

HIGH RELIABILITY HYBRID DC-DC CONVERTERS

DESCRIPTION

The DVFL series of high reliability DC-DC converters is operable over the full military (-55 °C to +125 °C) temperature range with no power derating. Unique to the DVFL series are robust and effective input and output filters which provide dramatically reduced input and output noise performance when compared to other manufacturers competing devices.

Operating at a nominal fixed frequency of 500 kHz, these regulated, isolated units utilize a high speed magnetic feedback design and 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 40 Volts per MIL-STD-704
- Up to 120 Watts Output Power
- Fault Tolerant Magnetic Feedback Circuit
- NO Use of Optoisolators
- Undervoltage Lockout
- Indefinite Short Circuit Protection
- Current Limit Protection
- Industry Standard Pinout
- Input Transient Voltage: 50 Volts for 1 second
- Precision Seam Welded Hermetic Package
- High Power Density: > 80 W/in³
- Custom Versions Available
- Additional Environmental Screening Available
- Meets MIL-STD-461 Revisions C, D, E and F EMC Requirements When Used With VPT's EMI Filters
- MIL-PRF-38534 Element Evaluated Components
- Space Applications should consider VPT's "S" Series of Radiation Tolerant Power Conversion Devices. Contact VPT for details.

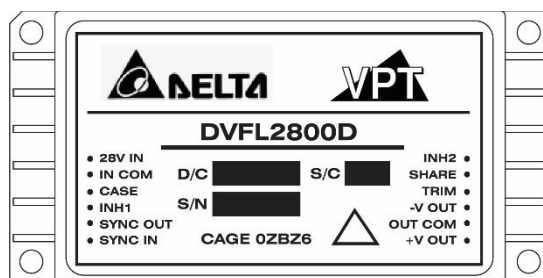


Figure 1 – DVFL2800D DC-DC Converter
(Exact marking may differ from that shown)

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load⁵, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	40 V _{DC}	Junction Temperature Rise to Case	+15°C
Input Voltage (Transient, 1 second)	50 Volts	Storage Temperature	-65°C to +150°C
Output Power ¹	120 Watts	Lead Solder Temperature (10 seconds)	270°C
ESD Rating per MIL-PRF-38543	1C	Weight (Maximum) (No Pin Extensions)	90 Grams

Parameter		Conditions	DVFL2805D			DVFL286R3D			Units
			Min	Typ	Max	Min	Typ	Max	
STATIC									
INPUT Voltage ⁴		Continuous	16	28	40	16	28	40	V
		Transient, 1 sec	-	-	50	-	-	50	V
Current		Inhibited 1	-	1	3	-	1	3	mA
		Inhibited 2	-	40	70	-	40	70	mA
		No Load	-	75	160	-	75	160	mA
Ripple Current		Full Load ⁵ , 20Hz to 10MHz	-	30	80	-	35	80	mA _{pp}
INH1 Pin Input ⁴			0	-	1.5	0	-	1.5	V
INH2 Pin Input ⁴			0	-	1	0	-	1	V
INH1 Pin Open Circuit Voltage ⁴			10.5	-	15	10.5	-	15	V
INH2 Pin Open Circuit Voltage ⁴			4	-	12	4	-	12	V
UVLO Turn On			14.5	-	16	14.5	-	16	V
UVLO Turn Off ⁴			13.5	-	15.5	13.5	-	15.5	V
OUTPUT Voltage ⁵		+V _{OUT} T _{CASE} = 25°C	4.95	5.00	5.05	6.237	6.3	6.363	V
		+V _{OUT} T _{CASE} = -55°C to +125°C	4.925	5.00	5.075	6.205	6.3	6.395	V
		-V _{OUT} T _{CASE} = 25°C	4.80	5.00	5.20	6.1	6.3	6.5	V
		-V _{OUT} T _{CASE} = -55°C to +125°C	4.75	5.00	5.25	6.048	6.3	6.552	V
Power ^{3,6}		Total	-	-	100	-	-	100	W
		±V _{OUT} Either Output	-	-	70	-	-	70	W
Current ^{3,6}		±V _{OUT} Either Output	-	-	14	-	-	11.1	A
Ripple Voltage		±V _{OUT} Full Load ⁵ , 20Hz to 10MHz	-	15	80	-	20	80	mV _{pp}
Line Regulation		+V _{OUT} V _{IN} = 16V to 40V	-	2	20	-	2	20	mV
		-V _{OUT} V _{IN} = 16V to 40V	-	10	200	-	10	200	mV
Load Regulation		+V _{OUT} No Load to Full Load ⁵	-	10	100	-	10	120	mV
		-V _{OUT} No Load to Full Load ⁵	-	55	200	-	70	200	mV
Cross Regulation		V1+ Load 30% - Load 70% V2+ Load 70% - Load 30%	-	260	450	-	300	450	mV
Voltage Trim		Full Load	-20	-	10	-20	-	10	%
Share Pin Voltage ⁴			2	-	4	2	-	4	V
EFFICIENCY		Full Load ⁵	73	80	-	76	81	-	%
LOAD FAULT POWER DISSIPATION		Overload ⁴	-	-	50	-	-	50	W
		Short Circuit	-	-	50	-	-	50	W
CAPACITIVE LOAD ⁴			-	-	500	-	-	500	μF
SWITCHING FREQUENCY			425	500	600	425	500	600	kHz
SYNC FREQUENCY RANGE		V _H – V _L = 5V Duty Cycle = 20% - 80%	500	-	600	500	-	600	kHz
ISOLATION		500 V _{DC} , T _{CASE} = 25°C	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)		AIF @ T _C = 55°C	-	400	-	-	400	-	kHrs

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load⁵, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	40 V _{DC}	Junction Temperature Rise to Case	+15°C
Input Voltage (Transient, 1 second)	50 Volts	Storage Temperature	-65°C to +150°C
Output Power ¹	120 Watts	Lead Solder Temperature (10 seconds)	270°C
ESD Rating per MIL-PRF-38543	1C	Weight (Maximum) (No Pin Extensions)	90 Grams

Parameter		Conditions	DVFL2805D			DVFL286R3D			Units
			Min	Typ	Max	Min	Typ	Max	
DYNAMIC									
Load Step Output Transient	±V _{OUT}	Half Load to Full Load	-	130	400	-	150	300	mV _{PK}
Load Step Recovery ²			-	200	500	-	200	500	μSec
Line Step Output Transient ⁴	±V _{OUT}	V _{IN} = 16V to 40V	-	300	600	-	250	600	mV _{PK}
Line Step Recovery ^{2, 4}			-	300	500	-	400	700	μSec
Turn On Delay	±V _{OUT}	V _{IN} = 0V to 28V	-	5	20	-	5	20	mSec
Turn On Overshoot			-	0	25	-	0	25	mV _{PK}

- Notes:
1. Dependent on output voltage.
 2. Time for output voltage to settle within 1% of its nominal value.
 3. Derate linearly to 0 at 135°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 +125°C, V_{IN} = +28V ± 5%, Full Load⁵, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	40 V _{DC}	Junction Temperature Rise to Case	+15°C
Input Voltage (Transient, 1 second)	50 Volts	Storage Temperature	-65°C to +150°C
Output Power ¹	120 Watts	Lead Solder Temperature (10 seconds)	270°C
ESD Rating per MIL-PRF-38543	1C	Weight (Maximum) (No Pin Extensions)	90 Grams

Parameter		Conditions	DVFL289R5D			DVFL2812D			Units
			Min	Typ	Max	Min	Typ	Max	
STATIC									
INPUT Voltage ⁴		Continuous	16	28	40	16	28	40	V
		Transient, 1 sec	-	-	50	-	-	50	V
Current		Inhibited 1	-	1	3	-	1	3	mA
		Inhibited 2	-	40	70	-	40	70	mA
		No Load	-	80	160	-	90	160	mA
Ripple Current		Full Load ⁵ , 20Hz to 10MHz	-	30	80	-	35	80	mA _{pp}
INH1 Pin Input ⁴			0	-	1.5	0	-	1.5	V
INH2 Pin Input ⁴			0	-	1	0	-	1	V
INH1 Pin Open Circuit Voltage ⁴			10.5	-	15	10.5	-	15	V
INH2 Pin Open Circuit Voltage ⁴			4	-	12	4	-	12	V
UVLO Turn On			14.5	-	16	14.5	-	16	V
UVLO Turn Off ⁴			13.5	-	15.5	13.5	-	15.5	V
OUTPUT Voltage ⁵		+V _{OUT} T _{CASE} = 25°C	9.405	9.5	9.595	11.88	12.00	12.12	V
		+V _{OUT} T _{CASE} = -55°C to +125°C	9.357	9.5	9.643	11.82	12.00	12.18	V
		-V _{OUT} T _{CASE} = 25°C	9.3	9.5	9.7	11.80	12.00	12.20	V
		-V _{OUT} T _{CASE} = -55°C to +125°C	9.12	9.5	9.88	11.52	12.00	12.48	V
Power ^{3,6}		Total	-	-	100	-	-	110	W
		±V _{OUT} Either Output	-	-	70	-	-	77	W
Current ^{3,6}		±V _{OUT} Either Output	-	-	7.4	-	-	6.4	A
Ripple Voltage		±V _{OUT} Full Load ⁵ , 20Hz to 10MHz	-	25	80	-	25	80	mV _{pp}
Line Regulation		+V _{OUT} V _{IN} = 16V to 40V	-	2	20	-	2	20	mV
		-V _{OUT} V _{IN} = 16V to 40V	-	10	200	-	10	200	mV
Load Regulation		+V _{OUT} No Load to Full Load ⁵	-	2	100	-	2	120	mV
		-V _{OUT} No Load to Full Load ⁵	-	45	200	-	40	200	mV
Cross Regulation		V1+ Load 30% - Load 70% V2+ Load 70% - Load 30%	-	220	450	-	220	450	mV
Voltage Trim		Full Load	-20	-	10	-20	-	10	%
Share Pin Voltage ⁴			2	-	4	2	-	4	V
EFFICIENCY		Full Load ⁵	79	83	-	80	86	-	%
LOAD FAULT POWER DISSIPATION		Overload ⁴	-	-	50	-	-	50	W
		Short Circuit	-	-	50	-	-	50	W
CAPACITIVE LOAD ⁴			-	-	500	-	-	500	μF
SWITCHING FREQUENCY			425	500	600	425	500	600	kHz
SYNC FREQUENCY RANGE		V _H – V _L = 5V Duty Cycle = 20% - 80%	500	-	600	500	-	600	kHz
ISOLATION		500 V _{DC} , T _{CASE} = 25°C	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)		AIF @ T _C = 55°C	-	400	-	-	400	-	kHrs

