Driving circuit examples of laser diodes

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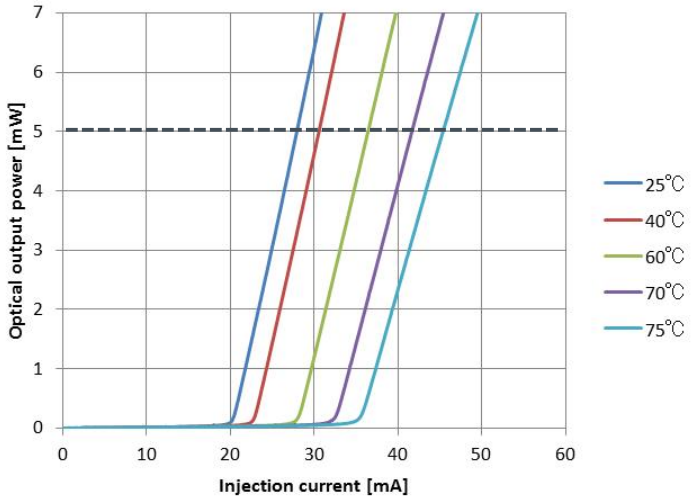
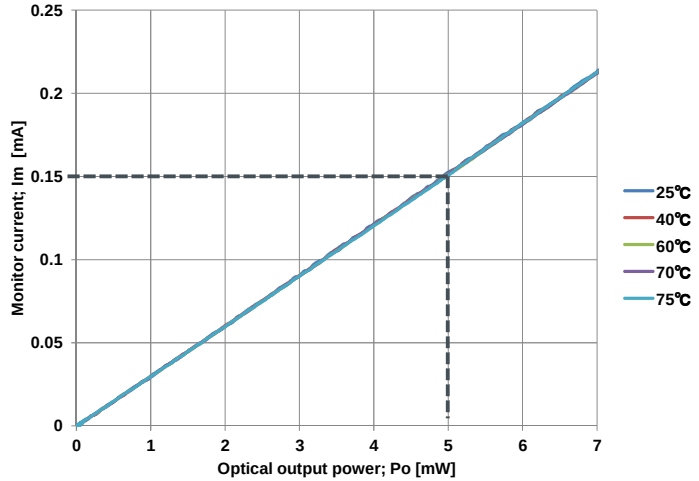
Optical module Business Unit
Photonics Div.
Product Development Dept. 1

Two way of driving LDs; ACC & APC

Graph 1. injection current vs optical output power



Graph 2. optical output power vs monitor current



When a constant current is injected, optical output power; Po of LD changes by the temperature. The example when 30mA is injected to LD on graph1 is as follows. If case temperature; Tc is 25 degrees Celsius, Po becomes about 6mW. If Tc is 60 degrees, Po might be about 1mW. If Tc is over 70 degrees, Po is only LED light.

In other words, if **auto current control; ACC** is adopted, it is possible to destroy LD by over power and to use no LD light.

Therefore ROHM recommend **auto power control; APC**. When photo diode is built in LD, Po is known by monitor current; Im. It is designed to keep almost same value regardless of Tc. If the injection current to LD on graph 2 is changed with keeping Im constant, Po becomes 5mW regardless of Tc.

