Product Document

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Demo Kit Manual

AS7225

Director Demo Kit User Guide

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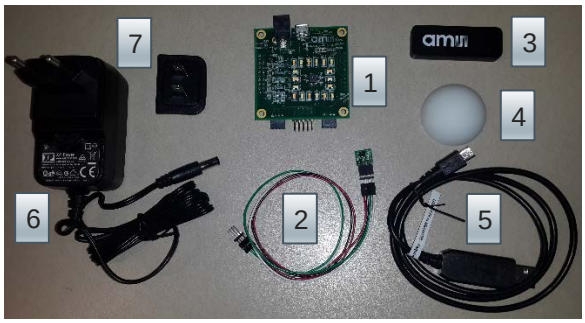
1 Introduction

AS7225 Director Demo Kit provides a platform to evaluate ams AS7225 Smart Lighting Director device. With AS7225 Evaluation User Interface running on Windows based personal computer, one can control various onboard LEDs and demonstrate the close loop of Color Tuning and Daylight features. The kit also serves as a development platform that a customer microcontroller can be used to control AS7225 device as well as onboard LED strings. This user guide describes the features and functions of AS7225 Director Demo Kit.

1.1 Kit Content

The following items are delivered with this Demo Kit.



Pos.	Item	Comment
1	AS7225 Director Demo Board	Evaluation Board With AS7225 and LEDs
2	External Sensor Board	TSL4531 and Temperature/ Humidity Sensor
3	USB Memory Stick	Documents and Software
4	Diffuser	Ping Pong Ball Diffuser
5	Serial Cable	FTDI USB-UART Cable
6	Power Adapter	12V Wall Plug Adapter
7	Plug Adapter	EU to US Plug Adapter

Figure 1. Kit Content

1.2 Connection

Figure 2. AS7225 Director Demo Kit Connection

2 Getting Started

The evaluation kit requires one time installation of FTDI CDM Driver for the USB-UART cable if it is not already installed on the computer. The installation file can be found in the USB Memory Stick. If there is an issue about the installations, please refer to www.ftdichip.com for more information.

The AS7225 Evaluation User Interface software does not need extra installation. Please copy the following files to any folder you would like to work with and run the .exe file to start the GUI.

#	File	Comment
1	AS7225_GUI_xx_xx_xx.exe	Excutable file (xx_xx_xx: Revision #)
2	FTD2XX_NET.dll	DLL file

Figure 3. AS7225 Evaluation User Interface Software Files

3 Hardware Description

The AS7225 Director Demo Kit design consists of AS726x device with associated flash memory, LED circuit, and jumper configuration for UART/I²C interface.

