



HAIDAR TECHNOLOGY, LLC.
The Next Generation Of Intelligent Embedded GUI Systems

WWW.haidartechnology.com

(614) 389-3022

Sales@haidartechnology.com

SegeNT
Serial-Enabled Graphic Engine
Hardware Reference Manual
REV 1.00

Revision 1.00

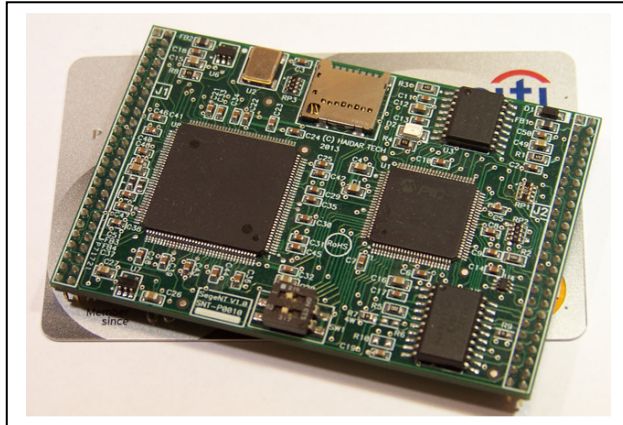
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1. Overview



It is a fast, simple and inexpensive production solution for adding a Graphical User Interface to an embedded system. SegeNT GUI Controller Board contains everything needed to drive the user interface. It just needs to be attached to a simple display interface board and the human interface is ready for production.

Using SegeNT is simply the quickest way to create stunning GUI without any graphical programming!

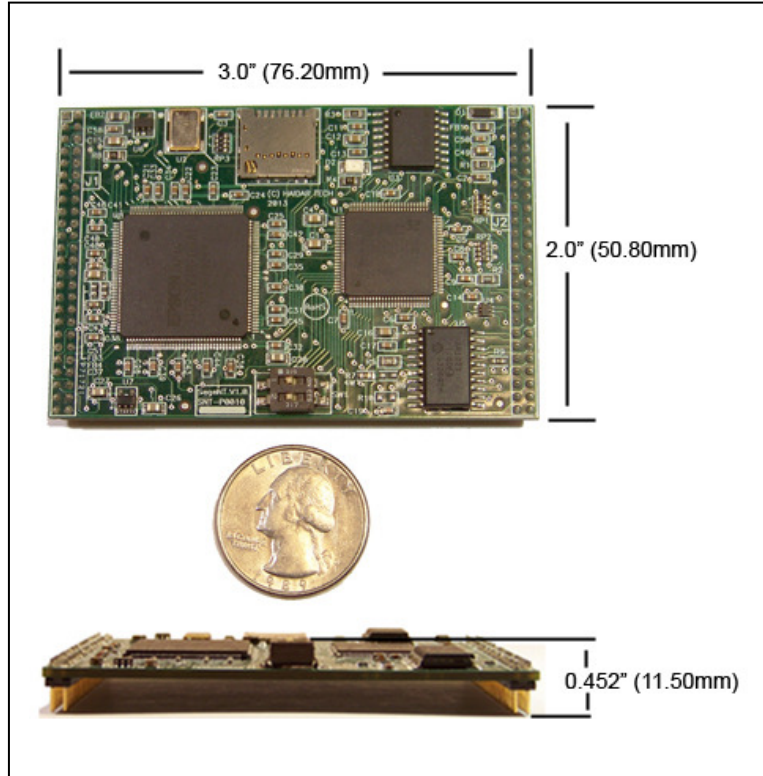
SegeNT is Hardware compatible with SegeMax.

Please see “SegeNT Software Manual” for more information about the operation and the commands of SegeNT.

2. Features

- Can drive any TFT Color LCD up to WVGA (800X480) and at 16BPP color depth
- Powerful 32-bit processor running at 80MHZ on board
- Powerful graphic controller with 1024KB RAM on board
- Powerful resistive touch screen on board
- Dedicated I2C bus for driving external Capacitive Touch Screen controller.
- 16Mbyte Flash memory for bitmaps, fonts and GUI storage
- Mono Audio output
- 7-bit, 100K (128 levels) Digital Pot for software brightness control
- CMOS (3.3V) RS232 and RS485 up to 115.2kb/sec serial interface
- Micro SD card with up to 2GB capacity (FAT16).
- 512Kbyte flash memory for user application.
- 3 layers of graphic with Alpha blending and transparency
- 8 General purpose digital Input/Output
- 8 Analog Input with 10-bit resolution
- 2 PWM Output
- Single Power supply operation (3.3V)
- Small size 3”X 2”
- Low Cost
- ROHS Compliant

3. Board Dimensions



Width	2.0" / 50.8mm
Length	3.0" / 76.2mm
Depth	0.45" / 11.5mm

4. Electrical Characteristics

SegeNT requires 3.3V DC. Exceeding the supply voltage over the typical value (3.3V) will cause a permanent damage to the board and to the attached LCD and void your warranty.