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load⁵, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	40 V _{DC}	Junction Temperature Rise to Case	+15°C
Input Voltage (Transient, 1 second)	50 Volts	Storage Temperature	-65°C to +150°C
Output Power ¹	120 Watts	Lead Solder Temperature (10 seconds)	270°C
ESD Rating per MIL-PRF-38543	1C	Weight (Maximum) (No Pin Extensions)	90 Grams

Parameter		Conditions	DVFL289R5D			DVFL2812D			Units
			Min	Typ	Max	Min	Typ	Max	
DYNAMIC									
Load Step Output Transient	±V _{OUT}	Half Load to Full Load	-	400	700	-	260	500	mV _{PK}
Load Step Recovery ²			-	250	500	-	140	500	μSec
Line Step Output Transient ⁴	±V _{OUT}	V _{IN} = 16V to 40V	-	550	1000	-	600	1200	mV _{PK}
Line Step Recovery ^{2, 4}			-	300	600	-	300	500	μSec
Turn On Delay	±V _{OUT}	V _{IN} = 0V to 28V	-	5	20	-	5	20	mSec
Turn On Overshoot			-	0	25	-	0	50	mV _{PK}

- Notes:
1. Dependent on output voltage.
 2. Time for output voltage to settle within 1% of its nominal value.
 3. Derate linearly to 0 at 135°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 +125°C, V_{IN} = +28V ± 5%, Full Load⁵, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	40 V _{DC}	Junction Temperature Rise to Case	+15°C
Input Voltage (Transient, 1 second)	50 Volts	Storage Temperature	-65°C to +150°C
Output Power ¹	120 Watts	Lead Solder Temperature (10 seconds)	270°C
ESD Rating per MIL-PRF-38543	1C	Weight (Maximum) (No Pin Extensions)	90 Grams

Parameter		Conditions	DVFL2815D			Units
			Min	Typ	Max	
STATIC						
INPUT Voltage ⁴		Continuous	16	28	40	V
		Transient, 1 sec	-	-	50	V
Current		Inhibited 1	-	1	3	mA
		Inhibited 2	-	40	70	mA
		No Load	-	110	160	mA
Ripple Current		Full Load ⁵ , 20Hz to 10MHz	-	40	80	mA _{p-p}
INH1 Pin Input ⁴			0	-	1.5	V
INH2 Pin Input ⁴			0	-	1	V
INH1 Pin Open Circuit Voltage ⁴			10.5	-	15	V
INH2 Pin Open Circuit Voltage ⁴			4	-	12	V
UVLO Turn On			14.5	-	16	V
UVLO Turn Off ⁴			13.5	-	15.5	V
OUTPUT Voltage ⁵	+V _{OUT}	T _{CASE} = 25°C	14.85	15.00	15.15	V
	+V _{OUT}	T _{CASE} = -55°C to +125°C	14.775	15.00	15.225	V
	-V _{OUT}	T _{CASE} = 25°C	14.80	15.00	15.20	V
	-V _{OUT}	T _{CASE} = -55°C to +125°C	14.40	15.00	15.60	V
Power ^{3,6}	Total		-	-	120	W
	±V _{OUT}	Either Output	-	-	84	W
Current ^{3,6}	±V _{OUT}	Either Output	-	-	5.6	A
Ripple Voltage	±V _{OUT}	Full Load ⁵ , 20Hz to 10MHz	-	30	80	mV _{p-p}
Line Regulation	+V _{OUT}	V _{IN} = 16V to 40V	-	2	20	mV
	-V _{OUT}	V _{IN} = 16V to 40V	-	10	200	mV
Load Regulation	+V _{OUT}	No Load to Full Load ⁵	-	2	120	mV
	-V _{OUT}	No Load to Full Load ⁵	-	30	200	mV
Cross Regulation	-V _{OUT}	V1+ Load 30% - Load 70% V2+ Load 70% - Load 30%	-	200	450	mV
Voltage Trim		Full Load	-20	-	10	%
Share Pin Voltage ⁴			2	-	4	V
EFFICIENCY		Full Load ⁵	81	86	-	%
LOAD FAULT POWER DISSIPATION		Overload ⁴	-	-	50	W
		Short Circuit	-	-	50	W
CAPACITIVE LOAD ⁴			-	-	500	μF
SWITCHING FREQUENCY			425	500	600	kHz
SYNC FREQUENCY RANGE		V _H – V _L = 5V Duty Cycle = 20% - 80%	500	-	600	kHz
ISOLATION		500 V _{DC} , T _{CASE} = 25°C	100	-	-	MΩ
MTBF (MIL-HDBK-217F)		AIF @ T _C = 55°C	-	400	-	kHrs

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load⁵, Unless Otherwise Specified)

ABSOLUTE MAXIMUM RATINGS

Input Voltage (Continuous)	40 V _{DC}	Junction Temperature Rise to Case	+15°C
Input Voltage (Transient, 1 second)	50 Volts	Storage Temperature	-65°C to +150°C
Output Power ¹	120 Watts	Lead Solder Temperature (10 seconds)	270°C
ESD Rating per MIL-PRF-38543	1C	Weight (Maximum) (No Pin Extensions)	90 Grams

Parameter		Conditions	DVFL2815D			Units
			Min	Typ	Max	
DYNAMIC						
Load Step Output Transient	±V _{OUT}	Half Load to Full Load	-	260	500	mV _{PK}
Load Step Recovery ²			-	110	500	μSec
Line Step Output Transient ⁴	±V _{OUT}	V _{IN} = 16V to 40V	-	600	1200	mV _{PK}
Line Step Recovery ^{2, 4}			-	300	500	μSec
Turn On Delay	±V _{OUT}	V _{IN} = 0V to 28V	-	5	20	mSec
Turn On Overshoot			-	0	50	mV _{PK}

- Notes:
1. Dependent on output voltage.
 2. Time for output voltage to settle within 1% of its nominal value.
 3. Derate linearly to 0 at 135°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

