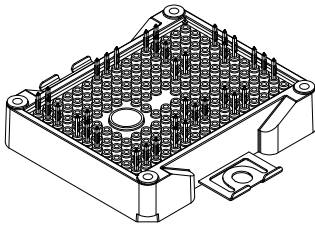
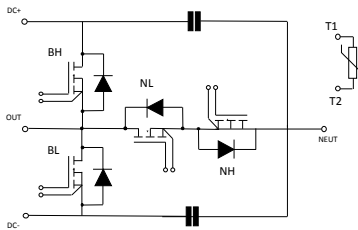


ACEPACK 2 power module, 3-level topology, based on silicon carbide Power MOSFETs 750 and 1200 V


ACEPACK 2

Product status link
[A2U8M12W3-FC](#)
Product summary

Order code	A2U8M12W3-FC
Marking	A2U8M12W3-FC
Package	ACEPACK 2
Leads type	Press-fit
Packing	Tray

Features

- ACEPACK 2 power module:
 - NH and NL: 750 V, 6 mΩ of typical $R_{DS(on)}$ each switch
 - BH and BL: 1200 V, 9.5 mΩ of typical $R_{DS(on)}$ each switch
 - 3 kVrms insulation
 - Integrated NTC temperature sensor
 - DC link capacitors between DC BUS and neutral
 - AIN DBC improved thermal performance
 - Press-fit contact pins

Application

- DC-DC converters

Description

This power module realizes a 3-level topology in an ACEPACK 2 module with NTC and capacitance, integrating the latest advances in silicon carbide MOSFETs from STMicroelectronics, represented by third generation technology. This modular solution is used to realize complex topologies with very high power density and efficiency requirements.

1 NH and NL electrical ratings

$T_J = 25\text{ °C}$ unless otherwise specified.

Table 1. NH and NL absolute maximum ratings

Symbol	Parameter	Value	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	750	V
V_{GS}	Gate-source voltage	-10 to 22	V
	Gate-source voltage, recommended operating values	-5 to 18	
I_D	Drain current (continuous) at $T_H = 25\text{ °C}$	180	A
$I_{DM}^{(1)}$	Repetitive peak drain current	360	A
T_J	Operating junction temperature range	-55 to 150	°C

1. Pulse width limited by safe operating area.

Table 2. NH and NL thermal data

Symbol	Parameter	Value	Unit
R_{thJH}	Thermal resistance, junction-to-heat sink, each switch (TIM = 120 μm , $\lambda = 3\text{ W}\cdot\text{m}^{-1}\cdot\text{°C}^{-1}$)	0.39	°C/W

2 NH and NL electrical characteristics

$T_J = 25\text{ °C}$ unless otherwise specified.

Table 3. NH and NL on/off-states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 18\text{ V}, I_D = 100\text{ A}$		6	8	m Ω
		$V_{GS} = 18\text{ V}, I_D = 100\text{ A}, T_J = 150\text{ °C}$		7.8		
$V_{GS(th)}$	Gate threshold voltage	$I_D = 2\text{ mA}, V_{DS} = V_{GS}$	1.8	3.2	4.2	V
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 750\text{ V}, V_{GS} = 0\text{ V}$			20	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0, V_{GS} = -10\text{ to }22\text{ V}$			± 100	nA
C_{iss}	Input capacitance			7660		pF
C_{oss}	Output capacitance	$f = 1\text{ MHz}, V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}$		634		pF
C_{rss}	Reverse transfer capacitance			67		pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}, I_D = 0\text{ A}$		1		Ω
Q_g	Total gate charge			288		nC
Q_{gs}	Gate-source charge	$V_{DD} = 400\text{ V}, V_{GS} = -5\text{ to }18\text{ V},$ $I_D = 100\text{ A}$		94		nC
Q_{gd}	Gate-drain charge			86		nC

Note: The $R_{DS(on)}$ is measured on kelvin. So the typical of 6 m Ω is due to a sum of switch resistance plus package resistance on NH and NL. Package resistance value for this path is 1.3 Ω .

