

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
- Parallel Up to 5 Units With Current Sharing
- Output Voltage Trim Up +10% or Down -20%
- Wide Input Voltage Range: 160 to 400 Volts
- Up to 175 Watts Output Power
- Radiation Immune Magnetic Feedback Circuit
- NO Use of Optoisolators
- Undervoltage Lockout
- Indefinite Short Circuit Protection
- Current Limit Protection
- Input Transient Voltage: 500 Volts for 1 second
- High Power Density: $\approx 80 \text{ W/in}^3$
- Custom Versions Available
- Additional Environmental Screening Available

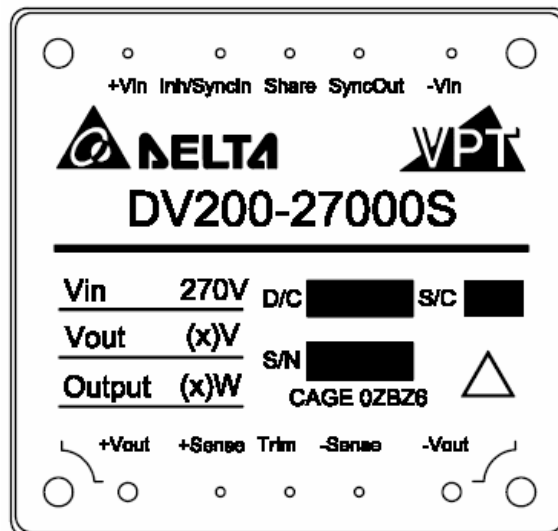


Figure 1 – DV200-27000S DC-DC Converter
(Not To Scale)

SPECIFICATIONS ($T_{CASE} = -55^{\circ}C$ to $+100^{\circ}C$, $V_{IN} = +270V \pm 5\%$, Full Load, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	400 V _{DC}	Junction Temperature Rise to Case	+25°C
Input Voltage (Transient, 1 second)	500 Volts	Storage Temperature	-65°C to +135°C
Output Power ^{1,2}	175 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, $T_{CASE} = +100^{\circ}C$)	40 Watts	Weight (Maximum)	115 Grams

Parameter	Conditions	DV200-2703R3S			DV200-27005S			Units
		Min	Typ	Max	Min	Typ	Max	
STATIC								
INPUT Voltage	Continuous	160	270	400	160	270	400	V
	Transient, 1 sec	-	-	500	-	-	500	V
Current	Inhibited	-	3	5	-	3	5	mA
	No Load	-	8	20	-	8	20	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	100	150	-	100	150	mA _{p-p}
Inhibit Pin Input ³	To Disable Output	0	-	1.5	0	-	1.5	V
Inhibit Pin Open Circuit Voltage ³		9.5	10.5	11.5	9.5	10.5	11.5	V
UVLO Turn On		140	150	159	140	150	159	V
UVLO Turn Off ³		135	145	155	135	145	155	V
OUTPUT Voltage	V_{OUT} $T_{CASE} = 25^{\circ}C$	3.27	3.30	3.33	4.95	5.00	5.05	V
	V_{OUT} $T_{CASE} = -55^{\circ}C$ to $+100^{\circ}C$	3.23	3.30	3.37	4.90	5.00	5.10	V
Power ²	$V_{IN} = 160V$ to $400V$	0	-	100	0	-	150	W
Current ²	I_{OUT} $V_{IN} = 160V$ to $400V$	0	-	30	0	-	30	A
Ripple Voltage	V_{OUT} Full Load, 10kHz to 10MHz	-	50	100	-	50	100	mV _{p-p}
Line Regulation	V_{OUT} $V_{IN} = 160V$ to $400V$	-	10	50	-	10	50	mV
Load Regulation	V_{OUT} No Load to Full Load	-	10	50	-	10	50	mV
Voltage Trim	V_{OUT} Full Load	-20	0	10	-20	-	10	%
EFFICIENCY	Full Load	76	78	-	80	83	-	%
LOAD FAULT POWER DISSIPATION	Overload ³	-	45	-	-	45	-	W
	Short Circuit	-	45	-	-	45	-	W
CAPACITIVE LOAD ³		-	-	2000	-	-	2000	μF
SWITCHING FREQUENCY		400	500	600	400	500	600	kHz
SYNC FREQUENCY RANGE	$V_H - V_L = 5V$ Duty Cycle = 20% - 80%	450	500	550	450	500	550	kHz
ISOLATION ⁴	1000 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	400	-	200	400	mV _{PK}
Load Step Recovery ⁵		-	200	300	-	200	300	μSec
Line Step Output Transient ³	V_{OUT} $V_{IN} = 180V$ to $400V$	-	200	500	-	200	500	mV _{PK}
Line Step Recovery ^{3,5}		-	50	200	-	50	200	μSec
Turn On Delay	V_{OUT} $V_{IN} = 0V$ to $270V$	-	150	300	-	150	300	mSec
Turn On Overshoot		-	0	15	-	0	25	mV _{PK}

