MAX2771 Evaluation Kit

Evaluates: MAX2771

General Description

The MAX2771 evaluation kit (EV kit) simplifies evaluation of the MAX2771, a next-generation Global Navigation Satellite System (GNSS) receiver covering the L1, L2, L5, E1, E5, E6, B1, B2, and B3 bands, as well as the GPS, GLONASS, Galileo, QZSS, IRNSS, and BeiDou navigation satellite systems on a single chip. It enables testing of device performance and requires no additional support circuitry. Standard 50Ω SMA connectors are included on the EV kit for the inputs and outputs to allow for quick and easy evaluation on the test bench.

The MAX2771 EV kit contains a microcontroller (MCU) that translates between the three-wire SPI interface and USB to allow the user to configure internal registers and modes with Graphical User Interface (GUI) software running on a PC. The EV kit is fully assembled and tested at the factory.

This document provides a component list, a list of equipment required to evaluate the device, a straightforward test procedure to verify functionality, a description of the EV kit circuit, the circuit schematic, and artwork for each layer of the printed circuit board (PCB).

Features

- Easy Evaluation of the MAX2771 IC
- +2.7V to +3.3V Single-Supply Operation
- 50Ω SMA Connectors on the RF and Baseband Input and Outputs
- All Critical Peripheral Components Included
- Micro-USB Port for Interfacing with PC

Quick Start

Required Equipment

This section lists the recommended test equipment to verify operation of the MAX2771. It is intended as a guide only and some substitutions are possible.

- One RF signal generator capable of delivering minimum -120dBm up to 3.0GHz (Keysight N5182B or equivalent)
- An RF spectrum analyzer with a range of 100kHz to 3.0GHz (Keysight N9020A or equivalent)
- A power supply capable of up to 1A at +2.7V to +6V
- One Digital multi-meter for measuring the supply current (Keysight 34461A or equivalent) (optional)
- 50Ω coaxial RF cable with SMA connectors
- A network analyzer (e.g., HP 8753D or equivalent) to measure small-signal return loss (optional)
- A dual power supply capable of delivering up to 1A at ±5V
- A user-supplied Windows-based PC
- Oscilloscope or logic analyzer to measure digital outputs(optional)

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

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Procedure

This section provides a step-by-step guide to operating the EV kit and testing the device functions.

Caution: Do not turn on the DC power or RF signal generators until all connections are completed.

The MAX2771 EV kit includes two on-board MAX8510 linear regulators for powering up the MAX2771 device to a regulated supply voltage of +2.85V. When using the linear regulators, connect pins 1-2 of headers J15 and J16. The MAX2771 can also be powered directly through an external power supply connected to pin 2 of these headers. Pin 1 of these 3-pin headers is marked with a dot on the silkscreen.

Download the MAX2771 EV Kit Software

- Download the MAX2771 EV kit software from the Maxim Integrated website, run the installation file, and install it.
- Start running the GUI program.

Powering the EV Kit

- Connect the PC to the on board MAX32625 PICO microcontroller module on the EV kit using the provided USB cable. The GUI should indicate EV kit connected in the status log.
- Connect a DC supply set to +3V (through an ammeter if desired) to headers J13 and ground J14 on the EV kit. Do not turn on the supply. When using the on-board linear regulators to power the MAX2771, connect pins 1-2 of headers J15 and J16.
- Connect a DC supply set to +5V to header J28 on the EV kit. Connect a DC supply set to -5V to header J29 on the EV kit. Do not turn on the supply. Connect the ground to J25.
- Make sure that headers J17– J24 are shorted for proper supply connection to the MAX2771.
- Turn on the power supplies, the digital multimeter should read around 20mA of current.

High-Band Connections

- Set the RF signal generator to 1575.42MHz, -110dBm power. Do not turn on the generator's output. Connect the RF signal generator to the LNA_HI_IN input (J4) using a coaxial RF cable with SMA connectors.
- Connect LNA_HI_OUT SMA connector (J5) to the MIX_HI_IN SMA connector (J6) on the EV kit using a short coaxial RF cable with SMA connectors.
- In the GUI's Streaming and Registers tab, write 0xBEA41603 to the register at address 0x0 and write 0x00C00002 to the register at address 0x9.
- Connect the output of the MAX4444 buffer, I_OUT_ANA (J10) on the EV kit to a spectrum analyzer using a coaxial RF cable with SMA connectors.
- In the GUI's Receiver, IF and AGC tab (make sure Auto Update is ON),
  - Select Filter type as bandpass filter.
  - Select Filter Order to 5th Order Butterworth option.
  - Select filter Bandwidth to 2.5MHz.
  - Select GAIN set from GAININ.
  - Select ADC Bypass mode in Output Driver Configuration.
- Turn on the RF signal generator output and observe the output in Signal analyzer at 4.092MHz. See Figure 1 below.
- Set the Driver Configuration to CMOS logic to observe the ADC digital output at J26 header pins. ADC Output Bit and Data format can be selected accordingly from GUI. See Figure 2.

