DELPHI SERIES

FEATURES

- Efficiency up to 83%
- Industry standard form factor and pinout
- Case size:
  33.4 x20.6 x10.2mm (1.31” x0.81” x0.40”)
- Input: 12V, 24V, 48V (2:1)
- Output: 3.3, 5, 12, 15, ±5, ±12, ±15V
- Remote on/off
- Low ripple and noise
- Short circuit protection
- 1500V isolation
- Mositure Sensitity Level (MSL) 2
- UL 94V-0 Package Material
- ISO 9001 and ISO14001 certified manufacturing facility

Delphi DSKW3000 Series DC/DC Power Modules: 24, 48Vin, 5W SMD

The Delphi DSKW3000, 24V and 48V 4:1 wide input, single or dual output, SMD form factor, isolated DC/DC converter is the latest offering from a world leader in power systems technology and manufacturing — Delta Electronics, Inc. The DSKW2000 series operate from 24V or 48V (4:1) and provides 3.3V, 5V, 12V, or 15V of single output or ±5V, ±12V, or ±15V of dual output in an industrial standard, plastic case encapsulated SMD package. This series provides up to 5W of output power with 1500V isolation and a typical full-load efficiency up to 83%. With creative design technology and optimization of component placement, these converters possess outstanding electrical and thermal performance, as well as extremely high reliability under highly stressful operating conditions.

OPTIONS

APPLICATIONS

- Industrial
- Transportation
- Process/ Automation
- Telecom
- Data Networking

Delta Electronics, Inc.

TECHNICAL SPECIFICATIONS

T_A = 25°C, airflow rate = 0 LFM, nominal Vin, nominal Vout, resistive load unless otherwise noted.

PARAMETER	NOTES and CONDITIONS	DSKW3000 (Standard)			
		Min.	Typ.	Max.	Units
ABSOLUTE MAXIMUM RATINGS					
Input Voltage					
Transient	24V input model, 1000ms	-0.7		50	Vdc
Transient	48V input model, 1000ms	-0.7		100	Vdc
Internal Power Dissipation				2500	mW
Operating Temperature	Ambient	-40		85	°C
	Case	-40		90	°C
Storage Temperature		-40		125	°C
Humidity				95	%
Lead Temperature in Assembly	1.5mm from case for 10 seconds			260	°C
Input/Output Isolation Voltage		1500			Vdc
INPUT CHARACTERISTICS					
Operating Input Voltage	24V model	18	24	36	
	48V model	36	48	75	Vdc
Turn-On Voltage Threshold	24V model	7	8	9	Vdc
	48V model	14	16	18	Vdc
Turn-Off Voltage Threshold	24V model	6	7	8	Vdc
	48V model	13	15	17	Vdc
Maximum Input Current	Please see Model List table on page 6				
No-Load Input Current	24V model		20		mA
	48V model		10		mA
Input Reflected Ripple Current	24V model		15		mA
	48V model		10		mA
Short Circuit Input Power	All models		1	3	W
Reverse Polarity Input Current				1	A
OUTPUT CHARACTERISTICS					
Output Voltage Set Point Accuracy			±0.5	±2.0	%
Output Voltage Balance	Dual output models		±0.5	±3.0	%
Output Voltage Regulation					
Over Load	Io=10% to 100%		±0.3	±1.0	%
Over Line	Vin= min to max		±0.2	±1.0	%
Over Temperature	Tc=-40°C to 100°C		±0.01	±0.02	%/C
Output Voltage Ripple and Noise	5Hz to 20MHz bandwidth				
Peak-to-Peak	Full Load, 0.47µF ceramic		50	85	mV
Peak-to-Peak, over line, load, temperature	Full Load, 0.47µF ceramic			100	mV
RMS	Full Load, 0.47µF ceramic			15	mV
Output Over Current/Power Protection	Auto restart	115			%
Output Short Circuit	Continuous				
Output Voltage Current Transient					
Step Change in Output Current	25% step change		±2	±6	%
Settling Time (within 1% Vout nominal)			250	500	uS
Maximum Output Capacitance	3.3V and 5V output			2000	µF
	12V output			470	µF
	15V output			330	µF
	±5V output, each output			680	µF
	±12V output, each output			330	µF
	±15V output, each output			220	µF
EFFICIENCY					
100% Load	Please see Model List table on page 6				
ISOLATION CHARACTERISTICS					
Isolation Voltage	Input to output, 60 Seconds	1500			Vdc
Isolation Voltage Test	Flash Test for 1 seconds	1650			Vdc
Isolation Resistance	500VDC	1000			MΩ
Isolation Capacitance	100KHz, 1V		650	750	pF
FEATURE CHARACTERISTICS					
Switching Frequency			340		kHz
ON/OFF Control					
Logic Low (module is off)	Von/off at Ion/off=1.0mA	-0.7		0.8	V
Logic High (module is on)	Von/off at Ion/off=0.0 µA	2.5		5.5	V
ON/OFF Current	Logic High, Von/off=max			10	mA
Leakage Current	Ion/off at Von/off=0.0V			-700	uA
GENERAL SPECIFICATIONS					
MTBF	MIL-HDBK-217F; Ta=25°C, Ground Benign	1			M hours
Weight			14		grams
Case Material	Non-conductive black plastic				
Flammability	UL94V-0				
Input Fuse	24V model, 1500mA slow blown type				
	48V model, 750mA slow blown type				

