EMC SHIELDING EFFECTIVENESS TEST REPORT

Test Specification : MIL-DTL 83528D
Manufacturer : Specialty Silicone Products, Inc
Test Samples :

1. **Type B Gasket**

DOCUMENT HISTORY				
REVISION	**ISSUE DATE**	**AFFECTED PAGE(S)**	**DESCRIPTION OF MODIFICATIONS**	**REVISED BY**
1.0	12 March 2004		Initial release	

TEST REPORT NO. 18225
from
D.L.S. Electronic Systems, Inc.

Test for Specialty Silicon Products, Inc

WRITTEN BY	REVIEWED BY	REVIEWED BY
Jereme Irwin	Jack Prawica	Brian Mattson

TEST PERSONNEL	TITLE
Jereme Irwin	EMC Test Engineer

TEST DATE(S)	August 06, 2012

TEST FACILITY	D.L.S. Electronic Systems,
ADDRESS	1250 Peterson Drive
CITY, STATE, ZIP CODE	Wheeling, IL. 60090
PHONE	(847) 537-6400
FAX	(847) 537-6488

ADMINISTRATIVE SUMMARY

REASON FOR TEST:

To test the shielding effectiveness of one material as specified in MIL-DTL-83528D.

TEST SPECIFICATION:

GENERAL SPECIFICATION FOR MIL-DTL 83528D GASKETING MATERIAL, CONDUCTIVE, SHIELDING GASKET, ELECTRONIC, ELASTOMER, EMI/RFI.

DATE(S) OF TEST:

August 06, 2012

TEST SAMPLES:

A total of one samples were presented for testing. Refer to Section 2 of this report for a description of each test sample along with the manufacturer's designation.

MANUFACTURER: Specialty Silicon Products, Inc
Corporate Technology Park
3 McCrea Hill Road
Ballston Spa, NY 12020

MANUFACTURERS REPRESENTATIVE:
John Hand

DISPOSITION OF TEST SAMPLE:
Samples will be returned to SSP, Inc.

TEST LOCATION:
D.L.S. Electronic Systems,
1250 Peterson Drive
Wheeling, IL. 60090

TEST PERSONNEL:

Jereme Irwin	EMC Test Engineer

SUMMARY OF TEST RESULTS:

The shielding effectiveness of the test samples can be found in data sheets located in Appendix C of this report.

TABLE OF CONTENTS

INTRODUCTION

This report documents the results of a series of EMI/EMC measurements performed on the test samples described in Section 2 of this report. The purpose of this series of tests was to demonstrate compliance of the test sample(s) with the requirements of the MIL-DTL-83528D Specification for comparison data of four different test samples using a MIL-DTL-83528D test fixture.

SECTIONS

SECTION 1 - CLIENT INFORMATION

COMPANY NAME ***ADDRESS*** ***CITY, STATE ZIP***	Specialty Silicone Products, Inc Corporate Technology Park 3 McCrea Hill Road Ballston Spa, NY 12020
CONTACT NAME ***TITLE*** ***PHONE*** ***E-MAIL***	John Hand Director of Operations (518) 885-8826 (518) 363-4682

MANUFACTURER ***ADDRESS*** ***CITY, STATE ZIP***	Specialty Silicone Products, Inc Corporate Technology Park 3 McCrea Hill Road Ballston Spa, NY 12020

SECTION 2 - PURPOSE OF TEST

The purpose of this series of tests was to verify the shielding effectiveness of the four samples for comparison.

SECTION 3 - TEST SAMPLE DESCRIPTION

The following table provides a list of each type of Gasket Material tested.

NO.	***Material***	***Description***
1.	Type B Gasket	26” x 26” Gasket

SECTION 4 - TEST SITE; FACILITIES, CONDITIONS AND TOLERANCES

The EMI measurements were performed through a test fixture designed to the IEEE-299 test specification. A modified MIL-DTL-83528D test fixture was located between two adjacent shielded enclosures. The receive chamber and the control (transmit) chamber meets the applicable requirements of NSA65-6. AC power is supplied to each enclosure from a dedicated isolation transformer through low-pass line filters, which provide a minimum of 120 dB of attenuation from 10 kHz to 10 GHz.

