

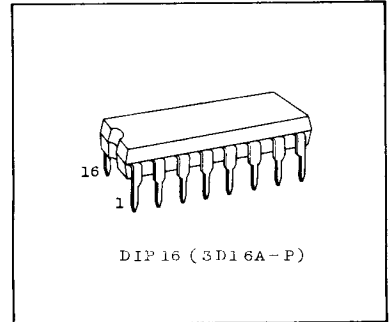
TC5036P, TC5048P 17-STAGE HIGH SPEED FREQUENCY DIVIDER

TC5036P and TC5048P are 17-stage ripple carry binary counters equipped with inverters for crystal oscillators.

As the first stage through the fourth stage are dynamic type counter, the high speed operation can be obtained but the operation starting from DC is not possible, so that these should be used in the range of $f_{MIN} \sim f_{MAX}$.

If ϕ input is opened ($\phi = "L"$), the inverted output of 9th stage appears on FC terminal. If ϕ input is set to "H", 9 stages from 9th stage through 17th stage can be also independently used having FC terminal as the clock input.

Outputs can be derived arbitrarily from stages 4, 12, 13, 14, 15, 16 and 17 of TC5036P and stages 4, 5, 6, 7, 14, 16 and 17 of TC5048P.



ABSOLUTE MAXIMUM RATINGS

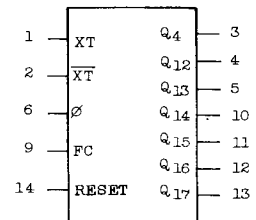
| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---------------------------|------------|------------------------------------|------|
| DC Supply Voltage | VDD1 | $V_{SS1} - 0.5 \sim V_{SS1} + 10$ | V |
| | VDD2 | $V_{SS1} - 0.5 \sim V_{DD1} + 0.5$ | |
| Input Voltage | XT | V_{IN} | V |
| | ϕ, FC | V_{IN} | |
| Output Voltage | VOUT | $V_{SS1} - 0.5 \sim V_{DD1} + 0.5$ | V |
| DC Input Current | IIN | ± 10 | mA |
| Power Dissipation | PD | 300 | mW |
| Storage Temperature Range | Tstg | -65 ~ 150 | °C |
| Lead Temp./Time | Tsol | 260°C · 10sec | |

TRUTH TABLE

| INPUTS | | | | FUNCTION (See Timing Chart) |
|--------------|----|-----------|------------------|--|
| RESET | XT | ϕ | FC | |
| H | | OPEN H | H * | $f_{Q4} = f_{XT} / 2^4$ $Q5 \sim Q_{17} = "L" \text{ LEVEL}$ |
| L | | OPEN | $\overline{Q_9}$ | $f_{Qn} = f_{XT} / 2^n$ $n; 5 \sim 17$ |
| L | | H | | $f_{Qn} = f_{XT} / 2^n \quad n; 5 \sim 7$ $f_{Qm} = f_{FC} / 2^{(m-8)} \quad m; 12 \sim 17$ |
| * Don't Care | | | | |

