Power Component: C750_B, C751_B

Product Description

The C750_B/C751_B Power Component series is a customizable Load Switch with current protection and soft-start to control in-rush current. Combine the C750_B, C751_B component with other Power Components to create a highly-integrated, custom-defined, AnDAPT AmP™ on-demand power management device.

Features

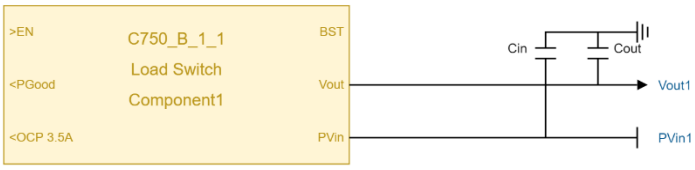
- Output voltage from 0.5V to 5V
- Low RDS_{ON} MOSFET: 30mΩ
- Maximum output current: 6A (AmP8D6)
- Soft-start to control inrush current
  - C750_B: CC soft-start with programmable soft-start current
  - C751_B: CV soft-start with programmable soft-start time
- OCP Current limit protection
- Short-circuit protection (SCP)
- Additional communication capabilities – I750, P750
- Power-good flag output and Enable input
- –40°C to +125°C operating junction temperature
- One SIM element used from AmP platform

Applications

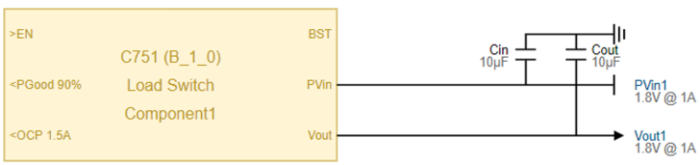
- Reverse-current protection
- Power isolation; reduce leakage current
- Protect circuits from inrush current or current spikes
- Reduce power and extend battery life; turn off power to unused circuits

Figure 1: C750_B, C751_B application schematics

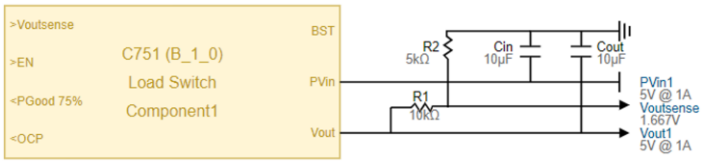
C750 “Internal” Sensing



C751 “Internal” Sensing



C751 “External” Sensing



C750_B vs C751_B Comparison Table

	C750_B	C751_B
Soft-Start	Constant-Current * **Soft-start current programmable*	Constant-Voltage* **Soft-start time programmable*
Vout Range	0.5V – 5.0V	Internal: 0.5V – 1.8V External: 1.8V – 5.0V

Product Detail

The C750_B/C751_B is a single channel high-side load switch designed for operation from 0.5V to 5.0 V. This load switch provides power domain isolation. The device contains a low on-resistance, N-channel MOSFET that supports more than 6A of continuous current and minimizes power loss. In addition, the device features over current and over voltage protection to protect the device against fault conditions.

The C750_B/C751_B is designed to cover the voltage range 0.5V to 5V.

The Load Switch is controlled by an on and off input, which is capable of interfacing directly with low-voltage control signals. The integrated linear Scalable Integrated MOSFET (SIM) provides up to 6A, output current. The maximum current is defined by the AmP device selected. The integrated current sense provides over-current protection (OCP).

The C750_B/C751_B has control and status pins including an enable input, a power-good output. The Load Switch parameters are specified by the power engineer using AnDAPT’s cloud-based WebAmp™ development software.

