**[Phase Comparator Section]**

**DC ELECTRICAL CHARACTERISTICS – continued** (Voltages Referenced to GND)

| Symbol | Parameter | Test Conditions | $V_{CC}$ Volts | Guaranteed Limit | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | – 55 to 25°C | ≤ 85°C | ≤ 125°C | |
| $V_{OL}$ | Maximum Low–Level Output Voltage Qa–Qh $PCP_{OUT}$, $PCn_{OUT}$ | $V_{out}$ = 0.1 V or $V_{CC}$ – 0.1 V<br>$\|I_{out}\| \leq$ 20 μA | 2.0<br>4.5<br>6.0 | 0.1<br>0.1<br>0.1 | 0.1<br>0.1<br>0.1 | 0.1<br>0.1<br>0.1 | V |
| | | $V_{in} = V_{IH}$ or $V_{IL}$<br>$\|I_{out}\| \leq$ 4.0 mA<br>$\|I_{out}\| \leq$ 5.2 mA | <br>4.5<br>6.0 | <br>0.26<br>0.26 | <br>0.33<br>0.33 | <br>0.4<br>0.4 | |
| $I_{in}$ | Maximum Input Leakage Current $SIG_{IN}$, $COMP_{IN}$ | $V_{in} = V_{CC}$ or GND | 2.0<br>3.0<br>4.5<br>6.0 | ± 3.0<br>± 7.0<br>± 18.0<br>± 30.0 | ± 4.0<br>± 9.0<br>± 23.0<br>± 38.0 | ± 5.0<br>± 11.0<br>± 27.0<br>± 45.0 | μA |
| $I_{OZ}$ | Maximum Three–State Leakage Current $PC2_{OUT}$ | Output in High–Impedance State<br>$V_{in} = V_{IH}$ or $V_{IL}$<br>$V_{out} = V_{CC}$ or GND | 6.0 | ± 0.5 | ± 5.0 | ± 10 | μA |
| $I_{CC}$ | Maximum Quiescent Supply Current (per Package)<br>(VCO disabled)<br>Pins 3, 5 and 14 at $V_{CC}$<br>Pin 9 at GND; Input Leakage at Pins 3 and 14 to be excluded | $V_{in} = V_{CC}$ or GND<br>$\|I_{out}\|$ = 0 μA | 6.0 | 4.0 | 40 | 160 | μA |

NOTE: Information on typical parametric values can be found in Chapter 2 of the Motorola High–Speed CMOS Data Book (DL129/D).

**[Phase Comparator Section]**

**AC ELECTRICAL CHARACTERISTICS** ($C_L$ = 50 pF, Input $t_r = t_f$ = 6.0 ns)

| Symbol | Parameter | $V_{CC}$ Volts | Guaranteed Limit | | | Unit |
|---|---|---|---|---|---|---|
| | | | – 55 to 25°C | ≤ 85°C | ≤ 125°C | |
| $t_{PLH}$,<br>$t_{PHL}$ | Maximum Propagation Delay, $SIG_{IN}$/$COMP_{IN}$ to $PC1_{OUT}$ (Figure 1) | 2.0<br>4.5<br>6.0 | 175<br>35<br>30 | 220<br>44<br>37 | 265<br>53<br>45 | ns |
| $t_{PLH}$,<br>$t_{PHL}$ | Maximum Propagation Delay, $SIG_{IN}$/$COMP_{IN}$ to $PCP_{OUT}$ (Figure 1) | 2.0<br>4.5<br>6.0 | 340<br>68<br>58 | 425<br>85<br>72 | 510<br>102<br>87 | ns |
| $t_{PLH}$,<br>$t_{PHL}$ | Maximum Propagation Delay, $SIG_{IN}$/$COMP_{IN}$ to $PC3_{OUT}$ (Figure 1) | 2.0<br>4.5<br>6.0 | 270<br>54<br>46 | 340<br>68<br>58 | 405<br>81<br>69 | ns |
| $t_{PLZ}$,<br>$t_{PHZ}$ | Maximum Propagation Delay, $SIG_{IN}$/$COMP_{IN}$ Output Disable Time to $PC2_{OUT}$ (Figures 2 and 3) | 2.0<br>4.5<br>6.0 | 200<br>40<br>34 | 250<br>50<br>43 | 300<br>60<br>51 | ns |
| $t_{PZH}$,<br>$t_{PZL}$ | Maximum Propagation Delay, $SIG_{IN}$/$COMP_{IN}$ Output Enable Time to $PC2_{OUT}$ (Figures 2 and 3) | 2.0<br>4.5<br>6.0 | 230<br>46<br>39 | 290<br>58<br>49 | 345<br>69<br>59 | ns |
| $t_{TLH}$,<br>$t_{THL}$ | Maximum Output Transition Time (Figure 1) | 2.0<br>4.5<br>6.0 | 75<br>15<br>13 | 95<br>19<br>16 | 110<br>22<br>19 | ns |

