

## HIGH RELIABILITY DC-DC CONVERTERS

### DESCRIPTION

The DV200 series of high reliability, isolated DC-DC converters is operable over a wide (-55 °C to +100 °C) temperature range with no power derating. Unique to the DV200 series is a magnetic feedback circuit that is radiation immune. Operating at a nominal fixed frequency of 500 kHz, these regulated, isolated units utilize well-controlled undervoltage lockout circuitry to eliminate slow start-up problems. The current sharing function allows a maximum of five units to be connected in parallel to boost the total output power to 5 times. The output voltage is trimmable up to +10% or down -20%.

These converters are designed and manufactured in a facility qualified to ISO9001 and certified to MIL-PRF-38534 and MIL-STD-883.

### FEATURES

- High Reliability
- Output Voltage Trim Up +10% or Down -20%
- Wide Input Voltage Range: 16 to 50 Volts
- Up to 200 Watts Output Power
- Up to 70% of Rated Output Power is Available for Each Output
- Radiation Immune Magnetic Feedback Circuit
- NO Use of Optoisolators
- Undervoltage Lockout
- Short Circuit Protection
- Current Limit Protection
- Input Transient Voltage: 55 Volts for 1 second
- High Power Density:  $\approx 80 \text{ W/in}^3$
- Custom Versions Available
- Additional Environmental Screening Available
- Meets MIL-STD-461C and MIL-STD-461D EMC Requirements When Used With a DVMN28 EMI Filter

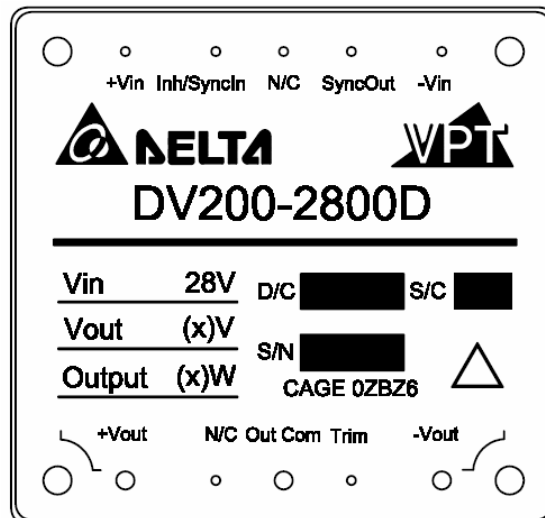


Figure 1 – DV200-2800D DC-DC Converter  
(Not To Scale)

SPECIFICATIONS ( $T_{CASE} = -55^{\circ}\text{C}$  to  $+100^{\circ}\text{C}$ ,  $V_{IN} = +28\text{V} \pm 5\%$ , Full Load, Unless Otherwise Specified)

## ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	50 V <sub>DC</sub>	Junction Temperature Rise to Case	+25°C
Input Voltage (Transient, 1 second)	55 Volts	Storage Temperature	-65°C to +135°C
Output Power <sup>1,3</sup>	200 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, $T_{CASE} = +100^{\circ}\text{C}$ )	44 Watts	Weight (Maximum)	115 grams

