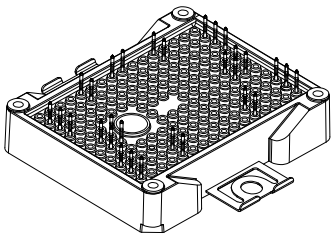
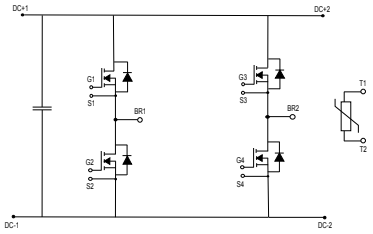
A2F20M65W3-FC

Datasheet

ACEPACK 2 power module, fourpack topology, 650 V, 23 mΩ typ. SiC Power MOSFET gen.3 with NTC and capacitance



ACEPACK 2



Features

- Fourpack topology
- ACEPACK 2 power module
  - 23 mΩ of typical $R_{DS(on)}$ each switch
  - Insulation voltage 2.5 kVrms
  - Integrated NTC temperature sensor
  - Integrated DC link capacitor
  - DBC Cu-Al_2O_3-Cu based
  - Press-fit contact pins

Applications

- DC-DC converters
- Solar inverters

Description

This power module realizes a fourpack 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.

Product status link
A2F20M65W3-FC

Product summary	
Order code	A2F20M65W3-FC
Marking	A2F20M65W3-FC
Package	ACEPACK 2
Leads type	Press-fit
Packing	Tray

1 Electrical rating

T_J = 25 °C unless otherwise specified.

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	650	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 °C	58	A
I_{DM}(1)	Pulsed peak drain current	155	A
T_J	Maximum junction temperature	150	°C
	Operating junction temperature range under switching conditions	-40 to 150	

1. *Current referred to 1 ms time pulse.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJH}	Thermal resistance, junction-to-heat sink (TIM = 120 µm, λ = 3 W•m^{-1}•°C^{-1})	0.98	°C/W

2 Electrical characteristics

Table 3. On/off-state

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 18 V , I_D = 32 A		23	34.5	mΩ
		V_{GS} = 18 V , I_D = 32 A,T_J = 150 °C		28		
$V_{GS(th)}$	Gate threshold voltage	I_D = 10 mA, V_{DS} = V_{GS}	1.8	3.1	4.2	V
I_{DSS}	Zero gate voltage drain current	V_{DS} = 650 V, V_{GS} = 0 V			20	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0, V_{GS} = -10 to 22 V			100	nA
C_{iss}	Input capacitance	f = 1 MHz, V_{DS} = 400 V, V_{GS} = 0 V		1840		pF
C_{oss}	Output capacitance			188		pF
C_{rss}	Reverse transfer capacitance			26		pF
Q_g	Total gate charge	V_{DD} = 400 V, V_{GS} = -5 to 18 V, I_D = 20 A		79		nC
Q_{gs}	Gate-source charge			23		nC
Q_{gd}	Gate-drain charge			29		nC

Table 4. Switching energy

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
dv/dt	On	V_{DS} = 400 V, I_D = 30 A, V_{GS} = -5 to 18 V, $R_{G(on)}$ = 6.8 Ω $R_{G(off)}$ = 4.7 Ω	-	16.12	-	V/ns
	Off		-	25.77	-	

Table 5. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD}	Forward on voltage drop	V_{GS} = 0 V, I_{SD} = 32 A	-	2.8	-	V

3 Electrical characteristics (curves)

Figure 1. Typical output characteristics (T_J = -40 °C)

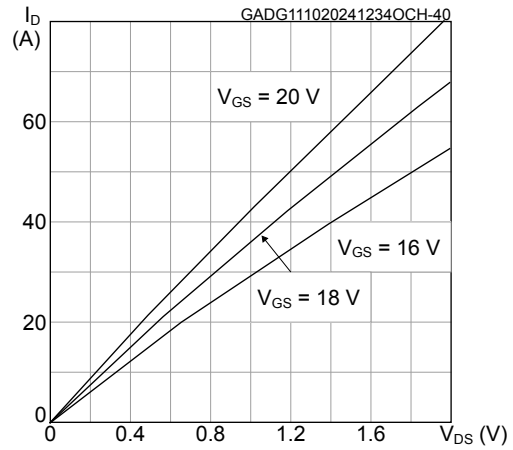


Figure 2. Typical output characteristics (T_J = 25 °C)

