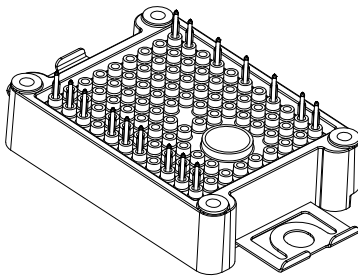
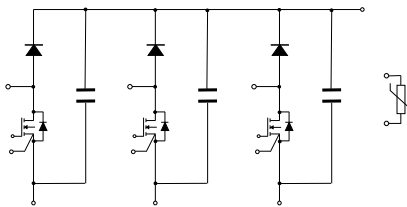


# ACEPACK 1 power module, boost topology 650 V, MDmesh M5 Power MOSFETs with SiC diode and NTC


**ACEPACK 1**


GADG130720211103SA


**Product status link**
[A1TB45W65M5-FC](#)
**Product summary**

<b>Order code</b>	A1TB45W65M5-FC
<b>Marking</b>	A1TB45W65M5-FC
<b>Package</b>	ACEPACK 1
<b>Leads type</b>	Press fit
<b>Packing</b>	Tray

## Features

- ACEPACK 1 power module
  - UL certified 2.5 kV insulation voltage
  - Press fit contact pins
  - Integrated DC link capacitor
- Triple boost topology
  - 650 V MDmesh M5 Power MOSFETs
  - 650 V, 1.45 V, Power Schottky SiC diode
- Integrated NTC temperature sensor

## Applications

- Battery charger
- UPS
- Solar applications

## Description

This ACEPACK 1 power module realizes a triple boost topology with three DC link capacitors and NTC that integrates three 650 V M5 Power MOSFETs and three SiC power Schottky diodes, all from STMicroelectronics.

This product is suitable as an AC-DC stage of battery management and in any UPS systems.

# 1 Electrical ratings

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

## 1.1 MOSFET

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	650	V
$V_{GS}$	Gate-source voltage	$\pm 25$	V
$I_D$	Drain current (continuous) at $T_C = 100\text{ °C}$	25	A
$I_{DM}$	Drain current (pulsed)	100	A
$dv/dt^{(1)}$	Peak diode recovery voltage slope	15	V/ns
$dv/dt^{(2)}$	MOSFET $dv/dt$ ruggedness	50	V/ns
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	250	W
$T_J$	Maximum junction temperature	150	$^{\circ}\text{C}$
$T_{Jop}$	Operating junction temperature range	-40 to 150	$^{\circ}\text{C}$

- $I_{SD} \leq 58\text{ A}$ ,  $di/dt = 400\text{ A}/\mu\text{s}$ ,  $V_{DS}(\text{peak}) < V_{(BR)DSS}$ ,  $V_{DD} = 400\text{ V}$  (from discrete device characterization).
- $V_{DS} \leq 520\text{ V}$  (from discrete device characterization).

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case (each MOSFET)	0.5	$^{\circ}\text{C}/\text{W}$

**Table 3. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
R <sub>DS(on)</sub>	Static drain-source on-resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 25 A		52	68	mΩ
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 25 A T <sub>C</sub> =150 °C		114		
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1 mA	3	4	5	V
I <sub>DSS</sub>	Zero gate voltage drain current	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 650 V, T <sub>C</sub> = 125 °C <sup>(1)</sup>			100	μA
I <sub>GSS</sub>	Gate-body leakage current	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±25 V			±100	nA
C <sub>iSS</sub>	Input capacitance	V <sub>DS</sub> = 100 V, f = 1 MHz, V <sub>GS</sub> = 0 V		6420		pF
C <sub>oSS</sub>	Output capacitance			170		pF
C <sub>rSS</sub>	Reverse transfer capacitance			11		pF
C <sub>o(tr)</sub> <sup>(2)</sup>	Equivalent output capacitance time related	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 0 to 520 V		536		pF
C <sub>o(er)</sub> <sup>(3)</sup>	Equivalent output capacitance energy related			146		pF
R <sub>G</sub>	Intrinsic gate resistance	f = 1 MHz open drain		1.3		Ω
Q <sub>g</sub>	Total gate charge	V <sub>CC</sub> = 520 V, I <sub>D</sub> = 25 A, V <sub>GS</sub> = 10 V		143		nC
Q <sub>gs</sub>	Gate-emitter charge			38		nC
Q <sub>gd</sub>	Gate-collector charge			64		nC

1. Defined by design, not subject to production test.

2. C<sub>o(tr)</sub> is a constant capacitance value that gives the same stored energy as C<sub>oSS</sub> while V<sub>DS</sub> is rising from 0 to 80% V<sub>DSS</sub>.

