30/35A Power Block: Non-Isolated DC-DC Power Modules

7Vdc –13.2Vdc input; 0.8Vdc to 3.3Vdc output; 30/35A Output Current

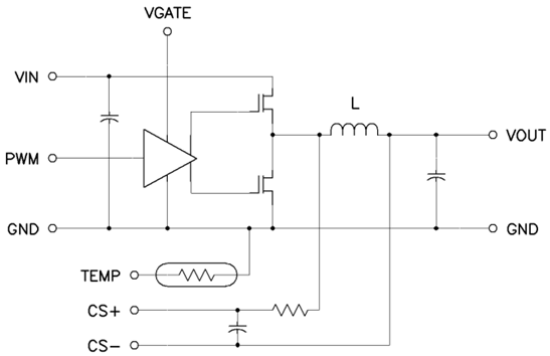
RoHS Compliant

Features

- Compliant to RoHS EU Directive 2002/95/EC (Z versions)
- Compatible in a Pb-free or SnPb reflow environment (Z versions)
- Wide Input voltage range (7.0Vdc - 13.2Vdc)
- Output voltage programmable from 0.8Vdc to 3.3Vdc via external PWM controller
- Cost efficient open frame design
- Parallelable through external PWM support
- Small size: 25.4 mm x 12.70 mm x 12.19 mm
- (1.0 in x 0.5 in x 0.48 in)
- *UL** 60950-1 2nd Ed. Recognized, *CSA*† C22.2 No. 60950-1-07 Certified, and *VDE*‡ (EN60950-1 2nd Ed.) Licensed
- ISO** 9001 and ISO 14001 certified manufacturing facilities
- Wide operating temperature range [-40°C to 85°C]

Applications

- Distributed power architectures
- Intermediate bus voltage applications
- Telecommunications equipment
- Servers and storage applications
- Networking equipment



Description

The 30/35A power blocks are non-isolated dc-dc modules consist of power components that that can deliver up to 35A of output current depending on output voltage. The modules are designed to operate with an input voltage from 7 to 13.2V and deliver an output voltage that can be set from 0.8 to 3.3V. They can deliver 35A at 1.0V output with an airflow of 200LFM at 55C. With the same airflow the modules can deliver 30A at an output voltage of 1.8V. The power block can be used in parallel to deliver currents in excess of 30/35A with the proper control scheme and the required airflow/ambient condition.

* *UL* is a registered trademark of Underwriters Laboratories, Inc.
† *CSA* is a registered trademark of Canadian Standards Association.
‡ *VDE* is a trademark of Verband Deutscher Elektrotechniker e.V.
** ISO is a registered trademark of the International Organization of Standards

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7Vdc –13.2Vdc input; 0.8Vdc to 3.3Vdc output; 30/35A Output Current

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only, functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect the device reliability.

Parameter	Device	Symbol	Min	Max	Unit
Input Voltage	All	V_{IN}	0	15	V
Operating Ambient Temperature			-40	85	°C

Electrical Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	All	V_{IN}	7	—	13.2	Vdc
Output Voltage Range	All	V_{OUT}	0.8		3.3	Vdc
Maximum Input Current (V_{IN}=7V – 13.2Vin, I_O=$I_{O,max}$, Vo=1.8Vo, F_{sw}=383kHz, 25°C)	All	$I_{IN,max}$		8.3		Adc
Gate Voltage Pin (+7V, Pin 5) Operating Voltage Range	All	V_{GATE}	6.7	7	7.5	Vdc
Under voltage lockout, rising					6.7	
Under voltage lockout, falling			4.7			
Hysteresis			0.75	1.2		
Gate Voltage Pin (+7V, Pin 5) Operating Current Range[4]				34		mA
PWM Control Range[1]	All	High	2.5		5.5	V
		Low			0.8	
Temperature Sense Voltage at 25°C[2]	All		1.345	1.35	1.355	V
Output Current : 1.0Vout	All	Io	0		35	Adc
1.8 Vout			0		30	
Efficiency [3]						
VIN= 12Vdc, TA=25°C, 383kHz switching frequency	VO, set = 1.0Vdc	η		88.5		%
IO=IO, max , VO= VO,set	VO,set = 1.8Vdc	η		92.5		%
	VO,set = 3.3Vdc	η		95.2		%

[1] Sourcing or sinking current to/from PWM (Pin 3) within the specified range will result in both high and low-side MOSFET's to be held off by the gate-driver circuitry.

[2] Requires 495µA of bias current sourced from Controller

[3] Gate drive and controller losses are included. For the purpose of this calculation, controller loss is assumed to be 0.2W

[4] Measurement done at 383kHz and 25°C

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7Vdc –13.2Vdc input; 0.8Vdc to 3.3Vdc output; 30/35A Output Current

General Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Ambient Temperature	All	TA	-40		85	°C
Storage Temperature	All	Tstg	-55		125	°C
Operating Altitude[5]			-500		10,000	Feet
Available Airflow (along either long or short isde)	All		200			LFM
Relative Humidity, Operating, Non-Condensing			10		90	%
Calculated MTBF (12Vin, 1.8Vo, 30A, 200LFM, T_A=40°C) Telecordia Issue 2 Method 1 Case 3	All			13,082,328		Hours
Weight			—	7.6 (0.27)	—	g (oz.)

