SGM4561
HDMI Interface Load Switch and Logic Level Translator

GENERAL DESCRIPTION

The SGM4561 provides the load switch and signal level shifting needed for HDMI interface. The part meets all type approval requirements of logical level shifting for HDMI interface and contains a 5.0V load switch to protect hot-insertion of HDMI interface. The load switch can support 200mA of load current.

Internal level translators allow controllers operating with supplies as low as 1.6V to translate 1.8V or 2.8V or 3.3V logical level to 5.0V logical level used by HDMI interface. The SGM4561 has a low operating current of typically 100μA.

The SGM4561 is available in the Green MSOP-10 package. It operates over an ambient temperature range of -40℃ to +85℃.

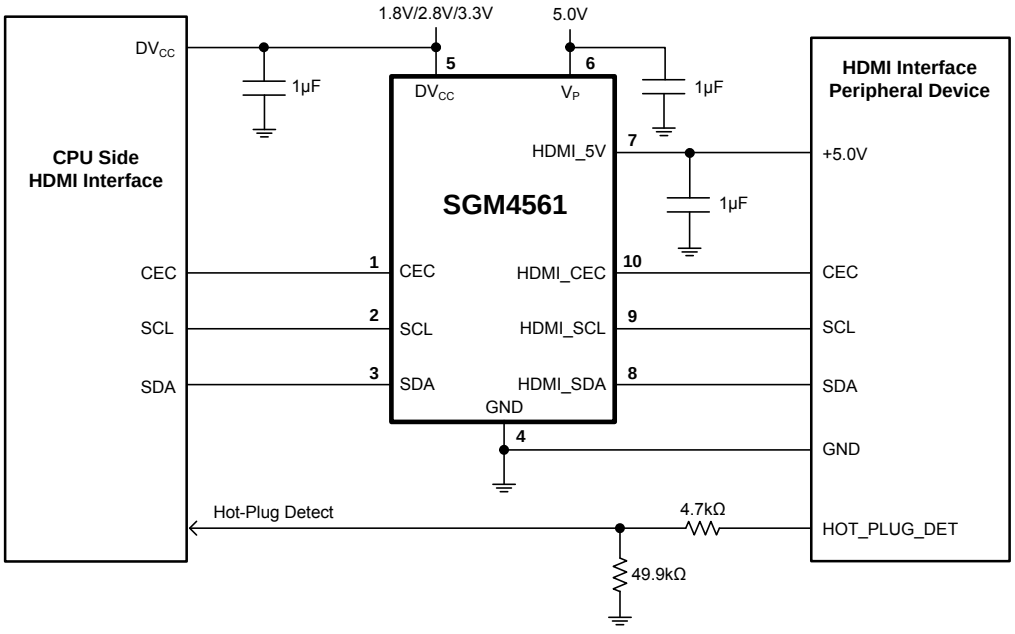
FEATURES

- **HDMI Interface Load Switch: 5.0V at 200mA**
- **5.0V to 5.5V Input Voltage Range for Load Switch**
- **1.6V to 5.5V Controller Side Logical Level Voltage Range**
- **Fast Signal Rise Times**
- **Built-In Fault Protection Circuitry**
- **Level Translators from 1.8V or 2.8V or 3.3V to 5.0V**
- **Low Operating Current**
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in Green MSOP-10 Package**

APPLICATIONS

HDMI Interface

TYPICAL APPLICATION



PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM4561	MSOP-10	-40℃ to +85℃	SGM4561YMS10G/TR	SGM4561 YMS10 XXXXX	Tape and Reel, 3000

NOTE: **XXXXX** = Date Code and Vendor Code.

ABSOLUTE MAXIMUM RATINGS

V_P, DV_{CC} to GND.....-0.3V to 6V
HDMI_5V to GND.....-0.3V to V_P + 0.3V
CEC, SCL, SDA to GND……...-0.3V to DV_{CC} + 0.3V
HDMI_CEC, HDMI_SCL, HDMI_SDA to GND
..…..... -0.3V to HDMI_5V + 0.3V
Package Thermal Resistance
MSOP-10, θ_{JA}……..……..230℃/W
Operating Temperature Range..... -40℃ to +85℃
Junction Temperature..... 150℃
Storage Temperature Range..... -65℃ to +150℃
Lead Temperature (Soldering, 10sec)..... 260℃
ESD Susceptibility
HBM.....4000V
MM.....400V

