SMD LAN Transformers

NLTN Series

FEATURES

- 10/100 Ethernet Applications
- Gigabit Ethernet Applications
- Single 1G Ethernet Applications
- Single 2.5G Ethernet Applications
- Single 10G Ethernet Applications
- Dual 1G Ethernet Applications
- IEC 61000-4-5 10/700us 4KV (CM)
- IEC 61000-4-5 10/700us 1KV (DM)
- Small SMT Packages
- Wide Temperature: -40°C to +85°C
- RoHS Compliant
- Taped And Reeled for Automatic Insertion

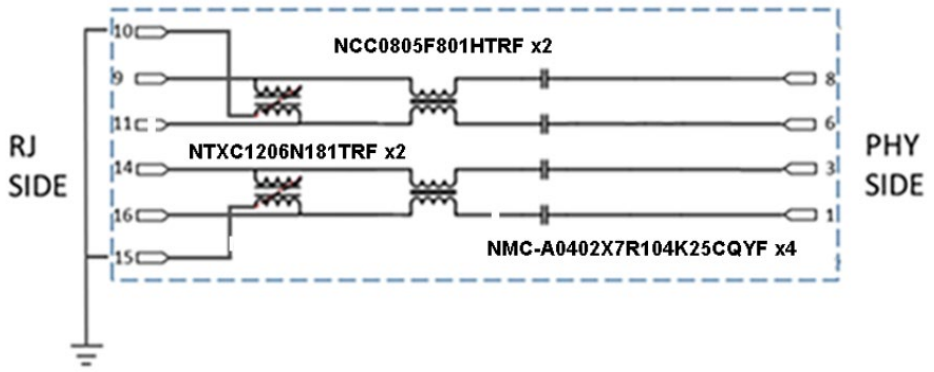
RoHS Compliant
includes all homogeneous materials
* See Part Number System for Details

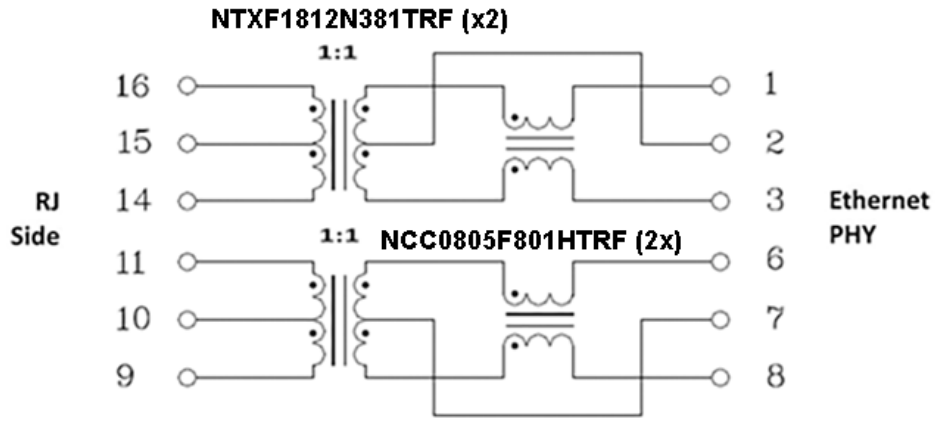
Part Number Designations

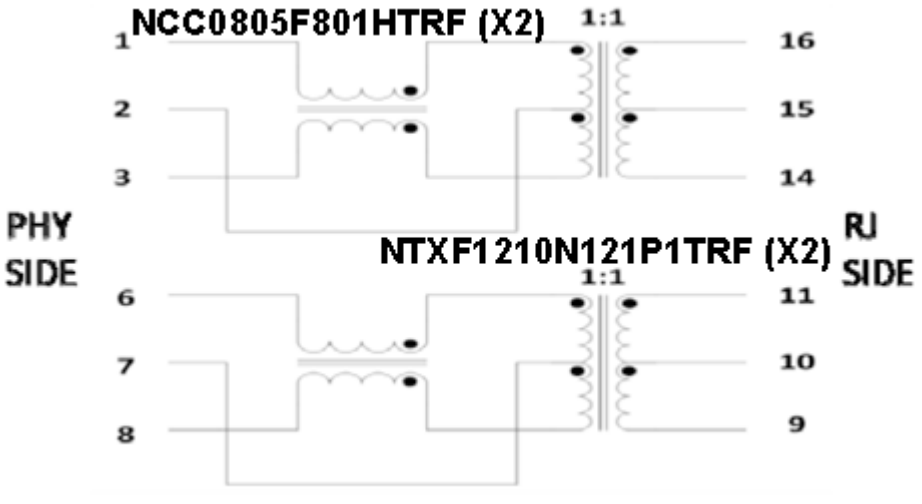
NLTN 12 C M 16 AXCN TR F

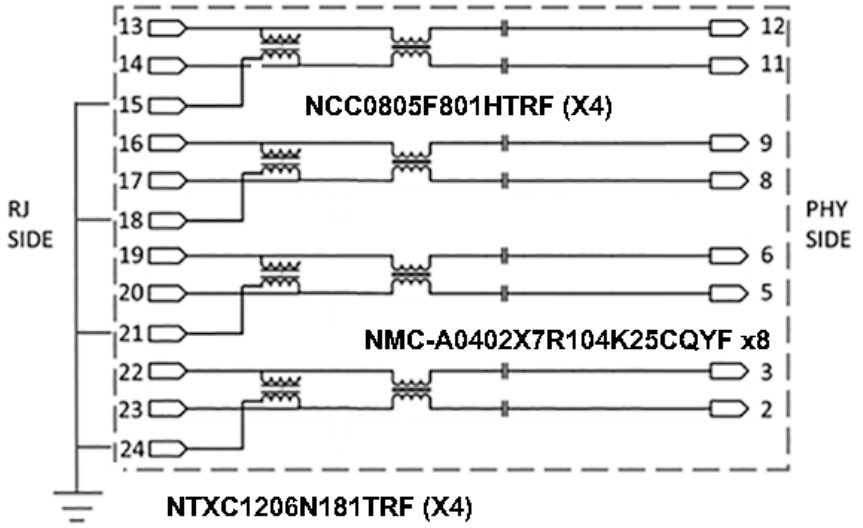
- F = RoHS Compliant
- TR= Tape and Reel Packaging
- AXCN, EDCN, etc. = Control Codes for Coupling Elements
- Pins = 16 = 16 Pins, 24 = 24 Pins, 48 = 48 Pins
- M = 10/100 Base-T, G = 1000 Base-T, S2 = 2.5, S10 = 10G Base-T, J = 10G Base-T, SD = Single 1G & Dual 10/100, D1 = Dual 1G
- Type = C = Capacitive, L = Inductive
- Size Code 12 = 12.7mm, 16 = 16.5mm, 17 = 17.5mm, 28 = 28.5mm
- NLTN = Series
  NLTN-P = Power over Ethernet (POE) Series

