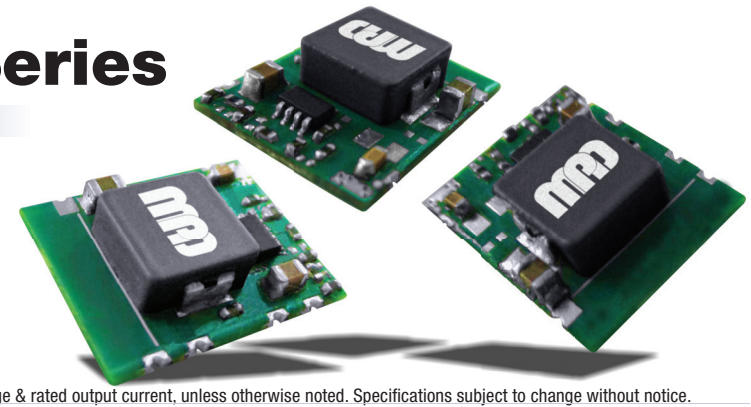
MLSR100 Series

High Efficiency, 1.0A Surface Mount, POL Switching Regulators



Key Features:

- Efficiency to 96%
- 1.0A Output Current
- Meets EN 62368
- Miniature SMT Construction
- Short Circuit Protected
- Low No-Load Input Current
- -40°C to +105°C Operation
- Wide Input Range
- Adjustable Output Voltage
- ***Low Cost***

Electrical Specifications

Specifications typical @ +25°C, nominal input voltage & rated output current, unless otherwise noted. Specifications subject to change without notice.

Input

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage Range	See Model Selection Guide on Page 2				
Start Up Time	See Note 1		5.0		mS
Input Filter	Internal Capacitors				
Input Reflected Ripple Current			35		mA P - P

Output

Parameter	Conditions		Min.	Typ.	Max.	Units
Output Voltage Accuracy					±2.0	%
Output Volage Adjust	See Note 2			±10		%
Line Regulation	VOUT = <3.0 VDC				±0.5	%
	VOUT = >3.0 VDC				±0.3	
Load Regulation	IOUT = 10% to 100%				±0.6	%
Ripple & Noise (20 MHz)	VOUT = <7.5 VDC				50	mV P - P
	VOUT = >7.5 VDC				35	
Temperature Coefficient					0.02	%/°C
Transient Response Time				250		µS
Transient Response Deviation	See Note 3	VOUT = <4.0 VDC			±5.0	%
		VOUT = >4.0 VDC			±3.0	
Output Short Circuit	Continuous (Autorecovery)					

General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	Not Isolated				
Switching Frequency	5 VIN Models		1.20		MHz
	24 VIN Models		0.41		

Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-40	+25	+105	°C
Storage Temperature Range		-55		+125	°C
Peak Reflow Temperature	See Note 4			245	°C
Moisture Sensitivity Level (MSL)	IPC/JEDEC J-STD-020D.1	Level 1 (See Note 5)			
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%

Physical

Case Size	See Mechanical Diagram (Page 5)
Case Material	Non-Conductive Black Plastic (UL-94V0)
Weight	0.049 Oz (1.4g)
24 VIN Models	0.80

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	2.0			MHours
Vibration	MIL STD 810F				

Tape & Reel

MicroPower Direct
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W: www.micropowerdirect.com

