

**NEW!**

# Coupled Inductors-LPD4012

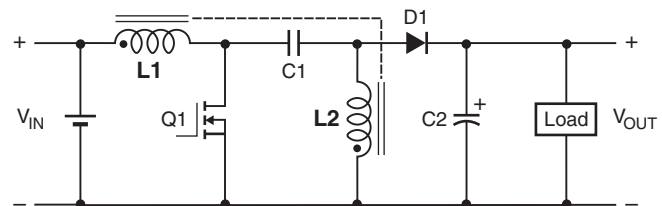
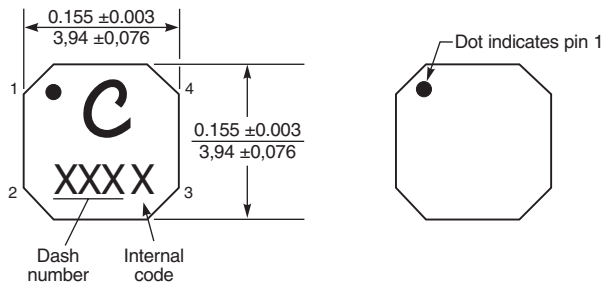
For SEPIC and other Applications



The LPD4012 coupled miniature shielded inductors are only 1,1 mm high and 4 mm square. Their excellent coupling coefficient ( $k \geq 0.94$ ) makes them 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.

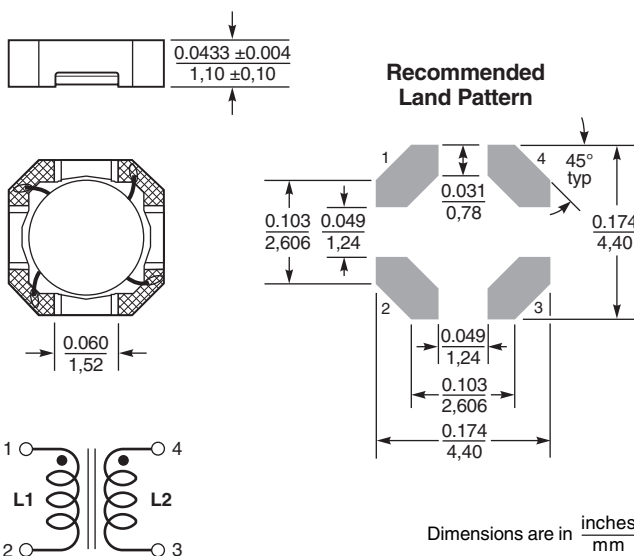
These inductors provide high efficiency and excellent current handling in a rugged, low cost part.

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.



### Typical SEPIC schematic

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



**Core material** Ferrite

**Core and winding loss** See [www.coilcraft.com/coupledloss](http://www.coilcraft.com/coupledloss)

**Weight** 54 – 64 mg

**Terminations** RoHS compliant silver-palladium-platinum-glass frit. Other terminations available at additional cost.

**Ambient temperature**  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  with  $I_{\text{rms}}$  current,  $+85^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  with derated current

**Storage temperature** Component:  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .  
Packaging:  $-40^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$

**Winding to winding isolation** 100 V

**Resistance to soldering heat** Max three 40 second reflows at  $+260^{\circ}\text{C}$ , parts cooled to room temperature between cycles

**Moisture Sensitivity Level (MSL)** 1 (unlimited floor life at  $<30^{\circ}\text{C}$  / 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** 1000/7" reel; 3500/13" reel Plastic tape: 12 mm wide, 0.25 mm thick, 8 mm pocket spacing, 1.32 mm pocket depth

**Recommended pick and place nozzle** OD: 4 mm; ID:  $\leq 2$  mm

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

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1102 Silver Lake Road Cary, Illinois 60013 Phone 847/639-6400 Fax 847/639-1469

E-mail [info@coilcraft.com](mailto:info@coilcraft.com) Web <http://www.coilcraft.com>



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## Coupled Inductors for SEPIC Applications – LPD4012 Series

