Discontinued

Dual Output
Mixed Voltage, DLV Models

37 Watt, Isolated DC/DC Converters
V_{OUT} Combinations of 3.3/2.5/1.8/1.5 Volts

Features

- **Two independently regulated outputs: 3.3V @ 6A; 2.5/1.8/1.5 @ 7A**
- **13A/37W total output current/power**
- **Input voltage ranges: 10-18V, 18-36V or 36-75V**
- **Standard 2" x 2" package/pinout**
- **High efficiency (to 85%)**
- **Stable no-load operation**
- **Independent V_{OUT} trim pins**
- **Remote on/off control**
- **Fully isolated (1500Vdc); I/O protected**
- **Output overvoltage protection**
- **Thermal shutdown**
- **UL60950/EN60950 certified**
- **CE marked**

Murata's new DLV Series, dual-output, low-voltage DC/DC's provide any output combination of 3.3V (to 6 Amps) and 2.5/1.8/1.5 (to 7 Amps). Designed with two control loops for two independently regulated outputs (both using synchronous rectification), DLV's are impressively efficient (to 85%) and able to supply their full 13 Amps of output current (37W for the 3.3V/2.5V models) up to +60°C ambient with no derating (model dependent).

Housed in standard 2" x 2" x 0.5" plastic packages, DLV's offer a number of functional options (positive or negative polarity on the control pin, addition of second V_{OUT} trim pin, etc.) that make them pin compatible with, yet more powerful than, virtually all 2" x 2" duals from other leading DC/DC manufacturers.

Assembled using fully automated, SMT-on-pcb techniques, DLV's provide stable no-load operation, excellent line/load regulation (±1%), quick step response (200µsec), and low output ripple/noise (80mVp-p). All devices feature full I/O fault protection including: input overvoltage and undervoltage shutdown, output overvoltage protection, current limiting, short-circuit protection, and thermal shutdown.

All DLV models are Qual/HALT/EMI tested and certified to the operational/functional-insulation requirements of UL60950/EN60950. 48V_{IN} models (75V_{IN} max.) carry the CE mark Selected models include RoHS-5 compliance with the lead exception.

