74AHC1G14-Q100; 74AHCT1G14-Q100

Inverting Schmitt trigger

Rev. 3 — 3 April 2020

Product data sheet

1. General description

74AHC1G14-Q100 and 74AHCT1G14-Q100 are high-speed Si-gate CMOS devices. They provide an inverting buffer function with Schmitt trigger action. These devices are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

The AHC device has CMOS input switching levels and supply voltage range 2 V to 5.5 V.

The AHCT device has TTL input switching levels and supply voltage range 4.5 V to 5.5 V.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Symmetrical output impedance
- · High noise immunity
- ESD protection:
 - MIL-STD-883, method 3015 exceeds 2000 V
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V (C = 200 pf, R = 0 Ω)
- Low power dissipation

3. Applications

- · Wave and pulse shapers
- Astable multivibrators
- Monostable multivibrators

4. Ordering information

Table 1. Ordering information

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Type number	Package											
	Temperature range	Name	Description	Version								
74AHC1G14GW-Q100	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package;	SOT353-1								
74AHCT1G14GW-Q100			5 leads; body width 1.25 mm									
74AHC1G14GV-Q100	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753								
74AHCT1G14GV-Q100	_											



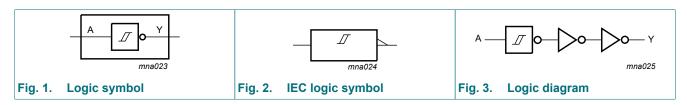
5. Marking

Table 2. Marking codes

Type number	Marking code[1]
74AHC1G14GW-Q100	AF
74AHCT1G14GW-Q100	CF
74AHC1G14GV-Q100	A14
74AHCT1G14GV-Q100	C14

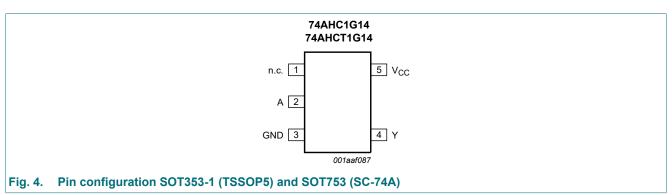
^[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

6. Functional diagram



7. Pinning information

7.1. Pinning



7.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
n.c.	1	not connected
A	2	data input
GND	3	ground (0 V)
Υ	4	data output
Vcc	5	supply voltage

8. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

Input	Output
A	Υ
L	Н
Н	L

9. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		-0.5	+7.0	V
VI	input voltage		-0.5	+7.0	V
I _{IK}	input clamping current	V _I < -0.5 V	-20	-	mA
I _{OK}	output clamping current	$V_O < -0.5 \text{ V or } V_O > V_{CC} + 0.5 \text{ V}$ [1]	-	±20	mA
I _O	output current	$-0.5 \text{ V} < \text{V}_{\text{O}} < \text{V}_{\text{CC}} + 0.5 \text{ V}$	-	±25	mA
I _{CC}	supply current		-	75	mA
I _{GND}	ground current		-75	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	total power dissipation	$T_{amb} = -40 ^{\circ}\text{C to } +125 ^{\circ}\text{C}$ [2]	-	250	mW

^[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

10. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	74AH	1C1G14-	Q100	74AH	Unit		
			Min	Тур	Max	Min	Тур	Max	
V_{CC}	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
VI	input voltage		0	-	5.5	0	-	5.5	V
Vo	output voltage		0	-	V _{CC}	0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	-40	+25	+125	°C

^[2] For SOT353-1 (TSSOP5) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C. For SOT753 (SC-74A) package: P_{tot} derates linearly with 3.8 mW/K above 85 °C.

