SN74LVC1G3157-Q1
SINGLE-POLE DOUBLE-THROW ANALOG SWITCH

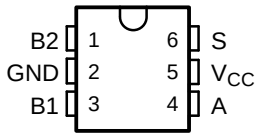
SCES463C – JUNE 2003 – REVISED JANUARY 2006

FEATURES

- **Qualification in Accordance With AEC-Q100** (1)
- **Qualified for Automotive Applications**
- **Customer-Specific Configuration Control Can Be Supported Along With Major-Change Approval**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)**
- **1.65-V to 5.5-V V_{CC} Operation**
- **Useful for Both Analog and Digital Applications**
- **Specified Break-Before-Make Switching**
- **Rail-to-Rail Signal Handling**
- **High Degree of Linearity**
- **High Speed, Typically 0.5 ns (V_{CC} = 3 V, C_L = 50 pF)**
- **Low On-State Resistance, Typically ≈6 Ω (V_{CC} = 4.5 V)**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**

(1) Contact factory for details. Q100 qualification data available on request.

DBV OR DCK PACKAGE
(TOP VIEW)



DESCRIPTION/ORDERING INFORMATION

This single-pole, double-throw (SPDT) analog switch is designed for 1.65-V to 5.5-V V_{CC} operation.

The SN74LVC1G3157-Q1 can handle both analog and digital signals. The device permits signals with amplitudes of up to V_{CC} (peak) to be transmitted in either direction.

Applications include signal gating, chopping, modulation or demodulation (modem), and signal multiplexing for analog-to-digital and digital-to-analog conversion systems.

ORDERING INFORMATION

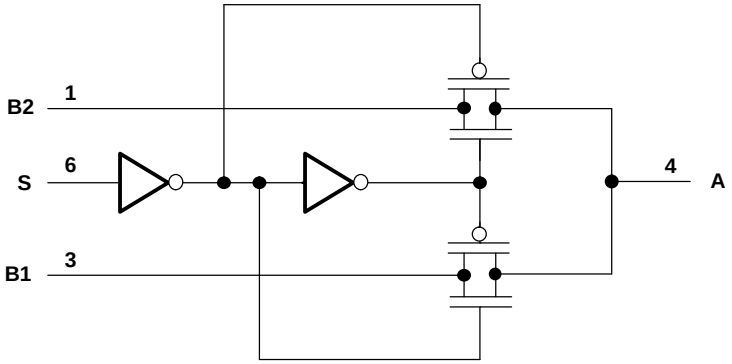
T_A	PACKAGE(1)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 125°C	SOT (SOT-23) – DBV	Tape and reel	1P1G3157QDBVRQ1	CC50
	SOT (SC-70) – DCK	Tape and reel	1P1G3157QDCKRQ1	C50

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE

CONTROL INPUT S	ON CHANNEL
L	B1
H	B2

LOGIC DIAGRAM (POSITIVE LOGIC)



Absolute Maximum Ratings(1)

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage range(2)		–0.5	6.5	V
V_{IN}	Control input voltage range(2)(3)		–0.5	6.5	V
$V_{I/O}$	Switch I/O voltage range(2)(3)(4)(5)		–0.5	V_{CC} + 0.5	V
I_{IK}	Control input clamp current	V_{IN} < 0		–50	mA
I_{IOK}	I/O port diode current	$V_{I/O}$ < 0		–50	mA
$I_{I/O}$	On-state switch current	$V_{I/O}$ = 0 to V_{CC}(6)		±128	mA
	Continuous current through V_{CC} or GND			±100	mA
θ_{JA}	Package thermal impedance(7)	DBV package		165	°C/W
		DCK package		258	
T_{stg}	Storage temperature range		–65	150	°C

(1) 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.
(2) All voltages are with respect to ground, unless otherwise specified.
(3) The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
(4) This value is limited to 5.5 V maximum.
(5) V_I, V_O, V_A, and V_{Bn} are used to denote specific conditions for $V_{I/O}$.
(6) I_I, I_O, I_A, and I_{Bn} are used to denote specific conditions for $I_{I/O}$.
(7) The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions(1)

			MIN	MAX	UNIT
V_{CC}			1.65	5.5	V
$V_{I/O}$			0	V_{CC}	V
V_{IN}			0	5.5	V
V_{IH}	High-level input voltage, control input	V_{CC} = 1.65 V to 1.95 V	$V_{CC} \times 0.75$		V
		V_{CC} = 2.3 V to 5.5 V	$V_{CC} \times 0.7$		
V_{IL}	Low-level input voltage, control input	V_{CC} = 1.65 V to 1.95 V		$V_{CC} \times 0.25$	V
		V_{CC} = 2.3 V to 5.5 V		$V_{CC} \times 0.3$	
$\Delta t/\Delta v$	Input transition rise/fall time	V_{CC} = 1.65 V to 1.95 V		20	ns/V
		V_{CC} = 2.3 V to 2.7 V		20	
		V_{CC} = 3 V to 3.6 V		10	
		V_{CC} = 4.5 V to 5.5 V		10	
T_A			–40	125	°C

