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# FFB2222A / FMB2222A / MMPQ2222A NPN Multi-Chip General-Purpose Amplifier

## Description

This device is for use as a medium power amplifier and switch requiring collector currents up to 500 mA. Sourced from process 19.

## Block Diagram

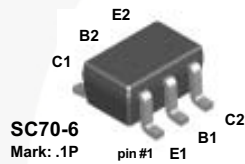


Figure 1. FFB2222A Device Package

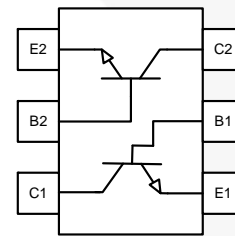


Figure 2. FFB2222A Internal Connection

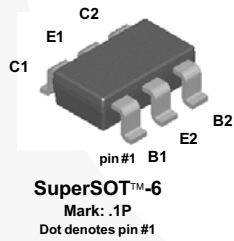


Figure 3. FMB2222A Device Package

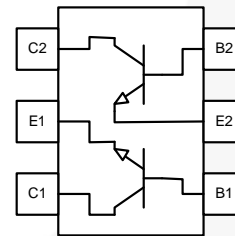


Figure 4. FMB2222A Internal Connection

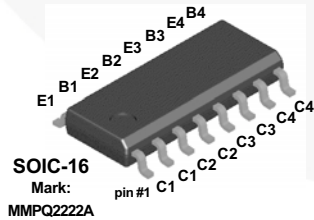


Figure 5. MMPQ2222A Device Package

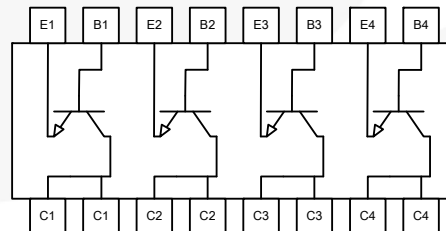


Figure 6. MMPQ2222A Internal Connection

## Ordering Information

| Part Number | Top Mark  | Package  | Packing Method |
|-------------|-----------|----------|----------------|
| FFB2222A    | .1P       | SC70 6L  | Tape and Reel  |
| FMB2222A    | .1P       | SSOT 6L  | Tape and Reel  |
| MMPQ2222A   | MMPQ2222A | SOIC 16L | Tape and Reel  |

## Absolute Maximum Ratings<sup>(1)</sup>

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| Symbol         | Parameter  | Value       | Unit             |
|----------------|--|-------------|------------------|
| $V_{CEO}$      | Collector-Emitter Voltage                        | 45          | V                |
| $V_{CBO}$      | Collector-Base Voltage                           | 75          | V                |
| $V_{EBO}$      | Emitter-Base Voltage                             | 5.0         | V                |
| $I_C$          | Collector Current - Continuous                   | 500         | mA               |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to +150 | $^\circ\text{C}$ |

### Note:

1. These ratings are based on a maximum junction temperature of  $150^\circ\text{C}$ . These are steady-state limits. Fairchild Semiconductor should be consulted on applications involving pulsed or low-duty cycle operations.

## Thermal Characteristics<sup>(2)</sup>

Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| Symbol          | Parameter   | Max.     |          |           | Unit                      |
|-----------------|---|----------|----------|-----------|---------------------------|
|                 |   | FFB2222A | FMB2222A | MMPQ2222A |                           |
| $P_D$           | Total Device Dissipation                                  | 300      | 700      | 1,000     | mW                        |
|                 | Derate Above $25^\circ\text{C}$                           | 2.4      | 5.6      | 8.0       | mW/ $^\circ\text{C}$      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient                   | 415      | 180      |           | $^\circ\text{C}/\text{W}$ |
|                 | Thermal Resistance, Junction-to-Ambient, Effective 4 Dies |          |          | 125       |                           |
|                 | Thermal Resistance, Junction-to-Ambient, Each Die         |          |          | 240       |                           |

