

# XMCA1 – 1200V XM3 Core Adapter Board

Designed for use with the 2ASC-12A1HP SiC Driver Core

## Overview

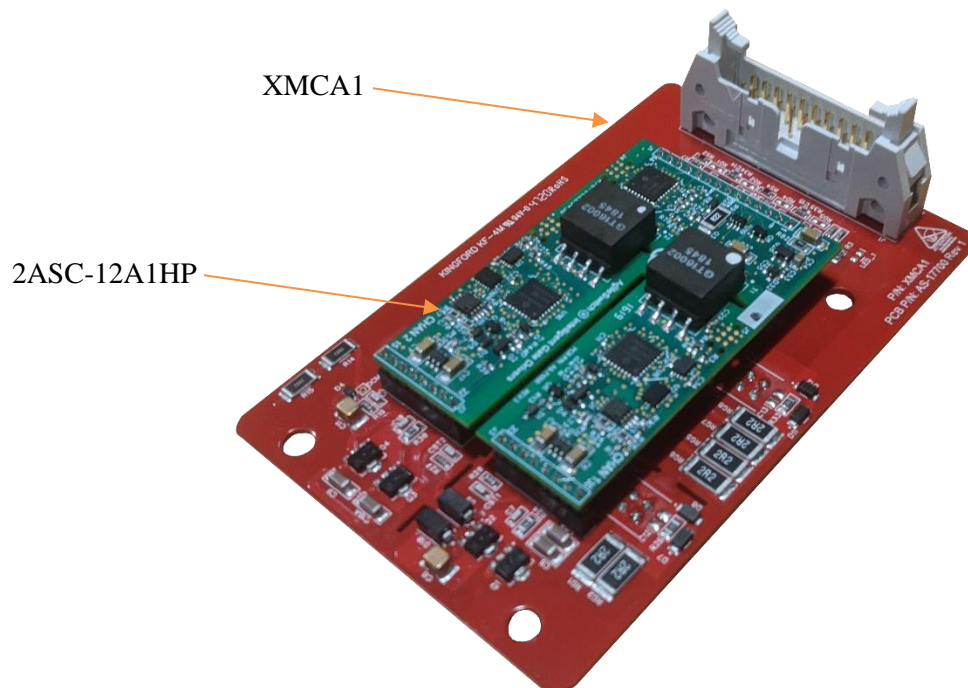
The AgileSwitch XMCA1 – 1200V XM3 Core Adapter Board is meant to serve as a quick evaluation tool for designers looking to design in the AgileSwitch 2ASC-12A1HP SiC Driver Core. The combination can be used with the Wolfspeed XM3 SiC Power Modules.

## Key Adapter Board Features

- UL Compliant - 1200V SiC MOSFET Modules
- Dual-Channel
- Robust High-Noise-Immunity Design
- Plug & Play for XM3 SiC Modules

## Applications

- Evaluation Tool



## Required Accessory\*

Part Number: **2ASC-12A1HP** (Gate Diver Core)

\*Not Included

## Evaluation Tools\*

**ASDAK- AgileSwitch SiC Accelerated Development Kits** provide the tools required to rapidly optimize the performance of SiC modules and systems. Each kit includes 2ASC Series Cores, ASBK-014, Module Adapter Boards, and optional Microchip SiC Modules.

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## System Overview

The basic topology of the driver core is shown in Figure 1.

