



October 2019

# Transformers for Switching Power Supplies

Pin terminal type (For multiple outputs)

## SRW series

---

**26EG (Vertical/Horizontal types)**

**28EG (Vertical/Horizontal types)**

## An attention matter on use

Please read this specifications before using this product by all means.

## An attention matter on security

I undertake use with this product, and it is paid attention enough, and please design an attention matter safely.

### ⚠ Attention on a design

- When you designs a base of an electric circuit.  
Please use size of the hole or pad which we recommend.
- Magnetic flux to leak out occurs. Please confirm it about influence of magnetic flux beforehand.  
There is fear to cause false movement of machinery.
- In a design of a base of an electric circuit, Please consider the next contents.  
In an applied safe standard.  
The trans and distance with other parts
- The product is not quakeproof structure.  
Accordingly please do not add vibration and a shock to it.  
There is fear to lose a function.

### ⚠ Attention on the handling

- Please do not use it when you let a product drop.  
The product produces possibility to lose a function
- Please pay attention to the pin which had it pointed keenly.  
There is danger to injure.
- Please avoid the next place. The place that receives a drop of water, trash, the dust, foggy influence. The place where direct rays of the sun hits. There is fear to cause false movement of machinery.
- Please prohibit safekeeping and use at the next place. Environment to be accompanied with gas corrosion, salt, acid, alkali. There is fear to lose a function.
- When you carry the product on a base of an electric circuit.  
Please do not use a metal tool. Because impossible power is added to a product.  
There is fear to lose a function.

### ⚠ Attention on the handling

- I considered the next matter, and we designed a product.  
Safe standard and power supply voltage and circuit drive condition, drive frequency and Duty ON-TIME.  
By those conditions, we decided structure and the turns number.  
Please avoid use in designed condition outside.  
There are destruction of a circuit part and fear of ignition.
- This product considered a characteristic of a component and a self temperature rise, and it was made.  
We select range of humidity as use temperature already.  
Please avoid use by range more than this.  
There are the damage and fear of ignition.
- Please avoid use in the environment next.  
The environment that trash and the dust stick to a product. There is fear to cause a fire.
- The products listed on this specification sheet are intended for use in general electronic equipment (AV equipment, telecommunications equipment, home appliances, amusement equipment, computer equipment, personal equipment, office equipment, measurement equipment, industrial robots) under a normal operation and use condition.
- The products are not designed or warranted to meet the requirements of the applications listed below, whose performance and/or quality require a more stringent level of safety or reliability, or whose failure, malfunction or trouble could cause serious damage to society, person or property.
- If you intend to use the products in the applications listed below or if you have special requirements exceeding the range or conditions set forth in this catalog, please contact us.

- (1) Aerospace/Aviation equipment
- (2) Transportation equipment (cars, electric trains, ships, etc.)
- (3) Medical equipment
- (4) Power-generation control equipment
- (5) Atomic energy-related equipment
- (6) Seabed equipment/applications
- (7) Transportation control equipment

- (8) Public information-processing equipment
- (9) Military equipment
- (10) Electric heating apparatus, burning equipment
- (11) Disaster prevention/crime prevention equipment
- (12) Safety equipment
- (13) Other applications that are not considered general-purpose applications

When designing your equipment even for general-purpose applications, you are kindly requested to take into consideration securing protection circuit/device or providing backup circuits in your equipment.

---

# Transformers for Switching Power Supplies

## SRW series

Contents	Page
Development Concept .....	4
Overview .....	5
Product Lineup.....	7
26EG (Vertical/Horizontal types) .....	8
28EG (Vertical/Horizontal types) .....	11
Design Reference for Switching Power Transformers.....	15

## Transformers for Switching Power Supplies

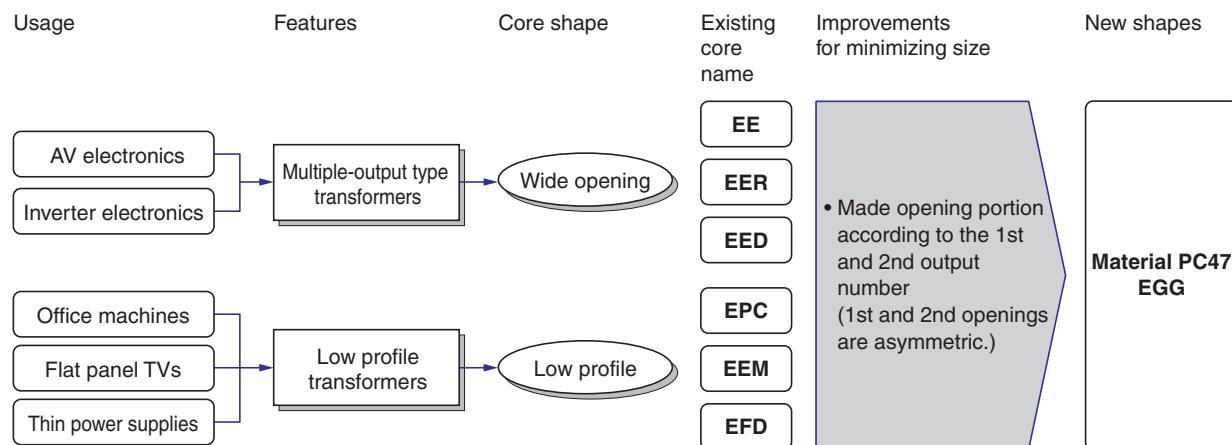
Product compatible with RoHS directive  
Compatible with lead-free solders

Pin terminal type (For multiple outputs)

# Development Concept of the SRW Series

Our newly developed transformers feature a new core shape using a new core material that is designed for different core usages based on the advantages of each material's characteristics. Our lineup of transformers (small, thin, or inexpensive) allows us to provide the best transformer for your needs. We can also provide different transformer shapes not shown in the catalog, so feel free to contact us.

