MIL-PRF-38534 CERTIFIED

M.S.KENNEDY CORP.

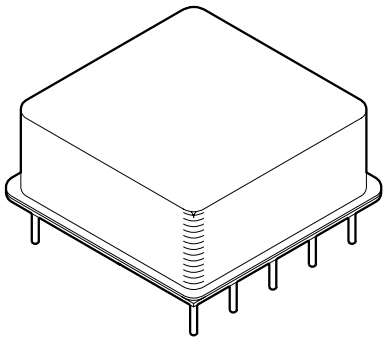
6W DUAL DC-DC CONVERTERS

DAC2800D SERIES

4707 Dey Road Liverpool, N.Y. 13088 (315) 701-6751

FEATURES:

- Wave Solderable Package
- All Ceramic Capacitors
- Surface Mount Magnetics
- 80 Volt Input Transient Tolerent
- Wide Supply Range - 11V to 50V
- High Isolation - 500V
- High Power Density - 15 W/in³
- Both Outputs Fully Regulated
- Tracking Output Voltage Adjustment - Standard
- Remote Shutdown
- Operates to 11V Input at 5W
- Available with ±12V or ±15V Outputs
- Contact MSK for MIL-PRF-38534 Qualification Status



DESCRIPTION:

The DAC2812D and DAC2815D DC-DC converters provide the ruggedness, reliability and features required to meet the advanced design challenges of today's hi-rel market. This has been accomplished while retaining a power density of 15 W/in^3 and 375 mW/gram of power/package performance. The use of advanced substrate and reflow soldering techniques during construction results in a rugged, cost-effective and completely solderable package.

The DAC2800D hybrid converter series utilizes all ceramic capacitors, surface mount magnetics, and ultrasonically bonded wires to provide reliable operation at all operating temperatures.

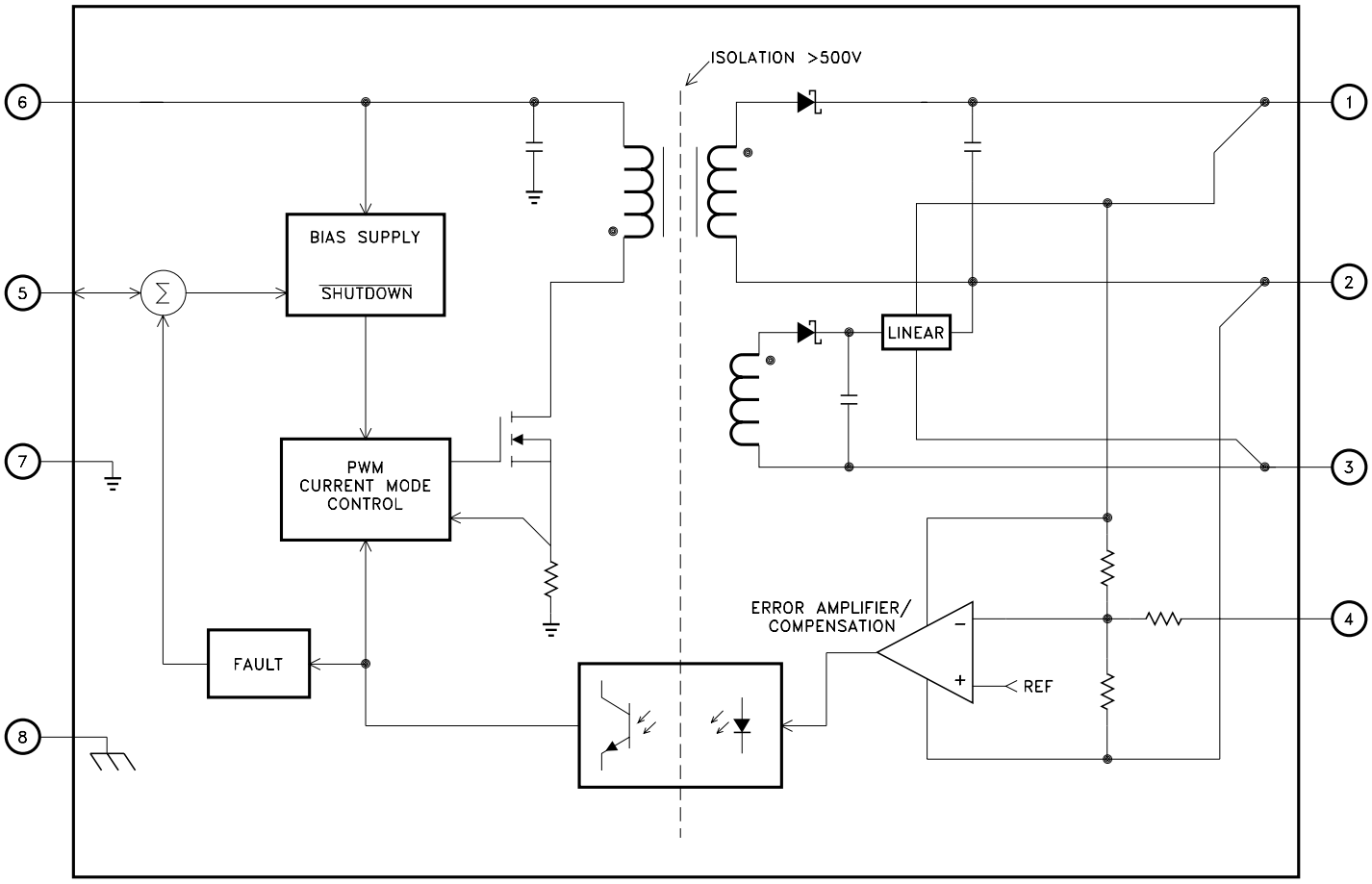
The DAC2800D series has two fully regulated tracking outputs. Standard features include output fault monitoring and/or turn on voltage point programming via the shutdown pin. All three functions may be implemented simultaneously with a minimum of external components. An output voltage adjustment / load compensation pin which adjusts both outputs simultaneously is also standard.