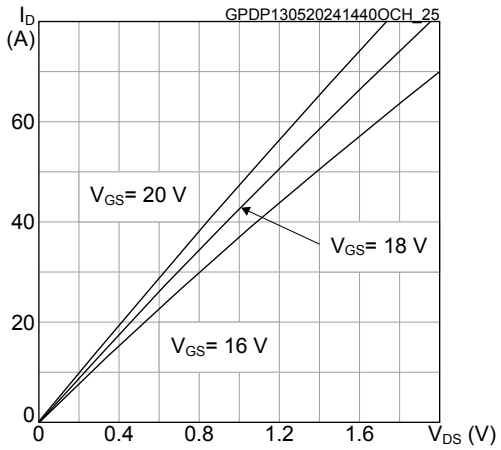


Figure 3. Typical output characteristics (T_J = 150 °C)

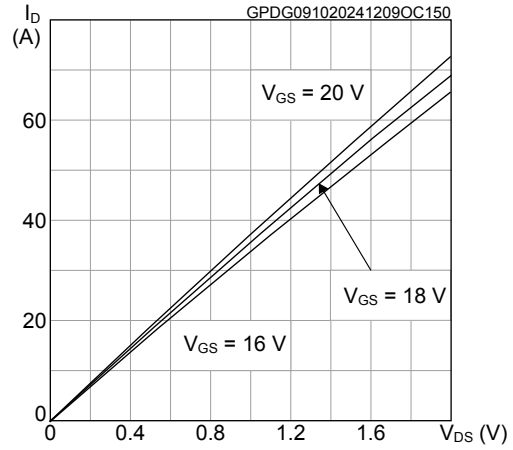


Figure 4. Typical transfer characteristics

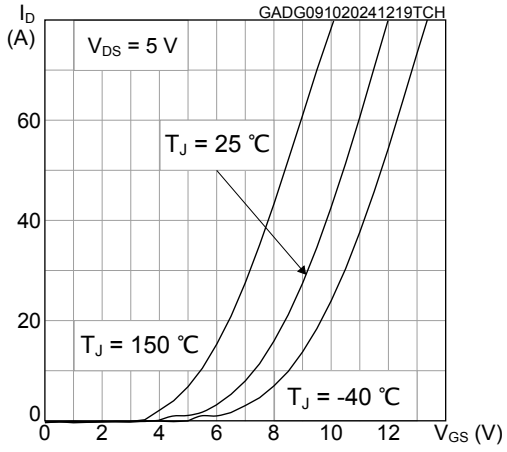


Figure 5. Typical diode forward characteristics

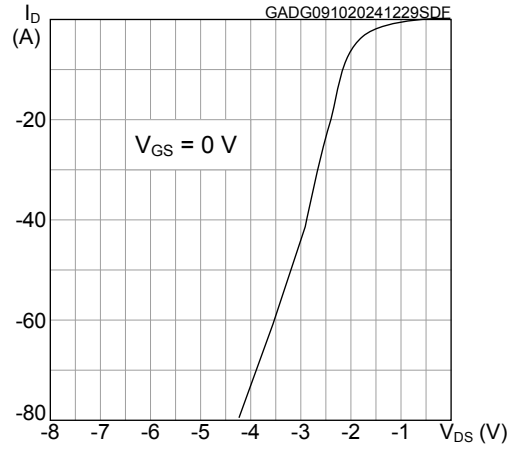
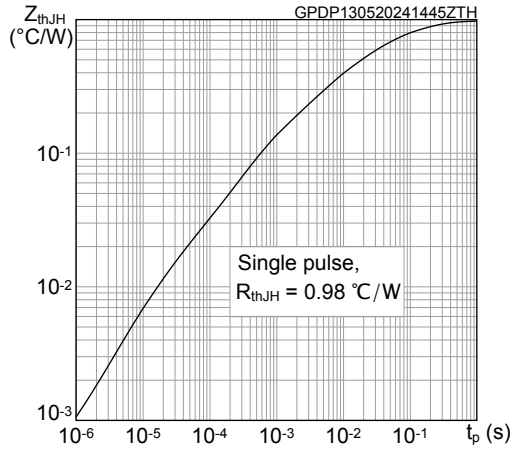