SECTION 5 - TEST EQUIPMENT

A complete test system equipment list is provided in APPENDIX A of this report. The equipment absolute performance calibration, of the equipment requiring calibration, is performed on an as needed basis in accordance with MIL-STD-45662. However, calibration periods do not exceed one (1) year. The test equipment is capable of making measurements within tolerances of at least +/- 2 dB amplitude and +/-2% frequency deviation. Equipment certifications showing traceability to NIST (National Institute of Standards and Technology) are maintained on file at D.L.S. Electronic Systems in Wheeling, IL. All equipment is checked and verified for proper operation before and after each series of tests.

SECTION 6 - TEST RESULTS

The following table lists the requirements and results for each of the test samples.

NO.	***Material***		***BEST ATTENUATION LEVEL (dB)***
1.	Type B Gasket		139.1@200MHz

The Specialty Silicone Products, Inc. gasket tested meets the requirements of Type B characteristics for MIL-DTL 83528D shielding effectiveness.

SECTION 7 - SHIELDING EFFECTIVENESS MEASUREMENTS

Detailed data sheets, which provide the entire shielding effectiveness results across the entire frequency range for each of the two samples, are provided in APPENDIX C of this report. The following information provides a description of the test data sheet information.

All amplitude measurement levels are recorded in dBuV.
Attenuation Levels are recorded in dB.

The data sheets contain the following categories:

- Frequency: Discreet frequency at which measurement was made. Recorded as MHz or GHz.
- Reference Level: Test level with shielding material not in place. This is an amplitude level recorded in dBuV.
- Attenuation: Added attenuation (20dB) to input of receiver when measuring the reference level so not to damage receiver; attenuation removed for testing of gasket. This value is added to the test level.
- Test Level: Measurement made with shielding material in the test fixture. This is an amplitude level recorded in dBuV.
- Shielding Effectiveness: Equal to [Reference Level minus the (Test Level minus the pre-amp)]. The result is in dB units.

APPENDIX A - TEST EQUIPMENT

A.1 Specific Equipment Used

Description	Manufacturer	Cal Due	Frequency	Model	Use	Serial No.
Amplifier, RF, Power	Amplifier Research	N/A	10kHz-220MHz	2500LM11	TX	22714
Amplifier, RF, Power	Amplifier Research	N/A	80-1000MHz	100W1000M1	TX	15187
Coupler	Amplifier Research	2/28/2013	10kHz-220MHz	DC2500	TX	27584
Coupler	Amplifier Research	2/28/2013	80-1000MHz	DC6180	TX	303130
Antenna,	EMCO	1/13/2013	20-300MHz	BIA-25C	RX	2617
Antenna,	Electro-Metrics	N/A	20-300MHz	3109	TX	9803-3163
Antenna,	EMCO	10/14/2012	200-1000MHz	3106	RX	9406-2575
Antenna,	Electro-Metrics	N/A	200-1000MHz	3106	TX	2127
Antenna, Horn	ETS Lindgren	N/A	1-18Ghz	3115	TX	2479
Antenna, Horn	EMCO	10/14/2012	1-18GHz	3115	RX	9912-9954
Pre-Amp	Planar	3/25/2013	1-20GHz	PTB-35-120-5R0-1	RX	PL3159
Generator, Microwave	Rohde & Schwarz	06/29/2013	1-20GHz	SMR 20	TX	100052
Spectrum Analyzer, RF	Agilent	06/23/2013	3Hz-44GHz	E4440A	RX	MY46186619

APPENDIX B - DESCRIPTION OF TEST METHODS

B.1 SHIELDING EFFECTIVENESS MEASUREMENTS

The shielding effectiveness measurements were made in accordance with MIL-DTL-83528D using a spectrum analyzer and a signal generator in conjunction with the appropriate power amplifiers and antennas. The transmitting antenna was located inside of a shielded control chamber located adjacent to the Receiving chamber. Reference levels were measured through the 26 inch by 26 inch opening in the shielded enclosure without the test sample in place. The minimum reference level recorded was 90dB at 20MHz, 110dB at 30-100MHz and 120dB at .2-10GHz. References were made with the antennas positioned in horizontal polarity separated by 2 meters 20-1000MHz and 1 meter 1-10GHz.

The test sample was compressed 10% when under test.

