Ordering number : EN*A1693A

Preliminary

SANYO Semiconductors

DATA SHEET

Bi-CMOS IC

LV5233H — 24ch LED Driver

Overview

The LV5233H is a semiconductor integrated circuit that incorporates a serial input and serial or parallel output 24-stage shift register that features a CMOS structure based on Bi-CMOS process technology. The LV5233H also contains an n-channel CMOS construction high-withstand-voltage, large-current drive 24-stage parallel output driver.
The protection circuit of the output malfunction is built into.

Features

- Serial input and serial or parallel output
- Enable input for output control
- Serial output enables cascade connection
- Low supply current (0.45mA typ. during standby ICC≤0.6mA)
- Serial input/output levels compatible with typical CMOS devices
- High-withstand-voltage LED driver with open drain output
  High withstand voltage (VDS < 42V) High-current drive (I_O max = 100mA)
- Operating temperature range Ta = -25 to 75°C
- Output malfunction protection circuit
  Reset input pin Thermal protection circuit V_{CC} decrease voltage confirmation

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max	SV_{CC}	6	V
Output voltage	V_O max	LEDO1 to LEDO24 off	42	V
Output current	I_O max		100	mA
Allowable power dissipation	Pd max	Ta ≤ 25°C *	1750	mW
Operating temperature	Topr		-25 to +75	°C
Storage temperature	Tstg		-40 to +125	°C

* Specified board : 114.3mm × 76.1mm × 1.6mm, glass epoxy board.

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}	SV_{CC}	5.0	V
Operating supply voltage range	V_{CC} op	SV_{CC}	3.0 to 5.5	V
Output applied voltage	V_O		42	V
Output current	I_O	Duty = 45% to 55%	100	mA

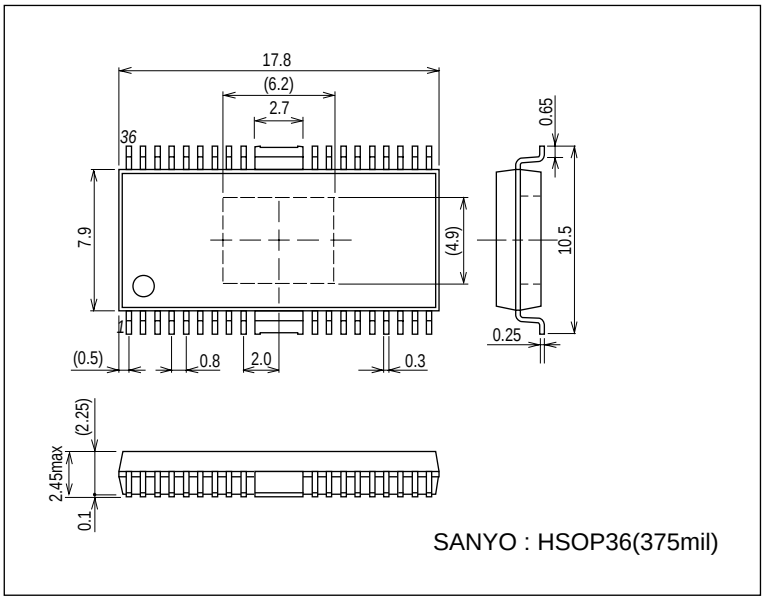
Electrical Characteristics at Ta = 25°C, V_{CC} = 5.0V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current drain	$I_{CC}1$	LEDO driver off (standby)		0.45	0.6	mA
LEDO output on resistance	Ron	I_O = 30mA		3		Ω
OFF leak current	Ileak	V_O = 42V		0	10	μA
Driver output malfunction prevention voltage	Vt		2.58	2.70	2.82	V
Control circuit block						
H level 1	$V_{IN}H1$	Input H level	V_{CC} × 0.8			V
L level 1	$V_{IN}L1$	Input L level	0		V_{CC} × 0.2	V
H level 2	V_OUTH1	SOUT I_O = -1mA	V_{CC} -0.3			V
L level 2	V_OUTL1	SOUT I_O = 1mA	0		0.3	V