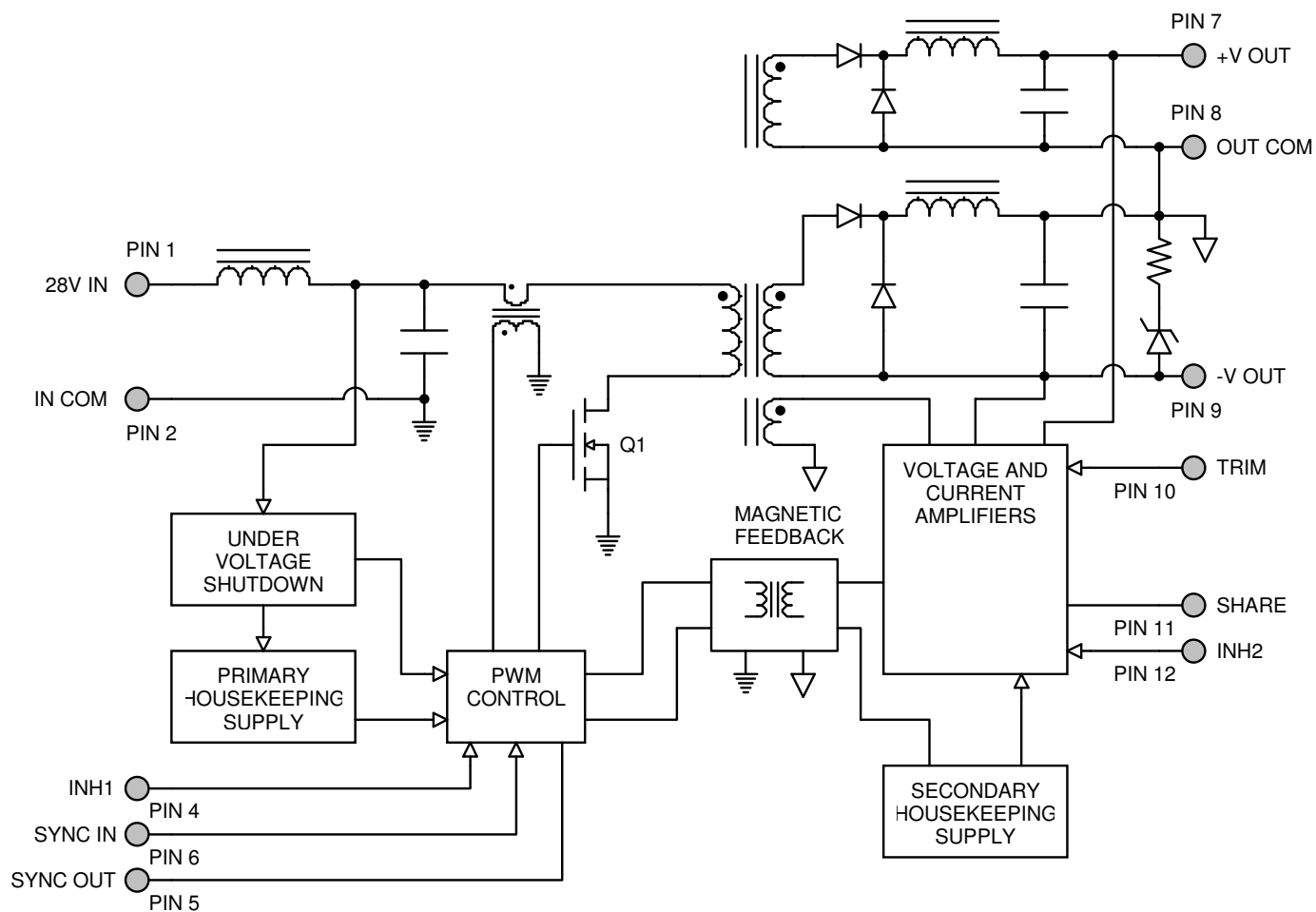


Figure 2

CONNECTION DIAGRAM

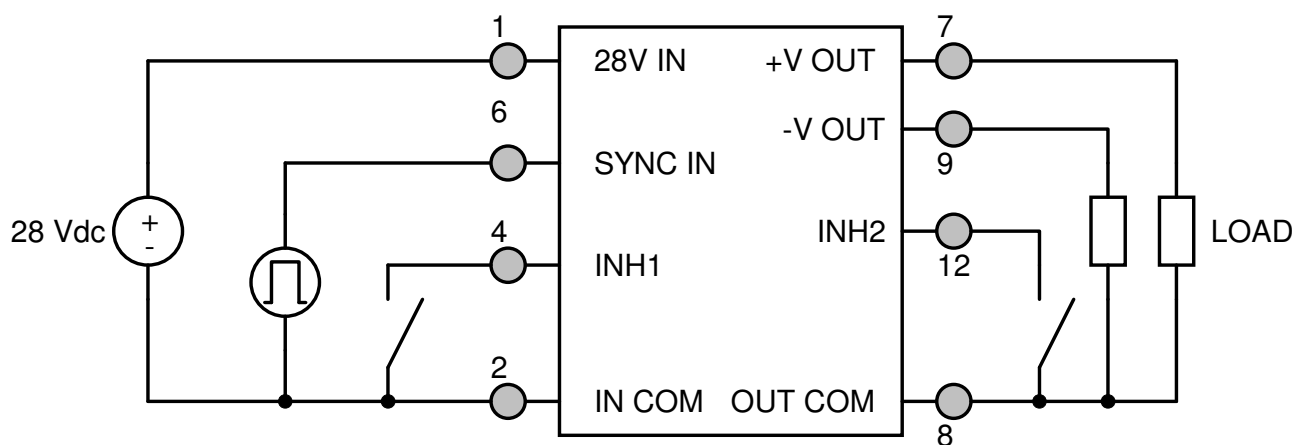


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAM

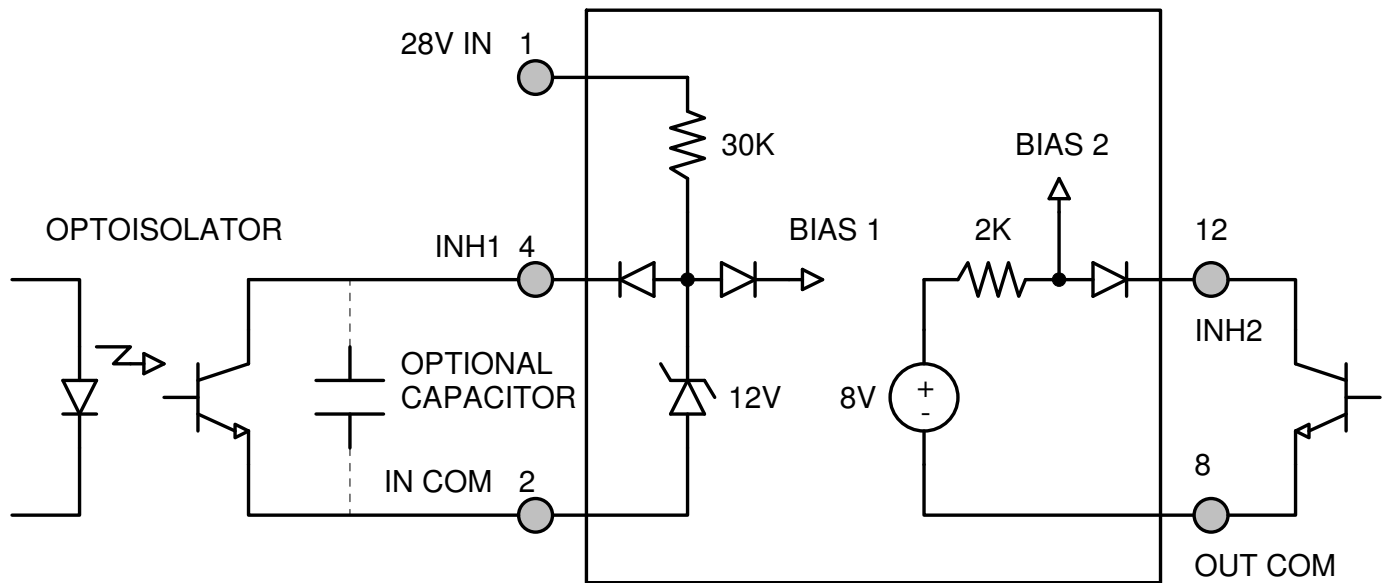


Figure 4 – Isolated Inhibit Drive and Internal Equivalent Circuit
(Shown with optional capacitor for turn-on delay)

