



This family of triple output DC/DC converters was developed for xDSL line card applications. Two independently regulated converters in a 2" x 2" x 0.5" plastic package offer 3.3V @ 4.25A and  $\pm 12V @ \pm 625mA$  or  $\pm 15V @ \pm 500mA$ .

## FEATURES

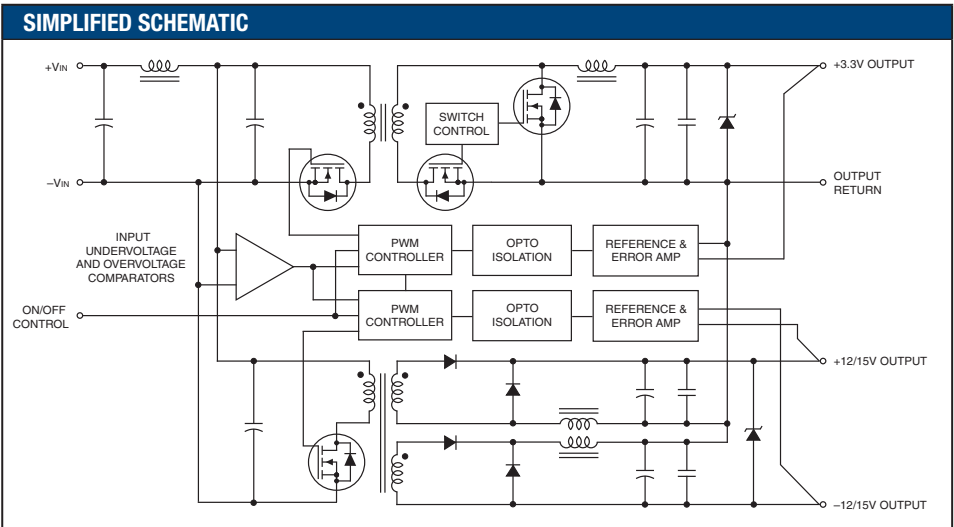
- Independently regulated 3.3V and  $\pm 12V$  or  $\pm 15V$  outputs
- 3.3V @ 4.25A and  $\pm 12V @ \pm 625mA$  or  $\pm 15V @ \pm 500mA$
- 30 Watts output power
- 87% efficiency; 75mV ripple/noise
- Input ranges: 18-36V or 36-75V
- 2" x 2" plastic package
- Designed to meet UL 1950 and EN60950 safety approvals
- Fully isolated, 1500Vdc guaranteed
- Basic Insulation transformer construction
- Input under and overvoltage shutdown
- Independent OVP; Short circuit protection
- Thermal shutdown

## PRODUCT OVERVIEW

Unlike topologies that provide auxiliary bipolar secondary voltages, the TWR-3.3/4250-12/625 and TWR-3.3/4250-15/500 have fully regulated bipolar control loops that offer the same  $\pm 1\%$  load regulation seen on the 3.3V primary output.

Available with input ranges of 18 to 36V (-D24), or 36 to 75V (-D48), this TWR series offers 87% efficiency,  $\pm 1\%$  line regulation, input overvoltage and undervoltage shutdown circuitry, output overvoltage and short circuit protection, as well as current limiting protection and thermal shutdown.

TWR triple output converters will deliver full output power in ambient, still air environments ranging from  $-40$  to  $+65^\circ C$ . Designed using Basic Insulation transformer construction, this family of converters guarantees 1500Vdc of isolation voltage and meets IEC950, UL1950 and EN60950 safety standards. "D48" models are CE marked (meet LVD requirements).



Typical topology is shown



PERFORMANCE SPECIFICATIONS AND ORDERING GUIDE ①												
Model Family	Output						Input			Efficiency <sup>⑤</sup>		Package (Case/ Pinout)
	V <sub>OUT</sub> (V)	I <sub>OUT</sub> ② (mA)	R/N (mVp-p) ③		Regulation		V <sub>IN</sub> Nom. (Volts)	Range (Volts)	I <sub>IN</sub> ④ (mA)	Min.	Typ.	
			Typ.	Max.	Line	Load ④						
TWR-3.3/4250-12/625-D24	3.3	4250	75	125	±1.0%	±1.0%	24	18-36	100/1420	83%	85%	C22/P31
	±12	±625	100	150	±1.0%	±1.0%						
TWR-3.3/4250-12/625-D48	3.3	4250	75	125	±1.0%	±1.0%	48	36-75	50/700	84%	86%	C22/P31
	±12	±625	100	150	±1.0%	±1.0%						
TWR-3.3/4250-15/500-D24	3.3	4250	75	125	±1.0%	±1.0%	24	18-36	100/1420	84%	85%	C22/P31
	±15	±500	100	150	±1.0%	±1.0%						
TWR-3.3/4250-15/500-D48	3.3	4250	75	125	±1.0%	±1.0%	48	36-75	50/700	84%	86%	C22/P31
	±15	±500	100	150	±1.0%	±1.0%						

