

# **S1F77330 Series Technical Manual**

## NOTICE

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## 1. OVERVIEW

The S1F77330 series is the bus switch suitable for USB applications. The adopted CMOS process technology characterizes the S1F77330 series by low power consumption. The compact WCSP adopted for the package enables the S1F77330 series to be mounted on high-density assemblies.

The built-in level shift circuit eliminates the need of external level shift circuitry for the input to this IC.

### 1.1 Features

- Input voltage range : 3.0V to 3.6V
- Low-current consumption : 14 $\mu$ A (MAX)
- Static current : 1 $\mu$ A (MAX)
- Bus switch ON resistance : 6.0 $\Omega$  (typ)
- Bus switch pin capacity (D system) : 2.7pF (typ)
- Bus switch pin capacity (D\* system) : 1.45pF (typ)

### 1.2 Application

- Mobile communication equipment (mobile phones, cordless phones, and wireless communication devices)
- Mobile AV equipment
- Home appliances
- Cameras, and video equipment
- Portable game devices
- Battery-based equipment

### 1.3 Package

- S1F77330M0A : PLP-10 (2.50mm $\times$ 2.70mm)
- S1F77330B0A : WCSP-10 (1.118mm $\times$ 1.625mm)

### 1.4 Application Circuit Example

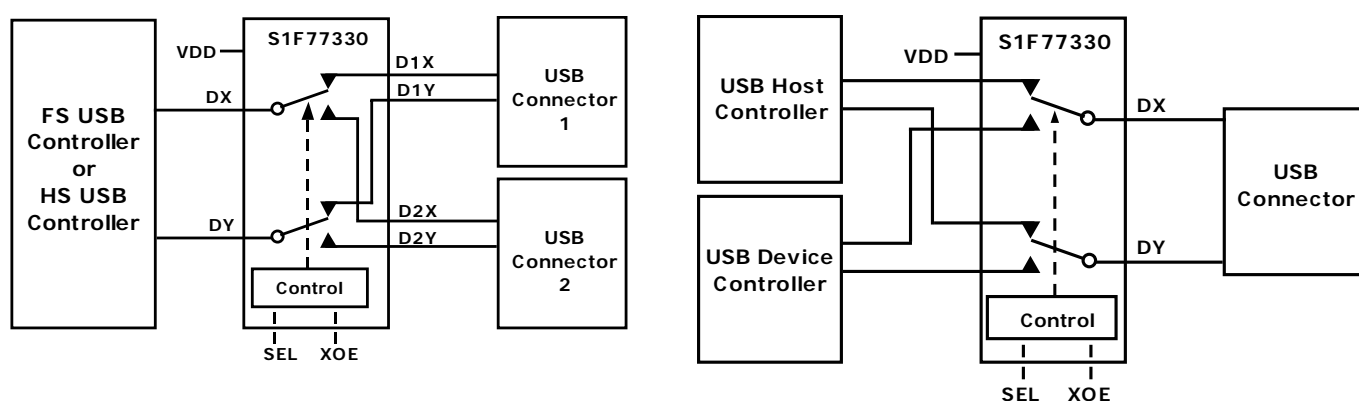
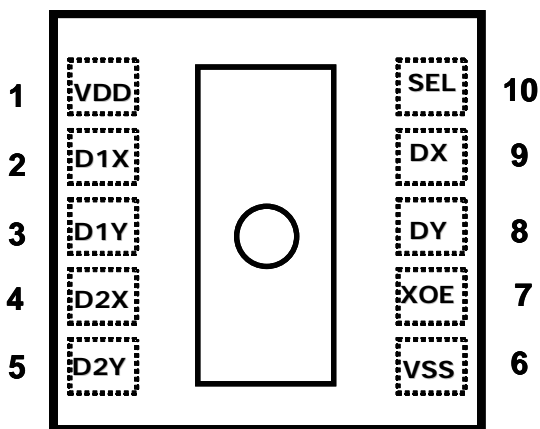


Figure 1 Application Circuit Example

# 1. OVERVIEW

## 1.5 Pin Assignment(S1F77330M0A)



(TOP VIEW)

Figure 2 Pin Assignment

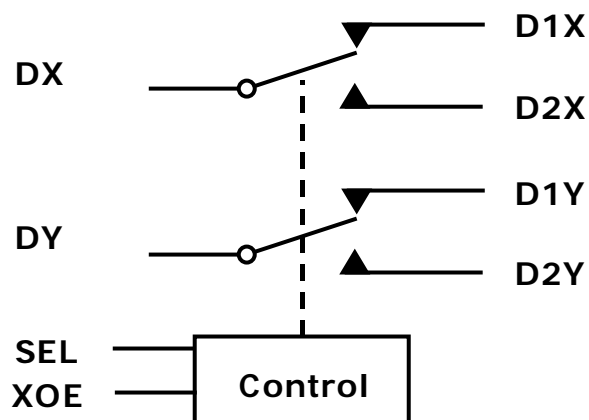


Figure 3 Bus switch symbol

\* Central land area in this IC is not used. Do not mount any pin

## 1.6 Pin Description(S1F77330M0A)

Pin No.	Pin Name	Pin Description
1	VDD	Power supply pin
2	D1X	Data port 1 (X)
3	D1Y	Data port 1 (Y)
4	D2X	Data port 2 (X)
5	D2Y	Data port 2 (Y)
6	Vss	GND pin
7	XOE	Bus switch enable input pin
8	DY	Data port COM(Y)
9	DX	Data port COM(X)
10	SEL	Switch select input pin