Current draw is as follows:

Configuration	Typical Current (mA) at 3.3V
SegeNT with no LCD attached	Max 100mA

5. Environmental

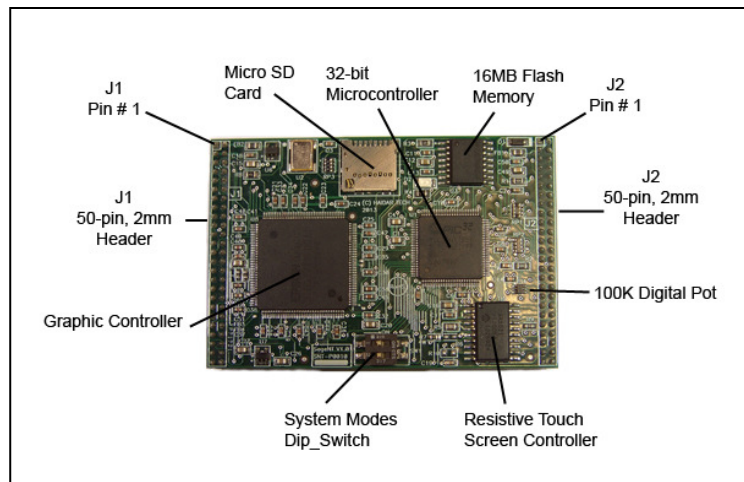
The standard SegeNT board is rated for commercial temperature operation of -20 to 85°C.

6. Electrical Specifications

Parameter	Symbol	Min.	Typ.	Max.	Units
Input Supply Voltage	VDD	-	3.3	3.7	V
High Level Input Voltage (VDD = 3.3V)	VIH	0.7VDD	-	VDD	V
Low Level Input Voltage (VDD = 3.3V)	VIL	0	-	0.3VDD	V
Digital sink/source current	Id	-	-	25	mA
Analog input voltage	Va	0	-	3.3V	V
RS232 TX/RX		0.7VDD	-	VDD	V

Warning: RX and TX use a CMOS level of 3.3V. Connecting them to standard (PC) RS232 with +/- 12V or other will damage the controller and void your warranty.

7. Board Hardware



8. Pin Description

- **J1 (50Pos, 2mm, DIL Header)**

J1 Pin Name	Pin #	Type	Tolerance	Description
LCD_PWR	1	PWR	3.3V	LCD 3.3V Power. Connect to the LCD Power input.
LCD_PWR	2	PWR	3.3V	LCD 3.3V Power. Connect to the LCD Power input.
GND	3	PWR	0V	Power Ground
GND	4	PWR	0V	Power Ground
ENAB	5	DOUT	3.3V	LCD Data Enable (DE) or Data Ready signal (DRDY). The active state of this signal indicates that the data in the RGB bus is valid and should be latched
HSYNC	6	DOUT	3.3V	LCD Horizontal Synchronization signal. It is also known as FPLINE or LP. This signal indicates the end of the line and the following valid pixels are part of the next line.
VSYNC	7	DOUT	3.3V	LCD Vertical Synchronization signal. It is also known as FPFAME or FLM. This signal indicates the end of the current frame.
PCLK	8	DOUT	3.3V	LCD Pixel Data clock signal. The active state of this signal will latch the RGB data.
B0	9	DOUT	3.3V	Blue Data 0 (LSB)
B1	10	DOUT	3.3V	Blue Data 1
B2	11	DOUT	3.3V	Blue Data 2
G0	12	DOUT	3.3V	Green Data 0 (LSB)
G1	13	DOUT	3.3V	Green Data 1
G2	14	DOUT	3.3V	Green Data 2
R0	15	DOUT	3.3V	Red Data 0 (LSB)
R1	16	DOUT	3.3V	Red Data 1
R2	17	DOUT	3.3V	Red Data 2
B3	18	DOUT	3.3V	Blue Data 3
B4	19	DOUT	3.3V	Blue Data 4
B5	20	DOUT	3.3V	Blue Data 5 (MSB)
G3	21	DOUT	3.3V	Green Data 3
G4	22	DOUT	3.3V	Green Data 4
G5	23	DOUT	3.3V	Green Data 5 (MSB)
R3	24	DOUT	3.3V	Red Data 3
R4	25	DOUT	3.3V	Red Data 4
R5	26	DOUT	3.3V	Red Data 5 (MSB)
NC	27			Do not connect. Leave open.
NC	28			Do not connect. Leave open.
NC	29			Do not connect. Leave open.
NC	30			Do not connect. Leave open.
NC	31			Do not connect. Leave open.
NC	32			Do not connect. Leave open.
GND	33	PWR	0V	Power Ground
GND	34	PWR	0V	Power Ground
AN0	35	AIN	3.3V	Analog Input 0