Table 4. NH and NL switching energy

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
dv/dt	On	$V_{DS} = 450\text{ V}, I_D = 100\text{ A},$	-	13.6	-	V/ns
	Off	$V_{GS} = -5\text{ to }20\text{ V}, R_G = 8.2\text{ }\Omega$	-	11.4	-	

Note: For complete switching behavior, refer to the dynamic summary report already shared.

Table 5. NH and NL source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD}	Forward on voltage drop	$V_{GS} = -5\text{ V}, I_{SD} = 100\text{ A}$	-	4.15	-	V

Note: For complete switching behavior, refer to the dynamic summary report already shared.

2.1 NH and NL electrical characteristics (curves)

Figure 1. NH and NL typical output characteristics
($T_J = -40\text{ }^\circ\text{C}$)

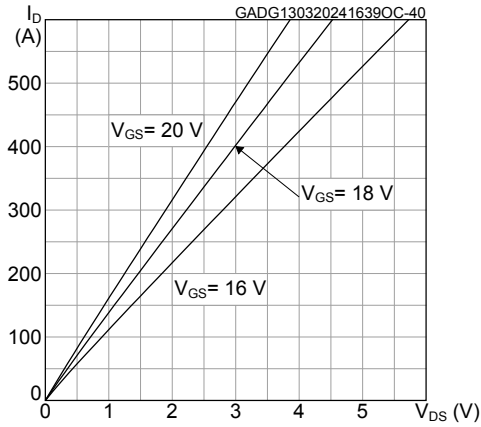


Figure 2. NH and NL typical output characteristics
($T_J = 25\text{ }^\circ\text{C}$)

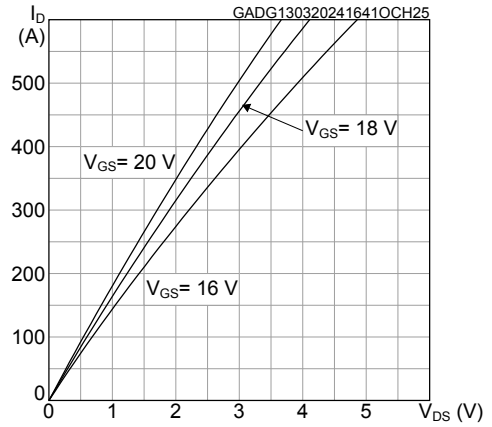


Figure 3. NH and NL typical output characteristics
($T_J = 150\text{ }^\circ\text{C}$)

