MAX20345 Evaluation Kit

Evaluates: MAX20345

General Description

The MAX20345 evaluation kit (EV kit) is a fully assembled and tested circuit for evaluating the MAX20345 wearable charge-management solution with I²C compatibility for low-power wearable applications. The device includes a linear battery charger, smart power selector, three ultra-low quiescent current buck regulators, a buck-boost regulator, three low-dropout (LDO) linear regulators, two load switches, and five GPIO pins.

Refer to the full MAX20345 IC datasheet for detailed information regarding the operation and features of the devices.

Benefits and Features

- RoHS Compliant
- Proven PCB Layout
- Fully Assembled and Tested
- I²C Serial Interface

Quick Start

Required Equipment

- GPIO Controller Device
- Adjustable Power Supply with 0V to 5V Capability
- Digital Multimeter (DMM)
- I²C Controller Device
- Cables with Grabber Connections

Optional Equipment

- Second Power Supply for LDOs and Load Switches
- Electronic Load
- 10kΩ Resistor

Procedure

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

Caution: Do not enable the power supply or external devices until all connections are made.

1) Connect the GPIO controller device to PFN1 (J6 pin 11). Set the output to low.
   Optional: If a GPIO controller is unavailable, connect a 10kΩ pullup resistor from PFN1 to BAT (J5 pin 4).
2) Connect the I²C controller device to GND (J5 pins 1 and 12, J6 pins 1 and 12), SDA (J6 pin 6), and SCL (J6 pin 7).
3) Set the power supply voltage to 3.7V and turn off the supply.
4) Connect the positive terminal of the 3.7V to V_{BAT} and the negative terminal to GND.
5) Turn on the 3.7V power supply.
6) Turn on the GPIO controller device and the I²C controller device.
7) Set the GPIO controller output high to enable the MAX20345.
8) Measure the voltage on SYS (J1 pin 1 and J6 pin 3) and confirm it equals V_{BAT}. If the SYS voltage is less than 2.7V, set the GPIO controller low for three seconds, then set it back to high.
   Optional: If using a 10kΩ pullup from PFN1 to BAT, short PFN1 to GND for three seconds, then release the short.
9) To enable Buck1, use the I²C controller to set Buck1En[1:0] = 01 by writing the value 0xE9 to register 0x16. Measure the voltage of BK1OUT (J4 pin 1) and confirm that it is 0.7V
10) To enable Buck2, use the I²C controller to set Buck2En[1:0] = 01 by writing the value 0xEB to register 0x1F. Measure the voltage of BK2OUT (J4 pin 2) and confirm that it is 1.2V
11) To enable Buck3, use the I²C controller to set Buck3En[1:0] = 01 by writing the value 0xED to register 0x28. Measure the voltage of BK3OUT (J4 pin 3) and confirm that it is 1.8V
12) If testing LDOs and load switches, set the second power supply voltage to the desired LDO or load switch input voltage. Turn off the power supply, connect the positive terminal to the LDO or load switch input, connect the negative terminal to GND, then turn on the power supply. Measure the LDO or load switch output and confirm that it matches the expected value setting.
13) To test the performance of regulators under a load, connect the electronic load to the regulator output pin.
14) The EV kit is ready for additional evaluation.

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

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Detailed Description of Hardware

The MAX20345 EV kit evaluates the MAX20345 wearable charge-management solution. The default settings of the EV kit differ from other versions of the IC to allow for flexible evaluation. Refer to Tables 1-3 for descriptions of the default settings and the readback values of the direct registers and AP registers on reset.

Optional Pullup Resistors

The EV kit includes space to install a resistor network to conveniently pull certain pins up or down. Connector J2 contains a path to a user supplied IO voltage V_{IO} at pin 1 and a path to GND at pin 6. A through-hole four-resistor network can be placed in J2 with the reference pin at either pin 1 or pin 6 of J2. This attaches the pullup or pulldown resistors on $\overline{INT}$, $\overline{RST}$, SDA, and SCL. V_{IO} is supplied through pin 2 of connector J1.

See Table 3 through Table 8 for pin descriptions of the connectors J1-J6.

