

[Outline]

When the motor drives with the stepping motor driver (product of Texas Instruments), it sometimes vibrates.

[Details of the motor driver]

Manufacturer : Texas Instruments
Type : DRV8825

[Driving conditions of the stepping motor driver]

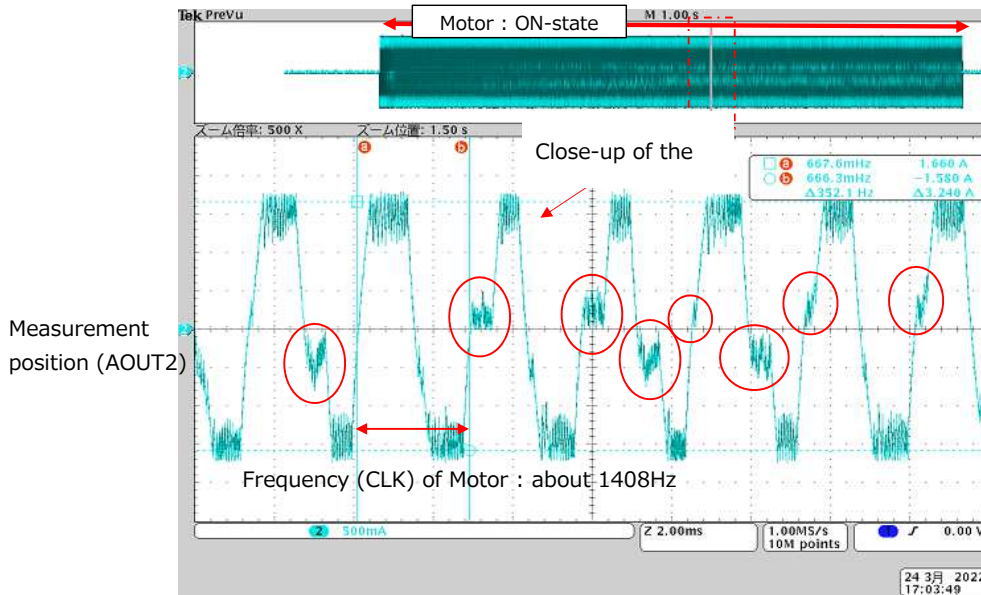
Driving Voltage : 24V
Frequency (CLK) : About 1400Hz
Set Current Value : 1.8A
Excitation (MODE) : 2 phase excitation (Full-step)
Attenuation Mode (DECAY) : High speed mode

[Details of the stepping motor driver]

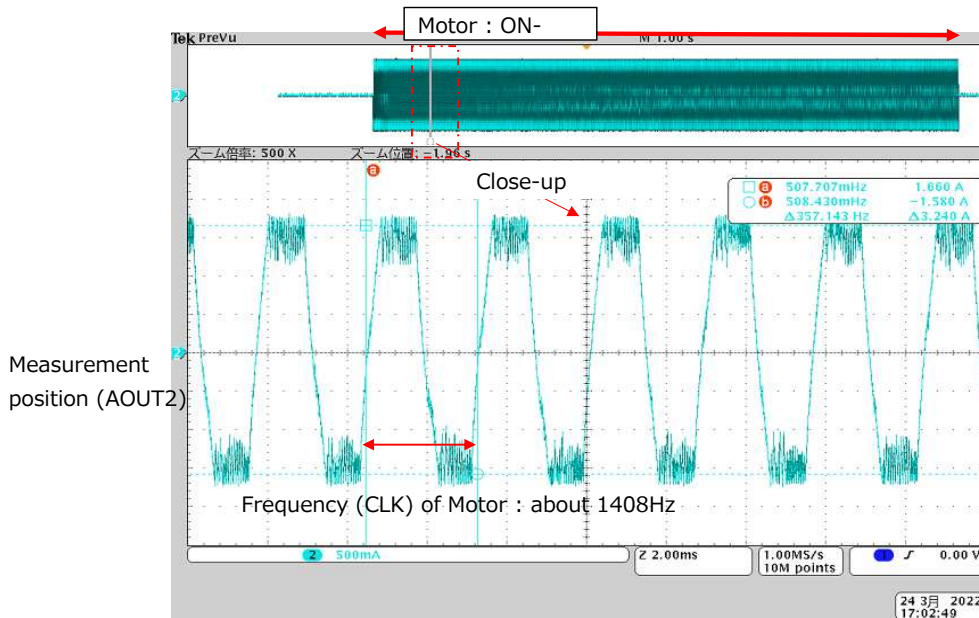
Manufacturer : MinebeaMitsumi
Type : 23KM-H251CNVA2439
Rated Voltage : 2.0V
Rated Current : 2.5A
Maximum Input : 10.0W
Maximum Static Torque : 66mNm
Detent Torque : 26mNm
Pull-out Torqye : 270mNm
Pull-in Torque : 26mNm
Present Activation Frequency (Max.) : 12000Hz
Driving Condition : DC24V
Winding Resistor : $0.8\Omega \pm 0.12\Omega$
Inductance : 2.0mH

