Click here to ask about the production status of specific part numbers.

MAX25512 Evaluation Kit

Evaluates: MAX25510, MAX25511, MAX25512

General Description

The MAX25512 evaluation kit (EV kit) demonstrates the MAX25512 integrated 4-channel high-brightness LED driver with I²C interface for automotive displays, and its stand-alone mode counterparts, namely the MAX25510 and MAX25511. The EV kit operates from a DC supply voltage between 3V and 36V, and the switching frequency can be either set at 2.2MHz or at 400kHz. The EV kit can be configured to operate in stand-alone mode or in I²C mode. Spread-spectrum mode (SSM) is enabled by default for electromagnetic interference (EMI) improvement, but it can be disabled either by acting on a register bit (MAX25512) or by properly choosing the resistor to be connected to the SET pin (MAX25510 and MAX25511).

The EV kit demonstrates phase-shifted pulse-width-modulation (PWM) dimming. Dimming can be performed either externally using a PWM signal applied to the DIM PCB pad or internally by programming the desired dimming frequency and individual duty cycle through I²C (MAX25512 only). The hybrid dimming feature can be enabled through a register bit to reduce EMI (MAX25512 only). The EV kit features a LED current foldback option either as a function of the temperature, by means of a negative temperature coefficient (NTC) sensor (not provided), or through analog dimming. I²C-programmable (MAX25512) or resistor-programmable (MAX25510 and MAX25511) automatic fading functionality is also available.

Finally, the EV kit demonstrates short-LED, open-LED, LED short to ground, boost output short to ground/undervoltage and overvoltage, and overtemperature-fault protection. For operation at switching frequencies other than 2.2MHz or 400kHz, the external components should be chosen according to the calculations in the IC data sheet.

The EV kit provides an I²C interface that can operate in conjunction with the MINIQUSB+ adapter board or a third-party I²C master. The EV kit also includes Windows®-compatible software that provides a simple graphical user interface (GUI) for exercising the features of the IC (MAX25512 only).

Note: The MAX25512 EV kit schematic and bill of materials (BOM) show only the MAX25512 (MAX25512ATG/V+) as U2, but there are no other differences if the MAX25512 is replaced by the MAX25510 (MAX25510ATGA/V+) or MAX25511 (MAX25511ATGA/V+).

Features

- Demonstrates Robustness of the MAX25510, MAX25511, and MAX25512
- Wide 3V to 36V Input Operating Range (up to 40V Load Dump)
- Powers High-Brightness (HB) LEDs (up to Four Strings) for Medium-to-Large-Sized LCD Displays in Automotive and Display Backlight Applications
- 400kHz to 2.2MHz Resistor-Programmable Switching Frequency with Spread-Spectrum Option
- Phase-Shift Dimming Option
- Demonstrates Cycle-by-Cycle Current Limit and Thermal-Shutdown Features
- Demonstrates Wide Dimming Ratio
- Demonstrates Hybrid Dimming for Better EMI and Acoustic Performance and Higher Dimming Ratio
- Demonstrates Fade In/Out for Smooth Brightness Transition
- Designed to Show Thermal Foldback Function
- I²C Programmability (MAX25512 only)
- Dedicated GUI
- Proven PCB and Thermal Design
- Fully Assembled and Tested

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

MAX25512 EV Kit Files

FILE	DESCRIPTION
MAX25512GUISetupV01.exe	Windows GUI Installer

319-100757; Rev 1; 6/21

maxim integrated™

Quick Start

Required Equipment

- MAX25512 EV kit
- 3V to 36V, 10A DC power supply
- Two digital voltmeters (DVMs)
- Four series-connected HB LED strings (9 LEDs each) rated to no less than 120mA
- Current probe to measure the HB LED current
- MINIQUSB+ interface board with USB cable (MAX25512 only)
- Windows-compatible PC with a spare USB port (MAX25512 only)

Procedure

The EV kit is fully assembled and tested. To verify board operation, follow these steps:

Caution: Do not turn on the power supply until all connections are completed.

I²C Mode (MAX25512)

1) Visit **www.maximintegrated.com** to download the latest version of the EV kit software, MAX25512GUI-SetupV01.exe, from the product's landing page.
2) Install the EV kit software (GUI) on your PC by running the MAX25512GUISetupV01.exe program. The EV kit software application is then installed together with the required MINIQUSB+ drivers.
3) Verify that jumper J21 is closed (2.2MHz switching frequency selected).
4) Verify that jumper J1 is closed (DS1 green LED connected).
5) Verify that jumpers J28 and J29 have shunts installed across pins 1-2 (SDA and SCL PCB pads connected to SDA and SCL IC pins).
6) Verify that jumpers J23 and J27 have shunts installed across pins 1-2 and 2-3, respectively (5V external regulator enabled).
7) Verify that jumpers J10 and J20 have shunts installed across pins 1-2 (RSDT and TEMP IC pins both connected to V18).
8) Verify that jumper J17 is closed (FAULT signaling through DS2 red LED enabled).
9) Verify that a shunt is installed across pins 1-2 on jumper J2 (device enabled).
10) Verify that a shunt is installed across pins 1-3 on jumper JMP1 (100mA current per channel selected).
11) Verify that jumpers JMP3, JMP6, JMP7, and JMP9 have shunts installed across pins 1-2 (bleed resistors connected, all current sinks enabled).
12) Connect the MINIQUSB+ interface board's P3 header to the J24 header on the EV kit.
13) Connect the positive terminal of the power supply to the IN PCB pad. Connect the negative terminal of the power supply to a PGND PCB pad.
14) Connect a DVM across the OUT1 and GND PCB pads.
15) Connect the four LED strings from BOOST to the OUT1, OUT2, OUT3, and OUT4 PCB pads.
16) Clip the current probe across the channel 1 HB LED+ wire to measure the LED current.
17) Turn on the power supply and set it to 12V. The green LED (DS1) should be on at this point.
18) Launch the EV kit software application.
19) From the EV kit software toolbar, select **Device** → **Scan for Address**. The GUI scans the I²C bus for available slave addresses on the bus and selects the first one (in this case, the MAX25512 I²C address). Press **OK** once the MAX25512 I²C address has been found.
20) Verify that the status bar in the bottom-right corner of the GUI displays **EV Kit: Connected**, as shown in Figure 1.
21) Check **ENA** to activate the driver in the **0x02 ISET** register group box.
22) Measure the voltage from each of the OUT_ PCB pads to PGND and verify the lowest voltage is approximately 0.7V.
23) Measure the LED current using the current probe and verify all channels.
24) For more details on how to use the GUI and all the features available, click on the GUI Help menu item.

Stand-Alone Mode (MAX25510 and MAX25511)

1) Verify that jumper J21 is closed (2.2MHz switching frequency selected).
2) Verify that jumper J1 is closed (DS1 green LED connected).
3) Verify that jumpers J28 and J19 have shunts installed across pins 2-3 and 1-2, respectively (SET IC pin connected to V18) and that jumper J29 has a shunt installed across pins 2-3 (ADIM PCB pad connected to ADIM IC pin).

