

# LR36685

## Vertical Driver IC for CCD Area Sensors

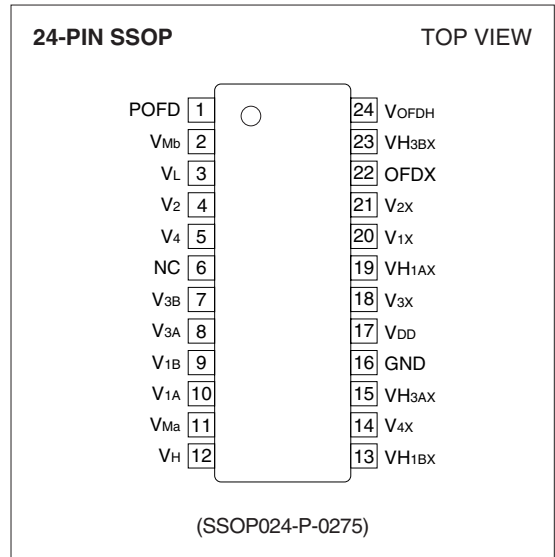
### DESCRIPTION

The LR36685 is a CMOS vertical clock driver and shutter driver IC for CCD area sensors which provides the functions to convert the voltage and impedance from the CMOS level.

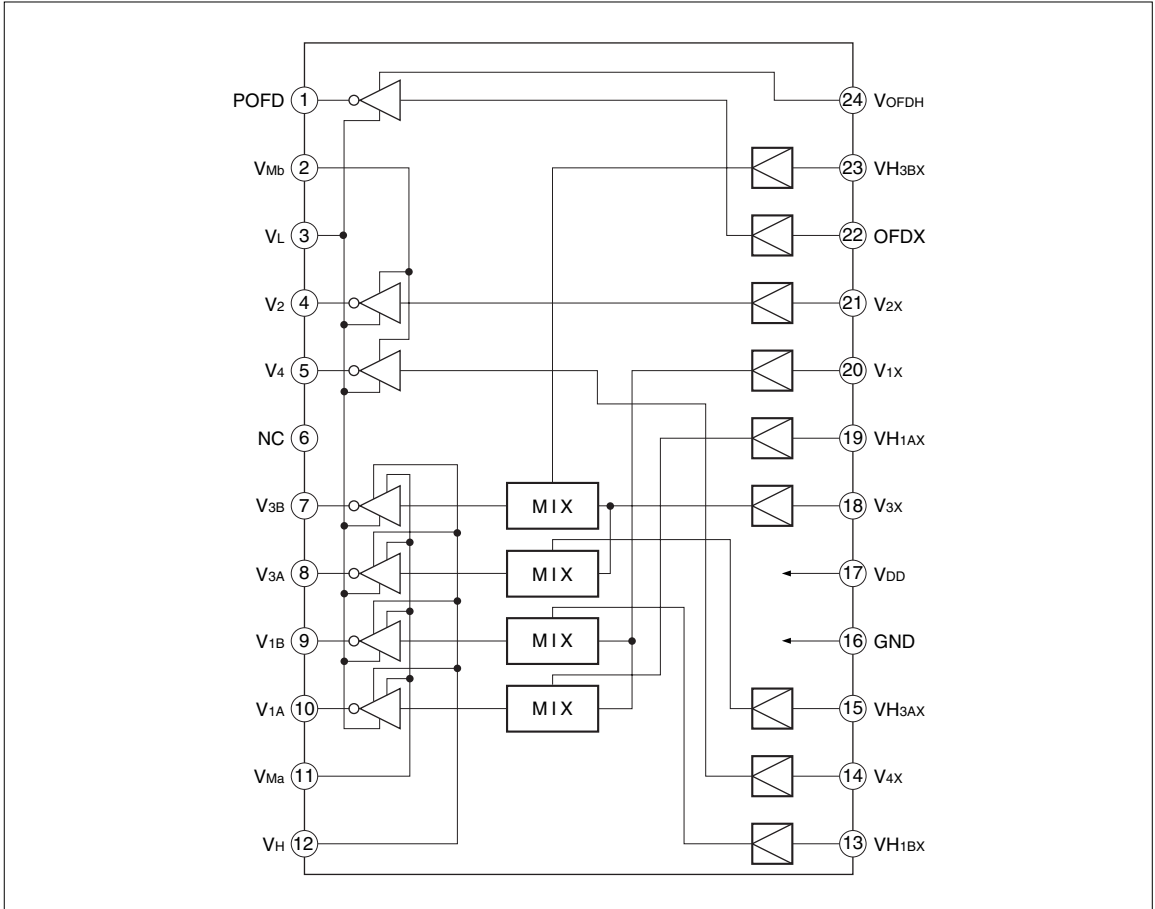
### FEATURES

- Built-in seven circuits
  - 2-level output :
    - 2 circuits for vertical CCD clock driver
    - Output voltage level (TYP.) =  $-9$  to  $0$  V
  - 3-level output :
    - 4 circuits for vertical CCD clock driver
    - Output voltage level (TYP.) =  $-9$  to  $0$  to  $+15$  V
  - 2-level output :
    - 1 circuit for shutter driver
    - Output voltage level (TYP.) =  $-9$  to  $+17$  V
- Switchable between NTSC (EIA) and PAL (CCIR) modes
- Package :
  - 24-pin SSOP (SSOP024-P-0275)

### PIN CONNECTIONS



BLOCK DIAGRAM



## PIN DESCRIPTION

PIN NO.	SYMBOL	PIN NAME	DESCRIPTION
1	POFD	OFD pulse output	An electronic shutter pulse output. (high level = VOFDH, low level = VL)
2	V <sub>Mb</sub>	Power supply	A power supply for high level of V <sub>2</sub> and V <sub>4</sub> .
3	V <sub>L</sub>	Power supply	A power supply for low level of all output pulses.
4	V <sub>2</sub>	Vertical transfer pulse output 2	A pulse to drive vertical CCD shift register. Connect to $\phi_{V2}$ .
5	V <sub>4</sub>	Vertical transfer pulse output 4	A pulse to drive vertical CCD shift register. Connect to $\phi_{V4}$ .
6	NC	No connection	No connection
7	V <sub>3B</sub>	Vertical transfer pulse output 3B	A pulse to drive vertical CCD shift register. Connect to $\phi_{V3B}$ .