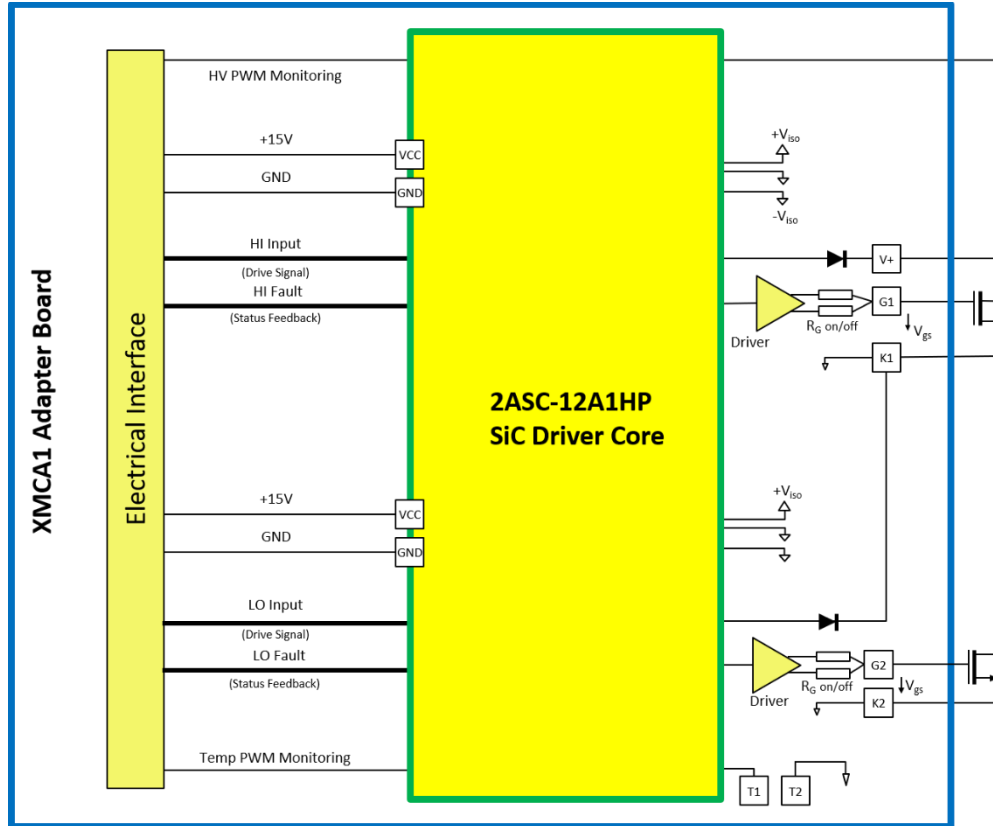


Figure 1 XMCA1 Adapter Board Basic Topology

## Absolute Maximum Ratings

Interaction of maximum ratings is dependent on operating conditions

Parameter	Description	Min	Max	Unit
Supply Voltage	VCC to GND	0	16.5	V
Peak Gate Current	Note 1	-20	20	A
Input Logic Levels	To GND	-0.5	15	V
Switching Frequency	Note 2		100	kHz
Working Voltage	Primary to Secondary, Secondary to Secondary		1200	V
Creepage Distance	Primary to Secondary Side	8		mm
dV/dt	Rate of change input to output	100		kV/ $\mu$ s
Operating Temperature	Ambient Operating Temperature	-40	+85	$^{\circ}$ C
Storage Temperature		-40	+90	$^{\circ}$ C

## Electrical Characteristics

Conditions:  $V_{SUP} = +15.0\text{ V}$ ,  $V_{IN\_LOGIC} = 15\text{V}$ , MOSFET ( $C_{iss} = 38\text{nF}$ ;  $Q_g = 1330\text{nC}$ )

Power Supply	Description	Min	Typ	Max	Unit
Supply Voltage	VCC to GND	14	15	16	V
Supply Current	Without Load		90		mA
Supply Current	With Load, Note 3		220		mA
Signal I/O	Description	Min	Typ	Max	Unit
Input Impedance	5V - Hi and Lo side input		100		$\Omega$
	15V – Hi & Lo side input		2000		$\Omega$
	5V Differential – Hi & Lo side input		240		$\Omega$
$V_{IN}$ Low	5V - Turn-off threshold			1.25	V
	15V – Turn-off threshold			4	V
$V_{IN}$ High	5V – Turn-on threshold	3.5			V
	15V – Turn-on threshold	10			V
$V_{IN}$ (differential option)	Difference between $V_{IN+}$ to $V_{IN-}$	2			V
Fault Output Voltage	Fault lines are open collect with 5mA load	0.3		24	V
Fault Output Current	Note 4			10	mA
Switching Frequency	Note 2			100	kHz

**Note 1:** Input signal should not be activated until 20 ms after power is applied to allow on board DC-DC converter to stabilize.

**Note 2:** Actual maximum switching speed is a function of gate capacitance.

**Note 3:** SiC MOSFET dependant, conditions listed above assume a MOSFET with  $C_{iss} = 38\text{nF}$  &  $Q_g = 1330\text{nC}$  operating at 50kHz

**Note 4:** Fault lines are open collector and require a pull-up resistor, 2K $\Omega$  recommended

## Interconnects

### Controller/Power to XMCA1 Connectors

Connector	Type	Ref	Manufacturer Part Number
Driver Board	20 Pin	J1	FCI 71918-220LF
Cable Assembly	20 Pin		FCI 71600-120LF

Recommended Cable for High Noise Environments: Flat Ribbon Cable, Twisted Pair, Shielded ([3M 1785/20 Series](#))

### MOSFET Terminals

Connector	Type	Ref	Manufacturer Part Number
Driver Board	4 Pin	J102, J104, J106, J107	ESQ-102-33-L-D

### MOSFET Terminals Pin Definitions

Pins	Description
4	G1
5	K1
6	G2
7	K2
8,9	V+
10,11	NTC1, NTC2

### 2ASC-12A1HP Connection Sockets

Connector	Type	Ref	Manufacturer Part Number
Input	14 Pin	J1	NPPN141BFCN-RC or similar
Ch 1, Ch 2	8 Pin	J2, J3	NPPN081BFCN-RC or similar

Note: The 2ASC-12A1HP can be mounted to the adapter board using sockets or by soldering.

