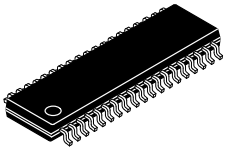
CM2030

HDMI Transmitter Port Protection and Interface Device

ON Semiconductor®

http://onsemi.com



TSSOP 38
TR SUFFIX
CASE 948AG

Product Description

The CM2030 HDMI Transmitter Port Protection and Interface Device is specifically designed for next generation HDMI Host interface protection.

An integrated package provides all ESD, level shifting/isolation, overcurrent output protection and backdrive protection for an HDMI port in a single 38−pin TSSOP package.

The CM2030 also incorporates a silicon overcurrent protection device for +5 V supply voltage output to the connector.

CM2030 is ideal for applications which do not require HDMI certification but can benefit from level shifters and backdrive protection.

Features

- Supports Thin Dielectric and 2−layer Boards
- Minimizes TMDS Skew with 0.05 pF Matching
- Long HDMI Cable Support with Integrated I^2C Accelerator
- Supports Direct Connection to CEC Microcontroller
- Integrated I^2C Level Shifting to CMOS Level Including Low Logic Level Voltages
- Integrated 8 kV ESD Protection and Backdrive Protection on All External I/O Lines
- Multiport I^2C Support Eliminates Need for Analog Mux on DDC Lines
- Simplified Layout with Matched 0.5 mm Trace Spacing
- These Devices are Pb−Free and are RoHS Compliant

Applications

- PC and Consumer Electronics
- Set Top Box, DVD RW, PC, Graphics Cards

MARKING DIAGRAM

CM2030−A0TR

CM2030−A0TR = Specific Device Code

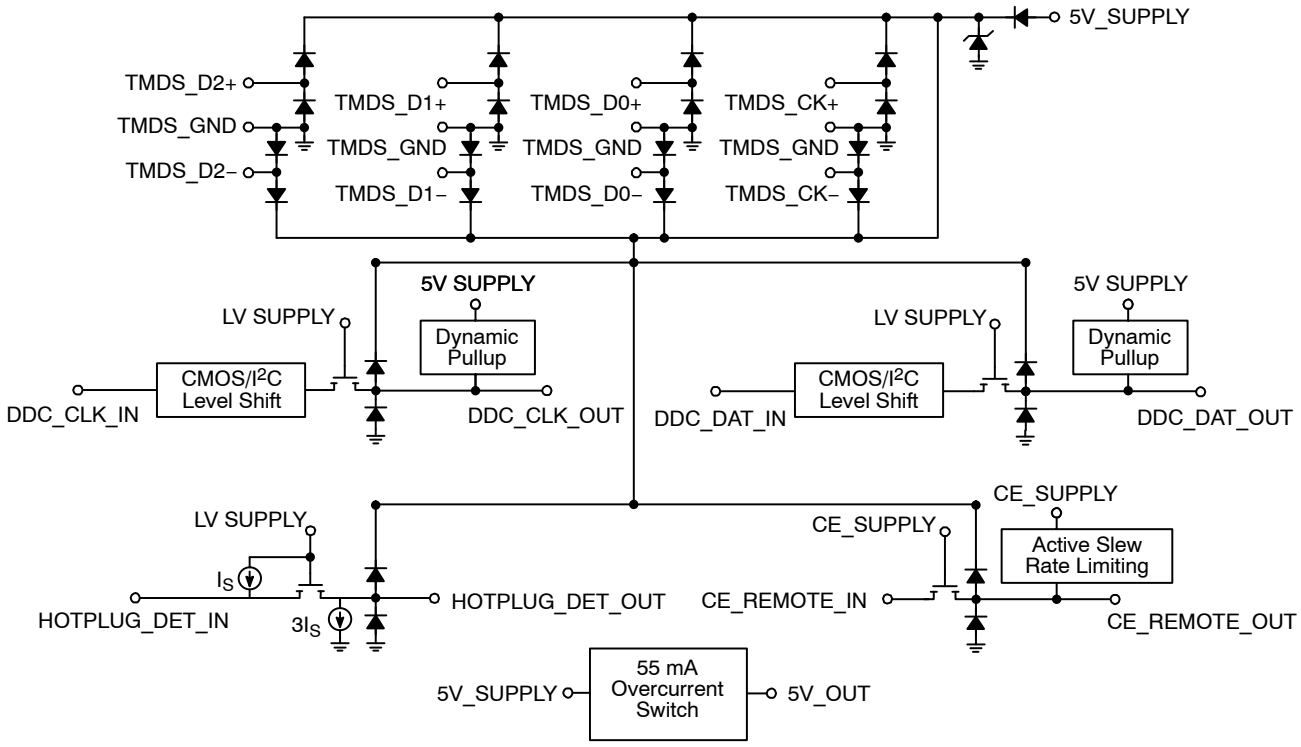
ORDERING INFORMATION

Device	Package	Shipping†
CM2030−A0TR	TSSOP−38 (Pb−Free)	2500/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

