

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.

This product may incorporate one or more of the following U.S. patents:

5,784,266
5,790,389
5,963,438
5,999,433
6,005,780
6,084,792
6,118,673

FEATURES

- High Reliability
- Parallel Up to 5 Units With Current Sharing
- Output Voltage Trim Up +10% or Down -20%
- Wide Input Voltage Range: 16 to 50 Volts
- Up to 200 Watts Output Power
- 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

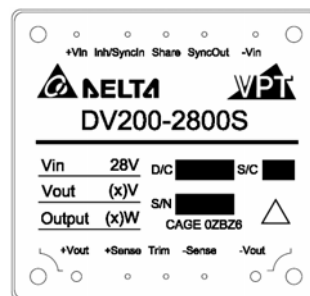


Figure 1 – DV200-2800S DC-DC Converter
(Not To Scale)

SPECIFICATIONS ($T_{CASE} = -55^{\circ}C$ to $+100^{\circ}C$, $V_{IN} = +28V \pm 5\%$, 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) ⁴	55 Volts	Storage Temperature	-65°C to +135°C
Output Power ^{1,3}	200 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, $T_{CASE} = +100^{\circ}C$)	44 Watts	Weight (Maximum)	115 Grams

Parameter	Conditions	DV200-283R3S			DV200-2805S			Units
		Min	Typ	Max	Min	Typ	Max	
STATIC								
INPUT Voltage ⁵	Continuous	16	28	50	16	28	50	V
	Transient, 1 sec ⁴	-	-	55	-	-	55	V
Current	Inhibited	-	6	10	-	6	10	mA
	No Load	-	20	50	-	20	50	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	-	100	-	-	100	mA _{p-p}
Inhibit Pin Input ⁴	To Disable Output	0	-	1.5	0	-	1.5	V
Inhibit Pin Open Circuit Voltage ⁴		8	9.5	11	8	9.5	11	V
UVLO Turn On		13.5	15	15.8	13.5	15	15.8	V
UVLO Turn Off ⁴		10.0	12.0	14.0	10.5	12.0	14.0	V
OUTPUT Voltage	V_{OUT} $T_{CASE} = 25^{\circ}C$	3.267	3.30	3.333	4.95	5.00	5.05	V
	V_{OUT} $T_{CASE} = -55^{\circ}C$ to $+100^{\circ}C$	3.25	3.30	3.35	4.925	5.00	5.075	V
Power ³	$V_{IN} = 18V$ to 50V	0	-	100	0	-	150	W
	$V_{IN} = 16V$ to 18V	0	-	60	0	-	90	W
Current ³	I_{OUT} $V_{IN} = 18V$ to 50V	0	-	30	0	-	30	A
	I_{OUT} $V_{IN} = 16V$ to 18V	0	-	18	0	-	18	A
Ripple Voltage	V_{OUT} Full Load, 10kHz to 10MHz	-	50	150	-	50	150	mV _{p-p}
	V_{OUT} Full Load, 10kHz to 2MHz	-	10	50	-	10	50	mV _{p-p}
Line Regulation	V_{OUT} $V_{IN} = 18V$ to 50V	-	10	80	-	10	80	mV
Load Regulation	V_{OUT} No Load to Full Load	-	10	100	-	10	100	mV
Voltage Trim	V_{OUT} Full Load	-20	0	10	-20	-	10	%
EFFICIENCY	Full Load	74	80	-	79	83	-	%
LOAD FAULT POWER DISSIPATION	Overload ⁴	-	45	-	-	45	-	W
	Short Circuit ⁴	-	45	-	-	45	-	W
CAPACITIVE LOAD ⁴		-	-	2000	-	-	2000	μ F
SWITCHING FREQUENCY		450	500	550	450	500	550	kHz
SYNC FREQUENCY RANGE	$V_H - V_L = 5V$ Duty Cycle = 20% - 80%	450	500	550	450	500	550	kHz
ISOLATION	500 V _{DC}	100	-	-	100	-	-	M Ω
MTBF (MIL-HDBK-217F)	GB @ $T_C = 55^{\circ}C$	-	955	-	-	955	-	kHrs
DYNAMIC								
Load Step Output Transient	V_{OUT} Half Load to Full Load	-	200	450	-	300	550	mV _{PK}
Load Step Recovery ²		-	200	650	-	200	600	μ Sec
Line Step Output Transient ⁴	V_{OUT} $V_{IN} = 18V$ to 40V	-	150	300	-	150	300	mV _{PK}
Line Step Recovery ^{2,4}		-	50	150	-	50	150	μ Sec
Turn On Delay	V_{OUT} $V_{IN} = 0V$ to 28V	-	20	30	-	20	30	mSec
Turn On Overshoot		-	0	30	-	0	50	mV _{PK}