DIO0	36	DIO	3.3V	Digital I/O 0
AN1	37	AIN	3.3V	Analog Input 1
DIO1	38	DIO	3.3V	Digital I/O 1
AN2	39	AIN	3.3V	Analog Input 2
DIO2	40	DIO	3.3V	Digital I/O 2
AN3	41	AIN	3.3V	Analog Input 3
DIO3	42	DIO	3.3V	Digital I/O 3
AN4	43	AIN	3.3V	Analog Input 4
DIO4	44	DIO	3.3V	Digital I/O 4
AN5	45	AIN	3.3V	Analog Input 5
DIO5	46	DIO	3.3V	Digital I/O 5
AN6	47	AIN	3.3V	Analog Input 6
DIO6	48	DIO	3.3V	Digital I/O 6
AN7	49	AIN	3.3V	Analog Input 7
DIO7	50	DIO	3.3V	Digital I/O 7

- **J2 (50Pos, 2mm, DIL Header)**

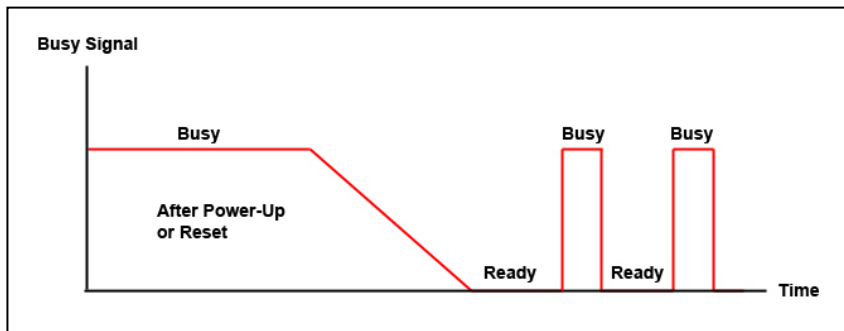
J2 Pin Name	Pin #	Type	Tolerance	Description
ICSP_VPP	1	PWR	-	Leave Open. This pin is used to program the microcontroller on board
VCC	2	PWR	3.3V	3.3V Power Input
VCC	3	PWR	3.3V	3.3V Power Input
GND	4	PWR	0V	Power Ground
GND	5	PWR	0V	Power Ground
NC	6			Not Connected. Leave Open.
ICSP_PGD	7	DIO	3.3V	Leave Open. This pin is used to program the microcontroller on board
NC	8			Not Connected. Leave Open.
ICSP_PGC	9	DIO	3.3V	Leave Open. This pin is used to program the microcontroller on board
NC	10			Not Connected. Leave Open.
NC	11			Not Connected. Leave Open.
NC	12			Not Connected. Leave Open.
NC	13			Not Connected. Leave Open.
NC	14			Not Connected. Leave Open.
RX	15	DIN	3.3V/5V	UART Receiver Input. This pin should be connected to the host UART Tx.
TX	16	DOUT	3.3V	UART Transmitter Output. This pin should be connected to the host UART RX.
NC	17			Not Connected. Leave Open.
NC	18			Not Connected. Leave Open.
AUDIO_MUTE	19	DOUT	3.3V	Active High. This pin is used to turn the audio amplifier On or Off. 4.7K Pull-Down resistor is needed for this pin.
AUDIO_PWM	20	DOUT	3.3V	Audio PWM output pin
NC	21			Not Connected. Leave Open.
GND	22	PWR	0V	Power Ground
RS485DE	23	DOUT	3.3V	Active High. This pin is used to turn the RS485/RS422 Transmitter On or Off. 4.7K Pull-Down resistor is needed for this pin.
BL_Enable	24	DOUT	3.3V	Active High. This pin is used to turn the LCD backlight power converter On or Off. 4.7K Pull-Down resistor is needed for this pin.
NotifyHost	25	DOUT	3.3V	Active Low. This pin is used to Notify the host when an object has been touched by the user. A pulse of 10msec width will be generated every time an object is touched. This pin should be connected to the host external interrupt. 4.7K Pull-Up resistor is needed for this pin.
Busy	26	DOUT	3.3V	Active Low. This pin is used to indicate the status of the controller. If it is Low, then the controller is Ready for a new command. If it is High, then the