3. C<sub>o(er)</sub> is a constant capacitance value that gives the same stored energy as C<sub>oSS</sub> while V<sub>DS</sub> is rising from 0 to 80% V<sub>DSS</sub>.

## 1.2 SiC Schottky diode

**Table 4. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{RRM}$	Repetitive peak reverse voltage	650	V
$T_J$	Maximum junction temperature	150	°C
$T_{Jop}$	Operative junction temperature range	-40 to 150	°C

**Table 5. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case (each diode)	1.65	°C/W

**Table 6. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
			$V_F$	Forward voltage drop	$I_F = 20\text{ A}$		$T_J = 25\text{ °C}$
			$T_J = 150\text{ °C}$	-	1.49	-	
$I_R$	Reverse leakage current	$V_R = 650\text{ V}$	$T_J = 25\text{ °C}$	-	30	-	µA
			$T_J = 150\text{ °C}$	-	280	-	

## 1.3 DC link capacitor

**Table 7. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{MAX}$	Maximum DC voltage	630	V
$T_{Jop}$	Operative junction temperature range	-40 to 150	°C

**Table 8. Electrical characteristics**

Symbol	Parameter	Value	Unit
C	Capacitance value	47	nF
	Tolerance	±10	%

## 1.4 NTC (B57451V5103G362)

**Table 9. 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		k $\Omega$
$\Delta R_{25}/R$	Resistance tolerance		-2		+2	%
$R_{100}$	Resistance rating	T = 100 °C		674.8		$\Omega$
$\Delta R_{100}/R$	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 ( $\pm 1\%$ )		4000		
T	Operating temperature range		-40		150	°C

**Figure 1. NTC typical resistance vs temperature**

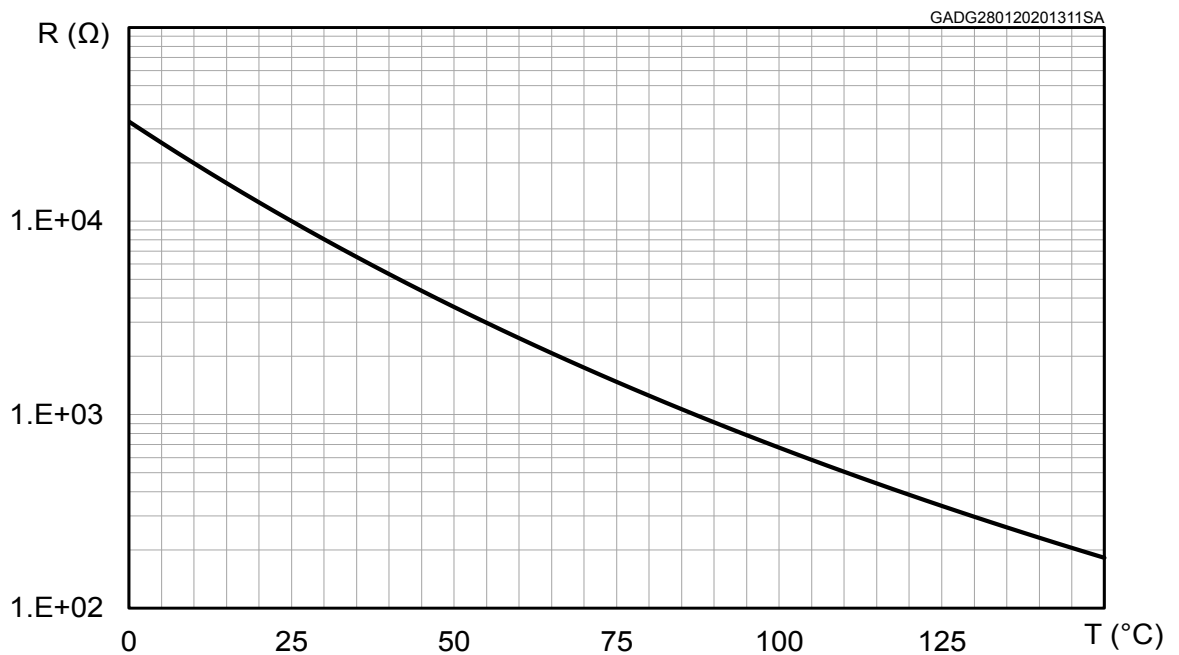
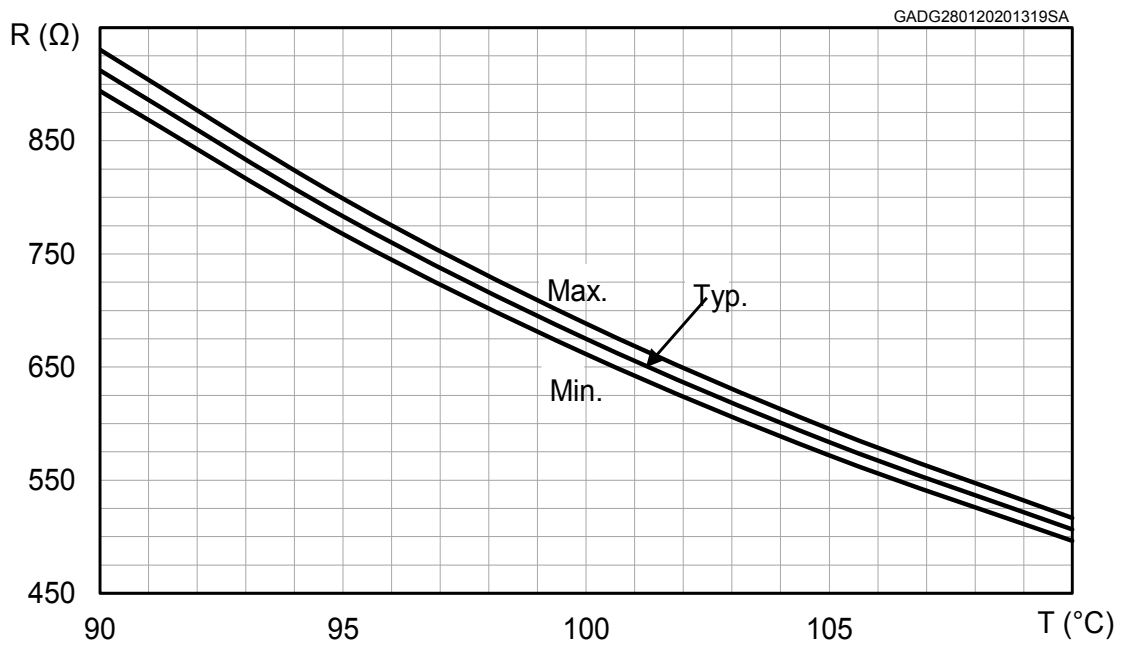


