

# PRELIMINARY

Product image to come

## PRODUCT OVERVIEW

The OKY-T/10 and -T/16 series are miniature SMT non-isolated Point-of-Load (POL) DC/DC power converters for embedded applications. The module is fully compatible with Distributed-power Open Standards Alliance (DOSA) industry-standard specifications ([www.dosapower.com](http://www.dosapower.com)). Applications include powering CPU's, datacom/telecom systems, distributed bus architectures (DBA), programmable logic and mixed voltage systems.

The wide input range is 8.3 to 14 Volts DC. Two maximum output currents are offered, 10 Amps (T/10 models) or 16 Amps (T/16 models). Based on fixed-frequency synchronous buck converter

switching topology, the high power conversion efficient Point of Load (POL) module features programmable output voltage and On/Off control. An optional Sequence/Track input allows controlled ramp-up and ramp-down outputs. The Sense input provides load compensation. These converters also include under voltage lock out (UVLO), output short circuit protection, over-current and over temperature protections.

These units are designed to meet all standard UL/EN/IEC 60950-1 safety and FCC EMI/RFI emissions certifications and RoHS-6 hazardous substance compliance.

## FEATURES

- Point-of-Load (POL) converters for distributed Bus architectures
- Wide 8.3-14 VDC input range
- Non-isolated output adjustable from 0.7525 to 3.6/5.5 Volts up to 16 Amps
- DOSA-compatible SMT package
- Sequence and track operation for phased startup
- Outstanding thermal performance and derating
- Extensive self-protection and short circuit features with no output reverse conduction
- On/Off control and trim functions
- High efficiency up to 94.5% with no heatsink
- Fully protected against temperature and voltage limits
- Designed to meet UL/EN/IEC 60950-1 safety approvals.

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### Simplified Block Diagram

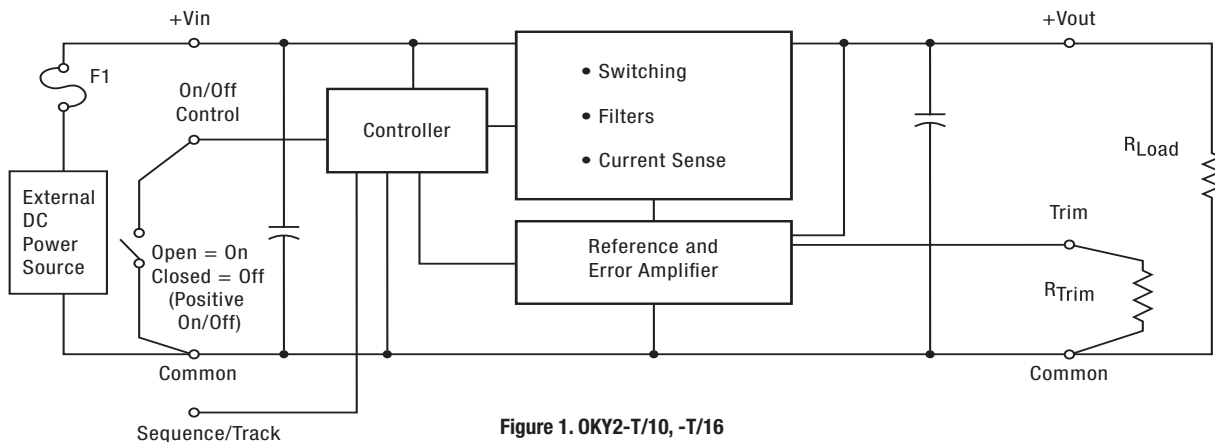


Figure 1. OKY2-T/10, -T/16

Note: Murata Power Solutions strongly recommends an external input fuse, F1. See specifications.



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## Performance Specifications and Ordering Guide

