

## VGA Port Protection with Integrated Sync Buffers

### Features

- 3 channels of ESD protection for RGB output pins meeting IEC-61000-4-2 Level 4 ESD requirements (8kV contact discharge)
- Very low loading capacitance from ESD protection diodes on VIDEO lines, 4pF typical
- 3.3/5V 24mA buffer drivers for HSYNC and VSYNC lines
- VESA Video Signal Standard (VSIS) - Version 1, Rev. 2 Compatible Outputs
- Compact 10-lead MSOP package
- Lead-free version available

### Applications

- VGA and DVI-I ports in:
  - Desktop and Notebook PCs
  - Graphics Cards
  - Set Top Boxes

### Product Description

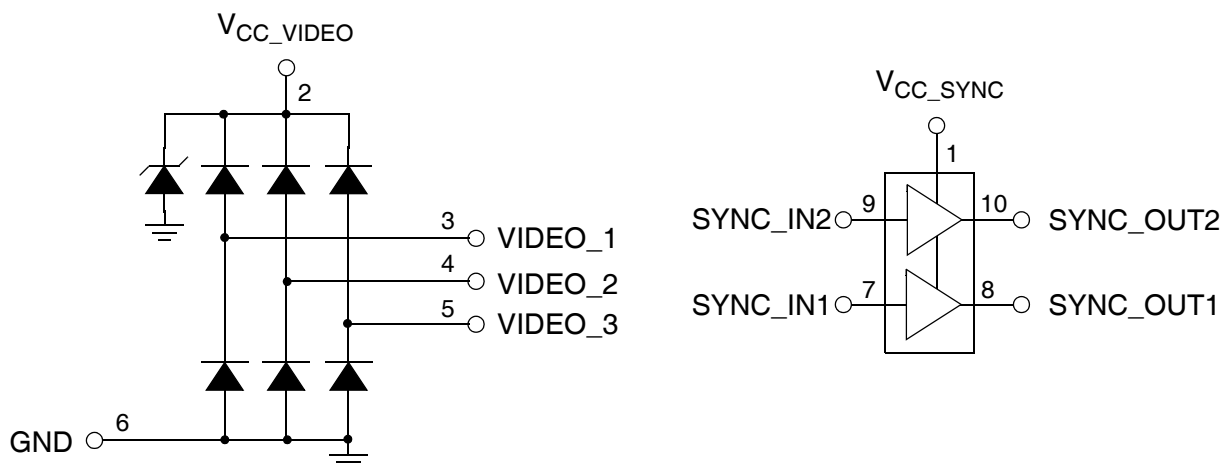
The CM2010 connects between a video graphics controller, embedded in a PC or in a graphics adapter card, and the VGA port connector. The CM2010 integrates ESD protection for 3 VGA output signals implemented with low-capacitance current steering diodes such that an ESD pulse is diverted into either the positive supply rail or ground, where it may be safely dissipated.

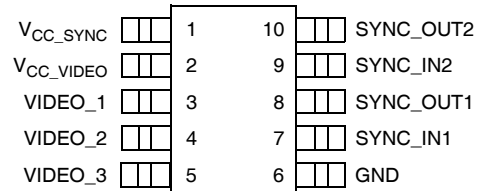
All ESD diodes are designed to safely handle the high current spikes specified by IEC61000-4-2 Level 4 ESD (8kV contact discharge).

Two 24mA non-inverting drivers provide buffering for the HSYNC and VSYNC signals from the video controller IC (SYNC1, SYNC2). These buffers accept low voltage input levels and convert them to CMOS output levels that swing between Ground and  $V_{CC\_SYNC}$ , which is typically 5V for Legacy VESA compatibility, but can be operated at 3.3V. Additionally, the output impedance of the drivers can be discretely adjusted via external series termination resistors ( $R_T$ ) for maximum flexibility. The output impedance of the drivers can be adjusted over a wide range from 15Ω to over 100Ω.

The CM2010 is supplied in a 10-lead MSOP package and is available with optional lead-free finishing.

### Simplified Electrical Schematic



**PACKAGE / PINOUT DIAGRAM**
**TOP VIEW**

**10-PIN MSOP**

Note: This drawing is not to scale.

**Ordering Information**
**PART NUMBERING INFORMATION**

Pins	Package	Standard Finish		Lead-free Finish	
		Ordering Part Number <sup>1</sup>	Part Marking	Ordering Part Number <sup>1</sup>	Part Marking
10	MSOP	CM2010-02MS	2010 02MS	CM2010-02MR	2010 02MR

Note 1: Parts are shipped in Tape &amp; Reel form unless otherwise specified.

