亞士晶科技
T-SMARTLINK MICROELECTRONICS

HDMI to VGA Converter with Audio DAC

DESCRIPTION

TS571 is complete and high-performance ASIC for conversion of HDMI/DVI to VGA. It supports 1920x1080 (1080p Full HD) include 720p & 1920x1200.

With embedded Audio DAC, LDO and HDCP engine, the TS571 provides cost effective solution and can be used in compact-designed applications.
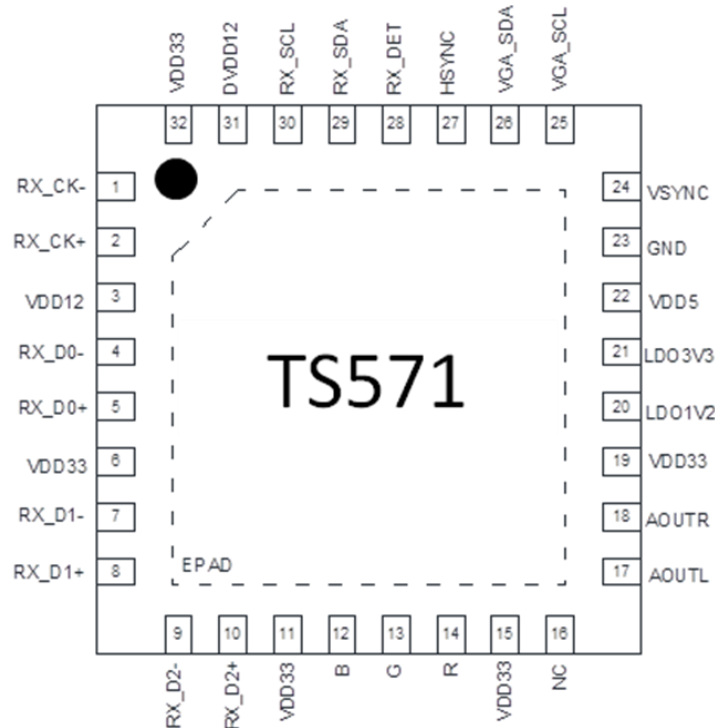
APPLICATION

➢ HDMI TO VGA adapter and cable

PACKAGE

➢ QFN32 (5*5*0.85)

FEATURES

➢ Compliant with HDMI 1.4b specification
➢ Supports up to 1920x1200@60Hz
➢ Embedded audio DAC
➢ On-chip HDCP1.4 Engine
➢ Built-in 3.3V and 1.2V voltage regulators.
➢ Support Hot Plug Detection.
➢ 1.2V Core power and 3.3V I/O power.
➢ ESD protection up to 2KV.
➢ Operating temperature range: 0°C to +85°C

HDMI to VGA Converter with Audio DAC

PIN DESCRIPTION

PIN No.	NAME	DESCRIPTION
1	RX_CK-	HDMI RX clock channel negative input.
2	RX_CK+	HDMI RX clock channel positive input.
3	VDD12	1.2V power input.
4	RX_D0-	HDMI RX channel 0 data input negative.
5	RX_D0+	HDMI RX channel 0 data input positive.
6	VDD33	3.3V power input.
7	RX_D1-	HDMI RX channel 1 data input negative.
8	RX_D1+	HDMI RX channel 1 data input positive.
9	RX_D2-	HDMI RX channel 2 data input negative.
10	RX_D2+	HDMI RX channel 2 data input positive.
11	VDD33	3.3V power input.
12	B	VGA blue channel output.
13	G	VGA green channel output.
14	R	VGA red channel output.
15	VDD33	3.3V power input.
16	NC	Reserved
17	AOUTL	Audio Left Channel Output.
18	AOUTR	Audio Right Channel Output.
19	VDD33	3.3V power input.
20	LDO1V2	Internal 1.2V LDO output.
21	LDO3V3	Internal 3.3V LDO output.
22	VDD5	5V power input.
23	GND	Ground.
24	VSYNC	Vertical sync. Signal. With internal 2.2K ohm pull-up resistor.
25	VGA_SCL	VGA DDC I2C clock. With internal 1.6K ohm pull-up resistor.
26	VGA_SDA	VGA DDC I2C data. With internal 1.6K ohm pull-up resistor.
27	HSYNC	Horizontal sync. Signal. With internal 2.2K ohm pull-up resistor.
28	RX_DET	HDMI hot plug detect output. With internal 1K ohm pull-up resistor.
29	RX_SDA	HDMI DDC I2C data. With internal 47K ohm pull-up resistor.
30	RX_SCL	HDMI DDC I2C clock.