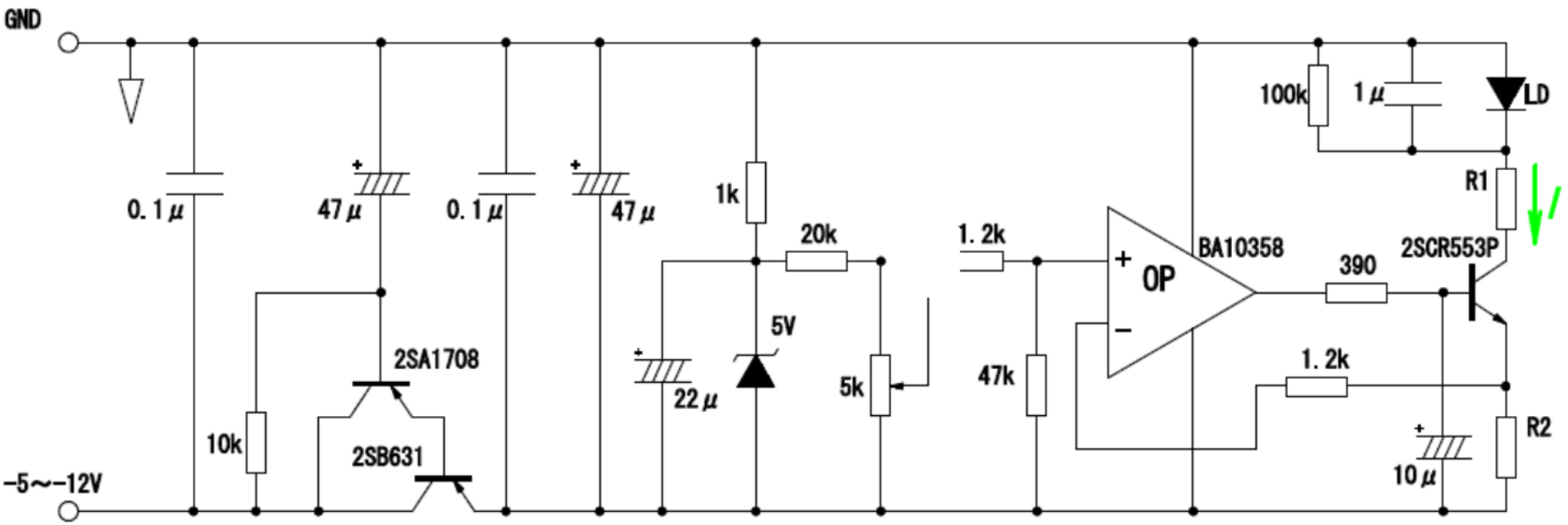
Mark	LD common	PD common
M	cathode	cathode
N	anode	cathode
P	cathode	anode

polarity

shown by the sixth character from the left of the type name.

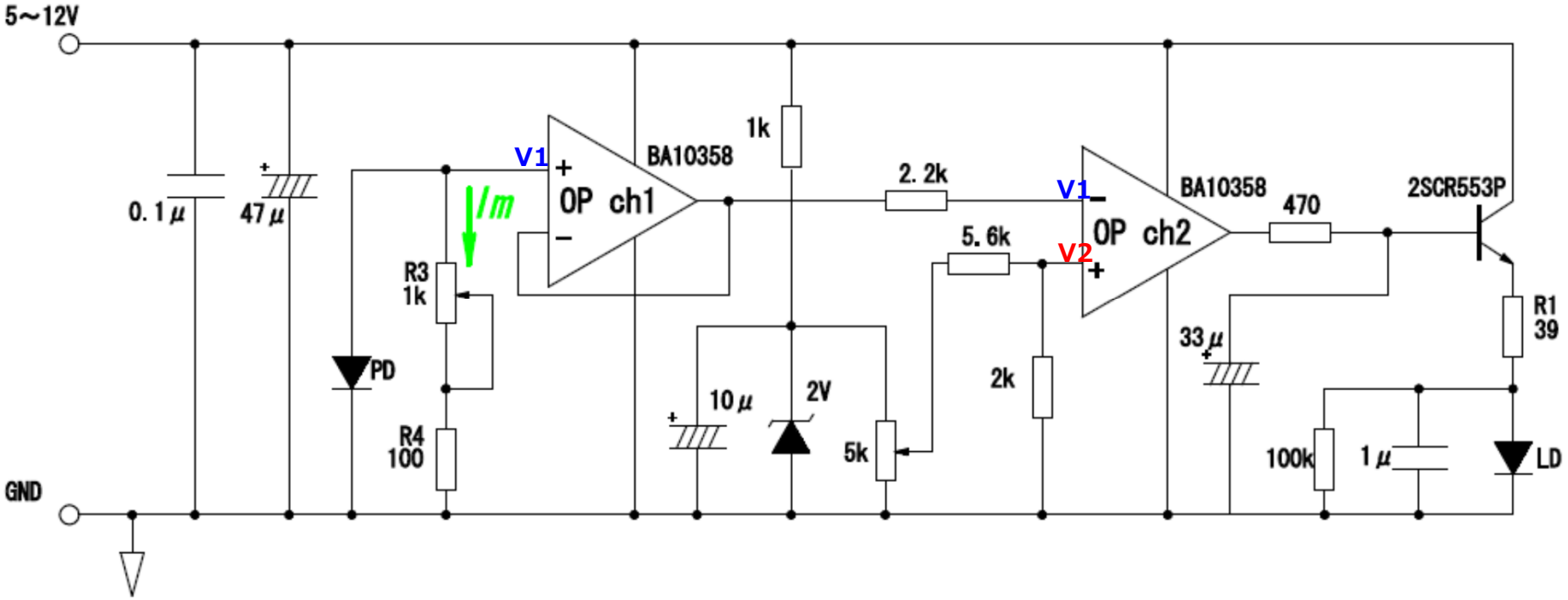
It is ROHM original mark.

