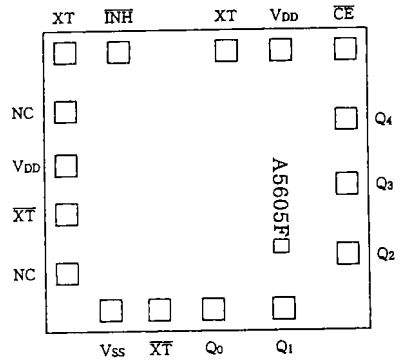
■ OVERVIEW

The SM5605F series are C-MOS LSIs for quartz oscillating module. Each LSI has a high frequency oscillating circuit and dividers with low current consumption. One of the output signals is a fundamental frequency and the others are divided frequencies. This series have two types of oscillating circuits. One is built-in capacitor for oscillating, and the other is the type of external capacitor.

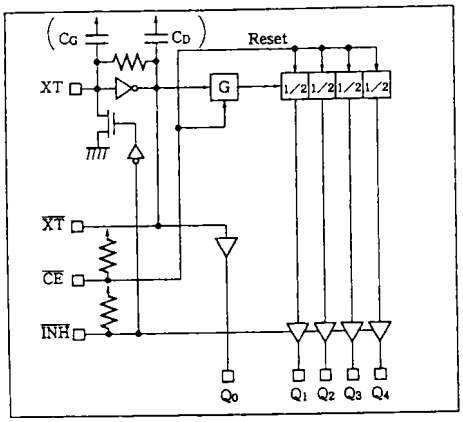
■ FEATURES

- Operating voltage (3 to 6V)
- Built-in feed back resistance of inverter amplifier
- Fundamental frequency and divided frequencies output
- Built-in capacitor for oscillating (FC type) CD-20pF (TYP), CG-20pF (TYP)
- Maximum frequency ... 30MHz
- Low current consumption
- Fan out 2TTL
- Standby function
- Chip form

■ PAD LOCATION



■ BLOCK DIAGRAM



■ PAD COORDINATES

UNIT: μm

NAME	X	Y
V_{SS}	285	155
$\overline{XT}$	485	155
Q_0	710	155
Q_1	1060	155
Q_2	1350	395
Q_3	1350	675
Q_4	1350	930
$\overline{CE}$	1350	1245
V_{DD}	1045	1245
XT	845	1245
$\overline{INH}$	465	1245
XT	155	1245
NC	155	955
V_{DD}	155	755
$\overline{XT}$	155	555
NC	155	355

CHIP SIZE:
1.5mm × 1.4mm
CHIP THICKNESS:
400 ±30 μm

■ PAD DESCRIPTION

NAME	FUNCTION
XT	Input terminal for oscillating
$\overline{XT}$	Output terminal for oscillating
$\overline{INH}$	"L" Standby mode On chip pull-up resistance
$\overline{CE}$	Output control for divided frequency Pull-up resistance
V_{DD}	Power-supply
V_{SS}	Ground
Q_0	Output terminal for fundamental frequency
Q_{1-4}	Output terminal for divided frequency

■ ABSOLUTE MAXIMUM RATING (V_{SS}=0V)

ITEM	SYMBOL	CONDITIONS	UNIT
Supply voltage	V_{DD}	V_{SS}-0.5 to V_{SS}+7.0	V
Input voltage	V_{IN}	V_{SS}-0.5 to V_{DD}+0.5	V
Output voltage	V_{OUT}	V_{SS}-0.5 to V_{DD}+0.5	V
Storage temperature	T_{STG}	-65 to +150	°C

■ RECOMMENDED OPERATIONAL CONDITIONS (V_{SS}=0V)

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Operating voltage	V_{DD}	3		6	V
Input voltage	V_{IN}	V_{SS}		V_{DD}	V
Operating temperature	T_{OPR}	-40		+85	°C

