# Specification for
# BTHQ 21605V-FSRE-I2C-COG

**Version October 2003**

supplied by Midas Components Ltd -- Tel : +44 1493 602602 -- www.midascomponents.co.uk

**DOCUMENT REVISION HISTORY 1:**

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| A | 2003.10.16 | First release. | SUNNY LEE | MICHAEL TSE |

# CONTENTS

# Specification
# of
# LCD Module Type
# Model No.: COG-BTHQ21605-02

## 1. General Description

- 16 characters (5 x 8 dots) x 2 lines FSTN Positive Black & White Reflective LCD Character module.
- Driving scheme: 1:18 multiplexed drive, 1/4 bias.
- Optimal view direction: 6 O'clock.
- Driving IC: 'PHILIPS' PCF 2119RU/2/F2 COG form LCD controller/driver.
- Data interface: $I^2C$-bus.
- RTV coating.

## 2. Mechanical Specifications

The mechanical detail is shown in Fig. 2 and summarized in Table 1 below.

Table 1

| Parameter | Specifications | Unit |
|---|---|---|
| Outline dimensions | 67.00(W) x 27.8(H) x 2.80(D) (Excluded pins and epoxy) | mm |
| Viewing area | 61.0(W) x 15.8(H) | mm |
| Active area | 56.20(W) x 11.50(H) | mm |
| Display format | 16 characters (5 x 8 dots) x 2 lines | - |
| Character size | 2.95(W) x 5.553(H) | mm |
| Character spacing | 0.60(W) x 0.394(H) | mm |
| Character pitch | 3.55(W) x 5.947(H) | mm |
| Dot size | 0.578(W) x 0.681(H) | mm |
| Dot spacing | 0.015(W) x 0.015(H) | mm |
| Dot pitch | 0.593(W) x 0.696(H) | mm |
| Weight | Approx. 10.0 | grams |

