

54AC646

Octal Transceiver/Register with TRI-STATE® Outputs

General Description

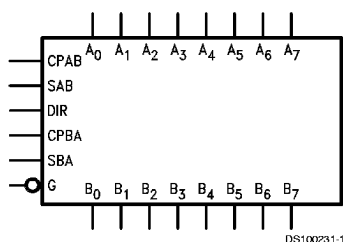
The 'AC646 consist of registered bus transceiver circuits, with outputs, D-type flip-flops and control circuitry providing multiplexed transmission of data directly from the input bus or from the internal storage registers. Data on the A or B bus will be loaded into the respective registers on the LOW-to-HIGH transition of the appropriate clock pin (CPAB or CPBA). The four fundamental data handling functions available are illustrated in *Figures 1, 2, 3, 4*.

- Multiplexed real-time and stored data transfers
- TRI-STATE outputs
- 300 mil slim dual-in-line package
- Outputs source/sink 24 mA
- 'ACT646 has TTL compatible inputs
- Standard Microcircuit Drawing (SMD) — 'AC646: 5962-89682

Features

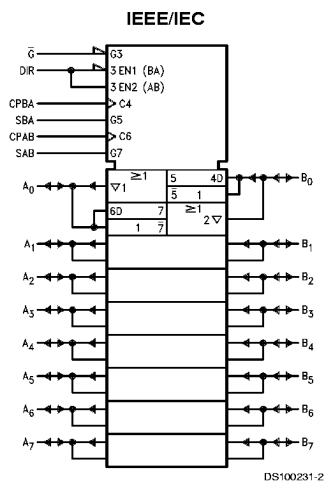
- Independent registers for A and B buses

Logic Symbols



DS100231-1

Pin Names	Description
A ₀ –A ₇	Data Register A Inputs
	Data Register A Outputs
B ₀ –B ₇	Data Register B Inputs
	Data Register B Outputs
CPAB, CPBA	Clock Pulse Inputs
SAB, SBA	Transmit/Receive Inputs
$\overline{G}$	Output Enable Input
DIR	Direction Control Input

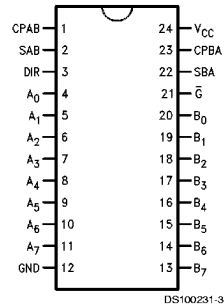


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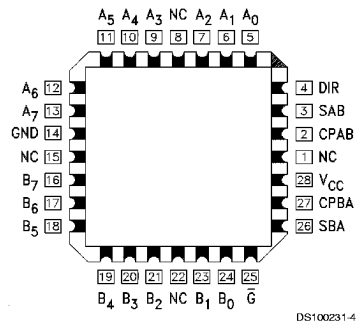
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Connection Diagrams

**Pin Assignment
for DIP and Flatpak**



**Pin Assignment
for LCC**



**Real Time Transfer
A-Bus to B-Bus**

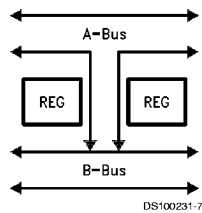


FIGURE 1.

**Real Time Transfer
B-Bus to A-Bus**

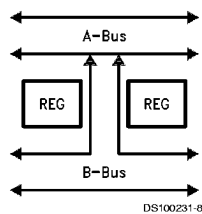


FIGURE 2.

**Storage from
Bus to Register**

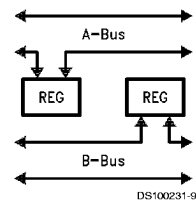


FIGURE 3.

**Transfer from
Register to Bus**

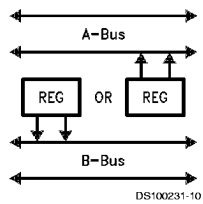


FIGURE 4.