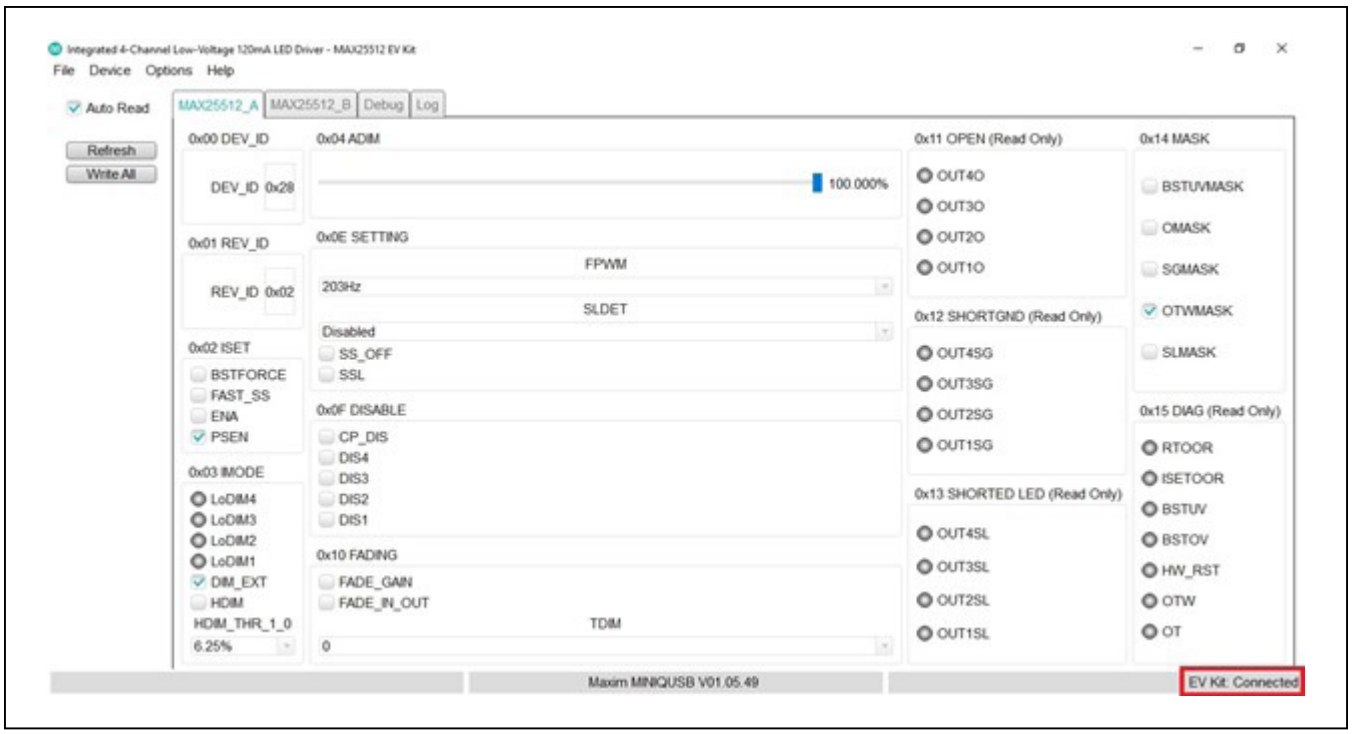


Figure 1. MAX25512 Evaluation Kit Software (GUI)

4) Verify that jumpers J23 and J27 have shunts installed across pins 1-2 and 2-3, respectively (5V external regulator enabled).
5) Verify that jumper J10 has a shunt installed across pins 2-3 (LED short detection enabled).
6) Verify that jumper J20 has a shunt installed across pins 1-2 (TEMP IC pin connected to V18).
7) Verify that jumper J17 is closed (FAULT signaling through DS2 red LED enabled).
8) Verify that a shunt is installed across pins 1-2 on jumper J2 (device enabled).
9) Verify that a shunt is installed across pins 1-3 on jumper JMP1 (100mA current per channel selected).
10) Verify that jumpers JMP3, JMP6, JMP7, and JMP9 have shunts installed across pins 1-2 (bleed resistors connected, all current sinks enabled).
11) Connect the positive terminal of the power supply to the IN PCB pad. Connect the negative terminal of the power supply to a PGND PCB pad.
12) Connect a DVM across the OUT1 and GND PCB pads.
13) Connect the four LED strings from BOOST to the OUT1, OUT2, OUT3, and OUT4 PCB pads.
14) Clip the current probe across the channel 1 HB LED+ wire to measure the LED current.
15) Turn on the power supply and set it to 12V. The green LED (DS1) and the LED strings should be on at this point.
16) Measure the voltage from each of the OUT_PCB pads to PGND and verify the lowest voltage is approximately 0.7V.
17) Measure the LED current using the current probe and verify all channels.

Detailed Description of Hardware

The MAX25512 EV kit demonstrates the MAX25510, MAX25511, and MAX25512 HB LED drivers with an integrated step-up DC-DC preregulator followed by four linear current sinks to drive up to four strings of LEDs. The preregulator switches at 2.2MHz (or at 400kHz) and operates as a current-mode-controlled regulator, providing up to 480mA for the linear current sinks, as well as overvolt-

age protection. The cycle-by-cycle current limit is internally fixed at 5.3A (3.8A for the MAX25510), while resistors R4 and R5 set the overvoltage protection voltage to 35V. The preregulator power section consists of inductor L2 and switching diode D1. The EV kit circuit operates from a 3V DC supply voltage up to the HB LED forward string voltage. The circuit handles load dump conditions up to 40V.

The EV kit circuit demonstrates ultra-low shutdown current when the EN pin of the device is pulled to ground by shorting the EN PCB pad to ground. Each of the four linear current sinks (OUT1–OUT4) is capable of operating up to 40V, sinking up to 120mA per channel.

Each of the four channels' linear current sinks is configurable for 120mA, 100mA, 50mA, or 20mA, or can be disabled independently either by acting on the **0x0F DISABLE** register group box (MAX25512 only) or by acting on jumpers JMP3, JMP6, JMP7, and JMP9 which are used to disable outputs selectively when the HB LED string is not connected. The EV kit features PCB pads to facilitate connecting HB LED strings for evaluation. The BOOST PCB pads provide connections for connecting each HB LED string's anode to the DC-DC preregulator output. The OUT1–OUT4 PCB pads provide connections for connecting each HB LED string's cathode to the respective current sink. Capacitors C18, C23, C24, and C25 are optional and can be included on the design to prevent oscillations and provide stability when using long, untwisted HB LED connecting cables during lab evaluation. These capacitors are not required if the connection between the LED driver and the HB LEDs is a low-inductance connection.

Table 1. SDA and SCL Supply (J26, J28–J31)

SHUNT POSITION					SDA AND SCL SUPPLY
J26	**J28**	**J29**	**J30**	**J31**	
Open*	1-2*	1-2*	Open*	Open*	3.3V (with MINIQUSB+ connected)
Open	1-2	1-2	Closed	Closed	VCC_EXT
1-External SDA 2-External SCL 3-External GND	1-2	1-2	Open	Open	Externally provided

**Default position.*

Table 2. DS1 Enable (J1)

SHUNT POSITION	DS1 POWER LED
Closed*	Connected
Open	Disconnected

**Default position.*

Table 3. Enable (J2)

SHUNT POSITION	EN PIN	EV KIT OPERATION
1-2*	Connected to IN	Enabled when IN is powered
2-3	Connected to EN PCB pad	Enabled/disabled by signal on EN PCB pad

**Default position.*

Table 4. VCC_EXT Generation (J23 and J27)

SHUNT POSITION		VCC_EXT SUPPLY
J23	**J27**	
1-2*	2-3*	5V (provided by on-board regulator)
2-3	1-2	Externally provided

**Default position.*

A DIM PCB pad is provided for using a digital PWM signal to control the brightness of the HB LEDs. Test points are also provided for easy access to the device's V18 regulator output as well as the IN, NGATE pins and the NTC sensor non-grounded terminal.

SDA and SCL Voltages (J26, J28–J31)

SDA and SCL voltage supplies (MAX25512 only) can be selected between the VCC_EXT voltage and the fixed 3.3V provided by the MINIQUSB+. Alternatively, the user can force an external voltage as digital reference (see Table 1).

Power LED Enable

A green LED (DS1) is used to indicate that the EV kit is powered on. The LED can be disconnected from the power supply, allowing precise current-consumption evaluation. See Table 2 for shunt positions.

Enable (EN)

The EV kit features an enable input that can be used to enable/disable the device and place it in shutdown mode. To enable the EV kit whenever power is applied to IN, place the jumper across pins 1-2 on jumper J2. To enable the EV kit using an external enable signal, place the jumper across pins 2-3 on J2 and apply a logic signal on the EN PCB input pad on the EV kit. A 1MΩ pulldown resistor on the EV kit pulls the EN input to ground in the event that J2 is left open or the EN signal is high impedance. Refer to the *Enable* section in the MAX25512 IC data sheet for additional information. See Table 3 for J2 jumper settings.

Logic Supply (VCC_EXT)

VCC_EXT voltage must be provided to ensure proper operation of device's DIM and FLTB pins (SDA and SCL pins can also be optionally pulled up to the same voltage). If enabled through J23 and J27 jumpers, an on-board linear regulator generates a fixed 5V to pullup the above-mentioned pins. Alternatively, an external logic supply can be used. See Table 4 for J23 and J27 jumper settings.

Switching Frequency

Jumper J21 is used to set the switching frequency of the MAX25512 to either 2.2MHz or 400kHz. When J21 is closed, the switching frequency is set to 2.2MHz. When J21 is open, the switching frequency is nominally 400kHz.