				controller is Busy and the Host should wait before sending any new commands. This pin should be connected to one of the host GPIO and the host needs to check it before sending commands. 4.7K Pull-Up resistor is needed for this pin.
HB_LED	27	DOUT	3.3V	Active High. This pin is used to drive the Heart Beat LED. The Heart Beat LED flashes normally at a rate of 10HZ. This pin should be connected to a LED through a limiting resistor
Buzzer	28	DOUT	3.3V	Active High. This pin is used to turn a Buzzer On or Off. 4.7K Pull-Down resistor is needed for this pin.
TX_LED	29	DOUT	3.3V	Active High. This pin is used to drive a Transmitter LED through a limiting resistor. The TX LED will turn on every time SegeNT send data to the host.
RX_LED	30	DOUT	3.3V	Active High. This pin is used to drive a Receiver LED through a limiting resistor. The RX LED will turn on every time SegeNT receive data from the host.
NC	31			Do not connect. Leave open.
Reset	32	DIN	3.3V	Active Low. This pin is used to reset SegeNT. Leave open if not used. Internally pulled up to VCC with 4.7K.
NC	33			Do not connect. Leave open.
NC	34			Do not connect. Leave open.
DPOT_H	35	ANA	3.3V	Digital POT H Terminal.
DPOT_W	36	ANA	3.3V	Digital POT Wiper Terminal.
GND	37	PWR	3.3V	Power Ground
NC	38			Do not connect. Leave open.
TS_XR	39	ANA	3.3V	Touch Screen X Right.
TS_YU	40	ANA	3.3V	Touch Screen Y Up.
TS_XL	41	ANA	3.3V	Touch Screen X Left.
TS_YB	42	ANA	3.3V	Touch Screen Y Bottom.
NC	43			Do not connect. Leave open.
TS_5W	44	ANA	3.3V	This pin for 5-wire touch screen. Leave open if is not used.
NC	45			Do not connect. Leave open.
PWM0	46	DO	3.3V	PWM Output 0
ADC_Vref	47	ANA	3.3V	ADC External Reference Voltage. Connect it to 2.5V reference voltage or tied it to GND if is not used.
PWM1	48	DO	3.3V	PWM Output 1
NC	49			Do not connect. Leave open.
NC	50			Do not connect. Leave open.

9. Busy signal

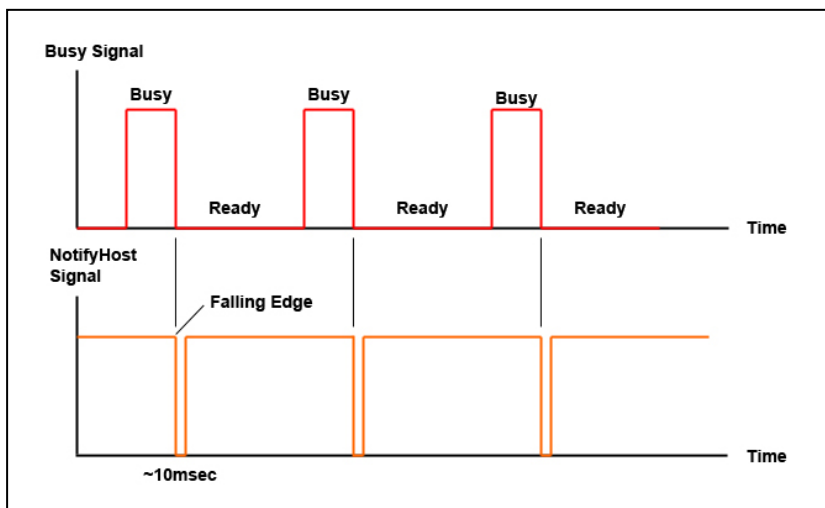
Busy signal is used to indicate the status of the controller. If it is Low, then the controller is Ready for a new command. If it is High, then the controller is Busy and the Host should wait before sending any new commands.

After power-up or reset, SegeNT goes into Busy state for ~500msec and then goes to Ready. Animation and all other objects that required to be redrawn after receiving a touch event like Button and Slider will cause SegeNT to be busy for certain period of time. During this time, SegeNT may not process any received command. The host needs to monitor this signal and send only new commands when it is in ready state.



10. NotifyHost Signal

NotifyHost signal is used to interrupt the host controller when an object has been touched by the user. A pulse of ~10msec is generated every time an object is touched and processed. This pin should be connected to the host external interrupt pin. This pulse can be used to interrupt the host at the falling edge. At the host NotifyHost ISR, the host needs to send the GUI command "Get_uiMessage" to read the UI message. This method of capturing the touch events ensures that the host will never miss any event and at the same reduce the complexity and bandwidth required by the host to capture the touch event.