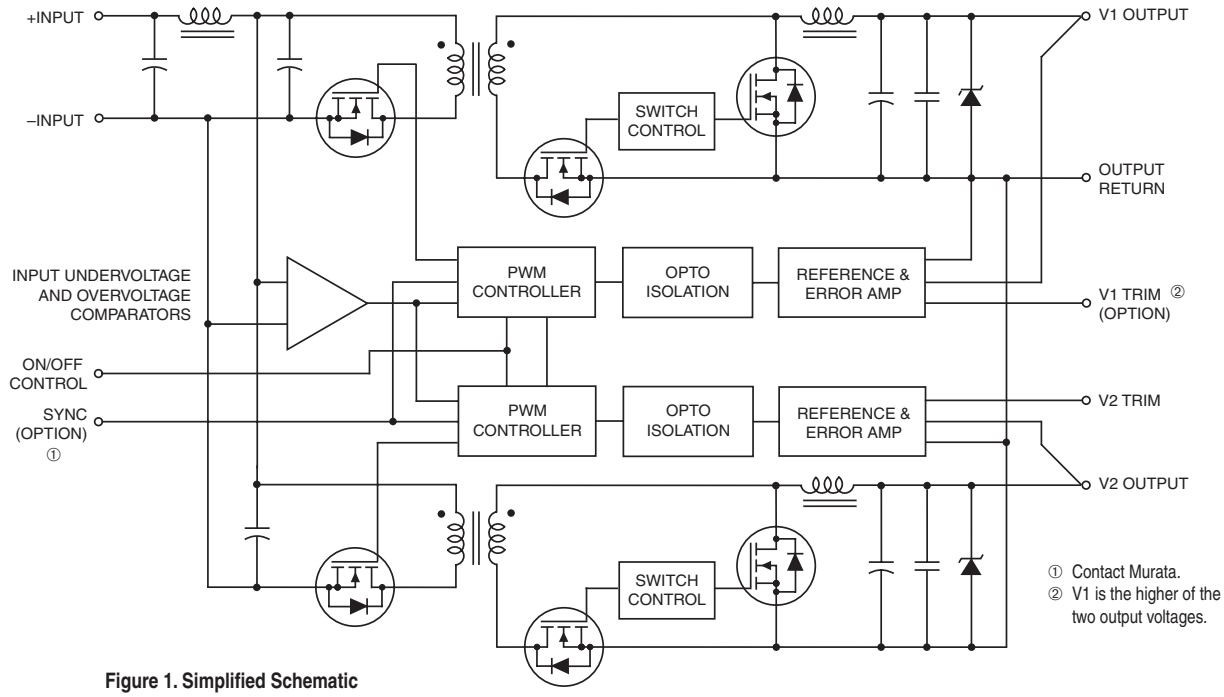


Figure 1. Simplified Schematic

Performance Specifications and Ordering Guide ①

Model	Output						Input			Efficiency		Package (Case, Pinout)
	V_{OUT} (Volts)	I_{OUT} ② (Amps)	R/N (mVp-p) ③		Regulation (Max.)		V_{IN} Nom. (Volts)	Range (Volts)	I_{IN} ⑤ (mA)	Min.	Typ.	
			Typ.	Max.	Line	Load ④						
DLV-3.3/6-1.5/7-D12	3.3	6	75	TBD	±1%	±1%	12	10-18	TBD	TBD	85%	C26, P54
	1.5	7	75	TBD	±1%	±1%						
DLV-3.3/6-1.5/7-D24	3.3	6	75	TBD	±1%	±1%	24	18-36	TBD	TBD	85%	C26, P54
	1.5	7	75	TBD	±1%	±1%						
DLV-3.3/6-1.5/7-D48	3.3	6	75	TBD	±1%	±1%	48	36-75	TBD	TBD	85%	C26, P54
	1.5	7	75	TBD	±1%	±1%						
DLV-3.3/6-1.8/7-D12	3.3	6	75	TBD	±1%	±1%	12	10-18	TBD	TBD	83%	C26, P47
	1.8	7	75	TBD	±1%	±1%						
DLV-3.3/6-1.8/7-D24	3.3	6	75	TBD	±1%	±1%	24	18-36	TBD	TBD	83%	C26, P47
	1.8	7	75	TBD	±1%	±1%						
DLV-3.3/6-1.8/7-D48	3.3	6	75	TBD	±1%	±1%	48	36-75	TBD	TBD	83%	C26, P47
	1.8	7	75	TBD	±1%	±1%						
DLV-3.3/6-2.5/7-D12	3.3	6	75	TBD	±1%	±1%	12	10-18	TBD	TBD	85%	C26, P40
	2.5	7	75	TBD	±1%	±1%						
DLV-3.3/6-2.5/7-D24	3.3	6	75	TBD	±1%	±1%	24	18-36	TBD	TBD	85%	C26, P40
	2.5	7	75	TBD	±1%	±1%						
DLV-3.3/6-2.5/7-D48	3.3	6	75	TBD	±1%	±1%	48	36-75	TBD	TBD	85%	C26, P40
	2.5	7	75	TBD	±1%	±1%						

① Typical at T_A = +25°C under nominal line voltage and "balanced," full-power conditions: 3.3V @ 4.5A/2.5V @ 6A; 3.3V @ 5.2A/1.8V @ 7A; 3.3V @ 5.2A/1.8V @ 7A.

② Any combination of rated I_{OUT} current are not to exceed 37 Watts of total output power. (See derating graphs.)

③ Ripple/Noise (R/N) measured over a 20MHz bandwidth. All models are specicfied with TBD ceramic capacitors.

④ Tested from no load to 100% load (other output at no load).

⑤ Nominal line voltage, no load/balanced full-power condition.