[5] Derate operating temperature 1°C per 1000 feet of altitude above sea level

Feature Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
Input power is applied for at least one second and then the On/Off input is enabled (delay from instant at which Von/Off is enabled until V_o = 10% of $V_{o, set}$)	All	Tdelay	—	3	—	msec
Output voltage Rise time (time for V_o to rise from 10% of Vo, set to 90% of Vo, set)						
1.0Vo	All	Trise	—	10	—	msec
1.8Vo	All	Trise	—	3	—	msec

Component Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
On board Input Capacitance (10uF/16V/X7R)[6]	All	Cin	—	6x10	—	µF
On board Output Capacitance (10uF/0805/6.3V/X7R)[6]	All	Cout	—	2x10	—	µF
Output to Ground Resistor (0805 package)	All	Rout	—	200	—	Ω
On board Inductor	All	L		380		nH
Inductor DCR (25°C)	All	R_L	0.51		0.57	mΩ
Inductor Saturation Current (125°C)	All	Isat		40		A
Inductance rolloff at Isat	All			20%		
Internal resistor for DCR sensing (between CS+ and inductor)[7]	All			2.37		kΩ

[6] Single 0.1uF/0402/16V/X7R provided apart from the 10uF capacitors

[7] External 0.22uF capacitor to be used across CS+ and CS-

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7Vdc –13.2Vdc input; 0.8Vdc to 3.3Vdc output; 30/35A Output Current

Characteristic Curves

The following figures provide typical characteristics for the 30/35A power block at 1.0Vo and 25°C.

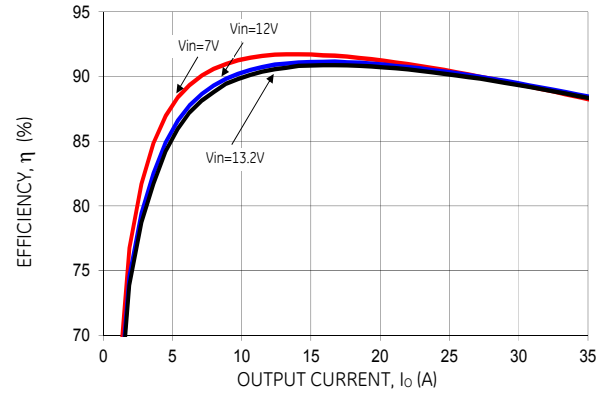

Figure 1. Converter Efficiency versus Output Current. f_{SW}=383kHz

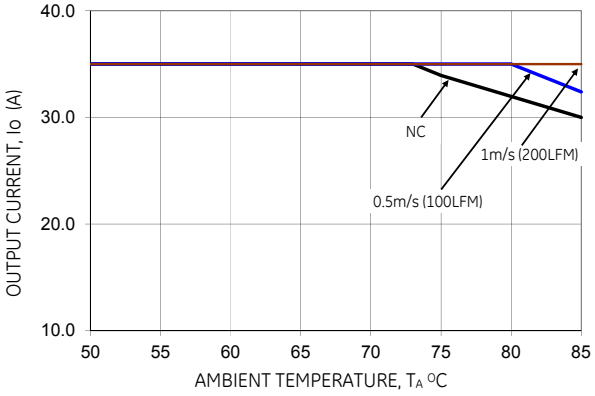

Figure 2. Derating Output Current versus Ambient Temperature and Airflow (12Vin)

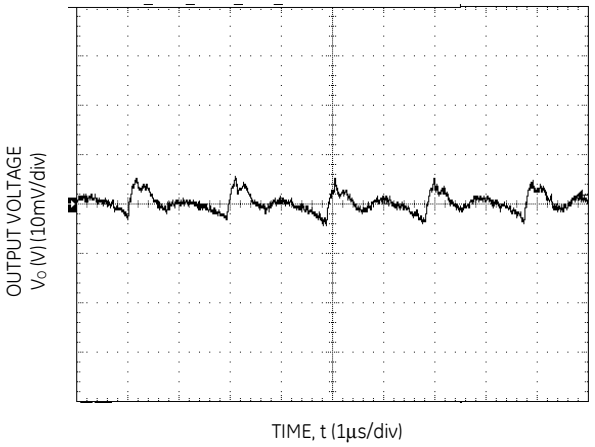

Figure 3. Typical output ripple and noise (V_{IN} = 12V, Io = Io,max, f_{SW}=514kHz)

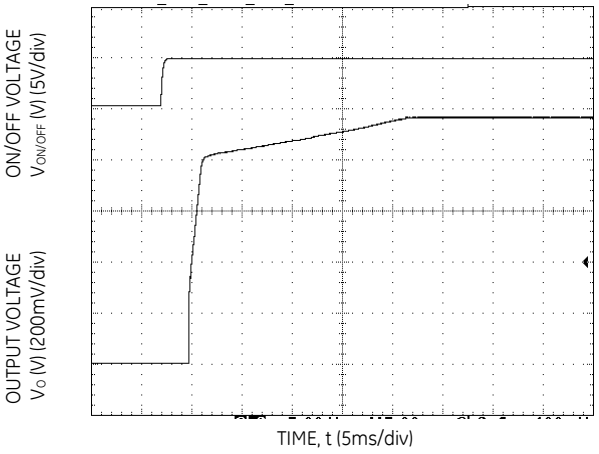

Figure 4. Typical Start-up Using On/Off Voltage (V_{IN} = 12V, Io = Io,max).