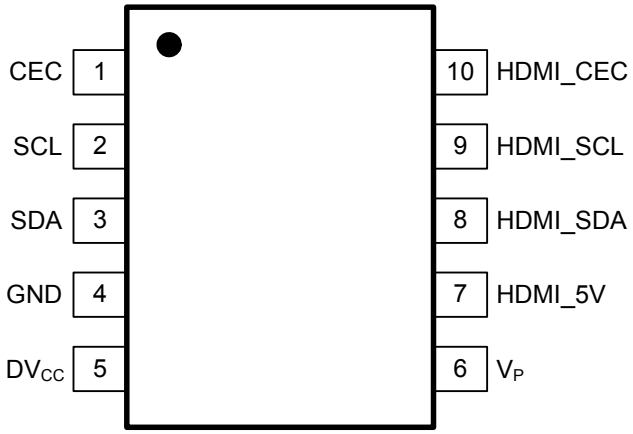
NOTE:
Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute Maximum rating conditions for extended periods may affect device reliability.

CAUTION

This integrated circuit can be damaged by ESD if you don’t pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

PIN CONFIGURATION (TOP VIEW)



MSOP-10

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	CEC	CEC Pin. Connect to CEC signal of HDMI interface at CPU side.
2	SCL	SCL Pin. Connect to SCL signal of HDMI interface at CPU side.
3	SDA	SDA Pin. Connect to SDA signal of HDMI interface at CPU side. This pin is used for bidirectional data transfer.
4	GND	Ground. Proper grounding and bypassing are required to meet high ESD specifications.
5	DV_{CC}	Supply Voltage for the CPU Side I/O Pins (CEC, SCL, SDA). When below 1.2V, the HDMI_5V supply is disabled. This pin should be bypassed with a 1μF ceramic capacitor close to the pin.
6	V_P	Load Switch Power Supply Input. This pin can be between 5.0V to 5.5V for normal operation. This pin should be bypassed with a 1μF ceramic capacitor close to the pin.
7	HDMI_5V	Load Switch Output. A 1μF low ESR capacitor needs to be connected close to the HDMI_5V pin for stable operation.
8	HDMI_SDA	Data I/O at HDMI Interface Side.
9	HDMI_SCL	SCL Pin at HDMI Interface Side. Fast rising and falling edges necessitate careful board layout for the SCL node.
10	HDMI_CEC	CEC Pin at HDMI Interface Side.

ELECTRICAL CHARACTERISTICS

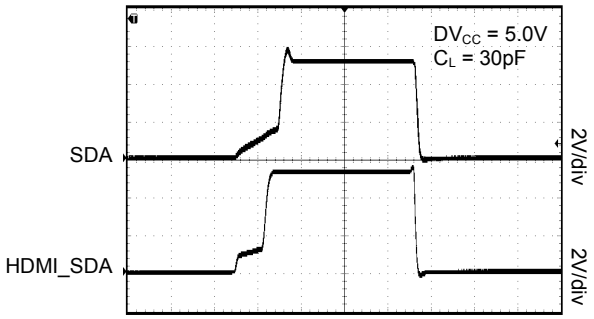
(V_P = 5.0V, DV_{CC} = 1.8V, T_A = 25℃, unless otherwise specified.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Power Supply					
V_P Operating Voltage		5.0		5.5	V
V_P Operating Current	V_P = 5.5V, I_{HDMI_5V} = 0mA		100	195	μA
DV_{CC} Operating Voltage		1.6		5.5	V
DV_{CC} Operating Current			5	10	μA
DV_{CC} Under-Voltage Lockout		0.8	1.0	1.2	V
HDMI_5V Output Voltage	I_{HDMI_5V} = 200mA		4.88		V
	V_P = 5.5V, I_{HDMI_5V} = 0mA to 200mA	4.825	5.0	5.175	
Controller Inputs/Outputs					
Input Voltage Range	SCL, CEC, SDA	0		DV_{CC}	V
High Input Threshold Voltage (V_{IH})	SCL, CEC, T_A = -40℃ to +85℃	0.9 × DV_{CC}			V
Low Input Threshold Voltage (V_{IL})	SCL, CEC, T_A = -40℃ to +85℃			0.1 × DV_{CC}	V
High Level Input Current (I_{IH})	SDA	-5		5	μA
Low Level Input Current (I_{IL})	SDA			1.75	mA
High Level Output Voltage (V_{OH})	SDA, I_{OH} = 20μA, HDMI_SDA = HDMI_5V	0.9 × DV_{CC}			V
Low Level Output Voltage (V_{OL})	SDA, I_{OL} = -200μA, HDMI_SDA = 0V			0.2	V
SDA Pull-Up Current	SDA = 1V		200	600	μA
HDMI Logical Inputs/Outputs					
High Level Output Voltage (V_{OH})	HDMI_SDA, I_{OH} = 20μA, SDA = DV_{CC}	0.9 × HDMI_5V			V
Low Level Output Voltage (V_{OL})	HDMI_SDA, I_{OL} = -1mA, SDA = 0V			0.3	V
High Level Output Voltage (V_{OH})	HDMI_SCL, I_{OH} = 20μA	0.9 × HDMI_5V			V
Low Level Output Voltage (V_{OL})	HDMI_SCL, I_{OL} = -200μA			0.15	V
High Level Output Voltage (V_{OH})	HDMI_CEC, I_{OH} = 20μA	0.9 × HDMI_5V			V
Low Level Output Voltage (V_{OL})	HDMI_CEC, I_{OL} = -200μA			0.2	V
HDMI_SDA Pull-Up Current	HDMI_SDA = 1V		400	1000	μA
HDMI Logical Timing Parameters					
HDMI_SCL Rise/Fall Time	Loaded with 30pF (10% to 90%)		3		ns
HDMI_CEC Rise/Fall Time	Loaded with 30pF (10% to 90%)		30		ns
HDMI_SDA Rise/Fall Time	Loaded with 30pF (10% to 90%)		150		ns
SCL Frequency	Loaded with 30pF			10	MHz

