = 175\text{ °C}$	-	29	-	
Fall time	t_f		$T_J = 25\text{ °C}$	-	10	-	
			$T_J = 175\text{ °C}$	-	10	-	
Turn-on switching energy	E_{on}		$T_J = 25\text{ °C}$	-	522	-	μJ
			$T_J = 175\text{ °C}$	-	469	-	
Turn-off switching energy	E_{off}		$T_J = 25\text{ °C}$	-	70	-	
			$T_J = 175\text{ °C}$	-	72	-	
Body Diode Ratings and Characteristics							
Forward diode voltage	V_{SD}		$V_{GS} = -5\text{ V}, I_{SD} = 13\text{ A}, T_J = 25\text{ °C}$	-	4.9	-	V
Continuous diode forward current	I_{SD}	$V_{GS} = -5\text{ V}, T_J = 25\text{ °C}$	-	-	37	A	
Pulsed diode forward current	I_{SDM}		-	-	102		
Reverse recovery time	t_{rr}	$V_{GS} = -5\text{ V}, I_{SD} = 26\text{ A},$ $V_R = 800\text{ V}, di/dt = 1000\text{ A/μs}$	-	48	-	ns	
Reverse recovery charge	Q_{rr}		-	162	-	nC	
Reverse recovery current	I_{rrm}		-	7	-	A	



