

**FAIRCHILD**  
SEMICONDUCTOR™

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## SCAN182541A Non-Inverting Line Driver with 25Ω Series Resistor Outputs

### General Description

The SCAN182541A is a high performance BiCMOS line driver featuring separate data inputs organized into dual 9-bit bytes with byte-oriented paired output enable control signals. This device is compliant with IEEE 1149.1 Standard Test Access Port and Boundary-Scan architecture with the incorporation of the defined Boundary-Scan test logic and test access port consisting of Test Data Input (TDI), Test Data Out (TDO), Test Mode Select (TMS), and Test Clock (TCK).

### Features

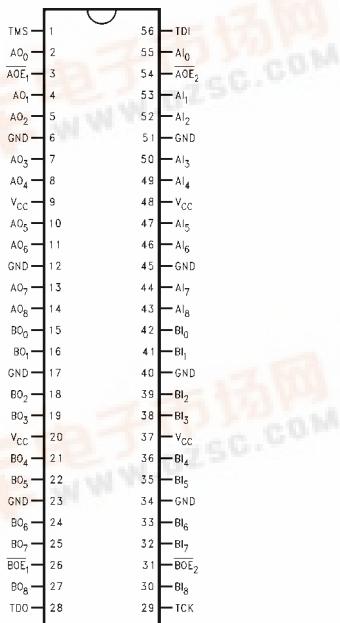
- IEEE 1149.1 (JTAG) Compliant
- High performance BiCMOS technology
- 25Ω series resistor outputs eliminate need for external terminating resistors
- Dual output enable signals per byte
- 3-STATE outputs for bus-oriented applications
- 25 mil pitch SSOP (Shrink Small Outline Package)
- Includes CLAMP, IDCODE and HIGHZ instructions
- Additional instructions SAMPLE-IN, SAMPLE-OUT and EXTTEST-OUT
- Power up 3-STATE for hot insert
- Member of Fairchild's SCAN Products

### Ordering Code:

Order Number	Package Number	Package Description
SCAN182541ASSC	MS56A	56-Lead Shrink Small Outline Package (SSOP), JEDEC MO-118, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

### Connection Diagram



### Pin Descriptions

Pin Names	Description
Al(0-8)	Input Pins, A Side
Bl(0-8)	Input Pins, B Side
AOE <sub>1</sub> , AOE <sub>2</sub>	3-STATE Output Enable Input Pins, A Side
BOE <sub>1</sub> , BOE <sub>2</sub>	3-STATE Output Enable Input Pins, B Side
AO(0-8)	Output Pins, A Side
BO(0-8)	Output Pins, B Side

SCAN182541A Non-Inverting Line Driver with 25Ω Series Resistor Outputs



### Truth Tables

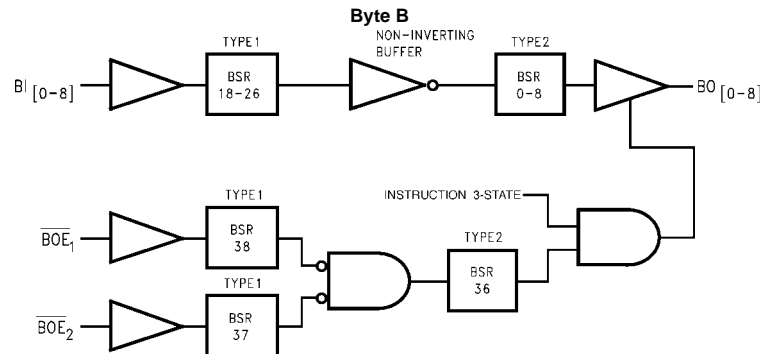
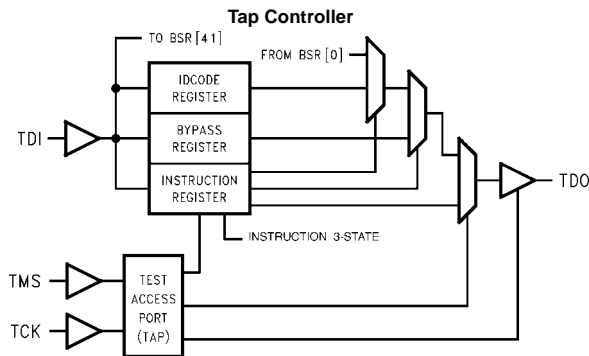
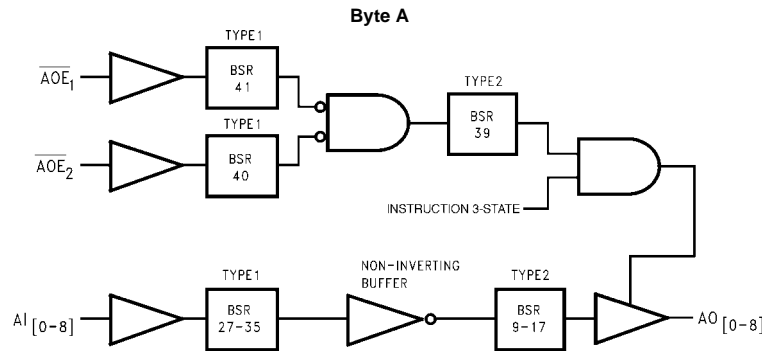
Inputs			AO <sub>(0-8)</sub>
$\uparrow$ AOE <sub>1</sub>	$\uparrow$ AOE <sub>2</sub>	AI <sub>(0-8)</sub>	
L	L	H	H
H	X	X	Z
X	H	X	Z
L	L	L	L

