ICL8810 116 W AC-DC reference design with IPD80R280P7

For battery charger with 115 V AC to 230 V AC nominal input and 30 V to 58 V constant current (CC) output up to 2 A load current

ER_2308_PL21_2309_093427

About this document

Scope and purpose

This document is an engineering report for the 116 W AC-DC converter reference design (orderable part number: REF_ICL8810_116W_BPA), which uses Infineon's ICL8810 flyback controller and IPD80R280P7 MOSFET.

This reference design board can be used for battery charging applications by adding both the battery safety switch and the charging profile control circuits externally. See the test setup and safety information section of this document for more information.

Intended audience

This document is intended for power supply design engineers, application engineers, and users of the 116 W AC-DC reference design board.

Table of contents

1 Test setup and safety information

This AC-DC reference design is a flyback converter with secondary-side regulated (SSR) constant current (CC) output. The CC output set-point is adjustable with a 0 to 3 V analog input signal.

As shown in Figure 1, to use this reference design board for battery charging application testing, you must add both the battery safety switch and the charging profile control circuits externally, which work according to the board and battery specification.

Attention: ***For safety reasons, it is prohibited to connect this reference design board to any battery without adding the battery safety switch and charging profile control circuits externally.***

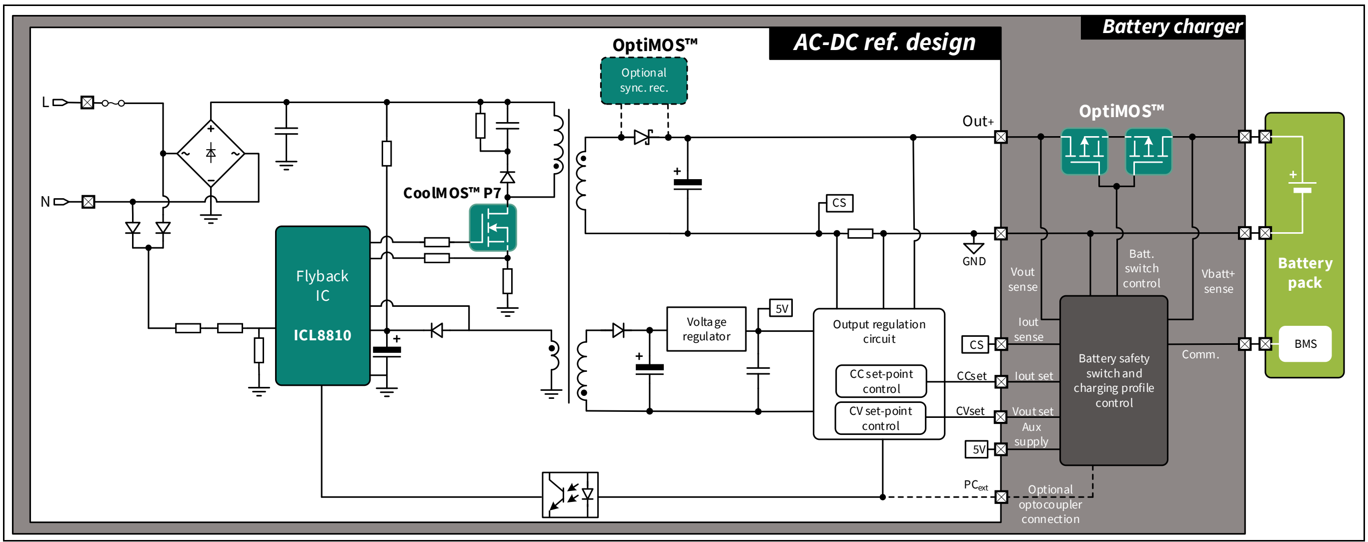


Figure 1 Test setup of AC-DC reference design with connections to external battery safety switch and charging profile control circuits, for battery charging application testing

Alternatively, a test setup using the electronic load (in constant voltage/CV mode) and DC source (for adjusting the CC set point) can be done based on Figure 2.

Figure 2 Test setup with electronic load and adjustable CC set point using DC source

Attention: ***Dangerous voltages are present on this reference design. Do not operate the board unless you are trained to handle high-voltage (HV) circuits. Do not leave this board unattended when it is powered up.***

Test setup and safety information

For EMI testing with full output power of 116 W, the test setup in Figure 3 is recommended.

Figure 3 EMI test setup with full output power

For no-load system standby power measurement, the test setup in Figure 4 is recommended.

Figure 4 No-load system standby power test setup

2 Design features

- Secondary-side regulation (SSR), with adjustable constant current (CC) output set-point from 0 to 2 A
- Supports wide output load range from 24 to 58 V (see Board specifications for details)
- High efficiency and low EMI with quasi-resonant (QR) valley switching
- Cost-effective flyback MOSFET with high performance, using CoolMOS™ P7 in SOT-223 package
- Full power efficiency more than 91 percent at 230 V_{RMS} AC input
- Four-point average efficiency more than 89 percent at high-line input voltage range and full power output
- Burst mode with reduced gate driver output voltage for lower standby power
- System standby power less than 300 mW for whole input voltage and range
- Power factor more than 0.9 for the whole input voltage range and full power output
- Harmonic current emissions under the limits specified by IEC 61000-3-2 Class A
- Adaptive brown-out level triggering based on bus voltage ripple to better protect primary components from overheating and saturation with higher brown-out level at higher power transfer
- Comprehensive set of protections: internal overtemperature protection (OTP), output overvoltage protection (OVP), V_{CC} OVP, primary-side overcurrent protection (OCP), brown-in and brown-out protection
- Soft-start to reduce component stress during turn-on

3 Board specifications

Table 1 lists the electrical specifications of the evaluation board.

Table 1 Electrical specifications

Specification	Symbol	Value	Unit
Normal operational AC input voltage	V AC	90 to 264	VRMS
Normal operational AC input frequency	F_{line}	47 to 63	Hz
CC output set-point	$I_{out,setpoint}$	0 to 2.0	A
CC output set-point control voltage (see Figure 5 for details)	CC_{set}	0 to 3	V
Output load range ($I_{out,setpoint}$ = 0 to 4 A)	$V_{load,CV}$	24 to 58	V
Input power under no-load condition (V AC = 230 V_{RMS}; F_{line} = 50 Hz; output open)	$P_{in,no-load}$	< 240	mW
Input power under no-load condition (V AC = 115 V_{RMS}; F_{line} = 50 Hz; output open)	$P_{in,no-load}$	< 100	mW
Steady-state output voltage limit under no-load condition	$V_{out,FB,limit}$	64	V
Efficiency at full output power (V AC = 230 V_{RMS}; output voltage = 58 V; $I_{out,setpoint}$ = 2.0 A)	η	91.2	%
Efficiency at full output power (V AC = 115 V_{RMS}; output voltage = 58 V; $I_{out,setpoint}$ = 2.0 A)	η	89.1	%
Four-point average efficiency – high-line low (V AC = 176 V_{RMS}; output voltage = 58 V; I_{out} = 0.5 A, 1 A, 1.5 A, and 2 A)	$\eta_{avg,4-point1}$	88.9	%
Four-point average efficiency – high-line high (V AC = 264 V_{RMS}; output voltage = 58 V; I_{out} = 0.5 A, 1 A, 1.5 A, and 2 A)	$\eta_{avg,4-point2}$	89.0	%
Four-point average efficiency – low-line low (V AC = 90 V_{RMS}; output voltage = 58 V; I_{out} = 0.5 A, 1 A, 1.5 A, and 2 A)	$\eta_{avg,4-point1}$	87.6	%
Four-point average efficiency – low-line high (V AC = 130 V_{RMS}; output voltage = 58 V; I_{out} = 0.5 A, 1 A, 1.5 A, and 2 A)	$\eta_{avg,4-point2}$	89.0	%