Figure 6. Maximum transient thermal impedance



4 NTC

Table 6. NTC temperature sensor, considered as standalone

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
R_{25}	Resistance rating	T = 25 °C		5		kΩ
R_{100}	Resistance rating	T = 100 °C		493		kΩ
ΔR/R	Deviation of R_{100}		-5		+5	%
$B_{25/50}$	B-constant			3375		K
$R_{25/80}$		T = 25 °C to 85 °C		3411		K
T	Operating temperature range		-40		150	°C

Figure 7. NTC typical resistance vs temperature

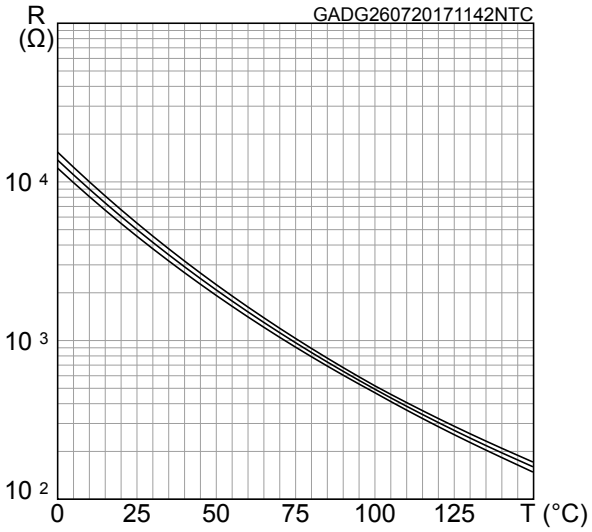
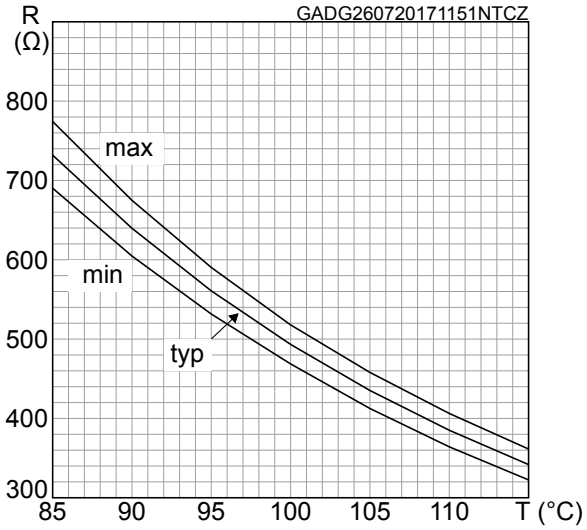


Figure 8. NTC resistance vs temperature, zoom



5 DC link capacitor (C1812X104KDRACTU)

Table 7. Absolute maximum rating for capacitor

Symbol	Parameter	Value	Unit
V_{MAX}	Maximum DC voltage	1000	V
C	Capacitance	100	nF
T	Operating temperature range	-40 to 125	°C

6 Package

Table 8. **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)	2.5	kVrms
CTI	Comparative tracking index	200	V
L_s	Stray inductance module loop	9.7	nH
T_{stg}	Storage temperature range	-40 to 125	°C

