# RD - 251019

## WT–V2Q reference design RD-251019

### Description:

This white paper describes a reference design module which allows the WT-VTQ to be used in many different scenarios for evaluation purposes, it can also be used as a direct plug in for end products. The design has several features which are listed below.

### Features:

- Complete certified multi use unit design for both testing and production.
- On board solder bridge jumpers to select output direction, mode and Vref.
- On board ENABLE inversion circuitry
- +5vdc, current limited auxiliary output
- Schmitt trigger inputs protected to +12vdc
- High power outputs protected again shorts to ground

### Function:

- Conversion of an analogue DC voltage to discrete quadrature A and B signals in two selectable modes.
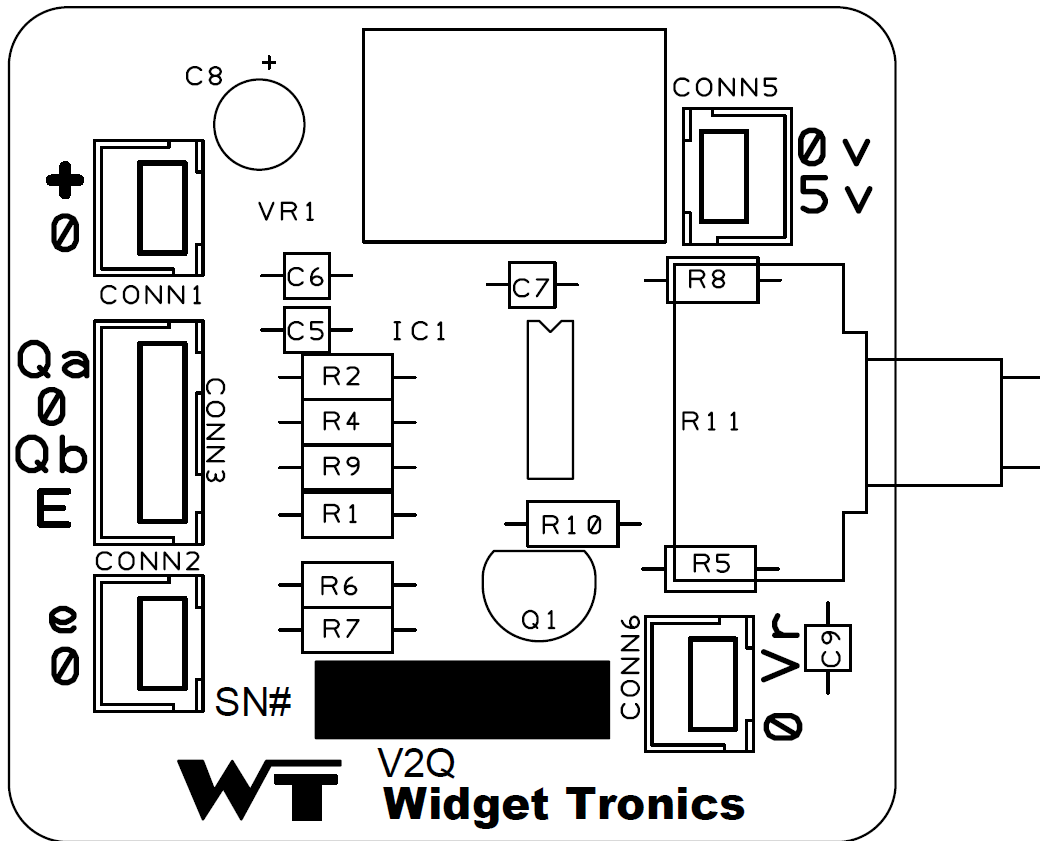
### Operating Characteristics:

- Operating Speed :
  - 400Hz to 13 kHz in bidirectional mode.
  - 200Hz to 14 kHz in unidirectional mode

- Input level absolute maximum :
  - Vref to +5v
  - Vin to+-5V
- Operating Voltage Range:
  - 9.0V to 50v  (see below *)
- Temperature Range:
  - Industrial: -40°C to +85°C

- On-board current limited 5.0vdc output for powering sensors and opto-couplers.
- On-board signal level invertor for driver unit enable (High to Low conversion)
- Output source/sink direct short to ground protection – no time limit.
- Output source/sink direct short to +12V protection – no time limit.
- 47mm x 47mm self-contained board with 40mm x 40mm spaced mounting holes.

*Power supply input MUST be within specified Operating Voltage Range. Rating based on VR1*

## CIRCUIT BOARD LAYOUT AND CONNECTOR DIAGRAM

Fig 1



| CONNECTOR | PIN | Direction | NAME | FUNCTION |
|---|---|---|---|---|
| CONN1 | 2 | Output | 0 | Ground rail |
|  | 1 | input | + | Supply voltage |
| CONN2 | 2 | Output | 0 | Ground rail |
|  | 1 | Input | e | enable term input |
| CONN3 | 1 | Output | Qa | Quadrature signal phase a output |
|  | 2 | Output | 0 | Ground rail |
|  | 3 | Output | Qb | Quadrature signal phase b output |
|  | 4 | Output | E | ENABLE term output (*inverted*) |
| CONN5 | 1 | Output | 5 | Auxiliary 5vdc output |
|  | 2 | Output | 0 | Ground rail |
| CONN6 | 1 | Output | 0 | Ground rail |
|  | 2 | Input | Vr | Reference voltage input |