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Immaterial

Inputs			BO <sub>(0-8)</sub>
$\uparrow$ BOE <sub>1</sub>	$\uparrow$ BOE <sub>2</sub>	BI <sub>(0-8)</sub>	
L	L	H	H
H	X	X	Z
X	H	X	Z
L	L	L	L

Z = High Impedance  
 $\uparrow$  = Inactive-to-active transition must occur to enable outputs upon power-up.

### Block Diagrams



Note: BSR stands for Boundary Scan Register.

## Description of BOUNDARY-SCAN Circuitry

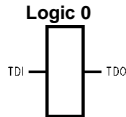
The scan cells used in the BOUNDARY-SCAN register are one of the following two types depending upon their location. Scan cell TYPE1 is intended to solely observe system data, while TYPE2 has the additional ability to control system data.

Scan cell TYPE1 is located on each system input pin while scan cell TYPE2 is located at each system output pin as well as at each of the two internal active-high output enable signals. AOE controls the activity of the A-outputs while BOE controls the activity of the B-outputs. Each will activate their respective outputs by loading a logic high.

The BYPASS register is a single bit shift register stage identical to scan cell TYPE1. It captures a fixed logic low.

The INSTRUCTION register is an 8-bit register which captures the default value of 10000001 (SAMPLE/PRELOAD) during the CAPTURE-IR instruction command. The benefit of capturing SAMPLE/PRELOAD as the default instruction during CAPTURE-IR is that the user is no longer required to shift in the 8-bit instruction for SAMPLE/PRELOAD. The sequence of: CAPTURE-IR→EXIT1-IR→ UPDATE-IR will update the SAMPLE/PRELOAD instruction. For more information refer to the section on instruction definitions.

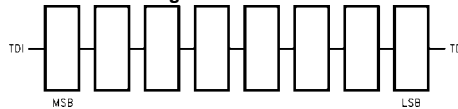
### Bypass Register Scan Chain Definition



SCAN182541A Product IDCODE  
(32-Bit Code per IEEE 1149.1)

Version	Entity	Part Number	Manufacturer ID	Required by 1149.1
0000	111111	0000001001	00000001111	1
<b>MSB</b>				<b>LSB</b>

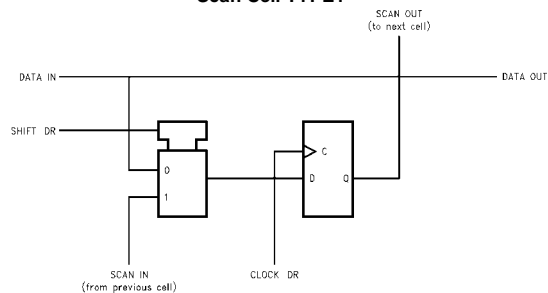
### Instruction Register Scan Chain Definition



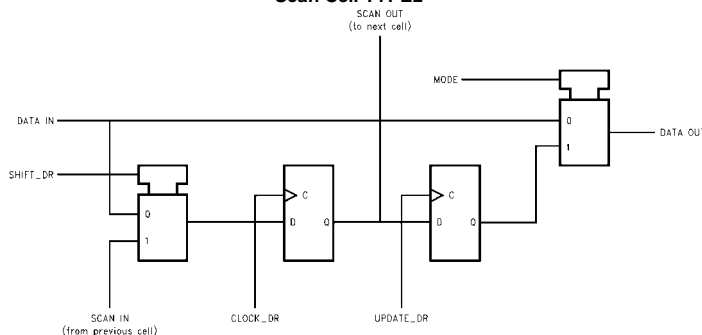
MSB→LSB

Instruction Code	Instruction
00000000	EXTTEST
10000001	SAMPLE/PRELOAD
10000010	CLAMP
00000011	HIGH-Z
01000001	SAMPLE-IN
01000010	SAMPLE-OUT
00100010	EXTTEST-OUT
10101010	IDCODE
11111111	BYPASS
All Others	BYPASS

