Advanced Analog

a division of Intech

AHE2800D Series

Hybrid - High Reliability DC/DC Converters

DESCRIPTION

The AHE2800D Series of DC/DC converters feature high power density and an extended temperature range for use in military and industrial applications. Designed to MIL-STD-704D input requirements, these devices have nominal 28VDC inputs with ±12V and ±15V dual outputs to satisfy a wide range of requirements. The circuit design incorporates a pulse width modulated push-pull topology operating in the feed-forward mode at a nominal switching frequency of 250kHz. Input to output isolation is achieved through the use of transformers in the forward and feedback circuits.

The advanced feedback design provides fast loop response for superior line and load transient characteristics and offers greater reliability and radiation tolerance than devices incorporating optical feedback circuits.

Three standard temperature grades are offered with screening options. Refer to Part Number section. They can be provided in a standard plug-in package for PC mounting or in a flanged package for more severe environments. Variations on these parameters and special screening requirements can be accommodated for specific customer applications. Contact factory with your requirements. Single output versions are available and are described in a separate data sheet.

FEATURES

- **17 - 40 VDC input range (28VDC nominal)**
- **±12V and ±15V outputs available**
- **Indefinite short circuit and overload protection**
- **12.9W/in³ power density**
- **15 watts output power**
- **Fast loop response for superior transient characteristics**
- **Operating temperature range from -55°C to +125°C available**
- **Popular industry standard pin-out**
- **Resistance seam welded case for superior long term hermeticity**
- **Efficiencies up to 82%**
- **Shutdown from external signal**
- **Military screening**
- **314,000 hour MTBF at 85°C, AUC**

SPECIFICATIONS

T_{CASE} = -55°C to +85°C, V_{IN} = +28 V ±5% unless otherwise specified.

ABSOLUTE MAXIMUM RATINGS

Input Voltage[1]	-0.5 V to +50 V	
Power Output	Internally limited, 17.5 W typical	
Soldering	300°C for 10 seconds	
Temperature Range[1]	Operating	-55°C +115°C case
	Storage	-65°C +135°C

Parameter	Conditions	AHE2812D Min	AHE2812D Typ	AHE2812D Max	AHE2815D Min	AHE2815D Typ	AHE2815D Max	Units
STATIC CHARACTERISTICS								
OUTPUT	V_{IN} = 17 to 40 V_{DC}							
Voltage	I_{OUT} = 0 to Full Load	±11.76	±12.00	±12.24	±14.70	±15.00	±15.30	V_{DC}
Current[6]		0.0		±625	0.0		±500	mA_{DC}
Ripple	Full Load, 20kHz to 2MHz		25	60		25	60	mV p-p
Accuracy	T_{CASE} = 25°C, Full Load	±11.88	±12.00	±12.12	±14.85	±15.00	±15.15	V_{DC}
Power[1]		15			15			W
REGULATION								
Line	V_{IN} = 17 to 40 V_{DC}			60			75	mV
Load	I_{OUT} = 0 to Full Load			120			150	mV
INPUT								
Voltage Range[5]		17.0	28.0	40.0	17.0	28.0	40.0	V_{DC}
Current	No Load		18	40		18	40	mA_{DC}
	Inhibited			18			18	mA_{DC}
Ripple Current	Full Load		25	50		25	50	mA p-p
EFFICIENCY	T_{CASE} = +25°C							
	Full Load	80			80			%
CAPACITIVE LOAD	No effect on performance	200			200			µF
LOAD FAULT POWER DISSIPATION				6			6	W
ISOLATION	Input to Output @ 500 V_{DC}	100			100			MΩ
DYNAMIC CHARACTERISTICS								
STEP LOAD CHANGES								
Output	50% Load ↔ 100% Load		±100			±100		mVpk
Transient	No Load ↔ Half Load		±250			±250		mVpk
Recovery[2]	50% Load ↔ 100% Load		25			25		µs
	No Load → 50% Load		500			500		µs
	50% Load → No Load		3			3		ms
STEP LINE CHANGES								
Output	Input step 17 to 40 V_{DC}		+180			+180		mVpk
Transient	Input step 40 to 17 V_{DC}		-600			-600		mVpk
Recovery[2]	Input step 17 to 40 V_{DC}		2			2		ms
	Input step 40 to 17 V_{DC}		2			2		ms
TURN-ON	V_{IN} = 17 to 40 V_{DC}							
Overshoot	I_{OUT} = 0 to 3.0 A_{DC}		0	600		0	600	mVpk
Delay[3]			8	10		8	10	ms
LOAD FAULT RECOVERY	V_{IN} = 17 to 40 V_{DC}		8	10		8	10	ms

