

**MN54F407-X REV 1A0**

Original Creation Date: 05/03/96

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Last Major Revision Date: 05/03/96

## DATA ACCESS REGISTER

### General Description

The F407 Data Access Register (DAR) performs memory address arithmetic for RAM resident stack applications. It contains three 4-bit registers intended for Program Counter (R0), Stack Pointer (R1), and Operand Address (R2). The F407 implements 16 instructions which allow either pre- or post-decrement/increment and register-to-register transfer in a single clock cycle. It is expandable in 4-bit increments and can operate at a 30 MHz microinstruction rate on a 16-bit word. The TRI-STATE outputs are provided for bus-oriented applications. The F407 is fully compatible with all TTL families.

### Industry Part Number

54F407

### NS Part Numbers

54F407DMQB

54F407FMQB

54F407LMQB

### Prime Die

M407

### Processing

MIL-STD-883, Method 5004

### Quality Conformance Inspection

MIL-STD-883, Method 5005

| Subgrp | Description         | Temp ( °C) |
|--------|---------------------|------------|
| 1      | Static tests at     | +25        |
| 2      | Static tests at     | +125       |
| 3      | Static tests at     | -55        |
| 4      | Dynamic tests at    | +25        |
| 5      | Dynamic tests at    | +125       |
| 6      | Dynamic tests at    | -55        |
| 7      | Functional tests at | +25        |
| 8A     | Functional tests at | +125       |
| 8B     | Functional tests at | -55        |
| 9      | Switching tests at  | +25        |
| 10     | Switching tests at  | +125       |
| 11     | Switching tests at  | -55        |

**Features**

- High-speed-greater than a 30 MHz microinstruction rate
- Three 4-bit registers
- 16 instruction for register manipulation
- Two separate output ports, one transparent
- Relative addressing capability
- TRI-STATE Outputs
- Optional pre- or post- arithmetic
- Expandable in multiples of four bits
- 24-pin slim package
- 9407 replacement

**(Absolute Maximum Ratings)**

(Note 1)

|                                                       |                         |
|-------------------------------------------------------|-------------------------|
| Storage Temperature                                   | -65 C to +150 C         |
| Ambient Temperature under Bias                        | -55C to +125C           |
| Junction Temperature under Bias                       | -55C to +125C           |
| Vcc Pin Potential to Ground Pin                       | -0.5V to +7.0V          |
| Input Voltage<br>(Note 2)                             | -0.5V to +7.0V          |
| Input Current<br>(Note 2)                             | -30 mA to +5.0mA        |
| Voltage Applied to Output in HIGH State (with Vcc=0V) |                         |
| Standard Output                                       | -0.5V to Vcc            |
| TRI-STATE Output                                      | -0.5V to +5.5V          |
| Current Applied to Output in LOW State (Max)          | twice the rated Iol(mA) |

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

**Recommended Operating Conditions**

|                              |                 |
|------------------------------|-----------------|
| Free Air Ambient Temperature |                 |
| Commercial                   | 0 C to +70 C    |
| Military                     | -55 C to +125 C |
| Supply Voltage               |                 |
| Military                     | +4.5V to +5.5V  |
| Commercial                   | +4.5V to +5.5V  |