Figure 2. NTC resistance vs temperature, zoom



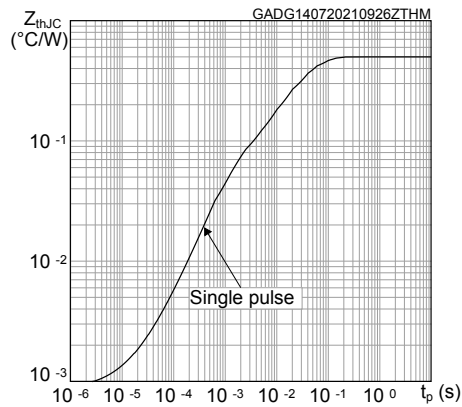
## 1.5 Package

Table 10. Absolute maximum ratings for ACEPACK 1 package

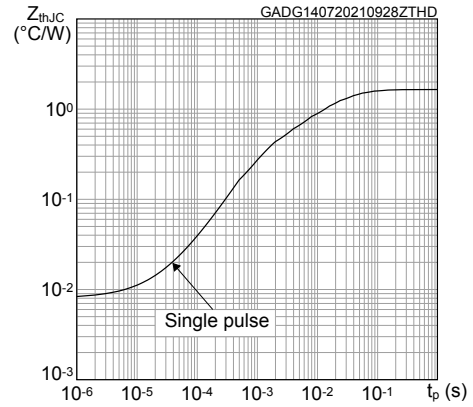
Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{isol}$	Isolation voltage (AC voltage $t = 60$ s)		-	2.5	kV
$T_{stg}$	Storage temperature range	-40	-	125	°C

