

To our customers,

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# M64886FP

## RF Transceiver for Short-range Wireless

REJ03F0087-0100Z

Rev.1.0

Sep.22.2003

### Description

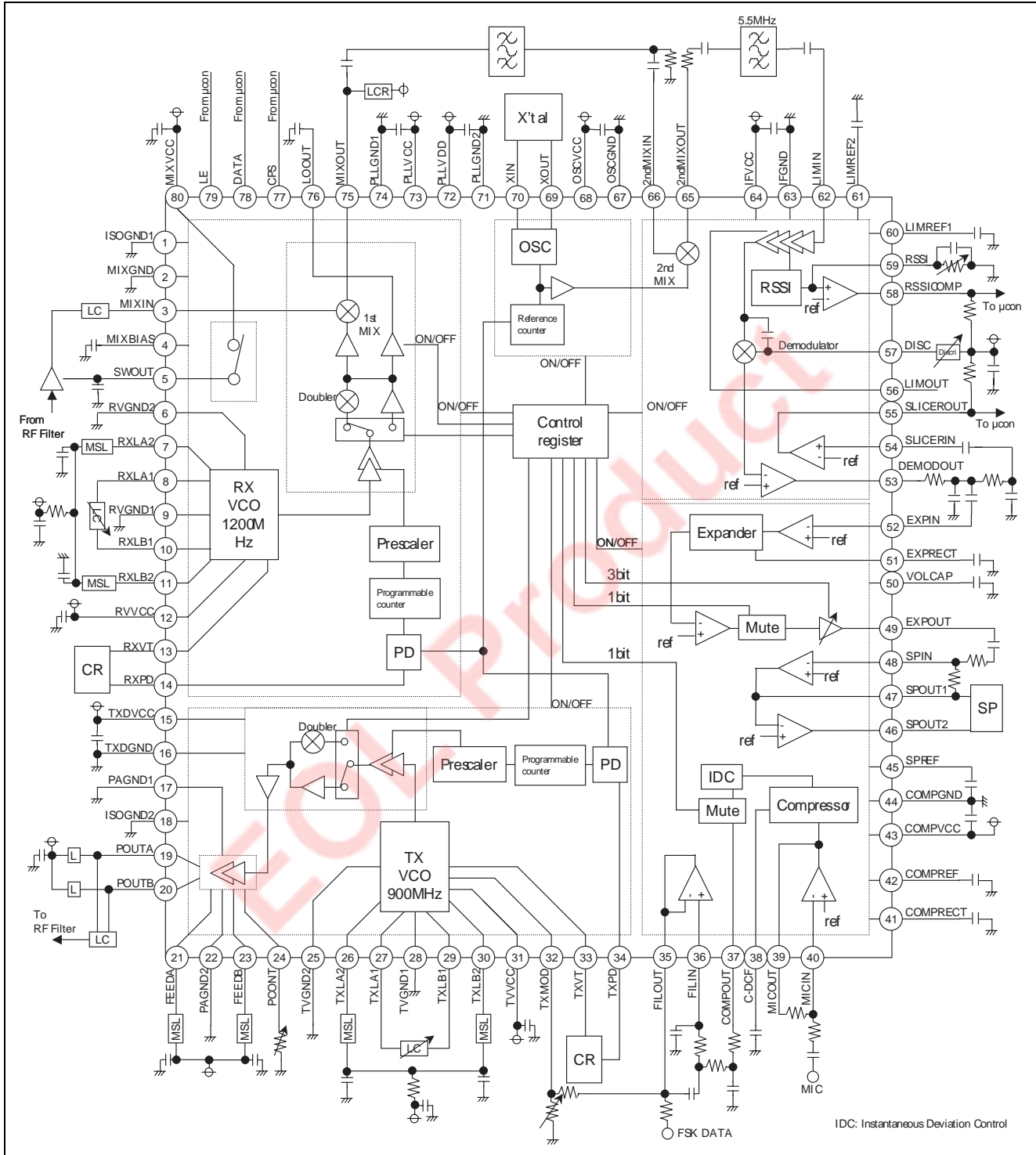
The M64886FP is a semiconductor integrated circuit designed for RF / IF / AF transceiver function with Dual PLL synthesizer for double conversion system cordless phone which used by 2.4 GHz and 900MHz ISM band of North America. It contains dual PLL and VCO circuit for RX / TX, PA for transmission output, double balance type mixer for the 1st and 2nd intermediate frequency, LIM and RSSI and Demodulator for 5.5 MHz, Expander (include volume control function) / Compressor (include IDC, Splutter Filter block) and Speaker / Microphone Amp for Audio signal. It is possible to control level of TX power by external variable resistor. It is designed using a high-frequency BiCMOS process and contributes to reduce size of system and power consumption.

### Features

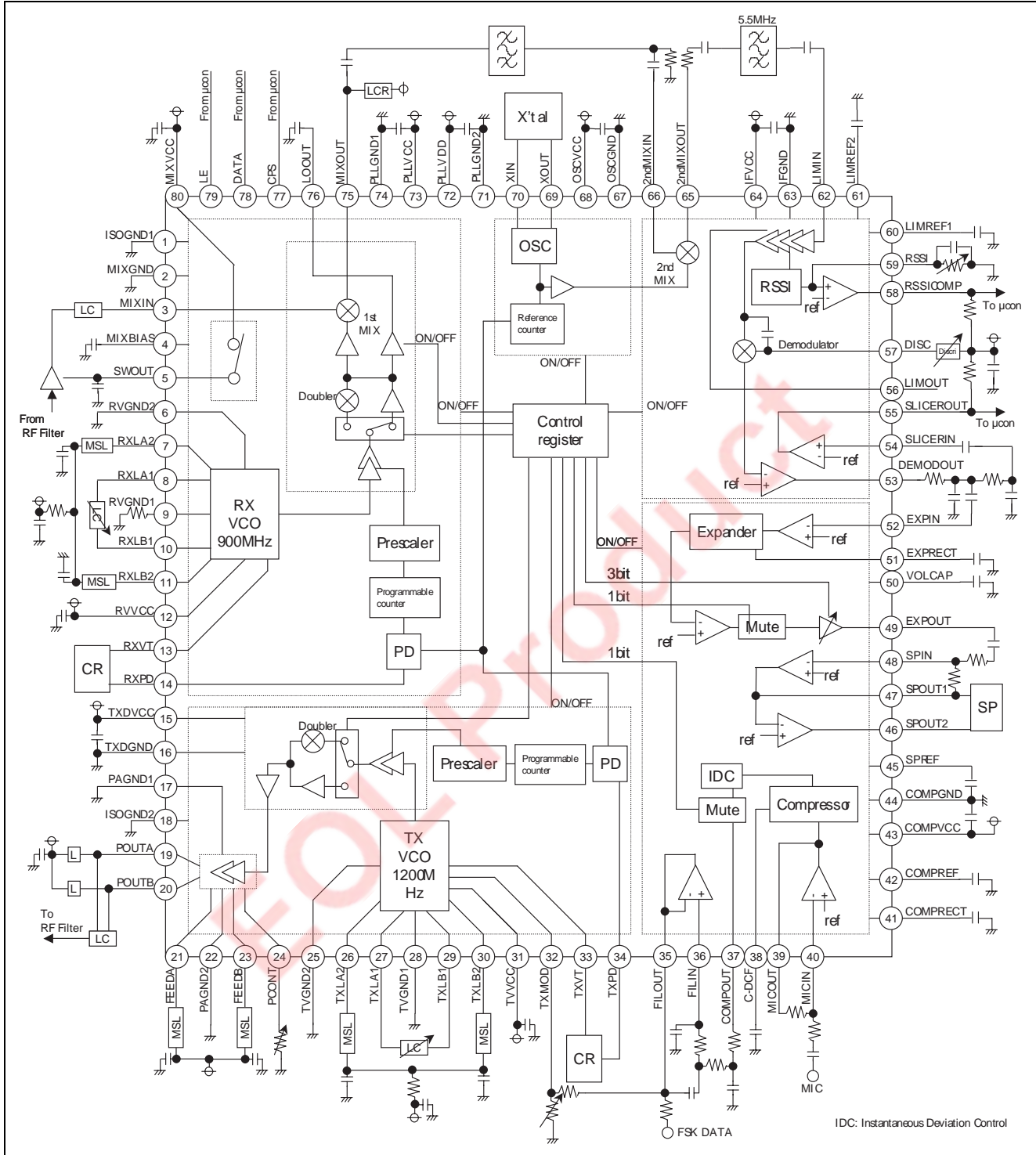
- Receiver
  - It is possible to construct double conversion system.
  - Built in 1st MIX for 1st IF which can respond up to 2.4 GHz band.
  - Built in 2nd MIX and LIMITTER and RSSI and Demodulator for 2nd IF.
  - Built in Expander and Speaker Amp for Audio signal.
- Transmission
  - Built in PA (Pout = -1dBm max) which can respond up to 2.4 GHz band.
  - It is possible to control level of power by external variable resistor.
  - Out put is differential type, it is need to connect to RF filter with a balun circuit.
  - Built in Microphone Amp and Compressor and IDC and Splutter Filter for Audio signal.
- Synthesizer
  - Built in Differential type VCO for TX and RX which can respond up to 1.2 GHz band.
  - Built in 2-multiple circuit which can respond up to 2.4 GHz band.
  - Built in 2-modulus prescaler which can respond up to 1.2 GHz band.
  - Built in current output type charge pump.
  - Built in B-E Colpitts type crystal oscillation for reference frequency.
- Current consumption
  - Stand by mode = PLL+VCO+ DBL+LO+MIX+IF = 28 mA Typ.
  - TX / RX mode (ID) = Stand by + PLL+VCO+DBL+PA = 55 mA Typ.
  - TX / RX mode (Talk) = TX / RX mode (ID) +AF+SP = 65 mA Typ.
  - Off mode = < 50  $\mu$ A

