

4ch Laser Diode Driver for Blue Laser Diode

■GENERAL DESCRIPTION

NJW4710 is a laser diode driver for the operation of a grounded blue laser diode. It is suited to drive a blue laser diode, because it is operated by split power supply. It includes 4 channels current amplifiers for 4 different optical power levels. An on-chip RF oscillator is provided to reduce laser mode noise during read mode. Oscillation frequency and oscillation amplitude are defined by two external resistors

■PACKAGE OUTLINE

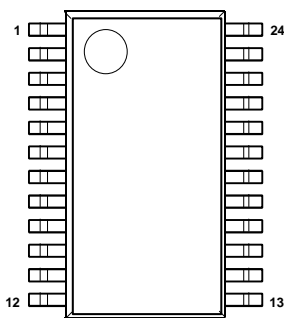


NJW4710VE1

■FEATURE

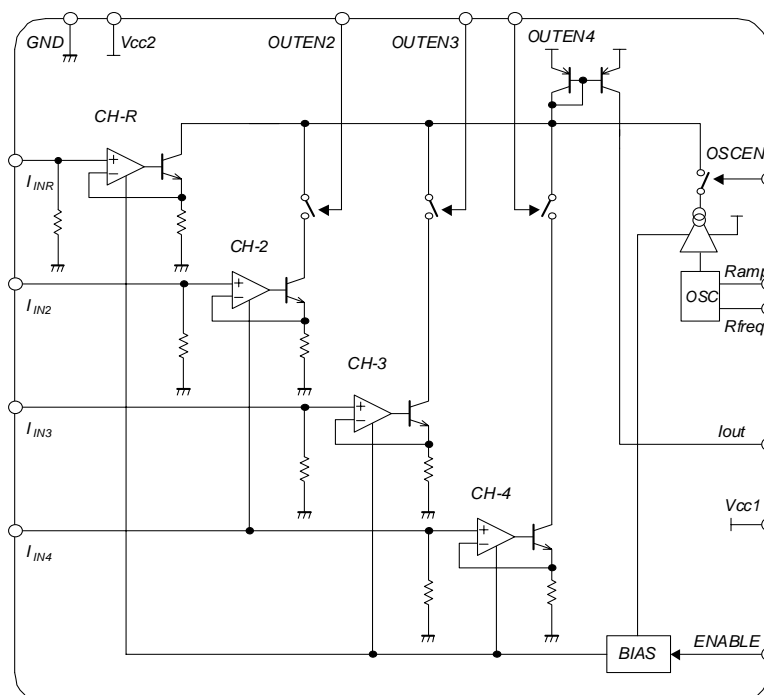
- Operating Voltage $V_{cc1}=4.5V$ to $5.5V$, $V_{cc2}=8.0$ to $10.0V$
- Internal Oscillator Circuit 200MHz to 500MHz
- Rise Time / Fall Time 0.8ns typ.
- Maximum Output Current 250mA typ.
- Bi-CMOS Technology
- Package Outline SSOP24-E1

■PIN CONFIGURATION



1:GND	13:GND
2:linR	14:Vcc2
3:GND	15:Vcc2
4:lin2	16:OSCEN
5:Rfreq	17:ENABLE
6:lin3	18:Ramp
7:lin4	19:GND
8:Vcc1	20:Iout
9:OUTEN2	21:Iout
10:OUTEN3	22:Vcc2
11:OUTEN4	23:Vcc2
12:GND	24:GND

■BLOCK DIAGRAM



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■ ABSOLUTE MAXIMUM RATINGS(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage 1	Vcc1	6.0	V
Supply Voltage 2	Vcc2	11.0	V
Input Voltage	Vin	6.0	V
Power Dissipation	P _D	700	mW
Operating Temperature Range	Topr	-40 to +85	°C
Storage Temperature Range	Tstg	-40 to +150	°C

■ RECOMMENDED OPERATING CONDITION(Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Voltage1	Vopr1		4.5	5.0	5.5	V
Operating Voltage2	Vopr2		8.0	9.0	10.0	V

