

8-Channel Analog Multiplexer/Demultiplexer with injection-current effect control

1 FEATURES

- **Injection-Current Cross Coupling** <1mV/mA
- **Low Crosstalk Between Switches**
- **Supply Operation: 2V to 6V**
- **Operating Temperature Range:**
-40°C to +125°C
- **PACKAGES: TSSOP16**
SOP16

2 APPLICATIONS

- **Sensors**
- **Analog and Digital Multiplexing and Demultiplexing**
- **A/D and D/A Conversion**
- **Signal Gating**
- **Battery-Operated Equipment**
- **Factory Automation**
- **Appliances**
- **Communications Circuits**

3 DESCRIPTIONS

This eight-channel CMOS analog multiplexer/demultiplexer is pin compatible with the RES74HC4851 function and, additionally, features injection-current effect control, which has excellent value in automotive applications where voltages in excess of normal supply voltages are common.

The injection-current effect control allows signals at disabled analog input channels to exceed the supply voltage without affecting the signal of the enabled analog channel. This eliminates the need for external diode/resistor networks typically used to keep the analog channel signals within the supply-voltage range.

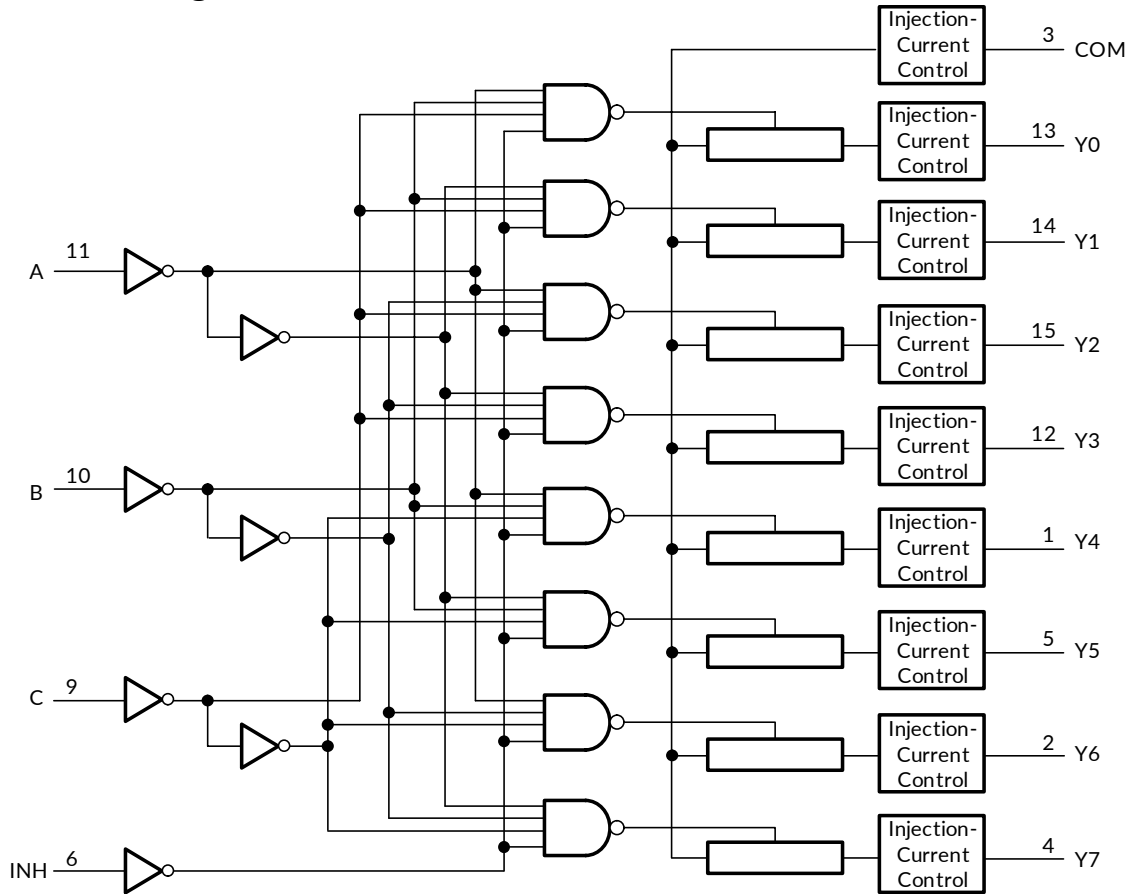
The RES74HC4851 is available in Green TSSOP16, packages. It operates over an ambient temperature range of -40°C to +125°C.

