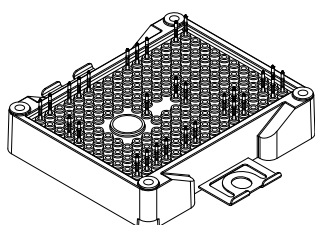
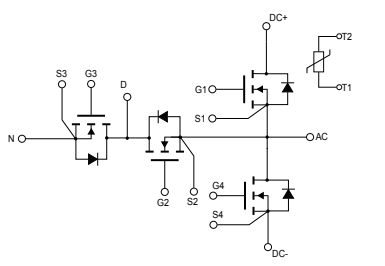


ACEPACK 2 power module, 3-level topology, 1200 V, 13 mΩ typ. SiC Power MOSFET gen.2 with NTC



ACEPACK 2



Features

- 3-level topology
- ACEPACK 2 power module
 - 13 mΩ of typical $R_{DS(on)}$ each switch
 - Insulation voltage UL certified of 2.5 kVrms
 - Integrated NTC temperature sensor
 - DBC Cu-Al₂O₃-Cu based
 - Press fit contact pins

Applications

- DC/DC converter

Description

This ACEPACK 2 power module represents a leg of a T-type 3-level inverter topology that integrates the advanced silicon carbide Power MOSFET technology from STMicroelectronics. This module leverages the innovative properties of the wide-bandgap SiC material and a high-thermal-performance substrate. The result is exceptionally low on-resistance per unit area and excellent switching performance that is virtually independent of temperature. An NTC sensor completes the design.



Product status link

[A2U12M12W2-F2](#)

Product summary

Order code	A2U12M12W2-F2
Marking	A2U12M12W2-F2
Package	ACEPACK 2
Packing	Tray
Leads type	Press fit

1 Electrical rating

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

Table 1. 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 $T_H = 25\text{ °C}$	75	A
I_{DM}	Repetitive peak drain current	150	A
T_J	Maximum junction temperature	175	°C
	Operating junction temperature range under switching conditions	-40 to 150	

1. Pulse width limited by maximum junction temperature.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJH}	Thermal resistance, junction-to-heat sink ($TIM = 120\text{ }\mu\text{m}$, $\lambda = 3\text{ W}\cdot\text{m}^{-1}\cdot\text{°C}^{-1}$)	0.78	°C/W

2 Electrical characteristics

Table 3. On/off-state

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	1200			V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 18\text{ V}$, $I_D = 75\text{ A}$		13	17	mΩ
		$V_{GS} = 18\text{ V}$, $I_D = 75\text{ A}$, $T_J = 150\text{ °C}$		20		
$V_{GS(th)}$	Gate threshold voltage	$I_D = 10\text{ mA}$, $V_{DS} = V_{GS}$	1.9	3.0	4.9	V
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 1200\text{ V}$, $V_{GS} = 0\text{ V}$			200	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0$, $V_{GS} = -10\text{ to }22\text{ V}$			±1	μA
C_{iss}	Input capacitance	$f = 1\text{ MHz}$, $V_{DS} = 800\text{ V}$, $V_{GS} = 0\text{ V}$		7000		pF
C_{oss}	Output capacitance			352		pF
C_{rss}	Reverse transfer capacitance			56		pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$		1		Ω
Q_g	Total gate charge	$V_{DS} = 450\text{ V}$, $V_{GS} = -5\text{ to }18\text{ V}$, $I_D = 100\text{ A}$		298		nC
Q_{gs}	Gate-source charge			97		nC
Q_{gd}	Gate-drain charge			108		nC

Table 4. Switching energy

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	$V_{DS} = 450\text{ V}$, $I_D = 75\text{ A}$, $R_{G(on)} = 5.6\text{ Ω}$, $R_{G(off)} = 1\text{ Ω}$, $V_{GS} = -5\text{ to }18\text{ V}$	-	0.52	-	mJ
E_{off}	Turn-off switching energy		-	0.32	-	
E_{on}	Turn-on switching energy	$V_{DS} = 450\text{ V}$, $I_D = 75\text{ A}$, $R_{G(on)} = 5.6\text{ Ω}$, $R_{G(off)} = 1\text{ Ω}$, $V_{GS} = -5\text{ to }18\text{ V}$, $T_J = 150\text{ °C}$	-	0.46	-	mJ
E_{off}	Turn-off switching energy		-	0.33	-	