ORDERING GUIDE																
Model Number ③	Output						Input				Efficiency		On/Off Polarity	Sequence/Track	Package, C83	
	V <sub>OUT</sub> (Volts)	I <sub>OUT</sub> (Amps max)	Power (Watts)	R/N (mVp-p)	Regulation (Max.)		V <sub>IN</sub> Nom. (Volts)	Range (Volts)	I <sub>IN</sub> , no load (mA)	I <sub>IN</sub> , full load (Amps)	Min.	Typ.			Case ①	Pinout
				Max. ⑤	Line	Load										
OKY-T/10-D12P-C	0.7525-5.5	10	50	40	±0.15%	±0.25%	12	8.3-14	80	4.41	93%	94.5%	Pos.	No	1.3x0.53x0.33 (33x13.5x8.4)	P66
OKY-T/10-D12N-C	0.7525-5.5	10	50	40	±0.15%	±0.25%	12	8.3-14	80	4.41	93%	94.5%	Neg.	No	1.3x0.53x0.33 (33x13.5x8.4)	P66
OKY2-T/10-D12P-C	0.7525-5.5	10	50	40	±0.15%	±0.25%	12	8.3-14	80	4.41	93%	94.5%	Pos.	Yes	1.3x0.53x0.33 (33x13.5x8.4)	P66
OKY2-T/10-D12N-C	0.7525-5.5	10	50	40	±0.15%	±0.25%	12	8.3-14	80	4.41	93%	94.5%	Neg.	Yes	1.3x0.53x0.33 (33x13.5x8.4)	P66
OKY-T/16-D12P-C	0.7525-5.5	16	80	40	±0.22%	±0.25%	12	8.3-14	80	7.09	92.5%	94%	Pos.	No	1.3x0.53x0.33 (33x13.5x8.4)	P66
OKY-T/16-D12N-C	0.7525-5.5	16	80	40	±0.22%	±0.25%	12	8.3-14	80	7.09	92.5%	94%	Neg.	No	1.3x0.53x0.33 (33x13.5x8.4)	P66
OKY2-T/16-D12P-C	0.7525-5.5	16	80	40	±0.22%	±0.25%	12	8.3-14	80	7.09	92.5%	94%	Pos.	Yes	1.3x0.53x0.33 (33x13.5x8.4)	P66
OKY2-T/16-D12N-C	0.7525-5.5	16	80	40	±0.22%	±0.25%	12	8.3-14	80	7.09	92.5%	94%	Neg.	Yes	1.3x0.53x0.33 (33x13.5x8.4)	P66

① Dimensions are in inches (mm).

② The input voltage range must be 13.2 Volts max. for V<sub>out</sub> >= 3.63 V.

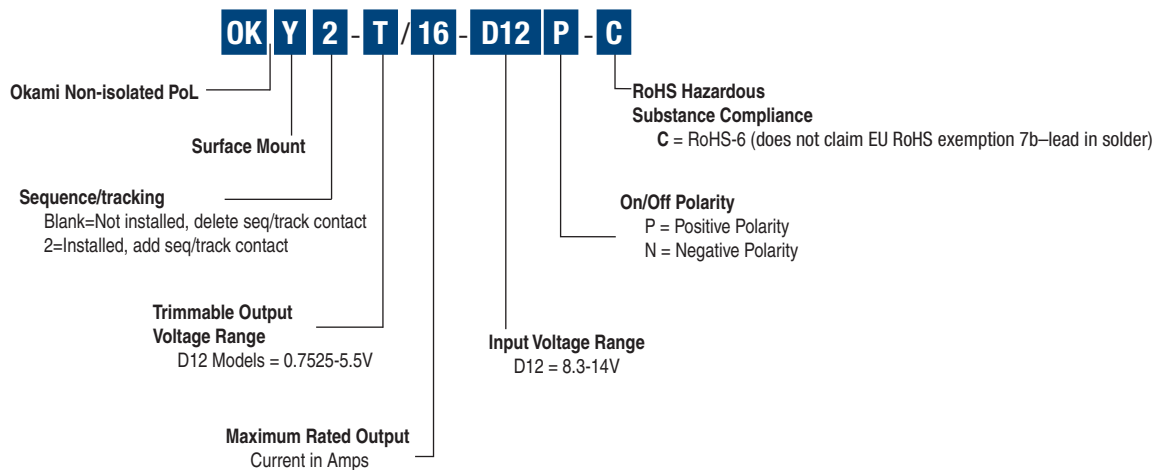
③ All specifications are at nominal line voltage, V<sub>out</sub>=nominal (5V for D12 models) and full load, +25 deg.C, unless otherwise noted.

Output capacitors are 1 µF ceramic and 10 µF electrolytic in parallel. Input cap is 22 µF. See detailed specifications. I/O caps are necessary for our test equipment and may not be needed for your application.

④ Use adequate ground plane and copper thickness adjacent to the converter.