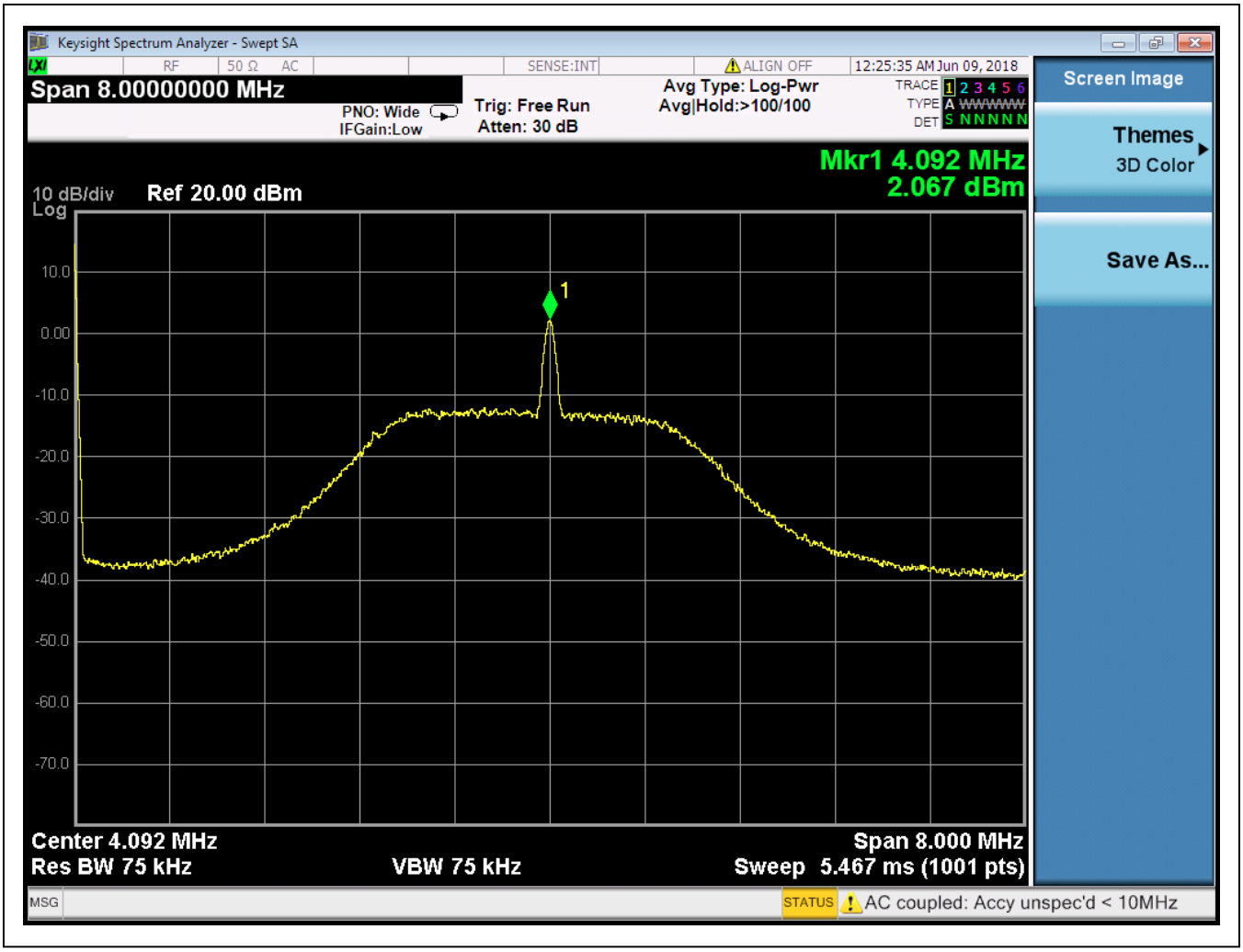


Figure 1. Spectrum of IF Signal within the Filter response (High Band)