(1) 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_{CC}	MIN	TYP(1)	MAX	UNIT
r_{on}	On-state switch resistance(2)		See Figure 1 and Figure 2	V_I = 0 V,	I_O = 4 mA	1.65 V		11	20	Ω
				V_I = 1.65 V,	I_O = –4 mA			15	50	
				V_I = 0 V,	I_O = 8 mA	2.3 V		8	12	
				V_I = 2.3 V,	I_O = –8 mA			11	30	
				V_I = 0 V,	I_O = 24 mA	3 V		7	9.5	
				V_I = 3 V,	I_O = –24 mA			9	20	
				V_I = 0 V,	I_O = 30 mA	4.5 V		6	7.5	
				V_I = 2.4 V,	I_O = –30 mA			7	12	
				V_I = 4.5 ,	I_O = –30 mA			7	15	
r_{range}	On-state switch resistance over signal range(2)(3)		$0 \le V_{Bn} \le V_{CC}$ (see Figure 1 and Figure 2)		I_A = –4 mA	1.65 V			140	Ω
					I_A = –8 mA	2.3 V			45	
					I_A = –24 mA	3 V			18	
					I_A = –30 mA	4.5 V			10	
Δr_{on}	Difference in on-state resistance between switches(2)(4)(5)		See Figure 1	V_{Bn} = 1.15 V,	I_A = –4 mA	1.65 V		0.5		Ω
				V_{Bn} = 1.6 V,	I_A = –8 mA	2.3 V		0.1		
				V_{Bn} = 2.1 V,	I_A = –24 mA	3 V		0.1		
				V_{Bn} = 3.15 V,	I_A = –30 mA	4.5 V		0.1		
$r_{on(flat)}$	On-state resistance flatness(2)(4)(6)		$0 \le V_{Bn} \le V_{CC}$		I_A = –4 mA	1.65 V		110		Ω
					I_A = –8 mA	2.3 V		26		
					I_A = –24 mA	3 V		9		
					I_A = –30 mA	4.5 V		4		
I_{off}(7)	Off-state switch leakage current		$0 \le V_I$, $V_O \le V_{CC}$ (see Figure 3)			1.65 V to 5.5 V			±1	µA
								±0.05	±1(1)	
$I_{S(on)}$	On-state switch leakage current		$V_I = V_{CC}$ or GND, V_O = Open (see Figure 4)			5.5 V			±1	µA
									±0.1(1)	
I_{IN}	Control input current		$0 \le V_{IN} \le V_{CC}$			0 V to 5.5 V			±1	µA
								±0.05	±1(1)	
I_{CC}	Supply current		$V_{IN} = V_{CC}$ or GND			5.5 V		1	10	µA
ΔI_{CC}	Supply-current change		$V_{IN} = V_{CC}$ – 0.6 V			5.5 V			500	µA
C_{in}	Control input capacitance	S				5 V		2.7		pF
$C_{io(off)}$	Switch input/output capacitance	Bn				5 V		5.2		pF
$C_{io(on)}$	Switch input/output capacitance	Bn				5 V		17.3		pF
		A						17.3		

(1) T_A = 25°C
(2) Measured by the voltage drop between I/O pins at the indicated current through the switch. On-state resistance is determined by the lower of the voltages on the two (A or B) ports.
(3) Specified by design
(4) $\Delta r_{on} = r_{on(max)} - r_{on(min)}$ measured at identical V_{CC}, temperature, and voltage levels
(5) This parameter is characterized, but not tested in production.
(6) Flatness is defined as the difference between the maximum and minimum values of on-state resistance over the specified range of conditions.
(7) I_{off} is the same as $I_{S(off)}$ (off-state switch leakage current).

Analog Switch Characteristics

T_A = 25°C

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	V_{CC}	TYP	UNIT
Frequency response (switch on)(1)	A or Bn	Bn or A	R_L = 50 Ω, f_{in} = sine wave (see Figure 6)	1.65 V	300	MHz
				2.3 V	300	
				3 V	300	
				4.5 V	300	
Crosstalk (between switches)(2)	B1 or B2	B2 or B1	R_L = 50 Ω, f_{in} = 10 MHz (sine wave) (see Figure 7)	1.65 V	–54	dB
				2.3 V	–54	
				3 V	–54	
				4.5 V	–54	
Feedthrough attenuation (switch off)(2)	A or Bn	Bn or A	C_L = 5 pF, R_L = 50 Ω, f_{in} = 10 MHz (sine wave) (see Figure 8)	1.65 V	–57	dB
				2.3 V	–57	
				3 V	–57	
				4.5 V	–57	
Charge injection(3)	S	A	C_L = 0.1 nF, R_L = 1 MΩ (see Figure 9)	3.3 V	3	pC
				5 V	7	
Total harmonic distortion	A or Bn	Bn or A	V_I = 0.5 Vp-p, R_L = 600 Ω, f_{in} = 600 Hz to 20 kHz (sine wave) (see Figure 10)	1.65 V	0.1	%
				2.3 V	0.025	
				3 V	0.015	
				4.5 V	0.01	

(1) Adjust f_{in} voltage to obtain 0 dBm at output. Increase f_{in} frequency until dB meter reads –3 dB.
(2) Adjust f_{in} voltage to obtain 0 dBm at input.
(3) Specified by design