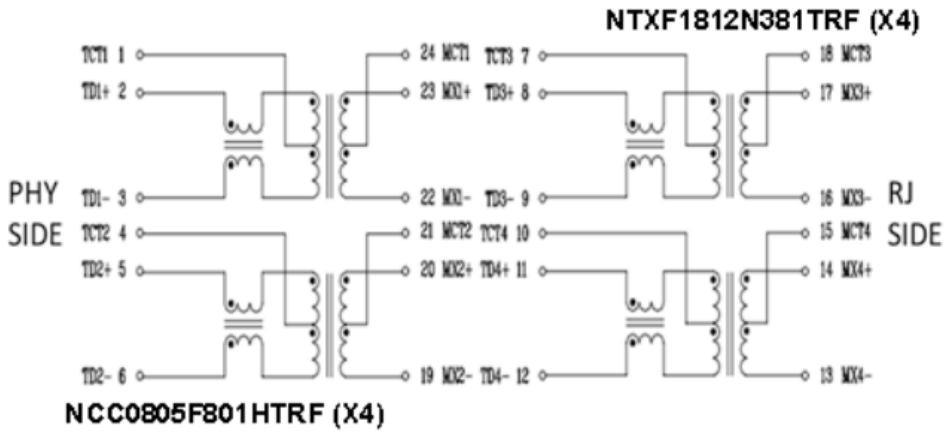
CHARACTERISTICS:

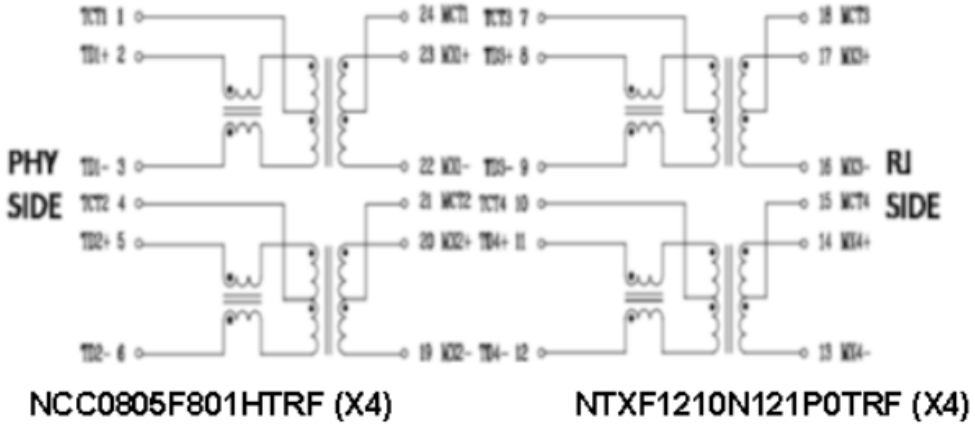
PN:	**NLTN12CM16EDCNTRF**
Application	10/100 Base-T, Single Port, Isolation Transformer
Type	**Capacitive** 1:1 ratio, 16 Pins
Operating Temperature Range	-40°C to +85°C (including self-heating)
Schematic	

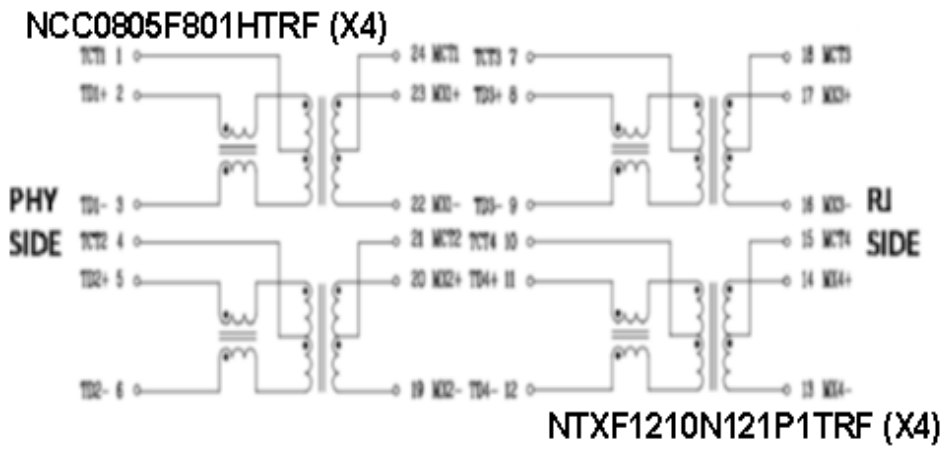
PN:	NLTN12LM16BXCNTRF
Application	10/100 Base-T, Single Port, Isolation Transformer, Low Profile
Type	**Inductive** 1:1 ratio, 16 Pins
Operating Temperature Range	-40°C to +85°C (including self-heating)
Schematic	

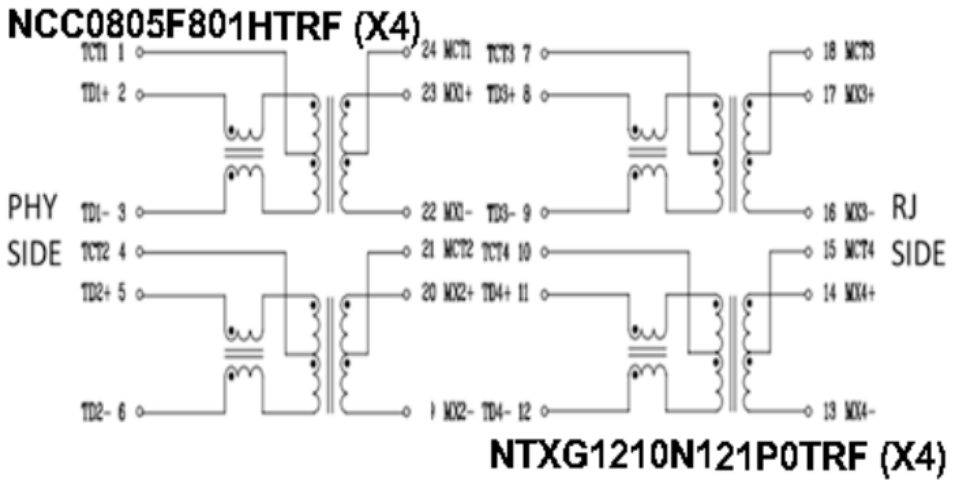
PN:	NLTN-P12LM16ABCNTRF
Application	10/100 Base-T, Single Port, Isolation Transformer, 16 Pins, Low Profile
Type	**Inductive, Power Over Ethernet (POE)** 1:1 ratio, up to 15W, 16 Pins, Low Profile
Operating Temperature Range	-40°C to +85°C (including self-heating)
Schematic	