Notes: 1. Dependant on output voltage. 2. Derate linearly to 0 at 125°C. 3. Verified by qualification testing. 4. Input to output and input to case. Isolation from output to case is 500VDC. 5. Time for output voltage to settle within 1% of its nominal value.

SPECIFICATIONS ($T_{CASE} = -55^{\circ}C$ to $+100^{\circ}C$, $V_{IN} = +270V \pm 5\%$, Full Load, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	400 V _{DC}	Junction Temperature Rise to Case	+25°C
Input Voltage (Transient, 1 second)	500 Volts	Storage Temperature	-65°C to +135°C
Output Power ^{1,2}	175 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, $T_{CASE} = +100^{\circ}C$)	40 Watts	Weight (Maximum)	115 Grams

Parameter	Conditions	DV200-27012S			DV200-27015S			Units
		Min	Typ	Max	Min	Typ	Max	
STATIC								
INPUT Voltage	Continuous	160	270	400	160	270	400	V
	Transient, 1 sec	-	-	500	-	-	500	V
Current	Inhibited	-	3	5	-	3	5	mA
	No Load	-	8	20	-	8	20	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	100	200	-	100	200	mA _{p-p}
Inhibit Pin Input ³	To Disable Output	0	-	1.5	0	-	1.5	V
Inhibit Pin Open Circuit Voltage ³		9.5	10.5	11.5	9.5	10.5	11.5	V
UVLO Turn On		140	150	159	140	150	159	V
UVLO Turn Off ³		135	145	155	135	145	155	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 $+100^{\circ}C$	11.76	12.0	12.24	14.70	15.0	15.30	V
Power ²	$V_{IN} = 160V$ to $400V$	0	-	175	0	-	175	W
Current ²	I_{OUT} $V_{IN} = 160V$ to $400V$	0	-	14.6	0	-	11.7	A
Ripple Voltage	V_{OUT} Full Load, 10kHz to 10MHz	-	50	150	-	50	150	mV _{p-p}
Line Regulation	V_{OUT} $V_{IN} = 160V$ to $400V$	-	10	50	-	10	50	mV
Load Regulation	V_{OUT} No Load to Full Load	-	10	50	-	10	50	mV
Voltage Trim	V_{OUT} Full Load	-20	-	10	-20	-	10	%
EFFICIENCY	Full Load	82	85	-	82	86	-	%
LOAD FAULT POWER DISSIPATION	Overload ³	-	45	-	-	45	-	W
	Short Circuit	-	45	-	-	45	-	W
CAPACITIVE LOAD ³		-	-	1000	-	-	1000	μF
SWITCHING FREQUENCY		400	500	600	400	500	600	kHz
SYNC FREQUENCY RANGE	$V_H - V_L = 5V$ Duty Cycle = 20% - 80%	450	500	550	450	500	550	kHz
ISOLATION ⁴	1000 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	-	900	1200	-	900	1200	mV _{PK}
Load Step Recovery ⁵		-	200	400	-	200	400	μSec
Line Step Output Transient ³	V_{OUT} $V_{IN} = 180V$ to $400V$	-	900	1200	-	900	1200	mV _{PK}
Line Step Recovery ^{3,5}		-	200	400	-	200	400	μSec
Turn On Delay	V_{OUT} $V_{IN} = 0V$ to $270V$	-	150	300	-	150	300	mSec
Turn On Overshoot		-	-	50	-	-	50	mV _{PK}

Notes: 1. Dependant on output voltage. 2. Derate linearly to 0 at 125°C. 3. Verified by qualification testing. 4. Input to output and input to case. Isolation from output to case is 500VDC. 5. Time for output voltage to settle within 1% of its nominal value.

