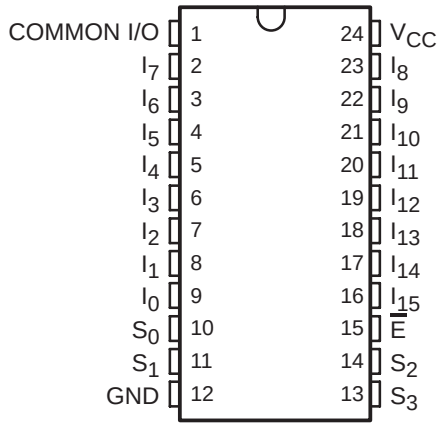
- **Qualified for Automotive Applications**
- **Wide Analog Input Voltage Range**
- **Low ON Resistance**
  - **70 Ω Typical (V_{CC} = 4.5 V)**
- **Fast Switching and Propagation Speeds**
- **“Break-Before-Make” Switching**
  - **6 ns Typical (V_{CC} = 4.5 V)**
- **Fanout (Over Temperature Range)**
  - **Standard Outputs: 10 LSTTL Loads**
  - **Bus Driver Outputs: 15 LSTTL Loads**
- **Wide Operating Temperature Range: −40°C to 85°C**
- **Balanced Propagation Delay and Transition Times**
- **Significant Power Reduction Compared to LSTTL Logic ICs**
- **4.5-V to 5.5-V Operation**
- **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 PACKAGE
(TOP VIEW)



description/ordering information

The CD74HCT4067 device is a digitally controlled analog switch that utilizes silicon-gate CMOS technology to achieve operating speeds similar to LSTTL, with the low power consumption of standard CMOS integrated circuits.

This analog multiplexer/demultiplexer controls analog voltages that may vary across the voltage supply range. It is a bidirectional switch, thus allowing any analog input to be used as an output and vice-versa. The switch has low “on” resistance and low “off” leakages. In addition, the device has an enable control that, when high, disables all switches to their “off” state.

ORDERING INFORMATION†

T_A	PACKAGE‡		ORDERABLE PART NUMBER§	TOP-SIDE MARKING
−40°C to 85°C	SOIC − M	Reel of 2000	CD74HCT4067IM96Q1	HCT4067I

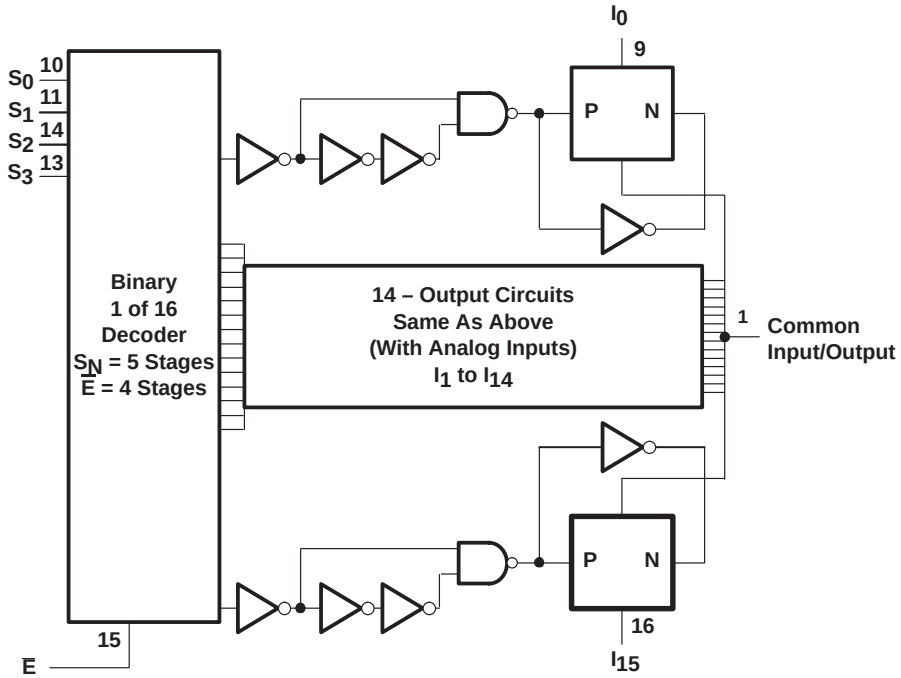
† For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at http://www.ti.com.
‡ Package drawings, thermal data, and symbolization are available at http://www.ti.com/packaging.
§ The suffix 96 denotes tape and reel.