TYPICAL PERFORMANCE CHARACTERISTICS

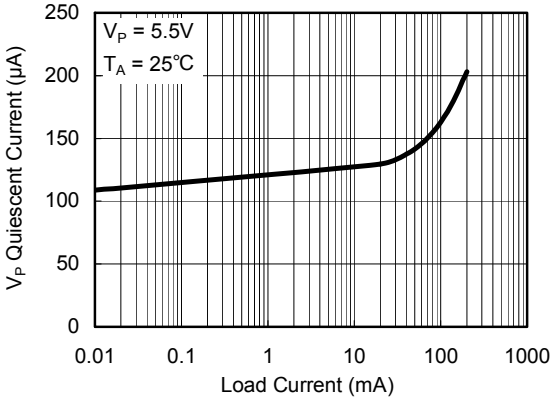
V_P = 5.0V, DV_{CC} = 1.8V, T_A = 25℃, unless otherwise specified.

Bidirectional Data Transfer

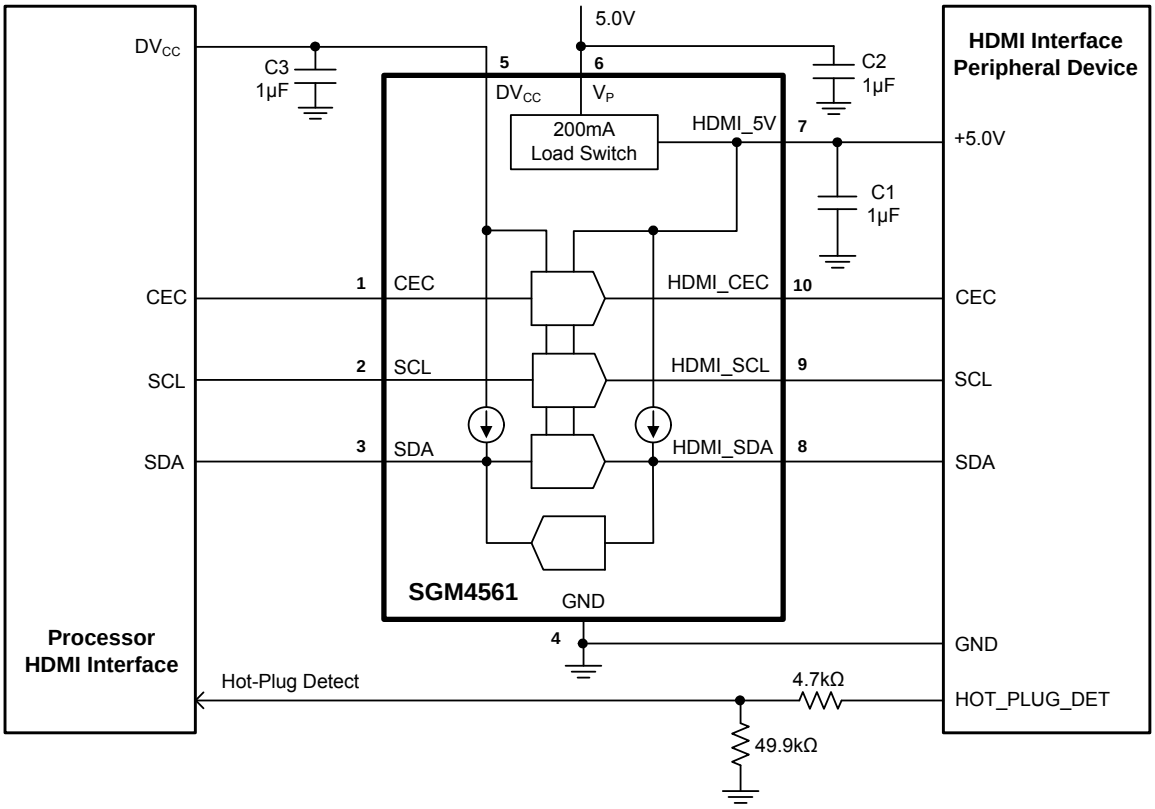


Time (200ns/div)

V_P Quiescent Current (I_{Vp}-I_{HDMI_5V}) vs. Load Current



BLOCK DIAGRAM



APPLICATION INFORMATION

The SGM4561 provides both load switch and internal level translators to allow low voltage controllers to interface with HDMI interface.

Load Switch for HDMI

The load switch can provide 200mA current with a 5.0V output voltage. The HDMI_5V output should be bypassed with a 1μF capacitor. V_P should be bypassed with a 1μF ceramic capacitor.

Level Translators

HDMI interface contains SCL, CEC and SDA which is a bidirectional data input/output. The SGM4561 provides level translators to allow controller to communicate with peripheral HDMI device. The HDMI_SCL and HDMI_CEC are level shifted from the controller supply (GND to DV_{CC}) to the HDMI interface peripheral supply (GND to HDMI_5V). The bidirectional channel is level shifted to the appropriate HDMI_5V voltage at the HDMI_SDA pin. An NMOS pass transistor performs the level shifting. If one side of the channel asserts a LOW, then the transistor will convey the LOW to the other side. Note that current passes from the receiving side of the channel to the transmitting side. The low output voltage of the receiving side will be dependent upon the voltage at the transmitting side plus the IR drop of the pass transistor.