Table 1. Register Bit Default Values

REGISTER BITS	MAX20345 EVKIT
SysMinVlt	4.0V
ILimBlank	Disabled
ILimCntl	450mA
IChgDone	30% I_{FCHG}
BatReChg	BatReg - 70mV
BatReg	4.20V
ChgEn	Enabled
PChgTmr	240min
VPChg	3.15V
IPChg	5% I_{FCHG}
ChgStepRise	3.80V
ChgAutoStp	Enabled
ChgAutoReSta	Enabled
MtChgTmr	60min
FChgTmr	600min
ChgIStep	50% I_{FCHG}
ChgStepHyst	400mV
Buck1VSet	0.70V
Buck1En	Disabled
Buck1IZCSet	10mA
ThmEn	Charge in T1-T3
Buck1ISet	150mA
Buck2VSet	1.200V
Buck2En	Disabled
Buck2IZCSet	20mA
Buck1SftStrt	100ms Soft-Start

REGISTER BITS	MAX20345 EVKIT
Buck1FETScale	Disabled
Buck2ISet	150mA
Buck3VSet	1.80V
Buck3En	Disabled
Buck3IZCSet	30mA
Buck2SftStrt	100ms Soft-Start
Buck2FETScale	Disabled
Buck3ISet	150mA
BBstVSet	5.00V
BBstEn	Disabled
BBstMode	Buck-Boost
Buck3SftStrt	100ms Soft-Start
Buck3FETScale	Disabled
BBstIPSet2	BBstIPSet1 + 100mA
BBstIPSet1	150mA
LDO1Mode	LDO
BBstFETScale	Disabled
LDO2Mode	Load Switch
LDO1VSet	1.8V
LDO1En	Disabled
LDO3Mode	LDO
LDO2VSet	1.8V
LDO2En	Disabled
LDO3VSet	0.7V
LDO3En	Disabled
BootDly	120ms

Table 1. Register Bit Default Values (continued)

REGISTER BITS	MAX20345 EVKIT
ChgAlwTry	Retry
SW2En	Disabled
LSW2LowIq	Voltage Protection
LSW1En	Disabled
LSW1LowIq	Voltage Protection
UsbOkselect	CHGIN Rise
PwrRstCfg	0b0110
SftRstCfg	Reset Regs
BAT Over Current ThresholdIBatOc	1600mA
FrshBatDis	1
Bk2Step	25mV
Buck1Seq	Buck1En after 100%
Bk1Step	10mV
Bk3Step	50mV
Buck2Seq	Buck2En after 100%
LDO1Seq	LDO1En after 100%

REGISTER BITS	MAX20345 EVKIT
BBstSeq	BBstEn after 100%
Buck3Seq	Buck3En after 100%
LSW1Seq	LSW1En after 100%
LDO3Seq	LDO3En after 100%
LDO2Seq	LDO2En after 100%
PFN1RInt	No Resistor
PFN2RInt	No Resistor
GlbPsvDsc	Enabled
LSW2Seq	LSW2En After 100%
BBstIAdptDis	Adaptive IPEAK
PFN1PUD	N/A
PFN2PUD	N/A
JEITASet	T4 = 25.53%, T3 = 32.94%
ILimMax	1000mA
TShdn	120°C

Table 2. I²C Direct Register Default Values

REGISTER	NAME	MAX20345 EVKIT
0x00	ChipID	0x07
0x01	ChipRev	0x01
0x09	IntMask0	0x00
0x0A	IntMask1	0x00
0x0B	IntMask2	0x00
0x0C	ILimCntl	0x86
0x0D	ChgCntl0	0x07
0x0E	ChgCntl1	0x73
0x0F	ChgTmr	0xFF
0x10	StepChgCfg0	0x30
0x11	StepChgCfg1	0x03
0x12	ThmCfg0	0x3F
0x13	ThmCfg1	0x1F
0x14	ThmCfg2	0x1F
0x15	MONCfg	0x10
0x16	Buck1Cfg	0xE1
0x17	Buck1VSet	0x40
0x18	Buck1ISet	0x86