**Pin Descriptions**
**PIN DESCRIPTIONS**

LEAD(s)	NAME	DESCRIPTION
1	V <sub>CC_SYNC</sub>	This is an isolated supply input for the SYNC_1 and SYNC_2 level shifters and their associated ESD protection circuits.
2	V <sub>CC_VIDEO</sub>	This is a supply pin specifically for the VIDEO_1, VIDEO_2 and VIDEO_3 ESD protection circuits.
3	VIDEO_1	Video signal ESD protection channel. This pin is typically tied one of the video lines between the VGA controller device and the video connector.
4	VIDEO_2	Video signal ESD protection channel. This pin is typically tied one of the video lines between the VGA controller device and the video connector.
5	VIDEO_3	Video signal ESD protection channel. This pin is typically tied one of the video lines between the VGA controller device and the video connector.
6	GND	Ground reference supply pin.
7	SYNC_IN1	Sync signal buffer input. Connects to the VGA controller side of one of the sync lines.
8	SYNC_OUT1	Sync signal buffer output. Connects to the video connector side of one of the sync lines.
9	SYNC_IN2	Sync signal buffer input. Connects to the VGA controller side of one of the sync lines.
10	SYNC_OUT2	Sync signal buffer output. Connects to the video connector side of one of the sync lines.

## Specifications

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATING	UNITS
$V_{CC\_VIDEO}$ and $V_{CC\_SYNC}$ Supply Voltage Inputs	6.0	V
ESD Clamp Diode Forward DC Current (applies only to SYNC drivers)	8	mA
DC Voltage at any channel Input	[GND - 0.5] to [ $V_{CC}$ + 0.5]	V
Operating Temperature Range	-40 to +85	°C
Storage Temperature Range	-40 to +150	°C

### ELECTRICAL OPERATING CHARACTERISTICS (SEE NOTE 1)

SYM-BOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
$I_{CC}$	$V_{CC}$ Supply Current	$V_{CC\_SYNC} = 5V$ ; SYNC inputs at GND or $V_{CC\_SYNC}$ ; SYNC outputs unloaded			50	$\mu A$
		$V_{CC\_SYNC} = 5V$ ; SYNC inputs at 3.0V; SYNC outputs unloaded			2.0	mA
$V_F$	Diode Forward Voltage	$I_F = 10mA$			1.0	V
$V_{IH}$	Logic High Input Voltage	$V_{CC\_SYNC} = 5.0V$ ; Note 2	1.5			V
$V_{IL}$	Logic Low Input Voltage	$V_{CC\_SYNC} = 5.0V$ ; Note 2			0.5	V
$V_{OH}$	Logic High Output Voltage	$I_{OH} = 8mA$ , $V_{CC\_SYNC} = 3.0V$ ; Note 2	2.0			V
		$I_{OH} = 12mA$ , $V_{CC\_SYNC} = 5.0V$ ; Note 2	2.0			V
		$I_{OH} = 24mA$ , $V_{CC\_SYNC} = 5.0V$ ; Note 2	2.0			V
$V_{OL}$	Logic Low Output Voltage	$I_{OL} = 8mA$ , $V_{CC\_SYNC} = 3.3V$ ; Note 2			0.8	V
		$I_{OL} = 12mA$ , $V_{CC\_SYNC} = 5.0V$ ; Note 2			0.8	V
		$I_{OL} = 24mA$ , $V_{CC\_SYNC} = 5.0V$ ; Note 2			0.8	V
$R_{OUT}$	SYNC Driver Output Resistance	$V_{CC\_SYNC} = 5.0V$ ; SYNC Inputs at GND or 3.0V		15		$\Omega$
$I_{IN}$	Input Current VIDEO Inputs	$V_{CC\_VIDEO} = 5.0V$ ; $V_{IN} = V_{CC\_VIDEO}$ or GND; $T_A = 25^\circ C$			$\pm 1$	$\mu A$
	SYNC_IN1, SYNC_IN2 Inputs	$V_{CC\_SYNC} = 5.0V$ ; $V_{IN} = V_{CC\_SYNC}$ or GND; $T_A = 25^\circ C$			$\pm 1$	$\mu A$
$C_{IN\_VID}$	VIDEO Input Capacitance	$V_{CC\_VIDEO} = 5.0V$ ; $V_{IN} = 2.5V$ ; $f = 1MHz$ ; Note 4			4.0	pF
		$V_{CC\_VIDEO} = 2.5V$ ; $V_{IN} = 1.25V$ ; $f = 1MHz$ ; Note 4			4.5	pF
$t_{PLH}$	SYNC Driver L => H Propagation Delay	$C_L = 10pF$ ; $V_{CC} = 5.0V$ ; Input $t_R$ and $t_F \leq 5ns$			12	ns
$t_{PHL}$	SYNC Driver H => L Propagation Delay	$C_L = 10pF$ ; $V_{CC} = 5.0V$ ; Input $t_R$ and $t_F \leq 5ns$			12	ns
$t_R, t_F$	SYNC Driver Output Rise & Fall Times	$C_L = 10pF$ ; $V_{CC} = 5.0V$ ; Input $t_R$ and $t_F \leq 5ns$ ; Notes 2, 4 & 5			3	ns
$V_{ESD}$	ESD Withstand Voltage	$V_{CC\_VIDEO} = V_{CC\_SYNC} = 5V$ ; Notes 3, 4	$\pm 8$			kV
$V_{CL}$	Clamping Voltage during ESD Discharge MIL-STD-883 (Method 3015), 8kV Positive Transients Negative Transients	Notes 3 and 4				
				+13 -13		V V

Note 1: All parameters specified over standard operating conditions unless otherwise noted.

