

**MN54ACTQ646-X REV 2A0**

 Original Creation Date: 07/16/96  
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 Last Major Revision Date: 03/15/99

**Octal Transceiver/Register with TRI-STATE Outputs**
**General Description**

The ACTQ646 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 ACTQ646 utilizes Quiet Series technology to guarantee quiet output switching improve dynamic threshold performance. FACT Quiet Series TM features GTO TM output control and undershoot corrector in addition to a split ground bus for superior performance.

**Industry Part Number**

54ACTQ646

**NS Part Numbers**

 54ACTQ646FMQB\*\*  
 54ACTQ646LMQB\*\*\*  
 54ACTQ646SDMQB\*

**Prime Die**

D646

**Controlling Document**

5962-92196

**Processing**

MIL-STD-883, Method 5004

**Quality Conformance Inspection**

MIL-STD-883 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**

- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Guaranteed pin-to-pin skew AC performance
- Independent registers for A and B busses
- Multiplexed real-time and stored data transfers
- 300 mil slim dual-in-line package
- Outputs source/sink 24 mA
- 4 kV minimum ESD immunity
- Standard Military Drawing (SMD)
- ACTQ646: 5962-9219601MKX\*, MLX\*\*, M3X\*\*\*

**(Absolute Maximum Ratings)**

(Note 1)

Supply Voltage (Vcc)	-0.5V to +7.0V
DC Input Diode Current (Iik)	
Vi = -0.5V	-20 mA
Vi = Vcc +0.5V	+20 mA
DC Input Voltage (Vi)	-0.5V to Vcc +0.5V
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 Output Source or Sink Current (Io)	±50 mA
DC Vcc or Ground Current per Output Pin (Icc or Ignd)	±50 mA
Storage Temperature (Tstg)	-65 C to +150 C
DC Latch-Up Source or Sink Current	±300 mA
Junction Temperature (Tj)	
CDIP	175 C

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™ circuits outside databook specifications.

**Recommended Operating Conditions**

(Note 1)

Supply Voltage (Vcc)	4.5V to 5.5V
Input Voltage (Vi)	0V to Vcc
Output Voltage (Vo)	0V to Vcc
Operating Temperature (Ta)	-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

Note 1: All commercial packaging is not recommended for applications requiring greater than 2000 temperature cycles from -40C to +125C.

## 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
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
VOL	Low level output voltage	VCC=4.5V, VIL=0.8V, IOL=24.0mA, VIH=2.0V	1, 2	OUTPUT		.36	V	1
			1, 2	OUTPUT		.50	V	2, 3
		VCC=4.5V, VIL=0.8V, IOL=50.0uA, VIH=2.0V	1, 2	OUTPUT		.10	V	1, 2, 3
			1, 2	OUTPUT		.36	V	1
		VCC=5.5V, VIL=0.8V, IOL=24.0mA, VIH=2.0V	1, 2	OUTPUT		.36	V	1
1, 2	OUTPUT			.50	V	2, 3		
VIOL	Dynamic Output Current LOW	VCC=5.5V, VIH=5.5V, VIL=0.0V, IOL=50.0mA	1, 2, 5	OUTPUT		1.65	V	1, 2, 3
VOH	High Level Output Voltage	VCC=4.5V, VIL=0.8V, IOH=-24.0mA, VIH=2.0V	1, 2	OUTPUT	3.86		V	1
			1, 2	OUTPUT	3.70		V	2, 3
		VCC=4.5V, VIL=0.8V, IOH=-50.0uA, VIH=2.0V	1, 2	OUTPUT	4.40		V	1, 2, 3
			1, 2	OUTPUT	4.86		V	1
		VCC=5.5V, VIL=0.8V, IOH=-24.0mA, VIH=2.0V	1, 2	OUTPUT	4.86		V	1
1, 2	OUTPUT		4.70		V	2, 3		
VIOH	Dynamic Output Current HIGH	VCC=5.5V, VIH=5.5V, VIL=0.0V, IOL=-50.0mA	1, 2, 5	OUTPUT	3.85		V	1, 2, 3
ICCH	Supply Current	VCC=5.5V, VIH=5.5V	1, 2	VCC		8.0	uA	1
			1, 2	VCC		160	uA	2, 3
ICCL	Supply Current	VCC=5.5V, VIH=0.0V	1, 2	VCC		8.0	uA	1
			1, 2	VCC		160	uA	2, 3
ICCT	Supply Current	VCC=5.5V, VINH=3.4V	1, 2	VCC		1.0	mA	1
			1, 2	VCC		1.6	mA	2, 3
IC CZ	Supply Current	VCC=5.5V, VIH=5.5V	1, 2	VCC		8.0	uA	1
			1, 2	VCC		160	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
IOZH	Maximum TRI-STATE Leakage Current	VCC=4.5V, VM=4.5V, VIH=2.0V	1, 2	OUTPUT		0.5	uA	1
			1, 2	OUTPUT		10.0	uA	2, 3
		VCC=5.5V, VM=5.5V, VIH=2.0V	1, 2	OUTPUT		0.5	uA	1
			1, 2	OUTPUT		10.0	uA	2, 3
IOZL	Maximum TRI-STATE Leakage Current	VCC=4.5V, VM=0.0V, VIH=2.0V	1, 2	OUTPUT		-0.5	uA	1
			1, 2	OUTPUT		-10.0	uA	2, 3
		VCC=5.5V, VM=0.0V, VIH=2.0V	1, 2	OUTPUT		-0.5	uA	1
			1, 2	OUTPUT		-10.0	uA	2, 3
VIKL		VCC=4.5V, IKL=-18mA	1, 2	INPUT		-1.2	V	1, 2, 3
VIKH		VCC=4.5V, IKH=18mA	1, 2	INPUT		5.7	V	1, 2, 3
VILD	Maximum Low Level Dynamic Input Voltage	VCC=5.0V, LOAD 50pF / 500 OHMS	6, 9	INPUT		0.8	V	4
VIHD	Minimum High Level Dynamic Input Voltage	VCC=5.0V, LOAD 50pF / 500 OHMS	6, 9	INPUT	2.2		V	4
VOLP	Quiet Output Maximum Dynamic Vol	VCC=5.0V, LOAD 50pF / 500 OHMS	6, 8	OUTPUT		1.5	V	4
VOLV	Quiet Output Minimum Dynamic Vol	VCC=5.0V, LOAD 50pF / 500 OHMS	6, 8	OUTPUT		-1.2	V	4
VOHP	Quiet Output Maximum Dynamic Voh	VCC=5.0V, LOAD 50pF / 500 OHMS	6, 10	OUTPUT		VOH +1.0	V	4
VOHV	Quiet Output Minimum Dynamic Voh	VCC=5.0V, LOAD 50pF / 500 OHMS	6, 10	OUTPUT		VOH -1.8	V	4

