



*Evaluation of SiC-based MOSFET
in Electronic Power Technology*

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The background is a solid dark blue color. In the four corners, there are decorative white line-art elements resembling circuit traces or neural network connections. These lines are thin and connect to small white circles, creating a grid-like pattern that is more organic and less rigid than a standard circuit board.

CATALOGUE

I. Research background

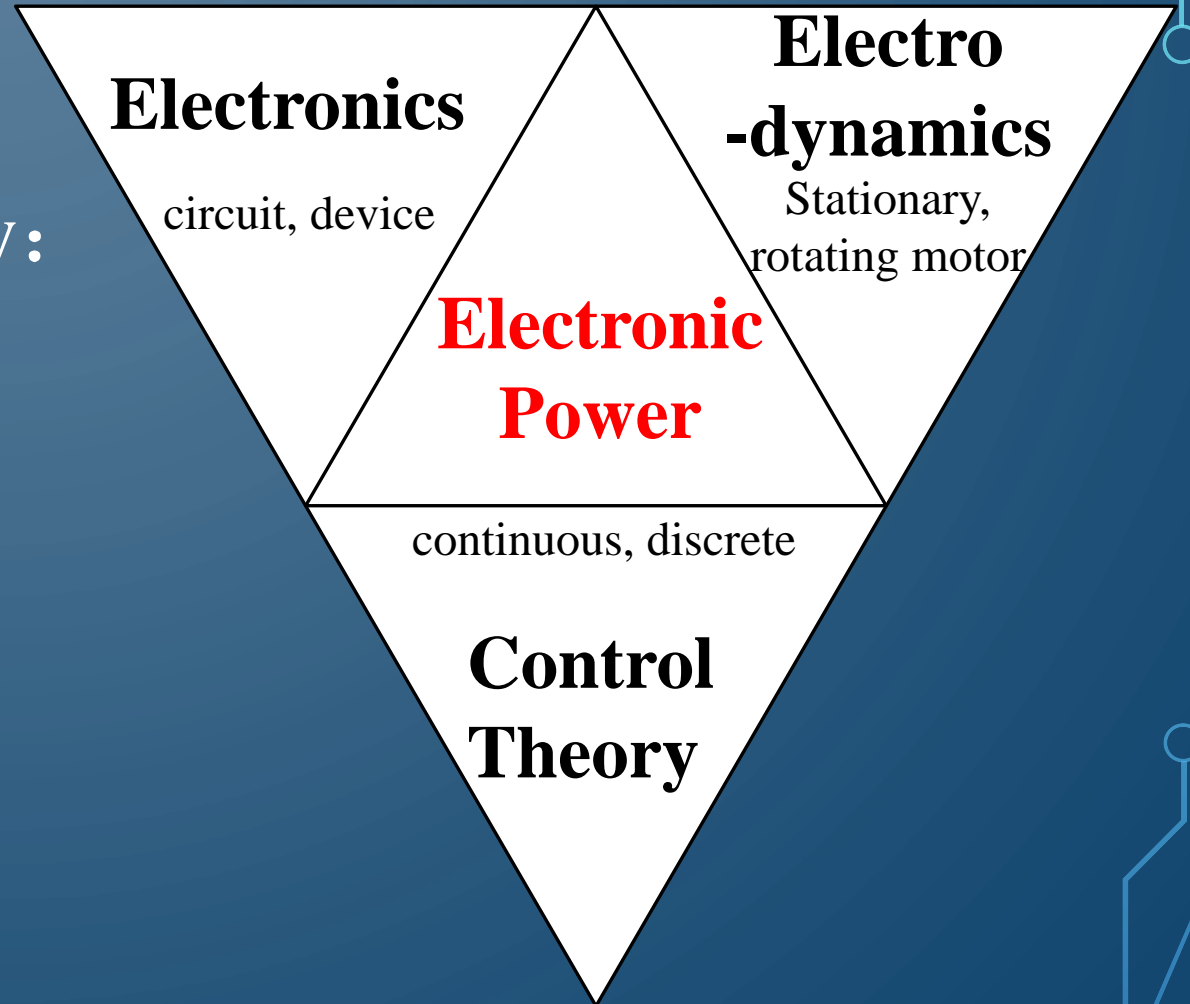
II. Theoretical analysis

III. Experimental research

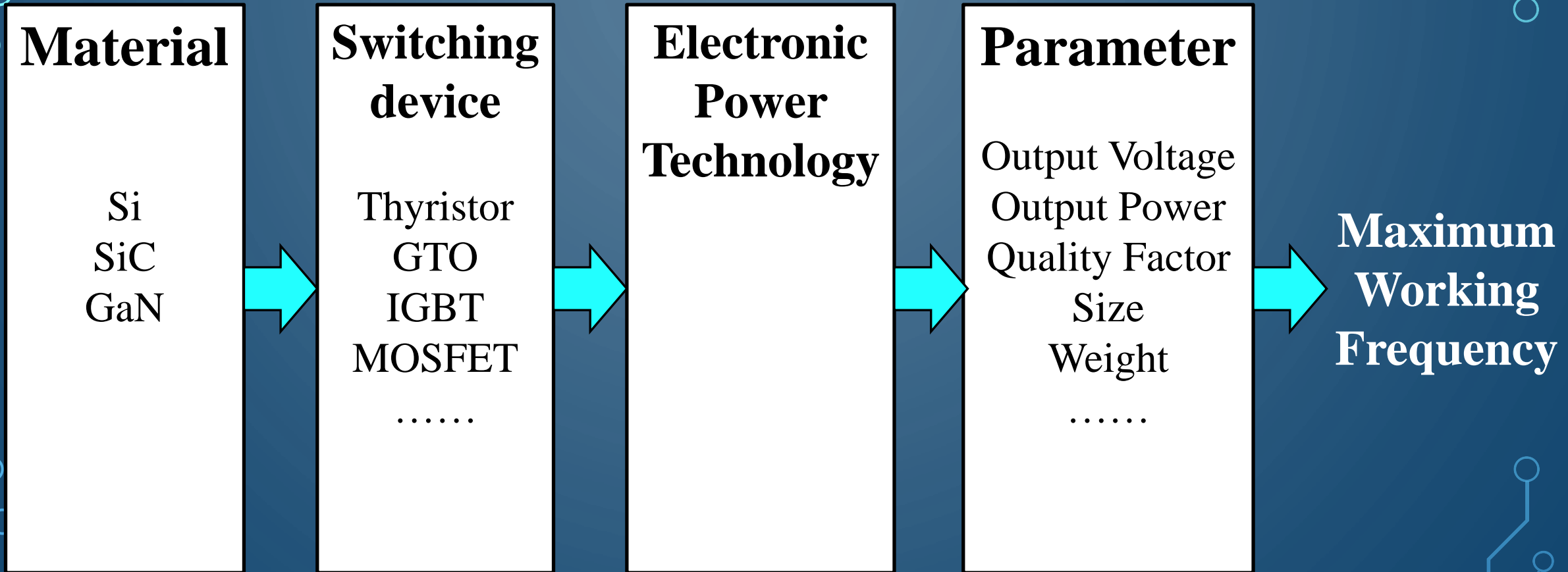
I. RESEARCH BACKGROUND

Electronic Power Technology:

uses power electronic devices to transform and control electric energy



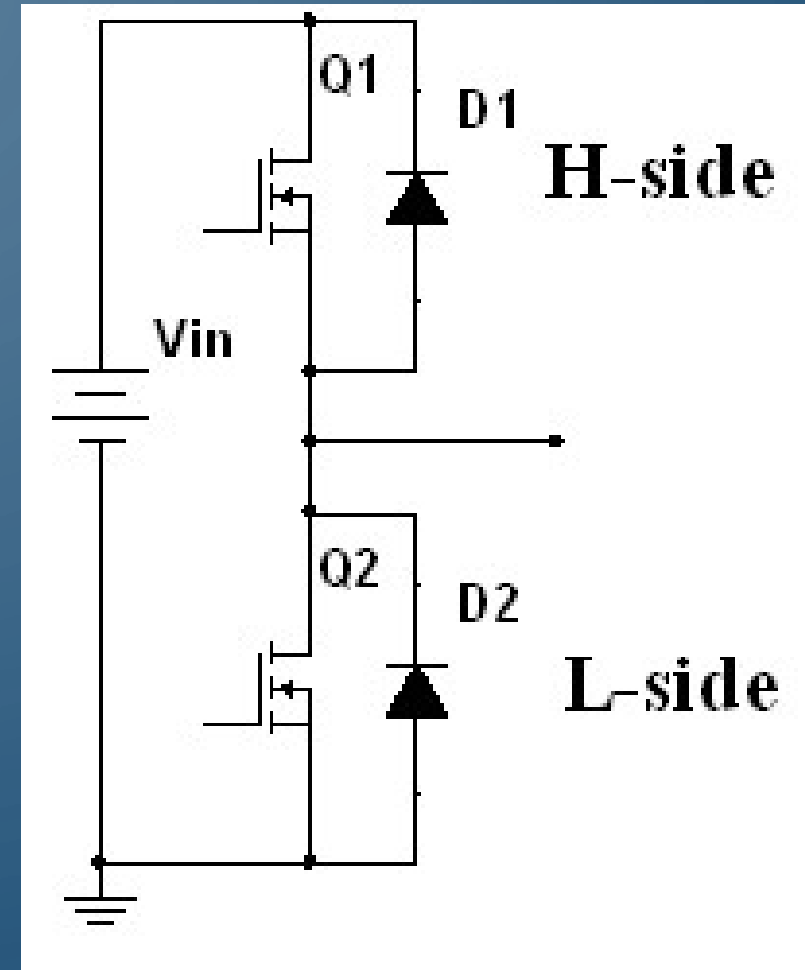
I. RESEARCH BACKGROUND



II. THEORETICAL ANALYSIS

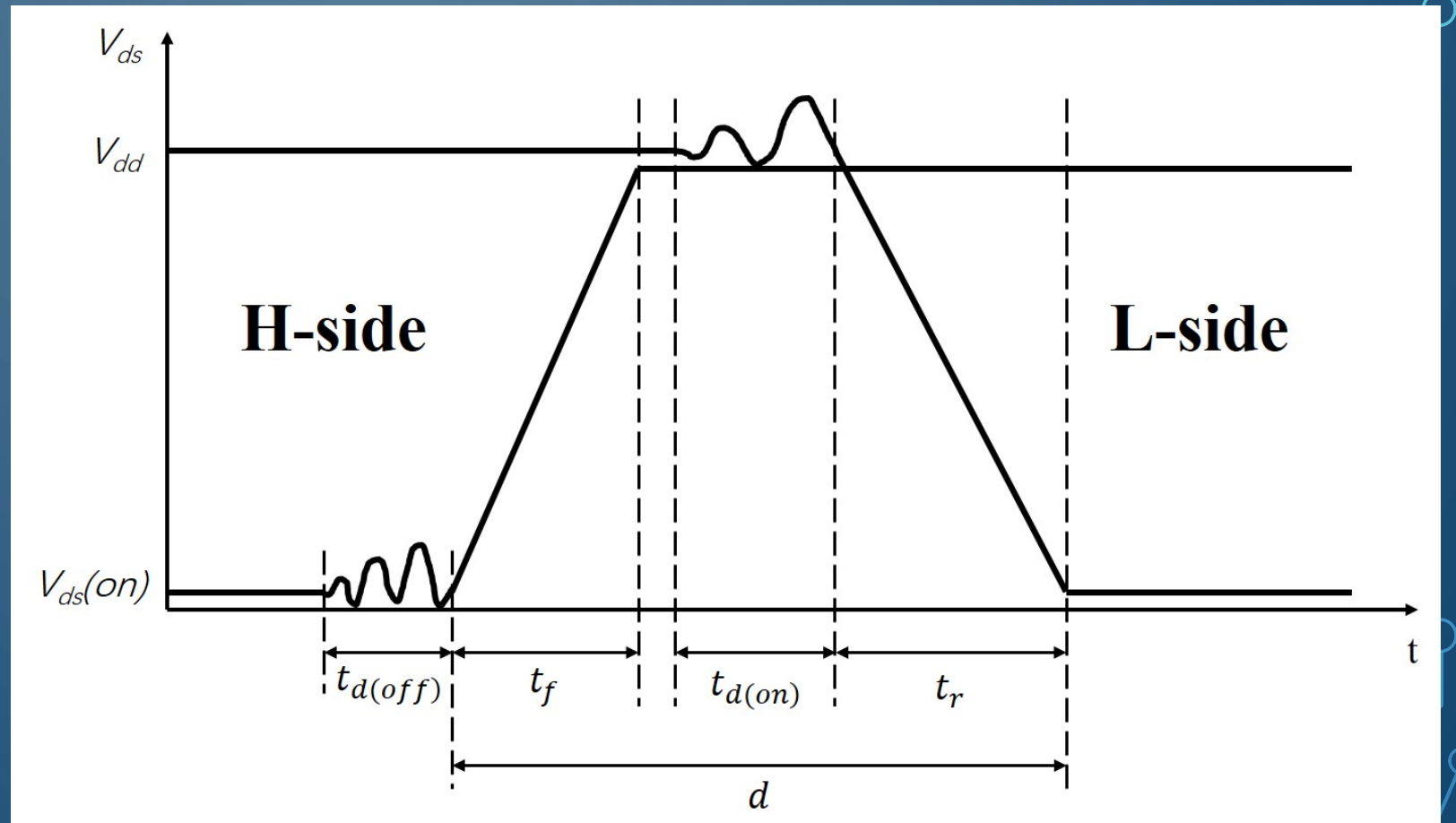
Dead Time:

The limit of maximum operating frequency.



II. THEORETICAL ANALYSIS

<i>Symbol</i>	<i>Parameter</i>
$t_{d(on)}$	Turn-On Delay Time
t_r	Turn-On Rise Time
$t_{d(off)}$	Turn-Off Delay Time
t_f	Turn-Off Fall Time
d	Dead Time