## Electrical Characteristics

### DC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)

DC: VCC 4.5V to 5.5V, Temp range: -55C to 125C

| SYMBOL  | PARAMETER                                      | CONDITIONS                                                     | NOTES | PIN-NAME          | MIN | MAX  | UNIT | SUB-GROUPS |
|---------|------------------------------------------------|----------------------------------------------------------------|-------|-------------------|-----|------|------|------------|
| IIH     | Input High Current                             | VCC=5.5V, VM=2.7V, VINH=5.5V, VINL=0.0V                        | 1, 3  | INPUTS            |     | 20   | uA   | 1, 2, 3    |
| IBVI    | Input High Current                             | VCC=5.5V, VM=7.0V, VINH=5.5V, VINL=0.0V                        | 1, 3  | INPUTS            |     | 100  | uA   | 1, 2, 3    |
| IIL     | Input LOW Current                              | VCC=5.5V, VM=0.5V, VINH=5.5V, VINL=0.0V                        | 1, 3  | INPUTS            |     | -0.4 | mA   | 1, 2, 3    |
| VOL (1) | Output LOW Voltage                             | VCC=4.5V, VIL=0.7V, IOL=8.0mA, VIH=2.0V, VINH=5.5V, VINL=0.0V  | 1, 3  | OUT EXCEPT PIN 13 |     | 0.5  | V    | 1, 2, 3    |
| VOH (1) | Output HIGH Voltage                            | VCC=4.5V, VIH=2.0V, IOH=-2.0mA, VIL=0.7V, VINH=5.5V, VINL=0.0V | 1, 3  | OUT EXCEPT PIN 13 | 2.4 |      | V    | 1, 2, 3    |
| IOS     | Short-Circuit Current                          | VCC=5.5V, VINH=5.5V, VM=0.0V, VINL=0.0V                        | 1, 3  | OUTPUTS           | -20 | -130 | mA   | 1, 2, 3    |
| VCD     | Input Clamp Diode Voltage                      | VCC=4.5V, IM=-18mA, VINH=5.5V, VINL=0.0V                       | 1, 3  | INPUTS            |     | -1.5 | mA   | 1, 2, 3    |
| ICC     | Supply Current                                 | VCC=5.5V, VINH=5.5V, VINL=0.0V                                 | 1, 3  | VCC               |     | 145  | mA   | 1, 2, 3    |
| ICEX    | Output HIGH Leakage Current                    | VCC=5.5V, VINH=5.5V, VINL=0.0V, VM=5.5V                        | 1, 3  | OUTPUTS           |     | 250  | uA   | 1, 2, 3    |
| VOL (2) | Output LOW Voltage                             | VCC=4.5V, VIL=0.7V, VIH=2.0V, IOL=4.0mA, VINH=5.5V, VINL=0.0V  | 1, 3  | OUT PIN 13 ONLY   |     | 0.5  | V    | 1, 2, 3    |
| VOH (2) | Output HIGH Voltage                            | VCC=4.5V, VIL=0.7V, VIH=2.0V, IOH=-400uA, VINH=5.5V, VINL=0.0V | 1, 3  | OUT PIN 13 ONLY   | 2.4 |      | V    | 1, 2, 3    |
| IOZH    | Output Leakage Current PINS 8,9,10,11,14,18,20 | VCC=5.5V, VIL=0.7V, VIH=2.0V, VM=2.7, VINH=5.5V, VINL=0.0V     | 1, 3  | OUTPUTS           |     | 100  | uA   | 1, 2, 3    |
| IOZL    | Output Leakage Current PINS 8,9,10,11,14,18,20 | VCC=5.5V, VIL=0.7V, VIH=2.0V, VM=0.5V, VINH=5.5V, VINL=0.0V    | 1, 3  | OUTPUTS           |     | -100 | uA   | 1, 2, 3    |

### AC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)

AC: CL=50pf, RL=500 OHMS, TR=2.5ns, TF=2.5ns SEE AC FIGS

|         |                   |                                            |      |          |     |      |    |        |
|---------|-------------------|--------------------------------------------|------|----------|-----|------|----|--------|
| tpLH(1) | Propagation Delay | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C | 2, 4 | CP to On | 7.0 | 16.5 | ns | 9      |
|         |                   |                                            | 2, 4 | CP to On | 7.0 | 24.0 | ns | 10, 11 |