Part number	AmP Platform	IOUT Max	VOUT Max
C750_B, C751_B*	AmPxD6	6A	5.0V

** The C751 requires an external resistor divider to sense the Vout when Vout is > 1.8V*

Pin Description Table

Port Name	Analog/ Digital	Input/ Output	Description
Pvin	Analog	I/P	Power switch input voltage
V_{OUT}	Analog	O/P	Power switch output voltage
Voutsense	Analog	I/P	(C751 only) Vout sensing
BST	Analog	I/P	Should be left floating.
EN	Digital	I/P	Enable input, logic high turns on power switch.
PGood	Digital	O/P	Power Good indicator. Turns High when output voltage reach 85% of V_{OUT}
OCP	Digital	O/P	Over Current Indicator Turns high when current exceeds OCP level

System Characteristics

Table 1: lists the system characteristics for the C750_B/C751_B Power Component when implemented in an AnDAPT AmP device.

Table 1: System Characteristics

Parameters	Min	Typ	Max	Units
Input voltage (C750_B, C751_B)	0.6		5	V
Output Current (I_{OUT})			6	A
Output MOSFET switch ($R_{DS(on)}$)		30		mΩ
Current Limit – OCP (C750_B, C751_B)	I_{OUT}		7	A
Overvoltage protection trip point range (OVP) C750_B, C751_B		V_{OUT} + 1V		V

For other device specifications, see the AnDAPT AmP Platform datasheet.

Customizable Options

Table 2 lists the various customizable options available for the C750_B/C751_B Power Component. These options are set graphically in the WebAmp development software.

Table 2: C750_B, C751_B Customizable Options

Option	Units
Input/Output voltage	V
Output Current	A
Enable OCP output to signal when overcurrent protection is triggered	On/Off
Overcurrent protection level (I_{OUT}+1A)	A
Enable soft start	On/Off
Soft-Start Current (C710 only)	A
Soft-Start Time (C711 only)	ms
Use optional PGood output to signal “power good”	On/Off

Advanced Capabilities and Options

Table 3 lists derivatives of the C750_B/C751_B component with additional capabilities plus other similar components potentially suitable for this application.

Table 3: C750_B, C751_B Advanced Capabilities Options

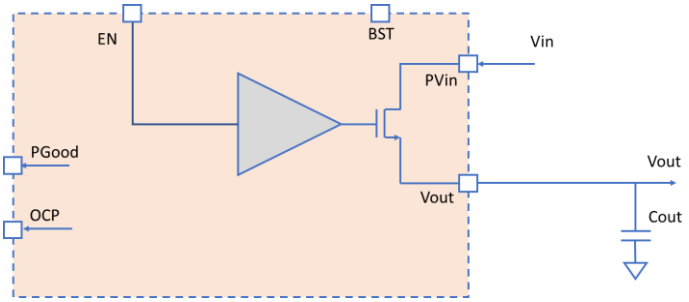
Description	Part Number
Standard Pro Series version (this component)	C750_B, C751_B
Add external control via I^2C bus interface	I750
Add telemetry and dynamic voltage scaling via DVS interface	P750

Theory of Operation

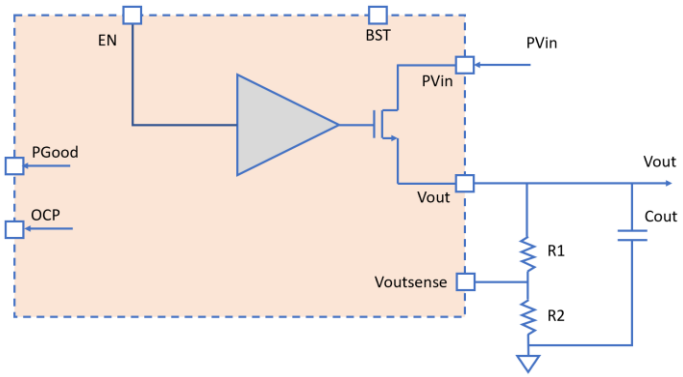
The C750_B/C751_B power component is a Load Switch used to provide power domain isolation under the control of an on/off (EN) digital input. The load switch is a low on-resistance N-channel MOSFET that supports up to 6A of continuous load current and minimizes power loss. A block diagram is shown below:

Block Diagram C750_B, C751_B

Internal Vout Sensing



External Vout Sensing



Feature Description

Several parameters can be adjusted using the WebAmp tool. When using the C750_B/C751_B in an adaptable product, the values by default are listed below.