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

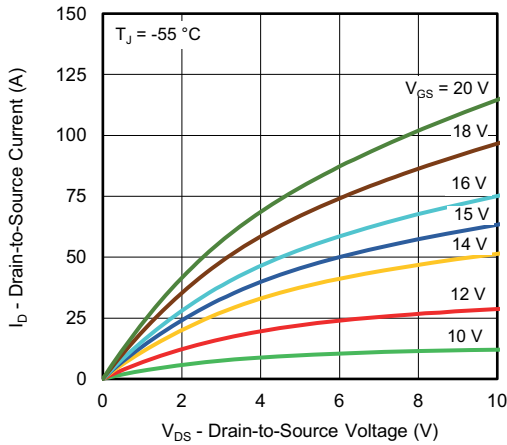


Fig. 1 - Typical Output Characteristics

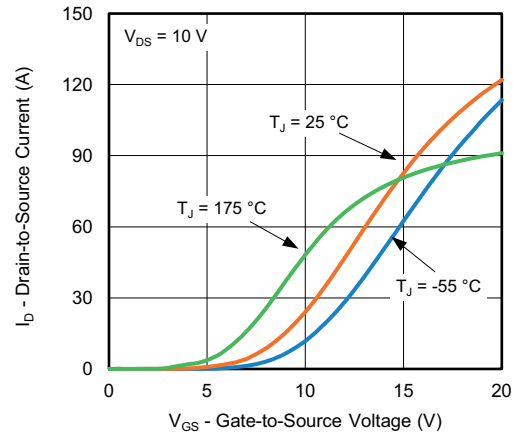


Fig. 4 - Typical Transfer Characteristics

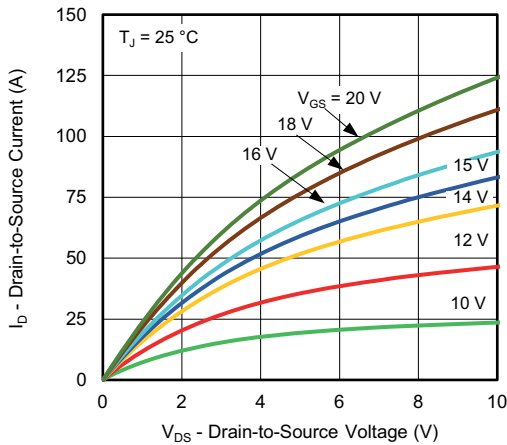


Fig. 2 - Typical Output Characteristics

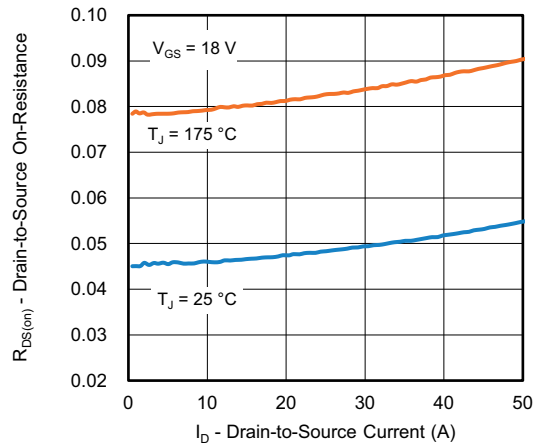


Fig. 5 - Normalized On-Resistance vs. Drain Current

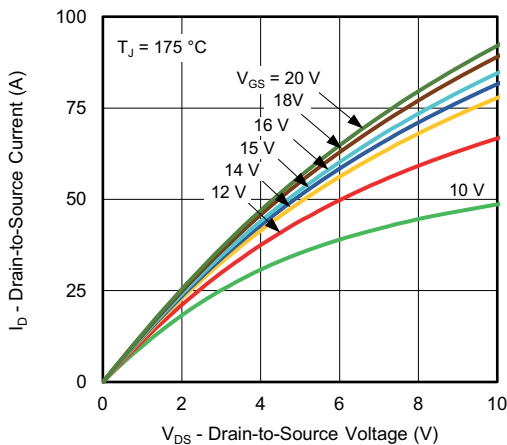