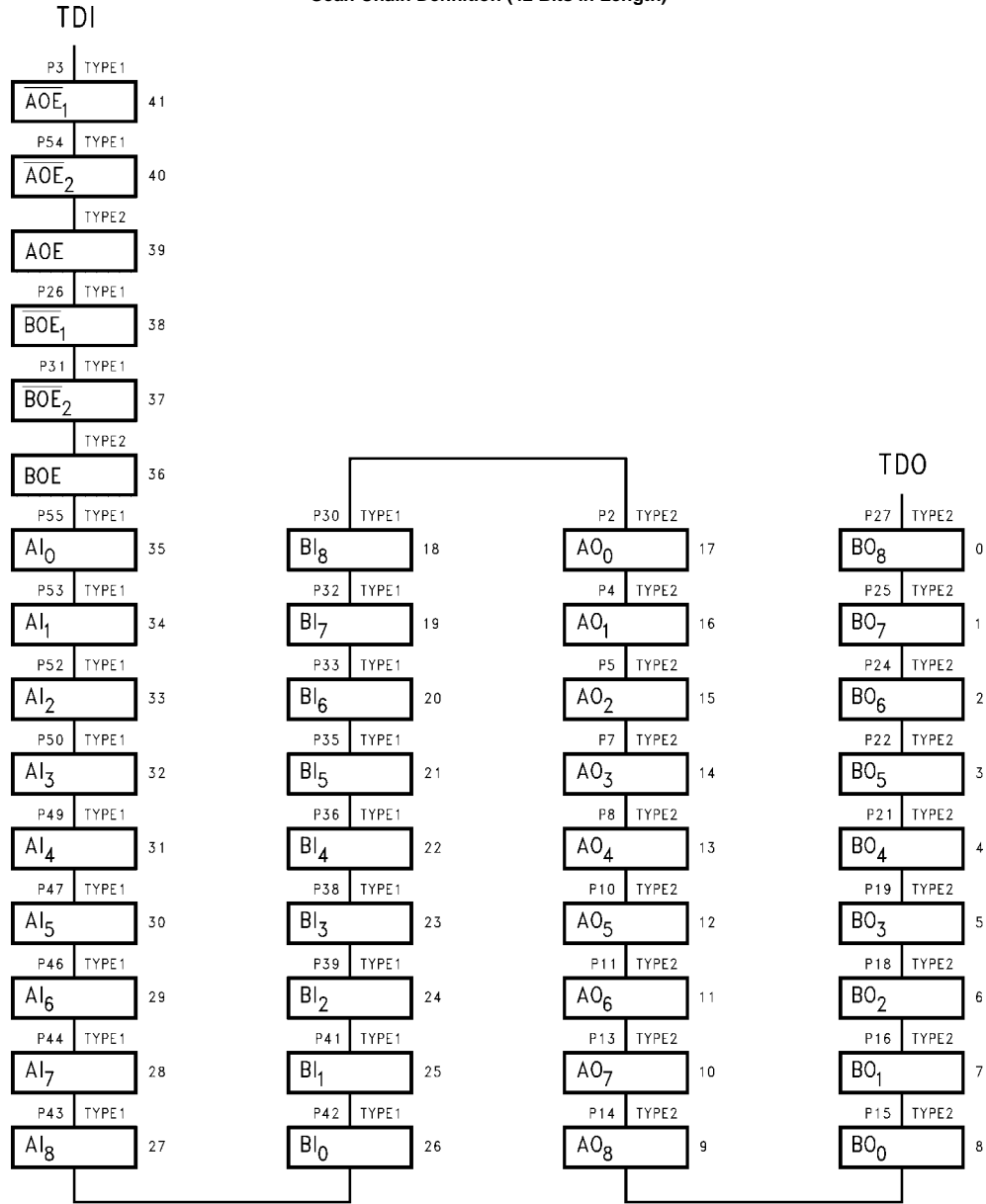
### Scan Cell TYPE1



### Scan Cell TYPE2

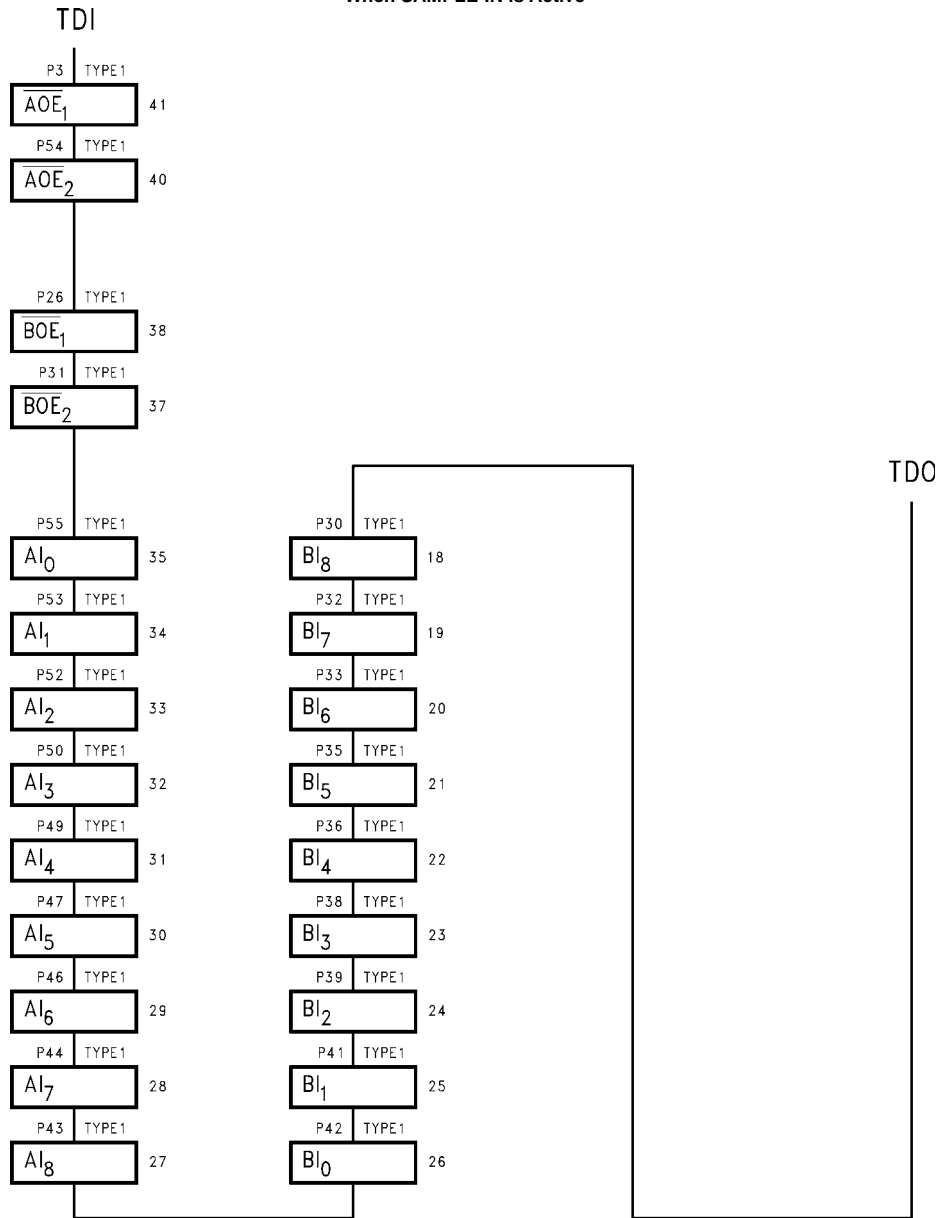


**Description of BOUNDARY-SCAN Circuitry** (Continued)  
**BOUNDARY-SCAN Register**  
**Scan Chain Definition (42 Bits in Length)**

