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# Coupled Inductors – MSD1278T

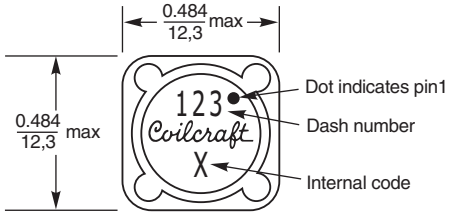
## For high temperature SEPIC applications

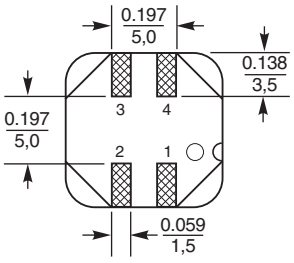



The MSD1278T series of coupled inductors was designed for high temperature applications – up to 125°C. The excellent coupling coefficient (k ≥ 0.94) makes it ideal for use in SEPIC applications. In SEPIC topologies, the required inductance for each winding in a coupled inductor is half the value needed for two separate inductors, allowing selection of a part with lower DCR and higher current handling.

These inductors provide high inductance, high efficiency and excellent current handling in a rugged, low cost part. They are well suited for use as VRM inductors in high-current DC-DC and VRM/VRD controllers.

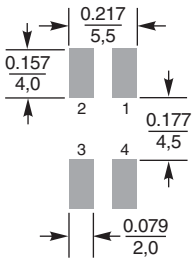
They can also be used as two single inductors connected in series or parallel, as a common mode choke or as a 1 : 1 transformer.

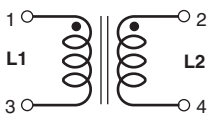


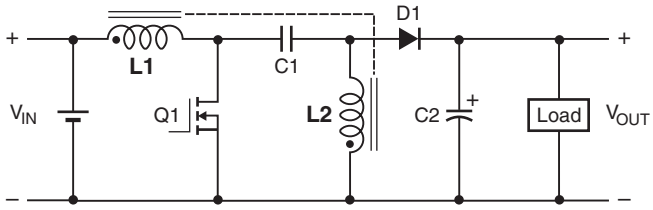




Dimensions are in inches / mm

**Recommended Land Pattern**




**Typical SEPIC schematic**
Refer to Application Note, Document 639,
"Selecting Coupled Inductors for SEPIC Applications"

**Core material** Ferrite

**Terminations** RoHS compliant matte tin over nickel over phos bronze. Other terminations available at additional cost.

**Weight:** 3.7 – 4.4 g

**Ambient temperature** –40°C to +125°C with Irms current, +125°C to +165°C with derated current

**Storage temperature** Component: –40°C to +165°C. Packaging: –40°C to +80°C

**Winding to winding isolation** 500 Vrms

**Resistance to soldering heat** Max three 40 second reflows at +260°C, parts cooled to room temperature between cycles

**Moisture Sensitivity Level (MSL)** 1 (unlimited floor life at <30°C / 85% relative humidity)

**Failures in Time (FIT) / Mean Time Between Failures (MTBF)** 38 per billion hours / 26,315,789 hours, calculated per Telcordia SR-332

**Packaging** 500/13″ reel; Plastic tape: 24 mm wide, 0.4 mm thick, 16 mm pocket spacing, 8.1 mm pocket depth

**PCB washing** Only pure water or alcohol recommended



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# High Temperature Coupled Inductors for SEPIC – MSD1278T

