

TCVS5V330FT

1. Functional Description

- Quad SPDT Video Switch

2. General

The TCVS5V330FT is a low On-resistance and low capacitance CMOS 4bit 1-of-2 multiplexer/demultiplexer.

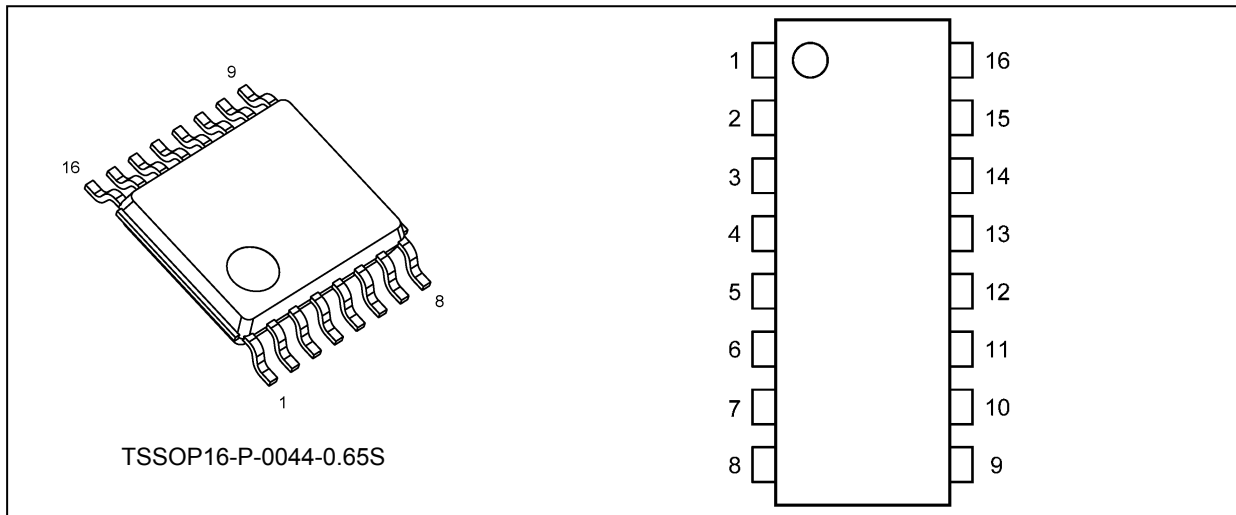
This device consists of four individual two-input multiplexer/demultiplexer with common select input (IN) and output enable (\overline{EN}). The D inputs is connected to the S1 or S2 outputs determined by the combination both the select input (IN) and output enable (\overline{EN}). When the output enable (\overline{EN}) input is held high level, the switches are open with regardless the state of select inputs and a high-impedance state exists between the switches.

All inputs are equipped with protection circuits against static discharge.

3. Features

- (1) Supply voltage: $V_{CC} = 4.0$ to 5.5 V
- (2) Switch terminal ON-capacitance: $C_{IO} = 8.5$ pF Switch ON (typ.) @ $V_{CC} = 5$ V
- (3) ON-resistance: $R_{ON} = 3 \Omega$ (typ.) @ $V_{CC} = 4.5$ V, $V_{IS} = 1$ V
- (4) ESD performance: Machine model $\geq \pm 200$ V, Human body model $\geq \pm 2000$ V
- (5) Power-down protection provided on all inputs and outputs.
- (6) TTL-level inputs (control/select inputs)
- (7) Package: TSSOP16

4. Packaging and Pin Assignment (Top View)



4.1. Pin Assignment

Pin No.	Pin Name	Pin No.	Pin Name
1	IN	16	V _{CC}
2	S1 _A	15	$\overline{\text{EN}}$
3	S2 _A	14	S1 _D
4	D _A	13	S2 _D
5	S1 _B	12	D _D
6	S2 _B	11	S1 _C
7	D _B	10	S2 _C
8	GND	9	D _C