SPECIFICATIONS ($T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$, $V_{IN} = +270\text{V} \pm 5\%$, Full Load, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	400 V _{DC}	Junction Temperature Rise to Case	+25°C
Input Voltage (Transient, 1 second)	500 Volts	Storage Temperature	-65°C to +135°C
Output Power ^{1,2}	175 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, $T_{CASE} = +100^{\circ}\text{C}$)	40 Watts	Weight (Maximum)	115 Grams

Parameter	Conditions	DV200-27028S			Units
		Min	Typ	Max	
STATIC					
INPUT Voltage	Continuous	160	270	400	V
	Transient, 1 sec	-	-	500	V
Current	Inhibited	-	3	5	mA
	No Load	-	8	20	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	100	200	mA _{p-p}
Inhibit Pin Input ³	To Disable Output	0	-	1.5	V
Inhibit Pin Open Circuit Voltage ³		9.5	10.5	11.5	V
UVLO Turn On		140	150	159	V
UVLO Turn Off ³		135	145	155	V
OUTPUT Voltage	V _{OUT} $T_{CASE} = 25^{\circ}\text{C}$	27.72	28.0	28.28	V
	V _{OUT} $T_{CASE} = -55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$	27.44	28.0	28.56	V
Power ²	V _{IN} = 160V to 400V	0	-	175	W
Current ²	I _{OUT} V _{IN} = 160V to 400V	0	-	6.25	A
Ripple Voltage	V _{OUT} Full Load, 10kHz to 10MHz	-	100	250	mV _{p-p}
Line Regulation	V _{OUT} V _{IN} = 160V to 400V	-	10	100	mV
Load Regulation	V _{OUT} No Load to Full Load	-	10	100	mV
Voltage Trim	V _{OUT} Full Load	-20	-	10	%
EFFICIENCY	Full Load	82	86	-	%
LOAD FAULT POWER DISSIPATION	Overload ³	-	45	-	W
	Short Circuit	-	45	-	W
CAPACITIVE LOAD ³		-	-	1000	μF
SWITCHING FREQUENCY		400	500	600	kHz
SYNC FREQUENCY RANGE	V _H - V _L = 5V Duty Cycle = 20% - 80%	450	500	550	kHz
ISOLATION ⁴	1000 V _{DC}	100	-	-	MΩ
MTBF (MIL-HDBK-217F)	GB @ T _C = 55°C	-	955	-	kHrs
DYNAMIC					
Load Step Output Transient	V _{OUT} Half Load to Full Load	-	1600	2400	mV _{PK}
Load Step Recovery ⁵		-	200	400	μSec
Line Step Output Transient ³	V _{OUT} V _{IN} = 180V to 400V	-	1600	2400	mV _{PK}
Line Step Recovery ^{3,5}		-	200	400	μSec
Turn On Delay	V _{OUT} V _{IN} = 0V to 270V	-	150	300	mSec
Turn On Overshoot		-	-	100	mV _{PK}

Notes: 1. Dependant on output voltage. 2. Derate linearly to 0 at 125°C. 3. Verified by qualification testing. 4. Input to output and input to case. Isolation from output to case is 500VDC. 5. Time for output voltage to settle within 1% of its nominal value.