The EV kit is optimized for 2.2MHz switching operation by default. When selecting a switching frequency of 400kHz, L2 should be changed to 22µH to maintain acceptable efficiency. Other component value adjustments may be needed.

The spread-spectrum feature can be enabled/disabled by checking/unchecking **SS_OFF** in the **0x0E SETTING** register group box (MAX25512 only) or by connecting a resistor of proper value between the IC's SET pin and ground (MAX25510 and MAX25511 only—see the *SET Pin Operation* section for details). It is also possible to select the amount of spread by checking (±4%)/unchecking (±6%) SSL in the above register group box (MAX25512 only).

Note: To change the amount of spread, spread-spectrum must first be disabled by checking **SS_OFF**. After the amount of spread has been selected, spread-spectrum can be reenabled by unchecking **SS_OFF**.

Refer to the *Oscillator Frequency/External Synchronization* and *Spread-Spectrum* sections in the MAX25512 and MAX25510/MAX25511 IC data sheets for more information. See Table 5 for J21 jumper settings.

HB LED Current

The EV kit features jumper JMP1 to configure the device's current sinks on all four channels. Place a shunt on JMP1 to configure the current-sink limits according to Table 6.

To reconfigure the circuit for another current-sink threshold, replace resistor R28, leave JMP1 open, and use the following equation to calculate a new value for the desired current:

$$I_{LED} = 1500 / R28$$

Table 5. Switching Frequency (J21)

SHUNT POSITION	RT PIN	EV KIT OPERATION
J21		
Closed*	RT connected to GND through 64.9kΩ // 14.3kΩ resistor	2.2MHz switching frequency
Open	RT connected to GND through 64.9kΩ resistor	400kHz switching frequency

**Default position.*

Table 6. LED Current (JMP1)

SHUNT POSITION	ISET RESISTOR SETTING	LED CURRENT SINK SETTING
1-3*	75kΩ // 18.7kΩ	100mA
1-2	75kΩ // 15kΩ	120mA
1-4	75kΩm // 49.9kΩ	50mA
Open	75kΩ	20mA

**Default position.*

Table 7. Selecting OUT_ Channels Operating State (JMP3, JMP6, JMP7, and JMP9)

OUT_	JUMPER	SHUNT POSITION	CHANNEL OPERATION
OUT1	JMP9	1-2*	Channel 1 operational; connect an HB LED string** between VOUT and OUT1. Bleed resistor connected.
		1-3	Channel 1 not used. OUT1 current sink disabled.
		1-4	Channel 1 shorted to GND to simulate a fault.
OUT2	JMP7	1-2*	Channel 2 operational; connect an HB LED string** between VOUT and OUT2. Bleed resistor connected.
		1-3	Channel 2 not used. OUT2 current sink disabled.
		1-4	Channel 2 shorted to GND to simulate a fault.
OUT3	JMP6	1-2*	Channel 3 operational; connect an HB LED string** between VOUT and OUT3. Bleed resistor connected.
		1-3	Channel 3 not used. OUT3 current sink disabled.
		1-4	Channel 3 shorted to GND to simulate a fault.
OUT4	JMP3	1-2*	Channel 4 operational; connect an HB LED string** between VOUT and OUT4. Bleed resistor connected.
		1-3	Channel 4 not used. OUT4 current sink disabled.
		1-4	Channel 4 shorted to GND to simulate a fault.

**Default position.*
***The series-connected HB LED string must be rated to no less than 120mA.*

where I_{LED} is the desired HB LED current per string in amperes (A) and R28 is the new resistor value in ohms (Ω), for obtaining the desired HB LED current. If the HB LED current is reconfigured to a different value, other components on the EV kit may need to be modified. Refer to the MAX25512 IC data sheet to calculate other component values.

Channel 1–Channel 4 Current-Sink Disabling

The EV kit features jumpers JMP3, JMP6, JMP7, and JMP9, which are used to put each OUT_ current sink in one of three operating states:

- Normal operation, i.e., OUT_ is connected to the corresponding ring on the board edge and LEDs are connected from there to the preregulator output VOUT
- OUT_ connected through a 10kΩ resistor to GND and thus disabled
- OUT_ shorted to GND, used to test fault detection

To disable a channel, install a jumper in the channel's respective jumper across pins 1-3, connecting the OUT_ to ground through a 10kΩ resistor. See Table 7 for jumper settings. The 100kΩ bleed resistors are installed to prevent the OUT_ leakage current from dimly turning on large LED strings even when the DIM signal is low. Note that each channel can be alternatively disabled through I^2C by acting on **0x0F DISABLE** register group box (MAX25512 only).

HB LED Digital Dimming Control

The EV kit features a DIM PCB input pad for connecting an external digital PWM signal. LED current can also be linearly varied between 100% and 0% by acting on the ADIM slider bar (MAX25512 only) or applying an external digital ADIM signal to the ADIM PCB input pad (MAX25510 and MAX25511 only).

Apply a digital PWM signal with a 0.4V logic-low level (or less) and 1.6V logic-high level (or greater). The DIM signal frequency should be at least 10kHz. To adjust the HB LED brightness either through PWM dimming or through analog dimming, vary the signal duty cycle from 0% to 100% and maintain a minimum pulse width of 300ns. Apply the digital PWM and ADIM signals to the DIM and ADIM PCB pads, respectively.

Note: Jumper J29 must be used to connect the ADIM PCB pad to the ADIM pin of the IC when MAX25510 or MAX25511 are used. See Table 9 for jumper settings.

PWM dimming can also be performed by programming the desired dimming level through I^2C (MAX25512 only). External dimming is enabled by default at each device's power up. To disable it, first uncheck **DIM_EXT** in the **0x03 IMODE** register group box, then select one of the available dimming frequencies in the **FPWM** section contained in the **0x0E SETTING** register group box. Individual channel brightness levels can finally be selected by acting on the **TON1–TON4** slider bars.

Note: To ensure that correct brightness levels are selected in internal dimming mode, each **TON_** slider bar must be zeroed at each device's power up.

For additional information on the device's digital dimming feature, refer to the *Dimming* section in the MAX25512 and MAX25510/MAX25511 IC data sheets.

Hybrid Dimming Operation

The Hybrid dimming feature can be used both with external and internal dimming (MAX25512 only). The device determines whether the LED current is to be dimmed by reducing the LED current or by chopping the LED current (depending on the hybrid dimming threshold set in the **HDIM_THR** section contained in the **0x03 IMODE** register group box). To enable the hybrid dimming feature, check **HDIM** in the **0x03 IMODE** register group box.

For additional information on the device's hybrid dimming feature, refer to the *Hybrid Dimming* section in the MAX25512 IC data sheet.

Phase-Shift Operation

The EV kit demonstrates the phase-shifting feature of the IC. When MAX25512 is used on the EV kit, phase shift is enabled by default at each device's power up. To disable the phase-shifting feature, uncheck **PSEN** in the **0x02 ISET** register group box. This operation must always be performed before enabling any LED string.

When the MAX25510 or MAX25511 are used on the EV kit, phase shift can be enabled/disabled by connecting a resistor of proper value between the ICs SET pin and ground (see the *SET Pin Operation* section for details).

When phase shifting is enabled, each current sink's turn-on is separated by 360°/n, where n is the number of enabled strings. When phase shifting is disabled, the dimming of each string is controlled by the DIM input (or by the **FPWM** and **TON_** settings if internal dimming is enabled when using the MAX25512), and all current sinks turn on and off at the same time.

LED Current Foldback Option

The EV kit demonstrates the temperature foldback feature of the IC. A shunt on jumper J20 allows to connect the

Table 8. ADIM Connection (J29)

SHUNT POSITION	ADIM PCB PAD
1-2*	Not connected to the IC (MAX25512 only)
2-3	Connected to the IC (MAX25510 and MAX25511 only)

**Default position.*

Table 9. TEMP Pin Connection (J20)

SHUNT POSITION	TEMP PIN	EV KIT OPERATION
1-2*	TEMP connected to NTC through 2kΩ resistor	Temperature foldback disabled
2-3	TEMP connected to V18	Temperature foldback enabled

**Default position.*

device's TEMP pin to an NTC sensor (NTCLE100E3103G or a similar NTC device) through R46 resistor according to Table 9. The selected NTC sensor can be installed on the EV kit using the J22 pins.

