National Semiconductor

MICROCIRCUIT DATA SHEET

MN54ACT818-X REV 1B0

Original Creation Date: 07/03/96
Last Update Date: 03/17/97
Last Major Revision Date: 07/03/96

8-Bit DIAGNOSTIC REGISTER

General Description

The ACT818 is a high speed general purpose pipeline register with an on-board diagnostic register for performing serial diagnostics and/or writable control store loading.

The D-to-Y path provides and 8-bit parallel data path pipeline register for normal system operation. The diagnostic register can load parallel data to or from the pinpline register and can output data through the D input port (as in WCS loading).

The 8-bit diagnostic register has multiplexer inputs that select parallel inputs from the Y-port or adjacent bits in the diagnostic register to operate as a right-shift-only register. This register can then participate in a serial loop throughout the system where normal data, address, status and control registers are replaced with ACT818 diagnostic pipeline registers. The loop can be used to scan in a complete test routine starting point (Data, Address, etc.). Then after a specified number of machine cycles it scans out the results to be inspected for the expected results. WCS loading can be accomplished using the same technique. An instruction word can be serially shifted into the shadow register and written into the WCS RAM by enabling the D output.

Industry Part Number

54ACT818

NS Part Numbers

54ACT818DMQB
54ACT818FMQB
54ACT818LMQB

Prime Die

J818

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 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

- On-line and off-line system diagnostics
- Swaps the contents of diagnostic register and output register
- Diagnostic register and diagnostic testing
- Cascadable for wide control words as used in microprogramming
- Edge-triggered D registers
- Outputs source/sink 24 mA
- ACT 181 has TTL-compatible inputs
- ACT 818 is funtionally- and pin-compatible to AMD Am29818 and MMI 74S818

Applications

- Register for microprogram control store
- Status register
- Data register
- Instruction register
- Interrupt mask register
- Pipeline register
- General purpose register
- Parallel-serial/serial-parallel converter

(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
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)	
ACT Devices	
Vin from 0.8V to 2.0V	
Vcc @ 4.5V, 5.5V	125 mV/ns

Note 1: Plastic DIP packaging is not recommended for applications requiring greater than 3000 temperature cycles from 0 C to 125 C.

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, VINL=0.0V	1, 2	IN		0.1	uA	1
			1, 2	IN		1.0	uA	2, 3
IIL	Low Level Input Current	VCC=5.5V, VM=0.0V, VINH=5.5V, VINL=0.0V	1, 2	IN		-0.1	uA	1
			1, 2	IN		-1.0	uA	2, 3
VOL	Low Level Output Voltage	VCC=4.5V, VINH=4.5V, VIL=0.8V, VIH=2.0V, IOL=50.0uA	1, 2	OUT		.10	V	1, 2, 3
		VCC=5.5V, VINH=5.5V, VIL=0.8V, VIH=2.0V, IOL=50.0uA	1, 2	OUT		.10	V	1, 2, 3
		VCC=4.5V, VINH=4.5V, VIL=0.8V, VIH=2.0V, IOL=24.0mA	1, 2	OUT		.50	V	2, 3
			1, 2	OUT		.36	V	1
		VCC=5.5V, VINH=5.5V, VIL=0.8V, VIH=2.0V, IOL=24.0mA	1, 2	OUT		.50	V	2, 3
			1, 2	OUT		.36	V	1
VIOL	Input Offset Voltage Low	VCC=5.5V, VINH=5.5V, VIL=0.8V, IOL=50.0mA	1, 2, 5	OUT		1.65	V	1, 2, 3
VOH	High Level Output Voltage	VCC=4.5V, VIL=0.8V, VIH=2.0V, IOH=-50.0uA	1, 2	OUT	4.40		V	1, 2, 3
		VCC=5.5V, VIL=0.8V, VIH=2.0V, IOH=-50.0uA	1, 2	OUT	5.40		V	1, 2, 3
		VCC=5.5V, VIL=0.8V, VIH=2.0V, IOH=-24.0mA	1, 2	OUT	4.70		V	2, 3
			1, 2	OUT	4.86		V	1
		VCC=4.5V, VIL=0.8V, VIH=2.0V, IOH=-24.0mA	1, 2	OUT	3.70		V	2, 3
			1, 2	OUT	3.86		V	1
VIOH	Input Offset Voltage High	VCC=5.5V, VIL=0.8V, VIH=2.0V, IOH=-50.0mA	1, 2, 5	OUT	3.85		V	1, 2, 3
IOZH	Maximum TRI-STATE	VCC=4.5V, VIH=2.0V, VM=4.5V, VINL=0.0V	1, 2	OUT		10.0	uA	2, 3
			1, 2	OUT		0.5	uA	1
		VCC=5.5V, VIH=2.0V, VM=5.5V, VINL=0.0V	1, 2	OUT		10.0	uA	2, 3
			1, 2	OUT		0.5	uA	1
IOZL	Maximum TRI-STATE	VCC=4.5V, VIH=2.0V, VM=0.0V, VINH=4.5V	1, 2	OUT		-10.0	uA	2, 3
			1, 2	OUT		-0.5	uA	1
		VCC=5.5V, VIH=2.0V, VM=0.0V, VINH=5.5V	1, 2	OUT		-10.0	uA	2, 3
			1, 2	OUT		-0.5	uA	1

