MOTOROLA

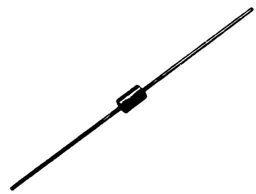
# BY 196 SERIES

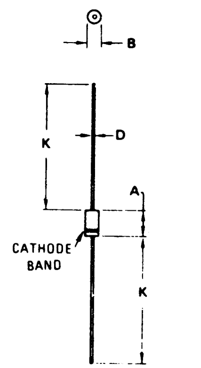
## SUBMINIATURE SIZE, AXIAL LEAD MOUNTED SOFT RECOVERY POWER RECTIFIERS

. . . designed for special applications such as dc power supplies, inverters, converters, ultrasonic systems, choppers, low RF interference and free wheeling diodes. A complete line of fast recovery rectifiers having typical recovery time of 500 nanoseconds providing high efficiency at frequencies to 250 Hz.

## SOFT RECOVERY POWER RECTIFIERS

100, 200, 400, 800 VOLTS
1.2 AMPERE






| DIM | MILLIMETERS MIN | MILLIMETERS MAX | INCHES MIN | INCHES MAX |
|---|---|---|---|---|
| A | 5.97 | 6.60 | 0.235 | 0.260 |
| B | 2.79 | 3.05 | 0.110 | 0.120 |
| D | 0.76 | 0.86 | 0.030 | 0.034 |
| K | 27.94 | - | 1.100 | - |

CASE 59-04

### DESIGNER'S DATA FOR „WORST CASE" CONDITIONS

The Designers Data Sheet permits the design of most circuits entirely from the information presented. Limit curves — representing device characteristic boundaries — are given to facilitate „worst case" design.

MAXIMUM RATINGS

| Ratings | Symbol | BY196 | BY197 | BY198 | BY199 | Unit |
|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RWM}$<br>$V_{RRM}$<br>$V_R$ | 100 | 200 | 400 | 800 | Volts |
| Non Repetitive Peak Reverse Voltage | $V_{RSM}$ | 200 | 300 | 500 | 1000 | Volts |
| RMS Reverse Voltage | $V_{R(RMS)}$ | 70 | 140 | 280 | 560 | Volts |
| Average Rectified Forward Current (Single phase, resistive load, $T_A = 75^o$ C) | $I_O$ | ← 1.2 (1) → | | | | Amp |
| Non-Repetitive Peak Surge Current (surge applied at rated load conditions) ($T_A = 25^o$ C) | $I_{FSM}$ | ← 70 → | | | | Amps |
| Operating Junction Temp. Range | $T_J$ | ← −65 to +150 → | | | | $^o$C |
| Storage Temperature Range | $T_{stg}$ | ← −65 to +175 → | | | | $^o$C |

1. Valid with leads at ambient Temperature at a Distance of 10 mm from case

THERMAL CHARACTERISTICS

| Characteristics | Symbol | Max. | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient (Typical Printed Circuit Board Mounting) | $R_{\theta JA}$ | 65 | $^o$C/W |

ELECTICAL CHARACTERISTICS

| Characteristics | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Forward Voltage ($I_F$ = 3,0 Amp. $T_A$ = 25 $^o$C) | $V_F$ | — | 1.1 | 1.3 | Volts |
| Reverse Current (rated dc voltage) $T_A$ = 25$^o$ C<br>$T_A$ = 100$^o$ C | $I_R$ | —<br>— | 1.0<br>5.0 | 10<br>100 | μA |

REVERSE RECOVERY CHARACTERISTICS

| Characteristics | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Reverse Recovery Time $I_F$ = 10 mA through $I_R$ = 10 mA to $I_R$ = 1 mA | $t_{rr}$ | — | — | 500 | ns |
| $I_F$ = 1 Amp. to $V_R$ = 30 $V_{DC}$ (figure 21) | $t_{rr}$ | — | 350 | 750 | ns |

### MECHANICAL CHARACTERISTICS

**CASE:** Void Free, Transfer Molded

**FINISH:** External leads are tin plated, leads are readily solderable

**POLARITY:** Cathode indicated by Polarity band

**WEIGHT:** 0.4 Grams (Approximately)

# BY 196 SERIES

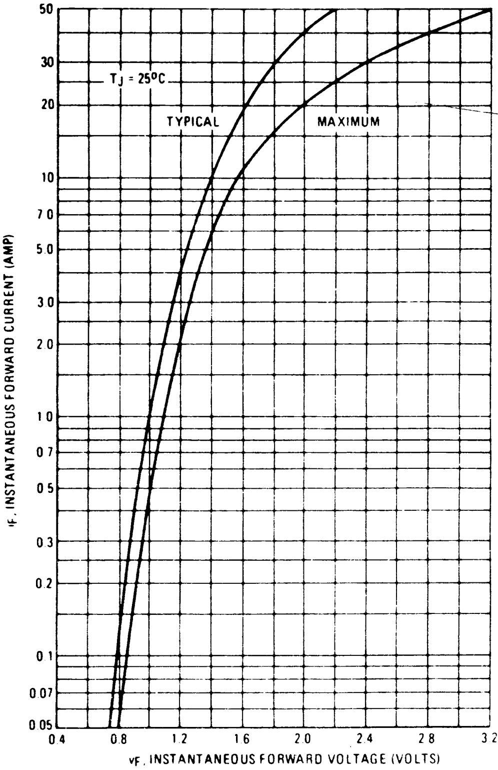



FIGURE 1 – FORWARD VOLTAGE

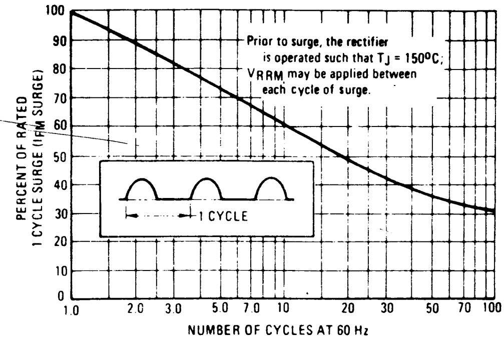



FIGURE 2 – MAXIMUM SURGE CAPABILITY

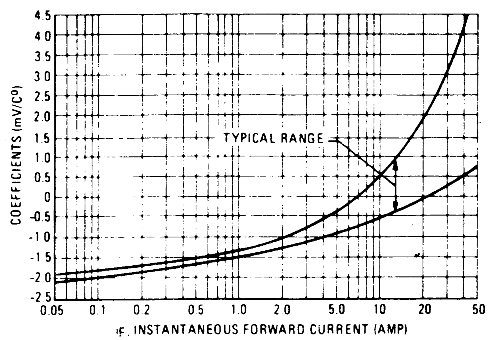



FIGURE 3 – TEMPERATURE COEFFICIENT

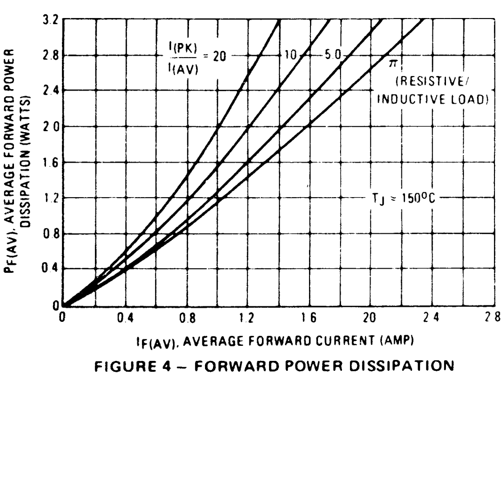



FIGURE 4 – FORWARD POWER DISSIPATION

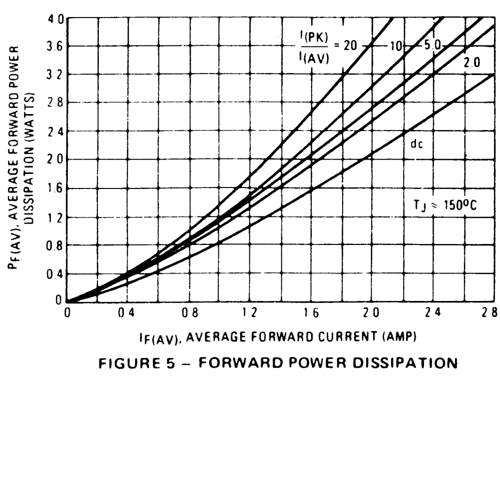



FIGURE 5 – FORWARD POWER DISSIPATION

## MAXIMUM CURRENT RATINGS
(SEE NOTES 1 and 2)

### SINE WAVE INPUT

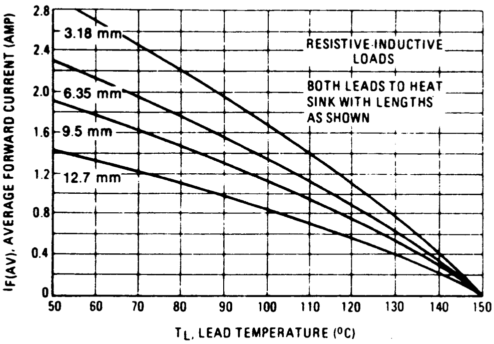



FIGURE 6 – EFFECT OF LEAD LENGTHS, RESISTIVE LOAD

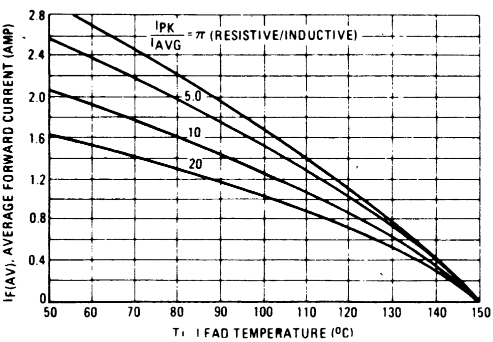



FIGURE 8 — 3.18 mm LEAD LENGTH, VARIOUS LOADS

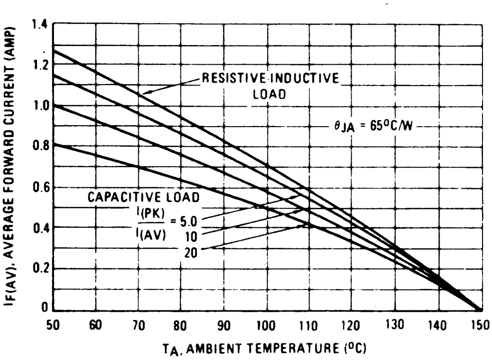



FIGURE 10 – PRINTED CIRCUIT BOARD MOUNTING, VARIOUS LOADS

### SQUARE WAVE INPUT

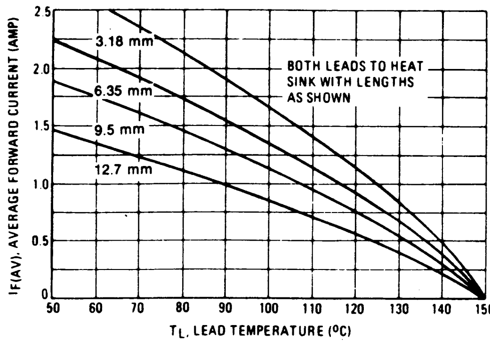



FIGURE 7 – EFFECT OF LEAD LENGTHS, RESISTIVE LOAD

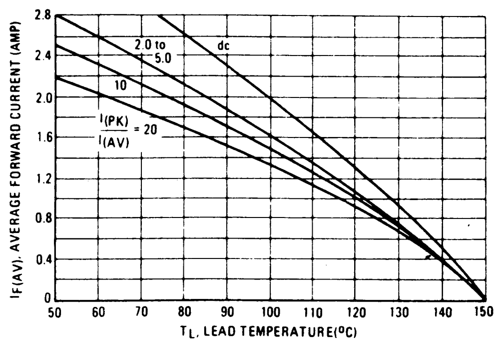



FIGURE 9 — 3.18 mm LEAD LENGTH, VARIOUS LOADS

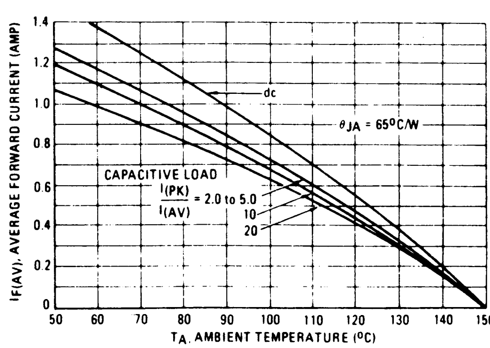



FIGURE 11 – PRINTED CIRCUIT BOARD MOUNTING, VARIOUS LOADS

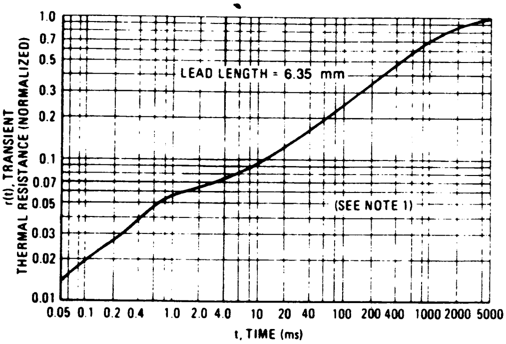



**FIGURE 12 – THERMAL RESPONSE**

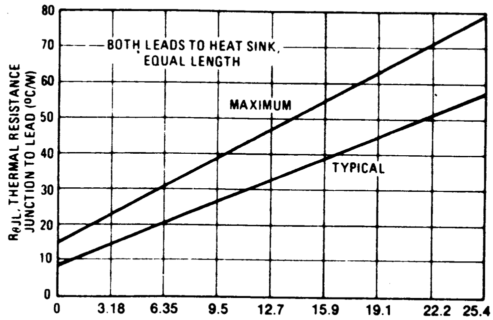
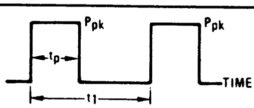



**FIGURE 13 – THERMAL RESISTANCE**

### NOTE 1




DUTY CYCLE, $D = t_p/t_1$
PEAK POWER, $P_{pk}$, is peak of an equivalent square power pulse.