The test levels were then recorded at each frequency and attenuation values were determined by calculating the difference between the reference level and the test level.

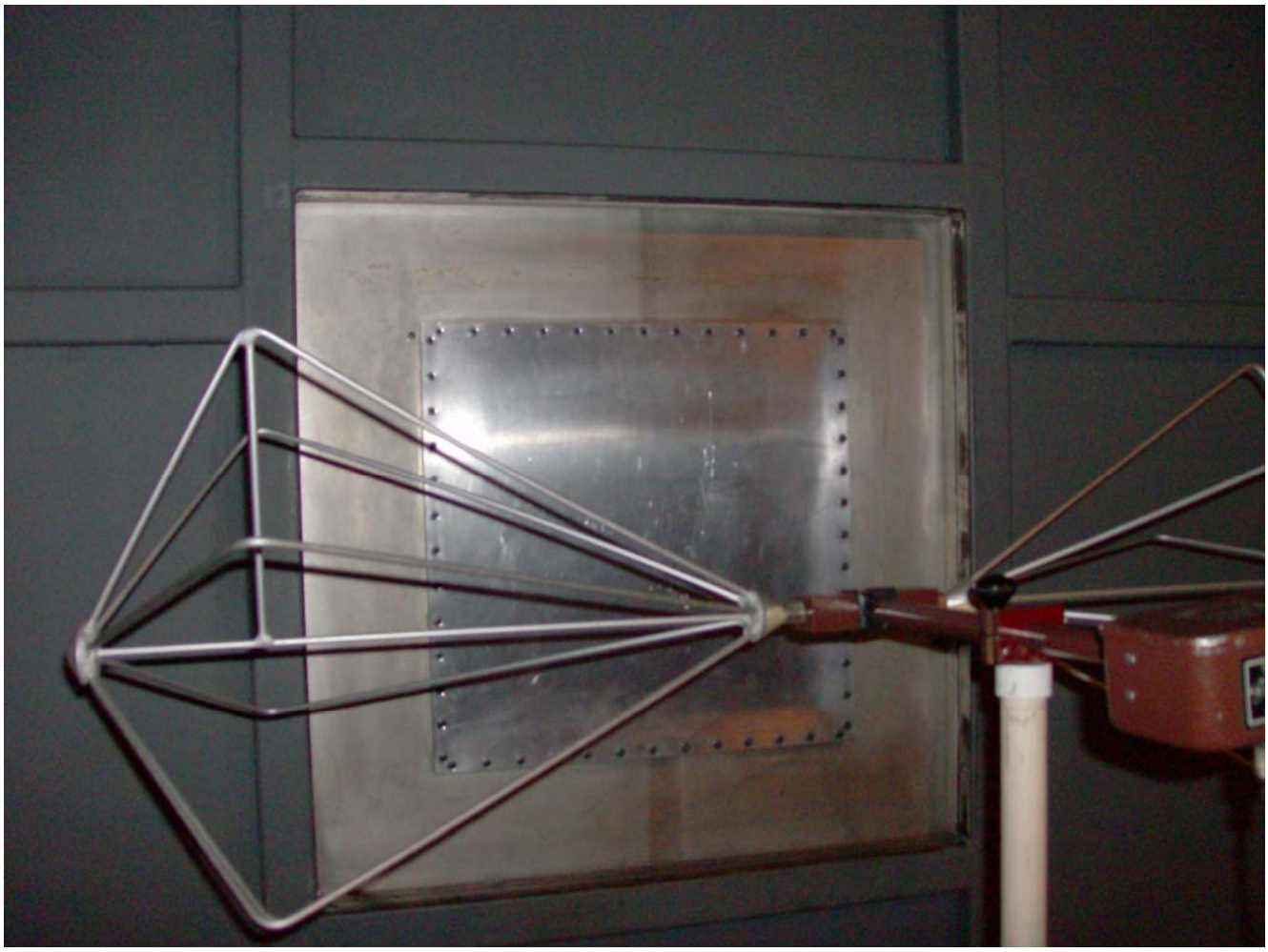
Dynamic Range is determined by placing a solid plate between the two chambers, measuring the amplitude of each frequency, then subtracting that from the reference level.