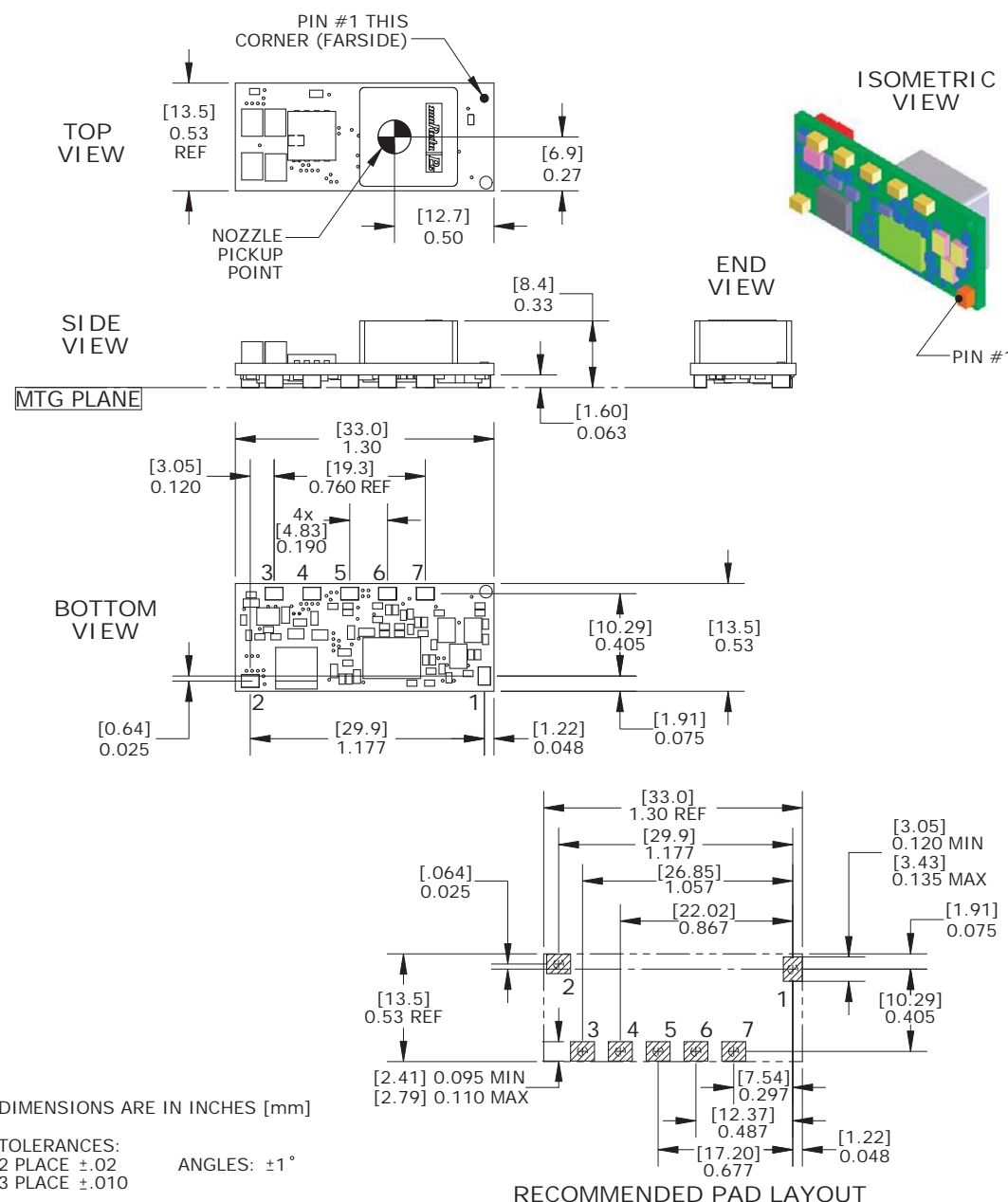
⑤ Ripple and Noise (R/N) is shown at V<sub>out</sub>=1V. See specs for details.

### PART NUMBER STRUCTURE



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**MECHANICAL SPECIFICATIONS**



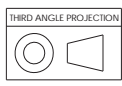
DIMENSIONS ARE IN INCHES [mm]

TOLERANCES:  
 2 PLACE ±.02      ANGLES: ±1°  
 3 PLACE ±.010

COMPONENTS SHOWN ARE FOR REFERENCE ONLY

MATERIAL:  
 SMT PINS: COPPER ALLOY

FINISH: (ALL PINS)  
 GOLD (5u"MIN) OVER NICKEL (50u" MIN)



I/O CONNECTIONS	
Pin	Function P66
1	On/Off Control *
2	+Vin
3	Vtrack Seq**
4	Gnd (Common)
5	+Vout
6	Trim
7	Sense

\* The Remote On/Off can be provided with either positive (P suffix) or negative (N suffix) polarity.  
 \*\* Vtrack Seq applies only to OKY2 models. No connection for OKY models.