# Block Diagram

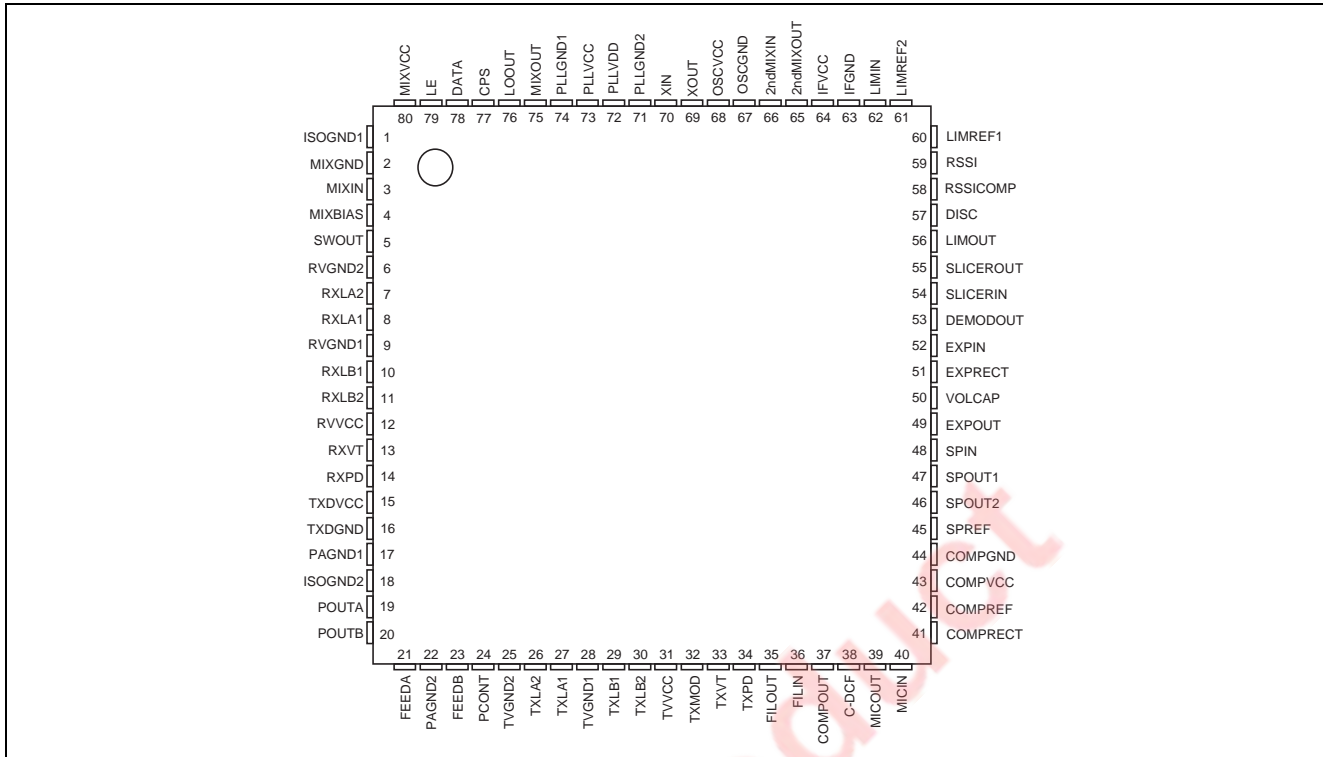
## 1. TX = 900M & RX = 2400M



2. TX = 2400M & RX = 900M



## Pin Configuration



## Pin Description

Pin No.	Symbol	Pin Name	Functions
1	ISOGND1	Isolation ground	DC ground for isolation.
2	MIXGND	1st Mixer ground	DC ground for 1st mixer.
3	MIXIN	Receive RF input	RF input pin (Base pin of internal Transistor). It is need to connect to matching circuit by external parts.
4	MIXBIAS	1st Mixer bias	1st Mixer bias voltage. Decoupled to ground with capacitor.
5	SWOUT	SW output	DC power supply to the external RF circuit.
6	RVGND2	RX VCO ground 2	DC ground for RX VCO.
7	RXLA2	RX VCO LA2	RX VCO amplifier output A2. Connect to inductor.
8	RXLA1	RX VCO LA1	RX VCO amplifier output A1.
9	RVGND1	RX VCO ground 1	DC ground for RX VCO.
10	RXLB1	RX VCO LB1	RX VCO amplifier output B1.Connect to LA1.
11	RXLB2	RX VCO LB2	RX VCO amplifier output B2.Connect to inductor.
12	RVVCC	Power supply (RX VCO)	DC power supply to the RX VCO.
13	RXVT	RX VCO tuning voltage input	RX VCO tuning voltage input from PLL loop filter.
14	RXPD	RX charge pump output	Charge pump output for RX PLL. When Rx is off, Charge pump output is HiZ.
15	TXDVCC	Power supply (TX Doublers)	DC power supply to the TX doublers.
16	TXDGND	TX Doublers ground	DC ground for TX doublers.
17	PAGND1	Power amp ground 1	DC ground for power amp.
18	ISOGND2	Isolation ground	DC ground for isolation.
19	POUTA	Transmit RF output A	RF output pin which is an open collector. Pull up to VCC with inductor.
20	POUTB	Transmit RF output B	RF output pin which is an open collector. Pull up to VCC with inductor.
21	FEEDA	Power amp feed A	Feed connect for 1st power amp, and outputs open collector. Pull up to VCC with inductor.
22	PAGND2	Power amp ground 2	DC ground for power amp.
23	FEEDB	Power amp feed B	Feed connect for 1st power amp, and outputs open collector. Pull up to VCC with inductor.
24	PCONT	Power amp control	It is possible to control level of PA. Connect to ground with variable resistor.

## Pin Description (cont.)

Pin No.	Symbol	Pin Name	Functions
25	TVGND2	TX VCO ground 2	DC ground for TX VCO.
26	TXLA2	TX VCO LA2	TX VCO amplifier output A2. Connect to inductor.
27	TXLA1	TX VCO LA1	TX VCO amplifier output A1.
28	TVGND1	TX VCO ground 1	DC ground for TX VCO.
29	TXLB1	TX VCO LB1	TX VCO amplifier output B1. Connect to LA1.
30	TXLB2	TX VCO LB2	TX VCO amplifier output B2. Connect to inductor.
31	TVVCC	Power supply (TX VCO)	DC power supply to the TX VCO.
32	TXMOD	TX modulation input	TX modulation input from splutter filter output.
33	TXVT	TX VCO tuning voltage input	TX VCO tuning voltage input from PLL loop filter.
34	TXPD	TX charge pump output	Charge pump output pin of TX PLL. When TX is off, Charge pump output is HiZ.
35	FILOUT	Splutter filter output	Splutter filter output pin.
36	FILIN	Splutter filter input	Splutter filter input pin.
37	COMPOUT	Compressor output	Compressor output pin .
38	C-DCF	Compander decouple	Internal compressor and expander reference voltage . Decoupled to ground with capacitor .
39	MICOUT	Mic output	Mic amp output pin
40	MICIN	Mic input	Mic amp input pin .
41	COMPRECT	Compressor rectifier	Internal compressor rectifier voltage . Decoupled to ground with capacitor .
42	COMPREF	Compressor reference	Internal compressor reference voltage. Decoupled to ground with capacitor .
43	COMPVCC	Power supply (Compander)	DC power supply to the compressor and expander .
44	COMPGND	Compander ground	DC ground for compressor and expander .
45	SPREF	Speaker reference	Speaker reference voltage . Decoupled to ground with capacitor .
46	SPOUT2	Speaker output 2	Speaker amp output pin 2 .
47	SPOUT1	Speaker output 1	Speaker amp output pin 1 .
48	SPIN	Speaker input	Speaker amp input pin 1 .
49	EXPOUT	Expander output	Expander output pin .
50	VOLCAP	Volume amplifier reference	Volume amplifier reference voltage. Decoupled to ground with capacitor .
51	EXPRECT	Expander rectifier	Internal expander rectifier voltage. Decoupled to ground with capacitor .
52	EXPIN	Expander input	Expander input pin . Demodulate signal input .



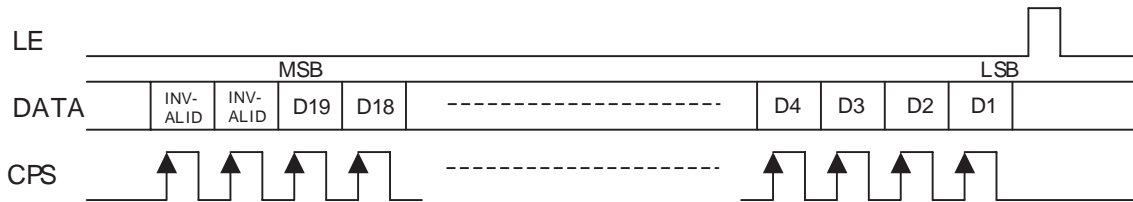
## Pin Description (cont.)