When the NTC senses a temperature higher than a limit value (set by R47), the LED current is linearly reduced with increasing temperature down to 20% of its initial value. Temperature values which would result in a LED current lower than 20% of its initial value causes the complete turning off of the current sinks.

For additional information on the device's temperature foldback operation, refer to the *Temperature Foldback* section in the MAX25512 IC data sheet.

Fault-Indicator Output ($\overline{FLT}$)

The EV kit features the device's open-drain $\overline{FLT}$ output. The $\overline{FLT}$ signal is pulled up to VCC_EXT by resistor R48. $\overline{FLT}$ goes low when an open-LED or shorted-LED string is detected, during thermal warning/shutdown or during boost undervoltage/overvoltage events. Keep jumper J17 closed to allow DS2 red LED enabling in case $\overline{FLT}$ goes low. Refer to the *Fault Protection* section in the MAX25512 IC data sheet for additional information on the $\overline{FLT}$ signal.

Shorted-LED Detection and Protection

The short-LED threshold can be set through I²C in the **SLDET** section contained in the **0x0E SETTING** register group box (MAX25512 only). A shorted LED is detected when the following condition is satisfied:

$$V_{OUT\_1-4} > V_{SLDET}$$

Alternatively, the short-LED threshold can be programmed through the RSDT input (all IC versions). R18 and R19 form a resistor-divider from V18 to RSDT to GND. A shorted LED is detected when the following condition is satisfied:

$$V_{OUT\_1-4} > 12 \times V_{RSDT}$$

When the short-LED threshold is reached, the affected current sink is disabled to reduce excess power dissipation and the $\overline{FLT}$ indicator asserts low. The short-LED detection feature is regulated through jumper J10. See Table 10 for jumper settings.

Overvoltage Detection and Protection

The resistors (R4 and R5) connected to BSTMON are configured for a VOUT_OVP of 35V which then equals the maximum converter output (VOUT) voltage. During an open-LED string condition, the converter output ramps up to the output overvoltage threshold. Capacitor C3 can be added to provide noise filtering to the overvoltage signal. To reconfigure the circuit for a different voltage, replace resistor R4 with a different value using the following equation:

$$R4 = [(V_{OUT\_OVP} / 0.95) - 1] \times R5$$

where R5 is 10kΩ, VOUT_OVP is the overvoltage-protection threshold desired, and R4 is the new resistor value for obtaining the desired overvoltage protection. Refer to the *Open-LED Management and Overvoltage Protection* section in the MAX25512 IC data sheet for additional information.

Fading Function

The fading option feature can be enabled for all dimming conditions (external or internal, with or without hybrid dimming) by checking **FADE_IN_OUT** in the **0x10 FADING** register group box (MAX25512 only). With fading enabled, any dimming duty-cycle change is applied incrementally, following an exponential increase/decrease with a gain of 6.25% (or 12.5% if **FADE_GAIN** is checked) per dimming cycle sequence.

Depending on the value set in the **TDIM** section, the user is also able to set a delay after which each duty-cycle update is carried out. The fading duty-cycle update occurs every 2^{TDIM} dimming cycles, where 2^{TDIM} can be equal to one of the following values: 1, 2, 4, 8, 16, or 32.

When MAX25510 or MAX25511 are used on the EV kit, the fading option can be enabled by connecting a resistor of proper value between the ICs SET pin and ground (see the *SET Pin Operation* section for details). In this case, fading gain and duty cycle updating rate are fixed to 6.25% and 1, respectively.

Refer to the *Automatic Fade-In/Fade-Out During Dimming* section in the MAX25512 and MAX25510/MAX25511 IC data sheets for additional information.

Table 10. Short-LED Detection (J10)

SHUNT POSITION	RSDT PIN	EV KIT OPERATION
1-2*	Connected to V18	Short-LED detection regulated through I²C (MAX25512 only)
2-3	Connected to R18/R19 resistor-divider	Short-LED detection regulated through resistor-divider

**Default position.*

SET Pin Operation

When the MAX25510 or MAX25511 are used on the EV kit, the following functions can be enabled/disabled by connecting the SET pin of the IC either to ground through a specific resistor or directly to ground/V18: phase-shifting, spread-spectrum, slow/fast start-up, and auto fade-in/out. Table 11 shows the jumper settings required to obtain the different function combinations.

Table 11. SET Pin Connection (J28, J3–J9, J11–J16, J18, and J19)

SET PIN	SET RESISTOR VALUE (Ω)	JUMPER	SHUNT POSITION	PHASE-SHIFTING	START-UP	SPREAD-SPECTRUM	AUTO FADE-IN/OUT
J28 Shunted in 2-3 Position, J19 Open	357	J18	Closed	ON	FAST	ON	OFF
	590	J16	Closed	ON	FAST	OFF	ON
	825	J15	Closed	ON	FAST	OFF	OFF
	1.13k	J14	Closed	ON	SLOW	ON	ON
	1.5k	J13	Closed	ON	SLOW	ON	OFF
	2k	J12	Closed	ON	SLOW	OFF	ON
	2.67k	J11	Closed	ON	SLOW	OFF	OFF
	5.9k	J9	Closed	OFF	FAST	ON	ON
	14.3k	J8	Closed	OFF	FAST	ON	OFF
	23.2k	J7	Closed	OFF	FAST	OFF	ON
	33.2k	J6	Closed	OFF	FAST	OFF	OFF
	45.3k	J5	Closed	OFF	SLOW	ON	ON
	60.4k	J4	Closed	OFF	SLOW	ON	OFF
	80.6k	J3	Closed	OFF	SLOW	OFF	ON
J28 Shunted in 2-3 Position	SET pin connected to GND	J19	2-3	ON	FAST	ON	ON
J28 Shunted in 2-3 Position*	SET pin connected to V18	J19	1-2	OFF	SLOW	OFF	OFF

**Default position.*

Ordering Information

PART	TYPE
MAX25512EVKIT#	EVKIT

#Denotes RoHS compliance.