Parameter	Conditions	DV200-2805D			DV200-2812D			Units	
		Min	Typ	Max	Min	Typ	Max		
<b>STATIC</b>									
INPUT Voltage <sup>7</sup>	Continuous	16	28	50	16	28	50	V	
	Transient, 1 sec	-	-	55	-	-	55	V	
Current	Inhibited	-	6	10	-	6	10	mA	
	No Load	-	20	80	-	20	80	mA	
Ripple Current	Full Load <sup>5</sup> , 20Hz to 10MHz	-	-	100	-	-	100	mA <sub>p-p</sub>	
Inhibit Pin Input <sup>4</sup>		0	-	1.5	0	-	1.5	V	
Inhibit Pin Open Circuit Voltage <sup>4</sup>		8	9.5	11	8	9.5	11	V	
UVLO Turn On		13.5	14	15.8	13.5	14	15.8	V	
UVLO Turn Off <sup>4</sup>		10	12	14	10	12	14	V	
OUTPUT Voltage	+V <sub>OUT</sub>	$T_{CASE} = 25^{\circ}\text{C}$	4.95	5.00	5.05	11.88	12.00	12.12	V
	+V <sub>OUT</sub>	$T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$	4.925	5.00	5.075	11.82	12.00	12.18	V
	-V <sub>OUT</sub>	$T_{CASE} = 25^{\circ}\text{C}$	4.80	5.00	5.20	11.76	12.00	12.24	V
	-V <sub>OUT</sub>	$T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$	4.85	5.00	5.25	11.52	12.00	12.48	V
Power <sup>3,6,7</sup>	Total	$V_{IN} = 18\text{V}$ to $50\text{V}$	-	-	150	-	-	175	W
		$V_{IN} = 16\text{V}$ to $18\text{V}$	-	-	90	-	-	105	W
	$\pm V_{OUT}$	$V_{IN} = 18\text{V}$ to $50\text{V}$ Either Output	-	-	105	-	-	122.5	W
		$V_{IN} = 16\text{V}$ to $18\text{V}$ Either Output	-	-	63	-	-	73.5	W
Current <sup>3,6,7</sup>	$\pm V_{OUT}$	$V_{IN} = 18\text{V}$ to $50\text{V}$ Either Output	-	-	21	-	-	10.2	A
		$V_{IN} = 16\text{V}$ to $18\text{V}$ Either Output	-	-	12.6	-	-	6.1	A
Ripple Voltage	$\pm V_{OUT}$	Full Load <sup>5</sup> , 20Hz to 10MHz	-	50	150	-	50	200	mV <sub>p-p</sub>
Line Regulation	+V <sub>OUT</sub>	$V_{IN} = 18\text{V}$ to $40\text{V}$	-	10	80	-	10	80	mV
	-V <sub>OUT</sub>	$V_{IN} = 18\text{V}$ to $40\text{V}$	-	10	200	-	10	200	mV
Load Regulation	+V <sub>OUT</sub>	No Load to Full Load <sup>5</sup>	-	10	80	-	10	80	mV
	-V <sub>OUT</sub>	No Load to Full Load <sup>5</sup>	-	10	200	-	10	200	mV
Cross Regulation	-V <sub>OUT</sub>	V1+ Load 30% - Load 70% V2+ Load 70% - Load 30%	-	-	550	-	-	550	mV
Voltage Trim		Full Load	-20	-	10	-20	-	10	%
EFFICIENCY		Full Load <sup>5</sup>	79	82	-	80	84	-	%
LOAD FAULT POWER DISSIPATION		Overload <sup>4</sup>	-	-	80	-	-	80	W
		Short Circuit	-	-	80	-	-	80	W
CAPACITIVE LOAD <sup>4</sup>		Either Output	-	-	1000	-	-	1000	$\mu\text{F}$
SWITCHING FREQUENCY			450	500	550	450	500	550	kHz
SYNC FREQUENCY RANGE		$V_H - V_L = 5\text{V}$ Duty Cycle = 20% - 80%	450	-	550	450	-	550	kHz
ISOLATION		500 V <sub>DC</sub> , $T_{CASE} = 25^{\circ}\text{C}$	100	-	-	100	-	-	M $\Omega$
MTBF (MIL-HDBK-217F)		GB @ $T_C = 55^{\circ}\text{C}$	-	955	-	-	955	-	kHrs

SPECIFICATIONS ( $T_{CASE} = -55^{\circ}\text{C}$  to  $+100^{\circ}\text{C}$ ,  $V_{IN} = +28\text{V} \pm 5\%$ , Full Load, Unless Otherwise Specified)

### ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	50 $V_{DC}$	Junction Temperature Rise to Case	+25°C
Input Voltage (Transient, 1 second)	55 Volts	Storage Temperature	-65°C to +135°C
Output Power <sup>1,3</sup>	200 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, $T_{CASE} = +100^{\circ}\text{C}$ )	44 Watts	Weight (Maximum)	115 grams

Parameter	Conditions	DV200-2805D			DV200-2812D			Units	
		Min	Typ	Max	Min	Typ	Max		
<b>DYNAMIC</b>									
Load Step Output Transient	$\pm V_{OUT}$	Half Load to Full Load	-	-	500	-	-	600	mV <sub>PK</sub>
Load Step Recovery <sup>2</sup>			-	-	500	-	-	500	$\mu\text{Sec}$
Line Step Output Transient <sup>4</sup>	$\pm V_{OUT}$	$V_{IN} = 18\text{V}$ to $40\text{V}$	-	300	600	-	600	1200	mV <sub>PK</sub>
Line Step Recovery <sup>2,4</sup>			-	300	500	-	300	500	$\mu\text{Sec}$
Turn On Delay	$\pm V_{OUT}$	$V_{IN} = 0\text{V}$ to $28\text{V}$	-	20	30	-	20	30	mSec
Turn On Overshoot			-	-	50	-	-	50	mV <sub>PK</sub>