30/35A Power Block: Non-Isolated DC-DC Power Modules

7Vdc –13.2Vdc input; 0.8Vdc to 3.3Vdc output; 30/35A Output Current

Characteristic Curves

The following figures provide typical characteristics for the 30/35A power block at 1.8Vo and 25°C.

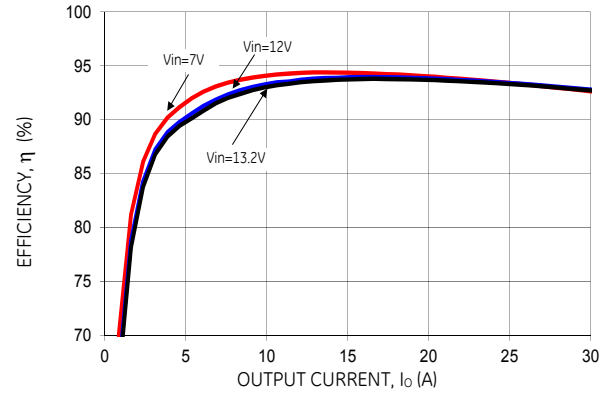

Figure 5. Converter Efficiency versus Output Current. f_{SW}=383kHz

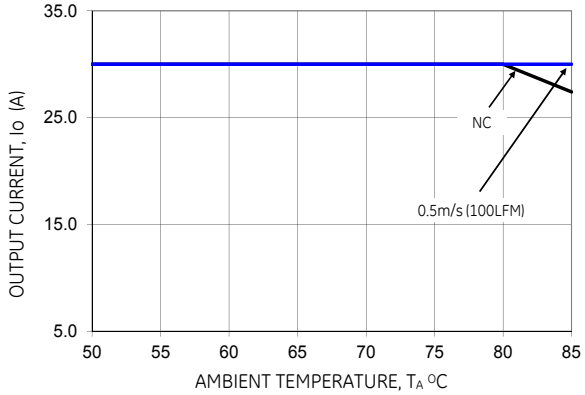

Figure 5. Derating Output Current versus Ambient Temperature and Airflow (12Vin).

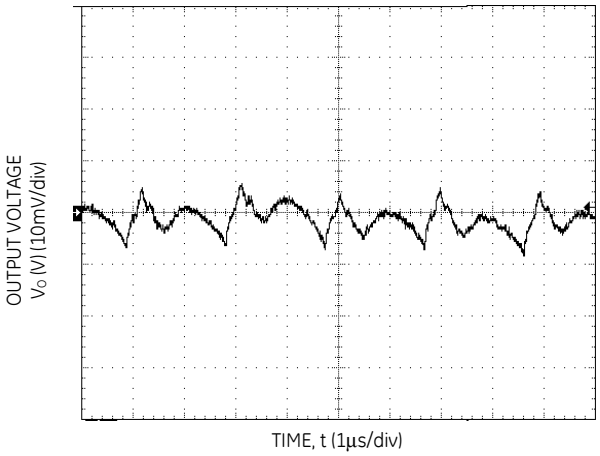

Figure 7. Typical output ripple and noise (V_{IN} = 12V, Io = Io,max, f_{SW}=514kHz).

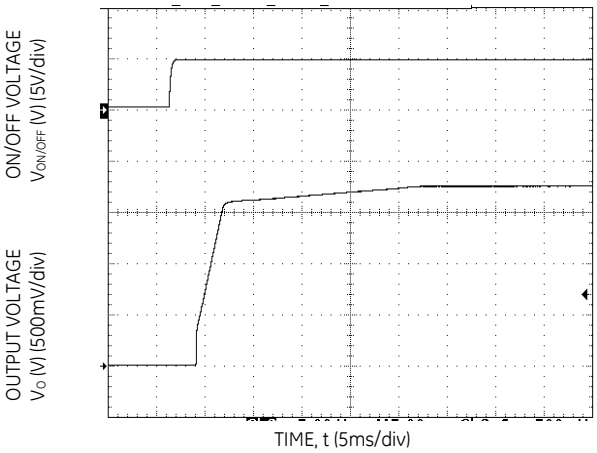

Figure 8. Typical Start-up Using On/Off Voltage (Io = Io,max).

