

Design Note

DN-EVALMF2ICE2A265-1

**CoolSET™
35W DVD Power Supply with ICE2A265**

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Power Management & Supply



Never stop thinking

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35W Multi Output Evaluation Board for DVD Supply with ICE2A265

The board described here was designed as a typical power supply in flyback converter topology with six output voltages and secondary control. This type of switch mode power supply is particularly suitable as an AC/DC power supply for DVD supply, video games, satellite decoders, etc. The switch mode power supply **ICE2A265** chip used for this application is a current-controlled pulse width modulator with integrated CoolMOS power switch. Special efforts have been made to compensate temperature dependency and to achieve a very high accuracy of the switching frequency. Furthermore, overload and open loop protection is implemented by controlling the feedback line. In case of overload or open loop, the IC is working in **auto restart** mode.



Fig: Evaluation board

Note:

Other output voltages can also be implemented very easily by a simple modification of the transformer and the output circuitry.

Technical specifications:

Input Voltage Range	190 ... 264V AC
Input Frequency	50, 60 Hz
Output Voltage 1	+5V +-3%; 1,5A peak
Output Voltage 2	+16V +-8%; 1,5A peak
Output Voltage 3	+12V +-8%; 70mA
Output Voltage 4	-12V +-8%; 70mA
Output Voltage 5	-22V +-8%; 50mA
Output Voltage 6 (isolated)	+5V +-5%; 40mA
Line Regulation (190 ...270V)	< 1% @ 5V
Load Regulation (10% ... 100%)	< 1% @ 5V
Efficiency	>80%
Switching Frequency	21....100 kHz
Temperature Range	0 ... 50°C

Circuit description:

Introduction

The **ICE2A265** chip used here was particularly designed for the use in flyback converters. As shown on the circuit diagram (p. 6), only a few additional components are required to create an AC/DC power supply.

Line Input

The AC line input side comprises the input fuse F1 as overcurrent protection the choke L1 and X2-capacitors C13 and C18 as radio interference suppressors. After the bridge rectifier D12...D15 and the input capacitor C1, a voltage of 200 to 380 VDC depending on input voltage is available.

ICE2A265 Power Supply

Startup

From the DC input voltage, the chip's starting current supply is derived using the resistors R6 and diode D11. 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 insufficient dielectric strength of the individual resistors.

Mode of Operation

During operation, the VCC pin is supplied via a separate transformer winding with associated rectification D10 and buffering C2, C21. The Resistor R8 is used for current limiting during the charging of C2. In order to not exceed the maximum voltage at the VCC pin, an external zenerdiode D9 is applied for voltage limitation.

Softstart

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

Primary Current – CoolMOS

Clamping Network

R12, C19 and D1 dissipate the energy of the leakage inductance.

Limitation of primary current

The CoolMOS source current is sensed by an external shunt resistor R7. When the voltage at R7 exceeds the internal current-limit threshold, the gate driver is shut off immediately.

Output Stage

On the secondary side the power is coupled out via a fast-acting diodes D2, D3, D4, D5, D7, D8 with low forward voltage. The capacitors C3, C4, C5, C9, C11, C26 provide energy buffering, a filter L2, C6; L3, C7; L4, C8; L5, C10; L6, C12 reduces the output voltage ripple considerably.

All storage capacitors are designed to have an internal resistance as small as possible (ESR). This minimizes the output voltage ripple caused by the triangular current characteristic. The output voltage level is set by resistors R1, R2 for the +5V output.

