

광통신 송수신모듈 구조

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광통신 송수신모듈구조

ETRI
광통신부품연구센터

2002. 5. 3

ETRI
한국전자통신연구원

ETRI Proprietary

- 1 -

광모듈구조연구팀

목 차

ETRI
광통신부품연구센터

- 서 론
- 광통신 송신모듈구조
- 광통신 수신모듈구조
- 광통신 송수신 모듈구조
- 결 론

ETRI Proprietary

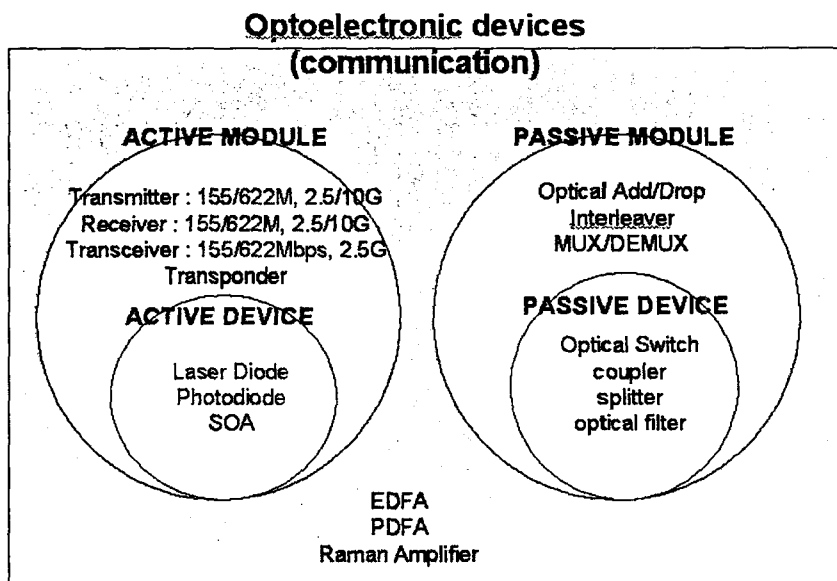
- 2 -

광모듈구조연구팀

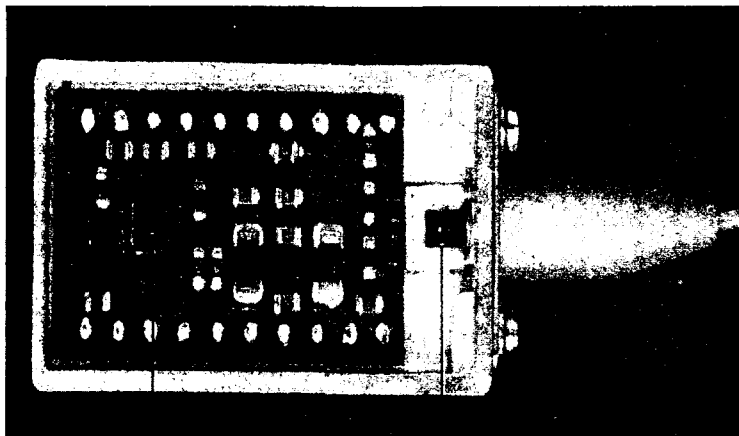
서 론(1)

- 광송신모듈에서는 LD에서 발생하는 열을 control하기 위한 Heatsink 및 TEC부착
- 광송신모듈은 고도의 광정렬 및 결합을 위한 구조요망
- 광수신모듈은 광정렬 및 열문제는 광송신모듈에 비해 less critical하나 전기적 출력이 약하므로 잡음발생이 작은 구조가 요망
- 광모듈의 소형화 및 집적화를 위한 array구조 및 통합모듈 구조개발

서 론(2)



광송신 모듈의 구조(1)



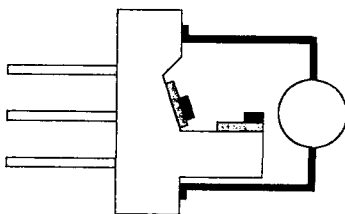
Tx IC

LD 결합모듈

155Mbps Optical transmitter

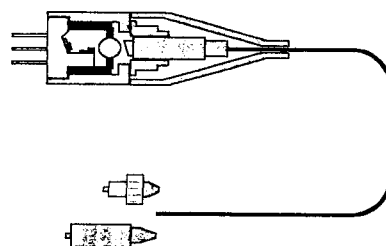
광송신 모듈의 구조(2)

TO can type (Ball lens type)