① Typical at T<sub>A</sub> = +25°C under nominal line voltage and maximum output currents.

② Any combination of +3.3V and ±12V/±15V rated output current, not to exceed the published I<sub>OUT</sub> specification (30 Watts).

③ Ripple/Noise (R/N) measured over a 20MHz bandwidth, specified with 0.2µF ceramic output capacitors.

④ Tested from 10% load to 100% load, other outputs at maximum load.

⑤ Nominal line voltage, no-load/full-load conditions.

**PART NUMBER STRUCTURE**

**TWR-3.3/4250-12/625-D48-C**

**Output Configuration:**  
T = Triple

**Wide Range Input**

**Nominal Primary Output:**  
Voltage (+3.3V)

**Maximum Primary Output**  
Current in mA

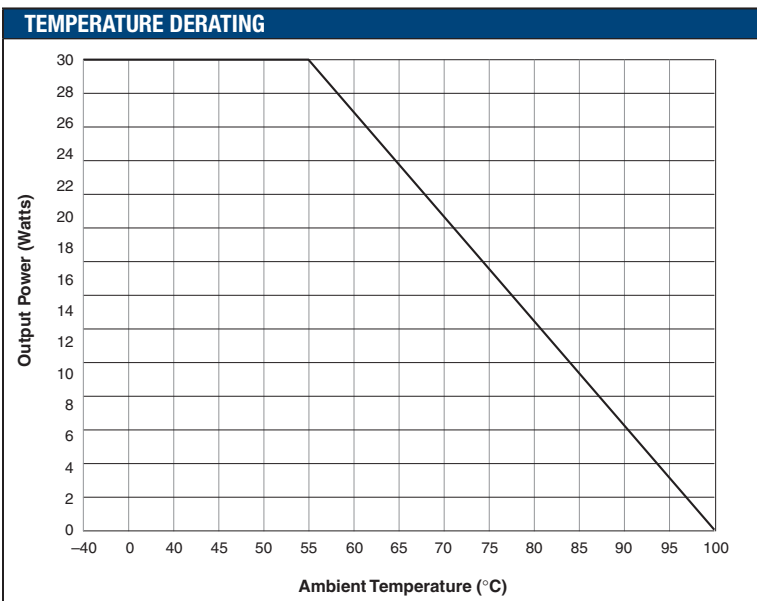
**Nominal Auxiliary Output:**  
Voltages (±12 or ±15V)

**RoHS-6 hazardous substance compliant\***

**Input Voltage Range:**  
D24 = 18-36V (24V nominal)  
D48 = 36-75V (48V nominal)

**Maximum Auxiliary Output:**  
Currents in mA from each output

\* Contact Murata Power Solutions Technologies for availability.



**MECHANICAL SPECIFICATIONS**

**Case C22**

PLASTIC CASE

STANDOFF 0.020 (0.51)

0.48 (12.19)

0.20 MIN (5.08)

0.040 ±0.001 DIA. (1.016 ±0.025)

1.800 (45.72)

0.10 (2.54)

0.200 (5.08)

1.200 (30.48)

3 EQ. SP. @ 0.400 (10.16)

2.00 (50.8)

0.40 (10.16)

0.100 (2.54)

0.400 (10.16)

1, 2, 4, 5, 6, 7, 8

**BOTTOM VIEW**

DIMENSIONS ARE IN INCHES (MM)

**INPUT/OUTPUT CONNECTIONS**

Pin	Function P31
1	+Input
2	-Input
3	No Pin
4	On/Off Control
5	+12V/15V Output
6	+3.3V Output
7	Common
8	-12V/15V Output

Dimensions are in inches (mm shown for ref. only).

**Third Angle Projection**

Tolerances (unless otherwise specified):  
.XX ± 0.02 (0.5)  
.XXX ± 0.010 (0.25)  
Angles ± 2°

Components are shown for reference only.

