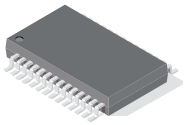
CCD VERTICAL DRIVER FOR DIGITAL CAMERAS

Check for Samples: VSP1900



FEATURES

- **CCD Vertical Driver:**
  - **Three Field CCD Support**
  - **Two Field CCD Support**
- **Output Drivers:**
  - **3 Levels Driver (V-Transfer) x 5**
  - **2 Levels Driver (V-Transfer) x 3**
  - **2 Levels Driver (E-Shutter) x 1**
- **Driver Capability:**
  - **450 pF to 1890 pF With 60 Ω to 240 Ω**
- **Input Phase:**
  - **3 State (V-Transfer) x 5**
  - **2 State (V-Transfer) x 3**
  - **2 State (E-Shutter) x 1**
- **Portable Operation**
  - **Input Interface: 2.7 V to 5.5 V**
- **Power Supply:**
  - **VDD 2.7 V to 5.5 V**
  - **VL –5 V to –9 V**
  - **VM GND**
  - **VH 11.5V to 15.5 V**

APPLICATIONS

- **Digital Camera**
- **Video Camera**

DESCRIPTION

The VSP1900 is a CCD vertical clock driver with electric-shutter support. This device is composed of eight vertical transfer channels, which support both 3-field CCD and 2-field CCD operation. The VSP1900 contributes low power consumption and device count reduction in the system.

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

PACKAGING ORDERING INFORMATION(1)

PRODUCT	PACKAGE	PACKAGE DESIGNATOR	OPERATING TEMPERATURE RANGE	PACKAGE MARKING	ORDER NUMBER	TRANSPORT MEDIA
VSP1900	TSSOP30	DBT	–25°C to 85°C	VSP1900	VSP1900	Tube (60 units per tube)

(1) For the most current specification and package information, refer to our web site at www.ti.com

ABSOLUTE MAXIMUM RATINGS

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

		VALUES	UNIT
Supply voltage	VDD	GND –0.3 to 7	V
	VL	GND to –10	
	VH	VL + 26	
Input voltage, V_{IN}		GND –0.3 to (VDD + 0.3)	V
Ambient temperature under bias		–25 to 85	°C
Storage temperature, T_{stg}		–55 to 150	°C
Junction temperature, T_J		150	°C
Package temperature (IR reflow, peak)		260	°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.

RECOMMENDED OPERATING CONDITIONS

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

	MIN	NOM	MAX	UNIT
Supply voltage, VDD	2.7		5.5.	V
Supply voltage, VL	–5		–9	V
Supply voltage, VH	11.5		15.5	V
Input voltage, V_{IN}		GND –.03 to (VDD + 0.3)		V

ELECTRICAL CHARACTERISTICS

All specifications at T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN(1)	TYP	MAX(1)	UNIT
DC power consumption				5.3		mW
Switching power consumption				550		mW
DC CHARACTERISTICS						
V_{IH}	High-level input voltage		0.7VDD			V
V_{IL}	Low-level input voltage				0.2VDD	V
I_{IN}	Input current	V_{IN} = GND to 5 V (without pullup or pulldown resistor)	–10	0	10	µA
		V_{IN} = GND to 5 V (pullup or pulldown resistor)	–625	0	625	
I_{IH}	Operating supply current			0.1	0.2	mA
I_{DD}				1		
I_{IL}				0.125		
I_{OL}	Output current	V1, V2, V3A, V3B, V4, V5A, V5B, V6 = –8.1 V	10			mA
I_{OM1}		V1, V2, V3A, V3B, V4, V5A, V5B, V6 = –0.2 V			–5	
I_{OM2}		V1, V3A, V3B, V5A, V5B = 0.2 V	5			
I_{OH}		V1, V3A, V3B, V5A, V5B = 14.55 V			–7.2	
I_{OSL}		SUB = –8.1 V	5.4			
I_{OSH}		SUB = 14.55 V			–4	