- LD chip
- Monitor PD chip
- LD sub-mount
- Monitor PD submount
- LD stem
- Stem cap

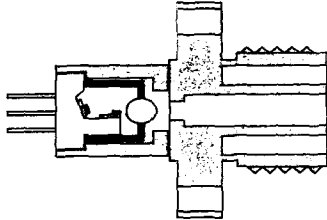
Coaxial type



- LD TO package
- Pigtail fiber
- TO housing
- Ferrule holder
- Rubber protector

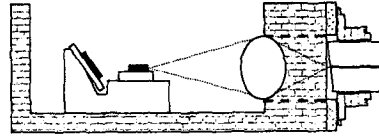
광송신 모듈의 구조(3)

Receptacle type



- LD TO package
- Receptacle
- Welding ring

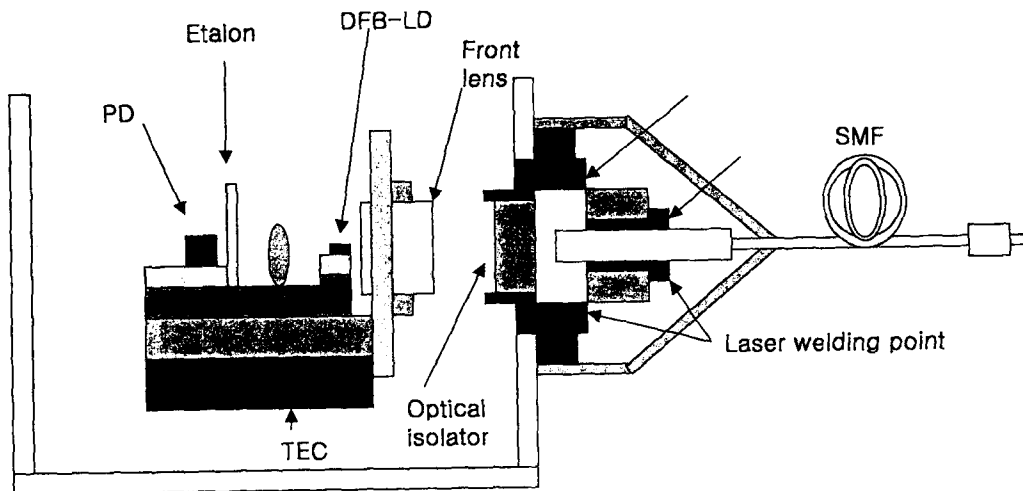
Mini-DIL type



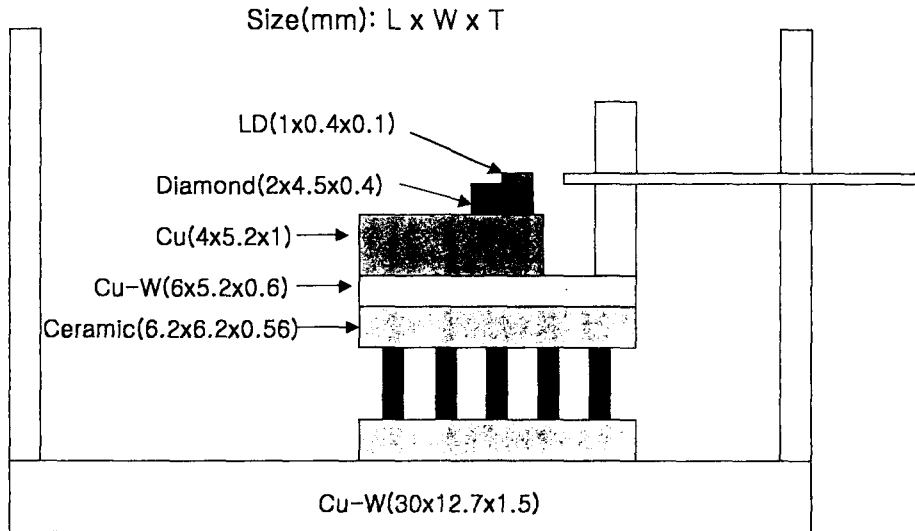
- LD sub-mount
- Monitor PD sub-mount
- Pedestal
- Lensed mini-DIL
- Pigtailed fiber
- Ferrule holder
- Rubber protector

광송신 모듈의 구조(4)

