300mA LASER Diode Driver

General Description

The EMD2160 is a LASER Diode (LD) driver with up to 300mA driving capability and 10kHz pulsed operation. To prevent driving LD with improper large current, a current limit circuit is designed in. Once the protecting circuit is triggered 3 times, the main driver would be ceased and wake-up it again by re-power on.

The CL100 is designed for selecting current limit levels. When CL100=Low, the current limit level is set around 300mA. When CL100=VCC or Floating, the current limit is set around 100mA.

Feature

- Up to 300mA driving capability
- With selectable current limit
- With Under Voltage Protection

Typical Application

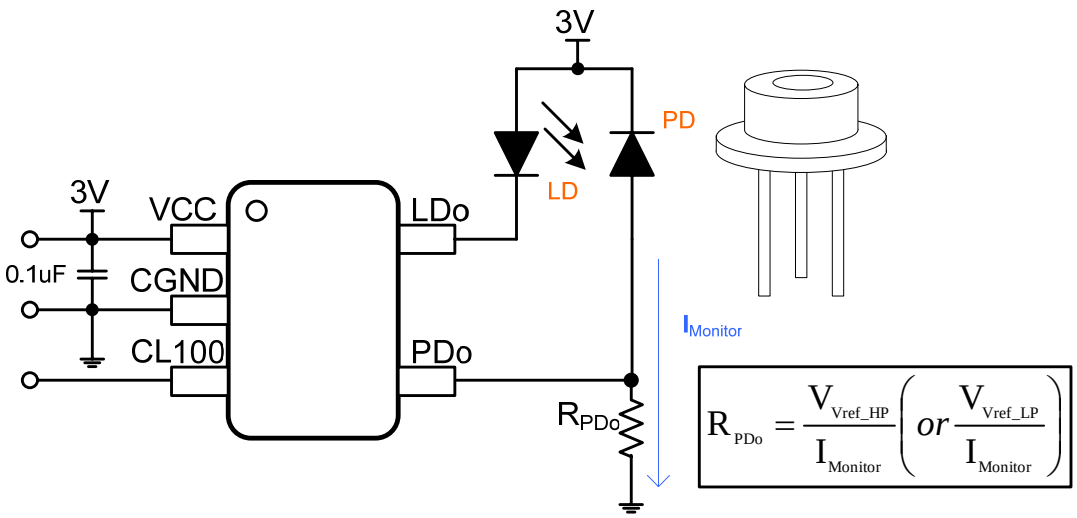
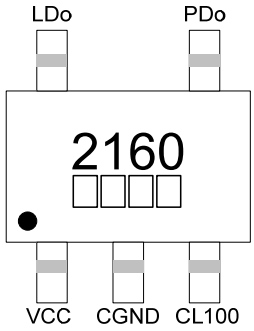


Fig. 1 Typical application circuit

Connection Diagram

SOT-23-5 (Top View)



Order Information

EMD2160-00VN05NR

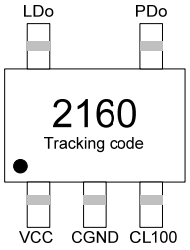
00 Output Current Adjustable

VN05 SOT-23-5 Package

NR RoHS & Halogen free

Rating: -40 to 85°C

Order, Mark & Packing Information

Package	Product ID	Packing code	Marking	Packing
SOT-23-5	EMD2160-00VN05NR	R		3K units Tape & Reel

Pin Locations & Functions

Pin Name	Pin No.	Description
VCC	**1**	Supply voltage.
CGND	**2**	Ground.
CL100	**3**	CL100=VCC/Floating; Current limit=100mA. CL100=Low; Current limit=300mA.
PDo	**4**	Feedback node for LASER output power control. Normally, a resistor around 10k between PDo and CGND is recommended.
LDo	**5**	Main LASER diode Driver.