APPENDIX C - Supplemental Data

Frequency (MHz)	Reference Level (dB)	Dynamic Range (Analyzer Reading)	Test Sample (Analyzer Reading)	Dynamic Range (dB)	Test Sample (Shielding Effectiveness) (dB)
20	90	-24.5	-23.5	114.5	113.5
30	105	-27.8	-23.8	132.8	128.8
40	110	-27.6	-24.1	137.6	134.1
60	110	-27.1	-22.3	137.1	132.3
80	110	-27.1	-20.5	137.1	130.5
100	110	-27.2	-21.3	137.2	131.3
200	120	-24.5	-19.1	144.5	139.1
400	120	-20.1	-15.1	140.1	135.1
600	120	-20.9	-14.7	140.9	134.7
800	120	-28.6	-18.3	148.6	138.3
1000	120	-5.3	2.3	125.3	117.7
2000	120	-13.4	-3.8	133.4	123.8
4100	120	-11.5	-1.3	131.5	121.3
6000	120	-13.5	-2.5	133.5	122.5
8000	120	-10.3	-3.3	130.3	123.3
10000	120	-8.4	1.7	128.4	118.3

Test Results

Photos taken during test:



20-200MHz

200-1000MHz

1-10GHz

EMP Survivability TEST REPORT

Test Specification :
Manufacturer :
Test Samples :

DOCUMENT HISTORY				
REVISION	**ISSUE DATE**	**AFFECTED PAGE(S)**	**DESCRIPTION OF MODIFICATIONS**	**REVISED BY**
1.0	12 March 2004		Initial release	

TEST REPORT NO.
from
D.L.S. Electronic Systems,

Test for Specialty Silicon Products, Inc

WRITTEN BY	**REVIEWED BY**	**REVIEWED BY**
Andrew Jovanovich	Jack Prawica	Brian Mattson

TEST PERSONNEL	**TITLE**
Andrew Jovanovich	EMC Test Engineer

TEST DATE(S)	June 21, 2012

TEST FACILITY	D.L.S. Electronic Systems,
ADDRESS	1250 Peterson Drive
CITY, STATE, ZIP CODE	Wheeling, IL. 60090
PHONE	(847) 537-6400
FAX	(847) 537-6488

ADMINISTRATIVE SUMMARY

REASON FOR TEST:

To test the EMP Survivability of 1 material as specified in MIL-DTL-83528D.

TEST SPECIFICATION:

MIL-DTL 83528D GASKETING MATERIAL, CONDUCTIVE, SHIELDING GASKET, ELECTRONIC, ELASTOMER, EMI/RFI
GENERAL SPECIFICATION FOR

DATE(S) OF TEST:

June 21, 2012

TEST SAMPLES:

A total of one sample was presented for testing. Refer to Section 2 of this report for a description of each test sample along with the manufacturer's designation.

MANUFACTURER: Specialty Silicon Products, Inc
Corporate Technology Park
3 McCrea Hill Road
Ballston Spa, NY 12020

MANUFACTURERS REPRESENTATIVE:
John Hand

DISPOSITION OF TEST SAMPLE:
Samples will be returned to SSP, Inc in Ballston Spa, NY.

TEST LOCATION:
D.L.S. Electronic Systems,
1250 Peterson Drive
Wheeling, IL. 60090

TEST PERSONNEL:

Andrew Jovanovich	EMC Test Engineer

SUMMARY OF TEST RESULTS:

Test results can be found under Section 6. The EMP Waveforms of the test samples can be found in data sheets located in Appendix C of this report.

TABLE OF CONTENTS

INTRODUCTION

This report documents the results of a series of EMI/EMC measurements performed on the test samples described in Section 2 of this report. The purpose of this series of tests was to demonstrate compliance of the test sample(s) with the requirements of the MIL-DTL-83528D Specification for comparison data of ten different test samples using a MIL-DTL-83528D test fixture.

SECTIONS

SECTION 1 - CLIENT INFORMATION

COMPANY NAME ***ADDRESS*** ***CITY, STATE ZIP***	Specialty Silicone Products, Inc Corporate Technology Park 3 McCrea Hill Road Ballston Spa, NY 12020
CONTACT NAME ***TITLE*** ***PHONE*** ***FAX***	John Hand Director of Operations (518) 885-8826 (518) 363-4682

MANUFACTURER ***ADDRESS*** ***CITY, STATE ZIP***	Specialty Silicone Products, Inc Corporate Technology Park 3 McCrea Hill Road Ballston Spa, NY 12020

SECTION 2 - PURPOSE OF TEST

The purpose of this series of tests was to verify the EMP Survivability of the one sample.

