

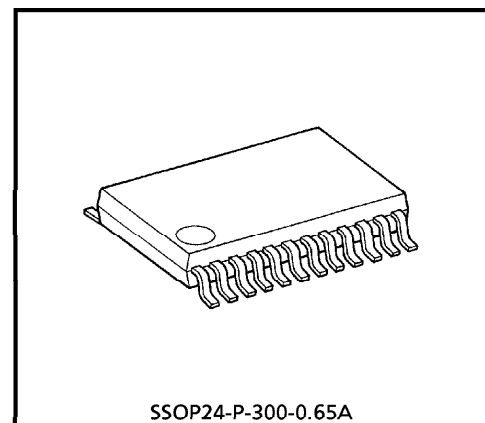
TA1235FN

I/Q DEMODULATOR FOR DIGITAL CATV

The TA1235FN is I/Q demodulator IC for Digital Cable Application. This IC integrates 2nd IF gain control amp, oscillator, mixers, RF-AGC control function and I/Q Baseband single ended amplifiers in a small package.

FEATURES

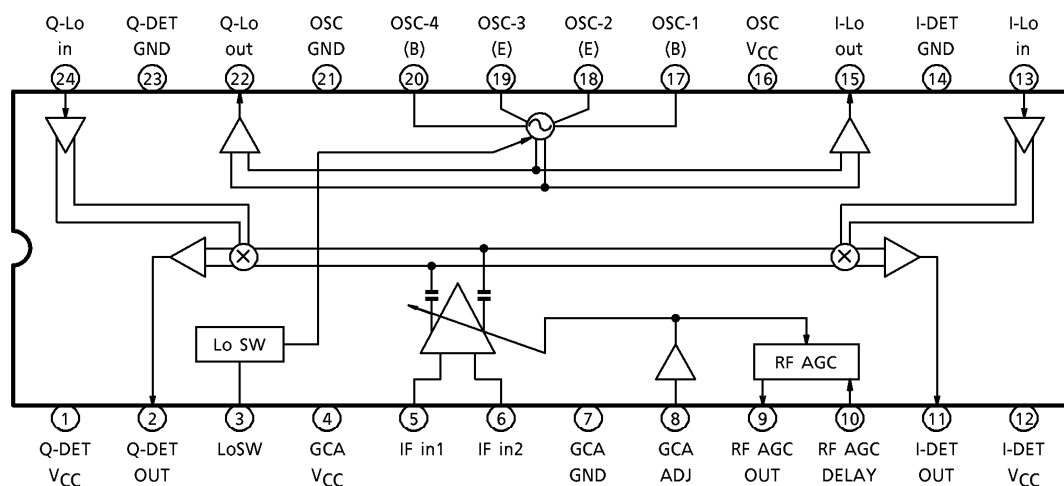
- 2nd IF gain control amplifier
- X'tal/LC application oscillator
- Local oscillator STANDBY function
- Mixers
- I/Q Baseband single ended amplifiers
- RF AGC function



SSOP24-P-300-0.65A

Weight : 0.09g (Typ.)