Functional Block Diagram

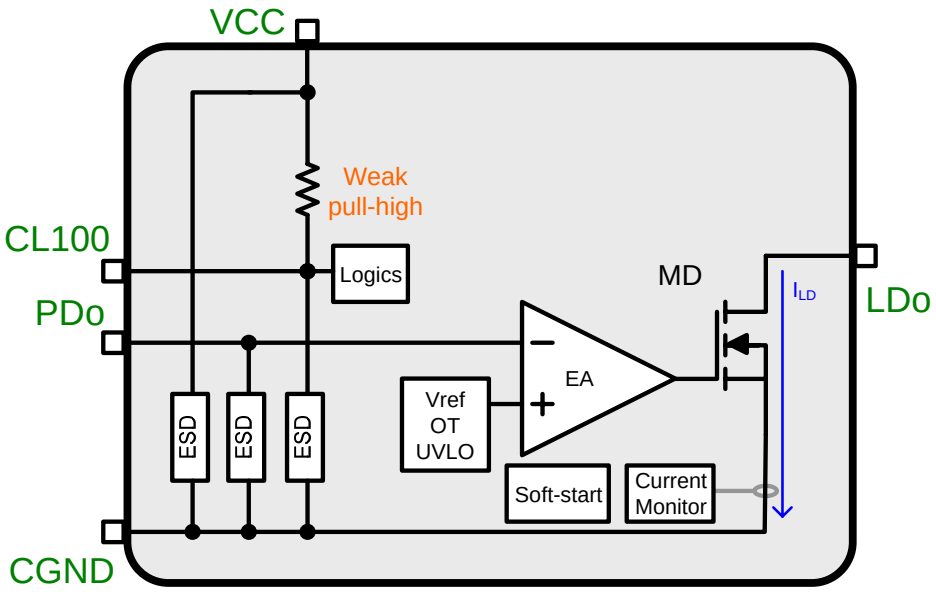


Fig. 2 Functional Block Diagram

Absolute Maximum Ratings (Note1, 2)

Devices are subjected to fail if they stay above absolute maximum ratings.

Supply Voltage (VCC) ---------- – 0.3V to +6.5V
Others (PDo,LDo,CL100) ---------- – 0.3V to VCC
Storage Temperature ---------- – 65°C to 150°C
Junction Temperature ---------- 150°C
Lead Temperature (Soldering, 10 sec) --------- 260°C
Latch up ---------- 200mA
HBM ESD ---------- 2000V
MM ESD ---------- 200V

Recommended Operating Rating (Note3, 4 and 5)

Supply Voltage (VCC) ---------- 3.0V to +5.5V Operating Junction Temperature ---- -40℃ to 100℃

Thermal Resistance

Symbol	**θJA**(Note 1)	**θJC (top)**(Note 2)
SOT-23-5	152 (℃/W)	81(℃/W)

Electrical Characteristics

VCC=3V, T_A=+25°C, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
VCC	Supply Voltage		3.0		5.5	V
V_{UVLO}	Under Voltage Lockout Threshold	VCC failing		2.4		V
V_{UVLO_HYS}	Hysteresis of Under Voltage Lockout	VCC rising		0.1		V
V_{Vref_LP}	Reference Voltage for Low Power LD	VCC=3V, CL100=3V or Floating	0.53	0.55	0.57	V
V_{Vref_HP}	Reference Voltage for High Power LD	VCC=3V, CL100=0V	1.06	1.1	1.14	V
I_{PDo}	PDo pin current	V_{PDo} =1.1V		1		nA
$R_{DS(ON)}$	Main Driver on Resistance	VCC=2.8V,		1	3	
V_{IL}	CL100 Input Low Voltage				0.4	V
V_{IH}	CL100 Input High Voltage		1.5			V
I_{CL100}	CL100 Input Current	V_{CL100}=0V		1		uA
$I_{O,100}$	In regulation Maximum Output Current	VCC=3V; CL100=3V	60	100	150	mA
$I_{O,300}$	In regulation Maximum Output Current	VCC=3V; CL100=0V	180	300	600	mA

Note 1: Absolute Maximum ratings indicate limits beyond which damage may occur. Electrical specifications do not apply when operating the device outside of its rated operating conditions.