■ ELECTRICAL CHARACTERISTICS

● DC CHARACTERISTICS(Vcc1=5V,Vcc2=9V,ENABLE=H,OUTEN=H,OSCEN=L H:5V,L:GND, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current 1	I _{cc1}	ENABLE≤0.5V	-	0	10	mA
Supply Current 2	I _{cc2}	IINR/2/3/4=0uA,Rfreq=OPEN,Ramp=OPEN	-	19	24	mA
Supply Current 3	I _{cc3}	OSCEN=H, Rfreq=3.6kΩ,Ramp=5kΩ	-	33	40	mA
Supply Current 4	I _{cc4}	OUTEN=H, IIN/2/3/4=500uA	-	62	76	mA
Supply Current 5	I _{cc5}	OUTEN=H, IINR/2/3/4=500uA	-	120	140	mA
High Level Input Voltage	VIH	OUTEN, OSCEN	2	-	-	V
Low Level Input Voltage	VIL	OUTEN, OSCEN	-	-	1.3	V
ENABLE High Level Input Voltage	EVIH	ENABLE	3	-	-	V
ENABLE Low Level Input Voltage	EVIL	ENABLE	-	-	1.5	V
OUTEN High Level Input Current	DIIH	OUTEN=5V	0	-	10	uA
OUTEN Low Level Input Current	DIIL	OUTEN=0V	-300	-	0	uA
ENABLE High Level Input Current	EIIH	ENABLE=5V	0	-	500	uA
ENABLE Low Level Input Current	EIIL	ENABLE=0V	-10	-	0	uA
OSCEN High Level Input Current	OIIH	OSCEN=5V	0	-	450	uA
OSCEN Low Level Input Current	OIIL	OSCEN=0V	-10	-	0	uA
V*1 Shut-Down Voltage	Vshut		3.40	-	3.75	V

● **Laser Amplifier DC CHARACTERISTICS**(Vcc1=5V, Vcc2=9V ENABLE=H,H:5V,L:GND,Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Current Gain	Gi	CHR/2/3/4, Vo=5V *1	80	110	140	MA /mA
Output Offset Current	Ios	CHR/2/3/4, Vo=5V *1	-5	-	+5	MA
Output Current Linearity	Iiin	CHR/2/3/4, Vo=5V *1	-3	-	+3	%
Input Current Range 1	Iin1	CHR	0	-	2	MA
Input Current Range 2	Iin2	CH2/3/4	0	-	3.5	MA
Maximum Output Current 1	Iomax1	CHR	50	100	-	MA
Maximum Output Current 2	Iomax2	CH2/3/4	100	200	-	MA
Iout Series Resintance	Ro	Iout=200mA	-	10	-	Ω
Input Resistance 1	Rin1	CHR	1.62	2.5	3.38	kΩ
Input Resistance 2	Rin2	CH2/3/4	325	500	675	Ω
Output OFF Current 1	Ioff1	ENABLE=L	-	-	5	MA
Output OFF Current 2	Ioff2	OUTEN=H, Total for All Channels	-	-	5	MA
Output OFF Current 3	Ioff2	OUTEN=L, IIN=0uA, Total for All Channels	-	-	5	MA
Output Current Supply Sensitivity 1	Vc1	V+1=5V±0.5V, V+2=9V±0.5V,Iout=40mA	-1	2	4	%/V
Output Current Supply Sensitivity 2	Vc2	V+1=5V±0.5V, V+2=9V±0.5V,Iout=80mA	-1	2	4	%/V
Output Current Temperature Sensitivity 1	TC1	Iout=40mA,CHR only	-	400	-	ppm/°C
Output Current Temperature Sensitivity 2	TC2	Iout=80mA,40mARead+40mA,Write	-	400	-	ppm/°C

*1 The amplifier linearity is calculated using best fit method at three points. The output currents chosen 20 mA, 40mA,and, 60mA.The transfer function for Iout is defined as follows: $I_{out} = (I_{IN} + GAIN) + IOS$

● **Laser Amplifier AC CHARACTERISTICS** (Vcc1=5V, Vcc2=9V,Iout=40mA DC with 40mA PULSE, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Rise Time	Tr	Iout= 40mA(Read)+40mA(10-90%)	-	0.8	-	ns
Fall Time	Tf	Iout= 40mA(Read)+40mA(10-90%)	-	0.8	-	ns
Over Shoot	OS		-	5	-	%
Iout ON Time	Ton	OUTEN 50% H→L to Iout 50%	-	1	-	ns
Iout OFF Time	Toff	OUTEN 50% H→L to Iout 50%	-	1	-	ns
Disable Time	Tdis	ENABLE 50%H→L to Iout 50%	-	20	-	ns
Enable Time	Ten	ENABLE 50%L→H to Iout 50%,	-	150	-	ns
HFM Disable Time	Tdiso	OSCEN H→L to Iout 50%	-	10	-	ns
HFM Enable Time	Teno	OSCEN L→H to Iout 50%,	-	10	-	ns
Oscillator Frequency	fOSC	Rfreq=3.6kΩ	280	350	420	MHz
Oscillator Temperature Coefficient	TcOSC	Rfreq=3.6kΩ	-	-300	-	ppm/°C
Output Current Noise	Ino	Iout=40mA,CHR only	-	0.9	-	nA/√Hz