## ■ CONCEPT



**⚠** Please be sure to request delivery specifications that provide further details on the features and specifications of the products for proper and safe use.  
Please note that the contents may change without any prior notice due to reasons such as upgrading.

# Transformers for Switching Power Supplies

Product compatible with RoHS directive  
Compatible with lead-free solders

Pin terminal type (For multiple outputs)

## Overview of the SRW Series

### ■ FEATURES

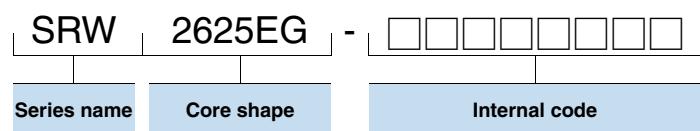
- The new high B, low loss PC47\* material allows for the product to be smaller.
- Adopts new EGG cores developed for power transformers.
- Suitable for applications in multiple output switching power supplies.
- It is a product conforming to RoHS directive.

\* Compatible material: PC47

### ■ APPLICATION

- DVD, DVD-R, STB, Air conditioners
- Multiple-output power supplies

### ■ PART NUMBER CONSTRUCTION



### ■ OPERATING TEMPERATURE RANGE, PACKAGE QUANTITY, PRODUCT WEIGHT

Type	Temperature range		Humidity range		Standard test conditions	
	Operating temperature*	Storage temperature	Operating humidity range**	Storage humidity range**	Ambient temperature	Relative humidity range***
	(°C)	(°C)	(%RH)	(%RH)	(°C)	(%RH)
SRW2625EG	-30 to +120	-40 to +80	10 to 95	10 to 95	25±10	25 to 75
SRW2630EG	-30 to +120	-40 to +80	10 to 95	10 to 95	25±10	25 to 75
SRW2826EG	-30 to +120	-40 to +80	10 to 95	10 to 95	25±10	25 to 75
SRW2833EG	-30 to +120	-40 to +80	10 to 95	10 to 95	25±10	25 to 75

\* With self-heating

\*\* Maximum wet-bulb temperature 38°C, without dewing

\*\*\*Without dewing

○ RoHS Directive Compliant Product: See the following for more details.<https://product.tdk.com/info/en/environment/rohs/index.html>

**⚠** Please be sure to request delivery specifications that provide further details on the features and specifications of the products for proper and safe use.  
Please note that the contents may change without any prior notice due to reasons such as upgrading.

# Overview of the SRW Series

## ■ GENERAL CHARACTERISTICS

Item	Standards	Test methods
Inductance	Individual specification (tolerance $\pm 10\%$ )	Use LCR meter (f=10kHz), 4263B or equivalent.
DC resistance	Less than $0.1\Omega$ : $\pm 30\%$ $0.1\Omega$ to $1.0\Omega$ : $\pm 20\%$ $1.0\Omega$ or more: $\pm 15\%$	Use Ohm-meter AX114N or equivalent.
Turn ratio and polarity	Specified value $\pm 1$ to 20%, individual specification	Use turn ratio tester TRM-201 (f=1 to 100kHz) or equivalent.
Withstand voltage	No abnormality between the primary and secondary windings, between the primary winding and the core, and so on.	Apply separately specified AC voltage (50Hz) for 1min.
Insulation resistance	$100M\Omega$ min.	Measure by applying DC.500V. Use insulation resistance meter SM-5E or equivalent.
Temperature rise	Standard design value $45^\circ\text{C}$ max. (thermocouple method) $55^\circ\text{C}$ max. (resistance method)	Measure the core surface by thermocouple method, and the windings by resistance method or thermocouple method.

## ■ RELIABILITY TESTS

Item	Standards	Test methods
Vibration resistance		Conform to JIS-C 5025. Sweep 1.5mm amplitude and 10-to-50-to-10Hz in 1min in X, Y, and Z directions for 2h respectively.
Heat resistance	Standard of inductance, insulation	Measure in normal temperature after leaving in $100 \pm 2^\circ\text{C}$ for 96h.
Cold resistance	resistance, withstand voltage must be satisfied.	Measure in normal temperature after leaving in $-40 \pm 2^\circ\text{C}$ for 96h.
Humidity resistance		Measure in normal temperature after leaving in $60 \pm 2^\circ\text{C}$ and 90 to 95(%RH for 96h.
Temperature cycle		One cycle is $-25^\circ\text{C}$ for 30min, normal temperature for 30min, and $85^\circ\text{C}$ for 30min; measure after 10 cycles of the test have been performed.
Terminal strength	$9.8\text{N}$ min.	Apply $9.8\text{N}$ load in the direction of terminal axis for $30 \pm 5$ s. Any terminal must not be pulled out or chatter.
Solderability	Solder covers more than 90%.	Dip in solder with the temperature of $245 \pm 2^\circ\text{C}$ for $3 \pm 0.5$ s.

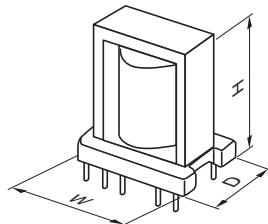
● The above listed items are representative examples.

The details can be found by referring to the appended individual delivery specifications.

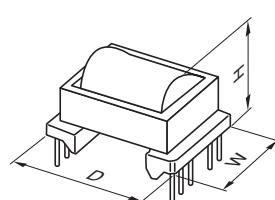
# Product Lineup

We have made a new lineup of replacement parts for products with different shapes that meet our customers' needs for smaller products. We can also provide different transformer shapes not shown in the catalog, so feel free to contact us.

