

# DATA SHEET

## **74F2952**

Registered transceiver, non-inverting  
(3-State)

## **74F2953**

Registered transceiver, inverting (3-State)

Product specification

1989 Sep 22

IC15 Data Handbook

## Transceivers

## 74F2952, 74F2953

74F2952 Registered transceiver, non-inverting (3-State)  
 74F2953 Registered transceiver, inverting (3-State)

## FEATURES

- 8-bit registered transceivers
- Two 8-bit, back-to-back registers store data moving in both directions between two bidirectional buses
- Separate Clock, Clock Enable and 3-State Enable provided for each register
- 74F2952 non-inverting
- 74F2953 inverting
- AM2952/2953 functional equivalent
- 'A' outputs sink 24mA and source 3mA
- 'B' outputs sink 64mA and source 15mA
- 300 mil wide 24-pin Slim DIP package

## DESCRIPTION

The 74F2952 and 74F2953 are 8-bit registered transceivers. Two 8-bit back-to-back registers store data flowing in both directions between two bi-directional buses. Data applied to the inputs is entered and stored on the rising edge of the Clock (CPXX) provided that the Clock Enable ( $\overline{\text{CEXX}}$ ) is Low. The data is then present at the 3-State output buffers, but is only accessible when the Output Enable ( $\overline{\text{OEXX}}$ ) is Low. Data flow from 'A' inputs to 'B' outputs is the same as for 'B' inputs to 'A' outputs.

TYPE	TYPICAL $f_{\text{MAX}}$	TYPICAL SUPPLY CURRENT (TOTAL)
74F2952	160MHz	105mA
74F2953	160MHz	105mA

## ORDERING INFORMATION

DESCRIPTION	COMMERCIAL RANGE $V_{\text{CC}} = 5V \pm 10\%$ , $T_{\text{amb}} = 0^{\circ}\text{C to } +70^{\circ}\text{C}$	PACKAGE DRAWING NUMBER
24-pin Plastic Slim DIP (300mil)	N74F2952N, N74F2953N	SOT222-1
24-pin Plastic SOL <sup>1</sup>	N74F2952D, N74F2953D	SOT137-1
28-pin Plastic Leaded Chip Carrier	N74F2952A, N74F2953A	SOT261-2

## NOTE:

1. Thermal mounting techniques are recommended. See *SMD Process Applications* for a discussion of thermal consideration for surface mounted devices.

## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74F(U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
A0 – A7	Port A, 3-State inputs	3.5/1.0	70 $\mu$ A/0.6mA
B0 – B7	Port B, 3-State inputs	3.5/1.0	70 $\mu$ A/0.6mA
CPAB, CPBA	Clock inputs	1.0/1.0	20 $\mu$ A/0.6mA
$\overline{\text{CEAB}}$ , $\overline{\text{CEBA}}$	Clock Enable inputs	1.0/1.0	20 $\mu$ A/0.6mA
$\overline{\text{OEAB}}$ , $\overline{\text{OEBA}}$	Output Enable inputs	1.0/1.0	20 $\mu$ A/0.6mA
A0 – A7	Port A, 3-State outputs	150/40	3.0mA/24mA
B0 – B7	Port B, 3-State outputs	750/106.7	15mA/64mA

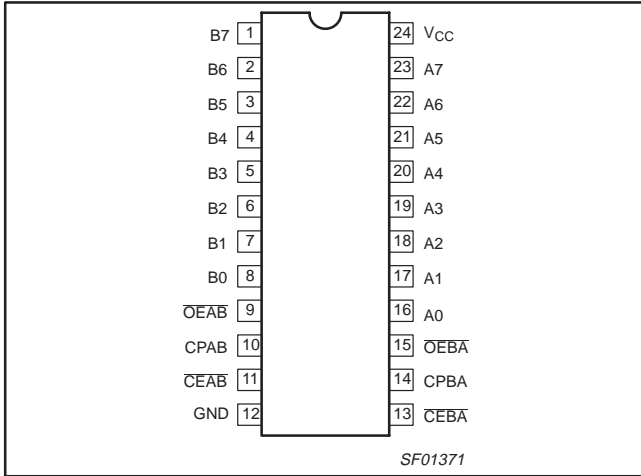
NOTE: One (1.0) FAST unit load is defined as: 20 $\mu$ A in the High state and 0.6mA in the Low state.