EMI FILTER HOOKUP DIAGRAM

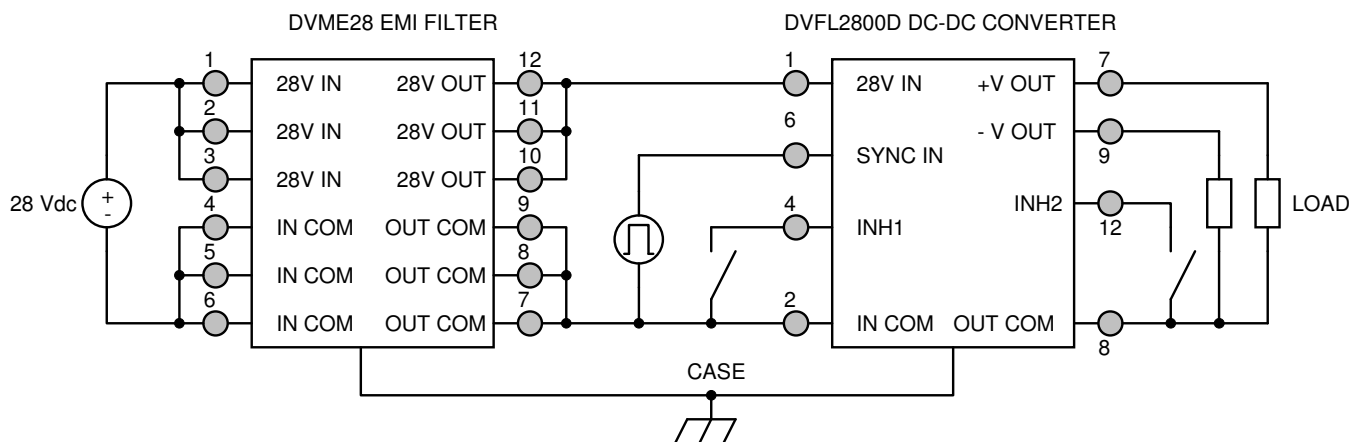


Figure 5 – Converter with EMI Filter

+28 VOLT OUTPUT CONNECTION DIAGRAM

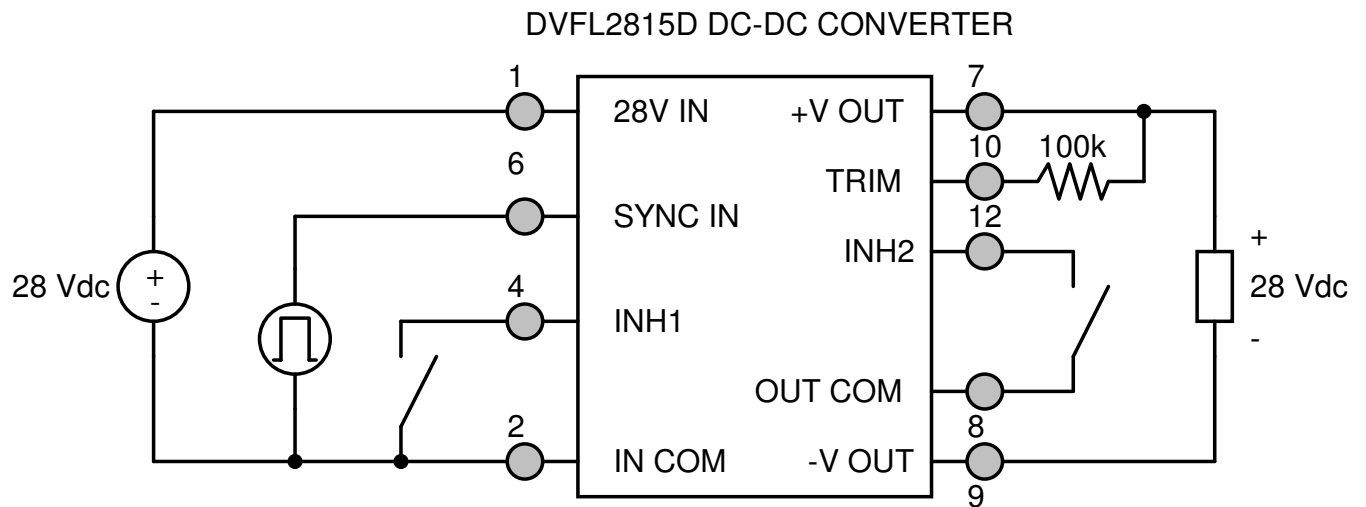


Figure 6: +28 Volt Output Converter Using DVFL2815D Converter

PARALLEL CONNECTION DIAGRAM

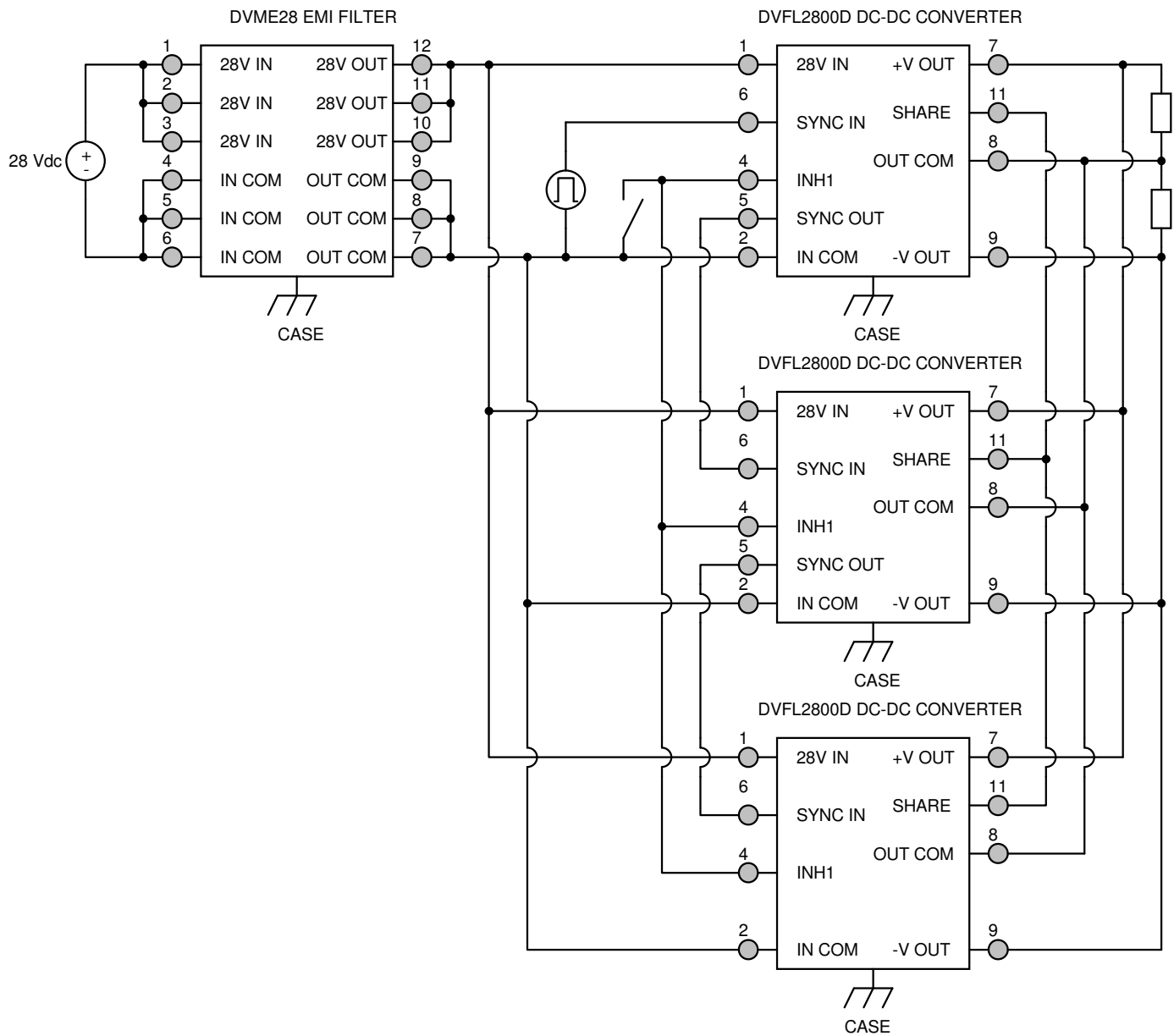
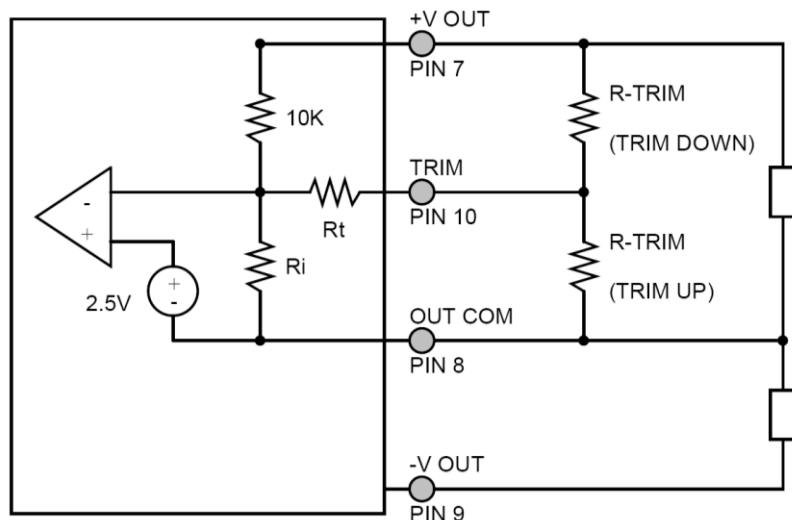


Figure 7 – Current Sharing Parallel Connection for Multiple Converters

OUTPUT VOLTAGE TRIM



The output voltage can be trimmed down by connecting a resistor between the TRIM pin (PIN 10) and the +V OUT pin (PIN 7), or can be trimmed up by connecting a resistor between the TRIM pin (PIN 10) 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 8 – Output Voltage Trim

DVFL2805D		DVFL286R3D		DVFL289R5D		DVFL2812D		DVFL2815D	
+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)
5.5	35.0k	6.9	28.1k	10.45	11.5k	13.2	5.8k	16.50	1.7k
5.4	47.5k	6.8	36.7k	10.3	16.5k	13.0	10.0k	16.25	5.0k
5.3	68.3k	6.7	49.6k	10.1	27.0k	12.8	16.2k	16.00	10.0k
5.2	110k	6.6	71.1k	9.9	48.0k	12.6	26.6k	15.75	18.3k
5.1	235k	6.5	114k	9.7	111k	12.4	47.3k	15.50	35.0k
5.0	-	6.4	243k	9.5	-	12.2	109k	15.25	85.0k
4.9	225k	6.3	-	9.4	681k	12.0	-	15.00	-
4.8	100k	6.2	367k	9.2	210k	11.8	454k	14.75	475k
4.7	58.3k	6.1	171k	9.0	116k	11.6	213k	14.50	225k
4.6	37.5k	6.0	106k	8.8	75.7k	11.4	134k	14.25	142k
4.5	25.0k	5.9	72.9k	8.6	53.3k	11.2	94.0k	14.00	100k
4.4	16.7k	5.8	53.2k	8.4	39.1k	11.0	70.1k	13.75	75.0k
4.3	10.7k	5.7	40.1k	8.2	29.2k	10.8	54.3k	13.50	58.3k
4.2	6.3k	5.6	30.8k	8.0	22.0k	10.6	42.9k	13.25	46.4k
4.1	2.8k	5.5	23.8k	7.8	16.4k	10.4	34.4k	13.00	37.5k
4.0	0	5.4	18.3k	7.6	12.1k	10.2	27.8k	12.75	30.6k
		5.3	13.9k			10.0	22.5k	12.50	25.0k
		5.2	10.4k			9.8	18.2k	12.25	20.5k
		5.1	7.4k			9.6	14.6k	12.00	16.7k

EFFICIENCY PERFORMANCE CURVES ($T_{CASE} = 25^{\circ}C$, Full Load, Unless Otherwise Specified)

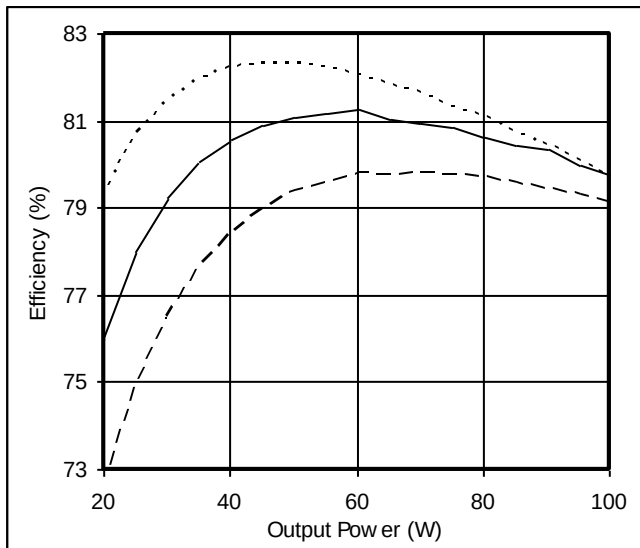
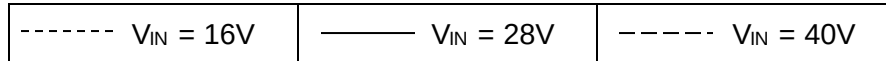


Figure 9 – DVFL2805D
Efficiency (%) vs. Output Power (W)

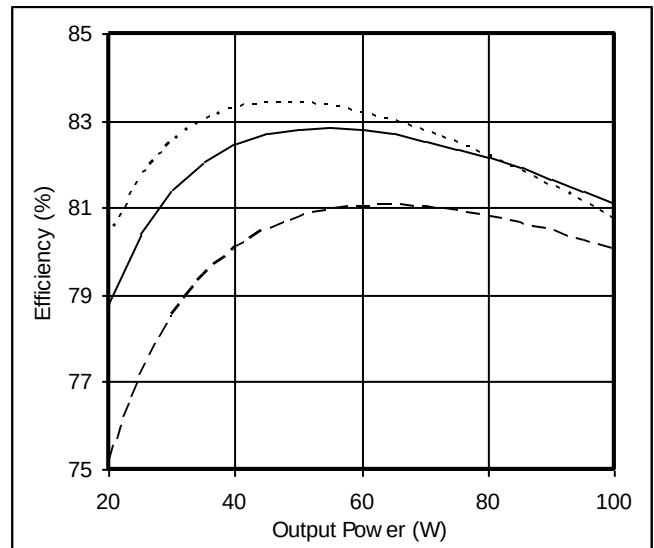


Figure 10 – DVFL286R3D
Efficiency (%) vs. Output Power (W)

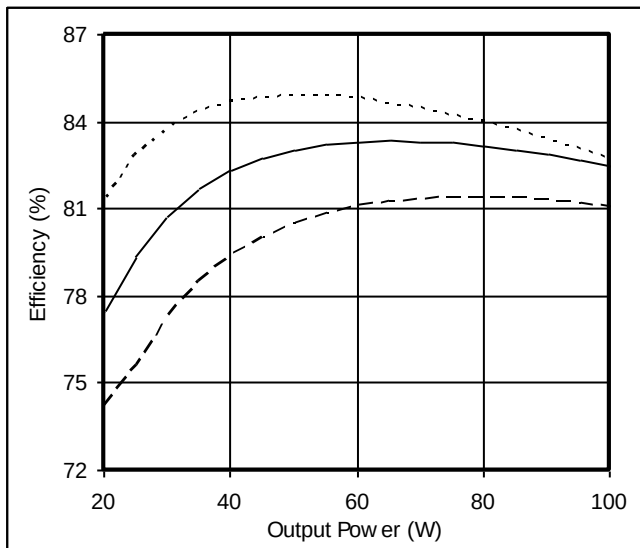


Figure 11 – DVFL289R5D
Efficiency (%) vs. Output Power (W)

