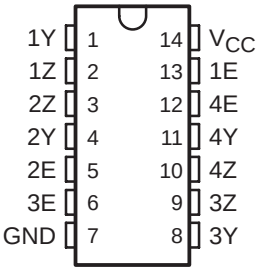
- **Qualified for Automotive Applications**
- **Low ON Resistance**
  − 25 Ω Typical (V_{CC} = 4.5 V)
- **Fast Switching and Propagation Speeds**
- **Low OFF Leakage Current**
- **Wide Operating Temperature Range: −40°C to 125°C**
- **Direct LSTTL Input Logic Compatibility: V_{IL} = 0.8 V Max, V_{IH} = 2 V Min**
- **CMOS Input Compatibility: $I_I \leq 1\ \mu A$ at V_{OL}, V_{OH}**

M OR PW PACKAGE
(TOP VIEW)



description/ordering information

The CD74HCT4066 contains four independent digitally controlled analog switches that use silicon-gate CMOS technology to achieve operation speeds similar to LSTTL, with the low power consumption of standard CMOS integrated circuits.

These switches feature the characteristic linear ON resistance of the metal-gate CD4066B. Each switch is turned on by a high-level voltage on its control input.

ORDERING INFORMATION†

T_A	PACKAGE‡		ORDERABLE PART NUMBER§	TOP-SIDE MARKING
−40°C to 125°C	SOIC − M	Reel of 2500	CD74HCT4066QM96Q1	HCT4066Q
	TSSOP − PW	Reel of 2000	CD74HCT4066QPWRQ1	HK4066Q

† For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at http://www.ti.com.
‡ Package drawings, thermal data, and symbolization are available at http://www.ti.com/packaging.
§ The suffix 96 denotes tape and reel.

FUNCTION TABLE

INPUT nE	SWITCH
L	Off
H	On

H = High level
L = Low level

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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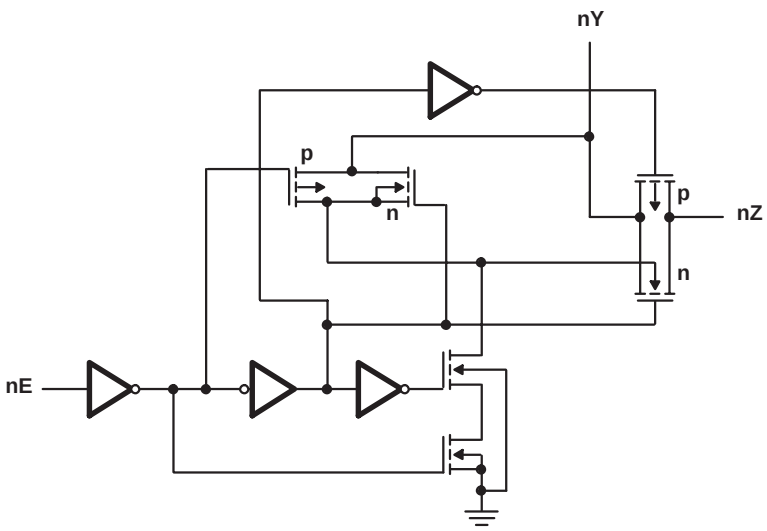
logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} (see Note 1) . . . . . −0.5 V to +7 V
Input clamp current, I_{IK} ($V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V) . . . . . ±20 mA
Output clamp current, I_{OK} ($V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V) . . . . . ±20 mA
Switch current, I_O (see Note 2) ($V_O > -0.5$ V or $V_O < V_{CC} + 0.5$ V) . . . . . ±25 mA
Output source or sink current per output pin, I_O ($V_O > -0.5$ V or $V_O < V_{CC} + 0.5$ V) . . . . . ±25 mA
Continuous current through V_{CC} or GND . . . . . ±50 mA
Package thermal impedance, θ_{JA} (see Note 3): D package . . . . . 86°C/W
PW package . . . . . 113°C/W
Storage temperature range, T_{stg} . . . . . −65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. All voltages referenced to GND unless otherwise specified.
2. In certain applications, the external load-resistor current may include both V_{CC} and signal-line components. To avoid drawing V_{CC} current when switch current flows into the transmission gate inputs (terminals 1, 4, 8, and 11), the voltage drop across the bidirectional switch must not exceed 0.6 V (calculated from r_{on} values shown in the electrical characteristics table). No V_{CC} current flows through R_L if the switch current flows into terminals 2, 3, 9, and 10.
3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 4)