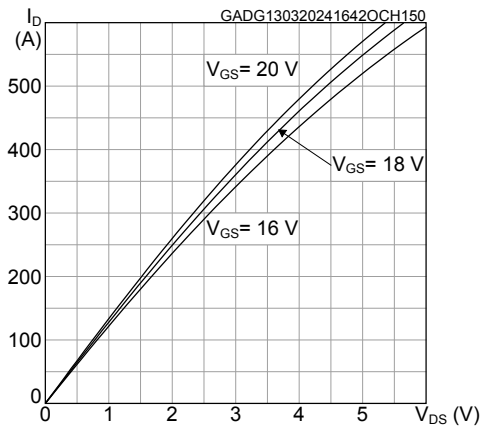


Figure 4. NH and NL typical transfer characteristics

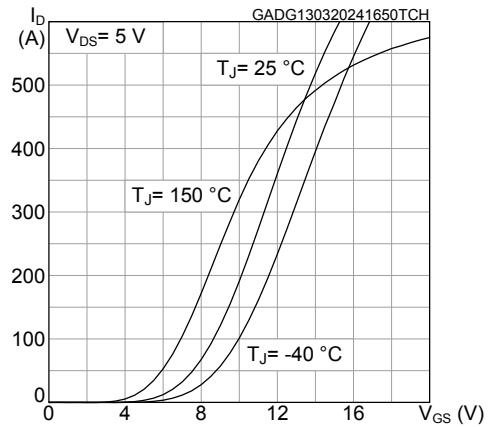


Figure 5. NH and NL typical diode forward characteristics

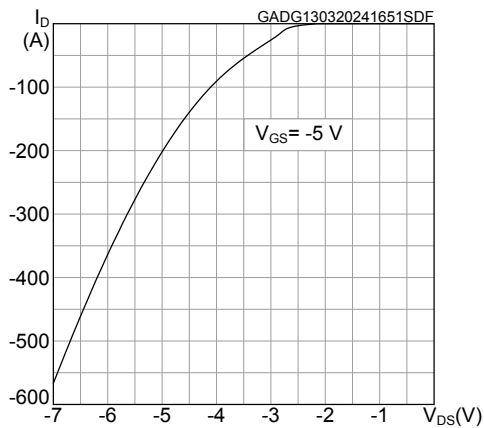
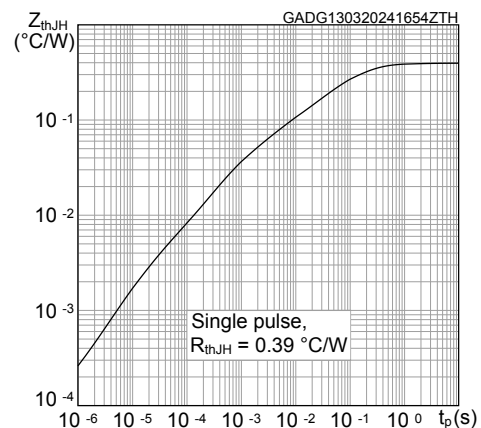


Figure 6. NH and NL maximum transient thermal impedance



3 BH and BL electrical ratings

$T_J = 25\text{ °C}$ unless otherwise specified.

Table 6. BH and BL absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	1200	V
V_{GS}	Gate-source voltage	-10 to 22	V
	Gate-source voltage, recommended operating values	-5 to 18	
I_D	Drain current (continuous) at $T_H = 25\text{ °C}$	140	A
$I_{DM}^{(1)}$	Repetitive peak drain current	280	A
T_J	Operating junction temperature range	-55 to 150	°C

1. Pulse width limited by maximum junction temperature.

Table 7. BH and BL thermal data

Symbol	Parameter	Value	Unit
R_{thJH}	Thermal resistance, junction-to-heat sink, each switch (TIM = 120 μm , $\lambda = 3\text{ W}\cdot\text{m}^{-1}\cdot\text{°C}^{-1}$)	0.39	°C/W

4 BH and BL electrical characteristics

$T_J = 25\text{ °C}$ unless otherwise specified.

Table 8. BH and BL on/off-state

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 18\text{ V}, I_D = 100\text{ A}$		9.5	12.5	m Ω
		$V_{GS} = 18\text{ V}, I_D = 100\text{ A}, T_J = 150\text{ °C}$		14.25		
$V_{GS(th)}$	Gate threshold voltage	$I_D = 2\text{ mA}, V_{DS} = V_{GS}$	1.8	2.5	4	V
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$			20	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0, V_{GS} = -10\text{ to }22\text{ V}$			± 100	nA
C_{iss}	Input capacitance			7370		pF
C_{oss}	Output capacitance	$f = 1\text{ MHz}, V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}$		363		pF
C_{rss}	Reverse transfer capacitance			56		pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}, I_D = 0\text{ A}$		1.1		Ω
Q_g	Total gate charge	$V_{DS} = 800\text{ V}, V_{GS} = -5\text{ to }18\text{ V},$ $I_D = 100\text{ A}$		304		nC
Q_{gs}	Gate-source charge			81		nC
Q_{gd}	Gate-drain charge			114		nC

Note: The $R_{DS(on)}$ is measured on power. So the typical of 9.5 m Ω is due to a sum of switch resistance plus package resistance for BH and BL. Package resistance value for this path is 2.3 m Ω .

