MLSR100C

1W, Compact, Single Output POL Switching Regulator

Key Features:

- 1W Output Power
- Miniature DFN Package
- -40°C - +105°C Operating Temperature Range
- Short Circuit Protected
- Industry Standard Pin-Out
- Up to 90% Efficiency

CE

RoHS

MicroPower Direct

MPD

MICROPOWER DIRECT

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	See Model Selection Guide on Page 2				VDC
Reverse Polarity at Input		Avoid / Not Protected			
Input Filter		Capacitance Filter			
CTRL	Module On	CTRL pin open or pulled high (TTL 1.6~5VDC)			
	Module Off	CTRL pin pulled low to GRND (-Vo) (0.~0.6VDC)			
	Nominal Vin, input current when off		240		uA

Output

Parameter	Conditions		Min.	Typ.	Max.	Units
Output Voltage Accuracy	Full Load	3.3V output		±2	±4	%
		Other outputs		±2	±3	
Line Regulation	Full Load			±0.2		%
Load Regulation	10-100% Load			±1		%
Ripple & Noise, See Note 1	20MHZ Bandwidth			75	150	mVp-p
	20MHz Bandwidth, 22uF External Capacitor			20	75	
Temperature Coefficient	-40°C to +105°C		--	±0.02		%/°C
Transient Response Deviation	Nominal Vin, 25% load step change	3.3/5/6.5/9V		50	150	mV
		12/15V outputs		100	300	
Transient Recovery Time	Nominal Vin, 25% load step change			0.1	0.8	ms
Output Short Circuit	Continuous, self-recovery					
Trim	Input Voltage Range			±10		%Vo

General

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching Frequency	Full Load, Nominal Input Voltage		1.0		MHz

Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range		-40		+105	°C
Storage Temperature Range		-55		+125	°C
Cooling	Free air convection				
Storage Humidity	Non condensing	5		95	%RH
Moisture Sensitivity Level	IPC/JEDEC J-STD-020D.1	Level 3			
Pollution Degree		PD3			

Physical

Case Size	0.35 x 0.28 x 0.12 in (See mechanical diagrams on page 5)
Case Material	Black plastic; flame retardant and heat resistant (UL94V-0 rated)
Weight	0.020 oz (0.58g) (See mechanical diagrams on page 5)

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL-HDBK-217F@25°C	8.552			MHours
Reflow Soldering Temperature	Peak temperature ≤245°C, duration ≤60s max. over 217°C				

EMI Characteristics

Parameter	Standard	Criteria	Level
Radiated Emissions, See Page 3	CISPR32/EN 55032		B
Conducted Emissions	CISPR32/EN 55032		B