BLOCK DIAGRAM



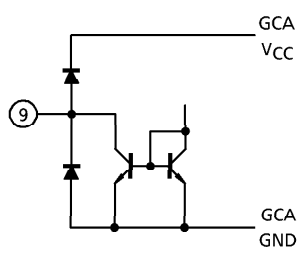
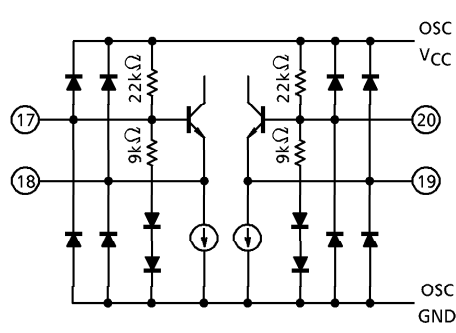
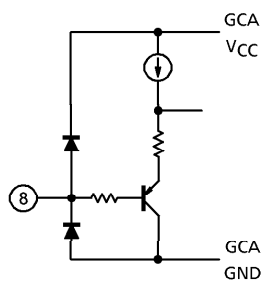
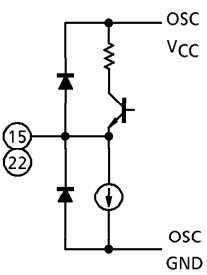
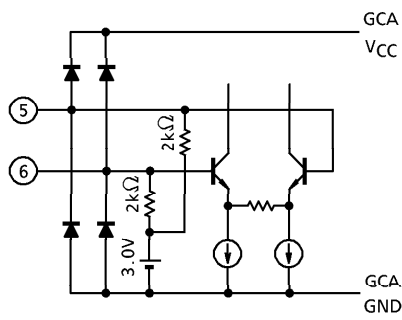
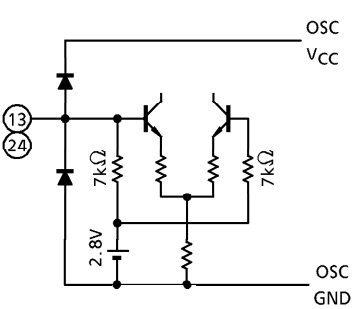
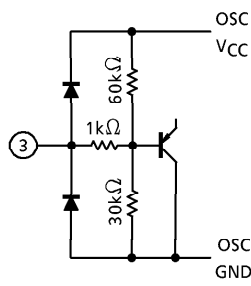
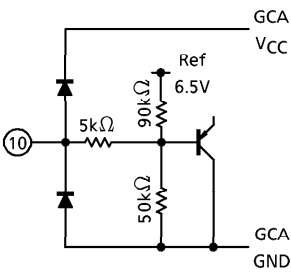
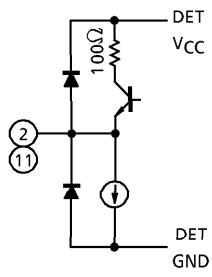
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TERMINAL LIST

PIN No.	PIN NAME	FUNCTION
1	Q-DET V _{CC}	Q Detection Supply Voltage
2	Q-DET OUT	Q Detection Output
3	Lo-SW	Local Oscillation standby-SW
4	GCA V _{CC}	Gain Control Amp Supply Voltage
5	IF-IN1	IF Signal Input 1
6	IF-IN2	IF Signal Input 2
7	GCA GND	Gain Control Amp GND
8	GCA CONTROL	Gain Control Amp Gain Control Input
9	RF AGC OUT	RF AGC Output
10	RF AGC DELAY	RF AGC Delay
11	I-DET OUT	I Detection Output
12	I-DET V _{CC}	I Detection Supply Voltage
13	I-Lo in	I Local Signal Input
14	I-DET GND	I Detection GND
15	I-Lo out	I Local Signal Output
16	OSC V _{CC}	Local Oscillation Supply Voltage
17	OSC-1 (B)	Local Oscillator 1 (Base)
18	OSC-2 (E)	Local Oscillator 2 (Emitter)
19	OSC-3 (E)	Local Oscillator 3 (Emitter)
20	OSC-4 (B)	Local Oscillator 4 (Base)
21	OSC GND	Local Oscillator GND
22	Q-Lo out	Q Local Signal Output
23	Q-DET GND	Q Detection GND
24	Q-Lo in	Q Local Signal Input

TERMINAL INTERFACE



MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V _{CC}	15	V
Power Dissipation	P _d (Note)	780	mW
Operating Temperature	T _{opr}	– 20~75	°C
Storage Temperature	T _{stg}	– 55~150	°C

(Note) When using the device at above Ta = 25°C, decrease the power dissipation by 9.1mW for each increase of 1°C.