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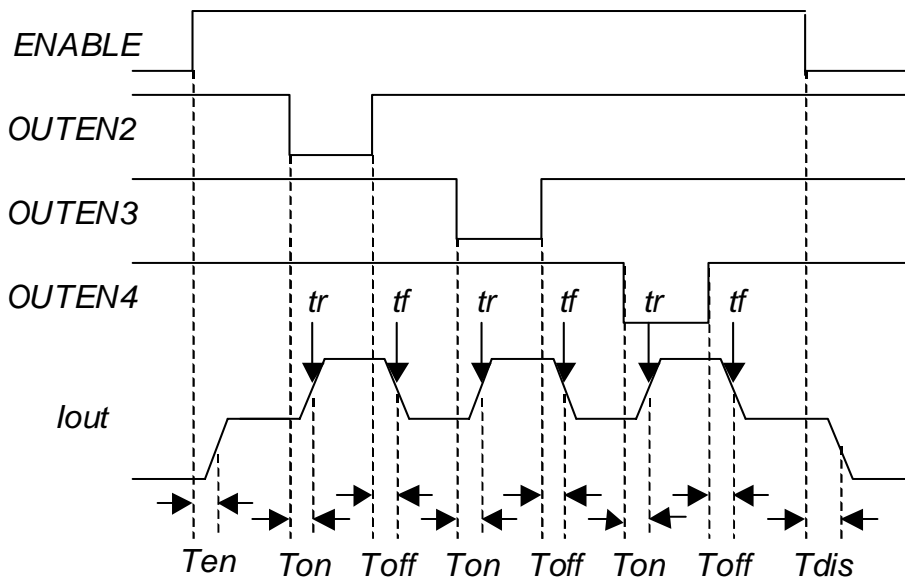
■ Iout Control

ENABLE	OUTEN2	OUTEN3	OUTEN4	Iout
L/OPEN	X	X	X	OFF
H	H/OPEN	H/OPEN	H/OPEN	$I_{OUT} = I_{INR} * 120$
H	L	H/OPEN	H/OPEN	$I_{OUT} = (I_{INR} + I_{IN2}) * 120$
H	L	L	H/OPEN	$I_{OUT} = (I_{INR} + I_{IN2} + I_{IN3}) * 120$
H	L	L	L	$I_{OUT} = (I_{INR} + I_{IN2} + I_{IN3} + I_{IN4}) * 120$

