



# LC4966

## Quad Bilateral Switch

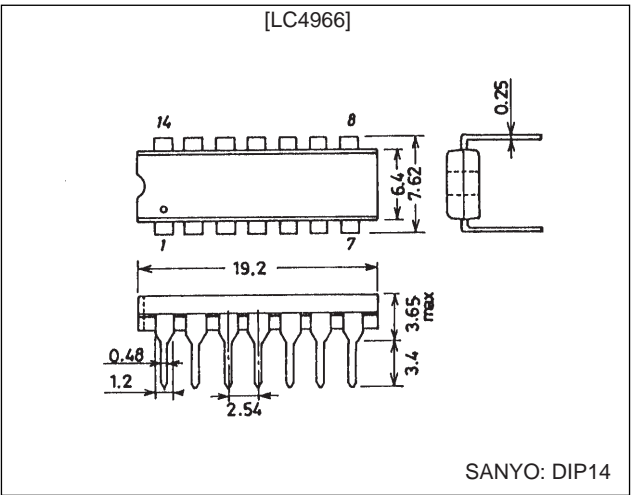
### Overview

The LC4966 is an IC that provides the same functions as the MLC4066B and the MLC4066BH over an expanded usable voltage range. The LC4966 provides four bidirectional switch circuits. These circuits form a low-impedance conducting path between the input and output sides when the corresponding control input (CONT) is set high, and form a high-impedance nonconducting open circuit when the control input is set low.

### Package Dimensions

unit: mm

3003A-DIP14



### Specifications

Absolute Maximum Ratings at  $T_a = 25^\circ\text{C}$ ,  $V_{SS} = 0\text{ V}$

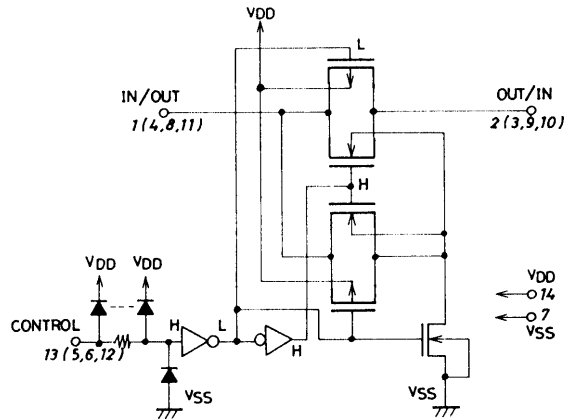
Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{DD\text{ max}}$		$V_{SS} - 0.5$ to $V_{SS} + 40$	V
Input voltage	$V_{IN}$		$V_{SS} - 0.5$ to $V_{DD} + 0.5$	V
Output voltage	$V_{OUT}$		$V_{SS} - 0.5$ to $V_{DD} + 0.5$	V
Input current	$I_{IN}$		$\pm 10$	mA
Potential difference between input and output when on	$V_I - V_O$		$\pm 0.5$	V
Lead soldering temperature time	$T_{sol}$	$t = 10\text{ s}$	260	$^\circ\text{C}$
Allowable power dissipation	$P_{d\text{ max}}$	$T_a \leq 85^\circ\text{C}$ , $I_{IN} = \pm 10\text{ mA}$	300	mW
Operating temperature	$T_{opr}$		$-40$ to $+85$	$^\circ\text{C}$
Storage temperature	$T_{stg}$		$-65$ to $+150$	$^\circ\text{C}$

Allowable Operating Ranges at  $T_a = -40$  to  $+85^\circ\text{C}$

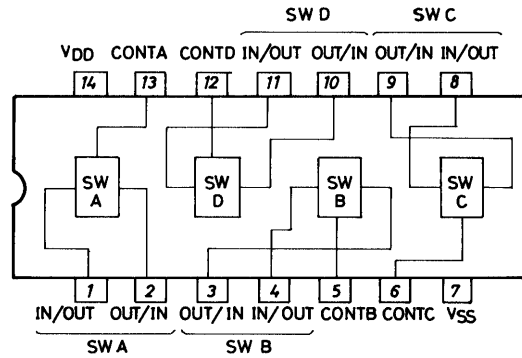
Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	$V_{DD}$		3 to 37	V
Input voltage	$V_{IN}$		0 to $V_{DD}$	V

