

SN74HC4851-Q1 Automotive 8-Channel Analog Multiplexer/Demultiplexer With Injection-Current Effect Control

1 Features

- AEC-Q100 qualified for automotive applications
 - Device Temperature Grade 1: –40°C to 125°C ambient operating temperature
- Injection-current cross coupling <1mV/mA (see [Section 8.1](#) in *Application Information*)
- Low crosstalk between switches
- Terminal compatible with CD74HC4051, SN74LV4051A, and CD4051B devices
- 2V to 5.5V V_{CC} operation
- Latch-up performance exceeds 100mA per JESD 78, class II

2 Applications

- Analog and digital multiplexing and demultiplexing
- Diagnostics and monitoring
- Zonal Architecture
- Body control modules
- Battery management systems (BMS)
- HVAC control module
- Automotive head unit
- Telematics
- On-board (OBC) and wireless charging

3 Description

This eight-channel CMOS analog multiplexer/demultiplexer is terminal compatible with the function of the '4051 device, and features injection-current effect control, which has excellent value in automotive applications where voltages in excess of normal supply voltages are common.

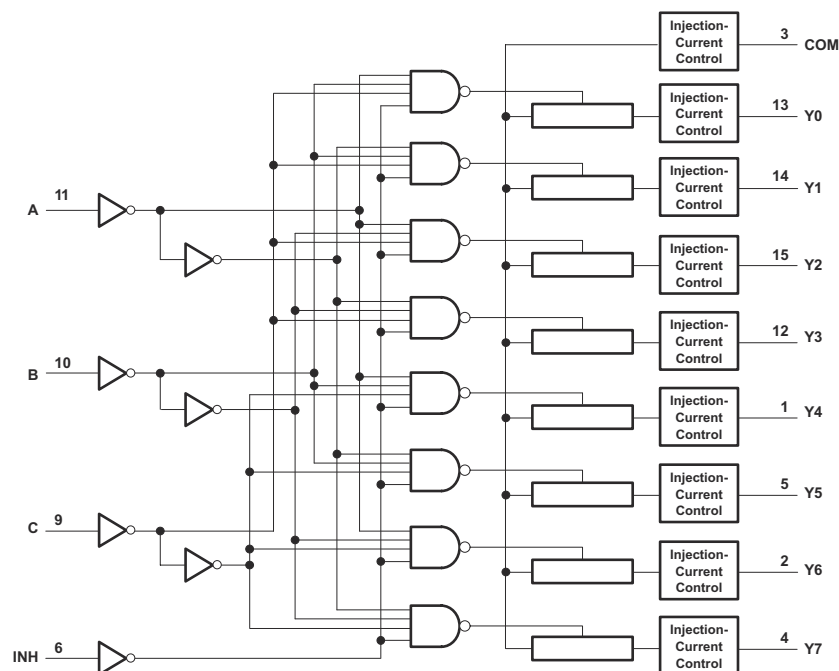
The injection-current effect control allows signals at disabled analog input channels to exceed the supply voltage without affecting the signal of the enabled analog channel. This feature eliminates the need for external diode/resistor networks typically used to keep the analog channel signals within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

Package Information

PART NUMBER	PACKAGE ⁽¹⁾	PACKAGE SIZE ⁽²⁾
SN74HC4851-Q1	PW (TSSOP, 16)	5mm × 6.4mm

(1) For more information, see [Section 11](#)

(2) The package size (length × width) is a nominal value and includes pins, where applicable.



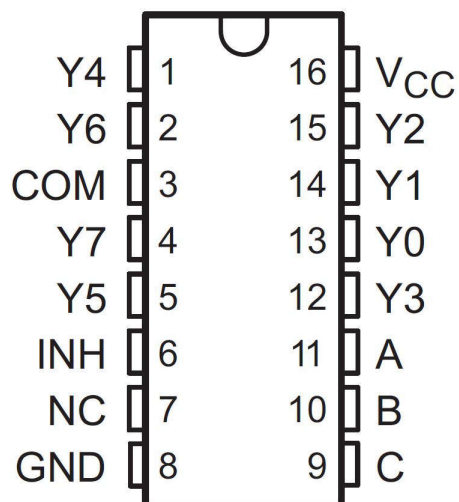
Logic Diagram (Positive Logic)



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4 Pin Configuration and Functions



NC – No internal connection

Figure 4-1. SN74HC4851-Q1 PW Package, 16-Pin TSSOP (Top View)

Table 4-1. Function Table

Inputs				On Channel
INH	C	B	A	Yx
L	L	L	L	Y0
L	L	L	H	Y1
L	L	H	L	Y2
L	L	H	H	Y3
L	H	L	L	Y4
L	H	L	H	Y5
L	H	H	L	Y6
L	H	H	H	Y7
H	X	X	X	None

5 Specifications

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)^{(1) (2)}

		MIN	MAX	UNIT
V_{CC}	Supply voltage	–0.5	6	V
V_{SEL} or V_{EN}	Logic control input pin voltage ($\overline{EN}$, A0, A1, A2)	–0.5	$V_{CC}+0.5V$	V
V_S or V_D	Source or drain voltage (Sx, D)	–0.5	$V_{CC}+0.5V$	V
I_{IK}	Input clamp current ($V_I < 0$ or $V_I > V_{CC}$)	–20	20	mA
I_{IOK}	I/O diode current ($V_{IO} < 0$ or $V_{IO} > V_{CC}$)	–20	20	mA
I_T	Switch through current ($V_{IO} = 0$ to V_{CC})	–25	25	mA
I_{GND}	Continuous current through V_{CC} or GND	–50	50	mA
T_{stg}	Storage temperature	–65	150	°C
T_J	Junction temperature		150	

- (1) Operation outside the *Absolute Maximum Ratings* may cause permanent device damage. Absolute maximum ratings do not imply functional operation of the device at these or any other conditions beyond those listed under *Recommended Operating Conditions*. If briefly operating outside the *Recommended Operating Conditions* but within the *Absolute Maximum Ratings*, the device may not sustain damage, but it may not be fully functional. Operating the device in this manner may affect device reliability, functionality, performance, and shorten the device lifetime.
- (2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

5.2 Thermal Information: SN74HC485x-Q1

THERMAL METRIC ⁽¹⁾		SN74HC485x-Q1	UNIT
		PW (TSSOP)	
		PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	139.6	°C/W