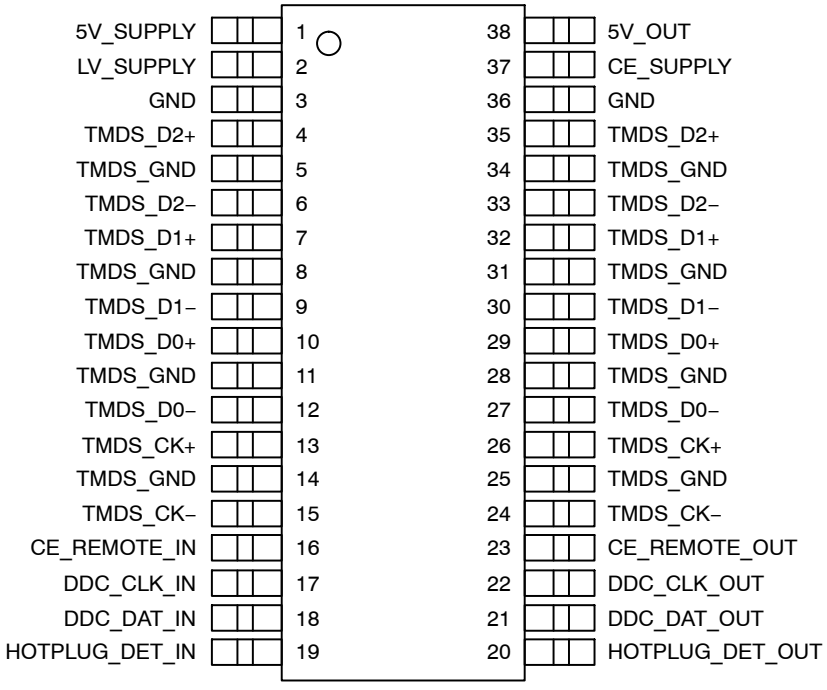
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ELECTRICAL SCHEMATIC



PACKAGE / PINOUT DIAGRAM

Top View



38−Pin TSSOP Package

Table 1. PIN DESCRIPTIONS

Pins	Name	ESD Level	Description
4, 35	TMDS_D2+	8 kV (Note 3)	TMDS 0.9 pF ESD Protection (Note 1)
6, 33	TMDS_D2−	8 kV (Note 3)	TMDS 0.9 pF ESD Protection (Note 1)
7, 32	TMDS_D1+	8 kV (Note 3)	TMDS 0.9 pF ESD Protection (Note 1)
9, 30	TMDS_D1−	8 kV (Note 3)	TMDS 0.9 pF ESD Protection (Note 1)
10, 29	TMDS_D0+	8 kV (Note 3)	TMDS 0.9 pF ESD Protection (Note 1)
12, 27	TMDS_D0−	8 kV (Note 3)	TMDS 0.9 pF ESD Protection (Note 1)
13, 26	TMDS_CK+	8 kV (Note 3)	TMDS 0.9 pF ESD Protection (Note 1)
15, 24	TMDS_CK−	8 kV (Note 3)	TMDS 0.9 pF ESD Protection (Note 1)
16	CE_REMOTE_IN	2 kV (Note 4)	CE_SUPPLY Referenced Logic Level In
23	CE_REMOTE_OUT	8 kV(Note 3)	5V_SUPPLY Referenced Logic Level Out plus 10 pF ESD (Note 6)
17	DDC_CLK_IN	2 kV (Note 4)	LV_SUPPLY Referenced Logic Level In
22	DDC_CLK_OUT	8 kV (Note 3)	5V_SUPPLY Referenced Logic Level Out plus 10 pF ESD (Note 6)
18	DDC_DAT_IN	2 kV (Note 4)	LV_SUPPLY Referenced Logic Level In
21	DDC_DAT_OUT	8 kV (Note 3)	5V_SUPPLY Referenced Logic Level Out plus 10 pF ESD (Note 6)
19	HOTPLUG_DET_IN	2 kV (Note 4)	LV_SUPPLY Referenced Logic Level In
20	HOTPLUG_DET_OUT	8 kV (Note 3)	5V_SUPPLY Referenced Logic Level Out plus 10 pF ESD. A 0.1 μF Bypass Ceramic Capacitor is Recommended on this Pin (Note 2).
2	LV_SUPPLY	2 kV (Note 4)	Bias for CE / DDC / HOTPLUG Level Shifters
37	CE_SUPPLY	2 kV (Notes 2 & 4)	CEC Bias Voltage. Previously CM2020 ESD_BYP Pin.
1	5V_SUPPLY	2 kV (Note 4)	Current Source for 5V_OUT, VREF for DDC I^2C Voltage References, and Bias for 8 kV ESD Pins.
38	5V_OUT	8 kV (Note 3)	55 mA Minimum Overcurrent Protected 5 V Output. This Output Must be Bypassed with a 0.1 μF Ceramic Capacitor.
3, 5, 8, 11, 14, 25, 28, 31, 34, 36	GND / TMDS_GND	N/A	GND Reference

1. These 2 pins need to be connected together in−line on the PCB. See recommended layout diagram.
2. This output can be connected to an external 0.1 μF ceramic capacitor/pads to maintain backward compatibility with the CM2020.
3. Standard IEC 61000−4−2, $C_{DISCHARGE}$ = 150 pF, $R_{DISCHARGE}$ = 330 Ω, 5V_SUPPLY and LV_SUPPLY within recommended operating conditions, GND = 0 V, 5V_OUT (pin 38), and HOTPLUG_DET_OUT (pin 20) each bypassed with a 0.1 μF ceramic capacitor connected to GND.
4. Human Body Model per MIL−STD−883, Method 3015, $C_{DISCHARGE}$ = 100 pF, $R_{DISCHARGE}$ = 1.5 kΩ, 5V_SUPPLY and LV_SUPPLY within recommended operating conditions, GND = 0 V, 5V_OUT (pin 38), and HOTPLUG_DET_OUT (pin 20) each bypassed with a 0.1 μF ceramic capacitor connected to GND.
5. These pins should be routed directly to the associated GND pins on the HDMI connector with single point ground vias at the connector.
6. The slew−rate control and active acceleration circuitry dynamically offsets the system capacitive load on these pins.