Regulation

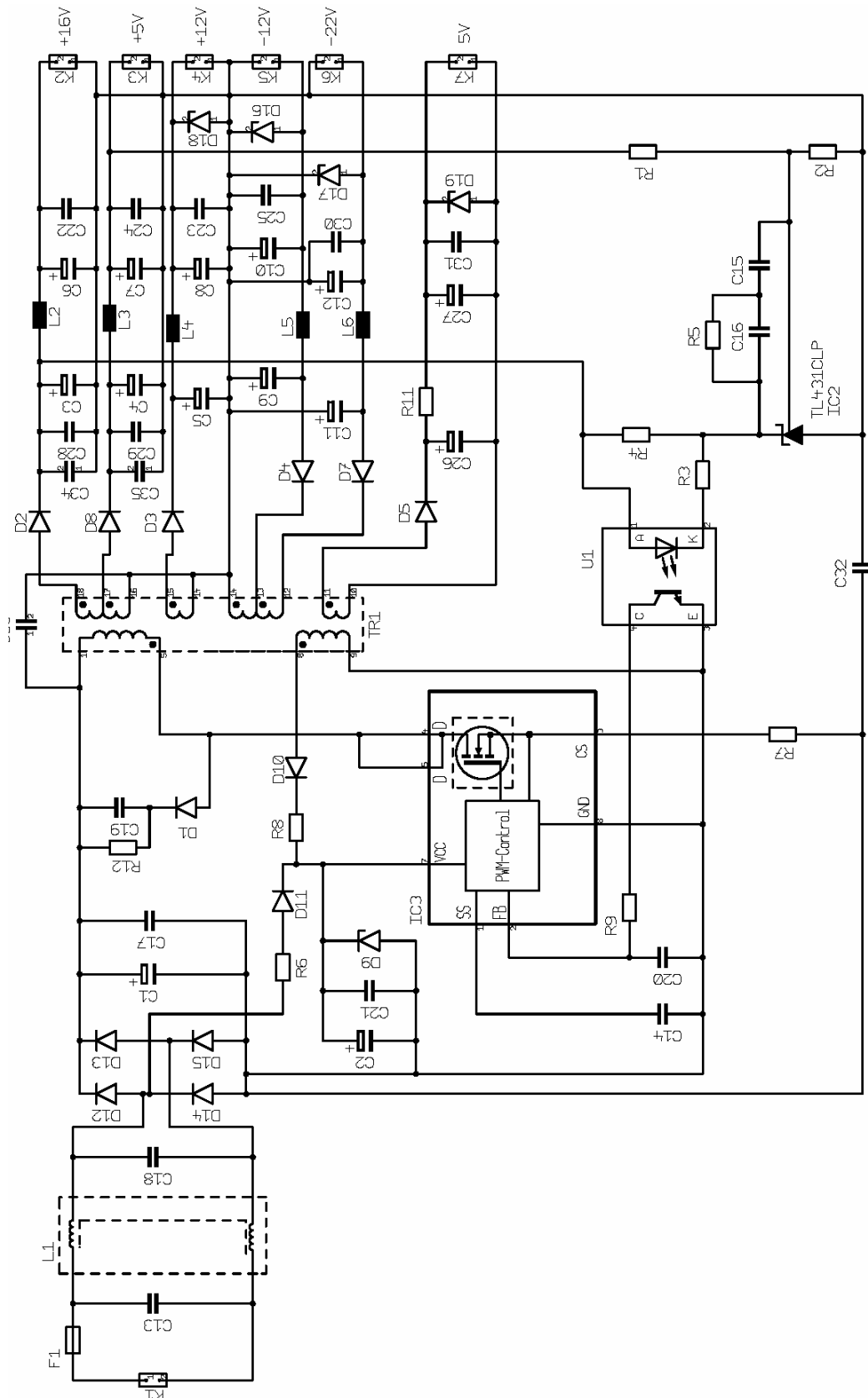
The output voltage is controlled using a type TL431 IC2 reference diode.

This device incorporates the voltage reference the error amplifier, and a driver stage. The compensation network C15, C16, 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 the resistors R3 and R4.

