Qmax is a global leader in the field of Automated Test Equipment PCB Repair, Diagnostic and Board Functional Test Systems. The **QT-200** Mixed Signal Functional Test System is a proven model being used by thousands of users world over for varied applications. **QT-200** can effectively test Digital, Analog and Mixed Technology ICs in In-Circuit, as wired condition and gives clear PASS-FAIL results. Hybrids, ASICs and house-coded ICs can be checked using QSM signature method. Optional IDDE software makes new device test program generation easy with graphical user interface.

**POWERFUL FEATURES**

- **In-Circuit Functional Test Library (Digital/Analog/Mixed Signal)** of >21K devices
- **QSM VI Signature method** for testing ASICs / Hybrids & Discretes
- **Test logic families:** TTL / CMOS / ECL / EIA / LSI / Linear / Memory
- **In-circuit IC identify** feature for house coded ICs and ICs with their number erased.
- **Automatic internal pull-up/down** for open collector and ECL devices
- Functional testing without need for learning from known good board or circuit diagram using Digital Simulators and Analog evaluation Software.
- On-Line Simulation makes accurate testing of sequential devices possible even when their Reset pins are disabled in In-Circuit conditions.
- **Board Learn / Compare mode** increases board recovery rate
- **Built-in Resistance, Capacitance and Voltage measurement capability**
- **Powerful logic waveform display window for failure confirmation**
- **CircuitTracer** for schematic generation / reverse engg. applications (Optional)
- **IDDE software** for easy **Device Test Program Generation** (Optional)
- **Russian Device Library** (Optional)

**APPLICATIONS**

- **PCB Repair Centers**
- **Production line Board Recovery / Functional Test Centers**
- **In-house maintenance**

**Qmax Users**

- Airport Authorities / Airlines
- Automobile Manufacturers
- Defence / Space / Atomic Research Organisations
- Defence Workshops / Factories
- Electronics Manufacturing / Service Companies
- Heavy Engineering Industries
- Port Authorities
- Private Corporates
- Public Sector Enterprises
- Steel / Cement Industries
- Telecom/Telephone Industries
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PCB Diagnostic & Functional Test System

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A5 Though Qmax's ICFT can test accurately a device irrespective of its In-Circuit configuration, if the in-circuit links are suspected then you will need either schematics or a good board to confirm if the in-circuit links are correct and intentional and not caused by solder bridges or track opens that may occur during a re-work. Board Learn and test yield higher results as it can also compare the In-Circuit configurations. Also in testing EPROMS and PAL devices, the proprietary data of an EPROM and logical equation of a PAL is required and this can be accommodated in Board Learn and Test.

Q6 How does QT200 handle ASIC or proprietary devices?
A6 If the ASIC device data is available (at least the pin description) then using IDDE – GTPG one can create a test program in a short time. Also the Qmax’s QSM VI Learn and Compare takes care of this kind of problems.

Q7 What is QSM VI?
A7 QSM VI is the second best method. This innovative VI method allows users to select, save and compare various VI trace signature combinations. This method allows detection of open/short between any pins/nodes on the device under test and functional failure from 70% to 80% degree of confidence on in-circuit components.

Standard VI trace: Normally this test is under power off condition. This is an acceptable method for detection of short or semi short on IC or failing components. The standard VI signature is referenced to ground. Its major problem is not being able to detect when two inputs that have the same signatures and shorted together. The resultant VI signature appears the same. For a 20 pin device it will learn 20 VI Trace for comparison. Standard VI is effective up to 50% on average. Very good for short-circuit to ground only.

QSM VI: The QSM VI has a movable reference. It will learn all the VI trace signature combinations and use these for comparison. This is a far more accurate method. Since it measures the VI impedance between all pins, it will be able to detect any leakage between the pins. This would result in a device functional failure. A 20 pin IC will have a total of 190 VI trace signatures. Moreover QSM VI can be carried out under power on condition. This allows the sink/source of the DUT to be compared. This is extremely useful in QA. QSM VI is effective up to 80% on an average.

Q8 Any other important points to take note when selecting a PCB repair systems?
A8 Make sure the tester you purchase has programmable time base, programmable drive/threshold levels, RAM based drive for accurate timing, Auto compensation for in-circuit configurations, Auto Pull up/down for Open collector/ open emitter devices, Auto guarding guide for reliable bus based device test, Simulation based test, Analog and mixed signal capability, Analog evaluation engine, proven library and best test interface to the device under test.
A Comprehensive Results Display

Clip Status Window provides user with information on which pins are linked, connected to power, Power-on impedance / voltage at every pin of the IC under test are displayed. Exceptionally low or abnormal impedance on IC pin will indicate possibly source / sink problem.