BACKDRIVE PROTECTION AND ISOLATION

Backdrive current is defined as the undesirable current flow through an I/O pin when that I/O pin's voltage exceeds the related local supply voltage for that circuitry. This is a potentially common occurrence in multimedia entertainment systems with multiple components and several power plane domains in each system.

For example, if a DVD player is switched off and an HDMI connected TV is powered on, there is a possibility of reverse current flow back into the main power supply rail of the DVD player from pull−ups in the TV. As little as a few milliamps of backdrive current flowing back into the power rail can charge the DVD player's bulk bypass capacitance on the power rail to some intermediate level. If this level rises above the power−on−reset (POR) voltage level of some of the integrated circuits in the DVD player, then these devices may not reset properly when the DVD player is turned back on.

If any SOC devices are incorporated in the design which have built−in level shifter and/or ESD protection structures, there can be a risk of permanent damage due to backdrive. In this case, backdrive current can forward bias the on−chip ESD protection structure. If the current flow is high enough, even as little as a few milliamps, it could destroy one of the SOC chip's internal DRC diodes, as they are not designed for passing DC.

To avoid either of these situations, the CM2030 was designed to block backdrive current, guaranteeing less than 5 μA into any I/O pin when the I/O pin voltage exceeds its related operating CM2030 supply voltage.

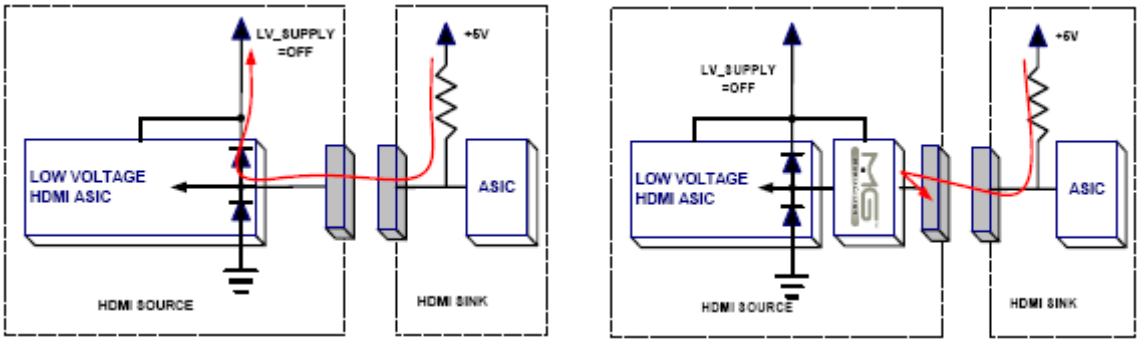


Figure 1. Backdrive Protection Diagram.

DISPLAY DATA CHANNEL (DDC) LINES

The DDC interface is based on the I^2C serial bus protocol for EDID configuration.

Dynamic Pullups

Based on the HDMI specification, the maximum capacitance of the DDC line can approach 800 pF (50 pF from source, 50 pF from sink, and 700 pF from cable). At the upper range of capacitance values (i.e. long cables), it becomes impossible for the DDC lines to meet the I^2C timing specifications with the minimum pull−up resistor of 1.5 kΩ.

For this reason, the CM2030 was designed with an internal I^2C accelerator to meet the AC timing specification even with very long and non−compliant cables.

The internal accelerator increases the positive slew rate of the DDC_CLK_OUT and DDC_DAT_OUT lines whenever the sensed voltage level exceeds 0.3*5V_SUPPLY (approximately 1.5 V). This provides faster overall risetime in heavily loaded situations without overloading the multi−drop open drain I^2C outputs elsewhere.

Figure 2 demonstrates the "worst case" operation of the dynamic CM2030 DDC level shifting circuitry (bottom) against a discrete NFET common−gate level shifter circuit with a typical 1.5 kW pullup at the source (top.) Both are shown driving an off−spec, but unfortunately readily available 31 m HDMI cable which exceeds the 700 pF HDMI specification. Some widely available HDMI cables have been measured at *over 4 nF.*

When the standard I/OD cell releases the NFET discrete shifter, the risetime is limited by the pullup and the parasitics of the cable, source and sink. For long cables, this can extend the risetime and reduce the margin for reading a valid "high" level on the data line. In this case, an HDMI source may not be able to read uncorrupted data and will not be able to initiate a link.

With the CM2030's dynamic pullups, when the ASIC driver releases its DDC line and the "OUT" line reaches at least 0.3*VDD (of 5V_SUPPLY), then the "OUT" active pullups are enabled and the CM2030 takes over driving the cable until the "OUT" voltage approaches the 5V_SUPPLY rail.

The internal pass element and the dynamic pullups also work together to damp reflections on the longer cables and keep them from glitching the local ASIC.

