



PRODUCT / PROCESS CHANGE NOTIFICATION

PCN-000640

Date: Feb 23 2021

P1/2

<input type="checkbox"/>	Semtech Corporation, 200 Flynn Road, Camarillo CA 93012
<input checked="" type="checkbox"/>	Semtech Canada Corporation, 4281 Harvester Road, Burlington, Ontario L7L 5M4 Canada
<input type="checkbox"/>	Semtech Irvine, 5141 California Ave., Suite 100, Irvine CA 92617
<input type="checkbox"/>	Semtech Neuchatel Sarl, Route des Gouttes d'Or 40, CH-2000 Neuchatel Switzerland
<input type="checkbox"/>	Semtech Bristol - EMEA Limited, Block B, St James Court, Great Park Road, Bristol BS32 4QJ, UK
<input type="checkbox"/>	Semtech Corpus Christi SA de CV, Carretera Matamorros Edificio 7, Reynosa, Tamaulipas, Mexico 88780
<input type="checkbox"/>	Semtech Plano, 1101 Resource Drive, Suite 121, Plano TX 75074
<input type="checkbox"/>	

Change Details

Part Number(s) Affected:

GN1412BINE3, GN1412BINTE3D
GN2012AINE3, GN2012AINTTE3D
GX4002-INE3

Customer Part Number(s) Affected: N/A

Description, Purpose and Effect of Change:

Semtech has qualified a second source for final electrical testing in order to improve security of supply and increase supply chain efficiency.

Final electrical testing is currently performed at ASE Malaysia on the LTX Fusion test platform.

Future testing will have the option of testing on an Advantest 93K test platform at KYEC in Taiwan.

KYEC is qualified supplier and 93K is qualified test platform for other similar products of the same package type (QFN).

Change Classification	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Minor	Impact to Form, Fit, Function	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Impact to Data Sheet	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	New Revision or Date	<input checked="" type="checkbox"/> N/A

Impact to Performance, Characteristics or Reliability:

There will be no impact as form, function, and fit of the product is not changing.

Test coverage on LTX was duplicated and qualified on the Advantest 93K.

Implementation Date	May 23 2021	Work Week	N/A
Last Time Ship (LTS) Of unchanged product	N/A	Affecting Lot No. / Serial No. (SN)	N/A
Sample Availability	Available	Qualification Report Availability	Available

Supporting Documents for Change Validation/Attachments:

- GN1412B KYEC Qualification Report
- GN2012A KYEC Qualification Report
- GX4002 KYEC Qualification Report




PRODUCT / PROCESS CHANGE NOTIFICATION

PCN-000640

Date: Feb 23 2021

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Issuing Authority	
Semtech Business Unit:	Signal Integrity Products
Semtech Contact Info:	Dusanka Hewlett QMS Manager, Quality Assurance Semtech Canada Corporation dhewlett@semtech.com
	
FOR FURTHER INFORMATION & WORLDWIDE SALES COVERAGE: http://www.semtech.com/contact/index.html#support	



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Security Level:	External	Document Status:	Active
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GN1412B

KYEC QUALIFICATION REPORT

Project: GN1412B

Revision Date: 1/17/2020

Status: Active

Revision: 1.0

Author(s): David Pham

Creation Date: 1/17/2020

Location: Semtech Burlington



Title:	GN1412B KYEC Qualification Report	Project Name:	GN1412B
Security Level:	External	Document Status:	Active
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Revision History

Status	Date	Rev. #	Reviser/Group	Description
Release	01/17/2020	1.0	David Pham	Initial Release



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1 Process Changes

1.1 Process Change Summary

Semtech is implementing a second source for final electrical testing of GN1412B in order to improve security of supply and increase supply chain efficiency. This change will require qualification of a new test platform. Final electrical testing was previously performed at ASE Malaysia on the LTX test platform. Future testing will have the option of testing on a Verigy 93k (V93k) test platform at KYEC. This report details the qualification procedure and correlation analysis performed to qualify the new test facility and test platform.