- Notes:
1. Dependant on output voltage.
  2. Time for output voltage to settle within 1% of its nominal value.
  3. Derate linearly to 0 at 110°C.
  4. Verified by qualification testing.
  5. Half load at  $+V_{OUT}$  and half load at  $-V_{OUT}$ .
  6. Up to 70% of the total power or current can be drawn from any one of the two outputs.
  7. 100% output power available for  $V_{IN} = 18\text{V}$  to  $50\text{V}$  and only 60% output power available for  $V_{IN} = 16\text{V}$  to  $18\text{V}$ .

SPECIFICATIONS ( $T_{CASE} = -55^{\circ}\text{C}$  to  $+100^{\circ}\text{C}$ ,  $V_{IN} = +28\text{V} \pm 5\%$ , Full Load, Unless Otherwise Specified)

## ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	50 V <sub>DC</sub>	Junction Temperature Rise to Case	+25°C
Input Voltage (Transient, 1 second)	55 Volts	Storage Temperature	-65°C to +135°C
Output Power <sup>1,3</sup>	200 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, $T_{CASE} = +100^{\circ}\text{C}$ )	44 Watts	Weight (Maximum)	115 grams

Parameter	Conditions	DV200-2815D			Units
		Min	Typ	Max	
<b>STATIC</b>					
INPUT Voltage <sup>7</sup>	Continuous	16	28	50	V
	Transient, 1 sec	-	-	55	V
Current	Inhibited	-	6	10	mA
	No Load	-	20	80	mA
Ripple Current	Full Load <sup>5</sup> , 20Hz to 10MHz	-	-	100	mA <sub>p-p</sub>
Inhibit Pin Input <sup>4</sup>		0	-	1.5	V
Inhibit Pin Open Circuit Voltage <sup>4</sup>		8	9.5	11	V
UVLO Turn On		13.5	14	15.8	V
UVLO Turn Off <sup>4</sup>		10	12	14	V
OUTPUT Voltage	+V <sub>OUT</sub> $T_{CASE} = 25^{\circ}\text{C}$	14.85	15.00	15.15	V
	+V <sub>OUT</sub> $T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$	14.775	15.00	15.225	V
	-V <sub>OUT</sub> $T_{CASE} = 25^{\circ}\text{C}$	14.70	15.00	15.30	V
	-V <sub>OUT</sub> $T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$	14.40	15.00	15.60	V
Power <sup>3,6,7</sup>	Total $V_{IN} = 18\text{V}$ to $50\text{V}$	-	-	200	W
	Total $V_{IN} = 16\text{V}$ to $18\text{V}$	-	-	120	W
	$\pm V_{OUT}$ $V_{IN} = 18\text{V}$ to $50\text{V}$ Either Output	-	-	140	W
	$\pm V_{OUT}$ $V_{IN} = 16\text{V}$ to $18\text{V}$ Either Output	-	-	84	W
Current <sup>3,6,7</sup>	$\pm V_{OUT}$ $V_{IN} = 18\text{V}$ to $50\text{V}$ Either Output	-	-	9.3	A
	$\pm V_{OUT}$ $V_{IN} = 16\text{V}$ to $18\text{V}$ Either Output	-	-	5.6	A
Ripple Voltage	$\pm V_{OUT}$ Full Load <sup>5</sup> , 20Hz to 10MHz	-	50	200	mV <sub>p-p</sub>
Line Regulation	+V <sub>OUT</sub> $V_{IN} = 18\text{V}$ to $40\text{V}$	-	10	80	mV
	-V <sub>OUT</sub> $V_{IN} = 18\text{V}$ to $40\text{V}$	-	10	200	mV
Load Regulation	+V <sub>OUT</sub> No Load to Full Load <sup>5</sup>	-	10	80	mV
	-V <sub>OUT</sub> No Load to Full Load <sup>5</sup>	-	10	200	mV
Cross Regulation	-V <sub>OUT</sub> V1+ Load 30% - Load 70% V2+ Load 70% - Load 30%	-	-	550	mV
Voltage Trim	Full Load	-20	-	10	%
EFFICIENCY	Full Load <sup>5</sup>	81	85	-	%
LOAD FAULT POWER DISSIPATION	Overload <sup>4</sup>	-	-	80	W
	Short Circuit	-	-	80	W
CAPACITIVE LOAD <sup>4</sup>	Either Output	-	-	1000	$\mu\text{F}$
SWITCHING FREQUENCY		450	500	550	kHz
SYNC FREQUENCY RANGE	$V_H - V_L = 5\text{V}$ Duty Cycle = 20% - 80%	450	-	550	kHz
ISOLATION	500 V <sub>DC</sub> , $T_{CASE} = 25^{\circ}\text{C}$	100	-	-	M $\Omega$
MTBF (MIL-HDBK-217F)	GB @ $T_C = 55^{\circ}\text{C}$	-	955	-	kHrs