30/35A Power Block: Non-Isolated DC-DC Power Modules

7Vdc –13.2Vdc input; 0.8Vdc to 3.3Vdc output; 30/35A Output Current

Characteristic Curves

The following figures provide typical characteristics for the 30/35A power block at 3.3Vo and 25°C.

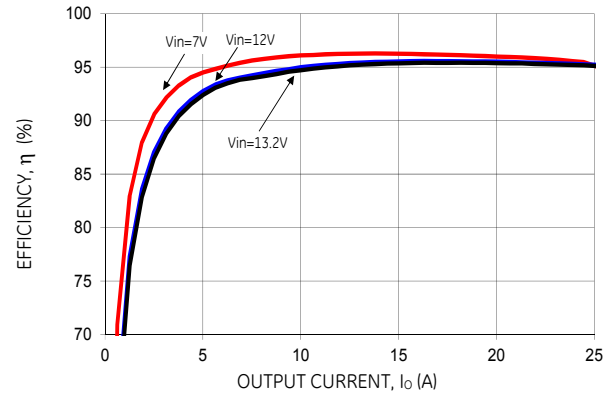

Figure 5. Converter Efficiency versus Output Current, f_{SW}=383kHz

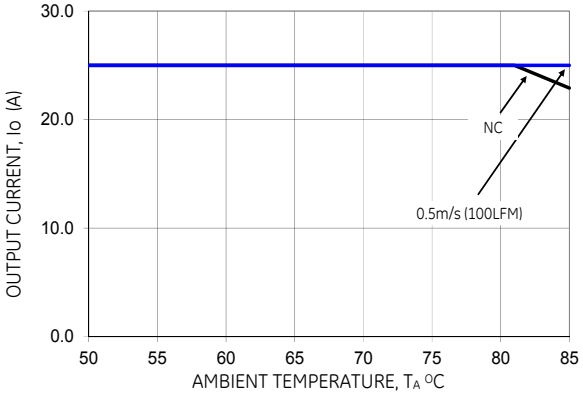

Figure 5. Derating Output Current versus Ambient Temperature and Airflow (12Vin).

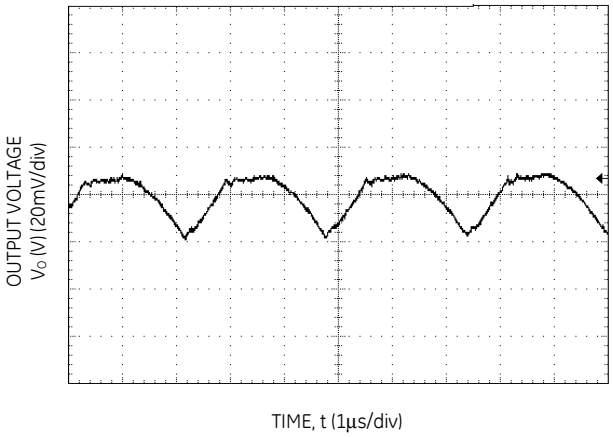

Figure 7. Typical output ripple and noise (V_{IN} = 12V, Io = Io,max, f_{SW}=383kHz).

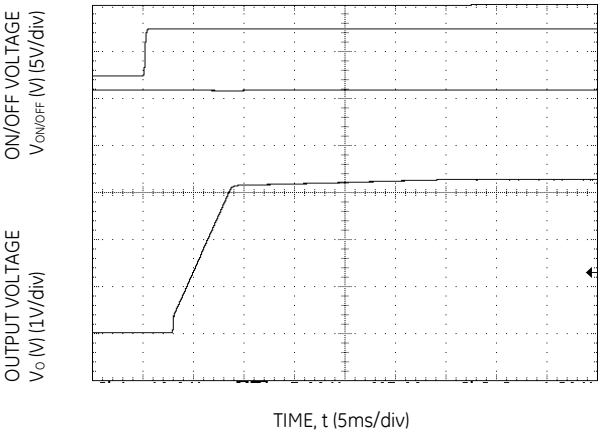

Figure 8. Typical Start-up Using On/Off Voltage (Io = Io,max).

Thermal Considerations

Power modules operate in a variety of thermal environments; however, sufficient cooling should always be provided to help ensure reliable operation.

Considerations include ambient temperature, airflow, module power dissipation, and the need for increased reliability. A reduction in the operating temperature of the module will result in an increase in reliability. The thermal data presented here is based on physical measurements taken in a wind tunnel. The test set-up is shown in Figure 9. The preferred airflow direction for the module is in Figure 10.

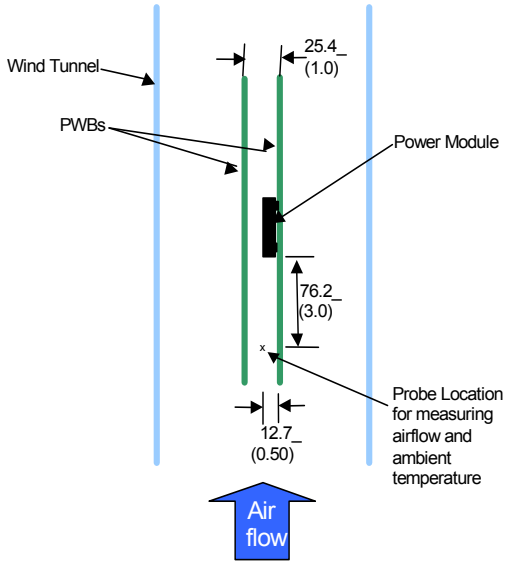

Figure 9. Thermal Test Setup.

