

Product Overview

NCA8T245 is an 8-bit buffer/driver with two separate power supply. The two power supply voltages range from 1.65V to 5.5V. The A port tracks V_{CCA} and B port tracks V_{CCB} , so it supports low-voltage bidirectional shift between any of the 1.8V, 2.5V, 3.3V and 5.5V.

NCA8T245 is mainly used for asynchronous communication between two data buses. The device provides a direction-control (DIR) input for transmitting data bidirectionally. When DIR is logic high, it transmits data from A to B, and from B to A when DIR is logic low. The output-enable /OE tracks V_{CCA} and is low active, When /OE is high, the outputs are in high-impedance state. During power up and power down, /OE should be tied to VCC through a pull-up resistor to ensure the outputs high impedance state.

Each channel of NCA8T245 supports maximum 32 mA current drive when the power supply of output side ranges from 4.5V to 5.5V. All unused inputs must be held at V_{CC} or GND to prevent excess supply current.

Key Features

- Qualified for Automotive applications:
NCA8T245-Q1TSXR
- Control inputs are referenced to V_{CCA}
- Power supply voltage: 1.65V to 5.5V
- ESD Protection Exceeds JESD 22
 - 4000V Human-Body Model (A114-A)
 - 2000V Charged-Device Model (C101)
- Operation temperature: -40°C~125°C
- RoHS-compliant package: TSSOP24

Applications

- Motor driver
- Traction inverter
- Industrial automation
- Telecom

Device Information

Part Number	Package	Body Size
NCA8T245-DTSXR	TSSOP24	7.80mm × 4.40mm
NCA8T245-Q1TSXR	TSSOP24	7.80mm × 4.40mm

Functional Block Diagrams

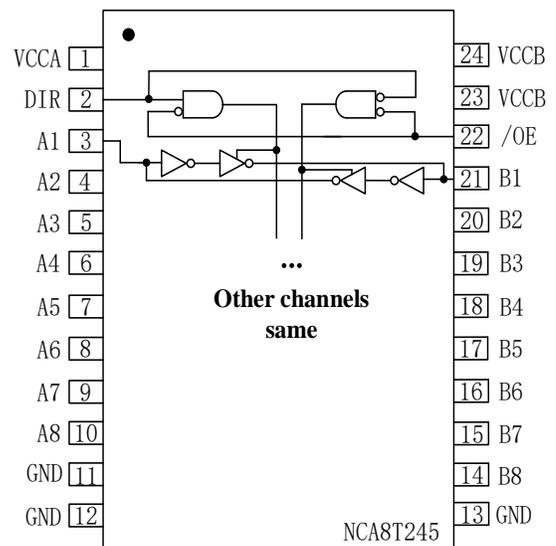


Figure 1. NCA8T245 Block Diagram

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1. Pin Configuration and Functions

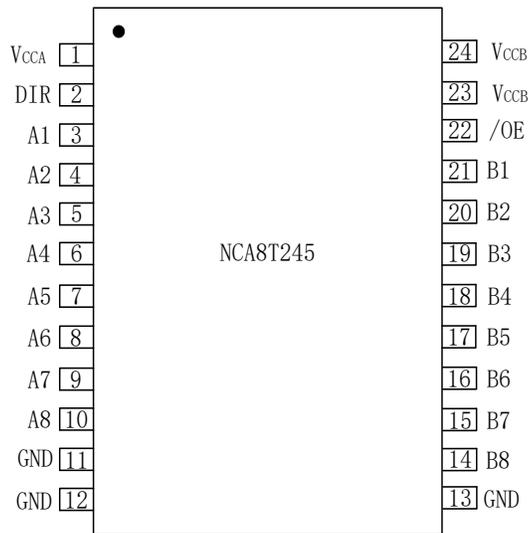


Figure 1.1 NCA8T245 Package

Table 1.1 NCA8T245 Pin Configuration and Description

NCA8T245 PIN NO.	SYMBOL	FUNCTION
1	V _{CCA}	Power supply for A side
2	DIR	Direction control, referenced to V _{CCA} . DIR is logic high, direction is from A to B while DIR is logic low, transmission is from B to A.
3	A1	Input/Output, referenced to V _{CCA}
4	A2	Input/Output, referenced to V _{CCA}
5	A3	Input/Output, referenced to V _{CCA}
6	A4	Input/Output, referenced to V _{CCA}
7	A5	Input/Output, referenced to V _{CCA}
8	A6	Input/Output, referenced to V _{CCA}
9	A7	Input/Output, referenced to V _{CCA}
10	A8	Input/Output, referenced to V _{CCA}
11	GND	Ground
12	GND	Ground
13	GND	Ground
14	B8	Input/Output, referenced to V _{CCB}
15	B7	Input/Output, referenced to V _{CCB}
16	B6	Input/Output, referenced to V _{CCB}