Pull-Up Current Sources

The current sources on the bidirectional pins (SDA, HDMI_SDA) are activated to achieve a fast rise time with a relatively small static current. Once a bidirectional pin is relinquished, a start-up current begins to charge the node.

Fault Detection

The HDMI_5V, HDMI_SDA, HDMI_SCL, HDMI_CEC and SDA pins are all protected against short-circuit faults. While there are no logic outputs to indicate that a fault has occurred, these pins will be able to tolerate the fault condition until it has been removed.

The HDMI_5V, HDMI_SDA and HDMI_CEC pins possess fault protection circuitry which will limit the current available to the pins. The HDMI_5V pin is capable of supplying approximately 300mA (TYP) before the output voltage is reduced.

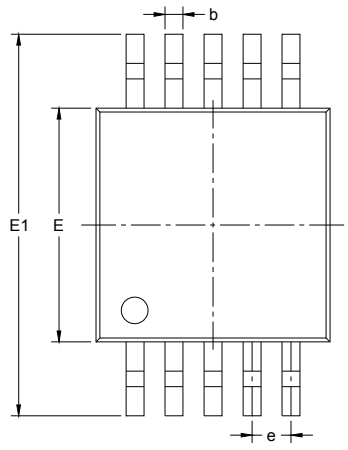
The HDMI_SCL pin is designed to tolerate faults by reducing the current drive capability of its output stage. After a fault is detected by the internal fault detection logic, the logic waits for a fault detection delay to elapse before reducing the current drive capability of the output stage. The reduced current drive allows the SGM4561 to detect when the fault has been removed.

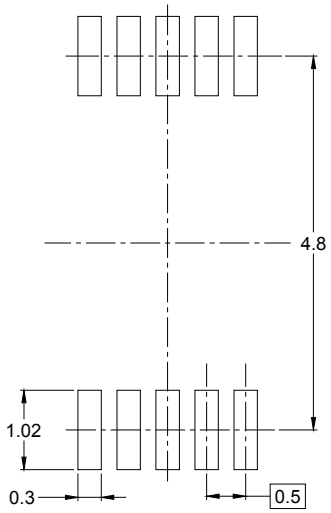
ESD Protection

In order to ensure proper ESD protection, careful board layout is required. The GND pin should be tied directly to a ground plane. The HDMI_5V capacitor should be located very close to the HDMI_5V pin and tied directly to the ground plane.

