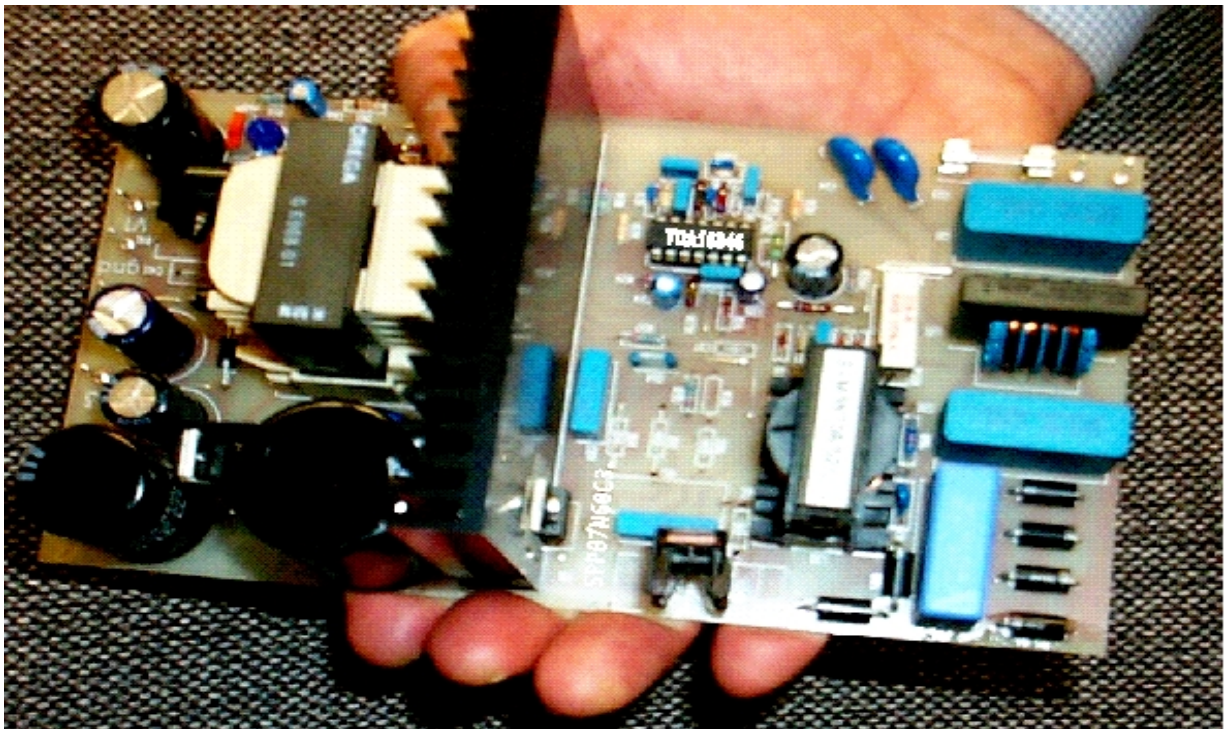


TDA 16846

200 W High Performance TV
SMPS Application Board
with PFC and
Standby Input Power <1W

TD3642_T



Contents:

- P. 3-4: Functional Description
- P. 5: Circuit Diagram
- P. 6-8: Measuring Results
- P. 9-10: PFC- Diagrams
- P. 11: Transformer Calculation
- P. 12-20: Transformer Data
- P. 21-22: List of Components
- P. 23: Layout
- P24: Component Placement Specification

Functional Description:

The SMPS TD 3642_T, whose circuit diagram shown on page 5, is a power supply especially for high end TV applications. It is equipped with a Charge Pump Circuit (L08, D08, C08) for Power Factor Correction (PFC) and a special low power standby burst mode circuit which makes only 1 W standby input power possible. This SMPS is running in fixed frequency mode but changes continually into freerunning mode at high output power. This kind of operation avoids jitter (unstable periods) in TV applications with periodically changing load which can sometimes cause distortions in the picture and noise in the transformer. The fixed frequency mode is realized by the RC- circuit R31 / C31 at pin 7.

In standby mode the output voltages are lowered to 25% of the value in normal mode. The lowered output voltages are the cause at primary side to switch into burst mode. The switching losses which are much dependent on the voltage are reduced. The reduction of the output voltages is done by switching off the switch S1 at the bottom of the voltage divider for V1. The reference diode D60 becomes conducting and pin 5 of TDA 16846 is pulled down by the optocoupler. The output pulses at pin 13 are stopped and the output voltages are falling until the output V2, which is provided for the standby supply output, has reached its lowered value which is determined by the Zener diode D61.

Burst mode consists of permanent startups. To get very low input power, no additional startup resistor is used which would generate additional power dissipation. The resistor R22 for the primary current simulation at pin 2 is also used as charging resistor for burst mode and has the high value 680 kOhm. To get a high burst repeat frequency in spite of the high charging resistor, the capacitor C26 at pin 14 is lowered from 22 μ F to 1 μ F.

During the burst the IC gets its supply voltage from a separate voltage supply circuit. The small capacitor C26 of only 1 μ F cannot store enough energy to supply the IC during the burst and for startup into normal mode. The advantage of this supply circuit is that the supply voltage is produced only as long as it is needed and no supply energy is wasted. This circuit is realized by the charge pump circuit C264, D27 and D28 which is supplied in turn by the pulses of the transformer supply winding (between transformer pins 5 and 8). The capacitor C263 smoothes the output voltage.

The output voltage is stabilized with the Zener diode D29 to 13 V. The diode D30 prevents that the current for charging C26 during startup is flowing backwards into the charge pump circuit. The anode of the diode D27 is not directly connected to ground but across a parallel RC circuit R262 / C262. This RC circuit allows operation of the charge pump circuit only for a short time. This is necessary to prevent overtemperature of the Zener diode D29 in normal mode and to make possible that the under voltage lockout function at pin 14 of TDA 16846 is still operative. The resistor R262 limits the current of the charge pump circuit in normal mode to approx. 3 mA so that the IC cannot be supplied by this circuit permanently. As soon as the regulation stops the output pulses after each burst, the charge pump circuit

stops to work and the storage capacitor C26 is discharged within short time. C26 is now charged by R22 for the next burst. The capacitor C261 parallel to C26 acts as a short circuit for RF noise.

During normal mode, especially at high mains voltage and low output current, when the SMPS runs with the fixed frequency, the charge pump circuit can produce a high negative voltage at the minus terminal of C262. This voltage is limited by the Zener diode D31 (91 V) to protect the capacitor C262 and the diodes D27 and D28 from overvoltage. To avoid overtemperature of D31, a resistor R331 takes over a big part of the leakage current.