Note 2: These parameters apply only to the SYNC drivers.

Note 3: Per the IEC-61000-4-2 International ESD Standard, Level 4 contact discharge method. BYP,  $V_{CC}$  must be bypassed to GND via a low impedance ground plane with a 0.22 $\mu F$ , low inductance, chip ceramic capacitor at each supply pin. ESD pulse is applied between the applicable pins and GND. ESD pulses can be positive or negative with respect to GND. Applicable pins are: VIDEO\_1, VIDEO\_2 and VIDEO\_3. All other pins are ESD protected to the industry standard  $\pm 2kV$  Human Body Model (MIL-STD-883, Method 3015).

Note 4: This parameter is guaranteed by design and characterization.

Note 5: Rise and fall times measured between 0.5V and 2.4V.

## Mechanical Details

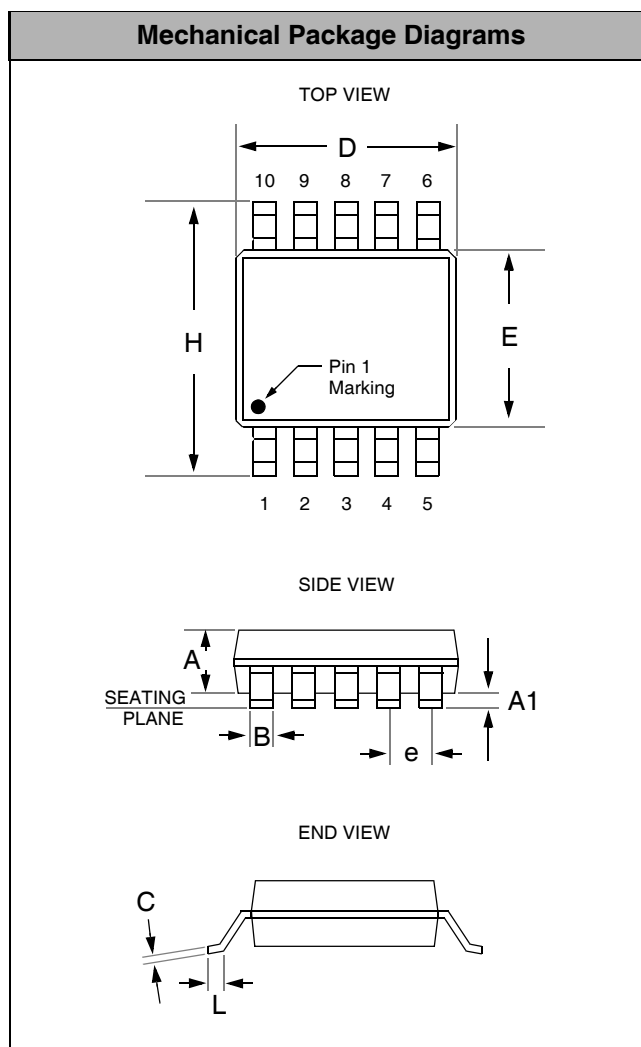
### MSOP Mechanical Specifications:

CM2010 devices are supplied in 10-pin MSOP packages. Dimensions are presented below.

For complete information on the MSOP-10 package, see the California Micro Devices MSOP Package Information document.

PACKAGE DIMENSIONS				
Package	MSOP			
Pins	10			
Dimensions	Millimeters		Inches	
	Min	Max	Min	Max
<b>A</b>	0.75	0.95	0.028	0.038
<b>A1</b>	0.05	0.15	0.002	0.006
<b>B</b>	0.18	0.40	0.006	0.016
<b>C</b>	0.18		0.007	
<b>D</b>	2.90	3.10	0.114	0.122
<b>E</b>	2.90	3.10	0.114	0.122
<b>e</b>	0.50 BSC		0.0196 BSC	
<b>H</b>	4.76	5.00	0.187	0.197
<b>L</b>	0.40	0.70	0.0137	0.029
<b># per tube</b>	80 pieces*			
<b># per tape and reel</b>	4000			
Controlling dimension: inches				

\* This is an approximate number which may vary.



**Package Dimensions for MSOP-10**