Fig. 3 - Typical Output Characteristics

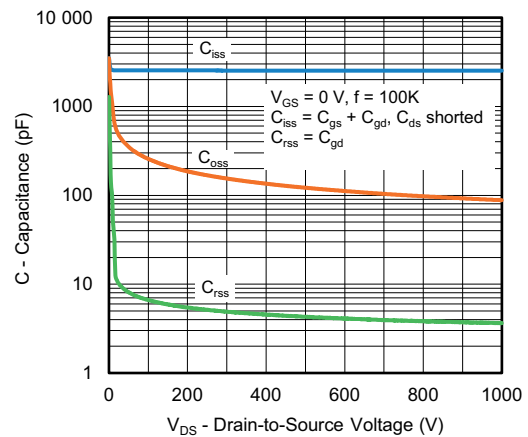


Fig. 6 - Typical Capacitance vs. Drain-to-Source Voltage

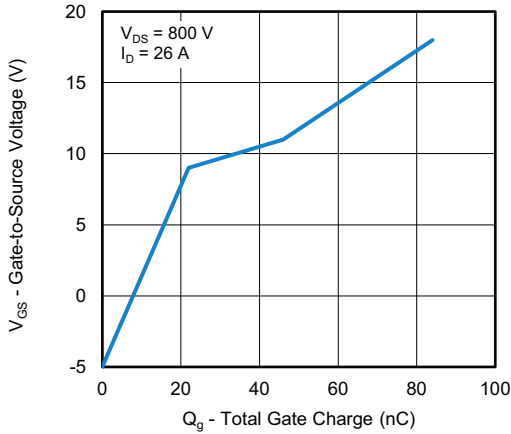


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

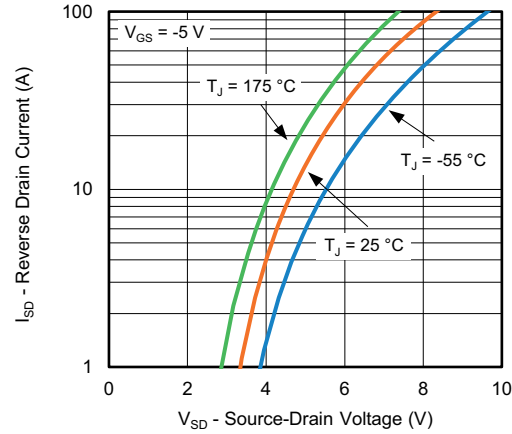


Fig. 10 - Typical Source-Drain Diode Forward Voltage

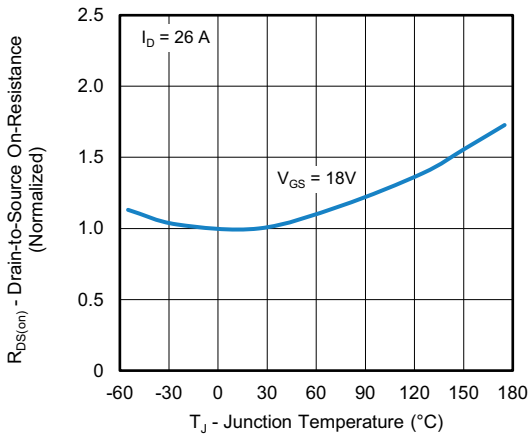


Fig. 8 - Normalized On-Resistance vs. Temperature

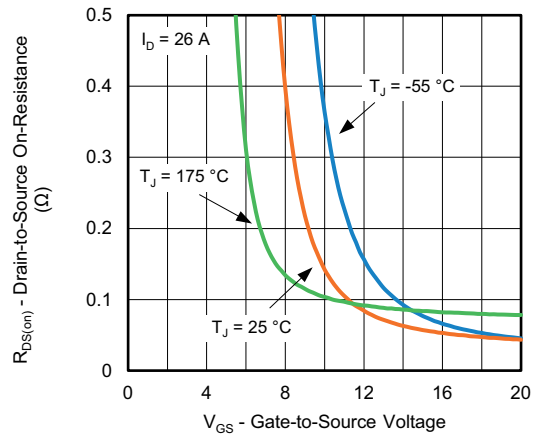