17	B5	Input/Output, referenced to V_{CCB}
18	B4	Input/Output, referenced to V_{CCB}
19	B3	Input/Output, referenced to V_{CCB}
20	B2	Input/Output, referenced to V_{CCB}
21	B1	Input/Output, referenced to V_{CCB}
22	/OE	Active low output enable, referenced to V_{CCA}
23	V_{CCB}	Power supply for B side
24	V_{CCB}	Power supply for B side

2. Absolute Maximum Ratings

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Power Supply Voltage	V_{CCA}, V_{CCB}	-0.5		7	V	
Input Voltage	V_I	-0.5		7	V	A, B port, control inputs
Output Voltage	V_O	-0.5		7	V	Voltage range applied to any output in the high-impedance or power-off state
		-0.5		$V_{CCA}/V_{CCB}+0.5$	V	Voltage range applied to any output in the high or low state
Input clamp current	I_{IK}			-50	mA	$V_I < 0$
Output clamp current	I_{OK}			-50	mA	$V_O < 0$
Continuous output current	I_O	-50		50	mA	$V_O=0$ to V_{CC}
		-100		100	mA	V_{CCA}, V_{CCB}, GND
Absolute Maximum Junction Temperature	T_J			150	°C	
Storage Temperature	T_{stg}	-65		150	°C	
Electrostatic discharge	HBM	-4000		4000	V	Per ANSI/ESDA/JEDEC JS-001
	CDM	-2000		2000	V	Per JEDEC specification JESD22- C101

3. Recommended Operating Conditions

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Power Supply Voltage	V_{CCA}, V_{CCB}	1.65		5.5	V	
High-level input voltage	V_{IH}	$V_{CC1}^{(1)} * 0.65$			V	V_{CC1} :1.65V to 1.95V
		1.7				V_{CC1} :2.3V to 2.7V
		2				V_{CC1} :3V to 3.6V
		$V_{CC1} * 0.7$				V_{CC1} :4.5V to 5.5V
Low-level input voltage	V_{IL}			$V_{CC1} * 0.35$	V	V_{CC1} :1.65V to 1.95V
				0.7		V_{CC1} :2.3V to 2.7V
				0.8		V_{CC1} :3V to 3.6V
				$V_{CC1} * 0.3$		V_{CC1} :4.5V to 5.5V
Input/Output Voltage	$V_{I/O}$	0		V_{CC0}	V	Active state
		0		5.5	V	3-state
High-level output current	I_{OH}	-4			mA	$V_{CC0}^{(2)}$:1.65V to 1.95V
		-8				V_{CC0} :2.3V to 2.7V
		-24				V_{CC0} :3V to 3.6V
		-32				V_{CC0} :4.5V to 5.5V
Low-level output current	I_{OL}			4	mA	V_{CC0} :1.65V to 1.95V
				8		V_{CC0} :2.3V to 2.7V
				24		V_{CC0} :3V to 3.6V
				32		V_{CC0} :4.5V to 5.5V
Input transition rise or fall rate	$\Delta t/\Delta v$			20	ns/V	V_{CC1} :1.65V to 1.95V
				20		V_{CC1} :2.3V to 2.7V
				10		V_{CC1} :3V to 3.6V
				5		V_{CC1} :4.5V to 5.5V
Operating free-air temperature	T_A	-40		125	°C	

(1) V_{CC1} is the power supply of data input port.

(2) V_{CC0} is the power supply of data output port.