Device Information ⁽¹⁾

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RES74HC4851CTR	TSSOP16	5.00mm×4.40mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

4 Functional Diagrams



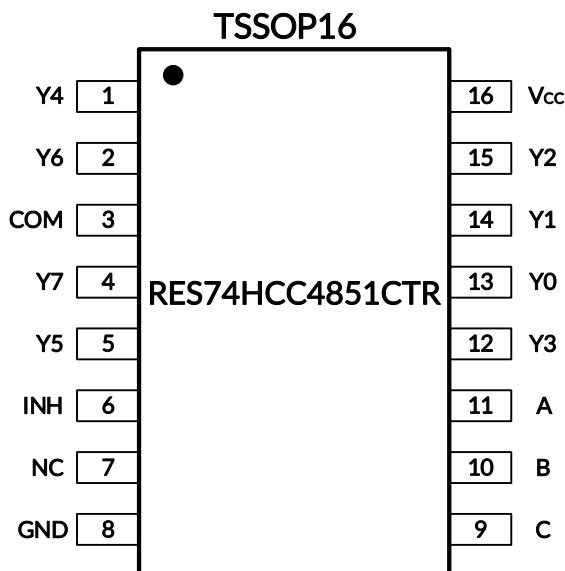
6 PACKAGE/ORDERING INFORMATION ⁽¹⁾

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING ⁽²⁾	MSL ⁽³⁾	PACKAGE OPTION
RES74HC4851	RES74HC4851CTR	-40°C ~+125°C	TSSOP16	RES74HC4851CTR	MSL3	Tape and Reel,4000

NOTE:

- (1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.
- (2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.
- (3) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

7 PIN CONFIGURATIONS (TOP VIEW)



7.1 PIN DESCRIPTION

NAME	RES74HCC4851CTR	FUNCTION
	TSSOP16	
Y0-Y7	13,14,15,12,1,5,2,4	Analog Switch Inputs or Outputs Y0-Y7.
COM	3	Analog Switch Input or Output.
V _{CC}	16	Positive Analog and Digital Supply Voltage Input
A	11	Digital Address "A" Input.
B	10	Digital Address "B" Input.
C	9	Digital Address "C" Input.
GND	8	Ground. Connect to digital ground.
NC	7	No Connect.
INH	6	Digital Enable Input. Normally connected to GND.

7.2 FUNCTION TABLE

INH	INPUT STATES			ON CHANNEL(S)
	C	B	A	
1	X	X	X	NONE
0	0	0	0	Y0
0	0	0	1	Y1
0	0	1	0	Y2
0	0	1	1	Y3
0	1	0	0	Y4
0	1	0	1	Y5
0	1	1	0	Y6
0	1	1	1	Y7

X=Don't care

NOTE: Input and output pins are identical and inter-changeable. Either may be considered an input or output; signals pass equally well in either direction.

8 SPECIFICATIONS

8.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) ⁽¹⁾

SYMBOL	PARAMETER		MIN	MAX	UNIT
V _{CC}	Supply Voltage range		-0.5	7	V
V _I	Input Voltage range ⁽²⁾		-0.5	V _{CC} +0.5	
V _{IO}	Switch I/O voltage range ^{(2) (3)}		-0.5	V _{CC} +0.5	
I _{IK}	Input clamp current	V _I < 0 or V _I > V _{CC}		±20	mA
I _{IOK}	I/O diode current	V _{IO} < 0 or V _{IO} > V _{CC}		±20	
I _T	Switch through current	V _{IO} = 0 to V _{CC}		±25	
	Continuous current through V _{CC} or GND			±50	
θ _{JA}	Package thermal impedance ⁽⁴⁾	TSSOP16		45	°C/W
T _J	Junction Temperature ⁽⁵⁾		-40	150	°C
T _{stg}	Storage temperature		-65	+150	

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

(3) This value is limited to 5.5 V maximum.

(4) The package thermal impedance is calculated in accordance with JESD-51.

(5) The maximum power dissipation is a function of T_{J(MAX)}, R_{θJA}, and T_A. The maximum allowable power dissipation at any ambient temperature is P_D = (T_{J(MAX)} - T_A) / R_{θJA}. All numbers apply for packages soldered directly onto a PCB.