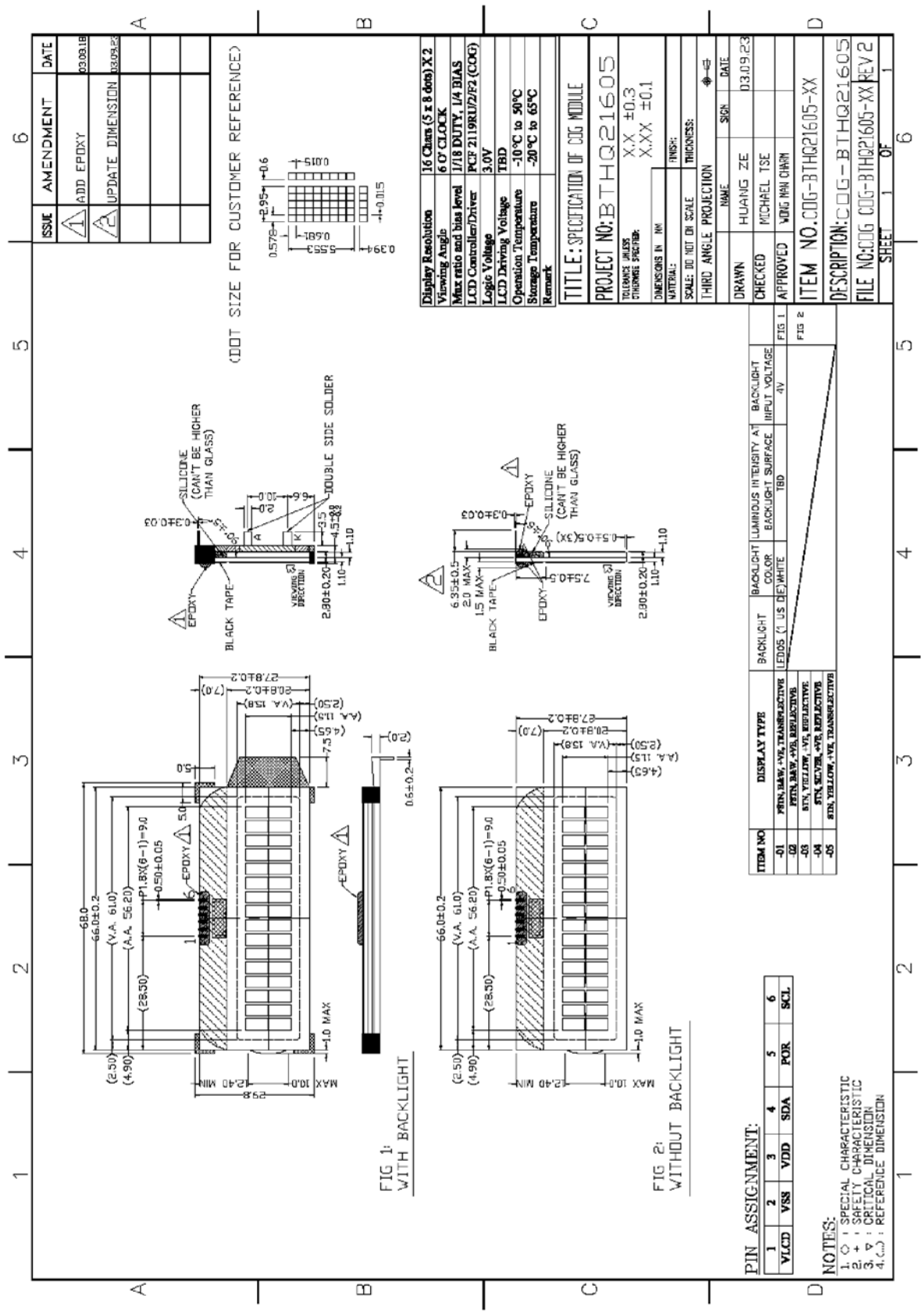



Figure 1 and Figure 2: Specification Drawing

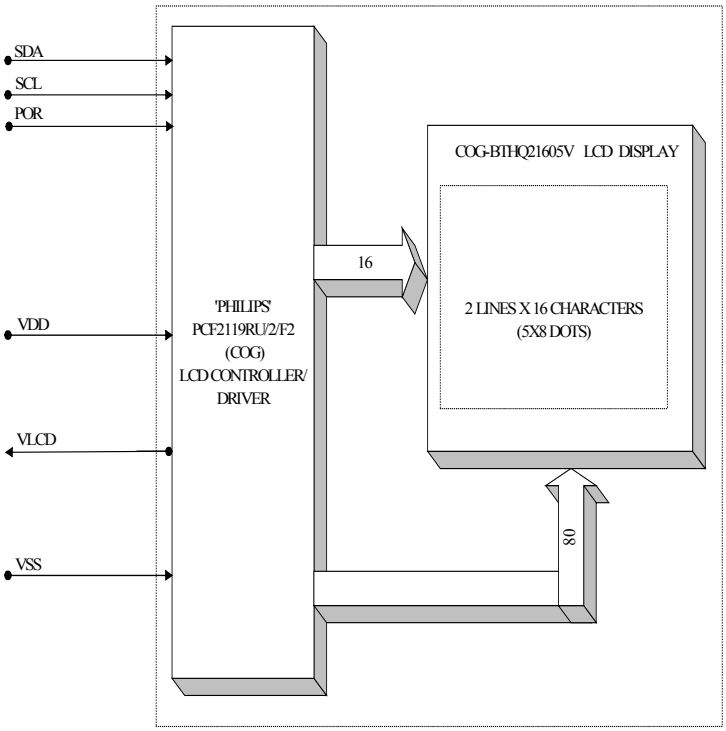
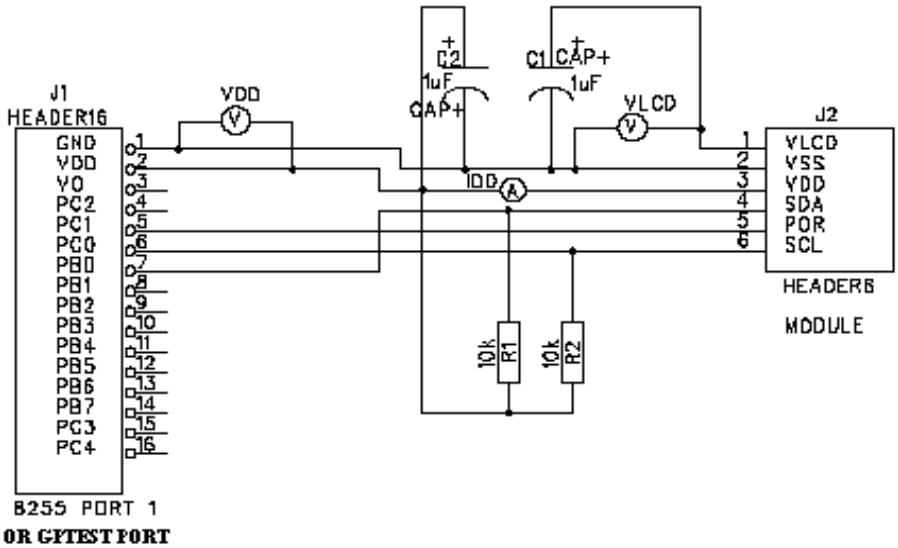