### Performance/Functional Specifications

Typical @ T<sub>A</sub> = +25°C under nominal line voltage, full-load conditions, unless noted. ①

Input	
<b>Input Voltage Range:</b>	
D24 Models	18-36 Volts (24V nominal)
D48 Models	36-75 Volts (48V nominal)
<b>Overvoltage Shutdown:</b>	
D24 Models	37-40 Volts (38V nominal)
D48 Models	77-81 Volts (79V nominal)
<b>Start-Up Threshold:</b> ②	
D24 Models	16-18 Volts (17V nominal)
D48 Models	34-36 Volts (35V nominal)
<b>Undervoltage Shutdown:</b> ②	
D24 Models	16-17.5 Volts (16.5V nominal)
D48 Models	32-35.5 Volts (34.5V nominal)
<b>Input Current:</b>	
Normal Operating Conditions	See Ordering Guide
Standby Mode:	
Off, OV, UV, Thermal Shutdown	10mA
<b>Input Reflected Ripple Current:</b>	
Source Impedance:	
D24 Models	200mA <sub>p-p</sub> max., 140mA <sub>p-p</sub> (typ.)
D48 Models	200mA <sub>p-p</sub> max., 140mA <sub>p-p</sub> (typ.)
<b>Internal Input Filter Type</b>	Pi (0.039μF - 2.2μH - 3.3μF)
<b>Reverse-Polarity Protection:</b> ②	
D24 Models	1 minute duration, 4A maximum
D48 Models	1 minute duration, 2A maximum
<b>On/Off Control (Pin 4)</b> ②③④⑥	On = open or 13V to +V <sub>IN</sub> , I <sub>IN</sub> = 50μA @ 13V Off = 0-0.8V, I <sub>IN</sub> = 1mA @ 0V
Output	
<b>V<sub>OUT</sub> Accuracy:</b>	
3.3V Output	±1.5%
±12V/±15V Output	±2%
<b>Ripple/Noise (20MHz BW)</b> ⑤	See Ordering Guide
<b>Line/Load Regulation</b>	See Ordering Guide
<b>Efficiency</b>	See Ordering Guide
<b>Minimum Loading Per Specification:</b>	
+3.3V Output	10% of I <sub>OUT</sub> maximum
±12V/±15V Output	±30mA
<b>Minimum Loading For Stability</b> ⑧	No load
<b>Isolation Voltage:</b>	
Input-to-Output	1500Vdc minimum
Input-to-Case	Plastic case
Output-to-Case	Plastic case
<b>Isolation Capacitance</b>	470pF
<b>Isolation Resistance</b>	100MΩ
<b>Current Limit Inception:</b>	
3.3V @ 97%V <sub>OUT</sub> (±12/±15V @ I <sub>OUT</sub> max.)	5.8-7.5 Amps (model dependent)
±12V @ 97%V <sub>OUT</sub> (+3.3V @ I <sub>OUT</sub> max.)	0.825-1.35 Amps
±15V @ 97%V <sub>OUT</sub> (+3.3V @ I <sub>OUT</sub> max.)	0.625-1.15 Amps
<b>Temperature Coefficient</b>	±0.02% per °C

Output (continued)	
<b>Short Circuit Current:</b>	
3.3V Output	2.5 Amps average, continuous
±12V/±15V Output	2.0 Amps average, continuous
<b>Overvoltage Protection:</b> ②	Magnetic feedback, transorb
3.3V Output	4.2Vdc
±12V Output	30Vdc (±15V differential)
±15V Output	36Vdc (±18V differential)
<b>Maximum Capacitive Loading:</b>	
3.3V Models	1000μF
5V Models	680μF
Dynamic Characteristics	
<b>Dynamic Load Response:</b>	
3.3V (50-100% step to 2%V <sub>OUT</sub> )	300μsec maximum
±12V/±15V (50-100% step to 2%V <sub>OUT</sub> )	300μsec maximum
<b>Start-Up Time:</b> ②	
V <sub>IN</sub> to V <sub>OUT</sub> :	
3.3V	10msec
±12V/±15V	15msec
On/Off to V <sub>OUT</sub>	10msec
<b>Switching Frequency</b>	350kHz (±30kHz)
Environmental	
<b>MTBF:</b> ②	
D24 Models	TBC
D48 Models	TBC
<b>Operating Temperature (Ambient):</b> ②	
Without Derating:	
D24 Models	-40 to +55°C
D48 Models	-40 to +55°C
With Derating	To +100°C (See Derating Curves)
<b>Case Temperature:</b>	
Maximum Operational	+100°C
For Thermal Shutdown	+110°C minimum, +118°C maximum
<b>Storage Temperature</b>	-40 to +120°C
Physical	
<b>Dimensions</b>	2" x 2" x 0.5" (50.8 x 50.8 x 12.7mm)
<b>Case Material</b>	Diallyl phthalate, UL94V-0 rated
<b>Pin Material</b>	Gold plate over copper alloy
<b>Weight:</b>	2.47 ounces (70g)
<b>Primary to Secondary Insulation Level</b>	Basic