# Transceivers

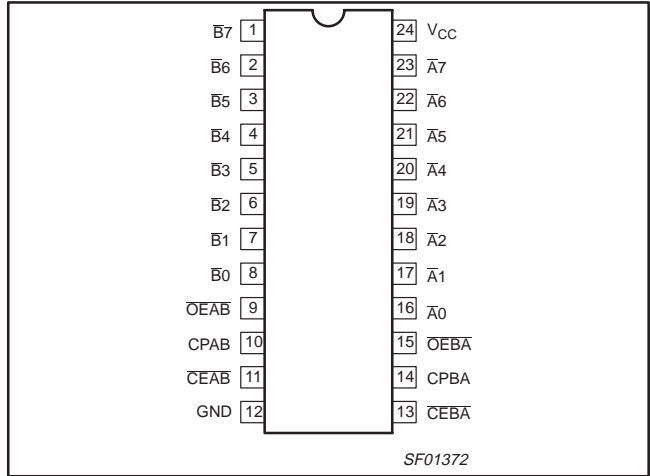
# 74F2952, 74F2953

## PIN CONFIGURATIONS

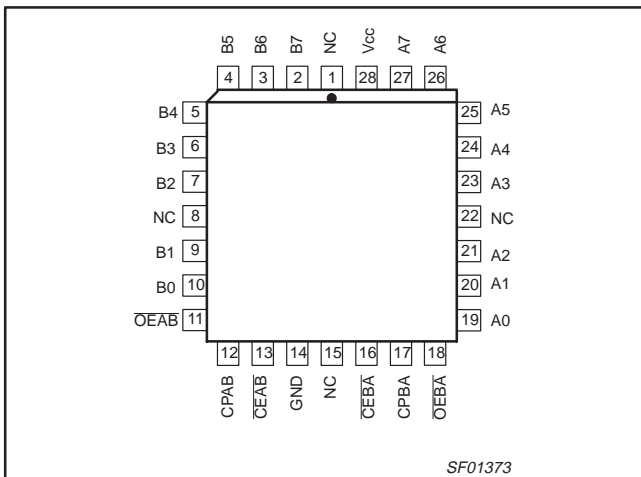
### DIP – 74F2952



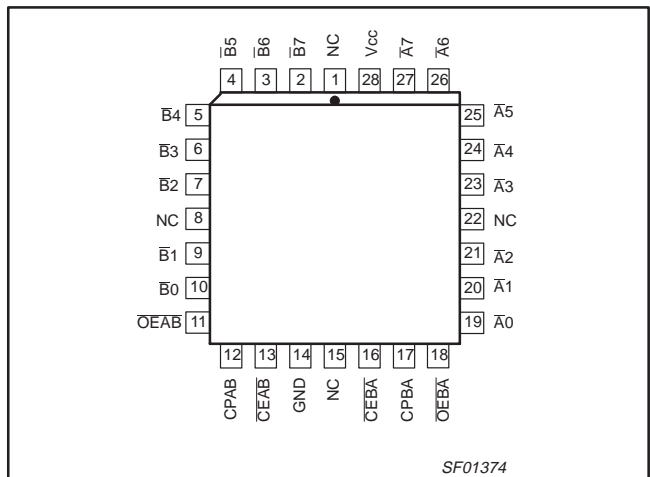
### DIP – 74F2953



### PLCC – 74F2952



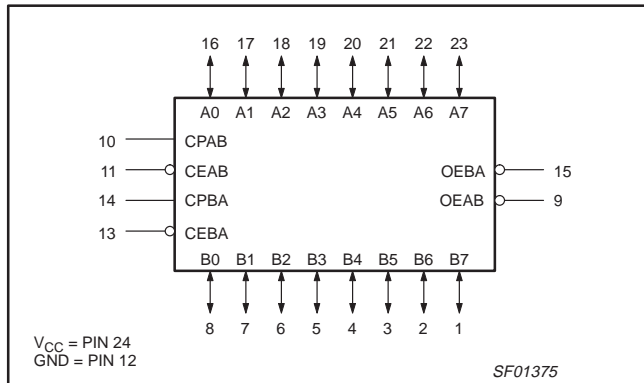
### PLCC – 74F2953



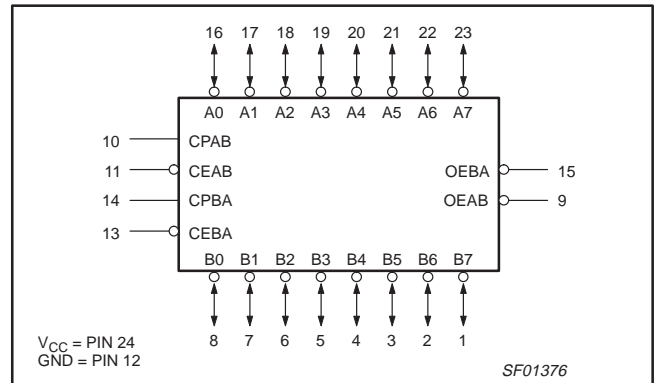
# Transceivers

# 74F2952, 74F2953

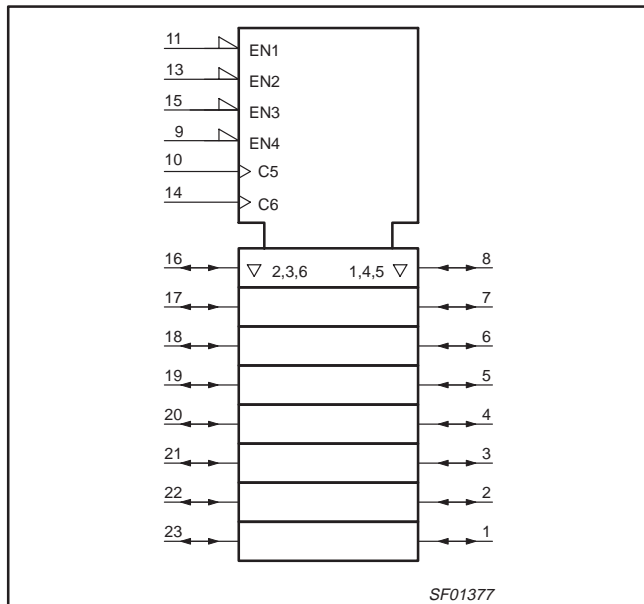
## LOGIC SYMBOL – 74F2952



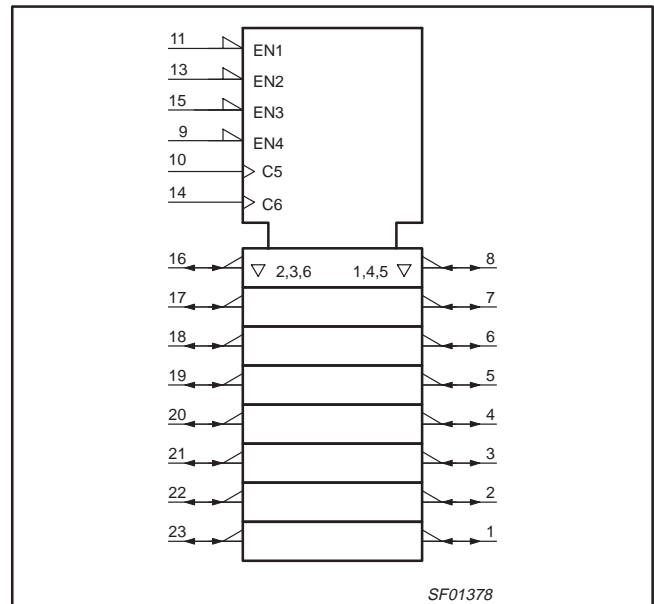
## LOGIC SYMBOL – 74F2953



## IEC/IEEE SYMBOL – 74F2952



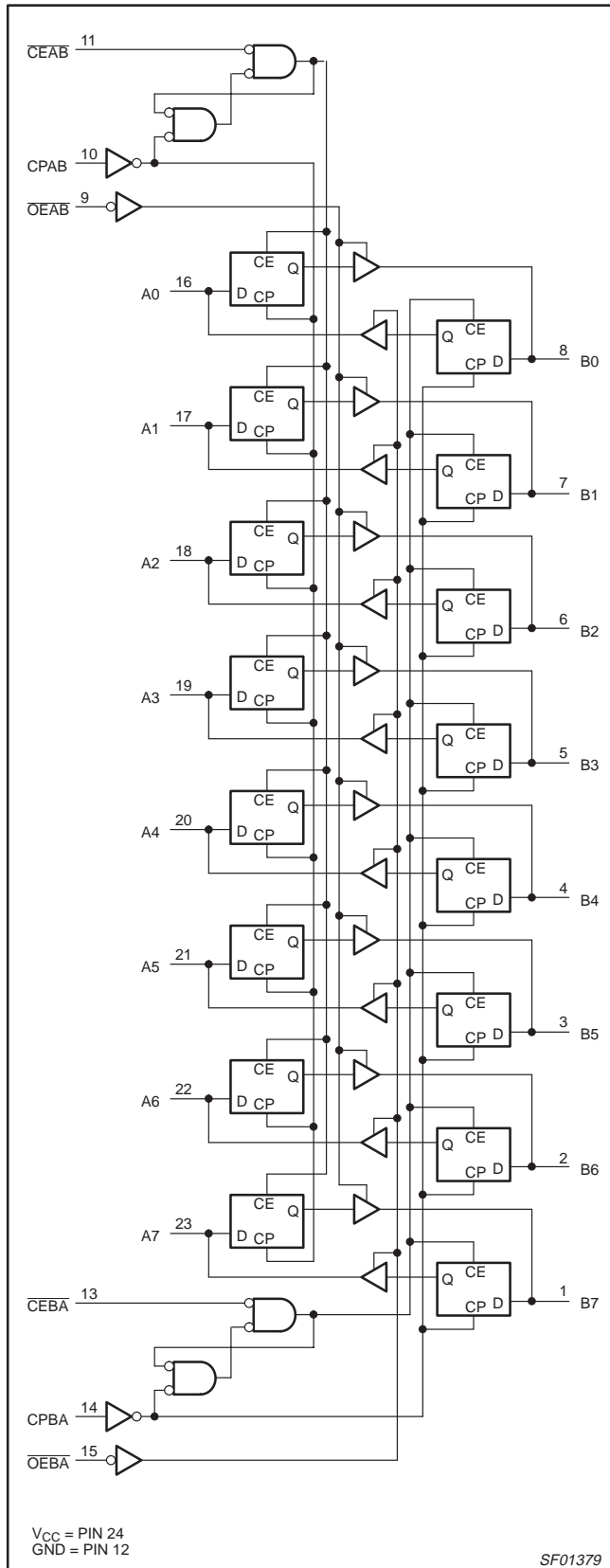
## IEC/IEEE SYMBOL – 74F2953



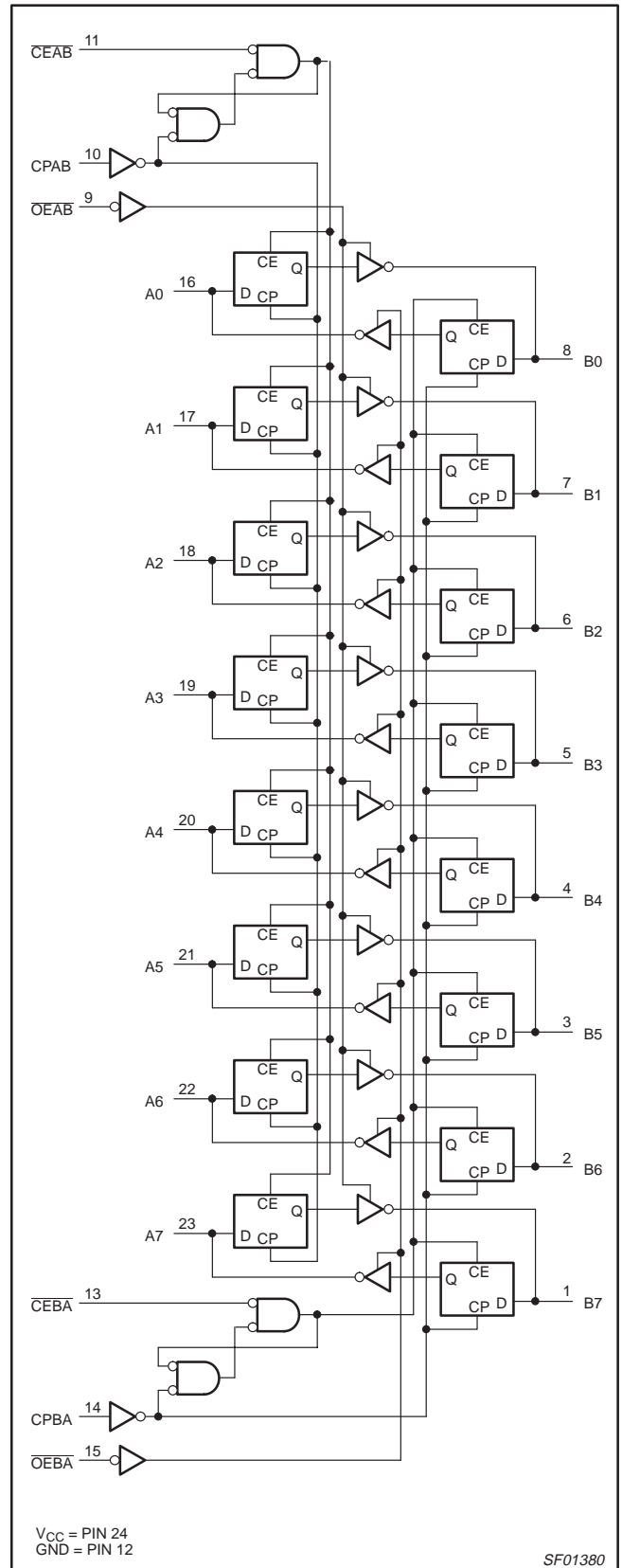
# Transceivers

# 74F2952, 74F2953

### LOGIC DIAGRAM – 74F2952



### LOGIC DIAGRAM – 74F2953



## Transceivers

## 74F2952, 74F2953

FUNCTION TABLE for Register An or Bn