ACC （電流一定）回路例

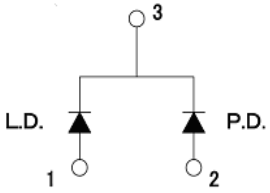


The optical output of the laser diode varies largely by the ambient temperature even when using a constant current.
Therefore an APC circuit (as described in the following sections) which is not influenced by an ambient temperature is used.

Auto Power Control drive circuit example for M type LDs



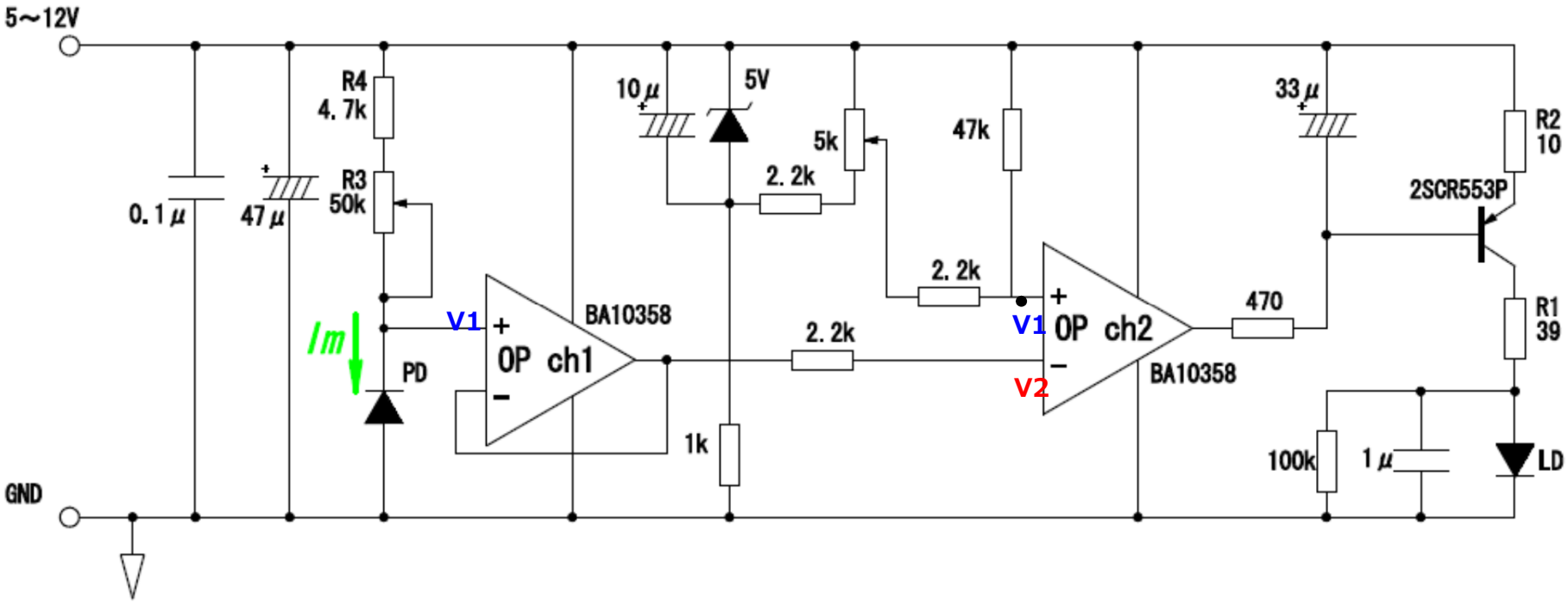
M type



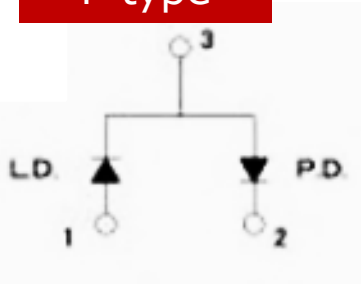
When LD is turned on, monitor current (Im) flows.
Im is proportional to the amount of light.
And Voltage become: V1=Im(R3+R4).
At same time, reference voltage V2 is generated by zenner diode and volume.
