Product Document

ams OSRAM

AS7220

Calibrated CCT and Lumen Maintenance Smart Lighting Manager

General Description

The AS7220 Smart Lighting Manager is part of the **ams** Cognitive Lighting™ family of products that enable lights to autonomously adapt to human lighting and energy conservation needs. The device is equipped with an advanced Cognitive Lighting Engine (CLE) to optimize CCT and lumen maintenance and color maintenance via a combination of PWM and/or 0-10V controls with dimming ballasts. Daylight harvesting can also be performed by adding an I²C connected **ams** ambient light sensor.

AS7220 XYZ chromatic white/color sensing provides mapping to x, y (z) of the CIE 1931 2-dimensional color gamut coordinates and scales the coordinates to the CIE 1976 u'v' coordinate system. The AS7220 integrates standard observer filters into standard silicon via nano-optic deposited interference filters which deliver high-stability over time and temperature. The LGA package includes a built-in aperture to control light entering the sensor array. Integrated intelligence enables lifetime CCT calibration to within 2-4 Macadam steps.

The AS7220 connects to standard 0-10V dimmer inputs and drives 0-10V dimming ballasts/drivers to enable a highly cost-effective white tunable current-steering luminaire design with a single-channel constant current ballast. Direct PWM inputs can also interface to standard LED drivers or multi-channel ballasts for constant voltage LED lighting architectures.

Ordering Information and *Content Guide* appear at end of datasheet.

Key Benefits & Features

The benefits and features of this device are listed below:

Figure 1:
Added Value of Using AS7220

| Benefits	Features
• Accurate maintenance of CCT and daylight responsive lighting	• Calibrated XYZ tri-stimulus color sensing for direct translation to CIE 1931/1976 standard observer color maps
• Lifetime-calibrated sensing with minimal drift over time or temperature	• Filter set realized by silicon interference filters
• Optional user/manufacturer configurable CCT maintenance and/or Lumen maintenance	• If enabled, desired CCT and/or Lumen settings are read by the Cognitive Light Engine and maintained by using spectrally tuned light
• Compatible with standard dimmer controls and occupancy sensors	• Directly interfaces to 0-10V dimmer controls and standard occupancy sensors
• Directly interfaces to LED string circuity via PWM outputs	• Built-in PWM generators to dim and control warm/cool luminaire LED strings • 12-bit resolution for precise control down to 1%
• Directly interfaces to ballast via 0-10V	• 0-10V analog output for control of conventional dimming ballasts in a current steering design
• Small package, wide operating range with critical optics built-in	• 20-pin LGA package 4.5mm x 4.7mm x 2.5mm with integrated aperture • -40 °C to 85°C

Applications

Autonomous, solid-state lighting manager for precision fixed CCT and daylight harvesting:

- Configurable CCT and/or lumen maintenance applications

- Luminaires intended to meet California Title 24 daylighting requirements
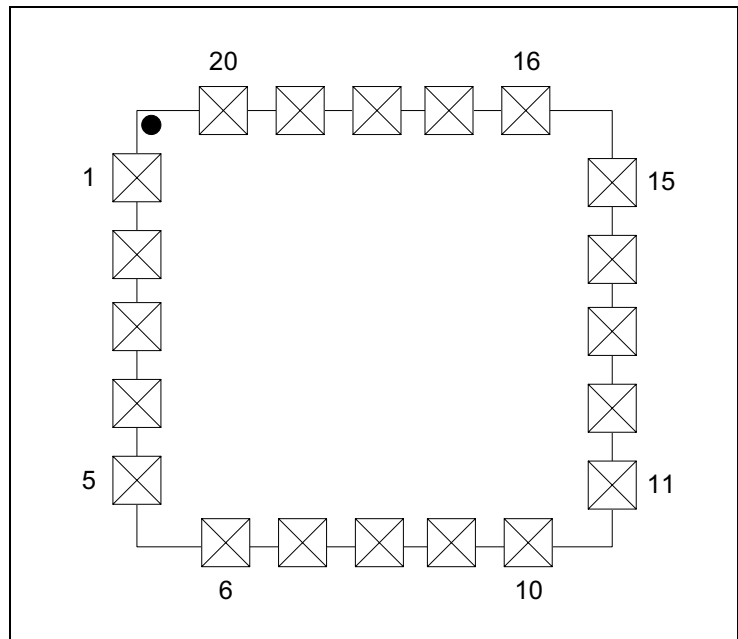
Block Diagram

Figure 2:
Functional Blocks of AS7220
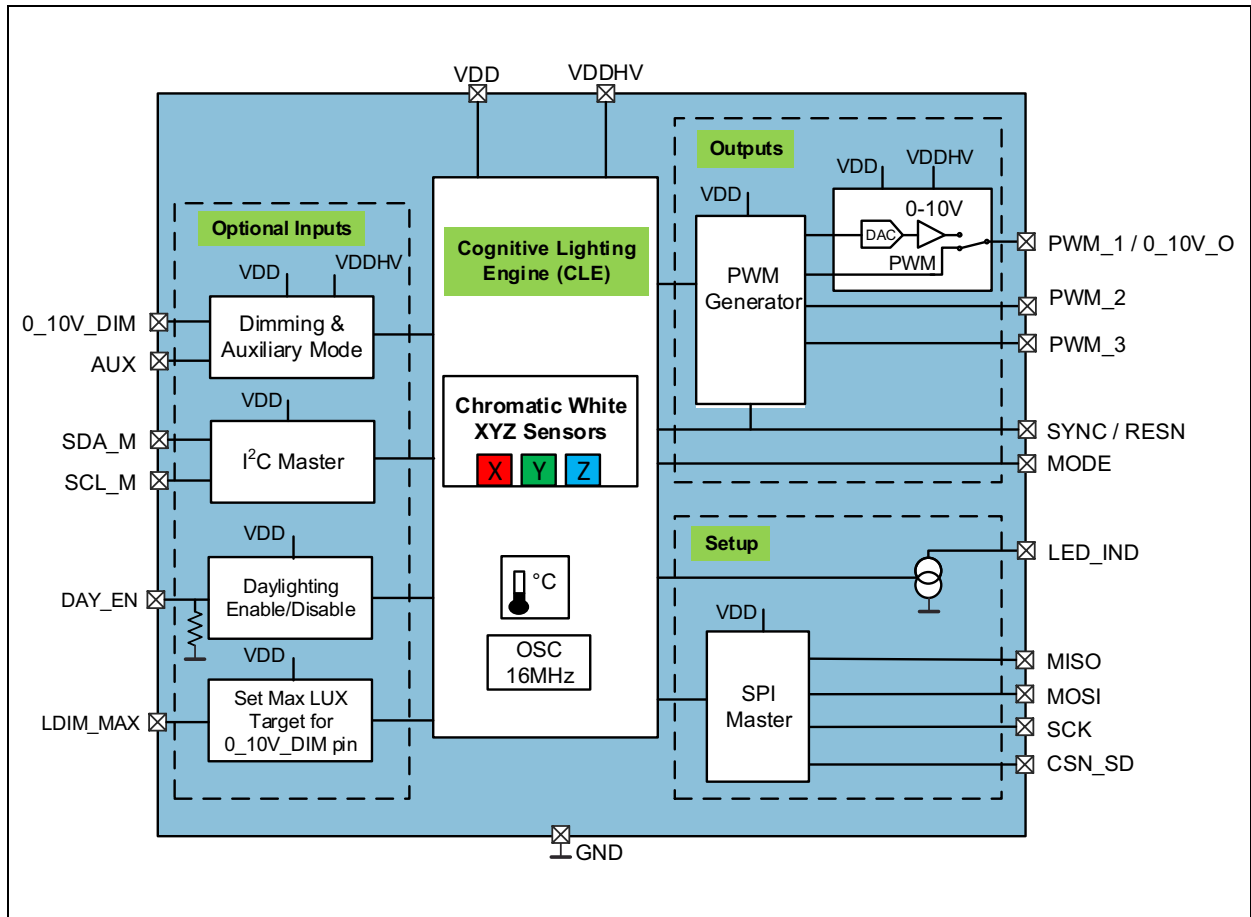
Functional Blocks of AS7220: The AS7220 provides closed loop Chromatic White sensing and PWM tuning while interfacing to local controls or other sensors

Pin Assignments

Figure 3:
Pin Diagram of AS7220 (Top View)

Figure 4:
Pin Description of AS7220 (20 Pin LGA)

Pin Number	Pin Name	Description
1	PWM_3	Digital PWM 3
2	SYNC	SYNC input
	RESN	Reset pin, active low
3	SCK	SPI serial clock
4	MOSI	SPI MOSI
5	MISO	SPI MISO
6	CSN_EE	Chip select for the required external serial flash memory, active low
7	CSN_SD	Chip select for SD Card interface, active low
8	AUX	Auxiliary mode input pin
9	SCL_M	I^{2}C master clock pin
10	SDA_M	I^{2}C master data pin
11	DAY_EN	Daylight enable, active high
12	LDIM_MAX	Sets maximum lumen for 0_10V_DIM inputs

Pin Number	Pin Name	Description
13	0_10V_DIM	0-10V input dimming pin
14	VDDHV	High voltage supply
15	MODE	Mode selection pin
16	GND	Ground
17	VDD	Low voltage supply
18	LED_IND	LED driver output for indicator LED, current sink
19	PWM_1	Digital PWM 1
	0_10V_O	0-10V output pin
20	PWM_2	Digital PWM 2

Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated under Electrical Characteristics is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. The device is not designed for high energy UV (ultraviolet) environments, including upward looking outdoor applications, which could affect long term optical performance.