The thermal reference points, T_{ref} used in the specifications are also shown in Figure 10. For reliable operation the temperatures at these points should not exceed 120°C. The output power of the module should not exceed the rated power of the module (Vo,set x Io,max).

Please refer to the Application Note "Thermal Characterization Process For Open-Frame Board-Mounted Power Modules" for a detailed discussion of thermal aspects including maximum device temperatures.

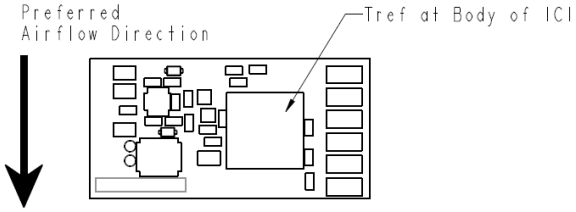

Figure 10. Location of hot-spot of the module (Tref).

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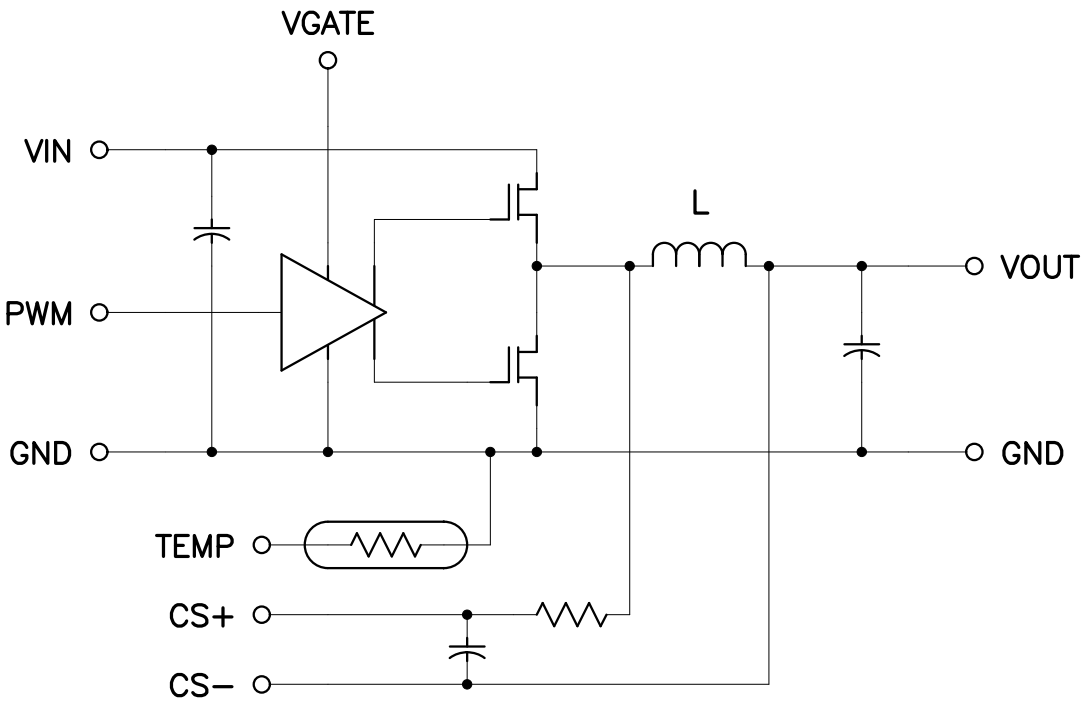
Connection Block Diagram



For DCR sensing, there shall be a 2.37K on power block (between CS+ and output inductor as shown) to work with an external 0.22uF capacitor. The C on power block across CS+ and CS- is not stuffed.

Safety Considerations

The APKM035SX series of power supplies were tested with an external 20A dc, fast-acting fuse in the ungrounded input. The use of no fuse or a higher rated fuse should be evaluated in the end-use equipment.

These power supplies were output overloaded; short circuited and single fault tested with an external control chip. The control chip, model LTC7510EUH# series or equivalent, provided the necessary control signals to operate the APKM035SX model. Consideration shall be taken at the end product approval to validate compatibility of the end product test results with the measured test characteristics of the subject power supplies.

30/35A Power Block: Non-Isolated DC-DC Power Modules

7Vdc –13.2Vdc input; 0.8Vdc to 3.3Vdc output; 30/35A Output Current

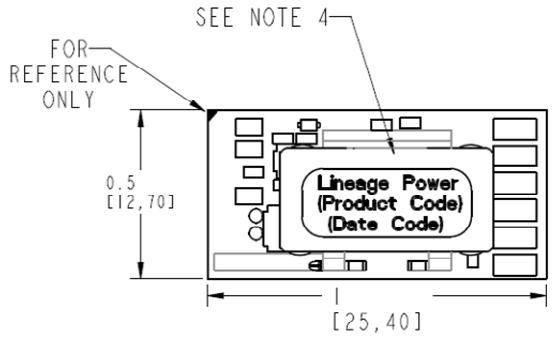
Mechanical Outline

Dimensions are in millimeters and (inches).