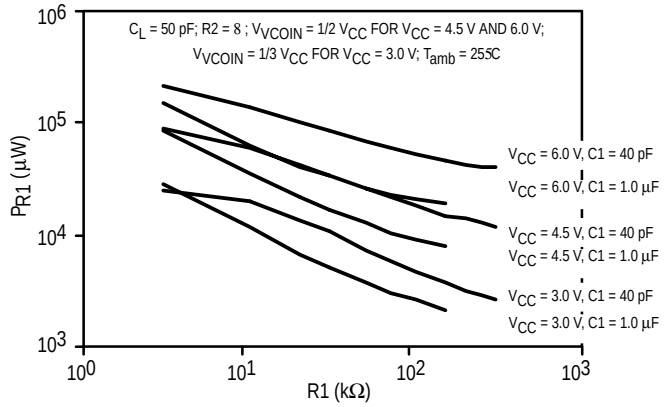



**Figure 16. Power Dissipation versus R1**

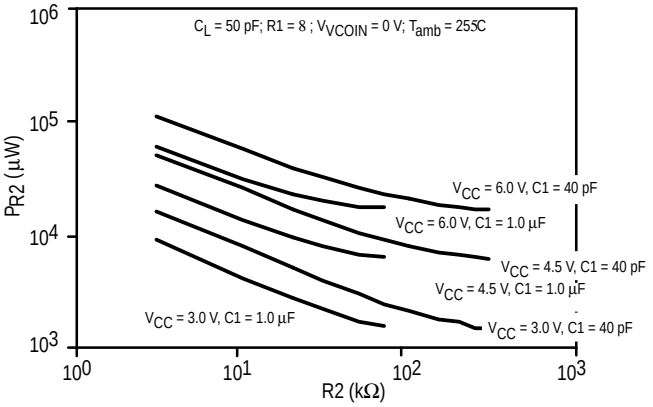



**Figure 17. Power Dissipation versus R2**

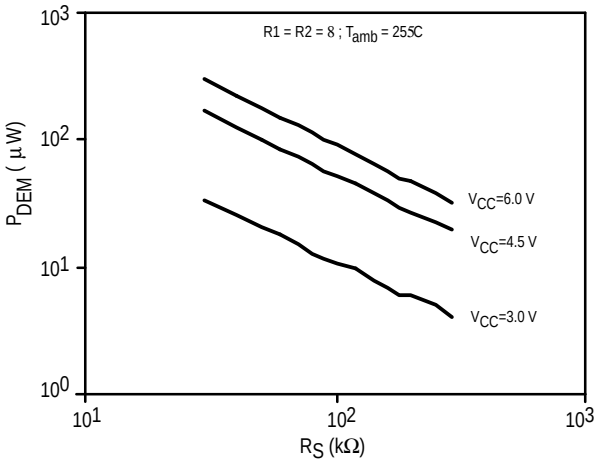



**Figure 18. DC Power Dissipation of Demodulator versus $R_S$**

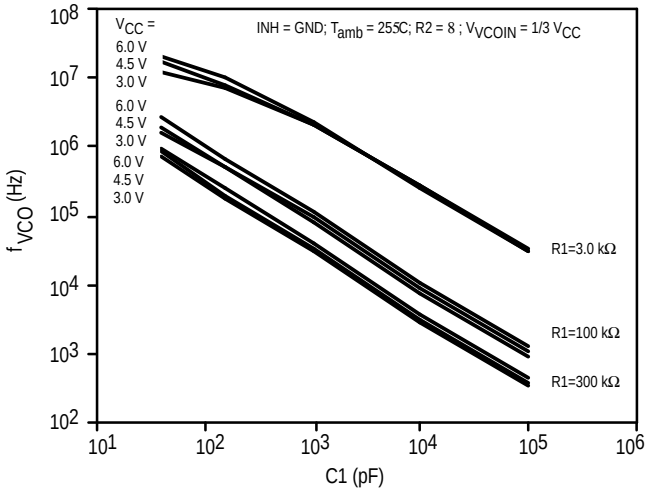



**Figure 19. VCO Center Frequency versus C1**

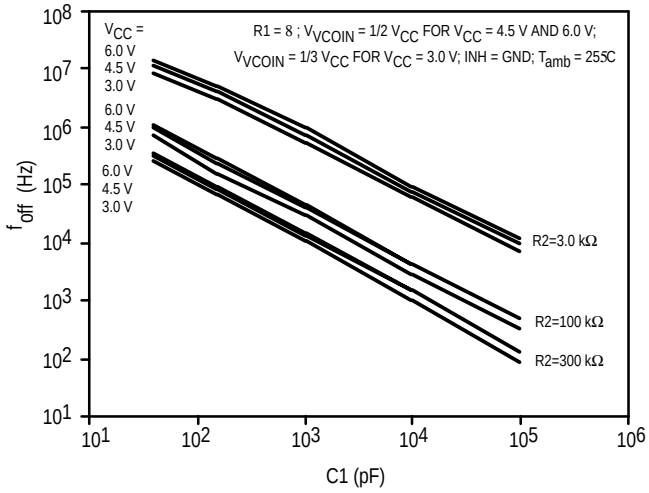