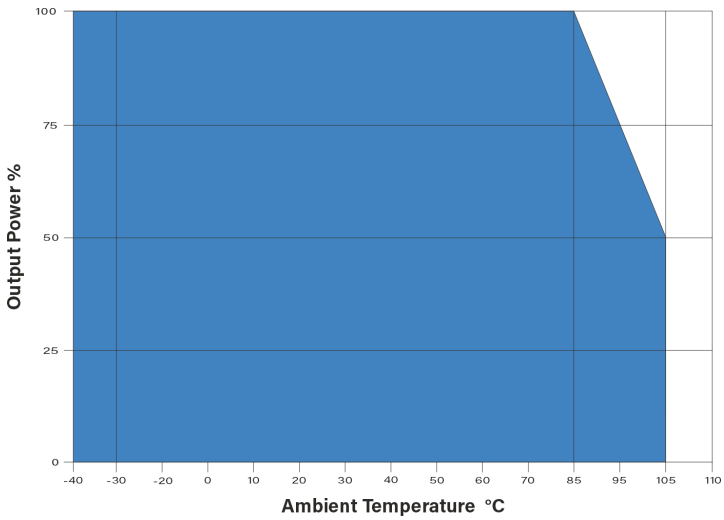
Model Selection Guide

Model Number	Input				Output			Full Load Efficiency (%, Typ)	Capacitive Load (µF, Max) (See Note 3)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)		
	Nominal	Range	Full Load (Typ)	No Load					
MLSR124-033C	24	4.75 - 36	170	0.1	3.3	1000	0	81	680
	12	8 - 27	170	0.1	-3.3	-500	0	81	330
MLSR124-05C	24	6.5 - 36	248	0.1	5	1000	0	84	680
	12	8 - 27	251	0.1	-5	-500	0	83	330
MLSR124-065C	24	8 - 36	315	0.1	6.5	1000	0	86	680
	12	8 - 24	322	0.1	-6.5	-500	0	84	330
MLSR124-09C	24	12 - 36	431	0.1	9	1000	0	87	680
	12	8 - 24	446	0.1	-9	-500	0	84	330
MLSR124-12C	24	15 - 36	562	0.1	12	1000	0	89	680
	12	8 - 20	357	0.1	-12	-300	0	84	330
MLSR124-15C	24	18 - 36	694	0.1	15	1000	0	90	680
	12	8 - 18	446	0.1	-15	-300	0	84	330

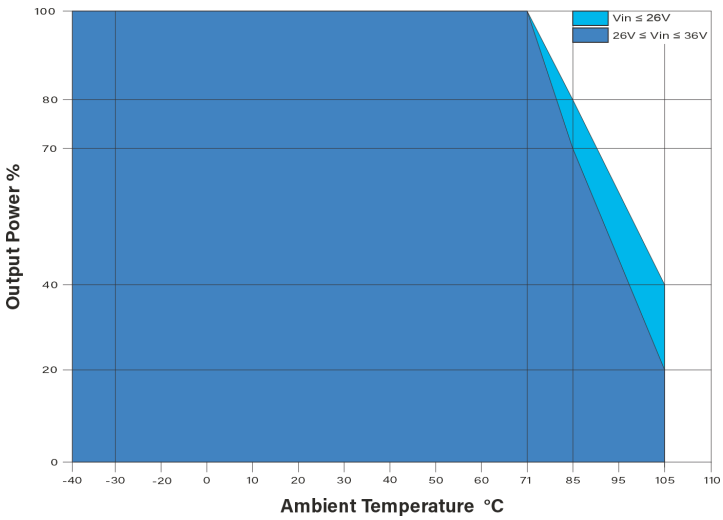
1. The "parallel cable" method is used for ripple & noise test.
2. If the product is not operated within the required load range, the product performance cannot be guaranteed to comply with all parameters in the datasheet.
3. The maximum capacitive load offered were tested at input voltage range and full load.
4. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25°C, humidity < 75% with nominal input voltage and rated output load.
5. For input voltage exceeding 30VDC, an input capacitor of 22uF/50V is required.
6. The positive output CTRL pin voltage is referenced to input GRND. Negative output CTRL voltage is referenced to -Vo.

For Tape & Reel packaging, add the suffix "**-TR**" to the model number (i.e. **MLSR124-05C-TR**). Details on Tape & Reel packaging are on page 6.

Temperature Derating: 3.3, 5, 6.5V Outputs



Temperature Derating: 9, 12, 15V Outputs



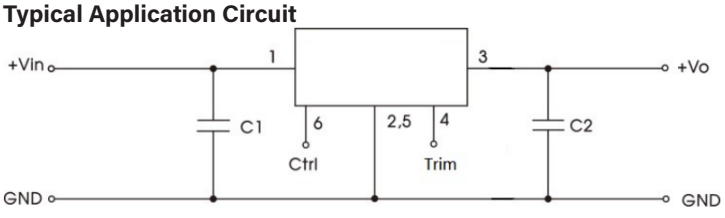
EMI Characteristics

Parameter	Standard	Criteria	Level
Radiated Emissions (RE)	CISPR32/EN55032		B (Note 2)
Conducted Emissions (CE)	CISPR32/EN55032		B (Note 2)
ESD	IEC/EN61000-4-2	B	Contact ±6kV (Note 1)
RS	IEC/EN61000-4-3	A	10V/m
CS	IEC/EN61000-4-6	A	3V.r.m.s
EFT	IEC/EN61000-4-4	B	±1kV(Note 3)
Surge	IEC/EN61000-4-5	B	line to line ±1kV (Note 3)