REGISTER	NAME	MAX20345 EVKIT
0x19	Buck1Ctr	0x01
0x1A	Buck1DVSCfg0	0x00
0x1B	Buck1DVSCfg1	0x00
0x1C	Buck1DVSCfg2	0x00
0x1D	Buck1DVSCfg3	0x00
0x1E	Buck1DVSSPI	0x00
0x1F	Buck2Cfg	0xE3
0x20	Buck2VSet	0x54
0x21	Buck2ISet	0x86
0x22	Buck2Ctr	0x02
0x23	Buck2DVSCfg0	0x00
0x24	Buck2DVSCfg1	0x00
0x25	Buck2DVSCfg2	0x00
0x26	Buck2DVSCfg3	0x00
0x27	Buck2DVSSPI	0x00
0x28	Buck3Cfg	0xE5
0x29	Buck3VSet	0x56
0x2A	Buck3ISet	0x86

Table 2. I²C Direct Register Default Values (continued)

REGISTER	NAME	MAX20345 EVKIT
0x2B	Buck3Ctr	0x04
0x2C	Buck3DVSCfg0	0x00
0x2D	Buck3DVSCfg1	0x00
0x2E	Buck3DVSCfg2	0x00
0x2F	Buck3DVSCfg3	0x00
0x30	Buck3DVSSPI	0x00
0x31	BBstCfg0	0xE5
0x32	BBstVSet	0x32
0x33	BBstISet	0x46
0x34	BBstCfg1	0x23
0x35	BBstCtr	0x08
0x36	BBstDVSCfg0	0x00
0x37	BBstDVSCfg1	0x00
0x38	BBstDVSCfg2	0x00
0x39	BBstDVSCfg3	0x00
0x3A	BBstDVSSPI	0x00
0x3B	LDO1Cfg	0xE1
0x3C	LDO1VSet	0x0A
0x3D	LDO1Ctr	0x01
0x3E	LDO2Cfg	0xE3
0x3F	LDO2VSet	0x09
0x40	LDO2Ctr	0x02
0x41	LDO3Cfg	0xE1
0x42	LDO3VSet	0x08
0x43	LDO3Ctr	0x04
0x44	LSW1Cfg	0xE1
0x45	LSW1Ctr	0x00
0x46	LSW2Cfg	0xE1
0x47	LSW2Ctr	0x00
0x48	MPC0Cfg	0x00
0x49	MPC1Cfg	0x00
0x4A	MPC2Cfg	0x00
0x4B	MPC3Cfg	0x00
0x4D	BootCfg	0x6B
0x4E	PwrCfg	0x01
0x52	LockMsk	0x00
0x53	LockUnlock	0xFF

Table 3. Connector J1

PIN	SIGNAL	DESCRIPTION
1	SYS	System load connection
2	V_{IO}	Externally supplied pullup reference
3	N.C.	Not Connected
4	N.C.	Not Connected
5	N.C.	Not Connected
6	N.C.	Not Connected
7	MPC3	Multipurpose control I/O 3
8	MPC2	Multipurpose control I/O 2

Table 4. Connector J2

PIN	SIGNAL	DESCRIPTION
1	V_{IO}	Externally supplied pullup reference
2	$\overline{INT}$	Interrupt open-drain output
3	$\overline{RST}$	Reset output. active-low, open-drain output
4	SDA	I²C serial data input/open-drain output
5	SCL	I²C serial clock input
6	GND	Ground

Connector J2 is intended for a resistor network to pull the signals up to V_{IO} or down to GND.

Table 5. Connector J3

PIN	SIGNAL	DESCRIPTION
1	CAP	Internal reference supply
2	TPUEXT	**TBD**
3	LSW2OUT	Load switch 2 output
4	LSW2IN	Load switch 2 input
5	LSW1OUT	Load switch 1 output
6	LSW1IN	Load switch 1 input
7	L1IN	LDO1 input
8	L1OUT	LDO1 output

Table 6. Connector J4

PIN	SIGNAL	DESCRIPTION
1	BK1OUT	Buck1 regulator output
2	BK2OUT	Buck2 regulator output
3	BK3OUT	Buck3 regulator output
4	L3IN	LDO3 input
5	L3OUT	LDO3 output
6	L2IN	LDO2 input
7	L2OUT	LDO2 output
8	BBOUT	Buck-Boost regulator output

