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TMG4903

Gesture, Color and Proximity Sensor Module with mobeam™ Barcode Emulation and IR Remote Control

General Description

The TMG4903 features ambient light and color (RGB) sensing, proximity detection, and IRBeam optical pattern generator capable of mobeam™ barcode emulation and IR remote control in parallel. In addition, the device integrates an IR LED and advanced LED driver, all within a low-profile and small footprint, 2.0mm x 5.0mm x 1.0mm package.

The Gesture and Proximity sensing function synchronizes IR emission and detection to sense gesture and proximity events. The architecture of the engine features automatic high sample rate activation, self-maximizing dynamic range, ambient light subtraction, advanced crosstalk cancelation, 14-bit data output, 32-dataset FIFO, and interrupt-driven I^2C communication. Sensitivity, power consumption, and noise can be optimized with adjustable IR LED timing and power. The gesture engine is capable of 3D detection of motion and position. Gesture interrupts are configurable to reduce I^2C communication load.The proximity engine recognizes detect/release events and produces a configurable interrupt whenever proximity result crosses upper or lower threshold settings.

The Ambient Light and Color Sensing function provides Red, Green, and Blue (RGB) ambient light sensing with a Clear reference (C). The color diode array has a UV/IR blocking filter and parallel ADCs to produce simultaneous 16-bit results. This architecture accurately measures ambient light and enables the calculation of illuminance, chromaticity, and color temperature to manage display appearance.

The IRBeam pattern generator supports mobeam™ barcode emulation and IR remote control. The engine features RAM for pattern storage and specialized control logic that is tailored to repetitively broadcast a barcode pattern using the integrated LED or an external LED with a low side driver. The IRBeam engine features adjustable timing, looping, and IR intensity to maximize successful transmission. IRBeam is designed to support all requirements for 1-D barcode transmission over IR to point-of-sale (POS) terminals as well as IR remote control.

Ordering Information and Content Guide appear at end of datasheet.

Key Benefits & Features

The benefits and features of TMG4903, Gesture, Color and Proximity Sensor Module with mobeam™ Barcode Emulation and IR Remote Control are listed below:

Figure 1:
Added Value of Using TMG4903

Benefit	Feature
• 2D and 3D gesture and proximity detection	• Automatic sample rate adjustment (1) • Self-maximizing dynamic range (2) • 2D and 3D gesture detect • Ambient light rejection • Advanced crosstalk compensation • AFE saturation flag • Programmable LED driver • Interrupt-driven I^2C communication
• Ambient light and color sensing	• Variable sensitivity • Designed to operate behind inked glass • UV/IR blocking filter • Programmable gain and integration time • 6.7M:1 dynamic range by gain adjustment only • Interrupt-driven I^2C communication
• IRBeam pattern generator	• mobeam™ support • Universal remote control support • Interrupt-driven I^2C communication
• Integrated LED and driver	• Calibrated emission and response • Invisible 950nm emission
• Low supply voltage	• 1.8V operation

Note(s):

1. While an object is detected, the sample rate increases automatically to improve response.
2. Device sensitivity is automatically adjusted based on reflected response to support a wide detection distance.

Applications

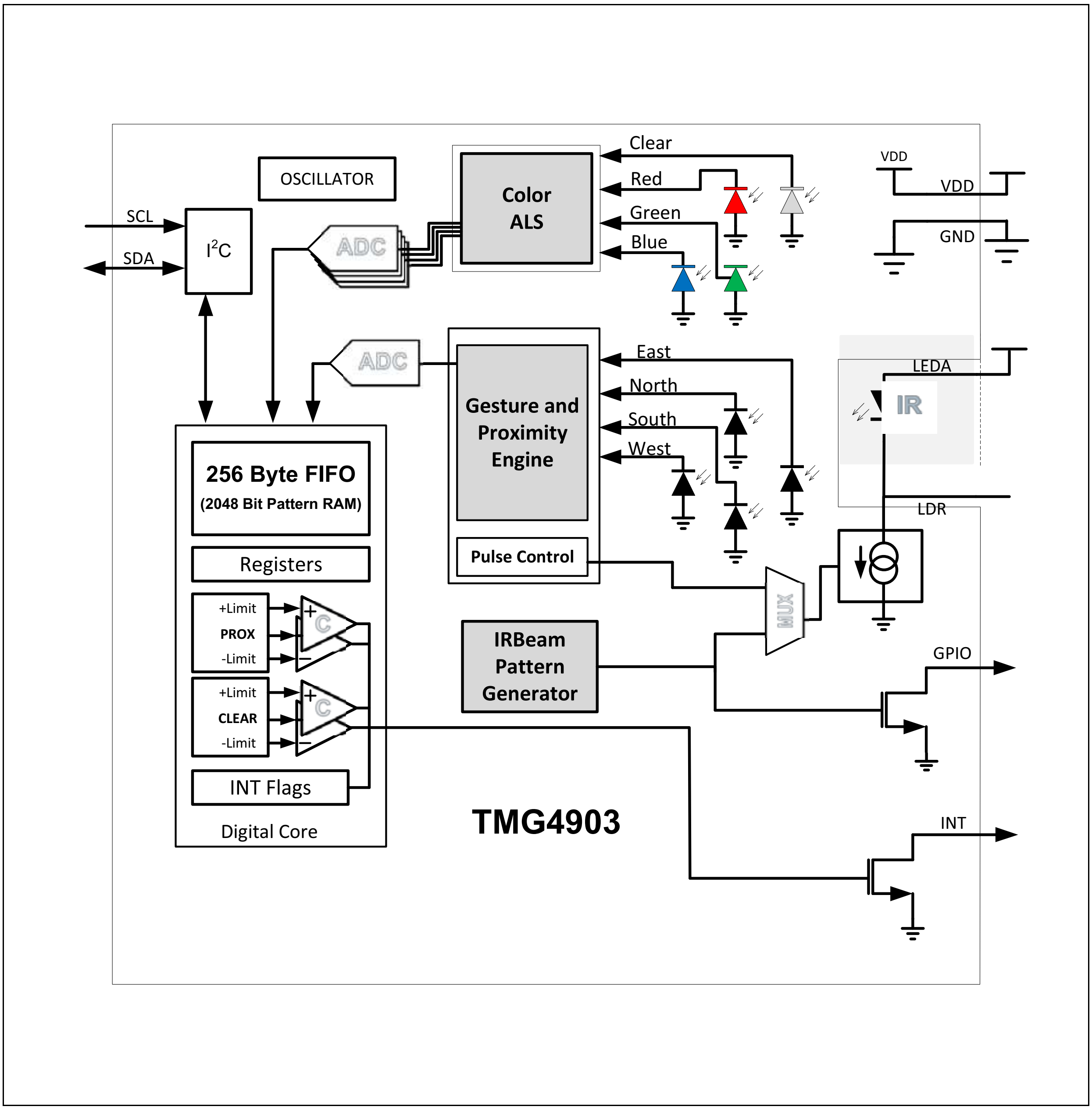
The TMG4903 applications include:

- Gesture detection
- Color sensing
- Ambient light sensing
- Cell phone touch screen disable
- Mechanical switch replacement
- 1D bar code emulation
- Universal remote control

Block Diagram

The functional blocks of this device are shown below:

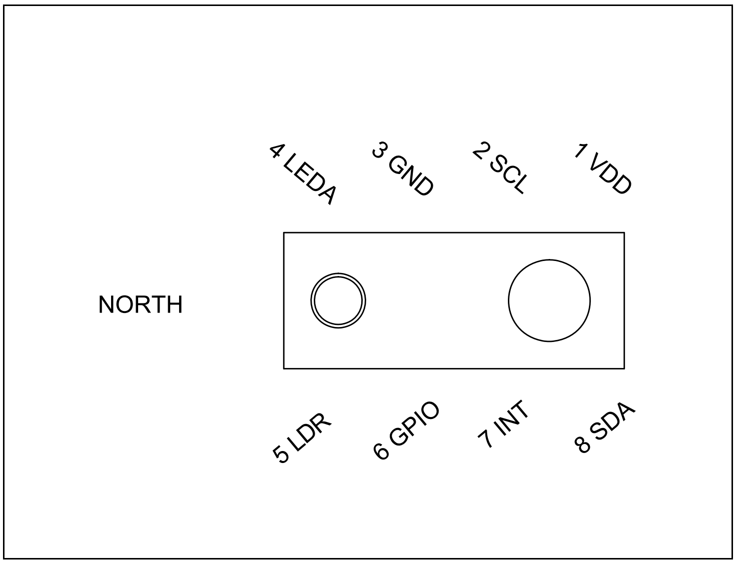
Figure 2:
TMG4903 Block Diagram



Pin Assignment

The device pin assignments are described below.