HDMI to VGA Converter with Audio DAC

		With internal 47K ohm pull-up resistor.
31	DVDD12	Core logic power, 1.2V.
32	VDD33	3.3V power input.
EPAD	EPAD	Please connect to ground

HDMI to VGA Converter with Audio DAC

BLOCK DIAGRAM
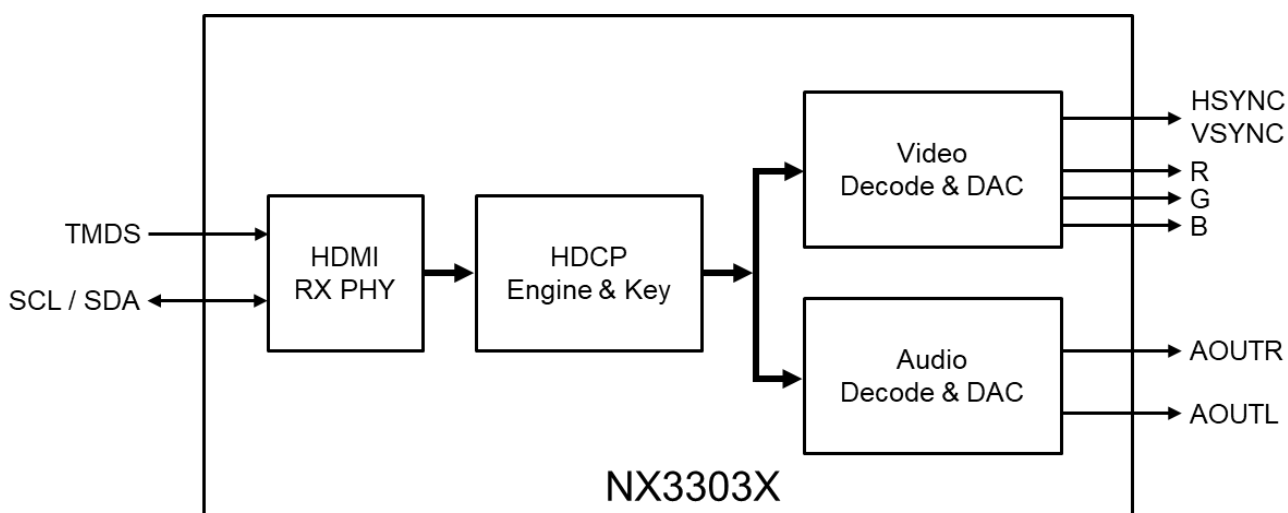
ABSOLUTE MAXIMUM RATING (T$_A$=25°C, unless otherwise specified)

PARAMETER	RATINGS
VDD5	-0.5V to 5.5V
VDD33, DVDD33	-0.5V to 3.63V
VDD12, DVDD12	-0.5V to 1.32V
Junction Temperature	0℃ to 125℃
Storage Temperature	-55℃ to 150℃
Operation Temperature	0℃ to 85℃
ESD HBM	± 2KV

Note: Stress above conditions may cause permanent damage to the device. Functional operation of this device should be restricted to the conditions described.