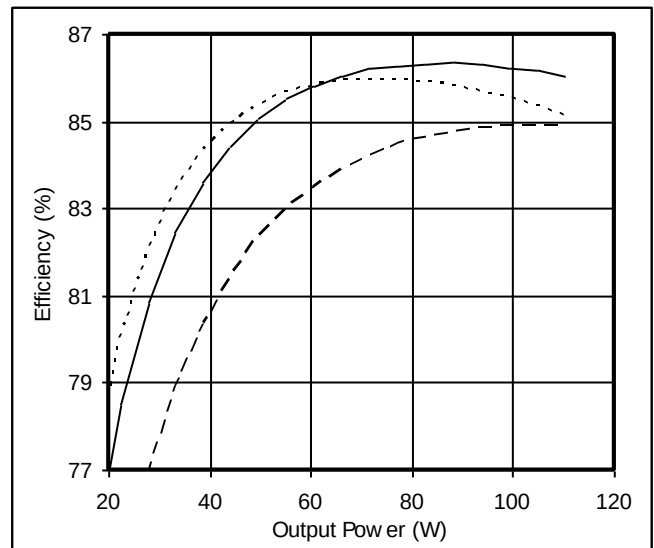


Figure 12 – DVFL2812D
Efficiency (%) vs. Output Power (W)

EFFICIENCY PERFORMANCE CURVES ($T_{CASE} = 25^{\circ}C$, Full Load, Unless Otherwise Specified)

----- $V_{IN} = 16V$	—— $V_{IN} = 28V$	----- $V_{IN} = 40V$
----------------------	-------------------	----------------------

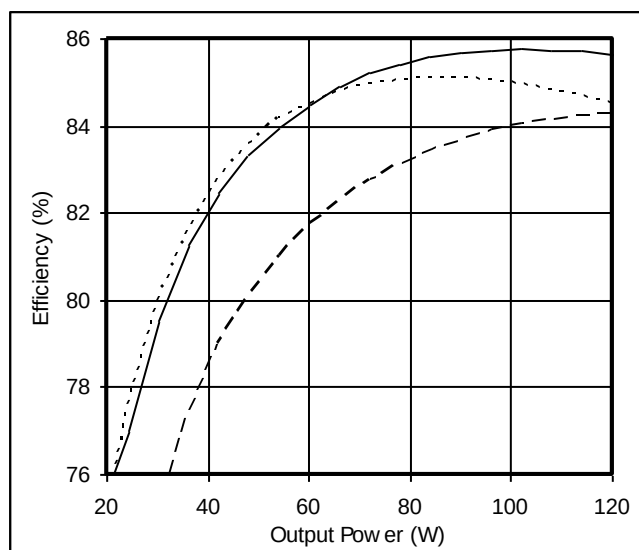


Figure 13 – DVFL2815D
Efficiency (%) vs. Output Power (W)

CROSS REGULATION CURVES ($T_{CASE} = 25^{\circ}C$, Full Load, Unless Otherwise Specified)

 +lo = 10%	 +lo = 30%	 +lo = 50%	 +lo = 70%
---	---	---	---

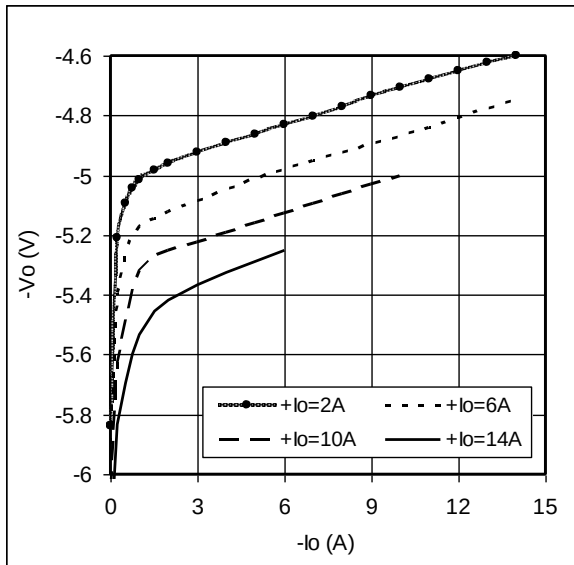


Figure 14 – DVFL2805D

-Vout (V) vs. -Iout (A)

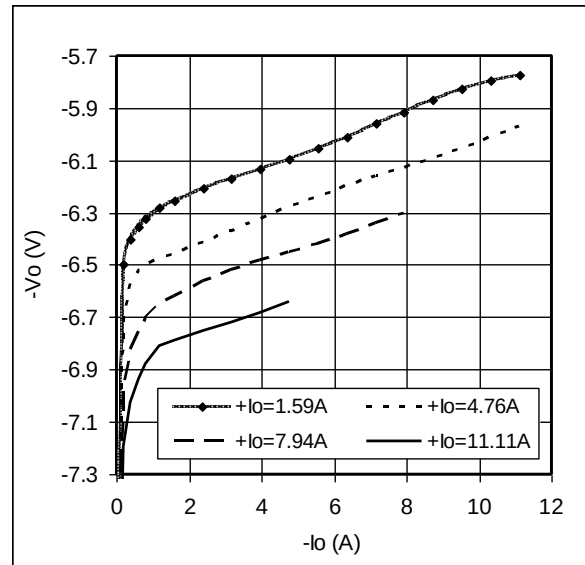


Figure 15 – DVFL286R3D

-Vout (V) vs. -Iout (A)

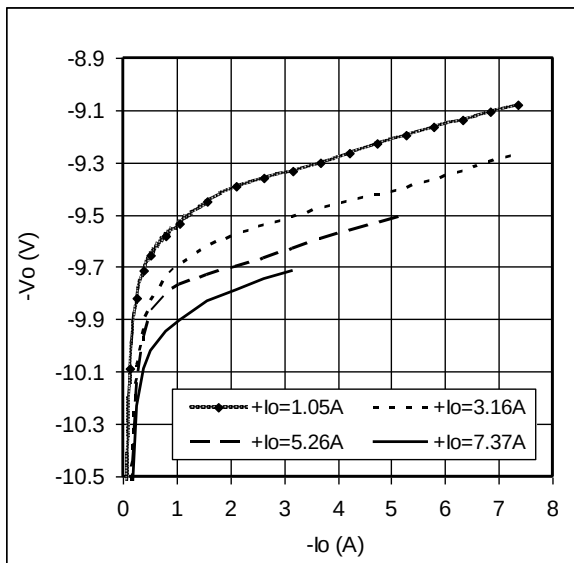


Figure 16 – DVFL289R5D

-Vout (V) vs. -Iout (A)

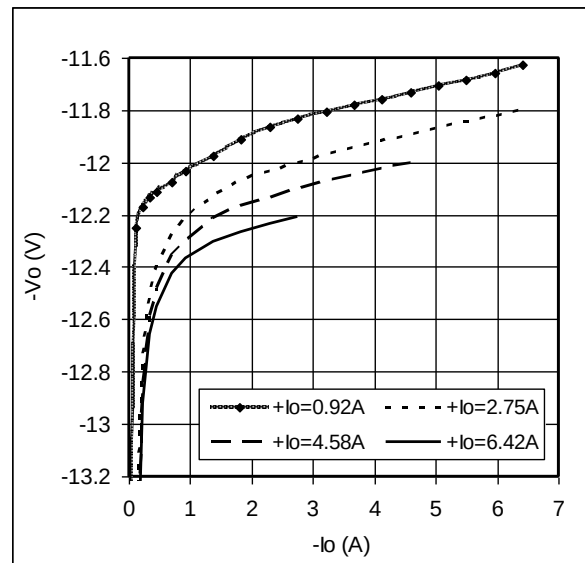


Figure 17 – DVFL2812D

-Vout (V) vs. -Iout (A)

CROSS REGULATION CURVES ($T_{CASE} = 25^{\circ}C$, Full Load, Unless Otherwise Specified)

 +lo = 10%	 +lo = 30%	 +lo = 50%	 +lo = 70%
---	---	---	---

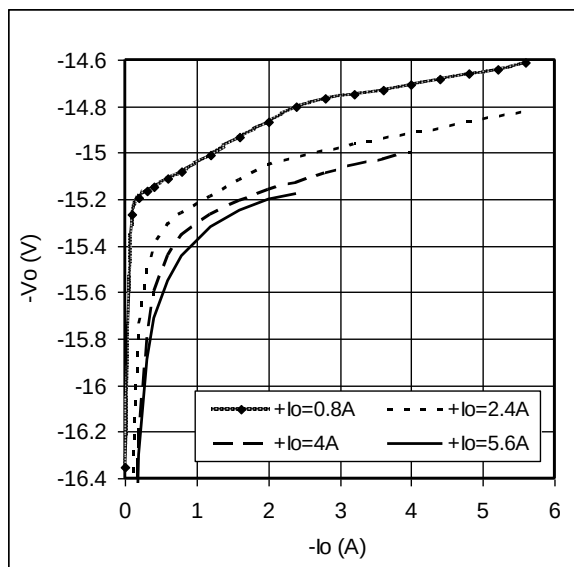


Figure 18 – DVFL2815D

-Vout (V) vs. -Iout (A)

EMI PERFORMANCE CURVES

($T_{CASE} = 25^{\circ}\text{C}$, $V_{IN} = +28\text{V} \pm 5\%$, Full Load, Unless Otherwise Specified)