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## Performance and Functional Specifications

See Note 1

Input	
Input Voltage Range	See Ordering Guide and Note 7.
Start-Up Voltage	7.75V (OKY2-T/16-D12)
Undervoltage Shutdown (see Note 15)	7.50V typ. (OKY2-T/16-D12)
Overvoltage Shutdown	None
Reflected (Back) Ripple Current (Note 2)	20 mA pk-pk
Internal Input Filter Type	Capacitive
Recommended External Fuse	20A
Reverse Polarity Protection	N/A. See fuse information
Input Current:	
Full Load Conditions	See Ordering Guide
Inrush Transient	0.4 A <sup>2</sup> Sec.
Shutdown Mode (Off, UV, OT)	5 mA
Output in Short Circuit	60 mA
No Load	80 mA
Low Line (Vin=Vmin, Vout=Vnom)	13.52 A. (OKY2-T/16-D12)
Remote On/Off Control (Note 5)	
Negative Logic ("N" model suffix)	ON = Open pin or ground to +0.3V. max. OFF = +2.5V min. to + Vin (max)
Positive Logic ("P" model suffix)	ON = Open pin to +Vin max. (internally pulled up) OFF = Ground pin to +0.3V. max.
Current	1 mA max.
Tracking/Sequencing	
Slew Rate	2 Volts per millisecond, max.
Tracking accuracy, rising input	Vout = +/-100 mV of Sequence In
Tracking accuracy, falling input	Vout = +/-200 mV of Sequence In
General and Safety	
Efficiency	See Ordering Guide
Switching Frequency	300 KHz ± 25 kHz
Start-Up Time (Vin on to Vout regulated) (On/Off to Vout regulated)	8 mSec for Vout=nominal 6 mSec for Vout=nominal
Isolation	Not isolated
Safety	Designed to meet UL/cUL 60950-1, CSA-C22.2 No. 60950-1, IEC/EN 60950-1
Calculated MTBF per Telcordia SR-322 (4a)	TBD??
Calculated MTBF per MIL-HDBK-217F (4b)	TBD??
Output	
Output Voltage Range	0.7525 to 5.5 V. (OKY2-T/16-D12)
Minimum Loading	No minimum load
Accuracy (50% load, untrimmed)	±2 % of Vnominal
Voltage Output Range (Note 13)	See Ordering Guide
Overvoltage Protection (Note 16)	None
Temperature Coefficient	±0.02% per oC of Vout range
Ripple/Noise (20 MHz bandwidth)	See Ordering Guide and note 8
Line/Load Regulation	See Ordering Guide and note 10
Maximum Capacitive Loading (Note 14)	
Cap-ESR=0.001 to 0.01 Ohms	1,000 µF
Cap-ESR >0.01 Ohms	5,000 µF
Current Limit Inception (Note 6) (98% of Vout setting, after warm up)	23 Amps (OKY2-T/16-D12)
Short Circuit Mode	
Short Circuit Current Output	2 A
Protection Method	Hiccup autorecovery upon overload removal. (Note 17)

Output, continued	
Short Circuit Duration	Continuous, no damage (output shorted to ground)
Prebias Startup	Converter will start up if the external output voltage is less than Vset
Dynamic Load Response (50-100% load step, di/dt=2.5A/µSec)	100 µSec max. to within ±2% of final value
Environmental	
Operating Temperature Range (Ambient) See derating curves	-40 to +85 deg. C. with derating (Note 9)
Operating PC Board Temperature	-40 to +100 deg. Celsius max., no derating (12)
Storage Temperature Range	-55 to +125 deg. C.
Thermal Protection/Shutdown	+130 deg. Celsius
Relative Humidity	to 85%RH/+85 deg. C., non-condensing
Physical	
Outline Dimensions	See Mechanical Specifications
Weight	0.25 ounces (6.4 grams)
Electromagnetic Interference	Designed to meet FCC part 15, class B, EN55022 and CISPR22 class B conducted and radiated (may need external filter)
Restriction of Hazardous Substances	RoHS-6 (does not claim EU RoHS exemption 7b-lead in solder)
MSL Rating	2
Absolute Maximum Ratings	
Input Voltage (Continuous or transient)	0 V to +15 Volts max. (D12 models) 0 V. to +TBD?? Volts max. (W5 models)
On/Off Control	0 V. min. to +Vin max.
Input Reverse Polarity Protection	See Fuse section
Output Current (Note 7)	Current-limited. Devices can withstand a sustained short circuit without damage. The outputs are not intended to accept appreciable reverse current.
Storage Temperature	-55 to +125 deg. C.
Lead Temperature	See soldering specifications