### Note:

2. PCB size: FR-4, 76 mm x 114 mm x 1.57 mm (3.0 inch x 4.5 inch x 0.062 inch) with minimum land pattern size.

## Electrical Characteristics

Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| Symbol        | Parameter   | Conditions  | Min. | Typ. | Max. | Unit |
|---------------|---|---|------|------|------|------|
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage <sup>(3)</sup>  | $I_C = 10\text{ mA}, I_B = 0$   | 40   |      |      | V    |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage                    | $I_C = 10\text{ }\mu\text{A}, I_E = 0$  | 75   |      |      | V    |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage                      | $I_E = 10\text{ }\mu\text{A}, I_C = 0$  | 5.0  |      |      | V    |
| $I_{CBO}$     | Collector Cut-Off Current                           | $V_{CB} = 60\text{ V}, I_E = 0$   |      |      | 10   | nA   |
| $I_{EBO}$     | Emitter Cut-Off Current                             | $V_{EB} = 3.0\text{ V}, I_C = 0$  |      |      | 10   | nA   |
| $h_{FE}$      | DC Current Gain                                     | $I_C = 0.1\text{ mA}, V_{CE} = 10\text{ V}$   | 35   |      |      |      |
|               |   | $I_C = 1.0\text{ mA}, V_{CE} = 10\text{ V}$   | 50   |      |      |      |
|               |   | $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$  | 75   |      |      |      |
|               |   | $I_C = 150\text{ mA}, V_{CE} = 10\text{ V}^{(3)}$   | 100  |      | 300  |      |
|               |   | $I_C = 150\text{ mA}, V_{CE} = 1.0\text{ V}^{(3)}$  | 50   |      |      |      |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage <sup>(3)</sup> | $I_C = 150\text{ mA}, I_B = 15\text{ mA}$   |      |      | 0.3  | V    |
|               |   | $I_C = 500\text{ mA}, I_B = 50\text{ mA}$   |      |      | 1.0  |      |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage <sup>(3)</sup>      | $I_C = 150\text{ mA}, I_B = 15\text{ mA}$   |      |      | 1.2  | V    |
|               |   | $I_C = 500\text{ mA}, I_B = 50\text{ mA}$   |      |      | 2.0  |      |
| $f_T$         | Current Gain - Bandwidth Product                    | $I_C = 20\text{ mA}, V_{CE} = 20\text{ V},$<br>$f = 100\text{ MHz}$                                     |      | 300  |      | MHz  |
| $C_{obo}$     | Output Capacitance                                  | $V_{CB} = 10\text{ V}, I_E = 0,$<br>$f = 100\text{ kHz}$  |      | 4.0  |      | pF   |
| $C_{ibo}$     | Input Capacitance                                   | $V_{EB} = 0.5\text{ V}, I_C = 0,$<br>$f = 100\text{ kHz}$   |      | 20   |      | pF   |
| NF            | Noise Figure  | $I_C = 100\text{ }\mu\text{A}, V_{CE} = 10\text{ V},$<br>$R_S = 1.0\text{ k}\Omega, f = 1.0\text{ kHz}$ |      | 2.0  |      | dB   |
| $t_d$         | Delay Time  | $V_{CC} = 30\text{ V}, V_{BE(OFF)} = 0.5\text{ V},$<br>$I_C = 150\text{ mA}, I_{B1} = 15\text{ mA}$     |      | 8    |      | ns   |
| $t_r$         | Rise Time   |   |      | 20   |      | ns   |
| $t_s$         | Storage Time  | $V_{CC} = 30\text{ V}, I_C = 150\text{ mA},$<br>$I_{B1} = I_{B2} = 15\text{ mA}$                        |      | 180  |      | ns   |
| $t_f$         | Fall Time   |   |      | 40   |      | ns   |

