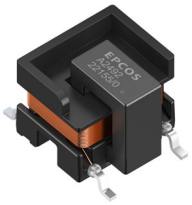
SMT gate-drive transformers

InsuGate series

Series/Type: **B78541A**

Date: August 2023

Construction



- Ferrite core MnZn
- SMD gullwing pins
- Triple insulated wire class F (155 °C)
- Bobbin material class CTI ≥ 600

Features

- Height ≤ 10 mm
- Small SMD package
- Flat L vs. temperature curve
- Coupling capacity typ. 4 pF
- RoHS compatible
- Qualified to AEC-Q200
- Wide temperature range up to +150 °C

Applications

- Switch-mode power supplies (bridge topologies)
- Gate-driver circuits
- Isolated DC/DC converters
- Galvanic-isolated single-channel IGBT driver IC

Insulation characteristics

- Plastic material UL94V-0, CTI ≥600 (class I)
- (N1, Core) / N2 creepage ≥ 9.2 mm, clearance ≥ 8.14 mm
- Insulated wire acc. IEC 61558-1 annex K, temp. class F (155 °C)
- Reinforced insulation [1] (N1, core) / N2, U_{OP} 300 V_{AC}
- Basic insulation [1] (N1, core) / N2, U_{OP} 700 $V_{DC\ peak}$

Marking

- Product brand, middle block of ordering code, date code, pin 1 marker, production place identification code

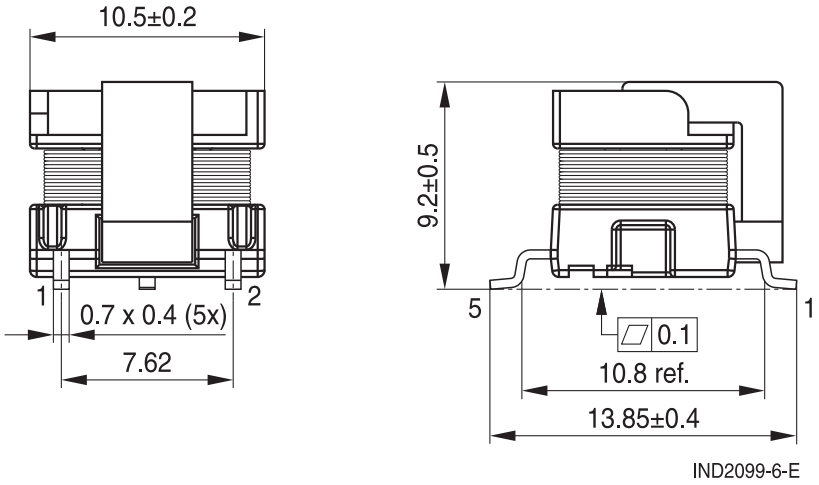
Delivery mode

- Blister tape 330 mm diameter
- Packing unit: 270 pcs per reel

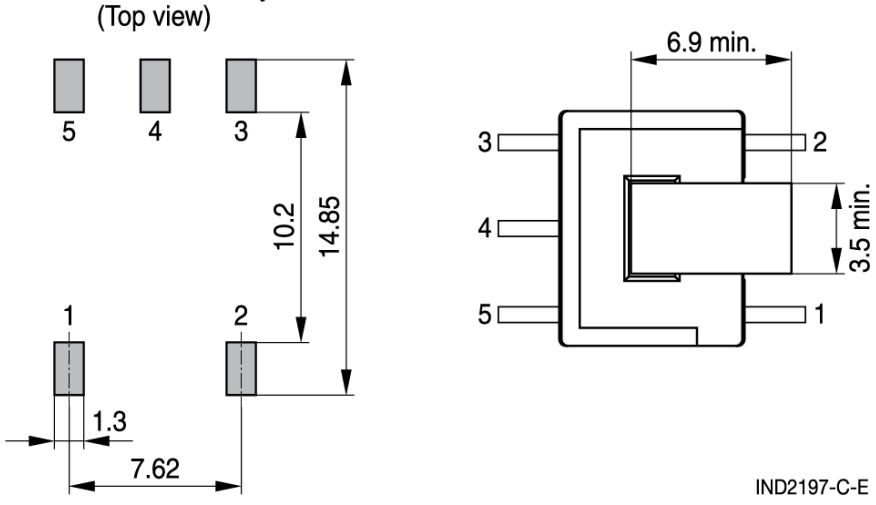
1) Refer to IEC 61558-1/2-16:2020: Reinforced insulation U_{OP} 300 V AC, OVC II, P2, altitude ≤5 km; Basic insulation U_{OP} 700 $V_{DC\ peak}$, max. transients V_{PEAK} 2.5 kV, P2, altitude ≤5 km.

Dimensional drawing and recommendation

Dimensions in mm



Recommended PCB layout
(Top view)



Technical data and measuring conditions

Specified at +25 °C if not mentioned otherwise, all values without tolerances are typical values.

