Powering Business Worldwide

Engineering Product Specification CL1004Rx-n-xxx-R

TITLE: **Multiphase Inductors, SMT** **REV A**

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1 Product features and environmental data

Product features

High current carrying capacity
Operating frequency range: up to 3MHz
20.0 mm x 10.0 mm footprint surface mount package in 4.0 mm height (2-phase)
30.0 mm x 10.0 mm footprint surface mount package in 4.0 mm height (3-phase)
Moisture Sensitivity Level (MSL): 1
Ferrite core material
Weight: 2.683 grams (2-ph), 4.079 grams (3-ph) typical
Termination finish: matte tin over nickel

Applications

Multi-phase and Vcore regulators
Voltage Regulator Modules (VRMs) and high-power density VRMs

- Server and desktop
- Central processing unit (CPU)
- Graphics processing unit (GPU)
- Application specific integrated circuit (ASIC)

Data networking and storage systems
Graphics cards and battery power systems
Point-of-Load modules

Environmental compliance and general specifications

Storage temperature range (Component): -40 °C to +125 °C
Operating temperature range: -40 °C to +125 °C (ambient plus self-temperature rise)
Solder reflow temperature: J-STD-020 (latest revision) compliant
RoHS
REACH
PFOS & PFOA
Halogen free, Sb2O3 and Red Phosphorus

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2 Specification

2.1 Electrical parameters

Part Number[12]	Number of Phase	OCL[1] (nH) ±20%		I_{RMS}[2] (A)	FLL1[3] (nH) Min.	I_{sat1}[4] (A)	I_{sat2}[5] (A)	DCR1[6] (mΩ) Max. @ +20 °C	DCR2[7] (mΩ) Max. @ +20 °C	SCL/phase[8] (nH) ±20%	FLL2[9] (nH) Min.	I_{sat3}[10] (A)	I_{sat4}[11] (A)
CL1004R2-2-R050-R	2	200 (1-2),(3-4)		39	128	21	17	0.59	0.30	50	32	70	60
CL1004R2-3-R050-R	3	200 (1-2),(5-6)	230 (3-4)	39	128	21	17	0.59	0.30	50	32	70	60
CL1004R3-2-R050-R	2	200 (1-2),(3-4)		39	128	21	17	0.59	0.30	50	32	70	60
CL1004R3-3-R050-R	3	200 (1-2),(5-6)	230 (3-4)	39	128	21	17	0.59	0.30	50	32	70	60

1. Open Circuit Inductance (OCL) Test parameters: 1 MHz, 0.1 V_{rms}, 0.0 Adc, +25 °C & 105 °C
2. I_{RMS}: DC Current that results in approximately 40 °C temperature rise above ambient. The 40 °C rise occurs when the specified current flows through each of the 2 or 3 windings. Derating is necessary for AC currents. PCB layout, trace thickness and width, air-flow, and proximity of other heat generating components will affect the temperature rise. It is recommended that the temperature of the part not exceed +125 °C under worst case operating conditions verified in the end application
3. Full Load Inductance for OCL (FLL1) Test parameters: 1 MHz, 0.1 V_{rms}, I_{sat1}, +25 °C
4. I_{sat1}: Peak current at which per phase OCL drops by approximately 20% @ +25 °C
5. I_{sat2}: Peak current at which per phase OCL drops by approximately 20% @ +105 °C
6. DCR1: tested from points A&B, as accepting criteria, for specific points see Section 2.2
7. DCR2: tested from points C&D, as reference, for specific points see Section 2.2
8. Short Circuit Inductance (SCL) Test Parameters: 1 MHz, 0.1 V_{rms}, 0.0 Adc, +25 °C & 105 °C
9. Full Load Inductance for SCL (FLL2) Test parameters: 1 MHz, 0.1 V_{rms}, I_{sat3}, +25 °C
10. I_{sat3}: Peak current at which per phase SCL drops by approximately 20% @ +25 °C
11. I_{sat4}: Peak current at which per phase SCL drops by approximately 20% @ +105 °C
12. Part Number Definition: CL1004Rx-n-Rxxx-R
    CL1004= Product code and size
    Rx= Version indicator
    n= Number of phases
    Rxxx= Leakage inductance value in µH, R= decimal point
    -R suffix = RoHS compliant