To determine maximum junction temperature of the diode in a given situation, the following procedure is recommended:

The temperature of the case should be measured using a thermocouple placed on the case as close as possible to the tie point. The thermal mass connected to the tie point is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulsed operation once steady-state conditions are achieved. Using the measured value of $T_C$, the junction temperature may be determined by:

$$T_J = T_C + \Delta T_{JC}$$

where $\Delta T_{JC}$ is the increase in junction temperature above the case temperature. It may be determined by:

$$\Delta T_{JC} = P_{pk} \cdot R_{\theta JC}\left[D + (1 - D) \cdot r(t_1 + t_p) + r(t_p) - r(t_1)\right]$$

where

$r(t)$ = normalized value of transient thermal resistance at time, t, from Figure 12, i.e.:

$r(t_1 + t_p)$ = normalized value of transient thermal resistance at time $t_1 + t_p$.

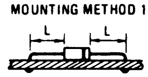
### NOTE 2

Data shown for thermal resistance junction-to-ambient ($\theta_{JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

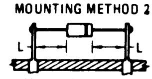
**TYPICAL VALUES FOR $\theta_{JA}$ IN STILL AIR**

| MOUNTING METHOD | LEAD LENGTH, L(mm) | | | | $R_{\theta JA}$ |
|---|---|---|---|---|---|
| | 3.81 | 6.35 | 12.7 | 19.1 | |
| 1 | 65 | 72 | 82 | 92 | °C/W |
| 2 | 74 | 81 | 91 | 101 | °C/W |
| 3 | | 40 | | | °C/W |

MOUNTING METHOD 1



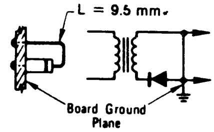

MOUNTING METHOD 2

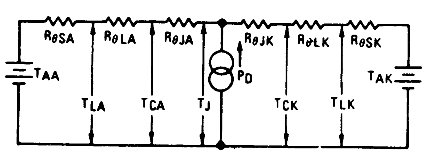



Vector pin mounting

MOUNTING METHOD 3

P. C. Board with
38.1 × 3.81 copper surface
L = 9.5 mm




Use of the above model permits junction to lead thermal resistance for any mounting configuration to be found. For a given total lead length, lowest values occur when one side of the rectifier is brought as close as possible to the heat sink. Terms in the model signify:

$T_A$ = Ambient Temperature
$T_L$ = Lead Temperature
$T_C$ = Case Temperature
$T_J$ = Junction Temperature
$R_{\theta S}$ = Thermal Resistance, Heat Sink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead to Heat Sink
$R_{\theta J}$ = Thermal Resistance, Junction to Case
$P_D$ = Power Dissipation

(Subscripts A and K refer to anode and cathode sides respectively.)

Values for thermal resistance components are:

$R_{\theta L}$ = 112°C/W/IN. Typically and 128°C/W/IN Maximum

$R_{\theta J}$ = 18°C/W Typically and 30°C/W Maximum

The maximum lead temperature may be calculated as follows:

$$T_L = 150° - \Delta T_{JL}$$

$\Delta T_{JL}$ can be calculated as shown in NOTE 1 or it may be approximated as follows:

$\Delta T_{JL} \approx R_{\theta JL} \bullet P_F$; $P_F$ may be formulated for sine-wave operation from Figure 3 or from Figure 4 for square-wave operation.

**FIGURE 14 – THERMAL CIRCUIT MODEL**

## TYPICAL DYNAMIC CHARACTERISTICS

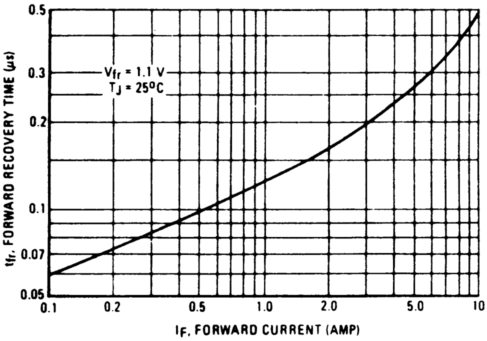



FIGURE 15 – FORWARD RECOVERY TIME

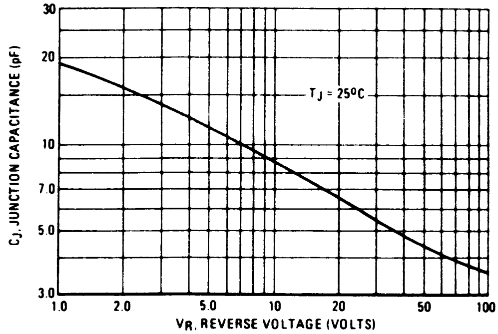



FIGURE 16 – JUNCTION CAPACITANCE

## TYPICAL RECOVERED STORED CHARGE DATA

**(SEE NOTE 3)**

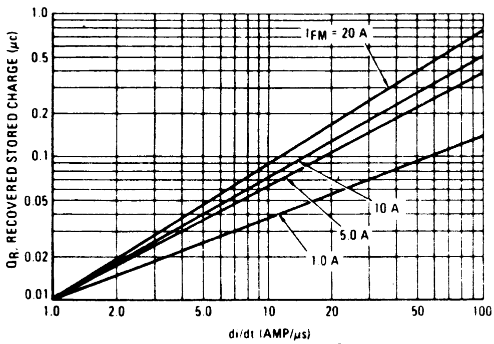



FIGURE 17 – $T_J$ = 25°C

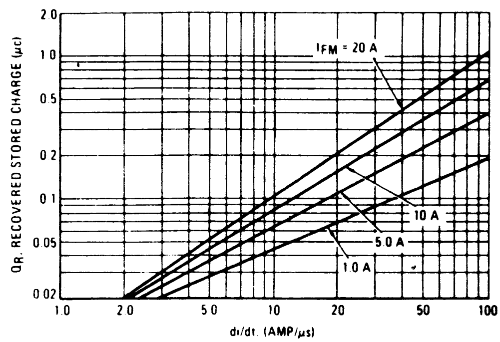



FIGURE 18 – $T_J$ = 75°C

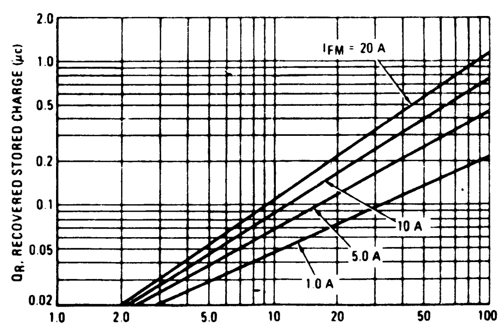



FIGURE 19 – $T_J$ = 100°C

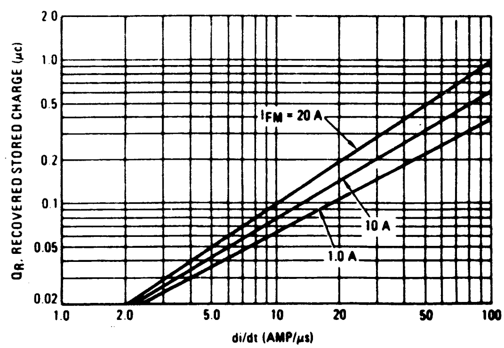



FIGURE 20 – $T_J$ = 150°C

MOTOROLA

# BY 406/407

## SUBMINIATURE SIZE, AXIAL LEAD MOUNTED FAST RECOVERY POWER RECTIFIERS

. . . designed for special applications such as dc power supplies, inverters, converters, ultrasonic systems, choppers, low RF interference and free wheeling diodes. A complete line of fast recovery rectifiers having typical recovery time of 200 nanoseconds providing high efficiency at frequencies to 250 Hz.

**DESIGNER'S DATA FOR „WORST CASE" CONDITIONS**
The Designers Data Sheet permits the design of most circuits entirely from the information presented. Limit curves — representing device characteristic boundaries — are given to facilitate „worst case" design.

MAXIMUM RATINGS

| Ratings | Symbol | BY 406 | BY 407 | Unit |
|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage | $V_{RWM}$<br>$V_{RRM}$ | 350 | 600 | Volts |
| DC Blocking Voltage | $V_R$ | 300 | 500 | Volts |
| Average Rectified Forward Current (Single phase, resistive load, $T_A$ = 75° C) | $I_{F(AV)}$ | ← 0,8 → | | Amp |
| Non-Repetitive Peak Surge Current (surge applied at rated load conditions) ($T_A$ = 75° C) | $I_{FSM}$ | ← 20 → | | Amps |
| Operating Junction Temp. Range | $T_J$ | ← –65 to +150 → | | °C |
| Storage Temperature Range | $T_{stg}$ | ← –65 to +175 → | | °C |

THERMAL CHARACTERISTICS

| Characteristics | Symbol | Max. | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient (Typical Printed Circuit Board Mounting) | $R_{\theta JA}$ | 65 | °C/W |

ELECTRICAL CHARACTERISTICS

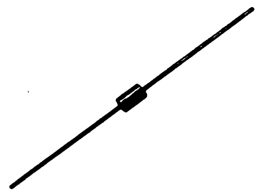
| Characteristics | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Forward Voltage ($I_F$ = 2,0 Amp. $T_A$ = 25 Grad C) | $V_F$ | — | 1,1 | 1,55 | Volts |
| Reverse Current (rated dc voltage) $T_A$ = 25° C<br>$T_A$ = 125° C | $I_R$ | —<br>— | 1,0<br>— | 2,0<br>125 | μA |

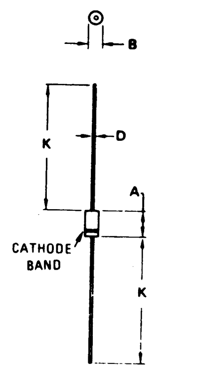
REVERSE RECOVERY CHARACTERISTICS

| Characteristics | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Reverse Recovery Time ($I_F$ = 10 mA to $V_R$ = 50 V | $t_{rr}$ | — | 150 | 300 | ns |

## FAST RECOVERY POWER RECTIFIERS

350/600 VOLTS
0.8 AMPERE






| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 5.97 | 6.60 | 0.235 | 0.260 |
| B | 2.79 | 3.05 | 0.110 | 0.120 |
| D | 0.76 | 0.86 | 0.030 | 0.034 |
| K | 27.94 | – | 1.100 | – |

