Thick Film Hybrid IC

No. 4937

STK730-060

Self-Excitation Type Semi-Regulated (World Spec.) Switching Regulator (110W Output)

Overview

The STK730-060 incorporates on-chip all the power switching, amplifier, error detection and overcurrent protection circuits required in a self-excitation type semi-regulated off-line switching regulator. As a result, it can be used in the design of switching power supplies with minimal number of external components. Furthermore, the adoption of MOSFET power switching elements supports a higher oscillator frequency than that possible with bipolar transistors. This allows smaller pulse transformers and capacitors to be used, making it possible to construct miniature power supply systems.

Applications

- CRT/CTV power supplies
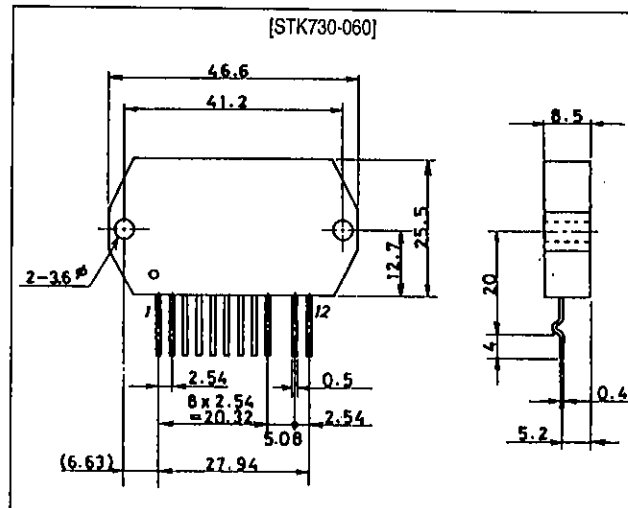- Office automation equipment power supplies

Features

- Power MOSFET devices
- Ideal for semi-regulated control switching supplies
- Error detection circuit on-chip (40.5 ± 0.5V set reference voltage)
- Overcurrent protection circuit on-chip
- Pin compatible with all other devices in the same series of devices with 110 to 280W power ratings
- Higher oscillator frequency allows the use of smaller pulse transformers
- IMST substrate acts as an electromagnetic shield, making low-noise designs possible
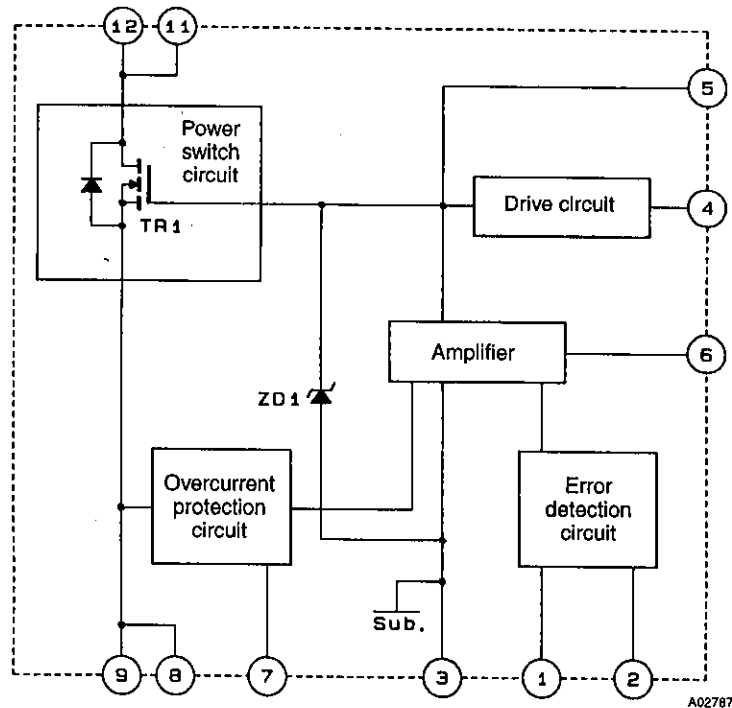
Package Dimensions

unit: mm

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[STK730-060]

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Block Diagram

The back surface of the IC is not an insulator, and is effectively at pin 3 potential.