(1) Specified by design

SWITCHING CHARACTERISTICS

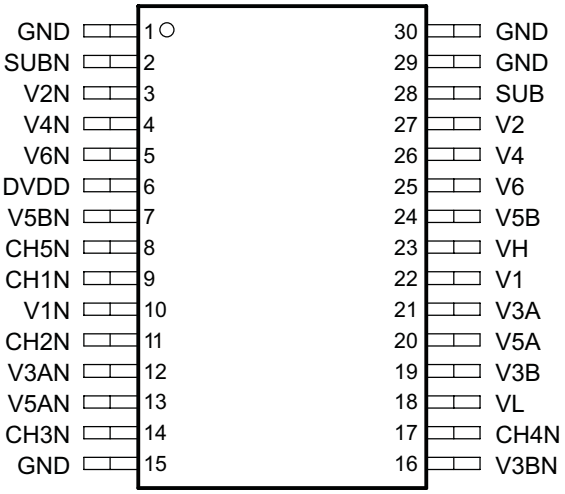
All specification at TA = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN(1)	TYP	MAX(1)	UNIT
$t_{d(PLM)}$	Propagation delay time			15	100	ns
$t_{d(PMH)}$				20	100	
$t_{d(PLH)}$				20	100	
$t_{d(PML)}$				15	50	
$t_{d(PHM)}$				30	50	
$t_{d(PHL)}$				30	50	
$t_{r(TLM)}$	Rise time	VL → VM			300	ns
$t_{r(TMH)}$		VM → VH			300	
$t_{r(TLH)}$		VL → VH			300	
$t_{f(TML)}$	Fall time	VM → VL			300	ns
$t_{f(THM)}$		VH → VM			300	
$t_{f(THL)}$		VH → VL			300	
$V_{n(CLH)}$	Output noise voltage				2	V
$V_{n(CLL)}$						
$V_{n(CMH)}$						
$V_{n(CML)}$						
$V_{n(CHL)}$						

(1) Specified by design

PIN ASSIGNMENTS

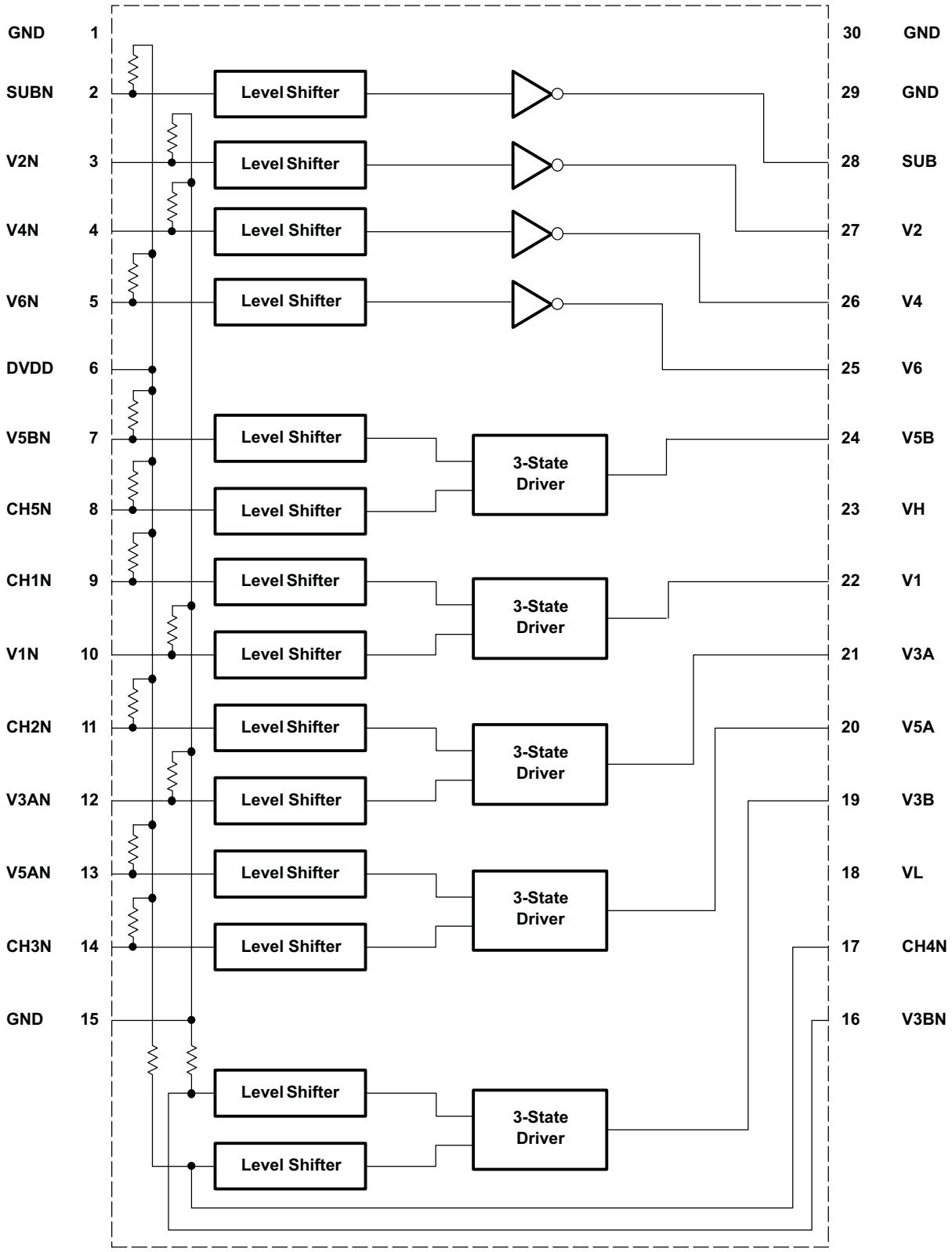
DBT PACKAGE
(TOP VIEW)



