

Introduction



Introduction

The application range of pulse transformers is very broad. In most cases, a signal or a control pulse must be transmitted between electrically isolated circuits. This problem exists in the activation of thyristors and triacs, or in the operation of FETs or IGBTs in high-power switching circuits.

Another application involves electrical isolation in telephone switchboards and data transfer systems.

High Insulation Rating

When used in power electronics, the secondary side of pulse transformers is normally at a high voltage potential. This requires a high insulation strength for pulse transformers.

Complying with VDE 110 b, Part 1, the following test voltages between the primary and the secondary circuits are required for transformers of Protection Class I and choke coils, as a function of the working voltage:

Working Voltage [V]	Test Voltage U_{isol} [V]
250 V	1500 V
500 V	2500 V
1000 V	3000 V

Test Voltage U_{isol}

The test voltages for TIMONTA pulse transformers depend on the type of winding and the coating on the coil wire. Exact information concerning each type is available in the technical specifications. The test voltage is in each case considerably higher than that prescribed by VDE 110 b.

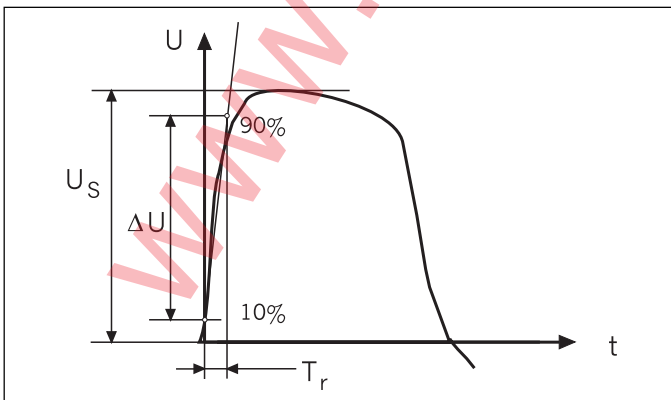
Partial Discharge Voltage U_e

Partial discharges during normal operation have little effect on the operation of the circuit, but can accelerate the ageing of the pulse transformer.

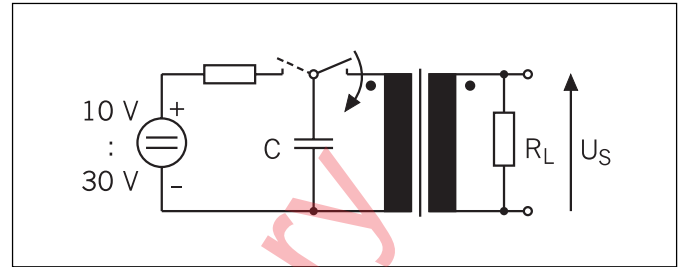
The glow discharge and the intermittent voltages are at least 50% higher than the approved working voltages for all TIMONTA pulse transformers. This provides the best assurance against long-term damage.

Definition of the Rise Time T_r

Over the almost straight-line in the lower 2/3 of the rise curve, i.e. in the area where the semiconductor is triggered with certainty, we draw a line and measure the time from 10% to 90% of the overall pulse height.



The measurement is made with the following circuit. The load resistance R_L is given for each type.



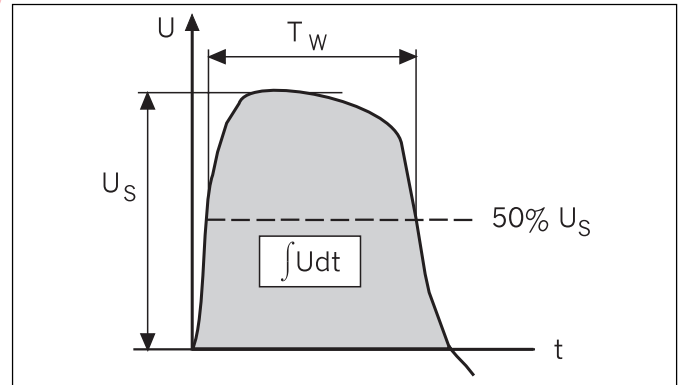
For a turns ratio of «1:1», the test voltage is 10 V; for «2:1» it is 20 V, and so on.