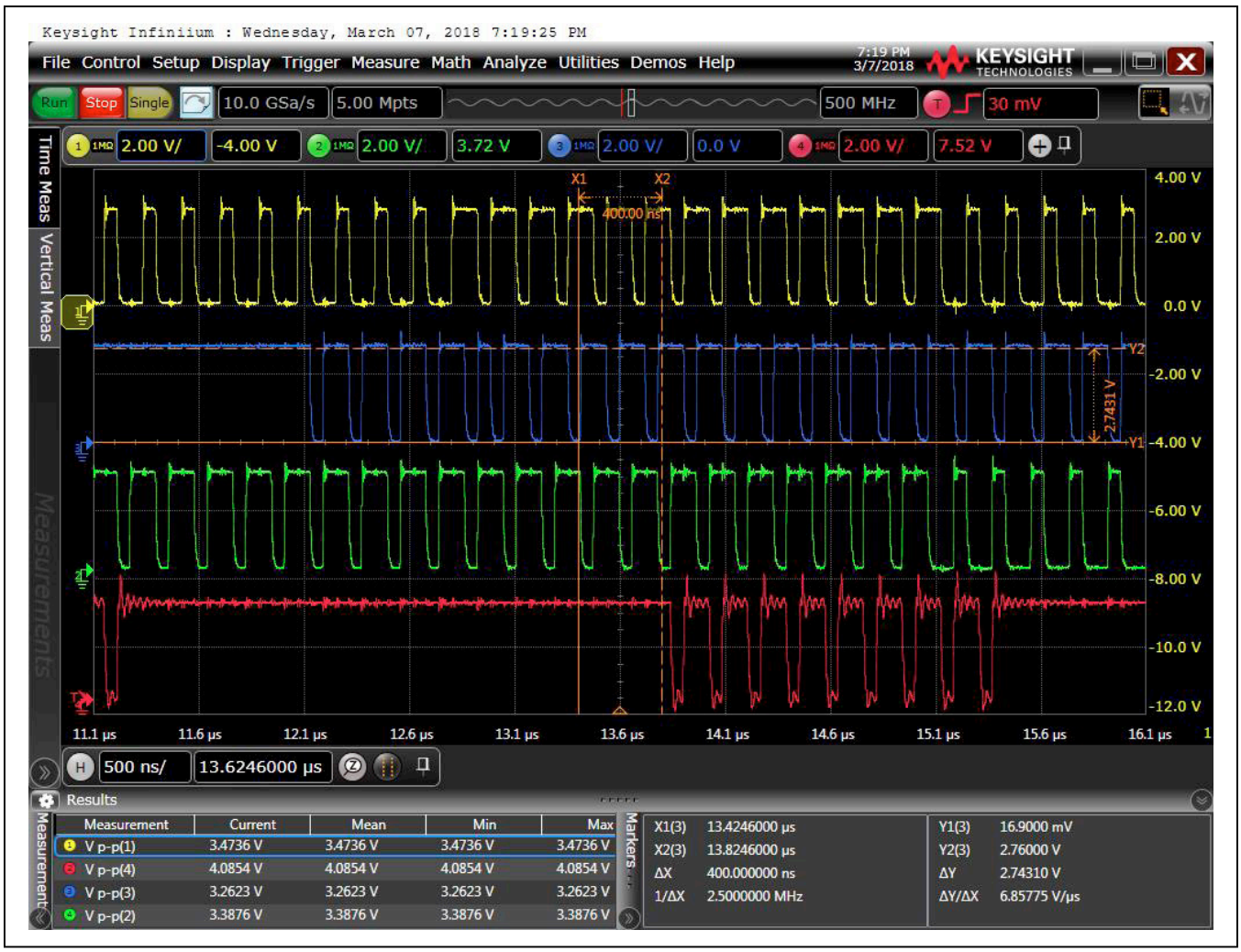


Figure 2. ADC Outputs on Oscilloscope

Low-Band Connections

- Set the RF signal generator to 1176.45MHz, -110dBm power. Do not turn on the generator's output. Connect the RF signal generator to the LNA_LO_IN input (J1) using a coaxial RF cable with SMA connectors.
- Connect LNA_LO_OUT SMA connector (J2) to the MIX_LO_IN SMA connector (J3) on the EV kit using a coaxial RF cable with SMA connectors.
- Connect the output of the MAX4444 buffer, I_OUT_ANA (J10) on the EV kit to a spectrum analyzer using coaxial RF cable with SMA connectors.
- In the GUI's Streaming and Registers tab, write 0xBEA41603 to the register at address 0x0 and write 0x00C00002 to the register at address 0x9.
- In the GUI's Receiver, PLL and Clock tab (make sure Auto Update is on),
  - Select L2/L5band.
  - Select Fractional PLL Mode in PLL Control Mode.
  - Set Reference division ratio to 3 and input LO Frequency to 1173.3333MHz.
  - Check for the Lock detect button to go green.
- In the GUI's Receiver IF and AGC tab,
  - Select 'LNA_LO is Active' in LNA Mode field.
  - Select Mixer Mode as 'Enable Low Band'
  - Select Filter type as bandpass filter.
  - Select Filter Order to 5th Order Butterworth option.
  - Select filter Bandwidth to 2.5MHz.
  - Update Centre Frequency bits with value 1100000.
  - Select GAIN set from GAININ in AGC mode
  - Select ADC Bypass mode in Output Driver Configuration.
- Turn on the RF signal generator output and observe the output in Signal analyzer at 3.11MHz.
- Set the Driver Configuration to CMOS logic to observe the ADC digital output at J26 header pins.

Layout Issues

A good PCB is an essential part of an RF circuit design. The EV kit PCB can serve as a guide for laying out a board using the MAX2771. Keep traces carrying RF signals as short as possible to minimize radiation and insertion loss. Use impedance control on all RF signal traces. The exposed paddle must be soldered evenly to the board's ground plane for proper operation. Use abundant vias beneath the exposed paddle and between RF traces to minimize undesired RF coupling. To minimize coupling between different sections of the IC, each VCC pin must have a bypass capacitor with low impedance to the closest ground at the frequency of interest. Do not share ground vias among multiple connections to the PCB ground plane. Refer to the Layout Issues section of the MAX2771 IC data sheet for more information

Component Suppliers

SUPPLIER	WEBSITE
Murata Mfg. Co., Ltd.	www.murata.com
Rakon Ltd.	www.rakon.com
Yageo Corporation	www.yageo.com
Kemet Electronics Pvt Ltd	www.kemet.com/

Note: *Indicate that you are using the MAX2771 when contacting these component suppliers.*