II. THEORETICAL ANALYSIS

$$q_d = \frac{d}{T} |_{\max}$$

$$f_{\max} = q_d / d$$

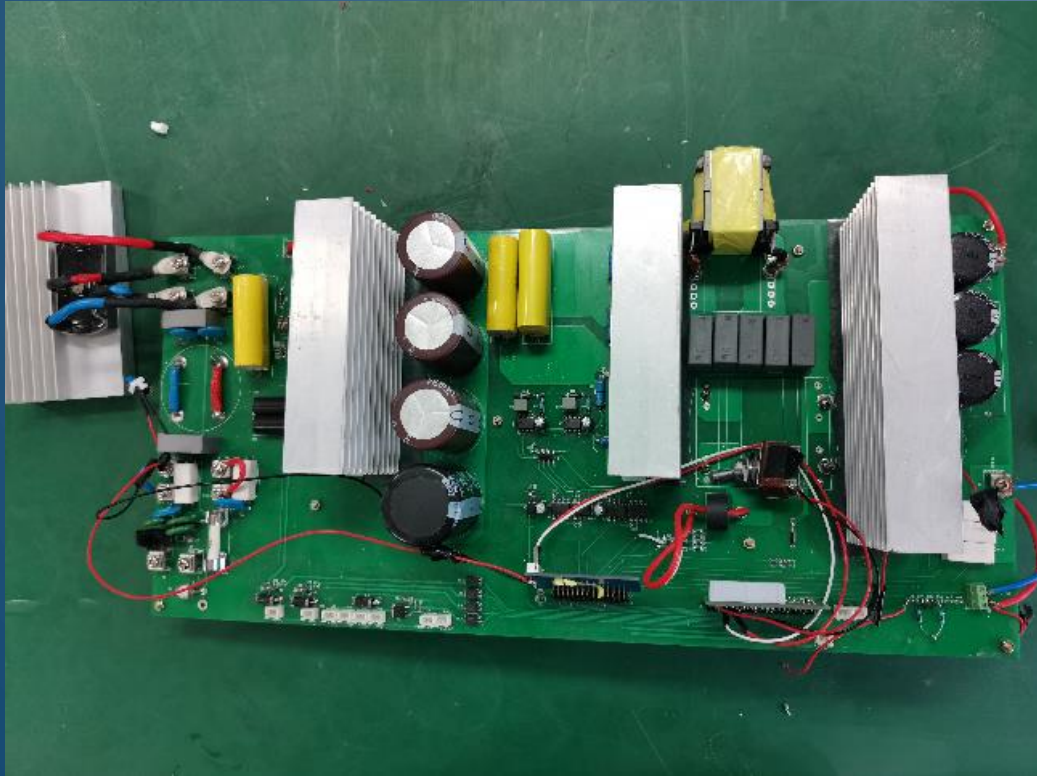
$$d_{\min} = t_r + t_f$$

$$\frac{f_{\max}(SiC)}{f_{\max}(Si)} = \frac{q_d/d(SiC)}{q_d/d(Si)} = \frac{t_r(Si) + t_f(Si)}{t_r(SiC) + t_f(SiC)}$$