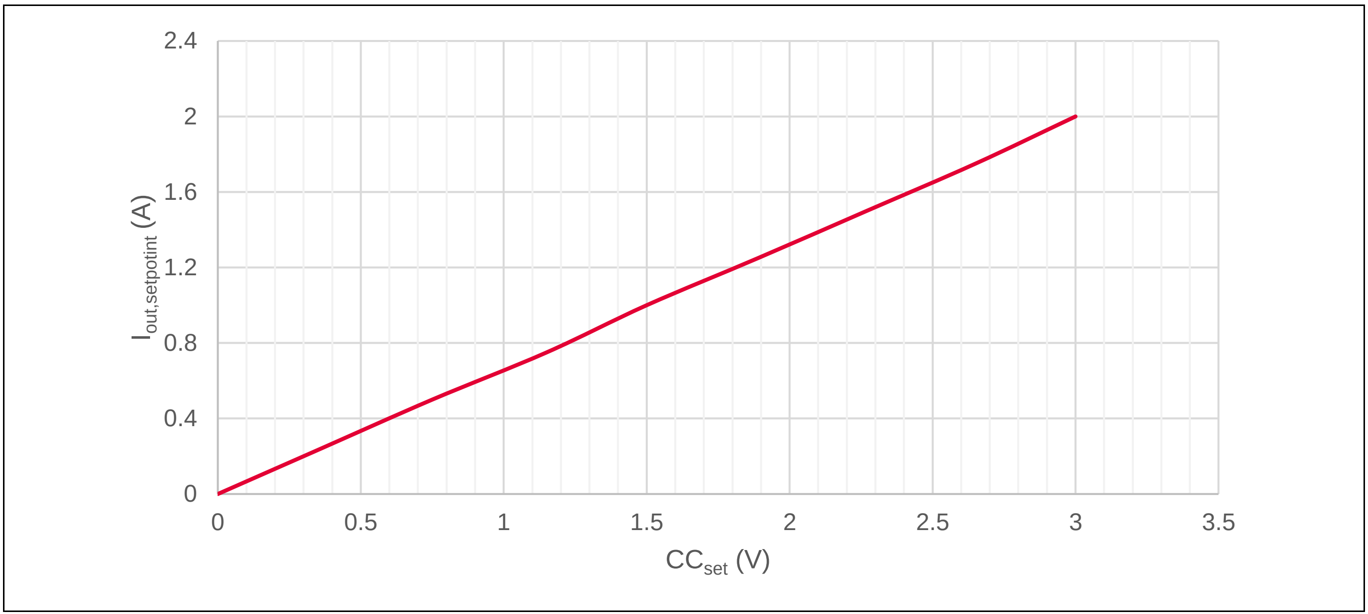


Figure 5 $I_{out,setpoint}$ **control based on** CC_{set} **input signal**

4 Schematic and PCB layout

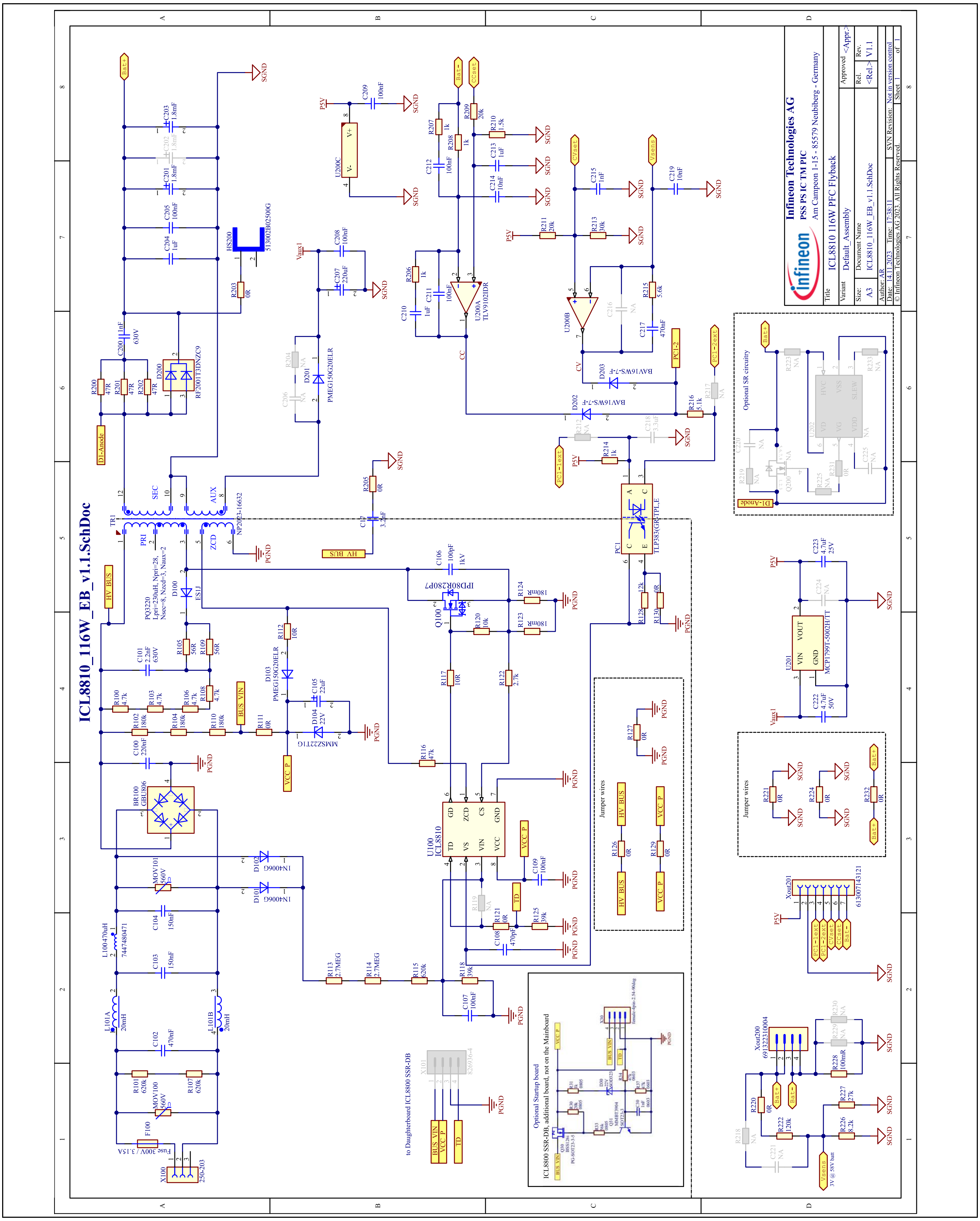


Figure 6 **Reference design board schematic**

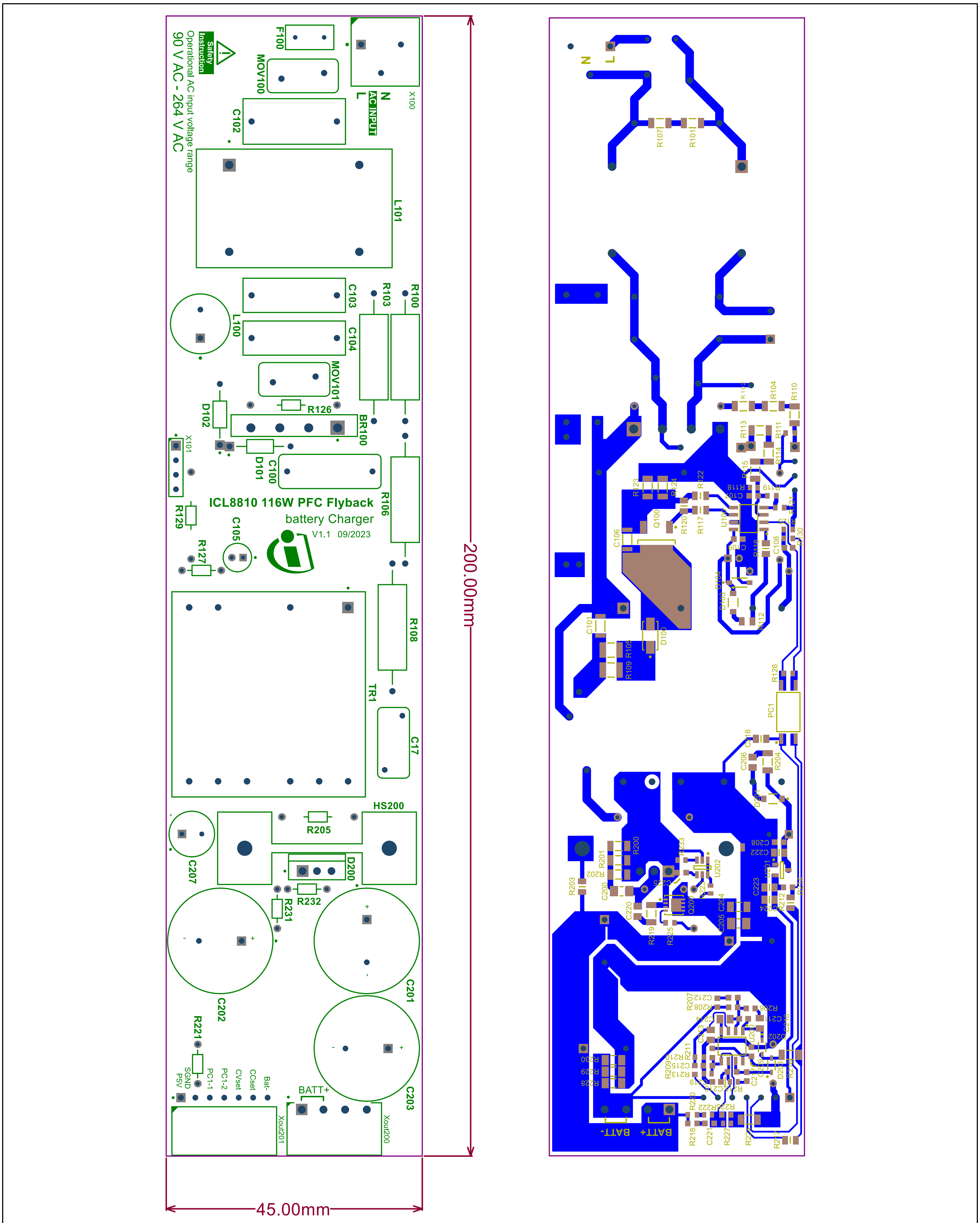


Figure 7 **PCB top (left) and bottom (right) layout of the reference design board**

5 Performance

The results shown in this section are based on the evaluation of a single board at room temperature.

5.1 Efficiency

The efficiency at 36 V output voltage with 2 A output current setting (CC set adjusted to 3 V) is measured at more than 90.3 percent at typical input voltage of 230 V_{RMS} and more than 88 percent across the whole low-line input voltage range, as shown in Figure 8.

