MAX25205 Evaluation Kit

Evaluates: MAX25205

General Description

The MAX25205 evaluation kit (EV kit) is a complete system for demonstrating the MAX25205 optical IR sensor in a typical gesture and proximity-sensing application.

The MAX25205 enables recognition of the following gestures:

- Hand Swipe Left, Right, Up, and Down
- Finger/Hand Rotation Clockwise and Counter-clockwise
- Air Click
- Proximity Detection and Linger-to-Click

The application circuit operates by illuminating the user's hand with a precision-controlled IR light source and measuring the reflected signal with the MAX25205's 6x10 (60 pixel) IR sensor array. The four-LED IR light source is PWM controlled with external FETs from the MAX25205's onboard FET driver. The return signal is analyzed with an embedded microcontroller that interprets the gestures.

The EV Kit consists of the following:

- MAX32620FTHR Microcontroller Platform
- Interface Shield Board
- MAX25205 Sensor Board
- Ribbon Cable (Connects Sensor Board to Shield Board)
- 3.3V Power Supply
- USB 2.0 Type A to Micro B Cable

***Ordering Information* appears at end of data sheet.**

Features and Benefits

- Simple yet Flexible Gesture Solution
- Lower Solution Cost than Camera-Based Systems
- Integrated Optics with ±20deg FOV
- Optimum Resolution for Dynamic Hand Gestures
- Built-in LED Driver with Ultra-Low-Power Operation
- 120kLux Ambient Light Performance
- Compact 20-pin, 4mm x 4mm QFN Package, Side-Wettable
- AEC-Q100
- -40°C to +85°C Operation

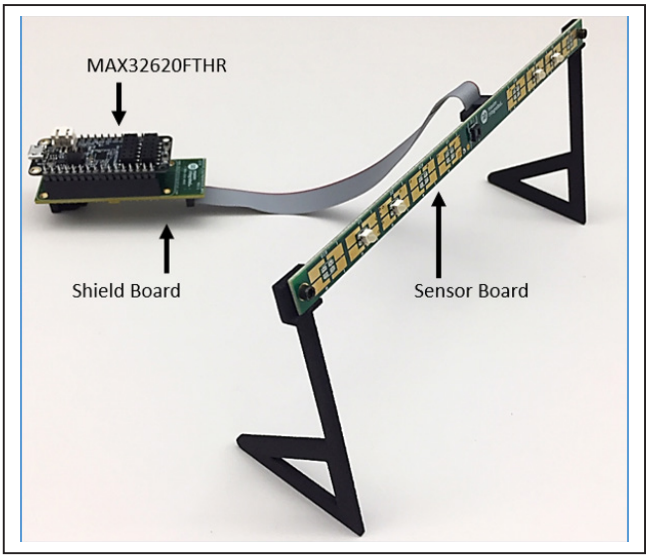


Figure 1. MAX25205 EV Kit

maxim integrated™

Quick Start

Required Equipment

- MAX25205 EV Kit
- Included USB 2.0 Type A to Micro B Cable
- Included 3.3V Power Supply
- Windows PC Running the Maxim Gesture Sensor EV Kit GUI

Note: In the following sections, software-related items are identified by bolding. Text in **bold** refers to items directly from the EV kit software. Text in **bold and underlined** refers to items from the Windows® operating system.

Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation:

1) Install the PC EV kit software by running the installation executable: MaximGestureSensorEVKit_SetupVx-x-x.exe. Follow the on-screen prompts for default installation, and install the driver when prompted.
2) Connect the external 3.3V supply to the shield board (see Figure 2).
3) Connect a USB cable from the MAX32620FTHR micro-USB port to the PC's USB port (see Figure 2).
4) Launch the PC GUI software. **Start → Maxim Integrated → MaximGestureSensorEVKit**.
5) The software should auto-detect the presence of the EV kit. To verify a successful connection, the lower right of the GUI should read "Connected on COMxx at 115200." If the software fails to make a connection, the following error message is reported: "COM Port Offline." See the troubleshooting section for help if this occurs.
6) Click on the **Run** button to activate the heat map. The frames-per-second (FPS) should report a non-zero value (depending on device configuration; see Figure 3). Click **Stop** when finished viewing.
Now that the EV kit is operating, proceed to evaluate gesture performance.