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. 100% output power available for $V_{IN} = 18V$ to 50V and only 60% output power available for $V_{IN} = 16V$ to 18V.

SPECIFICATIONS ($T_{CASE} = -55^{\circ}C$ to $+100^{\circ}C$, $V_{IN} = +28V \pm 5\%$, 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) ⁴	55 Volts	Storage Temperature	-65°C to +135°C
Output Power ^{1,3}	200 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, $T_{CASE} = +100^{\circ}C$)	44 Watts	Weight (Maximum)	115 Grams

Parameter	Conditions	DV200-2812S			DV200-2815S			Units
		Min	Typ	Max	Min	Typ	Max	
STATIC								
INPUT Voltage ⁵	Continuous	16	28	50	16	28	50	V
	Transient, 1 sec ⁴	-	-	55	-	-	55	V
Current	Inhibited	-	6	10	-	6	10	mA
	No Load	-	20	50	-	20	50	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	-	150	-	-	150	mA _{p-p}
Inhibit Pin Input ⁴	To Disable Output	0	-	1.5	0	-	1.5	V
Inhibit Pin Open Circuit Voltage ⁴		8	9.5	11	8	9.5	11	V
UVLO Turn On		13.5	15	15.8	13.5	15	15.8	V
UVLO Turn Off ⁴		10.0	12.0	14.0	10.0	12.0	14.0	V
OUTPUT Voltage	V_{OUT} $T_{CASE} = 25^{\circ}C$	11.88	12.0	12.12	14.85	15.0	15.15	V
	V_{OUT} $T_{CASE} = -55^{\circ}C$ to $+100^{\circ}C$	11.82	12.0	12.18	14.775	15.0	15.225	V
Power ³	$V_{IN} = 18V$ to 50V	0	-	175	0	-	200	W
	$V_{IN} = 16V$ to 18V	0	-	105	0	-	120	W
Current ³	I_{OUT} $V_{IN} = 18V$ to 50V	0	-	14.6	0	-	13.3	A
	I_{OUT} $V_{IN} = 16V$ to 18V	0	-	8.76	0	-	7.98	A
Ripple Voltage	V_{OUT} Full Load, 10kHz to 10MHz	-	100	200	-	100	200	mV _{p-p}
	V_{OUT} Full Load, 10kHz to 2MHz	-	5	30	-	5	30	mV _{p-p}
Line Regulation	V_{OUT} $V_{IN} = 18V$ to 50V	-	10	100	-	10	100	mV
Load Regulation	V_{OUT} No Load to Full Load	-	10	120	-	10	120	mV
Voltage Trim	V_{OUT} Full Load	-20	-	10	-20	-	10	%
EFFICIENCY	Full Load	82	84	-	82	86	-	%
LOAD FAULT POWER DISSIPATION	Overload ⁴	-	45	-	-	45	-	W
	Short Circuit ⁴	-	45	-	-	45	-	W
CAPACITIVE LOAD ⁴		-	-	1000	-	-	1000	μ F
SWITCHING FREQUENCY		450	500	550	450	500	550	kHz
SYNC FREQUENCY RANGE	$V_H - V_L = 5V$ Duty Cycle = 20% - 80%	450	500	550	450	500	550	kHz
ISOLATION	500 V _{DC}	100	-	-	100	-	-	M Ω
MTBF (MIL-HDBK-217F)	GB @ $T_C = 55^{\circ}C$	-	955	-	-	955	-	kHrs
DYNAMIC								
Load Step Output Transient	V_{OUT} Half Load to Full Load	-	550	1000	-	1000	1350	mV _{PK}
Load Step Recovery ²		-	200	400	-	200	500	μ Sec
Line Step Output Transient ⁴	V_{OUT} $V_{IN} = 18V$ to 40V	-	1000	1200	-	1000	1200	mV _{PK}
Line Step Recovery ^{2,4}		-	50	200	-	50	200	μ Sec
Turn On Delay	V_{OUT} $V_{IN} = 0V$ to 28V	-	20	30	-	20	30	mSec
Turn On Overshoot		-	-	50	-	-	50	mV _{PK}