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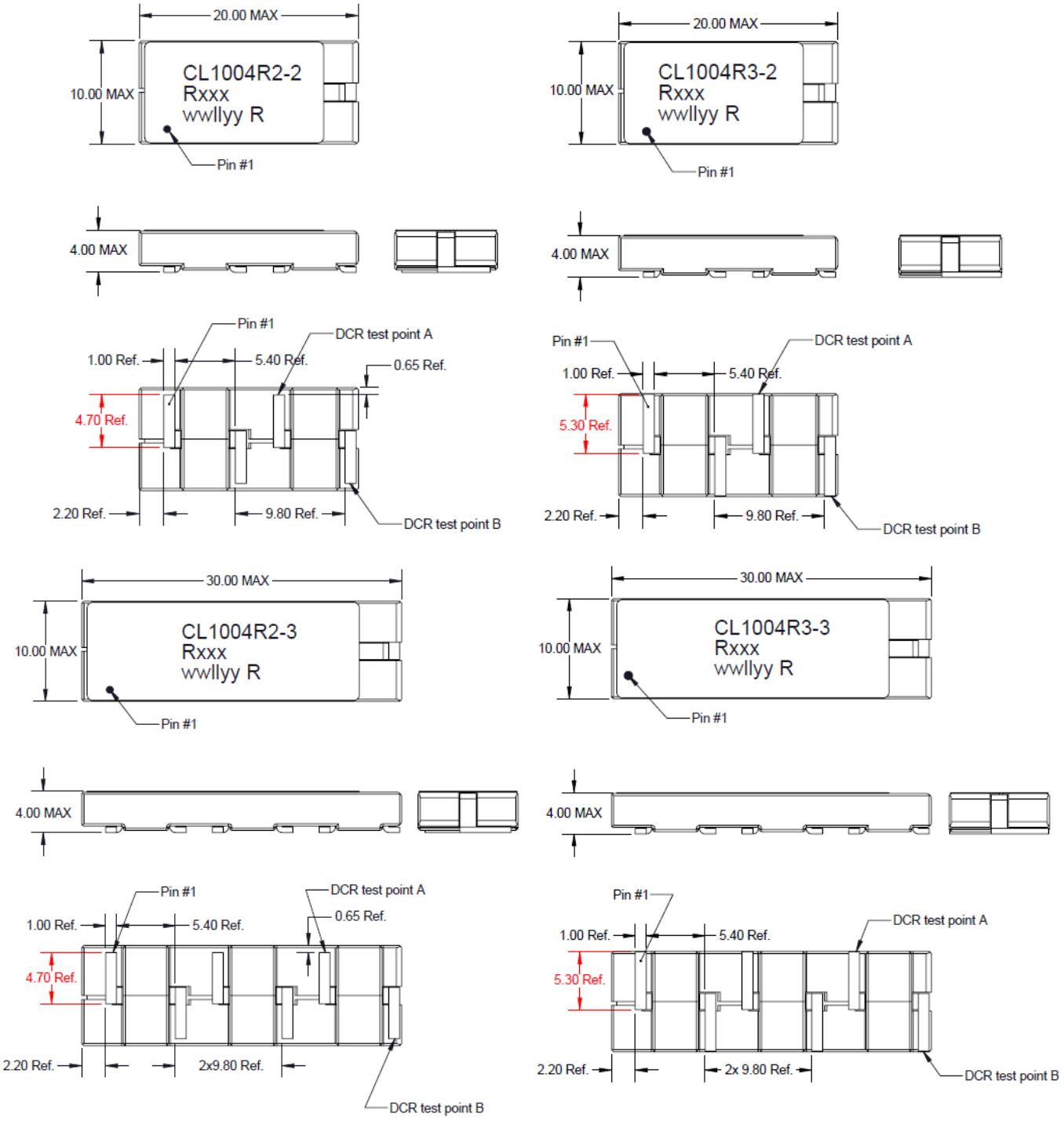
TITLE: **Multiphase Inductors, SMT** **REV A**

2.2 Mechanical parameters, schematic, pad layout- mm



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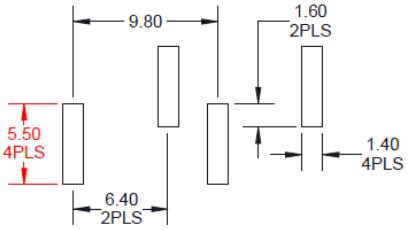
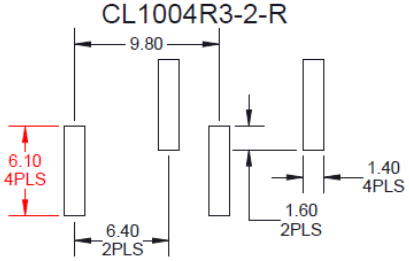
TITLE: **Multiphase Inductors, SMT** **REV A**

