DV200-27000D Series

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 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
- Output Voltage Trim Up +10% or Down –20%
- Wide Input Voltage Range: 160 to 400 Volts
- Up to 175 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
- Current Limit / Short Circuit Protection
- Input Transient Voltage: 500 Volts for 1 second
- High Power Density: ≈ 70 W/in^3
- Custom Versions Available
- Additional Environmental Screening Available

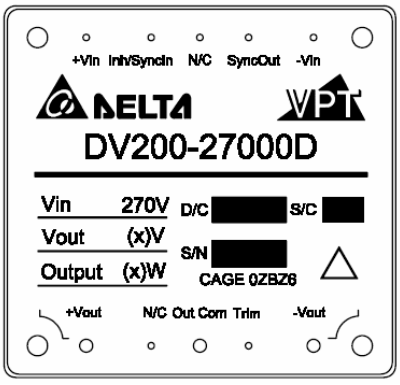

Figure 1 – DV200-27000D DC-DC Converter
(Not To Scale)

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SPECIFICATIONS (T_{CASE} = -55°C to +100°C, V_{IN} = +270V ± 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)[4]	500 Volts	Storage Temperature	-65°C to +135°C
Output Power[1,3]	175 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +100°C)	38 Watts	Weight (Maximum)	115 Grams

Parameter		Conditions	DV200-27005D			DV200-27012D			Units
			Min	Typ	Max	Min	Typ	Max	
STATIC									
INPUT Voltage		Continuous	160	270	400	160	270	400	V
		Transient, 1 sec[4]	-	-	500	-	-	500	V
Current		Inhibited	-	2	5	-	2	5	mA
		No Load	-	8	20	-	8	20	mA
Ripple Current		Full Load[5], 20Hz to 10MHz	-	100	175	-	100	200	mA_{p-p}
Inhibit Pin Input[4]			0	-	1.5	0	-	1.5	V
Inhibit Pin Open Circuit Voltage[4]			9.0	10.0	11.0	9.0	10.0	11.0	V
UVLO Turn On			140	150	159	140	150	159	V
UVLO Turn Off[4]			135	140	150	135	140	150	V
OUTPUT Voltage	$+V_{OUT}$	T_{CASE} = 25°C	4.95	5.00	5.05	11.88	12.00	12.12	V
	$+V_{OUT}$	T_{CASE} = -55°C to +100°C	4.90	5.00	5.10	11.76	12.00	12.24	V
	$-V_{OUT}$	T_{CASE} = 25°C	4.90	5.00	5.10	11.76	12.00	12.24	V
	$-V_{OUT}$	T_{CASE} = -55°C to +100°C	4.85	5.00	5.15	11.64	12.00	12.36	V
Power[3,6]	Total		0	-	150	0	-	175	W
	$\pm V_{OUT}$	Either Output	-	-	105	-	-	122.5	W
Current[3,6]	$\pm V_{OUT}$	Either Output	-	-	21	-	-	10.2	A
Ripple Voltage	$\pm V_{OUT}$	Full Load[5], 20Hz to 20MHz	-	100	150	-	100	150	mV_{p-p}
Line Regulation	$+V_{OUT}$	V_{IN} = 160V to 400V	-	10	50	-	10	50	mV
	$-V_{OUT}$	V_{IN} = 160V to 400V	-	10	100	-	10	100	mV
Load Regulation	$+V_{OUT}$	No Load to Full Load[5]	-	10	50	-	10	50	mV
	$-V_{OUT}$	No Load to Full Load[5]	-	10	100	-	10	100	mV
Cross Regulation	$-V_{OUT}$	+Load 70%, -Load 30% +Load 30%, -Load 70%	-	-	500	-	-	500	mV
Voltage Trim		Full Load	-20	-	10	-20	-	10	%
EFFICIENCY		Full Load[5]	80	83	-	83	87	-	%
LOAD FAULT POWER DISSIPATION		Overload[4]	-	30	-	-	30	-	W
		Short Circuit[4]	-	30	-	-	30	-	W
CAPACITIVE LOAD[4]		Either Output	-	-	1000	-	-	500	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		1000 V_{DC}, T_{CASE} = 25°C	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)		GB @ T_C = 55°C	-	955	-	-	955	-	kHrs