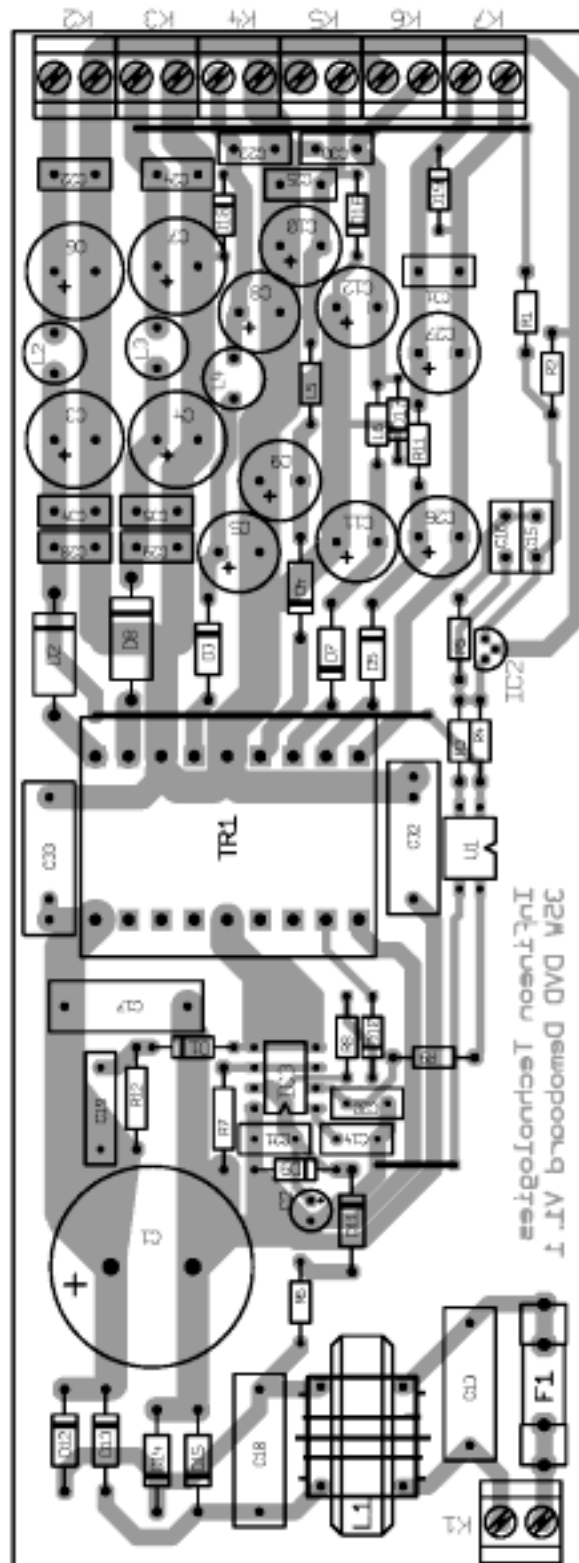
Optocoupler U1 is used for floating transmission of the control signal to the “Feedback” input of the **ICE2A265** control device. The optocoupler meets DIN VDE 884 requirements.

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

Schematic:



Board Layout; Component Legend:



Component side shown

Component List:

35W DVD Supply

Part List

08.06.2003

Pos.	Part	Pcs.	Type	Grid	Ordering Code	Manuf.
1	C1	1	47uF, 400V	10mm	B43501-	EPCOS
2	C2	1	47uF, 35V	2,5mm	B41821-	EPCOS
3	C3, C4, C6, C7	4	1000uF, 25V	5mm	KZE25VB1000MK20	NCC
4	C5, C9, C26	3	220uF, 25V	5mm	KZE25VB220MH11	NCC
5	C8, C10, C27	3	100uF, 25V	5mm	KZE25VB100MF11	NCC
6	C11	1	220uF, 35V	5mm	KZE35VB220MH15	NCC
7	C12	1	150uF, 35V	5mm	KZE35VB150MH11	NCC
8	C13, C18	2	0.1uF, 275V, X2	15mm	B81130-	EPCOS
9	C14, C15	2	470nF, 50V	5mm	B37984-	EPCOS
10	C16, C20	2	2,2nF, 50V	5mm	B37979-	EPCOS
11	C17		*			
12	C19	1	2,2nF, 400V	7,5mm	B32520-	EPCOS
13	C21, C22, C23, C24, C25, C30, C31	7	100nF, 50V	5mm	B37987-	EPCOS
14	C28, C29, C34, C35	4	1uF, 50V	5mm	B37984-	EPCOS
15	C33	1	1nF, 250V, Y1	12,5mm	WKP 1n M	Wima
16	D1	1	1N4937	10mm		
17	D2	2	MUR420	15mm		
18	D8	1	MBR540	15mm		
19	D3, D4, D5, D7	4	MUR120	12,5mm		
20	D9	1	BZX 79/B18	10mm		
21	D10	1	1N4148	10mm		
22	D11, D12, D13, D14, D15	5	1N4007	12,5mm		
23	D16, D18	2	*	10mm		
24	D17	1	*	10mm		
25	D19	1	*	10mm		
26	F1	1	Fuse 3,15A			
27	IC2	1	TL431CLP	SOT-54		
28	IC3	1	ICE2A265	DIP8		Infineon
29	U1	1	SFH617A-3X016	2,5mm		
30	K1, K2, K3, K4, K5, K6, K7	7	Connector 2	10mm		
31	Br1, Br2, Br3	3	wire			
32	L1	1	27mH, 0.9A		B82732-	EPCOS
33	L2, L3, L4	3	1uH, 3.7A	5mm	822LY-1ROM	Componex
34	L5, L6	2	2.2uH, 0.6A	10mm	B82141-	EPCOS
35	R1	1	4k92, 1%	10mm		
36	R2	1	4k7, 1%	10mm		
37	R3	1	750R	10mm		
38	R4	1	1,2k	10mm		
39	R5	1	47k	10mm		
40	R6	1	330k	10mm		
41	R7	1	0,68R 1%	12,5mm		
42	R8, R11	1	4,7R	10mm		
43	R9	1	22R	10mm		
44	R12	1	47k	12,5mm		
45	TR1	1	SMT1 coil former	4mm	see also Winding Instruction	Orega
46	TR1	1	ED29/ 0,98mm gap			Orega

