



DVFL2800S Series

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.

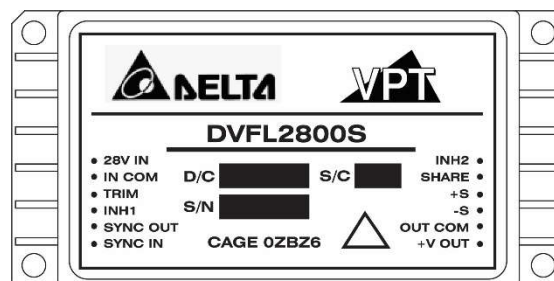


Figure 1 – DVFL2800S DC-DC Converter
(Exact marking may differ from that shown)

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load, 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-38534	1C	Weight (Maximum) (No Pin Extensions)	86 Grams

Parameter	Conditions	DVFL283R3S			DVFL2805S			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	6	-	1	6	mA
	Inhibited 2	-	40	70	-	40	70	mA
	No Load	-	60	120	-	65	120	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	25	80	-	35	80	mA _{p-p}
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	V _{OUT} T _{CASE} = 25°C	3.267	3.30	3.333	4.95	5.00	5.05	V
	V _{OUT} T _{CASE} = -55°C to +125°C	3.25	3.30	3.35	4.925	5.00	5.075	V
Power ³		0	-	66	0	-	100	W
Current ³	V _{OUT}	-	-	20	-	-	20	A
Ripple Voltage	V _{OUT} Full Load, 20Hz to 10MHz	-	15	80	-	15	80	mV _{p-p}
Line Regulation	V _{OUT} V _{IN} = 16V to 40V	-	2	20	-	2	20	mV
Load Regulation	V _{OUT} No Load to Full Load	-	2	80	-	2	100	mV
Voltage Trim ⁴	V _{OUT} Full Load	-10	-	10	-20	-	10	%
Share Pin Voltage ⁴		2	-	4	2	-	4	V
EFFICIENCY		68	72	-	72	78	-	%
LOAD FAULT POWER DISSIPATION	Overload ⁴	-	-	50	-	-	50	W
	Short Circuit	-	-	50	-	-	50	W
CAPACITIVE LOAD ⁴		-	-	1000	-	-	1000	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}	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)	AIF @ T _c = 55°C	-	400	-	-	400	-	kHrs

- 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.

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load, 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-38534	1C	Weight (Maximum) (No Pin Extensions)	86 Grams

Parameter	Conditions	DVFL283R3S			DVFL2805S			Units	
		Min	Typ	Max	Min	Typ	Max		
DYNAMIC									
Load Step Output Transient	V _{OUT}	Half Load to Full Load	-	140	400	-	160	400	mV _{PK}
Load Step Recovery ²			-	260	500	-	260	500	μSec
Line Step Output Transient ⁴	V _{OUT}	V _{IN} = 16V to 40V	-	300	600	-	300	600	mV _{PK}
Line Step Recovery ^{2,4}			-	300	500	-	300	500	μSec
Turn On Delay	V _{OUT}	V _{IN} = 0V to 28V	-	5	20	-	5	20	mSec
Turn On Overshoot			-	0	15	-	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.

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load, 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-38534	1C	Weight (Maximum) (No Pin Extensions)	86 Grams

Parameter	Conditions	DVFL286R3S			DVFL2807S			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	6	-	1	6	mA
	Inhibited 2	-	40	70	-	40	70	mA
	No Load	-	65	120	-	65	120	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	35	80	-	35	80	mA _{p-p}
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	V _{OUT} T _{CASE} = 25°C	6.237	6.3	6.363	6.93	7	7.07	V
	V _{OUT} T _{CASE} = -55°C to +125°C	6.205	6.3	6.395	6.895	7	7.105	V
Power ³		-	-	100	-	-	100	W
Current ³	V _{OUT}	-	-	15.9	-	-	14.3	A
Ripple Voltage	V _{OUT} Full Load, 20Hz to 10MHz	-	15	80	-	15	80	mV _{p-p}
Line Regulation	V _{OUT} V _{IN} = 16V to 40V	-	2	20	-	2	20	mV
Load Regulation	V _{OUT} No Load to Full Load	-	2	100	-	2	100	mV
Voltage Trim ⁴	V _{OUT} Full Load	-20	-	10	-20	-	10	%
Share Pin Voltage ⁴		2	-	4	2	-	4	V
EFFICIENCY		74	79	-	74	80	-	%
LOAD FAULT POWER DISSIPATION	Overload ⁴	-	-	50	-	-	50	W
	Short Circuit	-	-	50	-	-	50	W
CAPACITIVE LOAD ⁴		-	-	1000	-	-	1000	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}	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)	AIF @ T _c = 55°C	-	400	-	-	400	-	kHrs

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.

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load, 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-38534	1C	Weight (Maximum) (No Pin Extensions)	86 Grams

Parameter	Conditions	DVFL286R3S			DVFL2807S			Units	
		Min	Typ	Max	Max	Typ	Max		
DYNAMIC									
Load Step Output Transient	V _{OUT}	Half Load to Full Load	-	150	300	-	150	300	mV _{PK}
Load Step Recovery ²			-	200	350	-	200	350	μSec
Line Step Output Transient ⁴	V _{OUT}	V _{IN} = 16V to 40V	-	150	300	-	150	300	mV _{PK}
Line Step Recovery ^{2,4}			-	150	300	-	200	400	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.

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load, 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-38534	1C	Weight (Maximum) (No Pin Extensions)	86 Grams

Parameter	Conditions	DVFL2808S			DVFL289R5S			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	6	-	1	6	mA
	Inhibited 2	-	40	70	-	40	70	mA
	No Load	-	70	120	-	80	120	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	30	80	-	30	80	mA _{p-p}
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	V _{OUT} T _{CASE} = 25°C	7.92	8	8.08	9.405	9.5	9.595	V
	V _{OUT} T _{CASE} = -55°C to +125°C	7.88	8	8.12	9.357	9.5	9.643	V
Power ³		-	-	100	-	-	100	W
Current ³	V _{OUT}	-	-	12.5	-	-	10.5	A
Ripple Voltage	V _{OUT} Full Load, 20Hz to 10MHz	-	15	80	-	25	80	mV _{p-p}
Line Regulation	V _{OUT} V _{IN} = 16V to 40V	-	2	20	-	2	20	mV
Load Regulation	V _{OUT} No Load to Full Load	-	2	100	-	2	100	mV
Voltage Trim ⁴	V _{OUT} Full Load	-20	-	10	-20	-	10	%
Share Pin Voltage ⁴		2	-	4	2	-	4	V
EFFICIENCY		76	82	-	78	83	-	%
LOAD FAULT POWER DISSIPATION	Overload ⁴	-	-	50	-	-	50	W
	Short Circuit	-	-	50	-	-	50	W
CAPACITIVE LOAD ⁴		-	-	1000	-	-	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}	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)	AIF @ T _C = 55°C	-	400	-	-	400	-	kHrs

- 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.

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load, 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-38534	1C	Weight (Maximum) (No Pin Extensions)	86 Grams

Parameter	Conditions	DVFL2808S			DVFL289R5S			Units	
		Min	Typ	Max	Max	Typ	Max		
DYNAMIC									
Load Step Output Transient	V _{OUT}	Half Load to Full Load	-	200	350	-	1000	1300	mV _{PK}
Load Step Recovery ²			-	200	350	-	450	700	μSec
Line Step Output Transient ⁴	V _{OUT}	V _{IN} = 16V to 40V	-	250	450	-	850	1400	mV _{PK}
Line Step Recovery ^{2,4}			-	250	350	-	500	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.

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load, 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-38534	1C	Weight (Maximum) (No Pin Extensions)	86 Grams

Parameter	Conditions	DVFL2812S			DVFL2815S			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	6	-	1	6	mA
	Inhibited 2	-	40	70	-	40	70	mA
	No Load	-	80	120	-	85	120	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	30	80	-	30	80	mA _{p-p}
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	V _{OUT} T _{CASE} = 25°C	11.88	12.00	12.12	14.85	15.00	15.15	V
	V _{OUT} T _{CASE} = -55°C to +125°C	11.82	12.00	12.18	14.775	15.00	15.225	V
Power ³		-	-	110	-	-	120	W
Current ³	V _{OUT}	-	-	9.2	-	-	8.0	A
Ripple Voltage	V _{OUT} Full Load, 20Hz to 10MHz	-	25	80	-	25	80	mV _{p-p}
Line Regulation	V _{OUT} V _{IN} = 16V to 40V	-	2	20	-	2	20	mV
Load Regulation	V _{OUT} No Load to Full Load	-	2	120	-	2	120	mV
Voltage Trim ⁴	V _{OUT} Full Load	-20	-	10	-20	-	10	%
Share Pin Voltage ⁴		2	-	4	2	-	4	V
EFFICIENCY		79	86	-	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}	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)	AIF @ T _c = 55°C	-	400	-	-	400	-	kHrs

- 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.