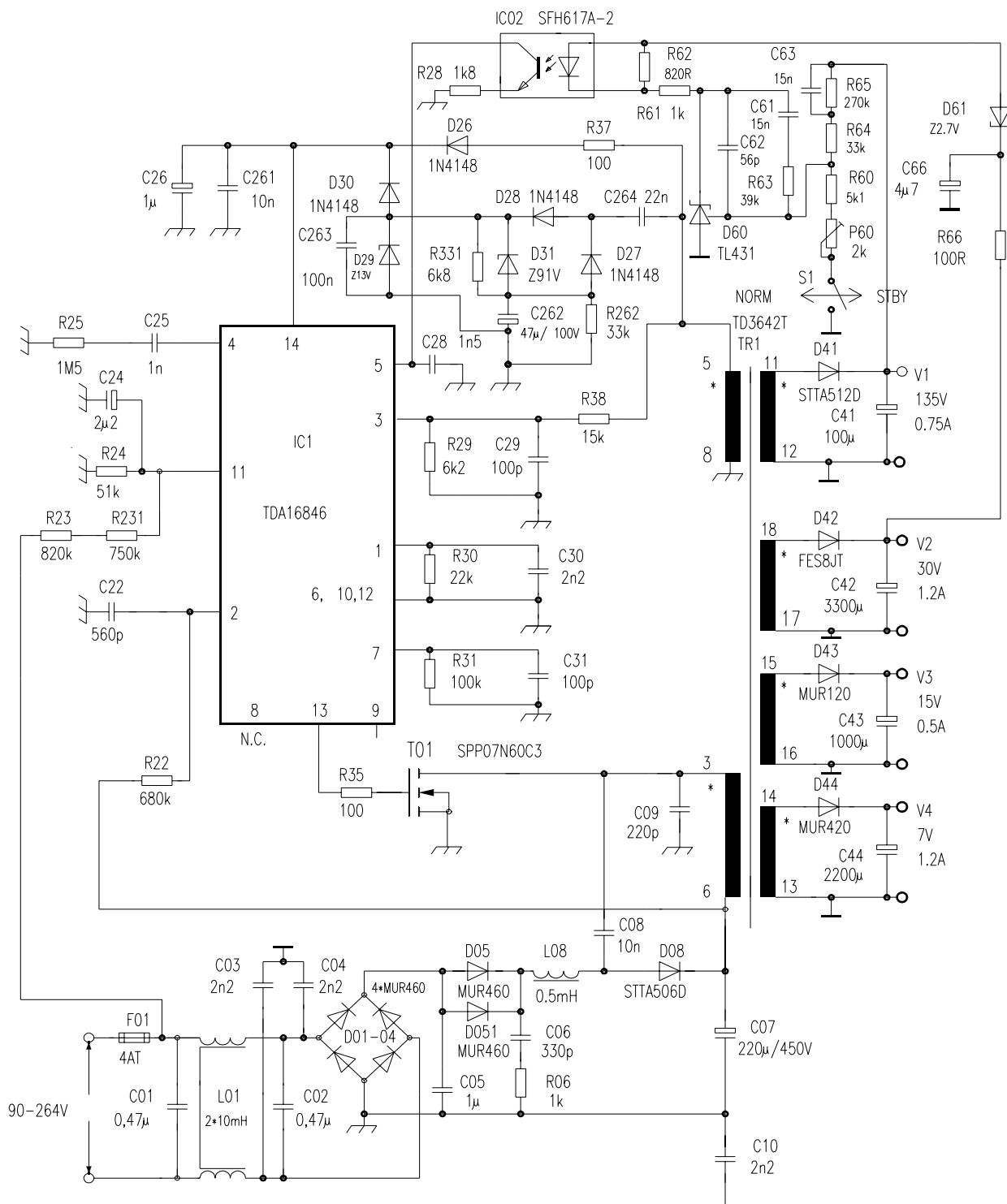
The RC circuit R66 / C66 acts as a delay circuit for the optocoupler supply voltage. The effect is a total stop of the output pulses at the end of each burst because the voltage at C66 is still rising and produces current through the opto coupler after the regulation circuit has already regulated down. In this way the after pulses behind the burst are avoided, the burst is shortened to its effective part and switching losses are brought to a minimum.

The RC circuit R25 / C25 at pin 4 shapes the regulation voltage in this way, that the switch on time during the burst is nearly constant. The resistor R25 causes a voltage drop at begin of the softstart current out of pin 4 and determines the starting value of the switch on pulses. With adjusting R25 and C25 an optimum has been found between power dissipation and noise in the transformer in standby burst mode. Bigger switch on pulses cause lower power dissipation but also higher noise in the transformer.

PFC circuit: The PFC (power factor correction) function is fulfilled with the charge pump circuit L08, D08 and C08. In freerunning applications with the charge pump circuit an additional diode between the drain of the MOS FET and the primary winding is necessary to avoid that current flies back into the primary winding and causes transformer oscillations with low frequency after the demagnetization. This diode can be saved in this SMPS because a stable distance between the zero crossings is not necessary.

The fixed frequency (time constant $R31 * C31$) is set to a value which is higher than the lowest freerunning frequency (at max. output load and lowest mains voltage). So at high output load the SMPS is freerunning. The point of transition is reached when the freerunning period becomes as long as the fixed frequency period. The advantage is that in fixed frequency mode no less energy can be transmitted by the transformer as in freerunning mode.

Undervoltage lockout: The voltage divider at pin 11 is not connected to the positive terminal of the primary capacitor but to the AC mains voltage. The advantages are lower power dissipation in the resistors R23, R231 and faster switch off in standby mode after disconnecting the SMPS from the mains. The reason for the 2 resistors R23 and R231 in series is that the voltages across each resistor are smaller and cheaper resistors can be used.