## 2 Electrical characteristics (curves)

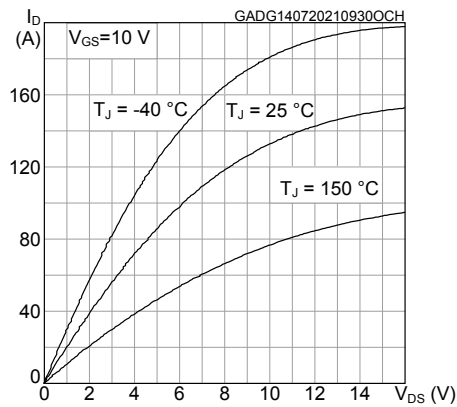
**Figure 3. Power MOSFET maximum transient thermal impedance**



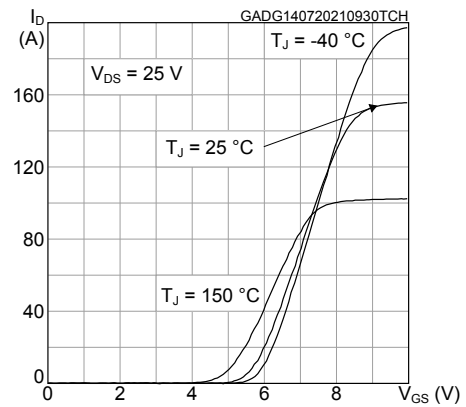
**Figure 4. Boost diode maximum transient thermal impedance**



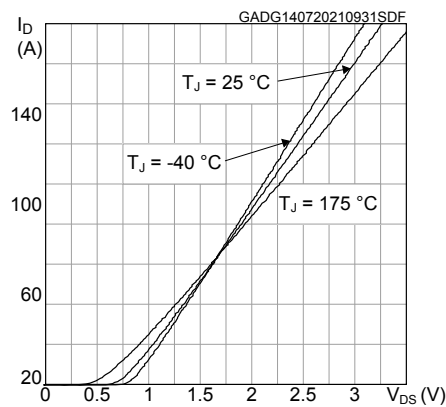
**Figure 5. Power MOSFET typical output characteristics**



**Figure 6. Power MOSFET typical transfer characteristics**

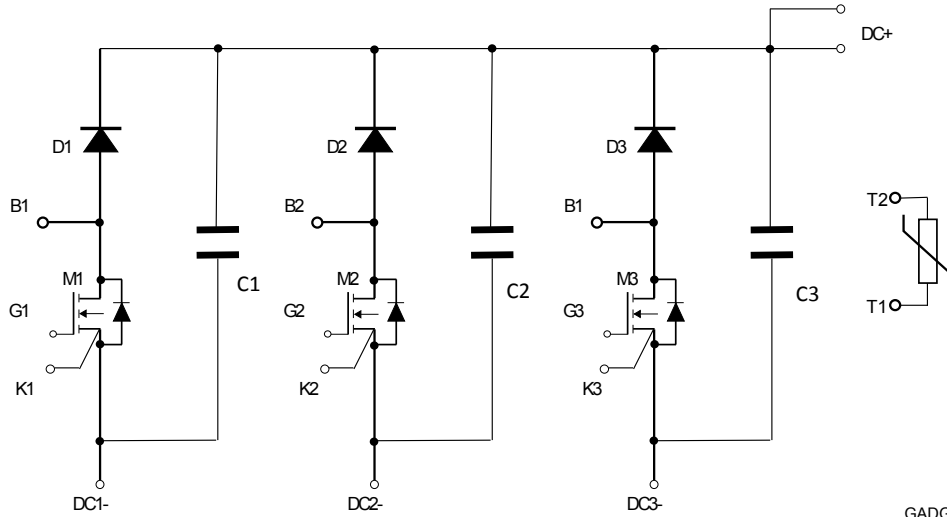


**Figure 7. Boost diode typical forward characteristics**



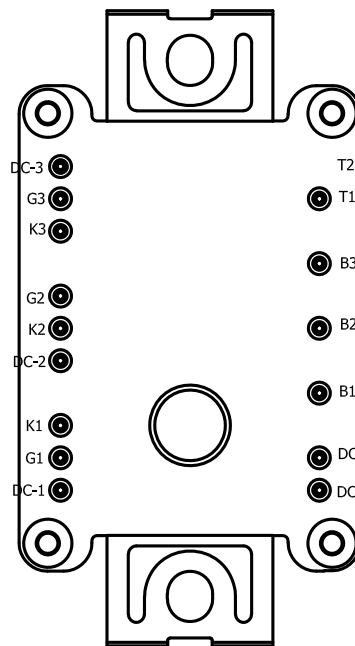
### 3 Electrical topology and pin description