SECTION 3 - TEST SAMPLE DESCRIPTION

The following table provides a list of each type of Metalized Material tested.

NO.	***Material***	***Description***
1.	EMP Test Sample	3” Diameter Gasket

SECTION 4 - TEST SITE; FACILITIES, CONDITIONS AND TOLERANCES

The EMP tests were performed through a test fixture designed to the MIL-DTL-83528D test specification. The test sample was placed in between the two half of the fixture applying 10% compression. A calibrated caliper was used to determine the proper compression amount. A 1MHz 900A pk-pk pulse was generated into the fixture and verified with an oscilloscope.

SECTION 5 - TEST EQUIPMENT

A complete test system equipment list is provided in APPENDIX A of this report. The equipment absolute performance calibration, of the equipment requiring calibration, is performed on an as needed basis in accordance with MIL-STD-45662. However, calibration periods do not exceed one (1) year. The test equipment is capable of making measurements within tolerances of at least +/- 2 dB amplitude and +/-2% frequency deviation. Equipment certifications showing traceability to NIST (National Institute of Standards and Technology) are maintained on file at D.L.S. Electronic Systems in Wheeling, IL. All equipment is checked and verified for proper operation before and after each series of tests.

SECTION 6 - TEST RESULTS

The following table lists the requirements and results for each of the test samples.

NO.	***Material***	***Before Measurement (Ohms-cm)***	***After Measurement (Ohms-cm)***
1	***EMP Test Sample (B)***	.0063 – Pass	.0067 – Pass

APPENDIX A - TEST EQUIPMENT

A.1 Specific Equipment Used

Description	Manufacturer	Model Number	Serial Number	Range	Cal On	Cal Due Dates
Oscilloscope	Agilent	Infiniium	MY40000161	2.25GHz	2/17/2012	2/17/2013
RF Cable	Pasternak	RG223/U	SN BNC 06/25	10Hz – 1GHz	8/9/2011	8/9/2012
Pulse Generator	Solar Electronics	9354-1	940519	10kHz – 100MHz	N/R	N/R
Test Fixture	N/A	N/A	N/A	N/A	N/R	N/R
Injection Probe	FCC	F-120	342	10kHz – 230MHz	N/R	N/R
Micrometer	Mitutoyo	Digimatic	0329104	N/A	8/24/2011	8/24/2012
Milliohmeter	Quadtech	1880	1261146	N/A	4/25/2012	4/26/2013

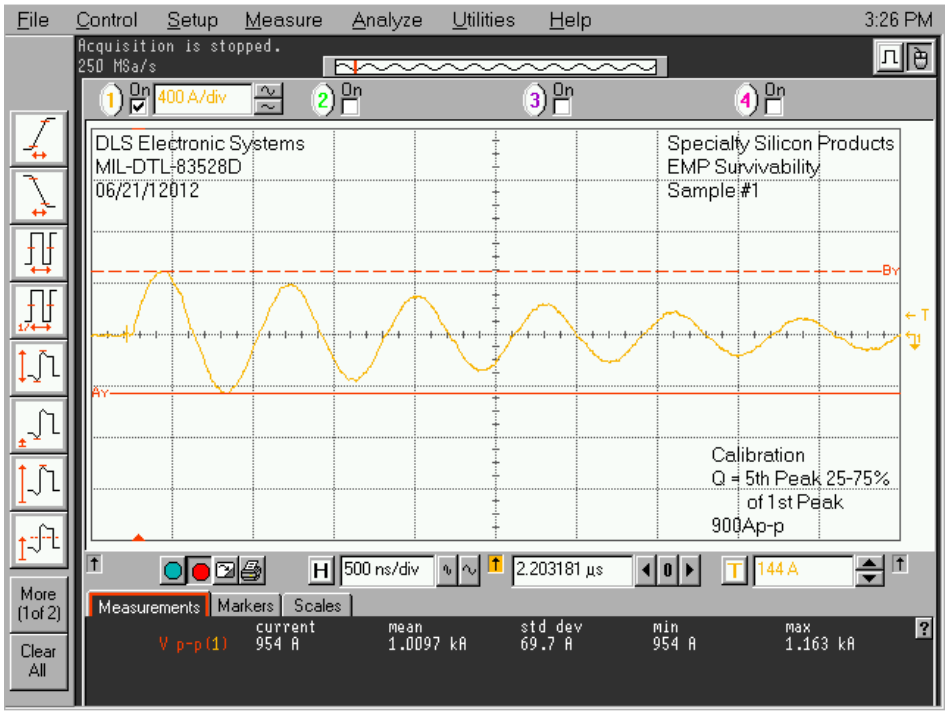
APPENDIX B - DESCRIPTION OF TEST METHODS