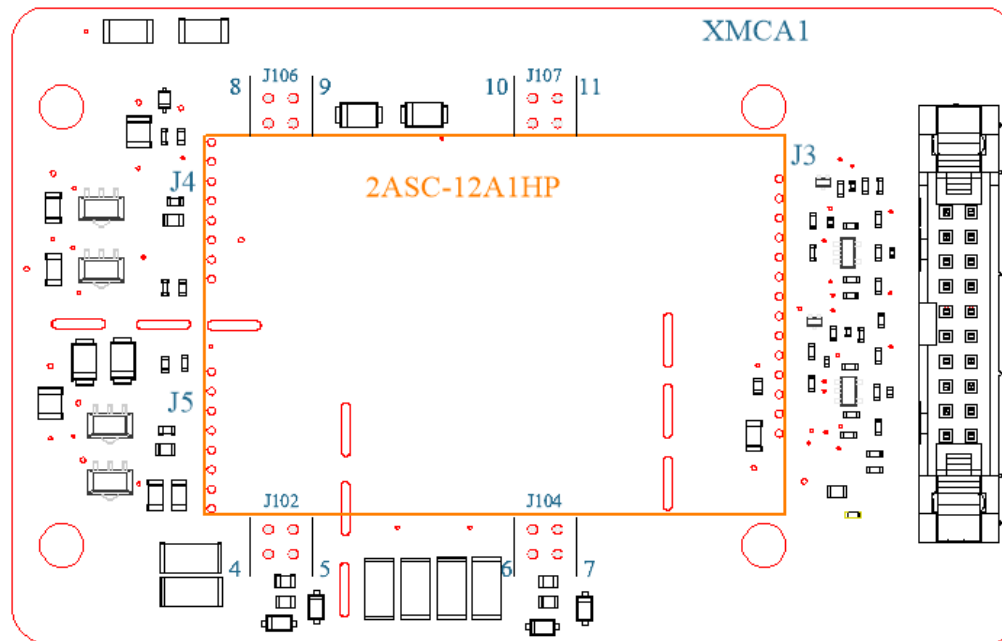


Figure 2 XMCA1 Interconnects on Adapter Board

## Mounting of Core Assembly on Adapter Board

### Method 1 - Soldering

2ASC-12A1HP can be directly soldered onto an Adapter Board without the need for additional support.

### Method 2 – Socket

2ASC-12A1HP can be plugged into female sockets on an Adapter Board.

### Recommended Sockets

Connector	Ref	Type	Manufacturer Part Number
Input	J3	14 Pin, 2mm pitch spacing	NPPN141BFCN-RC
Ch 1, Ch 2	J4, J5	8 Pin, 2mm pitch spacing	NPPN081BFCN-RC

## Recommended Interface Circuitry

### Primary

#### Block Diagram

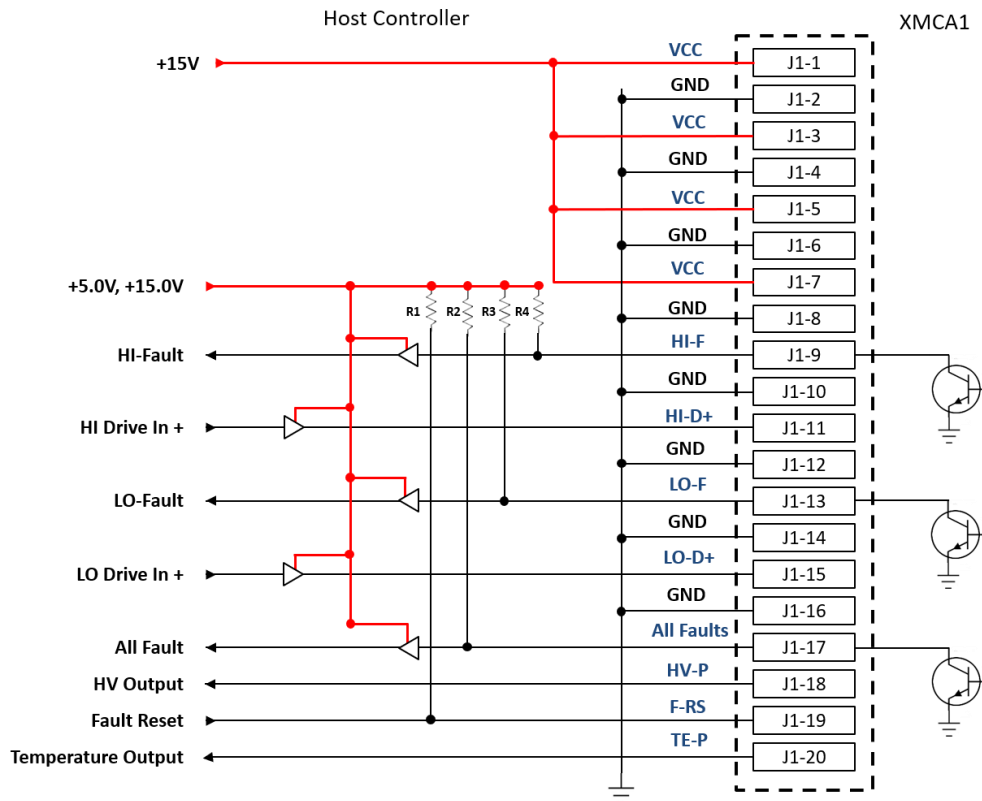


Figure 3 XMCA1 Recommended Interface Circuitry

## Temperature and High Voltage PWM Monitoring

The AgileSwitch 2ASC-12A1HP Driver provides two 31.5 kHz, 5.0V PWM output signals that monitor the thermistor temperature (isolated or non-isolated) and the DC Link Voltage (High Side drain to Low Side source) of the SiC MOSFET power module. The PWM signals have an output impedance of 510Ω. When combined with an external low pass filter, these signals represent a real time voltage for both High Voltage and Thermistor Temperature. A Sallen-Key active low pass filter can be used with these outputs as shown below with a 2 kHz cut-off frequency. The cut-off frequency can be optimized for your application. For simplicity, a simple RC low pass filter with 100 Hz cut-off frequency can also be used.