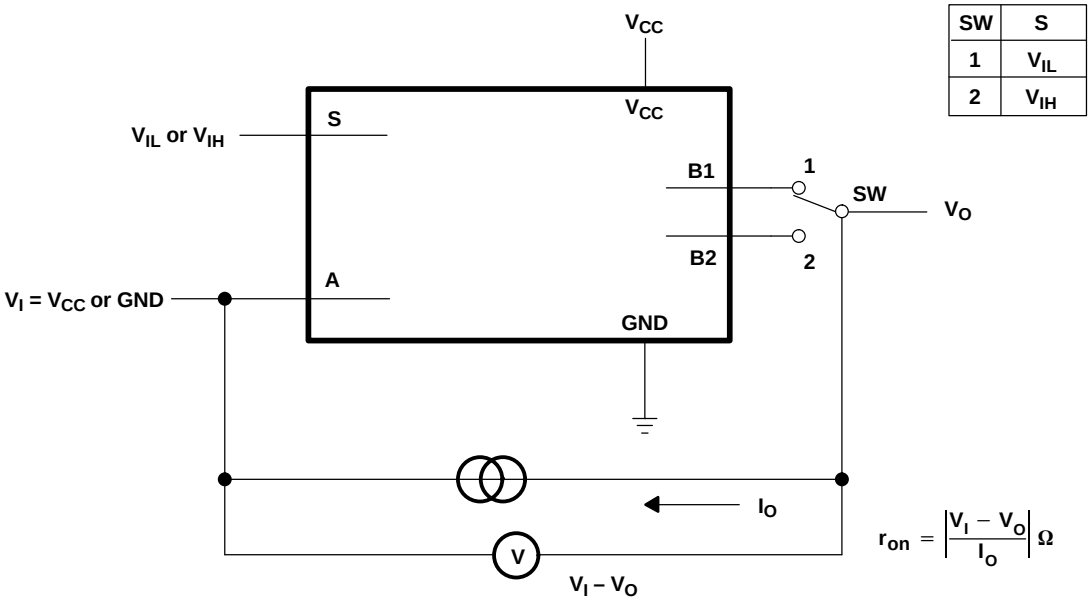
Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 5 and Figure 11)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 1.8 V ± 0.15 V		V_{CC} = 2.5 V ± 0.2 V		V_{CC} = 3.3 V ± 0.3 V		V_{CC} = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}(1)	A or Bn	Bn or A		2		1.2		0.8		0.3	ns
t_{en}(2)	S	Bn	7	24	3.5	14	2.5	7.6	1.7	5.7	ns
t_{dis}(3)			3	13	2	7.5	1.5	5.3	0.8	3.8	
t_{B-M}(4)			0.5		0.5		0.5		0.5		ns

(1) t_{pd} is the slower of t_{PLH} or t_{PHL}. Propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the specified load capacitance when driven by an ideal voltage source (zero output impedance).
(2) t_{en} is the slower of t_{PZL} or t_{PZH}.
(3) t_{dis} is the slower of t_{PLZ} or t_{PHZ}.
(4) Specified by design

PARAMETER MEASUREMENT INFORMATION



SW	S
1	V_{IL}
2	V_{IH}

Figure 1. On-State Resistance Test Circuit

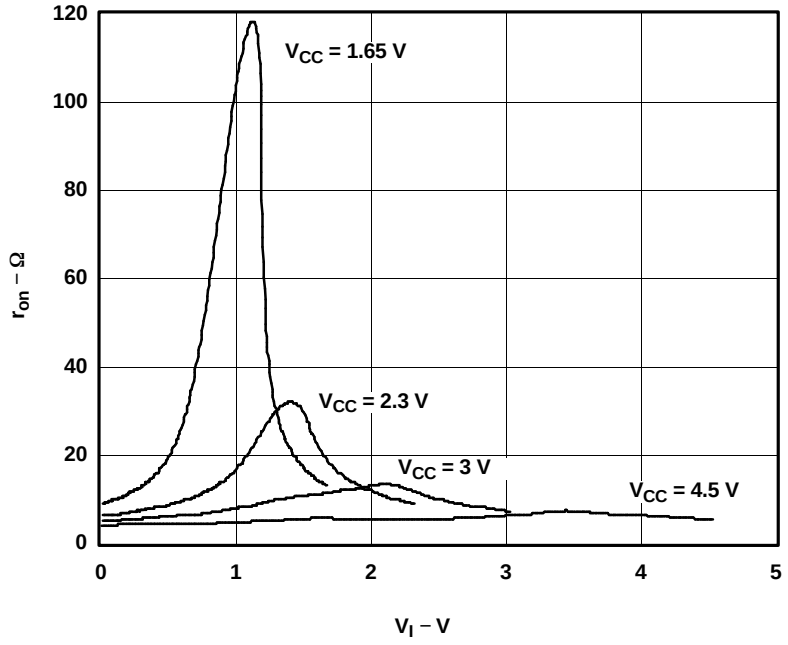
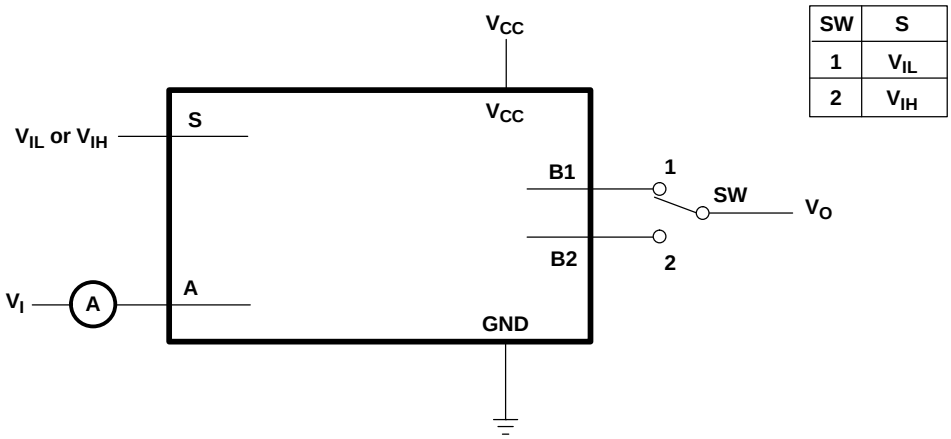