Trigger Current I_t

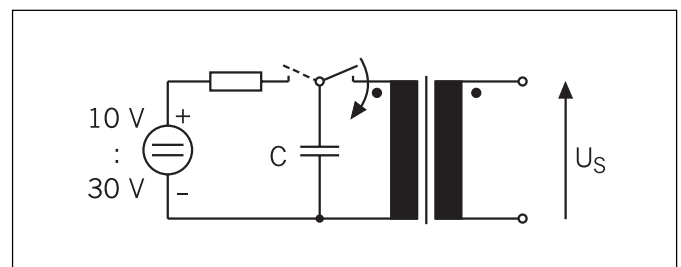
The maximum trigger current is a guide value. For a given current, the drop in voltage over the secondary winding resistance is smaller than one volt.

The Voltage-Time Integral $U_s \cdot T_w$

The voltage-time integral is the product of the pulse height and width, measured at half pulse height. The voltage-time integral is measured on the secondary side during operation under no load.



The voltage-time integral $U_s \cdot T_w$ is measured according to the principle of the following circuit. The same voltages as used for measuring the rise time are used.





Primary and Secondary Inductances L_p , L_s

Primary and secondary inductances are measured with a low-power signal of 0.1 mA/10 kHz at 25°C. The tolerance is -30% / +50%. The measured value can also vary up to $\pm 25\%$ under temperature variation in the range 0°C to 70°C.

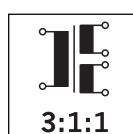
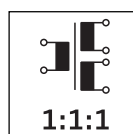
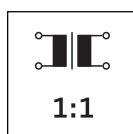
Coupling Capacity C_c

The coupling capacity is measured between the primary and one secondary winding. This value varies depending on the type of winding. Bifilar windings, designed for models with faster rise times, have higher coupling capacitances than the layer or selection windings.

In general, this value is not important with regards transmission properties. To guarantee effective interference protection from the control electronics, however, the smallest possible coupling capacity is desired.

Turn Ratio N

In the given turn ratios, the first figure always refers to the primary winding. Hence a «1:1» pulse transformer has the same number of winding on both the primary and the secondary windings. The turn ratio «3:1:1» stands for one primary and two secondary windings with a transformation ratio of three to one between the primary and the secondary windings.



On request, we can also supply pulse transformers with turn ratio not specified in our products lists.

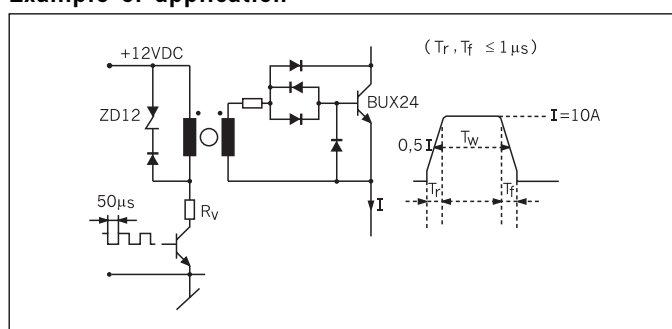
UL-Approbation

The plastic cases and the potting resin of all TIMONTA pulse transformers are fire resistant in compliance with UL 94 V-0.