	Current (single source)	Future (dual source)
Test Location	ASEM	KYEC or ASEM
Test Platform	LTX	V93K or LTX

1.2 Affected Products

Final Product
GN1412BINE3
GN1412BINTE3D



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2 Qualification Procedure

2.1 Procedure

Qualification of the V93k test platform at KYEC consisted of 3 main components:

- 1) Correlation testing
- 2) Gauge R&R (GR&R) testing
- 3) Large volume trial lot testing

Correlation testing was completed by testing a large number of devices on the reference tester (LTX) and then testing these same units on the new tester (V93K). The correlation units are from multiple foundry lot batches. These units consisted of both passing units and reject units captured from all major failure bin categories. The test data was then compared to ensure tester to tester correlation using the metrics detailed in section 3. Gauge R&R testing was performed in order to verify stability of the new test solution. Finally, a large volume trial lot was tested at KYEC to ensure that the final test program was adequate for mass production testing.

2.2 Qualification Devices

The sample size for correlation of test results on the LTX to the new platform at KYEC is summarized in the following table.

Function	Quantity	Comment
Yield Correlation	1128 units	500 passing units, 628 reject units
Bin Correlation	1128 units	500 passing units, 628 reject units
Key Parameter Correlation GR&R	12 units from 1 foundry lot	12 units from 1 foundry lot
Repeatability / GR&R	12 units from 1 foundry lot	12 units from 1 foundry lot
Trial lot	800 units from 1 foundry lot	Fresh material



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3 Analysis:

The correlation exercise consisted of a GR&R experiment and analysis to examine repeatability and tester platform variation. Results for all parametric tests were examined. For yield and bin correlation, a correlation material were tested on both platform LTX and V93K, and to conclude the yield verification, a trial lot of fresh untested devices were tested. The quantity of correlation material and trial lot are shown in above table.

3.1 Yield Comparison:

Overall yields were compared between the Reference Test System and the New Test System.

Results

The correlation units tested had comparable yield on LTX at ASEM and V93k at KYEC.

3.2 Bin Correlation

The GN1412B final test program consists of multiple pass and fail software bins. The correlation units were tested on both test platforms and a bin movement table was created to identify if parts were binned identically on both test systems.

Results

It was found that all parts were binned equivalently on both test solutions.



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3.3 Gauge R&R

GR&R analysis is a statistical method of systematically comparing the repeatability and reproducibility variances between two measurement systems. This is accomplished by using ANOVA (Analysis of Variance) to calculate the percentages of the repeatability and reproducibility variance components to the pass windows as defined by the test program limits. The goal of GR&R is to demonstrate that the new system will match or exceed the current benchmark, production test system performance on all critical parameters. The GRR maximum allowed for the total tolerance is 30%, this includes combined reproducibility and repeatability. 30% is an agreed industry standard.

For this qualification, the GR&R experiment was conducted with the following control factors:

- 1 Test platforms
- 1 Loadboard per platform
- 2 insertions
- 4 Test site per Loadboard
- 10 loops for repeatability
- 12 Known good samples

3.3.1 Results:

The comparison of the LTX and V93k GRR showed no discrepancies between test results.

Test category	GR&R Total Tolerance Acceptance Criteria	V93K GR&R	Bin correlation	Bin correlation
Continuity / ESD	<30%	Pass	Pass	Pass
PS Short	<30%	Pass	Pass	Pass
VCC resistance	<30%	Pass	Pass	Pass
Termination Resistance	<30%	Pass	Pass	Pass
VBIAS	<30%	Pass	Pass	Pass
Leakage	<30%	Pass	Pass	Pass
Swing	<30%	Pass	Pass	Pass
ICC	<30%	Pass	Pass	Pass
IBIAS LD	<30%	Pass	Pass	Pass
VPHOTO	<30%	Pass	Pass	Pass
CPA	<30%	Pass	Pass	Pass
Voltages	<30%	Pass	Pass	Pass
Jitter	<30%	Pass	Pass	Pass
PLL (BER test)	<30%	Pass	Pass	Pass
Loopback	<30%	Pass	Pass	Pass



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LOS	<30%	Pass	Pass	Pass
VEMRx	<30%	Pass	Pass	Pass
VEMTx	<30%	Pass	Pass	Pass
OTP readback	<30%	Pass	Pass	Pass

3.4 Large Volume Trial Test Run

A final trial lot test run of 800 fresh units was completed at KYEC using the final V93k test program. Review of this data showed that yields and failure Pareto were as expected.