Pin No.	Symbol	Pin Name	Functions
53	DEMODOOUT	Demodulator output	Demodulator output pin .
54	SLICERIN	Slicer input	Slicer input pin . Demodulate signal input .
55	SLICEROUT	Slicer output	Slicer output pin .
56	LIMOUT	Limiter output	Limiter output pin .
57	DISC	Discriminator port	Pull up to VCC with discriminator .
58	RSSICOMP	RSSI comparator output	RSSI voltage comparator output pin .
59	RSSI	RSSI output	RSSI output pin. It is need to pull down to ground with variable resistor .
60	LIMREF1	Limiter reference 1	Internal limiter reference voltage. Decoupled to ground with capacitor .
61	LIMREF2	Limiter reference 2	Internal limiter reference voltage. Decoupled to ground with capacitor .
62	LIMIN	Limiter input	Limiter input pin . 2nd IF signal input .
63	IFGND	2nd IF ground	DC ground for 2nd mixer and limiter and RSSI and demodulator .
64	IFVCC	Power supply (2nd IF)	DC power supply to the 2nd IF circuits .
65	2ndMIXOUT	2nd mixer output	2nd IF output .
66	2ndMIXIN	2nd mixer input	2nd MIX input pin . 1st IF signal input .
67	OSCGND	OSC ground	DC ground for OSCO.
68	OSCVCC	Power supply (OSC)	DC power supply to the OSC.
69	XOUT	X'tal oscillator circuit input	Emitter pin of internal transistor for crystal oscillator.
70	XIN	X'tal oscillator circuit input	Base pin of internal transistor for crystal oscillator.
71	PLLGND2	PLL ground 2	DC ground for PLL logic .
72	PLLVDD	Power supply (PLL)	DC power supply to the PLL logic .
73	PLLVCC	Power supply	DC power supply to the prescaler , CP and OSC .
74	PLLGND1	PLL ground 1	DC ground for prescaler , CP and OSC .
75	MIXOUT	1st mixer output	1st IF output . Connect to tank circuit.
76	LOOUT	Local output	Local output . Pull up to VCC with inductor . (Open Collector type)
77	CPS	Clock pulse input	Operates at the rising edge of the clock pulse of the shift resistor .
78	DATA	Data input	Inputs serial data .
79	LE	Load enable pulse input	Inputs the load enable pulse of 19th pulse counters .
80	MEXICO	Power supply (1st Mixer)	DC power supply to the 1st mixer .

## Functional Description

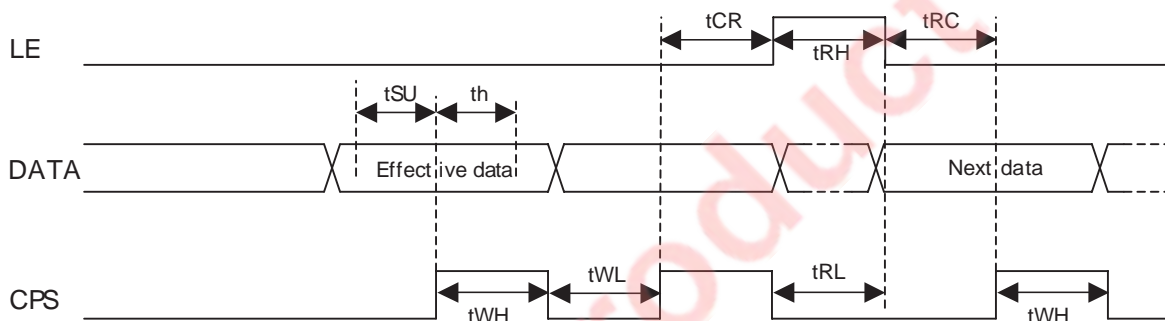
### 1. Data Input

#### (1) Data Entry



- Notes1. At the positive edge of CPS input, DATA input status is read into the shift resistor in sequence.  
 2. All data are set at the positive edge of the 19th pulse. Before MSB, CPS is invalid.  
 3. While LE is set to {L → H}, resistor status is read into latch.

#### (2) Input Signal Timing



$$t_{SU} = t_{WH} = t_{WL} = t_{CR} = t_{RC} > 40\text{n sec}$$

$$t_{RH} = t_{RL} > 20\text{n sec}$$

$$t_h > 10\text{n sec}$$

#### (3) Input Voltage

$$V_{IM} = V_{CC} - 0.3 \text{ to } 3.6 \text{ (V)}$$

$$V_{AL} = -0.2 \text{ to } 0.3 \text{ (V)}$$

## 2. Shift Register Bit Configuration

Shift register	MSB																LSB		
	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
REF divider	Invalid Data					lcp		Division ratio for REF divider (10bits)										H	H
	*	*	*	*	*	RB	RA	$2^9$ ----- $2^0$											
TX divider	Division ratio for TX divider (17 bits)																	L	H
	$2^{16}$ ----- $2^0$																		
RX divider	Division ratio for RX divider (17 bits)																	H	L
	$2^{16}$ ----- $2^0$																		
Control Data	Test Mode						LO Amp	DBL	Volume			Mute		ON/OFF			L	L	
	L	L	L	L	L	L	DK	DJ	DI	DH	DG	DF	DE	DD	DC	DB			DA

Notes: 4. DA , DB and DC are used to turn on / off the power supply to the TX and RX systems .

DC (AF)	DB (RX / IF)	DA (TX)	Description
L	L	L	TX and RX / IF and Speaker / Mic amp / Compander are all on .
H	L	L	ID mode. TX and RX / IF are on .
L	H	L	TX and Speaker/Mic amp / Compander are on .
H	H	L	Only TX is on .
L	L	H	RX /IF and Speaker / Mic amp / Compander are on .
H	L	H	Stand by mode . Only RX / IF is on .
L	H	H	Only Speaker / Mic amp / Compander are on .
H	H	H	TX and RX / IF and Speaker / Mic amp / Compander are all off .

Notes: 5. DD and DE are used to turn on/off the mute to the TX (DD) and RX (DE) systems .

DE / DD	Description
L	Mute on .
H	Mute off .

Notes: 6. DF, DG and DH are used to select volume level to be updated .

DH	DG	DF	volume level
H	H	H	0dB
H	H	L	-2.5dB
H	L	H	5.0dB
H	L	L	-7.5dB
L	H	H	-10.0dB
L	H	L	-12.5dB
L	L	H	-15.0dB

## M64886FP

Notes: 7. DI and DJ are used to turn on / off the Doublers to the TX (DI) and RX (DJ) systems .

DI / DJ	Description
L	Doubler on .
H	Doubler off . (Doubler through)

Notes 8. DK are used to turn on / off the Local Amp to the RX systems .

DK	Description
L	Local Amp on .
H	2mA

Notes 9. RA and RB are used to set the current of TX (RA) and RX (RB) charge pump .

RB / RA	Output current value of charge pump
L	400 $\mu$ A
H	2mA

Notes: 10. Current supplied to the charge pump for TX and RX can be set independently in systems .

However , when power supply is turned off , the charge pump output is placed in "HiZ" status regardless of set value .

11. The division ratio of the programmable divider for reference frequency is given in 10-bit binary code .

For reference N (Fref) =  $2 \times (20+22 \text{ to } 29) = 2 \times (5 \text{ to } 1023) = 10 \text{ to } 2046$  : Only even number .

12. The division ratio of the programmable divider for TX and RX are given in 17-bit binary code .

For TX local N (FvcoTX) = 4096 to 131071

For RX local N (FvcoRX) = 4096 to 131071

13 Example Data ( 1 )

/ Condition

TX VCO frequency = 950 MHz , TX local and TXOUT frequency = 1.90 GHz

RX VCO frequency = 896.75 MHz , RX local frequency = 916 MHz

TX and RX are all on , TX Doubler on , RX Doubler off , RX Local Amp off

Charge pump current = 400 $\mu$ A , volume level = -10 dB

Reference frequency = 10.25 MHz , Ch span = 250 kHz , Comparison frequency = 125 kHz

/ Setting

1) Control data 1 (when Power ON): MSB"0000001100111111100"LSB

2) N (Fref) = 10.25MHz / 125 kHz = 82

Fref bit condition= $82 / 2=41$  : MSB "00000010100111" LSB

3) N (FvcoTX) = 950MHz / 125 kHz = 7600: MSB "0000111011011000001" LSB

4) N (FvcoRX) = 896.75Hz / 125 kHz = 7174: MSB "0000111000000011010" LSB

5) Control data 2 : MSB "0000001100111100000" LSB

Example Data ( 2 )

/Condition

TX VCO frequency = 907 MHz , TX local and TXOUT frequency = 907 MHz

RX VCO frequency = 955.125 GHz , RX local frequency = 1.91025 GHz

TX and RX are all on , TX Doubler off , RX Doubler on , RX Local Amp on

Charge pump current = 400  $\mu$ A , volume level = -10Db

Reference frequency = 10.25 MHz , Ch span = 250 kHz , Comparison frequency = 125 kHz

/Setting

1) Control data 1 (when Power ON): MSB"0000000010111111100"LSB

2) N (Fref) = 10.25 MHz/125 kHz = 82

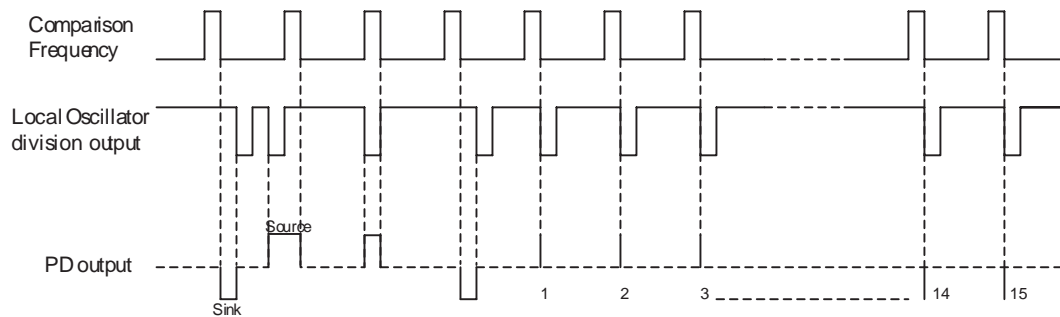
Fref bit condition= $82 / 2=41$ : MSB"00000010100111"LSB

3) N (FvcoTX) = 907 MHz / 125 kHz = 7256: MSB"0000111000101100001"LSB

4) N (FvcoRX) = 955.125Hz / 125 kHz = 7641: MSB"0000111011101100110"LSB

5) Control data 2: MSB"0000000010111100000"LSB

### 3. PD Output



Notes: 14. The PD output is placed in the “Sink” status when the phase of local oscillator division output is behind the phase comparison frequency. It is placed in the “Source” status when the phase of local oscillator division output advances .