SPECIFICATIONS ( $T_{CASE} = -55^{\circ}\text{C}$  to  $+100^{\circ}\text{C}$ ,  $V_{IN} = +28\text{V} \pm 5\%$ , Full Load<sup>5</sup>, Unless Otherwise Specified)

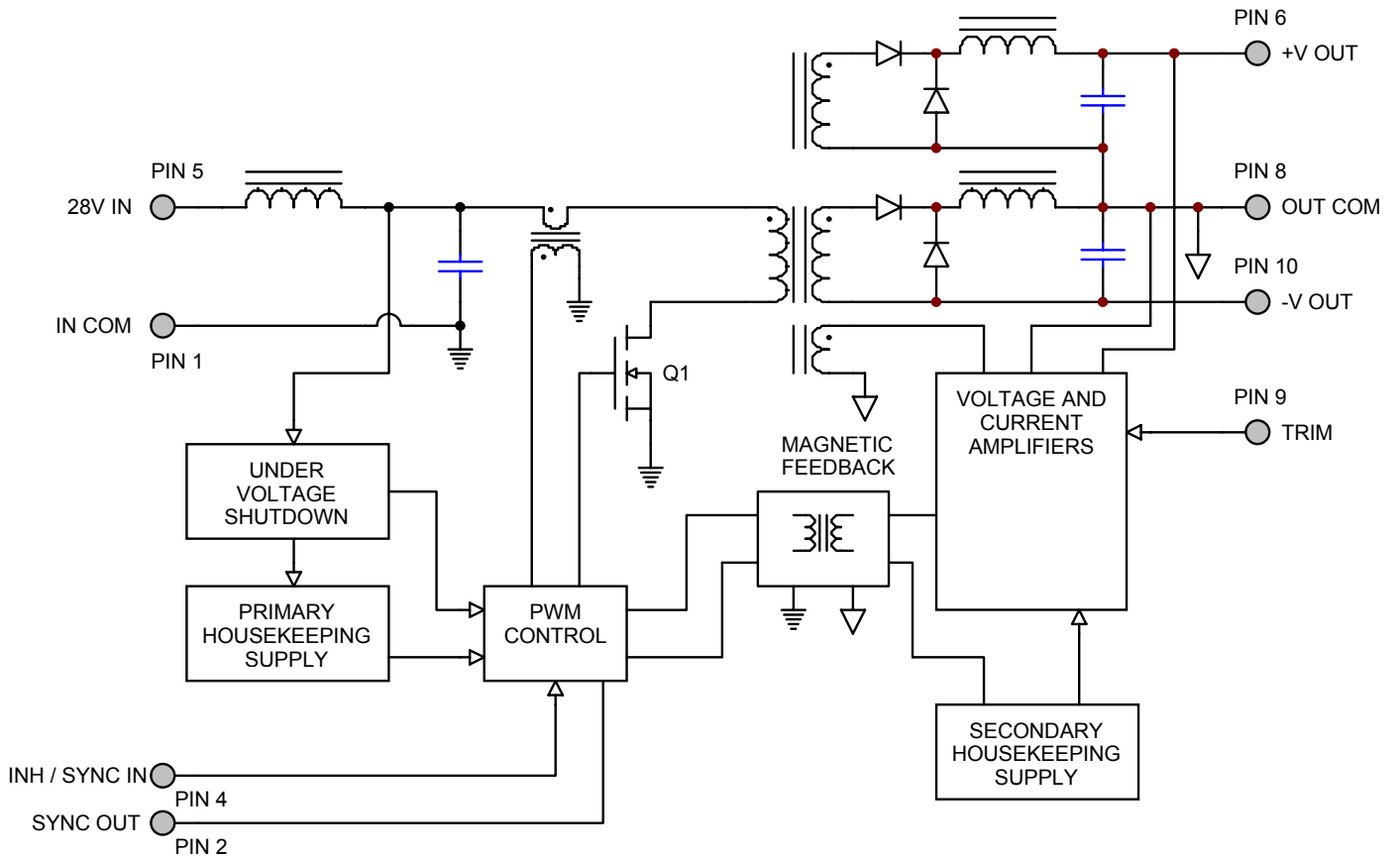
## ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	50 V <sub>DC</sub>	Junction Temperature Rise to Case	+25°C
Input Voltage (Transient, 1 second)	55 Volts	Storage Temperature	-65°C to +135°C
Output Power <sup>1,3</sup>	200 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, $T_{CASE} = +100^{\circ}\text{C}$ )	44 Watts	Weight (Maximum)	115 grams