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4 Conclusion

The KYEC V93k test platform provides equivalent test coverage to the ASEM LTX test platform.

The KYEC V93k test platform is deemed qualified for production testing of the GN1412B product.



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GN2012A

KYEC QUALIFICATION REPORT

Project: GN2012A

Revision Date: 1/17/2020

Status: Active

Revision: 1.0

Author(s): David Pham

Creation Date: 1/17/2020

Location: Semtech Burlington



Title:	GN2012A KYEC Qualification Report	Project Name:	GN2012A
Security Level:	External	Document Status:	Active
Division:	R&D AMS Product Engineering	Revision Date:	1/17/2020
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Revision History

Status	Date	Rev. #	Reviser/Group	Description
Release	09/17/2020	1.01	David Pham	Initial Release



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1 Process Changes

1.1 Process Change Summary

Semtech is implementing a second source for final electrical testing of GN2012A in order to improve security of supply and increase supply chain efficiency. This change will require qualification of a new test platform. Final electrical testing was previously performed at ASE Malaysia on the LTX test platform. Future testing will have the option of testing on a Verigy 93k (V93k) test platform at KYEC. This report details the qualification procedure and correlation analysis performed to qualify the new test facility and test platform.

	Current (single source)	Future (dual source)
Test Location	ASEM	KYEC or ASEM
Test Platform	LTX	V93K or LTX

1.2 Affected Products

Final Product
GN2012AINE3



Title:	GN2012A KYEC Qualification Report	Project Name:	GN2012A
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2 Qualification Procedure

2.1 Procedure

Qualification of the V93k test platform at KYEC consisted of 3 main components:

- 1) Correlation testing
- 2) Gauge R&R (GR&R) testing
- 3) Large volume trial lot testing

Correlation testing was completed by testing a large number of devices on the reference tester (LTX) and then testing these same units on the new tester (V93K). The correlation units are from multiple foundry lot batches. These units consisted of both passing units and reject units captured from all major failure bin categories. The test data was then compared to ensure tester to tester correlation using the metrics detailed in section 3. Gauge R&R testing was performed in order to verify stability of the new test solution. Finally, a large volume trial lot was tested at KYEC to ensure that the final test program was adequate for mass production testing.

2.2 Qualification Devices

The sample size for correlation of test results on the LTX to the new platform at KYEC is summarized in the following table.

Function	Quantity	Comment
Yield Correlation	1016 units	500 passing units, 516 reject units
Bin Correlation	1016 units	500 passing units, 516 reject units
Key Parameter Correlation GR&R	12 units from 1 foundry lot	12 units from 1 foundry lot
Repeatability / GR&R	12 units from 1 foundry lot	12 units from 1 foundry lot
Trial lot	800 units from 1 foundry lot	Fresh material



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3 Analysis:

The correlation exercise consisted of a GR&R experiment and analysis to examine repeatability and tester platform variation. Results for all parametric tests were examined. For yield and bin correlation, a correlation material were tested on both platform LTX and V93K, and to conclude the yield verification, a trial lot of fresh untested devices were tested. The quantity of correlation material and trial lot are shown in above table.

3.1 Yield Comparison:

Overall yields were compared between the Reference Test System and the New Test System.

Results

The correlation units tested had comparable yield on LTX at ASEM and V93k at KYEC.

3.2 Bin Correlation

The GN2012A final test program consists of multiple pass and fail software bins. The correlation units were tested on both test platforms and a bin movement table was created to identify if parts were binned identically on both test systems.

Results

It was found that all parts were binned equivalently on both test solutions.

3.3 Gauge R&R

GR&R analysis is a statistical method of systematically comparing the repeatability and reproducibility variances between two measurement systems. This is accomplished by using ANOVA (Analysis of Variance) to calculate the percentages of the repeatability and reproducibility variance components to the pass windows as defined by the test program limits. The goal of GR&R is to demonstrate that the new system will match or exceed the current benchmark, production test system performance on all critical parameters. The GRR maximum allowed for the total tolerance is 30%, this includes combined reproducibility and repeatability. 30% is an agreed industry standard.