5. Marking

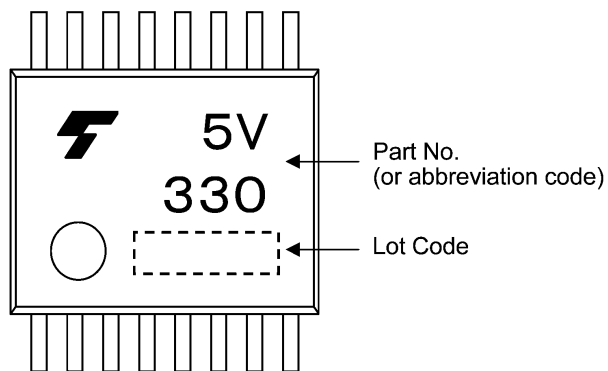


Fig. 5.1 Marking

6. Block Diagram

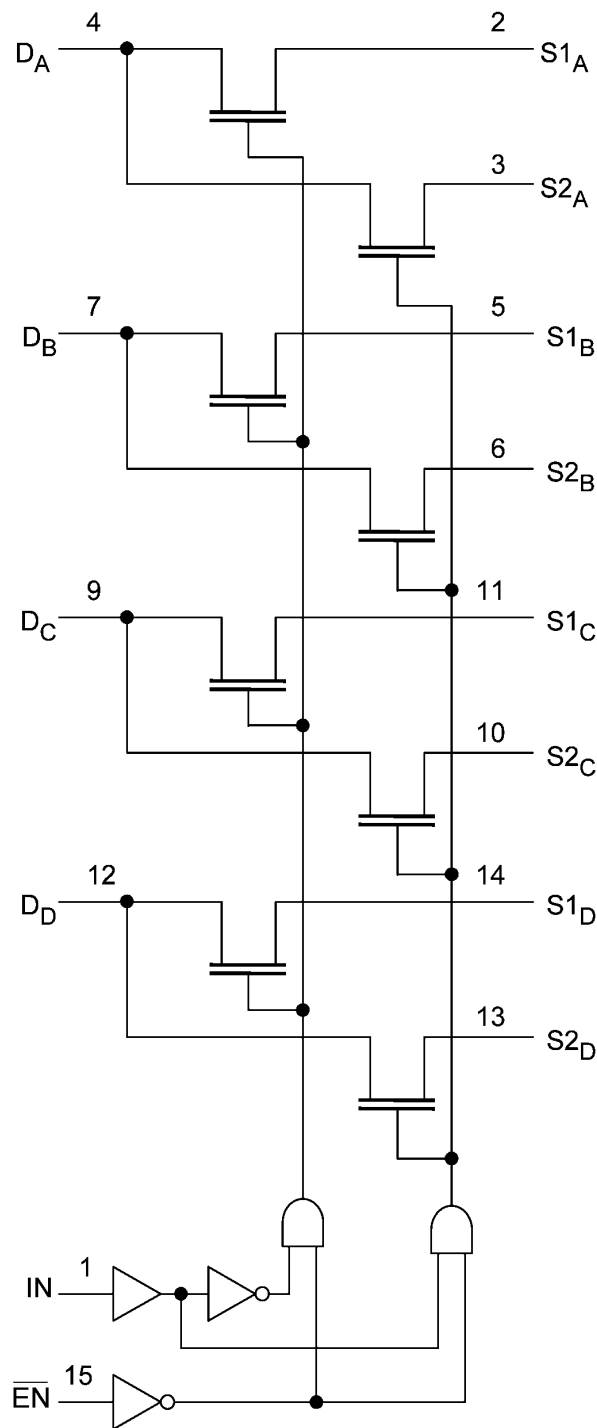


Fig. 6.1 Block Diagram

7. Principle of Operation

7.1. Truth Table

Input \overline{EN}	Input IN	Function
L	L	D port = S1 port
L	H	D port = S2 port
H	X	Disconnect

8. Absolute Maximum Ratings (Note)

Characteristics	Symbol	Note	Test Condition	Rating	Unit
Supply voltage	V_{CC}		—	-0.5 to 7.0	V
Input voltage (\overline{EN} , IN)	V_{IN}			-0.5 to 7.0	
Switch I/O voltage	V_S			-0.5 to 7.0	
Clamp diode current	I_{IK}			-50	mA
Switch I/O current	I_S			50	
Power dissipation	P_D			180	mW
V_{CC} /ground current	I_{CC}/I_{GND}			± 100	mA
Storage temperature	T_{stg}			-65 to 150	$^{\circ}C$

