

MLSR192K-16A

Miniature Surface Mount Non-Isolated 16A POL Switching Regulator



Key Features:

- Efficiency to 95%
- 16A Output Current
- Miniature SMT Package
- Short Circuit Protected
- Over Current Protected
- -40°C to +85°C Operation
- Remote On/Off
- Adjustable Output Voltage
- Industry Standard Pin-Out
- **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					
Input Current	No Load		70		mA	
Start-Up Voltage				8.3	VDC	
Under Voltage Protection		6			VDC	
Reverse Polarity Input	See Note 1					
Input Filter	Capacitor					
Output						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Output Voltage Accuracy	See Note 2		±1.0	±2.0		
Line Regulation	V _{IN} = Min to Max		±0.3		%	
Load Regulation	See Note 3		±0.4		%	
Ripple & Noise (20 MHz)	See Note 4		65	100	mV P - P	
Temperature Coefficient	100% Load		±0.02		%/°C	
Trim Range	See Page 7	0.75		5.0	VDC	
Transient Recovery Time, See Note 5			20		µSec	
Transient Response Deviation	MLSR120K-10A		±75		mV	
	MLSR192K-16A		±100		mV	
Over Current Protection, Nominal Input	MLSR120K-10A		320		%I _{OUT}	
	MLSR192K-16A		200		%I _{OUT}	
Output Short Circuit	Continuous (Autorecovery)					
General						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Isolation Voltage	Not Isolated					
Switching Frequency			300		kHz	
EMI Characteristics						
Parameter	Standard	Criteria		Level		
Radiated Emissions, See Page 2	CISPR32/EN 55032			Class B		
Radiated Emissions	CISPR32/EN 55032			Class B		
ESD	EN 61000-4-2	B		±6 kV Contact		
Environmental						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Operating Temperature Range	Ambient	-40	+25	+85	°C	
Storage Temperature Range		-55		+125	°C	
Humidity	RH, Non-condensing	5		95	%	
Peak Reflow Temperature	See Page 5			245	°C	
Moisture Sensitivity Level (MSL)	IPC/JEDEC J-STD-020D.1			Level 1 (See Page 5)		
Cooling	Free Air Convection					
Remote On/Off						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Unit On, See Note 6	MLSR192K-16AP (Pos Logic)	5.80		11.50		
	MLSR192K-16AN (Neg Logic)	0.0		0.50		
Unit Off, See Note 6	MLSR192K-16AP (Pos Logic)	0.0		0.50		
	MLSR192K-16AN (Neg Logic)	5.80		11.50		
Input Current When Off			2		mA	
Physical						
Case Size	See Mechanical Drawing (Page 8)					
Weight	0.282 Oz (8.6g)					
Reliability Specifications						
Parameter	Conditions	Min.	Typ.	Max.	Units	
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	1,000			kHours	

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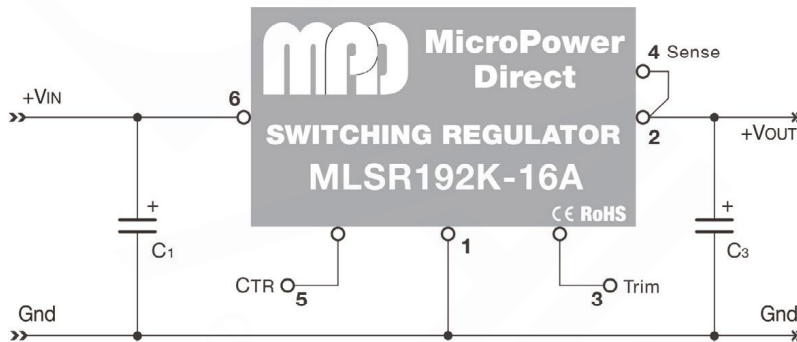
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Model Number	Input Voltage (VDC)		Output			Efficiency (%)		Capacitive Load (μF , Max)		Control Logic
	Nom.	Range	Minimum (VDC)	Maximum (VDC)	Current (A, Max)	Min. %	Typ. %	$1 \leq \text{ESR} < 10 \text{ m}\Omega$	$\text{ESR} \geq 10 \text{ m}\Omega$	
MLSR192K-16AP	12	8.30 - 14.0	0.75	5.0	16.0	92	95	5,000	6,000	Positive
MLSR192K-16AN	12	8.30 - 14.0	0.75	5.0	16.0	92	95	5,000	6,000	Negative

Notes:

- These units are not protected for a reverse polarity input. Damage to the unit could occur.
- Output voltage accuracy is specified at full load and nominal input voltage.
- Output load regulation is measured with the input voltage set to nominal (12 VDC) and the output load varied from 0% to 100%.
- When measuring output ripple, it is recommended that an external $1 \mu\text{F}$ ceramic capacitor & a $10 \mu\text{F}$ electrolytic capacitor be placed in parallel from the Vout pin to the GND pin.
- Transient recovery is measured too within a 1% error band for a load step change of 50% -50%-100%-50%. The $di/dt = 2.5\text{A} \mu\text{S}$ with external $470 \mu\text{F}$ polymer capacitors.
- The remote On/Off Control (pin 4) is referenced to ground. The range for the signal used to control the unit is $(V_{IN} - 2.5 \text{VDC})$ to V_{IN} .
- This regulator is not designed to be used in parallel to increase output power.
- The input should not exceed the range given in the model selection chart. Exceeding 15 VDC could damage the unit.
- It is recommended that an external fuse be used. The fuse should be selected based on the actual input current of the application. For more info, please contact the factory.