Ordering Information

PART	TYPE
MAX2771EVKIT#	EV Kit

#Denotes RoHS-compliant

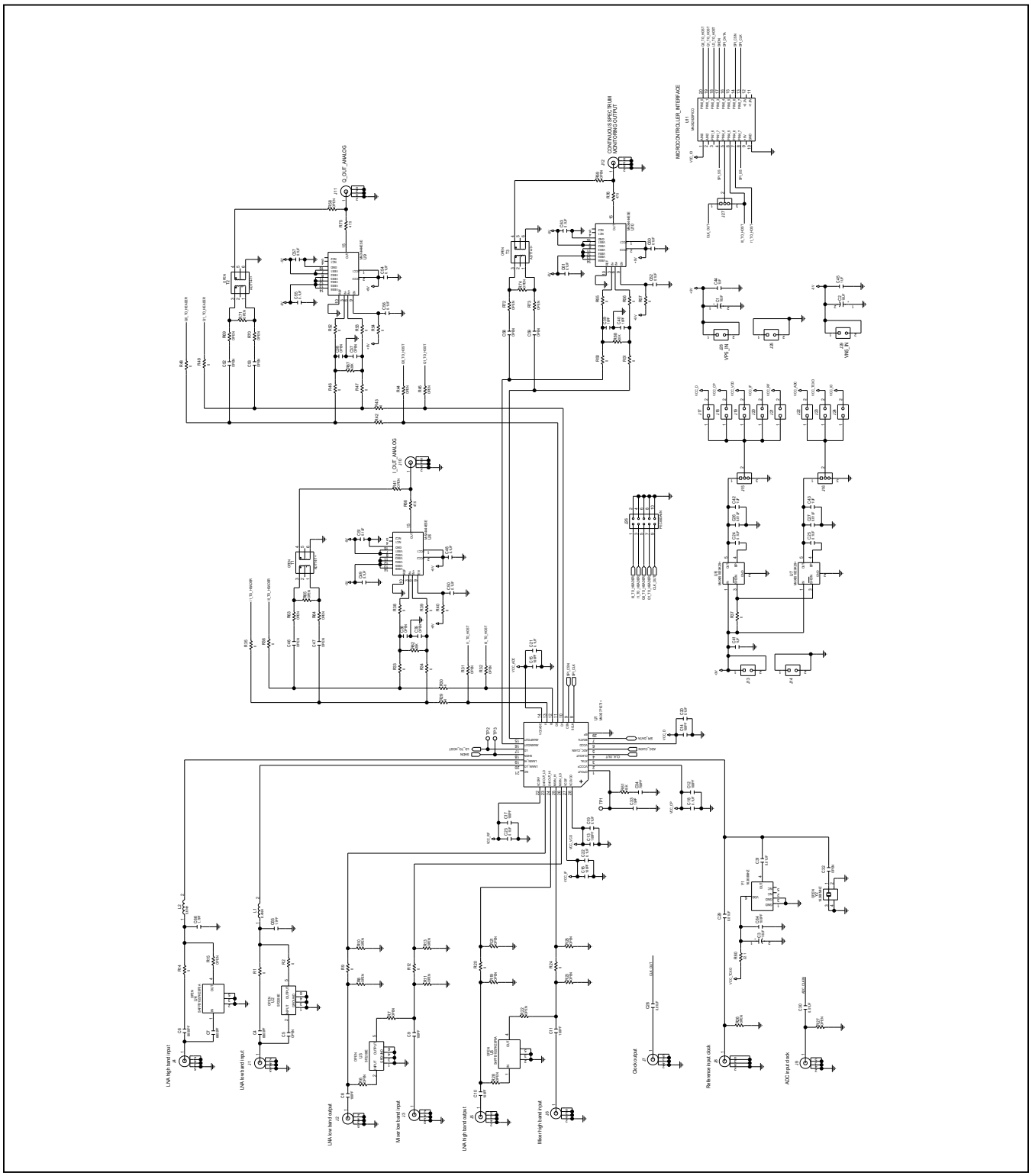
MAX2771 EV Kit Bill of Materials

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	C1-C3	-	3	TAJB106K016R; T494B106K016A	AVX;AVX	10UF	CAPACITOR; SMT (3528); TANTALUM CHIP; 10UF; 16V; TOL=10%	
2	C4, C6, C7	-	3	C0402C682K5RAC; GRM155R71H682KA88	KEMET;MURATA	6800PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 6800PF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
3	C8-C17, C64	-	11	C0402C101J5GAC; NMC0402NPO101J; CC0402JRNPO9BN101; GRM1555C1H101JA01; C1005C0G1H101J050	KEMET;NIC COMPONENTS CORP.;YAGEO PHICOMP;MURATA;TDK	100PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 100PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=C0G	
4	C18-C25, C48-C51, C54-C57, C60-C63	-	20	C0402C104J4RAC	KEMET	0.1UF	CAPACITOR; SMT; 0402; CERAMIC; 0.1uF; 16V; 5%; X7R; -55degC to + 125degC; 0 +/-15% degC MAX.	
5	C26-C31	-	6	NMC0402X7R103K16TRP; GRM155R71C103KA01; CC0402KRX7R7BB103	NIC COMPONENTS CORP.; MURATA;YAGEO	0.01UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.01UF; 16V; TOL=10%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=X7R	
6	C33	-	1	C0402C0G500-150JNP; GRM1555C1H150JA01	VENKEL LTD.;MURATA	15PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 15PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=C0G	
7	C34	-	1	CC0402KRX7R9BB751	YAGEO	750PF	CAP; SMT (0402); 750PF; 10%; 50V; X7R; CERAMIC CHIP	
8	C39, C40	-	2	C0402C100J5GAC; GRM1555C1H100JA01	KEMET;MURATA	10PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 10PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=C0G	
9	C41-C45	-	5	C0402C105K8PAC	KEMET	1UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 1UF; 10V; TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R	
10	C65	-	1	GRM1554C1E1R1CA01	MURATA	1.1PF	CAP; SMT (0402); 1.1PF; +/-0.25PF; 25V; JIS; CERAMIC CHIP ;	