### Note:

3. Pulse test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2.0\%$ .

## Typical Performance Characteristics

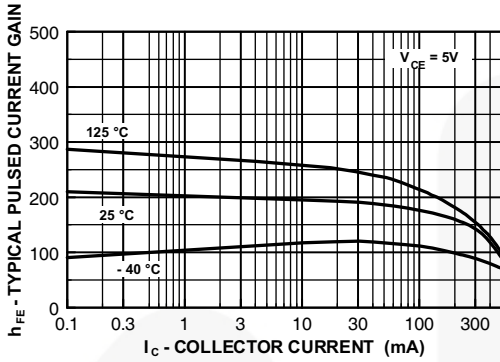


Figure 7. Typical Pulsed Current Gain vs. Collector Current

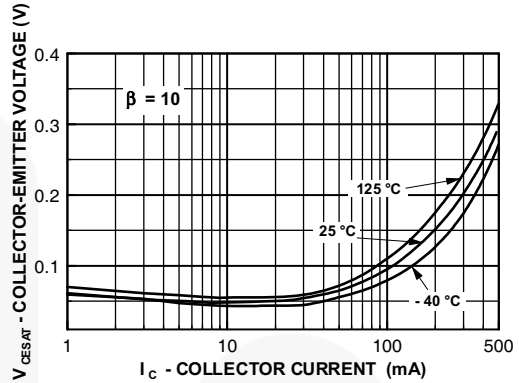


Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

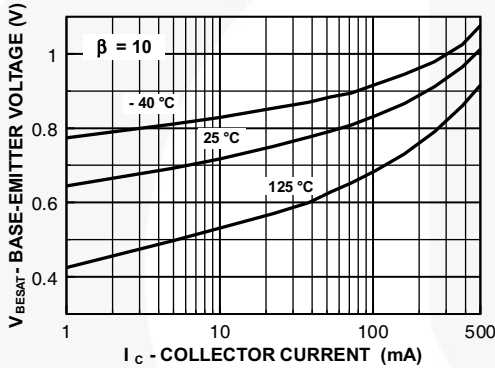


Figure 9. Base-Emitter Saturation Voltage vs. Collector Current

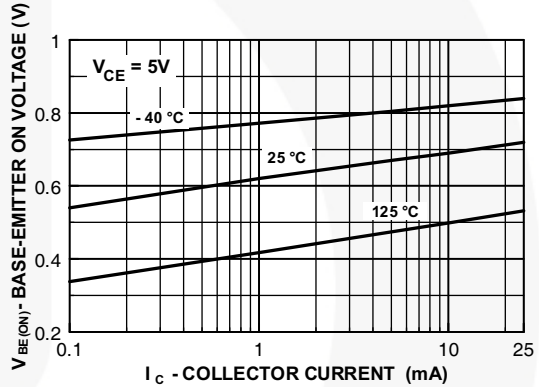


Figure 10. Base-Emitter On Voltage vs. Collector Current

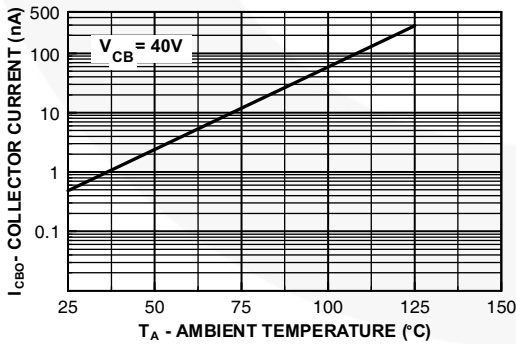