Fig. 11 - On-Resistance vs. Gate-to-Source Voltage

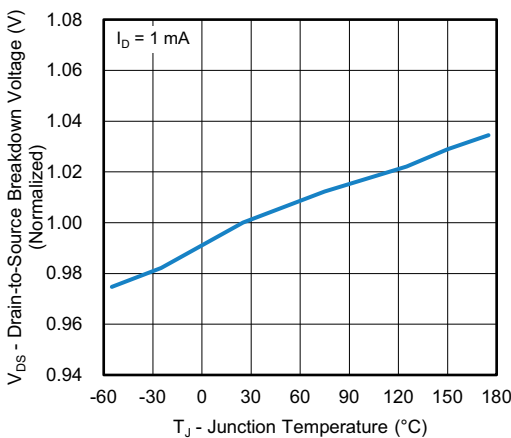


Fig. 9 - Drain-to-Source Voltage vs. Temperature

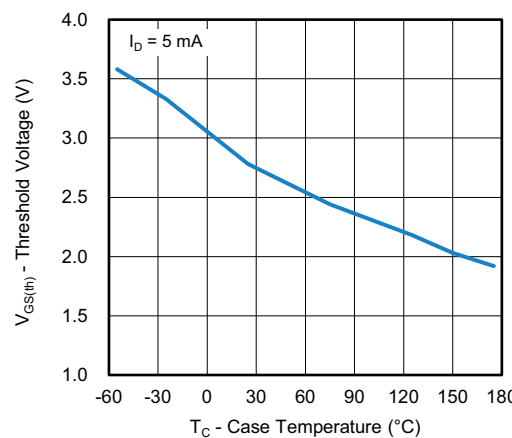


Fig. 12 - Threshold Voltage vs. Case Temperature

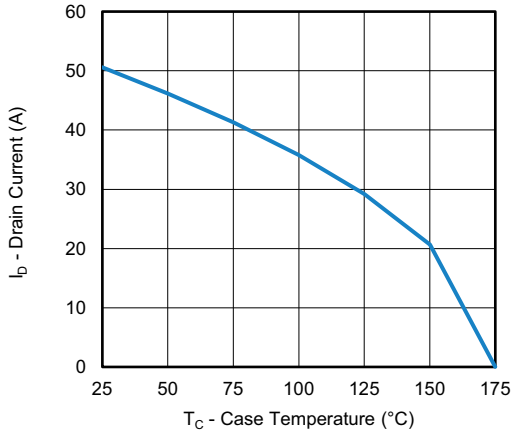


Fig. 13 - Drain Current vs. Case Temperature

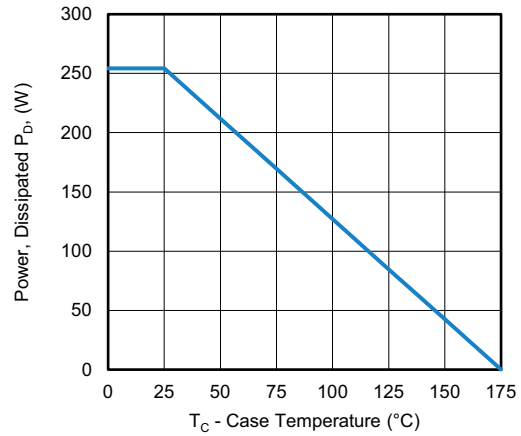


Fig. 15 - Power, Dissipated P_D vs. Case Temperature

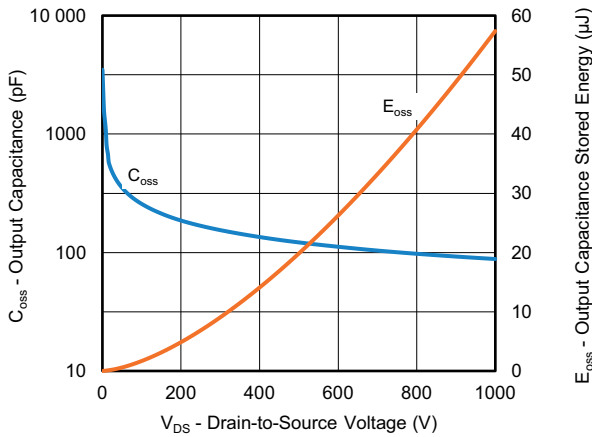