FUNCTION TABLE

S0	S1	S2	S3	$\overline{E}$	SELECTED CHANNEL
X	X	X	X	H	None
L	L	L	L	L	0
H	L	L	L	L	1
L	H	L	L	L	2
H	H	L	L	L	3
L	L	H	L	L	4
H	L	H	L	L	5
L	H	H	L	L	6
H	H	H	L	L	7
L	L	L	H	L	8
H	L	L	H	L	9
L	H	L	H	L	10
H	H	L	H	L	11
L	L	H	H	L	12
H	L	H	H	L	13
L	H	H	H	L	14
H	H	H	H	L	15

H = High level
L = Low level
X = Don't Care

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 ($V_O > -0.5$ 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 2) . . . . . 46°C/W
Maximum junction temperature, T_J . . . . . 150°C
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 are referenced to GND, unless otherwise specified.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 3)

			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	85	°C

NOTES: 3. 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 85°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
I_I	Logic input		V_{CC} or GND	5.5 V			±0.1		±1	µA
I_{IZ}	V_{IS} = V_{CC} or GND, $\overline{E}$ = V_{CC}			5.5 V			±0.8		±8	µA
r_{on}	I_O = 1 mA	V_{IS} = V_{CC} or GND	V_{CC} or GND	4.5 V		70	160		200	Ω
		V_{IS} = V_{CC} to GND	V_{CC} to GND	4.5 V		90	180		225	
Δr_{on}	Between any two switches			4.5 V		10				Ω
I_{CC}			V_{CC} or GND	5.5 V			8		80	µA
ΔI_{CC}	Per input pin: 1 unit load, See Note 4		V_{CC} − 2.1 V	4.5 V to 5.5 V		100	360		450	µA
C_I	Control inputs						10		10	pF

NOTE 4: 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†
S_0 - S_3	0.5
$\overline{E}$	0.3

† 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 5)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	V_{CC}	T_A = 25°C			T_A = −40°C TO 85°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
t_{pd}	I_n	Common I/O	C_L = 15 pF	5 V		6				ns
			C_L = 50 pF	4.5 V			15		19	
t_{en}	$\overline{E}$	Common I/O	C_L = 15 pF	5 V		25				ns
			C_L = 50 pF	4.5 V			60		75	
t_{en}	S_n	Common I/O	C_L = 15 pF	5 V		25				ns
			C_L = 50 pF	4.5 V			60		75	
t_{dis}	$\overline{E}$	Common I/O	C_L = 15 pF	5 V		23				ns
			C_L = 50 pF	4.5 V			55		69	
t_{dis}	S_n	Common I/O	C_L = 15 pF	5 V		21				ns
			C_L = 50 pF	4.5 V			58		73	

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 5)	96	pF

NOTE 5: 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 1 and Figure 7 and Notes 6 and 7	4.5 V	89	MHz
	Sine-wave distortion	See Figure 2	4.5 V	0.051	%
	Switch OFF signal feedthrough	See Figure 4 and Figure 8	4.5 V	−75	dB
C_S	Switch input capacitance			5	pF
C_{COM}	Common capacitance			50	pF

NOTES: 6. Adjust input voltage to obtain 0 dBm at output, f = 1 MHz.
7. V_{IS} is centered at $V_{CC}/2$.