Note 2: All voltages are with respect to the potential at the ground pin.

Note 3: T_J is a function of the ambient temperature T_A and power dissipation P_D ($T_J = T_A + (P_D) * (\theta_{JA})$).

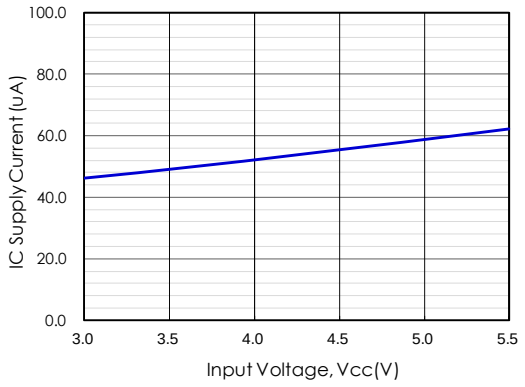
Note 4: θ_{JA} is measured in the natural convection at T_A=25℃ on a high effective thermal conductivity test board (2 layers, 2S0P).

Note 5: $\theta_{JC\ (top)}$ represents the resistance to the heat flows the chip to package top case.

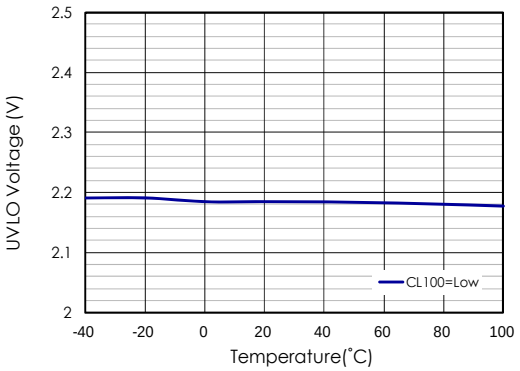
Typical Performance Characteristics

T_A=25℃, unless otherwise specified

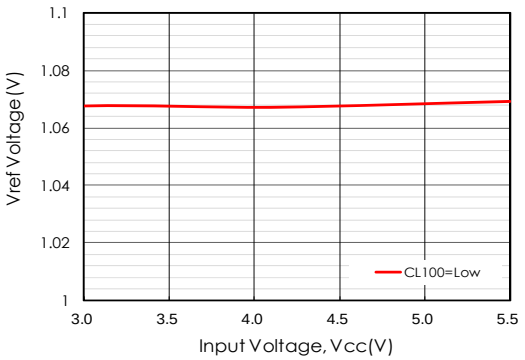
IC Supply Current (I_{IN}) vs. V_{CC}



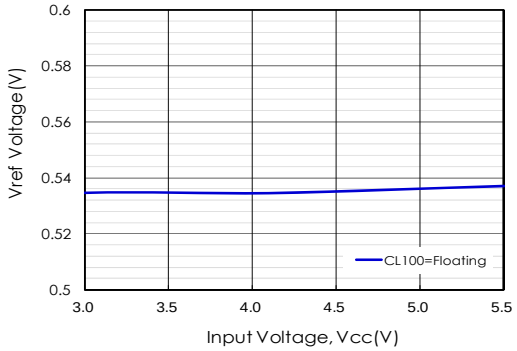
UVLO Voltage vs. Temperature



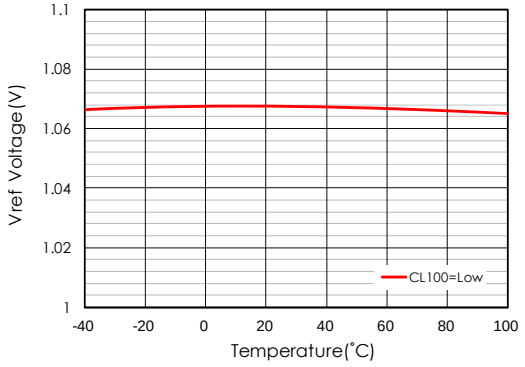
V_{Vref_LP} vs.V_{CC}



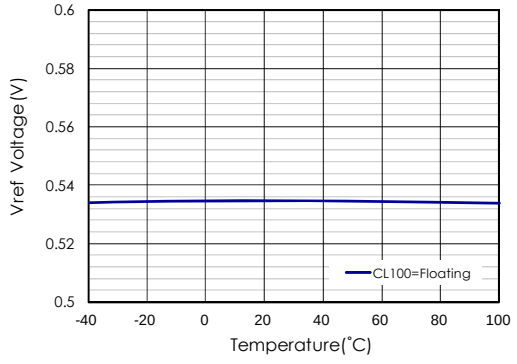
V_{Vref_HP} vs.V_{CC}



V_{Vref_LP} vs. Temperature



V_{Vref_HP} vs. Temperature



Typical Application Information

Continuous Wave (CW) Mode Power

The EMD2160 can be adapted to CW laser diodes from 2 to 40mW and usable laser module type as Fig.3.