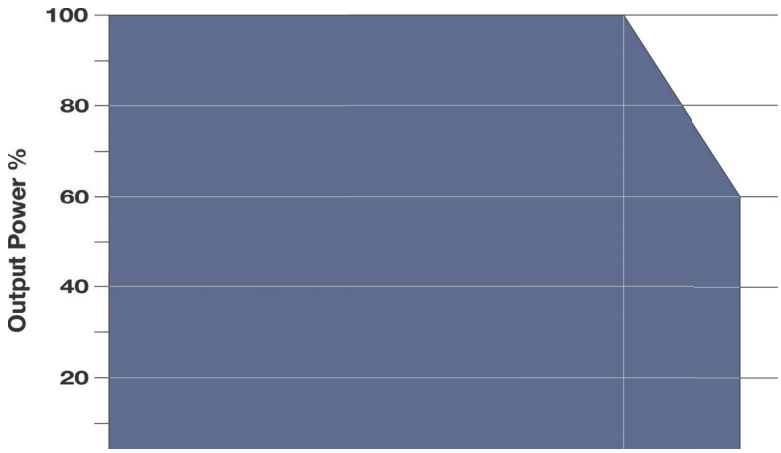
Model Selection Guide

Model Number	Input					Output		Efficiency (%, Typ)		Output Capacitive Load (µF, Max)
	Voltage (VDC)		Current (mA)			Voltage (VDC)	Current (mA, Max)	Full-Load (VIN, Min)	Full-Load (VIN, Max)	
	Nominal	Range	Full-Load (VIN, Max)	Full-Load (VIN, MIN)	No-Load					
MLSR105S-012(TR)	5.0	3.50 - 5.50	242	442	0.4	1.2	1,000	90.5	90.5	330
MLSR105S-015(TR)	5.0	3.50 - 5.50	297	544	0.4	1.5	1,000	92.0	92.0	330
MLSR105S-018(TR)	5.0	3.50 - 5.50	354	649	0.4	1.8	1,000	92.5	92.5	330
MLSR105S-02(TR)	5.0	3.80 - 5.50	484	697	0.4	2.5	1,000	94.5	94.0	330
MLSR124S-012W(TR)	24	4.60 - 36.0	47	300	1.5	1.2	1,000	87.0	72.0	330
MLSR124S-015W(TR)	24	4.60 - 36.0	55	367	1.5	1.5	1,000	89.0	76.0	330
MLSR124S-018W(TR)	24	4.60 - 36.0	64	433	1.5	1.8	1,000	90.5	79.0	330
MLSR124S-02W(TR)	24	4.60 - 36.0	84	588	1.5	2.5	1,000	92.5	83.0	330
MLSR124S-03W(TR)	24	4.75 - 36.0	106	740	1.5	3.3	1,000	94.0	86.5	330
MLSR124S-05W(TR)	24	6.50 - 36.0	156	806	1.5	5.0	1,000	95.5	89.5	330
MLSR124S-06W(TR)	24	9.00 - 36.0	201	765	1.5	6.5	1,000	94.5	90.0	330
MLSR124S-09W(TR)	24	12.0 - 36.0	272	786	1.5	9.0	1,000	95.5	92.0	330
MLSR124S-12W(TR)	24	15.0 - 36.0	359	843	1.5	12.0	1,000	95.0	93.0	330
MLSR124S-15W(TR)	24	18.0 - 36.0	444	869	1.5	15.0	1,000	96.0	94.0	330

Notes:
1. Specified at nominal VIN with a constant resistive load.
2. The 1.2V output models (**MLSR105S-012** & **MLSR124S-012**) can only be adjusted up. Negative adjustment is not supported on these models.
3. Transient recovery is measured at nominal VIN with an output load step change of 50% (50 to 100%).
4. The recommended solder reflow settings are a peak temperature of 245 °C for a maximum period (TPK) of 10S and a time above liquidous (TL) of ≤60 seconds at 217 °C. For more information, please contact the factory.
5. Any units that are not packaged in a vacuum sealed container should be stored in a controlled environment. Contact the factory for more information.
6. It is not recommended that a water wash process be used for board assemblies containing **MLSR100** units. Contact the factory for more information.
7. If the remote On/Off function is not used, pin 10 should be left open.
8. The input should not exceed the range given in the model selection chart. Exceeding this limit could damage the unit.
9. It is recommended that an external fuse be used. The fuse should be selected based upon the actual input current of the application. For more information please call the factory.

For Tape & Reel packaging add "TR" to the model number (**MLSR105S-015TR**). Details on Tape/Reel packaging are on pages 6 & 7.