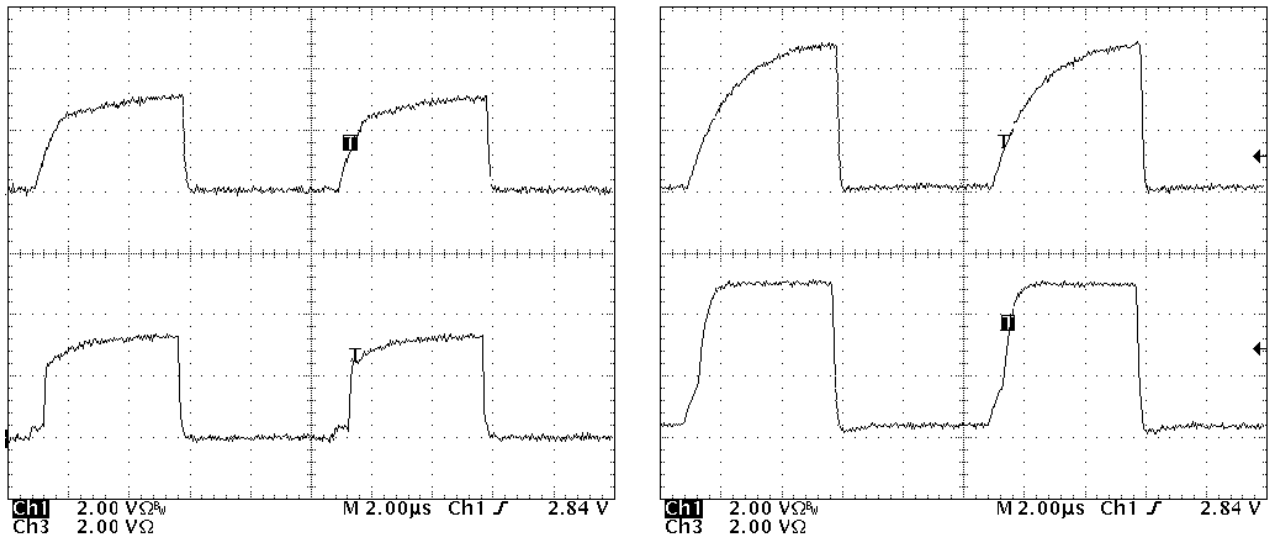


Figure 2. Dynamic DDC Pullups
(Discrete − Top, CM2030 − Bottom; 3.3 V ASIC − Left, 5 V Cable − Right)

I²C Low Level Shifting

In addition to the Dynamic Pullups described in the previous section, the CM2030 also incorporates improved I²C low−level shifting on the DDC_CLK_IN and DDC_DAT_IN lines for enhanced compatibility.

Typical discrete NFET level shifters can advertise specifications for low R_{DS}[on], but usually state relatively high $V_{[GS]}$ test parameters, requiring a 'switch' signal (gate voltage) as high as 10 V or more. At a sink current of 4 mA for the ASIC on DDC_XX_IN, the CM2030 guarantees no more than 140 mV increase to DDC_XX_OUT, even with a switching control of 2.5 V on LV_SUPPLY.

When I²C devices are driving the external cable, an internal pulldown on DDC_XX_IN guarantees that the VOL seen by the ASIC on DDC_XX_IN is equal to or lower than DDC_XX_OUT.

Multiport DDC Multiplexing

By switching LV_SUPPLY, the DDC/HPD blocks can be independently disabled by engaging their inherent "backdrive" protection. This allows N:1 multiplexing of the low−speed HDMI signals without any additional FET switches.

CONSUMER ELECTRONICS CONTROL (CEC)

The Consumer Electronics Control (CEC) line is a high level command and control protocol, based on a single wire multidrop open drain communication bus running at approximately 1 kHz (See Figure 3). While the HDMI link provides only a single point−to−point connection, up to ten (10) CEC devices may reside on the bus, and they may be daisy chained out through other physical connectors including other HDMI ports or other dedicated CEC links. The high level protocol of CEC can be implemented in a simple microcontroller or other interface with any I/OD (input/open−drain) GPIO.

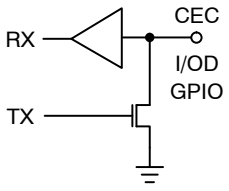


Figure 3. Typical µC I/OD Driver

To limit possible EMI and ringing in this potentially complex connection topology, the rise− and fall−time of this line are limited by the specification. However, meeting the slew−rate limiting requirements with additional discrete circuitry in this bi−directional block is not trivial without an additional RX/TX control line to limit the output slew−rate without affecting the input sensing (See Figure 4).

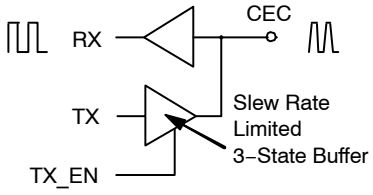


Figure 4. Three−Pin External Buffer Control

Simple CMOS buffers cannot be used in this application since the load can vary so much (total pullup of 27 kW to less

than 2 kW, and up to 7.3 nF total capacitance.) The CM2030 targets an output drive slew−rate of less than 100 mV/ms regardless of static load for the CEC line. Additionally, the same internal circuitry will perform active termination, thus reducing ringing and overshoot in entertainment systems connected to legacy or poorly designed CEC nodes.

The CM2030's bi−directional slew rate limiting is integrated into the CEC level−shifter functionality thus allowing the designer to directly interface a simple low voltage CMOS GPIO directly to the CEC bus and simultaneously guarantee meeting all CEC output logic levels and HDMI slew−rate and isolation specifications (See Figure 5).

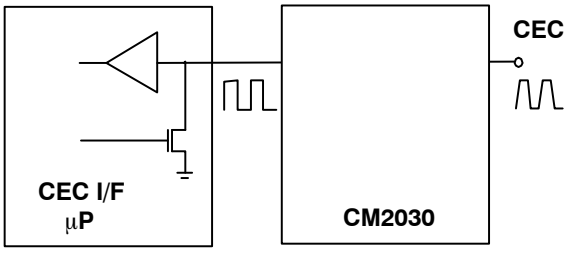


Figure 5. Integrated CM2030 Solution

The CM2030 also includes an internal backdrive protected static pullup 120 μA current source from the CE_SUPPLY rail in addition to the dynamic slew rate control circuitry.

Figure 6 shows a typical shaped CM2030 CEC output (bottom) against a ringing uncontrolled discrete solution (top).