| Part number[1] | Inductance[2] (µH) | DCR max[3] (Ohms) | SRF typ[4] (MHz) | Isat (A)[5] 10% drop | 20% drop | 30% drop | Irms (A) both windings[6] | one winding[7] |
|---|---|---|---|---|---|---|---|---|
| MSD1278T-472ML_ | 4.7 ±20% | 0.040 | 33.0 | 13.90 | 15.20 | 16.36 | 3.16 | 4.47 |
| MSD1278T-562ML_ | 5.6 ±20% | 0.046 | 30.0 | 13.38 | 14.86 | 15.74 | 2.87 | 4.06 |
| MSD1278T-682ML_ | 6.8 ±20% | 0.048 | 23.0 | 12.10 | 13.56 | 14.20 | 2.81 | 3.98 |
| MSD1278T-822ML_ | 8.2 ±20% | 0.055 | 20.0 | 10.30 | 11.52 | 12.20 | 2.76 | 3.90 |
| MSD1278T-103ML_ | 10 ±20% | 0.058 | 17.0 | 8.80 | 10.00 | 10.66 | 2.56 | 3.62 |
| MSD1278T-123ML_ | 12 ±20% | 0.062 | 15.0 | 8.20 | 9.18 | 9.74 | 2.48 | 3.50 |
| MSD1278T-153ML_ | 15 ±20% | 0.072 | 13.0 | 7.40 | 8.36 | 9.03 | 2.30 | 3.25 |
| MSD1278T-183ML_ | 18 ±20% | 0.080 | 12.0 | 6.50 | 7.38 | 7.86 | 2.18 | 3.08 |
| MSD1278T-223ML_ | 22 ±20% | 0.096 | 11.0 | 6.00 | 6.80 | 7.26 | 1.99 | 2.81 |
| MSD1278T-273ML_ | 27 ±20% | 0.120 | 10.0 | 5.80 | 6.56 | 7.02 | 1.78 | 2.52 |
| MSD1278T-333ML_ | 33 ±20% | 0.150 | 9.5 | 5.50 | 6.10 | 6.52 | 1.59 | 2.25 |
| MSD1278T-393ML_ | 39 ±20% | 0.161 | 8.5 | 4.70 | 5.26 | 5.60 | 1.54 | 2.18 |
| MSD1278T-473ML_ | 47 ±20% | 0.180 | 7.5 | 3.70 | 4.34 | 4.60 | 1.45 | 2.05 |
| MSD1278T-563ML_ | 56 ±20% | 0.190 | 7.0 | 3.60 | 4.18 | 4.50 | 1.41 | 2.00 |
| MSD1278T-683ML_ | 68 ±20% | 0.210 | 6.5 | 3.50 | 4.04 | 4.32 | 1.35 | 1.90 |
| MSD1278T-823ML_ | 82 ±20% | 0.280 | 5.0 | 3.30 | 3.72 | 4.02 | 1.16 | 1.65 |
| MSD1278T-104ML_ | 100 ±20% | 0.300 | 4.5 | 2.80 | 3.24 | 3.46 | 1.13 | 1.59 |
| MSD1278T-124KL_ | 120 ±10% | 0.410 | 4.3 | 2.60 | 2.94 | 3.16 | 0.96 | 1.36 |
| MSD1278T-154KL_ | 150 ±10% | 0.460 | 4.1 | 2.20 | 2.54 | 2.70 | 0.91 | 1.29 |
| MSD1278T-184KL_ | 180 ±10% | 0.510 | 4.0 | 2.10 | 2.42 | 2.58 | 0.86 | 1.22 |
| MSD1278T-224KL_ | 220 ±10% | 0.690 | 3.4 | 1.90 | 2.16 | 2.28 | 0.74 | 1.05 |
| MSD1278T-274KL_ | 270 ±10% | 0.900 | 3.1 | 1.70 | 1.94 | 2.10 | 0.65 | 0.92 |
| MSD1278T-334KL_ | 330 ±10% | 1.02 | 2.9 | 1.50 | 1.70 | 1.84 | 0.61 | 0.86 |
| MSD1278T-394KL_ | 390 ±10% | 1.12 | 2.7 | 1.40 | 1.60 | 1.70 | 0.58 | 0.82 |
| MSD1278T-474KL_ | 470 ±10% | 1.53 | 2.2 | 1.30 | 1.50 | 1.60 | 0.50 | 0.70 |
| MSD1278T-564KL_ | 560 ±10% | 1.69 | 2.0 | 1.20 | 1.34 | 1.46 | 0.47 | 0.67 |
| MSD1278T-684KL_ | 680 ±10% | 2.29 | 1.7 | 1.00 | 1.08 | 1.22 | 0.41 | 0.58 |
| MSD1278T-824KL_ | 820 ±10% | 2.55 | 1.4 | 0.900 | 1.04 | 1.18 | 0.39 | 0.55 |
| MSD1278T-105KL_ | 1000 ±10% | 2.87 | 1.3 | 0.850 | 0.948 | 1.05 | 0.37 | 0.52 |

1. When ordering, please specify **termination** and **packaging** code:

   **MSD1278T-105KL D**

   **Termination:** **L** = RoHS compliant matte tin over nickel over phos bronze
   Special order: **T** = RoHS tin-silver-copper (95.5/4/0.5) or **S** = non-RoHS tin-lead (63/37).

   **Packaging:** **D** = 13″ machine-ready reel. EIA-481 embossed plastic tape (500 parts per full reel).
   **B** = Less than full reel. In tape, but not machine ready. To have a leader and trailer added ($25 charge), use code letter D instead.
2. Inductance shown for each winding, measured at 100 kHz, 0.1 Vrms, 0 Adc on an Agilent/HP 4284A LCR meter or equivalent. When leads are connected in parallel, inductance is the same value. When leads are connected in series, inductance is four times the value.
3. DCR is for each winding. When leads are connected in parallel, DCR is half the value. When leads are connected in series, DCR is twice the value.
4. SRF measured using an Agilent/HP 4191A or equivalent. When leads are connected in parallel, SRF is the same value.
5. DC current, at which the inductance drops the specified amount from its value without current. It is the sum of the current flowing in both windings.
6. Equal current when applied to each winding simultaneously that causes a 40°C temperature rise from 25°C ambient. See temperature rise calculation.
7. Maximum current when applied to one winding that causes a 40°C temperature rise from 25°C ambient. See temperature rise calculation.
8. Electrical specifications at 25°C.