3.1 Hardware Architecture

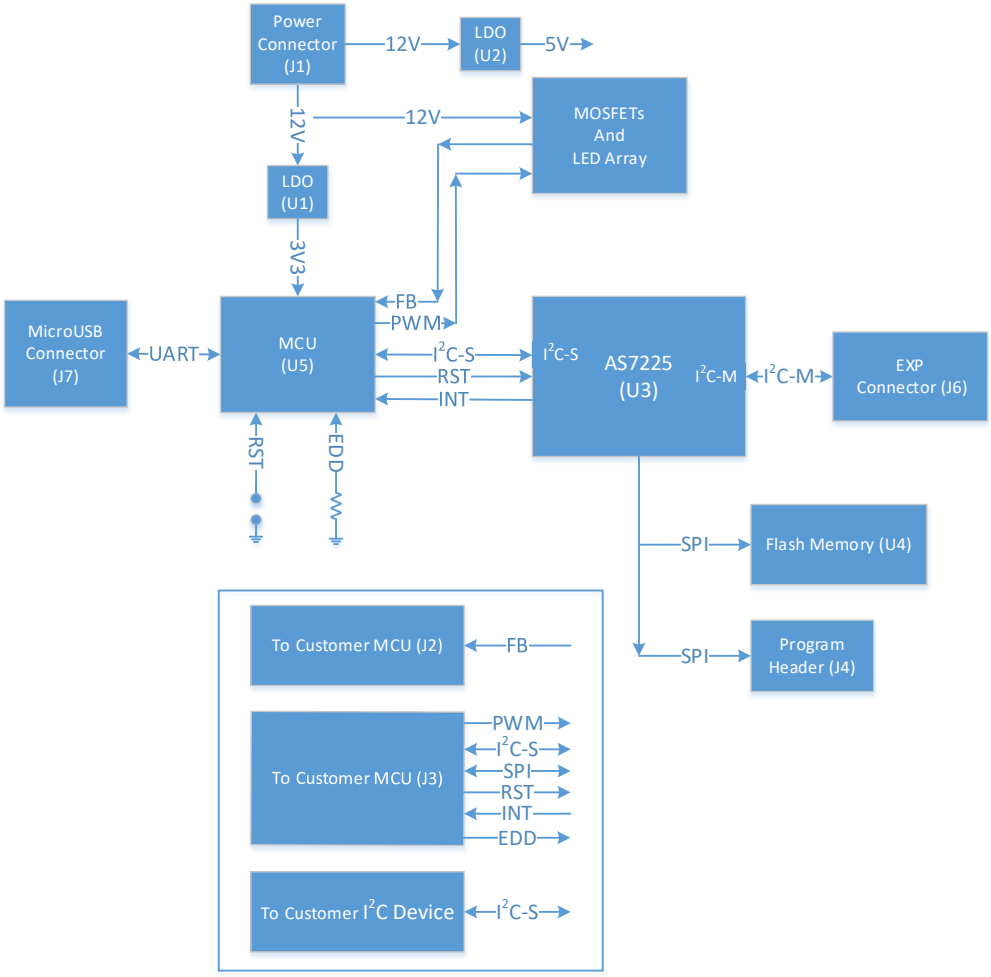
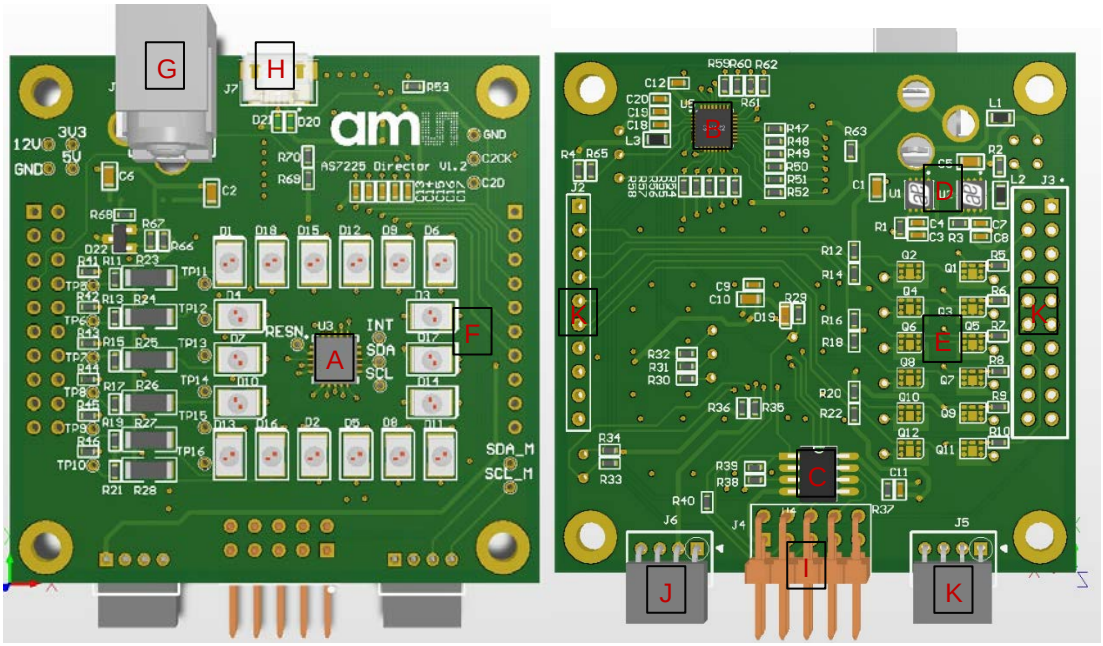


Figure 4. Board Block Diagram



Pos.	Designator	Comment
A	U3	AS7225 Device;
B	U5	Microcontroller (MCU);
C	U4	Flash Memory;
D	U1/U2	LDO Devices;
E	Q1-Q12	MOSFETs for LEDs;
F	D1-D18	LEDs; 6 Groups;
G	J1	12V Power Adapter Plug;
H	J7	MicroUSB Connector;
I	J4	Flash Memory Programming Header;
J	J6	Connector for External Sensors;
K	J2/J3/J5	Connectors for Customer MCU;

Figure 5. Devices, Connectors and LEDs

3.2 Power Supplies

The AS7225 Director Demo Kit is powered by 12V wall plug power adapter. The 12V supply provides the power to the LDOs as well as MOSFETs and LEDs circuitries. Onboard LDO U1 has 3.3V output, which is used for AS7225, Flash Memory, onboard MCU, and J6 for external sensors. The 3.3V can be also connected to customer microcontroller through J2. LDO U2 has 5V output and is connected to J3 for customer development purpose. Each LDO could deliver upto 200mA total current.