PARAMETER MEASUREMENT INFORMATION

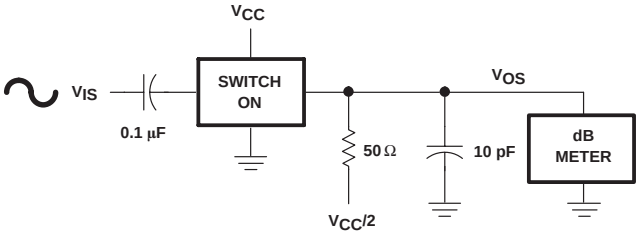


Figure 1. Frequency-Response Test Circuit

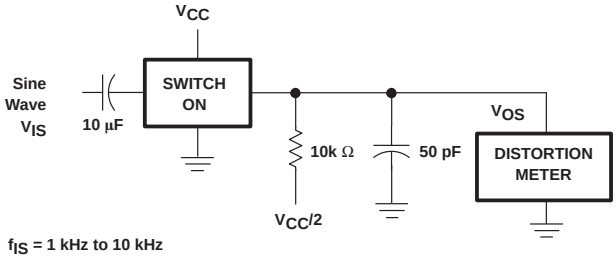


Figure 2. Sine-Wave Distortion Test Circuit

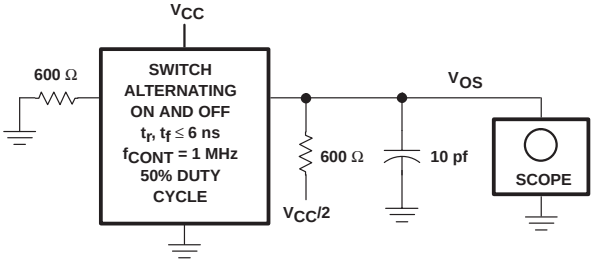


Figure 3. Control-to-Switch Feedthrough Noise Test Circuit

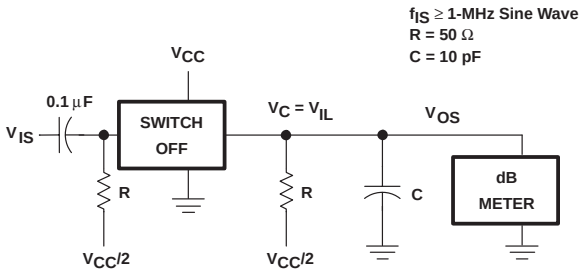
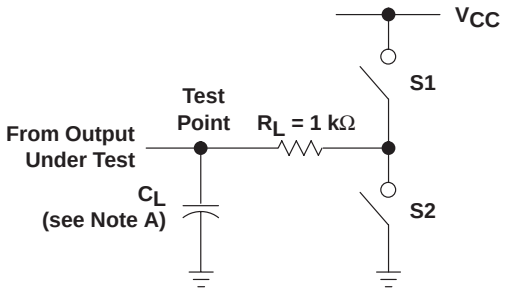


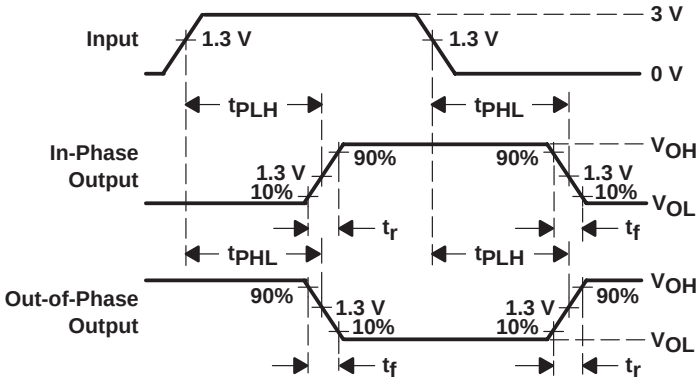
Figure 4. Switch OFF Signal Feedthrough Test Circuit

PARAMETER MEASUREMENT INFORMATION

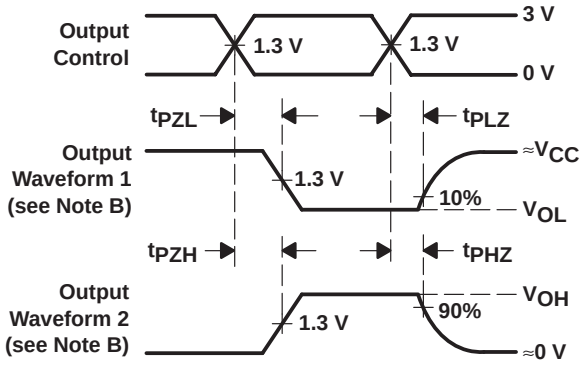


LOAD CIRCUIT

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 5. Load Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