SPECIFICATIONS (T_{CASE} = -55°C to +100°C, V_{IN} = +270V ± 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)[4]	500 Volts	Storage Temperature	-65°C to +135°C
Output Power[1,3]	175 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +100°C)	38 Watts	Weight (Maximum)	115 Grams

Parameter		Conditions	DV200-27005D			DV200-27012D			Units
			Min	Typ	Max	Min	Typ	Max	
DYNAMIC									
Load Step Output Transient	±V_{OUT}	Half Load to Full Load	-	200	400	-	500	900	mV_{PK}
Load Step Recovery[2]			-	200	300	-	200	400	µSec
Line Step Output Transient[4]	±V_{OUT}	V_{IN} = 180V to 400V	-	200	500	-	600	1200	mV_{PK}
Line Step Recovery[2, 4]			-	100	200	-	200	400	µSec
Turn On Delay	±V_{OUT}	V_{IN} = 0V to 270V	-	150	300	-	150	300	mSec
Turn On Overshoot[2]			-	0	25	-	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. 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.

SPECIFICATIONS (T_{CASE} = -55°C to +100°C, V_{IN} = +270V ± 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)[4]	500 Volts	Storage Temperature	-65°C to +135°C
Output Power[1,3]	175 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +100°C)	38 Watts	Weight (Maximum)	115 Grams

Parameter		Conditions	DV200-27015D			Units
			Min	Typ	Max	
STATIC						
INPUT Voltage		Continuous	160	270	400	V
		Transient, 1 sec[4]	-	-	500	V
Current		Inhibited	-	2	5	mA
		No Load	-	8	20	mA
Ripple Current		Full Load[5], 20Hz to 10MHz	-	100	200	mA_{p-p}
Inhibit Pin Input[4]			0	-	1.5	V
Inhibit Pin Open Circuit Voltage[4]			9.0	10.0	11.0	V
UVLO Turn On			140	150	159	V
UVLO Turn Off[4]			135	140	150	V
OUTPUT Voltage	$+V_{OUT}$	T_{CASE} = 25°C	14.85	15.00	15.15	V
	$+V_{OUT}$	T_{CASE} = -55°C to +100°C	14.70	15.00	15.30	V
	$-V_{OUT}$	T_{CASE} = 25°C	14.70	15.00	15.30	V
	$-V_{OUT}$	T_{CASE} = -55°C to +100°C	14.55	15.00	15.45	V
Power[3,6]	Total		-	-	175	W
	$\pm V_{OUT}$	Either Output	-	-	122.5	W
Current[3,6]	$\pm V_{OUT}$	Either Output	-	-	8.2	A
Ripple Voltage	$\pm V_{OUT}$	Full Load[5], 20Hz to 20MHz	-	100	150	mV_{p-p}
Line Regulation	$+V_{OUT}$	V_{IN} = 160V to 400V	-	10	50	mV
	$-V_{OUT}$	V_{IN} = 160V to 400V	-	10	100	mV
Load Regulation	$+V_{OUT}$	No Load to Full Load[5]	-	10	50	mV
	$-V_{OUT}$	No Load to Full Load[5]	-	10	100	mV
Cross Regulation	$-V_{OUT}$	+Load 70%, -Load 30% +Load 30%, -Load 70%	-	-	500	mV
Voltage Trim		Full Load	-20	-	10	%
EFFICIENCY		Full Load[5]	84	88	-	%
LOAD FAULT POWER DISSIPATION		Overload[4]	-	30	-	W
		Short Circuit[4]	-	30	-	W
CAPACITIVE LOAD[4]		Either Output	-	-	500	µF
SWITCHING FREQUENCY			400	500	600	kHz
SYNC FREQUENCY RANGE		$V_H - V_L$ = 5V Duty Cycle = 20% - 80%	450	500	550	kHz
ISOLATION		1000 V_{DC}, T_{CASE} = 25°C	100	-	-	MΩ
MTBF (MIL-HDBK-217F)		GB @ T_C = 55°C	-	955	-	kHrs

SPECIFICATIONS (T_{CASE} = -55°C to +100°C, V_{IN} = +270V ± 5%, Full Load[5], Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS			
Input Voltage (Continuous)	400 V_{DC}	Junction Temperature Rise to Case	+25°C
Input Voltage (Transient, 1 second)[4]	500 Volts	Storage Temperature	-65°C to +135°C
Output Power[1,3]	175 Watts	Lead Solder Temperature (10 seconds)	270°C
Power Dissipation (Full Load, T_{CASE} = +100°C)	38 Watts	Weight (Maximum)	115 Grams