Basic Configuration

You can adjust the output voltage and the maximum output current. For C750_B/C751_B, the default value is 2.5V for V_{OUT} and 3A for the output current.

Basic Configuration

PVin Name	PVin1	
Output Voltage	2.5	V
Vout Name	Vout1	
Output Current	3	A

Min Load required = 0.2mA

Output Capacitance

The C_{OUT} determines the slew rate of the C750_B output voltage during soft start. The default value is 10uF.

Slew rate (SR) is a function of the capacitance and the current, SR = I_{OUT}/C_{OUT}

For 6A, 10uF, the slew rate will be 0.6V/us

Cout

Cout	10	µF

Input Capacitance

The input capacitance C_{IN} is used to reduce the sensitivity of the circuit to the PCB layout, especially when high source impedance or long input traces are encountered. A 10uF minimum capacitance is recommended.

Fault Protection

The C750_B/C751_B is protected against damage due to excessive power dissipation by current limit (OCP) and output voltage protection (OVP).

When the output load exceeds the over current limit, the C750_B/C751_B turns off and PGood is deasserted.

You can enable or disable fault protection for current limit and OVP.

The default values are listed below for the C750_B/C751_B

Fault Protection

☑ Current limit

OCP Level	3.5	A

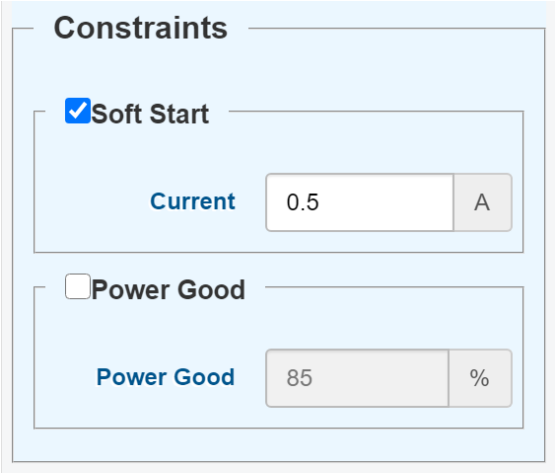
☐ Enable OVP

OVP Level	3.5	V

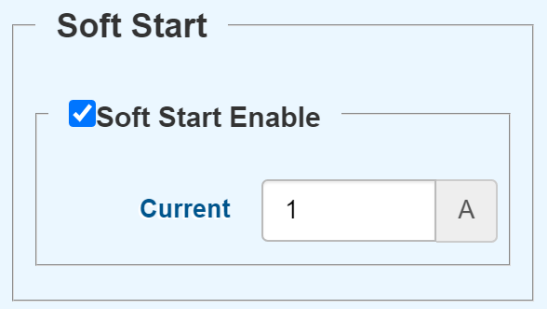
Note: please refer to errata at end of this datasheet.

Configuration (Constraints)

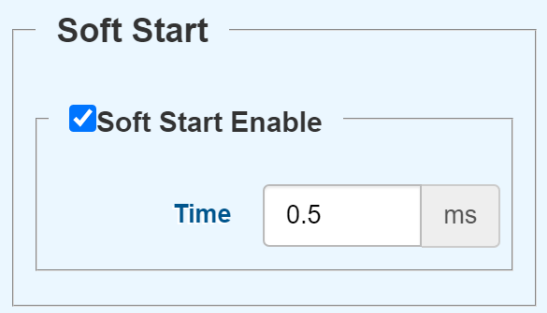
By default, the V_{OUT} Sense is internal for the C750_B.



The C750_B CC based soft start feature allows a controlled ramp of the output based on the value set by C_{OUT}



However the C751_B uses a CV based soft-start and allows the user to program a specific soft-start time independent of Cout. The soft-start time is programmable in the range 0.5ms to 8.0ms.