TERMINAL FUNCTIONS

TERMINAL		TYPE	DESCRIPTION
NAME	NO.		
GND	1, 15, 29, 30	P	Ground
SUBN	2	DI	CCD substrate clock SUB input
V2N	3	DI	Vertical transfer clock 2 input
V4N	4	DI	Vertical transfer clock 4 input
V6N	5	DI	Vertical transfer clock 6 input
DVDD	6	P	Digital power supply
V5BN	7	DI	Vertical transfer clock 5B input
CH5N	8	DI	Read out clock 5 input
CH1N	9	DI	Read out clock 1 input
V1N	10	DI	Vertical transfer clock 1 input
CH2N	11	DI	Read out clock 2 input
V3AN	12	DI	Vertical transfer clock 3A input
V5AN	13	DI	Vertical transfer clock 5A input
CH3N	14	DI	Read out clock 3 input
V3BN	16	DI	Vertical transfer clock 3B input
CH4N	17	DI	Read out clock 4 input
VL	18	P	Output driver power supply
V3B	19	DO	Vertical transfer clock 3B output
V5A	20	DO	Vertical transfer clock 5A output
V3A	21	DO	Vertical transfer clock 3A output
V1	22	DO	Vertical transfer clock 1 output
VH	23	P	Output driver power supply
V5B	24	DO	Vertical transfer clock 5B output
V6	25	DO	Vertical transfer clock 6 output
V4	26	DO	Vertical transfer clock 4 output
V2	27	DO	Vertical transfer clock 2 output
SUB	28	DO	CCD substrate clock SUB output