## Electrical Characteristics

### AC PARAMETERS(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)

AC: CL=50pf, RL=500 OHMS, TR=2.5ns, TF=2.5ns SEE AC FIGS

| SYMBOL  | PARAMETER                                 | CONDITIONS                                | NOTES | PIN-NAME          | MIN  | MAX  | UNIT | SUB-GROUPS |
|---------|-------------------------------------------|-------------------------------------------|-------|-------------------|------|------|------|------------|
| tpHL(1) | Propagation Delay                         | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | CP to 0n          | 4.0  | 9.5  | ns   | 9          |
|         |                                           |                                           | 2, 4  | CP to 0n          | 4.0  | 15.0 | ns   | 10, 11     |
| tpLH(2) | Propagation Delay I1-I3 to X0-X3, I0=LOW  | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  |                   | 7.5  | 17.0 | ns   | 9          |
|         |                                           |                                           | 2, 4  |                   | 7.5  | 21.0 | ns   | 10, 11     |
| tpHL(2) | Propagation Delay I1-I3 to X0-X3, I0=LOW  | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  |                   | 8.0  | 18.5 | ns   | 9          |
|         |                                           |                                           | 2, 4  |                   | 8.0  | 25.0 | ns   | 10, 11     |
| tpLH(3) | Propagation Delay I1-I3 to X0-X3, I0=HIGH | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  |                   | 8.5  | 31.0 | ns   | 9          |
|         |                                           |                                           | 2, 4  |                   | 8.5  | 50.0 | ns   | 10, 11     |
| tpHL(3) | Propagation Delay I1-I3 to X0-X3, I0=HIGH | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  |                   | 6.5  | 22.5 | ns   | 9          |
|         |                                           |                                           | 2, 4  |                   | 6.5  | 35.0 | ns   | 10, 11     |
| tpLH(4) | Propagation Delay                         | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | CP to Xn, I0=LOW  | 7.0  | 17.5 | ns   | 9          |
|         |                                           |                                           | 2, 4  | CP to Xn, I0=LOW  | 7.0  | 24.0 | ns   | 10, 11     |
| tpHL(4) | Propagation Delay                         | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | CP to Xn, I0=LOW  | 8.5  | 24.0 | ns   | 9          |
|         |                                           |                                           | 2, 4  | CP to Xn, I0=LOW  | 8.5  | 28.0 | ns   | 10, 11     |
| tpLH(5) | Propagation Delay                         | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | CP to Xn, I0=HIGH | 16.0 | 35.0 | ns   | 9          |
|         |                                           |                                           | 2, 4  | CP to Xn, I0=HIGH | 16.0 | 43.0 | ns   | 10, 11     |
| tpHL(5) | Propagation Delay                         | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | CP to Xn, I0=HIGH | 11.5 | 28.5 | ns   | 9          |
|         |                                           |                                           | 2, 4  | CP to Xn, I0=HIGH | 11.5 | 36.5 | ns   | 10, 11     |
| tpLH(6) | Propagation Delay                         | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | Dn to Xn          | 6.5  | 19.5 | ns   | 9          |
|         |                                           |                                           | 2, 4  | Dn to Xn          | 6.5  | 29.0 | ns   | 10, 11     |

