

# DIGITRON SEMICONDUCTORS

**MAC3010 SERIES**  
**MAC3020 SERIES**  
**MAC3030 SERIES**  
**MAC3040 SERIES**

**SILICON BIDIRECTIONAL THYRISTORS**

Available Non-RoHS (standard) or RoHS compliant (add PBF suffix).

Available as "HR" (high reliability) screened per MIL-PRF-19500, JANTX level. Add "HR" suffix to base part number.

## MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

| Rating                                                                        | Symbol              | Current Ratings |             |            |            |             |            | Unit             |
|-------------------------------------------------------------------------------|---------------------|-----------------|-------------|------------|------------|-------------|------------|------------------|
|                                                                               |                     | -4              | -8          | -15        | -25        | -40         | -401       |                  |
| RMS on-state current (full sine wave, 50 to 60Hz)                             | I <sub>T(RMS)</sub> | 4.0             | 8.0         | 15         | 25         | 40          | 40         | Amps             |
| Peak non-repetitive surge current<br>(1 cycle, 60 Hz, T <sub>C</sub> = 110°C) | I <sub>TSM</sub>    | 30              | 80          | 150        | 250        | 300         | 300        | Amps             |
| Circuit fusing considerations<br>(T <sub>J</sub> = -40 to +110°C, t = 8.3ms)  | I <sup>2</sup> t    | 3.6             | 26          | 90         | 260        | 370         | 370        | A <sup>2</sup> s |
| Peak gate voltage (t ≤ 2.0μs)                                                 | V <sub>GM</sub>     | ±5              | ±10         | ±10        | ±10        | ±10         | ±10        | Volts            |
| Peak gate power (t ≤ 2.0μs)                                                   | P <sub>GM</sub>     | 10              | 20          | 20         | 20         | 20          | 20         | Watts            |
| Peak gate current (t ≤ 2.0μs)                                                 | I <sub>GM</sub>     | 11              | 12          | 12         | 12         | 12          | 12         | Amps             |
| Average gate power<br>(T <sub>C</sub> = 80°C, t = 8.3ms)                      | P <sub>G(AV)</sub>  | 0.5             |             |            |            |             |            | Watts            |
| Operating junction temperature range                                          | T <sub>J</sub>      | -40 to +100     | -40 to +125 |            |            | -40 to +100 |            | °C               |
| Storage temperature range                                                     | T <sub>stg</sub>    | -40 to +150     |             |            |            |             |            | °C               |
| Mounting torque                                                               | -                   | 6.0             | 8.0         | 8.0        | 8.0        | 30          | 30         | In. lb.          |
| Peak repetitive forward voltage<br>MAC3010/MAC3030<br>MAC3020/MAC3040         | V <sub>DRM</sub>    | 250<br>400      | 250<br>400  | 250<br>400 | 250<br>400 | 250<br>400  | 250<br>400 | Volts            |

Note 1:  $V_{DRM}$  for all types can be applied on a continuous basis. Blocking voltage shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.

## THERMAL CHARACTERISTICS

| Characteristic                                 | Symbol          | Current Ratings |     |     |     |     |      | Unit               |
|------------------------------------------------|-----------------|-----------------|-----|-----|-----|-----|------|--------------------|
|                                                |                 | -4              | -8  | -15 | -25 | -40 | -401 |                    |
| <b>Thermal resistance, junction to case</b>    | $R_{\theta JC}$ | 3.5             | 2.2 | 2.0 | 1.2 | 0.9 | 0.9  | $^\circ\text{C/W}$ |
| <b>Thermal resistance, junction to ambient</b> | $R_{\theta JA}$ | 75              | 60  | 60  | 60  | 1.0 | 1.0  | $^\circ\text{C/W}$ |

## ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ and either polarity of MT2 to MT1 voltage unless otherwise noted)

| Characteristic                                                                                                                                                                                                | Symbol    | Min | Typ. | Max | Unit  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----|------|-----|-------|
| <b>-4 CURRENT RATING</b>                                                                                                                                                                                      |           |     |      |     |       |
| <b>Peak blocking current</b> <sup>(2)</sup><br>(Rated $V_{DRM}$ @ $T_J = 110^\circ\text{C}$ )                                                                                                                 | $I_{DRM}$ | -   | -    | 2.0 | mA    |
| <b>Peak on-state voltage</b> (either direction)<br>( $I_{TM} = 6\text{A}$ peak, pulse width $\leq 2\text{ms}$ , duty cycle $\leq 2\%$ )                                                                       | $V_{TM}$  | -   | -    | 2.0 | Volts |
| <b>Gate trigger current</b> (continuous dc)<br>( $V_D = 12\text{V}$ , $R_L = 100\Omega$ )<br>MT2(+),G(+); MT2(-),G(-)                                                                                         | $I_{GT}$  | -   | -    | 30  | mA    |
| <b>Gate trigger voltage</b> (continuous dc)<br>( $V_D = 12\text{V}$ , $R_L = 100\Omega$ )<br>MT2(+),G(+); MT2(-),G(-)<br>( $R_L = 10\text{k}\Omega$ , $T_J = 110^\circ\text{C}$ )<br>MT2(+),G(+); MT2(-),G(-) | $V_{GT}$  | -   | -    | 2.0 | Volts |
|                                                                                                                                                                                                               |           | 0.2 | -    | -   |       |
| <b>Holding current</b><br>( $V_D = 12\text{V}$ , $I_{TM} = 200\text{mA}$ , gate open)                                                                                                                         | $I_H$     | -   | -    | 40  | mA    |

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MAC3040 SERIES

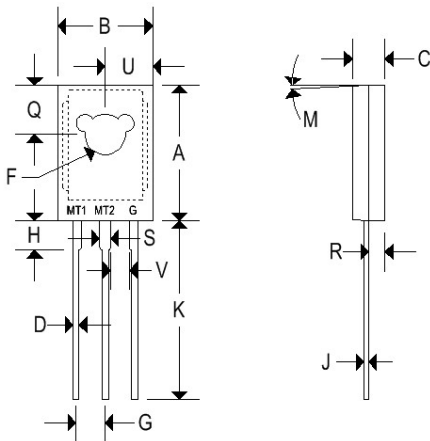
SILICON BIDIRECTIONAL THYRISTORS

| Characteristic                                                                                                                               | Symbol     | Min | Typ. | Max | Unit      |
|----------------------------------------------------------------------------------------------------------------------------------------------|------------|-----|------|-----|-----------|
| Gate controlled turn on time<br>( $I_{TM} = 6A$ peak, $I_G = 100mA$ )                                                                        | tgt        | -   | 1.5  | -   | $\mu s$   |
| Critical rate of rise of commutation voltage<br>( $I_{TM} = 6A$ peak, commutating $di/dt = 3.1A/ms$ , gate unenergized, $T_C = 85^\circ C$ ) | $dv/dt(c)$ | -   | 5.0  | -   | $V/\mu s$ |
| Critical rate of rise of off-state voltage<br>(exponential waveform, $T_C = 110^\circ C$ )                                                   | $dv/dt$    | -   | 20   | -   | $V/\mu s$ |

Note 2: Ratings apply for open gate conditions. Thyristor devices shall not be tested with a constant current source for blocking voltage such that the voltage applied exceeds the rated blocking voltage.

## MECHANICAL CHARACTERISTIC

|         |                             |
|---------|-----------------------------|
| Case    | TO-126 (MAC3010-4)          |
| Marking | Body painted, alpha-numeric |
| Pin out | See below                   |



|   | TO-126 |       |             |        |
|---|--------|-------|-------------|--------|
|   | Inches |       | Millimeters |        |
|   | Min    | Max   | Min         | Max    |
| A | 0.425  | 0.435 | 10.80       | 11.050 |
| B | 0.295  | 0.305 | 7.490       | 7.750  |
| C | 0.095  | 0.105 | 2.410       | 2.670  |
| D | 0.020  | 0.026 | 0.510       | 0.660  |
| F | 0.115  | 0.125 | 2.920       | 3.180  |
| G | 0.091  | 0.097 | 2.310       | 2.460  |
| H | 0.050  | 0.095 | 1.270       | 2.410  |
| J | 0.015  | 0.025 | 0.380       | 0.640  |
| K | 0.595  | 0.655 | 15.110      | 16.640 |
| M | 3° TYP |       | 3° TYP      |        |
| Q | 0.148  | 0.158 | 3.760       | 4.010  |
| R | 0.045  | 0.055 | 1.140       | 1.400  |
| S | 0.025  | 0.035 | 0.640       | 0.890  |
| U | 0.145  | 0.155 | 3.680       | 3.940  |
| V | 0.040  | -     | 1.020       | -      |