■ ELECTRICAL CHARACTERISTICS

V_{DD}=5V, Ta=-40°C ~ +85°C

ITEM	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Output current 1 ("H" level)	I_{OH1}	Exclude $\overline{XT}$ terminal	V_{DH} = 0.9V_{DD}	1.0			mA
Output current 1 ("L" level)	I_{OL1}	Fig. 1, V_{DD} = -5V ±0.5V	V_{OL}=0.1V_{DD}	3.2			
Output current 2 ("H" level)	I_{OH2}	Exclude XT terminal	V_{OH}=2.4V	1.0			mA
Output current 2 ("L" level)	I_{OL2}	Fig. 1, V_{DD}=5V ±0.5V	V_{OL}=0.4V	3.2			
Output current 3 ("H" level)	I_{OH3}	V_{OH}=4.5V	Ta=25°C, V_{DD} = 5V	3.5	5	6.5	mA
Output current 3 ("L" level)	I_{OL3}	V_{OL}=0.5V	$\overline{XT}$ terminal, Fig. 6	3.5	5	6.5	mA
Input voltage ("H" level)	V_{IH}	INH, $\overline{CE}$ terminal		0.8V_{DD}			V
Input voltage ("L" level)	V_{IL}	V_{DD}=-5V ±0.5V				0.2V_{DD}	
Input bias voltage	V_{XBS}	$\overline{XT}$ terminal Ta=25°C	Fig. 2	2.2	2.5	2.8	V
Current consumption 1	I_{DD1}	$\overline{CE}$, INH=OPEN	Fig. 3		4.5	6.5	mA
Current consumption 2	I_{DD2}	$\overline{CE}$="L", INH=OPEN	Fig. 3		3.5	5.5	
Current consumption 3	I_{DD3}	INH="L", $\overline{CE}$=OPEN			0.1	0.4	
Pull-up resistance	R_{UP}	Ta=25°C	Fig. 4	20	40	80	kΩ
Feed back resistance	Rf	Ta=25°C	Fig. 5	1		5	MΩ
Internal capacitor	CG	f=1MHz		10	20	35	pF
	CD	f=1MHz		10	20	35	

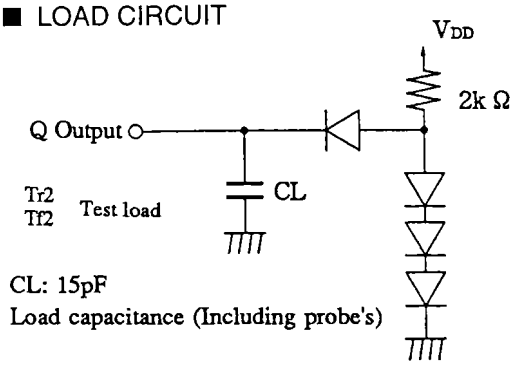
■ SWITCHING CHARACTERISTICS

f=16MHz (Except $\overline{XT}$ terminal), V_{DD}=-5V ±0.5V, Ta=25°C

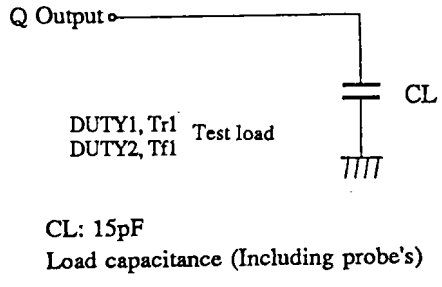
ITEM	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Output rise time 1	T_{r1}	Fig. 3, Circuit-2, 0.1V_{DD} → 0.9V_{DD}			5	10	nS
Output rise time 2	T_{r2}	Fig. 3, Circuit-1, 0.4V_{DD} → 2.4V_{DD}			5	10	nS
Output fall time 1	T_{f1}	Fig. 3, Circuit-2, 0.9V_{DD} → 0.1V_{DD}			5	10	nS
Output fall time 2	T_{f2}	Fig. 3, Circuit-1, 2.4V_{DD} → 0.4V_{DD}			5	10	nS
Duty of fundamental output	DUTy1	Fig-3, Circuit-2, V_{DD}= 5V	Q0	40		60	%
Duty of divided output	DUTy2		Q1 to Q4	45		55	
Output delay time 1	T_{PLH1}	Q1 output monitor			30	60	nS
Output delay time 1	T_{PHL1}	V_{DD}=5V at INH			35	70	
Output delay time 2	T_{PLH2}	Q1 output monitor			70	140	
Output delay time 2	T_{PHL2}	V_{DD}=5V at $\overline{CE}$			70	140	nS