			MIN	MAX	UNIT
V_{CC}	Supply voltage		4.5	5.5	V
V_{IH}	High-level input voltage		2		V
V_{IL}	Low-level input voltage			0.8	V
V_I	Input voltage		0	V_{CC}	V
V_O	Output voltage		0	V_{CC}	V
t_t	Input transition (rise and fall) time	V_{CC} = 4.5 V	0	500	ns
T_A	Operating free-air temperature		−40	125	°C

NOTES: 4. All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

PARAMETER	TEST CONDITIONS		V_I	V_{CC}	T_A = 25°C			T_A = −40°C TO 125°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
I_{IL}	Any control		V_{CC} or GND	5.5 V			±0.1		±1	µA
I_{IZ}	V_{IS} = V_{CC} or GND		V_{IL}	5.5 V			±0.1		±1	µA
r_{on}	I_O = 1 mA, See Figure 7	V_{IS} = V_{CC} or GND	V_{CC}	4.5 V		25	80		128	Ω
		V_{IS} = V_{CC} to GND	V_{CC}	4.5 V		35	95		142	
Δr_{on}	Between any two switches		V_{CC}	4.5 V		1				Ω
I_{CC}			V_{CC} or GND	5.5 V			2		40	µA
ΔI_{CC}	Per input pin: 1 unit load, See Note 5		V_{CC} − 2.1 V	4.5 V to 5.5 V		100	360		490	µA
C_I	Control inputs						10		10	pF

NOTE 5: For dual-supply systems, theoretical worst case (V_I = 2.4 V, V_{CC} = 5.5 V) specification is 1.8 mA.

HCT input loading

INPUT	UNIT LOADS†
All	1

† Unit load is ΔI_{CC} limit specified in the electrical characteristics table, e.g., 360 µA max at 25°C.

switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 6)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	V_{CC}	T_A = 25°C			T_A = −40°C TO 125°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
t_{pd}	Y or Z	Z or Y	C_L = 15 pF	5 V		4				ns
			C_L = 50 pF	4.5 V			12		18	
t_{en}	E	Y or Z	C_L = 15 pF	5 V		9				ns
			C_L = 50 pF	4.5 V			24		36	
t_{dis}	E	Y or Z	C_L = 15 pF	5 V		14				ns
			C_L = 50 pF	4.5 V			35		53	

operating characteristics, V_{CC} = 5 V, T_A = 25°C, input t_r, t_f = 6 ns

PARAMETER		TYP	UNIT
C_{pd}	Power dissipation capacitance (see Note 6)	38	pF

NOTE 6: C_{pd} is used to determine the dynamic power consumption (P_D), per package.
$P_D = (C_{pd} \times V_{CC}^2 \times f_I) + \Sigma (C_L + C_S) \times V_{CC}^2 \times f_O$
f_O = output frequency
f_I = input frequency
C_L = output load capacitance
C_S = switch capacitance
V_{CC} = supply voltage

analog channel characteristics, T_A = 25°C

PARAMETER		TEST CONDITIONS	V_{CC}	TYP	UNIT
f_{max}	Switch frequency response bandwidth at −3 dB	See Figure 2 and Figure 8 and Notes 7 and 8	4.5 V	200	MHz
	Crosstalk between any two switches	See Figure 1 and Figure 9 and Notes 8 and 9	4.5 V	−72	dB
	Total harmonic distortion	See Figure 3, 1 kHz, V_{IS} = 4 V_{P-P}	4.5 V	0.023	%
	Control to switch feedthrough noise	See Figure 4	4.5 V	130	mV
	Switch OFF signal feedthrough	See Figure 5 and Figure 9 and Notes 8 and 9	4.5 V	−72	dB
C_S	Switch input capacitance			5	pF

NOTES: 7. Adjust input voltage to obtain 0 dBm at output, f = 1 MHz.
8. V_{IS} is centered at $V_{CC}/2$.
9. Adjust input for 0 dBm at V_{IS}.