ELECTRICAL CHARACTERISTICS CURVES

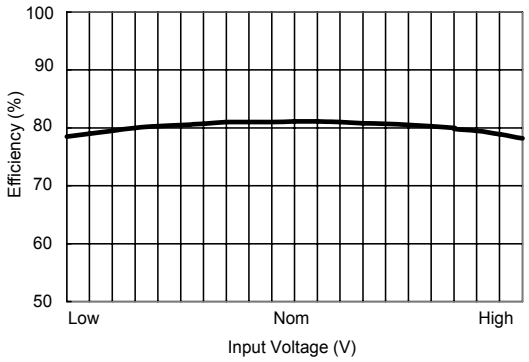


Figure 1: *Efficiency vs. Input Voltage (Single Output)*

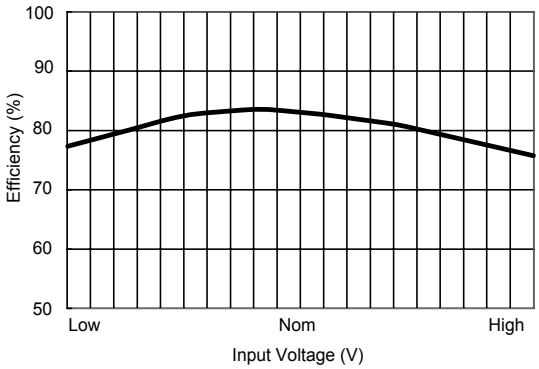


Figure 2: *Efficiency vs. Input Voltages (Dual Output)*

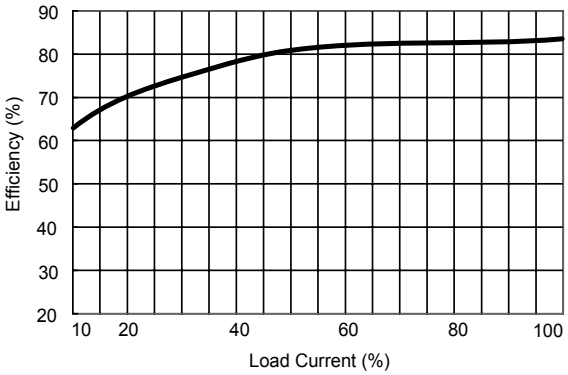


Figure 3: *Efficiency vs. Output Load (Single Output)*

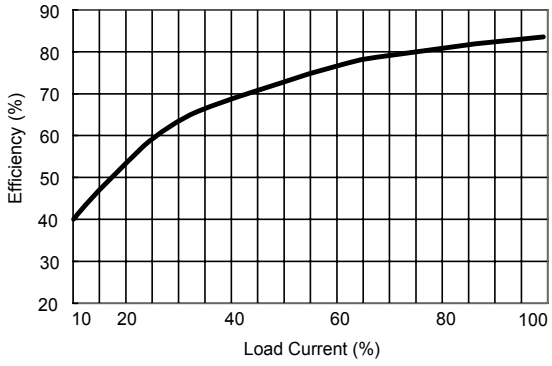
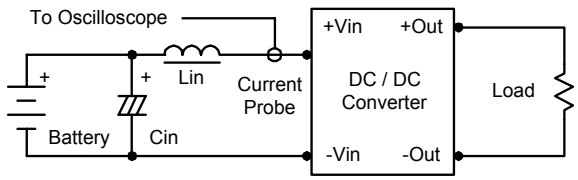


Figure 4: *Efficiency vs. Output Load (Dual Output)*

Test Configurations

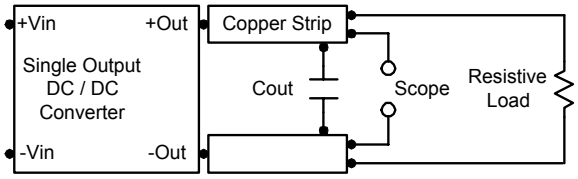
Input Reflected-Ripple Current Test Setup

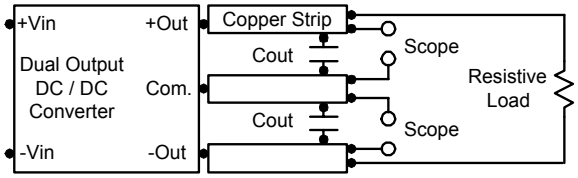


Input reflected-ripple current is measured with a inductor Lin (4.7uH) and Cin (220uF, ESR < 1.0Ω at 100 KHz) to simulate source impedance. Capacitor Cin is to offset possible battery impedance. Current ripple is measured at the input terminals of the module and measurement bandwidth is 0-500 KHz.