Notes:

1. Above +85°C case temperature, derate output power linearly to 0 and maximum input voltage linearly to 42V at +115°C case.
2. Recovery time is measured from the initiation of the input transient to where V_{OUT} has returned to within ±1% of V_{OUT} at 50% load.
3. Turn-on delay time measurement is for either an application of power at the input or a signal at the shutdown pin.
4. Load faults include either overload or short circuit conditions.
5. For operation at 16V_{DC}, derate output power by 33%.
6. At least 25% of the total load should be on the positive output

SPECIFICATIONS

T_{CASE} = -55°C to +105°C, V_{IN} = +28 V ±5% unless otherwise specified.

ABSOLUTE MAXIMUM RATINGS

Input Voltage[6]	-0.5 V to +50 V
Power Output	Internally limited, 17.5 W typical
Soldering	300°C for 10 seconds
Temperature Range[1]	Operating -55°C +125°C case
	Storage -65°C +135°C

Parameter	Conditions	AHE2812D/ES Min	AHE2812D/ES Typ	AHE2812D/ES Max	AHE2815D/ES Min	AHE2815D/ES Typ	AHE2815D/ES Max	Units
STATIC CHARACTERISTICS								
OUTPUT	V_{IN} = 17 to 40V_{DC}							
Voltage	I_{OUT} = 0 to Full Load	±11.76	±12.00	±12.24	±14.70	±15.00	±15.30	V_{DC}
Current[7]		0.0		±625	0.0		±500	mA_{DC}
Ripple	Full Load, 20kHz to 2MHz		25	60		25	60	mV p-p
Accuracy	T_{CASE} = 25°C, Full Load	±11.88	±12.00	±12.12	±14.85	±15.00	±15.15	V_{DC}
Power[1]		15			15			W
REGULATION								
Line	V_{IN} = 17 to 40 V_{DC}			60			75	mV
Load	I_{OUT} = 0 to Full Load			120			150	mV
INPUT								
Voltage Range[5]		17.0	28.0	40.0	17.0	28.0	40.0	V_{DC}
Current	No Load		18	40		18	40	mA_{DC}
	Inhibited			18			18	mA_{DC}
Ripple Current	Full Load		25	50		25	50	mA p-p
EFFICIENCY	T_{CASE} = +25°C							
	Full Load	80			80			%
CAPACITIVE LOAD	No effect on performance	200	1000		200	1000		µF
LOAD FAULT POWER DISSIPATION				6			6	W
ISOLATION	Input to Output @ 500 V_{DC}	100			100			MΩ
DYNAMIC CHARACTERISTICS								
STEP LOAD CHANGES								
Output	50% Load ↔ 100% Load		±100			±100		mVpk
Transient	No Load ↔ Half Load		±250			±250		mVpk
Recovery[2]	50% Load ↔ 100% Load		25			25		µs
	No Load → 50% Load		500			500		µs
	50% Load → No Load		3			3		ms
STEP LINE CHANGES								
Output	Input step 17 to 40 V_{DC}		+180			+180		mVpk
Transient	Input step 40 to 17 V_{DC}		-600			-600		mVpk
Recovery[2]	Input step 17 to 40 V_{DC}		2			2		ms
	Input step 40 to 17 V_{DC}		2			2		ms
TURN-ON	V_{IN} = 17 to 40 V_{DC}							
Overshoot	I_{OUT} = 0 to 3.0A_{DC}		0	600		0	600	mVpk
Delay[3]			8	10		8	10	ms
LOAD FAULT RECOVERY[4]	V_{IN} = 17 to 40 V_{DC}		8	10		8	10	ms

Notes:
1. Above +105°C case temperature, derate output power linearly to 0 at +125°C case.
2. Recovery time is measured from the initiation of the input transient to where V_{OUT} has returned to within ±1% of V_{OUT} at 50% load.
3. Turn-on delay time measurement is for either an application of power at the input or a signal at the shutdown pin.
4. Load faults include either overload or short circuit conditions.
5. For operation at 16V_{DC}, derate output power by 33%.
6. Above +85°C case temperature, derate maxumum input voltage linearly to 33V at 125°C case.
7. At least 25% of the total load should be on the positive output.

SPECIFICATIONS

T_{CASE} = -55°C to +125°C, V_{IN} = +28 V ±5% unless otherwise specified.