Derating Curve



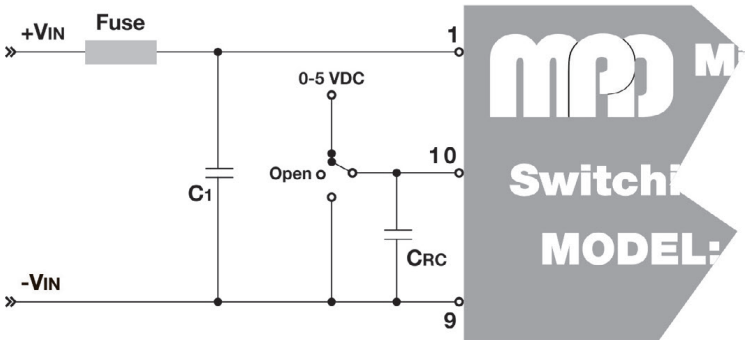
Remote ON/OFF Control

Parameter	Conditions	Min.	Typ.	Max.	Units
Unit On	See Note Below	2.0		5.0	VDC
Unit Off	See Note Below	0.0		0.4	VDC
Off Current	5 VIN Models			0.30	mA
	24 VIN Models			0.80	

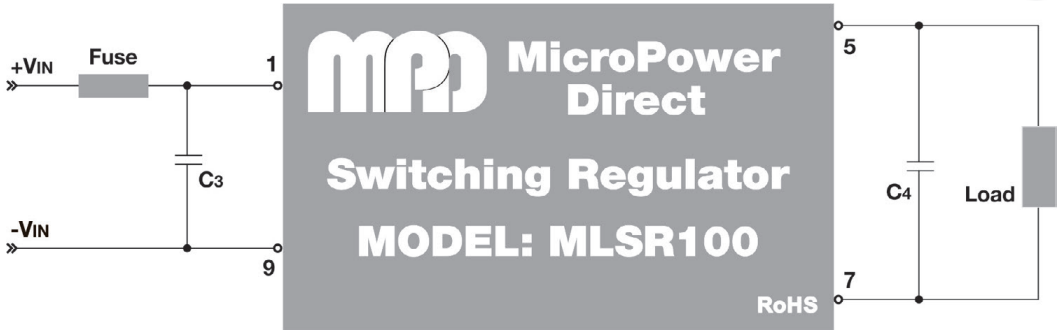
All **ML100SR** units can be started or shutdown by the control pin input (pin 10). The diagram at right shows a simple input circuit for the control pin.

The unit operates when this input is left open or connected to 2 to 5VDC. The unit shuts down if the voltage level is lowered to 0 to 0.4V or if pin 10 is connected to pin 9.

MLSR100 Remote On/Off Connection



Simple Connection

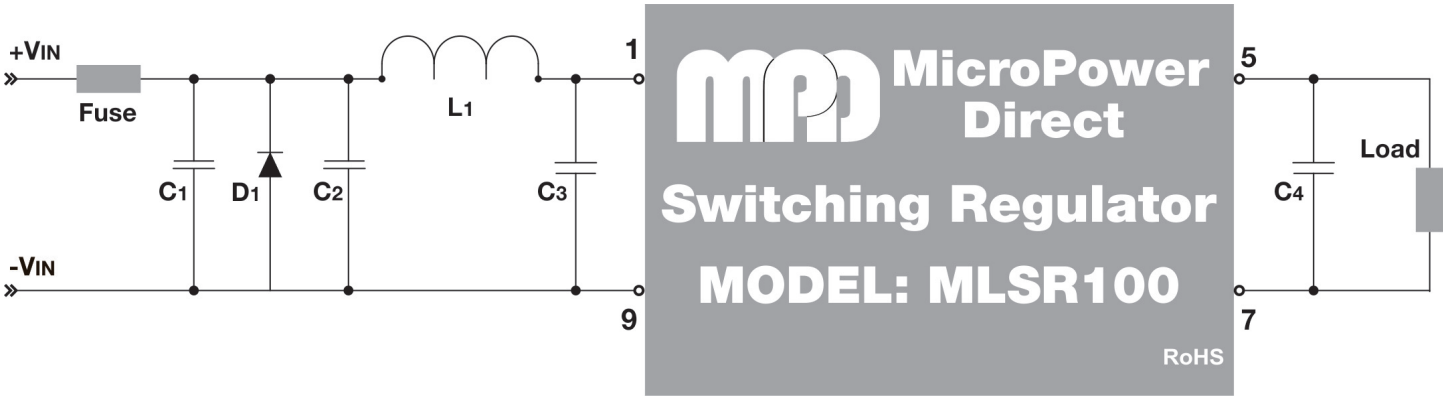


Recommended component values

C3	C4
10 µF	47 µF
Required	Optional

The diagram at left illustrates a simple connection of the **MLSR100** series. Capacitor C3 is required and should be mounted close to the unit. Capacitor C4 provides some filtering of the output. It is not required for the unit to operate normally. Both components should be low ESR electrolytic capacitors.