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load, 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-38534	1C	Weight (Maximum) (No Pin Extensions)	86 Grams

Parameter	Conditions	DVFL2812S			DVFL2815S			Units	
		Min	Typ	Max	Min	Typ	Max		
DYNAMIC									
Load Step Output Transient	V _{OUT}	Half Load to Full Load	-	570	1000	-	640	1000	mV _{PK}
Load Step Recovery ²			-	290	500	-	260	500	μSec
Line Step Output Transient ⁴	V _{OUT}	V _{IN} = 16V to 40V	-	600	1200	-	600	1200	mV _{PK}
Line Step Recovery ^{2,4}			-	300	500	-	300	500	μSec
Turn On Delay	V _{OUT}	V _{IN} = 0V to 28V	-	5	20	-	5	20	mSec
Turn On Overshoot			-	0	50	-	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.

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load, 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-38534	1C	Weight (Maximum) (No Pin Extensions)	86 Grams

Parameter	Conditions	DVFL2818S			DVFL2828S			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	6	-	1	6	mA
	Inhibited 2	-	40	70	-	40	70	mA
	No Load	-	100	160	-	110	160	mA
Ripple Current	Full Load, 20Hz to 10MHz	-	30	80	-	35	80	mA _{p-p}
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	V _{OUT} T _{CASE} = 25°C	17.82	18	18.18	27.72	28	28.28	V
	V _{OUT} T _{CASE} = -55°C to +125°C	17.73	18	18.27	27.58	28	28.42	V
Power ³		-	-	120	-	-	115	W
Current ³	V _{OUT}	-	-	6.67	-	-	4.1	A
Ripple Voltage	V _{OUT} Full Load, 20Hz to 10MHz	-	60	100	-	50	120	mV _{p-p}
Line Regulation	V _{OUT} V _{IN} = 16V to 40V	-	2	20	-	20	80	mV
Load Regulation	V _{OUT} No Load to Full Load	-	2	120	-	25	100	mV
Voltage Trim ⁴	V _{OUT} Full Load	-20	-	10	-20	-	10	%
Share Pin Voltage ⁴		2	-	4	2	-	4	V
EFFICIENCY		80	85	-	81	85	-	%
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}	100	-	-	100	-	-	MΩ
MTBF (MIL-HDBK-217F)	AIF @ T _C = 55°C	-	400	-	-	400	-	kHrs

- 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.

SPECIFICATIONS (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 5%, Full Load, 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-38534	1C	Weight (Maximum) (No Pin Extensions)	86 Grams

Parameter	Conditions	DVFL2818S			DVFL2828S			Units	
		Min	Typ	Max	Min	Typ	Max		
DYNAMIC									
Load Step Output Transient	V _{OUT}	Half Load to Full Load	-	1100	1500	-	1000	1500	mV _{PK}
Load Step Recovery ²			-	350	700		200	350	μSec
Line Step Output Transient ⁴	V _{OUT}	V _{IN} = 16V to 40V	-	1000	1900	-	1000	2200	mV _{PK}
Line Step Recovery ^{2,4}			-	450	700		200	400	μSec
Turn On Delay	V _{OUT}	V _{IN} = 0V to 28V	-	5	20	-	5	20	mSec
Turn On Overshoot			-	0	50	-	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.