RECOMMENDED PCB LAYOUT

CL1004R2-2-R

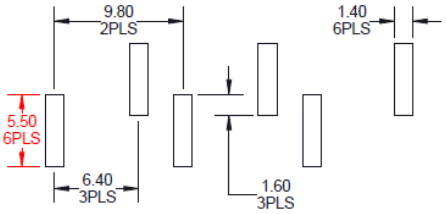


CL1004R3-2-R

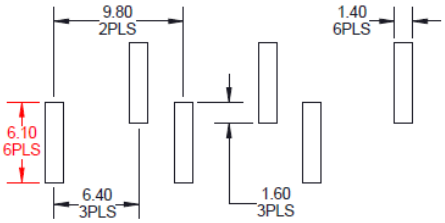


RECOMMENDED PCB LAYOUT

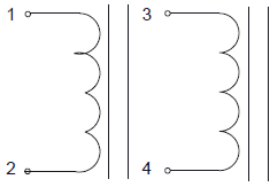
CL1004R2-3-R



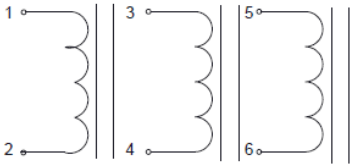
CL1004R3-3-R

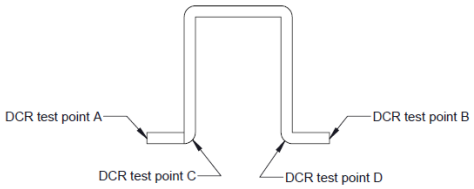


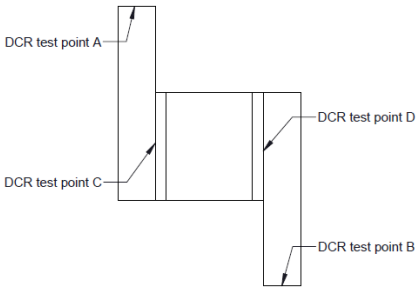
SCHEMATICS



SCHEMATICS







Part marking: CL1004=Product code and size, Rx=Version indicator, n=Number of phases (2/3)

Rxxx=leakage inductance value in uH, R=decimal point

wwllyy R=(DateCode) (Revision)

All soldering surfaces to be coplanar within 0.13 millimeters

Tolerances are ±0.15 millimeters unless stated otherwise

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Pad layout tolerances are ±0.1 millimeters unless stated otherwise

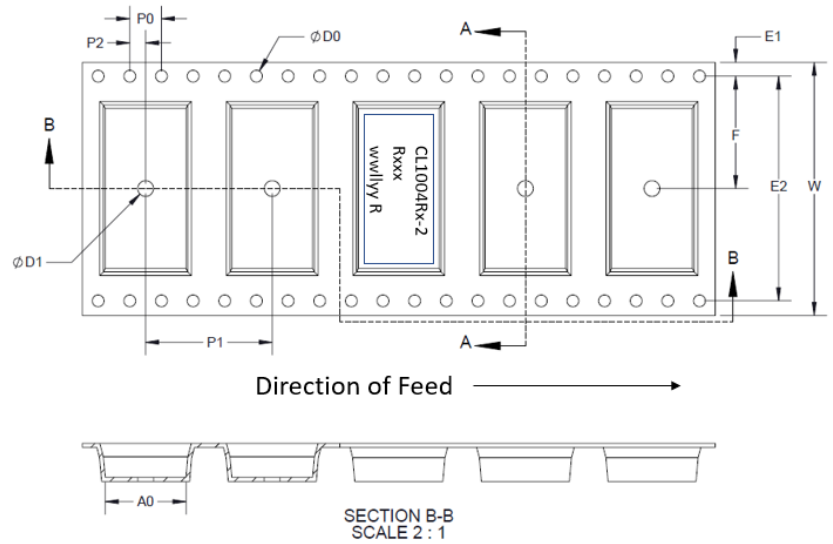
DCR measured from point “A” to point “B” as accepting criteria, from point ‘C’ to point ‘D’ as reference value, for specific values see Section 2.1