Typical Connection, With Input Filter



EMI/EMC Characteristics

Parameter	Standard	Criteria	Level
Radiated Emissions, See note 1	EN 55032		Class B
Conducted Emissions, See note 1	EN 55032		Class B
ESD	EN 61000-4-2	A	±4 kV Air
RS	EN 61000-4-3	A	10V/m
EFT, See Note 2	EN 61000-4-4	A	±1 kV
Surge, See Note 3	EN 61000-4-5	A	±1 kV
CS	EN 61000-4-6	A	3 Vrms
PFMF	EN 61000-4-8	A	100 A/m

The diagram above illustrates a typical connection of the **MLSR100** series for applications that require meeting conducted EMC standards.

This circuit will typically meet the requirements of EN 55032 class B. Some notes on this diagram (starting with the input circuit) are given at left below.

The recommended component values for are:

Input V	Fuse	C1	D1	C2
5 VIN	Contact Factory	2200 µF/50V	SMDJ 6.0A	1206, 10 µF, 50V
24 VIN	Contact Factory	330 µF/100V	SMDJ 36A	1206, 4.7 µF, 50V

Input V	L1	C3	C4
5 VIN	6.8 µH	1206, 10 µF, 50V	47 µF
24 VIN	33 µH	1206, 10 µF, 50V	47 µF

Notes:

1. All input/output filtering capacitors should have a low equivalent impedance. Voltage derating of all capacitors should be 60% or greater.
2. To meet the requirements of EN 55032, the external components C1, D1, L1, C2 and C3 are required. This is illustrated in the typical connection diagram at above.Contact the factory for more information.
3. To meet the requirements of EN 61000-4-4, an external input capacitor is needed. The typical connection diagram above shows capacitor C1, which would typically achieve this. Contact the factory for more information.
4. To meet the requirements of EN 61000-4-5, an external input capacitor is needed. The typical connection diagram above shows capacitor C1, which would typically achieve this. Contact the factory for more information.
5. For noise sensitive applications, it is recommended that the external capacitor C4 be placed from the +VOUT pin to the -VOUT pin. Care must be taken in choosing capacitors not to exceed the capacitive load specification for the unit.

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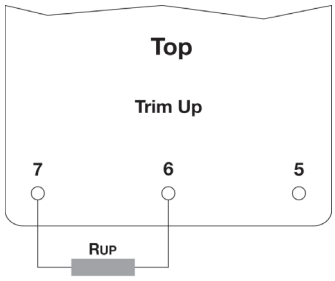
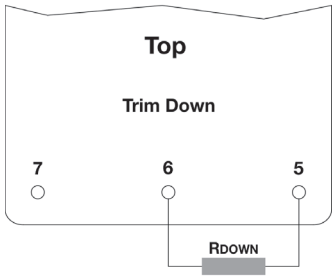
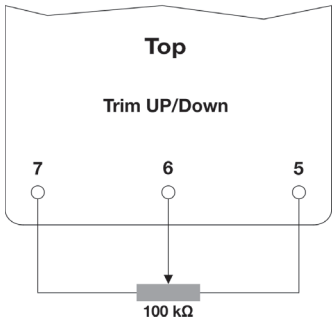
Output Trim Resistor Values

An external resistor can be used to adjust the converter output up/down by about 10%. The connection is shown in the diagrams below. The charts give the required trim resister value for a given percentage change in the output voltage. If required, the output may be adjusted using a 100 kΩ connected as shown below. The output should only be changed by ±10% of nominal value. The charts below give the resister values for trimming in increments of 1%.



