

Design Note

DN-Charger_Adapter 10W

**CoolSET™
10W Charger / Adapter with ICE2A165**

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Power Management & Supply



Never stop thinking

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Technical specifications:

Input Voltage Range	85 ... 270V AC
Input Frequency	50, 60 Hz
Output Voltage	5V +-5%
Output Power	14W
Line Regulation (85 ...270V)	< 1%
Load Regulation (10% ... 100%)	< 1%
Efficiency	> 70%
Output Ripple Voltage	< 100mV
Input Power @ no-load	<400mW
Switching Frequency	21...100 kHz
Temperature Range	0 ... 70°C

Circuit description:
Introduction

The **ICE2A165** chip used here was specially designed for use in flyback converters. As shown on the circuit diagram (p. 3), only a few additional components are required to create an AC/DC power supply.

Line Input

The AC line input side comprises input fuse F1 as overcurrent protection as well as choke L5 and X2 capacitor C8 as radio interference suppressors. After bridge rectifier BR1 and input capacitor C3, a voltage of 90 to 380 VDC depending on input voltage is available.

ICE2A165 Power Supply
Startup

From this voltage, the chip's starting current supply is derived using resistors R6 and R7. Because of the low current drain of <55 uA, high-value resistors can be used. Series connection of the resistors is necessary for reasons of dielectric strength of the individual resistors.

Operation Mode

During operation, the VCC pin is supplied via a separate transformer winding with associated rectification D2 and buffering C4, C13. Resistor R8 is used for current limiting during charging of C4. In order not to exceed the maximum voltage at VCC pin an external zenerdiode D4 limits this voltage. During no-load condition the switching frequency is reduced down to 21kHz in order to reduce the switching losses.

Softstart

The Soft-Start function is realised by an internal resistor and the external capacitor C14.

Primary Current – CoolMOS
Snubber Network

R10, C12 and D3 are dissipate the energy of the leakage inductance.

Limitation of primary current

The CoolMOS source current is sensed with an external shunt resistor R17. When the voltage at R17 exceeds the internal Current-Limit threshold the gate driver is shut off immediately.

Output Stage

Output Voltage

Power is coupled out on the secondary side via a fast-acting diode D1 with low forward voltage. Capacitor C5 performs energy buffering, a following filter L3, C9 considerably reduces the output voltage ripple.

Storage capacitor C5 is designed to exhibit as small an internal resistance as possible (ESR) in order to minimize the output voltage ripple caused by the triangular current characteristic. The output voltage is set with resistors R1, R2.

Regulation

The output voltage is controlled using a type TL431 reference diode.

This device incorporates the voltage reference as well as the error amplifier and a driver stage.

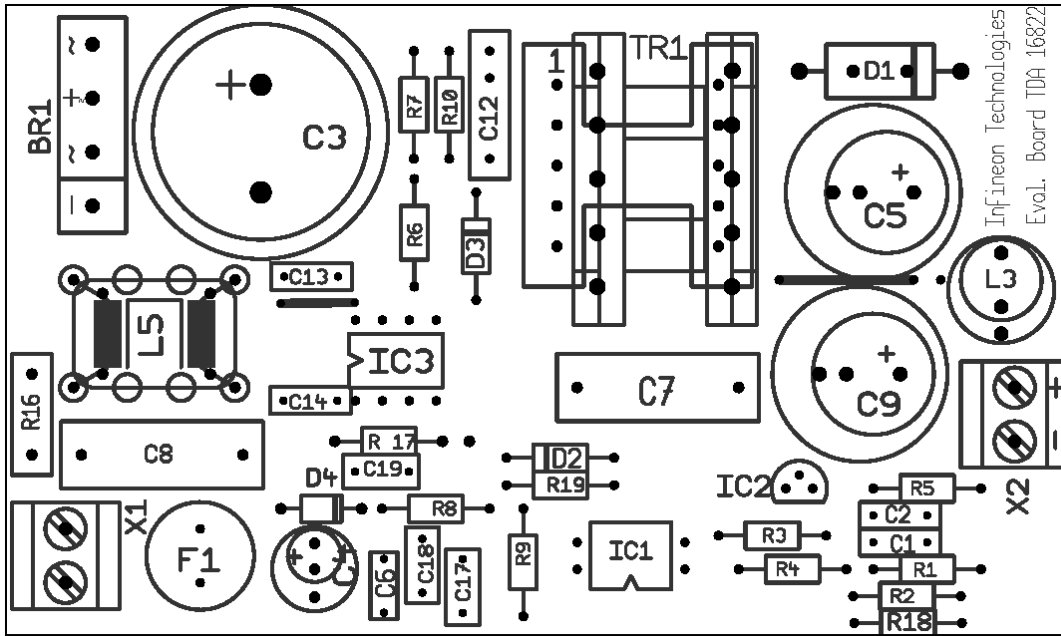
Compensation network C1, C2, R1, R5 constitutes the external circuitry of the error amplifier of IC2.