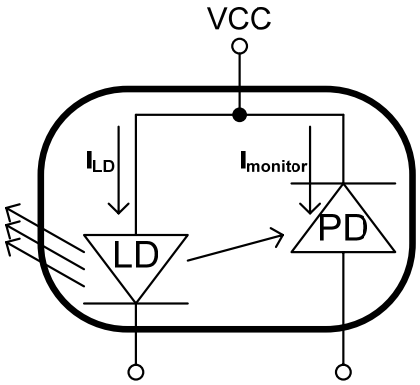


Fig.3 Laser Module type for EMD2160

The pin PDo is used to adjust the sensitivity of the monitor diode and to set a desired power for the optical laser diode.

Example 1a

A laser diode with 5mW optical output, monitor diode with 0.033mA/mW and CL100 is floating. For 2mW optical output, the RPDo can be calculated as following equation:

$$RPDo = \frac{V_{Vref\_LP}}{0.033 \times 2} = \frac{0.55}{0.066} \approx 8.3k\Omega \#$$

Example 1b

A laser diode with 5mW optical output, monitor diode with 0.033mA/mW and CL100 is Low. For 5mW optical output, the RPDo can be calculated as following equation:

$$RPDo = \frac{V_{Vref\_LP}}{0.033 \times 5} = \frac{1.1}{0.165} \approx 6.7k\Omega \#$$

Pulsed Operation –Structure-1

Fig.4 shows the simplified design for pulsed operation, up to 10kHz pulsed operation could be also provided by EMD2160. Beside, in order to avoid overdriving the laser diode during pulsed operation, the laser rising current with 15us delay is designed for soft-start.