## Equivalent Circuit

(1/4 LC4966)



## Pin Assignment and Equivalent Circuit Block Diagram



## Electrical Characteristics at $T_a = 25 \pm 2^\circ\text{C}$ , $V_{SS} = 0\text{ V}$

Parameter	Symbol	Conditions	min	typ	max	Unit
Input high-level control voltage	$V_{IH}$	$V_{DD} = 5\text{ V}$ , for a current between input and output $> 10\text{ }\mu\text{A}$	3.5			V
		$V_{DD} = 10\text{ V}$ , for a current between input and output $> 10\text{ }\mu\text{A}$	8.0			V
		$V_{DD} = 15\text{ V}$ , for a current between input and output $> 10\text{ }\mu\text{A}$	12.5			V
		$V_{DD} = 20\text{ V}$ , for a current between input and output $> 10\text{ }\mu\text{A}$	17.0			V
		$V_{DD} = 30\text{ V}$ , for a current between input and output $> 10\text{ }\mu\text{A}$	27.0			V
		$V_{DD} = 37\text{ V}$ , for a current between input and output $> 10\text{ }\mu\text{A}$	34.0			V
Input low-level control voltage	$V_{IL}$	$V_{DD} = 5\text{ V}$ , for a current between input and output $< 10\text{ }\mu\text{A}$			1.0	V
		$V_{DD} = 10\text{ V}$ , for a current between input and output $< 10\text{ }\mu\text{A}$			2.0	V
		$V_{DD} = 15\text{ V}$ , for a current between input and output $< 10\text{ }\mu\text{A}$			2.5	V
		$V_{DD} = 20\text{ V}$ , for a current between input and output $< 10\text{ }\mu\text{A}$			2.5	V
		$V_{DD} = 30\text{ V}$ , for a current between input and output $< 10\text{ }\mu\text{A}$			3.0	V
		$V_{DD} = 37\text{ V}$ , for a current between input and output $< 10\text{ }\mu\text{A}$			3.0	V