Table 9. BH and BL switching energy

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
dv/dt	On	$V_{DS} = 450\text{ V}, I_D = 100\text{ A},$ $R_G = 8.2\text{ }\Omega, V_{GS} = -5\text{ to }20\text{ V}$	-	15	-	V/ns
	Off		-	12.4	-	

Note: For complete switching behavior, refer to the dynamic summary report already shared.

Table 10. BH and BL source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD}	Forward on voltage drop	$V_{GS} = -5\text{ V}, I_{SD} = 100\text{ A}$	-	5.2	-	V

Note: For complete switching behavior, refer to the dynamic summary report already shared.

4.1 BH and BL electrical characteristics (curves)

Figure 7. BH and BL typical output characteristics
($T_J = -40\text{ }^\circ\text{C}$)

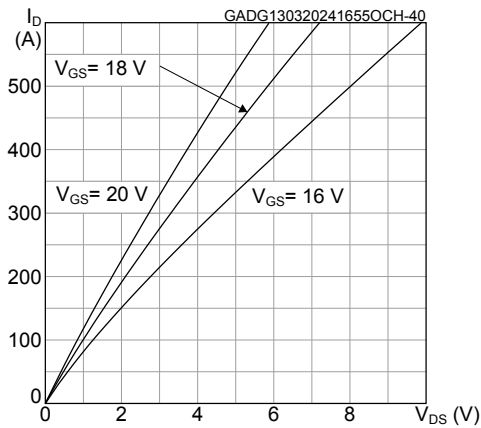


Figure 8. BH and BL typical output characteristics
($T_J = 25\text{ }^\circ\text{C}$)

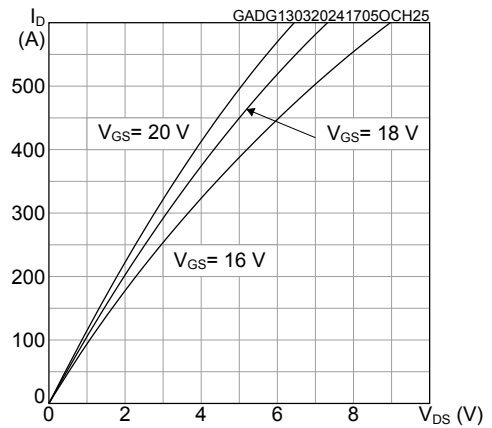


Figure 9. BH and BL typical output characteristics
($T_J = 150\text{ }^\circ\text{C}$)

