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IRDC2086S-DF DEMO BOARD EVALUATION PROCEDURE

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Overview

This document describes how to connect and evaluate the supplied IRDC2086S-DF demo board. The demo board incorporates a new DC Bus Converter chipset in a fixed-frequency, open-loop isolated full-bridge DC-DC converter with 4:1 input to output voltage conversion ratio. The chipset consists of a primary side IC (IR2086S), two 80V primary side FETs (IRF7493), two 30V secondary side FETs (IRF6603), a primary side biasing FET (IRF7380) and a secondary side gate clamp FET (IRF9956). The front side and back side of the demo board are shown in Fig. 1.

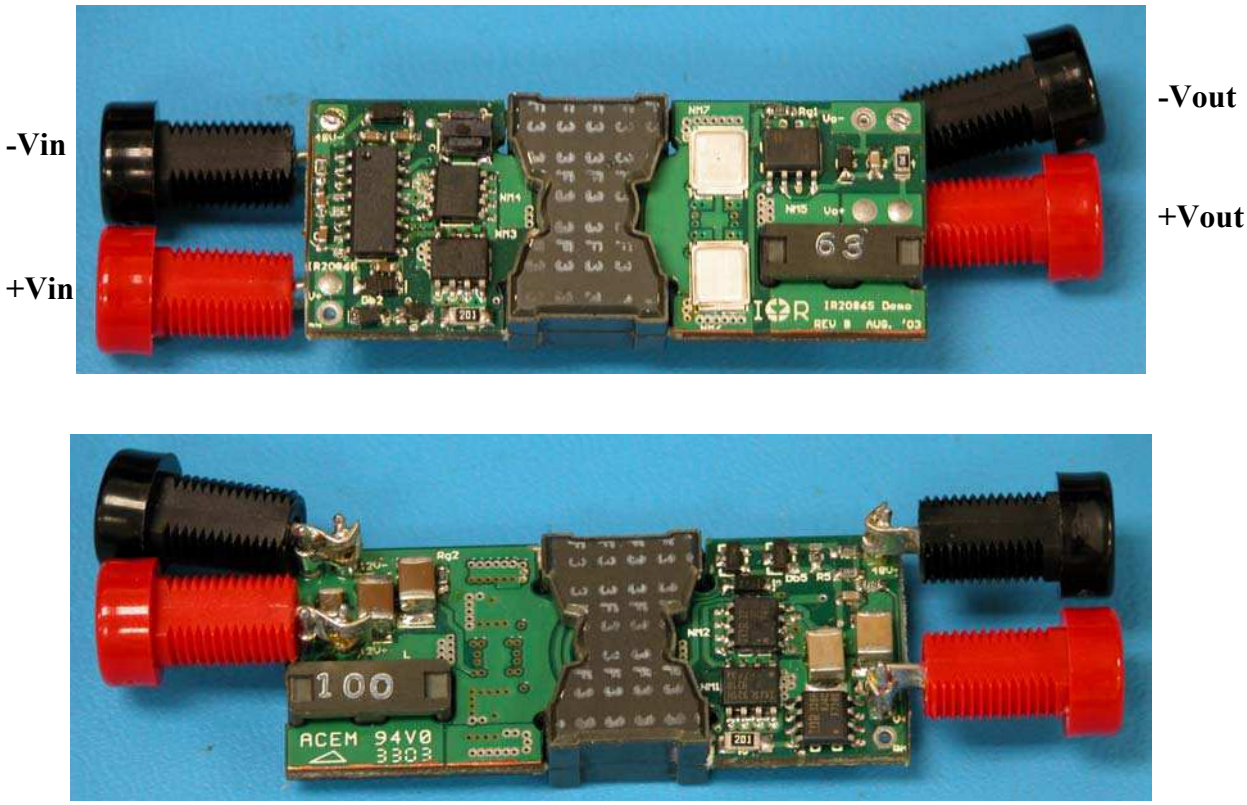

Fig. 1 Front side and back side of the DC Bus Converter demo board with IR2086S ChipSet with marked input and output pins.

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IRDC2086S-S Quick Evaluation Procedure

To evaluate the operation and performance of the IRDC2086S-DF demo board, connect a power supply to its input terminals, and a power load to its output terminals. Input and output terminals are marked in Fig. 1. To duplicate the performance data reported on page two, approximately 400 LFM of airflow is needed across the module.

IRDC2086S-S Demo Board Description and circuit capability

The circuit is designed to deliver continuous 20A output current in 36V – 54V input voltage range, with 400 LFM of airflow. Output voltage for this input voltage range will vary from 9V to 13.5V, and the total available output power from the module will range from around 180W at 36V to up to 270W at 54V input.