Figure 5:
Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Units	Comments
Electrical Parameters					
V_{DD_MAX}	Supply Voltage VDD	-0.3	5	V	Pin VDD to GND, Low voltage pin
V_{DDHV_MAX}	Supply Voltage VDDHV	-0.3	20	V	Pin VDDHV to GND, High voltage pin
V_{DD_IO}	Input/Output Pin Voltage	-0.3	VDD + 0.3	V	Low voltage pins to GND
V_{DDHV_IO}	Input/Output Pin Voltage	-0.3	VDDHV + 0.3	V	High voltage pins to GND
I_{SCR}	Input Current (latch-up immunity)		± 100	mA	JESD78D
Electrostatic Discharge					
ESD_{HBM}	Electrostatic Discharge HBM		±1000	V	JS-001-2014
ESD_{CDM}	Electrostatic Discharge CDM		±500	V	JSD22-C101F
Temperature Ranges and Storage Conditions					
T_{strg}	Storage Temperature	-40	85	°C	
T_{body}	Package Body Temperature		260	°C	IPC/JEDEC J-STD-020. The reflow peak soldering temperature (body temperature) is specified according IPC/JEDEC J-STD-020 "Moisture/Reflow Sensitivity Classification for Non-hermetic Solid State Surface Mount Devices"
RH_{NC}	Relative Humidity (non-condensing)	5	85	%	
MSL	Moisture Sensitivity Level		3		Represents a 168 hour max. floor lifetime

Electrical Characteristics

All limits are guaranteed with VDD = 3.3V, VDDHV = 12V, T_{AMB} = 25ºC. The parameters with min and max values are guaranteed with production tests or SQC (Statistical Quality Control) methods.

If VDD and VDDHV are to be the same voltage, they should be sourced by the same 2.97-3.6V supply.

Figure 6:
Electrical Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
General Operating Conditions						
VDD	Low Voltage Operating Supply		2.97	3.3	3.6	V
VDDHV	High Voltage Operating Supply		VDD	12	15	V
T_{AMB}	Operating Temperature		-40	25	85	°C
I_{VDD}	Operating Current				5	mA
Internal RC Oscillator						
F_{OSC}	Internal RC Oscillator Frequency		15.7	16	16.3	MHz
t_{JITTER}[1]	Jitter	@25°C			1.2	ns
0-10V Output (0_10V_O pin)						
R_{OUT_10}	Resistive Load		1			kΩ
I_{S_10}	Source Current		10			mA
I_{SINK_10}	Sink Current		-10			mA
I_{LEAK_HV}	HV Output Leakage Current	VIN=12V, DAC and PWM1 both disabled	-1.6		-0.73	mA
C_{LOAD_10}	Capacitive Load				100	pF
V_{OUT_10}[2]	Output Swing		0		10	V
AUX Input						
AUX_{IN}	AUX Input Voltage	For 100% AUX A/D Conversion		3.0		V
R_{IN_AUX}	Analog Input Resistance		168	240	312	kΩ
0-10V Inputs (0_10V_DIM and LDIM)						
R_{IN_HV}	Analog Input Resistance	VDDHV ≥ 12V	138	200	315	kΩ

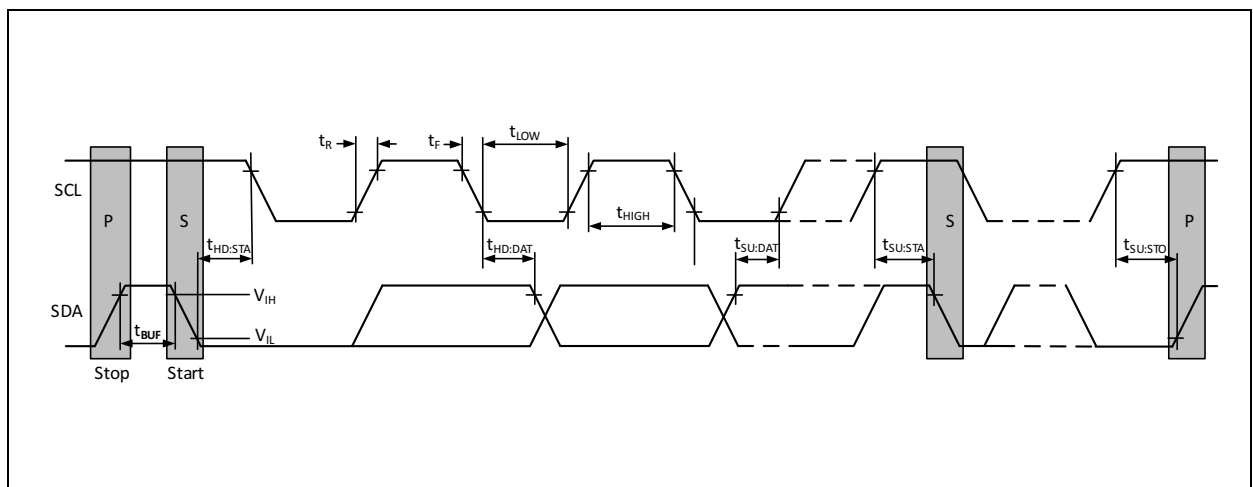| Symbol	Parameter	Conditions	Min	Typ	Max	Unit
DAY_EN and LDIM Inputs						
$V_{MAX\_DAY\_EN}$	Maximum Pin Voltage for DAY_EN				VDD + 0.3	V
V_{MAX_LDIM}	Maximum Pin Voltage for LDIM				VDDHV+ 0.3	V
$R_{INT\_DAY\_EN}$	Internal Resistor (to GND) for DAY_EN Pin			10		kΩ
Temperature Sensor						
D_{TEMP}	Absolute Accuracy of the Internal Temperature Measurement		-8.5		8.5	°C
Indicator LED						
I_{IND}	LED Current		1		8	mA
I_{ACC}	Accuracy of Current		-30		30	%
V_{LED}	Voltage Range of Connected LED	Vds of current sink	0.3		VDD	V
Digital Inputs and Outputs						
I_{IH}, I_{IL}	Logic Input Current	Vin=0V or VDD	-1		1	µA
I_{IL} SYNC/RESN	Logic Input Current (SYNC/RESN pin)	Vin=0V	-1		-0.2	mA
V_{IH}	CMOS Logic High Input		0.7* VDD		VDD	V
V_{IL}	CMOS Logic Low Input		0		0.3* VDD	V
V_{OH}	CMOS Logic High Output	I=1mA			VDD-0.4	V
V_{OL}	CMOS Logic Low Output	I=1mA			0.4	V
t_{RISE} [1]	Current Rise Time	C(Pad)=30pF			5	ns
t_{FALL} [1]	Current Fall Time	C(Pad)=30pF			5	ns

Note(s):

1. Guaranteed, not production tested
2. For VDDHV>10.5, output max is 10V, else output max tracks VDDHV

Figure 7:
I²C Master Timing Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		I²C Interface				
f_{SCLK}	SCL Clock Frequency			100	400	kHz
t_{BUF}	Bus Free Time Between a STOP and START		1.3			µs
$t_{HD:STA}$	Hold Time (Repeated) START		0.6			µs
t_{LOW}	LOW Period of SCL Clock		1.3			µs
t_{HIGH}	HIGH Period of SCL Clock		0.6			µs
$t_{SU:STA}$	Setup Time for a Repeated START		0.6			µs
$t_{HD:DAT}$	Data Hold Time		0		0.9	µs
$t_{SU:DAT}$	Data Setup Time		100			ns
t_R	Rise Time of Both SDA and SCL		20		300	ns
t_F	Fall Time of Both SDA and SCL		20		300	ns
$t_{SU:STO}$	Setup Time for STOP Condition		0.6			µs
C_B	Capacitive Load for Each Bus Line	CB — total capacitance of one bus line in pF			400	pF
$C_{I/O}$	I/O Capacitance (SDA, SCL)				10	pF