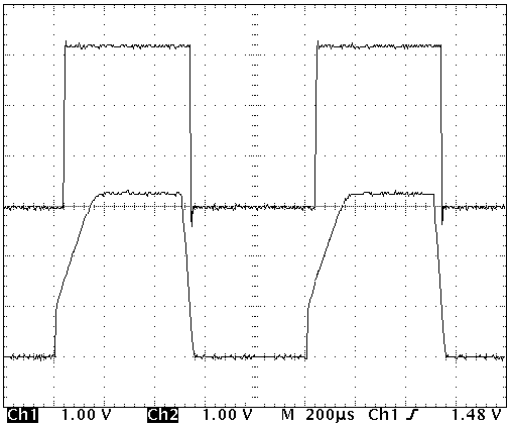


Figure 6. CM2030 CEC Output

HDMI certification requires capacitance measurement of the CEC line to be less than 150 pF per device. Due to the active circuit inside the CM2030 CEC line, CM2030 may cause false readings during the CEC capacitance measurement and not pass the test. The active circuit of the CM2030 CEC line would react with the LCR meter and cause false capacitance readings. There is no issue with the operation of the CM2030 CEC line during normal operations. In fact, CM2030 CEC has shown to improve the signal integrity of the CEC line. CM2030 can be used for applications which do not require HDMI certification or applications which do not use the CEC line.

HOTPLUG DETECT LOGIC

The CM2030 ensures that the local ASIC will properly detect an HDMI compliant Sink. The current sink maintains a local logic "low" when no system is connected.

A valid pullup on the HDMI connector pin will overdrive the internal pulldown and deliver a logic "high" to the local ASIC.

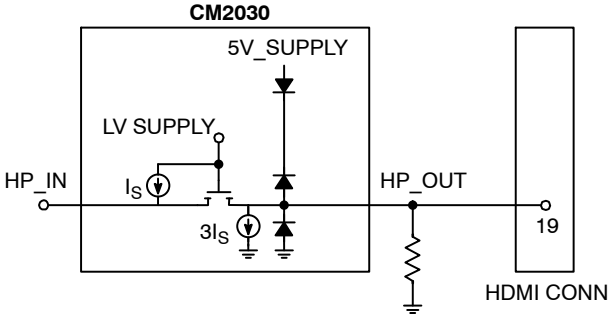


Figure 7. Hotplug Detect Circuit

A 15 KΩ pull down resistor should be connected between HP_OUT and ground as required by HDMI specification. There should be no pull up on the HP_IN, ASIC side of CM2030.

SPECIFICATIONS

Table 2. ABSOLUTE MAXIMUM RATINGS

Parameter	Rating	Units
V_{CC5}, V_{CCLV}	6.0	V
DC Voltage at any Channel Input	[GND − 0.5] to [VCC + 0.5]	V
Storage Temperature Range	−65 to +150	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Table 3. STANDARD (RECOMMENDED) OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Units
5V_SUPPLY	Operating Supply Voltage	–	5	5.5	V
LV_SUPPLY	Bias Supply Voltage	1.0	3.3	5.5	V
CE_SUPPLY	Bias Supply Voltage	3.0	3.3	3.6	V
–	Operating Temperature Range	−40	–	85	°C

Table 4. ELECTRICAL OPERATING CHARACTERISTICS (Note 7)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I_{CC5}	Operating Supply Current	5V_SUPPLY = 5.0 V, CEC_OUT = 3.3 V, LV_SUPPLY = 3.3 V, CE_SUPPLY = 3.3 V, DDC = 5 V (Note 12)		300	350	μA
I_{CCLV}	Bias Supply Current	LV_SUPPLY = 3.3 V (Note 12)		60	150	μA
I_{CCCE}	Bias Supply Current	CE_SUPPLY = 3.3 V, CEC_OUT = 0 V (Notes 12 and 13)		60	150	μA
I_{CEC}	Current Source on CEC Pin	CE_SUPPLY = 3.3 V,	111	120	128	mA
V_{DROP}	5V_OUT Overcurrent Out Put Drop	5V_SUPPLY = 5.0 V, I_{OUT} = 55 mA		65	100	mV
I_{SC}	5V_OUT Short Circuit Cur Rent Limit	5V_SUPPLY = 5.0 V, 5V_OUT = GND	90	135	175	mA
I_{OFF}	OFF State Leakage Current, Level Shifting NFET	LV_SUPPLY = 0 V		0.1	5	μA
$I_{BACKDRIVE}$, CEC	Current Through CE−REMOTE_OUT when Powered Down	CE−REMOTE_IN = CE_SUPPLY < CE_REMOTE_OUT		0.1	1.8	μA
$I_{BACKDRIVE}$, TMDS	Current Through TMDS Pins when Powered Down	All Supplies = 0 V, TMDS_[2:0]+/, TMDS_CK+/ = 4 V		0.1	5	μA
$I_{BACKDRIVE}$, 5V_OUT	Current Through 5V_OUT when Powered Down	All Supplies = 0 V, 5V_OUT_PIN = 5 V		0.1	5	μA
$I_{BACKDRIVE}$, DDC	Current Through DDC_DAT/CLK_OUT when Powered Down	All Supplies = 0 V, DDC_DAT/CLK_OUT = 5 V, DDC_DAT/CLK_IN = 0 V		0.1	5	μA
$I_{BACKDRIVE}$, HOTPLUG	Current Through HOTPLUG_DET_OUT when Powered Down	All Supplies = 0 V, HOTPLUG_DET_OUT = 5 V, HOTPLUG_IN = 0 V		0.1	5	μA
CEC_{SL}	CEC Slew Limit	Measured from 10−90% or 90−10%		0.26	0.65	V/μs