200 W SMPS Demoboard TD3642-T with PFC and Standby Burst Mode

27.04.2001

Output Voltages of 200W-Demoboard TD3642T with Burst-Mode and TDA 16846

(Mains 110V)

	V 1	V 2	V 3	V 4	V 5	V- IC	Input power	eff.
--	-----	-----	-----	-----	-----	-------	-------------	------

Nominalload

V	135V	30,64V	15,09V	7,08V				
						11,62V	91,6W	88,55%
C	0,4A	0,6A	0,25A	0,7A				

Maximalload

V	135V	30,55V	15,02V	7,00V				
						11,94V	181,5W	84,74%
C	0,75A	1,2A	0,5A	1,2A				

Minimalload

V	135V	30,53V	15,03V	7,07V				
						11,47V	74,3W	86,28%
C	0,280A	0,6A	0,25A	0,6A				

Stand by1 (burst mode)

V	57,62V	7,20V						
						11,70V	0,5W	72,00%
C	0	0,05A	0	0				

Stand by2 (burst mode)

V	51,23V	7,24V						
						11,69V	0,4W	54,00%
C	0	0,03A	0	0				

Output Voltages of 200W-Demoboard TD3642T with Burst-Mode and TDA 16846

(Mains 230V)

	V 1	V 2	V 3	V 4	V 5	V- IC	Input power	eff.
--	-----	-----	-----	-----	-----	-------	-------------	------

Nominalload

V	135V	30,60V	15,06V	7,07V				
						11,57V	98,00W	82,72%
C	0,4A	0,6A	0,250A	0,7A				

Maximalload

V	135V	30,53V	15,01V	7,00V				
						11,92V	175,3W	87,74%
C	0,75A	1,2A	0,5A	1,2A				

Minimalload

V	135V	30,46V	14,98V	7,05V				
						11,49V	80,00W	80,62%
C	0,280A	0,6A	0,25A	0,6A				

Stand by1 (burst mode)

V	53,03V	7,23V						
						11,65V	0,8W	44,81%
C	0	0,05A	0	0				

Stand by2 (burst mode)

V	51,53V	7,25V						
						11,63V	0,5W	46,18%
C	0	0,03A	0	0				

Output Voltages of 200W-Demoboard TD3642T with Burst-Mode and TDA 16846

(Mains 264V)

	V 1	V 2	V 3	V 4	V 5	V- IC	Input power	eff.
--	-----	-----	-----	-----	-----	-------	-------------	------

Nominalload

V	135V	30,58V	15,04V	7,07V				
						11,61V	100,7W	80,49%
C	0,4A	0,6A	0,25A	0,7A				

Maximalload

V	135V	30,52V	15,01V	7,00V				
						11,91V	178,5W	86,15%
C	0,75A	1,2A	0,5A	1,2A				

Minimalload

V	135V	30,43V	14,98V	7,05V				
						11,51V	83,2W	64,03%
C	0,280A	0,6A	0,25A	0,6A				

Stand by1 (burst mode)

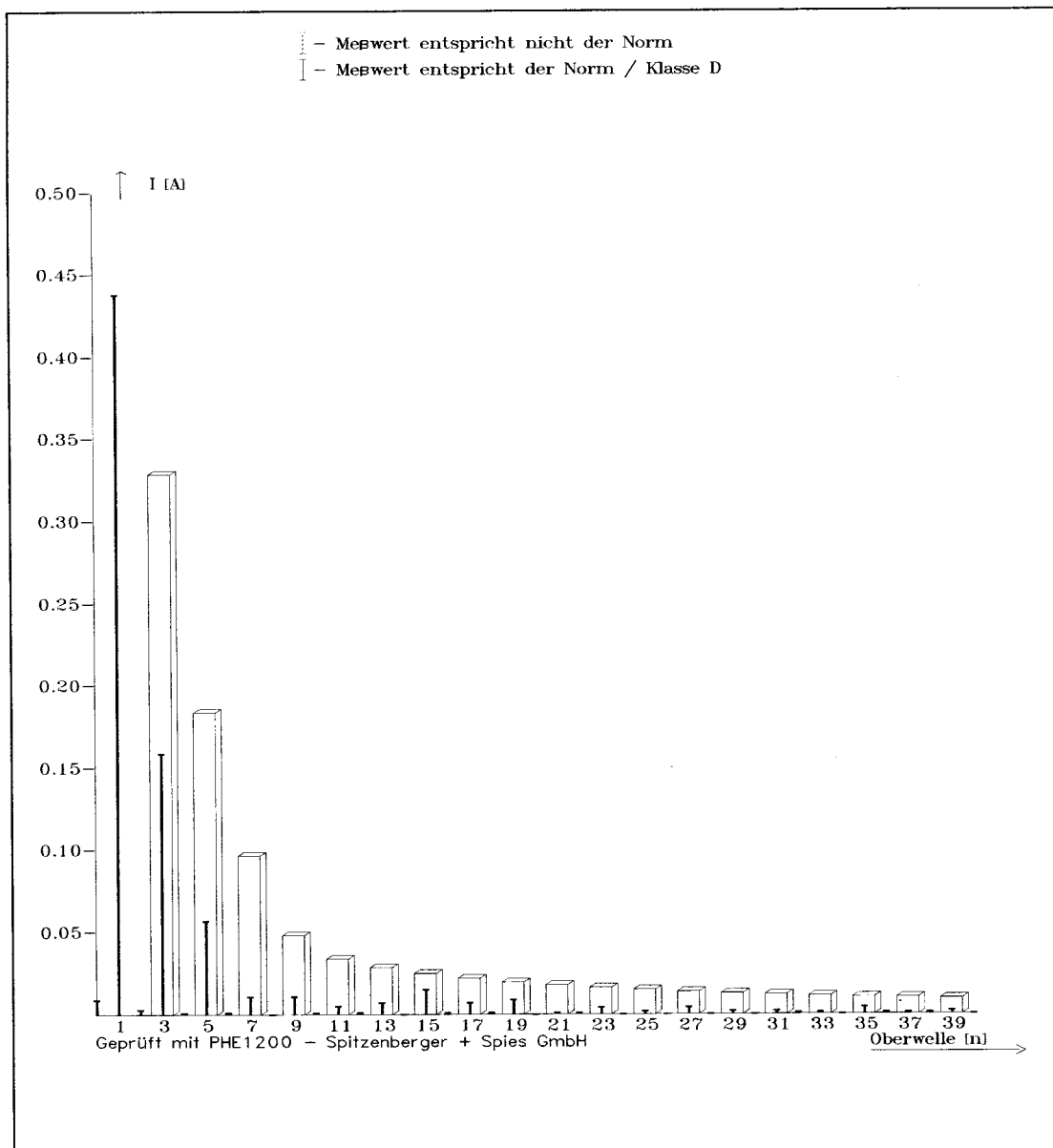
V	56,60V	7,23V						
						11,65V	0,9W	40,16%
C	0	0,05A	0	0				

Stand by2 (burst mode)