Peak-to-Peak Output Noise Measurement

Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC/DC Converter. A Cout of 0.47uF ceramic capacitor is placed between the terminals shown below.





Design & Feature Considerations

The DSKW3000 circuit block diagrams are shown in Figures 5 and 6.

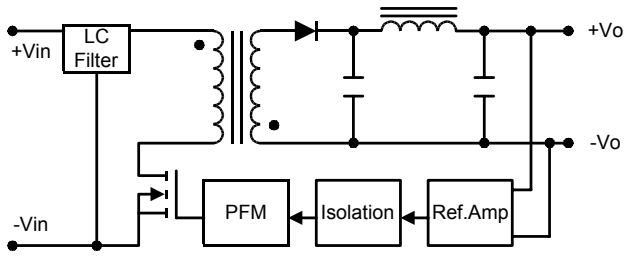


Figure 5: *Block diagram of DSKW3000 single output modules.*

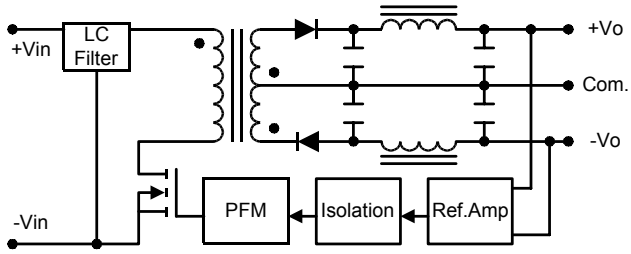
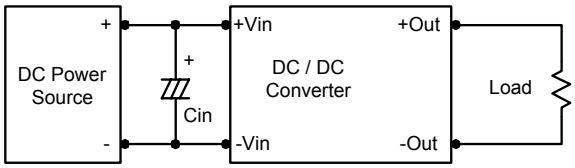


Figure 6: *Block diagram of DSKW3000 dual output modules*

Input Source Impedance

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.



In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.

