ON Semiconductor®

NC7SZU04
TinyLogic® UHS Unbuffered Inverter

Features

- Unbuffered for Crystal Oscillator and Analog Applications
- Balanced Output Drive: ±16mA at 4.5V V_{CC}
- Broad V_{CC} Operating Range: 1.65V to 5.5V
- Matches Performance of LCX Operated at 3.3V V_{CC}
- Low Quiescent Power: I_{CC}<2µA, V_{CC}=5.5V, T_A=25°C
- Ultra-Small MicroPak™ Packages
- Space-Saving SOT23 and SC70 Packages

Description

The NC7SZU04 is a single unbuffered inverter from ON Semiconductor's Ultra-High Speed series of TinyLogic®. The special purpose unbuffered circuit design is primarily intended for crystal oscillator or analog applications. The device is fabricated with advanced CMOS technology to achieve ultra-high speed with high output drive while maintaining low static power dissipation over a broad V_{CC} operating range. The device is specified to operate over the 1.65V to 5.5V V_{CC} range.

Ordering Information

Part Number	Top Mark	Eco Status	Package	Packing Method
NC7SZU04M5X	7ZU4	RoHS	5-Lead SOT23, JEDEC MO-178 1.6mm	3000 Units on Tape & Reel
NC7SZU04P5X	ZU4	RoHS	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3000 Units on Tape & Reel
NC7SZU04L6X	C5	RoHS	6-Lead MicroPak™, 1.00mm Wide	5000 Units on Tape & Reel
NC7SZU04FHX	C5	Green	6-Lead, MicroPak2, 1x1mm Body, .35mm Pitch	5000 Units on Tape & Reel

October-2017, Rev. 2

Publication Order Number:
NC7SZU04/D

Connection Diagrams

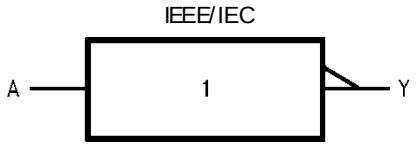


Figure 1. Logic Symbol

Pin Configurations

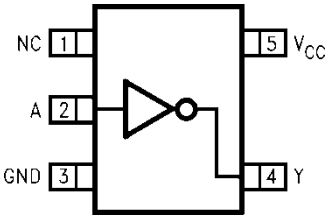


Figure 2. SC70 and SOT23 (Top View)

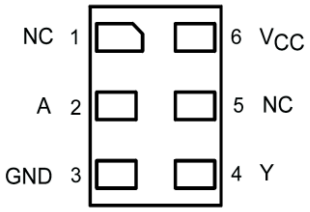


Figure 3. MicroPak (Top Through View)

Pin Definitions

Pin # SC70 / SOT23	Pin # MicroPak	Name	Description
1	1,5	NC	No Connect
2	2	A	Input
3	3	GND	Ground
4	4	Y	Output
5	6	V_{CC}	Supply Voltage

Function Table

Y = /A

Inputs	Output
A	**Y**
L	H
H	L

H = HIGH Logic Level

L = LOW Logic Level

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter		Min.	Max.	Unit
V_{CC}	Supply Voltage		-0.5	6.0	V
V_{IN}	DC Input Voltage		-0.5	6.0	V
V_{OUT}	DC Output Voltage		-0.5	6.0	V
I_{IK}	DC Input Diode Current	V_{IN} < -0.5V		-50	mA
		V_{IN} > V_{CC}+5.0V		+20	
I_{OK}	DC Output Diode Current	V_{OUT} < -0.5V		-50	mA
		V_{OUT} > 0.5V, V_{CC}=GND		+50	
I_{OUT}	DC Output Current			±50	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current			±100	mA
T_{STG}	Storage Temperature Range		-65	+150	°C
T_J	Junction Temperature Under Bias			+150	°C
T_L	Junction Lead Temperature (Soldering, 10 Seconds)			+260	°C
P_D	Power Dissipation at +85°C	SOT-23		200	mW
		SC70-5		150	
		MicroPak-6		130	
		MicroPak2-6		120	
ESD	Human Body Model, JEDEC:JESD22-A114			4000	V
	Charge Device Model, JEDEC:JESD22-C101			2000	

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. ON Semiconductor does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Conditions	Min.	Max.	Unit
V_{CC}	Supply Voltage Operating		1.65	5.50	V
	Supply Voltage Data Retention		1.50	5.50	
V_{IN}	Input Voltage		0	5.5	V
V_{OUT}	Output Voltage		0	V_{CC}	V
T_A	Operating Temperature		-40	+85	°C
θ_{JA}	Thermal Resistance	SOT-23		300	°C/W
		SC70-5		425	
		MicroPak-6		500	
		MicroPak2-6		560	