FIGURE 1 — CURRENT DERATING AND  
POWER DISSIPATION  
REFERENCE: CASE TEMPERATURE

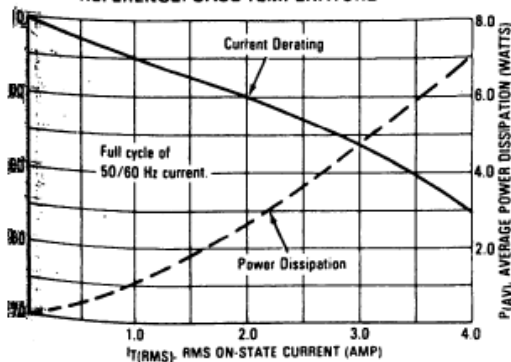
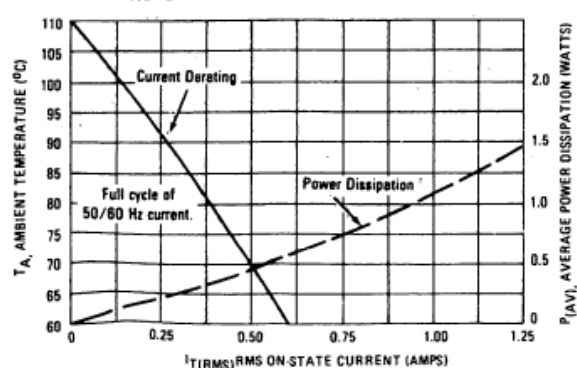


FIGURE 1A — POWER DISSIPATION  
REFERENCE: AMBIENT TEMPERATURE



# DIGITRON SEMICONDUCTORS

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MAC3040 SERIES

SILICON BIDIRECTIONAL THYRISTORS

**ELECTRICAL CHARACTERISTICS** ( $T_C = 25^\circ\text{C}$  and either polarity of MT2 to MT1 voltage unless otherwise noted)

| Characteristic                                                                                                                                                                                                | Symbol     | Min         | Typ.        | Max                | Unit             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|-------------|--------------------|------------------|
| <b>-8, -15, -25 CURRENT RATING</b>                                                                                                                                                                            |            |             |             |                    |                  |
| <b>Peak blocking current</b> <sup>(2)</sup><br>(@ $T_J = 125^\circ\text{C}$ )                                                                                                                                 | $I_{DRM}$  | -           | -           | 2.0                | mA               |
| <b>Peak on-state voltage</b><br>( $I_{TM} = \sqrt{2} I_{T(RMS)}$ A peak, pulse width $\leq 2$ ms, duty cycle $\leq 2\%$ )<br>MAC3030-8<br>MAC3030-15<br>MAC3030-25                                            | $V_{TM}$   | -<br>-<br>- | -<br>-<br>- | 1.6<br>1.6<br>1.85 | Volts            |
| <b>Gate trigger current</b> (continuous dc)<br>( $V_D = 12\text{V}$ , $R_L = 100\Omega$ )<br>MT2(+),G(+); MT2(-),G(-)                                                                                         | $I_{GT}$   | -           | -           | 40                 | mA               |
| <b>Gate trigger voltage</b> (continuous dc)<br>( $V_D = 12\text{V}$ , $R_L = 100\Omega$ )<br>MT2(+),G(+); MT2(-),G(-)<br>( $R_L = 10\text{k}\Omega$ , $T_J = 125^\circ\text{C}$ )<br>MT2(+),G(+); MT2(-),G(-) | $V_{GT}$   | -<br>0.2    | -<br>-      | 2.0<br>-           | Volts            |
| <b>Holding current</b><br>( $V_D = 12\text{V}$ , $I_{TM} = 200\text{mA}$ , gate open)                                                                                                                         | $I_H$      | -           | -           | 40                 | mA               |
| <b>Gate controlled turn on time</b><br>( $I_{TM} = \sqrt{2} I_{T(RMS)}$ A peak, $I_G = 100\text{mA}$ )                                                                                                        | $t_{gt}$   | -           | 1.5         | -                  | $\mu\text{s}$    |
| <b>Critical rate of rise of commutation voltage</b><br>( $I_{TM} = \sqrt{2} I_{T(RMS)}$ A peak, commutating $di/dt = 0.52 I_{T(RMS)}$ A/ms, gate unenergized,<br>$T_C = 80^\circ\text{C}$ )                   | $dv/dt(c)$ | -           | 5.0         | -                  | V/ $\mu\text{s}$ |
| <b>Critical rate of rise of off-state voltage</b><br>(exponential waveform, $T_C = 125^\circ\text{C}$ )                                                                                                       | $dv/dt$    | 40          | -           | -                  | V/ $\mu\text{s}$ |