Pin Functions

Number	Function
1	V_{rel} (40.5V typ) input
2	Error detection level
3	Ground
4	Drive voltage input
5	TR1 gate
6	Amplifier circuit control
7	OCP setting level input
8	TR1 source
9	TR1 source
11	TR1 drain
12	TR1 drain

Specifications

Maximum Ratings at Ta = 25°C, Tc = 25°C unless otherwise specified

Parameter	Symbol	Conditions	Ratings	Unit
Operating substrate temperature	Tc max	Recommended value is 105°C.	115	°C
AC input voltage	V_{AC}	Specified test circuit	280	Vrms
Operating temperature	Topg		−10 to +85	°C
Storage temperature	Tstg		−30 to +115	°C
Maximum output power	Wo max	Specified test circuit, V_O = 135V	110	W

Parameter	Symbol	Conditions	Ratings	Unit
[TR1]				
Drain current	I_D	Refer to ASO characteristics for overcurrent condition.	3	A
Pulse drain current	$I_{D(pulse)}$		7	A
Drain reverse current	I_{DR}		3	A
Gate-source voltage	V_{GSS}		±30	V
Allowable power dissipation	P_D		78.1	W
Chip junction temperature	Tj max		150	°C
Thermal resistance	θj·c		1.6	°C/W
[ZD1]				
Allowable power dissipation	P_{ZD1}		500	mW
Chip junction temperature	Tj(ZD1) max		125	°C
Thermal resistance	θj·c(ZD1)		0.2	°C/mW

Allowable Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Pin 4 input voltage	V_4		±8 to ±24	V
Oscillator frequency	f_{OSC}		20 to 120	kHz

Operating Characteristics at Ta = 25°C, Tc = 25°C unless otherwise specified, specified test circuit

Parameter	Symbol	Conditions	min	typ	max	Unit
Output voltage setting		I_{IN} = 8mA	40.0	40.5	41.0	V
Output voltage temperature coefficient		Tc = 0 to 105°C, I_{IN} = 8mA	–	7	–	mV/°C
[TR1]						
Drain-source breakdown voltage	$V_{(BR)DSS}$	I_D = 10mA, V_{GS} = 0V	900	–	–	V
Gate-source cutoff voltage	$V_{GS(off)}$	I_D = 1mA, V_{DS} = 10V	2.0	–	3.0	V
ON resistance	$R_{DS(on)}$	I_D = 1.5A, V_{GS} = 10V	–	5.0	7.0	Ω
Input capacitance	Ciss	V_{DS} = 10V, V_{GS} = 0V, f = 1MHz	–	500	–	pF
[ZD1]						
Zener voltage	V_Z	I_Z = 5mA	23.7	–	26.3	V

Circuit Function Diagram

Inrush limiting resistor
Snubber ciruit
Starting resistor
Current detection resistor
OCP level setting capacitor
Vin (AC)
Vout
T1
NP
NS
ND1
ND2
STK730-060

