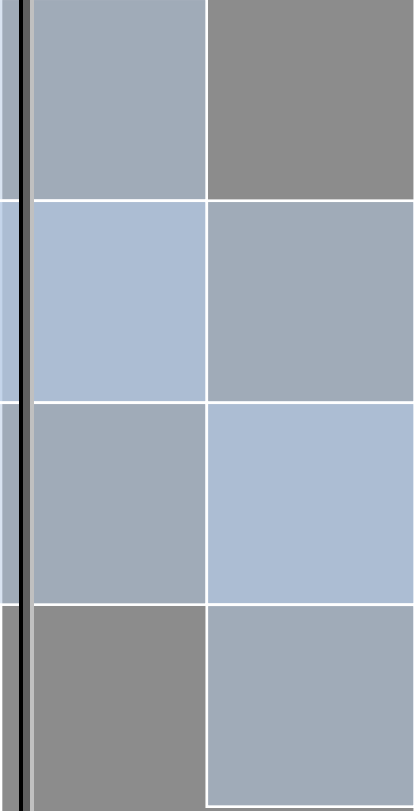


FTI 1000 Manual

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Introduction

Purpose of this Manual

The purpose of this manual is to provide information about the AC libraries and tests that can potentially be run in FTI Studio, as well as information regarding the Instrument Configuration, Library Manager, and FTIMarker applications.

Please consult the FTI Studio User Interface Manual for detailed and specific information regarding the interface and creating/running tests.

The tests within each library chapter are arranged in tabular order and follow this format:

Overview: indicating what the general purpose of the test is,

Description: describes how the test performs and functions

Simplified Schematics/Block diagrams: presents a pictorial and conceptual overview of the functioning of the test

Test parameters: includes a screen capture of the test as well as testing parameters and values

Important Note:

Although the FTI 1000 system you purchased has the ability to run all the tests we provide, some of the tests are specific to the type of equipment you are using including any add on equipment. If your Focused Test representative has not covered or gone over with you specific tests that are to be run on your system(s), any excluded tests are not meant to be run and may result in run time errors.

Chapter 1:

Working with FET AC Library Tests

Working with FET AC Library Tests

- ✓ AC Kelvin
- ✓ AC Kelvin Engr.
- ✓ AC VGS
- ✓ AC UIL_dutON
- ✓ AC UIL
- ✓ AC UIL Multi
- ✓ AC Gate Charge Isource
- ✓ AC Gate Charge IsourceX
- ✓ AC RGCG

Libraries and Tests

Libraries in FTI are defined by the Library Manager application. This application contains a list of all the libraries and tests provided to FTI Studio. Depending on what components you are testing and what needs to be tested, you may not be able to run every single test. A run through of the Library Manager application and how to add additional tests is discussed later in the manual.

Important Note:

Although the FTI 1000 system you purchased has the ability to run all the tests we provide, some of the tests are specific to the type of equipment you are using including any add on equipment. If your Focused Test representative has not covered or gone over with you specific tests that are to be run on your system(s), any excluded tests are not meant to be run and may result in run time errors..

AC Kelvin Test

Overview:

The AC Kelvin Test, checks the Kelvin connection on the DUT utilizing the AC board.

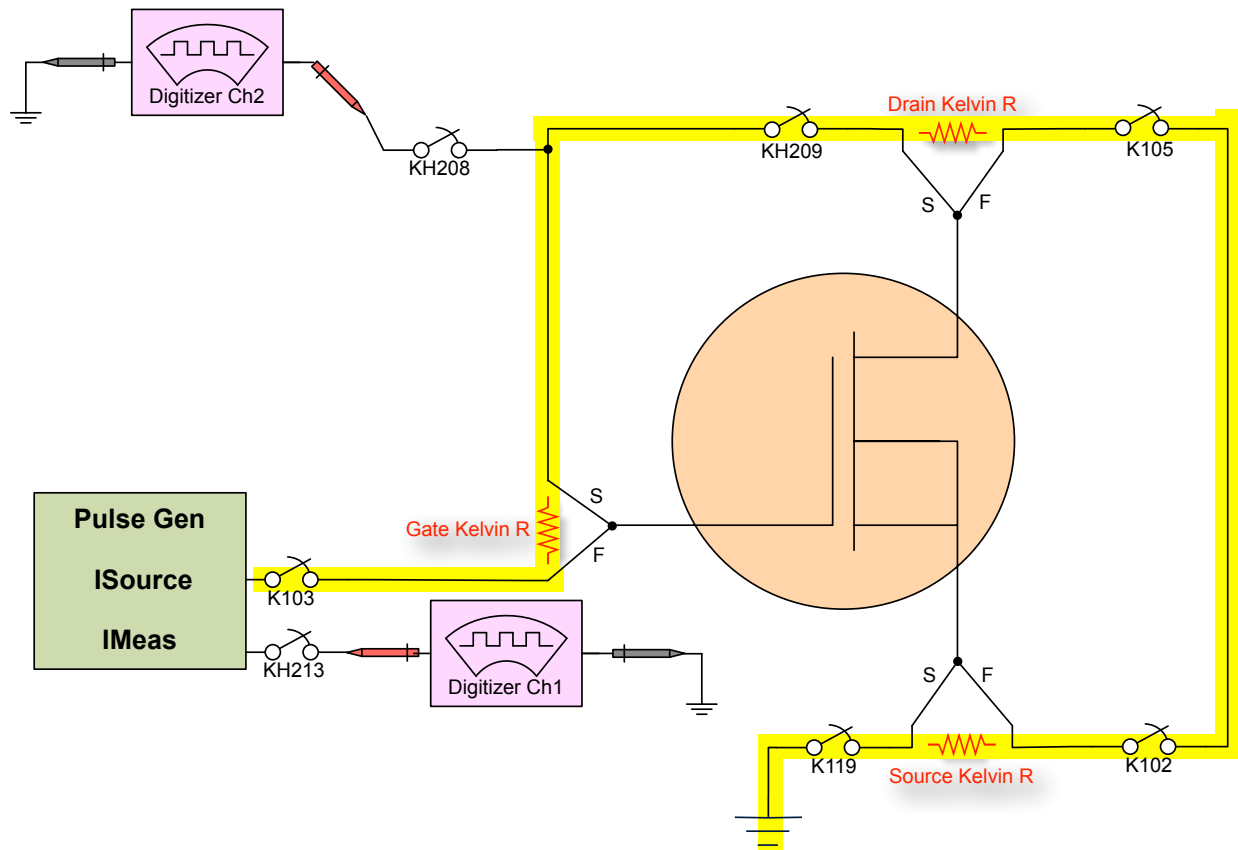
Description:

The Gate is connected to the Pattern Generator Source pin, which is generating current.

The test runs by forcing a current (parameter *Gate Current* is typically 20mA) into the Gate pin, across the kelvin connection at the drain and again across the kelvin connection at the source into ground. Digitizer 1 is used to measure the voltage from the kelvin connection across the Gate, Drain, and Source. As long as the Kelvin connection is valid, there will be a low resistance through the current forced across the Kelvin connections and closed relays. Digitizer 2 is used in Engineering mode only and will be discussed in the next test description.

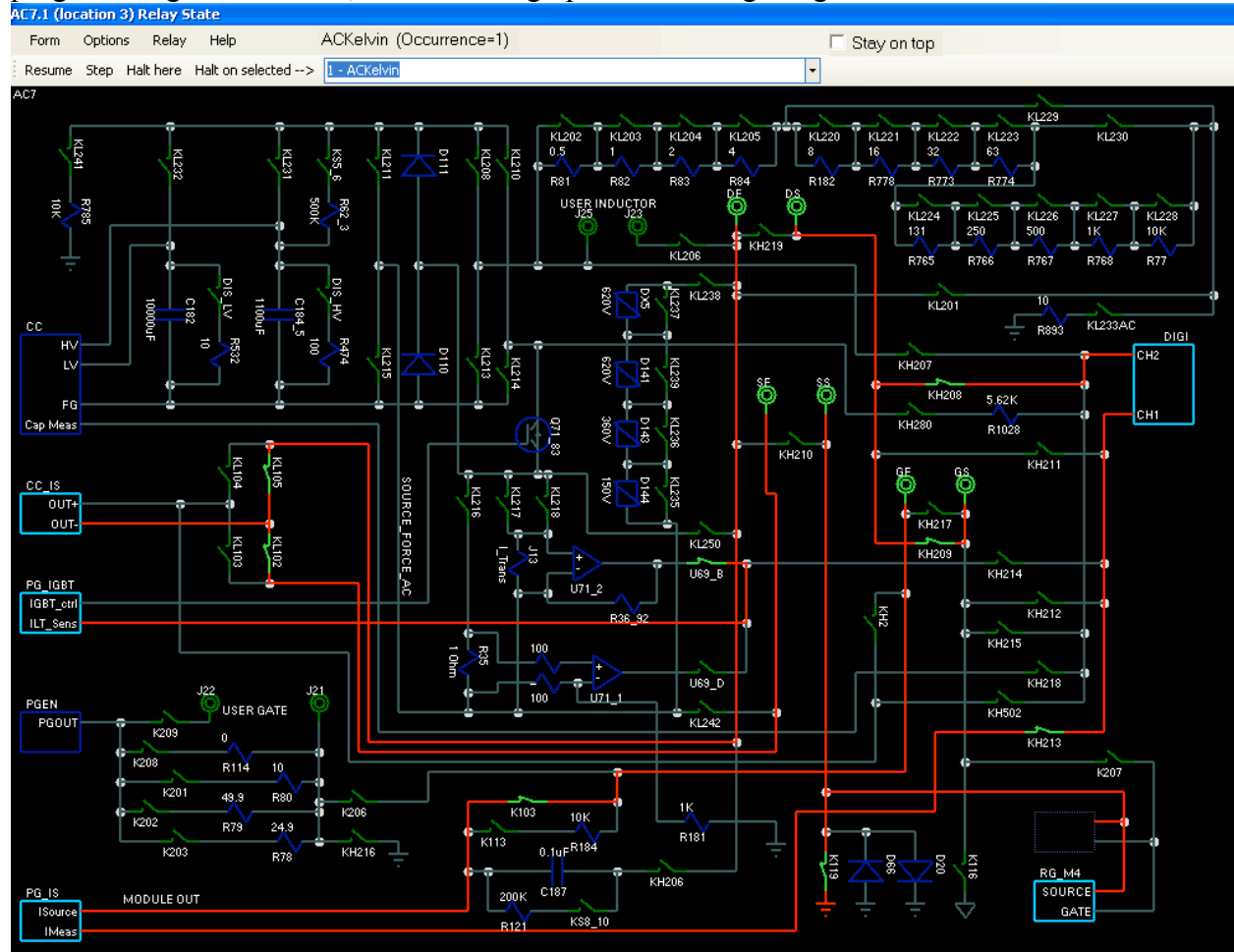
AC Kelvin Test – Sum of Kelvin Resistances, Gate, Drain, Source

Configuration for N-Channel and P-Channel devices, 3 pin series path + Gate.



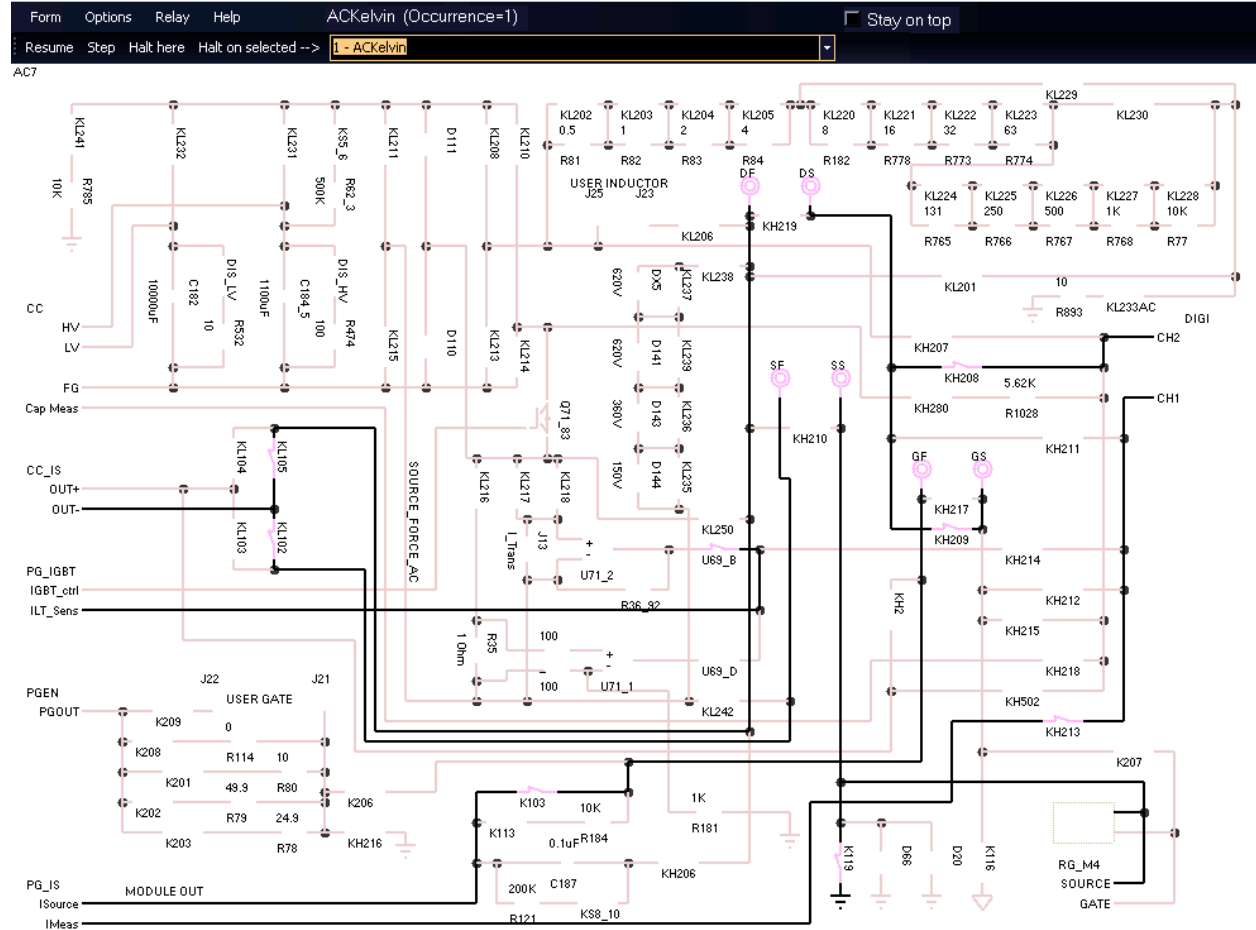
AC Kelvin Test Relay State

If the user were to click on the graphics button, to bring up the relay state in the test programming environment, it would bring up the following image.



As the user is aware, the RED highlighted lines are the ones connected to the activated relay contacts shown in green. To get a clearer view, the image is inverted on a separated color channel to improve clarity.

AC7.1 (Location 3) Relay State



AC Kelvin Test Parameters

Misc	
EngMode	False
GateCurrent	0.02
GateKelvin	True
Pulsewidth	0.002
RKELVIN_MAX	10
Samples	10

<i>EngMode</i>	False for manufacturing, True for engineering
<i>Gate Current</i>	Amount of gate current for stimulus
<i>Gate Kelvin</i>	True for Measuring Kelvin
<i>PulseWidth</i>	<p>Length of time, in seconds, to apply current.</p> <p>This must be set long enough for the power to rise fully. With longer cables, or coaxial cables going to a prober, extra time will need to be used, especially with higher voltage devices.</p> <p>Adjust the pulse (increase <i>PulseWidth</i>) until a stable reading is achieved.</p>
<i>RKELVIN_MAX</i>	Upper Specification Limit
<i>Samples</i>	<p>Number of measurement samples to average result.</p> <p>The digitizer on the AC board can be programmed from 200kSPS to 25 MSPS. For this test, it is usually programmed to 1MSPS for a sample rate of 1uSec per sample.</p> <p>Five (5) is normally adequate, but at lower currents, or with more noise, more samples may be required.</p> <p>If the number of samples is increased, <i>PulseWidth</i> may need to be increased to match. For example 100 samples would take 100 usec, so with a <i>PulseWidth</i> of 2msec, this allows 1.9 msec for the voltage to stabilize, which would be enough for low voltages, but above 100V make sure the value is settled. If you try to reduce <i>PulseWidth</i> so that it is less than the time required to make the measurements, the software will generate an alarm each time the test runs.</p> <p>Measurement samples are taken at the end of the pulse.</p>

AC Kelvin Test Example Datalog

DataLogger		Binner	Summary
Bin Yield			
Test Yield			
Site Yield			
Raw Data			
Water Map			
Statistics			
Histograms			
Trend Plots			
Correlation			
Water Map			

DEVICE 1	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS
TestName	Test	Min	Value	Max	
ACKelvin	1.0	0.000Ohms	932.648mOhms	10.000Ohms	KELVIN Resistance

AC Kelvin Test Engineering

Overview:

The AC Kelvin Test Engineering, checks the Kelvin connection on the DUT utilizing the AC board with additional results to provide debug abilities.

Description:

The Gate is connected to the Pattern Generator Source pin, which is generating current.

This test is split into 5 parts. The first part is identical to the Production AC Kelvin Test discussed in the last section. The next part is using Digitizer 2 to measure the combination of Drain + Source. The alst 3 parts individually test the Gate, Drain, and Source Kelvin resistance.

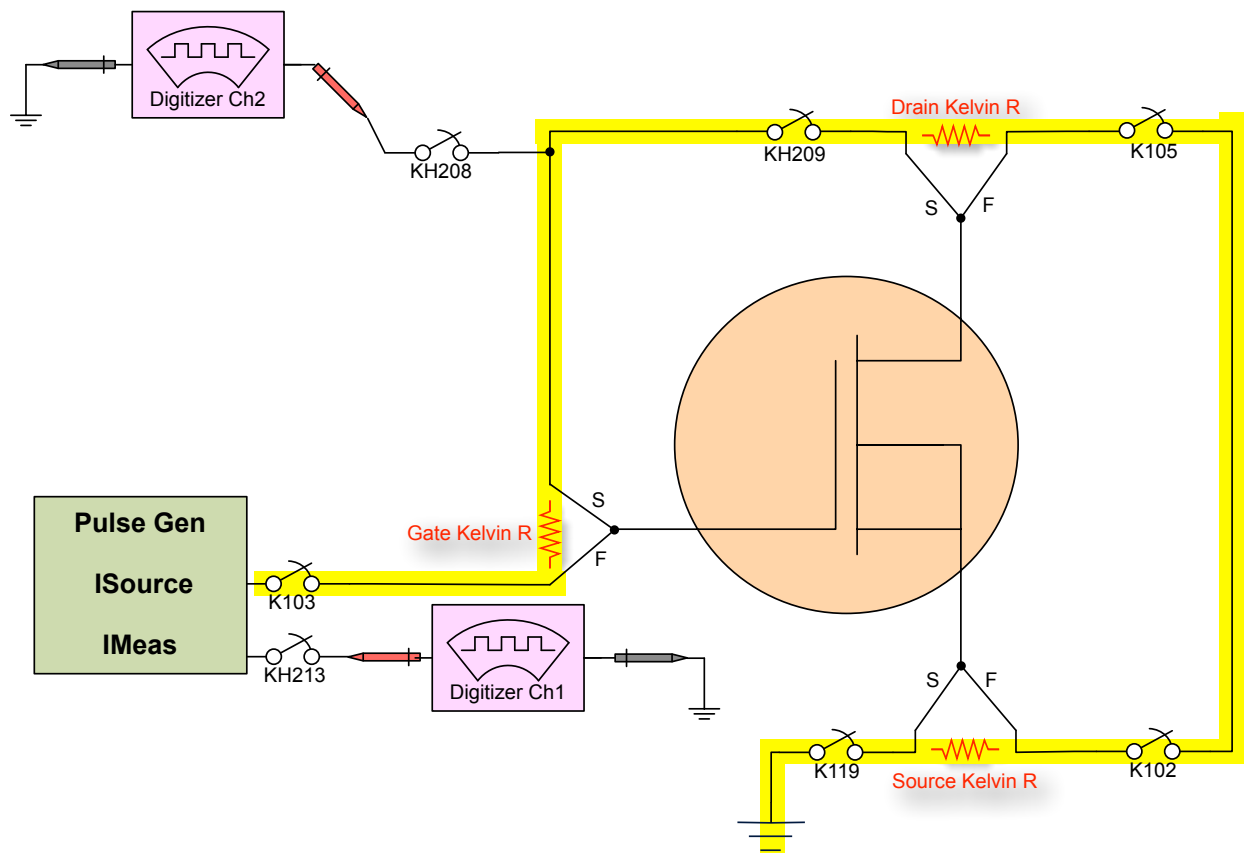
Step 1 – Gate + Drain + Source Kelvin Resistance & Drain + Source.

The test runs by forcing a current (parameter *Gate Current* is typically 20mA) into the Gate pin, across the kelvin connection at the drain and again across the kelvin connection at the source into ground.

Digitizer 1 is used to measure the voltage from the kelvin connection across the Gate, Drain, and Source.

AC Kelvin Test – Step : Sum of Kelvin Resistances, Gate, Drain, Source, Sum of Drain, Source

Configuration for N-Channel and P-Channel devices, 3 pin series path + Gate, Step 1 – Digitizer Ch1 All 3, Digitizer Ch2 Drain + Source.

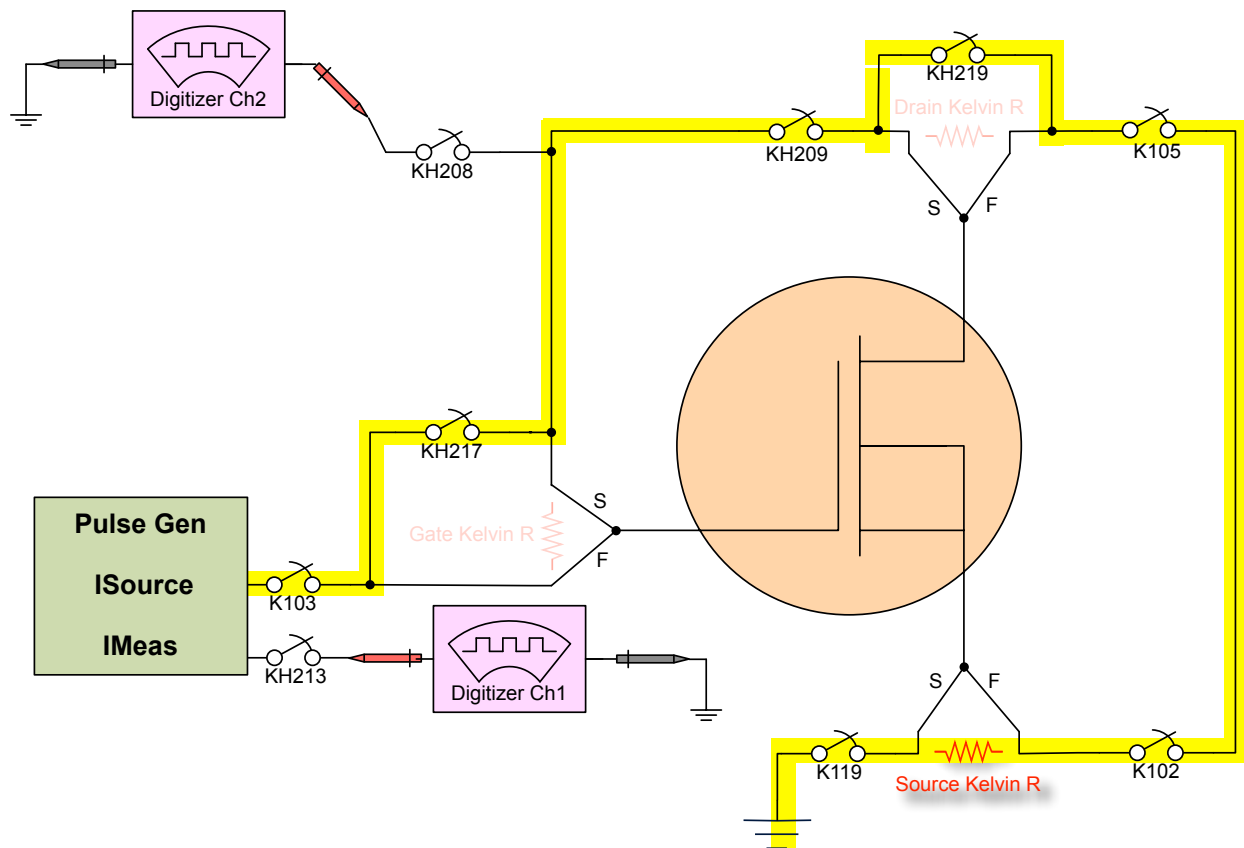


Step 2&3 – Source Kelvin Measurement.

This now starts the testing of the Gate, Drain, and Source independently. The first part of this, Step 2&3, shorts the Gate and Drain to test the Source. The Drain is shorted by KH219 and the Gate is shorted by KH217. The Digitizer Channel 2 is used to test the voltage on the Source, as this is closer to the Source pin, than Digitizer Channel 1. The Gate Kelvin resistance is then the absolute value of the voltage on Digitizer Channel 2 divided by the force current, (parameter *Gate Current* is typically 20mA) into the Gate pin.

AC Kelvin Test Engineering – Steps 2&3

Configuration for N-Channel and P-Channel devices, 3 pin series path + Gate, Steps 2 & 3 – Digitizer Ch2.