Note 2: Ratings apply for open gate conditions. Thyristor devices shall not be tested with a constant current source for blocking voltage such that the voltage applied exceeds the rated blocking voltage

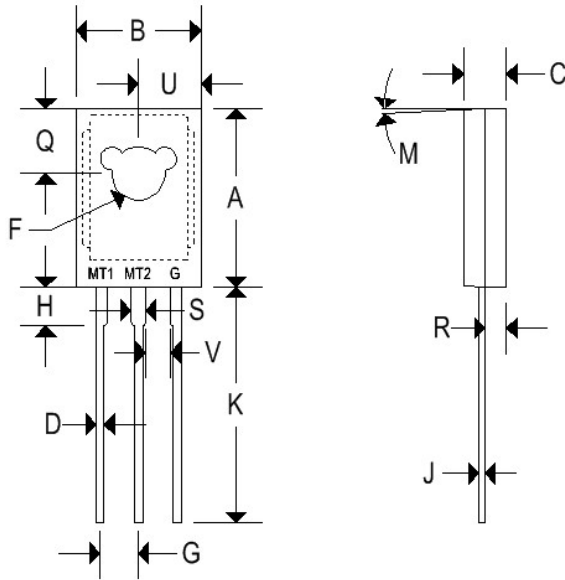
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MAC3010 SERIES  
MAC3020 SERIES  
MAC3030 SERIES  
MAC3040 SERIES

SILICON BIDIRECTIONAL THYRISTORS

## MECHANICAL CHARACTERISTIC

|         |                                |
|---------|--------------------------------|
| Case    | TO-220AB (MAC3010-8, -15, -25) |
| Marking | Body painted, alpha-numeric    |
| Pin out | See below                      |



|   | TO-220AB |       |             |        |
|---|----------|-------|-------------|--------|
|   | Inches   |       | Millimeters |        |
|   | Min      | Max   | Min         | Max    |
| A | 0.575    | 0.620 | 14.600      | 15.750 |
| B | 0.380    | 0.405 | 9.650       | 10.290 |
| C | 0.160    | 0.190 | 4.060       | 4.820  |
| D | 0.025    | 0.035 | 0.640       | 0.890  |
| F | 0.142    | 0.147 | 3.610       | 3.730  |
| G | 0.095    | 0.105 | 2.410       | 2.670  |
| H | 0.110    | 0.155 | 2.790       | 3.930  |
| J | 0.014    | 0.022 | 0.360       | 0.560  |
| K | 0.500    | 0.562 | 12.700      | 14.270 |
| L | 0.045    | 0.055 | 1.140       | 1.390  |
| N | 0.190    | 0.210 | 4.830       | 5.330  |
| Q | 0.100    | 0.120 | 2.540       | 3.040  |
| R | 0.080    | 0.110 | 2.040       | 2.790  |
| S | 0.045    | 0.055 | 1.140       | 1.390  |
| T | 0.235    | 0.255 | 5.970       | 6.480  |
| U | -        | 0.050 | -           | 1.270  |
| V | 0.045    | -     | 1.140       | -      |
| Z | -        | 0.080 | -           | 2.030  |