Abbreviations used in the technical data

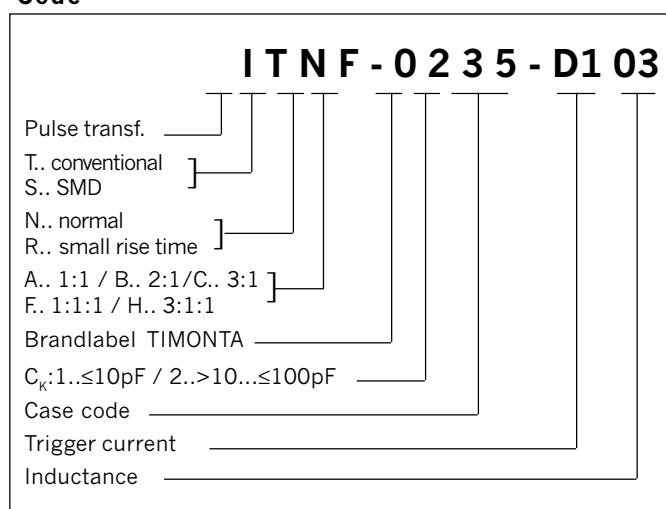
$\int U dt$	Voltage-time integral ($U_s \cdot T_w$)
T_r	Pulse rise time
P_m	Power dissipation at ambient 50°C
P	Power dissipation at elevated temperature
ϑ_a	Ambient temperature
I_t	Trigger current
C_c	Coupling capacity
R_L	Test load resistance (secondary)
R_p	Primary resistance
R_s	Secondary resistance
L_p	Primary inductance = $L_s \times N^2$
L_s	Secondary inductance
U_{eff}	Working voltage primary-secondary in V_{RMS}
U_{isol}	Test voltage
N	Turns ratio

Example of application



Power transistor in pulse operation

Code

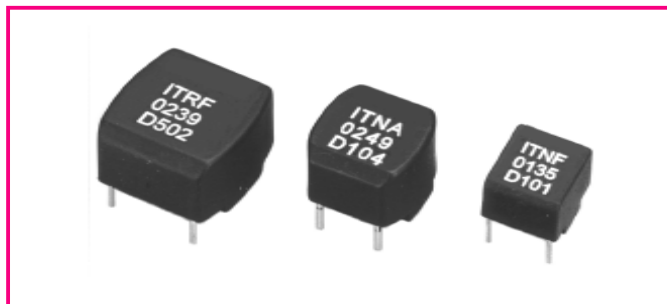


Pulse Transformer for Conventional Board Assemblies



IT Series, Turns Ratio 1:1, 2:1 and 1:1:1

Voltage-time integral $U_s \times T_w$:	150 - 400 V μ s
Pulse rise time T_r :	0.05 - 1.5 μ s
Working voltage:	$U_{eff} \leq 600$ VAC
Partial discharge voltage:	$U_e \leq 1.5 \times U_{eff}$
Climatic category:	25/100/21 acc. to IEC 60068-1
Plastic case:	UL 94 V-0
Potting resin:	UL 94 V-0



TIMONTA pulse transformers have been specially developed for the control of semi-conductors in power electronics.

Application possibilities are numerous and various and deal mainly with triggering Thyristors, Triacs, power transistors and IGBTs.

In most cases there is a suitable model available from the balanced component series for the development of dependable and economical circuits.

The desired specifications are archived through specifically selected materials and well-developed winding technology, and provide the following advantages:

- Electrical separation of circuit and power circuit, with a high insulation rating of at least 3.2 kV between the primary and secondary windings.
- Electrical separation with high insulation rating (at least 500 V) between secondary windings.
- Simple circuit layout, since there is sufficient power available to the circuit. This makes special extra provision on the power supply side unnecessary.
- Small coupling capacitances between primary and secondary windings limit transient feedback from the power supply side to the control electronics.
- The defined partial discharge voltage guarantees an effectively unlimited serviceable life.

Technical Data

Description	$\int U dt$ [V μ s]	T_r [μ s]	R_L [Ω]	I_t [A]	R_p [Ω]	R_s [Ω]	C_c [pF]	U_{isol} [kV~]	$P_m^{(1)}$ [W]	Case	Turn ratio [N]	L_s [mH]	Application
ITNA-0235-D103	200	0.9	100	0.1	1	1	20	3.5	0.5	35 - 3	1 : 1	2.8	Universal
ITRA-0235-D103	200	0.05	100	0.1	1.5	1	80	3.2	0.5	35 - 3	1 : 1	2.8	$T_R \leq 0.05 \mu s$
ITNA-0249-D104	300	1	100	0.1	0.7	0.7	20	3.5	0.7	49 - 3	1 : 1	3.5	Universal
ITRA-0249-D104	300	0.05	100	0.1	0.7	0.7	90	3.2	0.7	49 - 3	1 : 1	3.5	$T_R \leq 0.05 \mu s$
ITNA-0239-D202	400	1	60	0.17	0.4	0.4	20	3.5	1.0	39 - 3	1 : 1	2.2	Universal
ITRA-0239-D502	400	0.1	20	0.5	0.4	0.4	100	3.2	1.0	39 - 3	1 : 1	2.2	$T_R \leq 0.1 \mu s$