Fig. 14 - Output Capacitance and its Stored Energy vs. Drain-to-Source Voltage

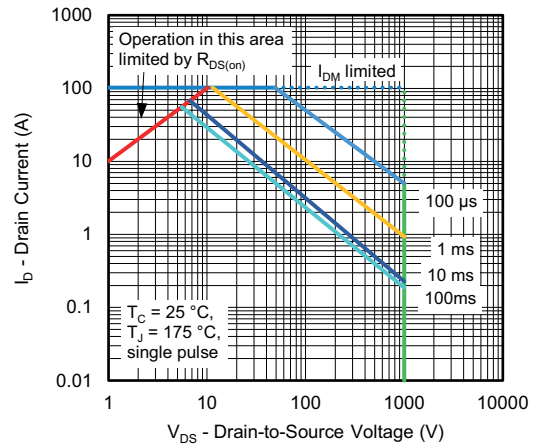


Fig. 16 - Safe Operating Area

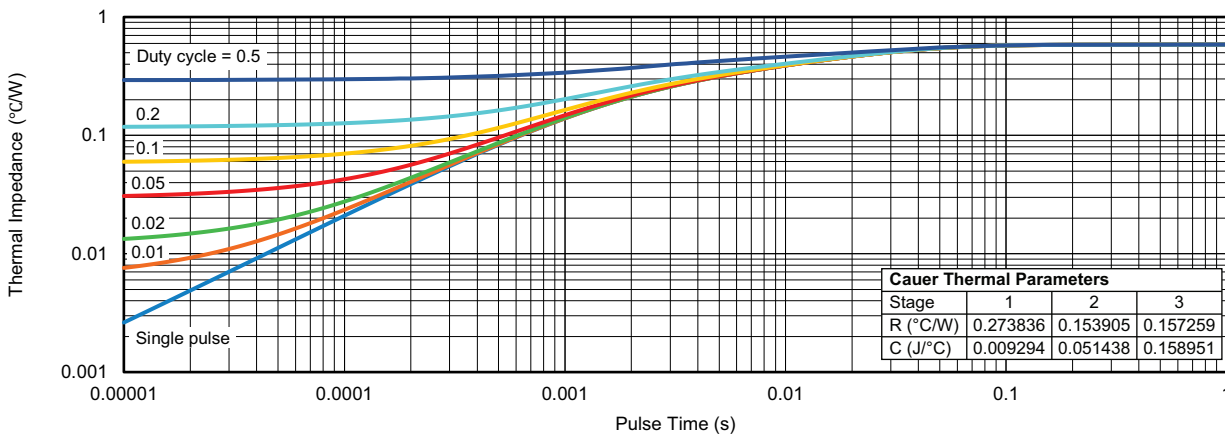


Fig. 17 - Transient Thermal Impedance

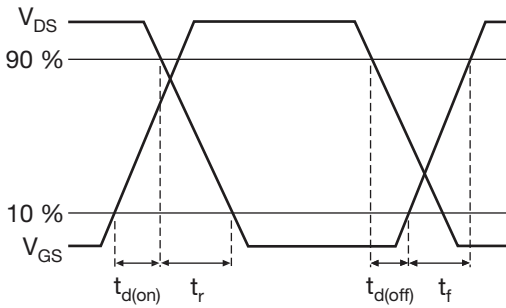


Fig. 18 - Waveforms of Switching Time

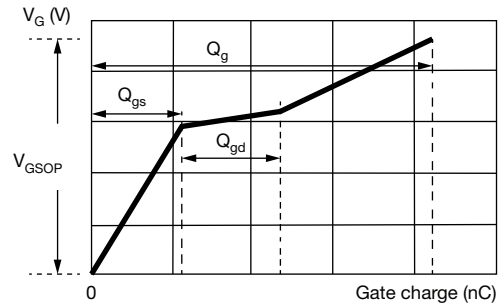


Fig. 21 - Waveforms for Gate Charge

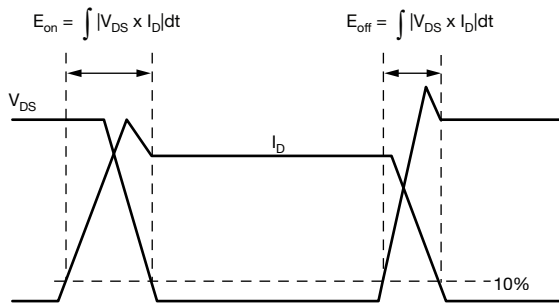