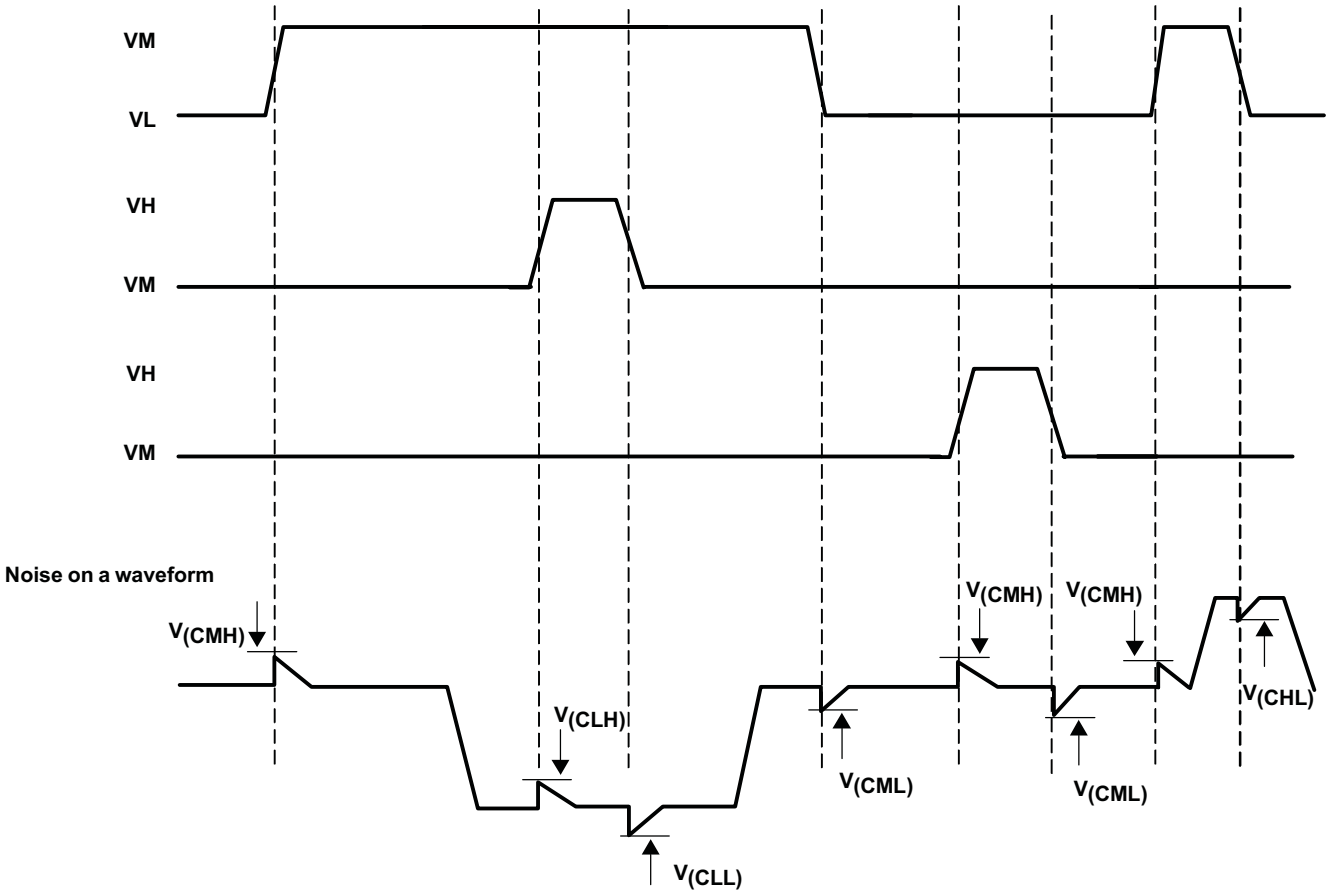
FUNCTIONAL BLOCK DIAGRAM



TRUTH TABLE

INPUT				OUTPUT		
V1N V3AN V3BN V5AN V5BN	CH1N CH2N CH4N CH3N CH5N	 V2N V4N V6N	 SUBN	V1 V3A V3B V5A V5B	 V2 V4 V6	 SUBN
L	L	X	X	VH	X	X
L	H	X	X	VM	X	X
H	L	X	X	Z	X	X
H	H	X	X	VL	X	X
X	X	L	X	X	VM	X
X	X	H	X	X	VL	X
X	X	X	L	X	X	VH
X	X	X	H	X	X	VL

SWITCHING WAVEFORM



LOADING DIAGRAM

Vertical clock series resistor	R1, R2, R4, R6	60 Ω
	R3A, R5A	240 Ω
	R3B, R5B	80 Ω
Vertical clock to GND	CΦV1	1280 pF
	CΦV3A, CΦV3B	640 pF
	CΦV5A, CΦV5B	640 pF
	CΦV2, CΦV4, CΦV6	400 pF
Between vertical clock	CΦV12	510 pF
	CΦV23A, CΦV23B	50 pF
	CΦV45A, CΦV45B	50 pF
	CΦV3A4, CΦV3B4	260 pF
	CΦV5A6, CΦV5B6	260 pF
	CΦV61	100 pF
Substrate clock to GND	CΦVSUB	1000 pF
Vertical clock GND resistor	R GND	18 Ω