ITNB-0249-D101	250	1	100	0.1	1.0	0.5	20	3.5	0.7	49 - 3	2 : 1	1.6	Universal
ITRB-0249-D101	250	0.05	100	0.1	1.0	0.5	70	3.2	0.7	49 - 3	2 : 1	1.4	$T_R \leq 0.05 \mu s$
ITNB-0239-D202	350	1.5	60	0.17	0.8	0.4	20	3.5	1.0	39 - 3	2 : 1	1.8	Universal
ITRB-0239-D502	350	0.5	20	0.5	0.8	0.4	90	3.2	1.0	39 - 3	2 : 1	1.8	$T_R \leq 0.5 \mu s$

ITNF-0135-D101	150	0.9	100	0.1	0.5	0.5	10	3.5	0.5	35 - 4	1 : 1 : 1	1.1	Universal
ITRF-0235-D101	150	0.05	100	0.1	1	0.5	40	3.2	0.5	35 - 4	1 : 1 : 1	1.1	$T_R \leq 0.05 \mu s$
ITNF-0249-D101	250	1	100	0.1	0.5	0.5	20	3.5	0.7	49 - 4	1 : 1 : 1	1.4	Universal
ITRF-0249-D101	250	0.05	100	0.1	0.4	0.5	70	3.2	0.7	49 - 4	1 : 1 : 1	1.2	$T_R \leq 0.05 \mu s$
ITNF-0239-D202	350	1.5	60	0.17	0.4	0.4	20	3.5	1.0	39 - 4	1 : 1 : 1	1.6	Universal
ITRF-0239-D502	350	0.5	20	0.5	0.4	0.4	90	3.2	1.0	39 - 4	1 : 1 : 1	1.6	$T_R \leq 0.5 \mu s$

Table data at ϑ_a 25°C

(1) $P_m @ \vartheta_a$ 50°C; Power derating over 50°C: $P = P_m \times (100 - \vartheta_a) / 50$