RECOMMENDED OPERATING CONDITION

PIN No.	PIN NAME	MIN.	TYP.	MAX.	UNIT
1	Q-DET V _{CC}	8.1	9.0	9.9	V
4	GCA V _{CC}	8.1	9.0	9.9	V
12	I-DET V _{CC}	8.1	9.0	9.9	V
16	L-OSC V _{CC}	8.1	9.0	9.9	V

ELECTRICAL CHARACTERISTICS

DC Characteristics (Unless otherwise specified, V_{CC} = 9V, Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	I _{CC} total	1	—	30	40	55	mA
Terminal Voltage	V ₂	1	V _{AGC} = 3.5V	3.0	4.0	6.0	V
	V ₃		—	1.8	2.3	2.8	
	V ₅		—	2.5	3.0	3.5	
	V ₆		—	2.5	3.0	3.5	
	V ₉		—	0.0	—	0.5	
	V ₁₀		—	2.0	2.5	3.0	
	V ₁₁		V _{AGC} = 3.5V	3.0	4.5	6.0	
	V ₁₃		—	2.1	2.8	3.5	
	V ₁₅		—	7.3	8.0	8.7	
	V ₁₇		—	3.0	3.6	4.2	
	V ₁₈		—	2.2	2.9	3.6	
	V ₁₉		—	2.2	2.9	3.6	
	V ₂₀		—	3.0	3.6	4.2	
	V ₂₂		—	7.3	8.0	8.7	
	V ₂₄		—	2.1	2.8	3.5	

ELECTRICAL CHARACTERISTICSAC Characteristics (Unless otherwise specified, $V_{CC} = 9V$, $T_a = 25^\circ C$)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
IF Input Signal Bandwidth	IFBW		—	30	—	60	MHz
IF Input Signal Level	IFin		Baseband Output = $1.0V_{p-p}$	60	—	90	$dB_{\mu V}$
Standard Baseband Output Level	Bout		—	—	1.0	—	V_{p-p}
Baseband Output Bandwidth	B-BW		(Note 1)	DC	—	10	MHz
Baseband Output Deflection	$B\Delta G$		(Note 1) 100kHz~10MHz	0.0	—	1.0	dB_{p-p}
Baseband Output DC Change	$B\Delta V$		(Note 2) GCA : MIN~MAX Gain	—	—	200	mV
Local Oscillator Operation	fOSC		—	30	—	60	MHz
Local Oscillator Defeat Level	VLo		(Note 3)	0.0	—	1.0	V
GCA Control Range	ΔG_{gca}		(Note 4)	30	60	—	dB
GCA Control Voltage	ΔV_{gca}		—	0.0	—	5.0	V
GCA Control Sensitivity	$\Delta G / \Delta V$		(Note 5)	—	20	30	dB / V
RF AGC MAX Output Voltage	$V_{AGC\ H}$		Pull Up = $39k\Omega$	8.5	—	—	V
RF AGC MIN Output Voltage	$V_{AGC\ L}$		Pull Up = $39k\Omega$	—	—	0.2	V
Noise Figure 1	NF1		(Note 6) IF in = $60dB_{\mu V}$	—	23	—	dB
Noise Figure 2	NF2		(Note 6) IF in = $90dB_{\mu V}$	—	48	—	dB
2nd Intermodulation	IM2		(Note 7)	—	55	—	dB
3rd Intermodulation	IM3		(Note 7)	—	55	—	dB
I/Q Differential Gain Balance	ΔGIQ		—	—	—	± 1	dB
I/Q Differential Phase Balance	ΔPIQ		—	—	—	± 2	°
Local Leak	Lo-B		(Note 8) Local→Baseband	—	15	—	dB

TEST CONDITIONS

(Note 1) Baseband output bandwidth, Baseband output deflection

Local oscillator : External Lo-in

Lo : $f_o = 44\text{MHz}$, -10dBmW

IF input signal : $f_{in} = 34\sim 54\text{MHz}$, -20dBmW

IF GCA voltage : $f_{in} = 43.9\text{MHz}$, -20dBmW

Apply external voltage to the GCA ADJ terminal (Pin 8)

So that the Q-DET OUT terminal (Pin 2), I-DET OUT terminal (Pin 11) output level will be 0dBmW .

Measure the Baseband output bandwidth and Baseband output deflection of the I/Q output terminal (Pin 2, 11) when the IF input frequency varlabled.