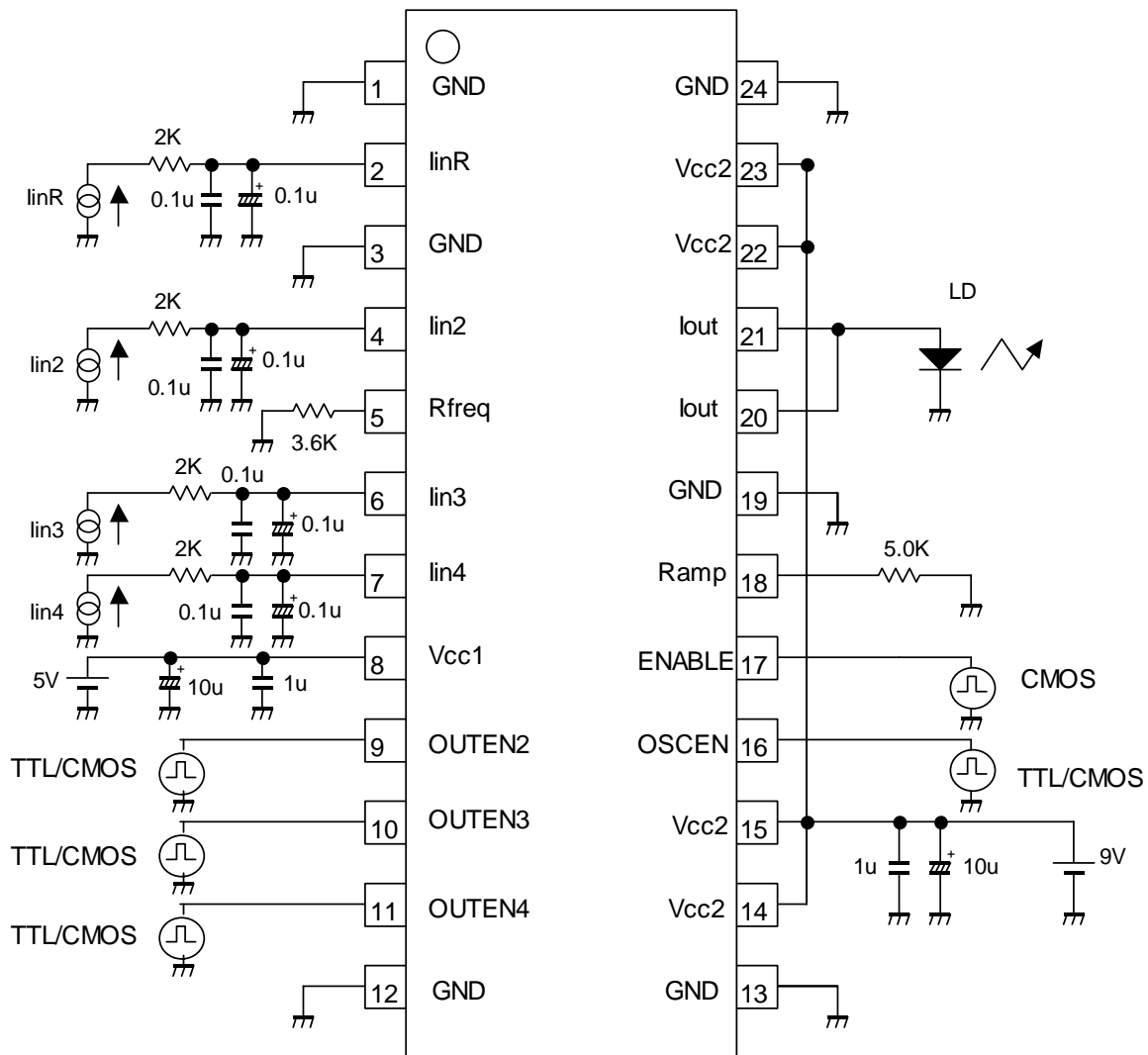
■ Oscillator Control

ENABLE	OSCN	OUTEN2	OUTEN3	OUTEN4	OSCILLATOR
L/OPEN	X	X	X	X	OFF
H	L/OPEN	X	X	X	OFF
H	H	X	X	X	ON

■ Timing Diagram



TEST CIRCUIT



■ TERMINAL EXPLANATION

Pin No.	Pin Name	Function
1 3 12 13 19 24	GND	GND
2	linR	Input of constant current output circuit for Read Channel. Output current value is set up by input current or input voltage.
4	lin2	Input of constant current output circuit for Erase, Write Channel. Output current value is setup by input current or input voltage.
5	Rfreq	Set up for oscillator frequency. Resistance is connected to GND and a setup in optional frequency.
6	lin3	Input of constant current output circuit for Erase, Write Channel. Output current value is setup by input current or input voltage.
7	lin4	Input of constant current output circuit for Erase, Write Channel. Output current value is setup by input current or input voltage.
8	Vcc1	Supply voltage for amplifier circuit: Vcc1=5V
9	OUTEN2	Output current control for channel 2 High(<2V) or OPEN: Non-Output Low(>1.3V): Output
10	OUTEN3	Output current control for channel 3 High(<2V) or OPEN: Non-Output Low(>1.3V): Output
11	OUTEN4	Output current control for channel 4 High(<2V) or OPEN: Non-Output Low(>1.3V): Output
14 15 22 23	Vcc2	Supply voltage for output circuit: Vcc2=9V
16	OSCEN	Output control for oscillator. High(<2V): Oscillation superposition Low(>1.3V) or OPEN: Non-Output
17	ENABLE	Control for IC. High(<3V): Output Low(>1.5V) or OPEN: Non-Output
18	Ranp	Setup for oscillation superposition. Resistance is connected to GND and a setup in optional oscillation superposition.
20 21	Iout	Output current terminal. Please connect cathode common type laser or floating type laser to GND.

*Please set up Low voltage not less than GND-0.3V, and High voltage of each control terminal (ENABLE, OUTEN 2, 3, and 4, OSCEN) does not exceed Vcc1+0.3V.