Microsoft Corporation registered trademark and registered service mark

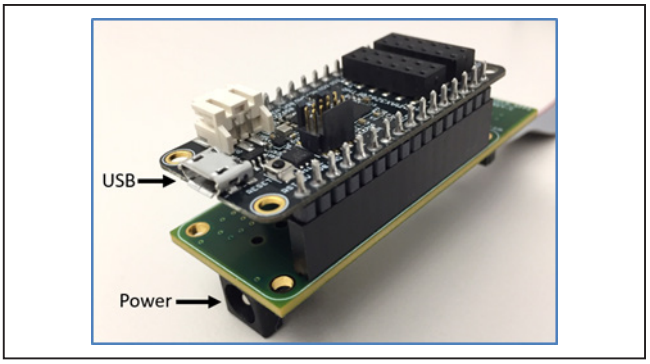


Figure 2. USB and Power Connectors

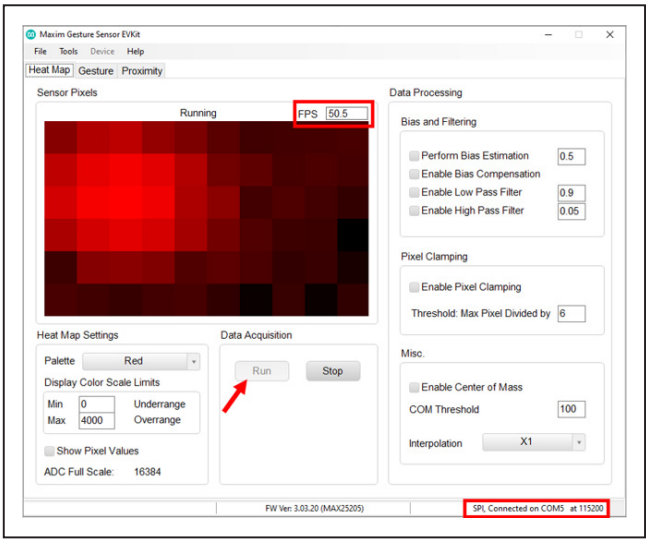


Figure 3. Heat Map Tab

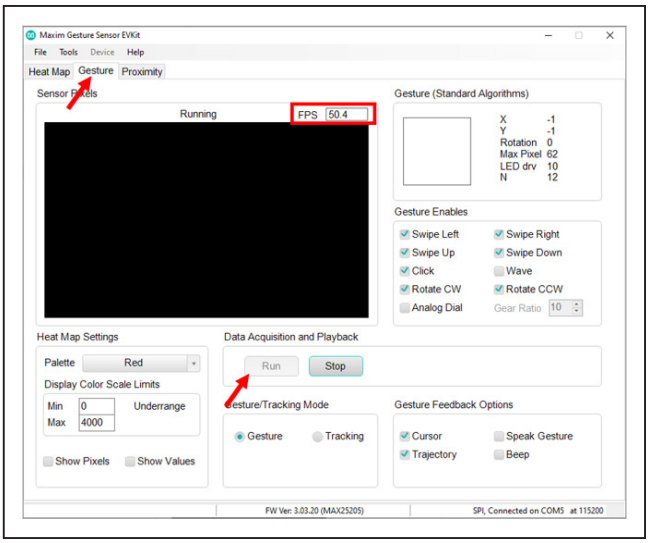


Figure 4. Gesture Tab

7) Click on the **Gesture** tab.
8) Click **Run**. If everything is working correctly, the GUI should report a non-zero frames-per-second (FPS) reading (see Figure 4).
9) Gestures, object position, and other gesture-related information will be displayed in the **Gesture** panel in the upper right of the GUI.
10) See *Detailed Description* for proper sensor setup to achieve good gesture performance.

Detailed Description

Notes on Proper Setup for Good Gesture Performance

The sensor should be positioned so that the face of the sensor is aimed at the horizontal, or no more than 15 degrees from the horizontal. If desired, the sensor board can be attached to a stand using the mounting holes on either end of the sensor board.

The sensor should be set up so that it has an unobstructed field of view. If the sensor is set on a table, make sure that the table top is not in the sensor's field of view (check