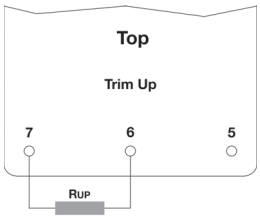


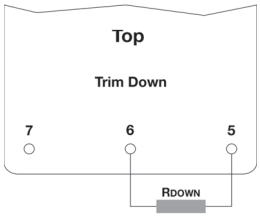


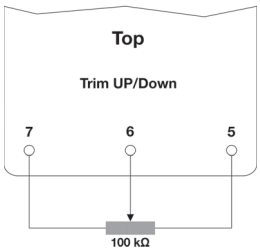
MLSR105S-012											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT=	1.212	1.224	1.236	1.248	1.260	1.272	1.284	1.296	1.308	1.320	VDC
RUP	890.000	440.000	290.000	215.000	170.000	140.000	118.571	102.500	90.000	80.000	kΩ
MLSR105S-015											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	1.515	1.530	1.545	1.560	1.575	1.590	1.605	1.620	1.635	1.650	VDC
RUP	955.300	475.300	315.300	235.300	187.300	155.300	132.443	115.300	101.967	91.300	kΩ
-Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	1.485	1.470	1.455	1.440	1.425	1.410	1.395	1.380	1.365	1.350	VDC
RDOWN	223.300	103.300	63.300	43.300	31.300	23.300	17.586	13.300	9.967	7.300	kΩ
MLSR105S-018											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	1.818	1.836	1.854	1.872	1.890	1.908	1.926	1.944	1.962	1.980	VDC
RUP	999.000	499.000	332.333	249.000	199.000	165.667	141.857	124.000	110.111	99.000	kΩ
-Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	1.782	1.764	1.746	1.728	1.710	1.692	1.674	1.656	1.638	1.620	VDC
RDOWN	187.000	87.000	53.667	37.000	27.000	20.333	15.571	12.000	9.222	7.000	kΩ
MLSR105S-02											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	2.525	2.550	2.575	2.600	2.625	2.650	2.675	2.700	2.725	2.750	VDC
RUP	1592.500	792.500	525.833	392.500	312.500	259.167	221.071	192.500	170.278	152.500	kΩ
-Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	2.475	2.450	2.425	2.400	2.375	2.350	2.325	2.300	2.275	2.250	VDC
RDOWN	372.500	792.500	525.833	392.500	312.500	259.167	221.071	192.500	170.278	152.500	kΩ
MLSR124S-012W											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT=	1.212	1.224	1.236	1.248	1.260	1.272	1.284	1.296	1.308	1.320	VDC
RUP	667.637	319.058	207.286	152.193	119.387	97.619	82.121	70.525	61.522	54.329	kΩ
MLSR124S-015W											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	1.515	1.530	1.545	1.560	1.575	1.590	1.605	1.620	1.635	1.650	VDC
RUP	1019.653	513.633	343.056	257.407	205.901	171.515	146.930	128.478	114.118	102.626	kΩ
-Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	1.485	1.470	1.455	1.440	1.425	1.410	1.395	1.380	1.365	1.350	VDC
RDOWN	151.571	68.579	41.231	27.615	19.465	14.038	10.166	7.264	5.009	3.205	kΩ
MLSR124S-018W											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	1.818	1.836	1.854	1.872	1.890	1.908	1.926	1.944	1.962	1.980	VDC
RUP	875.986	431.568	286.085	213.832	170.635	141.902	121.409	106.057	94.126	84.588	kΩ
-Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	1.782	1.764	1.746	1.728	1.710	1.692	1.674	1.656	1.638	1.620	VDC
RDOWN	131.857	61.368	37.458	25.424	18.178	13.336	9.873	7.272	5.248	3.628	kΩ
MLSR124S-02W											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	2.525	2.550	2.575	2.600	2.625	2.650	2.675	2.700	2.725	2.750	VDC
RUP	963.299	443.741	288.020	213.066	168.984	139.956	119.397	104.071	92.207	82.750	kΩ
-Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	2.475	2.450	2.425	2.400	2.375	2.350	2.325	2.300	2.275	2.250	VDC
RDOWN	142.846	71.090	44.980	31.471	23.215	17.646	13.636	10.611	8.248	6.350	kΩ
MLSR124S-03W											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	3.333	3.366	3.399	3.432	3.465	3.498	3.531	3.564	3.597	3.630	VDC
RUP	853.300	424.300	281.300	209.800	166.900	138.300	117.871	102.550	90.633	81.100	kΩ
-Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	3.267	3.234	3.201	3.168	3.135	3.102	3.069	3.036	3.003	2.970	VDC
RDOWN	226.300	105.300	64.967	44.800	32.700	24.633	18.871	14.550	11.189	8.500	kΩ
MLSR124S-05W											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	5.050	5.100	5.150	5.200	5.250	5.300	5.350	5.400	5.450	5.500	VDC
RUP	941.383	439.647	284.989	209.822	165.391	136.044	115.214	99.663	87.610	77.995	kΩ
-Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	4.950	4.900	4.850	4.800	4.750	4.700	4.650	4.600	4.550	4.500	VDC
RDOWN	211.976	102.684	63.703	43.696	31.522	23.333	17.449	13.015	9.556	6.780	kΩ