Note:

1. Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

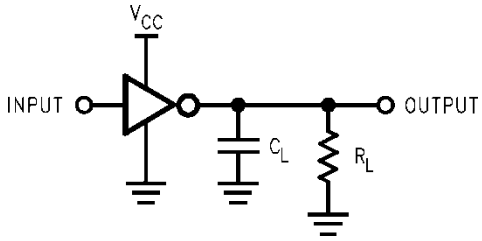
Symbol	Parameter	V_{CC}	Conditions		T_A=+25°C			T_A=-40 to +85°C		Units
					Min.	Typ.	Max.	Min.	Max.	
V_{IH}	HIGH Level Input Voltage	1.8 to 2.7			0.85V_{CC}			0.85V_{CC}		V
		3.0 to 5.5			0.80V_{CC}			0.80V_{CC}		
V_{IL}	LOW Level Input Voltage	1.8 to 2.7					0.15V_{CC}		0.15V_{CC}	V
		3.0 to 5.5					0.20V_{CC}		0.20V_{CC}	
V_{OH}	HIGH Level Output Voltage	1.65	V_{IN}=V_{IL}, I_{OH}=-100µA		1.55	1.65		1.55		V
		1.80			1.60	1.80		1.60		
		2.30			2.10	2.30		2.10		
		3.00			2.70	3.00		2.70		
		4.50			4.00	4.40		4.00		
		1.65	V_{IN}=GND	I_{OH}=-4mA	1.29	1.52		1.29		
		2.30		I_{OH}=-4mA	1.90	2.14		1.90		
		3.00		I_{OH}=-8mA	2.40	2.75		2.40		
		3.00		I_{OH}=-12mA	2.30	2.61		2.30		
		4.50		I_{OH}=-16mA	3.80	4.13		3.80		
V_{OL}	LOW Level Output Voltage	1.65	V_{IN}=V_{IH}, I_{OL}=100µA			0.00	0.10		0.10	V
		1.80				0.00	0.20		0.20	
		2.30				0.00	0.20		0.20	
		3.00				0.00	0.30		0.30	
		4.50				0.00	0.50		0.50	
		1.65	V_{IN}=V_{CC}	I_{OL}=4mA		0.80	0.24		0.24	
		2.30		I_{OL}=4mA		0.10	0.30		0.30	
		3.00		I_{OL}=8mA		0.17	0.40		0.40	
		3.00		I_{OL}=12mA		0.25	0.55		0.55	
		4.50		I_{OL}=16mA		0.226	0.55		0.55	
I_{IN}	Input Leakage Current	0 to 5.5	V_{IN}=5.5V, GND				±1		±10	µA
I_{CC}	Quiescent Supply Current	1.65 to 5.50	V_{IN}=5.5V, GND				2		20	µA
I_{CCPEAK}	Peak Supply Current in Analog Operation	1.8	V_{OUT}=Open, V_{IN}=Adjust for Peak I_{CC} Current			2				mA
		2.5				4				
		3.3				10				
		5.0				30				

AC Electrical Characteristics

Symbol	Parameter	V_{CC}	Conditions	T_A=+25°C			T_A=-40 to +85°C		Units	Figure
				Min.	Typ.	Max.	Min.	Max.		
t_{PLH}, t_{PHL}	Propagation Delay	1.65	C_L=15pF, R_L=1MΩ,	1.0		11.7	1.0	12.1	ns	Figure 4 Figure 5
		1.80		1.0		8.5	1.0	9.0		
		2.50 ± 0.20		0.8		6.2	0.8	6.5		
		3.30 ± 0.30		0.5		4.5	0.5	4.8		
		5.00 ± 0.50		0.5		3.9	0.5	4.1		
		3.30 ± 0.30	C_L=50pF, R_L=500Ω,	1.0		6.0	1.0	6.5		
		5.00 ± 0.50		0.8		5.0	0.8	5.5		
C_{IN}	Input Capacitance	0.00			4.5				pF	
C_{PD}	Power Dissipation Capacitance(2)	3.30			6.3				pF	Figure 6
		5.00			9.5					

Note:

2. C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output lading and operating at 50% duty cycle. C_{PD} is related to I_{CCD} dynamic operating current by the expression: $I_{CCD}=(C_{PD})(V_{CC})(f_{IN})+(I_{CC}static)$.