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

9. Operating Ranges (Note)

Characteristics	Symbol	Note	Test Condition	Rating	Unit
Supply voltage	V_{CC}		—	4.0 to 5.5	V
Input voltage (\overline{EN} , IN)	V_{IN}			0 to 5.5	
Switch I/O voltage	V_S			0 to 5.5	
Operating temperature	T_{opr}			-40 to 85	$^{\circ}C$
Input rise time	dt/dv			0 to 10	ns/V
Input fall time			0 to 10		

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs and bus inputs must be tied to either V_{CC} or GND.

10. Electrical Characteristics

10.1. DC Characteristics (Unless otherwise specified, $T_a = -40$ to $85^{\circ}C$)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	Min	Typ.	Max	Unit
High-level input voltage (\overline{EN} , IN)	V_{IH}		—	4.0 to 5.5	2.0	—	—	V
Low-level input voltage (\overline{EN} , IN)	V_{IL}		—	4.0 to 5.5	—	—	0.8	
Hysteresis voltage (\overline{EN} , IN)	V_H		$V_{IN} = 0$ V	5.5	—	100	—	mV
Input leakage current (\overline{EN} , IN)	I_{IN}		$V_{IN} = 0$ to 5.5 V	4.0 to 5.5	—	—	± 1.0	μA
Power-OFF leakage current	I_{OFF}		D, S, IN, $\overline{EN} = 0$ to 5.5 V	0	—	—	10	
Switch OFF-state leakage current	I_{SZ}		D, S = 0 to 5.5 V, $\overline{EN} = V_{CC}$	4.0 to 5.5	—	—	± 1.0	
ON-resistance	R_{ON}	(Note 1), (Note 2)	$V_{IS} = 1$ V, $I_{IS} = 13$ mA, $R_L = 75 \Omega$	4.5	—	3	7	Ω
			$V_{IS} = 2$ V, $I_{IS} = 26$ mA, $R_L = 75 \Omega$	4.5	—	4	8	
Quiescent supply current	I_{CC}		$V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0$ V	5.5	—	—	3	μA
	ΔI_{CC}		$V_{IN} = 3.4$ V (one input)	5.5	—	—	500	

Note 1: All typical values are at $T_a = 25^{\circ}C$.

Note 2: Measured by the voltage drop between A and B pins at the indicated current through the switch. On resistance is determined by the lower of the voltages on the two (A or B) pins.

10.2. AC Characteristics (Unless otherwise specified, $T_a = -40$ to 85°C)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	Min	Typ.	Max	Unit
Turn-ON time (IN to bus)	t_{on}		$R_L = 75 \Omega$, $C_L = 20 \text{ pF}$, See Fig. 11.1	4.5	—	6.5	10	ns
Turn-OFF time (IN to bus)	t_{off}		$R_L = 75 \Omega$, $C_L = 20 \text{ pF}$, See Fig. 11.		—	2.5	6	

10.3. Analog Switch (Note) (Unless otherwise specified, $T_a = -40$ to 85°C)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	Min	Typ.	Max	Unit
OFF isolation (non-adjacent)	OIRR		$R_L = 150 \Omega$, $f = 10 \text{ MHz}$, See Fig. 11.2	5.0	—	-58	—	dB
Crosstalk (non-adjacent)	X_{talk}		$R_L = 150 \Omega$, $f = 10 \text{ MHz}$, See Fig. 11.3		—	-60	—	
-3dB Bandwidth	BW		$R_L = 150 \Omega$, $f = 10 \text{ MHz}$, See Fig. 11.4		300	—	—	MHz
Differential gain	DG		$R_L = 150 \Omega$, $f = 3.58 \text{ MHz}$, See Fig. 11.5		—	0.64	—	%
Differential phase	DP		$R_L = 150 \Omega$, $f = 3.58 \text{ MHz}$, See Fig. 11.5		—	0.1	—	$^\circ$

Note: Parameter guaranteed by design.