This circuitry allows the feedback to be precisely matched to dynamically varying load conditions, thereby providing stable control. The maximum current through the optocoupler diode and the voltage reference is set by using resistors R3, R4.

Optocoupler IC1 is used for floating transmission of the control signal to the "Feedback" input of the **ICE2A165** control device. The optocoupler used meets DIN VDE 884 requirements.

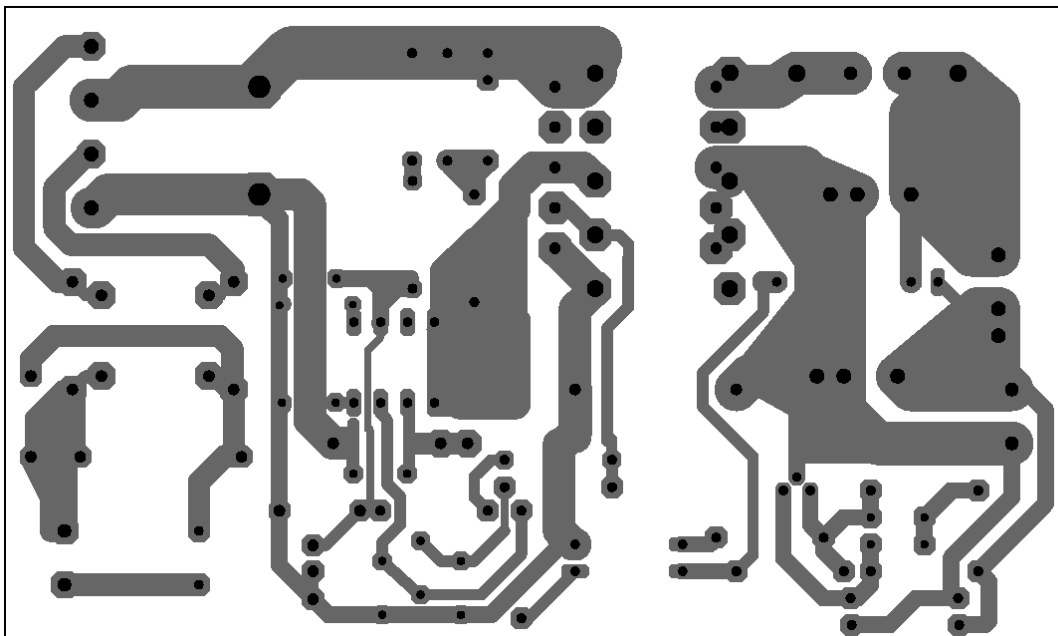
Design calculations for the components and the transformer were performed in accordance with **Application Note "AN-SMPS-ICE2AXXX for OFF – Line Switch Mode Power Supplies"**.