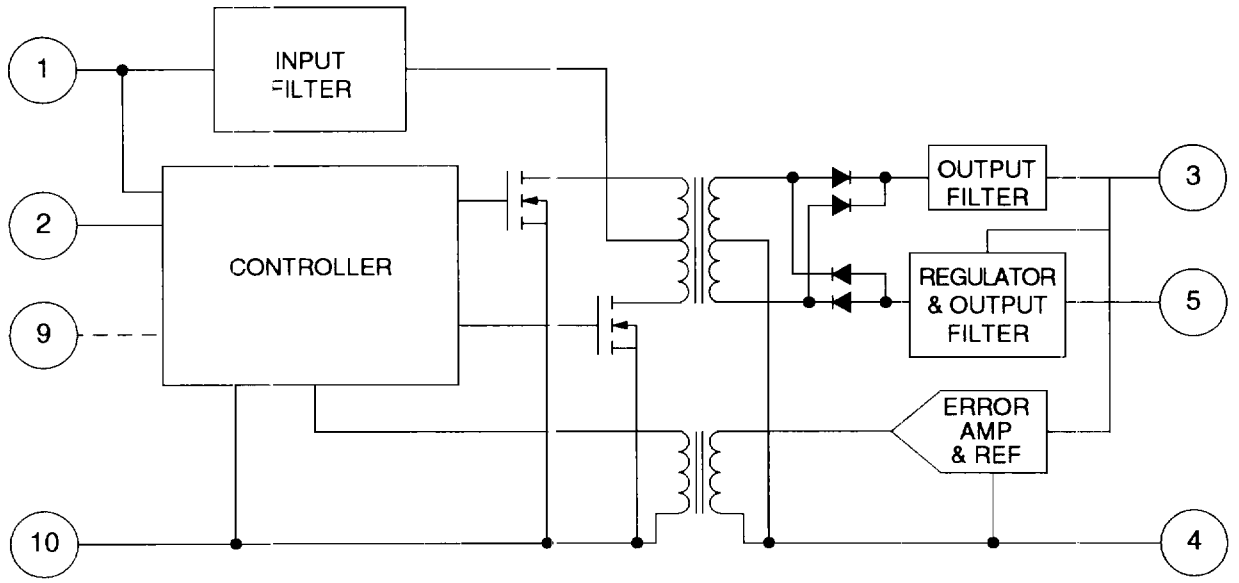
ABSOLUTE MAXIMUM RATINGS

Input Voltage	-0.5 V to +50 V
Power Output	Internally limited, 17.5 W typical
Soldering	300°C for 10 seconds
Temperature Range[1]	Operating -55°C +135°C case
	Storage -65°C +135°C

Parameter	Conditions	AHE2812D/HB Min	AHE2812D/HB Typ	AHE2812D/HB Max	AHE2815D/HB Min	AHE2815D/HB Typ	AHE2815D/HB Max	Units
STATIC CHARACTERISTICS								
OUTPUT	V_{IN} = 17 to 40V_{DC}							
Voltage	I_{OUT} = 0 to Full Load	±11.76	±12.00	±12.24	±14.70	±15.00	±15.30	V_{DC}
Current[6]		0.0		±625	0.0		±500	mA_{DC}
Ripple	Full Load, 20kHz to 2MHz		25	60		25	60	mV p-p
Accuracy	T_{CASE} = 25°C, Full Load	±11.88	±12.00	±12.12	±14.85	±15.00	±15.15	V_{DC}
Power[1]		15			15			W
REGULATION								
Line	V_{IN} = 17 to 40 V_{DC}			60			75	mV
Load	I_{OUT} = 0 to Full Load			120			150	mV
INPUT								
Voltage Range[5]		17.0	28.0	40.0	17.0	28.0	40.0	V_{DC}
Current	No Load		18	40		18	40	mA_{DC}
	Inhibited			18			18	mA_{DC}
Ripple Current	Full Load		25	50		25	50	mA p-p
EFFICIENCY	T_{CASE} = +25°C	80			80			%
	Full Load							
CAPACITIVE LOAD	No effect on performance			200			200	µF
LOAD FAULT POWER DISSIPATION				6			6	W
ISOLATION	Input to Output @ 500 V_{DC}	100		100				MΩ
DYNAMIC CHARACTERISTICS								
STEP LOAD CHANGES								
Output	50% Load ↔ 100% Load		±100	±450		±100	±450	mVpk
Transient	No Load ↔ Half Load		±250	±760		±250	±750	mVpk
Recovery[2]	50% Load ↔ 100% Load		25	70		25	70	µs
	No Load → 50% Load		500	1500		500	1500	µs
	50% Load → No Load		3	5		3	5	ms
STEP LINE CHANGES								
Output	Input step 17 to 40 V_{DC}		+180	1200		+180	1500	mVpk
Transient	Input step 40 to 17 V_{DC}		-600	-1500		-600	-1500	mVpk
Recovery[2]	Input step 17 to 40 V_{DC}		2	4		2	4	ms
	Input step 40 to 17 V_{DC}		2	4		2	4	ms
TURN-ON	V_{IN} = 17 to 40 V_{DC}							
Overshoot	I_{OUT} = 0 to 3.0A_{DC}		0	600		0	600	mVpk
Delay[3]			8	10		8	10	ms
LOAD FAULT RECOVERY[4]	V_{IN} = 17 to 40 V_{DC}		8	10		8	10	ms