Table 5. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD}	Forward on voltage drop	$V_{GS} = 0\text{ V}$, $I_{SD} = 75\text{ A}$	-	2.9	-	V
E_{rr}	Reverse recovery energy	$V_{DD} = 450\text{ V}$, $I_{SD} = 75\text{ A}$, $V_{GS} = -5\text{ V}$	-	182	-	μJ
t_{rr}	Reverse recovery time		-	20	-	ns
Q_{rr}	Reverse recovery charge		-	546	-	nC
I_{RRM}	Reverse recovery current		-	46	-	A

2.1 Electrical characteristics (curves)

Figure 1. Typical output characteristics ($T_J = -40\text{ }^{\circ}\text{C}$)

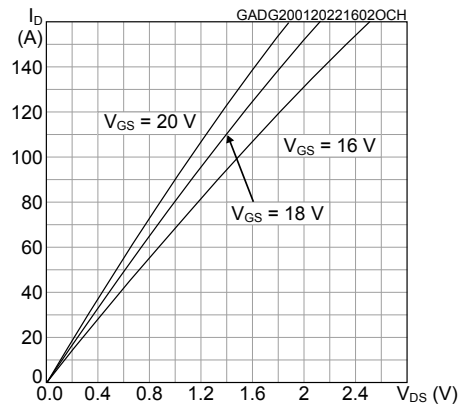


Figure 2. Typical output characteristics ($T_J = 25\text{ }^{\circ}\text{C}$)

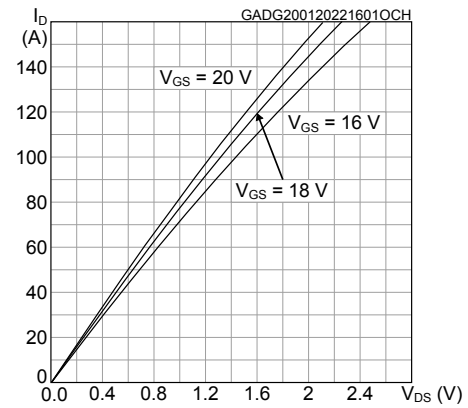


Figure 3. Typical output characteristics ($T_J = 150\text{ }^{\circ}\text{C}$)

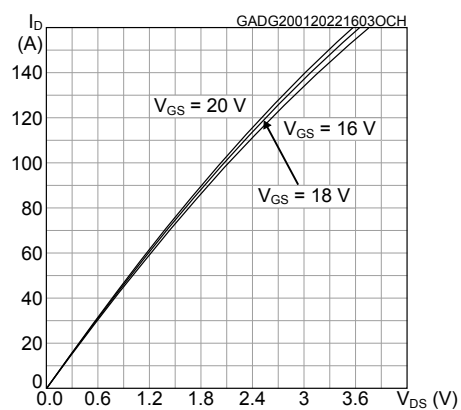


Figure 4. Typical transfer characteristics

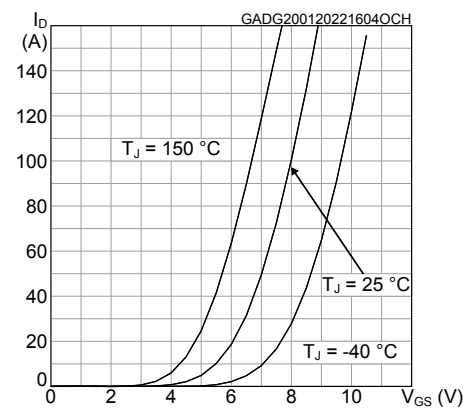


Figure 5. Typical diode forward characteristics (terminal)