8	V <sub>3A</sub>	Vertical transfer pulse output 3A	A pulse to drive vertical CCD shift register. Connect to $\phi_{V3A}$ .
9	V <sub>1B</sub>	Vertical transfer pulse output 1B	A pulse to drive vertical CCD shift register. Connect to $\phi_{V1B}$ .
10	V <sub>1A</sub>	Vertical transfer pulse output 1A	A pulse to drive vertical CCD shift register. Connect to $\phi_{V1A}$ .
11	V <sub>Ma</sub>	Power supply	A power supply for intermediate level of V <sub>1A</sub> , V <sub>1B</sub> , V <sub>3A</sub> and V <sub>3B</sub> .
12	V <sub>H</sub>	Power supply	A power supply for high level of V <sub>1A</sub> , V <sub>1B</sub> , V <sub>3A</sub> and V <sub>3B</sub> .
13	VH <sub>1BX</sub>	Readout pulse input 1B	A pulse that transfers the charge of the photo-diode to the vertical shift register.
14	V <sub>4X</sub>	Vertical transfer pulse input 4	A vertical transfer pulse input.
15	VH <sub>3AX</sub>	Readout pulse input 3A	A pulse that transfers the charge of the photo-diode to the vertical shift register.
16	GND	Ground	A grounding pin.
17	V <sub>DD</sub>	Power supply	A power supply for input pulses.
18	V <sub>3X</sub>	Vertical transfer pulse input 3	A vertical transfer pulse input.
19	VH <sub>1AX</sub>	Readout pulse input 1A	A pulse that transfers the charge of the photo-diode to the vertical shift register.
20	V <sub>1X</sub>	Vertical transfer pulse input 1	A vertical transfer pulse input.
21	V <sub>2X</sub>	Vertical transfer pulse input 2	A vertical transfer pulse input.
22	OFDX	OFD pulse input	An electronic shutter pulse input.
23	VH <sub>3BX</sub>	Readout pulse input 3B	A pulse that transfers the charge of the photo-diode to the vertical shift register.
24	VOFDH	Power supply	A power supply for high level of POFD.