Traces or vias underneath the inductor is not recommended

3 Packaging information- mm

Drawing not to scale

Supplied in tape and reel packaging, 900 parts per 13” diameter reel



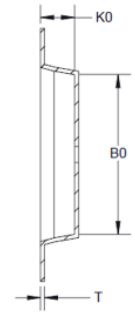
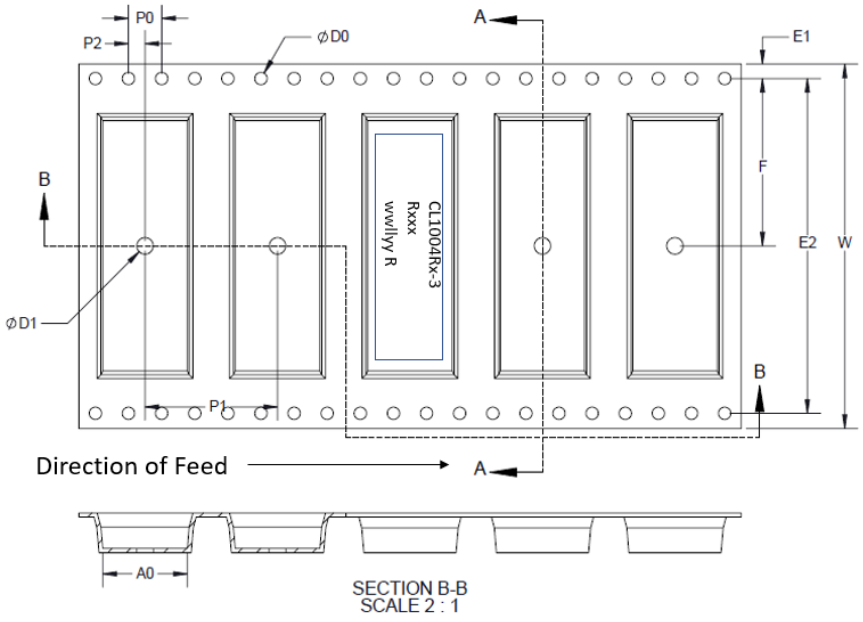


TABLE A	
Item	Dimensions
W±0.30	32.00
F±0.10	14.20
E1±0.10	1.75
E2±0.10	28.40
P0±0.10	4.00
P1±0.10	16.00
P2±0.10	2.00
D0+0.10/-0	1.50
D1 Min.	2.00
A0±0.10	10.20
B0±0.10	20.20
K0±0.10	4.30
T±0.05	0.30



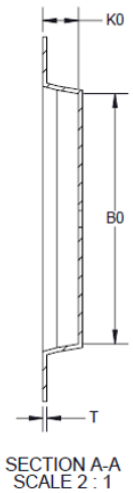


TABLE A	
Item	Dimensions
W±0.30	44.00
F±0.10	20.20
E1±0.10	1.75
E2±0.10	40.40
P0±0.10	4.00
P1±0.10	16.00
P2±0.10	2.00
D0+0.10/-0	1.50
D1 Min.	2.00
A0±0.10	10.20
B0±0.10	30.20
K0±0.10	4.30
T±0.05	0.30