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

5.3 Recommended Operating Conditions

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

			MIN	NOM	MAX	UNIT
V _{CC}	Supply voltage		2		5.5	V
V _{IH}	Input logic high	2V	1.5			V
		2.5V	2.1			
		3.3V	2.3			
		4.5V	3.15			
		5.5V	4.2			
V _{IL}	Input logic low	2V	0		0.5	V
		2.5V	0		0.7	
		3.3V	0		0.8	
		4.5V	0		0.95	
		5.5V	0		1.05	
V _{SEL} or V _{EN}	Logic control input pin voltage ($\overline{\text{EN}}$, A0, A1, A2)		0		V _{CC}	V
V _S or V _D	Signal path input/output voltage (source or drain pin) (Sx, D)		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} = 5.5V			400	
T _A	Ambient temperature		–40		125	°C

5.4 Electrical Characteristics

At specified $V_{CC} \pm 10\%$

Typical values measured at nominal V_{CC} .

PARAMETER		TEST CONDITIONS	V _{CC}	Operating free-air temperature (T _A)									UNIT
				25°C			–40°C to 85°C			–40°C to 125°C			
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
R _{ON}	On-state switch resistance	V _S = 0V to V _{CC} I _{SD} = 0.5mA	2V	500	650	670	700	Ω					
			3V	215	280	320	360						
			3.3V	210	270	305	345						
			4.5V	160	210	240	270						
Δ _{RON}	On-state switch resistance matching between inputs	V _S = V _{CC} / 2 I _{SD} = 0.5mA	2V	4	13	18	23	Ω					
			3V	2	10	12	16						
			3.3V	2	9	12	16						
			4.5V	2	9	12	16						
I _I	Control input current	V _I = V _{CC} or GND	5V	±0.1		±0.1		±1		μA			
I _{S(OFF)}	Off-state switch leakage current (any one channel)	Switch Off V _{INH} =V _{IH} V _D = V _{CC} / GND V _S = GND / V _{CC}	5V	±0.1		±0.5		±1		μA			
	Off-state switch leakage current (common channel)			±0.2		±2		±4		μA			
I _{S(ON)}	Channel on-state leakage current	Switch Off V _{INH} =V _{IL} V _D = V _{CC} / GND V _S = GND / V _{CC}	5V	±0.1		±0.5		±1		μA			
I _{DD}	V _{CC} supply current	Logic inputs = 0V or V _{CC}	5V	2		20		40		μA			
C _{IC}	Control input capacitance	A, B, C, INH		3.5	10	10		10		pF			
C _{IS}	Common terminal capacitance	Switch off		22	40	40		40		pF			
C _{OS}	Switch terminal capacitance	Switch off		6.7	15	15		15		pF			
C _{PD}	Power Dissipation Capacitance	No Load t _r = t _f = 1ns f = 1MHz	3.3V	32						pF			
			5V	37									

5.5 Timing Characteristics

At specified $V_{CC} \pm 10\%$

Typical values measured at nominal V_{CC} .

PARAMETER		TEST CONDITIONS	V _{CC}	Operating free-air temperature (T _A)									UNIT
				25°C			−40°C to 85°C			−40°C to 125°C			
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
SWITCHING CHARACTERISTICS ⁽¹⁾													
t _{PD}	Propagation delay	C _L = 50pF Sx to D, D to Sx	2V	19.5	30	34	37	ns					
			3V	12	17.5	19.5	21.5						
			3.3V	11	16.5	18.5	20.5						
			5.5V	8.6	14	15	16						
t _{TRAN}	Transition-time between inputs	R _L = 10kΩ, C _L = 50pF Ax to D, Ax to Sx	2V	44	94	103	103	ns					
			3V	30	63	67	67						
			3.3V	23	51	54	54						
			5.5V	18	43	46	46						
t _{ON(EN)}	Turnon-time from enable	R _L = 10kΩ, C _L = 50pF EN to D, EN to Sx	2V	95	105	115	ns						
			3V	90	100	110							
			3.3V	85	95	105							
			5V	80	90	100							
t _{OFF(EN)}	Turnoff time from enable	R _L = 10kΩ, C _L = 50pF EN to D, EN to Sx	2V	95	105	115	ns						
			3V	90	100	110							
			3.3V	85	95	105							
			5.5V	80	90	100							

(1) $t_{PLH}/t_{PHL} = t_{PD}$ propagation delay time, $t_{PZH}/t_{PZL} = t_{ON(EN)}$ enable delay time, $t_{PHZ}/t_{PLZ} = t_{OFF(EN)}$ disable delay time, t_{PLH}/t_{PHL} Channel select = t_{TRAN}

5.6 Injection Current Coupling

At specified $V_{CC} \pm 10\%$

Typical values measured at nominal V_{CC} and $T_A = 25^\circ\text{C}$.

PARAMETER		V _{CC}	TEST CONDITIONS	-40°C to 125°C			UNIT
				MIN	TYP	MAX	
INJECTION CURRENT COUPLING							
ΔV _{OUT}	Maximum shift of output voltage of enabled analog input ⁽¹⁾	3.3V	R _S ≤ 3.9kΩ	I _{INJ} ≤ 1mA	0.05	1	mV
		5V			0.1	1	
		3.3V		I _{INJ} ≤ 10mA	0.345	5	
		5V			0.067	5	
		3.3V	R _S ≤ 20kΩ	I _{INJ} ≤ 1mA	0.05	2	
		5V			0.11	2	
		3.3V		I _{INJ} ≤ 10mA	0.05	20	
		5V			0.024	20	