Absolute maximums are stress ratings. Exposure of devices to greater than any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than those listed in the Performance/Functional Specifications Table is not implied nor recommended.

### Specification Notes:

- Specifications are typical at +25 deg.C, Vin=nominal (+12V. for D12 models and +5V. for W5 models), Vout=nominal (+5V for D12 models, +3.3V. for W5 models), full load, external caps and natural convection unless otherwise indicated. Extended tests at higher power must supply substantial forced airflow. All models are tested and specified with external 1 µF paralleled with 10 µF ceramic/tantalum output capacitors and a 22 µF external input capacitor. All capacitors are low ESR types. These capacitors are necessary to accommodate our test equipment and may not be required to achieve specified performance in your applications. However, Murata Power Solutions recommends installation of these capacitors. All models are stable and regulate within spec under no-load conditions.
- Input Back Ripple Current is tested and specified over a 5 Hz to 20 MHz bandwidth. Input filtering is Cin=2 x 100 µF tantalum, Cbus=1000 µF electrolytic, Lbus=1 µH.
- Note that Maximum Power Derating curves indicate an average current at nominal input voltage. At higher temperatures and/or lower airflow, the DC/DC converter will tolerate brief full current outputs if the total RMS current over time does not exceed the Derating curve.
- Mean Time Before Failure is calculated using the Telcordia (Belcore) SR-332 Method 1, Case 3, ISSUE 2, ground fixed controlled conditions, Tambient=+25 deg.C, full output load, natural air convection.

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**Specification Notes, Cont.:**

- (4b) Mean Time Before Failure is calculated using MIL-HDBK-217F, GB ground benign, Tambient=+25 deg.C, full output load, natural air convection.
- (5) The On/Off Control Input should use either a switch or an open collector/open drain transistor referenced to -Input Common. A logic gate may also be used by applying appropriate external voltages which not exceed +Vin.
- (6) Short circuit shutdown begins when the output voltage degrades approximately 2% from the selected setting.
- (7) For W5 models, the Input Voltage must exceed the Output Voltage at all times by the ratio of Vin >= (1.15 x Vout).
- (8) Output noise may be further reduced by adding an external filter. At zero output current, the output may contain low frequency components which exceed the ripple specification. The output may be operated indefinitely with no load.
- (9) All models are fully operational and meet published specifications, including "cold start" at -40°C.
- (10) Regulation specifications describe the deviation as the line input voltage or output load current is varied from a nominal midpoint value to either extreme.
- (11) Other input or output voltage ranges will be reviewed under scheduled quantity special order.
- (12) Maximum PC board temperature is measured with the sensor in the center of the converter.
- (13) Do not exceed maximum power specifications when adjusting the output trim.
- (14) The maximum output capacitive loads depend on the the Equivalent Series Resistance (ESR) of the external output capacitor and, to a lesser extent, the distance and series impedance to the load. Larger caps will reduce output noise but may change the transient response. Newer ceramic caps with very low ESR may require lower capacitor values to avoid instability. Thoroughly test your capacitors in the application. Please refer to the Output Capacitive Load Application Note.
- (15) Do not allow the input voltage to degrade lower than the input undervoltage shutdown voltage at all times. Otherwise, you risk having the converter turn off. The undervoltage shutdown is not latching and will attempt to recover when the input is brought back into normal operating range.
- (16) The outputs are not intended to sink appreciable reverse current.
- (17) "Hiccup" overcurrent operation repeatedly attempts to restart the converter with a brief, full-current output. If the overcurrent condition still exists, the restart current will be removed and then tried again. This short current pulse prevents overheating and damaging the converter. Once the fault is removed, the converter immediately recovers normal operation.