■ APPLICATION

● Set up for operating voltage

Recommended operating voltage of NJW4710 is $V_{cc}=5V, V_{cc}=9V$.

$V_{cc2}=9V$ is set up in consideration of the forward voltage [VF] (6V max.) of a Blue Laser Diode.

Therefore, in the case of a Red Laser Diode or Blue Laser Diode with low forward voltage, please set up the power supply voltage of V_{cc2} above the following.

Operating voltage of V_{cc2} = forward voltage(MAX) of laser diode + 3V

● Set up for output current

Current gains of each channels of all are 120mA/mA typ.

Set up of the output current value in current input and voltage input is below.

In the case of current input

Please input current to IC. Output current is the following.

$$I_{out}=120 \cdot I_{in} \text{ [mA]}$$

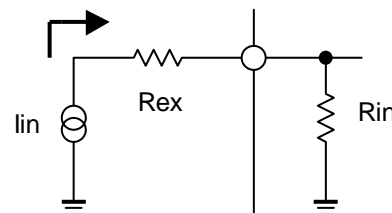


Fig.2 In the case of current input

In the case of voltage input

Output current is the following.

$$I_{out}=120 \cdot V_{in}/(R_{ex}+R_{in}) \text{ [mA]}$$

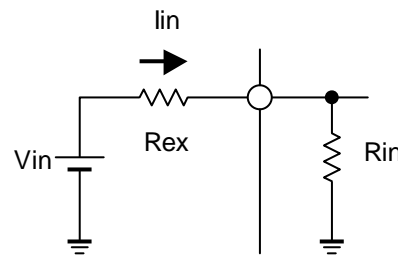


Fig.3 In the case of voltage input

Output current can be set up by $R_{ex}=0\text{ohm}$.
However, to reduce input noise,
please add a capacitor between R_{ex} and GND.
(Refer to TEST CIRCUIT).

R_{in} (input resistance of IC) is CH-R:2.5kohm, CH-2/3/4:500ohm.

● Set up for internal Oscillator

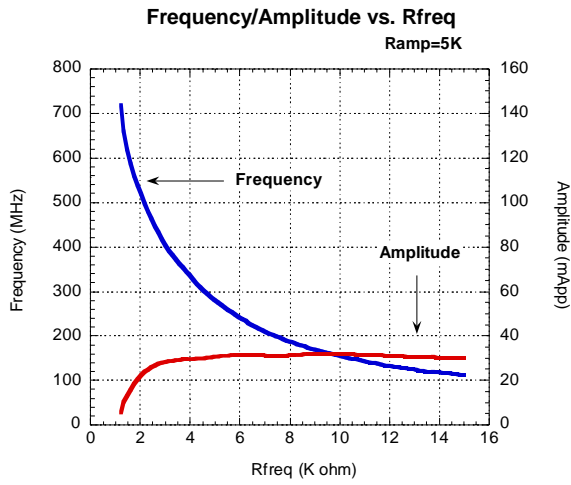
NJW4710 contained in the oscillator for the light power change reduction by the return light noise of laser.

The quality of reading improves by operating oscillator and output it.

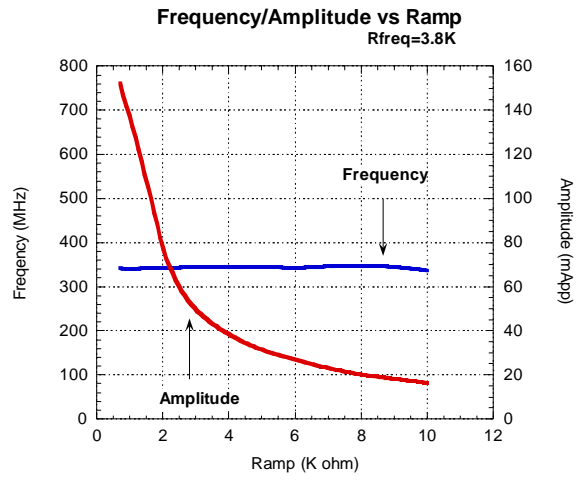
In this oscillator, oscillation frequency can be set up by connect resistance with a R_{freq} (5pin) between GND. Moreover, set up of the amount of oscillation superposition can be performed by connect resistance with a R_{amp} (18pin) between GND.