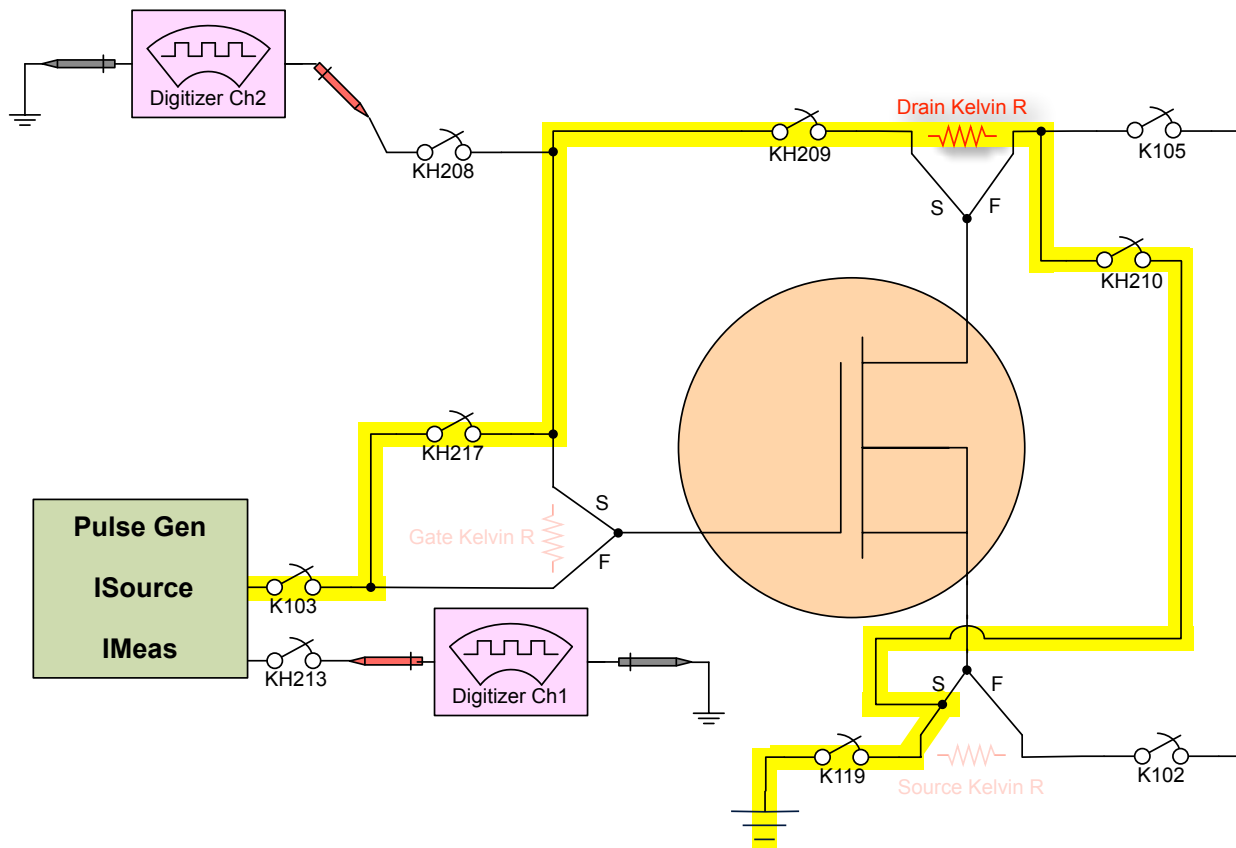


Step 4&5 – Drain Kelvin Measurement.

These 2 steps open the short at the Drain, and now short the Gate via relay KH210. The Digitizer Channel 2 is used to test the voltage on the Drain, as this is closer to the Drain pin, than Digitizer Channel 1. The Drain Kelvin resistance is then the absolute value of the voltage on Digitizer Channel 2 divided by the force current, (parameter *Gate Current* is typically 20mA) into the Gate pin.

AC Kelvin Test Engineering – Steps 4&5

Configuration for N-Channel and P-Channel devices, 3 pin series path + Gate,
Steps 4 & 5 – Digitizer Ch2.

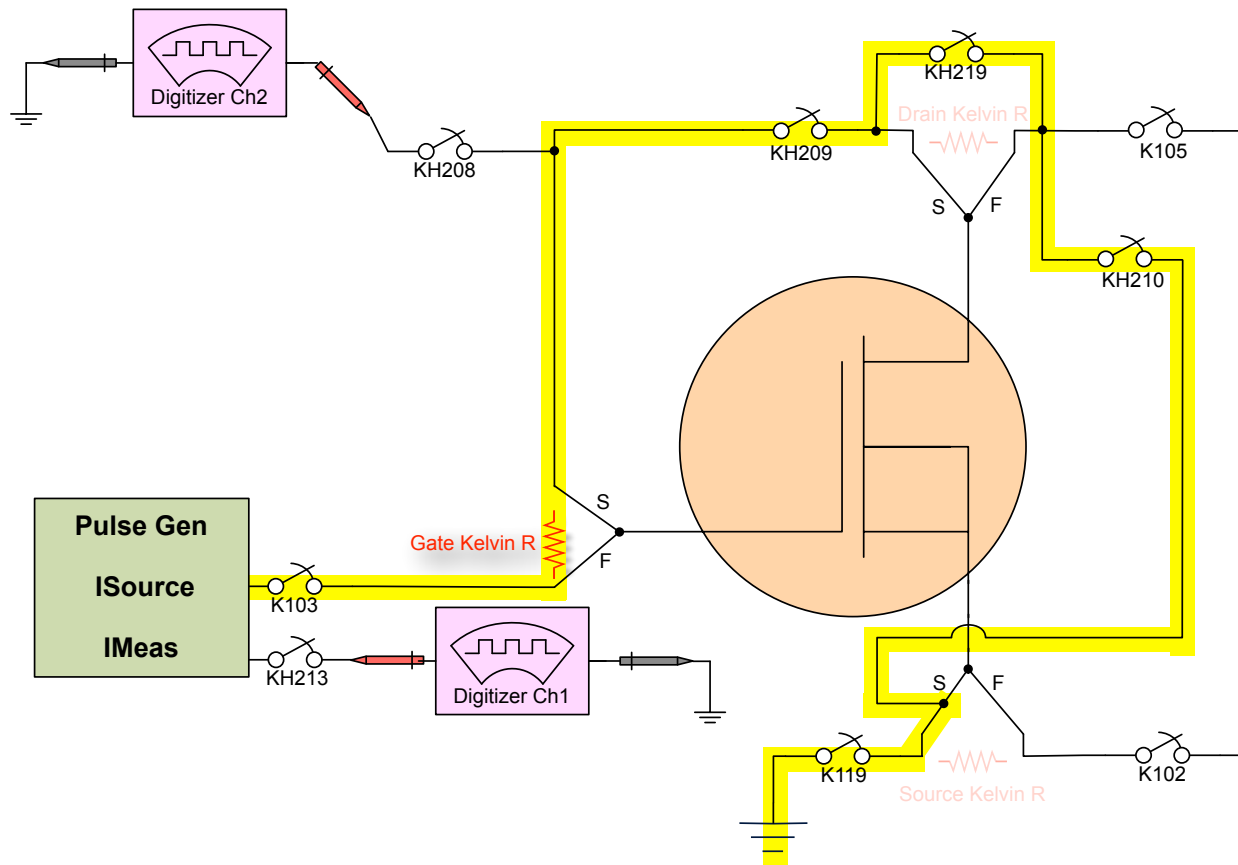


Step 6&7 – Gate Kelvin Resistance.

These 2 steps open the short at the Gate and re-instate the short at the Drain. The Digitizer Channel 1 is now used to test the voltage on the Gate, as this is on the correct side of the Gate to make a valid measurement. The Gate Kelvin resistance is then the absolute value of the voltage on Digitizer Channel 1 divided by the force current, (parameter *Gate Current* is typically 20mA) into the Gate pin.

AC Kelvin Test Engineering – Steps 6&7

Configuration for N-Channel and P-Channel devices, 3 pin series path + Gate, Steps 6 & 7 – Digitizer Ch1.



AC Kelvin Test Engineering Parameters

Misc	
EngMode	True
GateCurrent	0.02
GateKelvin	True
Pulsewidth	0.002
RKELVIN_MAX	10
Samples	10

EngMode	False for manufacturing, True for engineering
Gate Current	Amount of gate current for stimulus
Gate Kelvin	True for Measuring Kelvin
PulseWidth	<p>Length of time, in seconds, to apply current.</p> <p>This must be set long enough for the power to rise fully. With longer cables, or coaxial cables going to a prober, extra time will need to be used, especially with higher voltage devices.</p> <p>Adjust the pulse (increase <i>PulseWidth</i>) until a stable reading is achieved.</p>
RKELVIN_MAX	Upper Specification Limit
Samples	<p>Number of measurement samples to average result.</p> <p>The digitizer on the AC board can be programmed from 200kSPS to 25 MSPS. For this test, it is usually programmed to 1MSPS for a sample rate of 1uSec per sample.</p> <p>Five (5) is normally adequate, but at lower currents, or with more noise, more samples may be required.</p> <p>If the number of samples is increased, <i>PulseWidth</i> may need to be increased to match. For example 100 samples would take 100 usec, so with a <i>PulseWidth</i> of 2msec, this allows 1.9 msec for the voltage to stabilize, which would be enough for low voltages, but above 100V make sure the value is settled. If you try to reduce <i>PulseWidth</i> so that it is less than the time required to make the measurements, the software will generate an alarm each time the test runs.</p> <p>Measurement samples are taken at the end of the pulse.</p>

AC Kelvin Test Engineering Example Datalog

Datalogger						
Binner						
Summary						
Bin Yield						
Test Yield						
Site Yield						
Raw Data	DEVICE 1	FLOW NewFlow	SITE 1	SBIN 2	HBIN 2	FAIL
Water Map	TestName	Test	Min	Value	Max	
Statistics	ACKelvin	1.0	0.0000hms	891.814mOhms	10.0000hms	KELVIN Resistance (0.618V)
Histograms	ACKelvin	1.1	0.0000hms	267.661mOhms	10.0000hms	Drain + Source Resistance (0.005V)
Trend Plots	ACKelvin	1.2F	0.0000hms	29.7750hms	10.0000hms	Source Resistance (0.004V)
Correlation	ACKelvin	1.3F	0.0000hms	29.5930hms	10.0000hms	Drain Resistance (-0.008V)
Water Map	ACKelvin	1.4	0.0000hms	868.152mOhms	10.0000hms	Gate Resistance (0.617V)

AC VGS Test

Overview:

The AC VGS test utilizes the AC board to measure the DC VGS.

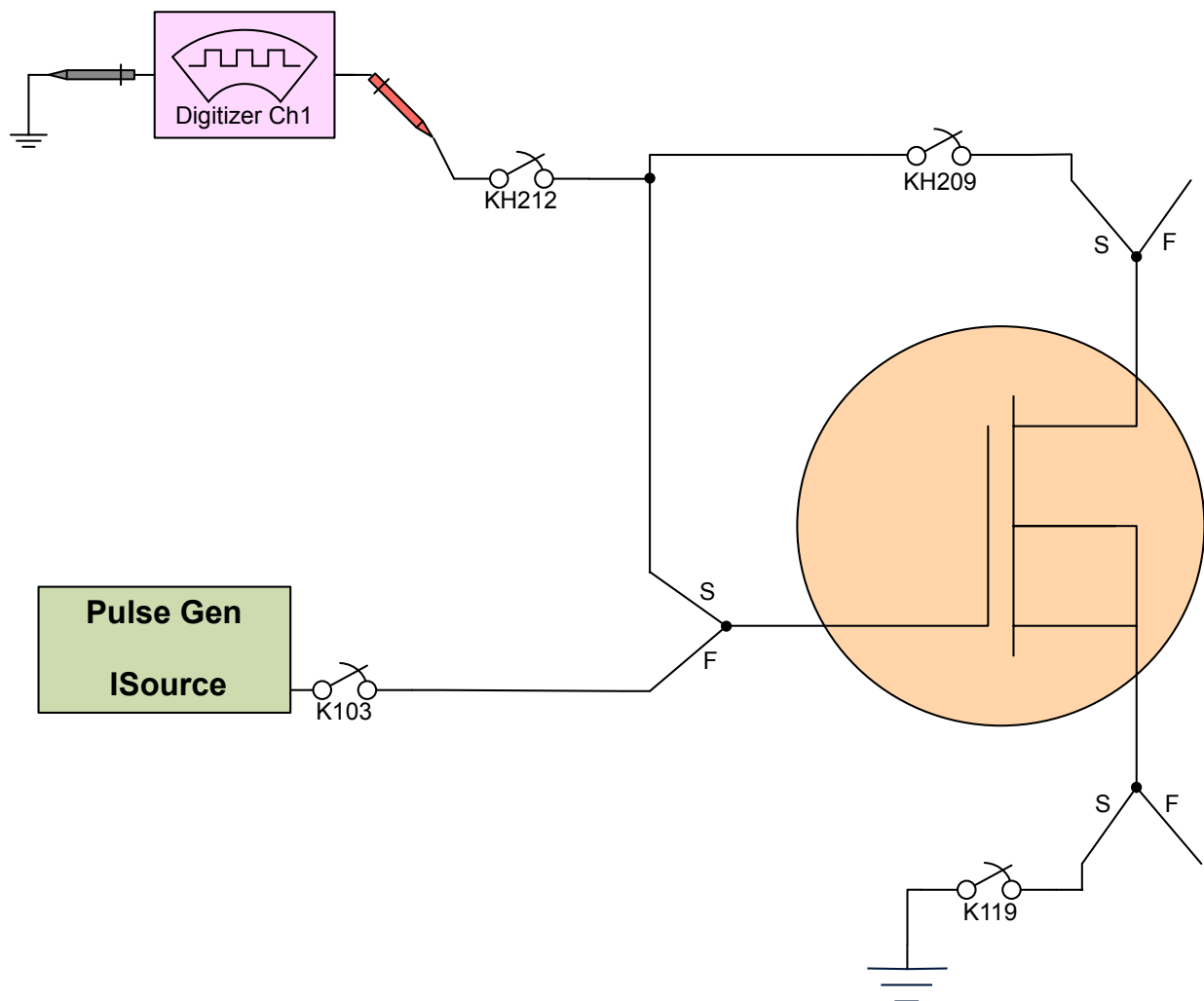
Description:

The Gate is connected to the Pattern Generator Source pin, which is generating current while the Gate and Drain are shorted together.

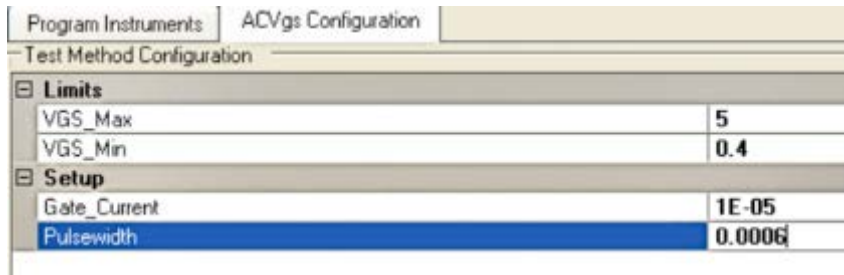
The test runs by forcing a current (parameter *Gate Current* is typically 10uA) into the Gate pin, and measuring the voltage on the Gate Sense line with Digitizer Ch1.

AC VGS Test

Configuration for N-Channel and P-Channel devices.

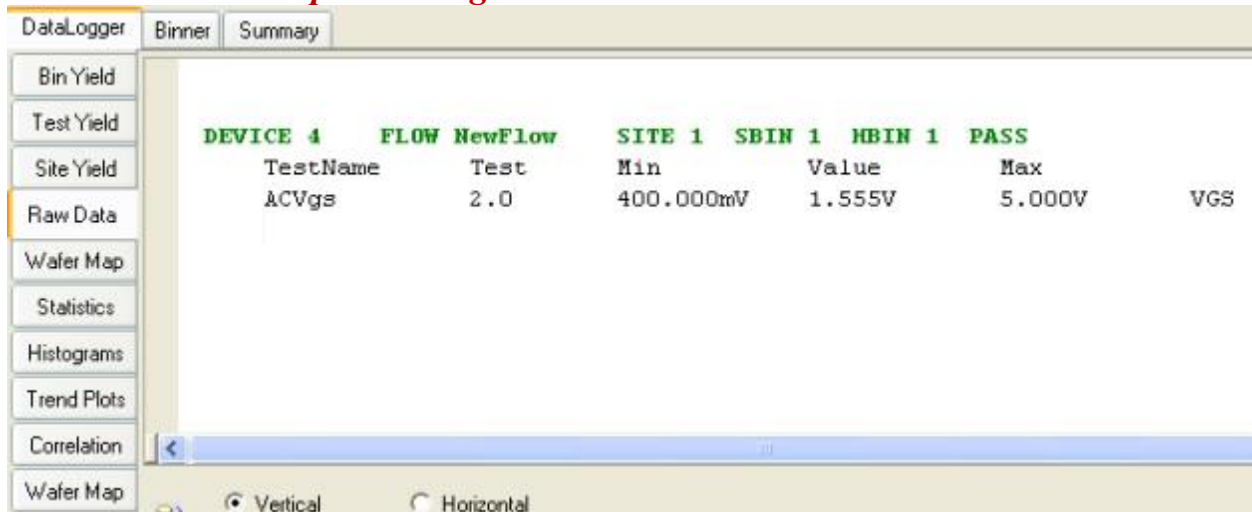


AC VGS Test Parameters



VGS_Max	Upper Specification Limit
VGS_Min	Lower Specification Limit
Gate Current	Amount of gate current for stimulus
PulseWidth	<p>Length of time, in seconds, to apply current.</p> <p>This must be set long enough for the power to rise fully. With longer cables, or coaxial cables going to a prober, extra time will need to be used, especially with higher voltage devices.</p> <p>Adjust the pulse (increase <i>PulseWidth</i>) until a stable reading is achieved.</p>

AC VGS Test Example Datalog



AC UIL_dutOn Test

Overview:

The AC UIL_dutOn test utilizes the AC board to test the Unclamped Inductive Load test for avalanche testing by turning on the DUT, in order to reduce the inductor charging time.

Description:

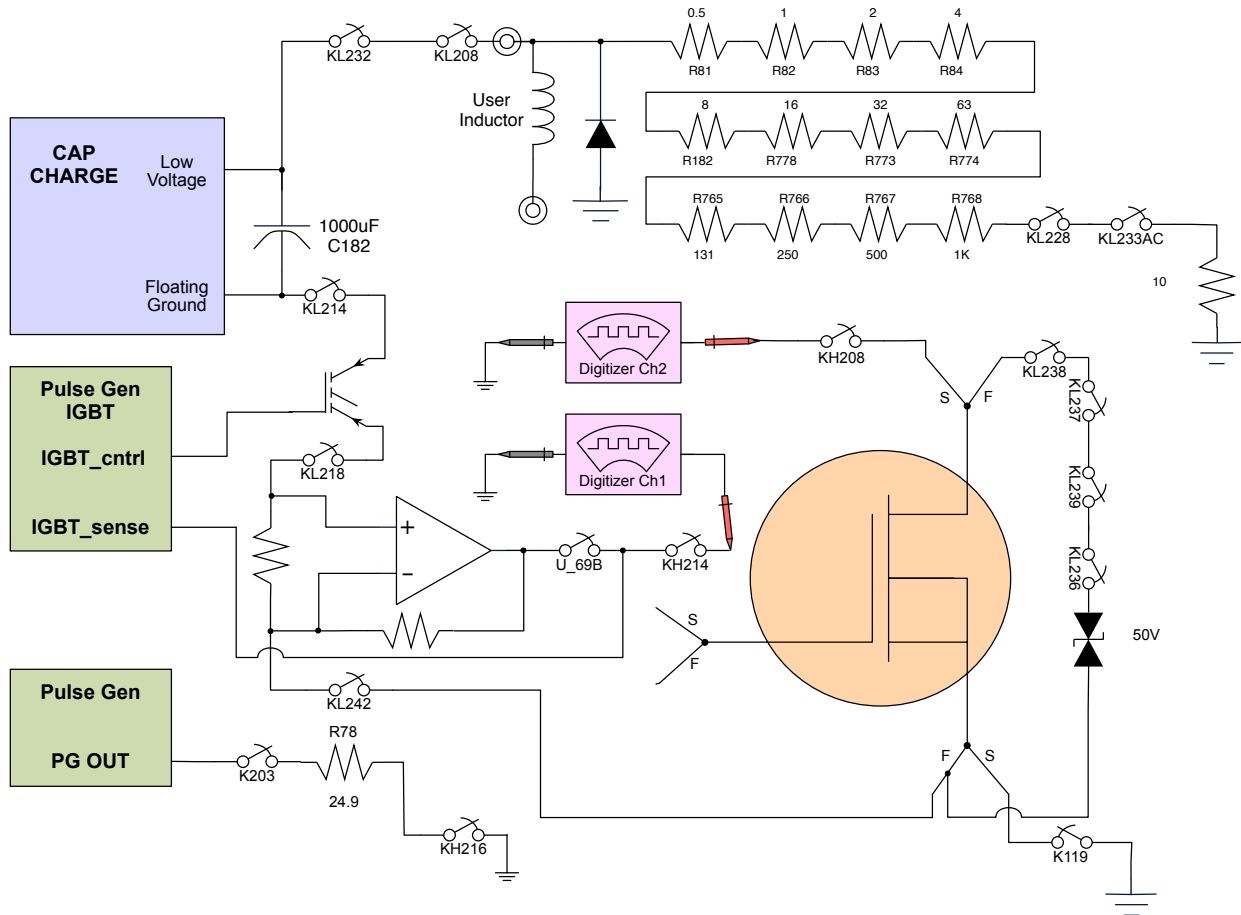
The UIL test takes place in 3 steps. The first step is to charge the capacitor with the resistive load to stabilize the capacitive charger. The capacitor will act as the V_{DD} supply.

The second step is to connect the inductor and to disconnect the resistive load on the capacitor. There are three choices for the inductor used. The first is a discrete inductor plugged into the tester. The second choice is the 6 user value chosen inductor box and the third choice is the user chosen EPROM inductor box.

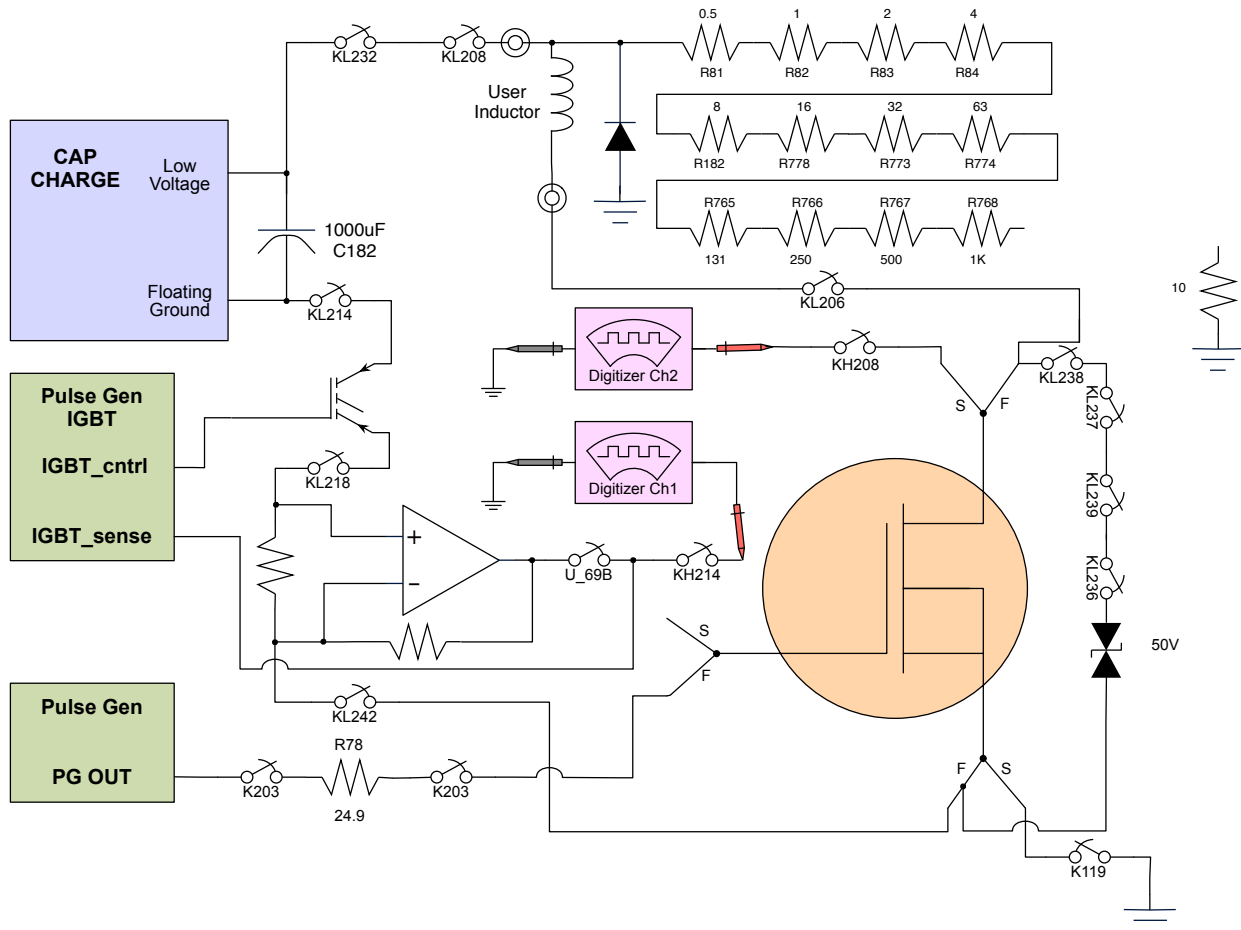
The third step, monitor both the BV_{DSS} voltage and I_D current in order to determine the Peak Avalanche Drain Voltage and Drain Current. When the Drain current has hit the peak value the DUT is turned off by driving the gate to zero and the high speed switch is opened. Then the inductor discharges. The information obtained from the digitizers is used to calculate the Avalanche pulse width and the dissipated energy.