BLOCK DIAGRAM

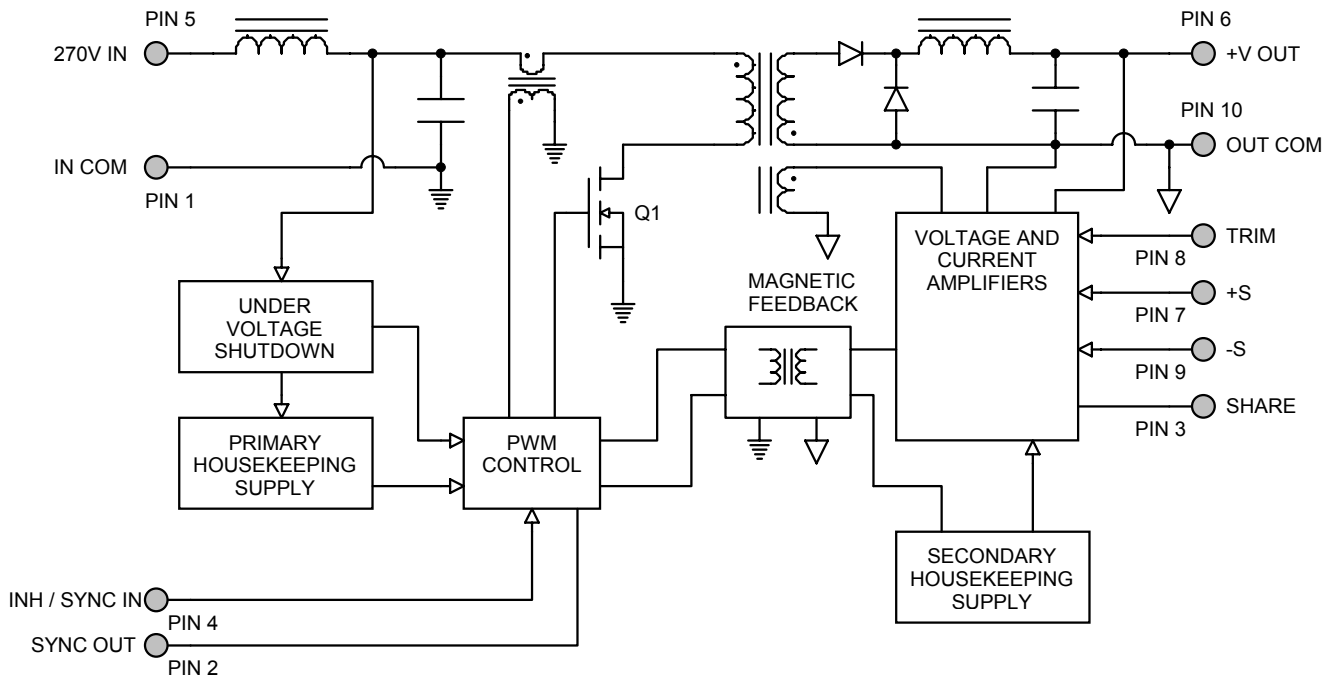


Figure 2

CONNECTION DIAGRAM

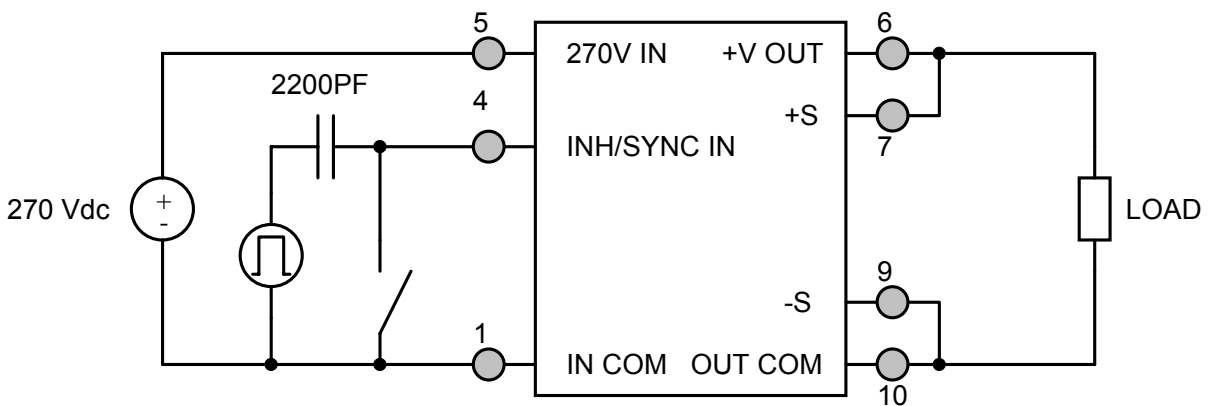


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