**ABSOLUTE MAXIMUM RATINGS**(T<sub>A</sub> = +25 °C)

PARAMETER	SYMBOL	RATING	UNIT	NOTE
Supply voltage	V <sub>DD</sub>	GND – 0.3 to GND + 6.0	V	1
	V <sub>H</sub> – V <sub>L</sub>	29.0	V	
	V <sub>Ma</sub> , V <sub>Mb</sub>	V <sub>L</sub> to V <sub>H</sub>	V	
	V <sub>O</sub> FDH – V <sub>L</sub>	34.0	V	
Input voltage	V <sub>IN</sub>	GND – 0.3 to V <sub>DD</sub> + 0.3	V	
Storage temperature	T <sub>STG</sub>	–55 to +150	°C	

**NOTE :**1. V<sub>H</sub> (MIN.) = V<sub>DD</sub>, V<sub>O</sub>FDH (MIN.) = V<sub>DD</sub>, V<sub>L</sub> (MAX.) = GND**RECOMMENDED OPERATING CONDITIONS**

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage	V <sub>DD</sub>	3.0	3.3	5.5	V
	V <sub>H</sub> – V <sub>L</sub>	17.0	24.0	27.0	V
	V <sub>H</sub>	12.0	15.0	20.0	V
	V <sub>L</sub>	–10.0	–9.0	–5.0	V
	V <sub>Ma</sub> , V <sub>Mb</sub>		0.0		V
	V <sub>O</sub> FDH – V <sub>L</sub>	17.0	26.0	32.0	V
	V <sub>O</sub> FDH	12.0	17.0	24.0	V
Input voltage	V <sub>IN</sub> (Low)	0		0.25V <sub>DD</sub>	V
	V <sub>IN</sub> (High)	0.8V <sub>DD</sub>		V <sub>DD</sub> + 0.2	V
Operating frequency	NTSC		15.734		kHz
	PAL		15.625		kHz
Operating temperature	T <sub>OPR</sub>	–20		+70	°C

## ELECTRICAL CHARACTERISTICS

## DC Characteristics

(V<sub>DD</sub> = +3.3 V, V<sub>H</sub> = +15.0 V, V<sub>L</sub> = -9.0 V, V<sub>Ma</sub> = V<sub>Mb</sub> = 0 V, V<sub>OFDH</sub> = +17.0 V, T<sub>A</sub> = +25 °C)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	NOTE
Input "Low" voltage	V <sub>IL</sub>		0.0		0.25V <sub>DD</sub>	V	
Input "High" voltage	V <sub>IH</sub>		0.8V <sub>DD</sub>		V <sub>DD</sub> + 0.2	V	
Input "Low" current	I <sub>IL</sub>	V <sub>IL</sub> = 0 V			200	μA	
Input "High" current	I <sub>IH</sub>	V <sub>IH</sub> = 3.3 V			1.0	μA	
Output "Low" voltage	V <sub>OL</sub>	I <sub>OL</sub> < 1 μA			-8.9	V	1, 2, 3
Output "High" voltage	V <sub>OH</sub>	I <sub>OH</sub> < 1 μA	14.9			V	2
Output "High" voltage	V <sub>OFDH</sub>	I <sub>OFDH</sub> < 1 μA	16.9			V	3
Output "Intermediate" voltage	V <sub>OMLa</sub>	I <sub>OMLa</sub> < 1 μA	-0.1		0.1	V	2
	V <sub>OMHa</sub>	I <sub>OMHa</sub> < 1 μA	-0.1		0.1	V	
	V <sub>OMLb</sub>	I <sub>OMLb</sub> < 1 μA	-0.1		0.1	V	1
	V <sub>OMHb</sub>	I <sub>OMHb</sub> < 1 μA	-0.1		0.1	V	
Output "Low" current	I <sub>OL</sub>	V <sub>OL</sub> = V <sub>L</sub> + 0.1 V	1.0			mA	1, 2, 3
Output "High" current	I <sub>OH</sub>	V <sub>OH</sub> = V <sub>H</sub> - 0.1 V	1.0			mA	2
Output "High" current	I <sub>OFDH</sub>	V <sub>OFDH</sub> = V <sub>OFDH</sub> - 0.1 V	1.0			mA	3
Output "Intermediate" current	I <sub>OMLa</sub>	V <sub>OMLa</sub> = V <sub>M</sub> - 0.1 V	1.0			mA	2
	I <sub>OMHa</sub>	V <sub>OMHa</sub> = V <sub>M</sub> + 0.1 V	1.0			mA	
	I <sub>OMLb</sub>	V <sub>OMLb</sub> = V <sub>M</sub> - 0.1 V	1.0			mA	1
	I <sub>OMHb</sub>	V <sub>OMHb</sub> = V <sub>M</sub> + 0.1 V	1.0			mA	
Output ON resistance	R <sub>ONH</sub>	I <sub>OH</sub> = 20 mA		30		Ω	2
	R <sub>ONOFH</sub>	I <sub>OFDH</sub> = 20 mA		20		Ω	3
	R <sub>ONM</sub>	I <sub>OM</sub> = 20 mA		25		Ω	1, 2
	R <sub>ONL</sub>	I <sub>OL</sub> = 20 mA		20		Ω	1, 2, 3
Static current	I <sub>DD</sub>				2.0	mA	
	I <sub>H</sub>				200	μA	
	I <sub>OFDH</sub>				200	μA	
	I <sub>M</sub>				200	μA	
	I <sub>L</sub>				200	μA	