## 1.7 Truth Table(S1F77330M0A)

SEL	XOE	Bus Switch status
X	HIGH	Disconnected
LOW	LOW	DX = D1X, DY = D1Y
HIGH	LOW	DX = D2X, DY = D2Y

## 1.5 Pin Assignment(S1F77330B0A)

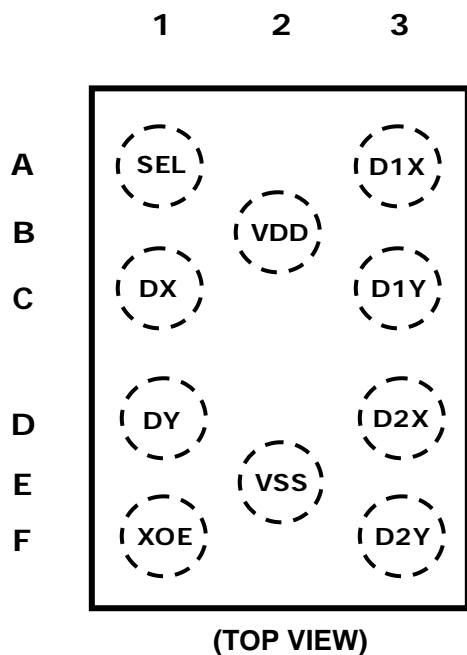


Figure 2 Pin Assignment

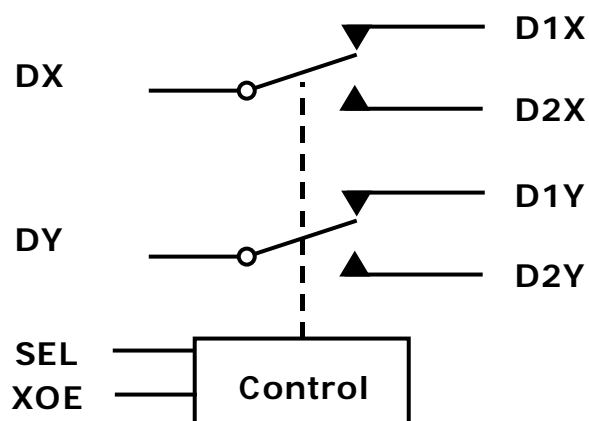


Figure 3 Bus switch symbol

## 1.6 Pin Description(S1F77330B0A)

Pin No.	Pin Name	Pin Description
A1	SEL	Switch select input pin
C1	DX	Data port COM(X)
D1	DY	Data port COM(Y)
F1	XOE	Bus switch enable input pin
E2	Vss	GND pin
F3	D2Y	Data port 2 (Y)
D3	D2X	Data port 2 (X)
C3	D1Y	Data port 1 (Y)
A3	D1X	Data port 1 (X)
B2	VDD	Power supply pin

## 1.7 Truth Table(S1F77330B0A)

SEL	XOE	Bus Switch status
X	HIGH	Disconnected
LOW	LOW	DX = D1X, DY = D1Y
HIGH	LOW	DX = D2X, DY = D2Y