[Current Waveform for when passing a current through a winding wire (In case of vibrating the stepping motor.)]

When the winding resistor (AOUT2) of the stepping motor is measured with an ammeter, the vibration is generated and the waveform becomes deformed.



The motor vibrates at the positions circled in red.
The vibration is generated in a certain period of time after the motor is turned on.



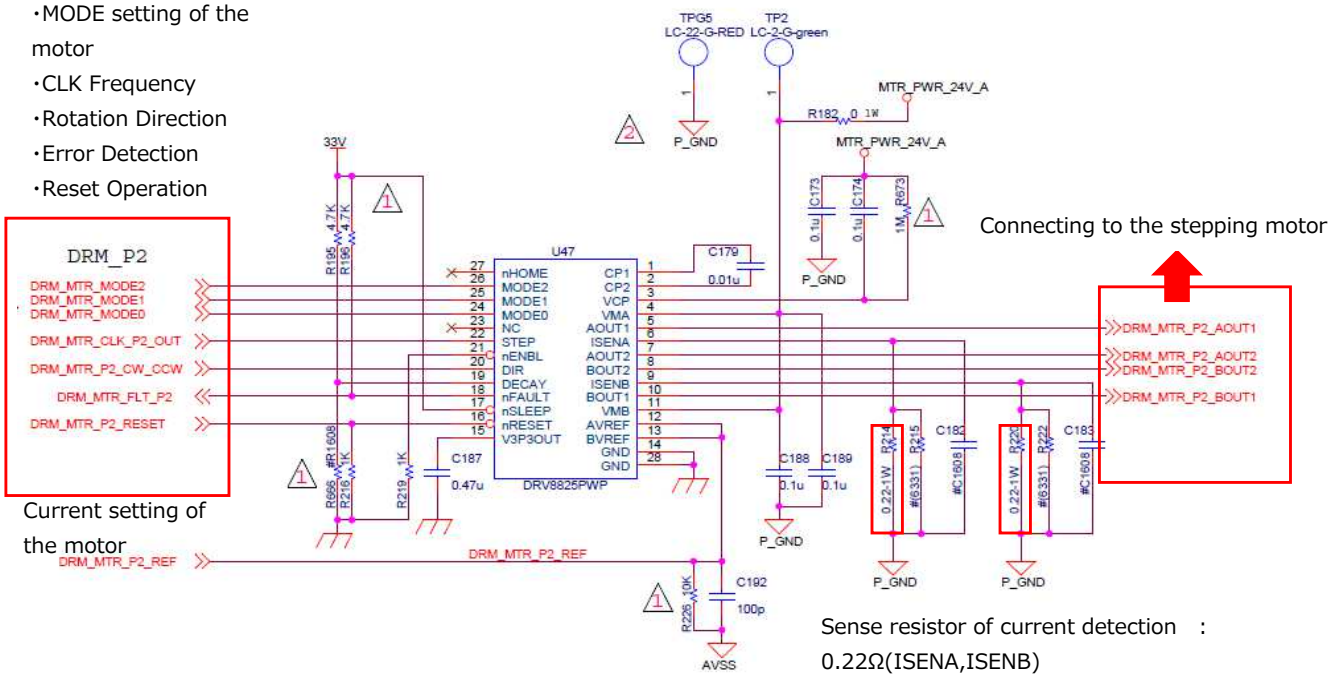
There is no vibration for a while after the motor is turned on.