PARAMETER MEASUREMENT INFORMATION

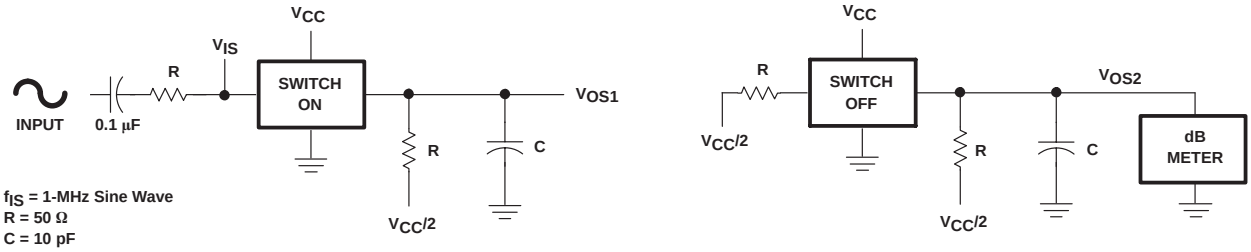


Figure 1. Crosstalk Between Two Switches Test Circuit

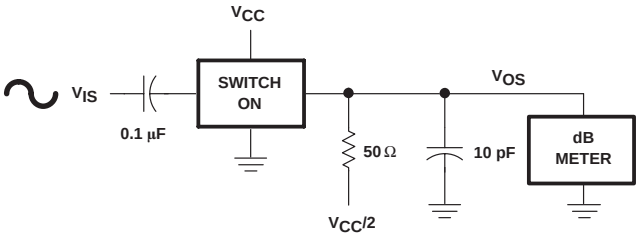


Figure 2. Frequency-Response Test Circuit

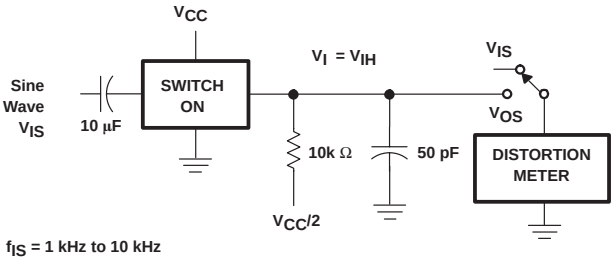


Figure 3. Total Harmonic Distortion Test Circuit

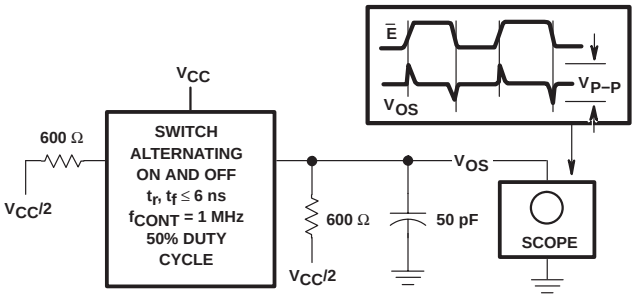


Figure 4. Control-to-Switch Feedthrough Noise Test Circuit

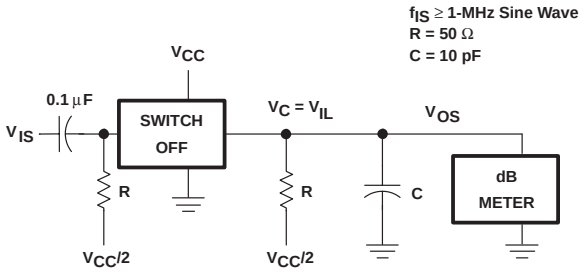
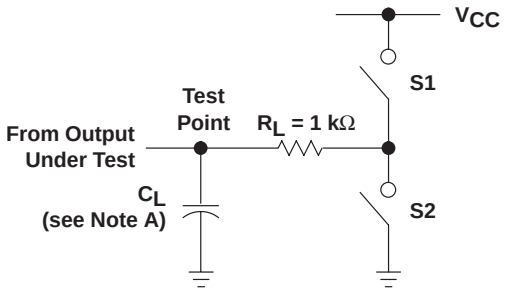


