



VRS+ and VRS- to measure the differential input voltage across the inputs ( $V_{SENSE}$ ).

- 6) Install jumper J2 and connect the positive terminal of the calibrator/DC power supply to OVC input. Set the calibrator/DC power supply voltage output to 500mV.
- 7) Connect the second voltmeter across OUT and GND test point to measure the MAX40056F/MAX40056T/MAX40056U output.
- 8) Connect the third voltmeter across COP and GND test point to measure over current fault status at COP output.
- 9) Turn on the power supplies and the calibrator and then the electronic load.
- 10) Enable the electronic load.
- 11) Verify that the first voltmeter displays 300mA x 50mΩ = +15mV and the second voltmeter displays 2.25V.
- 12) Verify that the COP output is high (+3.3V).
- 13) Now change the OVC input from 500mV to 1V on the calibrator output setting.
- 14) Verify that the COP output is low (~0V).
- 15) Turn off the electronic load and set the electronic load to source 300mA.
- 16) Turn on the electronic load and verify that the first voltmeter displays -15mV and the second voltmeter displays 750mV.
- 17) Verify that the COP output is low (~0V).
- 18) After the functions are verified, do not forget to turn off the electronic load, calibrator and the power supply.

### Detailed Description of Hardware

The MAX40056 EV kit provides a proven design to evaluate MAX40056F/MAX40056T/MAX40056U high-precision, high-voltage bidirectional current sense amplifier for PWM application. The device offers precision accuracy specifications of input offset voltage ( $V_{OS}$ ) less than 10μV (max) and gain error less than 0.2% (max).

The device has a proprietary input stage designed to reject high gradient PWM common mode voltage inputs and still accurately monitors the load current across its inputs.

**Table 1. Jumper Functions (J1 – J2)**

JUMPER LABEL	DEFAULT POSITION	FUNCTION
J1	Not Installed	OVC threshold input provided by REF output. Install R5 and R6 to create OVC threshold.
J2	Installed	OVC threshold input provided by external source

### Theory of Operation

#### Bidirectional Operation

The MAX40056 EV kit evaluates the MAX40056F/MAX40056T/MAX40056U bidirectional current sense amplifier. The output is set to the  $V_{REF}$  voltage at no load. The  $V_{REF}$  voltage can either be from internal 1.5V reference voltage generated or an external reference supplied at  $V_{REF}$  input. That sets the bias voltage to  $V_{REF}$  (V) for a no-current condition. Current in the positive direction in reference to RS+ and RS- increases the output voltage from  $V_{REF}$  (V) and current in the negative direction decreases the output voltage from  $V_{REF}$  (V).

Hence, the output equation becomes:

$$V_{OUT} (V) = [(I_{LOAD}(A) \times R_{SENSE}(\Omega)) \times GAIN(V/V)] + V_{REF}(V)$$

#### External Reference

When choosing external reference at  $V_{REF}$  input, it is recommended to choose  $V_{REF}$  (V) = (1/2) x  $V_{DD}$  (V) and the  $V_{DD}$  (V) value must not exceed absolute maximum ratings.

#### Overcurrent Fault Protection

The MAX40056 device features an integrated window comparator to monitor overcurrent conditions. An overcurrent threshold voltage input is provided to the OVC input, which monitors for overcurrent detection in both the direction. When an overcurrent condition occurs, the output of the window comparator goes low indicating a fault detection.

The input range for OVC input is from 0.08V to MIN ( $V_{REF} - 0.08, V_{DD} - 1.25$ ).

#### Threshold Input Options

When using an external voltage source to provide OVC threshold to the CIP input, install Jumper J2 and remove J1 if installed. Also make sure that the resistors R5 and R6 are also not populated.

When using the reference voltage to provide OVC threshold to the CIP input, remove J2 and install J1. Also install R5 and R6 resistors to create the desired value of OVC threshold value.

$$V_{OVC} (V) = [(V_{REF} \times R_6)/(R_5 + R_6)]$$

While choosing the value of R5 and R6, make sure the total resistance is large so that the REF output is not loaded. Recommended choice of  $R_5 + R_6 = 500k\Omega$ .