Table 7. Connector J5

PIN	SIGNAL	DESCRIPTION
1	GND	Ground
2	N.C.	Not Connected
3	N.C.	Not Connected
4	N.C.	Not Connected
5	N.C.	Not Connected
6	SET	External resistor for battery charge current level setting
7	TPU	Battery temperature thermistor measurement pullup. Do not exceed 1mA load on TPU.
8	THM	Battery thermistor measurement connection
9	BAT	Battery connection
10	SYS	System load connection
11	CHGIN	+28V/-5.5V protected charger input
12	GND	Ground

Table 8. Connector J6

PIN	SIGNAL	DESCRIPTION
1	GND	Ground
2	IVMON	Monitor multiplexer output
3	N.C.	Not Connected
4	$\overline{INT}$	Interrupt open-drain output
5	$\overline{RST}$	Reset output. active-low, open-drain output
6	SDA	I^2C serial data input/open-drain output
7	SCL	I^2C serial clock input
8	MPC1	Multipurpose control I/O 1
9	MPC0	Multipurpose control I/O 0
10	PFN2	Configurable power mode control pin ($\overline{KOUT}$)
11	PFN1	Configurable power mode control pin ($\overline{KIN}$)
12	GND	Ground

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Murata Americas	770-436-1300	www.murata.com/en-us

Note: *Indicate that you are using the MAX20345 when contacting these component suppliers.*