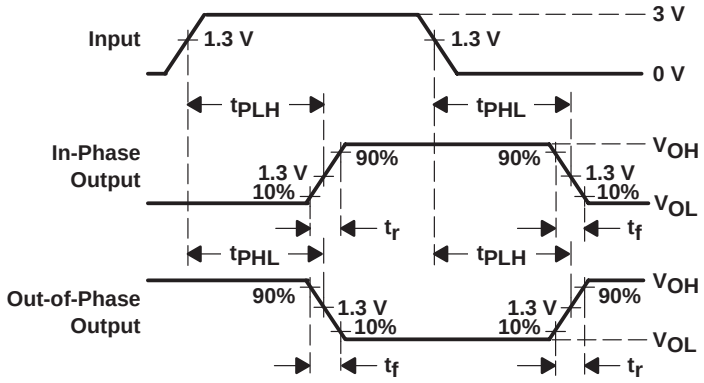
Figure 5. Switch OFF Signal Feedthrough Test Circuit

PARAMETER MEASUREMENT INFORMATION

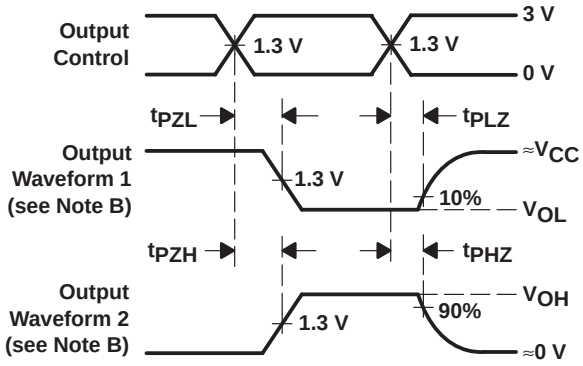


LOAD CIRCUIT

PARAMETER		S1	S2
t_{en}	t_{PZH}	Open	Closed
	t_{PZL}	Closed	Open
t_{dis}	t_{PHZ}	Open	Closed
	t_{PLZ}	Closed	Open
t_{pd}		Open	Open



VOLTAGE WAVEFORMS
PROPAGATION DELAY AND OUTPUT TRANSITION TIMES



VOLTAGE WAVEFORMS
OUTPUT ENABLE AND DISABLE TIMES

NOTES: A. C_L includes probe and test-fixture capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
C. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r = 6 ns, t_f = 6 ns.
D. For clock inputs, f_{max} is measured with the input duty cycle at 50%.
E. The outputs are measured one at a time, with one input transition per measurement.
F. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
G. t_{PZL} and t_{PZH} are the same as t_{en}.
H. t_{PLH} and t_{PHL} are the same as t_{pd}.