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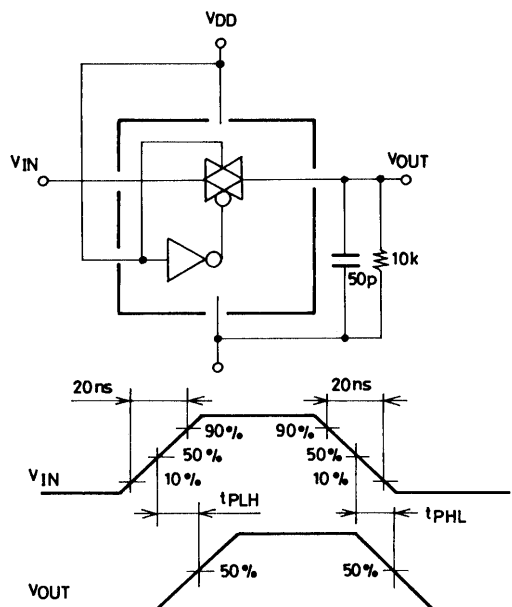
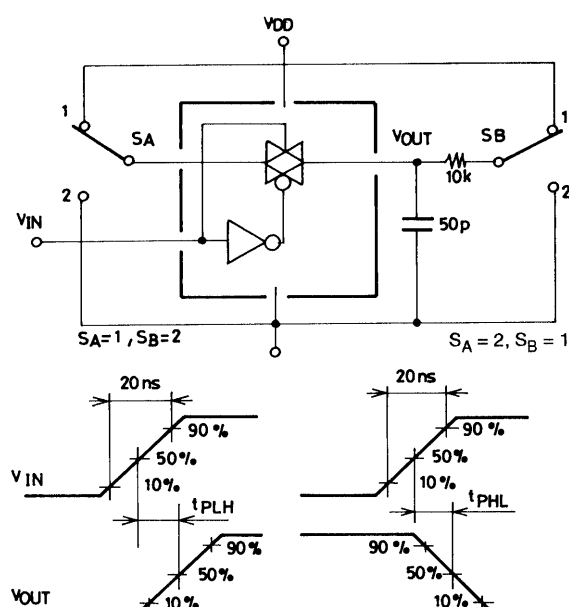
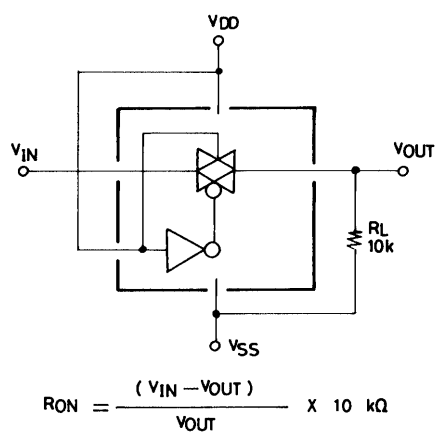
Parameter	Symbol	Conditions	min	typ	max	Unit
On resistance	$R_{ON}$	$V_{DD} = 5\text{ V}, V_{IN} = 5\text{ V}, I = \pm 1\text{ mA}$		110	220	$\Omega$
		$V_{DD} = 5\text{ V}, V_{IN} = 2.5\text{ V}, I = \pm 1\text{ mA}$		90	180	$\Omega$
		$V_{DD} = 5\text{ V}, V_{IN} = 0.25\text{ V}, I = \pm 1\text{ mA}$		110	220	$\Omega$
		$V_{DD} = 10\text{ V}, V_{IN} = 10\text{ V}, I = \pm 3\text{ mA}$		70	140	$\Omega$
		$V_{DD} = 10\text{ V}, V_{IN} = 5\text{ V}, I = \pm 3\text{ mA}$		50	100	$\Omega$
		$V_{DD} = 10\text{ V}, V_{IN} = 0.25\text{ V}, I = \pm 3\text{ mA}$		70	140	$\Omega$
		$V_{DD} = 15\text{ V}, V_{IN} = 15\text{ V}, I = \pm 3\text{ mA}$		60	120	$\Omega$
		$V_{DD} = 15\text{ V}, V_{IN} = 7.5\text{ V}, I = \pm 3\text{ mA}$		40	80	$\Omega$
		$V_{DD} = 15\text{ V}, V_{IN} = 0.25\text{ V}, I = \pm 3\text{ mA}$		60	120	$\Omega$
		$V_{DD} = 20\text{ V}, V_{IN} = 20\text{ V}, I = \pm 3\text{ mA}$		60	120	$\Omega$
		$V_{DD} = 20\text{ V}, V_{IN} = 10\text{ V}, I = \pm 3\text{ mA}$		40	80	$\Omega$
		$V_{DD} = 20\text{ V}, V_{IN} = 0.25\text{ V}, I = \pm 3\text{ mA}$		60	120	$\Omega$
		$V_{DD} = 30\text{ V}, V_{IN} = 30\text{ V}, I = \pm 3\text{ mA}$		50	100	$\Omega$
		$V_{DD} = 30\text{ V}, V_{IN} = 15\text{ V}, I = \pm 3\text{ mA}$		35	70	$\Omega$
		$V_{DD} = 30\text{ V}, V_{IN} = 0.25\text{ V}, I = \pm 3\text{ mA}$		50	100	$\Omega$
		$V_{DD} = 37\text{ V}, V_{IN} = 37\text{ V}, I = \pm 3\text{ mA}$		45	90	$\Omega$
		$V_{DD} = 37\text{ V}, V_{IN} = 19\text{ V}, I = \pm 3\text{ mA}$		30	60	$\Omega$
		$V_{DD} = 37\text{ V}, V_{IN} = 0.25\text{ V}, I = \pm 3\text{ mA}$		45	90	$\Omega$
		$V_{DD} = +5\text{ V}, V_{IN} = -5\text{ V}, V_{IN} = 5\text{ V}, I = \pm 3\text{ mA}$		70	140	$\Omega$
		$V_{DD} = +5\text{ V}, V_{SS} = -5\text{ V}, V_{IN} = \pm 0.25\text{ V}, I = \pm 3\text{ mA}$		50	100	$\Omega$
		$V_{DD} = +5\text{ V}, V_{SS} = -5\text{ V}, V_{IN} = -5\text{ V}, I = \pm 3\text{ mA}$		70	140	$\Omega$
		$V_{DD} = +7.5\text{ V}, V_{SS} = -7.5\text{ V}, V_{IN} = 5\text{ V}, I = \pm 3\text{ mA}$		60	120	$\Omega$