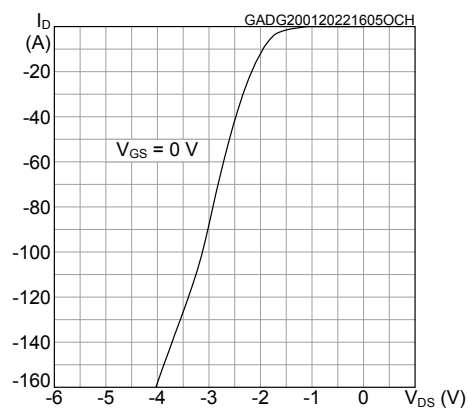


Figure 6. Typical gate charge characteristics

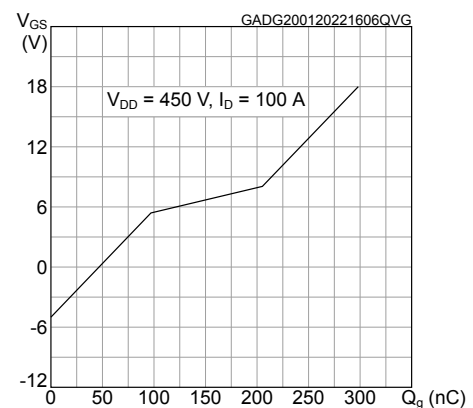


Figure 7. Typical switching energy vs drain current
($T_J = 25^\circ\text{C}$)

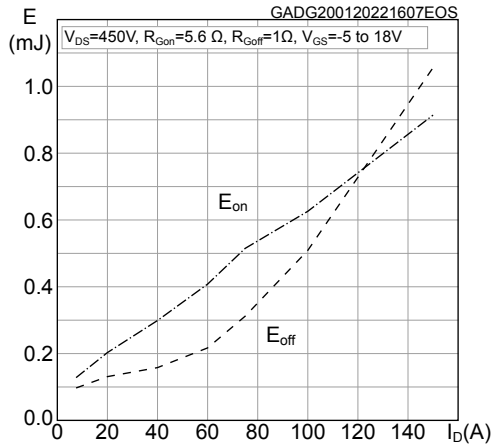


Figure 8. Typical switching energy vs drain current
($T_J = 150^\circ\text{C}$)

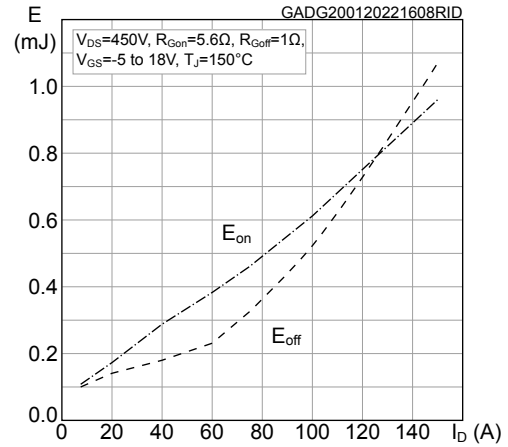


Figure 9. Typical switching energy vs gate resistance
($T_J = 25^\circ\text{C}$)

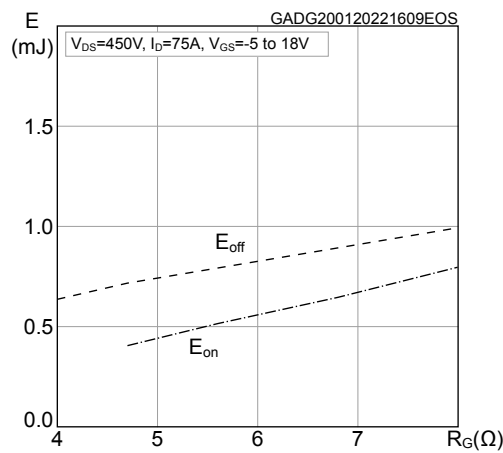


Figure 10. Typical switching energy vs gate resistance
($T_J = 150^\circ\text{C}$)