11	C66	-	1	GJM1555C1H1R7WB01	MURATA	1.7PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 1.7PF; 50V; TOL=0.05PF; TG=-55 DEGC TO +125 DEGC; TC=C0G	
12	J1-J4, J10-J12	-	7	142-0701-801	JOHNSON COMPONENTS	142-0701-801	CONNECTOR; FEMALE; BOARDMOUNT; END LAUNCH JACK RECEPTACLE- ROUND CONTACT; STRAIGHT; 2PINS	
13	J5-J9	-	5	142-0701-201	JOHNSON COMPONENTS	142-0701-201	CONNECTOR; FEMALE THREADED; THROUGH HOLE; SMA; STRAIGHT THROUGH; 5PINS	
14	J13, J14, J17-J25, J28, J29	-	13	PEC02SAAN	SULLINS	PEC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS	
15	J15, J16, J27	-	3	PEC03SAAN	SULLINS	PEC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS	
16	J26	-	1	PEC05DAAN	SULLINS ELECTRONICS CORP.	PEC05DAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 10PINS; -65 DEGC TO +125 DEGC	
17	L1	-	1	LQW18AN8N4C80	MURATA	8.4NH	INDUCTOR; SMT (0603); WIREWOUND; 8.4NH; 0.2NH; 1.6A ;	
18	L2	-	1	LQW18AN5N6C80	MURATA	5.6NH	INDUCTOR; SMT (0603); WIREWOUND; 5.6NH; 0.2NH; 1.9A ;	
19	R1, R2, R14, R29, R30, R33-R40, R42, R43, R46-R57	-	27	RC0402JR-070RL; CR0402-16W-000RJT	YAGEO PHYCOMP; VENKEL LTD.	0	RESISTOR; 0402; 0 OHM; 5%; JUMPER; 0.063W; THICK FILM	
20	R9, R12, R20, R24	-	4	RC1608J000CS; CR0603-J/-000ELF;RC0603JR-070RL	SAMSUNG ELECTRONICS; BOURNS;YAGEO PH	0	RESISTOR; 0603; 0 OHM; 5%; JUMPER; 0.10W; THICK FILM	
21	R60	-	1	CR0402-16W-22R1FT	VENKEL LTD.	22.1	RESISTOR; 0402; 22.1 OHM; 1%; 100PPM; 0.063W; THICK FILM	
22	R61	-	1	ERJ-2GEJ153	PANASONIC	15K	RESISTOR; 0402; 15K OHM; 5%; 200PPM; 0.1W; THICK FILM	
23	R62, R67, R68	-	3	ERJ-2GEJ203X	PANASONIC	20K	RESISTOR; 0402; 20K OHM; 5%; 200PPM; 0.10W; THICK FILM	
24	R66, R75, R76	-	3	CR0402-16W-47R5FT; CRCW040247R5FK	VENKEL LTD.;VISHAY	47.5	RESISTOR; 0402; 47.5 OHM; 1%; 100PPM; 0.063W; THICK FILM	

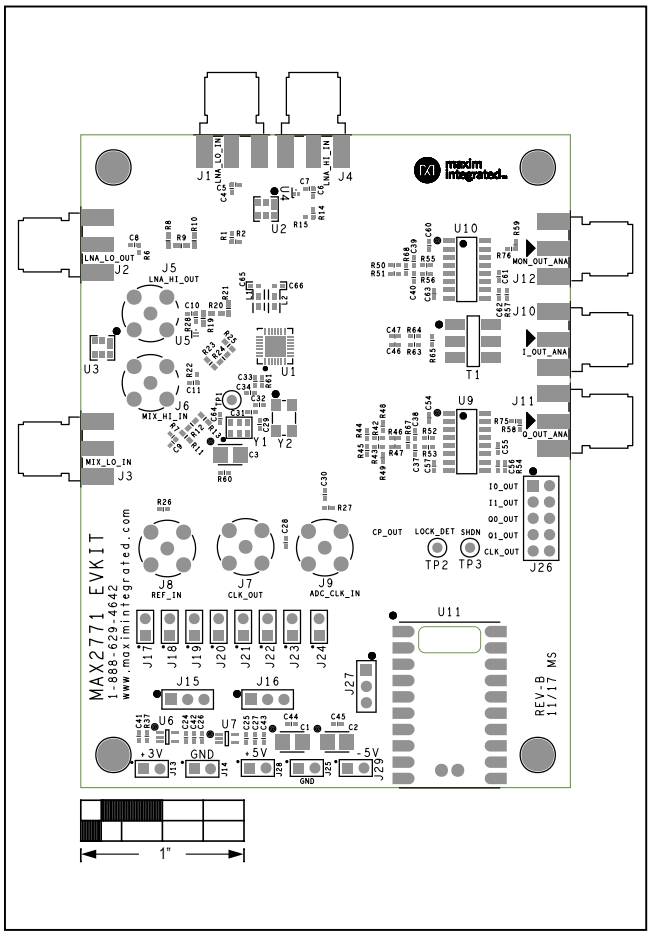
MAX2771 EV Kit Bill of Materials (continued)

