



One of the World's Largest
Manufacturers
of Discrete Semiconductors and Passive Components

Production Part Approval Process

The following PPAP documentation is assembled according to the AIAG, 4th Edition PPAP Manual and applicable customer requirements

IHLP2020CZERxxxM5A

Generic PPAP

Generic PPAP

8/22/2017

Production Part Approval Process

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AIAG, 4th Edition PPAP Manual and applicable customer requirements**

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Vishay / Dale Electronics

1505 East Hwy 50 Yankton, SD 57078, USA Phone (605) 665-9301 Fax (605) 668-4247

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DISCRETE SEMICONDUCTORS AND PASSIVE COMPONENTS

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**Note: Generic PPAPs do not include all sections shown in the Table of Contents.
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Production Part Approval Process

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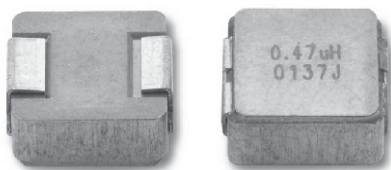
Section 1. Design Records

Vishay / Dale Electronics

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ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DISCRETE SEMICONDUCTORS AND PASSIVE COMPONENTS

Low Profile, High Current IHLP® Inductors



Manufactured under one or more of the following:

US Patents; 6,198,375/6,204,744/6,449,829/6,460,244.

Several foreign patents, and other patents pending.

STANDARD ELECTRICAL SPECIFICATIONS

L ₀ INDUCTANCE ± 20 % AT 100 kHz, 0.25 V, 0 A (μH)	DCR TYP. 25 °C (mΩ)	DCR MAX. 25 °C (mΩ)	HEAT RATING CURRENT DC TYP. (A) ⁽³⁾	SATURATION CURRENT DC TYP. (A) ⁽⁴⁾	SRF TYP. (MHz)
0.22	3.95	4.23	18	11	190
0.33	4.9	5.34	16	9.8	117
0.47	6.02	6.44	14.5	8.7	94.8
0.68	9.1	9.74	11.3	8.2	77.7
1	11.5	12.1	10.8	8	60.7
1.5	18	19.8	7.9	7.1	49.2
2.2	24.7	26	6.6	6.3	39.8
3.3	44.0	47.0	5.3	5.5	33.4
4.7	72.8	78.3	4.1	3.7	23.8
6.8	104	111	3.2	2.2	18.8
10	132	138	2.8	1.6	15.9
15	195	208	2.4	1.6	14.1

Notes

- (1) All test data is referenced to 25 °C ambient
- (2) Operating temperature range -55 °C to +155 °C
- (3) DC current (A) that will cause an approximate ΔT of 40 °C
- (4) DC current (A) that will cause L₀ to drop approximately 20 %
- (5) The part temperature (ambient + temp. rise) should not exceed 155 °C under worst case operating conditions. Circuit design, component placement, PWB trace size and thickness, airflow and other cooling provisions all affect the part temperature. Part temperature should be verified in the end application
- (6) Maximum Recommended Operating Voltage (Across Inductor) = 100 V

FEATURES

- High temperature, up to 155 °C
- Shielded construction
- Excellent DC/DC energy storage up to 1 MHz to 2 Mhz. Filter inductor applications up the SRF (see Standard Electrical Specifications table).
- Lowest DCR/μH, in this package size
- Handles high transient current spikes without saturation
- Ultra low buzz noise, due to composite construction
- AEC-Q200 qualified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE
GRADE

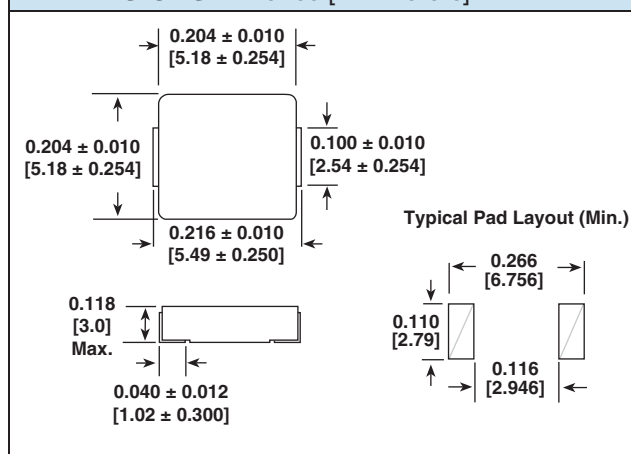


RoHS
COMPLIANT

APPLICATIONS

- Engine and transmission control units
- Diesel injection drivers
- DC/DC converter for entertainment / navigation systems
- Noise suppression for motors
 - Windshield wipers
 - Power seats
 - Power mirrors
 - Heating and ventilation blowers
 - HID lighting
- LED drivers

DIMENSIONS in inches [millimeters]



DESCRIPTION

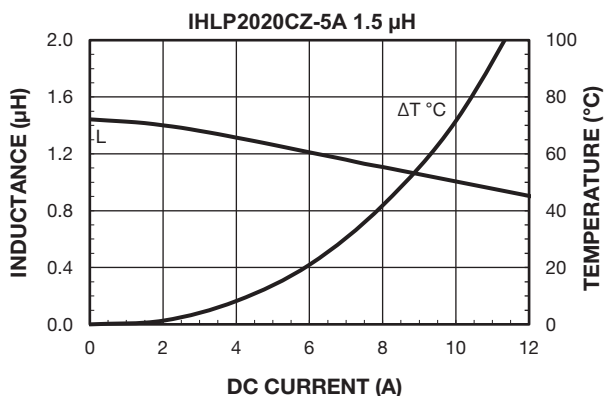
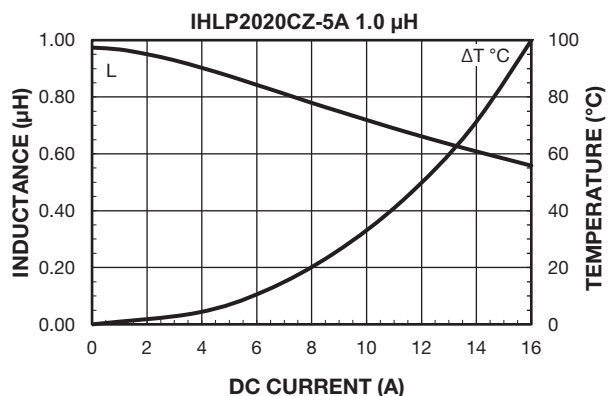
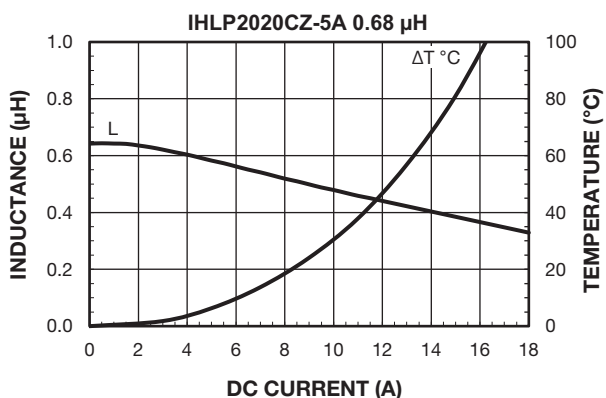
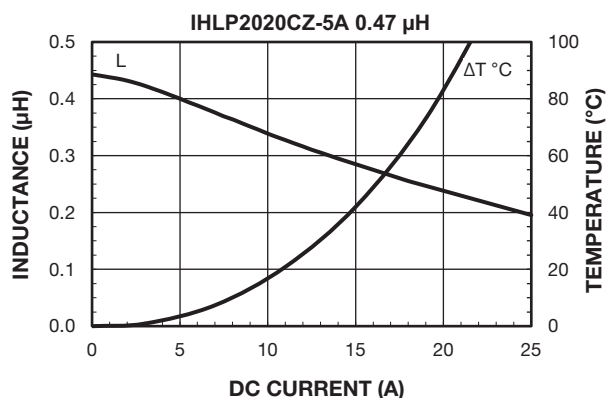
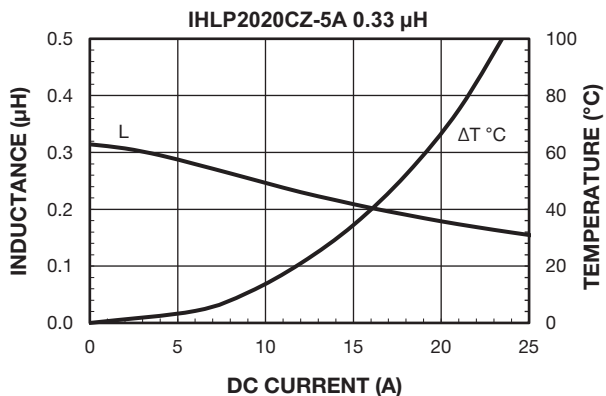
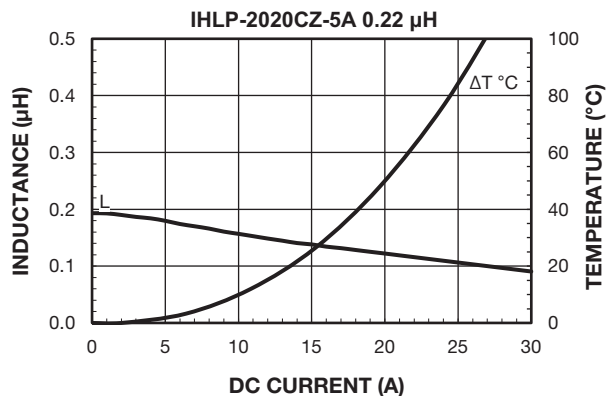
IHLP-2020CZ-5A	1.5 μH	± 20 %	ER	e3
MODEL	INDUCTANCE VALUE	INDUCTANCE TOLERANCE	PACKAGE CODE	JEDEC® LEAD (Pb)-FREE STANDARD

GLOBAL PART NUMBER

I	H	L	P	2	0	2	0	C	Z	E	R	1	R	5	M	5	A
PRODUCT FAMILY				SIZE						PACKAGE CODE		INDUCTANCE VALUE			TOL.	SERIES	

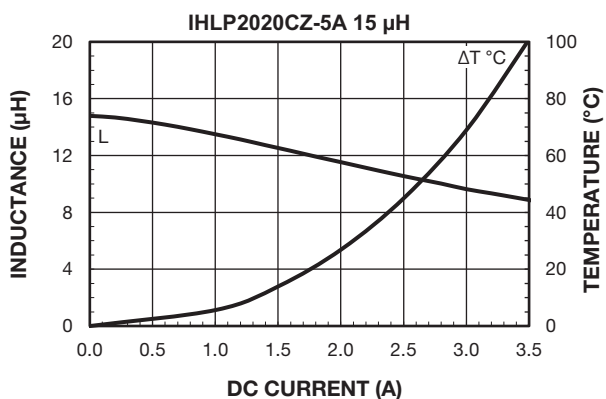
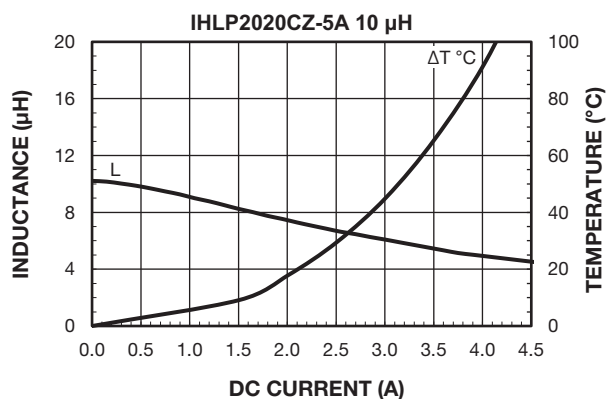
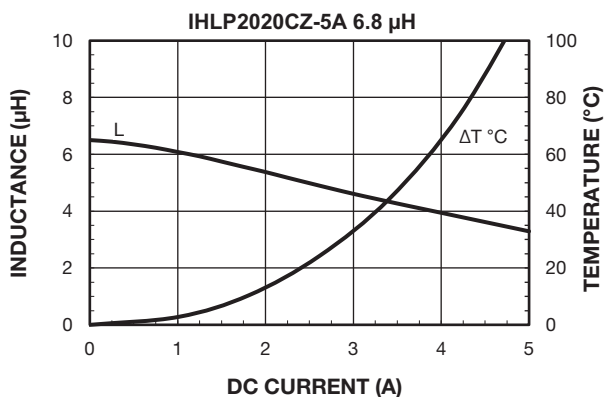
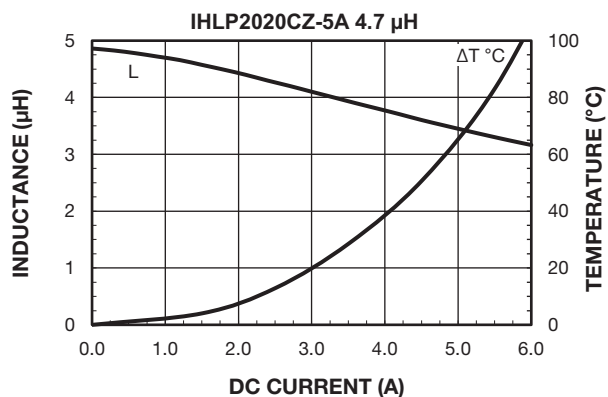
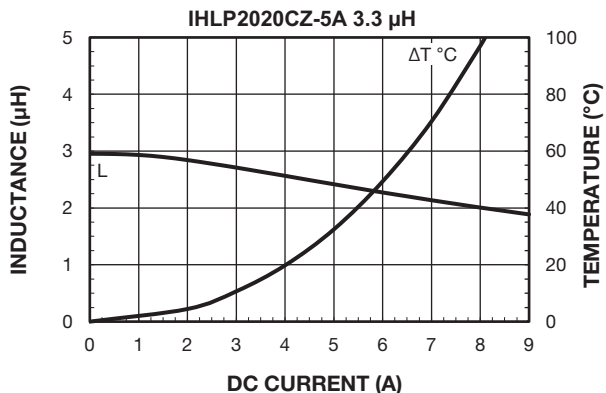
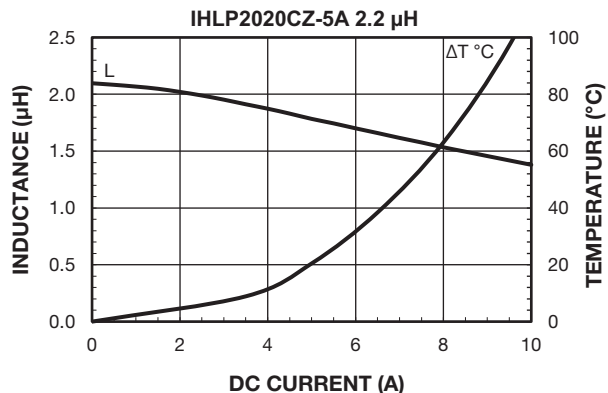


PERFORMANCE GRAPHS



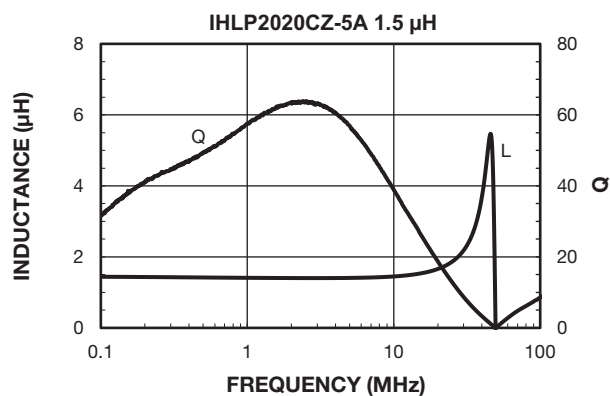
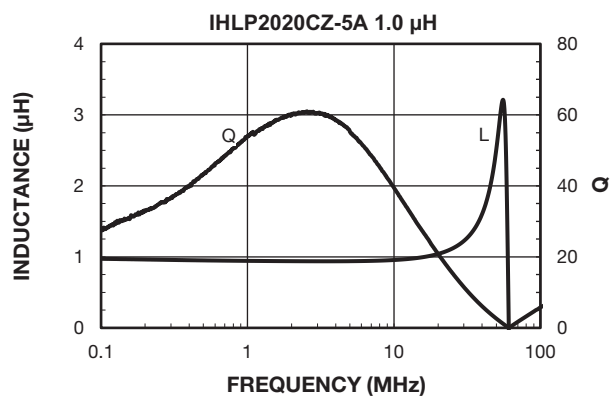
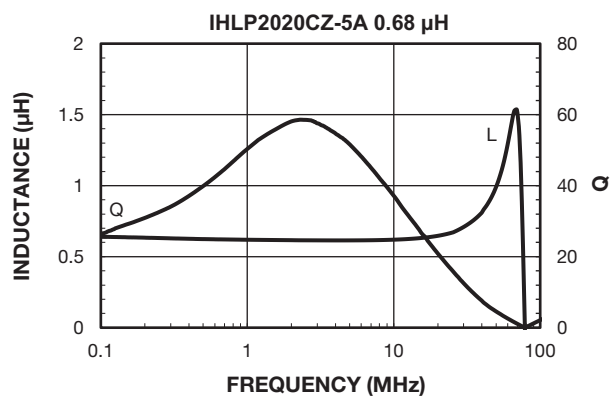
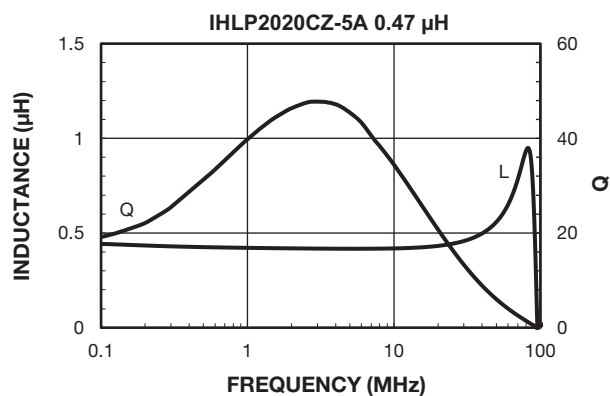
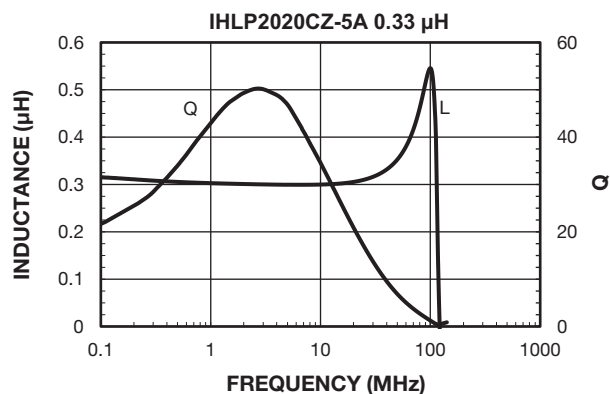
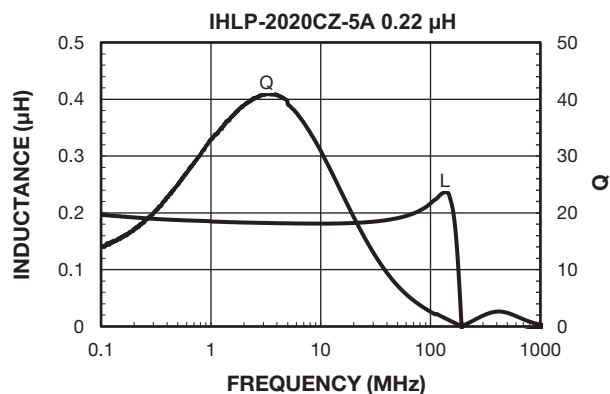