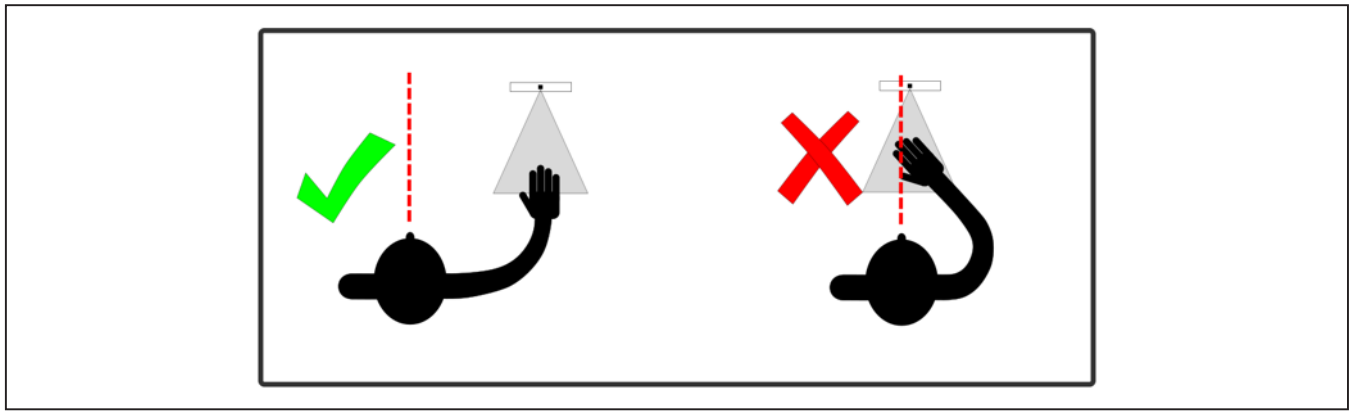


Figure 5: Correct Sensor Position, Directed to Side of Body

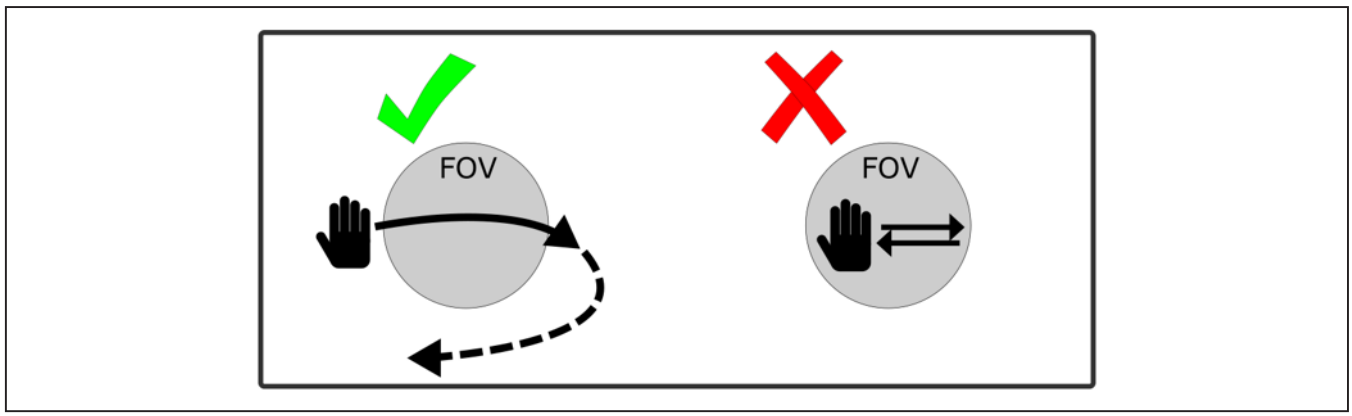


Figure 6: Horizontal Swipes

the **Heat Map** view to verify that the field of view is empty when not actively performing gestures).

The sensor should be positioned to the right of the body, not aimed directly at the torso. This allows gestures to be made naturally with the hand positioned off to the side. The sensor position with respect to the body should be similar to how it would be configured in the car, with the sensor mounted just above the infotainment display in the center console, to the right of the driver.

Gestures should be made in a single, smooth motion, with the hand entering the field of view at the beginning of the gesture and exiting the field-of-view at completion of the gesture.

Figure 6 shows the correct way to perform left/right swipe gestures. The palm should be perpendicular to the sensor.

Figure 7 shows the correct way to perform up/down swipe gestures. The hand must enter and then exit the field of view and then not re-enter the field of view, to indicate completion of the gesture. The palm or the back of the hand should be perpendicular to the sensor.

Figure 8 shows the correct way to perform rotations. The rotation should be drawn with at least two fingers. The