Figure 3:
Pin Diagram



Pin Description

Figure 4:
Pin Description

Pin Number	Pin Name	Description
1	V_{DD}	Supply voltage (1.8V)
2	SCL	I^2C serial clock terminal
3	GND	Ground. All voltages are referenced to GND
4	LEDA	LED anode
5	LDR	LED driver (sinks current) and LED cathode (for direct access to LED)
6	GPIO	Open drain IRBeam output or alternate interrupt
7	INT	Interrupt. Open drain output and logic level output for external IR LED circuit
8	SDA	I^2C serial data I/O terminal

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 Recommended Operating Conditions is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Figure 5:
Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Units	Comments
V_{DD}	Supply voltage	-0.3	2.2	V	
V_{LEDA}	LED anode supply	-0.3	3.6	V	
V_{IO}	Digital I/O terminal voltage	-0.3	3.6	V	
V_{LDR}	Terminal voltage	-0.3	3.6	V	See note (2)
I_{IO}	Output terminal current	-1	20	mA	
T_{strg}	Storage temperature range	-40	85	ºC	
ESD_{HBM}	ESD tolerance, human body model	±2000		V	

Note(s):

1. All voltages with respect to GND
2. Measured with LDR = OFF or LDR = ON and LDRIVE = 310mA.

Electrical Characteristics

The parameters with min and max values are guaranteed with production tests or SQC (Statistical Quality Control) methods.

Figure 6:
Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Units
V_{DD}	Supply voltage	1.7	1.8	2.0	V
T_A	Operating free-air temperature [1]	-30		85	°C

Note(s):

1. While the device is operational across the temperature range, functionality will vary with temperature. Specifications are stated at 25°C, unless otherwise noted.

Figure 7:
Operating Characteristics, VDD = 1.8 V, T_A = 25°C (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
f_{OSC}	Oscillator frequency			8.1		MHz
I_{DD}	Supply current [1]	Active ALS state (PON=AEN=1, PEN=IBEN=0) [2]		150	200	µA
		Idle state (PON=1, AEN=PEN=IBEN=0) [3]		30	60	
		Sleep state [4]		0.4	5	
V_{OL}	INT, SDA, GPIO output low voltage	6 mA sink current			0.6	V
I_{LEAK}	Leakage current, SDA, SCL, INT, GPIO, LDR pins		-5		5	µA
V_{IH}	SCL, SDA input high voltage		1.26			V
V_{IL}	SCL, SDA input low voltage				0.54	V

Note(s):

1. Values are shown at the VDD pin and do not include current through the IR LED.
2. This parameter indicates the supply current during periods of ALS integration. If Wait is enabled (WEN=1), the supply current is lower during the Wait period.
3. Idle state occurs when PON=1 and all functions are not enabled.
4. Sleep state occurs when PON = 0 and I^2C bus is idle. If Sleep state has been entered as the result of operational flow, SAI = 1, PON will remain high.

Figure 8:
ALS/Color Operating Characteristics, VDD = 1.8 V, T_A = 25°C, AGAIN = 16x, ATIME = 0xF6 (unless otherwise noted)

Parameter	Conditions	Min	Typ	Max	Units
Integration time step size (1), (2)		2.68	2.78	2.90	ms
Dark ADC count value (2)	E_e = 0 µW/ cm^2 AGAIN: 64x ATIME: 100ms (0xDC)	0	1	3	counts
Gain scaling, relative to 16x gain setting	AGAIN: 1/4x	0.0135		0.0175	x
	AGAIN: 1x	0.058		0.067	
	AGAIN: 4x	0.237		0.263	
	AGAIN: 64x	3.75		4.37	
Clear channel irradiance responsivity	White LED, 2700K	8.94	10.28	11.62	counts/ (µW/ cm^2)
Lux accuracy (3)	White LED, 2700K	90	100	110	%
ADC Noise (4)	AGAIN: 16x		0.005		% Full Scale

Note(s):

1. Integration time is configured from 1 step (0xFF) to 256 steps (0x00) for a typical range of 2.78ms to 711.11ms. An ATIME setting of 0xFF results in a full-scale count value of 1024. Each additional integration step adds 1024 counts to full scale. To enable 16-bit ADC range, 64 or more integration steps (177.8ms or more) are required (ATIME <= 0xC0).
2. The typical 3-sigma distribution is between 0 and 1 count for an AGAIN setting of 16x.
3. Lux accuracy is function of red, green, blue and clear channels, and not 100% production tested.
4. ADC noise is calculated as the standard deviation of 1000 data samples.

Figure 9:
Color Ratio Characteristics, VDD = 1.8V, T_A = 25°C

Parameter	Test Conditions	Ratio of Color to Clear Channel					
		Red Channel		Green Channel		Blue Channel	
		Min	Max	Min	Max	Min	Max
Color ADC count value ratio: Color/Clear	White LED, 2700 K	45%	65%	19%	39%	15%	40%
	λ_D = 465 nm (1)	0%	15%	10%	42%	70%	90%
	λ_D = 525 nm (2)	4%	25%	60%	85%	10%	45%
	λ_D = 615 nm (3)	80%	110%	0%	14%	5%	24%

Note(s):

1. The 465 nm input irradiance is supplied by an InGaN light-emitting diode with the following characteristics: dominant wavelength λ_D = 465 nm, spectral halfwidth Δλ½ = 22 nm.
2. The 525 nm input irradiance is supplied by an InGaN light-emitting diode with the following characteristics: dominant wavelength λ_D = 525 nm, spectral halfwidth Δλ½ = 35 nm.
3. The 615 nm input irradiance is supplied by an AlInGaP light-emitting diode with the following characteristics: dominant wavelength λ_D = 615 nm, spectral halfwidth Δλ½ = 15 nm.

Figure 10:
Gesture and Proximity Operating Characteristics, VDD = 1.8 V, T_A = 25°C (unless otherwise noted)

Parameter	Conditions	Min	Typ	Max	Unit
ADC conversion time step size			20		µs
Offset (no target response) (1)	PGAIN = 2 (4x) PGLDRIVE = 7 (150mA) PGPULSE_LEN = 1 (8µs) No target present After electrical calibration		16	36	counts
Part to part variation (2)	PGAIN = 2 (4x) PGLDRIVE = 1 (30mA) PGPULSE_LEN = 1 (8µs) d=23mm round target 30mm target distance After electrical calibration	75	100	125	%
Response, absolute (3)	PGAIN = 2 (4x) PGLDRIVE = 7 (150mA) PGPULSE_LEN = 1 (8µs) 100x100mm, 90% reflective Kodak gray card 100mm target distance After electrical calibration	670	840	1010	counts
Photodiode relative deviation, north and south channels (4)		-25		25	%
Photodiode relative deviation, east and west channels (4)		-25		25	
Noise/Signal (5)	PGAIN = 2 (4x) PGLDRIVE = 2 (50mA) PGPULSE_LEN = 1 (8µs) PGPULSE = 7 (8 pulses)			2	%

Note(s):

1. Offset varies with power supply characteristics and system noise.
2. Production tested result is the average of 5 readings expressed relative to a calibrated response.
3. Representative result by characterization. Device settings can vary from 1 to 64 pulse count, 4µs to 32µs pulse width, 10mA to 310mA current setting, and 1x to 8x electrical gain. Refer to Figure 22 for device performance with different settings.
4. Relative mismatch in the response between opposing channels.
5. Production tested result is the standard deviation of 20 readings as a percentage of full scale response.