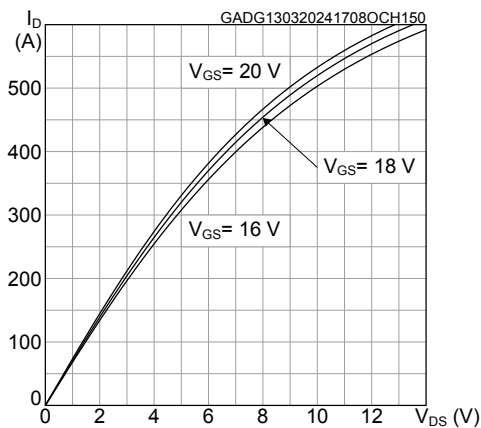


Figure 10. BH and BL typical transfer characteristics

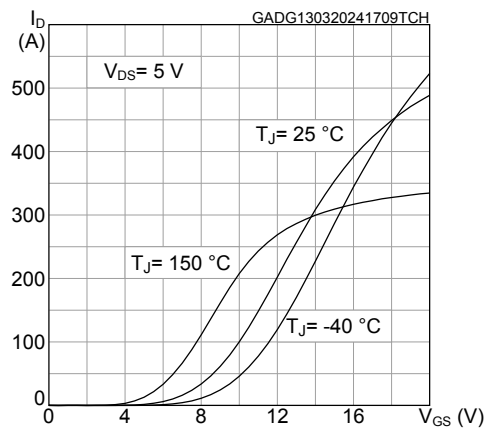


Figure 11. BH and BL typical diode forward characteristics

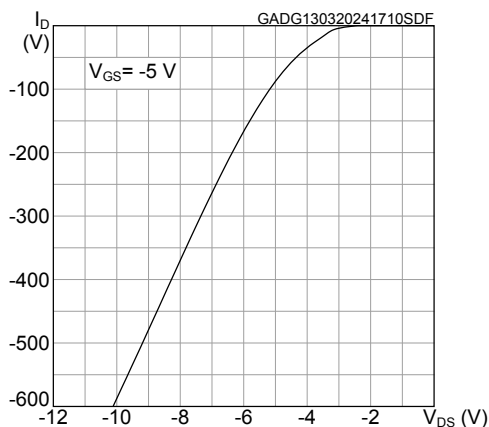
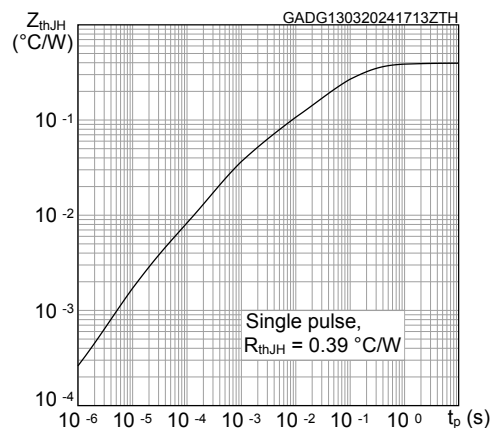


Figure 12. BH and BL maximum transient thermal impedance



5 DC link capacitor (CGA9Q1C0G2J104J280KC)

Table 11. Absolute maximum rating for capacitor

Symbol	Parameter	Value	Unit
V _{MAX}	Maximum DC voltage	630	V
T	Operative temperature range	-40 to 125	°C

Table 12. Electrical characteristics – capacitor

Symbol	Parameter	Min.	Typ.	Max.	Unit
C1, C2	Capacitance value		100		nF
	Tolerance	-5		+5	%

6 NTC (B57451V5103G362)

Table 13. Absolute maximum ratings for NTC temperature sensor, considered as stand-alone

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
R ₂₅	Resistance rating	T = 25 °C		10		kΩ
ΔR ₂₅ /R	Resistance tolerance		-2		+2	%
R ₁₀₀	Resistance rating	T = 100 °C		674.8		Ω
ΔR ₁₀₀ /R	Resistance tolerance		-4.75		4.75	%
R _{25/50}	B-value	T=25 °C to 50 °C		3940		K
R _{25/85}		T=25 °C to 85 °C		3980		
R _{25/100}		T=25 °C to 100 °C (±1%)		4000		
T	Operating temperature range		-40		150	°C