HDMI to VGA Converter with Audio DAC

ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Recommended Operating Conditions					
5V Power Supply	VDD5	4.5	5.0	5.5	V
3.3V Power Supply	VDD33 / DVDD33	3.0	3.3	3.6	V
1.2V Power Supply	VDD12 / DVDD12	1.1	1.2	1.3	V
Operating temperature range	TOPR	0	-	85	$^\circ$C
5V Supply current (1080P/60Hz)	IVDD5	-	200	-	mA
Digital I/O Characteristics					
High-level Output Voltage	VOH	2.4	-	-	V
Low-level Output Voltage	VOL	-	-	0.4	V
High-level Input Voltage	VIH	2	-	5.5	V
Low-level Input Voltage	VIL	-0.3	-	0.8	V
Input leakage Current	ILI	-	-	±1	µA
VGA DAC Characteristics – Static Performance					
MAX Luminance Voltage (Input Data=FFh)	VMAX	-	708	-	mV
MIN Luminance Voltage (Input Data=00h)	VMIN	-	0	-	mV
Resolution (Each DAC)	BDAC	-	-	8	Bits
Integral Linearity Error	INL	-1	-	1	LSB
Differential Linearity Error	DNL	-0.5	-	0.5	LSB
VGA DAC Characteristics – Analog Output					
Output Current	IDAC	-	18.5	-	mA
Imbalance between DACs	KIMBAL	-2	1.8	2	%
Analog output settling time	TS	-	15	-	ns
Video Channel Rise/Fall Time	TR/F	0.5	1	2	ns
HDMI Receiver AC Characteristics					

HDMI to VGA Converter with Audio DAC

Intra-Pair Differential Input Skew	TDPS	-	-	0.4	Tbit
Channel to Channel Differential Input Skew	TCCS	-	-	1	Tpixel
Differential Input Clock Jitter Tolerance	TIJIT	-	-	0.3	Tbit
TMDS Clock Frequency	FRXC	25	-	200	MHz

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## PCB Layout Guideline

A. Principle of Impedance control

The length of intra-pair should be equal and the pair of trace should be routed closely. Components or Via on differential channel must be placed symmetrically. The distance between two traces of the differential pair must remain constant from beginning to the end. Calculations of differential impedance are necessary for differential signals and traces.

a. HDMI the differential trace impedance: 100 ohm+/-15%
b. Display Port the differential trace impedance: 100 ohm +/-15%
c. USB 2.0 the differential trace impedance: 90 ohm +/-15%
d. USB Type-C the differential trace impedance: 90 ohm +/-15%

B. Symmetry in the Differential Pairs

Route all high-speed differential pairs together symmetrically and parallel to each other. Deviating from this requirement occurs naturally during package escape and when routing to connector pins. These deviations must be as short.
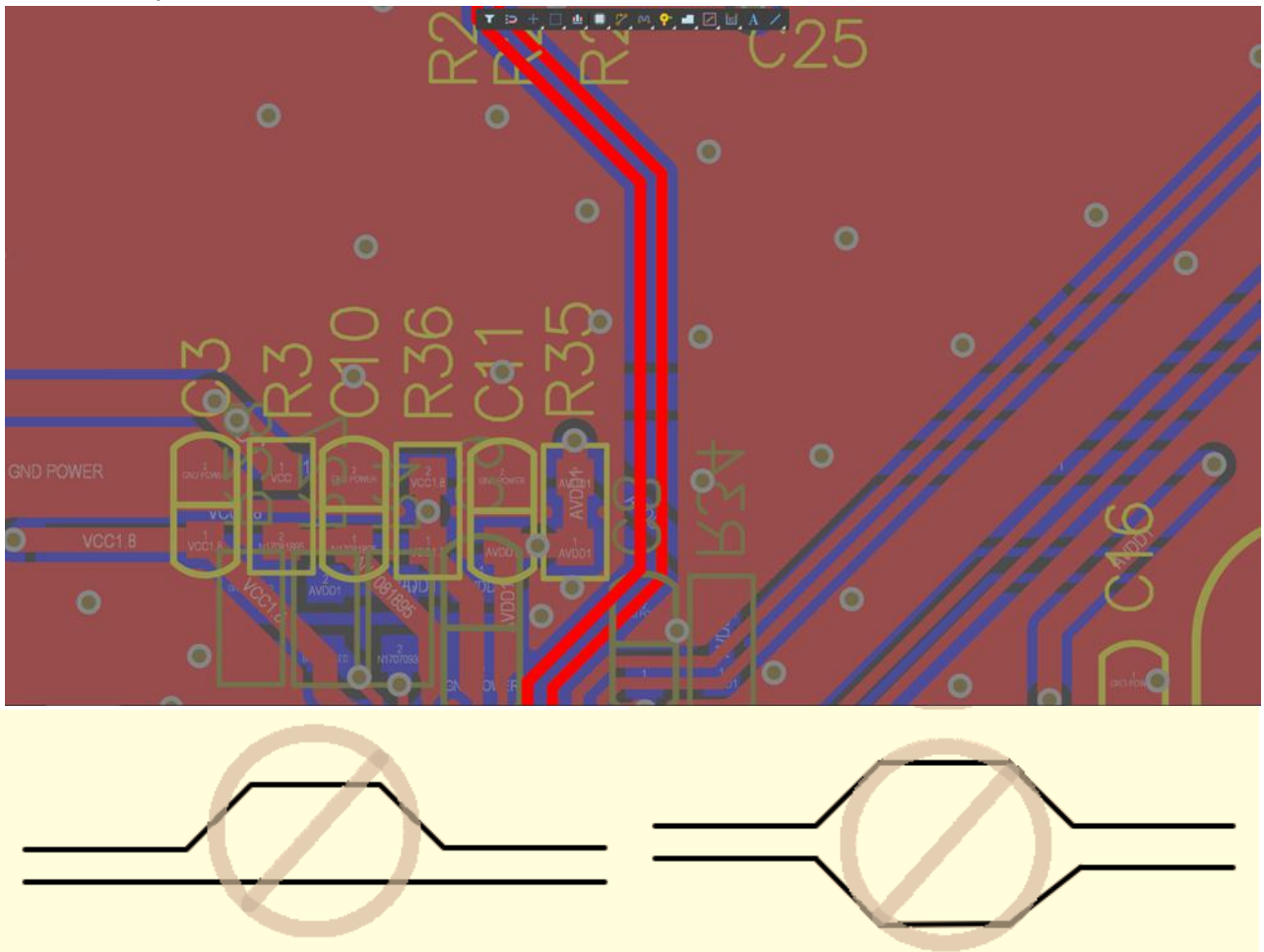
C. Surface-Mount Device Pad Discontinuity Mitigation