Typical operational frequency	100 ... 500 kHz
High voltage test AC (N1, core) / N2	3 kV_{RMS}, 50 Hz, 1 sec
High voltage type test AC, (N1, core) / N2	3.75 kV_{RMS}, 50 Hz, 60 sec
Insulation resistance R_{ISO} (N1, core) / N2	>100 MΩ
Partial discharge inception voltage (N1, core) / N2	>1050 V_{peak} (type test)
Partial discharge extinction voltage (N1, core) / N2	>840 V_{peak} (type test)
Surge voltage test (N1, core) / N2, type test	6 kV_{peak}; 1.2/50 µs
Creepage distance (N1, core) / N2	≥9.2 mm
Clearance distance (N1, core) / N2	≥8.14 mm
Resistance to reflow soldering heat	In accordance with JEDEC J-STD-020D T_{peak} = +245 °C (T_{peak} –5 °C for 30 seconds)
Operating temperature range	–40 °C ... +150 °C (component)
Storage conditions	–25 °C ... +40 °C, humidity ≤75% RH
Weight	Approx. 2 g

Characteristics and ordering codes

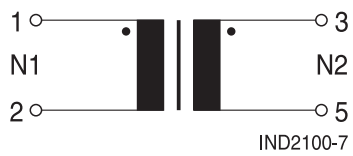
Ordering code	Turns ratio N1:N2 or N1:N2a:N2b	L_{N1} µH @100 kHz, 100 mV	$L_{leak, typ}$ µH @N2 shorted	$E*dt_{N1}$ [1] µVs (unipolar/ bipolar), @T<150 °C	$R_{DC,N1}$ mΩ
B78541A2467A003	1 : 1.08	≥ 50	0.6	15 / 30	250
B78541A2492A003	1 : 1.07 : 0.6	≥ 50	0.7	15 / 30	420

1) T ≤150 °C, $\hat{B}$ = 200 mT, ΔB = 400 mT (bipolar mode). The maximum volt-sec rating limits the peak flux densitiy to $\hat{B}$ = 200 mT when used in a unipolar drive application. For bipolar drive applications, a maximum volt-sec of two times is acceptable (ΔB 400 mT).

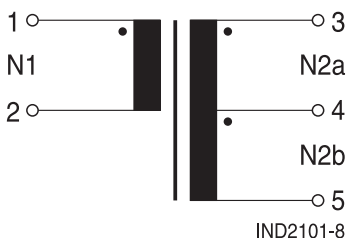
Ordering code	$R_{DC,N2a}$ mΩ	$R_{DC,N2b}$ mΩ	$Cp_{N1/N2}$ pF @20 kHz, 1 V	Schematic
B78541A2467A003	250	n.a.	4	A1
B78541A2492A003	350	240	4	A2