7. Operating Characteristics are over Standard Operating Conditions unless otherwise specified.
8. Standard IEC61000−4−2, $C_{DISCHARGE}$ = 150 pF, $R_{DISCHARGE}$ = 330 Ω, 5V_SUPPLY = 5 V, 3.3V_SUPPLY = 3.3 V, LV_SUPPLY = 3.3 V, GND = 0 V.
9. Human Body Model per MIL−STD−883, Method 3015, $C_{DISCHARGE}$ = 100 pF, $R_{DISCHARGE}$ = 1.5 kΩ, 5V_SUPPLY = 5V, 3.3V_SUPPLY = 3.3 V, LV_SUPPLY = 3.3 V, GND = 0 V.
10. Intra−pair matching, each TMDS pair (i.e. D+, D−)
11. These measurements performed with no external capacitor on V_P (V_P floating)
12. These static measurements do not include AC activity on controlled I/O lines.
13. This measurement does not inclue supply current for the 120 μA current source on the CEC pin.

Table 4. ELECTRICAL OPERATING CHARACTERISTICS (Note 7)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
CEC_{RT}	CEC Rise Time	Measured from 10−90% Assumes a signal swing from 0−3.3 V	26.4		250	μs
CEC_{FT}	CEC Fall Time	Measured from 90−10% Assumes a signal swing from 0−3.3 V	4		50	μs
VACC	Turn On Threshold of I^2C / DDC Accelerator	Voltage is 0.3 ±10% X 5 V_Supply (Note 8)	1.35	1.5	1.65	V
$V_{ON(DDC_OUT)}$	Voltage Drop across DDC Level Shifter	LV_SUPPLY = 3.3 V, 3 mA Sink at DDCIN, DDCOUT < VACC		150	225	mV
$V_{OL(DDC_IN)}$	Logic Level (ASIC side) when I^2C / DDC Logic Low Applied (I^2C Pass−through Compatibility)	DDC_OUT = 0.4 V, LV_SUPPLY = 3.3 V, 1.5 kΩ pullup on DDC_OUT to 5.0 V (Note 8)		0.3	0.4	V
$tr_{(DDC)}$	DDC_OUT Line Risetime, VACC < VDDC_OUT < (5V_Supply − 0.5 V)	DDC_IN floating, LV_SUPPLY = 3.3 V, 1.5 kΩ pullup on DDC_OUT to 5.0 V, Bus Capacitance = 1500 pF			1	μs
V_F	Diode Forward Voltage Top Diode Bottom Diode	IF = 8 mA, T_A = 25°C	 0.6 0.6	 0.85 0.85	 0.95 0.95	V
V_{ESD}	ESD Withstand Voltage (IEC)	Pins 4, 7, 10, 13, 20, 21, 22, 23, 24, 27, 30, 33, T_A = 25°C (Note 8)	±8			kV
V_{ESD}	ESD Withstand Voltage (HBM)	Pins 1, 2, 16, 17, 18, 19, 37, 38, T_A = 25°C	±2			kV
V_{CL}	Channel Clamp Voltage Positive Transients Negative Transients	T_A = 25°C, I_{PP} = 1 A, t_P = 8/20 μS (Note 11)		 11.0 2.0		V
R_{DYN}	Dynamic Resistance Positive Transients Negative Transients	T_A = 25°C, I_{PP} = 1 A, t_P = 8/20 μS Any I/O pin to Ground (Note 11)		 1.4 0.9		Ω
I_{LEAK}	TMDS Channel Leakage Current	T_A = 25°C		0.01	1	μA
C_{IN}, TMDS	TMDS Channel Input Capacitance	5V_SUPPLY = 5.0 V, Measured at 1 MHz, V_{BIAS} = 2.5 V		0.9	1.2	pF
ΔC_{IN}, TMDS	TMDS Channel Input Capacitance Matching	5V_SUPPLY = 5.0 V, Measured at 1 MHz, V_{BIAS} = 2.5 V (Note 10)		0.05		pF
C_{MUTUAL}	Mutual Capacitance between Signal Pin and Adja Cent Signal Pin	5V_SUPPLY = 0 V, Measured at 1 MHz, V_{BIAS} = 2.5 V		0.07		pF
C_{IN}, DDCOUT	Level Shifting Input Capacitance, Capacitance to GND	5V_SUPPLY = 0 V, Measured at 100 kHz, V_{BIAS} = 2.5 V		10		pF
C_{IN}, CECOUT	Level Shifting Input Capacitance, Capacitance to GND	5V_SUPPLY = 0 V, Measured at 100 kHz, V_{BIAS} = 1.65 V		10		pF
C_{IN}, HPOUT	Level Shifting Input Capacitance, Capacitance to GND	5V_SUPPLY = 0 V, Measured at 100 kHz, V_{BIAS} = 2.5 V		10		pF

7. Operating Characteristics are over Standard Operating Conditions unless otherwise specified.
8. Standard IEC61000−4−2, $C_{DISCHARGE}$ = 150 pF, $R_{DISCHARGE}$ = 330 Ω, 5V_SUPPLY = 5 V, 3.3V_SUPPLY = 3.3 V, LV_SUPPLY = 3.3 V, GND = 0 V.
9. Human Body Model per MIL−STD−883, Method 3015, $C_{DISCHARGE}$ = 100 pF, $R_{DISCHARGE}$ = 1.5 kΩ, 5V_SUPPLY = 5V, 3.3V_SUPPLY = 3.3 V, LV_SUPPLY = 3.3 V, GND = 0 V.
10. Intra−pair matching, each TMDS pair (i.e. D+, D−)
11. These measurements performed with no external capacitor on V_P (V_P floating)
12. These static measurements do not include AC activity on controlled I/O lines.
13. This measurement does not inclue supply current for the 120 μA current source on the CEC pin.