INPUTS			INTERNAL Q	OPERATING MODE
An or Bn	CPXX	CEXX		
X	X	H	NC	Hold data
L	↑	L	L	Load data
H	↑	L	H	

H = High voltage level  
 L = Low voltage level  
 ↑ = Low-to-High transition  
 X = Don't Care  
 XX = AB or BA  
 NC = No Change

FUNCTION TABLE for Output Enable

INPUTS OEXX	INTERNAL Q	An or Bn OUTPUTS		OPERATING MODE
		74F2952	74F2953	
H	X	Z	Z	Disable outputs
L	L	L	H	Enable outputs
L	H	H	L	

H = High voltage level  
 L = Low voltage level  
 X = Don't Care  
 XX = AB or BA  
 Z = High impedance "off" state

## ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limits set forth in this table may impair the useful life of the device.  
 Unless otherwise noted these limits are over the operating free-air temperature range.)

SYMBOL	PARAMETER	RATING	UNIT
V <sub>CC</sub>	Supply voltage	-0.5 to +7.0	V
V <sub>IN</sub>	Input voltage	-0.5 to +7.0	V
I <sub>IN</sub>	Input current	-30 to +5	mA
V <sub>OUT</sub>	Voltage applied to output in High output state	-0.5 to +5.5	V
I <sub>OUT</sub>	Current applied to output in Low output state	A0 – A7	48
		B0 – B7	128
T <sub>amb</sub>	Operating free-air temperature range	0 to +70	°C
T <sub>stg</sub>	Storage temperature range	-65 to +150	°C

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5.0	5.5	V
V <sub>IH</sub>	High-level input voltage	2.0			V
V <sub>IL</sub>	Low-level input voltage			0.8	V
I <sub>IK</sub>	Input clamp current			-18	mA
I <sub>OH</sub>	High-level output current	A0 – A7		-3	mA
		B0 – B7		-15	mA
I <sub>OL</sub>	Low-level output current	A0 – A7		24	mA
		B0 – B7		64	mA
T <sub>amb</sub>	Operating free-air temperature range	0		+70	°C