① All models are specified with external 0.2μF ceramic output capacitors.

② See Technical Notes/Graphs for details.

③ The On/Off control function can be replaced with a Sync function. See Part Number Suffixes and Technical Notes for details.

④ Applying a voltage to On/Off Control (pin 4) when no input power is applied to the converter can cause permanent damage.

⑤ Output noise may be further reduced with the installation of additional external output capacitors. See Technical Notes.

⑥ On/Off control is designed to be driven with open collector or by appropriate voltage levels. Voltages must be referenced to the input return pin (-Input).

⑦ Demonstrated MTBF available on request.

⑧ For conditions with less than minimum loading, outputs remain stable. However, regulation performance will degrade.

### Absolute Maximum Ratings

<b>Input Voltage:</b>		
Continuous:	D24A Models	42 Volts
	D48A Models	81 Volts
Transient (100msec):	D24A Models	50 Volts
	D48A Models	100 Volts
<b>Input Reverse-Polarity Protection</b> Ⓢ		
	Input Current must be limited. 1 minute duration. Fusing recommended.	
	D24A Models	4 Amps
	D48A Models	2 Amps
<b>Output Current</b> Ⓢ		
	Current limited. Devices can withstand an indefinite output short circuit.	
<b>On/Off Control (Pins 3 &amp; 4) Max. Voltages</b>		
	Referenced to –Input (pin 2)	
	No Suffix	+VIN
	"S" Suffix	+5.7 Volts
<b>Storage Temperature</b>		
	–40 to +120°C	
<b>Lead Temperature</b>		
	See soldering guidelines	

These 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.

## TECHNICAL NOTES

### I/O Filtering and Noise Reduction

All TWR 30W Series models achieve their rated ripple and noise specifications without the use of external input/output capacitors. In critical applications, input/output ripple/noise may be further reduced by installing additional external I/O caps. Input capacitors, which function primarily as energy-storage elements, should be selected for bulk capacitance, low ESR and high rms-ripple-current ratings. Output capacitors, which function more as true filter elements, should be selected for bulk capacitance, low ESR, and appropriate frequency response. All caps should have appropriate voltage ratings and be mounted as close to the converters as possible. Temperature variations for all parameters should obviously be taken into consideration.

### Input Fusing

Certain applications and/or safety agencies may require the installation of fuses at the inputs of power conversion components. Fuses should also be used if the possibility of sustained, non-current-limited, input-voltage polarity reversals exists. For DATEL TWR 30W DC/DC Converters, you should use slow-blow type fuses with values no greater than the following.

Model Number	Fuse Value
TWR-3.3/4250-12/625-D24	4 Amps
TWR-3.3/4250-12/625-D48	2 Amps
TWR-3.3/4250-15/500-D24	4 Amps
TWR-3.3/4250-15/500-D48	2 Amps

### Start-Up Threshold and Undervoltage Shutdown

Under normal start-up conditions, TWR 30W triples will not begin to regulate until the ramping input voltage exceeds the Start-Up Threshold Voltage (typically 17V for "D24" models and 35V for "D48" models). Once operating, devices will not turn off until the input voltage drops below the Undervoltage Shutdown/Lockout limit (typically 16.5V for "D24" models and 34.5V for "D48" models). Subsequent re-start will not occur until the input is brought back up to the Start-Up Threshold. This built-in hysteresis obviously avoids any indeterminate on/off conditions at a single voltage.

### Start-Up Time

For all models in the TWR 30W Series,  $V_{IN}$  to  $V_{OUT}$  Start-Up Time is the interval between the time at which a rapidly ramping input voltage crosses the turn-on threshold point and the fully loaded output voltages enter and remain within their specified accuracy bands. Actual measured times will vary with output capacitance and load.