## NOTES :

1. Applied to outputs (V<sub>2</sub>, V<sub>4</sub>).
2. Applied to outputs (V<sub>1A</sub>, V<sub>1B</sub>, V<sub>3A</sub>, V<sub>3B</sub>).
3. Applied to output (POFD).

## AC Characteristics

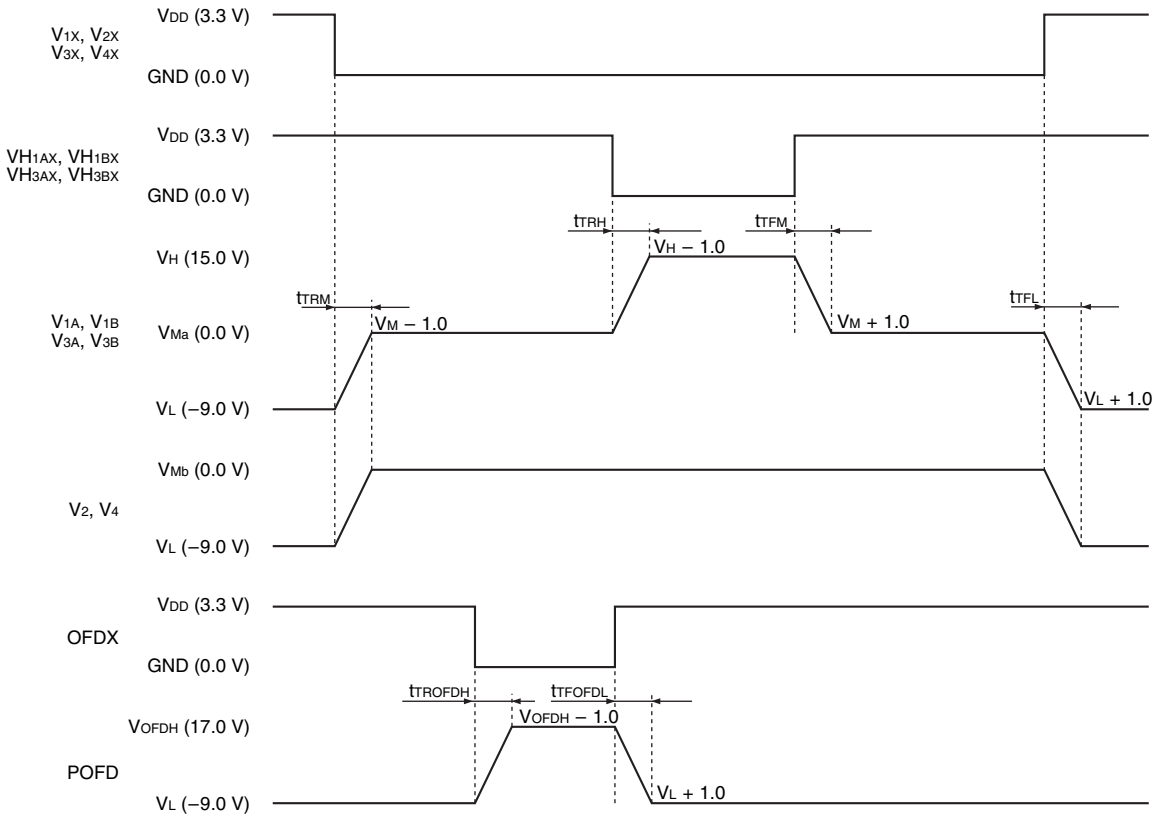
(V<sub>DD</sub> = +3.3 V, V<sub>H</sub> = +15.0 V, V<sub>L</sub> = -9.0 V, V<sub>Ma</sub> = V<sub>Mb</sub> = 0 V, V<sub>OFDH</sub> = +17.0 V, T<sub>A</sub> = +25 °C,  
Shutter speed : 1/100 000 s)