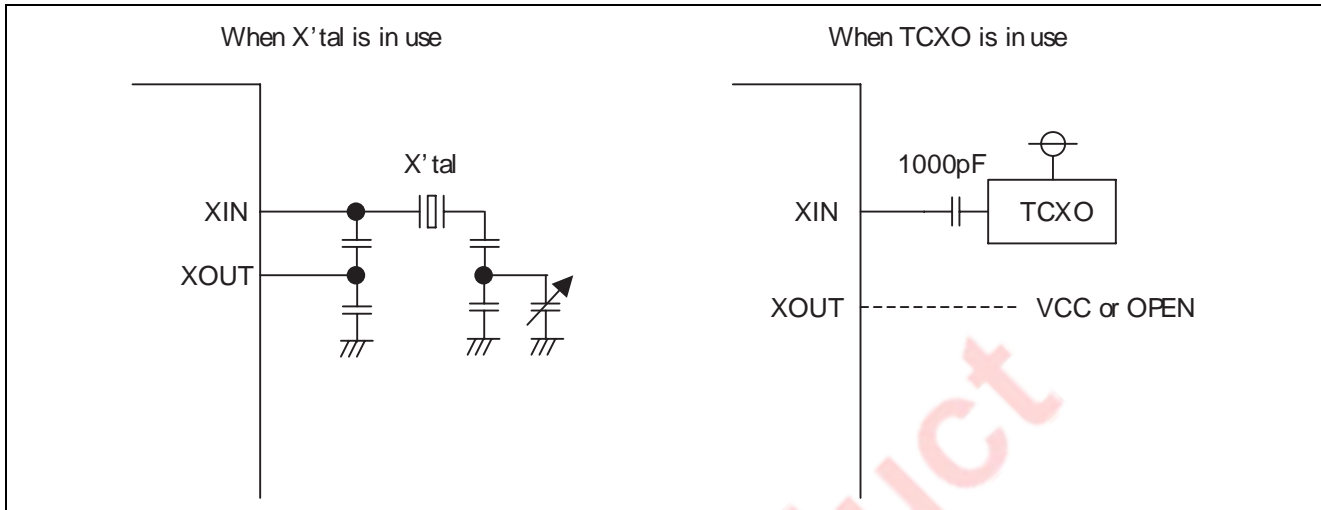
15. “-----” means high impedance status .

EOL Product

## 4. X'tal Oscillation Circuit

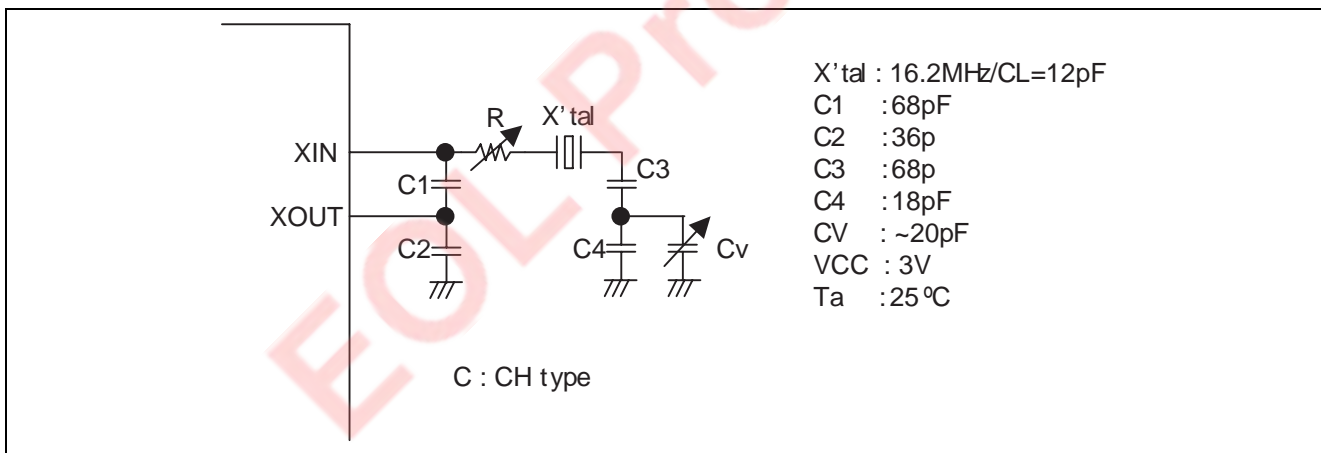
### 4.1 Connection of reference oscillation block

Built-in buffer transistor for oscillation enables direct oscillation at X'tal.  
Connections of X'tal and TCXO are shown below . (recommended circuit)