## Transceivers

74F2952, 74F2953

**DC ELECTRICAL CHARACTERISTICS**

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER		TEST CONDITIONS <sup>1</sup>			LIMITS			UNIT
						MIN	TYP <sup>2</sup>	MAX	
V <sub>OH</sub>	High-level output voltage	A0–A7	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN	I <sub>OH</sub> = –3mA	±10% V <sub>CC</sub>	2.4			V
					±5% V <sub>CC</sub>	2.7	3.3		V
		B0–B7		I <sub>OH</sub> = –15mA	±10% V <sub>CC</sub>	2.0			V
					±5% V <sub>CC</sub>	2.0			V
V <sub>OL</sub>	Low-level output voltage	A0–A7	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN	I <sub>OL</sub> = 24mA	±10% V <sub>CC</sub>		0.35	0.50	V
					±5% V <sub>CC</sub>		0.35	0.50	V
		B0–B7		I <sub>OL</sub> = 48mA	±10% V <sub>CC</sub>		0.38	0.55	V
					±5% V <sub>CC</sub>		0.42	0.55	V
V <sub>IK</sub>	Input clamp voltage		V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>			–0.73	–1.2	V	
I <sub>I</sub>	Input current at maximum input voltage	CPAB, CPBA, OEAB, OEBA, CEAB, CEBA	V <sub>CC</sub> = 5.5V, V <sub>I</sub> = 7.0V				100	μA	
		A0–A7, B0–B7	V <sub>CC</sub> = 5.5V, V <sub>I</sub> = 5.5V				1	mA	
I <sub>IH</sub>	High-level input current	CPAB, CPBA, OEAB, OEBA, CEAB, CEBA	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V				20	μA	
I <sub>IL</sub>	Low-level input current	CPAB, CPBA, OEAB, OEBA, CEAB, CEBA	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5V				–0.6	mA	
I <sub>IH</sub> +I <sub>OZH</sub>	Off-state output current High-level voltage applied	A0–A7, B0–B7	V <sub>CC</sub> = MAX, V <sub>O</sub> = 2.7V				70	μA	
I <sub>IL</sub> +I <sub>OZL</sub>	Off-state output current Low-level voltage applied	A0–A7, B0–B7	V <sub>CC</sub> = MAX, V <sub>O</sub> = 0.5V				–600	μA	
I <sub>OS</sub>	Short-circuit output current <sup>3</sup>	A0–A7	V <sub>CC</sub> = MAX, V <sub>O</sub> = 0V		–60		–150	mA	
		B0–B7			–100		–225	mA	
I <sub>CC</sub>	Supply current (total)	I <sub>CCH</sub>	V <sub>CC</sub> = MAX			90	140	mA	
		I <sub>CCCL</sub>				120	175	mA	
		I <sub>CCZ</sub>				105	155	mA	

**NOTES:**

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at V<sub>CC</sub> = 5V, T<sub>amb</sub> = 25°C.
- Not more than one output should be shorted at a time. For testing I<sub>OS</sub>, the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a High output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I<sub>OS</sub> tests should be performed last.

## Transceivers

74F2952, 74F2953

## AC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITION	LIMITS					UNIT
			$T_{amb} = +25^{\circ}\text{C}$ $V_{CC} = +5\text{V}$ $C_L = 50\text{pF}, R_L = 500\Omega$			$T_{amb} = 0^{\circ}\text{C to } +70^{\circ}\text{C}$ $V_{CC} = +5\text{V} \pm 10\%$ $C_L = 50\text{pF}, R_L = 500\Omega$		
			MIN	TYP	MAX	MIN	MAX	
$f_{MAX}$	Maximum clock frequency	Waveform 1	145	160		135		MHz
$t_{PLH}$ $t_{PHL}$	Propagation delay CPBA or CPAB to An or Bn	Waveform 1	3.0 3.5	5.0 6.0	7.5 8.5	2.5 3.5	8.0 9.0	ns
$t_{PZH}$ $t_{PZL}$	Output Enable time OEBA or OEAB to An or Bn	Waveform 3 Waveform 4	2.0 3.5	4.5 6.0	7.0 9.5	2.0 3.0	8.0 10.0	ns
$t_{PHZ}$ $t_{PLZ}$	Output Disable time OEBA or OEAB to An or Bn	Waveform 3 Waveform 4	2.0 1.5	4.0 3.5	8.0 6.5	1.5 1.0	9.0 7.0	ns

## AC SETUP REQUIREMENTS

SYMBOL	PARAMETER	TEST CONDITION	LIMITS					UNIT
			$T_{amb} = +25^{\circ}\text{C}$ $V_{CC} = +5\text{V}$ $C_L = 50\text{pF}, R_L = 500\Omega$			$T_{amb} = 0^{\circ}\text{C to } +70^{\circ}\text{C}$ $V_{CC} = +5\text{V} \pm 10\%$ $C_L = 50\text{pF}, R_L = 500\Omega$		
			MIN	TYP	MAX	MIN	MAX	
$t_s(H)$ $t_s(L)$	Setup time, High or Low An or Bn to CPAB or CPBA	74F2952	4.5 3.5			5.0 4.0		ns
$t_s(H)$ $t_s(L)$	Setup time, High or Low An or Bn to CPAB or CPBA	74F2953	4.0 3.5			4.0 4.0		ns
$t_h(H)$ $t_h(L)$	Hold time, High or Low An or Bn to CPAB or CPBA	Waveform 2	0.0 0.0			0.0 0.0		ns
$t_s(H)$ $t_s(L)$	Setup time, High or Low $\overline{CEAB}, \overline{CEBA}$ to CPAB, CPBA	Waveform 2	0.0 4.0			0.0 4.0		ns
$t_h(H)$ $t_h(L)$	Hold time, High or Low $\overline{CEAB}, \overline{CEBA}$ to CPAB, CPBA	Waveform 2	2.5 2.5			2.5 3.0		ns
$t_w(H)$ $t_w(L)$	CPAB or CPBA pulse width, High or Low	Waveform 1	3.0 3.5			3.0 3.5		ns