Function Table

Inputs						Data I/O (Note 1)		Function
$\overline{G}$	DIR	CPAB	CPBA	SAB	SBA	A ₀ –A ₇	B ₀ –B ₇	
H	X	H or L	H or L	X	X	Input	Input	Isolation
H	X	↗	X	X	X			Clock A _n Data into A Register
H	X	X	↗	X	X			Clock B _n Data into B Register
L	H	X	X	L	X	Input	Output	A _n to B _n — Real Time (Transparent Mode)
L	H	↗	X	L	X			Clock A _n Data into A Register
L	H	H or L	X	H	X			A Register to B _n (Stored Mode)
L	H	↗	X	H	X			Clock A _n Data into A Register and Output to B _n
L	L	X	X	X	L	Output	Input	B _n to A _n — Real Time (Transparent Mode)
L	L	X	↗	X	L			Clock B _n Data into B Register
L	L	X	H or L	X	H			B Register to A _n (Stored Mode)
L	L	X	↗	X	H			Clock B _n Data into B Register and Output to A _n

H = HIGH Voltage Level

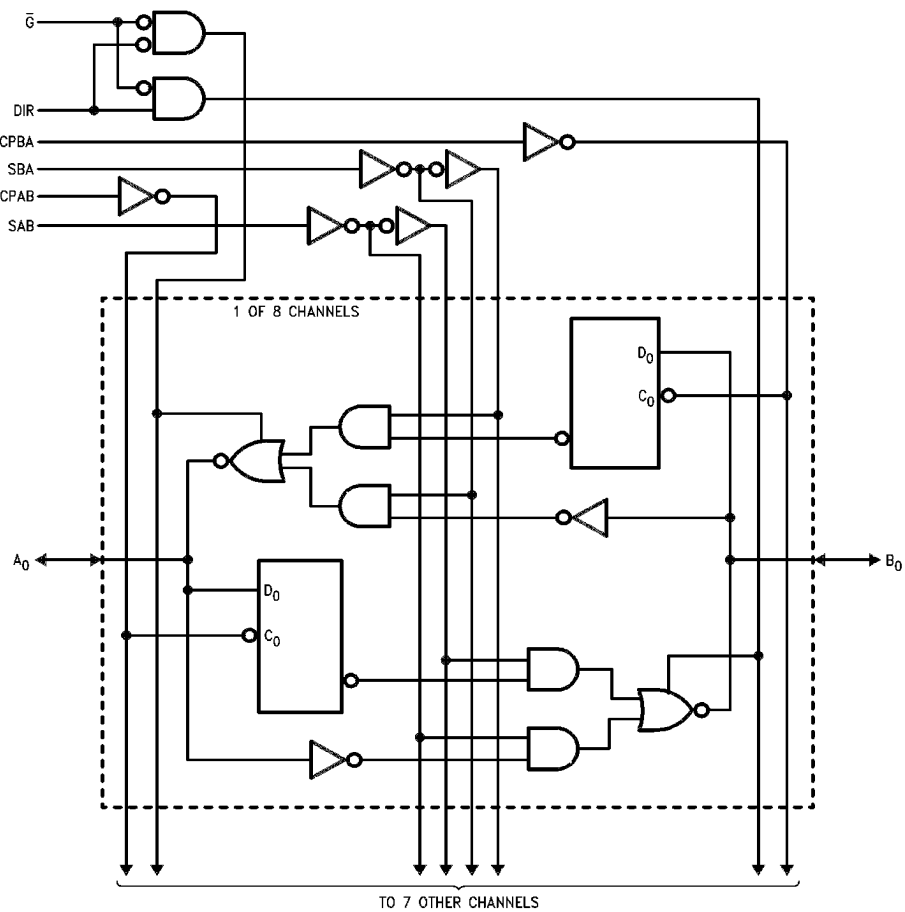
L = LOW Voltage Level

X = Immaterial

↗ = LOW-to-HIGH Transition

Note 1: The data output functions may be enabled or disabled by various signals at the $\overline{G}$ and DIR inputs. Data input functions are always enabled; i.e., data at the bus pins will be stored on every LOW-to-HIGH transition of the appropriate clock inputs.