# 1. OVERVIEW

## 1.8 Block Diagram

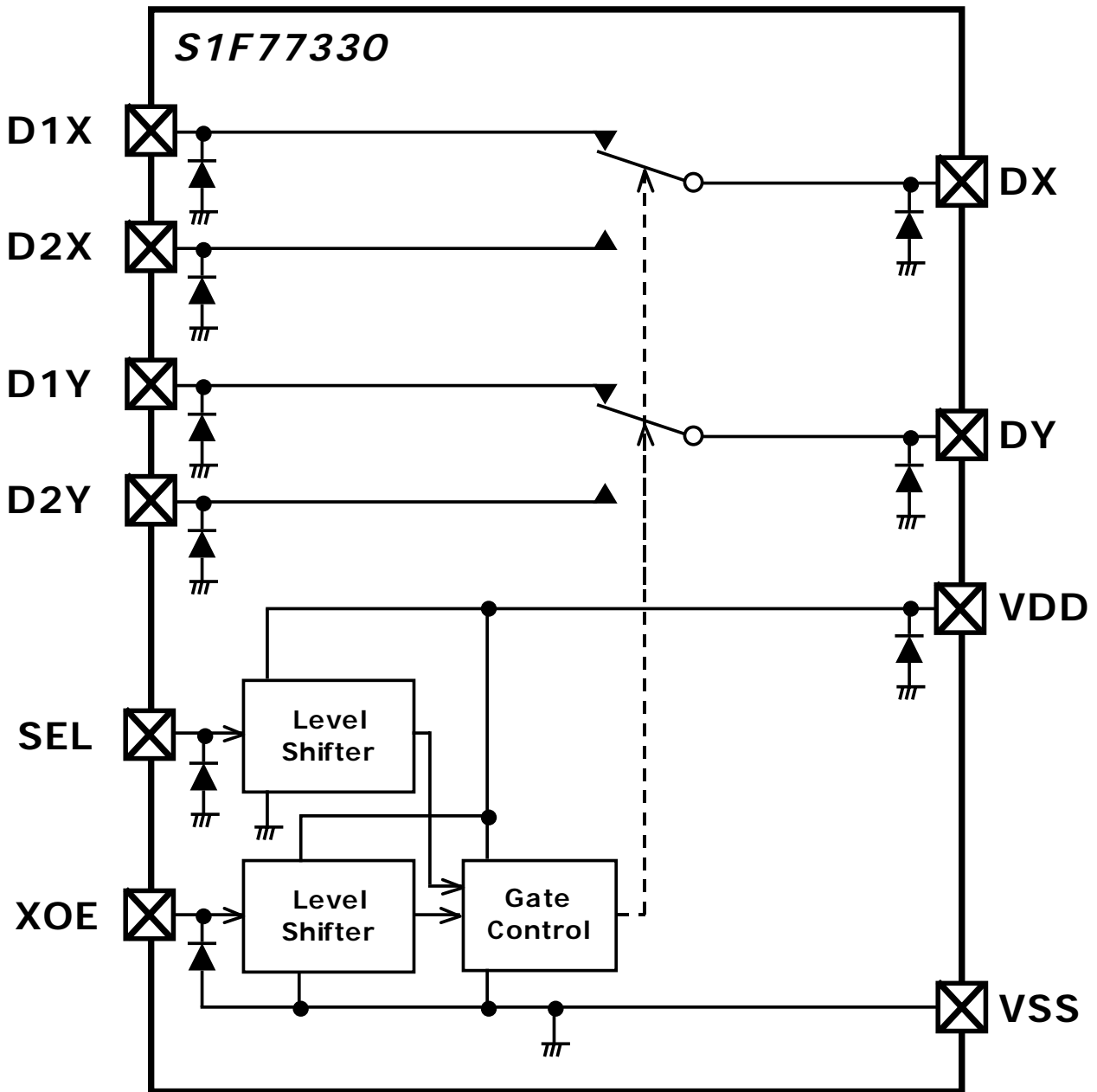


Figure 4 Block diagram

## 2. ELECTRICAL CHARACTERISTICS

### 2.1 Absolute Maximum Ratings

Item		Symbol	Min.	Max.	Unit
Supply voltage		V <sub>DD</sub>	-0.3	4.6	V
Input pin voltage	XOE, SEL	V <sub>IN</sub>	-0.3	7.0	V
Switch input voltage	D1X,D2X,D1Y,D2Y,DX,DY	V <sub>SW</sub>	-0.3	7.0	V
Storage temperature		T <sub>STG</sub>	-65	150	°C

### 2.2 Recommended Operating Conditions

Item		Symbol	Min.	Max.	Unit
Supply voltage		V <sub>DD</sub>	3.0	3.6	V
Input pin voltage	XOE,SEL	V <sub>IN</sub>	0.0	5.5	V
Switch input voltage	D1X,D2X,D1Y,D2Y,DX,DY	V <sub>SW</sub>	0.0	5.5	V
Operating temperature		T <sub>a</sub>	-40	85	°C

### 2.3 DC Electrical Characteristics

(Unless otherwise specified: T<sub>a</sub>=-40°C to 85°C)

Item	Symbol	Conditions	V <sub>DD</sub> [V]	Min.	Typ.	Max.	Unit
Clamp diode voltage	V <sub>IK</sub>	I <sub>L</sub> =18mA	3.0			-1.2	V
High Level Input voltage	V <sub>IH</sub>		3.0 to 3.6	1.2			V
Low Level Input voltage	V <sub>IL</sub>		3.0 to 3.6			0.4	V
Input pin leak	I <sub>IN</sub>	0V ≤ V <sub>IN</sub> ≤ V <sub>CC</sub>	3.6	-1.0		1.0	μA
Switch off leak	I <sub>OZ</sub>	0V ≤ V <sub>SW</sub> ≤ V <sub>CC</sub>	3.6	-1.0		1.0	μA
Power off Leakage current (DX, DY)	I <sub>OFF</sub>	0V ≤ V <sub>SW</sub> ≤ V <sub>CC</sub> , V <sub>CC</sub> =0V	0.0	-2.0		2.0	μA
Switch ON resistance	R <sub>ON</sub>	V <sub>SW</sub> =0.4V, I <sub>ON</sub> , =-8mA	3.0		6.0	9.0	Ω
ΔON resistance	ΔR <sub>ON</sub>	V <sub>SW</sub> =0.4V, I <sub>ON</sub> , =-8mA	3.0		0.35		Ω
ON resistance flatness	R <sub>ON</sub> (Flat)	0V ≤ V <sub>SW</sub> ≤ 1V, I <sub>ON</sub> =-8mA	3.0		2.0		Ω
Quiescent current	I <sub>CC</sub>	V <sub>IN</sub> =3.6V	3.6			1.0	μA
Current consumption	I <sub>CCT</sub>	V <sub>IN</sub> =0V, V <sub>SW</sub> =2.6V	3.6			14.0	μA

\* Describe the value based on the USB full speed standard.