8.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

			VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±2000	V
		Charged-device model (CDM), per ANSI/ESDA/JEDEC JS-002 ⁽²⁾	±1000	
		Machine Model (MM)	±200	

(1) JEDEC document JEP155 states that 500 V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250 V CDM allows safe manufacturing with a standard ESD control process.



ESD SENSITIVITY CAUTION

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

8.3 Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted) ⁽¹⁾

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
V _{CC}	Supply Voltage		2	6	V
V _{IH}	High-level input voltage control inputs	V _{CC} =2V	1.6		V
		V _{CC} =3V	2.2		
		V _{CC} =3.3V	2.4		
		V _{CC} =4.5V	3.15		
		V _{CC} =6V	4.2		
V _{IL}	Low-level input voltage control inputs	V _{CC} =2V		0.5	V
		V _{CC} =3V		0.9	
		V _{CC} =3.3V		1	
		V _{CC} =4.5V		1.35	
		V _{CC} =6V		1.8	
V _I	Control input voltage		0	V _{CC}	V
V _{IO}	Input/output voltage		0	V _{CC}	V
$\Delta t/\Delta v$	Input transition rise or fall time	V _{CC} =2V		1000	ns
		V _{CC} =3V		800	
		V _{CC} =3.3V		700	
		V _{CC} =4.5V		500	
		V _{CC} =6V		400	
T _A	Operating temperature		-40	+125	°C

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

8.4 ELECTRICAL CHARACTERISTICS

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

PARAMETER	SYMBOL	TEST CONDITIONS	V _{CC}	T _A =25°C			UP TO 85°C		UP TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
On-state switch resistance	R _{ON}	I _T = 2mA, V _I =V _{CC} to GND, V _{INH} =V _{IL}	2V		470	650		670		700	Ω
			3V		210	280		320		360	
		I _T ≤ 2mA, V _I =V _{CC} to GND, V _{INH} =V _{IL}	3.3V		155	215		250		260	
			4.5V		105	130		140		150	
			6V		85	95		110		120	
Difference in on-state resistance between switches	ΔR _{ON}	I _T = 2mA, V _I =V _{CC} /2, V _{INH} =V _{IL}	2V		4	10		15		20	Ω
			3V		2	8		12		16	
		I _T ≤ 2mA, V _I =V _{CC} /2, V _{INH} =V _{IL}	3.3V		2	8		12		16	
			4.5V		2	8		12		16	
			6V		3	9		13		18	
Control input current	I _I	V _I = V _{CC} or GND	6V			±0.1		±0.1		±1	μA
Off-state switch leakage current (any one channel)	I _{S(OFF)}	V _I =V _{CC} or GND, V _{INH} =V _{IH}	6V			±0.1		±0.5		±1	μA
Off-state switch leakage current (common channel)						±0.2		±2		±4	
On-state switch leakage current	I _{S(ON)}	V _I =V _{CC} or GND, V _{INH} =V _{IL}	6V			±0.1		±0.5		±1	μA
Supply current	I _{CC}	V _I =V _{CC} or GND	6V			2		5		20	μA
Control input capacitance	C _{IC}	A, B, C, INH			3.5	10		10		10	pF
Common terminal capacitance	C _{IS}	Switch off			22	40		40		40	
Switch terminal capacitance	C _{OS}	Switch off			6.7	15		15		15	
Off Isolation	O _{ISO}	R _L =50Ω, f=1MHz	5V		-75						dB
Cross talk	XTALK	R _L =50Ω, f=1MHz	5V		-77						dB
-3dB Bandwidth	BW	R _L =50Ω	5V		150						MHz
			3.3V		140						MHz

8.5 Injection Current Coupling Specifications

T_A = -40°C to 125°C

PARAMETER	SYMBOL	TEST CONDITIONS		V _{CC}	MIN	TYP ⁽¹⁾	MAX	UNIT
Maximum shift of output voltage of enabled analog channel	V _{Δout}	R _S ≤ 3.9KΩ	I _I ⁽²⁾ ≤ 1mA	3.3V		0.17	1	mV
				5V		0.30	1	
			I _I ⁽²⁾ ≤ 10mA	3.3V		0.34	5	
				5V		0.38	5	
		R _S ≤ 20KΩ	I _I ⁽²⁾ ≤ 1mA	3.3V		0.81	2	
				5V		0.86	2	
			I _I ⁽²⁾ ≤ 10mA	3.3V		2.27	20	
				5V		2.34	20	

(1) Typical values are measured at T_A = 25°C.