PART NUMBER STRUCTURE

DLV - 3.3 / 6 - 2.5 / 7 - D48 T N - Y

- **DLV** — Dual Low Voltage/ Mixed-Voltage Series
- **3.3** — V_1 Nominal Output Voltage
- **6** — I_1 Maximum Output Current
- **2.5** — V_2 Nominal Output Voltage
- **7** — I_2 Maximum Output Current
- **D48** — Input Voltage Range: **D12** = 10-18 Volts (12V nominal), **D24** = 18-36 Volts (24V nominal), **D48** = 36-75 Volts (48V nominal)
- **T N** — Add T and N suffixes as desired
- **-Y** — RoHS-5 hazardous substance compliance

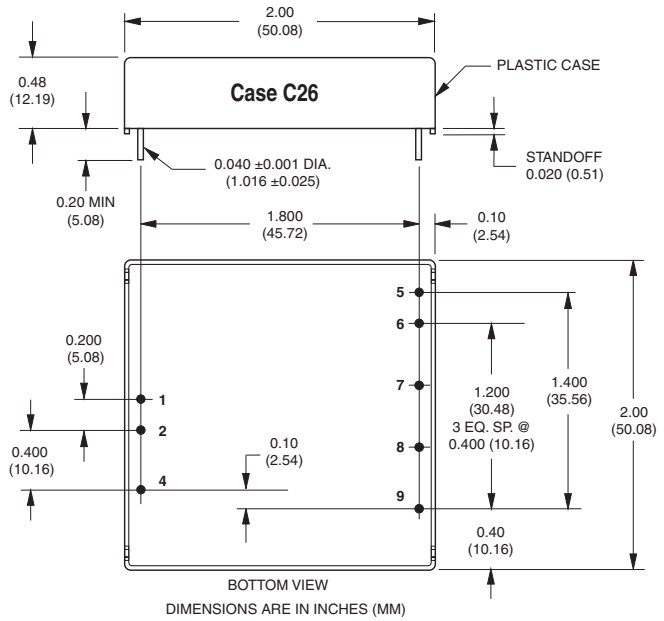
Part Number Suffixes

Standard DLV DC/DC's provide a Trim function (Pin 9) for the lower of the two output voltages. A Trim pin (Pin 5) for the higher voltage can be added by indicating a "T" suffix. An "N" suffix indicates that the On/Off Control function incorporates negative polarity logic.

No Suffix	Pins 5 not installed, positive polarity On/Off Control
T Suffix	Pin 5 added for higher voltage Trim option
N Suffix	Negative polarity On/Off Control

Note: Not all model number combinations are available. Contact Murata Power Solutions.

MECHANICAL SPECIFICATIONS



I/O Connections				
Pin	Function P40	Function P47	Function P48	Function P54
1	+Input	+Input	+Input	+Input
2	–Input	–Input	–Input	–Input
3	No Pin	No Pin	No Pin	No Pin
4	On/Off Control	On/Off Control	On/Off Control	On/Off Control
5	+3.3V Trim*	+3.3V Trim*	+2.5V Trim*	+3.3V Trim*
6	+3.3V Output	+3.3V Output	+2.5V Output	+3.3V Output
7	Output Return	Output Return	Output Return	Output Return
8	+2.5V Output	+1.8V Output	+1.8V Output	+1.5V Output
9	+2.5V Trim	+1.8V Trim	+1.8V Trim	+1.5V Trim

* Optional pins

Performance/Functional Specifications

Typical @ T_A = +25°C under nominal line voltage, balanced "full-load" conditions, unless noted. ①