Figure 2. Typical r_{on} as a Function of Input Voltage (V_I) for V_I = 0 to V_{CC}

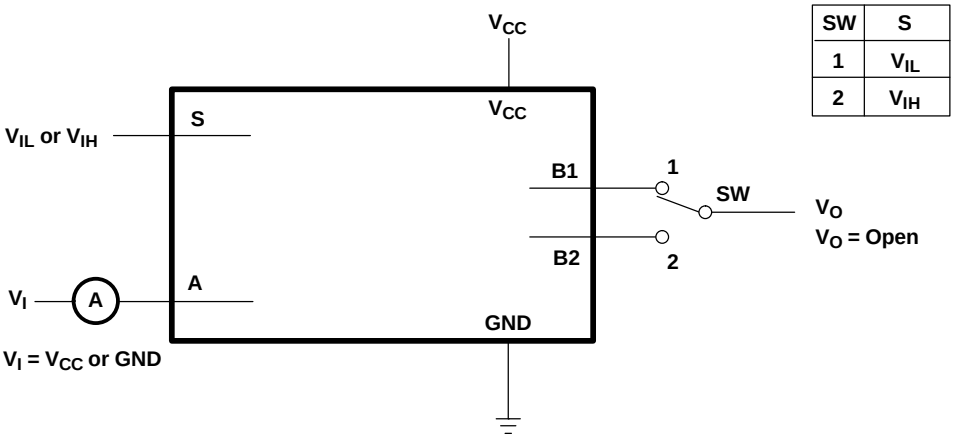
PARAMETER MEASUREMENT INFORMATION (continued)



SW	S
1	V_{IL}
2	V_{IH}

Condition 1: V_I = GND, V_O = V_{CC}
Condition 2: V_I = V_{CC}, V_O = GND

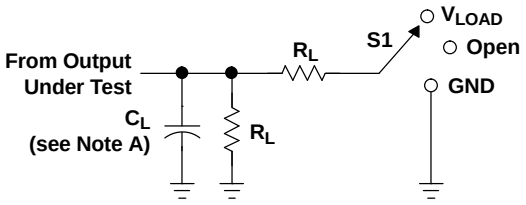
Figure 3. Off-State Switch Leakage-Current Test Circuit



SW	S
1	V_{IL}
2	V_{IH}

Figure 4. On-State Switch Leakage-Current Test Circuit

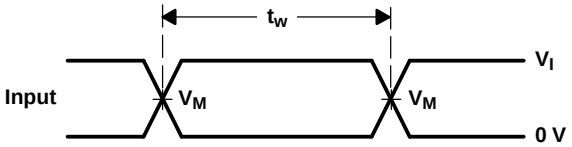
PARAMETER MEASUREMENT INFORMATION (continued)



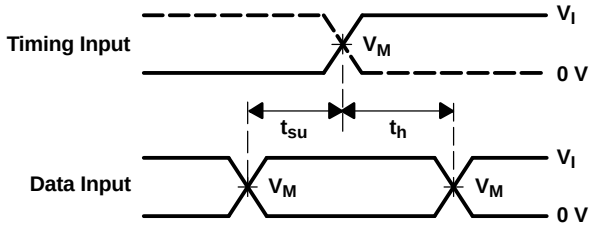
LOAD CIRCUIT

TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND

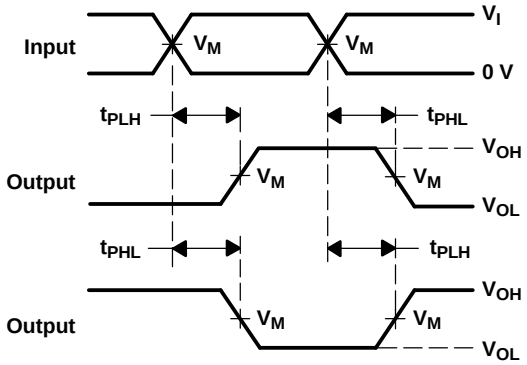
V_{CC}	INPUTS		V_M	V_{LOAD}	C_L	R_L	V_Δ
	V_I	t_r/t_f					
1.8 V ± 0.15 V	V_{CC}	≤2 ns	$V_{CC}/2$	$2 \times V_{CC}$	50 pF	500 Ω	0.3 V
2.5 V ± 0.2 V	V_{CC}	≤2 ns	$V_{CC}/2$	$2 \times V_{CC}$	50 pF	500 Ω	0.3 V
3.3 V ± 0.3 V	V_{CC}	≤2.5 ns	$V_{CC}/2$	$2 \times V_{CC}$	50 pF	500 Ω	0.3 V
5 V ± 0.5 V	V_{CC}	≤2.5 ns	$V_{CC}/2$	$2 \times V_{CC}$	50 pF	500 Ω	0.3 V