fo: Input frequency to XT terminal

■ LOAD CIRCUIT



Circuit-1



Circuit-2

■ TEST CIRCUIT

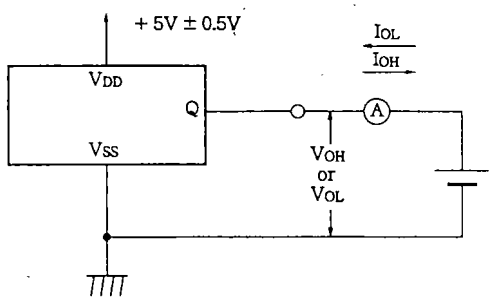


Fig. 1

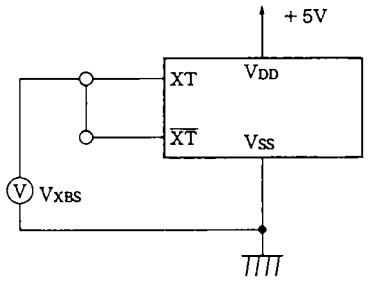
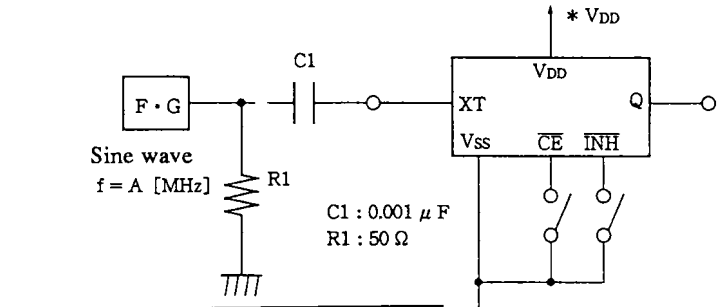