Input	
Input Voltage Range:	
D12 Models	10-18 Volts (12V nominal)
D24 Models	18-36 Volts (24V nominal)
D48 Models	36-75 Volts (48V nominal)
Overvoltage Shutdown:	
D12 Models	19-23 Volts (21V nominal)
D24 Models	37-42 Volts (40V nominal)
D48 Models	77-81 Volts (79V nominal)
Start-Up Threshold:	
D12 Models	9-10 Volts (9.3V nominal)
D24 Models	16.5-18 Volts (17V nominal)
D48 Models	34.5-36 Volts (35V nominal)
Undervoltage Shutdown:	
D12 Models	8.5-9.6 Volts (9.3V nominal)
D24 Models	16-17 Volts (16.5V nominal)
D48 Models	33-35 Volts (34V nominal)
Input Current:	
Normal Operating Conditions	See Ordering Guide
Standby Mode:	
Off, OV, UV, Thermal Shutdown	10mA typical
Input Reflected Ripple Current:	
Source Impedance	
D12 Models	TBD
D24 Models	TBD
D48 Models	TBD
Internal Input Filter Type	Pi (0.039µF - 2.2µH - TBD)
Reverse-Polarity Protection:	
D12 Models	TBD minute duration, 6A maximum
D24 Models	TBD minute duration, 4A maximum
D48 Models	TBD minute duration, 2A maximum
On/Off Control (Pin 4): ③ ④ ⑥	
D12, D24, D48 Models	On = open or TBD to +V_{IN},
I_{IN} = TBDµA @ TBDV	
Off = 0-0.8V, I_{IN} = TBD @ 0V	
D12N, D24N, D48N Models	On = 0-0.8V, I_{IN} = TBD @ 0V
Off = open or TBD to +5.5V	
I_{IN} = TBDµA @ TBDV	

Output	
V_{OUT} Accuracy	
3.3V/1.5V and 3.3V/1.8VModels	1% / 2% maximum
3.3V/2.5V Models	1% / 1.5% maximum
Minimum Loading Per Specification	No load
Ripple/Noise (20MHz BW)	See Ordering Guide
Line/Load Regulation	See Ordering Guide
Efficiency	See Ordering Guide/Efficiency Curves
Trim Range ⑧	±5% each output
Isolation Voltage:	
Input-to-Output	1500Vdc
Isolation Capacitance	470pF
Isolation Resistance	100MΩ
Current Limit Inception:	
3.3/1.5V Models	
3.3V @ 98.5%V_{OUT}, 1.5V @ TBDA	TBD Amps
1.5V @ 98%V_{OUT}, 3.3V @ TBDA	TBD Amps

Output (continued)	
Current Limit Inception:	
3.3/1.8V Models	
3.3V @ 98.5%V_{OUT}, 1.8V @ TBDA	TBD Amps
1.8V @ 98%V_{OUT}, 3.3V @ TBDA	TBD Amps 98.5%V_{OUT}
3.3V/2.5V Models	
3.3V @ 98.5%V_{OUT}, , 2.5V @ TBDA	TBD Amps
2.5V @ 98%V_{OUT}, 3.3V @ TBDA	TBD Amps
Short Circuit Current:	
3.3V Outputs	TBD Amps average, continuous
2.5V Outputs	TBD Amps average, continuous
1.8V Outputs	TBD Amps average, continuous
1.5V Outputs	TBD Amps average, continuous
Overvoltage Protection:	Comparator, magnetic feedback
3.3/1.5V Models	TBD/TBD
3.3/1.8V Models	TBD/TBD
3.3/2.5V Models	TBD/TBD
Maximum Capacitive Loading	
3.3/1.5V Models	TBD/TBDµF
3.3/1.8V Models	TBD/TBDµF
3.3/2.5V Models	TBD/TBDµF
Temperature Coefficient	±0.02% per °C

Dynamic Characteristics	
Dynamic Load Response:	
3.3/1.5V Models	
3.3V (50-100% step to 1%V_{OUT})	TBD µsec maximum
1.8V (50-100% step to 2%V_{OUT})	TBD µsec maximum
3.3/1.8V Models	
3.3V (50-100% step to 1%V_{OUT})	TBD µsec maximum
1.8V (50-100% step to 2%V_{OUT})	TBD µsec maximum
3.3V/2.5V Models	
3.3V (50-100% step to 1%V_{OUT})	TBD µsec maximum
2.5V (50-100% step to 1.5%V_{OUT})	TBD µsec maximum
Start-Up Time:	
V_{IN} to V_{OUT}	TBD
On/Off to V_{OUT}	TBD
Switching Frequency	225kHz (±TBD kHz)