Capacitor mounted close to the input of the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 KHz) capacitor of a 2.2uF for the 24V and 48V devices.

Design & Feature Considerations

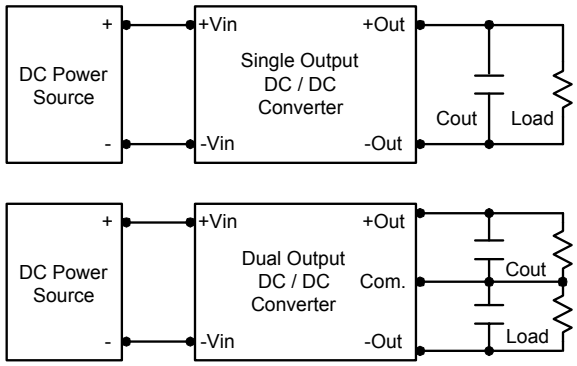
Maximum Capacitive Load

The DSKW3000 series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time.

Output Ripple Reduction

A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance.

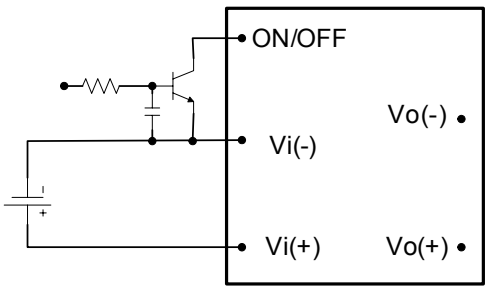
To reduce output ripple, it is recommended to use 3.3uF capacitors at the output.



Remote On/Off

The DSKW3000 has positive remote on/off logic. Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low.

Remote on/off can be controlled by an external switch between the on/off terminal and the -Vin terminal. The switch can be an open collector or equivalent.



Overcurrent Protection

To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally once the output current is brought back into its specified range.

Soldering and Cleaning Considerations

Post solder cleaning is usually the final board assembly process before the board or system undergoes electrical testing. Inadequate cleaning and/or drying may lower the reliability of a power module and severely affect the finished circuit board assembly test. Adequate cleaning and/or drying is especially important for un-encapsulated and/or open frame type power modules. For assistance on appropriate soldering and cleaning procedures, please contact Delta's technical support team.

Notes:

1. These power converters require a minimum output load to maintain specified regulation (please see page 6 for the suggested minimum load). Operation under no-load conditions will not damage these modules; however, they may not meet all specifications listed above.

2. These DC/DC converters should be externally fused at the front end for protection.

THERMAL CONSIDERATIONS

Thermal management is an important part of the system design. To ensure proper, reliable operation, sufficient cooling of the power module is needed over the entire temperature range of the module. Convection cooling is usually the dominant mode of heat transfer.

Hence, the choice of equipment to characterize the thermal performance of the power module is a wind tunnel.

Thermal Testing Setup

Delta's DC/DC power modules are characterized in heated vertical wind tunnels that simulate the thermal environments encountered in most electronics equipment. This type of equipment commonly uses vertically mounted circuit cards in cabinet racks in which the power modules are mounted.

The following figure shows the wind tunnel characterization setup. The power module is mounted on a test PWB and is vertically positioned within the wind tunnel. The space between the facing PWB and PWB is constantly kept at 25.4mm (1'').