The board also has the test points for 12V, 3.3V, 5V, and GND. It would be convenient for engineering development.

3.3 AS7225

The AS7225 serves as a White Color Director for a companion host MCU. When a white color target is set, AS7225 measures the current CCT and provides high level calculated white color tuning control loop information for onboard LED channel PWMs to the host MCU via I^2C registers. The host MCU configures the PWM outputs to drive external MOSFETs for the target CCT. The CCT gradually matches to the target CCT.

Silimarly with ams TSL4531 is attached, the director operation also provides illuminance control information for Daylighting. TSL4531 reports the lux value and AS7225 provides the control information. Without ams TSL4531 attached, AS7225 will report the lux value for inside area of diffuser.

On the current external sensor board, U2 is TSL4531 and U3 is the temperature and humity sensor on another side. When test with TSL4531, TSL4531 should be pointed to the tested area.

If AS7225 demo board is used to test with a real luminaire, please point AS7225 inward for white color tuning applications and point out of the luminaire for daylighting.

3.4 Microcontroller

3.4.1 Interface

The onboard MCU provides UART interface to communicate to AS7225 Evaluation User Interface software or other terminal software. The cable with USB and MicroUSB connectors is not a regular USB download cable for a cell phone. The cable converts the signals between USB and UART so please use the cable provided by the demo kit.

The MCU also receives the control loop information from AS7225 via I^2C interface and drives MOSFETs with PWMs for onboard LEDs control. The MCU is the master of I^2C and AS7225 is the slave. Please note AS7225 can be also the master of I^2C when it controls TSL4531 sensor.

3.4.2 Firmware Update

Please visit download.ams.com for avaiable firmware and utility.

The MCU firmware can be updated with AS7225 Evaluation User Interface software version 0.7.x or later. Please refer to the user guide for detail information.

The firmware can be also updated with the command line utility. Please copy the utility software, efm8load.exe, and a firmware, AS7225host_xx_xx_xx.efm, into same folder and check the comm port number for AS7225 demo kit. Then follow the steps below to update the firmware.

1. Run a terminal application with the comm port configured as 115200 Baud Rate, 8-Bit Data, No Plarity, 1-Bit Stop.
2. Type “BL = 1” in the terminal window. This command sets the MCU into bootload mode.
3. Close the terminal application.
4. Run a command line window (Start -> Run -> cmd) and navigate to the folder of the utility and the firmware.
5. Type “efm8load –p com3 AS7225host_xx_xx_xx.efm8” and press the return key. The com3 should be replaced with your comm port number.

6. Wait until the update is done.

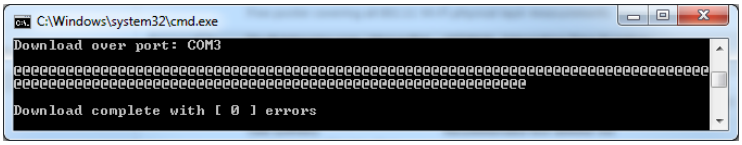


Figure 6. Firmware Update

3.4.3 External MCU Connection

AS7225 demo board allows onboard MCU to be suspended and an external MCU can be connected to the board to control AS7225 device and/or onboard LEDs. This would minimize the hardware development time and test AS7225 in a real application.

The onboard MCU can be suspended either by installing a 0Ω resistor on R70 or by pulling EDD signal to LOW. The EDD signal is connected to pin8 of onboard MCU and pin7 of J3. The external MCU could pull the EDD to LOW to suspend onboard MCU. Then the external MCU can control AS7225 through I^2C bus on J3 as well as onboard LEDs with PWM/FB signals on J3/J2. Extra sensors can be added via the I^2C bus on J5.

3.5 LED Circuitries

There are six LED strings on AS7225 demo board. Each LED string has three LEDs in serial and it is controlled by a pai of MOSFETs. PWM and FB signals are used by the MCU to control the current through the LEDs.

4 Software Description

4.1 AS7225 Evaluation User Interface

The demo kit comes with AS7225 Evaluation User Interface software running on a Windows computer for evaluating AS7225 features. Please refer to the application note in the USB Data Stick for how to use the software.

4.2 Windows Terminal Application

The host MCU supports UART interface with AT commands to communicate to AS7225. The AT commands can be used to configure AS7225. There are also some commands can be used for the host MCU configuration.

Any Windows terminal application would be good for sending the commands. A freeware, Putty.exe as an example, can be downloaded form the internet. The comm port configuration should be 115200 Baud Rate, 8-Bit Data, No Plarity, 1-Bit Stop.

