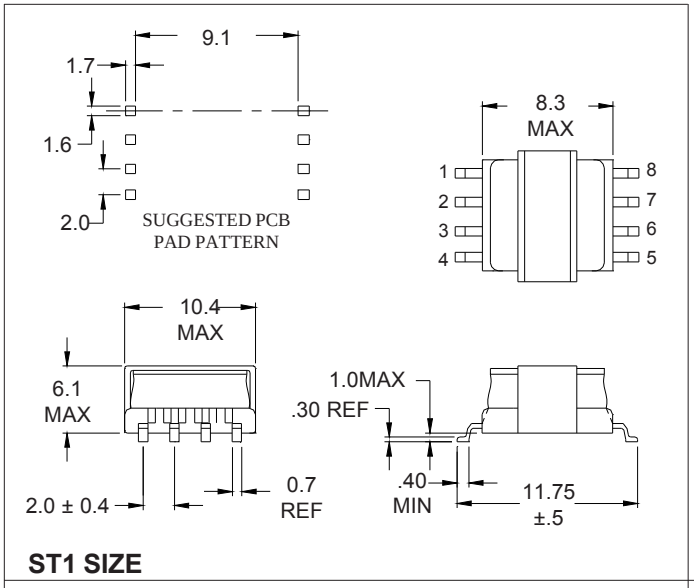
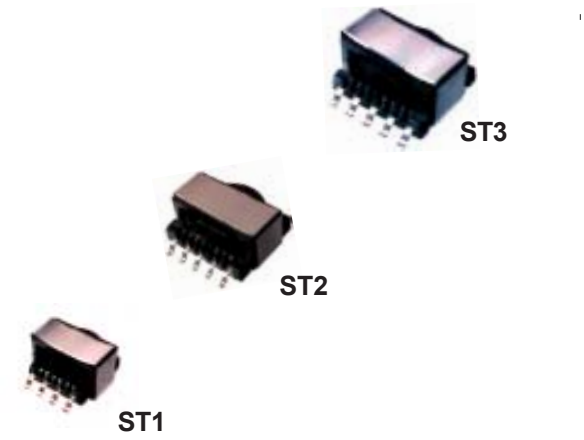
Miniature Surface Mount Customizable Transformers / Inductors

These are Torotel's newest *"customizable catalog"* surface mount parts. Standardized catalog materials and processes are used to meet your custom electrical requirements - ***the best of both worlds!*** The parts are designed primarily to be used as transformers, but can also be used as inductors and can be manufactured for commercial or military applications. ST1, ST2, and ST3 designations refer to unit size. A unique number will be assigned and added to the "ST -" designation to identify the custom portion of the design.

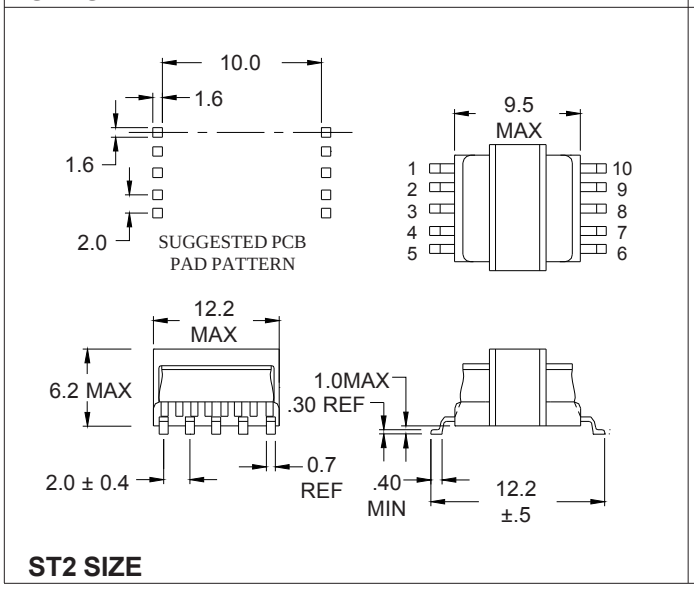
An estimation of the size and layout necessary to meet your requirements can be determined from the graphs and charts which follow. Generally units can be designed from 10 Khz to 500 Khz and up to 150 volts peak. Temperature limitation is from -55°C to +130°C (ambient plus temperature rise). The cores are a ferrite material and the insulation used is UL listed for 130°C operation. Contact Torotel Products for an exact customized design or for design assistance.