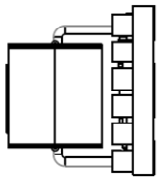
Tolerances: x.x mm ± 0.5 mm (x.xx in. ± 0.02 in.) [unless otherwise indicated]

x.xx mm ± 0.25 mm (x.xxx in ± 0.010 in.)

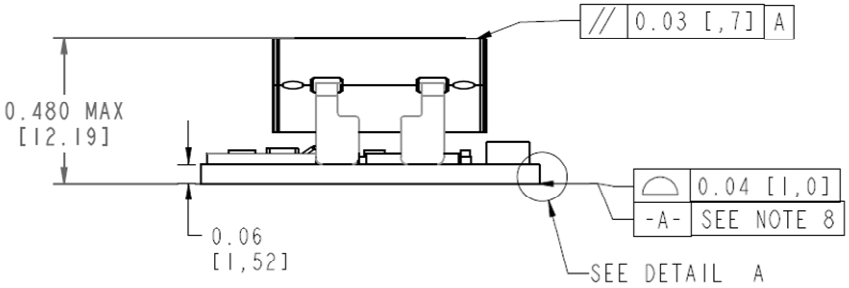
Angles ±2 DEG

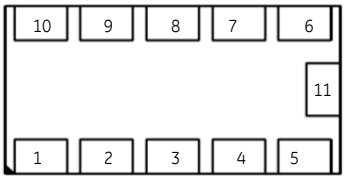


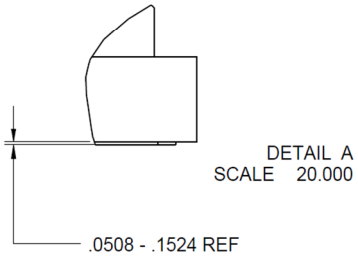
TOP VIEW



END VIEW







PIN	FUNCTION	PIN	FUNCTION
1	Vout	7	-Cs
2	GND	8	+Cs
3	PWM	9	GND
4	TEMP	10	Vout
5	+7V	11	GND
6	Vin		

30/35A Power Block: Non-Isolated DC-DC Power Modules

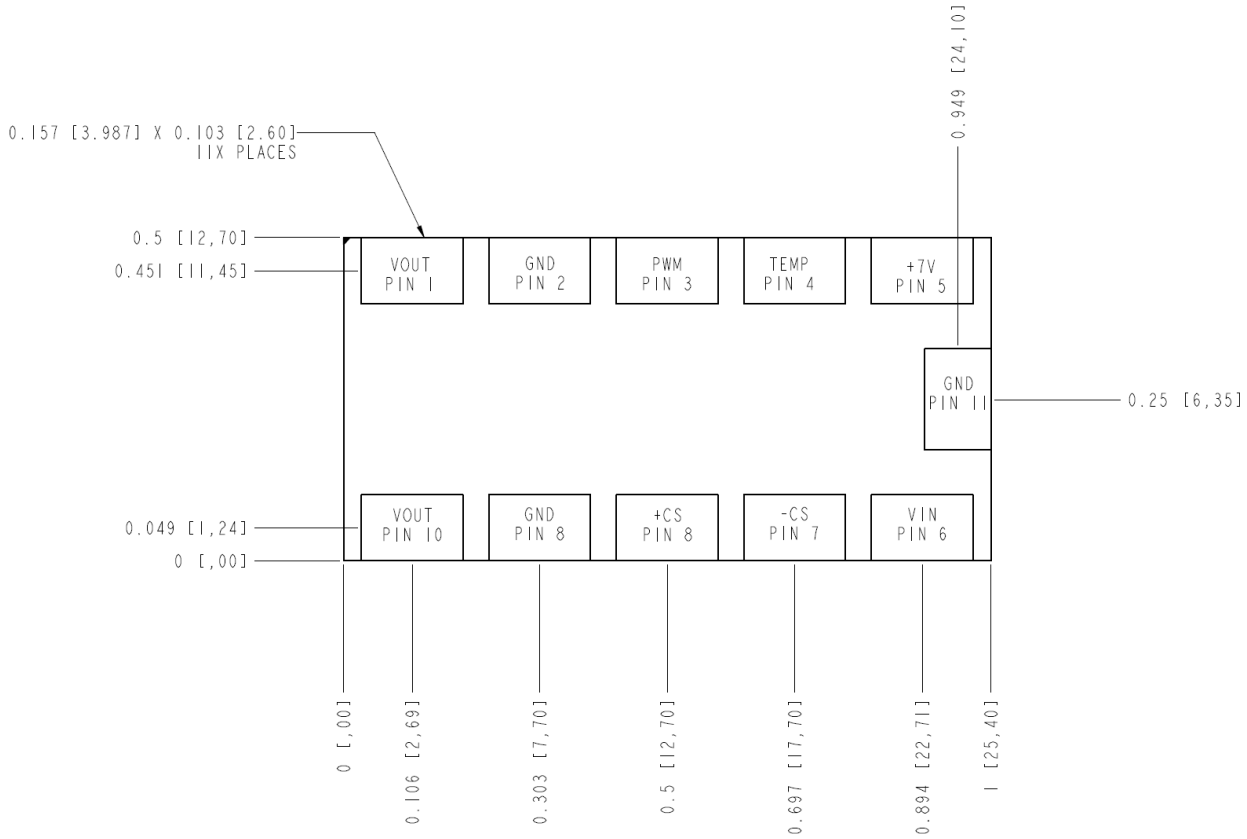
7Vdc –13.2Vdc input; 0.8Vdc to 3.3Vdc output; 30/35A Output Current