7 Electrical topology and pin description

Figure 9. **Electrical topology and pin description**

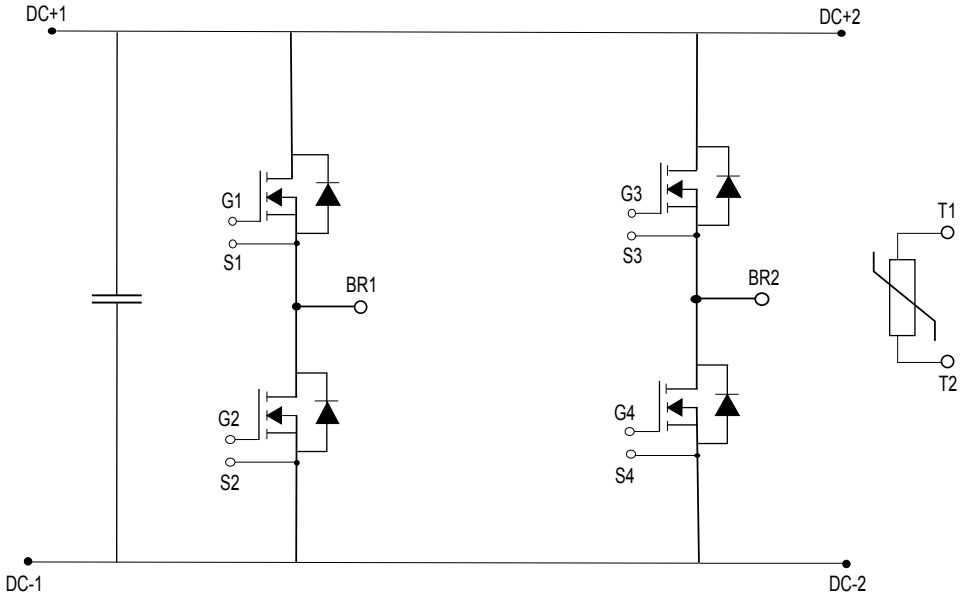
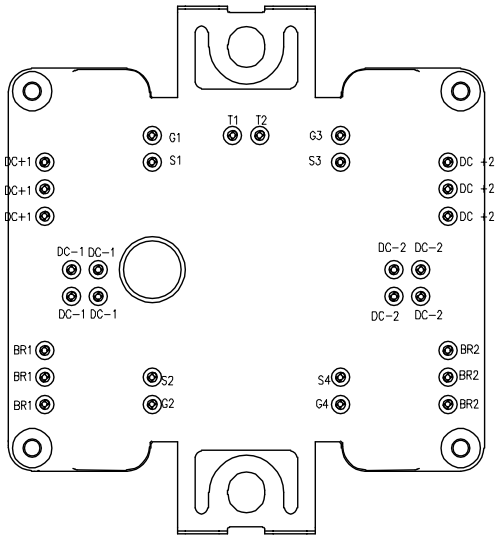


Figure 10. **Package top view with pinout**



GPDP140520241046SA

8 Package information

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.

8.1 ACEPACK 2 fourpack D2 press-fit package information

Figure 11. ACEPACK 2 fourpack D2 press-fit package outline (dimensions are in mm)