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P$_D$ — Tc

Allowable power dissipation, P$_D$ — W

Substrate temperature, Tc — °C

ASO

Drain current, I$_D$ — A

Drain-source voltage, V$_{DS}$ — V

10μs
100μs
1ms
PW = 10ms
DC Operation
1 pulse
Ta = 25°C
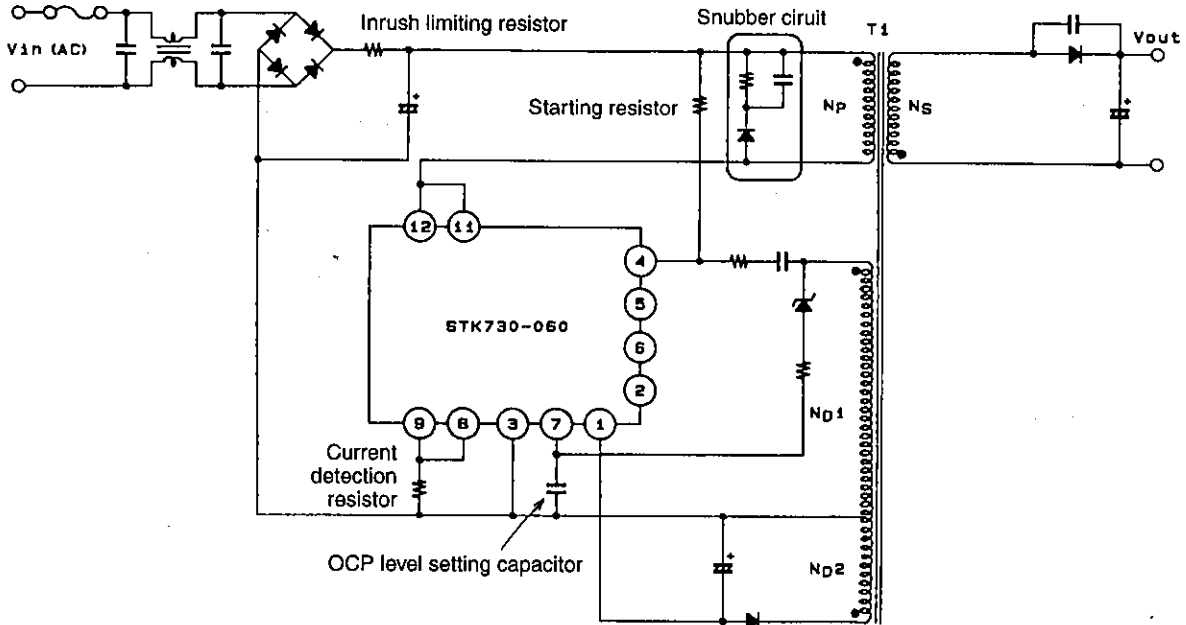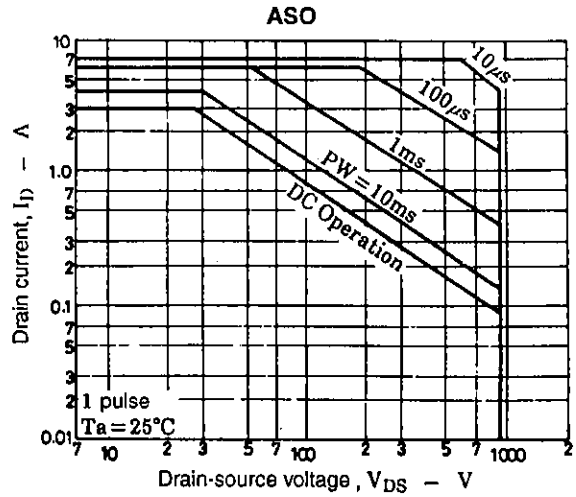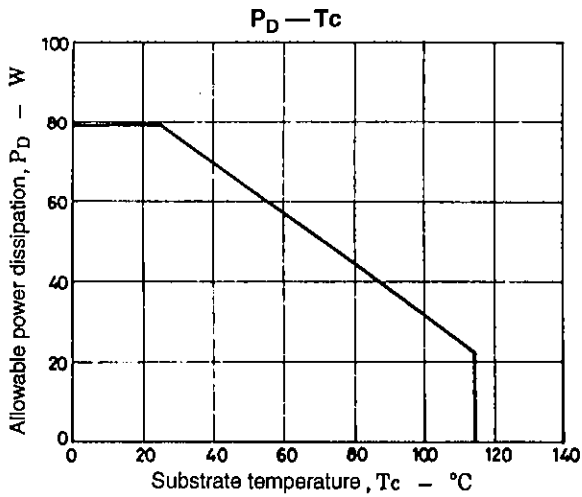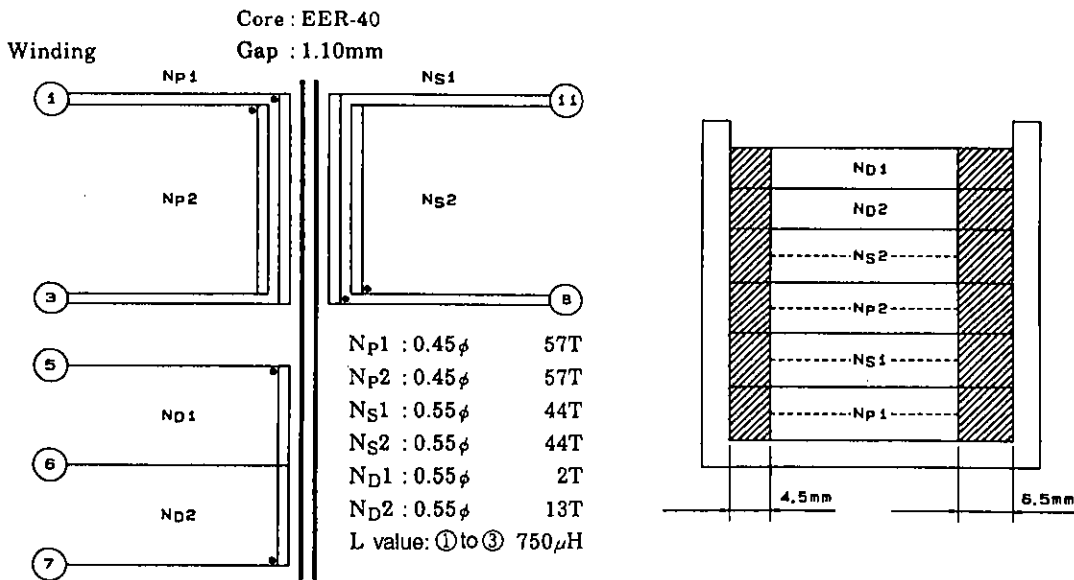
Sample Application Circuit (200V System)