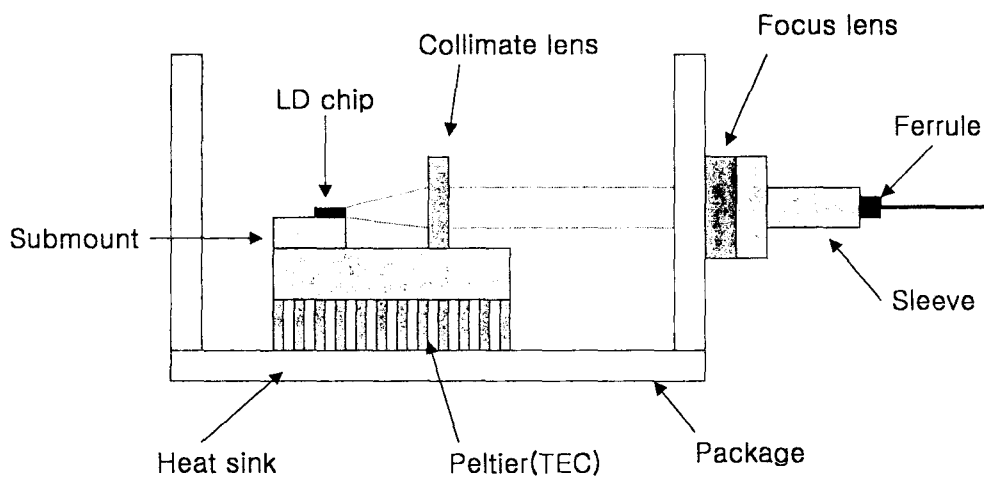
Butterfly type



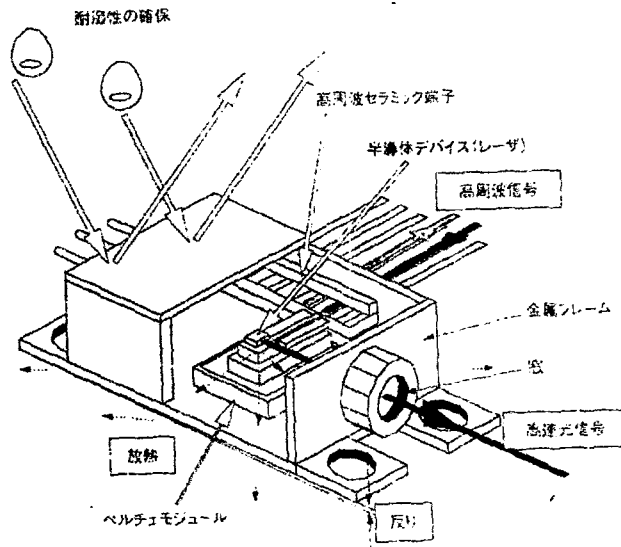
광송신 모듈의 구조



광송신 모듈의 구조(Moritex사)

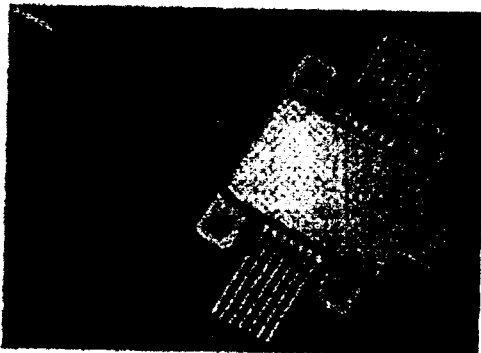


광송신 모듈의 구조(NTT사)