4. Thermal Information

Parameters	Symbol	TSSOP24	Unit
Junction-to-ambient thermal resistance	θ_{JA}	90.6	°C/W
Junction-to-case(top) thermal resistance	$\theta_{JC (top)}$	27.6	°C/W

Junction-to-board thermal resistance	θ_{JB}	45.3	°C/W
Junction-to-top characterization parameter	Ψ_{JT}	1.3	°C/W
Junction-to-board characterization parameter	Ψ_{JB}	44.8	°C/W

5. Specifications

5.1. Electrical Characteristics

(Ta=-40°C to 125°C. Unless otherwise noted, Typical values are at Ta = 25°C)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
High-level output voltage	V_{OH}	$V_{CC0}^{(1)}-0.1$			V	$I_{OH}=-100\mu A$, $V_{CCA}=V_{CCB}=1.65$ to 4.5V
		1.2				$I_{OH}=-4mA$, $V_{CCA}=V_{CCB}=1.65V$
		1.9				$I_{OH}=-8mA$, $V_{CCA}=V_{CCB}=2.3V$
		2.4				$I_{OH}=-24mA$, $V_{CCA}=V_{CCB}=3V$
		3.8				$I_{OH}=-32mA$, $V_{CCA}=V_{CCB}=4.5V$
Low-level output voltage	V_{OL}			0.1	V	$I_{OL}=100\mu A$, $V_{CCA}=V_{CCB}=1.65$ to 4.5V
				0.45		$I_{OL}=4mA$, $V_{CCA}=V_{CCB}=1.65V$
				0.3		$I_{OL}=8mA$, $V_{CCA}=V_{CCB}=2.3V$
				0.55		$I_{OL}=24mA$, $V_{CCA}=V_{CCB}=3V$
				0.55		$I_{OL}=32mA$, $V_{CCA}=V_{CCB}=4.5V$
Input current	I_i	-2		2	μA	DIR pin $V_i=V_{CCA}$ or GND, $V_{CCA}=V_{CCB}=1.65$ to 5.5V
Shut down leakage current	I_{off}	-2		2	μA	V_i or $V_o=0$ to 5.5V, $V_{CCA}=0V$, $V_{CCB}=0$ to 5.5V
		-2		2		V_i or $V_o=0$ to 5.5V, $V_{CCA}=0$ to 5.5V, $V_{CCB}=0V$
Three-state output current	I_{oz}	-2		2	μA	$V_o = V_{CC0}$ or GND, /OE = V_{IH} $V_{CCA}=V_{CCB}=1.65$ to 5.5V
Supply current	I_{CCA}			15	μA	$V_i = V_{CC1}^{(2)}$ or GND, $I_o = 0$ $V_{CCA}=V_{CCB}=1.65$ to 5.5V
				15		$V_i = V_{CC1}$ or GND, $I_o = 0$ $V_{CCA}=5V$, $V_{CCB}=0V$
				-2		$V_i = V_{CC1}$ or GND, $I_o = 0$ $V_{CCA}=0V$, $V_{CCB}=5V$
	I_{CCB}			15	μA	$V_i = V_{CC1}$ or GND, $I_o = 0$ $V_{CCA}=V_{CCB}=1.65$ to 5.5V

				-2		$V_i = V_{CCi}$ or GND, $I_o = 0$ $V_{CCA}=5V, V_{CCB}=0V$
				15		$V_i = V_{CCi}$ or GND, $I_o = 0$ $V_{CCA}=0V, V_{CCB}=5V$
	$I_{CCA}+I_{CCB}$			25	uA	$V_i = V_{CCi}$ or GND, $I_o = 0$ $V_{CCA}=V_{CCB}=1.65$ to $5.5V$
Increasing supply current ⁽³⁾	ΔI_{CCA}			50	uA	One A port at $V_{CCA}-0.6V$, $V_{CCA}=V_{CCB}=3$ to $5.5V$ DIR at V_{CCA} , B port = open
				50		DIR at $V_{CCA}-0.6V$, B port = open, $V_{CCA}=V_{CCB}=3$ to $5.5V$ A port at V_{CCA} or GND
	ΔI_{CCB}			50	uA	One B port at $V_{CCB}-0.6V$, $V_{CCA}=V_{CCB}=3$ to $5.5V$ DIR at GND, A port = open
Input capacitance	C_i		4		pF	Control inputs
Output capacitance	C_o		8.5		pF	

- (1) V_{CCo} is the power supply of output.
- (2) V_{CCi} is the power supply of input.
- (3) The increasing of supply current for each input that is at one of the specified voltage levels, rather than 0V or V_{CC} .

