

# ITC59100

test measurement unit (TMU)



## overview

The ITC59100 Test Measurement Unit (TMU), which plugs into the ITC59000 Test Platform, performs gate charge (Qg) measurements that conform to MIL-STD-750C, Notice 2, Method 3471 and JEDEC Standard JESD24-2. In addition the ITC59100 TMU performs an internal gate resistance (Rg) test method that conforms to JEDEC Standard JESD24-11.

The ITC59100 TMU has an electronic Gate Current Regulator, a Drain Current Regulator, and the Logic needed to test a variety of MOSFET and IGBT package types, over a wide range of user programmable voltage, current, and time parameters.

In order to ensure accurate, noise-free measurements, each TMU is cable-connected to a remote pod that is located as close as practical to the handler or to a manual test socket. This remote pod contains the kelvin detection circuits for the gate force and sense, buffers the analog signals and contains the resonating inductor that completes the RLC circuit with the DUT gate capacitance and gate resistance.

Sort Criteria for each test can be defined. The ITC59000 combines the results from each TMU to sort devices to physical handler bins.

## key features

- Controlled by an onboard microprocessor
- Fully simultaneous testing of half bridge devices
- Maximum of 100 volts and 100 Amperes for the Drain voltage and current
- Maximum of 10 mA of Gate current and  $\pm 20$  volts
- Fast Kelvin Test on all test channel connections
- Accurate I and V waveform digitization



## gate charge test

In the ITC59100 Test Measurement Unit, a constant current source drives the gate and a second constant current source provides the drain load. Before running the gate charge test, an opens and shorts test can be run to ensure the DUT is correctly inserted in the handler contacts. A gate current equal to the test current is applied to turn the device on and then the test current is applied in the reverse direction to turn the gate off. The gate charge is measured during the turn-off of the device and is identical to that required during turn-on. Both the gate and drain waveforms are digitized during the turn-off sequence and are used to calculate the various parameters of gate charge, as well as  $R_{DS}$  (On). The user has the option to use either the measured gate threshold value or a pre-set value in the gate charge calculations.

Constant current sources are used so that the slope of the charge curve can be easily converted into Gate Charge by simply multiplying time and current. Also a current source drain load (an active MOSFET current regulator) is used because it is usable over a wider current and voltage range than an inductive or a resistive load.

## gate resistance test

The ITC59100 TMU can also measure the equivalent series gate resistance of a MOSFET device, conforming to JEDEC Standard JESD24-11 test method.

To perform the gate resistance measurement, ITC places an inductor in series with the gate drive. A sine wave is applied to the gate through the resulting RLC circuit and the frequency is varied until a rough resonant point is found by measuring the voltage across and current through the RLC circuit. A kelvin path is used to eliminate contact resistance from the measurement

A second sweep is now performed but in smaller steps to find the exact point of resonance. At this point, the gate's L and C reactance cancel each other, the current is in phase with the voltage and the remaining impedance is the gate resistance itself. Multiple measurements are taken and averaged and the resultant R is calculated. This is the Rg value.



# ITC59100Rg

**test measurement unit (TMU)**

## gate resistance test

The ITC59100Rg TMU, which plugs into the ITC59000 Test Platform, measures the equivalent series gate resistance (Rg) of a MOSFET device, conforming to JEDEC Standard JESD24-11 test method.

To perform the gate resistance measurement, an inductor is placed in series with the gate drive. A sine wave is applied to the gate through the resulting RLC circuit and the frequency is varied until a rough resonant point is found by measuring the voltage across and current through the RLC circuit.

A second sweep is now performed but in smaller steps to find the exact point of resonance. At this point, the gate's L and C reactance cancel each other, the current is in phase with the voltage and the remaining impedance is the gate resistance itself. Multiple measurements are taken and averaged and the resultant R is calculated. This is the Rg value.

Sort Criteria for each test can be defined. The ITC59000 combines the results from each TMU to sort devices to physical handler bins.

# ITC59100Qg

**test measurement unit (TMU)**

## gate charge test

The ITC59100Qg TMU, which plugs into the ITC59000 Test Platform, performs gate charge (Qg) measurements that conform to MIL-STD-750C, Notice 2, Method 3471 and JEDEC Standard JESD24-2. In the ITC59100Qg TMU a constant current source drives the gate and a second constant current source provides the drain load. A relatively high gate current is first applied to turn the device on and then the test current is applied in the reverse direction to turn the gate off. The gate charge is measured during the turn-off of the device and is identical to that required during turn-on. Both the gate and drain waveforms are digitized during the turn-off sequence and are used to calculate the various parameters of gate charge, as well as  $R_{DS}$  (On).

Constant current sources are used so that the slope of the charge curve can be easily converted into Gate Charge by simply multiplying time and current. Also a current source drain load (an active MOSFET current regulator) is used because it is usable over a wider current and voltage range than an inductive or a resistive load.

Sort Criteria for each test can be defined. The ITC59000 combines the results from each TMU to sort devices to physical handler bins.

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