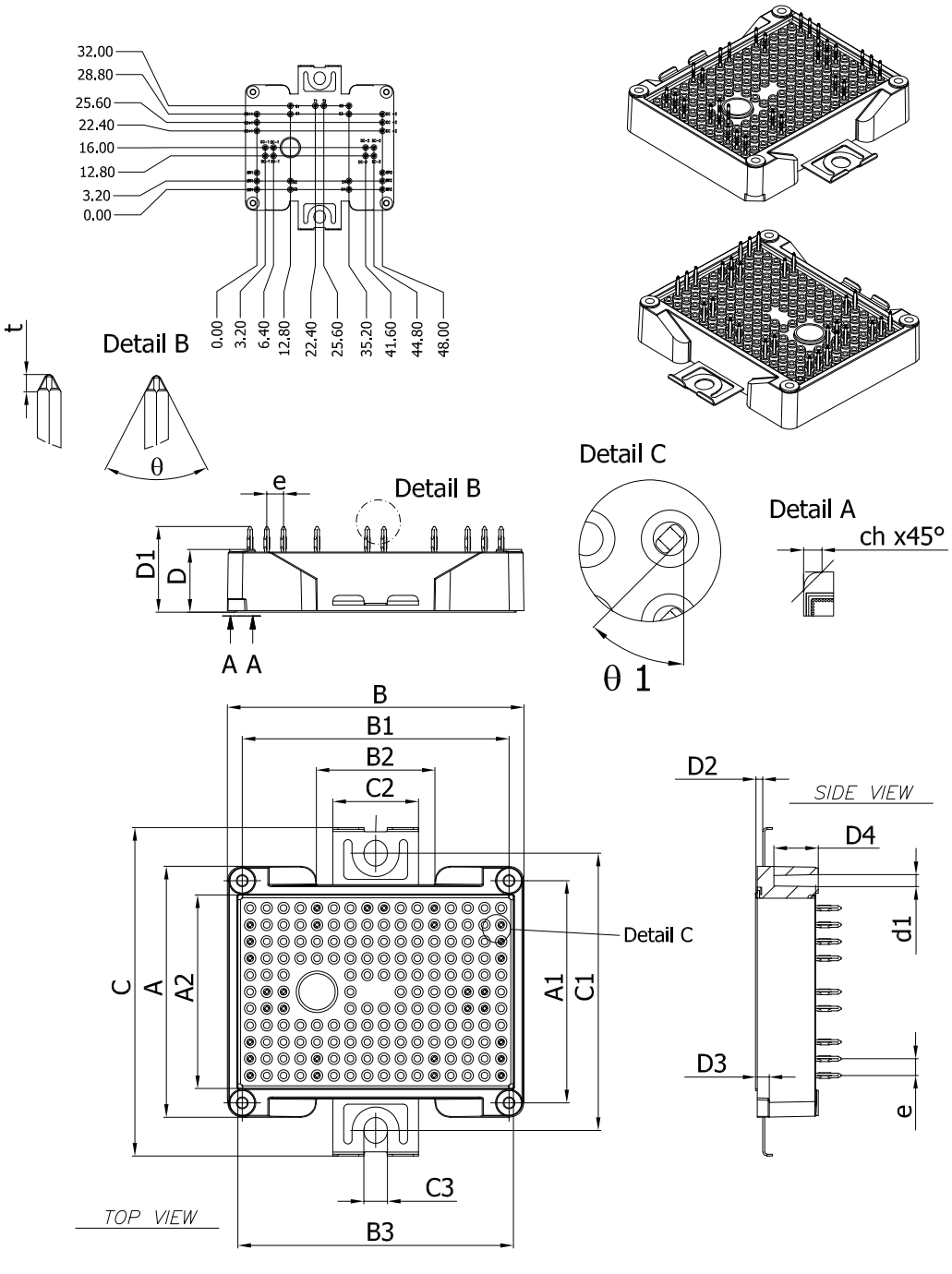
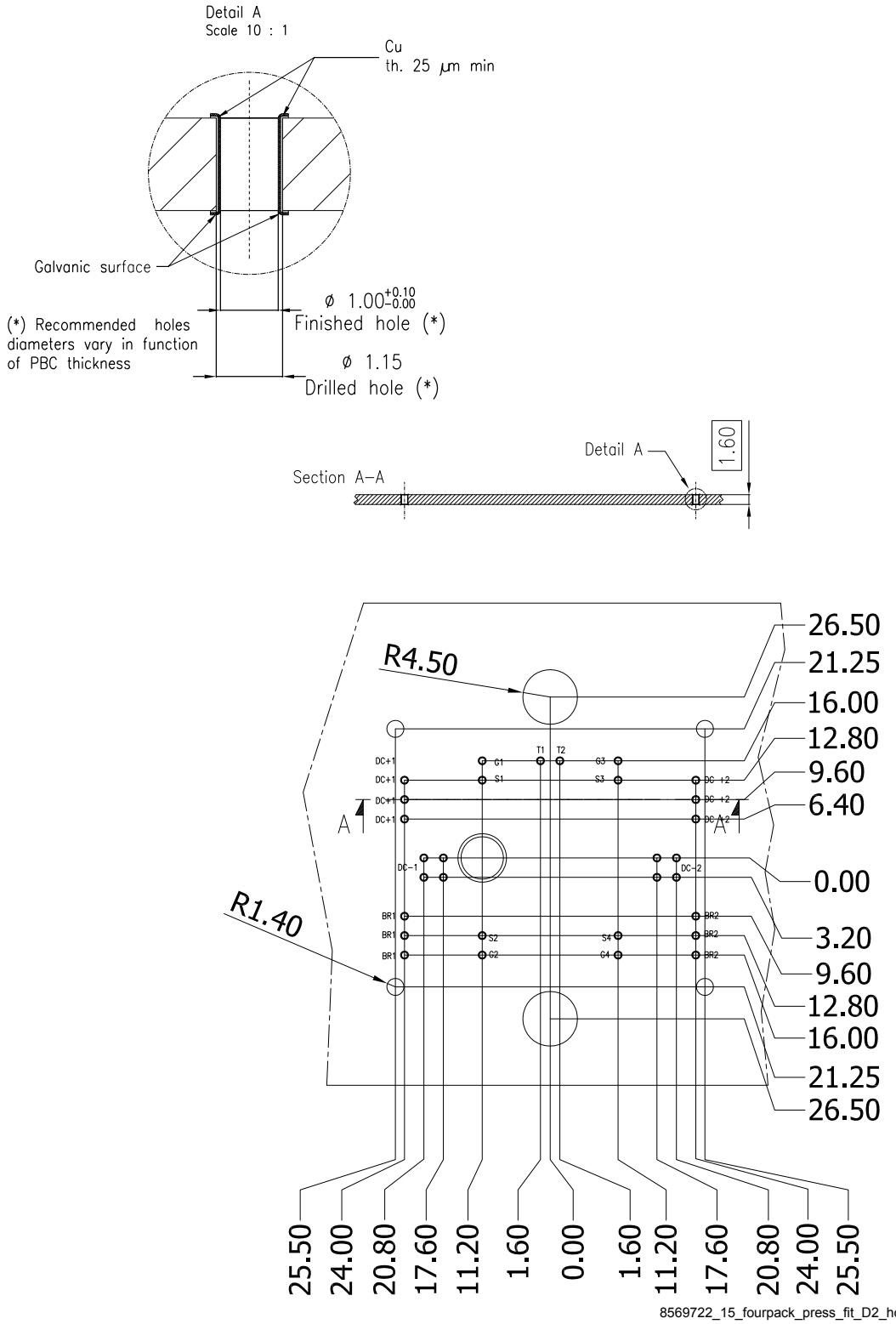