MAX40056 EV Kit Bill of Materials

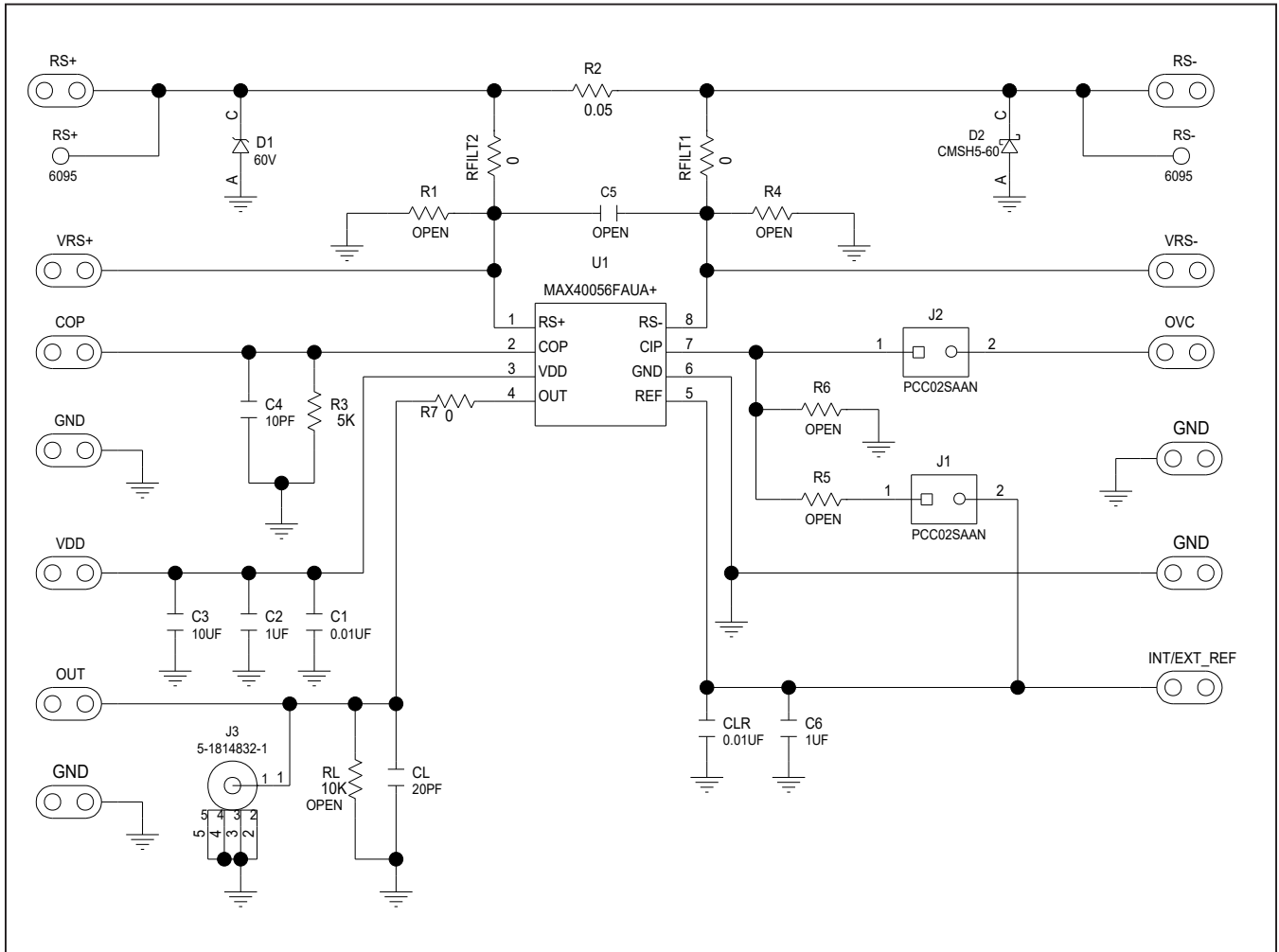
ITEM	REF_DES	DN/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	C1	-	1	C0805C103F1GAC	KEMET	0.01UF	CAPACITOR; SMT (0805); CERAMIC CHIP; 0.01UF; 100V; TOL=1%; TG=-55 DEGC TO +125 DEGC; TC=C0G	
2	C2, C6	-	2	GRM31CR72A105KA01L; C3216X7R2A105K160	MURATA;TDK	1UF	CAPACITOR; SMT; 1206; CERAMIC; 1uf; 100V; 10%; X7R; -55degC to + 125degC	
3	C3	-	1	CKG57NX7R2A106M500JH	TDK	10UF	CAPACITOR; SMT (2220); CERAMIC CHIP; 10UF; 100V; TOL=20%; MODEL=C SERIES; TG=-55 DEGC TO +125 DEGC; TC=X7R	
4	C4	-	1	C1608C0G1H100D080AA	TDK	10PF	CAPACITOR; SMT (0603); CERAMIC CHIP; 10PF; 50V; TOL=0.5PF; TG=-55 DEGC TO +125 DEGC; TC=C0G	
5	CL	-	1	C0603C200J5GAC; GRM1885C1H200JA01	KEMET;MURATA	20PF	CAPACITOR; SMT (0603); CERAMIC CHIP; 20PF; 50V; TOL=5%; MODEL=C; TG=-55 DEGC TO +125 DEGC; TC=C0G	
6	CLR	-	1	C1608C0G1H103J; CGA3E2C0G1H103J080AD; GRM1885C1H103JA01	TDK;TDK;MURATA	0.01UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.01UF; 50V; TOL=5%; TG=-55 DEGC to +125 DEGC; TC=C0G	
7	COP, GND, GND1-GND3, INT/EXT_REF, OUT, OVC, RS+, RS-, VDD, VRS+, VRS-	-	13	9020 BUSS	WEICO WIRE	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG	
8	D1	-	1	SMBJ60A	DIODES INCORPORATED	60V	DIODE; TVS; SMB (DO-214AA); VRM=60V; IF=6.2A	