11. Static characteristics

Table 7. Static characteristics

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		25 °C		-40 °C	to +85 °C	-40 °C t	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	1
For type	74AHC1G14-Q	100				'				
V _{OH}	HIGH-level	$V_I = V_{T+}$ or V_{T-}								
	output voltage	I _O = -50 μA; V _{CC} = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I _O = -50 μA; V _{CC} = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I _O = -50 μA; V _{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -4.0 mA; V _{CC} = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
		I _O = -8.0 mA; V _{CC} = 4.5 V	3.94	-	-	3.8	-	3.70	-	V
V _{OL}	LOW-level	$V_I = V_{T+}$ or V_{T-}								
	output voltage	I _O = 50 μA; V _{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 50 μA; V _{CC} = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 50 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		I _O = 8.0 mA; V _{CC} = 4.5 V	-	-	0.36	-	0.44	-	0.55	V
l _l	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	1.0	-	10	-	40	μΑ
Cı	input capacitance		-	1.5	10	-	10	-	10	pF
For type	74AHCT1G14-	Q100					1	ı		
V _{OH}	HIGH-level	$V_{I} = V_{T+} \text{ or } V_{T-}; V_{CC} = 4.5 \text{ V}$								
	output voltage	I _O = -50 μA	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -8.0 mA	3.94	-	-	3.8	-	3.70	-	V
V _{OL}	LOW-level	$V_{I} = V_{T+} \text{ or } V_{T-}; V_{CC} = 4.5 \text{ V}$								
	output voltage	Ι _Ο = 50 μΑ	-	0	0.1	-	0.1	-	0.1	V
		I _O = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
l _l	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	1.0	-	10	-	40	μΑ
ΔI _{CC}	additional supply current	per input pin; $V_I = 3.4 \text{ V}$; other inputs at V_{CC} or GND; $I_O = 0 \text{ A}$; $V_{CC} = 5.5 \text{ V}$	-	-	1.35	-	1.5	-	1.5	mA
C _I	input capacitance		-	1.5	10	-	10	-	10	pF

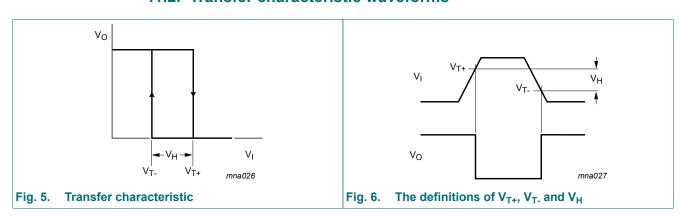
11.1. Transfer characteristics

Table 8. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V). See Fig. 5 and Fig. 6.

Symbol	Parameter	Conditions		25 °C		-40 °C	to +85 °C	-40 °C t	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
For type	74AHC1G14-Q1	00								'
V _{T+}	positive-going	V _{CC} = 3.0 V	-	-	2.2	-	2.2	-	2.2	V
	threshold voltage	V _{CC} = 4.5 V	-	-	3.15	-	3.15	-	3.15	V
	Voltage	V _{CC} = 5.5 V	-	-	3.85	-	3.85	-	3.85	V
V _{T-}	negative-going	V _{CC} = 3.0 V	0.9	-	-	0.9	-	0.9	-	V
	threshold voltage	V _{CC} = 4.5 V	1.35	-	-	1.35	-	1.35	-	V
	voitage	V _{CC} = 5.5 V	1.65	-	-	1.65	-	1.65	-	V
V _H	hysteresis voltage	V _{CC} = 3.0 V	0.3	-	1.2	0.3	1.2	0.25	1.2	V
		V _{CC} = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V _{CC} = 5.5 V	0.5	-	1.6	0.5	1.6	0.45	1.6	V
For type	74AHCT1G14-0	100	,							
V _{T+}	positive-going	V _{CC} = 4.5 V	-	-	2.0	-	2.0	-	2.0	V
	threshold voltage	V _{CC} = 5.5 V	-	-	2.0	-	2.0	-	2.0	V
V _{T-}	negative-going	V _{CC} = 4.5 V	0.5	-	-	0.5	-	0.5	-	V
	threshold voltage	V _{CC} = 5.5 V	0.6	-	-	0.6	-	0.6	-	V
V _H	hysteresis	V _{CC} = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
	voltage	V _{CC} = 5.5 V	0.4	-	1.6	0.4	1.6	0.35	1.6	V