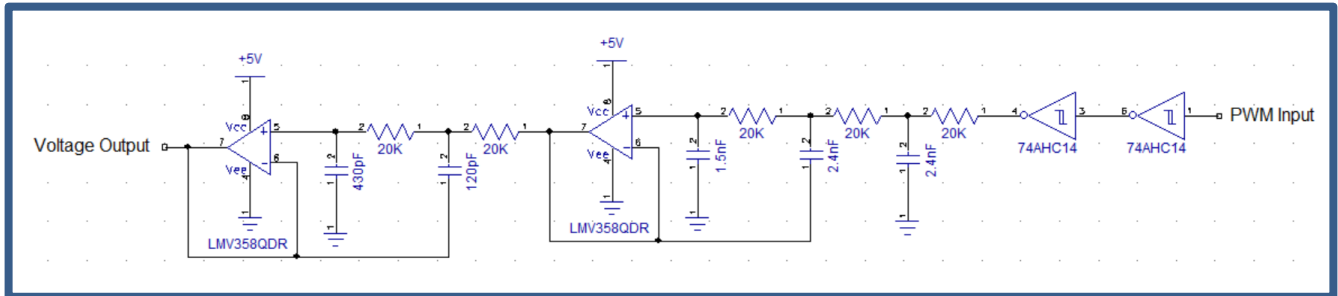
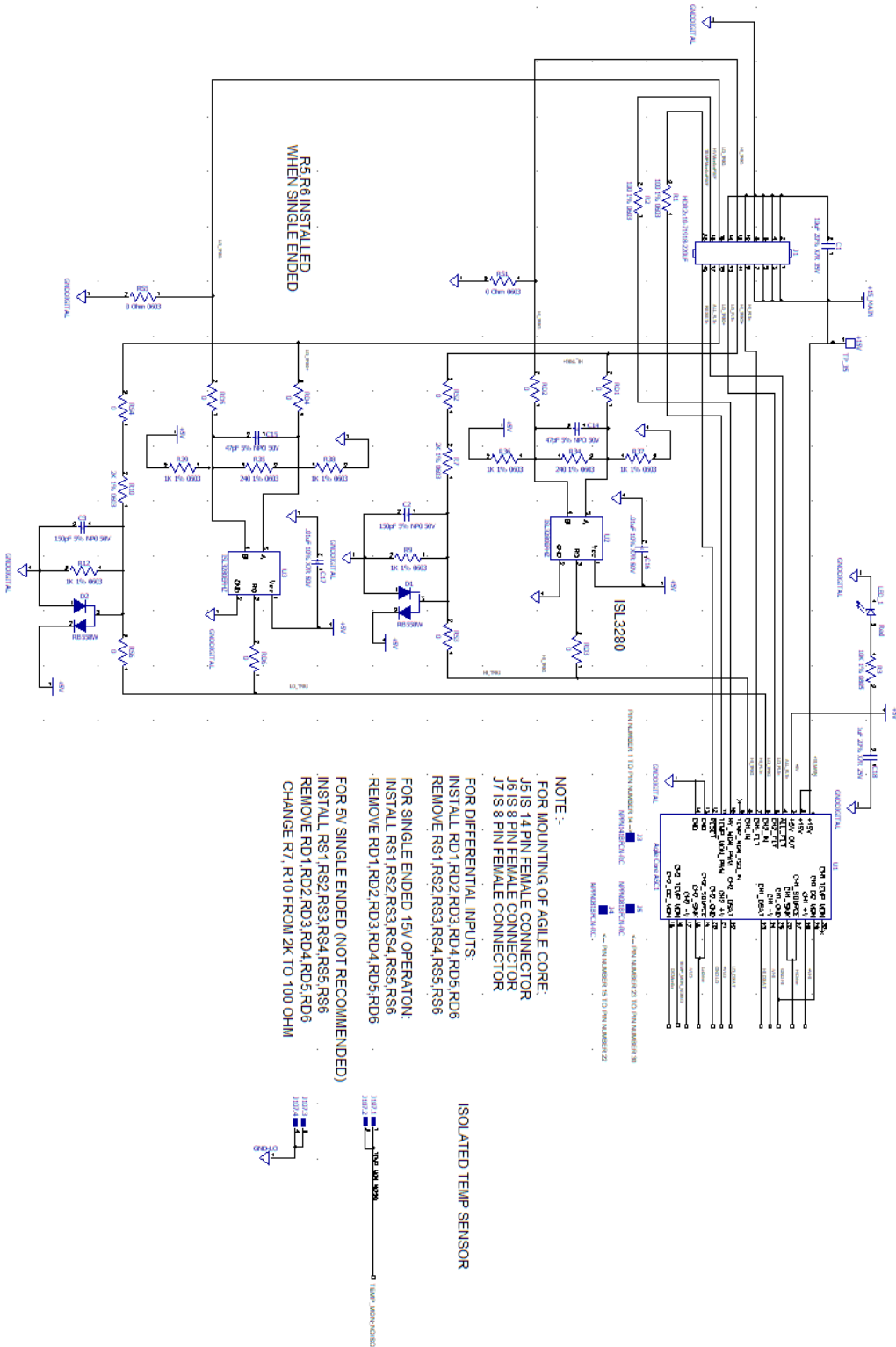


