

4

"

"

2019

5

5

2018 2022

1.

1.1

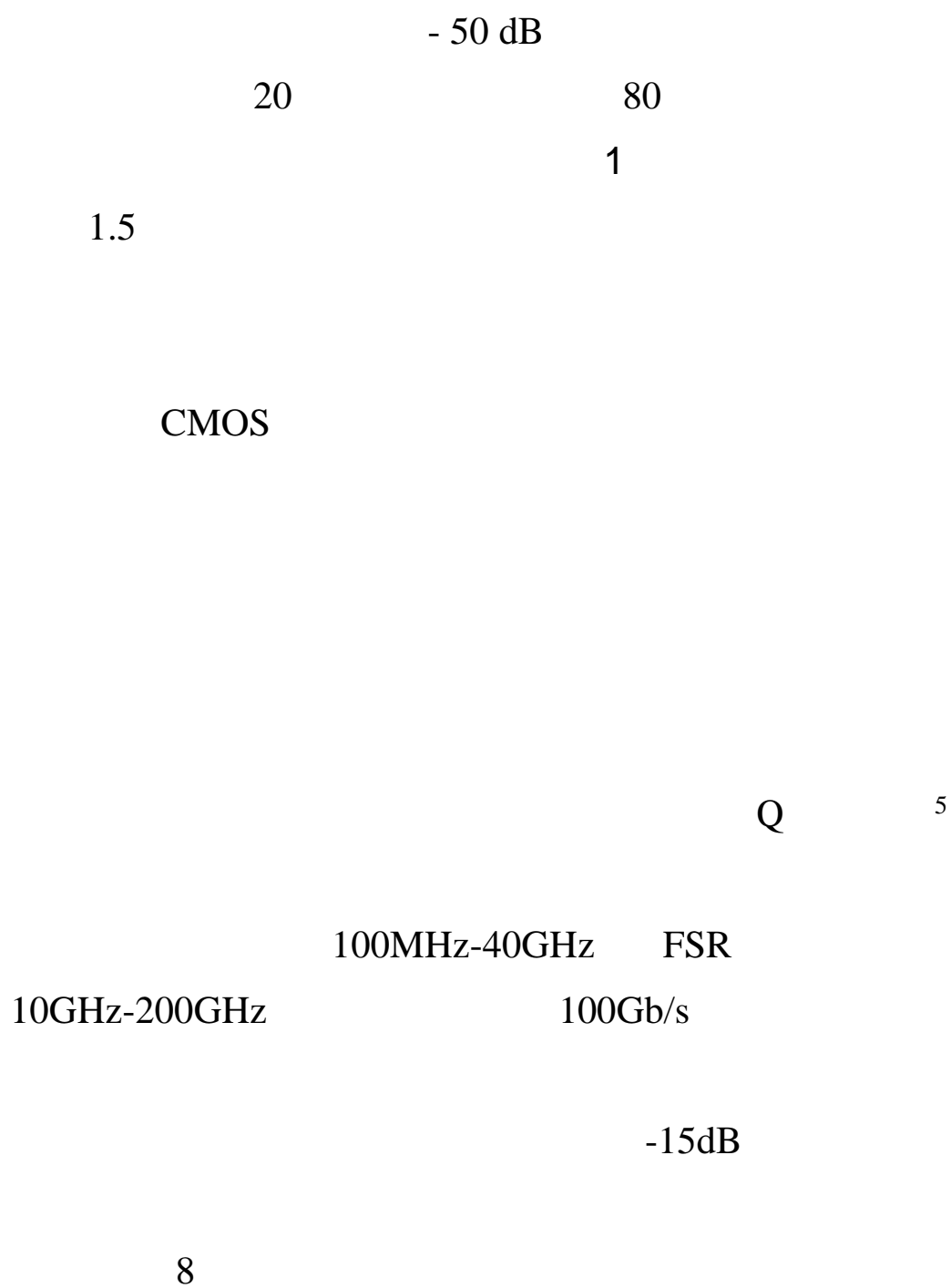
ICR

)

-30dB
30

1.4

CMOS



20

80

1.6

CDCG-ROADM

CDCG-ROADM

1×20

12.5GHz

2×1×20

6.25GHz

CDCG-ROADM

30

1.7

50Gb PON

50G

EML

EML

DML

APD

EML

APD

PON

50Gb/s
 (TIA) 50Gb/s
 (LA) 50Gb/s
 (CDR)
 DML 50Gb/s
 DML
 50G EML 3dB
 6dBm 50G APD 3dB 35GHz
 -20dBm@1E-3 50G DML 3dB
 6dBm ER 4dB O
 50Gb/s TIA
 GHz @ APD =22fF 50Gb/s LA
 400mVpp
 50Gb/s CDR
 8ps-pp 400mVpp
 50Gb/s DML
 15ns 80mA 100mA
 30
 1.8 DFB PAM4 100G
 PAM4
 DFB
 112Gb/s PAM4
 112Gb/s