AC UIL_dutOn Test

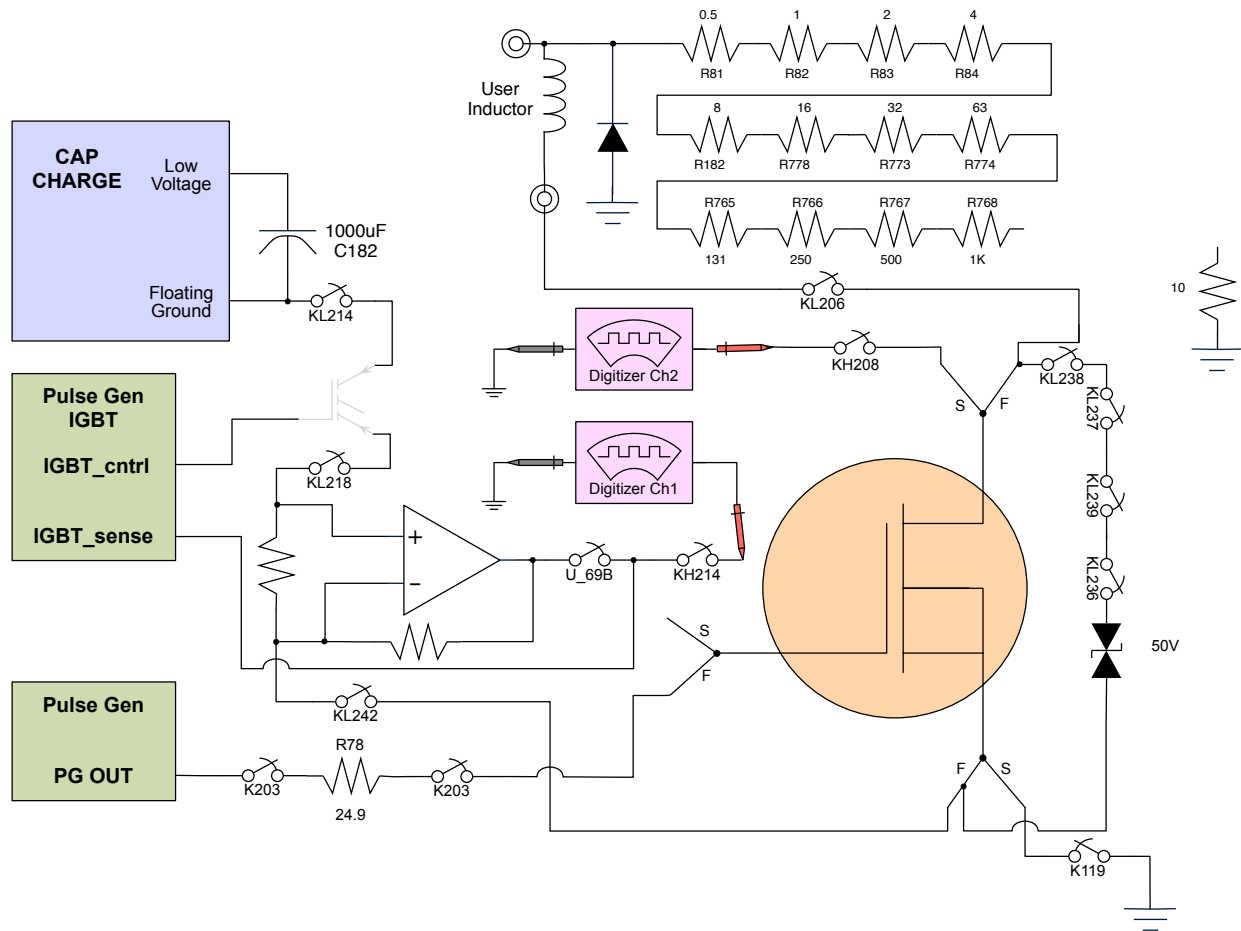
Configuration for N-Channel and P-Channel devices. Step 1. Charge the VDD to the necessary voltage.



Configuration for N-Channel and P-Channel devices. Step 2. Connect the inductor to the DUT, disconnect the resistive load and connect and turn on the Gate pulse generator.



Configuration for N-Channel and P-Channel devices. Step 3. Monitor BV_{DSS} voltage and I_D current. Drive Gate to zero and turn off high speed switch when I_D current hits peak to disconnect V_D to allow inductor to discharge. Calculate avalanche pulse width and the dissipated energy.

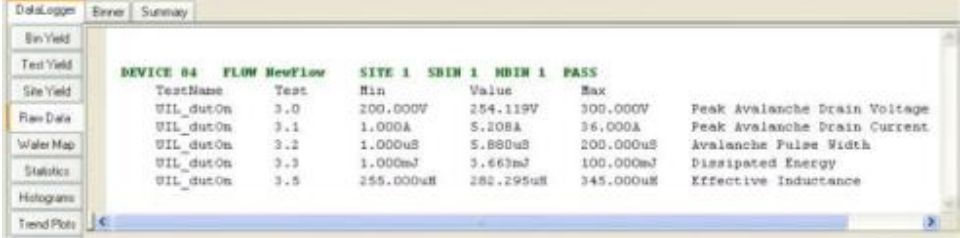


AC UIL_dutOn Test Parameters

Program Golden Units	Program Profiler	Program Variables	Program Instruments	UIL_dutOn Configuration
Test Method Configuration				
Limit				
EnergyMax				0.1
EnergyMin				0.01
Peak_max				36
Peak_min				10
PulseWidthMax				0.0002
PulseWidthMin				1E-05
VavalMax				45
VavalMin				24
Setup				
CapVoltage				36
ID				20
Inductance				0.0003
VGS				20
Setup_Calibration				
CalibrationVerify				False
CorrectionFactor				0
VerifyOnly				False
Setup_Engineering				
CheckCapVoltage				False
CoaxialGateConn				False
DrainClampV				AUTO
EngMode				False
FilterIDspike				True
ScopeTimeBase				AUTO
Setup_Gate				
GateRes				r25ohms
Setup_Inductor				
CheckIndTolerance				5
CheckInductance				False
Inductor1				1E-05
Inductor2				0.0001
Inductor3				0.0003
Inductor4				0.001
Inductor5				0.003
Inductor6				0.01
InductorSelction				3
InductorType				DiscreteInductor

Energy Max	This value is calculated, using the following equation. $E_{AS} = \frac{1}{2}L \cdot I_D^2$. As shown in the test parameters on the previous page, the value of 0.1 is in joules and is the default value that the software enters. For and Inductance of 300uH with a 5% Tolerance (inputted by user in CheckIndTolerance field), and a maximum current of 36 Amperes the calculation is, $E_{AS} = \frac{1}{2} 1.05 \cdot 0.0003 \cdot 36 \cdot 36 = 0.2041$
Energy Min	This value is calculated, using the following equation. $E_{AS} = \frac{1}{2}L \cdot I_D^2$. As shown in the test parameters on the previous page, the value of 0.01 is in joules and is the default value that the software enters. For and Inductance of 300uH with a 5% Tolerance (inputted by user in CheckIndTolerance field), and a maximum current of 36 Amperes the calculation is, $E_{AS} = \frac{1}{2} 0.95 \cdot 0.0003 \cdot 10 \cdot 10 = 0.0143$
Peak Imax	Upper Specification Limit – chosen by user
Peak Imin	Lower Specification Limit – chosen by user
PulseWidthMax	This value is calculated, using the following equation. $t_{pulse} = \frac{L \cdot I_D}{BV_{DSS}}$. As shown in the test parameters on the previous page, the value 0.0002 is the default value. For and Inductance of 300uH with a 5% Tolerance (inputted by user in CheckIndTolerance field), a maximum current of 36 Amperes, and a BV _{DSS} minimum of 24V, the calculation is, $t_{pulse} = \frac{1.05 \cdot 300e-6 \cdot 36}{24} = 459e-6$
PulseWidthMin	This value is calculated, using the following equation. $t_{pulse} = \frac{L \cdot I_D}{BV_{DSS}}$. As shown in the test parameters on the previous page, the value 0.0002 is the default value. For and Inductance of 300uH with a 5% Tolerance (inputted by user in CheckIndTolerance field), a minimum current of 10 Amperes, and a BV _{DSS} maximum of 45V, the calculation is, $t_{pulse} = \frac{0.95 \cdot 300e-6 \cdot 10}{45} = 63.3e-6$
VavalMax	Upper Specification Limit – chosen by user
VavalMin	Lower Specification Limit – chosen by user
Cap Voltage	Voltage to Charge capacitor to. Choices are 0 to 70V. If 0V is chosen will place to maximum of 70V. This allows for different Cap Voltage units to be programmed to maximum value without knowing the specification for each and every unit.
ID	Peak Inductor current desired in amperes. Range is from -101A to + 101A.
Inductance	Nominal inductance value used

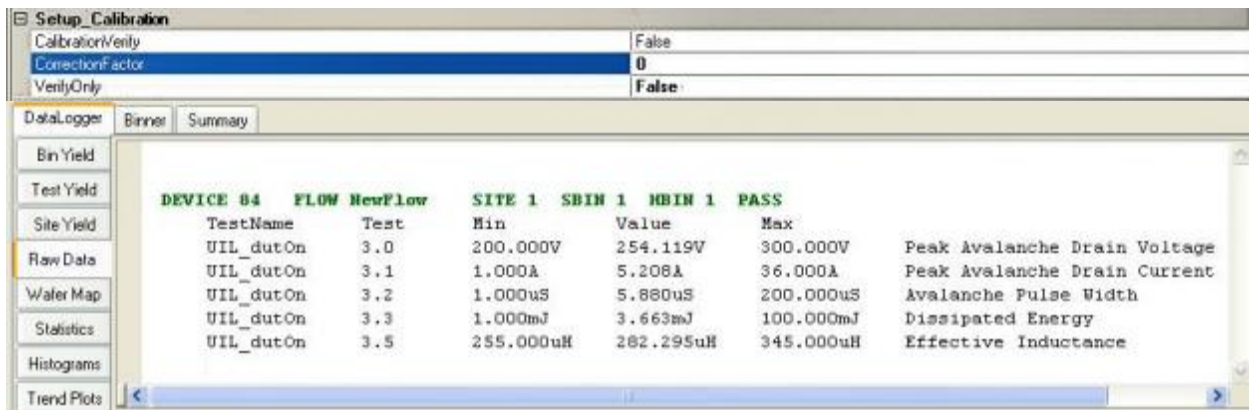
<i>VGS</i>	-20V to +20V. Choose correct value for either N Channel or P Channel
<i>Calibration Verify</i>	Please see Calibration Option, next section.
<i>Correction Factor</i>	Please see Calibration Option, next section.
<i>VerifyOnly</i>	Please see Calibration Option, next section.
<i>CheckCapVoltage</i>	In engineering mode, to check capacitor voltage, set to True. See CheckCapVoltage section to see the one additional item added to the datalog when this is set to TRUE.
<i>CoaxialGateConn</i>	In engineering mode, for using a coaxial connection set to True, else False
<i>DrainClampV</i>	Clamp Voltage to be applied. Range is from 50 to 800V and is done AUTO or manually. This is for hardware protection in the event the DUT fails.
<i>EngMode</i>	Engineering Mode, Set to True for engineering mode, False for no engineering mode. In engineering mode additional information is provided to the test engineer. See Engineering Mode Datalog Section to see additional information.
<i>FilterIDSpikes</i>	Filter out spike in current waveform. Choices are True for yes, and False for no.
<i>ScopeTimeBase</i>	Choices are 10uS/division to 1mS/division, or to use Auto for calculated value

GateRes	Gate Resistance. Choices are 0, 10, 25 50 Ohms
CheckIndTolerance	Tolerance value in percent. If CheckInductor is True, the inductance value will be measured and compared against tolerance
CheckInductor	True to check inductor value and will be included in the datalog value, else False. Uses $L \cdot di/dt$ to calculate the inductor. 
Inductor1	10uH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
Inductor2	100uH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
Inductor3	300uH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
Inductor4	1mH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
Inductor5	3mH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
Inductor6	10mH – All values in here are user selectable for the Inductor Box that holds 6 inductors.

<i>InductorSelection</i>	For this test, AC UIL_dutOn, it does not matter what is entered in this field.
<i>InductorType</i>	<p>DiscreteInductor: for external discrete inductor</p> <p>InductorBoxSlot1: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot2: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot3: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot4: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot5: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot6: Chooses value in Inductor1 slot above.</p> <p>InductorBox_Select_Inductance_Value – If the inductor values are programmed into the Inductor box EPROM, the user would enter the desired value of inductance in the nominal inductance value field, and the EPROM Inductor box would select the closest value.</p>

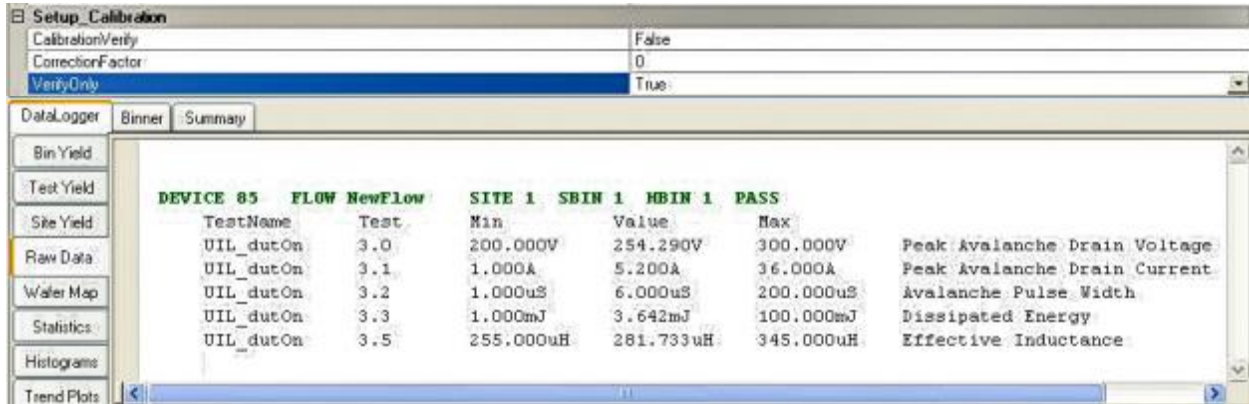
AC UIL_dutOn Calibration Options/Test Parameters

Calibration Verify	False
Correction Factor	0
VerifyOnly	False OR True



Tests and datalogs UIL_dutOn parameters with the Drain Current being 208mA greater than the desired value of 5A.

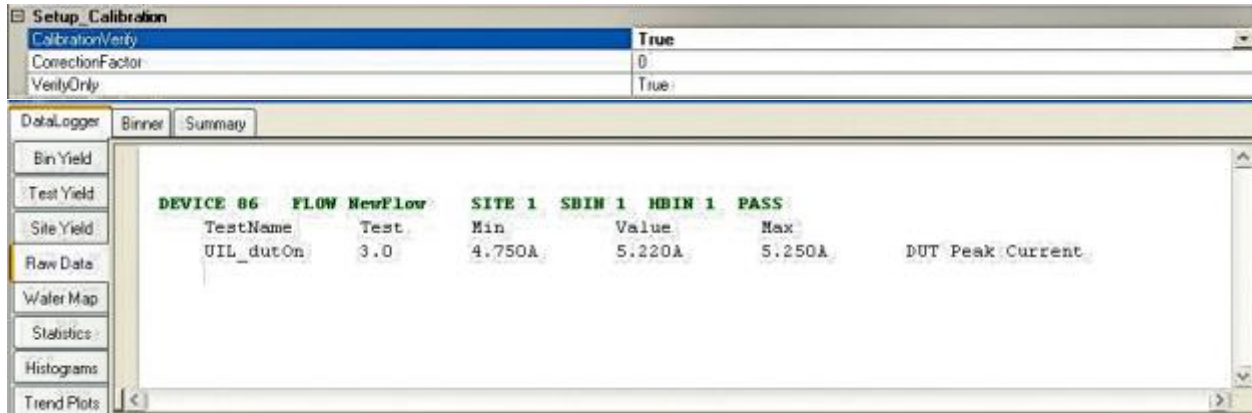
USE THIS TO FOR PRODUCTION WITH NO CALIBRATION FACTOR



Tests and datalogs UIL_dutOn parameters with the Drain Current being 200mA greater than the desired value of 5A.

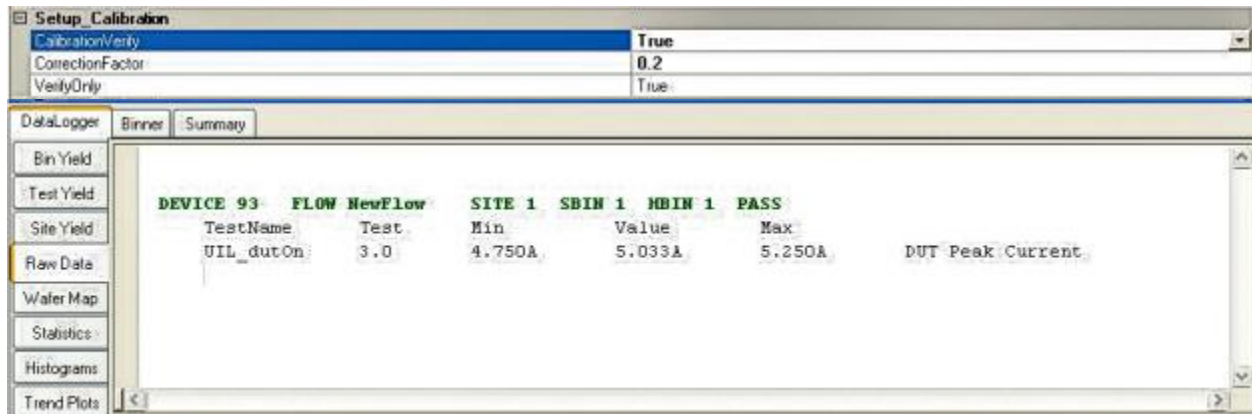
Calibration Verify = FALSE, Correction Factor = 0, tests DUT without Correction Factor

Calibration Verify	True
Correction Factor	0 or Calibration Factor
VerifyOnly	True



Tests and datalogs ONLY DUT Peak Current, showing that without calibration it is 220mA greater than the desired value of 5A.

USE THIS TO VERIFY UNCALIBRATED VALUE

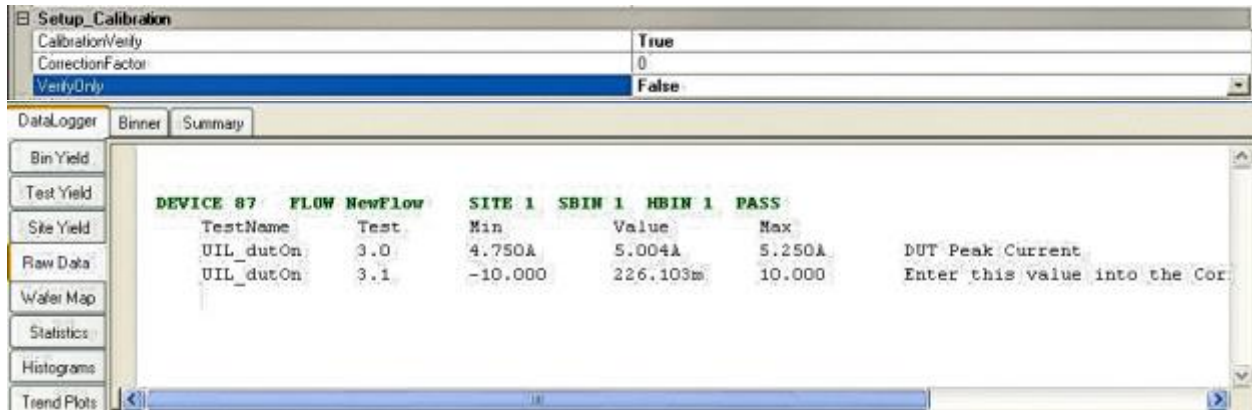


Tests and datalogs ONLY DUT Peak Current, showing that with calibration it is 33mA greater than the desired value of 5A. This value will move around a bit, based upon the switching times of the DUT.

USE THIS TO VERIFY CALIBRATED VALUE

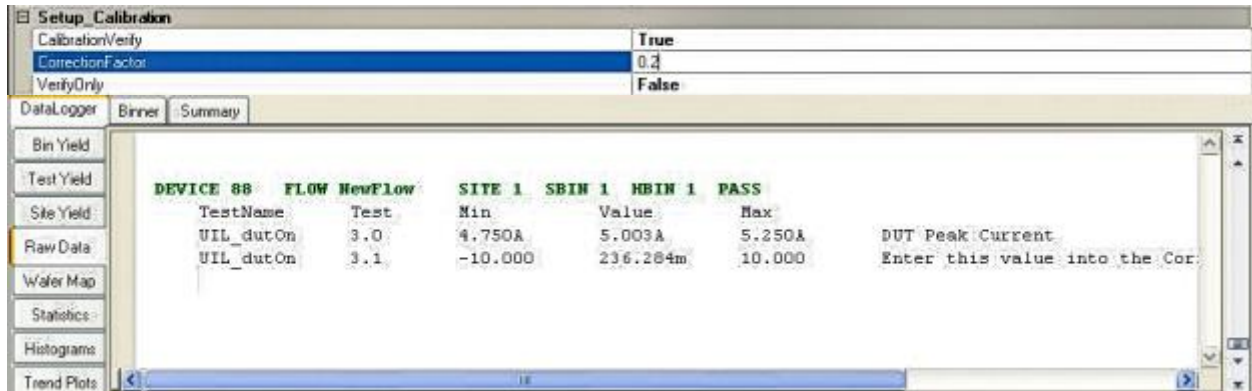
Calibration Verify = TRUE, and VerifyOnly = TRUE, will verify DUT Peak Current only, with or without a Correction Factor

Calibration Verify	True
Correction Factor	0 or a calibration factor
VerifyOnly	False



Tests and datalogs the value of DUT Peak Current – Calibrated to the desired value - and the calibration factor that needs to be entered into the Correction Factor field on the Test Method Configuration Panel. Calibration is done by measuring the time delay between the desired value (in this case, 5.0A) and the value measured (in this 5.220A from the previous screen) and using $V = L \frac{di}{dt}$, determines a delta I value to aim for.

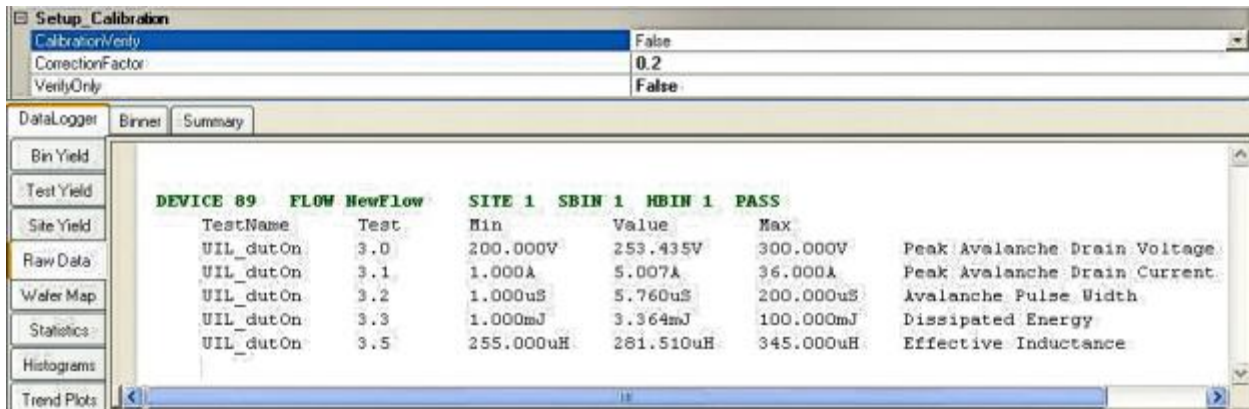
USE THIS TO DETERMINE CALIBRATION FACTOR



Tests and datalogs the value of DUT Peak Current – Calibrated to the desired value - and the calibration factor that needs to be entered into the Correction Factor field on the Test Method Configuration Panel. Calibration is done by measuring the time delay between the desired value (in this case, 5.0A) and the value measured (in this 5.220A from the previous screen) and using $V = L \frac{di}{dt}$, determines a delta I value to aim for. Please note that it does not matter whether or not a calibration factor has already been entered. As long as the CalibrationVerify is TRUE, the test will be calibrated.

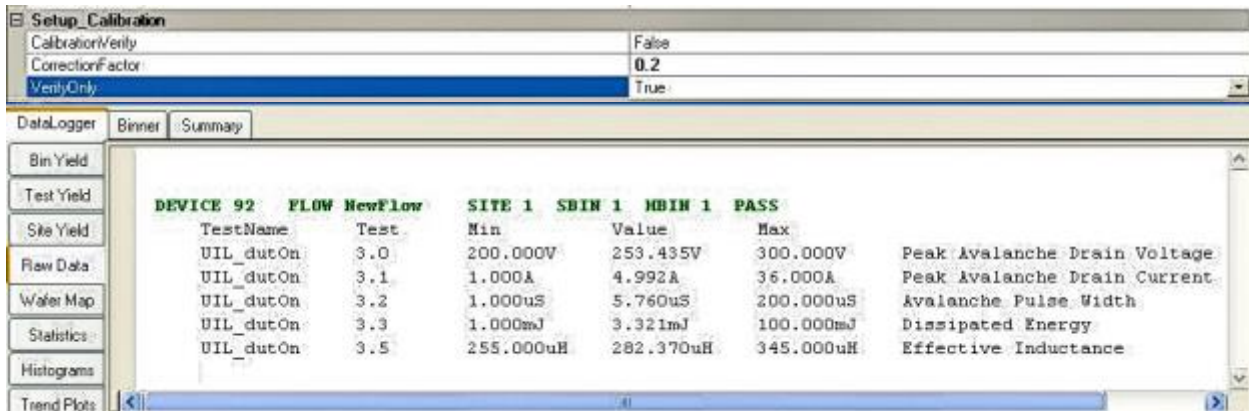
Calibration Verify = TRUE will calibrate DUT Peak Current and datalog Correction Factor with or without a Correction Factor in the field.

Calibration Verify	False
Correction Factor	Calibration factor
VerifyOnly	False OR True



Tests and datalogs the value for the UIL_dutOn tests, with the Peak Avalanche Current calibrated to the corrected value.

USE THIS FOR PRODUCTION WITH CALIBRATION FACTOR



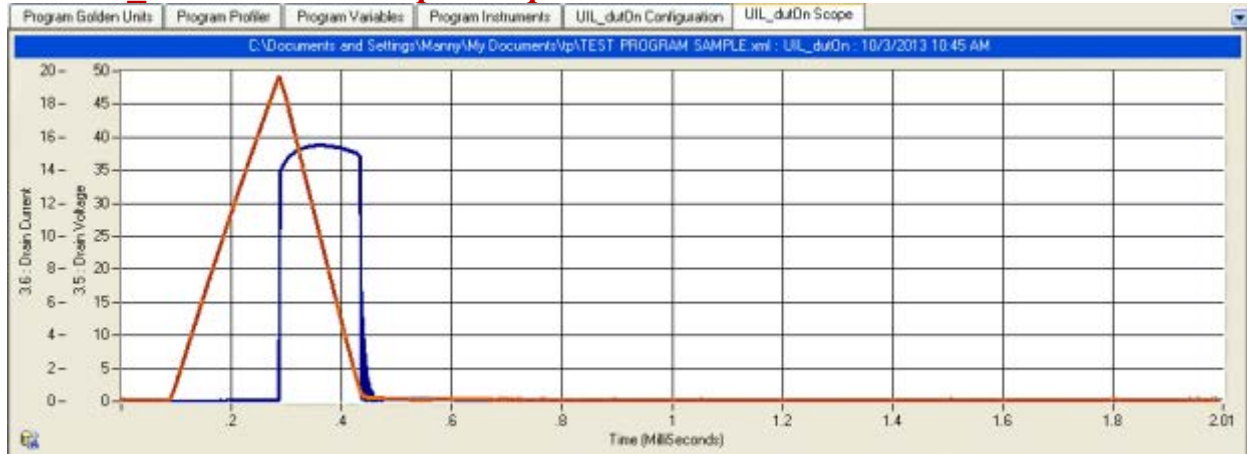
Tests and datalogs the value for the UIL_dutOn tests, with the Peak Avalanche Current calibrated to the corrected value. Please note that it does not matter whether or not the VerifyOnly is True or False, the presence of the corrected value is all that is necessary to test and datalog the corrected results.