Component Legend:



Board Layout:

Component side shown



Component List:

Part List

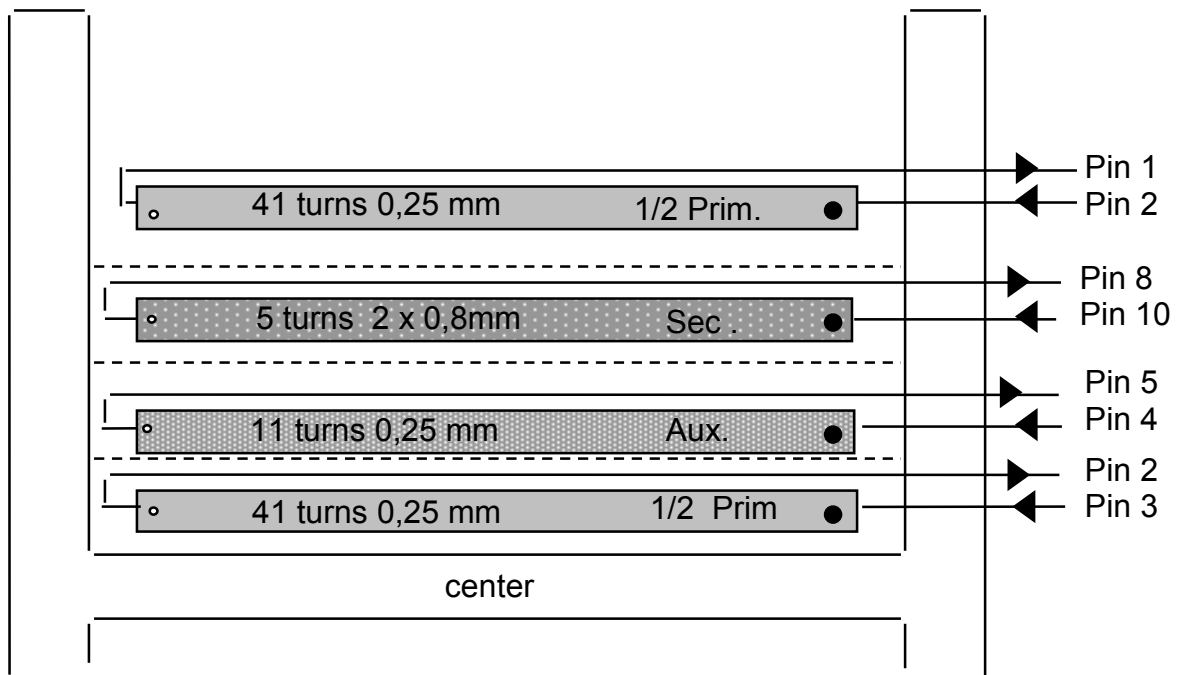
ICE2A165 Evaluation Board 5V/ 10W
07.08.2001

Pos.	Part	Type	Comment
1	BR1	B500 C1500	
2	C1	470nF, 50V	
4	C2	10nF, 50V	
5	C3	47uF, 400V	
6	C4	22uF, 50V	
7	C5	1000uF, 25V	
8	C6	4,7nF, 50V	
9	C7	2,2nF,250V, Y1	
10	C8	0,1uF, 275V, X2	
11	C9	1000uF, 25V	
12	C12	1nF, 400V	
13	C13	100nF, 50V	
14	C14	220nF, 50V	
15	D1	SB540	
16	D2	1N4148	
17	D3	1N4937	
18	D4	ZPD18	
19	F1	Microfuse 3,15A	
20	IC1	SFH617A-3X016	
21	IC11	ICE2A165	
22	IC2	TL431CLP	
23	L3	1uH, 3,7A	
24	L5	27mH, 0,4A	
25	R1	4,7k, 1%	
26	R2	4,7k, 1%	
27	R3	180R	
28	R4	1k	
29	R5	4,7k	
30	R6	360k	
31	R7	360k	
32	R8	4,7R	
33	R9	22R	
34	R10	100k, 1W	
35	R16	*	
36	R17	1,4R, 0,6W, 1%,	
37	R18	*	
38	TR1	E20 Coil Former	
39	TR1	E20/10/6, 0,5 N27	
40	X1	Connector 2pol.	
41	X2	Connector 2pol.	