Figure 3: Block Diagram




NOTES

1. VLCD is measured between pin 1 (VLCD) & pin 2 (VSS) of module

2. IDD is measured in series between pin 2 (VDD) of 8255 or gptest
   and pin 3 (VDD) of module

3. VDD=3V is measured between pin 2 (VDD) & pin 1 (GND) of 8255 or gptest

Figure 4: Reference Circuit

## 3. Interface signals

Table 2

| Pin No. | Symbol | Description |
|---|---|---|
| 1 | VLCD | LCD driver voltage |
| 2 | VSS | Ground (0V) |
| 3 | VDD | Power supply for logic. |
| 4 | SDA | $I^2C$ serial data input/output |
| 5 | POR | External power –on reset input. Active High. |
| 6 | SCL | $I^2C$ serial clock input |

## 4. Absolute Maximum Ratings

### 4.1 Electrical Maximum Ratings (Ta = 25 ºC)

Table 3

| Parameter | Condition | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|---|
| Supply voltage range (Logic) | - | VDD - VSS | -0.5 | +4.0 | V |
| Input voltage range | OSC,SCL,SDA | Vi | -0.5 | VDD +0.5 | V |
| Input voltage range (LCD) | | $V_{LCD}$ | -0.5 | +6.5 | V |

Note:

The modules may be destroyed if they are used beyond the absolute maximum ratings.

All voltage values are referenced to VSS = 0V.

### 4.2 Environmental Condition

Table 4

| Item | Operating Temperature (Topr) | | Storage Temperature (Tstg) | | Remark |
|---|---|---|---|---|---|
| | Min. | Max. | Min. | Max. | |
| Ambient Temperature | -10°C | +50°C | -20°C | +65°C | Dry |
| Humidity | 95% max. RH for Ta ≤ 40°C<br>< 95% RH for Ta > 40°C | | | | no condensation |
| Vibration (IEC 68-2-6) cells must be mounted on a suitable connector | Frequency: 10 ~ 55 Hz<br>Amplitude: 0.75 mm<br>Duration: 20 cycles in each direction. | | | | 3 directions |
| Shock (IEC 68-2-27) Half-sine pulse shape | Pulse duration : 11 ms<br>Peak acceleration: 981 $m/s^2$ = 100g<br>Number of shocks : 3 shocks in 3 mutually perpendicular axes. | | | | 3 directions |

## 5. Electrical Specifications

### 5.1 Typical Electrical Characteristics

At Ta = 25 °C, VDD = 3V±5%, VSS=0V.