5.2. Dynamic Characteristics — $V_{CCA}=1.8V \pm 0.15V$

($V_{CCA}=1.8V \pm 0.15V, T_a=-40^\circ C$ to $125^\circ C$. Unless otherwise noted, Typical values are at $T_a = 25^\circ C$) (See [figure 5.1](#))

Parameters	Symbol	$V_{CCB}=1.8V \pm 0.15V$		$V_{CCB}=2.5V \pm 0.2V$		$V_{CCB}=3.3V \pm 0.3V$		$V_{CCB}=5V \pm 0.5V$		Unit	Comments
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
		Propagation Delay	t_{PLH}	1	15	1	15	1	15		
t_{PHL}											
t_{PLH}	1		15	1	15	1	15	1	15	ns	B to A
t_{PHL}											
Enable to Data high Valid	t_{PZH}	2	25	2	25	2	25	2	25	ns	/OE to A
Enable to Data Low Valid	t_{PZL}										
Enable to Data high Valid	t_{PZH}		25		20		25		25	ns	/OE to B
Enable to Data Low Valid	t_{PZL}										
Disable high to tri-state	t_{PHZ}		25		25		25		25	ns	/OE to A

Disable low to tri-state	t_{PLZ}										
Disable high to tri-state	t_{PHZ}		25		25		25		25	ns	/OE to B
Disable low to tri-state	t_{PLZ}										

5.3. Dynamic Characteristics — $V_{CCA}=2.5V \pm 0.2V$

($V_{CCA}=2.5V \pm 0.2V$, $T_a=-40^{\circ}C$ to $125^{\circ}C$. Unless otherwise noted, Typical values are at $T_a = 25^{\circ}C$) (See [figure 5.1](#))

Parameters	Symbol	$V_{CCB}=1.8V \pm 0.15V$		$V_{CCB}=2.5V \pm 0.2V$		$V_{CCB}=3.3V \pm 0.3V$		$V_{CCB}= 5V \pm 0.5V$		Unit	Comments
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
		Propagation Delay	t_{PLH}	1.5	15	1.5	15	1.5	15		
t_{PHL}											
t_{PLH}	1.5		15	1.5	15	1.5	15	1.5	15	ns	B to A
t_{PHL}											
Enable to Data high Valid	t_{PZH}	1	20	1	20	1	20	1	20	ns	/OE to A
Enable to Data Low Valid	t_{PZL}										
Enable to Data high Valid	t_{PZH}	1	20	1	20	1	20	1	20	ns	/OE to B
Enable to Data Low Valid	t_{PZL}										
Disable high to tri-state	t_{PHZ}		20		20		20		20	ns	/OE to A
Disable low to tri-state	t_{PLZ}										
Disable high to tri-state	t_{PHZ}		20		20		20		20	ns	/OE to B
Disable low to tri-state	t_{PLZ}										

5.4. Dynamic Characteristics — $V_{CCA}=3.3V \pm 0.3V$

($V_{CCA}=3.3V \pm 0.3V$, $T_a=-40^{\circ}C$ to $125^{\circ}C$. Unless otherwise noted, Typical values are at $T_a = 25^{\circ}C$) (See [figure 5.1](#))

Parameters	Symbol	$V_{CCB}=1.8V \pm 0.15V$		$V_{CCB}=2.5V \pm 0.2V$		$V_{CCB}=3.3V \pm 0.3V$		$V_{CCB}= 5V \pm 0.5V$		Unit	Comments
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
		Propagation Delay	t_{PLH}	1.5	15	1.5	15	1.5	15		
t_{PHL}											
t_{PLH}	1.5		15	1.5	15	1.5	15	1.5	15	ns	B to A
t_{PHL}											
Enable to Data high Valid	t_{PZH}	1.5	20	1.5	20	1.5	20	1.5	20	ns	/OE to A