(1) I_{INJ} = total current injected into all disabled channels

6 Parameter Measurement Information

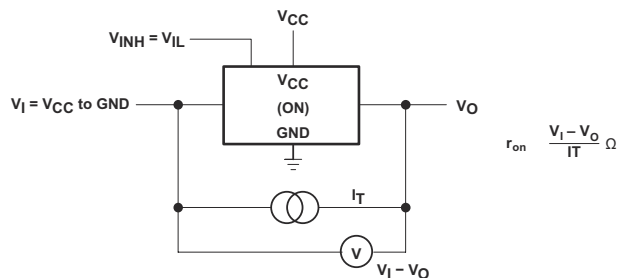


Figure 6-1. On-State-Resistance Test Circuit

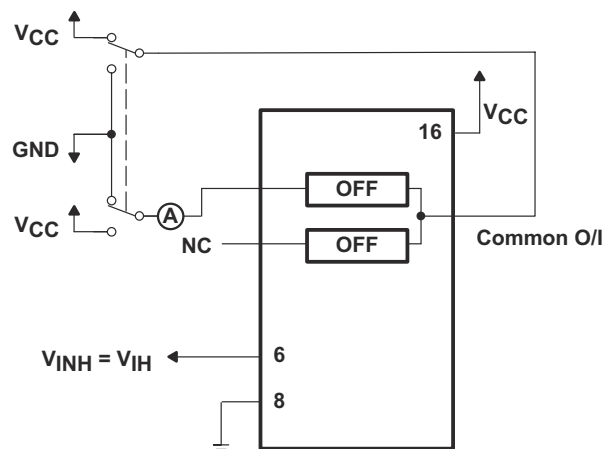


Figure 6-2. Maximum Off-Channel Leakage Current, Any One Channel, Test Setup

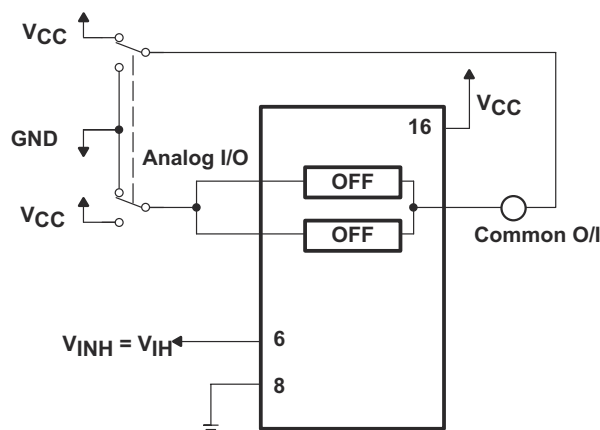


Figure 6-3. Maximum Off-Channel Leakage Current, Common Channel, Test Setup

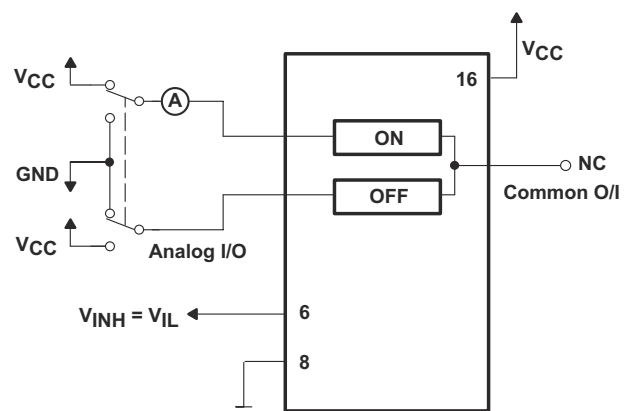


Figure 6-4. Maximum On-Channel Leakage Current, Channel To Channel, Test Setup

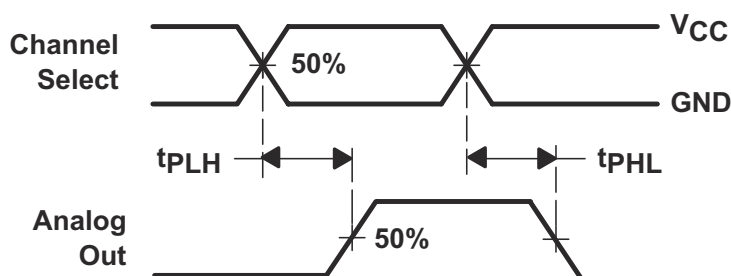
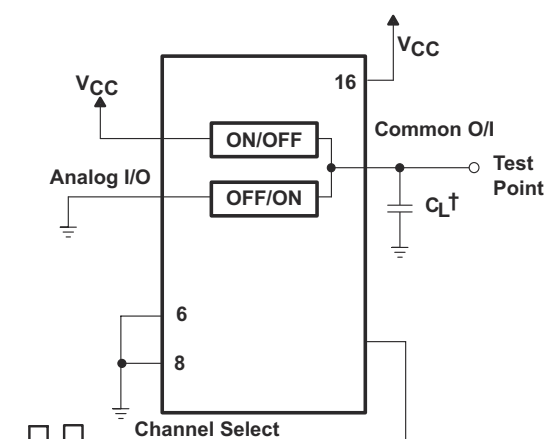


Figure 6-5. Propagation Delays, Channel Select to Analog Out



† Includes all probe and jig capacitance

Figure 6-6. Propagation-Delay Test Setup, Channel Select to Analog Out

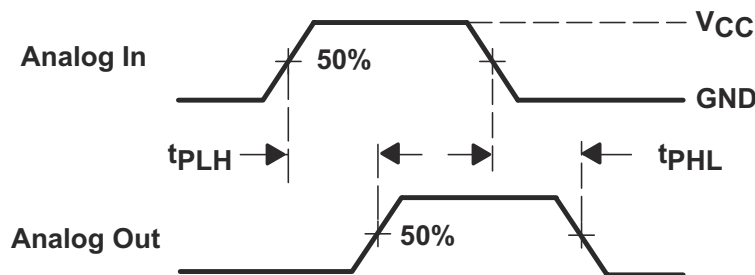
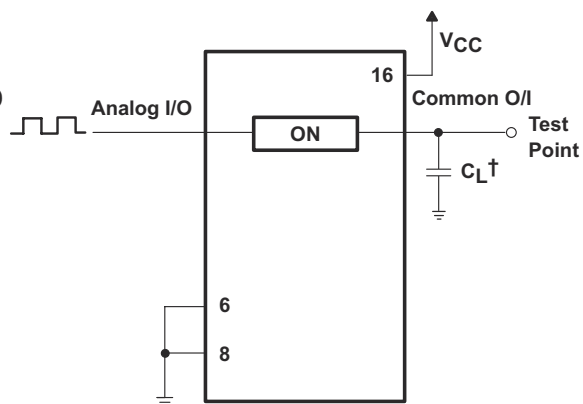