BLOCK DIAGRAM

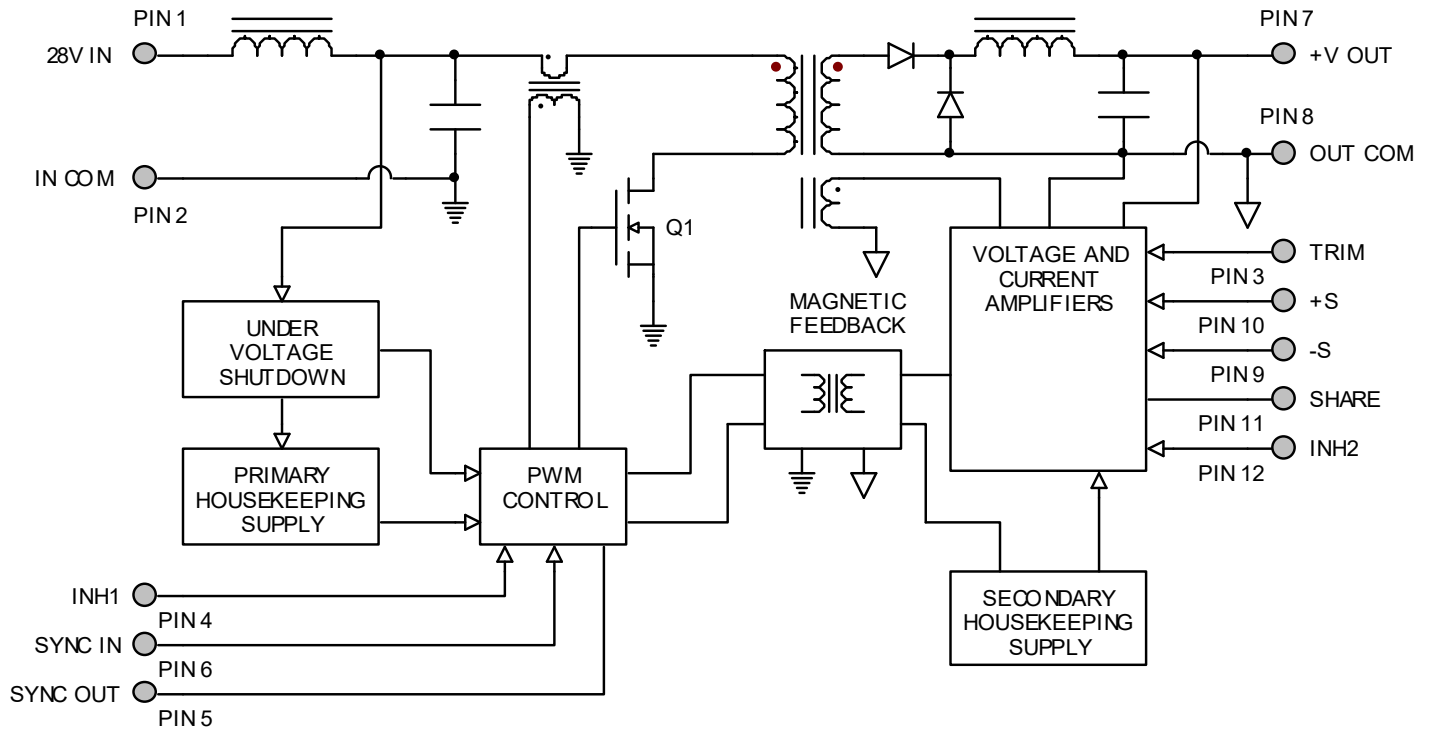


Figure 2

CONNECTION DIAGRAM

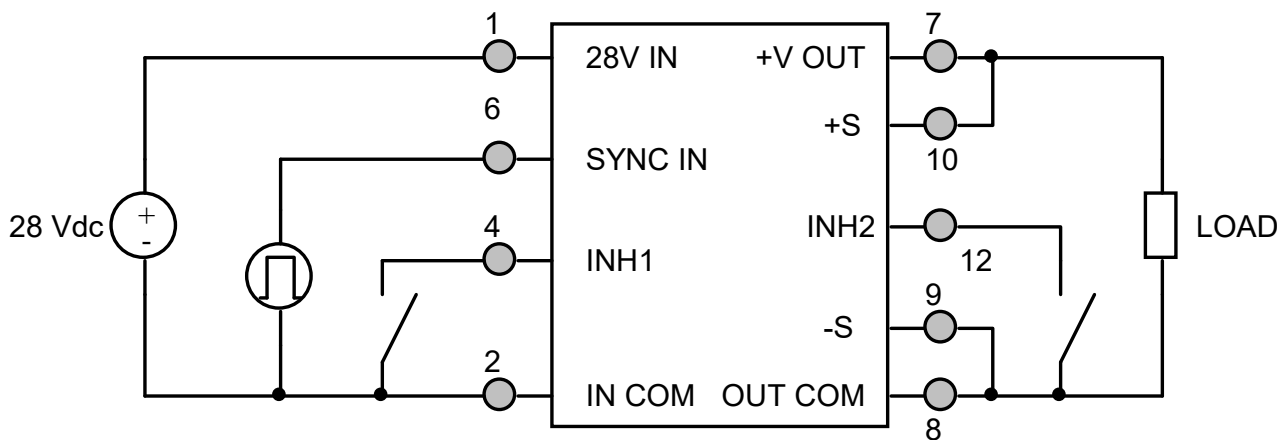


Figure 3

INHIBIT DRIVE CONNECTION DIAGRAM

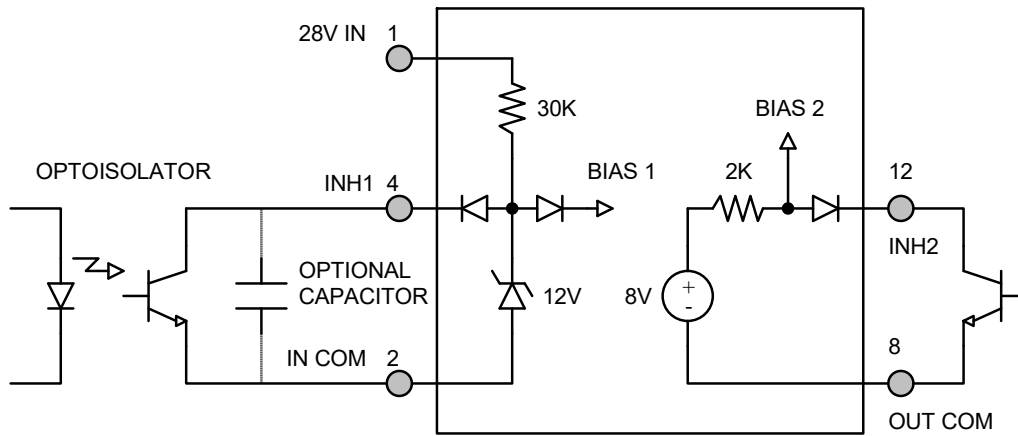


Figure 4 – Isolated Inhibit Drive and Internal Equivalent Circuit
(Shown with optional capacitor for turn-on delay)

EMI FILTER HOOKUP DIAGRAM

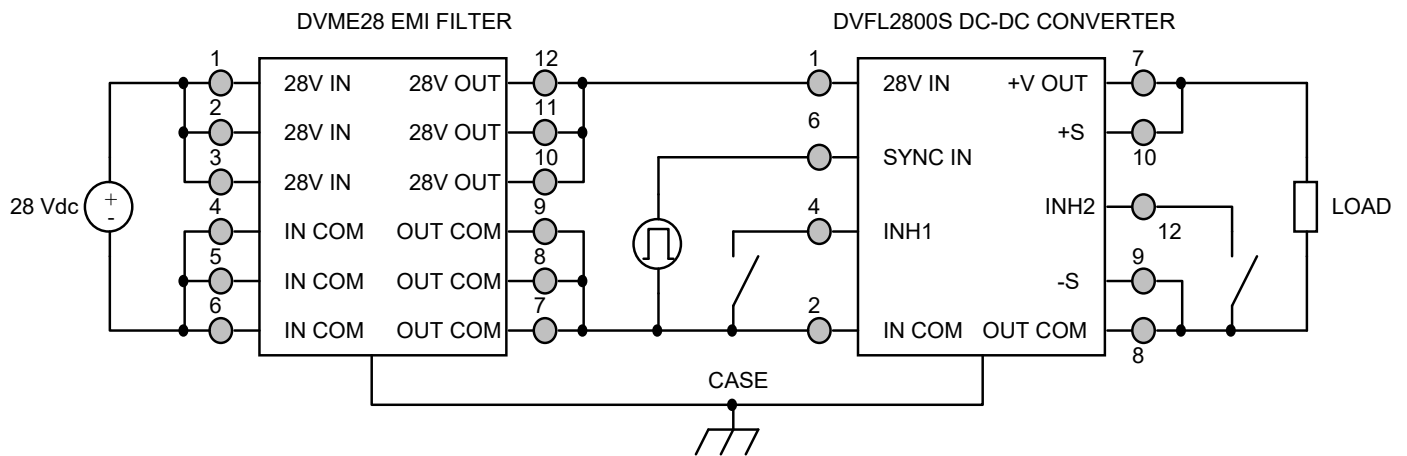


Figure 5 – Converter with EMI Filter

PARALLEL CONNECTION DIAGRAMS

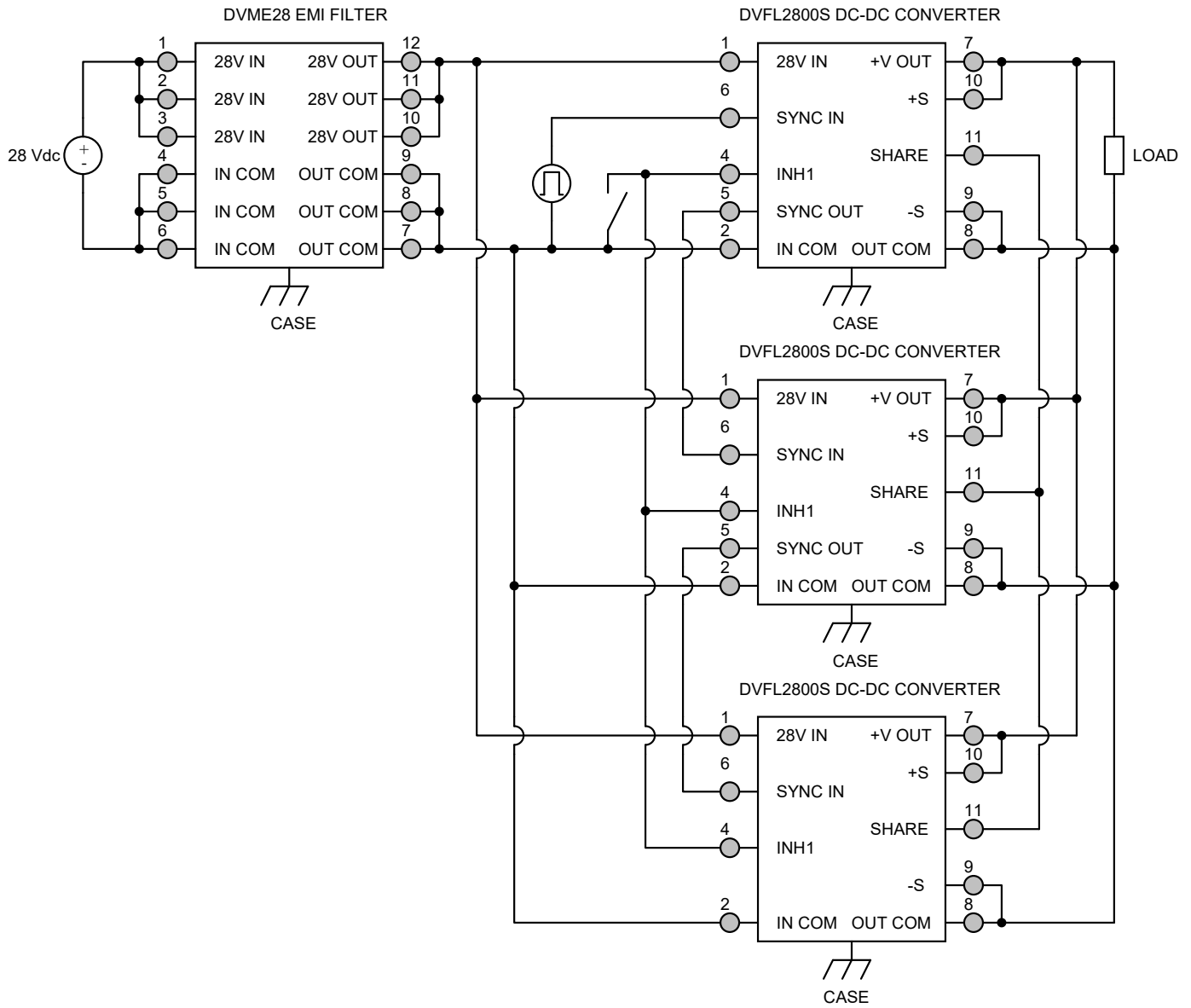
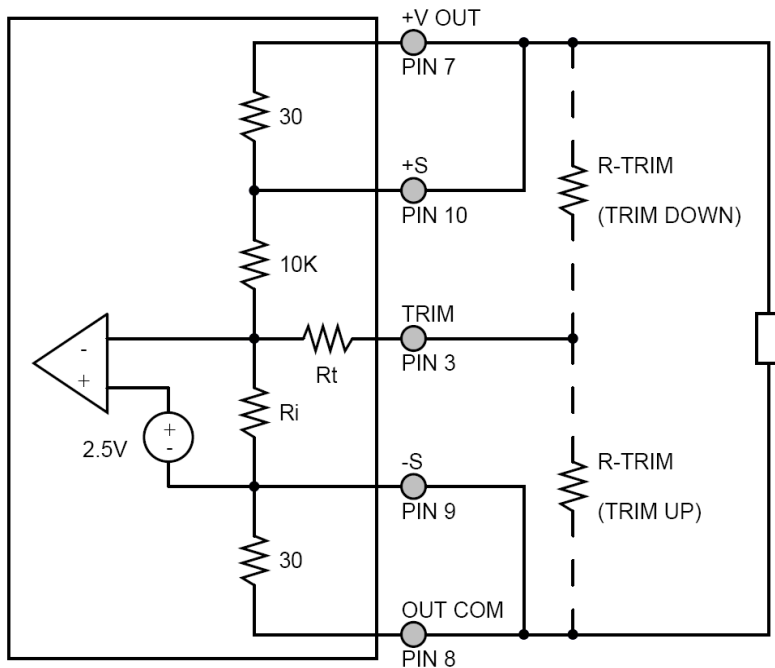


