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AN-6059SC — FSHDMI08应用指南

FSHDMI08目标应用和开关概要

概要

FSHDMI08是针对单链结数码影像模式所设计，它包括DVI和HDMI。FSHDMI08使用无源设计结构能够处理数据率高达1.65Gbps。它完全与HDMI 1.2a 和 HDMI1.3a需要总的的数据率不高于1.65Gbps的应用相兼容。类似的应用要求720p解像度，在1.3a的规格中使用更高的色深（如16字节）。FSHDMI08在它的上一代产品FSHDMI04的基础上提供了几个改进；其中之一就是合并入四条额外的信号开关，这些开关被设计用来处理DDC信号路由的特殊需要。这些额外的路径消除了对第二个开关的需要。另外，FSHDMI08还允许直通信号的路由和提供数据线(SDA)和时钟线(SCL)内建电压的转换。

关键的开关参数

HDMI和DVI数据率对于未压缩的数字视频的传送相当的高。在单链HDMI连接中，每对TMDS¹传送数据速率高达1.65Gbps，基于高速数据传送协议的设计带来了新的应用挑战。在这种环境里，先前微不足道的寄生电容的值，线载，和信号失配都可能导致误码率的增加，甚至造成传送或接收数据的失败。HDMI和DVI规范在电气特性中几乎没有留给加入的非理想开关器件带来的变化余地。因此，板的布线，ESD的抑制能力和开关的可选择性都必须考虑。以下是在选择一个HDMI开关时的一些关键功能特性。

导通电容与导通电阻

导通电容有效地决定了开关对TMDS数据流的影响。过大的开关电容会导致信号谐波含量的衰减。具体体现在被削的边缘和变慢的上升和下降时间。通道上电容的失配对HDMI和DVI的规范影响很大，它加大了满足延迟规范难度。如当以最高的数据率传送时，即对内时间偏斜不超过 $0.15T_{bit}$ 时，也就是说不大于90ps。HDMI/DVI开关设计师所面对的一个设计问题就是在导通电容和导通电阻之间折衷关系。无可避免，低的导通电容和高的带宽要求提高导通阻抗，这也是HDMI/DVI开关必须被设计在有关应用的根本原因之一。

带宽

第二个极重要的开关特性是带宽。为了以最高的数据率传送数据，HDMI/DVI开关的带宽必须至少为825MHz。这个值由数据传送速度1.65Gbps衍生而来的。考虑到在上升和下降沿触发相位数据，开关在0到825MHz范围内必须不得高于3dB信号流失。如果没有这种性能当开关传送极高的视频输出分辨率时会严重地衰减数据流。这会导致由HDMI和DVI接收器恢复数据失败。

¹如要了解更多的HDMI信号的背景，请参考关于FSHDMI04的应用笔记 <http://www.fairchildsemi.com/an/AN/AN-6015.pdf>.

应用指南

以下部分主要提供在PCB设计中几个主题指南。如需更具体的信息，请联系Fairchild Semiconductor的代表。

使用FSHDMI08来隔离在SDA, SCL和CEC数据线上的电压

HDMI使用的DDC信号线(SDA和SCL)是基于内置集成电路规范。这些信号线和HPD(热插拔信号)被用作内部的源端设备和目标端设备之间的通讯，允许系统到达适当的设备。FSHDMI08可以路由除了TMDS信号以外随同控制线的这三种信号。SDA和SCL信号线使用上拉参考，根据内置集成电路规范漏极开路信号模式能够以高达5V的电压为参考。很多HDMI接收芯片最大的输入信号为3.3V，为了解决潜在的问题。一些设计者依赖加电压转换在SDA和SCL线上来防止HDMI接收器被破坏。FSHDMI08的SDA, SCL, HPD, 和CEC输入天生具有耐电压的能力，这允许这些线被用来隔离开关两边不同的电压，从而消除了对额外元件的需要。为了使用这一特性， V_{DDC} 供电管脚不能大于最大的输入电压。在典型的应用中， V_{DDC} 管脚电压是3.3V，这是起于FSHDMI08自动隔离了5V源端内置集成电路上拉和3.3V目标端内置集成电路上拉。(图例1)。