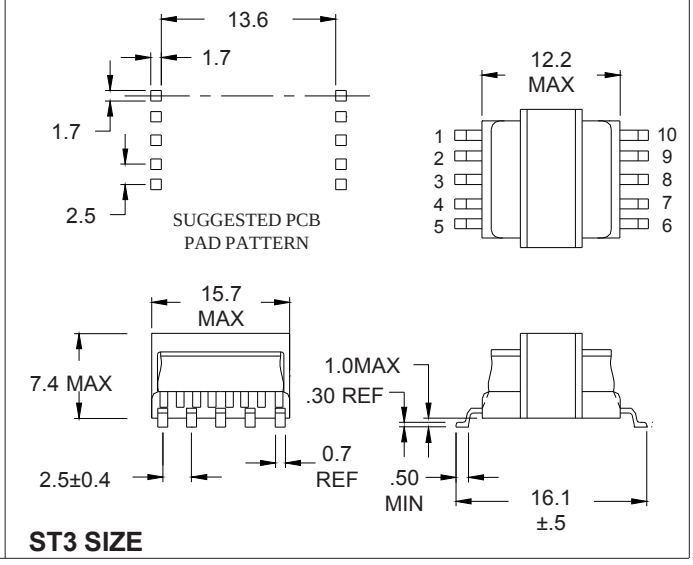
ST1 SIZE



(Dimensions shown are millimeters)



ST2 SIZE



ST3 SIZE

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Phone: (913) 747-6111 or (800) 246-5650
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Chart 1 is used to determine the minimum number of turns necessary for the voltmicrosecond product required. This will result in the maximum flux density recommended, 250 mT (2500 gauss). A slightly higher flux density may be achievable depending on actual operating conditions. Flux density is inversely proportional to the number of turns, given a constant voltmicrosecond product.

Chart 2 indicates the maximum number of turns that can be placed on the winding form for the size in question. In conjunction, Chart 2 also shows the recommended maximum current carrying capability of the common magnet wire sizes used. This is based on 250 circular mils per amp which is a good starting point for an acceptable temperature rise. Variations in input voltage / frequency, ambient temperature and allowable temperature rise will affect the actual current carrying capability of the wire and design in general.

Chart 3 shows the total loss allowed versus the expected temperature rise. The total loss (expressed in milliwatts) includes both copper loss and core loss. Ideally the core loss and the copper loss should be close in value. The square of the continuous rms current multiplied by the direct current winding resistance (Rdc) will yield the copper loss. Each winding must be added together for the total copper loss. Tables 1 and 2 can be used to calculate the Rdc of a winding, depending on the size selected. The number of turns multiplied by the mean length of each turn (mlt), then multiplied by the Rdc factor will yield an estimation of the Rdc. A note must be added here regarding losses due to ac resistance (Rac) as a result of skin and proximity effects. For these approximations, Rac is assumed as being negligible compared to Rdc. This can be assured by choosing the correct wire size and winding technique for the frequency used. As a guide, a good starting point would be to choose #26 awg or finer wire for 100 Khz operation, #30 awg or finer wire for 250 Khz operation or #33 awg or finer wire for 500 Khz operation. If, due to current capacity requirements, a larger wire size is needed than that which is recommended for the frequency, then several strands of a smaller size wire should be used.