Figure 6 – Current Sharing Parallel Connection for Multiple Converters

OUTPUT VOLTAGE TRIM



The output voltage can be trimmed down by connecting a resistor between the TRIM pin (PIN 3) and the +V OUT pin (PIN 7), or can be trimmed up by connecting a resistor between the TRIM pin (PIN 3) 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 7 – Output Voltage Trim

DVFL283R3S		DVFL2805S		DVFL286R3S		DVFL2807S		DVFL2808S	
+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	35.0k	6.9	28.1k	7.70	21.0k	8.80	16.3k
3.55	85.0k	5.4	47.5k	6.8	36.7k	7.55	30.8k	8.65	23.5k
3.50	110k	5.3	68.3k	6.7	49.6k	7.40	48.0k	8.50	35.1k
3.45	152k	5.2	110k	6.6	71.1k	7.25	85.8k	8.35	56.5k
3.40	235k	5.1	235k	6.5	114k	7.10	237k	8.20	110.3k
3.35	485k	5.0	-	6.4	243k	7.00	-	8.05	490.6k
3.30	-	4.9	225k	6.3	-	6.85	277k	8.00	-
3.25	135k	4.8	100k	6.2	367k	6.70	126k	7.90	522k
3.20	55.0k	4.7	58.3k	6.1	171k	6.55	75.7k	7.75	195k
3.15	28.3k	4.6	37.5k	6.0	106k	6.40	50.5k	7.60	112k
3.10	15.0k	4.5	25.0k	5.9	72.9k	6.25	35.4k	7.45	74.9k
3.05	7.0k	4.4	16.7k	5.8	53.2k	6.10	25.3k	7.30	53.5k
3.00	1.7k	4.3	10.7k	5.7	40.1k	5.95	18.1k	7.15	39.7k
		4.2	6.3k	5.6	30.8k	5.80	12.7k	7.00	30.0k
		4.1	2.8k	5.5	23.8k	5.65	8.52k	6.85	22.8k
		4.0	0	5.4	18.3k			6.70	17.3k
				5.3	13.9k			6.55	12.9k
				5.2	10.4k			6.40	9.37k
				5.1	7.4k				

(continued on next page)

OUTPUT VOLTAGE TRIM

DVFL289R5S		DVFL2812S		DVFL2815S		DVFL2818S		DVFL2828S	
+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)
10.45	11.5k	13.2	5.8k	16.50	1.7k	19.8	5.07k	30.8	0.91k
10.3	16.5k	13.0	10.0k	16.25	5.0k	19.5	8.08k	30.4	2.42k
10.1	27.0k	12.8	16.2k	16.00	10.0k	19.2	12.6k	30.0	4.55k
9.9	48.0k	12.6	26.6k	15.75	18.3k	18.9	20.1k	29.6	7.74k
9.7	111k	12.4	47.3k	15.50	35.0k	18.6	35.2k	29.2	13.1k
9.5	-	12.2	109k	15.25	85.0k	18.3	80.4k	28.8	23.7k
9.4	681k	12.0	-	15.00	-	18.0	-	28.4	55.6k
9.2	210k	11.8	454k	14.75	475k	17.7	540k	28.0	-
9.0	116k	11.6	213k	14.50	225k	17.4	259k	27.6	632k
8.8	75.7k	11.4	134k	14.25	142k	17.1	166k	27.2	307k
8.6	53.3k	11.2	94.0k	14.00	100k	16.8	119k	26.8	198k
8.4	39.1k	11.0	70.1k	13.75	75.0k	16.5	91.3k	26.4	144k
8.2	29.2k	10.8	54.3k	13.50	58.3k	16.2	72.6k	26.0	112k
8.0	22.0k	10.6	42.9k	13.25	46.4k	15.9	59.2k	25.6	90.0k
7.8	16.4k	10.4	34.4k	13.00	37.5k	15.6	49.2k	25.2	74.5k
7.6	12.1k	10.2	27.8k	12.75	30.6k	15.3	41.4k	24.8	62.9k
		10.0	22.5k	12.50	25.0k	15.0	35.2k	24.4	53.9k
		9.8	18.2k	12.25	20.5k	14.7	30.1k	24.0	46.6k
		9.6	14.6k	12.00	16.7k	14.4	25.9k	23.6	40.7k
								23.2	35.8k
								22.8	31.6k
								22.4	28.0k

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

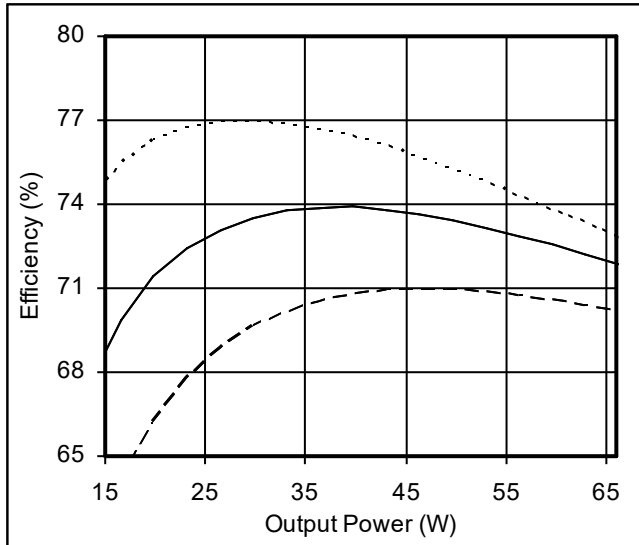


Figure 8 – DVFL283R3S
Efficiency (%) vs. Output Power (W)

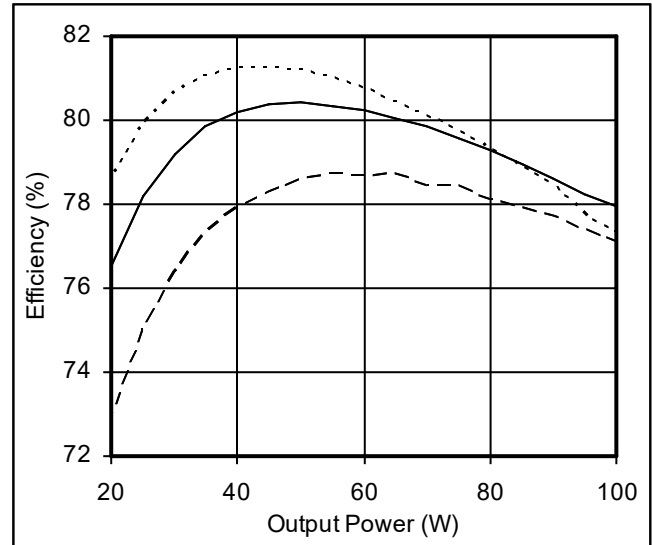


Figure 9 – DVFL2805S
Efficiency (%) vs. Output Power (W)

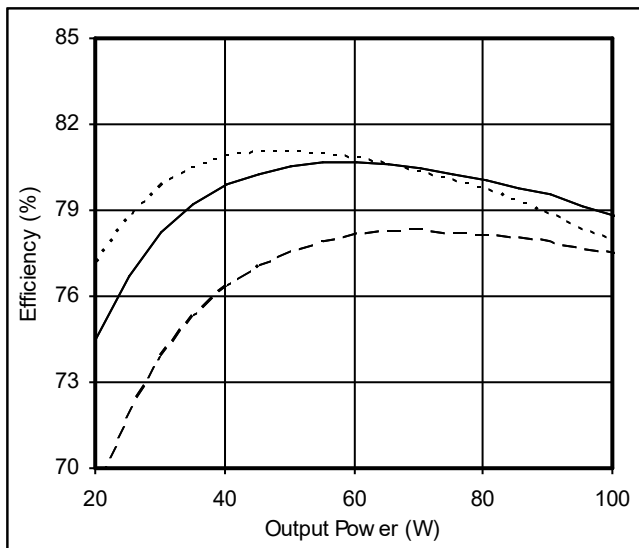


Figure 10 – DVFL286R3S
Efficiency (%) vs. Output Power (W)