PERFORMANCE GRAPHS



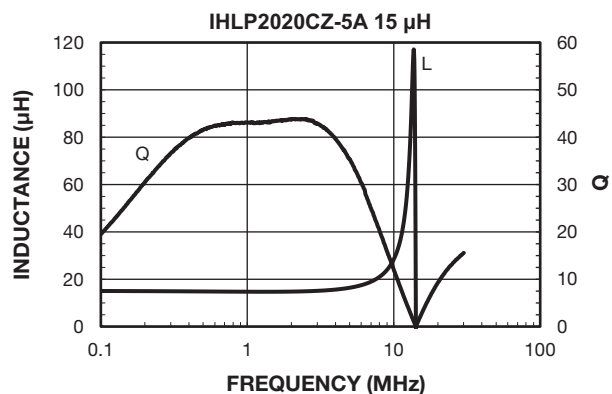
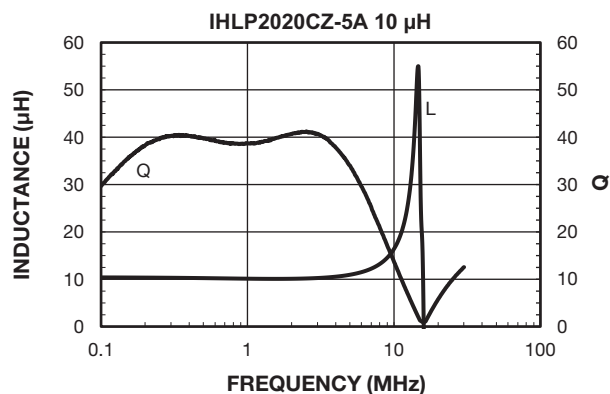
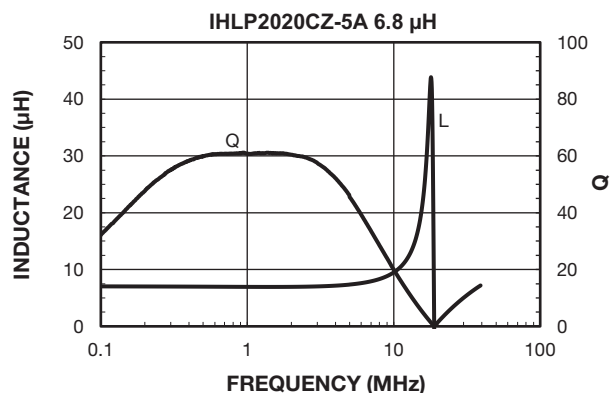
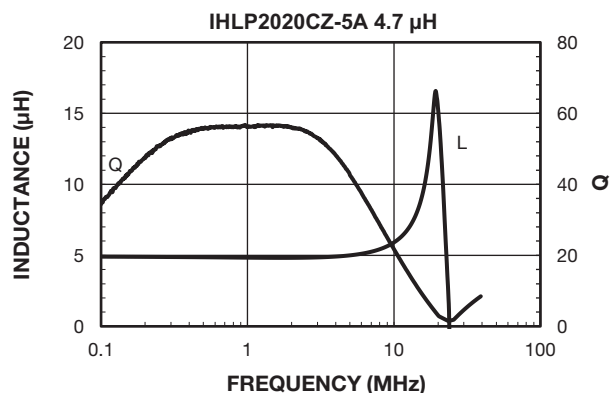
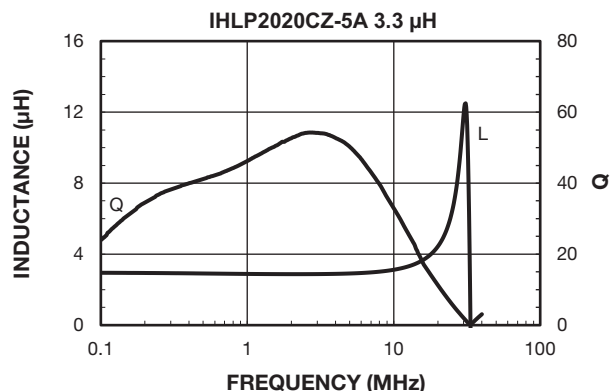
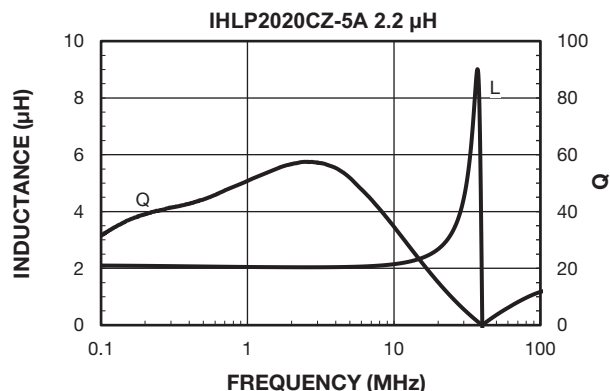


PERFORMANCE GRAPHS: INDUCTANCE AND Q VS. FREQUENCY



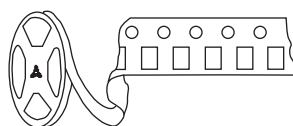


PERFORMANCE GRAPHS: INDUCTANCE AND Q VS. FREQUENCY

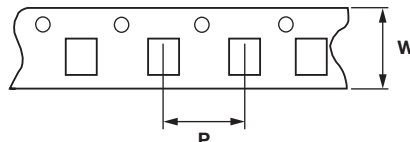


SMD Magnetics Packaging Methods

TAPE AND REEL in inches [millimeters] - Meets EIA RS-481 tape and reel packaging standard



User Direction of Feed



Carrier Dimensions

MODEL	PACKAGE CODE			REEL SIZE	CARRIER TAPE WIDTH (W)	COMPONENT PITCH (P)	UNITS/ REEL	PACKAGE CODE			UNITS/ BULK
	PREVIOUS CODE	GLOBAL CODE LEAD (Pb)-BEARING	GLOBAL CODE LEAD (Pb)-FREE					PREVIOUS CODE	GLOBAL CODE LEAD (Pb)-BEARING	GLOBAL CODE LEAD (Pb)-FREE	
IHLP-1212ABER	-	-	ER	13	0.472 [12.0]	0.315 [8.0]	3000	-	-	-	-
IHLP-1212ABEV	-	-	ER	13	0.472 [12.0]	0.315 [8.0]	4000	-	-	-	-
IHLP-1212AEER	-	-	ER	13	0.472 [12.0]	0.315 [8.0]	3000	-	-	-	-
IHLP-1212BZER	-	-	ER	13	0.472 [12.0]	0.315 [8.0]	3000	-	-	-	-
IHLP-1212BZEV	-	-	ER	13	0.472 [12.0]	0.315 [8.0]	4000	-	-	-	-
IHLP-1616AB	-	-	ER	13	0.472 [12.0]	0.315 [8.0]	4000	-	-	EB	100
IHLP-1616BZ	-	-	ER	13	0.472 [12.0]	0.315 [8.0]	4000	-	-	EB	100
IHLP-2020AB	-	-	ER	13	0.472 [12.0]	0.315 [8.0]	4000	-	-	EB	100
IHLP-2020BZ	-	-	ER	13	0.472 [12.0]	0.315 [8.0]	2000	-	-	EB	100
IHLP-2020CZ	-	-	ER	13	0.472 [12.0]	0.315 [8.0]	2000	-	-	EB	100
IHLP-2525AH	-	-	ER	13	0.630 [16.0]	0.315 [8.0]	2000	-	-	EB	100
IHLP-2525BD	-	-	ER	13	0.630 [16.0]	0.315 [8.0]	2000	-	-	EB	100
IHLP-2525CZ	-	-	ER	13	0.630 [16.0]	0.315 [8.0]	2000	-	-	EB	100
IHLP-2525EZ	-	-	ER	13	0.630 [16.0]	0.472 [12.0]	500	-	-	EB	100
IHLP-3232CZ	-	-	ER	13	0.630 [16.0]	0.472 [12.0]	1000	-	-	EB	100
IHLP-3232DZ	-	-	ER	13	0.630 [16.0]	0.472 [12.0]	500	-	-	EB	100
IHLP-4040DZ	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	500	-	-	EB	100
IHLP-5050CE	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	500	-	-	EB	100
IHLP-5050EZ	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	250	-	-	EB	100
IHLP-5050FD	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	250	-	-	EB	100
IHLP-6767DZ	-	-	ER	13	0.945 [24.0]	0.945 [24.0]	250	-	-	EB	100
IHLP-6767GZ	-	-	ER	13	0.945 [24.0]	0.945 [24.0]	200	-	-	EB	100
IHLP-8787MZ	-	-	ER	13	1.73 [44.0]	1.26 [32.0]	100	-	-	-	-
IHCL-4040DZ	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	500	-	-	EB	100
IHLD-4032KB	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	250	-	-	EB	100
IHLD-3232HB	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	250	-	-	EB	100
IHLE-2525CD	-	-	ER	13	0.630 [16.0]	0.315 [8.0]	2000	-	-	EB	100
IHLE-3232DD	-	-	ER	13	0.630 [16.0]	0.472 [12.0]	500	-	-	EB	100
IHLE-4040DD	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	500	-	-	EB	100
IHLR-4040DZ	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	500	-	-	EB	100
IHLM-2525CZ	-	-	ER	13	0.630 [16.0]	0.315 [8.0]	2000	-	-	EB	100
IHLW-4040CF	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	500	-	-	EB	100
IHLW-5050CE	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	500	-	-	EB	100
IFLP-4040DZ	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	500	-	-	EB	100
IFLR-2727EZ	-	-	ER	13	0.630 [16.0]	0.630 [16.0]	1000	-	-	-	-
IFLR-4027EZ	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	1000	-	-	-	-
IFLR-4031GC	-	-	ER	13	0.945 [24.0]	0.472 [12.0]	500	-	-	EB	100
IFLR-5151HZ	-	-	ER	13	0.945 [24.0]	0.630 [16.0]	450	-	-	EB	100

**TAPE AND REEL** in inches [millimeters] - Meets EIA RS-481 tape and reel packaging standard

MODEL	PACKAGE CODE			REEL SIZE	CARRIER TAPE WIDTH (W)	COMPONENT PITCH (P)	UNITS/ REEL	PACKAGE CODE			UNITS/ BULK
	PREVIOUS CODE	GLOBAL CODE LEAD (Pb)- BEARING	GLOBAL CODE LEAD (Pb)-FREE					PREVIOUS CODE	GLOBAL CODE LEAD (Pb)- BEARING	GLOBAL CODE LEAD (Pb)-FREE	
IFSC-0806AZ	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	2000	-	-	-	-
IFSC-1008AB	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	2000	-	-	-	-
IFSC-1111AZ	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	2000	-	-	-	-
IFSC-1111AB	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	2000	-	-	-	-
IFSC-1515AH	-	-	ER	13	0.472 [12.0]	0.315 [8.0]	2000	-	-	-	-
IHHP-0806AZ-01	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	2000	-	-	-	-
IHHP-0806AB-01	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	2000	-	-	-	-
IHHP-1008AZ-01	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	3000	-	-	-	-
IHHP-1008AB-01	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	3000	-	-	-	-
IHHP-1212ZH-01	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	3000	-	-	-	-
IHHP-1212AZ-01	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	3000	-	-	-	-
IHSM-3825	RC2	RE	ER	13	0.945 [24.0]	0.472 [12.0]	750	P09	PJ	EB	100
IHSM-4825	RC2	RE	ER	13	0.945 [24.0]	0.472 [12.0]	750	P09	PJ	EB	100
IHSM-5832	RC3	RF	ER	13	1.26 [32.0]	0.472 [12.0]	500	P09	PJ	EB	100
IHSM-7832	RC4	RG	ER	13	1.73 [44.0]	0.472 [12.0]	500	P09	PJ	EB	100
IDC-2512	-	-	ER	13	0.630 [16.0]	0.315 [8.0]	2000	-	-	-	-
IDC-5020	-	-	ER	13	0.630 [16.0]	0.472 [12.0]	500	-	-	-	-
IDC-7328	-	-	ER	13	0.945 [24.0]	0.945 [24.0]	250	-	-	-	-
IDCS-2512	-	-	ER	13	0.630 [16.0]	0.315 [8.0]	2000	-	-	-	-
IDCS-5020	-	-	ER	13	0.630 [16.0]	0.472 [12.0]	500	-	-	-	-
IDCS-7328	-	-	ER	13	0.945 [24.0]	0.945 [24.0]	250	-	-	-	-
IDCP-1813	-	-	ER	13	0.472 [12.0]	0.315 [8.0]	2000	-	-	-	-
IDCP-2218	-	-	ER	13	0.472 [12.0]	0.315 [8.0]	1500	-	-	-	-
IDCP-3114	-	-	ER	13	0.630 [16.0]	0.472 [12.0]	1000	-	-	-	-
IDCP-3020	-	-	ER	13	0.630 [16.0]	0.472 [12.0]	1000	-	-	-	-
IDCP-3722	-	-	ER	13	0.945 [24.0]	0.472 [12.0]	500	-	-	-	-
IDCP-3916	-	-	ER	13	0.945 [24.0]	0.472 [12.0]	500	-	-	-	-
IFCB-0402	-	-	ER	7	0.315 [8.0]	0.079 [2.0]	10 000	-	-	-	-
ILC-0402	-	-	ER	7	0.315 [8.0]	0.079 [2.0]	10 000	-	-	-	-
ILC-0603	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	4000	-	-	-	-
ILC-0805	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	4000	-	-	-	-
IMC-0402	-	-	ER	7	0.315 [8.0]	0.079 [2.0]	10 000	-	-	-	-
IMC-0402-01	-	-	ER	7	0.315 [8.0]	0.079 [2.0]	10 000	-	-	-	-
IMC-0603	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	4000	-	-	-	-
IMC-0603-01	-	-	ER	7	0.315 [8.0]	0.079 [2.0]	3000	-	-	-	-
IMC-0805-01	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	2000	-	-	-	-
IMC-1008	-	-	ER	7	0.315 [8.0]	0.157 [4.0]	2000	-	-	-	-
IMC-1210	R98/RB3 R99/RB4	SY/AN SZ/R9	ER/ET ES/EU	7 13	0.315 [8.0] 0.315 [8.0]	0.157 [4.0] 0.157 [4.0]	2000 7500	B13	BN	EB	500
IMC-1210-100	R98/RB3 R99/RB4	SY/AN SZ/R9	ER/ET ES/EU	7 13	0.315 [8.0] 0.315 [8.0]	0.157 [4.0] 0.157 [4.0]	2000 7500	B13	BN	EB	500
IMC-1812	R73/R92 R13/R91	RV/RX RQ/RW	ER/ET ES/EU	7 13	0.472 [12.0] 0.472 [12.0]	0.315 [8.0] 0.315 [8.0]	500 2000	B13	BN	EB	500
IMCH-1812	-	-	ER	7	0.472 [12.0]	0.315 [8.0]	500	-	-	-	-
IMC-2220	-	-	ER	13	0.630 [16.0]	0.472 [12.0]	1000	-	-	-	-

IHLP PACKAGING

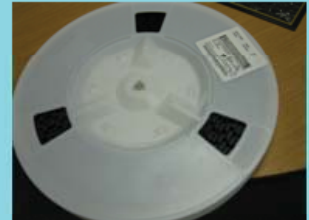
COMPONENT PHOTO



POCKET TAPE PHOTO



REEL PHOTO



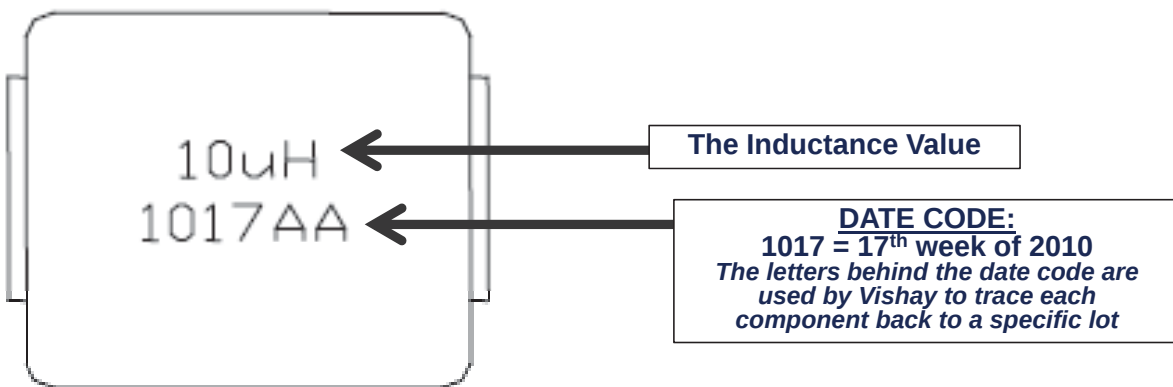
CONTAINER PHOTO



UNIT LOAD PHOTO



IHLP COMPONENT PRINT





Production Part Approval Process

The following PPAP documentation is assembled according to
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Terminal Plating Info

Part Number (CUSTOMER)	Part Number (Vishay)	Layer structure with base and coating material used:	Layer thickness and tolerances of the coatings (base material, intermediate layer, final finish)	Kind of Coating or technology (e.g. galvanized, chemically hot tin- plated,..)
Generic PPAP	IHLP2020CZERxxxM5A	Cu - Base Material Ni- Intermediate Layer Sn- Finish Layer	Cu: 0.152 +/- .0254mm Ni: 1.27um to 3.175um Sn: 4.57um to 6.35 um	Electroplated



Production Part Approval Process

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Cross-Section IHLP-2020CZ



10uH

0.47uH



Production Part Approval Process

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Example Photos of IHLP Welds

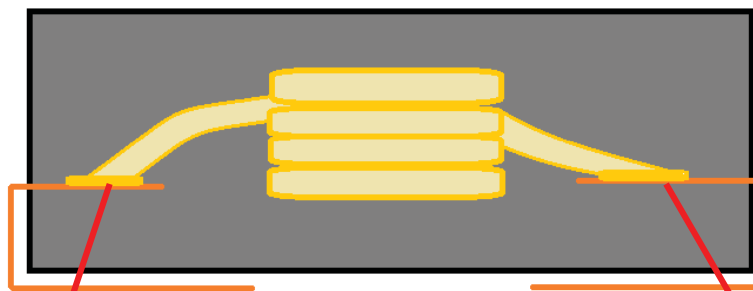




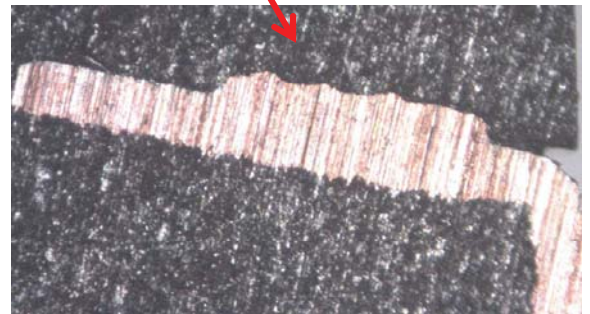
Production Part Approval Process

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Cross sectional Photos of IHLP Welds



Inter-Metallic
bonding
between the
wire and
Leadframe



Production Part Approval Process

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Use the control buttons below to navigate through the PPAP sections.

Section 2: Engineering Change Documents

There are no applicable Engineering Change Documents for this part number.

Vishay / Dale Electronics

1505 East Hwy 50 Yankton, SD 57078, USA Phone (605) 665-9301 Fax (605) 668-4247

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DISCRETE SEMICONDUCTORS AND PASSIVE COMPONENTS

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[Section 3: Customer Engineering Approval](#)

Customer Engineering Approval does not apply for this part number

Production Part Approval Process

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Section 8: Measurement System Analysis



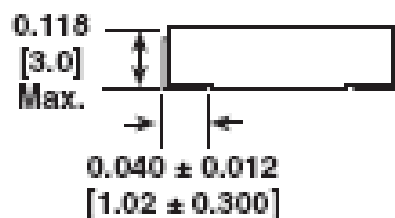
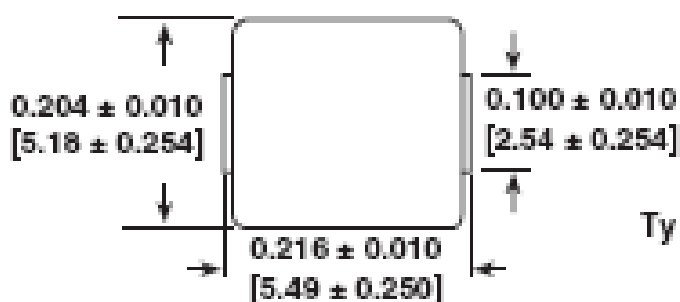
Production Part Approval Process

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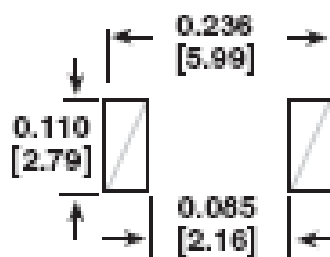
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[Section 9: Dimensional Analysis](#)

DIMENSIONS in inches [millimeters]



Typical Pad Layout (Min.)