**Figure 20. Frequency Offset versus C1**

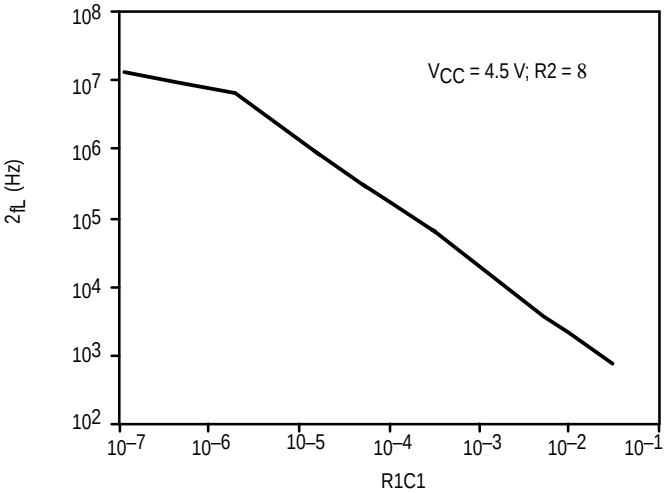



**Figure 21. Typical Frequency Lock Range ($2f_L$) versus $R_1C_1$**

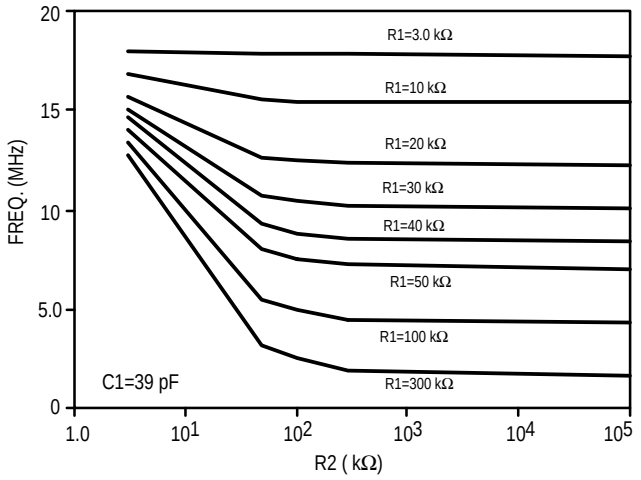



**Figure 22. R2 versus $f_{max}$**

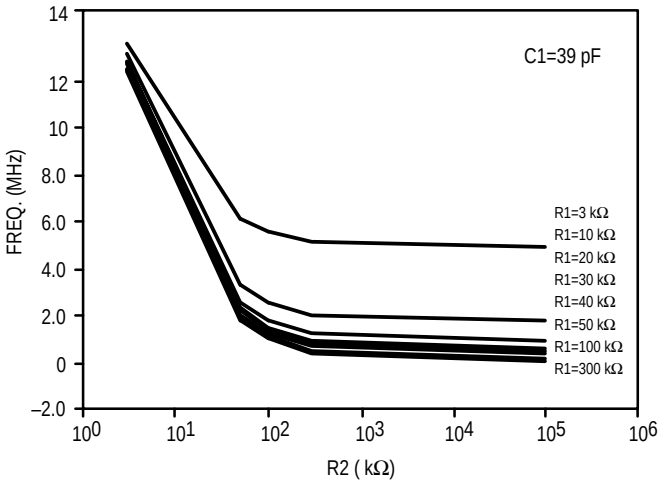



**Figure 23. R2 versus $f_{min}$**

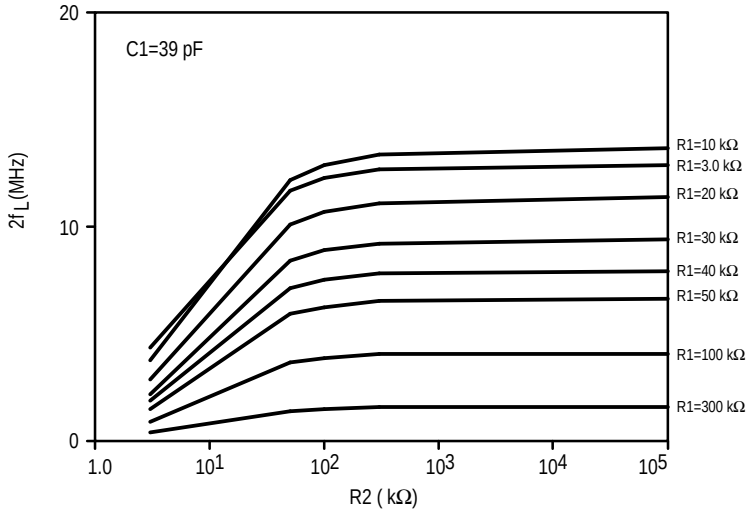