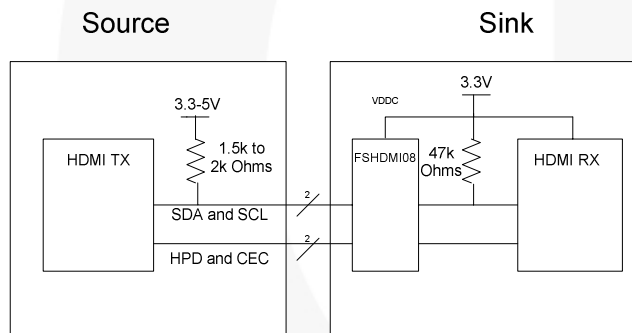


图1：配置FSHDMI08来隔离SDA和SCL的电压

如果要完成这一特性，还需注意当使用这一配置，只有SDA和SCL的输出线由 V_{DDC} 供电电源所控制，HPD和CEC线是有限制的，在最初的HDMI电缆插入期间，当HPD信号检测到来自HDMI电缆的5V供电电源时它会被接收端接受。根据HDMI的1.3a版的规范，HPD输出信号必须坚持在高平值（范围在2.3V-5.5V）。经由

FSHDMI08在HPD和CEC路径上的电压源驱动的信号输出被限制在比选择好的 V_{DDC} 的值小0.7V。针对上述的例子 ($V_{DDC} = 3.3V$)，对于输入电压在2.6V到5.5V范围内的情形合成的输出是2.6V，小于2.6V的输入可以毫无衰减地通过FSHDMI08。CEC输出的最小值被特定为2.5V。基于这种原因，在这种应用中建议 V_{DDC} 最小值为3.3V。为了更大一些的余地，增加 V_{DDC} 的值使它略高于3.3V，这样 $V_{DDC}-0.7V$ 的值小于等于在SDA和SCL上允许的输入电压的最大值。在以上的例子中，可以接受的 V_{DDC} 供电范围是3.3到4.0V。根据上述的参考指南，FSHDMI08能够被用于路由和隔离在SDA和SCL线上的电压同时路由在HPD和CEC线上的电压。

当有源输入存在时断电的应用

当 V_{CC} 不存在时FSHDMI08的TMDS信号线没有过压保护来防止元件被破坏。所以在有信号到FSHDMI08但没有供电电压的应用中，采取预防措施来确保FSHDMI08不被破坏并且没有TMDS的信号经由FSHDMI08传送到其它下游的元件。

避免断电时有源HDMI信号到FSHDMI08的方法是从HDMI电缆给FSHDMI08 V_{CC3} 上电。FSHDMI08的低功率操作就是允许元件从电缆上电。电路图例见2图：

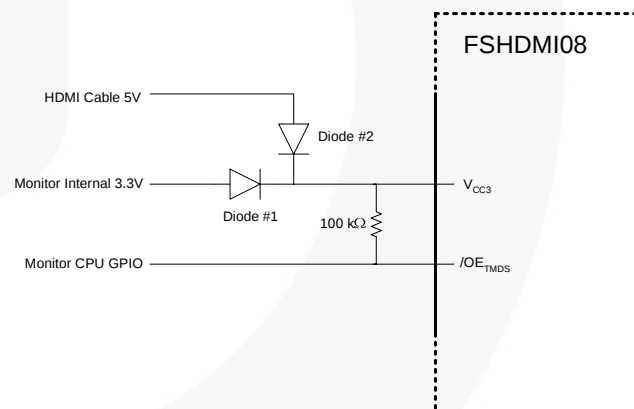


图2：当有源输入存在时断电的应用

在图2中, 来自HDMI电缆的电源为5V。这5V 不能直接供给FSHDMI08的 V_{CC3} 因为FSHDMI08的最大的推荐供电电压 V_{CC3} 是4.3V。为了防止超过最大的推荐值, 一个或更多的二极管被放置在 5V 和 FSHDMI08供电管脚 (图2中二极管#2)。经由二极管下降的电压必须至少1.0V 来保证FSHDMI08的供电低于4.3V。同时在系统3.3V的供电处放置一个二极管 (图2中二极管 #1), 来防止从电缆来的5V电压驱动整个系统供电。对于二极管#1建议使用一个正向电压不超过0.2V的肖特基二极管。这样能够确保供给 V_{CC3} 管脚的电压适合元件操作。二极管#2可以是两个二极管串联。一种可能的解决方案是二极管#2用二个Fairchild1N4148二极管串联(每个下降0.6V, 一共1.2V) 和二极管#1用一个Fairchild MBR0530 二极管(0.2V下降)。注意FSHDMI08静态电流的消耗非常低(<1 μ A), 所以通过二极管的电压降会低于所期望的。