Figure 13. NTC typical resistance vs temperature

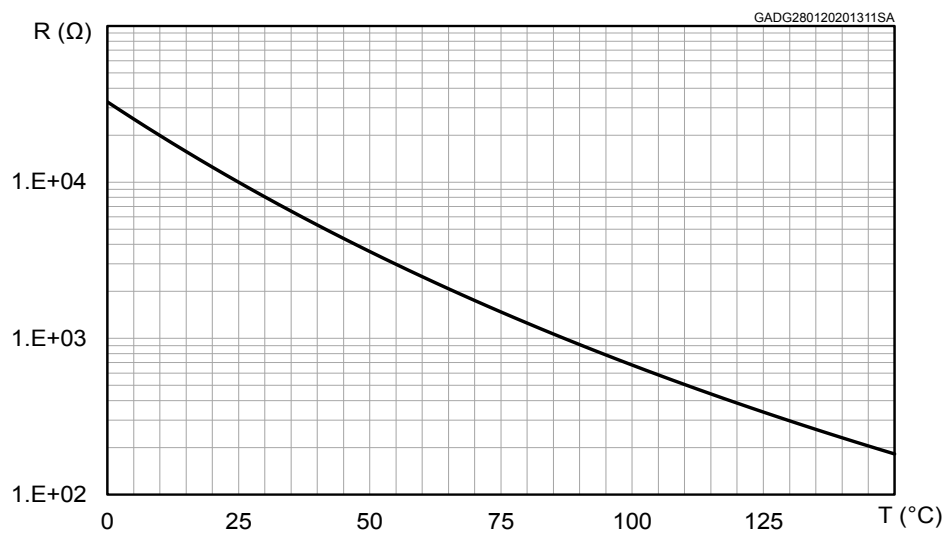
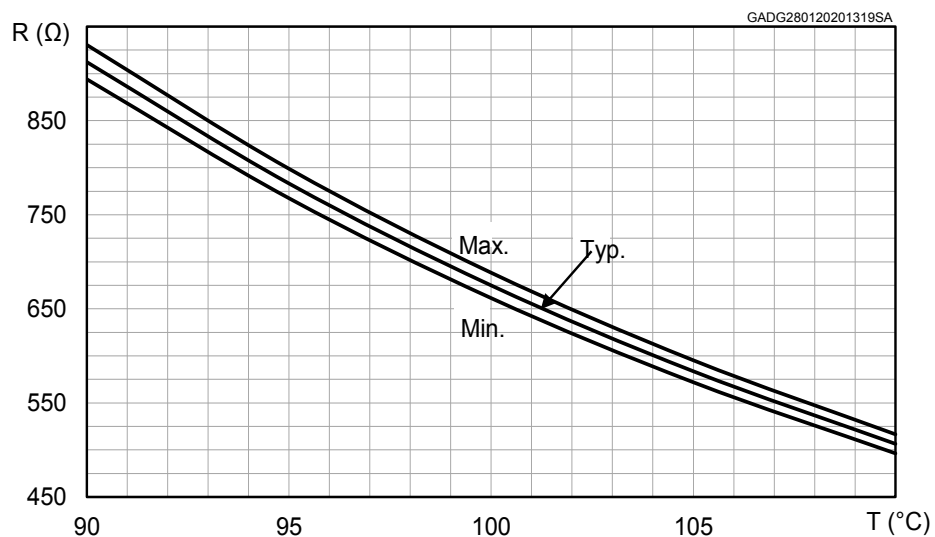