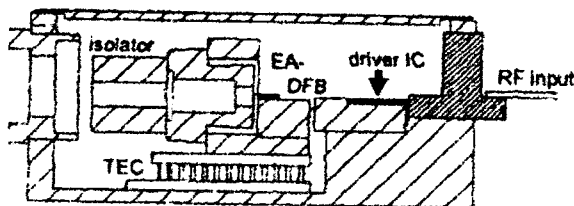


10Gbps LD module

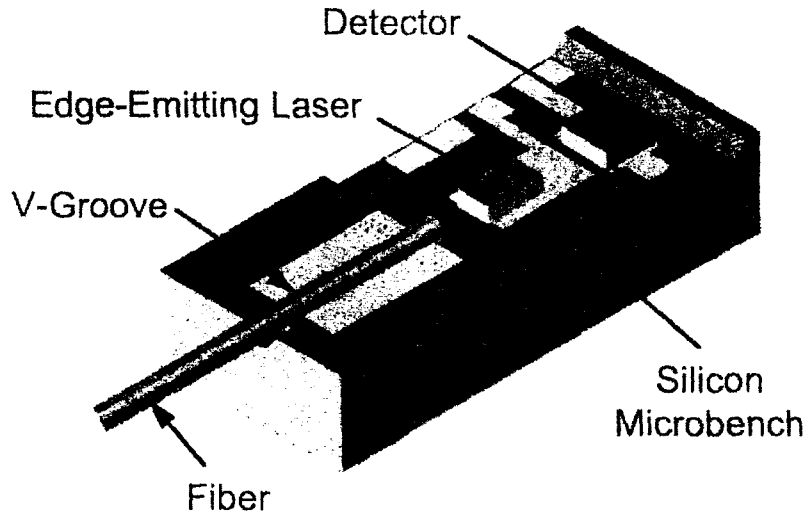
광송신 모듈구조 (Sumitomo사)



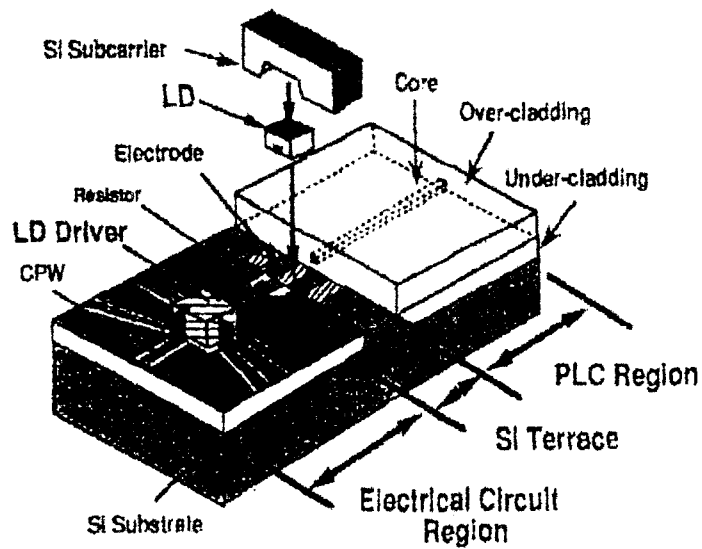
Transmission speed: 10Gbps
 Package size(mm):12(W)x17.6(L)x7.1(H)
 Package volume : 1.5 cc



SiOB LD모듈구조(1)

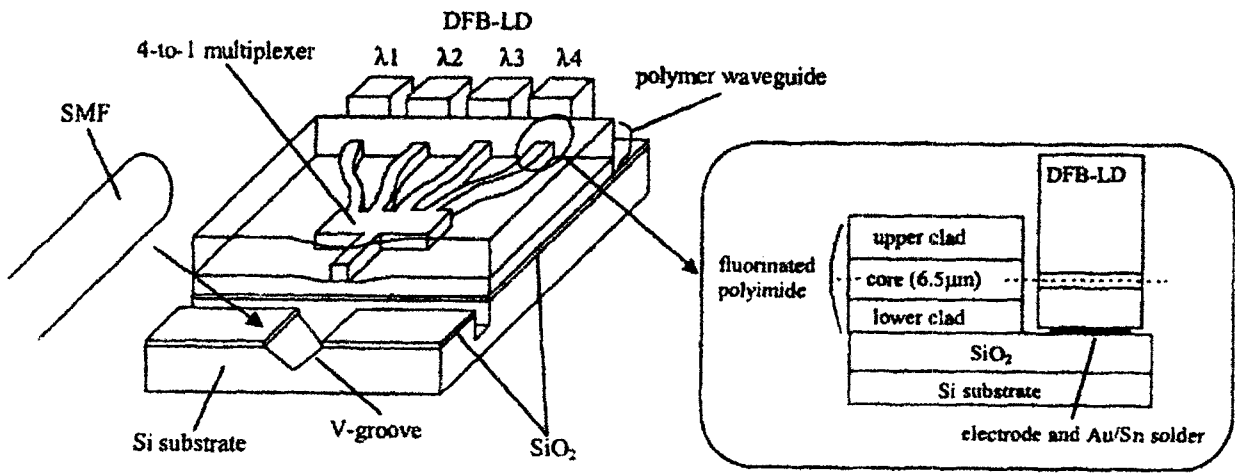


SiOB LD모듈구조(2)