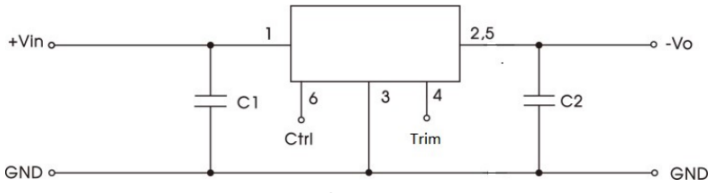
Notes:
1. The static level of the CTRL and trim pin is ±2kV when they are not connected to external devices. It is suggested to connect an external capacitor (225k/50V) from CTRL to GND/-Vo to meet ESD (±6kV) of the CTRL pin, and to connect a varistor (22V/30A) from trim to GND/-Vo to meet ESD (±6kV) of the trim pin.
2. Use EMC Compliance Circuit (Part 2) to meet CISPR/EN55032 level B.
3. Use EMC Compliance Circuit (Part 1) to meet EN61000-4-4 and EN61000-4-5.

Application Circuits

Typical Application Circuit



Positive output



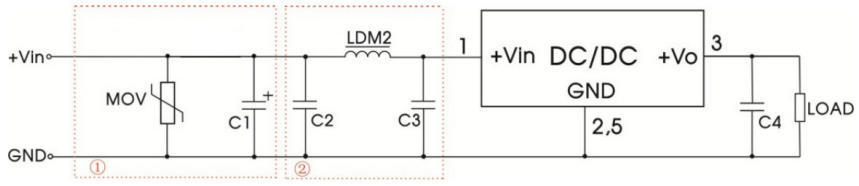
Negative output

Model	C1 (Ceramic)	C2 (Ceramic)	Ra1/Ra2 (Trim)
MLSR124-033C	10uF/50V	22uF/10V	Refer to trim resistance calculation
MLSR124-05C		22uF/10V	
MLSR124-065C		22uF/16V	
MLSR124-09C		22uF/16V	
MLSR124-12C		22uF/25V	
MLSR124-15C		22uF/25V	

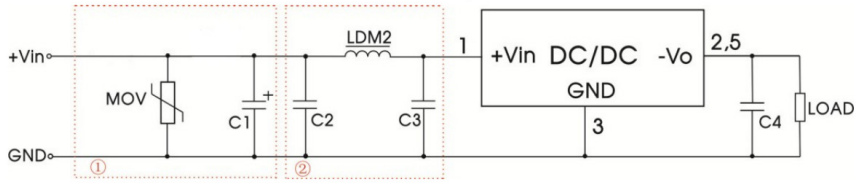
CTRL	Module On	CTRL pin open or pulled high (TTL 1.6~5VDC)
	Module Off	CTRL pin pulled low to GRND (-Vo) (0.~0.6VDC)
	Nominal Vin, input current when off	240 uA

Notes:
1. The required C1 and C2 capacitors must be connected as close as possible to the terminals of the module.
2. Refer to the table for capacitor values. For certain applications, increased values and/or tantalum or low ESR electrolytic capaictors may also be used instead.
3. Converter cannot be used for hot swap and with output in parallel.

EMC Compliance Circuit



Positive output



Negative output

Model	MOV	C1	C2	LDM2	C3	C4
MLSR124-033/05/065 (Positive output)	S20K30	680uF/50V	10uF/50V	68uH	-	22uF/25V
Others	S20K30	680uF/50V	10uF/50V	68uH	10uF/50V	22uF/25V

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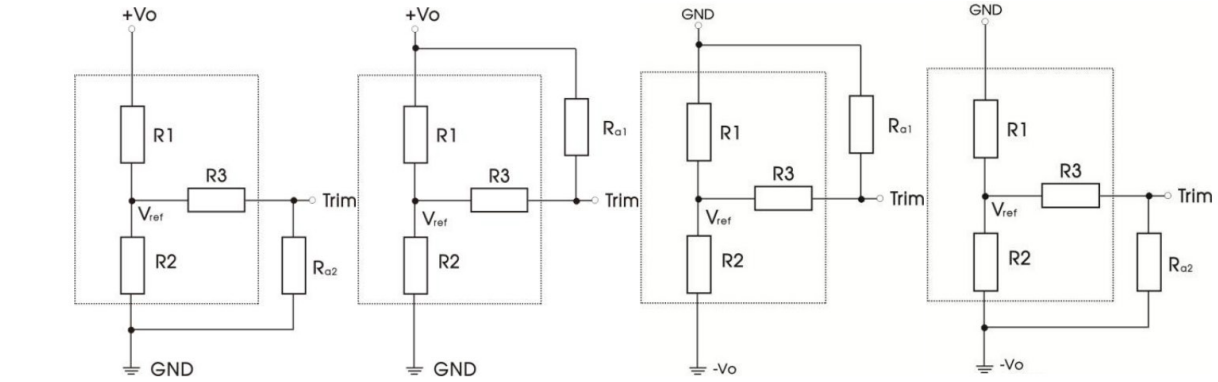
Trim Function for Output Voltage Adjustment (Open if Unused)