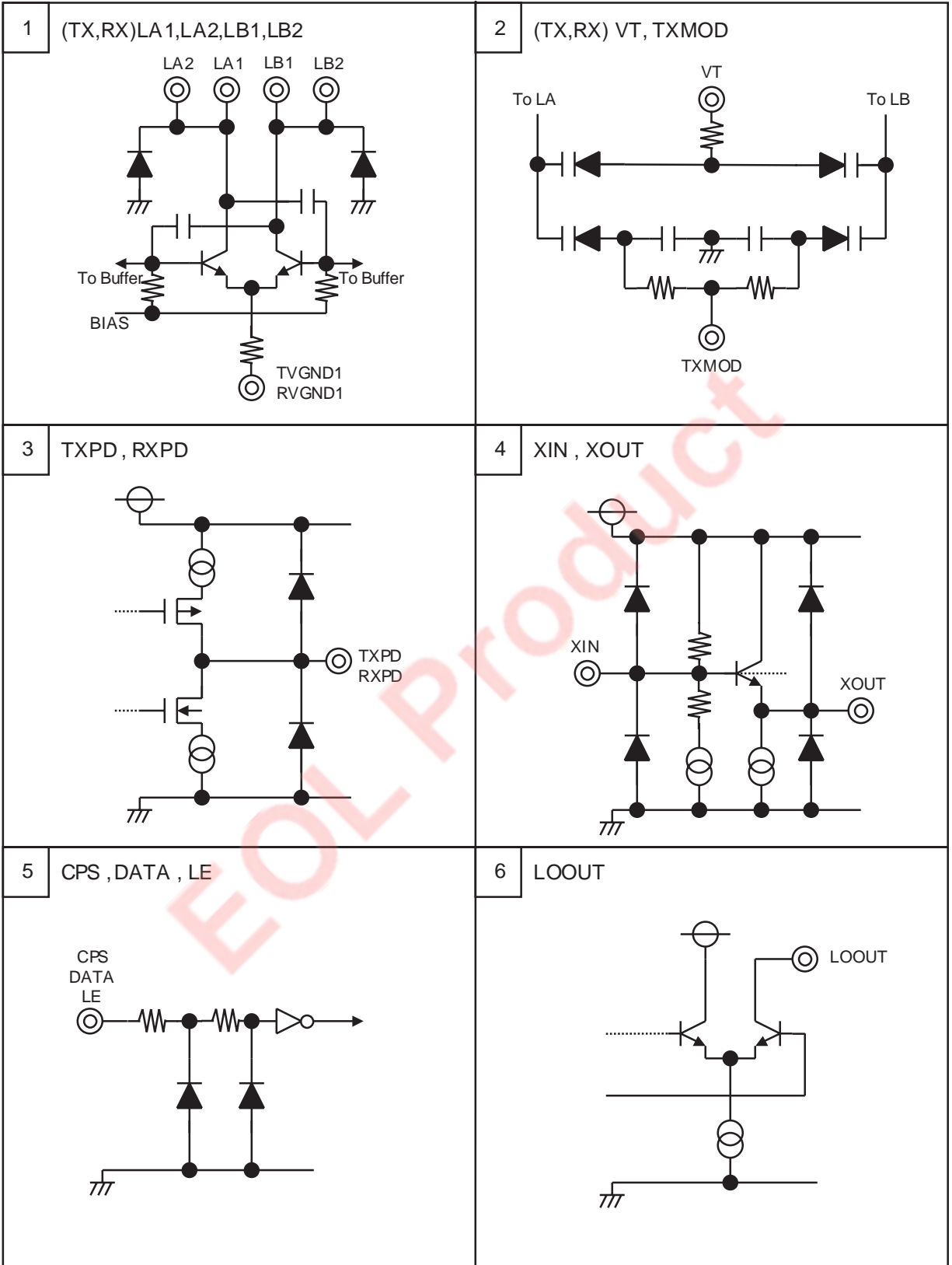


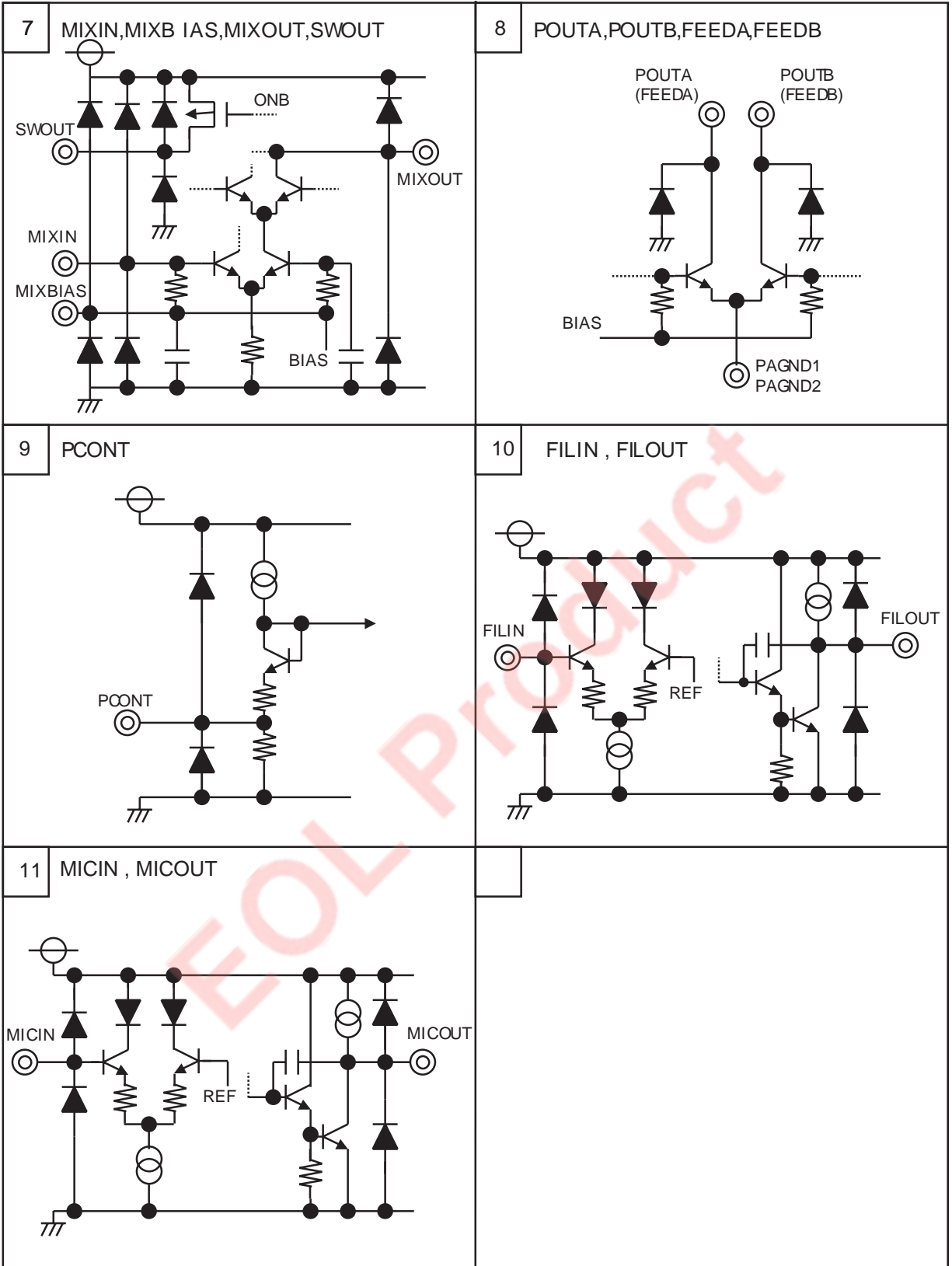
### 4.2 Negative Resistor Evaluation Circuit

Negative resistor in the oscillation circuit are measured on the conditions with coefficients shown in drawing below.