The On/Off to  $V_{OUT}$  Start-Up Time assumes the converter is turned off via the On/Off Control with the nominal input voltage already applied to the converter. The specification defines the interval between the time at which the converter is turned on and the fully loaded output voltages enter and remain within their specified accuracy bands.

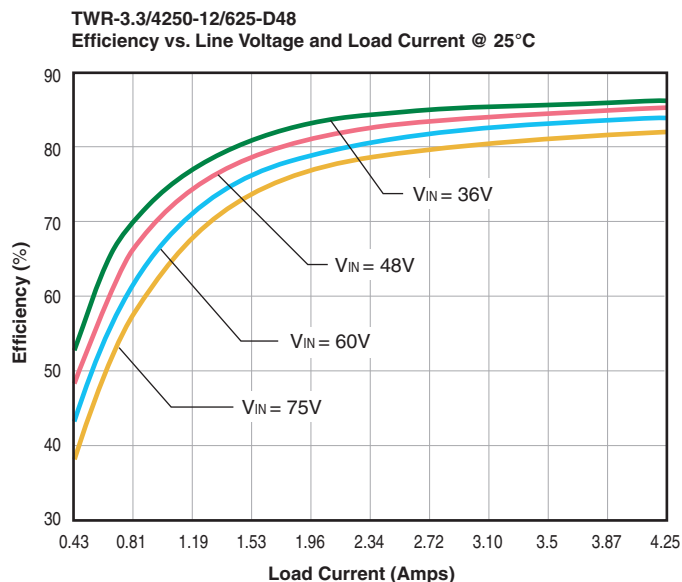
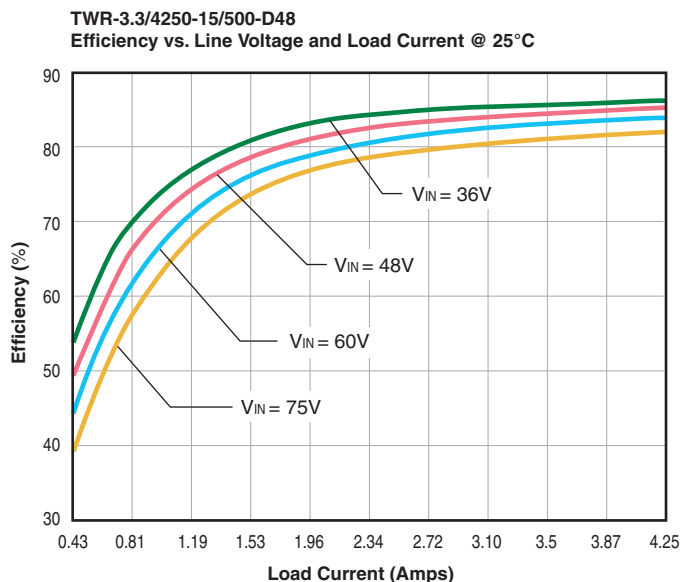
### On/Off Control

The On/Off Control pin (pin 4) is provided for remote on/off operation. TWR 30W Series converters are designed so that they are enabled when the control pin is pulled high or left open (normal mode) and disabled when the control pin is pulled low (to less than +0.8V relative to –Input, pin 2).

Dynamic control of the on/off function is best accomplished with a mechanical relay or an open-collector/open-drain drive circuit (optically isolated if appropriate). The drive circuit should be able to sink appropriate current (see Performance/Functional Specifications) when activated.

Applying an external voltage to pin 4 when no input power is applied to the converter can cause permanent damage to the converter. The on/off control function, however, is designed such that the converter can be disabled (pin 4 pulled low) while input power is ramping up and then "released" once the input has stabilized. The time duration between the point at which the converter is released and its fully loaded output voltage settles to within specified accuracy can be found in the Performance/Functional Specifications.

**Typical Performance Curves**



**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.

Wave Solder Operations for through-hole mounted products (THMT)			
For Sn/Ag/Cu based solders:		For Sn/Pb based solders:	
Maximum Preheat Temperature	115° C.	Maximum Preheat Temperature	105° C.
Maximum Pot Temperature	270° C.	Maximum Pot Temperature	250° C.
Maximum Solder Dwell Time	7 seconds	Maximum Solder Dwell Time	6 seconds