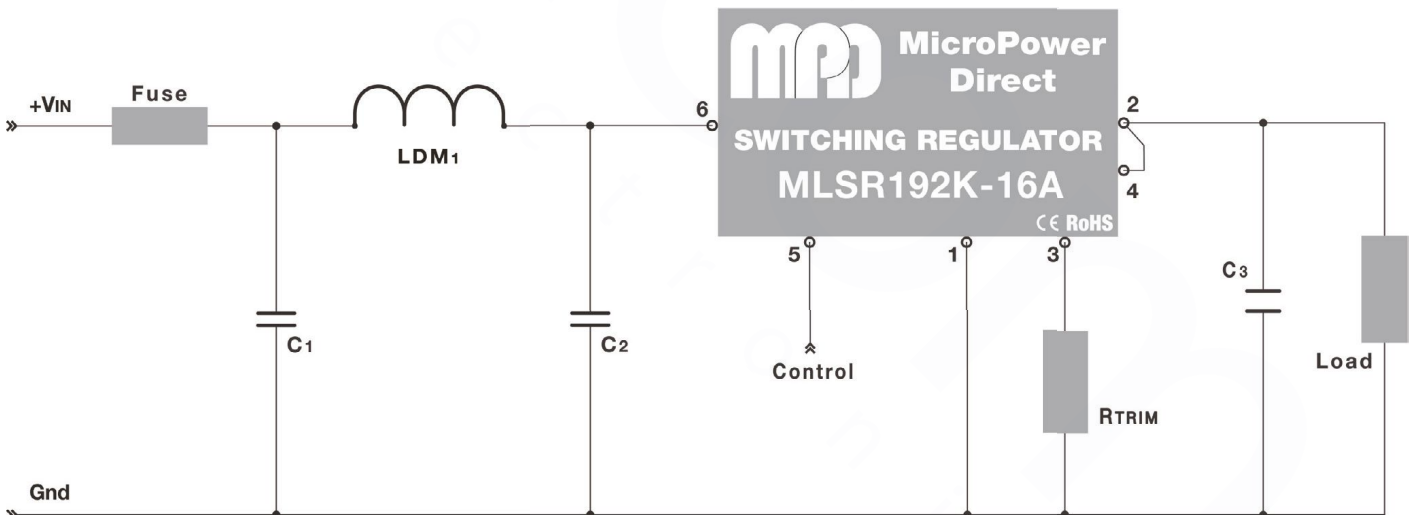
Simple Connection



The diagram at left illustrates a simple connection of the MLSR192K-16A. For applications that do not require the circuit to meet EMI/EMC specifications, the capacitors C1 and C3 will reduce input/output ripple and improve the regulator stability over time and temperature. The recommended component values are given in the table below. Both capacitors are required for proper operation.

C1	C3
220 $\mu\text{F}/35\text{V}$	47 $\mu\text{F}/16\text{V}$

Typical Connection



The diagram above illustrates a typical connection of the MLSR192K-16A for an application that requires compliance to EMI/EMC standards EN 55032 & EN 61000-4 (as specified on page 1). Some notes on these components are:

- An external fuse is recommended to protect the unit in the event of a fault on the input line. The fuse should be selected based on the actual input current of the application. For more info, please contact the factory.
- The output filtering capacitor (C3) is a high frequency, low resistance electrolytic capacitor. Care must be taken in choosing this capacitor not to exceed the

capacitive load specification for the unit. Voltage derating of capacitors should be 80% or above.

3. Suggested component values are:

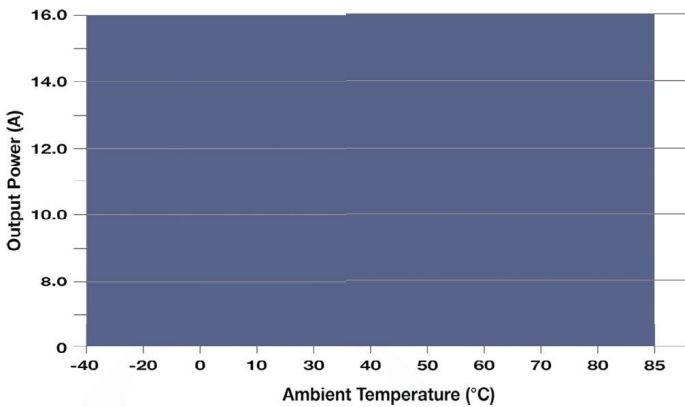
Component	Value
C1	1,000 $\mu\text{F}/35\text{V}$
LDM1	6.8 μH
C2	1,000 $\mu\text{F}/35\text{V}$
RTRIM	See Note Page 7
C3	22 $\mu\text{F}/16\text{V}$

- If compliance to the radiated emissions standards (RE) is all that is required, the values of C1 & C2 can be reduced to 100, 1,000 $\mu\text{F}/35\text{V}$
- For proper operation, capacitor C1 and C3 are required. For applications that do not need compliance to EMC standards, see the simple connection above.

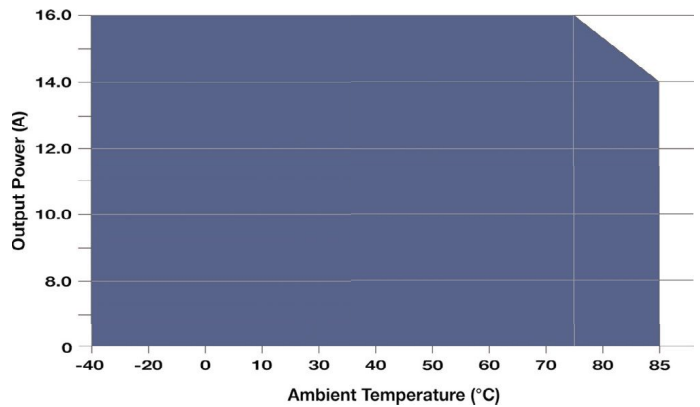
Temperature Derating Curves: MLSR192K-16A

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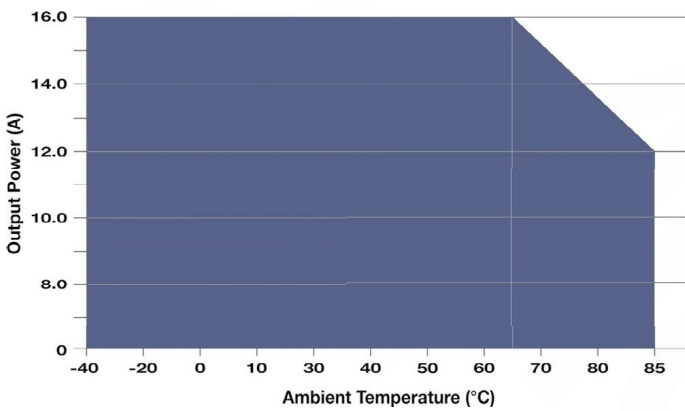
V_{IN} = 12V, V_{OUT} = <0.75 VDC, Air Flow = 300 LFM