Production Part Approval Process

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Section 9: Dimensional Analysis

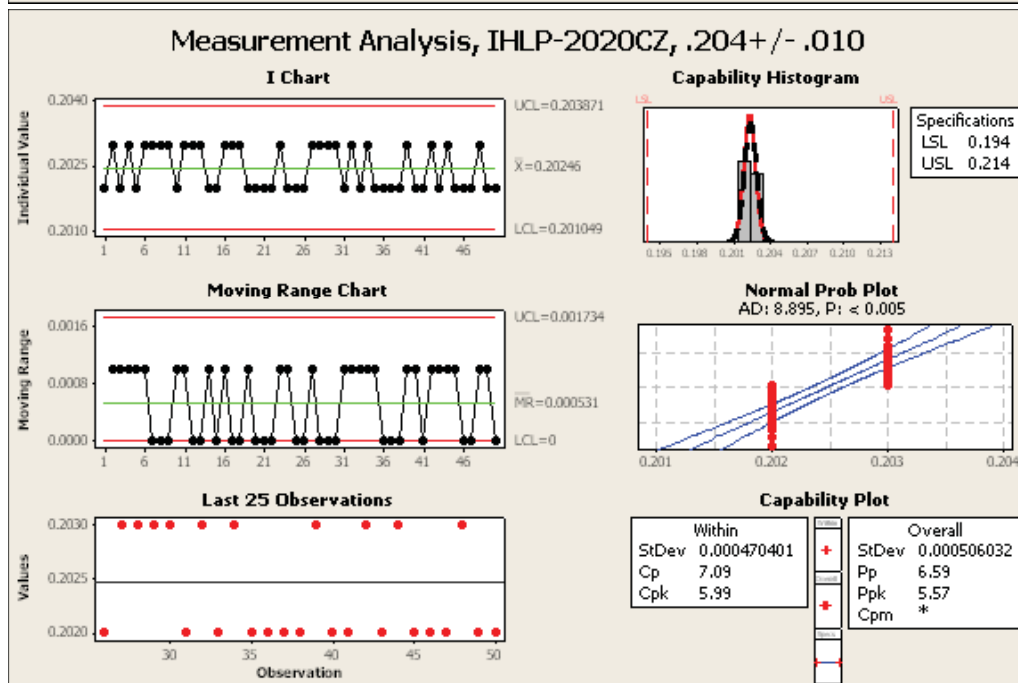
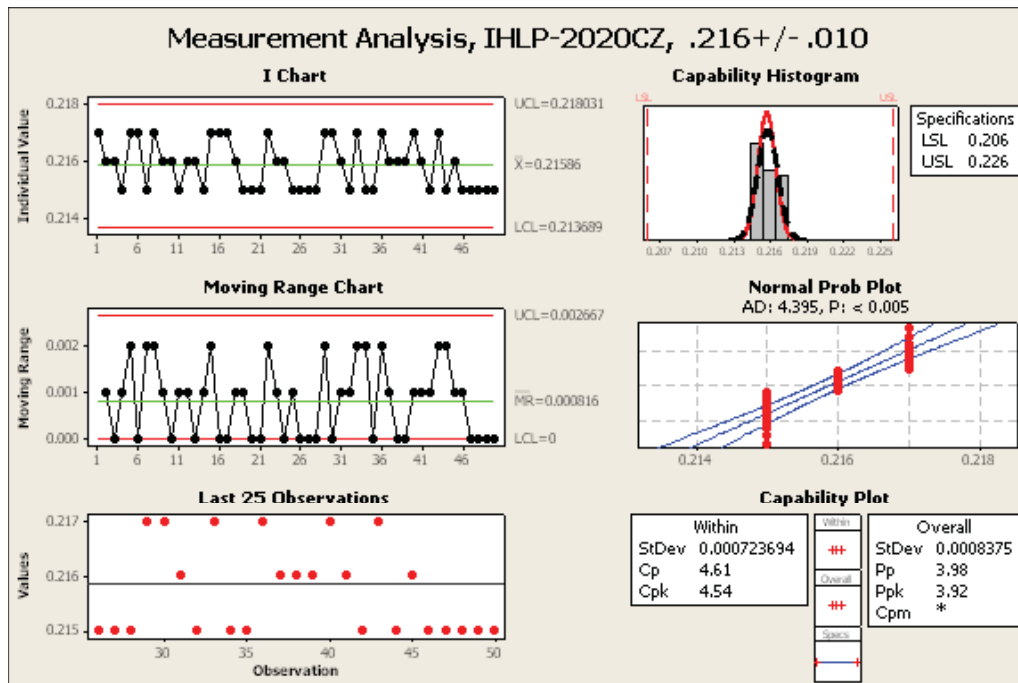
Dimensional Analysis, IHLP2020CZ					
Length	Width	Height	Tab Length		Tab Width
.216+/- .010	.204+/- .010	.118Max	.040+/- .012		.100+/- .010
0.217	0.202	0.114	0.042	0.037	0.099
0.216	0.203	0.113	0.034	0.045	0.099
0.216	0.202	0.114	0.04	0.034	0.099
0.215	0.203	0.114	0.042	0.03	0.099
0.217	0.202	0.113	0.041	0.045	0.099
0.217	0.203	0.114	0.045	0.035	0.099
0.215	0.203	0.113	0.047	0.04	0.099
0.217	0.203	0.114	0.036	0.042	0.099
0.216	0.203	0.114	0.045	0.04	0.099
0.216	0.202	0.114	0.048	0.042	0.099
0.215	0.203	0.114	0.041	0.036	0.099
0.216	0.203	0.113	0.037	0.046	0.099
0.216	0.203	0.113	0.045	0.038	0.099
0.215	0.202	0.113	0.042	0.046	0.099
0.217	0.202	0.113	0.046	0.035	0.099
0.217	0.203	0.113	0.045	0.032	0.099
0.217	0.203	0.114	0.043	0.033	0.099
0.216	0.203	0.113	0.047	0.035	0.099
0.215	0.202	0.113	0.044	0.035	0.099
0.215	0.202	0.114	0.044	0.031	0.099
0.215	0.202	0.113	0.047	0.035	0.099
0.217	0.202	0.113	0.047	0.04	0.099
0.216	0.203	0.113	0.045	0.031	0.099
0.216	0.202	0.114	0.046	0.038	0.099
0.215	0.202	0.114	0.037	0.043	0.099
0.215	0.202	0.113	0.035	0.045	0.099
0.215	0.203	0.114	0.042	0.035	0.099
0.215	0.203	0.113	0.045	0.038	0.099
0.217	0.203	0.114	0.048	0.034	0.099
0.217	0.203	0.114	0.042	0.039	0.099
0.216	0.202	0.114	0.043	0.03	0.099
0.215	0.203	0.114	0.044	0.036	0.099
0.217	0.202	0.113	0.042	0.031	0.099
0.215	0.203	0.113	0.046	0.036	0.099
0.215	0.202	0.113	0.039	0.035	0.099
0.217	0.202	0.114	0.043	0.038	0.099
0.216	0.202	0.113	0.044	0.036	0.099
0.216	0.202	0.114	0.045	0.041	0.099
0.216	0.203	0.114	0.047	0.039	0.099
0.217	0.202	0.114	0.036	0.042	0.099
0.216	0.202	0.114	0.046	0.041	0.099
0.215	0.203	0.113	0.046	0.039	0.099
0.217	0.202	0.114	0.045	0.039	0.099
0.215	0.203	0.113	0.047	0.04	0.099
0.216	0.202	0.114	0.044	0.039	0.099
0.215	0.202	0.114	0.041	0.038	0.099
0.215	0.202	0.114	0.045	0.036	0.099
0.215	0.203	0.113	0.042	0.033	0.099
0.215	0.202	0.113	0.045	0.038	0.099
0.215	0.202	0.114	0.04	0.036	0.099

Production Part Approval Process

The following PPAP documentation is assembled according to
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Use the control buttons below to navigate through the PPAP sections.

Section 9: Dimensional Analysis

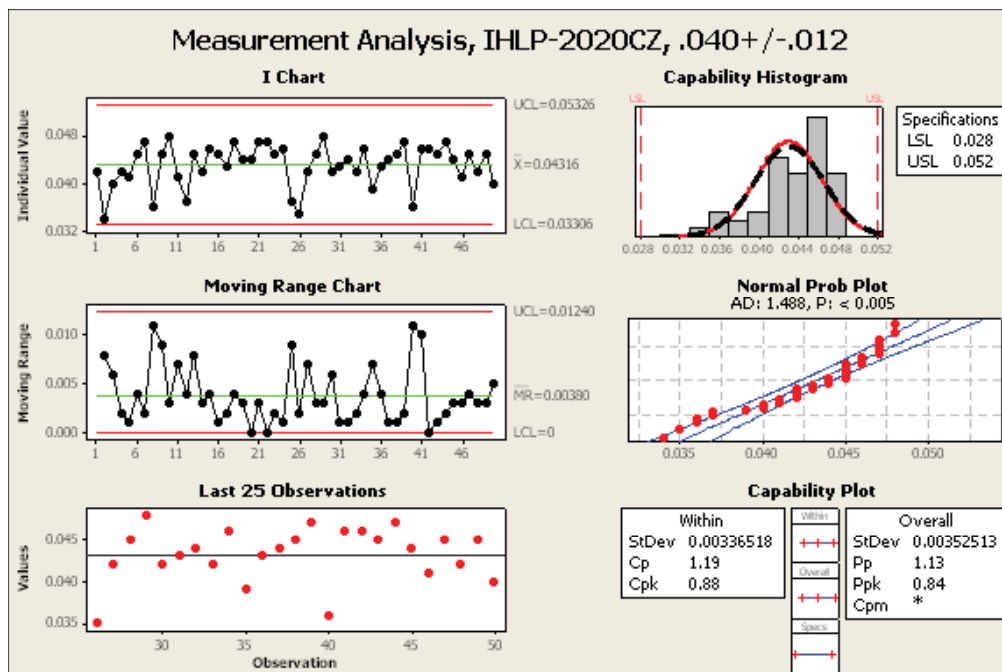
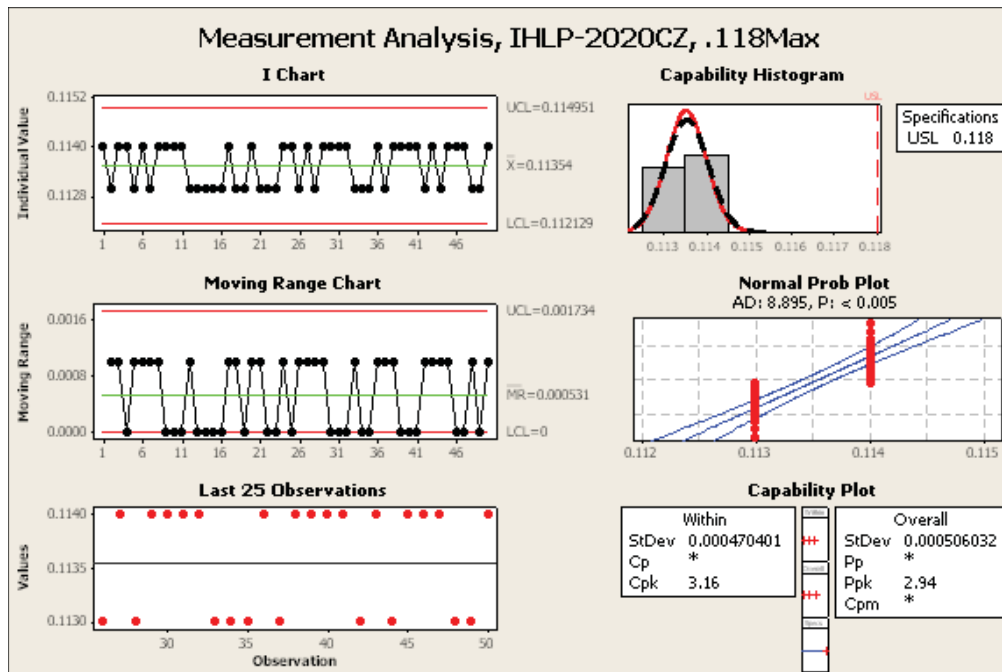


Production Part Approval Process

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Use the control buttons below to navigate through the PPAP sections.

Section 9: Dimensional Analysis





SECTION 10

Performance TEST RESULTS

DANSHUI MANUFACTURING LOCATION

A **WORLD OF**
SOLUTIONS





IHLP2020CZER1R0M5A
IHLP2020CZER4R7M5A
IHLP2020CZER100M5A

TOP HEADER

- Parts were manufactured in the Danshui, China manufacturing location.



IHLP2020CZER1R0M5A

Test #	Description	Ref. Spec. Meth / Cond	Test Conditions	End Point Δ requirements	Sample Size	Meas Temp							
0	3x reflow Preconditioning for lead-free products	ICP 10,373	As specified in sections 6.3 thru 6.4 except Visual per DPS-11,865 10X magnification										
1	Pre- and Post-Stress Electrical Test	IHLP Data Sheet	L (μ H) – 100KHz and 250mV DCR – 25°C Ambient	L = $\pm 15\%$ of initial, DCR = $\pm 15\%$ of initial	All tests requiring electrical data								
3	High Temp Exposure	IEC-60068 Part 2-2 test group BA	155C for 2000 hours, unpowered readings at 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at LT/RT/HT LT=Low Temperature=-55°C, RT=Room Temperature=+25°C, HT=High Temperature=+125°C for -A1/1A models. HT=High Temperature =+155°C for -5A models.	L = $\pm 20\%$ of initial, DCR = $\pm 20\%$ of initial	77			Inductance (μ H)			DC Resistance ($m\Omega$)		
								Initial	Final	% Δ	Initial	Final	% Δ
						-55 deg. C	Maximum	1.093	1.122	6.062	7.789	7.643	0.149
							Minimum	0.828	0.876	2.684	7.180	7.041	-3.662
							Mean	0.950	0.994	4.667	7.459	7.324	-1.795
							Std Dev	0.052	0.051	0.666	0.131	0.130	1.002
						+25 deg. C		Initial	Final	% Δ	Initial	Final	% Δ
							Maximum	1.109	1.142	6.637	11.457	11.388	-0.175
							Minimum	0.831	0.883	3.047	7.553	10.510	-1.250
							Mean	0.955	1.005	5.190	10.853	10.814	-0.749
							Std Dev	0.054	0.053	0.630	0.410	0.153	0.208
						+155 deg. C		Initial	Final	% Δ	Initial	Final	% Δ
							Maximum	1.115	1.184	9.096	17.399	17.223	0.299
							Minimum	0.827	0.897	6.156	15.946	15.790	-1.235
							Mean	0.954	1.027	7.726	16.489	16.391	-0.594
							Std Dev	0.055	0.056	0.552	0.247	0.250	0.371



IHLP2020CZER1R0M5A

								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
Low Temperature Storage	EC-60068 Part 2-1 test group Aa	-55°C for 2000 hours unpow er ed readings at 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at LT/RT/H	L= ±20% of initial, DCR = ±20% of initial	77	-55 deg. C	Maximum	1.069	1.067	0.023	7.855	7.855	1.195	
						Mimimum	0.808	0.807	-0.322	7.172	7.154	-2.089	
						Mean	0.942	0.941	-0.362	7.433	7.405	-0.362	
						Std Dev	0.054	0.054	1.015	0.153	0.143	1.015	
					+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ	
						Maximum	1.076	1.077	0.093	11.407	11.412	0.553	
						Mimimum	0.811	0.810	-0.243	10.540	10.547	-0.076	
						Mean	0.948	0.947	-0.065	10.881	10.868	-0.119	
					Std Dev	0.055	0.055	0.059	0.177	0.177	0.254		
					+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ	
						Maximum	1.076	1.077	0.371	17.248	17.189	2.581	
						Mimimum	0.806	0.807	0.098	15.921	15.884	-0.904	
						Mean	0.943	0.945	0.229	16.512	16.505	-0.037	
					Std Dev	0.056	0.056	0.051	0.278	0.273	0.528		



IHLP2020CZER1R0M5A

									Inductance (μH)			DC Resistance (mΩ)		
									Initial	Final	%Δ	Initial	Final	%Δ
4	Temperature Cycling	IEC-60068, Part 2.14 test group Na	-55°C to +125°C (+155° C for -5A models) dwell time = 30 min. transfer time ≤10 sec. no. of cycles = 1000 unpowered initial (0 cycles) and final 1000 cycles). Readings at LT/RT/HT	L= ±20% of initial, DCR = ±20% of initial	77	-55 deg. C	Maximum	1.087	1.094	4.838	7.791	7.716	1.170	
							Minimum	0.824	0.840	0.579	7.110	7.063	-2.484	
							Mean	0.939	0.956	1.813	7.411	7.345	-0.877	
							Std Dev	0.057	0.056	0.567	0.164	0.148	0.972	
						+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ	
							Maximum	1.093	1.106	5.261	11.402	11.401	0.472	
							Minimum	0.829	0.847	1.226	10.558	10.492	-0.972	
							Mean	0.944	0.964	2.187	10.890	10.860	-0.275	
						+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ	
							Maximum	1.096	1.125	6.982	17.426	17.262	0.752	
							Minimum	0.825	0.857	2.651	15.899	15.840	-1.318	
							Mean	0.940	0.976	3.888	16.491	16.407	-0.508	
						Std Dev	0.058	0.058	0.657	0.346	0.343	0.462		

											Inductance (μH)			DC Resistance (mΩ)		
											Initial	Final	%Δ	Initial	Final	%Δ
7	Biased Humidity	IEC-60068 Part 2-67	Temperature = 85°C ±20°C Humidity = 85% ±5% RH Duration = 1000 hours Power = No Power Initial (0hr.) and final (1000hr.) readings at LT/RT/HT	L= ±20% of initial, DCR = ±20% of initial	77	-55 deg. C	Maximum	1.049	1.053	0.515	7.865	7.814	2.393			
							Minimum	0.806	0.806	-0.344	7.117	7.182	-1.502			
							Mean	0.938	0.939	0.180	7.431	7.445	0.196			
							Std Dev	0.058	0.058	0.176	0.159	0.149	1.040			
						+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ			
							Maximum	1.056	1.055	-0.076	11.409	11.468	0.909			
							Minimum	0.810	0.807	-0.795	10.573	10.602	-0.183			
							Mean	0.944	0.941	-0.297	10.921	10.943	0.194			
						+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ			
							Maximum	1.055	1.058	0.637	17.186	17.184	0.234			
							Minimum	0.805	0.807	-0.219	16.071	15.925	-1.158			
							Mean	0.940	0.942	0.222	16.579	16.501	-0.467			
						Std Dev	0.060	0.060	0.161	0.266	0.273	0.369				



IHLP2020CZER1R0M5A

								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
8	Operational Life	MIL-STD-202, Method 108A	Temperature = 85°C for -1A/A1 models. Temperature =115° C for 5A models. Duration = 2000hrs. Power = As noted on the test request. Readings at 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at LT/RT/HT	L= ±20% of initial, DCR =±20% of initial	77	-55 deg. C	Maximum	1.089	1.108	4.343	7.849	7.992	4.125
							Mimimum	0.811	0.839	-1.493	7.133	7.192	-1.493
							Mean	0.946	0.967	1.207	7.480	7.569	1.207
							Std Dev	0.062	0.061	1.254	0.159	0.153	1.254
						+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	1.096	1.132	5.577	11.424	11.577	2.175
							Mimimum	0.815	0.851	2.609	10.527	10.561	0.083
							Mean	0.952	0.986	3.575	10.900	11.005	0.966
						+155 deg. C	Std Dev	0.063	0.064	0.446	0.209	0.213	0.559
								Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	1.096	1.144	6.662	17.362	17.486	2.339
							Mimimum	0.811	0.855	3.525	15.884	16.002	-0.237
							Mean	0.948	0.993	4.672	16.492	16.647	0.943
							Std Dev	0.064	0.065	0.489	0.322	0.316	0.713
9	External Visual	MIL-STD-883G Method 2009.9	Inspect construction and workmanship.	Pass all criteria as defined in DPS-11,865 VA1	All	na	Pass						
10	Physical Dimensions	JESD22 Method JB-100	Verify physical dimensions per part specification	All parts within dimensional tolerance per data sheet	30	na	Pass						
12	Resistance to Solvents	MIL-STD-202G Method 215K	Add Aqueous wash chemical. OKEM Clean or equivalent. Do not use banned solvents.	Pass all criteria as defined in DPS-11,865 VA1 L= ±20% of initial, DCR =±20% of initial	5	na	Pass						



IHLP2020CZER1R0M5A

13	Mechanical Shock	IEC-60068 part 2.27 test group Ea with precondition per 0 above	Pulse Shape-Half Sine Normal Pulse Length 6ms Peak acceleration-100g No. shocks-6 each in both directions of each axis (total of 36) Initial and final readings at LT/RT/HT	L=±20% of initial, DCR =±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	1.106	1.105	-0.027	7.637	7.649	0.323
Minimum	0.812	0.811	-0.358	7.207	7.192		-0.358						
Mean	0.949	0.947	-0.182	7.402	7.399		-0.032						
Std Dev	0.068	0.068	0.088	0.103	0.106		0.206						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	1.115	1.119	0.397	11.309	11.389	1.057						
	Minimum	0.815	0.815	-0.171	10.588	10.662	0.376						
	Mean	0.953	0.954	0.114	10.866	10.942	0.699						
+155 deg. C	Std Dev	0.069	0.070	0.125	0.150	0.153	0.181						
		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	1.115	1.115	0.254	17.280	17.259	0.249						
	Minimum	0.810	0.811	-0.133	16.013	16.007	-0.185						
	Mean	0.948	0.949	0.126	16.487	16.495	0.046						
	Std Dev	0.070	0.070	0.075	0.276	0.269	0.121						

14	Vibration	IEC-60068 PART 2-6 TEST GROUP Fc. With precondition per 0 above	Pulse Shape-sine wave range of frequency 1 10-55Hz. Amplitude ±0.75mm Range of frequency 2 55-2000Hz Amplitude; 10G Frequency Sweep: 1 oct./min. Duration: 24 h each of 3 axis. Initial and final readings at LT/RT/HT	L=±20% of initial, DCR =±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	1.052	1.050	-0.075	7.684	7.663	1.834
Minimum	0.839	0.838	-0.239	7.144	7.116		-1.442						
Mean	0.946	0.944	-0.154	7.380	7.406		0.356						
Std Dev	0.060	0.059	0.047	0.131	0.135		0.799						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	1.060	1.060	0.082	11.097	11.068	0.182						
	Minimum	0.841	0.840	-0.148	10.524	10.501	-0.417						
	Mean	0.951	0.950	-0.064	10.811	10.788	-0.214						
+155 deg. C	Std Dev	0.061	0.061	0.062	0.149	0.153	0.160						
		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	1.058	1.058	0.229	16.798	16.760	0.571						
	Minimum	0.834	0.835	0.020	15.930	15.970	-0.367						
	Mean	0.946	0.947	0.127	16.413	16.417	0.027						
	Std Dev	0.062	0.061	0.046	0.245	0.232	0.276						