Parameter	Conditions	DV200-2815D			Units	
		Min	Typ	Max		
<b>DYNAMIC</b>						
Load Step Output Transient	$\pm V_{OUT}$	Half Load to Full Load	-	-	600	mV <sub>PK</sub>
Load Step Recovery <sup>2</sup>			-	-	500	$\mu\text{Sec}$
Line Step Output Transient <sup>4</sup>	$\pm V_{OUT}$	$V_{IN} = 18\text{V}$ to $40\text{V}$	-	600	1200	mV <sub>PK</sub>
Line Step Recovery <sup>2,4</sup>			-	300	500	$\mu\text{Sec}$
Turn On Delay	$\pm V_{OUT}$	$V_{IN} = 0\text{V}$ to $28\text{V}$	-	20	30	mSec
Turn On Overshoot			-	-	50	mV <sub>PK</sub>

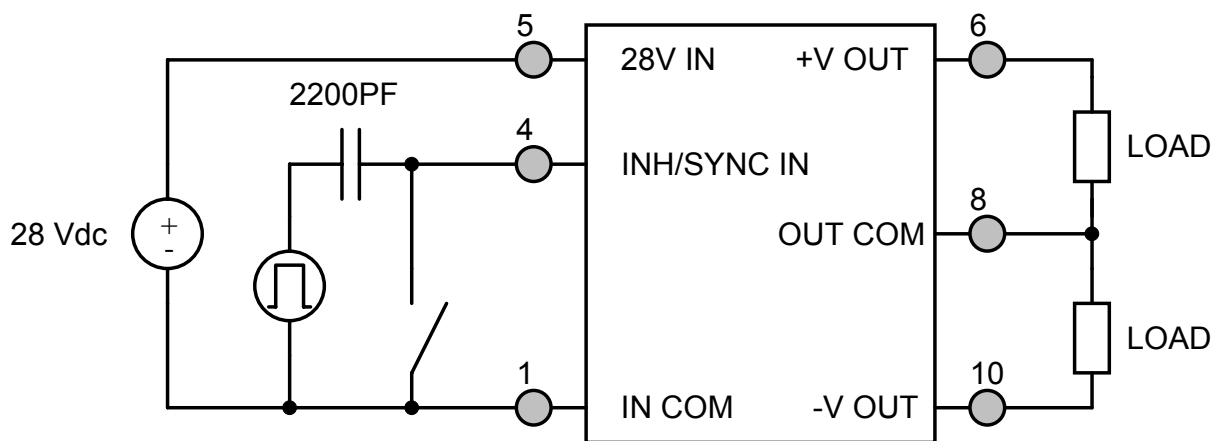
- Notes:
1. Dependant on output voltage.
  2. Time for output voltage to settle within 1% of its nominal value.
  3. Derate linearly to 0 at  $110^{\circ}\text{C}$ .
  4. Verified by qualification testing.
  5. Half load at  $+V_{OUT}$  and half load at  $-V_{OUT}$ .
  6. Up to 70% of the total power or current can be drawn from any one of the two outputs.
  7. 100% output power available for  $V_{IN} = 18\text{V}$  to  $50\text{V}$  and only 60% output power available for  $V_{IN} = 16\text{V}$  to  $18\text{V}$ .