(2) I_I = total current injected into all disabled channels.

8.6 Switching Characteristics, $V_{CC} = 2\text{ V}$

over recommended operating free-air temperature range, $C_L = 50\text{ pF}$ (unless otherwise noted).⁽¹⁾

PARAMETER		FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			UP TO 85°C		UP TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	Propagation delay time	COM or Y_n	Y_n or COM		19.5	31.5		33		34.5	ns
t_{PHL}											
t_{PLH}	Propagation delay time	Channel Select	COM or Y_n		36	59		62.5		66	ns
t_{PHL}											
t_{PZH}	Enable delay time	INH	COM or Y_n			49.5		52		54	ns
t_{PZL}											
t_{PHZ}	Disable delay time	INH	COM or Y_n			153		178.5		204	ns
t_{PLZ}											

(1) This parameter is ensured by design and/or characterization and is not tested in production.

8.7 Switching Characteristics, $V_{CC} = 3\text{ V}$

over recommended operating free-air temperature range, $C_L = 50\text{ pF}$ (unless otherwise noted).⁽¹⁾

PARAMETER		FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			UP TO 85°C		UP TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	Propagation delay time	COM or Y_n	Y_n or COM		9.5	16.5		18		19	ns
t_{PHL}											
t_{PLH}	Propagation delay time	Channel Select	COM or Y_n		18	28.5		33		37	ns
t_{PHL}											
t_{PZH}	Enable delay time	INH	COM or Y_n			22		24.5		27	ns
t_{PZL}											
t_{PHZ}	Disable delay time	INH	COM or Y_n			121.5		143.5		165	ns
t_{PLZ}											

(1) This parameter is ensured by design and/or characterization and is not tested in production.

8.8 Switching Characteristics, $V_{CC} = 3.3\text{ V}$

over recommended operating free-air temperature range, $C_L = 50\text{ pF}$ (unless otherwise noted).⁽¹⁾

PARAMETER		FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			UP TO 85°C		UP TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	Propagation delay time	COM or Y_n	Y_n or COM		8.5	15		16		16.5	ns
t_{PHL}											
t_{PLH}	Propagation delay time	Channel Select	COM or Y_n		15.5	25		26.5		28.5	ns
t_{PHL}											
t_{PZH}	Enable delay time	INH	COM or Y_n			20.5		22.5		24	ns
t_{PZL}											
t_{PHZ}	Disable delay time	INH	COM or Y_n			120		130		159	ns
t_{PLZ}											

(1) This parameter is ensured by design and/or characterization and is not tested in production.

8.9 Switching Characteristics, $V_{CC} = 4.5\text{ V}$

over recommended operating free-air temperature range, $C_L = 50\text{ pF}$ (unless otherwise noted).⁽¹⁾

PARAMETER		FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			UP TO 85°C		UP TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	Propagation delay time	COM or Y_n	Y_n or COM		7.5	13.5		14		14.5	ns
t_{PHL}											
t_{PLH}	Propagation delay time	Channel Select	COM or Y_n		11	19.5		20.5		21	ns
t_{PHL}											
t_{PZH}	Enable delay time	INH	COM or Y_n			14.5		16.5		18	ns
t_{PZL}											
t_{PHZ}	Disable delay time	INH	COM or Y_n			121.5		124		126	ns
t_{PLZ}											

(1) This parameter is ensured by design and/or characterization and is not tested in production.

8.10 Switching Characteristics, $V_{CC} = 6\text{ V}$

over recommended operating free-air temperature range, $C_L = 50\text{ pF}$ (unless otherwise noted).⁽¹⁾

PARAMETER		FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			UP TO 85°C		UP TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	Propagation delay time	COM or Y_n	Y_n or COM		5	12		13		14	ns
t_{PHL}											
t_{PLH}	Propagation delay time	Channel Select	COM or Y_n		9.5	17.5		18.5		19	ns
t_{PHL}											
t_{PZH}	Enable delay time	INH	COM or Y_n			9		11		12.5	ns
t_{PZL}											
t_{PHZ}	Disable delay time	INH	COM or Y_n			112.5		114.5		117	ns
t_{PLZ}											

(1) This parameter is ensured by design and/or characterization and is not tested in production.