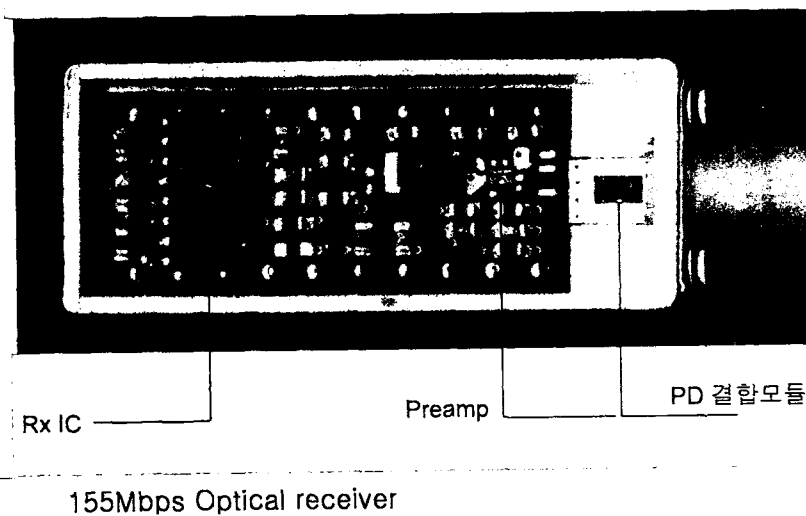
NTT- 2.5 Gbps LD 모듈

SiOB LD모듈구조(Hitachi사)



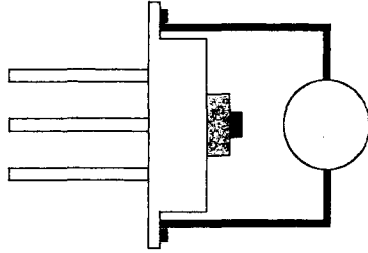
Transmission speed: 10Gbps
Low cost polymer PLC platform

광수신 모듈구조 (1)



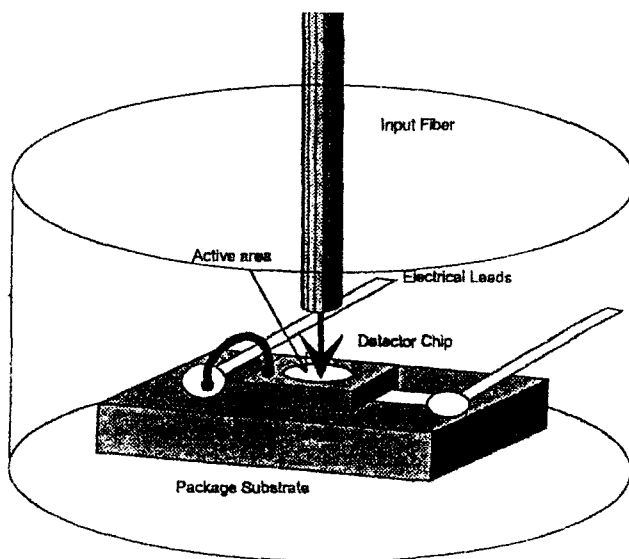
광수신 모듈구조 (2)

TO can type (Ball lens type)



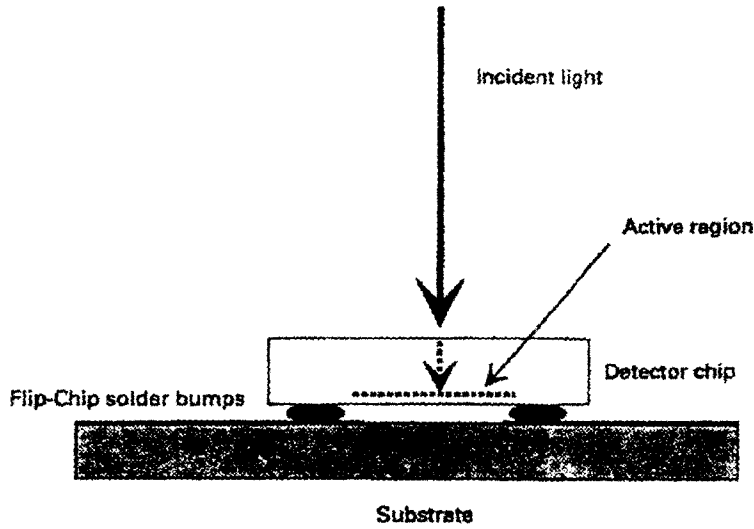
- PD chip
- PD sub-mount
- PD stem
- Stem cap

광수신 모듈구조 (3)