Figure 6-7. Propagation Delays, Analog In to Analog Out



† Includes all probe and jig capacitance

Figure 6-8. Propagation-Delay Test Setup, Analog In to Analog Out

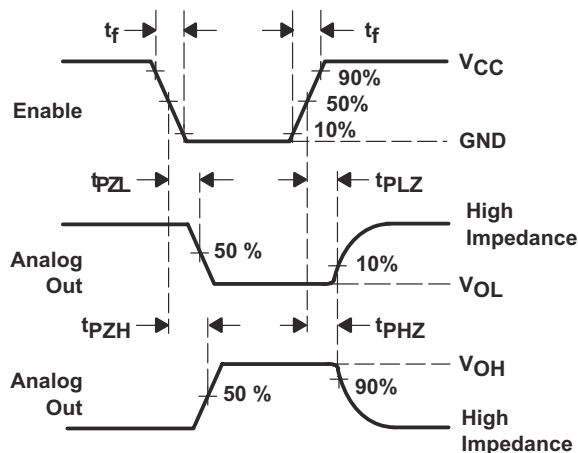


Figure 6-9. Propagation Delays, Enable to Analog Out

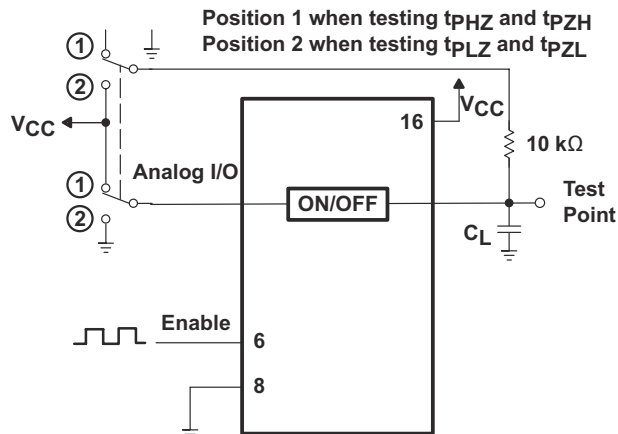


Figure 6-10. Propagation-Delay Test Setup, Enable to Analog Out

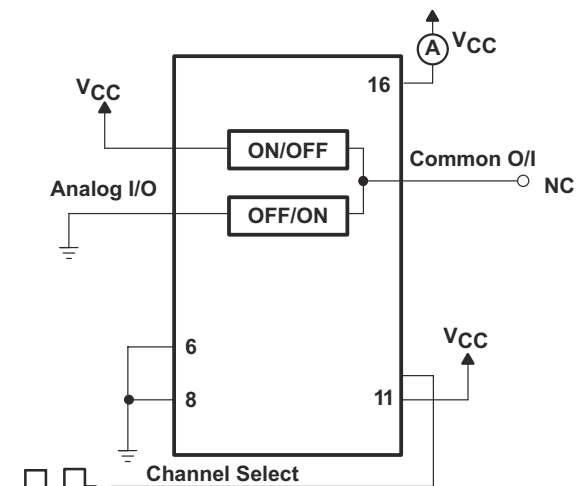


Figure 6-11. Power-Dissipation Capacitance Test Setup

7 Detailed Description

7.1 Functional Block Diagram

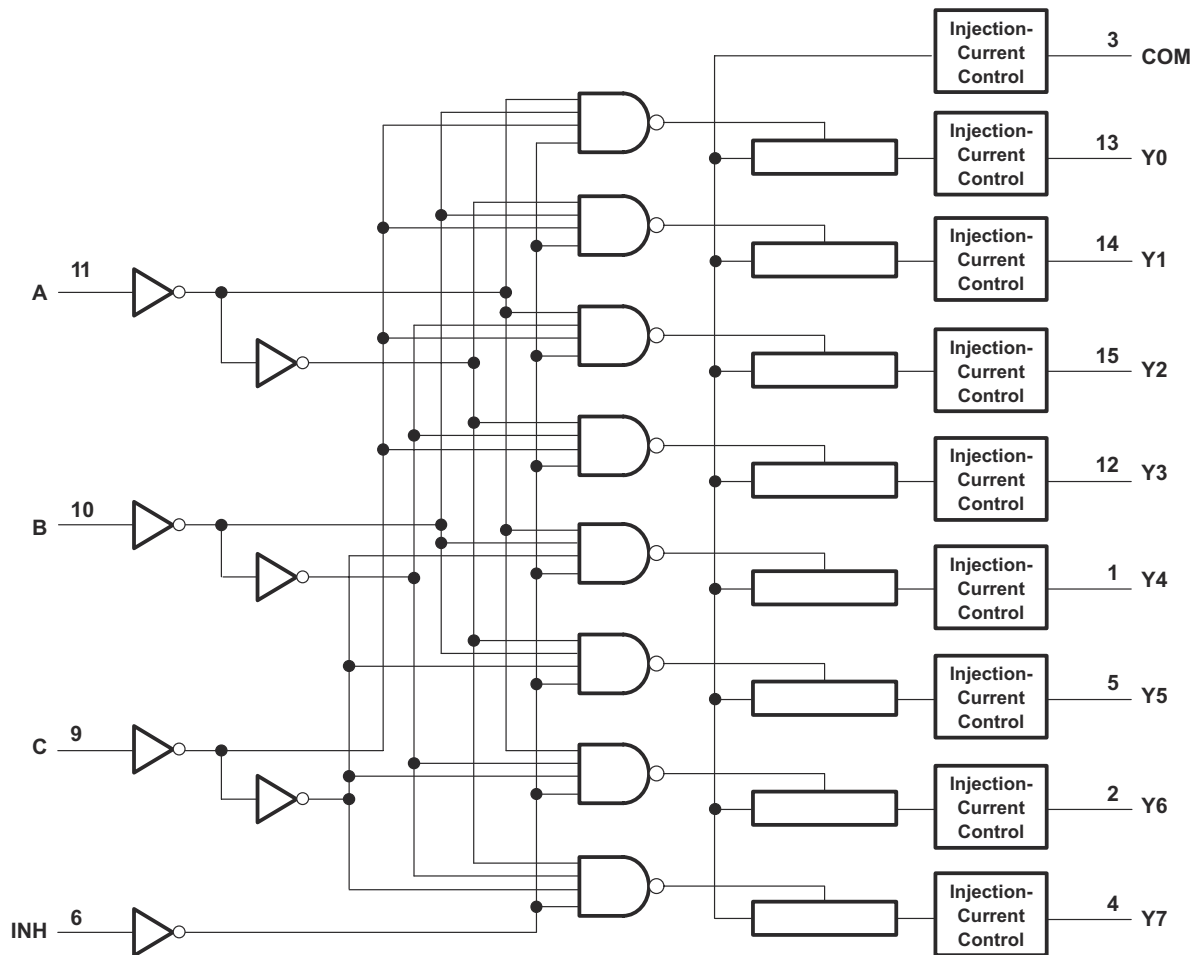


Figure 7-1. Logic Diagram (Positive Logic)