Vertical type



Horizontal type



## Product Lineup

New shaped*1	Core parameter				Bobbin Type*3	Bobbin parameter			Dimensions			
	General-purpose shaped cores	Cross-sectional center leg area Ae (mm <sup>2</sup> )	Reference output power*2 (W)	Switching Frequency fsw(kHz)		Terminal			Depth D (mm)	Width W (mm)	Height H (mm) max.	
						Bobbin Type*3	Pin pitch P (mm)	Lead space F (mm)				
For multiple outputs (Vertical type)												
SRW2625EG	EER32	81.1	51	50	II	5.0	22.5	12	30.0	30.0	33.0	
SRW2630EG			68	50	II	5.0	22.5	12	30.0	30.0	38.0	
SRW2826EG			60	50	II	5.0	22.5	12	32.0	32.0	33.0	
SRW2833EG	EER35	90.3	83	50	II	5.0	22.5	12	32.0	32.0	40.0	
					III	4.0	22.5	18	32.0	40.0	40.0	
For multiple outputs (Horizontal type)												
SRW2630EG	EER32	81.1	58	50	I H	5.0	32.5	12	40.5	32.0	33.0	
SRW2833EG	EER35	90.3	72	50	I H	5.0	35.0	12	43.0	33.0	33.5	

\*1 Ferrite cores are not sold separately.

\*2 The reference output was obtained under conditions where the frequency was 50kHz and creepage distance was 4mm. (See the relevant page for details of each shape.) The reference output differs depending on the switching device, switching frequency, transformer temperature, conditions, etc. Use this output for reference.

\*3 The bobbin is made from phenol with a flame resistance grade of 94V-2 or higher.

# SRW series For Multiple Outputs (Vertical type) 26EG series

## ELECTRICAL CHARACTERISTICS

■ Recommended range

Type	Frequency	Transformer handling power(W) [Vertical/Horizontal type]*								
		Creepage distance		0.0mm	2.0mm	2.5mm	3.2mm	4.0mm	5.0mm	6.4mm
SRW2625EG	50kHz	79	79	65/-	61/-	56/-	51/-	44/-	34/-	23/-
	75kHz	118	118	97/-	92/-	85/-	76/-	66/-	51/-	35/-
	100kHz	120	120	99/-	94/-	86/-	78/-	67/-	52/-	35/-
SRW2630EG	50kHz	92	92	80/75	77/70	72/64	68/58	61/49	53/37	43/23
	75kHz	138	138	120/112	115/106	109/97	102/87	92/74	80/56	65/35
	100kHz	133	133	116/109	111/102	105/94	98/84	89/71	77/54	63/34

\* The Vertical type places its described creepage distance and its half distance on the terminal side and guard side, respectively. The Horizontal type places its described creepage distance on both sides.

Transformer-handling power may differ depending on switching devices, switching frequency, transformer temperature, conditions during usage, etc. Therefore, use the handling power for reference only.

Type	Core parameter			Bobbin parameter			Dimensions			Applications					
	General-purpose cores	cores material	center leg area Ae (mm <sup>2</sup> )	Bobbin Type	Spool width (mm) min.	Spool height (mm) min.	Number of pins	Depth	Width	Height	STB	Air conditioner	DVD	BD	Others
								D	W	H					
SRW2625EG				II	17.0	5.4	12	30.0	30.0	33.0		○	○	○	○
SRW2630EG	EER32	PC47	81.1	II	22.7	5.8	12	30.0	30.0	38.0		○	○	○	○
				I H	21.5	5.8	12	40.5	32.0	33.0	○				

## STANDARD CORE AL-value

Type	AL-value: R20 series(nH/N <sup>2</sup> )											
	100	112	125	140	160	180	200	224	250	280	315	400
For multiple outputs (Depth · Width)												
SRW2625EG	○	○	○	○	○	○	○	○	○			
SRW2630EG	○	○	○	○	○	○	○	○	○	○		

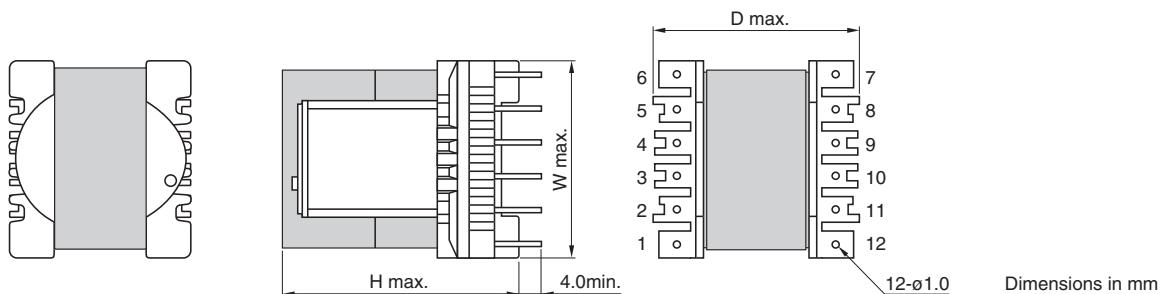
In order to respond to our customers' requested delivery dates and costs, TDK can provide standard GAP products (indicated by "○" in the below chart) for each shape.

Please contact us about other GAP products separately.

# SRW series For Multiple Outputs (Vertical type) 26EG series

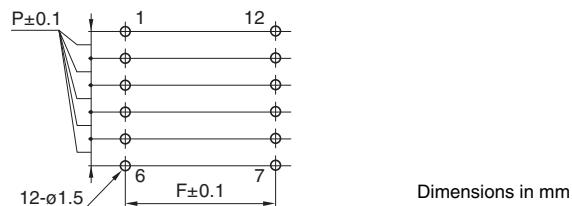
## ■ SHAPE & DIMENSIONS

Bobbin type : II



Type	Bobbin type	D max.	W max.	H max.	P	F
SRW2625EG	II	30.0	30.0	33.0	5.0	22.5
SRW2630EG	II	30.0	30.0	38.0	5.0	22.5