Fig. 19 - Waveforms for Switching Energy

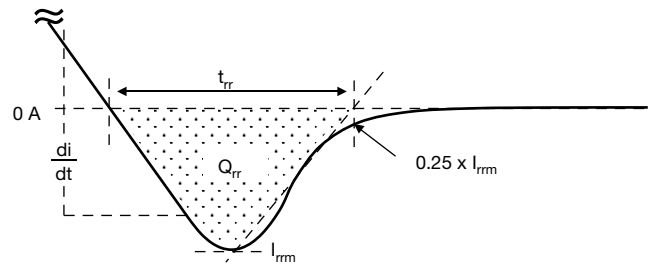


Fig. 22 - Waveforms for Reverse Recovery

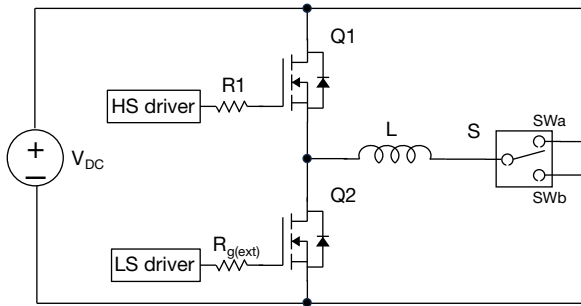


Fig. 20 - Switching and Reverse Diode Characteristics Measurement Circuit

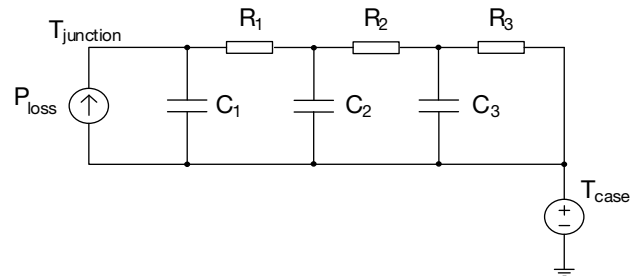


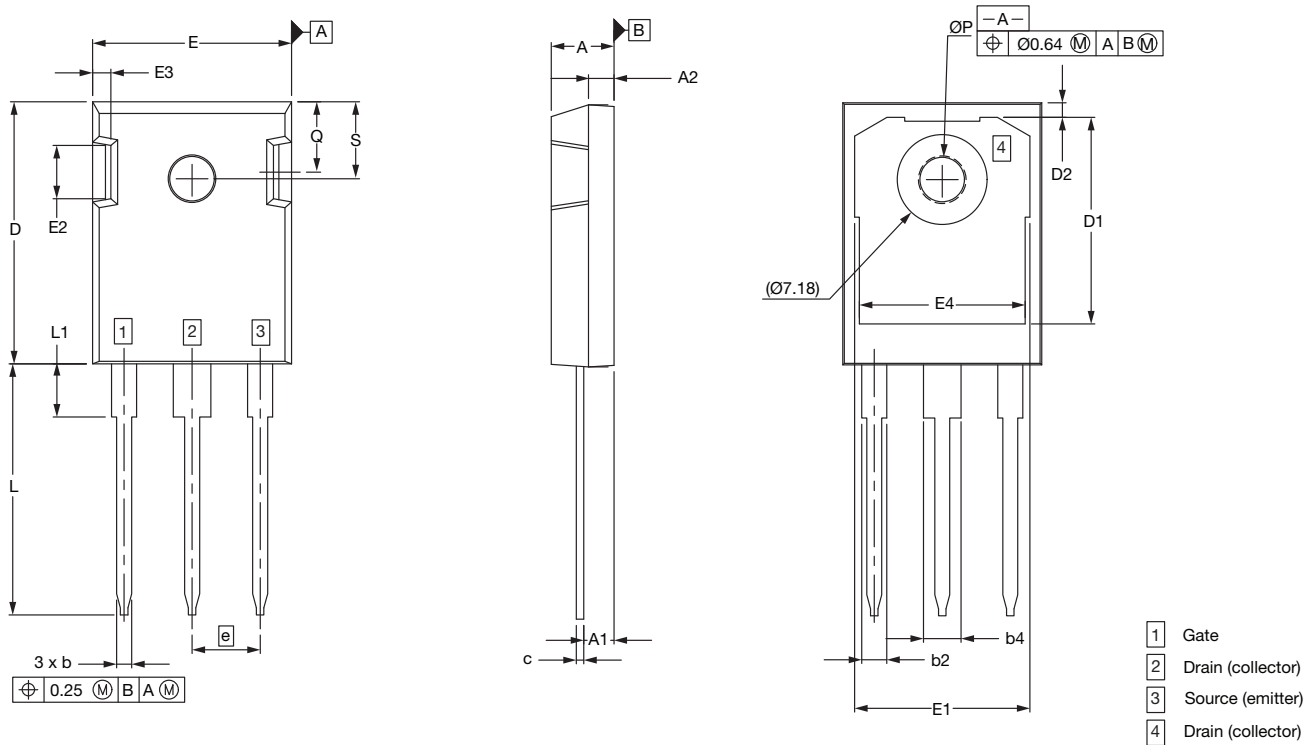
Fig. 23 - Thermal Equivalent Circuit

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Case Outline for TO-247AD 3L