* = not assembled

Transformer Construction:

Winding Instruction

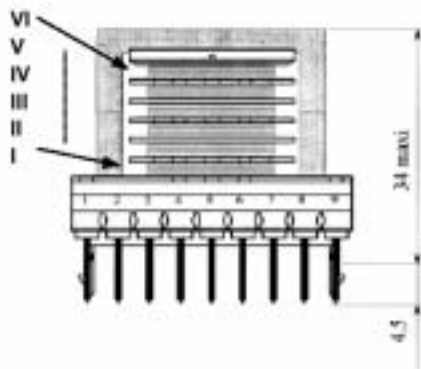
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Product: **35W DVD Multioutput**

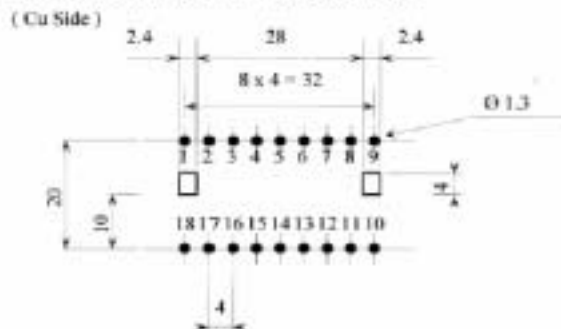
Core Type: ED29/10/12//ED29/15/12
 Bobbin: SMT1
 Al-Value: 154 nH (240nH + 260nH)
 gap: 0,9 mm (0,47mm + 0,43mm)
 Margin:

Inductance: 498 uH
 Leakage Ind.: 10 uH

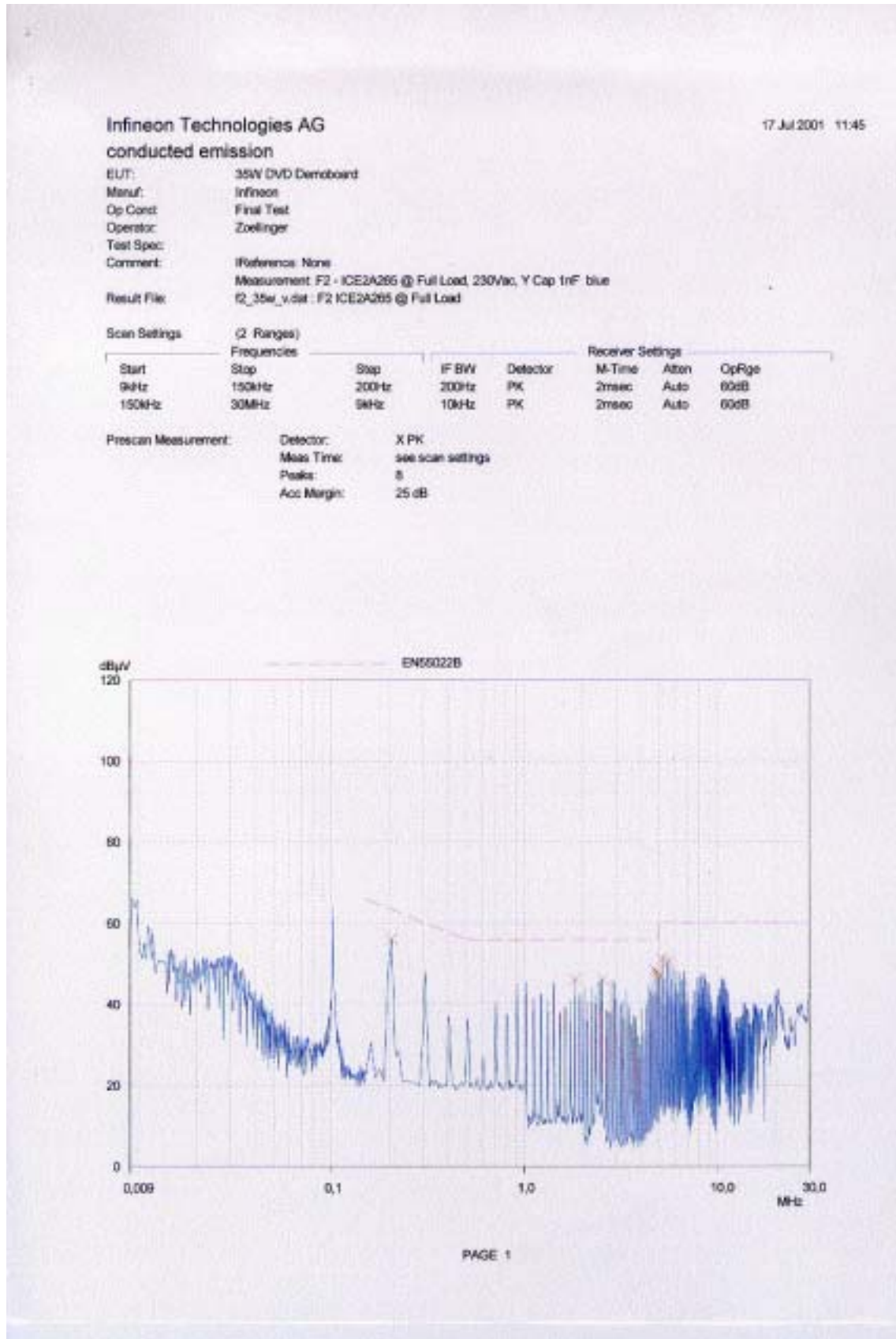
Slot No	Winding	Start	End	Nr. of Turns	Nr. of Parallel	Wire Size
II	Prim.	5	1	58	1	0,28
II	Aux.	8	9	7	1	0,28
I	+5V	17	16	3	3	0,28
I	+16V	18	17	6	2	0,28
I	+12V	15	14	7	1	0,28
IV	Prim.	5	1	58	1	0,28
III	+5V	17	16	3	3	0,28
III	+16V	18	17	6	2	0,28
III	-12V	14	13	7	1	0,28
VI	Prim.	5	1	58	1	0,28
V	+5V	17	16	3	3	0,28
V	+16V	18	17	6	2	0,28
V	-22V	13	12	5	1	0,28
V	+5Viso	11	10	3	1	0,28



RECOMMENDED PUNCHING DIAGRAM



Measurements:



References:

- [1] ICE2AXXX for OFF-Line Switch Mode Power Supplies
Application Note, Infineon Technologies

- [2] CoolSET -II
Off-line SMPS Current Mode Controller with High Voltage CoolMOS on Board
Datasheet, Infineon Technologies

Revision History		
Design Note DN-EVALM-ICE2A265-1		
Actual Release: V1.0 Date: 11.04.2002		Previous Release: V1.0
Page of actual Rel.	Page of prev. Rel.	Subjects changed since last release
12	--	New Transformer Construction

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