Figure 8:
I²C Master Timing Diagram

Figure 9:
SPI Timing Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		SPI Interface				
f_{SCK}	Clock Frequency		0		16	MHz
t_{SCK_H}	Clock High Time		40			ns
t_{SCK_L}	Clock Low Time		40			ns
t_{SCK_RISE}	SCK Rise Time		5			ns
t_{SCK_FALL}	SCK Fall Time		5			ns
t_{CSN_S}	CSN Setup Time	Time between CSN high-low transition to first SCK high transition	50			ns
t_{CSN_H}	CSN Hold Time	Time between last SCK falling edge and CSN low-high transition	100			ns
t_{CSN_DIS}	CSN Disable Time		100			ns
t_{DO_S}	Data-Out Setup Time		5			ns
t_{DO_H}	Data-Out Hold Time		5			ns
t_{DI_V}	Data-In Valid		10			ns

Figure 10:
SPI Master Write Timing Diagram
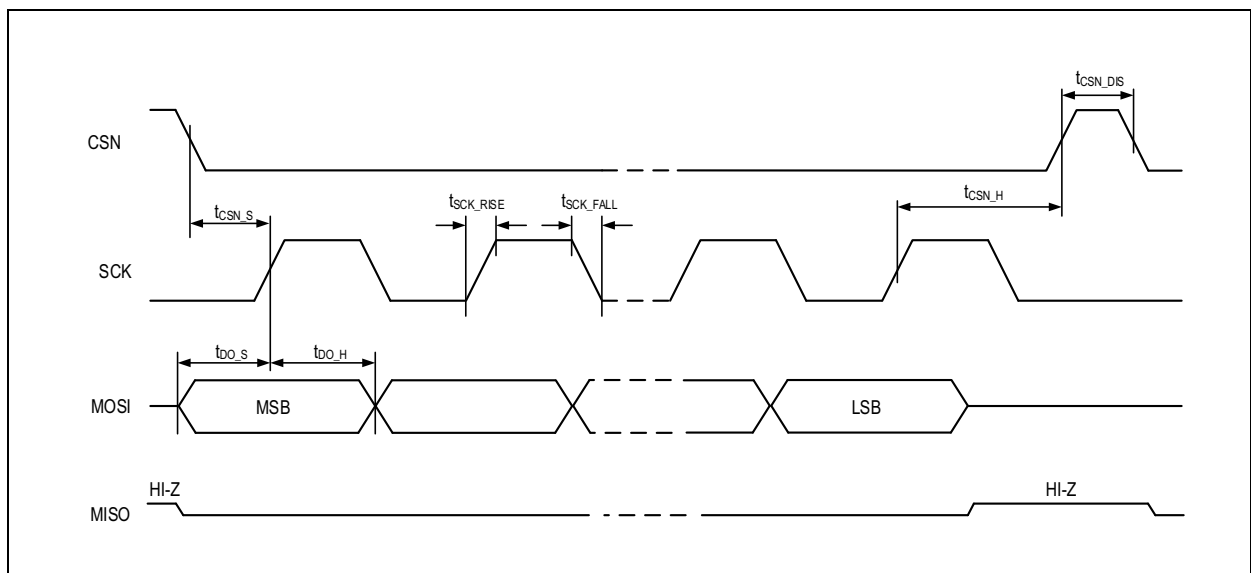
Figure 11:
SPI Master Read Timing Diagram
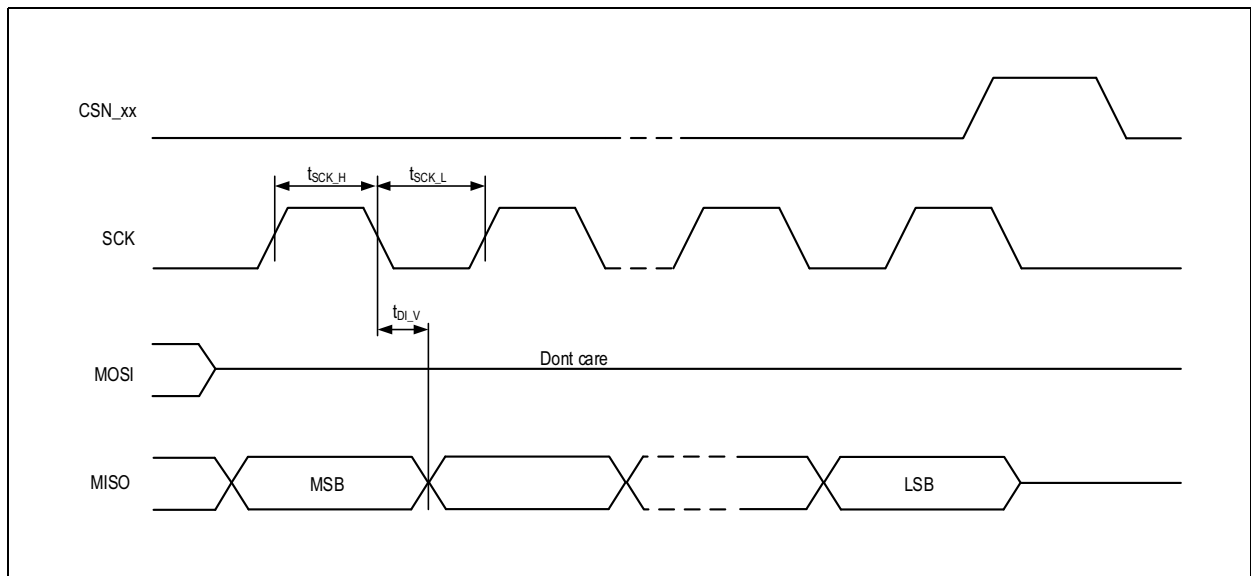
Figure 12:
Typical Spectral Responsivity
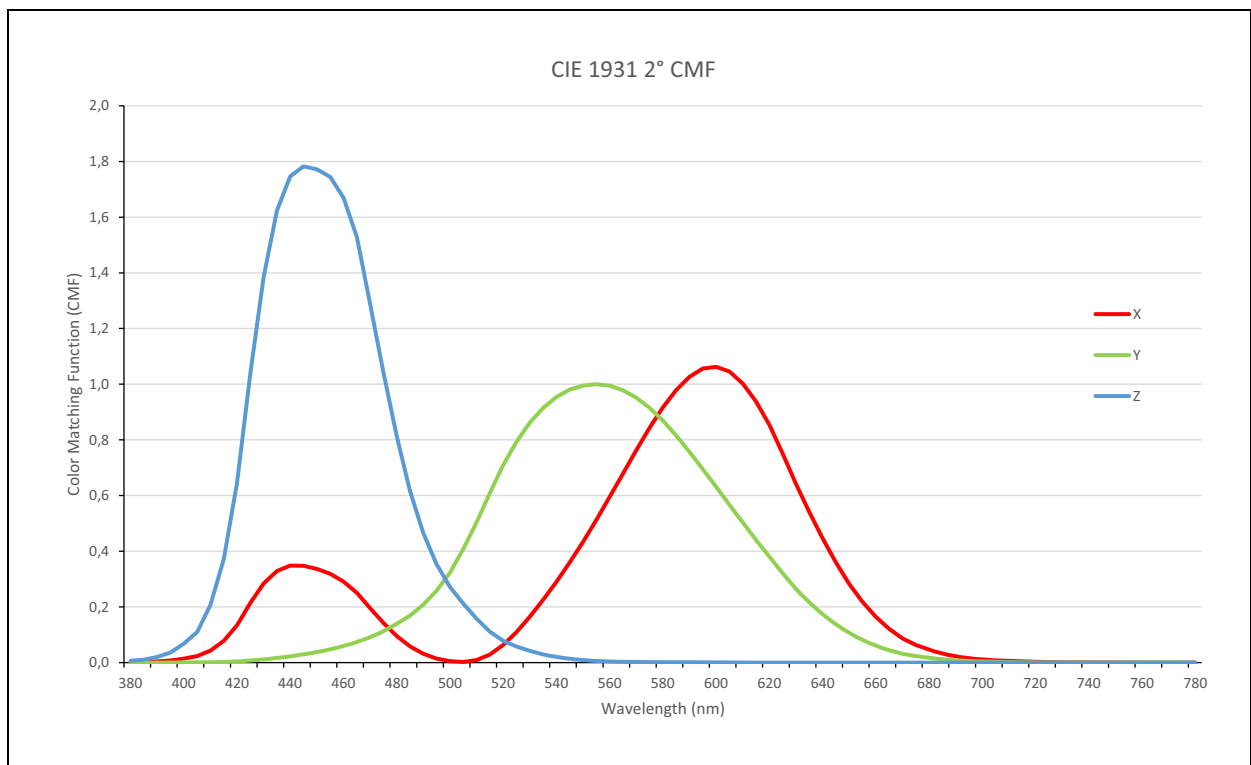
Figure 13:
AS7220 Optical Characteristics

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
Color_m[2]	Color Measurement Accuracy	White Light CCT=2700K, 3500K, 4500K and 5700K		0.002		du'v'
Z_count	Z Channel Count Accuracy	White light CCT = 5700K	3.375	4.5	5.625	counts/ ($\mu W/cm^2$)

Note(s):