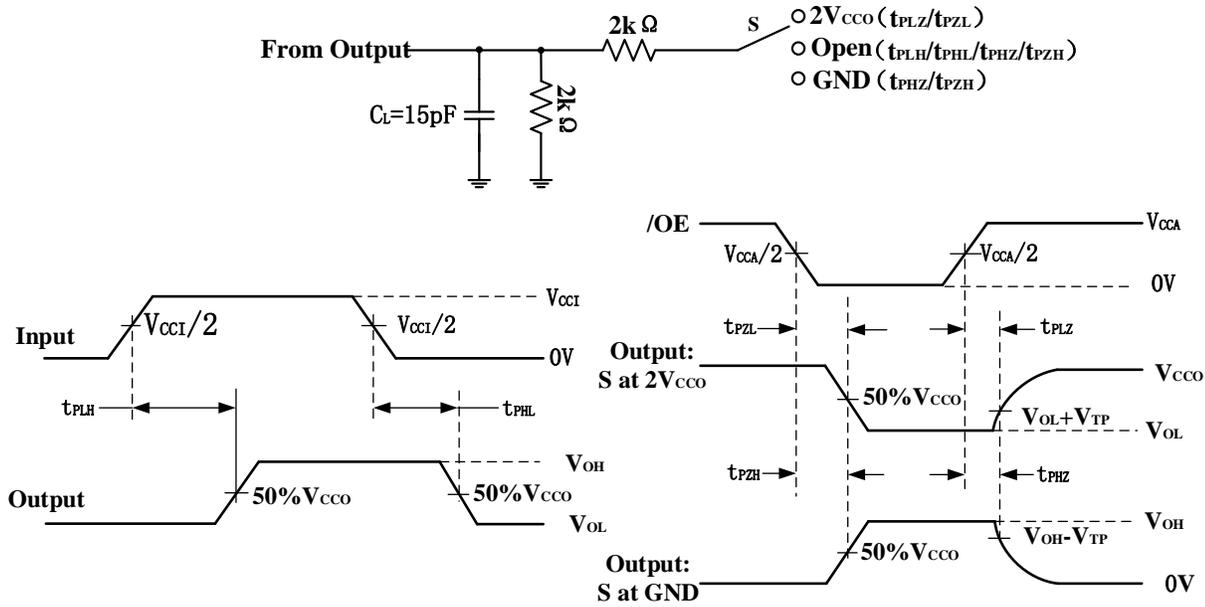
Enable to Data Low Valid	t_{PZL}										
Enable to Data high Valid	t_{PZH}	1.5	20	1.5	20	1.5	20	1.5	20	ns	/OE to B
Enable to Data Low Valid	t_{PZL}										
Disable high to tri-state	t_{PHZ}	1.5	20	1.5	20	1.5	20	1.5	20	ns	/OE to A
Disable low to tri-state	t_{PLZ}										
Disable high to tri-state	t_{PHZ}	1.5	20	1.5	20	1.5	20	1.5	20	ns	/OE to B
Disable low to tri-state	t_{PLZ}										

5.5. Dynamic Characteristics — $V_{CCA}=5V \pm 0.5V$

($V_{CCA}=5V \pm 0.5V$, $T_a=-40^{\circ}C$ to $125^{\circ}C$. Unless otherwise noted, Typical values are at $T_a = 25^{\circ}C$) (See [figure 5.1](#))

Parameters	Symbol	$V_{CCB}=1.8V \pm 0.15V$		$V_{CCB}=2.5V \pm 0.2V$		$V_{CCB}=3.3V \pm 0.3V$		$V_{CCB}=5V \pm 0.5V$		Unit	Comments
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
		Propagation Delay	t_{PLH}	1.5	25	1	20	1	10		
t_{PHL}	1.5		25	1	20	1	10	1	10	ns	B to A
t_{PZH}	1		15	1	15	1	15	1	15	ns	/OE to A
t_{PZL}	1		15	1	15	1	15	1	15	ns	/OE to B
Enable to Data high Valid	t_{PZH}	1	15	1	15	1	15	1	15	ns	/OE to A
Enable to Data Low Valid	t_{PZL}	1	15	1	15	1	15	1	15	ns	/OE to B
Disable high to tri-state	t_{PHZ}	1.5	15	1.5	15	1.5	15	1.5	15	ns	/OE to A
Disable low to tri-state	t_{PLZ}	1.5	15	1.5	15	1.5	15	1.5	15	ns	/OE to B

5.6. Parameter measurement information



Note: (1) All input pulses with the following characteristics: PRR ≤10MHz, ZO = 50 Ω, dv/dt ≥1V/ns.
 (2) VCCO=1.8V ± 0.15V or VCCO=2.5V ± 0.2V: VTP=0.15V; VCCO=3.3V ± 0.3V or VCCO=5V ± 0.5V: VTP=0.3V.

Figure 5.1. Load Circuit and Voltage Waveforms

6. Function Description

6.1. Overview

NCA8T245 is an 8-bit buffer with dual supply and bidirectional transmission. A port and control signal pin are referenced to VCCA while B port is referenced to VCCB. The supply voltages VCCA and VCCB range from 1.65V to 5.5V, so NCA8T245 can shift different voltage level. It provides eight bidirectional channels with direction control DIR and output-enable(/OE). When DIR is logic high, the direction is from A to B and when DIR is logic low, the transmission is from B to A. /OE is low active, When /OE is high, the outputs are in the high-impedance state. During power up and power down, /OE should be tied to Vcc through a pull-up resistor to ensure the high impedance state. All unused inputs of NCA8T245 must be held at Vcc or GND to prevent excess Icc.