**BLOCK DIAGRAM**



**Figure 2**

**CONNECTION DIAGRAM**



**Figure 3**

INHIBIT DRIVE CONNECTION DIAGRAMS

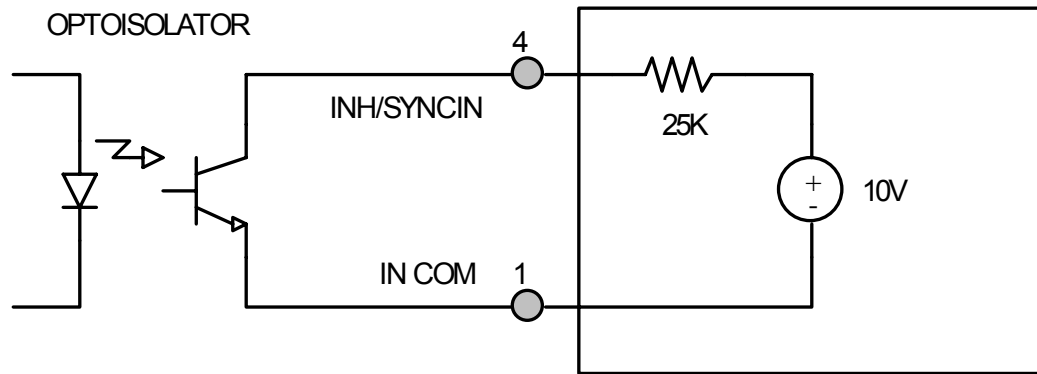
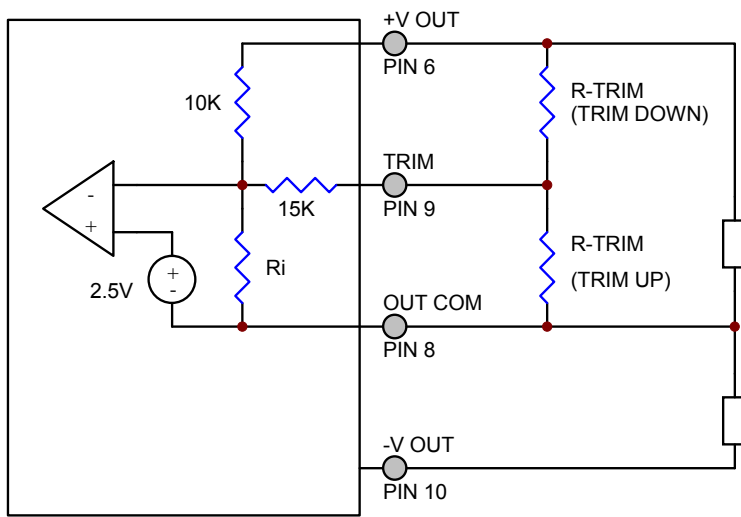