11.2. Transfer characteristic waveforms



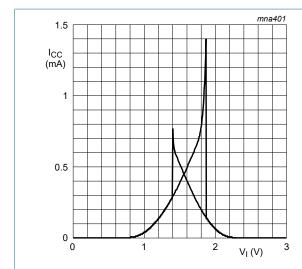


Fig. 7. Typical 74AHC1G14-Q100 transfer characteristics; V_{CC} = 3.0 V

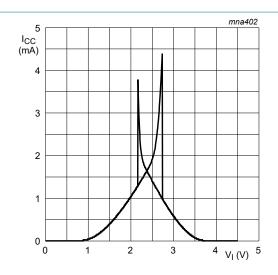


Fig. 8. Typical 74AHC1G14-Q100 transfer characteristics; V_{CC} = 4.5 V

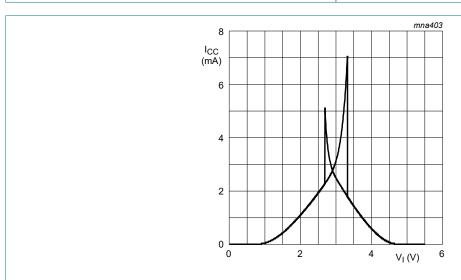


Fig. 9. Typical 74AHC1G14-Q100 transfer characteristics; $V_{CC} = 5.5 \text{ V}$

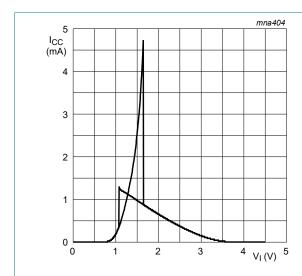


Fig. 10. Typical 74AHCT1G14-Q100 transfer characteristics; V_{CC} = 4.5 V

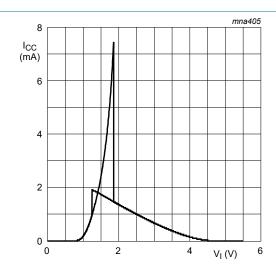


Fig. 11. Typical 74AHCT1G14-Q100 transfer characteristics; V_{CC} = 5.5 V

12. Dynamic characteristics

Table 9. Dynamic characteristics

GND = 0 V; $t_r = t_f \le 3.0$ ns. For waveform see Fig. 12. For test circuit see Fig. 13.

Symbol	Parameter	Conditions			25 °C		-40 °C	to +85 °C	-40 °C t	o +125 °C	Unit
				Min	Тур	Max	Min	Max	Min	Max	
For type	74AHC1G14	-Q100				1			1		
t _{pd}	propagation	A to Y;	[1]								
	delay	V _{CC} = 3.0 V to 3.6 V	[2]								
		C _L = 15 pF		-	4.2	12.8	1.0	15.0	1.0	16.5	ns
		C _L = 50 pF		-	6.0	16.3	1.0	18.5	1.0	20.5	ns
		V _{CC} = 4.5 V to 5.5 V	[3]								
		C _L = 15 pF		-	3.2	8.6	1.0	10.0	1.0	11.0	ns
		C _L = 50 pF		-	4.6	10.6	1.0	12.0	1.0	13.5	ns
C _{PD}	power dissipation capacitance	per buffer; $C_L = 50 \text{ pF}$; [4] f = 1 MHz; $V_I = \text{GND to } V_{CC}$		-	12	-	-	-	-	-	pF
For type	74AHCT1G1	4-Q100							l	'	
t _{pd}	propagation delay	A to Y; V _{CC} = 4.5 V to 5.5 V	[1][3]								
		C _L = 15 pF		-	4.1	7.0	1.0	8.0	1.0	9.0	ns
		C _L = 50 pF		-	5.9	8.5	1.0	10.0	1.0	11.0	ns
C _{PD}	power dissipation capacitance	per buffer; V _I = GND to V _{CC}	[4]	-	13	-	-	-	-	-	pF

 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ where:

 f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in Volts.

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 t_{pd} is the same as t_{PLH} and t_{PHL} . Typical values are measured at V_{CC} = 3.3 V. Typical values are measured at V_{CC} = 5.0 V.

^[4] C_{PD} is used to determine the dynamic power dissipation P_D (μ W).