PARAMETER	SYMBOL	CONDITIONS	TYP.	MAX.	UNIT
Sequential delay	t <sub>TRM</sub> (V <sub>L</sub> →V <sub>M</sub> )	V <sub>IN</sub> to V <sub>M</sub> - 1.0 V (V <sub>1A</sub> , V <sub>1B</sub> , V <sub>2</sub> , V <sub>3A</sub> , V <sub>3B</sub> , V <sub>4</sub> )	600	1 200	ns
	t <sub>TFL</sub> (V <sub>M</sub> →V <sub>L</sub> )	V <sub>IN</sub> to V <sub>L</sub> + 1.0 V (V <sub>1A</sub> , V <sub>1B</sub> , V <sub>2</sub> , V <sub>3A</sub> , V <sub>3B</sub> , V <sub>4</sub> )	600	1 200	ns
	t <sub>TRH</sub> (V <sub>M</sub> →V <sub>H</sub> )	V <sub>IN</sub> to V <sub>H</sub> - 1.0 V (V <sub>1A</sub> , V <sub>1B</sub> , V <sub>3A</sub> , V <sub>3B</sub> )	800	1 600	ns
	t <sub>TFM</sub> (V <sub>H</sub> →V <sub>M</sub> )	V <sub>IN</sub> to V <sub>M</sub> + 1.0 V (V <sub>1A</sub> , V <sub>1B</sub> , V <sub>3A</sub> , V <sub>3B</sub> )	800	1 600	ns
	t <sub>TROFDH</sub> (V <sub>L</sub> →V <sub>OFDH</sub> )	V <sub>IN</sub> to V <sub>OFDH</sub> - 1.0 V (POFD)	80	160	ns
	t <sub>TFOFDL</sub> (V <sub>OFDH</sub> →V <sub>L</sub> )	V <sub>IN</sub> to V <sub>L</sub> + 1.0 V (POFD)	80	160	ns
Dynamic current	I <sub>DYN</sub>	During operation	5	10	mA

### NOTE :

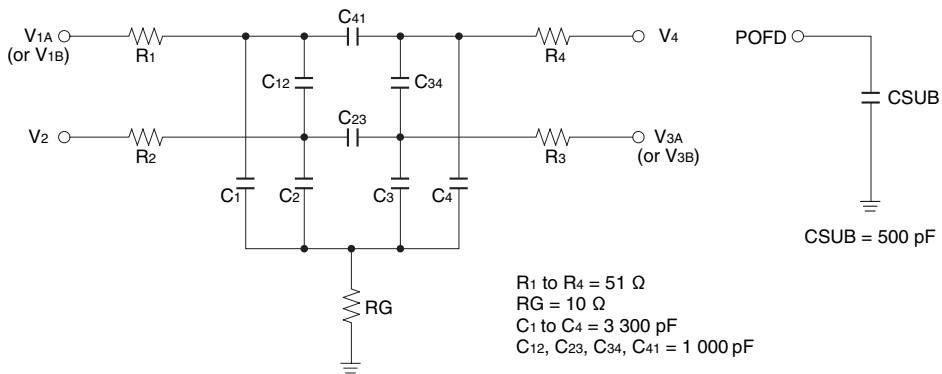
Refer to "[Switching Characteristics Conditions](#)" and "[Equivalent Circuit](#)".

### Switching Characteristics Conditions



### Equivalent Circuit

(While  $V_{1A}$  and  $V_{3A}$  [or  $V_{1B}$  and  $V_{3B}$ ] are measured,  $V_{1B}$  and  $V_{3B}$  [or  $V_{1A}$  and  $V_{3A}$ ] are open.)



PACKAGE

(Unit : mm)

24 SSOP (SSOP024-P-0275)