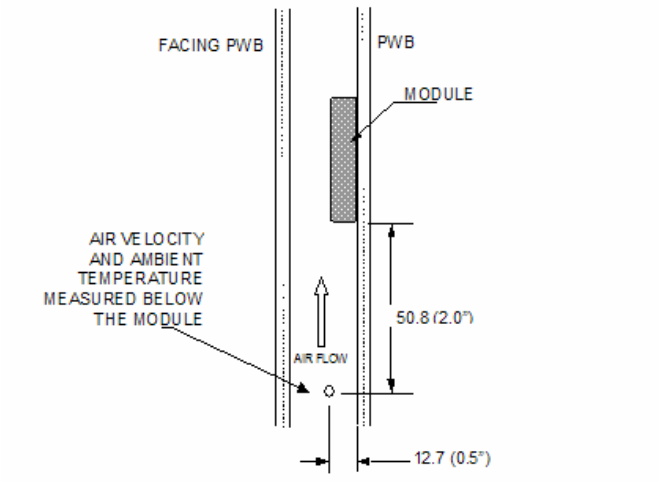


Figure 7: *Wind tunnel test setup*

Thermal Derating

Heat can be removed by increasing airflow over the module. To enhance system reliability, the power module should always be operated below the maximum operating temperature. If the temperature exceeds the maximum module temperature, reliability of the unit may be affected.

THERMAL CURVES

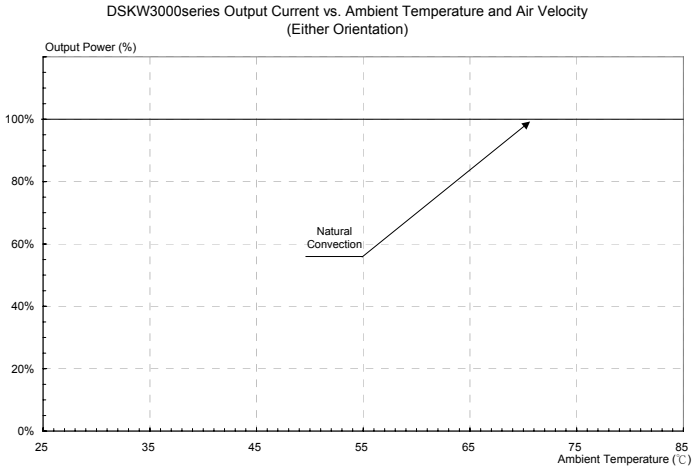
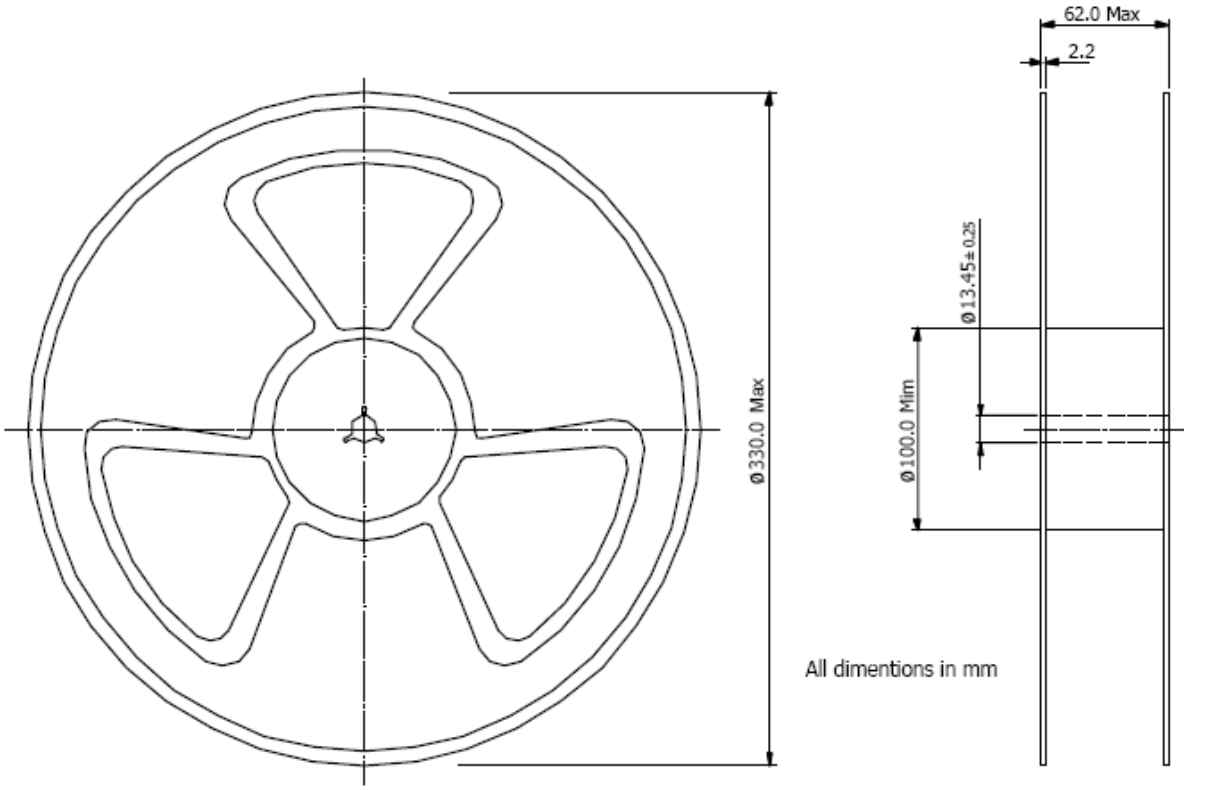