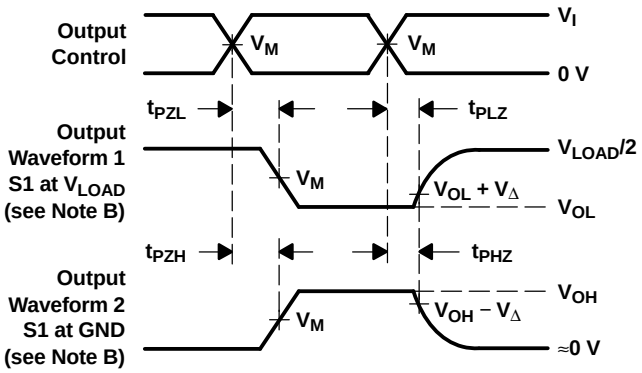
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS

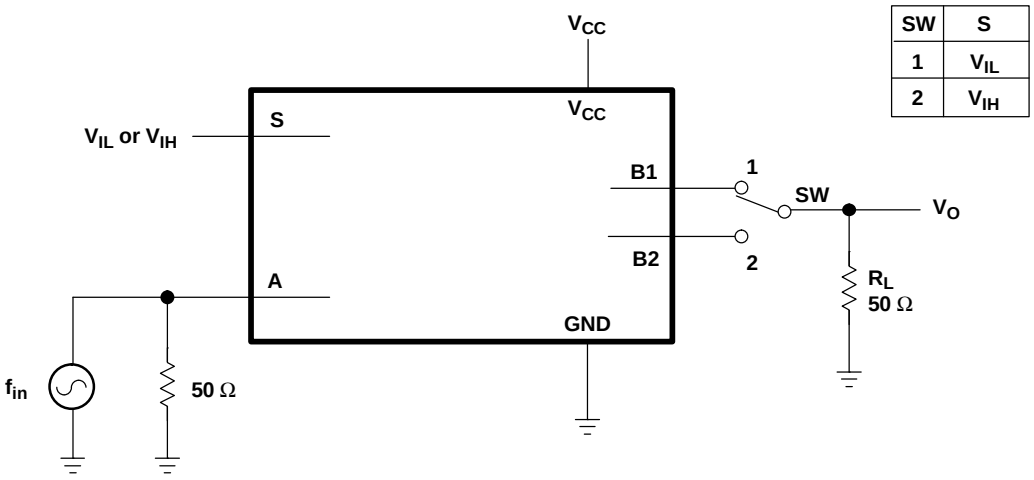


VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

NOTES: A. C_L includes probe and jig 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. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω.
D. The outputs are measured one at a time, with one transition per measurement.
E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
F. t_{PZL} and t_{PZH} are the same as t_{en}.
G. t_{PLH} and t_{PHL} are the same as t_{pd}.
H. All parameters and waveforms are not applicable to all devices.

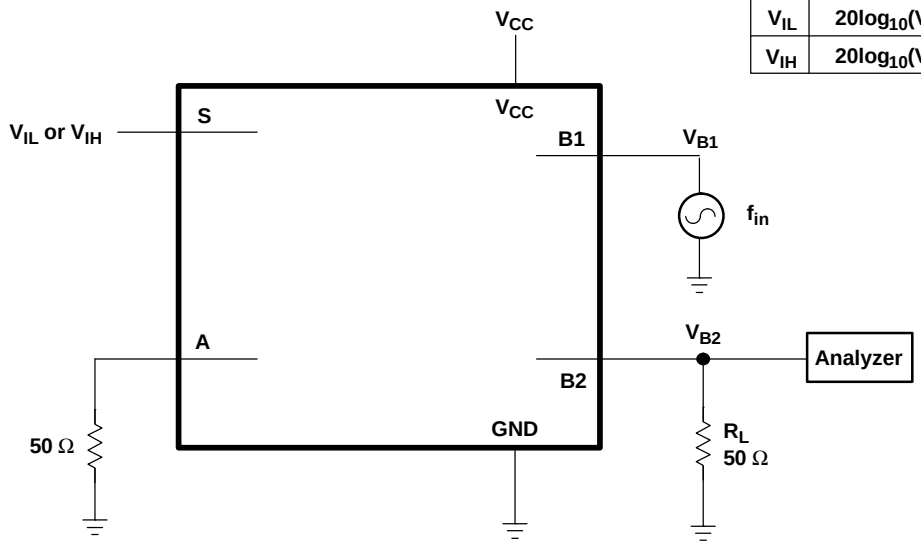
Figure 5. 9Load Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION (continued)



SW	S
1	V_{IL}
2	V_{IH}

Figure 6. Frequency Response (Switch On)



S	TEST CONDITION
V_{IL}	$20\log_{10}(V_{O2}/V_I)$
V_{IH}	$20\log_{10}(V_{O1}/V_I)$

Figure 7. Crosstalk (Between Switches)

PARAMETER MEASUREMENT INFORMATION (continued)