(Note 2) Baseband Output DC level change

Local oscillator : Self oscillation

Lo : $f_o = 44\text{MHz}$

IF input signal : IF input terminal (Pin 5, 6) to AC GND (at $0.01\mu\text{F}$)

IF GCA voltage : Apply external voltage to the GCA ADJ terminal (Pin 8)
 $0\text{V}\rightarrow 5\text{V}$.

Measure the Baseband output DC level change of the I/Q output terminal (Pin 2, 11) when the IF GCA voltage gradually raise up.

(Note 3) Local oscillator defeat Level

Local oscillator : Self oscillation

Lo : $f_o = 44\text{MHz}$

Local SW voltage : Apply external voltage to the GCA ADJ terminal (Pin 8)
 $5\text{V}\rightarrow 0\text{V}$.

Using a spectrum analyzer, monitor the Local oscillation signal (44MHz).

Measure the Local oscillation defeat DC level of the Local SW terminal (Pin 3) when the Local SW voltage gradually lower.

(Note 4) GCA Control Range

Local oscillator : Self oscillation
Lo : $f_o = 44\text{MHz}$

IF input signal : $f_{in} = 45\text{MHz}$, -60dBmW

IF GCA voltage: Apply external voltage to the GCA ADJ terminal (Pin 8)
0V, 5V.

Measure the detection output level of the I/Q output terminal (Pin 2, 11) when the IF GCA apply external voltage 0V, 5V.

Calculate The GCA control Range

$$\text{GCA Control Range} = \text{MAX Gain (IF GCA = 5V)} - \text{MIN Gain (IF GCA = 0V)} \quad [\text{dB}]$$

(Note 5) GCA Control Sensitivity

Local oscillator : Self oscillation
Lo : $f_o = 44\text{MHz}$

IF input signal : $f_{in} = 45\text{MHz}$, -60dBmW

IF GCA voltage: Apply external voltage to the GCA ADJ terminal (Pin 8)
1V→2V.

Measure the detection output level of the I/Q output terminal (Pin 2, 11) when the IF GCA apply external voltage 1V→2V.

Calculate The GCA control Sensitivity.

$$\begin{aligned} \text{GCA Control Sensitivity} = \\ (\text{detection output level 2 (IF GCA = 2V)} - \text{level 1 (IF GCA = 1V)}) / 1V \quad [\text{dB/V}] \end{aligned}$$

(Note 6) Noise Figure

Local oscillator : External Lo-in
Lo : $f_o = 44\text{MHz}$, -10dBmW

IF input signal : $f_{in} = 45\text{MHz}$, -60dBmW

IF GCA voltage: Apply external voltage to the GCA ADJ terminal (Pin 8)
So that the I/Q output terminal (Pin 2, 11), output level will be 0dBmW.

Using a spectrum analyzer, monitor the floor-noise level of the I/Q output terminal (Pin 2, 11).

Calculate The Noise Figure

$$\text{Noise Figure} = 174 - 60 + \text{Noise level} - 3 \quad [\text{dB}]$$

(Note 7) 2nd Intermodulation (IM2), 3rd Intermodulation (IM3)

Local oscillator : External Lo-in

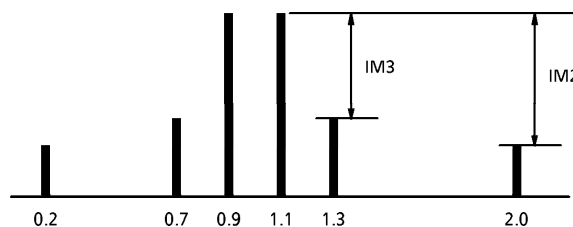
Lo : $f_o = 44\text{MHz}$, -10dBmW

IF input signal : $f_{in1} = 42.9\text{MHz}$, $f_{in2} = 43.1\text{MHz}$ Mixed signal, -20dBmW

IF GCA voltage: Apply external voltage to the GCA ADJ terminal (Pin 8)

So that the I/Q output terminal (Pin 2, 11) output level will be 0dBmW .