1. Typical values at Lux ≥50, Integration time=400.4ms, Gain=1x, T_{AMB} = 25°C.

2. Calibration and measurements are made using diffused light.

Figure 14:
AS7220 LGA Package Field of View
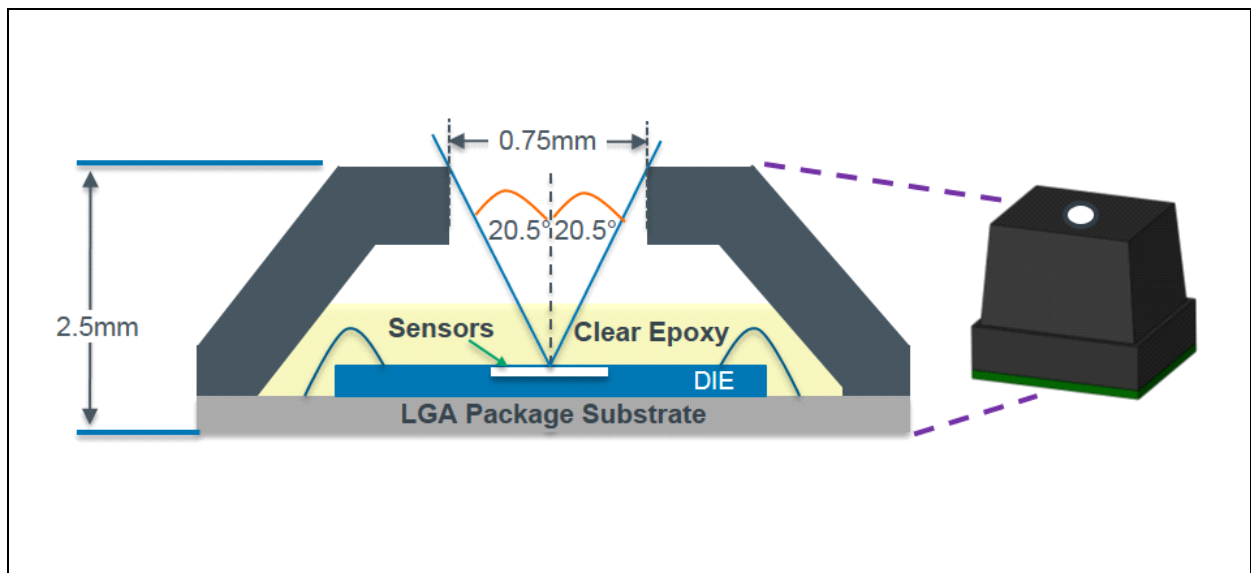
Detailed Description

AS7220 Smart Lighting Manager - Overview

The Cognitive Light Engine (CLE) is the "brains" of the Smart Lighting Manager. The CLE constantly processes information from the calibrated XYZ chromatic white/color sensor and inputs while controlling outputs. AS7220 initial setup and ongoing parameter storage is automatically performed by software within the required external serial flash memory, via SPI bus.

XYZ color point response is implemented via standard observer interference filters which are extremely stable over time and temperature. Filter accuracy is affected by the optical angle of incidence which itself is limited by an integrated aperture and an internal micro-lens structure in the AS7220. The package field of view (PFOV) is ±20.5° to deliver the specified accuracy. External optics can be used as needed to expand or reduce this built in PFOV.

A luminaire solution for chromatic white/color maintenance with CCT maintenance and/or lumen maintenance requires the AS7220. A luminaire solution with chromatic white color/maintenance, lumen maintenance and daylighting requires only the addition of an **ams** TSL4531 single chip ambient light sensor, connected via I^{2}C. Refer to the table in Figure 15 below.

Overall AS7220 timing generation uses an on chip 16MHz temperature compensated oscillator for master clock timing.

Refer to the separate AS7220 User Guide for additional usage and setup information.

Figure 15:
AS7220 Solution Chart

Solution Required			Device Orientation (from luminaire light source)	
Chromatic Color Maintenance	Lumen Maintenance	Daylighting	AS7220	TSL4531 (optional)
√	√	×	↑ (into luminaire)	× (not required)
√	√	√	↑ (into luminaire)	↓ (into room)

XYZ Chromatic White Color Sensor

The XYZ chromatic white/color sensor, part of the AS7220 Cognitive Light Engine (CLE), is a next-generation digital color sensor device. The sensor contains an integrating analog-to-digital converter (16-bit resolution ADC), which integrates current from photodiodes. Upon completion of the conversion cycle, the result is transferred to the corresponding data registers. Transfers are double-buffered to ensure integrity of the data is maintained.

AS7220 Inputs

Figure 16:
VDDHV Based Settings for Inputs

VDDHV	Dimming
10.5-15V	Direct input for 0_10V_DIM, dimming input
2.97-10V [1]	External 5:1 resistor divider for 0-10V_DIM, dimming input [2]

Note(s):

1. For VDDHV <= 3.6V, VDDHV and VDD should be tied together.
2. With external dividers connected to 0-10V inputs, the max voltage to the device input is 2V.

Figure 17:
0-10V Dimming Pin Input
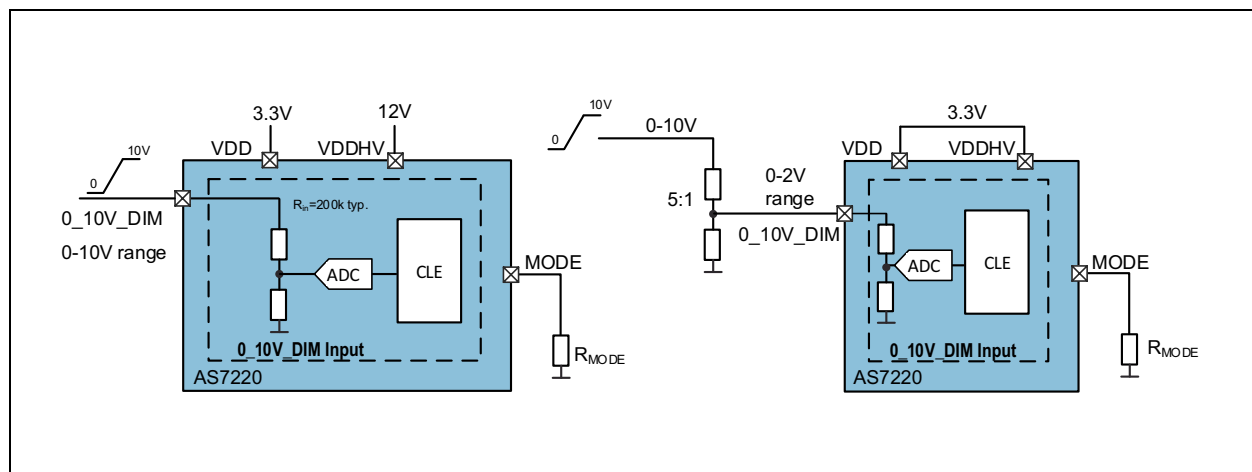
For the AS7220, dimming is accomplished from the input pin (0_10V_DIM). Local hardware inputs can be provided by, for example, a slide control dimmer. The 0-10V DIM analog input signal is downscaled by the AS7220 with an internal voltage divider and converted to a 10 bit digital value, 0V=full dimming, 10V=no dimming. When using the internal voltage divider the voltage at the VDDHV pin has to be higher than 10V, typically 12V.

If a second supply is not available, VDDHV and VDD are tied together and the downscale has to be implemented using an external resistor divider. The maximum range in the downscaled input is limited to 2V. Hence to accept a full range 10V signal the input resistor divider has to be 5:1 ratio. Dependent on the level at pin VDDHV the Smart Lighting Manager automatically scales the internal A/D for either a 0-2V or 0-10V range. Refer to the Figures above. If the 0_10V_DIM pin is not used, an external resister pull-up connecting it to VDDHV is recommended.