Input voltage: 170 to 270VAC
Output voltage: 135VDC
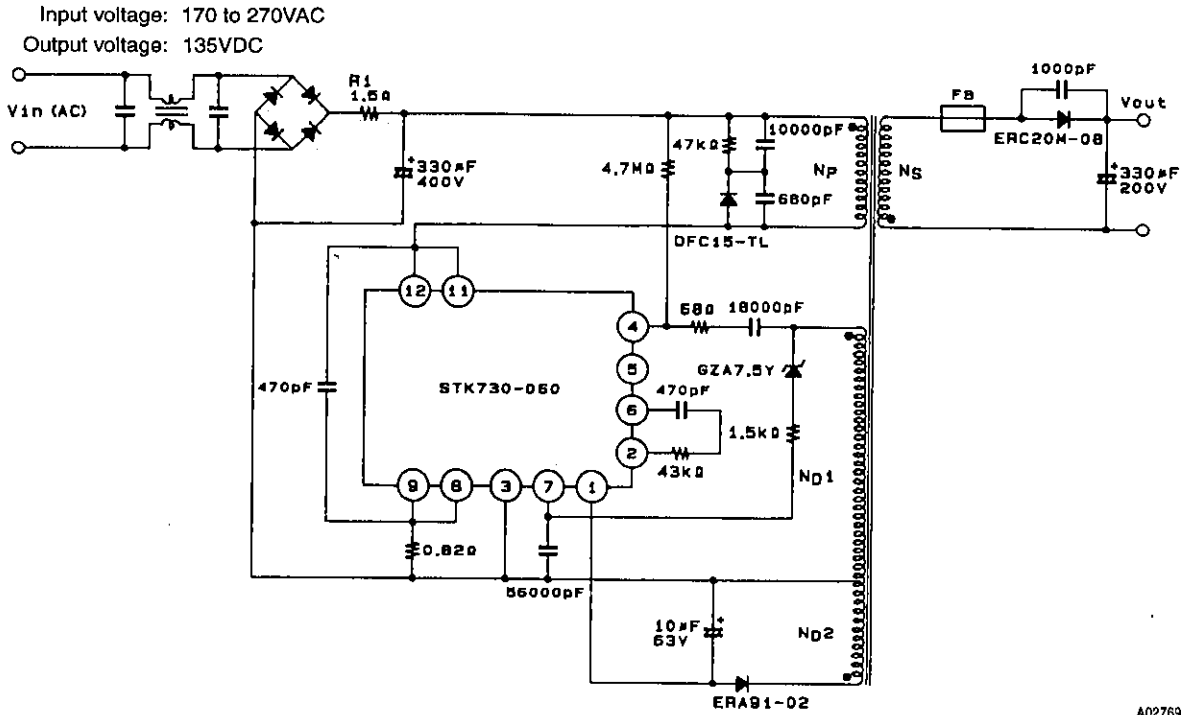
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Pulse Transformer Specifications

Core : EER-40
Gap : 1.10mm

$N_{P}1$: 0.45ϕ 57T
$N_{P}2$: 0.45ϕ 57T
$N_{S}1$: 0.55ϕ 44T
$N_{S}2$: 0.55ϕ 44T
$N_{D}1$: 0.55ϕ 2T
$N_{D}2$: 0.55ϕ 13T
L value: ① to ③ 750μH