On request, models with other turn ratios are available

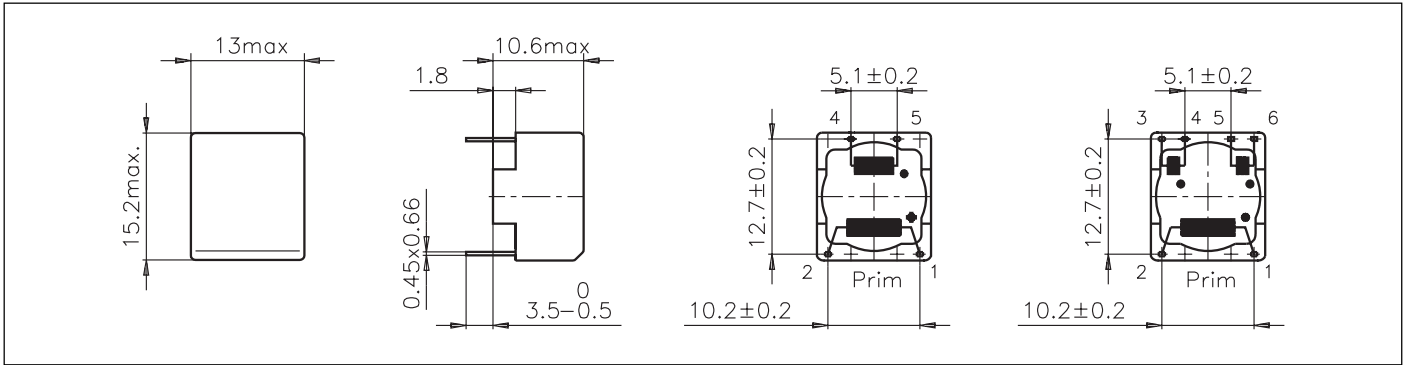
Conventional Cases



Case 35

35-3

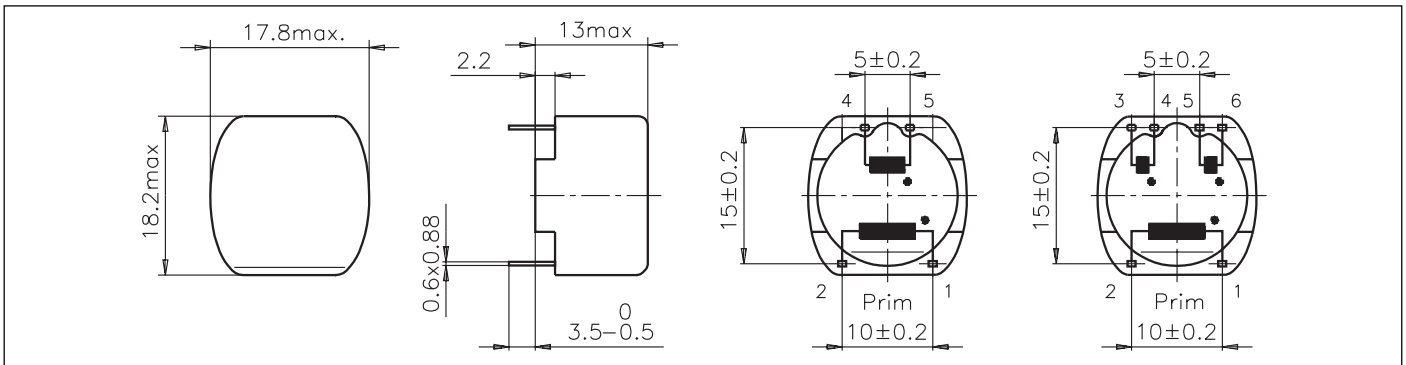
35-4



Case 49

49-3

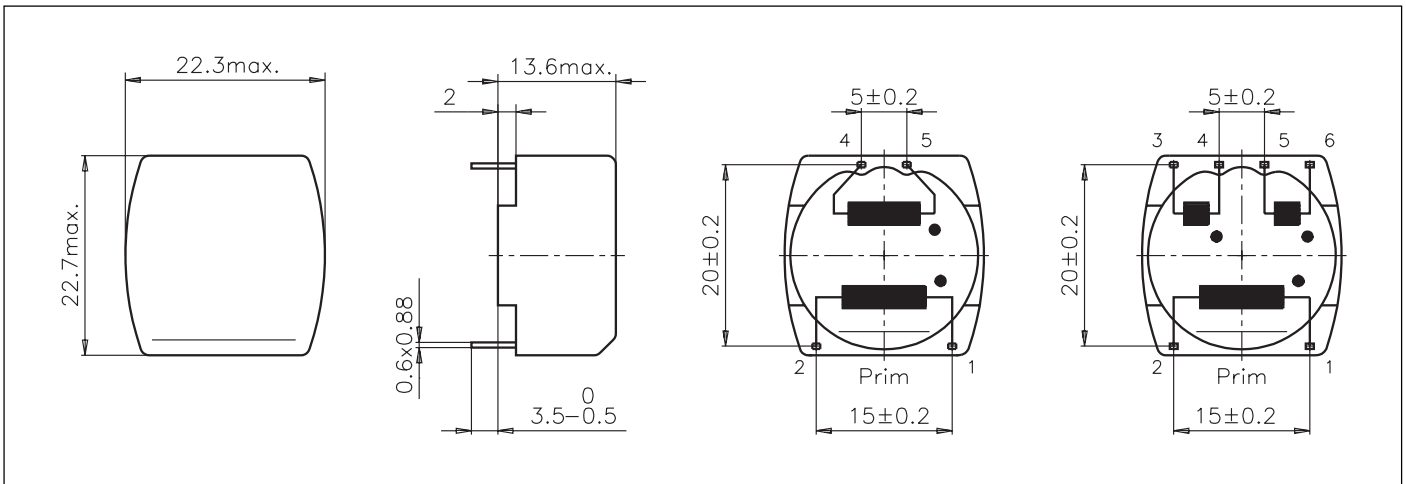
49-4



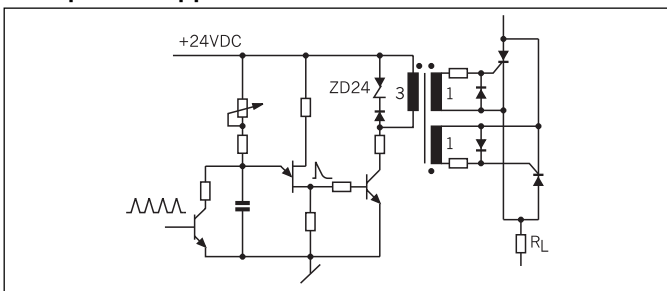
Case 39

39-3

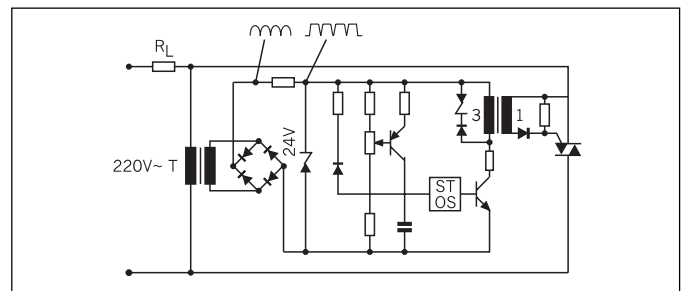
39-4



Examples of applications



Firing of antiparallel Thyristors (SCR's) by means of unijunction and transistor amplifiers



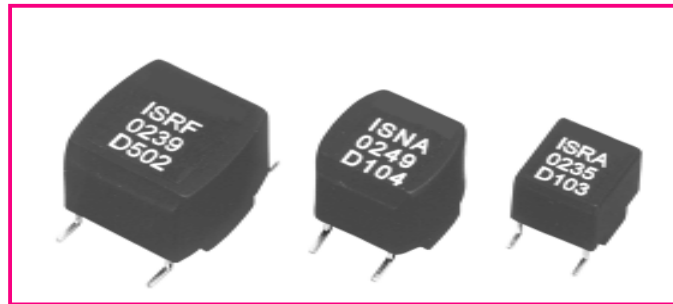
Triac phase angle control

Pulse Transformers for SMD-Assemblies



IS Series, Turns Ratio 1:1, 2:1 and 1:1:1

Voltage time integral $U_s \times T_w$:	150 - 400 Vμs
Pulse rise time T_r:	0.05 - 1.5 μs
Working voltage:	$U_{eff} \leq 600$ VAC
Partial discharge voltage:	$U_e \leq 1.5 \times U_{eff}$
Climatic category:	25/100/21 acc. to IEC 60068-1
Plastic case:	UL 94 V-0
Potting resin:	UL 94 V-0



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ISNA-0235-D103	200	0.9	100	0.1	1	1	20	3.5	0.5	35-3S	1:1	2.8	Universal
ISRA-0235-D103	200	0.05	100	0.1	1.5	1	80	3.2	0.5	35-3S	1:1	2.8	$T_R \leq 0.05 \mu s$
ISNA-0249-D104	300	1	100	0.1	0.7	0.7	20	3.5	0.7	49-3S	1:1	3.5	Universal
ISRA-0249-D104	300	0.05	100	0.1	0.7	0.7	90	3.2	0.7	49-3S	1:1	3.5	$T_R \leq 0.05 \mu s$
ISNA-0239-D202	400	1	60	0.17	0.4	0.4	20	3.5	1.0	39-3S	1:1	2.2	Universal
ISRA-0239-D502	400	0.1	20	0.5	0.4	0.4	100	3.2	1.0	39-3S	1:1	2.2	$T_R \leq 0.1 \mu s$