		$V_{DD} = +7.5\text{ V}, V_{SS} = -7.5\text{ V}, V_{IN} = \pm 0.25\text{ V}, I = \pm 3\text{ mA}$		40	80	$\Omega$
		$V_{DD} = +7.5\text{ V}, V_{SS} = -7.5\text{ V}, V_{IN} = -5\text{ V}, I = \pm 3\text{ mA}$		60	120	$\Omega$
		$V_{DD} = +10\text{ V}, V_{SS} = -10\text{ V}, V_{IN} = 10\text{ V}, I = \pm 3\text{ mA}$		60	120	$\Omega$
		$V_{DD} = +10\text{ V}, V_{SS} = -10\text{ V}, V_{IN} = \pm 0.25\text{ V}, I = \pm 3\text{ mA}$		40	80	$\Omega$
		$V_{DD} = +10\text{ V}, V_{SS} = -10\text{ V}, V_{IN} = -10\text{ V}, I = \pm 3\text{ mA}$		60	120	$\Omega$
		$V_{DD} = +15\text{ V}, V_{SS} = -15\text{ V}, V_{IN} = 15\text{ V}, I = \pm 3\text{ mA}$		50	100	$\Omega$
		$V_{DD} = +15\text{ V}, V_{SS} = -15\text{ V}, V_{IN} = \pm 0.25\text{ V}, I = \pm 3\text{ mA}$		35	70	$\Omega$
		$V_{DD} = +15\text{ V}, V_{SS} = -15\text{ V}, V_{IN} = -15\text{ V}, I = \pm 3\text{ mA}$		50	100	$\Omega$
		$V_{DD} = +18.5\text{ V}, V_{SS} = -18.5\text{ V}, V_{IN} = 18.5\text{ V}, I = \pm 3\text{ mA}$		45	90	$\Omega$
		$V_{DD} = +18.5\text{ V}, V_{SS} = -18.5\text{ V}, V_{IN} = \pm 0.25\text{ V}, I = \pm 3\text{ mA}$		30	60	$\Omega$
		$V_{DD} = +18.5\text{ V}, V_{SS} = -18.5\text{ V}, V_{IN} = -18.5\text{ V}, I = \pm 3\text{ mA}$		45	90	$\Omega$
Input off leakage current	$I_{OFF}$	$V_{DD} = 37\text{ V}, V_{IN} = 37\text{ V}, V_{OUT} = 0\text{ V}$		$\pm 1$	$\pm 500$	nA
		$V_{DD} = 37\text{ V}, V_{IN} = 0\text{ V}, V_{OUT} = 37\text{ V}$		$\pm 1$	$\pm 500$	nA
Quiescent current drain	$I_{DD}$	$V_{DD} = 5\text{ V}$		0.001	1	$\mu\text{A}$
		$V_{DD} = 10\text{ V}$		0.001	2	$\mu\text{A}$
		$V_{DD} = 15\text{ V}$		0.002	4	$\mu\text{A}$
		$V_{DD} = 20\text{ V}$		0.004	8	$\mu\text{A}$
		$V_{DD} = 25\text{ V}$		0.01	20	$\mu\text{A}$
		$V_{DD} = 30\text{ V}$		0.02	40	$\mu\text{A}$
		$V_{DD} = 35\text{ V}$		0.04	80	$\mu\text{A}$
		$V_{DD} = 37\text{ V}$		0.1	160	$\mu\text{A}$
Input high-level control current	$I_{IH}$	$V_{DD} = 37\text{ V}, V_{IN} = 37\text{ V}$		$10^{-4}$	3	$\mu\text{A}$
Input low-level control current	$I_{IL}$	$V_{DD} = 37\text{ V}, V_{IN} = 0\text{ V}$		$-10^{-4}$	3	$\mu\text{A}$
Input capacitance	$C_{IN}$	Control inputs		5	7.5	pF
		Switch input and outputs		10		pF