9	D2	-	1	CMSH5-60	CENTRAL SEMICONDUCTOR	CMSH5-60	DIODE; SCH; SILICON SCHOTTKY RECTIFIER;SMC; PIV=60V; IF=5A	
10	J1, J2	-	2	PCC02SAAN	SULLINS	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65 DEGC TO +125 DEGC	
11	J3	-	1	5-1814832-1	TYCO	5-1814832-1	CONNECTOR; FEMALE; THROUGH HOLE; CONN SOCKET SMA STR DIE CAST PCB; STRAIGHT; 5PINS	
12	R2	-	1	CRA2512-FZ-R050ELF	BOURNS	0.05	RES; SMT (2512); 0.05; 1%; +/-50PPM/DEGC; 3W	
13	R3	-	1	PNM0603E5001B5T5	VISHAY DALE	5K	RESISTOR; 0603; 5K OHM; 0.1%; 25PPM; 0.15W; THIN FILM	
14	R7, RFILT1, RFILT2	-	3	RC1608J000CS; CR0603-J-000ELF;RC0603JR-070RL	SAMSUNG ELECTRONICS; BOURNS;YAGEO PH	0	RESISTOR; 0603; 0 OHM; 5%; JUMPER; 0.10W; THICK FILM	
15	RS+1, RS-1	-	2	6095	KEYSTONE	6095	CONNECTOR; FEMALE; PANELMOUNT; NON-INSULATED RECESSED HEAD BANANA JACK; STRAIGHT THROUGH; 1PIN	
16	U1	-	1	MAX40056FAUA+	MAXIM	MAX40056FAUA+	EVKIT PART - IC; MAX40056; BI-DIRECTIONAL CURRENT-SENSE AMPLIFIER; PACKAGE OUTLINE: 21-0036; PACKAGE CODE: U8+4	
17	PCB	-	1	MAX40056	MAXIM	PCB	PCB.MAX40056	-
18	RL	DNP	0	301-10K-RC	XICON	10K	RESISTOR, 0603, 10K OHM, 5%, 200PPM, 1/16W, THICK FILM	
19	C5	DNP	0	N/A	N/A	OPEN	PACKAGE OUTLINE 0603 NON-POLAR CAPACITOR	
20	R1, R4-R6	DNP	0	N/A	N/A	OPEN	PACKAGE OUTLINE 0603 RESISTOR	
TOTAL			34					