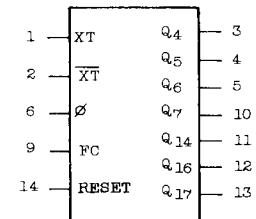
PIN ASSIGNMENT

TC5036P



VDD1 ; 16 VSS1 ; 8
VDD2 ; 15 VSS2 ; 7

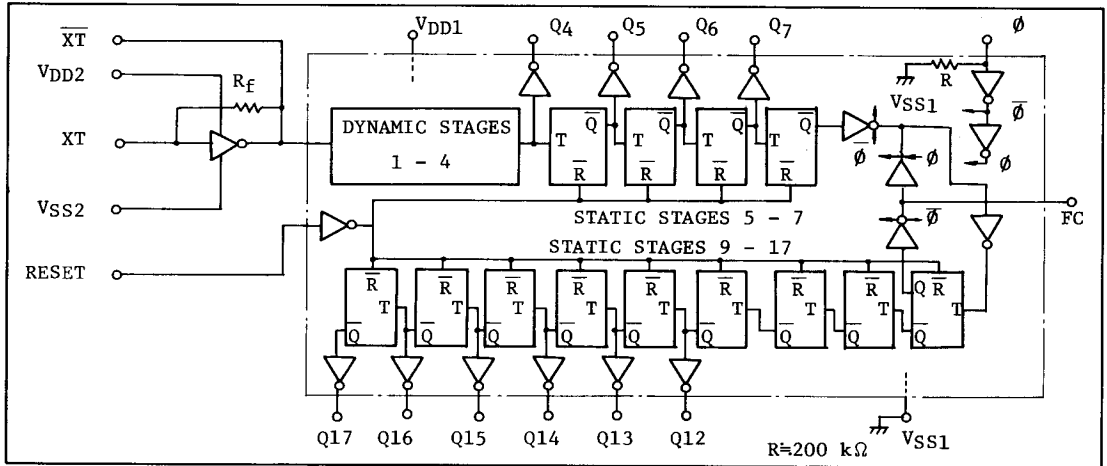
TC5048P



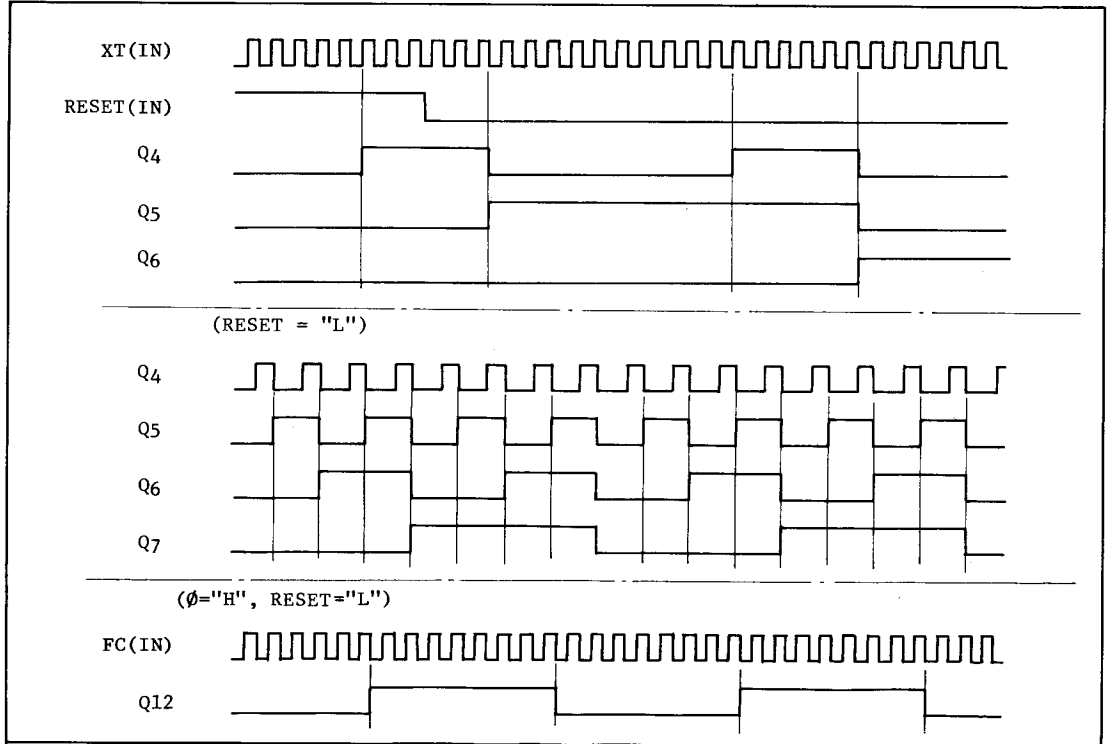
VDD1 ; 16 VSS1 ; 8
VDD2 ; 15 VSS2 ; 7

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BLOCK DIAGRAM



TIMING CHART



RECOMMENDED OPERATING CONDITIONS (V_{SS1}=V_{SS2}=0V)

| CHARACTERISTIC | SYMBOL | MIN. | TYP. | MAX. | UNIT. |
|-----------------|--------------------------------------|------|------|--------------------------------------|-------|
| Supply Voltage | V _{DD1} V _{DD2} | 3 | - | 8 | V |
| Input Voltage | V _{IN} | 0 | - | V _{DD1} V _{DD2} | V |
| Operating Temp. | Topr | -40 | - | 85 | °C |