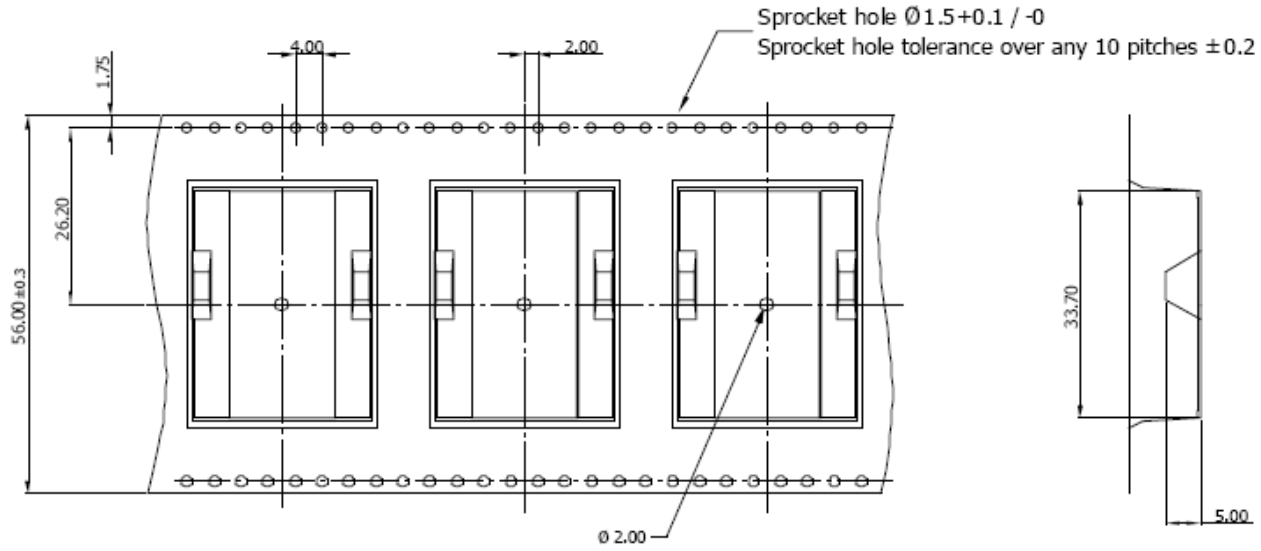
Figure 8: *Derating Curve*

MODEL LIST

MODEL NAME	INPUT		OUTPUT			Full Load Efficiency
	Vdc (V)	Max (mA)	Vdc (V)	Max (mA)	Min (mA)	%
DSKW3021	24 (9 ~ 36)	217	3.3	1200	120	76
DSKW3022		260	5	1000	100	80
DSKW3023		251	12	417	42	83
DSKW3024		251	15	333	33	83
DSKW3025		260	±5	±500	±50	80
DSKW3026		251	±12	±208	±21	83
DSKW3027		252	±15	±167	±17	83
DSKW3031	48 (18 ~ 75)	109	3.3	1200	120	76
DSKW3032		130	5	1000	100	80
DSKW3033		126	12	417	42	83
DSKW3034		125	15	333	33	83
DSKW3035		130	±5	±500	±50	80
DSKW3036		125	±12	±208	±21	83
DSKW3037		126	±15	±167	±17	83