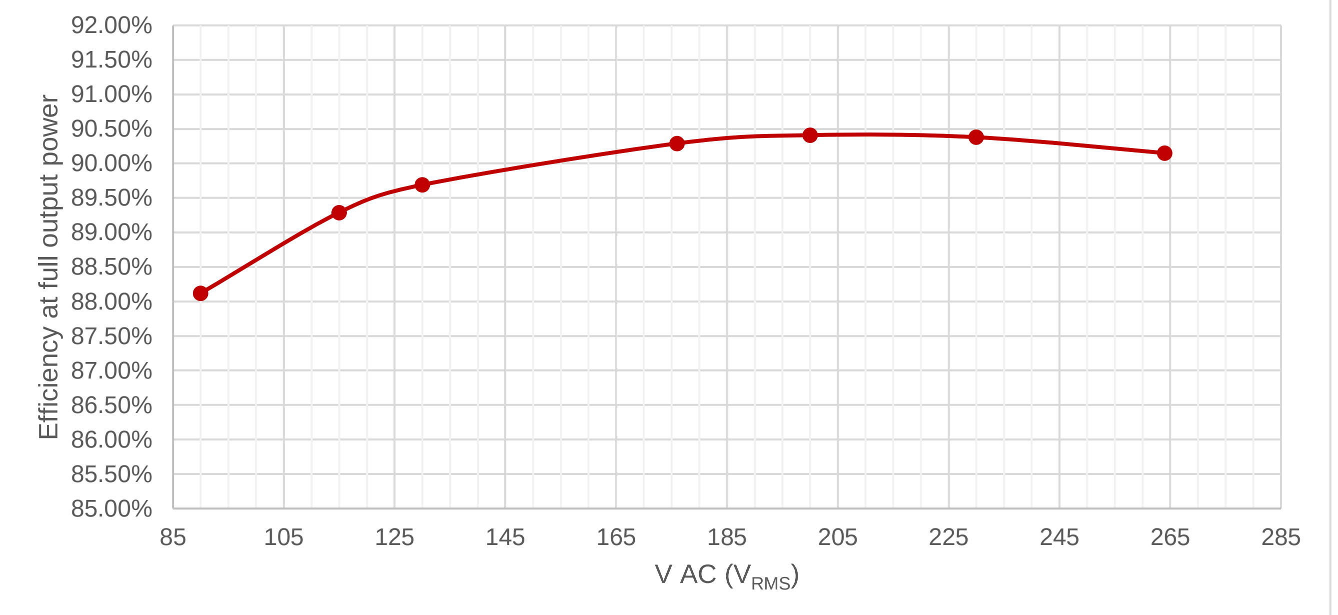


Figure 8 Efficiency versus input voltage at 36 V and 2 A output (72 W)

For high-line input voltage range, the efficiency at full output power (116 W) is more than 90.8 percent and 91.2 percent at typical V AC of 230 V_{RMS}, as shown in Figure 9.

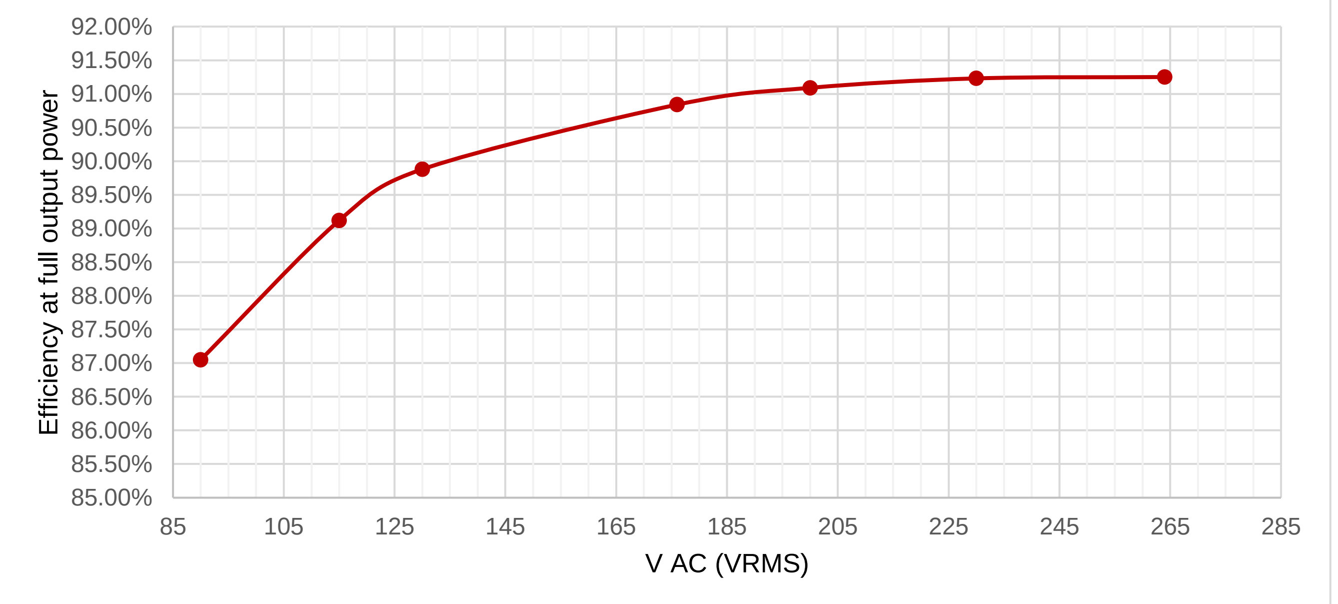


Figure 9 Efficiency versus input voltage at 58 V and 2 A output (116 W)

The four-point average efficiency for 58 V output voltage for input voltage corner-cases is presented in Table 2. The measurement reveals an average efficiency value of more than 89 percent at minimum and maximum of high-line input voltage. The same measurement performed at low-line input voltage range indicates an average efficiency value of more than 87.5 percent.