Table 5

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating voltage (Logic) | VDD-VSS | | 2.85 | 3.0 | 3.15 | V |
| Operating voltage for LCD (built-in) | VLCD-VSS | Note 1 | 5.0 | 5.3 | 5.6 | V |
| Input signal voltage low (SDA, SCL) | Vil | | 0 | - | 0.3 VDD | V |
| Input signal voltage high (SDA, SCL) | Vih | | 0.7 VDD | - | 5.5 | V |
| Operating supply current | $I_{DD}$ | Character mode, VDD =3.0V | - | 0.17 | 0.26 | mA |
| | | Checker board mode, VDD =3.0V | - | 0.18 | 0.27 | mA |

Note (1) : There is tolerance in optimum LCD driving voltage during production and it will be within the specified range.

## 5.2 Timing Specifications

Ta = -10 °C to +50 °C, VDD =1.8 ~ 5.5V, VSS=0V; $V_{LCD}$= 2.2V to 6.5V.

Refer to Fig. 5, $I^2C$ Bus Timing Diagram of 'PHILIPS' PCF2119.

Table 6

| **Parameters** | **Symbol** | **Min.** | **Typ.** | **Max.** | **Unit** |
|---|---|---|---|---|---|
| LCD frame frequency (internal clock) (note 1) | $f_{FR}$ | 45 | 81 | 147 | Hz |
| Oscillator frequency(not available at any pin) | $f_{OSC}$ | 140 | 250 | 450 | kHz |
| External clock frequency | $f_{OSC(ext)}$ | tbf | - | 450 | kHz |
| Oscillator start-up time after power-down | $t_{OSCST}$ | - | 200 | 300 | µs |
| **Timing characteristics: $I^2C$-bus interface;** (note 2) | | | | | |
| SCL clock frequency | $f_{SCL}$ | - | - | 400 | kHz |
| SCL clock LOW period | $t_{LOW}$ | 1.3 | - | - | µs |
| SCL clock HIGH period | $t_{HIGH}$ | 0.6 | - | - | µs |
| Data set-up time | $t_{SU;DAT}$ | 100 | - | - | ns |
| Data hold time | $t_{HD;DAT}$ | 0 | - | - | ns |
| SCL and SDA rise time | $t_r$ | - | - | 300 | ns |
| SCL and SDA fall time | $t_f$ | - | - | 300 | ns |
| Capacitive bus line load | $C_B$ | | | 400 | pF |
| Set-up time for a repeated START condition | $t_{SU;STA}$ | 0.6 | - | - | µs |
| START condition hold time | $t_{HD;STA}$ | 0.6 | - | - | µs |
| Set-up time for STOP condition | $t_{SU;STO}$ | 0.6 | - | - | µs |
| Tolerable spike width on bus | $t_{SW}$ | - | - | 50 | ns |

Notes :

1. VDD=5.0V.

2. All timing values are valid within the operating supply voltage and ambient temperature range and are referenced to $V_{IL}$ and $V_{IH}$ with an input voltage swing to VSS to VDD.