Figure 18:
AUX Input
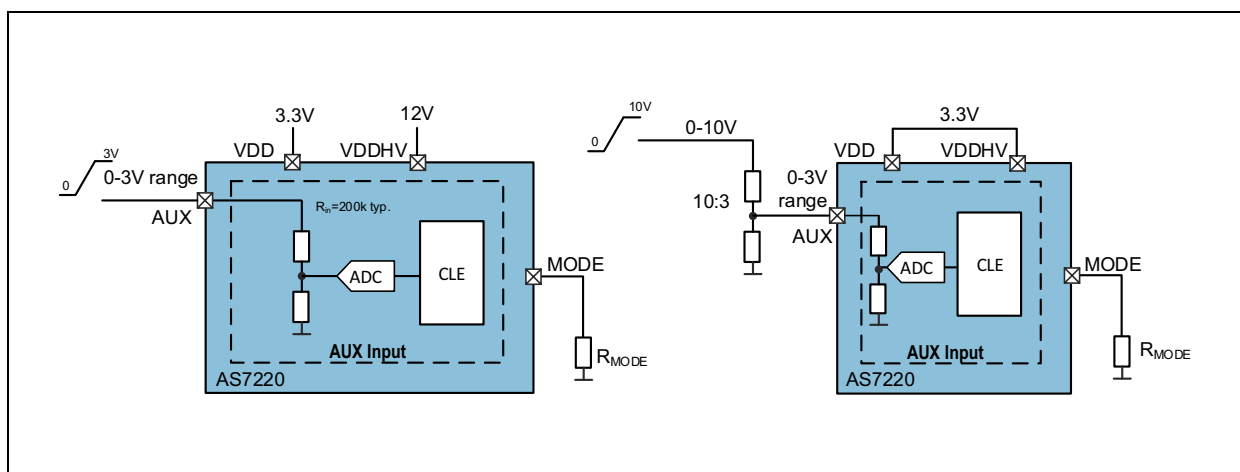
The AUX input is used as a sensor input to allow additional control, in addition to the 0-10V slider dimming function the 0_10V_DIM pin does. The sensed AUX voltage is scaled and used to multiply the dimming scale. The auxiliary sensor input (AUX) has a 0-3V range for its default analog sensing mode. With this 0-3V range external ranges such as 0-10V can be accommodated using external resister divider networks such as a 10:3 network for a 0-10V occupancy sensor. The AUX pin can also be configured for digital sensing (0, 1 where 1=VDD) in one of two ways. A flash memory reserved location can be set when programming the Flash device for operation, or external I²C access port expanders native to the AS7220 can be used to set digital sensing. Refer to the separate AS7220 User Guide for detailed design information for AUX usage. If the AUX pin is not used, an external resistor pull-up connecting it to VDD is recommended.

External sensors with native support by the AS7220 can be added via the I²C master interface. For example the **ams** TSL4531 can be used to add Daylighting operation to the AS7220. Once the TSL4531 is detected by the AS7220, and the DAY_EN pin has been set to 1 (VDD), daylighting operation begins.

Lumen and/or CCT maintenance can also be configured two ways. One is by programming reserved AS7220 flash memory locations when the entire memory is being programmed.

Alternately, for the flexibility of being able to set these maintenance functions with dip switches designed into the luminaire, the AS7220 I²C master interface can be used to interface to I²C port expanders that are native to the AS7220. These ports are then automatically used to read dip-switch settings for maintenance. Refer to the separate AS7220 User Guide for detailed design information for Lumen and CCT maintenance.

The AS7220 can also use an input, the LDIM pin, to set a maximum LUX target for the dimmer input (0_10V_DIM pin). The LDIM pin voltage is converted to one of five max LUX target settings: 0 (LDIM off), 100, 250, 500 or 1000. An LDIM setting, other than 0 (off), is only used if daylighting is enabled (DAY_EN pin) and the AS7220 detects an external **ams** TSL4531 needed for daylighting as described above. The daylighting LUX target is set one of two ways. If LDIM is off, the LUX target is set after every movement of the dimmer input by briefly opening the daylighting control loop and measuring LUX. If LDIM is on, the dimmer input sets the LUX target by percentage (0-100%) of the LDIM LUX maximum setting. Refer to the separate AS7220 User Guide for detailed design information for LDIM operation.

Synchronization and Reset

Figure 19:
Synchronization and Reset Circuit
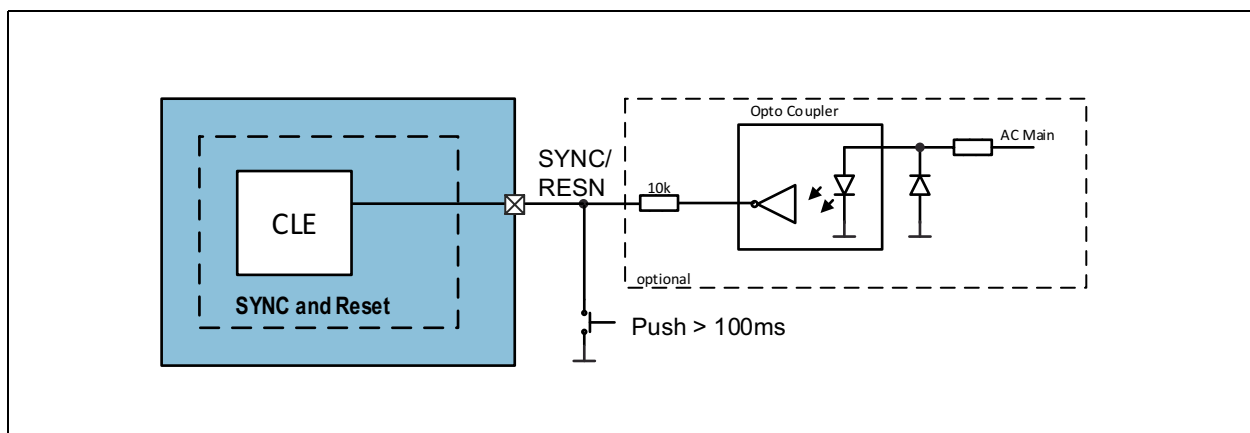
Synchronization and Reset Circuit: This figure shows the basic diagram when using reset and synchronization function together.

AS7220 provides optional synchronization of the PWMs. This sync signal can be derived from the AC mains to enable all luminaires in a room to be synchronized to prevent beat frequency flicker. If the SYNC pin is left open, synchronization is automatically disabled by the internal pull-up connected to the SYNC/RESN pin.

Refer to the Figure above. When pulled down for more than 100ms the SYNC/RESN pin will reset the AS7220 Smart Lighting Manager. In this case the push-button "overrides" the output of the opto-coupler. Therefore a resistor should be placed in series with the opto-coupler.

AS7220 Outputs

The AS7220 outputs, used to control dimming and LED warm/cool strings, can be configured as either three PWM outputs, two PWMs and one analog output, or two PWMs. The PWMs are 12 bit and are factory set to 888 Hz. Refer to the Figure below.

The three PWM outputs, PWM_1, PWM_2 and PWM_3 all switch with the same frequency, but not simultaneously for better EMI performance.

The PWM_1 output can be set to either analog (0-VDDHV) or digital (0-VDDHV) dimming. Analog dimming range is 0-100%. Digital Dimming range is 0-100%. PWM2 and PWM3 are used for cool white and warm white LED color controlling. Either string can be warm or cool as the AS7220 automatically configures string color type. Range is 0-100% for both PWM2 and PWM3.

To set the desired device operation MODE use the appropriate R_{MODE} resistor, also shown in the Figure below.

Figure 20:
Outputs

MODE	R_{MODE}	Setting	Outputs	
			PWM_1/0_10V_O	**PWM_2 and PWM_3**
0	100 Ω	0-10V analog	Analog 0-VDDHV [1]	Digital PWMs (0-VDD)
1	470 Ω	0-10V digital	Digital PWM (0-VDDHV) [1]	Digital PWMs (0-VDD)
2	1000 Ω	Digital 2-CH color tuning	n.a.	Digital PWMs (0-VDD), w/Dimming

Note(s):

1. For VDDHV>10.5, output max is 10V, else output max tracks VDDHV.

Indicator LED

An LED, connected to pin LED_IND, is used to indicate programming progress of the device. During programming of the AS7220 via an external SD card, the indicator LED starts blinking operation. When programming is finished the indicator LED stays on. The LED_IND pin is set for 1mA operation by the AS7220 factory firmware, and is not under user control.

Refer to the separate **ams** document for a complete description of AS7220 Firmware Update Methodology.

I²C Master Interface (Local Sensor Interface)

The I²C Master interface can be used to connect external sensors native to the AS7220 (such as Daylight, Occupancy, CO sensors, etc.). Refer to the separate **ams** Application note for external sensor usage with the AS7220.

I²C Feature List

- Clock is set to 100kHz

- 7+1-bit addressing mode.

- **Write formats:** Single-Byte-Write, Page-Write

- **Read formats:** Random-Read, Sequential-Read

The AS7220 is compatible to the NXP two wire specifications. http://www.nxp.com/documents/user_manual/UM10204.pdf Version 4.0 Feb 2012 for standard mode and fast mode.