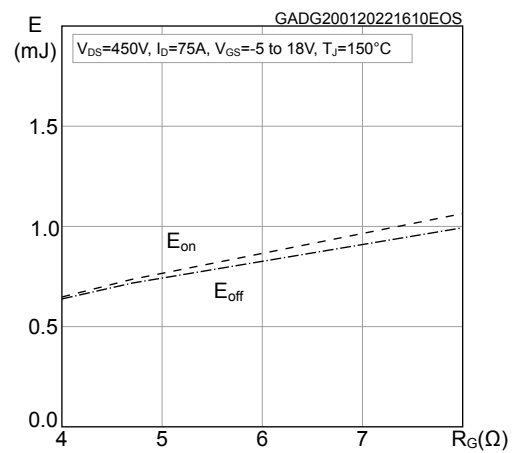


Figure 11. Typical switching energy vs temperature

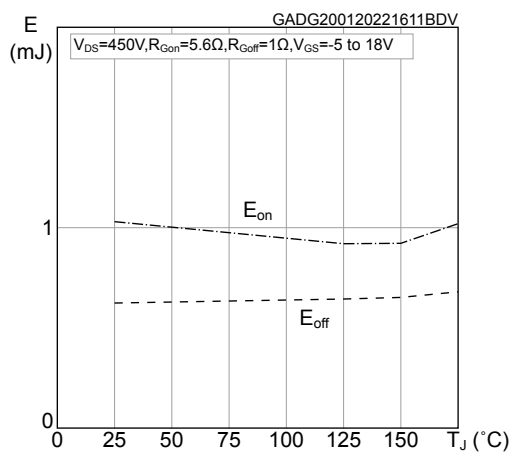


Figure 12. Typical switching energy vs V_{GS} ($T_J = 25^\circ\text{C}$)

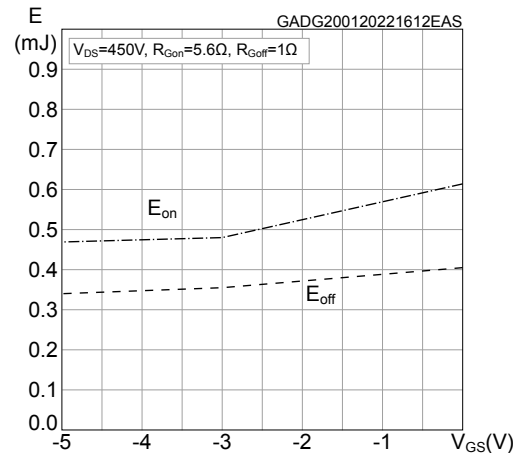


Figure 13. Typical switching energy vs V_{GS} ($T_J = 150^\circ\text{C}$)

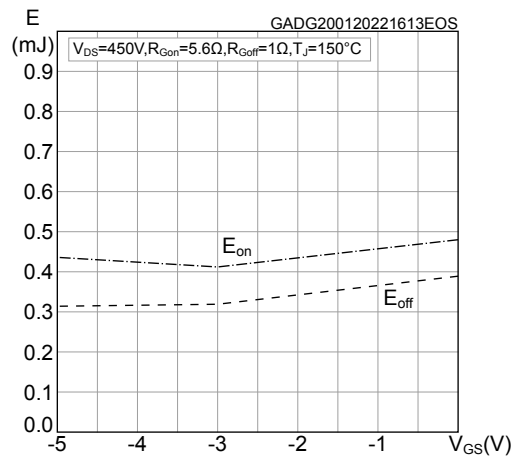
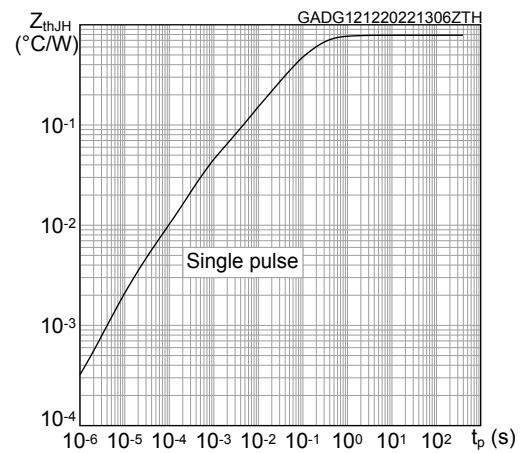


Figure 14. Maximum transient thermal impedance



3 NTC

Table 6. Absolute maximum ratings for NTC temperature sensor, considered as stand-alone