Continued on page 5

Output Trim Resistor Values, Continued from page 4

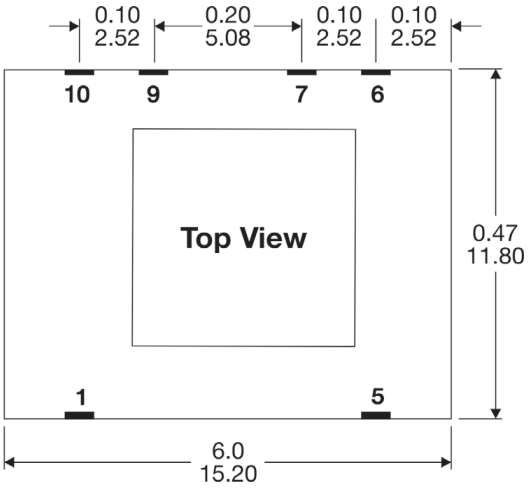


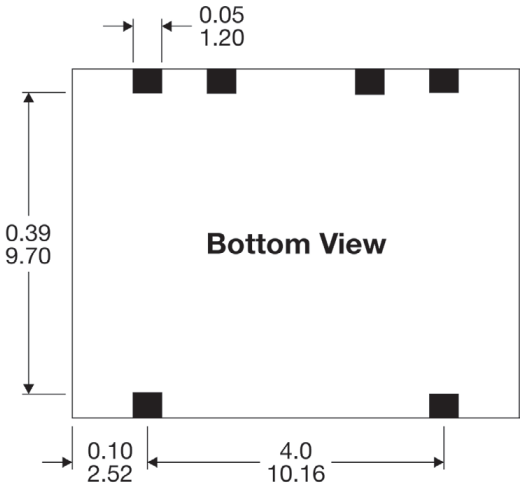




MLSR124S-06W											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	6.565	6.630	6.695	6.760	6.825	6.890	6.955	7.020	7.085	7.150	VDC
RUP	866.405	410.827	268.137	198.395	157.049	129.690	110.247	95.719	84.451	75.457	kΩ
-Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	6.435	6.370	6.305	6.240	6.175	6.110	6.045	5.980	5.915	5.850	VDC
RDOWN	193.180	93.521	58.406	40.476	29.592	22.284	17.038	13.089	10.009	7.540	kΩ
MLSR124S-09W											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	9.090	9.180	9.270	9.360	9.450	9.540	9.630	9.720	9.810	9.900	VDC
RUP	749.196	379.825	253.379	189.514	150.987	125.216	106.765	92.903	82.107	73.462	kΩ
-Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	8.910	8.820	8.730	8.640	8.550	8.460	8.370	8.280	8.190	8.100	VDC
RDOWN	229.900	104.397	64.437	44.397	32.440	24.496	18.834	14.596	11.304	8.672	kΩ
MLSR124S-12W											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	12.120	12.240	12.360	12.480	12.600	12.720	12.840	12.960	13.080	13.200	VDC
RUP	1108.333	519.737	337.069	248.077	195.408	160.593	135.870	117.405	103.090	91.667	kΩ
-Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	11.880	11.760	11.640	11.520	11.400	11.280	11.160	11.040	10.920	10.800	VDC
RDOWN	425.000	210.714	134.677	95.732	72.059	56.148	44.718	36.111	29.396	24.010	kΩ
MLSR124S-015W											
+Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	15.150	15.300	15.450	15.600	15.750	15.900	16.050	16.200	16.350	16.500	VDC
RUP	714.409	341.175	223.581	165.984	131.800	109.165	93.072	81.042	71.710	64.260	kΩ
-Trim	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10	%
VOUT	14.850	14.700	14.550	14.400	14.250	14.100	13.950	13.800	13.650	13.500	VDC
RDOWN	139.022	341.175	223.581	165.984	131.800	109.165	93.072	81.042	71.710	64.260	kΩ