Figure 14. NTC resistance vs temperature, zoom



7 Package

Table 14. ACEPACK 2 package

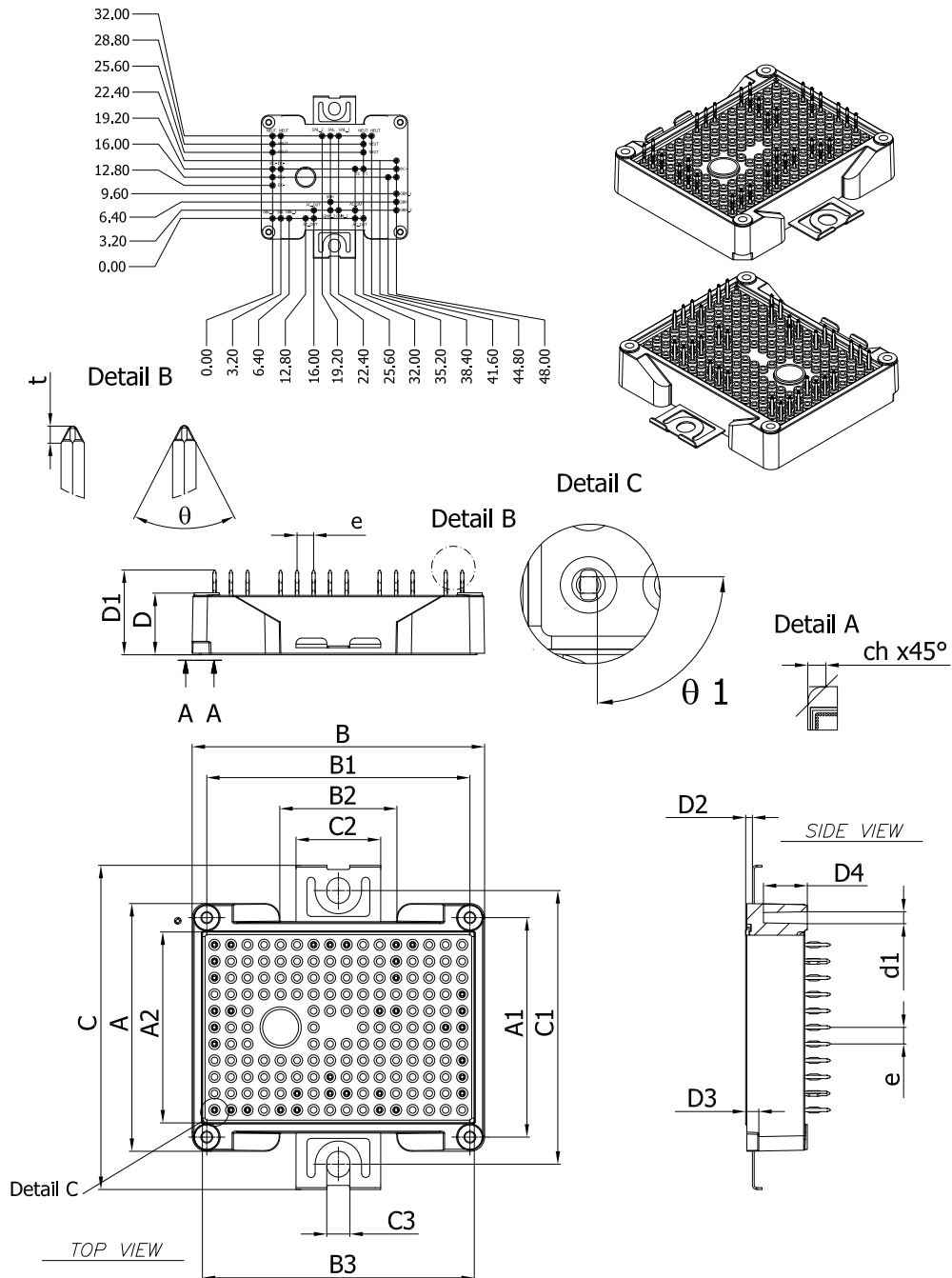
Symbol	Parameter	Value	Unit
V _{ISO}	Isolation withstand voltage applied between each pin and heat sink plate (AC voltage, t = 60 s)	3	kVrms
CTI	Comparative tracking index	200	V
L _s	Stray inductance module loop	10	nH
T _{stg}	Storage temperature range	-40 to 125	°C

9 Package information

In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

9.1 ACEPACK 2, 3-level press-fit package information

Figure 17. ACEPACK 2, 3-level press-fit package outline (dimensions are in mm)