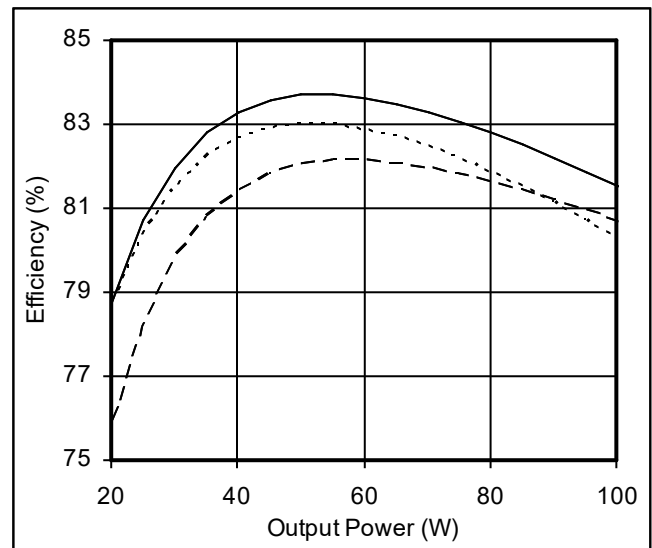


Figure 11 – DVFL2807S
Efficiency (%) vs. Output Power (W)

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

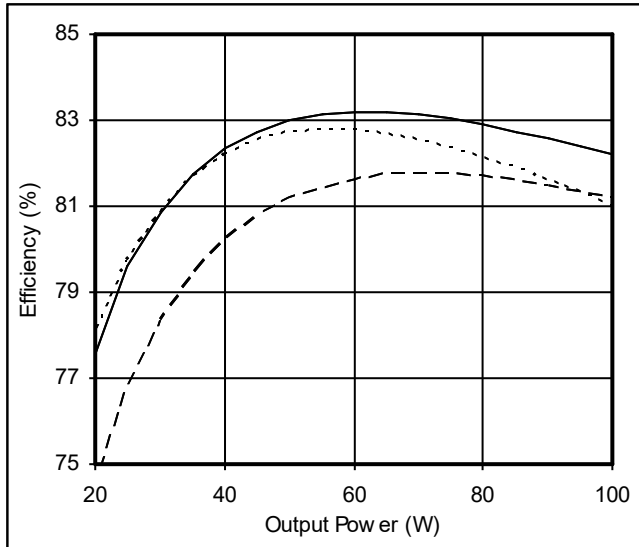


Figure 12 – DVFL2808S
Efficiency (%) vs. Output Power (W)

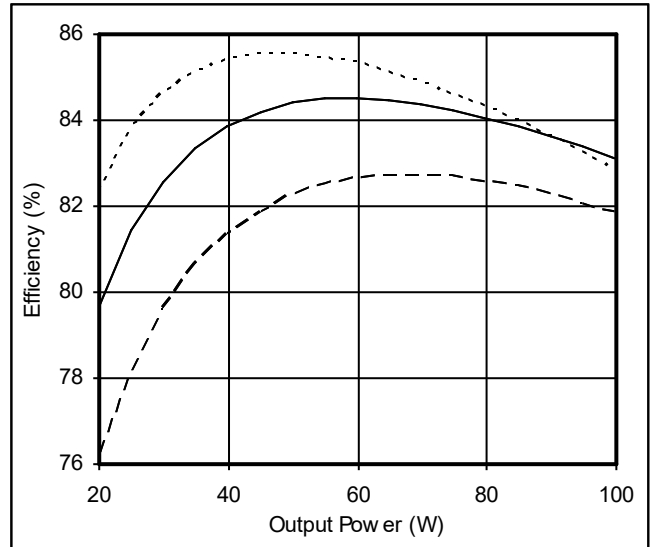


Figure 13 – DVFL289R5S
Efficiency (%) vs. Output Power (W)

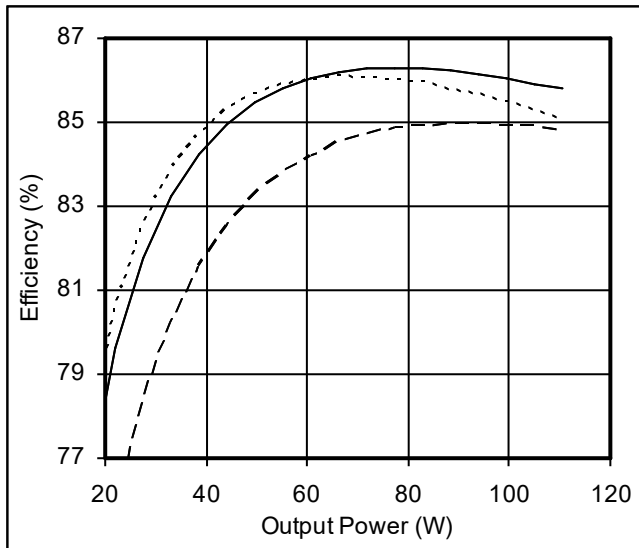


Figure 14 – DVFL2812S
Efficiency (%) vs. Output Power (W)

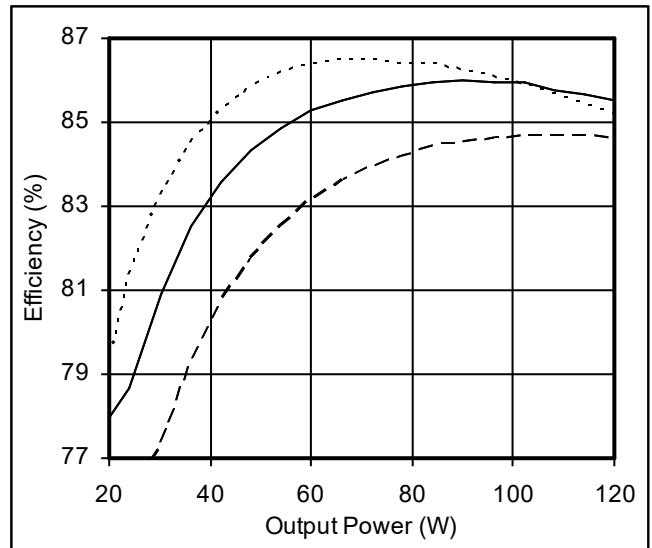


Figure 15 – DVFL2815S
Efficiency (%) vs. Output Power (W)

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

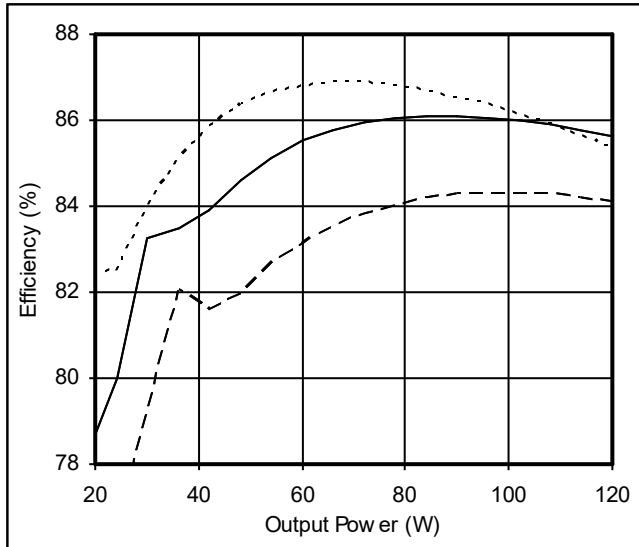


Figure 16 – DVFL2818S
Efficiency (%) vs. Output Power (W)