Recommended Pad Layout

Dimensions are in millimeters and (inches).

Tolerances: x.x mm ± 0.5 mm (x.xx in. ± 0.02 in.) [unless otherwise indicated]

x.xx mm ± 0.25 mm (x.xxx in ± 0.010 in.)



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1	Vout	7	-Cs
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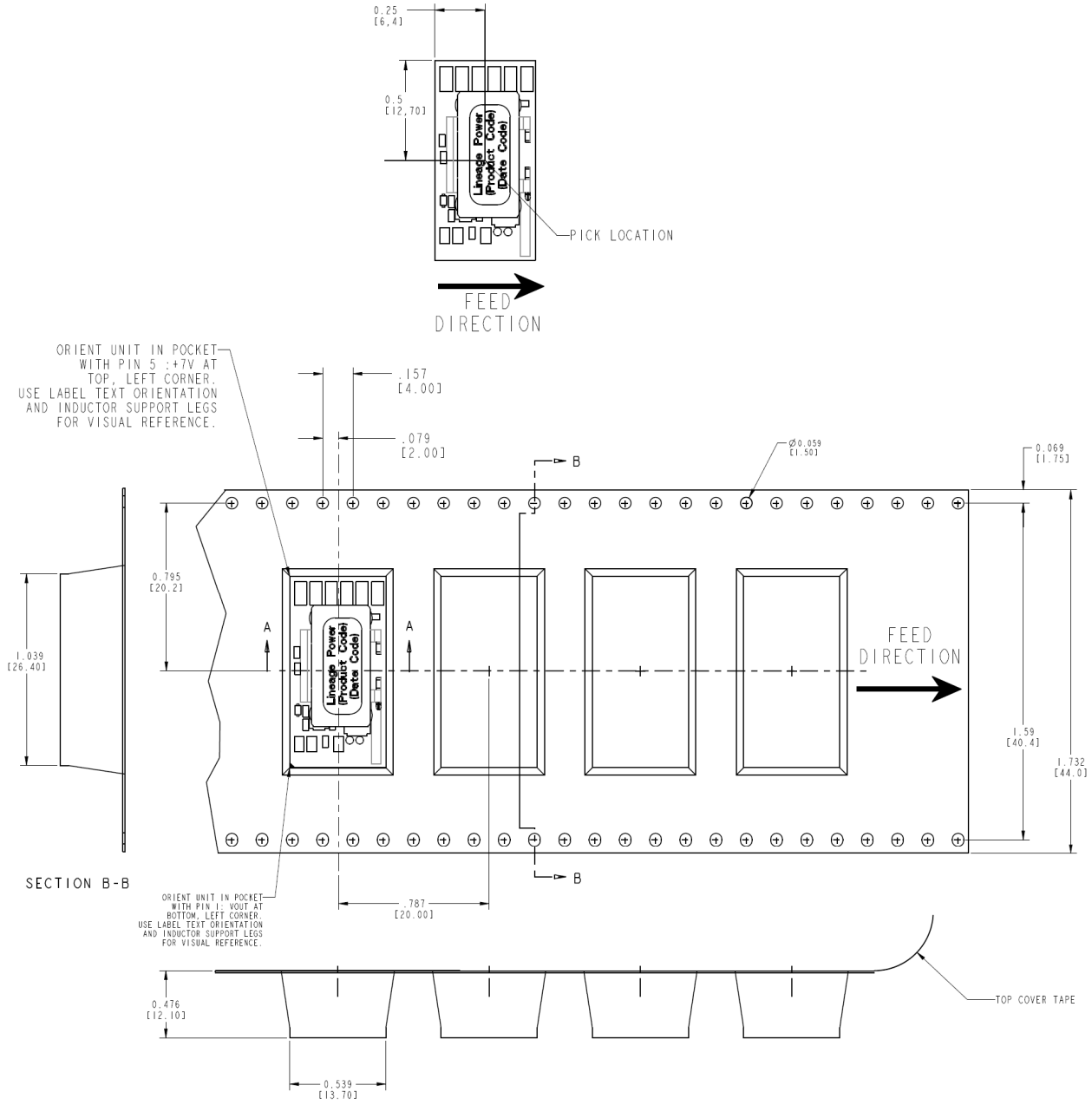
6	Vin		

30/35A Power Block: Non-Isolated DC-DC Power Modules

7Vdc –13.2Vdc input; 0.8Vdc to 3.3Vdc output; 30/35A Output Current

Packaging Details

The 30/35A power block modules are supplied in tape & reel as standard. Modules are shipped in quantities of 170 modules per reel. All Dimensions are in millimeters and (in inches).