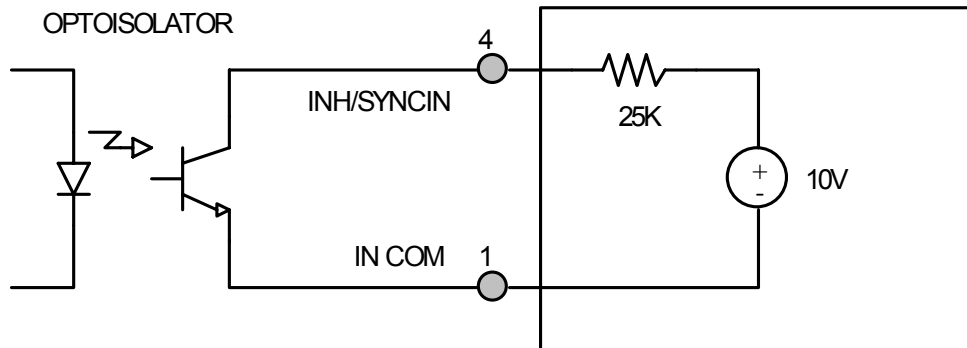


Figure 4 – Isolated Inhibit Drive and Internal Equivalent Circuit

PARALLEL CONNECTION DIAGRAM

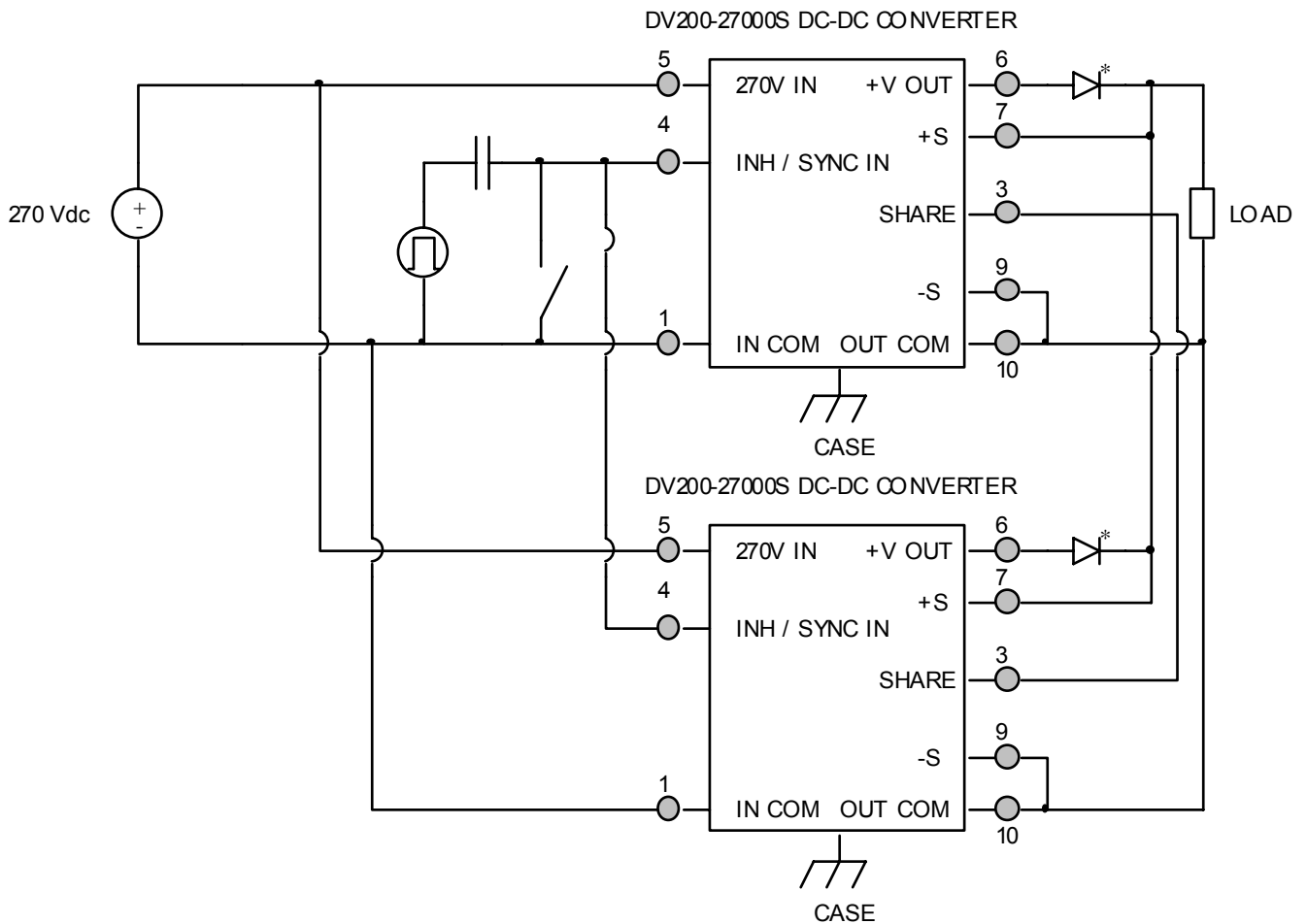
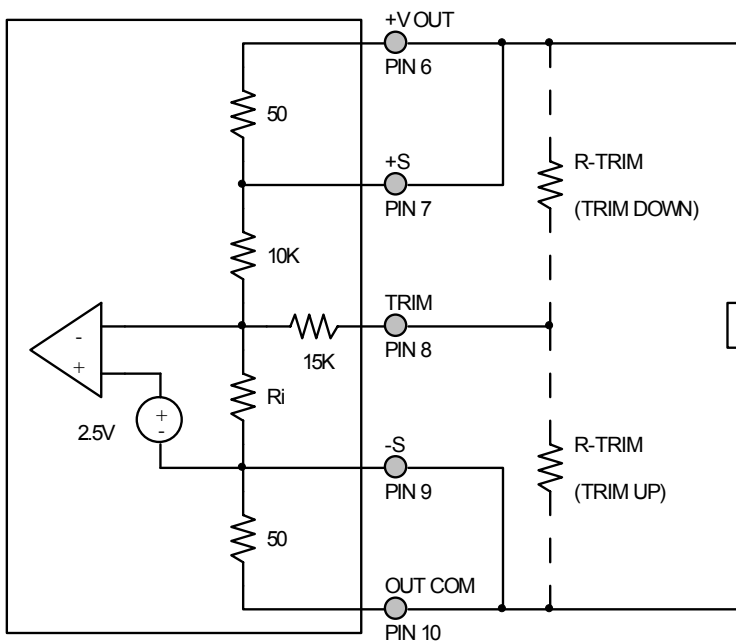


Figure 5 – Parallel Connection with Current Sharing
(*Shown with optional "OR" ing diode)