Measure the 2nd Intermodulation (IM2), 3rd Intermodulation (IM3) of the I/Q output terminal (Pin 2, 11) at following diagram.



(Note 8) Local leak level (Local→Baseband)

Local oscillator : External Lo-in

Lo : $f_o = 44\text{MHz}$, -10dBmW

IF input signal : IF input terminal (Pin 5, 6) to AC GND (at $0.01\mu\text{F}$)

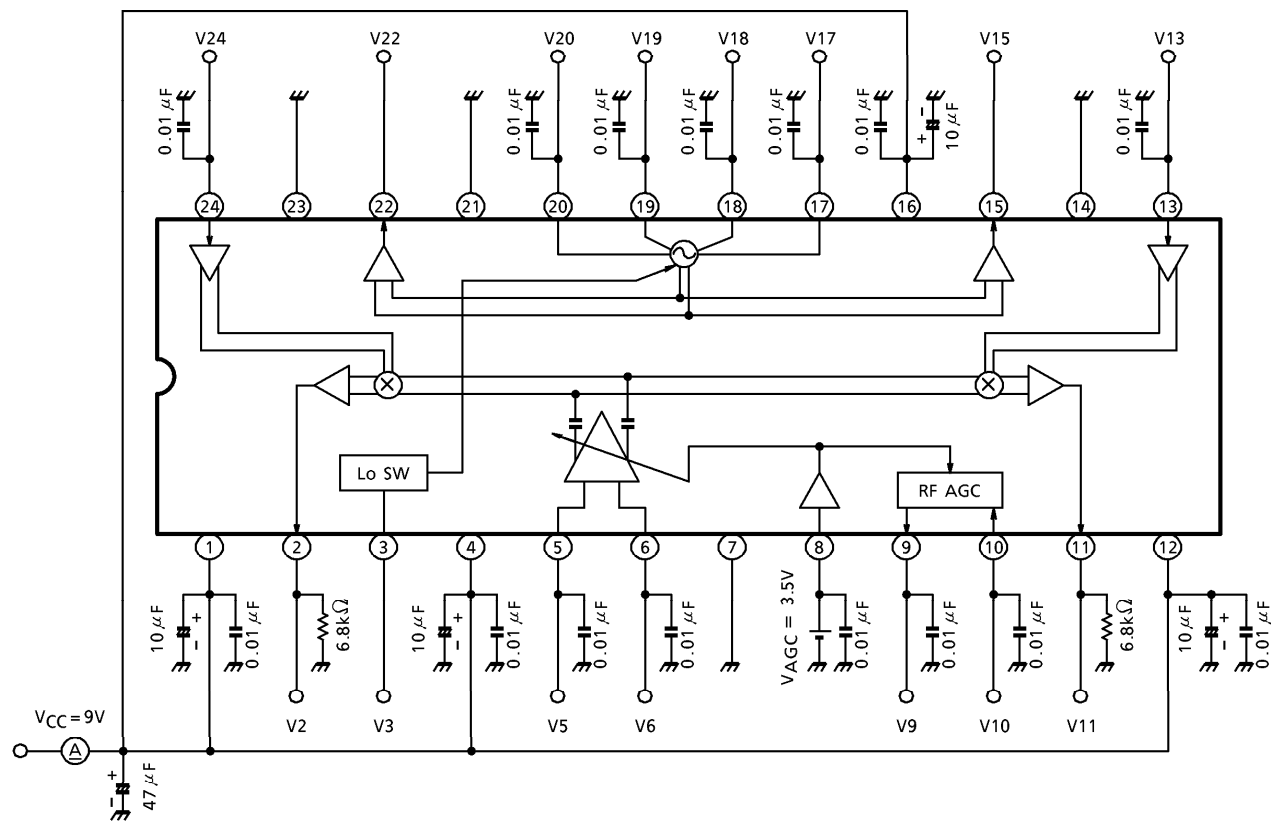
IF GCA voltage: Apply external voltage to the GCA ADJ terminal (Pin 8)

$0\text{V} \rightarrow 5\text{V}$.