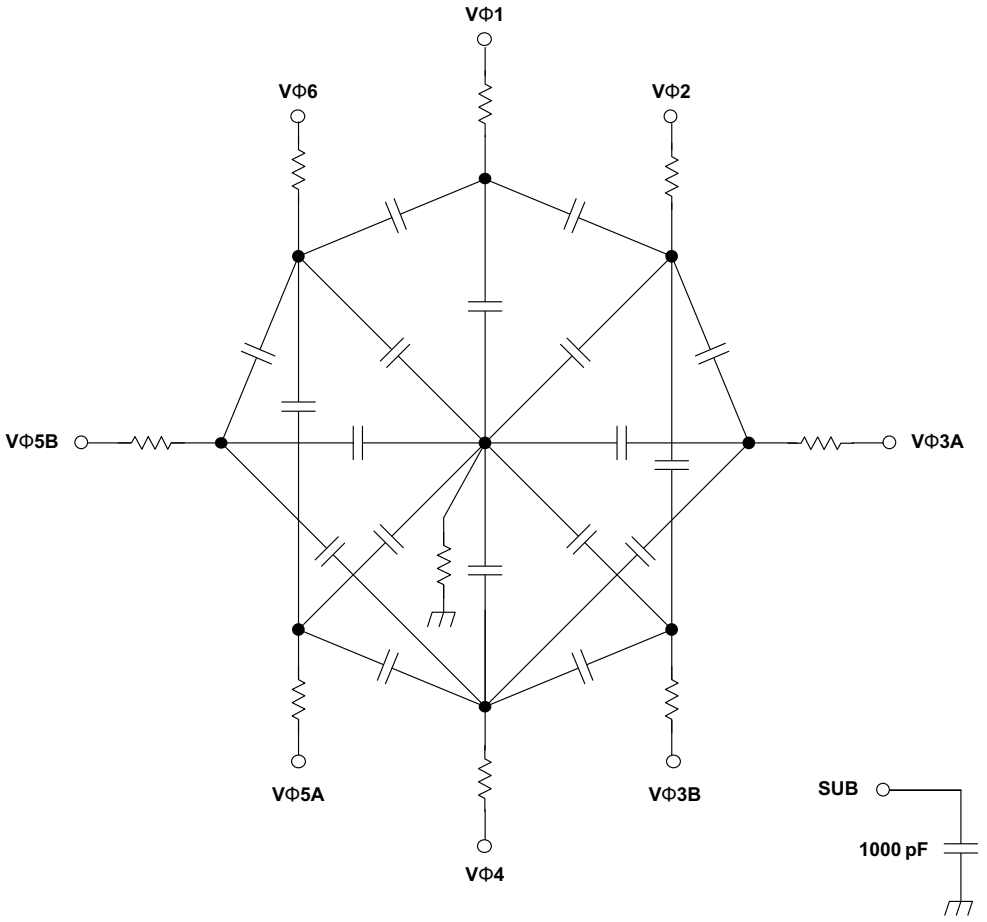


Figure 1. VSP1900 Loading Diagram

DESCRIPTION

The VSP1900 is a CCD vertical clock driver with electric shutter. The VSP1900 is composed of five 3-state and three 2-state vertical transfer channels, which support both 3 field and 2 field CCD operation. The VSP1900 contributes low power consumption and parts number reduction in the system.

OPERATION

Power On/Off Sequence

This is the same as the CCD power up sequence, when power on, VDD powers on first VH, VM powers on second, and VL powers on later. When powering off, VL powers off first, VH, VM powers off second, and VDD powers off later.

Vertical Transfer Signal

The VSP1900 receives signals from TG (CCD timing generator). The input signal is converted into the operating voltage levels of the CCD by the level shifter. The level shifter circuits connect to a 2-state or 3-state driver, which is connected to the CCD input pin. While using a 2-field CCD, one of the 3-state drivers is used as a 2-state driver. The CH#N pin is pulled up internally, so that the VH level does not appear on the output pin.