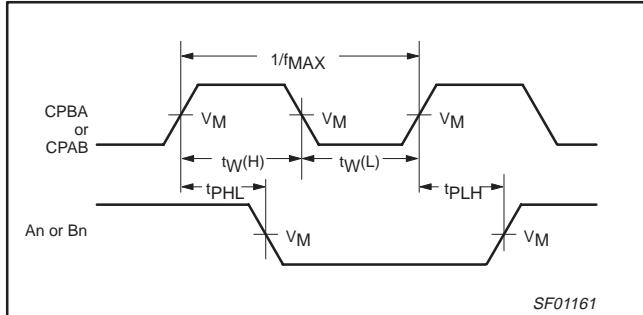
# Transceivers

# 74F2952, 74F2953

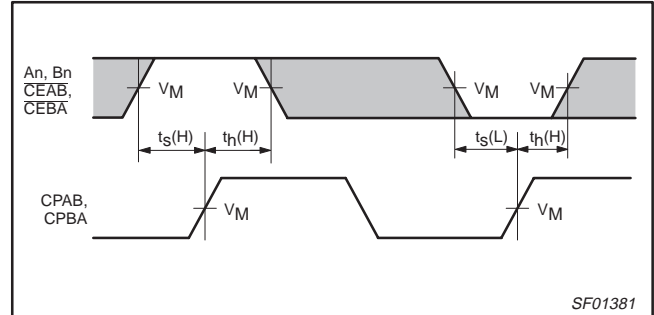
## AC WAVEFORMS

For all waveforms,  $V_M = 1.5V$ .

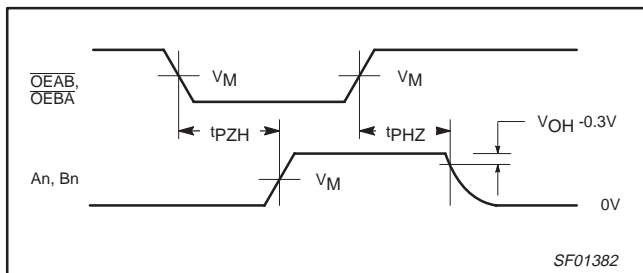
The shaded areas indicate when the input is permitted to change for predictable output.



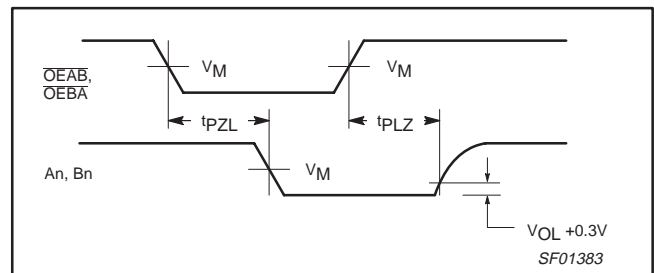
**Waveform 1. Propagation Delay, Clock Input to Output, Clock Pulse Width, and Maximum Clock Frequency**



**Waveform 2. Data Setup and Hold Times**



**Waveform 3. 3-State Output Enable Time to High Level and Output Disable Time from High Level**



**Waveform 4. 3-State Output Enable Time to Low Level and Output Disable Time from Low Level**

## TEST CIRCUIT AND WAVEFORMS

**Test Circuit for 3-State Outputs**

SWITCH POSITION	
TEST	SWITCH
$t_{PLZ}$	closed
$t_{PZL}$	closed
All other	open

**DEFINITIONS:**  
 $R_L$  = Load resistor; see AC electrical characteristics for value.  
 $C_L$  = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value.  
 $R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of pulse generators.

**Input Pulse Definition**

family	INPUT PULSE REQUIREMENTS					
	amplitude	$V_M$	rep. rate	$t_w$	$t_{TLH}$	$t_{THL}$
74F	3.0V	1.5V	1MHz	500ns	2.5ns	2.5ns