**Output Voltage Adjustment**

The output voltage may be adjusted over a limited range by connecting an external trim resistor (Rtrim) between the Trim pin and Ground. The Rtrim resistor must be a 1/10 Watt precision metal film type, ±1% accuracy or better with low temperature coefficient, ±100 ppm/°C. or better. Mount the resistor close to the converter with very short leads or use a surface mount trim resistor.

In the tables opposite, the calculated resistance is given. Do not exceed the specified limits of the output voltage or the converter's maximum power rating when applying these resistors. Also, avoid high noise at the Trim input. However, to prevent instability, you should never connect any capacitors to Trim.

**OKY2-T/10-D12, -T/16-D12**

Output Voltage	Calculated Rtrim (KΩ)
5.0 V.	1.472
3.3 V.	3.122
2.5 V.	5.009
2.0 V.	7.416
1.8 V.	9.024
1.5 V.	13.05
1.2 V.	22.46
1.0 V.	41.424
0.7525 V.	∞ (open)

**Resistor Trim Equation, D12 models:**

$$R_{TRIM} (\Omega) = \frac{10500}{V_{OUT} - 0.7525V} - 1000$$

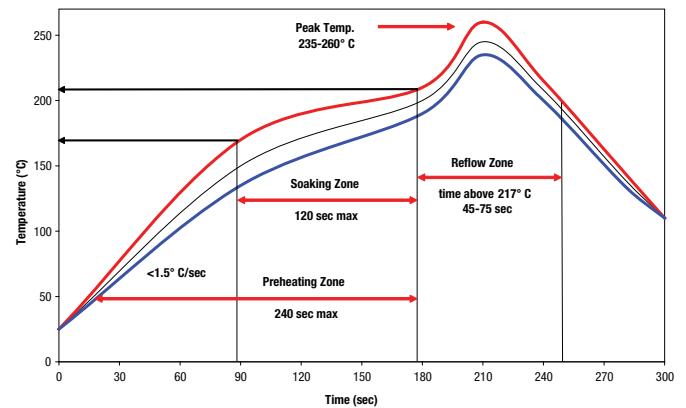
**Soldering Guidelines**

Murata Power Solutions recommends the specifications below when installing these converters. These specifications vary depending on the solder type. Exceeding these specifications may cause damage to the product. Be cautious when there is high atmospheric humidity. We strongly recommend a mild pre-bake (100 °C. for 30 minutes). Your production environment may differ therefore please thoroughly review these guidelines with your process engineers.

**Reflow Solder Operations for surface-mount products (SMT)**

For Sn/Ag/Cu based solders:	
Preheat Temperature	Less than 1 °C. per second
Time over Liquidus	45 to 75 seconds
Maximum Peak Temperature	260 °C.
Cooling Rate	Less than 3 °C. per second
For Sn/Pb based solders:	
Preheat Temperature	Less than 1 °C. per second
Time over Liquidus	60 to 75 seconds
Maximum Peak Temperature	235 °C.
Cooling Rate	Less than 3 °C. per second