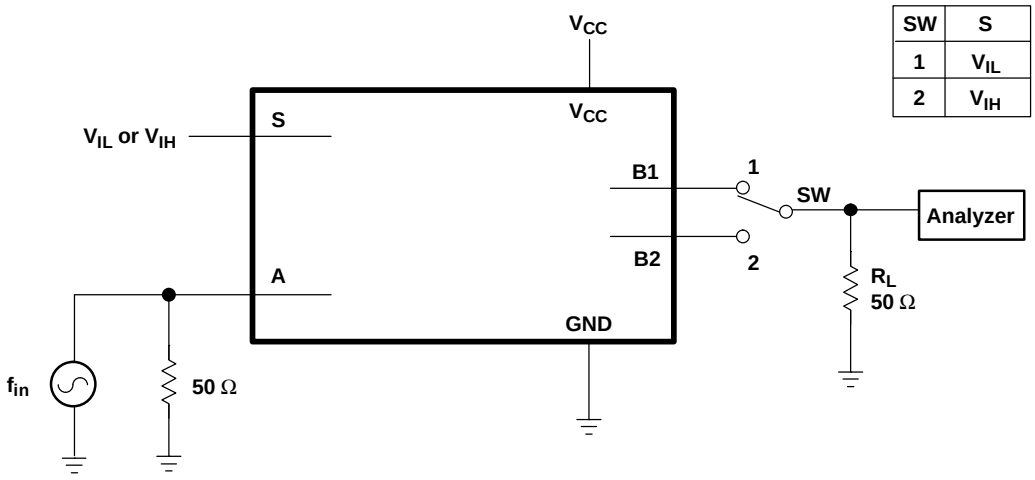


Figure 8. Feedthrough

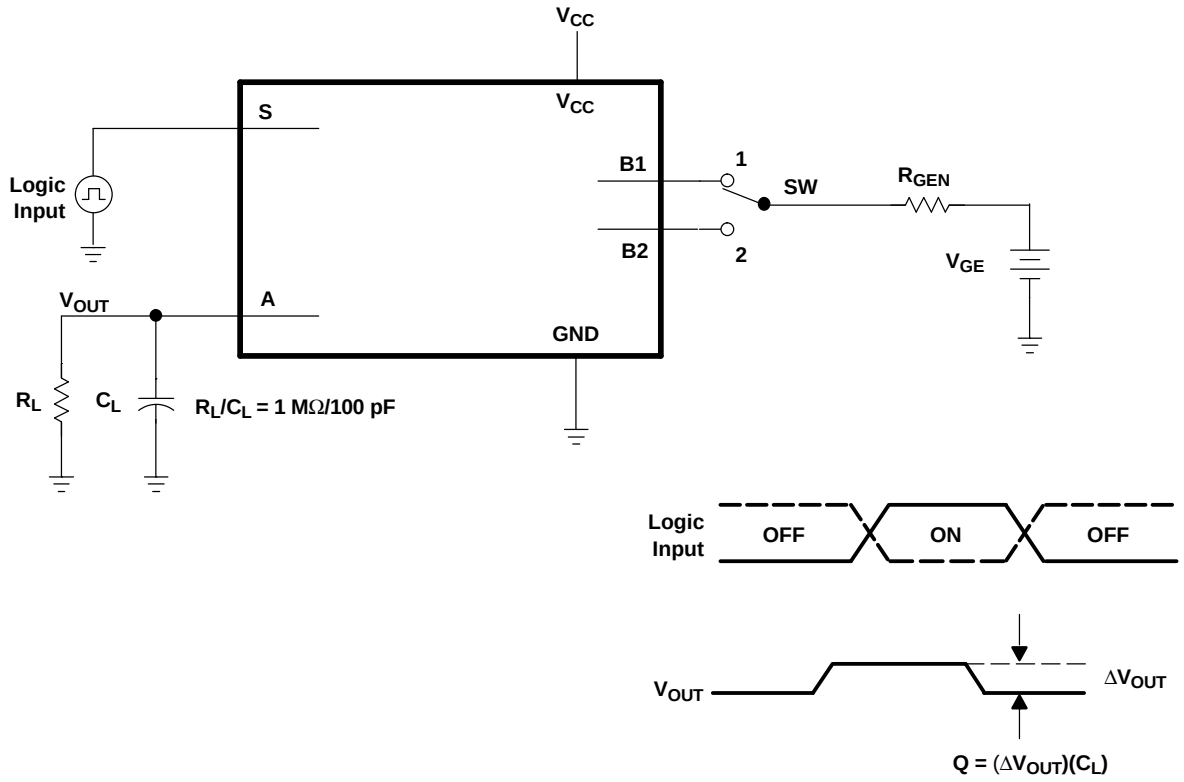


Figure 9. Charge-Injection Test

PARAMETER MEASUREMENT INFORMATION (continued)