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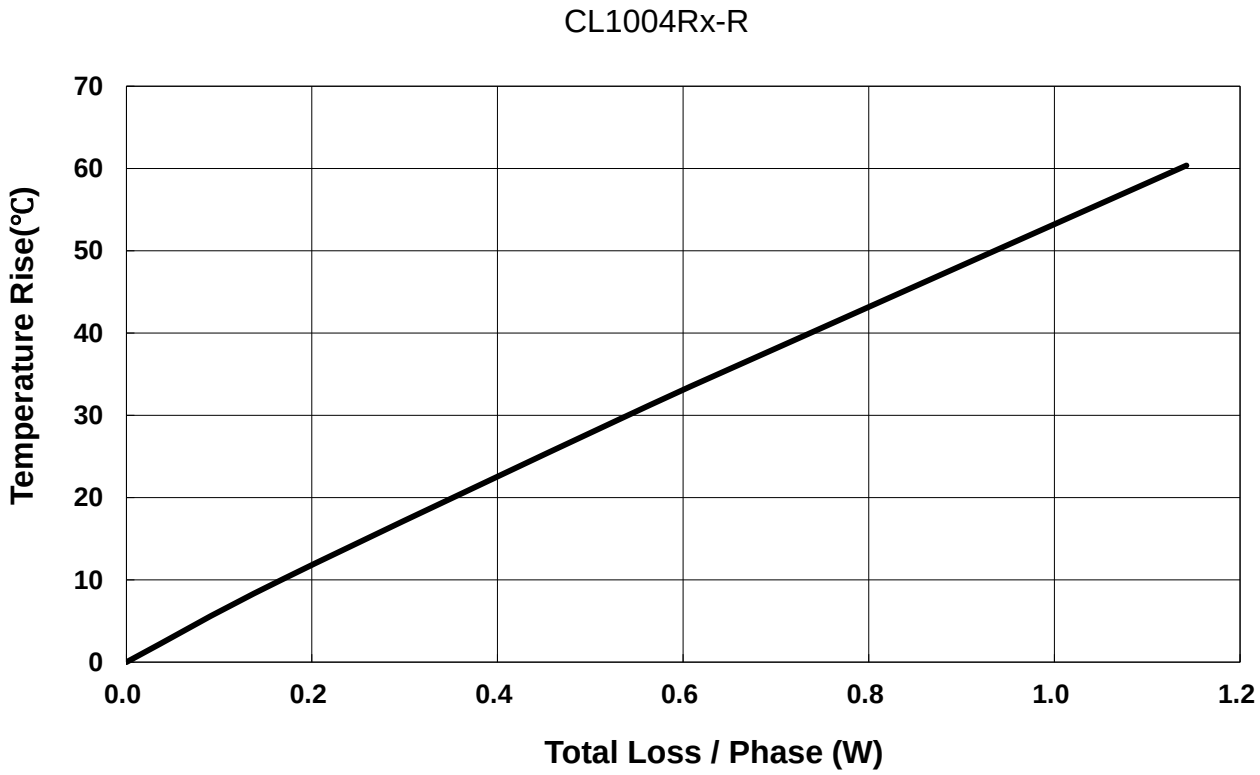
4 Temperature Rise vs. Total Loss



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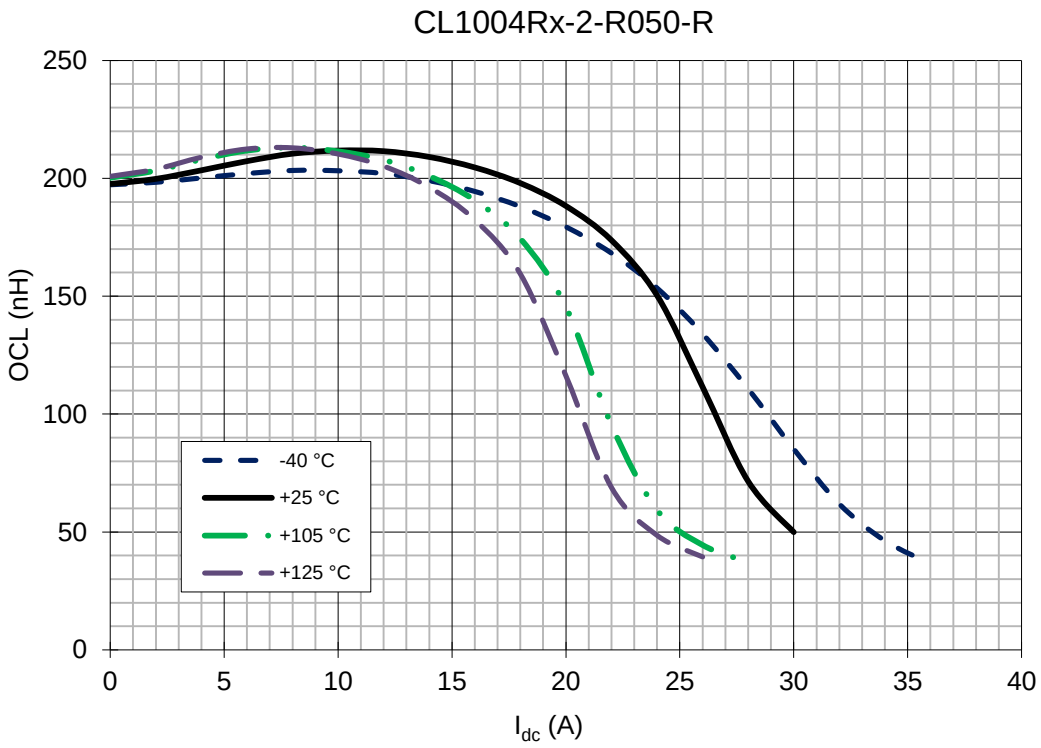
5 Inductance characteristics --- OCL