IHLP2020CZER1R0M5A

									Inductance (μH)			DC Resistance (mΩ)		
									Initial	Final	%Δ	Initial	Final	%Δ
							-55 deg. C	Maximum	1.042	1.042	12.964	7.806	7.705	6.813
Mimimum	0.827	0.882	-12.131	7.187	7.125	-5.809								
Mean	0.951	0.936	-1.340	7.467	7.443	-0.304								
Std Dev	0.053	0.047	6.716	0.134	0.176	2.787								
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ							
	Maximum	1.050	1.049	13.686	11.417	11.412	6.718							
	Mimimum	0.826	0.888	-11.916	10.600	10.675	-3.242							
	Mean	0.956	0.943	-1.041	10.878	10.924	0.443							
Std Dev	0.054	0.048	6.886	0.179	0.237	2.423								
+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ							
	Maximum	1.048	1.042	13.606	17.393	17.410	6.019							
	Mimimum	0.823	0.885	-12.422	16.028	16.179	-4.458							
	Mean	0.953	0.939	-1.187	16.515	16.576	0.391							
Std Dev	0.054	0.047	6.879	0.299	0.390	2.522								
15	Resistance to Solder Heat	MIL-STD-202G Method 210F Condition K	IR/convection reflow. 250 ± 5°C for 30 ± 5sec. Ramp rate 1°C/s to 4°C/; Above 183°C for 90s-120s	L=±20% of initial, DCR =±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)			
								Initial	Final	%Δ	Initial	Final	%Δ	
						+25 deg. C	Maximum	1.048	1.042	0.437	11.233	11.198	-0.045	
							Mimimum	0.817	0.821	-0.585	10.583	10.548	-0.423	
							Mean	0.943	0.943	-0.072	10.885	10.852	-0.307	
Std Dev	0.062	0.061	0.296	0.178	0.179		0.071							
17	ESD	AEC-Q200-002	Determine the Classification of the part.	L=±20% of initial, DCR =±20% of initial	15			Inductance (μH)			DC Resistance (mΩ)			
								Initial	25KV	%Δ	Initial	25KV	%Δ	
						+25 deg. C	Maximum	1.033	1.035	0.523	11.225	11.245	0.178	
							Mimimum	0.871	0.873	0.170	10.622	10.616	-0.183	
							Mean	0.947	0.950	0.290	10.950	10.943	-0.067	
Std Dev	0.047	0.047	0.099	0.181	0.186		0.098							
18	Solderability	J-STD-002C Method B1	4 hours @ 155°C dry heat @ 255°C. 90° dipping angle.	95% or greater coverage on "A" (seating plane) per J-STD-002C	15	NA	Pass							



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								Inductance (μH)			DC Resistance (mΩ)		
								Initial			Initial		
19	Electrical Characterization	User Specification	Min, Max, Mean, and Standard Deviation @ Min (-55C), Room, and Max (+125C) operating temperatures. After mounted, allow +/-5% shift DCR at room temp. 55C/+125C DCR Max calculated using temp conversion for copper: $R_2 = [(T_2 + 234.5) / (234.5 + T_A)] * 1.05R_A$ (A = Ambient, 2 = new con)	Final Test: L= ±20% of initial, DCR per calculated limits described in test conditions. L test for -55C & +125C = ±20% initial	30	-55 deg. C	Maximum	1.042			7.806		
							Mimimum	0.827			7.187		
							Mean	0.951			7.467		
							Std Dev	0.053			0.134		
						+25 deg. C		Initial			Initial		
							Maximum	1.050			11.417		
							Mimimum	0.826			10.600		
							Mean	0.956			10.878		
						+155 deg. C	Std Dev	0.054			0.179		
								Initial			Initial		
							Maximum	1.048			17.393		
							Mimimum	0.823			16.028		
							Mean	0.953			16.515		
							Std Dev	0.054			0.299		
21	Board Flex	AEC-Q200-005 Appendix 2	2mm minimum flex for 60 (+5) sec	Pass all criteria as defined in DPS-11,865 VA1 L= ±20% of initial, DCR = ±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						+25 deg. C	Maximum	1.055	1.066	1.917	11.210	11.165	4.841
							Mimimum	0.836	0.850	-7.475	10.190	10.357	-3.114
							Mean	0.954	0.949	-0.403	10.686	10.780	0.908
							Std Dev	0.047	0.044	2.399	0.235	0.227	2.039
22	Terminal Strength	AEC-Q200-006 Appendix 1	Force of 1.8kg (17.7 N) for 60 seconds	Pass all criteria as defined in DPS-11,865 VA1 L= ±20% of initial, DCR = ±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						+25 deg. C	Maximum	1.065	1.069	0.562	11.382	11.332	0.037
							Mimimum	0.824	0.826	0.160	10.580	10.557	-0.618
							Mean	0.952	0.955	0.373	10.892	10.864	-0.255
							Std Dev	0.064	0.064	0.094	0.205	0.199	0.168



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Test #	Description	Ref. Spec. Meth / Cond	Test Conditions	End Point Δ requirements	Sample Size	Meas Temp							
0	3x reflow Preconditioning for lead-free products	ICP 10,373	As specified in sections 6.3 thru 6.4 except Visual per DPS-11,865 10X magnification										
1	Pre- and Post-Stress Electrical Test	IHLP Data Sheet	L (μ H) – 100KHz and 250mV DCR – 25°C Ambient	L = $\pm 15\%$ of initial, DCR = $\pm 15\%$ of initial	All tests requiring electrical data								
3	High Temp Exposure	IEC-60068 Part 2-2 test group BA	155C for 2000 hours, unpowered readings at 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at LT/RT/HT LT=Low Temperature=-55°C, RT=Room Temperature= $\pm 25^\circ$ C, HT=High Temperature= $\pm 125^\circ$ C for -A1/1A models. HT=High Temperature = $\pm 155^\circ$ C for -5A models.	L = $\pm 20\%$ of initial, DCR = $\pm 20\%$ of initial	77			Inductance (μ H)			DC Resistance ($m\Omega$)		
								Initial	Final	% Δ	Initial	Final	% Δ
						-55 deg. C	Maximum	4.773	5.109	13.879	50.270	50.100	1.294
							Minimum	3.832	4.280	7.029	48.540	48.100	-2.592
							Mean	4.243	4.674	10.218	49.222	48.851	-0.751
							Std Dev	0.204	0.183	1.315	0.326	0.403	0.826
						+25 deg. C	Initial	Final	% Δ	Initial	Final	% Δ	
							Maximum	4.819	5.146	14.036	72.630	71.660	-0.565
							Minimum	3.846	4.294	6.772	70.650	69.690	-2.111
							Mean	4.268	4.700	10.188	71.557	70.584	-1.359
							Std Dev	0.210	0.188	1.402	0.463	0.406	0.332
						+155 deg. C	Initial	Final	% Δ	Initial	Final	% Δ	
							Maximum	4.864	5.295	14.368	108.810	107.050	-0.274
							Minimum	3.902	4.399	8.851	105.280	103.970	-2.447
							Mean	4.312	4.819	11.788	106.849	105.457	-1.301
							Std Dev	0.207	0.200	1.154	0.774	0.706	0.422



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								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	4.723	4.746	15.168	50.840	51.420	10.669
Mimimum	3.650	3.937	-9.326	45.270	48.920		-1.068						
Mean	4.157	4.225	1.713	49.499	49.982		0.992						
Std Dev	0.186	0.172	3.271	0.703	0.471		1.490						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	4.765	4.777	1.639	72.750	72.050	-0.056						
	Mimimum	3.900	3.957	0.141	70.780	70.180	-1.624						
	Mean	4.208	4.242	0.809	71.739	71.172	-0.789						
	Std Dev	0.183	0.176	0.385	0.461	0.448	0.347						
+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	4.804	4.814	14.949	107.920	107.390	0.998						
	Mimimum	3.739	3.980	-8.958	104.950	104.350	-1.926						
	Mean	4.222	4.262	1.012	106.491	106.046	-0.416						
	Std Dev	0.186	0.179	3.257	0.670	0.802	0.629						



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4	Temperature Cycling	IEC-60068, Part 2.14 test group Na	-55°C to +125°C (+155° C for -5A models) dwell time = 30 min. transfer time ≤10 sec. no. of cycles = 1000 unpowered initial (0 cycles) and final 1000 cycles). Readings at LT/RT/HT	L= ±20% of initial, DCR = ±20% of initial	77			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	4.769	4.931	10.430	50.510	50.420	1.465
Minimum	3.793	3.970	2.725	48.750	48.920		-1.548						
Mean	4.197	4.426	5.459	49.555	49.515		-0.080						
Std Dev	0.214	0.209	1.381	0.371	0.342		0.679						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	4.840	4.965	10.138	72.440	72.150	0.639						
	Minimum	3.833	3.996	1.942	70.340	70.260	-0.972						
	Mean	4.237	4.451	5.067	71.495	71.201	-0.410						
+155 deg. C	Std Dev	0.219	0.209	1.503	0.428	0.395	0.323						
		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	4.879	5.061	10.783	108.830	107.380	0.596						
	Minimum	3.867	4.064	3.468	105.230	104.600	-1.879						
	Mean	4.270	4.532	6.147	106.803	105.875	-0.866						
	Std Dev	0.219	0.218	1.388	0.740	0.637	0.538						

7	Biased Humidity	IEC-60068 Part 2-67	Temperature = 85°C ±20°C Humidity = 85% ±5% RH Duration = 1000 hours Power = No Power Initial (0hr.) and final (1000hr.) readings at LT/RT/HT	L= ±20% of initial, DCR = ±20% of initial	77			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	4.578	4.413	0.159	50.040	50.710	3.699
Minimum	3.692	3.362	-10.906	47.800	48.490		-0.918						
Mean	4.083	3.905	-4.451	49.134	49.611		0.975						
Std Dev	0.207	0.280	2.862	0.418	0.498		1.011						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	4.613	4.445	0.281	71.940	72.670	2.688						
	Minimum	3.772	3.378	-10.986	69.540	70.290	-0.364						
	Mean	4.113	3.931	-4.507	70.662	71.294	0.896						
+155 deg. C	Std Dev	0.207	0.284	2.962	0.578	0.517	0.566						
		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	4.635	4.538	1.187	106.950	108.610	3.527						
	Minimum	3.754	3.435	-11.478	102.250	104.530	-0.899						
	Mean	4.151	4.001	-3.685	104.465	106.150	1.621						
	Std Dev	0.211	0.286	2.957	1.149	0.797	0.994						



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								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
8	Operational Life	MIL-STD-202, Method 108A	Temperature = 85°C for -1A/A1 models. Temperature =115° C for 5A models. Duration = 2000hrs. Pow er = As noted on the test request. Readings a 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at LT/RT/HT	L=±20% of initial, DCR =±20% of initial	77	-55 deg. C	Maximum	4.297	4.488	9.618	50.490	50.380	1.610
							Mimimum	3.766	4.015	3.615	48.600	48.250	-2.437
							Mean	3.988	4.248	6.565	49.528	49.269	-0.518
							Std Dev	0.162	0.138	1.464	0.438	0.455	0.848
						+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	4.322	4.543	10.259	73.030	73.120	1.857
							Mimimum	3.786	4.062	4.406	70.390	70.390	-1.144
							Mean	4.010	4.294	7.141	71.532	71.677	0.203
						+155 deg. C	Std Dev	0.165	0.141	1.462	0.571	0.618	0.602
								Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	4.346	4.639	10.668	108.460	107.610	0.958
							Mimimum	3.798	4.132	6.400	104.340	103.980	-1.547
							Mean	4.032	4.377	8.577	106.422	105.929	-0.461
							Std Dev	0.162	0.147	1.242	0.970	0.888	0.516
9	External Visual	MIL-STD-883G Method 2009.9	Inspect construction and workmanship.	Pass all criteria as defined in DPS-11,865 VA1	All	na	Pass						
10	Physical Dimensions	JESD22 Method JB-100	Verify physical dimensions per part specification	All parts within dimensional tolerance per data sheet	30	na	Pass						
12	Resistance to Solvents	MIL-STD-202G Method 215K	Add Aqueous wash chemical. OKEM Clean or equivalent. Do not use banned solvents.	Pass all criteria as defined in DPS-11,865 VA1 L=±20% of initial, DCR =±20% of initial	5	na	Pass						



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13	Mechanical Shock	IEC-60068 part 2.27 test group Ea with precondition per 0 above	Pulse Shape-Half Sine Normal Pulse Length 6ms Peak acceleration-100g No. shocks-6 each in both directions of each axis (total of 36) Initial and final readings at LT/RT/HT	L=±20% of initial, DCR =±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	4.534	4.594	2.221	49.890	49.730	1.428
Mimimum							3.786	3.804	0.289	48.120	48.480	-0.586	
Mean							4.134	4.172	0.947	48.939	49.171	0.479	
Std Dev							0.176	0.176	0.706	0.472	0.344	0.686	
+25 deg. C							Initial	Final	%Δ	Initial	Final	%Δ	
						Maximum	4.559	4.625	2.513	71.290	71.880	1.878	
						Mimimum	3.805	3.824	-0.105	69.220	70.320	0.413	
						Mean	4.160	4.202	1.010	70.328	71.155	1.177	
+155 deg. C						Std Dev	0.182	0.179	0.848	0.564	0.465	0.422	
							Initial	Final	%Δ	Initial	Final	%Δ	
						Maximum	4.604	4.612	0.477	105.750	107.230	3.637	
						Mimimum	3.832	3.843	0.097	102.280	104.430	0.010	
						Mean	4.207	4.217	0.233	103.973	106.111	2.062	
						Std Dev	0.183	0.182	0.095	0.959	0.752	0.937	
14	Vibration	IEC-60068 PART 2-6 TEST GROUP Fc. With precondition per 0 above	Pulse Shape-sine wave range of frequency 1 10-55Hz. Amplitude ±0.75mm Range of frequency 2 55-2000Hz Amplitude; 10G Frequency Sw eep: 1 oct./min. Duration: 24 h each of 3 axis. Initial and final readings at LT/RT/HT	L=±20% of initial, DCR =±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	4.627	4.660	0.989	49.940	49.750	0.933
							Mimimum	3.991	4.006	0.105	48.980	48.280	-2.286
							Mean	4.222	4.241	0.453	49.426	49.053	-0.750
							Std Dev	0.167	0.169	0.231	0.315	0.381	0.881
						+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	4.693	4.714	0.581	72.380	72.110	0.588
							Mimimum	4.021	4.037	0.013	70.910	70.100	-1.655
							Mean	4.260	4.275	0.369	71.429	71.173	-0.358
						+155 deg. C	Std Dev	0.175	0.175	0.117	0.420	0.467	0.518
								Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	4.733	4.742	0.368	108.160	107.140	0.066
							Mimimum	4.053	4.061	-0.126	105.990	104.720	-1.643
							Mean	4.299	4.306	0.164	106.761	105.940	-0.768
							Std Dev	0.176	0.177	0.110	0.622	0.654	0.463



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							Inductance (μH)			DC Resistance (mΩ)			
							Initial	Final	%Δ	Initial	Final	%Δ	
Bump	IEC-60068 part 2-29 test group Eb with precondition per 0 above.	Pulse shape: half sine Nominal pulse length: 6 ms Peak Acceleration: 40g No. of shocks: 4000 each mechanical axis. Initial and final readings at LT/RT/HT	L=±20% of initial, DCR =±20% of initial	30	-55 deg. C	Maximum	4.433	4.448	1.344	50.670	50.230	4.235	
						Mimimum	3.821	3.836	0.193	46.990	48.840	-1.172	
						Mean	4.075	4.090	0.367	49.119	49.442	0.675	
						Std Dev	0.162	0.164	0.209	0.796	0.398	1.256	
					+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ	
						Maximum	4.462	4.490	0.801	71.770	72.060	4.179	
						Mimimum	3.836	3.859	0.443	68.680	70.300	0.098	
						Mean	4.092	4.116	0.591	70.489	71.115	0.896	
					+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ	
						Maximum	4.514	4.524	0.329	104.780	106.810	7.053	
						Mimimum	3.879	3.885	-3.820	99.670	104.250	1.397	
						Mean	4.140	4.142	0.047	103.001	105.728	2.663	
					Std Dev	0.169	0.170	0.734	1.341	0.614	1.367		
15	Resistance to Solder Heat	MIL-STD-202G Method 210F Condition K	IR/convection reflow. 250 ± 5°C for 30 ± 5sec. Ramp rate 1°C/s to 4°C/ Above 183°C for 90s-120s	L=±20% of initial, DCR = ±20% of initial	30	+25 deg. C		Inductance (μH)			DC Resistance (mΩ)		
							Initial	Final	%Δ	Initial	Final	%Δ	
							Maximum	4.492	4.593	4.894	72.860	73.090	0.710
							Mimimum	3.780	3.920	1.158	71.280	71.450	-0.445
						Mean	4.144	4.257	2.759	72.054	72.072	0.024	
Std Dev	0.203	0.190	0.960	0.438	0.491	0.331							
17	ESD	AEC-Q200-002	Determine the Classification of the part.	L= ±20% of initial, DCR = ±20% of initial	15	+25 deg. C		Inductance (μH)			DC Resistance (mΩ)		
							Initial	25KV	%Δ	Initial	25KV	%Δ	
							Maximum	4.392	4.400	0.821	73.630	73.770	1.320
							Mimimum	3.762	3.776	0.182	71.570	70.880	-2.018
						Mean	4.015	4.035	0.493	72.809	72.529	-0.382	
Std Dev	0.214	0.211	0.190	0.605	0.802	0.917							
18	Solderability	J-STD-002C Method B1	4 hours @ 155°C dry heat @ 255°C. 90° dipping angle.	95% or greater coverage on "A" (seating plane) per J-STD-002C.	15	NA	Pass						



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19	Electrical Characterization	User Specification	Min, Max, Mean, and Standard Deviation @ Min (-55C), Room, and Max (+125C) operating temperatures. After mounted, allow +/-5% shift DCR at room temp. -55C/+125C DCR Max calculated using temp conversion for copper: $R_2 = [(T_2 + 234.5) / (234.5 + T_A)] * 1.05R_A$ (A = Ambient, 2 = new con)	Final Test: L=±20% of initial, DCR per calculated limits described in test conditions. L test for -55C & +125C = ±20% initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial			Initial		
						-55 deg. C	Maximum	4.433			50.670		
							Minimum	3.821			46.990		
							Mean	4.075			49.119		
							Std Dev	0.162			0.796		
						+25 deg. C		Initial			Initial		
							Maximum	4.462			71.770		
							Minimum	3.836			68.680		
							Mean	4.092			70.489		
						+155 deg. C		Initial			Initial		
							Maximum	4.514			104.780		
							Minimum	3.879			99.670		
							Mean	4.140			103.001		
							Std Dev	0.169			1.341		
21	Board Flex	AEC-Q200-005 Appendix 2	2mm minimum flex for 60 (+5) sec	Pass all criteria as defined in DPS-11,865 VA1 L=±20% of initial, DCR =±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						+25 deg. C	Maximum	4.585	4.600	0.515	72.800	72.600	0.825
							Minimum	3.792	3.800	-0.208	70.950	71.200	-0.785
							Mean	4.048	4.059	0.266	72.001	71.909	-0.126
							Std Dev	0.194	0.197	0.157	0.413	0.315	0.396
22	Terminal Strength	AEC-Q200-006 Appendix 1	Force of 1.8kg (17.7 N) for 60 seconds	Pass all criteria as defined in DPS-11,865 VA1 L=±20% of initial, DCR =±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						+25 deg. C	Maximum	4.590	4.595	0.207	73.820	73.610	2.364
							Minimum	3.760	3.663	-2.900	71.320	71.260	-2.426
							Mean	4.076	4.069	-0.176	72.775	72.596	-0.237
							Std Dev	0.206	0.217	0.582	0.775	0.736	1.351



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Test #	Description	Ref. Spec. Meth / Cond	Test Conditions	End Point Δ requirements	Sample Size	Meas Temp							
0	3x reflow Preconditioning for lead-free products	ICP 10,373	As specified in sections 6.3 thru 6.4 except Visual per DPS-11,865 10X magnification										
1	Pre- and Post-Stress Electrical Test	IHLP Data Sheet	L (uH) – 100KHz and 250mV DCR – 25°C Ambient	L=±15% of initial, DCR =±15% of initial	All tests requiring electrical data								
3	High Temp Exposure	IEC-60068 Part 2-2 test group BA	155C for 2000 hours, unpowered readings at 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at LT/RT/HT LT=Low Temperature=-55°C, RT=Room Temperature=+25°C, HT=High Temperature=+125°C for -A1/1A models. HT=High Temperature =+155°C for -5A models.	L=±20% of initial, DCR =±20% of initial	77			Inductance (uH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	10.421	11.416	18.852	85.950	85.040	2.668
							Minimum	7.294	8.252	4.423	81.880	81.810	-2.556
							Mean	8.871	9.835	10.975	83.741	83.252	-0.575
							Std Dev	0.826	0.815	2.200	0.808	0.603	1.133
						+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	10.506	11.503	19.290	122.210	122.160	2.245
							Minimum	7.330	8.297	6.730	117.490	118.570	-1.182
							Mean	8.935	9.918	11.134	120.135	120.001	-0.108
							Std Dev	0.849	0.832	2.324	0.956	0.729	0.749
						+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	10.542	11.805	19.375	182.230	182.850	1.386
							Minimum	7.355	8.426	9.519	176.290	159.670	-10.764
							Mean	8.925	10.124	13.489	178.611	177.919	-0.385
							Std Dev	0.836	0.898	2.002	1.417	3.720	2.034



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								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	10.627	10.657	4.006	85.650	89.050	6.417
Mimimum	6.426	6.609	-0.966	81.680	80.170		-2.647						
Mean	8.929	9.014	0.987	83.371	84.520		1.381						
Std Dev	0.805	0.793	1.024	0.728	1.100		1.191						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	10.742	10.717	4.008	122.570	123.340	2.847						
	Mimimum	6.452	6.631	-1.135	117.370	104.710	-10.938						
	Mean	8.993	9.059	0.764	120.245	120.763	0.432						
	Std Dev	0.828	0.808	1.081	1.192	2.041	1.499						
+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	10.724	10.736	1.671	181.960	182.870	2.019						
	Mimimum	6.589	6.657	-1.240	174.540	174.280	-1.969						
	Mean	9.022	9.055	0.369	179.098	179.496	0.225						
	Std Dev	0.810	0.804	0.390	1.564	1.805	0.804						