8 Application and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

8.1 Application Information

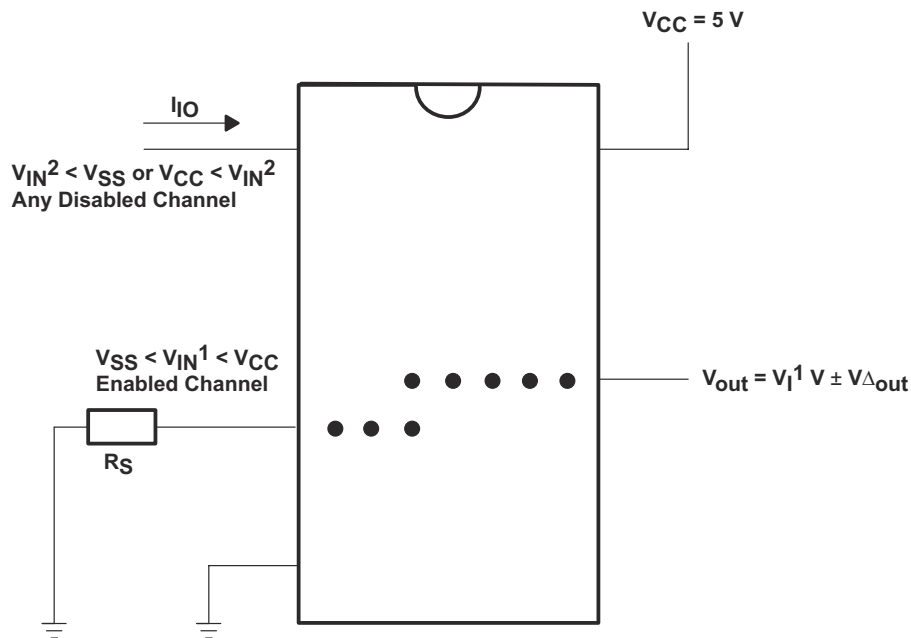


Figure 8-1. Injection-Current Coupling Specification

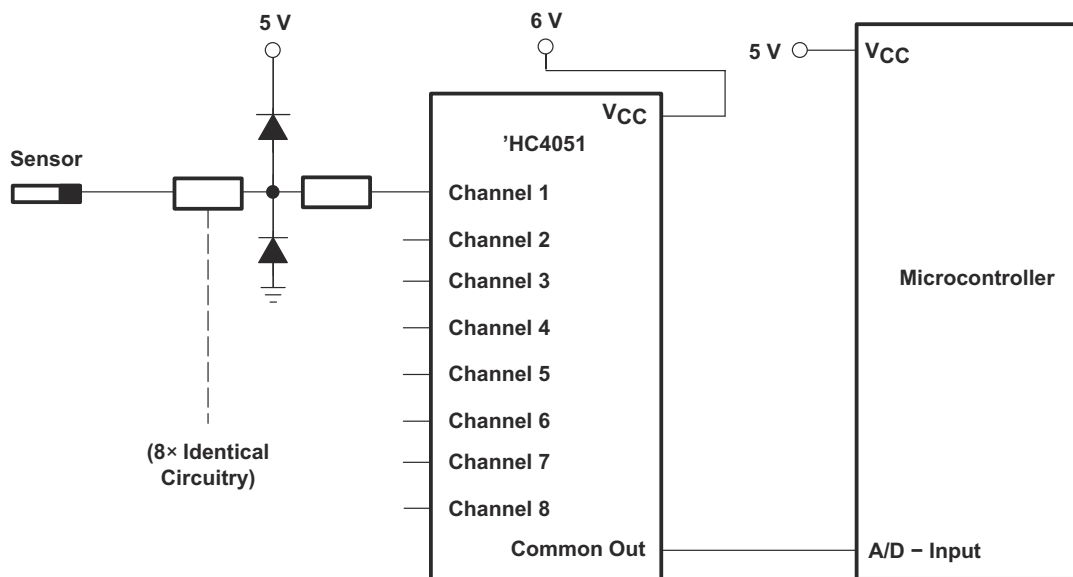


Figure 8-2. Alternate Solution Requires 32 Passive Components and One Extra 6V Regulator to Suppress Injection Current Into a Standard 'HC4051 Multiplexer