12.1. Waveform and test circuit

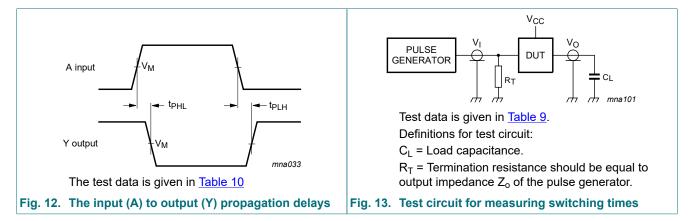


Table 10 Test data

Table 10. Test data								
Type number	Input	Input						
	V _I	V _M	V _M					
74AHC1G14-Q100	GND to V _{CC}	0.5 x V _{CC}	0.5 x V _{CC}					
74AHCT1G14-Q100	GND to 3.0 V	1.5 V	0.5 x V _{CC}					

13. Application information

The slow input rise and fall times cause additional power dissipation, which can be calculated using the following formula:

 $P_{add} = f_i x (t_r x \Delta I_{CC(AV)} + t_f x \Delta I_{CC(AV)}) x V_{CC}$ where:

- P_{add} = additional power dissipation (μW);
- f_i = input frequency (MHz);
- t_r = input rise time (ns); 10 % to 90 %;
- t_f = input fall time (ns); 90 % to 10 %;
- ΔI_{CC(AV)} = average additional supply current (µA).

Average additional I_{CC} differs with positive or negative input transitions, as shown in <u>Fig. 14</u> and <u>Fig. 15</u>.

For 74AHC1G14-Q100 and 74AHCT1G14-Q100 used in relaxation oscillator circuit, see Fig. 16.

Note to the application information:

· All values given are typical unless otherwise specified.

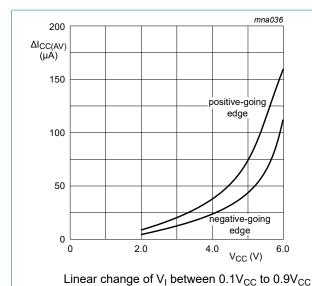
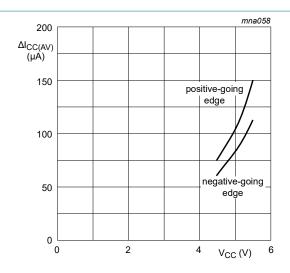
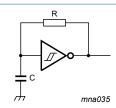


Fig. 14. Average additional I_{CC} for 74AHC1G14-Q100 Schmitt trigger devices



Linear change of V_I between $0.1V_{CC}$ to $0.9V_{CC}$

Fig. 15. Average additional I_{CC} for 74AHCT1G14-Q100 Schmitt trigger devices



 $f = \frac{1}{T} \approx \frac{1}{K \times RC}$ For K-factor, see Fig. 17

Fig. 16. Relaxation oscillator using the 74AHC1G14-Q100 and 74AHCT1G14-Q100

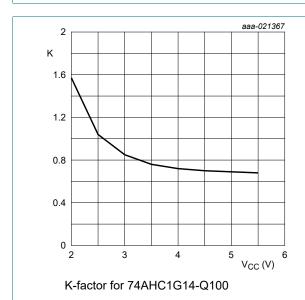
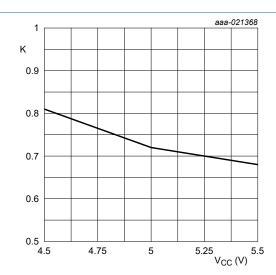