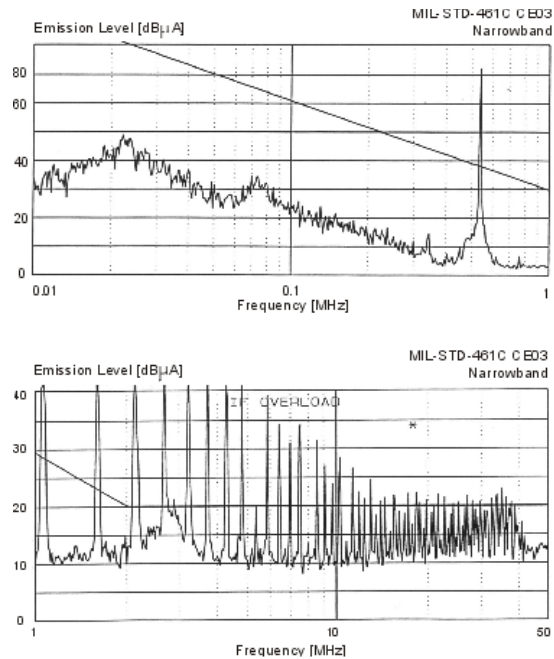


Figure 19 – DVFL2800D without EMI Filter

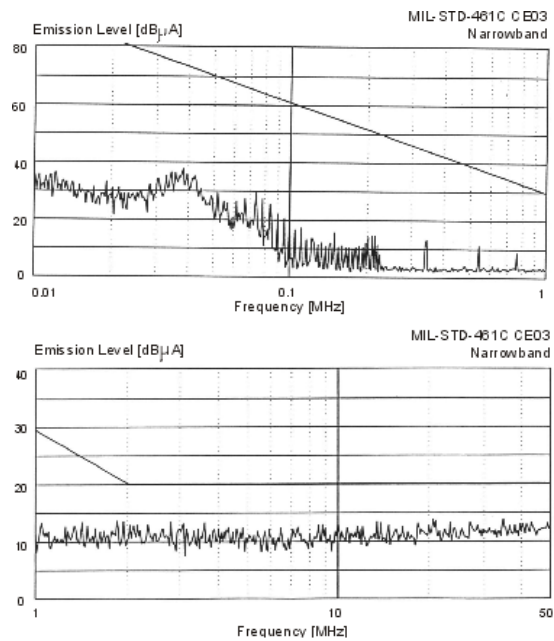
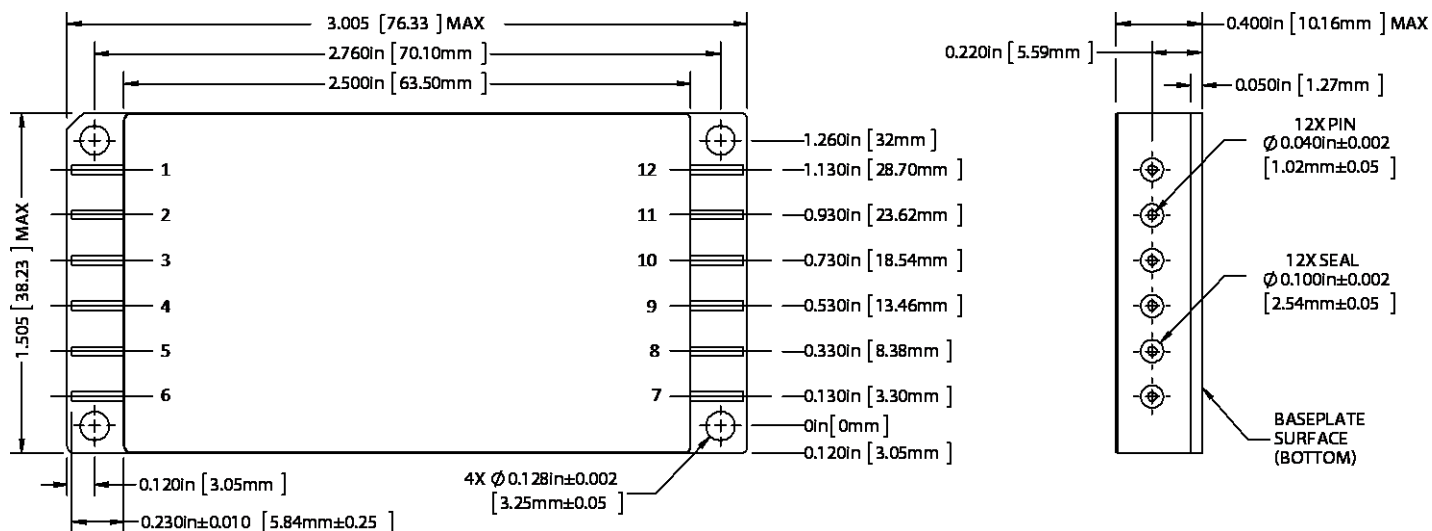


Figure 20 – DVFL2800D with EMI Filter

STANDARD PACKAGE DRAWINGS

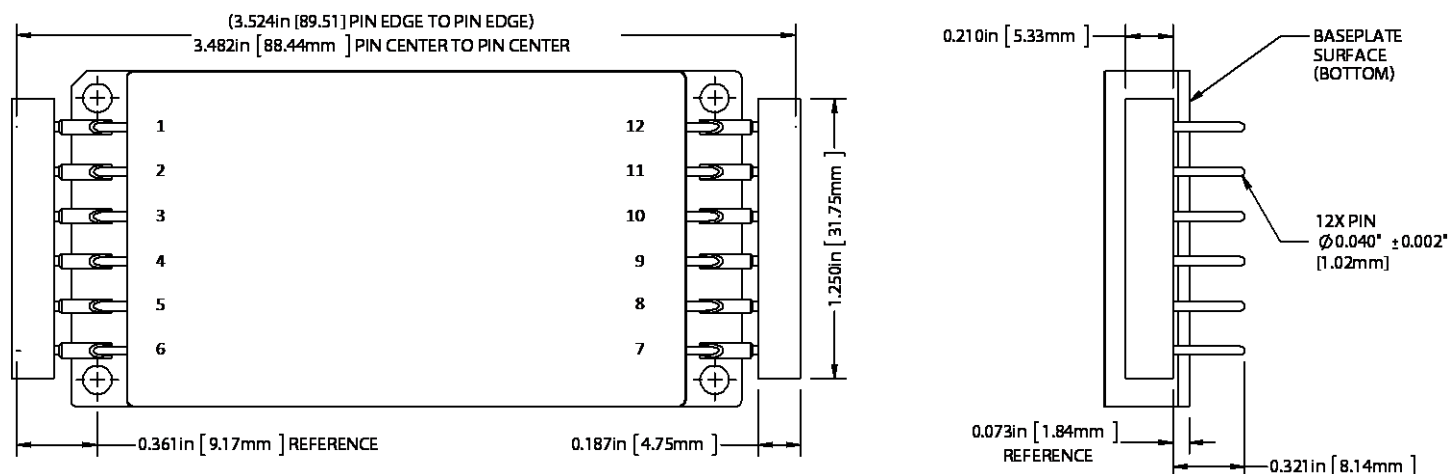


1. Tolerances are +0.005" unless otherwise stated
2. Case temperature is measured on the center of the baseplate surface
3. Mounting holes are not threaded. Recommended fastener is 4-40
4. Product Materials:
Case (Steel, gold over nickel plated); Cover (Kovar, nickel plated); Pin (Copper-cored alloy 52, gold over nickel plated); Pin Seals (Glass)

Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	28V IN	4	INH1	7	+V OUT	10	TRIM
2	IN COM	5	SYNC OUT	8	OUT COM	11	SHARE
3	CASE	6	SYNC IN	9	-V OUT	12	INH2

Figure 21 – Standard Package and Pinout

STANDARD PACKAGE DRAWINGS

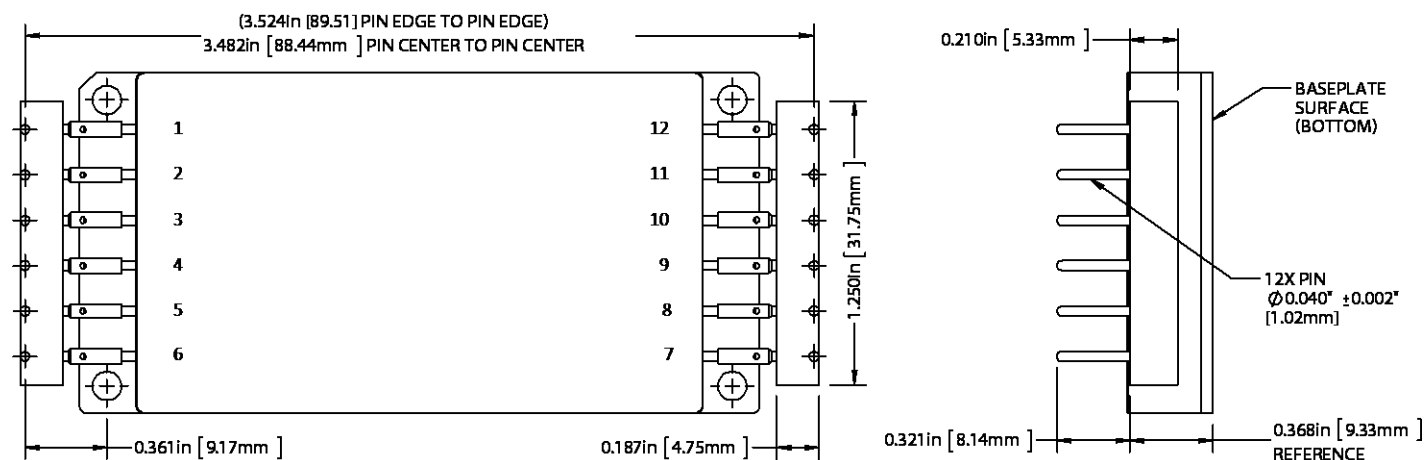


1. Tolerances are +0.005" unless otherwise stated
2. Case temperature is measured on the center of the baseplate surface
3. Mounting holes are not threaded. Recommended fastener is 4-40
4. Product Materials:
Case (Steel, gold over nickel plated); Cover (Kovar, nickel plated); Pin (Copper-cored alloy 52, gold over nickel plated); Pin Seals (Glass)
5. Pin Extension Materials:
Body (Diallyl-Phthalate/DAP, WH-9100-BLK F-Type or equivalent), Pins (Copper Alloy, Sn90/Pb10 solder plated)

Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	28V IN	4	INH1	7	+V OUT	10	TRIM
2	IN COM	5	SYNC OUT	8	OUT COM	11	SHARE
3	CASE	6	SYNC IN	9	-V OUT	12	INH2

Figure 22 – Standard Package with Down-Leads and Pinout

STANDARD PACKAGE DRAWINGS

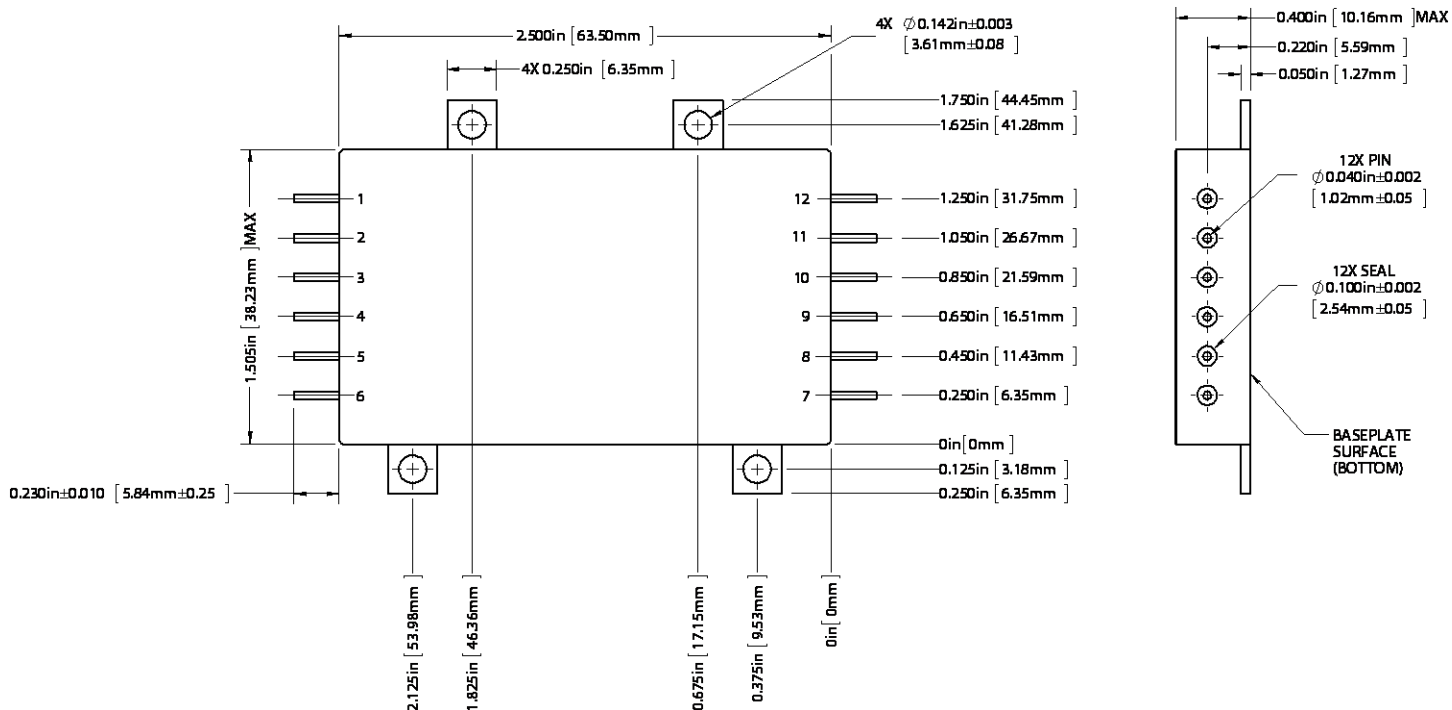


1. Tolerances are +0.005" unless otherwise stated
2. Case temperature is measured on the center of the baseplate surface
3. Mounting holes are not threaded. Recommended fastener is 4-40
4. Product Materials:
Case (Steel, gold over nickel plated); Cover (Kovar, nickel plated); Pin (Copper-cored alloy 52, gold over nickel plated); Pin Seals (Glass)
5. Pin Extension Materials:
Body (Diallyl-Phthalate/DAP, WH-9100-BLK F-Type or equivalent), Pins (Copper Alloy, Sn90/Pb10 solder plated)

Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	28V IN	4	INH1	7	+V OUT	10	TRIM
2	IN COM	5	SYNC OUT	8	OUT COM	11	SHARE
3	CASE	6	SYNC IN	9	-V OUT	12	INH2

Figure 23 – Standard Package with Up-Leads and Pinout

FLANGED PACKAGE DRAWINGS

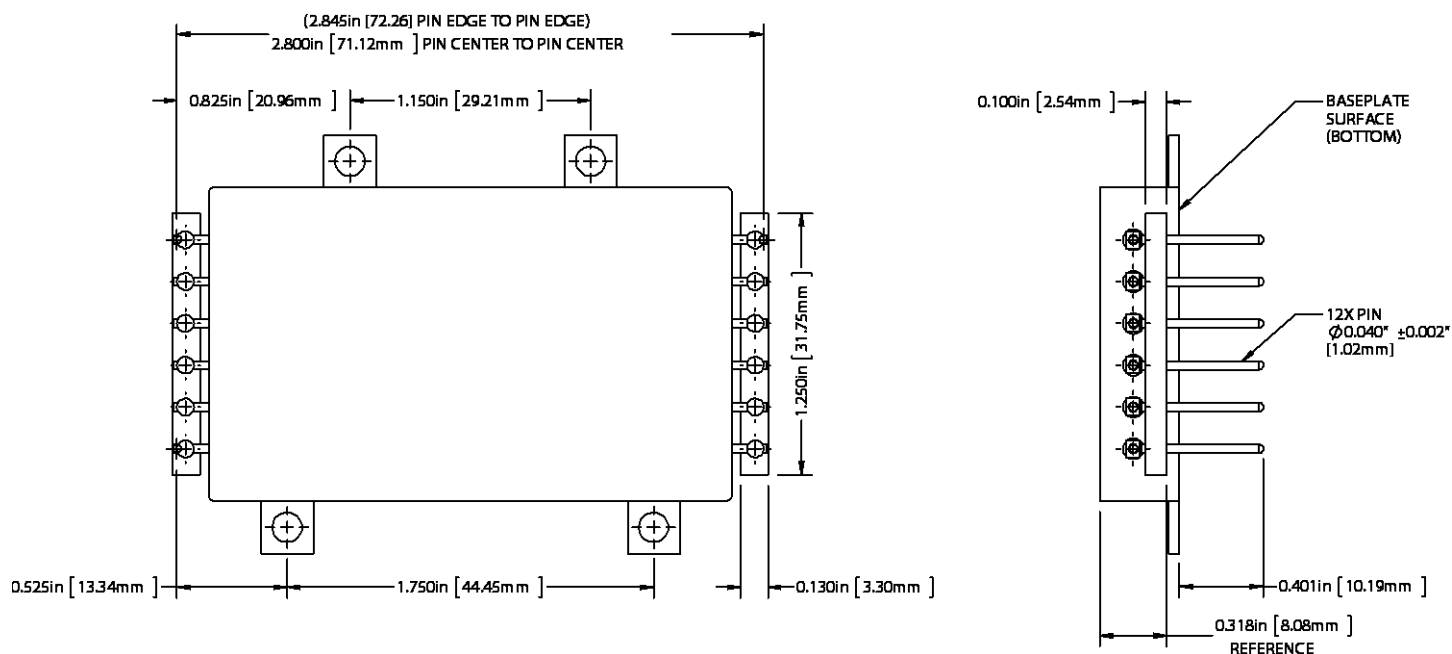


1. Tolerances are +0.005" unless otherwise stated
2. Case temperature is measured on the center of the baseplate surface
3. Mounting holes are not threaded. Recommended fastener is 4-40
4. Product Materials:
Case (Steel, gold over nickel plated); Cover (Kovar, nickel plated); Pin (Copper-cored alloy 52, gold over nickel plated); Pin Seals (Glass)

Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	28V IN	4	INH1	7	+V OUT	10	TRIM
2	IN COM	5	SYNC OUT	8	OUT COM	11	SHARE
3	CASE	6	SYNC IN	9	-V OUT	12	INH2