CASE 59-04

### MECHANICAL CHARACTERISTICS

**CASE:** Void Free, Transfer Molded

**FINISH:** External leads are tin plated, leads are readily solderable

**POLARITY:** Cathode indicated by Polarity band

**WEIGHT:** 0.4 Grams (Approximately)

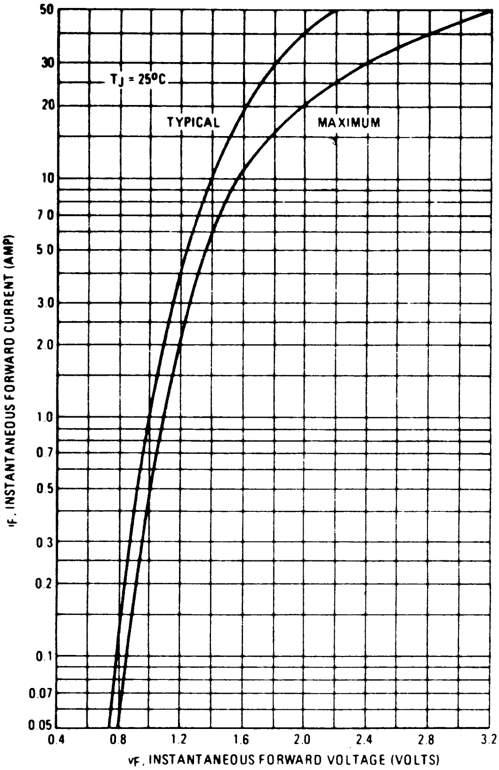



FIGURE 1 – FORWARD VOLTAGE

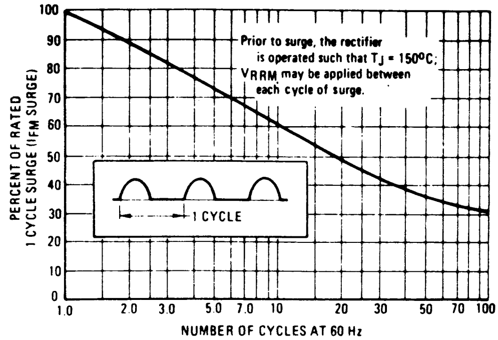



FIGURE 2 – MAXIMUM SURGE CAPABILITY

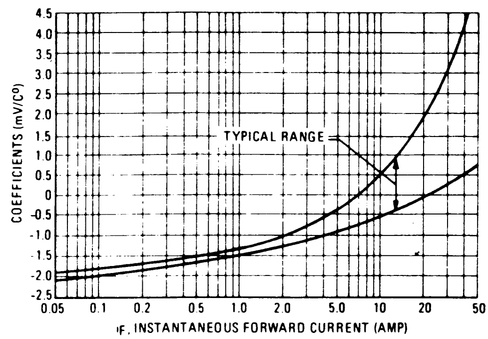



FIGURE 3 – TEMPERATURE COEFFICIENT

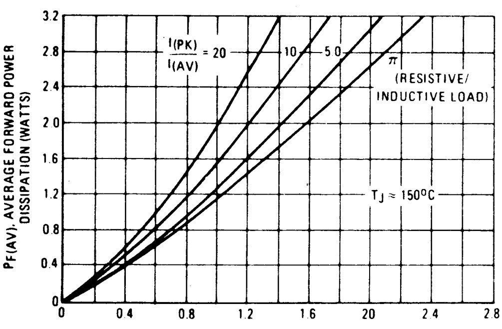



FIGURE 4 – FORWARD POWER DISSIPATION

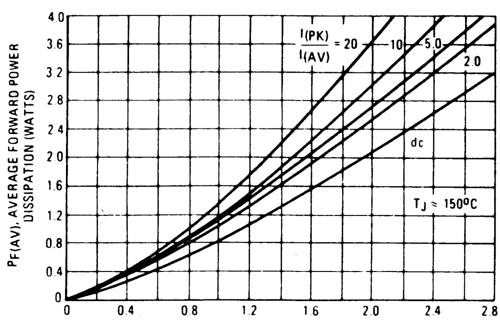



FIGURE 5 – FORWARD POWER DISSIPATION

## MAXIMUM CURRENT RATINGS
(SEE NOTES 1 and 2)

### SINE WAVE INPUT

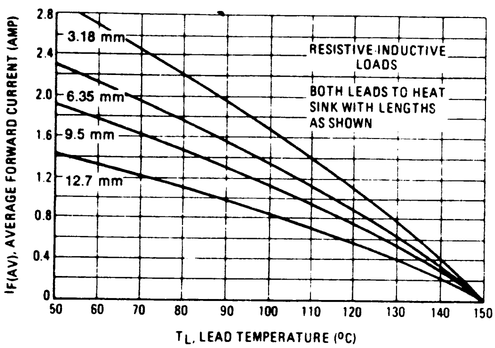



FIGURE 6 – EFFECT OF LEAD LENGTHS, RESISTIVE LOAD

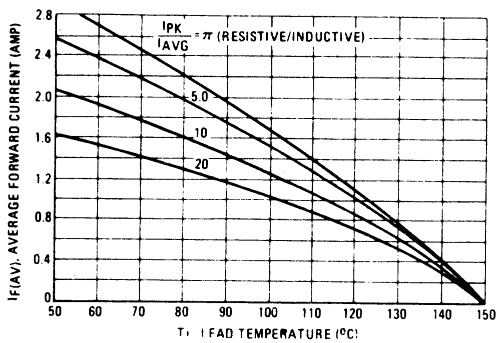



FIGURE 8 — 3.18 mm LEAD LENGTH, VARIOUS LOADS

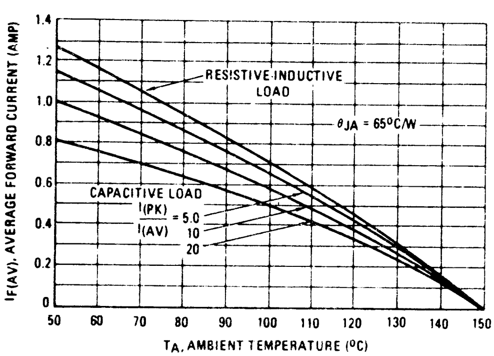



FIGURE 10 – PRINTED CIRCUIT BOARD MOUNTING, VARIOUS LOADS

### SQUARE WAVE INPUT

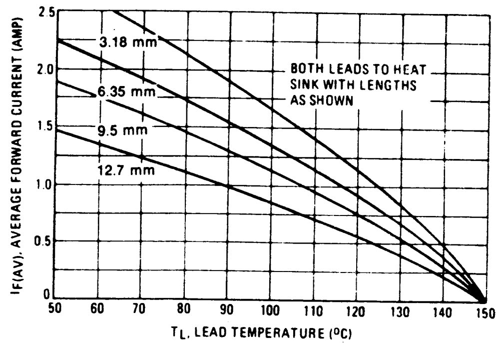



FIGURE 7 – EFFECT OF LEAD LENGTHS, RESISTIVE LOAD

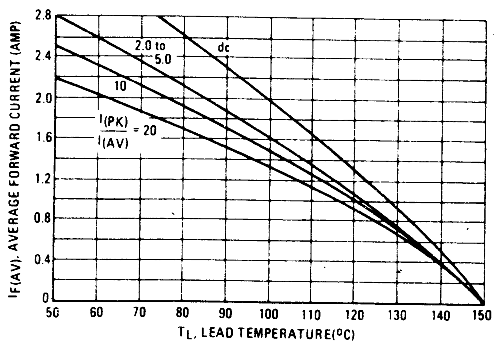



FIGURE 9 — 3.18 mm LEAD LENGTH, VARIOUS LOADS

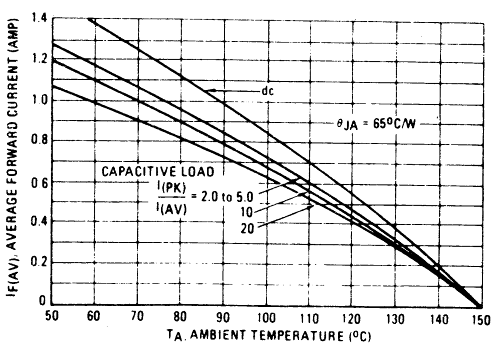



FIGURE 11 – PRINTED CIRCUIT BOARD MOUNTING, VARIOUS LOADS

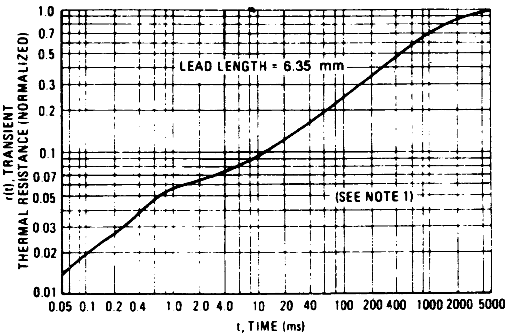



**FIGURE 12 – THERMAL RESPONSE**

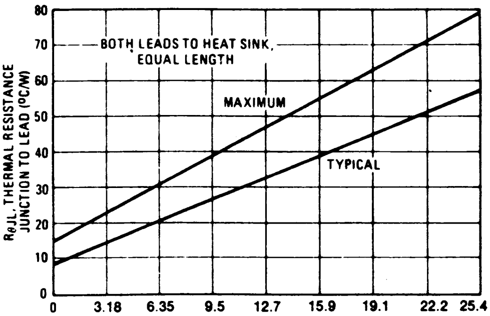
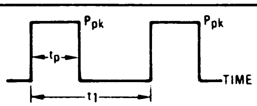



**FIGURE 13 – THERMAL RESISTANCE**

### NOTE 1




DUTY CYCLE, $D = t_p/t_1$
PEAK POWER, $P_{pk}$, is peak of an equivalent square power pulse.

To determine maximum junction temperature of the diode in a given situation, the following procedure is recommended:

The temperature of the case should be measured using a thermocouple placed on the case as close as possible to the tie point. The thermal mass connected to the tie point is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulsed operation once steady-state conditions are achieved. Using the measured value of $T_C$, the junction temperature may be determined by:

$$T_J = T_C + \Delta T_{JC}$$

where $\Delta T_{JC}$ is the increase in junction temperature above the case temperature. It may be determined by:

$$\Delta T_{JC} = P_{pk} \cdot R_{\theta JC} \left[ D + (1 - D) \cdot r(t_1 + t_p) + r(t_p) - r(t_1) \right]$$

where

$r(t)$ = normalized value of transient thermal resistance at time, t, from Figure 12, i.e.:

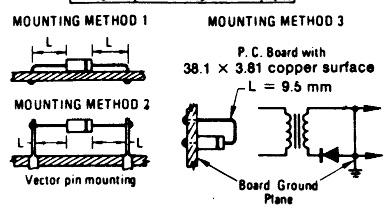
$r(t_1 + t_p)$ = normalized value of transient thermal resistance at time $t_1 + t_p$.

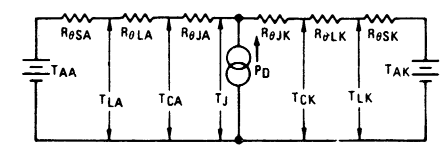
### NOTE 2

Data shown for thermal resistance junction-to-ambient ($\theta_{JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

**TYPICAL VALUES FOR $\theta_{JA}$ IN STILL AIR**

| MOUNTING METHOD | LEAD LENGTH, L(mm) 3.81 | 6.35 | 12.7 | 19.1 | $R_{\theta JA}$ |
|---|---|---|---|---|---|
| 1 | 65 | 72 | 82 | 92 | °C/W |
| 2 | 74 | 81 | 91 | 101 | °C/W |
| 3 | 40 | | | | °C/W |




Use of the above model permits junction to lead thermal resistance for any mounting configuration to be found. For a given total lead length, lowest values occur when one side of the rectifier is brought as close as possible to the heat sink. Terms in the model signify:

$T_A$ = Ambient Temperature
$T_L$ = Lead Temperature
$T_C$ = Case Temperature
$T_J$ = Junction Temperature
$R_{\theta S}$ = Thermal Resistance, Heat Sink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead to Heat Sink
$R_{\theta J}$ = Thermal Resistance, Junction to Case
$P_D$ = Power Dissipation

(Subscripts A and K refer to anode and cathode sides respectively.)

Values for thermal resistance components are:

$R_{\theta L}$ = 112°C/W/IN. Typically and 128°C/W/IN Maximum
$R_{\theta J}$ = 18°C/W Typically and 30°C/W Maximum

The maximum lead temperature may be calculated as follows:

$$T_L = 150° - \Delta T_{JL}$$

$\Delta T_{JL}$ can be calculated as shown in NOTE 1 or it may be approximated as follows:

$\Delta T_{JL} \approx R_{\theta JL} \bullet P_F$; $P_F$ may be formulated for sine-wave operation from Figure 3 or from Figure 4 for square-wave operation.

**FIGURE 14 – THERMAL CIRCUIT MODEL**

## TYPICAL DYNAMIC CHARACTERISTICS

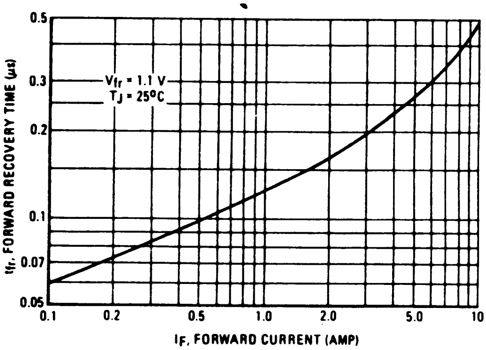



FIGURE 15 – FORWARD RECOVERY TIME

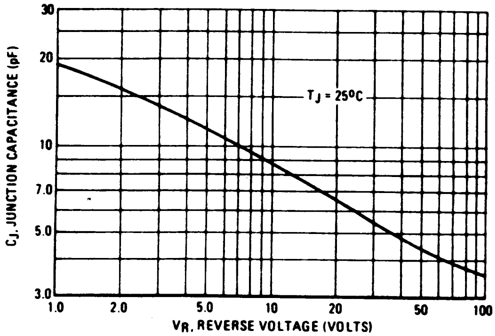



FIGURE 16 – JUNCTION CAPACITANCE

## TYPICAL RECOVERED STORED CHARGE DATA
**(SEE NOTE 3)**

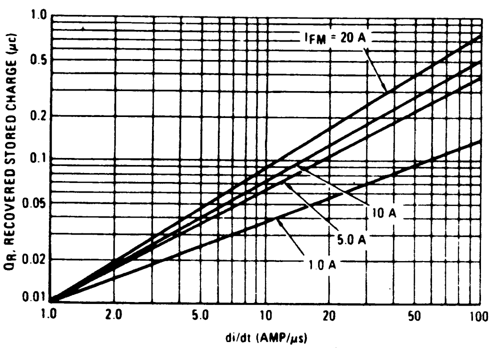



FIGURE 17 – $T_J$ = 25°C

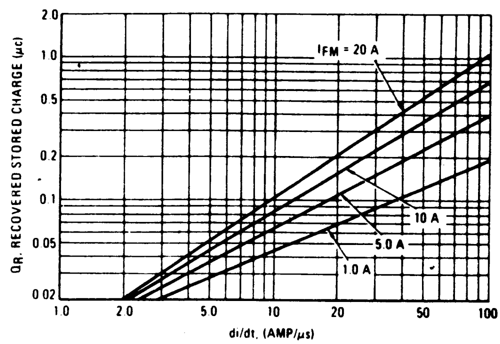



FIGURE 18 – $T_J$ = 75°C

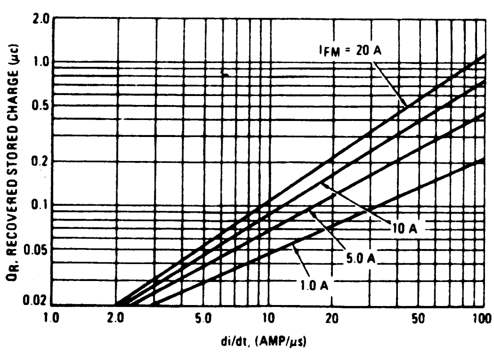



FIGURE 19 – $T_J$ = 100°C

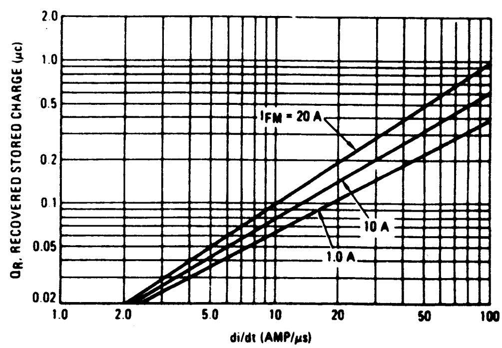



FIGURE 20 – $T_J$ = 150°C

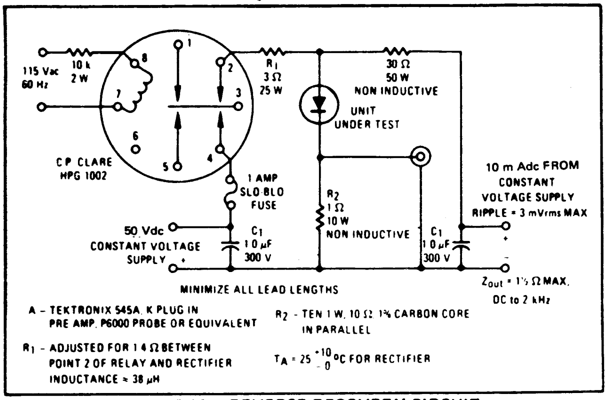



**FIGURE 21 – REVERSE RECOVERY CIRCUIT**

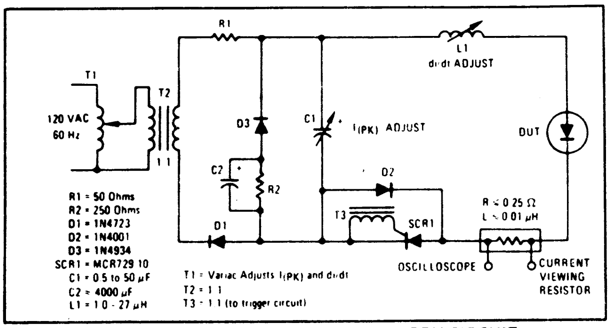



**FIGURE 22 – JEDEC REVERSE RECOVERY CIRCUIT**

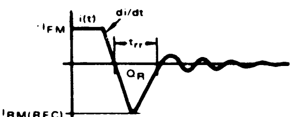
**NOTE 3**

Reverse recovery time is the period which elapses from the time that the current, thru a previously forward biased rectifier diode, passes thru zero going negatively until the reverse current recovers to a point which is less than 10% peak reverse current.

Reverse recovery time is a direct function of the forward current prior to the application of reverse voltage.

For any given rectifier, recovery time is very circuit dependent. Typical and maximum recovery time of all Motorola fast recovery power rectifiers are rated under a fixed set of conditions using $I_F$ = 10 mA $V_R$ = 50 VR. In order to cover all circuit conditions, curves are given for typical recovered stored charge versus commutation di/dt for various levels of forward current and for junction temperatures of 25°C, 75°C, 100°C, and 150°C.