Table 2 Four-point average efficiency at 58 V output voltage in input voltage corner-cases

V AC (V_{RMS})	Output load (V)	$I_{out,setpoint}$ (mA)	$I_{out,setpoint}$ (%)	Efficiency (%)	Four-point average efficiency (%)
176	58	2000	100	90.83	89.32
		1500	75	90.76	
		1000	50	89.77	
		500	25	85.93	
264	58	2000	100	91.25	89.00
		1500	75	90.69	
		1000	50	89.22	
		500	25	84.82	
90	58	2000	100	87.04	87.64
		1500	75	88.49	
		1000	50	88.71	
		500	25	86.31	
130	58	2000	100	89.91	89.00
		1500	75	90.19	
		1000	50	89.69	
		500	25	86.22	

For an output voltage of 36 V, the four-point average efficiency is measured at more than 88 percent for the input voltage corner cases as shown in Table 3.

Table 3 Four-point average efficiency at 36 V output voltage in input voltage corner-cases

V AC (V_{RMS})	Output load (V)	$I_{out,setpoint}$ (mA)	$I_{out,setpoint}$ (%)	Efficiency (%)	Four-point average efficiency (%)
176	36	2000	100	90.31	88.96
		1500	75	90.28	
		1000	50	89.34	
		500	25	85.92	
264	36	2000	100	90.22	88.01
		1500	75	89.57	
		1000	50	88.28	
		500	25	83.95	
90	36	2000	100	88.12	88.23
		1500	75	88.84	
		1000	50	89.01	
		500	25	86.93	
130	36	2000	100	89.69	88.90
		1500	75	90.02	
		1000	50	89.64	
		500	25	86.26	

5.2 Standby power

Under no-load conditions, the input power measurement indicates a value under 120 mW at the low-line input voltage range and 300 mW at the high-line input voltage range, as shown in Figure 10 and Figure 11.

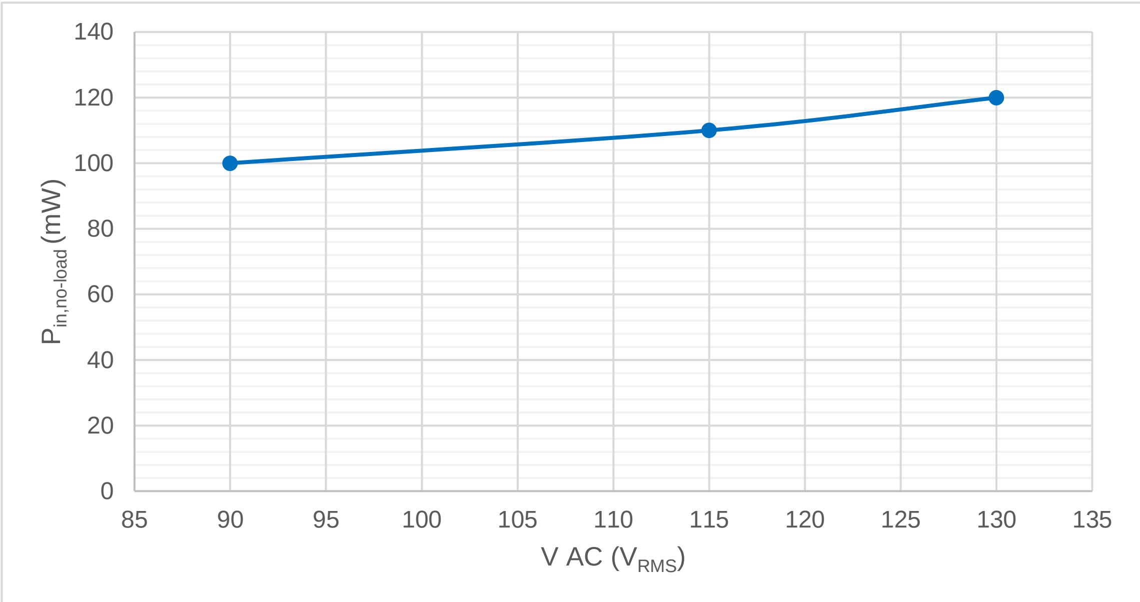


Figure 10 Input power under no-load condition at low-line input

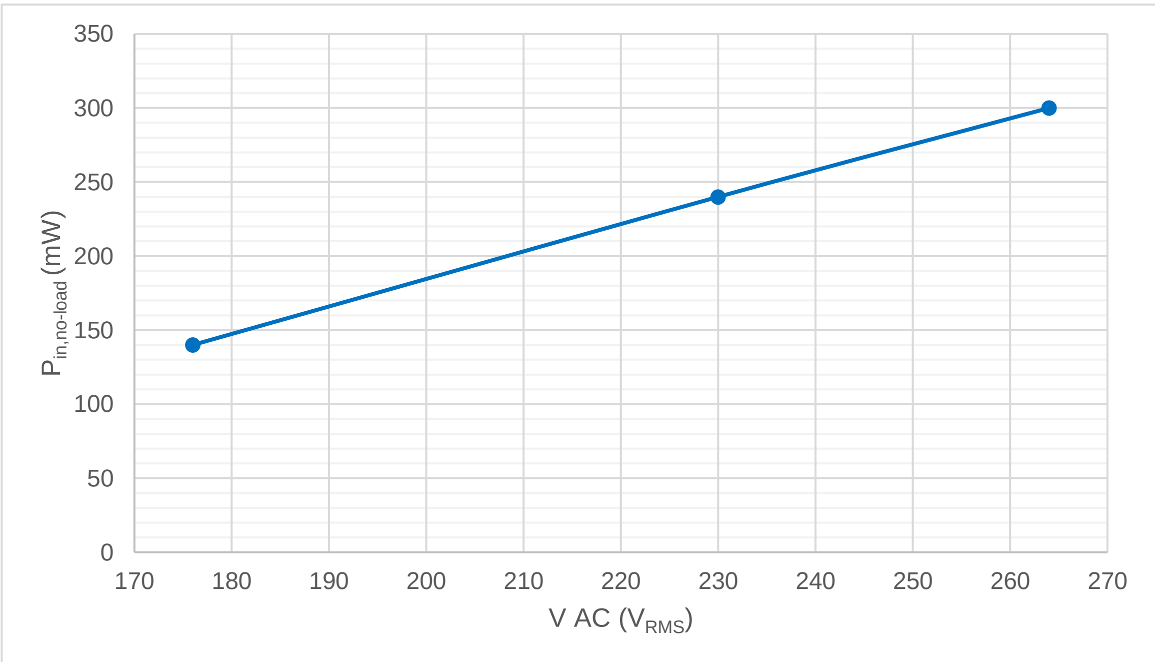


Figure 11 Input power under no-load condition at high-line input

5.3 PFC performance

Table 4 shows the PFC performance at 58 V and 36 V output voltages at 115 V AC and 230 V AC input voltages. In all conditions the output current is set at 2 A. High power factor is achieved as shown in the measurement.

Table 4 Power factor measurement

V AC (V) / Output voltage (V)	115	230
36	0.98	0.90
58	0.98	0.94

As shown in Figure 12, the measured harmonic currents are low to comply with IEC 61000-3-2 Class A.

