

Configurable Analog Supply Current Measurement Instrument

FEATURES

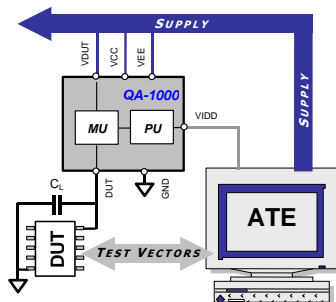
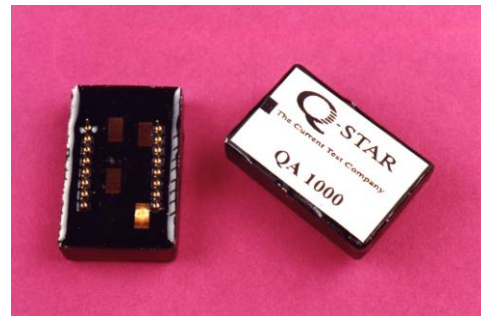
- I_{DDX} Measurement Bandwidth: 1.5 MHz
- I_{DDX} Sensitivity: 30 nArms
- I_{DDX} Measurement Range: 0 – 50 mA
- Loading Capacitance: 20 – 500 nF

APPLICATIONS

- Continuous Analog Supply Current Measurement
- Static Analog Supply Current Measurements
- Analog Current Measurements

DESCRIPTION

The QA-1000 is a configurable analog supply current measurement instrument, designed for probe and final test and continuous current measurement applications. The QA-1000 operates according to the Stabilized Voltage Drop principle. Its unique design ensures its transparency. The QA-1000 is designed to accurately measure analog (supply) currents of maximum 50mA, thereby providing a high repeatability. The module has 2 user selectable measurement ranges: 0-5mA and 0-50mA. The



measurement instrument has a bandwidth of 1.5MHz, offers a best resolution of 30 nArms, and is capable to drive reasonable capacitive loads (up to several 100nF).

The QA-1000 has no digital control pins. It measures continuously and relies for further signal processing and decision making on the capabilities of the mixed-signal ATE or test control equipment to which it is connected. The QA-1000 provides an analog output voltage, corresponding to the measured current. The figure shows a block diagram of the QA-1000 as well as a typical application diagram.

MAIN CHARACTERISTICS

The QA-1000 is a fast and sensitive current measurement device with a very low internal resistance. The module is designed to be inserted between the DUT supply provide by the ATE and the supply pin of the DUT. The QA-1000 consists of 2 active units, a measurement unit (MU) and a processing unit (PU). The measurement unit converts (MU) the measured analog current in a corresponding voltage. The processing unit is configurable and contains amplification and filtering functionality. The

Parameter	Min.	Typ.	Max.	Unit
Positive supply		15		V
Negative supply		-15		V
DUT Supply	0	3-5	8	V
I/V Conversion factor	100		1000	$\mu\text{V}/\mu\text{A}$
Measurement Range	0		50	mA
Resolution	0.03		4	μArms
Bandwidth	30	300	1500	kHz
Capacitive Load	20		500	nF
Rin			1	Ω

unit provides a well-regulated DUT supply in the 0-8V range under control of the VDUT input voltage. The QA-1000 has a broad application range. Examples are the application for low-power/low-voltage ICs and during voltage stress test applications. The optimal performance of the instrument is a function of the desired accuracy, the bandwidth and the value of the loading capacitance C_L (the DUT local on-pin supply decoupling capacitance)

CONFIGURING THE QA-1000

The processing unit of the QA-1000 is configurable by making the proper pin (jumper) connections. A first jumper (JP1) allows selecting the amplification factor (1 or 10). This allows changing the current to voltage conversion factor from $100\mu\text{V}/\mu\text{A}$ to $1\text{mV}/\mu\text{A}$. Selecting a higher ratio decreases the measurement range from 0-50mA to 0-5mA, but does not influence the driving capability of the DUT pin (50mA max). A second set of jumpers (JP2&3) determines the filter characteristics, allowing to select the actual bandwidth (1.5MHz, 300kHz or 30kHz) in function of desired speed and accuracy.