MAX25512 EV Kit Bill of Materials

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	ADIM, BOOST, BOOST1, DIM, EN, EXT_LOGIC, FLT, GND, GND1-GND3, IN, OUT1-OUT4, PGND, PGND1, PGND2, SCL, SDA, SYNC, VTEMP	-	23	9020 BUSS	WEICO WIRE	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG	
2	C2, C6, C16, C21	-	4	UMK107BJ105KA; C1608X5R1H105K080AB; CL10A105KB8NNN; GRM188R61H105KAAL	TAIYO YUDEN;TDK;SAMSUNG; MURATA	1UF	CAP; SMT (0603); 1UF; 10%; 50V; X5R; CERAMIC	
3	C4	-	1	C1608X7S2A104K080AB	TDK	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 100V; X7S; CERAMIC	
4	C5, C26	-	2	C1210C475K5RAC; GRM32ER71H475KA88; CNC6P1X7R1H475K250AE	KEMET;MURATA;TDK	4.7UF	CAP; SMT (1210); 4.7UF; 10%; 50V; X7R; CERAMIC	
5	C9, C10	-	2	EEE-TG1H470UP	PANASONIC	47UF	CAP; SMT (CASE_F); 47UF; 20%; 50V; ALUMINUM-ELECTROLYTIC	
6	C11	-	1	GCM188R71H332KA37	MURATA	3300PF	CAP; SMT (0603); 3300PF; 10%; 50V; X7R; CERAMIC	
7	C14	-	1	C0603C105K4RAC; C1608X7R1C105K080AC; EMK107B7105KA; CGA3E1X7R1C105K080AC; 0603YC105KAT2A	KEMET;MURATA;TDK;TAIYO YUDEN;TDK;AVX	1UF	CAP; SMT (0603); 1UF; 10%; 16V; X7R; CERAMIC	
8	C17	-	1	GRM32ER71H106KA12; CL32B106KBJNNN; UMJ325KB7106KMH; 12105C106K4Z2A	MURATA;SAMSUNG ELECTRONICS;TAIYO YU	10UF	CAP; SMT (1210); 10UF; 10%; 50V; X7R; CERAMIC	
9	C19	-	1	CGA2B3X7R1H104K050BB; GCM155R71H104KE02; CGA2B3X7R1H104K050BE	TDK;MURATA;TDK	0.1UF	CAP; SMT (0402); 0.1UF; 10%; 50V; X7R; CERAMIC	
10	C20	-	1	GRM188R71C333KA01	MURATA	0.033UF	CAP; SMT (0603); 0.033UF; 10%; 16V; X7R; CERAMIC	
11	C22	-	1	GRM1885C1H102JA01; C1608C0G1H102J080AA; GCM1885C1H102JA16	MURATA;TDK;MURATA	1000PF	CAP; SMT (0603); 1000PF; 5%; 50V; C0G; CERAMIC	
12	C27	-	1	TMK212AB7475K; CGJ4J1X7R1E475K125AC; C2012X7R1E475K125AB; CGA4J1X7R1E475K125AC; GRM21BZ71E475KE15	TAIYO YUDEN;TDK;TDK; TDK;MURATA	4.7UF	CAP; SMT (0805); 4.7UF; 10%; 25V; X7R; CERAMIC	
13	C28	-	1	C0603H101J5GAC	KEMET	100PF	CAP; SMT (0603); 100PF; 5%; 50V; C0G; CERAMIC	
14	C31	-	1	C0603C100K1GAC	KEMET	10PF	CAP; SMT (0603); 10PF; 10%; 100V; C0G; CERAMIC	
15	C33	-	1	GRM033C71C104KE14	MURATA	0.1UF	CAP; SMT (0201); 0.1UF; 10%; 16V; X7S; CERAMIC	
16	C34, C38, C40	-	3	GCJ188R71H104KA12; GCM188R71H104K; CGA3E2X7R1H104K080AA; CGA3E2X7R1H104K080AD; CL10B104KB8WPN	MURATA;MURATA;TDK; TDK;SAMSUNG	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 50V; X7R; CERAMIC	
17	C226	-	1	C2012X7R1H225K125AC	TDK	2.2UF	CAP; SMT (0805); 2.2UF; 10%; 50V; X7R; CERAMIC	
18	D1	-	1	B540CQ-13-F	DIODES INCORPORATED	B540CQ-13-F	DIODE; SCH; SMC; PIV=40V; IF=5A	
19	D3	-	1	CMPD914E	CENTRAL SEMICONDUCTOR	CMPD914E	DIODE; SWT; SMT (SOT23-3); PIV=150V; IF=0.1A	
20	D4	-	1	B160B-13-F	DIODES INCORPORATED	B160B-13-F	DIODE; SCH; SMB (DO-214AA); PIV=60V; IF=1A	
21	DS1	-	1	LGL29K-F2J1-24-Z	OSRAM	LGL29K-F2J1-24-Z	DIODE; LED; SMARTLED; GREEN; SMT; PIV=1.7V; IF=0.02A	
22	DS2	-	1	LS L29K-G1J2-1-Z	OSRAM	LS L29K-G1J2-1-Z	DIODE; LED; SMART; RED; SMT (0603); PIV=1.8V; IF=0.02A; -40 DEGC TO +100 DEGC	
23	INPUT, NGATE, NTC, TP1, TP2, V18	-	6	5011	N/A	5011	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
24	J1, J3-J9, J11-J18, J21, J22, J30, J31	-	20	PBC02SAAN	SULLINS ELECTRONICS CORP.	PBC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS	
25	J2, J10, J19, J20, J23, J26-J29	-	9	PEC03SAAN	SULLINS	PEC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS	
26	J24	-	1	803-87-020-20-001101	PRECI-DIP SA	803-87-020-20-001101	EVKIT PART-CONNECTOR; FEMALE; TH; DOUBLE ROW; 2.54MM; RIGHT ANGLE SOLDER TAIL; MATING PIN DIA 0.76MM; RIGHT ANGLE; 20PINS;	

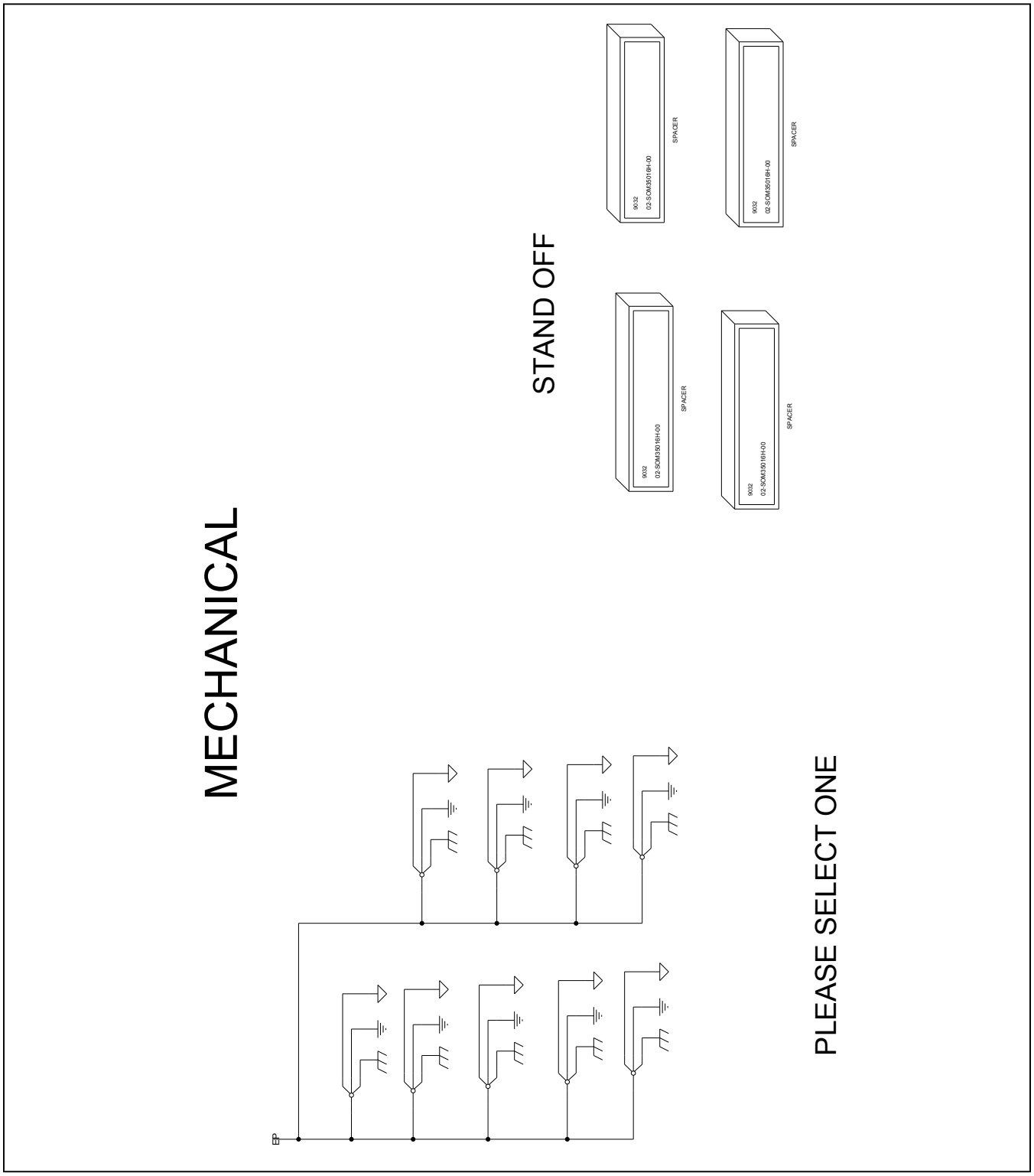
MAX25512 EV Kit Bill of Materials (continued)