Schematics

A1

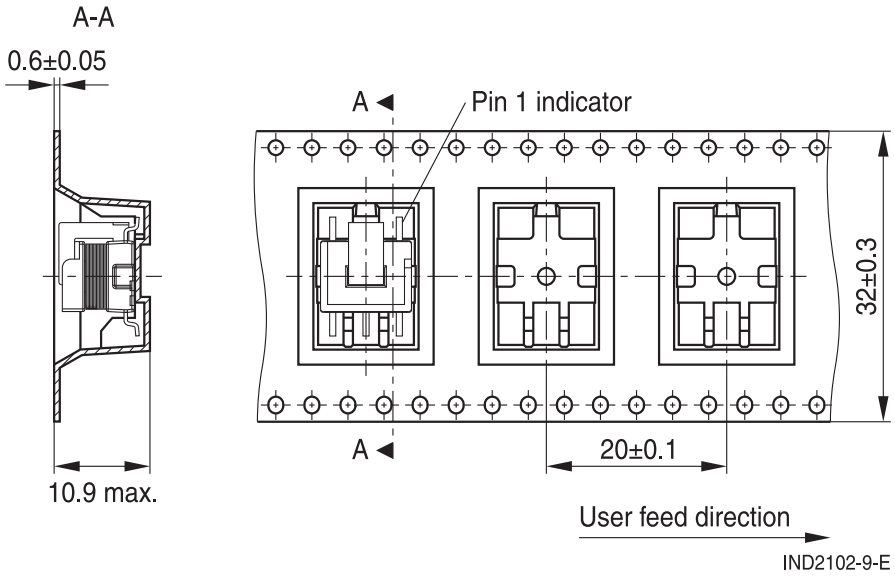


A2

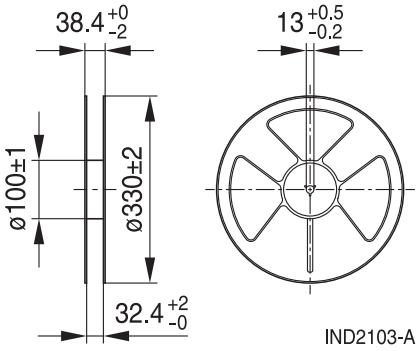


Taping and packing

Blister tape

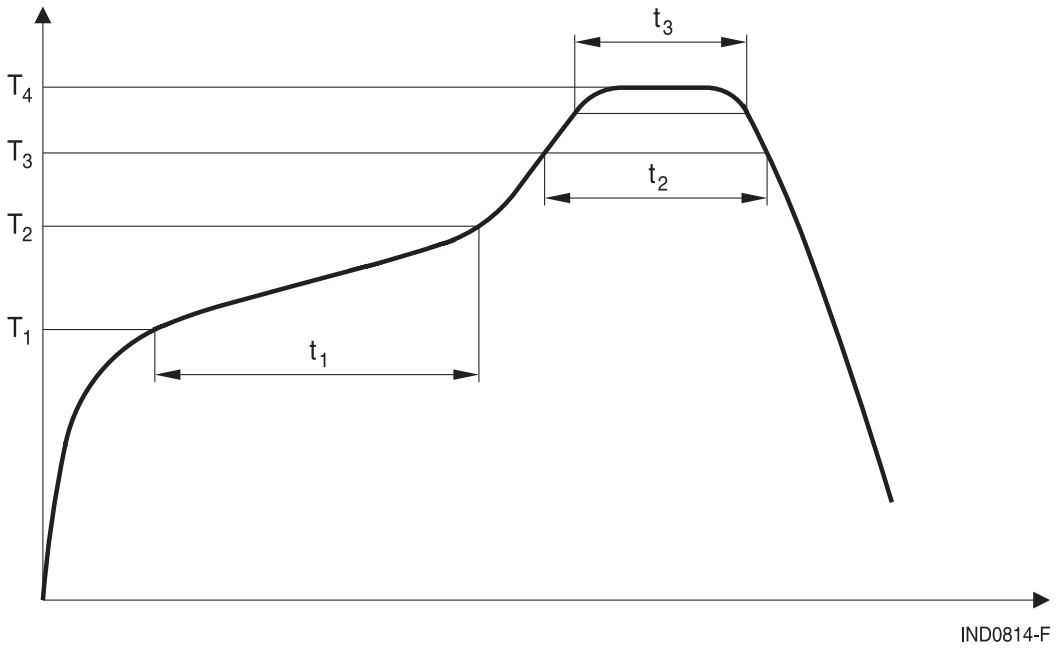


Reel



Recommended reflow soldering curve

Pb-free solder material (based on JEDEC J-STD 020E)



T_1 °C	T_2 °C	T_3 °C	T_4 °C	t_1 s	t_2 s	t_3 s
150	200	217	245	60 – 120	60 – 150	< 30 at T_4 –5 °C

Time from +24 °C to T_4: max. 480 s

Maximal numbers of reflow cycles: 3

Cautions and warnings

- Please note the recommendations in our Inductors data book (latest edition), online catalogs and in the data sheets.
  - Particular attention should be paid to the derating curves, if given. Derating applies in the case the ambient temperature in application exceeds the rated temperature of the component.
  - Ensure the operation temperature of the component in application, not to exceed the maximum specified value or the upper climatic category temperature.
  - The soldering conditions should also be observed. Temperatures quoted in relation to wave soldering refer to the pin, not the housing.
- If the components are to be washed varnished it is necessary to check whether the washing varnish agent that is used has a negative effect on the wire insulation, any plastics that are used, or on glued joints. It is possible for washing varnish agent residues to have a negative effect in the long−term on wire insulation.
  Washing processes may damage the product due to the possible static or cyclic mechanical loads (e.g., ultrasonic cleaning). They may cause cracks to develop on the product and its parts, which might lead to reduced reliability or lifetime.
- The following points must be observed if the components are potted, sealed, or varnished in customer applications:
  - Many potting, sealing of varnishing materials shrink as they harden. They therefore exert a pressure on the plastic housing or core. This pressure can have a deleterious effect on electrical properties, and in extreme cases can damage the core or plastic housing mechanically.
  - It is necessary to check whether the potting, sealing or varnishing materials used attacks or destroys the wire insulation, plastics, or glue.
  - The effect of the potting, sealing, or varnishing materials may change the high−frequency behavior of the components.
- Magnetic core materials such as ferrites are sensitive to direct impact. This can cause the core material to flake or lead to breakage of the magnetic core material.
- Any type of tension or pressure on the product may result in damage and affect its functionality and reliability.
  - The products are only to be attached to fixings or mounting holes provided for this purpose in accordance with the data sheet.
  - If additional mechanical forces are applied to the component, e.g., application of gap pads, it is necessary to check whether they attack or destroy any part of the component.
  - It is not permitted for the product specified in the data sheet to assume a mechanical function in the final application.
- Inductance value can drop if external metallic or magnetic parts will be put close to the coil or into the air gap of the coil or core or magnetic material.
- Even for customer-specific products, conclusive validation of the component in the circuit can only be carried out by the customer.

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1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application.** As a rule, we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.

2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified.** In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.

3. **The warnings, cautions and product-specific notes must be observed**.

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