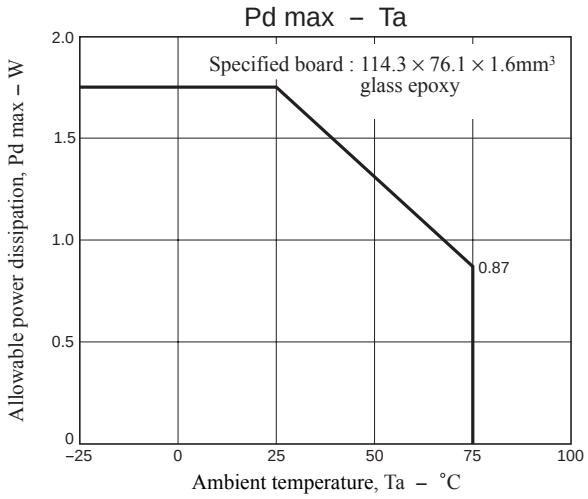
Package Dimensions

unit : mm (typ)

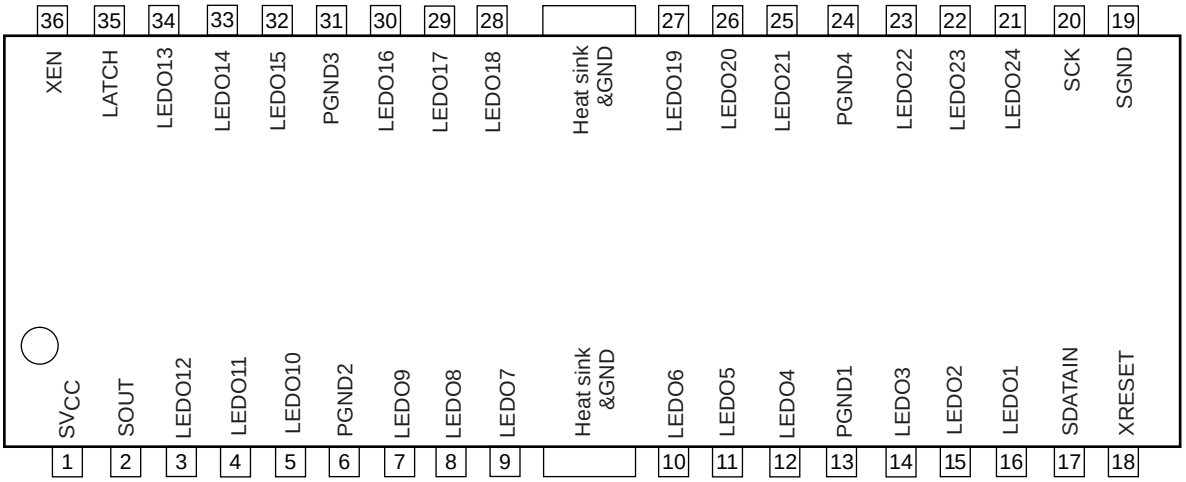
3235A



SANYO : HSOP36(375mil)