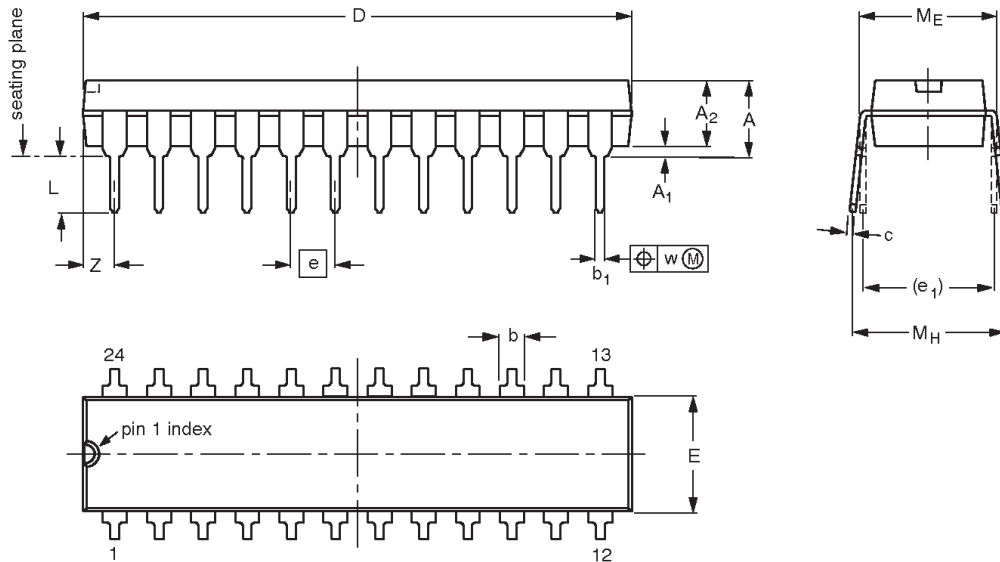
SF00777

Transceivers

74F2952, 74F2953

DIP24: plastic dual in-line package; 24 leads (300 mil)

SOT222-1



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.70	0.38	3.94	1.63 1.14	0.56 0.43	0.36 0.25	31.9 31.5	6.73 6.48	2.54	7.62	3.51 3.05	8.13 7.62	10.03 7.62	0.25	2.05
inches	0.185	0.015	0.155	0.064 0.045	0.022 0.017	0.014 0.010	1.256 1.240	0.265 0.255	0.100	0.300	0.138 0.120	0.32 0.30	0.395 0.300	0.01	0.081

Note

1. Plastic or metal protrusions of 0.01 inches maximum per side are not included.

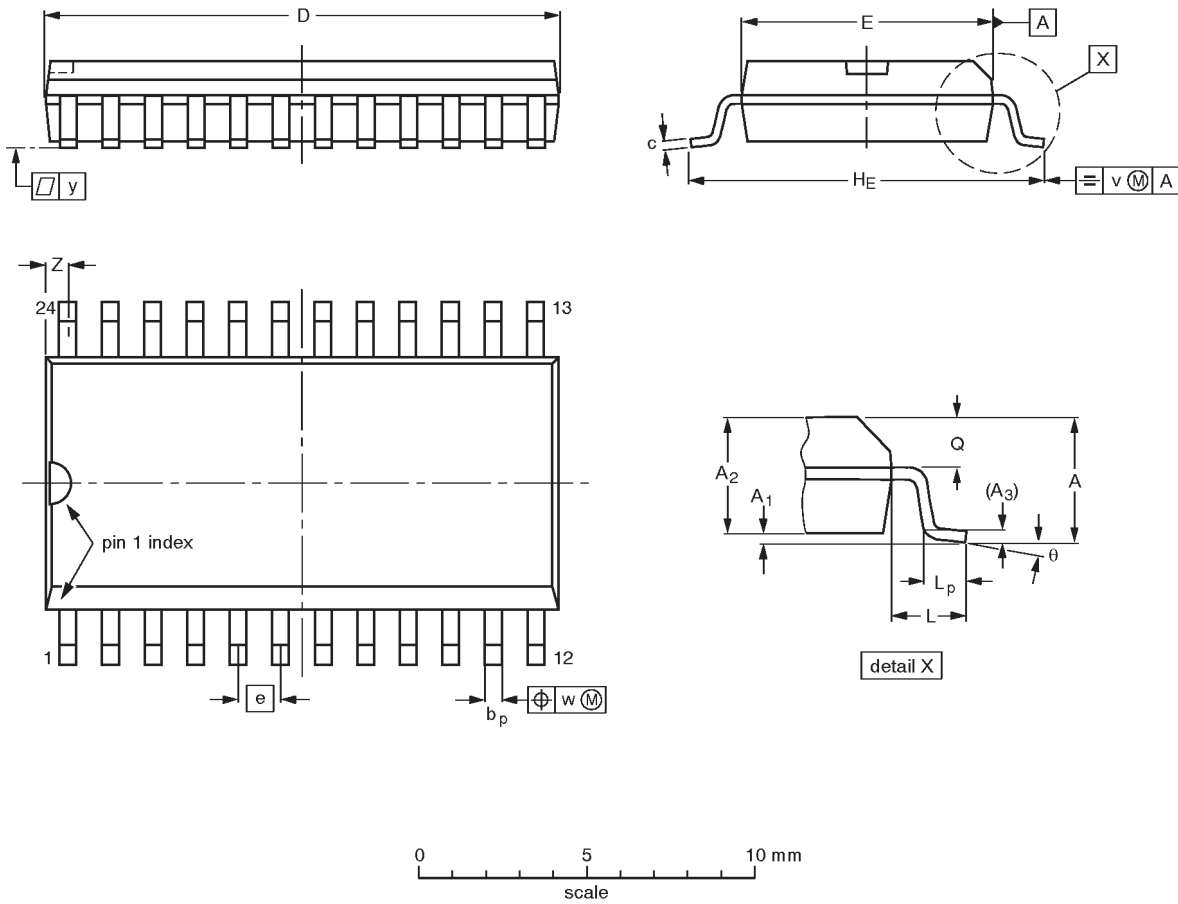
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT222-1		MS-001AF				95-03-11