### AC PARAMETERS

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

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

tpLH(1)	Propagation Delay	Vcc = 4.5V	3, 4, 7	CP to BUS	2.0	10.5	ns	9
			3, 4, 7	CP to BUS	2.0	12.0	ns	10, 11

## Electrical Characteristics

### AC PARAMETERS (Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)  
 AC: CL=50pf, RL=500 OHMS, TR/TF=3.0ns, Temp range: -55C to +125C. 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	3, 4, 7	CP to BUS	2.0	10.5	ns	9
			3, 4, 7	CP to BUS	2.0	12.0	ns	10, 11
tpLH(2)	Propagation Delay	Vcc= 4.5V	3, 4, 7	BUS to BUS	2.0	10.0	ns	9
			3, 4, 7	BUS to BUS	2.0	11.0	ns	10, 11
tpHL(2)	Propagation Delay	Vcc= 4.5V	3, 4, 7	BUS to BUS	2.0	10.0	ns	9
			3, 4, 7	BUS to BUS	2.0	11.0	ns	10, 11
tpLH(3)	Propagation Delay	Vcc= 4.5V	3, 4, 7	SBA/SAB to Bus	2.0	11.0	ns	9
			3, 4, 7	SBA/SAB to Bus	2.0	12.5	ns	10, 11
tpHL(3)	Propagation Delay	Vcc= 4.5V	3, 4, 7	SBA/SAB to Bus	2.0	11.0	ns	9
			3, 4, 7	SBA/SAB to Bus	2.0	12.5	ns	10, 11
tpZH(1)	Enable Time	Vcc= 4.5V	3, 4, 7	DIR to BUS	1.5	13.0	ns	9
			3, 4, 7	DIR to BUS	1.5	15.0	ns	10, 11
tpZL(1)	Enable Time	Vcc= 4.5V	3, 4, 7	DIR to BUS	1.5	13.0	ns	9
			3, 4, 7	DIR to BUS	1.5	15.0	ns	10, 11
tpHZ(1)	Disable Time	Vcc= 4.5V	3, 4, 7	DIR to BUS	1.5	11.0	ns	9
			3, 4, 7	DIR to BUS	1.5	12.0	ns	10, 11
tpLZ(1)	Disable Time	Vcc= 4.5V	3, 4, 7	DIR to BUS	1.5	11.0	ns	9
			3, 4, 7	DIR to BUS	1.5	12.0	ns	10, 11
tpZH(2)	Enable Time	Vcc= 4.5V	3, 4, 7	$\bar{G}$ to BUS	1.5	11.5	ns	9
			3, 4, 7	$\bar{G}$ to BUS	1.5	15.0	ns	10, 11

## Electrical Characteristics

### AC PARAMETERS (Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)  
 AC: CL=50pf, RL=500 OHMS, TR/TF=3.0ns, Temp range: -55C to +125C. NOTE: -55C TEMPERATURE, SUBGROUP 11 IS GUARANTEED BUT NOT TESTED.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tpZL(2)	Enable Time	Vcc= 4.5V	3, 4, 7	$\bar{G}$ to BUS	1.5	11.5	ns	9
			3, 4, 7	$\bar{G}$ to BUS	1.5	15.0	ns	10, 11
tpHZ(2)	Disable Time	Vcc= 4.5V	3, 4, 7	$\bar{G}$ to BUS	1.5	11.0	ns	9
			3, 4, 7	$\bar{G}$ to BUS	1.5	12.0	ns	10, 11
tpLZ(2)	Disable Time	Vcc= 4.5V	3, 4, 7	$\bar{G}$ to BUS	1.5	11.0	ns	9
			3, 4, 7	$\bar{G}$ to BUS	1.5	12.0	ns	10, 11
tw(L/H)	Clock Pulse Width	Vcc= 4.5V	6	CP	4.0		ns	9, 10, 11
ts(L/H)	Setup Time HIGH or LOW	Vcc= 4.5V	6	BUS to CP	3.0		ns	9, 10, 11
th(L/H)	Hold Time HIGH or LOW	Vcc= 4.5V	6	BUS to CP	1.5		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)

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

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: MAX NUMBER OF OUTPUTS DEFINED AS (N). DATA INPUTS ARE DRIVEN 0V TO 3V. ONE OUTPUT @ VOH.

**Revision History**

Rev	ECN #	Rel Date	Originator	Changes
2A0	M0003316	05/27/99	Linda Collins	Added VOHV and VOHP. Added note 10.