Parameter		Conditions	DV200-27015D			Units
			Min	Typ	Max	
DYNAMIC						
Load Step Output Transient	±V_{OUT}	Half Load to Full Load	-	500	900	mV_{PK}
Load Step Recovery[2]			-	200	400	µSec
Line Step Output Transient[4]	±V_{OUT}	V_{IN} = 180V to 400V	-	750	1500	mV_{PK}
Line Step Recovery[2, 4]			-	200	400	µSec
Turn On Delay	±V_{OUT}	V_{IN} = 0V to 270V	-	150	300	mSec
Turn On Overshoot[2]			-	-	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. 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.

BLOCK DIAGRAM

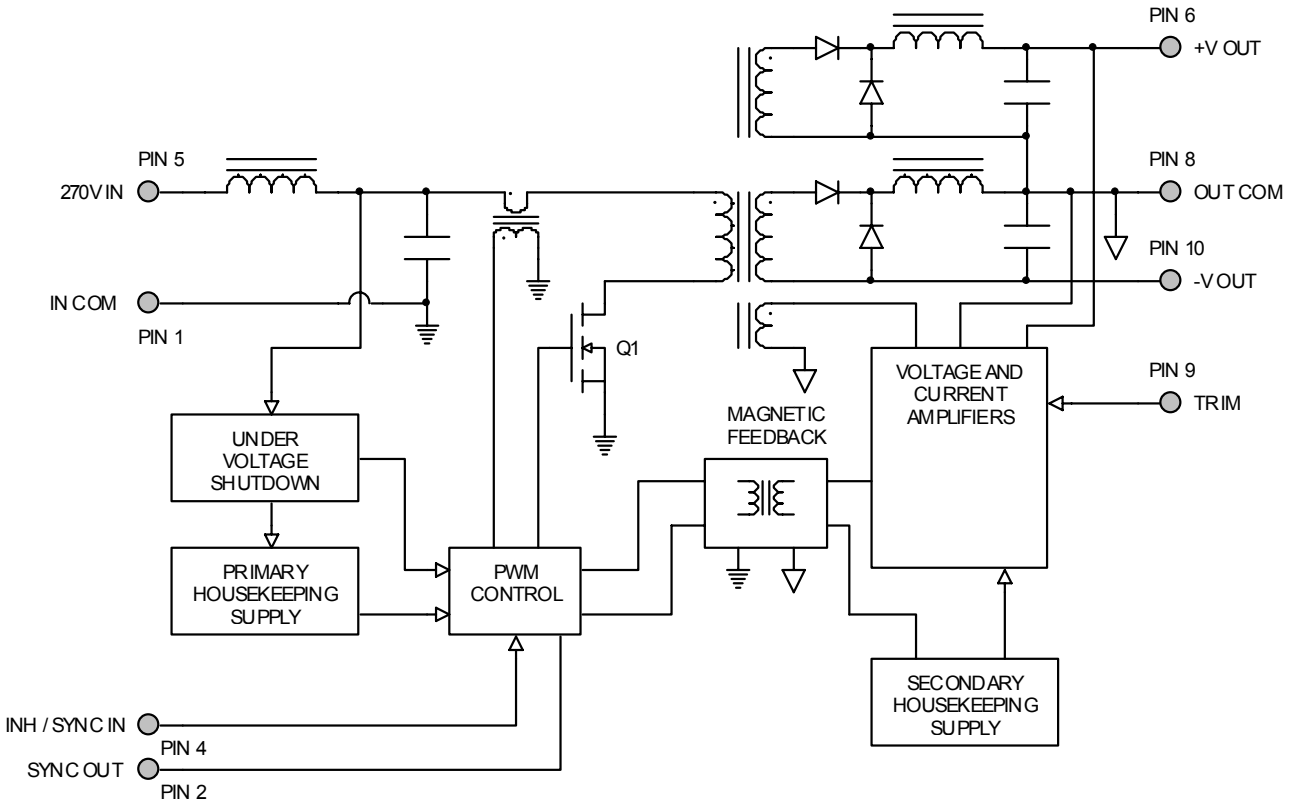


Figure 2

CONNECTION DIAGRAM

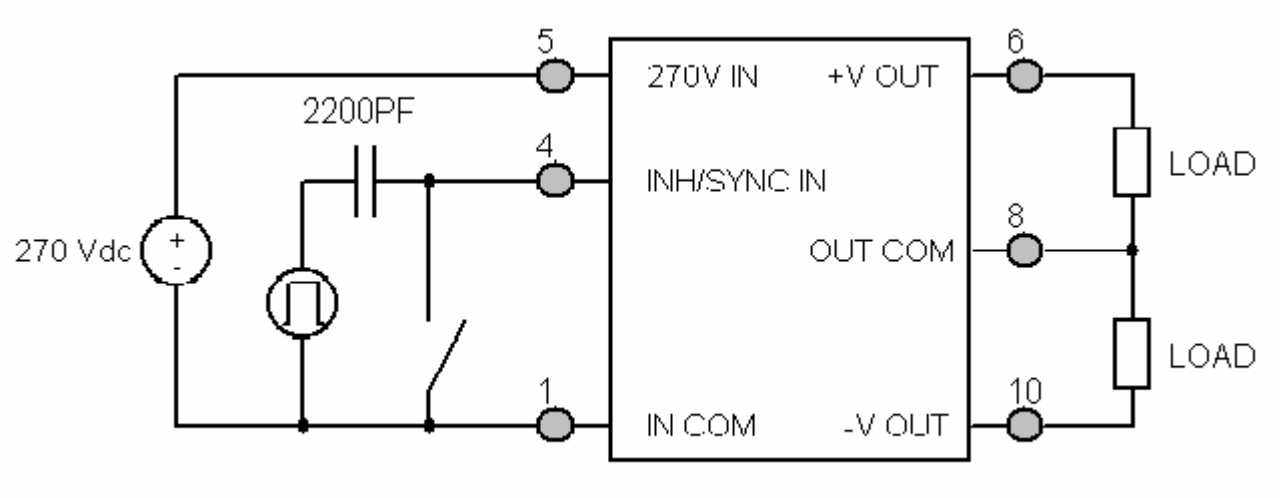


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAMS

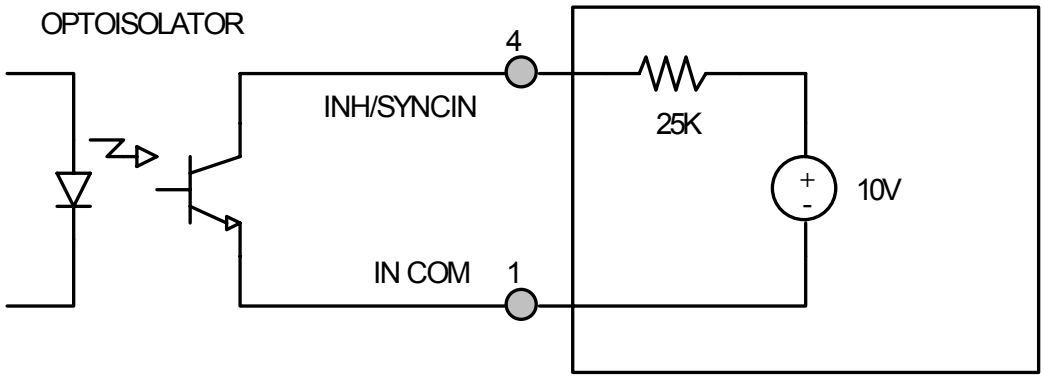
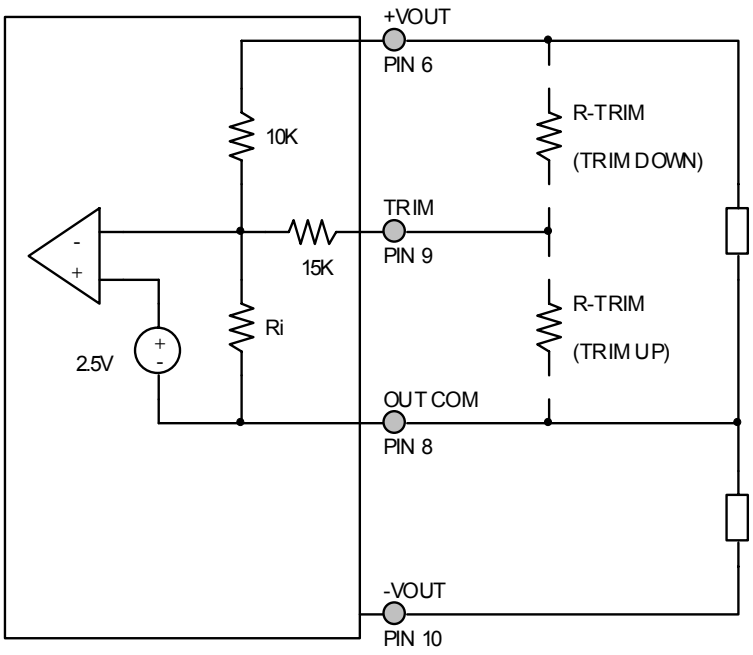


