

# SAWフィルタを用いたゲート駆動回路

都市教養学部 理工学系 電気電子工学コース 准教授 五箇 繁善

## Introduction

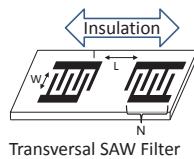
次世代電力変換回路として期待されているマルチレベルインバータを対象とした、パワーデバイス多接続時における高信頼動作を実現するための新たなゲート駆動回路を提案。本研究では表面弾性波(SAW)デバイスを用いることで、マルチレベルインバータのゲート駆動回路に必要な電氣的絶縁、多チャンネル接続が可能となる。

## Experimental Results

### SAW Filters

#### SAW filter specifications

- Band pass filter
- Piezoelectric substrate: 128° Y-X LiNbO<sub>3</sub>
- Curie point of LiNbO<sub>3</sub>: 1200 °C
- Electrode type: single
- Material of electrode: Al
- Film thickness: 1000 Å



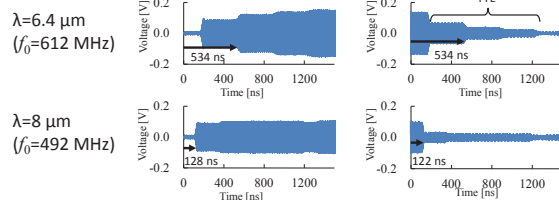
Two types of SAW filter

Wavelength $\lambda$ [ $\mu\text{m}$ ]	Center frequency $f_0$ [MHz]	Propagation length L	Number of electrode finger pairs N
6.4	612	100 $\lambda$ (640 $\mu\text{m}$ )	15
8.0	492	50 $\lambda$ (400 $\mu\text{m}$ )	10

#### Delay times

- The SAW filter delay times were measured by switching the RF signal.

\* The delay time was 63% of the output waveform variation except the delay time of DDS

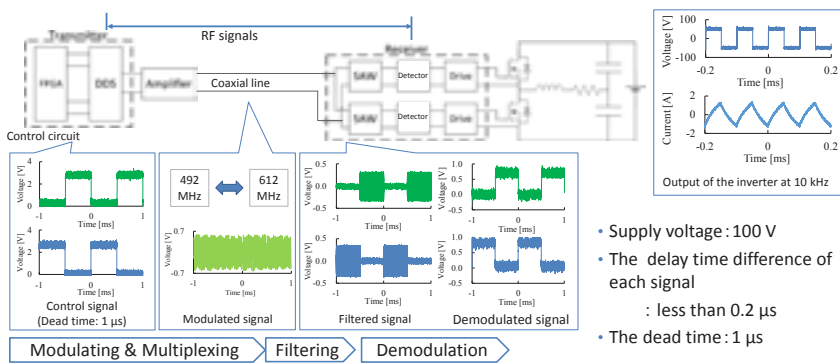


Outputs of SAW filters

- The delay time of  $\lambda=6.4 \mu\text{m}$  was larger than that of  $8.0 \mu\text{m}$  because
  - ✓ Propagation length L was 240  $\mu\text{m}$  longer.
  - ✓ TTE (Triple Transit Echo) was clearly observed.



### Circuit Structure and Output waveforms



- Supply voltage: 100 V
- The delay time difference of each signal : less than 0.2  $\mu\text{s}$
- The dead time: 1  $\mu\text{s}$

✓ The proposal system was operated without any problems.

### Total Delay Times

\* Total delay time was defined as the time until the gate driver determines whether the voltage exceeds the threshold value.

Frequency (MHz)	Delay times ( $\mu\text{s}$ )	
	Rise	Fall
612	0.53	0.82
492	0.45	1.01

We accomplished the target delay time of 1  $\mu\text{s}$ .

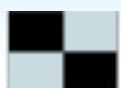
- Rise**
- The delay time was caused by the SAW filter.
  - To reduce the delay time, the propagation length L have to be shorten.
- Fall**
- The delay time was caused by the gate driver.
  - To reduce the delay time, the threshold value have to be adjusted.

## ここがポイント！

- ✓ 次世代電力変換回路に適している
- ✓ 電氣的絶縁回路が不要
- ✓ 高温動作が可能
- ✓ 配線数の大幅低減

## 想定される用途

- 次世代電力変換回路
- モーター近傍などの高温動作用途



お問い合わせ先  
**首都大学東京 総合研究推進機構 URA室**  
 TEL : 042-677-2759 mail: soudanmi@mj.tmu.ac.jp