Fig. 2

* Test of I_{DD} V_{DD}=5V

* Test of switching characteristics V_{DD}=5V±0.5V



ITEM	A	INPUT VOLTAGE
I_{DD}	16MHz	$4V_{p-p}$
Switching item	16MHz	$5V_{p-p}$

Fig. 3

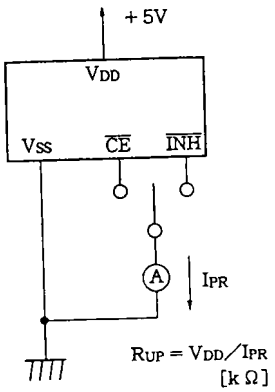


Fig. 4

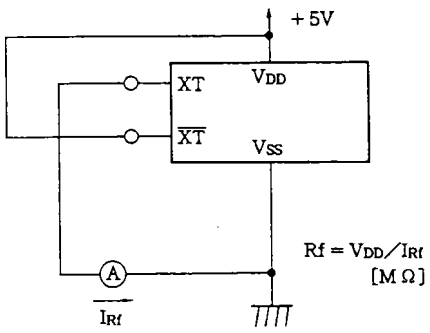


Fig. 5

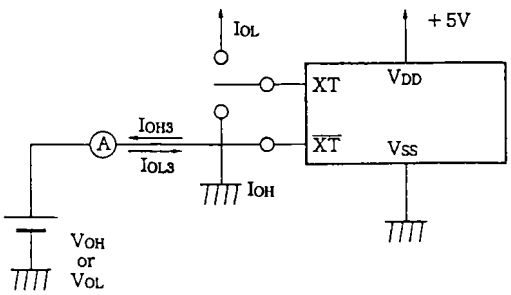
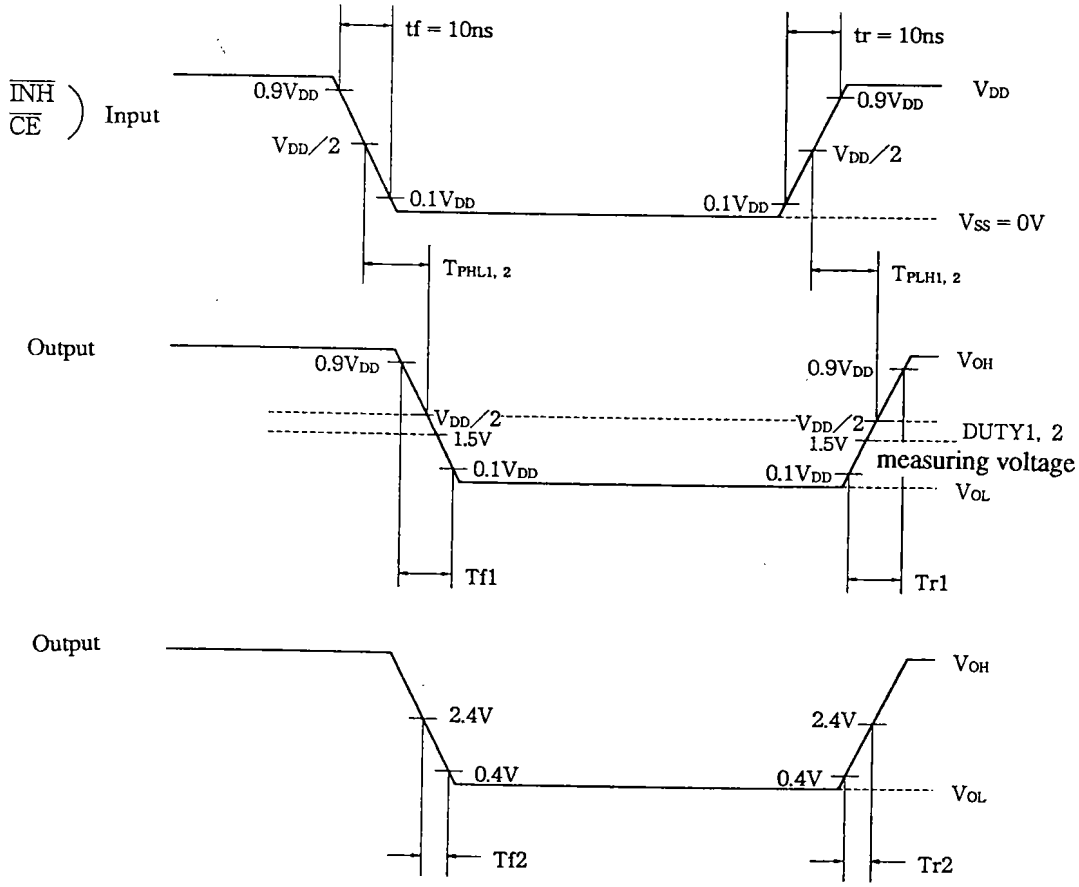


Fig. 6

■ WAVEFORMS FOR SWITCHING TIME



■ SERIES TABLE

SERIES	Built-in capacity type
SM5605FA	No capacity
SM5605FC	CD, CG=20pF (TYP.)

■ FUNCTIONAL TABLE

$\overline{INH}$	$\overline{CE}$	Q_0	Q_1	Q_2	Q_3	Q_4
H or OPEN	H or OPEN	fo	fo/2	fo/4	fo/8	fo/16
H or OPEN	L	fo	L	←	←	←
L	H or OPEN	L	←	←	←	←
L	L	L	←	←	←	←