Table 6.1 Function Table

DIR	/OE	A	B	VCCA	VCCB	Comment
L ⁽¹⁾	L	L	L	Ready	Ready	Normal operation. Transmission from B to A
L	L	H	H	Ready	Ready	
H	L	L	L	Ready	Ready	Normal operation. Transmission from A to B
H	L	H	H	Ready	Ready	
L	H	Z	X	Ready	Ready	Output Disabled, the output is high impedance.
H	H	X	Z	Ready	Ready	
X	X	Z	Z	Ready	Unready	The output follows the same status with the input after Vcc is powered on and output is enabled.
X	X	Z	Z	Unready	Ready	
X	X	Z	Z	Unready	Unready	

(1) L=Logic low; H=Logic high; X=Logic low or logic high.

7. Application Note

7.1. Application Information

The NCA8T245 can be used in voltage level-shift applications for interface device or systems requiring different voltages. The maximum output current can be up to 32 mA at 5V supply.

7.2. Typical Application Circuit

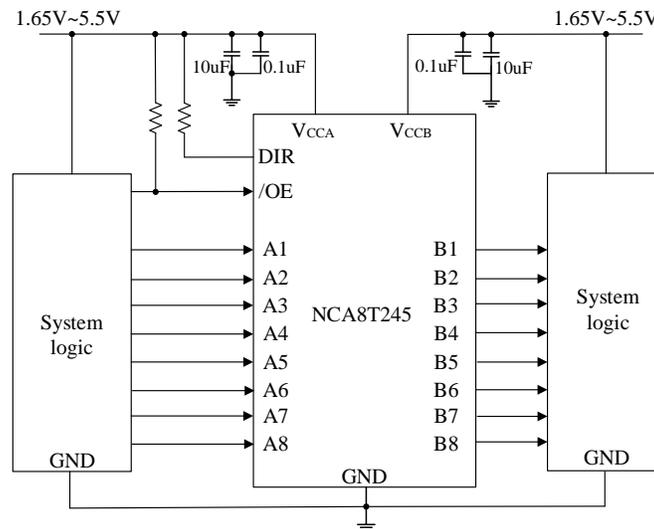


Figure 7.1 Typical application circuit for NCA8T245

8. Package Information

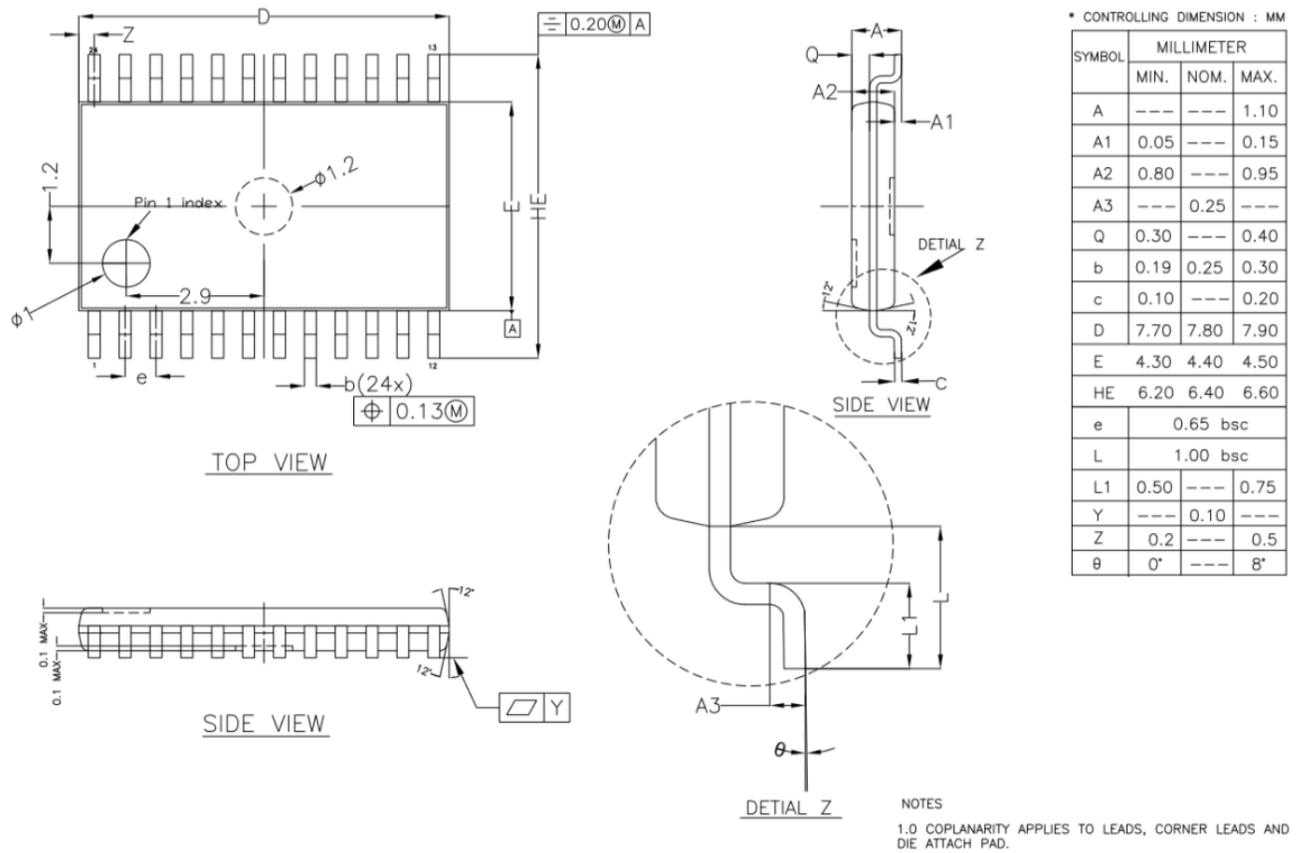


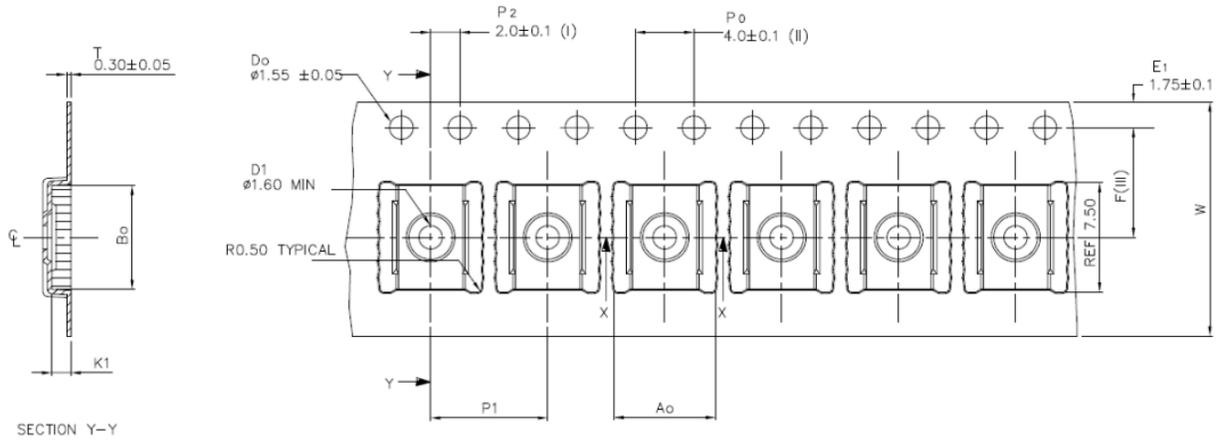
Figure 8.1 TSSOP24 Package Shape and Dimension in millimeters

9. Ordering Information

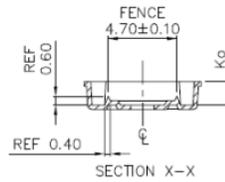
Part Number	PINS	Temperature	MSL	Package Type	Package Drawing	SPQ
NCA8T245-DTSXR	24	-40 to 125°C	1	TSSOP24	TSSOP24	2500
NCA8T245-Q1TSXR	24	-40 to 125°C	1	TSSOP24	TSSOP24	2500

NOTE: All packages are RoHS-compliant with peak reflow temperatures of 260 °C according to the JEDEC industry standard classifications and peak solder temperatures.