## Electrical Characteristics

### AC PARAMETERS(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)

AC: CL=50pf, RL=500 OHMS, TR=2.5ns, TF=2.5ns SEE AC FIGS

| SYMBOL   | PARAMETER         | CONDITIONS                                | NOTES | PIN-NAME          | MIN | MAX  | UNIT | SUB-GROUPS |
|----------|-------------------|-------------------------------------------|-------|-------------------|-----|------|------|------------|
| tpHL(6)  | Propagation Delay | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | D $\bar{n}$ to Xn | 3.0 | 12.0 | ns   | 9          |
|          |                   |                                           | 2, 4  | D $\bar{n}$ to Xn | 3.0 | 20.5 | ns   | 10, 11     |
| tpLH(7)  | Propagation Delay | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | CI to Xn          | 4.0 | 14.0 | ns   | 9          |
|          |                   |                                           | 2, 4  | CI to Xn          | 4.0 | 22.0 | ns   | 10, 11     |
| tpHL(7)  | Propagation Delay | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | CI to Xn          | 4.5 | 12.0 | ns   | 9          |
|          |                   |                                           | 2, 4  | CI to Xn          | 4.5 | 14.0 | ns   | 10, 11     |
| tpLH(8)  | Propagation Delay | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | IO to Xn          | 4.0 | 11.5 | ns   | 9          |
|          |                   |                                           | 2, 4  | IO to Xn          | 4.0 | 14.5 | ns   | 10, 11     |
| tpHL(8)  | Propagation Delay | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | IO to Xn          | 3.0 | 13.0 | ns   | 9          |
|          |                   |                                           | 2, 4  | IO to Xn          | 3.0 | 19.5 | ns   | 10, 11     |
| tpLH(9)  | Propagation Delay | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | CP to CO          | 9.0 | 24.5 | ns   | 9          |
|          |                   |                                           | 2, 4  | CP to CO          | 9.0 | 33.0 | ns   | 10, 11     |
| tpHL(9)  | Propagation Delay | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | CP to CO          | 6.5 | 25.0 | ns   | 9          |
|          |                   |                                           | 2, 4  | CP to CO          | 6.5 | 38.0 | ns   | 10, 11     |
| tpLH(10) | Propagation Delay | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | CI to CO          | 3.0 | 8.5  | ns   | 9          |
|          |                   |                                           | 2, 4  | CI to CO          | 3.0 | 11.0 | ns   | 10, 11     |
| tpHL(10) | Propagation Delay | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | CI to CO          | 3.0 | 9.0  | ns   | 9          |
|          |                   |                                           | 2, 4  | CI to CO          | 3.0 | 10.0 | ns   | 10, 11     |
| tpLH(11) | Propagation Delay | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | D $\bar{n}$ to CO | 3.0 | 7.5  | ns   | 9          |
|          |                   |                                           | 2, 4  | D $\bar{n}$ to CO | 3.0 | 10.0 | ns   | 10, 11     |

## Electrical Characteristics

### AC PARAMETERS(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)

AC: CL=50pf, RL=500 OHMS, TR=2.5ns, TF=2.5ns SEE AC FIGS

| SYMBOL   | PARAMETER                                                           | CONDITIONS                                | NOTES | PIN-NAME                   | MIN  | MAX  | UNIT | SUB-GROUPS |
|----------|---------------------------------------------------------------------|-------------------------------------------|-------|----------------------------|------|------|------|------------|
| tpHL(11) | Propagation Delay                                                   | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | D $\bar{n}$ to C $\bar{O}$ | 3.5  | 9.0  | ns   | 9          |
|          |                                                                     |                                           | 2, 4  | D $\bar{n}$ to C $\bar{O}$ | 3.5  | 10.0 | ns   | 10, 11     |
| tpLH(12) | Propagation Delay                                                   | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | I1-I3 to C $\bar{O}$       | 8.0  | 20.0 | ns   | 9          |
|          |                                                                     |                                           | 2, 4  | I1-I3 to C $\bar{O}$       | 8.0  | 23.0 | ns   | 10, 11     |
| tpHL(12) | Propagation Delay                                                   | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  | I1-I3 to C $\bar{O}$       | 6.0  | 21.0 | ns   | 9          |
|          |                                                                     |                                           | 2, 4  | I1-I3 to C $\bar{O}$       | 6.0  | 32.5 | ns   | 10, 11     |
| tpZH(1)  | Enable Time<br>E $\bar{O}0$ to $\bar{O}n$ or<br>E $\bar{O}X$ to Xn  | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  |                            | 4.5  | 15.5 | ns   | 9          |
| tpZH(1)  | Enable Time<br>E $\bar{O}0$ to $\bar{O}n$ or<br>E $\bar{O}X$ to Xn  | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  |                            | 4.5  | 26.0 | ns   | 10, 11     |
| tpZL(1)  | Enable Time<br>E $\bar{O}0$ to $\bar{O}n$ or<br>E $\bar{O}X$ to Xn  | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  |                            | 3.5  | 13.0 | ns   | 9          |
| tpZL(1)  | Enable Time<br>E $\bar{O}0$ to $\bar{O}n$ or<br>E $\bar{O}X$ to Xn  | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  |                            | 3.5  | 16.0 | ns   | 10, 11     |
| tpHZ(2)  | Disable Time<br>E $\bar{O}0$ to $\bar{O}n$ or<br>E $\bar{O}X$ to Xn | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  |                            | 2.0  | 7.0  | ns   | 9          |
| tpHZ(2)  | Disable Time<br>E $\bar{O}0$ to $\bar{O}n$ or<br>E $\bar{O}X$ to Xn | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  |                            | 2.0  | 9.0  | ns   | 10, 11     |
| tpLZ(2)  | Disable Time<br>E $\bar{O}0$ to $\bar{O}n$ or<br>E $\bar{O}X$ to Xn | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  |                            | 5.0  | 16.5 | ns   | 9          |
| tpLZ(2)  | Disable Time<br>E $\bar{O}0$ to $\bar{O}n$ or<br>E $\bar{O}X$ to Xn | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 2, 4  |                            | 5.0  | 18.0 | ns   | 10, 11     |
| tcw      |                                                                     | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 5     | CLOCK PERIOD               | 32.0 |      | ns   | 9          |
|          |                                                                     |                                           | 5     | CLOCK PERIOD               | 36.0 |      | ns   | 10, 11     |