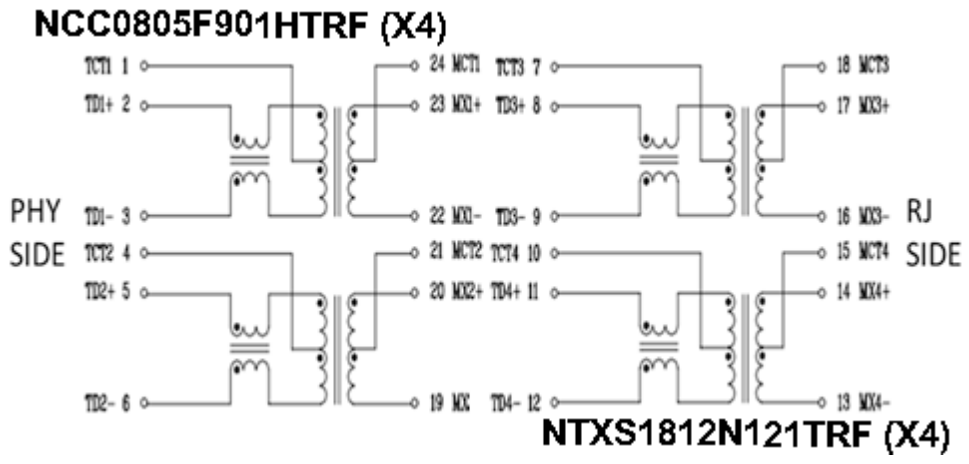
PN:	NLTN16CM24EDCNTRF
Application	Dual 10/100 Base-T, 1G Single Port, Isolation Transformer
Type	**Capacitive**, 1:1 ratio, 24 Pins
Operating Temperature Range	-40°C to +85°C (including self-heating)
Schematic	

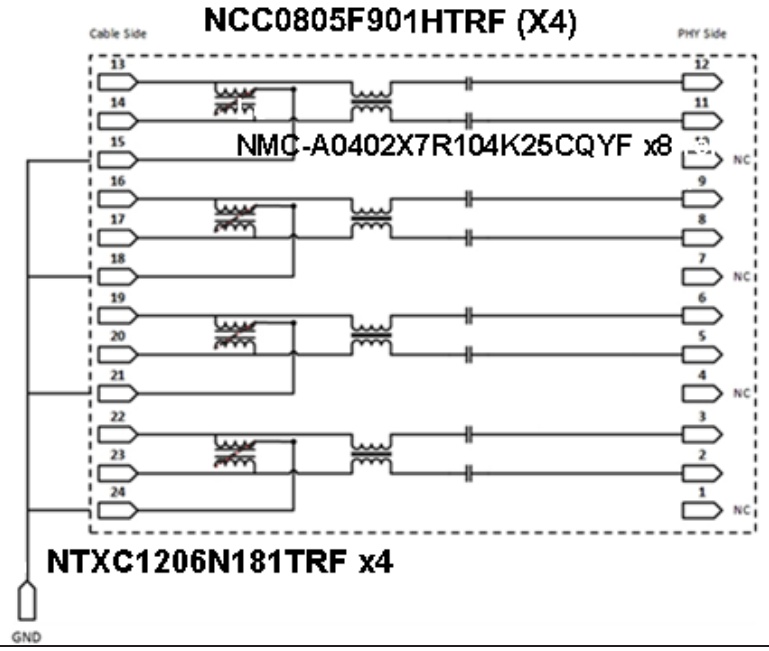
PN:	NLTN16LM24BXCNTRF
Application	Dual 10/100 Base-T, 1G Single Port, Isolation Transformer
Type	**Inductive** 1:1 ratio, 24 Pins, Low Profile
Operating Temperature Range	-40°C to +85°C (including self-heating)
Schematic	

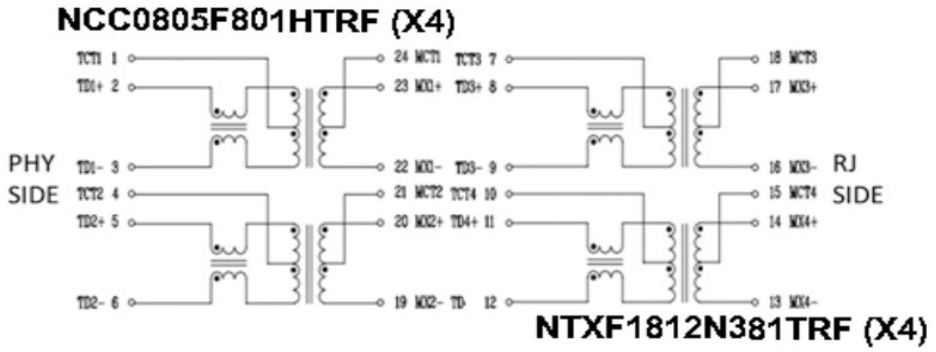
PN:	**NLTN-P16LG24APCNTRF**
Application	1000 Base-T (1G) Single Port, Isolation Transformer, Low Profile
Type	**Inductive, Power Over Ethernet (POE)** 1:1 ratio, up to 15W, 24 Pins, Low Profile
Operating Temperature Range	-40°C to +85°C (including self-heating)
Schematic	

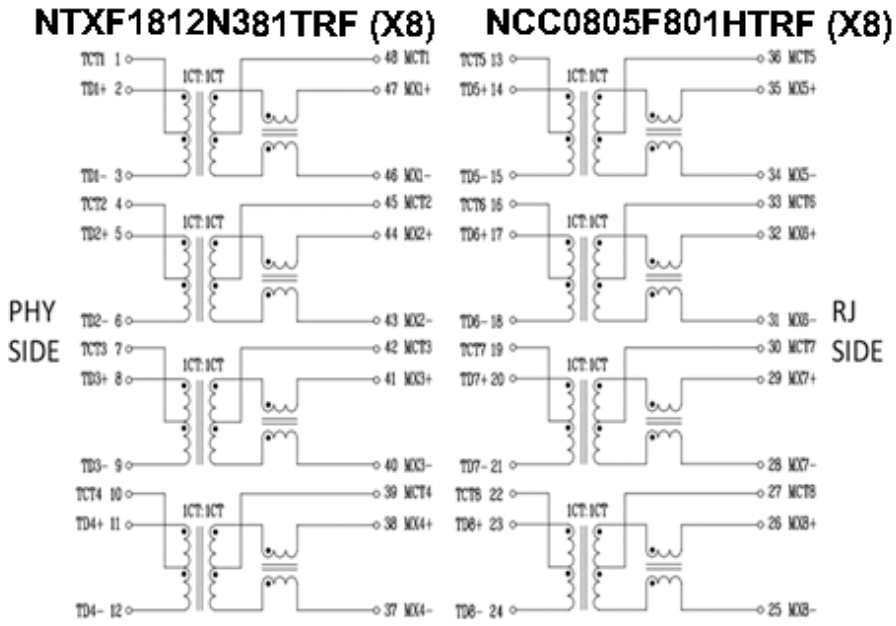
PN:	**NLTN-P16LG24ABCNTRF**
Application	1000 Base-T (1G) Single Port, Isolation Transformer, Low Profile
Type	**Inductive, Power Over Ethernet (POE)** 1:1 ratio, up to 30W, 24 Pins, Low Profile
Operating Temperature Range	-40°C to +85°C (including self-heating)
Schematic	