Reel Dimensions:

Outside Dimensions:	330.2 mm (13.00)
Inside Dimensions:	177.8 mm (7.00")
Tape Width:	44.00 mm (1.732")

Surface Mount Information

Pick and Place

The 30/35A power block modules use an open frame construction and are designed for a fully automated assembly process. The modules are fitted with a label designed to provide a large surface area for pick and place operations. The label meets all the requirements for surface mount processing, as well as safety standards, and is able to withstand reflow temperatures of up to 300ºC. The label also carries product information such as product code, serial number and the location of manufacture.

Nozzle Recommendations

The module weight has been kept to a minimum by using open frame construction. Variables such as nozzle size, tip style, vacuum pressure and placement speed should be considered to optimize this process. The minimum recommended inside nozzle diameter for reliable operation is 3mm. The maximum nozzle outer diameter, which will safely fit within the allowable component spacing, is 7 mm.

Bottom Side / First Side Assembly

This module is not recommended for assembly on the bottom side of a customer board. If such an assembly is attempted, components may be dislodged during the second reflow process.

Lead Free Soldering

The modules are lead-free (Pb-free) and RoHS compliant and fully compatible in a Pb-free soldering process. Failure to observe the instructions below may result in the failure of or cause damage to the modules and can adversely affect long-term reliability.

Pb-free Reflow Profile

Power Systems will comply with J-STD-020 Rev. C (Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices) for both Pb-free solder profiles and MSL classification procedures. This standard provides a recommended forced-air-convection reflow profile based on the volume and thickness of the package (table 4-2). The suggested Pb-free solder paste is Sn/Ag/Cu (SAC). The recommended linear reflow profile using Sn/Ag/Cu solder is shown in Fig. 11. Soldering outside of the recommended profile requires testing to verify results and performance.

MSL Rating

The 30/35A power block modules have a MSL rating of 2a.

Storage and Handling

The recommended storage environment and handling procedures for moisture-sensitive surface mount packages is detailed in J-STD-033 Rev. A (Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices). Moisture barrier bags (MBB) with desiccant are required for MSL ratings of 2 or greater. These sealed packages should not be broken until time of use. Once the original package is broken, the floor life of the product at conditions of ≤ 30°C and 60% relative humidity varies according to the MSL rating (see J-STD-033A). The shelf life for dry packed SMT packages will be a minimum of 12 months from the bag seal date, when stored at the following conditions: < 40° C, < 90% relative humidity.

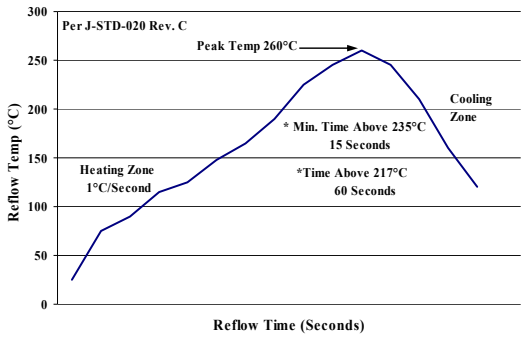


Figure 11. Recommended linear reflow profile using Sn/Ag/Cu solder.

Post Solder Cleaning and Drying Considerations

Post solder cleaning is usually the final circuit-board assembly process prior to electrical board testing. The result of inadequate cleaning and drying can affect both the reliability of a power module and the testability of the finished circuit-board assembly. For guidance on appropriate soldering, cleaning and drying procedures, refer to *Board Mounted Power Modules: Soldering and Cleaning* Application Note (AN04-001).

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7Vdc –13.2Vdc input; 0.8Vdc to 3.3Vdc output; 30/35A Output Current

Ordering Information

Please contact your GE Energy Sales Representative for pricing, availability and optional features.

Table 1. Device Codes

Device Code	Input Voltage Range	Output Voltage	Output Current	Comcode
APKM035S-SRZ	7 – 13.2Vdc	0.8 – 3.3Vdc	30/35A	CC109172895

-Z refers to RoHS compliant parts

Table 2. Coding Scheme

Package Identifier	Family	Power Classification	Output current	Output voltage	Options	ROHS Compliance
A	**PK**	**M**	**035**	**S**	**-SR**	**Z**
Austin Series	PK = power block	M = Mega	35A	S = Single Output	S = Surface Mount R = Tape & Reel	Z = ROHS6

Contact Us

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+91.80.28411633

www.ge.com/powerelectronics

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