National Semiconductor

MICROCIRCUIT DATA SHEET

MN54ACTQ544-X REV 2A0

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Octal Registered Transceiver with TRI-STATE Outputs

General Description

The ACTQ544 is an inverting octal transceiver containing two sets of D-type registers for temporary storage of data flowing in either direction. Separate Latch Enable and Output Enable inputs are provided for each register to permit independent input and output control in either direction of data flow. The 544 inverts data in both directions.

The ACTQ544 utilizes NSC's FACT TM Quiet Series technology to guarantee quiet output switching the improved dynamic threshold performance. FACT Quiet series features GTO output control and undershoot corrector in addition to split ground bus for superior performance.

Industry Part Number

54ACTQ544

NS Part Numbers

54ACTQ544FMQB
54ACTQ544LMQB
54ACTQ544SDMQB

Prime Die

D544

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883 5005

Subgrp	Description	Temp (^{O}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
- 8-bit inverting octal latched transceiver
- Separate controls for data flow in each direction
- Back-to-back registers for storage
- Outputs source/sink 24 mA
- 4kV minimum ESD immunity
- 300 mil slim PDIP/SOIC

(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
PDIP	140 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 TM 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: Surface mount and plastic dip 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, VM=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, VM=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
		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
		VCC=5.5V, VIL=0.8V, IOL=50.0uA, VIH=2.0V	1, 2	OUTPUT		.10	V	1, 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
		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
		VCC=5.5V, VIL=0.8V, IOH=-50.0uA, VIH=2.0V	1, 2	OUTPUT	5.40		V	1, 2, 3
VIOH	Dynamic Output Current HIGH	VCC=5.5V, VIH=5.5V, VIL=0.0V, IOH=-50.0mA	1, 2, 5	OUTPUT	3.85		V	1, 2, 3
ICCH	Supply Current	VCC=5.5V	1, 2	VCC		8.0	uA	1
			1, 2	VCC		160	uA	2, 3
ICCL	Supply Current	VCC=5.5V	1, 2	VCC		8.0	uA	1
			1, 2	VCC		160	uA	2, 3
ICCZ	Supply Current	VCC=5.5V	1, 2	VCC		8.0	uA	1
			1, 2	VCC		160	uA	2, 3
ICCT	Supply Current	VCC=5.5V, VIHT=VCC-2.1V	1, 2	VCC		1.0	mA	1
			1, 2	VCC		1.6	mA	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
IOZHT	Maximum I/O Leakage Current	VCC=4.5V, VM=4.5V, VIH=2.0V	1, 2	I/O PINS		0.5	uA	1
			1, 2	I/O PINS		10.0	uA	2, 3
		VCC=5.5V, VM=5.5V, VIH=2.0V	1, 2	I/O PINS		0.5	uA	1
			1, 2	I/O PINS		10.0	uA	2, 3
IOZLT	Maximum I/O Leakage Current	VCC=4.5V, VM=0.0V, VIH=2.0V	1, 2	I/O PINS		-0.5	uA	1
			1, 2	I/O PINS		-10.0	uA	2, 3
		VCC=5.5V, VM=0.0V, VIH=2.0V	1, 2	I/O PINS		-0.5	uA	1
			1, 2	I/O PINS		-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	Maximum 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

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 An to Bn or Bn to An	VCC=4.5V	3, 4, 7		2.0	8.5	ns	9
			3, 4, 7		2.0	9.5	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 An to Bn or Bn to An	VCC=4.5V	3, 4, 7		2.0	8.5	ns	9
			3, 4, 7		2.0	9.5	ns	10, 11
tpLH(2)	Propagation Delay $\overline{LEBA}$ or $\overline{LEAB}$ to An or Bn	VCC=4.5V	3, 4, 7		2.0	9.5	ns	9
tpLH(2)	Propagation Delay $\overline{LEBA}$ or $\overline{LEAB}$ to An or Bn	VCC=4.5V	3, 4, 7		2.0	11.0	ns	10, 11
tpHL(2)	Propagation Delay $\overline{LEBA}$ or $\overline{LEAB}$ to An or Bn	VCC=4.5V	3, 4, 7		2.0	9.5	ns	9
tpHL(2)	Propagation Delay $\overline{LEBA}$ or $\overline{LEAB}$ to An or Bn	VCC=4.5V	3, 4, 7		2.0	11.0	ns	10, 11
tpZH(1)	Output Enable $\overline{OEAB}$ or $\overline{OEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	11.0	ns	9
tpZH(1)	Output Enable $\overline{OEAB}$ or $\overline{OEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	13.0	ns	10, 11
tpZL(1)	Output Enable $\overline{OEAB}$ or $\overline{OEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	11.0	ns	9
tpZL(1)	Output Enable $\overline{OEAB}$ or $\overline{OEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	13.0	ns	10, 11
tpHZ(1)	Output Disable $\overline{OEBA}$ or $\overline{OEAB}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	8.0	ns	9
tpHZ(1)	Output Disable $\overline{OEBA}$ or $\overline{OEAB}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	9.0	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
tpLZ(1)	Output Disable $\overline{OEAB}$ or $\overline{OEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	8.0	ns	9
tpLZ(1)	Output Disable $\overline{OEAB}$ or $\overline{OEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	9.0	ns	10, 11
tpZH(2)	Output Enable $\overline{CEAB}$ or $\overline{CEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	11.0	ns	9
tpZH(2)	Output Enable $\overline{CEAB}$ or $\overline{CEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	13.0	ns	10, 11
tpZL(2)	Output Enable $\overline{CEAB}$ or $\overline{CEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	11.0	ns	9
tpZL(2)	Output Enable $\overline{CEAB}$ or $\overline{CEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	13.0	ns	10, 11
tpHZ(2)	Output Disable $\overline{CEAB}$ or $\overline{CEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	8.0	ns	9
tpHZ(2)	Output Disable $\overline{CEAB}$ or $\overline{CEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	9.0	ns	10, 11
tpLZ(2)	Output Disable $\overline{CEAB}$ or $\overline{CEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	8.0	ns	9
tpLZ(2)	Output Disable $\overline{CEAB}$ or $\overline{CEBA}$ to An or Bn	VCC=4.5V	3, 4, 7		1.5	9.0	ns	10, 11
ts(H/L)	Setup Time HIGH or LOW An or Bn to $\overline{LEAB}$ or $\overline{LEBA}$	VCC=4.5V	3, 4, 7		3.0		ns	9, 10, 11
th(H/L)	Hold Time HIGH or LOW An or Bn to $\overline{LEAB}$ or $\overline{LEBA}$	VCC=4.5V	3, 4, 7		1.5		ns	9, 10, 11
tw(H/L)	Pulse Width $\overline{LEAB}$ or $\overline{LEBA}$	VCC=4.5V	3, 4, 7		4.0		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 MINIMUM 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.

Revision History

Rev	ECN #	Rel Date	Originator	Changes
2A0	M0003313	05/25/99	Linda Collins	Removed the reference to SMD 5962-9219301 from the Features section. Changedthe test condition from VIHT=VCC-2.0V to VIHT=VCC-2.1V for ICCT. Changed the test conditions from VM=4.5V to VM=0.0V and VM=5.5V to VM=0.0V for IOZLT. Changed the limit from 1.6V max. to 1.5V max for VOLP.

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