V	50,8V	7,25V						
						11,63V	0,6W	36,25%
C	0	0,03A	0	0				

OBERWELLENANALYSE nach EN 60555

(Linear) 1. Zeitfenster von 1



Prüfer: Schmidt

Prüfling: Fa. INFINEON 200W PFC

Datum: 10.10.2000

Info: SMPS WITH TDA 16846

Info:

Spannungskennndaten: 229.9 Veff

k = 0.33 %

Stromkennndaten: 0.4741 Aeff

k = 39.05 %

Leistungskennndaten: + 96.80 W

P1: 96.33 W 109.06 VA

Leistungsfaktor: 0.888 pf

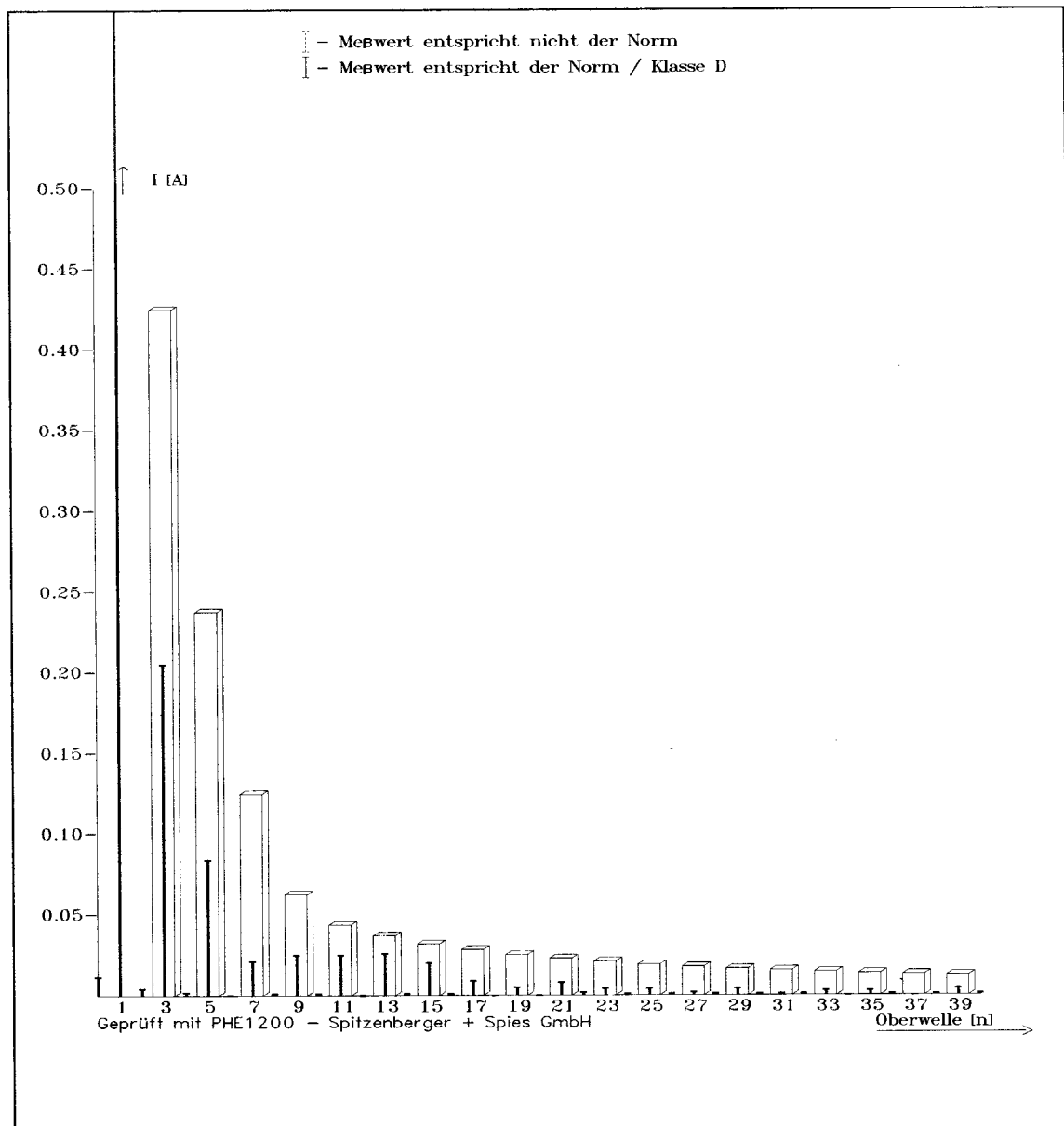
Cos Phi: 0.956

Frequenz: 50.00 Hz

VH10= 00.06% -090.0 deg AH10= 00.12% -094.

OBERWELLENANALYSE nach EN 60555

(Linear) 1. Zeitfenster von 1



Prüfer: Schmidt
 Prüfling: Fa.INFINEON 200W PFC
 Datum: 10.10.2000
 Info: SMPS WITH TDA 16846
 Info:
 Spannungsdaten: 229.8 Veff k = 0.27 %
 Stromdaten: 0.6079 Aeff k = 40.85 %
 Leistungsdaten: +125.06 W P1: 124.48 W 139.78 VA
 Leistungsfaktor: 0.895 pf Cos Phi: 0.969
 Frequenz: 50.03 Hz VH10= 00.03% -131.8 deg AH10= 00.09% -077.

Infineon AI IP TM

20.09.2000

Transformer data calculated for PFC SMPS TD3642_T

Core = SMT4/192, Mat. N27, AL = 192 nH, Ae = 180 mm²

Input- voltage- range	90 V - 270 V
Primary inductivity	151 uH
Max. Magnetization, 29.5 kHz	296.79 mT
Max. Input- / Outputpower	195.2 W / 156.2 W
Induced voltage in prim. winding	73 V
Max. Drainvoltage	595 V
Max. Draincurrent	9.94 A
Lowest SMPS- Frequency / long. per.	29.5 kHz / 33.9 us
Sec. voltage per turn	2.6 V
Max. switch on time	11.8 us