PN:	NLTN16LS224AGCGTRF
Application	Single 2.5G, Single Port, Isolation Transformer
Type	**Inductive**, 1:1 ratio, 24 Pins
Operating Temperature Range	-40°C to +85°C (including self-heating)
Schematic	

PN:	NLTN16LS1024ASCSTRF
Application	Single 10G, Single Port, Isolation Transformer
Type	**Inductive**, 1:1 ratio, 24 Pins
Operating Temperature Range	-40°C to +85°C (including self-heating)
Schematic	

PN:	**NLTN17CM24EDCNTRF**
Application	10/100 Base-T Dual port or 1G Single port.
Type	**Capacitive** 1:1 ratio, 24 Pins
Operating Temperature Range	-40°C to +85°C (including self-heating)
Schematic	

PN:	**NLTN17LM24BXCNTRF**
Application	10/100 Base-T Dual port or 1G Single port.
Type	**Inductive** 1:1 ratio, 24 Pins, Low Profile
Operating Temperature Range	-40°C to +85°C (including self-heating)
Schematic	

PN:	NLTN28LD148BXCNTRF
Application	Dual 1G, Single Port, Isolation Transformer
Type	Inductive, 1:1 ratio, 48 Pins
Operating Temperature Range	-40°C to +85°C (including self-heating)
Schematic	

Typical Performance Characteristics

Part Number	Insertion Loss (dB Max)	Return Loss (dB min)			Differential Mode to Common Mode Rejection (DCMR) (dB min)		
	1 to 100Mhz	30Mhz	60Mhz	100Mhz	30Mhz	60Mhz	100Mhz
NLTN12CM16EDCNTRF	-1.0	-20	-15	-10	-25	-25	-25
NLTN12LM16BXCNTRF	-1.0	-20	-15	-10	-25	-25	-25
NLTN16CM24EDCNTRF	-1.0	-20	-15	-10	-25	-25	-25
NLTN16LM24BXCNTRF	-1.0	-20	-15	-10	-25	-25	-25
NLTN17CM24EDCNTRF	-1.0	-20	-15	-10	-25	-25	-25
NLTN17LM24BXCNTRF	-1.0	-20	-15	-10	-25	-25	-25
NLTN28LD148BXCNTRF	-1.0	-20	-15	-10	-25	-25	-25

Part Number	Insertion Loss (dB Max)	Return Loss (dB min)				Differential Mode to Common Mode Rejection (DCMR) (dB min)	
	1 to 100Mhz	1~30Mhz	30~60Mhz	60~80Mhz	80~100MHz	1~60Mhz	60~100Mhz
NLTN-P12LM16ABCNTRF	-1.1	-20	-18	-14	-12	-35	-30

Part Number	Insertion Loss (dB Max)	Return Loss (dB min)					Differential Mode to Common Mode Rejection (DCMR) (dB min)	
	1 to 100Mhz	1~30Mhz	40Mhz	50Mhz	60~80MHz	100Mhz	1~60Mhz	60~100Mhz
NLTN-P16LG24APCNTRF	-1.1	-18	-14.4	-13.1	-12	-10	-35	-30
NLTN-P16LG24ABCNTRF	-1.1	-18	-14.4	-13.1	-12	-10	-35	-30

Part Number	Insertion Loss (dB Max)	Return Loss (dB min)		Differential Mode to Common Mode Rejection (DCMR) (dB min)	
	1 to 250MHz	1~40MHz	40~500MHz	1 ~ 250MHz	250 ~ 250MHz
NLTN16LS224AGCGTRF	-3.0	-16	-5	-30	-22

Part Number	Insertion Loss (dB Max)	Return Loss (dB min)		Differential Mode to Common Mode Rejection (DCMR) (dB min)	
	1 to 500MHz	1~40MHz	40~500MHz	1 ~ 250MHz	250 ~ 500MHz
NLTN16LS1024ASCSTRF	-3.0	-16	-5	-22	-18

Typical Performance Characteristics Continued

Part Number	OCL (uH Min) @100KHz/0.1V with 8mA DC Bias	Cross Talk (db min)	Inductance Pins	Input-Output Isolation	Resistance to Solder Heat
NLTN12CM16EDCNTRF	200	-35	1-3, 6-8, 9-11,14-16	N/A	+260°C for 10 seconds
NLTN12LM16BXCNTRF	350	-38	1-3, 6-8, 9-11, 14-16	1500VAC/60s	+260°C for 10 seconds
NLTN-P12LM16ABCNTRF	90	-38	1-3, 6-8, 9-11, 14-16	1500VAC/60s	+260°C for 10 seconds
NLTN16CM24EDCNTRF	200	-35	2-3, 5-6, 8-9 ,11-12 ,13-14, 16-17, 19-20, 22-23	N/A	+260°C for 10 seconds
NLTN16LM24BXCNTRF	350	-35	2-3, 5-6, 8-9 ,11-12 ,13-14, 16-17, 19-20, 22-23	1500VAC/60s	+260°C for 10 seconds
NLTN-P16LG24APCNTRF	90	-35	2-3, 5-6, 8-9 ,11-12 ,13-14, 16-17, 19-20, 22-23	1500VAC/60s	+260°C for 10 seconds
NLTN-P16LG24ABCNTRF	90	-35	2-3, 5-6, 8-9 ,11-12 ,13-14, 16-17, 19-20, 22-23	1500VAC/60s	+260°C for 10 seconds
NLTN16LS224AGCGTRF	120	-35	2-3, 5-6, 8-9 ,11-12 ,13-14, 16-17, 19-20, 22-23	1500VAC/60s	+260°C for 10 seconds
NLTN16LS1024ASCSTRF	120	-30	2-3, 5-6, 8-9 ,11-12 ,13-14, 16-17, 19-20, 22-23	1500VAC/60s	+260°C for 10 seconds
NLTN17CM24EDCNTRF	200	-35	2-3, 5-6, 8-9 ,11-12 ,13-14, 16-17, 19-20, 22-23	N/A	+260°C for 10 seconds
NLTN17LM24BXCNTRF	350	-35	2-3, 5-6, 8-9 ,11-12 ,13-14, 16-17, 19-20, 22-23	1500VAC/60s	+260°C for 10 seconds
NLTN28LD148BXCNTRF	350	-35	2-3, 5-6, 8-9 ,11-12, 14-15, 17-18, 20-21, 23-24 ,25-26, 28-29, 31-32, 34-35, 37-38, 40-41, 43-44, 46-47	1500VAC/60s	+260°C for 10 seconds

DIMENSIONS: (mm)