Calibration Verify = FALSE with a Correction Factor tests and datalogs the UIL_dutOn tests only with or without the VerifyOnly field TRUE or FALSE

AC UIL_dutOn Test Example Datalog

DEVICE 1	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS	
TestName	Test	Min	Value	Max		
UIL_dutOn	3.0	24.000V	38.784V	45.000V		Peak Avalanche Drain Voltage
UIL_dutOn	3.1	10.000A	19.801A	36.000A		Peak Avalanche Drain Current
UIL_dutOn	3.2	10.000uS	149.500uS	200.000uS		Avalanche Pulse Width
UIL_dutOn	3.3	10.000mJ	56.727mJ	100.000mJ		Dissipated Energy

AC UIL_dutOn Test Example Scope Plot



AC UIL_dutOn CheckCapVoltage Options/Test Parameters

DEVICE 100	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS	
TestName	Test	Min	Value	Max		
UIL_dutOn	3.0	200.000V	253.948V	300.000V		Peak Avalanche Drain Voltage
UIL_dutOn	3.1	1.000A	5.006A	36.000A		Peak Avalanche Drain Current
UIL_dutOn	3.2	1.000uS	5.760uS	200.000uS		Avalanche Pulse Width
UIL_dutOn	3.3	1.000mJ	3.371mJ	100.000mJ		Dissipated Energy
UIL_dutOn	3.5	255.000uH	281.590uH	345.000uH		Effective Inductance
UIL_dutOn	3.6	26.000V	36.710V	46.000V		Cap Voltage

AC UIL_dutOn Engineering Options/Test Parameters

TestName	Test	Min	Value	Max	
UIL_dutOn	3.0	200.000V	253.606V	300.000V	Peak Avalanche Drain Voltage
UIL_dutOn	3.1	1.000A	5.003A	36.000A	Peak Avalanche Drain Current
UIL_dutOn	3.2	1.000uS	5.760uS	200.000uS	Avalanche Pulse Width
UIL_dutOn	3.3	1.000mJ	3.333mJ	100.000mJ	Dissipated Energy
UIL_dutOn	3.5		8.333MHz		Digitizer clock sampling freq
UIL_dutOn	3.6		3.906K		Number of digitized samples
UIL_dutOn	3.7		4.726A		Adjusted ILT trip current
UIL_dutOn	3.8		300.000uh		Selected Inductor value
UIL_dutOn	3.9		281.721uh		Measured Inductor value
UIL_dutOn	3.10		5.003A		Averaged peak current
UIL_dutOn	3.11		3.502A		icharge
UIL_dutOn	3.12		33.600us		Inductor charge rate (10%-80%)
UIL_dutOn	3.13		43.320us		Inductor charge rate (10%-pk)
UIL_dutOn	3.14	255.000uH	281.721uH	345.000uH	Effective Inductance
UIL_dutOn	3.15	26.000V	36.675V	46.000V	Cap Voltage

Additional information for Engineering Use

<i>Digitizer Clock Sampling Frequency</i>	Provides the sample rate information
<i>Number of Digitized Samples</i>	Provides the number of samples used
<i>Adjusted Trip Current</i>	Provides the adjusted trip current value after calibration factor is applied
<i>Selected Inductor Value</i>	Provides feedback on what inductor value was chosen
<i>Measured Inductor Value</i>	Provides the measured inductor value
<i>Averaged Peak Current</i>	Provides the now adjusted peak current value measured after calibration
<i>iCharge</i>	This is the current used to charge and recharge the capacitor in between UIL tests.

<i>Inductor Charge Rate (10%-80%)</i>	Provides the time to charge the inductor from 10% to 80%
<i>Inductor Charge Rate (10%-Peak)</i>	Provides the time to charge the inductor from 10% to Peak value
<i>Effective Inductor Value</i>	Provides the measured inductor value
<i>Cap Voltage</i>	Provides the measured capacitance voltage value

AC UIL Test

Overview:

The AC UIL test utilizes the AC board to test the Unclamped Inductive Load test.

Description:

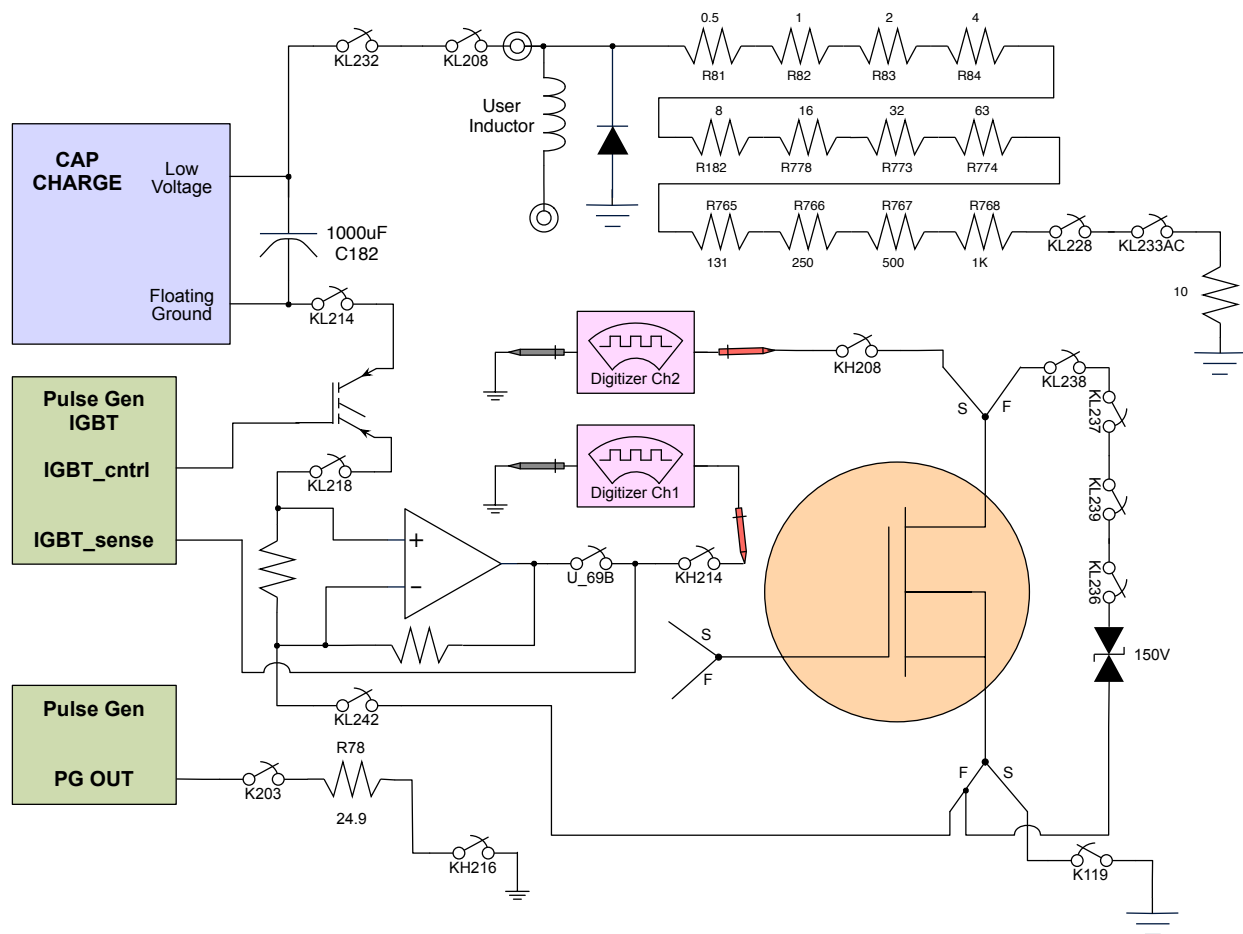
The UIL test takes place in 3 steps. The first step is to charge the capacitor with the resistive load to stabilize the capacitive charger. The capacitor will act as the V_{DD} supply.

The second step is to connect the inductor and to disconnect the resistive load on the capacitor. There are three choices for the inductor used. The first is a discrete inductor plugged into the tester. The second choice is the 6 user value chosen inductor box and the third choice is the user chosen EPROM inductor box.

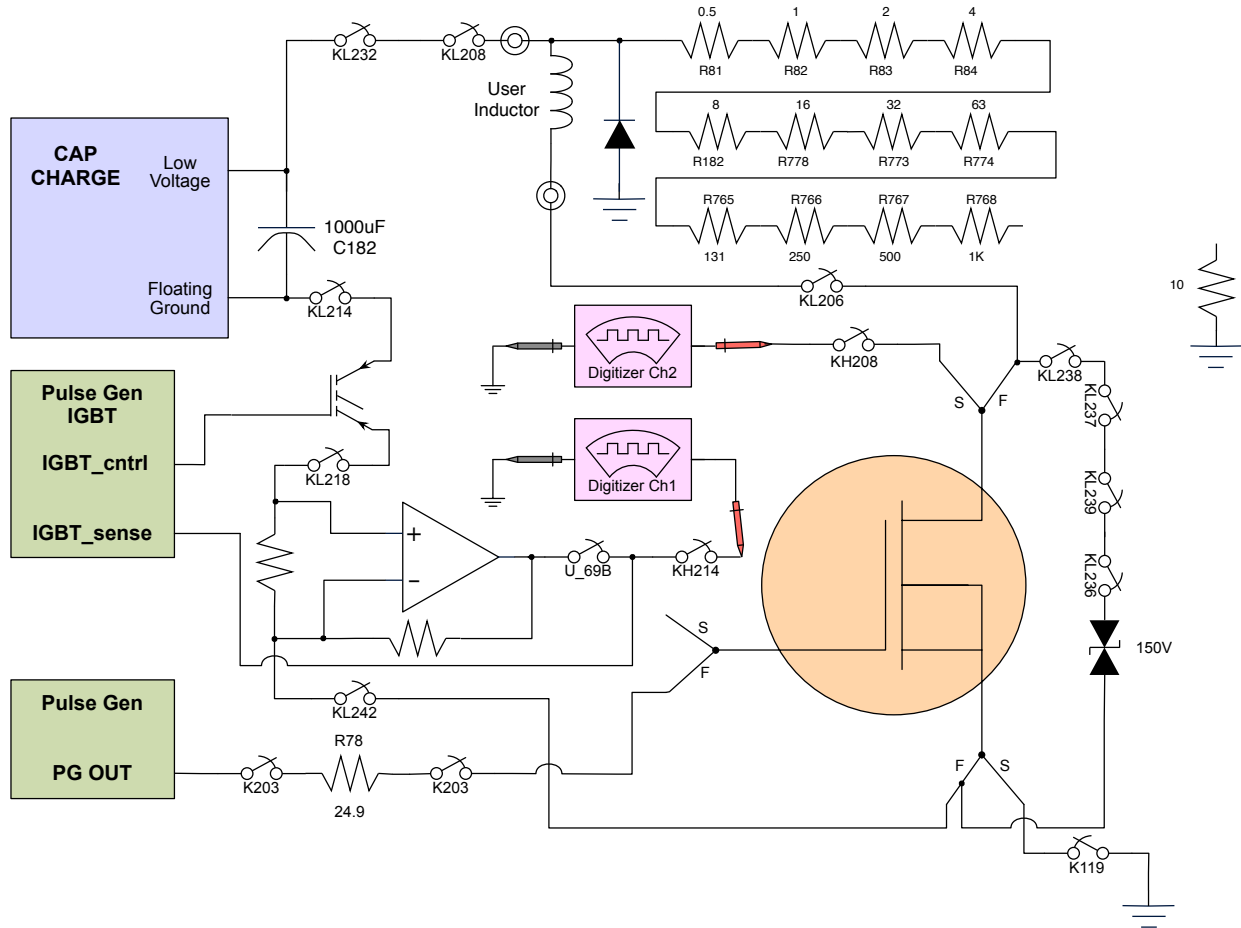
The third step, monitor both the BV_{DSS} voltage and I_D current in order to determine the Peak Avalanche Drain Voltage and Drain Current. When the Drain current has hit the peak value the DUT is turned off by driving the gate to zero. Then the inductor discharges. There is also an option to disconnect the Drain Voltage by opening the high speed switch. The information obtained from the digitizers is used to calculate the Avalanche pulse width and the dissipated energy.

AC UIL Test

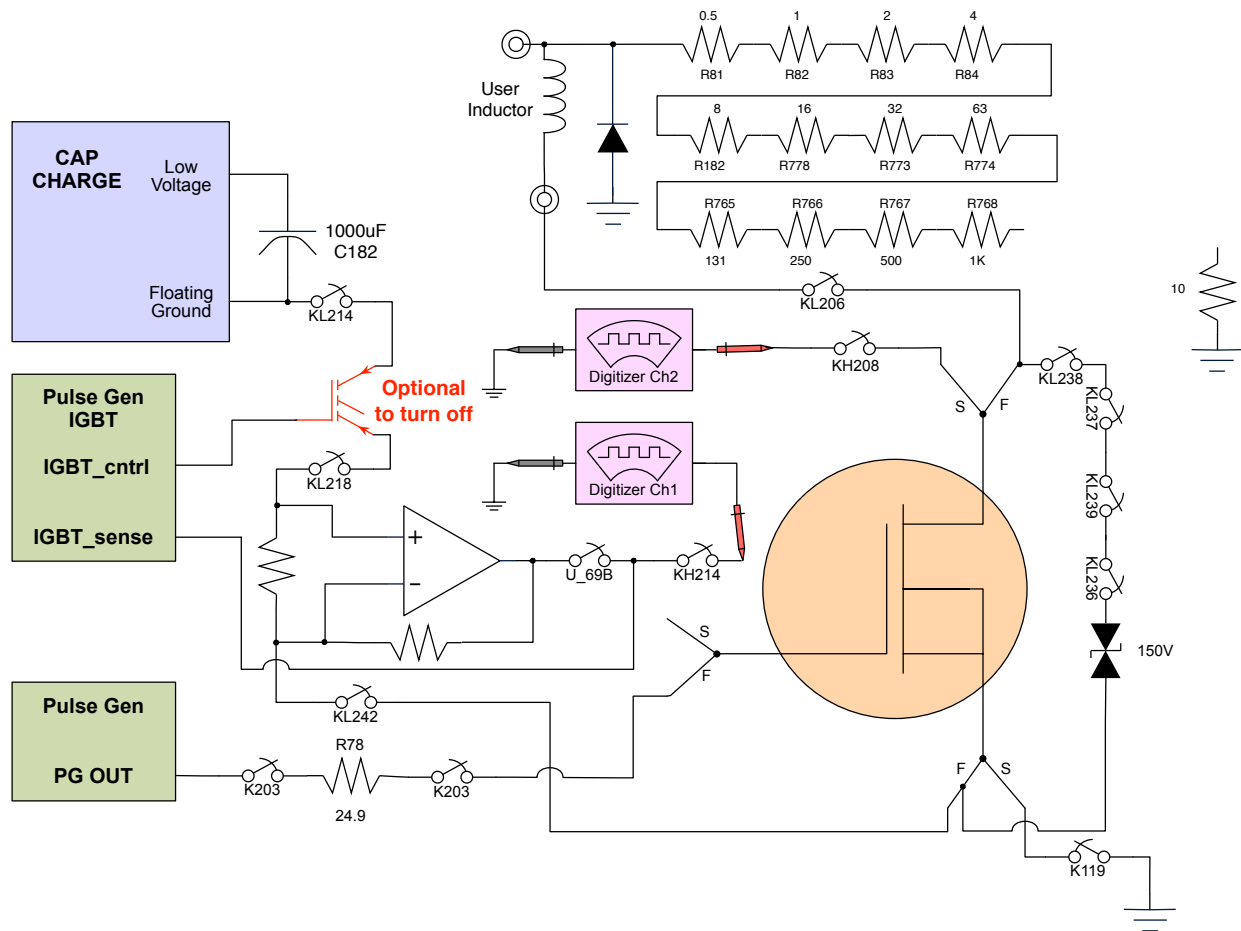
Configuration for N-Channel and P-Channel devices. Step 1. Charge the VDD to the necessary voltage.



Configuration for N-Channel and P-Channel devices. Step 2. Connect the inductor to the DUT, disconnect the resistive load and connect and connect the Gate pulse generator.



Configuration for N-Channel and P-Channel devices. Step 3. Turn on the Gate Pulse Generator, and digitize BV_{DSS} voltage and I_D current from start to finish. Turn the Gate to zero (0) once the peak value is achieved. Calculate avalanche pulse width and the dissipated energy.



AC UIL Test Parameters

Test Method Configuration	
Limits	
AvalPulse_Max	0.5
AvalPulse_Min	1E-06
Energy_Max	5
Energy_Min	1E-06
PeakI_max	100
PeakI_min	0.1
Setup	
GateVoltage	20
Inductance	0.0003
PeakDrainCurrent	14
RatedBVDSS	36
VDD	36
Setup_Behavior	
DisplayResultsAsPositive	True
VDD_DISCONNECT	True
Setup_Calibration	
CalibrationVerify	False
CorrectionFactor	-0.2055
VerifyOnly	True
Setup_Engineering	
AutoComputeLimits	True
DrainClampV	AUTO
EngMode	True
FilterDspike	False
ScopeTimeBase	AUTO
Setup_Gate	
GateDrvResistance	r50ohms
Setup_Inductor	
CheckInductance	False
IndTolerance	5
Inductor1	1E-05
Inductor2	0.0001
Inductor3	0.0003
Inductor4	0.001
Inductor5	0.003
Inductor6	0.01
InductorType	DiscreteInductor
EngMode	
This parameter is no longer used and has no function.	

<i>AvalPulse_Max</i>	Upper Specification Limit – chosen by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>AvalPulse_Min</i>	Lower Specification Limit – chosen by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>Energy_Max</i>	Upper Specification Limit – chosen by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>Energy_Min</i>	Lower Specification Limit – chosen by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>PeakImax</i>	Set by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>PeakImin</i>	Set by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>GateVoltage</i>	Set by user
<i>Inductance</i>	Set by user
<i>PeakDrainCurrent</i>	Set by user
<i>RatedBVDSS</i>	Set by user
<i>VDD</i>	Set by user
<i>DisplayResultsAsPositive</i>	User option to show all results as positive
<i>VDD_DISCONNECT</i>	User choice to disconnect VDD when Peak Drain Current level is achieved

<p><i>Calibration Verify</i></p>	<div data-bbox="548 201 1429 296"> <table border="1"> <tr> <td colspan="2">Setup_Calibration</td> </tr> <tr> <td>Calibrator/Verify</td> <td>True</td> </tr> <tr> <td>CorrectionFactor</td> <td>0</td> </tr> <tr> <td>VerifyOnly</td> <td>False</td> </tr> </table> </div> <p data-bbox="548 331 1393 401">Set Calibration Verify and Verify Only as indicated and run the test. Datalog will be as shown.</p> <div data-bbox="548 436 1429 506"> <table border="1"> <thead> <tr> <th>DEVICE 6</th> <th>FLOW NewFlow</th> <th>SITE 1</th> <th>SBIN 1</th> <th>HBIN 1</th> <th>PASS</th> </tr> </thead> <tbody> <tr> <td>TestName</td> <td>Test</td> <td>Min</td> <td>Value</td> <td>Max</td> <td></td> </tr> <tr> <td>UIL</td> <td>200.0</td> <td>13.440A</td> <td>13.994A</td> <td>14.560A</td> <td>DUT Peak Current</td> </tr> <tr> <td>UIL</td> <td>200.1</td> <td>-10.000</td> <td>-205.500m</td> <td>10.000</td> <td>Enter this value into the CorrectionFactor parameter</td> </tr> </tbody> </table> </div>	Setup_Calibration		Calibrator/Verify	True	CorrectionFactor	0	VerifyOnly	False	DEVICE 6	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS	TestName	Test	Min	Value	Max		UIL	200.0	13.440A	13.994A	14.560A	DUT Peak Current	UIL	200.1	-10.000	-205.500m	10.000	Enter this value into the CorrectionFactor parameter												
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<p><i>AutoComputeLimits</i></p>	<p data-bbox="548 1377 1409 1446">To automatically calculate limits, set to TRUE, else set to FALSE if user wants to calculate manually and enter</p>																																												

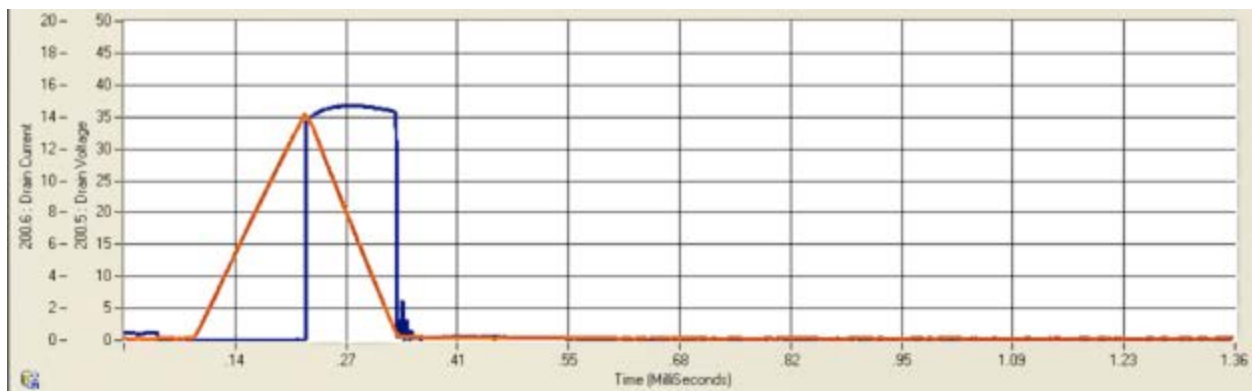
<i>DrainClampV</i>	Clamp Voltage to be applied. Range is from 50 to 800V and is done AUTO or manually. This is for hardware protection in the event the DUT fails.
<i>EngMode</i>	In this test, EngMode performs no functions
<i>FilterIDSpike</i>	Filter out spike in current waveform. Choices are True for yes, and False for no.
<i>ScopeTimeBase</i>	Choices are 10uS/division to 1mS/division, or to use Auto for calculated value
<i>GateDrvResistance</i>	Gate Resistance. Choices are 0, 10, 25 50 Ohms
<i>CheckInductor</i>	True to check inductor value and will be included in the datalog value, else False. Uses $L \cdot di/dt$ to calculate the inductor.
<i>CheckIndTolerance</i>	Tolerance value in percent. If CheckInductor is True, the inductance value will be measured and compared against tolerance
<i>Inductor1</i>	10uH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
<i>Inductor2</i>	100uH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
<i>Inductor3</i>	300uH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
<i>Inductor4</i>	1mH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
<i>Inductor5</i>	3mH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
<i>Inductor6</i>	10mH – All values in here are user selectable for the Inductor Box that holds 6 inductors.

InductorType	<p>DiscreteInductor: for external discrete inductor</p> <p>InductorBoxSlot1: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot2: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot3: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot4: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot5: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot6: Chooses value in Inductor1 slot above.</p> <p>InductorBox_Select_Inductance_Value –If the inductor values are programmed into the Inductor box EPROM, the user would enter the desired value of inductance in the nominal inductance value field, and the EPROM Inductor box would select the closest value.</p>
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AC UIL Test Example Datalog

DEVICE 8	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS	
UIL	200.0	25.200V	36.472V	72.000V		Peak Avalanche Drain Voltage
UIL	200.1	100.000mA	13.949A	100.000A		Peak Avalanche Drain Current
UIL	200.2	29.167uS	111.180uS	250.000uS		Avalanche Pulse Width
UIL	200.3	5.880mJ	28.810mJ	52.920mJ		Dissipated Energy

AC UIL Test Example Scope Plot



AC UIL Multi Test

Overview:

The AC UIL Multi test utilizes the AC board to test multiple Unclamped Inductive Load test pulses.

Description:

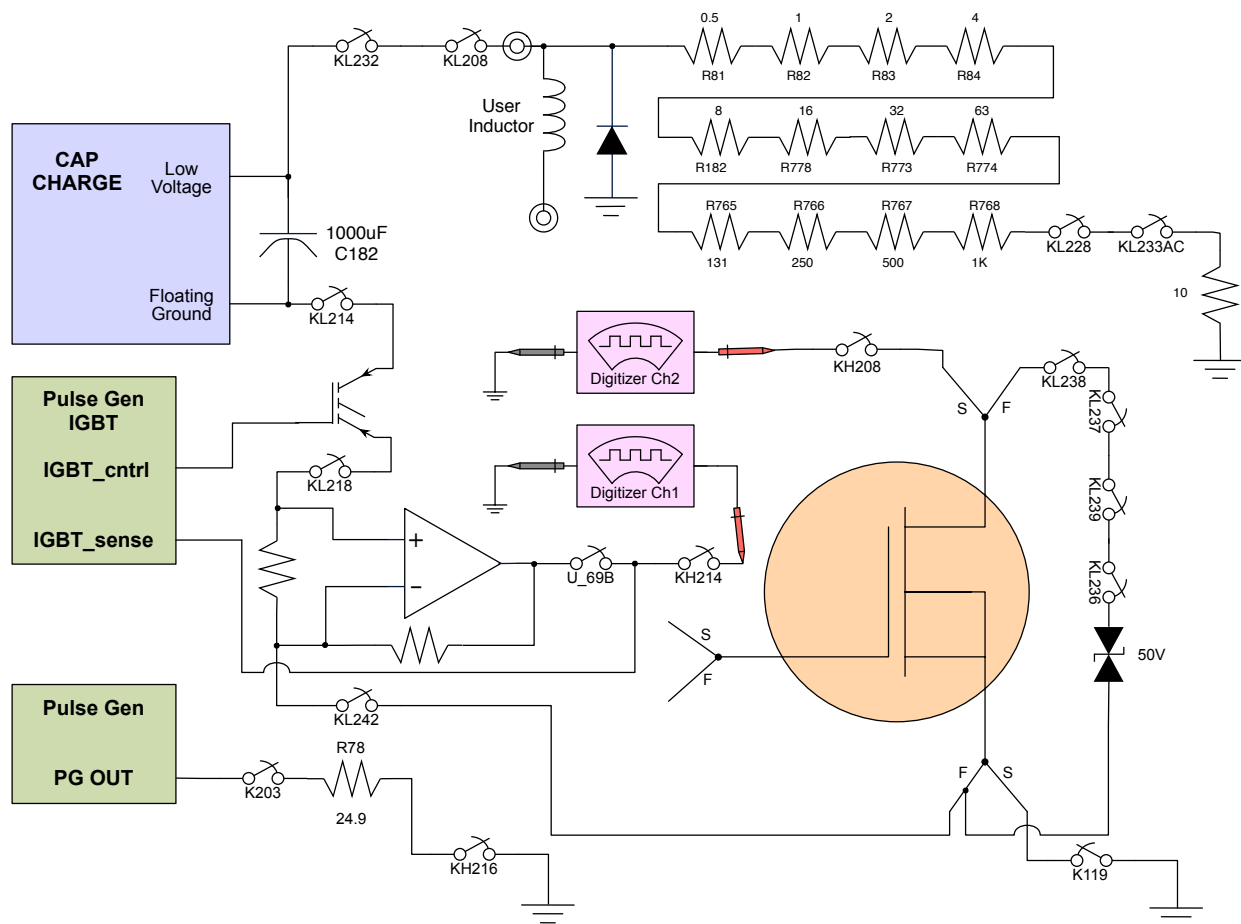
The UIL test takes place in 3 steps. The first step is to charge the capacitor with the resistive load to stabilize the capacitive charger. The capacitor will act as the V_{DD} supply.