Transceivers

74F2952, 74F2953

SO24: plastic small outline package; 24 leads; body width 7.5 mm

SOT137-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	15.6 15.2	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.61 0.60	0.30 0.29	0.050	0.42 0.39	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

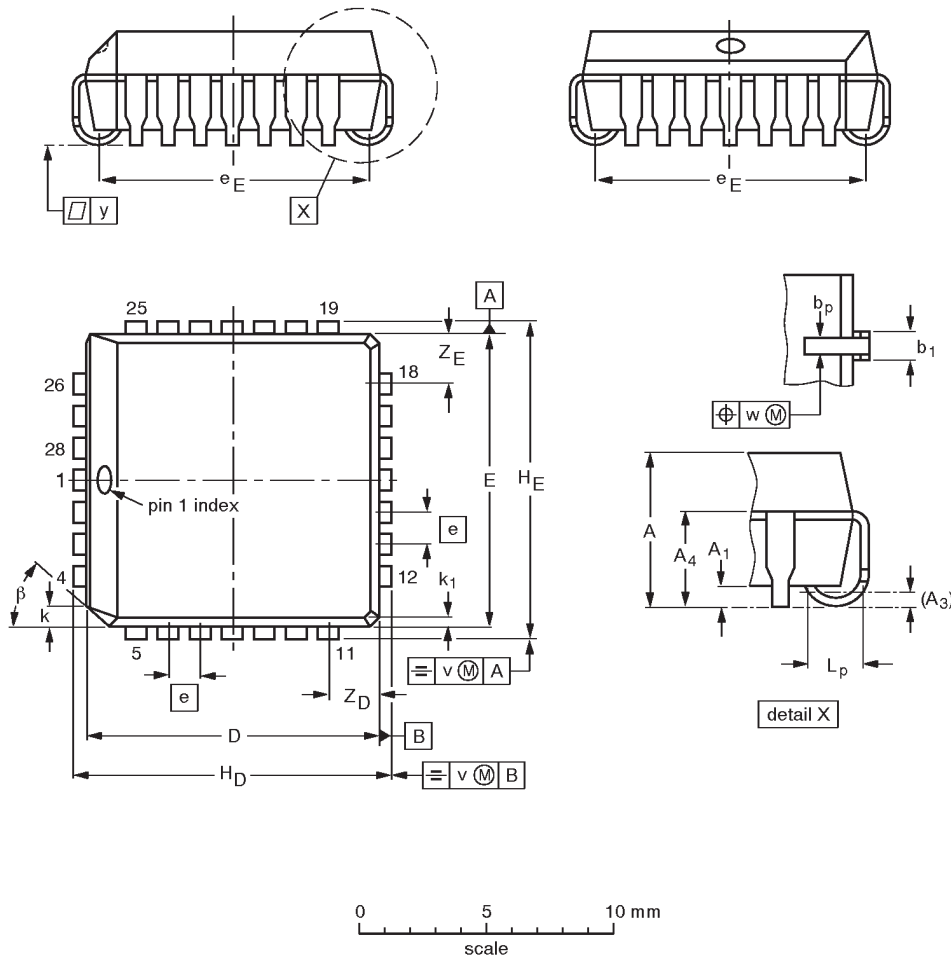
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT137-1	075E05	MS-013AD				-92-11-17 95-01-24

Transceivers

74F2952, 74F2953

PLCC28: plastic leaded chip carrier; 28 leads

SOT261-2



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	A <sub>1</sub> min.	A <sub>3</sub>	A <sub>4</sub> max.	b <sub>p</sub>	b <sub>1</sub>	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>D</sub>	e <sub>E</sub>	H <sub>D</sub>	H <sub>E</sub>	k	k <sub>1</sub> max.	L <sub>p</sub>	v	w	y	Z <sub>D</sub> <sup>(1)</sup> max.	Z <sub>E</sub> <sup>(1)</sup> max.	$\beta$
mm	4.57 4.19	0.51	0.25	3.05	0.53 0.33	0.81 0.66	11.58 11.43	11.58 11.43	1.27	10.92 9.91	10.92 9.91	12.57 12.32	12.57 12.32	1.22 1.07	0.51	1.44 1.02	0.18	0.18	0.10	2.16	2.16	45°
inches	0.180 0.165	0.020	0.01	0.12	0.021 0.013	0.032 0.026	0.456 0.450	0.456 0.450	0.05	0.430 0.390	0.430 0.390	0.495 0.485	0.495 0.485	0.048 0.042	0.020	0.057 0.040	0.007	0.007	0.004	0.085	0.085	

Note

1. Plastic or metal protrusions of 0.01 inches maximum per side are not included.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT261-2					92-11-17 95-02-25

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Transceivers

74F2952, 74F2953

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**NOTES**

## Transceivers

74F2952, 74F2953

## DEFINITIONS

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	<b>Formative or in Design</b>	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
<i>Preliminary Specification</i>	<b>Preproduction Product</b>	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
<i>Product Specification</i>	<b>Full Production</b>	This data sheet contains Final Specifications. Philips Semiconductors reserves the right to make changes at any time without notice, in order to improve design and supply the best possible product.

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