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
25	SU15-SU24	-	10	STC02SYAN	SULLINS ELECTRONICS CORP.	STC02SYAN	TEST POINT; JUMPER; STR; TOTAL LENGTH=0.256IN; BLACK; INSULATION=PBT CONTACT=PHOSPHOR BRONZE; COPPER PLATED TIN OVERALL	
26	TP1-TP3	-	3	5000	KEYSTONE	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
27	U1	-	1	MAX2771ETI+	MAXIM	MAX2771ETI+	EVKIT PART-IC; UNIVERSAL GNSS RECEIVER; TQFN28-EP; PACKAGE OUTLINE DRAWING: 21-0140; PACKAGE CODE: T2855+3; PACKAGE LAND PATTERN; 90-0023	
28	U6, U7	-	2	MAX8510EXK29+	MAXIM	MAX8510EXK29+	IC; VREG; ULTRA-LOW-NOISE; HIGH PSRR; LOW-DROPOUT; 0.12A LINEAR REGULATOR; SC70-5	
29	U8-U10	-	3	MAX4444ESE+	MAXIM	MAX4444ESE	IC; DLRX; ULTRA-HIGH-SPEED; LOW-DISTORTION; DIFFERENTIAL-TO-SINGLE-ENDED LINE RECEIVERS WITH ENABLE	
30	U11	-	1	MAX32625PICO	MAXIM	MAX32625PICO	MODULE; BOARD; MAX32625PICO BOARD DESIGN FOR MAX32625 ARM CORTEX-M4F; BOARD; LAMINATED PLASTIC WITH COPPER CLAD;	
31	Y1	-	1	IT3200C_16.368MHZ	RAKON	16.368MHZ	EVKIT PART -CRYSTAL; SMT 3.2 MM X 2.5 MM; 10PF; 16.368MHZ; +/-1PPM; +/-0.5PPM TO +/-5PPM	
32	PCB	-	1	MAX2771	MAXIM	PCB	PCB:MAX2771	-
33	C5	DNP	0	C0402C682K5RAC; GRM155R71H682KA88	KEMET;MURATA	6800PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 6800PF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
34	C32	DNP	0	NMC0402X7R103K16TRP; GRM155R71C103KA01; CC0402KRX7R7BB103	NIC COMPONENTS CORP.; MURATA;YAGEO	0.01UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.01UF; 16V; TOL=10%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=X7R	
35	C35-C38	DNP	0	C0402C100J5GAC; GRM1555C1H100JA01	KEMET;MURATA	10PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 10PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=C0G	
36	C46, C47, C52, C53, C58, C59	DNP	0	C0402C104J4RAC	KEMET	0.1UF	CAPACITOR; SMT; 0402; CERAMIC; 0.1uF; 16V; 5%; X7R; -55degC to + 125degC; 0 +/-15% degC MAX.	
37	R6, R7, R15, R22, R28, R31, R32, R41, R44, R45, R58, R59	DNP	0	RC0402JR-070RL; CR0402-16W-000RJT	YAGEO PHYCOMP; VENKEL LTD.	0	RESISTOR; 0402; 0 OHM; 5%; JUMPER; 0.063W; THICK FILM	
38	R26, R27	DNP	0	CRCW040249R9FK; RK73H1ETTP49R9F	VISHAY DALE;KOA SPEER	49.9	RESISTOR; 0402; 49.9 OHM; 1%; 100PPM; 0.0625W; THICK FILM	
39	R63, R64, R69, R70, R72, R73	DNP	0	CRCW04021K00FK; RC0402FR-071KL	VISHAY DALE;YAGEO PHICOMP	1K	RESISTOR; 0402; 1K; 1%; 100PPM; 0.0625W; THICK FILM	
40	R65, R71, R74	DNP	0	CRCW0402200RFK	VISHAY DALE	200	RESISTOR; 0402; 200 OHM; 1%; 100PPM; 0.063W; THICK FILM	
41	T1-T3	DNP	0	ADTT4-1+	MINI-CIRCUITS	ADTT4-1+	EVKIT PART -TRANSFORMER; SMT; 0.2-120MHZ; SURFACE MOUNT RF TRANSFORMER	
42	U2, U3	DNP	0	SF2208E	MURATA	SF2208E	EVKIT PART-FILTER; SAW; SAW FILTER; SMD; 1227MHZ	
43	U4, U5	DNP	0	SAFFB1G57KE0F0A	MURATA	SAFFB1G57KE0F0A	FILTER; SAW; HI-FREQUENCY CERAMIC SOLUTION; SMT; 1575.4MHZ	
44	Y2	DNP	0	RSX-5_16.368MHZ	RAKON	16.368MHZ	EVKIT PART -CRYSTAL; SMT 5X3.2; 5PF TO 50PF; 16.368MHZ; +/-5PPM TO +/-25PPM; +/-5PPM TO +/-50PPM	
45	R8, R10, R11, R13, R19, R21, R23, R25	DNP	0	N/A	N/A	OPEN	PACKAGE OUTLINE 0603 RESISTOR	
TOTAL			146					