Ordering Information

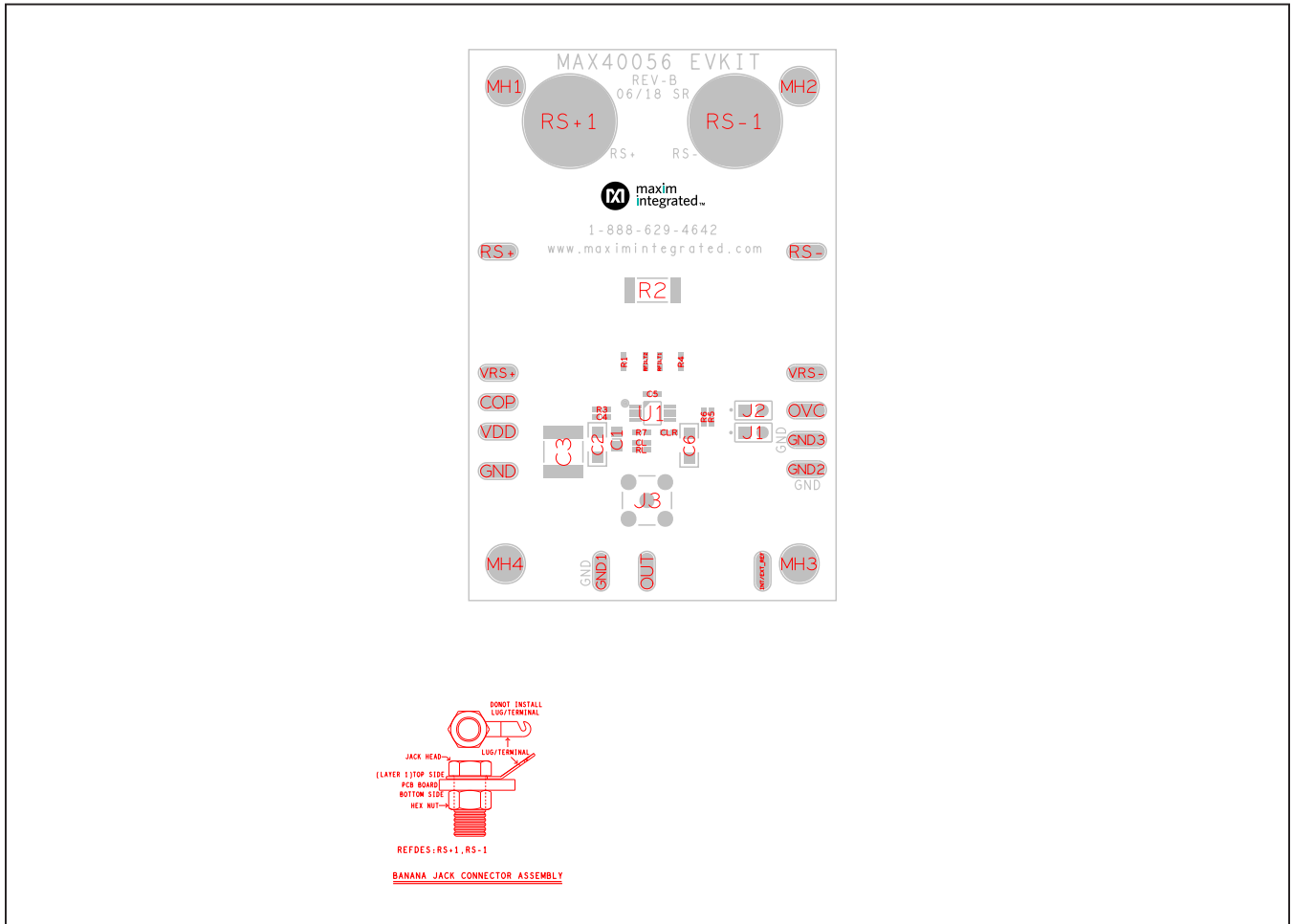
PART	TYPE
MAX40056EVKIT#	EV Kit

#Denotes a RoHS-compliant device that may include lead(Pb) that is exempt under the RoHS requirements.

