EIGHT CHANNELS DIGITAL STORAGE OSCILLOSCOPE

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To my beloved parents and all my family members

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ABSTRACT

The traditional two or four channels oscilloscope is not very useful to study behavior of many modern intelligent sensors or system on chips (SOC) as many of them contains more than four signals. An eight channels digital storage oscilloscope is considered good to analyze these devices, hence, proposed in this project. This project is to demonstrate knowledge of microprocessor system design, skills in signal conditioning techniques and analogue system design involving op-amp by developing a prototype of eight channels digital storage oscilloscope.

ABSTRAK

Osiloskop tradisional yang mempunyai dua atau empat saluran tidak sangat berguna untuk mengkaji operasi banyak sensor pintar moden atau sistem pada cip (SOC) kerana kebanyakannya mengandungi lebih daripada empat isyarat. Osiloskop penyimpanan digital lapan saluran adalah baik untuk menganalisis alat-alat ini. Ini menjadi cadangan projek ini. Projek ini adalah untuk menunjukkan pengetahuan reka sistem mikropemproses, kemahiran dalam teknik penyesuaian isyarat dan reka sistem analog melibatkan Op-Amp dengan membuat prototaip osiloskop penyimpanan digital lapan saluran.

TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURES

LIST OF ABBREVIATIONS

DSO	-	Digital Storage Oscilloscope
ADC	-	Analog-to-Digital Converter
SOC	-	System On Chips
I2C	-	Inter IC
SPI	-	Serial Peripheral Interface
UART	-	Universal Asynchronous Receiver Transmitter
CAN	-	Controller Area Network
SENT	-	Single Edge Nibble Transmission
LIN	-	Local interconnect network
DAC	-	Digital-to-Analog Converter
PWM	-	Pulse Width Modulator
IC	-	Integrate Circuit
LCD	-	Liquid Crystal Display
HDMI	-	High-Definition Multimedia Interface
GPIO	-	General-purpose input/output
VGA	-	Variable Gain Amplifier
PCB	-	Printed Circuit Board

LIST OF SYMBOLS

Δ	-	Delta
Hz	-	Hertz
dB	-	Decibel
Ω	-	Ohms

LIST OF APPPENDICES

CHAPTER 1

INTRODUCTION

1.1 Introduction

Digital Storage Oscilloscope (DSO) have started appear in the early 1970s. Since then DSO developed to a point that replaced the analog oscilloscope in market [4] [5] [8]. Analog input signal converted to digital and stored in memory to be processed and display in DSO. Thus the Analog to Digital Converter (ADC) is heart of DSO. Typically DSO will have two or four analog channels.

1.2 Problem Statement

Use four analog channels DSO to study behavior of many modern intelligent sensors or System On Chips (SOC) become difficult as many of them contain more than four signals. Example, the Advanced Driver Assistance Systems (ADAS) SOC MPC5775K offers I2C, CAN, SPI, SENT, LIN, DAC, FlexRay and FlexPWM which

need more than four channels to debug [1]. Beside this, analyze seven channel audio applications, multiple power supply rails sequencing monitoring, and Mutli-sensor system also requires more than four channels [2]. Most of DSO in market offers either two or four analog channels capability. An eight channels standalone DSO is costly.

1.3 Objectives

The objective of this project is to study DSO analog block, digital block, signal processing, and display and design eight channels digital storage oscilloscope prototype.

1.4 Scope of Work

There are a few things that have to be highlighted to ensure this project is done within the scope of the objective. Scopes of work are:

i. Digital system design involves microprocessor selection from IC and processor technology and peripherals.

ii. Analogue system design involves op-amp, filter and ADC selection.

iii. Signal conditioning techniques covers attenuation, amplification and filtering.

iv. Prototype of the oscilloscope will be targeted for lower sample rate or lower frequency input signal to reduce cost of this project.

1.5 Contribution

Exploit signal conditioning and processing techniques used for eight channels DSO and develop prototype of DSO with eight channels.

1.6 Project Report Outline

This report is a document for master project in Electrical - Electronic and Telecommunication Engineering. The report is organized in the following manner.

Chapter 1 describes introduction, problem statement and objectives of the projects. The project’s scope also stated in Chapter 1.

Chapter 2 summarized the literature review of DSO, it's signal processing, analog signal conditioning and system design.

Chapter 3 explains in detail project methodology and design of the DSO.

Chapter 4 is about the results and analysis had been made.

Chapter 5 concludes the proposed design and some suggestion given for future improvement.

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