当元件由电缆上电时, 来自电缆的电压可使FSHDMI08的输出使能端处在高平态, 也就是说输出被断开。信号不会传送到断电态下的系统元件, 这由在图2中在元件的电源管脚和TMDS输出使能管脚之间放置一个100-k Ω 的电阻来实现。当系统被上电时, TMDS输出使能管脚必须被拉到低电平, 这由系统的GPIO管脚来实现。当系统被上电和激活时, GPI管脚把TMDS输出拉到低电平。当系统被断电时 TMDS输出使能通过100-k Ω 的电阻被拉到高电平。

ESD保护和FSHDMI08

FSHDMI08通常是在靠近HDMI连接器的信号线上第一个集成电路, 必须提供第一道ESD防御保护。FSHDMI08有非常强的ESD性能并且基于JEDEC JESD22-A114来设计防止人体放电模式ESD, 高达8kV的值通常足以防止系统的ESD问题。对于要求更高ESD保护的设计者 使用专为高速信号设计的超低电容, 具有ESD抑制能力的元件。作为参考点, 这种元件应该使用低于0.8pF电容负载到TMDS信号线来避免导致信号的不完整。

关于Fairchild的ESD测试方法的更多信息, 请参考以下的应用笔记:

<http://www.fairchildsemi.com/an/AN/AN-6019.pdf>.

FSHDMI08布线指南

HDMI应用在每条线上使用高频, 数字数据传输; 电路板的布线是系统成功执行的重要因素。以下电路板的布线指南可以辅助高速电路板的设计。在实时的应用中并没有完美的电路板, 所以在设计中尽可能地遵守建议指南:

- 通过把FSHDMI08尽可能地靠近HDMI接收器来最小化布线长度。尽可能把FSHDMI08和HDMI接收器放在靠近HDMI连接器的地方。
- 对于TMDS对(TMDS0, TMDS1, TMDS2)使用紧密的耦合的100-Ohm差分可控阻抗的布线或者是松散的耦合的可控阻抗的单终结布线。
- 在FSHDMI08 TMDS 信号线上最小化过孔的使用率。仅在必须连接HDMI连接器或HDMI接收器芯片时使用过孔。
- 校验所有的TMDS对的线长的一致来最小化对内偏移 (在TMDS+, TMDS-之间的差小于250mil)
- 使所有的TMDS 对 TMDS0, TMDS1, TMDS2 的线一致保持在30mils来最小化对间偏斜。
- 在相邻的, 紧密耦合差分对或松散耦合50-Ohm线之间保持个体空间至少三倍于介电高度。如果可能的话, 在同一层放置一条地平线在平行的差分对之间。
- 对于所有的TMDS信号线使用单一的, 共享的, 统一的地平面。
- 从TMDS信号线中隔离出任何高频数据线来避免交叉耦合(至少3倍于介电高度间距)。
- 放置一个0.1 μ F旁路电容尽可能地靠近FSHDMI08的 V_{CC} 管脚。因为FSHDMI08是无源器件在稳态操作下使用小于1 μ A 的电流。一个单一的旁路电路是足够的。
- **可选性:** 在高速电路板布线专家中有一些争论关于是否避免90度的角来减少信号的反射和偏斜。一些文章建议这并不影响信号的完整性。但还是建议预防环绕信号角的是使用。

Fairchild 有为三种封装所准备的布线示范并且Gerber 文件根据要求提供了辅助电路板的设计和布线。联系你的Fairchild代表来要求这些文件的副本或演示板。以下是图例和FSHDMI08应用板的Gerber文件。