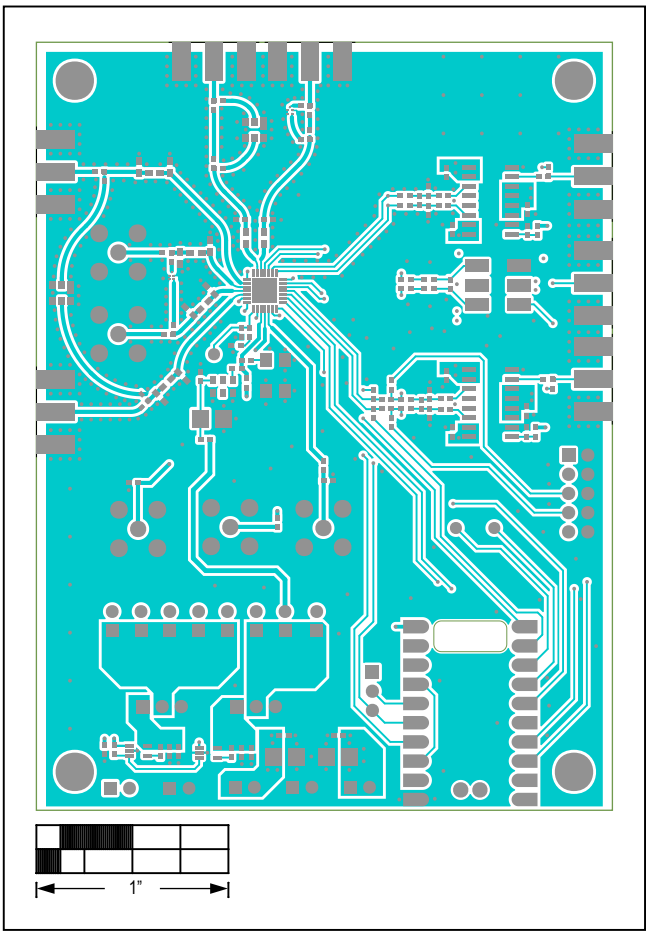
MAX2771 EV Kit Schematics



MAX2771 EV Kit PCB Layout Diagrams

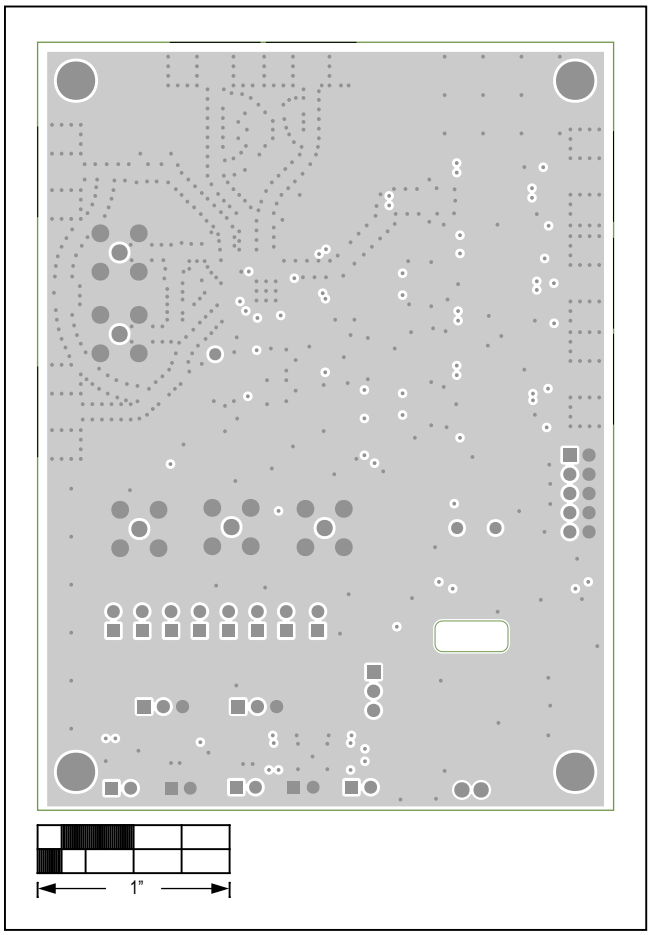


MAX2771 EV Kit—Top Silkscreen

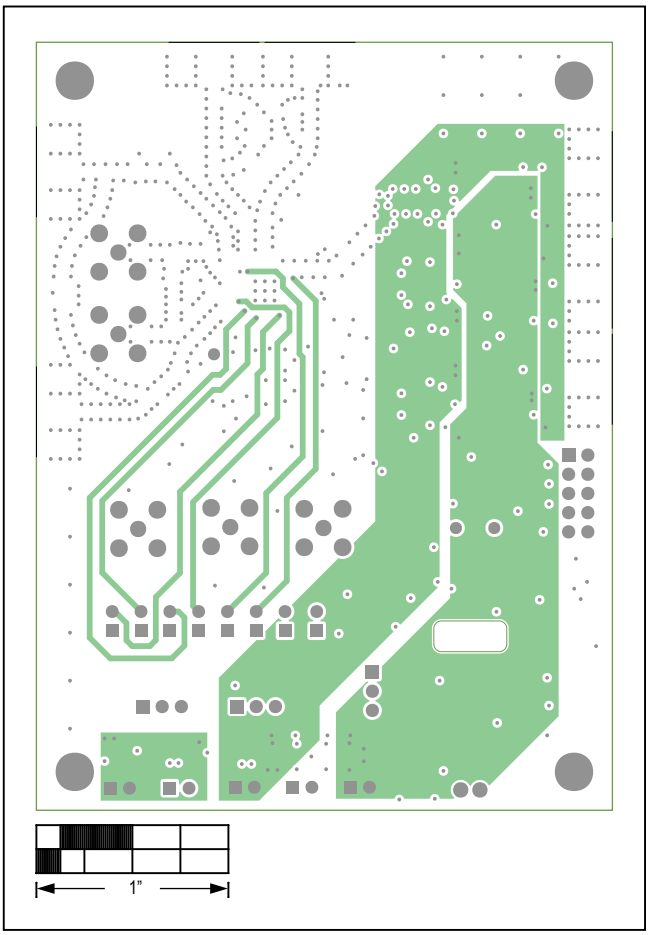


MAX2771 EV Kit—Top

MAX2771 EV Kit PCB Layout Diagrams (continued)