Fault tolerant design protects these converters from most external circuit faults. The ±output and output adjust pins will withstand +25 V while the shutdown pin will withstand +50 V, protecting the converters from a variety of system or board faults; e.g. solder bridges etc. Unique load fault protection circuitry allows this converter to pull up loads having difficult static load line characteristics and allows short term load excursions significantly beyond ratings in most applications.

A transformer isolated flyback converter topology operating at a switching frequency of 400 kHz allows operation over a wide input voltage range. Internal filtering of outputs eliminates the need for external capacitors in many applications.

The 8-pin package is hermetically sealed and isolated from the internal circuits. Heat sinking is recommended for full power operation at elevated ambient temperatures.

EQUIVALENT SCHEMATIC



TYPICAL APPLICATIONS

- Isolated Step Down Power Supply
- Microprocessor Power Source
- Low Voltage Subsystem Power Source
  ±Analog Power Source

PIN-OUT INFORMATION

1	+Output	8	Case
2	Output Common		
3	-Output	7	-Input
4	Adjust/Comp		
5	Shutdown Plus	6	+Input

ABSOLUTE MAXIMUM RATINGS

V_{IN} Input Voltage (pin 7 to pin 6) . . . . . +50V
V_{INT} Input Transient (pin 7 to pin 6 @ 50mS) . . 80V
I_{OUT} Output Current
DAC2812D . . ⑧ 360mA
DAC2815D . . ⑧ 288mA
T_C Case Temperature Range
DAC2800D H/E . . . . . -55°C to +125°C
DAC2800D . . . . . -40°C to +85°C

T_{ST} Storage Temperature Range . . . -65°C to +150°C
T_{LD} Lead Temperature Range
(10 Seconds) . . . . . 300°C
P_D Power Dissipation . . . . . See Efficiency Curve
T_J Junction Temperature . . . . . 150°C
θ_{JC} Thermal Resistance
(Switches) . . . . . 5.0°C/W

NOTE: Continuous operation at or above the absolute maximum ratings may adversely effect the performance and/or life of the device.

ELECTRICAL SPECIFICATIONS

DAC2812D

Parameter	Test Conditions ①	Group A Subgroup	DAC2812D H/E			DAC2812D			Units
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Output Voltage		1	±11.9	±12.0	±12.1	±11.85	±12.0	±12.15	VDC
		2,3	±11.76	-	±12.24	-	-	-	VDC
Output Current ② ⑧	11V≤VIN≤50V	1	±208	-	-	±208	-	-	mA
		2,3	±208	-	-	-	-	-	mA
	16V≤VIN≤40V	1	±250	-	-	±250	-	-	mA
		2,3	±250	-	-	-	-	-	mA
Output Voltage Ripple	BW = 10KHz to 2MHz	1	-	15	60	-	15	60	mVrms
		2,3	-	-	100	-	-	-	mVrms
Input Current Ripple ②	BW = 10KHz to 2MHz	1	-	85	140	-	85	140	mAp-p
	LIN = 2μH	2,3	-	-	225	-	-	-	mAp-p
Line Regulation	VIN = 11,28 and 40V	1	-	±5	±25	-	±5	±30	mV
	±IOUT = 209mA	2,3	-	-	±50	-	-	-	mV
Load Regulation	VIN = 28VDC	1	-	±5	±25	-	±5	±30	mV
	±IOUT = 0,105 and 209mA	2,3	-	-	±50	-	-	-	mV
Cross Regulation ⑩		1	-	0.1	1	-	0.1	1	%
		2,3	-	0.1	1	-	-	-	%
Efficiency		1	60	64	-	60	64	-	%
		2,3	60	-	-	-	-	-	%
Step Load Response	±IOUT = 105mA to/from 209mA	4	-	±400	-	-	±400	-	mV
	Transition TIme = 30μS	5,6	-	±400	-	-	-	-	mV
Step Load Recovery	±IOUT = 105mA to/from 209mA	4	-	200	-	-	200	-	μS
	Transition TIme = 30μS	5,6	-	200	-	-	-	-	μS
Step Line Response ②	VIN = 16V to/from 40V	4	-	±200	±500	-	±200	±500	mV
	Transition Time = 30μS	5,6	-	-	±500	-	-	-	mV
Step Line Recovery ②	VIN = 16V to/from 40V	4	-	250	-	-	250	-	μS
	Transition Time = 30μS	5,6	-	250	-	-	-	-	μS
Start Up Overshoot		4	-	0	200	-	0	200	mV
		5,6	-	-	200	-	-	-	mV
Start Up Delay		4	-	40	60	-	40	60	mS
		5,6	-	-	60	-	-	-	mS
Shutdown Delay ②		4	-	250	500	-	250	500	μS
		5,6	-	200	-	-	-	-	μS
Shutdown Recovery ②		-	-	40	60	-	40	60	mS
Input Voltage Range ②	POUT = 6.0W MAX.	1,2,3	16	-	40	16	-	40	V
	POUT = 5W MAX.	1,2,3	11	-	50	11	-	50	V
Quiescent Current	Enabled, IOUT = 0mA	1,2,3	-	50	70	-	50	70	mA
	Disabled IOUT = 0mA	1,2,3	-	1.25	2.5	-	1.25	2.5	mA
Capacitive Load ② ⑨	Per Output VIN = 16-40V	1,2,3	-	-	100	-	-	100	μF
	Per Output VIN = 11-50V	1,2,3	-	-	50	-	-	50	μF
Isolation	Input to output or any pin to case @ 500V	1	100	-	-	100	-	-	MΩ
Short Circuit Current Limit ⑦		1	-	-	-	-	-	-	A
Switching Frequency		4	375	400	425	350	400	450	KHz
VOUT Adjustment Range	RPOT = 50KΩ	1	±10	-		±10	-	-	%