Waveform Analysis Window gives user an opportunity to verify and pass / fail results on the DUT. This feature helps the user to prevent wrongful removal of good devices from the DUT. Many PCB test systems do not allow the user to verify a device failure. This is a very important feature.

Test Message Window provides complete test message for confirmation failure analysis.

Identify allows user to identify unmarked / unknown devices in-circuit.

Device Data provides user with IC pin out and functional description.

Library Window shows which library is being used (Qmax User or Others).

Enter name of IC and press Enter.

Display shows test under Library Threshold or User definable threshold. This allows user to check for IC sink / Source / bus faults.

Guard pin control for bus devices.

Time Base Select to test device under different speed.

Resistor / Capacitor / Voltage Measurement selection.
QSM VI - An Innovative Technique

**TTL Dual D-Type Positive-Edge-Triggered Flip-Flops With Preset and Clear**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.7%</td>
<td>CL1T</td>
<td>14</td>
</tr>
<tr>
<td>7.7%</td>
<td>D1</td>
<td>2</td>
</tr>
<tr>
<td>7.7%</td>
<td>CLK1</td>
<td>3</td>
</tr>
<tr>
<td>7.7%</td>
<td>SETT</td>
<td>4</td>
</tr>
<tr>
<td>100.0%</td>
<td>Q1</td>
<td>5</td>
</tr>
<tr>
<td>7.7%</td>
<td>Q1</td>
<td>6</td>
</tr>
<tr>
<td>15.4%</td>
<td>GND</td>
<td>7</td>
</tr>
</tbody>
</table>

Screen shows QSM VI detecting a 7474 failing due to illegal short to GND on pin 5. Occurrence failures stands at 100.0% on pin 5. Other pins give a 7.7% Occurrence failure. This very important feature indicates an “external” problem rather than an “internal” IC failure.

Overview of Board Under Test (BUT)

Screen shows Board View featuring ICs under test’s position are displayed for easy location during Board Test Compare Mode. ICs will be shown in Green if it Passes; Red if it Fails; Yellow if learned as Wired OR and Deep Blue if Unlearnt.

In-Circuit Functional Testing of Analog ICs

Screen shows functional test waveform of an op-amp (LM348). The actual output response is shown in black at pin 14. The waveform shows real functional test of linear devices. The green traces at pin 12 and 13 are the inputs from the QT200 drivers. The resultant inputs are shown in black on trace 4 and 5 from the top. The test pattern functionally check the op-amp during linear and saturation mode. This test is performed in-circuit. QT200 has an evaluation engine that allows the user to test linear devices in-circuit without the need to learn from a known good board. This is another very powerful feature found on QT200. Without this feature, you will need to learn the response from a known good board.

Functional Testing of Mixed Signal ICs

Functional Test on a DAC08. The 8 inputs are driven with a binary data stream. The DAC08 output at pin 4 is a current source and therefore connected to an op-amp circuit. QT200 flying channel is used to pick the output response form this op-amp output. QT200 analyses the result and declared that the DAC08 passes the test. This functional test is performed under power-on and in-circuit. QT200 offers the unique capability to test mixed signal type devices using its both digital and analog drivers simultaneously.

QSM VI — A Powerful Tool for Failure Analysis

QSM VI multiple display screen showing pin failures with reference to other pins. Deviation and Occurrence failure (a feature unique with Qmax systems) provides a very powerful failure analysis tool.

Deviation failures provide indication of how badly a pin deviates from that of a known good signature. Occurrence failure gives an indication of frequencies of failures of a pin with reference to all the other pins. The combination of these two reports provides the user with very good indication as to the nature of the failed components or ICs.

QSM VI is very effective in detecting failures on custom ICs and components. It has been used by IC manufacturers in their Failure Analysis department. Production line as stuffed PCB Recovery System and complements the ICFT in normal PCB repair.
**CircuitTracer (Optional)**

This optional software package helps the user to trace the intra links between the pins of an IC and also the interlinks between pins of various ICs which can be accessed through appropriate test clips. The software detects the links, which are colour coded and further it automatically generates the Netlists. The Netlist file is then converted to file formats, which are compatible to CAD software packages like ORCAD or EDWIN. This process helps in Reverse Engineering of the PCB i.e. to generate the Schematic Diagram / Circuit Diagram of the Board Under Test from the board itself.

**Integrated Device Development Environment — IDDE (Optional)**

IDDE is also an Optional Software Package which is extremely useful for Device Test Program Generation. IDDE stands for Integrated Device Development Environment. There are three modes in this package, namely,

**QDDL** : Qmax Device Description Language, which is mainly used for generating test program for SSI / MSI devices using logic primitives and simple commands.