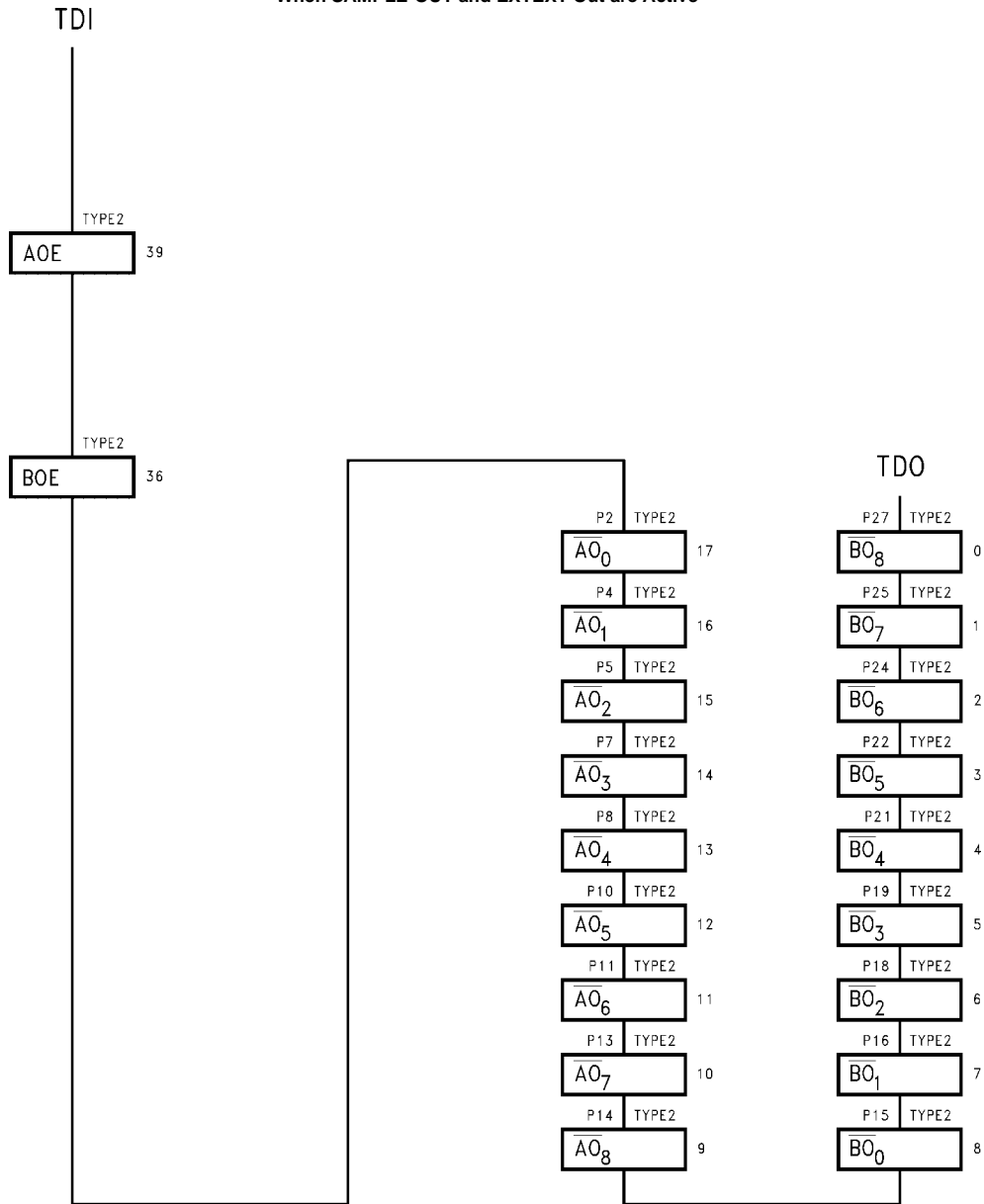


**Description of BOUNDARY-SCAN Circuitry** (Continued)

Input BOUNDARY-SCAN Register  
 Scan Chain Definition (22 Bits in Length)  
 When SAMPLE-IN is Active



**Description of BOUNDARY-SCAN Circuitry** (Continued)  
 Output BOUNDARY-SCAN Register  
 Scan Chain Definition (20 Bits in Length)  
 When SAMPLE-OUT and EXTEXT Out are Active



**Description of BOUNDARY-SCAN Circuitry** (Continued)  
**BOUNDARY-SCAN Register Definition Index**

Bit No.	Pin Name	Pin No.	Pin Type	Scan Cell Type	
41	$\overline{AOE}_1$	3	Input	TYPE1	Control Signals
40	$\overline{AOE}_2$	54	Input	TYPE1	
39	$\overline{AOE}$		Internal	TYPE2	
38	$\overline{BOE}_1$	26	Input	TYPE1	
37	$\overline{BOE}_2$	31	Input	TYPE1	
36	$\overline{BOE}$		Internal	TYPE2	
35	$AI_0$	55	Input	TYPE1	A-in
34	$AI_1$	53	Input	TYPE1	
33	$AI_2$	52	Input	TYPE1	
32	$AI_3$	50	Input	TYPE1	
31	$AI_4$	49	Input	TYPE1	
30	$AI_5$	47	Input	TYPE1	
29	$AI_6$	46	Input	TYPE1	
28	$AI_7$	44	Input	TYPE1	
27	$AI_8$	43	Input	TYPE1	
26	$BI_0$	42	Input	TYPE1	B-in
25	$BI_1$	41	Input	TYPE1	
24	$BI_2$	39	Input	TYPE1	
23	$BI_3$	38	Input	TYPE1	
22	$BI_4$	36	Input	TYPE1	
21	$BI_5$	35	Input	TYPE1	
20	$BI_6$	33	Input	TYPE1	
19	$BI_7$	32	Input	TYPE1	
18	$BI_8$	30	Input	TYPE1	
17	$AO_0$	2	Output	TYPE2	A-out
16	$AO_1$	4	Output	TYPE2	
15	$AO_2$	5	Output	TYPE2	
14	$AO_3$	7	Output	TYPE2	
13	$AO_4$	8	Output	TYPE2	
12	$AO_5$	10	Output	TYPE2	
11	$AO_6$	11	Output	TYPE2	
10	$AO_7$	13	Output	TYPE2	
9	$AO_8$	14	Output	TYPE2	
8	$BO_0$	15	Output	TYPE2	B-out
7	$BO_1$	16	Output	TYPE2	
6	$BO_2$	18	Output	TYPE2	
5	$BO_3$	19	Output	TYPE2	
4	$BO_4$	21	Output	TYPE2	
3	$BO_5$	22	Output	TYPE2	
2	$BO_6$	24	Output	TYPE2	
1	$BO_7$	25	Output	TYPE2	
0	$BO_8$	27	Output	TYPE2	