## 2. ELECTRICAL CHARACTERISTICS

### 2.4 AC Electrical Characteristics

(Unless otherwise specified: Ta=-40°C to 85°C)

Item	Symbol	Conditions	VDD[V]	Min.	Typ.	Max.	Unit
Turn ON Time	t <sub>ON</sub>	R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF	3.0 to 3.6		5	21	μs
Turn OFF Time	t <sub>OFF</sub>	R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF	3.0 to 3.6		23	50	ns
Propagation Delay	t <sub>PD</sub>	R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF	3.3		0.25		ns
OFF Isolation	OIRR	R <sub>L</sub> =50Ω, C <sub>L</sub> =0pF, f=240MHz	3.0 to 3.6		-34		dB
Crosstalk	X <sub>talk</sub>	R <sub>L</sub> =50Ω, f=240MHz	3.0 to 3.6		-30		dB
-3dB Bandwidth	BW	R <sub>L</sub> =50Ω, C <sub>L</sub> =0pF, f=240MHz	3.0 to 3.6		900		MHz
Channel to Channel Skew	t <sub>SK(O)</sub>	R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF	3.0 to 3.6		50		ps
Skew of Opposite Transitions of the Same Output	t <sub>SK(P)</sub>	R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF	3.0 to 3.6		20		ps
Total Jitter	t <sub>j</sub>	R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF, t <sub>R</sub> =t <sub>F</sub> =500ps at 480Mbps	3.0 to 3.6		200		ps

### 2.5 Capacitance

(Unless otherwise specified: Ta=-40°C to 85°C)

Item	Symbol	Conditions	VDD[V]	Min.	Typ.	Max.	Unit
Control input pin capacitance	C <sub>IN</sub>	V <sub>DD</sub> =0V, f=1MHz	0.0		7.0		pF
Bus switch ON capacitance	C <sub>ON</sub>	V <sub>IN</sub> =0V, f=1MHz	3.3		4.4		pF
Bus switch OFF capacitance1 (D1X, D1Y, D2X, D2Y)	C <sub>OFF1</sub>	V <sub>DD</sub> =0V, f=1MHz	0.0		1.45		pF
Bus switch OFF capacitance2 (DX, DY)	C <sub>OFF2</sub>	V <sub>DD</sub> =0V, f=1MHz	0.0		2.7		pF