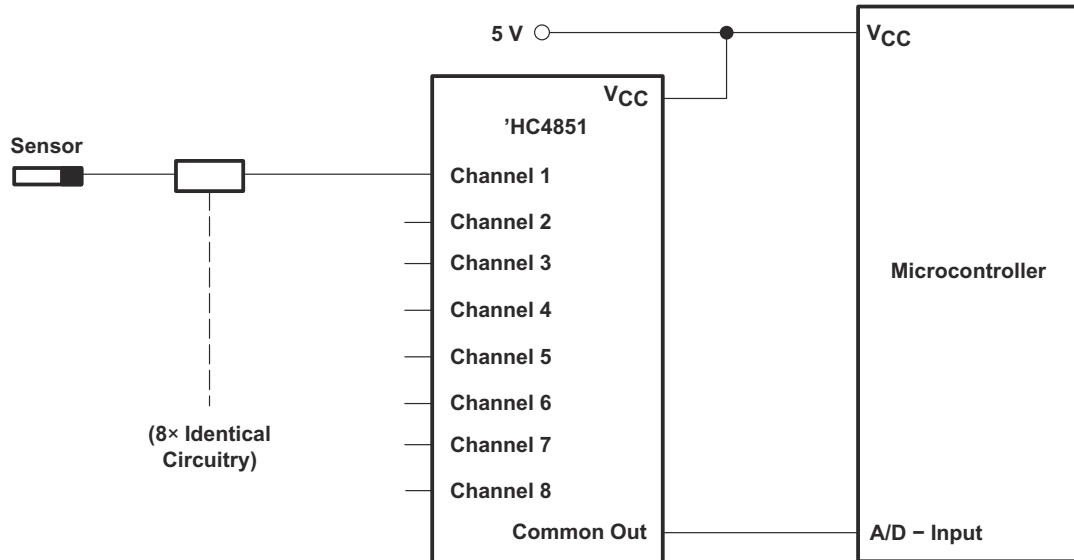


Figure 8-3. Solution by Applying the 'HC4851 Multiplexer

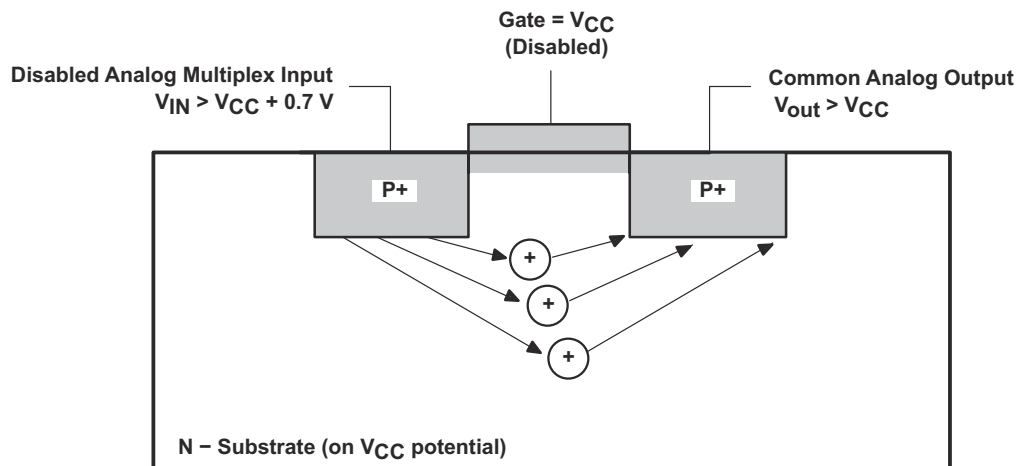


Figure 8-4. Diagram of Bipolar Coupling Mechanism (Appears if V_{IN} Exceeds V_{CC} , Driving Injection Current Into the Substrate)

9 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

9.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](https://www.ti.com). Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

9.2 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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9.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.

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9.4 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

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.

9.5 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

10 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision D (June 2024) to Revision E (January 2025)	Page
• Updated first point to "AEC-Q100 qualified" and added Device Temperature Grade.....	1

Changes from Revision C (October 2012) to Revision D (June 2024)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document.....	1
• Changed VCC ABS Max from 7V to 6V.....	4
• Changed R0JA.....	4
• Recommended supply changed from 6V to 5.5V and all test conditions using 6V were removed.....	5
• Changed ttran, tON, tOFF parameters.....	7

11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical packaging and orderable information. 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 left hand navigation.

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
SN74HC4851QDRG4Q1	NRND	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC4851Q
SN74HC4851QDRG4Q1.A	NRND	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC4851Q
SN74HC4851QDRQ1	NRND	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC4851Q
SN74HC4851QDRQ1.A	NRND	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC4851Q
SN74HC4851QPWRG4Q1	NRND	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC4851Q
SN74HC4851QPWRG4Q1.A	NRND	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC4851Q
SN74HC4851QPWRQ1	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC4851Q
SN74HC4851QPWRQ1.A	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HC4851Q

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

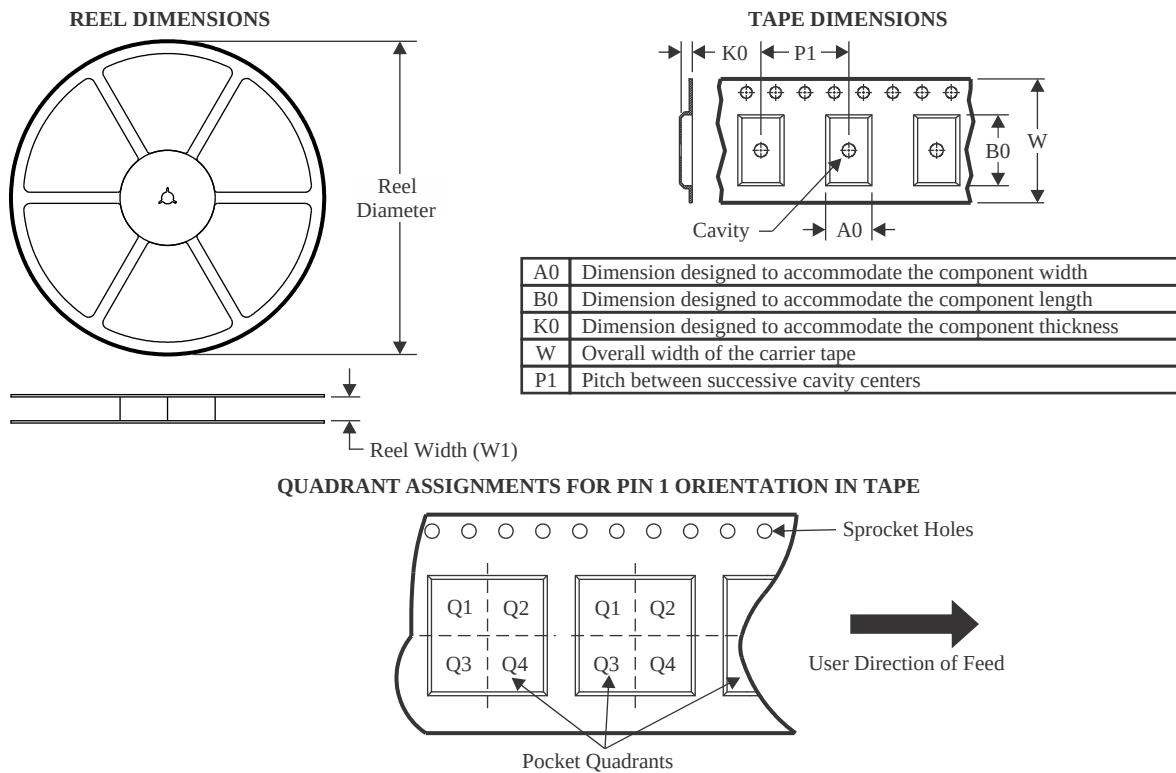
OTHER QUALIFIED VERSIONS OF SN74HC4851-Q1 :