FIGURE 2 — RMS CURRENT DERATING

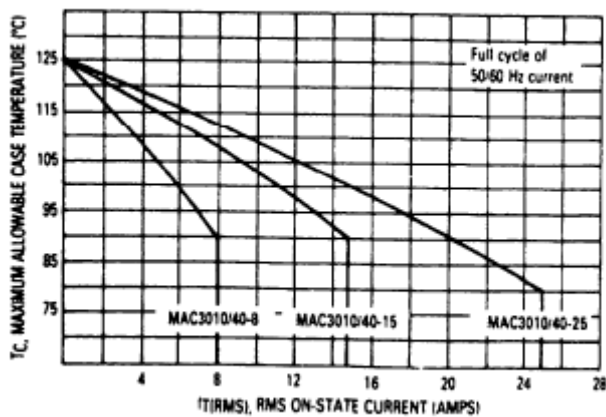
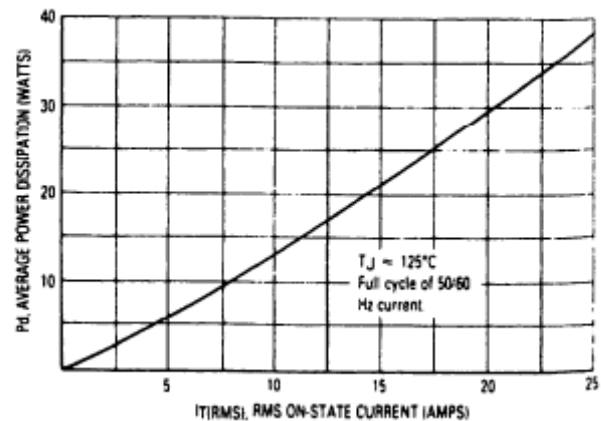


FIGURE 3 — ON-STATE POWER DISSIPATION



# DIGITRON SEMICONDUCTORS

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SILICON BIDIRECTIONAL THYRISTORS

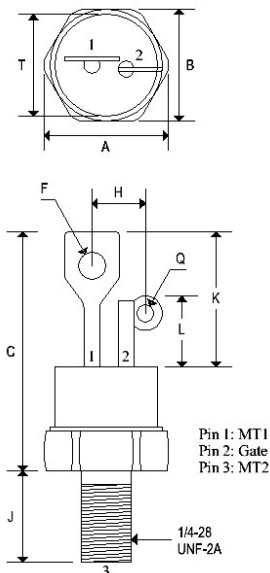
**ELECTRICAL CHARACTERISTICS** ( $T_C = 25^\circ\text{C}$  and either polarity of MT2 to MT1 voltage unless otherwise noted)

| Characteristic                                                                                                                                                                                                | Symbol           | Min      | Typ. | Max      | Unit                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------|------|----------|------------------------|
| <b>-40, -401 CURRENT RATING</b>                                                                                                                                                                               |                  |          |      |          |                        |
| <b>Peak blocking current</b> <sup>(2)</sup><br>(@ $T_J = 110^\circ\text{C}$ )                                                                                                                                 | $I_{\text{DRM}}$ | -        | -    | 2.0      | mA                     |
| <b>Peak on-state voltage</b> (either direction)<br>( $I_{\text{TM}} = 56\text{A}$ peak, pulse width $\leq 2\text{ ms}$ , duty cycle $\leq 2\%$ )                                                              | $V_{\text{TM}}$  | -        | -    | 1.85     | Volts                  |
| <b>Gate trigger current</b> (continuous dc)<br>( $V_D = 12\text{V}$ , $R_L = 100\Omega$ )<br>MT2(+),G(+); MT2(-),G(-)                                                                                         | $I_{\text{GT}}$  | -        | -    | 40       | mA                     |
| <b>Gate trigger voltage</b> (continuous dc)<br>( $V_D = 12\text{V}$ , $R_L = 100\Omega$ )<br>MT2(+),G(+); MT2(-),G(-)<br>( $R_L = 10\text{k}\Omega$ , $T_J = 110^\circ\text{C}$ )<br>MT2(+),G(+); MT2(-),G(-) | $V_{\text{GT}}$  | -<br>0.2 | -    | 2.0<br>- | Volts                  |
| <b>Holding current</b><br>( $V_D = 12\text{V}$ , $I_{\text{TM}} = 200\text{mA}$ , gate open)                                                                                                                  | $I_{\text{H}}$   | -        | -    | 50       | mA                     |
| <b>Gate controlled turn on time</b><br>( $I_{\text{TM}} = 56\text{A}$ peak, $I_{\text{G}} = 200\text{mA}$ )                                                                                                   | $t_{\text{gt}}$  | -        | 1.5  | -        | $\mu\text{s}$          |
| <b>Critical rate of rise of commutation voltage</b><br>( $I_{\text{TM}} = 56\text{A}$ peak, commutating $di/dt = 22\text{ A/ms}$ , gate unenergized, $T_C = 60^\circ\text{C}$ )                               | $dv/dt(c)$       | 5.0      | -    | -        | $\text{V}/\mu\text{s}$ |
| <b>Critical rate of rise of off-state voltage</b><br>(exponential waveform, $T_C = 110^\circ\text{C}$ )                                                                                                       | $dv/dt$          | 30       | -    | -        | $\text{V}/\mu\text{s}$ |