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
ICCH	Supply Current Outputs HIGH	VCC=5.5V, VINH=5.5V, VINL=0.0V	1, 2	VCC		8.0	uA	1
			1, 2	VCC		160	uA	2, 3
ICCL	Supply Current Outputs LOW	VCC=5.5V, VINL=0.0V	1, 2	VCC		8.0	uA	1
			1, 2	VCC		160	uA	2, 3
ICCZ	Supply Current Outputs Tri-State	VCC=5.5V, VINH=5.5V, VINL=0.0V	1, 2	VCC		8.0	uA	1
			1, 2	VCC		160	uA	2, 3
ICCT	Supply Current per Input	VCC=5.5V, VIHT=VCC-2.1V	1, 2	VCC		1.0	mA	1
			1, 2	VCC		1.6	mA	2, 3

AC PARAMETERS

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

tpLH1	Propagation Delay	Vcc=4.5V	3, 4, 7	PCLK-Yn	2.5	8.5	ns	9
			3, 4, 7	PCLK-Yn	2.5	10.0	ns	10, 11
tpLH2	Propagation Delay	Vcc=4.5V	3, 4, 7	DCLK-SDO	3.5	12.0	ns	9
			3, 4, 7	DCLK-SDO	3.5	15.5	ns	10, 11
tpLH3	Propagation Delay	Vcc=4.5V	3, 4, 7	MODE-SDO	3.5	11.0	ns	9
			3, 4, 7	MODE-SDO	3.5	13.5	ns	10, 11
tpLH4	Propagation Delay	Vcc=4.5V	3, 4, 7	SDI-SDO	3.0	10.0	ns	9
			3, 4, 7	SDI-SDO	3.0	12.0	ns	10, 11
tpHL1	Propagation Delay	Vcc=4.5V	3, 4, 7	PCLK-Yn	2.5	8.0	ns	9
			3, 4, 7	PCLK-Yn	2.5	10.0	ns	10, 11
tpHL2	Propagation Delay	Vcc=4.5V	3, 4, 7	DCLK-SDO	3.5	11.5	ns	9
			3, 4, 7	DCLK-SDO	3.5	14.0	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. NOTE: -55C TEMPERATURE, SUBGROUP 11 IS GUARANTEED BUT NOT TESTED.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tpHL3	Propagation Delay	Vcc=4.5V	3, 4, 7	MODE-SDO	3.5	10.0	ns	9
			3, 4, 7	MODE-SDO	3.5	12.0	ns	10, 11
tpHL4	Propagation Delay	Vcc=4.5V	3, 4, 7	SDI-SDO	3.0	9.5	ns	9
			3, 4, 7	SDI-SDO	3.0	11.5	ns	10, 11
tpZH1	Output Enable Time	Vcc=4.5V	3, 4, 7	$\overline{OEY}$-Yn	2.5	9.5	ns	9
			3, 4, 7	$\overline{OEY}$-Yn	2.5	11.0	ns	10, 11
tpZH2	Output Enable Time	Vcc=4.5V	3, 4, 7	DCLK-Dn	3.0	11.0	ns	9
			3, 4, 7	DCLK-Dn	3.0	13.5	ns	10, 11
tpZL1	Output Enable Time	Vcc=4.5V	3, 4, 7	$\overline{OEY}$-Yn	2.5	10.5	ns	9
			3, 4, 7	$\overline{OEY}$-Yn	2.5	12.0	ns	10, 11
tpZL2	Output Enable Time	Vcc=4.5V	3, 4, 7	DCLK-Dn	3.0	11.5	ns	9
			3, 4, 7	DCLK-Dn	3.0	14.0	ns	10, 11
tpLZ1	Output Disable Time	Vcc=4.5V	3, 4, 7	$\overline{OEY}$-Yn	1.5	8.5	ns	9