Pin Assignment

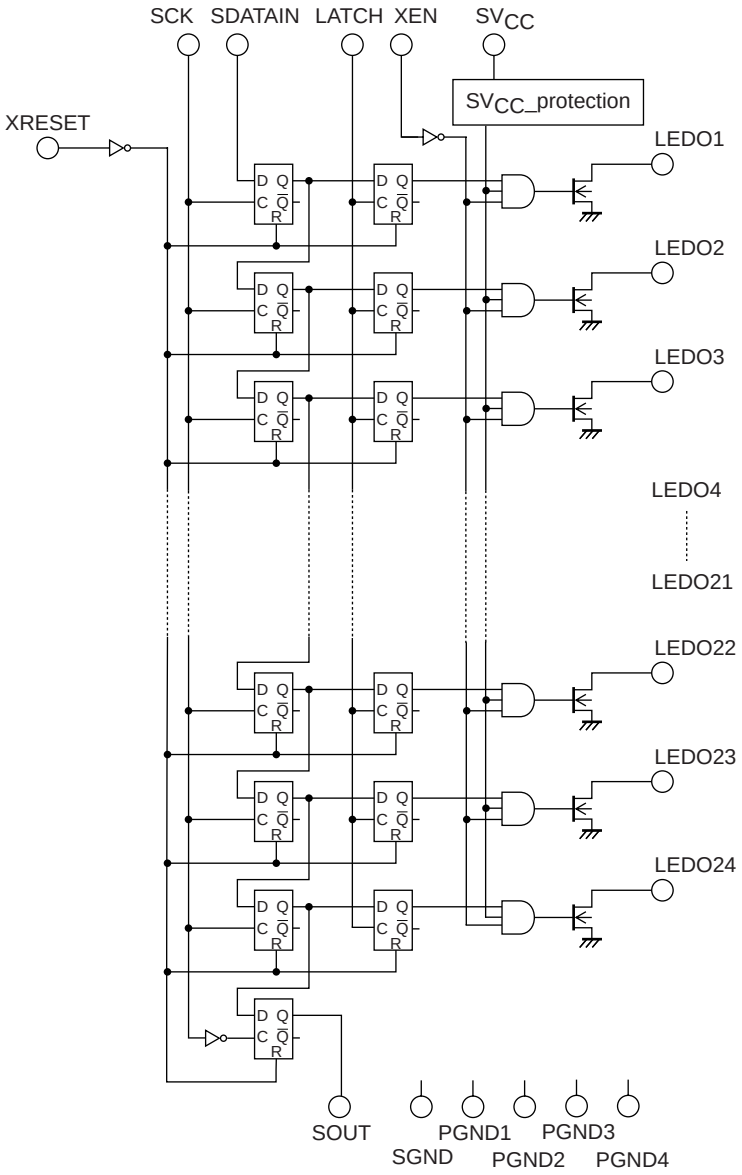


Top view

Pin Descriptions

Pin No.	Pin name	I/O	Description
1	SV_{CC}		Power supply
2	SOUT	O	shift register output (final-stage shift register)
3	LEDO12	O	LEDO12 Latch output (LEDO12 of shift register)
4	LEDO11	O	LEDO11 Latch output (LEDO11 of shift register)
5	LEDO10	O	LEDO10 Latch output (LEDO10 of shift register)
6	PGND2		GND
7	LEDO9	O	LEDO9 Latch output (LEDO9 of shift register)
8	LEDO8	O	LEDO8 Latch output (LEDO8 of shift register)
9	LEDO7	O	LEDO7 Latch output (LEDO7 of shift register)
Heat sink			
10	LEDO6	O	LEDO6 Latch output (LEDO6 of shift register)
11	LEDO5	O	LEDO5 Latch output (LEDO5 of shift register)
12	LEDO4	O	LEDO4 Latch output (LEDO4 of shift register)
13	PGND1		GND
14	LEDO3	O	LEDO3 Latch output (LEDO3 of shift register)
15	LEDO2	O	LEDO2 Latch output (LEDO2 of shift register)
16	LEDO1	O	LEDO1 Latch output (LEDO1 of shift register)
17	SDATAIN	I	Serial Input
18	XRESET	I	Reset input (shift register and latch)
19	SGND		GND
20	SCK	I	Clock input (for shift register)
21	LEDO24	O	LEDO24 Latch output (LEDO24 of shift register)
22	LEDO23	O	LEDO23 Latch output (LEDO23 of shift register)
23	LEDO22	O	LEDO22 Latch output (LEDO22 of shift register)
24	PGND4		GND
25	LEDO21	O	LEDO21 Latch output (LEDO21 of shift register)
26	LEDO20	O	LEDO20 Latch output (LEDO20 of shift register)
27	LEDO19	O	LEDO19 Latch output (LEDO19 of shift register)
Heat sink			
28	LEDO18	O	LEDO18 Latch output (LEDO18 of shift register)
29	LEDO17	O	LEDO17 Latch output (LEDO17 of shift register)
30	LEDO16	O	LEDO16 Latch output (LEDO16 of shift register)
31	PGND3		GND
32	LEDO15	O	LEDO15 Latch output (LEDO15 of shift register)
33	LEDO14	O	LEDO14 Latch output (LEDO14 of shift register)
34	LEDO13	O	LEDO13 Latch output (LEDO13 of shift register)
35	LATCH	I	Latch input When the latch input is held low, the LED0 output status is retained. When a high-level is input, the LED0 outputs change when the status of the shift register changes.
36	XEN	I	Enable inputs (LEDO1 to LEDO24) When a high-level is input, all the LED0 outputs are turned off. When a low-level is input, the shift register data is output to LED0.