Avoid including surface-mount devices (SMDs) on high-speed signal traces because these devices introduce discontinuities that can negatively affect signal quality. When SMDs are required on the signal traces (for example, the USB SuperSpeed transmit AC coupling capacitors) the maximum permitted component size is 0603. It is strongly recommended use 0402 or smaller size. Place these components symmetrically during the layout process to ensure optimum signal quality and to minimize reflection. For examples of correct and incorrect AC coupling capacitor placement.
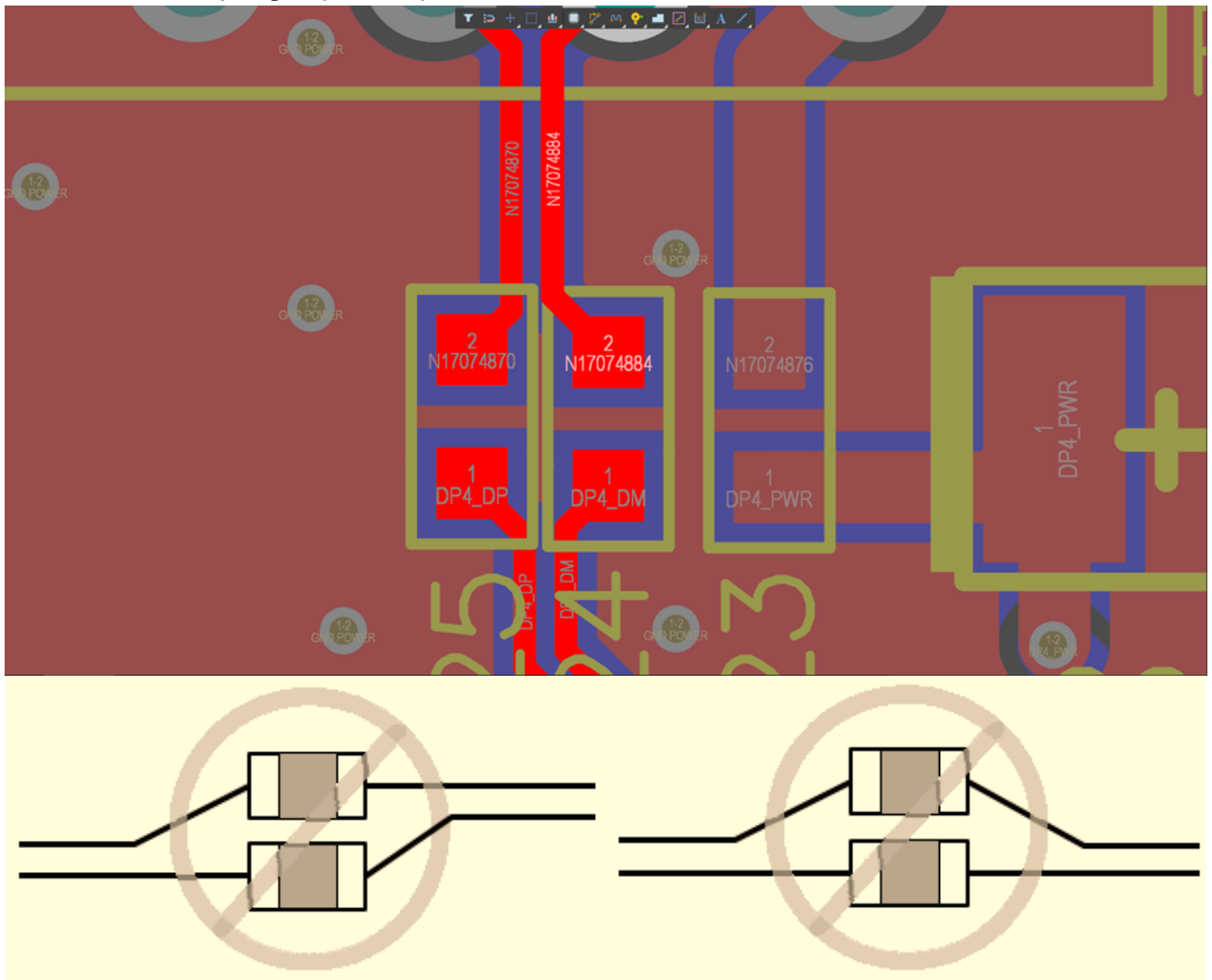
D. Exposed Pad (ePad)