Ordering Information

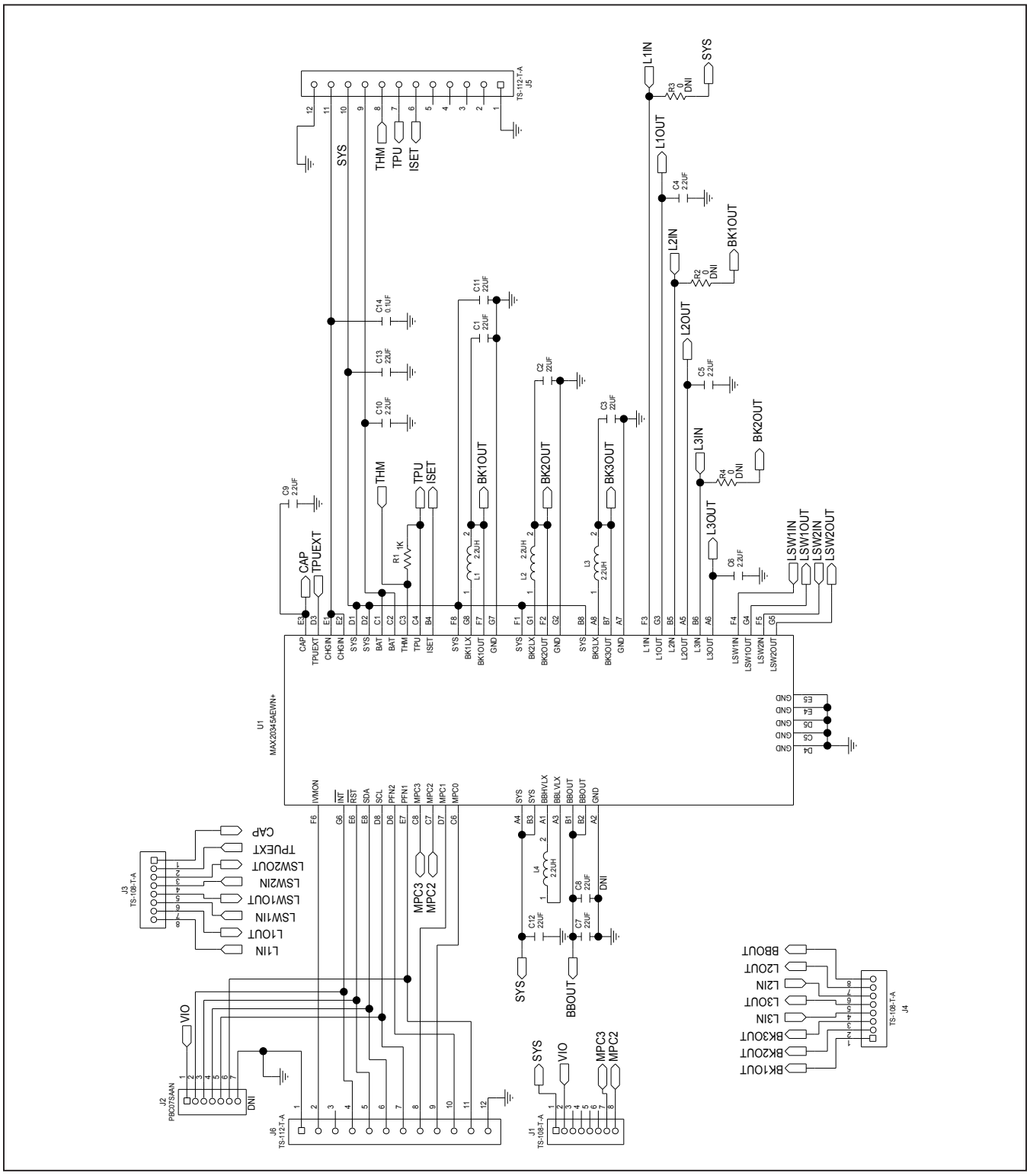
PART	TYPE
MAX20345EVKIT#	EV Kit

#Denotes RoHS Compliant

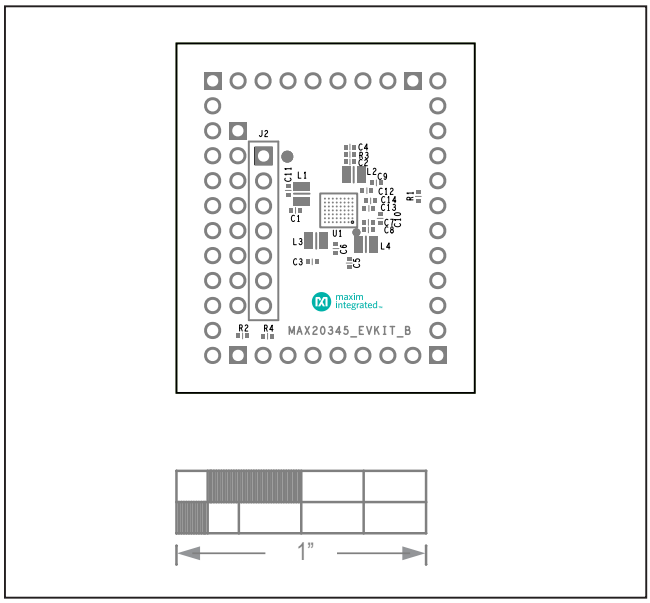
MAX20345 EV Kit Bill of Materials

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	C1-C3, C7, C11-C13	-	7	GRM155R60J226ME11	MURATA	22UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 22UF; 6.3V; TOL=20%; TC=X5R ;	
2	C4-C6, C9, C10	-	5	C1005X5R0J225K050BC	TDK	2.2UF	CAPACITOR; SMT (0402); CERAMIC; 2.2UF; 6.3V; TOL=[10%]; MODEL=C SERIES; TG=-55 DEGC TO +85 DEGC; TC=X5R	
3	C14	-	1	CGA2B3X7R1V104K050BB	TDK	0.1UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1UF; 35V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R; AUTO	
4	J1, J3, J4	-	3	TS-108-T-A	SAMTEC	TS-108-T-A	CONNECTOR; MALE; THROUGH HOLE; PRECISION MACHINED TERMINAL STRIP; STRAIGHT; 8PINS	
5	J5, J6	-	2	TS-112-T-A	SAMTEC	TS-112-T-A	CONNECTOR; MALE; THROUGH HOLE; PRECISION MACHINED TERMINAL STRIP; STRAIGHT; 12PINS	