NOTES:

① +VIN = 28V, IOUT = ±250mA, TA = TC = 25°C unless otherwise specified.
② Guaranteed by design but not tested. Typical parameters are representative of actual device performance but are for reference only.
③ Industrial grade and "E" suffix devices shall be tested to subgroups 1 and 4 unless otherwise specified.
④ Military grade devices ("H" suffix) shall be 100% tested to subgroups 1, 2, 3 and 4.
⑤ Subgroups 5 and 6 testing available upon request.
⑥ Subgroup 1, 4 TA = TC = +25°C
2, 5 TA = TC = +125°C
3, 6 TA = TC = -55°C
⑦ Device has internal shutdown feature that pulses the output with a low duty cycle during faults.
⑧ Up to 80% of total load may be drawn from either output.
⑨ Connect capacitors from + output to common and -output to common only. Do not exceed a 4:1 capacitor imbalance.
⑩ 1.0W load on output under test, 1.0W to 4.0W load change on the other.

ELECTRICAL SPECIFICATIONS

DAC2815D

Parameter	Test Conditions ①	Group A Subgroup	DAC2815D H/E			DAC2815D			Units
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Output Voltage		1	±14.9	±15.0	±15.1	±14.85	±15.0	±15.15	VDC
		2,3	±14.7	±15.0	±15.3	-	-	-	VDC
Output Current ② ⑧	11V≤VIN≤50V	1	±167	-	-	±167	-	-	mA
		2,3	±167	-	-	-	-	-	mA
	16V≤VIN≤40V	1	±200	-	-	±200	-	-	mA
		2,3	±200	-	-	-	-	-	mA
Output Voltage Ripple	BW = 10KHz to 2MHz	1	-	15	60	-	15	60	mVrms
		2,3	-	-	100	-	-	-	mVrms
Input Current Ripple ②	BW = 10KHz to 2MHz LIN = 2µH	1	-	85	140	-	85	140	mAp-p
		2,3	-	-	225	-	-	-	mAp-p
Line Regulation	VIN = 11,28 and 40V ±IOUT = 167mA	1	-	±5	±25	-	±5	±30	mV
		2,3	-	-	±50	-	-	-	mV
Load Regulation	VIN = 28VDC ±IOUT = 0, 84 and 167mA	1	-	±5	±25	-	±5	±30	mV
		2,3	-	-	±50	-	-	-	mV
Cross Regulation ⑩		1	-	0.1	1	-	0.1	1	%
		2,3	-	0.1	1	-	-	-	%
Efficiency		1	61	65	-	61	65	-	%
		2,3	61	-	-	-	-	-	%
Step Load Response	±IOUT = 84mA to/from 167mA Transition TIme = 30µS	4	-	±400	-	-	±400	-	mV
		5,6	-	±400	-	-	-	-	mV
Step Load Recovery	±IOUT = 84mA to/from 167mA Transition TIme = 30µS	4	-	200	-	-	200	-	µS
		5,6	-	200	-	-	200	-	µS
Step Line Response ②	VIN = 16V to/from 40V Transition Time = 30µS	4	-	±200	±500	-	±200	±500	mV
		5,6	-	-	±500	-	-	-	mV
Step Line Recovery ②	VIN = 16V to/from 40V Transition Time = 30µS	4	-	250	-	-	250	-	µS
		5,6	-	250	-	-	-	-	µS
Start Up Overshoot		4	-	0	200	-	0	200	mV
		5,6	-	0	200	-	-	-	mV
Start Up Delay		4	-	40	60	-	40	60	mS
		5,6	-	-	60	-	-	-	mS
Shutdown Delay ②		4	-	250	500	-	250	500	µS
		5,6	-	-	500	-	-	-	µS
Shutdown Recovery ②		-	-	40	60	-	40	60	mS
Input Voltage Range ②	POUT = 6.0W MAX.	1,2,3	16	-	40	16	-	40	V
	POUT = 5W MAX.	1,2,3	11	-	50	11	-	50	V
Quiescent Current	Enabled, IOUT = 0mA	1,2,3	-	50	70	-	50	70	mA
	Disabled IOUT = 0mA	1,2,3	-	1.25	2.5	-	1.25	2.5	mA
Capacitive Load ② ⑨	Per Output VIN = 16V-40V	1,2,3	-	-	100	-	-	100	µF
	Per Output VIN = 11V-50V	1,2,3	-	-	50	-	-	50	µF
Isolation	Input to output or any pin to case @ 500V	1	100	-	-	100	-	-	MΩ
Short Circuit Current Limit ⑦		1	-	-	-	-	-	-	A
Switching Frequency		4	375	400	425	350	400	450	KHz
VOUT Adjustment Range	RPOT = 50KΩ	1	±10	-	-	±10	-	-	%