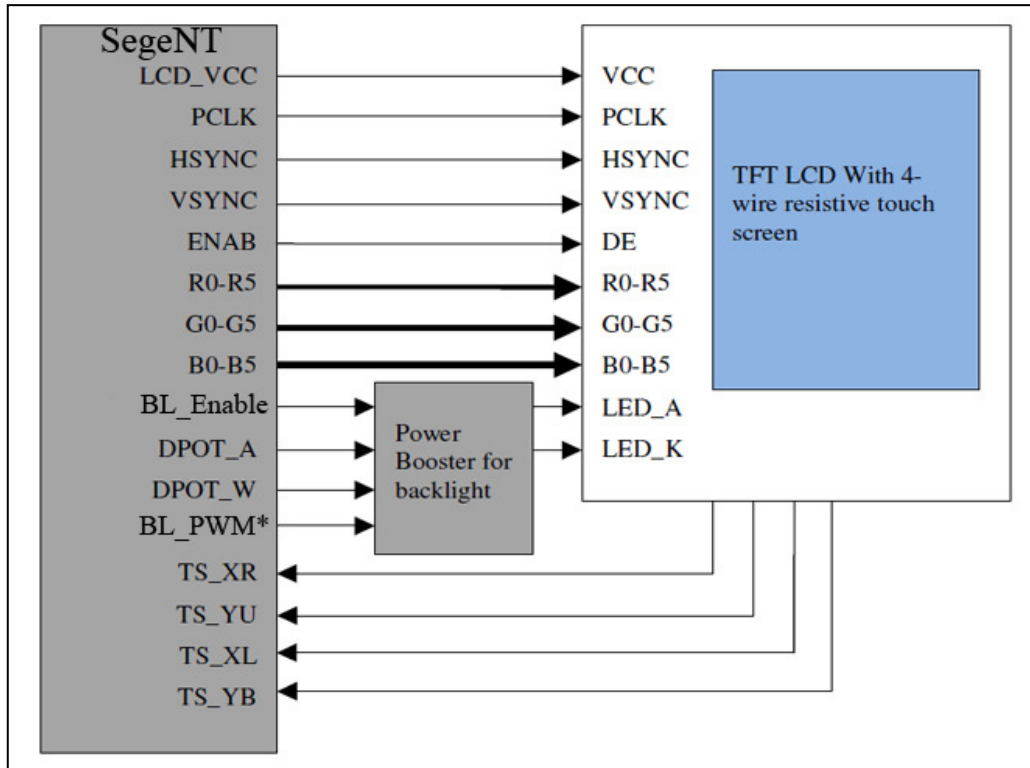


11. Micro SD Card

SegeNT used the off the shelf standard micro SD memory cards with up to 2GB capacity useable with FAT16 formatting. It is only used to fast Program the GUI Project at production to update the GUI project in the field. The SD card is not required for normal operation as all the GUI project is saved to the internal 16MByte flash memory.

12. LCD Interface

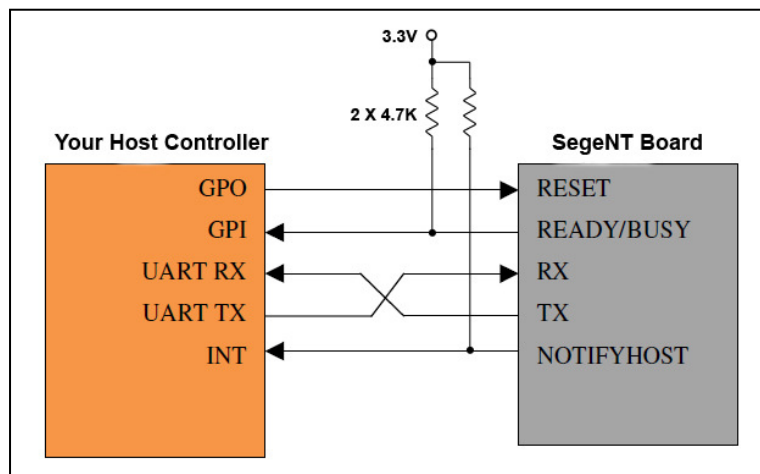
SegeNT can drive a TFT color LCD with 18-Bit (6-bit for Red, 6-bit for Green and 6-bit for Blue) or 24-bit (8-bit for Red, 8-bit for Green and 8-bit for Blue) Digital RGB bus. The figure below shows how to interface SegeNT to 18-bit RBG LCD.



For 24-bit RGB displays, SegeNT R5 will be connected to the Display R7 and the same for the other colors. The display R1, R0, G1, G0, B1 and B0 must be connected to ground.

13. Host Interface

SegeNT can be interfaced to any microcontroller or processor with UART. Only 5 pins are required by the host to complete the interface. The figure below shows the basic interface between SegeNT and general microcontroller.



14. System Mode Dip Switches

SegeNT has 2 Dip-Switches which are used to set the system mode of operation.

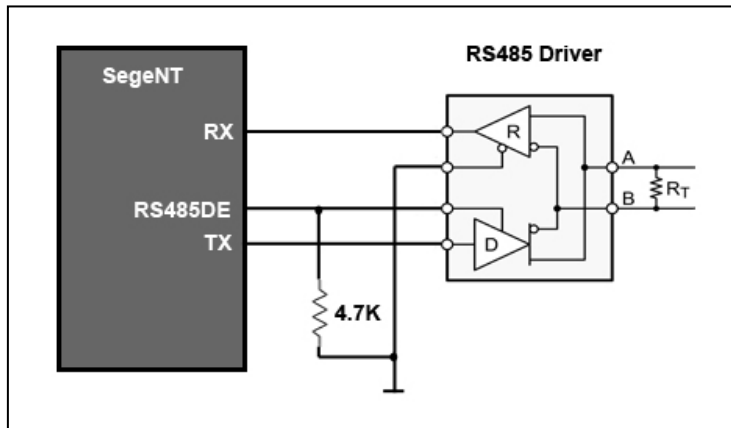
Dip Switch 1	Dip Switch 2	System Mode	Description
OFF	OFF	NORMAL	Normal Operation.
ON	OFF	TEST	Test mode is used to put SegeNT into a known state by bypassing the Configuration Header and used default setting instead. Haidar's splash screen will be displayed. This mode is used for testing the SegeNT and the attached display. The default settings are include: DVID = 16 Baud Rate = 115.2KB/Sec
OFF	ON	CAL	Touch Screen Calibration Mode. Only valid for resistive touch screens.
ON	ON	PROGRAM	Program the GUI Project form the micro SD card.