The circuit will start to operate as soon as the primary Vcc reaches about 9V – typically at 12Vin. At this low input voltage, the output voltage will be only about 3V, and the secondary Vcc will be insufficient to turn on channels of the secondary side synchronous rectifier MOSFETs. To avoid excessive body diode conduction losses, output current during slow input voltage ramp-up should be set at less than 2A. Full output current can be applied in the above specified input voltage range.

A complete schematic of the demo board is shown in Fig. 2. The circuit design is optimized in order to demonstrate true performance of the IR2086S control IC, IRF7493 primary FETs and IRF6603 secondary FETs. Therefore, no test pins are available on the board. To probe the circuit waveforms use an oscilloscope probe with minimal length for the ground pin and connect directly to the pins of the IC / MOSFET device.

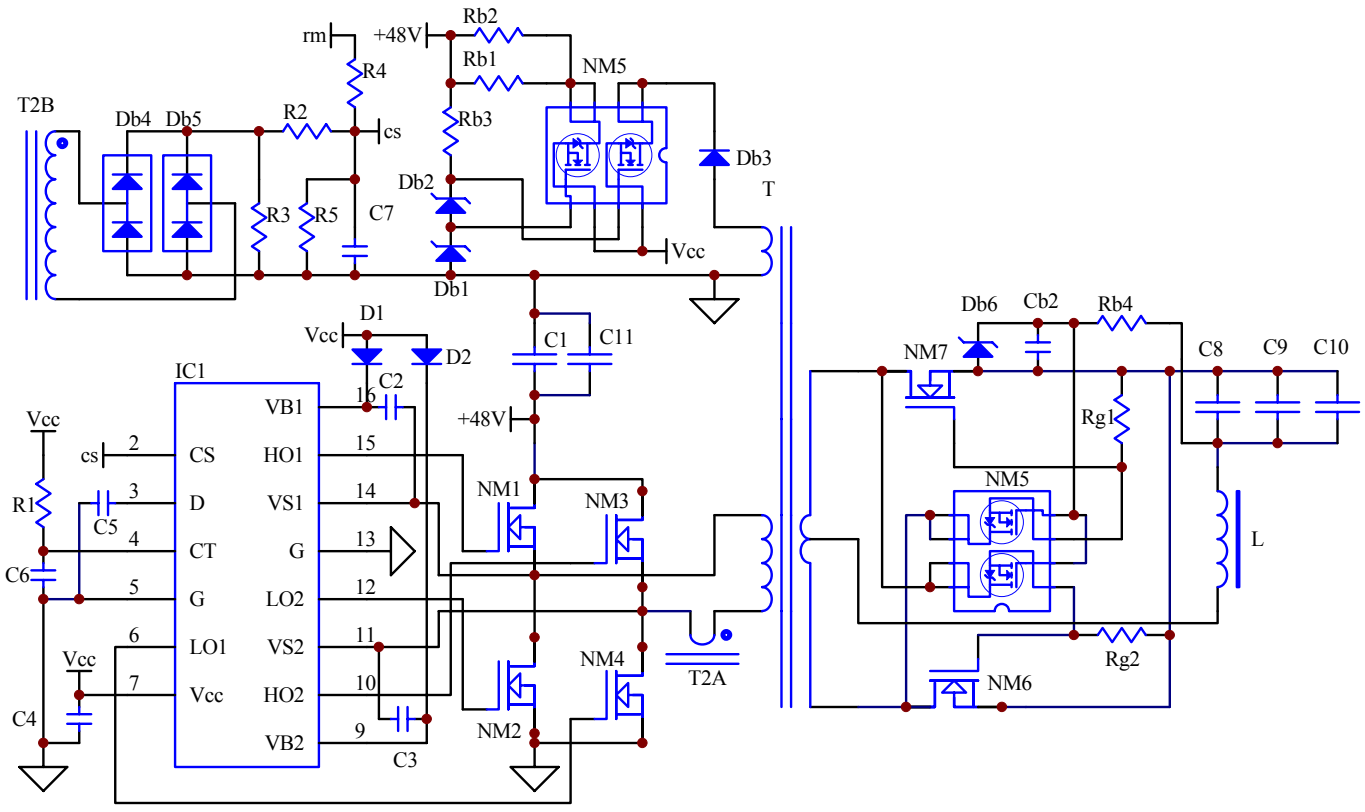