10.4. Capacitive Characteristics (Note) (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	Typ.	Unit
Input capacitance (\overline{EN} , IN)	C_{IN}		$V_{IN} = 0 \text{ V}$	5.0	5	pF
Switch terminal OFF-capacitance (D+, D-)	$C_{I/O}$		$\overline{EN} = V_{CC}$, $V_{IS} = 0 \text{ V}$, $f = 1 \text{ MHz}$		5.5	
Switch terminal OFF-capacitance (S+, S-)					4	
Switch terminal ON-capacitance					8.5	

Note: Parameter guaranteed by design.

11. AC Test Circuits and Waveforms

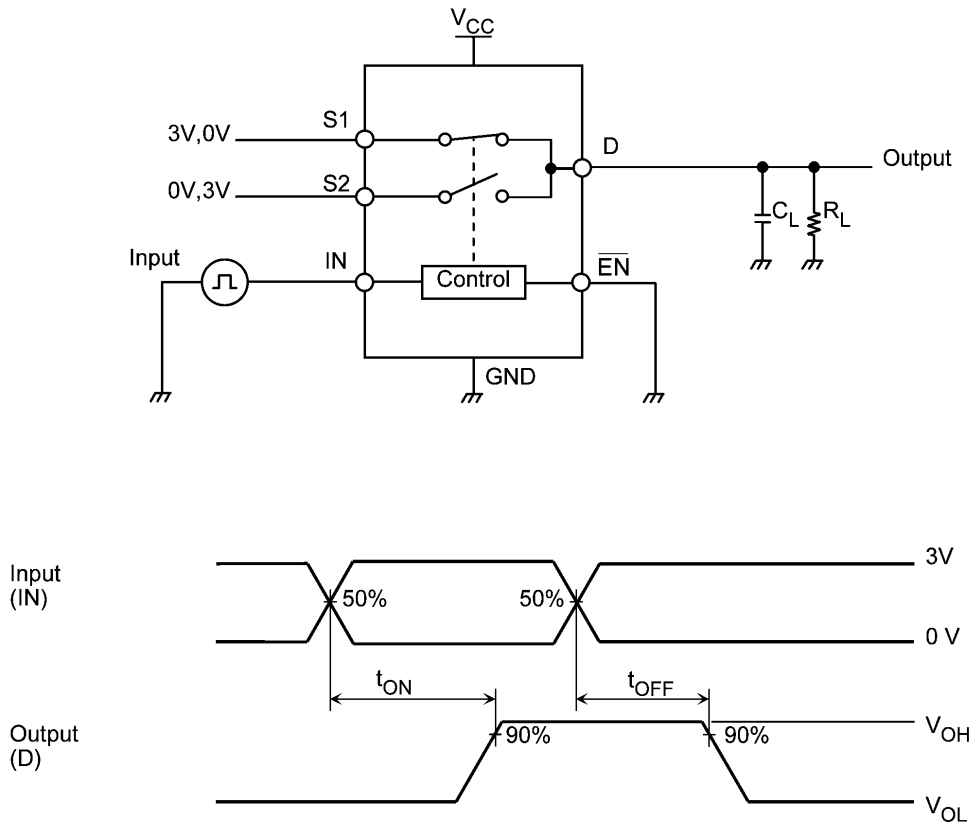
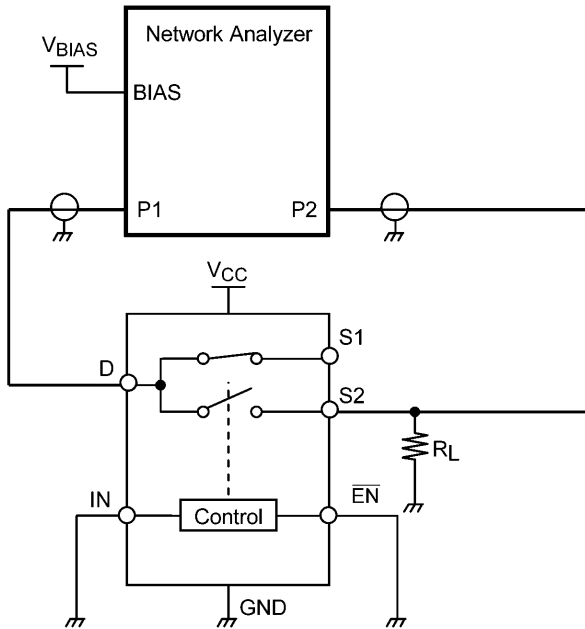
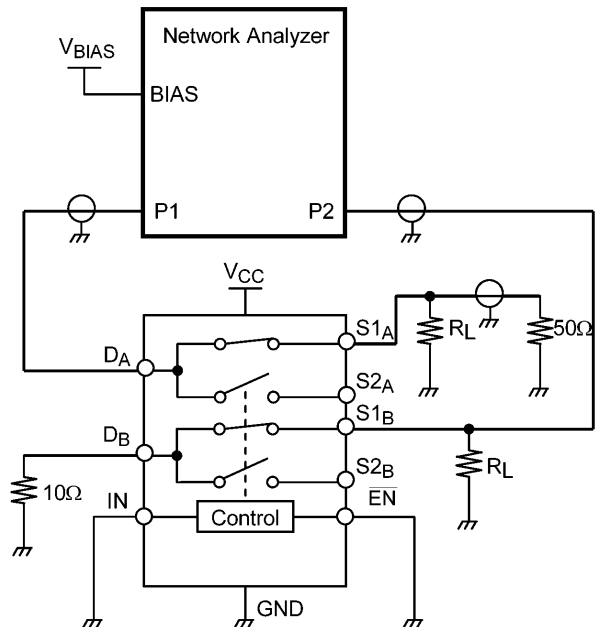