Figure 11. Collector Cut-Off Current vs. Ambient Temperature

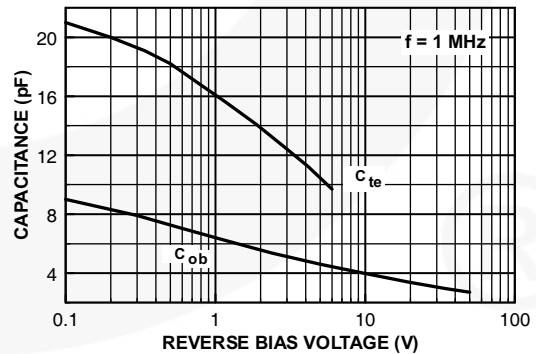
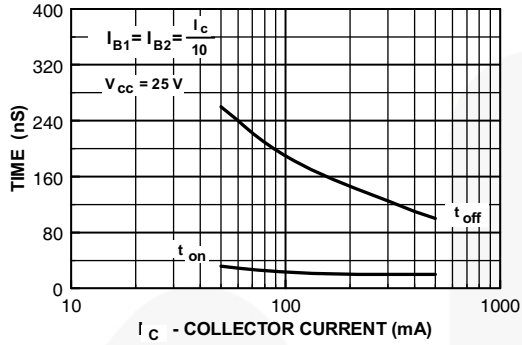
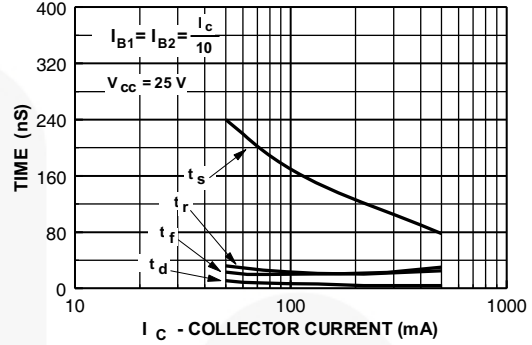


Figure 12. Emitter Transition and Output Capacitance vs. Reverse Bias Voltage

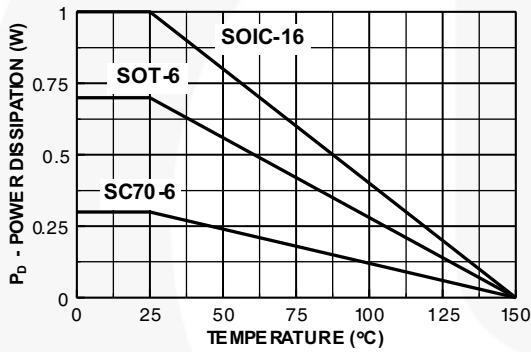
**Typical Performance Characteristics** (Continued)



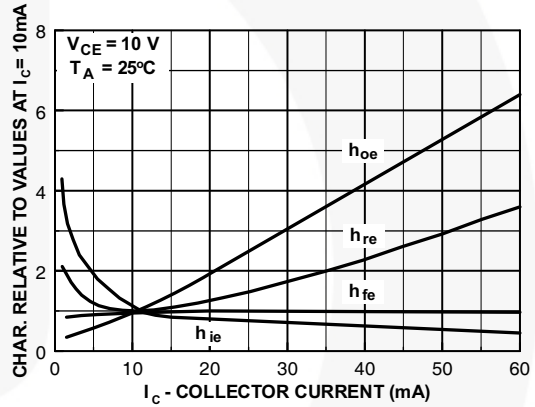
**Figure 13. Turn-On and Turn-Off Times vs. Collector Current**



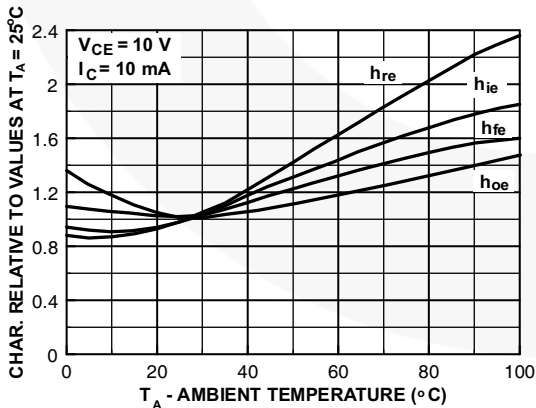
**Figure 14. Switching Time vs. Collector Current**