State JP	ON	OFF
JP1 ⁽¹⁾	1mV/ μ A	100 μ V/ μ A
JP2 ^{(2) (3)}	300 kHz	1.5 MHz
JP3 ^{(2) (3)}	30 kHz	

⁽¹⁾ Setting of I/V factor
⁽²⁾ Setting of bandwidth
⁽³⁾ JP2 and JP3 must be closed exclusively, only one of them might be closed for a given configuration.

APPLICATION

The QA-1000 can be used to perform both static and continuous (supply) current measurements. The module has two measurement ranges (0-5mA; 0-50mA) in which it can perform current measurements with a best resolution of 30nArms. The measurement range and bandwidth is programmable and can be set to 1.5MHz, 300kHz and 30kHz for both the 5mA and 50mA range by making the proper module connections. Three typical application diagrams are shown in figures 1-3.

The QA-1000 should be placed as close as possible to the DUT. All connections to the QA-1000 should be well designed not to degrade the measurement instrument's accuracy. The QA-1000's power-on delay time is about 1 second. The ATE is expected to deliver a permanent high quality V_{DUT} reference signal (DUT supply voltage reference) for the DUT. The V_{DUT} pin must not left floating.

The value of the on-pin decoupling capacitance (C_L) is preferable in the 20nF - 500nF range, higher values can be handled but decrease the measurement instrument's measurement bandwidth. Global decoupling capacitors should be placed at the VDUT side of the measurement instrument. Two typical application diagrams are shown below. Decoupling capacitors are not shown on the diagrams.

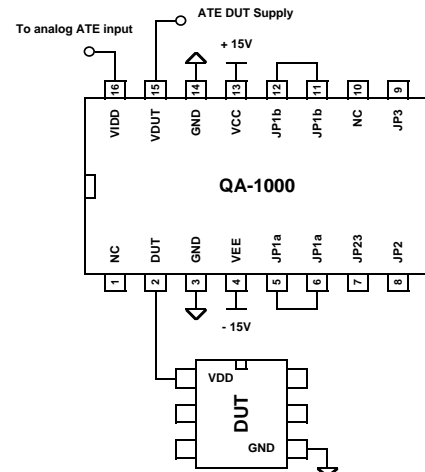


Figure 1. 5mA range, 1.5 MHz bandwidth

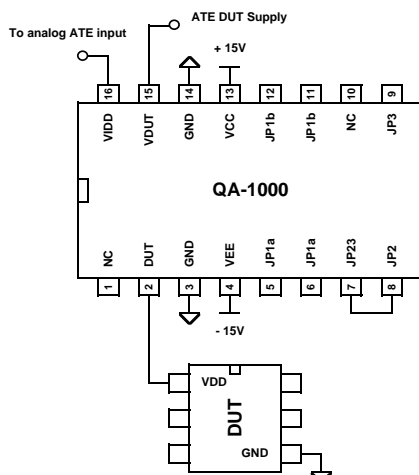


Figure 2. 50mA range, 300kHz bandwidth

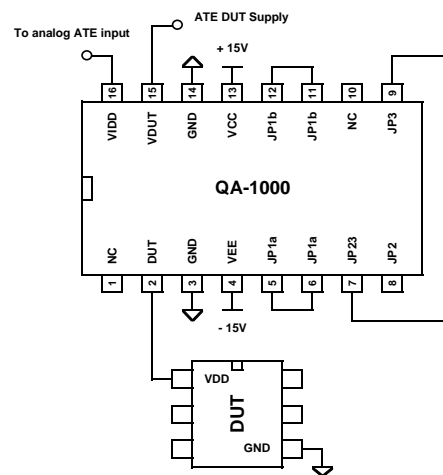


Figure 3. 5mA range, 30kHz bandwidth