Notes:
1. Above +125°C case temperature, derate output power linearly to 0 at +135°C case.
2. Recovery time is measured from the initiation of the input transient to where V_{OUT} has returned to within ±1% of V_{OUT} at 50% load.
3. Turn-on delay time measurement is for either an application of power at the input or a signal at the shutdown pin.
4. Load faults include either overload or short circuit conditions.
5. For operation at 16V_{DC}, derate output power by 33%.
6. At least 25% of the total load should be on the positive output.

BLOCK DIAGRAM (Single Output)



APPLICATION INFORMATION

Inhibit Function

Connecting the inhibit input (Pin 2) to input common (Pin 10) will cause the converter to shut down. It is recommended that the inhibit pin be driven by an open collector device capable of sinking at least 400µA of current. The open circuit voltage of the inhibit input is 11.5 +1 VDC.

EMI Filter

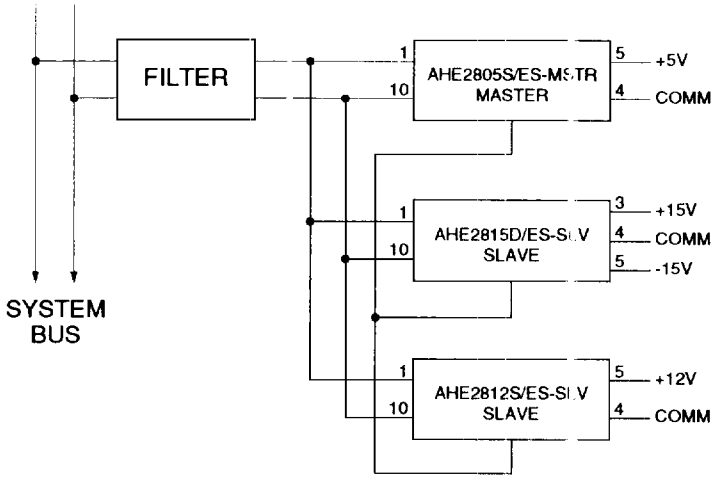
An optional EMI filter (AFC461) will reduce the input ripple current to levels below the limits imposed by MIL-STD-461B CEO3.

Device Synchronization

Whenever multiple DC/DC converters are utilized in a single system, significant low frequency noise may be generated due to slight difference in the switching frequencies of the converters (beat frequency noise). Because of the low frequency nature of this noise (typically less than 10 kHz), it is difficult to filter out and may interfere with proper operation of sensitive systems (communi cations, radar or telemetry). Advanced Analog offers an option which provides synchronization of multiple AHE/ATW converters, thus eliminating this type of noise.

To take advantage of this capability, the system designer must assign one of the converters as the master. Then, by definition, the remaining converters become slaves and will operate at the masters' switching frequency. The user should be aware that the synchronization system is fail-safe; that is, the slaves will continue operating should the master frequency be interrupted for any reason. The layout must be such that the synchronization output (Pin 9) of the master device is connected to the synchronization input (Pin 9) of each slave device. It is advisable to keep this run short to minimize the possibility of radiating the 250kHz switching frequency.

The appropriate parts must be ordered to utilize this feature. After selecting the converters required for the system, an 'MSTR' suffix is added for the master converter part number and an 'SLV' suffix is added for slave part number.