Part number <sup>1</sup>	Inductance <sup>2</sup> ( $\mu$ H)	DCR max <sup>3</sup> (Ohms)	SRF typ <sup>4</sup> (MHz)	Isat (A) <sup>5</sup>			Irms (A)	
				10% drop	20% drop	30% drop	both windings <sup>6</sup>	one winding <sup>7</sup>
LPD4012-331NL_	0.33 $\pm$ 30%	0.042	255	5.2	5.4	5.6	1.87	2.65
LPD4012-561NL_	0.56 $\pm$ 30%	0.087	185	3.7	3.8	3.9	1.30	1.84
LPD4012-821NL_	0.82 $\pm$ 30%	0.100	130	3.2	3.3	3.4	1.21	1.72
LPD4012-152ML_	1.5 $\pm$ 20%	0.185	86	2.50	2.81	2.91	1.15	1.62
LPD4012-222ML_	2.2 $\pm$ 20%	0.235	70	2.30	2.40	2.50	0.95	1.35
LPD4012-332ML_	3.3 $\pm$ 20%	0.320	48	1.80	1.90	2.00	0.75	1.06
LPD4012-472ML_	4.7 $\pm$ 20%	0.500	39	1.60	1.70	1.80	0.65	0.92
LPD4012-562ML_	5.6 $\pm$ 20%	0.620	32	1.50	1.60	1.60	0.55	0.78
LPD4012-682ML_	6.8 $\pm$ 20%	0.530	31	1.20	1.52	1.63	0.60	0.86
LPD4012-822ML_	8.2 $\pm$ 20%	0.600	29	1.10	1.20	1.30	0.55	0.78
LPD4012-103ML_	10 $\pm$ 20%	0.750	25	0.98	1.00	1.10	0.50	0.71
LPD4012-153ML_	15 $\pm$ 20%	1.13	21	0.90	0.72	0.74	0.43	0.60
LPD4012-223ML_	22 $\pm$ 20%	1.63	15	0.70	0.82	0.84	0.34	0.48
LPD4012-333ML_	33 $\pm$ 20%	1.83	12	0.37	0.57	0.58	0.31	0.44
LPD4012-473ML_	47 $\pm$ 20%	2.52	8.8	0.33	0.39	0.40	0.28	0.39
LPD4012-683ML_	68 $\pm$ 20%	3.23	7.8	0.27	0.36	0.37	0.25	0.36
LPD4012-823ML_	82 $\pm$ 20%	3.66	7.3	0.27	0.27	0.29	0.23	0.31
LPD4012-104ML_	100 $\pm$ 20%	4.76	6.1	0.22	0.28	0.29	0.20	0.27
LPD4012-124ML_	120 $\pm$ 20%	5.54	5.3	0.21	0.26	0.27	0.19	0.27
LPD4012-154ML_	150 $\pm$ 20%	6.90	4.6	0.18	0.26	0.27	0.17	0.23
LPD4012-184ML_	180 $\pm$ 20%	8.75	4.1	0.16	0.21	0.23	0.14	0.18
LPD4012-224ML_	220 $\pm$ 20%	11.24	3.3	0.15	0.16	0.17	0.12	0.17
LPD4012-334ML_	330 $\pm$ 20%	17.00	2.8	0.13	0.16	0.16	0.10	0.14
LPD4012-474ML_	470 $\pm$ 20%	24.50	2.3	0.10	0.11	0.12	0.09	0.13
LPD4012-564ML_	560 $\pm$ 20%	26.00	2.1	0.07	0.14	0.15	0.08	0.12

1. Please specify **termination** and **packaging** codes:

LPD4012-564ML C

**Termination:** L = RoHS compliant Silver-palladium-platinum-glass frit.  
Special order:  
T = RoHS tin-silver-copper (95.5/4/0.5) or S = non-RoHS tin-lead (63/37).

**Packaging:** C = 7" machine-ready reel. EIA-481 embossed plastic tape (1000 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.  
D = 13" machine-ready reel. EIA-481 embossed plastic tape. Factory order only, not stocked (3500 parts per full reel).