Environmental	
MTBF	
D12 Models	TBD hours
D24 Models	TBD hours
D48 Models	TBD hours
Operating Temperature (Ambient):	
Without Derating:	
3.3/1.8V Models	TBD
3.3V/2.5V Models	TBD
With Derating	To +100°C (See Derating Curves)
Case Temperature:	
Maximum Operational	+100°C
For Thermal Shutdown	TBD minimum, TBD maximum
Storage Temperature	–40 to +120°C

Physical	
Dimensions	2" x 2" x 0.5" (50.8 x 50.8 x 12.7mm)
Case Material	Diallyl phthalate, UL94V-0 rated
Pin Material	Brass, solder coated
Weight:	TBD
Primary to Secondary Insulation Level	Operational

① All models are specified with external TBD ceramic output capacitors.
② See Technical Notes/Graphs for details.
③ Devices may be order with opposite polarity. 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 may 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 (pin 2).
⑦ Demonstrated MTBF available on request.
⑧ Trim function for the higher of two voltages available with "T" suffix. See Part Number Suffixes and Technical Notes for details.

Absolute Maximum Ratings		
Input Voltage:		
Continuous:	D12 Models	23 Volts
	D2A Models	42 Volts
	D48 Models	81 Volts
Transient (100msec):	D12 Models	25 Volts
	D24 Models	50 Volts
	D48 Models	100 Volts
Input Reverse-Polarity Protection ②		Input Current must be limited. TBD minute duration. Fusing recommended.
D12A Models		6 Amps
D24A Models		4 Amps
D48A Models		2 Amps
Output Current ②		Current limited. Devices can withstand an indefinite output short circuit.
On/Off Control (Pin 4) Max. Voltages		
Referenced to –Input (pin 2)		
No Suffix		$+V_{IN}$
"N" Suffix		+8 Volts
Sync Control (Pin 3) Max. Voltages		
"S" Suffix		+5.7 Volts
Storage Temperature		–40 to +120°C
Lead Temperature (Soldering, 10 sec.)		+300°C

These are stress ratings. Exposure of devices to 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

On/Off Control

The primary-side, remote On/Off Control function (pin 4) can be specified to operate with either positive or negative polarity. Positive polarity devices (no suffix) are enabled when pin 4 is left open or pulled high (+TBDV to +TBDV with respect to –Input). Positive polarity devices are disabled when pin 4 is pulled low (0-0.8V with respect to –Input). Negative polarity devices are off when pin 4 is high/open and on when pin 2 is pulled low.

For applications where power sequencing is critical, the DLV series can be confi gured such that the On/Off Control pin will enable/disable only the higher of the two output voltages. Contact Murata for more information.

Trimming Output Voltages

These DLV converters have a trim capability (pins 9 & 5) that allow users to independently adjust the output voltages ±5%. (Note: pin 5 is an option, see ordering information.) Adjustments to the output voltages can be accomplished via a trim pot, Figure 2, or a single fixed resistor as shown in Figures 3 and 4. A single fixed resistor can increase or decrease the output voltage depending on its connection. Fixed resistors should have absolute TCR's less than 100ppm/°C to minimize sensitivity to changes in temperature.

A single resistor connected from the Trim pin 9 to +Output (pin 8), see Figure 3, will decrease the lower output voltage. A resistor connected from Trim pin 9 to Output Return (pin 7) will increase the lower output voltage. See Figure 4.

Similarly, the higher output voltage can be adjusted using a single resistor connected from the Trim (pin 5) to +Output (pin 6) or to Output Return (pin 7). See Figures 3 and 4.