ISNB-0249-D101	250	1	100	0.1	1.0	0.5	20	3.5	0.7	49-3S	2:1	1.6	Universal
ISRB-0249-D101	250	0.05	100	0.1	1.0	0.5	70	3.2	0.7	49-3S	2:1	1.4	$T_R \leq 0.05 \mu s$
ISNB-0239-D202	350	1.5	60	0.17	0.8	0.4	20	3.5	1.0	39-3S	2:1	1.8	Universal
ISRB-0239-D502	350	0.5	20	0.5	0.8	0.4	90	3.2	1.0	39-3S	2:1	1.8	$T_R \leq 0.5 \mu s$

ISNF-0135-D101	150	0.9	100	0.1	0.5	0.5	10	3.5	0.5	35-4S	1:1:1	1.1	Universal
ISRF-0235-D101	150	0.05	100	0.1	1	0.5	40	3.2	0.5	35-4S	1:1:1	1.1	$T_R \leq 0.05 \mu s$
ISNF-0249-D101	250	1	100	0.1	0.5	0.5	20	3.5	0.7	49-4S	1:1:1	1.4	Universal
ISRF-0249-D101	250	0.05	100	0.1	0.4	0.5	70	3.2	0.7	49-4S	1:1:1	1.2	$T_R \leq 0.05 \mu s$
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ISRF-0239-D502	350	0.5	20	0.5	0.4	0.4	90	3.2	1.0	39-4S	1:1:1	1.6	$T_R \leq 0.5 \mu s$

Table data at $\vartheta_a 25^\circ C$

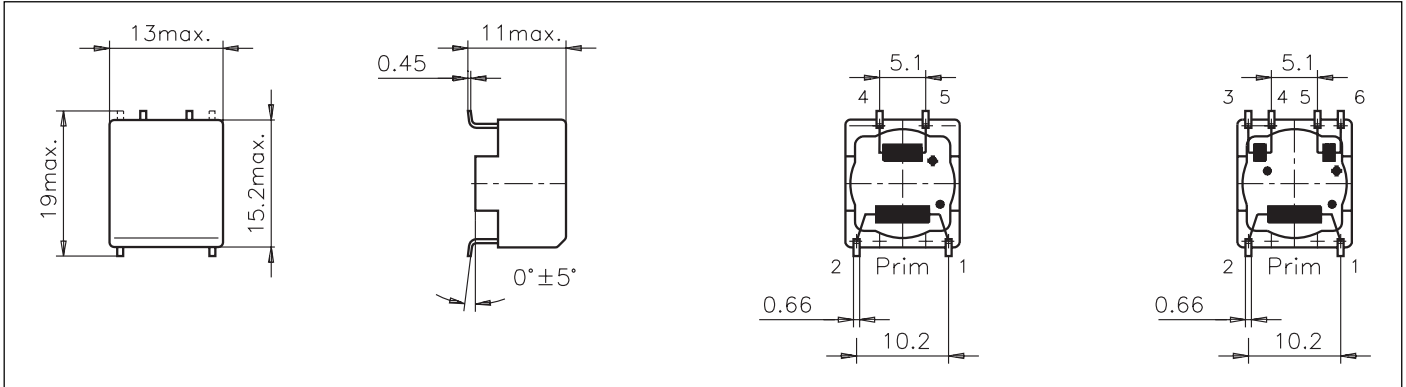
(1) $P_m @ \vartheta_a 50^\circ C$; Power derating over $50^\circ C$: $P = P_m \times (100 - \vartheta_a) / 50$