NOTES:

① +VIN = 28V, IOUT = ±200mA, TA = TC = 25°C unless otherwise specified.
② Guaranteed by design but not tested. Typical parameters are representative of actual device performance but are for reference only.
③ Industrial grade and "E" suffix devices shall be tested to subgroups 1 and 4 unless otherwise specified.
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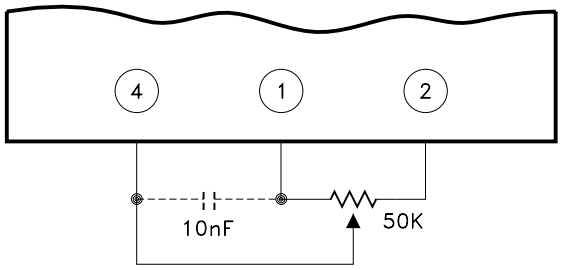
⑦ Device has internal shutdown feature that pulses the output with a low duty cycle during faults.
⑧ Up to 80% of total load may be drawn from either output.
⑨ Connect capacitors from + output to common and -output to common only. Do not exceed a 4:1 capacitor imbalance.
⑩ 1.0W load on output under test, 1.0W to 4.0W load change on the other.

APPLICATION NOTES

POWER SUPPLIES

The output voltage of the DAC2812D and DAC2815D may be adjusted from 90% to 110% of nominal value by the use of a 50KΩ potentiometer as shown. Adjustment beyond this range is possible however certain characteristics of the converter such as but not limited to input voltage range, efficiency, ripple and temperature performance will change. Characterization by the user is recommended in such applications.



Adjust/comp (pin 4) may be driven by external circuitry referenced to pin 2 (-output) if desired. Grounding pin 4 causes voltage to increase (25% typically) while driving pin 4 above 1.3V causes output voltage to decrease. Pin 4 may be driven negative without damage, however the resultant increase in converter output voltage should be considered. Pin 4 may be driven through 10KΩ or more if connection of the comp function is also required.

The comp function of pin 4 allows load transient response to be tailored to suit specific application requirements. This feature may be utilized by connecting a 10 or less nF capacitor between pins 4 and 1.

SHUTDOWN PLUS

Pin 5 is used for remote shutdown, output fault detection, and/or setting the input voltage point at which the converter will turn on as shown in the typical application diagram. No connection to pin 5 is necessary for normal operation of the converter. Pin 5 is referenced to the pin 7 (-input).

Shutdown may be implemented by simply connecting pin 5 to an open collector logic output or switch rated at 2.5mA, 25Vdc or higher.

Input voltage turn on point is programmed with a single resistor from pin 5 to 7. An input turn on/off hysteresis (typically 3.5% of Vin) will be observed. This should be considered when making or verifying set point adjustment. The value of the setpoint resistor may be determined by the following:

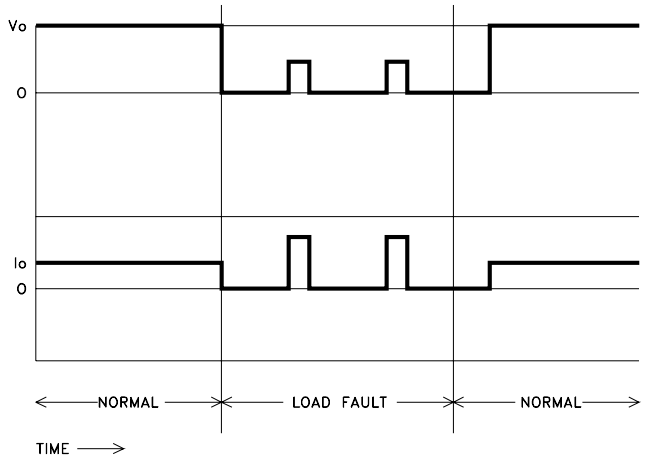
$$R = \frac{210 \cdot 10^3}{E_{TO} - 9.5} \quad (\pm 10\% \text{ accuracy at } 25°C)$$

Set point temperature coefficient is typically +400ppm/°C.