Positive output trim up | Positive output trim down | Negative output trim up | Negative output trim down

Notes:
1. Positive output application: connect trim resistor to GRND/Vo respectively for adjusting up/down.
2. Negative output application: connect trim resistor to GRND/Vo- respectively for adjusting up/down.

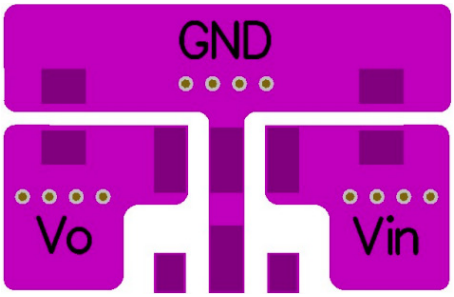
Trim up: $R_{a2}=\frac{aR_2}{R_2-a}-R_3,\quad a=R_2//(R_3+R_{a2})=\frac{V_{ref}}{V_o'-V_{ref}}R_1$

Trim down: $R_{a1}=\frac{aR_1}{R_1-a}-R_3,\quad a=R_1//(R_3+R_{a1})=\frac{V_o'-V_{ref}}{V_{ref}}R_2$

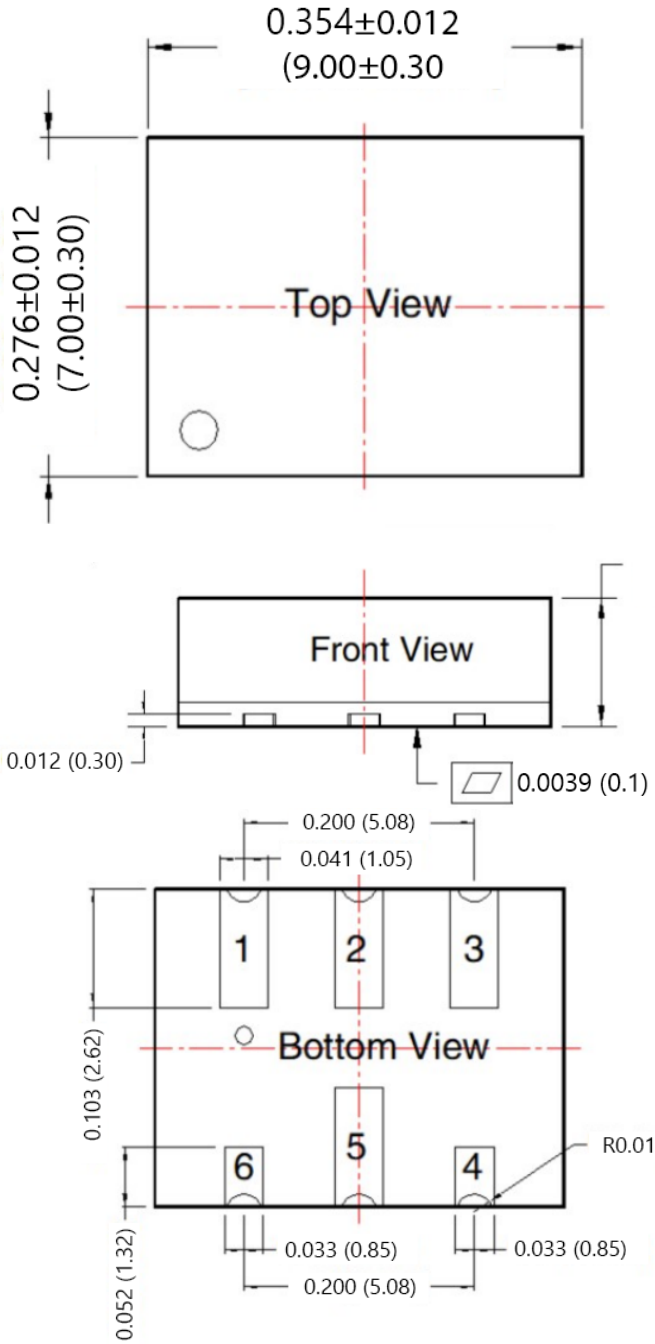
VOUT (V)	R1 (KΩ)	R2 (KΩ)	R3 (KΩ)	Vref (V)
3.3	150	33	180	0.6
5	100	13.66	82	0.6
6.5	32.4	3.3	20	0.6
9	100	7.14	47	0.6
12	100	5.28	43	0.6
15	180	7.5	51	0.6