MAX40056 EV Kit Schematic

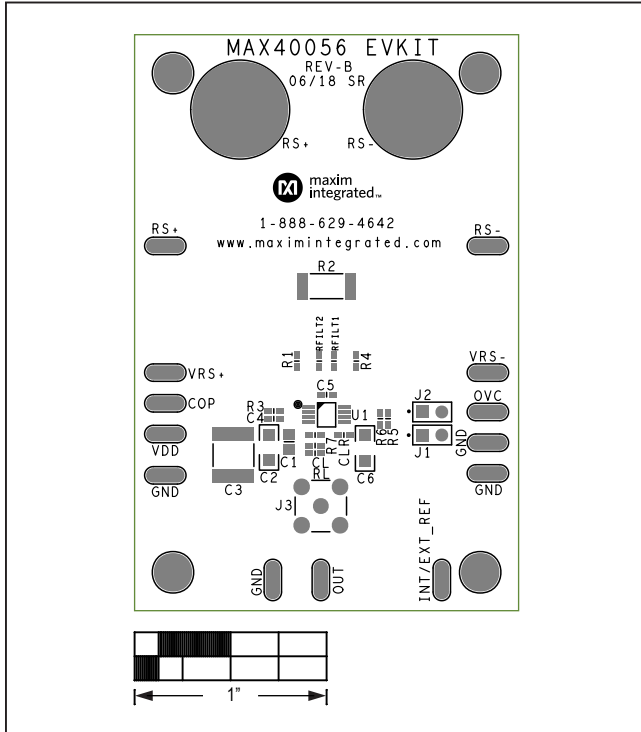


### MAX40056 EV Kit PCB Layout Diagrams

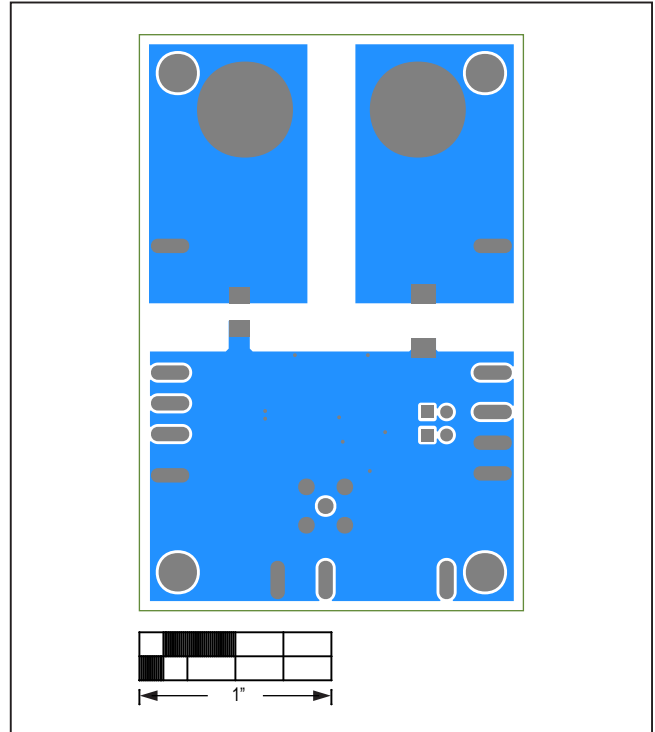


MAX40056 EV Kit PCB Layout Diagrams—Assembly Top

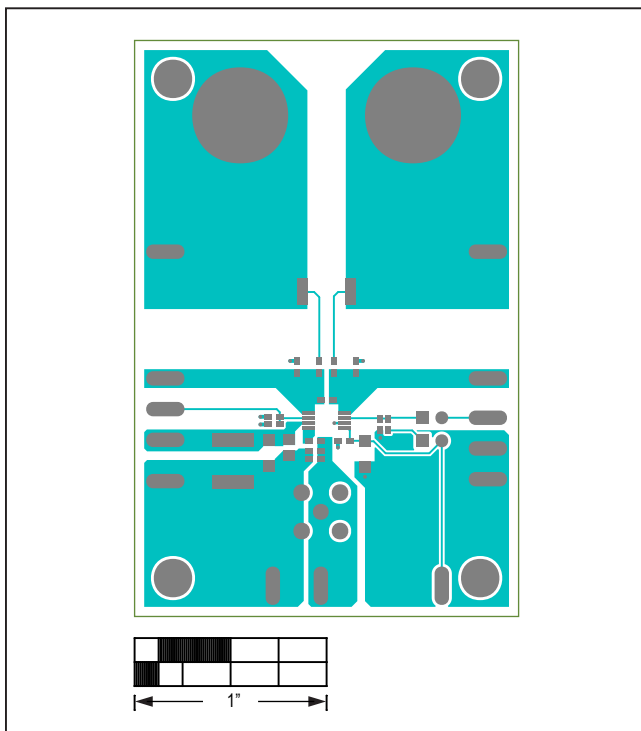
MAX40056 EV Kit PCB Layout Diagrams (continued)