Figure 11:
Proximity Test Circuit

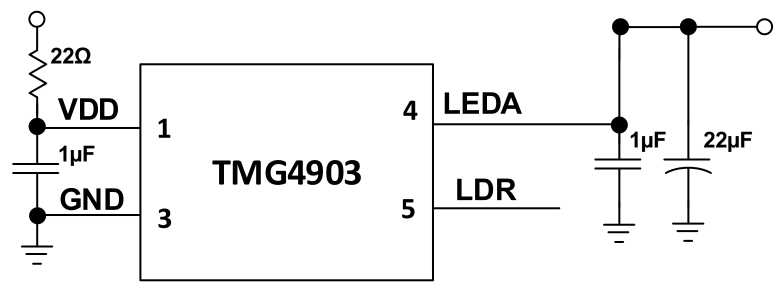


Figure 12:
Wait Characteristics, VDD = 1.8 V, T_A = 25°C, WEN = 1 (unless otherwise noted)

Parameter	Conditions	Min	Typ	Max	Units
Wait step size		2.68	2.78	2.90	ms
Long wait step size			33.3		ms

Figure 13:
IRBeam Operating Characteristics, VDD = 1.8 V, T_A = 25°C (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{(PBT\ min)}$	Minimum bit time	IBEN = 1		0.25		µs

Timing Characteristics

Figure 14:
AC Electrical Characteristics, VDD = 1.8 V, T_A = 25°C (unless otherwise noted)

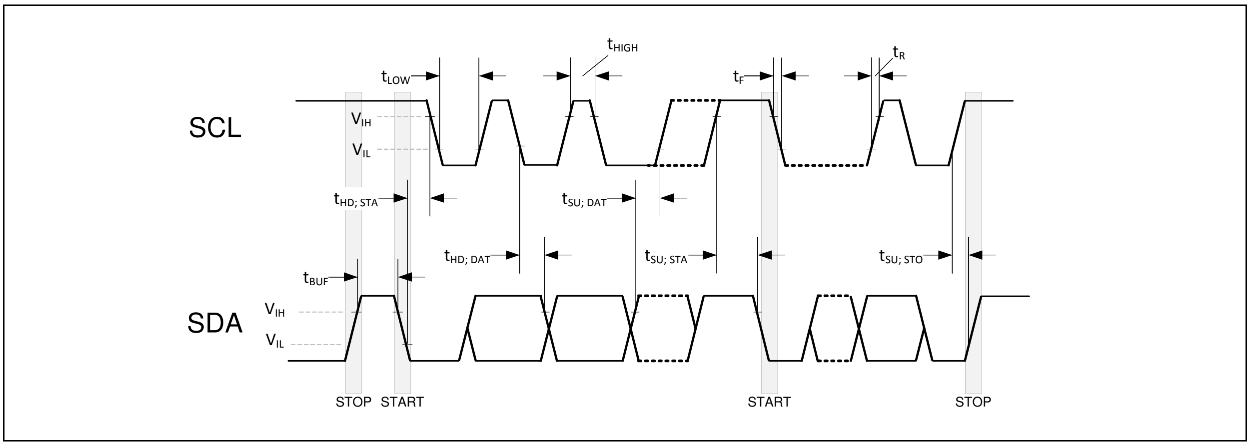
Parameter	Description	Min	Typ	Max	Unit
f_{SCL} (1)	Clock frequency (I^2C only)	0		400	kHz
t_{BUF} (1)	Bus free time between start and stop condition	1.3			µs
$t_{HS;STA}$ (1)	Hold time after (repeated) start condition. After this period, the first clock is generated.	0.6			µs
$t_{SU;STA}$ (1)	Repeated start condition setup time	0.6			µs
$t_{SU;STO}$ (1)	Stop condition setup time	0.6			µs
$t_{HD;DAT}$ (1)	Data hold time	0			ns
$t_{SU;DAT}$ (1)	Data setup time	100			ns
t_{LOW} (1)	SCL clock low period	1.3			µs
t_{HIGH} (1)	SCL clock high period	0.6			µs
t_F (1)	Clock/data fall time			300	ns
t_R (1)	Clock/data rise time			300	ns
C_i (1)	Input pin capacitance			10	pF

Note(s):