**Figure 24. R2 versus Frequency Lock Range ($2f_L$)**

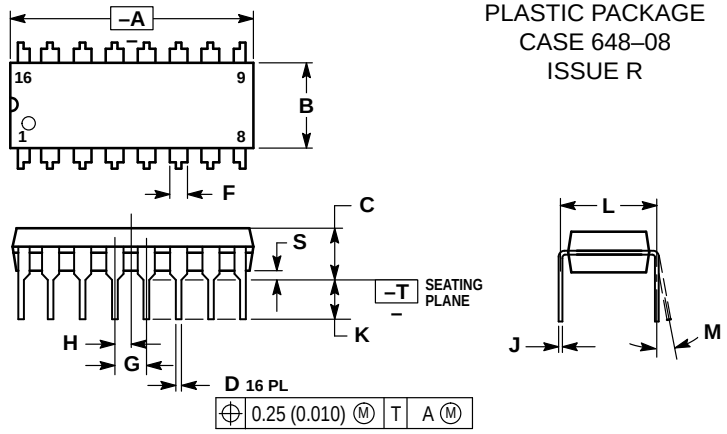
## APPLICATION INFORMATION

The following information is a guide for approximate values of R1, R2, and C1. Figures 19, 20, and 21 should be used as references as indicated below, also the values of R1, R2, and C1 should not violate the Maximum values indicated in the DC ELECTRICAL CHARACTERISTICS tables.