Figure 8. Electrical topology and pin description



GADG130720211018SA

Figure 9. Package top view with pinout



GADG130720211000SA

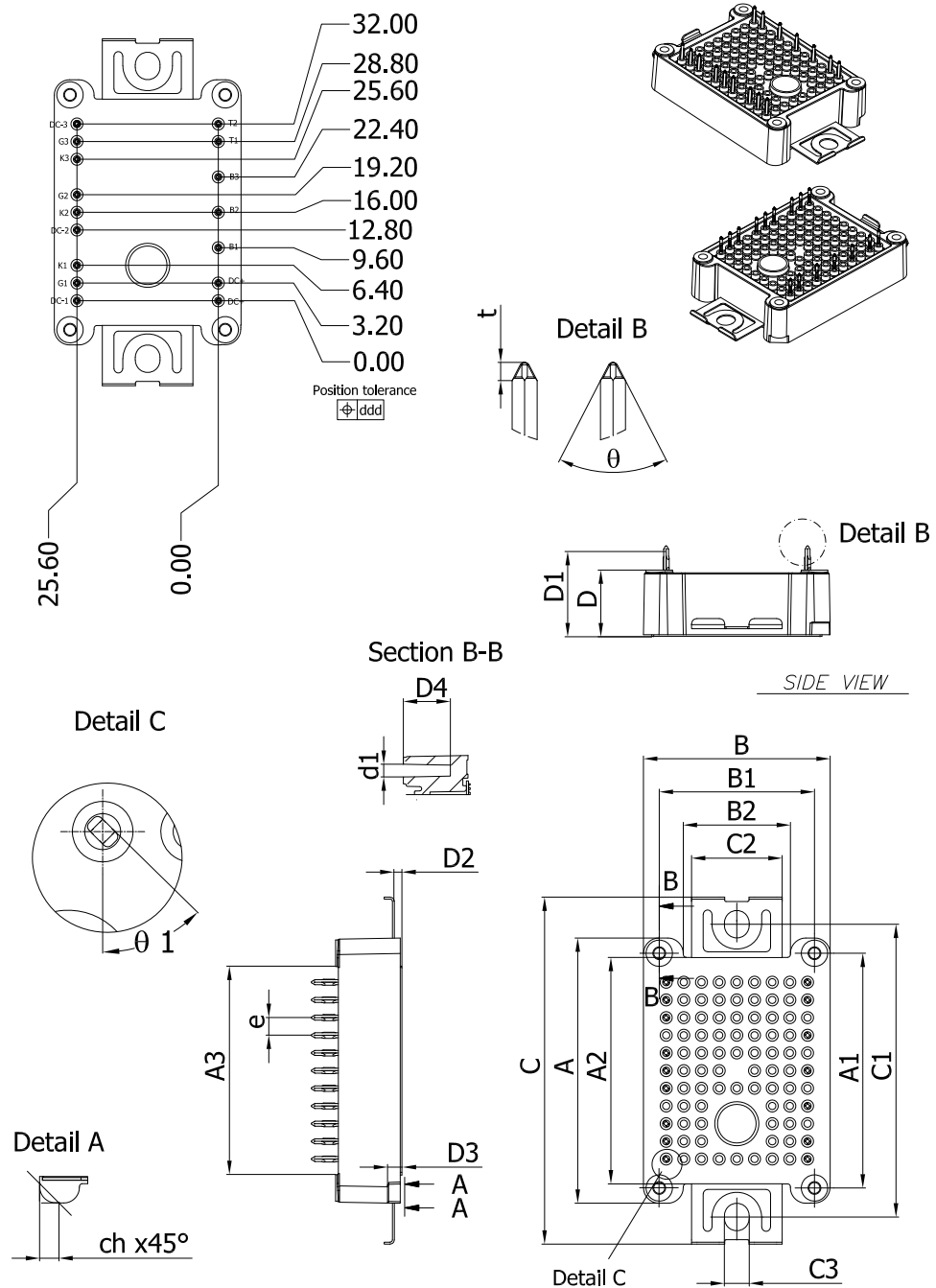


## 4 Package information

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](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 ACEPACK 1 triple boost press fit package information