Note:

3. C_L includes load and stray capacitance.
4. Input PRR=1.0MHz; t_W=500ns

Figure 4. AC Test Circuit

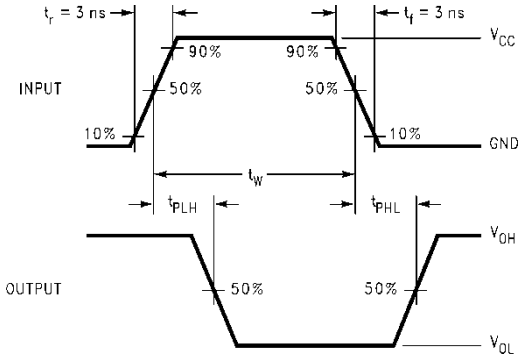
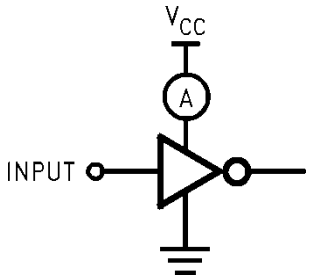


Figure 5. AC Waveforms



Note:

5. When operating the NC7SZU04's unbuffered output stage in its linear range, as in oscillator applications, care must be taken to observe maximum power rating for the device and package. The high drive nature of the design of the output stage results in substantial simultaneous conduction currents when the stage is in the linear region. *See the I_{CCPEAK} specification in the DC Electrical Characteristics table*.
6. Input=AC Waveform; t_r=t_f=1.8ns; PRR=variable; Duty Cycle =50%.

Figure 6. Test Circuit

Physical Dimensions

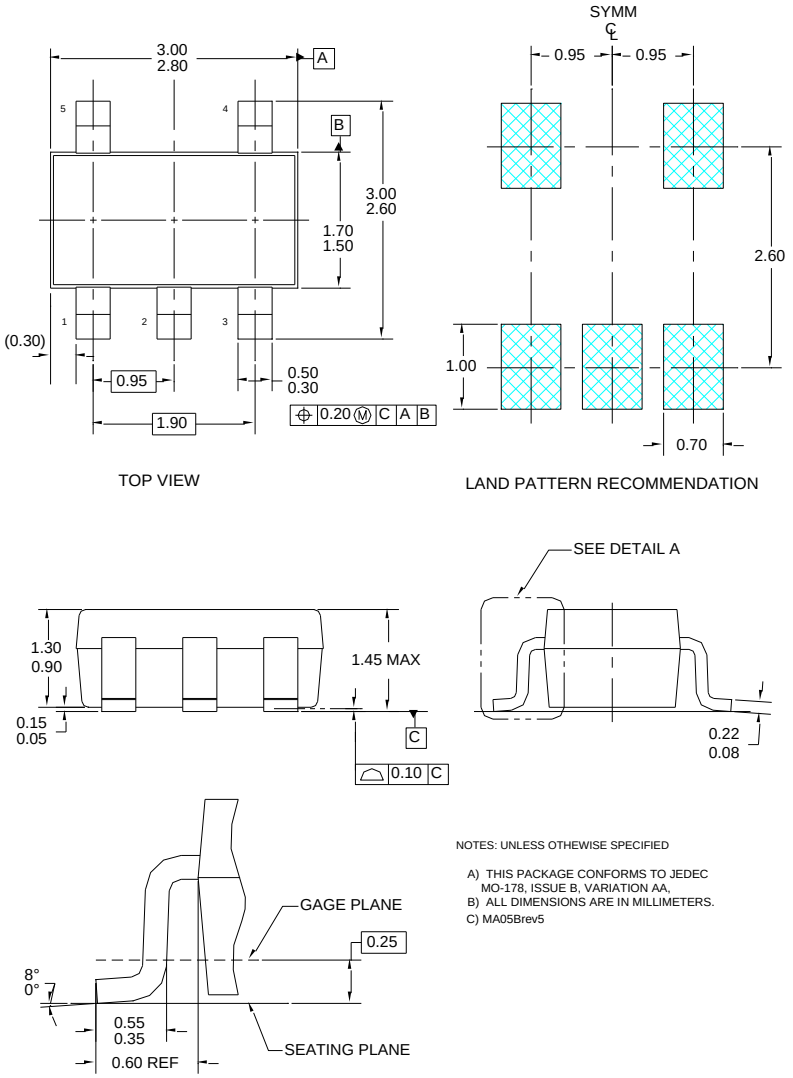


Figure 7. 5-Lead SOT23, JEDEC MO-178 1.6mm

Package drawings are provided as a service to customers considering ON Semiconductor components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a ON Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of ON Semiconductor's worldwide terms and conditions, specifically the warranty therein, which covers ON Semiconductor products.