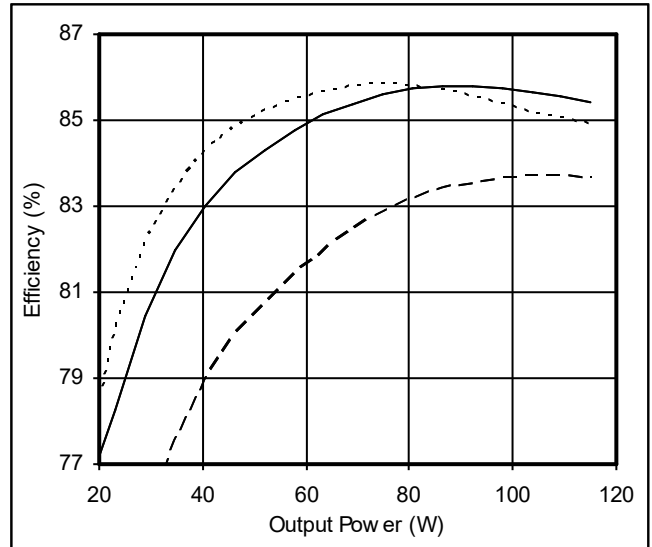


Figure 17 – DVFL2828S
Efficiency (%) vs. Output Power (W)

EMI PERFORMANCE CURVES

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

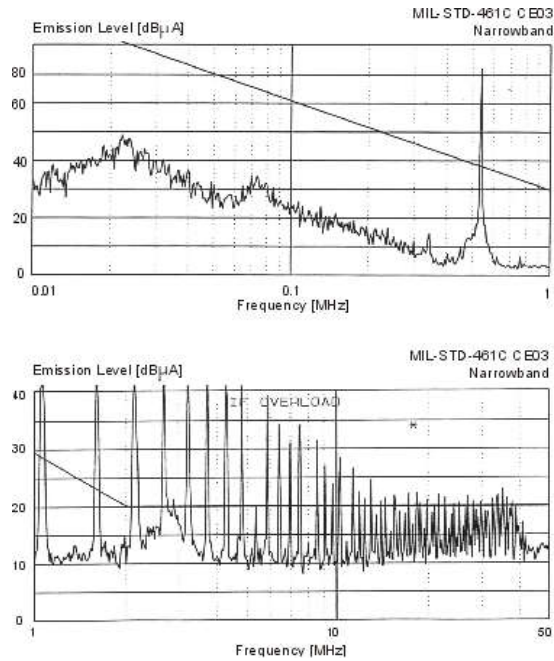


Figure 18 – DVFL2800S without EMI Filter

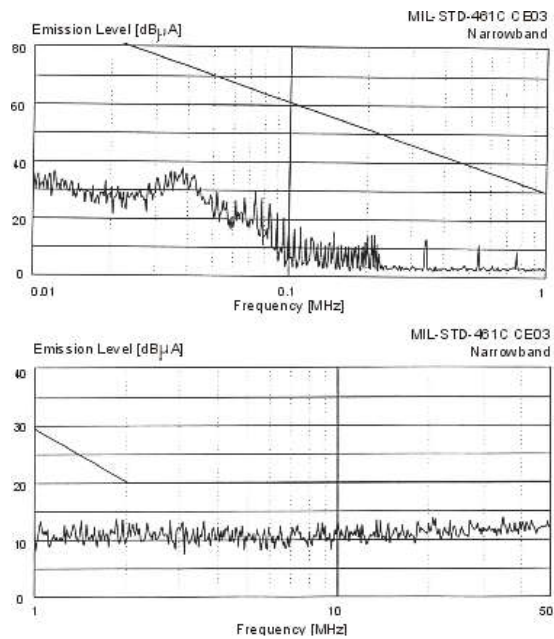
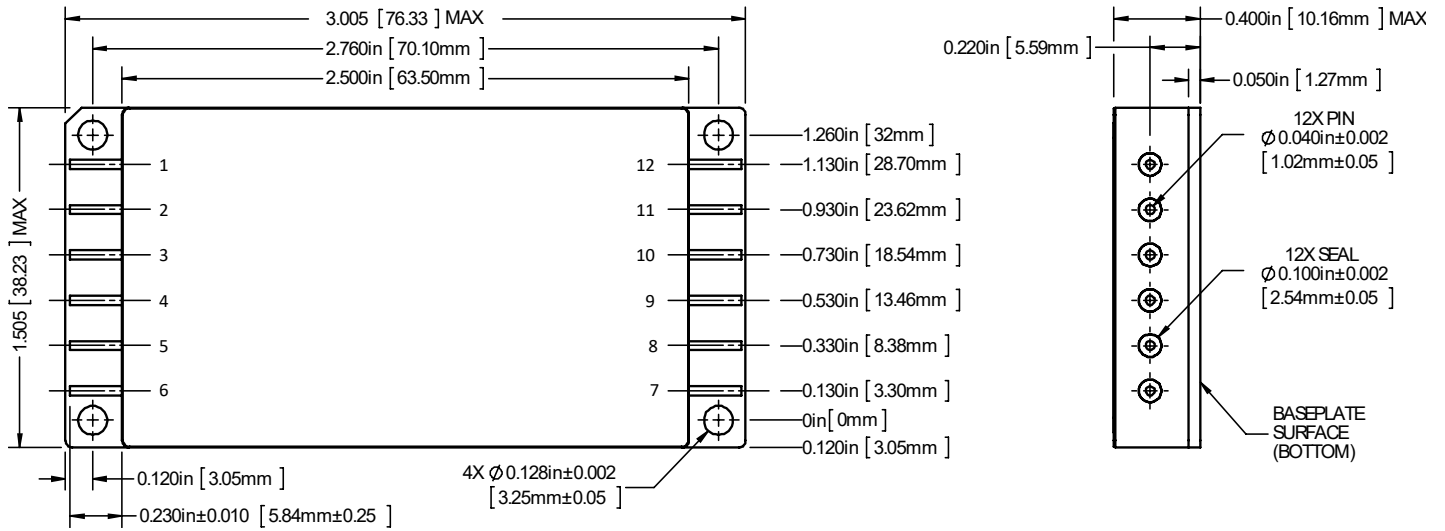


Figure 19 – DVFL2800S with EMI Filter

STANDARD PACKAGE DRAWINGS

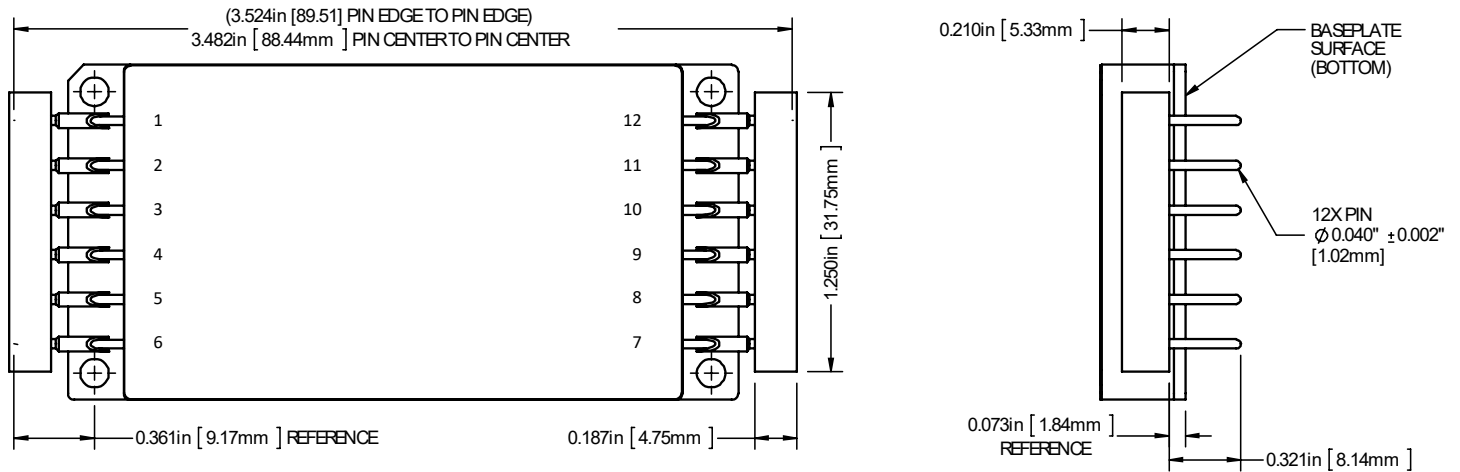


1. Tolerances are +0.005" unless otherwise stated
2. Case temperature is measured on the center of the baseplate surface
3. Mounting holes are not threaded. Recommended fastener is 4-40
4. Product Materials:
 Case (Steel, gold over nickel plated); Cover (Kovar, nickel plated); Pin (Copper-cored alloy 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	+S
2	IN COM	5	SYNC OUT	8	OUT COM	11	SHARE
3	TRIM	6	SYNC IN	9	-S	12	INH2