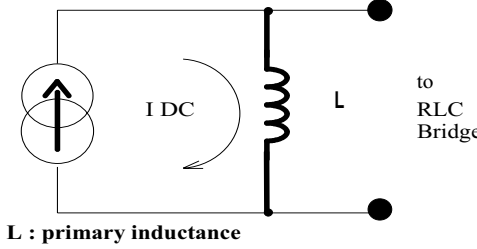
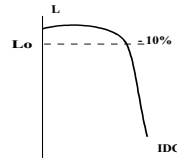
Windg.	n / I/A	Irms/cross s.	Umin/Umax/V	Uact/V
Prim.	28 / 1.72	3.46 / .87		
IC-supply	5			12.3
U 1	52 / .75	1.11 / .28	134 / 136	134.15
U 2	12 / 1.2	1.78 / .44	29 / 31	30.19
U 3	6 / .5	.74 / .19	14 / 16	14.59
U 4	3 / 1.2	1.78 / .44	6.5 / 7.5	6.8

Output voltages incl. 1 V voltage drop at sec. diodes

Current density 4 A/mm²

THOMSON <small>MULTI MEDIA</small>		SMT 4	40326 - xx
		SPF : G 6968-01	
INFINEON <i>technologies</i>			
Switch Mode Transformer OREGA			
For 200W demo Board NTTD 3642 with TDA 16846			
<i>ITEMS</i>		<u>CONTENTS</u>	<i>PAGES</i>
Electrical characteristics			2
Output characteristics / Circuit Diagram			3
Mechanical specification			4
Material List			5
Safety Specification			6
Marking			7
Packaging			8
Winding specification			9
Number of pages			9
Reliability Specification			REF P 014
<i>Ince</i>	<i>Date</i>	<i>Subject</i>	<i>LAB.</i>
00	14/02/00	First Edition	
01	22/09/00	Modifications : Winding specification. Al value. Wire diameter.	Hervé Faivre Development Lab wound Devices E-mail : faivreh@thmulti.com) Tel : 33 (0) 3 84 64 54 54 Fax : 33 (0) 3 84 64 54 28
OREGA		PRODUCT SPECIFICATIONS	Page : 1

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THOMSONMULTI MEDIA		SMT 4	40326 - xx
		SPF : G 6968-01	
CHARACTERISTICS Unless otherwise specified,the standard range of atmospheric conditions for making measurements and test is as follows: Ambiant temperature: 25° C +/- 5° C Relative humidity : 45% to 85% Air pressure : 860 HPa to 1060 HPa			
ELECTRICAL CHARACTERISTICS			
ITEMS		CONDITIONS	SPECIFICATIONS
1	primary inductance	measuring points 3 and 6 measuring frequency 1 KHz applied voltage 250mV	Lp = 151 μH +/-10%
2	leakage inductance	measuring points 3 and 6 measuring frequency 1 KHz (All secondary short circuited)	/
3	DC superimposed inductance	<div></div>	<div>L = Lo x 0.9 for Isat = 8.75 A at 100°C</div> <div></div>
4	Max. primary power		200 W
5	Operating voltage		90Vac - 270Vac
6	Operating Frequency		34 kHz min.
7	Controller circuit		TDA 16846
8	Regulation Mode		Secondary (135v)
OREGA		PRODUCT SPECIFICATIONS	Page : 2

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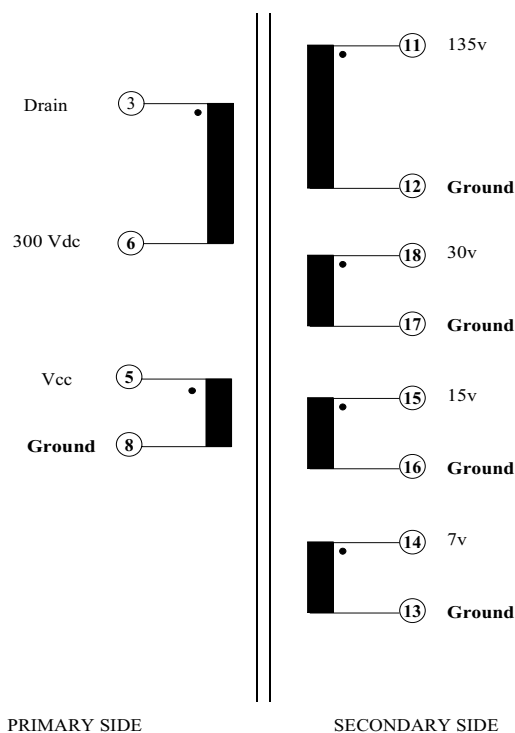
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40326 - xx
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OUTPUT CHARACTERISTICS

Pins	Value	Loads Max	Remarks
3-6			Mains
5-8		20mA	Vcc
11-12	135v	750mA	B+
18-17	30v	1200mA	
15-16	15v	500mA	
14-13	7v	1200mA	

CIRCUIT DIAGRAM

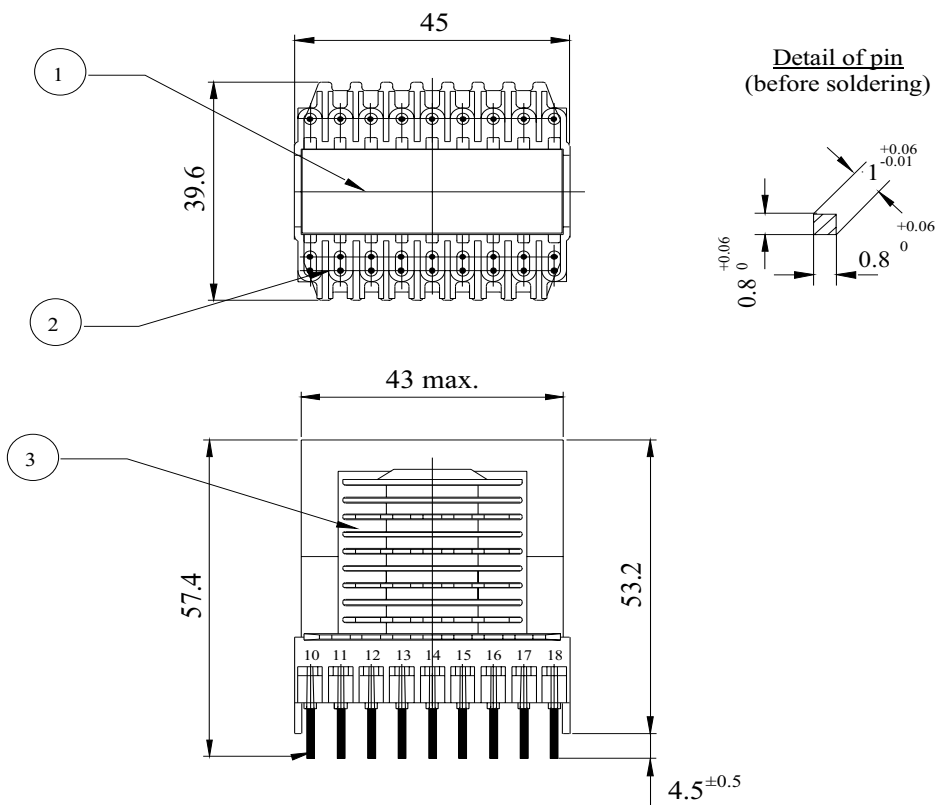

OREGA
PRODUCT SPECIFICATIONS
Page :
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THOMSON MULTI MEDIA