B.1 EMP Survivability Test Methods

The sample is placed in a test fixture and the gasket is compressed 10%. A 1MHz pulse is applied at 900A P-P. A before and after resistance measurement is taken, and then inspected for damage (if any) after the test. A second sample is then tested for repeatability.

APPENDIX C - Supplemental Data:

Saved: 21 JUN 2012 15:26:17



Acquisition	Sampling mode real time Configuration 4GSa/s Memory depth automatic Memory depth 1255pts Sampling rate automatic Sampling rate 250 MSa/s Averaging off 9-bit BW Filter off Interpolation on
Channel 1	Scale 400 A/div Offset -5.5 A Coupling DC Impedance 1M Ohm Attenuation 200.0 : 1 Atten units ratio Skew 0.0 s Ext adapter None Ext coupler None Ext gain 1.00E+00 Ext offset 0.0E+00
Time base	Scale 500 ns/div Position 2.203181 µs Reference center
Trigger	Mode edge Sweep triggered Hysteresis normal Holdoff time 60 ns Coupling DC Source channel 1 Trigger level 144 A Slope rising

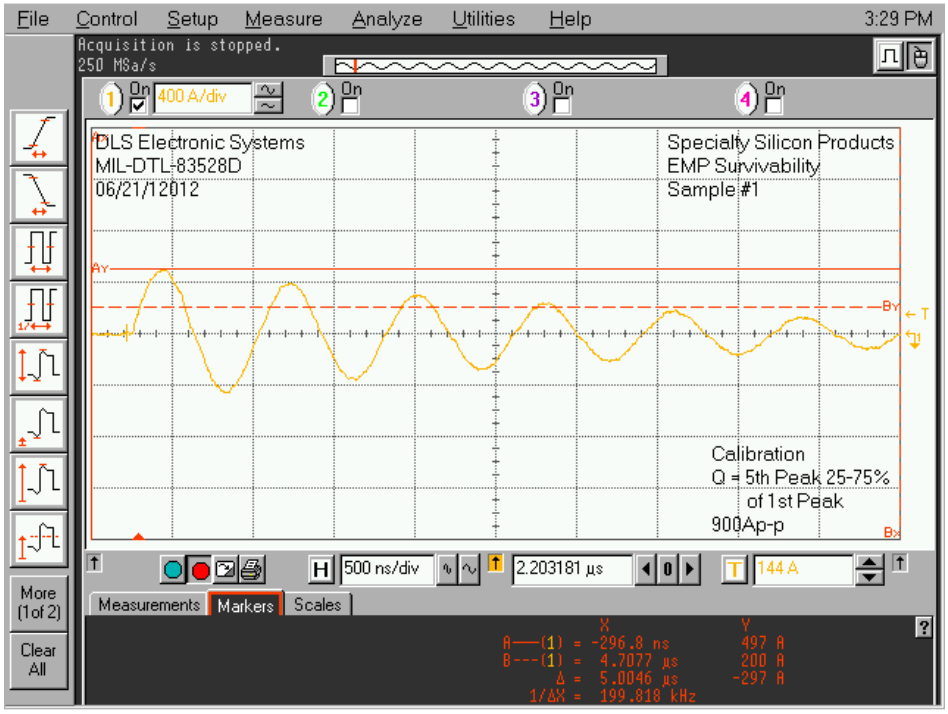
Measure

	current	mean	std dev	min	max
V p-p(1)	954 A	1.0097 kA	69.7 A	954 A	1.163 kA

Marker

	current	mean		X	Y
V p-p(1)	954 A	1.0097 kA	A—(1) =	----------	-463 A
			B---(1) =	----------	491 A
			Δ =	----------	954 A
			1/ΔX =	----------	