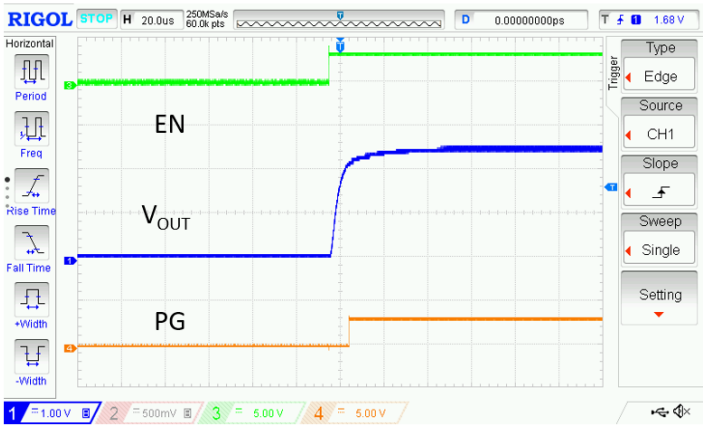


Typical Characteristics

Unless otherwise specified: TA = 25°C

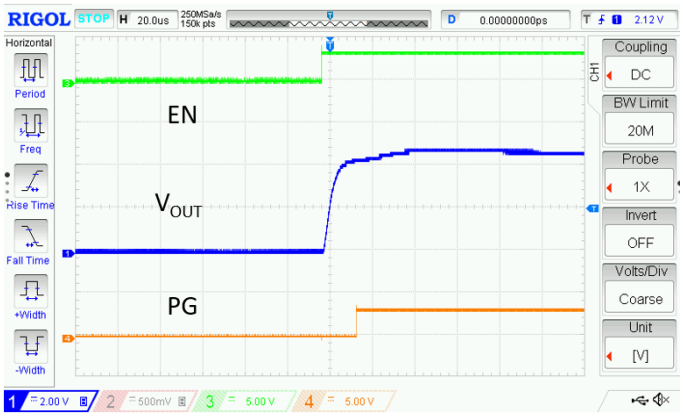
Soft Start C750_B

V_{OUT}= 2.5V No load



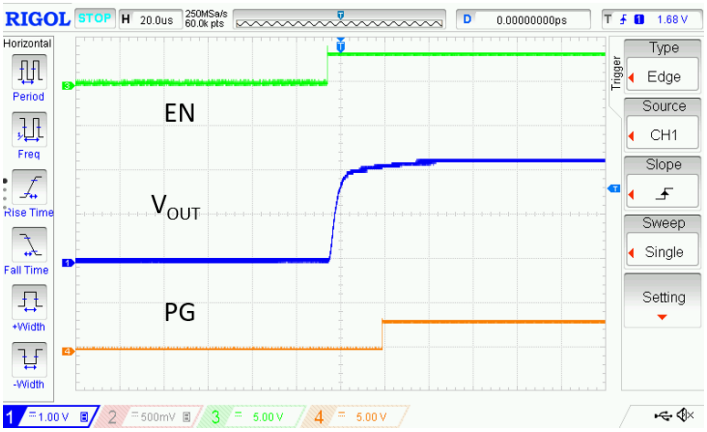
Soft Start C750_B

V_{OUT}= 5V, 2.3 Ohm load



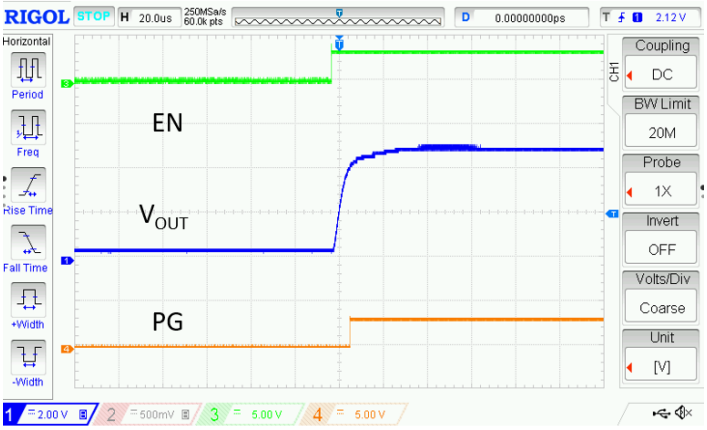
Soft Start C750_B

V_{OUT} = 2.5V, 1.2 Ohm load



Soft Start C750_B

V_{OUT}= 5V No load

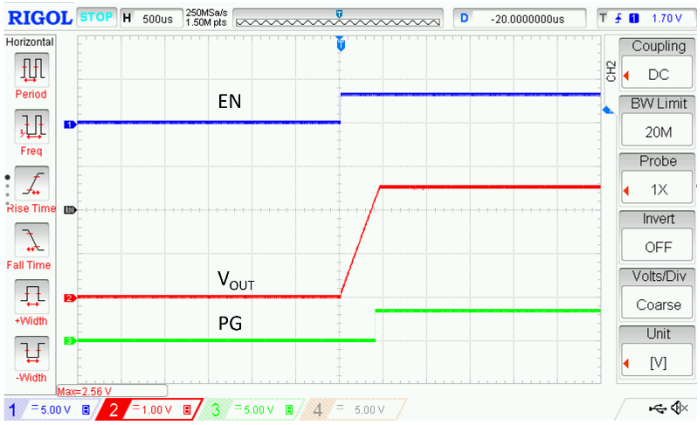


Typical Characteristics

Unless otherwise specified: TA = 25°C

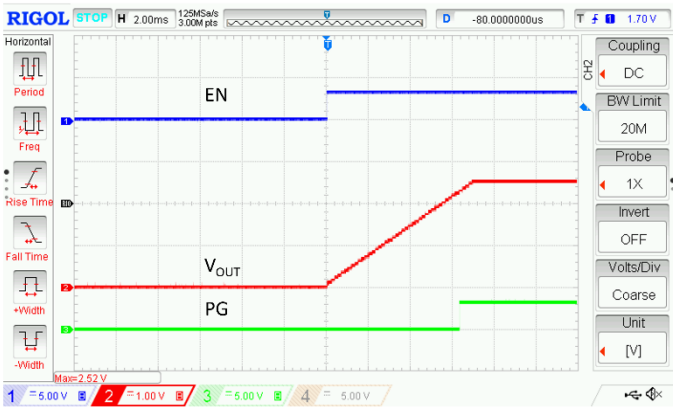
Soft Start C751_B

V_{OUT}= 2.5V 0.5ms Soft-Start Time



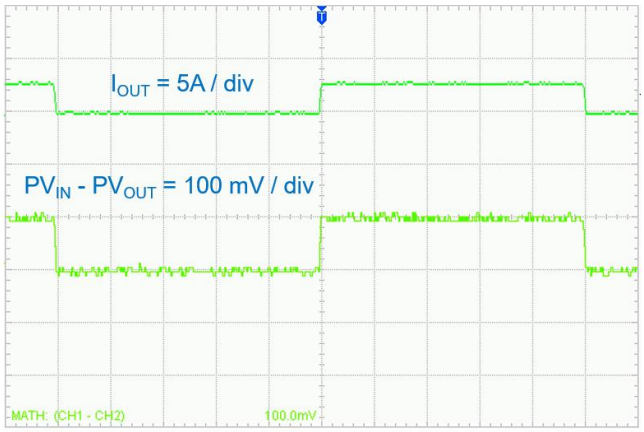