| Phase Comparator 1 | | Phase Comparator 2 | | Phase Comparator 3 | |
|---|---|---|---|---|---|
| $R_2 = \infty$ | $R_2 \neq \infty$ | $R_2 = \infty$ | $R_2 \neq \infty$ | $R_2 = \infty$ | $R_2 \neq \infty$ |
| ωGiven f0<br>ωUse f0 with Figure 19 to determine R1 and C1.<br>(see Figure 23 for characteristics of the VCO operation) | ωGiven f0 and fL<br>ωCalculate $f_{min}$ $f_{min}$ = f0–fL<br>ωDetermine values of C1 and R2 from Figure 20.<br>ωDetermine R1–C1 from Figure 21.<br>ωCalculate value of R1 from the value of C1 and the product of R1C1 from Figure 21.<br>(see Figure 24 for characteristics of the VCO operation) | ωGiven $f_{max}$ and f0<br>ωDetermine the value of R1 and C1 using Figure 19 and use Figure 21 to obtain 2fL and then use this to calculate $f_{min}$. | ωGiven f0 and fL<br>ωCalculate $f_{min}$ $f_{min}$ = f0–fL<br>ωDetermine values of C1 and R2 from Figure 20.<br>ωDetermine R1–C1 from Figure 21.<br>ωCalculate value of R1 from the value of C1 and the product of R1C1 from Figure 21.<br>(see Figure 24 for characteristics of the VCO operation) | ωGiven $f_{max}$ and f0<br>ωDetermine the value of R1 and C1 using Figure 19 and Figure 21 to obtain 2fL and then use this to calculate $f_{min}$. | ωGiven f0 and fL<br>ωCalculate $f_{min}$: $f_{min}$ = f0–fL<br>ωDetermine values of C1 and R2 from Figure 20.<br>ωDetermine R1–C1 from Figure 21.<br>ωCalculate value of R1 from the value of C1 and the product of R1C1 from Figure 21.<br>(see Figure 24 for characteristics of the VCO operation) |

## OUTLINE DIMENSIONS

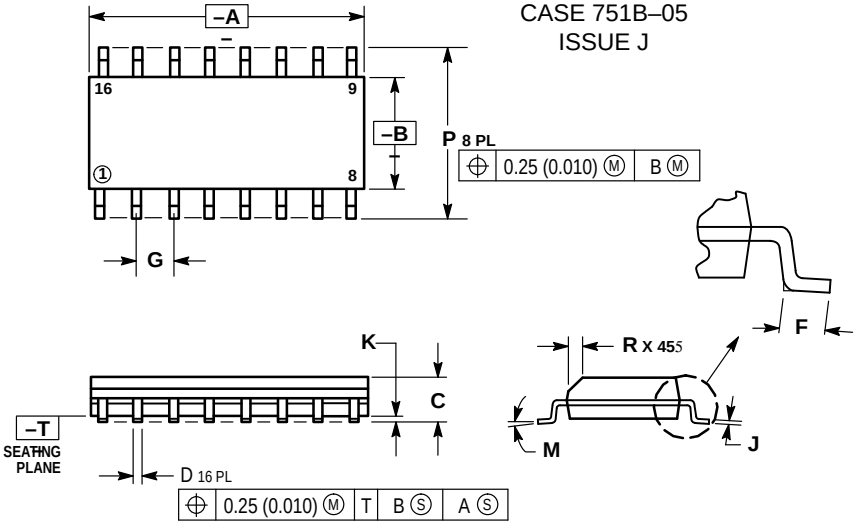
### N SUFFIX
PLASTIC PACKAGE
CASE 648–08
ISSUE R




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.740 | 0.770 | 18.80 | 19.55 |
| B | 0.250 | 0.270 | 6.35 | 6.85 |
| C | 0.145 | 0.175 | 3.69 | 4.44 |
| D | 0.015 | 0.021 | 0.39 | 0.53 |
| F | 0.040 | 0.070 | 1.02 | 1.77 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.050 BSC | | 1.27 BSC | |
| J | 0.008 | 0.015 | 0.21 | 0.38 |
| K | 0.110 | 0.130 | 2.80 | 3.30 |
| L | 0.295 | 0.305 | 7.50 | 7.74 |
| M | 05 | 105 | 05 | 105 |
| S | 0.020 | 0.040 | 0.51 | 1.01 |

### D SUFFIX
PLASTIC SOIC PACKAGE
CASE 751B–05
ISSUE J




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 9.80 | 10.00 | 0.386 | 0.393 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.054 | 0.068 |
| D | 0.35 | 0.49 | 0.014 | 0.019 |
| F | 0.40 | 1.25 | 0.016 | 0.049 |
| G | 1.27 BSC | | 0.050 BSC | |
| J | 0.19 | 0.25 | 0.008 | 0.009 |
| K | 0.10 | 0.25 | 0.004 | 0.009 |
| M | 05 | 75 | 05 | 75 |
| P | 5.80 | 6.20 | 0.229 | 0.244 |
| R | 0.25 | 0.50 | 0.010 | 0.019 |

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