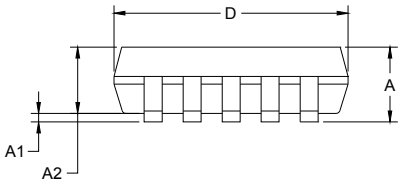
PACKAGE OUTLINE DIMENSIONS

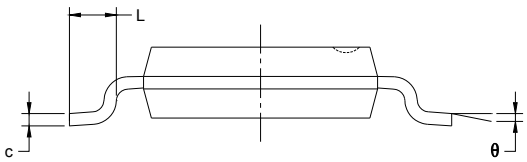
MSOP-10





RECOMMENDED LAND PATTERN (Unit: mm)

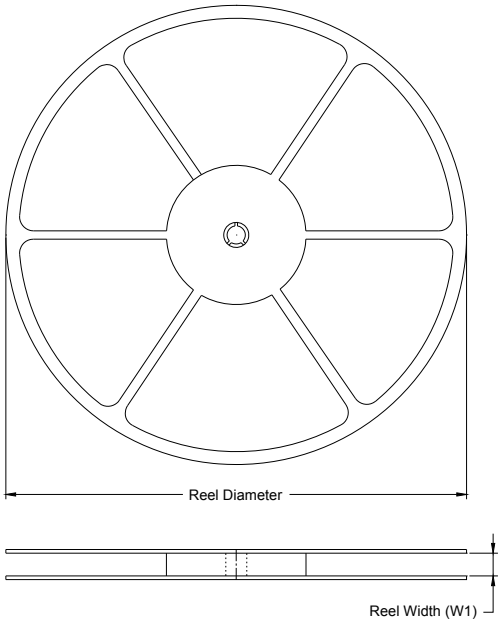




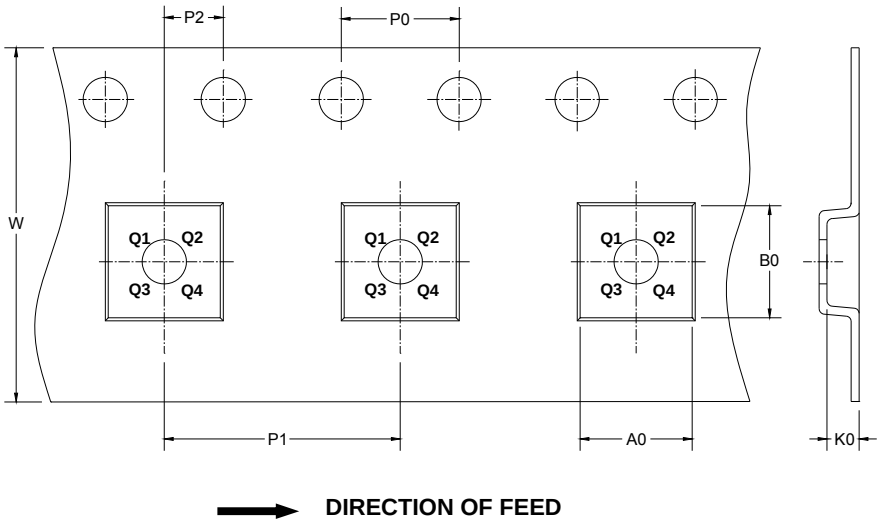
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.500 BSC		0.020 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS

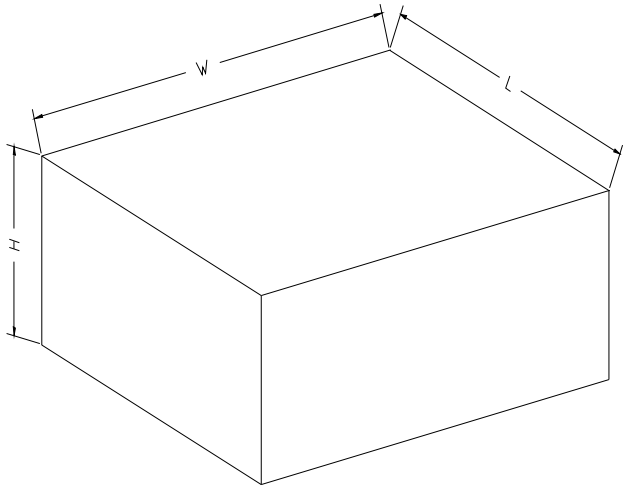


NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
MSOP-10	13″	12.4	5.2	3.3	1.2	4.0	8.0	2.0	12.0	Q1

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
13″	386	280	370	5