Command	Response	Description / Parameters
AS7225 AT Commands		
Status		
AT	OK	NOP
ATVERSW	OK	Return the current software version number

Command	Response	Description / Parameters
ATVERHW	OK	Returns the system hardware as a HEX value of the form PRDTx where P=PartID and R=ChipRevision and DT= DeviceType
ATTEMP	OK	Read the current device temperature in degrees Celsius
ATXYZC	OK	Read calibrated X, Y, and Z data
ATSMALLXYC	OK	Read calibrated x and y for CIE 1931 color gamut
ATUVPRIMEC	OK	Read calibrated u', v' and u, v for CIE 1976 color gamut
ATDATA	OK	read all six raw values: red, green, blue, ir, dark, clear
ATDUVC	OK	Read delta uv values
ATESP	OK	Read the single 16 bit sum of ESP1 board devices available
Director Configration		
ATCHAN1	OK	CHAN_MODE 0: DIMMING CHAN_MODE 1: DIMMING CHAN_MODE 2: overall brightness (only for information)
ATCHAN2	OK	CHAN_MODE 0: disabled (0) CHAN_MODE 1: STRING1 COLOR_TUNING CHAN_MODE 2: STRING1 COLOR_TUNING with DIMMING
ATCHAN3	OK	"CHAN_MODE 0: disabled (0) CHAN_MODE 1: STRING1 complement COLOR_TUNING CHAN_MODE 2: STRING2 COLOR_TUNING with DIMMING"
ATCHANMOD	<*value*>OK	Select the channel mode. After channel switch, learning is again necessary
ATLEARN	<*value*>OK	Enables the channel learn mode. The maximum ratings will be saved internally. On software reset or power cycle the data will be available again and learn mode will be disabled
ATINTRP	<*value*>OK	"Enable/Disable Interrupt Pin, Default pin state: low (pin disabled) or high (pin enabled), Goes to low when new channel values are available. Will be reseted to high, if channel data were read"
ATCALC	<*value*>OK	Starts new calculation
Control		
ATINTTIME	<*value*>OK	"Set sensor integration time. Integration time = <value> x ~2.8msecs."
ATGAIN	<*value*>OK	"Set sensor gain: 0=1X gain, 1=3.7X, 2=16X, 3=64X"

Command	Response	Description / Parameters
ATLED0	<*value*>OK	Enables or disables the indication led
ATSRST	OK	Software reset
ATFRST	OK	Factory Reset. Stored values are reset to 'Factory' defaults. Afterwards a software reset is started.
Correlated Color Temperature (CCT)		
ATCCTT	<*value*>OK	Set the color control target value in integer (in Kelvin)
ATCCTC	OK	Return the calibrated CCT value
Daylight Harvesting / Illumination Control		
ATLUXT	<*value*>OK	Set illumination target LUX value
ATLUXC	OK	Read the illumination in lux (if external TSL4531, use this)
Calibration Values		
ATNORMGAIN	<*value*>OK	Set/Get the gain which the calibration values were measured
ATNORMINTT	<*value*>OK	Set/Get the integration time which the calibration values were measured
ATIRXS	<*value*>OK	Write IR scalar for value X
ATIRYS	<*value*>OK	Write IR scalar for value Y
ATIRZS	<*value*>OK	Write IR scalar for value Z
ATCMxy	<*value*>OK	Write 3x3 color matrix to flash, x,y = [0..2]
ATAMxy	<*value*>OK	Write 3x3 application matrix to flash, x,y = [0..2]
Firmware Updatwe		
ATFWU	-	Starts firmware update process and transfer the bin file checksum
ATFW	-	"Download new firmware Up to 7 bytes of FW image at a time (14 hex bytes with no leading or trailing 0x) Repeat command till all 56Kbytes of firmware are downloaded"
ATFWS	-	"Tests the checksum on the non-active FW partition and, if correct, switches active partition. This is a toggle and can be used to toggle between the 2 FW partitions. Note: the first 5 bytes in page 0 are not touched. It is only a temporary switch and must be used to check the new firmware whether the communication works!"
ATFWL	-	This command locks the current firmware to starts on power cycles. It rewrites the first five bytes in page0!