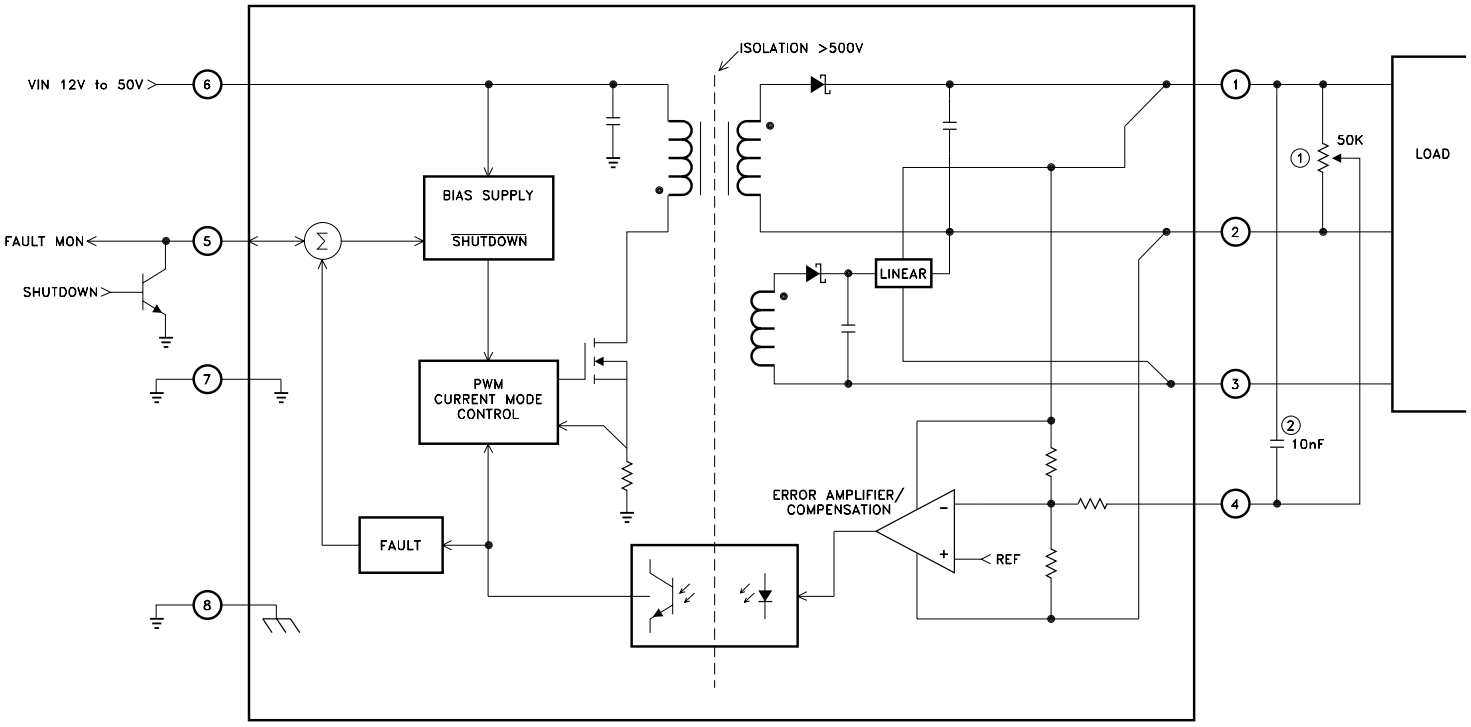
Output fault monitoring is accomplished by observing pin 5 with a high impedance monitoring circuit. Pin 5 voltage drops from over 10V to below 1V when a load fault causes the converters fault protection circuitry to activate. It will remain low for at least 100mS and return high. If the load fault is still present pin 5 will return low and the cycle will repeat. A resistor >400KΩ from pin 5 to 7 provides pull down for pin 5 if there is no input setpoint programming resistor already in place.

LOAD FAULT RESPONSE

The MSK families of DC-DC converters share load fault philosophies. Load fault conditions include short-circuit and severe overload conditions. The DAC2800D converter series responds to load faults by turning off all power conversion circuits for 250mS and then attempting to restart for 10mS (typical). The net "on" duty factor during a fault is very low resulting in low converter dissipation and immunity from overheating at 125°C. Current beyond rated can flow into the load at startup time. This allows the converter to bring up capacitive and other difficult load types more reliably than competing converters.



TYPICAL APPLICATION CIRCUIT



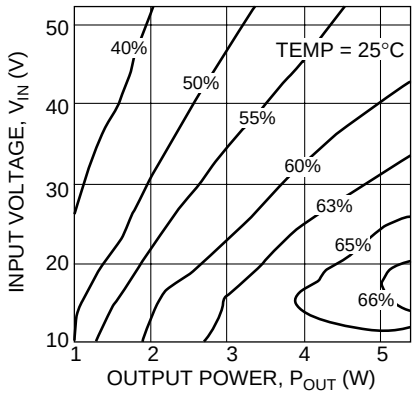
NOTES:

1. OPTIONAL OUTPUT ADJUSTMENT RESISTOR. SEE PARAGRAPH TITLED POWER SUPPLIES.
2. OPTIONAL COMPENSATION CAPACITOR. SEE PARAGRAPH TITLED POWER SUPPLIES.