## ■ RECOMMENDED BASE MATERIAL OPENING SIZE

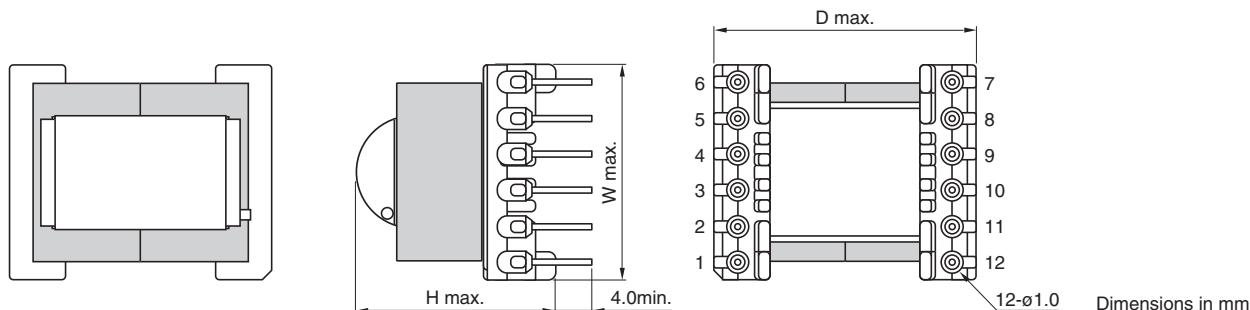


**⚠** Please be sure to request delivery specifications that provide further details on the features and specifications of the products for proper and safe use.  
Please note that the contents may change without any prior notice due to reasons such as upgrading.

# SRW series For Multiple Outputs (Horizontal type) 26EG series

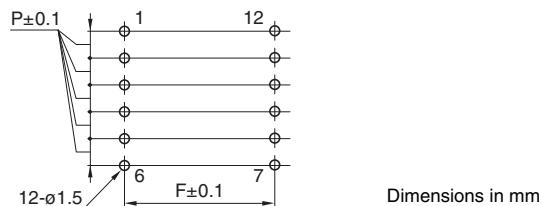
## ■ SHAPE & DIMENSIONS

Bobbin type : IH



Type	Bobbin type	D max.	W max.	H max.	P	F
SRW2630EG	IH	40.5	32.0	33.0	5.0	32.5

## ■ RECOMMENDED BASE MATERIAL OPENING SIZE



**⚠** Please be sure to request delivery specifications that provide further details on the features and specifications of the products for proper and safe use.  
Please note that the contents may change without any prior notice due to reasons such as upgrading.

## SRW series For Multiple Outputs (Vertical type) 28EG series

## ■ ELECTRICAL CHARACTERISTICS

■ Recommended range

Type	Frequency	Transformer handling power(W) [Vertical/Horizontal type]*								
		Creepage distance		0.0mm	2.0mm	2.5mm	3.2mm	4.0mm	5.0mm	6.4mm
SRW2826EG	50kHz	91	76/-	72/-	66/-	60/-	52/-	42/-	29/-	
	75kHz	136	113/-	107/-	99/-	90/-	78/-	62/-	44/-	
	100kHz	127	105/-	100/-	92/-	84/-	73/-	58/-	41/-	
SRW2833EG	50kHz	111	97/91	94/87	89/80	83/72	77/62	67/49	56/33	
	75kHz	155	136/128	131/121	125/112	117/101	107/88	94/69	79/47	
	100kHz	145	127/119	122/113	116/104	109/94	100/82	88/64	73/44	

\* The Vertical type places its described creepage distance and its half distance on the terminal side and guard side, respectively. The Horizontal type places its described creepage distance on both sides.

Transformer-handling power may differ depending on switching devices, switching frequency, transformer temperature, conditions during usage, etc. Therefore, use the handling power for reference only.

Type	Core parameter			Bobbin parameter			Dimensions			Applications					
	General-purpose cores	cores material	center leg area Ae (mm <sup>2</sup> )	Bobbin Type	Spool width (mm) min.	Spool height (mm) min.	Number of pins	Depth D (mm)max.	Width W	Height H	STB	Air conditioner	DVD	BD	Others
SRW2826EG				II	17.7	5.5	12	32.0	32.0	33.0			○	○	○
SRW2833EG	EER35	PC47	90.3	II	24.4	5.7	12	32.0	32.0	40.0			○	○	○
				III	24.4	5.7	18	32.0	40.0	40.0					
				I H	23.0	5.7	12	43.0	33.0	33.5	○		○	○	○

## ■ STANDARD CORE Al-value

Type	Al-value: R20 series(nH/N <sup>2</sup> )											
	100	112	125	140	160	180	200	224	250	280	315	400
For multiple outputs (Depth · Width)												
SRW2826EG	○	○	○	○	○	○	○	○	○			
SRW2833EG	○	○	○	○	○	○	○	○	○	○		

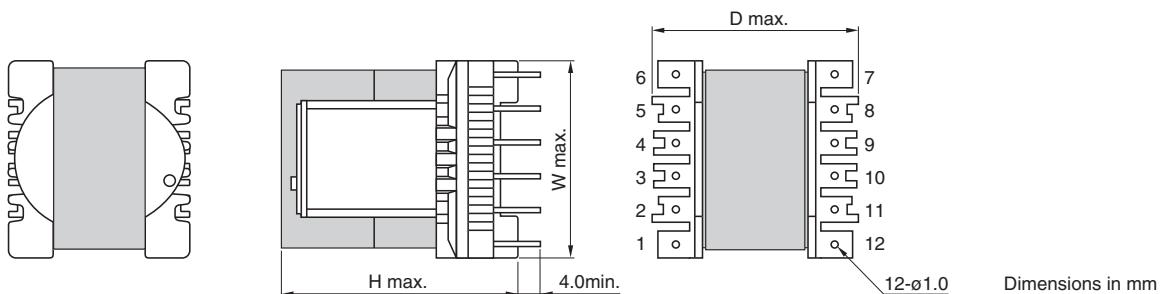
In order to respond to our customers' requested delivery dates and costs, TDK can provide standard GAP products (indicated by "○" in the below chart) for each shape.

Please contact us about other GAP products separately.