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4	Temperature Cycling	IEC-60068, Part 2.14 test group Na	-55°C to +125°C (+155° C for -5A models) dwell time = 30 min. transfer time ≤10 sec. no. of cycles = 1000 unpowered initial (0 cycles) and final 1000 cycles). Readings at LT/RT/HT	L= ±20% of initial, DCR = ±20% of initial	77			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	10.792	10.820	16.699	84.900	85.900	4.678
Mimimum	7.256	7.853	0.186	80.160	81.960		-1.985						
Mean	8.860	9.369	5.890	83.017	83.756		0.902						
Std Dev	0.786	0.698	2.270	0.992	0.846		1.393						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	10.991	10.943	9.223	122.670	122.920	4.016						
	Mimimum	7.294	7.879	-0.437	114.550	118.310	-0.624						
	Mean	8.947	9.416	5.390	119.034	120.558	1.292						
+155 deg. C	Std Dev	0.824	0.722	1.986	1.556	0.970	1.094						
		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	10.975	11.121	10.199	181.080	183.750	4.093						
	Mimimum	7.319	7.956	1.332	172.020	175.730	-0.295						
	Mean	8.968	9.534	6.447	176.134	179.373	1.844						
	Std Dev	0.824	0.747	1.907	2.001	1.782	0.793						

7	Biased Humidity	IEC-60068 Part 2-67	Temperature = 85°C ±20°C Humidity = 85% ±5% RH Duration = 1000 hours Power = No Power Initial (0hr.) and final (1000hr.) readings at LT/RT/HT	L= ±20% of initial, DCR = ±20% of initial	77			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	10.534	10.483	9.230	86.880	85.840	2.794
Mimimum	7.011	6.719	-5.319	80.890	82.640		-2.191						
Mean	8.976	8.967	-0.100	84.128	84.010		-0.132						
Std Dev	0.882	0.886	1.519	0.992	0.700		0.968						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	10.601	10.544	1.153	122.630	122.180	1.674						
	Mimimum	7.033	6.748	-5.093	117.710	117.680	-2.162						
	Mean	9.031	9.014	-0.204	120.513	120.332	-0.148						
+155 deg. C	Std Dev	0.897	0.905	1.054	0.926	0.850	0.569						
		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	10.523	10.687	2.492	182.150	182.150	5.151						
	Mimimum	7.058	6.882	-3.355	168.700	172.890	-1.762						
	Mean	8.944	9.083	1.528	176.677	178.896	1.280						
	Std Dev	0.872	0.914	1.048	2.946	1.504	1.665						



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								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
8	Operational Life	MIL-STD-202, Method 108A	Temperature = 85°C for -1A/A1 models. Temperature =115° C for 5A models. Duration = 2000hrs. Power = As noted on the test request. Readings at 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at LT/RT/HT	L=±20% of initial, DCR =±20% of initial	77	-55 deg. C	Maximum	10.553	11.057	12.171	86.230	86.320	1.985
							Mimimum	7.593	8.259	-0.159	82.600	82.320	-2.838
							Mean	8.945	9.640	7.880	84.342	84.009	-0.389
							Std Dev	0.717	0.655	1.968	0.796	0.785	0.979
						+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	10.683	11.237	12.671	125.660	124.030	3.062
							Mimimum	7.623	8.344	4.954	118.420	119.190	-2.702
							Mean	9.007	9.754	8.407	121.326	121.382	0.060
						+155 deg. C	Std Dev	0.742	0.681	1.765	1.479	1.099	1.476
								Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	10.730	11.527	14.681	184.160	182.830	1.731
							Mimimum	7.608	8.451	7.321	175.720	175.800	-2.094
							Mean	8.974	9.896	10.373	180.157	179.835	-0.175
							Std Dev	0.744	0.722	1.739	1.656	1.613	0.841
9	External Visual	MIL-STD-883G Method 2009.9	Inspect construction and workmanship.	Pass all criteria as defined in DPS-11,865 VA1	All	na	Pass						
10	Physical Dimensions	JESD22 Method JB-100	Verify physical dimensions per part specification	All parts within dimensional tolerance per data sheet	30	na	Pass						
12	Resistance to Solvents	MIL-STD-202G Method 215K	Add Aqueous wash chemical. OKEM Clean or equivalent. Do not use banned solvents.	Pass all criteria as defined in DPS-11,865 VA1 L=±20% of initial, DCR =±20% of initial	5	na	Pass						



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13	Mechanical Shock	IEC-60068 part 2.27 test group Ea with precondition per 0 above	Pulse Shape-Half Sine Normal Pulse Length 6ms Peak acceleration-100g No. shocks-6 each in both directions of each axis (total of 36) Initial and final readings at LT/RT/HT	L=±20% of initial, DCR =±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	9.912	10.195	4.404	85.910	86.070	0.590
Minimum	6.644	6.863	1.005	83.420	83.270		-0.619						
Mean	8.097	8.341	3.047	84.853	84.802		-0.061						
Std Dev	0.975	0.987	0.819	0.538	0.614		0.348						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	9.993	10.296	4.536	123.110	123.160	0.130						
	Minimum	6.654	6.876	0.965	119.770	119.720	-0.199						
	Mean	8.124	8.378	3.141	121.651	121.582	-0.057						
+155 deg. C	Std Dev	0.989	1.008	0.844	0.796	0.832	0.095						
		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	10.139	10.202	1.080	183.390	183.460	0.078						
	Minimum	6.764	6.821	0.082	178.450	178.450	-0.133						
	Mean	8.245	8.302	0.705	181.132	181.067	-0.036						
	Std Dev	0.978	0.978	0.285	1.198	1.206	0.052						

14	Vibration	IEC-60068 PART 2-6 TEST GROUP Fc. With precondition per 0 above	Pulse Shape-sine wave range of frequency 1 10-55Hz. Amplitude ±0.75mm Range of frequency 2 55-2000Hz Amplitude; 10G Frequency Sweep: 1 oct./min. Duration: 24 h each of 3 axis. Initial and final readings at LT/RT/HT	L=±20% of initial, DCR =±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	10.716	10.752	1.226	85.950	85.280	0.641
Minimum	7.192	7.244	-0.608	83.430	82.940		-0.968						
Mean	9.137	9.178	0.441	84.739	84.347		-0.461						
Std Dev	0.814	0.822	0.529	0.579	0.534		0.427						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	10.842	10.892	1.390	123.200	122.720	0.454						
	Minimum	7.194	7.247	-0.624	119.830	119.700	-0.704						
	Mean	9.179	9.224	0.482	121.638	121.423	-0.176						
+155 deg. C	Std Dev	0.841	0.854	0.556	0.795	0.722	0.357						
		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	10.650	10.703	0.687	184.160	183.540	0.561						
	Minimum	7.153	7.165	0.149	178.820	178.670	-0.411						
	Mean	8.980	9.020	0.444	181.589	181.462	-0.069						
	Std Dev	0.826	0.832	0.148	1.268	1.106	0.272						



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								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
Bump	IEC-60068 part 2-29 test group Eb with precondition per 0 above.	Pulse shape: half sine Nominal pulse length: 6 ms Peak Acceleration: 40g No. of shocks: 4000 each mechanical axis. Initial and final readings at LT/RT/HT	L=±20% of initial, DCR =±20% of initial	30	-55 deg. C	Maximum	10.443	10.500	2.198	86.600	85.830	-0.355	
						Minimum	7.619	7.702	-1.517	83.070	82.700	-1.063	
						Mean	8.962	9.060	1.088	84.881	84.360	-0.614	
						Std Dev	0.912	0.929	0.811	0.685	0.652	0.209	
					+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ	
						Maximum	10.603	10.676	2.199	123.680	123.750	0.168	
						Minimum	7.628	7.709	-1.526	119.030	119.230	-0.032	
						Mean	8.999	9.108	1.203	121.457	121.541	0.069	
					+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ	
						Maximum	10.590	10.613	0.713	184.100	184.180	0.580	
						Minimum	7.549	7.572	-0.421	177.050	177.570	0.022	
						Mean	8.894	8.926	0.361	180.429	180.898	0.260	
Std Dev	0.945	0.953	0.247	1.358	1.294	0.152							
15	Resistance to Solder Heat	MIL-STD-202G Method 210F Condition K	IR/convection reflow. 250 ± 5°C for 30 ± 5sec. Ramp rate 1°C/s to 4°C/; Above 183°C for 90s-120s	L= ±20% of initial, DCR = ±20% of initial	30	+25 deg. C		Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	10.576	10.491	7.392	123.940	122.920	-0.548
							Minimum	6.416	6.845	-0.801	120.940	119.900	-1.070
							Mean	8.226	8.558	4.237	122.328	121.279	-0.857
Std Dev	0.992	0.884	2.034	0.807	0.762	0.121							
17	ESD	AEC-Q200-002	Determine the Classification of the part.	L= ±20% of initial, DCR = ±20% of initial	15	+25 deg. C		Inductance (μH)			DC Resistance (mΩ)		
								Initial	25KV	%Δ	Initial	25KV	%Δ
							Maximum	9.934	9.965	1.128	123.340	123.170	-0.065
							Minimum	7.595	7.665	0.250	121.160	121.050	-0.219
							Mean	8.478	8.530	0.620	122.663	122.475	-0.153
Std Dev	0.628	0.622	0.283	0.620	0.608	0.040							
18	Solderability	J-STD-002C Method B1	4 hours @ 155°C dry heat @ 255°C. 90° dipping angle.	95% or greater coverage on "A" (seating plane) per J-STD-002C.	15	NA	Pass						



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								Inductance (μH)			DC Resistance (mΩ)		
						Initial					Initial		
19	Electrical Characterization	User Specification	Min, Max, Mean, and Standard Deviation @ Min (-55C), Room, and Max (+125C) operating temperatures. After mounted, allow +/-5% shift DCR at room temp. -55C/+125C DCR Max calculated using temp conversion for copper: $R_2 = [(T_2 + 234.5) / (234.5 + T_A)] * 1.05R_A$ (A = Ambient, 2 = new con)	Final Test: L= ±20% of initial, DCR per calculated limits described in test conditions. L test for -55C & +125C = ±20% initial	30	-55 deg. C	Maximum	10.443			86.600		
							Mimimum	7.619			83.070		
							Mean	8.962			84.881		
							Std Dev	0.912			0.685		
						+25 deg. C		Initial		Initial			
							Maximum	10.603	123.680				
							Mimimum	7.628	119.030				
							Mean	8.999	121.457				
							Std Dev	0.940	0.902				
							+155 deg. C		Initial		Initial		
								Maximum	10.590	184.100			
								Mimimum	7.549	177.050			
						Mean		8.894	180.429				
						Std Dev	0.945	1.358					
	Board Flex	AEC-Q200-005 Appendix 2	2mm minimum flex for 60 (+5) sec	Pass all criteria as defined in DPS-11,865 VA1 L= ±20% of initial, DCR = ±20% of initial	30	Inductance (μH)			DC Resistance (mΩ)				
						Initial Final %Δ			Initial Final %Δ				
						+25 deg. C	Maximum	10.199	10.281	0.919	123.650	123.560	0.033
							Mimimum	7.124	7.166	0.106	121.040	120.820	-0.542
							Mean	8.347	8.400	0.628	122.444	122.173	-0.221
Std Dev	0.870	0.878	0.143	0.642	0.611		0.125						
	Terminal Strength	AEC-Q200-006 Appendix 1	Force of 1.8kg (17.7 N) for 60 seconds	Pass all criteria as defined in DPS-11,865 VA1 L= ±20% of initial, DCR = ±20% of initial	30	Inductance (μH)			DC Resistance (mΩ)				
						Initial Final %Δ			Initial Final %Δ				
						+25 deg. C	Maximum	10.461	10.562	0.975	123.440	123.520	0.416
							Mimimum	7.331	7.360	-0.056	120.680	120.420	-0.508
							Mean	8.681	8.736	0.627	122.393	122.251	-0.116
Std Dev	0.781	0.794	0.259	0.707	0.793		0.229						



SECTION 10

Performance Test Results

IHLP2020CZ-5A

BEER'SHEVA, Israel Manufacturing location





IHLP2020CZER1R0M5A
IHLP2020CZER4R7M5A
IHLP2020CZER100M5A

TOP HEADER

- Parts were manufactured in the Beer'Sheva, Israel manufacturing location.



IHLP2020CZER1R0M5A

Test #	Description	Ref. Spec. Meth / Cond	Test Conditions	End Point Δ requirements	Sample Size	Meas Temp							
0	3x reflow Preconditioning for lead-free products	ICP 10,373	As specified in sections 6.3 thru 6.4 except Visual per DPS-11,865 10X magnification										
1	Pre- and Post-Stress Electrical Test	IHLP Data Sheet	L (μ H) – 100KHz and 250mV DCR – 25°C Ambient	L = $\pm 15\%$ of initial, DCR = $\pm 15\%$ of initial	All tests requiring electrical data								
3	High Temp Exposure	IEC-60068 Part 2-2 test group BA	155C for 2000 hours, unpowered readings at 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at LT/RT/HT LT=Low Temperature=-55°C, RT=Room Temperature=+25°C, HT=High Temperature=+125°C for -A1/1A models. HT=High Temperature =+155°C for -5A models.	L = $\pm 20\%$ of initial, DCR = $\pm 20\%$ of initial	77			Inductance (μ H)			DC Resistance (m Ω)		
								Initial	Final	% Δ	Initial	Final	% Δ
						-55 deg. C	Maximum	1.065	1.116	7.487	8.076	8.556	9.650
							Minimum	0.863	0.920	4.521	7.579	7.896	1.192
							Mean	0.982	1.042	6.139	7.801	8.187	4.953
							Std Dev	0.039	0.038	0.540	0.101	0.148	2.100
						+25 deg. C	Initial	Final	% Δ	Initial	Final	% Δ	
							Maximum	1.076	1.131	8.352	11.709	11.991	3.081
							Minimum	0.870	0.931	4.604	11.287	11.235	-2.575
							Mean	0.989	1.053	6.442	11.526	11.651	1.078
							Std Dev	0.040	0.039	0.616	0.075	0.145	0.969
						+155 deg. C	Initial	Final	% Δ	Initial	Final	% Δ	
							Maximum	1.073	1.164	10.669	17.794	17.334	-1.219
							Minimum	0.865	0.867	-6.827	17.231	16.446	-6.711
							Mean	0.985	1.076	9.159	17.498	16.957	-3.083
							Std Dev	0.040	0.048	1.918	0.126	0.158	1.064



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								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
Low Temperature Storage	EC-60068 Part 2-1 test group Aa	-55°C for 2000 hours unpowered readings at 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at LT/RT/H	L=±20% of initial, DCR =±20% of initial	77	-55 deg. C	Maximum	1.085	1.088	0.873	8.014	8.619	10.415	
						Minimum	0.904	0.907	0.082	7.160	7.966	2.290	
						Mean	0.989	0.992	0.223	7.790	8.256	5.996	
						Std Dev	0.035	0.035	0.110	0.096	0.139	2.045	
					+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ	
						Maximum	1.094	1.095	0.787	11.664	11.669	0.259	
						Minimum	0.910	0.912	-0.098	11.395	11.493	-1.493	
						Mean	0.997	0.998	0.127	11.541	11.313	-0.411	
					+155 deg. C	Std Dev	0.036	0.036	0.133	0.068	0.086	0.439	
							Initial	Final	%Δ	Initial	Final	%Δ	
						Maximum	1.089	1.092	1.112	17.788	17.409	-0.948	
						Minimum	0.908	0.911	0.056	17.202	16.648	-5.372	
						Mean	0.993	0.996	0.233	17.496	17.002	-2.819	
						Std Dev	0.035	0.035	0.127	0.142	0.163	1.061	



IHLP2020CZER1R0M5A

4	Temperature Cycling	IEC-60068, Part 2.14 test group Na	-55°C to +125°C (+155° C for -5A models) dwell time = 30 min. transfer time ≤10 sec. no. of cycles = 1000 unpowered initial (0 cycles) and final 1000 cycles). Readings at LT/RT/HT	L= ±20% of initial, DCR = ±20% of initial	77			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	1.050	1.063	2.483	7.968	8.208	6.459
Mimimum	0.853	0.874	1.050	7.581	7.875		0.470						
Mean	0.982	1.000	1.932	7.780	8.038		3.326						
Std Dev	0.033	0.032	0.297	0.084	0.076		1.400						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	1.060	1.074	2.990	11.668	11.619	0.192						
	Mimimum	0.856	0.880	1.406	11.379	11.339	-0.883						
	Mean	0.987	1.009	2.296	11.507	11.461	-0.402						
	Std Dev	0.033	0.033	0.324	0.063	0.062	0.243						
+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	1.057	1.094	4.963	17.819	17.346	-1.250						
	Mimimum	0.853	0.891	3.468	17.218	16.634	-4.241						
	Mean	0.983	1.024	4.196	17.508	17.035	-2.699						
	Std Dev	0.033	0.034	0.312	0.124	0.149	0.790						

7	Biased Humidity	IEC-60068 Part 2-67	Temperature = 85°C ±20°C Humidity = 85% ±5% RH Duration = 1000 hours Power = No Power Initial (0hr.) and final (1000hr.) readings at LT/RT/HT	L= ±20% of initial, DCR = ±20% of initial	77			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	1.089	1.091	1.086	7.949	7.953	1.016
Mimimum	0.846	0.852	-0.557	7.660	7.643		-0.222						
Mean	0.985	0.989	0.419	7.793	7.804		0.150						
Std Dev	0.043	0.043	0.374	0.063	0.068		0.244						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	1.097	1.089	0.182	11.652	11.732	1.082						
	Mimimum	0.849	0.850	-0.848	11.318	11.373	0.254						
	Mean	0.990	0.987	-0.267	11.483	11.559	0.659						
	Std Dev	0.044	0.043	0.230	0.073	0.077	0.162						
+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	1.093	1.089	0.678	17.784	17.929	1.916						
	Mimimum	0.848	0.853	-0.519	17.142	17.252	0.081						
	Mean	0.987	0.989	0.188	17.485	17.602	0.672						
	Std Dev	0.044	0.043	0.256	0.151	0.150	0.418						



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								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
8	Operational Life	MIL-STD-202, Method 108A	Temperature = 85°C for -1A/A1 models. Temperature =115° C for 5A models. Duration = 2000hrs. Pow er = As noted on the test request. Readings a 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at LT/RT/HT	L=±20% of initial, DCR =±20% of initial	77	-55 deg. C	Maximum	1.066	1.115	8.901	8.044	7.876	0.688
							Mimimum	0.883	0.929	4.063	7.678	7.543	-2.996
							Mean	0.985	1.045	6.082	7.806	7.714	-1.175
							Std Dev	0.038	0.038	0.960	0.078	0.064	0.834
						+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	1.073	1.129	9.863	11.812	11.753	-0.251
							Mimimum	0.889	0.944	5.025	11.331	11.266	-0.809
							Mean	0.991	1.060	6.927	11.584	11.523	-0.521
						+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	1.074	1.167	13.225	17.873	17.882	0.118
							Mimimum	0.886	0.969	8.283	17.378	17.250	-1.666
							Mean	0.989	1.091	10.264	17.627	17.568	-0.332
						Std Dev	0.039	0.041	0.946	0.114	0.128	0.300	
9	External Visual	MIL-STD-883G Method 2009.9	Inspect construction and workmanship.	Pass all criteria as defined in DPS-11,865 VA1	All	na	Pass						
10	Physical Dimensions	JESD22 Method JB-100	Verify physical dimensions per part specification	All parts within dimensional tolerance per data sheet	30	na	Pass						
12	Resistance to Solvents	MIL-STD-202G Method 215K	Add Aqueous wash chemical. OKEM Clean or equivalent. Do not use banned solvents.	Pass all criteria as defined in DPS-11,865 VA1 L=±20% of initial, DCR =±20% of initial	5	na	Pass						



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13	Mechanical Shock	IEC-60068 part 2.27 test group Ea with precondition per 0 above	Pulse Shape-Half Sine Normal Pulse Length 6ms Peak acceleration-100g No. shocks-6 each in both directions of each axis (total of 36) Initial and final readings at LT/RT/HT	L=±20% of initial, DCR ≈±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	1.110	1.109	0.043	7.921	8.349	7.126
Minimum	0.878	0.878	-0.159	7.590	7.871		1.897						
Mean	0.986	0.985	-0.048	7.787	8.099		4.020						
Std Dev	0.043	0.043	0.050	0.092	0.114		1.425						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	1.120	1.120	0.170	11.643	11.692	0.840						
	Minimum	0.882	0.882	-0.182	11.343	11.380	0.131						
	Mean	0.993	0.993	-0.002	11.518	11.563	0.388						
+155 deg. C	Std Dev	0.044	0.044	0.083	0.075	0.075	0.146						
		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	1.118	1.120	0.297	17.808	17.518	-0.583						
	Minimum	0.878	0.880	0.119	17.299	16.744	-3.208						
	Mean	0.989	0.991	0.187	17.530	17.184	-1.972						
	Std Dev	0.044	0.044	0.040	0.133	0.165	0.669						

14	Vibration	IEC-60068 PART 2-6 TEST GROUP Fc. With precondition per 0 above	Pulse Shape-sine wave range of frequency 1 10-55Hz. Amplitude ±0.75mm Range of frequency 2 55-2000Hz Amplitude; 10G Frequency Sweep: 1 oct./min. Duration: 24 h each of 3 axis. Initial and final readings at LT/RT/HT	L=±20% of initial, DCR ≈±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	1.073	1.075	0.654	8.011	8.082	2.861
Minimum	0.853	0.854	0.088	7.573	7.634		-0.469						
Mean	0.977	0.979	0.185	7.761	7.852		1.185						
Std Dev	0.047	0.047	0.100	0.106	0.122		0.931						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	1.086	1.087	0.747	11.716	11.712	0.430						
	Minimum	0.853	0.860	0.066	11.340	11.355	-0.035						
	Mean	0.984	0.986	0.226	11.504	11.512	0.071						
+155 deg. C	Std Dev	0.049	0.048	0.150	0.081	0.077	0.091						
		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	1.086	1.089	0.650	17.769	17.717	0.549						
	Minimum	0.852	0.854	0.157	17.239	17.092	-1.328						
	Mean	0.981	0.983	0.266	17.516	17.436	-0.458						
	Std Dev	0.049	0.049	0.086	0.132	0.143	0.484						