9 Operating Characteristics

$T_A = 25^\circ\text{C}$ (see Figure 12)

SYMBOL	PARAMETER	V_{CC}	TEST CONDITIONS	TYP	UNIT
C_{PD}	Power dissipation capacitance	3.3V	No load	15	pF
		5V		13	

10 APPLICATION INFORMATION

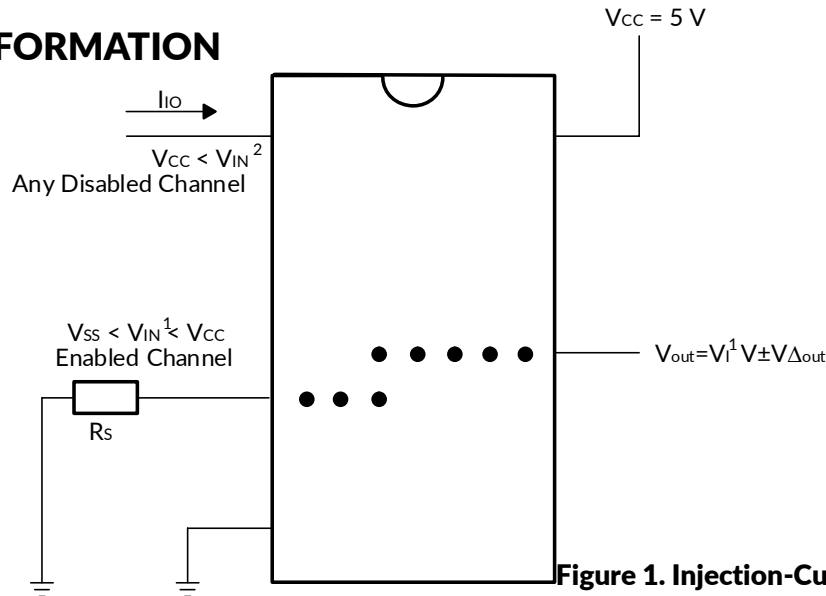


Figure 1. Injection-Current Coupling Specification

Diagram illustrating the measurement of MOSFET on-resistance (r_{on}).

The MOSFET is configured with its gate connected to V_{cc} and its source connected to GND. The drain is connected to a voltage source $V_i = V_{cc}$ to GND. A current source I_T is connected between the drain and the output node V_o . A voltmeter V is connected across the output node V_o and the source GND, measuring the voltage drop $V_i - V_o$.

The MOSFET is labeled with V_{cc} (ON) and GND. The current source is labeled I_T . The voltmeter is labeled V . The output voltage is labeled V_o . The input voltage is labeled $V_i = V_{cc}$ to GND. The gate voltage is labeled $V_{INH} = V_{IL}$.

The on-resistance is calculated as:

$$r_{on} = \frac{V_i - V_o}{I_T} \Omega$$

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Parameter Measurement Information (continued)