**WEST** : Waveform Event Specification & Testing is for LSI/ VLSI ICs. Test Program generation using WEST requires Training and it is similar to C language.

**GTPG** : In Graphical Test Program Generation mode the user can directly define the required test input waveforms for the Device Under Test or even for the entire Board Under Test graphically and if the expected Output waveforms are known to the user the same also can be defined. Otherwise the output from Known Good Board can be learnt and stored as master reference for future comparisons. This mode is extremely useful to test devices / simple boards without any need to write complex test programs.

**Test Interface (Optional)**

- **SOIC clip for in-circuit testing of SMD devices.** Various pin counts clips are available to handle the different ICs. The test clip is interfaced to the test clip via a test cable assembly connected to the QT200 front panel.

- **Qmax TO39 type test probes designed for functional/VI testing of transistors from the solder side.** This access to the pins greatly improves the test-ability of many ICs on a board under test.

- **Qmax TO5 and TO39 type solder side test probes.** These can be interfaced to QT200 via test cable assembly.

- **Qmax solder side 20 pin test probes designed for high density PCB.** Access from the solder side allows the user to test ICs which otherwise would be blocked by other components.

*(For more information on Qmax Test Interface accessories ask for Qmax Clips & Probes brochure)*
**DIGITAL TEST CAPABILITY**

- **No of i/o channel**: 48 Channels expandable to 96 channels – Desk Top Version
- **Drive output Current**: 650mA per pin/channel as per Interim Defence Standards 00-53/1.
- **Pin Memory**: 8K X 4 bits RAM behind each pin.
- **Pattern Depth**: 8K test vectors.
- **Pattern Rate**: 500 KHz.
- **Clock Rate**: 0.25 MHz (Min. Clock tick 0.5 MHz).
- **Test Rate**: Programmable from 62.5 Hz to 0.5 MHz.
- **Loops & Conditional Loops**: Unlimited.
- **Drive States**: Hi, Low and Tristate Hybrid pin drivers detachable by user.
- **Drive Pattern**: User definable and standard waveform include sine, ramp, triangle, square etc.
- **Resolution**: 12 Bit Resolution.
- **No of Channels**: 3 (Single or Multiple trace)
- **Input Impedance**: 50 Ohms to >5 MOhms.
- **Trigger**: Auto, Normal, Single, positive or negative trigger
- **Time Base**: 80 µsec. to 9.6 millisec.
- **DC Stimulus**: 8 programmable.
- **Drive Source Impedance**: Programmable in 5 steps from 50 Ohms to 100 kOhms.
- **ESD DAMAGE TEST**
  - **Drive Frequencies**: 40 Hz, 312 Hz, 2.5 KHz.
  - **Drive Voltages**: 13V Max. to 2.5V Min.
  - **Drive Current**: 25mA Max. @ 2.5V to 0.065mA Min. @ 13V

**QSM AND VI TRACE**

- **Pin Memory**: 8K X 24 bits RAM. This is used to store, drive or read signals from the pin under test.
- **Frequency**: 0.25 Hz to 250 KHz
- **Amplitude**: 0.1V to +/-13V Peak.
- **Drive Source Impedance**: Programmable in 5 steps from 50 Ohms to 100 kOhms.
- **Function Generator**: Can be used as a Function Gen. with max. amp. of +/- 13V.
- **DRC Check**: Auto DRC check on Interactive / Board Learn / Test

**ANALOG PIN ELECTRONICS (contd.)**

- **Drive current**: 650mA per pin/channel as per Interim Defence Standards 00-53/1.
- **Input impedance**: > 2 meg Ohms
- **Max Input**: 26V.
- **Input impedance**: > 260 Ohms
- **Programmable Load**: 50 E, 200 E, 1K, 10K and 100K
- **Pulse Width**: 2 µsec to 16 milli sec.
- **Input Impedance**: 100K minimum
- **Sensor Threshold**: Dual.
- **Input Impedance**: 100K minimum
- **Sense Low**: +/-10V, 80mV accuracy
- **Sense High**: +/-10V, 80mV accuracy
- **Drive Low**: 0 to –10V Programmable in steps of 80mV.
- **Drive States**: High, Low and Tristate Hybrid pin drivers detachable by user.
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  - **Drive Frequencies**: 40 Hz, 312 Hz, 2.5 KHz.
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**GENERAL**

- **CE Mark**: Approved
- **Interface**: USB Interface ver. 2.0 with Windows 2000 / XP operating system (Optional).
- **Power requirement**: 220VAC @ 6.5KVA
- **Physical Dimension**: Approx. 47 cm (W) X 41.5 cm (D) x 29 cm (H).
- **Weight**: Approx. 30Kgs net.