**Absolute Maximum Ratings** (Note 1)

Storage Temperature	-65°C to +150°C
Ambient Temperature under Bias	-55°C to +125°C
Junction Temperature under Bias	-55°C to +150°C
V <sub>CC</sub> Pin Potential to Ground Pin	-0.5V to +7.0V
Input Voltage (Note 2)	-0.5V to +7.0V
Input Current (Note 2)	-30 mA to +5.0 mA
Voltage Applied to Any Output in Disabled or Power-Off State	-0.5V to +5.5V
in the HIGH State	-0.5V to V <sub>CC</sub>
Current Applied to Output in LOW State (Max)	Twice the Rated I <sub>OL</sub> (mA)
DC Latchup Source Current	-500 mA
Over Voltage Latchup (I/O)	10V
EDS (HBM) Min.	2000V

**Recommended Operating Conditions**

Free Air Ambient Temperature	-40°C to +85°C
Supply Voltage	+4.5V to +5.5V
Minimum Input Edge Rate	( $\Delta V/\Delta t$ )
Data Input	50 mV/ns
Enable Input	20 mV/ns

**Note 1:** Absolute Maximum Ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

**Note 2:** Either voltage limit or current limit is sufficient to protect inputs.

**DC Electrical Characteristics**

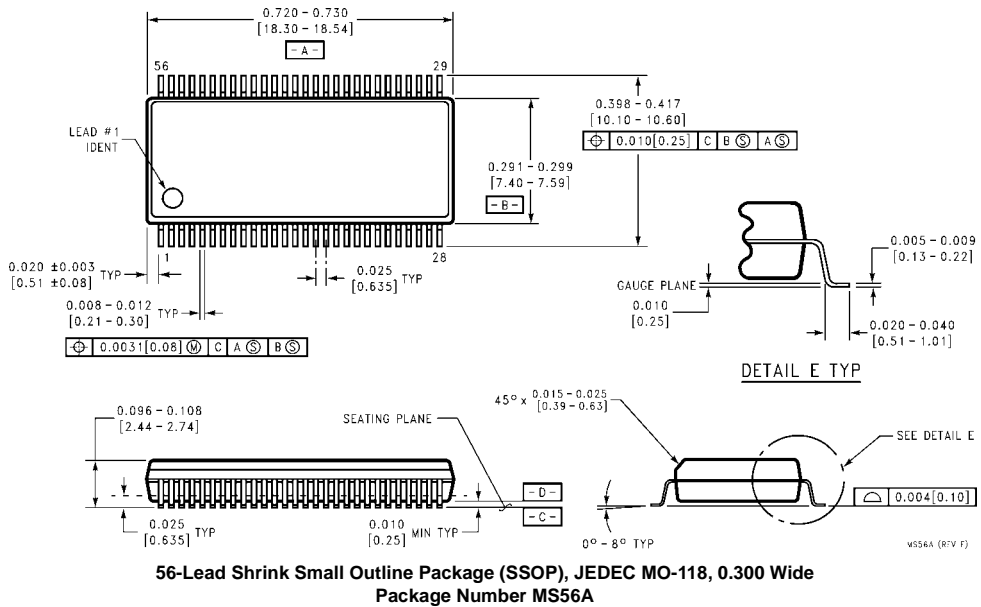
Symbol	Parameter	V <sub>CC</sub>	Min	Typ	Max	Units	Conditions
V <sub>IH</sub>	Input HIGH Voltage		2.0			V	Recognized HIGH Signal
V <sub>IL</sub>	Input LOW Voltage				0.8	V	Recognized LOW Signal
V <sub>CD</sub>	Input Clamp Diode Voltage	Min			-1.2	V	I <sub>IN</sub> = -18 mA
V <sub>OH</sub>	Output HIGH Voltage	Min	2.5			V	I <sub>OH</sub> = -3 mA
		Min	2.0			V	I <sub>OH</sub> = -32 mA
V <sub>OL</sub>	Output LOW Voltage	Min			0.8	V	I <sub>OL</sub> = 15 mA
I <sub>IH</sub>	Input HIGH Current	All Others	Max		5	μA	V <sub>IN</sub> = 2.7V (Note 3)
			Max		5	μA	V <sub>IN</sub> = V <sub>CC</sub>
		TMS, TDI	Max		5	μA	V <sub>IN</sub> = V <sub>CC</sub>
I <sub>BVI</sub>	Input HIGH Current Breakdown Test	Max			7	μA	V <sub>IN</sub> = 7.0V
I <sub>BVIT</sub>	Input HIGH Current Breakdown Test (I/O)	Max			100	μA	V <sub>IN</sub> = 5.5V
I <sub>IL</sub>	Input LOW Current	All Others	Max		-5	μA	V <sub>IN</sub> = 0.5V (Note 3)
			Max		-5	μA	V <sub>IN</sub> = 0.0V
		TMS, TDI	Max		-385	μA	V <sub>IN</sub> = 0.0V
V <sub>ID</sub>	Input Leakage Test	0.0	4.75			V	I <sub>ID</sub> = 1.9 μA All Other Pins Grounded
I <sub>IH</sub> + I <sub>OZH</sub>	Output Leakage Current	Max			50	μA	V <sub>OUT</sub> = 2.7V
I <sub>IL</sub> + I <sub>OZL</sub>	Output Leakage Current	Max			-50	μA	V <sub>OUT</sub> = 0.5V
I <sub>OZH</sub>	Output Leakage Current	Max			50	μA	V <sub>OUT</sub> = 2.7V
I <sub>OZL</sub>	Output Leakage Current	Max			-50	μA	V <sub>OUT</sub> = 0.5V
I <sub>OS</sub>	Output Short-Circuit Current	Max	-100		-275	mA	V <sub>OUT</sub> = 0.0V
I <sub>CEX</sub>	Output HIGH Leakage Current	Max			50	μA	V <sub>OUT</sub> = V <sub>CC</sub>
I <sub>ZZ</sub>	Bus Drainage Test	0.0			100	μA	V <sub>OUT</sub> = 5.5V All Others Grounded