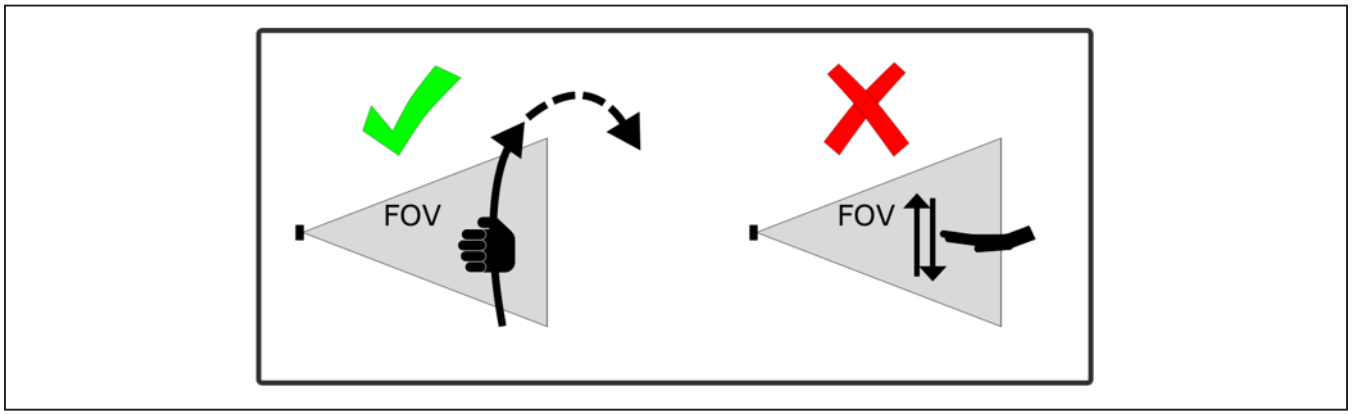


Figure 7: Vertical Swipes

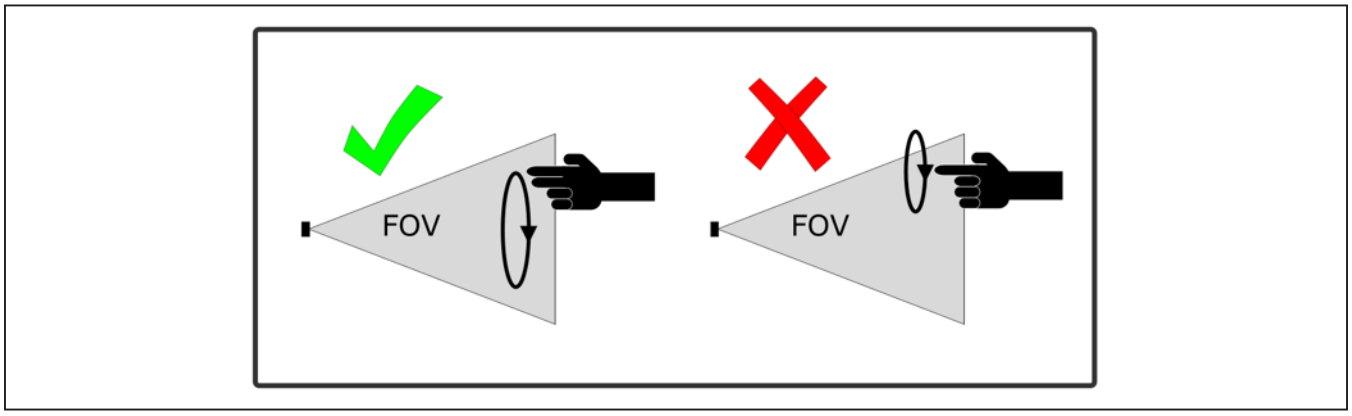


Figure 8: Rotations

Supported Gestures

GESTURE	DESCRIPTION	ICON
Swipes	Swipe gestures can be made in four directions: right, left, up, and down. Swipes are indicated by a chevron pointed in the direction of the swipe.	
Rotation	Rotations can be made in the clockwise or counterclockwise direction. Rotation is indicated by a dial graphic. A full rotation event is indicated by incrementing or decrementing the number shown on the dial. In addition, continuous rotation is indicated by the status bar going around the dial. By selecting the **Analog Dial** checkbox, the displayed rotation amount is scaled by the gear ratio value, which allows fine control over the dial setting.	
Air Click	An air-click gesture is performed by bringing the palm of the hand directly toward the sensor and then directly away from the sensor in one quick smooth motion. The air click is indicated by a small filled circle.	
Wave	A wave gesture is performed by swiping to the right across at least half of the FOV, then left at least 10 cm, then right again to exit the FOV.	

Error Events

EVENT	DESCRIPTION	ICON
Gesture Error	An unresolved or ambiguous gesture that remains in the field of view beyond the specified maximum gesture duration is indicated by the X icon. To clear the error, simply remove the hand from the field of view.	
Sunlight Rejection	This fault state occurs when intense direct sunlight is detected on the sensor. The algorithm rejects sensor frames while this fault state is active. This capability reduces the possibility of false positives due to invalid pixel readings. The fault state is automatically cleared after direct sunlight is no longer detected.	

circle of rotation should be about 10cm in diameter, with the entire circle gesture performed within the field of view.

EV Kit System Functionality and Block Diagram

The EV kit uses a MAX32620FTHR (ARM Cortex-M4F) microcontroller platform to perform the following functions:

- Serial communications to the MAX25205 to configure the sensor and read back sensor data.
- Monitor interrupts from the MAX25205.
- Run the gesture recognition algorithm.
- Packetize the sensor data and gesture results, and stream data to the PC over the USB serial port.