Command	Response	Description / Parameters
ATFWC	*OK*	This command gives information about the current firmware state
ATFWA	-	Only for backward compatibility to support old firmware update mechanism. Always returns with OK. Because of flash devices it is not possible to increment the address separatly (Page erase necessary!)
Host MCU Commands(I2C)		
BL=1		
RD=<*addr*>	<*value*>OK	Read a single-byte I^2C register at <*addr*> (hex) and return the <*value*> (hex)
RD16=<*addr*>	<*value*>OK	Read a two-byte I^2C register at <*addr*> (hex) and return the <*value*> (decimal)
WA=<*addr*>	OK	Set the I^2C register <*addr*> (hex) for I^2C write
WA?	<*value*>OK	Read current I^2C register address set by WA
WR=<*value*>	OK	Write <*value*> (hex) to the I^2C register address set by WA
POLLING=<0|1>	OK	Set the polling mode enable (1) or disable (0)
INTEN=<0|1>	OK	Set the interrupt mode enable (1) or disable (0)
PWM1=<*value*>	OK	Manual PWM1 override, both POLLING and INTEN have to be 0
PWM1?	<*value*>OK	Read current PWM1 setting, returning a value in [0…2047]
PWM2=<*value*>	OK	Manual PWM2 override, both POLLING and INTEN have to be 0
PWM2?	<*value*>OK	Read current PWM2 setting, returning a value in [0…2047]
PWM3=<*value*>	OK	Manual PWM3 override, both POLLING and INTEN have to be 0
PWM3?	<*value*>OK	Read current PWM3 setting, returning a value in [0…2047]
PWM4=<*value*>	OK	Manual PWM4 override, both POLLING and INTEN have to be 0
PWM4?	<*value*>OK	Read current PWM4 setting, returning a value in [0…2047]
PWM5=<*value*>	OK	Manual PWM5 override, both POLLING and INTEN have to be 0
PWM5?	<*value*>OK	Read current PWM5 setting, returning a value in [0…2047]
PWM6=<*value*>	OK	Manual PWM6 override, both POLLING and INTEN have to be 0
PWM6?	<*value*>OK	Read current PWM6 setting, returning a value in [0…2047]
INT?	<0|1>OK	Read interrupt pin state, active (0) or not active (1)

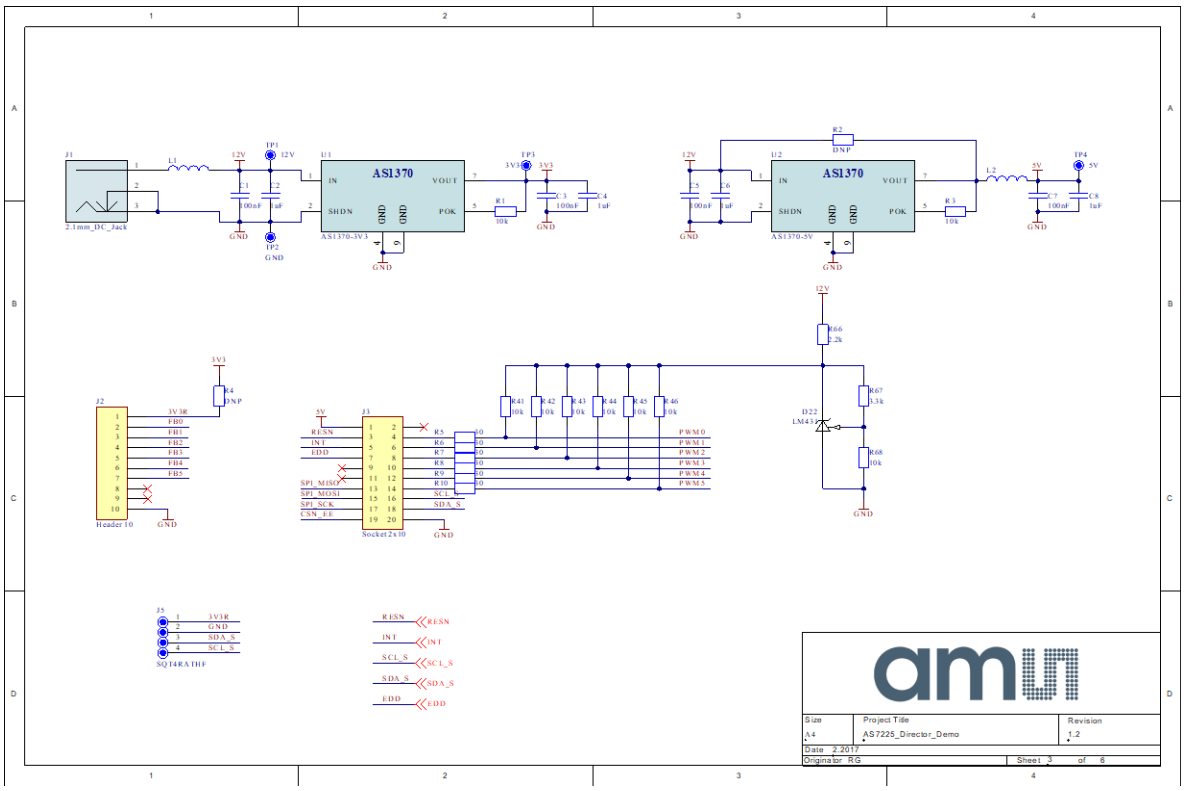
Command	Response	Description / Parameters
TEMP?	<*value*>OK	Read host controller device temperature in Celsius
C1G?	<*value*>OK	Read AS7225 director channel 1 result registers
C2G?	<*value*>OK	Read AS7225 director channel 2 result registers
C3G?	<*value*>OK	Read AS7225 director channel 3 result registers
C4G?	<*value*>OK	Read AS7225 director channel 4 result registers
C5G?	<*value*>OK	Read AS7225 director channel 5 result registers
C6G?	<*value*>OK	Read AS7225 director channel 6 result registers
SRST		Reset host MCU
RST25	OK	Reset AS7225
FWVER	<*value*>OK	Read host FW version