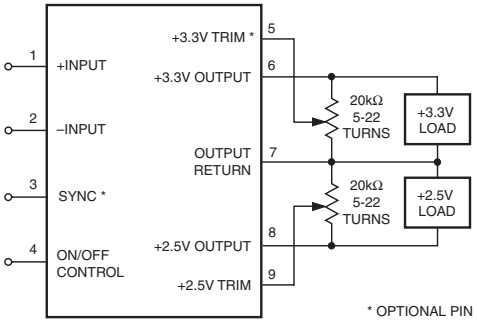


Figure 2. Trim Connections Using A Trim Pot

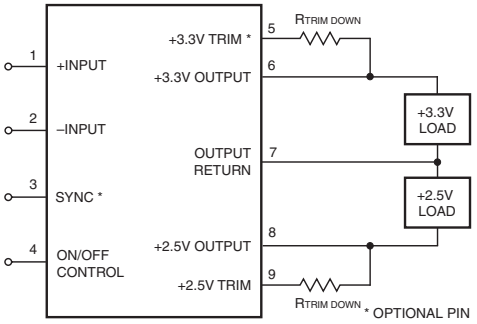


Figure 3. Trim Connections To Decrease Output Voltages Using Fixed Resistors

3.3 Volt Trim Down

$$R_{T_{DOWN}}(k\Omega) = \left[\frac{3.48(V_O - 1.577)}{3.3 - V_O}\right] - 25.5$$

2.5 Volt Trim Down

$$R_{T_{DOWN}}(k\Omega) = \left[\frac{2.41(V_O - 1.18)}{2.5 - V_O}\right] - 17.4$$

1.8 Volt Trim Down

$$R_{T_{DOWN}}(k\Omega) = \left[\frac{1.73(V_O - 0.86)}{1.8 - V_O}\right] - 14.17$$