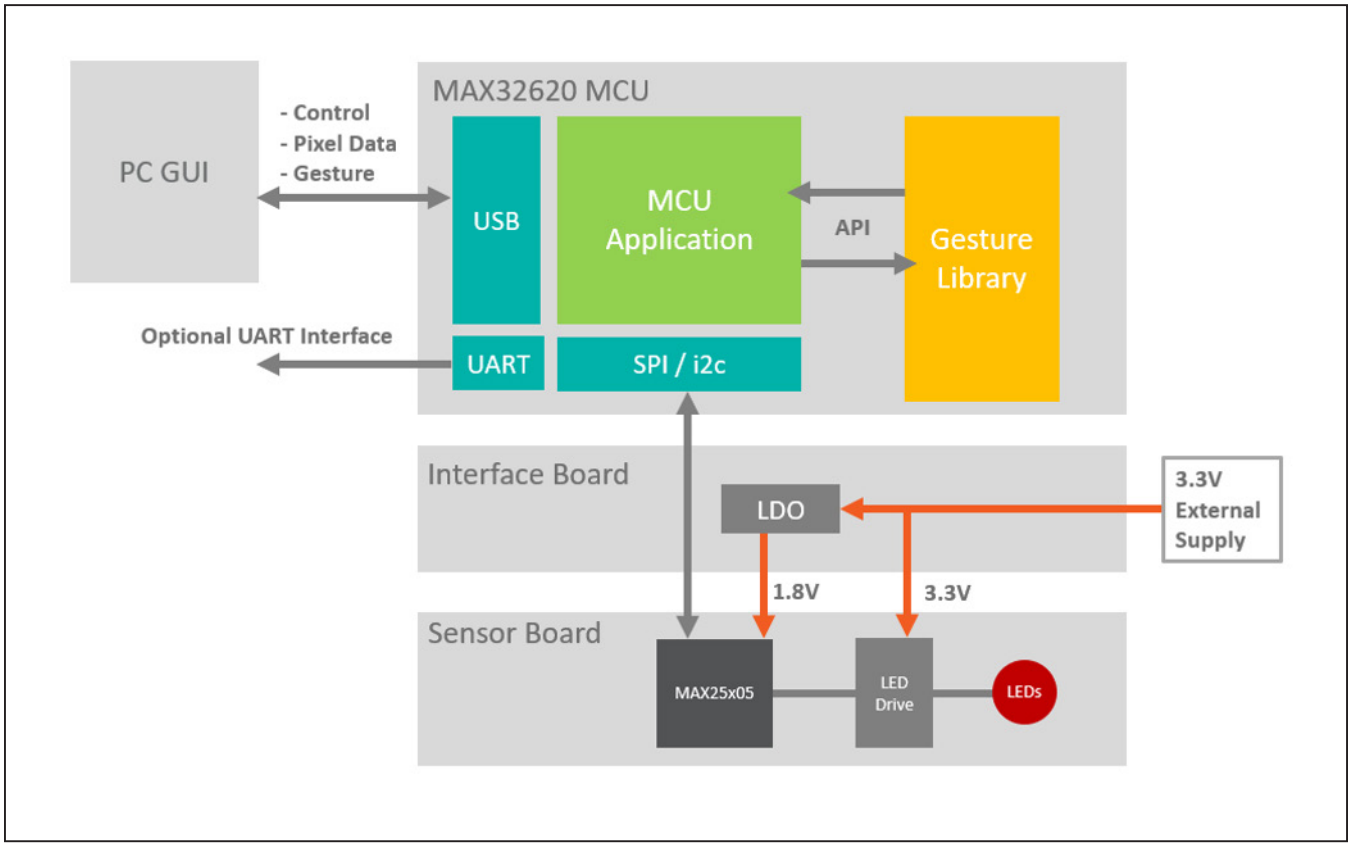


Figure 9. System Diagram

The interface board connects the MCU and the sensor board and provides power to the MAX25205 and external LEDs.

Updating Firmware

The gesture firmware on the MAX32620FTHR can be updated with the following procedure.

1) Connect the MAX32620FTHR to the PC with a USB cable.
2) Open a **File Explorer** window on the PC.
3) Enter the bootloader mode on the MAX32620FTHR by holding the BOOT button down and simultaneously pressing and releasing the RESET button. Release the BOOT button to complete the operation.
4) The MAX32620FTHR appears as **BOOTLOADER** drive in the **File Explorer** directory heirarchy.
5) Drag and drop the firmware .bin file into the **BOOTLOADER** drive. The MAX32620FTHR blinks its LEDs while it updates the firmware.
6) Once the blinking stops, press the RESET button or disconnect and reconnect the USB to restart the MCU.

Troubleshooting

If the software fails to connect to the sensor, check the **Device Manager** to determine if the driver was installed properly. When the EV kit is connected to the PC, the device should show up under the **Ports** section as **Maxim Serial Port**.

Manual connection to the EV kit can be performed under the **Device Menu**.

Ordering Information

PART	TYPE
MAX25205EVKIT#	EV Kit

#Denotes RoHS compliant.