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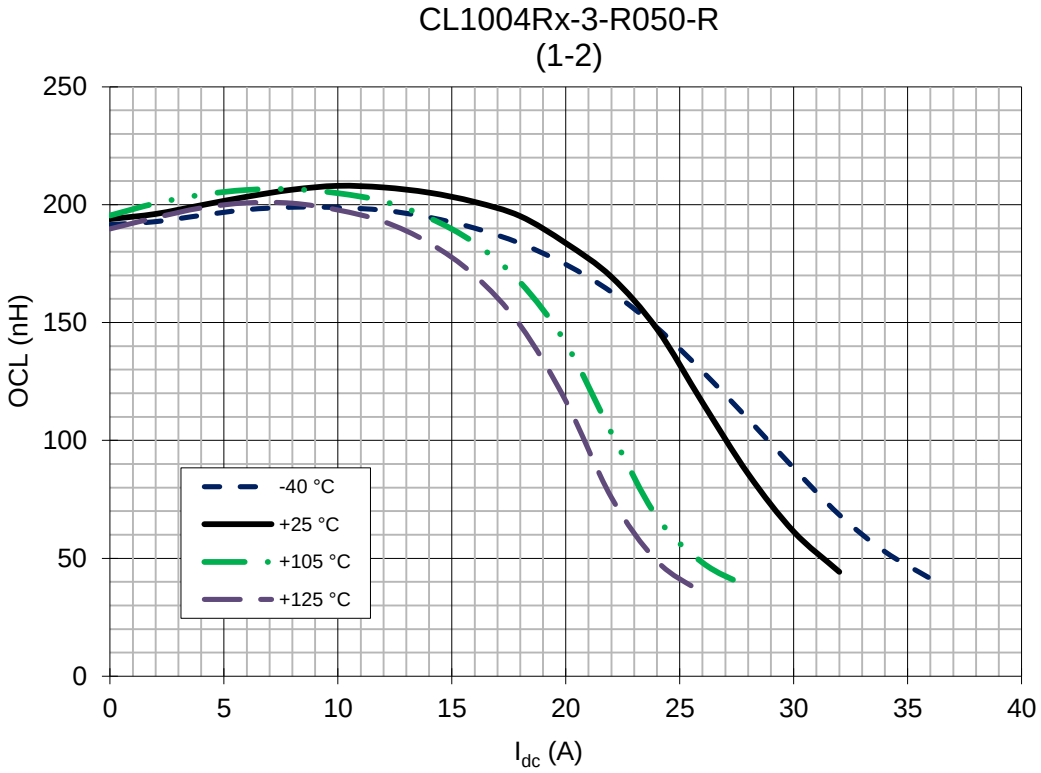