Series	Figure	A	B	C	D	E	F	A'	B'	C'
NLTN12_	1	12.7 ±0.25	8.87 ±0.25	4.0 ±0.25	0.6 ±0.25	1.27 ±0.25	1.0 ±0.25	8.87 ±0.25	7.2 ±0.25	0.8 ±0.05
NLTN-P12	2	12.7 ±0.25	8.67 ±0.25	4.0 ±0.25	0.6 ±0.25	1.27 ±0.25	1.0 ±0.25	8.89 ±0.25	7.2 ±0.25	0.8 ±0.05
NLTN16_	3	16.5 ± 0.2	10.0 ± 0.2	4.15 ± 0.2	6.75 ± 0.2	4.75 ± 0.2	3.75 ±0.2	15.99 ± 0.2	9.5 ± 0.2	0.8 ± 0.2
NLTN-P16	4	16.5 ± 0.25	10.3 ± 0.25	4.1 ±0.25	6.75 ± 0.25	4.75 ±0.25	3.75 ±0.25	16.0 ±0.25	9.65 ±0.25	0.8 ±0.05
NLTN16_LS	5	16.5 ± 0.25	10.3 ± 0.25	4.1 ±0.25	6.75 ±0.25	4.75 ±0.25	3.75 ±0.25	16.0 ±0.25	9.65 ±0.25	0.8 ±0.05
NLTN17_	6	17.5 ±0.2	14.6 ± 0.2	4.5 ±0.2	6.86 ±0.2	4.32 ±0.2	3.05 ±0.2	17.03 ±0.2	13.92 ±0.2	1.0 ±0.2
NLTN28_	7	28.58 ±0.25	14.6 ±0.25	5.0 Max	6.64 ±0.25	4.6 ±0.25	3.58 ±0.25	28.08 ±0.25	13.99 ±0.25	1.2 ±0.25

Figure 1

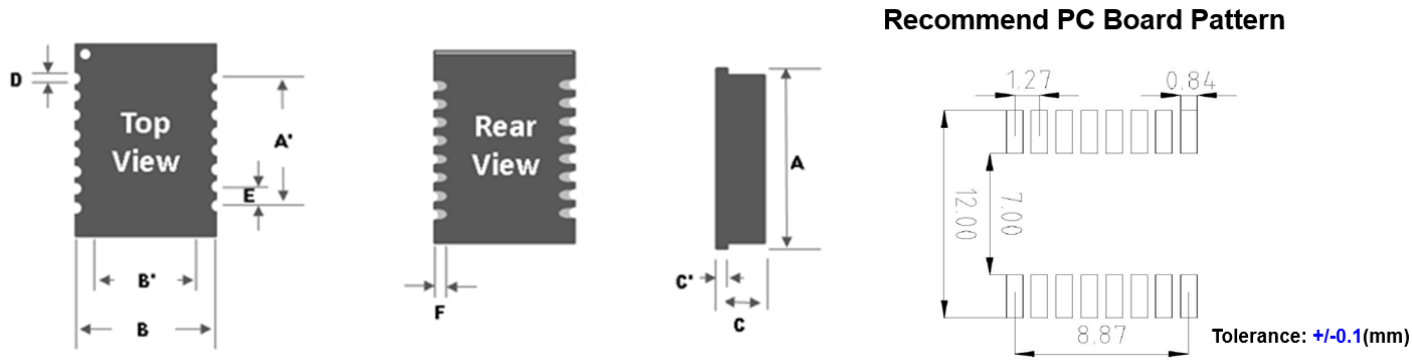


Figure 2

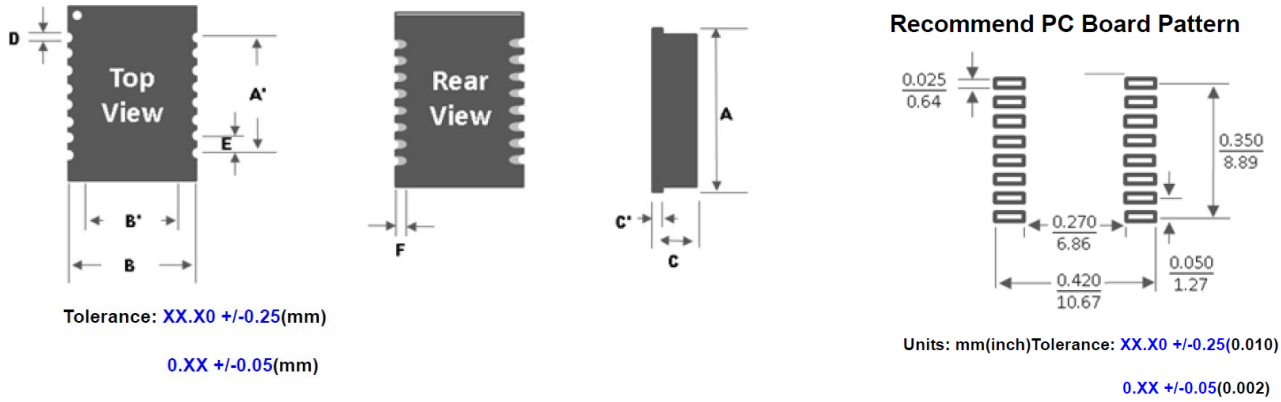
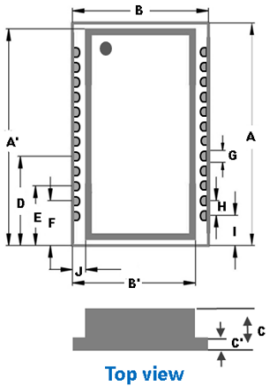
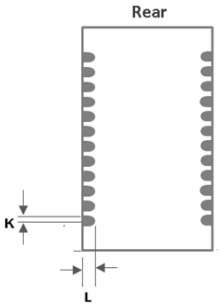


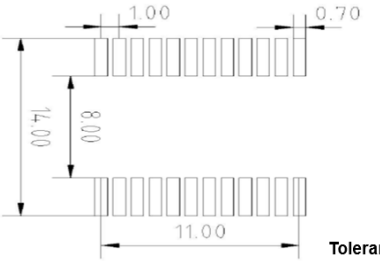
Figure 3





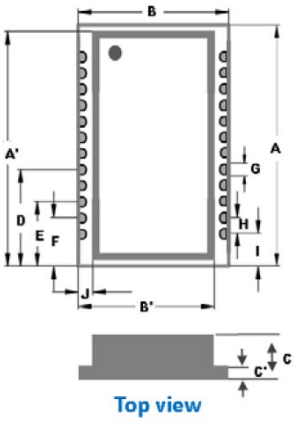
Tolerance: +/-0.25(mm)

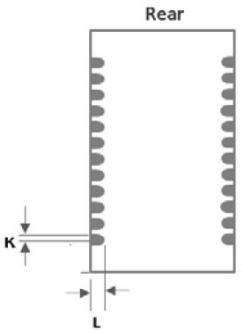
Recommend PC Board Pattern



Tolerance: +/-0.1(mm)