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. 100% output power available for $V_{IN} = 18V$ to 50V and only 60% output power available for $V_{IN} = 16V$ to 18V.

BLOCK DIAGRAM

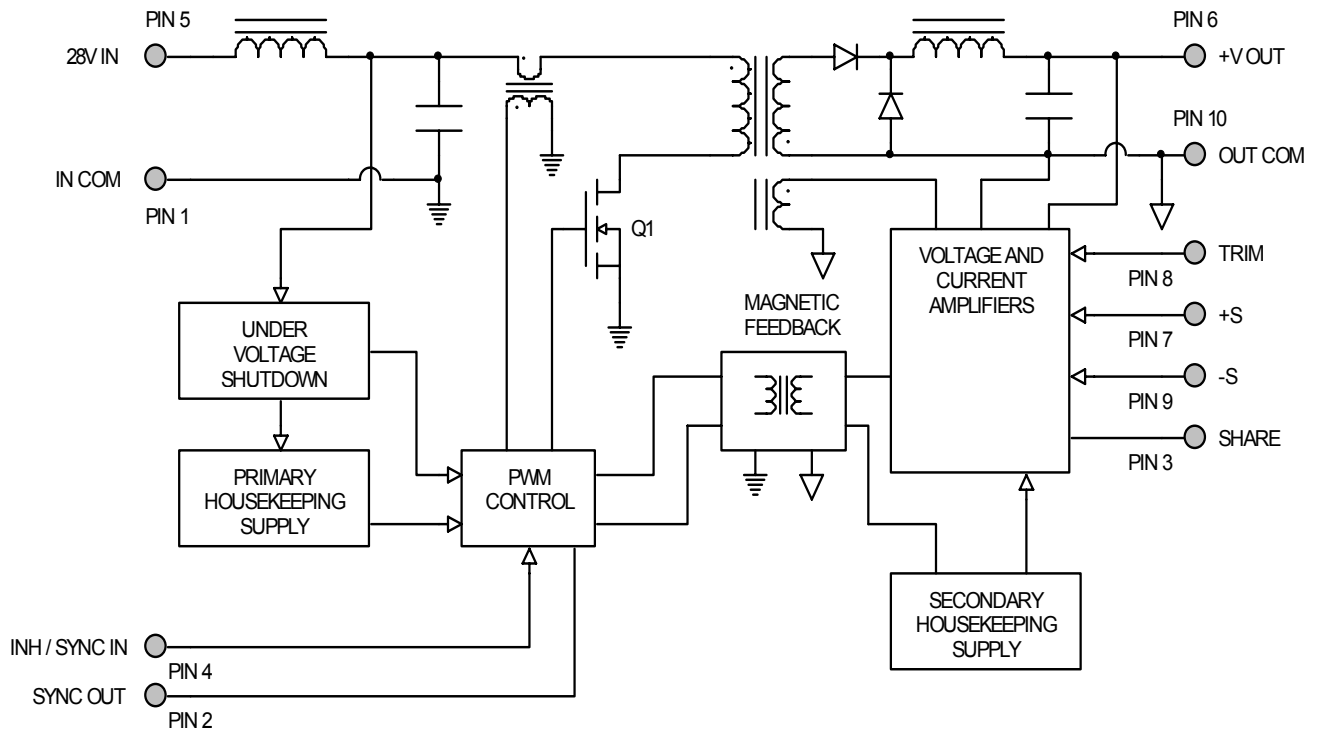


Figure 2

CONNECTION DIAGRAM

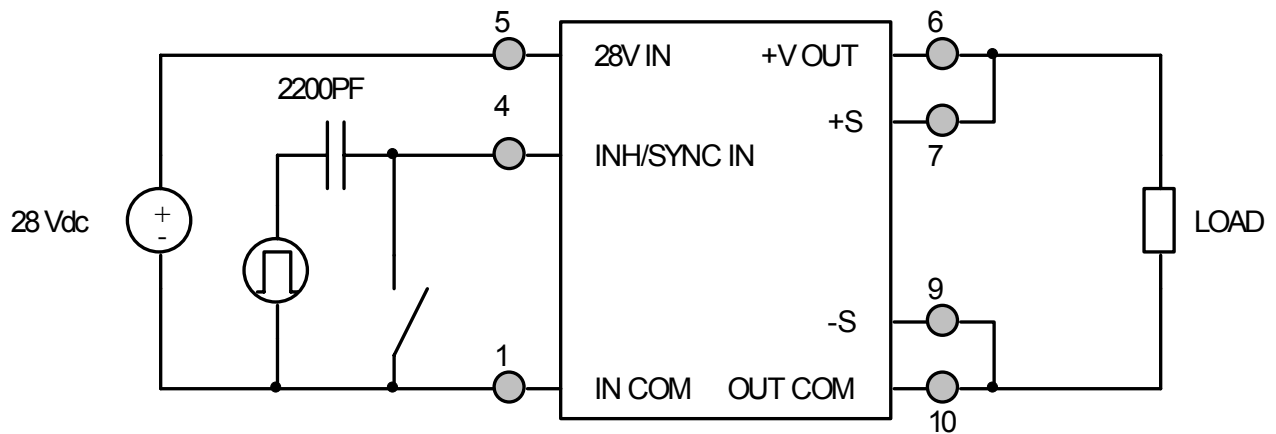


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

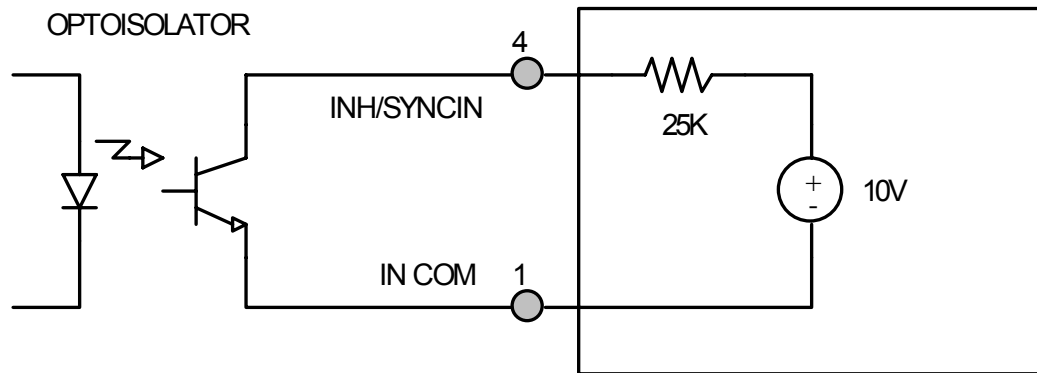


