

MN54ACTQ16646-X REV 1A0

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16-Bit Transceiver/Register with Tri-State Outputs
General Description

The ACTQ16646 contains sixteen non-inverting bidirectional registered bus transceivers providing multiplexed transmission of data directly from the input bus or from the internal storage registers. Each byte has separate control inputs which can be shorted together for full 16-bit operation. The DIR inputs determine the direction of data flow through the device. The CPAB and CPBA inputs load data into the registers on the LOW-to-HIGH transition. The 'ACTQ16646 utilizes NSC Quiet Series technology to guarantee quiet output switching and improved dynamic threshold performance. FACT Quiet Series features GTO output control and undershoot corrector for superior performance.

Industry Part Number

54ACTQ16646

NS Part Numbers

54ACTQ16646FMQB

Prime Die

D16646

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 5005

Subgrp	Description	Temp (°C)
1	Static tests at	+25 C
2	Static tests at	+125 C
3	Static tests at	-55 C
4	Dynamic tests at	+25 C
5	Dynamic tests at	+125 C
6	Dynamic tests at	-55 C
7	Functional tests at	+25 C
8A	Functional tests at	+125 C
8B	Functional tests at	-55 C
9	Switching tests at	+25 C
10	Switching tests at	+125 C
11	Switching tests at	-55 C

Features

- Utilizes NSC FACT Quiet Series technology
- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Guaranteed pin-to-pin output skew
- Separate control logic for each byte and nibble
- 16-bit version of the ACTQ646
- Outputs source/sink 24 mA
- Independent registers for A and B buses
- Multiplexed real-time and stored data transfers
- Separate control logic for each byte

(Absolute Maximum Ratings)

(Note 1)

Supply Voltage (Vcc)	-0.5V to +7.0V
DC Input Diode Current (Iik)	
Vin = -0.5V	-20 mA
Vin = Vcc +0.5V	+20 mA
DC Output Diode Current (Iok)	
Vo = -0.5V	-20 mA
Vo = Vcc +0.5V	+20 mA
DC Output Voltage (Vo)	-0.5V to Vcc +0.5V
DC Vcc or Ground Current per Output Pin	±50 mA
Junction Temperature (Tj)	
Ceramic Flatpack	+175 C
Thermal Resistance	
JUNCTION-TO-CASE (Theta JC)	10C/ Watt
JUNCTION-TO-AMBIENT (Theta JA)	80C/ Watt
(1 Watt at no airflow)	
Storage Temperature	-65 C to +150 C
Lead Temperature	
(Soldering, 10 Seconds)	+300 C
ESD Classification	CLASS 1
Maximum Power Dissipation	750 mW
DC Output Source/Sink Current (Io)	±50 mA

Note 1: 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 TM circuits outside databook specifications.

Recommended Operating Conditions

Supply Voltage (Vcc)	4.5V to 5.5V
Input Voltage (Vi)	0V to Vcc
Output Voltage (Vo)	0V to Vcc
Operating Temperature	-55 C to +125 C
Minimum Input Edge Rate (Delta V/Delta t)	
ACTQ Devices	
Vin from 0.8V to 2.0V	
Vcc @ 4.5V, 5.5V	125 mV/ns
Maximum Output Current	
High Level (Ioh)	-24 mA
Low Level (Iol)	24 mA

Electrical Characteristics

DC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)