To use these curves, it is necessary to know the forward current level just before commutation, the circuit commutation di/dt, and the operating junction temperature. The reverse recovery test current waveform for all Motorola fast recovery rectifiers is shown.




From stored charge curves versus di/dt, recovery time ($t_{rr}$) and peak reverse recovery current ($I_{RM(REC)}$) can be closely approximated using the following formulas:

$$t_{rr} = 1.41 \times \left[\frac{Q_R}{di/dt}\right]^{1/2}$$

$$I_{RM(REC)} = 1.41 \times \left[Q_R \times di/dt\right]^{1/2}$$

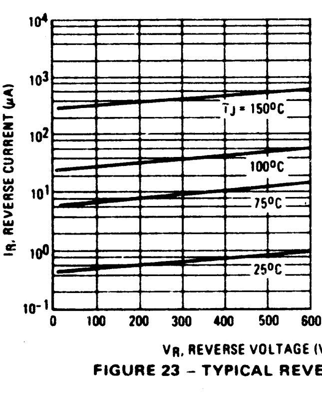



**FIGURE 23 – TYPICAL REVERSE LEAKAGE**

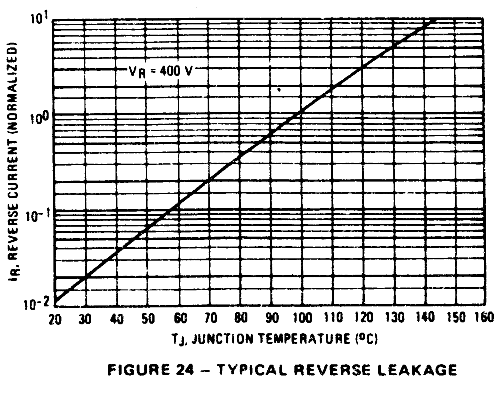



**FIGURE 24 – TYPICAL REVERSE LEAKAGE**

MOTOROLA

# BY 601 thru BY 608 SERIES

## "SURMETIC" RECTIFIERS

. . . subminiature size, axial lead mounted rectifiers for general-purpose main rectifier applications in TV/HiFi sets and domestic appliances.

**Designers Data for "Worst Case" Conditions**

The Designers Data Sheets permit the design of most circuits entirely from the information presented. Limit curves – representing boundaries on device characteristics – are given to facilitate "worst case" design.

**LEAD MOUNTED SILICON RECTIFIERS**

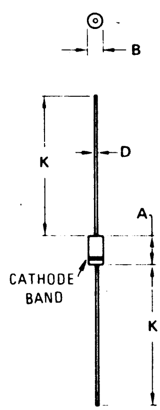
50–1250 VOLTS
DIFFUSED JUNCTION

## MAXIMUM RATINGS

| Rating | Symbol | BY601 | BY602 | BY603 | BY604 | BY605 | BY606 | BY607 | BY608 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 50 | 100 | 200 | 400 | 600 | 800 | 1000 | 1250 | Volts |
| Non-Repetitive Peak Reverse Voltage (halfwave, single phase, 50 Hz) | $V_{RSM}$ | 60 | 120 | 240 | 480 | 720 | 1000 | 1200 | 1500 | Volts |
| RMS Reverse Voltage | $V_{R(RMS)}$ | 35 | 70 | 140 | 280 | 420 | 560 | 700 | 850 | Volts |
| Average Rectified Forward Current (single phase, resistive load, 50 Hz, see Figure 8, $T_A = 75$ °C) | $I_O$ | 1.5 | | | | | | | | Amp |
| Non-Repetitive Peak Surge Current (surge applied at rated load conditions, see Figure 2) | $I_{FSM}$ | 50 (for 1 cycle) | | | | | | | | Amp |
| Operating and Storage Junction Temperature Range | $T_J, T_{stg}$ | −65 to +175 | | | | | | | | °C |

## ELECTRICAL CHARACTERISTICS

| Characteristic and Conditions | Symbol | Typ | Max | Unit |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage Drop ($I_F = 1.5$ Amp, $T_J = 25$ °C) Figure 1 | $V_F$ | 1.0 | 1.15 | Volts |
| Maximum Reverse Current (rated dc voltage)<br>$T_J = 25$ °C<br>$T_J = 100$ °C | $I_R$ | <br>0.05<br>1.0 | <br>10<br>50 | µA |




| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 5.97 | 6.60 | 0.235 | 0.260 |
| B | 2.79 | 3.05 | 0.110 | 0.120 |
| D | 0.76 | 0.86 | 0.030 | 0.034 |
| K | 27.94 | | 1.100 | – |

**CASE 59-04**
Does Not Conform to DO-41 Outline.

## MECHANICAL CHARACTERISTICS

**CASE:** Void free, Transfer Molded.
**MAXIMUM LEAD TEMPERATURE FOR SOLDERING PURPOSES:** 350 °C, 1.27 cm from case for 10 seconds at 2.27 kg tension.
**FINISH:** All external surfaces are corrosion-resistant, leads are readily solderable.
**POLARITY:** Cathode indicated by color band.
**WEIGHT:** 0.40 Grams (approximately).

**FIGURE 1 – FORWARD VOLTAGE**

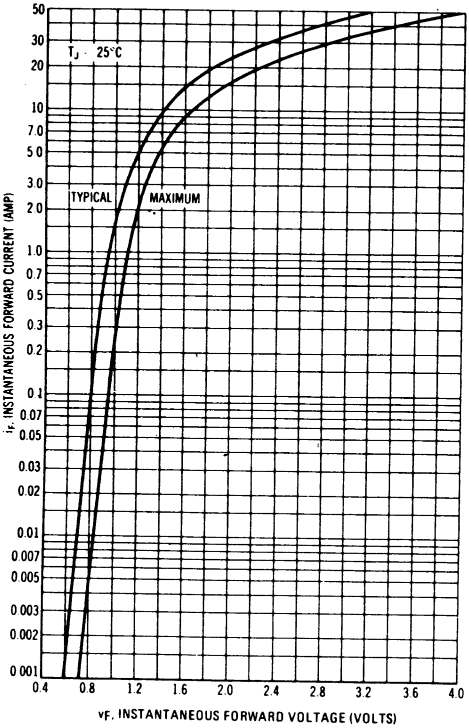



**FIGURE 2 – NON REPETITIVE SURGE CAPABILITY**

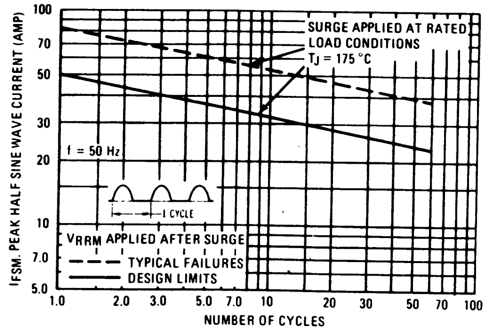



**FIGURE 3 – FORWARD VOLTAGE TEMPERATURE COEFFICIENT**

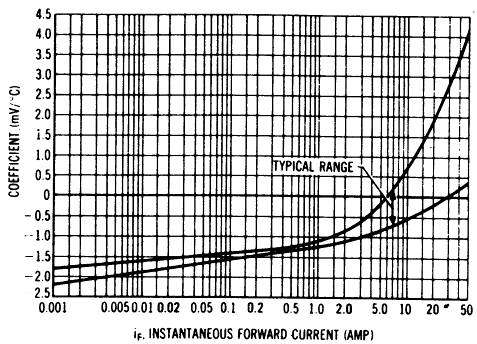
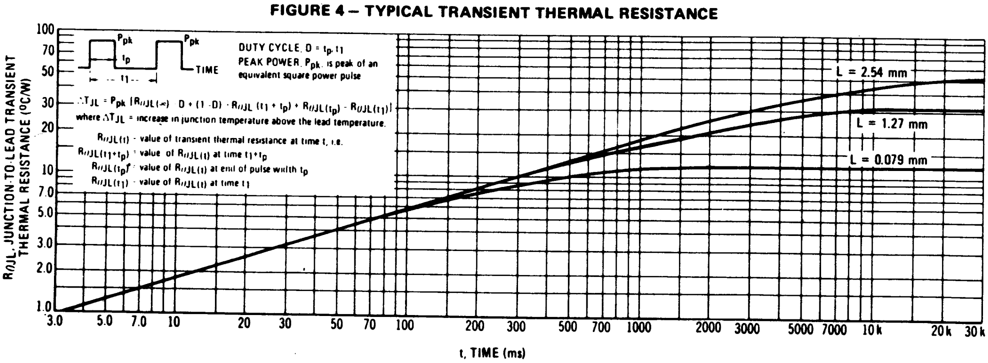



**FIGURE 4 – TYPICAL TRANSIENT THERMAL RESISTANCE**




The temperature of the lead should be measured using a thermocouple placed on the lead as close as possible to the tie point. The thermal mass connected to the tie point is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulsed operation once steady-state conditions are achieved. Using the measured value of $T_L$, the junction temperature may be determined by:

$$T_J = T_L + \Delta T_{JL}.$$

## CURRENT DERATING DATA

**FIGURE 5 – FORWARD POWER DISSIPATION**

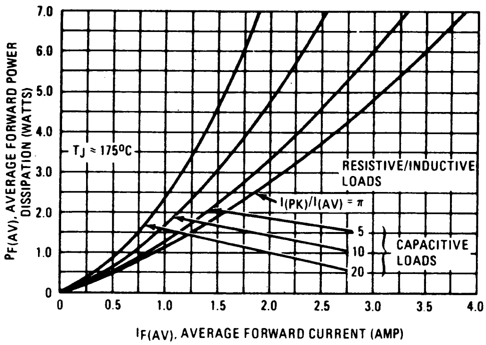



**FIGURE 6 – EFFECT OF LEAD LENGTHS, RESISTIVE LOAD**

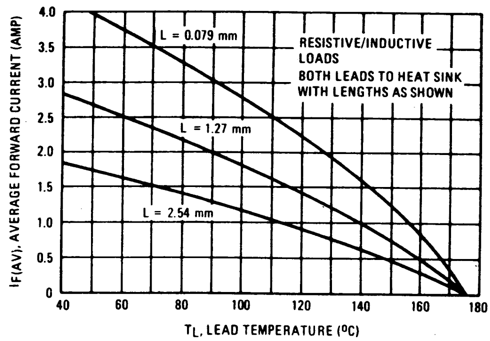



**FIGURE 7 – 1.27 mm LEAD LENGTH, VARIOUS LOADS**

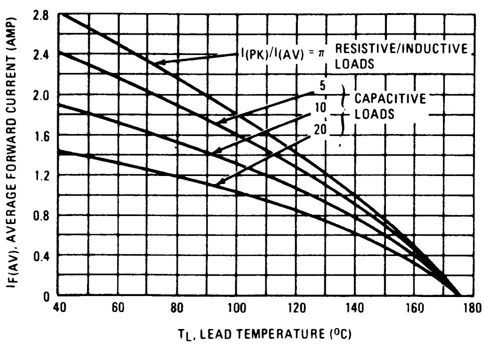



**FIGURE 8 – PRINTED CIRCUIT BOARD MOUNTING VARIOUS LOADS**

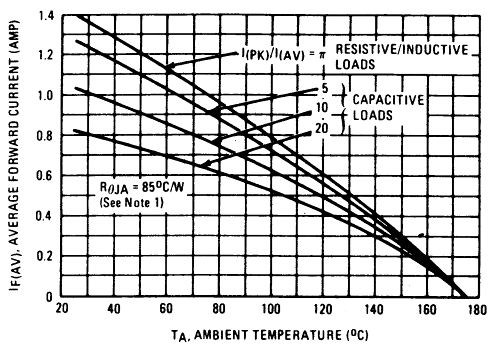
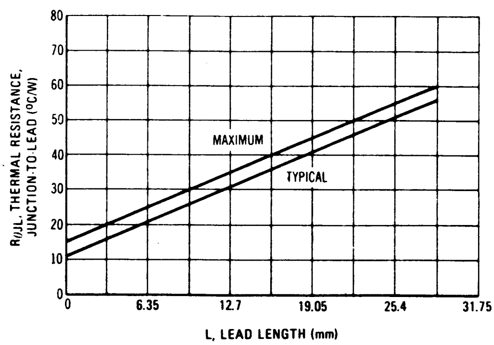


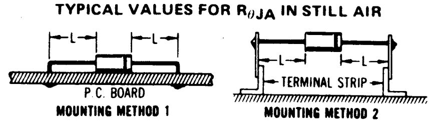

**FIGURE 9 – STEADY-STATE THERMAL RESISTANCE**




**NOTE 1**

Data shown for thermal resistance junction-to-ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured

**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**




| MOUNTING METHOD | LEAD LENGTH (cm) | | | $R_{\theta JA}$ |
|---|---|---|---|---|
| | 0.079 | 1.27 | 2.54 | |
| 1 | — | 75 | 85 | C/W |
| 2 | 55 | 72 | 85 | C/W |