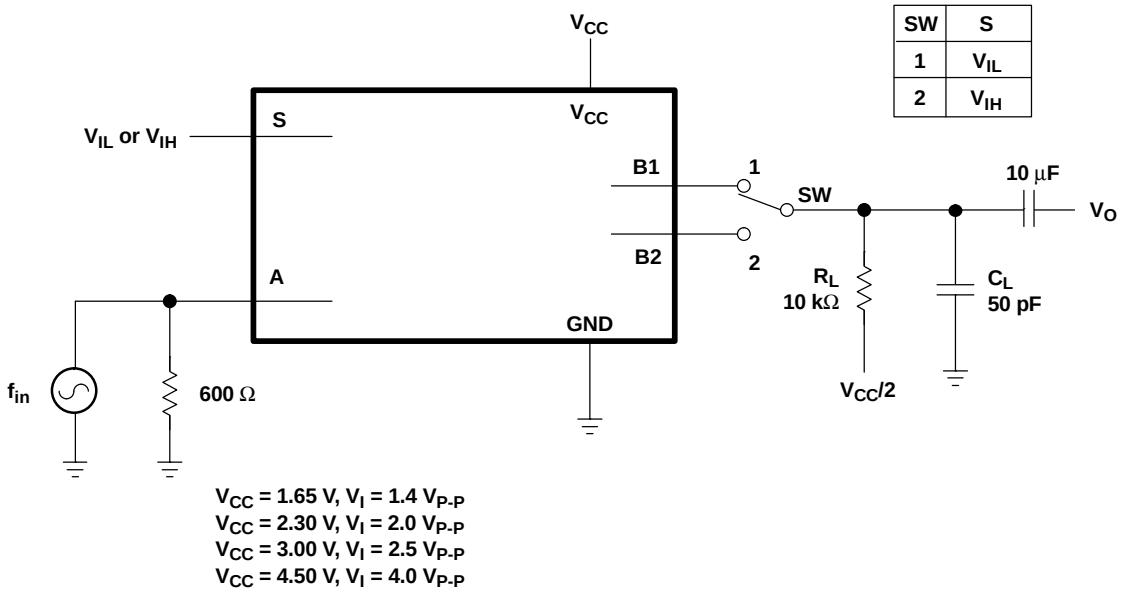


Figure 10. Total Harmonic Distortion

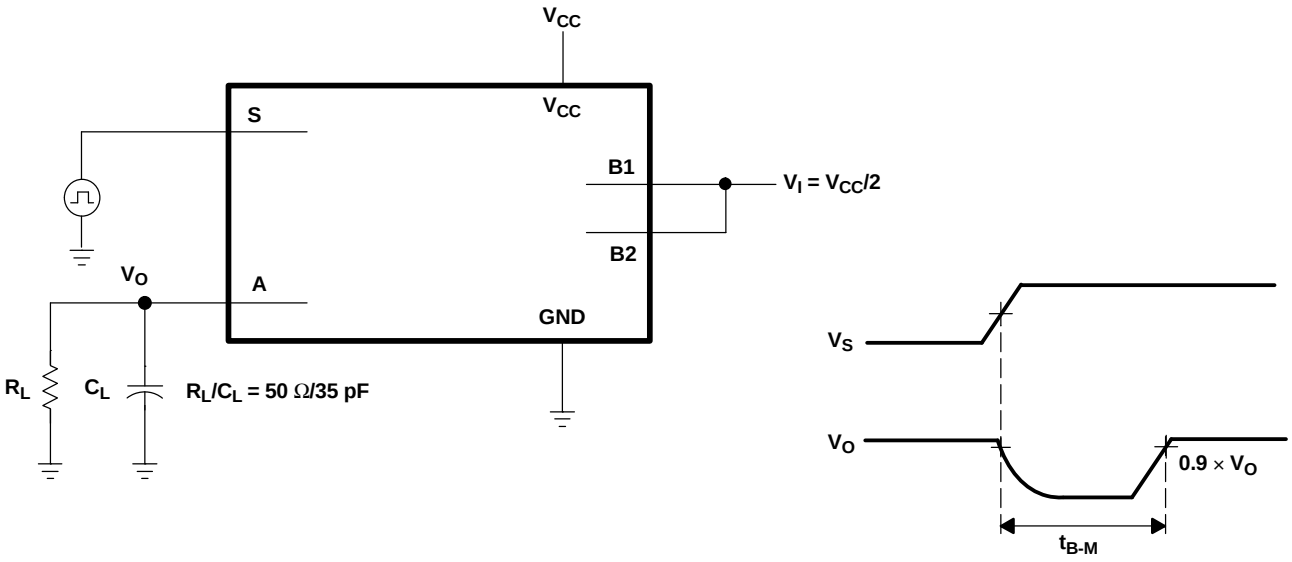


Figure 11. Break-Before-Make Internal Timing

PACKAGING INFORMATION

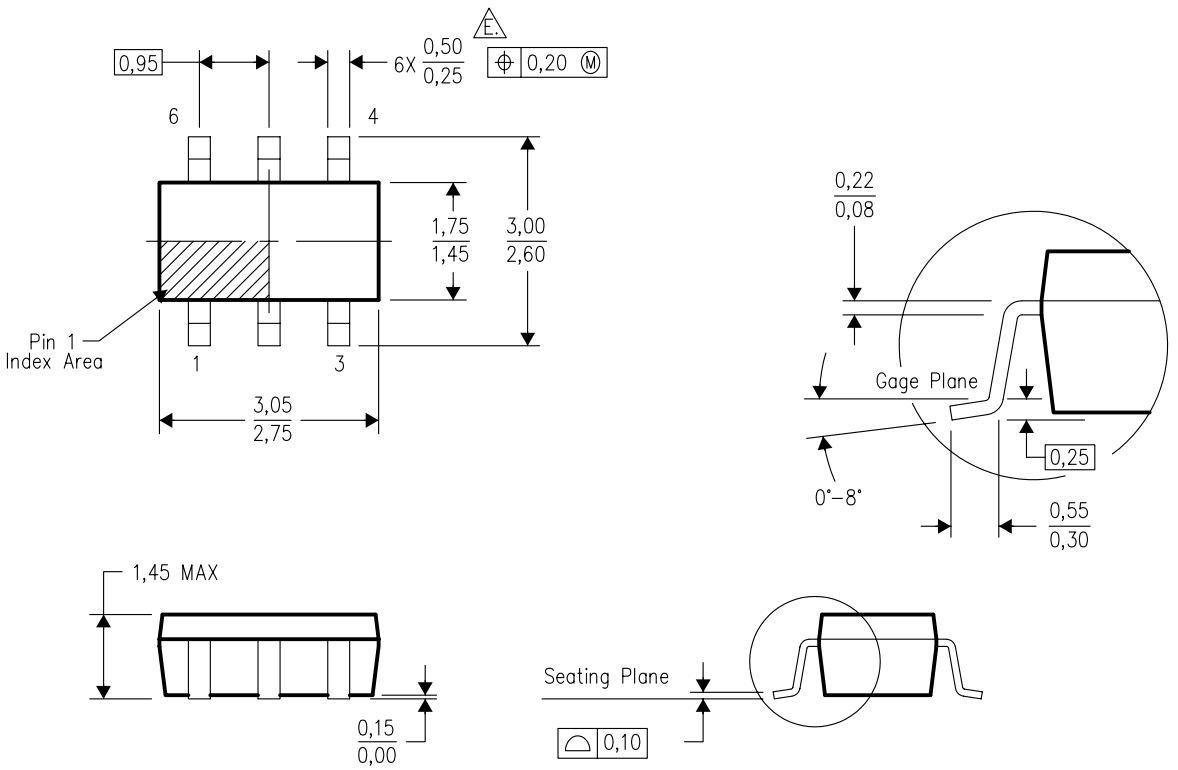
Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
1P1G3157QDBVRQ1	ACTIVE	SOT-23	DBV	6	3000	Pb-Free (RoHS)	CU NIPDAU	Level-1-260C-UNLIM
1P1G3157QDCKRQ1	ACTIVE	SC70	DCK	6	3000	Pb-Free (RoHS)	NIPDAU	Level-1-260C-UNLIM