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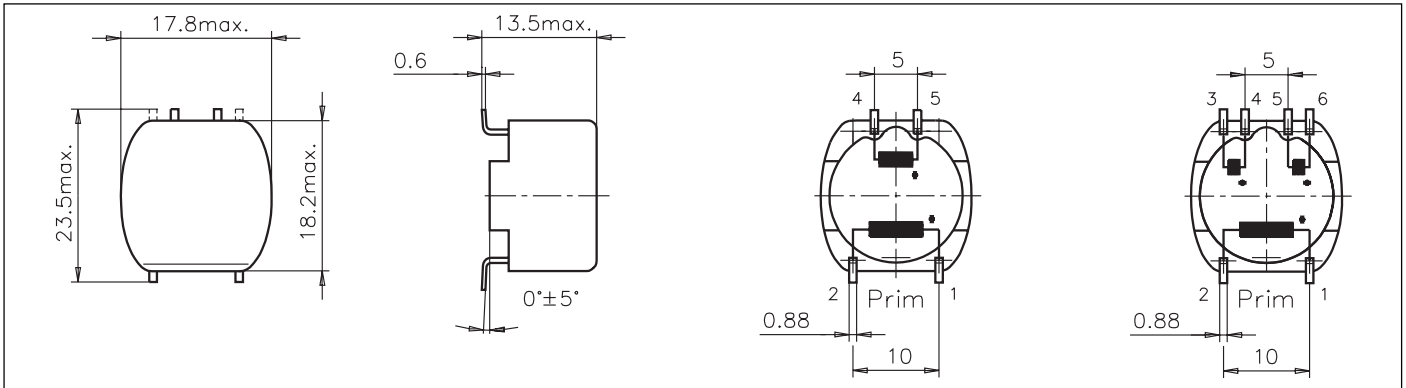
Case for SMD mounting



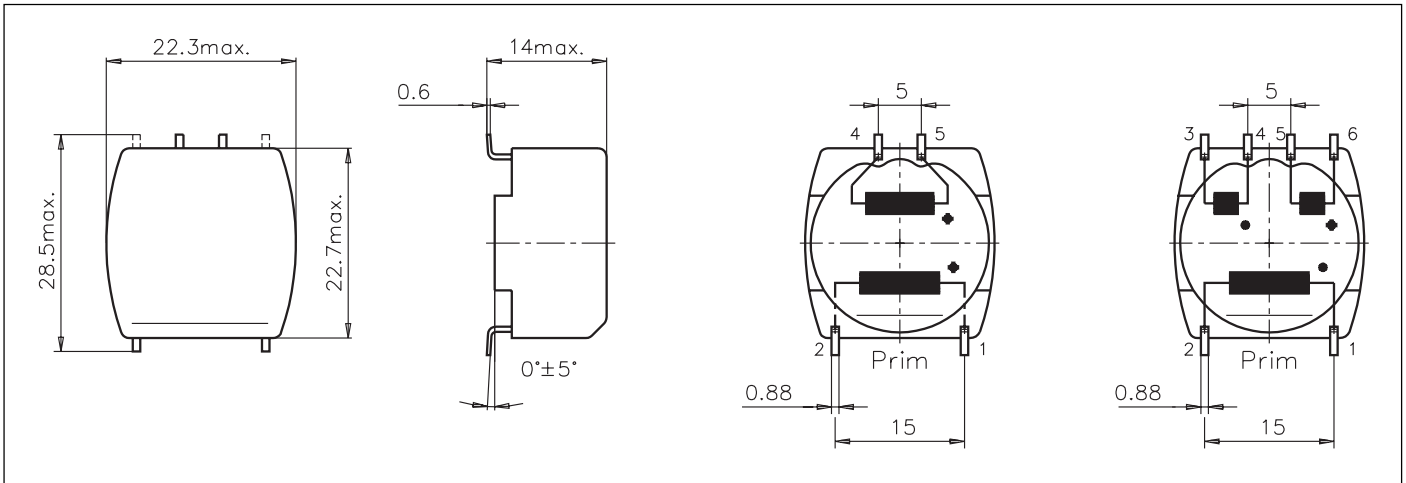
Case 35S



Case 49S



Case 39S



Possible solder land pattern for SMD mounting

Case 35S