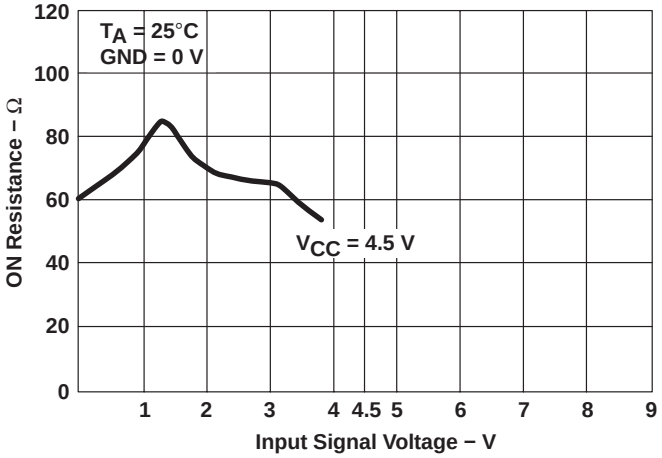


Figure 6. ON Resistance vs Input Signal Voltage

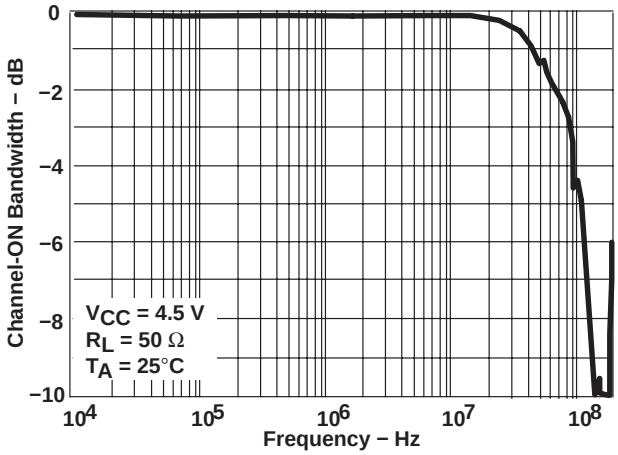


Figure 7. Switch Frequency Response

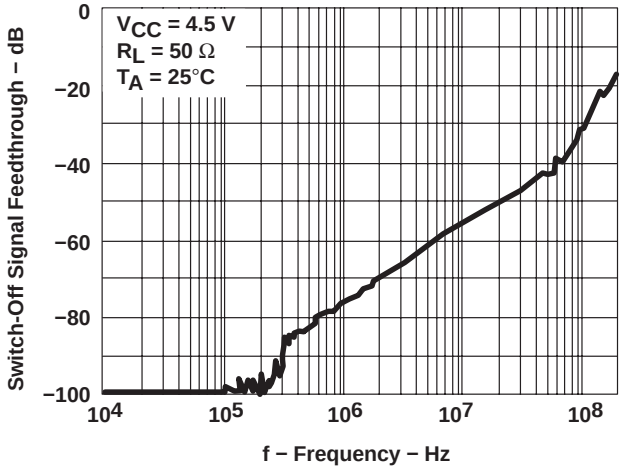


Figure 8. Switch-OFF Signal Feedthrough vs Frequency

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
CD74HCT4067IM96Q1	ACTIVE	SOIC	DW	24	2000	TBD	Call TI	Call TI
D24067IM96G4Q1	ACTIVE	SOIC	DW	24	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.