Figure 6. Load Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

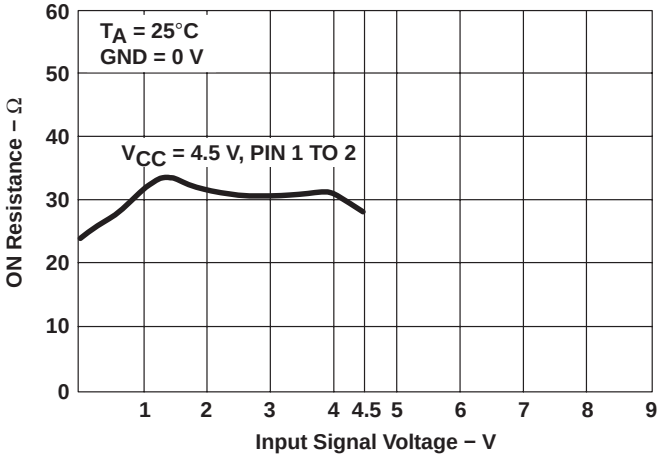


Figure 7. Typical ON Resistance vs Input Signal Voltage

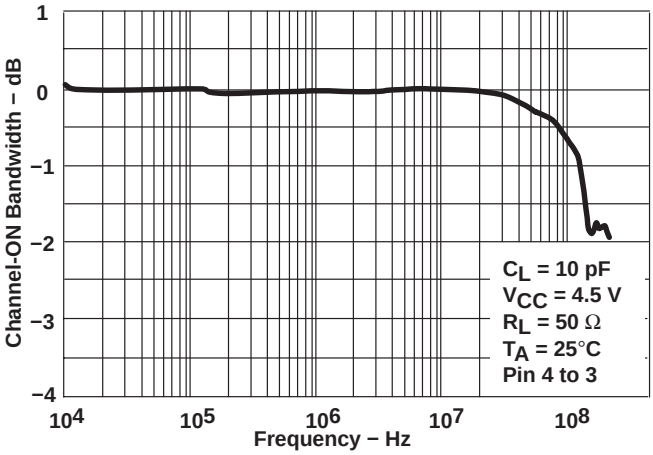


Figure 8. Switch Frequency Response, V_{CC} = 4.5 V

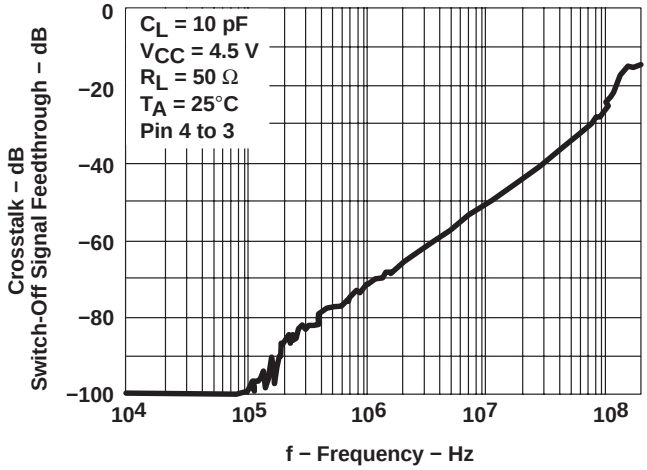


Figure 9. Switch-OFF Signal Feedthrough and Crosstalk vs Frequency, V_{CC} = 4.5 V

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
CD74HCT4066QM96Q1	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
CD74HCT4066QPWRQ1	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
D24066QM96G4Q1	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
HCT4066QPWRG4Q1	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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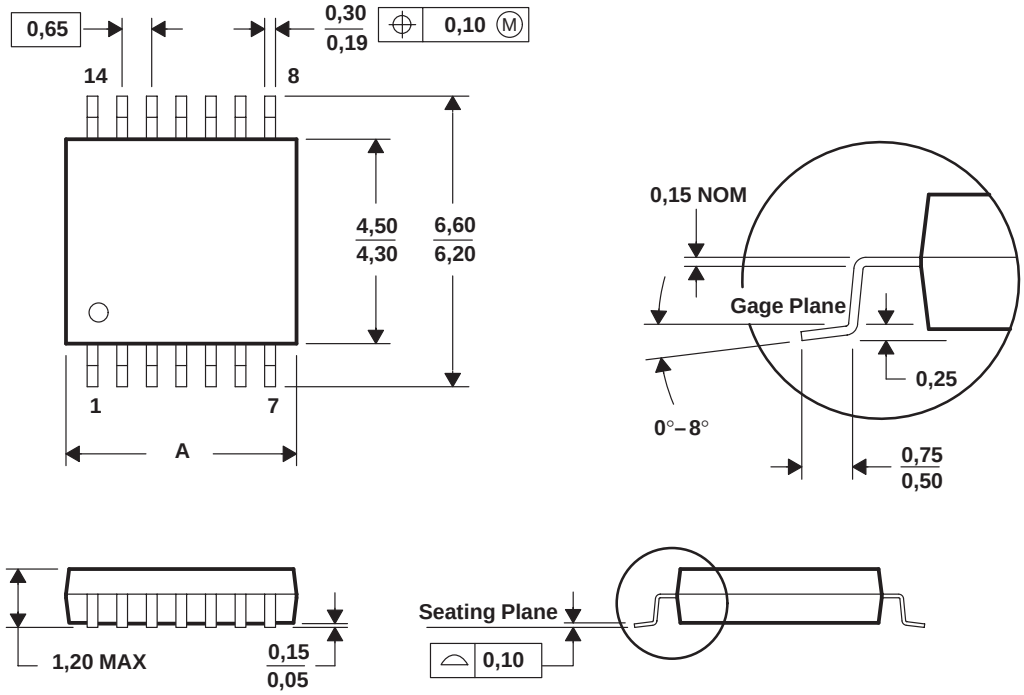
OTHER QUALIFIED VERSIONS OF CD74HCT4066-Q1 :
- Catalog: CD74HCT4066