Figure 4 – Isolated Inhibit Drive and Internal Equivalent Circuit

OUTPUT VOLTAGE TRIM

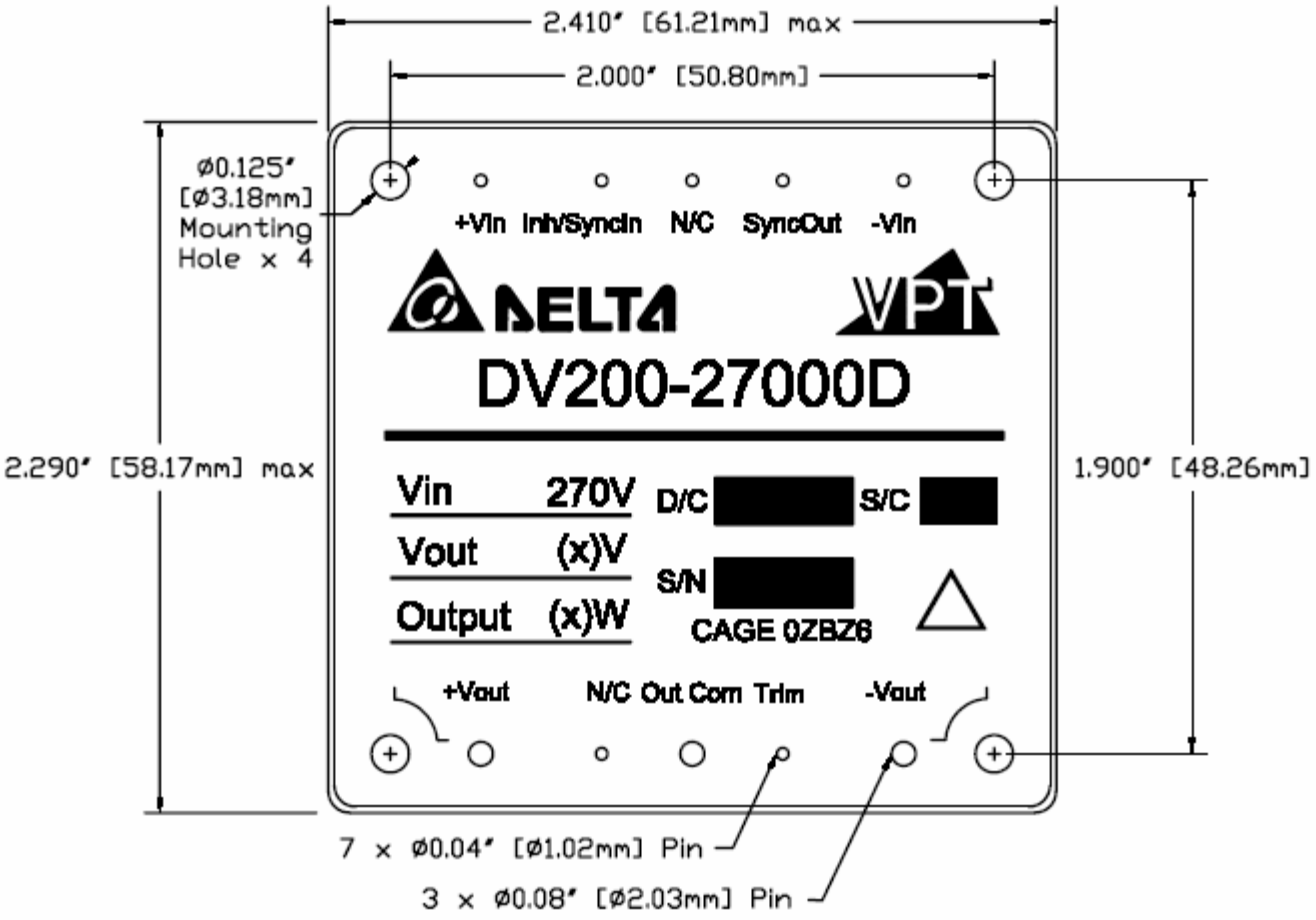


The output voltage can be trimmed down by connecting a resistor between the TRIM pin (PIN 9) and the +V OUT pin (PIN 6), or can be trimmed up by connecting a resistor between the TRIM pin (PIN 9) and the OUT COM pin (PIN 8). The maximum trim range is +10% up and –20% down. The appropriate resistor values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

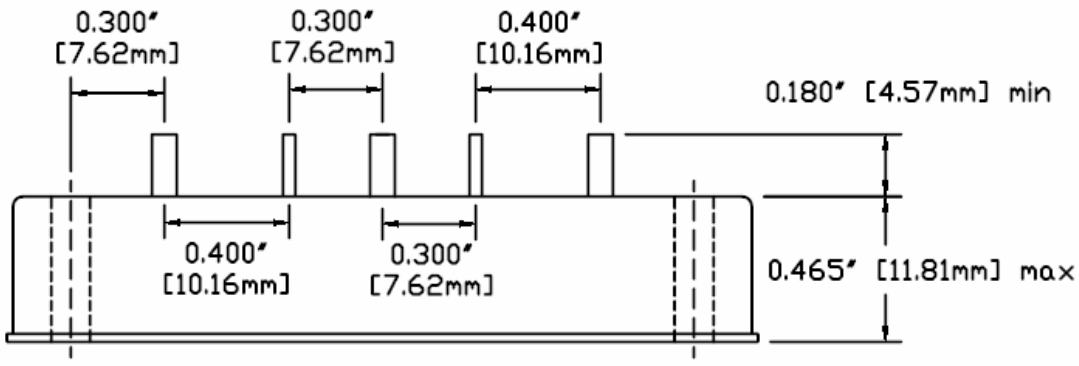
Figure 5 – Output Voltage Trim

DV200-27005D		DV200-27012D		DV200-27015D	
$\pm V_{OUT}$ (V)	R_{TRIM} (Ω)	$\pm V_{OUT}$ (V)	R_{TRIM} (Ω)	$\pm V_{OUT}$ (V)	R_{TRIM} (Ω)
5.5	37.6k	13.2	6.9k	16.50	3k
5.4	50.7k	13.0	11.3k	16.25	6.6k
5.3	72.6k	12.8	17.9k	16.00	12k
5.2	116k	12.6	28.8k	15.75	21k
5.1	248k	12.4	50.6k	15.50	39k
5.0	-	12.2	116k	15.25	93k
4.9	237k	12.0	-	15.00	-
4.8	106k	11.8	477k	14.75	514k
4.7	62.1k	11.6	225k	14.50	244k
4.6	40.2k	11.4	141k	14.25	154k
4.5	27.0k	11.2	99.6k	14.00	109k
4.4	18.3k	11.0	74.5k	13.75	82.2k
4.3	12.0k	10.8	57.9k	13.50	64.2k
4.2	7.3k	10.6	45.9k	13.25	51.3k
4.1	3.7k	10.4	37.0k	13.00	41.7k
4.0	765	10.2	30.0k	12.75	34.2k
		10.0	24.5k	12.50	28.2k
		9.8	19.9k	12.25	23.3k
		9.6	16.1k	12.00	19.2k

PACKAGE SPECIFICATIONS



TOP VIEW



SIDE VIEW

PIN	FUNCTION
1	IN COM
2	SYNC OUT
3	N/C
4	INH / SYNC IN
5	270V 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	270V 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	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-	270	05	D	/ML	-	XXX
1	2	3	4	5		6

(1)	(2)		(3)	
Product Series	**Nominal Input Voltage**		**Output Voltage**	
DV200-	**270**	270 Volts	**05** **12** **15**	±5 Volts ±12 Volts ±15 Volts

(4)		(5)		(6)
Number of Outputs		**Screening Code[1]**		**Additional Screening Code**
D	Dual	**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:

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Fax: (425) 353-4030
E-mail: vptsales@vpt-inc.com