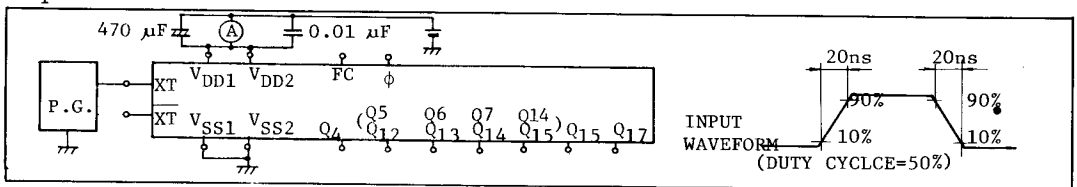
ELECTRICAL CHARACTERISTICS (V_{SS1}=V_{SS2}=0V, V_{DD1}=V_{DD2})

| CHARACTERISTIC | SYMBOL | TEST CONDITIONS | V _{DD} (V) | -40°C | | 25°C | | | 85°C | | UNIT | |
|--|-----------------|--|---------------------|---|------|-------|-------------------|-------|-------|------|--------|---|
| | | | | MIN. | MAX. | MIN. | TYP. | MAX. | MIN. | MAX. | | |
| High Level Output Voltage | V _{OH} | I _{OUT} < 1μA V _{IN} =V _{DD} , V _{SS} | 5 | 4.95 | - | 4.95 | 5.00 | - | 4.95 | - | V | |
| Low Level Output Voltage | V _{OL} | I _{OUT} < 1μA V _{IN} =V _{DD} , V _{SS} | 5 | - | 0.05 | - | 0.00 | 0.05 | - | 0.05 | V | |
| High Level Output Current | Q FC XT | I _{OH} | 5 | V _{OH} =4.6V V _{IN} =V _{SS} , V _{DD} | | -0.2 | - | -0.16 | -0.8 | - | -0.12 | - |
| | | | | V _{OH} =4.6V V _{IN} =V _{SS} , V _{DD} | | 0.025 | - | -0.02 | -0.06 | - | -0.015 | - |
| | | | | V _{OL} =0.4V V _{IN} =V _{DD} , V _{SS} | | - | - | - | - | - | - | - |
| Low Level Output Current | Q FC XT | I _{OL} | 5 | V _{OL} =0.4V V _{IN} =V _{DD} , V _{SS} | | 0.52 | - | 0.44 | 1.5 | - | 0.36 | - |
| | | | | V _{OL} =0.4V V _{IN} =V _{DD} , V _{SS} | | - | - | - | - | - | - | - |
| | | | | V _{OL} =0.4V V _{IN} =V _{DD} , V _{SS} | | 0.10 | - | 0.08 | 0.25 | - | 0.06 | - |
| High Level Input Voltage | V _{IH} | V _{OUT} =0.5V, 4.5V I _{OUT} < 1μA | 5 | 3.5 | - | 3.5 | 2.75 | - | 3.5 | - | V | |
| Low Level Input Voltage | V _{IL} | V _{OUT} =0.5V, 4.5V I _{OUT} < 1μA | 5 | - | 1.5 | - | 2.25 | 1.5 | - | 1.5 | V | |
| High Level Input Current (except XT, φ) | I _{IH} | V _{IH} =8V | 8 | - | 0.2 | - | 10 ⁻⁵ | 0.2 | - | 1.0 | μA | |
| Low Level Input Current (except, XT, φ) | I _{IL} | V _{IL} =0V | 8 | - | -0.2 | - | -10 ⁻⁵ | -0.2 | - | -1.0 | μA | |
| Operating Current Consumption (TC5048BP) | I _T | f _{XT} =1MHz | 5 | - | - | - | 100 | 500 | - | - | μA | |