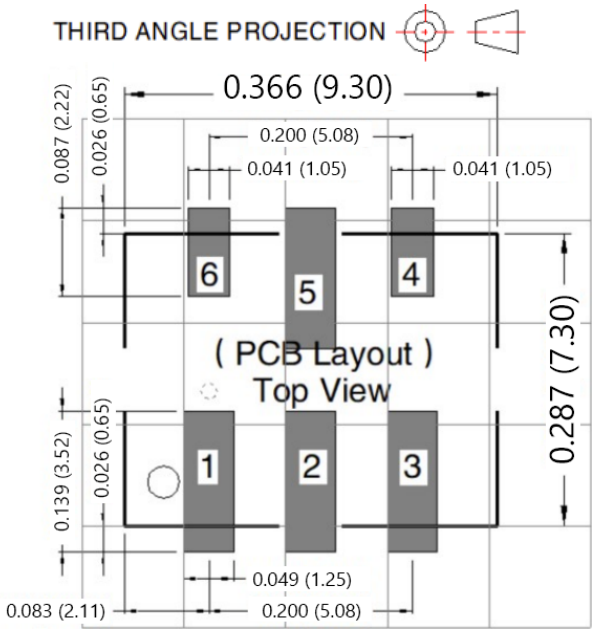
VOUT Nom.	±3.3VDC		±5VDC		±6.5VDC		±9VDC		±12VDC		±15VDC	
VOUT Trim	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)
2.97	815	-	-	-	-	-	-	-	-	-	-	-
3.63	-	117.3	-	-	-	-	-	-	-	-	-	-
4.5	-	-	710	-	-	-	-	-	-	-	-	-
5.5	-	-	-	36.2	-	-	-	-	-	-	-	-
5.85	-	-	-	-	245.4	-	-	-	-	-	-	-
7.15	-	-	-	-	-	9.5	-	-	-	-	-	-
8.1	-	-	-	-	-	-	783.2	-	-	-	-	-
9.9	-	-	-	-	-	-	-	19.9	-	-	-	-
10.8	-	-	-	-	-	-	-	-	833.5	-	-	-
13.2	-	-	-	-	-	-	-	-	-	5.5	-	-
13.5	-	-	-	-	-	-	-	-	-	-	1497	-
16.5	-	-	-	-	-	-	-	-	-	-	-	21