## TYPICAL DYNAMIC CHARACTERISTICS

**FIGURE 10 – FORWARD RECOVERY TIME**

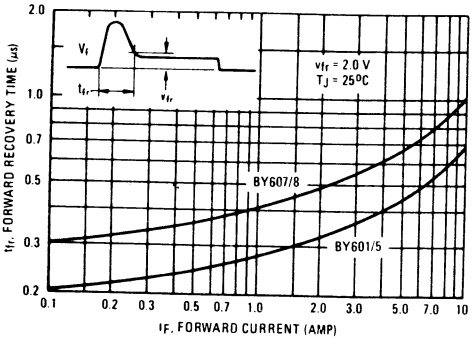



**FIGURE 11 – REVERSE RECOVERY TIME**

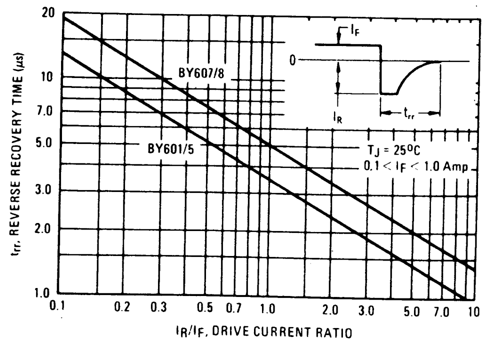



**FIGURE 12 – JUNCTION CAPACITANCE**

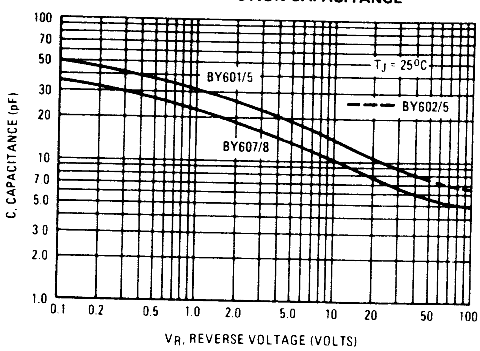



**FIGURE 13 – RECTIFICATION WAVEFORM EFFICIENT FOR SINE WAVE**

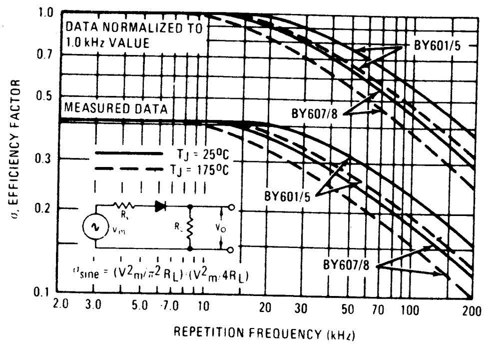
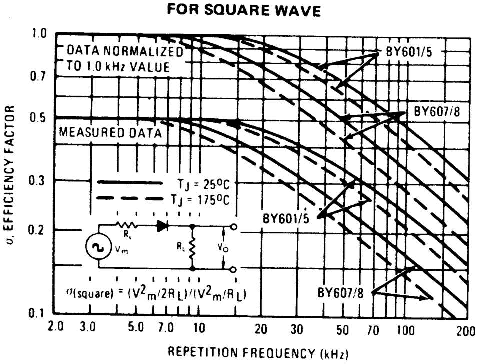



**FIGURE 14 – RECTIFICATION WAVEFORM EFFICIENCY FOR SQUARE WAVE**




### RECTIFIER EFFICIENCY NOTE

The rectification efficiency factor σ shown in Figures 13 and 14 was calculated using the formula:

$$\sigma = \frac{P_{dc}}{P_{rms}} = \frac{\dfrac{V^2_{O(dc)}}{R_L}}{\dfrac{V^2_{O(rms)}}{R_L}} \bullet 100\% = \frac{V^2_{O(dc)}}{V^2_{O(ac)} + V^2_{O(dc)}} \bullet 100\% \quad (1)$$

For a sine wave input $V_m \sin(\omega t)$ to the diode, assumed lossless, the maximum theoretical efficiency factor becomes 40%; for a square wave input of amplitude $V_m$, the efficiency factor becomes 50%. (A full wave circuit has twice these efficiencies).

As the frequency of the input signal is increased, the reverse recovery time of the diode (Figure 11) becomes significant, resulting in an increasing ac voltage component across $R_L$ which is opposite in polarity to the forward current thereby reducing the value of the efficiency factor σ, as shown in Figures 13 and 14.

It should be emphasized that Figures 13 and 14 show waveform efficiency only; they do not account for diode losses. Data was obtained by measuring the ac component of $V_O$ with a true rms voltmeter and the dc component with a dc voltmeter. The data was used in Equation 1 to obtain points for the Figures.

MOTOROLA

# BYS08 Series

## Advance Information

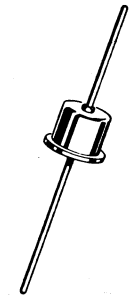
### SWITCHMODE POWER RECTIFIERS

Epitaxial construction with oxyde passivation and metal overlap contact – ion implanted guard ring for transient voltage protection.

- lowest combinated power losses
- high surge capability
- majority carrier conduction

**SCHOTTKY BARRIER RECTIFIERS**

**8 AMPERES**
**20 TO 50 VOLTS**



3

**MAXIMUM RATINGS**

| Rating | Symbol | BYS08 –20 | BYS08 –30 | BYS08 –45 | BYS08 –50 | Units |
|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | 30 | 45 | 50 | Volts |
| Average Rectified Forward Current Square Wave, $V_r$ rated | $I_{F\ (AV)}$ | 8 (Tc = 100 °C) | | | | Amp. |
| Non-Repetitive Peak Surge Current, 10 mS | $I_{FSM}$ | 400 (for 1 cycle) | | | | Amp. |
| Operating and Storage Junction Temperature | $T_J$, $T_{STG}$ | –65 to +150 | | | | °C |
| Peak Operating Junction Temperature | $T_{J\ (PK)}$ | 175 | | | | °C |
| Voltage Rate of Change | dv/dT | 1000 | | | | Volts µ sec. |

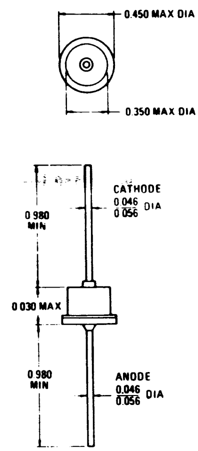
**THERMAL CHARACTERISTICS**

| Characteristics | Symbol | Typ | Max. | Unit |
|---|---|---|---|---|
| Thermal Resistance Jonction to case | $R_{\theta jc}$ | 2.5 | 3 | °C/W |

**ELECTRICAL CHARACTERISTICS**

| Characteristics | | | Symbol | Typ | Max. | Units |
|---|---|---|---|---|---|---|
| Instantaneous Forward Voltage | $I_F$ = 8 Amp. | $T_C$ = 25° C<br>$T_C$ = 100° C<br>$T_C$ = 150° C | $V_F$ | 0.44<br>0.37<br>0.34 | 0.50<br>0.47<br>– | Volts |
| | $I_F$ = 16 Amp. | $T_C$ = 25° C<br>$T_C$ = 100° C<br>$T_C$ = 150° C | $V_F$ | 0.50<br>0.44<br>0.41 | 0.58<br>0.54<br>– | Volts |
| Instantaneous Reverse Current, Rated $V_R$ | $T_C$ = 25° C | BYS08–20/30<br>BYS08–45/50 | $I_R$ | 25<br>50 | 250<br>500 | µA |
| | $T_C$ = 100° C | BYS08–20/30<br>BYS08–45/50 | $I_R$ | 4<br>8 | 10<br>20 | mA |

| Characteristics | Symbol | | | | | Units |
|---|---|---|---|---|---|---|
| Minimum Reverse Breakdown Voltage 10 mA, Tc = 25 °C | $V_{BR}$ | 30 | 40 | 47 | 53 | Volts |




CASE 60

### NOTE 1 : DETERMINATING MAXIMUM RATINGS

Reverse power dissipation and the possibility of thermal runaway must be considered when operating this rectifier at reverse voltages above 0.2 $V_{RWM}$. Proper derating may be accomplished by use of equation (1):

$$T_{A(max)} = T_{J(max)} - R_{\theta JA} P_{F(AV)} - R_{\theta JA} P_{R(AV)} \quad (1)$$

where

- $T_{A(max)}$ = Maximum allowable ambient temperature.
- $T_{J(max)}$ = Maximum allowable junction temperature. (150°C or the temperature at which thermal runaway occurs, whichever is lowest).
- $P_{F(AV)}$ = Average forward power dissipation.
- $P_{R(AV)}$ = Average reverse power dissipation.
- $R_{\theta JA}$ = Junction-to-ambient thermal resistance.

Figure 1 permits easier use of equation(1) by taking reverse power dissipation and thermal runaway into consideration. The figure solves for a reference temperature as determinated by equation(2):

$$T_R = T_{J(max)} - R_{\theta JA} P_{R(AV)} \quad (2)$$

Substituting equation (2) into equation (1) yields:

$$T_{A(max)} - T_R - R_{\theta JA} P_{F(AV)} \quad (3)$$

Inspections of equations (2) and (3) reveals that $T_R$ is the ambient temperature at which thermal runaway occurs or where $T_J = 150°C$ when forward power is zero.

### HOW TO USE FIG. 1 TO FIND TR (MAX)

EXAMPLE: find TA (max) for BYS 08-30 operated in a 5 V/6 A forward converter as rectifying diode, $\delta mm = 0.3$, $\delta max = 0.5$, $V_{RRM} = 17$ V and $R\theta JA = 20°C/W$

**STEP 1**

Find VR equivalent $= VRRM\sqrt{1 - \delta min} = 17\sqrt{0.7} = 14.2$ V

**STEP 2**

Find TR from fig.1. Horizontally, intercept VR = 14.2 V with the BYS 08-30 curve. Vertically intercept this point with the RθJA = 20°C/W curve. Read directly TR = 119°C.

**STEP 3**

Find PF(AV) from fig. 3. (IF(AV) for the rectifying diode is : Io x δ max = 6 A x 0.5 = 3 A). Read PF(AV) = 1.5 W

**STEP 4**

Find TA(max) from equation (3)

TA(max) = TR − RθJA x PF(AV)
= 119°C − 30°C = 89°C

**FIGURE 1 – MAXIMUM REFERENCE TEMPERATURE**

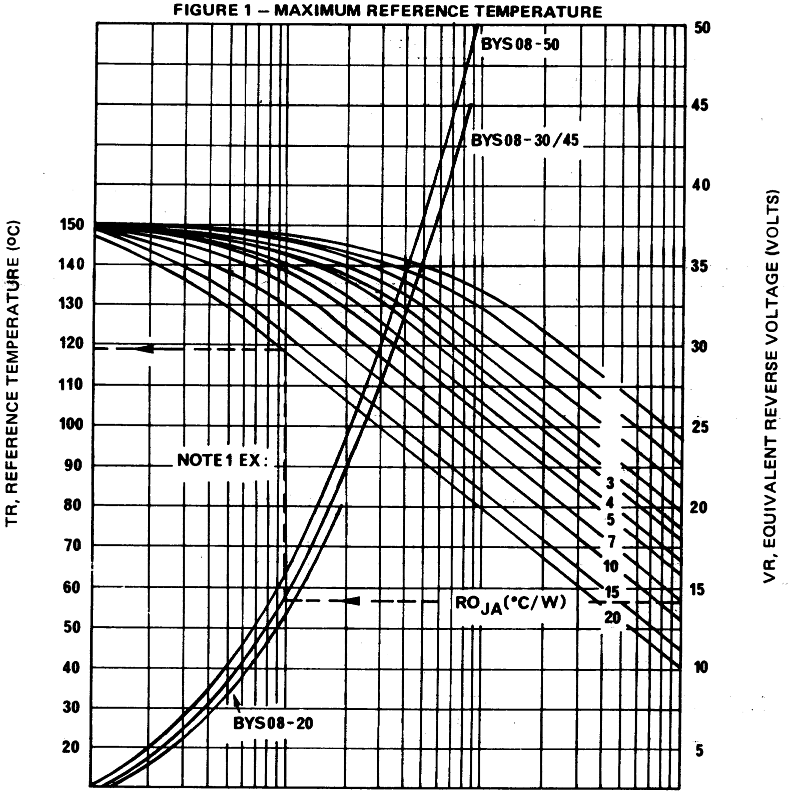


**FIGURE 2 – TYPICAL FORWARD VOLTAGE**

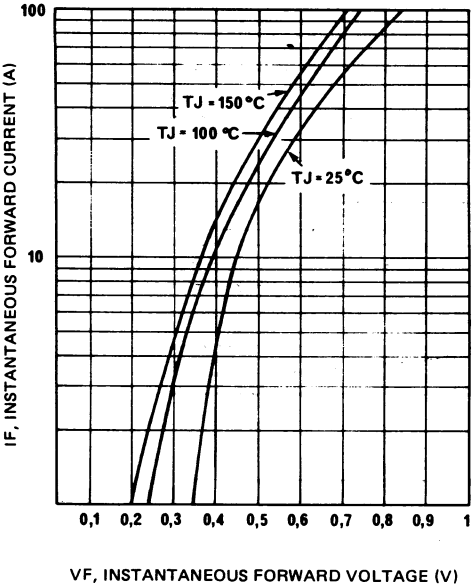



**FIGURE 3 – MAXIMUM SURGE CAPABILITY**

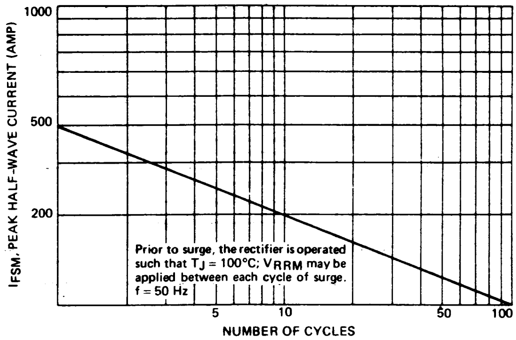



**FIGURE 4 – FORWARD POWER DISSIPATION**

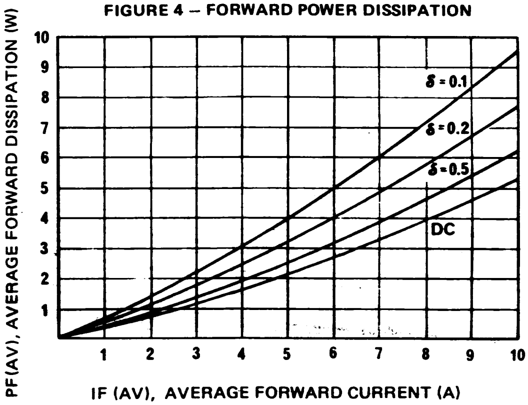



**FIGURE 5 – THERMAL RESPONSE**

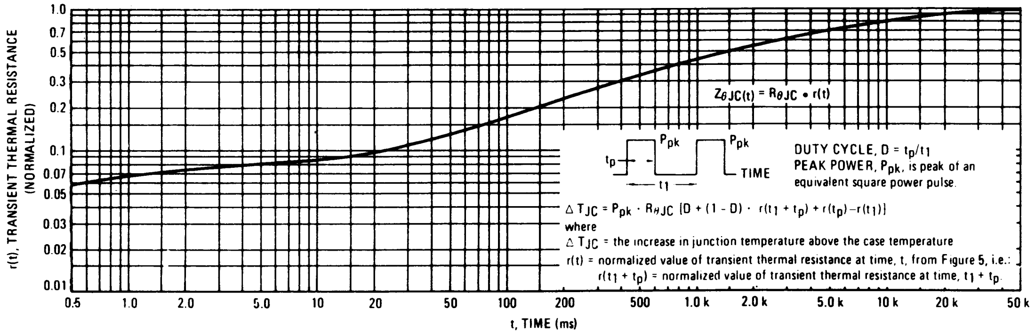


FIGURE 6 – CAPACITANCE

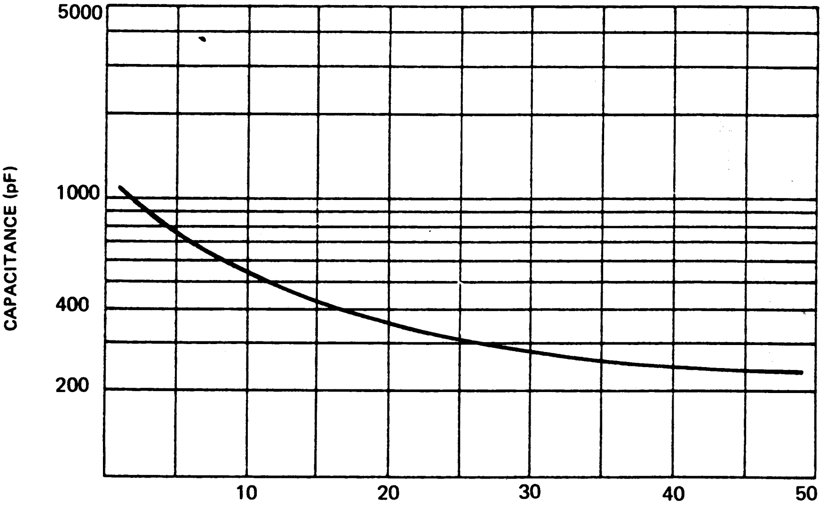
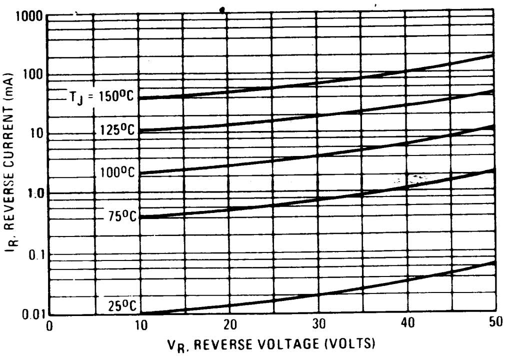