3. TYPICAL CHARACTERISTICS DIAGRAMS

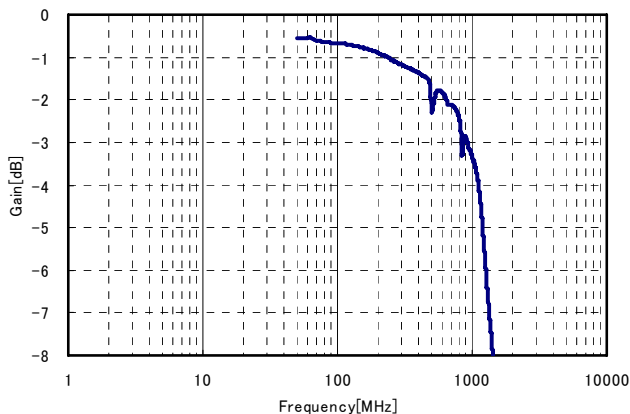


Figure 5 Gain-frequency characteristic

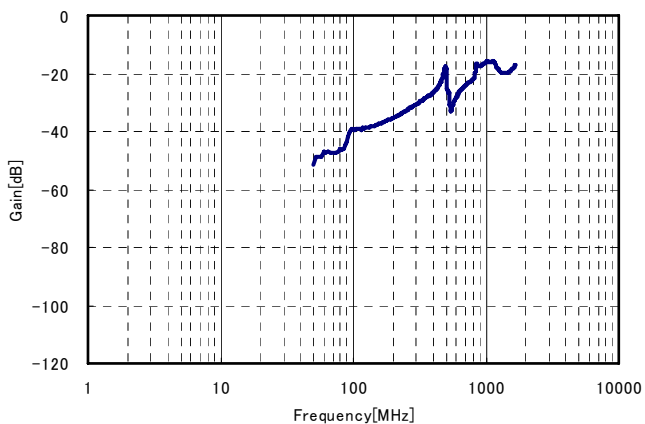


Figure 6 OFF Isolation

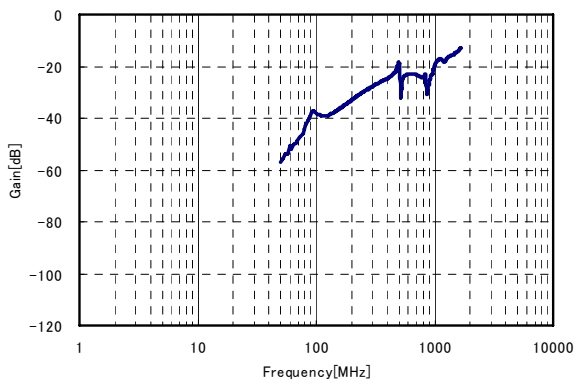


Figure 7 Crosstalk

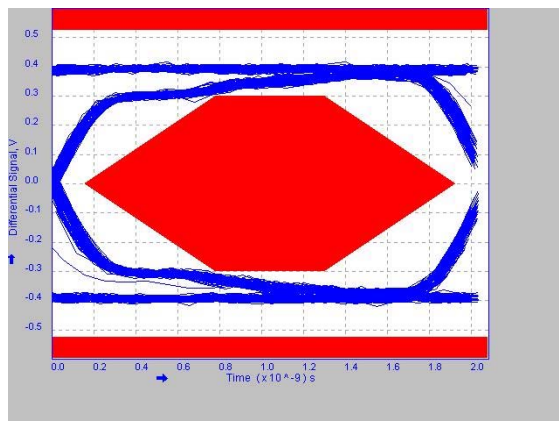


Figure 8 HS-Eye characteristic

## 4. TEST DIAGRAMS

### 4. TEST DIAGRAMS

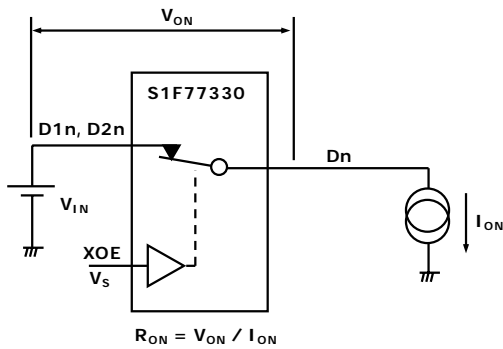


Figure 9 ON resistance

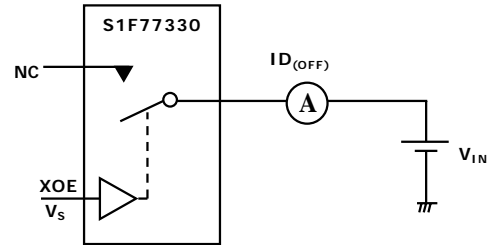


Figure 10 OFF-leakage