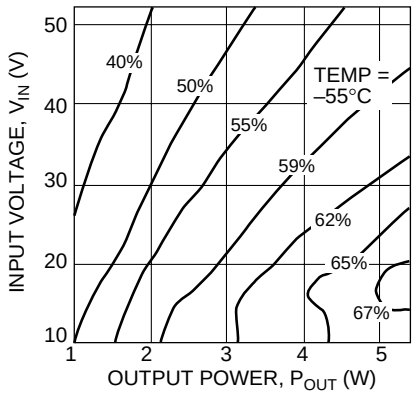
TYPICAL PERFORMANCE CURVES

DAC2812D

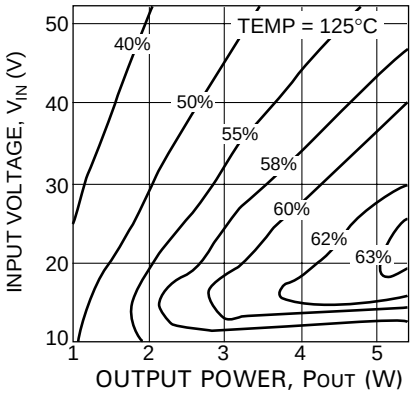
EFFICIENCY CONTOURS



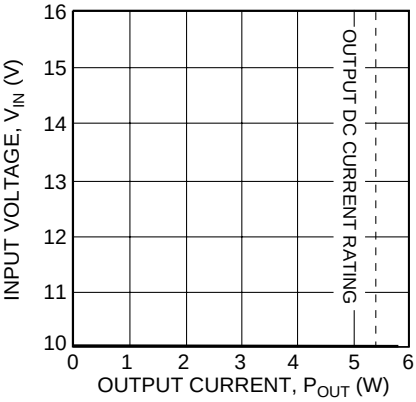
EFFICIENCY CONTOURS



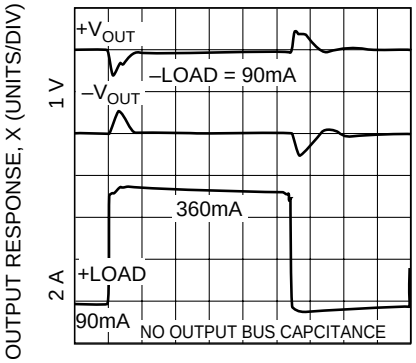
EFFICIENCY CONTOURS



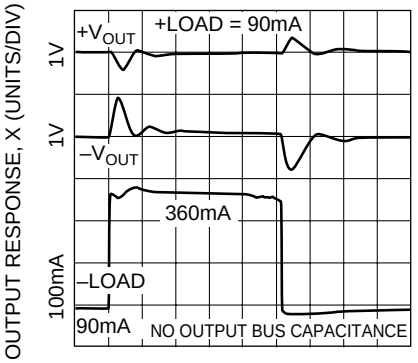
LOW LINE DROP OUT



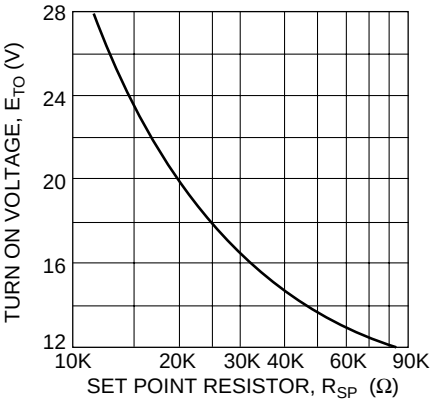
+ LOAD TRANSIENT RESPONSE



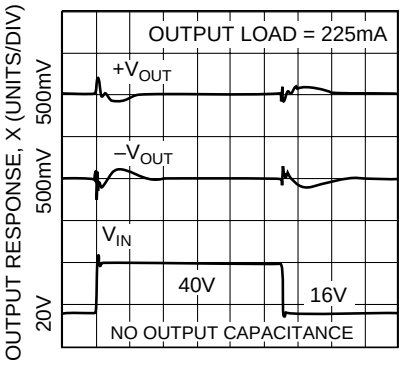
– LOAD TRANSIENT RESPONSE