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									Inductance (μH)			DC Resistance (mΩ)		
									Initial	Final	%Δ	Initial	Final	%Δ
							-55 deg. C	Maximum	1.045	1.044	0.031	7.938	8.286	6.859
Mimimum	0.888	0.887	-0.189	7.544	7.861	1.293								
Mean	0.976	0.976	-0.067	7.753	8.069	4.086								
Std Dev	0.038	0.038	0.052	0.106	0.124	1.446								
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ							
	Maximum	1.050	1.052	0.385	11.660	11.764	0.929							
	Mimimum	0.892	0.894	0.066	11.341	11.411	0.407							
	Mean	0.981	0.983	0.182	11.495	11.570	0.652							
Std Dev	0.038	0.038	0.084	0.070	0.074	0.138								
+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ							
	Maximum	1.047	1.049	0.301	17.741	17.403	-0.463							
	Mimimum	0.891	0.892	0.137	17.243	16.774	-3.046							
	Mean	0.978	0.980	0.208	17.469	17.150	-1.825							
	Std Dev	0.037	0.037	0.041	0.132	0.139	0.670							

15	Resistance to Solder Heat	MIL-STD-202G Method 210F Condition K	IR/convection reflow. 250 ± 5°C for 30 ± 5sec. Ramp rate 1°C/s to 4°C/s; Above 183°C for 90s-120s	L= ±20% of initial, DCR =±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						+25 deg. C	Maximum	1.051	1.037	-0.119	11.616	11.603	0.087
							Mimimum	0.946	0.943	-1.570	11.372	11.359	-0.449
							Mean	0.997	0.990	-0.663	11.523	11.507	-0.141
Std Dev	0.030	0.027	0.332	0.062	0.061		0.147						

17	ESD	AEC-Q200-002	Determine the Classification of the part.	L= ±20% of initial, DCR =±20% of initial	15			Inductance (μH)			DC Resistance (mΩ)		
								Initial	25KV	%Δ	Initial	25KV	%Δ
						+25 deg. C	Maximum	1.077	1.081	0.529	11.686	11.788	1.245
							Mimimum	0.891	0.895	0.193	11.493	11.578	0.464
							Mean	0.999	1.002	0.365	11.591	11.679	0.751
Std Dev	0.044	0.044	0.086	0.061	0.063		0.192						

18	Solderability	J-STD-002C Method B1	4 hours @ 155°C dry heat @ 255°C. 90° dipping angle.	95% or greater coverage on "A" (seating plane) per J-STD-002C	15	NA	Pass					
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19	Electrical Characterization	User Specification	Min, Max, Mean, and Standard Deviation @ Min (-55C), Room, and Max (+125C) operating temperatures. After mounted, allow +/-5% shift DCR at room temp. -55C/+125C DCR Max calculated using temp conversion for copper: $R_2 = [(T_2 + 234.5) / (234.5 + T_A)] * 1.05R_A$ (A = Ambient, 2 = new con)	Final Test: L=±20% of initial, DCR per calculated limits described in test conditions. L test for -55C & +125C = ±20% initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial			Initial		
						-55 deg. C	Maximum	1.045			7.938		
							Minimum	0.888			7.544		
							Mean	0.976			7.753		
							Std Dev	0.038			0.106		
						+25 deg. C		Initial			Initial		
							Maximum	1.050			11.660		
							Minimum	0.892			11.341		
							Mean	0.981			11.495		
							Std Dev	0.038			0.070		
						+155 deg. C		Initial			Initial		
							Maximum	1.047			17.741		
							Minimum	0.891			17.243		
							Mean	0.978			17.469		
							Std Dev	0.037			0.132		
21	Board Flex	AEC-Q200-005 Appendix 2	2mm minimum flex for 60 (+5) sec	Pass all criteria as defined in DPS-11,865 VA1 L=±20% of initial, DCR =±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						+25 deg. C	Maximum	1.079	1.079	0.105	11.742	11.679	0.276
							Minimum	0.912	0.913	-0.124	11.426	11.357	-0.780
							Mean	0.992	0.992	0.001	11.608	11.557	-0.433
							Std Dev	0.037	0.036	0.059	0.071	0.067	0.234
22	Terminal Strength	AEC-Q200-006 Appendix 1	Force of 1.8kg (17.7 N) for 60 seconds	Pass all criteria as defined in DPS-11,865 VA1 L=±20% of initial, DCR =±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						+25 deg. C	Maximum	1.062	1.064	0.616	11.716	11.647	0.417
							Minimum	0.911	0.912	-0.072	11.355	11.308	-0.414
							Mean	0.993	0.993	0.065	11.557	11.539	-0.149
							Std Dev	0.038	0.038	0.131	0.087	0.085	0.185



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Test #	Description	Ref. Spec. Meth / Cond	Test Conditions	End Point Δ requirements	Sample Size	Meas Temp							
0	3x reflow Preconditioning for lead-free products	ICP 10,373	As specified in sections 6.3 thru 6.4 except Visual per DPS-11,865 10X magnification										
1	Pre- and Post-Stress Electrical Test	IHLP Data Sheet	L (uH) – 100KHz and 250mV DCR – 25°C Ambient	L= ±15% of initial, DCR = ±15% of initial	All tests requiring electrical data								
3	High Temp Exposure	IEC-60068 Part 2-2 test group BA	155C for 2000 hours, unpowered readings at 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at LT/RT/HT LT=Low Temperature=-55°C, RT=Room Temperature=+25°C, HT=High Temperature=+125°C for -A1/1A models. HT=High Temperature =+155° C for -5A models.	L= ±20% of initial, DCR = ±20% of initial	77			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	4.958	5.243	6.901	51.640	50.000	-0.383
							Minimum	4.340	4.639	5.160	49.110	48.290	-4.027
							Mean	4.633	4.917	6.150	50.385	49.294	-2.159
							Std Dev	0.106	0.103	0.440	0.537	0.372	0.911
						+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	4.997	5.282	7.037	74.050	73.840	0.873
							Minimum	4.356	4.663	5.398	72.160	72.070	-1.197
							Mean	4.647	4.947	6.442	73.138	73.042	-0.129
							Std Dev	0.108	0.106	0.292	0.482	0.376	0.532
						+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	5.003	5.422	9.367	112.490	113.310	1.687
							Minimum	4.354	4.752	8.148	109.170	109.330	-0.720
							Mean	4.644	5.055	8.854	110.631	110.933	0.276
							Std Dev	0.110	0.117	0.259	0.853	0.815	0.640



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								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	4.857	4.857	0.163	51.760	50.700	0.488
Mimimum	4.437	4.428	-0.937	49.100	48.590		-3.692						
Mean	4.657	4.654	-0.063	50.206	49.789		-0.822						
Std Dev	0.084	0.084	0.166	0.591	0.488		1.038						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	4.859	4.870	0.578	74.230	74.200	0.480						
	Mimimum	4.421	4.438	-0.106	72.510	72.630	-0.286						
	Mean	4.654	4.666	0.260	73.335	73.311	-0.033						
	Std Dev	0.086	0.085	0.116	0.362	0.329	0.164						
+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	4.858	4.860	0.139	113.760	113.580	1.647						
	Mimimum	4.434	4.424	-1.069	109.650	110.240	-1.061						
	Mean	4.665	4.655	-0.207	111.366	111.486	0.111						
	Std Dev	0.089	0.088	0.288	0.848	0.726	0.657						



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4	Temperature Cycling	IEC-60068, Part 2.14 test group Na	-55°C to +125°C (+155° C for -5A models) dwell time = 30 min. transfer time ≤10 sec. no. of cycles = 1000 unpowered initial (0 cycles) and final 1000 cycles). Readings at LT/RT/HT	L=±20% of initial, DCR = ±20% of initial	77			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	4.973	5.041	2.283	51.990	50.250	-1.098
Mimimum	4.435	4.517	0.580	49.160	48.360		-4.922						
Mean	4.661	4.740	1.697	50.574	49.332		-2.447						
Std Dev	0.111	0.109	0.223	0.620	0.433		0.995						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	4.999	5.070	2.623	74.220	73.990	0.219						
	Mimimum	4.439	4.538	0.531	72.480	72.200	-0.819						
	Mean	4.667	4.760	1.992	73.434	73.135	-0.406						
+155 deg. C	Std Dev	0.116	0.111	0.287	0.371	0.395	0.224						
		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	5.000	5.146	3.926	112.590	113.270	1.342						
	Mimimum	4.436	4.586	1.847	109.410	109.830	-0.488						
Mean	4.664	4.815	3.224	110.843	111.246	0.365							
Std Dev	0.119	0.117	0.276	0.789	0.722	0.493							

7	Biased Humidity	IEC-60068 Part 2-67	Temperature = 85°C ±20°C Humidity = 85% ±5% RH Duration = 1000 hours Pow er = No Power Initial (0hr.) and final (1000hr.) readings at LT/RT/HT	L=±20% of initial, DCR = ±20% of initial	77			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	5.050	5.082	0.947	52.300	51.670	0.401
Mimimum	4.487	4.512	0.230	49.390	49.140		-1.661						
Mean	4.640	4.669	0.615	50.536	50.210		-0.642						
Std Dev	0.092	0.095	0.169	0.569	0.511		0.485						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	5.086	5.075	0.576	74.340	74.360	0.614						
	Mimimum	4.491	4.493	-0.238	72.540	72.440	-0.576						
	Mean	4.650	4.653	0.065	73.439	73.478	0.053						
+155 deg. C	Std Dev	0.098	0.096	0.126	0.373	0.404	0.296						
		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	5.128	5.124	-0.034	112.740	112.960	0.418						
	Mimimum	4.492	4.488	-0.157	109.780	109.330	-0.544						
Mean	4.669	4.665	-0.086	111.138	110.965	-0.156							
Std Dev	0.102	0.102	0.030	0.681	0.718	0.166							



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								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
8	Operational Life	MIL-STD-202, Method 108A	Temperature = 85°C for -1A/A1 models. Temperature =115° C for 5A models. Duration = 2000hrs. Pow er = As noted on the test request. Readings a 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at LT/RT/HT	L= ±20% of initial, DCR =±20% of initial	77	-55 deg. C	Maximum	4.929	5.650	17.817	51.110	55.060	9.333
							Mimimum	4.427	4.554	-2.552	49.640	50.310	-0.099
							Mean	4.647	5.299	14.060	50.372	51.822	2.879
							Std Dev	0.104	0.148	2.763	0.333	0.917	1.747
						+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	4.974	5.661	17.516	74.320	74.050	1.300
							Mimimum	4.439	4.570	-2.897	72.380	71.930	-1.518
							Mean	4.671	5.309	13.667	73.307	73.064	-0.331
						+155 deg. C	Std Dev	0.107	0.148	2.738	0.391	0.487	0.576
								Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	4.993	5.784	20.000	112.050	110.490	8.102
							Mimimum	4.427	4.638	-0.929	100.370	101.860	-6.921
							Mean	4.664	5.414	16.110	103.558	106.639	3.120
							Std Dev	0.110	0.154	3.028	3.873	1.805	4.268
9	External Visual	MIL-STD-883G Method 2009.9	Inspect construction and workmanship.	Pass all criteria as defined in DPS-11,865 VA1	All	na	Pass						
10	Physical Dimensions	JESD22 Method JB-100	Verify physical dimensions per part specification	All parts within dimensional tolerance per data sheet	30	na	Pass						
12	Resistance to Solvents	MIL-STD-202G Method 215K	Add Aqueous wash chemical. OKEM Clean or equivalent. Do not use banned solvents.	Pass all criteria as defined in DPS-11,865 VA1 L= ±20% of initial, DCR =±20% of initial	5	na	Pass						



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13	Mechanical Shock	IEC-60068 part 2.27 test group Ea with precondition per 0 above	Pulse Shape-Half Sine Normal Pulse Length 6ms Peak acceleration-100g No. shocks-6 each in both directions of each axis (total of 36) Initial and final readings at LT/RT/HT	L=±20% of initial, DCR =±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	4.870	4.871	0.153	50.860	52.530	5.105
							Minimum	4.407	4.399	-0.180	49.090	50.260	1.186
							Mean	4.601	4.598	-0.058	49.928	51.399	2.949
							Std Dev	0.111	0.112	0.062	0.477	0.643	1.095
						+25 deg. C	Initial	Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	4.887	4.891	0.437	74.050	74.940	1.348
							Minimum	4.404	4.410	0.061	72.690	73.540	0.987
							Mean	4.606	4.612	0.125	73.338	74.175	1.140
							Std Dev	0.114	0.114	0.064	0.309	0.336	0.115
						+155 deg. C	Initial	Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	4.884	4.892	0.472	112.830	109.860	-1.914
							Minimum	4.387	4.395	0.046	109.450	105.520	-3.772
							Mean	4.594	4.601	0.151	111.322	108.228	-2.780
							Std Dev	0.118	0.116	0.088	0.820	1.199	0.680
						-55 deg. C	Maximum	4.908	4.913	0.178	51.040	52.670	5.948
							Minimum	4.520	4.517	-0.105	48.860	50.620	1.705
							Mean	4.657	4.657	-0.004	49.950	51.714	3.536
							Std Dev	0.099	0.101	0.060	0.538	0.591	1.082
						+25 deg. C	Initial	Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	4.950	4.948	0.074	74.830	74.480	1.807
							Minimum	4.535	4.527	-0.190	72.300	73.360	-0.855
							Mean	4.679	4.676	-0.064	73.402	73.890	0.669
							Std Dev	0.104	0.106	0.072	0.588	0.314	0.682
						+155 deg. C	Initial	Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	4.972	4.969	0.140	113.060	109.800	-2.209
							Minimum	4.511	4.511	-0.114	109.700	106.600	-4.254
							Mean	4.669	4.670	0.019	111.396	108.085	-2.971
							Std Dev	0.114	0.113	0.069	0.755	0.678	0.522



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									Inductance (μH)			DC Resistance (mΩ)		
									Initial	Final	%Δ	Initial	Final	%Δ
Bump	IEC-60068 part 2-29 test group Eb with precondition per 0 above.	Pulse shape: half sine Nominal pulse length: 6 ms Peak Acceleration: 40g No. of shocks: 4000 each mechanical axis. Initial and final readings at LT/RT/HT	L=±20% of initial, DCR =±20% of initial	30	-55 deg. C	Maximum	4.991	4.982	-0.006	50.810	55.190	10.589		
						Minimum	4.488	4.486	-0.173	49.220	53.320	6.839		
						Mean	4.665	4.661	-0.088	49.988	54.296	8.620		
						Std Dev	0.114	0.113	0.047	0.443	0.518	0.928		
					+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ		
						Maximum	5.016	5.017	0.291	74.250	74.550	0.858		
						Minimum	4.487	4.497	0.026	73.090	73.350	-0.041		
						Mean	4.669	4.677	0.175	73.629	73.949	0.434		
					+155 deg. C	Std Dev	0.120	0.119	0.060	0.323	0.326	0.287		
							Initial	Final	%Δ	Initial	Final	%Δ		
						Maximum	5.043	5.041	0.091	112.720	111.430	0.000		
						Minimum	4.475	4.475	-0.104	110.280	108.890	-2.742		
					Mean	4.664	4.665	0.022	111.454	109.900	-1.391			
					Std Dev	0.127	0.126	0.043	0.805	0.612	0.737			
15	Resistance to Solder Heat	MIL-STD-202G Method 210F Condition K	IR/convection reflow. 250 ± 5°C for 30 ± 5sec. Ramp rate 1°C/s to 4°C/; Above 183°C for 90s-120s	L= ±20% of initial, DCR = ±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)			
								Initial	Final	%Δ	Initial	Final	%Δ	
						+25 deg. C	Maximum	4.819	4.826	0.474	74.080	73.960	0.109	
							Minimum	4.422	4.442	0.113	72.850	72.500	-0.819	
							Mean	4.625	4.638	0.270	73.396	73.173	-0.304	
Std Dev	0.105	0.102	0.119	0.272	0.333		0.270							
17	ESD	AEC-Q200-002	Determine the Classification of the part.	L= ±20% of initial, DCR = ±20% of initial	15			Inductance (μH)			DC Resistance (mΩ)			
								Initial	25KV	%Δ	Initial	25KV	%Δ	
						+25 deg. C	Maximum	4.672	4.673	0.349	74.060	73.750	-0.381	
							Minimum	4.494	4.177	-10.304	72.750	72.300	-1.148	
							Mean	4.597	4.557	-0.835	73.417	73.031	-0.530	
Std Dev	0.050	4.177	2.672	0.357	0.399		0.189							
18	Solderability	J-STD-002C Method B1	4 hours @ 155°C dry heat @ 255°C. 90° dipping angle.	95% or greater coverage on "A" (seating plane) per J-STD-002C	15	NA	Pass							



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19	Electrical Characterization	User Specification	Min, Max, Mean, and Standard Deviation @ Min (-55C), Room, and Max (+125C) operating temperatures. After mounted, allow +/-5% shift DCR at room temp. -55C/+125C DCR Max calculated using temp conversion for copper: $R_2 = [(T_2 + 234.5) / (234.5 + T_A)] * 1.05R_A$ (A = Ambient, 2 = new con)	Final Test: L= ±20% of initial, DCR per calculated limits described in test conditions. L test for -55C & +125C = ±20% initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial			Initial		
						-55 deg. C	Maximum	4.991			50.810		
							Minimum	4.488			49.220		
							Mean	4.665			49.988		
							Std Dev	0.114			0.443		
						+25 deg. C		Initial			Initial		
							Maximum	5.016			74.250		
							Minimum	4.487			73.090		
							Mean	4.669			73.629		
							Std Dev	0.120			0.323		
						+155 deg. C		Initial			Initial		
							Maximum	5.043			112.720		
							Minimum	4.475			110.280		
							Mean	4.664			111.454		
							Std Dev	0.127			0.805		
21	Board Flex	AEC-Q200-005 Appendix 2	2mm minimum flex for 60 (+5) sec	Pass all criteria as defined in DPS-11,865 VA1 L= ±20% of initial, DCR = ±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						+25 deg. C	Maximum	4.962	5.036	5.245	73.680	73.490	-0.068
							Minimum	4.326	4.436	-7.495	72.160	71.870	-0.670
							Mean	4.597	4.667	1.604	72.980	72.684	-0.406
							Std Dev	0.172	0.148	3.628	0.379	0.391	0.107
22	Terminal Strength	AEC-Q200-006 Appendix 1	Force of 1.8kg (17.7 N) for 60 seconds	Pass all criteria as defined in DPS-11,865 VA1 L= ±20% of initial, DCR = ±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						+25 deg. C	Maximum	4.851	4.934	2.628	74.020	75.200	1.677
							Minimum	4.439	4.522	1.625	72.700	72.960	0.150
							Mean	4.641	4.725	1.814	73.398	73.979	0.791
							Std Dev	0.105	0.110	0.198	0.365	0.601	0.458



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Test #	Description	Ref. Spec. Meth / Cond	Test Conditions	End Point Δ requirements	Sample Size	Meas Temp								
0	3x reflow Preconditioning for lead-free products	ICP 10,373	As specified in sections 6.3 thru 6.4 except Visual per DPS-11,865 10X magnification											
1	Pre- and Post-Stress Electrical Test	IHLP Data Sheet	L (μ H) – 100KHz and 250mV DCR – 25°C Ambient	L = $\pm 15\%$ of initial, DCR = $\pm 15\%$ of initial	All tests requiring electrical data									
3	High Temp Exposure	IEC-60068 Part 2-2 test group BA	155°C for 2000 hours, unpowered readings at 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at LT/RT/HT LT=Low Temperature=-55°C, RT=Room Temperature=+25°C, HT=High Temperature=+125°C for -A1/1A models. HT=High Temperature =+155° C for -5A models.	L = $\pm 20\%$ of initial, DCR = $\pm 20\%$ of initial	77			Inductance (μ H)			DC Resistance ($m\Omega$)			
								Initial	Final	% Δ	Initial	Final	% Δ	
						-55 deg. C	Maximum	9.912	10.312	4.591	91.730	89.160	-0.147	
							Minimum	8.624	8.979	2.907	86.860	85.910	-3.579	
							Mean	9.256	9.624	3.980	89.151	87.558	-1.780	
							Std Dev	0.275	0.282	0.255	1.095	0.798	0.813	
						+25 deg. C		Initial	Final	% Δ	Initial	Final	% Δ	
							Maximum	9.955	10.356	5.175	131.720	130.680	0.233	
							Minimum	8.647	8.998	1.970	127.700	127.110	-1.008	
							Mean	9.266	9.651	4.159	129.739	129.026	-0.549	
							Std Dev	0.282	0.286	0.555	0.861	0.820	0.258	
						+155 deg. C		Initial	Final	% Δ	Initial	Final	% Δ	
							Maximum	9.931	10.496	6.691	200.360	199.520	0.654	
							Minimum	8.591	9.105	3.929	193.370	192.780	-0.679	
							Mean	9.223	9.768	5.904	196.325	196.030	-0.150	
							Std Dev	0.281	0.293	0.363	1.596	1.577	0.356	



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								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						-55 deg. C	Maximum	10.089	10.119	0.301	92.460	89.860	-0.349
Mimimum	8.438	8.429	-0.949	87.510	85.950		-4.209						
Mean	9.283	9.271	-1.656	89.585	88.096		-1.656						
Std Dev	0.319	0.319	0.965	1.002	0.847		0.965						
+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	10.182	10.198	0.508	131.390	131.210	0.441						
	Mimimum	8.414	8.443	-0.091	127.860	127.750	-0.556						
	Mean	9.289	9.308	0.209	129.686	129.510	-0.136						
	Std Dev	0.330	0.327	0.111	0.729	0.775	0.212						
+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ						
	Maximum	10.217	10.210	0.215	199.350	200.900	1.639						
	Mimimum	8.375	8.379	-0.223	191.880	193.820	-0.284						
	Mean	9.253	9.257	0.039	195.618	196.708	0.559						
	Std Dev	0.332	0.332	0.061	1.559	1.322	0.524						