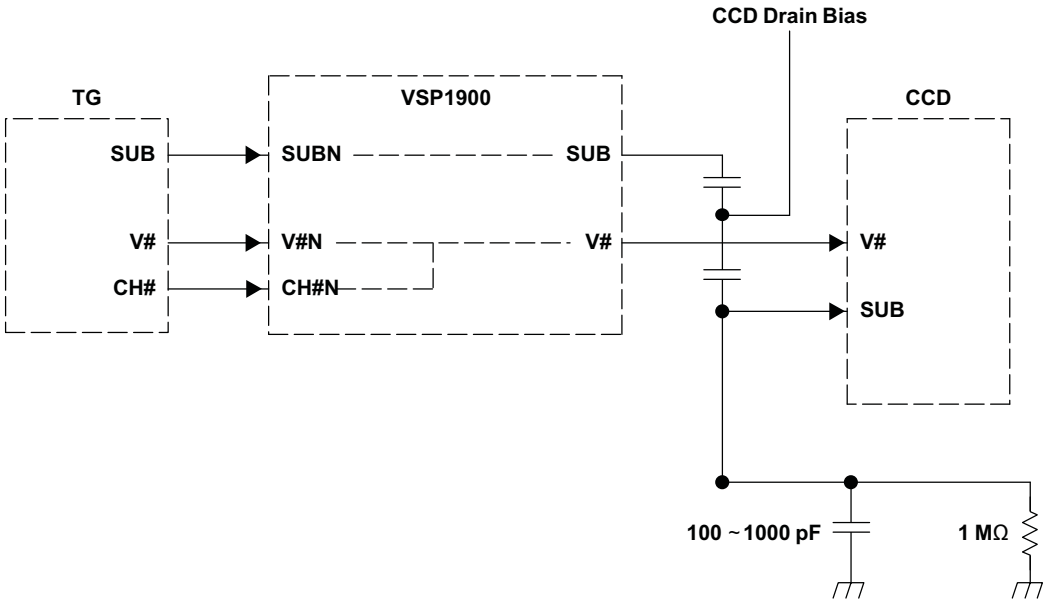


Figure 2. VSP1900 Circuit Application

REVISION HISTORY

Changes from Original (March 2003) to Revision A	Page
• Changed the last sentence of the Description From: "part number reduction in the system." To: " device count reduction in the system.	1
• Deleted the Tape and reel option from the Ordering Information Table	2
• Changed the Package temperature value From 2.35°C to 260°C	2
• Added Table Note " Specified by Design" to the MIN and MAX columns of the ELECTRICAL CHARACTERISTICS and SWITCHING CHARACTERISTICS.	3
• Changed the Truth Table	6

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
VSP1900DBT	ACTIVE	TSSOP	DBT	30	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	0 to 85	VSP1900	Samples
VSP1900DBTG4	ACTIVE	TSSOP	DBT	30	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	0 to 85	VSP1900	Samples

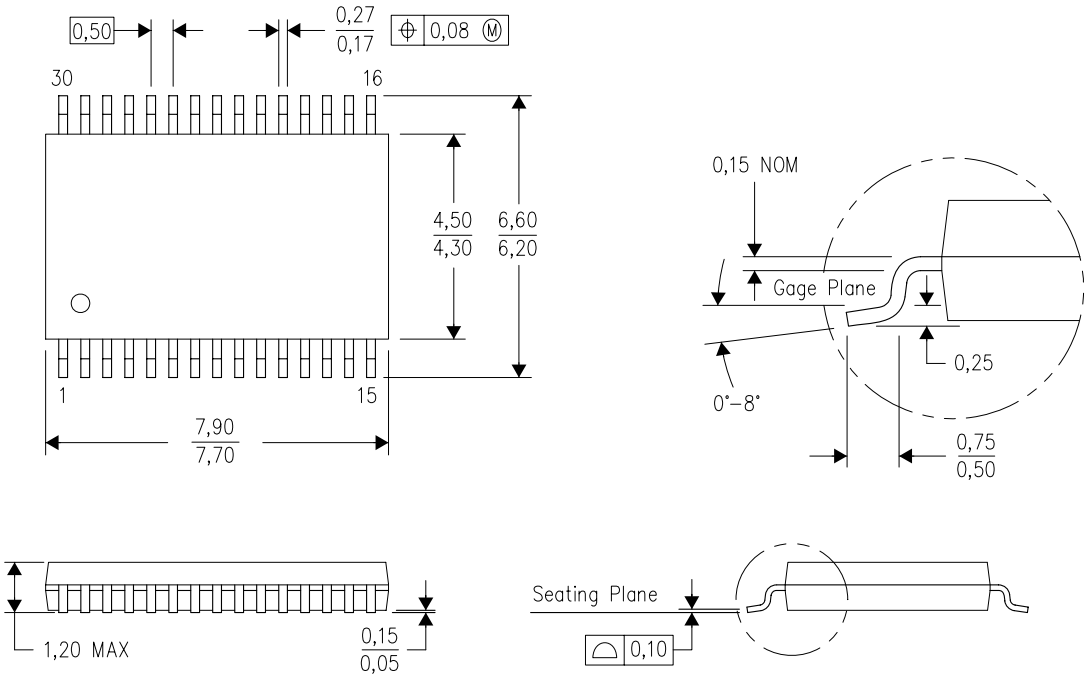
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, 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.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

DBT (R–PDSO–G30) PLASTIC SMALL OUTLINE



4073252–5/I 03/11

NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.
D. Falls within JEDEC MO–153.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

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

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license 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 significant portions 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. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

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

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

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