Figure 4 – Isolated Inhibit Drive and Internal Equivalent Circuit

PARALLEL CONNECTION DIAGRAM

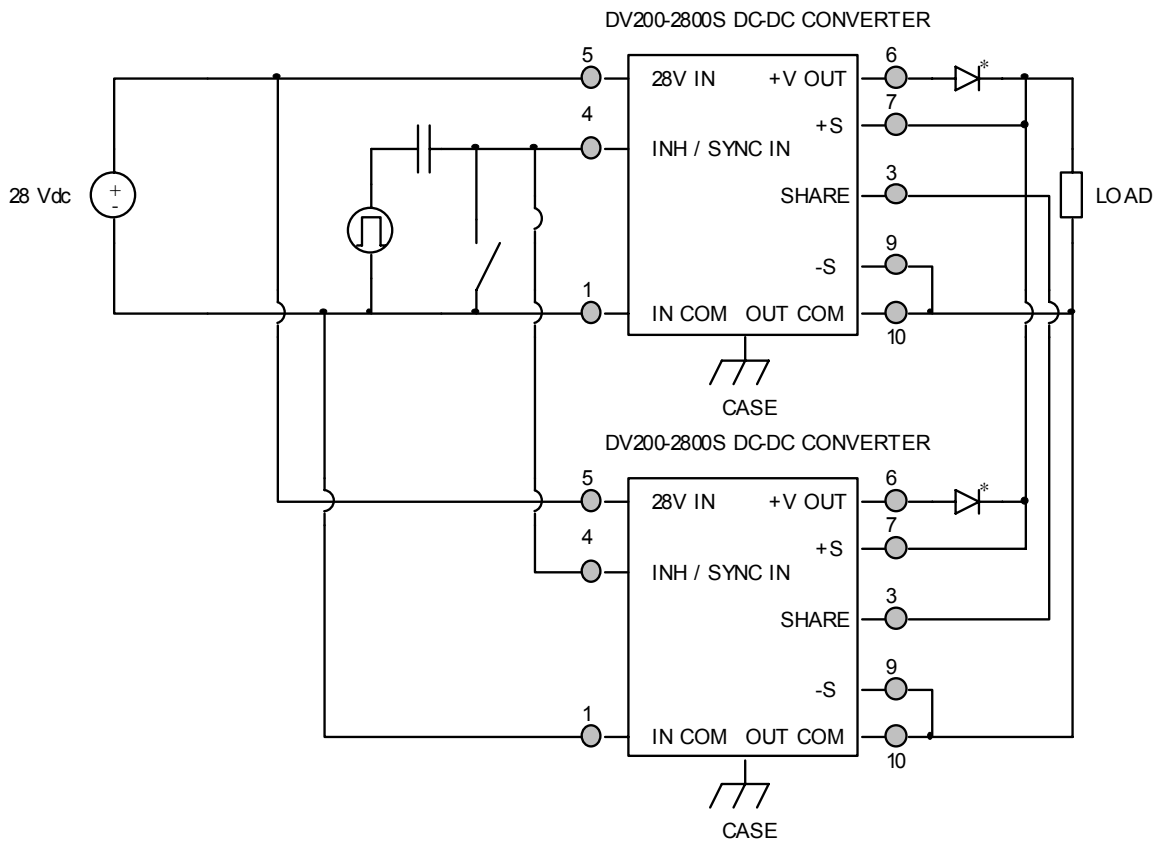
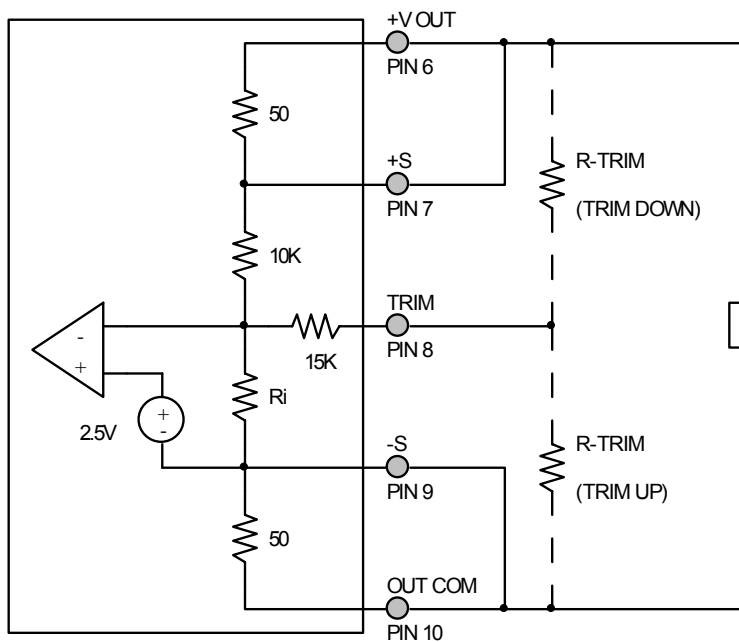