1. Specified by design and characterization; not production tested.

Timing Diagram

Figure 15:
Timing Parameter Measurement Drawing



Typical Operating Characteristics

Figure 16:
Spectral Responsivity

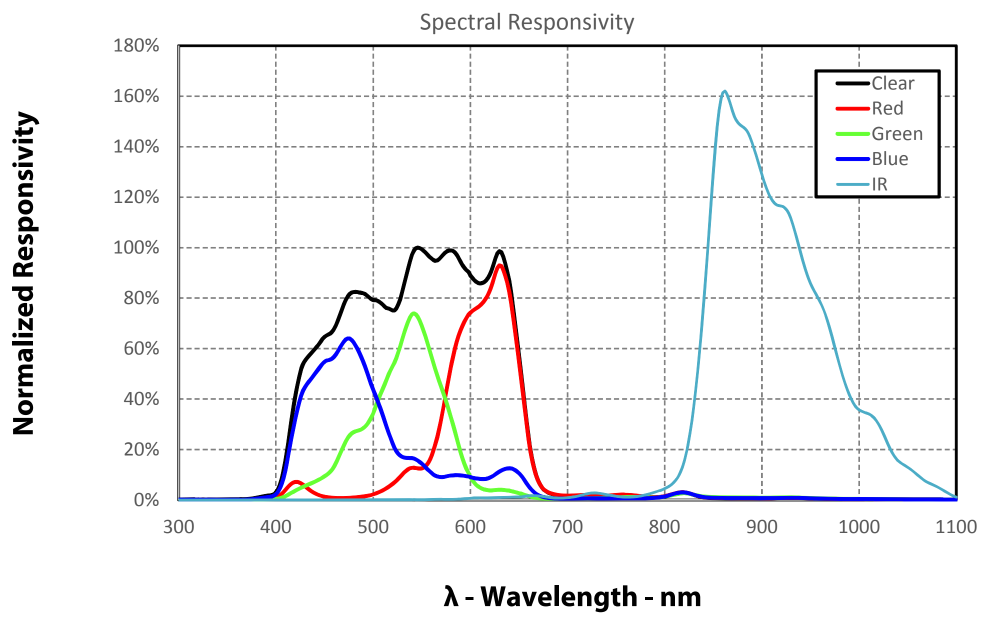


Figure 17:
CRGB Responsivity vs. Angular Displacement

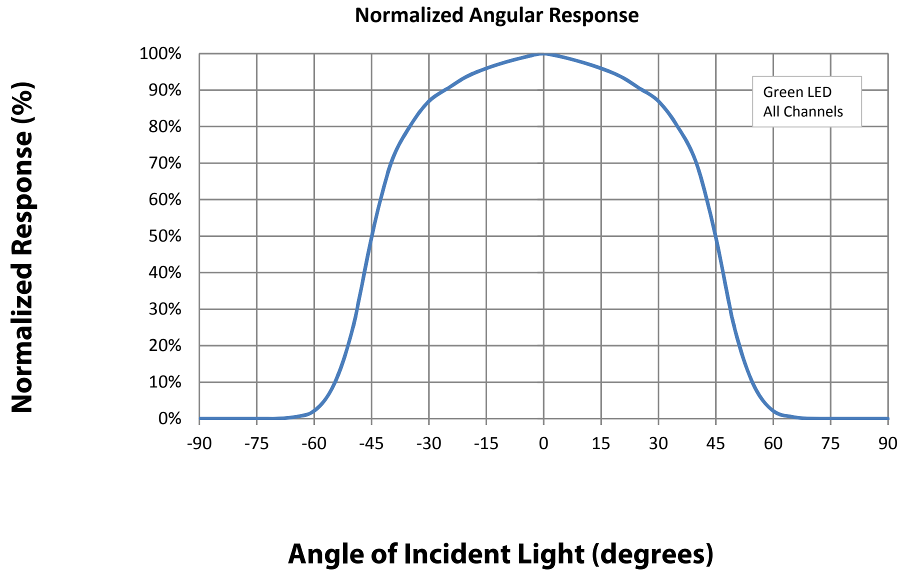


Figure 18:
Typical LDR Current vs. Voltage

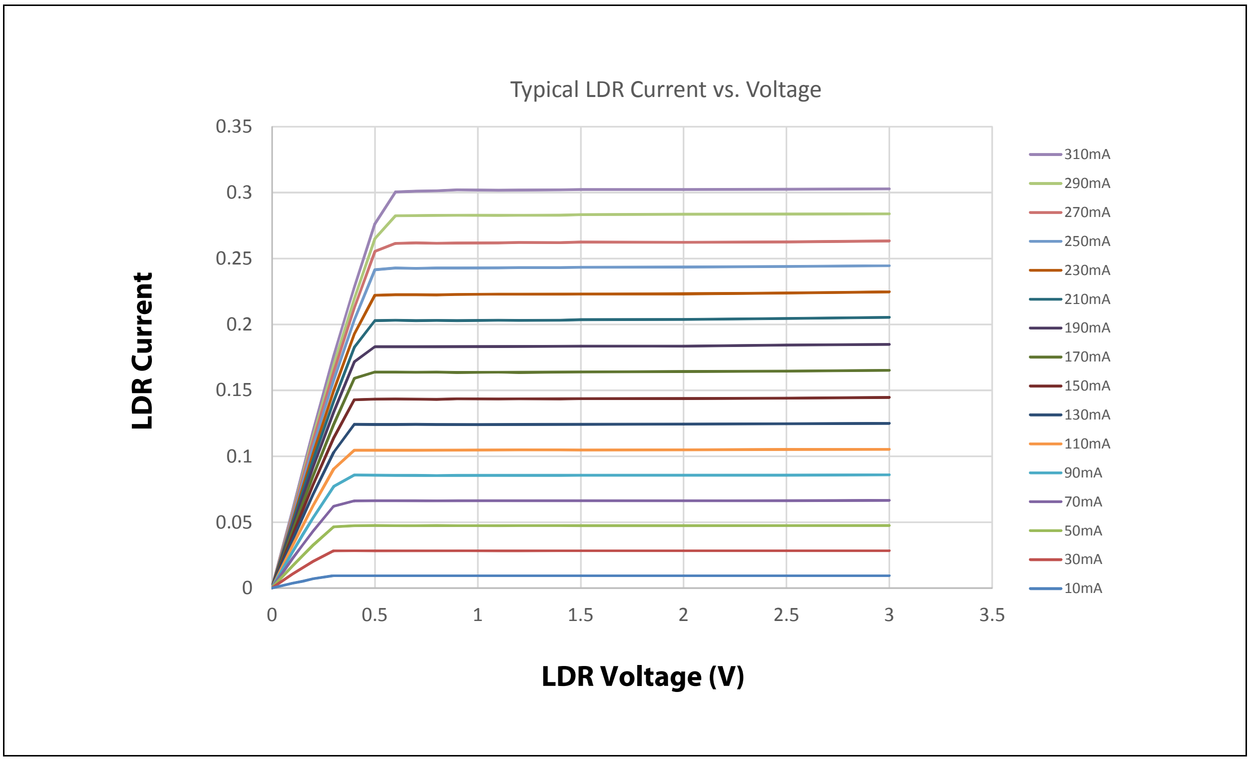


Figure 19:
Responsivity Temperature Coefficient

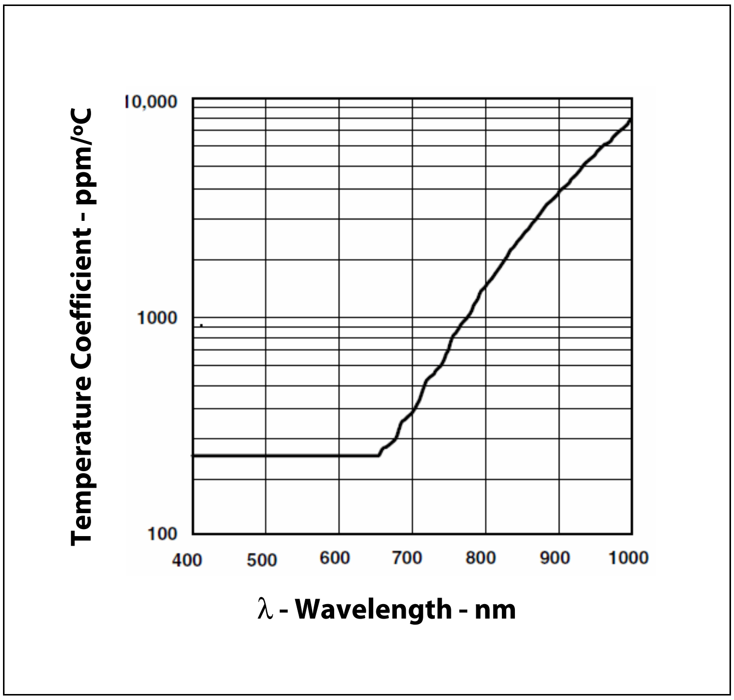


Figure 20:
Illuminance (Lux) vs. Counts (Clear Channel)