The above 2 waveforms show that the vibration is generated gradually after the motor starts to drive. As another case, the motor vibrates for a while after it starts to drive and the vibration is gradually disappeared.

Not all motor drivers in the same production lot have the vibration issue. (Some of them have the vibration issue, and some of them have no vibration issue.)

[Our circuit diagram (around the motor driver)]

- MODE setting of the motor
- CLK Frequency
- Rotation Direction
- Error Detection
- Reset Operation

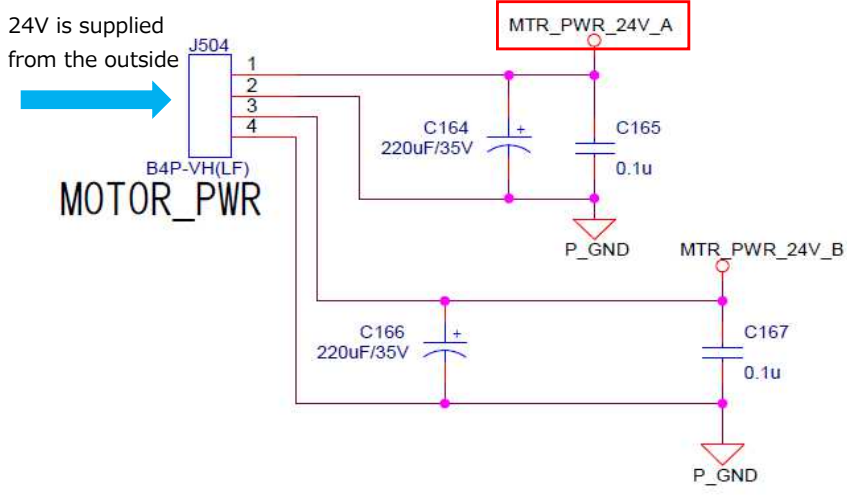


Current setting of the motor
DRM_MTR_P2_REF

Sense resistor of current detection :
0.22Ω (ISENA, ISENB)

[Our circuit diagram (around the motor driver)]

Connecting to the power supply pin



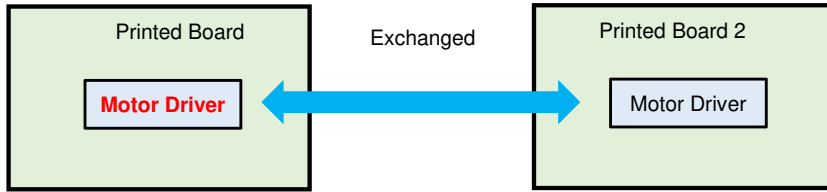
We tested it and confirmed the followings.

[Test Method]

We prepared 2 Printed Boards and 2 Motor Drivers (one of them had vibration issue and the other had no issue), and then checked whether or not the issue was shifted by exchanging these motor drivers.

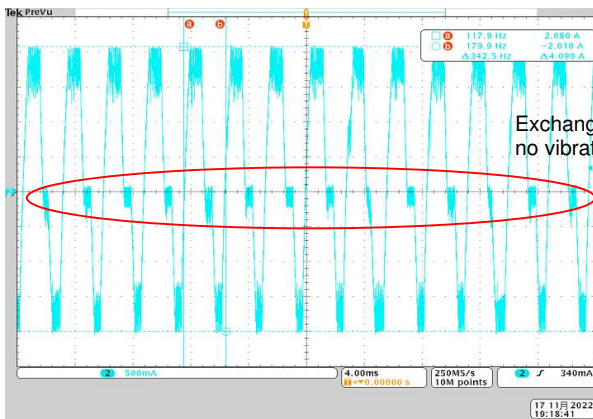
Printed Board 1 with the Motor Driver having the vibration issue.

Printed Board 2 with the Motor Driver having no vibration issue. .



Printed Board 1 with the Motor Driver having the vibration issue.