OP2 always control the base current for output transistor so that it is always V1=V2 and constant current flows into LD.

Note) V1 must not exceed 0.5V

Auto Power Control drive circuit example for P type LDs



P type



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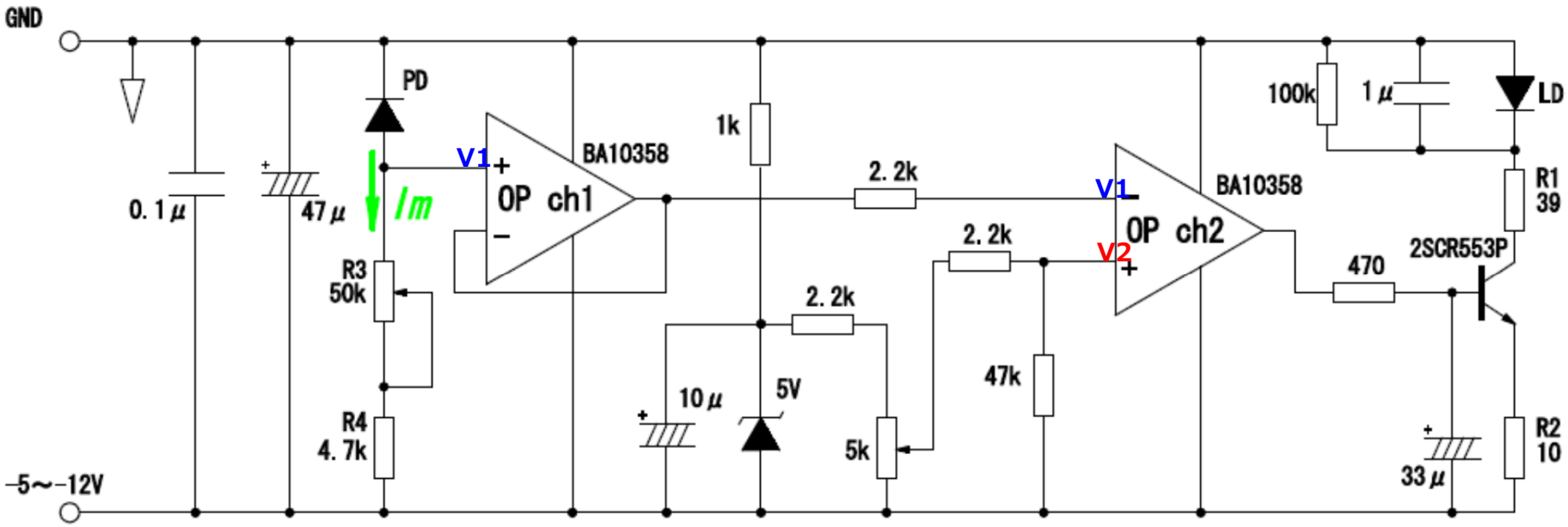
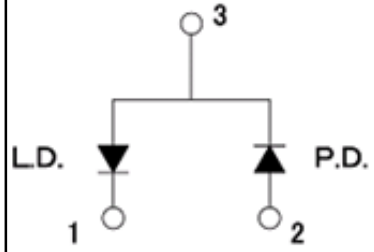
And Voltage become: V1=Im(R3+R4).
At same time, reference voltage V2 is generated by zenner diode and volume.
OP2 always control the base current for output transistor so that it is always V1=V2 and constant current flows into LD.