FACILITY CODE: N



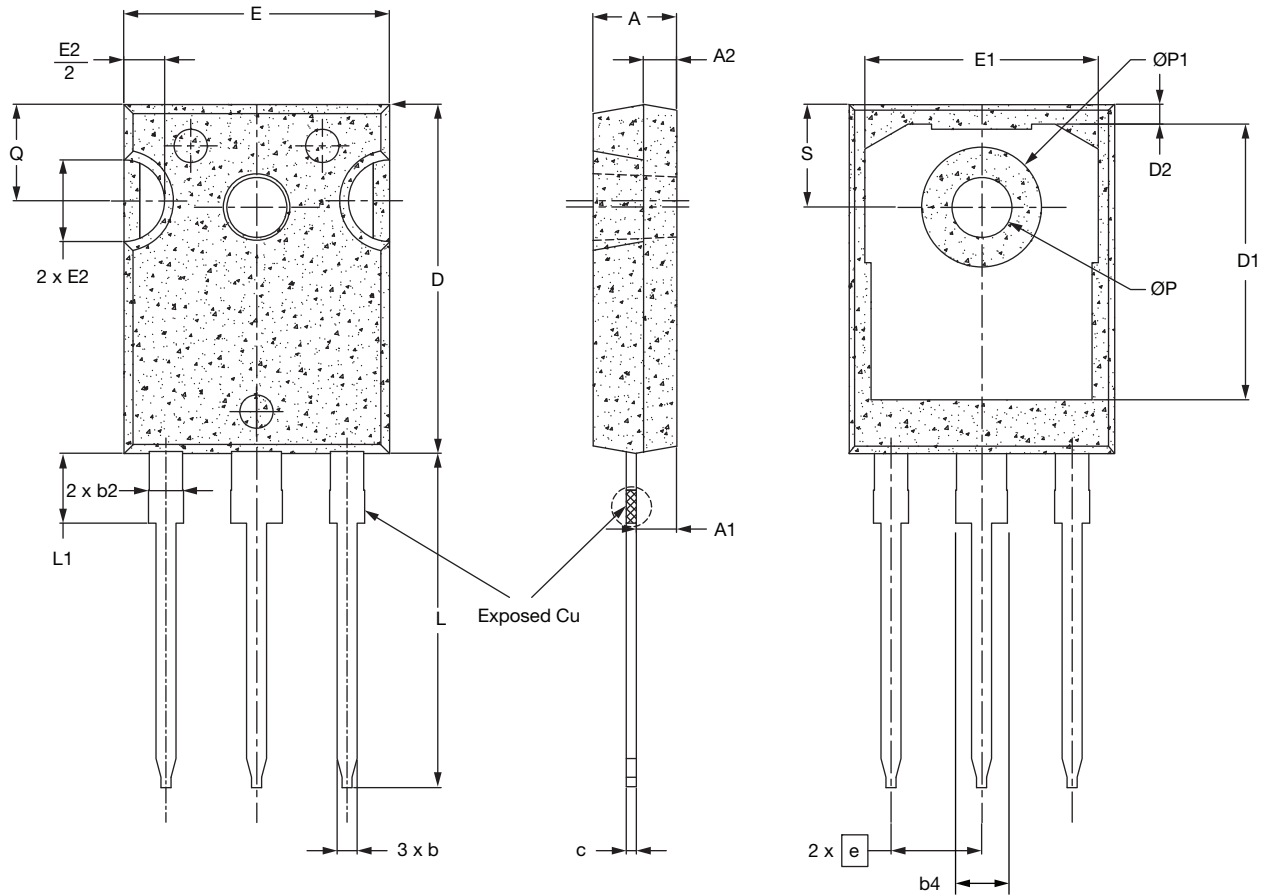
DIM.	MILLIMETERS	
	MIN.	MAX.
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b	1.07	1.33
b2	1.91	2.41
b4	2.87	3.38
c	0.55	0.68
D	20.80	21.10
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	5.44 BSC.	
N	3	
L	19.81	20.32
L1	4.10	4.40
ØP	3.51	3.65
Q	5.49	6.00
S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

Notes

- All metal surfaces: tin plated (MATTE), except area of cut
- Dimensioning and tolerancing 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: S25-0779-Rev. C, 08-Jul-2025
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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