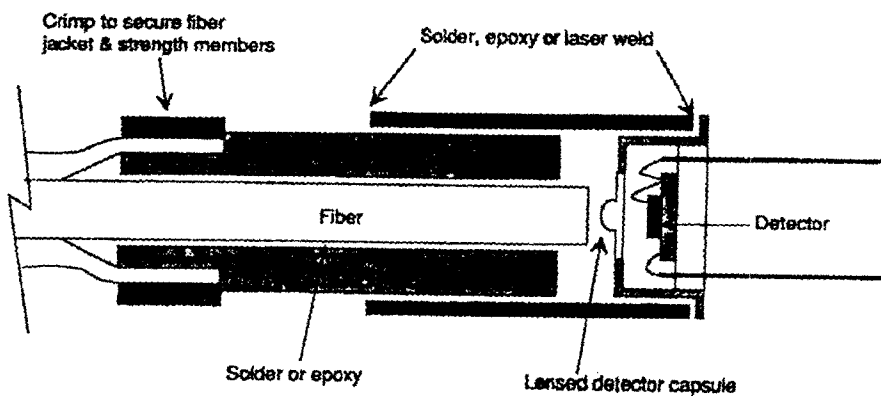
- Capacitance proportional to the active area
- High frequency response detector small an active area as possible

광수신 모듈구조 (3)



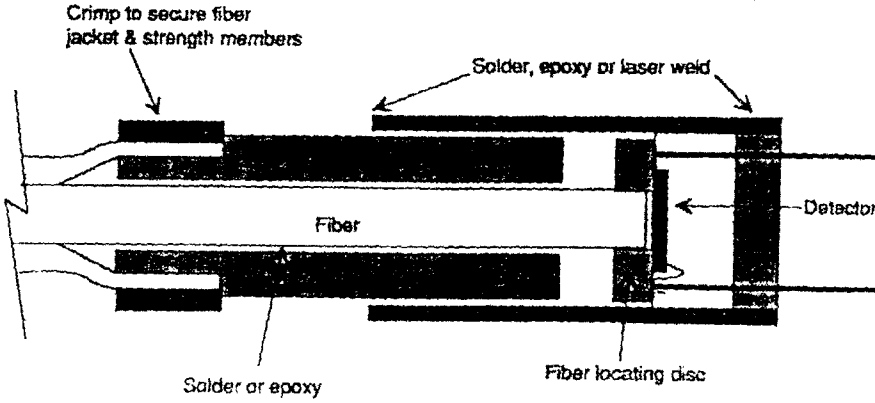
- Light incident on backside
- Transmitting to active area
- Flip chip bonded PD

광수신 모듈구조 (6)



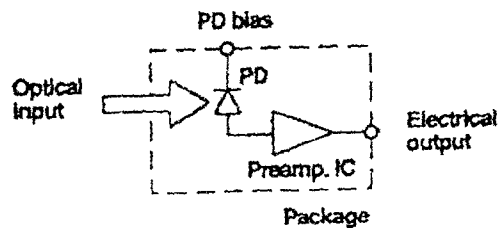
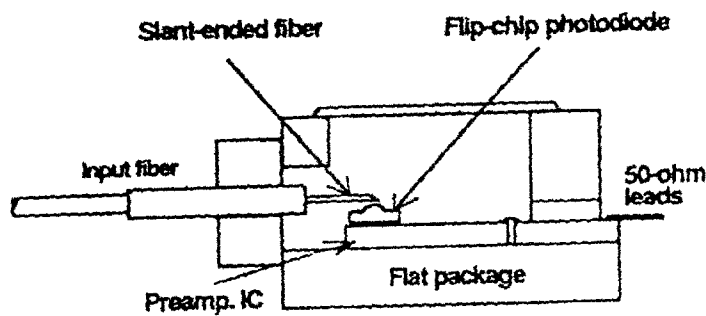
- Lensed glass window
- PD attached on submount
- Higher coupling efficiency

광수신 모듈구조 (7)



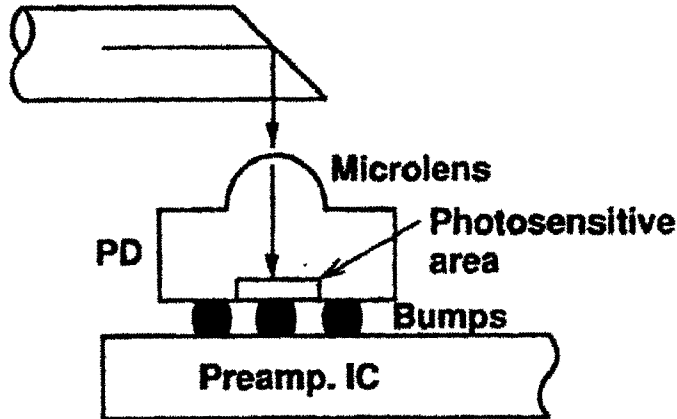
- Flat glass window
- Fiber must be located close to the PD
- Large active area