Auto Power Control drive circuit example for N type LDs



N type



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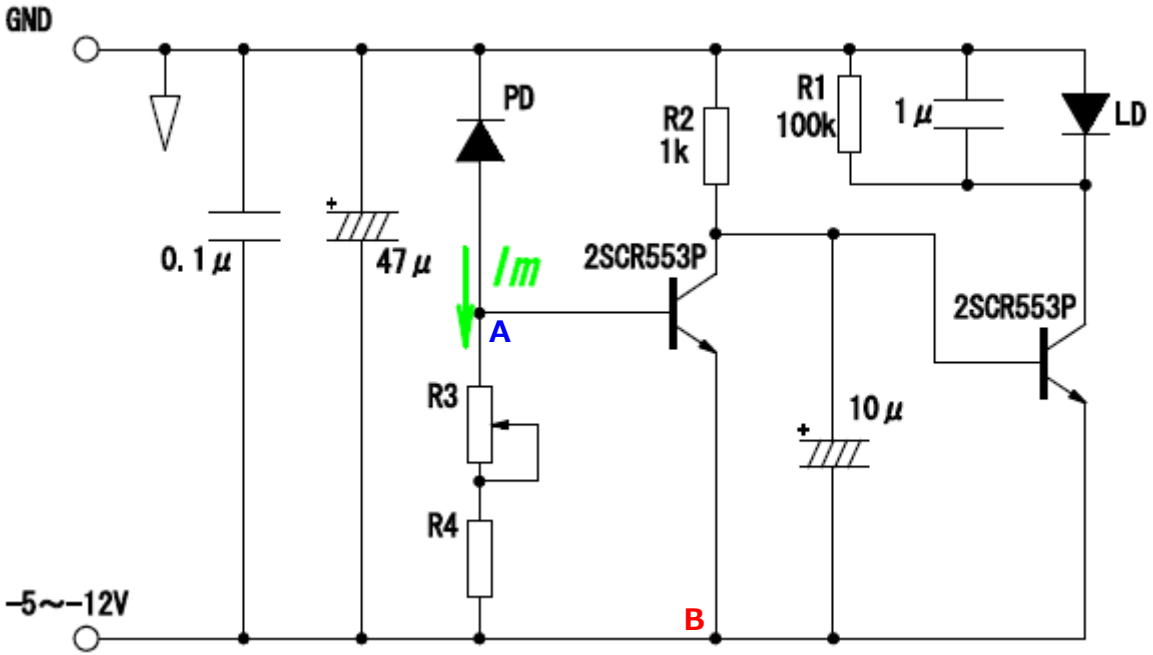
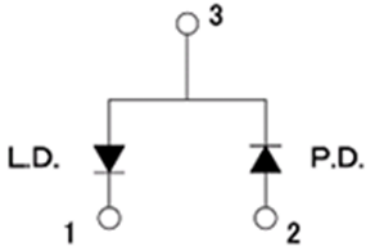
Im is proportional to the amount of light.
And Voltage become: V1=Im(R3+R4).
At same time, reference voltage V2 is generated by zenner diode and volume.
OP2 always control the base current for output transistor so that it is always V1=V2 and constant current flows into LD.

Auto Power Control drive circuit example for N type LDs (without Op-amp.)



N type



The voltage between A-B will be the one between the base-emitter of the transistor.
(It's about 0.55V in the case of an upper figure.)
For example

Po adjustment area : 0.5- 2 mW
Im of that case : 0.018 - 0.072mA

R4 = 0.55/0.072 = 7.64 [kΩ]
R3+R4 = 0.55/0.018 = 30.6 [kΩ]
∴ R3 = 22.9 [kΩ]

ROHM Co.,Ltd.