FIGURE 7 – TYPICAL REVERSE CURRENT




## NOTE 2 HIGH FREQUENCY OPERATION

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 6).

**Rectification efficiency measurements show that ope**ration will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 per cent at 2.0 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, where as perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss; it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

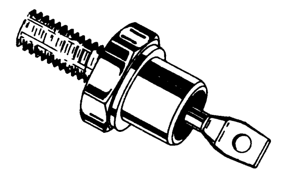
MOTOROLA

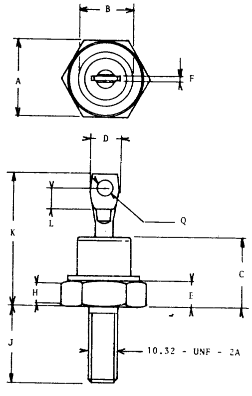
# BYS 35 SERIES

## ADVANCE INFORMATION

## SCHOTTKY BARRIER RECTIFIERS

35 AMPERES
20 to 50 VOLTS






| DIM | MILLIMETERS min. | MILLIMETERS max. | INCHES min. | INCHES max. |
|---|---|---|---|---|
| A | 10.77 | 11.10 | 0.424 | 0.437 |
| B | | | | 0.424 |
| C | - | 10.29 | | 0.450 |
| D | | | - | 0.250 |
| E | 1.91 | 4.45 | 0.075 | 0.175 |
| F | 0.6 | - | 0.023 | - |
| H | 1.5 | - | 0.06 | - |
| J | 10.72 | 11.51 | 0.422 | 0.453 |
| K | - | 20.32 | - | 0.800 |
| L | 2.0 | - | 0.078 | - |
| Q | 1.5 | - | 0.060 | |

**Do 4**
**Case 56–02**

### Switchmode Power Rectifiers

Epitaxial construction with oxyde passivation and metal overlap contact — ion implanted guard ring for transient voltage protection

- lowest combinated power losses
- high surge capability
- majority carrier conduction

### MAXIMUM RATINGS

| Rating | Symbol | BYS35 –20 | BYS35 –30 | BYS35 –45 | BYS35 –50 | Units |
|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | 30 | 45 | 50 | Volts |
| Average Rectified Forward Current, Rated $V_R$ Square Wave | $I_{F\ (AV)}$ | 35 ($T_C$ = 100° C) | | 35 ($T_C$ = 90° C) | | Amp. |
| Non-Repetifive Peak Surge Current, 10 mS | $I_{FSM}$ | ← 600 → | | | | Amp. |
| Operating and Storage Junction Temperature | $T_J, T_{STG}$ | ← –65 to +150 → | | | | °C |
| Peak Operating Junction Temperature | $T_J$ (PK) | ← 175 → | | | | °C |
| Voltage Rate of Change | dv/dT | ← 1000 → | | | | Volts/µ Sec. |

### THERMAL CHARACTERISTICS

| Characteristics | Symbol | Typ | Max. | Unit |
|---|---|---|---|---|
| Thermal Resistance Jonction to case | $R_{\theta jc}$ | 1.2 | 1.5 | °C/W |

### ELECTRICAL CHARACTERISTICS

| Characteristics | Symbol | Typ | Max. | Units |
|---|---|---|---|---|
| Instantaneous Forward Voltage | | | | |
| $I_F$ = 35 Amp. $T_C$ = 25° C | $V_F$ | 0.55 | 0.63 | Volts |
| $T_C$ = 100° C | | 0.48 | 0.60 | |
| $T_C$ = 150° C | | 0.45 | – | |
| $I_F$ = 70 Amp. $T_C$ = 25° C | | 0.70 | 0.80 | |
| $T_C$ = 100° C | | 0.62 | 0.77 | |
| $T_C$ = 150° C | | 0.57 | – | |
| Instantaneous Reverse Current, Rated $V_R$ | | | | |
| $T_C$ = 25° C BYS35–20/30 | $I_R$ | 70 | 700 | µA |
| BYS35–45/50 | | 100 | 1000 | |
| $T_C$ = 100° C BYS35–20/30 | | 8 | 15 | mA |
| BYS35–45/50 | | 12 | 25 | |

| Characteristics | Symbol | BYS35-20 | BYS35-30 | BYS35-45 | BYS35-50 | Units |
|---|---|---|---|---|---|---|
| Minimum Reverse Breakdown Voltage $I_{BR}$ = 10 mA, $T_C$ = 25° C | $V_{BR}$ | 30 | 40 | 47 | 53 | Volts |

### MECHANICAL CHARACTERISTICS

**CASE:** welded, hermetically sealed
**POLATITY:** cathode to case
**MOUNTING POSITIONS:** any
**STUD TORQUE:** 15 in. lb. max.

### NOTE 1: DETERMINING MAXIMUM RATINGS

Reverse power dissipation and the possibility of thermal runaway must be covered when operating this rectifier at reverse voltages above 0,2 VRWM. Proper operating may be accomplished by use of equation:

(1) TA (max) = TJ max – RθJA.PF (AV) – RθJA (AV)

where:

- TA (max) = maximum allowable ambient temperature
- TJ (max) = maximum allowable junction temperature
- PF (AV) = average forward power dissipation
- PR (AV) = average reverse power dissipation
- RθJA = junction to ambient thermal resistance

Figure 1 permits easier use of equation (1) by taking reverse power dissipation and thermal runaway into consideration. The figure solves for a reference temperature as determined by equation (2):

(2) TR = TJ max – RθJA PR (AV)

substituting equation (2) into equation (1) yields:

(3) TA (max) = TR – RθJA RF (AV)

### HOW TO USE FIG. 1 TO FIND TR (MAX)

Example: find TA (max) for BYS 35–30 operated in a 5 volts/12 A flyback convertor, 6 min = 0,5, VRRM = 12 volts and RθJA = 5° C/W.

**STEP 1**

Find VR equivalent = VRRM $\sqrt{8}$ = 12 $\sqrt{0,5}$ = 8,5 V.

**STEP 2**

Find TR from fig. 1 horizontaly intercept VR = 8,5 V with the BYS 35–30 curve. Vertically intercept this point with the RθJA = 5° C/W curve. Read TR directly, TR = 142° C.

**STEP 3**

Find PF (AV) from figure 3. Read PF (AV) = 6 W.

**STEP 4**

Find TA (max) from equation (3)
TA max = TR – RθJA. PF (AV)
= 142° C–30° C
= 112° C

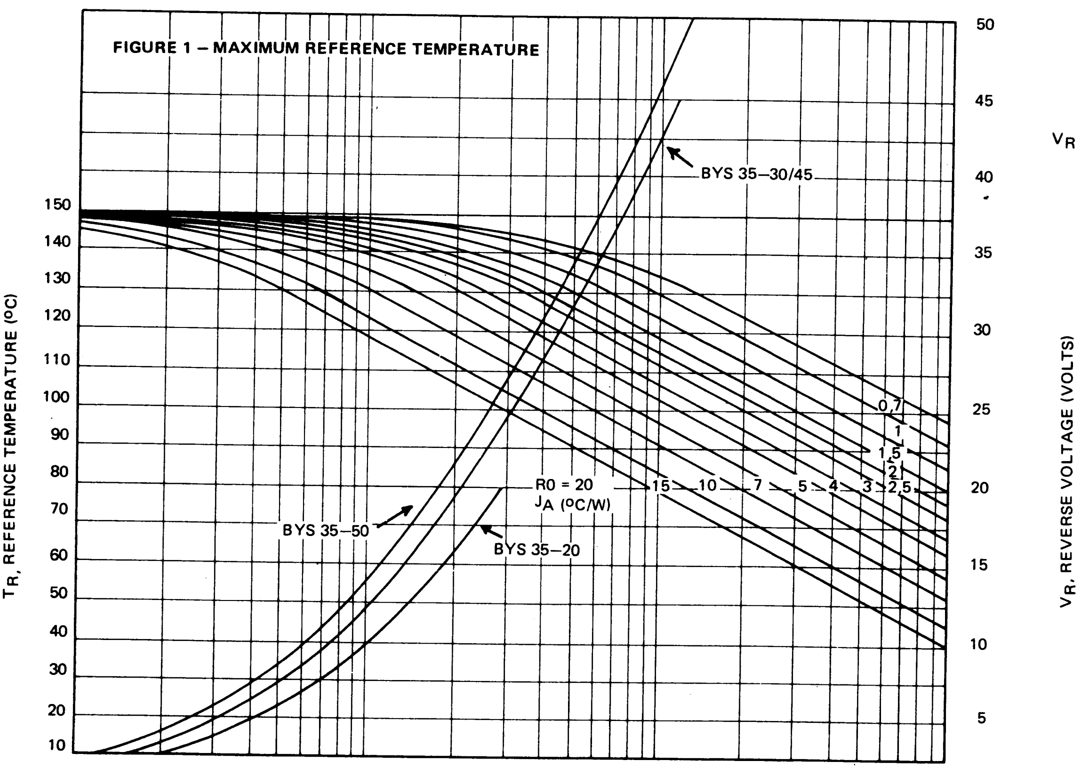
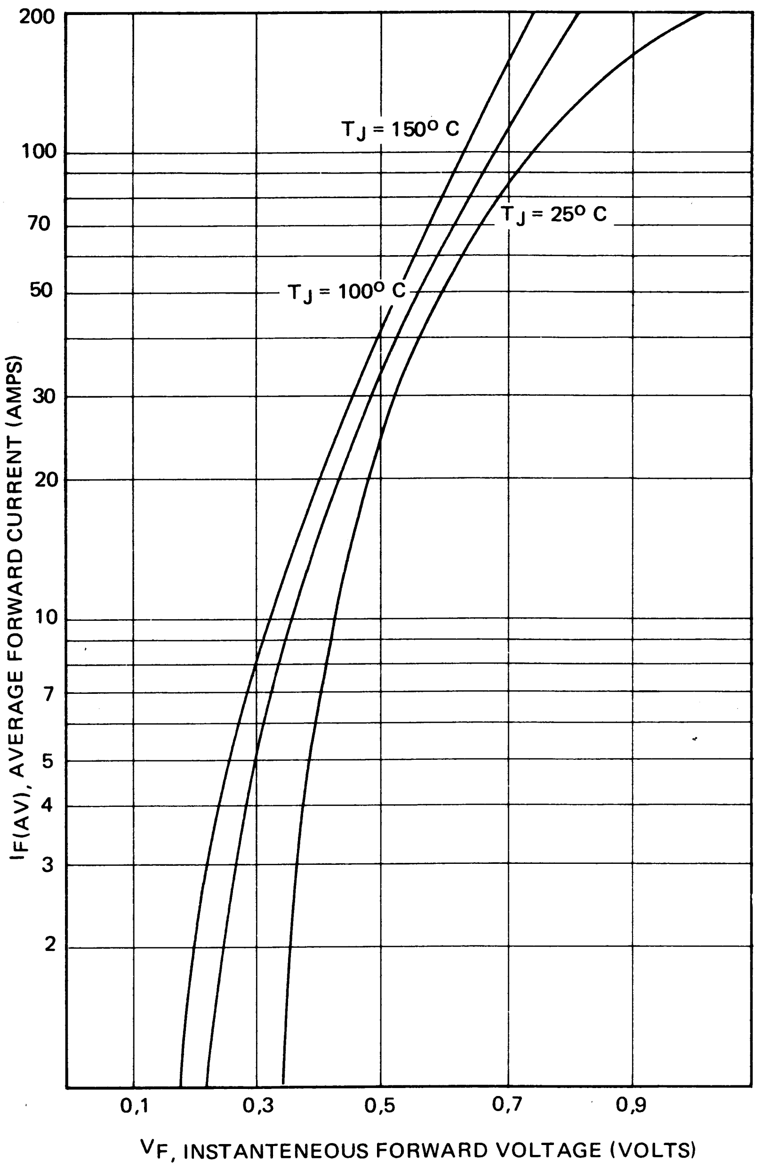
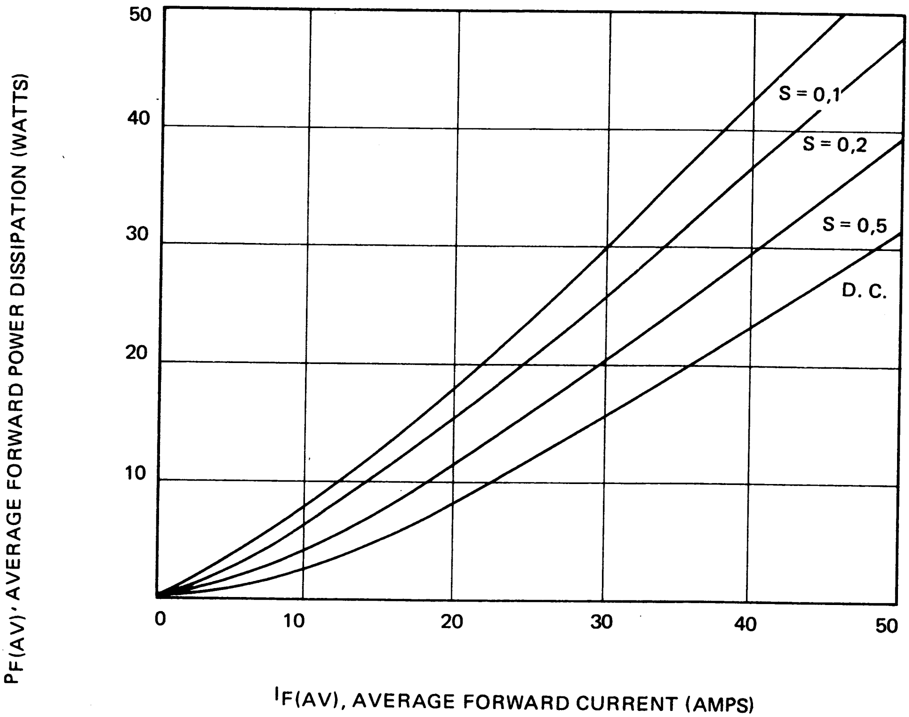