Figure 5 – Parallel Connection with Current Sharing
 (*Shown with optional "OR" ing diode)

OUTPUT VOLTAGE TRIM

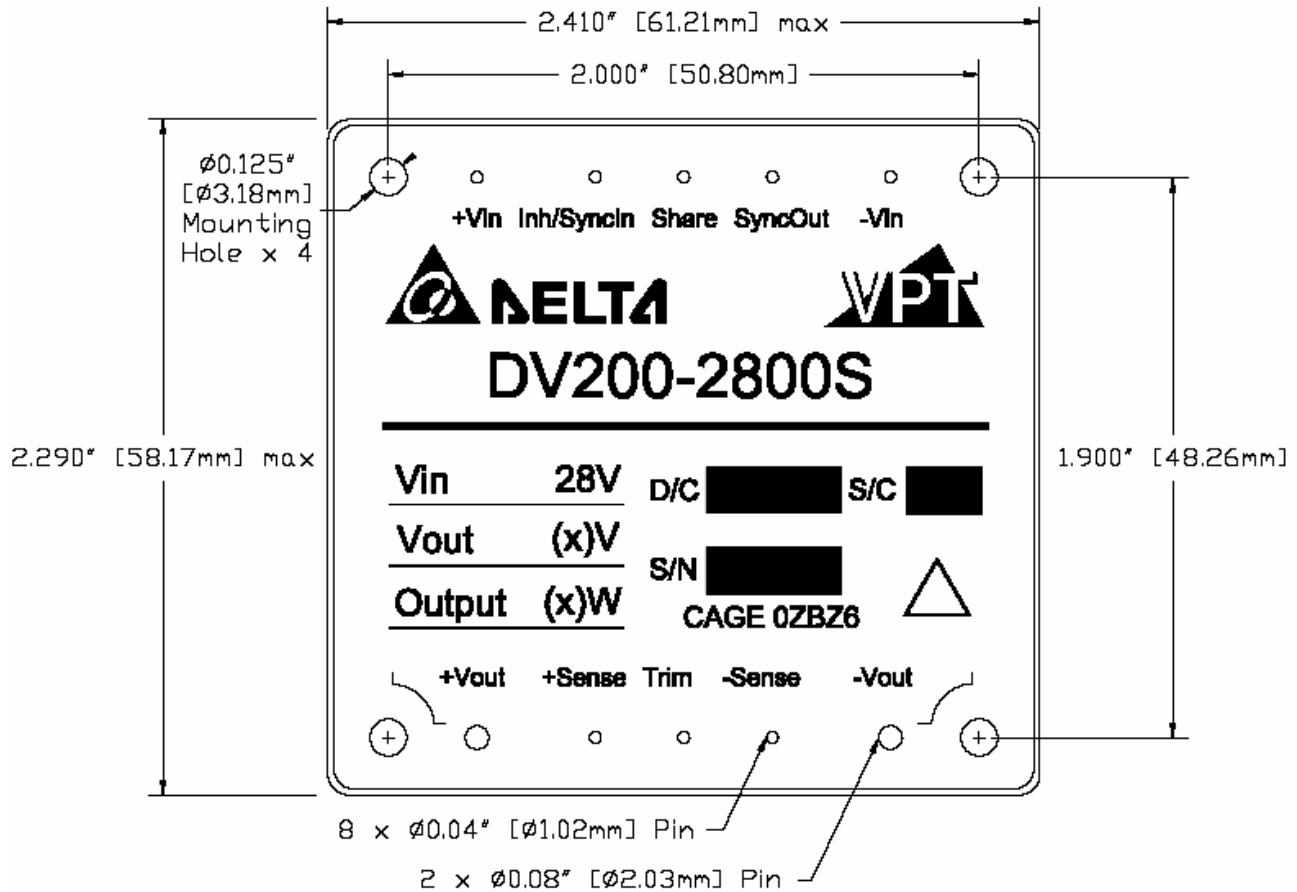


The output voltage can be trimmed down by connecting a resistor between the TRIM pin (PIN 8) and the +V OUT pin (PIN 6), or can be trimmed up by connecting a resistor between the TRIM pin (PIN 8) and the OUT COM pin (PIN 10). The maximum trim range is +10% up and -20% down. The appropriate resistor values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