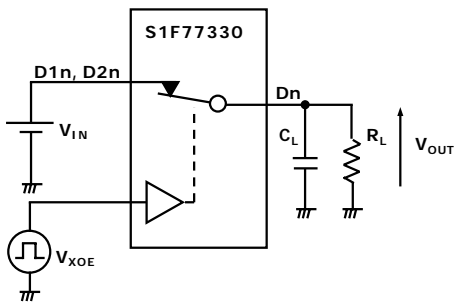


Figure 11 AC characteristic

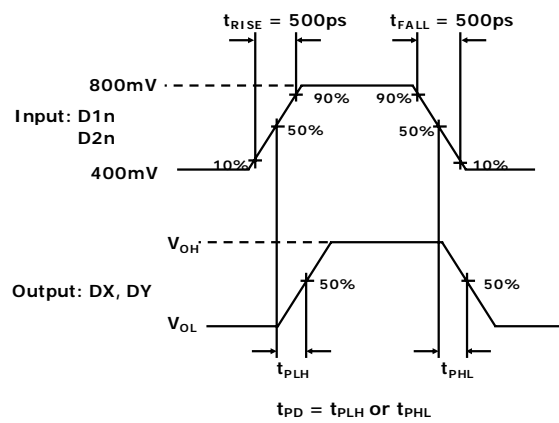


Figure 12 Switch Propagation delay waveform

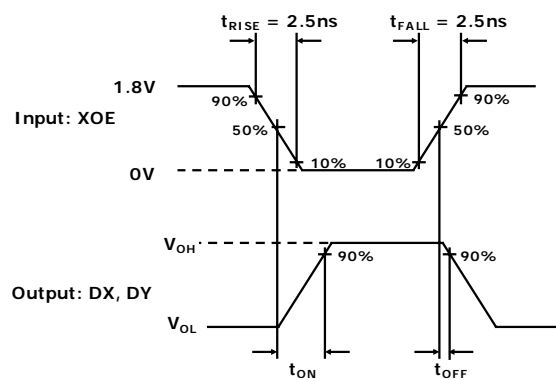


Figure 13 Turn on/Turn off waveform

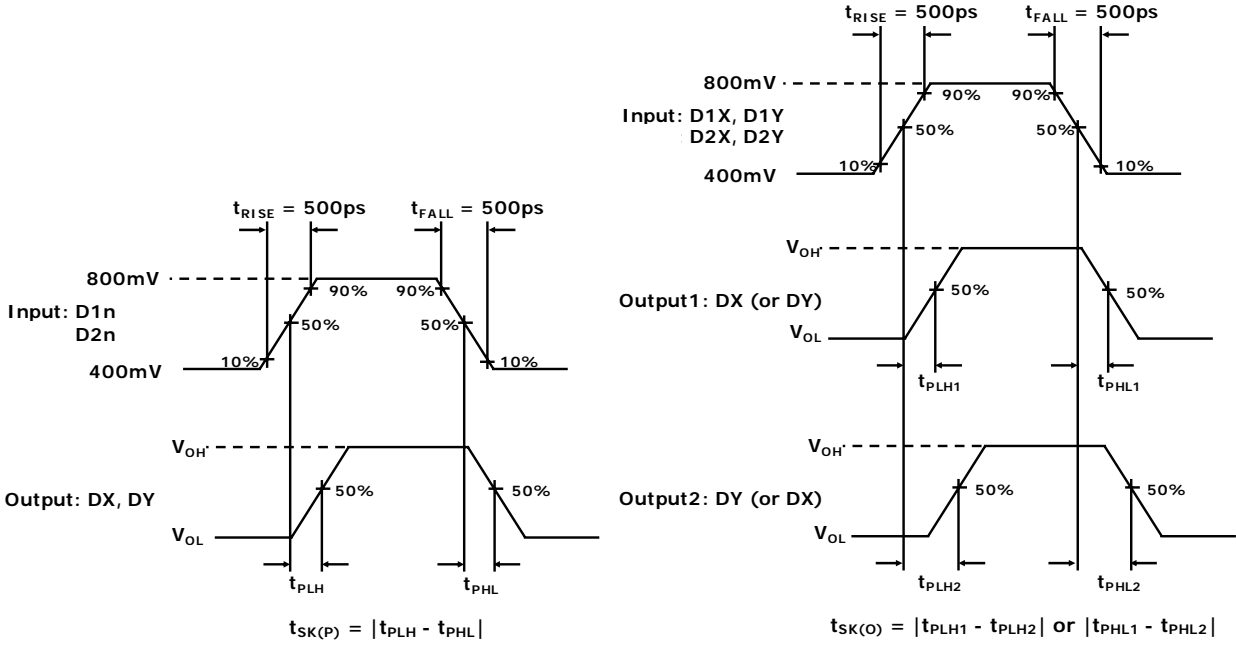


Figure 14 Switch skew test waveform

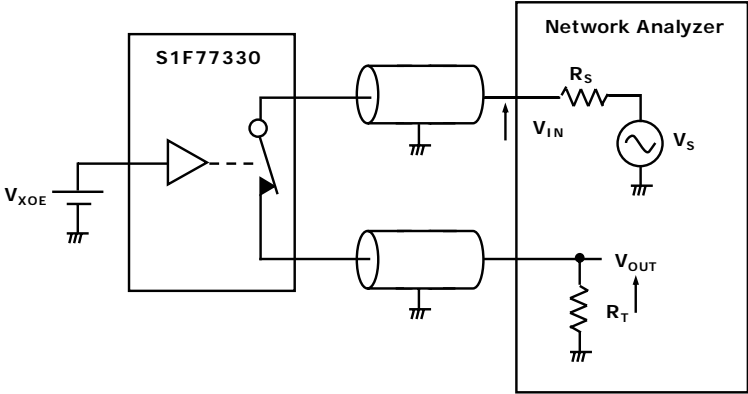


Figure 15 Bandwidth measurement circuit

## 4. TEST DIAGRAMS

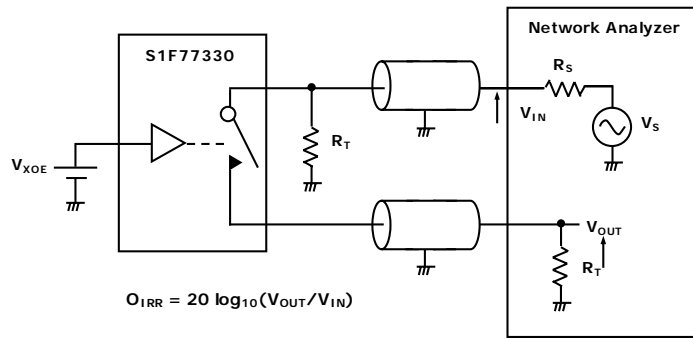


Figure 16 OFF isolation

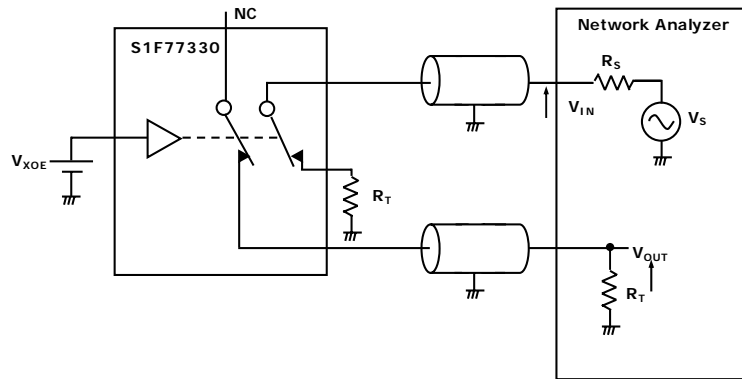