Or.	U1 [V]	hdf[%]	I1 [A]	hdf[%]
Tot.	115.21		0.6880	
dc	---------	-------	---------	-------
1	115.21	100.000	0.6830	99.275
2	0.09	0.076	0.0012	0.167
3	0.07	0.057	0.0810	11.767
4	0.04	0.034	0.0008	0.121
5	0.03	0.028	0.0095	1.388
6	0.02	0.015	0.0009	0.125
7	0.01	0.011	0.0062	0.895
8	0.02	0.021	0.0010	0.152
9	0.02	0.017	0.0049	0.717
10	0.01	0.010	0.0007	0.101
11	0.02	0.013	0.0053	0.772
12	0.01	0.009	0.0008	0.112
13	0.02	0.019	0.0039	0.566
14	0.01	0.009	0.0007	0.105
15	0.01	0.011	0.0042	0.618
16	0.01	0.011	0.0006	0.087
17	0.02	0.017	0.0023	0.340
18	0.02	0.014	0.0007	0.098
19	0.01	0.009	0.0022	0.326
20	0.01	0.006	0.0011	0.154

a)

Or.	U1 [V]	hdf[%]	I1 [A]	hdf[%]
Tot.	230.76		0.3553	
dc	---------	-------	---------	-------
1	230.76	100.000	0.3507	98.716
2	0.20	0.088	0.0010	0.295
3	0.11	0.048	0.0556	15.661
4	0.10	0.045	0.0006	0.172
5	0.08	0.033	0.0072	2.028
6	0.05	0.024	0.0005	0.138
7	0.04	0.016	0.0044	1.245
8	0.03	0.012	0.0006	0.178
9	0.03	0.012	0.0032	0.896
10	0.03	0.013	0.0004	0.108
11	0.03	0.014	0.0027	0.773
12	0.03	0.014	0.0005	0.132
13	0.03	0.013	0.0007	0.205
14	0.02	0.009	0.0003	0.081
15	0.02	0.007	0.0008	0.235
16	0.02	0.007	0.0005	0.134
17	0.01	0.006	0.0010	0.288
18	0.02	0.007	0.0005	0.154
19	0.01	0.006	0.0010	0.283
20	0.02	0.009	0.0008	0.238

b)

Or.	U1 [V]	hdf[%]	I1 [A]	hdf[%]
Tot.	115.14		1.0895	
dc	---------	-------	---------	-------
1	115.14	100.000	1.0814	99.265
2	0.21	0.180	0.0030	0.272
3	0.12	0.103	0.1269	11.649
4	0.08	0.072	0.0023	0.212
5	0.04	0.036	0.0182	1.675
6	0.04	0.038	0.0015	0.134
7	0.05	0.044	0.0107	0.982
8	0.04	0.034	0.0018	0.163
9	0.05	0.044	0.0095	0.869
10	0.02	0.020	0.0014	0.125
11	0.03	0.025	0.0098	0.901
12	0.02	0.020	0.0008	0.073
13	0.07	0.064	0.0054	0.499
14	0.03	0.023	0.0022	0.198
15	0.02	0.017	0.0103	0.946
16	0.01	0.009	0.0013	0.122
17	0.06	0.052	0.0030	0.275
18	0.02	0.018	0.0016	0.145
19	0.04	0.033	0.0076	0.699
20	0.02	0.013	0.0024	0.220

c)

Or.	U1 [V]	hdf[%]	I1 [A]	hdf[%]
Tot.	230.75		0.5565	
dc	---------	-------	---------	-------
1	230.75	100.000	0.5485	98.565
2	0.13	0.058	0.0012	0.224
3	0.13	0.057	0.0922	16.577
4	0.05	0.023	0.0005	0.089
5	0.05	0.021	0.0139	2.506
6	0.04	0.015	0.0003	0.059
7	0.03	0.013	0.0062	1.117
8	0.02	0.011	0.0003	0.056
9	0.02	0.010	0.0040	0.715
10	0.02	0.008	0.0003	0.054
11	0.02	0.009	0.0030	0.538
12	0.02	0.007	0.0003	0.061
13	0.01	0.005	0.0025	0.453
14	0.01	0.006	0.0004	0.071
15	0.01	0.006	0.0021	0.383
16	0.01	0.006	0.0005	0.086
17	0.01	0.004	0.0017	0.311
18	0.01	0.003	0.0004	0.065
19	0.01	0.003	0.0013	0.228
20	0.01	0.003	0.0005	0.097

d)

Figure 12 Harmonics current measurements: a) 115 V AC, 36 V output, b) 230 V AC, 36 V output, c) 115 V AC, 58 V output, and d) 230 V AC, 58 V output

5.4 Brown-in and brown-out protection

ICL8810 features an adaptive brown-out level triggering based on bus voltage ripple.

As shown in Table 5 and Table 6, with these features, this reference design demonstrates a higher brown-out level at higher power transfer, while still ensuring sufficient hysteresis between brown-in and brown-out. As a result, ICL8810 can better protect the primary components from overheating and saturation when an input undervoltage condition occurs.

Table 5 Brown-in test result

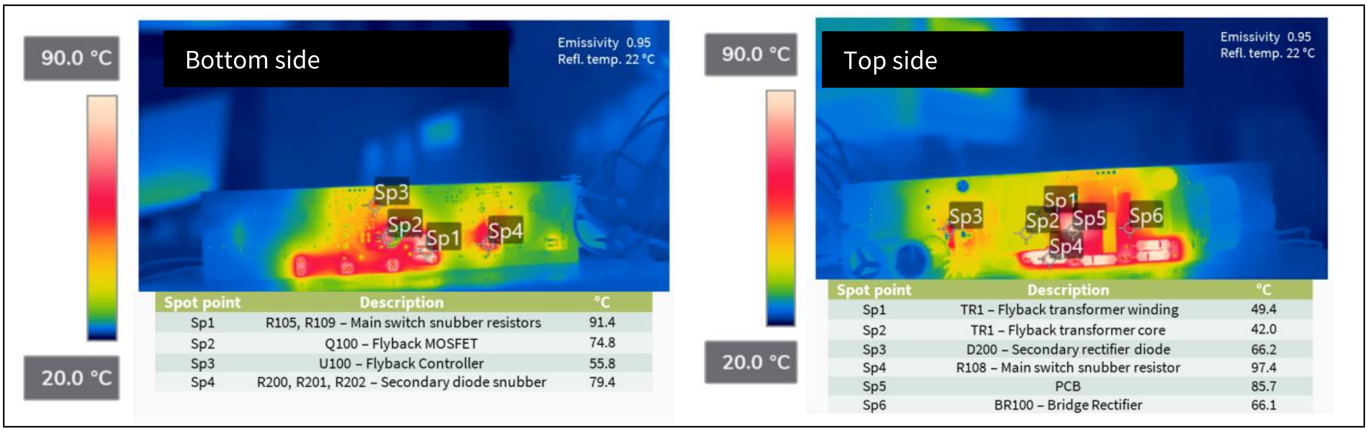
F_{line} (Hz)	Output voltage (V)	$I_{out,setpoint}$ (mA)	$I_{out,setpoint}$ (%)	Brown-in V AC (V_{RMS})
50	58	0	0	89.8
		1000	50	89.9
	36	0	0	89.8
		1000	50	90.1

Table 6 Brown-out test result

F_{line} (Hz)	Output load (V)	$I_{out,setpoint}$ (mA)	$I_{out,setpoint}$ (%)	Brown-out V AC (V_{RMS})
50	58	0	0	64.5
		1000	50	65.1
	36	0	0	64.1
		1000	50	64.9

5.5 Thermal test

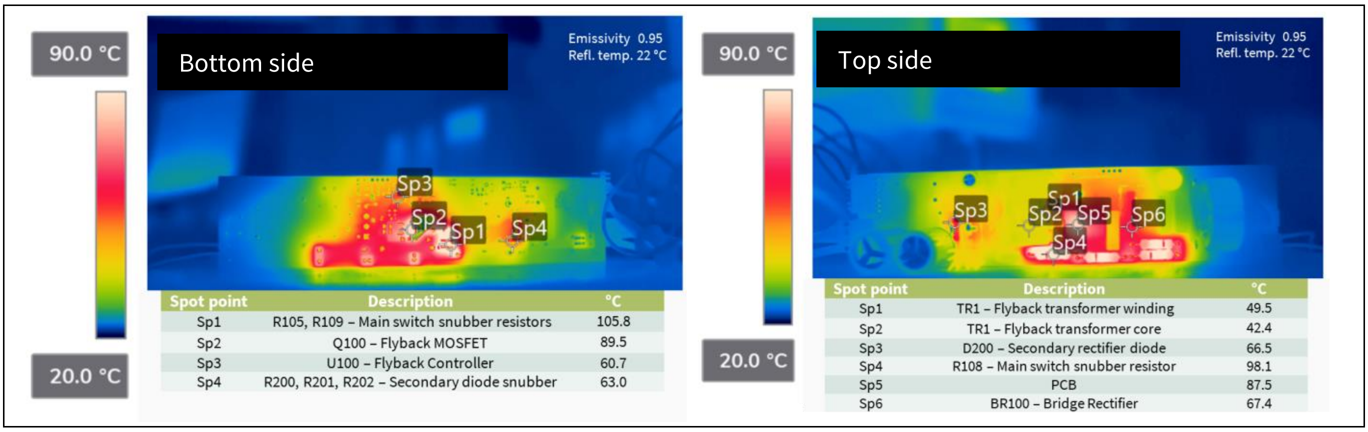
The open-frame thermal measurement is done after one hour of operation with full output power (116 W) using an infrared (IR) thermography camera. The ambient temperature is approximately 22°C.