OUTPUT VOLTAGE TRIM

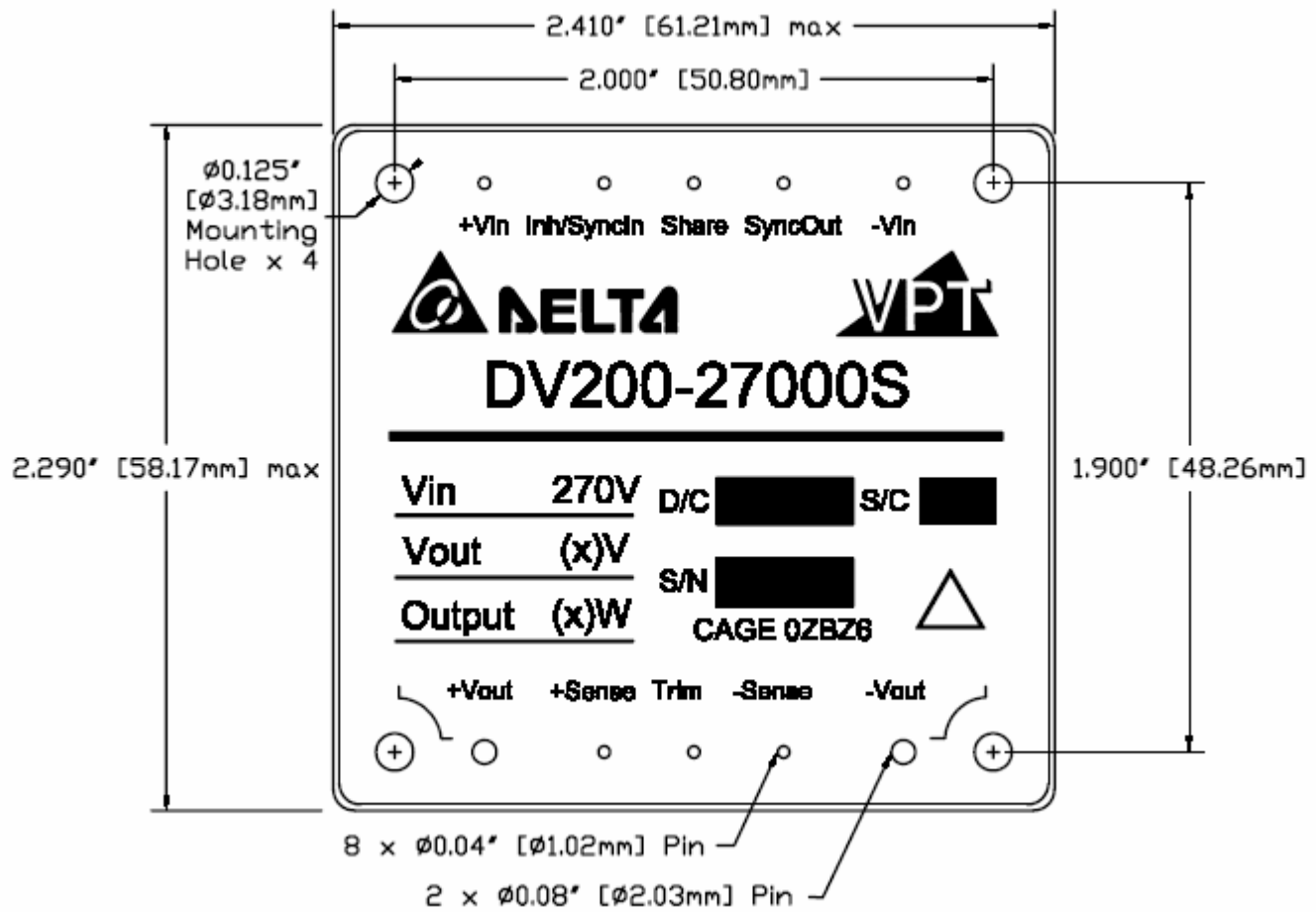


The output voltage can be trimmed down by connecting a resistor between the TRIM pin (PIN 8) and the +V OUT pin (PIN 6), or can be trimmed up by connecting a resistor between the TRIM pin (PIN 8) and the OUT COM pin (PIN 10). The maximum trim range is +10% up and -20% down. The appropriate resistor values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