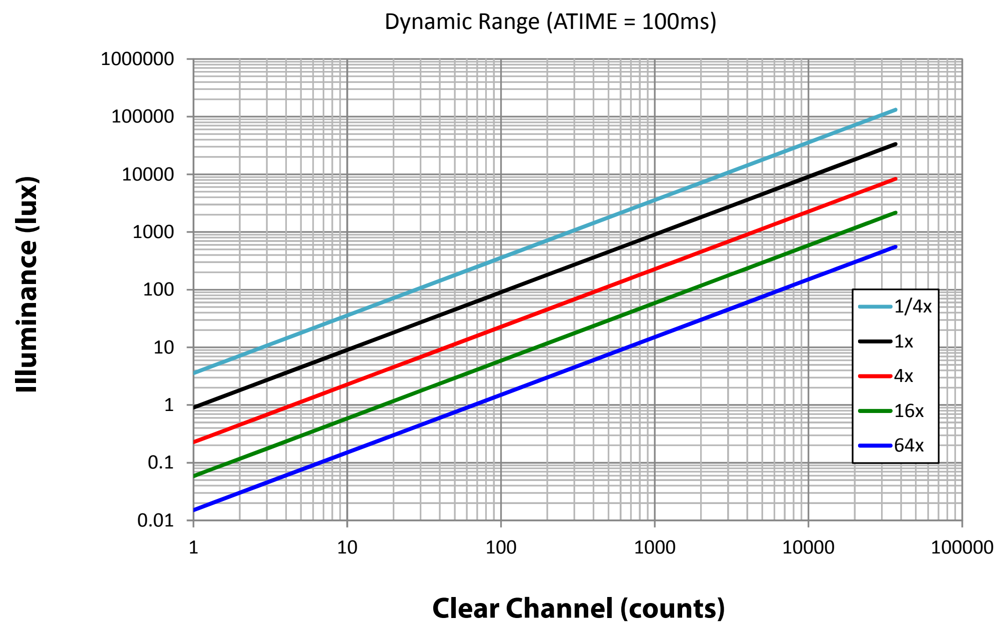
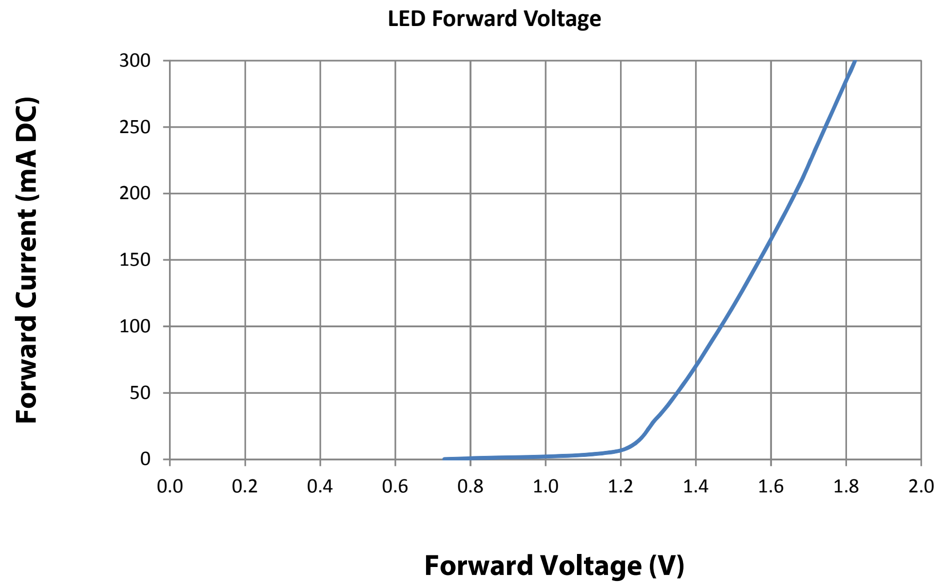


Figure 21:
950nm LED Forward Voltage vs. Current



Note(s):

1. The voltage on the LDR pin (VLEDA – VLED FORWARD) must be sufficiently large to guarantee proper operation of the regulated current sink.