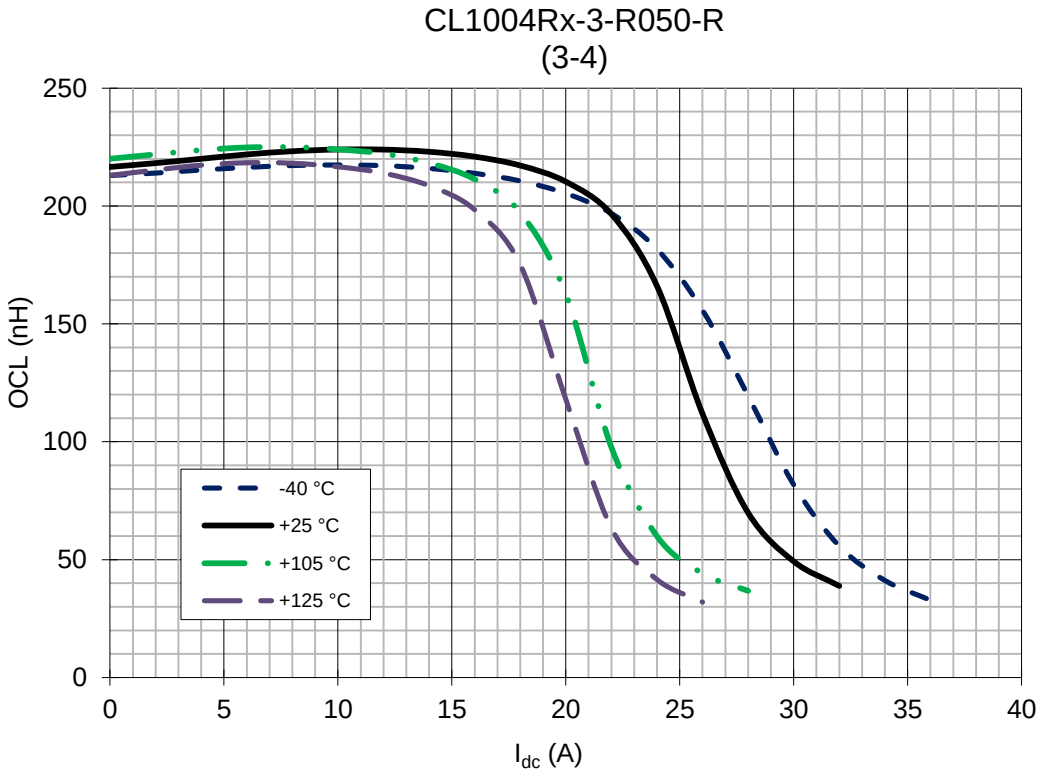
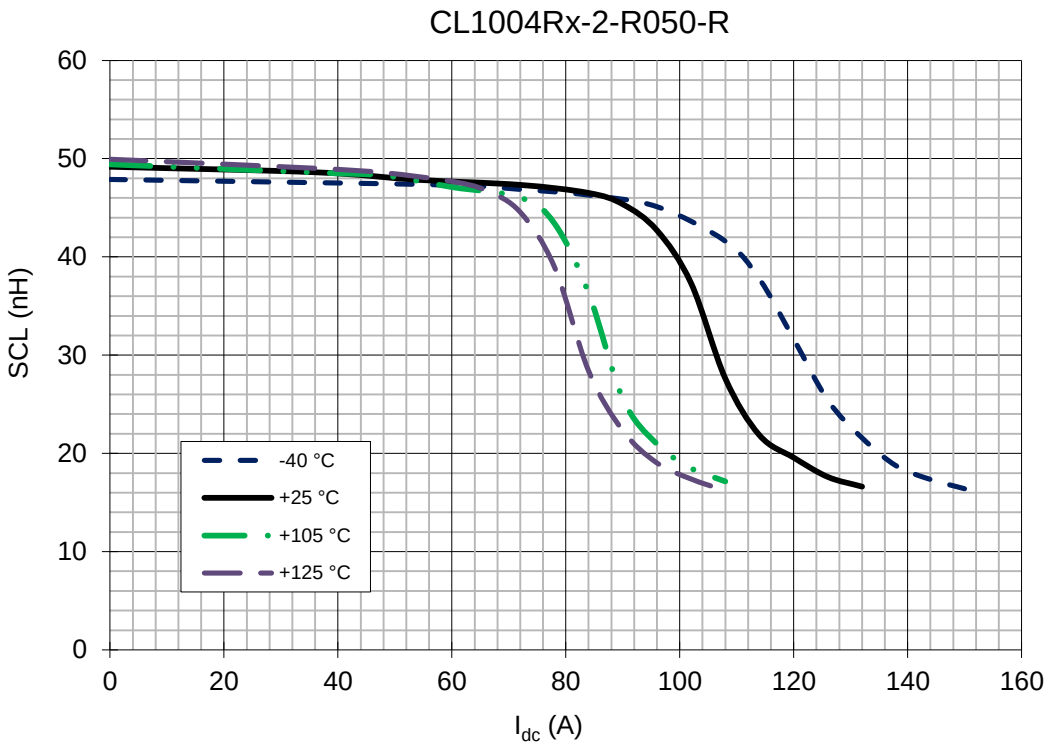