6	L1-L4	-	4	DFE201612E-2R2M	MURATA	2.2UH	INDUCTOR; SMT (0806); WIREWOUND CHIP; 2.2UH; TOL=+/-20%; 1.8A	
7	R1	-	1	ERJ-2RKF1001	PANASONIC	1K	RESISTOR; 0402; 1K OHM; 1%; 100PPM; 0.10W; THICK FILM	
8	U1	-	1	MAX20345AEWN+	MAXIM	MAX20345AEWN+	EVKIT PART - IC; PMIC WITH ULTRA-LOW IQ VOLTAGE REGULATORS; OHR DRIVER AND CHARGER FOR SMALL LITHIUM ION SYSTEMS; WLP 56 PINS; 0.4MM PITCH; PACKAGE CODE: W563H3+1; PACKAGE OUTLINE DRAWING: 21-100260	
9	PCB	-	1	MAX20345	MAXIM	PCB	PCB:MAX20345	-
10	C8	DNP	0	GRM155R60J226ME11	MURATA	22UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 22UF; 6.3V; TOL=20%; TC=X5R ;	
11	J2	DNP	0	PBC07SAAN	SULLINS ELECTRONICS CORP.	PBC07SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 7PINS; -65 DEGC TO +125 DEGC	
12	R2-R4	DNP	0	RC0402JR-070RL; CR0402-16W-000RJT	YAGEO PHYCOMP;VENKEL LTD.	0	RESISTOR; 0402; 0 OHM; 5%; JUMPER; 0.063W; THICK FILM	
TOTAL			25					