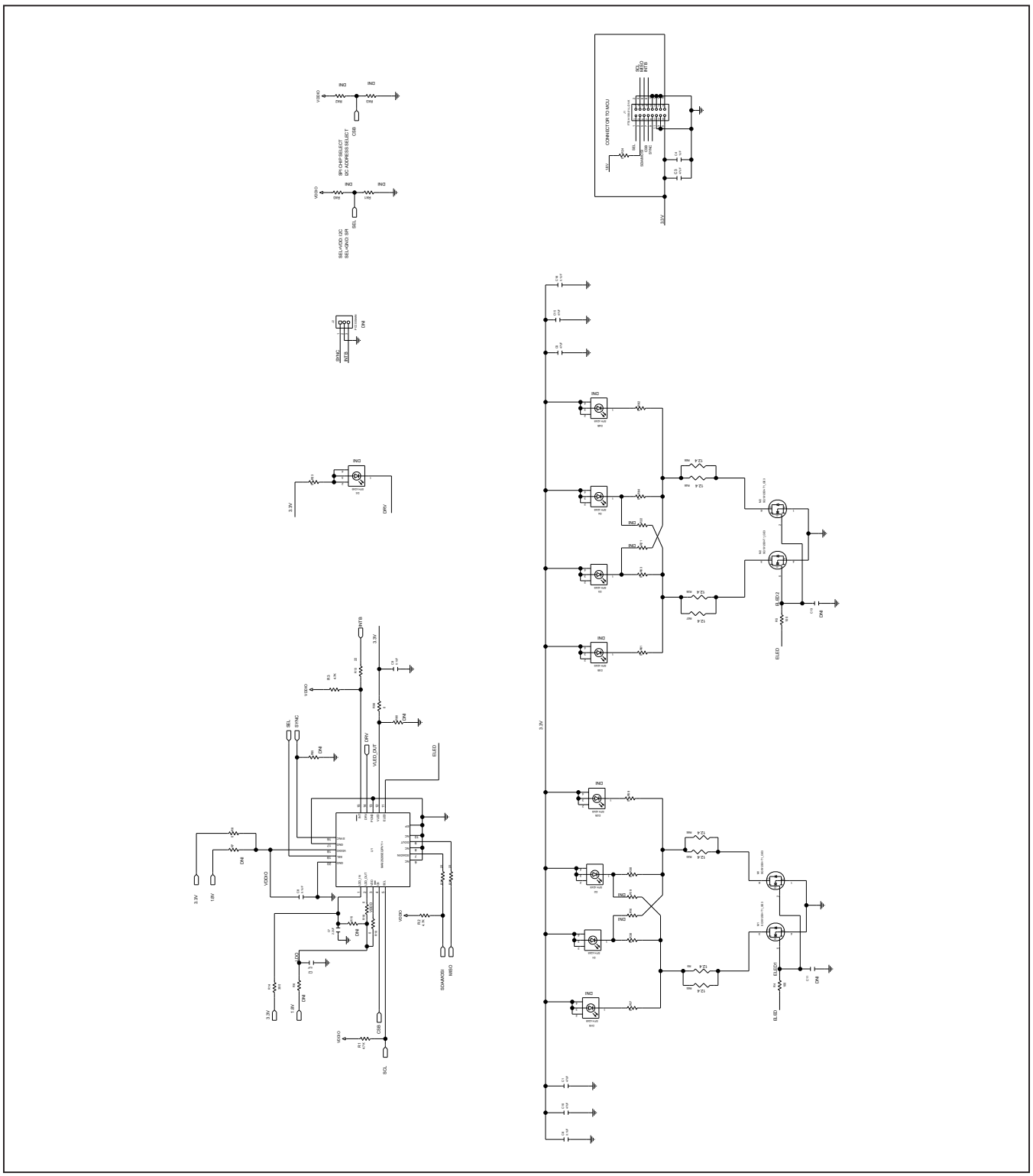
MAX25205 EV Kit Bill of Materials

ITEM	QTY	REF DES	VAR STATUS	MAXINV	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	5	C1, C3, C5, C10, C15	Pref	20-0047U-A38	GRM21BR61A476ME15	MURATA	47UF	CAP; SMT (0805); 47UF; 20%; 10V; X5R; CERAMIC CHIP	
2	2	C2, C4	Pref	20-0001U-O3	UMK107BJ105KA; C1608X5R1H105K080AB; CL10A105KB8NNN; GRM188R61H105KAAL	TAIYO YUDEN;TDK; SAMSUNG;MURATA	1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 1UF; 50V; TOL=10%; MODEL=_MK SERIES; TG=-55 DEGC TO +85 DEGC	
3	4	C6, C8, C9, C16	Pref	20-000U1-03	885012206071; CGJ3E2X7R1E104K080AA; C1608X7R1E104K080AA; C0603C104K3RAC; GRM188R71E104KA01; C1608X7R1E104K; 06033C104KAT2A; CGA3E2X7R1E104K080AA; GCJ188R71E104KA12	WURTH ELECTRONICS INC; TDK;TDK;KEMET;AVX; TDK;MURATA	0.1UF	CAPACITOR; SMT; 0603; CERAMIC; 0.1uF; 25V; 10%; X7R; -55degC to + 125degC; +/-15% from -55degC to +125degC	
4	1	C7	Pref	20-002U2-L3	C1608X5R1E225K; TMK107ABJ225KA; TMK107BJ225KA; GRM188R61E225KA12	TDK;TAIYO YUDEN; TAIYO YUDEN;MURATA	2.2UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 2.2UF; 25V; TOL=10%; MODEL=; TG=-55 DEGC TO +85 DEGC; TC=X5R	
5	2	D1, D4	Pref	30-SFH4248-00	SFH 4248	OSRAM	SFH 4248	DIODE; LED; INFRARED EMITTER; INFRARED; SMT; PIV=1.5V; IF=0.1A; -40 DEGC TO +100 DEGC	
6	2	D2, D3	Pref	30-SFH4249-00	SFH 4249	OSRAM	SFH 4249	DIODE; LED; INFRARED EMITTER; INFRARED; SMT; PIV=5.0V; IF=0.1A; -40 DEGC TO +100 DEGC	
7	1	J1	Pref	01-FTSH10801LDVK16P-19	FTSH-108-01-L-DV-K	SAMTEC	FTSH-108-01-L-DV-K	CONNECTOR; MALE; SMT; MICRO HEADER; STRAIGHT; 16PINS	
8	2	M1, M2	Pref	90-SQ1912EHT1GE3-32	SQ1912EH-T1_GE3	VISHAY SILICONIX	SQ1912EH-T1_GE3	TRAN; NCH; SC70-6; PD-(1.5W); I-(0.8A); V-(20V)	
9	1	MISC1	Pref	02-INLETBLADE-05	KTPS12-03320WA-VI-P1	VOLGEN	KTPS12-03320WA-VI-P1	ACCESSORY; ADAPTER; UNIVERSAL INPUT; WALL MOUNT ADAPTER	
10	1	MISC2	Pref	01-FFSD08D060001N16P-08	FFSD-08-D-06.00-01-N	SAMTEC	FFSD-08-D-06.00-01-N	CONNECTOR; FEMALE; TIGER EYE FLAT IDC WIRE CABLE; WIREMOUNT; 16PINS	
11	3	R1-R3	Pref	80-004K7-19	CRCW06034K70FK	VISHAY DALE	4.7K	RESISTOR; 0603; 4.7K; 1%; 100PPM; 0.10W; THICK FILM	
12	2	R4, R5	Pref	80-0100R-53	CRCW0603100RJN; ERJ-3GEYJ101	VISHAY DALE;PANASONIC	100	RESISTOR; 0603; 100 OHM; 5%; 200PPM; 0.10W; THICK FILM	