Figure 22:
Gesture and Proximity Response vs. Target Distance

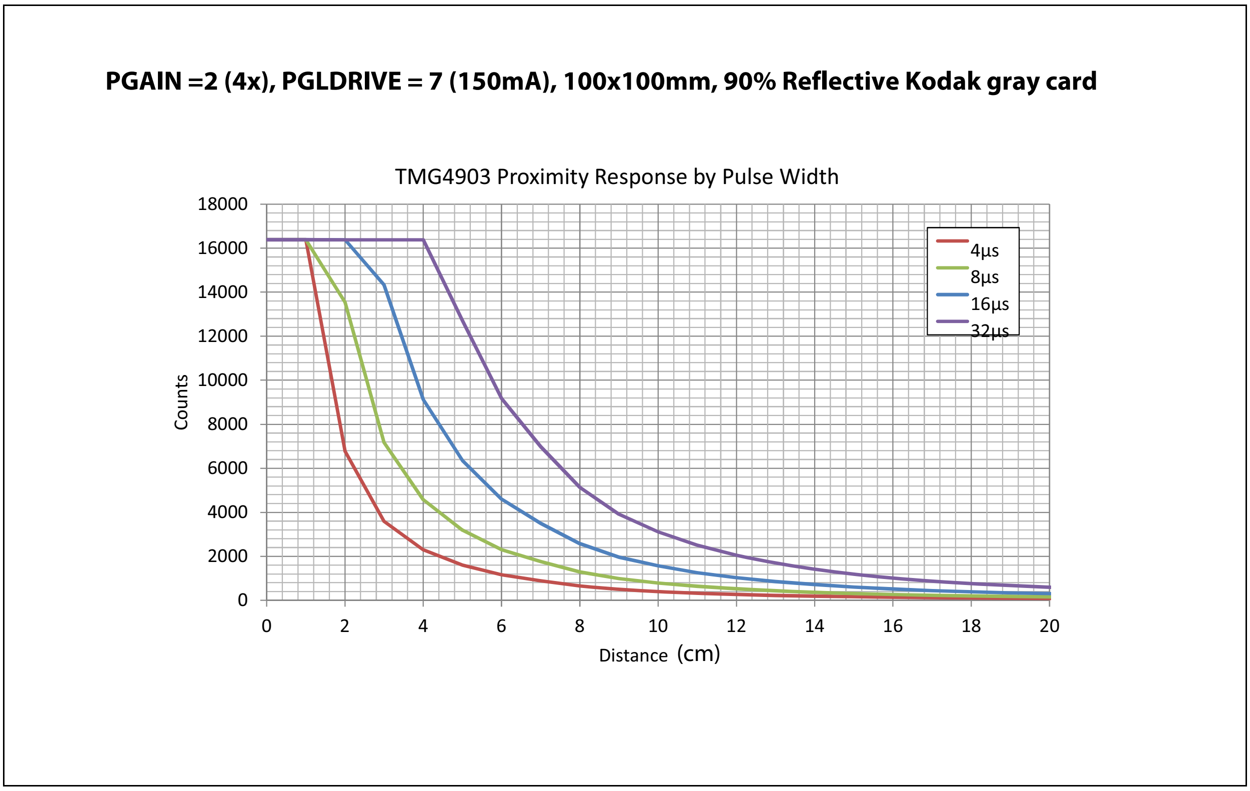


Figure 23:
Gesture Angle Response

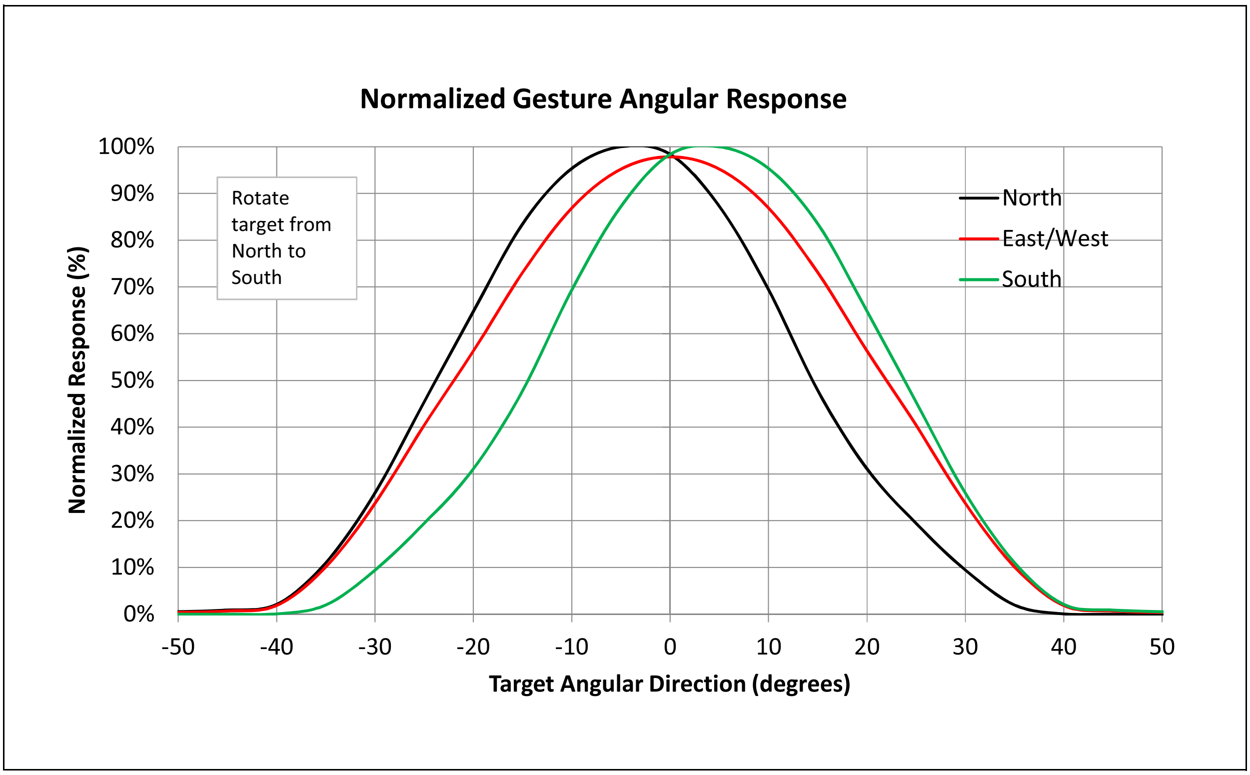
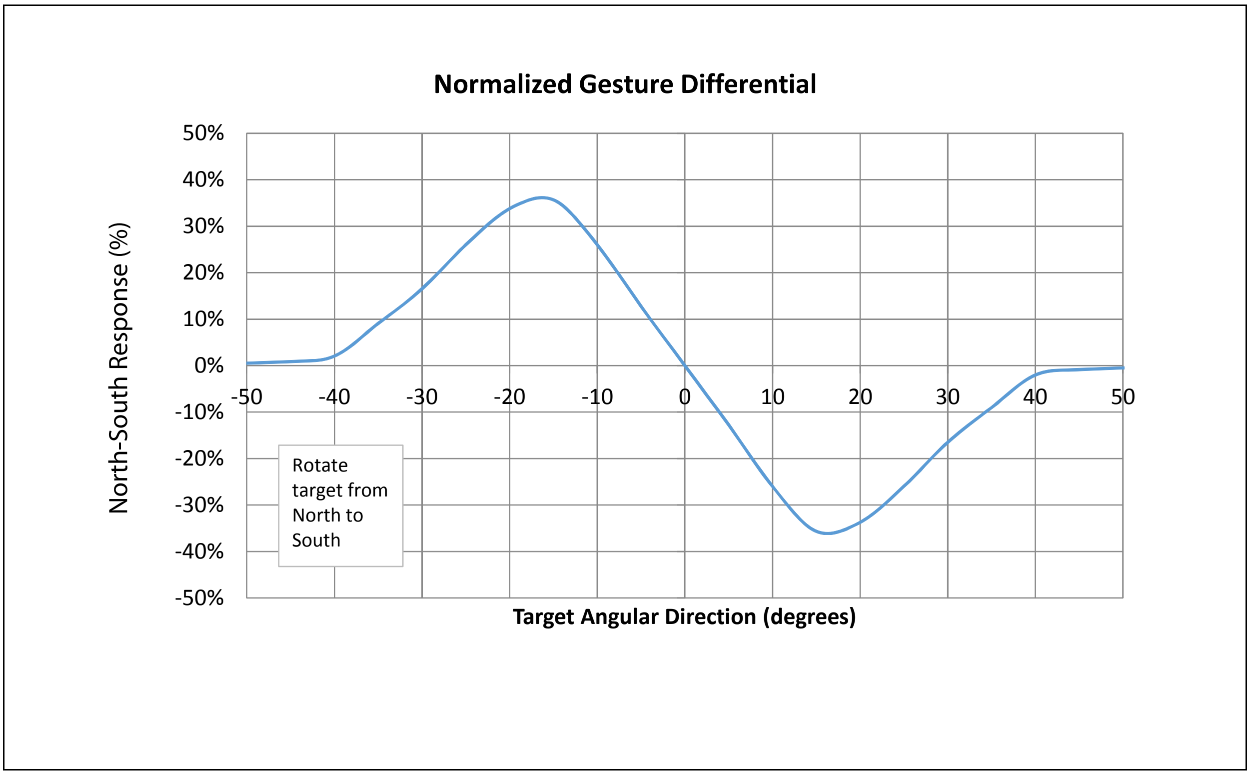


Figure 24:
Gesture Differential



Note(s):

1. The East-West Response (%) is the same vs Target Angular Direction when the target is rotated from East to West.

I²C Protocol

The device uses I²C serial communication protocol for communication. The device supports 7-bit chip addressing and both standard and full-speed clock frequency modes. Read and Write transactions comply with the standard set by Philips (now NXP).

Internal to the device, an 8-bit buffer stores the register address location of the desired byte to read or write. This buffer auto-increments upon each byte transfer and is retained between transaction events (I.e. valid even after the master issues a STOP command and the I²C bus is released). During consecutive Read transactions, the future/repeated I²C Read transaction may omit the memory address byte normally following the chip address byte; the buffer retains the last register address +1.

All 16-bit fields have a latching scheme for reading and writing. In general it is recommended to use I²C bursts whenever possible, especially in this case when accessing two bytes of one logical entity. When reading these fields, the low byte must be read first, and it triggers a 16-bit latch that stores the 16-bit field. The high byte must be read immediately afterwards. When writing to these fields, the low byte must be written first, immediately followed by the high byte. Reading or writing to these registers without following these requirements will cause errors.

I²C Write Transaction

A Write transaction consists of a START, CHIP-ADDRESSWRITE, REGISTER-ADDRESS WRITE, DATA BYTE(S), and STOP. Following each byte (9TH clock pulse) the slave places an ACKNOWLEDGE/NOT- ACKNOWLEDGE (ACK/NACK) on the bus. If NACK is transmitted by the slave, the master may issue a STOP.

I²C Read Transaction

A Read transaction consists of a START, CHIP-ADDRESSWRITE, REGISTER-ADDRESS, RESTART, CHIP-ADDRESSREAD, DATA BYTE(S), and STOP. Following all but the final byte the master places an ACK on the bus (9TH clock pulse). Termination of the Read transaction is indicated by a NACK being placed on the bus by the master, followed by STOP.

The I²C bus protocol was developed by Philips (now NXP). For a complete description of the I²C protocol, please review the NXP I²C design specification.