Block Diagram



Function

The LV5233H consists of 1) an 24-stage D-type flip-flop and 2) an 24-stage D-type flip-flop connected to the output of 1). When data is supplied to the serial data input (SDATAIN) and the clock pulse is supplied to the clock input (SCK), the serial data input signal is input to the internal shift register and the data already in the shift register shifted sequentially when the clock changes from low to high.

The serial output (SOUT) is used to connect multiple LV5233H to expand the number of bits and is connected to the SDATAIN of the next stage. (Cascade connection supported.)

For parallel output, when the output control enable input (XEN) is low, the latch input (LATCH) changes from low to high and the clock pulse input changes from low to high, the serial data input signal is output to LED01, and the output is shifted sequentially. For parallel outputs (LED2 to LED24), the signals whose polarities inverted from those of the serial data input (SDATAIN) are output.

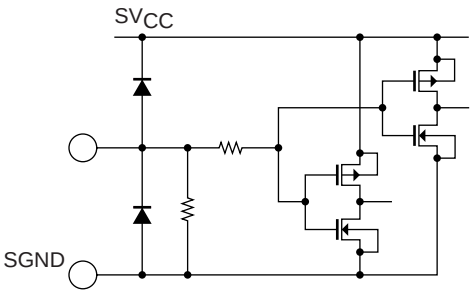
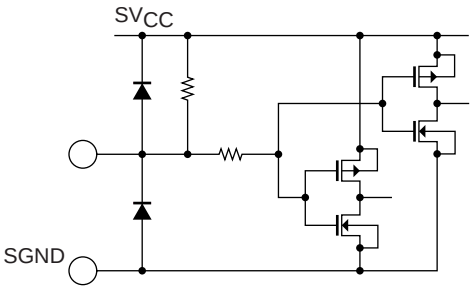
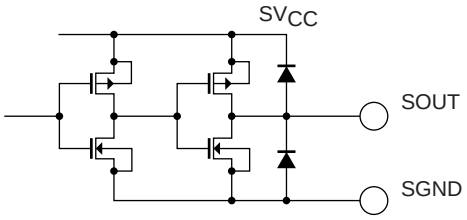
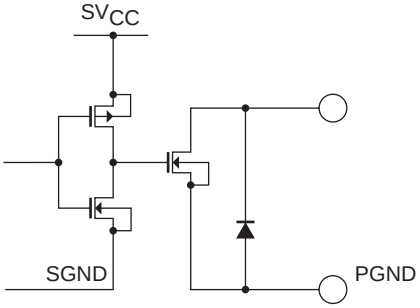
When the EN input is high, outputs LED01 through LED01 all turn off.

When the reset input is low, outputs LED01 through LED24 and SOUT outputs all turn off. The power must be turned on after checking that the reset input is low.

To prevent the malfunction, the output load protection circuit is built into. The output of LEDO1 to LEDO24 is compulsorily turned off when becoming below the voltage with a constant there is V_{CC}.