Using a spectrum analyzer, monitor the Local oscillation (44MHz) leak level of the I/Q output terminal (Pin 2, 11).

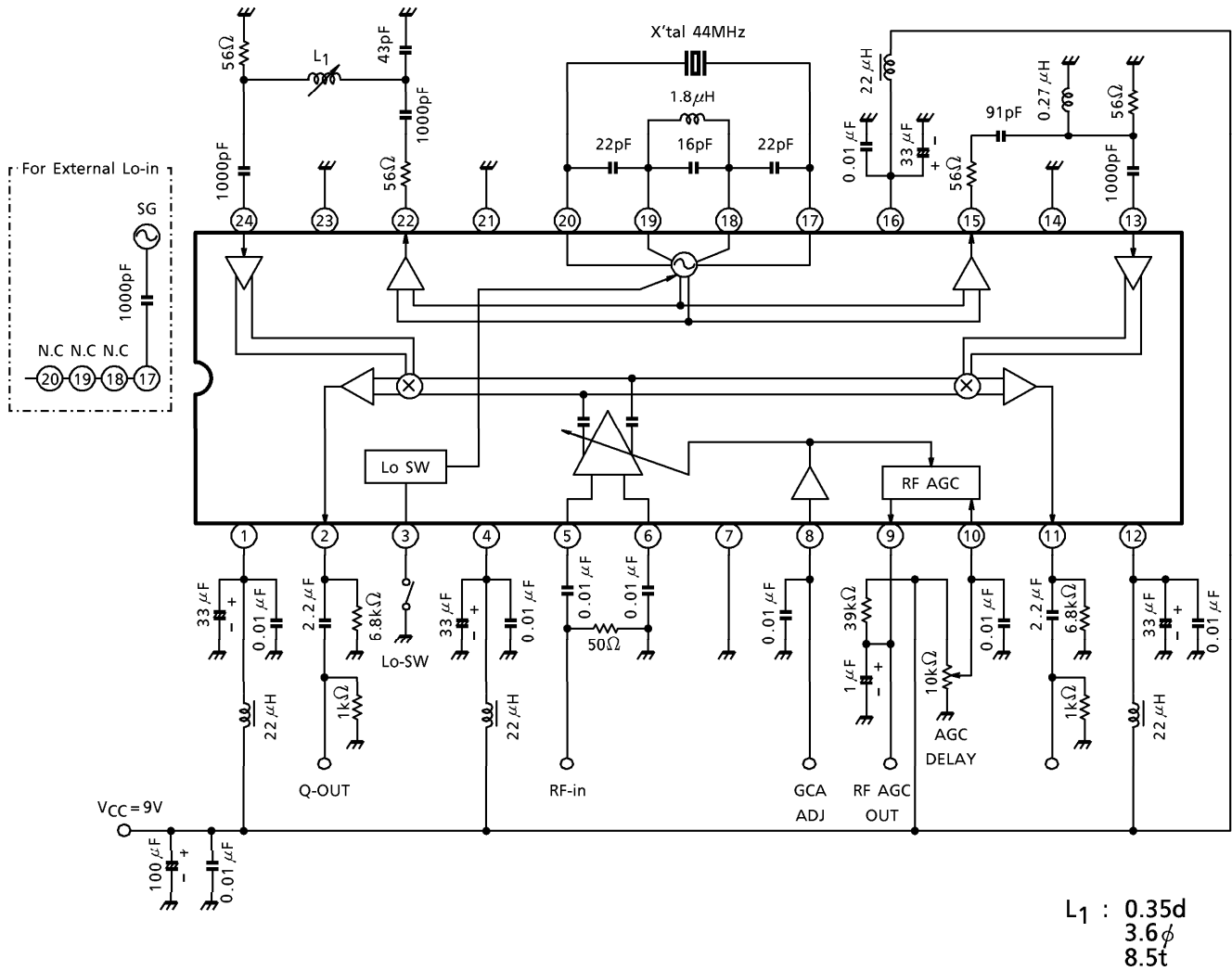
Measure the Local leak level of the I/Q output terminal (Pin 2, 11) when the IF GCA voltage variable.