Fig. 2 Complete schematic of IRDC2086S-DF Demo Board

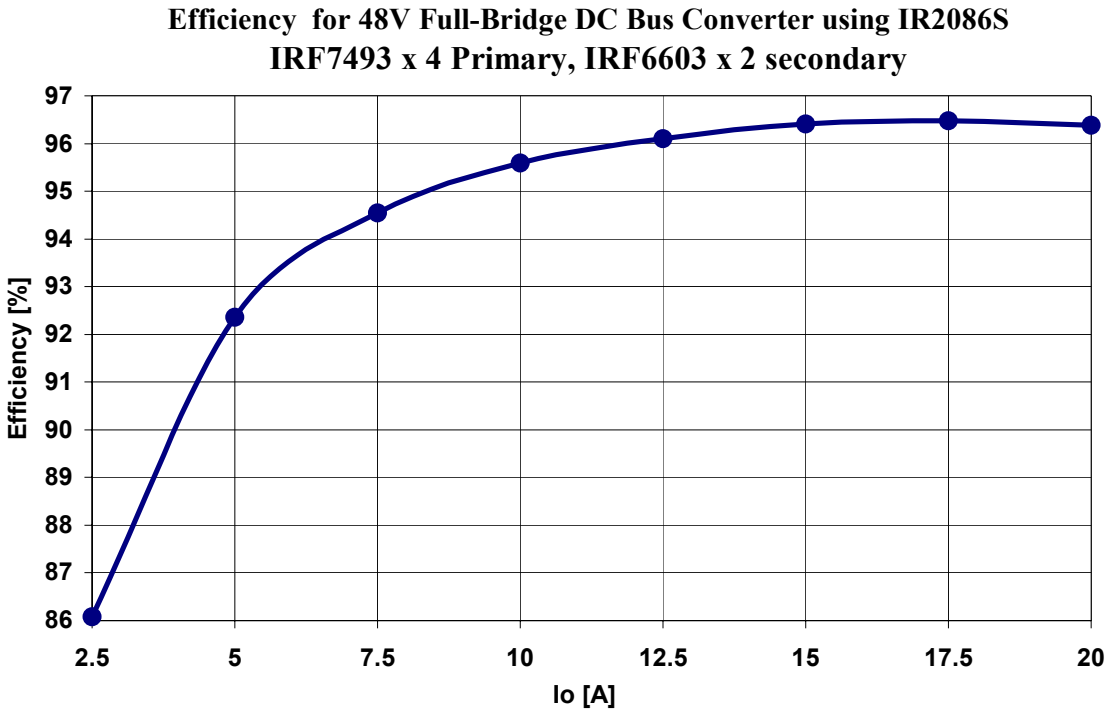


Fig. 3 Efficiency at 48Vin, 240W out max, 12Vout, 200kHz, and 400LFM air flow

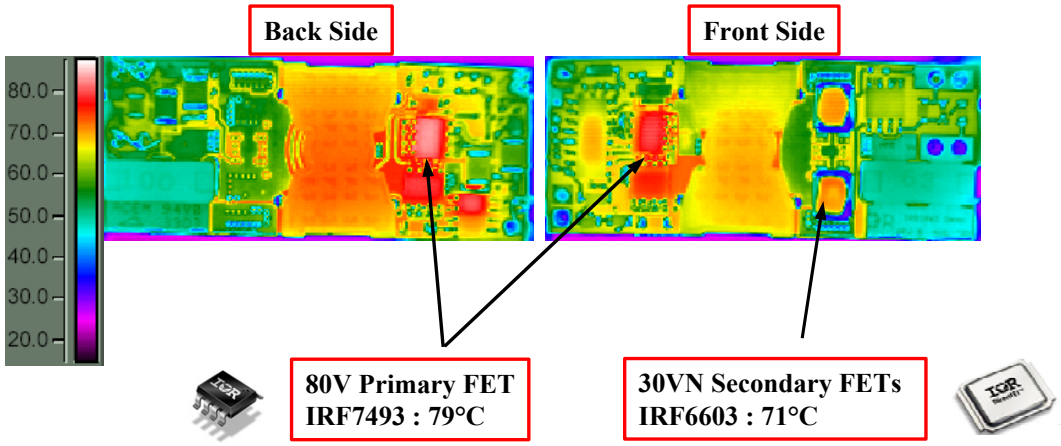


Fig. 4 Thermal image of IR2086S demo board at 48Vin, 20Aout, and 400LFM air flow

To measure circuit efficiency, voltage and current at the input and output of the demo board need to be accurately measured. Use of calibrated shunts for input and output current measurements is strongly recommended, as is use of a thermal camera for thermal performance evaluation. Typical efficiency and a thermal image for 240W output power at 48Vin are shown in Fig. 3 and 4. Inputs and outputs of two or more modules can be connected in parallel to provide required higher output power. Due to natural output voltage droop associated with open-loop operation, no additional circuitry is required for relatively accurate current sharing (in the range of +/-10%).