			3, 4, 7	$\overline{OEY}$-Yn	1.5	10.0	ns	10, 11
tpLZ2	Output Disable Time	Vcc=4.5V	3, 4, 7	DCLK-Dn	1.5	10.5	ns	9
			3, 4, 7	DCLK-Dn	1.5	12.0	ns	10, 11
tpHZ1	Output Disable Time	Vcc=4.5V	3, 4, 7	$\overline{OEY}$-Yn	2.0	10.5	ns	9
			3, 4, 7	$\overline{OEY}$-Yn	2.0	12.0	ns	10, 11
tpHZ2	Output Disable Time	Vcc=4.5V	3, 4, 7	DCLK-Dn	2.0	12.0	ns	9
			3, 4, 7	DCLK-Dn	2.0	13.5	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. NOTE: -55C TEMPERATURE, SUBGROUP 11 IS GUARANTEED BUT NOT TESTED.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
ts(1)	Setup Time	Vcc=4.5V	6	D-PCLK	4.0		ns	9
			6	D-PCLK	6.0		ns	10, 11
th(1)	Hold Time	Vcc=4.5V	6	D-PCLK	1.0		ns	9, 10, 11
ts(2)	Setup Time	Vcc=4.5V	6	MODE-PCLK	4.5		ns	9
			6	MODE-PCLK	6.0		ns	10, 11
th(2)	Hold Time	Vcc=4.5V	6	MODE-PCLK	0.0		ns	9, 10, 11
ts(3)	Setup Time	Vcc=4.5V	6	Y-DCLK	2.5		ns	9, 10, 11
th(3)	Hold Time	Vcc=4.5V	6	Y-DCLK	1.0		ns	9
			6	Y-DCLK	1.5		ns	10, 11
ts(4)	Setup Time	Vcc=4.5V	6	MODE-DCLK	4.0		ns	9
			6	MODE-DCLK	4.5		ns	10, 11
th(4)	Hold Time	Vcc=4.5V	6	MODE-DCLK	1.0		ns	9, 10, 11
ts(5)	Setup Time	Vcc=4.5V	6	SDI-DCLK	3.5		ns	9
			6	SDI-DCLK	4.5		ns	10, 11
th(5)	Hold Time	Vcc=4.5V	6	SDI-DCLK	1.0		ns	9, 10, 11
ts(6)	Setup Time	Vcc=4.5V	6	DCLK-PCLK	9.0		ns	9
			6	DCLK-PCLK	11.5		ns	10, 11
ts(7)	Setup Time	Vcc=4.5V	6	PCLK-DCLK	11.0		ns	9
			6	PCLK-DCLK	12.5		ns	10, 11
tw(1)	Pulse Width	Vcc=4.5V	6	PCLK(H)	3.0		ns	9
			6	PCLK(H)	3.5		ns	10, 11
tw(2)	Pulse Width	Vcc=4.5V	6	DCLK(L)	3.0		ns	9, 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. NOTE: -55C TEMPERATURE, SUBGROUP 11 IS GUARANTEED BUT NOT TESTED.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tw(3)	Pulse Width	Vcc=4.5V	6	SDI(L)	3.0		ns	9
			6	SDI(L)	3.5		ns	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, GUARDBAND LIMITS SET FOR +25C, 2 MSEC DURATION MAX.
Note 6: NOT TESTED AT +125C & -55C TEMPERATURE (DESIGN CHARACTERIZATION DATA)
Note 7: +25C & +125C MIN LIMITS GUARANTEED FOR 5.5V BY GUARDBANDING 4.5V MINIMUM LIMITS.