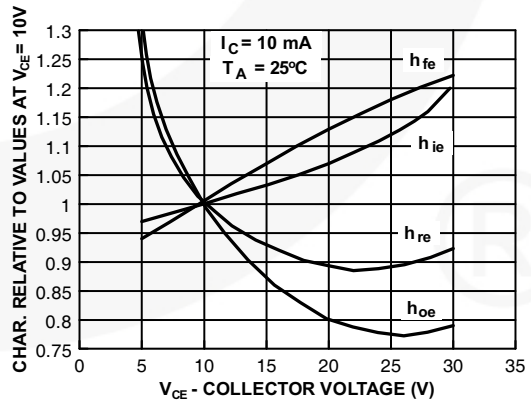
**Figure 15. Power Dissipation vs. Ambient Temperature**



**Figure 16. Common Emitter Characteristics**



**Figure 17. Common Emitter Characteristics**



**Figure 18. Common Emitter Characteristics**

Test Circuits

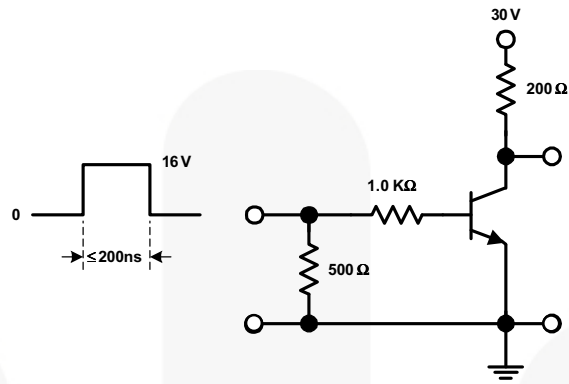


Figure 19. Saturated Turn-On Switching Time

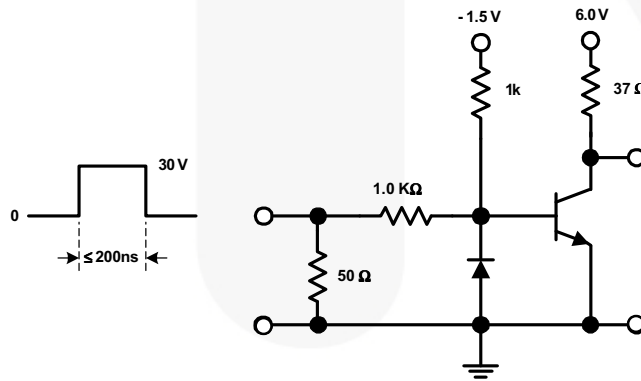
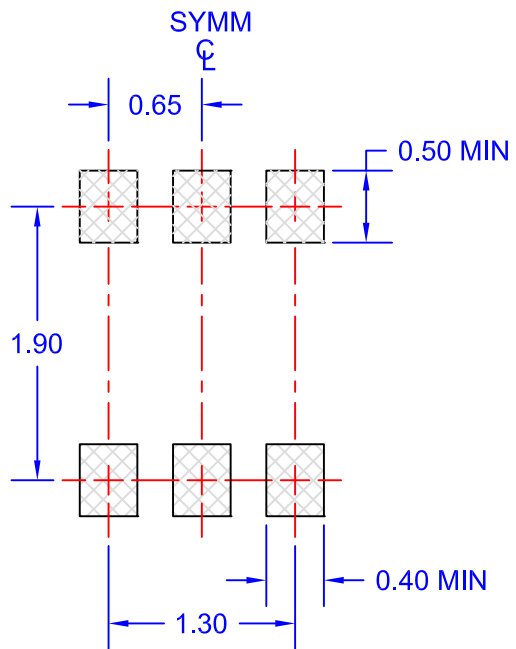
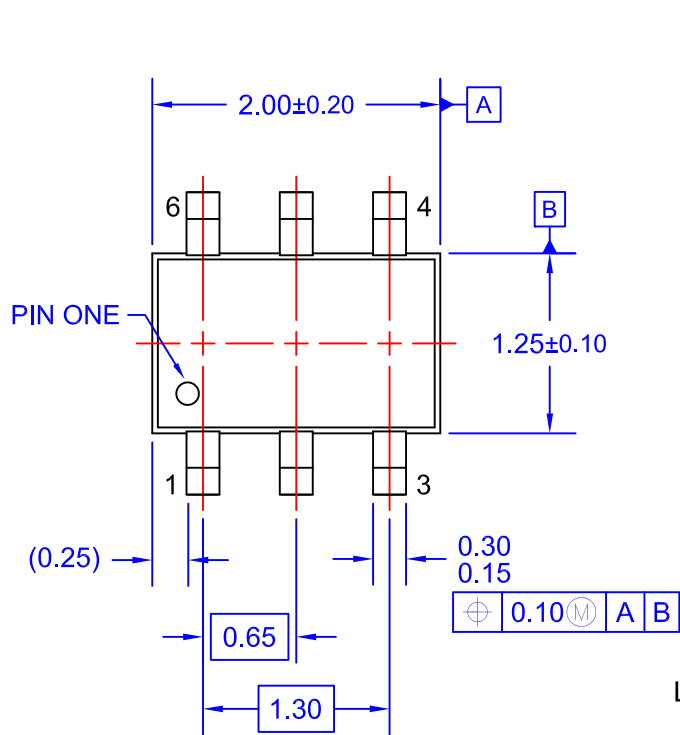
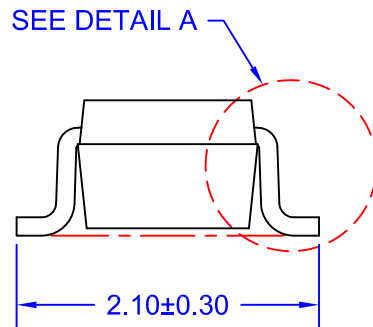
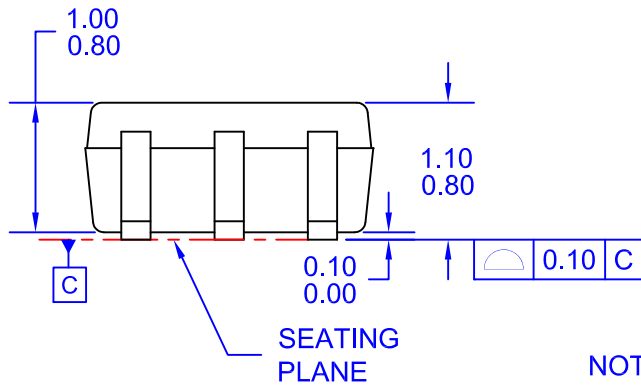