PERFORMANCE INFORMATION

Typical Filter Performance (T_A = 25°C, DC Bias = 0 V, 50 Ω Environment)

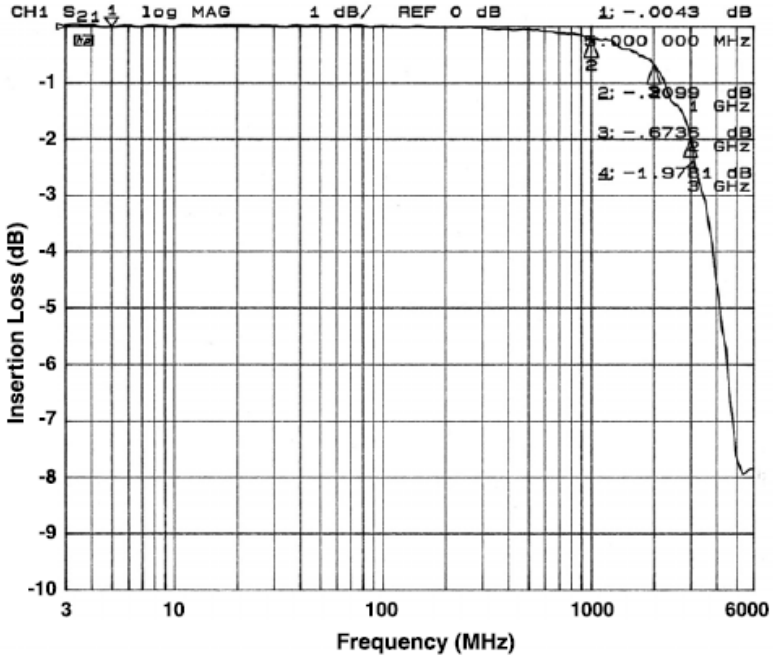


Figure 8. Insertion Loss vs. Frequency (TMDS_D1− to GND)

APPLICATION INFORMATION

Design Considerations

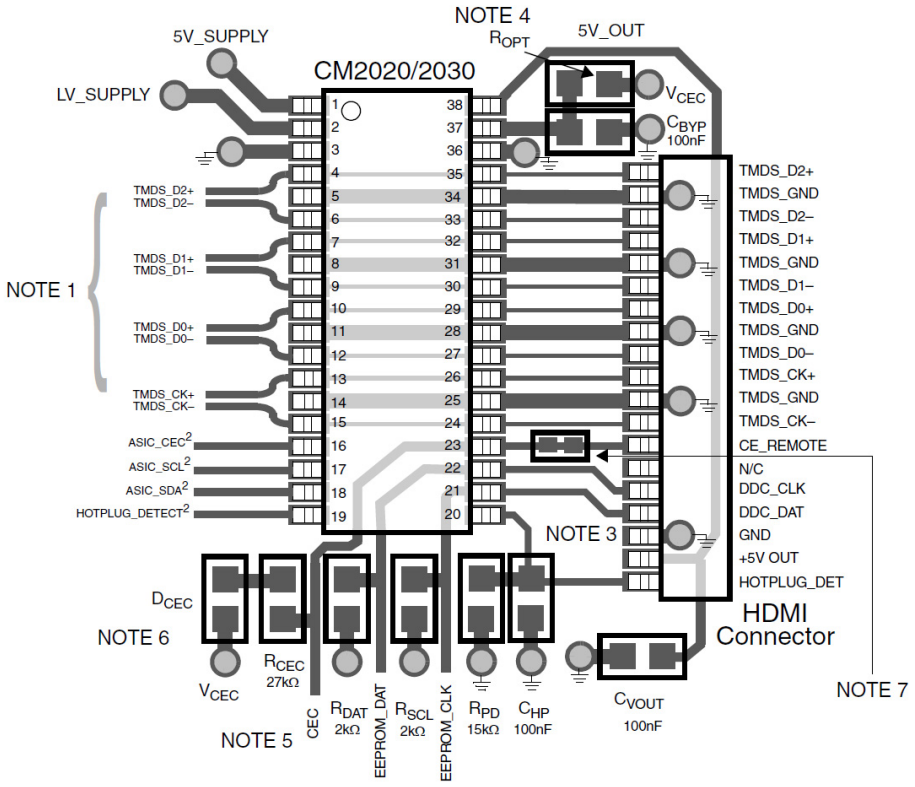
5V_OUT (pin 38)

Maximum overcurrent protection output drop at 55 mA on 5V_OUT is 100 mV. To meet HDMI output requirements of 4.8−5.3 V, an input of greater than 4.9 V should be used (i.e. 5.1 V ±4%)

DUT On vs. DUT Off

Many HDMI CTS tests require a power off condition on the System Under Test. Many discrete ESD diode configurations can be forward biased when their VDD rail is lower than the I/O pin bias, thereby exhibiting extremely high apparent capacitance measurements, for example. The *MediaGuard*™ backdrive isolation circuitry limits this current to less than 5 mA, and will help ensure HDMI compliance.

APPLICATION INFORMATION (Cont'd)



LAYOUT NOTES

1) Differential TMDS Pairs should be designed as normal 100Ω HDMI Microstrip. Single Ended (decoupled) TMDS traces underneath MediaGuard™, and traces between MediaGuard™ and Connector should be tuned to match chip/connector IBIS parasitics.

2) Level Shifter signals should be biased with a weak pullup to the desired local LV_SUPPLY. If the local ASIC includes sufficient pullups to register a logic high, then external pullups may not be needed.