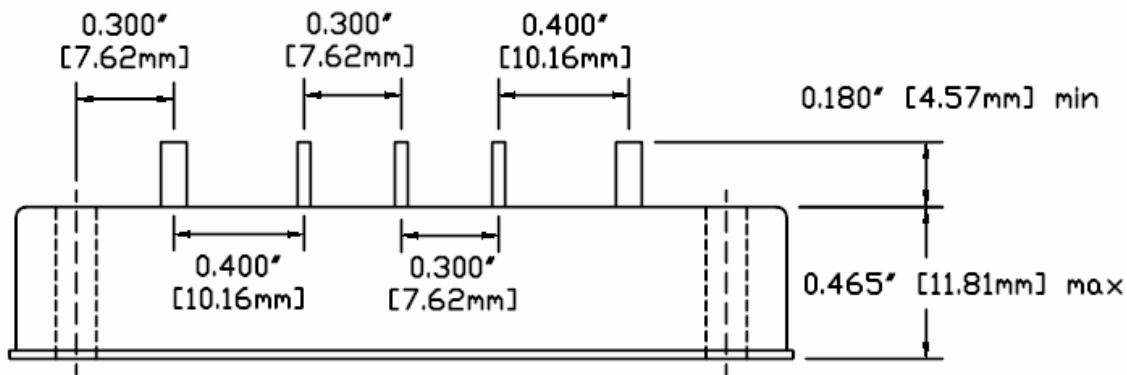
Figure 6 – Output Voltage Trim

DV200-283R3S		DV200-2805S		DV200-2812S		DV200-2815S	
+V _{OUT} (V)	R _{TRIM} (Ω)	+V _{OUT} (V)	R _{TRIM} (Ω)	+V _{OUT} (V)	R _{TRIM} (Ω)	+V _{OUT} (V)	R _{TRIM} (Ω)
3.60	68.3k	5.5	35k	13.2	5.8k	16.50	1.7k
3.55	85k	5.4	47.5k	13.0	10k	16.25	5k
3.50	110k	5.3	68.3k	12.8	16.2k	16.00	10k
3.45	151.7k	5.2	110k	12.6	26.6k	15.75	18.3k
3.40	235k	5.1	235k	12.4	47.3k	15.50	35k
3.35	485k	5.0	-	12.2	109k	15.25	85k
3.30	-	4.9	225k	12.0	-	15.00	-
3.25	135k	4.8	100k	11.8	454k	14.75	475k
3.20	55k	4.7	58.3k	11.6	213k	14.50	225k
3.15	28.3k	4.6	37.5k	11.4	134k	14.25	142k
3.10	15k	4.5	25k	11.2	94k	14.00	100k
3.05	7k	4.4	16.7k	11.0	70.1k	13.75	75k
3.00	1.7k	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



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

SIDE VIEW

Figure 7 – 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	SHARE	Current Share
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	+S	Positive Sense
8	TRIM	Trim Output Voltage to +10%, -20% of Nominal Value
9	-S	Return Sense
10	OUT COM	Output Common Connection

ENVIRONMENTAL SCREENING

Screening	Condition	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 ¹ 100% at 25°C	•	•
Final Inspection	MIL-STD-883, Test 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

DV200-	28	05	S	/ML	-	XXX
1	2	3	4	5		6

(1)	(2)		(3)	
Product Series	Nominal Input Voltage		Output Voltage	
DV200-	28	28 Volts	3R3 05 12 15	3.3 Volts 5 Volts 12 Volts 15 Volts

(4)		(5)		(6)
Number of Outputs		Screening Code ¹		Additional Screening Code
S	Single	None /ML	Standard Military	Contact Sales

Notes: 1. VPT Inc. reserves the right to ship higher screened products to meet lower screened orders at our sole discretion unless specifically forbidden by customer contract.

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: vpsales@vpt-inc.com

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