15. RS485/RS422 Interface

SegeNT has one serial port, which can be used as RS232, RS422 or RS485. All signals (RX, TX and RS485DE) are at CMOS level (3.3V). By default, the serial communication is 115.2KB/Sec baud, 8 data bits, and no parity with one stop bit. For PC RS232 communication, RS232 driver (like MAX3232) is needed to convert the signal level from 3.3V to $\pm 12V$.

Multipoint RS485/422 communication bus can be also used by the host controller to communicate with one or more SegeNT boards. Each board must have a unique address (from 1 to 254) or DeviceID (DVID) which can be set in software. The default DVID is 16.

RS485DE output is used to enable/disable the RS485/422 transmitter driver.



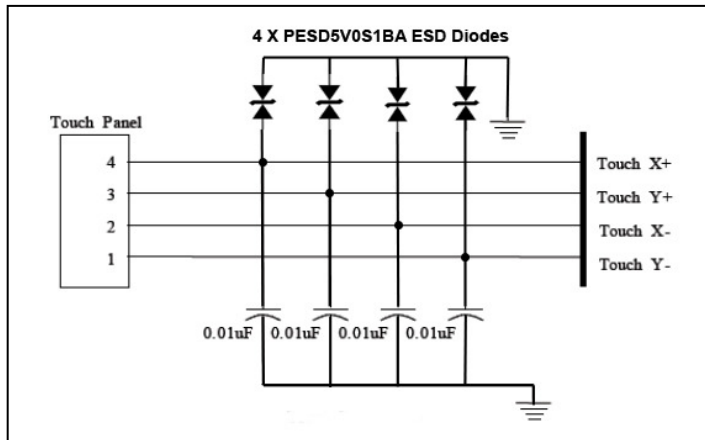
16. Digital POT

SegeNT has one MCP4018 100K 7-Bit Digital Potentiometer from Microchip. It is used to adjust the brightness of the LCD or it can be used as a general purpose POT. At Power-Up or after a Reset, the wiper position is set at full scale (127). The wiper position is not saved in the EEPROM and the host needs to set it after reset or power-on. Keep the voltage of DPOT_H at 3.3V or lower.

17. Touch Screen Controller

SegeNT has AR1021 Resistive Touch Screen Controller from Microchip. It can drive 4-wire or 5-wire resistive touch screen with 10-bit resolution.

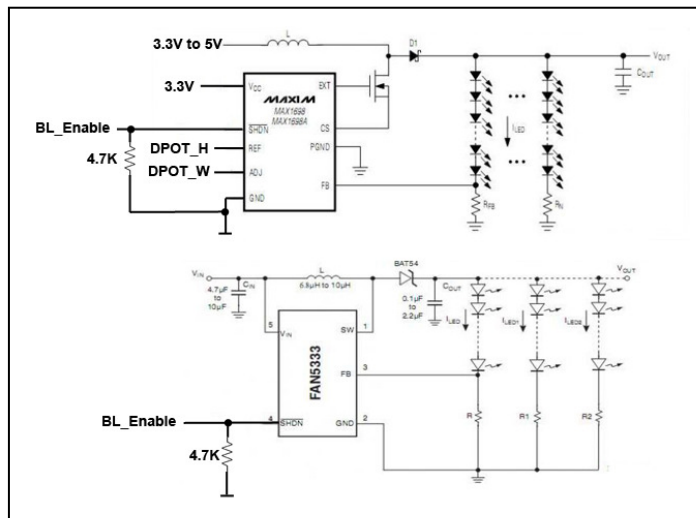
As shown in the schematic below, one 0.01uF capacitor and one ESD diode are needed for each pin of the touch screen. Place the capacitor and the diode as close as possible to the touch screen connector.



18. LCD Backlight Driver

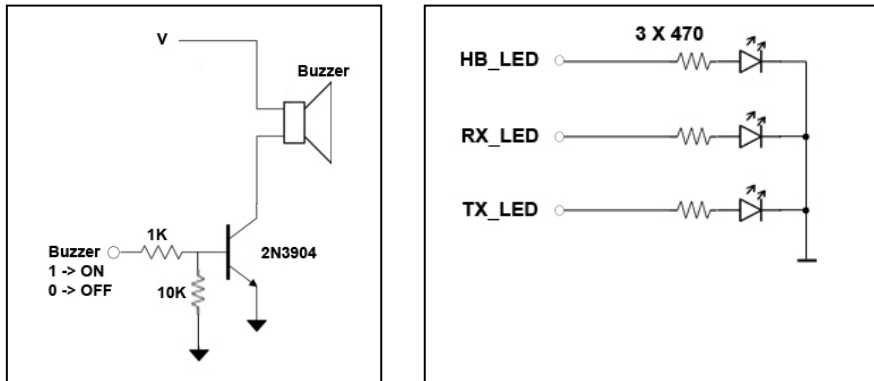
For LCD with LED backlight, it is recommended to use constant current, Serial LED driver to control the backlight. Below is a schematic for LED driver based on Max1698 from Maxim and FAN5333A from Fairchild.