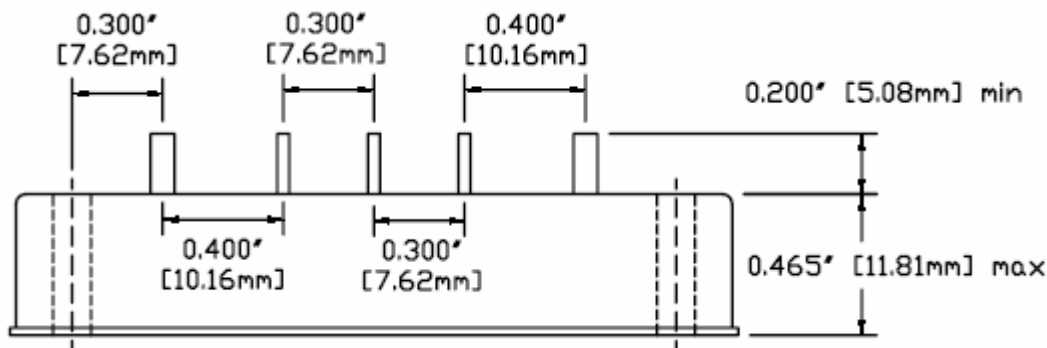
Figure 6 – Output Voltage Trim

DV200-2703R3S		DV200-27005S		DV200-27012S		DV200-27015S		DV200-27028S	
+V _{OUT} (V)	R _{TRIM} (Ω)	+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	30.5	1.9k
3.55	85k	5.4	47.5k	13.0	10k	16.25	5k	30	6.2k
3.50	110k	5.3	68.3k	12.8	16.2k	16.00	10k	29.5	13.2k
3.45	151.7k	5.2	110k	12.6	26.6k	15.75	18.3k	29	27.3k
3.40	235k	5.1	235k	12.4	47.3k	15.50	35k	28.5	69.7k
3.35	485k	5.0	-	12.2	109k	15.25	85k	28	-
3.30	-	4.9	225k	12.0	-	15.00	-	27.5	832k
3.25	135k	4.8	100k	11.8	454k	14.75	475k	27	400k
3.20	55k	4.7	58.3k	11.6	213k	14.50	225k	26.5	256k
3.15	28.3k	4.6	37.5k	11.4	134k	14.25	142k	26	184k
3.10	15k	4.5	25k	11.2	94k	14.00	100k	25.5	141k
3.05	7k	4.4	16.7k	11.0	70.1k	13.75	75k	25	112k
3.00	1.7k	4.3	10.7k	10.8	54.3k	13.50	58.3k	24.5	91.4k
		4.2	6.3k	10.6	42.9k	13.25	46.4k	24	76k
		4.1	2.8k	10.4	34.4k	13.00	37.5k	23.5	64k
		4.0	0	10.2	27.8k	12.75	30.6k	23	54.4k
				10.0	22.5k	12.50	25k	22.5	46.6k
				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	SHARE
4	INH / SYNC IN
5	270V IN
6	+V OUT
7	+S
8	TRIM
9	-S
10	OUT COM

Figure 7 – Package and Pinout
(Dimensional Limits are ±0.005" Unless Otherwise Stated)

PACKAGE PIN DESCRIPTION

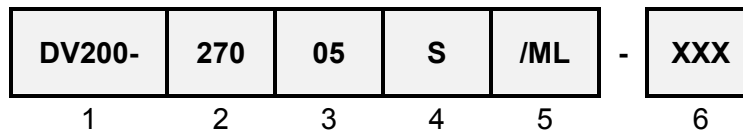
Pin	Function	Description
1	IN COM	Input Common Connection
2	SYNC OUT	Output Synchronization Signal
3	SHARE	Current Share
4	INH / SYNC IN	Logic Low = Disabled Output. Unconnected or open collector TTL or Square-wave Synchronization Signal = Enabled Output.
5	270V IN	Positive Input Voltage Connection
6	+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	MIL-STD-883	Standard (No Suffix)	Military /ML
Pre-Cap Inspection	IPC-A-610 Class III	•	•
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	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



(1) Product Series	(2) Nominal Input Voltage		(3) Output Voltage	
DV200-	270	270 Volts	3R3 05 12 15 28	3.3 Volts 5 Volts 12 Volts 15 Volts 28 Volts

(4) Number of Outputs		(5) Screening Code		(6) Additional Screening Code
S	Single	None /ML	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) 487-4850
Fax: (425) 487-4802
E-mail: sales@vpt-inc.com

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