Temperature Rise Test PCB Layout



Mechanical Diagrams





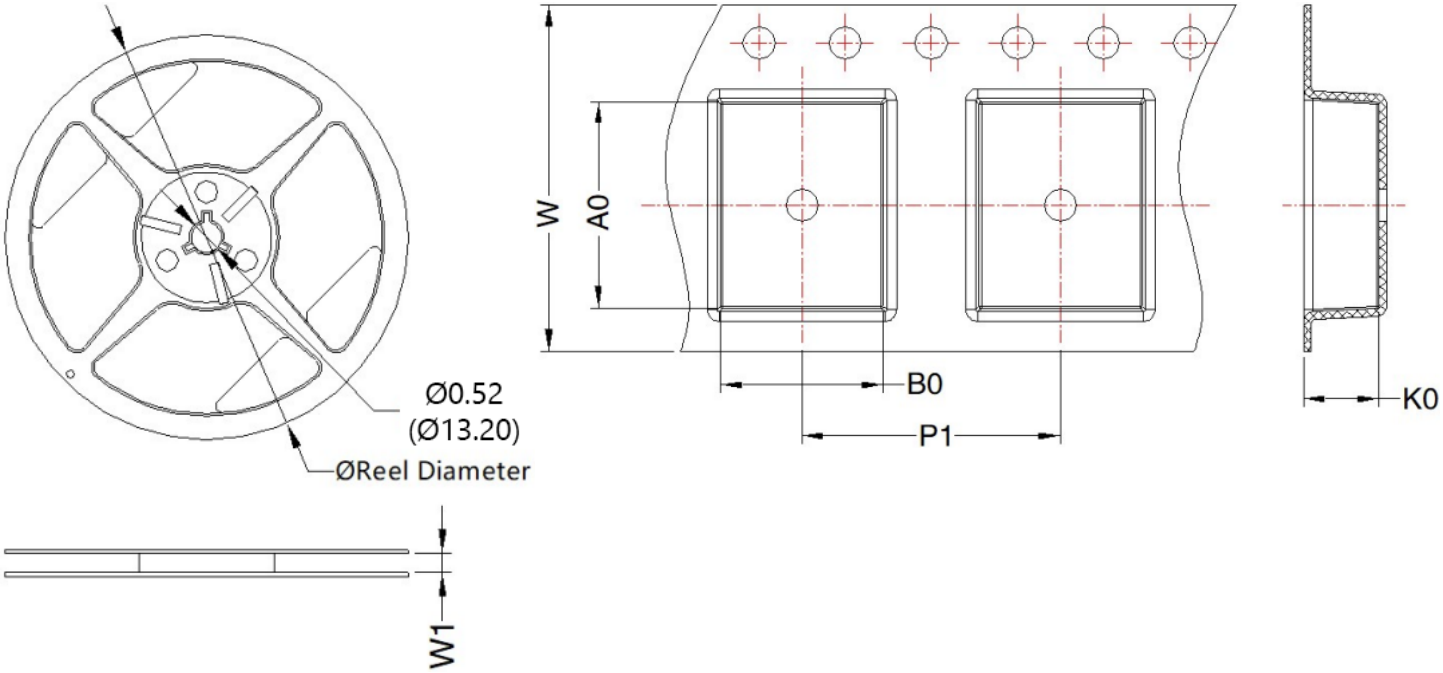
Note: Grid 2.54 x 2.54 mm

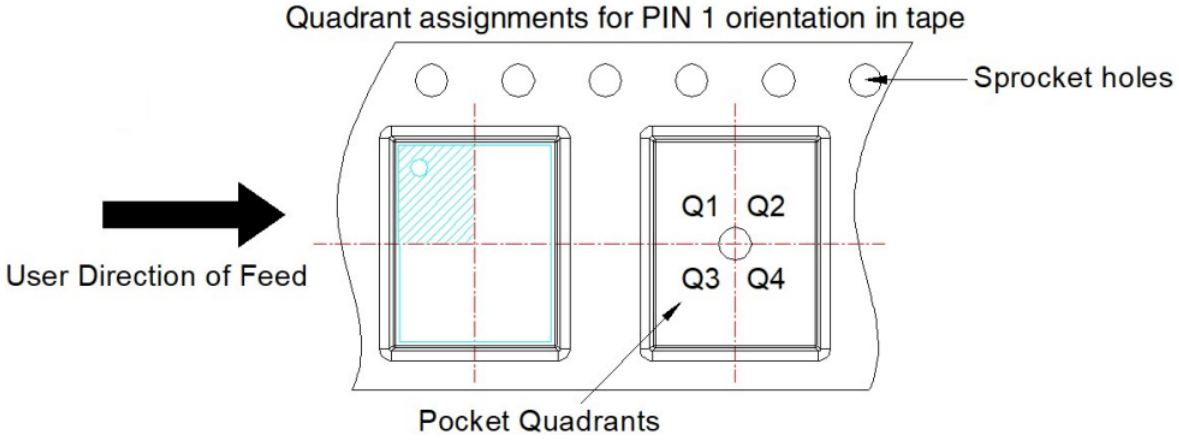
Pin	Positive Output	Negative Output
1	+Vin	+Vin
2	GND	-Vo
3	+Vo	GND
4	Trim	Trim
5	GND	-Vo
6	CTRL	CTRL

Notes:
- All dimensions are typical in inches (mm)
- General tolerances: ±0.004 (±0.10)

Weight:
- 0.020 oz (0.58g)

Tape/Reel Packaging





Package Type	Pin	MPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin 1 Quadrant
DFN 7x9	7	400	180.0	16.4	9.56	7.56	3.5	12.0	16.0	Q1