Printed Board 1 with the Motor Driver having no vibration issue.



vibrating

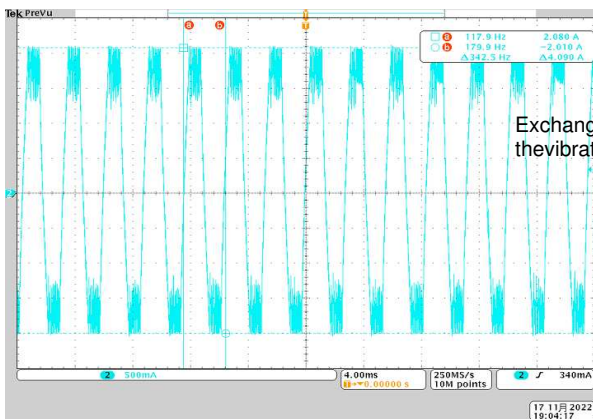
Exchanged with the motor driver having no vibration issue.



No vibration after exchanging with the motor driver having no vibration issue.

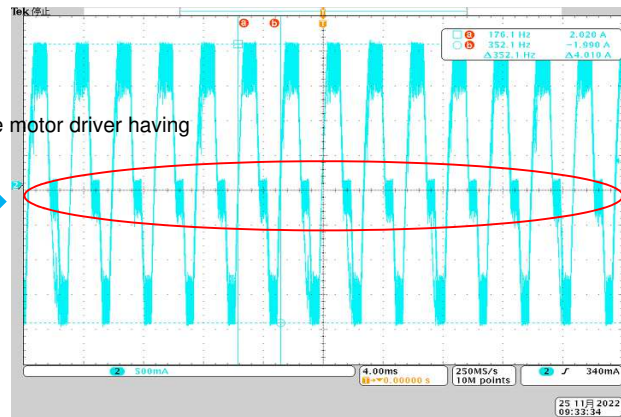
Printed Board 2 with the Motor Driver having no vibration issue.

Printed Board 2 with the Motor Driver having the vibration issue.



No vibration

Exchanged with the motor driver having the vibration issue.



Vibration was generated after exchanging with the motor driver having the vibration issue.

[Result]

Printed Board 1 : As there was no vibration issue after exchanging with the motor driver having no vibration issue, the issue seems to be on the motor driver.
Printed Board 2 : As the vibration was generated after exchanging with the motor driver having the vibration issue, the issue seems to be on the motor driver.

[Our Request]

- We would like you to tell us why the stepping motor vibrates and its solution.
- We can provide the IC having the issue for investigation. Is it possible for you to check it?

=END=

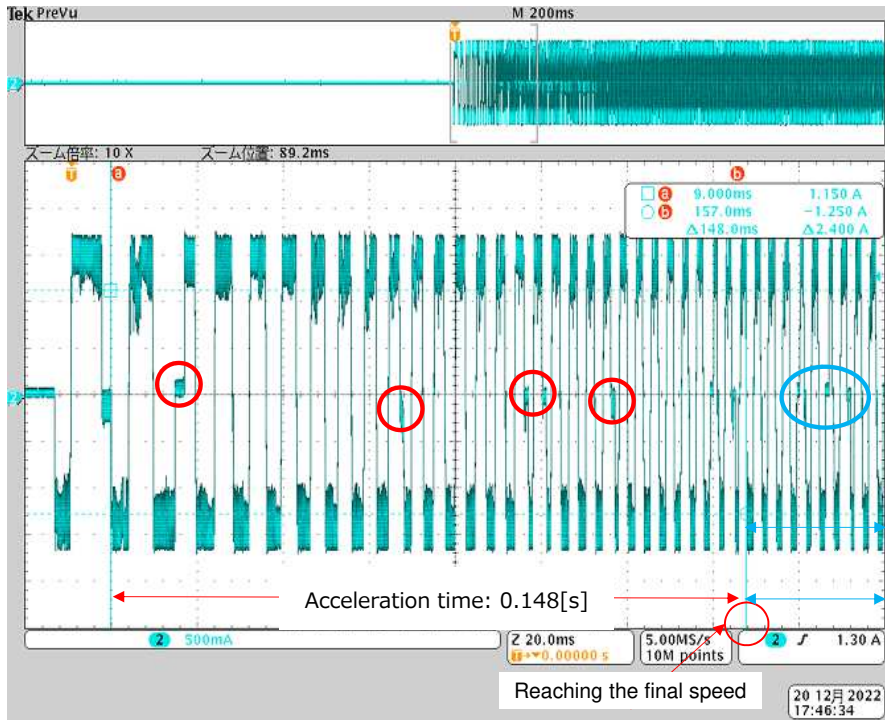
We would respond to the questions from Mr. Ryan Kehr.