DC: VCC 4.5V to 5.5V, Temp range: -55C to 125C. NOTE: -55C TEMPERATURE, SUBGROUP 3 IS GUARANTEED BUT NOT TESTED.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
VOL	Low level output voltage	VCC=4.5V, IOL=50.0uA, VIL=0.8V, VIH=2.0V, VINL=0.0V, VINH=4.5V	1, 2	OUTPUT		.10	V	1, 2, 3
		VCC=5.5V, IOL=50.0uA, VIL=0.8V, VIH=2.0V, VINL=0.0V, VINH=5.5V	1, 2	OUTPUT		.10	V	1, 2, 3
		VCC=4.5V, IOL=24.0mA, VIL=0.0V, VIH=2.0V, VINL=0.0V, VINH=4.5V	1, 2	OUTPUT		.36	V	1
			1, 2	OUTPUT		.50	V	2, 3
		VCC=5.5V, IOL=24.0mA, VIL=0.0V, VIH=2.0V, VINL=0.0V, VINH=5.5V	1, 2	OUTPUT		.36	V	1
			1, 2	OUTPUT		.50	V	2, 3
VIOL	Dynamic Output Current LOW	VCC=5.5V, IOL=50.0mA, VIL=0.0V, VIH=5.5V	1, 2, 5	OUTPUT		1.65	V	1, 2, 3
VOH	High Level Output Voltage	VCC=4.5V, IOH=-50.0uA, VIL=0.8V, VIH=2.0V, VINL=0.0V, VINH=4.5V	1, 2	OUTPUT	4.4		V	1, 2, 3
		VCC=5.5V, IOH=-50.0uA, VIL=0.8V, VIH=2.0V, VINL=0.0V, VINH=5.5V	1, 2	OUTPUT	5.4		V	1, 2, 3
		VCC=4.5V, IOH=-24.0mA, VIL=0.8V, VIH=2.0V, VINL=0.0V, VINH=4.5V	1, 2	OUTPUT	3.86		V	1
			1, 2	OUTPUT	3.7		V	2, 3
		VCC=5.5V, IOH=24.0mA, VIL=0.8V, VIH=2.0V, VINL=0.0V, VINH=5.5V	1, 2	OUTPUT	4.86		V	1
			1, 2	OUTPUT	4.7		V	2, 3
VIOH	Dynamic Output Current HIGH	VCC=5.5V, IOH=-50.0mA, VIL=0.0V, VIH=5.5V	1, 2, 5	OUTPUT	3.85		V	1, 2, 3
IIH	High Level input Current	VCC=5.5V, VIH=5.5V	1, 2	INPUT		0.1	uA	1
			1, 2	INPUT		1.0	uA	2, 3
IIL	Low Level input Current	VCC=5.5V, VIL=0.0V	1, 2	INPUT		-0.1	uA	1
			1, 2	INPUT		-1.0	uA	2, 3
ICC	Supply Current	VCC=5.5V, VIN=5.5V or 0.0C	1, 2	VCC		8.0	uA	1
			1, 2	VCC		160	uA	2, 3
ICCT	Supply Current per Input	VCC=5.5V, VINH=3.4V	1, 2	VCC		1.6	mA	1, 2, 3
IOZHT	Tri-state Leakage Current	VCC=4.5V, VOUT=4.5V, VIN=0.0V, VIH(OE)=2.0V	1, 2	OUTPUT		0.5	uA	1
			1, 2	OUTPUT		10	uA	2, 3
		VCC=5.5V, VOUT=5.5V, VIN=0.0V, VIH(OE)=2.0V	1, 2	OUTPUT		0.5	uA	1
			1, 2	OUTPUT		10	uA	2, 3

Electrical Characteristics

DC PARAMETERS(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)

DC: VCC 4.5V to 5.5V, Temp range: -55C to 125C. NOTE: -55C TEMPERATURE, SUBGROUP 3 IS GUARANTEED BUT NOT TESTED.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
IOZLT	Tri-state Leakage current	VCC=4.5V, VOUT=0.0V, VIN=4.5V, VIH(OE)=2.0V	1, 2	OUTPUT		-0.5	uA	1
			1, 2	OUTPUT		-10	uA	2, 3
		VCC=5.5V, VOUT=0.0V, VIN=5.5V, VIH(OE)=2.0V	1, 2	OUTPUT		-0.5	uA	1
			1, 2	OUTPUT		-10	uA	2, 3
VIKL	Negative Input Clamp Voltage	VCC=4.5V, IKL=-18mA	1, 2	INPUT		-1.2	V	1, 2, 3
VIKH	Positive Input Clamp Voltage	VCC=4.5V, IKH=18mA	1, 2	INPUT		5.7	V	1, 2, 3
CIN	INPUT PIN CAPACITANCE		6	INPUT		12	pF	4
COUT	OUTPUT PIN CAPACITANCE		6	OUTPUT		12	pF	4
CPD	Power Dissipation Capacitance		6	VCC		100	pF	4
VILD	Maximum Low Dynamic Input Voltage Level	VCC=5.0V, LOAD 50pF / 500 OHMS	6, 9	INPUT		0.8	V	4
VIHD	Minimum High Dynamic Input Voltage Level	VCC=5.0V, LOAD 50pF / 500 OHMS	6, 9	INPUT	2.0		V	4
VOLP	Quick Output Maximum Dynamic Vol	VCC=5.0V, LOAD 50pF / 500 OHMS Maximum High Output Noise	6, 8	OUTPUT		0.8	V	4
VOLV	Quiet Output Minimum Dynamic Vol	VCC=5.0V, LOAD 50pF / 500 OHMS Maximum Low Output Noise	6, 8	OUTPUT		-0.8	V	4
VOHP	High Output Level Overshoot	VCC=5.0V, LOAD 50pF / 500 OHMS Maximum Overshoot	6, 8	OUTPUT		VOH +1.5	V	4
VOHV	High Output Level Overshoot	VCC=5.0V, LOAD 50pF / 500 OHMS Minimum Vcc Droop	6, 8	OUTPUT		VOH -1.8	V	4