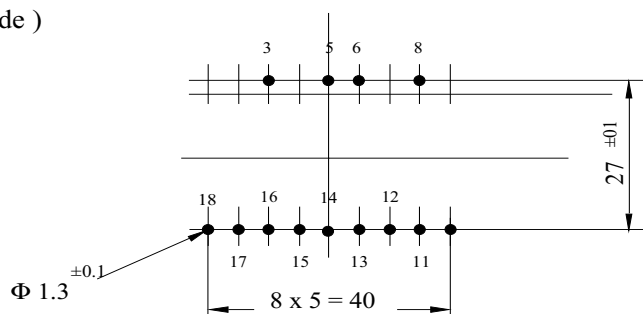
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40326 - xx
SPF : G 6968-01

MECHANICAL CHARACTERISTICS



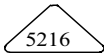
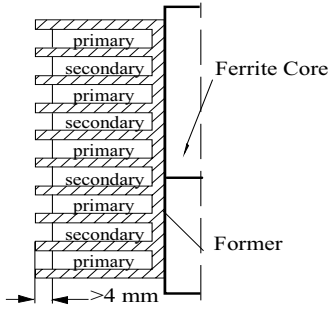
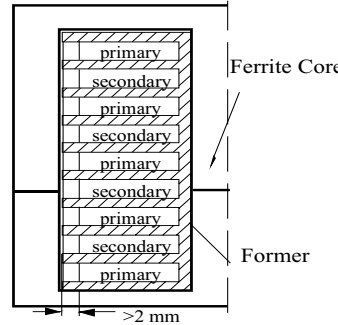
RECOMMENDED PUNCHING DIAGRAM

(CU Side)


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PRODUCT SPECIFICATIONS
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<div> <div>THOMSON</div> <div>MULTI MEDIA</div> </div>					SMT 4	40326 - xx	
					SPF : G 6968-01		
<div>MATERIAL LIST</div>							
Nr	Designation	Reference	Material	Supplier	Generation compound	Standards certification	U L rating
1	Ferrite Core	42x21x15	$Al = 192 \text{ nH} \pm 4 \%$ $I_s > 2.45 \text{ A at } 23^\circ\text{C} \pm 3^\circ\text{C}$ $I_s > 2.70 \text{ A at } 100^\circ\text{C} \pm 5^\circ\text{C}$ on coil test 100 turns		Ferrite		
2	Former		Rynite FR 515	DUPONT DE NEMOURS	P E T	UL : E 69578M	94 V0 0.86
3	Winding		Enamelled wire Grade 2	ALCATEL CUIVRE	Copper	UL : E 67139M IEC 317.21	155 ° MW 80 c
OREGA		PRODUCT SPECIFICATIONS				Page :	5

THOMSON <small>MULTI MEDIA</small>		SMT 4	40326 - xx
		SPF : G 6968-01	
SAFETY :			
	ITEMS	CONDITIONS	SPECIFICATIONS
1	Thiscktness of insulation, creepage distances and clearances.	Minimum thickness between the primary and the secondary for the plsatic part Applicable standard : IEC 65 (international electrotechnical commission)	In conformity
2	Dielectric strength	According to IEC 65 § 10.3 Dielectric strength between primary and secondary checked on production line	In conformity
3	Safety standard approval	DIN VDE 0860/05.89 clause 14.3.2a	Certified N° :  5216
		BSI BS 415.1994/clause 14.3.2a	Certified N° : 7467
		IMQ CEI 12.13/5a-1988+ Var. V1/1990 (HD 195 S4) clause 5,14.3.2a	Certified N° : CS.n.V.3509
4	Cross section of windings	primary wire / secondary wire	
		primary wire & secondary wire / ferrite core	
OREGA		PRODUCT SPECIFICATIONS	Page : 6

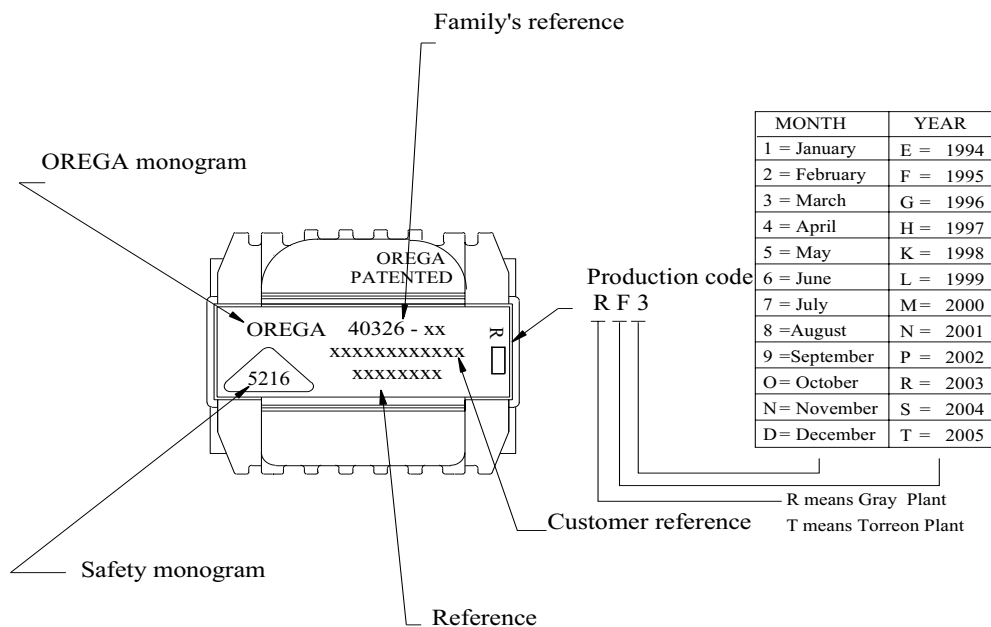
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MARKING

(by ink or label)


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<div>THOMSONMULTI MEDIA</div>	SMT 4	40326 - xx
	SPF : G 6968-01	