# SRW series For Multiple Outputs (Vertical type) 28EG series

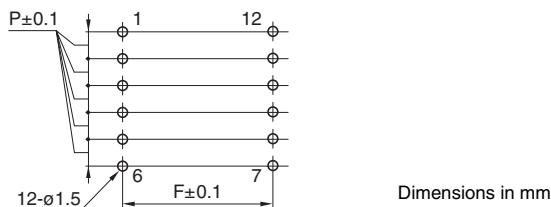
## ■ SHAPE & DIMENSIONS

Bobbin type : II



Type	Bobbin type	D max.	W max.	H max.	P	F
SRW2826EG	II	32.0	32.0	33.0	5.0	22.5
SRW2833EG	II	32.0	32.0	40.0	5.0	22.5

## ■ RECOMMENDED BASE MATERIAL OPENING SIZE

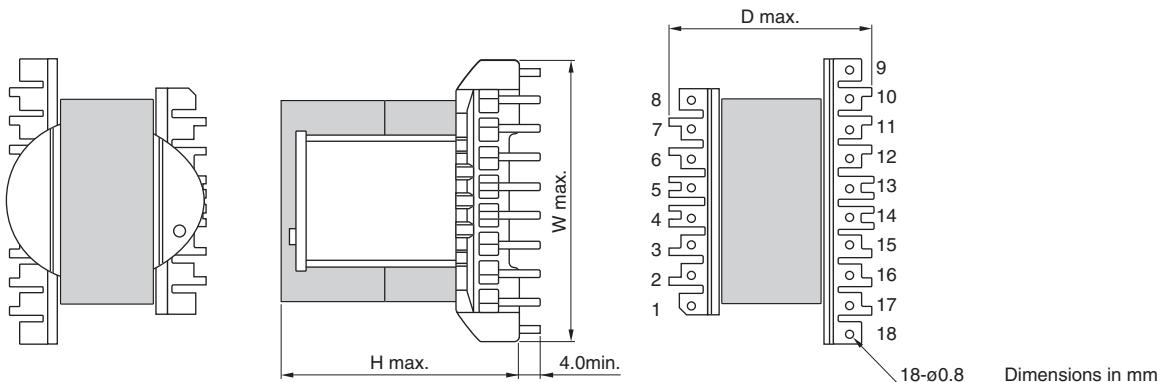


**⚠** Please be sure to request delivery specifications that provide further details on the features and specifications of the products for proper and safe use.  
Please note that the contents may change without any prior notice due to reasons such as upgrading.

# SRW series For Multiple Outputs (Vertical type) 28EG series

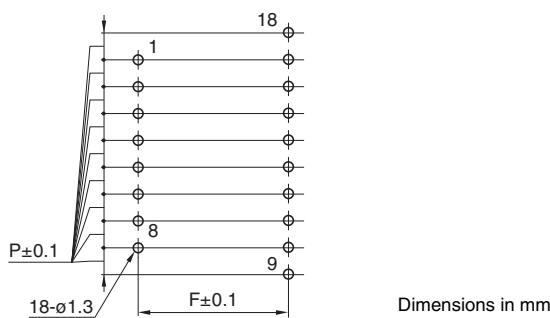
## ■ SHAPE & DIMENSIONS

Bobbin type : III



Type	Bobbin type	D max.	W max.	H max.	P	F
SRW2833EG	III	32.0	40.0	40.0	4.0	22.5

## ■ RECOMMENDED BASE MATERIAL OPENING SIZE

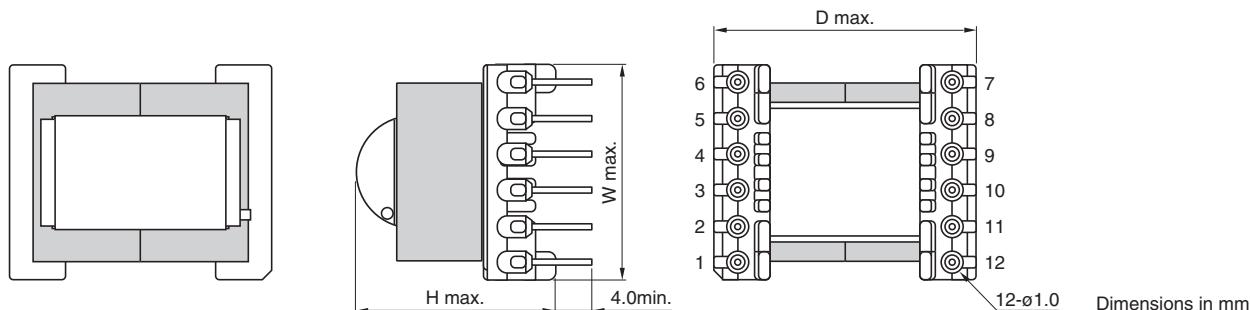


**⚠** Please be sure to request delivery specifications that provide further details on the features and specifications of the products for proper and safe use.  
Please note that the contents may change without any prior notice due to reasons such as upgrading.

# SRW series For Multiple Outputs (Horizontal type) 28EG series

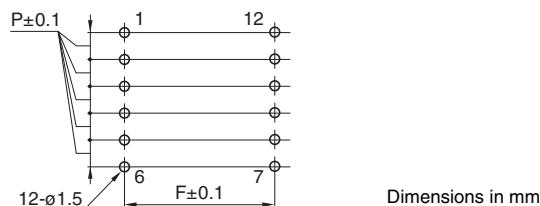
## ■ SHAPE & DIMENSIONS

Bobbin type : IH



Type	Bobbin type	D max.	W max.	H max.	P	F
SRW2833EG	IH	43.0	33.0	33.5	5.0	35.0

## ■ RECOMMENDED BASE MATERIAL OPENING SIZE



**⚠** Please be sure to request delivery specifications that provide further details on the features and specifications of the products for proper and safe use.  
Please note that the contents may change without any prior notice due to reasons such as upgrading.

# Design Reference for Switching Power Transformers

## • Maximum allowable temperature

The maximum ambient temperature of the transformer is E Class (120°C).