For LCD with CCFL backlight, a high voltage DC/AC CCFL converter is needed to drive the backlight. Use "BL_Enable" signal to turn the converter ON/OFF.



19. External Buzzer and Status LEDs

A single tone buzzer is used for audible user interface or as general purpose audible alarm. The status LEDs (optional) are used to visually show the serial interface activity and the system status.



20. Analog Inputs

There are 8 analog inputs available to the user. The maximum range is from 0V to 3.3V with 10-bit resolution. The ADC reference voltage input is user defined and can be set to Internal (3.3V) or external (2.5V) via "ADC_Vref". The ADC output is digitally filtered using the following difference equation:

$$Y(k) = a * X(k) + (1-a) * X(k-1)$$

Where:

Y(k) is the present filter output

X(k) is the present filter input

X(k-1) is the previous filter input

a is the filter coefficient

Keep the voltage at each pin at 3.3V or less. Higher voltage will damage the SegeNT and void your warranty.

21. Digital Inputs/Outputs

There are 8 general purpose digital inputs/outputs available to the user. Each digital IO can be set by the user to be Input or Output. The default setting is all outputs. The voltage tolerance for all digital IO is 3.3V and maximum sink or source current for each one is 10mA. The voltage at any digital input must be 3.3V or less. Higher voltage will damage the SegeNT and void your warranty.

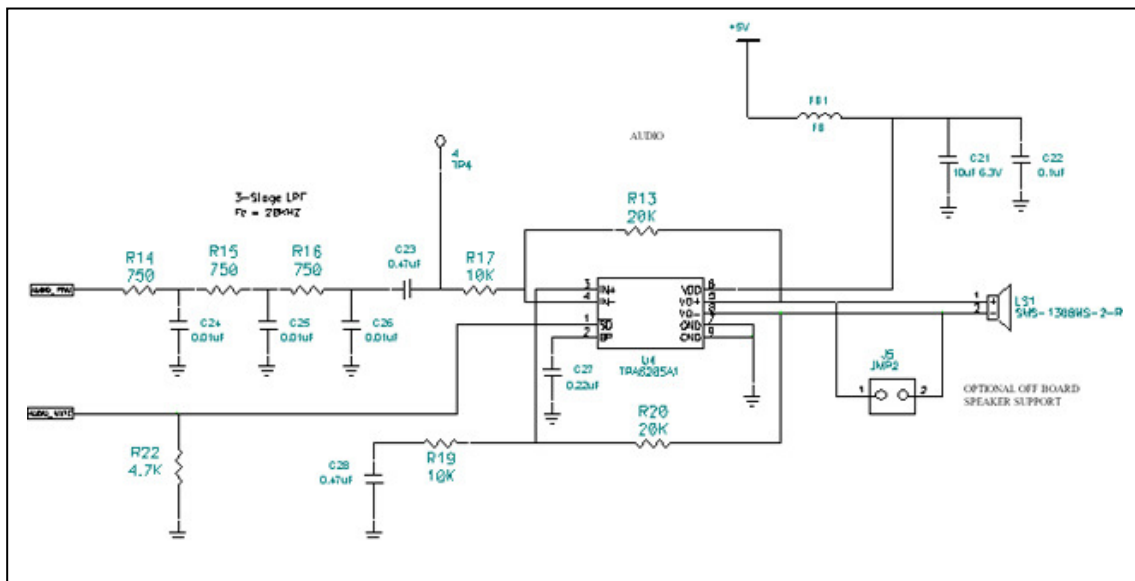
22. PWM Outputs

There are 2 general purpose PWM outputs available to the user. The frequency at 50% duty cycle is set to 1KHZ and the duty cycle range is from 0 (0%) to 312 (100%).