- 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.
- 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.
- SRF measured using an Agilent/HP 4191A or equivalent. When leads are connected in parallel, SRF is the same value.
- 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.
- Equal current when applied to each winding simultaneously that causes a 40°C temperature rise from 25°C ambient. See temperature rise calculation.
- Maximum current when applied to one winding that causes a 40°C temperature rise from 25°C ambient. See temperature rise calculation.
- 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 =  $(I_{L1}^2 + I_{L2}^2) \times \text{DCR}$  in Watts (W)

Temperature rise = Winding power loss  $\times \frac{135^\circ\text{C}}{\text{W}}$

### Examples for LPD4012-821ML:

#### Equal current in each winding (1.21 A):

Winding power loss =  $(1.21^2 + 1.21^2) \times 0.10 = 0.293 \text{ W}$

Temperature rise =  $0.293 \text{ W} \times \frac{135^\circ\text{C}}{\text{W}} = 39.6^\circ\text{C}$

#### Unequal current ( $I_{L1} = 1.5 \text{ A}$ , $I_{L2} = 0.8 \text{ A}$ ):

Winding power loss =  $(1.5^2 + 0.8^2) \times 0.10 = 0.289 \text{ W}$

Temperature rise =  $0.289 \text{ W} \times \frac{135^\circ\text{C}}{\text{W}} = 39.0^\circ\text{C}$

### 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](http://www.coilcraft.com/coupledloss).

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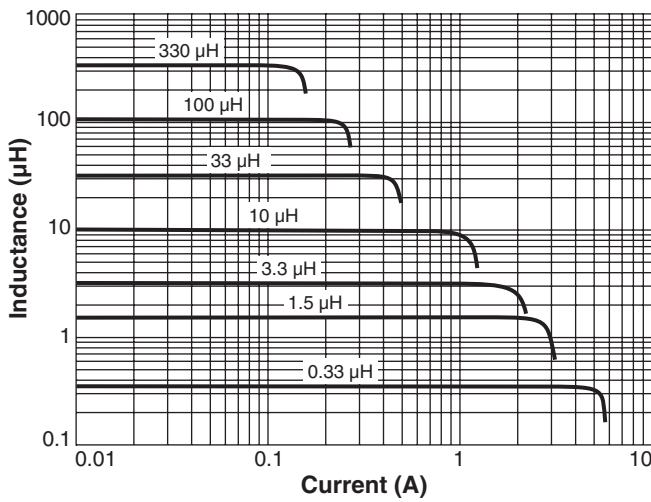
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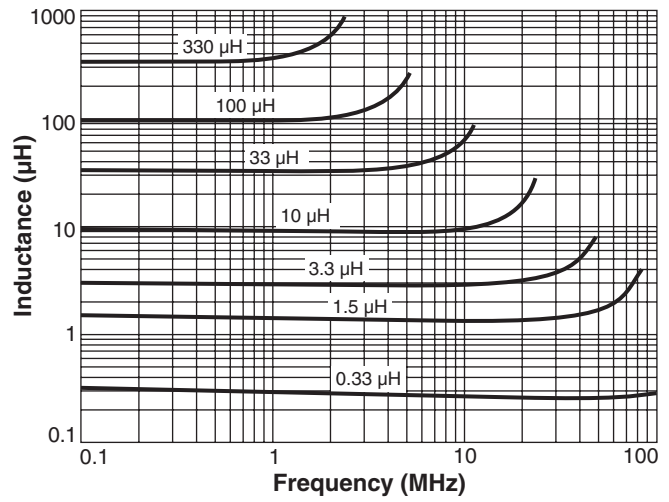
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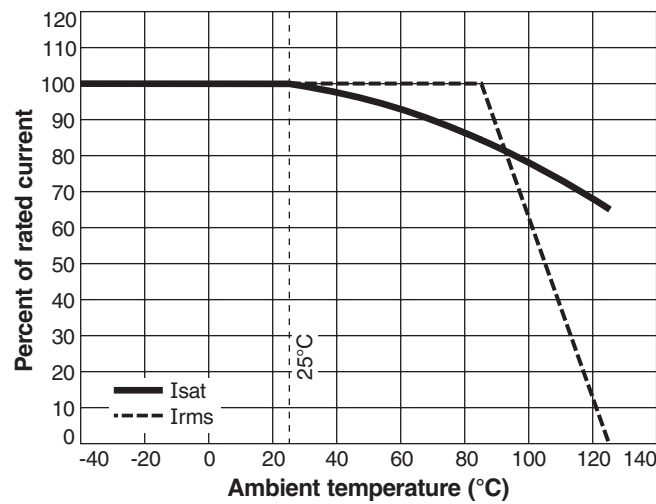
## Typical L vs Current



## Typical L vs Frequency



## Typical Current Derating



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