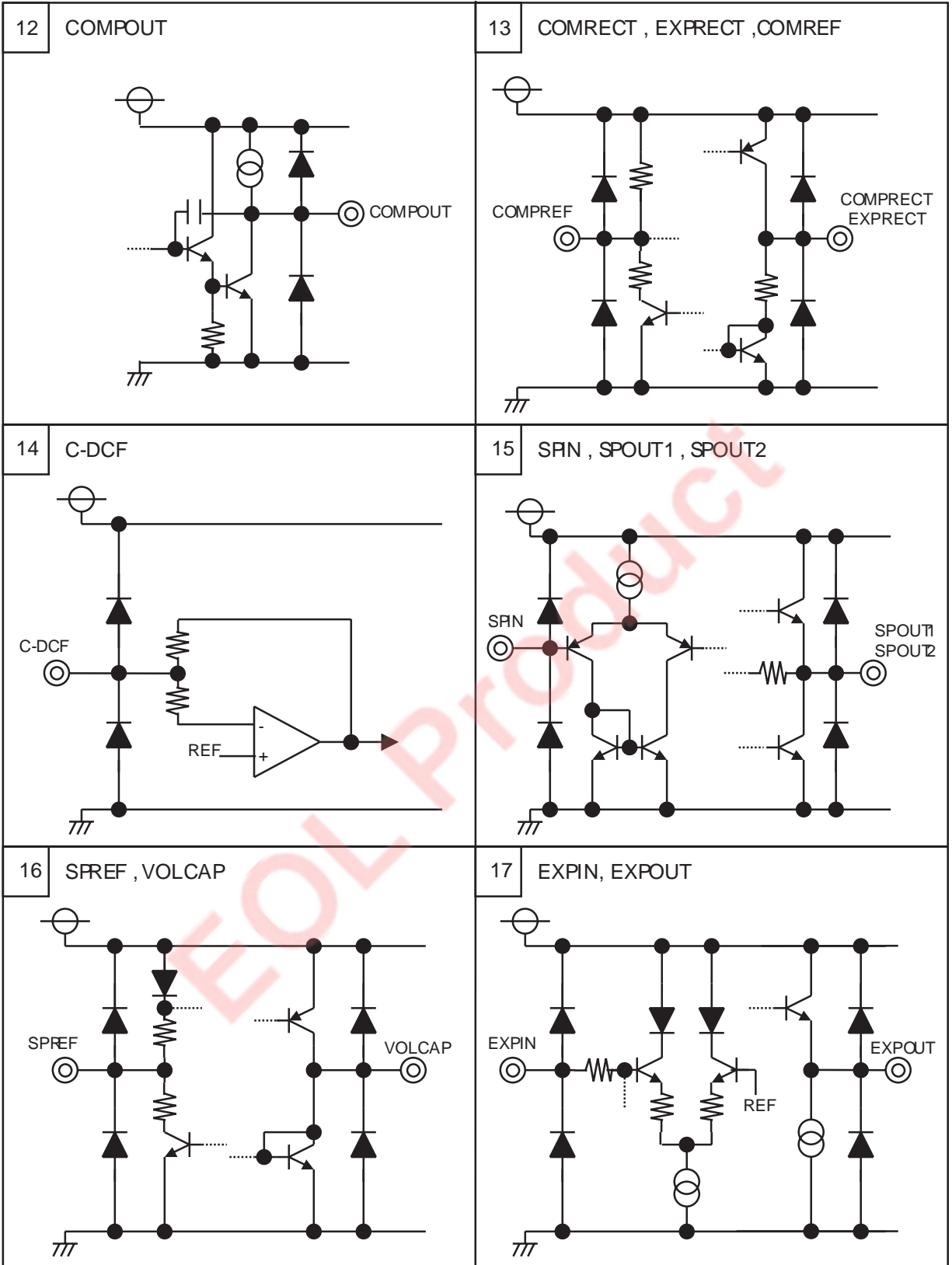


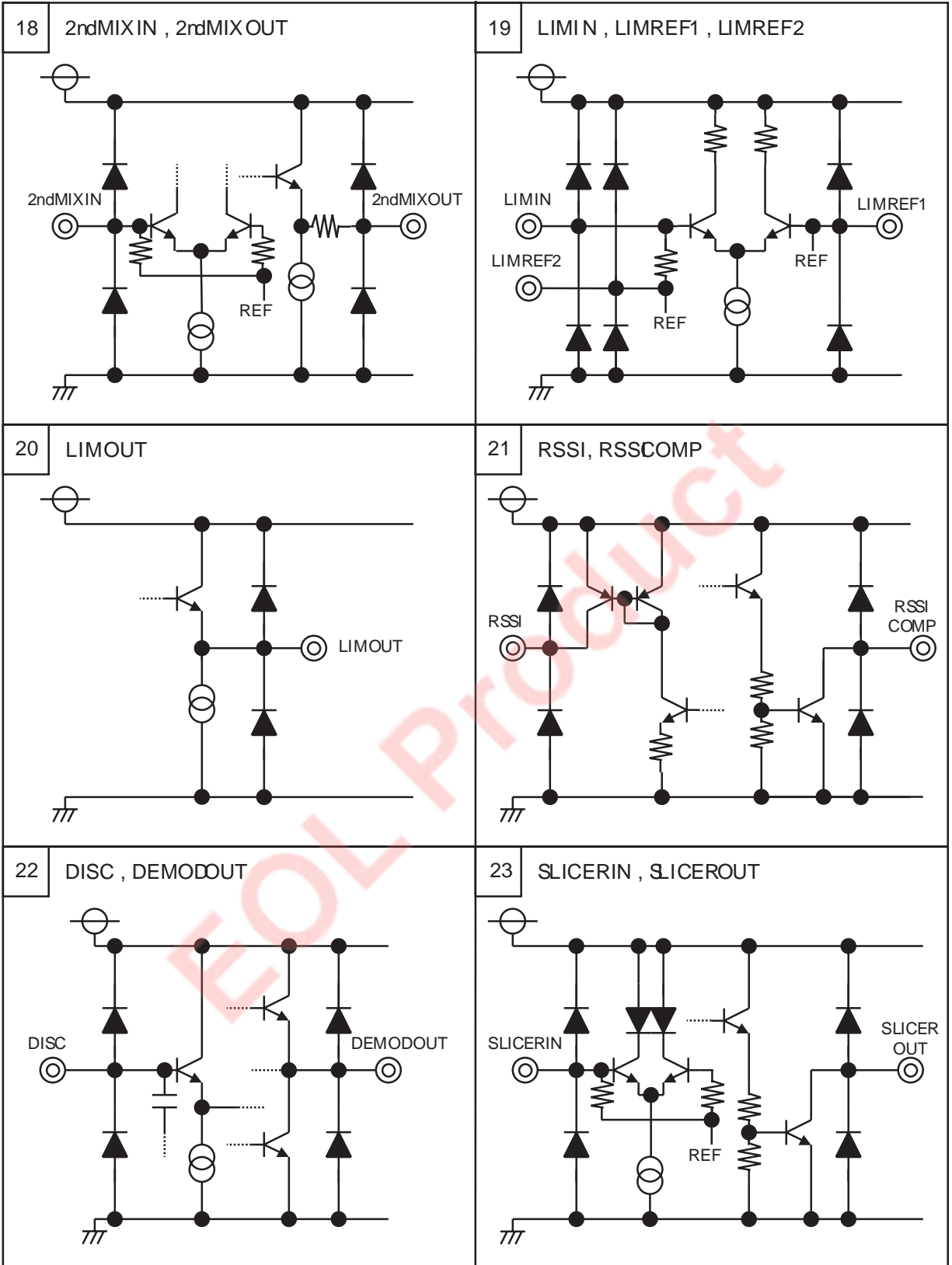
Input Output Equivalent Circuit







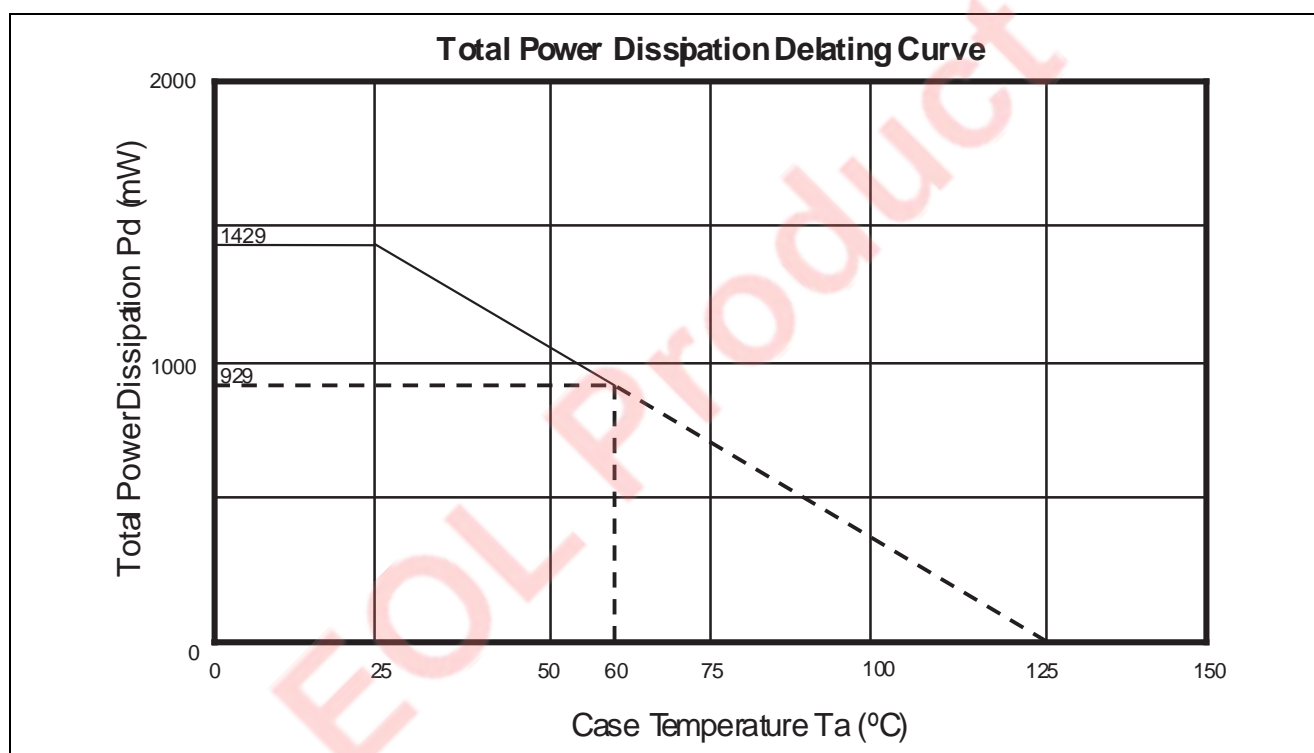




## Absolute Maximum Ratings

( $T_a = 25^\circ\text{C}$  except operating ambient temperature and storage ambient temperature.)

Parameter	Symbol	Test Condition	Ratings		Unit
			Min.	Max.	
Supply Voltage	VCC	GOD = 0 V	-0.3	4.0	
Output Voltage	Vo	FEEDA , FEEDB , POUTA , POUTB , TXLA2 , TXLB2 , RXLA2 , RXLB2 , LOOUT	0	4.0	V
Input Voltage	Vi	CPS , DATA , LE	-0.3	4.0	V
Power Consumption	Pd	$T_a = 60^\circ\text{C}$ , $T_j = 125^\circ\text{C}$ , $\theta_{ja} = 70^\circ\text{C} / \text{W}$	-	929	mW
Junction Temperature	Tj			125	$^\circ\text{C}$
Operating Ambient Temperature	Topr		-10	60	$^\circ\text{C}$
Storage Ambient Temperature	Tstg		-40	125	$^\circ\text{C}$



## Recommended Operating Conditions

(VCC = 3 V / Ta = 25°C , unless otherwise noted)

Parameter	Symbol	Pin	Test Condition	Limits		Unit
				Min.	Max.	
Supply Voltage	VCC	All VCC	GND = 0 V	2.7	3.6	V
RF Input Frequency	FRFIN	MIXIN	–	800	2480	MHz
RF Input Power	PRFIN	MIXIN	–	–	0	dBm
RF Output Frequency	FRFOUT	POUTA POUTB	–	800	2480	MHz
Transmission Local Oscillation Frequency	FLOTX	TXLA1 TXLA2 TXLB1 TXLB2	–	400	1240	MHz
Reception Local Oscillation Frequency	FLORX	RXLA1 RXLA2 RXLB1 RXLB2	–	400	1250	MHz
Reference Oscillation Frequency	FOSC	XIN	VXN = 0.2~1.0 Vpp	3	20	MHz
XIN Input Amplitude	VXIN	XIN	Fosc = 3 to 20 MHz	0.2	1.0	Vpp
Mic Amp Input Power	PMICIN	MICIN	–	0.3	VCC – 0.3	V
Electric Potential between VCC and other VCC				–0.1	0.1	V

## Electrical Characteristics

(VCC = 3 V / Ta = 25°C, unless otherwise noted)

Block	Parameter			Limits			Unit	Measurement circuit
				Min.	Typ.	Max.		
ALL	Standby Current	ICC off	All VCC	When all systems are turned off .			50	μA
	Operating Current	ICC1	All VCC	Standby mode ON: 1stMIX to DEMODOCOMP			28 (TBD)	mA
		ICC2	All VCC	RX-TX mode (ID) ON : ID mode			55 (TBD)	mA
		ICC3	All VCC	RX-TX mode (Tark) When all systems returned on .			65 (TBD)	mA
		ICC4	COMPVCC	ICQ of Speaker and Expander and Compressor .			12 (TBD)	mA

## Electrical Characteristics (cont.)

(VCC = 3 V / Ta = 25°C, unless otherwise noted)

Block	Parameter	Sym- bol	Pin	Test Condition	Limits			Unit	Measurement circuit	
					Min.	Typ.	Max			
PLL	"H" input voltage	VIH	CPS, DATA, LE	Vcc = 2.7 to 3.6 V	VCC -0.3		3.6	V		
	"L" input voltage	VIL	CPS DATA, LE	Vcc = 2.7 to 3.6 V	-0.2		3.0	V		
	"H" input current	IIH	CPS DATA, LE	Vcc = 3.6 V, VIH = 3.6 V			2	μA		
	"L" input current	IIL	CPS DATA, LE	Vcc = 3.6 V, VIL = 0 V	-2			μA		
	CP output current (Source & Sink current)	ICPO	TXPD, RXPD	VPD = 1.5 V	DI, DJ = L			400	μA	
					DI, DJ = H			20	mA	
CP output leak current	ICPLK	TXPD, RXPD	Vcc = 3.6 V, VPD = 1.8 V, Vo = HiZ (OFF)		-100		100	nA		
OSC	OSC bias current	IBIAS1	XOUT	VIH = 3.0 V	175	250	325	μA		
	OSC bias voltage	IBIAS1	XIN	IIF = 0 μA	2.6	2.9	3.0	V		
	OSC bias voltage	VBIAS 2	XOUT	IIF = 0 μA	1.8	2.1	2.4	V		
	Negative Resister	NR	XIN	Shown in Page 12	100	330		Ω		

## Electrical Characteristics (cont)

(VCC = 3V / Ta = 25°C , unless otherwise noted)