AC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)

AC: Temp range:-55C to 125C, CL=50pF, RL=500 OHMS, TR/TF=3.0nS. NOTE: -55C TEMPERATURE, SUBGROUP 11 IS GUARANTEED BUT NOT TESTED.

tpLH(1)	Propagation Delay	VCC=4.5V An/Bn to Bn/An	3, 4, 7	Bus to Bus	3.2	8.6	ns	9
			3, 4, 7	Bus to Bus	3.2	10.2	ns	10, 11

Electrical Characteristics

AC PARAMETERS(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)

AC: Temp range:-55C to 125C, CL=50pF, RL=500 OHMS, TR/TF=3.0nS. NOTE: -55C TEMPERATURE, SUBGROUP 11 IS GUARANTEED BUT NOT TESTED.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tpHL(1)	Propagation Delay	VCC=4.5V An/Bn to Bn/An	3, 4, 7	Bus to Bus	2.9	8.5	ns	9
			3, 4, 7	Bus to Bus	2.9	10.2	ns	10, 11
tpLH(2)	Propagation Delay	VCC=4.5V CPAB/CPBA to An/Bn	3, 4, 7	CP to Bus	3.3	8.9	ns	9
			3, 4, 7	CP to Bus	3.3	10.8	ns	10, 11
tpHL(2)	Propagation Delay	VCC=4.5V CPAB/CPBA to An/Bn	3, 4, 7	CP to Bus	3.6	9.4	ns	9
			3, 4, 7	CP to Bus	3.6	11.5	ns	10, 11
tpLH(3)	Propagation Delay	VCC=4.5V SAB/SBA to Bn/An (w/ An or Bn HIGH or LOW)	3, 4, 7	SEL to Bus	3.2	9.5	ns	9
			3, 4, 7	SEL to Bus	3.2	11.5	ns	10, 11
tpHL(3)	Propagation Delay	VCC=4.5V SAB/SBA to Bn/An (w/ An or Bn HIGH or LOW)	3, 4, 7	SEL to Bus	3.1	8.9	ns	9
			3, 4, 7	SEL to Bus	3.1	11.3	ns	10, 11
tpZL(1)	Enable Time	VCC=4.5V Enable Time	3, 4, 7	G to An/Bn	3.8	10.5	ns	9
			3, 4, 7	G to An/Bn	3.8	12.9	ns	10, 11
tpZH(1)	Enable Time	VCC=4.5V Enable Time	3, 4, 7	G to An/Bn	3.3	9.4	ns	9
			3, 4, 7	G to An/Bn	3.3	11.9	ns	10, 11
tpLZ(1)	Disable Time	VCC=4.5V Disable Time	3, 4, 7	G to An/Bn	2.6	8.3	ns	9
			3, 4, 7	G to An/Bn	2.6	9.5	ns	10, 11
tpHZ(1)	Disable Time	VCC=4.5V Disable Time	3, 4, 7	G to An/Bn	2.3	8.1	ns	9
			3, 4, 7	G to An/Bn	2.3	9.8	ns	10, 11
tpZL(2)	Enable Time	VCC=4.5V Enable Time	3, 4, 7	Dir to An/Bn	4.3	11.8	ns	9
			3, 4, 7	Dir to An/Bn	4.3	14.0	ns	10, 11

Electrical Characteristics

AC PARAMETERS(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)