Switching Characteristics at  $T_a = 25 \pm 2^\circ\text{C}$ 

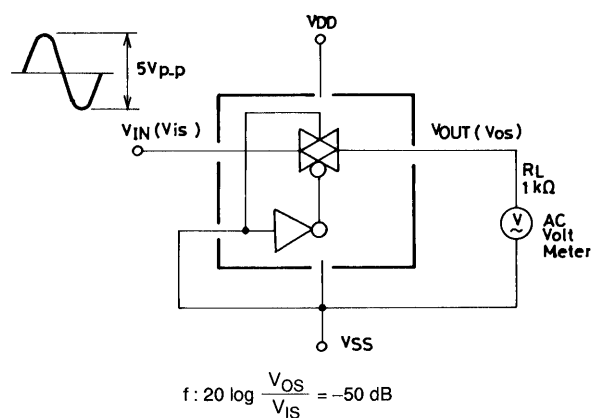
Parameter	Symbol	Conditions	min	typ	max	Unit
Transmission time (IN to OUT)	$t_{PLH}, t_{PHL}$	$V_{DD} = 5\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		15	45	ns
		$V_{DD} = 10\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		10	30	ns
		$V_{DD} = 15\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		8	25	ns
		$V_{DD} = 20\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		8	25	ns
		$V_{DD} = 25\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		8	25	ns
		$V_{DD} = 30\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		7	25	ns
		$V_{DD} = 35\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		7	25	ns
		$V_{DD} = 37\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		7	25	ns
Transmission time (control $\rightarrow$ OUT)	$t_{PLH}, t_{PHL}$	$V_{DD} = 5\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		100	200	ns
		$V_{DD} = 10\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		40	70	ns
		$V_{DD} = 15\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		35	60	ns
		$V_{DD} = 20\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		35	60	ns
		$V_{DD} = 25\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		35	60	ns
		$V_{DD} = 30\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		35	60	ns
		$V_{DD} = 35\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		35	60	ns
		$V_{DD} = 37\text{ V}, R_L = 10\text{ k}\Omega, C_L = 50\text{ pF}$		35	60	ns
Maximum control input frequency	$f_{\text{max}} (c)$	$V_{DD} = 5\text{ V}, C_L = 15\text{ pF}$		1.0		MHz
		$V_{DD} = 10\text{ V}, C_L = 15\text{ pF}$		1.0		MHz
		$V_{DD} = 20\text{ V}, C_L = 15\text{ pF}$		1.0		MHz
		$V_{DD} = 30\text{ V}, C_L = 15\text{ pF}$		1.0		MHz
		$V_{DD} = 37\text{ V}, C_L = 15\text{ pF}$		1.0		MHz
Maximum transmission frequency	$f_{\text{max}} (I-O)$	$V_{DD} = +5\text{ V}, V_{SS} = -5\text{ V}, R_L = 10\text{ k}\Omega, C_L = 15\text{ pF}^{*1}$		35		MHz
		$V_{DD} = +10\text{ V}, V_{SS} = -10\text{ V}$		40		MHz
		$V_{DD} = +15\text{ V}, V_{SS} = -15\text{ V}$		50		MHz
		$V_{DD} = +18.5\text{ V}, V_{SS} = -18.5\text{ V}$		50		MHz
Sine wave total harmonic distortion		$V_{DD} = +5\text{ V}, V_{SS} = -5\text{ V}, R_L = 10\text{ k}\Omega, f = 1\text{ kHz}^{*2}$		0.010		%
		$V_{DD} = +10\text{ V}, V_{SS} = -10\text{ V}$		0.005		%
		$V_{DD} = +15\text{ V}, V_{SS} = -15\text{ V}$		0.005		%
		$V_{DD} = +18.5\text{ V}, V_{SS} = -18.5\text{ V}$		0.005		%
Feedthrough (switch off state)		$V_{DD} = +5\text{ V}, V_{SS} = -5\text{ V}, R_L = 10\text{ k}\Omega^{*3}$		1		MHz
		$V_{DD} = +10\text{ V}, V_{SS} = -10\text{ V}$		1		MHz
		$V_{DD} = +15\text{ V}, V_{SS} = -15\text{ V}$		1		MHz
		$V_{DD} = +18.5\text{ V}, V_{SS} = -18.5\text{ V}$		1		MHz