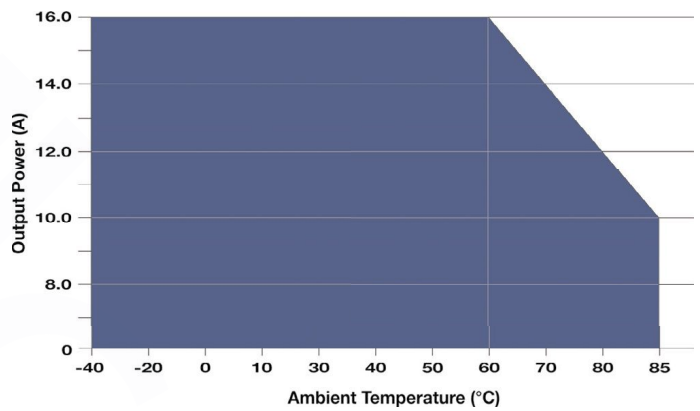
V_{IN} = 12V, V_{OUT} = <0.75 VDC, Air Flow = 200 LFM



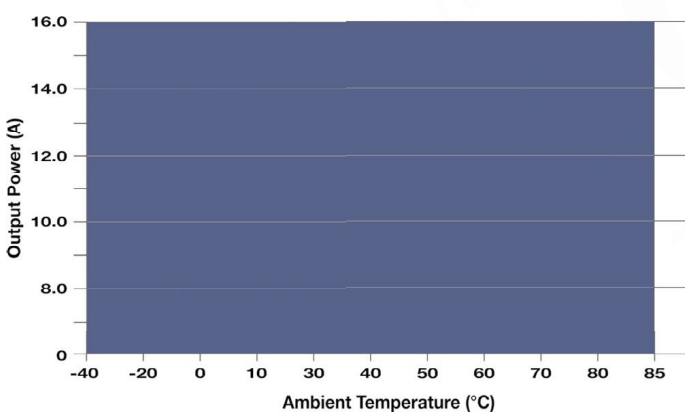
V_{IN} = 12V, V_{OUT} = <0.75 VDC, Air Flow = 100 LFM



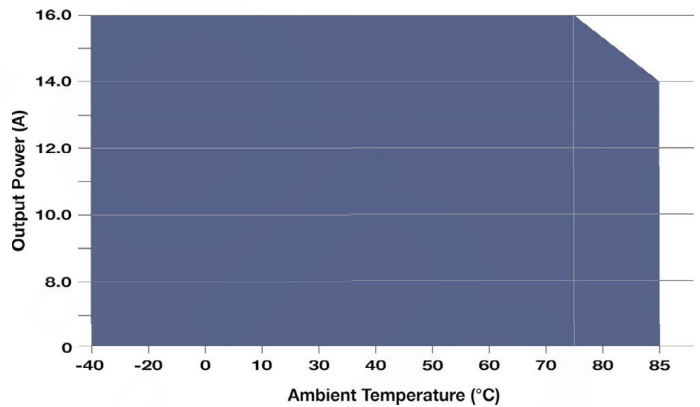
V_{IN} = 12V, V_{OUT} = <0.75 VDC, Air Flow = 20 LFM



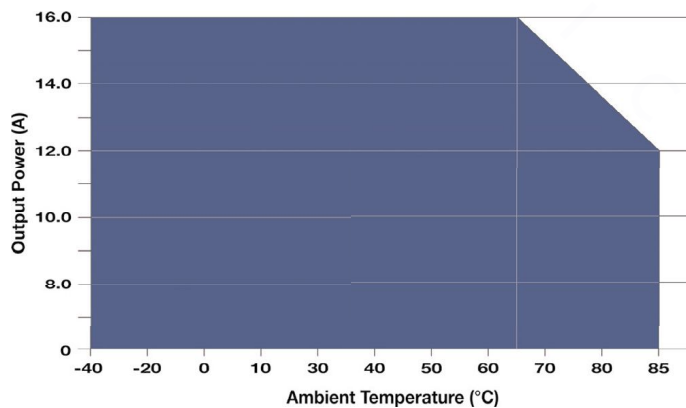
V_{IN} = 12V, V_{OUT} = 3.3 VDC, Air Flow = 400 LFM



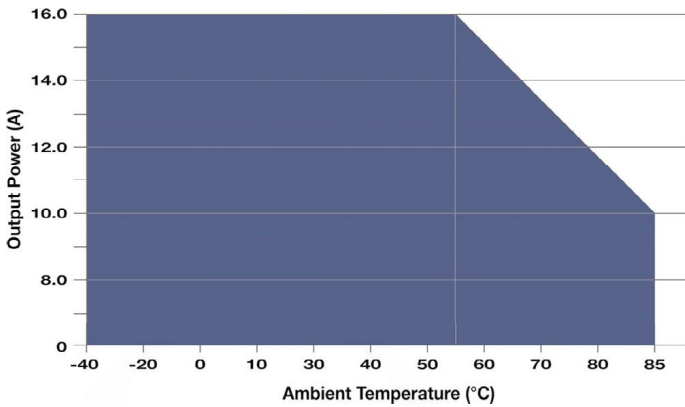
V_{IN} = 12V, V_{OUT} = 3.3 VDC, Air Flow = 300 LFM



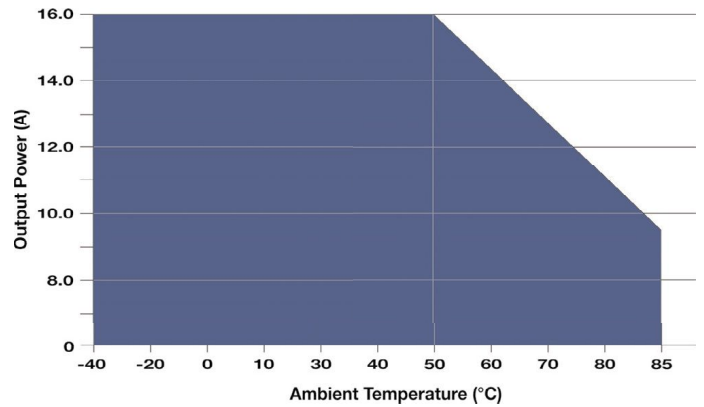
V_{IN} = 12V, V_{OUT} = 3.3 VDC, Air Flow = 200 LFM