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
R_{25}	Resistance rating	$T = 25\text{ }^{\circ}\text{C}$		5		$\text{k}\Omega$
R_{100}	Resistance rating	$T = 100\text{ }^{\circ}\text{C}$		493		Ω
$\Delta R_{100}/R$	Resistance tolerance		-5		5	%
B	B value	$T = 25\text{ to }50\text{ }^{\circ}\text{C}$		3375		K
		$T = 25\text{ to }85\text{ }^{\circ}\text{C}$		3411		
T	Operating temperature range		-40		150	$^{\circ}\text{C}$

Figure 15. NTC typical resistance vs temperature

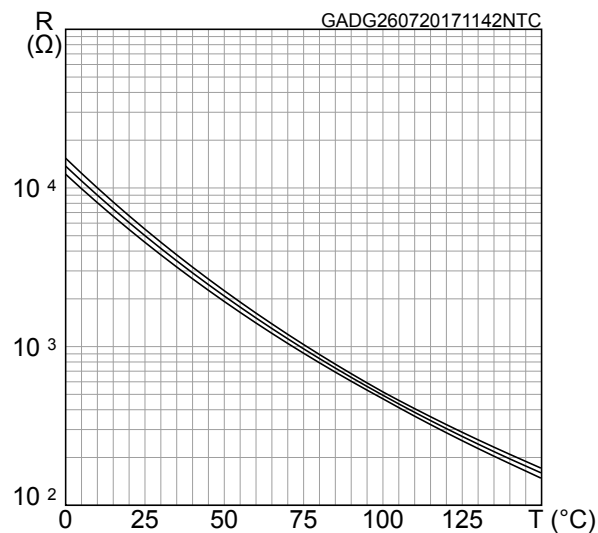
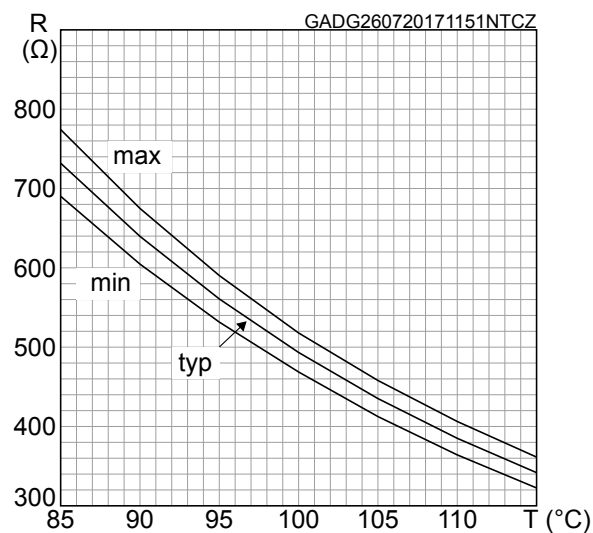


Figure 16. NTC resistance vs temperature, zoom



4 Package

Table 7. ACEPACK 2 package

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{ISO}	Isolation withstand voltage applied between each pin and heat sink plate (AC voltage, $t = 60$ s)	2.5			kVrms
M_d	Mounting torque (M4 screw)	2.0		2.3	N•m
CTI	Comparative tracking index	200			
L_s	Stray inductance module loop		10		nH
T_{stg}	Storage temperature range	-40		125	°C