For this qualification, the GR&R experiment was conducted with the following control factors:

- 1 Test platforms
- 2 Loadboard per platform
- 2 insertions
- 4 Test site per Loadboard
- 10 loops for repeatability
- 12 Known good samples



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3.3.1 Results:

The comparison of the LTX and V93k GRR showed no discrepancies between test results.

Test category	GR&R Total Tolerance Acceptance Criteria	V93K GR&R	Bin correlation
Continuity/ESD	<30%	Pass	Pass
PS Short	<30%	Pass	Pass
VCC resistance	<30%	Pass	Pass
Termination Resistance	<30%	Pass	Pass
VBIAS	<30%	Pass	Pass
Leakage	<30%	Pass	Pass
Swing	<30%	Pass	Pass
ICC	<30%	Pass	Pass
Voltages	<30%	Pass	Pass
Jitter	<30%	Pass	Pass
BER	<30%	Pass	Pass
Autobypass BER	<30%	Pass	Pass
IJT	<30%	Pass	Pass
SPA	<30%	Pass	Pass
CLKDIV	<30%	Pass	Pass
Loopback	<30%	Pass	Pass
LOS	<30%	Pass	Pass
PRBS gen check	<30%	Pass	Pass
VEMRx	<30%	Pass	Pass
VEMTx	<30%	Pass	Pass
REFCLK	<30%	Pass	Pass
OTP readback	<30%	Pass	Pass
Die temperature	<30%	Pass	Pass

3.4 Large Volume Trial Test Run

A final trial lot test run of 800 fresh units was completed at KYEC using the final V93k test program. Review of this data showed that yields and failure pareto were as expected.



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4 Conclusion

The KYEC V93k test platform provides equivalent test coverage to the ASEM LTX test platform.

The KYEC V93k test platform is deemed qualified for production testing of the GN2012A product.



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GX4002

KYEC Qualification Report

Project: GX4002
Status: Active
Author(s): David Pham

Revision Date: 1/10/2021
Revision: 1.0
Creation Date: 1/10/2021

Location: Semtech Burlington



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Revision History

Status	Date	Rev. #	Reviser/Group	Description
Draft	1/22/2016	0.0	Stephen Innes	Initial Draft
Active	01/12/2021	1.0	David Pham	Final version release

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1 Process Changes

1.1 Process Change Summary

Semtech is implementing a second source for final electrical testing of GX4002 in order to improve security of supply and increase supply chain efficiency. This change will require qualification of a new test platform. Final electrical testing was previously performed at ASE Malaysia on the LTX Fusion test platform. Future testing will have the option of testing on a Advantest 93k (V93k) test platform at KYEC. This report details the qualification procedure and correlation analysis performed to qualify the new test facility and test platform.

Table 1.1: Process change Summary

	Current (single source)	Future (dual source)
Test Location	ASEM	KYEC or ASEM
Test Platform	LTX	V93K or LTX

1.2 Affected Products

Table 1.2: Affected products

Final Product Name
GX4002-INE3

2 Qualification Procedure

2.1 Procedure

Qualification of the V93k test platform at KYEC consisted of 3 main components:

- 1) Correlation testing
- 2) Gauge R&R (GR&R) testing
- 3) Large volume trial lot testing

Correlation testing was completed by testing a large number of devices on the reference tester at ASEM (LTX) and then testing these same units on the new tester at KYEC (V93k). The correlation units consisted of >1200 units from multiple foundry lot batches. These units

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consisted of both passing units and reject units captured from all major failure bin categories. The test data was then compared to ensure tester to tester correlation using the metrics detailed in section 3. Gauge R&R testing was performed in order to verify stability of the new test solution and to qualify multiple sets of hardware to be used in production. Finally, a large volume trial lot was tested at KYEC to ensure that the final test program was adequate for mass production testing.

2.2 Qualification Devices

The sample size for correlation of test results on the LTX to the new platform at KYEC is summarized in table 2.1.