13	13	R8, R10, R17, R18, R23, R24, R38, R58, R59, R61-R64	Pref	80-0000R-AA6	CRCW06030000Z0	VISHAY DALE	0	RESISTOR; 0603; 0 OHM; 0%; JUMPER; 0.1W; THICK FILM	
14	8	R9, R20, R28, R48, R65-R68	Pref	80-012R4-AA77	ERJ-8ENF12R4	PANASONIC	12.4	RES; SMT (1206); 12.4; 1%; +/-100PPM/DEGC; 0.25W	
15	3	R11-R13	Pref	80-0022R-24	CRCW060322R0FK; CRCW060322R0FKEA	VISHAY;VISHAY	22	RESISTOR; 0603; 22 OHM; 1%; 100PPM; 0.10W; THICK FILM	
16	1	R14	Pref	80-0390R-24	CRCW0603390RFK	VISHAY DALE	390	RESISTOR; 0603; 390 OHM; 1%; 100PPM; 0.10W; THICK FILM	
17	1	R56	Pref	80-0000R-BA47	CRCW080500000Z0EAHP; HCJ0805ZT0R00	VISHAY;STACKPOLE ELECTRONICS INC.	0	RESISTOR; 0805; 0 OHM; 0%; JUMPER; 0.5W; THICK FILM	
18	1	U1	Pref	00-SAMPLE-02	MAX25205EQP/VY+	MAXIM	MAX25205EQP/VY+	EVKIT PART - IC; GESTURE SENSOR FOR AUTOMOTIVE APPLICATIONS; OCQFN20-EP 4MM X 4MM X 1.40MM; 0.5MM PITCH; PACKAGE OUTLINE DRAWING: 21-100404; PACKAGE LAND PATTERN: 90-100083; PACKAGE CODE: Q2044Y+2	
19	1	PCB	-	N/A	MAX25105_SENSORBOARD_ APPS_B	MAXIM	PCB	PCB:MAX25105_SENSORBOARD_ APPS_B	-
TOTAL	54								

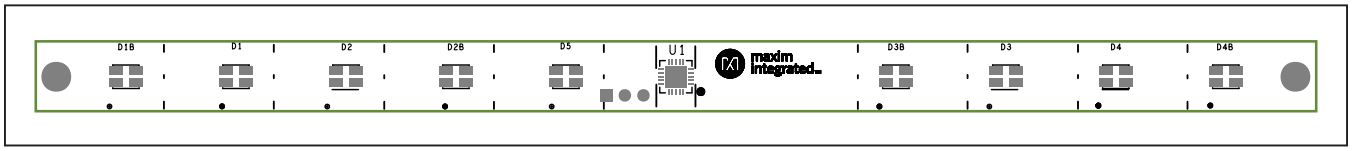
DO NOT PURCHASE(DNP)									
ITEM	QTY	REF DES	VAR STATUS	MAXINV	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	2	C11, C13	DNP	20-0010P-F9	C0402C100J5GAC; GRM1555C1H100JA01	KEMET;MURATA	10PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 10PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=C0G	DNI
2	2	D1B, D4B	DNP	30-SFH4248-00	SFH 4248	OSRAM	SFH 4248	DIODE; LED; INFRARED EMITTER; INFRARED; SMT; PIV=1.5V; IF=0.1A; -40 DEGC TO +100 DEGC	DNI
3	3	D2B, D3B, D5	DNP	30-SFH4249-00	SFH 4249	OSRAM	SFH 4249	DIODE; LED; INFRARED EMITTER; INFRARED; SMT; PIV=5.0V; IF=0.1A; -40 DEGC TO +100 DEGC	DNI
4	1	J2	DNP	01-PCC03SAAN3P-21	PCC03SAAN	SULLINS	PCC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 3PINS; -65 DEGC TO +125 DEGC	DNI
5	12	R6, R7, R15, R16, R19, R21, R22, R40-R43, R60	DNP	80-0000R-AA6	CRCW06030000Z0	VISHAY DALE	0	RESISTOR; 0603; 0 OHM; 0%; JUMPER; 0.1W; THICK FILM	DNI
6	1	R55	DNP	80-0001K-24	CRCW06031K00FK; ERJ-3EKF1001	VISHAY DALE;PANASONIC	1K	RESISTOR; 0603; 1K; 1%; 100PPM; 0.10W; THICK FILM	DNI
TOTAL	21								