Application Information

Schematics

Figure 21:
LED Chromatic Color and Lumen Maintenance with Daylighting
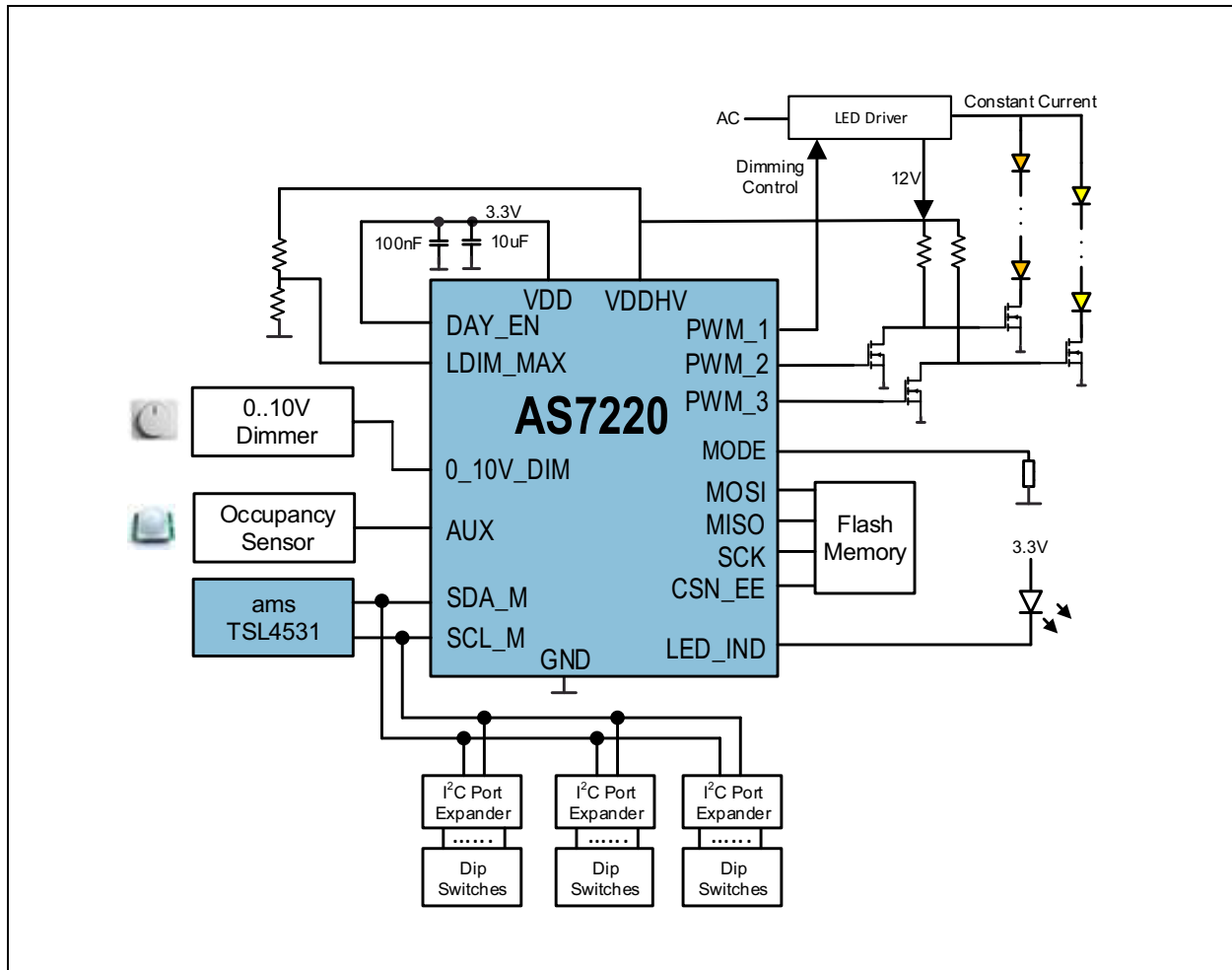
Note(s):

1. Mechanically, the AS7220 is inward luminaire looking for color tuning and the **ams** TSL4531 is outward luminaire looking to support Daylighting.

2. The I²C port expanders and dip switches are only needed to allow field setting of desired Color and Lumen Maintenance values. The port expanders are not needed if a one time setting of maintenance values when the luminaire is manufactured is desired, as one time settings can be made in the external flash memory at the time of flash programming.

3. Refer to the AS7220 User Guide for detailed design and general information regarding Lumen and CCT maintenance.

PCB Layout

Suggested PCB pad layout guidelines for the LGA package are shown. Flash Gold is recommended as a surface finish for the landing pads.

Figure 22:
Typical Layout Routing
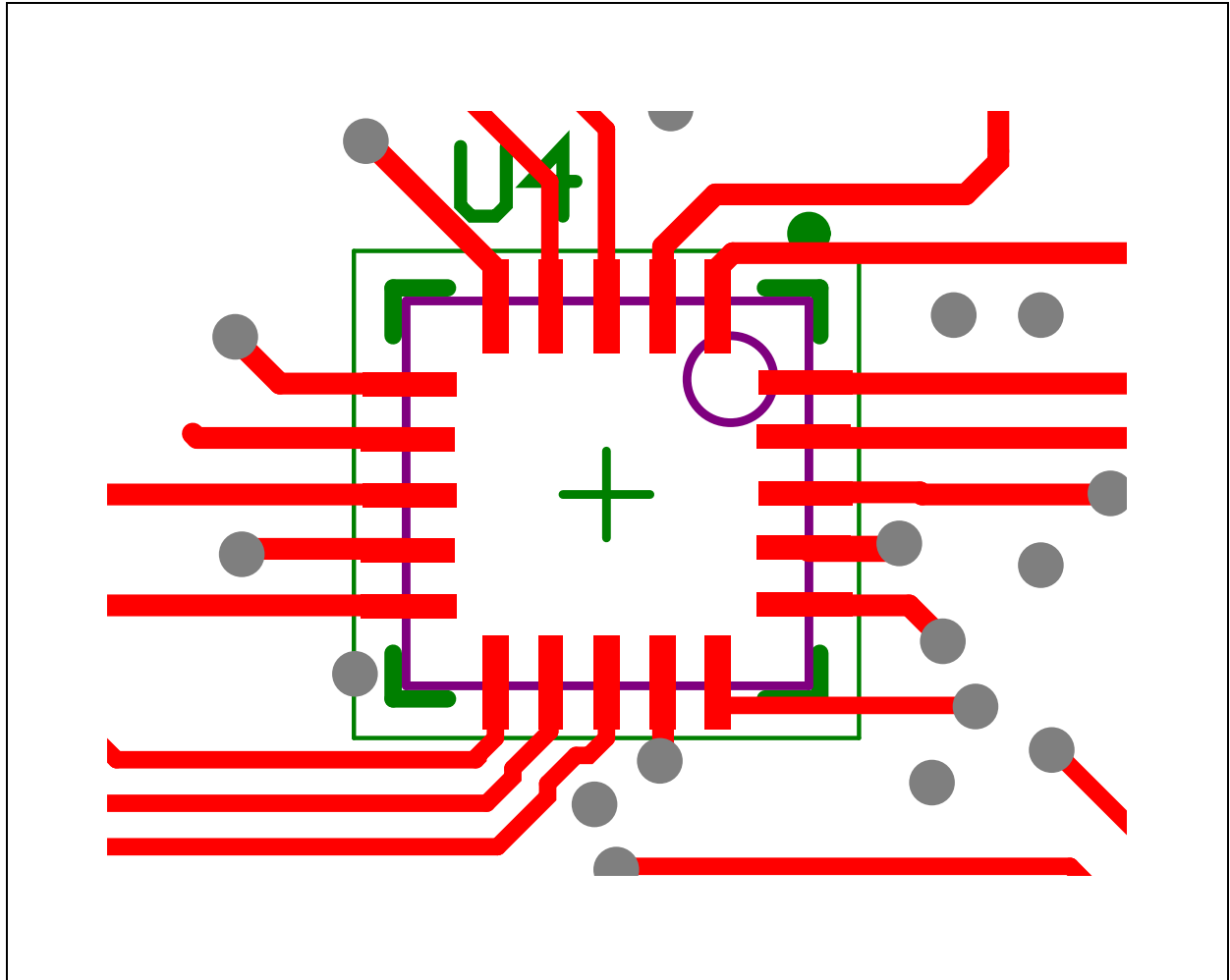

In order to prevent interference, avoid trace routing feedthroughs with exposure directly under the AS7220. An example routing is illustrated in the diagram.

The AS7220 Smart Lighting Integration Kit (SLIK) demo board with schematic and PCB layout documentation is available from **ams** for additional design information.