## Schematic

The schematic in figure 2 shows the circuitry for the AN-25109 application board. (PCB25109)

*Fig 2*
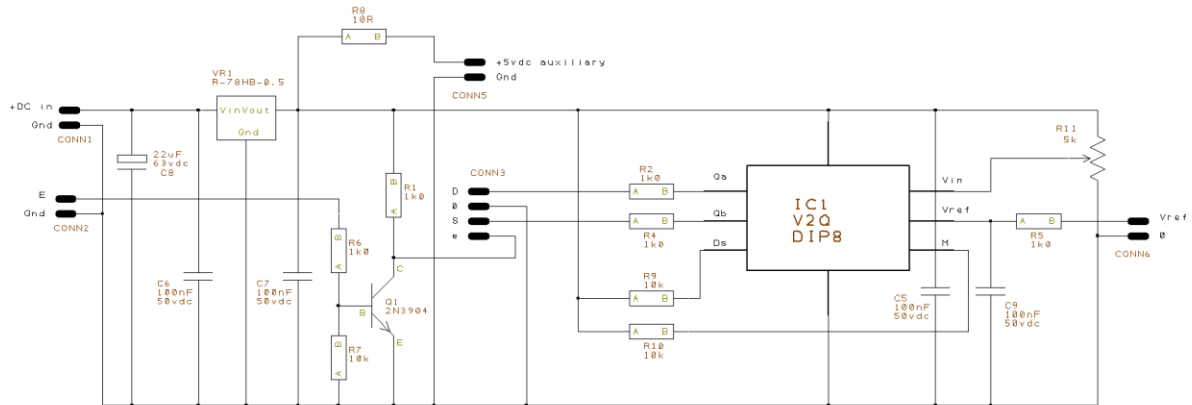


## Bill of materials

| Component ref | Type | Qty | Value | Manufacturer part # | RS part # |
|---|---|---|---|---|---|
| IC1 | Processor | 1 | V2Q | WT-V2Q | - |
| VR1 | Regulator | 1 | 78HB5.05 | R-78HB5.0-0.5L | 672-7095 |
| Q1 | Transistor | 1 | 2N3904 | 2N3904TA | 124-1317 |
| C8 | Capacitor | 1 | 22uF 63vdc | SK063M0022BZF-0611 | 440-6480 |
| C5,C6,C7 | Capacitor | 3 | 100nF 50vdc | K104K15X7RF5TH5 | 852-3277 |
| R8 | Resistor | 1 | 10R | LR1F10R | 125-1154 |
| R11 | Potentiometer | 1 | 5K | 91A1A-B24-B13L | 851-7382 |
| R1,R2,R4,R5,R6 | Resistor | 5 | 1K | LR1F1K0 | 148-506 |
| R7,R9,R10 | Resistor | 3 | 10K | LR1F10K | 148-736 |
| CONN1,2,5 | Socket | 3 | 2 pin | B2B-XH-A(LF)(SN) | 820-1554 |
| CONN3 | Socket | 1 | 4 pin | B3B-XH-A(LF)(SN) | 820-1557 |
| CONN4 | Socket | 1 | 3 pin | B4B-XH-A(LF)(SN) | 820-1551 |
| PCB | FR4 | 1 | 1.6mm | PCB251019 | - |

## ELECTRICAL SPECIFICATIONS

### Absolute Maximum Ratings (†)

Ambient temperature under bias.................................................................................-40°C to +125°C
Storage temperature ...............................................................................................-65°C to +150°C
Voltage on Input pins with respect to $V_{SS}$..................................................................................5.0V
Voltage on Output pins with respect to $V_{SS}$...............................................................................6.0V
Maximum sink/source @ 5.0V on output pins…………………………………………………………10 mA
-40°C ≤ $T_A$ ≤ +85°C ..............................................................................................................100 mA
+85°C ≤ $T_A$ ≤ +125°C ..............................................................................................................55 mA
Total power dissipation...........................................................................................................400 mW
Maximum noise level on $V_{SS}$.................................................................................................4 mv
Sunk by any output pin............................................................................................................10 mA
Sourced by any output pin.......................................................................................................10 mA
Clamp current, $I_K$ ($V_{PIN}$ < 0 or $V_{PIN}$ > $V_{DD}$) .....................................................................±15 mA
Total power dissipation...........................................................................................................400 mW
Output low condition…………………………………………………………………………………….0.6V
Output high condition………………………………………………………………………… $V_{DD}$ - 0.7V
Capacitive loading on all digital pins…………………………………………………………………..50pF
Analogue to digital conversion resolution……………………………………………………………...10 bit
Analogue input pin capacitance………………………………………………………………………….10pF
Maximum allowable analogue impedance………………………………………………………………10 kΩ
Output low condition…………………………………………………………………………………….0.6V
Maximum quadrature frequency (bidirectional mode)………………………………………………….13 kHz
Minimum quadrature frequency (bidirectional mode) ………………………………….………..……..400 Hz
Maximum quadrature frequency (unidirectional mode)………………………………………………….14 kHz
Minimum quadrature frequency (unidirectional mode)…………………………………….……………200 Hz

**Note 1:** Maximum current rating requires even load distribution across I/O pins. Maximum current rating may be limited by the device package power dissipation characterizations, see "Thermal Characteristics" to calculate device specifications.

**†** IMPORTANT NOTICE: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure above maximum rating conditions for extended periods may affect device reliability.

**Document Revisions**

1.0   – First release

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