Saved: 21 JUN 2012 15:29:59



Acquisition	Sampling mode real time Configuration 4GSa/s Memory depth automatic Memory depth 1255pts Sampling rate automatic Sampling rate 250 MSa/s Averaging off 9-bit BW Filter off Interpolation on
Channel 1	Scale 400 A/div Offset -5.5 A Coupling DC Impedance 1M Ohm Attenuation 200.0 : 1 Atten units ratio Skew 0.0 s Ext adapter None Ext coupler None Ext gain 1.00E+00 Ext offset 0.0E+00
Time base	Scale 500 ns/div Position 2.203181 µs Reference center
Trigger	Mode edge Sweep triggered Hysteresis normal Holdoff time 60 ns Coupling DC Source channel 1 Trigger level 144 A Slope rising

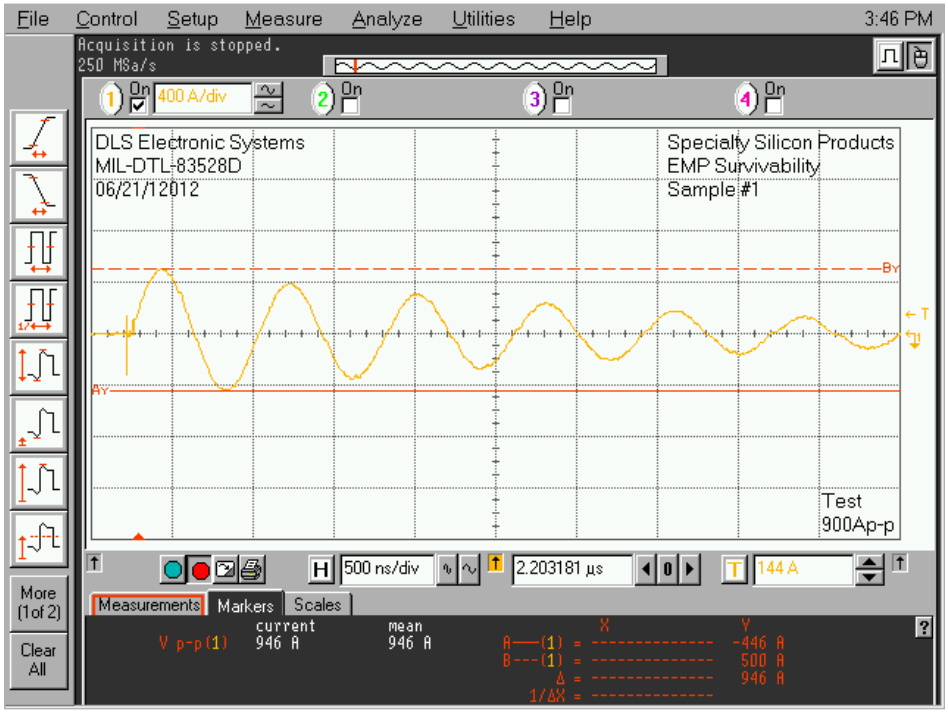
Measure

	current	mean	std dev	min	max
V p-p(1)	954 A	1.0097 kA	69.7 A	954 A	1.163 kA

Marker

	current	mean	X	Y
V p-p(1)	954 A	1.0097 kA	A—(1) = -296.8 ns	497 A
			B---(1) = 4.7077 µs	200 A
			Δ = 5.0046 µs	-297 A
			1/ΔX = 199.818 kHz	

Saved: 21 JUN 2012 15:46:41



Acquisition
Sampling mode real time Configuration 4GSa/s
Memory depth automatic Memory depth 1255pts
Sampling rate automatic Sampling rate 250 MSa/s
Averaging off
9-bit BW Filter off Interpolation on

Channel 1
Scale 400 A/div Offset -5.5 A Coupling DC Impedance 1M Ohm
Attenuation 200.0 : 1 Atten units ratio Skew 0.0 s
Ext adapter None Ext coupler None
Ext gain 1.00E+00 Ext offset 0.0E+00