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
27	J25	-	1	HTSW-112-11-G-S-RA	SAMTEC	HTSW-112-11-G-S-RA	CONNECTOR; MALE; THROUGH HOLE; SQUARE POST HEADER; RIGHT ANGLE; 12PINS ;	
28	JMP1, JMP3, JMP6, JMP7, JMP9	-	5	PEC04SAAN	SULLINS ELECTRONICS CORP.	PEC04SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 4PINS	
29	L1	-	1	XAL4020-601ME	COILCRAFT	0.60UH	INDUCTOR; SMT; CORE MATERIAL= COMPOSITE; 0.60UH; TOL=+/-20%; 11.7A	
30	L2	-	1	MSS1278T-472ML	COILCRAFT	4.7UH	INDUCTOR; SMT; FERRITE BOBBIN CORE; 4.7UH; TOL=+/-0.2; 6.2A; -40 DEGC TO +125 DEGC	
31	Q1	-	1	NVMFS5C677NLT1G	ON SEMICONDUCTOR	NVMFS5C677NLT1G	TRAN; NCH; POWER MOSFET; SO-8FL; PD-(3.5W); I-(36A); V-(60V)	
32	Q2	-	1	SI1317DL-T1-GE3	VISHAY SILICONIX	SI1317DL-T1-GE3	TRAN; P-CHANNEL 20V (D-S) MOSFET; PCH; SOT-323; PD-(0.5W); I-(-1.4A); V-(-20V)	
33	Q3	-	1	MMBT3904LT3G	ON SEMICONDUCTOR	MMBT3904	TRANSISTOR, NPN, SOT-23, PD=0.225W, IC=0.2A, VCEO=40V	
34	R2	-	1	CRCW06033K00FK	VISHAY DALE	3K	RES; SMT (0603); 3K; 1%; +/-100PPM/DEGC; 0.1000W	
35	R3	-	1	CRCW08050000ZS; RC2012J000	DIGI-KEY	0	RES; SMT (0805); 0; JUMPER; JUMPER; 0.1250W	
36	R4	-	1	RG2012N-364-W	SUSUMU CO LTD	360K	RES; SMT (0805); 360K; 0.05%; +/-10PPM/DEGC; 0.1250W	
37	R5	-	1	TNPW080510K0BE; ERA-6YEB103V	VISHAY DALE;PANASONIC	10K	RES; SMT (0805); 10K; 0.10%; +/-25PPM/DEGK; 0.1250W	
38	R6	-	1	301-10K-RC	XICON	10K	RES; SMT (0603); 10K; 5%; +/-200PPM/DEGC; 0.0630W	
39	R7	-	1	CRCW060360K4FK	VISHAY DALE	60.4K	RES; SMT (0603); 60.4K; 1%; +/-100PPM/DEGC; 0.1000W	
40	R9	-	1	CRCW06031M00FK; MCR03EZPFX1004	VISHAY DALE;ROHM	1M	RES; SMT (0603); 1M; 1%; +/-100PPM/DEGC; 0.1000W	
41	R10	-	1	CRCW060345K3FK; ERJ-3EKF4532	VISHAY DALE;PANASONIC	45.3K	RES; SMT (0603); 45.3K; 1%; +/-100PPM/DEGC; 0.1000W	
42	R11	-	1	LRC-LRZ2010LF-R000	TT ELECTRONICS	0	RES; SMT (2010); 0; JUMPER; CURRENT SENSE	
43	R12	-	1	CRCW060333K2FK	VISHAY DALE	33.2K	RES; SMT (0603); 33.2K; 1%; +/-100PPM/DEGC; 0.1000W	
44	R13	-	1	ERJ-3EKF2322	PANASONIC	23.2K	RES; SMT (0603); 23.2K; 1%; +/-100PPM/DEGC; 0.1000W	
45	R14, R51	-	2	ERJ-3EKF1432	PANASONIC	14.3K	RES; SMT (0603); 14.3K; 1%; +/-100PPM/DEGC; 0.1000W	
46	R15	-	1	CRCW06035K90FK; ERJ-3EKF5901	VISHAY DALE;PANASONIC	5.9K	RES; SMT (0603); 5.9K; 1%; +/-100PPM/DEGC; 0.1000W	
47	R16	-	1	CRCW06032K67FK	VISHAY DALE	2.67K	RES; SMT (0603); 2.67K; 1%; +/-100PPM/DEGC; 0.1000W	
48	R17, R46	-	2	RNCP0603FTD2K00	STACKPOLE ELECTRONICS INC.	2K	RES; SMT (0603); 2K; 1%; +/-100PPM/DEGC; 0.1250W	
49	R18	-	1	ERJ-3EKF1692; RC0603FR-0716K9	PANASONIC;YAGEO PHYCOMP	16.9K	RES; SMT (0603); 16.9K; 1%; +/-100PPM/DEGC; 0.1000W	
50	R19, R27, R29, R36, R38, R41, R45, R48	-	8	CHPHT0603K1002FGT	VISHAY SFERNICE	10K	RES; SMT (0603); 10K; 1%; +/-100PPM/DEGC; 0.0125W	
51	R20, R62, R63	-	3	TNPW06031K50BE; ERA-3YEB152V	VISHAY DALE;PANASONIC	1.5K	RES; SMT (0603); 1.5K; 0.10%; +/-25PPM/DEGK; 0.1000W	
52	R21	-	1	RK73H1JTTD1131F	KOA SPEER ELECTRONICS INC	1.13K	RES; SMT (0603); 1.13K; 1%; +/-100PPM/DEGC; 0.1000W	
53	R22	-	1	CRCW0603825RFK	VISHAY DALE	825	RES; SMT (0603); 825; 1%; +/-100PPM/DEGC; 0.1000W	
54	R23, R34, R37, R43	-	4	CRCW0603100KFK; RC0603FR-07100KL; RC0603FR-13100KL; ERJ-3EKF1003; AC0603FR-07100KL	VISHAY DALE;YAGEO; YAGEO;PANASONIC	100K	RES; SMT (0603); 100K; 1%; +/-100PPM/DEGC; 0.1000W	
55	R24	-	1	CRCW0603590RFK; ERJ-3EKF5900	VISHAY DALE;PANASONIC	590	RES; SMT (0603); 590; 1%; +/-100PPM/DEGC; 0.1000W	
56	R25	-	1	TNPW0603357RBE	VISHAY DALE	357	RES; SMT (0603); 357; 0.10%; +/-100PPM/DEGC; 0.1000W	
57	R26	-	1	CRCW060310R0FK; MCR03EZPFX10R0; ERJ-3EKF10R0	VISHAY DALE;ROHM	10	RES; SMT (0603); 10; 1%; +/-100PPM/DEGC; 0.1000W	
58	R28	-	1	TNPW060375K0BE; 2312-201-77503	VISHAY DALE;VISHAY DALE	75K	RES; SMT (0603); 75K; 0.10%; +/-100PPM/DEGC; 0.1000W	
59	R30	-	1	CRCW060315K0FK	VISHAY DALE	15K	RES; SMT (0603); 15K; 1%; +/-100PPM/DEGC; 0.1000W	
60	R31, R42, R44, R54, R57, R60, R61, R66-R69, R76	-	12	CRCW06030000Z0	VISHAY DALE	0	RES; SMT (0603); 0; JUMPER; JUMPER; 0.1000W	
61	R32	-	1	ERJ-3EKF1872; CRCW060318K7FK	PANASONIC;VISHAY	18.7K	RES; SMT (0603); 18.7K; 1%; +/-100PPM/DEGC; 0.1000W	