Soft Start C751_B

V_{OUT}= 2.5V 8ms Soft-Start Time



Transient Response C750_B, C751_B

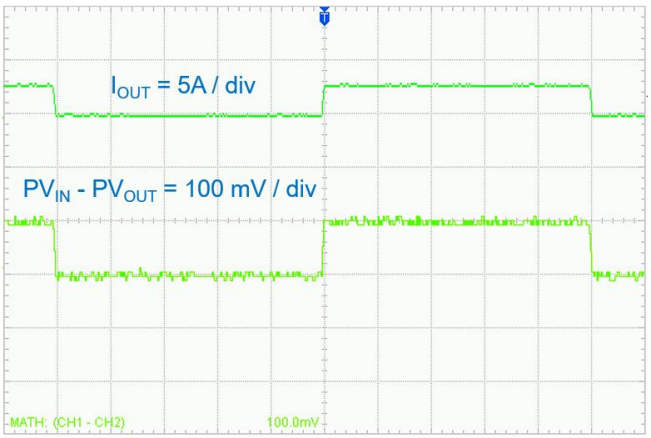
PV_{IN} = 5V, (PV_{IN} - PV_{OUT}) = 100 mV, I_{OUT} = 0 to 3A Load step



Time = 2ms / div

Transient Response C750_B, C751_B

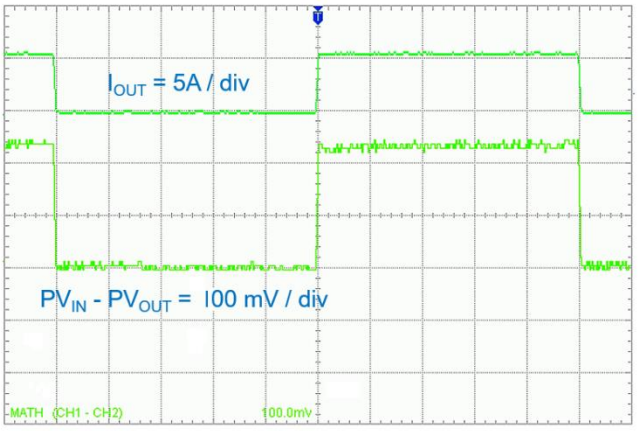
PV_{IN} = 5V, (PV_{IN} - PV_{OUT}) = 100 mV, I_{OUT} = 0 to 3A Load step



Time = 2ms / div

Transient Response C750_B, C751_B

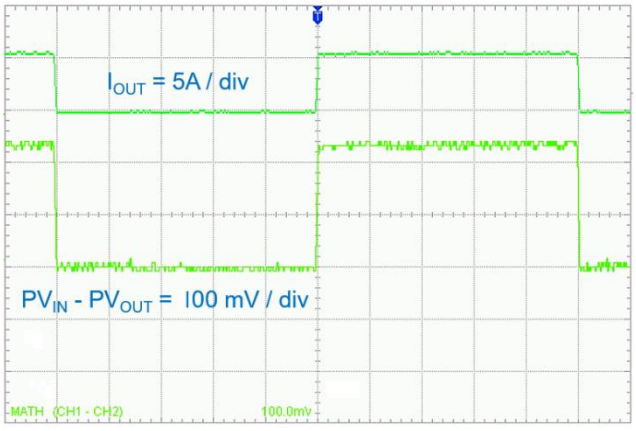
PV_{IN} = 2.5V, (PV_{IN} - PV_{OUT}) = 240 mV, I_{OUT} = 0 to 6A Load step



Time = 2ms / div

Transient Response C750_B, C751_B

PV_{IN} = 1.8V, (PV_{IN} - PV_{OUT}) = 240 mV, I_{OUT} = 0 to 6A Load step



Time = 2ms / div

C750_B Resource Usage

Circuit Stats...

Number of AnD_Temp_Sensor	1
Number of AnD_SIM_Linear	1
Number of AnD_SIM_Protect	1
Number of AnD_SIM_Sense	1
Number of AnD_Analog_IO	6
Number of AnD_ATC_IO	3
Number of AnD_ATC_Comp	2
Number of AnD_Nref_fix	3
Number of AnD_PTG_Phase_Count	1
Number of AnD_PTG_GBUF	1
Number of AnD_PTG_OSC	1
Number of AnD_DFFN	7
Number of AnD_DFF	3
Number of LUT4	24

Resource Usage...

io	3 used	(Capacity 24)
clb	6 used	(Capacity 64)
sim	1 used	(Capacity 8)
atc	2 used	(Capacity 6)
corner	3 used	(Capacity 4)
ptg	1 used	(Capacity 2)
uLogic	24 used	(Capacity 512)

Components Stats...