Table 9. **ACEPACK 2 fourpack D2 press-fit mechanical data**

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	11.65	12.00	12.35
D1	15.90	16.40	16.90
D2	1.10	1.30	1.50
D3	2.30	2.50	2.70
D4			8.50
t	0.30	0.40	0.50
θ	52°	60°	68°
θ1		45°	
e		3.20 BSC	
d1		2.30 REF	
ch		3.50 REF	

Figure 12. ACEPACK 2 fourpack D2 press-fit recommended PCB holes layout (dimensions are in mm)



8569722_15_fourpack_press_fit_D2_holes_layout

Revision history

Table 10. **Document revision history**

Date	Revision	Changes
07-Nov-2023	1	First release.
08-Jul-2024	2	Modified *Table 1. Absolute maximum ratings*, *Table 2. Thermal data*, *Table 3. On/off-state*, *Table 4. Switching energy* and *Table 5. Source-drain diode*. Added *Section 3: Electrical characteristics (curves)*. Added *Section 5: DC link capacitor (C1812X104KDRACTU)*. Modified *Figure 10. Package top view with pinout*. Updated *Section 8.1: ACEPACK 2 fourpack D2 press-fit package information*. Minor text changes.
14-Oct-2024	3	Updated *Table 1. Absolute maximum ratings*, *Table 3. On/off-state*. Updated *Section 3: Electrical characteristics (curves)*.
28-Oct-2024	4	Updated title, Features, Application and Description in cover page.

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