3) Place MediaGuard™ as close to the connector as possible, and as with any controlled impedance line always avoid placing any silk−screen printing over TMDS traces.

4) CM2020/CM2030 footprint compatibility − For the CM2030, Pin 37 becomes the V_{CEC} power supply pin for the slew−rate limiting circuitry. This can be supplied by a 0 Ω jumper to V_{CEC} which should be depopulated to utilize the CM2020. The 100 nF C_{BYP} is recommended for all applications.

5) CEC pullup isolation. The 27k R_{CEC} and a Schottky D_{CEC} provide the necessary isolation for the CEC pullup.

Note: *This circuitry is used only in the CM2020.* Depopulate the components for CM2030 applications in a CM2020/CM2030 dual footprint layout.

6) Footprint compatibility − The CM2030 has (built−in) internal backdrive protection.

The CM2020 does not not have internal backdrive protection and requires the external R_{CEC} and D_{CEC} components.

7) (For CM2030) If CEC firmware *is not* implemented, *do not* populate with 0 Ω resistor. If CEC firmware is implemented, then populate with 0 Ω resistor. (For CM2020) Populate with 0 Ω resistor in either case.

Figure 9. Typical Application for CM2030

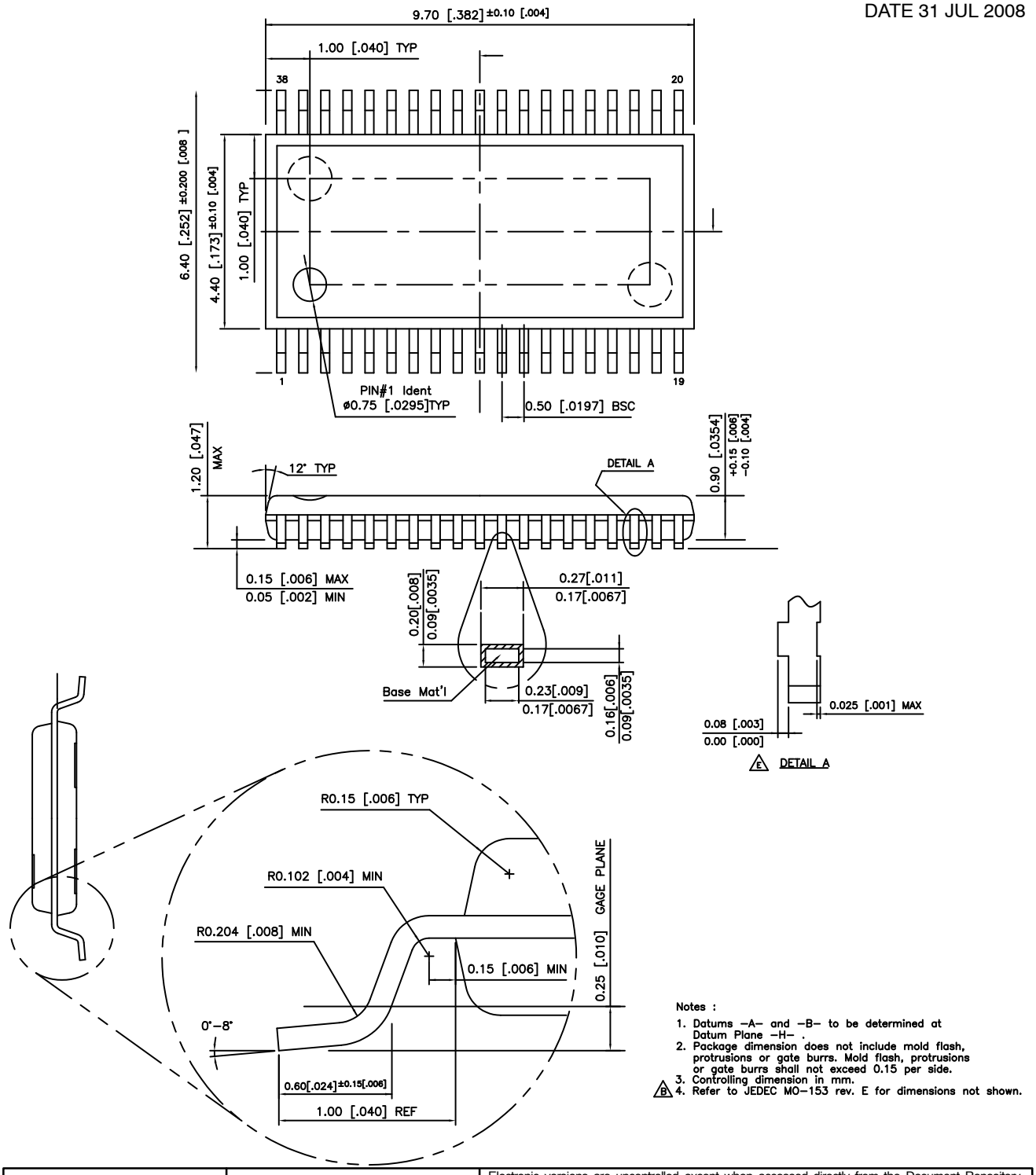
MediaGuard is a trademark of Nagra France.

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

TSSOP 38
CASE 948AG−01
ISSUE O

DATE 31 JUL 2008



Notes :
1. Datums −A− and −B− to be determined at Datum Plane −H− .
2. Package dimension does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.15 per side.
3. Controlling dimension in mm.
B 4. Refer to JEDEC MO−153 rev. E for dimensions not shown.

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DESCRIPTION:	**TSSOP 38**	**PAGE 1 OF 1**

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