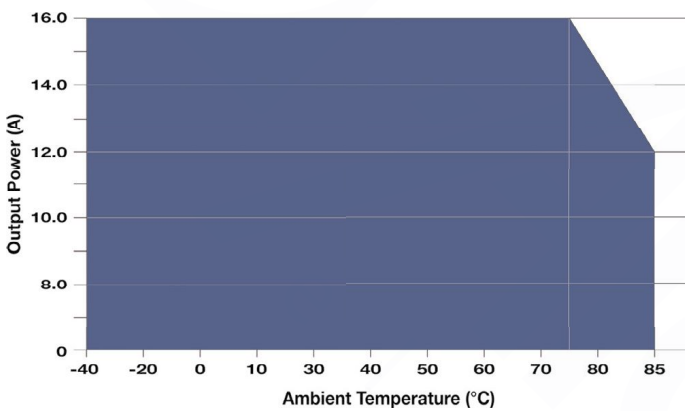
V_{IN} = 12V, V_{OUT} = 3.3 VDC, Air Flow = 100 LFM



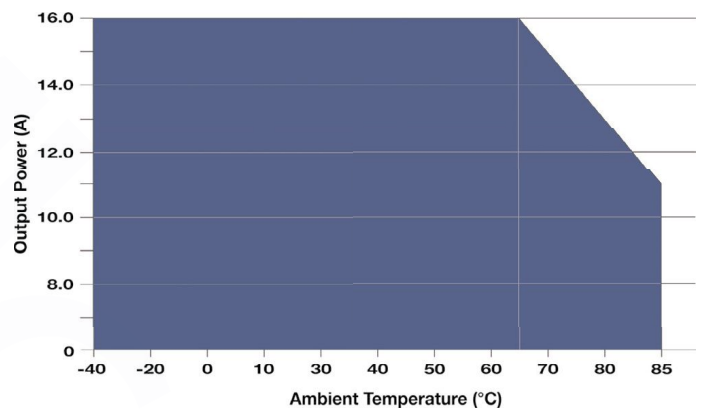
V_{IN} = 12V, V_{OUT} = 3.3 VDC, Air Flow = 20 LFM



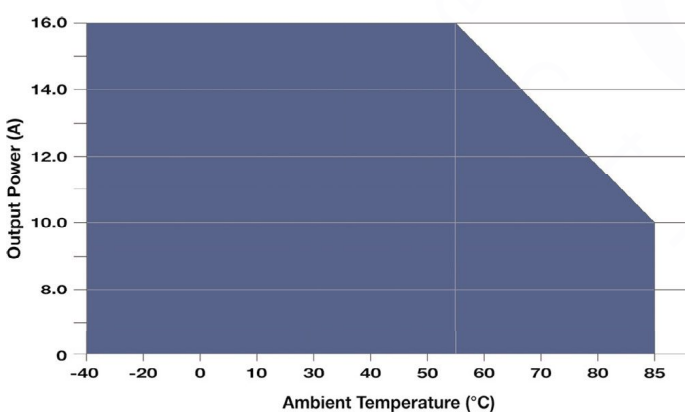
V_{IN} = 12V, V_{OUT} = 5.0 VDC, Air Flow = 400 LFM



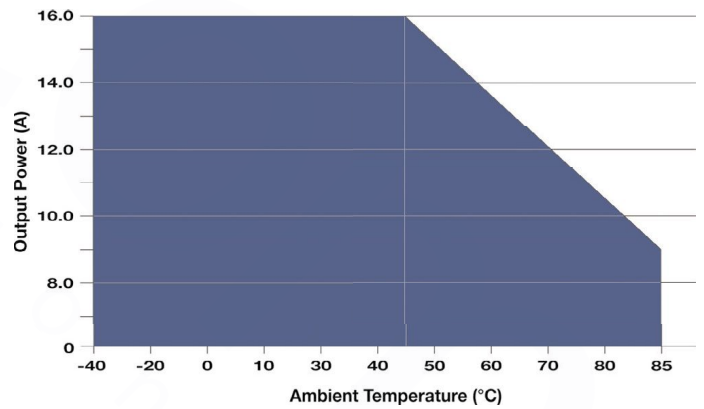
V_{IN} = 12V, V_{OUT} = 5.0 VDC, Air Flow = 300 LFM



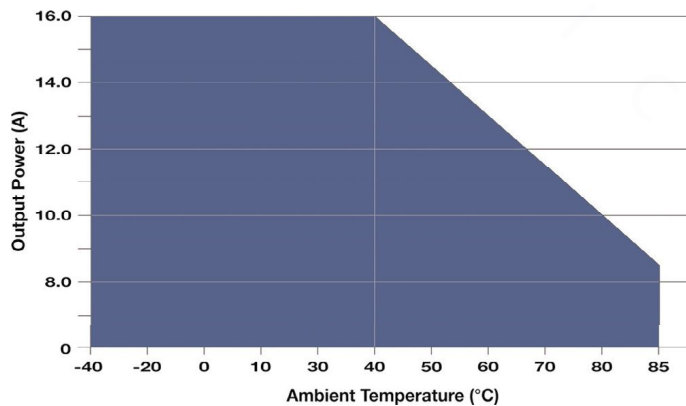
V_{IN} = 12V, V_{OUT} = 5.0 VDC, Air Flow = 200 LFM



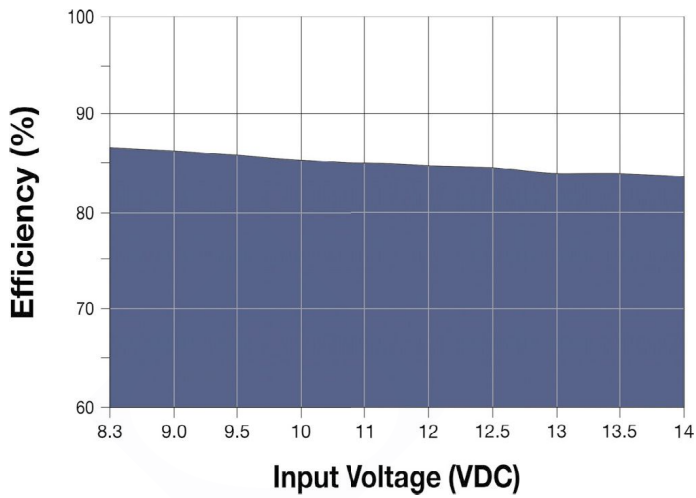
V_{IN} = 12V, V_{OUT} = 5.0 VDC, Air Flow = 100 LFM