However, there is no E Class for transformers shipped for North America; therefore, the maximum ambient temperature is Class 105 (105°C). [Class 130 (130°C) is possible when UL1446 insulating system is applied.]

## • Temperature rise in Transformers

In normal design condition, 55°C or less (using the resistance method) is the target of temperature rise of windings. Therefore, the maximum ambient temperature at this time is 65°C (50°C max. for North America).

In case of measuring the temperature of the windings by thermocouple, 10 to 15°C more would be allowable.

## • Dealing with safety regulations

Designs are made in consideration of materials, structures and so on that the designed transformers are comply with designated safety regulations.

### (1)Regarding the core

To be handled in the same manner as Basic Insulation.

### (2)Distance between transformer and other parts

Please keep the distance between the transformer and other parts in according with applicable safety standards.

## • Concerning of the influence of leakage flux

Due to the fact that there is always some degree of leakage flux from transformer, designs should be made to keep them apart as much as possible from parts that are easily affected by this.

## • Magnetic saturation of the core

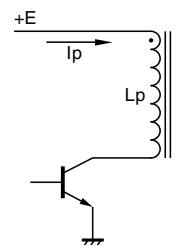
(1)Magnetic operating condition of the core in the transformer are determined by maximum operation temperature (including temperature rise) and driving condition in circuits. If product is used in condition that exceed these conditions, there is a possibility of occurring magnetic saturation of the core. The following items could be possible cause of core saturation.

- The product is used in conditions that exceed the maximum operating temperature.
- Operating frequencies are lower than the ones initially designed. (longer ON time)
- The input voltage is abnormally higher than the specified values.

(2)To check on the saturation of the core it is possible to judge from current waveforms of primary winding. Current flowing in the inductor changes in a straight line in relation to time as in the figure a) in accordance with

$$I = \frac{E}{L} \times T$$

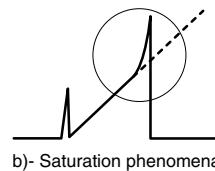
However, in the event that a saturation phenomena has occurred in the core, inductance is reduced causing a rapid and drastic increase of current as shown figure b).



<In the case of flyback>



a)- Normal

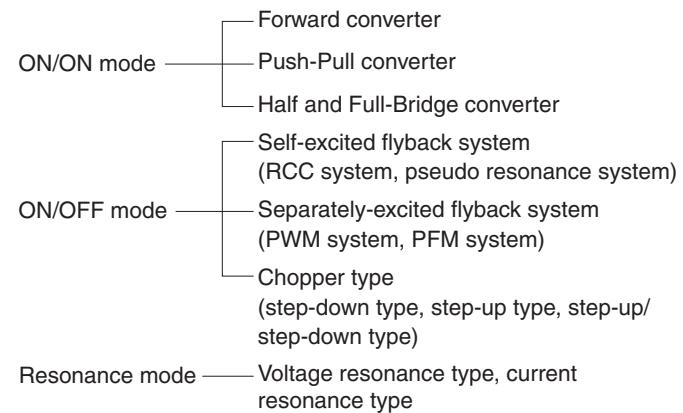


b)- Saturation phenomena

(3)In this case, there is possibility that a breakdown may occur due to surpassing the rated current of the switch it is necessary to have over current protection circuit or modify transformer design.

## • Circuit topologies of switching power supply

The term "topology" refers to the arrangement of the power components within the switching power supply design. There are several different kind of circuit topologies as following;

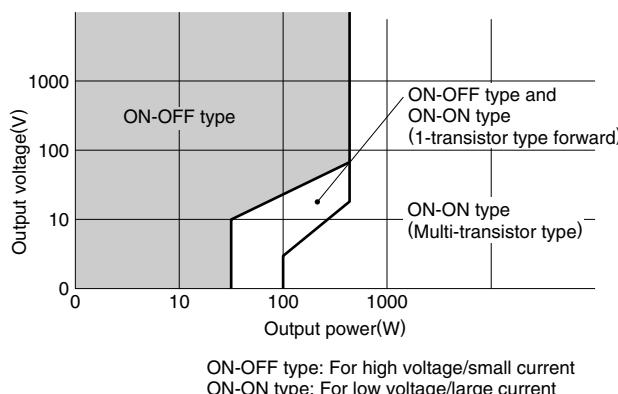


## TRANSFORMERS

- Which topology of switching power supply to use?

Each topology has its relative merit in terms of cost and performance. One topology may have a low parts cost but only be able to provide a limited amount of power; another may have ample power capability but cost more, and so on.

The following relationship between output voltage and power give us one suggestion when we need to chose topology in given conditions;

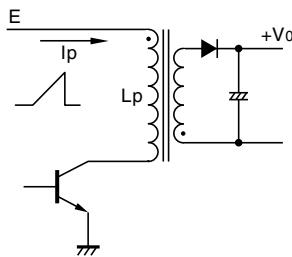


- The deference of power conversion between Forward and Flyback modes.

Since the forward mode converter is a system that performs power transmission to the output side during ON period of switching transistor, it is possible to work with the large output current. Consequently, forward converter method is suitable to large current output with relatively lower output voltage.

To the contrary, Flyback mode converter is a system that input power is stored within the Inductor or primary coil in the transformer as a magnetic energy during ON period of switching transistor and the stored energy transmit to output side during OFF period of switching transistor. Accordingly, Flyback mode converter is suitable to high voltage and low current output, and does not suite to large current output.

- The stored energy within the inductor.



$$\text{Energy stored in the inductor } L_p \text{ is } W = \frac{1}{2} \times L_p \times I_p^2 \times [J]$$

when  $I_p$  is a triangular wave,  
and electric power (energy per unit time) is

$$P = \frac{[J]}{[S]} = \frac{1}{2} \times L_p \times I_p^2 \times f [W]$$

Where,

$L_p$ : Inductance of primary winding

$I_p$ : Peak value of primary current

$f$ : Switching frequency

- How to decide primary inductance ( $L_p$ )?