(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.

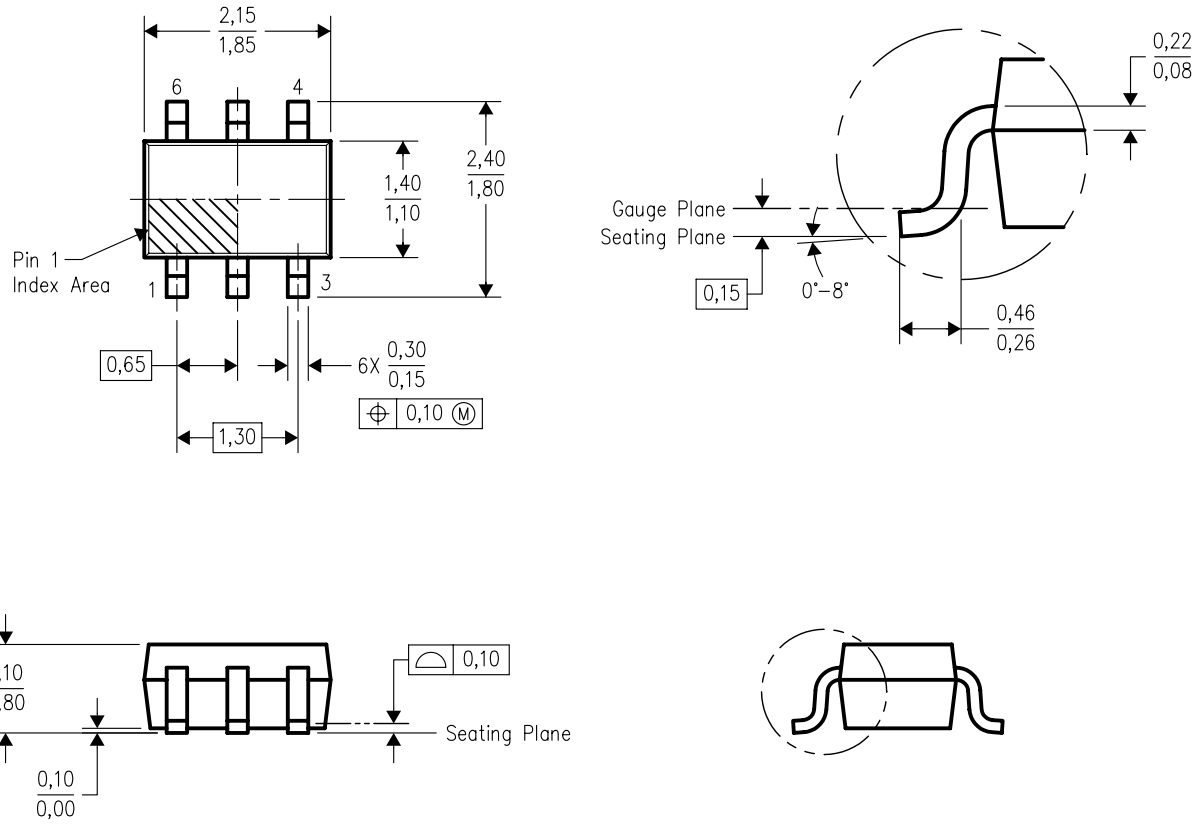
DBV (R–PDSO–G6) PLASTIC SMALL–OUTLINE PACKAGE



4073253–5/K 03/2006

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. Mold flash and protrusion shall not exceed 0.15 per side.
D. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
E. Falls within JEDEC MO–178 Variation AB, except minimum lead width.

DCK (R–PDSO–G6) PLASTIC SMALL–OUTLINE PACKAGE



4093553–3/E 10/2005

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. Mold flash and protrusion shall not exceed 0.15 per side.
D. Falls within JEDEC MO–203 variation AB.

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 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.

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.

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
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

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