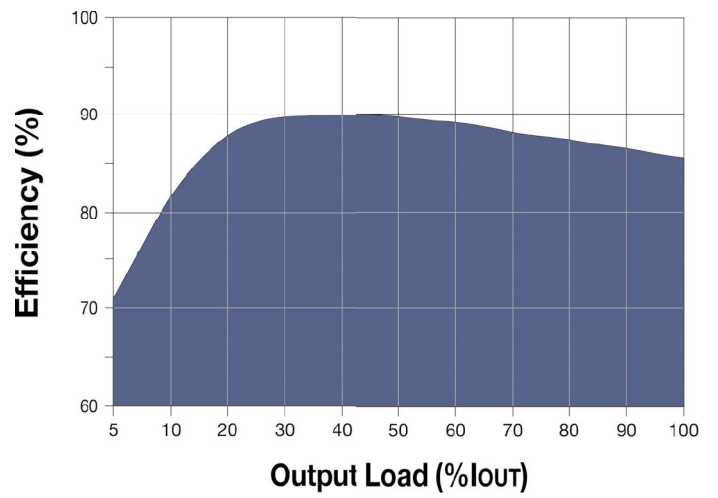
V_{IN} = 12V, V_{OUT} = 5.0 VDC, Air Flow = 20 LFM



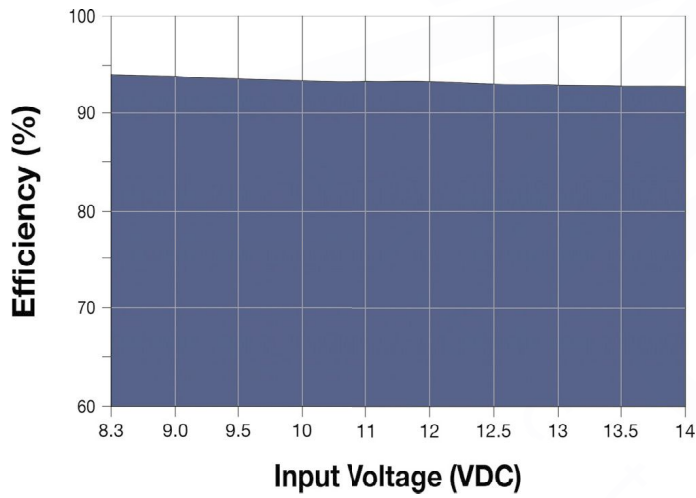
Characteristic Curves: MLSR192K-16A



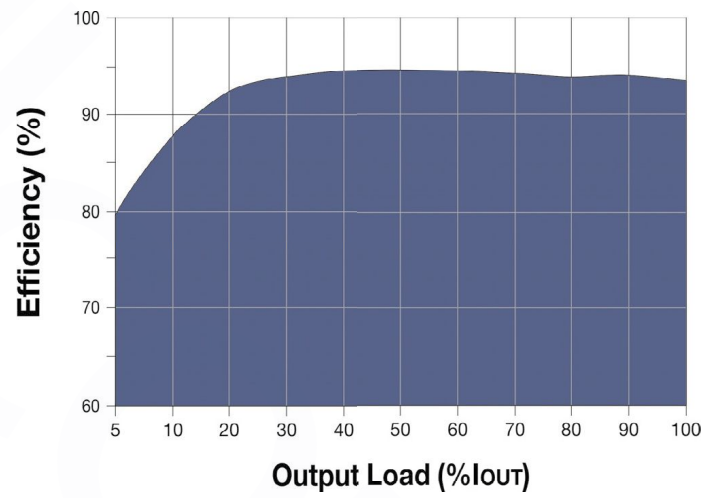
Efficiency vs Input Voltage ($V_{OUT} = 1.2V$, $I_{OUT} = 16A$)



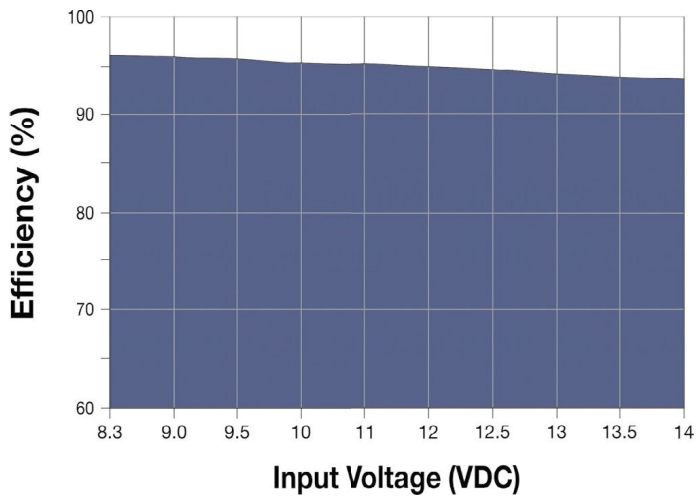
Efficiency vs Output Load ($V_{IN} = 12V$, $V_{OUT} = 1.2V$)



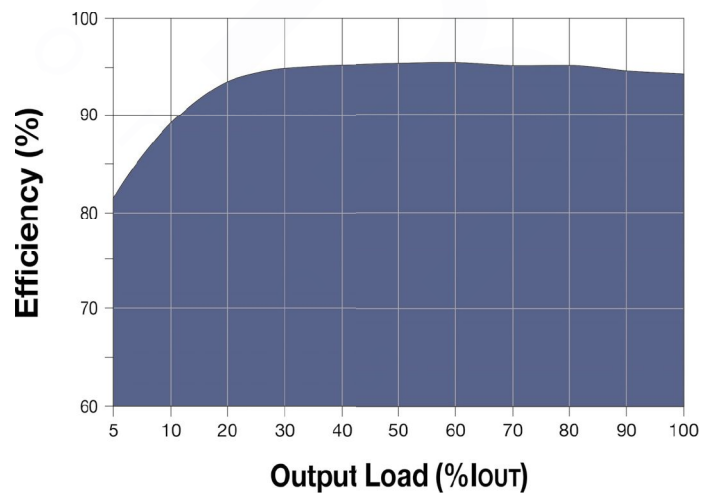
Efficiency vs Input Voltage ($V_{OUT} = 3.3V$, $I_{OUT} = 16A$)



Efficiency vs Output Load ($V_{IN} = 12V$, $V_{OUT} = 3.3V$)



Efficiency vs Input Voltage ($V_{OUT} = 5.0V$, $I_{OUT} = 16A$)



Efficiency vs Output Load ($V_{IN} = 12V$, $V_{OUT} = 5.0V$)