Tape and Reel Specifications

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
M5X	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

Physical Dimensions

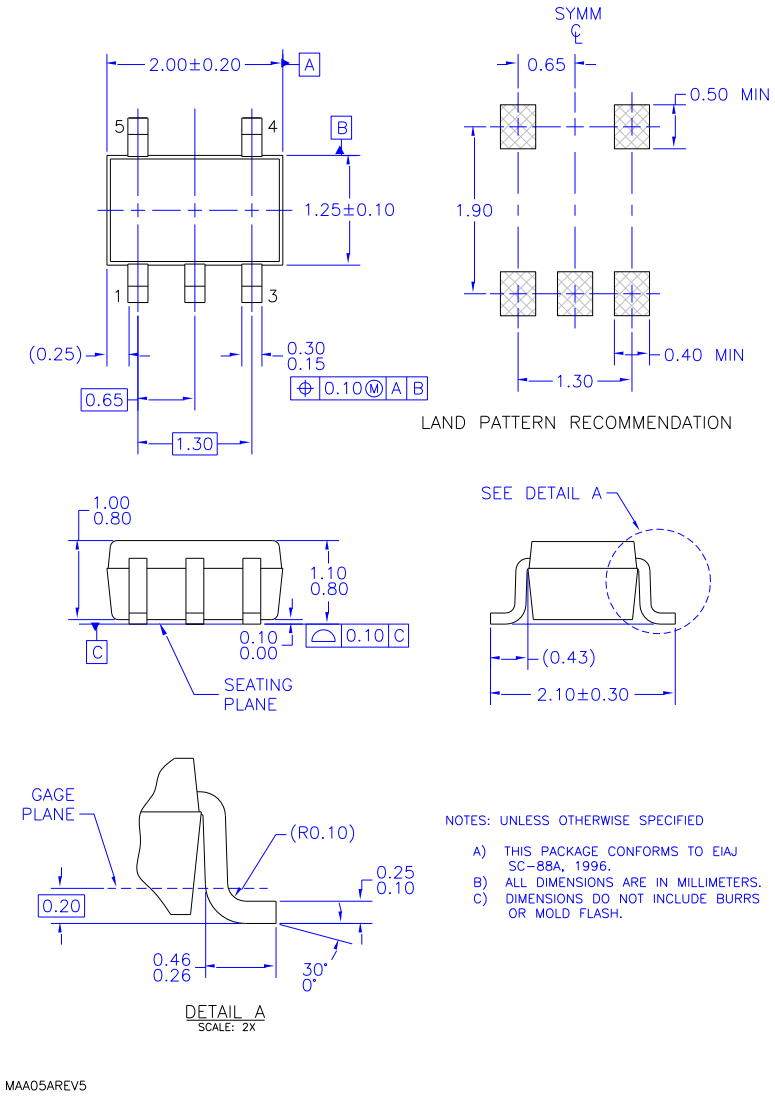


Figure 8. 5-Lead, SC70, EIAJ SC-88a, 1.25mm Wide

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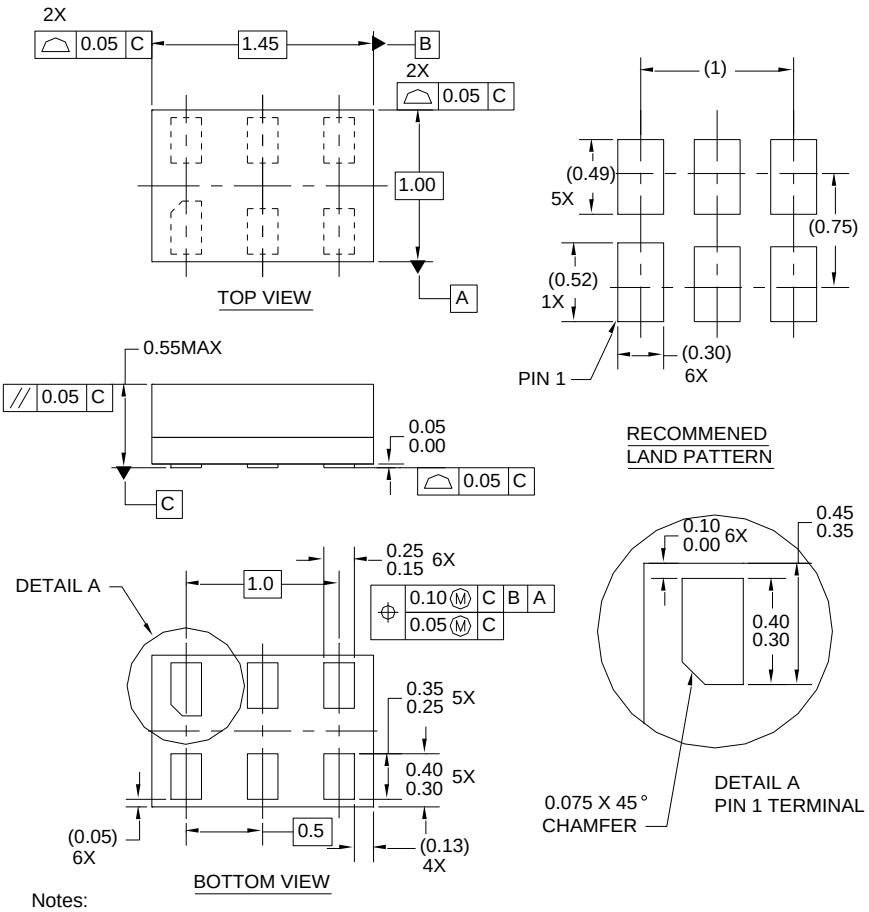
Tape and Reel Specifications