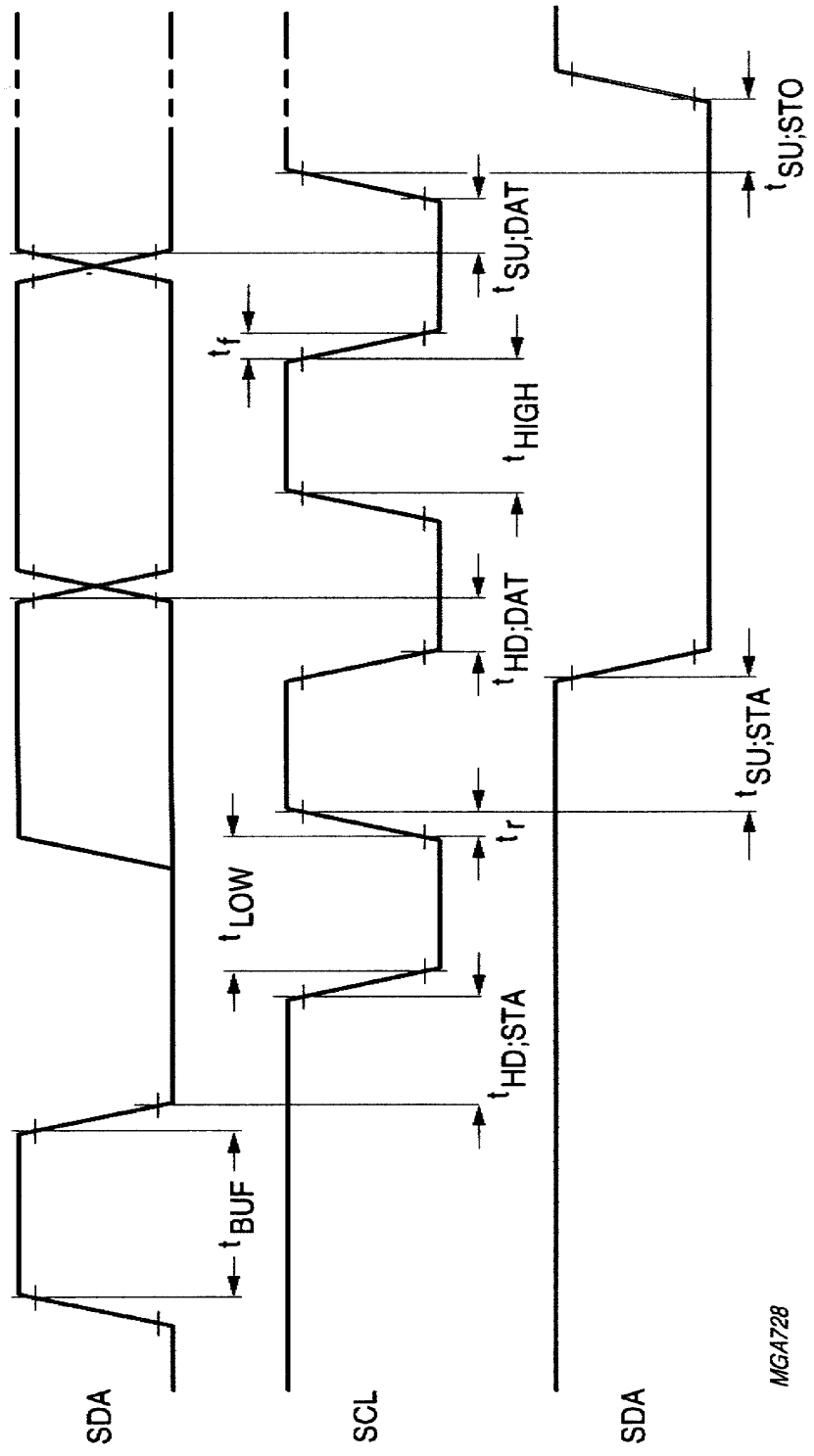



Figure 5: I$^2$C Bus Timing Diagram of 'PHILIPS' PCF2119.

## 6. Character Set 'R' in CGROM

| lower 4 bits \ upper 4 bits | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| xxxx 0000 | 1 |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |
| xxxx 0001 | 2 |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |
| xxxx 0010 | 3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| xxxx 0011 | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| xxxx 0100 | 5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| xxxx 0101 | 6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| xxxx 0110 | 7 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| xxxx 0111 | 8 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| xxxx 1000 | 9 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| xxxx 1001 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| xxxx 1010 | 11 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| xxxx 1011 | 12 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| xxxx 1100 | 13 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| xxxx 1101 | 14 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| xxxx 1110 | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| xxxx 1111 | 16 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |