

## Advanced (Delta) Issq Measurement Instrument Supporting Various Test Applications

### FEATURES

- DUT Supply independent
- Wide measurement range: 0 – 30mA
- Typical measurement time: 100µs
- High single sample resolution: 50nA<sub>RMS</sub>
- 16-bit ISSQ Value Read Out
- 3-Wire Serial Interface
- On-board data processing capabilities

### APPLICATIONS

- ATE Probe Card Applications
- ATE Interface Board Applications
- Automotive Issq Applications
- Delta Issq Measurements
- Pre & Post Stress Delta Issq
- Issq Pass/Fail Measurements
- Issq Read Out Measurements

### DESCRIPTION

The QD-1030 is a full featured, configurable quiescent ground current (ISSQ) measurement instrument, serving both probe and final test and designed for probe card and interface board applications. The instrument supports a wide range of ISSQ test and measurements applications and provides digital measurement values as well as a pass/fail output signal. On-board memory and data processing capabilities allow implementing various advanced current based test strategies including but not limited to a wide range of Delta-ISSQ approaches

The QD-1030 operates according to the SVD principle and is designed to be inserted in the ground path in between the DUT and system ground. Its unique design ensures transparency to both the ATE and DUT, under all conditions. The unit causes no additional voltage drop during the measurement. The QD-1030 offers the capability to perform accurate and highly repeatable high speed (up to 10kHz) quiescent supply current measurements with nA resolution/repeatability.

The instrument can be configured for a wide range of measurement ranges (0-30mA). The QD-1030 requires only a single positive supply, and provides, under all conditions, a stable virtual system ground. The module can be used for a wide range of applications such as high voltage (automotive) ICs, ultra low voltage circuits and mixed mode circuits with separate grounding. The serial output provides the Pass/Fail flag and/or the measured/processed ISSQ value with 16-bit resolution.

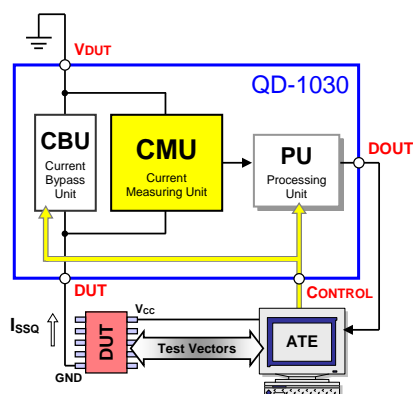
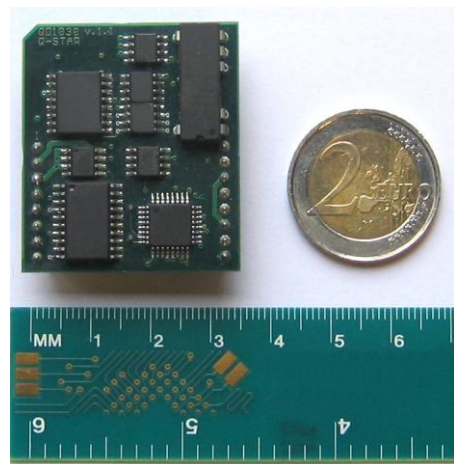


Figure 1. QD-1030 Issq Application

The QD-1030 has an on-board compensated bypass switch, which minimises charge transfers and assures transparency under all conditions. This switch has very low impedance and is capable of transferring large transient currents. To assure DUT ground stability, the bypass switch is automatically activated when the measured current is out of the instrument's measurement range.

By default the QD-1030's Current Measurement Unit (CMU) is optimised to perform an ISSQ measurement in 100µs. The processing and read out time is function of the application and takes typically 20µs.

The default measurement range of the QD-1030 is set to 0-1mA with a single sample resolution of 90nA<sub>RMS</sub>. Other possible fixed measurement ranges are 0-100µA, 0-10mA and 0-30mA with a single sample resolution of 50nA<sub>RMS</sub>, 400nA<sub>RMS</sub> and 2.2µA<sub>RMS</sub>. All these parameters can be customised for optimal performance in function of desired measurement speed/resolution.



## OPERATING MODES

The QD-1030 has two main operating modes: **bypass mode** and **measurement mode**. During bypass, the instrument provides a low resistance path between DUT ground and system ground. During measurement, the actual measurement(s) take(s) place. The instrument can be programmed during bypass mode. The programming operation allows to select the measurement approach and to set the pass/fail level(s). A simple programming protocol is used.

The normal measurement cycle consists of a settling period (typ. 100µs) followed by a capture, processing and read-out period (typ. 20µs). When in measurement mode the module is acting as DUT system ground. When during measurement mode the measured current is out of the instrument's measurement range, then the QD-1030 automatically switches back to bypass mode, meanwhile indicating a fail situation. Figures 1 and 2 show a general application diagram as well as a typical measurement cycle.

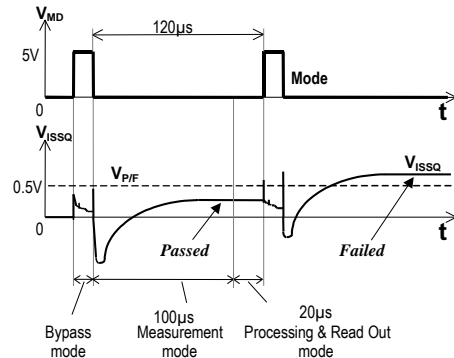


Figure 2. QD-1030 Typical Measurement Cycle

## TYPICAL APPLICATIONS

The QD-1030 can be applied in various ways; some of them are listed below:

- The unit can be used as a pass/fail (P/F) instrument,
- The instrument can be used as a measurement device to determine the exact value of the measured current. The QD-1030 digitises the measured value with a 16-bit resolution. This value can be read out using the serial interface.
- The QD-1030 can be used as a delta-ISSQ instrument. Example of delta approaches currently supported are:
  - Vector-to-vector delta, providing a 16-bit delta value and/or P/F flag.
  - Vector-to-“reference vector” delta, providing a 16-bit delta value and/or P/F flag per vector referred to the measured value of the reference vector.
  - Vector-to-“external reference” (provided by the ATE and loaded in the module during configuring) delta, providing a 16-bits delta value and/or P/F flag per vector referred to the external reference. The reference value can be changed on a vector-to-vector basis.
  - Pre-to-post stress delta, providing a 16-bit delta value and/or P/F flag per vector referred to the pre stress measured value of the same vector.

For all operating modes using a pass/fail flag, the pass/fail flag is generated either as a result of comparing the measurement result (measured value or calculated delta) with a single pass/fail reference value or a pass/fail reference window. During a window comparison, a pass is flagged if the measured ISSQ value or calculated delta is within the boundaries of the reference window. The QD-1030 supports a modification of the pass/fail reference level or window on a vector-to-vector basis, so it supports the use of current signatures.

## ELECTRICAL SPECIFICATIONS

| SYMBOL               | PARAMETER                | MIN  | TYP  | MAX  | UNITS             |
|----------------------|--------------------------|------|------|------|-------------------|
| V <sub>CC</sub>      | Positive Supply Voltage  | +4.5 | +5.0 | +5.5 | V                 |
| CMR                  | Measurement Range        | 0.1  | 1    | 30   | mA                |
| ΔISSQ                | Single Sample Resolution | 50   | 90   | 2200 | nA <sub>RMS</sub> |
| t <sub>MEASURE</sub> | Measurement Time         | (1)  | 100  | (2)  | µs                |
| V <sub>I</sub> VISSQ | V/I Conversion Ratio     | 0.5  | 5    | 50   | mV/µA             |
| I <sub>SST</sub>     | Transient Current        |      | 30   |      | A                 |
| R <sub>ON</sub>      | On Resistance            |      | 20   |      | mΩ                |

(1) The QD-1030 can be used to perform static measurements

(2) The maximum measurement time is dependent on the number of samples taken. 115µs @ 1 sample, 150µs @ 4 samples, 290µs @ 16 samples.