CHART 1

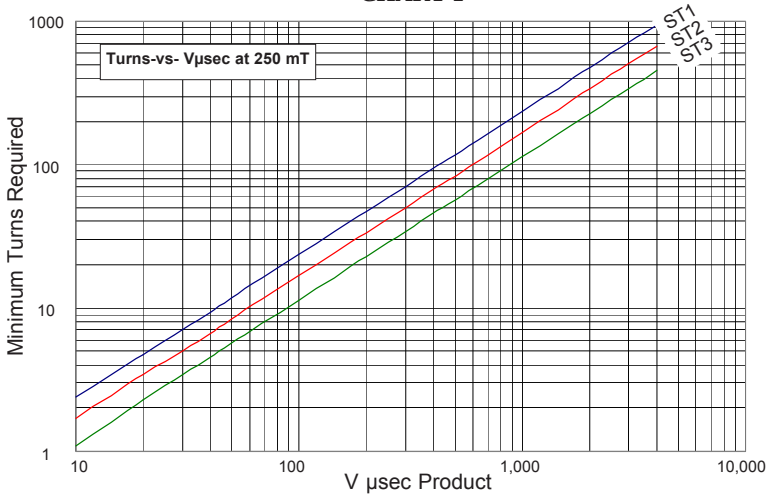

CHART 2

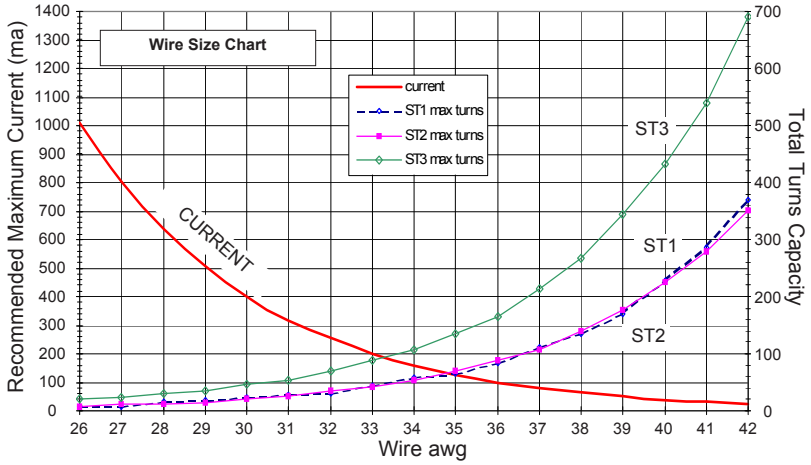

CHART 3

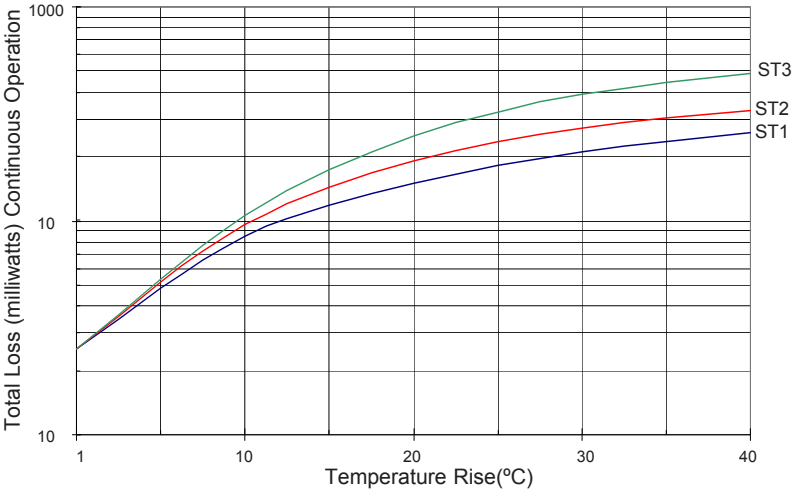

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Table 1

Size	Winding MLT (ft)	Inductance Factor*
ST1	0.0603	850
ST2	0.0708	1200
ST3	0.0886	1400

*These values are typical for a specific standard material. Various materials and gapping possibilities can vary this value from 100 to 1600 depending on core size.