**FIGURE 2 – TYPICAL FORWARD VOLTAGE**




FORWARD POWER DISSIPATION

**FIGURE 3 – FORWARD POWER DISSIPATION**



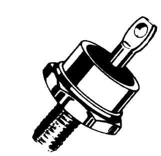
MOTOROLA

# BYS 60 SERIES

## ADVANCE INFORMATION

## SCHOTTKY BARRIER RECTIFIERS

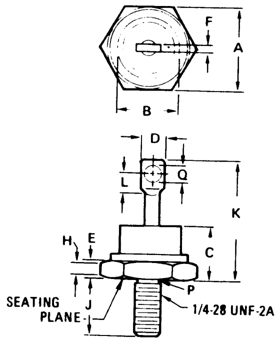
60 AMPERES
20 to 50 VOLTS



### Switchmode Power Rectifiers

Epitaxial construction with oxyde passivation and metal overlap contact — ion implanted guard ring for transient voltage protection

- lowest combinated power losses
- high surge capability
- majority carrier conduction




| DIM | MILLIMETERS MIN | MILLIMETERS MAX | INCHES MIN | INCHES MAX |
|---|---|---|---|---|
| A | 16.94 | 17.45 | 0.667 | 0.687 |
| B | – | 16.94 | – | 0.667 |
| C | – | 11.43 | – | 0.450 |
| D | – | 9.53 | – | 0.375 |
| E | 2.92 | 5.08 | 0.115 | 0.200 |
| F | – | 2.03 | – | 0.080 |
| H | 1.52 | – | 0.060 | – |
| J | 10.72 | 11.51 | 0.422 | 0.453 |
| K | – | 25.40 | – | 1.000 |
| L | 3.96 | – | 0.152 | – |
| P | 5.59 | 6.32 | 0.220 | 0.249 |
| Q | 3.56 | 4.45 | 0.140 | 0.175 |

NOTES:
1. Dimension "P" is diameter.
2. All JEDEC dimensions and notes apply.

CASE 257-01
DO-5

### MAXIMUM RATINGS

| Rating | Symbol | BYS60 –20 | BYS60 –30 | BYS60 –45 | BYS60 –50 | Units |
|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | 30 | 45 | 50 | Volts |
| Average Rectified Forward Current, Rated $V_R$ Square Wave | $I_{F\,(AV)}$ | 60 ($T_C = 100^\circ$ C) | | 60 ($T_C = 90^\circ$ C) | | Amp. |
| Non-Repetitive Peak Surge Current, 10 mS | $I_{FSM}$ | ← 800 (for 1 cycle) → | | | | Amp. |
| Operating and Storage Junction Temperature | $T_J, T_{STG}$ | ← –65 to +150 → | | | | °C |
| Peak Operating Junction Temperature | $T_{J\,(PK)}$ | ← 175 → | | | | °C |
| Voltage Rate of Change | dv/dT | ← 1000 → | | | | Volts/μ Sec. |

### THERMAL CHARACTERISTICS

| Characteristics | Symbol | Typ | Max. | Unit |
|---|---|---|---|---|
| Thermal Resistance Jonction to case | $R_{\theta jc}$ | 0,7 | 0,9 | °C/W |

### ELECTRICAL CHARACTERISTICS

| Characteristics | Symbol | Typ | Max. | Units |
|---|---|---|---|---|
| Instantaneous Forward Voltage | | | | |
| $I_F$ = 60 Amp. $T_C = 25^\circ$ C | $V_F$ | 0,65 | 0,70 | Volts |
| $T_C = 100^\circ$ C | | 0,60 | 0,68 | |
| $T_C = 150^\circ$ C | | 0,55 | – | |
| $I_F$ = 120 Amp. $T_C = 25^\circ$ C | | 0,79 | 0,86 | |
| $T_C = 100^\circ$ C | | 0,74 | 0,81 | |
| $T_C = 150^\circ$ C | | 0,68 | – | |
| Instantaneous Reverse Current, Rated $V_R$ | | | | |
| $T_C = 25^\circ$ C BYS 60–20/30 | $I_R$ | 70 | 700 | μA |
| BYS 60–45/50 | | 100 | 1000 | |
| $T_C = 100^\circ$ C BYS 60–20/30 | | 8 | 15 | mA |
| BYS 60–45/50 | | 12 | 25 | |

| Characteristics | Symbol | BYS60 –20 | BYS60 –30 | BYS60 –45 | BYS60 –50 | Units |
|---|---|---|---|---|---|---|
| Minimum Reverse Breakdown Voltage (R 10 mA, $T_C = 25^\circ$ C | $V_{BR}$ | 30 | 40 | 47 | 53 | Volts |

### MECHANICAL CHARACTERISTICS

**CASE:** welded, hermetically sealed
**POLATITY:** cathode to case
**MOUNTING POSITIONS:** any
**STUD TORQUE:** 25 in. lb. max.

## NOTE 1: DETERMINING MAXIMUM RATINGS

Reverse power dissipation and the possibility of thermal runaway must be covered when operating this rectifier at reverse voltages above 0,2 VRWM. Proper operating may be accomplished by use of equation:

(1) TA (max) = TJ max – RθJA.PF. (AV) – RθJA (AV)

where:

TA (max) = maximum allowable ambient temperature
TJ (max) = maximum allowable junction temperature
PF (AV) = average forward power dissipation
PR (AV) = average reverse power dissipation
RθJA = junction to ambient thermal resistance

Figure 1 permits easier use of equation (1) by taking reverse power dissipation and thermal runaway into consideration. The figure solves for a reference temperature as determined by equation (2):

(2) TR = TJ max – RθJA PR (AV)

substituting equation (2) into equation (1) yields:

(3) TA (max) = TR – RθJA RF (AV)

## HOW TO USE FIG. 1 TO FIND TR (MAX)

Example:
Find TA (max) for BYS 60–30 operated in a 5 V/40 A forward converter as free wheel diode, 6 min = 0,35,VRRM = 17 V and RθJA = 5° C/W.

**STEP 1**

Find VR equivalent = VRRM $\sqrt{3}$ min = 17 $\sqrt{0,35}$ = 10 V.

**STEP 2**

Find TR from fig. 1 horizontaly intercept VR = 10 V with the BYS 60–30 curve. Vertically intercept this point with the RθJA = 5° C/W curve. Read TR directly, TR = 141° C.

**STEP 3**

Find PF (AV) from fig. 3 (IF (AV) in the free wheel diode is:
Io. (1 –5 min) = 26 A). Read PF (AV) = 16 W.

**STEP 4**

Find TA (max) from equation (3)
TA max = TR – RθJA. PF (AV)
= 141° C–80° C = 61° C

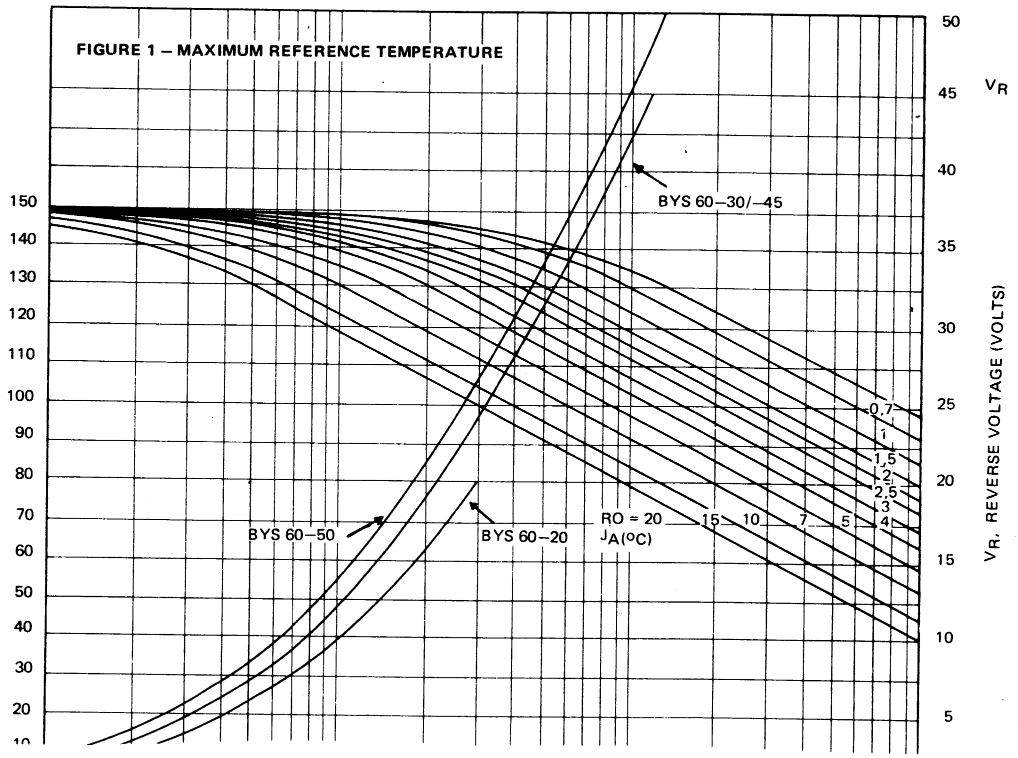


FIGURE 2 – TYPICAL FORWARD VOLTAGE

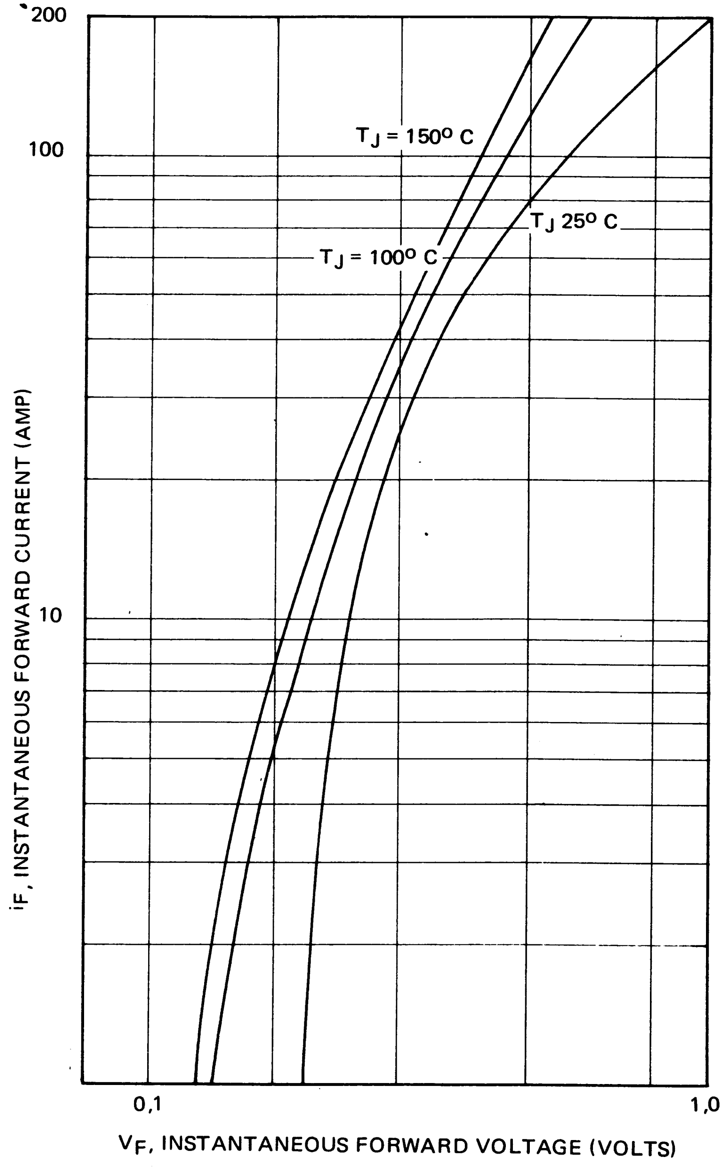
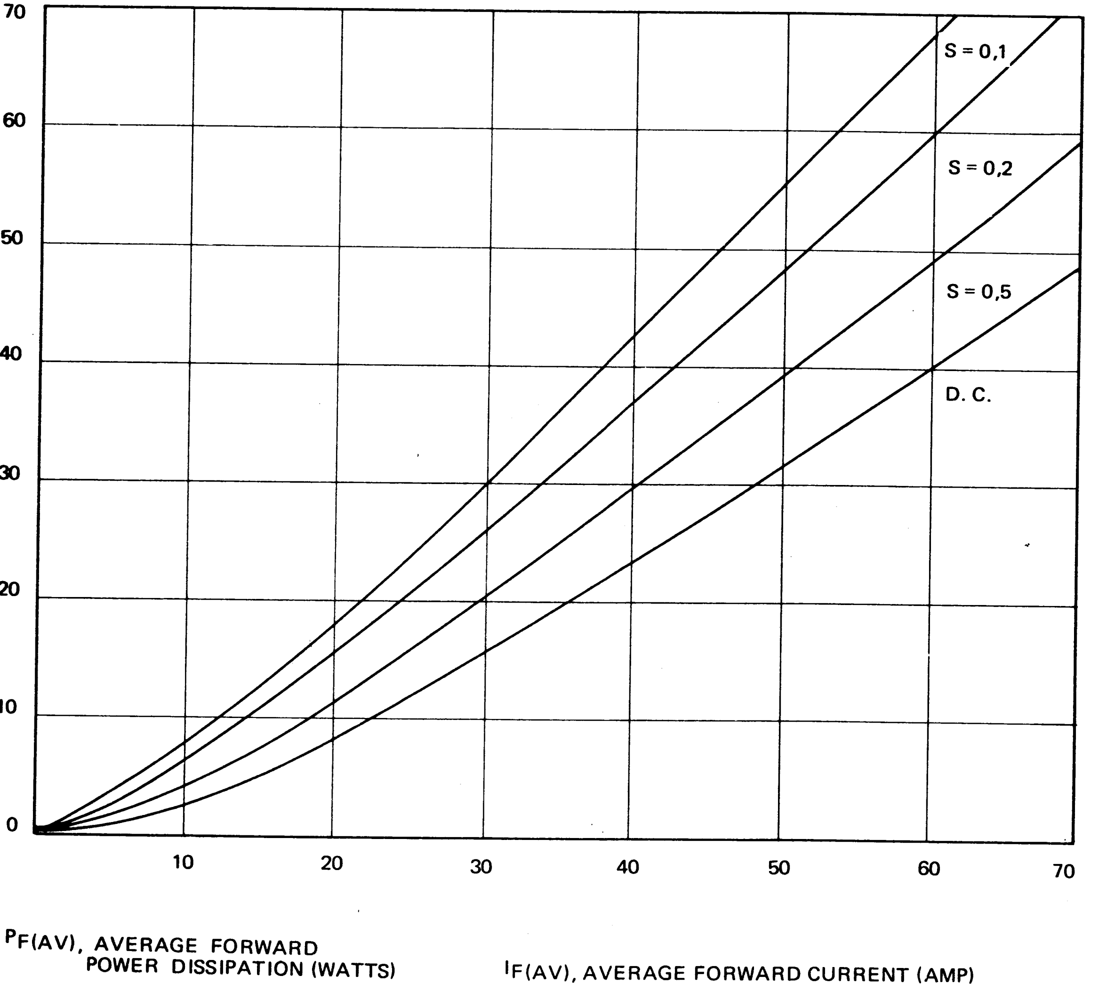