5

Figure 17. Electrical topology and pin description

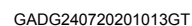


Figure 18. Package top view with pinout

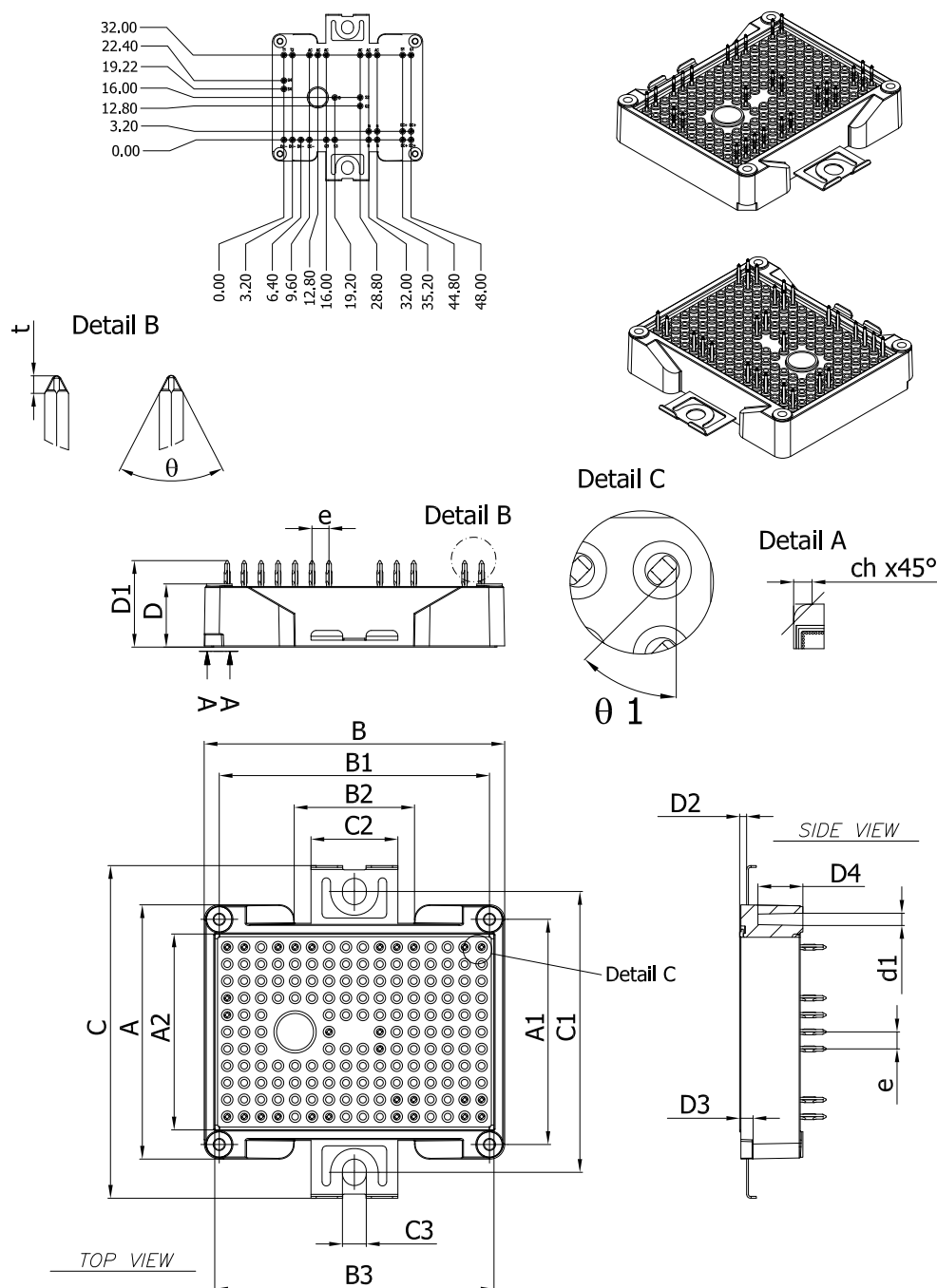


6 Package information

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.

6.1 ACEPACK 2 3-level T-type press fit package information

Figure 19. ACEPACK 2 3-level T-type press fit package outline (dimensions are in mm)