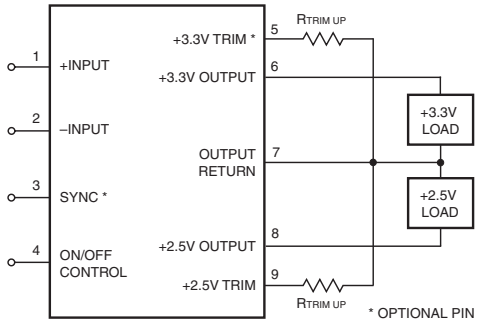


Figure 4. Trim Connections To Increase Output Voltages Using Fixed Resistors

3.3 Volt Trim Up

$$R_{T_{UP}}\ (k\Omega) = \left[\frac{5.88}{V_O - 3.3}\right] - 25.5$$

2.5 Volt Trim Up

$$R_{T_{UP}}\ (k\Omega) = \left[\frac{2.84}{V_O - 2.5}\right] - 17.4$$

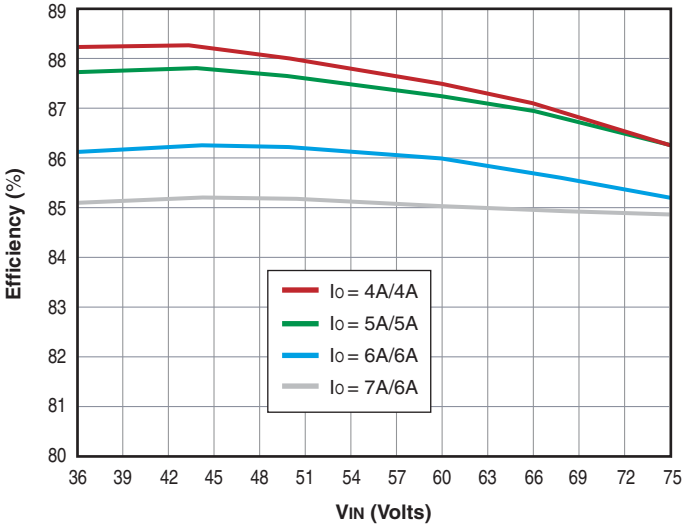
1.8 Volt Trim Up

$$R_{T_{UP}}\ (k\Omega) = \left[\frac{1.49}{V_O - 1.8}\right] - 14.17$$

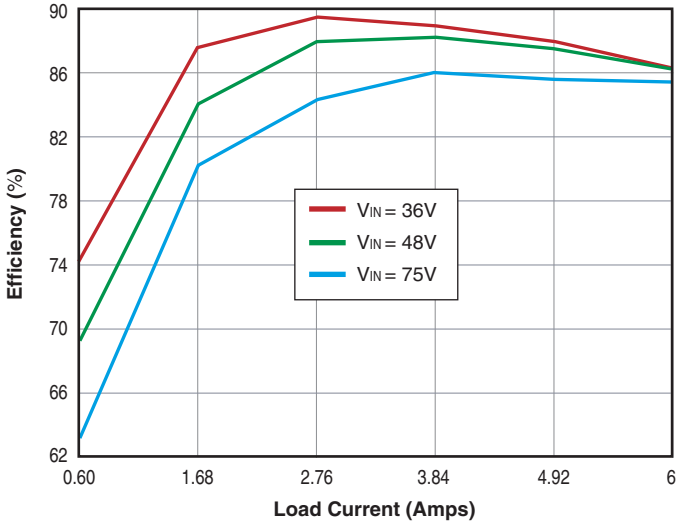
Note: Resistor values are in kΩ. Accuracy of adjustment is subject to tolerances of resistors and factory-adjusted output accuracy. V_O = desired output voltage.

TYPICAL PERFORMANCE CURVES

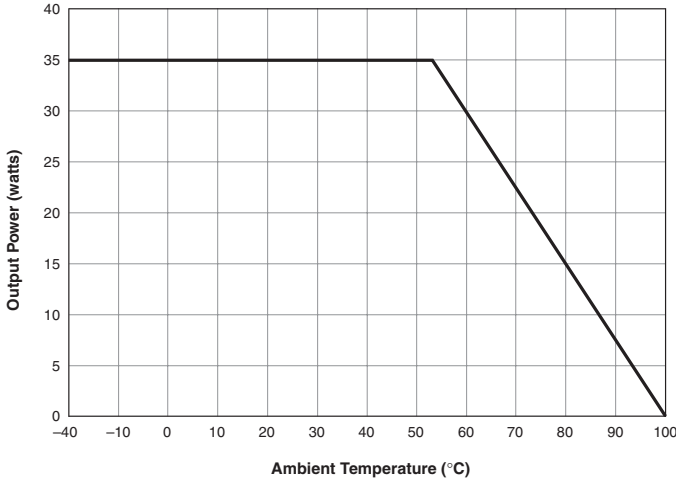
DLV-3.3/6-2.5/7-D48TN Efficiency vs. Load and V_{IN}



DLV-3.3/6-2.5/7-D48TN Efficiency vs. Line and Load



DLV-3.3/6-2/5/7-D48TN Output Power vs. Ambient Temperature
(V_{IN} nominal, natural convection air flow.)



Adaptations

Several different additional configurations are available on these converters. Generally, these are modifications of an existing standard product. In some cases, they are designated with an additional 5-digit suffix on the end of the root parent standard model number. The actual details of the modifi cation are contained in a Specifi cation Control Drawing maintained by Murata and tracked using this same 5-digit special number suffi x. These adapted products are normally built in the same production facilities and to the same quality standards as catalog products. Usually, they share the same components.

Once a modified product has been configured and supplied to a customer, it may be available as a "standard" product to other customers, assuming there is no proprietary status or other restriction. There may be scheduling and minimum order requirements for such products. Contact Murata directly if you are interested in your own set of adaptations or modifi cations.

Currently, the following product is offered for sale:

DLV-3.3/6-2.5/7-D48TN-30865
DLV-3.3/6-2.5/7-D48TN-30865-Y (RoHS-5)

This is a standard DLV-3.3/6-2.5/7-D48TN with a 100 Volt overvoltage shutdown.

RoHS-5 compliance refers to the exclusion of the six hazardous substances in the RoHS specification with the excepion of lead. C&D Technologies' RoHS-5 products use all the conforming RoHS materials, however our solders are Sn63/Pb37.