- Catalog : [SN74HC4851](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74HC4851QPWRG4Q1	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74HC4851QPWRQ1	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS

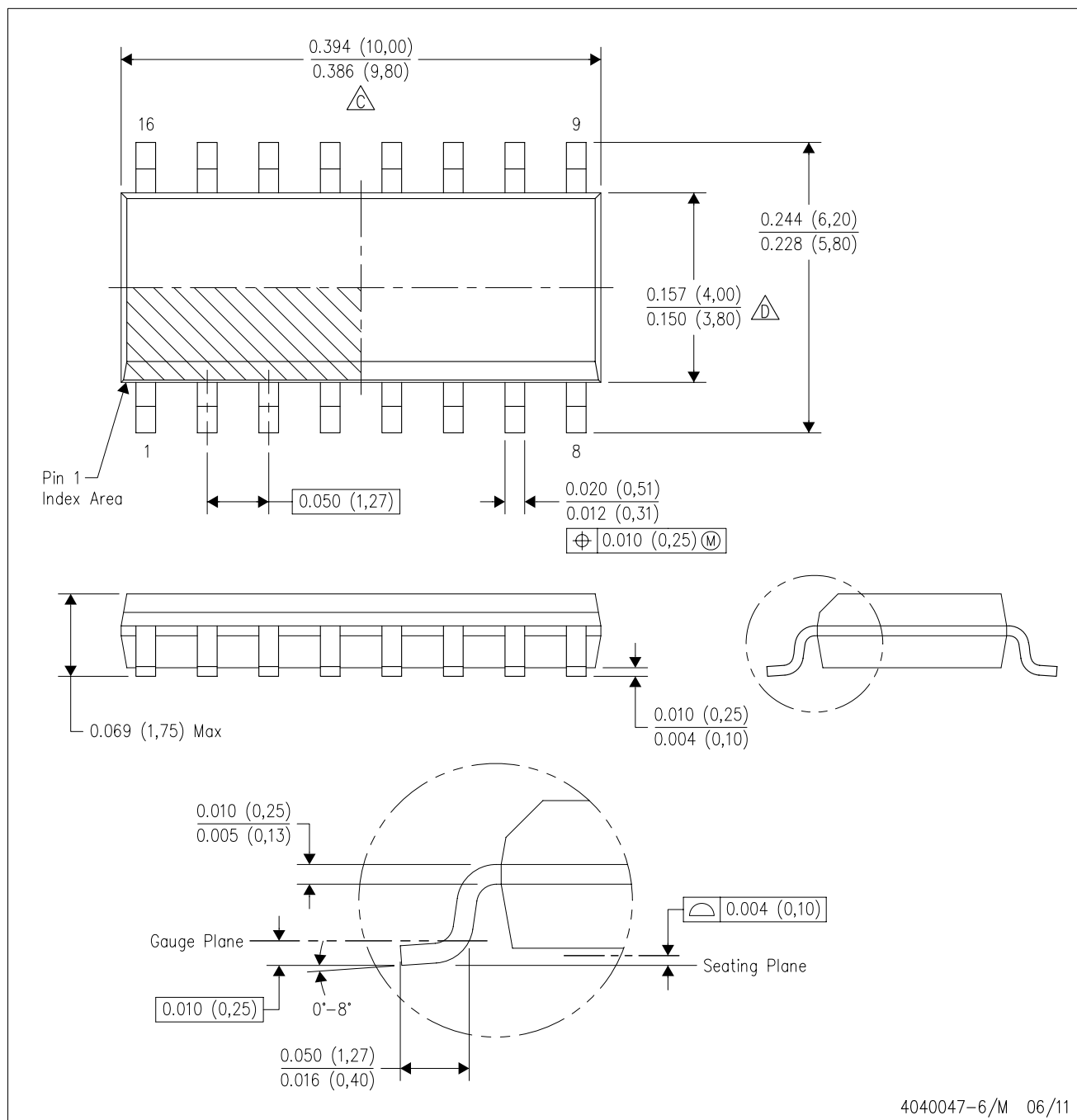


*All dimensions are nominal

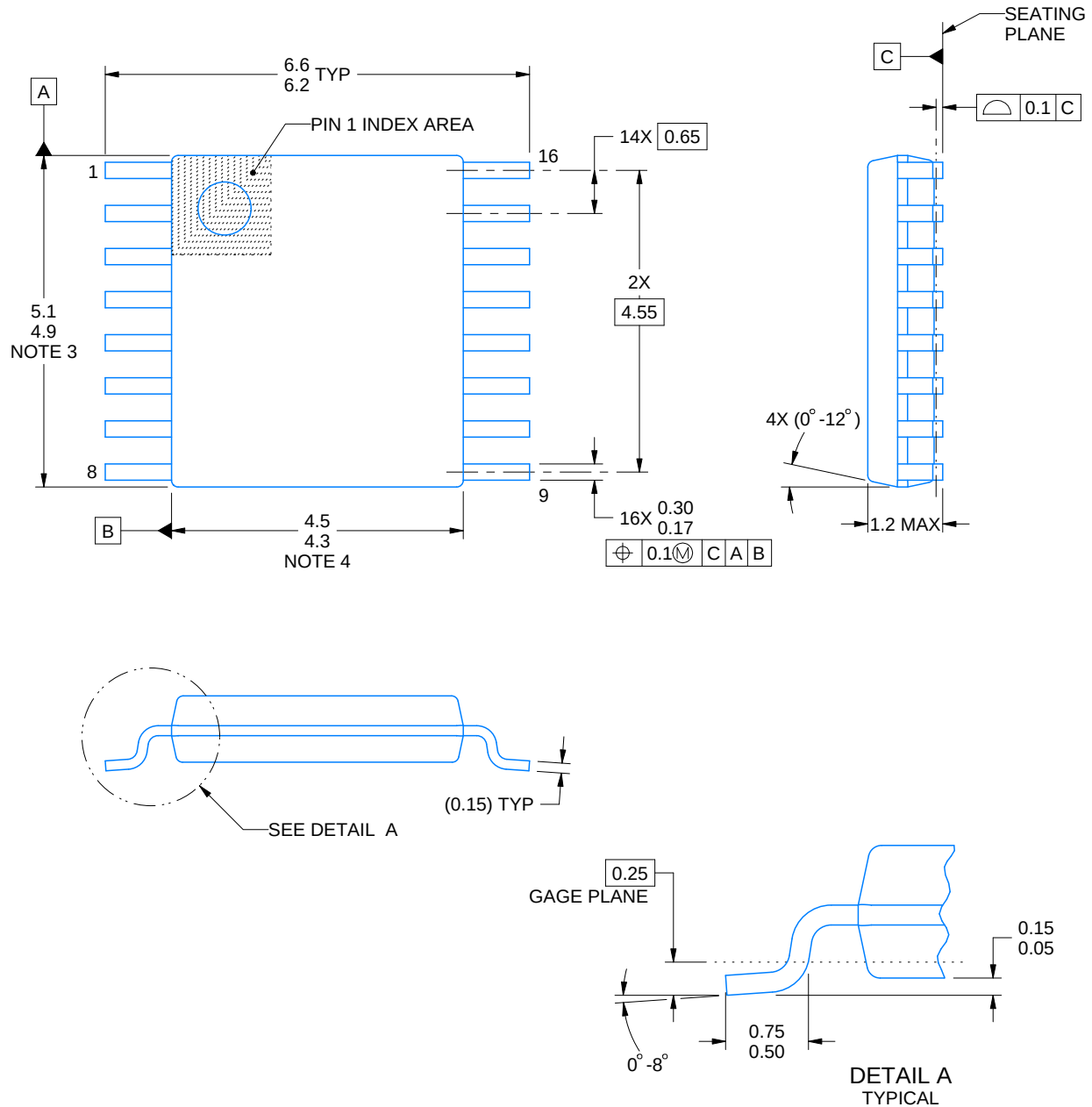
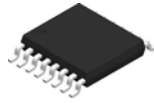
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74HC4851QPWRG4Q1	TSSOP	PW	16	2000	353.0	353.0	32.0
SN74HC4851QPWRQ1	TSSOP	PW	16	2000	353.0	353.0	32.0