PACKAGING

Preformed tray

SMT

1 preformed tray (cover)

3 preformed trays of 35 pieces

THOMSON TELEVISION COMPONENTS FRANCE

REF.:

Customer reference

TTCF reference

QTY.:

APPROVAL:

PACKAGING

Single piece weight ≈ 125 g

105 pieces per box

Total box weight ≈ 14 Kg

SHIPMENT

Europallet (1200x800mm)

24 boxes per pallet

Total quantity = 2520 pieces

Total weight ≈ 350 Kg

OREGA

FRAGILE

290

390

(Dimensions in mm)

OREGA

PRODUCT SPECIFICATIONS

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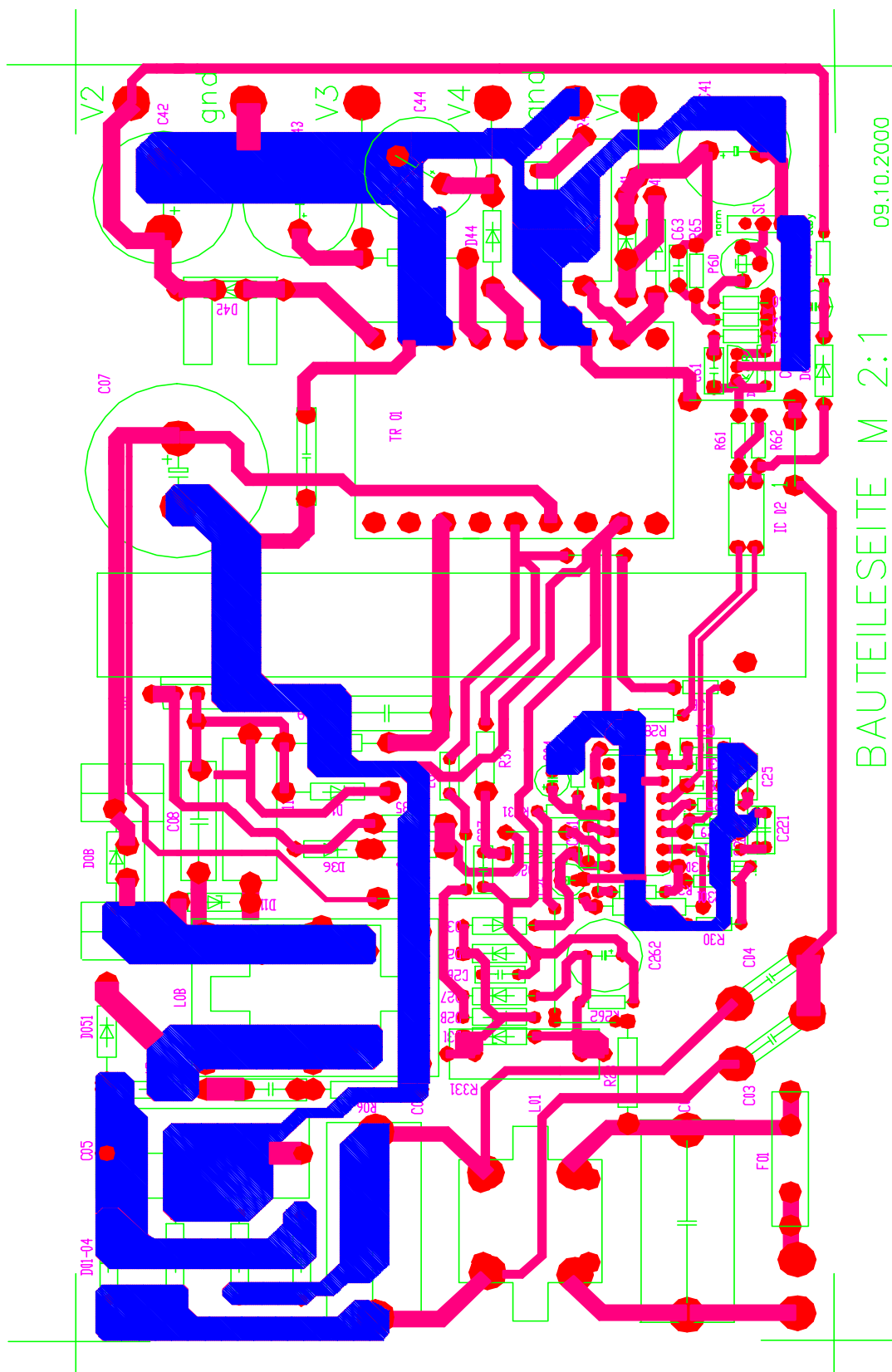
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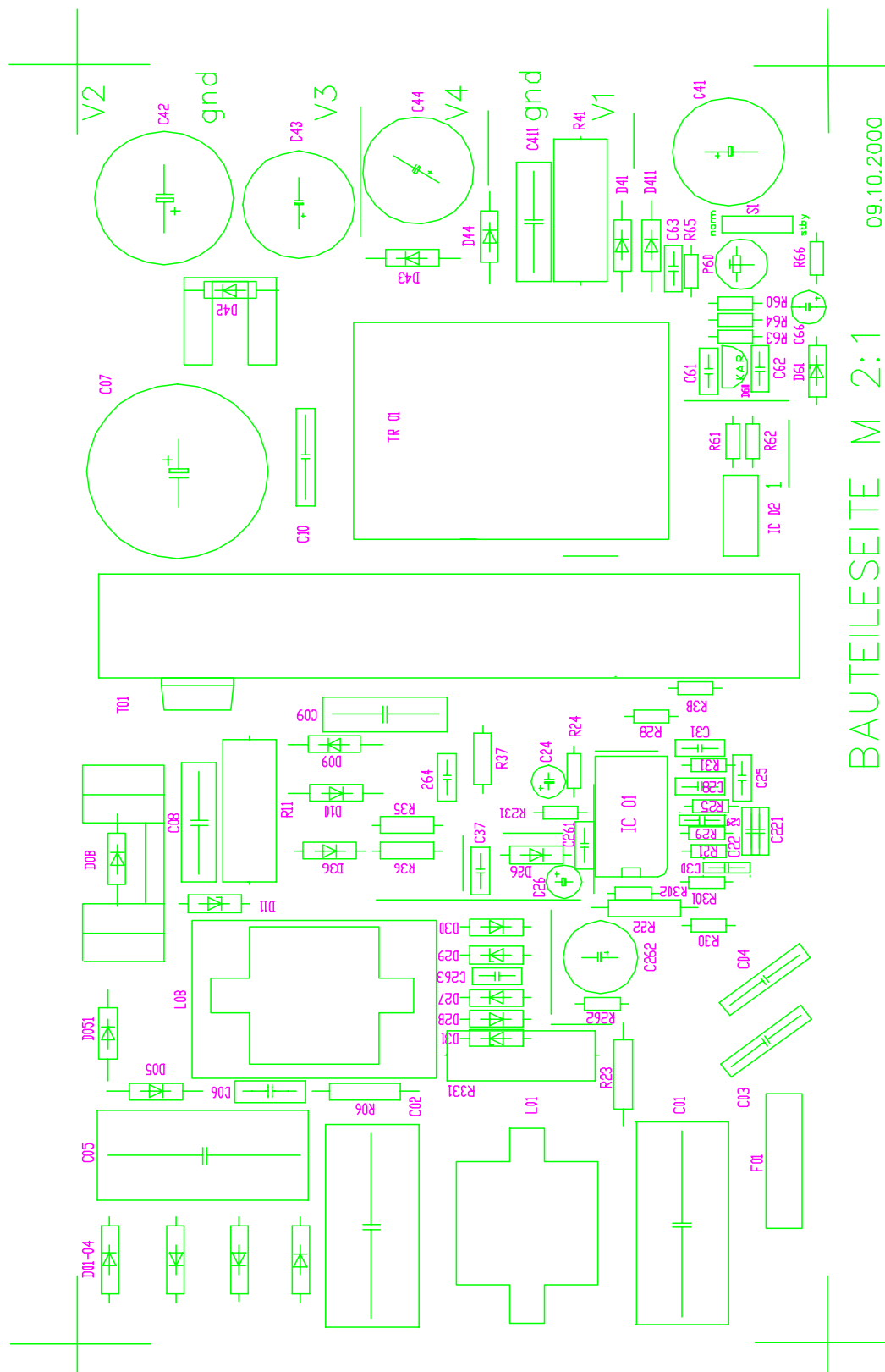
THOMSON MULTI MEDIA	SMT 4	40326 - xx
	SPF : G 6968-01	
<p><u>CONTACT :</u></p> <p>Jean-Michel BOUILLOT</p> <p>Application Manager</p> <p>GSM : 33 / (0) 6 85 31 78 80 D.I.O: 33 / (0) 3 84 64 54 26 Lab. Fax : 33 / (0) 3 84 64 54 28 E-mail : bouillotj@thmulti.com</p> <p>THOMSON TELEVISION COMPONENTS FRANCE</p> <p>Route de Noiron, B.P.24, 70101 Gray Cedex, France Tel plant :33 / (0) 3 84 64 54 00 Fax plant :33 / (0) 3 84 64 54 45</p>		
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Component	Value	Order-Nr.	Manufacturer
IC 01	TDA 16846		INFINEON
IC 02	SFH617A-2		INFINEON
T 01	SPP07N60S5 (600V / 0.6 Ohm)		INFINEON
D 01 - D 04	MUR 460		MOTOROLA
D 05	MUR 460		MOTOROLA
D 051	MUR 460		MOTOROLA
D 08	STTA 506D (600V ; 5A; 20ns)		ST
D 26	1N4148 (100V; 0,15A; 8ns)		
D 27	1N4148 (100V; 0,15A; 8ns)		
D 28	1N4148 (100V; 0,15A; 8ns)		
D 29	Z 13V ZENER DIODE		
D 30	1N4148 (100V; 0,15A; 8ns)		
D 31	Z 91V ZENER DIODE		ITT
D 41	STTA 512D (1200V; 4A;75ns)		ST
D 42	FES 8 JT (600V; 8A; 50ns)		GI
D 43	MUR 120 (200V; 1A; 25ns)		MOTOROLA
D 44	MUR 420 (200V, 4A, 25ns)		MOTOROLA
D 60	TL 431		ST
D 61	Z 2V7 ZENER DIODE		
C 01	µ47 275V AC; X 2	B 81133	EPCOS
C 02	µ47 275V AC; X 2	B 81133	EPCOS
C 03	2n2 250V ; Y 1		ROEDERSTEIN
C 04	2n2 250V ; Y 1		ROEDERSTEIN
C 05	1µ 400V		PHILIPS
C 06	330p /1KV CERAMIK		
C 07	220µ /450V ELKO	B 43502-A5227-M	EPCOS
C 08	10n /1000V MKP	B 32622	EPCOS
C 09	220p/1600V MFP	B 32642	EPCOS
C 10	2n2 250V ; Y 1		ROEDERSTEIN
C 22	560p/63V CG		EPCOS
C 24	2µ2/ 16V ELKO		EPCOS
C 25	1n / 63V MKT		EPCOS
C 26	1µ / 25V ELKO		
C 261	10n / 63V MKT		EPCOS
C 262	47µ/100V ELKO	B 41821	EPCOS
C 263	100n/63V MKT		EPCOS
C 264	22n/ 250V MKT		EPCOS