Table 2

Wire Size (awg)	Rdc Factor (ohms per ft)
26	0.04102
27	0.05144
28	0.06531
29	0.08121
30	0.1037
31	0.1309
32	0.1620
33	0.2057
34	0.2613
35	0.3307
36	0.4148
37	0.5121
38	0.6482
39	0.8466
40	1.079
41	1.323
42	1.659

Charts 4a through 4c can be used to approximate the core loss for various frequencies and flux densities.

Table 1 indicates an inductance factor for each part size. These values are typical for a specific standard core material with no air gap and is listed as a reference value. Various configurations, materials and gapping possibilities can vary these values from 100 to 1600. Actual operating flux densities will also affect the factor to a certain extent. Multiplying the inductance factor by the square of the turns will yield an inductance expressed in nanohenries.

CHART 4a

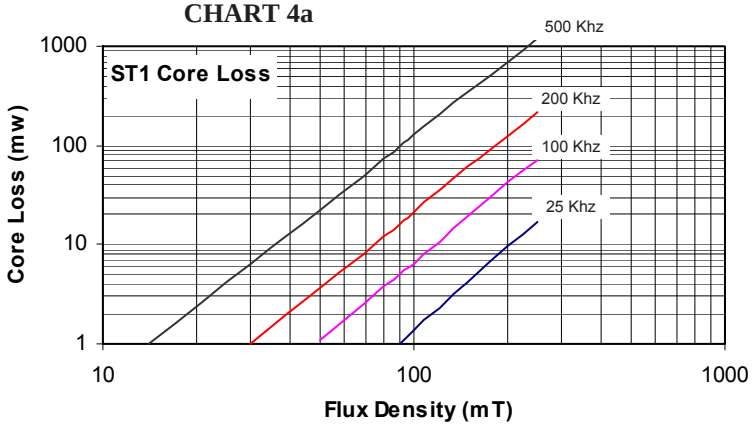


CHART 4b

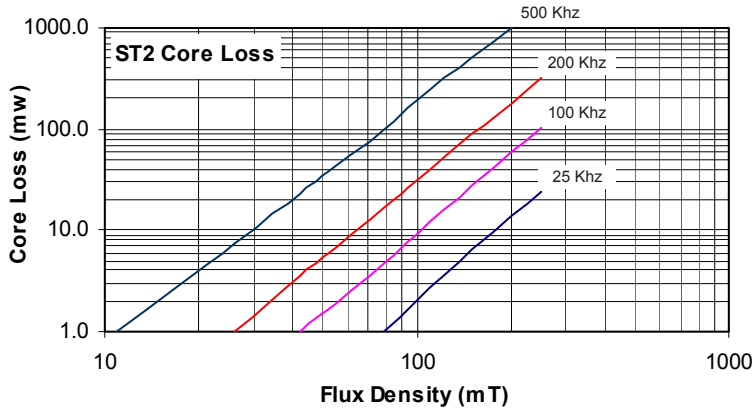
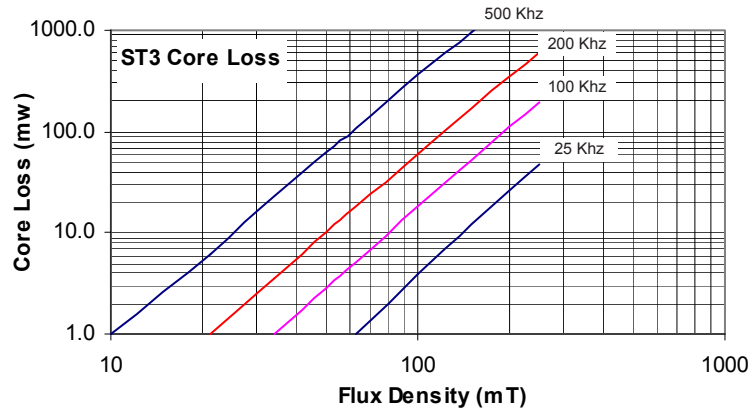


CHART 4c



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