Figure 4 Example of a Low Pass Filter for DC Link PWM output

# XMCA1 – XM3 SiC Driver Core Adapter

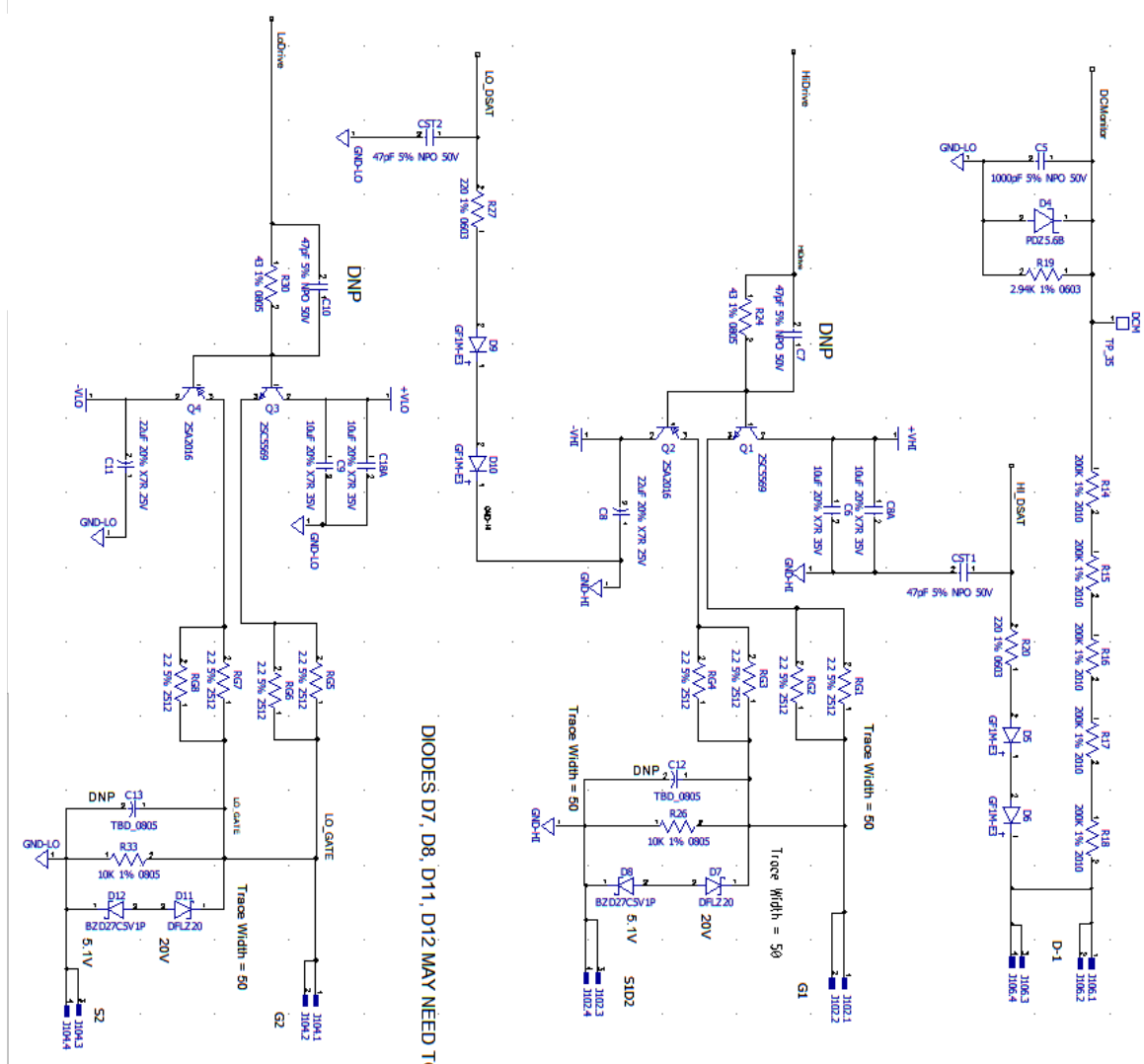
## Schematic

### Control I/O – Sheet 1 of 2





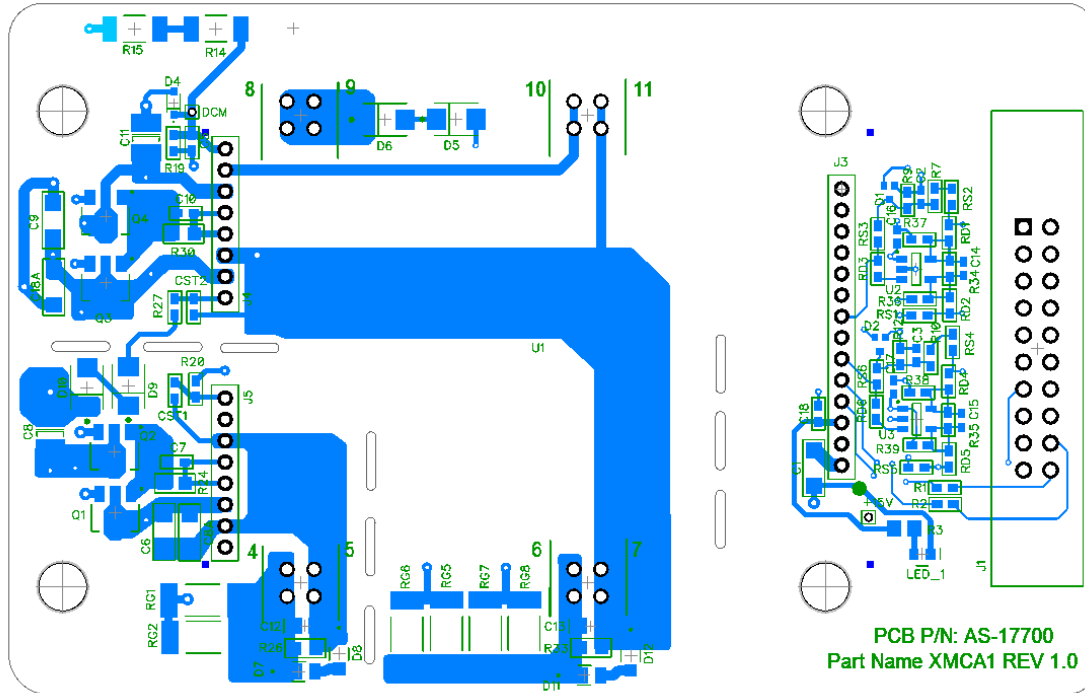
## HI & LO Side Drivers – Sheet 2 of 2



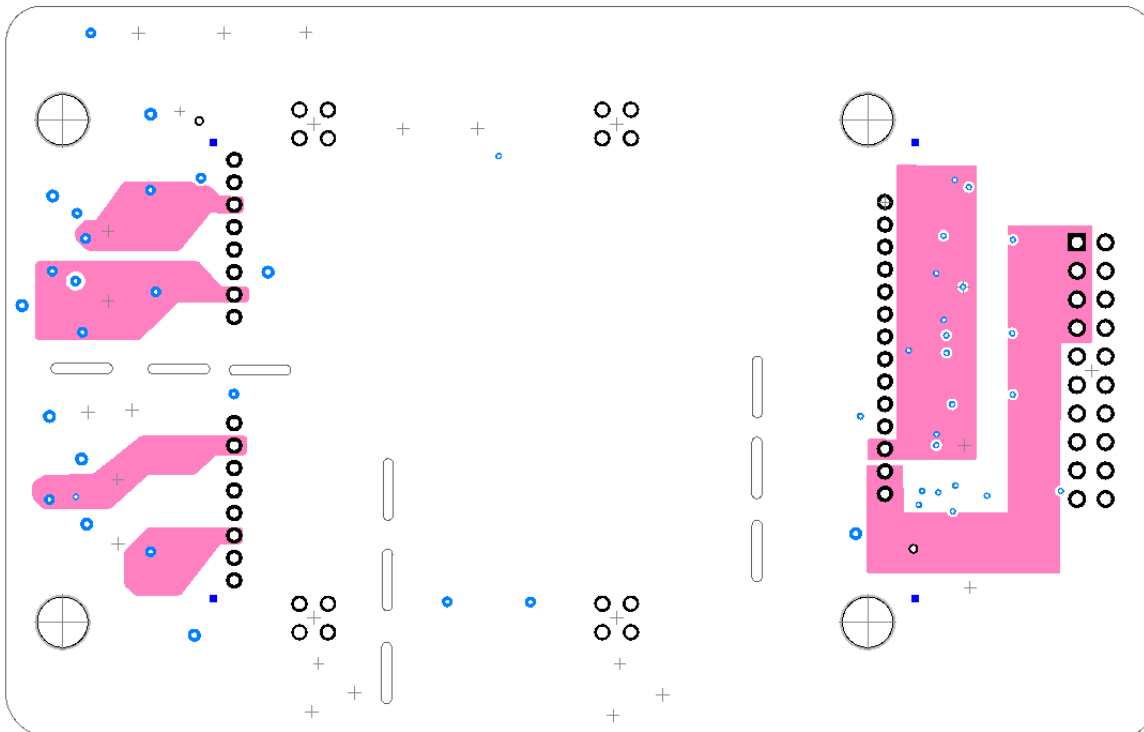
DIODES D7, D8, D11, D12 MAY NEED TO BE CHANGED FOR DIFFERENT MODULES

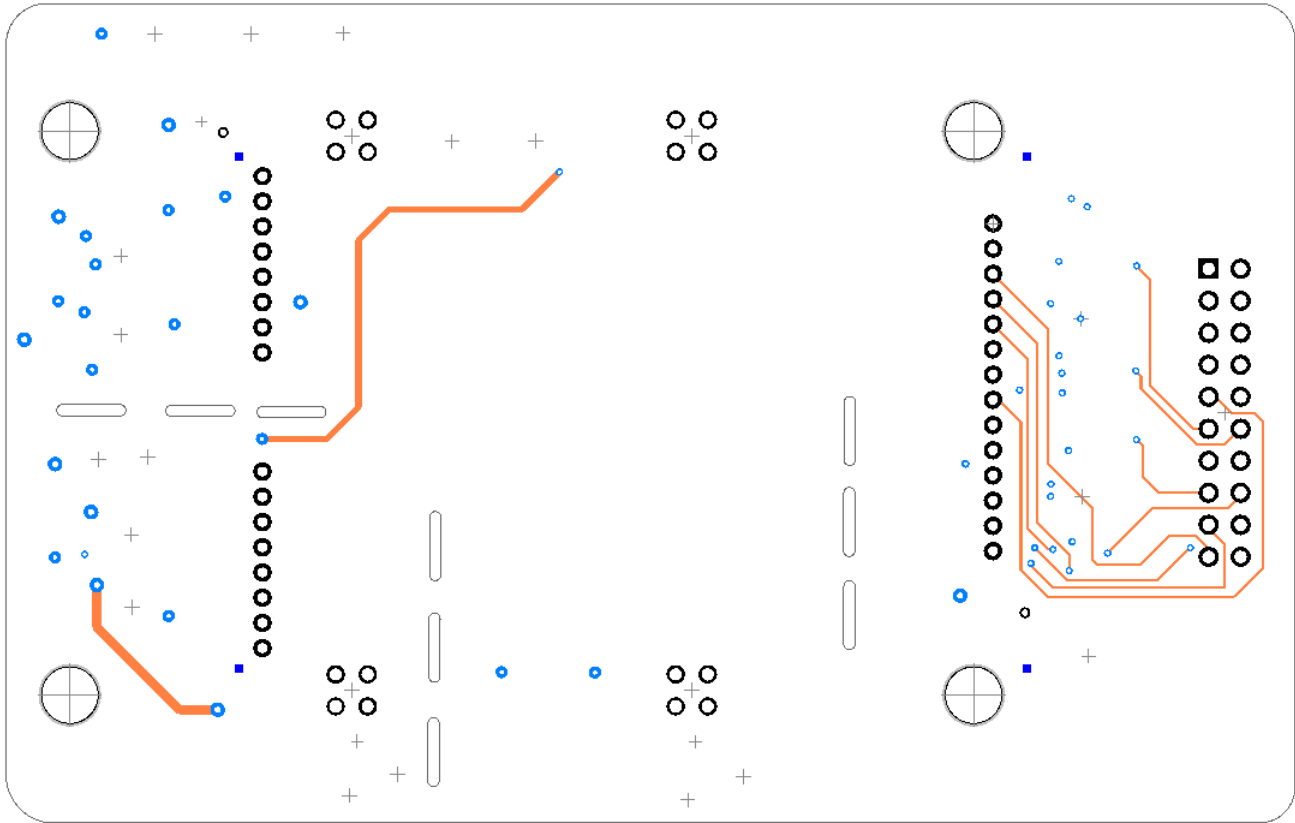
## Layout

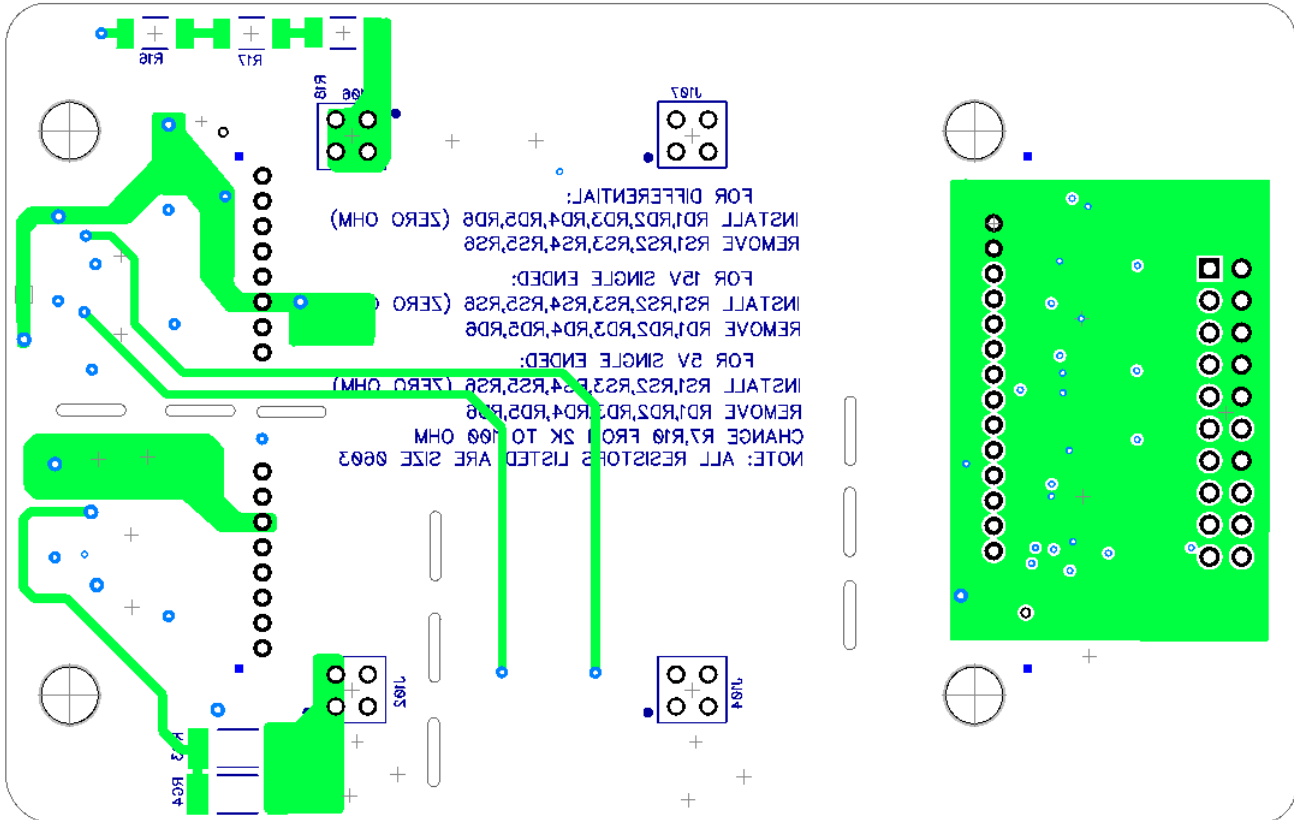