Figure 20 – Standard Package and Pinout

STANDARD PACKAGE DRAWINGS

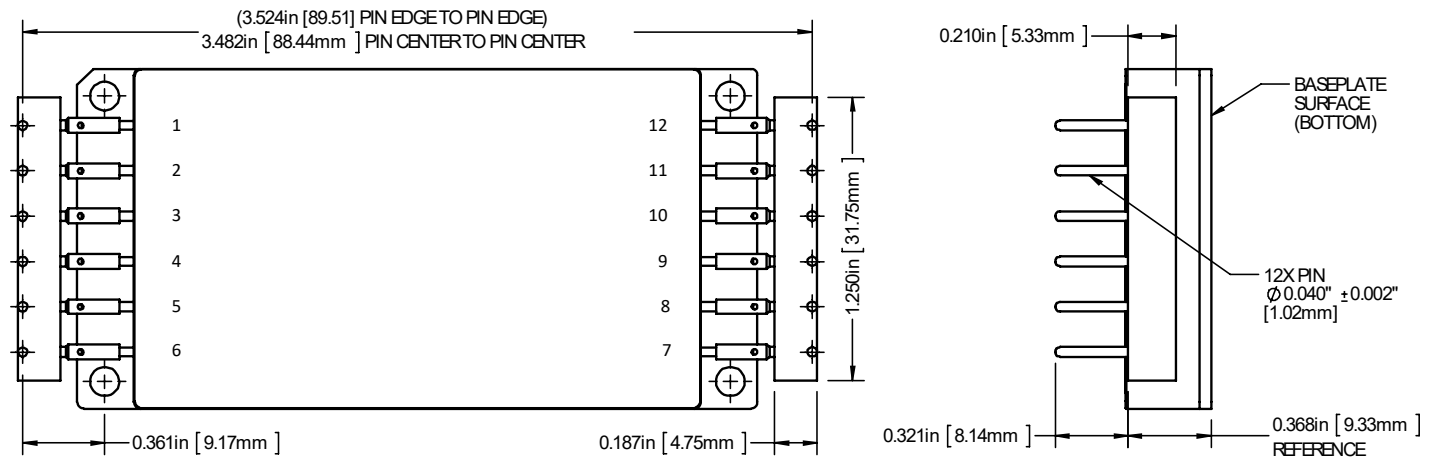


1. Tolerances are +0.005" unless otherwise stated
2. Case temperature is measured on the center of the baseplate surface
3. Mounting holes are not threaded. Recommended fastener is 4-40
4. Product Materials:
Case (Steel, gold over nickel plated); Cover (Kovar, nickel plated); Pin (Copper-cored alloy 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)
6. Reference Figure 20 for any dimension not explicitly shown.

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

Figure 21 – Standard Package with Down-Leads and Pinout

STANDARD PACKAGE DRAWINGS

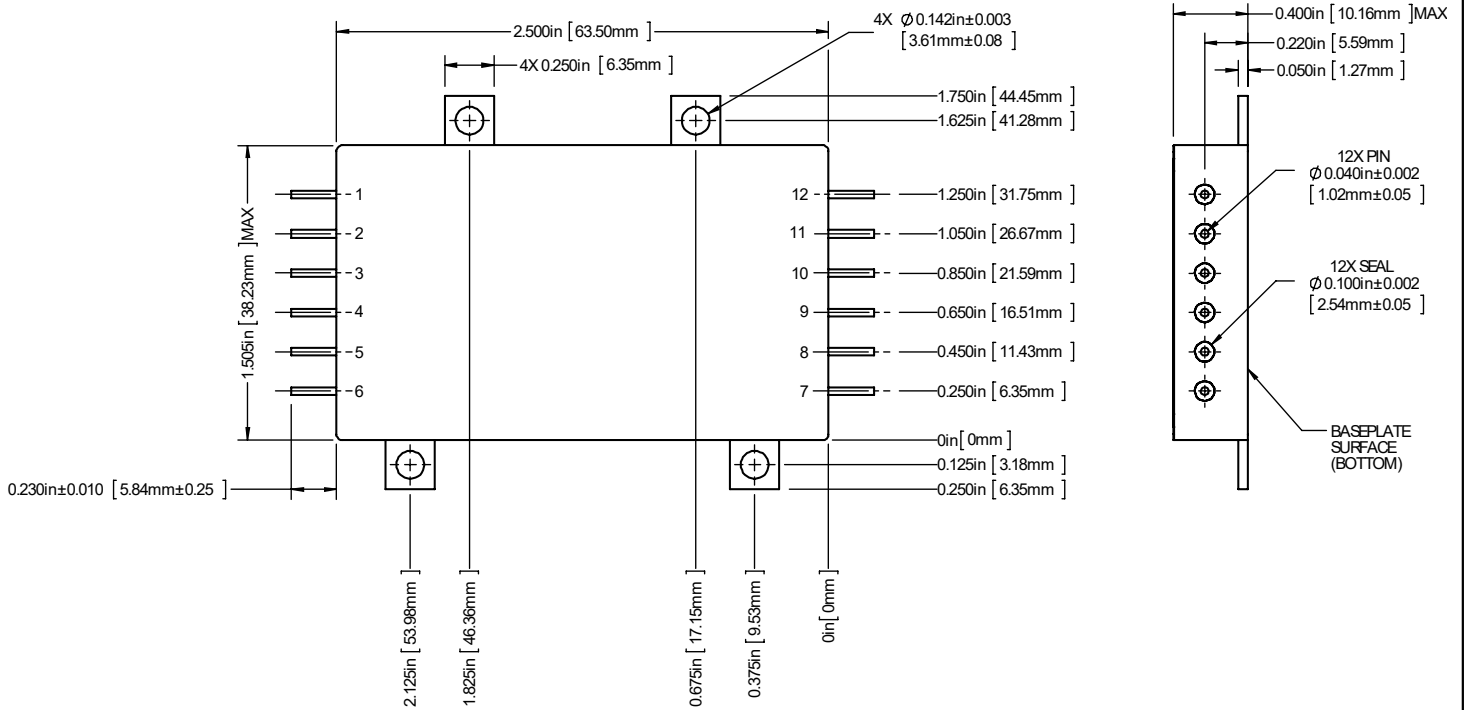


1. Tolerances are +0.005" unless otherwise stated
2. Case temperature is measured on the center of the baseplate surface
3. Mounting holes are not threaded. Recommended fastener is 4-40
4. Product Materials:
Case (Steel, gold over nickel plated); Cover (Kovar, nickel plated); Pin (Copper-cored alloy 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).
6. Reference Figure 20 for any dimension not explicitly shown.

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

Figure 22 – Standard Package with Up-Leads and Pinout

FLANGED PACKAGE DRAWINGS

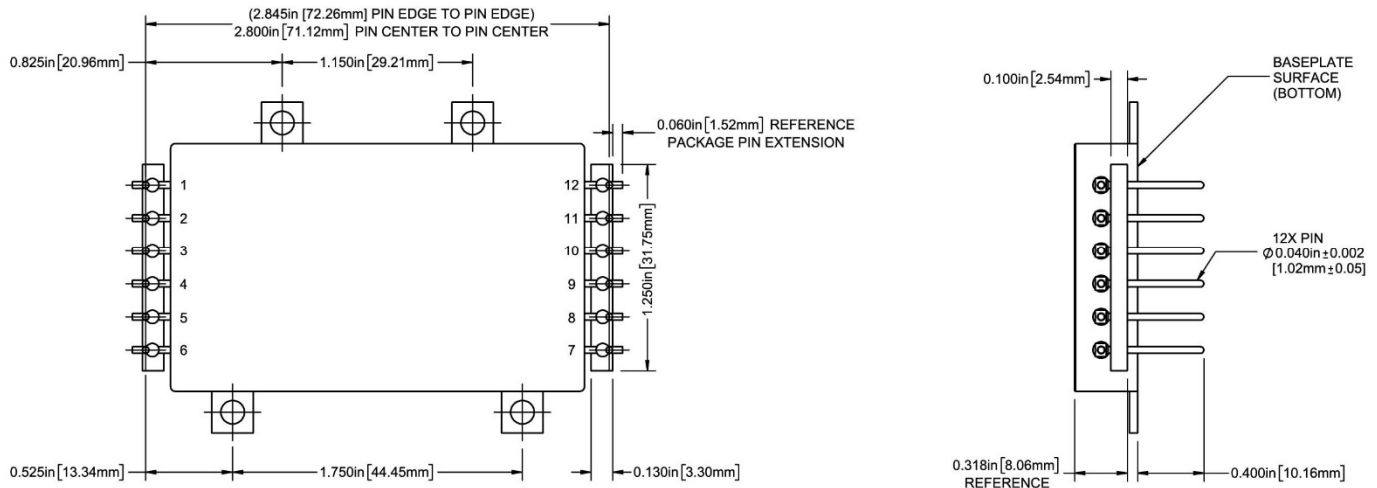


1. Tolerances are +0.005" unless otherwise stated
2. Case temperature is measured on the center of the baseplate surface
3. Mounting holes are not threaded. Recommended fastener is 4-40
4. Product Materials:
Case (Steel, gold over nickel plated); Cover (Kovar, nickel plated); Pin (Copper-cored alloy 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	+S
2	IN COM	5	SYNC OUT	8	OUT COM	11	SHARE
3	TRIM	6	SYNC IN	9	-S	12	INH2