Block	Parameter	Symbol	Pin	Test Condition	Limits			Unit	Measurement circuit
					Min.	Typ.	Max		
RF (VCO)	Output Current	IVCO	RXLA1 RXLA2 RXLB1 RXLB2	TXLA1 TXLA2, TXLB1, TXLB2, DC current		4.7		mA	
			RXLA1 RXLA2 RXLB1 RXLB2	TXLA1 TXLA2, TXLB1, TXLB2, DC current		4.7		mA	
PLL	Bias Voltage	VLNA	MIXIN	IIF = 0 $\mu$ A		1.4		V	
	Sensitivity	SIN	MIXIN	MIXIN– 50ohm-match 12dB SINAD		-105	-102 (TBD)	dBm	
	Voltage Conversion Gain	CG	MIXIN MIXOUT	MIXIN to MIXOUT FRFIN = 2400 MHz PRFIN = -60 dBm FLORX = 1195 MHz MIXOUT = 10 MHz		22.0	–	dB	Reference Value
	Input Power 1dB Compression	IP1dB	MIXIN, MIXOUT	MIXIN to MIXOUT FRFIN = 2400 MHz PRFIN = -60 dBm FLORX = 1195 MHz MIXOUT = 10 MHz		-23.0		dBm	Reference Value
	3rd Input Intercept Point	IIP3	MIXIN, MIXOUT	MIXIN to MIXOUT FMIXIN = 2400 MHz $\Delta f1 = FMIXIN+300$ kHz $\Delta f2 = FMIXIN+600$ kHz PMIXIN = -40 dBm FLORX = 1195 MHz IFOUT = 10 MHz		-14.0		dBm	Reference Value
	LOOUT Power	PLO	LOOUT	FLORX = 950 MHz FLOOUT=1900 MHz		-10	(TBD)	dBm	
RF (TX)	Transmission Output Power	PRFOUT	POUTA POUTB	FRFOUT = 2400 MHz PCONT adjust by external variable resistor		-1		dBm	
	TX Modulation	FMOD	TXMOD POUTA POUTB	FRFOUT = 2400 MHz TXMOD adjust by external variable resistor		$\pm 30$		kHz	

## Electrical Characteristics (cont)

(VCC = 3 V / Ta = 25°C , unless otherwise noted)

Block	Parameter	Symbol	Pin	Test Condition	Limits			Unit	Measur ement circuit
					Min.	Typ.	Max.		
DEM0D	Output Voltage	VO1	2ndMIXIN DEM0D0UT	2ndMIXIN = 10.7 MHz, 80 dBμ, Dev = ±30 kHz FOSC = 16.2 MHz 2nd.IF = 5.5 MHz		100		mVrms	
RSSI	RSSI Output Voltage	VRSSI1	2ndMIXIN RSSI	2ndMIXIN = 100 dBμ		1.65		V	
		VRSSI2		2ndMIXIN = 70 dBμ		1.45			
		VRSSI3		2ndMIXIN = 30 dBμ		0.60			
		VRSSI4		Non input at 2nd MIXIN		0.35			
RSSI- Comp.	Threshold Voltage 1	VTH1	RSSI		0.5	0.7	0.9	V	
	Hysteresis width	HYS	RSSICOMP		120	150	180	mV	
	"H" Output Voltage 2	VOH2			2.3		3.0	V	
	"L" Output Voltage 2	VOL2			0		0.3	V	
Slicer	Duty Ratio 1	DR1	SLICERIN SLICEROUT	SLICERIN fin = 30 kHz Vin = 100 mVrms	45	50	55	%	
	Duty Ratio 2	DR2	SLICERIN SLICEROUT	SLICERIN fin = 1 kHz Vin = 20 mVrms	45	50	55	%	
	Threshold Voltage 2	VTH2	SLICERIN		1.3	1.5	1.7	V	
	"H" Output Voltage 3	VOH3	SLICEROUT		2.3		3.0	V	
	"L" Output Voltage 3	VOL3	SLICEROUT		0		0.3	V	

## Electrical Characteristics 5

(VCC=3V / Ta = 25°C , unless otherwise noted)

Block	Parameter	Symbol	Pin	Test Condition	Limits			Unit	Measur ement circuit
					Min.	Typ.	Max.		
Expander	Output Reference Voltage 1	VSO1	EXPOUT	Vin = -20 dBV = 0 dB	-24.0	-20.0	-16.0	dBV	
	Delta Gain 1	dG1		Delta Vin = +5dB	-1.0	-0.1	+1.0	dB	
	Delta Gain 2	dG2		Delta Vin = -10dB	-1.0	0	+1.0		
	Delta Gain 3	dG3		Delta Vin = -20dB	-1.5	+0.1	+1.5		
	Distortion 1	THD1		Vin = -20dBV		0.5	1.0	%	
	Limiting Voltage 1	VL1		point of THD = 10%	0.3	0.5		Vrms	
	Mute Attenuation 1	ATT1		RX Mute ON Vin = -20 dBV	50	60		dB	
Volume Amp	GAIN	G1	EXPOUT	DF, DG, DH = 1, 1, 1		0		dB	
		G2		DF, DG, DH = 0, 1, 1	-4.0	-2.5	-1.0		
		G3		DF, DG, DH = 1, 0, 1	-6.5	-5.0	3.5		
		G4		DF, DG, DH = 0, 0, 1	-9.5	-7.5	-5.5		
		G5		DF, DG, DH = 1, 1, 0	-12.0	-10.0	-8.0		
		G6		DF, DG, DH = 0, 1, 0	-15.0	-12.5	10.0		
		G7		DF, DG, DH = 1, 0, 0	-17.5	-15.0	12.5		
Speaker Amp	Open Loop Gain	GVO	SPIN SPOUT1 SPOUT2	Open Loop		71		dB	
	Voltage Gain 1	GV1	SPIN SPOUT1	fin = 1 kHz vin = 100 mVrm	Amp1	12.0	14.0	16.0	dB
	Voltage Gain 2	GV2	SPOUT1 SPOUT2	RL = 150 Ω	Amp2	-3.0	0.0	+3.0	dB
	Voltage Gain 3	GV3	SPIN SPOUT1 SPOUT2		Amp1 +Amp2	18.0	20.0	22.0	dB
	Distortion 2	THD2	SPOUT2		PO = 10 mW		0.5	1.0	%
	Max. Output Power	POM	SPOUT2		THD < 10%	13	19		mW
	Load Impedance	RL	SPOUT2	Fin = 1 kHz Vin = 100 mVrms		32	150		Ω



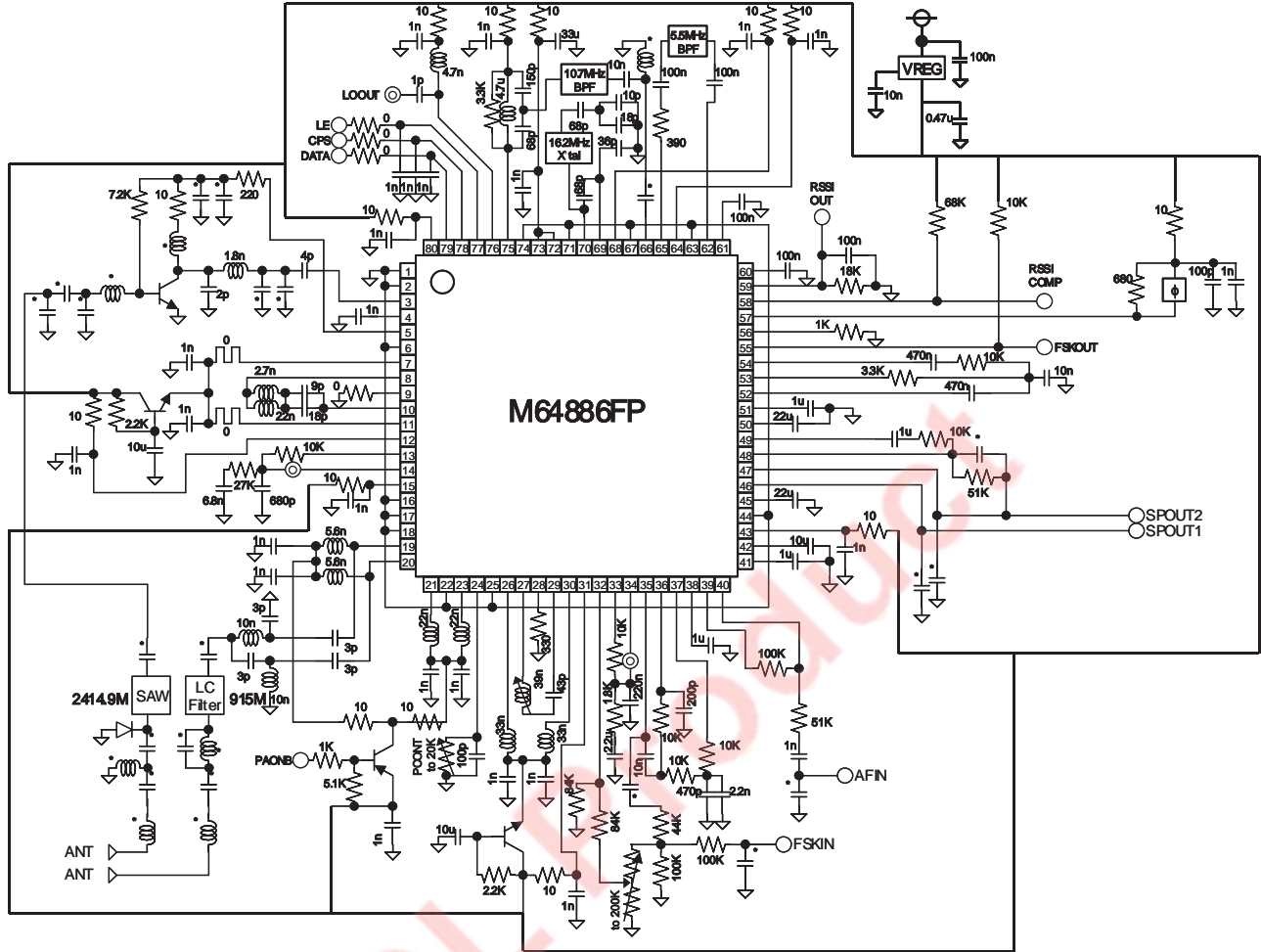
## Electrical Characteristics 6

( VCC=3V / Ta=25°C , unless otherwise noted )