* = not assembled

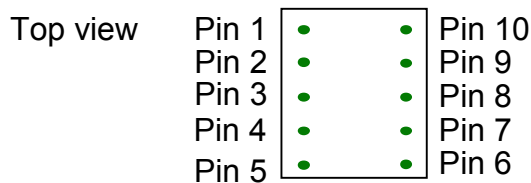
Transformer Construction

Core Material: E20/10/6; N27
 gap: 0,5mm
 Al = 103nH
 Lp = 692uH
 Coil former: horizontal version

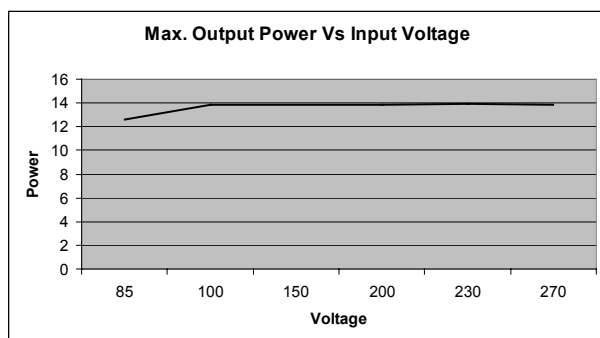
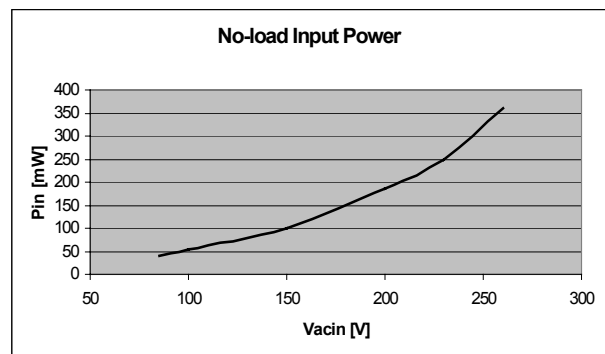
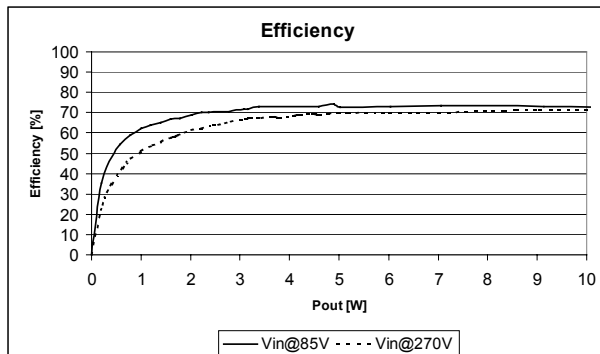


----- meens one layer Makrofol

Primary winding	41 + 41 turns	0,25 mm Ø	
Aux. winding	11 turns	0,25 mm Ø	
Secondary winding	5 turns	2 x 0,80 mm Ø	with triple Insulation



Measurements:



Note:

The built-in transformer does **not** comply with EN60950 safety requirements in respect of electrical isolation.

References:

- [1] ICE2AXXX for OFF-Line Switch Mode Power Supplies Application Note, Infineon Technologies
- [2] CoolSET-II Off-line SMPS Current Mode Controller with 650V/800V CoolMOS on Board Datasheet, Infineon Technologies

Revision History		
Application Note AN-EVAL-ICE2A165-1		
Actual Release: V1.1 Date:07.08.2001		Previous Release: V1.0
Page of actual Rel.	Page of prev. Rel.	Subjects changed since last release
12	12	First Issue
12	12	Part List, Transformer Construction

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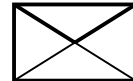
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