Spot point	Description	°C
Sp1	R105, R109 – Main switch snubber resistors	91.4
Sp2	Q100 – Flyback MOSFET	74.8
Sp3	U100 – Flyback Controller	55.8
Sp4	R200, R201, R202 – Secondary diode snubber	79.4

Spot point	Description	°C
Sp1	TR1 – Flyback transformer winding	49.4
Sp2	TR1 – Flyback transformer core	42.0
Sp3	D200 – Secondary rectifier diode	66.2
Sp4	R108 – Main switch snubber resistor	97.4
Sp5	PCB	85.7
Sp6	BR100 – Bridge Rectifier	66.1

Figure 13 IR thermal image at 230 V AC input



Spot point	Description	°C
Sp1	R105, R109 – Main switch snubber resistors	105.8
Sp2	Q100 – Flyback MOSFET	89.5
Sp3	U100 – Flyback Controller	60.7
Sp4	R200, R201, R202 – Secondary diode snubber	63.0

Spot point	Description	°C
Sp1	TR1 – Flyback transformer winding	49.5
Sp2	TR1 – Flyback transformer core	42.4
Sp3	D200 – Secondary rectifier diode	66.5
Sp4	R108 – Main switch snubber resistor	98.1
Sp5	PCB	87.5
Sp6	BR100 – Bridge Rectifier	67.4

Figure 14 IR thermal image at 115 V AC input

5.6 Conducted emissions (EN 55022 class B)

The conducted emissions test is performed at full output power (116 W) based on EN 55022 standard Class B limits, as shown in Figure 15 and Figure 16.

The measurement equipment used for this conducted emissions test was Rohde & Schwarz HM6050-2 and Tektronix RSA503A.

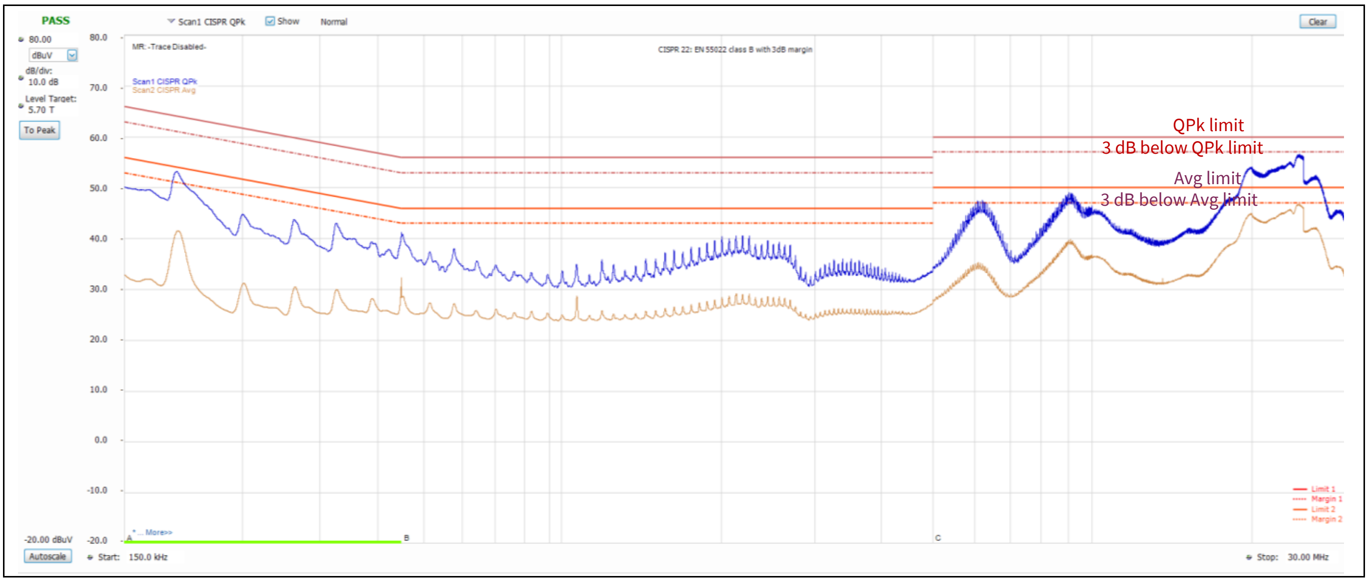


Figure 15 Conducted emissions (live) test result at V AC = 115 V_{RMS}, F_{line} = 50 Hz, P_{out} = 116 W

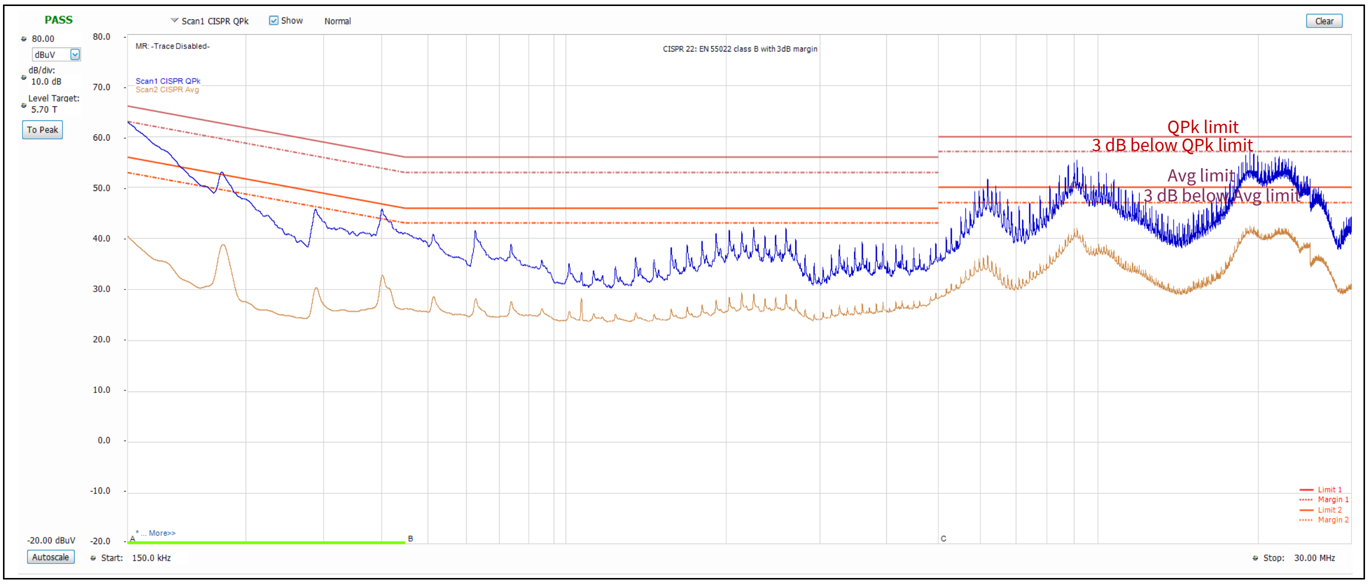


Figure 16 Conducted emissions (live) test result at V AC = 230 V_{RMS}, F_{line} = 50 Hz, P_{out} = 116 W

6 Bill of materials and transformer specifications

This section provides the bill of materials (BOM) and the transformer specifications.