DC Electrical Characteristics (Continued)								
Symbol	Parameter	V <sub>CC</sub>	Min	Typ	Max	Units	Conditions	
I <sub>CCH</sub>	Power Supply Current	Max			250	μA	V <sub>OUT</sub> = V <sub>CC</sub> ; TDI, TMS = V <sub>CC</sub>	
		Max			1.0	mA	V <sub>OUT</sub> = V <sub>CC</sub> ; TDI, TMS = GND	
I <sub>CCL</sub>	Power Supply Current	Max			65	mA	V <sub>OUT</sub> = LOW; TDI, TMS = V <sub>CC</sub>	
		Max			65.8	mA	V <sub>OUT</sub> = LOW; TDI, TMS = GND	
I <sub>CCZ</sub>	Power Supply Current	Max			250	μA	TDI, TMS = V <sub>CC</sub>	
		Max			1.0	mA	TDI, TMS = GND	
I <sub>CC1</sub>	Additional I <sub>CC</sub> /Input	All Other Inputs TDI, TMS Inputs	Max			2.9	mA	V <sub>IN</sub> = V <sub>CC</sub> - 2.1V
			Max			3	mA	V <sub>IN</sub> = V <sub>CC</sub> - 2.1V
I <sub>CCD</sub>	Dynamic I <sub>CC</sub>	No Load	Max		0.2	mA/ MHz	Outputs Open One Bit Toggling, 50% Duty Cycle	
<b>Note 3:</b> Guaranteed not tested.								
AC Electrical Characteristics								
Normal Operation:								
Symbol	Parameter	V <sub>CC</sub> (V) (Note 4)	T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF			Units		
			Min	Typ	Max			
t <sub>PLH</sub>	Propagation Delay	5.0	1.0	3.4	5.2	ns		
t <sub>PHL</sub>	Data to Q		1.9	4.1	6.5			
t <sub>PLZ</sub>	Disable Time	5.0	2.0	5.2	8.7	ns		
t <sub>PHZ</sub>			1.9	5.6	9.2			
t <sub>PZL</sub>	Enable Time	5.0	2.4	6.1	9.6	ns		
t <sub>PZH</sub>			1.6	5.1	8.5			
t <sub>PLH</sub>	Propagation Delay	5.0	3.2	6.0	9.4	ns		
t <sub>PHL</sub>	TCK to TDO		4.5	7.6	11.3			
t <sub>PLZ</sub>	Disable Time	5.0	2.5	5.8	9.9	ns		
t <sub>PHZ</sub>	TCK to TDO		3.7	7.4	11.8			
t <sub>PZL</sub>	Enable Time	5.0	4.9	8.6	12.9	ns		
t <sub>PZH</sub>	TCK to TDO		3.1	6.7	10.7			
t <sub>PLH</sub>	Propagation Delay		3.7	6.7	10.3	ns		
t <sub>PHL</sub>	TCK to Data Out during Update-DR State	5.0	4.9	8.3	12.4			
t <sub>PLH</sub>	Propagation Delay		4.2	7.9	12.2	ns		
t <sub>PHL</sub>	TCK to Data Out during Update-IR State	5.0	5.3	9.2	13.8			
t <sub>PLH</sub>	Propagation Delay		5.0	9.4	14.6	ns		
t <sub>PHL</sub>	TCK to Data Out during Test Logic Reset State	5.0	6.2	10.9	16.4			
t <sub>PLZ</sub>	Disable Time		3.7	7.9	13.0	ns		
t <sub>PHZ</sub>	TCK to Data Out during Update-DR State	5.0	4.3	8.7	13.7			
t <sub>PLZ</sub>	Disable Time		3.7	8.5	14.2	ns		
t <sub>PHZ</sub>	TCK to Data Out during Update-IR State	5.0	4.3	9.4	14.8			
t <sub>PLZ</sub>	Disable Time		4.7	10.1	16.6	ns		
t <sub>PHZ</sub>	TCK to Data Out during Test Logic Reset State	5.0	5.5	10.9	17.3			
t <sub>PZL</sub>	Enable Time		5.5	9.8	14.7	ns		
t <sub>PZH</sub>	TCK to Data Out during Update-DR State	5.0	4.0	7.9	12.5			
t <sub>PZL</sub>	Enable Time		5.8	10.9	16.5	ns		
t <sub>PZH</sub>	TCK to Data Out during Update-IR State	5.0	4.3	9.0	14.4			
t <sub>PZL</sub>	Enable Time		6.6	12.5	19.1	ns		
t <sub>PZH</sub>	TCK to Data Out during Test Logic Reset State	5.0	4.9	10.5	16.9			
<b>Note 4:</b> Voltage Range 5.0V ± 0.5V								