광수신 모듈구조 (Fujitsu)



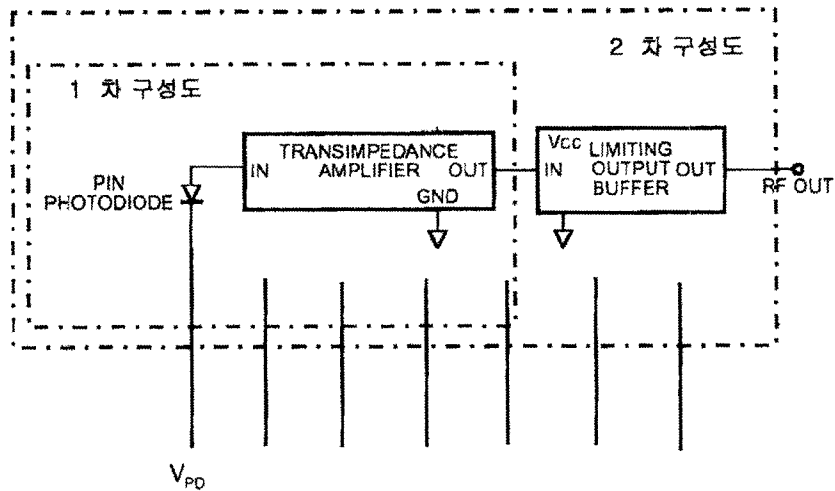
Optical coupling system

Slant-ended fiber (SEF)

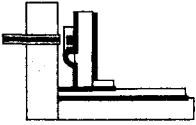
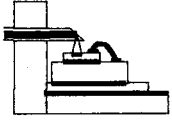


광송신모듈 BLOCK DIAGRAM

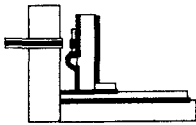
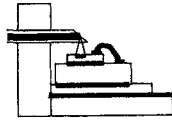
FUNCTIONAL BLOCK DIAGRAM



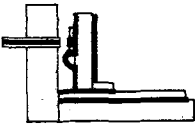
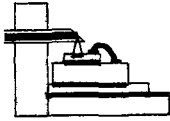
광수신 모듈구조의 장·단점 비교(1)

PD module Type	Optical design	R/F design
<p>Up-right</p> 	<ul style="list-style-type: none"> - Lensed fiber사용시 구조가 간단 - Lensed fiber사용으로 취급용이 및 효율향상 - Fiber와 PD거리 500μm 조정이 고난도 - SiOB에 적용 곤란 	<ul style="list-style-type: none"> - Submount와 substrate 연결에 wire bonding 대신 다른 연결구조 구현가능
<p>Flat</p> 	<ul style="list-style-type: none"> - Fiber와 PD의 거리 조정시 렌즈 사용으로 align이 용이 - SiOB에 적용 가능 - Lensed fiber사용시 구조가 복잡해짐 - Slant-ended fiber 사용시 lens의 실장 및 고정하기 위한 구조물 필요 	<ul style="list-style-type: none"> - Submount와 substrate 연결에 wire bonding 불가피

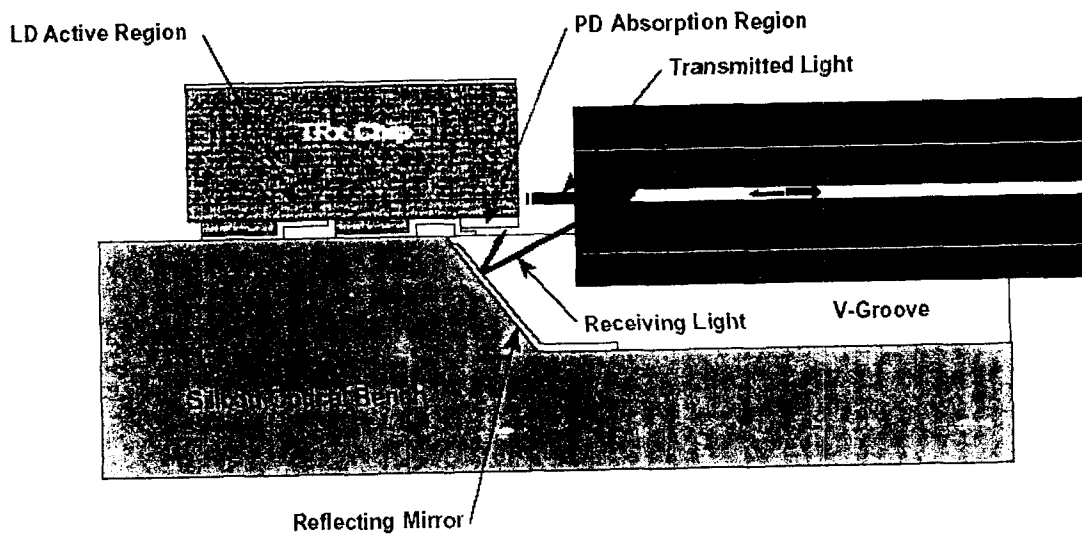
광수신 모듈구조의 장·단점 비교(2)