$techmap\otp_fuse_module

AnD_DFF	3
AnD_DFFN	7

component_1

AnD_ATC_Comp	1
AnD_Nref_fix	2
AnD_SIM_Linear	1
AnD_SIM_Protect	1
AnD_SIM_Sense	1

otp_fuse_module

AnD_ATC_Comp	1
AnD_Nref_fix	1

C751_B Resource Usage (Internal Vout sensing)

Circuit Stats...

Number of AnD_Temp_Sensor	1
Number of AnD_SIM_Linear	1
Number of AnD_SIM_Protect	1
Number of AnD_SIM_Sense	1
Number of AnD_Analog_IO	6
Number of AnD_ATC_IO	3
Number of AnD_ATC_Comp	2
Number of AnD_PMT	1
Number of AnD_Nref_fix	3
Number of AnD_PTG_Phase_Count	1
Number of AnD_PTG_GBUF	1
Number of AnD_PTG_OSC	1
Number of AnD_DFFN	7
Number of AnD_DFF	10
Number of LUT4	46

Resource Usage...

io	3 used	(Capacity 24)
clb	8 used	(Capacity 64)
pmt	1 used	(Capacity 16)
sim	1 used	(Capacity 8)
atc	2 used	(Capacity 6)
corner	3 used	(Capacity 4)
ptg	1 used	(Capacity 2)
uLogic	46 used	(Capacity 512)

Components Stats...

$techmap\component_1

AnD_DFF	7

$techmap\otp_fuse_module

AnD_DFF	3
AnD_DFFN	7

component_1

AnD_ATC_Comp	1
AnD_Nref_fix	2
AnD_PMT	1
AnD_SIM_Linear	1
AnD_SIM_Protect	1
AnD_SIM_Sense	1

otp_fuse_module

AnD_ATC_Comp	1
AnD_Nref_fix	1

C751_B Resource Usage (External Vout sensing)

Circuit Stats...

Number of AnD_Temp_Sensor	1
Number of AnD_SIM_Linear	1
Number of AnD_SIM_Protect	1
Number of AnD_SIM_Sense	1
Number of AnD_Analog_IO	6
Number of AnD_ATC_IO	4
Number of AnD_ATC_Comp	2
Number of AnD_PMT	1
Number of AnD_Nref_fix	4
Number of AnD_PTG_Phase_Count	1
Number of AnD_PTG_GBUF	1
Number of AnD_PTG_OSC	1
Number of AnD_DFFN	7
Number of AnD_DFF	10
Number of LUT4	45

Resource Usage...

io	4 used	(Capacity 24)
clb	8 used	(Capacity 64)
pmt	1 used	(Capacity 16)
sim	1 used	(Capacity 8)
atc	2 used	(Capacity 6)
corner	3 used	(Capacity 4)
ptg	1 used	(Capacity 2)
uLogic	45 used	(Capacity 512)

Components Stats...

$techmap\component_1

AnD_DFF	7

$techmap\otp_fuse_module

AnD_DFF	3
AnD_DFFN	7

component_1

AnD_ATC_Comp	1
AnD_Nref_fix	3
AnD_PMT	1
AnD_SIM_Linear	1
AnD_SIM_Protect	1
AnD_SIM_Sense	1

otp_fuse_module

AnD_ATC_Comp	1
AnD_Nref_fix	1

Additional Resources

- AnDAPT AmP Platform datasheet

Errata

Date	Errata
06/19/2020	When operating the C750_B, C751_B above 4.0V OCP operation is not guaranteed.

Revision History

Date	Revision
08/17/2020	Added LDSW C751_B to C750_B datasheet
06/19/2020	Platform B version B release
01/21/2019	Preliminary release

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