CL1004Rx-3-R050-R
(1-2)
OCL (nH)
250
200
150
100
50
0
0
5
10
15
20
25
30
35
40
I_{dc} (A)
-40 °C
+25 °C
+105 °C
+125 °C


CL1004Rx-3-R050-R
(3-4)
OCL (nH)
250
200
150
100
50
0
0
5
10
15
20
25
30
35
40
I_{dc} (A)
-40 °C
+25 °C
+105 °C
+125 °C

6 Inductance characteristics --- SCL



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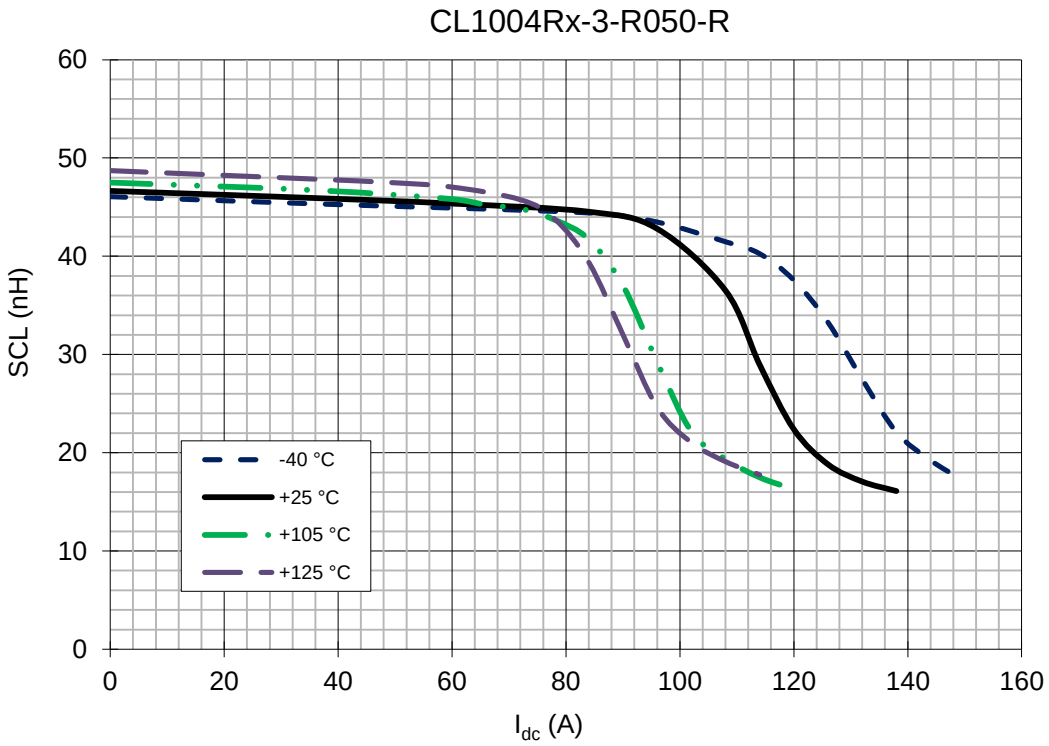

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7 Solder reflow profile

Solder reflow profile

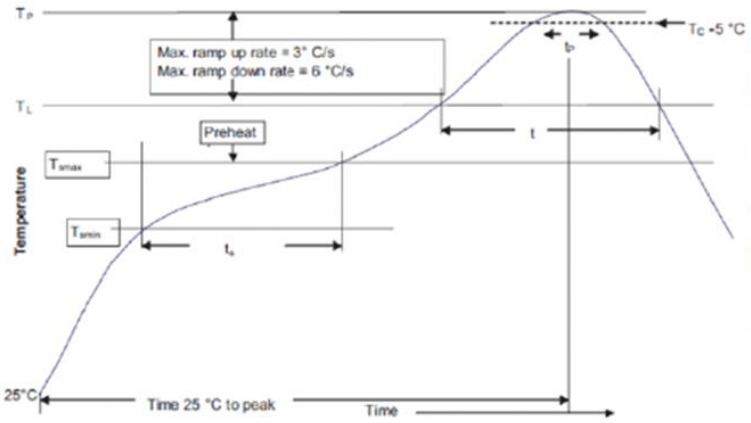

Table 1 - Standard SnPb solder (T_C)

Package thickness	Volume mm3 <350	Volume mm3 ≥350
<2.5 mm)	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2 - Lead (Pb) free solder (T_C)

Package thickness	Volume mm³ <350	Volume mm³ 350 - 2000	Volume mm³ >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 – 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	250 °C	245 °C	245 °C

Reference J-STD-020

Profile feature		Standard SnPb solder	Lead (Pb) free solder
Preheat and soak	• Temperature min. (T_{smin})	100 °C	150 °C
	• Temperature max. (T_{smax})	150 °C	200 °C
	• Time (T_{smin} to T_{smax}) (t_s)	60-120 seconds	60-120 seconds
Ramp up rate T_L to T_p		3 °C/ second max.	3 °C/ second max.
Liquidous temperature (T_L) Time (t_L) maintained above T_L		183 °C 60-150 seconds	217 °C 60-150 seconds
Peak package body temperature (Tp)*		Table 1	Table 2
Time (t_p)* within 5 °C of the specified classification temperature (T_C)		20 seconds*	30 seconds*
Ramp-down rate (T_p to T_L)		6 °C/ second max.	6 °C/ second max.
Time 25 °C to peak temperature		6 minutes max.	8 minutes max.

* Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.

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