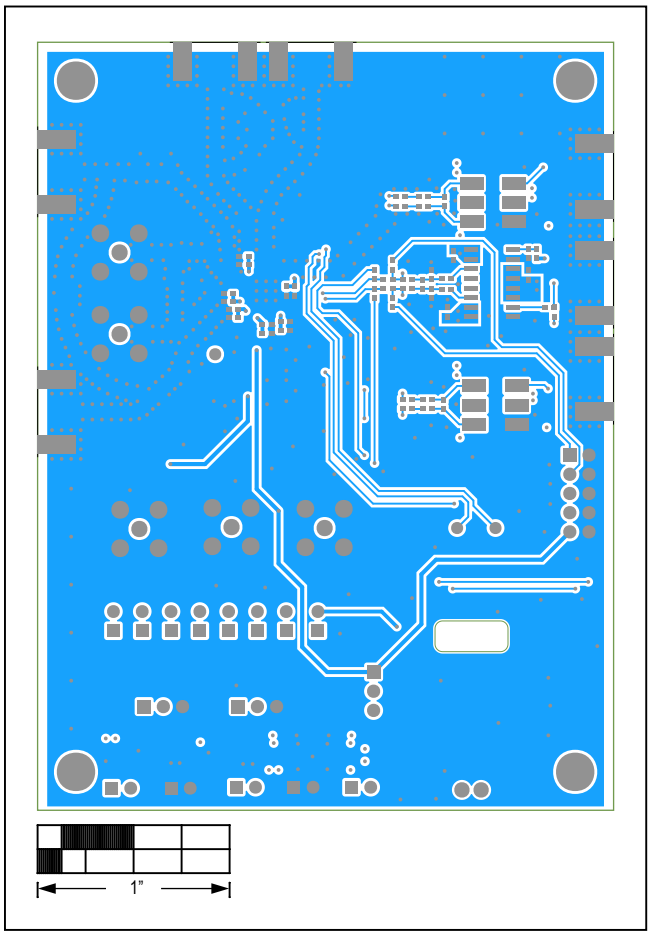


MAX2771 EV Kit—Level 2 GND

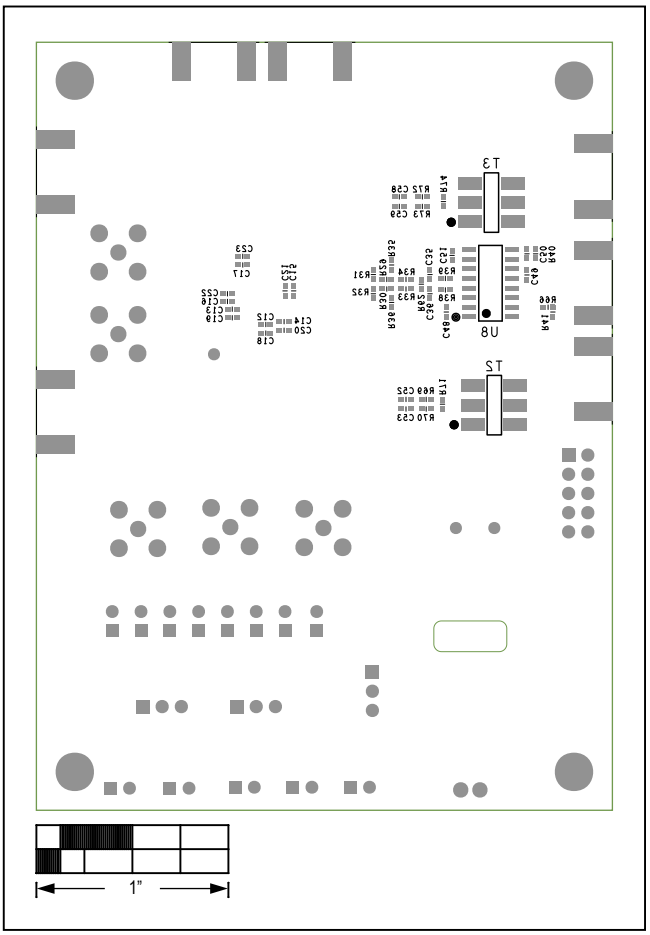


MAX2771 EV Kit—Level 3 PWR

MAX2771 EV Kit PCB Layout Diagrams (continued)



MAX2771 EV Kit—Bottom



MAX2771 EV Kit—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	8/18	Initial release	—

For pricing, delivery, and ordering information, please visit Maxim Integrated's online storefront at https://www.maximintegrated.com/en/storefront/storefront.html.

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- *Специальные условия для постоянных клиентов.*
- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
- *Работу по проектам и поставку образцов.*
- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
- *Входной контроль качества.*
- *Наличие сертификата ISO.*

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Конструкторский отдел помогает осуществить:

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