[Question1]

When driving, is there an acceleration period before motor reaches the final speed?
Does vibration occur during this period or once motor reaches final speed?

[Answer]

The acceleration time is 0.148[s], and the motor vibrates before and after reaching the final speed.



- ↔ The acceleration time is 0.148 [s], but the vibration already generates before reaching the final speed (part in a red circle).
- ↔ The vibration generates after reaching the final speed. (part in a blue circle)

[Caution]

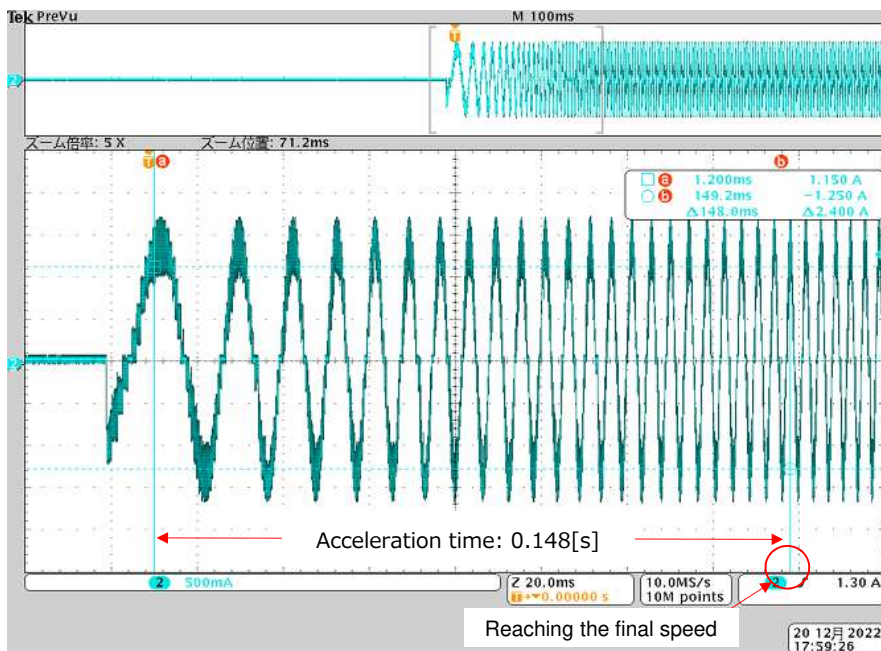
Frequency (CLK) of Motor : The frequency shown in the above is about 1184Hz.
It slightly differs from the one described in page 1 (about 1400Hz), but the vibration generates.

[Question2]

Have they tried using micro-stepping modes to see if that improves the vibration?

[Answer]

We checked it with 8 microsteps/step and confirmed that it was improved.
However, since 8 microsteps do not have enough torque, 8 microsteps cannot be used.



[Question3]

I saw they swapped PCB/components. Did they also try with different motors to see if vibration follows motor...possibly?

[Answer]

The vibration generates even if the motor is changed.

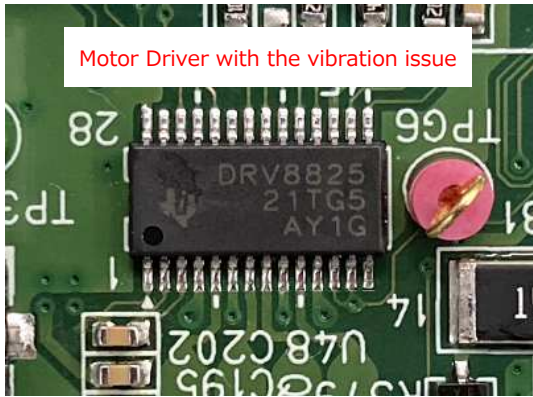
[Question4]

Can the customer please share the date code of the units with vibration vs. the units with no vibration issue?

A picture of the top of the package is what I need.

[Answer]

It is as follows.



DRV8825 21TG5 AY1G is written on the surface of the package.



DRV8825 98TG5 CCGF is written on the surface of the package.

=END=