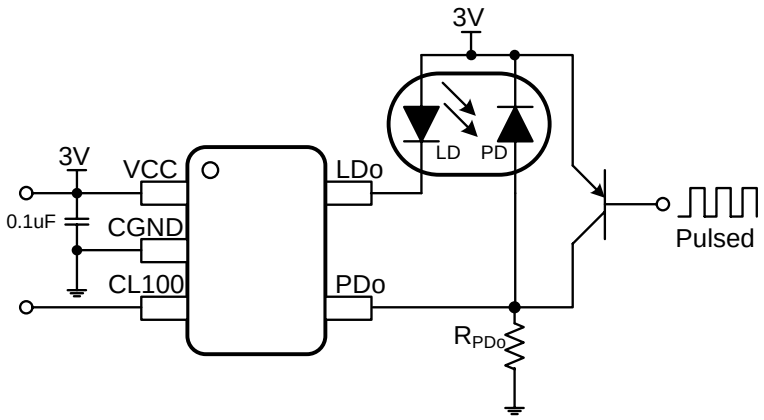
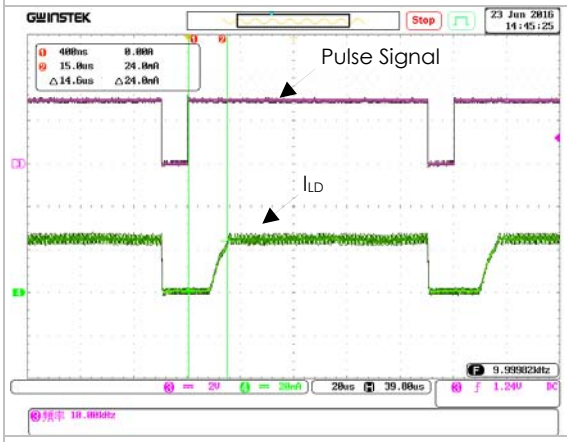
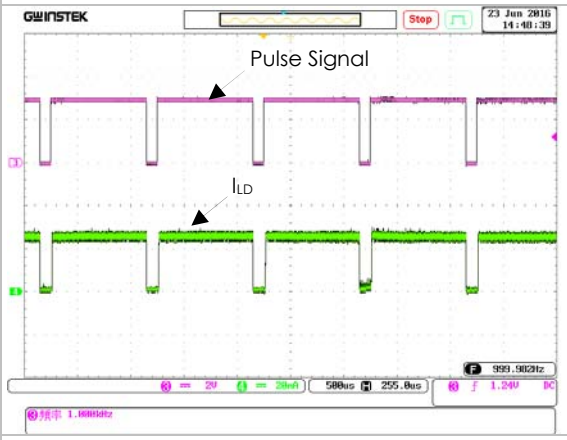


Fig.4 Pulsed operation example on PDo pin

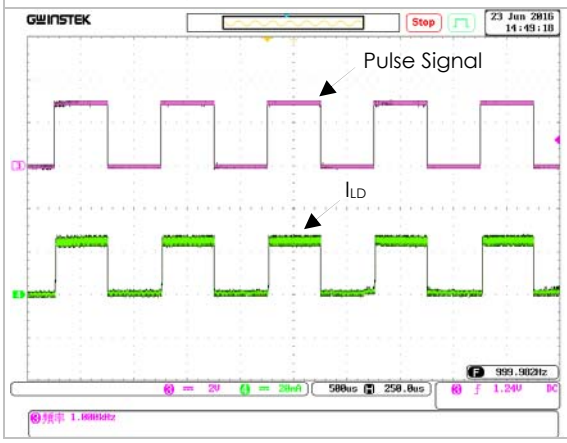
Pulsed Operation with 10kHz/D=90%



Pulsed Operation with 1kHz/D=90%



Pulsed Operation with 1kHz/D=50%



Pulsed Operation with 1kHz/D=10%

Pulsed Operation –Structure-2

In addition, the EMD2160 with pulsed operation is not only applied on PDo pin, but also it is adapted with pulsed operation on VCC pin, as shown in Fig.5. Nevertheless, due to the VCC UVLO, the I_{LD} delay (turn-on delay + rising delay) would be raised above 20us.