Note 2: Ratings apply for open gate conditions. Thyristor devices shall not be tested with a constant current source for blocking voltage such that the voltage applied exceeds the rated blocking voltage

## MECHANICAL CHARACTERISTIC

|                 |                             |
|-----------------|-----------------------------|
| <b>Case</b>     | TO-48 (MAC3010-40)          |
| <b>Marking</b>  | Body painted, alpha-numeric |
| <b>Polarity</b> | Cathode is stud             |



|   | TO-48  |       |             |        |
|---|--------|-------|-------------|--------|
|   | Inches |       | Millimeters |        |
|   | Min    | Max   | Min         | Max    |
| A | 0.604  | 0.614 | 15.340      | 15.600 |
| B | 0.551  | 0.559 | 14.000      | 14.200 |
| C | 1.050  | 1.190 | 2.670       | 30.230 |
| F | 0.135  | 0.160 | 3.430       | 4.060  |
| H | -      | 0.265 | -           | 6.730  |
| J | 0.420  | 0.455 | 10.670      | 11.560 |
| K | 0.620  | 0.670 | 15.750      | 17.020 |
| L | 0.300  | 0.350 | 7.620       | 8.890  |
| Q | 0.055  | 0.085 | 1.400       | 2.160  |
| T | 0.501  | 0.505 | 12.730      | 12.830 |

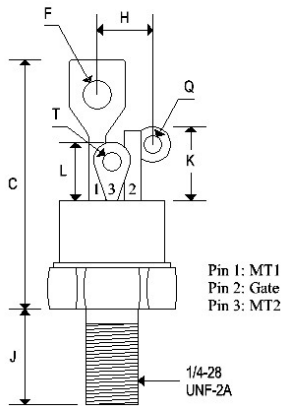
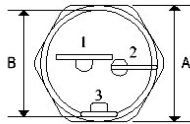
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SILICON BIDIRECTIONAL THYRISTORS

## MECHANICAL CHARACTERISTIC

|          |                             |
|----------|-----------------------------|
| Case     | TO-48 ISO (MAC3010-401)     |
| Marking  | Body painted, alpha-numeric |
| Polarity | Cathode is stud             |



|   | TO-48 ISO |       |             |        |
|---|-----------|-------|-------------|--------|
|   | Inches    |       | Millimeters |        |
|   | Min       | Max   | Min         | Max    |
| A | 0.551     | 0.559 | 14.000      | 14.200 |
| B | 0.501     | 0.505 | 12.730      | 12.830 |
| C | -         | 1.280 | -           | 32.510 |
| F | -         | 0.160 | -           | 4.060  |
| H | -         | 0.265 | -           | 6.730  |
| J | 0.420     | 0.455 | 10.670      | 11.560 |
| K | 0.300     | 0.350 | 7.620       | 8.890  |
| L | 0.255     | 0.275 | 6.480       | 6.990  |
| Q | 0.055     | 0.085 | 1.400       | 2.160  |
| T | 0.135     | 0.150 | 3.430       | 3.810  |

FIGURE 4 — RMS CURRENT DERATING

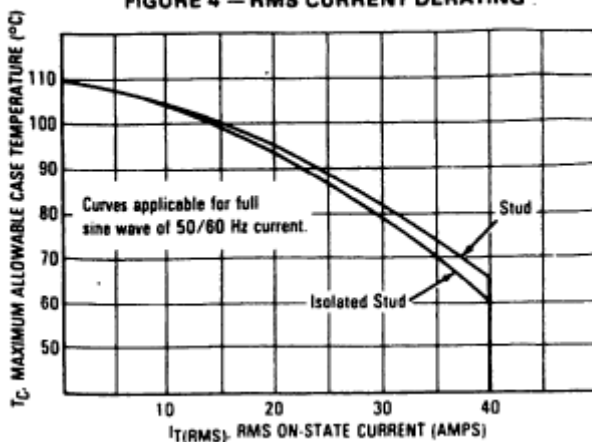


FIGURE 5 — ON-STATE POWER DISSIPATION