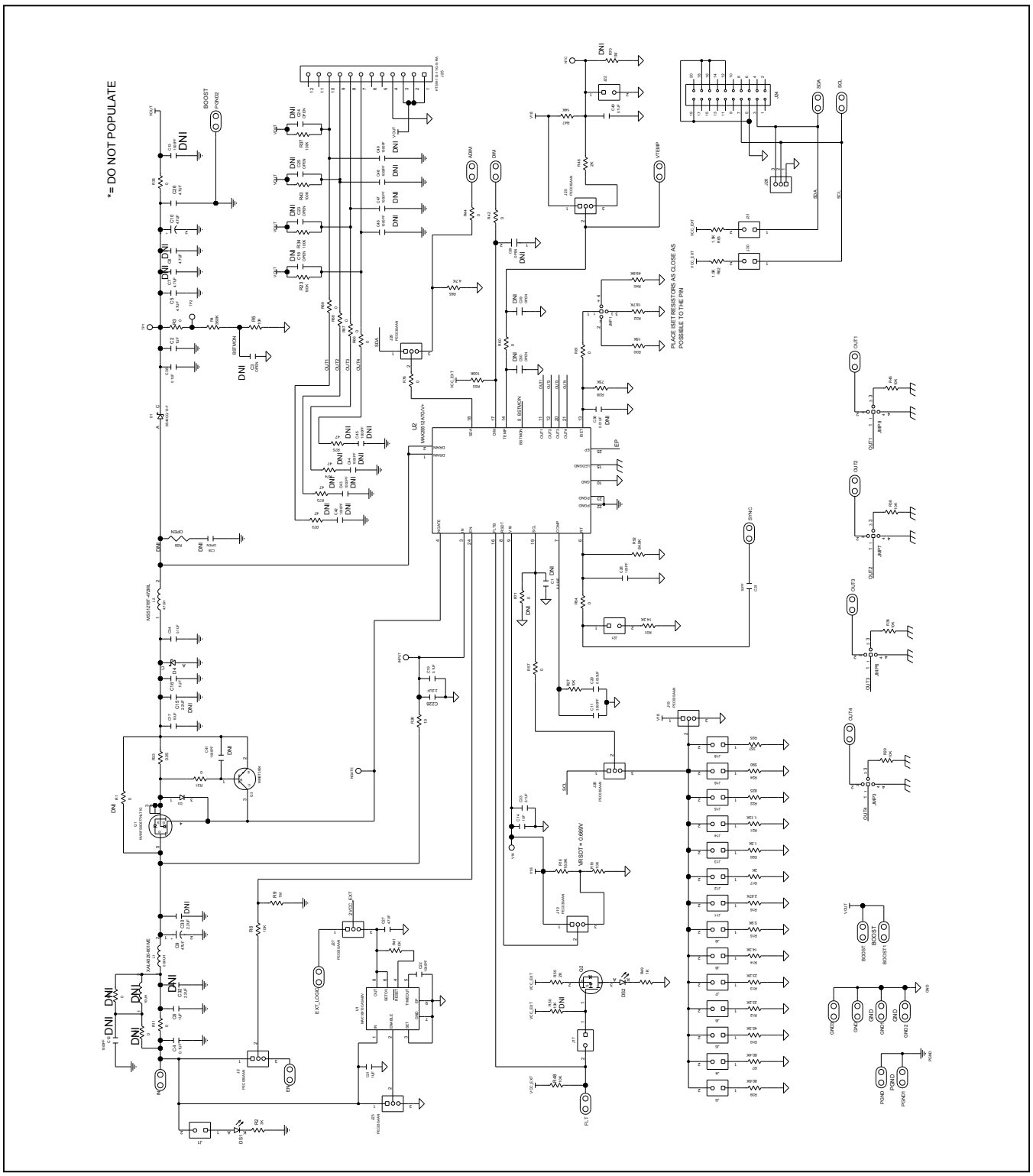
MAX25512 EV Kit Bill of Materials (continued)

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
62	R33	-	1	WFMB2010R0500F	VISHAY	0.05	RES; SMT (2010); 0.05; 1%; +/-50PPM/DEGC; 2W	
63	R35	-	1	CRCW12060000ZS; ERJ-8GEY0R00	VISHAY DALE;PANASONIC	0	RES; SMT (1206); 0; JUMPER; JUMPER; 0.2500W	
64	R39	-	1	CRCW060380K6FK; ERJ-3EKF8062; RC0603FR-0780K6L	VISHAY;PANASONIC;YAGEO	80.6K	RES; SMT (0603); 80.6K; 1%; +/-100PPM/DEGK; 0.1000W	
65	R40	-	1	CRCW060349K9FK; ERJ-3EKF4992	VISHAY DALE;PANASONIC	49.9K	RES; SMT (0603); 49.9K; 1%; +/-100PPM/DEGC; 0.1000W	
66	R47	-	1	ERJ-3EKF1402; CRCW060314K0FK	PANASONIC;VISHAY	14K	RES; SMT (0603); 14K; 1%; +/-100PPM/DEGC; 0.1000W	
67	R49	-	1	ERA-3ARB102	PANASONIC	1K	RES; SMT (0603); 1K; 0.10%; +/-10PPM/DEGC; 0.1000W	
68	R52	-	1	ERJ-3EKF6492	PANASONIC	64.9K	RES; SMT (0603); 64.9K; 1%; +/-100PPM/DEGC; 0.1000W	
69	R53	-	1	ERA-3AEB104; AT0603BRD07100KL	PANASONIC;YAGEO	100K	RES; SMT (0603); 100K; 0.10%; +/-25PPM/DEGC; 0.1000W	
70	R55	-	1	CRCW06032K0FK; ERJ-3EKF2001; RC0603FR-072KL; CRCW06032K00FK	VISHAY;PANASONIC; YAGEO;VISHAY	2K	RES; SMT (0603); 2K; 1%; +/-100PPM/DEGC; 0.1000W	
71	R65	-	1	ERJ-3GEYJ472	PANASONIC	4.7K	RES; SMT (0603); 4.7K; 5%; +/-200PPM/DEGC; 0.1000W	
72	SPACER1-SPACER4	-	4	9032	KEYSTONE	9032	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON	
73	U1	-	1	MAX16910CASA8/V+	MAXIM	MAX16910CASA8/V	IC; VREG; EXPOSED PAD 0.2A, AUTOMOTIVE, ULTRA-LOW QUIESCENT CURRENT, LINEAR REGULATOR; NSOIC8 150MIL	
74	U2	-	1	MAX25512ATG/V+	MAXIM	MAX25512ATG/V+	EVKIT PART - IC; MAX25512; 4-CHANNEL LOW-VOLTAGE 120MA WHITE LED BACKLIGHT DRIVER WITH INTEGRATED BOOST CONVERTER; PACKAGE OUTLINE NUMBER: 21-0139; LAND PATTERN NUMBER: 90-0022; PACKAGE CODE: T2044	
75	PCB	-	1	MAX25512	MAXIM	PCB	PCB:MAX25512	-
76	C1, C36	DNP	0	CGA3EANP02A103J080AC	TDK	0.01UF	CAP; SMT (0603); 0.01UF; 5%; 100V; C0G; CERAMIC	
77	C3, C18, C23-C25, C39, C50	DNP	0	N/A	N/A	OPEN	CAPACITOR; SMT (0603); OPEN; FORMFACTOR	
78	C7, C8	DNP	0	C1210C475K5RAC; GRM32ER71H475KA88; CNC6P1X7R1H475K250AE	KEMET;MURATA;TDK	4.7UF	CAP; SMT (1210); 4.7UF; 10%; 50V; X7R; CERAMIC	
79	C12, C13, C41	DNP	0	GRM1885C1H102JA01; C1608C0G1H102J080AA; GCM1885C1H102JA16	MURATA;TDK;MURATA	1000PF	CAP; SMT (0603); 1000PF; 5%; 50V; C0G; CERAMIC	
80	C15, C30, C32	DNP	0	C2012X7R1H225K125AC	TDK	2.2UF	CAP; SMT (0805); 2.2UF; 10%; 50V; X7R; CERAMIC	
81	C29	DNP	0	N/A	N/A	OPEN	EVKIT USE ONLY;DUAL PACKAGE OUTLINE 0603 AND 0805 NON-POLAR CAPACITOR	
82	C35	DNP	0	N/A	N/A	OPEN	CAPACITOR; SMT (0805); OPEN; FORMFACTOR	
83	C42-C49	DNP	0	GRM1885C1H102FA01	MURATA	1000PF	CAP; SMT (0603); 1000PF; 1%; 50V; C0G; CERAMIC	
84	L3	DNP	0	XAL5050-103ME	COILCRAFT	10UH	INDUCTOR; SMT; COMPOSITE CORE; 10UH; TOL=+/-20%; 4.9A	
85	R1, R8	DNP	0	LRC-LRZ2010LF-R000	TT ELECTRONICS	0	RES; SMT (2010); 0; JUMPER; CURRENT SENSE	
86	R50	DNP	0	CHPHT0603K1002FGT	VISHAY SFERNICE	10K	RES; SMT (0603); 10K; 1%; +/-100PPM/DEGC; 0.0125W	
87	R56	DNP	0	CRCW12060000ZS; ERJ-8GEY0R00	VISHAY DALE;PANASONIC	0	RES; SMT (1206); 0; JUMPER; JUMPER; 0.2500W	
88	R58	DNP	0	N/A	N/A	OPEN	RESISTOR; 0805; OPEN; FORMFACTOR	
89	R70	DNP	0	CRCW06031M00FK; MCR03EZPFX1004	VISHAY DALE;ROHM	1M	RES; SMT (0603); 1M; 1%; +/-100PPM/DEGC; 0.1000W	
90	R71	DNP	0	CRCW06030000Z0	VISHAY DALE	0	RES; SMT (0603); 0; JUMPER; JUMPER; 0.1000W	
91	R72-R75	DNP	0	CRCW060347R0FK	VISHAY DALE	47	RES; SMT (0603); 47; 1%; +/-100PPM/DEGC; 0.1000W	
TOTAL			168					