Logic Diagram



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Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings (Note 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Supply Voltage (V_{CC})	–0.5V to +7.0V
DC Input Diode Current (I_{IK})	
$V_I = -0.5V$	–20 mA
$V_I = V_{CC} + 0.5V$	+20 mA
DC Input Voltage (V_I)	–0.5V to $V_{CC} + 0.5V$
DC Output Diode Current (I_{OK})	
$V_O = -0.5V$	–20 mA
$V_O = V_{CC} + 0.5V$	+20 mA
DC Output Voltage (V_O)	–0.5V to $V_{CC} + 0.5V$
DC Output Source	
or Sink Current (I_O)	± 50 mA
DC V_{CC} or Ground Current	
per Output Pin (I_{CC} or I_{GND})	± 50 mA
Storage Temperature (T_{STG})	–65°C to +150°C

Junction Temperature (T_J)

CDIP

175°C

Recommended Operating Conditions

Supply Voltage (V_{CC})	
'AC	2.0V to 6.0V
Input Voltage (V_I)	0V to V_{CC}
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A)	
54AC	–55°C to +125°C
Minimum Input Edge Rate ($\Delta V/\Delta t$)	
'AC Devices	
V_{IN} from 30% to 70% of V_{CC}	
V_{CC} @ 3.3V, 4.5V, 5.5V	125 mV/ns

Note 2: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT® circuits outside databook specifications.

DC Characteristics for 'AC Family Devices

Symbol	Parameter	V_{CC} (V)	54AC	Units	Conditions
			$T_A =$ –55°C to +125°C		
			Guaranteed Limits		
V_{IH}	Minimum High Level Input Voltage	3.0	2.1	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		4.5	3.15		
		5.5	3.85		
V_{IL}	Maximum Low Level Input Voltage	3.0	0.9	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		4.5	1.35		
		5.5	1.65		
V_{OH}	Minimum High Level Output Voltage	3.0	2.9	V	$I_{OUT} = -50 \mu A$
		4.5	4.4		
		5.5	5.4		
		3.0	2.4	V	(Note 3) $V_{IN} = V_{IL}$ or V_{IH} $I_{OH} = -12$ mA $I_{OH} = -24$ mA $I_{OH} = -24$ mA
		4.5	3.7		
		5.5	4.7		
V_{OL}	Maximum Low Level Output Voltage	3.0	0.1	V	$I_{OUT} = 50 \mu A$
		4.5	0.1		
		5.5	0.1		
		3.0	0.50	V	(Note 3) $V_{IN} = V_{IL}$ or V_{IH} $I_{OH} = 12$ mA $I_{OL} = 24$ mA $I_{OH} = 24$ mA
		4.5	0.50		
		5.5	0.50		
I_{IN}	Maximum Input Leakage Current	5.5	± 1.0	μA	$V_I = V_{CC}, GND$
I_{OLD}	Minimum Dynamic Output Current (Note 4)	5.5	50	mA	$V_{OLD} = 1.65V$ Max
I_{OHD}		5.5	–50	mA	$V_{OHD} = 3.85V$ Min

DC Characteristics for 'AC Family Devices (Continued)

Symbol	Parameter	V _{CC} (V)	54AC	Units	Conditions
			T _A = -55°C to +125°C		
			Guaranteed Limits		
I _{CC}	Maximum Quiescent Supply Current	5.5	160.0	μA	V _{IN} = V _{CC} or GND
I _{OZT}	Maximum I/O Leakage Current	5.5	±10.0	μA	V _I (OE) = V _{IL} , V _{IH} V _I = V _{CC} , GND V _O = V _{CC} , GND

Note 3: All outputs loaded; thresholds on input associated with output under test.

Note 4: Maximum test duration 2.0 ms, one output loaded at a time.

Note 5: I_{IN} and I_{CC} @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V_{CC}.

I_{CC} for 54AC @ 25°C is identical to 74AC @ 25°C.