Figure 4

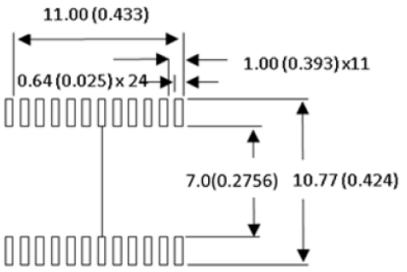




Tolerance: XX.X0 +/-0.25(mm)

0.XX +/-0.05(mm)

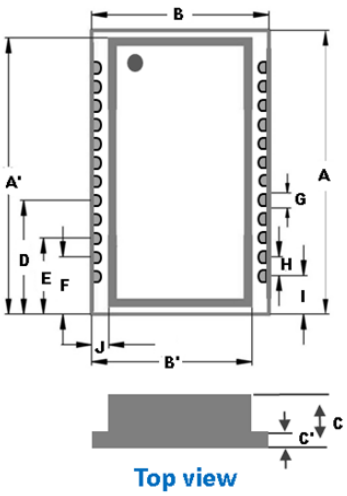
Recommend PC Board Pattern

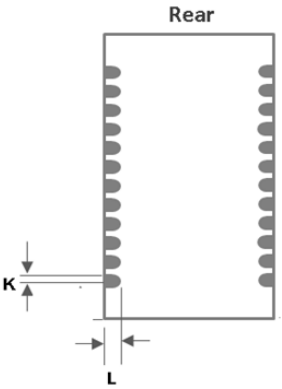


Units: mm(inch)Tolerance: XX.X0 +/-0.25(0.010)

0.XX +/-0.05(0.002)

Figure 5

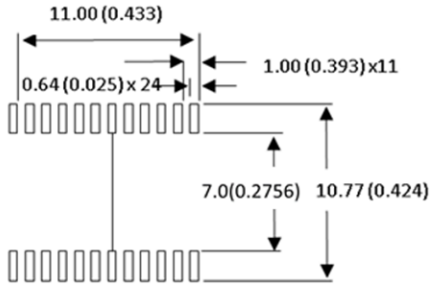




Tolerance: XX.X0 +/-0.25(mm)

0.XX +/-0.05(mm)

Recommend PC Board Pattern



Units: mm(inch)Tolerance: XX.X0 +/-0.25(0.010)

0.XX +/-0.05(0.002)

Figure 6

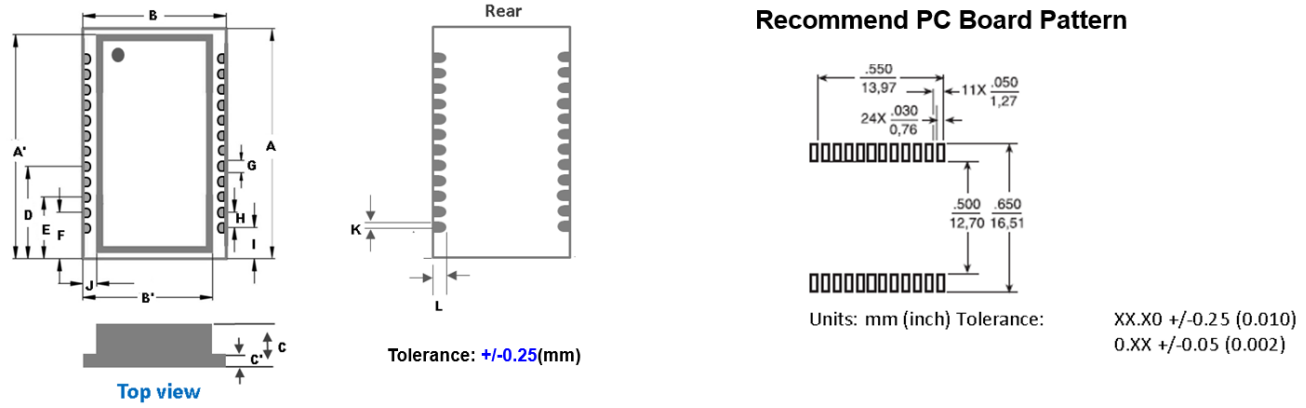
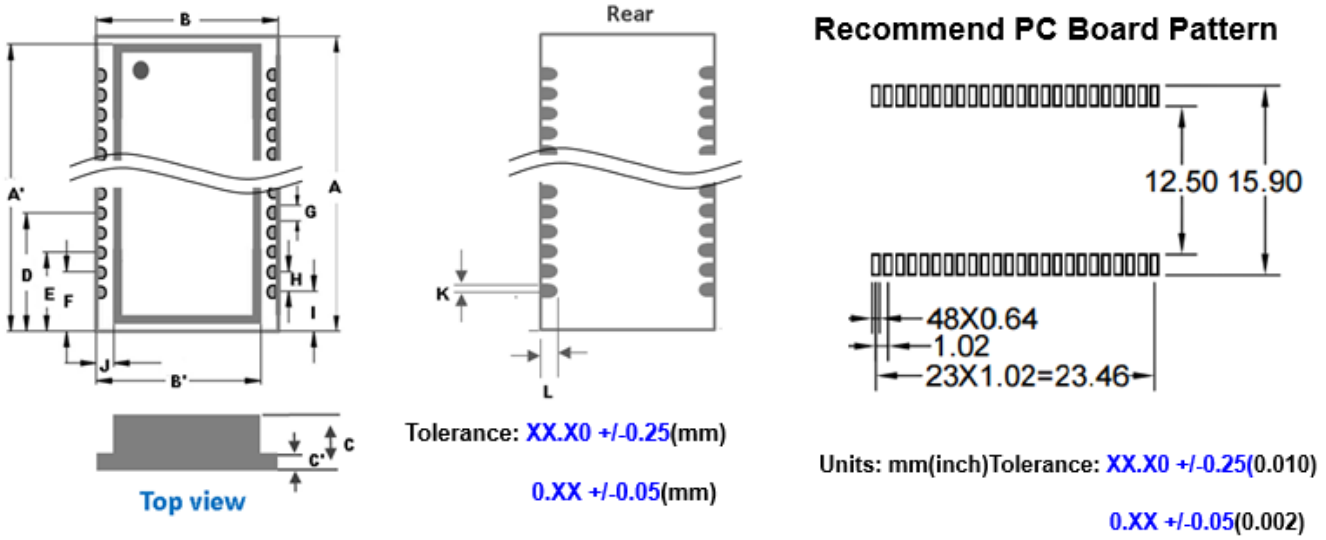
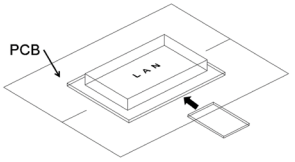