6.1 BOM

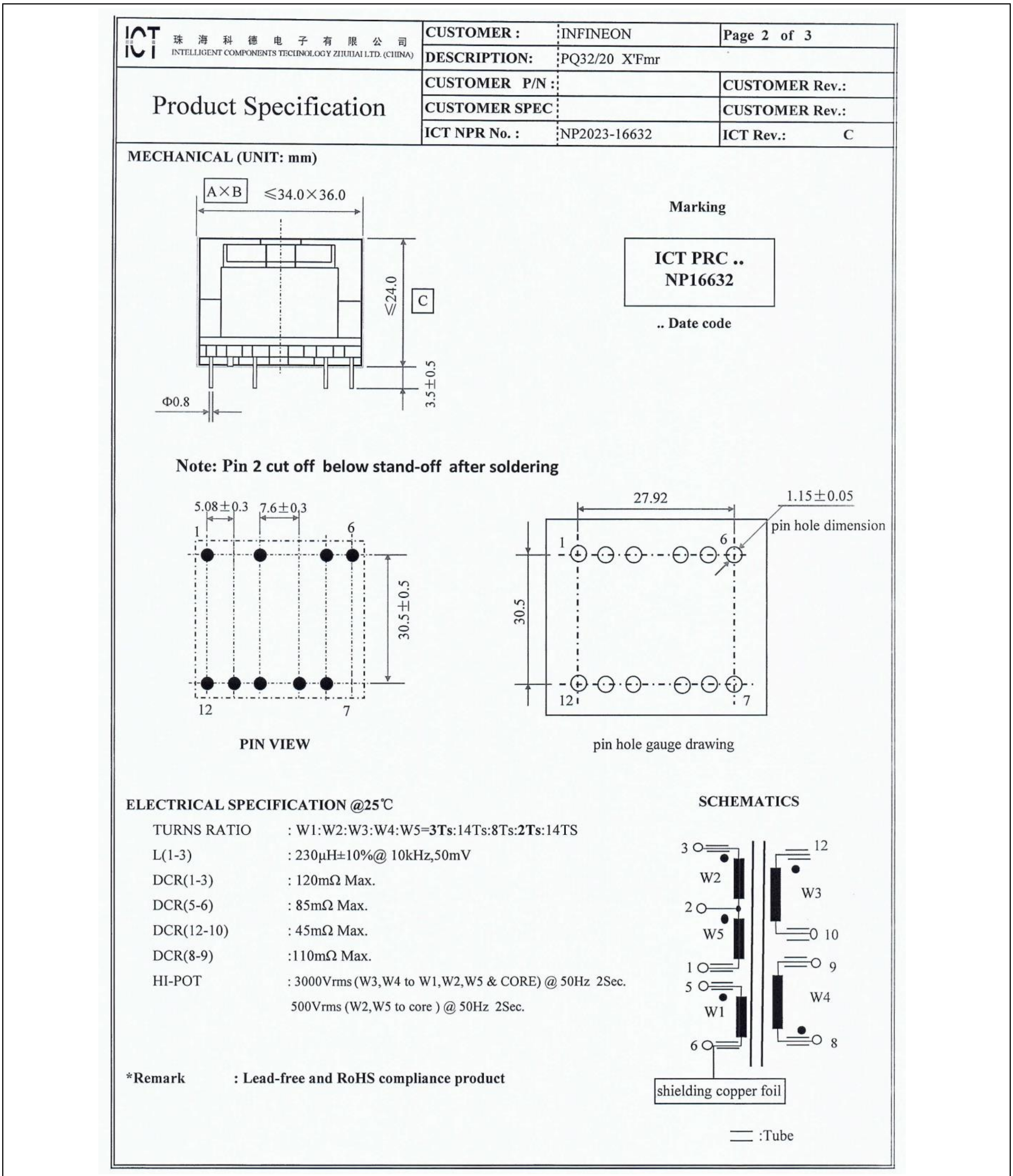
Table 7 BOM of the reference design board

Designator	Description	Part number	Manufacturer
BR100	Dio GBU806/ / THT/ /	GBU806	Diodes Incorporated
C17	Cap 3.2nF/ / THT 9.5mm/ /20%	440LD32-R	Vishay
C100	Cap 220nF/ 630V/ THT/Radial/ /10%	890334025027CS	Wurth Elektronik
C101	Cap 2.2nF/ 630V/ 1206/ X7R/10%	GRM31AR72J222KW01	Murata
C102	Cap 470nF/ 630V/ THT/Radial/ /10%	890324025039CS	Wurth Elektronik
C103, C104	Cap 150nF/ 630V/ THT/Radial/ /10%	890334025022CS	Wurth Elektronik
C105	Cap 22uF/ 50V/ THT/Radial/ /20%	860080672001	Wurth Elektronik
C106	Cap 100pF/ 1kV/ 1206/ C0G/5%	GRM31A5C3A101JW01	Murata
C107, C109, C208, C209, C211, C212	Cap 100nF/ 50V/ 0603/ X7R/10%	06035C104K4Z2A	AVX
C108	Cap 470pF/ 50V/ 0603/ X7R/10%	885012206081	Wurth Elektronik
C200	Cap 1nF/ 630V/ 1206/ C0G/5%	CGA5F4C0G2J102J085AA	TDK Corporation
C201, C203	Cap 1.8mF/ 80V/ THT/Radial/ /20%	EKZN800ELL182MM40S	Nippon Chemi-Con
C204	Cap 1uF/ 100V/ 1206/ X7R/10%	12061C105KAT2A	AVX
C205	Cap 100nF/ 100V/ 3216 (1206)/ /10%	CGA5H2X8R2A104K115AA	TDK Corporation
C207	Cap 220uF/ 35V/ THT/Radial/ /20%	860010574011	Wurth Elektronik
C210, C213	Cap 1uF/ 50V/ 0805/ X7R/10%	GCM21BR71H105KA03	Murata
C214	Cap 10nF/ 50V/ 0805/ X7R/10%	C0805C103K5RACAUTO	Kemet
C215	Cap 1nF/ 50V/ 0603/ C0G/1%	C0603C102F5GAC	Kemet
C217	Cap 470nF/ 25V/ 0603/ X7R/10%	GCM188R71E474KA64	Murata
C219	Cap 10nF/ 16V/ 0603/ X7R/10%	885012206040	Wurth Elektronik
C222	Cap 4.7uF/ 50V/ 0805/ X5R/10%	GRM21BR61H475KE51	Murata
C223	Cap 4.7uF/ 25V/ 0805/ X7R/10%	GRM21BR71E475KA73	Murata
D100	Dio ES1J/ / SMA (DO-214AC)/ /	ES1J	ON Semiconductor
D101, D102	Dio 1N4006G/ / DO-41 (Case 59-10)/ /	1N4006G	ON Semiconductor
D103, D201	Dio PMEG150G20ELR/ / SOD123W/ /	PMEG150G20ELR	Nexperia
D104	Dio 22V/ / SOD-123/ /	MMSZ22T1G	ON Semiconductor
D200	Dio RF2001T3DNZC9/ / TO-220FN-3/ /	RF2001T3DNZC9	ROHM Semiconductors
D202, D203	Dio BAV16WS-7-F/ / SOD-323/ /	BAV16WS-7-F	Diodes Incorporated
F100	Res Fuse 300V / 3.15A/ 300V/ THT/Radial/ /	SS-5H-3.15A-APH	Bussmann