Component	Value	Order-Nr.	Manufacturer
C 28	1n5 /63V CG		EPCOS
C 29	100p/63V CG		EPCOS
C 30	2n2 /63V MKT		EPCOS
C 31	100p /63V CG		EPCOS
C 41	100μ/160V	B 43821-A1107-M	EPCOS
C 42	3300μ/40V	B 41503-A7338-M	EPCOS
C 43	1000μ/25V	B 41821	EPCOS
C 44	2200μ/16V		
C 61	15n /63V MKT		EPCOS
C 62	56p /63V CG		EPCOS
C 63	15n /250V MKT		EPCOS
C 66	4μ7 /63V ELKO		EPCOS
R 06	1K 1.5W		VITROHM
R 22	680K 1.5W		VITROHM
R 23	820k		
R 231	750k		
R 24	51k		
R 25	1M5		
R 262	33K		
R 28	1K8		
R 29	6K2		
R 30	22K		
R 31	100K		
R 331	6k8/4W		VITROHM
R 35	100		
R 37	100		
R 38	15K		
P 60	2K POTENTIOMETER		
R 60	5K1		
R 61	1K		
R 62	820		
R 63	39K		
R 64	33K		
R 65	270K		
R 66	100		
L 01	2x10mH/2,6A	B 82734-A2262-A30	EPCOS
L 08	0,5 mH	W 708/52/C	EPCOS
TR 1	SMT 4	40326xx,SPFG696801	THOMSON
S 1	SWITCH		SECKE
F 01	4A T FUSE		





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09.10.2000