<b>AC Operating Requirements</b>				
Scan Test Operation:				
Symbol	Parameter	V <sub>CC</sub> (V) (Note 5)	T <sub>A</sub> = -40°C to +85°C	Units
			C <sub>L</sub> = 50 pF	
			Guaranteed Minimum	
t <sub>S</sub>	Setup Time Data to TCK (Note 6)	5.0	2.2	ns
t <sub>H</sub>	Hold Time Data to TCK (Note 6)	5.0	1.8	ns
t <sub>S</sub>	Setup Time, H or L $\overline{AOE}_n, \overline{BOE}_n$ to TCK (Note 7)	5.0	3.7	ns
t <sub>H</sub>	Hold Time, H or L TCK to $\overline{AOE}_n, \overline{BOE}_n$ (Note 7)	5.0	1.8	ns
t <sub>S</sub>	Setup Time, H or L Internal $\overline{AOE}_n, \overline{BOE}_n$ to TCK (Note 8)	5.0	2.7	ns
t <sub>H</sub>	Hold Time, H or L TCK to Internal $\overline{AOE}_n, \overline{BOE}_n$ (Note 8)	5.0	1.8	ns
t <sub>S</sub>	Setup Time, H or L TMS to TCK	5.0	7.5	ns
t <sub>H</sub>	Hold Time, H or L TCK to TMS	5.0	1.8	ns
t <sub>S</sub>	Setup Time, H or L TDI to TCK	5.0	5.0	ns
t <sub>H</sub>	Hold Time, H or L TCK to TDI	5.0	2.0	ns
t <sub>W</sub>	Pulse Width TCK H L	5.0	10.0 10.8	ns
f <sub>MAX</sub>	Maximum TCK Clock Frequency	5.0	50	MHz
t <sub>PU</sub>	Wait Time, Power Up to TCK	5.0	100	ns
t <sub>DN</sub>	Power Down Delay	0.0	100	ms
<p><b>Note 5:</b> Voltage Range 5.0V ± 0.5V</p> <p><b>Note 6:</b> This delay represents the timing relationship between the data input and TCK at the associated scan cells numbered 0-8, 9-17, 18-26 and 27-35.</p> <p><b>Note 7:</b> Timing pertains to BSR 38 and 41 or BSR 37 and 40.</p> <p><b>Note 8:</b> This delay represents the timing relationship between AOE/BOE and TCK for scan cells 36 and 39 only.</p> <p><b>Note:</b> All Input Timing Delays involving TCK are measured from the rising edge of TCK.</p>				
<b>Capacitance</b>				
Symbol	Parameter	Typ	Units	Conditions, T <sub>A</sub> = 25°C
C <sub>IN</sub>	Input Capacitance	5.8	pF	V <sub>CC</sub> = 0.0V
C <sub>OUT</sub>	Output Capacitance (Note 9)	13.8	pF	V <sub>CC</sub> = 5.0V
<p><b>Note 9:</b> C<sub>OUT</sub> is measured at frequency f = 1 MHz, per MIL-STD-883B, Method 3012.</p>				

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



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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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