Typical Synchronization Connection Diagram

PIN DESIGNATION

AHE2812D
AHE2815D

Pin 1	Positive input	Pin 10	Input common
Pin 2	Inhibit input	Pin 9	N/C or sync.
Pin 3	Positive output	Pin 8	Case ground
Pin 4	Output common	Pin 7	N/C
Pin 5	Negative output	Pin 6	N/C

PART NUMBER

AHF 28 xx D x / x - xxx

Model
Input Voltage

Output Voltage
12–12 VDC
15–15 VDC

Dual Output

Package Option
F—Flange
Omit for standard

Synchronization Option
MSTR—Master
SLV—Slave

Temperature Range
Omit for -55°C to +85°C
ES— -55°C to +105°C
HB— -55°C to +125°C

HB Screening Process

Per MIL-STD-883C, Method 5008

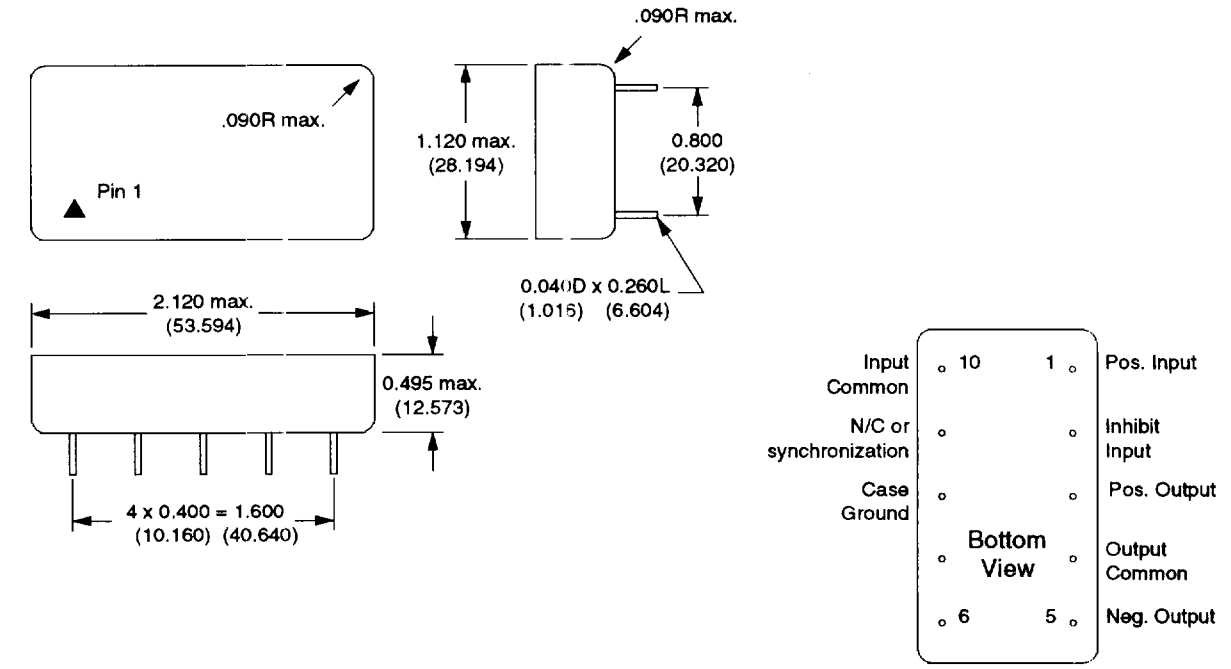
Test Inspection	Method	Condition
Pre-Seal Internal Visual	2017	
Stabilization Bake	1008	C
Temperature Cycling	1010	C
Constant Acceleration	2001	A, Y1 direction
Burn-in	1015	Tc = +125°C
Final Electrical Test		Tc = -55,+25,+125°C
Gross Leak	1014	C
Fine Leak	1014	A
External Visual	2009	