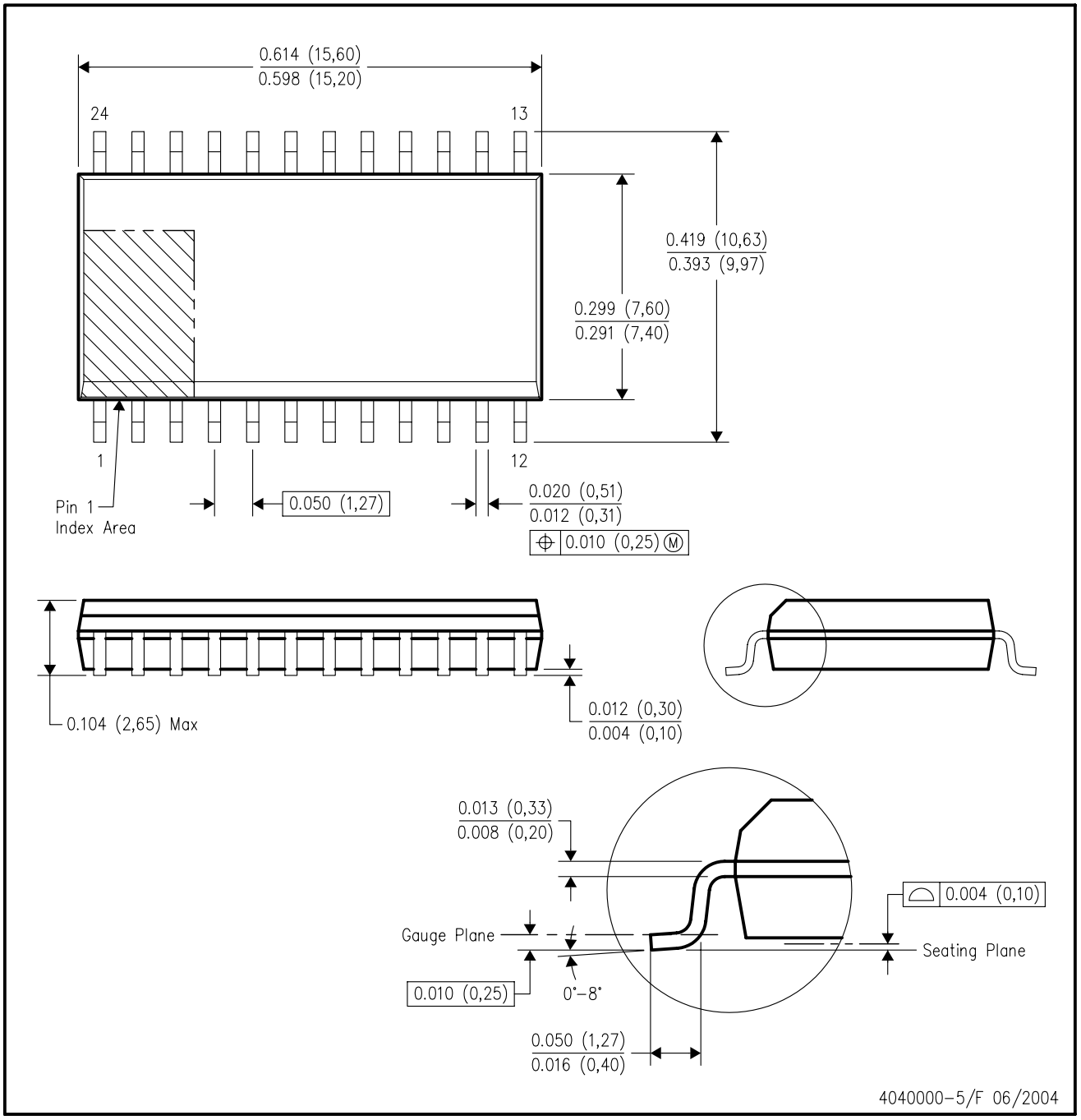
(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been 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.

OTHER QUALIFIED VERSIONS OF CD74HCT4067-Q1 :
- Catalog: CD74HCT4067

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

DW (R–PDSO–G24) PLASTIC SMALL–OUTLINE PACKAGE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS–013 variation AD.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Broadband	www.ti.com/broadband
DSP	dsp.ti.com	Digital Control	www.ti.com/digitalcontrol
Clocks and Timers	www.ti.com/clocks	Medical	www.ti.com/medical
Interface	interface.ti.com	Military	www.ti.com/military
Logic	logic.ti.com	Optical Networking	www.ti.com/opticalnetwork
Power Mgmt	power.ti.com	Security	www.ti.com/security
Microcontrollers	microcontroller.ti.com	Telephony	www.ti.com/telephony
RFID	www.ti-rfid.com	Video & Imaging	www.ti.com/video
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265