Figure 23 – Flanged Package and Pinout

FLANGED PACKAGE DRAWINGS

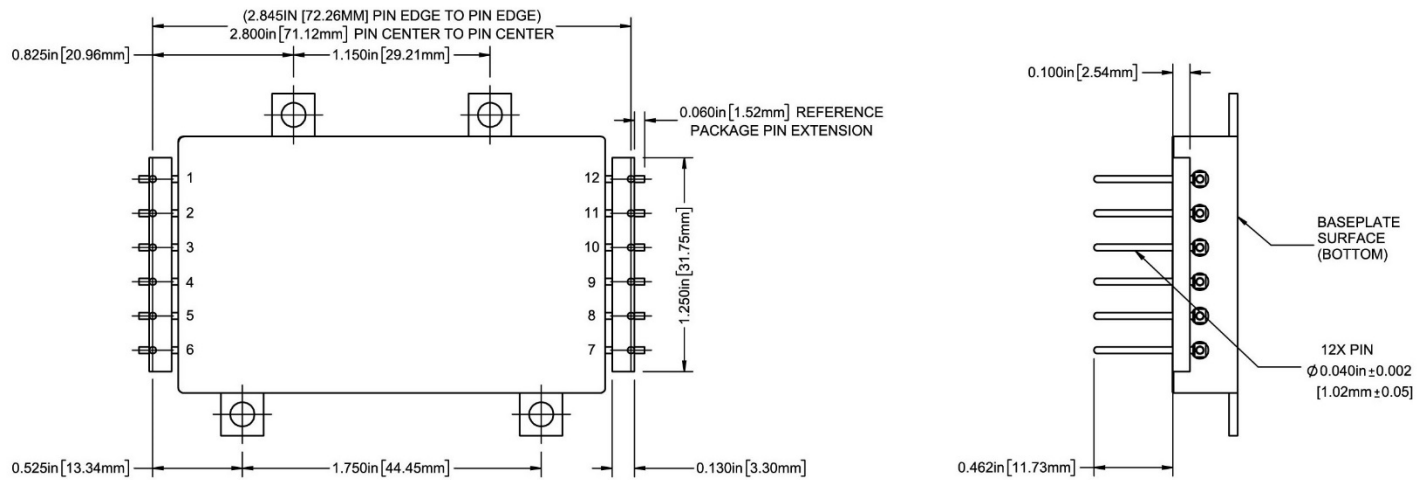


1. Tolerances are +0.005" unless otherwise stated
2. Case temperature is measured on the center of the baseplate surface
3. Mounting holes are not threaded. Recommended fastener is 4-40
4. Product Materials:
Case (Steel, gold over nickel plated); Cover (Kovar, nickel plated); Pin (Copper-cored alloy 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)
6. Reference Figure 23 for any dimension not explicitly shown.

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

Figure 24 – 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)
6. Reference Figure 23 for any dimension not explicitly shown.

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

Figure 25 – Flanged Package with Up-Leads and Pinout

PACKAGE PIN DESCRIPTION

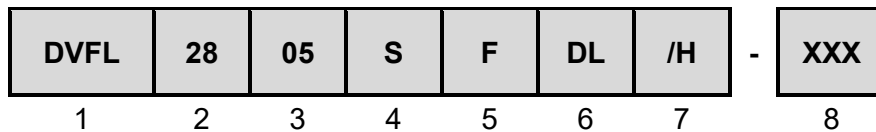
Pin	Function	Description
1	28V IN	Positive Input Voltage Connection
2	IN COM	Input Common Connection
3	TRIM	Trim Output Voltage to +10%, -20% of Nominal Value
4	INH1	Logic Low = Disabled Output. Connecting the inhibit(1) pin to input common causes converter shutdown. Logic High = Enabled Output. Unconnected 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	-S	Return Sense
10	+S	Positive Sense
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



(1) Product Series	(2) Nominal Input Voltage		(3) Output Voltage		(4) Number of Outputs	
DVFL	28	28 Volts	3R3 05 6R3 07 08 9R5 12 15 18 28	3.3 Volts 5 Volts 6.3 Volts 7 Volts 8 Volts 9.5 Volts 12 Volts 15 Volts 18 volts 28 volts	S	Single

(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)	DVFL2800S Series Similar Part Number	Standard Microcircuit Drawing (SMD)	DVFL2800S Series Similar Part Number
5962-0724301HXC 5962-0724301HXA 5962-0724301KXC 5962-0724301KXA 5962-0724301HYC 5962-0724301HYA 5962-0724301KYC 5962-0724301KYA	DVFL283R3S/H DVFL283R3S/H-E DVFL283R3S/K DVFL283R3S/K-E DVFL283R3SF/H DVFL283R3SF/H-E DVFL283R3SF/K DVFL283R3SF/K-E	5962-0724306HXC 5962-0724306HXA 5962-0724306KXC 5962-0724306KXA 5962-0724306HYC 5962-0724306HYA 5962-0724306KYC 5962-0724306KYA	DVFL289R5S/H DVFL289R5S/H-E DVFL289R5S/K DVFL289R5S/K-E DVFL289R5SF/H DVFL289R5SF/H-E DVFL289R5SF/K DVFL289R5SF/K-E
5962-0724302HXC 5962-0724302HXA 5962-0724302KXC 5962-0724302KXA 5962-0724302HYC 5962-0724302HYA 5962-0724302KYC 5962-0724302KYA	DVFL2805S/H DVFL2805S/H-E DVFL2805S/K DVFL2805S/K-E DVFL2805SF/H DVFL2805SF/H-E DVFL2805SF/K DVFL2805SF/K-E	5962-0724303HXC 5962-0724303HXA 5962-0724303KXC 5962-0724303KXA 5962-0724303HYC 5962-0724303HYA 5962-0724303KYC 5962-0724303KYA	DVFL2812S/H DVFL2812S/H-E DVFL2812S/K DVFL2812S/K-E DVFL2812SF/H DVFL2812SF/H-E DVFL2812SF/K DVFL2812SF/K-E
5962-0724308HXC 5962-0724308HXA 5962-0724308KXC 5962-0724308KXA 5962-0724308HYC 5962-0724308HYA 5962-0724308KYC 5962-0724308KYA	DVFL286R3S/H DVFL286R3S/H-E DVFL286R3S/K DVFL286R3S/K-E DVFL286R3SF/H DVFL286R3SF/H-E DVFL286R3SF/K DVFL286R3SF/K-E	5962-0724304HXC 5962-0724304HXA 5962-0724304KXC 5962-0724304KXA 5962-0724304HYC 5962-0724304HYA 5962-0724304KYC 5962-0724304KYA	DVFL2815S/H DVFL2815S/H-E DVFL2815S/K DVFL2815S/K-E DVFL2815SF/H DVFL2815SF/H-E DVFL2815SF/K DVFL2815SF/K-E
5962-0724305HXC 5962-0724305HXA 5962-0724305KXC 5962-0724305KXA 5962-0724305HYC 5962-0724305HYA 5962-0724305KYC 5962-0724305KYA	DVFL2807S/H DVFL2807S/H-E DVFL2807S/K DVFL2807S/K-E DVFL2807SF/H DVFL2807SF/H-E DVFL2807SF/K DVFL2807SF/K-E	5962-0724309HXC 5962-0724309HXA 5962-0724309KXC 5962-0724309KXA 5962-0724309HYC 5962-0724309HYA 5962-0724309KYC 5962-0724309KYA	DVFL2818S/H DVFL2818S/H-E DVFL2818S/K DVFL2818S/K-E DVFL2818SF/H DVFL2818SF/H-E DVFL2818SF/K DVFL2818SF/K-E
*T.B.D.	DVFL2808S/H DVFL2808S/K	5962-0724307HXC 5962-0724307HXA 5962-0724307KXC 5962-0724307KXA 5962-0724307HYC 5962-0724307HYA 5962-0724307KYC 5962-0724307KYA	DVFL2828S/H DVFL2828S/H-E DVFL2828S/K DVFL2828S/K-E DVFL2828SF/H DVFL2828SF/H-E DVFL2828SF/K DVFL2828SF/K-E

Do not use the DVFL2800S 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.