AC Electrical Characteristics

Symbol	Parameter	V _{CC} (V) (Note 6)	54AC		Units	Fig. No.
			T _A = -55°C to +125°C C _L = 50 pF			
			Min	Max		
t _{PLH}	Propagation Delay	3.3	1.0	20.0	ns	
	Clock to Bus	5.0	1.5	14.0		
t _{PHL}	Propagation Delay	3.3	1.0	17.5	ns	
	Clock to Bus	5.0	1.5	12.0		
t _{PLH}	Propagation Delay	3.3	1.0	15.0	ns	
	Bus to Bus	5.0	1.5	10.0		
t _{PHL}	Propagation Delay	3.3	1.0	14.5	ns	
	Bus to Bus	5.0	1.5	9.5		
t _{PLH}	Propagation Delay	3.3	1.0	17.0	ns	
	SBA or SAB to A _n or B _n (w/ A _n or B _n HIGH or LOW)	5.0	1.5	12.0		
t _{PHL}	Propagation Delay	3.3	1.0	17.0	ns	
	SBA or SAB to A _n or B _n (w/ A _n or B _n HIGH or LOW)	5.0	1.5	12.0		
t _{PZH}	Enable Time	3.3	1.0	13.0	ns	
	$\overline{G}$ to A _n or B _n	5.0	1.5	9.5		
t _{PZL}	Enable Time	3.3	1.0	15.5	ns	
	$\overline{G}$ to A _n or B _n	5.0	1.5	11.0		
t _{PHZ}	Disable Time	3.3	1.0	14.0	ns	
	$\overline{G}$ to A _n or B _n	5.0	1.5	11.0		
t _{PLZ}	Disable Time	3.3	1.0	13.5	ns	
	$\overline{G}$ to A _n or B _n	5.0	1.5	11.0		
t _{PZH}	Enable Time	3.3	1.0	14.5	ns	
	DIR to A _n or B _n	5.0	1.5	10.5		
t _{PZL}	Enable Time	3.3	1.0	16.0	ns	
	DIR to A _n or B _n	5.0	1.5	12.5		
t _{PHZ}	Disable Time	3.3	1.0	14.5	ns	
	DIR to A _n or B _n	5.0	1.5	12.0		

AC Electrical Characteristics (Continued)

Symbol	Parameter	V _{CC} (V) (Note 6)	54AC		Units	Fig. No.
			T _A = −55°C to +125°C C _L = 50 pF			
			Min	Max		
t _{PLZ}	Disable Time DIR to A _n or B _n	3.3 5.0	1.0 1.5	16.5 12.0	ns	

Note 6: Voltage Range 3.3 is 3.3V ±0.3V
Voltage Range 5.0 is 5.0V ±0.5V

AC Operating Requirements

Symbol	Parameter	V _{CC} (V) (Note 7)	54AC	Units	Fig. No.
			T _A = -55° C to +125° C C _L = 50 pF		
			Guaranteed Minimum		
t _s	Setup Time, HIGH or LOW Bus to Clock	3.3	6.0	ns	
		5.0	4.5		
t _h	Hold Time, HIGH or LOW Bus to Clock	3.3	1.5	ns	
		5.0	2.0		
t _w	Clock Pulse Width HIGH or LOW	3.3	5.0	ns	
		5.0	5.0		