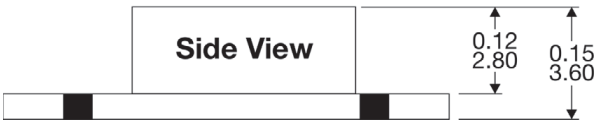
Mechanical Dimensions





Pin Connections

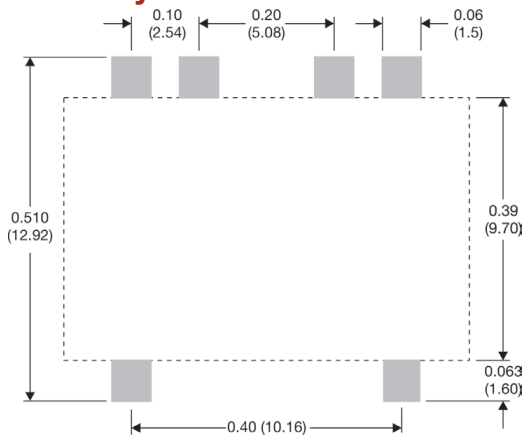
Pin	Description
1	+VIN
5	+VOUT
6	Trim
7	-VOUT
9	-VIN
10	Remote On/Off



Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.01 (±0.25)

Solder Layout



Packaging Specifications