### Layer 1 - Top



### Layer 2 - Voltage



*Layer 3 – Signals*

**Layer 4 - Bottom\_GND**


## Part Numbers & Configuration Details

		Part Number
<b>Hardware Settings</b>	<b>Symbol</b>	<b>XMCA1</b>
R <sub>gon</sub> (Turn-on Gate Resistance)	R <sub>GON</sub>	1.1 Ω
R <sub>goff</sub> (Turn-off Gate Resistance)	R <sub>GOFF</sub>	1.1 Ω
Input Triggers	V <sub>IN_LOGIC</sub>	15V
Trigger Type	-	Single ended

## Design Files

The Schematic, Layout and Bill of Materials for the XMCA1 are publicly available for download.

Please visit [Microchip.com](http://Microchip.com) for access to these files.

## Important Precautions

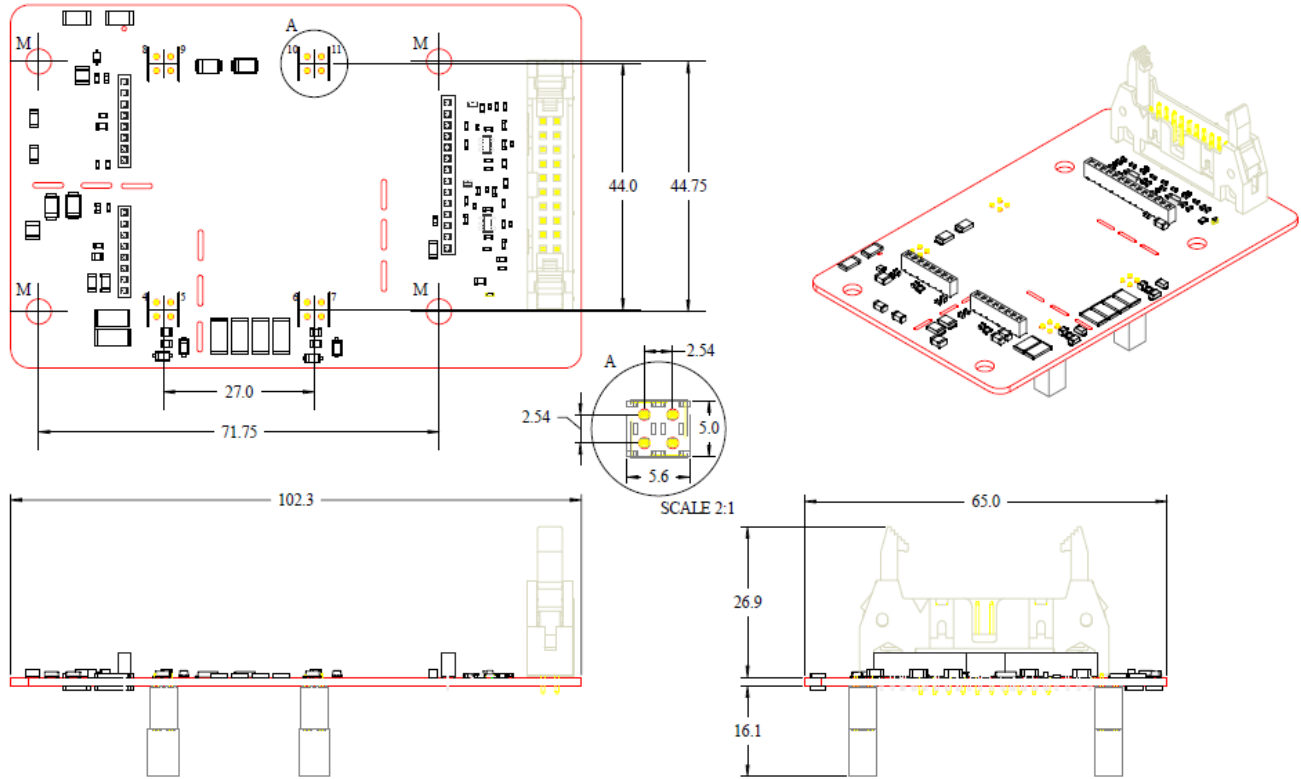


**Caution: Handling devices with high voltages involves risk to life. It is imperative to comply with all respective precautions and safety regulations.**

**When installing the core and adapter board, please make sure that power is turned off. Hot swapping may cause damage to the IC components on the board.**

**AgileSwitch assumes that the core and adapter board have been mounted on the SiC MOSFET prior to start-up testing. It is recommended that the user checks that the SiC MOSFET power modules are operating inside the Specified Operating Area (SOA) as specified by the module manufacturer including short circuit testing under very low load conditions.**

## Mechanical Dimensions



Dimensions are in mm.

## Revisions

Prepared By	Approved By	Version	Date	Description
N. Satheesh A. Fender		1	1/13/2021	Preliminary Release