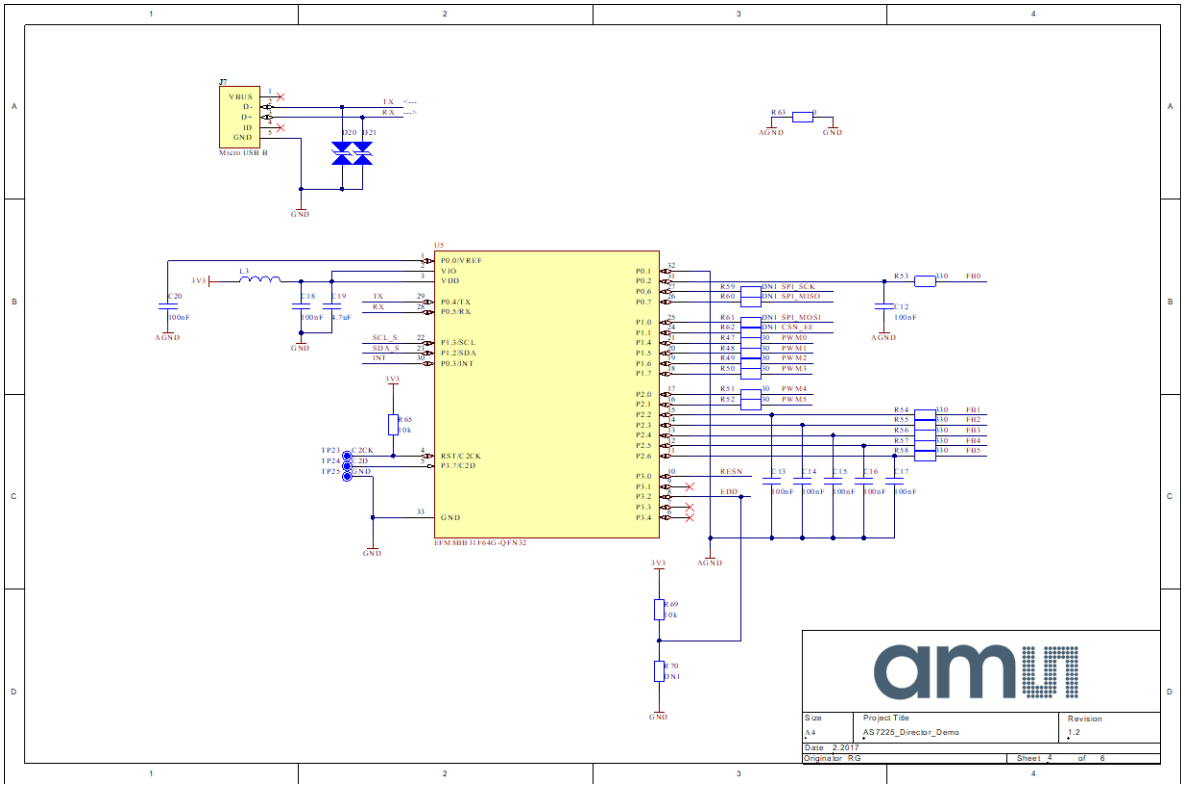
Figure 7. Command Table

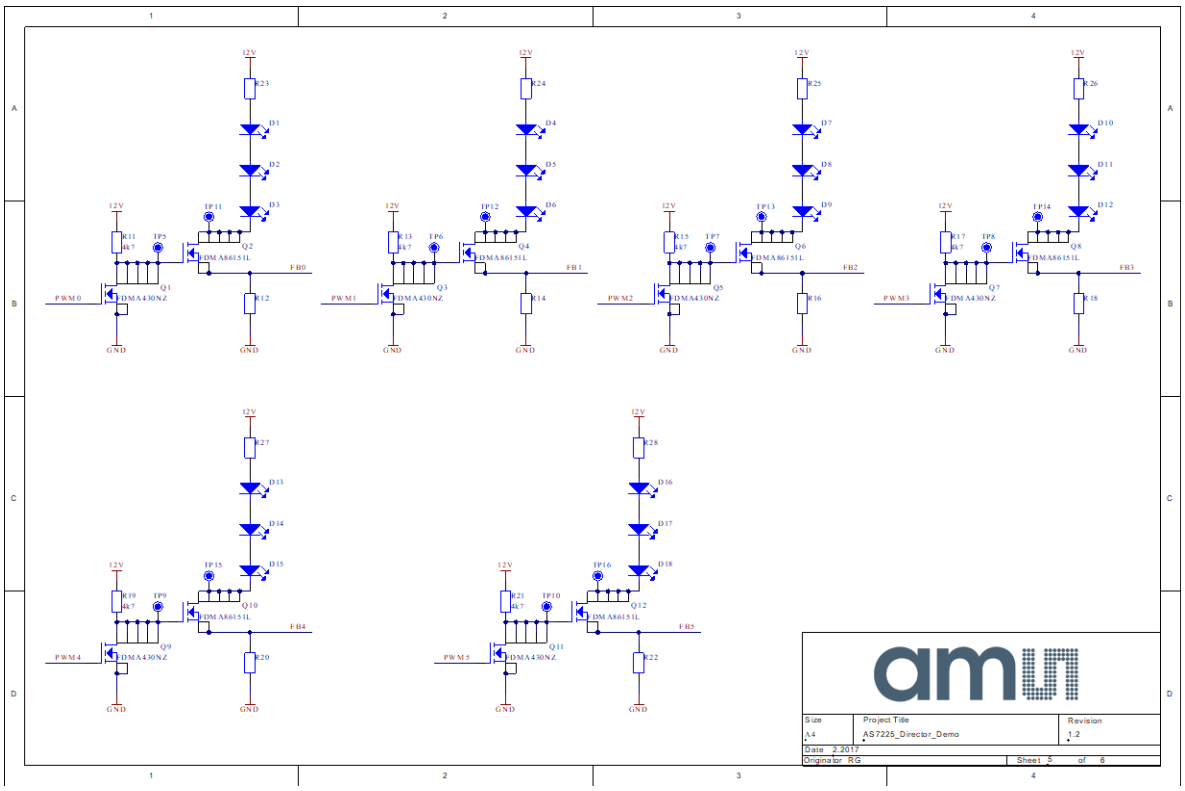
Note:

1. The internal connection between Host MCU and AS7225 is via I2C communication in AS7225 evaluation demo kit and so the AT Command in Host MCU will work. For accessing the AT Command in AS7225 the Host firmware and hardware communication to AS7225 device should be configured to UART.
2. For using the I2C commands the register command set with their address is described in the AS7225_Command .xlsx file.
3. Currently, the Demo board is controlled with Host microcontroller. In order to use AS7225 with an external microcontroller the Host microntroller should be disabled as two masters won't be supported. Also, configure the external microcontroller and AS7225 by I2C communication.