Designator	Description	Part number	Manufacturer
HS200	Mec 513002B02500G/ / Heatsink, TO-220, 34.92mm L X 12.7mm W X 25.4mm H/ /	513002B02500G	Aavid Thermalloy
L100	Ind 470uH/ / Radial Type/ /10%	7447480471	Wurth Elektronik
L101	Ind 20mH/ / THT/ /	8110-RC	Bourns
MOV100, MOV101	Res 560V/ 460V/ THT/ /	MOV-10D561K	Bourns
PC1	TLP383(GR-TPL,E/ / TLP383/ /	TLP383	Toshiba
Q100	Tra IPD80R280P7/ / PG-TO252-3-313/ /	IPD80R280P7	Infineon Technologies
R100, R103, R106, R108	Res 4.7k/ 750V/ THT/Axial/ /5%	RR03J4K7TB	TE Connectivity
R101, R107	Res 620k/ 200V/ 1206/ /1%	CRCW1206620KFK	Vishay
R102, R104, R110	Res 180k/ 200V/ 1206/ /1%	CRCW1206180KFK	Vishay
R105, R109	Res 56R/ 200V/ 1210/ /1%	CRCW121056R0FK	Vishay
R111, R121, R130, R220	Res 0R/ 75V/ 0603/ /0R	RC0603JR-070RL	Yageo
R112, R117	Res 10R/ 150V/ 0805/ /1%	RC0805FR-0710RL	Yageo
R113, R114	Res 2.7MEG/ 200V/ 1206/ /1%	CRCW12062M70FK	Vishay
R115	Res 620k/ 200V/ 1206/ /1%	CRCW1206620KFK	Vishay
R116	Res 47k/ 200V/ 0805/ /1%	ERJ-6ENF4702V	Panasonic
R118	Res 39k/ 75V/ 0603/ /1%	CRCW060339K0FK	Vishay
R120	Res 10k/ 150V/ 805/ /5%	RMCF0805JT10K0	Stackpole Electronics
R122	Res 2.7k/ 150V/ 0805/ /1%	CRCW08052K70FK	Vishay
R123, R124	Res 180mR/ / 1206/ /1%	KDV12FR180ET	Ohmite
R125	Res 39k/ 75V/ 0603/ /1%	RC0603FR-0739KL	Yageo
R126, R127, R129, R205, R221, R232	Res 0R/ / THT/Axial/ /	ZOR-12-R-52-0R	Yageo
R128	Res 12k/ 50V/ 0603/ /1%	RC0603FR-0712KL	Yageo
R200, R201, R202	Res 47R/ 200V/ 1206/ /1%	CRCW120647R0FKEAHP	Vishay
R203	Res 0R/ 150V/ 805/ /	RMCF0805ZT0R00	Stackpole Electronics
R206, R207, R208, R214	Res 1k/ 75V/ 0603/ /1%	ERJ3EKF1001V	Panasonic
R209, R211	Res 20k/ 50V/ 0603/ /1%	MCR03EZPFX2002	ROHM Semiconductors
R210	Res 1.5k/ 75V/ 0603/ /1%	RC0603FR-071K5L	Yageo
R213	Res 30k/ 75V/ 0603/ /1%	CRCW060330K0FK	Vishay
R215	Res 5.6k/ 75V/ 0603/ /1%	CRCW06035K60FK	Vishay
R216	Res 5.1k/ 200V/ 1206/ /1%	CRCW12065K10FK	Vishay

Designator	Description	Part number	Manufacturer
R222	Res 120k/ 75V/ 0603/ /1%	CRCW0603120KFK	Vishay
R224	Res 0R/ 200V/ 1206/ /0%	CRCW12060000Z0EA	Vishay
R226	Res 8.2k/ / 0603/ /1%	CRCW06038K20FKEAC	Vishay
R227	Res 27k/ 75V/ 0603/ /1%	CRCW060327K0FK	Vishay
R228	Res 100mR/ / 1206/ /1%	ERJ8BWFR100V	Panasonic
TR1	Tra NP2023-16632/ / THT/ /	NP2023-16632	ICT
U100	Int ICL8810/ / PG-DSO-8/ /	ICL8810	Infineon Technologies
U200	Ana TLV9102IDR/ / SOIC-8/ /	TLV9102IDR	Texas Instruments
U201	Pow MCP1799T-5002H/TT/ / SOT23/ /	MCP1799T-5002H/TT	Microchip Technology
X100	Con 250-203/ / THT/ /	250-203	WAGO
Xout200	Con 691322310004/ / WR-TBL/ /	691322310004	Wurth Elektronik
Xout201	Con 613007143121/ / THT 7 PIN 2.54 mm pitch/ /	613007143121	Wurth Elektronik

6.2 Transformer specifications



ICT 珠海科德电子有限公司 INTELLIGENT COMPONENTS TECHNOLOGY ZHUHAI LTD. (CHINA)	CUSTOMER :	INFINEON	Page 2 of 3
	DESCRIPTION:	PQ32/20 X'Fmr	
Product Specification	CUSTOMER P/N :		CUSTOMER Rev.:
	CUSTOMER SPEC		CUSTOMER Rev.:
	ICT NPR No. :	NP2023-16632	ICT Rev.: C

MECHANICAL (UNIT: mm)

Note: Pin 2 cut off below stand-off after soldering

ELECTRICAL SPECIFICATION @25℃

TURNS RATIO	: W1:W2:W3:W4:W5=**3Ts**:14Ts:8Ts:**2Ts**:14TS
L(1-3)	: 230μH±10%@ 10kHz,50mV
DCR(1-3)	: 120mΩ Max.
DCR(5-6)	: 85mΩ Max.
DCR(12-10)	: 45mΩ Max.
DCR(8-9)	:110mΩ Max.
HI-POT	: 3000Vrms (W3,W4 to W1,W2,W5 & CORE) @ 50Hz 2Sec. 500Vrms (W2,W5 to core) @ 50Hz 2Sec.

*Remark : Lead-free and RoHS compliance product

Figure 17 Flyback transformer (TR1) mechanical and electrical specifications

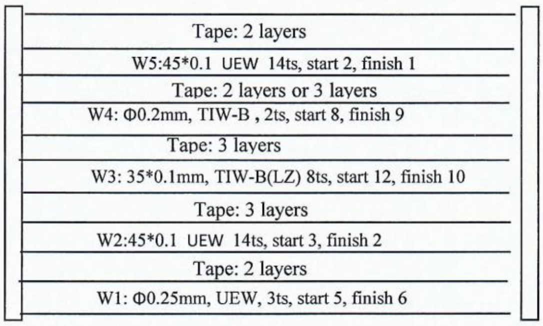
ICT 珠海科德电子有限公司 INTELLIGENT COMPONENTS TECHNOLOGY ZHUHAI LTD. (CHINA)	CUSTOMER :	INFINEON	Page 3 of 3
	DESCRIPTION:	PQ32/20 X'Fmr	
Product Specification	CUSTOMER P/N :		CUSTOMER Rev.:
	CUSTOMER SPEC:		CUSTOMER Rev.:
	ICT NPR No. :	NP2023-16632	ICT Rev.: C

MATERIALS:

BOBBIN	: PQ32, Vertical, 1Section, PHENOLIC (PM-9820 or T375HF)
CORE	: PQ32/20, TPW33 or DMR95 or PG312 or HC95 or HPP-95 or equal, GAP=2*0.29mm
WIRE	: (W1)Φ0.25mm, 1UEW or 2UEW, 155°C,
	: (W2,W5) 45*0.1mm 1UEW or 2UEW, 155°C
	:(W3) 35*0.1 TIW-B(LZ) or equal
	:(W4) 0.20mm, TIW-B or equal
TAPE	: 10mm width & 15mm width & 17mm width, #1350F-1 or CT280 or equal
TUBE	: Teflon tube, AWG#17L,AWG#26L,AWG#30L
GLUE	: F121A/B or TA452A/B or LO-200QA/B
VARNISH	: V1630FS or BC-359 or equal
COPPER FOIL	: 10mm width

(C)

WINDING CONSTRUCTION



NOTE : one layer of tape between layer and layer for W2 winding and W5 winding

Rev.	Change history
A	
B	change W1 turns from 4 to 3 and change W4 turns from 3 to 2
C	correct core material and add varnish

Figure 18 Flyback transformer (TR1) materials and winding construction specifications

Revision history

Document revision	Date	Description of changes
V 1.0	2023-11-17	Initial release

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