Refer to Doc 639 “Selecting Coupled Inductors for SEPIC Applications.”
Refer to Doc 362 “Soldering Surface Mount Components” before soldering.

### Temperature rise calculation based on specified Irms

Winding power loss = $(I_{L1}^2 + I_{L2}^2) \times$ DCR in Watts (W)

Temperature rise ($\Delta t$) = Winding power loss $\times \frac{52.6°C}{W}$

$\Delta t = (I_{L1}^2 + I_{L2}^2) \times \text{DCR} \times \frac{52.6°C}{W}$

**Example 1.** MSD1278T-153ML (Equal current in each winding)
Winding power loss = $(2.3^2 + 2.3^2) \times 0.072 = 0.761$ W

$\Delta t = 0.761 \text{ W} \times \frac{52.6°C}{W} = 40°C$

**Example 2.** MSD1278T-153ML ($I_{L1} = 2.4$ A, $I_{L2} = 1.3$ A)
Winding power loss = $(2.4^2 + 1.3^2) \times 0.072 = 0.536$ W

$\Delta t = 0.536 \text{ W} \times \frac{52.6°C}{W} = 28.2°C$

### Coupled Inductor Core and Winding Loss Calculator

This web-based utility allows you to enter frequency, peak-to-peak (ripple) current, and Irms current to predict temperature rise and overall losses, including core loss. Visit www.coilcraft.com/coupledloss.



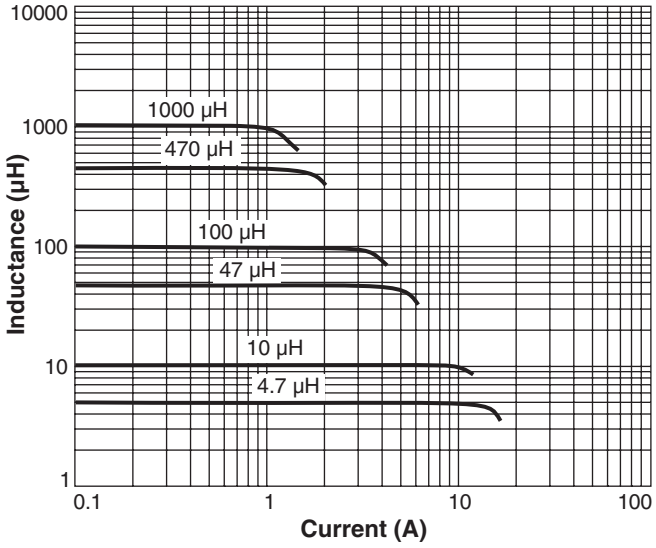
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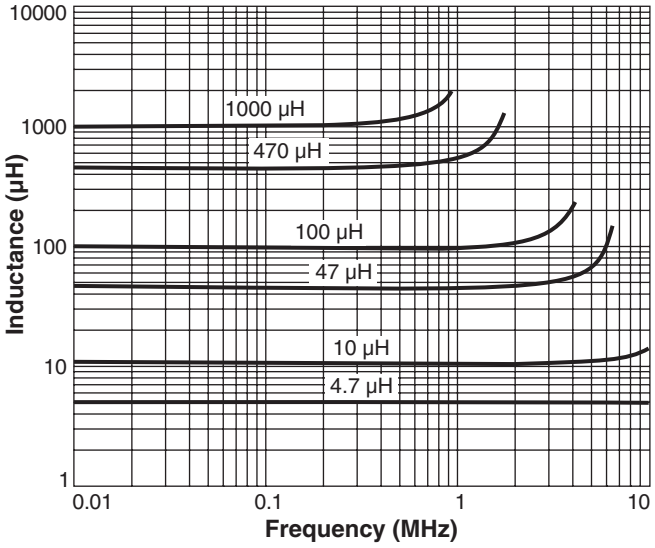
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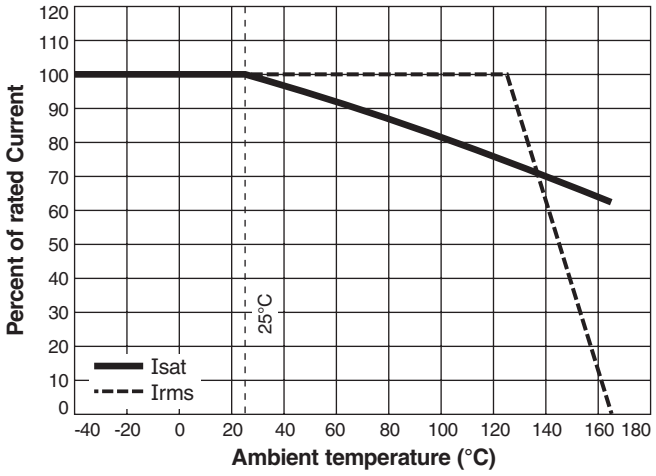
## Typical L vs Current




## Typical L vs Frequency




## Current Derating






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