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								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
4	Temperature Cycling	IEC-60068, Part 2.14 test group Na	-55°C to +125°C (+155° C for -5A models) dwell time = 30 min. transfer time ≤10 sec. no. of cycles = 1000 unpowered initial (0 cycles) and final 1000 cycles). Readings at LT/RT/HT	L= ±20% of initial, DCR = ±20% of initial	77	-55 deg. C	Maximum	10.260	10.278	1.475	92.860	88.850	-0.996
							Minimum	8.554	8.662	0.178	87.170	84.890	-5.405
							Mean	9.285	9.379	1.006	89.831	87.294	-2.813
							Std Dev	0.317	0.315	0.186	1.194	0.770	1.116
								Initial	Final	%Δ	Initial	Final	%Δ
						+25 deg. C	Maximum	10.293	10.320	1.480	132.010	130.610	0.210
							Minimum	8.577	8.679	0.260	128.150	126.810	-1.871
							Mean	9.303	9.384	0.881	129.931	129.078	-0.655
							Std Dev	0.319	0.316	0.390	0.901	0.810	0.390
								Initial	Final	%Δ	Initial	Final	%Δ
						+155 deg. C	Maximum	10.271	10.491	2.564	198.468	200.850	1.708
							Minimum	8.523	8.727	1.225	190.910	193.120	-0.274
							Mean	9.254	9.433	1.937	195.468	196.509	0.534
							Std Dev	0.324	0.329	0.230	1.712	1.608	0.520
	Initial	Final	%Δ	Initial	Final		%Δ						

								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
7	Biased Humidity	IEC-60068 Part 2-67	Temperature = 85°C ±20°C Humidity = 85% ±5% RH Duration = 1000 hours Power = No Power Initial (0hr.) and final (1000hr.) readings at LT/RT/HT	L= ±20% of initial, DCR = ±20% of initial	77	-55 deg. C	Maximum	9.769	9.794	0.399	92.280	90.610	0.425
							Minimum	8.820	8.836	0.119	87.620	87.090	-1.848
							Mean	9.285	9.309	0.261	89.501	89.005	-0.550
							Std Dev	0.242	0.243	0.051	0.971	0.787	0.571
								Initial	Final	%Δ	Initial	Final	%Δ
						+25 deg. C	Maximum	9.786	9.767	0.360	131.660	131.710	0.468
							Minimum	8.779	8.809	-0.398	128.100	128.080	-0.278
							Mean	9.274	9.272	-0.021	129.977	130.009	0.025
							Std Dev	0.249	0.242	0.169	0.796	0.836	0.127
								Initial	Final	%Δ	Initial	Final	%Δ
						+155 deg. C	Maximum	9.749	9.744	0.448	200.520	200.480	0.792
							Minimum	8.787	192.550	-0.196	192.290	192.550	-0.216
							Mean	9.243	196.588	0.043	196.123	196.588	0.238
							Std Dev	0.245	1.642	0.158	1.746	1.642	0.274
	Initial	Final	%Δ	Initial	Final		%Δ						



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								Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
8	Operational Life	MIL-STD-202, Method 108A	Temperature = 85°C for -1A/A1 models. Temperature =115° C for -5A models. Duration = 2000hrs. Power = As noted on the test request. Readings a 0, 250, 500, 1000 and 2000 hour intervals. Initial (0 hr.) and final (2000 hr.) readings at L/T/RT/HT	L= ±20% of initial, DCR =±20% of initial	77	-55 deg. C	Maximum	10.519	11.243	17.935	90.840	92.150	3.882
							Mimimum	8.237	8.987	3.723	86.770	86.240	-2.685
							Mean	9.219	10.142	10.017	89.219	88.140	-1.208
							Std Dev	0.393	0.434	1.845	0.725	1.102	1.064
						+25 deg. C		Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	10.630	11.359	17.495	131.790	131.660	1.406
							Mimimum	8.270	9.052	3.974	127.340	126.520	-2.432
							Mean	9.259	10.209	10.280	129.994	129.379	-0.473
						+155 deg. C		Initial	Final	%Δ	Initial	Final	%Δ
							Maximum	10.621	11.579	19.534	199.390	198.810	1.993
							Mimimum	8.213	9.150	6.510	191.480	183.880	-7.398
							Mean	9.187	10.340	12.575	196.029	195.554	-0.239
						Std Dev	0.406	0.452	1.850	1.689	2.263	1.135	
9	External Visual	MIL-STD-883G Method 2009.9	Inspect construction and workmanship.	Pass all criteria as defined in DPS-11,865 VA1	All	na	Pass						
10	Physical Dimensions	JESD22 Method JB-100	Verify physical dimensions per part specification	All parts within dimensional tolerance per data sheet	30	na	Pass						
12	Resistance to Solvents	MIL-STD-202G Method 215K	Add Aqueous wash chemical. OKEM Clean or equivalent. Do not use banned solvents.	Pass all criteria as defined in DPS-11,865 VA1 L= ±20% of initial, DCR = ±20% of initial	5	na	Pass						



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									Inductance (μH)			DC Resistance (mΩ)		
									Initial	Final	%Δ	Initial	Final	%Δ
							-55 deg. C	Maximum	10.051	10.052	0.176	90.040	93.930	5.658
Mimimum	8.655	8.651	-1.141	86.300	89.020	1.634								
Mean	9.247	9.237	-0.107	88.418	91.456	3.434								
Std Dev	0.292	0.295	0.227	0.943	1.461	1.069								
	Initial	Final	%Δ	Initial	Final	%Δ								
+25 deg. C	Maximum	10.096	10.067	-0.022	131.300	133.040	1.422							
	Mimimum	8.671	8.670	-0.297	128.320	129.890	1.050							
	Mean	9.277	9.263	-0.156	129.551	131.127	1.216							
	Std Dev	0.297	0.293	0.068	0.855	0.904	0.102							
		Initial	Final	%Δ	Initial	Final	%Δ							
+155 deg. C	Maximum	10.036	10.051	0.274	200.010	194.960	-1.741							
	Mimimum	8.620	8.630	0.040	193.430	186.370	-5.616							
	Mean	9.219	9.232	0.145	196.612	189.431	-3.649							
	Std Dev	0.296	0.296	0.056	1.760	2.311	1.111							
		Initial	Final	%Δ	Initial	Final	%Δ							

									Inductance (μH)			DC Resistance (mΩ)		
									Initial	Final	%Δ	Initial	Final	%Δ
							-55 deg. C	Maximum	9.693	9.732	0.401	90.020	91.870	3.710
Mimimum	8.473	8.466	-0.109	86.820	87.940	-0.111								
Mean	9.202	9.205	0.037	88.397	89.966	1.779								
Std Dev	0.278	0.281	0.097	0.908	1.019	1.046								
	Initial	Final	%Δ	Initial	Final	%Δ								
+25 deg. C	Maximum	9.738	9.726	-0.092	131.090	132.420	1.404							
	Mimimum	8.486	8.473	-0.196	128.460	129.780	0.995							
	Mean	9.240	9.226	-0.154	129.512	131.033	1.174							
	Std Dev	0.286	0.285	0.122	0.650	0.666	0.122							
		Initial	Final	%Δ	Initial	Final	%Δ							
+155 deg. C	Maximum	9.692	9.700	0.387	200.370	198.610	-0.025							
	Mimimum	8.413	8.427	-0.168	194.080	192.990	-1.864							
	Mean	9.173	9.174	0.015	196.489	195.063	-0.724							
	Std Dev	0.287	0.285	0.129	1.421	1.426	0.468							
		Initial	Final	%Δ	Initial	Final	%Δ							



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									Inductance (μH)			DC Resistance (mΩ)		
									Initial	Final	%Δ	Initial	Final	%Δ
							-55 deg. C	Maximum	9.826	9.808	-0.115	92.860	92.740	0.549
Minimum	8.484	8.468	-0.325	85.640	86.110	-1.408								
Mean	9.196	9.176	-0.216	88.317	87.989	-0.367								
Std Dev	0.314	0.312	0.059	1.526	1.367	0.586								
+25 deg. C	Initial	Initial	Final	%Δ	Initial	Final	%Δ							
	Maximum	9.892	9.885	0.030	133.950	135.910	2.519							
	Minimum	8.507	8.508	-0.166	130.020	127.690	-2.268							
	Mean	9.225	9.223	-0.024	131.647	131.614	-0.023							
+155 deg. C	Std Dev	0.318	0.317	0.039	0.975	1.791	1.307							
	Initial	Initial	Final	%Δ	Initial	Final	%Δ							
	Maximum	9.886	9.885	0.057	196.700	196.070	0.383							
	Minimum	8.452	8.454	-0.114	190.000	188.170	-2.024							
Std Dev	9.169	9.167	-0.025	193.229	191.616	-0.834								
	0.326	0.325	0.039	1.723	1.985	0.723								
15	Resistance to Solder Heat	MIL-STD-202G Method 210F Condition K	IR/convection reflow. 250 ± 5°C for 30 ± 5sec. Ramp rate 1°C/s to 4°C/s; Above 183°C for 90s-120s	L= ±20% of initial, DCR = ±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)			
								Initial	Final	%Δ	Initial	Final	%Δ	
						+25 deg. C	Maximum	9.953	9.913	1.194	131.140	130.670	-0.191	
							Minimum	8.747	8.815	-0.397	127.910	127.560	-0.425	
							Mean	9.311	9.350	0.423	129.868	129.455	-0.318	
Std Dev	0.289	0.270	0.339	0.788	0.781		0.059							
17	ESD	AEC-Q200-002	Determine the Classification of the part.	L= ±20% of initial, DCR = ±20% of initial	15			Inductance (μH)			DC Resistance (mΩ)			
								Initial	25KV	%Δ	Initial	25KV	%Δ	
						+25 deg. C	Maximum	10.046	9.754	-0.923	131.790	131.120	-0.276	
							Minimum	8.856	8.532	-5.368	128.750	128.290	-0.531	
							Mean	9.319	9.094	-2.398	130.147	129.632	-0.395	
Std Dev	4.539	0.300	1.374	0.757	0.743		0.087							
18	Solderability	J-STD-002C Method B1	4 hours @ 155°C dry heat @ 255°C. 90° dipping angle.	95% or greater coverage on "A" (seating plane) per J-STD-002C	15	NA	Pass							



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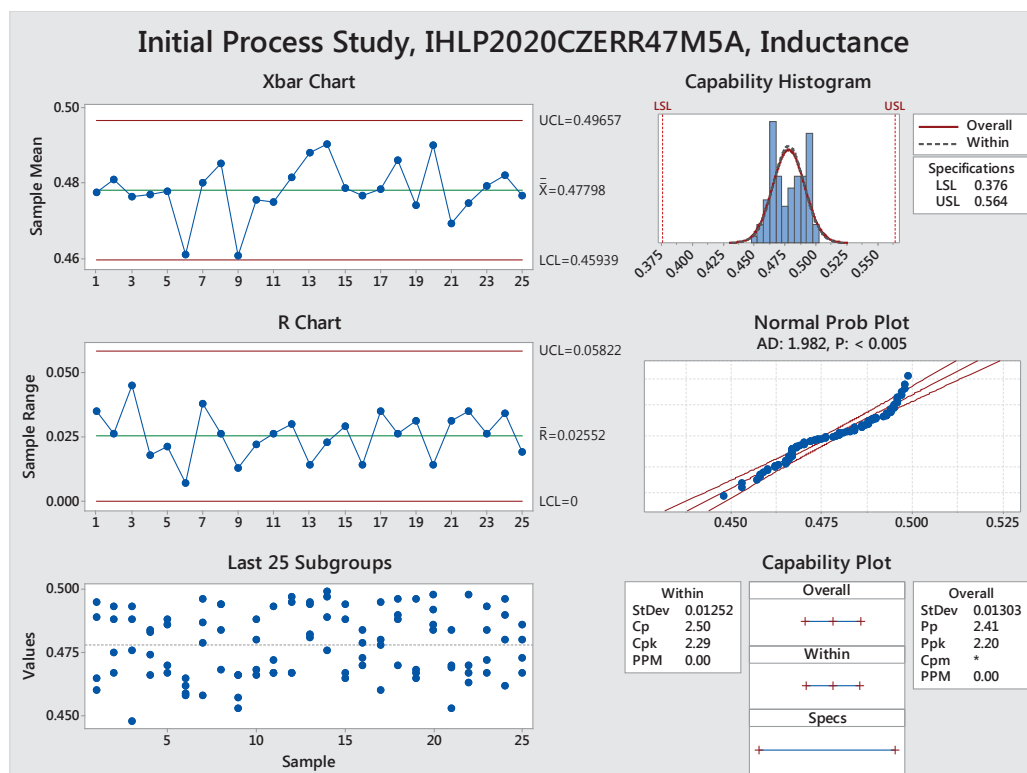
19	Electrical Characterization	User Specification	Min, Max, Mean, and Standard Deviation @ Min (-55C), Room, and Max (+125C) operating temperatures. After mounted, allow +/-5% shift DCR at room temp. -55C/+125C DCR Max calculated using temp conversion for copper: $R_2 = [(T_2 + 234.5) / (234.5 + T_A)] * 1.05R_A$ (A = Ambient, 2 = new con)	Final Test: L = ±20% of initial, DCR per calculated limits described in test conditions. L test for -55C & +125C = ±20% initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial			Initial		
						-55 deg. C	Maximum	9.826			92.860		
							Minimum	8.484			85.640		
							Mean	9.196			88.317		
							Std Dev	0.314			1.526		
						+25 deg. C		Initial			Initial		
							Maximum	9.892			133.950		
							Minimum	8.507			130.020		
							Mean	9.225			131.647		
							Std Dev	0.318			0.975		
						+155 deg. C		Initial			Initial		
							Maximum	9.886			196.700		
							Minimum	8.452			190.000		
							Mean	9.169			193.229		
							Std Dev	0.326			1.723		
21	Board Flex	AEC-Q200-005 Appendix 2	2mm minimum flex for 60 (+5) sec	Pass all criteria as defined in DPS-11,865 VA1 L = ±20% of initial, DCR = ±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						+25 deg. C	Maximum	9.775	9.711	2.102	130.720	130.120	0.109
							Minimum	8.739	8.754	-3.163	127.140	126.650	-0.515
							Mean	9.290	9.339	0.549	128.770	128.288	-0.374
							Std Dev	0.292	0.275	1.536	0.823	0.807	0.101
22	Terminal Strength	AEC-Q200-006 Appendix 1	Force of 1.8kg (17.7 N) for 60 seconds	Pass all criteria as defined in DPS-11,865 VA1 L = ±20% of initial, DCR = ±20% of initial	30			Inductance (μH)			DC Resistance (mΩ)		
								Initial	Final	%Δ	Initial	Final	%Δ
						+25 deg. C	Maximum	10.268	10.437	1.653	131.210	131.210	0.062
							Minimum	8.575	8.678	1.087	128.030	128.040	-0.176
							Mean	9.287	9.409	1.310	129.789	129.772	-0.013
							Std Dev	0.335	0.345	0.142	0.799	0.782	0.052

Production Part Approval Process

The following PPAP documentation is assembled according to
AIAG, 4th Edition PPAP Manual and applicable customer requirements

Initial Process Study IHLP2020CZERR47M5A, Inductance

Inductance (uH)							
1	0.495	26	0.458	51	0.482	76	0.465
2	0.489	27	0.479	52	0.495	77	0.498
3	0.46	28	0.487	53	0.497	78	0.484
4	0.465	29	0.494	54	0.499	79	0.492
5	0.493	30	0.468	55	0.489	80	0.486
6	0.488	31	0.484	56	0.476	81	0.453
7	0.475	32	0.494	57	0.465	82	0.484
8	0.467	33	0.466	58	0.488	83	0.469
9	0.448	34	0.457	59	0.467	84	0.47
10	0.476	35	0.466	60	0.494	85	0.463
11	0.493	36	0.453	61	0.479	86	0.467
12	0.488	37	0.468	62	0.47	87	0.498
13	0.474	38	0.466	63	0.484	88	0.47
14	0.466	39	0.488	64	0.473	89	0.467
15	0.484	40	0.48	65	0.478	90	0.493
16	0.483	41	0.472	66	0.495	91	0.472
17	0.467	42	0.467	67	0.48	92	0.484
18	0.47	43	0.467	68	0.46	93	0.462
19	0.488	44	0.493	69	0.496	94	0.49
20	0.486	45	0.467	70	0.47	95	0.496
21	0.465	46	0.495	71	0.488	96	0.48
22	0.462	47	0.467	72	0.49	97	0.486
23	0.459	48	0.497	73	0.467	98	0.473
24	0.458	49	0.494	74	0.468	99	0.467
25	0.496	50	0.481	75	0.496	100	0.48

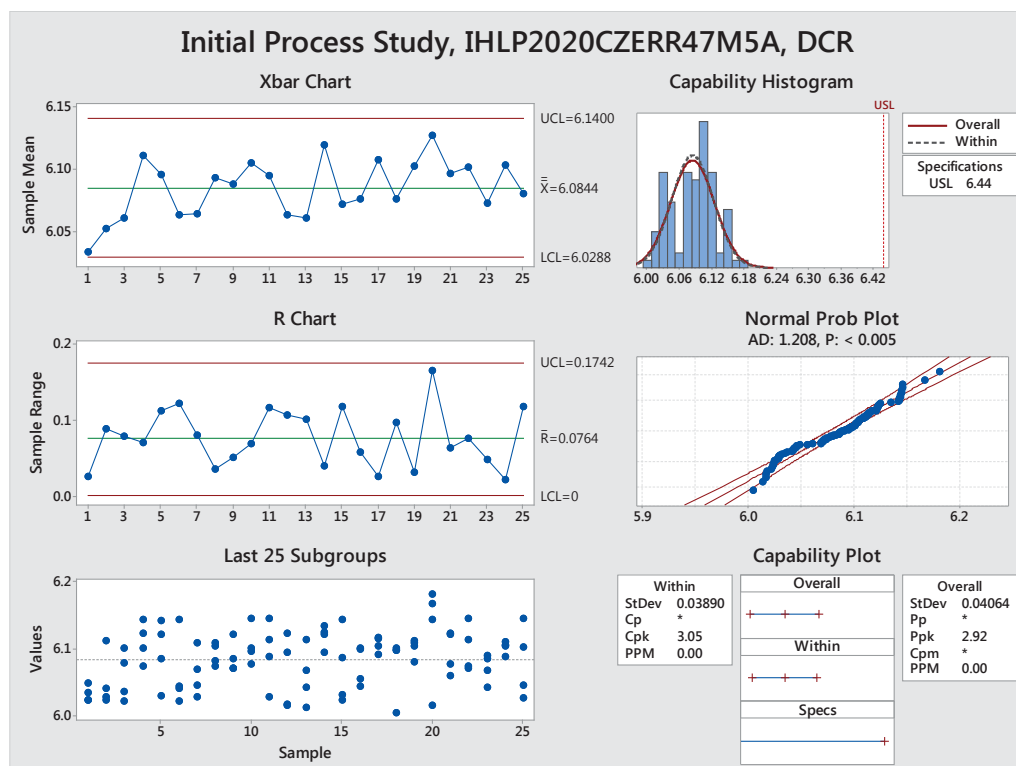


Production Part Approval Process

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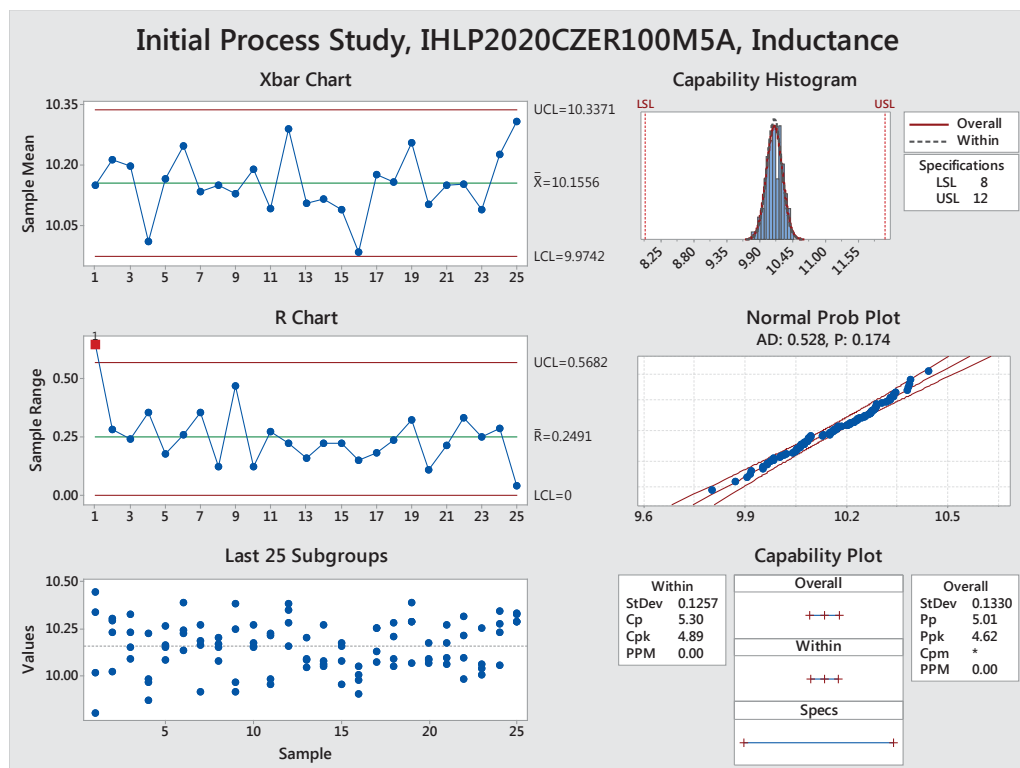
Initial Process Study IHLP2020CZERR47M5A, DC Resistance