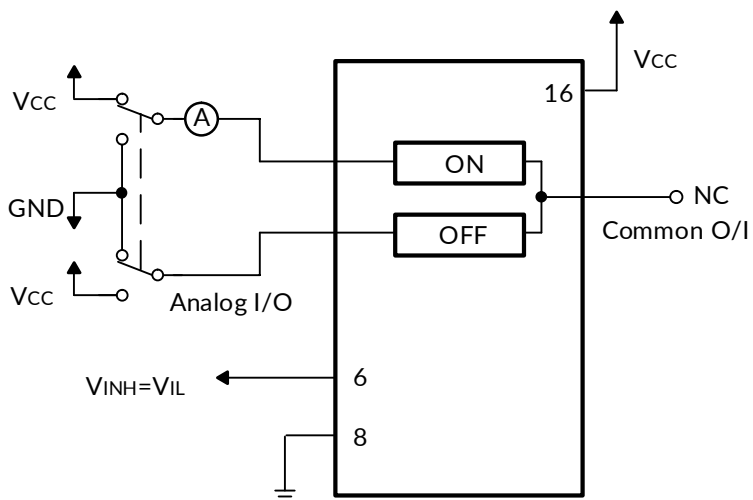


Figure 5. Maximum On-Channel Leakage Current, Channel to Channel, Test Setup

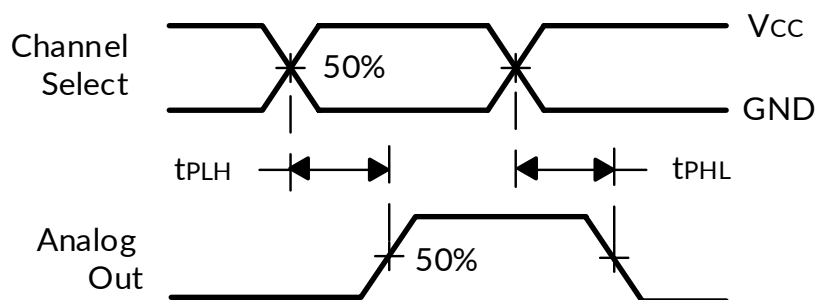
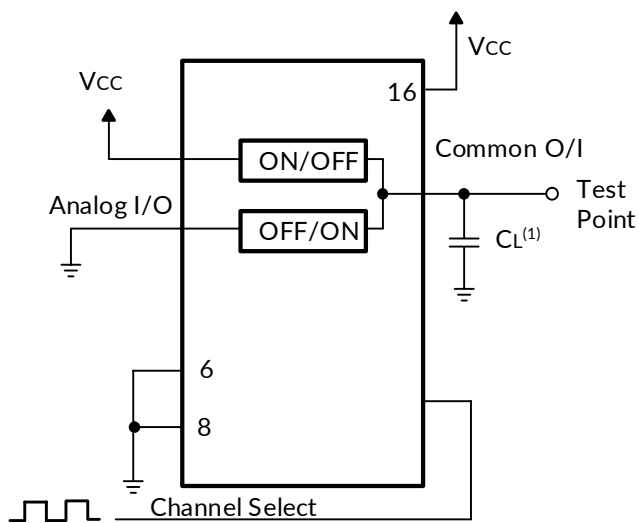


Figure 6. Propagation Delays, Channel Select to Analog Out



(1) Includes all probe and jig capacitance

Figure 7. Propagation-Delay Test Setup, Channel Select to Analog Out

Parameter Measurement Information (continued)

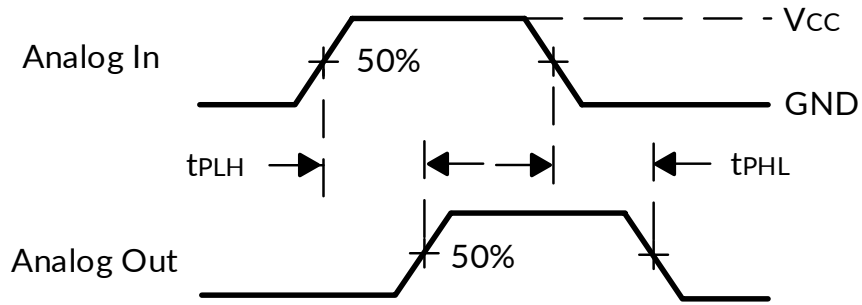
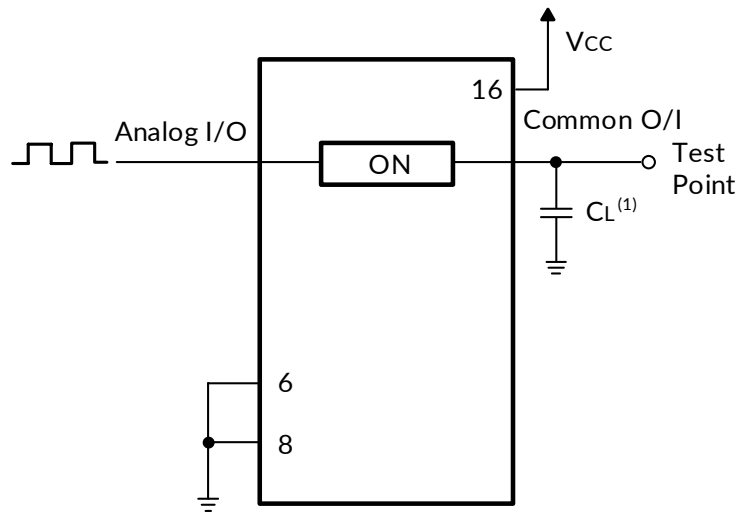


