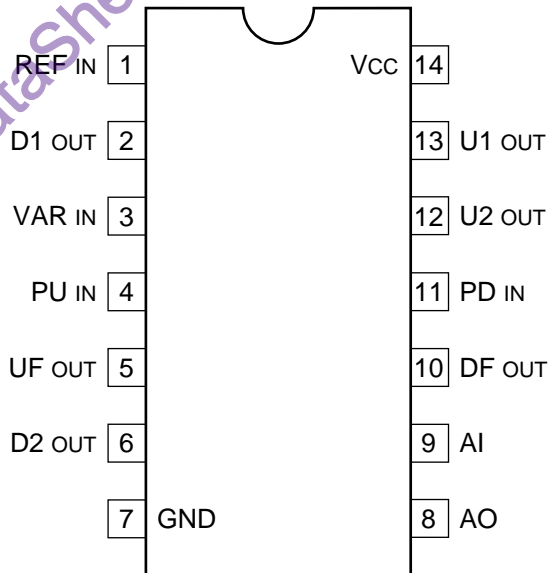


PHASE-FREQUENCY DETECTOR

—TOP VIEW—

**INPUT**

AI : FILTER AMP
 PD : CHARGE PUMP DOWN
 PU : CHARGE PUMP UP
 REF : REFERENCE
 VAR : VARIABLE

OUTPUT

AO : FILTER AMP
 D1, D2 : DOWN
 DF : CHARGE PUMP DOWN
 U1, U2 : UP
 UF : CHARGE PUMP UP

PHASE FREQ. DET-1
 FALLING EDGE SENSING TYPE

| INPUTS | OUTPUTS | |
|--------------------------------|---------|----|
| | U1 | D1 |
| $f_V = f_R$ | 1 | 1 |
| $\phi_V = \phi_R$ | 1 | 1 |
| $f_V < f_R$ | 0 | 1 |
| $\phi_V \text{ lags } \phi_R$ | 0 | 1 |
| $f_V > f_R$ | 1 | 0 |
| $\phi_V \text{ leads } \phi_R$ | 1 | 0 |

PHASE FREQ. DET-2
 FOR 50% DUTY CYCLES

| INPUTS | | OUTPUTS | |
|--------|-----|---------|----|
| REF | VAR | U2 | D2 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 0 |

0 : LOW LEVEL
 1 : HIGH LEVEL