10. Tape and Reel Information

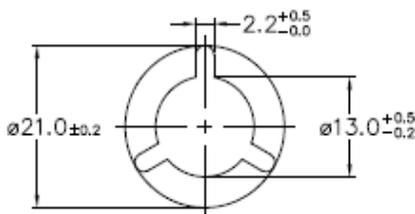
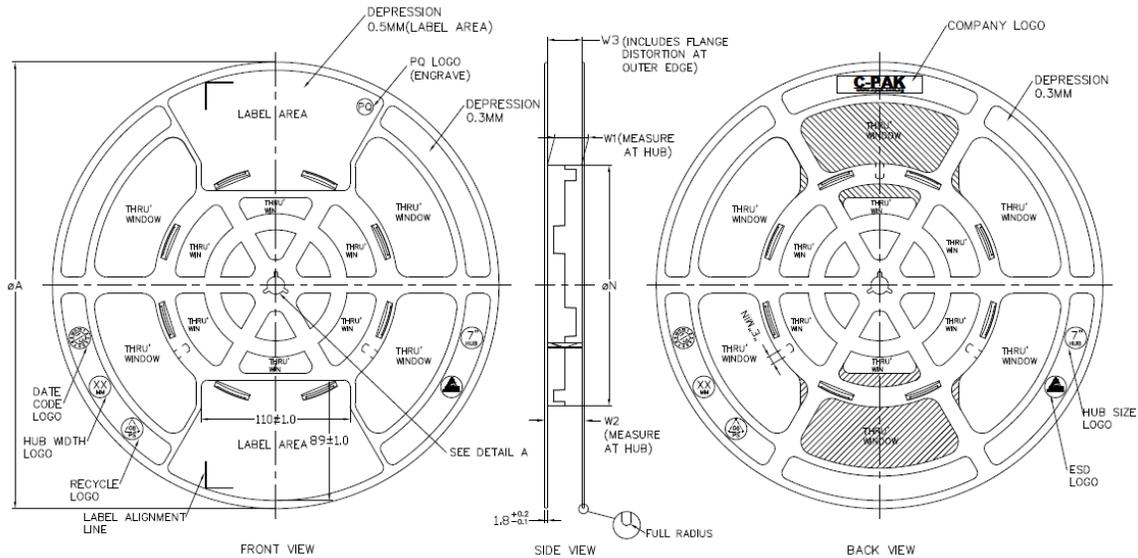


Ao	6.95 +/−0.1
B0	7.10 +/−0.1
K0	1.60 +/−0.1
K1	1.30 +/−0.1
F	7.50 +/−0.1
P1	8.00 +/−0.1
W	16.00 +/−0.3



- (I) Measured from centreline of sprocket hole to centreline of pocket.
- (II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
- (III) Measured from centreline of sprocket hole to centreline of pocket.
- (IV) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.



ARBOR HOLE
DETAIL A
SCALE : 3:1

PRODUCT SPECIFICATION						
TAPE WIDTH	øA ±2.0	øN ±2.0	W1	W2 (MAX)	W3	E (MIN)
08MM	330	178	8.4 ±0.3	14.4	SHALL ACCOMMODATE TAPE WIDTH WITHOUT INTERFERENCE	5.5
12MM	330	178	12.4 ±0.3	18.4		5.5
16MM	330	178	16.4 ±0.3	22.4		5.5
24MM	330	178	24.4 ±0.3	30.4		5.5
32MM	330	178	32.4 ±0.3	38.4		5.5

SURFACE RESISTIVITY			
LEGEND	SR RANGE	TYPE	COLOUR
A	BELOW 10 ⁹	ANTISTATIC	ALL TYPES
B	10 ⁸ TO 10 ¹¹	STATIC DISSIPATIVE	BLACK ONLY
C	10 ³ & BELOW 10 ³	CONDUCTIVE (GENERIC)	BLACK ONLY
E	10 ⁸ TO 10 ¹¹	ANTISTATIC (COATED)	ALL TYPES

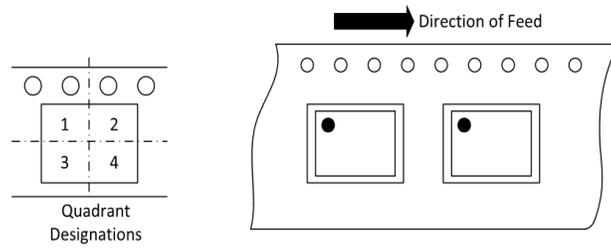


Figure 10.1 Tape and Reel Information of TSSOP

11. Revision History

Revision	Description	Date
1.0	Initial Version.	2023/4/23

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