Fig. 17. Typical K-factor for relaxation oscillator

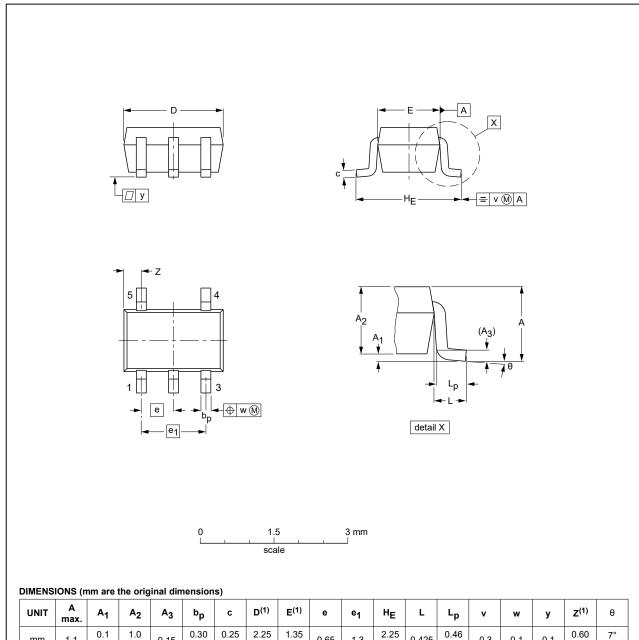


K-factor for 74AHCT1G14-Q100

14. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1



UNIT	A max.	A ₁	A ₂	А3	bp	С	D ⁽¹⁾	E ⁽¹⁾	е	e ₁	HE	L	Lp	v	w	у	Z ⁽¹⁾	θ
mm	1.1	0.1 0	1.0 0.8	0.15	0.30 0.15	0.25 0.08	2.25 1.85	1.35 1.15	0.65	1.3	2.25 2.0	0.425	0.46 0.21	0.3	0.1	0.1	0.60 0.15	7° 0°

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE		REFER	ENCES	EUROPEAN	ISSUE DATE
VERSION	IEC	JEDEC	JEITA	PROJECTION	ISSUE DATE
SOT353-1		MO-203	SC-88A		-00-09-01 03-02-19

Fig. 18. Package outline SOT353-1 (TSSOP5)

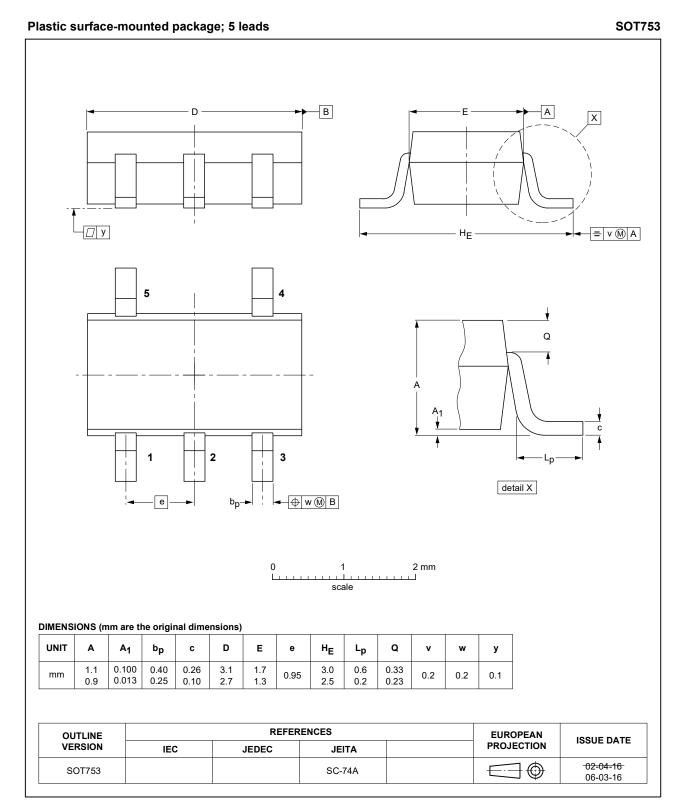


Fig. 19. Package outline SOT753 (SC-74A)

15. Abbreviations

Table 11. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
MIL	Military
MM	Machine Model
TTL	Transistor-Transistor Logic

16. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
74AHC_AHCT1G14_Q100 v.3	20200403	Product data sheet	-	74AHC_AHCT1G14_Q100 v.2	
Modifications:	 The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Table 5: Derating values for P_{tot} total power dissipation updated. 				
74AHC_AHCT1G14_Q100 v.2	20160118	Product data sheet	-	74AHC_AHCT1G14_Q100 v.1	
Modifications:	Fig. 17 added (typical K-factor for relaxation oscillator).				
74AHC_AHCT1G14_Q100 v.1	20120713	Product data sheet	-	-	

17. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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Product data sheet

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