AC: Temp range:-55C to 125C, CL=50pF, RL=500 OHMS, TR/TF=3.0nS. NOTE: -55C TEMPERATURE, SUBGROUP 11 IS GUARANTEED BUT NOT TESTED.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tpZH(2)	Enable Time	VCC=4.5V Enable Time	3, 4, 7	Dir to An/Bn	3.7	10.8	ns	9
			3, 4, 7	Dir to An/Bn	3.7	12.8	ns	10, 11
tpLZ(2)	Disable Time	VCC=4.5V Disable Time	3, 4, 7	Dir to An/Bn	2.5	9.2	ns	9
			3, 4, 7	Dir to An/Bn	2.5	11.0	ns	10, 11
Tset(H/L)	Setup time High/LOW	VCC=5.0V	6	An/Bn to CP	3.0		ns	9, 10, 11
Thold(H/L)	Hold time (HIGH/LOW)	VCC=5.0V	6	An/Bn to CP	1.5		ns	9, 10, 11
Twidth(H/L)	Pulse width (HIGH/LOW)	VCC=5.0V	6	CP	4.0		ns	9, 10, 11
TOSHL/TOSLH	Pin-to-Pin Skew	VCC=5.0V Clock to Bus	6, 10	Pin to Pin Skew		1.0	ns	9, 10, 11
TOSLH/TOSHL	Pin-to-Pin Skew	VCC=5.0V Bus to Bus	6, 10	Pin to Pin Skew		1.0	ns	9, 10, 11
TOSHL	Pin-to-Pin Skew	VCC=5.0V Select to Bus (w/An or Bn HIGH or LOW)	6, 10	Pin to Pin Skew		1.0	ns	9, 10, 11
TOSLH	Pin-to-Pin Skew	VCC=5.0V Select to Bus (w/An or Bn HIGH or LOW)	6, 10	Pin to Pin Skew		1.2	ns	9, 10, 11
TOST	Pin-to-Pin Skew	VCC=5.0V Clock to Bus	6, 10	Pin to Pin Skew		2.1	ns	9, 10, 11
		VCC=5.0V Bus to Bus	6, 10	Pin to Pin Skew		1.0	ns	9, 10, 11
		VCC=5.0V Select to Bus	6, 10	Pin to Pin Skew		2.7	ns	9, 10, 11

Note 1: SCREEN TESTED 100% ON EACH DEVICE AT +25C & +125C TEMPERATURE, SUBGROUPS 1, 2, 7, & 8.

Note 2: SAMPLE TESTED (METHOD 5005, TABLE 1) ON EACH MFG. LOT AT +25C & +125C TEMPERATURE, SUBGROUPS A1, 2, 7, & 8.

Note 3: SCREEN TESTED 100% ON EACH DEVICE AT +25C TEMPERATURE ONLY SUBGROUP A9.

Note 4: SAMPLE TESTED (METHOD 5005, TABLE 1) ON EACH MFG. LOT AT +25C & +125C TEMPERATURE, SUBGROUPS A9 & 10.

Note 5: TRANSMISSION LINE DRIVING TEST, GUARDBANDED LIMITS SET FOR +25C, 2 MSEC DURATION MAX.

Note 6: GUARANTEED BUT NOT TESTED. (DESIGN CHARACTERIZATION DATA ONLY.)

Note 7: +25C & +125C MIN LIMITS GUARANTEED FOR 5.5V BY GUARDBANDING 4.5V MIN. LIMITS.

(Continued)

- Note 8: MAX NUMBER OF OUTPUTS DEFINED AS (N). DATA INPUTS ARE DRIVEN 0V TO 3V. ONE OUTPUT @ VOL.
- Note 9: MAX NUMBER OF DATA INPUTS (N) SWITCHING. (N-1) INPUTS SWITCHING 0V TO 3V. INPUT-UNDER-TEST SWITCHING 3V TO THRESHOLD (VILD), 0V TO THRESHOLD (VIHD), FREQ= 1 MHZ.
- Note 10: Skew is defined as the absolute value of the difference between the actual propagation delays for any two separate outputs of the same device. The specification applies to any outputs switching HIGH to LOW (TOSHL), LOW to HIGH (TOSLH), or any combination switching LOW to HIGH and/or HIGH to LOW (TOST).

Graphics and Diagrams

GRAPHICS#	DESCRIPTION
WA56ARB	CERPAC, 56 LEAD, .025 LEAD PITCH (P/P DWG)

See attached graphics following this page.