**Figure 10. ACEPACK 1 triple boost press fit package outline (dimensions are in mm)**

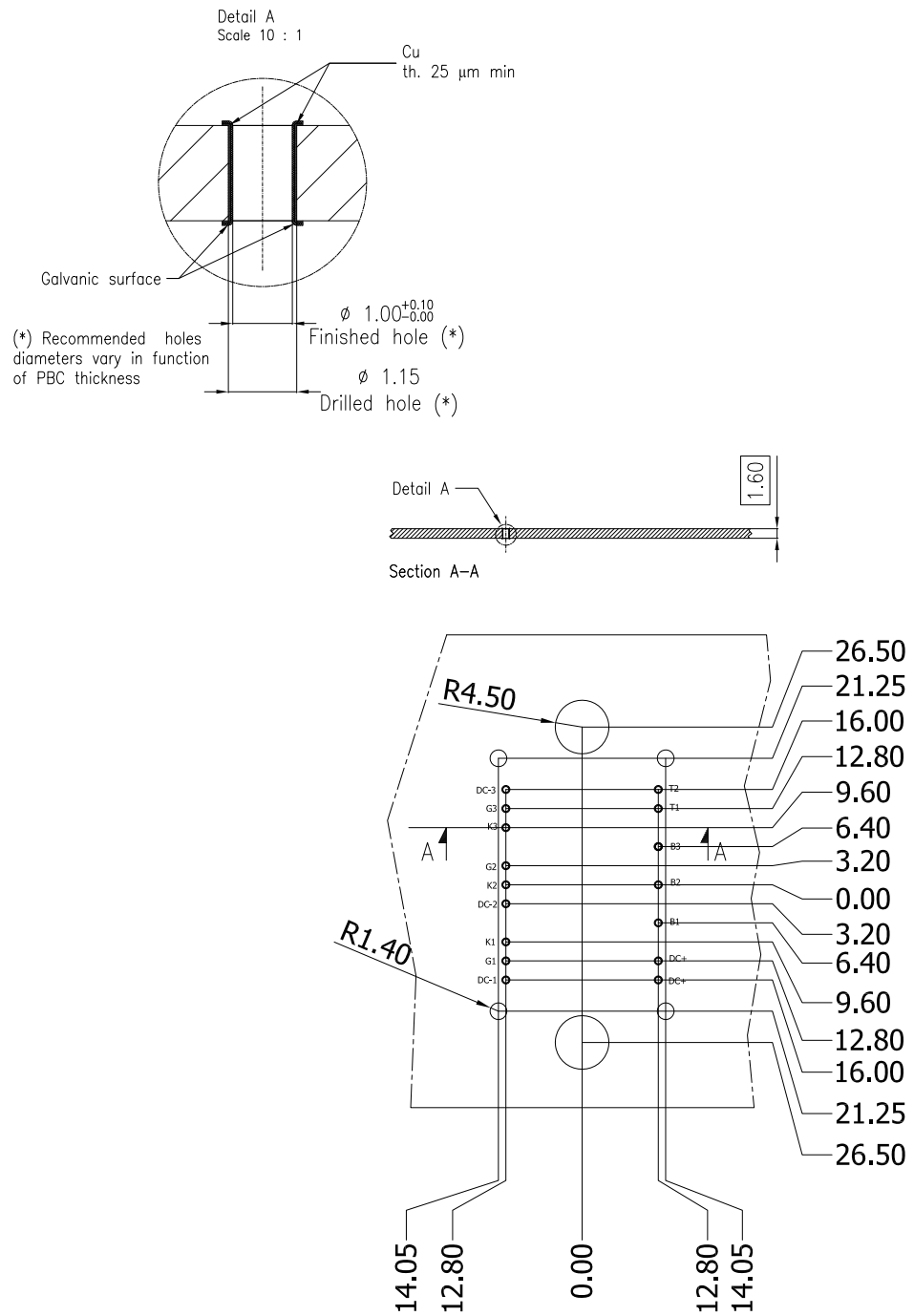


8569715\_Rev9\_triple\_boost

**Table 11. ACEPACK 1 triple boost press fit package mechanical data**

Ref.	mm		
	Min.	Typ.	Max.
A	47.70	48.00	48.30
A1	42.30	42.50	42.70
A2	40.80	41.00	41.20
A3	36.80 REF		
B	33.50	33.80	34.10
B1	27.90	28.10	28.30
B2	19.20	19.40	19.60
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°	
ddd	0.40		
e	3.20 BSC		
d1	2.30 REF		
ch	3.50 REF		

**Figure 11. ACEPACK 1 triple boost press fit PCB holes layout (dimensions are in mm)**



8569715\_Rev9\_holes\_layout\_triple\_boost\_press\_fit

## Revision history

Table 12. Document revision history

Date	Revision	Changes
30-Jul-2021	1	First release.

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