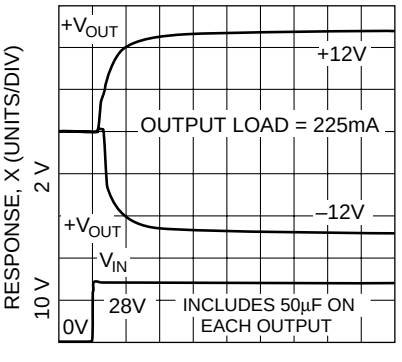
TURN ON THRESHOLD



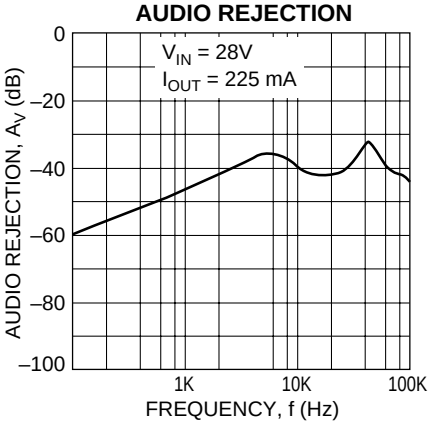
LINE TRANSIENT RESPONSE



TURN ON RESPONSE



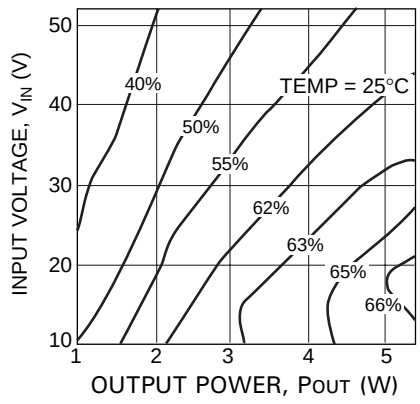
AUDIO REJECTION



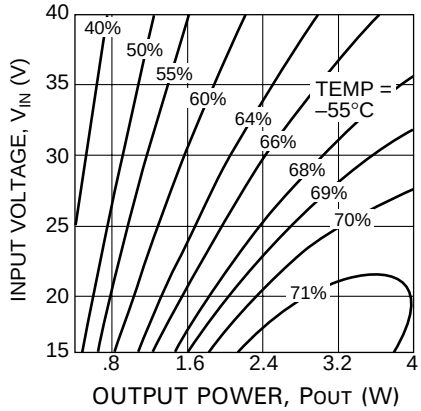
TYPICAL PERFORMANCE CURVES

DAC2815D

EFFICIENCY CONTOURS



EFFICIENCY CONTOURS



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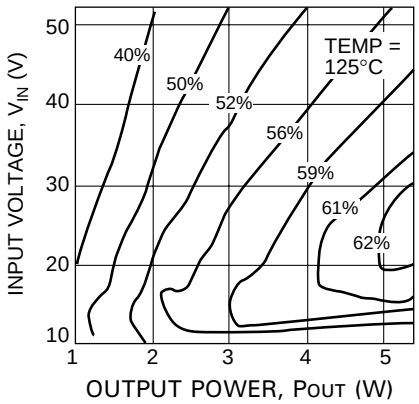
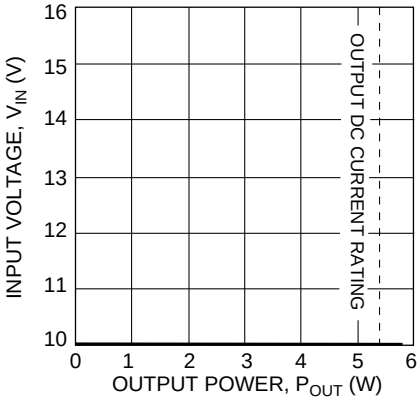
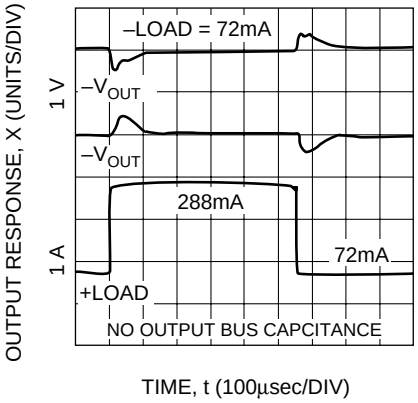