TEST CIRCUIT 1
DC Characteristic

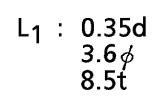


TEST CIRCUIT 2

AC Characteristic

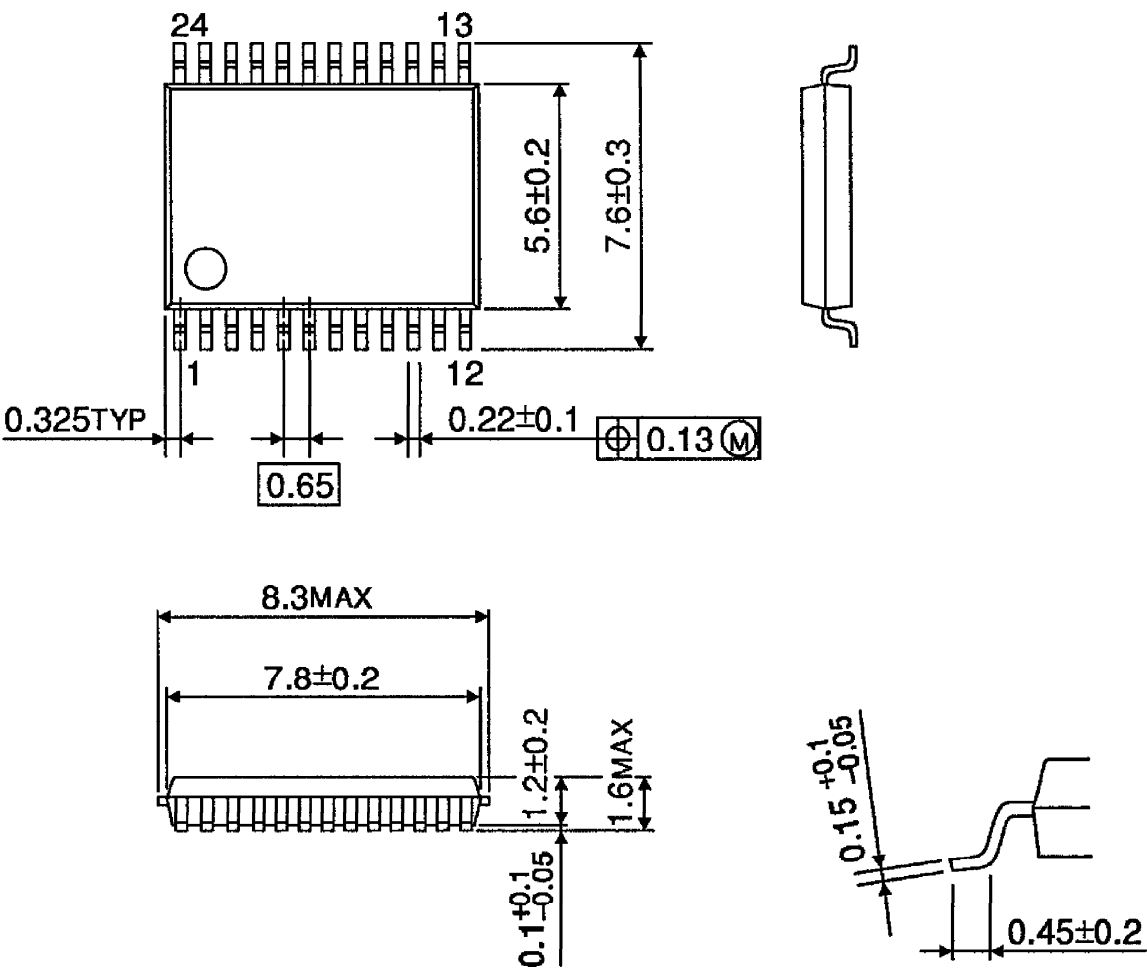


APPLICATION CIRCUIT (US I/Q DEMO)



PACKAGE DIMENSIONS
SSOP24-P-300-0.65A

Unit : mm



Weight : 0.09g (Typ.)