SWITCHING CHARACTERISTICS (V_{DD1}=V_{DD2}, V_{SS1}=V_{SS2}=0V, Ta=25°C, C_L=50pF)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | V _{DD} (V) | MIN. | TYP. | MAX. | UNIT. |
|--|-------------------------------------|----------------|---------------------|------|------|------|-------|
| Output Rise Time (Q OUTPUT) | t _{TLH} | | 5 | - | 130 | 250 | ns |
| Output Fall Time (Q OUTPUT) | t _{THL} | | 5 | - | 130 | 250 | ns |
| Input Amp Vias Resistance | R _f | | 8 | 0.6 | - | 3.0 | MΩ |
| Propagation Delay Time (XT-Q ₄) | t _{pLH} , t _{pHL} | | 5 | - | 250 | 600 | ns |
| Propagation Delay Time (XT-Q ₁₇) | t _{pLH} , t _{pHL} | | 5 | - | - | 8.0 | μs |
| Prop. Delay Time (RESET-Q) | t _{pHL} (RESET) | | 5 | - | - | 2000 | ns |
| Min. Clear Pulse Width | t _w (RESET) | | 5 | - | - | 1000 | ns |
| Max. Clock Frequency | f _{MAX} (XT) | | 5 | 8 | 14 | - | MHz |
| Min. Clock Frequency | f _{MIN} (XT) | | 5 | - | - | 20 | kHz |
| Max. Clock Frequency | f _{MAX} (FC) | | 5 | 1.0 | - | - | MHz |
| Max. Clock Rise Time | t _{rCL} | | 5 | 20 | - | - | μs |
| Max. Clock Fall Time | t _{fCL} | (XT, FC) | 5 | 20 | - | - | μs |
| Input Capacitance | C _{IN} | except FC | 5 | - | 5 | 7.5 | pF |

I_T TEST CIRCUIT

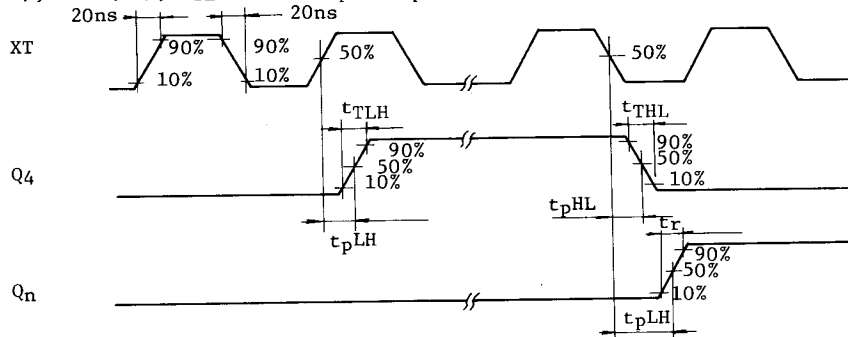


TC5036P, TC5048P

SWITCHING TIME TEST WAVEFORMS

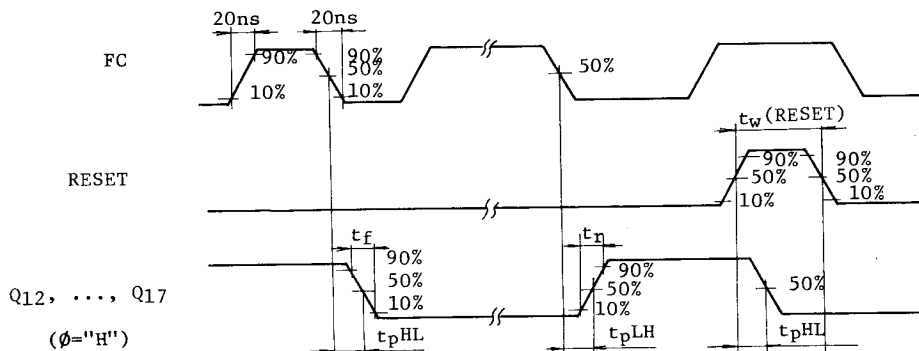
WAVEFORM 1.

1. $f_{MAX}(XT)$, $f_{MIN}(XT)$, t_{TLH} , t_{THL} , t_{pLH} , t_{pHL}



WAVEFORM 2.

2. $f_{MAX}(FC)$, $t_w(\text{RESET})$, $t_{pHL}(\text{RESET})$



TYPICAL APPLICATION