Figure 25:
Simplified State Diagram

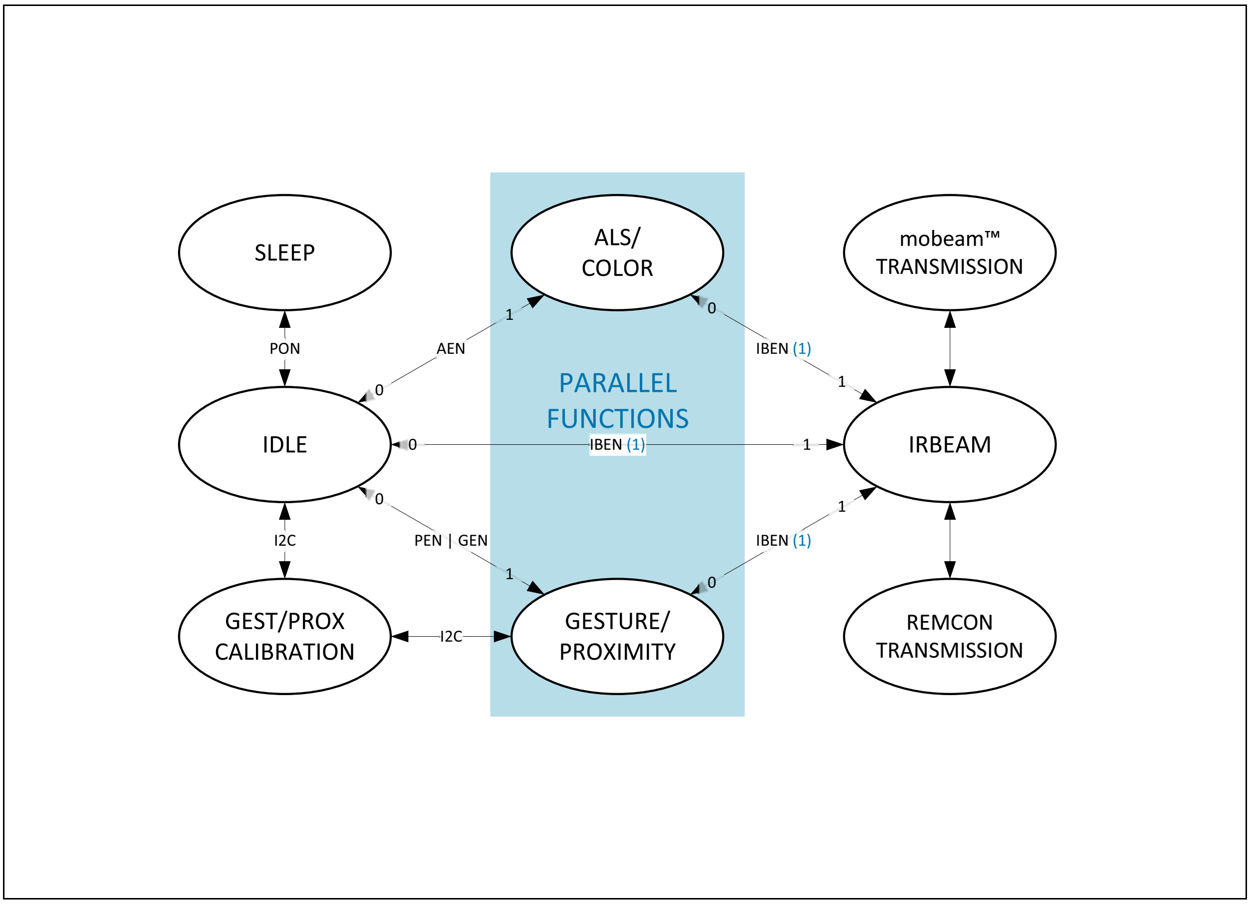
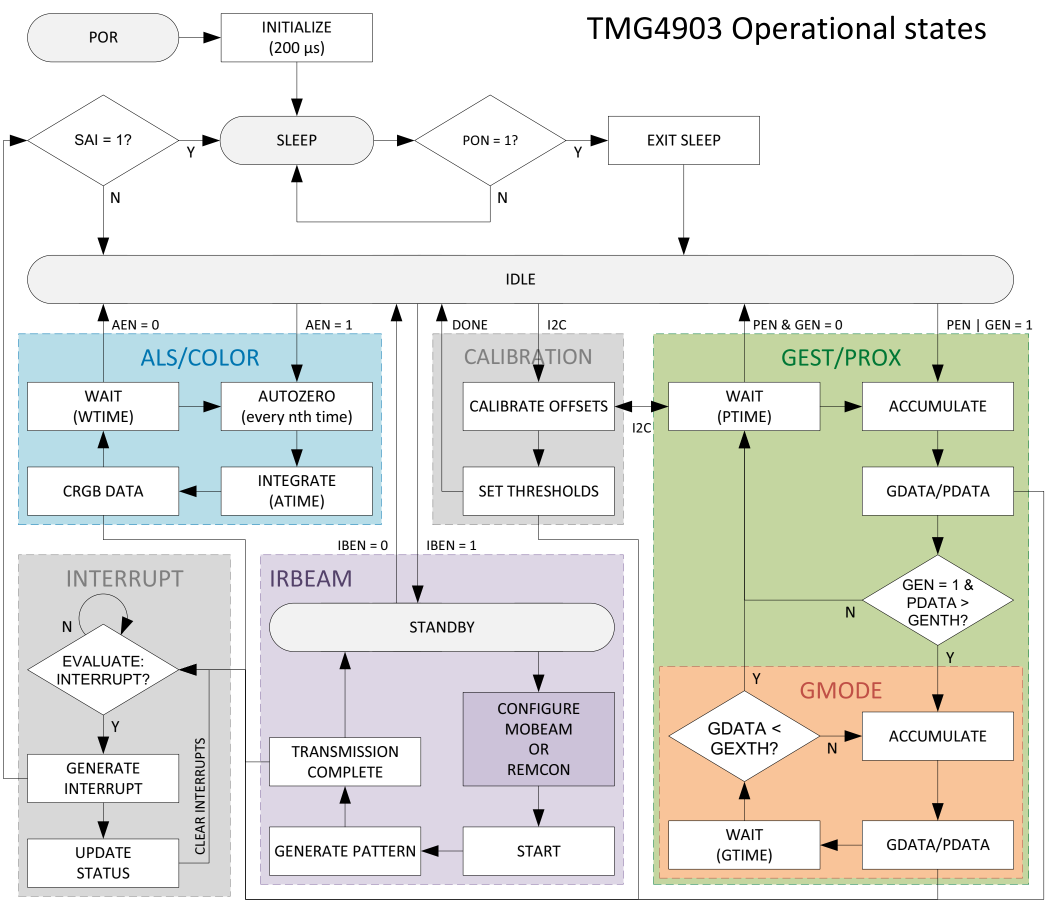


Figure 26:
Detailed State Diagram



Note(s):

1. While IRBeam is enabled (IBEN = 1), PROXIMITY is disabled automatically.

Detailed Description

Upon power-up, POR, the device initializes. During initialization (typically 200µs), the device will deterministically send NAK on I^2C and cannot accept I^2C transactions. All communication with the device must be delayed, and all outputs from the device must be ignored including interrupts. After initialization, the device enters the SLEEP state. In this operational state the internal oscillator and other circuitry are not active, resulting in ultra-low power consumption. If I^2C transaction occurs during this state, the I^2C core wake up temporarily to service the communication. Once the Power ON bit, PON, is enabled, the device enters the IDLE state in which the internal oscillator and attendant circuitry are active, but power consumption remains low. The first time the SLEEP state is exited and any functions are enabled (PEN | GEN | AEN | IBEN = 1) an EXIT SLEEP pause occurs followed by an immediate entry into the selected engines. If all functions are disabled (PEN = 0 & AEN = 0 & IBEN = 0), the device returns to the IDLE state.

As depicted in Figure 25 and Figure 26, the gesture/proximity and CRGB color sensing functions operate in parallel when enabled (PEN | GEN | AEN = 1). The IRBeam pattern generator takes priority when enabled (IBEN = 1). Proximity will not function, and ALS integration only occurs while IRBeam is in standby. In addition, when proximity calibration is requested, it will temporarily disable the proximity function. A simplified state diagram for each function is depicted in Figure 26. Each function is individually configured (e.g. Gain, ADC integration time, wait time, persistence, thresholds, etc.).

Sleep After Interrupt Operation

If Sleep After Interrupt is enabled (SAI = 1), the state machine will enter SLEEP when non-gesture interrupts occur. However, for IRBeam and gesture, the state machine remains in these active modes to continue to support these functions. Entering SLEEP does not automatically change any of the register settings (e.g. PON bit is still high, but the normal operational state is over-ridden by SLEEP state). SLEEP state is terminated when the SAI bit is cleared.

Register Description

The device is controlled and monitored by registers accessed through the I²C serial interface. These registers provide for a variety of control functions and can be read to determine results of the ADC conversions. The register set is summarized in Figure 27.