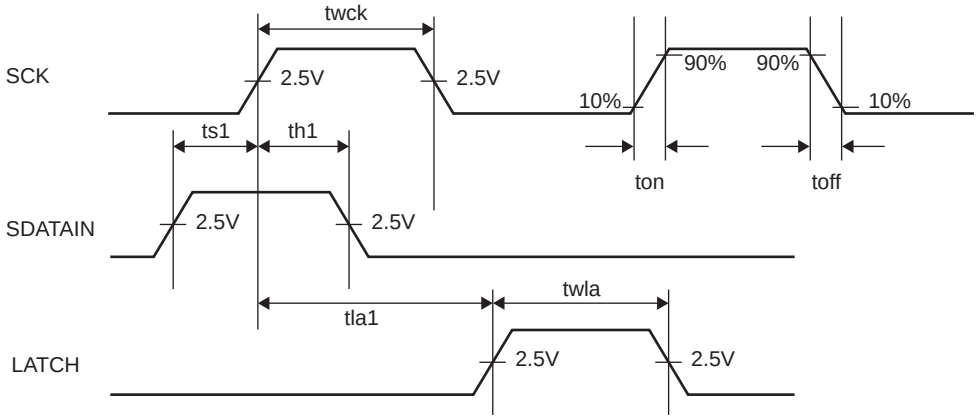
Moreover, a thermal circuit is built into, and the output of LEDO1 to LEDO24 is turned off compulsorily when becoming it at the temperature that exceeds the temperature of the junction in IC.

Pin Functions

Pin No.	Pin Name	Pin function	Equivalent Circuit
17 20	SDATAIN SCK	Pull-down input	
18 35 36	XRESET LATCH XEN	Pull-up input	
2	SOUT	SOUT output	
3 4 5 7 8 9 10 11 12 14 15 16 21 22 23 25 26 27 28 29 30 32 33 34	LEDO12 LEDO11 LEDO10 LEDO9 LEDO8 LEDO7 LEDO6 LEDO5 LEDO4 LEDO3 LEDO2 LEDO1 LEDO24 LEDO23 LEDO22 LEDO21 LEDO20 LEDO19 LEDO18 LEDO17 LEDO16 LEDO15 LEDO14 LEDO13	LEDO outputs LEDO1 to LEDO24	

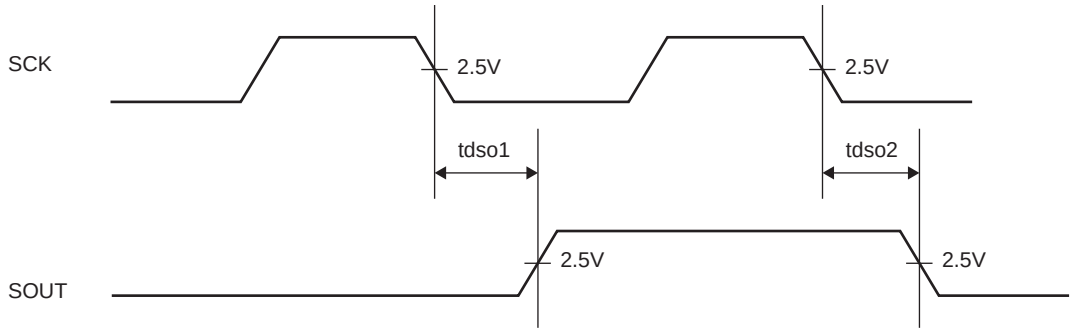
Timing conditions

Parameter	symbol	Conditions	min	typ	max	unit
Clock frequency	fs1	SCK Duty = 50%			10	MHz
Clock pulse width	twck	SCK	50			ns
Latch pulse width	twla	LATCH	50			ns
Data set up time	ts1	SDATAIN setup time relative to the rise of SCK	25			ns
Data hold time	th1	SDATAIN data hold time relative to the rise of SCK	25			ns
Clock latch time	tla1		100			ns
Input conditions 1	ton	SCK and SDATAIN rise time			100	ns
Input conditions 2	toff	SCL and SDATAIN fall time			100	ns