Figure 8. Propagation Delays, Analog In to Analog Out



(1) Includes all probe and jig capacitance

Figure 9. Propagation-Delay Test Setup, Analog In to Analog Out

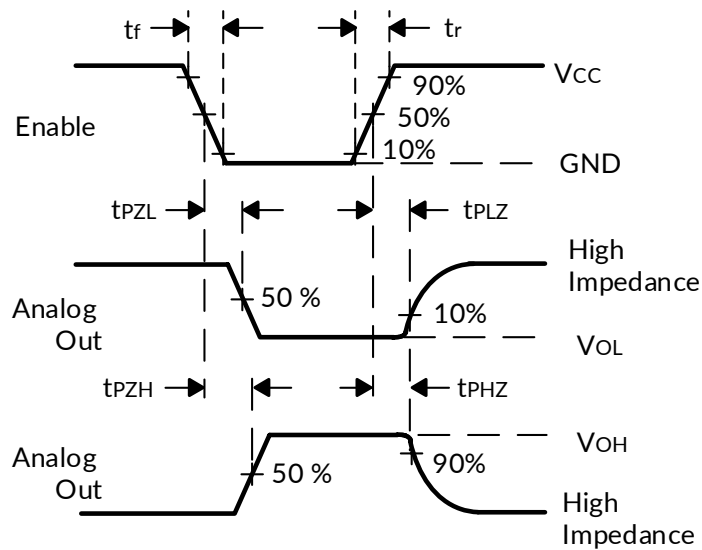


Figure 10. Propagation Delays, Enable to Analog Out

Parameter Measurement Information (continued)

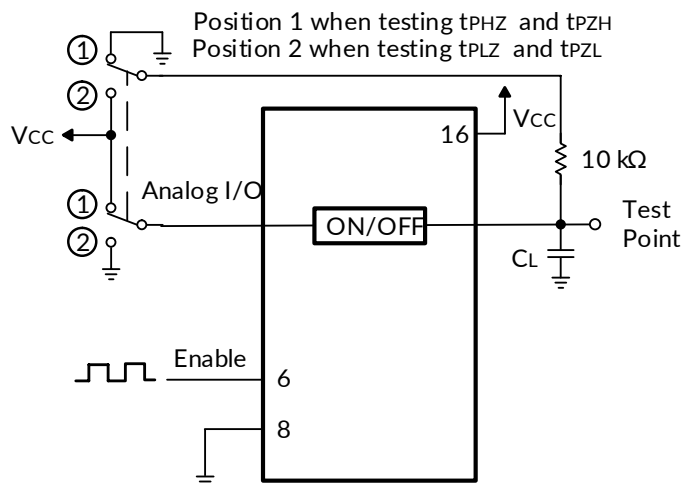


Figure 11. Propagation-Delay Test Setup, Enable to Analog Out

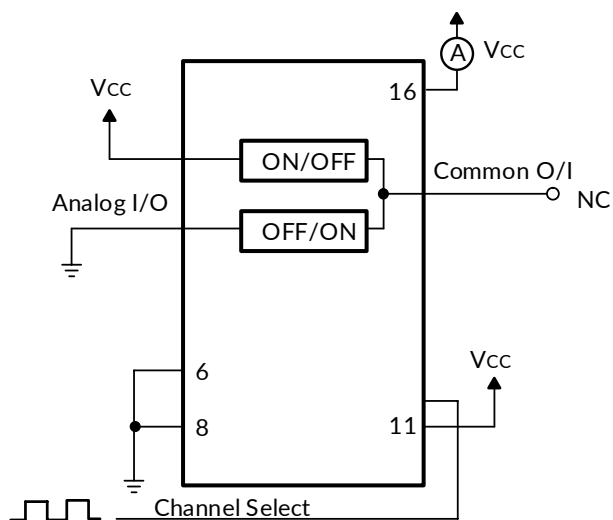
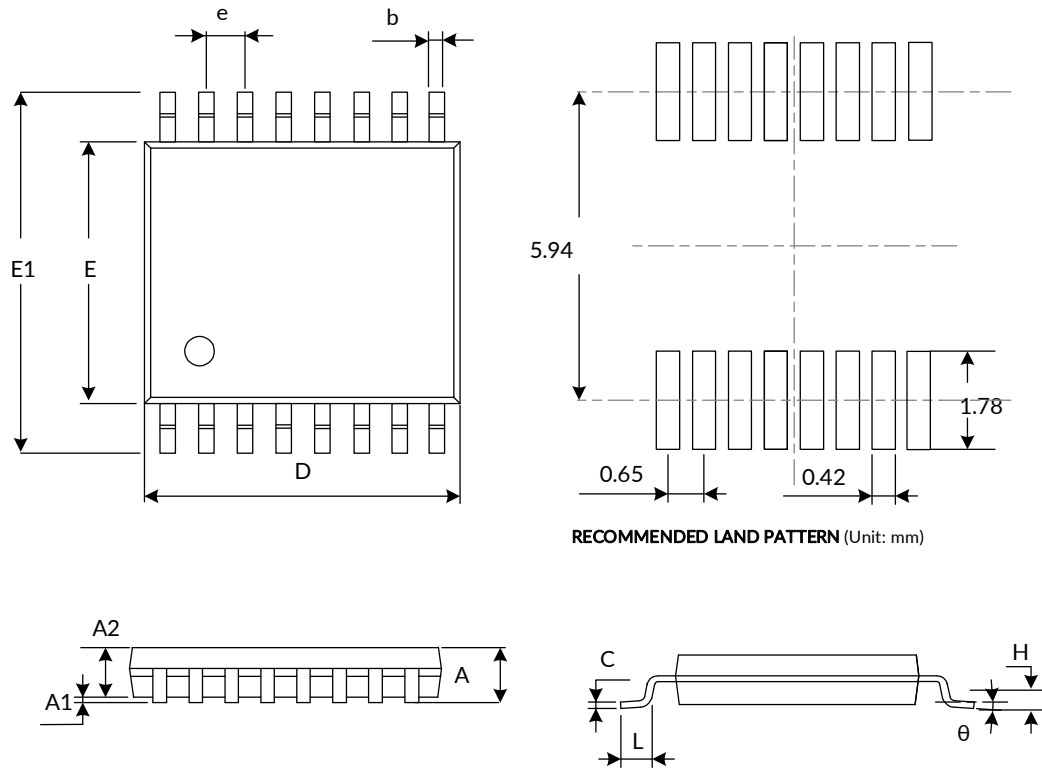