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$V_O - I_O$

Ta = 25°C
Core : EER-40 (Gap 1.1mm)
R1 = 0Ω

Vin(AC) = 264V
Vin(AC) = 170V

Output voltage, V_O — V
Output current, I_O — A

$V_O - I_O$

Vin(AC) = 170V
Vin(AC) = 264V

Ta = 25°C
Core : EER-40 (Gap 1.1mm)
R1 = 0Ω

Output voltage, V_O — V
Output current, I_O — A

$\eta - I_O$

Vin(AC) = 170V
Vin(AC) = 264V

Ta = 25°C
Core : EER-40 (Gap 1.1mm)
R1 = 0Ω

Efficiency, η — %
Output current, I_O — A

$f_{osc} - I_O$

Vin(AC) = 264V
Vin(AC) = 170V

Ta = 25°C
Core : EER-40 (Gap 1.1mm)
R1 = 0Ω

Oscillator frequency, f_{osc} — kHz
Output current, I_O — A

Sample Application Circuit (World Input System)

Input voltage: 85 to 264VAC
Output voltage: 135VDC

Vin (AC)
R1 1.5Ω
330μF 400V
47kΩ
1.5MΩ
22000pF
470pF
DFC15-TL
Np
Ns
220pF
Vout
ERC20M-08
330μF 200V
12 11
470pF
STK730-060
4
5
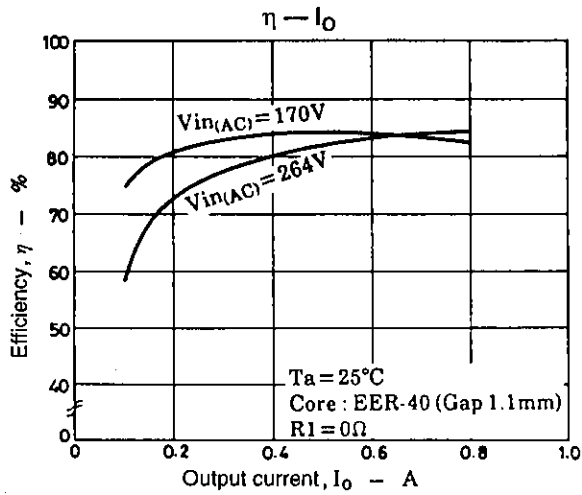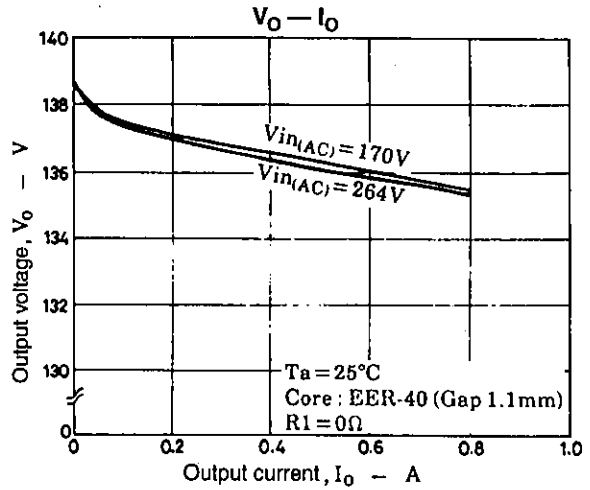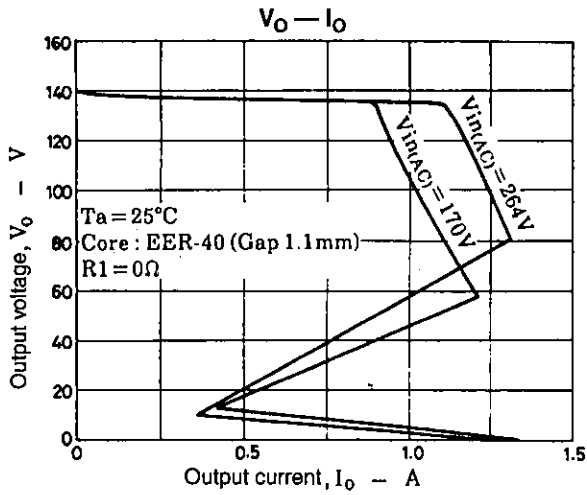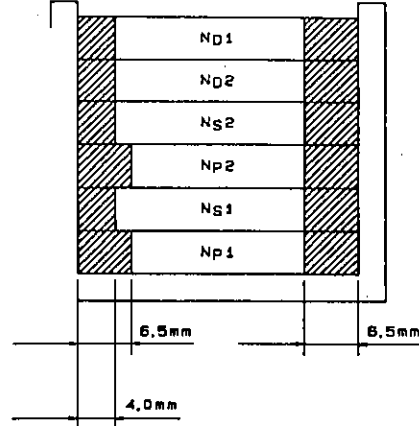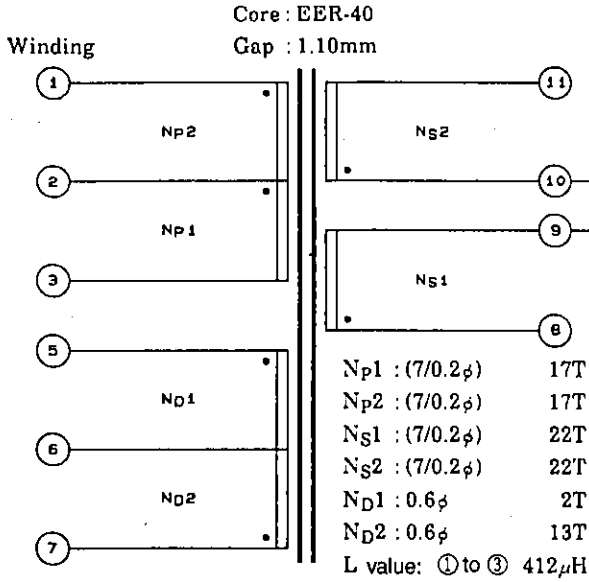6
2
9 8 3 7 1
47Ω 27000pF
GZA7.5Y
330pF
1.5kΩ
36kΩ
Np1
0.56Ω
39000pF
10μF 63V
Np2
ERA91-02
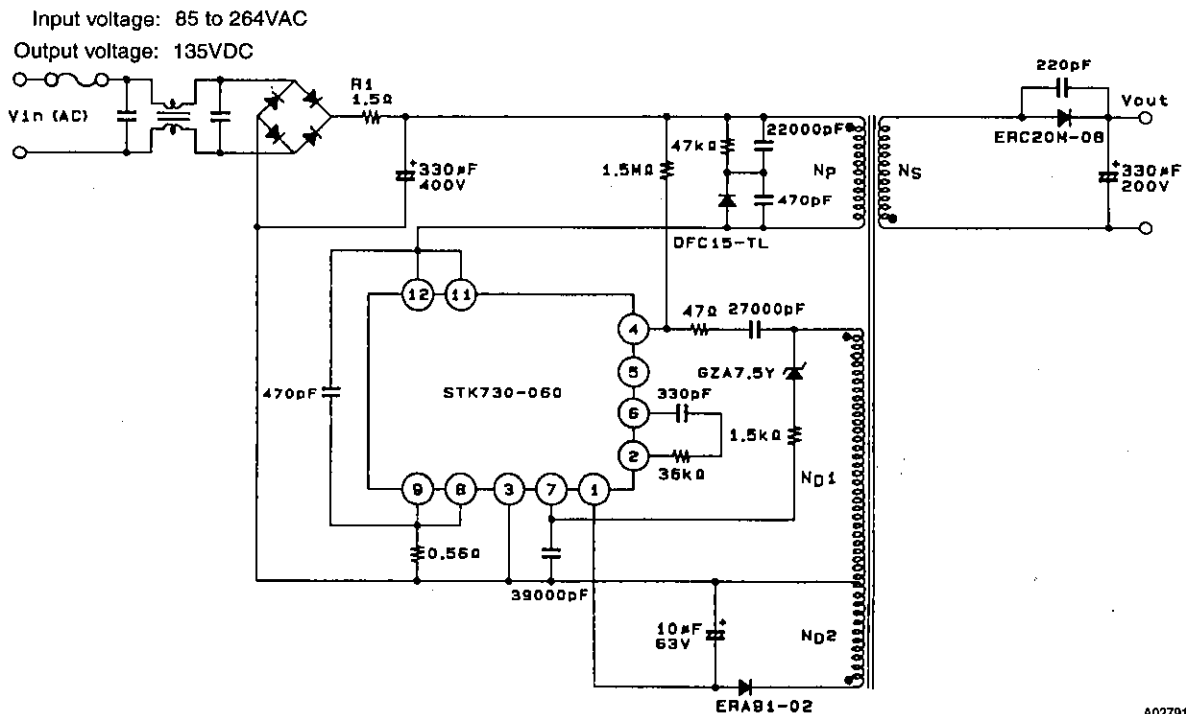
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Pulse Transformer Specifications