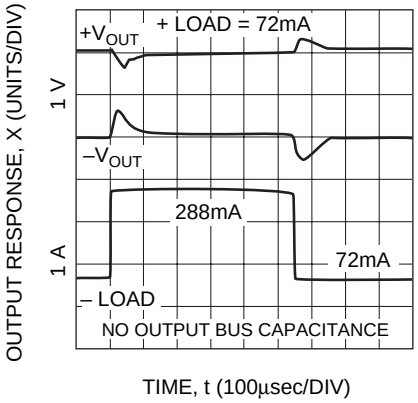
LOW LINE DROP OUT



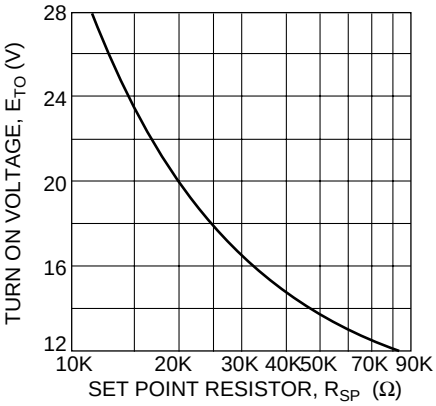
LOAD TRANSIENT RESPONSE



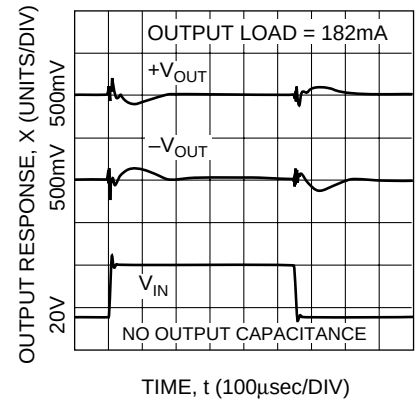
– LOAD TRANSIENT RESPONSE



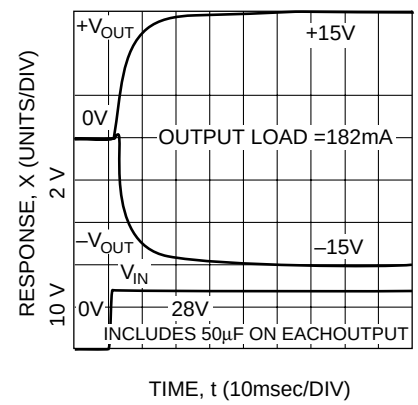
TURN ON THRESHOLD



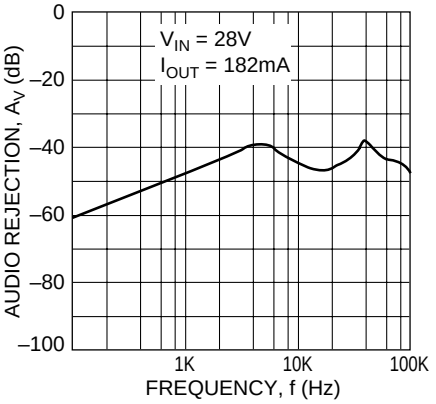
LINE TRANSIENT RESPONSE



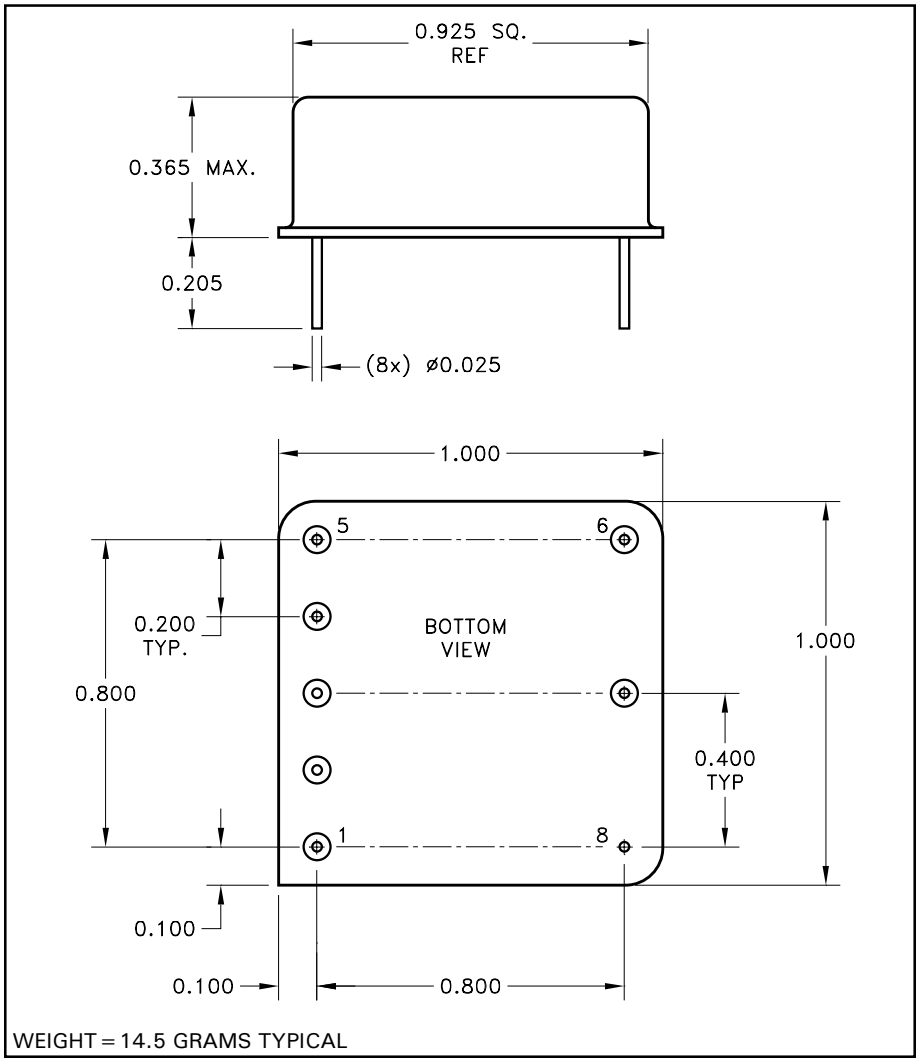
TURN ON RESPONSE



AUDIO REJECTION



MECHANICAL SPECIFICATIONS



WEIGHT = 14.5 GRAMS TYPICAL

NOTE: ALL DIMENSIONS ARE ±0.010 INCHES UNLESS OTHERWISE LABELED.
ESD Triangle indicates Pin 1.

ORDERING INFORMATION

Part Number	Screening Level	Output Voltage
DAC2812D	Industrial	±12V
DAC2812DE	Extended Reliability	
DAC2812DH	MIL-PRF-38534 Class H	
DAC2815D	Industrial	±15V
DAC2815DE	Extended Reliability	
DAC2815DH	MIL-PRF-38534 Class H	

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