Figure 17 Crosstalk

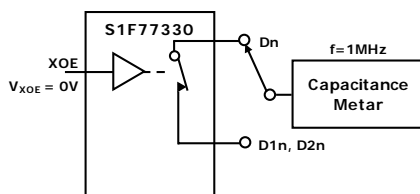


Figure 18 ON capacitance

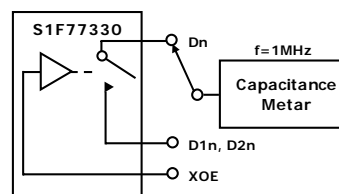
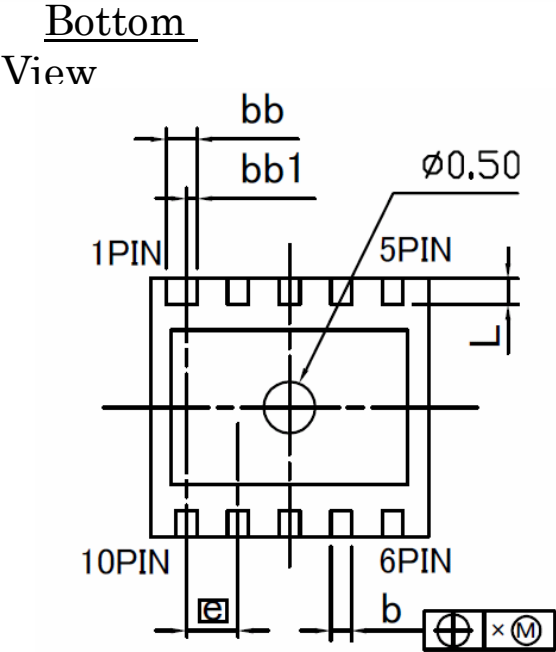
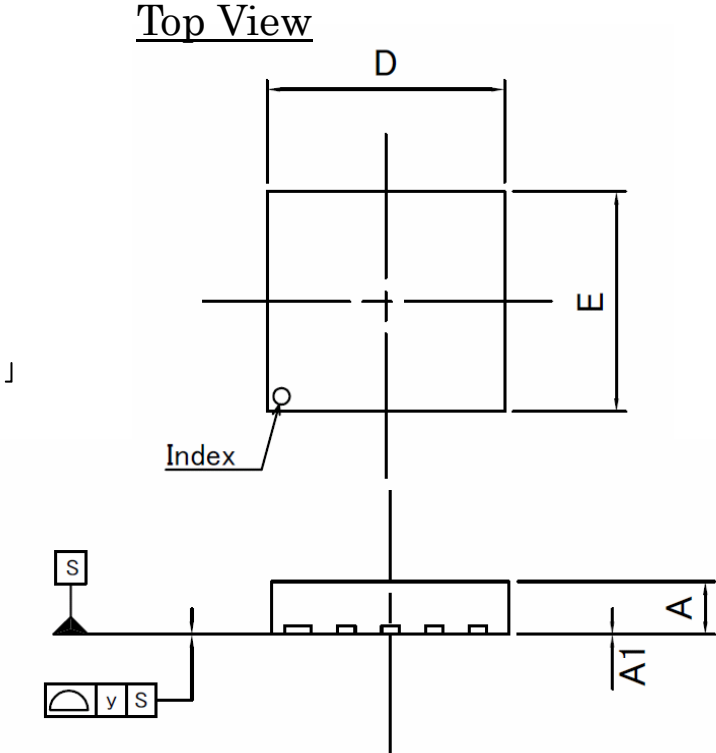


Figure 19 OFF Capacitance

5. PACKAGE INFORMATION

5.1 Package Outline



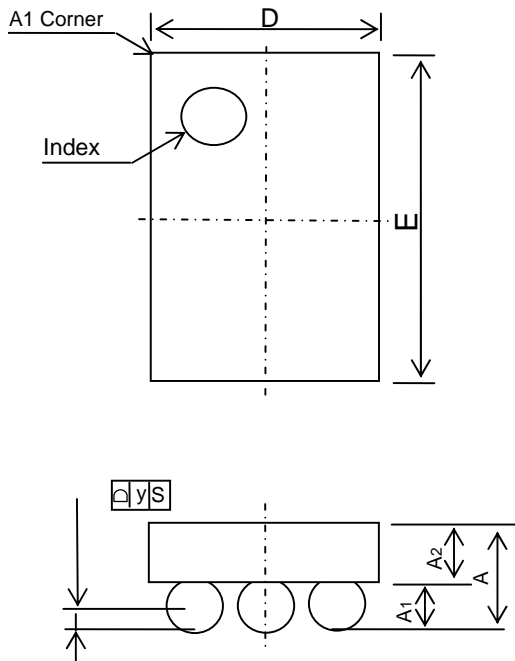
Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	-	2.7	-
E	-	2.5	-
A	-	-	0.65
A <sub>1</sub>	0	-	-
e	-	0.5	-
b	0.1	-	0.3
bb	0.2	-	0.4
bb <sub>1</sub>	-	0.1	-
L	0.15	-	0.35
x	-	-	0.1
y	-	-	0.08