Figure 27:
Control Register Map

Address	Register Name	R/W	Register Function	Reset Value
0x00 – 0x7F	RAM	R/W	Volatile Storage for Pattern data	0x00
0x80	ENABLE	R/W	Enables states and interrupts	0x00
0x81	ATIME	R/W	ADC integration time	0xFF
0x82	PTIME	R/W	Proximity sample time	0x00
0x83	WTIME	R/W	ALS wait time	0xFF
0x84	AILTL	R/W	ALS interrupt low threshold low byte	0x00
0x85	AILTH	R/W	ALS interrupt low threshold high byte	0x00
0x86	AIHTL	R/W	ALS interrupt high threshold low byte	0x00
0x87	AIHTH	R/W	ALS interrupt high threshold high byte	0x00
0x88	PILTL	R/W	Proximity interrupt low threshold low byte	0x00
0x89	PILTH	R/W	Proximity interrupt high threshold high byte	0x00
0x8A	PIHTL	R/W	Proximity interrupt low threshold low byte	0x00
0x8B	PIHTH	R/W	Proximity interrupt high threshold high byte	0x00
0x8C	PERS	R/W	ALS & Proximity interrupt persistence filters	0x00
0x8D	CFG0	R/W	Configuration register zero	0xA0
0x8E	PGCFG0	R/W	Proximity pulse width and count	0x4F
0x8F	PGCFG1	R/W	Proximity gain and LED current	0x80
0x90	CFG1	R/W	Configuration register one	0x00
0x91	REVID	R	Revision ID	0x02
0x92	ID	R	Device ID	0xB8
0x93	STATUS	R	Device status register one	0x00
0x94	CDATAL	R	Clear ADC low data register	0x00
0x95	CDATAH	R	Clear ADC high data register	0x00
0x96	RDATAL	R	Red ADC low data register	0x00

Address	Register Name	R/W	Register Function	Reset Value
0x97	RDATAH	R	Red ADC high data register	0x00
0x98	GDATAL	R	Green ADC low data register	0x00
0x99	GDATAH	R	Green ADC high data register	0x00
0x9A	BDATAL	R	Blue ADC low data register	0x00
0x9B	BDATAH	R	Blue ADC high data register	0x00
0x9C	PDATAL	R	Proximity ADC low data register	0x00
0x9D	PDATAH	R	Proximity ADC high data register	0x00
0x9E	STATUS2	R	Additional device status	0x00
0x9F	CFG2	R/W	Configuration register two	0x04
0xA0	ICONFIG	R/W	IRBeam configuration register one	0x00
0xA1	ICONFIG2	R/W	IRBeam configuration register two	0x00
0xA2	ISNL	R/W	IRBeam symbol loops	0x00
0xA3	ISOFF	R/W	IRBeam delay between symbol loops	0x00
0xA4	IPNL	R/W	IRbeam packet loops	0x00
0xA5	IPOFF	R/W	IRBeam delay between packet loops	0x00
0xA6	IBT	R/W	IRBeam time period	0x00
0xA7	ISLEN	R/W	IRBeam symbol length	0x00
0xA8	ISTATUS	R	IRBeam status	0x00
0xA9	ISTART	R/W	IRBeam start transmission	0x00
0xAB	CFG3	R/W	Configuration register three	0x00
0xAC	CFG4	R/W	Configuration register four	0x07
0xAD	CFG5	R/W	Configuration register five	0x08
0xB0	GCFG0	R/W	Gesture configuration register zero	0x00
0xB1	GCFG1	R/W	Gesture configuration register one	0x8F
0xB2	GCFG2	R/W	Gesture configuration register two	0x80
0xB3	STATUS3	R	Status register three	0x00
0xB4	GTIME	R/W	Gesture time	0x0A
0xB5	GST_CTRL	R/W	Gesture control	0x00
0xB6	GTHR_INL	R/W	Gesture entry threshold low byte	0x00
0xB7	GTHR_INH	R/W	Gesture entry threshold high byte	0x00

Address	Register Name	R/W	Register Function	Reset Value
0xB8	GTHR_OUTL	R/W	Gesture exit threshold low byte	0x00
0xB9	GTHR_OUTH	R/W	Gesture exit threshold high byte	0x00
0xBA	GFIFO_LVL	R	Gesture FIFO entries waiting for readout	0x00
0xBB	GSTATUS	R	Gesture status	0x00
0xBC	CONTROL	R/W	Control register	0x00
0xBD	AUXID	R	Auxiliary ID	0x00
0xC0	OFFSETNL	R/W	North channel offset low byte	0x00
0xC1	OFFSETNH	R/W	North channel offset high byte	0x00
0xC2	OFFSETSL	R/W	South channel offset low byte	0x00
0xC3	OFFSETSH	R/W	South channel offset high byte	0x00
0xC4	OFFSETWL	R/W	West channel offset low byte	0x00
0xC5	OFFSETWH	R/W	West channel offset high byte	0x00
0xC6	OFFSETEL	R/W	East channel offset low byte	0x00
0xC7	OFFSETEH	R/W	East channel offset high byte	0x00
0xD0	PBSLN_MEASL	R	Measured baseline low byte	0x00
0xD1	PBSLN_MEASH	R	Measured baseline high byte	0x00
0xD2	PBSLNL	R	Stored baseline low byte	0x00
0xD3	PBSLNH	R	Stored baseline high byte	0x00
0xD6	AZ_CONFIG	R/W	Configure CRGB autozero frequency	0xFF
0xD7	CALIB	R/W	Start offset calibration	0x00
0xD8	CALIBCFG0	R/W	Calibration configuration register zero	0x44
0xD9	CALIBCFG1	R/W	Calibration configuration register one	0x0C
0xDA	CALIBCFG2	R/W	Calibration configuration register two	0x20
0xDB	CALIBCFG3	R/W	Calibration configuration register three	0x10
0xDC	CALIBSTAT	R/W	Calibration status	0x00
0xDD	INTENAB	R/W	Interrupt enable	0x00
0xDE	INCLEAR	R/W	Interrupt clear	0x00
0xF8	GFIFO0L	R	Gesture FIFO North low byte	0x00
0xF9	GFIFO0H	R	Gesture FIFO North high byte	0x00
0xFA	GFIFO1L	R	Gesture FIFO South low byte	0x00

Address	Register Name	R/W	Register Function	Reset Value
0xFB	GFIFO1H	R	Gesture FIFO South high byte	0x00
0xFC	GFIFO2L	R	Gesture FIFO West low byte	0x00
0xFD	GFIFO2H	R	Gesture FIFO West high byte	0x00
0xFE	GFIFO3L	R	Gesture FIFO East low byte	0x00
0xFF	GFIFO3H	R	Gesture FIFO East high byte	0x00

Enable Register (ENABLE 0x80)

Enable has fields that power on the device and enable the functions. Before enabling any functions, all of the bits associated with each function must be set. Changing control register values while operating may result in invalid results.

Figure 28:
Enable Register

7	6	5	4	3	2	1	0
IBEN	GEN	PIEN	AIEN	WEN	PEN	AEN	PON

Field	Bits	Description
IBEN	7	**IRBeam Enable.** When asserted, the LED driver pin (LDR) is controlled by the IRBeam state machine. Proximity is suppressed. ALS continues in the background except when IBUSY = 1 (ISTATUS register).
GEN	6	**Gesture Enable.** When asserted, the gesture state machine can be activated by setting GMODE = 1 or when a proximity value is above the gesture entry threshold.
PIEN	5	**Proximity Interrupt Enable.** When asserted permits proximity interrupts to be generated, subject to the proximity thresholds and persistence filter.
AIEN	4	**ALS Interrupt Enable.** When asserted permits ALS interrupts to be generated, subject to the ALS thresholds and persistence filter.
WEN	3	**Wait Enable.** This bit activates the wait feature. Writing a 1 activates the wait timer. Writing a 0 disables the wait timer.
PEN	2	**Proximity Enable.** This bit activates the proximity function. Writing a 1 enables proximity. Writing a 0 disables proximity.
AEN	1	**ALS Enable.** This bit activates the ALS/Color functionality. Writing a 1 enables ALS/Color. Writing a 0 disables ALS/Color.
PON	0	**Power ON.** This bit activates the internal oscillator to permit the timers and ADC channels to operate. Writing a 1 activates the oscillator. Writing a 0 disables the oscillator and clears IBEN, PEN, and AEN. Only set this bit after all other registers have been initialized by the host.