Package Drawings & Markings

Figure 23:
Package Drawing
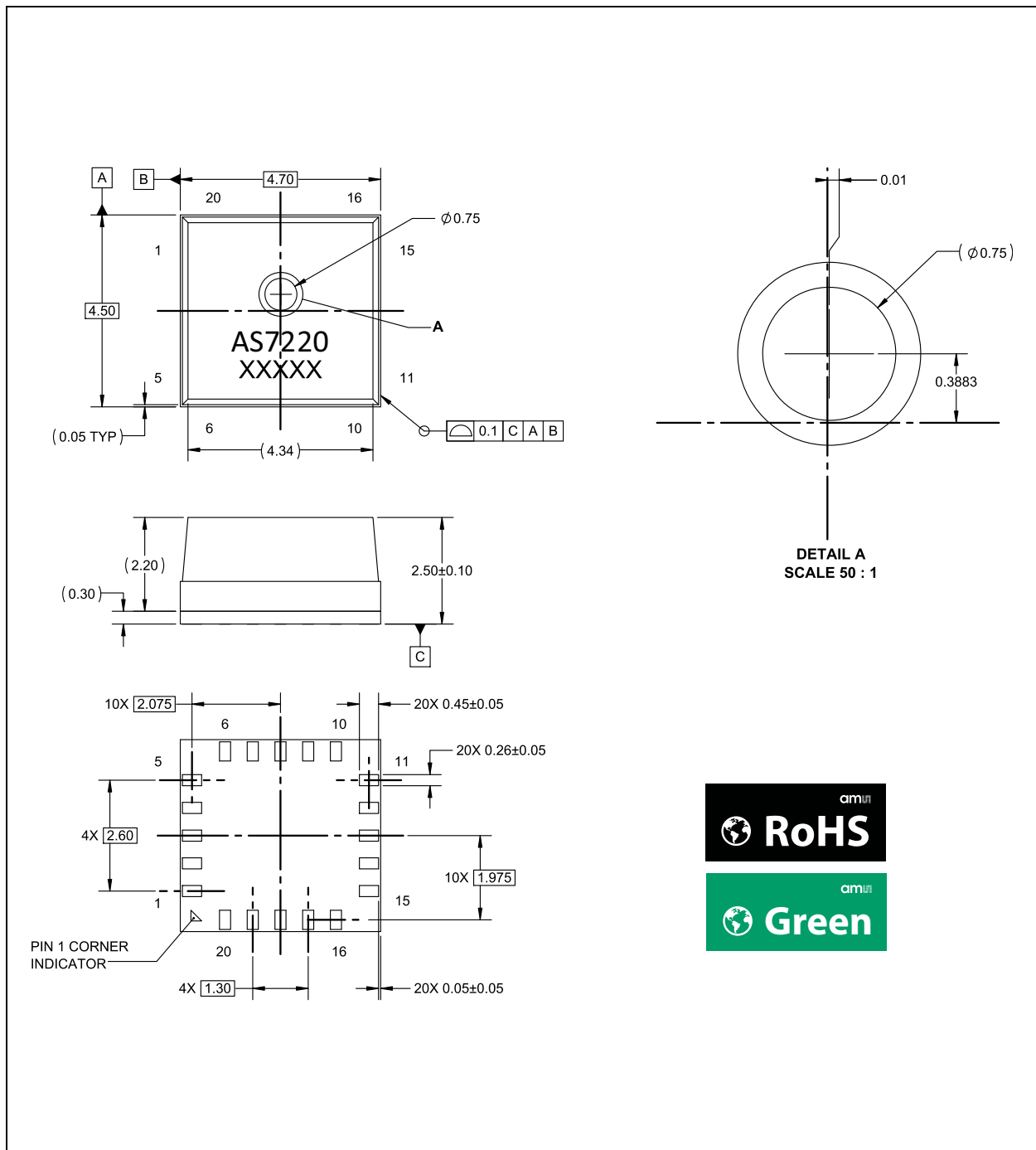
Note(s):

1. XXXXX = tracecode

2. Unless otherwise specified, all dimensions are in millimeters.

3. Tolerances: Angular (±0.5°), Two Place Decimal (±0.015), Three Place Decimal (±0.010)

4. Contact finish is Au.

5. This package contains no lead (Pb).

6. This drawing is subject to change without notice.

PCB Pad Layout

Suggested PCB pad layout guidelines for the LGA package are show. Flash Gold is recommended as a surface finish for the landing pads.

Figure 24:
Recommended PCB Pad Layout
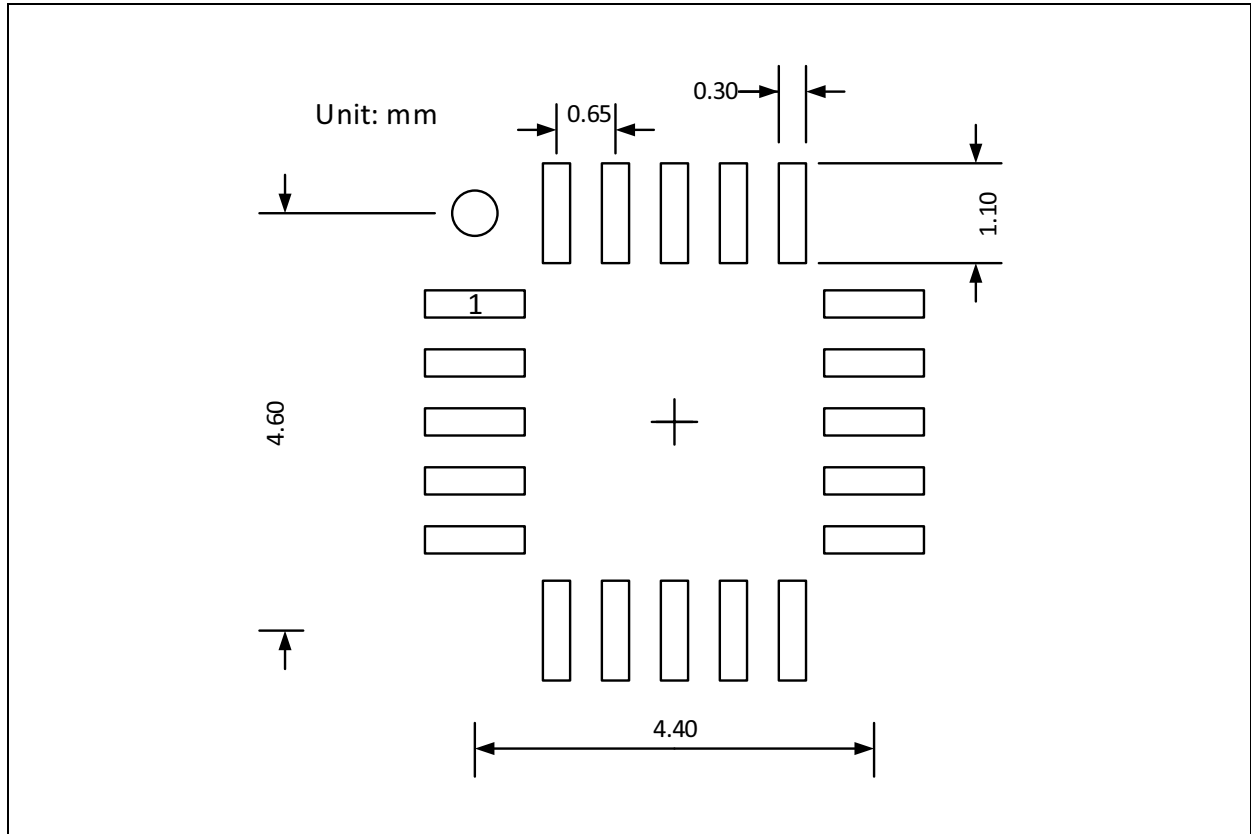
Note(s):

1. Unless otherwise specified, all dimensions are in millimeters.

2. Dimensional tolerances are ±0.05mm unless otherwise noted.

3. This drawing is subject to change without notice.

Mechanical Data

Figure 25:
Tape & Reel Information

Ao	4.80	+/- 0.10
Bo	5.00	+/- 0.10
Ko	2.80	+/- 0.10
F	5.50	+/- 0.05
P1	8.00	+/- 0.10
W	12.00	+/- 0.30
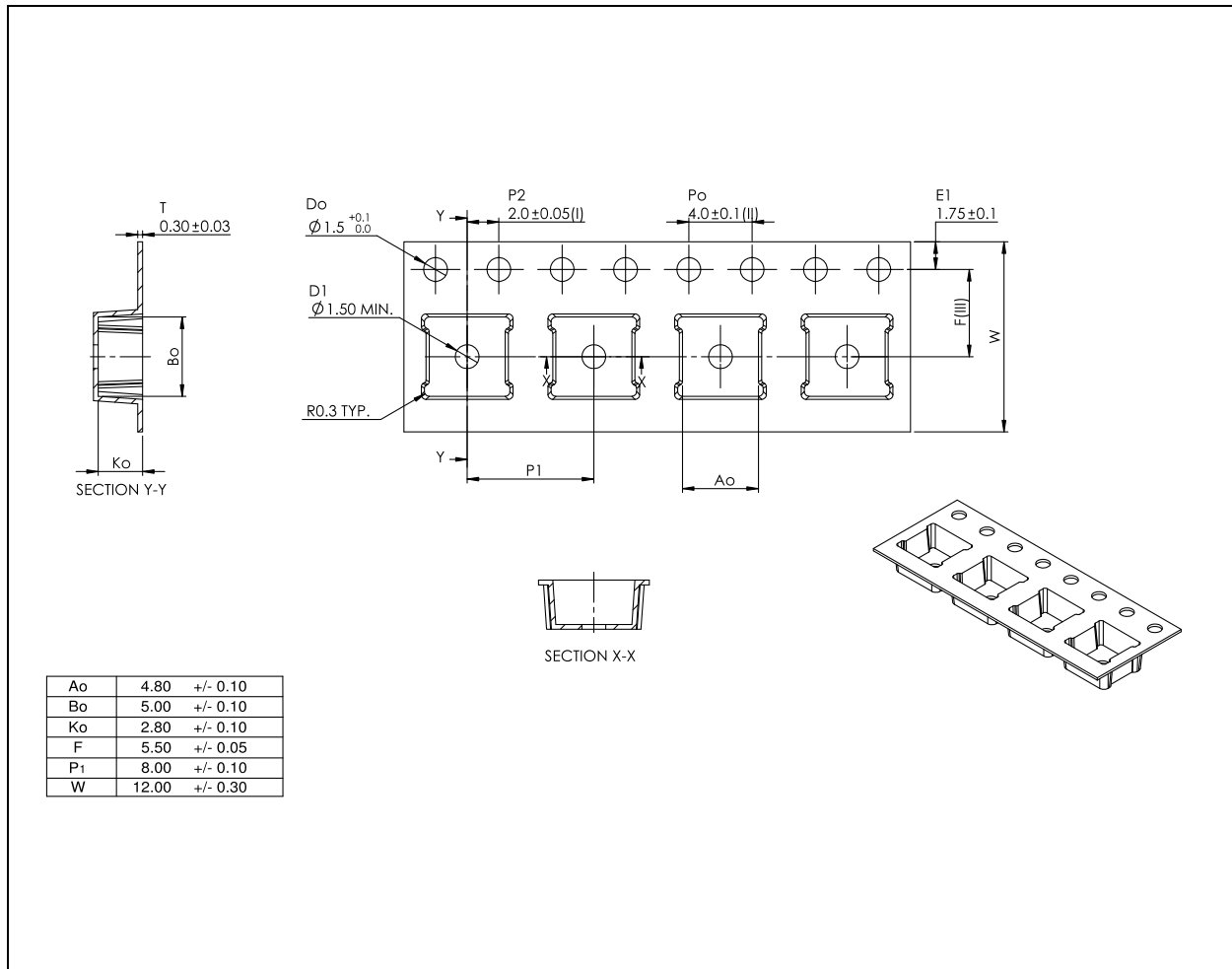
Note(s):