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AC.



4220204/B 12/2023

NOTES:

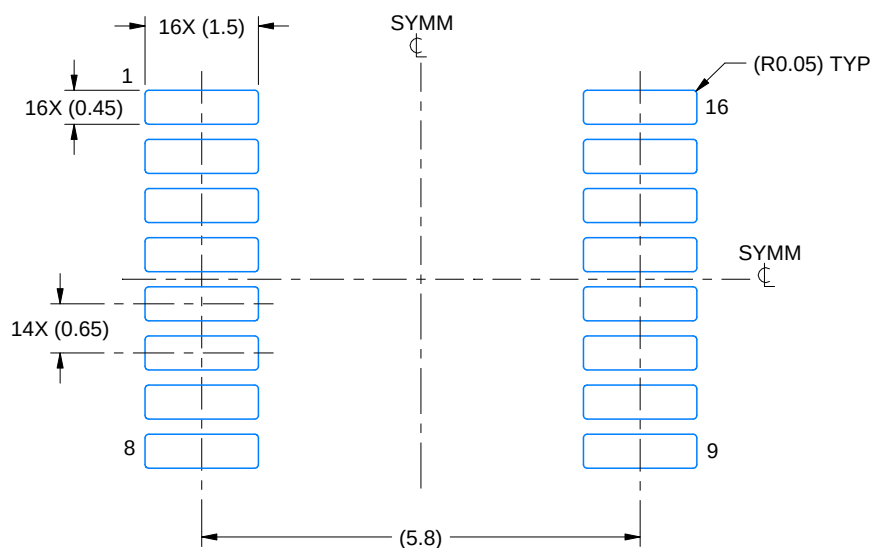
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

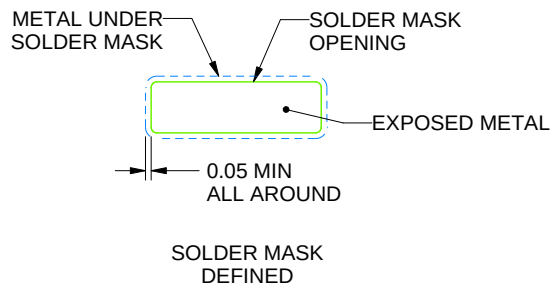
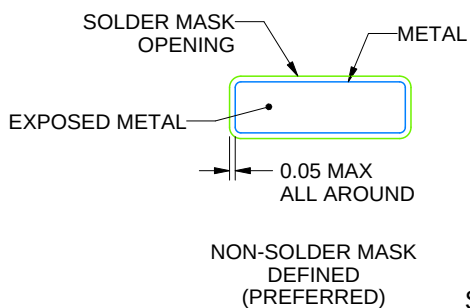
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

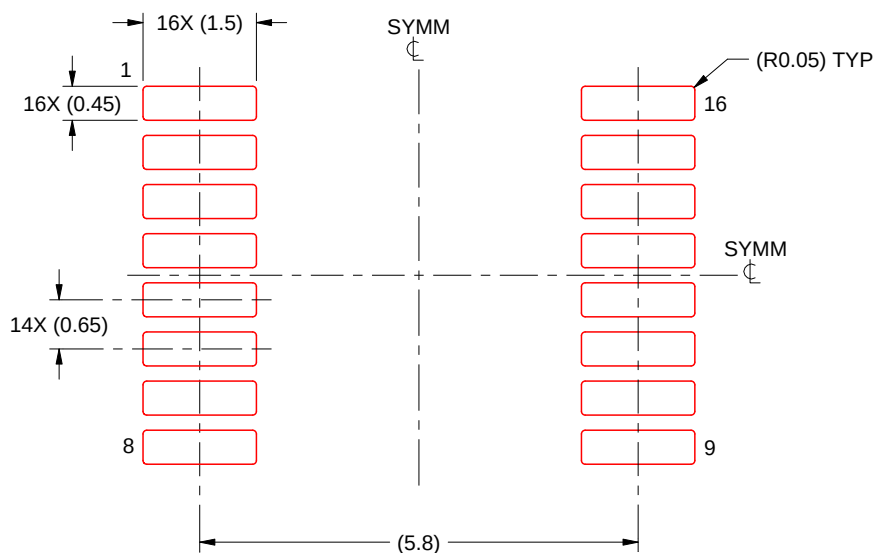
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

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NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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