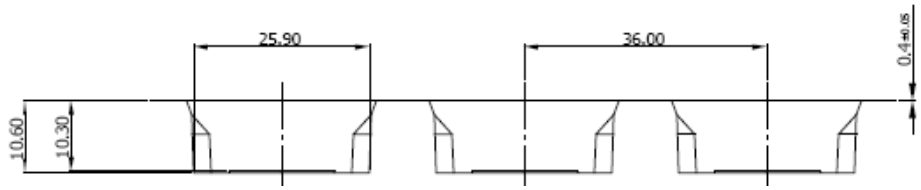
PACKAGE: TAPE & REEL



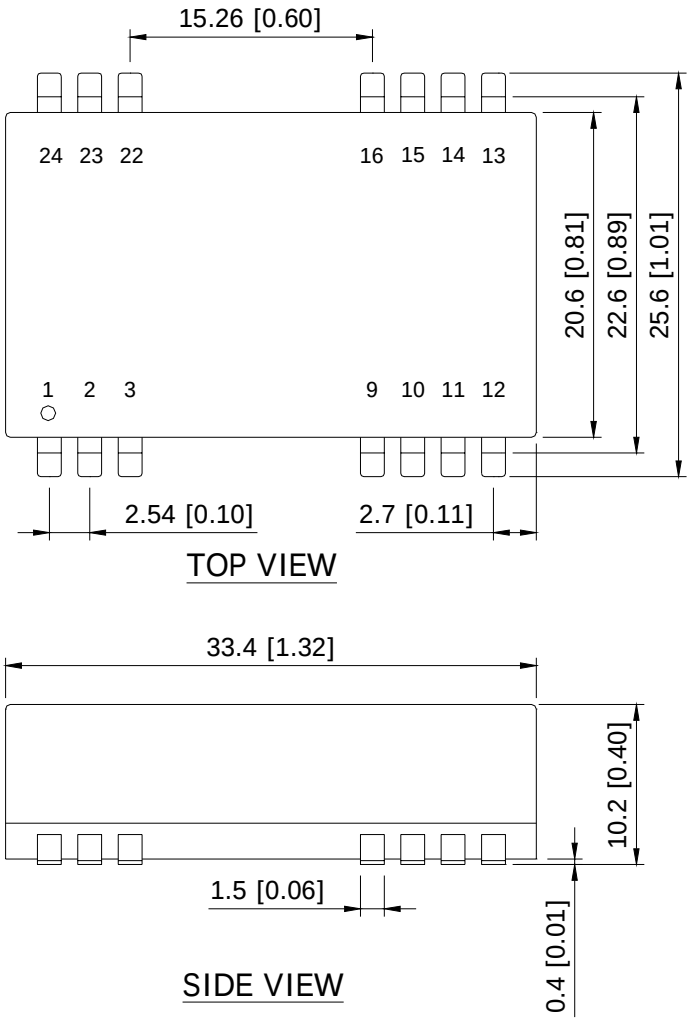


All dimenions in mm
XX.XX± 0.1

Direction of Unreeling



MECHANICAL DRAWING



Pin	Single Output	Dual Output
1	On/Off	On/Off
2	-Vin	-Vin
3	-Vin	-Vin
9	NC	Common
10	NC	NC
11	NC	-Vout
12	NC	NC
13	NC	NC
14	+Vout	+Vout
15	NC	NC
16	-Vout	Common
22	+Vin	+Vin
23	+Vin	+Vin
24	NC	NC

NOTES:
DIMENSIONS ARE IN MILLIMETERS AND (INCHES)
TOLERANCES: X.Xmm±0.5mm(X.XX in.±0.02 in.)
X.XXmm±0.25mm(X.XXX in.±0.010 in.)

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WARRANTY

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