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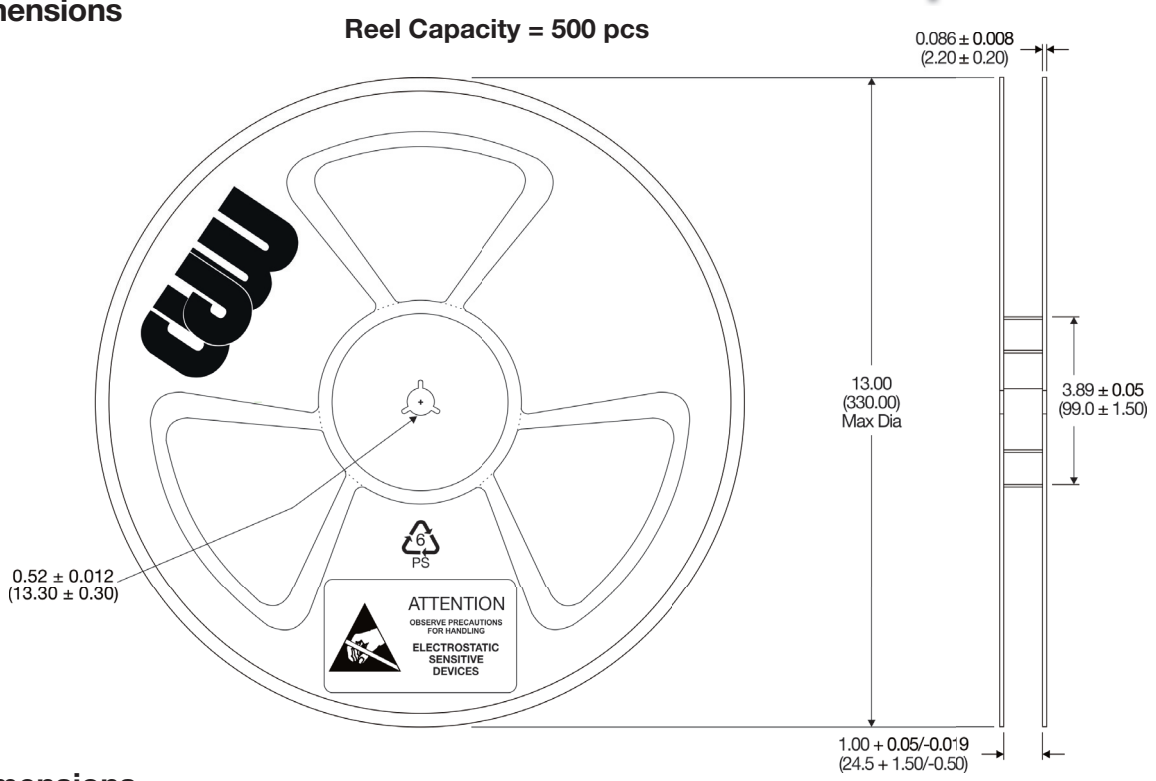
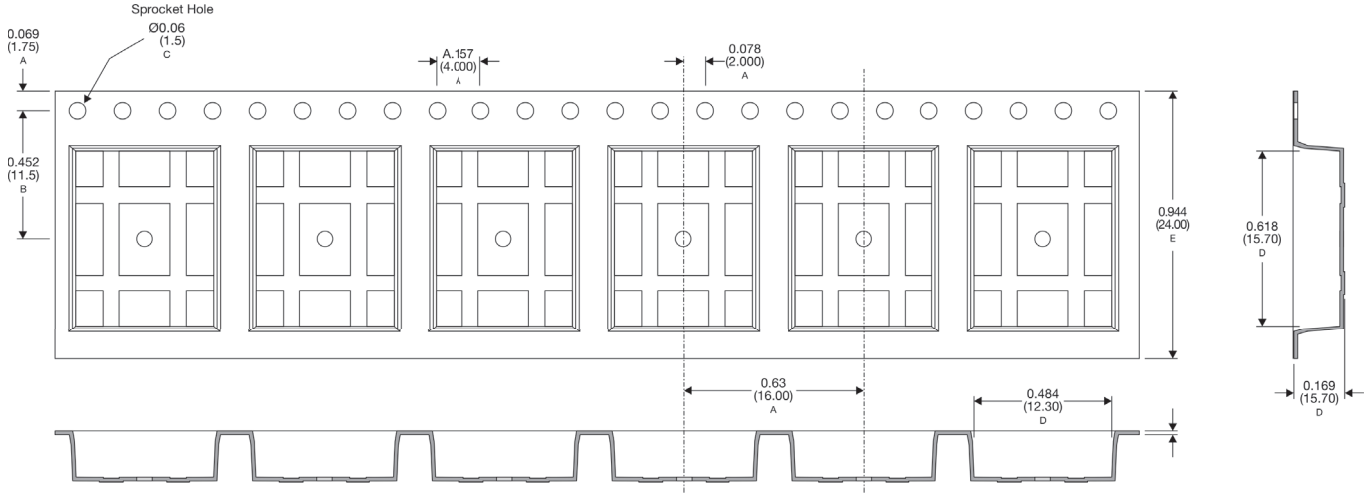
Reel Dimensions

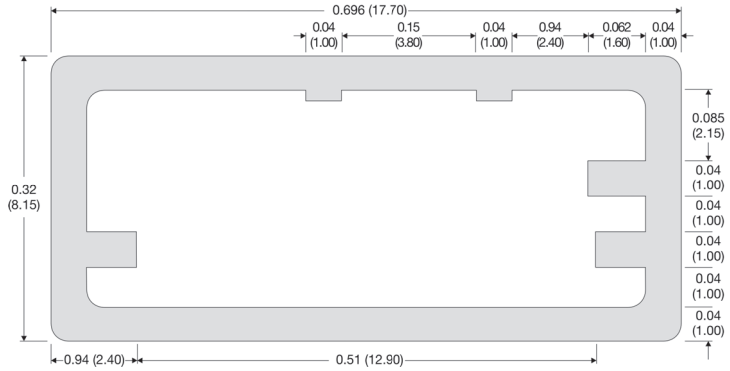
Reel Capacity = 500 pcs



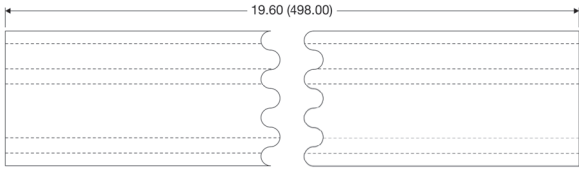
Tape Dimensions



Tube Dimensions



Tube Capacity = 40 pcs



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