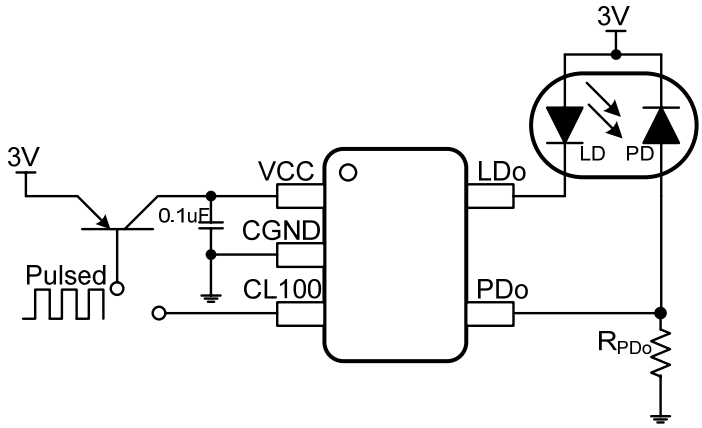
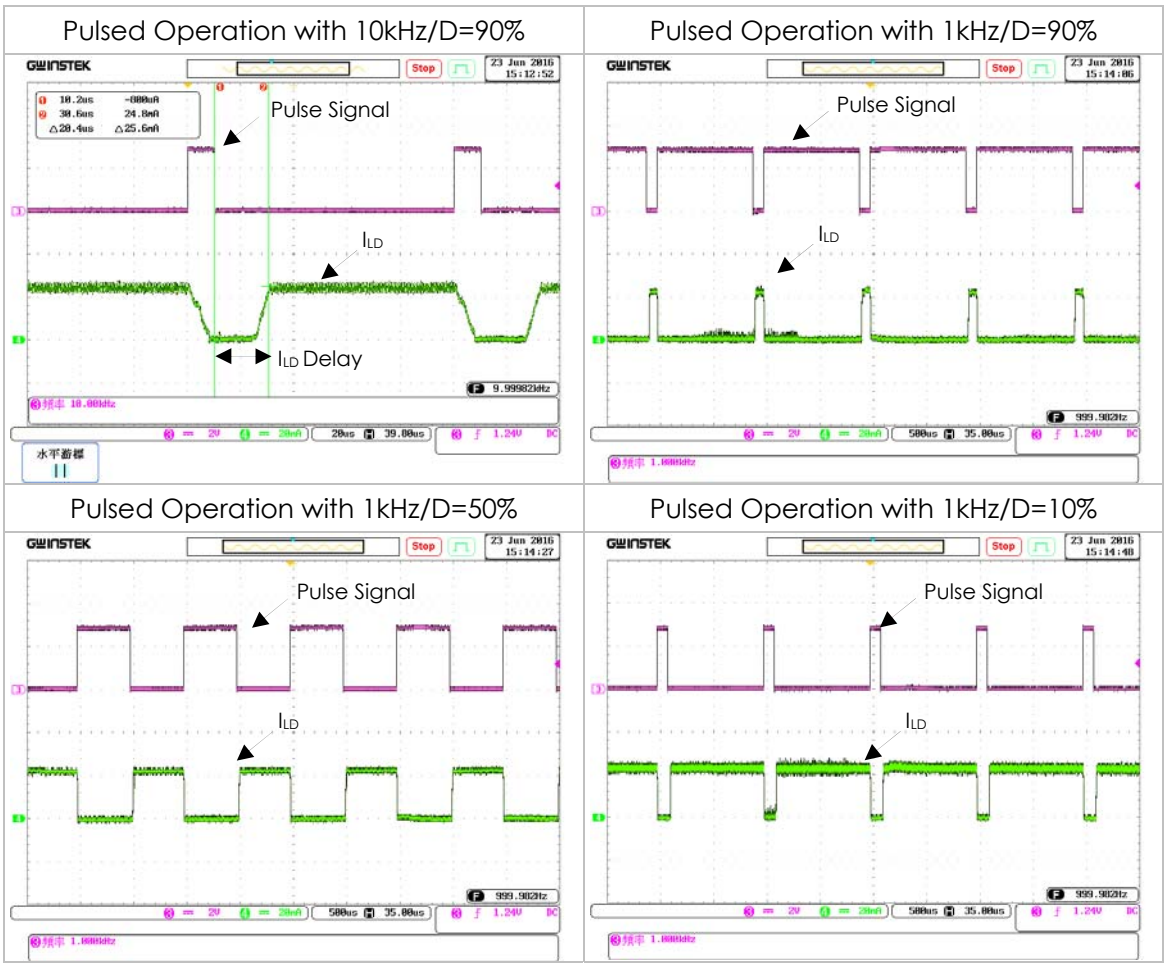


Fig.5 Pulsed operation example on VCC pin



Driving High V_F Laser Diode

Due to the VCC AMR of EMD2160 is 6.5V, an external boost or charge-pump IC could be adapted to supply the laser module, and the application structure as shown in Fig.6.