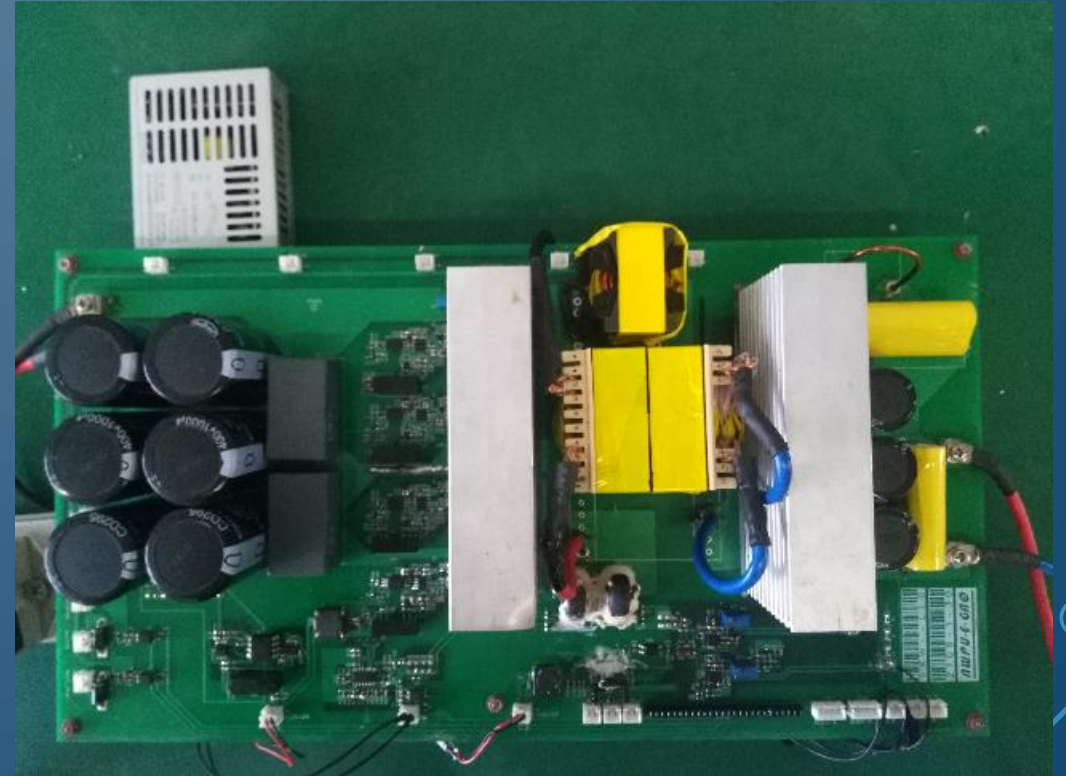
$$f_{\max} = \frac{q_d}{t_r + t_f}$$

III. EXPERIMENTAL RESEARCH

Full bridge LLC resonant converter



Si-based MOSFET



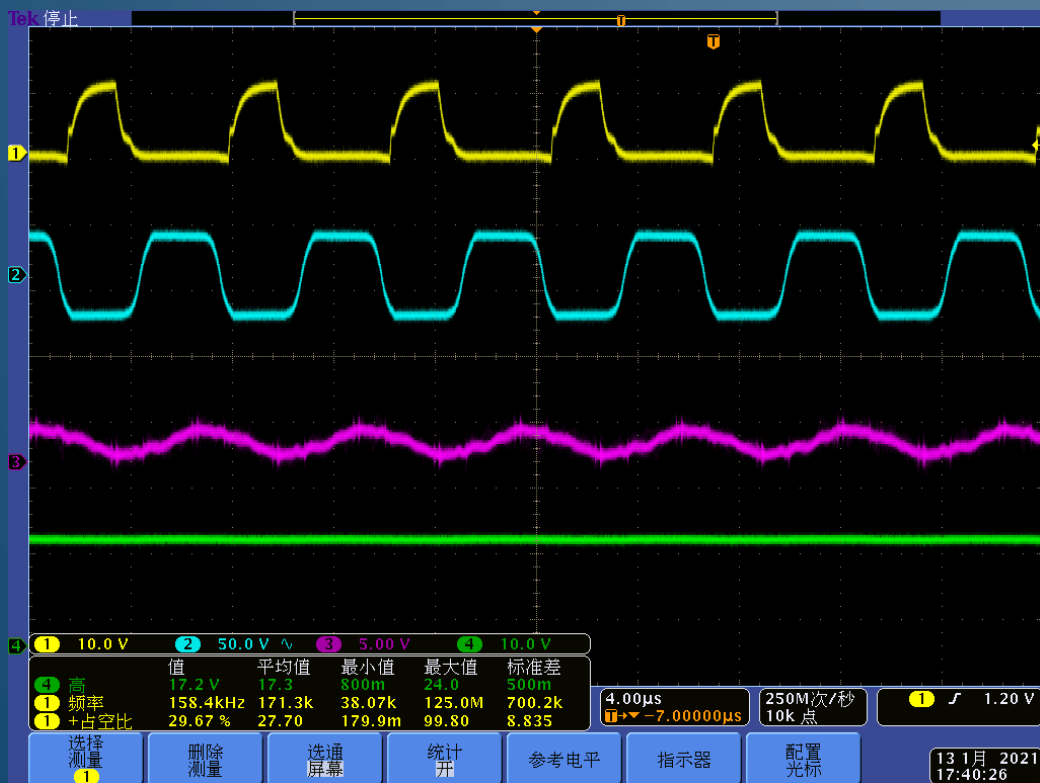
SiC-based MOSFET

III. EXPERIMENTAL RESEARCH

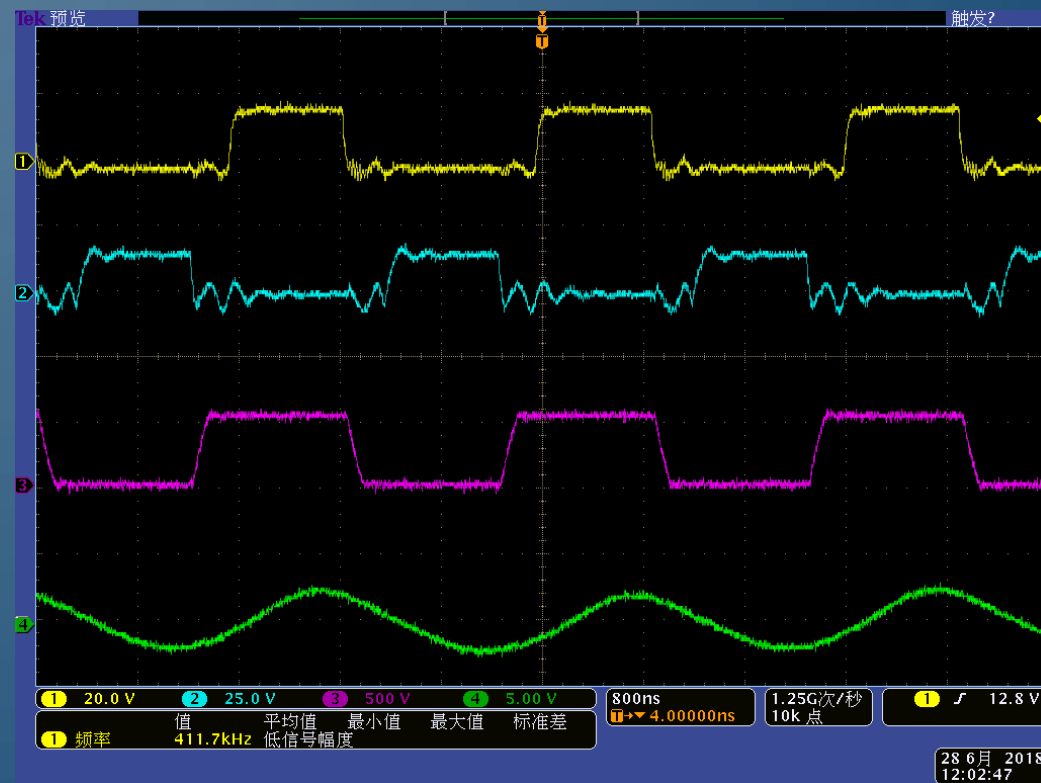
<i>Symbol</i>	<i>Parameter</i>	<i>Unit</i>	<i>FCH47N60</i> <i>(Si)</i>	<i>C3M0065100K</i> <i>(SiC)</i>
$t_{d(on)}$	Turn-On Delay Time	ns	185	20
t_r	Turn-On Rise Time		210	10
$t_{d(off)}$	Turn-Off Delay Time		520	19
t_f	Turn-Off Fall Time		75	8
d	Dead Time		470	38

III. EXPERIMENTAL RESEARCH

Converter working waveform



Si-based MOSFET



SiC-based MOSFET

III. EXPERIMENTAL RESEARCH

$$f_{\max} = \frac{q_d}{t_r + t_f}$$

Calculated value: $\frac{f_{\max}(SiC)}{f_{\max}(Si)} = \frac{t_r(Si) + t_f(Si)}{t_r(SiC) + t_f(SiC)} = \frac{850ns}{274ns} = 310\%$

Actual value: $\frac{f_{\max}(SiC)}{f_{\max}(Si)} = \frac{412kHz}{141kHz} = 292\%$

$$\delta = \frac{310\% - 292\%}{292\%} = 6.16\%$$

The background is a solid dark blue color. In the four corners, there are decorative white line-art patterns resembling circuit board traces or neural network connections. These patterns consist of straight lines of varying lengths that meet at right angles, with small white circles at the end of the lines, suggesting nodes or connection points.

Thanks~