Fig. 11.1 Turn-ON and Turn-OFF Times (t_{on} , t_{off})



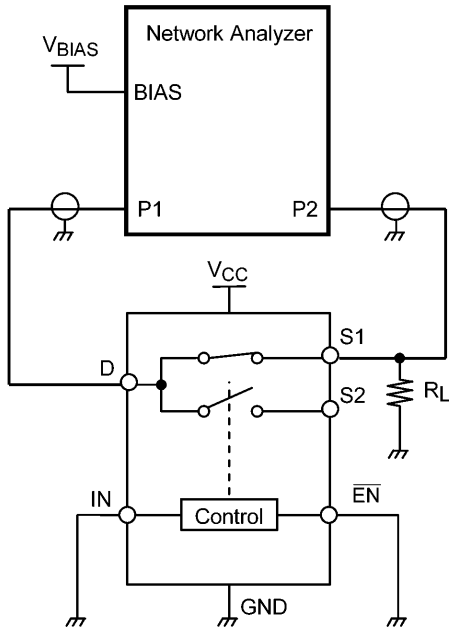
All unused ports are connected to GND through 50Ω pull-down resistors.

Fig. 11.2 OFF Isolation



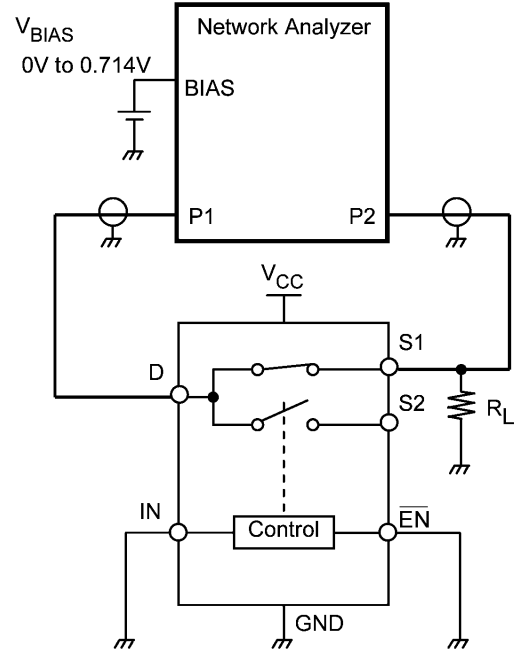
All unused ports are connected to GND through 50Ω pull-down resistors.

Fig. 11.3 Crosstalk



All unused ports are left open.