**Recommended Lead-free Solder Reflow Profile**

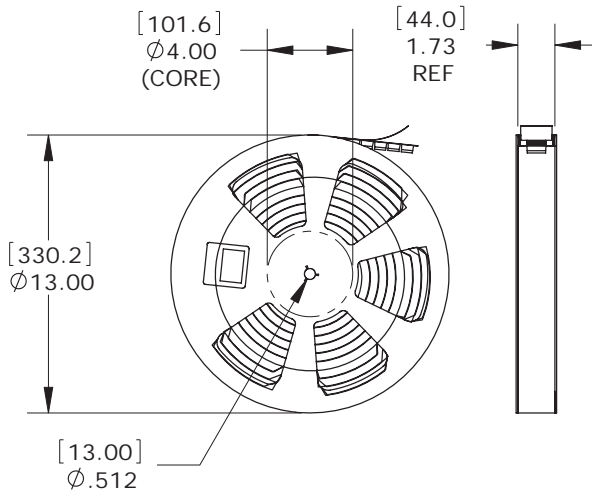
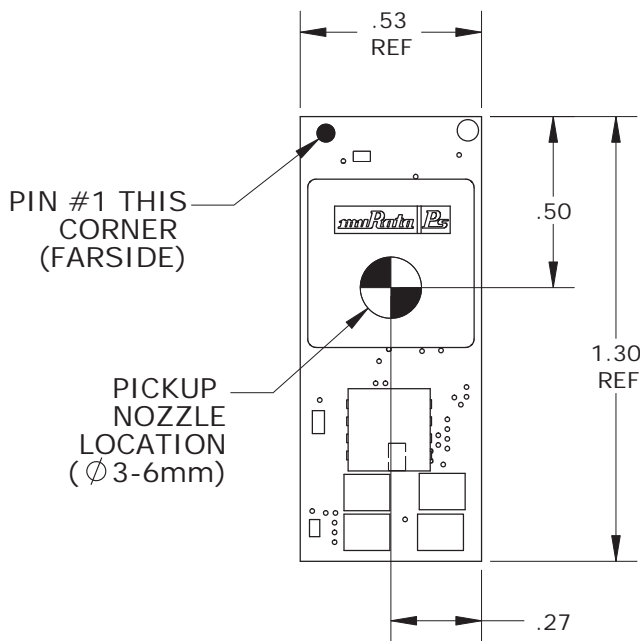
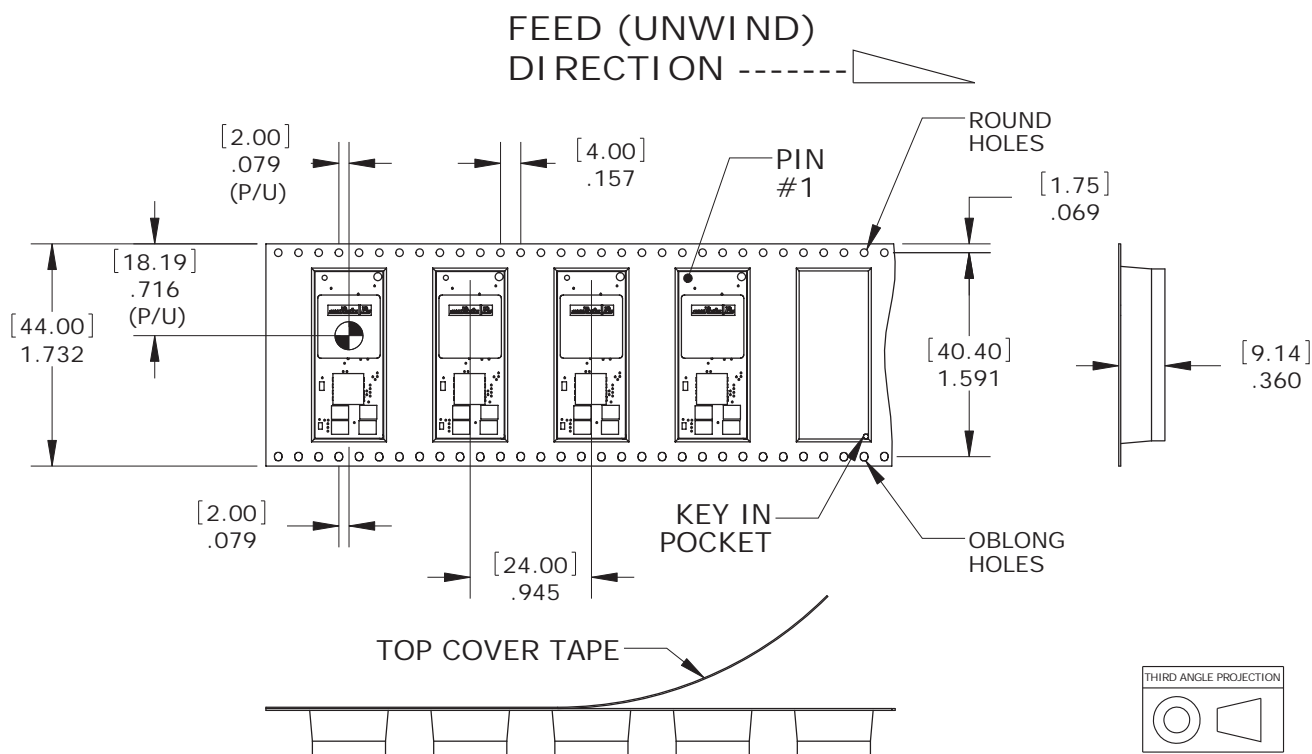


High trace = normal upper limit

Low trace - normal lower limit

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**TAPE & REEL INFORMATION**



**REEL INFORMATION  
(250 UNITS PER REEL)**

**PICK & PLACE PICKUP (P/U)**