(1) When the self-excited flyback system is selected:

$$\text{Using the formula } P = \frac{1}{2} \times L_p \times I_p^2 \times f [W],$$

it is possible to calculate the inductance value needed for the desired output  $P$  under the fixed  $I_p$  value.

By deriving  $E \times T_{on} = L_p \times i$  from the formula

$$E = L_p \times \frac{di}{dt},$$

the current which flows through the inductor becomes  $i = \frac{E \times T_{on}}{L_p}$ .

By substituting this with  $P = \dots$ , the formula of

$$P = \frac{1}{2} \times L_p \times \left( \frac{E \times T_{on}}{L_p} \right)^2 \times f = \frac{1}{2} \times \frac{E^2 \times T_{on}^2}{L_p} \times f \text{ results.}$$

$$\text{From this, the formula } L_p = \frac{E^2 \times T_{on}^2}{2 \times P} \times f \text{ results.}$$

Where,

$E$ : Input voltage

$T_{on}$ : On time

$f$ : Switching frequency

In actual designs this value is to be slightly lowered in consideration of the transformer's efficiency.

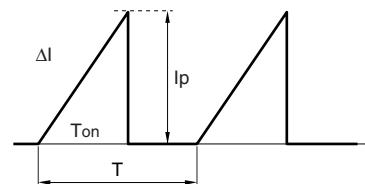
(2) When the separately-excited flyback system is selected:

The coefficient  $k$  is added because a direct current is superimposed on the primary current waveform.

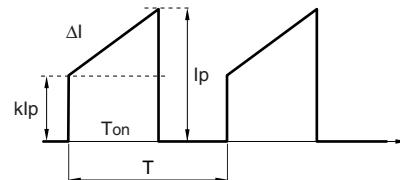
$$L_p = \frac{E^2 \times T_{on}^2}{2 \times P} \times f \times \frac{(1+k)}{(1-k)}$$

#### The primary current waveforms

The self-excited flyback system(RCC)



The separately-excited flyback system



## TRANSFORMERS

## • How to decide number of turns of primary winding?

$$N_P = \frac{E_{\min} \times T_{on \max}}{\Delta B \times A \times (1-k)}$$

Where,

E min.: Lower limit value of input voltage (Vdc)

A: Core cross section area ( $m^2$ )

D: Duty ratio

Ton max.: The maximum ON time for switching transistor (sec.)

$\Delta$ : Operating flux density (T)

## (1) When the self-excited flyback system is selected:

$$N_P = \frac{E_{\min} \times T_{on \max}}{\Delta B \times A} \quad (T_{on \max} = \frac{D}{f})$$

## (2) When the separately-excited flyback system is selected:

$$N_P = \frac{E_{\min} \times T_{on \max}}{\Delta B \times A \times (1-k)}$$

Precautions must be taken as the upper limit value of  $\Delta B$  changes according to core materials, operating temperatures, frequencies, etc.

## • Determining of secondary winding

ON-OFF mode

As it is necessary to consider the voltage drop of the rectifier diode on the secondary side,

$$N_S = N_P \times \frac{V_o + V_F}{E_{\min}} \times \frac{1-D}{D}$$

Where,

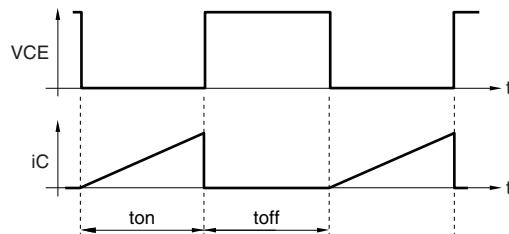
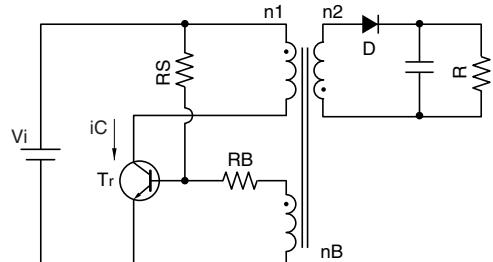
Vf: Voltage drop of the rectifier diode

V<sub>o</sub> : Output voltage

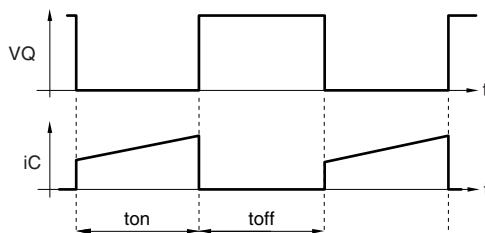
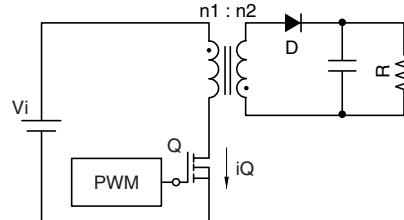
$$\frac{T_{on \max}}{1/f} = D : \text{Duty ratio}$$

## • Example of drive waveforms

## (1) When the self-excited flyback system is selected (RCC)



## (2) When the separately-excited flyback system is selected



## • In order for designing the transformer, the following conditions are necessary.

It is greatly appreciated customer give us those conditions by filling out required information with the appended "Transformer specifications / inquiry form".

## (1) Circuit topology

Flyback system, forward system, etc.

## (2) Used IC

Design with a high degree of perfection is possible when IC manufacturer and model number information are provided.

## (3) Input voltage range

The lower limit of rectified voltage is important, in particular.

## (4) Operating frequency (fixed/variable)

It is especially necessary to determine the lower limit frequency for the maximum load condition in Flyback converter.

## (5) Maximum duty ratio

It is necessary to specify maximum ON time when input voltage is lower limit, approximately 45% should be the maximum for external excitation system.

## (6) Operating temperature range, maximum temperature rise

This is the allowable temperature rise in the transformer, should be equal to the value that ambient temperature has been taken from the temperature index of the materials which is 120°C(105°C in UL system).