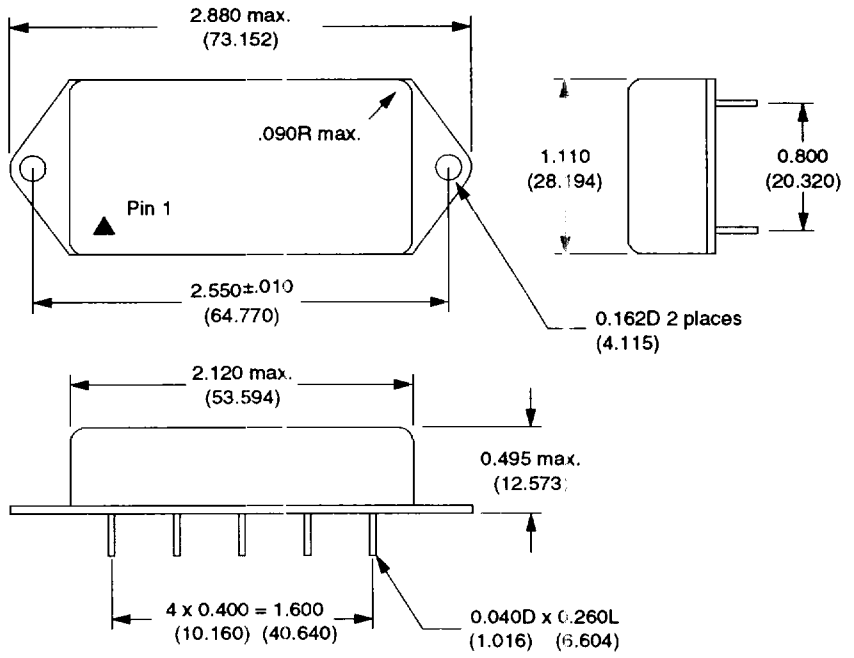
ES Screening Process

Same as HB screening except as follows:

Test Inspection	Method
Constant Acceleration	2001, 500g's
Burn-in	1015, 96hrs.
Final Electrical	25°C only

MECHANICAL OUTLINE





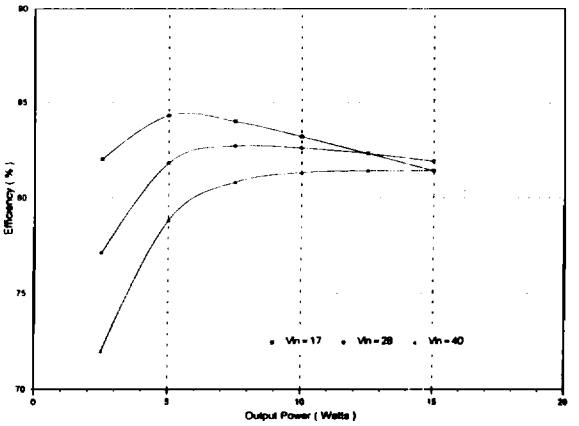
Weight
Standard—55 grams max.
Flange—58 grams max.

STANDARDIZED MILITARY DRAWING CROSS REFERENCE

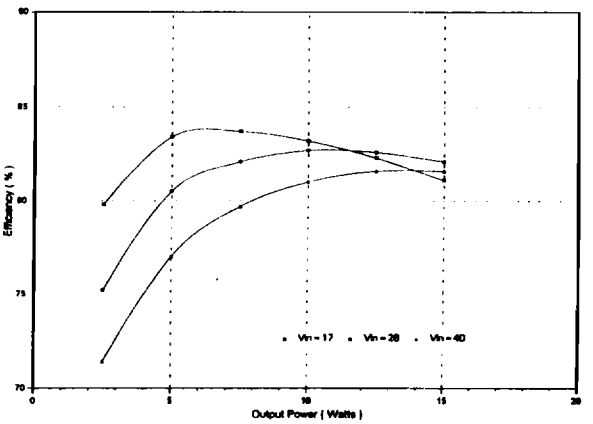
Standardized military drawing PIN	Vendor CAGE number	Vendor similar PIN
5962-9157501HXX	52467	AHE2815D/CH
5962-9157501HZX	52467	AHE2815DF/CH
5962-9157502HXX	52467	AHE2815D/CH-SLV
5962-9157502HZX	52467	AHE2815DF/CH-SLV
5962-9157503HXX	52467	AHE2815D/CH-MSTR
5962-9157503HZX	52467	AHE2815DF/CH-MSTR

Standardized military drawing PIN	Vendor CAGE number	Vendor similar PIN
5962-9204001HXX	52467	AHE2812D/CH
5962-9204001HZX	52467	AHE2812DF/CH
5962-9204002HXX	52467	AHE2812D/CH-SLV
5962-9204002HZX	52467	AHE2812DF/CH-SLV
5962-9204003HXX	52467	AHE2812D/CH-MSTR
5962-9204003HZX	52467	AHE2812DF/CH-MSTR

AHE2812D EFFICIENCY



AHE2815D EFFICIENCY



Advanced Analog
a division of Intech

MIL-STD-1772
Qualified

2270 Martin Avenue
Santa Clara CA 95050-2781
(408) 988-4930 FAX (408) 988-2702