As shown in Fig. 2, the primary side current is sensed with a current transformer. The current transformer turns ratio is 150 to 1. The sensed AC current information is rectified and then provided as an input into the current sense pin of the IR2086S after some RC filtering. Fig. 5 shows the output voltage during current hiccup mode. The current limit was set approximately at 22A and the load was increased over the current trip point. It can be seen that the controller IR2086S attempts to turn on the converter once in a period of 500ms. The 500ms period is determined by the external capacitance of C5 (100nF).

Fig. 6 shows all the PCB layers. The Gerber files are available upon request. Table 1 lists all the components for the demo board.

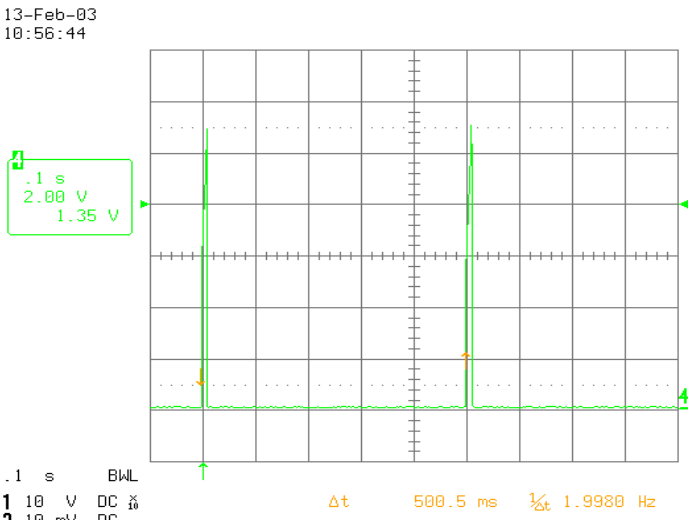
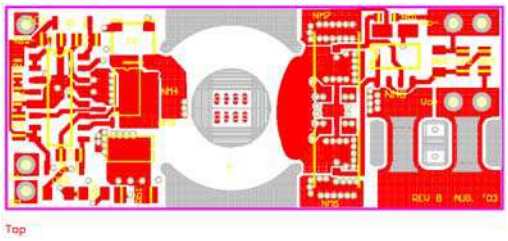
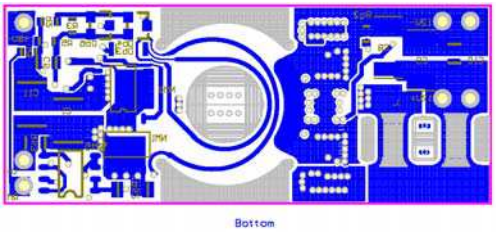


Fig. 5: Output voltage waveform during hiccup mode at current limit setting of 22A