Table 2.1: Sample Sizes

Function	Quantity	Description
Yield Correlation	1279 units from 14 different foundry lots	809 passing units + 470 reject units used
Bin Correlation	1279 units from 14 different foundry lots	809 passing units + 470 reject units used
Key Parameter Correlation	1279 units from 14 different foundry lots	809 passing units + 470 reject units used
Repeatability / GR&R	24 units from 1 foundry lot	12 passing units + 12 reject units used
Trial lot	800 units from 1 foundry lot	Fresh untested material

3 Analysis

The correlation exercise consisted of several types of analysis to ensure correlation between the Reference Test System (LTX) and the New Test System (V93k). Yield comparison and bin-to-bin correlation were completed over a large volume of correlation parts. Key parametric parameters were compared using various statistical methods including mean shift and standard deviation shift to ensure the results aligned between both testers. A visual verification of the individual test histograms was also completed to ensure consistent distributions. Based on the correlation results, test limits were adjusted on the new tester to ensure that the correlation parts were binned identically on both testers.

3.1 Yield Comparison

Overall yields were compared between the Reference Test System and the New Test System. Correlation is achieved if yields are within 1%.

Results

The correlation units tested had comparable yield on LTX at ASEM and V93k at KYEC. Yields were less 1% different.

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3.2 Bin Correlation

The GX4002 final test program consists of multiple pass and fail software bins. The correlation units were tested on both test platforms and a bin movement table was created to identify if parts were binned identically on both test systems.

Results

It was found that within the margin of error all parts were binned equivalently on both test solutions.

3.3 Means Comparison

For the means comparison, correlation is achieved if the mean value from the LTX Test System is within 10% of the mean value from the V93k Test System as it relates to the guard banded test boundaries or within the tester accuracy of the measurement. The mean shift value was calculated as follows:

$$\frac{|\bar{X}_{NEW} - \bar{X}_{REF}|}{T_{high} - T_{low}}$$

Results

Test category	Acceptance Criteria	Result
Continuity / ESD	<10%	Pass
Termination Resistance	<10%	Pass
Leakage	<10%	Pass
Termination Resistance	<10%	Pass
Swing	<10%	Pass
Icc/Power	<10%	Pass
CPA	<10%	Pass
Voltages Levels	<10%	Pass
Jitter	<10%	Pass
Lock	<10%	Pass
IJT	<10%	Pass
FSM	<10%	Pass
Loopback	<10%	Pass
Clock Divide	<10%	Pass
LOS	<10%	Pass
HEM	<10%	Pass
VEM	<10%	Pass

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PRBS Gen/checker	<10%	Pass
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3.4 StdDev Comparison

For the standard deviation comparison, correlation is achieved if the standard deviation from the V93k Test System is within 10% of the standard deviation from the LTX Reference Test System as it relates to the guard banded test boundaries. The calculated value is as follows:

$$\frac{|\sigma_{NEW} - \sigma_{REF}|}{T_{high} - T_{low}}$$

Results

Test category	Acceptance Criteria	Result
Continuity / ESD	<10%	Pass
Termination Resistance	<10%	Pass
Leakage	<10%	Pass
Termination Resistance	<10%	Pass
Swing	<10%	Pass
Icc/Power	<10%	Pass
CPA	<10%	Pass
Voltages Levels	<10%	Pass
Jitter	<10%	Pass
Lock	<10%	Pass
IJT	<10%	Pass
FSM	<10%	Pass
Loopback	<10%	Pass
Clock Divide	<10%	Pass
LOS	<10%	Pass
HEM	<10%	Pass
VEM	<10%	Pass
PRBS Gen/checker	<10%	Pass

3.5 Histogram Comparison

Each histogram was compared one-to-one and evaluated for anomalies such as multi-modes, skew, and kurtosis.

Results

The comparison of the LTX and V93k histograms showed no discrepancies between test results



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3.6 Large Volume Trial Test Run

A final trial lot test run of 800 fresh units was completed at KYEC using the final V93k test program. Review of this data showed that yields and failure pareto were as expected.



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4 Conclusion

The KYEC V93k test platform was found to provide equivalent test coverage to the ASEM LTX test platform.

The KYEC V93k test platform is deemed qualified for production testing of the GX4002 product.