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
P5X	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

Physical Dimensions



Notes:

1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994

MAC06AREVC

Figure 9. 6-Lead, MicroPak™, 1.0mm Wide

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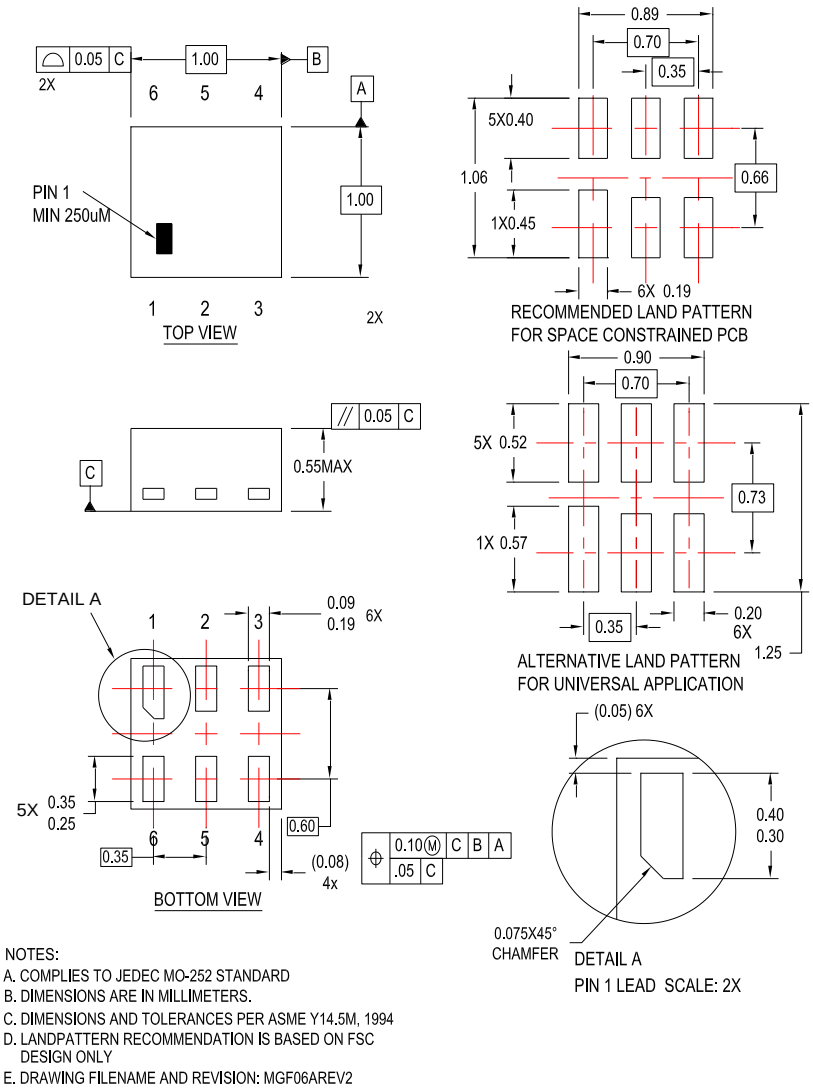
Tape and Reel Specifications

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
L6X	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

Physical Dimensions



NOTES:
A. COMPLIES TO JEDEC MO-252 STANDARD
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
D. LANDPATTERN RECOMMENDATION IS BASED ON FSC DESIGN ONLY
E. DRAWING FILENAME AND REVISION: MGF06AREV2

Figure 10.6-Lead, MicroPak2, 1x1mm Body, .35mm Pitch

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Tape and Reel Specifications

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
FHX	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

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