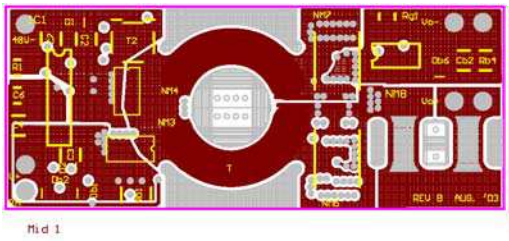
Top Layer



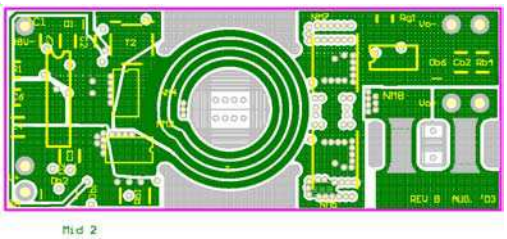
Bottom Layer



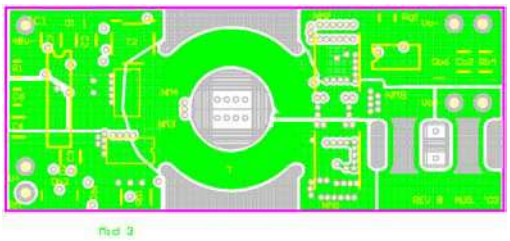
Layer #1



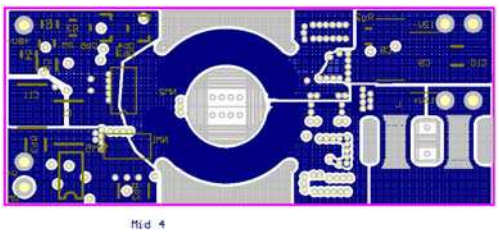
Layer #2



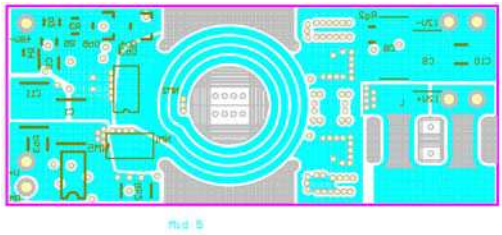
Layer #3



Layer #4



Layer #5



Layer #6

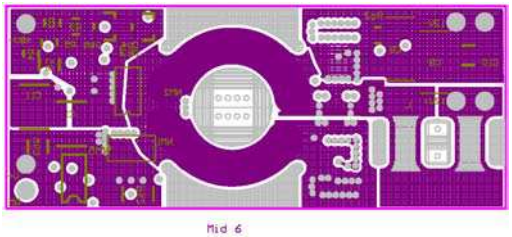


Fig. 6 IRDC2086S-DF Demo Board PCB Layout (Total of 8 layers)

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Table1. IRDC2086S-DF DC Bus Converter Demo Board BOM

Used	Designator	Footprint	Description	Part Value	Tolerance	Disti Part #	Mfg
2	C5, Cb2	603	Ceramic Capacitor	0.1uFd	16V	GRM188R71C104KA01D	Murata
1	R2	603	Thick Film	1.8K	5%	311-1.80KHTR-ND	Digi-Key
1	C10	1210	Ceramic Capacitor	10uFd	16V	GRM32NF51C106ZA01L	Murata
4	C2, C3, C4	603	Ceramic Capacitor	1.0uFd	16V	GRM188R61C105KA93D	Murata
2	C1, C11	1812	Ceramic Capacitor	1.0uFd	100V	ECJ5YB2A105M	Panasonic
1	Db2	SOD323F	Zener	BZT52C3V0SDICT-ND	3V	BZT52C3V0SDICT-ND	Digi-Key
1	R3	603	Thick Film	7.5	1%	311-7.50HTR-ND	Digi-Key
1	Db6	SOD323	Zener	BZT52C9V1SDICT-ND	9V	BZT52C9V1SDICT-ND	Digi-Key
4	R4, R5 Rg1, Rg2	603	Thick Film	10K	5%	311-10.0KHTR-ND	Digi-Key
1	C7	603	Ceramic Capacitor	10nFd	16V	LLL185R71E103MA01L	Murata
2	C8, C9	1812	Ceramic Capacitor	22uFd	16V	ECJ5YB1C226M	Panasonic
1	Db1	SOD323F	Zener	BZT52C12DICT-ND	12V	BZT52C12DICT-ND	Digi-Key
2	Rb3, Rb4	805	Thick Film	39K	5%	311-39.0KHTR-ND	Digi-Key
1	C6	603	Ceramic Capacitor	47pFd	50V	GRM1885C1H470JA01D	Murata
1	R1	603	Thick Film	60.4K	1%	311-60.4KHTR-ND	Digi-Key
3	D1, D2, Db3	SOD123	Rectifier	BAV16WDICT	75V	BAV16WDICT-ND	Digi-Key
2	Rb1, Rb2	1206	Thick Film	200	5%	311-200FTR-ND	Digi-Key
2	Db4, Db5	SOT23	Rectifier	BAT54S	30V	BAT54S	Internationsl
1	L	LOUTD	Inductor Core	Planer Inductor	*	E14/3.5/5-3F3 E14/3.5/5-3F3-A160	Ferrox Cube
1	IC1	SO-16	Integrated Circuit	IR2086S	9.5-16.0V	IR2086S	International Rectifier
1	T	PRI_TD	Inductor Core	Planer Transformer	Gap = 5 mil	PQ20/16-3F3 (8.4mm) 250FN029 (2.5mils Kapton) 113-576 (Kapton tape)	Ferrox Cube Dupont Contact east
2	NM6, NM7	6603	Transistor	IRF6603	30V	IRF6603	International Rectifier
1	NM5	SO-8	Transistor	IRF7380	80V	IRF7380	International Rectifier
4	NM1, NM2, NM3, NM4	MLP1	Transistor	IRF7493	80V	IRF7493	International Rectifier
1	NM8	SO-8	Transistor	IRF9956	80V	IRF9956TR	International Rectifier
1	T2	T2A	CT-Current Transformer		*	PCD1548CT-ND	Digi-Key