Figure 4 – Isolated Inhibit Drive and Internal Equivalent Circuit

## OUTPUT VOLTAGE TRIM



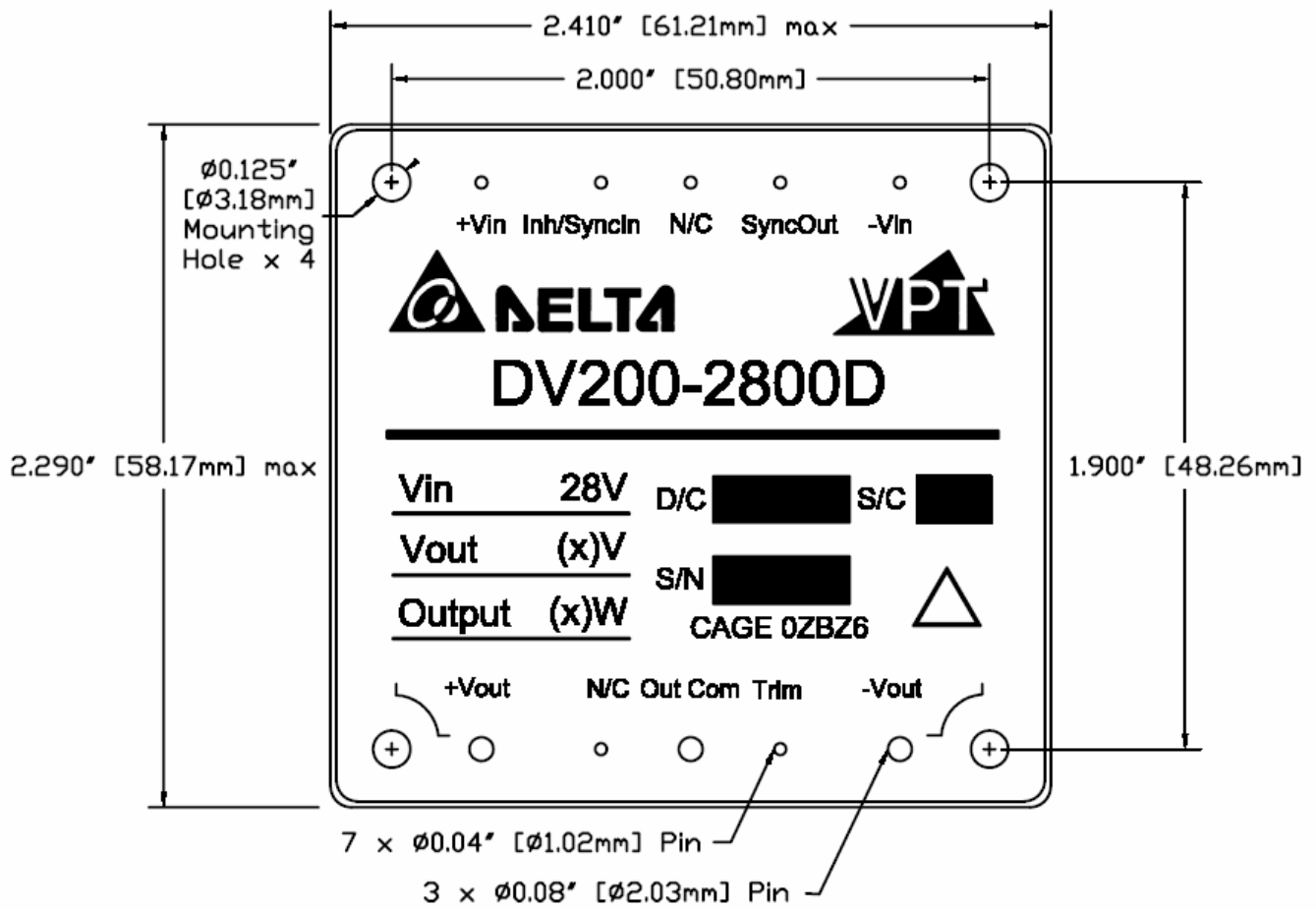
The output voltage can be trimmed down by connecting a resistor between the TRIM pin (PIN 9) and the +V OUT pin (PIN 6), or can be trimmed up by connecting a resistor between the TRIM pin (PIN 9) and the OUT COM pin (PIN 8). The maximum trim range is +10% up and -20% down. The appropriate resistor values versus the output voltage are given in the trim table below.