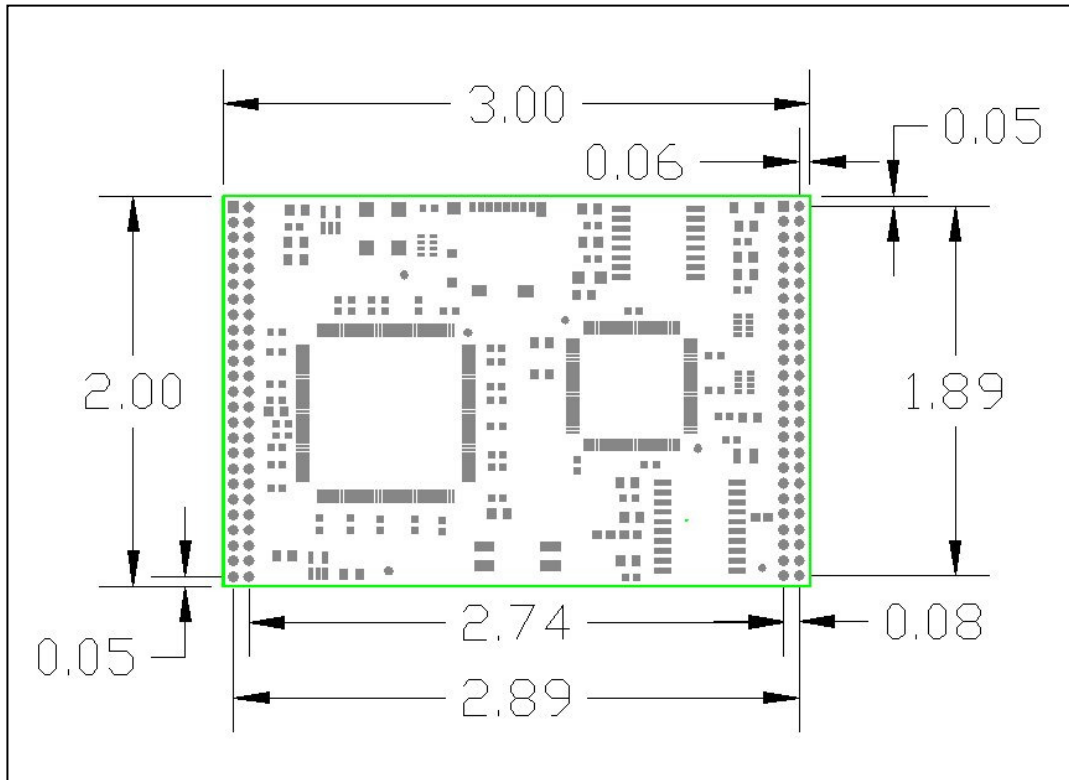
23. Audio Output

SegeNT is able to generate sounds or playback audio files using one PWM output "Audio_PWM". The PWM output signal needs to be converted to analog signal so it can be heard through a speaker. The audio PWM switching frequency is set at 44.1KHZ. Audio_Mute signal is used to shut down the audio amplifier. LPF is used to convert the PWM signal into analog signal. A 3-order simple LPF with a cut off frequency of 20KHZ is sufficient enough to do the conversion with minimum noise.

24. Complete Audio Circuit



25. Mechanical Details



All Dimensions in inches

26. Manual Change History

Date	Revision	Change
1/17/2014	REV1.00	Initial version of this manual

27. Hardware Limited Warranty

Haidar Technology, LLC. Warrants its hardware products to be free from manufacturing defects in materials and workmanship under normal use for a period of one (1) year from the date of purchase from Haidar. This warranty extends to products purchased directly from Haidar or an authorized Haidar distributor. Purchasers should inquire of the distributor regarding the nature and extent of the distributor's warranty, if any. Haidar shall not be liable to honor the terms of this warranty if the product has been used in any application other than that for which it was intended, or if it has been subjected to misuse, accidental damage, modification, or improper installation procedures. Furthermore, this warranty does not cover any product that has had the serial number altered, defaced, or removed. This warranty shall be the sole and exclusive remedy to the original purchaser. In no event shall Haidar be liable for incidental or consequential damages of any kind (property or economic damages inclusive) arising from the sale or use of this equipment. Haidar is not liable for any claim made by a third party or made by the purchaser for a third party. Haidar shall, at its option, repair or replace any product found defective, without charge for parts or labor. Repaired or replaced equipment and parts supplied under this warranty shall be covered only by the unexpired portion of the warranty. Except as expressly set forth in this warranty, Haidar makes no other warranties, expressed or implied, nor authorizes any other party to offer any warranty, including any implied warranties of merchantability or fitness for a particular purpose. Any implied warranties that may be imposed by law are limited to the terms of this limited warranty. This warranty statement supercedes all previous warranties, and covers only the Haidar hardware.

28. Returns and Repair Policy

No merchandise may be returned for credit, exchange, or service without prior authorization from. To obtain warranty service, contact the factory and request an RMA (Return Merchandise Authorization) number. Enclose a note specifying the nature of the problem, name and phone number of contact person, RMA number, and return address. Authorized returns must be shipped freight prepaid to Haidar Technology with the RMA number clearly marked on the outside of all cartons. Shipments arriving freight collect or without an RMA number shall be subject to refusal. Haidar reserves the right in its sole and absolute discretion to charge a 15% restocking fee, plus shipping costs, on any products returned with an RMA.

Return freight charges following repair of items under warranty shall be paid by Haidar, shipping by standard ground carrier. In the event repairs are found to be non-warranty, return freight costs shall be paid by the purchaser.