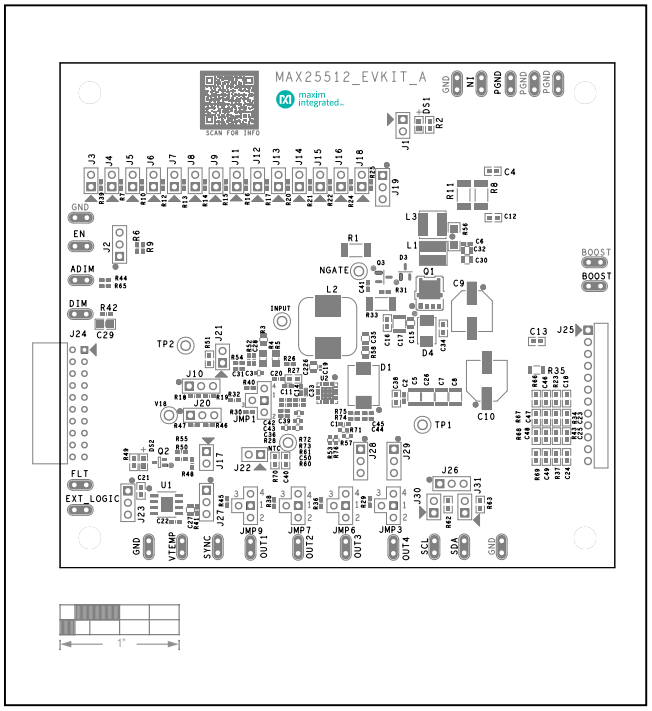
MAX25512 EV Kit Schematics



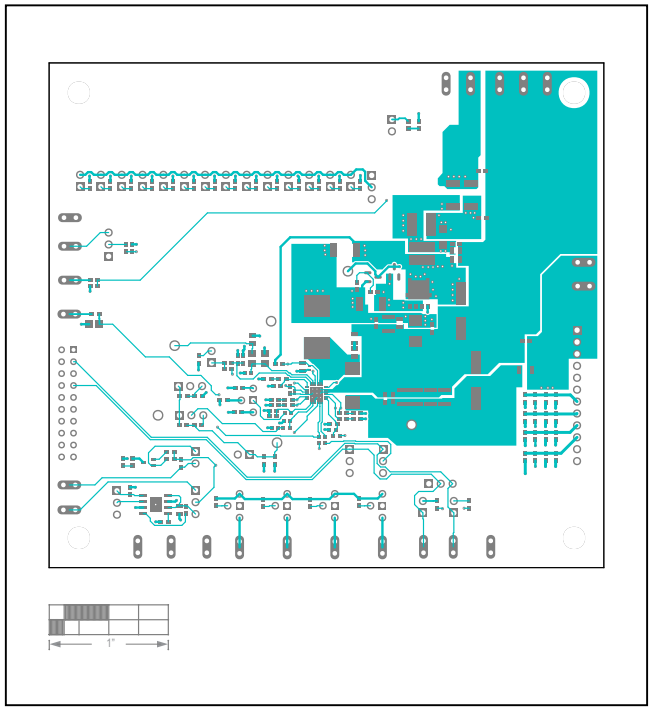
MAX25512 EV Kit Schematics (continued)



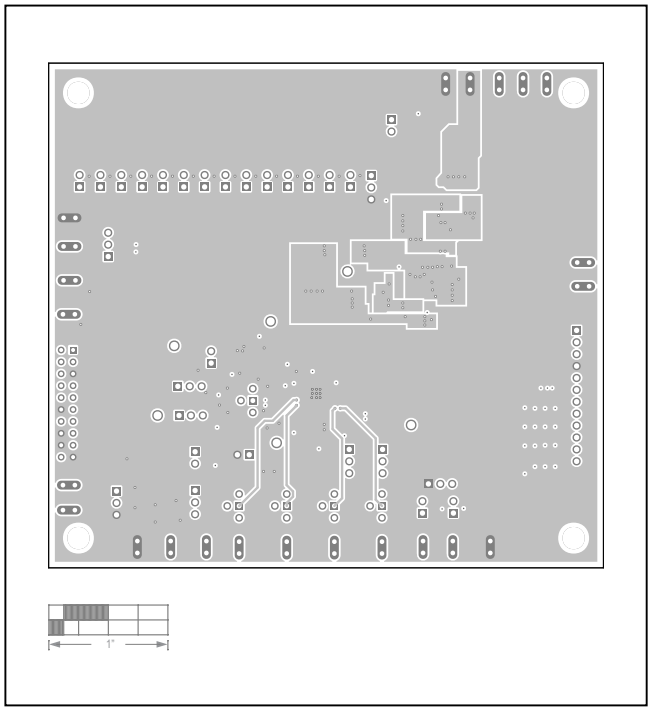
MAX25512 EV Kit PCB Layout Diagrams



MAX25512 EV Kit Component Placement Guide—Top Silkscreen

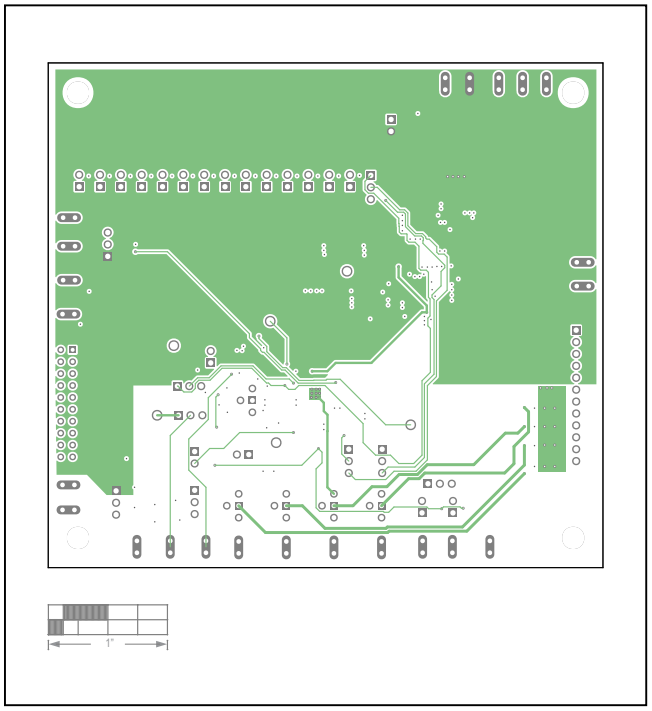


MAX25512 EV Kit PCB Layout—Top Layer

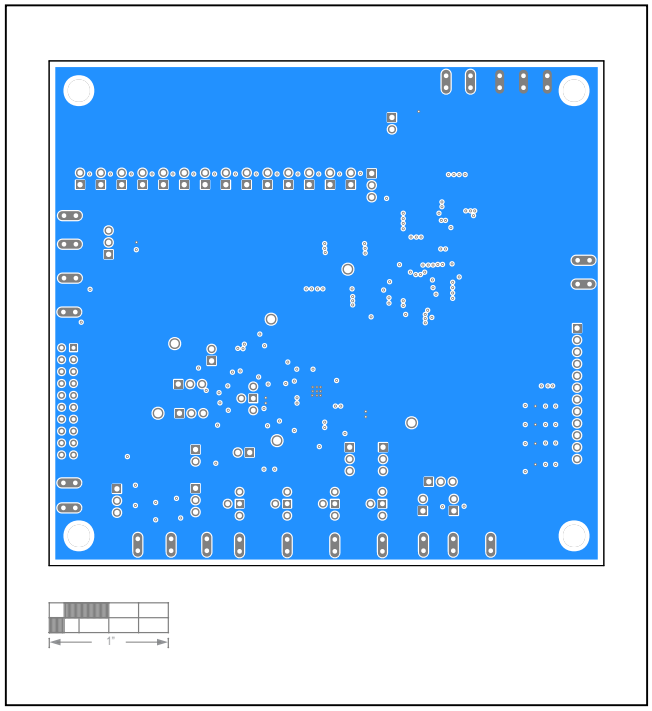


MAX25512 EV Kit PCB Layout—Internal Layer 2

MAX25512 EV Kit PCB Layout Diagrams (continued)



MAX25512 EV Kit PCB Layout—Internal Layer 3



MAX25512 EV Kit PCB Layout—Bottom Layer

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/21	Initial release	—
1	6/21	Added operation with MAX25510 and MAX25511 throughout the document Updated document title, *General Description*, *Features*, *Quick Start*, *Detailed Description of Hardware*	1–8

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