1=1mm

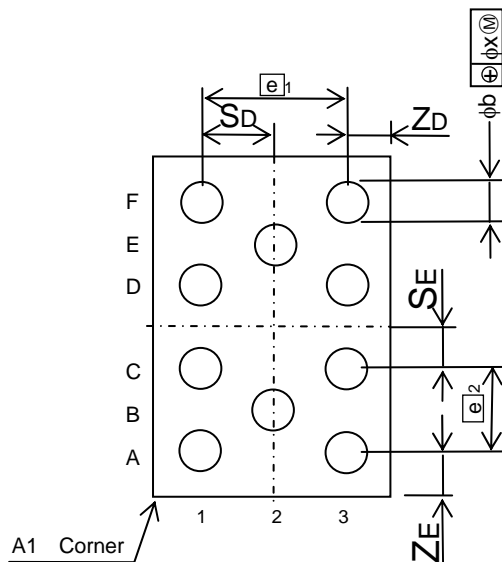
## 5. PACKAGE INFORMATION

### 5.1 Package Outline

#### Top View



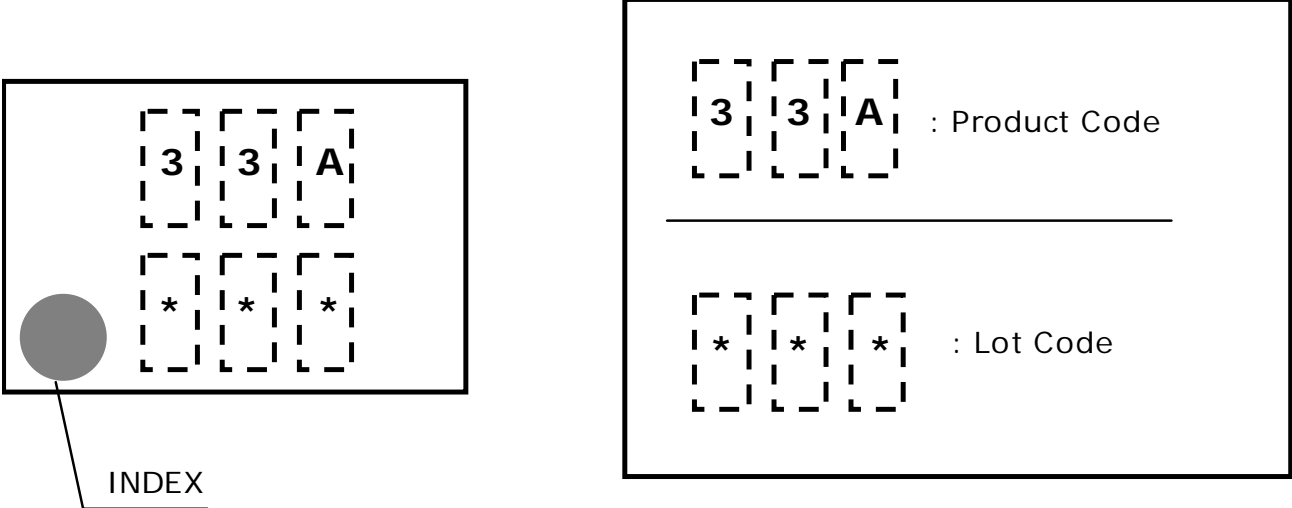
#### Bottom View



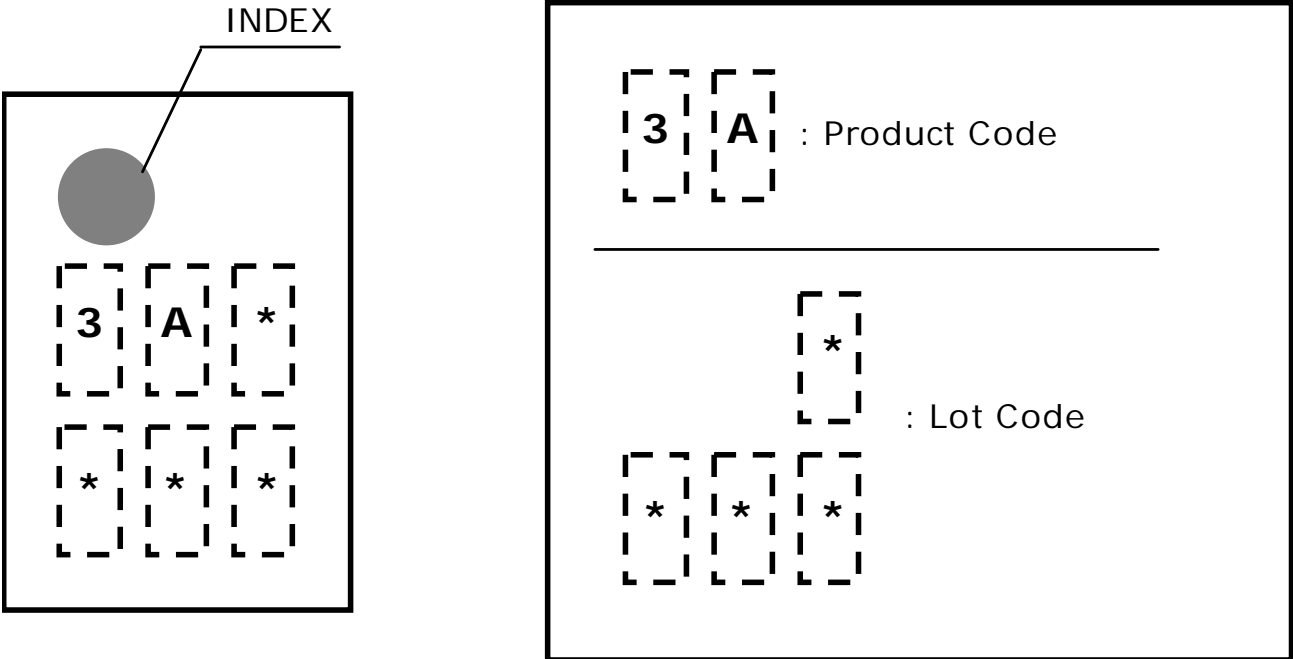
(unit:mm)

Symbol	Dimension in Millimeters		
	Min.	Nom.	Min.
D	—	1.118	—
E	—	1.625	—
A	—	—	0.59
A1	—	0.23	—
A2	—	—	—
e1	—	0.693	—
e2	—	0.40	—
b	0.23	0.26	0.29
x	—	—	0.08
y	—	—	0.05
SD	—	0.3465	—
SE	—	0.20	—
ZD	—	0.2125	—
ZE	—	0.2125	—

5.2 Marking(S1F77330M0A)



5.2 Marking(S1F77330B0A)





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