Note 1. Vis is a  $\pm 2.5\text{ Vp-p}$  sine wave;  $f_{\text{max}}$ :  $20\log(V_{\text{os}}/V_{\text{is}})$  = the  $-3\text{ dB}$  frequency.  
 2. Vis is a  $\pm 2.5\text{ Vp-p}$  sine wave.  
 3. Vis is a  $\pm 2.5\text{ Vp-p}$  sine wave. Frequency (feedthrough):  $20\log(V_{\text{os}}/V_{\text{is}})$  =  $-50\text{ dB}$

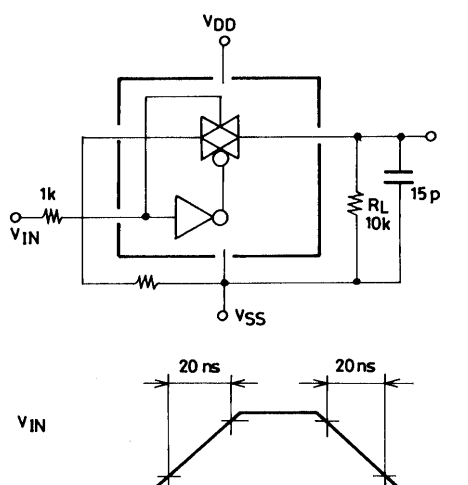
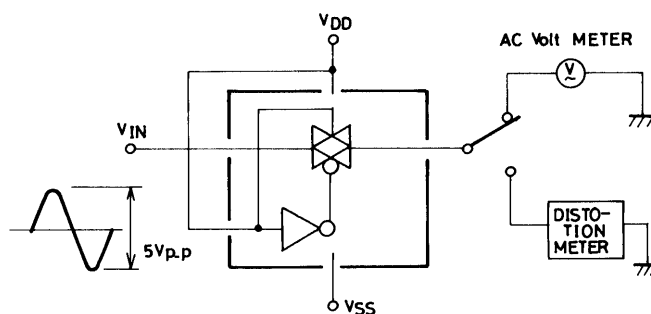
## Test Circuits and Waveforms

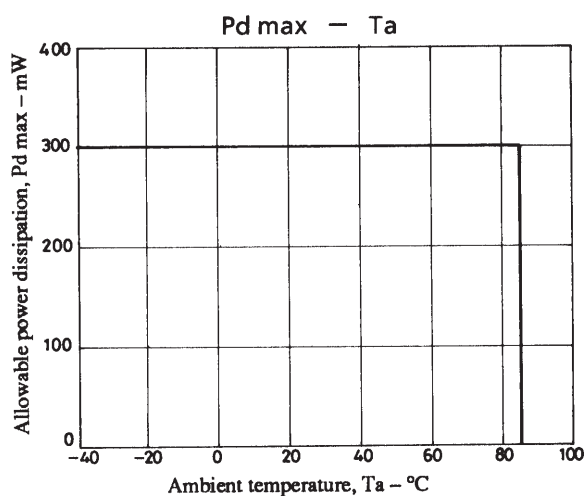
Unit (resistance:  $\Omega$ , capacitance: F)1.  $t_{PLH}$ ,  $t_{PHL}$  (IN-OUT) Test Circuit2.  $t_{PLH}$ ,  $t_{PHL}$  (Control-OUT) Test Circuit3.  $R_{ON}$  Test Circuit

## 4. Feedthrough Test Circuit



## 5. Crosstalk

6. Frequency Response ( $f_{max}$ ) and Total Harmonic Distortion



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