Figure 20. Saturated Turn-Off Switching Time





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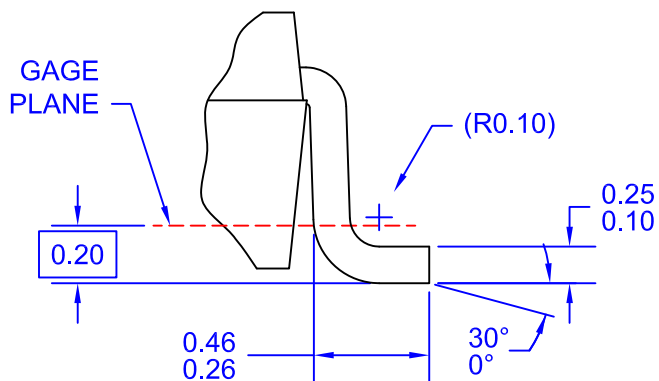


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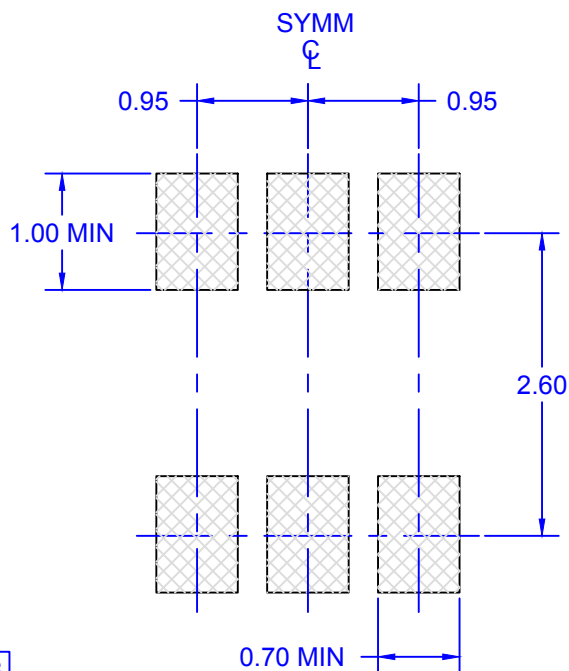
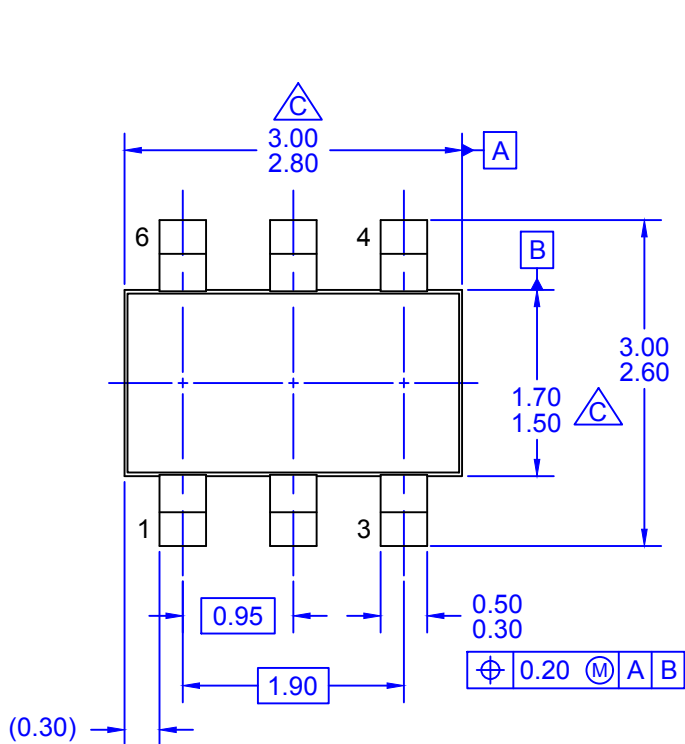
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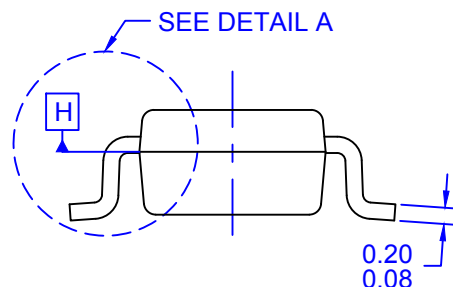
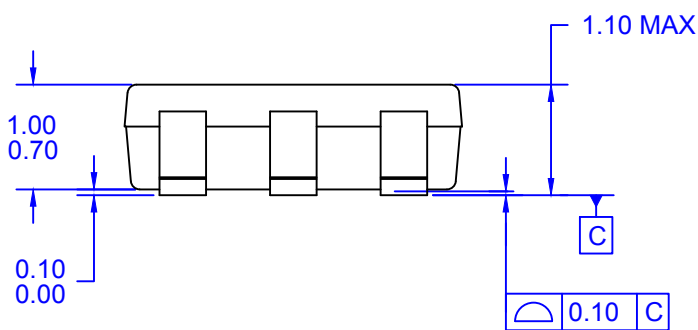
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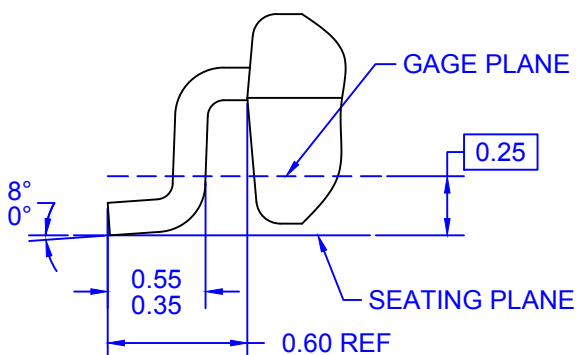