External Trim

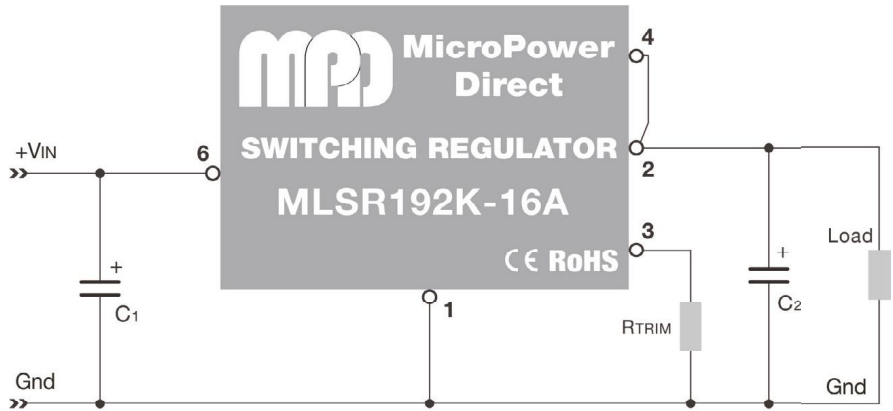
An external resistor can be used to adjust the unit output up from 0.7525 VDC to 5.0 VDC. The connection is shown in the diagram at right. The required resistor value (RTRIM) is calculated by the formula:

$$R_{TRIM} = \frac{7,200}{V_o - 0.7525} - 1,000 = x\Omega$$

Where RTRIM = The value of the external trim resistor
 Vo = The output voltage value required.
 If a resistor is not connected (pin 2 is left open), the regulator output will be 0.7525 VDC.

Using the formula, some common outputs are set with the following values:

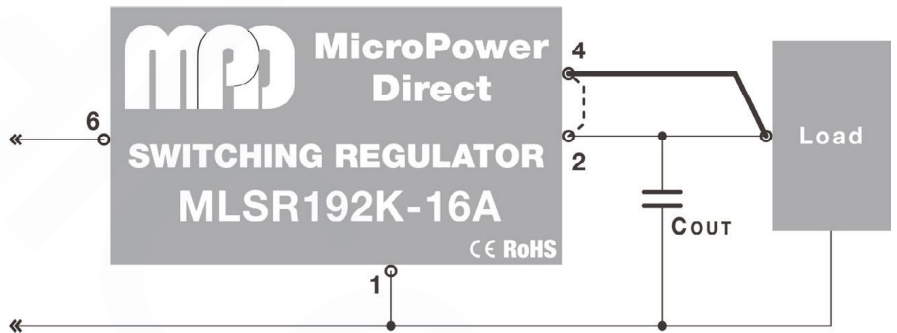
VOUT	RTRIM	VOUT	RTRIM
1.2 VDC	15.089 kΩ	2.5 VDC	3.120 kΩ
3.3 VDC	1.826 kΩ	5.0 VDC	695Ω



Remote Sense Connection

The MSLR192K-16A includes a remote sense function to help compensate for losses over the output line. The connection is illustrated at right. Some precautions include:

1. If not used, the sense output (pin 4) should be strapped to the plus output (pin 2).
2. Any connection to the remote sense pin should be kept as short as possible to avoid picking up noise or interference which could cause instability.
3. If used, it's recommended that long wires be avoided. PCB tracks with an adequate cross sectional area or cables should be used instead. When connecting the regulator to the load, the voltage drop across the output connection should be kept below 0.3V to insure the output voltage remains within specified limits.



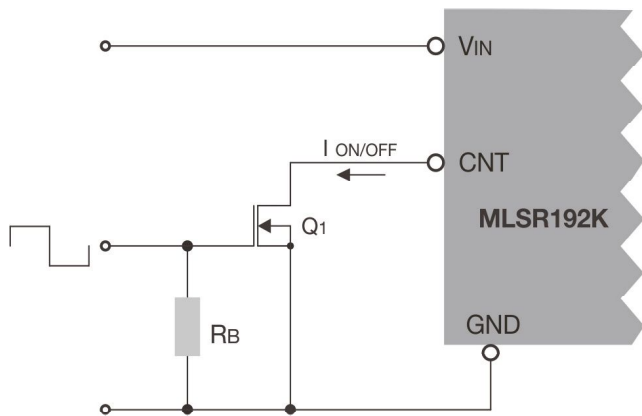
Please contact the factory with any questions.

Remote On/Off Control

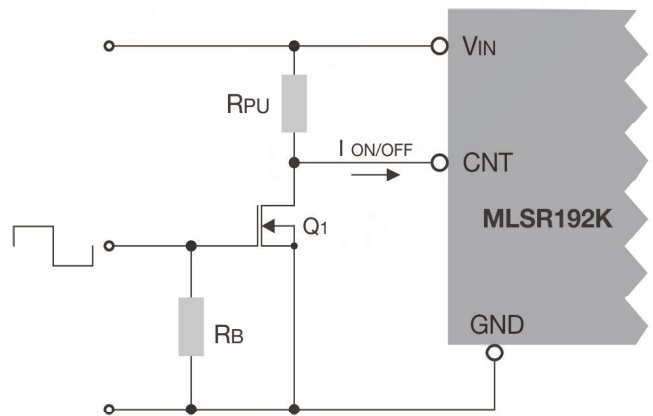
A remote on/off control function is also included in the MSLR192K-16A. A typical connection is shown below for positive & negative logic units. If not used, the control input (Pin 5) should be left open for positive logic units or grounded for negative logic units. Illustrated below are simple connections for adding a control signal to the circuit.

For the positive logic connection an open drain, N channel MOSFET is connected between the control input (Pin 5) and ground (pin 1). With positive logic, the unit is turned on during a logic high and off during a logic low. The bleeder resistor insures the MOSFET turns off. The connection is illustrated below.

For the negative logic connection, a pull up resistor is added insure the input is "high" when the MOSFET switch is turned off. With negative logic, the unit is turned on during a logic low and off during a logic high. Again, the bleeder resistor just insures the MOSFET turns off. The connection is illustrated below.