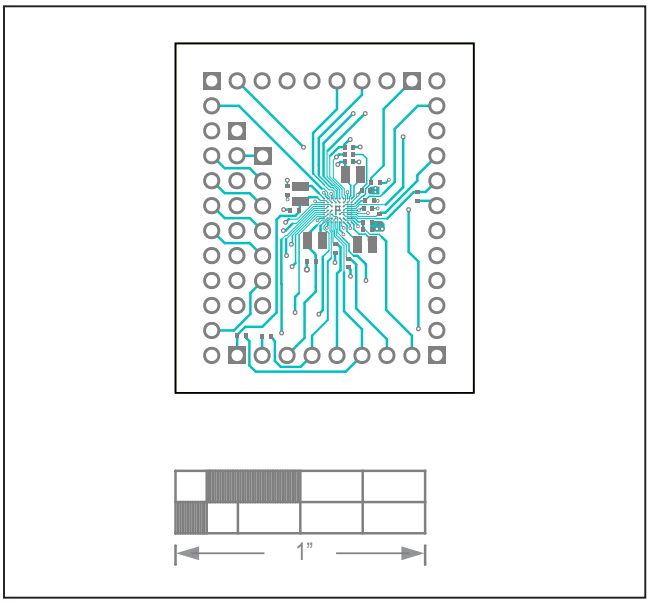
MAX20345 EV Kit Schematic



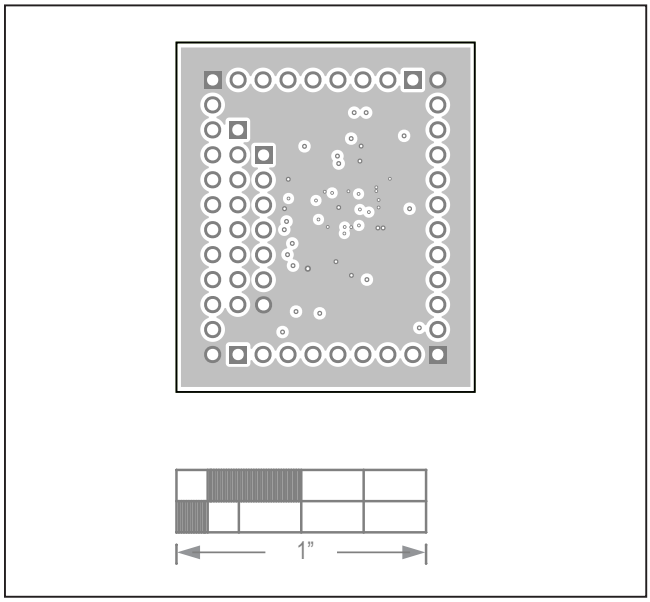
MAX20345 EV Kit PCB Layout



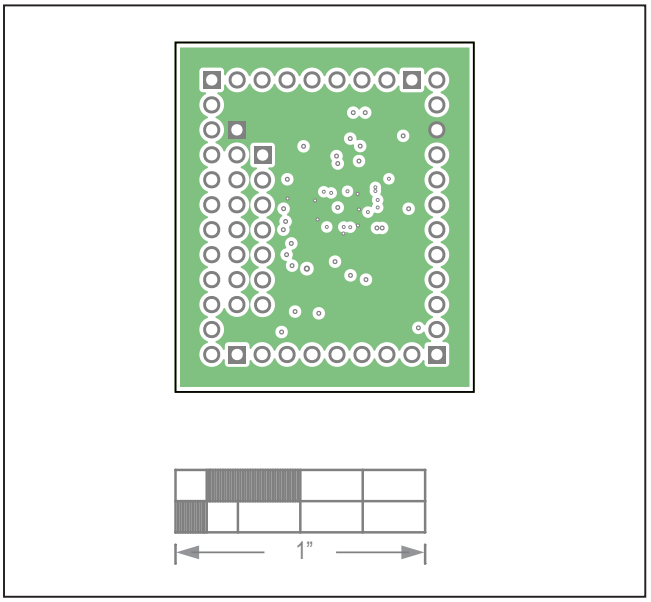
MAX20345 EV Kit PCB—Silk Top



MAX20345 EV Kit PCB—Top Layer

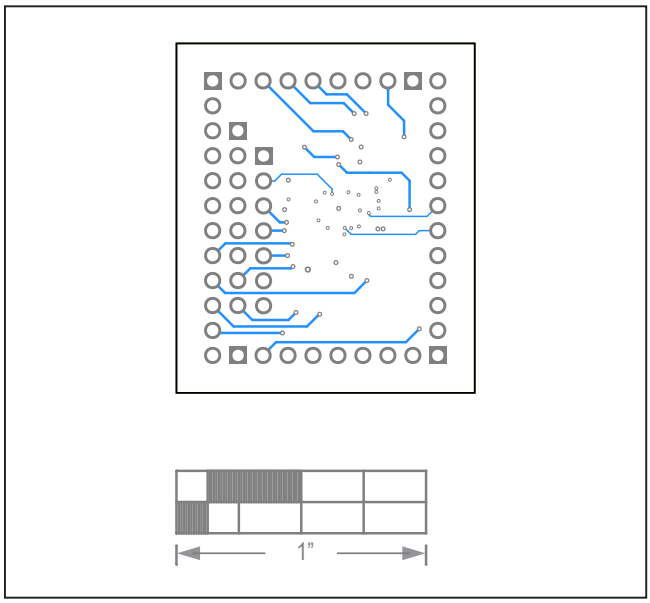


MAX20345 EV Kit PCB—Layer 2

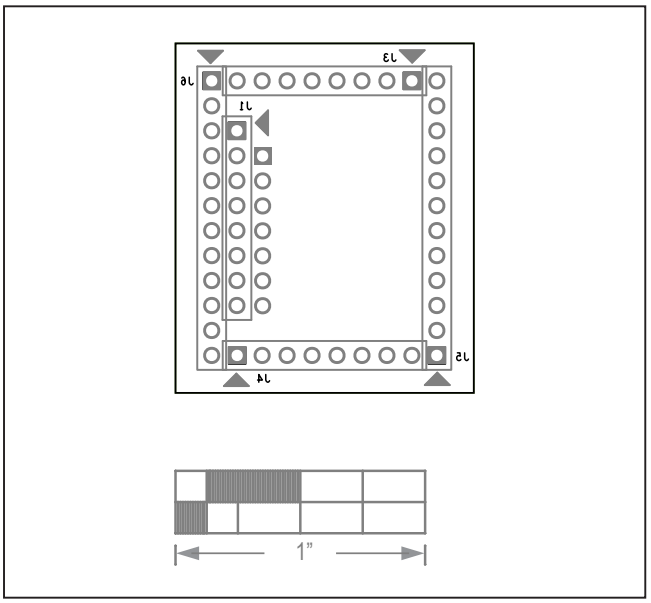


MAX20345 EV Kit PCB—Layer 3

MAX20345 EV Kit PCB Layout



MAX20345 EV Kit PCB—Bottom Layer



MAX20345 EV Kit PCB—Silk Bottom