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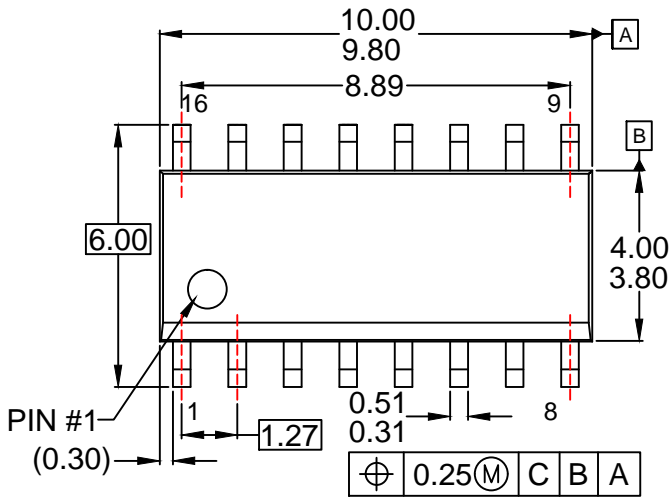
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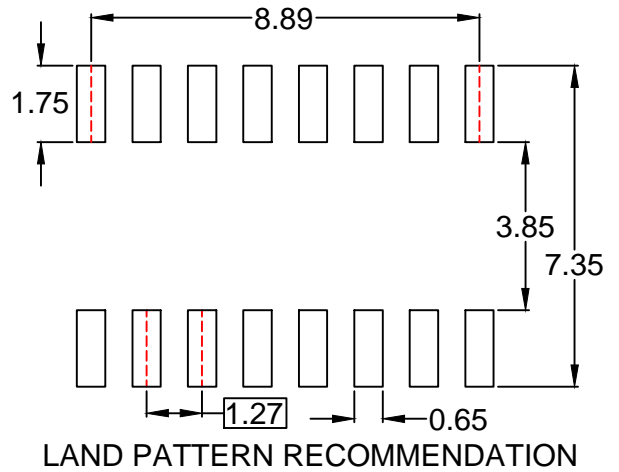
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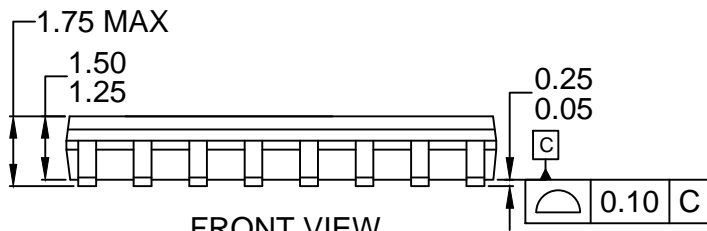




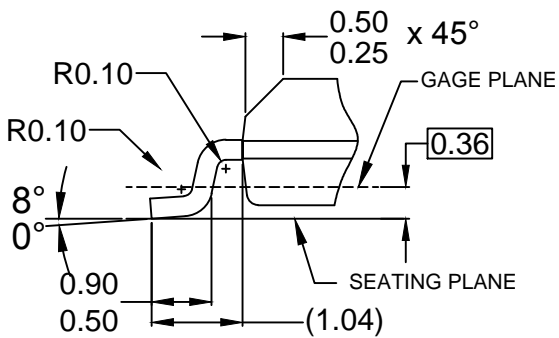
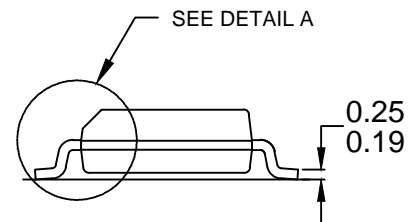
TOP VIEW



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FRONT VIEW



DETAIL A

SCALE: 2:1

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