Fig. 11.4 -3dB Bandwidth

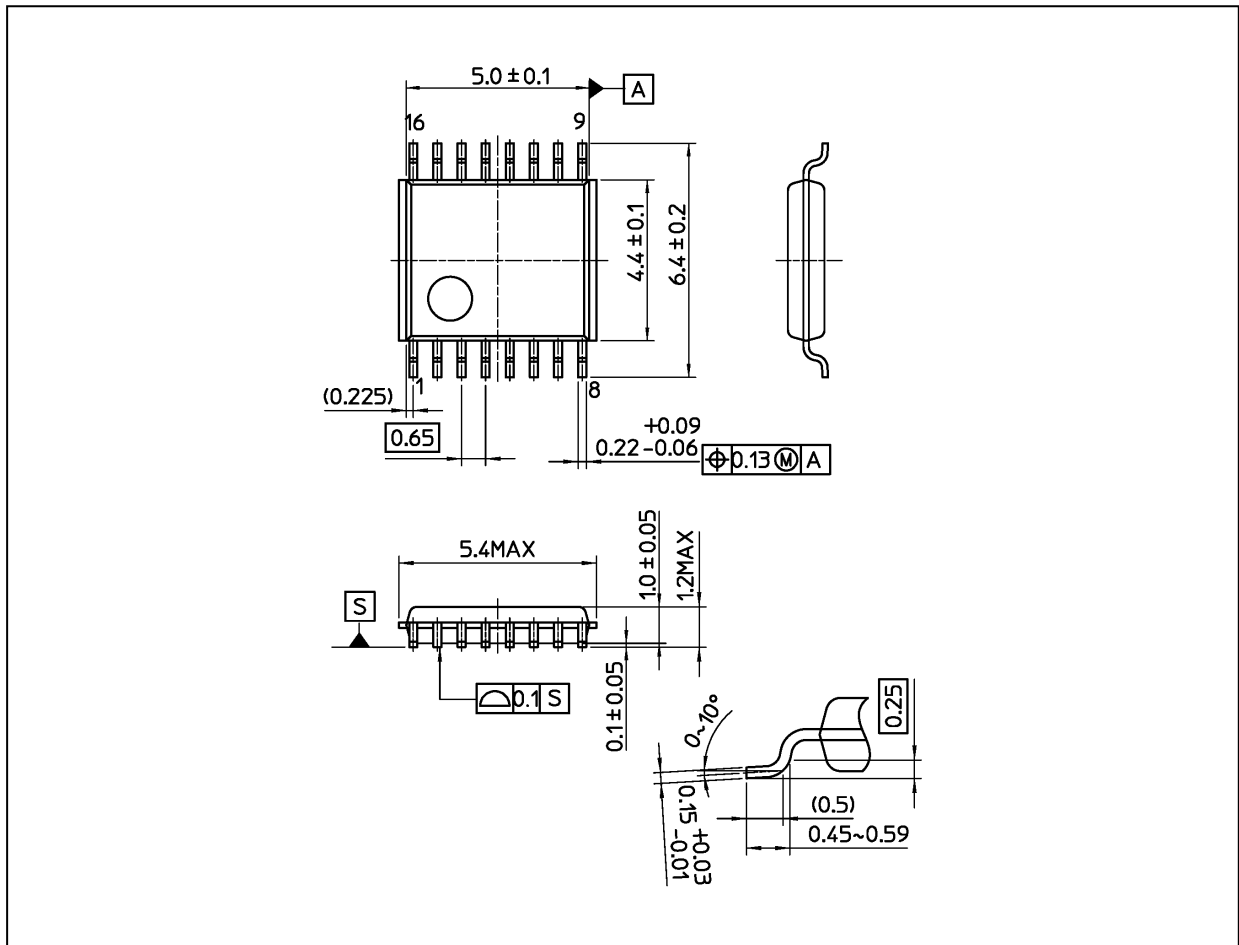


Differential gain and Differential phase are the difference measurement between two bias levels, for instance analog input signals of 0V to 0.714V.

Fig. 11.5 Differential Gain, Differential Phase

Package Dimensions

Unit: mm



Weight: 0.06 g (typ.)

Package Name(s)
TOSHIBA: TSSOP16-P-0044-0.65S
Nickname: TSSOP16

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