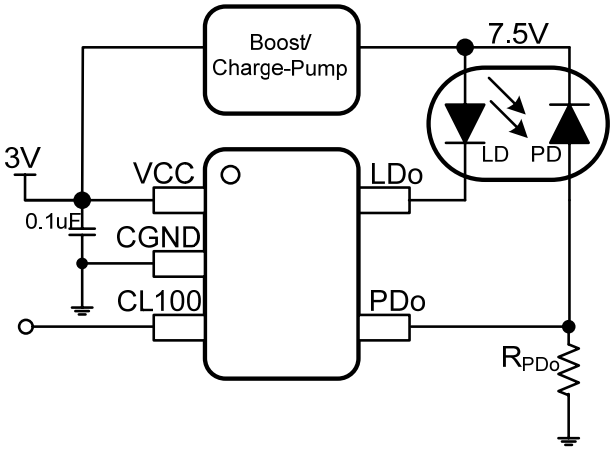
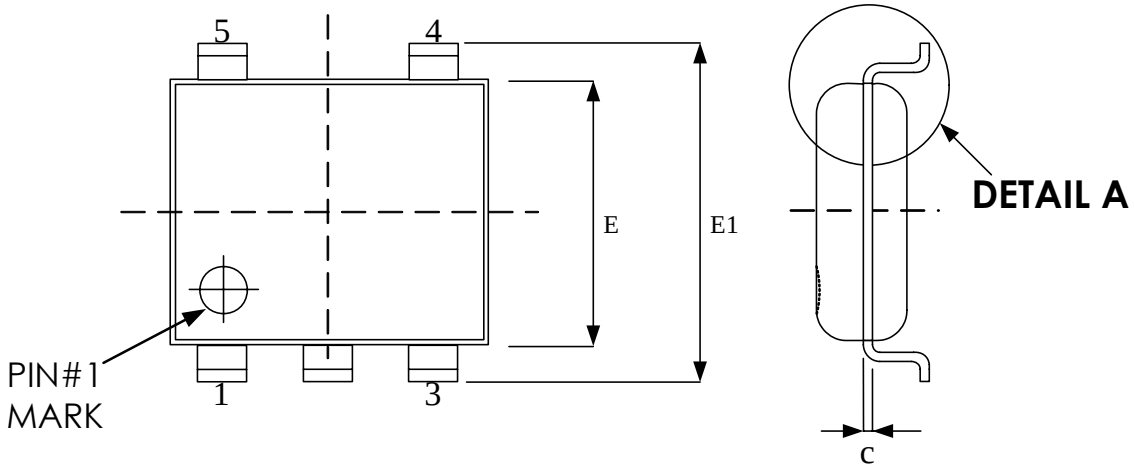
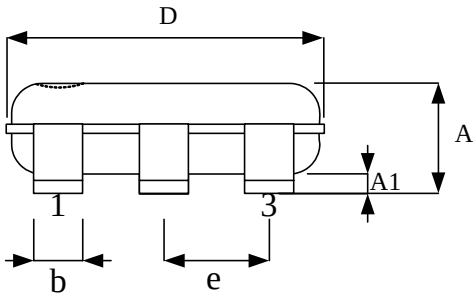


Fig.6 Driving High V_F Laser Diode

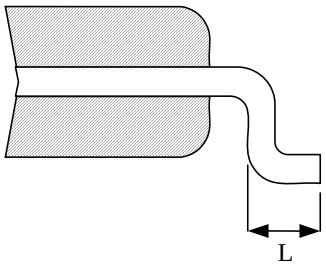
Package Outline Drawing
SOT-23-5



TOP VIEW



SIDE VIEW



DETAIL A

Symbol	Dimension in mm	
	Min.	Max.
A	0.90	1.45
A1	0.00	0.15
b	0.30	0.50
c	0.08	0.25
D	2.70	3.10
E	1.40	1.80
E1	2.60	3.00
e	0.95 BSC	
L	0.30	0.60

Revision History

Revision	Date	Description
0.1	2016.06.01	Preliminary
0.2	2016.07.18	Undated application circuit and information

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