The second step is to connect the inductor and to disconnect the resistive load on the capacitor. There are three choices for the inductor used. The first is a discrete inductor plugged into the tester. The second choice is the 6 user value chosen inductor box and the third choice is the user chosen EPROM inductor box.

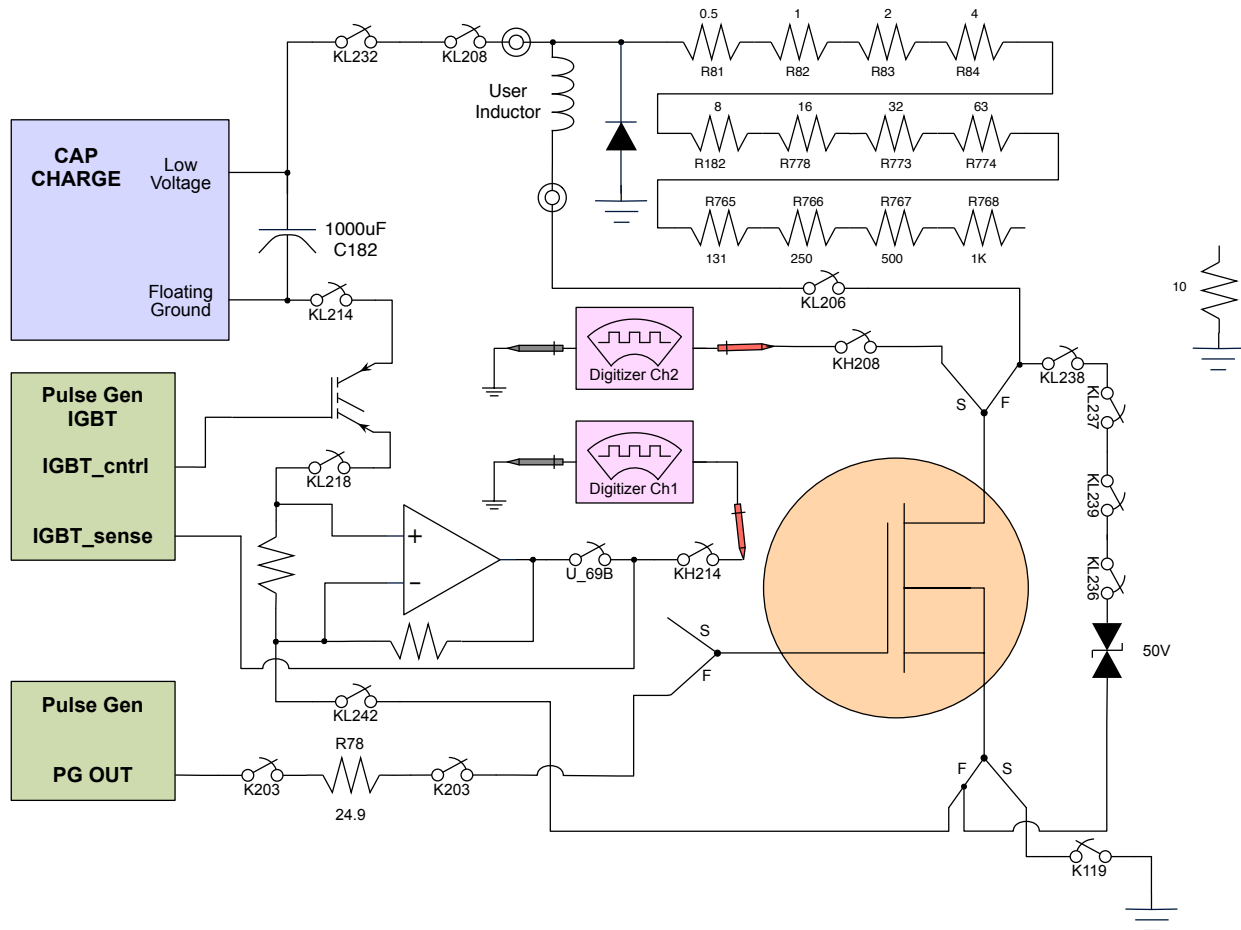
The third step, monitor both the BV_{DSS} voltage and I_D current in order to determine the Peak Avalanche Drain Voltage and Drain Current. When the Drain current has hit the peak value the DUT is turned off by driving the gate to zero. Then the inductor discharges. There is also an option to disconnect the Drain Voltage by opening the high speed switch. The information obtained from the digitizers is used to calculate the Avalanche pulse width and the dissipated energy.

AC UIL Multi Test

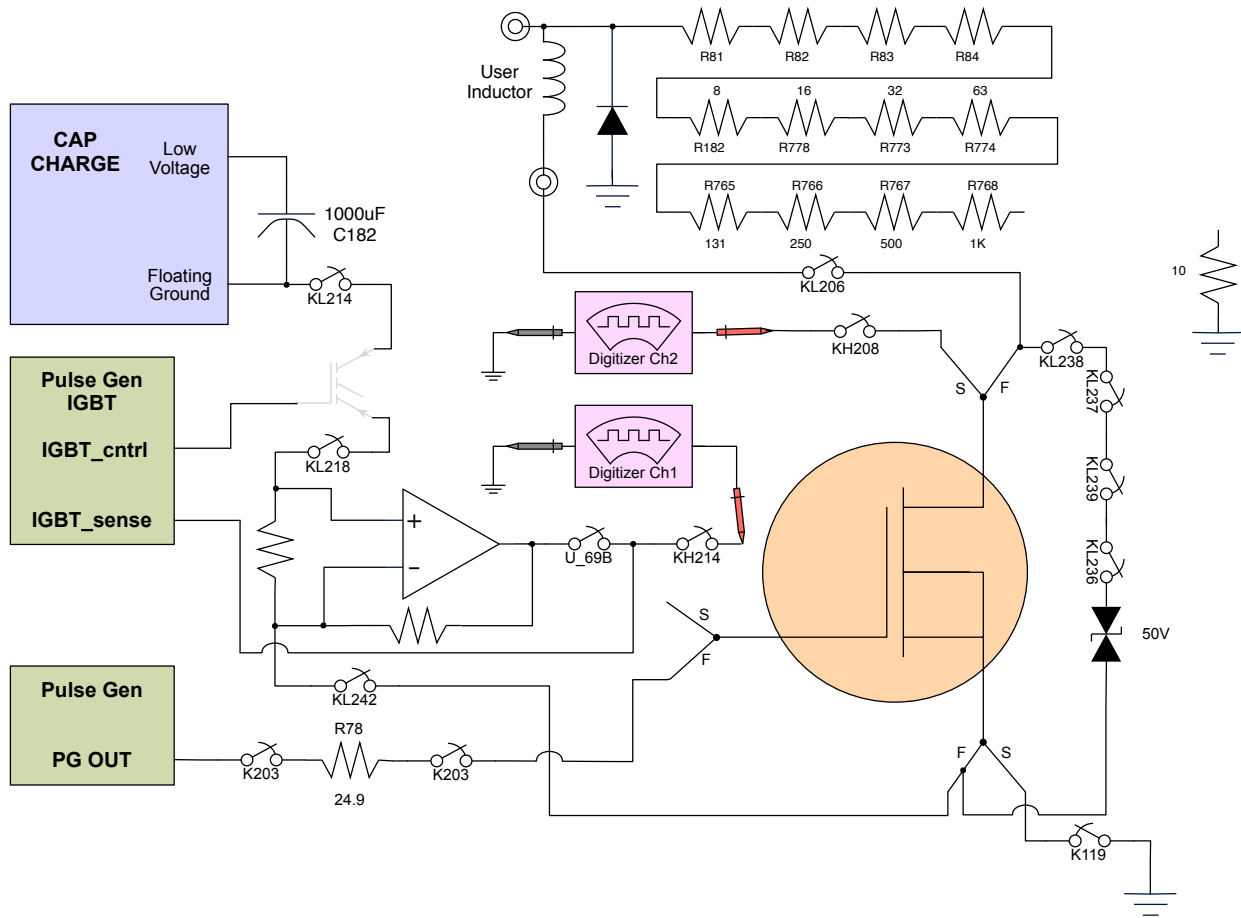
Configuration for N-Channel and P-Channel devices. Step 1. Charge the VDD to the necessary voltage.



Configuration for N-Channel and P-Channel devices. Step 2. Connect the inductor to the DUT, disconnect the resistive load and connect and connect the Gate pulse generator.



Configuration for N-Channel and P-Channel devices. Step 3. Turn on the Gate Pulse Generator, and digitize BV_{DSS} voltage and I_D current from start to finish. Turn the Gate to zero (0) once the peak value is achieved. Calculate avalanche pulse width and the dissipated energy.



AC UIL Multi Test Parameters

GateChargelourceX Configuration	GateChargelource Configuration	UIL Configuration	UIL_dutOn Configuration
Test Method Configuration			
Limit			
EnergyMax		0.0529	
EnergyMin		0.0058	
PulseWidthMax		0.00025	
PulseWidthMin		2.9167E-05	
VavalMax		72	
VavalMin		25	
Limits			
PeakI_max		100	
PeakI_min		0	
Setup			
CapVoltage		36	
ID		14	
Inductance		0.0003	
No_Of_Pulses		2	
TimeBetweenPulses		0.02	
VGS		15	
Setup_Calibration			
CalibrationVerify		False	
CorrectionFactor		0	
VerifyOnly		True	
Setup_Engineering			
CheckCapVoltage		True	
DrainClampV		clamp50V	
EngMode		False	
FilterDspike		True	
J_Computation		IntegrationMethod	
RunTime		0	
ScopeTimeBase		AUTO	
Setup_Gate			
GateRes		r50ohms	
Setup_Inductor			
CheckIndTolerance		5	
CheckInductance		False	
Inductor1		1E-05	
Inductor2		0.0001	
Inductor3		0.0003	
Inductor4		0.001	
Inductor5		0.003	
Inductor6		0.01	
InductorSelction		1	
InductorType		DiscreteInductor	
Inductor6 Specifies Indutor 6 value.			

<i>Energy Max</i>	Upper Specification Limit – chosen by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>Energy Min</i>	Lower Specification Limit – chosen by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>PulseWidthMax</i>	Set by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>PulseWidthMin</i>	Set by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>AvalPulse_Max</i>	Upper Specification Limit – chosen by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>AvalPulse_Min</i>	Lower Specification Limit – chosen by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>PeakImax</i>	Set by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>PeakImin</i>	Set by user, or automatically calculated when AutoComputeLimits is set to TRUE
<i>CapVoltage</i>	Set by user
<i>ID</i>	Drain Current set by user
<i>Inductance</i>	Set by user
<i>No_Of_Pulses</i>	Number of pulses to test UIL, set by user
<i>TimeBetweenPulses</i>	Time in seconds between pulses set by user
<i>VGS</i>	Gate Source voltage set by user

<p>Calibration Verify</p>	 <p>Set Calibration Verify and Verify Only as indicated and run the test. Datalog will be as shown.</p> <pre> DEVICE 2 FLOW NewFlow SITE 1 SBIN 1 HBIN 1 PASS TestName Test Min Value Max UIL_Multi 300.0 13.300A 14.039A 14.700A DUT Peak Current UIL_Multi 300.1 -10.000 -106.800m 10.000 Enter this value into the CorrectionFactor </pre>
<p>Correction Factor</p>	 <p>Set Calibration Verify and Verify Only as indicated and run the test. Enter the calibration value from the previous datalog information.</p> <pre> DEVICE 3 FLOW NewFlow SITE 1 SBIN 1 HBIN 1 PASS TestName Test Min Value Max UIL_Multi 300.0 13.300A 13.998A 14.700A DUT Peak Current </pre> <p>The desired value is 14Amps, the calibrated value is 13.998Amps.</p>
<p>Verify Only</p>	 <p>Set Calibration Verify and Verify Only as indicated with the correction factor entered.</p> <pre> DEVICE 4 FLOW NewFlow SITE 1 SBIN 1 HBIN 1 PASS TestName Test Min Value Max UIL_Multi 300.0 25.000V 36.438V 72.000V Peak Avalanche Drain Voltage UIL_Multi 300.1 0.000A 13.928A 100.000A Peak Avalanche Drain Current UIL_Multi 300.2 29.167uS 111.520uS 250.000uS First Avalanche Pulse Width UIL_Multi 300.3 5.800mJ 28.422mJ 52.900mJ First pulse Dissipated Energy UIL_Multi 300.5 26.000V 35.958V 46.000V Cap Voltage </pre> <p>The production datalog contains all the datalog information with the calibrated value for peak avalanche drain current.</p>
<p>Check Cap Voltage</p>	<p>Set by user. Datalogs value of Capacitor Voltage</p> <pre> DEVICE 4 FLOW NewFlow SITE 1 SBIN 1 HBIN 1 PASS TestName Test Min Value Max UIL_Multi 300.0 25.000V 36.438V 72.000V Peak Avalanche Drain Voltage UIL_Multi 300.1 0.000A 13.928A 100.000A Peak Avalanche Drain Current UIL_Multi 300.2 29.167uS 111.520uS 250.000uS First Avalanche Pulse Width UIL_Multi 300.3 5.800mJ 28.422mJ 52.900mJ First pulse Dissipated Energy UIL_Multi 300.5 26.000V 35.958V 46.000V Cap Voltage </pre>
<p>Drain Clamp V</p>	<p>Clamp Voltage to be applied. Range is from 50 to 800V and is done AUTO or manually. This is for hardware protection in the event the DUT fails.</p>
<p>Eng Mode</p>	<p>In this test, Eng Mode performs no functions</p>

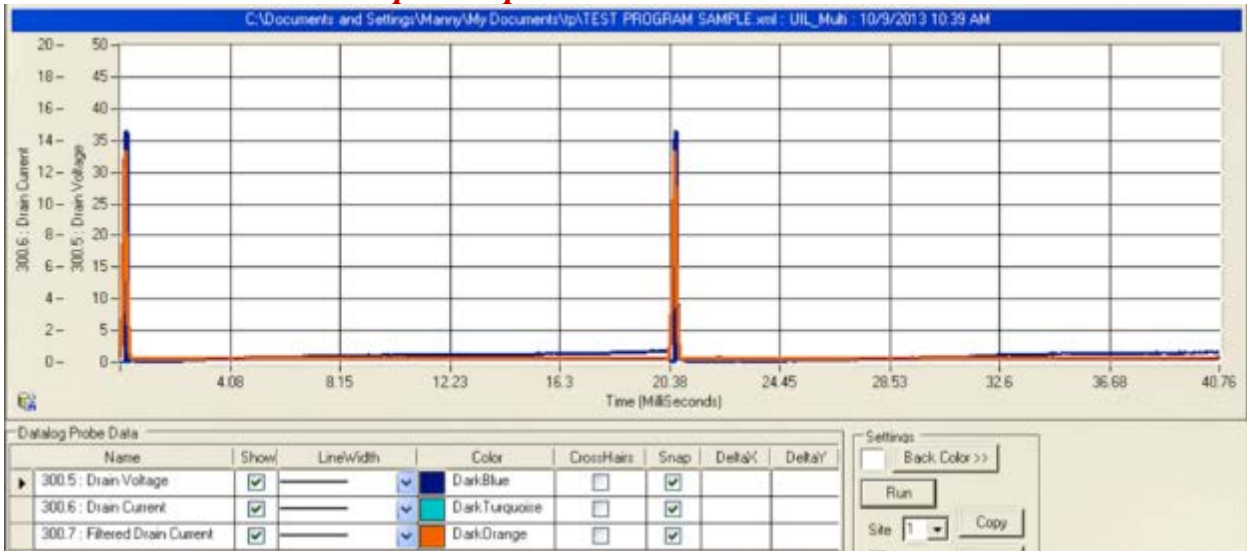
<i>FilterIDSpike</i>	Filter out spike in current waveform. Choices are True for yes, and False for no.
<i>J_Computation</i>	<p>2 Choices available for energy calculation, IntegrationMethod & Computation method.</p> <p>Integration Datalog</p> <pre> DEVICE 20 FLOW NewFlow SITE 1 SBIN 1 HBIN 1 PASS TestName Test Min Value Max UIL_Multi 300.0 25.000V 36.527V 72.000V Peak Avalanche Drain Voltage UIL_Multi 300.1 0.000A 13.821A 100.000A Peak Avalanche Drain Current UIL_Multi 300.2 29.167uS 109.820uS 250.000uS First Avalanche Pulse Width UIL_Multi 300.3 5.800mJ 28.232mJ 52.900mJ First pulse Dissipated Energy UIL_Multi 300.5 26.000V 35.948V 46.000V Cap Voltage </pre> <p>Computation Datalog</p> <pre> DEVICE 19 FLOW NewFlow SITE 1 SBIN 1 HBIN 1 PASS TestName Test Min Value Max UIL_Multi 300.0 25.000V 36.472V 72.000V Peak Avalanche Drain Voltage UIL_Multi 300.1 0.000A 13.866A 100.000A Peak Avalanche Drain Current UIL_Multi 300.2 29.167uS 109.480uS 250.000uS First Avalanche Pulse Width UIL_Multi 300.3 5.800mJ 27.951mJ 52.900mJ First pulse Dissipated Energy UIL_Multi 300.5 26.000V 35.920V 46.000V Cap Voltage </pre>
<i>RunTime</i>	If this value is less than 500nS, then the ScopeTimeBase time will be used.
<i>ScopeTimeBase</i>	Choices are 10uS/division to 1mS/division, or to use Auto for calculated value
<i>GateRes</i>	Gate Resistance. Choices are 0, 10, 25 50 Ohms
<i>CheckInductor</i>	True to check inductor value and will be included in the datalog value, else False. Uses $L \cdot di/dt$ to calculate the inductor.
<i>CheckIndTolerance</i>	Tolerance value in percent. If CheckInductor is True, the inductance value will be measured and compared against tolerance

<i>Inductor1</i>	10uH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
<i>Inductor2</i>	100uH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
<i>Inductor3</i>	300uH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
<i>Inductor4</i>	1mH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
<i>Inductor5</i>	3mH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
<i>Inductor6</i>	10mH – All values in here are user selectable for the Inductor Box that holds 6 inductors.
<i>InductorType</i>	<p>DiscreteInductor: for external discrete inductor</p> <p>InductorBoxSlot1: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot2: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot3: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot4: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot5: Chooses value in Inductor1 slot above.</p> <p>InductorBoxSlot6: Chooses value in Inductor1 slot above.</p> <p>InductorBox_Select_Inductance_Value –If the inductor values are programmed into the Inductor box EPROM, the user would enter the desired value of inductance in the nominal inductance value field, and the EPROM Inductor box would select the closest value.</p>

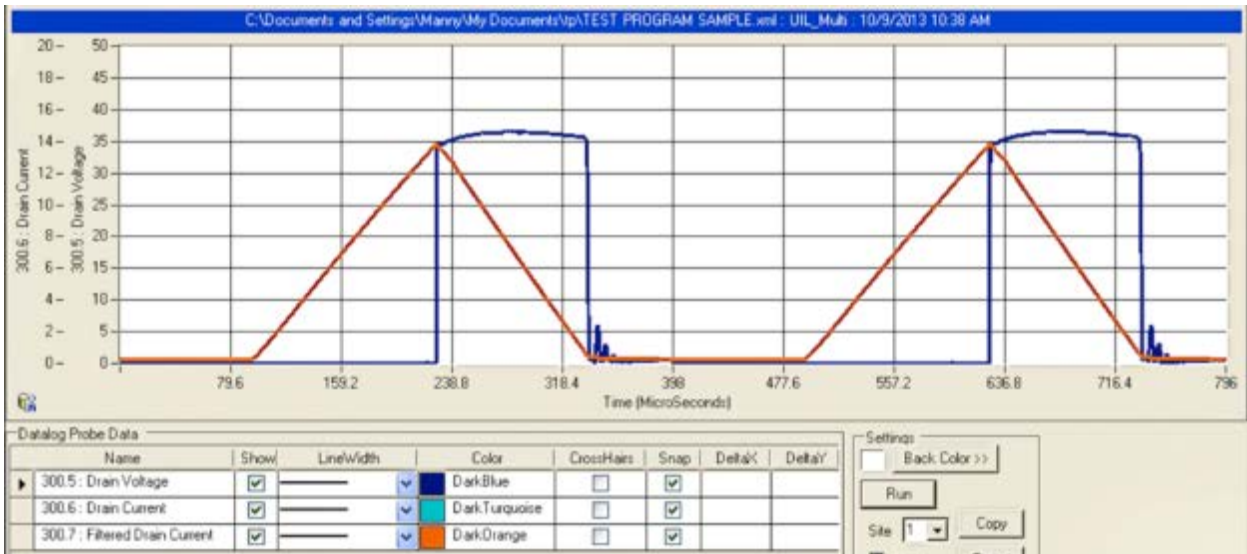
AC UIL Multi Test Example Datalog

DEVICE 20	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS	
TestName	Test	Min	Value	Max		
UIL_Multi	300.0	25.000V	36.527V	72.000V		Peak Avalanche Drain Voltage
UIL_Multi	300.1	0.000A	13.821A	100.000A		Peak Avalanche Drain Current
UIL_Multi	300.2	29.167uS	109.820uS	250.000uS		First Avalanche Pulse Width
UIL_Multi	300.3	5.800mJ	28.232mJ	52.900mJ		First pulse Dissipated Energy
UIL_Multi	300.5	26.000V	35.948V	46.000V		Cap Voltage

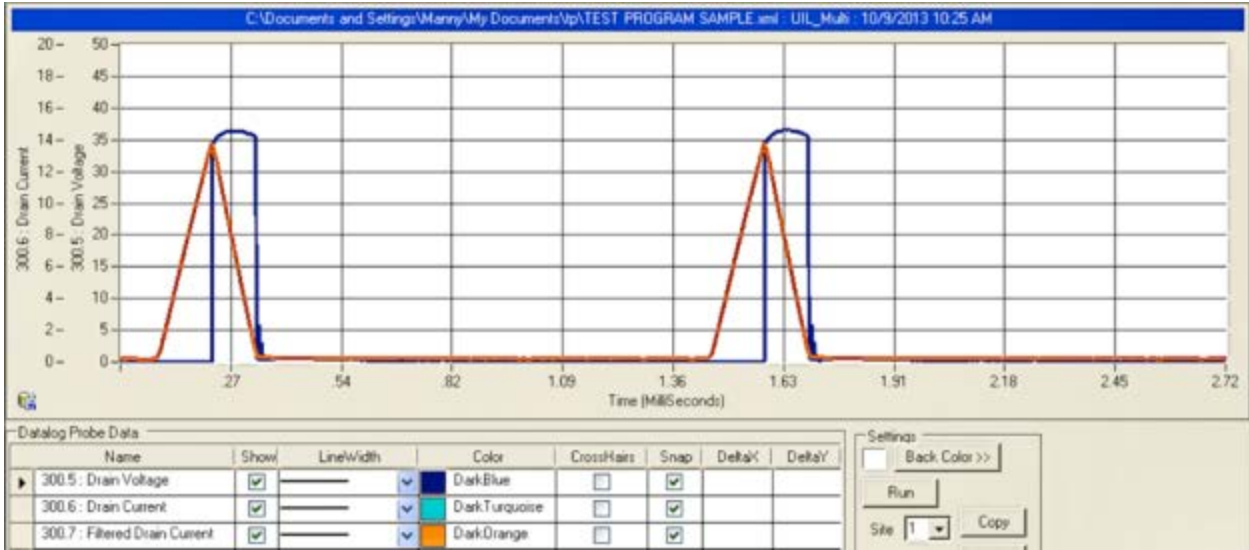
AC UIL Multi Test Example Scope Plot



1mS Timebase



10uS Timebase



AUTO Timebase

AC Gate Charge I_{SOURCE}

Overview:

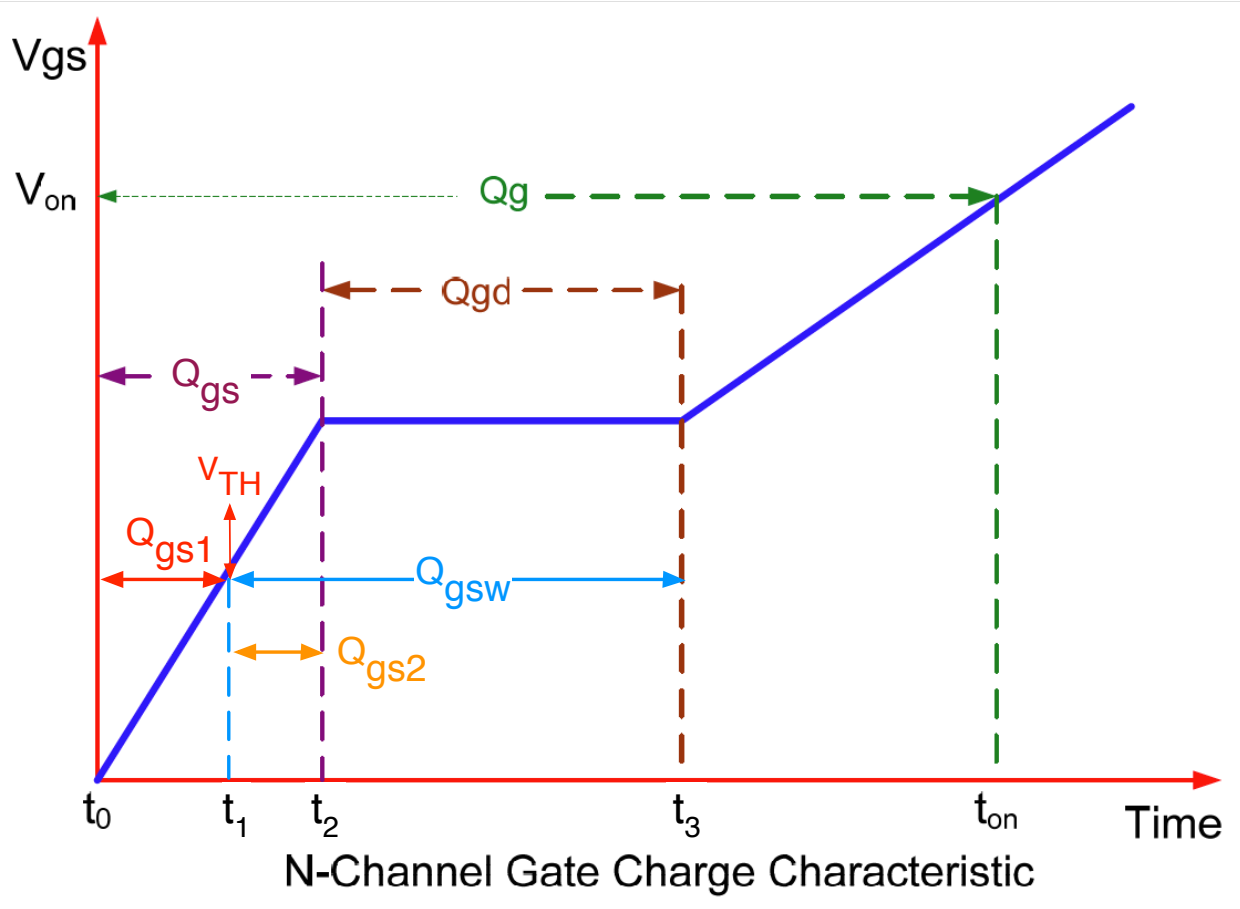
The AC Gate Charge I_{SOURCE} test utilizes the AC board to test the gate charge of the DUT.