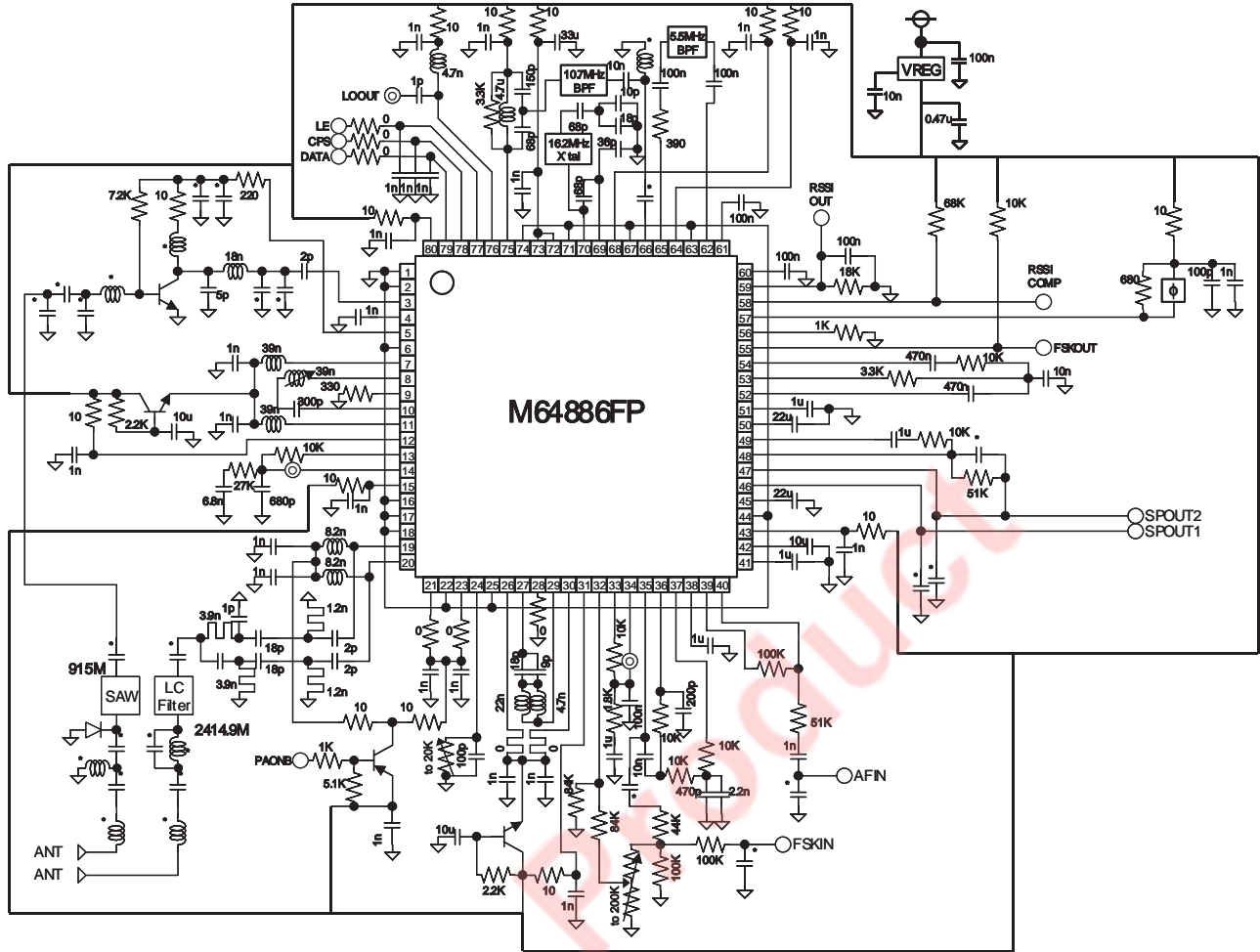
Block	Parameter	Sym- bol	Pin	Test Condition	Limits			Unit	Measur- ement circuit
					Min.	Typ.	Max.		
Mic Amp	Gain	GMA	MICIN MICOUT	MICIN fin = 1 kHz Open Loop	40	60		dB	
Comp ressor	Output Reference Voltage 2	VSO2	COMPOUT	in = -20dBV = 0dB	-22.5	-21.0	-19.5	dBV	
	Delta Gain 4	dG4		Delta Vin = +5dB	-1.0	0	+1.0	dB	
	Delta Gain 5	dG5		Delta Vin = -10 dB	-1.0	0	+1.0		
	Delta Gain 6	dG6		Delta Vin = -20 dB	-1.5	-0.3	+1.5		
	Delta Gain 3	THD3		Vin= -20 dBV		0.5	1.0	%	
	Limiting Voltage 2	VL2			360	450	540	mVpp	
	Mute Attenuation 2	ATT2		TX Mute ON Vin = -20 dBV	50	60		dB	
Splatter Filter	Voltage Gain	GA	FILIN FILOUT	FILIN fin = 1 kHz Vin = 100 mVrms	-0.5	0	+0.5	dB	
		dF1		FILIN fin = 10 kHz Vin=100mVrms		-3			
		dF2		FILIN fin = 100 kHz Vin = 100 mVrms		-60			
	Distortion 4	THD4		FILIN fin = 1 kHz Vin = 100 mVrms		0.02	0.1	%	

# Application Example

## 1. Application Circuit for 900M / 2.4 GHz System



2. Application Circuit for 2.4G / 900 MHz System



**Parts List for Application Circuit**

<b>Parts</b>	<b>Maker</b>	<b>Model Number</b>	<b>Outline</b>
2416 MHz RF Filter	JRC	NSVS775	3*3*1.15mm, Type SMD
900 MHz RF Filter	JRC	NSVS781	3*3*1.mm, Type SMD
2.8 V Regulator	TOKO	TK11128CS	Type SOT23-5
16.2 MHz X'tal	KSS	( KSS16L2M T )	Type HC49 / U-S
10.7 MHz Ceramic BPF	Murata	SFELA10M7GA00-B0	2.5mm Pitch, 3 Terminal
5.5 MHz Ceramic BPF	Murata	SFSRA5M50BF00-B0	2.5mm Pitch, 3 Terminal
5.5 MHz Ceramic Discriminator	Murata	CDSRH5M50EK023-B0	5mm Pitch, 2 Terminal
Chip L	TOKO	LL1608-FS	Type 1608

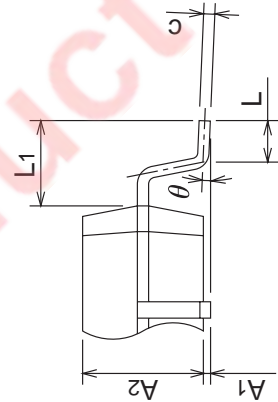
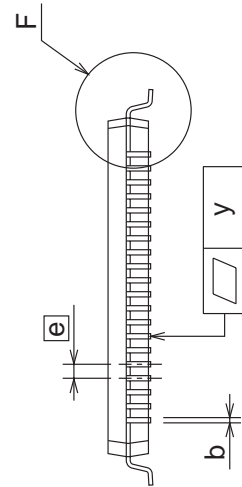
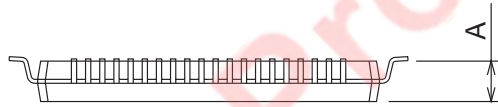
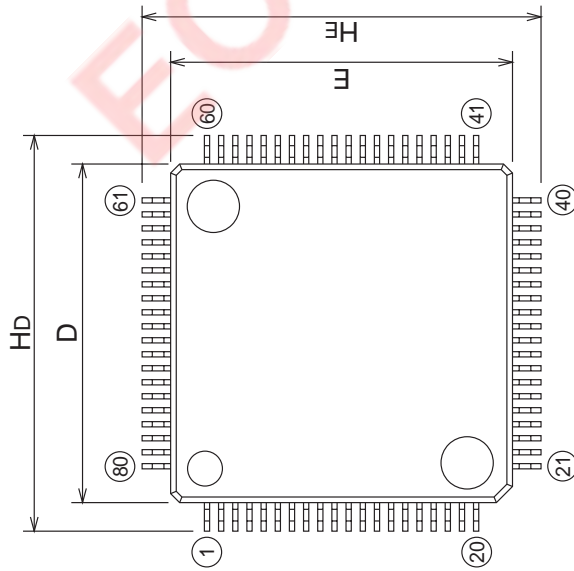
**Cautions for Handling Application Board**

- In this diagram each element constant is only an example , so please check up the values before using this IC .
- In this diagram, coefficients of the X'tal oscillation circuit are just examples. Please ask X'tal unit vendor about the best values of customer's specification.
- For the achievement of high performances in the RX system , the 50  $\Omega$ -matching is necessary in the RFIN port .
- Please place external elements connected to the RF line , near the pins .
- All VCC's decoupling capacitances are important for the achievement of high performances . Please place these elements near the pins.

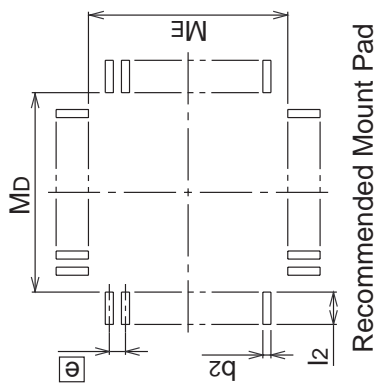
Package Dimensions

80P6Q-A Plastic 80pin 12x12mm body LQFP

EIAJ Package Code LQFP80-P-1212-0.5	JEDEC Code —	Weight(g)	Lead Material Cu Alloy
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Detail F



Recommended Mount Pad

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	—	—	1.7
A1	0	0.1	0.2
A2	—	1.4	—
b	0.13	0.18	0.28
c	0.105	0.125	0.175
D	11.9	12.0	12.1
E	11.9	12.0	12.1
e	—	0.5	—
HD	13.8	14.0	14.2
HE	13.8	14.0	14.2
L	0.3	0.5	0.7
L1	—	1.0	—
y	—	—	0.1
theta	0°	—	10°
b2	—	0.225	—
l2	1.0	—	—
MD	—	12.4	—
ME	—	12.4	—

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