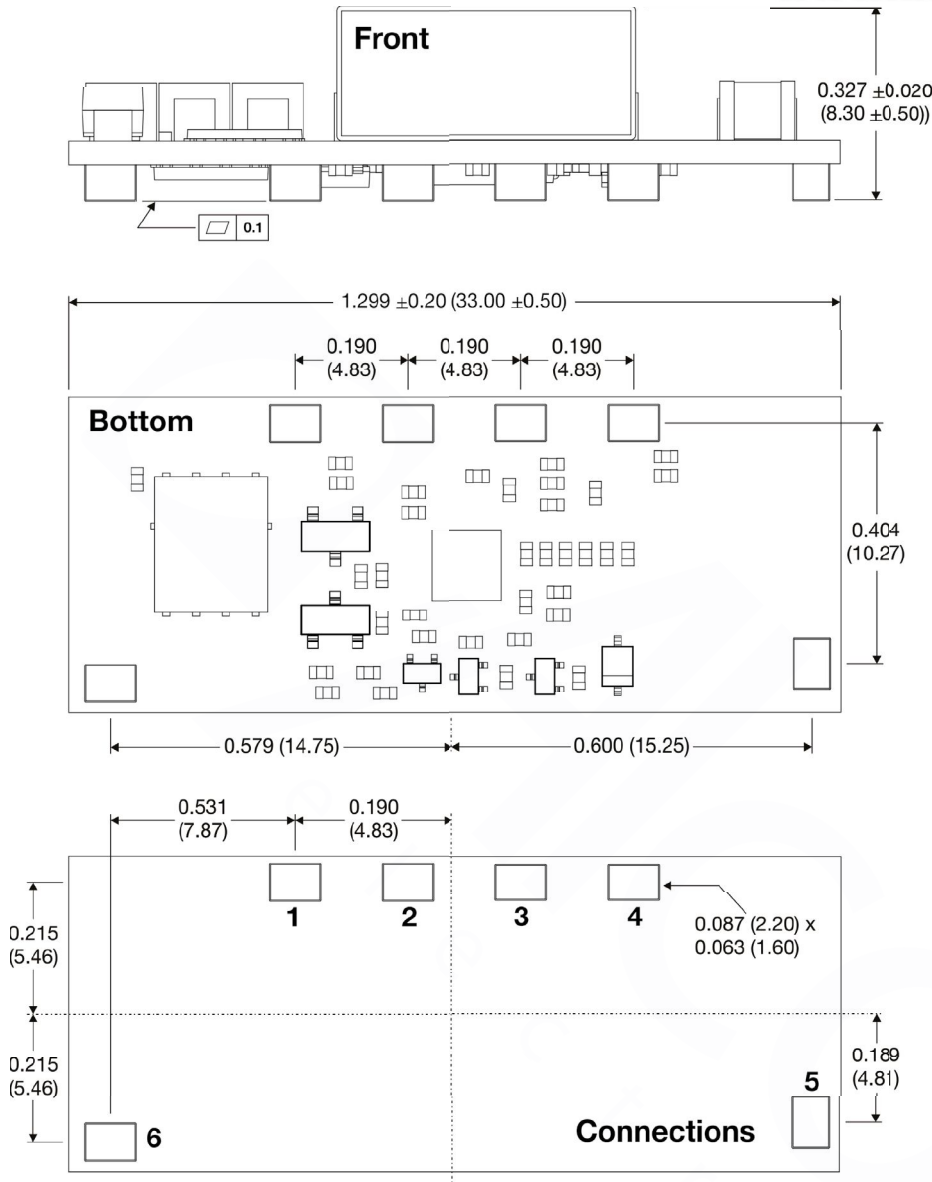
Positive Control



Negative Control

Mechanical Dimensions

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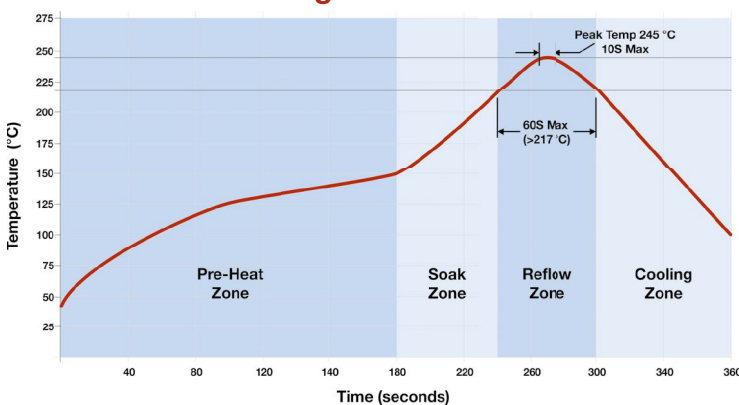
PAD CONNECTIONS

Pin	Function
1	GND
2	V _{OUT}
3	Trim
4	Sense
5	Control
6	V _{IN}

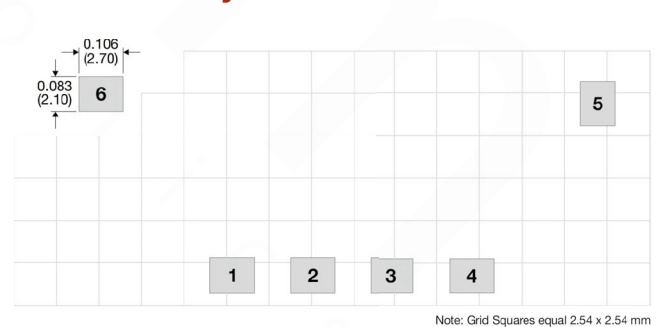
Notes:

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

Reflow Solder Settings



Solder Pad Layout

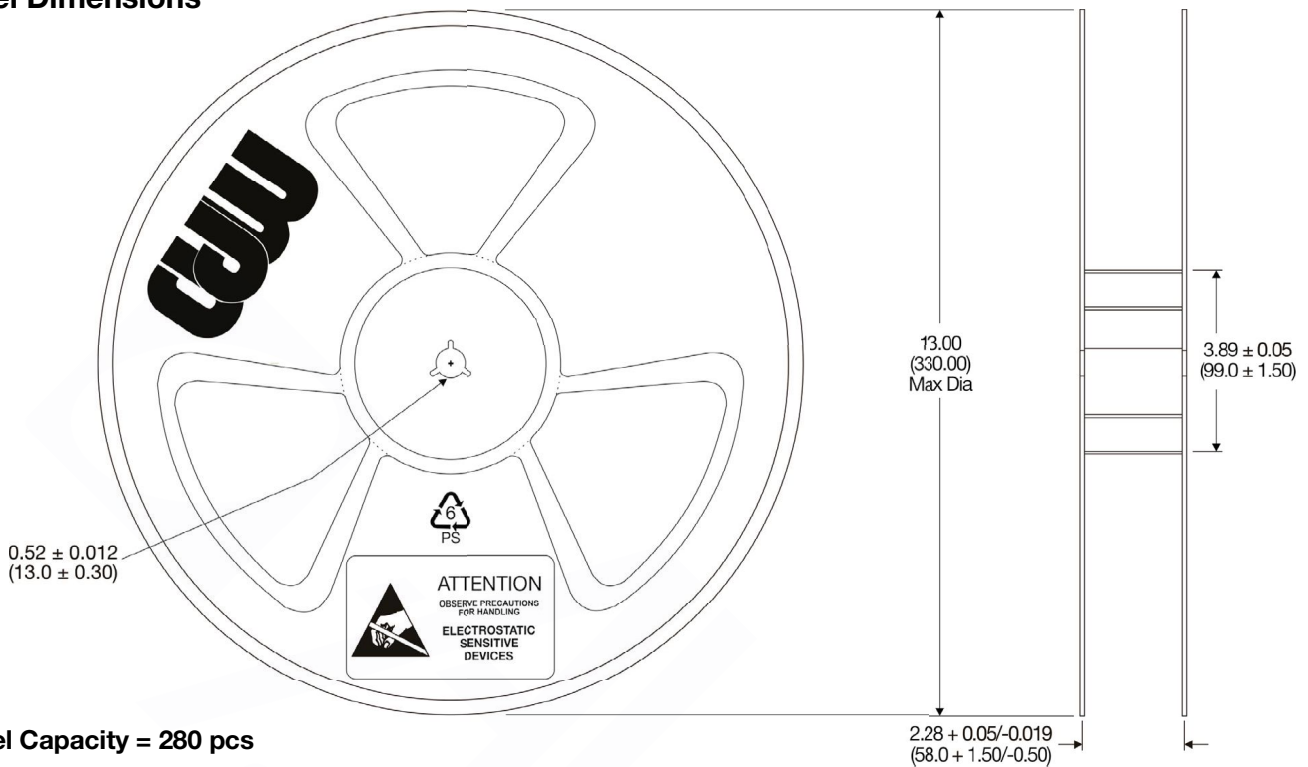


The ML5SR192K-16A is designed to meet the IPC/JEDEC standard J-STD-020D for reflow soldering. The recommended reflow settings are a peak temperature of 245 °C for a maximum period (TPK) of 10S and a time above liquidous (TL) of ≤ 60 seconds at 217 °C, as illustrated above.

The product should be stored in moisture barrier bags or a similar environment to prevent oxidation on the connection pads. For more information, please contact the factory.

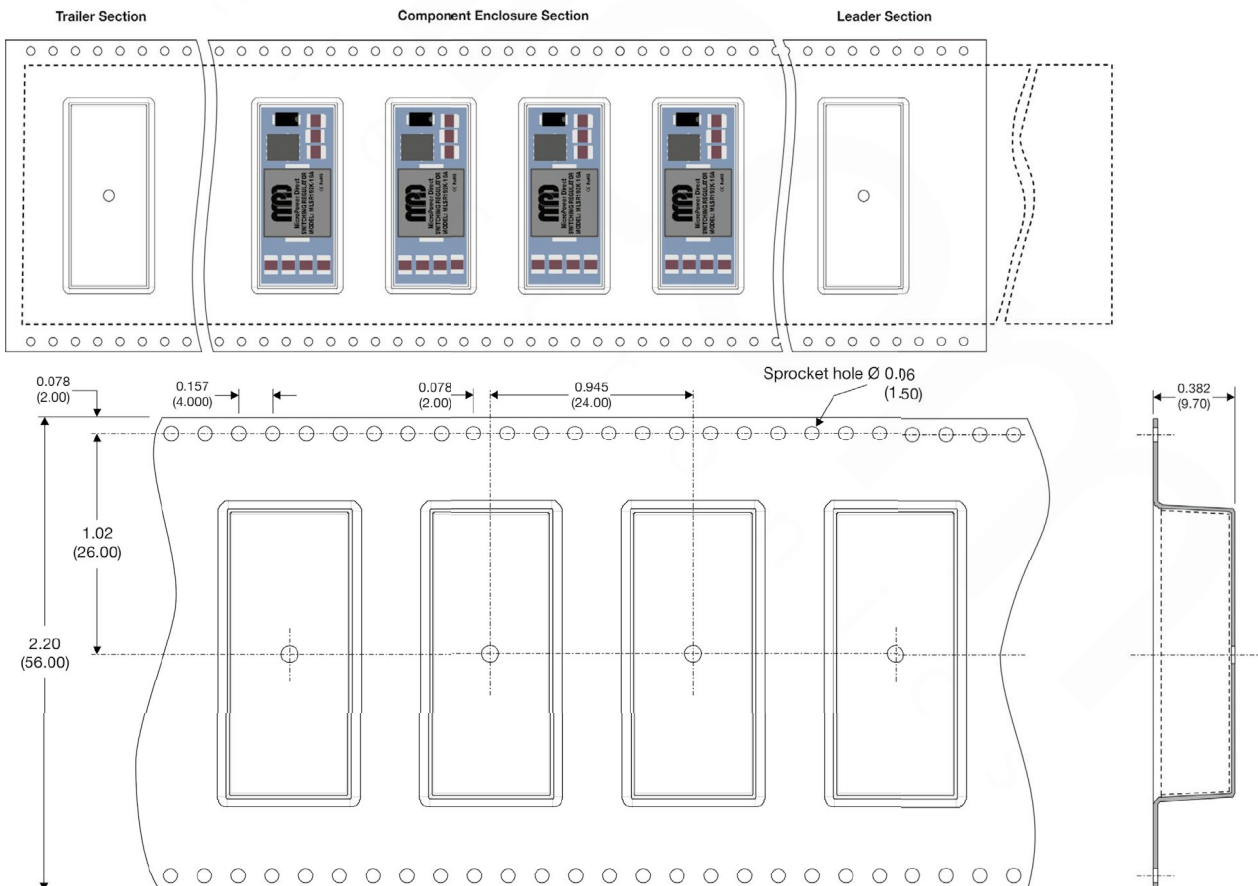
Packaging Specifications
Reel Dimensions

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Reel Capacity = 280 pcs

Tape Dimensions



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All MLSR1xxK-1xA reels are sealed in moisture barrier packaging. Any units that are not packaged in a vacuum sealed container should be stored in a controlled environment. Contact the factory for more information.

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