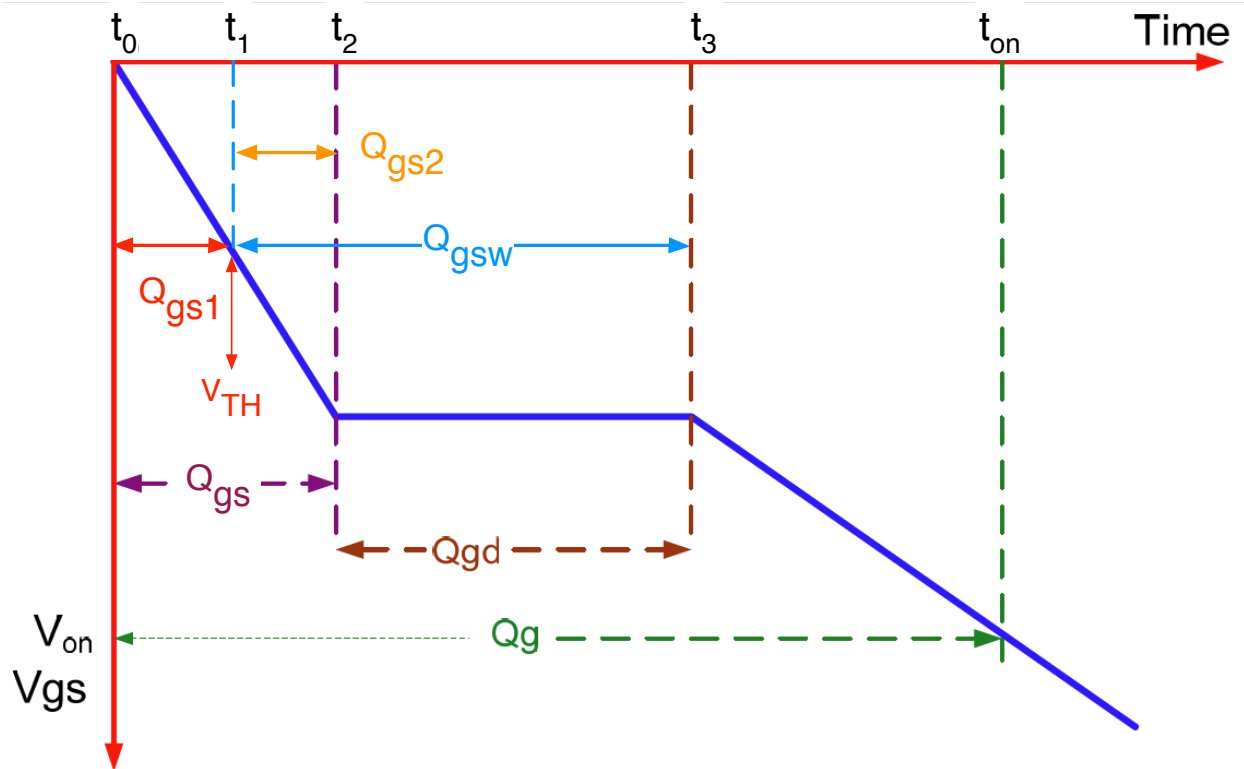
Description:

The Gate Charge test takes place in 2 steps. The first step sets the clamp voltage on the Drain to Source current source and measures this value. The clamped voltage will act as the V_{DD} supply.

The second step is to connect the digitizer to measure the Drain and the Gate. The Drain is measured directly, and the Gate is measured by measuring the buffered voltage of the pulse generator current source. The current source is turned on and ramps up, $I/C=\Delta V/\Delta T$, and from the digitized results 3 gate charge terms are determined. These are Q_{GS} , Q_{GD} , and Q_G .

In order to calculate the gate charges, the current flowing into the gate must be constant, as shown in the figures below for the N-Channel and P-Channel devices.





P-Channel Gate Charge Characteristic

The time between the start of the current flowing (t_0) and the first inflection point (t_1), multiplied by the current is equal to the charge Q_{GS} . Expressed in equation form,

$$Q_{GS} = (t_1 - t_0) \cdot I_G$$

In a similar fashion,

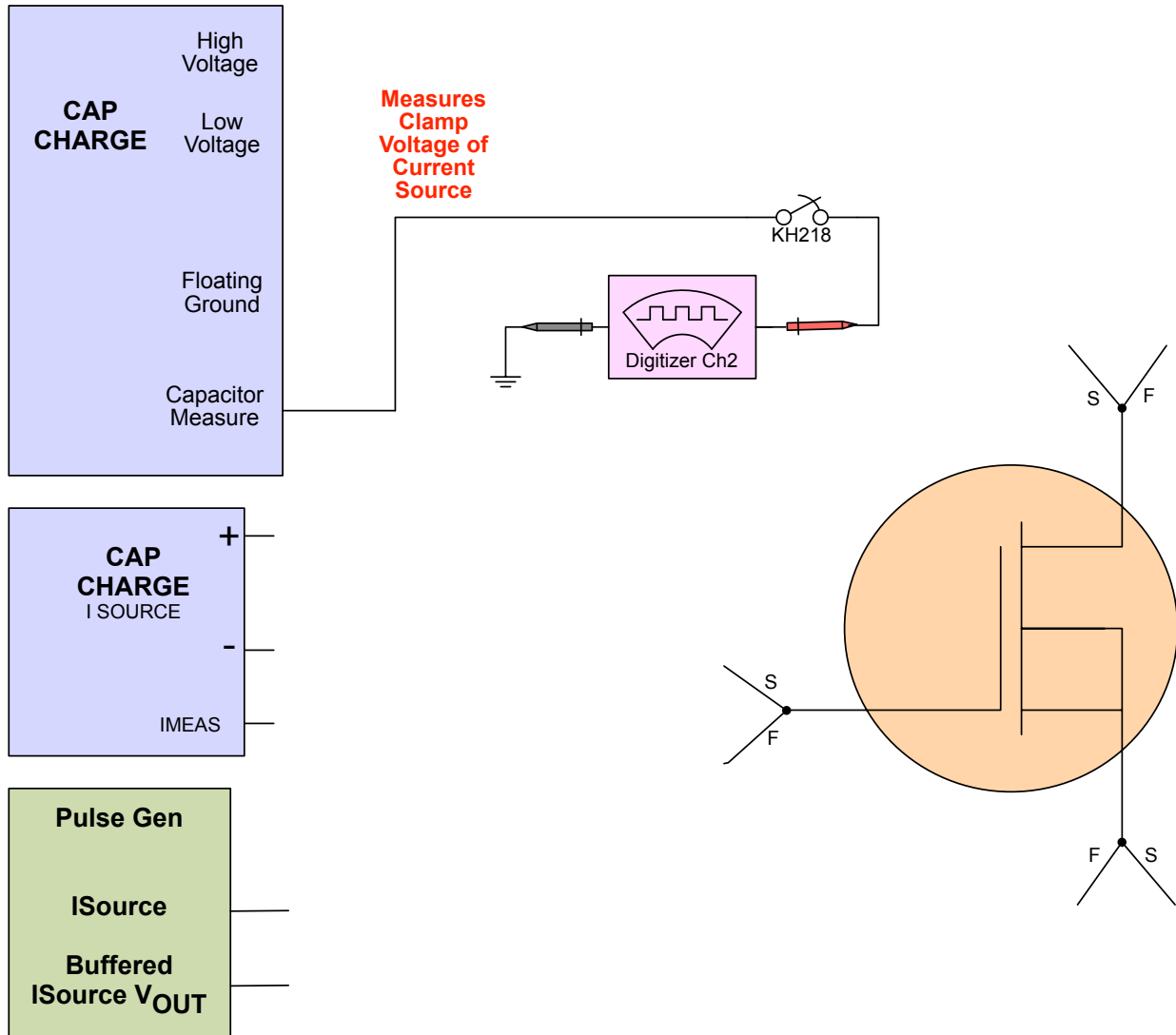
$$Q_{GD} = (t_2 - t_1) \cdot I_G$$

Q_G is calculated in a different manner. Q_G is defined as the charge to fully turn on the device. This is measured from the t_0 point, to the time that the V_{GS} has reached a defined level. Typically this is 10V and for the newer logic devices, 4.5V. This formula is:

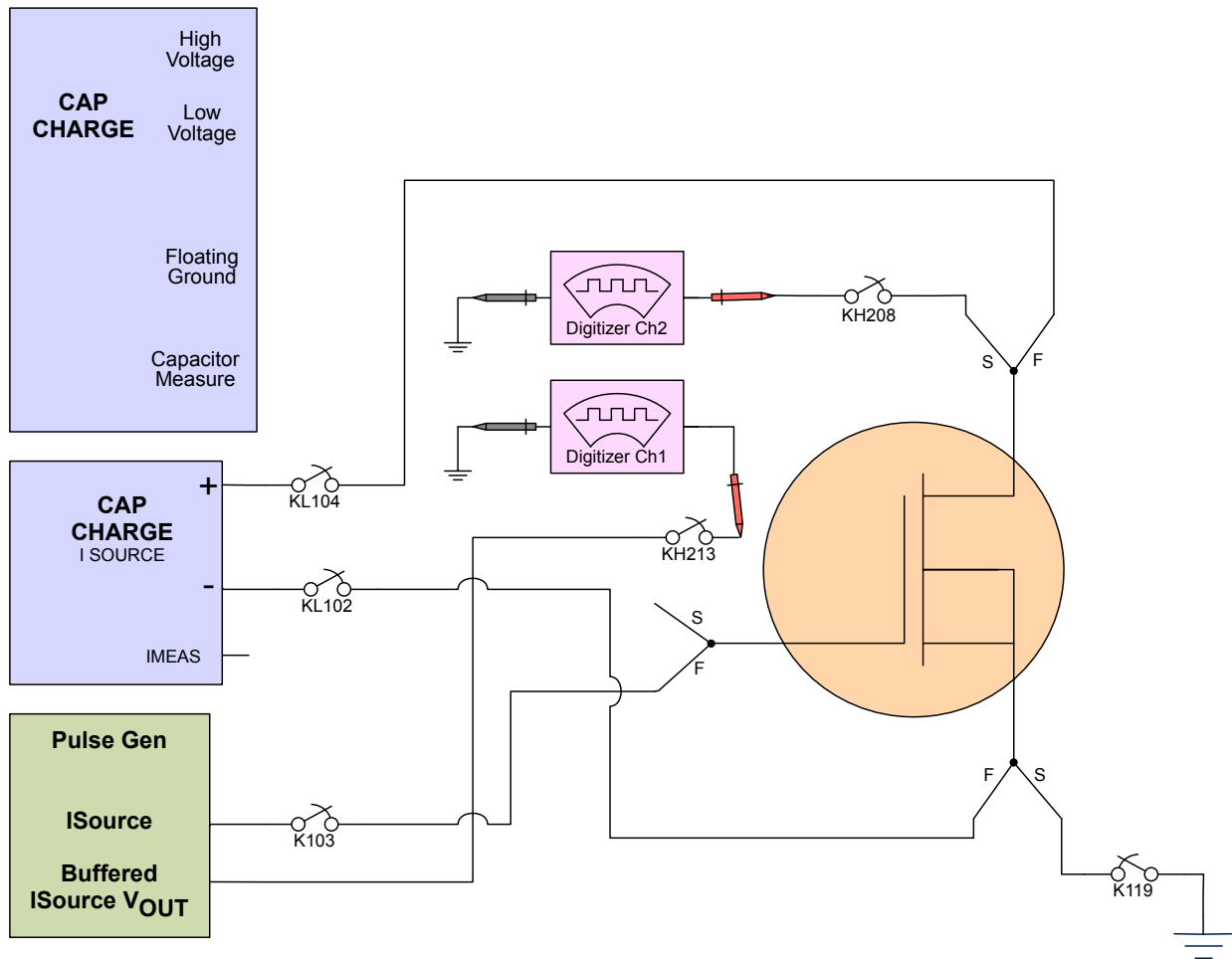
$$Q_G = (t_{ON} - t_0) \cdot I_G$$

AC Gate Charge I_{Source} Test

Configuration for N-Channel and P-Channel devices. Step 1. Turn on Current Source and let it settle at its clamped voltage level. Measure the clamped voltage.

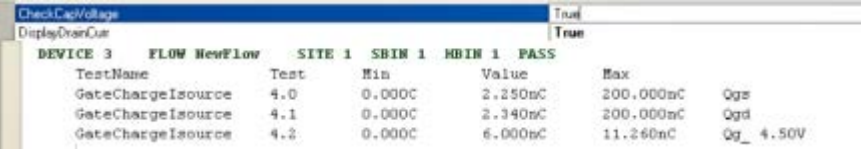
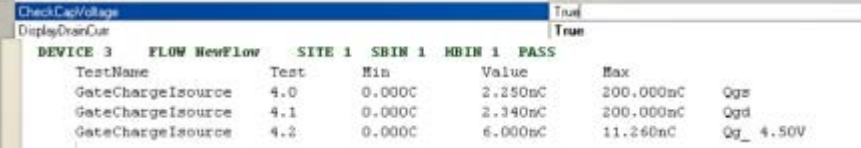


Configuration for N-Channel and P-Channel devices. Step 2. Connect the digitizers to the Drain and the buffered I_{Source} V_{OUT} . Turn on the I_{Source} and digitize the the Gate and Drain Voltages. Using the chosen Test Method, calculate the 3 gate charge values



AC Gate Charge I_{Source} Test Parameters

Program Golden Units	Program Profiler	Program Variables	Program Instruments	GateChargeSourceX Configuration
Test Method Configuration				
Limits				
Qg1_max				1.126E-08
Qg1_min				0
Qg2_max				Qg2_max
Qg2_min				Qg2_min
Qgd_max				2E-07
Qgd_min				0
Qgs_max				2E-07
Qgs_min				0
Setup				
ID				8.8
IG				2E-06
Qg_Voltage1				4.5
Qg_Voltage2				0
VDS				15
SuperUser				
CalFactor				1.16E-10
CheckCapVoltage				False
DisplayDrainCurr				False
GateRes10K				False
Meas_On_FALL				False
ScopeTimeBase				AUTO
TestMethod				IntersectingLines
Threshold				1
VdsLinesThresPecent				50
X_Axis				Coulombs

<i>Qg1_Max</i>	Upper Specification Limit – chosen by user
<i>Qg1_Min</i>	Lower Specification Limit – chosen by user
<i>Qg2_Max</i>	Upper Specification Limit – chosen by user
<i>Qg2_Min</i>	Lower Specification Limit – chosen by user
<i>Qgd_Max</i>	Upper Specification Limit – chosen by user
<i>Qgd_Min</i>	Lower Specification Limit – chosen by user
<i>Qgs_Max</i>	Upper Specification Limit – chosen by user
<i>Qgs_Min</i>	Lower Specification Limit – chosen by user
<i>ID</i>	Set by user
<i>IG</i>	Set by user
<i>Qg_Voltage1</i>	Set by user
<i>Qg_Voltage2</i>	Set by user
<i>VDS</i>	Set by user
<i>CalFactor</i>	Value to be entered when DUT has been calibrated
<i>CheckCapVoltage</i>	Provides the measured capacitance voltage value, when TRUE. ¹ 
<i>DisplayDrainCurr</i>	Provides the measured drain current value, when TRUE. ² 

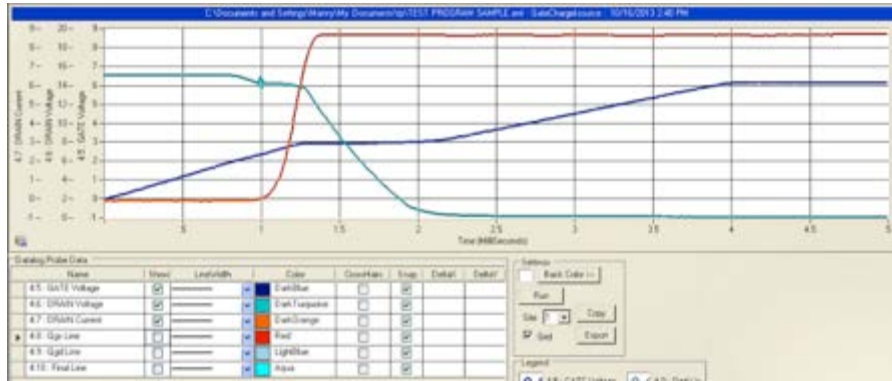
¹ this does not work properly in the release 8.1.40 version of the library but will be fixed in future releases

² this does not work properly in the release 8.1.40 version of the library but will be fixed in future releases

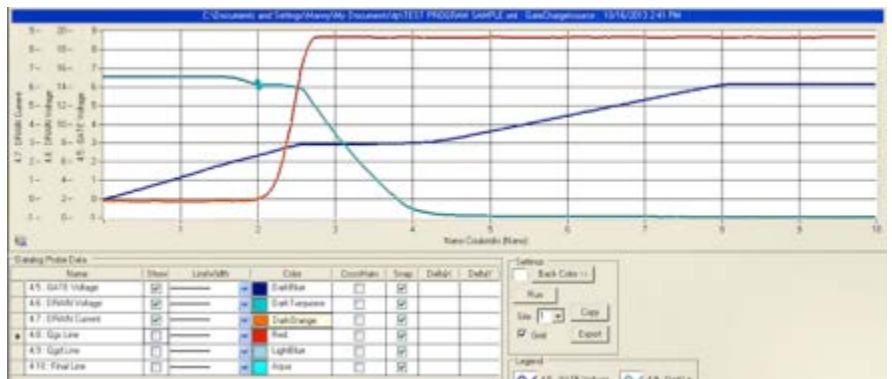
<i>GateRes10K</i>	Used to stabilize the Vgs voltage for devices that have very low Qg to prevent the voltage from overshooting.
<i>MeasOnFALL</i>	Inverts the control signal to measure all parameters at the turn off of the device. NOTE that this mode requires the appropriate version of Capcharge module hardware, 4.82.0 of the cap charger.
<i>ScopeTimeBase</i>	Choices are 10uS/division to 1mS/division, or to use Auto for calculated value
<i>TestMethod</i>	Three choices available: IntersectingLinesVDS, ChangeofSlope, DoubleDifferential, IntersectingLines
<i>VdsLinesTresPecent</i>	High Threshold for IntersectingLinesVDS test method

X_Axis

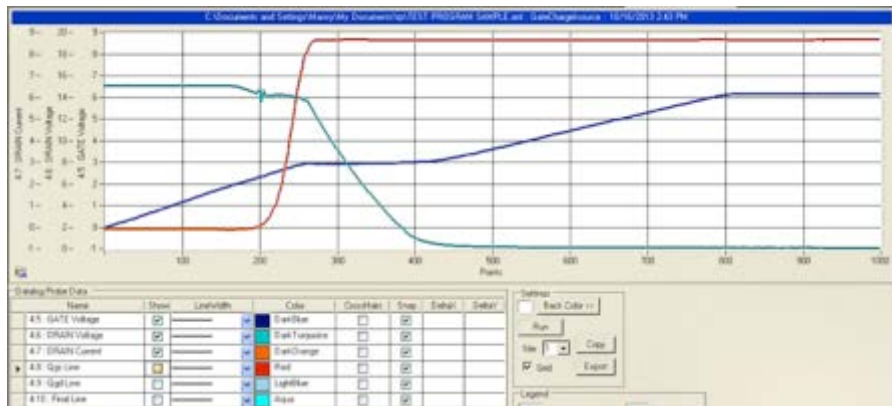
Three choices: Coulombs, Time, and DataPoints.



Time Screenshot



Coulombs Screenshot



Datapoints Screenshot

AC Gate Charge I_{Source} Calibration Method

Step 1

Take DUT out of socket, close socket and run test.

TestName	Test	Min	Value	Max	
GateChargeIsource	50.0	0.000C	120.000pC	200.000nC	Qgs
GateChargeIsource	50.1	0.000C	-120.000pC	200.000nC	Qgd
GateChargeIsource	50.2	0.000C	1.160nC	11.260nC	Qg_ 4.50V

Step 2

Take result circled above, divide by 10 and enter into correction factor box.

SuperUser	
CalFactor	1.16E-10
CheckCapVoltage	False
DisplayDrainCurr	False

Run test again. The new result should read 0.0

TestName	Test	Min	Value	Max	
GateChargeIsource	50.0	0.000C	0.000C	200.000nC	Qgs
GateChargeIsource	50.1	0.000C	0.000C	200.000nC	Qgd
GateChargeIsource	50.2	0.000C	0.000C	11.260nC	Qg_ 4.50V

AC Gate Charge I_{Source} Example Datalog

TestMethod	ChangeOfSlope
Threshold	1
VdsLinesThresPecent	50
X_Axis	Coulombs

VdsLinesThresPecent
VDS percentage threshold for 1st Miller point determination.

NewConfiguration

DataLogger	Binner	Summary
Bin Yield		
Test Yield		
Site Yield		
Raw Data		
Wafer Map		

DEVICE 5	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS		
TestName	Test	Min	Value	Max			
GateChargeIsource	50.0	0.000C	7.840nC	200.000nC	Qgs		
GateChargeIsource	50.1	0.000C	1.990nC	200.000nC	Qgd		
GateChargeIsource	50.2	0.000C	5.510nC	11.260nC	Qg_ 4.50V		

Change of Slope method

TestMethod	DoubleDifferential
Threshold	1
VdsLinesThresPecent	50
X_Axis	Coulombs

TestMethod
Method of determining points of inflection

NewConfiguration

DataLogger	Binner	Summary
Bin Yield		
Test Yield		
Site Yield		
Raw Data		
Wafer Map		

DEVICE 4	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS		
TestName	Test	Min	Value	Max			
GateChargeIsource	50.0	0.000C	10.000pC	200.000nC	Qgs		
GateChargeIsource	50.1	0.000C	10.000pC	200.000nC	Qgd		
GateChargeIsource	50.2	0.000C	5.720nC	11.260nC	Qg_ 4.50V		

Double Differential method

TestMethod	IntersectingLinesVDS
Threshold	1
VdsLinesThresPecent	50
X_Axis	Coulombs

GateRes10K
true to check cap voltage

NewConfiguration

DataLogger	Binner	Summary
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Bin Yield	
Test Yield	
Site Yield	
Raw Data	
Wafer Map	

DEVICE 3	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS		
TestName	Test	Min	Value	Max			
GateChargeIsource	50.0	0.000C	2.210nC	200.000nC	Qgs		
GateChargeIsource	50.1	0.000C	2.030nC	200.000nC	Qgd		
GateChargeIsource	50.2	0.000C	5.670nC	11.260nC	Qg_ 4.50V		

Intersecting Lines VDS method

TestMethod	IntersectingLinesVDS
Threshold	1
VdsLinesThresPecent	50
X_Axis	Coulombs

GateRes10K
true to check cap voltage

NewConfiguration

DataLogger	Binner	Summary
------------	--------	---------

Bin Yield	
Test Yield	
Site Yield	
Raw Data	
Wafer Map	

DEVICE 3	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS		
TestName	Test	Min	Value	Max			
GateChargeIsource	50.0	0.000C	2.210nC	200.000nC	Qgs		
GateChargeIsource	50.1	0.000C	2.030nC	200.000nC	Qgd		
GateChargeIsource	50.2	0.000C	5.670nC	11.260nC	Qg_ 4.50V		

Intersecting Lines method

AC Gate Charge I_{Source} Example Datalog with CapVoltage and GateRes10K

CheckCapVoltage	True
DisplayDrainCurr	False
GateRes10K	True
Meas_On_FALL	False
ScopeTimeBase	AUTO
TestMethod	IntersectingLines
Threshold	1
VdsLinesThresPecent	50
X_Axis	Coulombs

CheckCapVoltage
True to measure and wait for cap voltage.