5 AS7225 Director Demo Kit Schematics






12V
R23
R24
R25
R26
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
TP11
TP12
TP13
TP14
TP5
TP6
TP7
TP8
R11
R13
R15
R17
4k7
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
DMA430NZ
DMA86151L
PWM0
PWM1
PWM2
PWM3
FB0
FB1
FB2
FB3
R12
R14
R16
R18
GND
R27
R28
D13
D14
D15
D16
D17
D18
TP15
TP16
TP9
TP10
R19
R21
Q9
Q10
Q11
Q12
PWM4
PWM5
FB4
FB5
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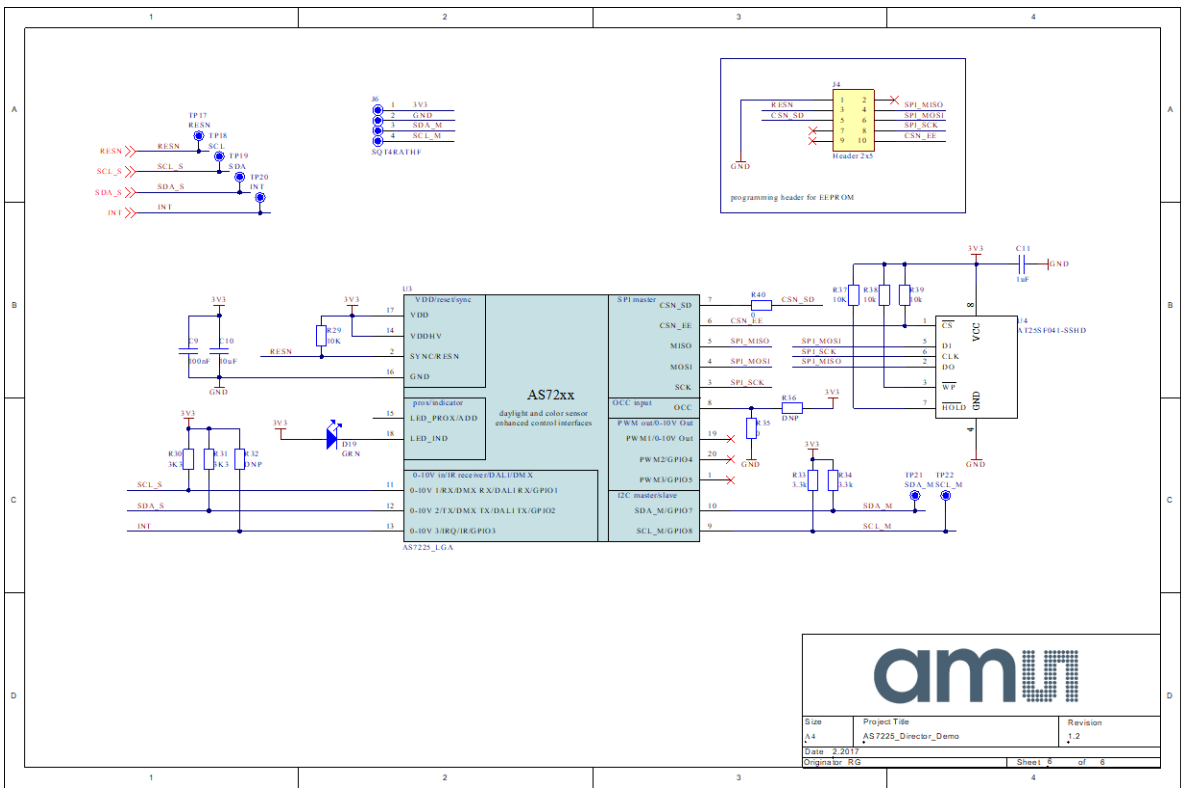
Revision
1.2
Date 2.2017
Originator RG
Sheet 5 of 6


TP17
RESN
TP18
SCL
TP19
SDA
TP20
INT
SCL_S
SDA_S
J6
3V3
GND
SDA_M
SCL_M
SQT4RATHF
J4
SPI_MISO
SPI_MOSI
SPI_SCK
CSN_EE
Header 2x5
programming header for EEPROM
U3
VDD/reset/sync
VDD
VDDHV
SYNC/RESN
GND
pros/indicator
LED_PROX/ADD
LED_IND
AS72xx
daylight and color sensor
enhanced control interfaces
0-10V in/IR receiver/DALI/DMX
0-10V 1/RX/DMX RX/DALI RX/GPIO1
0-10V 2/TX/DMX TX/DALI TX/GPIO2
0-10V 3/IRQ/IRGPIO3
AS7225_LGA
SPI master
CSN_SD
CSN_EE
MISO
MOSI
SCK
OCC input
OCC
PWM out/0-10V Out
PWM1/0-10V Out
PWM2/GPIO4
PWM3/GPIO5
I2C master/slave
SDA_M/GPIO7
SCL_M/GPIO8
C9
C10
100nF
10uF
R29
10K
C11
1uF
R37
10K
R38
10K
R39
10K
R40
0
R36
DNP
R35
0
R33
3.3k
R34
3.3k
TP21
TP22
SDA_M
SCL_M
D19
GRN
R30
3K3
R31
3K3
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WP
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Size
A4
Project Title
AS7225_Director_Demo
Revision
1.2
Date 2.2017
Originator RG
Sheet 6 of 6

6 Ordering & Contact Information

Ordering Code	Description
AS7225 DEMO KIT	AS7225 Smart Light Director Demo Kit

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8 Revision Information

Changes from previous version to current revision 2-00 (2018-Jun-08)	Page
ATCommand and I2C Command table was modified accoding to new firmware release	7-11
Added a Note	11

Note: Page numbers for the previous version may differ from page numbers in the current revision.
Correction of typographical errors is not explicitly mentioned.