## Electrical Characteristics

### AC PARAMETERS(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)

AC: CL=50pf, RL=500 OHMS, TR=2.5ns, TF=2.5ns SEE AC FIGS

| SYMBOL     | PARAMETER                                                | CONDITIONS                                | NOTES | PIN-NAME          | MIN  | MAX | UNIT | SUB-GROUPS |
|------------|----------------------------------------------------------|-------------------------------------------|-------|-------------------|------|-----|------|------------|
| ts(H/L)(1) | Setup Time HIGH or LOW                                   | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 5     | I1-I3 to CP       | 4.0  |     | ns   | 9          |
|            |                                                          |                                           | 5     | I1-I3 to CP       | 4.5  |     | ns   | 10, 11     |
| th(H/L)(1) | Hold Time HIGH or LOW                                    | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 5     | I1-I3 to CP       | 0    |     | ns   | 9, 10, 11  |
| ts(H/L)(2) | Setup Time $\overline{Dn}$ or $\overline{CI}$ to Neg. CP | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 5     |                   | 16.5 |     | ns   | 9          |
| ts(H/L)(2) | Setup Time $\overline{Dn}$ or $\overline{CI}$ to Neg. CP | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 5     |                   | 18.5 |     | ns   | 10, 11     |
| th(H/L)(2) | Hold Time $\overline{Dn}$ or $\overline{CI}$ to Neg. CP  | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 5     |                   | 0    |     | ns   | 9, 10, 11  |
| ts(H/L)(3) | Setup Time $\overline{CI}$ to Pos. CP                    | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 5     |                   | 13.0 |     | ns   | 9          |
| ts(H/L)(3) | Setup Time $\overline{CI}$ to Pos. CP                    | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 5     |                   | 14.5 |     | ns   | 10, 11     |
| th(H/L)(3) | Hold Time $\overline{CI}$ to Pos. CP                     | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 5     |                   | 0    |     | ns   | 9, 10, 11  |
| tw (H/L)   | CLOCK PULSE WIDTH                                        | VCC=5.0V @ 25C, VCC=4.5V & 5.5V @-55/125C | 5     | CLOCK PULSE WIDTH | 7.5  |     | ns   | 9          |
|            |                                                          |                                           | 5     | CLOCK PULSE WIDTH | 8.5  |     | ns   | 10, 11     |

Note 1: Screen tested 100% on each device at -55 C, +25 C & +125 C temperature, Subgroups A1, 2, 3, 7 & 8.

Note 2: Screen tested 100% on each device at +25 C temperature only, Subgroup A9.

Note 3: Sample tested (Method 5005, Table 1) on each MFG. lot at +25 C, +125 C & -55 C temp., Subgroups A1, 2, 3, 7 & 8.

Note 4: Sample Tested (Method 5005, Table 1) on each MFG. lot at +25 C Subgroup A9, & periodically at +125 C & -55 C temp., Subgroups 10 & 11.

Note 5: Not tested at +25C, +125C, or -55C Temperature. (DESIGN CHARACTERIZATION DATA).