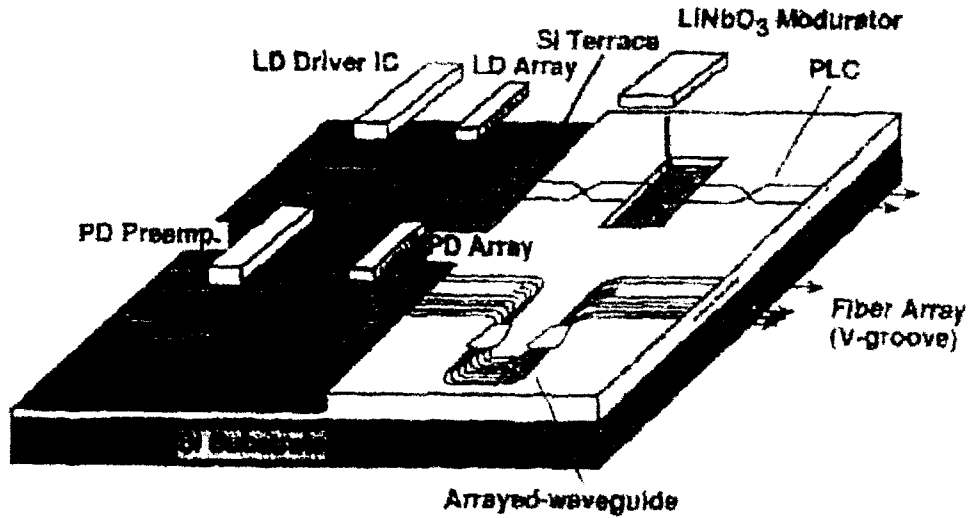
PD module Type	Bonding technology	Alignment technology
<p>Up-right</p> 	<ul style="list-style-type: none"> - Submount 크기로 PD 위치조절 용이 - Spacer 설치 불필요 - Submount 가공 복잡 - Submount에 긴 전극 길이 불가피 	<ul style="list-style-type: none"> - Fiber alignment 용이 - Hermetic sealing이 용이 - 렌즈, 파이버, Ferrule의 동시 정렬요구 - Sealing process 중 열 발생으로 인한 변형위험
<p>Flat</p> 	<ul style="list-style-type: none"> - Submount bonding의 안정성 - Submount에 짧은 전극 길이 가능 - PD 위치조절이 곤란 - Spacer 설치 필요 	<ul style="list-style-type: none"> - 고정밀의 alignment이 가능 - Fiber의 rolling이 필요 - Fiber의 처짐 또는 진동에 대해 불안정 - Ferrule의 metalization 필요

광수신 모듈구조의 장·단점 비교(3)

PD module Type	Testing and reliability	Others
<p>Up-right</p> 	<p>- Submount의 본딩 상태 불안정으로 신뢰성 시험시 문제발생 우려</p>	<p>- 구조가 간단하여 저렴화 가능</p>
<p>Flat</p> 	<p>-Submount의 본딩 상태 안정으로 신뢰성 시험에 문제 없음</p>	<p>-Slant-ended fiber 제작 어려움 - Low profile의 패키징 가능</p>

광송수신 모듈구조 (1)





결론

- 광송수신모듈 구조에서는 저가격화를 위해 TEC없는 모듈구조 연구
- 광정렬시 Tolerance가 큰 구조개발
- Low profile의 광송수신모듈 구조 개발
- 대용량 광송수신을 위한 array구조 개발
- 광송신과 수신 가능한 광송수신모듈 개발