1. All dimensions in millimeters unless of otherwise stated.

2. Measured from centreline of sprocket hole to centreline of pocket.

3. Cumulative tolerance of 10 sprocket holes is ±0.20.

4. Measured from centreline of sprocket hole to centreline of pocket.

5. Other material available.

Soldering, Manufacturing Process Considerations & Storage Information

Solder Reflow Profile

The module has been tested and has demonstrated an ability to be reflow soldered to a PCB substrate. The solder reflow profile describes the expected maximum heat exposure of components during the solder reflow process of product on a PCB. Temperature is measured on top of component. The components should be limited to a maximum of three passes through this solder reflow profile.

Figure 26:
Recommended Reflow Soldering Profile

Profile Feature	Reference	Device
Average temperature gradient in preheating		2.5°C/s
Soak Time	t_{SOAK}	2 to 3 minutes
Time above 217°C (T1)	t_1	Max 60s
Time above 230°C (T2)	t_2	Max 50s
Time above Tpeak - 10°C (T3)	t_3	Max 10s
Peak temperature in reflow	Tpeak	260°C
Temperature gradient in cooling		Max - 5°C/s

Figure 27:
Soldering Profile Graph
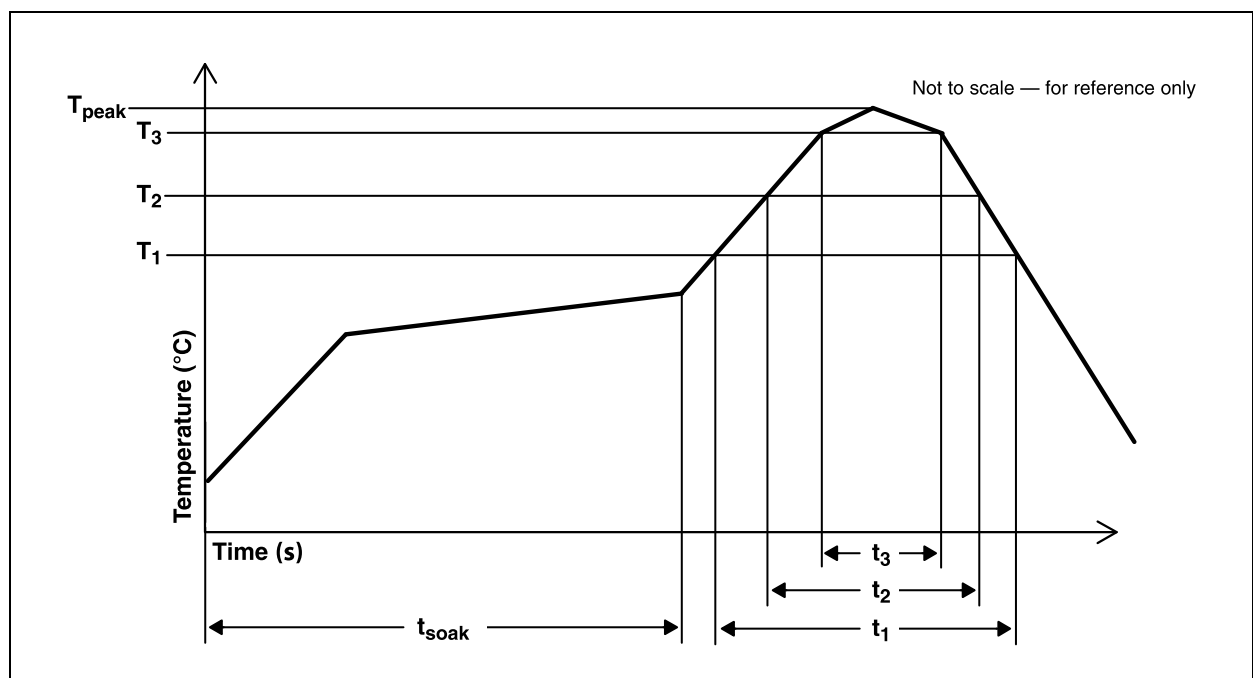
Manufacturing Process Considerations

The AS7220 package is compatible with standard reflow no-clean and cleaning processes including aqueous, solvent or ultrasonic techniques. However, as an open-aperture device, precautions must be taken to avoid particulate or solvent contamination as a result of any manufacturing processes, including pick and place, reflow, cleaning, integration assembly and/or testing. Temporary covering of the aperture is allowed. To avoid degradation of accuracy or performance in the end product, care should be taken that any temporary covering and associated sealants/debris are thoroughly removed prior to any optical testing or final packaging.

Storage Information

Moisture Sensitivity Optical characteristics of the device can be adversely affected during the soldering process by the release and vaporization of moisture that has been previously absorbed into the package. To ensure the package contains the smallest amount of absorbed moisture possible, each device is baked prior to being dry packed for shipping. Devices are dry packed in a sealed aluminized envelope called a moisture-barrier bag with silica gel to protect them from ambient moisture during shipping, handling, and storage before use.

Shelf Life

The calculated shelf life of the device in an unopened moisture barrier bag is 12 months from the date code on the bag when stored under the following conditions:

- Shelf Life: 12 months

- Ambient Temperature: <40°C

- Relative Humidity: <90%

Rebaking of the devices will be required if the devices exceed the 12 month shelf life or the Humidity Indicator Card shows that the devices were exposed to conditions beyond the allowable moisture region.

Floor Life

The module has been assigned a moisture sensitivity level of MSL 3. As a result, the floor life of devices removed from the moisture barrier bag is 168 hours from the time the bag was opened, provided that the devices are stored under the following conditions:

- Floor Life: 168 hours

- Ambient Temperature: <30°C

- Relative Humidity: <60%

If the floor life or the temperature/humidity conditions have been exceeded, the devices must be rebaked prior to solder reflow or dry packing.

Rebaking Instructions

When the shelf life or floor life limits have been exceeded, rebake at 50°C for 12 hours.

Ordering & Contact Information

Figure 28:
Ordering Information [1]

Ordering Code	Description	Package	Marking	Delivery Form	Delivery Quantity
AS7220- BLGT	Calibrated CCT and Lumen Maintenance Smart Lighting Manager	20-pin LGA	AS7220	Tape & Reel	2000 pcs/reel

Note(s):

1. Required companion serial flash memory (must be **ams** verified) is ordered from the flash memory supplier (e.g. AT25SF041-SSHD-B from Adesto Technologies).
2. AS7220 flash memory software is available from **ams**.

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Headquarters
ams AG
Tobelbader Strasse 30
8141 Premstaetten
Austria, Europe

Tel: +43 (0) 3136 500 0

Website: www.ams.com

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ams Green (RoHS compliant and no Sb/Br): ams Green defines that in addition to RoHS compliance, our products are free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material).

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Document Status

Document Status	Product Status	Definition
Product Preview	Pre-Development	Information in this datasheet is based on product ideas in the planning phase of development. All specifications are design goals without any warranty and are subject to change without notice
Preliminary Datasheet	Pre-Production	Information in this datasheet is based on products in the design, validation or qualification phase of development. The performance and parameters shown in this document are preliminary without any warranty and are subject to change without notice
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Revision Information

Initial production version 1-00

Content Guide