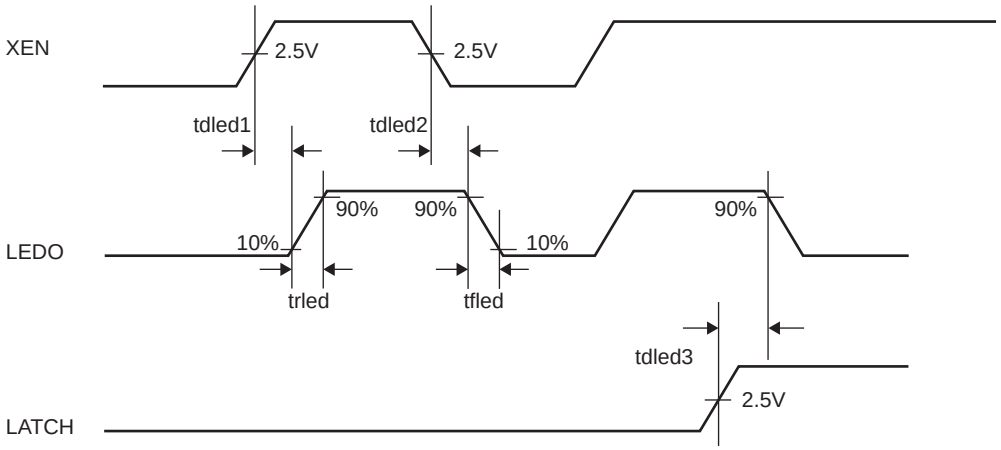
SOUT output timings

Parameter	symbol	Conditions	min	typ	max	unit
SOUT delay time 1	tdso1	The time from a SCK falling edge to SOUT rising edge			50	ns
SOUT delay time 2	tdso2	The time from a SCK falling edge to SOUT falling edge			50	ns

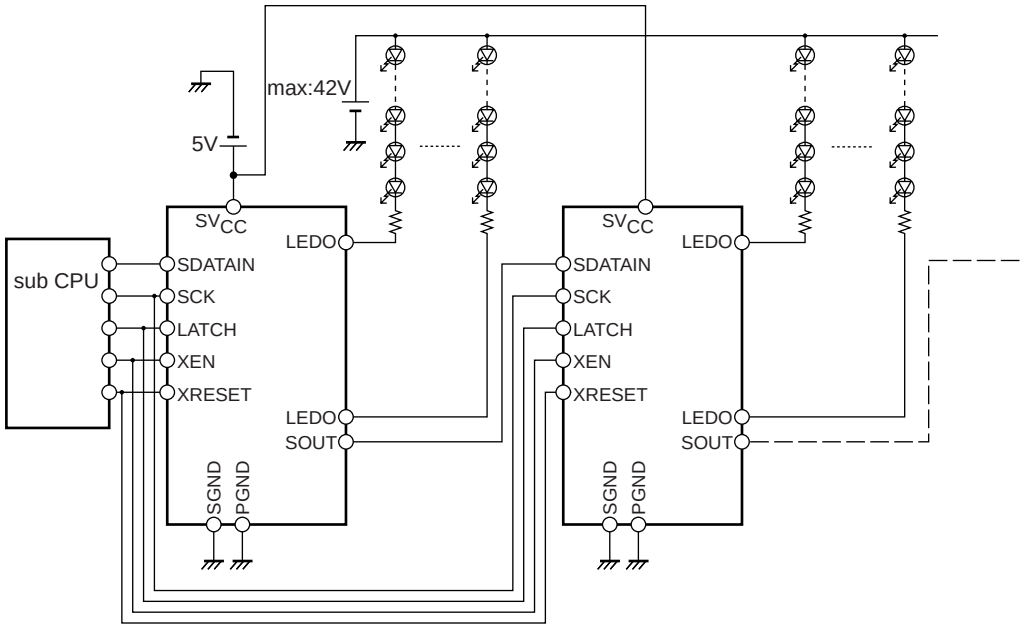


LEDO output timings

Parameter	symbol	Conditions	min	typ	max	unit
LEDO delay time 1	tdled1	The time from an XEN rising edge to LEDO rising edge CL = 30pF, I_O = 100mA, V_O = 42V		100		ns
LEDO delay time 2	tdled2	The time from an XEN falling edge to LEDO falling edge CL = 30pF, I_O = 100mA, V_O = 42V		100		ns
LEDO rise time	trled	LEDO rise time CL = 30pF, I_O = 100mA, V_O = 42V		200		ns
LEDO fall time	tfled	LEDO fall time CL = 30pF, I_O = 100mA, V_O = 42V		200		ns
LEDO delay time 3	tdled3	The time from a LATCH rising edge to LEDO falling edge CL = 30pF, I_O = 100mA, V_O = 42V		200		ns



Application Circuit Example



Allowable output current characteristics