Figure 24 – Flanged Package and Pinout

FLANGED PACKAGE DRAWINGS

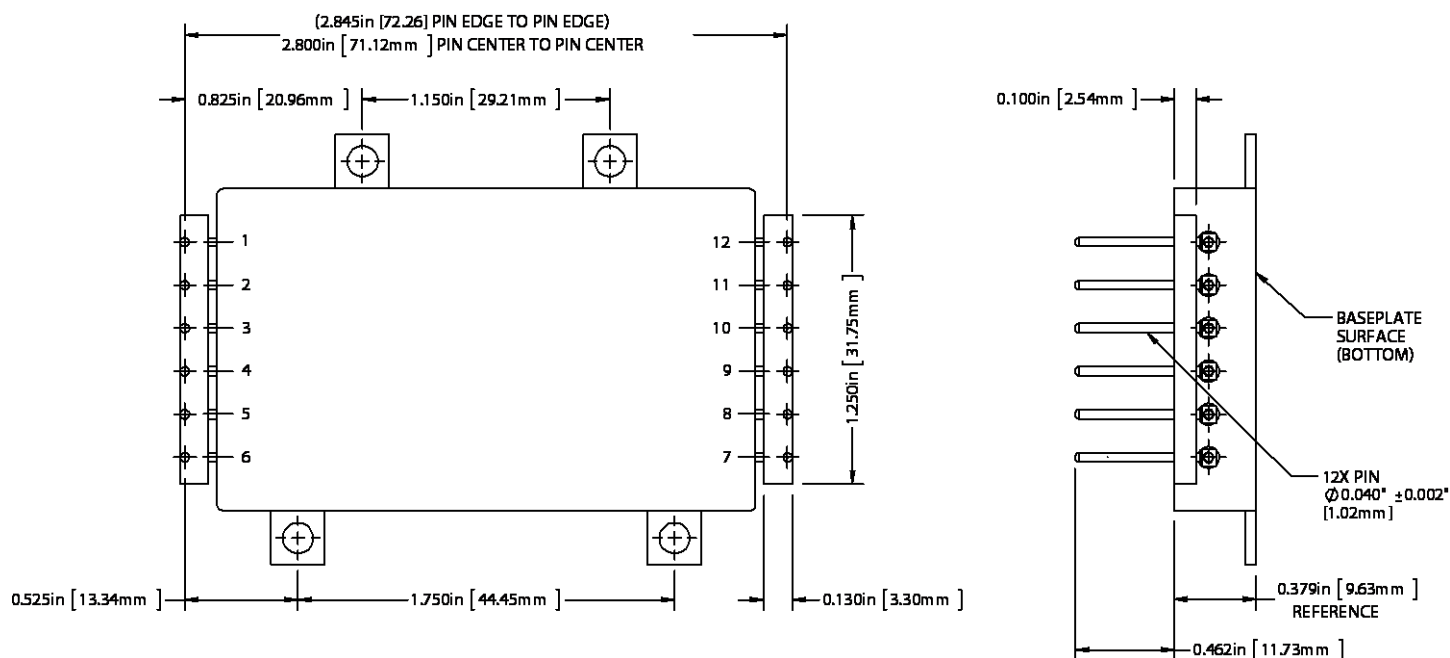


1. Tolerances are ± 0.005 " unless otherwise stated
2. Case temperature is measured on the center of the baseplate surface
3. Mounting holes are not threaded. Recommended fastener is 4-40
4. Product Materials:
Case (Steel, gold over nickel plated); Cover (Kovar, nickel plated); Pin (Copper-cored alloy 52, gold over nickel plated); Pin Seals (Glass)
5. Pin Extension Materials:
Body (Diallyl-Phthalate/DAP, WH-9100-BLK F-Type or equivalent), Pins (Copper Alloy, Sn90/Pb10 solder plated)

Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	28V IN	4	INH1	7	+V OUT	10	TRIM
2	IN COM	5	SYNC OUT	8	OUT COM	11	SHARE
3	CASE	6	SYNC IN	9	-V OUT	12	INH2

Figure 25 – Flanged Package with Down-Leads and Pinout

FLANGED PACKAGE DRAWINGS



1. Tolerances are +0.005" unless otherwise stated
2. Case temperature is measured on the center of the baseplate surface
3. Mounting holes are not threaded. Recommended fastener is 4-40
4. Product Materials:
Case (Steel, gold over nickel plated); Cover (Kovar, nickel plated); Pin (Copper-cored alloy 52, gold over nickel plated); Pin Seals (Glass)
5. Pin Extension Materials:
Body (Diallyl-Phthalate/DAP, WH-9100-BLK F-Type or equivalent), Pins (Copper Alloy, Sn90/Pb10 solder plated)

Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	28V IN	4	INH1	7	+V OUT	10	TRIM
2	IN COM	5	SYNC OUT	8	OUT COM	11	SHARE
3	CASE	6	SYNC IN	9	-V OUT	12	INH2

Figure 26 – Flanged Package with Up-Leads and Pinout

PACKAGE PIN DESCRIPTION

Pin	Function	Description
1	28V IN	Positive Input Voltage Connection
2	IN COM	Input Common Connection
3	CASE	Case Connection
4	INH1	Logic Low = Disabled Output. Connecting the inhibit(1) pin to input common causes converter shutdown. Logic High = Enabled Output. Unconnected or open collector TTL.
5	SYNC OUT	Output Synchronization Signal
6	SYNC IN	Input Synchronization Signal
7	+V OUT	Positive Output Voltage Connection
8	OUT COM	Output Common Connection
9	-V OUT	Negative Output Voltage Connection
10	TRIM	Trim Output Voltage to +10%, -20% of Nominal Value
11	SHARE	Current Share
12	INH2	Logic Low = Disabled Output. Connecting the inhibit(2) pin to output common causes converter shutdown. Logic High = Enabled Output. Unconnected or open collector TTL.

ENVIRONMENTAL SCREENING (100% Tested Per MIL-STD-883 as referenced to MIL-PRF-38534)

Test	MIL-STD-883 Test Method, Condition	No Suffix (Standard) Non-QML (5)	/ES (Extended) Non-QML (5)	/HB (HB) Non-QML (5)	/H (Class H) (10)	/KB (KB) Non-QML (5)	/K (Class K) (10)
Non-Destructive Bond Pull	TM2023	• (4)	• (4)	• (4)	• (4)	•	•
Internal Visual	TM2010, TM2017, TM2032 (MIL-STD-750, TM2072, TM2073)	•	•	•	•	•	•
Temperature Cycling	TM1010, Condition C -65°C to 150°C, Ambient			•	•	•	•
	TM1010, Condition B -55°C to 125°C, Ambient		•				
Constant Acceleration	TM2001, 3000g, Y1 Direction			•	•	•	•
	TM2001, 500g, Y1 Direction		•				
PIND (7)	TM2020, Condition A					•	•
Pre Burn-In Electrical	25°C					•	•
Burn-In	TM1015, 320 hrs, 125°C, Case Typ					•	•
	TM1015, 160 hrs, 125°C, Case Typ			•	•		
	96 hrs, 125°C, Case Typ		•				
	24 hrs, 125°C, Case Typ	•					
Final Electrical	MIL-PRF-38534, Group A Subgroups 1-6 -55°C, 25°C, 125°C (3)			•	•	•	•
	MIL-PRF-38534, Group A Subgroups 1 and 4 25°C	•	•				
Hermeticity (Seal)	TM1014, Fine Leak, Condition A2 or B1		•	•	•	•	•
	TM1014, Gross Leak, Condition C or B2		•	•	•	•	•
	Gross Leak, Dip (1 x 10 ⁻³)	•					
Radiography (8)	TM2012					•	•
External Visual	TM2009	•	•	•	•	•	•

- Notes:
- (1) Contact Sales for more information concerning additional environmental screening and testing options desired.
 - (2) VPT Inc. reserves the right to ship higher screened or SMD products to meet lower screened orders at our sole discretion unless specifically forbidden by customer contract.
 - (3) 100% R&R testing with all test data included in product shipment.
 - (4) Not required per MIL-PRF-38534. Test is performed for additional product quality assurance.
 - (5) Non-QML products may not meet all requirements of MIL-PRF-38534.
 - (6) Note intentionally not used.
 - (7) PIND test Certificate of Compliance included in product shipment.
 - (8) Radiographic test Certificate of Compliance and film(s) or data CD included in product shipment.
 - (9) Note intentionally not used.
 - (10) QML screening levels are not available for products with Up-Leaded or Down-Leaded pin extensions added.

ORDERING INFORMATION

DVFL	28	05	D	F	DL	/H	-	XXX
1	2	3	4	5	6	7		8

(1) Product Series	(2) Nominal Input Voltage	(3) Output Voltage	(4) Number of Outputs
DVFL	28 28 Volts	05 6.3 9.5 12 15 ±5 Volts ±6.3 Volts ±9.5 Volts ±12 Volts ±15 Volts	D Dual

(5) Package Option	(6) Package Lead Option	(7) Screening Code ^{1,2,3}	(8) Additional Screening Code
None F Standard Flanged	None DL UL No Lead Extensions Down-Lead Up-Lead	None /ES /HB /H /KB /K Standard Extended Class HB Class H Class KB Class K	Contact Sales

- Notes:
1. Contact the VPT Inc. Sales Department for availability of Class H (/H) or Class K (/K) qualified products.
 2. VPT Inc. reserves the right to ship higher screened or SMD products to meet lower screened orders at our sole discretion unless specifically forbidden by customer contract.
 3. Class H and Class K not available for DL and UL Package Lead Options.

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.

SMD (STANDARD MICROCIRCUIT DRAWING) NUMBERS

Standard Microcircuit Drawing (SMD)	DVFL2800D Series Similar Part Number
5962-0724401HXA 5962-0724401HXC 5962-0724401KXA 5962-0724401KXC 5962-0724401HYA 5962-0724401HYC 5962-0724401KYA 5962-0724401KYC	DVFL2805D/H-E DVFL2805D/H DVFL2805D/K-E DVFL2805D/K DVFL2805DF/H-E DVFL2805DF/H DVFL2805DF/K-E DVFL2805DF/K
*T.B.D.	DVFL286R3D/H DVFL286R3D/K
*T.B.D.	DVFL289R5D/H DVFL289R5D/K
5962-0724402HXA 5962-0724402HXC 5962-0724402KXA 5962-0724402KXC 5962-0724402HYA 5962-0724402HYC 5962-0724402KYA 5962-0724402KYC	DVFL2812D/H-E DVFL2812D/H DVFL2812D/K-E DVFL2812D/K DVFL2812DF/H-E DVFL2812DF/H DVFL2812DF/K-E DVFL2812DF/K
5962-0724403HXA 5962-0724403HXC 5962-0724403KXA 5962-0724403KXC 5962-0724403HYA 5962-0724403HYC 5962-0724403KYA 5962-0724403KYC	DVFL2815D/H-E DVFL2815D/H DVFL2815D/K-E DVFL2815D/K DVFL2815DF/H-E DVFL2815DF/H DVFL2815DF/K-E DVFL2815DF/K

Do not use the DVFL2800D Series similar part number for SMD product acquisition. It is listed for reference only. For exact specifications for the SMD product, refer to the SMD drawing. SMDs can be downloaded from the DLA Land and Maritime (Previously known as DSCC) website at <https://landandmaritimeapps.dla.mil/programs/defaultapps.asp>. The SMD number listed above represents the Federal Stock Class, Device Type, Device Class Designator, Case Outline, Lead Finish and RHA Designator (where applicable). Please reference the SMD for other screening levels, lead finishes, and radiation levels. All SMD products are marked with a "Q" on the cover as specified by the QML certification mark requirement of MIL-PRF-38534.

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: vptsales@vptpower.com

All information contained in this datasheet is believed to be accurate, however, no responsibility is assumed for possible errors or omissions. The products or specifications contained herein are subject to change without notice.