New Configuration

DataLogger	Binner	Summary
Bin Yield		
Test Yield		
Site Yield		
Raw Data		
Wafer Map		

DEVICE 1	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS		
TestName	Test	Min	Value	Max			
GateChargeIsource	50.0	0.000C	2.250nC	200.000nC	Qgs		
GateChargeIsource	50.1	0.000C	1.940nC	200.000nC	Qgd		
GateChargeIsource	50.2	0.000C	5.710nC	11.260nC	Qg_ 4.50V		

GateRes10K and CheckCapVoltage False

GateRes10K	False
Meas_On_FALL	False
ScopeTimeBase	AUTO
TestMethod	IntersectingLines
Threshold	1
VdsLinesThresPecent	50
X_Axis	Coulombs

GateRes10K
true to check cap voltage

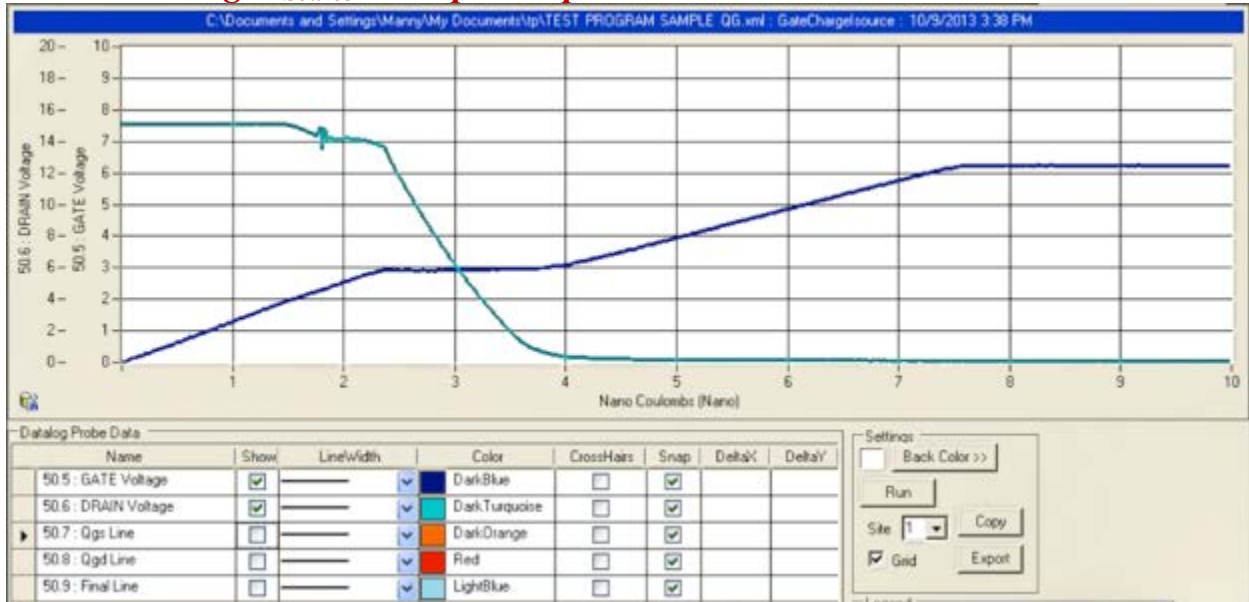
New Configuration

DataLogger	Binner	Summary
Bin Yield		
Test Yield		
Site Yield		
Raw Data		
Wafer Map		

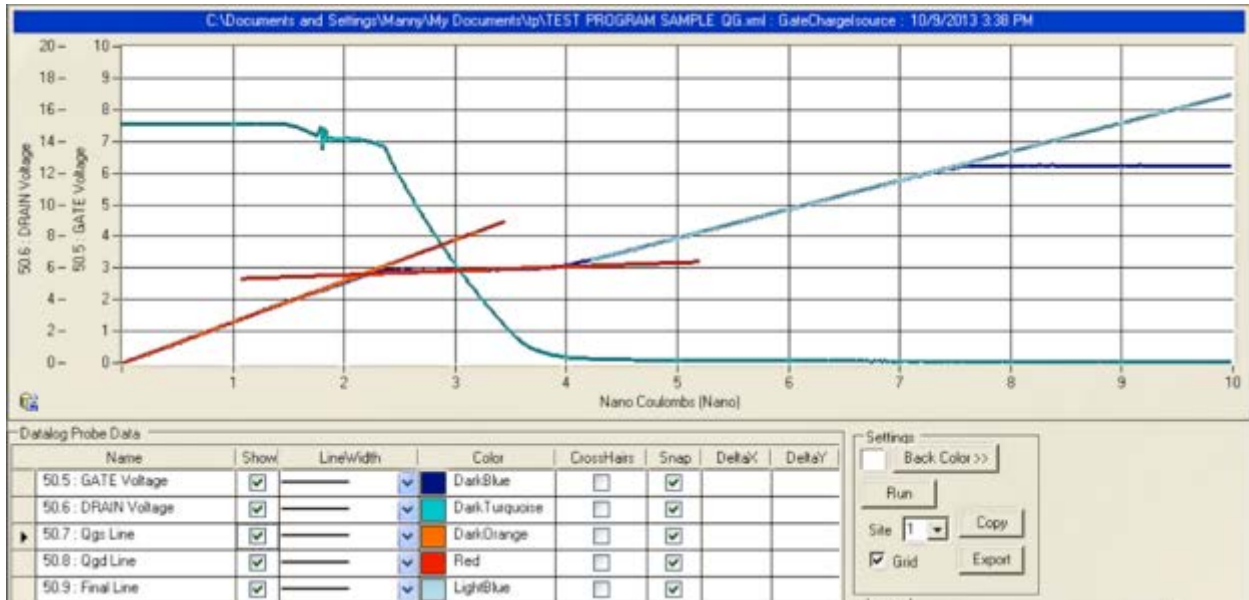
DEVICE 2	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS		
TestName	Test	Min	Value	Max			
GateChargeIsource	50.0	0.000C	2.200nC	200.000nC	Qgs		
GateChargeIsource	50.1	0.000C	2.110nC	200.000nC	Qgd		
GateChargeIsource	50.2	0.000C	5.730nC	11.260nC	Qg_ 4.50V		

GateRes10K and CheckCapVoltage True

AC Gate Charge I_{Source} Example Scope Plot



With lines turned off



With lines turned on

AC Gate Charge $I_{SourceX}$

Overview:

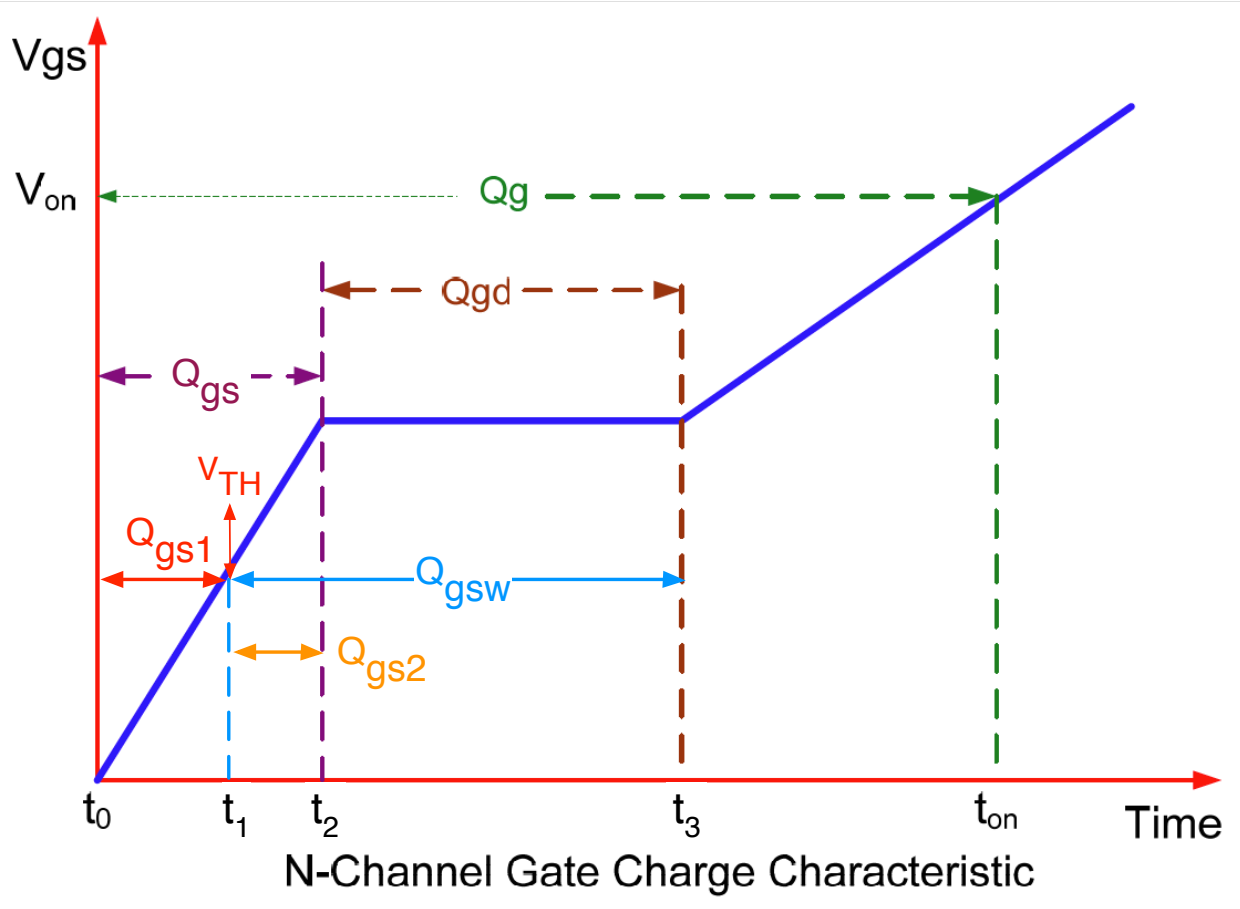
The AC Gate Charge $I_{SourceX}$ test utilizes the AC board to test the gate charge of the DUT.

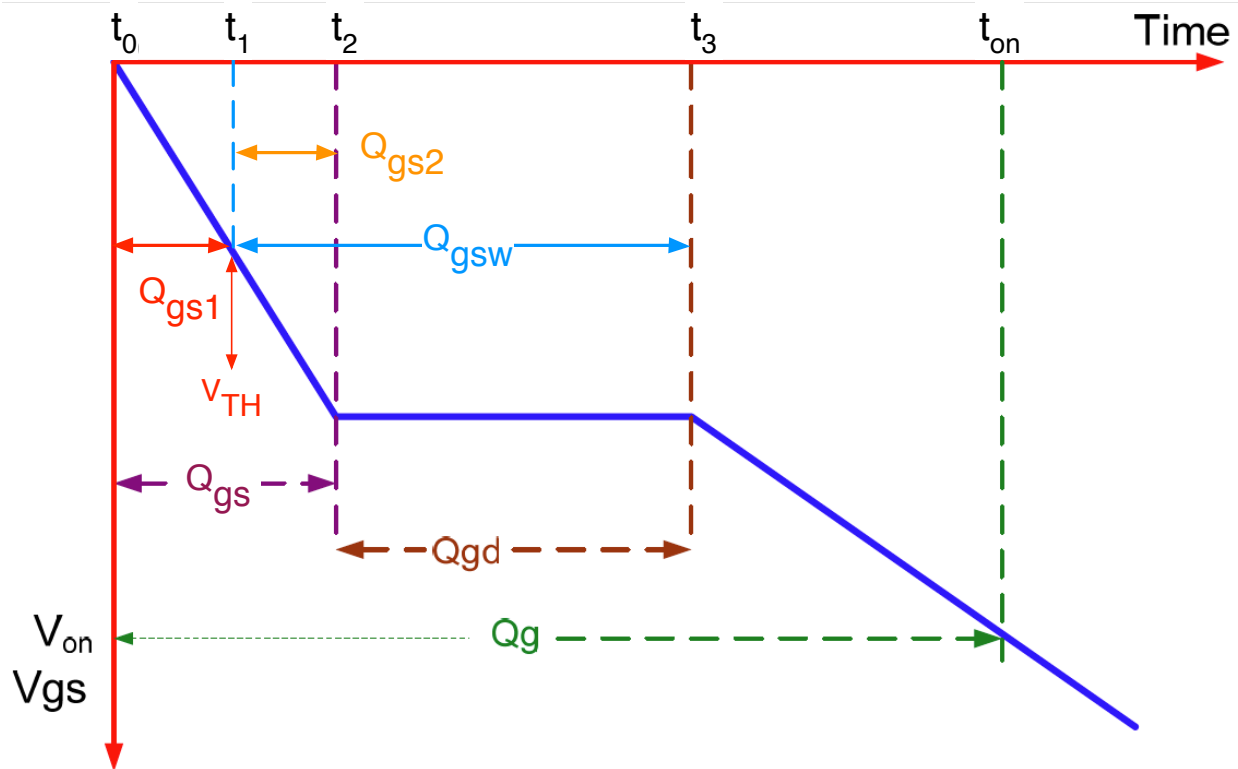
Description:

The Gate Charge test takes place in 2 steps. The first step sets the clamp voltage on the Drain to Source current source and measures this value. The clamped voltage will act as the V_{DD} supply.

The second step is to connect the digitizer to measure the Drain and the Gate. The Drain is measured directly, and the Gate is measured by measuring the buffered voltage of the pulse generator current source. The current source is turned on and ramps up, $I/C=\Delta V/\Delta T$, and from the digitized results 6 gate charge terms are determined. These are Q_{GS} , Q_{GS1} , Q_{GS2} , Q_{GSW} , Q_{GD} , and Q_G .

In order to calculate the gate charges, the current flowing into the gate must be constant, as shown in the figures below for the N-Channel and P-Channel devices.





P-Channel Gate Charge Characteristic

The time between the start of the current flowing (t_0) and the second inflection point (t_2), multiplied by the current is equal to the charge Q_{GS} . Expressed in equation form,

$$Q_{GS} = (t_2 - t_0) \cdot I_G$$

In a similar fashion,

$$Q_{GD} = (t_3 - t_2) \cdot I_G$$

$$Q_{GS1} = (t_1 - t_0) \cdot I_G$$

$$Q_{GS2} = (t_2 - t_1) \cdot I_G$$

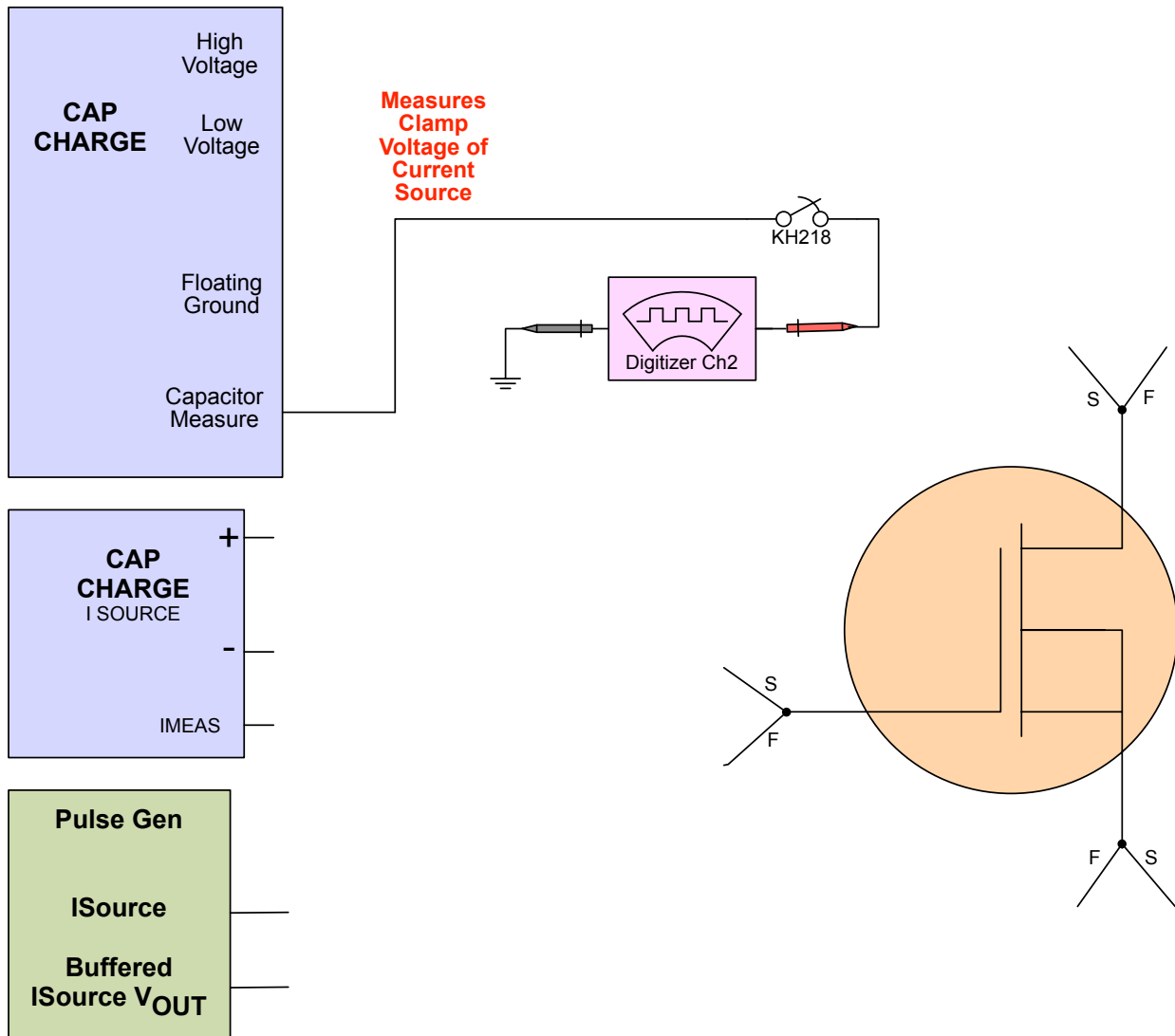
$$Q_{GSW} = (t_3 - t_1) \cdot I_G$$

Q_G is calculated in a different manner. Q_G is defined as the charge to fully turn on the device. This is measured from the t_0 point, to the time that the V_{GS} has reached a defined level. Typically this is 10V and for the newer logic devices, 4.5V. This formula is:

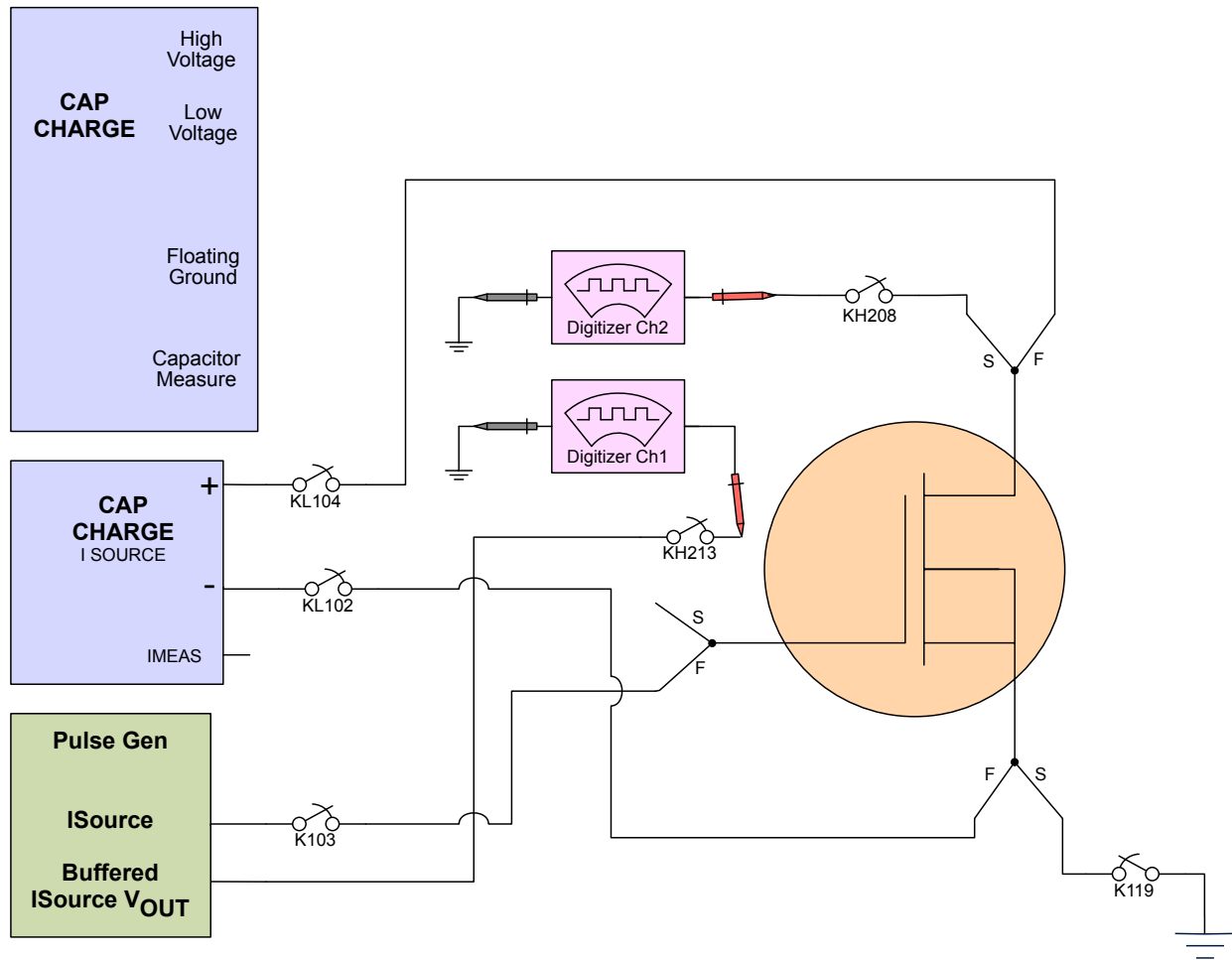
$$Q_G = (t_{ON} - t_0) \cdot I_G$$

AC Gate Charge $I_{SourceX}$ Test

Configuration for N-Channel and P-Channel devices. Step 1. Turn on Current Source and let it settle at its clamped voltage level. Measure the clamped voltage.



Configuration for N-Channel and P-Channel devices. Step 2. Connect the digitizers to the Drain and the buffered I_{Source} V_{OUT} . Turn on the I_{Source} and digitize the the Gate and Drain Voltages. Using the chosen Test Method, calculate the 3 gate charge values






AC Gate Charge $I_{SourceX}$ Test Parameters

Test Method Configuration

Limits	
Qg1_max	1.126E-08
Qg1_min	3E-09
Qg2_max	Qg2_max
Qg2_min	1E-08
Qgd_max	2E-07
Qgd_min	0
Qgs_max	4E-07
Qgs_min	1E-08
Limits_Qgx	
QgdQgs1_max	2.8
QgdQgs1_min	0.59
Qgs1_max	7.7E-09
Qgs1_min	0
Qgsw_max	2E-07
Qgsw_min	0
Setup	
ID	8.8
IG	2E-06
Qg_Voltage1	4.5
Qg_Voltage2	0
TestNum	2
VDS	15
SuperUser	
CalFactor	3.2E-10
CheckCapVoltage	True
DataPointsDisplay	False
DisplayDrainCurr	True
EngMode	True
GateRes10K	False
Meas_On_FALL	False
ScopeTimeBase	AUTO
TestMethod	IntersectingLinesVDS
Threshold	1
VdsLinesThresPecent	95
VdsLinesThresPercentLow	5
X_Axis	Coulombs
Qg1_max	
Limit in Coulombs	

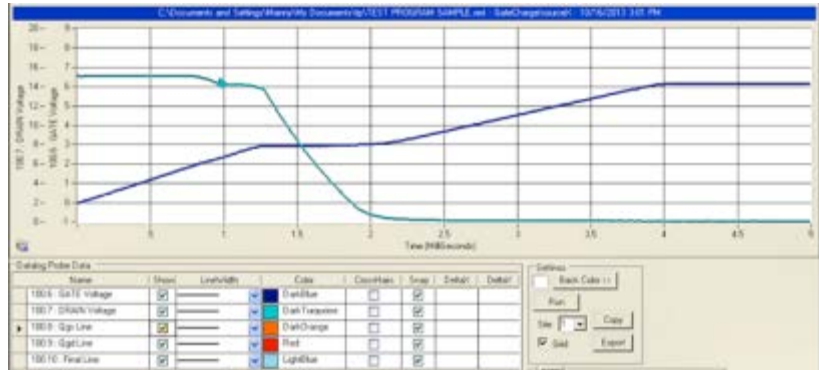
<i>Qg1_Max</i>	Upper Specification Limit – chosen by user
<i>Qg1_Min</i>	Lower Specification Limit – chosen by user
<i>Qg2_Max</i>	Upper Specification Limit – chosen by user
<i>Qg2_Min</i>	Lower Specification Limit – chosen by user
<i>Qgd_Max</i>	Upper Specification Limit – chosen by user
<i>Qgd_Min</i>	Lower Specification Limit – chosen by user
<i>Qgs_Max</i>	Upper Specification Limit – chosen by user
<i>Qgs_Min</i>	Lower Specification Limit – chosen by user
<i>QgdQgs1_Max</i>	Upper Specification Limit – chosen by user
<i>QgdQgs1_Min</i>	Lower Specification Limit – chosen by user
<i>Qgs1_Max</i>	Upper Specification Limit – chosen by user
<i>Qgs1_Min</i>	Lower Specification Limit – chosen by user
<i>Qgsw_Max</i>	Upper Specification Limit – chosen by user
<i>Qgsw_Min</i>	Lower Specification Limit – chosen by user
<i>ID</i>	Set by user
<i>IG</i>	Set by user
<i>Qg_Voltage1</i>	Set by user
<i>Qg_Voltage2</i>	Set by user

<p>TestNum</p>	<p>Test number for VGS threshold</p> <p>Running the VGS test is mandatory in order to calculate Qgs1. Without running the VGS test, the Qgs1 test will fail as indicated in the datalog below.</p>  <p>Referring to the test number and running the VGS threshold test allows the Qgs1 to be determined and the test functions properly</p> 
<p>VDS</p>	<p>Set by user</p>
<p>CalFactor</p>	<p>Value to be entered when DUT has been calibrated</p>
<p>CheckCapVoltage</p>	<p>Provides the measured capacitance voltage value, when TRUE.</p> 

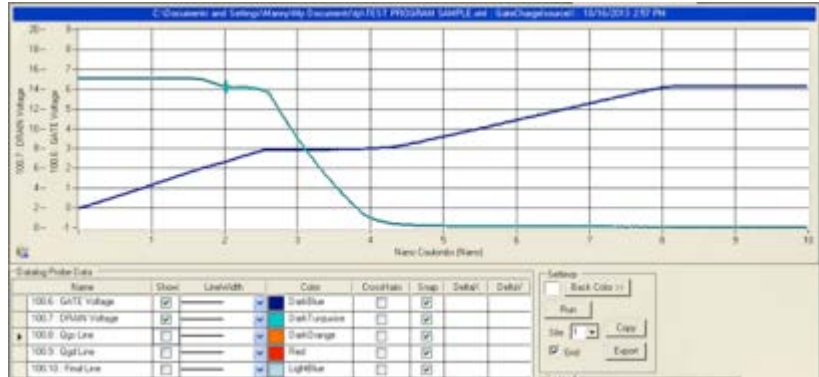
<i>DataPointsDisplay</i>	This is a legacy variable associated with the scope tool, and is no longer needed for this purpose.
<i>DisplayDrainCurr</i>	This is a legacy variable associated with the scope tool to enable/disable Drain current display. This is no longer needed for this purpose.
<i>EngMode</i>	Legacy variable to enable scope data display. No longer required.
<i>GateRes10K</i>	Used to stabilize the Vgs voltage for devices that have very low Qg to prevent the voltage from overshooting.
<i>MeasOnFALL</i>	Inverts the control signal to measure all parameters at the turn off of the device. NOTE that this mode requires the appropriate version of Capcharge module hardware, 4.82.0 of the cap charger.
<i>ScopeTimeBase</i>	Choices are 10uS/division to 1mS/division, or to use Auto for calculated value
<i>TestMethod</i>	Four choices available: IntersectingLinesVDS Lines, IntersectingLinesVDS, ChangeofSlope, DoubleDifferential
<i>VdsLinesTresPecent</i>	High Threshold for IntersectingLinesVDS test method
<i>VdsLinesTresPecentLow</i>	Low Threshold for IntersectingLinesVDS test method

X_Axis

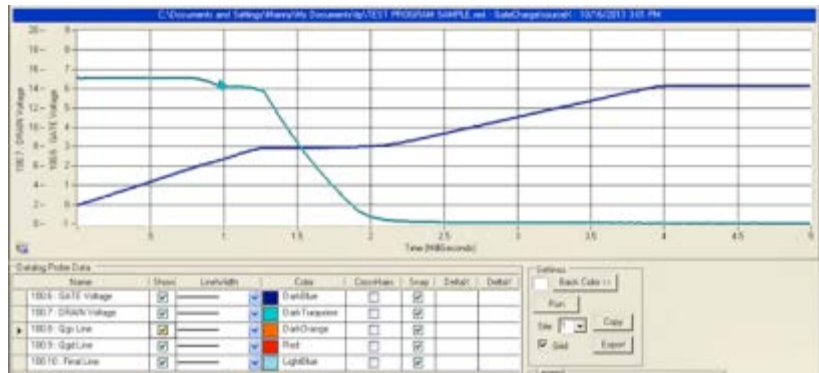
Three choices: Coulombs, Time, and DataPoints. Need screen shot
 Has 3 options. Datapoints, Coulombs, and Time



Time Display



Coulombs Display



Datapoints Display ³

³ this does not work properly in the release 8.1.40 version of the library but will be fixed in future releases

AC Gate Charge $I_{SourceX}$ Calibration Method

Step 1

Take DUT out of socket, close socket and run test.