Time base
Scale 500 ns/div Position 2.203181 µs Reference center

Trigger
Mode edge Sweep triggered
Hysteresis normal Holdoff time 60 ns Coupling DC
Source channel 1 Trigger level 144 A Slope rising

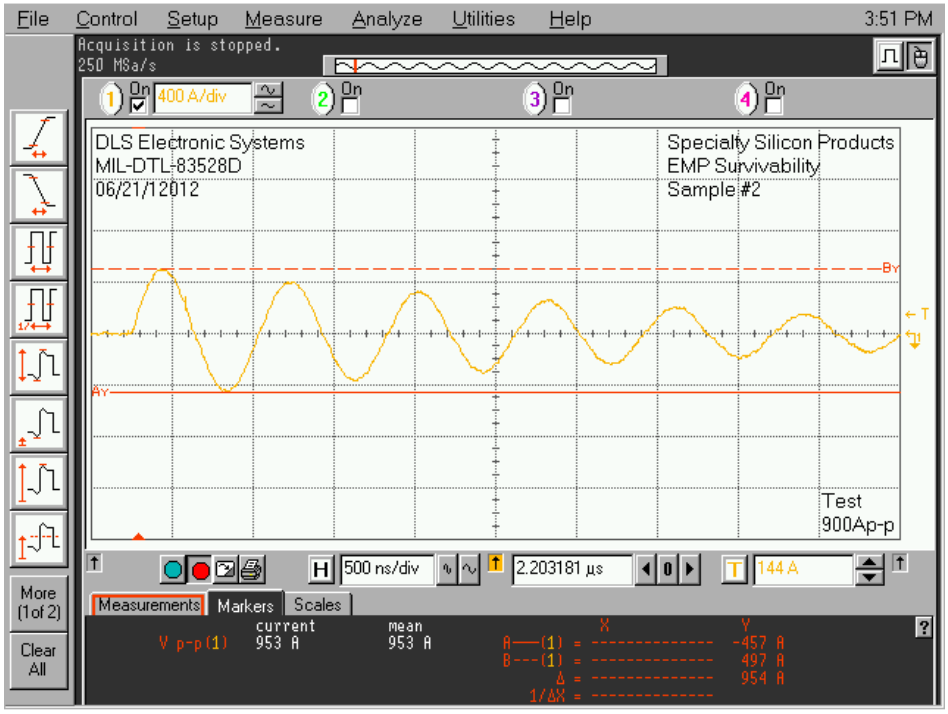
Measure

	current	mean	std dev	min	max
V p-p(1)	946 A	946 A	0 A	946 A	946 A

Marker

	current	mean	X	Y
V p-p(1)	946 A	946 A	A—(1) =	-446 A
			B---(1) =	500 A
			Δ =	946 A
			1/ΔX =	

Saved: 21 JUN 2012 15:51:55



Acquisition	Sampling mode real time Configuration 4GSa/s Memory depth automatic Memory depth 1255pts Sampling rate automatic Sampling rate 250 MSa/s Averaging off 9-bit BW Filter off Interpolation on
Channel 1	Scale 400 A/div Offset -5.5 A Coupling DC Impedance 1M Ohm Attenuation 200.0 : 1 Atten units ratio Skew 0.0 s Ext adapter None Ext coupler None Ext gain 1.00E+00 Ext offset 0.0E+00
Time base	Scale 500 ns/div Position 2.203181 µs Reference center
Trigger	Mode edge Sweep triggered Hysteresis normal Holdoff time 60 ns Coupling DC Source channel 1 Trigger level 144 A Slope rising

Measure

	current	mean	std dev	min	max
V p-p(1)	953 A	953 A	0 A	953 A	953 A

Marker

	current	mean	X	Y
V p-p(1)	953 A	953 A	A—(1) =	-457 A
			B---(1) =	497 A
			Δ =	954 A
			1/ΔX =	

Photos:

Calibration

Gasket Thickness

Gasket Compression


TRANSIENT PULSE GENERATOR
3880
MIL-DTL-83528C
EMP Survivability
Test
900Ap-p
Specialty Silicon Products
DLS Electronic Systems, Inc.
Andy J., EMC Engineer
Lab H

Test