112Gb/s

10km

112Gb/s PAM4

QSFP

10km

1310nm

-1.4dBm

OMAouter

-6.1dBm@1E-3

DFB

3dB

1310nm

ER

3.5dB

3dB

112Gb/s PAM4

DFB

FEC

-3

30

1.9 CMOS

CMOS

CMOS

Tb/s

2

ps

40

20

80

1.10

400Gb/s

400Gb/s

400Gb/s

400Gb/s

400Gb/s

400Gb/s

400Gb/s

400Gb/s

400Gb/s

56Gb/s

840~860nm

830~870nm

-5dBm@BER 2E-4

-2dBm

-7dBm@BER 2E-4

400Gb/s

MSA

ZR

1.11 5G

5G

25Gb/s

5G

/

25Gb/s

-40~+90

dB

-5

-40~+85

Cyclic

/

G.metro

±50pm

-25dB

25Gb/s

G.metro

20

5G

30

1.12

(

)

:

1550nm/1064nm

-8

1550nm/1064nm

1550nm/1064nm

1550nm/1064nm

1550nm/1064nm

-43dBm@10Gb/s

30

1.13

()

-140dBc/Hz@10kHz

1525-1565nm

8

100 GHz

2/3

$10^{-19}/$

50ps

30

1.14

(

)

1×8

32×32

25GHz

200

6

DC-60GHz

-10dB

2/3

5~40GHz

1×8

32×32

DC-20GHz

2 40GHz

30

2.

2.1

)

(

III-V

Si III-V

Si III-V

)

512×4

¹² cmHz^{1/2}/W

20 80
 2.2 ()
 Si Ge LNOI
 LNOI
 LNOI
 PIN APD
 Si Ge
 Si LNOI
 LNOI
 GHz LNOI V
 dB
 30
 2.3

/

2

30

2.4

50

30

2.7

()

TOF

2.8 100G/400G

(

)

100G/400G

100Gb/s 400Gb/s

			VCSEL	
Driver+CDR				TIA+CDR
	100G/400G			
	DFB		Driver+CDR	
	TIA+CDR		400Gb/s	
			EML	
Driver+CDR			TIA+CDR	PAM4
	PAM4			
PAM4	/			100Gb/s
200Gb/s			Driver	
	TIA			
	VCSEL			100Gb/s
	28Gb/s	400Gb/s		56Gb/s
PAM4			6mA	6mA
			DFB	
	100Gb/s		28Gb/s	400Gb/s
	56Gb/s	PAM4		
30mA	30mA			EML
			64Gb/s	PAM4
			Driver	Driver
	700mV			
TIA				
Driver	TIA	Driver	TIA	
	30GHz	Driver	400mV	

Driver

TIA

30dB

30

3.

3.1

MCU

MCU

MCU

CPU

MCU

200 MHz

CPU

2

250

3

10

85

CAN 2.0A/B

AEC-Q100 Grade 1

ECU

3.2

	USB 4.0	DP 2.0		PCIe
USB 2.0/3.0	DP	USB 4.0		
			USB 4.0	DP 2.0
Gbps PHY			20 Gbps	<1E-9
<100 mW/		0.6%		>24
dB		USB 4.0	DP 2.0	PHY
	BIST		PRBS31	80-bit
		FEC		
USB 4.0	DP 2.0		4	2
2		20 Gbps	USB 4.0	DP
2.0		USB 4.0		PCIe
USB 2.0/3.0	DP	USB 4.0		USB 4.0
DP 2.0				USB 4.0

1000

3.3

NB-IoT GNSS
SoC

CMOS

NB-IoT GNSS

SoC

CMOS

NB-IoT GNSS

NB-IoT

GNSS

1.8 V ~ 4.2 V

700 MHz ~ 2.4 GHz NB-IoT

-117 dBm @ 180 kHz PSM 2 W,

65 mW

23 dBm GNSS

-146 dBm,

-155 dBm

-158 dBm

3.5m

CEP,

1

10 mW

NB-IoT

100

3.4

8

3

1 rms @

0.5-100 Hz

1 GΩ

70 dB

20 mV

0.5%

3.8 DRAM

AI

DRAM AI

DRAM

DRAM DRAM

DRAM AI

8 Gb

CNN DRAM

GPU TPU CNN

2

4.

4.1 EDA

EDA 1

AI EDA

2

EDA

3

4

7/5nm

1 AI EDA EDA

10% 2 0.5 VDD

3

5 4 500
5 20 50
5.
5.1

CMOS

CMOS 3 nm 100 nm 20 ns
0.1 pJ 10
1 Mb