Winding

Core : EER-40
Gap : 1.10mm

N_{P1} : (7/0.2ϕ) 17T
N_{P2} : (7/0.2ϕ) 17T
N_{S1} : (7/0.2ϕ) 22T
N_{S2} : (7/0.2ϕ) 22T
N_{D1} : 0.6ϕ 2T
N_{D2} : 0.6ϕ 13T
L value: ① to ③ 412µH

N_{D1}
N_{D2}
N_{S2}
N_{P2}
N_{S1}
N_{P1}

6.5mm   6.5mm
4.0mm

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$V_O - I_O$

$Ta = 25°C$
Core : EER-40 (Gap 0.6mm)
$R1 = 0Ω$

$Vin_{(AC)} = 100V$
$Vin_{(AC)} = 85V$
$Vin_{(AC)} = 264V$

Output voltage, V_O — V
Output current, I_O — A

$V_O - I_O$

$Vin_{(AC)} = 264V$
$Vin_{(AC)} = 85V$

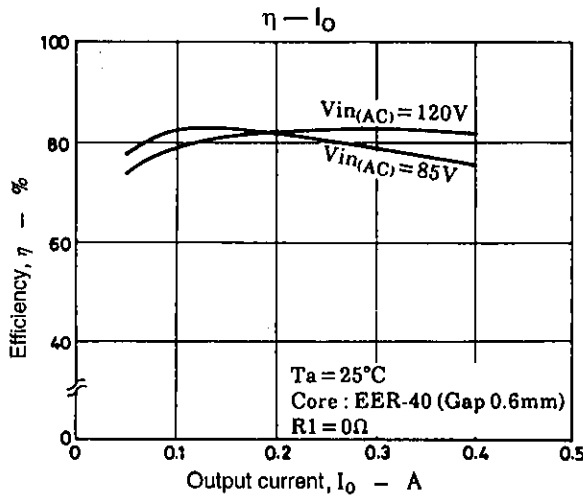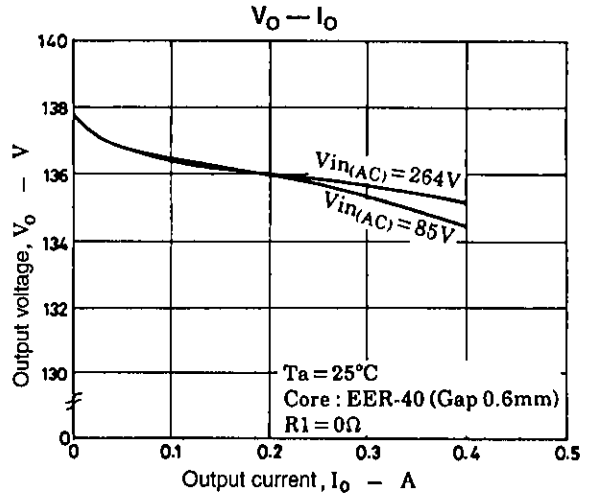$Ta = 25°C$
Core : EER-40 (Gap 0.6mm)
$R1 = 0Ω$

Output voltage, V_O — V
Output current, I_O — A

$\eta - I_O$

$Vin_{(AC)} = 120V$
$Vin_{(AC)} = 85V$

$Ta = 25°C$
Core : EER-40 (Gap 0.6mm)
$R1 = 0Ω$

Efficiency, η — %
Output current, I_O — A

$\eta - I_O$

$Vin_{(AC)} = 170V$
$Vin_{(AC)} = 264V$

$Ta = 25°C$
Core : EER-40 (Gap 0.6mm)
$R1 = 0Ω$

Efficiency, η — %
Output current, I_O — A

$f_{osc} - I_O$

Series Organization

These devices form a series with varying output power ratings.

Device	Maximum ratings					Operating characteristics		
	V_{DSS} [V]	Tstg [°C]	Tc max [°C]	Tj max [°C]	I_D [A]	Input voltage [V]	Output power [W]	ON resistance [Ω]
STK730-010	500	−30 to +115	+115	+150	6.0	85 to 132	110	1.4
STK730-020					8.0		145	0.8
STK730-030					10.0		180	0.7
STK730-040					12.0		210	0.55
STK730-050					15.0		280	0.3
STK730-060	900				3.0	170 to 264	110	5.0
STK730-070					5.0		180	3.0
STK730-080					6.0		210	2.0
STK730-090					8.0		280	1.2