NOTE: Qualified Version Definitions:
- Catalog - TI's standard catalog product

PW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN

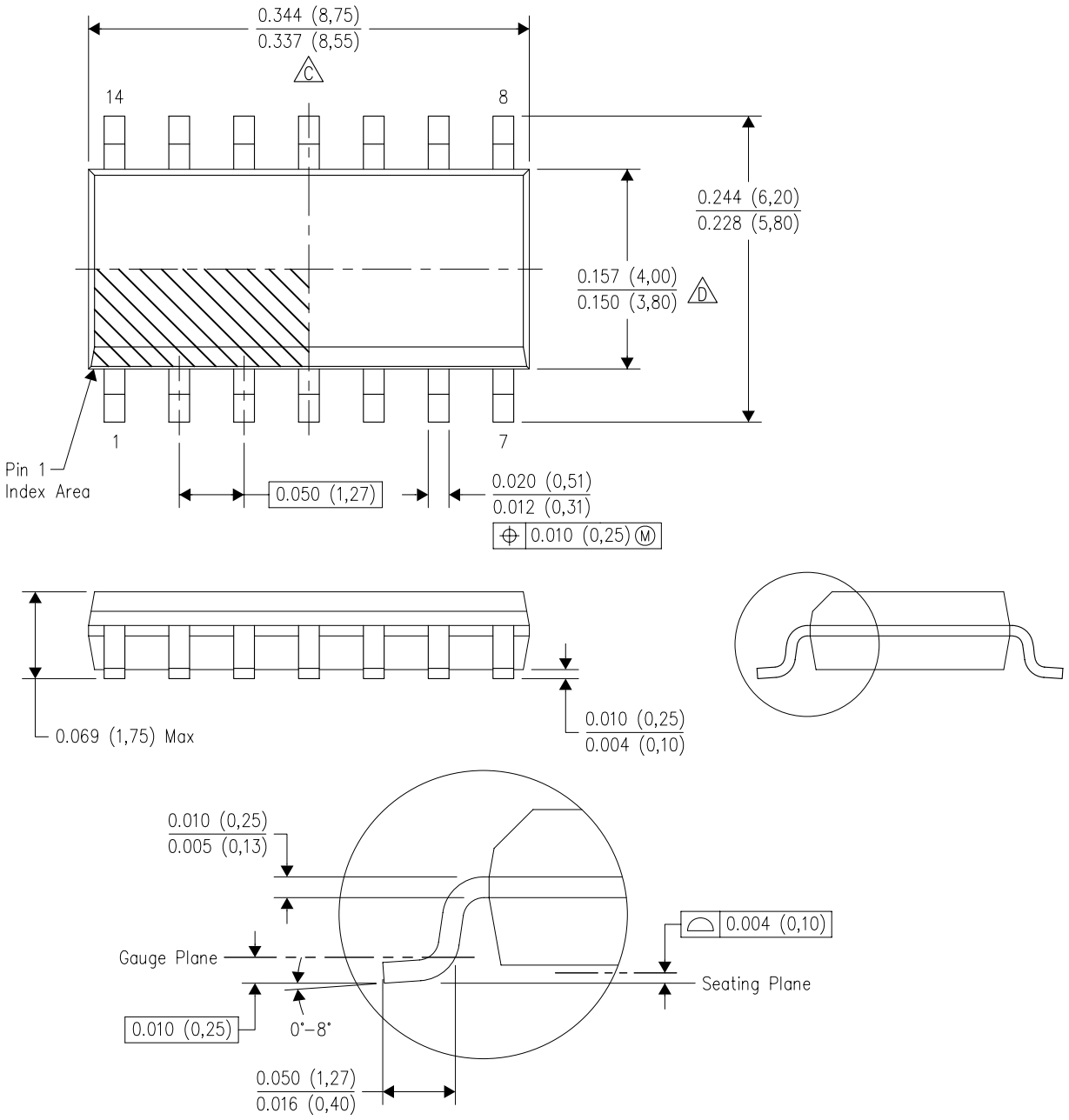


DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-153

D (R–PDSO–G14) PLASTIC SMALL–OUTLINE PACKAGE



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 .006 (0,15) per end.
D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
E. Reference JEDEC MS–012 variation AB.

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RFID	www.ti-rfid.com	Telephony	www.ti.com/telephony
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

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