Figure 12. Power-Dissipation Capacitance Test Setup

12 PACKAGE OUTLINE DIMENSIONS

TSSOP16⁽³⁾



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A ⁽¹⁾		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D ⁽¹⁾	4.860	5.100	0.191	0.201
E ⁽¹⁾	4.300	4.500	0.169	0.177
E1	6.200	6.600	0.244	0.260
e	0.650(BSC) ⁽²⁾		0.026(BSC) ⁽²⁾	
L	0.500	0.700	0.02	0.028
H	0.25TYP		0.01TYP	
θ	1°	7°	1°	7°

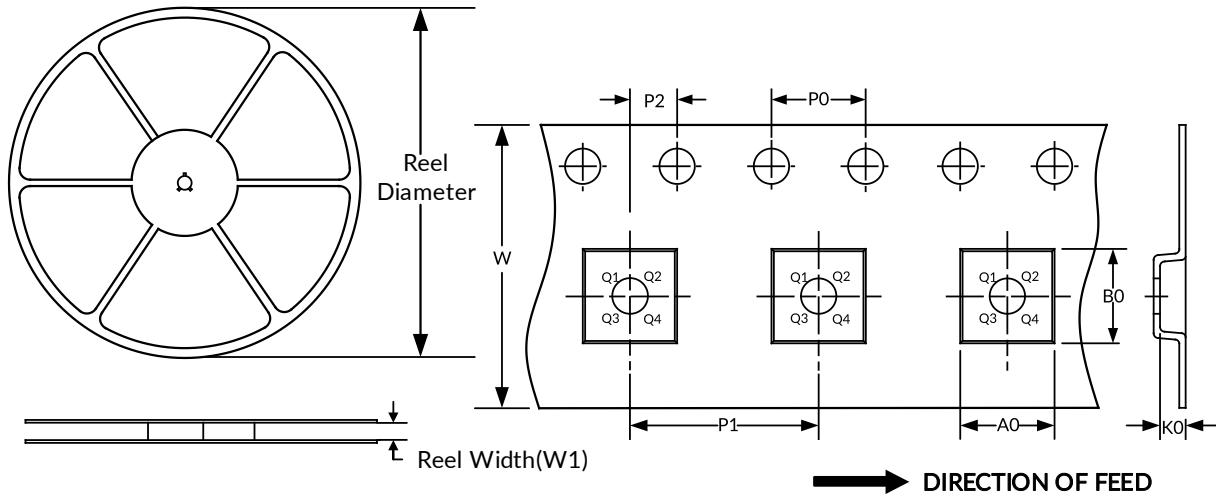
NOTE:

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

13 TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSION



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width(mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
TSSOP16	13"	12.4	6.90	5.60	1.20	4.0	8.0	2.0	12.0	Q1

NOTE:

1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.