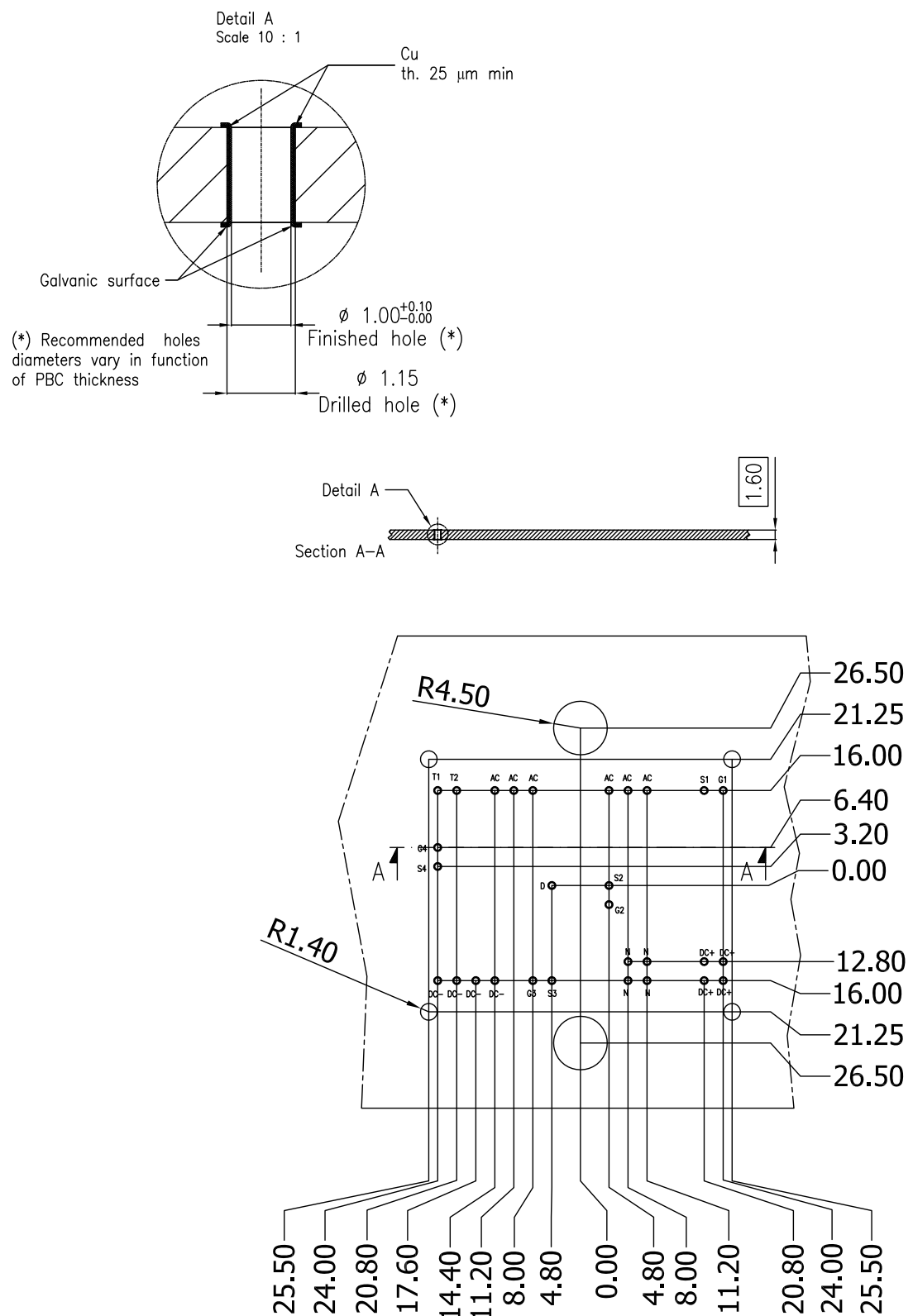


8569722 12 3L T-type

Table 8. ACEPACK 2 3-level T-type 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 20. ACEPACK 2 3-level T-type press fit recommended PCB holes layout (dimensions are in mm)



8569722_12_3L_T-type_recomm_PCB_hol_lay

Revision history

Table 9. Document revision history

Date	Revision	Changes
14-Sep-2021	1	First release.
11-Feb-2022	2	Updated title, features and description in cover page. Updated <i>Table 2. Thermal data</i> , <i>Table 3. On/off-state</i> , and <i>Table 5. Source-drain diode</i> . Updated <i>Table 7. ACEPACK 2 package</i> . Updated <i>Section 2.1 Electrical characteristics (curves)</i> . Minor text changes.
16-Mar-2023	3	Modified <i>Table 2. Thermal data</i> . Modified <i>Figure 14. Maximum transient thermal impedance</i> .

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