Figure 7



Reliability Tests

Item	Performance	Test Condition – Method - Equipment
Insertion Loss	Refer to standard electrical characteristics list.	Agilent E5071C
Retuen Loss		
Cross talk		
DCMR		
Operating Temperature	-40℃~+85℃(Including self - temperature rise)	
Storage Temperature	-40℃~+85℃(Product without taping)	
Life Test	Appearance：No damage. Insertion Loss：within spec. Return Loss：within spec.	Preconditioning: Run through Reflow for 3 times. (IPC/JEDEC J-STD-020E Classification Reflow Profiles) Temperature： 85±2℃ Duration：1000±12hrs Measured at room temperature after placing for 24 hrs
Humidity Resistance Test		Preconditioning: Run through Reflow for 3 times. (IPC/JEDEC J-STD-020E Classification Reflow Profiles) Humidity：85±3 % R.H, Temperature：85℃±2℃ Duration：1000hrs Min. Bead: with 100% rated current. Inductance: with 10% rated current. Measured at room temperature after placing for 24 hrs
Thermal shock Test	Appearance：No damage. Insertion Loss：within spec. Return Loss：within spec.	Preconditioning: Run through Reflow for 3 times. (IPC/JEDEC J-STD-020E Classification Reflow Profiles) Step1：-40±2℃ 30±5min Step2：85±2℃ ≦0.5min Step3：85±2℃ 30±5min Number of cycles： 500 Measured at room temperature after placing for 24 hrs
Vibration Test		Preconditioning: Run through Reflow for 3 times. (IPC/JEDEC J-STD-020E Classification Reflow Profiles) Oscillation Frequency: 10Hz～2KHz～10Hz for 20 minutes Equipment： Vibration checker Total Amplitude:10g Testing Time: 12 hours (20 minutes, 12 cycles each of 3 orientations)
Solderability Test	More than 95% of bottom terminal electrode should be covered with solder.	a. Method B, 4 hrs @155°C dry heat @235°C±5°C Test time:5 +0/-0.5 seconds. b. Method D category 3. (steam aging 8hours ± 15 min) @ 260°C±5°C Test time: 30 +0/-0.5 seconds.
Resistance To Solder Heat Test	Appearance：No damage.	Depth: completely cover bottom the termination Temperature(°C): 260 ±5 (solder temp) / Time(s): 10 ±1 / Temperature ramp/immersion and emersion rate: 25mm/s ±6 mm/s / Number of heat cycles: 1
Terminal Strength Test	Series No. / 2(Kg) LAN / 1.0(min.)	With the component mounted on a PCB with the device to be tested, apply a force to the side of a device being tested. This force shall be applied for 60 +1 seconds. Also, the force shall be applied gradually as not to apply a shock to the component being tested.

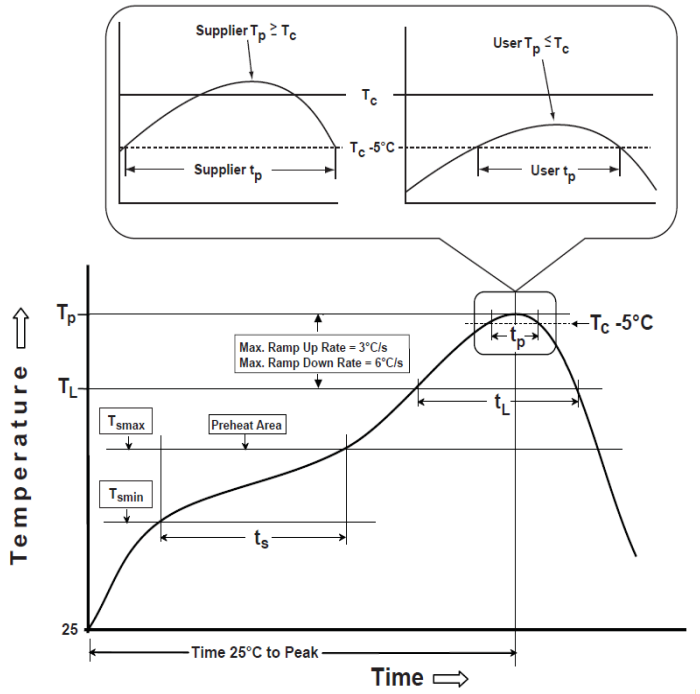


Soldering

MSL Level: Level 1

Soldering Reflow: Recommended temperature profiles for lead-free reflow soldering; Figure 8.
Peak Temperature (Tp) : +260°C for 10 seconds maximum

Figure.8 - Soldering Reflow / Reflow per IPC/JEDEC J-STD-020E



Reflow Cycles: 3 times max

Profile Type:	Pb-Free Assembly
Preheat -Temperature Min(T_{smin}) -Temperature Max(T_{smax}) -Time(t_s)from(T_{smin} to T_{smax})	 150℃ 200℃ 60-120seconds
Ramp-up rate($T_L$to T_p)	3℃/second max.
Liquidus temperature(T_L) Time(t_L)maintained above T_L	217℃ 60-150 seconds
Classification temperature(T_c)	See Table (1.2)
Time(t_p) at Tc- 5℃ (Tp should be equal to or less than Tc.)	< 30 seconds
Ramp-down rate(T_p to T_L)	6℃ /second max.
Time 25℃ to peak temperature	8 minutes max.

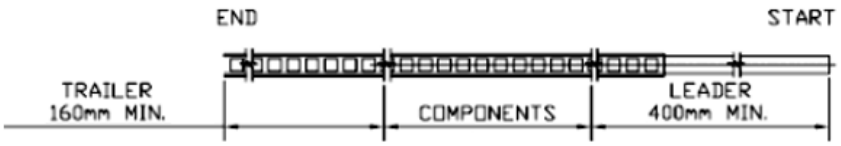
Table (1.2) Package Thickness/Volume and Classification Temperature (T_c)

	Package Thickness	Volume mm^3 <350	Volume mm^3 350-2000	Volume mm^3 >2000
PB-Free Assembly	<1.6mm	260℃	260℃	260℃
	1.6-2.5mm	260℃	250℃	245℃
	≥2.5mm	250℃	245℃	245℃

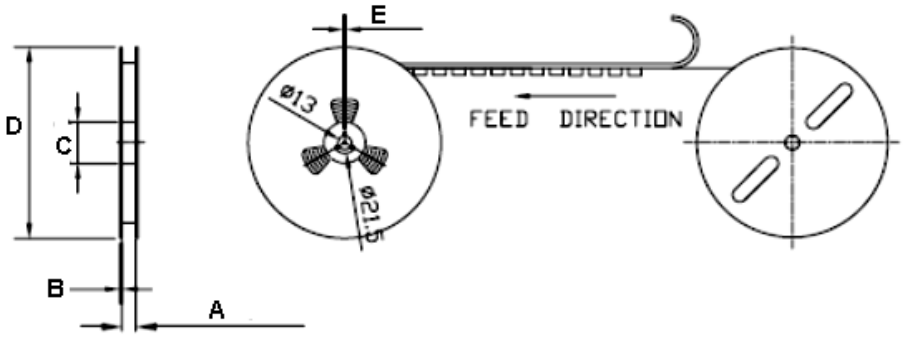
Reflow is referred to standard IPC/JEDEC J-STD-020E。

PACKAGING:

Packaging Information

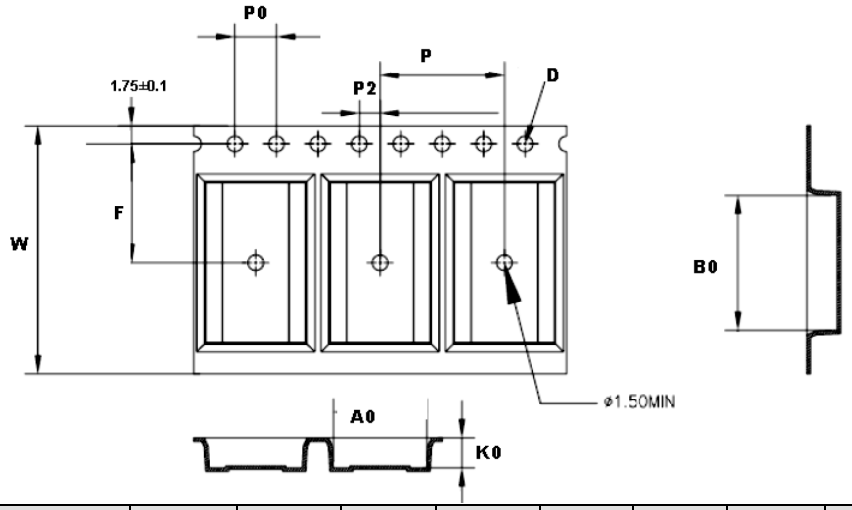


(1) Reel Dimensions



PN	A(mm)	B(mm)	C(mm)	D(mm)	E(mm)
NLTN12CM16EDCNTRF	24.4±2.0	2.1±0.15	φ100	φ330±2	2.5
NLTN12LM16BXCNTRF	24.4±2.0	2.1±0.15	φ100	φ330±2	2.5
NLTN-P12LM16ABCNTRF	24.4±2.0	2.1±0.15	φ100	φ330±2	2.5
NLTN16CM24EDCNTRF	33.5±2.0	2.0±0.15	φ100	φ330±2	2.5
NLTN16LM24BXCNTRF	33.5±2.0	2.0±0.15	φ100	φ330±2	2.5
NLTN-P16LG24APCNTRF	33.5±2.0	2.0±0.15	φ100	φ330±2	2.5
NLTN-P16LG24ABCNTRF	33.5±2.0	2.0±0.15	φ100	φ330±2	2.5
NLTN16LS224AGCGTRF	33.5±2.0	2.0±0.15	φ100	φ330±2	2.5
NLTN16LS1024ASCSTRF	33.5±2.0	2.0±0.15	φ100	φ330±2	2.5
NLTN17CM24EDCNTRF	33.5±2.0	2.0±0.15	φ100	φ330±2	2.5
NLTN17LM24BXCNTRF	33.5±2.0	2.0±0.15	φ100	φ330±2	2.5
NLTN28LD148BXCNTRF	45.5±2.0	2.0±0.15	φ100	φ330±2	2.5

(2) Tape Dimension



PN	Bo(mm)	Ao(mm)	Ko(mm)	P(mm)	Po(mm)	P2(mm)	W(mm)	F(mm)	D(mm)
NLTN12CM16EDCNTRF	13.0±0.1	9.0±0.1	4.4±0.1	16.0±0.1	4.0±0.1	2.0±0.1	24.0±0.3	11.5±0.1	1.5±0.1
NLTN12LM16BXCNTRF	13.0±0.1	9.0±0.1	4.4±0.1	16.0±0.1	4.0±0.1	2.0±0.1	24.0±0.3	11.5±0.1	1.5±0.1
NLTN-P12LM16ABCNTRF	13.0±0.1	9.0±0.1	4.9±0.1	16.0±0.1	4.0±0.1	2.0±0.1	32.0±0.3	14.2±0.1	1.5±0.1
NLTN16CM24EDCNTRF	16.8±0.1	10.6±0.1	4.9±0.1	16.0±0.1	4.0±0.1	2.0±0.1	32.0±0.3	14.2±0.1	1.5±0.1
NLTN16LM24BXCNTRF	16.8±0.1	10.6±0.1	4.9±0.1	16.0±0.1	4.0±0.1	2.0±0.1	32.0±0.3	14.2±0.1	1.5±0.1
NLTN-P16LG24APCNTRF	16.8±0.1	10.6±0.1	4.9±0.1	16.0±0.1	4.0±0.1	2.0±0.1	32.0±0.3	14.2±0.1	1.5±0.1
NLTN-P16LG24ABCNTRF	16.8±0.1	10.6±0.1	4.9±0.1	16.0±0.1	4.0±0.1	2.0±0.1	32.0±0.3	14.2±0.1	1.5±0.1
NLTN16LS224AGCGTRF	16.8±0.1	10.6±0.1	4.9±0.1	16.0±0.1	4.0±0.1	2.0±0.1	32.0±0.3	14.2±0.1	1.5±0.1
NLTN16LS1024ASCSTRF	16.8±0.1	10.6±0.1	4.9±0.1	16.0±0.1	4.0±0.1	2.0±0.1	32.0±0.3	14.2±0.1	1.5±0.1
NLTN17CM24EDCNTRF	17.93±0.1	15.3±0.1	4.8±0.1	24.0±0.1	4.0±0.1	2.0±0.1	32.0±0.3	11.5±0.1	1.5±0.1
NLTN17LM24BXCNTRF	17.93±0.1	15.3±0.1	4.8±0.1	24.0±0.1	4.0±0.1	2.0±0.1	32.0±0.3	11.5±0.1	1.5±0.1
NLTN28LD148BXCNTRF	28.9±0.1	14.9±0.1	5.8±0.1	20.0±0.1	4.0±0.1	2.0±0.1	44.0±0.3	20.2±0.1	1.5±0.1

(3) Packaging Quantity

PN	Reel / Pcs
NLTN12CM16EDCNTRF	800
NLTN12LM16BXCNTRF	800
NLTN-P12LM16ABCNTRF	800
NLTN16CM24EDCNTRF	800
NLTN16LM24BXCNTRF	800
NLTN-P16LG24APCNTRF	800
NLTN-P16LG24ABCNTRF	800
NLTN16LS224AGCGTRF	800
NLTN16LS1024ASCSTRF	800
NLTN17CM24EDCNTRF	400
NLTN17LM24BXCNTRF	400
NLTN28LD148BXCNTRF	500

Storage – Shipment - Handling Notice

1.) Storage Conditions (component level)

To maintain the solderability of terminal electrodes:

- Store Indoors
- Temperature: +5°C ~ +35°C (41°F ~ 95°F)
- Relative humidity: 40 to 75%
- Avoid storage where chlorine or sulfur exists in the atmosphere

2.) Period:

- Recommended to use within 12 months from the time of delivery.

Shipment / Handling:

- Products should be handled with care to avoid damage or contamination
- The use of tweezers or vacuum pick up is strongly recommended for individual components
- Bulk handling should ensure that abrasion and mechanical shock are minimized.