布线图例

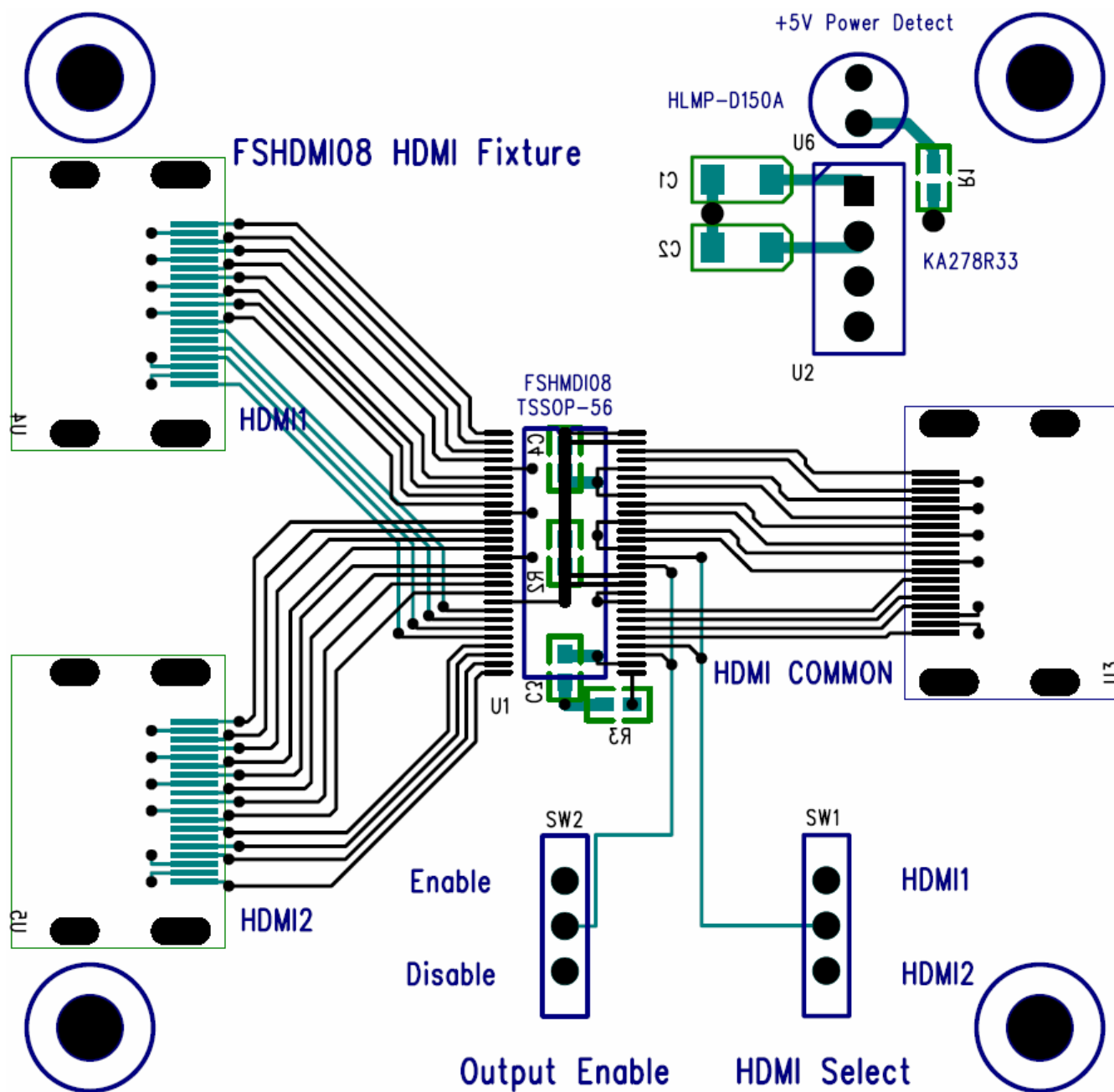


图3: FSHDMI08 布线图例- 评估板

图例

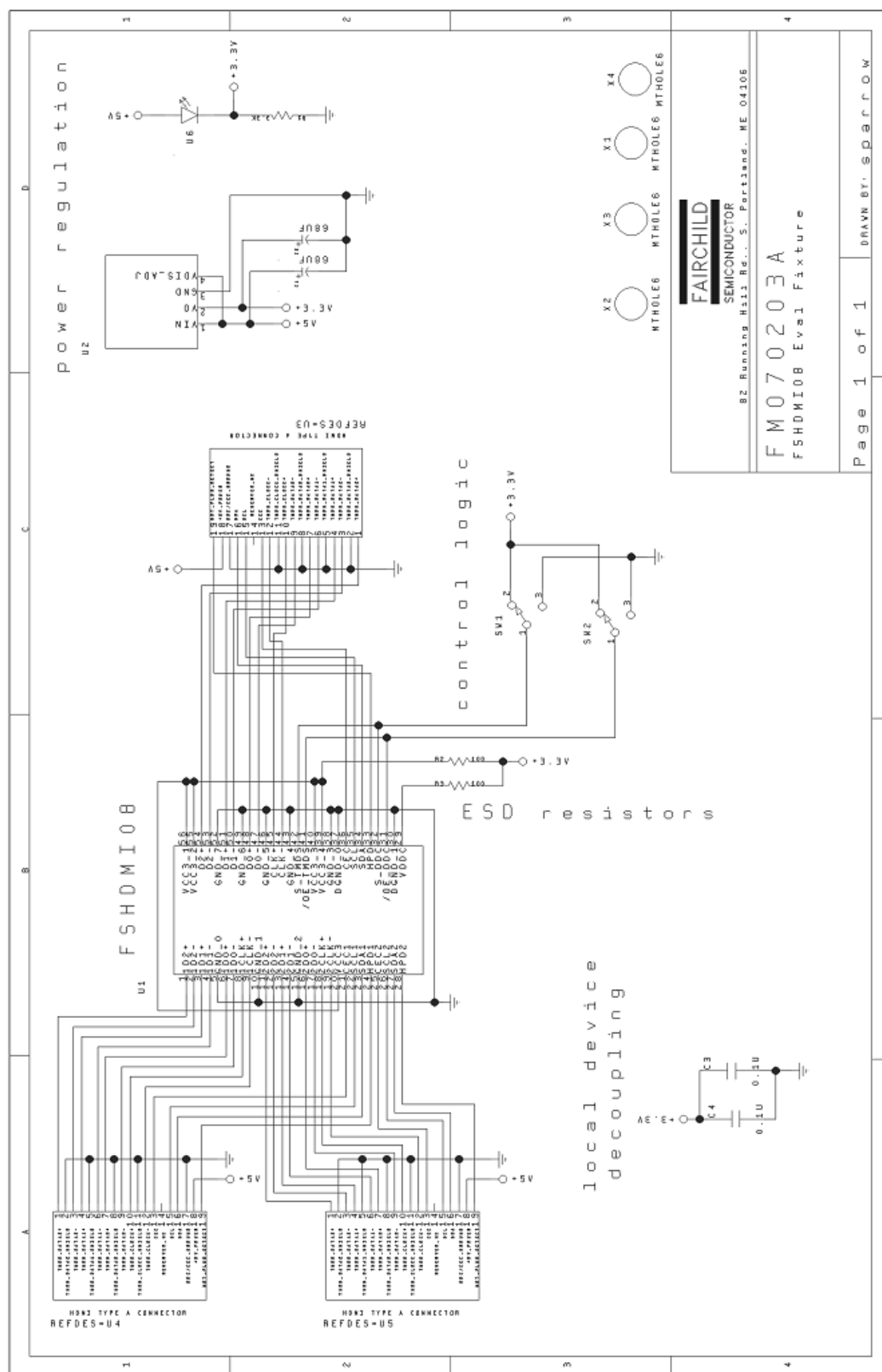


图4: FSHDMI08 图例-评估板

相关链接

AN-6015 — FSHDMI04 Applications Guide

<http://www.fairchildsemi.com/an/AN/AN-6015.pdf>

AN-6019 — Fairchild Analog Switch Products ESD Test Methodology Overview

<http://www.fairchildsemi.com/an/AN/AN-6019.pdf>

The I²C-BUS Specification, Version 2.1, January 2000

http://www.nxp.com/acrobat_download/literature/9398/39340011.pdf

THE “I²C Specification” and Information Page

http://www.nxp.com/news/backgrounders/bg_esc9727/index.html

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