PACKOUT (These are purchased parts but not assembled on PCB and will be shipped with PCB)									
ITEM	QTY	REF DES	VAR STATUS	MAXINV	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
TOTAL	0								

MAX25205 EV Kit Schematic



MAX25205 EV Kit Layout



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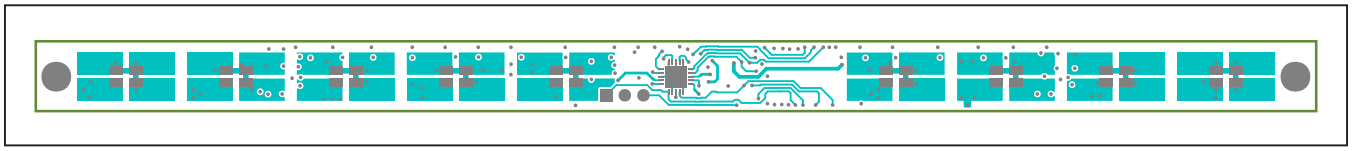

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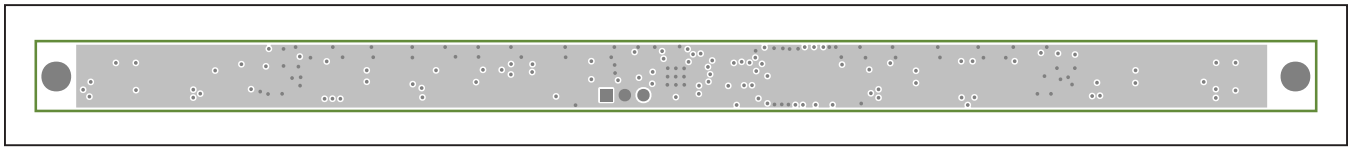
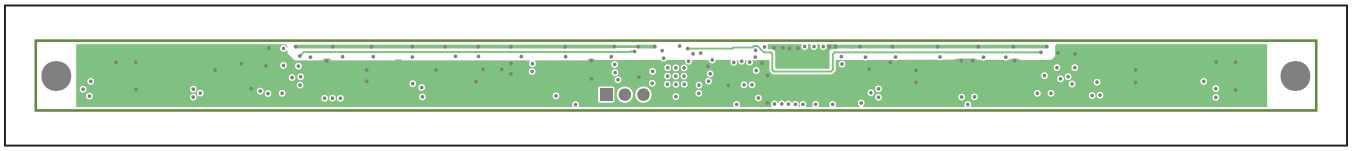


Layer1



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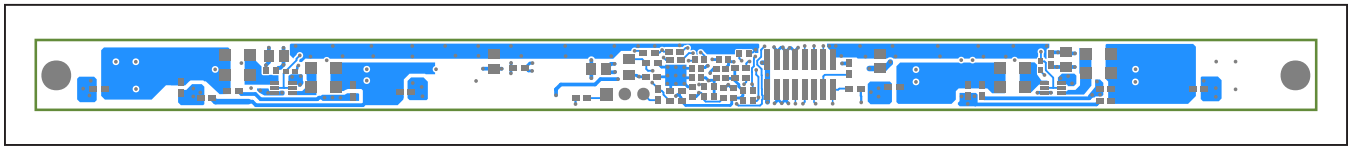

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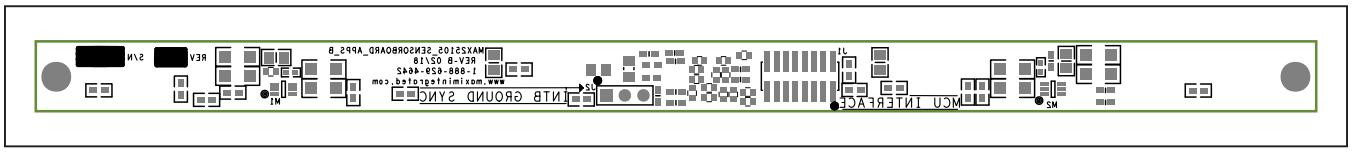

Silk Bottom