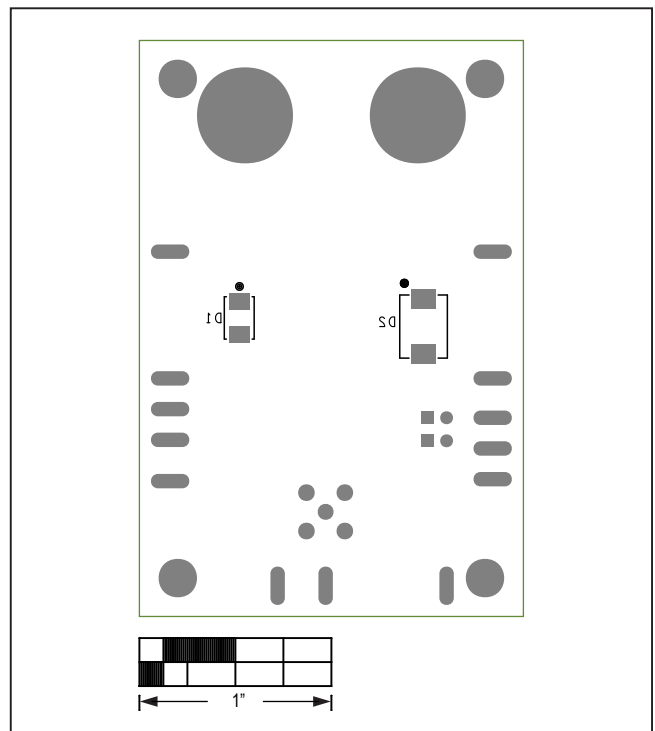
MAX40056 EV Kit PCB Layout Diagrams—Top Silkscreen



MAX40056 EV Kit PCB Layout Diagrams—Bottom



MAX40056 EV Kit PCB Layout Diagrams—Top



MAX40056 EV Kit PCB Layout Diagrams—Bottom Silkscreen

MAX40056 Evaluation Kit

Evaluates: MAX40056F  
MAX40056T  
MAX40056U

## Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	10/18	Initial release	—
1	12/18	Updated data sheet title, part number, and <i>Ordering Information</i>	1–7

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

*Maxim Integrated cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim Integrated product. No circuit patent licenses are implied. Maxim Integrated reserves the right to change the circuitry and specifications without notice at any time.*

## MAXESSENTIAL01+

### Description

The Essential Analog toolkit contains a unique collection of Maxim's high-performance, analog building block products. This curated group of parts represent a selection of Maxim's vast product lines, specific to 20 product categories, from key performance areas including power efficiency, precise measurement, reliable connectivity, and robust protection.

The ICs in the toolkit offer the breadth of each product category: low power, low noise, multi-channel, high resolution, high accuracy, and high speed. All these features empower your designs and bring value to your systems.

At 6.4cm x 8.9cm x 1.3cm, the box itself is small, lightweight, and easy to carry. Products are guarded from ESD using a gel and ESD-protected box.

A guide that labels each of the part types inside the box supports the toolkit. Go to the Maxim website to find more information for the individual part numbers.

When planning your next design, pick up an Essential Analog toolkit to review Maxim's high-performance analog products.

### Key Features

- Small, 6.4cm x 8.9cm x 1.3cm Package
- ESD Protection-Lined Package
- Accelerate Your Design with Quick Access





What's Included in the Box?

Efficient Power				
Buck	Boost	Buck-Boost	LDO	Continua
MAX38640 MAX15026	MAX17225 MAX668	MAX77827 MAX77816	MAX38902B MAX1510	MAX38888
Precision Measurement				
ADC	DAC	Audio Amp	Op Amp	CSA
MAX11410 MAX11168	MAX5541 MAX5715	MAX98357A MAX98390	MAX40075 MAX40100	MAX44284 MAX40201
Rugged Connectivity				
RS-485	RS-232	CAN	BTR Switch	Wireless
MAX14780E MAX3485AE	MAX13235E MAX33250E	MAX13054A MAX33054E	MAX14778 MAX14763	MAX41460 MAX7034
Robust Protection				
Supervisor	Temp Sensor	Isolator	Ideal Diode/V <sub>REF</sub>	RTC
MAX16150 MAX16140	MAX6680 MAX31875	MAX12930 MAX22445	MAX40203 MAX6078A	MAX31341B DS3231MZ