TestName	Test	Min	Value	Max	
GateChargeIsource	50.0	0.000C	120.000pC	200.000nC	Qgs
GateChargeIsource	50.1F	0.000C	-120.000pC	200.000nC	Qgd
GateChargeIsource	50.2	0.000C	1.160nC	11.260nC	Qg_ 4.50V

Step 2

Take result circled above, divide by 10 and enter into correction factor box.

CalFactor	1.16E-10
CheckCapVoltage	False
DisplayDrainCurr	False

Run test again. The new result should read 0.0

TestName	Test	Min	Value	Max	
GateChargeIsource	50.0	0.000C	0.000C	200.000nC	Qgs
GateChargeIsource	50.1	0.000C	0.000C	200.000nC	Qgd
GateChargeIsource	50.2	0.000C	0.000C	11.260nC	Qg_ 4.50V

AC Gate Charge $I_{SourceX}$ Example Datalog

TestMethod	ChangeOfSlope
Threshold	1
VdsLinesThresPecent	95
VdsLinesThresPercentLow	5
X_Axis	Coulombs

ScopeTimeBase
Overridden by RunTime parameter. AUTO uses 2-times PulsewidthMax value

NewConfiguration

DataLogger	Binnet	Summary
Bin Yield	DEVICE 24 FLOW NewFlow SITE 1 SBIN 1 HBIN 1 PASS	
Test Yield	TestName	Test Min Value Max
Site Yield	ACKelvin	1.0 0.000Ohms 690.124mOhms 15.000Ohms KELVIN Resistance
Raw Data	ACKVgs	2.0 400.000mV 1.634V 5.000V VGS
Wafer Map	GateChargeIsourceX	4.1 0.000C 1.360nC 7.700nC Qgs1 0 to Vth
Statistics	GateChargeIsourceX	4.2 0.000C 7.580nC 200.000nC Qgs1 Qgs2 + Qgd
	GateChargeIsourceX	4.3 0.000C 1.990nC 200.000nC Qgd
	GateChargeIsourceX	4.4 3.000nC 4.650nC 11.260nC Qg_ 4.50V
	GateChargeIsourceX	4.5 590.000nC 1.463C 2.800C Qgd/Qgs1

Change of Slope method

TestMethod	DoubleDifferential
Threshold	1
VdsLinesThresPecent	95
VdsLinesThresPercentLow	5
X_Axis	Coulombs

Meas_On_FALL
Set true to measure FET turn off.

NewConfiguration

DataLogger	Binnet	Summary
Bin Yield	DEVICE 23 FLOW NewFlow SITE 1 SBIN 2 HBIN 2 FAIL	
Test Yield	TestName	Test Min Value Max
Site Yield	ACKelvin	1.0 0.000Ohms 684.409mOhms 15.000Ohms KELVIN Resistance
Raw Data	ACKVgs	2.0 400.000mV 1.602V 5.000V VGS
Wafer Map	GateChargeIsourceX	4.1 0.000C 1.350nC 7.700nC Qgs1 0 to Vth
Statistics	GateChargeIsourceX	4.2F 0.000C -1.330nC 200.000nC Qgs1 Qgs2 + Qgd
	GateChargeIsourceX	4.3 0.000C 10.000pC 200.000nC Qgd
	GateChargeIsourceX	4.4 3.000nC 4.760nC 11.260nC Qg_ 4.50V
	GateChargeIsourceX	4.5F 590.000nC 7.407nC 2.800C Qgd/Qgs1

Double Differential method

TestMethod		IntersectingLinesVDS
Threshold		1
VdsLinesThresPecent		95
VdsLinesThresPercentLow		5
X_Axis		Coulombs

TestMethod
Method of determining points of inflection

NewConfiguration							
DataLogger	Binner	Summary					
Bin Yield		DEVICE 22	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS
Test Yield		TestName	Test	Min	Value	Max	
Site Yield		ACKelvin	1.0	0.0000hms	708.699mOhms	15.0000hms	KELVIN Resistance
Raw Data		ACVgs	2.0	400.000mV	1.642V	5.000V	VGS
		GateChargeIsourceX	4.1	0.000C	1.390nC	7.700nC	Qgs1 0 to Vth
Wafer Map		GateChargeIsourceX	4.2	0.000C	2.040nC	200.000nC	Qgs+ Qgs2 + Qgd
		GateChargeIsourceX	4.3	0.000C	1.880nC	200.000nC	Qgd
Statistics		GateChargeIsourceX	4.4	3.000nC	4.700nC	11.260nC	Qg_ 4.50V
		GateChargeIsourceX	4.5	590.000mC	1.353C	2.800C	Qgd/Qgs1

Intersecting Lines VDS method

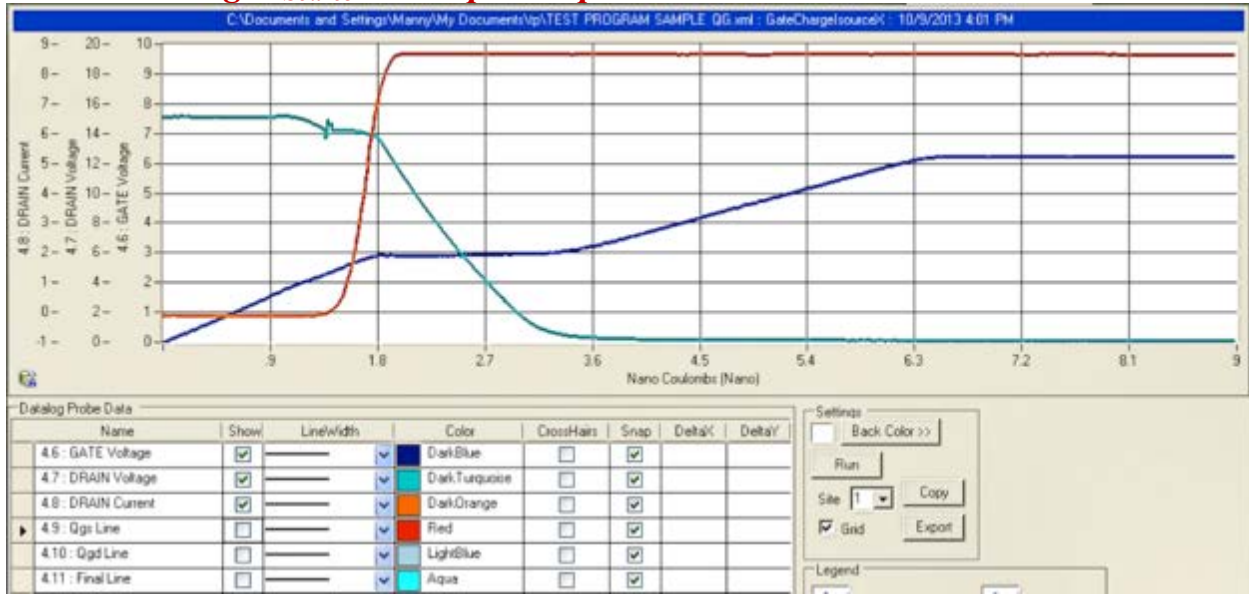
TestMethod		IntersectingLines
Threshold		1
VdsLinesThresPecent		95
VdsLinesThresPercentLow		5
X_Axis		Coulombs

TestMethod
Method of determining points of inflection

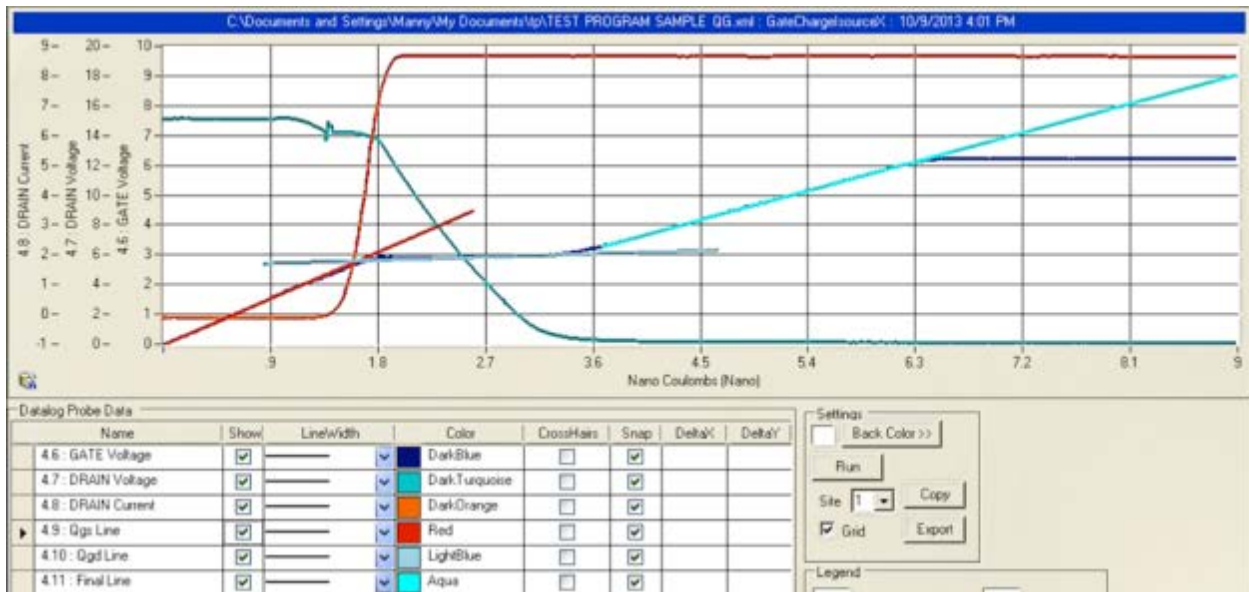
NewConfiguration							
DataLogger	Binner	Summary					
Bin Yield		DEVICE 25	FLOW NewFlow	SITE 1	SBIN 1	HBIN 1	PASS
Test Yield		TestName	Test	Min	Value	Max	
Site Yield		ACKelvin	1.0	0.0000hms	707.985mOhms	15.0000hms	KELVIN Resistance
Raw Data		ACVgs	2.0	400.000mV	1.636V	5.000V	VGS
		GateChargeIsourceX	4.1	0.000C	1.400nC	7.700nC	Qgs1 0 to Vth
Wafer Map		GateChargeIsourceX	4.2	0.000C	2.170nC	200.000nC	Qgs+ Qgs2 + Qgd
		GateChargeIsourceX	4.3	0.000C	1.920nC	200.000nC	Qgd
Statistics		GateChargeIsourceX	4.4	3.000nC	4.810nC	11.260nC	Qg_ 4.50V
		GateChargeIsourceX	4.5	590.000mC	1.371C	2.800C	Qgd/Qgs1

Intersecting Lines method

AC Gate Charge $I_{SourceX}$ Example Scope Plot



With lines turned off



With lines turned on

AC $R_G C_G$ Test

Overview:

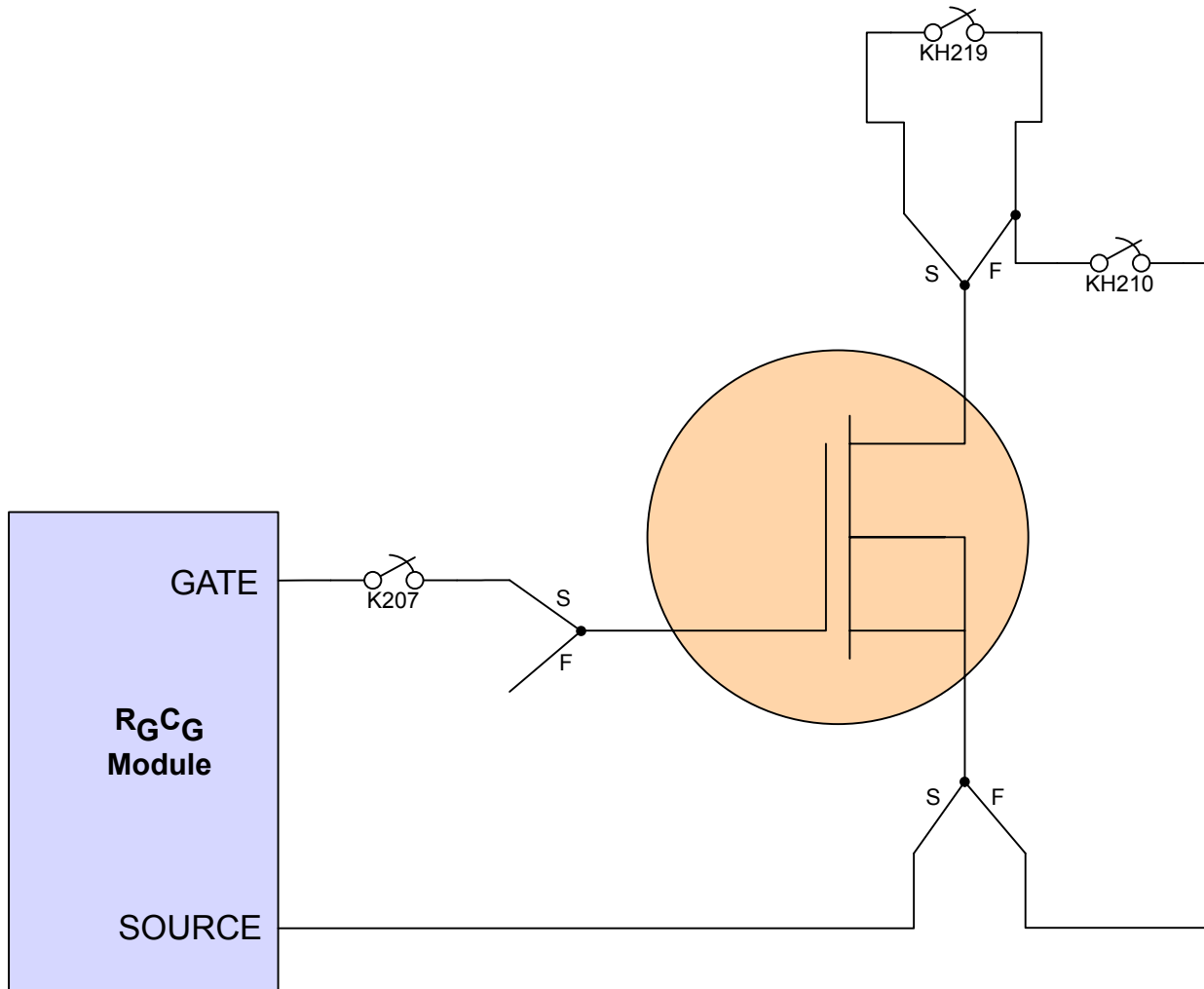
The AC $R_G C_G$ test utilizes the AC board to test the R_G and C_G for Mosfet devices. It uses the small signal resonance technique. Resonance is detected between one of three inductors and the capacitance of the Gate. The values for R_G and C_G are calculated.

Description:

The AC $R_G C_G$ chooses one of three inductor values, 6uH, 22uH, and 100uH. Then the signal generator sweeps from 200kHz to 5MHz and looks for the resonant point. When the circuit is in resonance, the phase of the stimulus voltage and return current are the same. A software search is performed, by comparing the phase of the voltage and current signals, using an optimized algorithm to find phase alignment in the fastest possible time. From this, $Z = V/I$. And since the reactive components don't enter the impedance equation at resonance, the peak or RMS voltage of V and I can be used. From this information, the values of the R_G and C_G are calculated. R_G range is from 0.2 to 200 Ohms, and the C_G is from 100pF to 200nF. This is done with a Gate bias level shift from -10V to + 10V.

AC R_GC_G Test

Configuration for N-Channel and P-Channel devices. Step 1. Charge the VDD to the necessary voltage.



AC R_GC_G Test Parameters

Program Golden Units	Program Profiler	Program Variables	Program Instruments	ACKelvin Configuration	RGSRTTest Configuration
Test Method Configuration					
Diag					
CalCaps				none	
CalResistor				none	
Limit					
CgMaxLimit				1E-06	
CgMinLimit				1E-10	
RgMaxLimit				2.74	
RgMinLimit				0.1	
Misc					
BinaryMode				False	
DisplayMode				CgRgOnly	
EngMode				False	
ResonanceInductor				Ind22uH	
StartFreq				400000	
StopFreq				2000000	
Setup					
BiasVoltage				0	
ConnectionMethod				Using_Banana_Connectors	
D_S_short				True	
LowCap				False	
TestMode				Standard	
DisplayMode					
Additional data to log.					

<i>CalCaps</i>	This is for debugging purposes. Options are NONE or 11 choices of capacitors: 150pF, 300pF, 600pF, 1000pF, 1200pF, 2400pF, 3600pF, 4700pF, 7100pF, 10,000pF, 14,700pF.
<i>CalResistor</i>	This is for debugging purposes. Options are NONE or 4 choices of resistors: 0, 1.6 2 10 Ohms.
<i>CgMaxLimit</i>	Upper Specification Limit – chosen by user
<i>CgMinLimit</i>	Lower Specification Limit – chosen by user
<i>RgMaxLimit</i>	Upper Specification Limit – chosen by user
<i>RgMinLimit</i>	Lower Specification Limit – chosen by user
<i>BinaryMode</i>	Options are TRUE, FALSE. If false, the frequency is shifted in linear steps. If TRUE, the frequency is shifted in binary steps.

DisplayMode

Options are C_GR_G Only, C_GR_GFres, C_GR_GFresSteps, AllPoints

DEVICE 10		FLOW	NewFlow1	SITE 1	SBIN 1	HBIN 1	PASS
TestName	Test	Min	Value	Max			
RGSRTTest	7.0	100.000pF	808.374pF	1.000uF			Gate Cap
RGSRTTest	7.1	100.000m	1.776	2.740			Rg Ohms

C_GR_G Only

DEVICE 9		FLOW	NewFlow1	SITE 1	SBIN 1	HBIN 1	PASS
TestName	Test	Min	Value	Max			
RGSRTTest	7.0	100.000pF	808.866pF	1.000uF			Gate Cap
RGSRTTest	7.1	100.000m	1.794	2.740			Rg Ohms
RGSRTTest	7.2	400.000KHz	1.128MHz	2.000MHz			Res Frequency

C_GR_GFres

DEVICE 8		FLOW	NewFlow1	SITE 1	SBIN 1	HBIN 1	PASS
TestName	Test	Min	Value	Max			
RGSRTTest	7.0	100.000pF	808.866pF	1.000uF			Gate Cap
RGSRTTest	7.1	100.000m	1.794	2.740			Rg Ohms
RGSRTTest	7.2	400.000KHz	1.128MHz	2.000MHz			Res Frequency
RGSRTTest	7.3	0.000	6.000	50.000			Coarse Steps
RGSRTTest	7.4	0.000	11.000	50.000			Fine Steps

C_GR_GFresSteps

DEVICE 6		FLOW	NewFlow1	SITE 1	SBIN 1	HBIN 1	PASS
TestName	Test	Min	Value	Max			
RGSRTTest	7.0	100.000pF	808.866pF	1.000uF			Gate Cap
RGSRTTest	7.1	100.000m	1.790	2.740			Rg Ohms
RGSRTTest	7.2	400.000KHz	1.128MHz	2.000MHz			Res Frequency
RGSRTTest	7.3	0.000	6.000	50.000			Coarse Steps
RGSRTTest	7.4	0.000	11.000	50.000			Fine Steps
RGSRTTest	7.5	400.000KHz	400.000KHz	2.000MHz			Frequency
RGSRTTest	7.6		0.000deg				Phase
RGSRTTest	7.7	400.000KHz	600.000KHz	2.000MHz			Frequency
RGSRTTest	7.8		0.000deg				Phase
RGSRTTest	7.9	400.000KHz	800.000KHz	2.000MHz			Frequency
RGSRTTest	7.10		0.000deg				Phase
RGSRTTest	7.11	400.000KHz	1.000MHz	2.000MHz			Frequency
RGSRTTest	7.12		105.524deg				Phase
RGSRTTest	7.13	400.000KHz	1.100MHz	2.000MHz			Frequency
RGSRTTest	7.14		129.452deg				Phase
RGSRTTest	7.15	400.000KHz	1.200MHz	2.000MHz			Frequency
RGSRTTest	7.16		263.057deg				Phase
RGSRTTest	7.17	400.000KHz	1.200MHz	2.000MHz			Frequency
RGSRTTest	7.18		263.053deg				Phase
RGSRTTest	7.19	400.000KHz	1.050MHz	2.000MHz			Frequency
RGSRTTest	7.20		110.793deg				Phase
RGSRTTest	7.21	400.000KHz	1.125MHz	2.000MHz			Frequency
RGSRTTest	7.22		170.562deg				Phase
RGSRTTest	7.23	400.000KHz	1.163MHz	2.000MHz			Frequency
RGSRTTest	7.24		246.432deg				Phase
RGSRTTest	7.25	400.000KHz	1.144MHz	2.000MHz			Frequency
RGSRTTest	7.26		221.147deg				Phase
RGSRTTest	7.27	400.000KHz	1.134MHz	2.000MHz			Frequency
RGSRTTest	7.28		197.918deg				Phase
RGSRTTest	7.29	400.000KHz	1.130MHz	2.000MHz			Frequency
RGSRTTest	7.30		184.404deg				Phase
RGSRTTest	7.31	400.000KHz	1.127MHz	2.000MHz			Frequency
RGSRTTest	7.32		177.738deg				Phase
RGSRTTest	7.33	400.000KHz	1.129MHz	2.000MHz			Frequency
RGSRTTest	7.34		180.969deg				Phase
RGSRTTest	7.35	400.000KHz	1.128MHz	2.000MHz			Frequency
RGSRTTest	7.36		179.314deg				Phase
RGSRTTest	7.37	400.000KHz	1.128MHz	2.000MHz			Frequency
RGSRTTest	7.38		179.500deg	180.095deg	180.500deg		Phase

AllPoints

EngMode

Engineering Mode, options are TRUE for engineering mode, and FALSE for no

	<p>engineering mode. When true, forces display of resonant frequency.</p> <pre> DEVICE 5 FLOW NewFlow1 SITE 1 SBIN 1 HBIN 1 PASS TestName Test Min Value Max RGSRTTest 7.0 100.000pF 808.866pF 1.000uF Gate Cap RGSRTTest 7.1 100.000m 1.790 2.740 Rg Ohms RGSRTTest 7.2 400.000KHz 1.128MHz 2.000MHz Res Frequency </pre>
ResonanceInductor	Only the 22uH selection is valid. All other selections are ignored.
StartFrequency	Set by user – lowest value is 200kHz
StopFrequency	Set by user – highest value is 5MHz
BiasVoltage	User set bias voltage. -10V to +10V.
Connection Method	This parameter is for the next generation of RG module, and is ignored for the 2.X revision RG modules.
D_S_Short	TRUE to short Drain and Source, else for no short set to FALSE. If using a DXM (Dual-Die Extended MUX), set this to false, and set the DXM selection to short Drain-to-Source.
LowCap	<p>Used to reduce parasitic capacitance of the system when measuring low DUT Cg devices. Setting to TRUE is useful only if Gate-Force and Source-Force cable wire can be disabled between the test-head and the DUT during the RgCg measurement.</p> <p>If not able to disconnect the Gate-Force and Source-Force wires between the test-head and DUT, leave this parameter FALSE.</p> <p>If using a DXM, set to TRUE, as the DXM is able to disconnect the Gate-Force and Source-Force cable wires to the test-head. This will improve RgCg measurements.</p>

TestMode

Options, Standard, Phase Search, Moving Average, and Sweep. Standard – big steps from start to stop frequency to find resonance. Sweep starts with 50 small steps. Moving Average starts with the rolling average of the last 10 devices as a start frequency. For best results, start and stop frequency need to be within 200kHz of nominal resonance. Phase search is similar to Standard, except using phase as the search criteria.

TestName	Test	Min	Value	Max	
ROSSTest	7.0	100.000pF	808.781pF	1.000uF	Gate Cap
ROSSTest	7.1	100.000m	1.783	2.740	Rg Otam
ROSSTest	7.2	400.000kHz	1.128MHz	2.000MHz	Res Frequency

Sweep

TestName	Test	Min	Value	Max	
ROSSTest	7.0	100.000pF	808.715pF	1.000uF	Gate Cap
ROSSTest	7.1	100.000m	1.790	2.740	Rg Otam
ROSSTest	7.2	400.000kHz	1.128MHz	2.000MHz	Res Frequency

Moving

TestName	Test	Min	Value	Max	
ROSSTest	7.0	100.000pF	808.934pF	1.000uF	Gate Cap
ROSSTest	7.1	100.000m	1.794	2.740	Rg Otam
ROSSTest	7.2	400.000kHz	1.128MHz	2.000MHz	Res Frequency

Phase

TestName	Test	Min	Value	Max	
ROSSTest	7.0	100.000pF	808.864pF	1.000uF	Gate Cap
ROSSTest	7.1	100.000m	1.794	2.740	Rg Otam
ROSSTest	7.2	400.000kHz	1.128MHz	2.000MHz	Res Frequency

Standard