DCR							
1	6.049	26	6.109	51	6.014	76	6.081
2	6.035	27	6.029	52	6.114	77	6.143
3	6.025	28	6.07	53	6.135	78	6.017
4	6.024	29	6.109	54	6.122	79	6.167
5	6.029	30	6.074	55	6.095	80	6.181
6	6.112	31	6.083	56	6.125	81	6.078
7	6.024	32	6.104	57	6.143	82	6.124
8	6.042	33	6.072	58	6.025	83	6.121
9	6.023	34	6.121	59	6.032	84	6.061
10	6.037	35	6.071	60	6.087	85	6.074
11	6.08	36	6.086	61	6.045	86	6.146
12	6.101	37	6.096	62	6.102	87	6.114
13	6.144	38	6.146	63	6.099	88	6.071
14	6.123	39	6.077	64	6.056	89	6.069
15	6.074	40	6.101	65	6.116	90	6.043
16	6.101	41	6.088	66	6.092	91	6.091
17	6.03	42	6.114	67	6.117	92	6.086
18	6.122	43	6.029	68	6.105	93	6.104
19	6.086	44	6.145	69	6.098	94	6.111
20	6.142	45	6.123	70	6.005	95	6.106
21	6.144	46	6.017	71	6.102	96	6.089
22	6.022	47	6.018	72	6.098	97	6.103
23	6.041	48	6.095	73	6.105	98	6.046
24	6.044	49	6.043	74	6.109	99	6.027
25	6.046	50	6.069	75	6.112	100	6.145



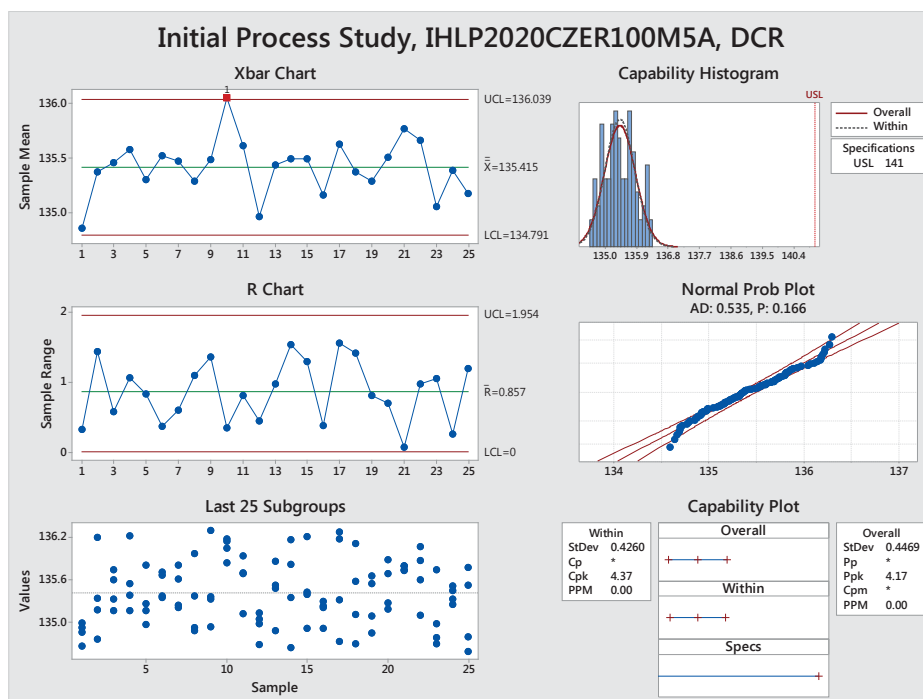
Initial Process Data, IHLP2020CZER100M5A

Inductance (uH)							
1	10.445	26	10.186	51	10.088	76	10.288
2	9.801	27	10.163	52	10.084	77	10.173
3	10.017	28	10.272	53	10.273	78	10.084
4	10.339	29	10.17	54	10.076	79	10.067
5	10.232	30	10.2	55	10.061	80	10.089
6	10.305	31	10.077	56	10.05	81	10.273
7	10.023	32	10.151	57	10.173	82	10.095
8	10.29	33	9.916	58	10.157	83	10.062
9	10.232	34	10.246	59	9.952	84	10.172
10	10.325	35	10.384	60	10.076	85	9.985
11	10.152	36	9.966	61	9.904	86	10.317
12	10.087	37	10.15	62	9.975	87	10.094
13	9.87	38	10.271	63	10.004	88	10.215
14	9.965	39	10.175	64	10.052	89	10.062
15	9.985	40	10.159	65	10.075	90	10.005
16	10.223	41	9.952	66	10.253	91	10.04
17	10.263	42	9.984	67	10.255	92	10.255
18	10.151	43	10.226	68	10.128	93	10.341
19	10.086	44	10.212	69	10.091	94	10.276
20	10.164	45	10.159	70	10.05	95	10.054
21	10.24	46	10.347	71	10.284	96	10.232
22	10.39	47	10.279	72	10.21	97	10.289
23	10.132	48	10.381	73	10.288	98	10.289
24	10.225	49	10.205	74	10.386	99	10.329
25	9.917	50	10.046	75	10.066	100	10.33



Initial Process Data, IHLP2020CZER100M5A

DC Resistance (mΩ)							
1	134.9229	26	135.6136	51	135.8601	76	135.086
2	134.9905	27	135.239	52	134.8833	77	135.6838
3	134.6629	28	135.8082	53	134.6433	78	135.2782
4	134.8603	29	134.9278	54	136.1723	79	135.1895
5	135.3376	30	135.9708	55	135.8178	80	135.8881
6	135.1741	31	135.3693	56	135.3503	81	135.748
7	134.7674	32	134.8788	57	135.4273	82	135.8003
8	136.2005	33	136.2947	58	134.9192	83	135.7284
9	135.3264	34	135.334	59	135.3984	84	135.8022
10	135.7401	35	135.365	60	136.213	85	136.0663
11	135.6048	36	134.9397	61	135.2943	86	135.8724
12	135.1698	37	135.8381	62	134.9113	87	135.6022
13	136.2249	38	136.0452	63	135.2135	88	135.0989
14	135.3825	39	136.1462	64	135.2308	89	134.7883
15	135.5488	40	136.1801	65	136.1841	90	134.9829
16	135.1599	41	135.6972	66	134.7246	91	135.7466
17	135.8064	42	135.6916	67	135.3217	92	134.698
18	135.1699	43	135.1239	68	136.2756	93	135.2536
19	135.263	44	135.9339	69	134.6998	94	135.4442
20	134.9733	45	134.9778	70	136.1099	95	135.5135
21	135.346	46	135.0475	71	135.1069	96	135.3252
22	135.6612	47	134.6864	72	135.5828	97	135.5255
23	135.3758	48	135.132	73	134.8534	98	134.7986
24	135.7116	49	135.4848	74	135.6573	99	134.5918
25	135.2138	50	135.5245	75	135.5512	100	135.778



Production Part Approval Process

**The following PPAP documentation is assembled according to
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Use the control buttons below to navigate through the PPAP sections.

Section 12: Qualified Laboratories

Vishay / Dale Electronics

1505 East Hwy 50 Yankton, SD 57078, USA Phone (605) 665-9301 Fax (605) 668-4247

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DISCRETE SEMICONDUCTORS AND PASSIVE COMPONENTS

Production Part Approval Process

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Section 13: Appearance Approval Report

Inductors, like many other electronic components are specified for their electrical properties. There are no specific requirements stated for the physical appearance of inductors, e.g. color of inductors. Therefore, the Appearance Approval Report does not apply in this case.

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Section 14: Sample Product

Sample product from the Vishay Manufacturing Facility is available upon request

Production Part Approval Process

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Section 15: Master Sample

Master Sample(s) will be retained at the Vishay Manufacturing Facility with a copy of the PPAP

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Production Part Approval Process

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[Section 16: Checking Aids](#)

Checking Aids are not required for this electronic component

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Section 17: Records of Compliance

Moisture Sensitivity Level: 1

Production Part Approval Process

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Use the control buttons below to navigate through the PPAP sections.

[Section 19: Bulk Material Requirements](#)

Bulk Material Requirements do not apply to this Electronic Component.

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IHLP Standards of Manufacture

IHLP INTRODUCTION SURFACE IRREGULARITIES CRITERIA FOR REJECTION SUMMARY

INTRODUCTION

Scope

This document was written for the purpose of helping customers better understand the product they are purchasing. It will give the customer an idea as to the type of cosmetic irregularities that may occur from time to time during the manufacture of the component itself or during customer use of the component.

This document also discusses the criteria that have been developed for rejection of irregularities that are determined to be excessive.

While it would be desirable to have cosmetically perfect IHLP inductors, the powdered iron manufacturing technique has cosmetic limitations.

Certified test labs have performed extensive environmental testing on IHLP's with and without cosmetic imperfections according to AEC-Q200 standards for such tests as thermal shock, mechanical shock, vibration, humidity and others. This testing has shown that the cosmetic imperfections listed in this document do not affect the performance or reliability of the IHLP inductor. Test results are available upon request.

Product

The IHLP inductor is unique from most inductors. The inductor body is a soft magnetic composite (SMC), not a ferrite. It is made from an iron powder mixture and cemented together using a resin binder. This powder mixture, when pressed around the inductor coil, greatly enhances the electrical properties of the inductor and gives protection from environmental forces. After pressing, the component is cured in an oven to increase the bonding strength of the resin binders with the iron powder, yielding excellent electrical and physical properties.

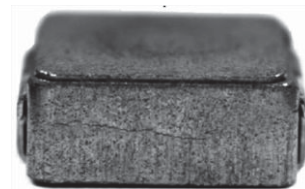
The IHLP inductor provides the best combination of:

- Inductance
- Low Core Loss
- Saturation
- Temperature Stability
- Smallest Footprint
- Lowest Profile

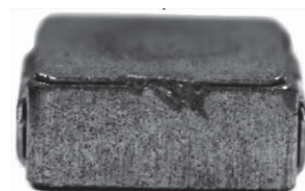
Surface irregularities

The following pages include descriptions of the most common irregularities seen on IHLP inductors. Common causes are described along with variations in their magnitude. Customers may at some time see one or all of these irregularities.

Those that are determined to adversely affect the customer's use of the component are rejected, but minor (acceptable) irregularities will occasionally be present. With the use of this guide, a customer will better understand the effect of each irregularity.



Cracks



Chips



Oxidation

IHLP Standards of Manufacture

CRACKS

Cracks within the inductor body are unavoidable during the manufacturing process. Small cracks are caused by die wall friction when the parts are ejected during the pressing process and by expansion of the coil during the process of curing the resin binder in the powdered iron body. Unlike ferrite material, cracks on the IHLP body do not affect the electrical performance of the component.

Reliability testing has shown that even cracks in excess of 0.005" will not cause the component to fail electrically or physically in field application. Acceptance widths are adopted based on the ability to detect cracks both at the component and circuit level.



Terminal area crack, acceptable

Cracks coming from the top corner of the terminal are a normal occurrence and are caused by terminal expansion during curing operations.



Negligible crack, acceptable

Negligible cracks are those that are nearly invisible without magnification.



Minor crack, acceptable

Minor cracks are those that are visible without magnification but are not apparent without close inspection.



Moderate crack, rejectable

Moderate cracks are those that are obvious upon examination and continue across most of the component.



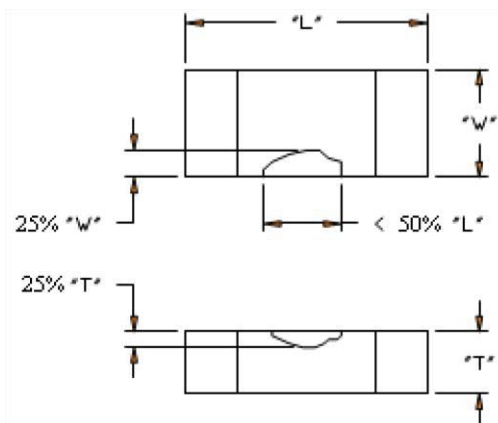
Major crack, rejectable

Major cracks are those that are obvious to a customer and would possibly result in large chip-outs that would expose the coil and lead frame.

IHLP Standards of Manufacture

CHIPS

Chipping of the inductor body can occur during normal processing and testing of the inductor. The acceptance criteria for chipping vary with the size of the component, but current acceptance standards are based on IPCA-610. The effect of chipping is negligible as long as the inductor coil is not showing. See IPC standard for class 1 and 2 components below.



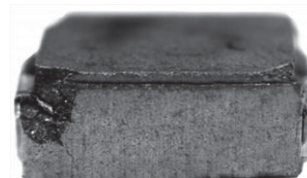
T	25 % of the thickness
W	25 % of the width
L	50 % of the length

Chips typically occur on the edges and corners of the inductor body. They are slightly darker in color and rougher in appearance than the surrounding material.



Minor chipping, acceptable

Minor chips in the inductor body are those that are typically shallow imperfections that occur on the corners and edge of components. No coil wire or lead frame is showing and the chip does not affect the performance or reliability of the component.



Major chipping, rejectable

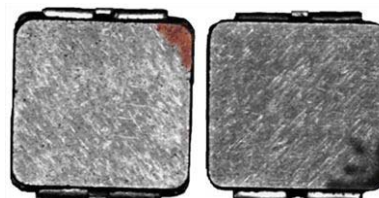
Major chips in the inductor body are those that are very obvious to the customer and may expose the wire coil or lead frame.

OXIDATION

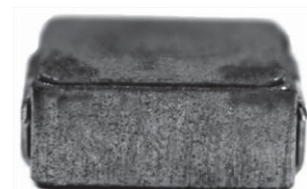
The IHLP inductor is predominately iron and oxidation may occur in a small percentage of the inductors. Resin binders give moderate protection, but some slight oxidation may occur. All components should be stored away from heat, humidity and ionized atmospheres as much as possible before mounting.

Basic steps should be taken in order to limit surface oxidation, including keeping the IHLP inductors sealed in their packaging until PCB mounting.

In the case that oxidation does occur, the effects are contained to the surface of the component and do not penetrate into the core material. No electrical effects have ever been documented due to oxidation of the IHLP product. Oxidation should never be considered a reliability risk.



Top view



Side view

IHLP Standards of Manufacture

OTHER

A very small number of other irregularities have been reported. These occur at an exceedingly low rate and typically do not affect the components electrically. These include:

Foreign material may be seen pressed into the upper terminals. This material is of the same material as the inductor body and should not be a reason for rejection unless solderability is affected.



Foreign material: Acceptable

Scratches may be seen on the surface of the inductor body. Scratches are an acceptable surface irregularity.



Scratch: Acceptable

SUMMARY

The IHLP inductor is comprised of an iron powder body compressed around a coil. Due to the fact that this iron powder body is not solid like ferrite material, irregularities such as cracks and chips do not affect the electrical properties, or the reliability of the component. Criteria have been determined for the acceptability of the components that allow for a robust manufacturing process as well as an acceptable degree of cosmetic irregularity.

Reliability testing has been done on the effects of cracking of the iron powder body and on the oxidation of the iron particles that are present on the surface. Testing has shown no reliability issues from either of these cosmetic differences.



Instructions

ASSEMBLY INSTRUCTIONS

General

This document provides instructions on mounting for the different types of packages, specifically on the different methods of soldering.

If the device is to be mounted near heat-generating components, consideration must be given to the resultant increase in ambient temperature.

Soldering Instructions

Protection against overheating is essential when a device is being soldered. Therefore, the PCB traces should be left as long as possible. The maximum permissible soldering temperature is governed by the maximum permissible heat that may be applied to the package.

The maximum soldering iron (or solder bath) temperatures are given in the individual Datasheets. During soldering, no forces must be transmitted from the pins to the case (e.g., by spreading the pins).

Soldering Methods

There are several methods for soldering devices onto the substrate. The following list is not complete.

a. Soldering in the Vapor Phase

Soldering in saturated vapor is also known as condensation soldering. This soldering process is used as a batch system (dual vapor system) or as a continuous single vapor system. Both systems may also include a pre-heating of the assemblies to prevent high temperature shock and other undesired effects.

b. Infrared Soldering

By using infrared (IR) reflow soldering, the heating is contact-free and the energy for heating the assembly is derived from direct infrared radiation and from convection.

The heating rate in an IR furnace depends on the absorption coefficients of the material surfaces and on the ratio of component's mass to an As-irradiated surface.

The temperature of parts in an IR furnace, with a mixture of radiation and convection, cannot be determined in advance. Temperature measurement may be performed by measuring the temperature of a certain component while it is being transported through the furnace.

The temperatures of small components, soldered together with larger ones, may rise up to 280 °C.

Influencing parameters on the internal temperature of the component are as follows:

- Time and power
- Mass of the component
- Size of the component
- Size of the printed circuit board
- Absorption coefficient of the surfaces
- Packing density
- Wavelength spectrum of the radiation source
- Ratio of radiated and convected energy

As a general rule of thumb, maximum temperature should be reached within 360 s and time above solder liquids temperature should be reached in less than 180 s.

Temperature/time profiles of the entire process and the influencing parameters are given. The IR reflow profile is shown in Figure 1.

c. Wave Soldering

In wave soldering one or more continuously replenished waves of molten solder are generated, while the substrates to be soldered are moved in one direction across the crest of the wave. Maximum soldering temperature should not exceed 260 °C for 20 s.

d. Iron Soldering

This process cannot be carried out in a controlled situation. It should therefore not be used in applications where reliability is important. There is no SMD classification for this process.

CLEANING INSTRUCTIONS

A no clean solder system is recommended for IHLP's.

If cleaning must be performed, an Isopropyl alcohol is recommended. If de-ionized Water Wash is used insure it is followed by a thorough warm air dry cycle to avoid oxidation.

Some cleaning solutions, especially those containing non-linear alcohol will attack the IHLP and should be avoided. It is recommended that any chemical cleaning solution be thoroughly rinsed with clean water. The IHLP should be tested for compatibility with any cleaning solution before production assembly.

TYPICAL REFLOW SOLDERING PROFILE

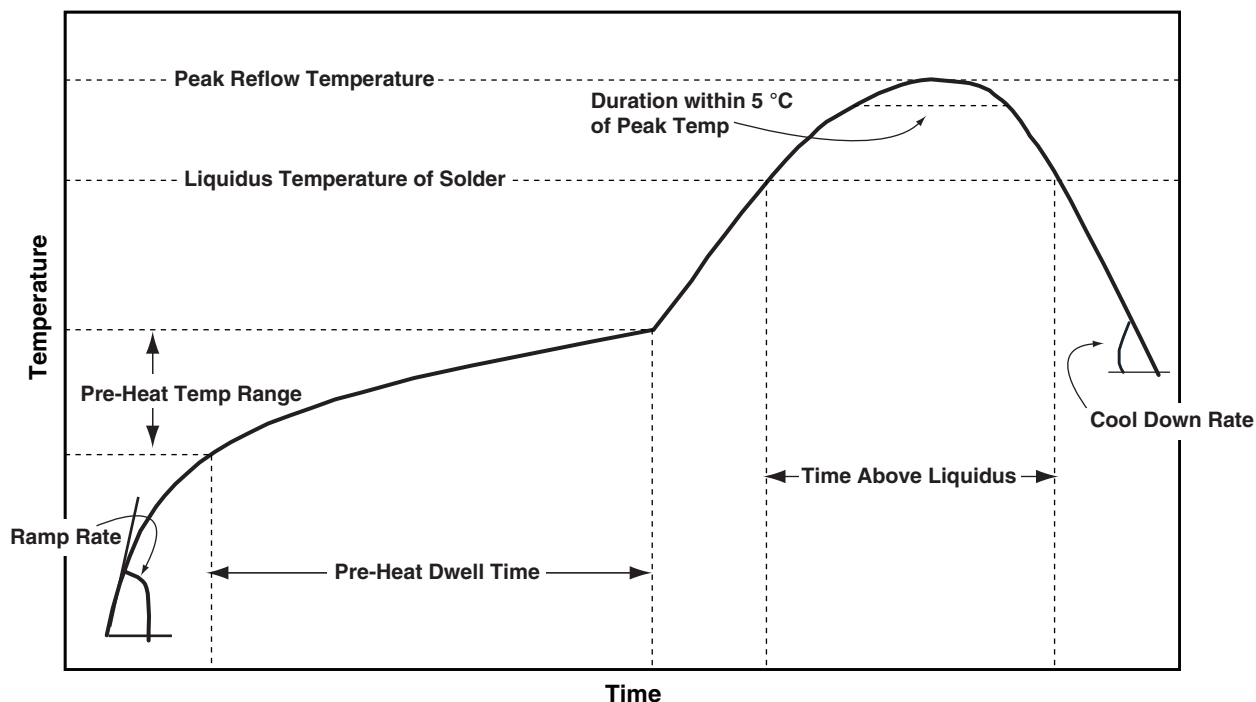


Fig. 1 - Infrared reflow soldering (SMD package)

LEAD (Pb)-FREE SOLDER (SnAgCu) REFLOW PROFILE ATTRIBUTES	
PROFILE ATTRIBUTE	PROFILE ATTRIBUTE
Peak Reflow Temperature	255 (± 5) °C
Time within 5 °C of Peak Temperature	30 s max.
Liquidus Temperature of Solder	~ 217 °C
Cool Down Rate	6 °C/s max.
Time above Liquidus	60 s to 150 s
Pre-heat Temperature Range	150 °C to 200 °C
Pre-heat Dwell Time	60 s to 120 s
Maximum Ramp Rate	3 °C/s max.