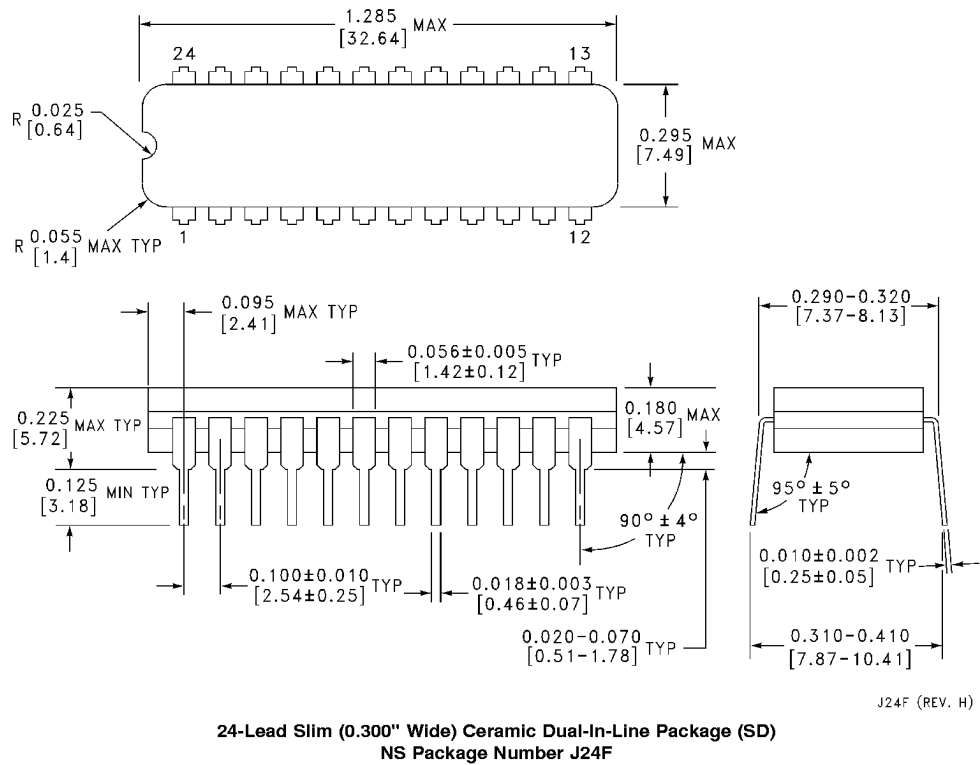
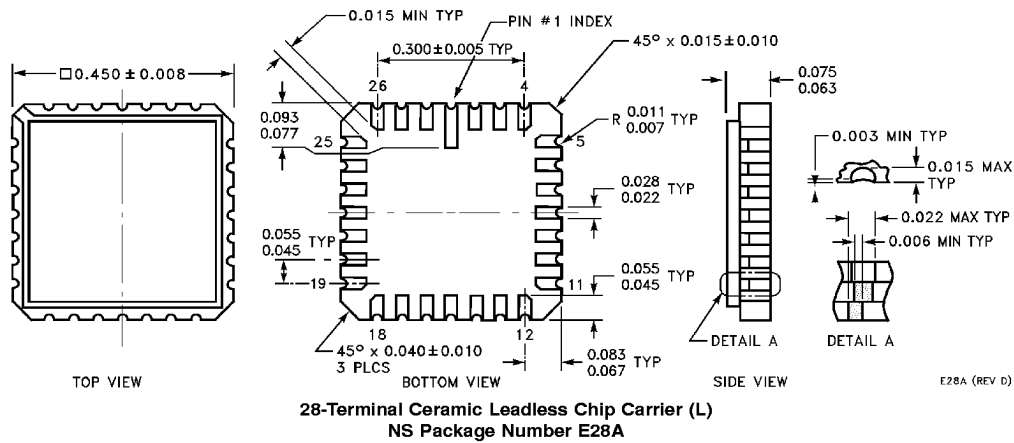
Note 7: Voltage Range 3.3 is 3.3V ±0.3V
Voltage Range 5.0 is 5.0V ±0.5V

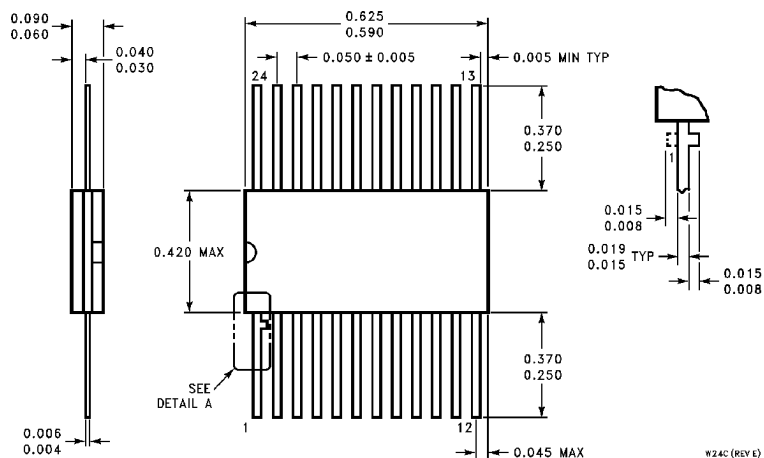
Capacitance

Symbol	Parameter	Typ	Units	Conditions
C _{IN}	Input Capacitance	4.5	pF	V _{CC} = OPEN
C _{I/O}	Input/Output Capacitance	15.0	pF	V _{CC} = 5.0V
C _{PD}	Power Dissipation Capacitance	60.0	pF	V _{CC} = 5.0V



Physical Dimensions inches (millimeters) unless otherwise noted



Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

24-Lead Ceramic Flatpak (F)
NS Package Number W24C

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