Oscillation frequency is 150MHz to 600MHz. It can adjust to 10mApp to 100mApp (Refer to TYPICAL CHARACTERISTICS) in the amount of high frequency superposition.

Output of this oscillator is PUSH-PULL circuit. Therefore, the output of the oscillator for high frequency superposition is overlapped focusing on the output current value set up in the constant current output circuit.



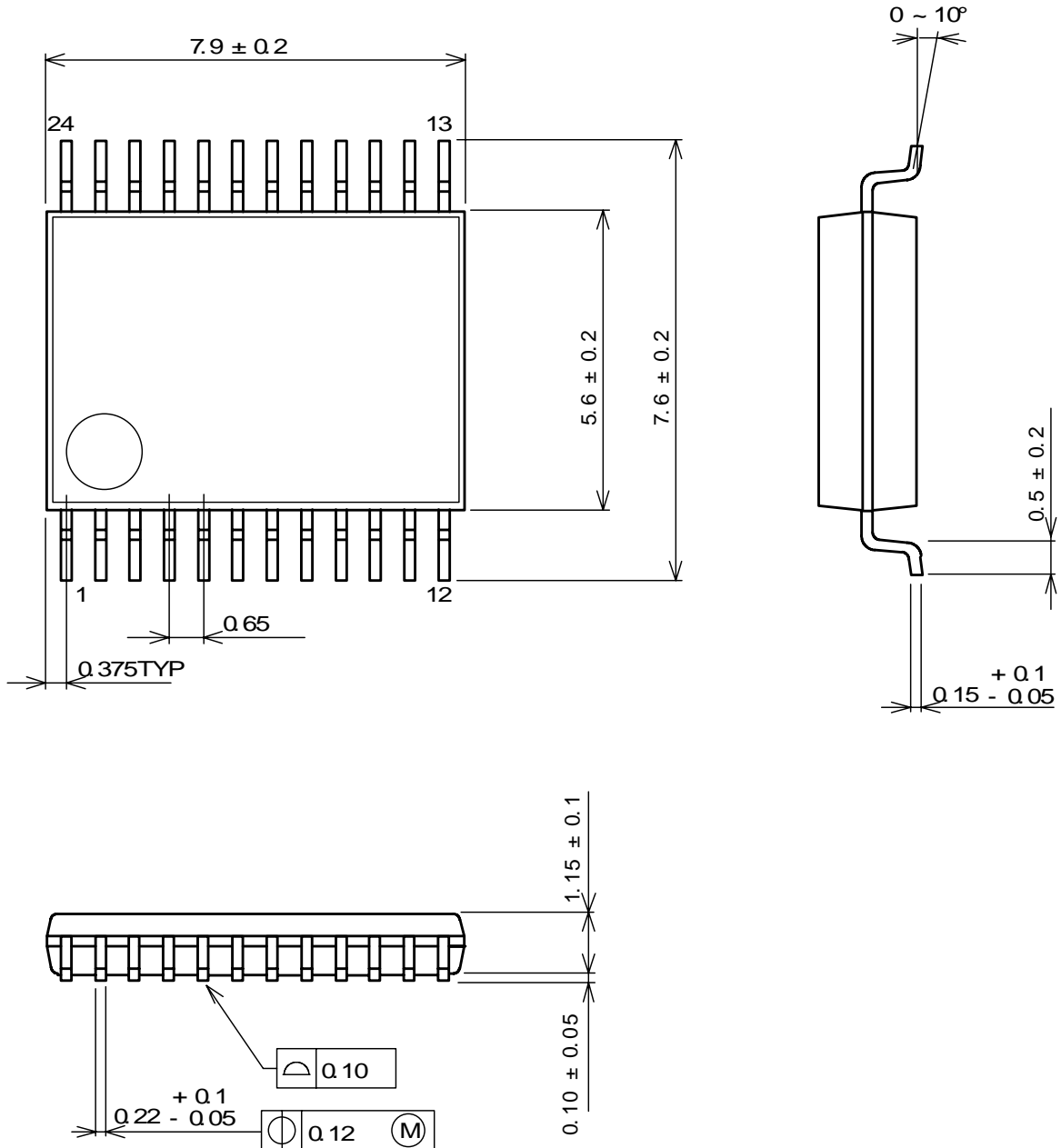
Oscillation frequency/Amplitude
vs. Resistance for set up frequency



Oscillation frequency/Amplitude
vs. Resistance for set up overlap

■ PACKAGE OUTLINE

SSOP24-E1



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