Figure 5 – Output Voltage Trim

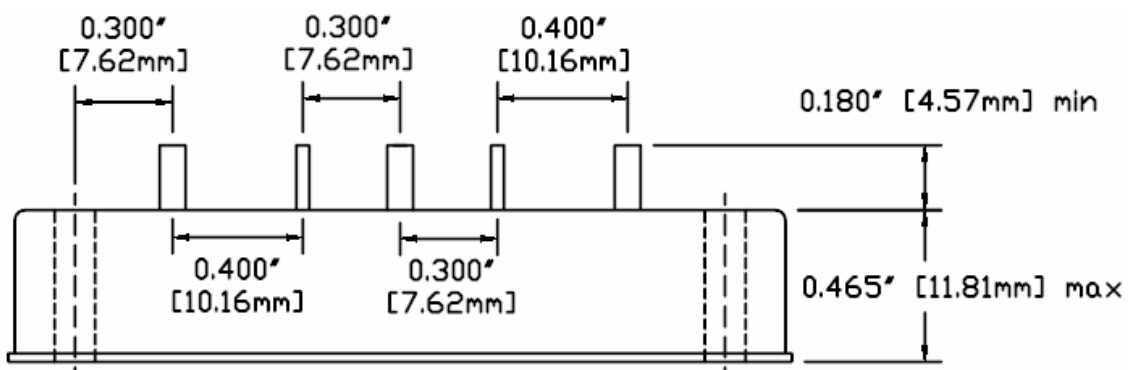
DV200-2805D		DV200-2812D		DV200-2815D	
$\pm V_{OUT}$ (V)	$R_{TRIM}$ ( $\Omega$ )	$\pm V_{OUT}$ (V)	$R_{TRIM}$ ( $\Omega$ )	$\pm V_{OUT}$ (V)	$R_{TRIM}$ ( $\Omega$ )
5.5	35k	13.2	5.8k	16.50	1.7k
5.4	47.5k	13.0	10k	16.25	5k
5.3	68.3k	12.8	16.2k	16.00	10k
5.2	110k	12.6	26.6k	15.75	18.3k
5.1	235k	12.4	47.3k	15.50	35k
5.0	-	12.2	109k	15.25	85k
4.9	225k	12.0	-	15.00	-
4.8	100k	11.8	454k	14.75	475k
4.7	58.3k	11.6	213k	14.50	225k
4.6	37.5k	11.4	134k	14.25	142k
4.5	25k	11.2	94k	14.00	100k
4.4	16.7k	11.0	70.1k	13.75	75k
4.3	10.7k	10.8	54.3k	13.50	58.3k
4.2	6.3k	10.6	42.9k	13.25	46.4k
4.1	2.8k	10.4	34.4k	13.00	37.5k
4.0	0	10.2	27.8k	12.75	30.6k
		10.0	22.5k	12.50	25k
		9.8	18.2k	12.25	20.5k
		9.6	14.6k	12.00	16.7k



**PACKAGE SPECIFICATIONS**



**TOP VIEW**



**SIDE VIEW**

PIN	FUNCTION
1	IN COM
2	SYNC OUT
3	N/C
4	INH / SYNC IN
5	28V IN
6	+V OUT
7	N/C
8	OUT COM
9	TRIM
10	-V OUT

**Figure 6 – Package and Pinout**  
(Dimensional Limits are ±0.005" Unless Otherwise Stated)

## PACKAGE PIN DESCRIPTION

Pin	Function	Description
1	IN COM	Input Common Connection
2	SYNC OUT	Output Synchronization Signal
3	N/C	No Connection
4	INH / SYNC IN	Logic Low = Disabled Output. Unconnected or open collector TTL or Square-wave Synchronization Signal = Enabled Output.
5	28V IN	Positive Input Voltage Connection
6	+V OUT	Positive Output Voltage Connection
7	N/C	No Connection
8	OUT COM	Output Common Connection
9	TRIM	Trim Output Voltage to +10%, -20% of Nominal Value
10	-V OUT	Negative Output Voltage Connection

## ENVIRONMENTAL SCREENING

Screening	MIL-STD-883	Standard (No Suffix)	Military /ML
Pre-Cap Inspection	IPC-A-610 Class II	•	•
Temperature Cycling	-55°C, 100°C, 10 cycles		•
Burn-In	96 hours at +100°C 12 hours at +100°C	•	•
Final Electrical	100% at -55°C, 25°C, 100°C <sup>1</sup> 100% at 25°C	•	•
Final Inspection	Method 2009	•	•

Note: 1. 100% R&R testing at -55°C, +25°C, and +100°C with all test data included in product shipment.

## ORDERING INFORMATION

<b>DV200-</b>	<b>28</b>	<b>05</b>	<b>D</b>	<b>/ML</b>	-	<b>XXX</b>
1	2	3	4	5		6

(1)	(2)		(3)	
Product Series	Nominal Input Voltage		Output Voltage	
<b>DV200-</b>	<b>28</b>	28 Volts	<b>05</b> <b>12</b> <b>15</b>	±5 Volts ±12 Volts ±15 Volts

(4)		(5)		(6)
Number of Outputs		Screening Code		Additional Screening Code
<b>D</b>	Dual	<b>None</b> <b>/ML</b>	Standard Military	Contact Sales

Please contact your sales representative or the VPT Inc. Sales Department for more information concerning additional environmental screening and testing, different input voltage, output voltage, power requirement, source inspection, and/or special element evaluation for space or other higher quality applications.

## CONTACT INFORMATION

To request a quotation or place orders please contact your sales representative or the VPT Inc. Sales Department at:

**Phone:** (425) 353-3010  
**Fax:** (425) 353-4030  
**E-mail:** sales@vpt-inc.com

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