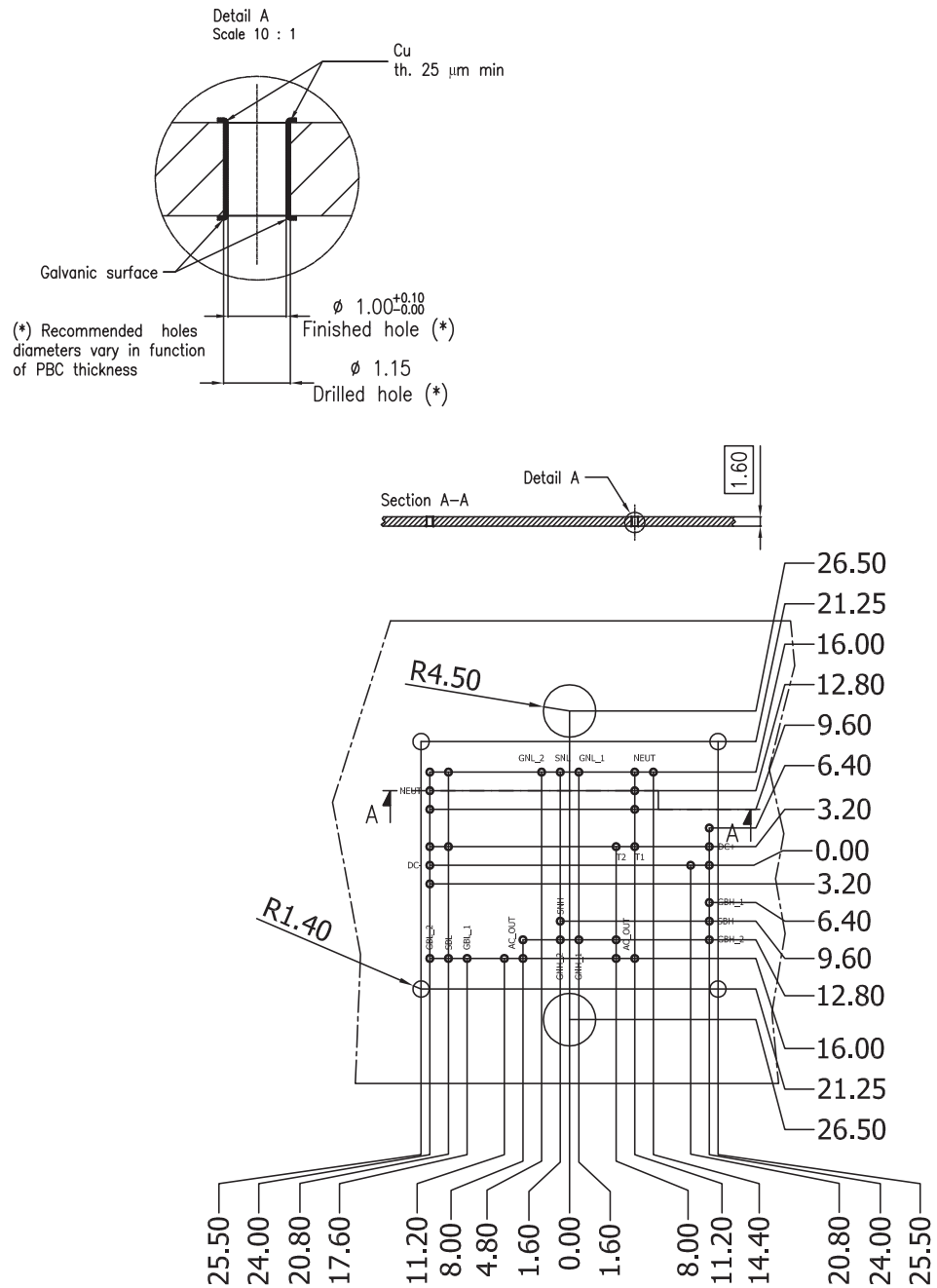


8569722_14_C_Three_PFP

Table 15. ACEPACK 2, 3-level press-fit mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	47.70	48.00	48.30
A1	42.30	42.50	42.70
A2	37.00 REF		
B	56.40	56.70	57.00
B1	50.85	51.00	51.15
B2	22.40	22.70	23.00
B3	52.70 REF		
C	62.30	62.80	63.30
C1	52.90	53.00	53.10
C2	16.20	16.40	16.60
C3	4.40	4.50	4.60
D	11.90	12.25	12.60
D1	16.45	16.70	17.10
D2	1.35	1.55	1.75
D3	2.55	2.75	2.95
D4			8.50
t	0.30	0.40	0.50
θ	52°	60°	68°
θ1		90°	
e	3.20 BSC		
d1	2.30 REF		
ch	3.50 REF		

Figure 18. ACEPACK 2, 3-level press-fit recommended PCB holes layout (dimensions are in mm)



8569722_14_C_ACEPACK2_three_pr_recomm_PCB_hol_lay

Revision history

Table 16. Document revision history

Date	Revision	Changes
14-May-2024	1	First release.
01-Aug-2024	2	Updated Features in cover page, Section 4: BH and BL electrical characteristics and Table 14. ACEPACK 2 package .

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