## (7) Required safety regulations

Structures and materials are chosen to comply with required safety regulations.

## (8) Output voltage/current

Required for determination of the winding ratios and wire gage.

## (9) Transformer outside dimension

It is necessary for determining the shape.

## (10) Instructions concerning circuit designs and pin configuration of transformer

Type of the secondary rectifier diode is important in particular because of voltage drop between First recovery and Schottky barrier type is different, it will affect to design of number of turns of transformer.

# Transformers for Switching Power Supplies Specification Request Form

Issued on \_\_\_\_\_

1. Company name \_\_\_\_\_  
Address \_\_\_\_\_
2. Department, applicant's name (Including the sample-sending destination)  
Name: \_\_\_\_\_  
TEL/FAX: \_\_\_\_\_  
E-mail: \_\_\_\_\_

## 3. Circuit system

Flyback method      Forward method      Others \_\_\_\_\_

## 4. Input specifications

AC input voltage: Rated \_\_\_\_\_ (V) ~ \_\_\_\_\_ (V)      Operating range: \_\_\_\_\_ (V) ~ \_\_\_\_\_ (V)  
DC input voltage: Rated \_\_\_\_\_ (V) ~ \_\_\_\_\_ (V)      Operating range: \_\_\_\_\_ (V) ~ \_\_\_\_\_ (V)

## 5. Output voltage/Current/Diode used (diode voltage drop)

	Output specifications	Example	Output1	Output2	Output3	Output4	Output5	Output6	Output7	VCC
Power application	Motor									
Output voltage(V) (Accuracy)	50V (±5V)									
Output Current(A)	Minimum	0								
Typical $\Delta T$ measuring condition	0.8									
Maximum time	1A, 10sec.									
Peak time	2A, 3sec.									
Primary/Secondary	Secondary									
Feedback	No									
Rectifier diode	FRD									
VF(V)	0.1									

(Rectifier diode F.R.D: Fast Recovery Diode, S.B.D: Schottky Barrier Diode)

• Request for connection method      Yes      No (When checking "Yes", please attach a drawing separately.)      • Pin assignments changes      Possible      Impossible

## 6. Clock frequency ( Flexible / Fixed )      fsw \_\_\_\_\_ ~ \_\_\_\_\_ (kHz)

## 7. Max. duty or max. ON time      D max. \_\_\_\_\_ (%),      T max. \_\_\_\_\_ (s)

## 8. Input capacitor capacitance      CIN \_\_\_\_\_ ( $\mu$ F)

(If not specified, design will be performed using a value of (   )  $\mu$ F x 4, which is 4 times greater than the output power for 100V and worldwide transformers, and an output power of (   )  $\mu$ F for 200V transformers.)

## 9. Operating temperature range, max. temperature rise, and ambient temperature \_\_\_\_\_ to \_\_\_\_\_ ( $^{\circ}$ C) $\Delta T$ \_\_\_\_\_ ( $^{\circ}$ C)      Typ.      Max.)      Ambient temperature \_\_\_\_\_ $^{\circ}$ C

## 10. Desired core size and outer dimensions of transformer

Core size \_\_\_\_\_      Outer dimensions of the transformer L \_\_\_\_\_ x W \_\_\_\_\_ x H \_\_\_\_\_ mm max.

## 11. Safety standard compliance

Electrical Appliances and Material Safety Act, Appendix 8       CSA \_\_\_\_\_       Others \_\_\_\_\_  
 UL \_\_\_\_\_       IEC \_\_\_\_\_

Application for the transformer      Yes\*      Set purchase      No (Please bear in mind that the application fee may be borne by the customer.)

Insulation type      Basic insulation      Reinforced insulation      Double insulation      Other (   )

Pollution degree      1      2      3 (If not specified, design will be performed with a pollution degree of 2.)

## 12. Safety distance (Please enter the distance prescribed by the company.)

Primary - secondary: \_\_\_\_\_ mm or greater      Primary - primary: \_\_\_\_\_ mm or greater      Primary - core: \_\_\_\_\_ mm or greater  
Secondary - secondary: \_\_\_\_\_ mm or greater      Secondary - core: \_\_\_\_\_ mm or greater

## 13. Withstand voltage (Please enter the voltage prescribed by the company.)

Primary - secondary:      AC _____ (V) _____ (min) _____ (mA)	Primary - core:      AC _____ (V) _____ (min) _____ (mA)
Primary - primary:      AC _____ (V) _____ (min) _____ (mA)	Secondary - core:      AC _____ (V) _____ (min) _____ (mA)
Secondary - secondary:      AC _____ (V) _____ (min) _____ (mA)	

## 14. Please Enter the Power Devices to be Used.

In addition, if there are recommended transformer specifications, etc., presented by the device manufacturer, please attach these separately.

Manufacturer name: \_\_\_\_\_      Product No.: \_\_\_\_\_

## 15. Mass production and prototyping information

Final set name: \_\_\_\_\_      Mass production requested price/currency: \_\_\_\_\_  
Acceptance conditions of the above price, delivery location (FOB CHN, CIF LA., DDP Paris, etc.) \_\_\_\_\_

Mass production quantity \_\_\_\_\_ pcs. /M      Mass production start time \_\_\_\_\_  
Prototyping time: (ES1) \_\_\_\_\_ (ES2) \_\_\_\_\_ (PP1) \_\_\_\_\_ (PP2) \_\_\_\_\_ (MP1) \_\_\_\_\_

## 16. Required sample quantity \_\_\_\_\_ pcs.

Requested delivery time: \_\_\_\_\_

## 17. If there are any other requests (priorities in the company, size or price, etc.) or alterable items, please provide a description.

Person in Charge from Sales Promotion Dep.: \_\_\_\_\_ Recorded Date \_\_\_\_\_

Person in Charge from Sales Dep.: \_\_\_\_\_ Recorded Date \_\_\_\_\_

Prototype No.: \_\_\_\_\_ Recorded Date \_\_\_\_\_