ExposedPad (ePad) is used as electrical ground of the package for applications requiring

optimum thermal performance. Soldering the ePad on to the ground plane of PCB is required to fulfill package power dissipation requirement. A clearance on the PCB between the edge of ePad and the inner edges of lead Pads should be designed at least 0.25 mm to avoid electrical short.
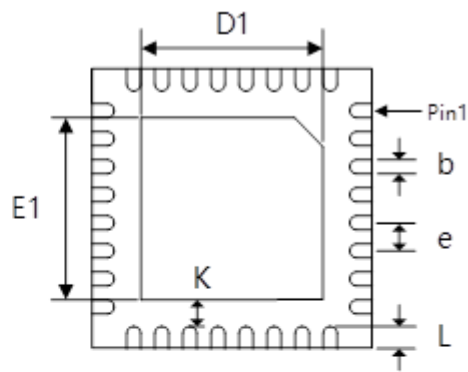
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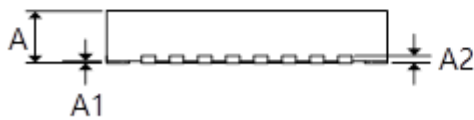
PACKAGE INFORMATION

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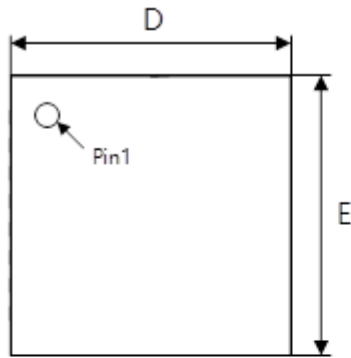
TOP-VIEW

BOTTOM-VIEW

SIDE-VIEW

Symbol	Dimensions In Millimeters		
	Min	Nom	Max
A	0.83	0.85	0.88
A1	0.00	-	0.05
A2	0.203REF		
b	0.23	0.25	0.27
D	4.95	5.00	5.05
D1	3.60	3.65	3.70
E	4.95	5.00	5.05
E1	3.60	3.65	3.70
e	0.48	0.50	0.52
K	0.33REF		
L	0.30	0.35	0.40