**FIGURE 3 – FORWARD POWER DISSIPATION**



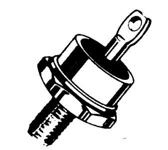
**MOTOROLA**

# BYS 75 SERIES

## ADVANCE INFORMATION

## SCHOTTKY BARRIER RECTIFIERS

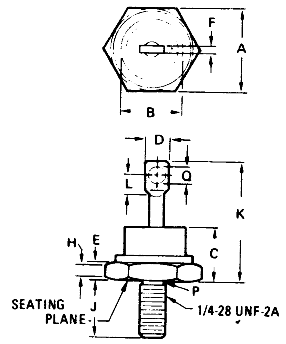
75 AMPERES
20 to 50 VOLTS



### Switchmode Power Rectifiers

Epitaxial construction with oxyde passivation and metal overlap contact — ion implanted guard ring for transient voltage protection

- lowest combinated power losses
- high surge capability
- majority carrier conduction




| DIM | MILLIMETERS MIN | MILLIMETERS MAX | INCHES MIN | INCHES MAX |
|---|---|---|---|---|
| A | 16.94 | 17.45 | 0.667 | 0.687 |
| B | – | 16.94 | – | 0.667 |
| C | – | 11.43 | – | 0.450 |
| D | – | 9.53 | – | 0.375 |
| E | 2.92 | 5.08 | 0.115 | 0.200 |
| F | – | 2.03 | – | 0.080 |
| H | 1.52 | – | 0.060 | – |
| J | 10.72 | 11.51 | 0.422 | 0.453 |
| K | – | 25.40 | – | 1.000 |
| L | 3.96 | – | 0.152 | – |
| P | 5.59 | 6.32 | 0.220 | 0.249 |
| Q | 3.56 | 4.45 | 0.140 | 0.175 |

NOTES:
1. Dimension "P" is diameter.
2. All JEDEC dimensions and notes apply.

CASE 257-01
DO-5

### MAXIMUM RATINGS

| Rating | Symbol | BYS75 –20 | BYS75 –30 | BYS75 –45 | BYS75 –50 | Units |
|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | 30 | 45 | 50 | Volts |
| Average Rectified Forward Current, Rated $V_R$ Square Wave | $I_{F\,(AV)}$ | 75 ($T_C$ = 100° C) | | 75 ($T_C$ = 90° C) | | Amp. |
| Non-Repetitive Peak Surge Current, 10 mS | $I_{FSM}$ | ← 1000 → | | | | Amp. |
| Operating and Storage Junction Temperature | $T_J$, $T_{STG}$ | ← –65 to +150 → | | | | °C |
| Peak Operating Junction Temperature | $T_J$ (PK) | ← 175 → | | | | °C |
| Voltage Rate of Change | dv/dT | ← 1000 → | | | | Volts/µ Sec. |

### THERMAL CHARACTERISTICS

| Characteristics | Symbol | Typ | Max. | Unit |
|---|---|---|---|---|
| Thermal Resistance Jonction to case | $R_{\theta jc}$ | 0.6 | 0.75 | °C/W |

### ELECTRICAL CHARACTERISTICS

| Characteristics | Symbol | Typ | Max. | Units |
|---|---|---|---|---|
| Instantaneous Forward Voltage<br>$I_F$ = 75 Amp. $T_C$ = 25° C<br>$T_C$ = 100° C<br>$T_C$ = 150° C<br>$I_F$ = 150 Amp. $T_C$ = 25° C<br>$T_C$ = 100° C<br>$T_C$ = 150° C | $V_F$ | 0.6<br>0.55<br>0.53<br>0.8<br>0.68<br>0.64 | 0.72<br>0.64<br>–<br>0.88<br>0.78<br>– | Volts |
| Instantaneous Reverse Current, Rated $V_R$<br>$T_C$ = 25° C BYS75–20/30<br>BYS75–45/50 | $I_R$ | 90<br>130 | 1000<br>1200 | µA |
| $T_C$ = 100° C BYS75–20/30<br>BYS75–45/50 | $I_R$ | 15<br>40 | 25<br>50 | mA |

| Characteristics | Symbol | | | | | Units |
|---|---|---|---|---|---|---|
| Minimum Reverse Breakdown Voltage ($I_{BR}$ = 10 mA, $T_C$ = 25° C) | $V_{BR}$ | 30 | 40 | 47 | 53 | Volts |

### MECHANICAL CHARACTERISTICS

**CASE:** welded, hermetically sealed
**POLATITY:** cathode to case
**MOUNTING POSITIONS:** any
**STUD TORQUE:** 25 in. lb. max.

## NOTE 1: DETERMINING MAXIMUM RATINGS

Reverse power dissipation and the possibility of thermal runaway must be covered when operating this rectifier at reverse voltages above 0,2 VRWM. Proper operating may be accomplished by use of equation:

(1) TA (max) = TJ max – RθJA.PF (AV) – RθJA PR (AV)

where:

- TA (max) = maximum allowable ambient temperature
- TJ (max) = maximum allowable junction temperature
- PF (AV) = average forward power dissipation
- PR (AV) = average reverse power dissipation
- RθJA = junction to ambient thermal resistance

Figure 1 permits easier use of equation (1) by taking reverse power dissipation and thermal runaway into consideration. The figure solves for a reference temperature as determined by equation (2):

(2) TR = TJ max – RθJA PR (AV)

substituting equation (2) into equation (1) yields:

(3) TA (max) = TR – RθJA RF (AV)

## HOW TO USE FIG. 1 TO FIND TR (MAX)

Example:
Find TA (max) for BYS 60–30 operated in a 5 V/60 A forward converter as frectifiyng diode, 5 min = 0,35, 5 max = 0,5, VRRM = 17 V and R0JA = 3° C/W

**STEP 1**

Find VR equivalent = VRRM $\sqrt{1-5\ \text{min}}$ = 17 $\sqrt{0{,}65}$ = 13,7 V

**STEP 2**

Find TR from fig. 1 horizontaly intercept VR = 13,7V with the BYS 75–30 curve. Vertically intercept this point with the RθJA = 3° C/W curve. Read directly, TRT= 140° C.

**STEP 3**

Find PF (AV) from fig. 4 (IF (AV) for the rectifying diode is Io x 5 max IF (AV) = Io.0,5 = 30A) Read PF (AV) = 18 W

**STEP 4**

Find TA (max) from equation (3)
TA max = TR – RθJA. PF (AV)
= 140° C–86° C

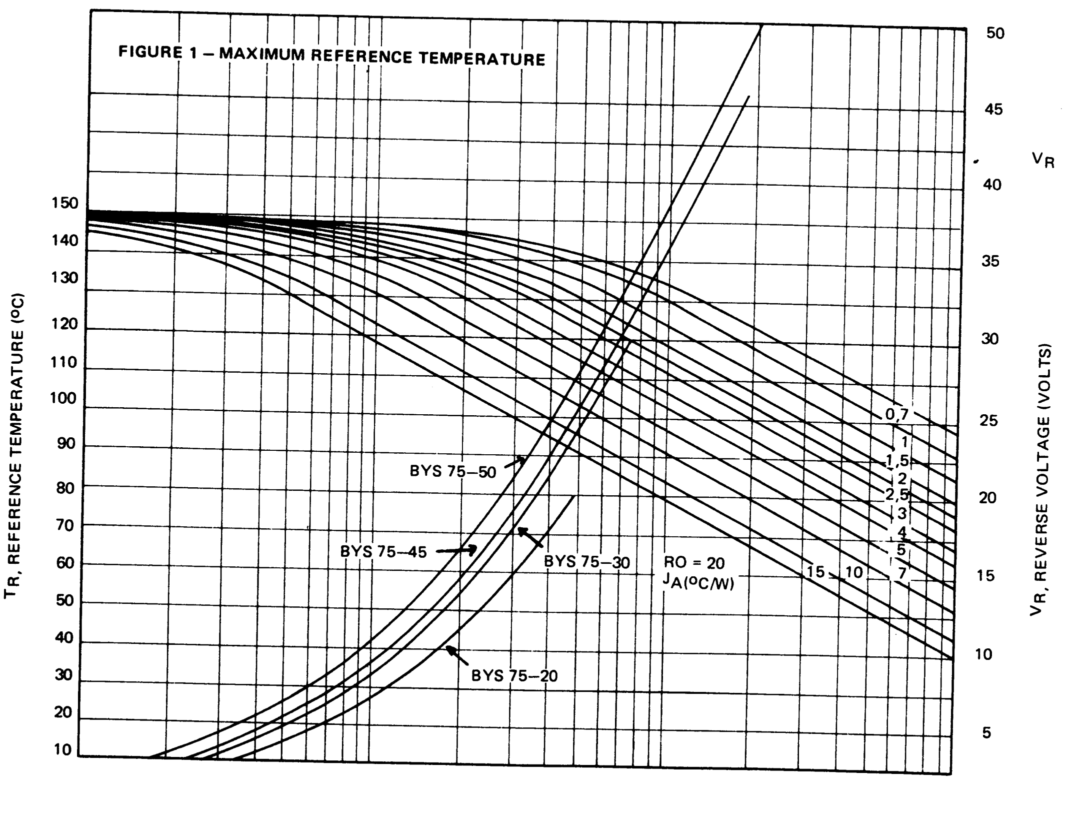


FIGURE 2 – TYPICAL FORWARD VOLTAGE

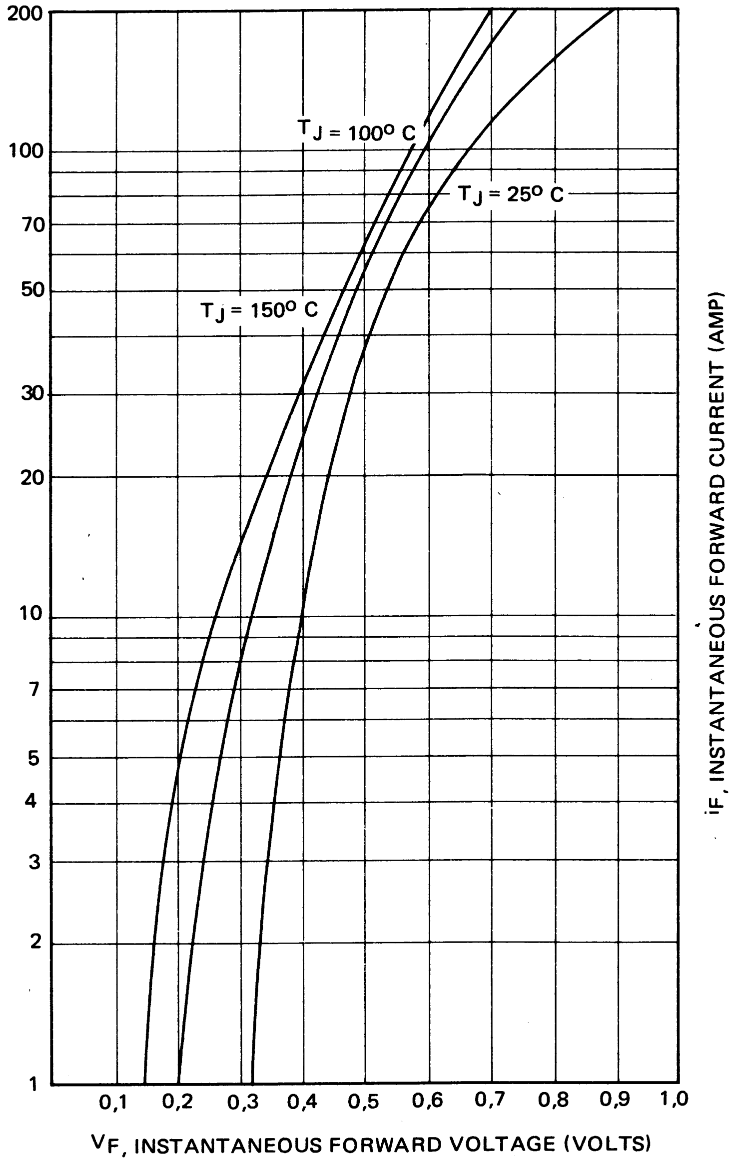


FIGURE 3 — FORWARD POWER DISSIPATION

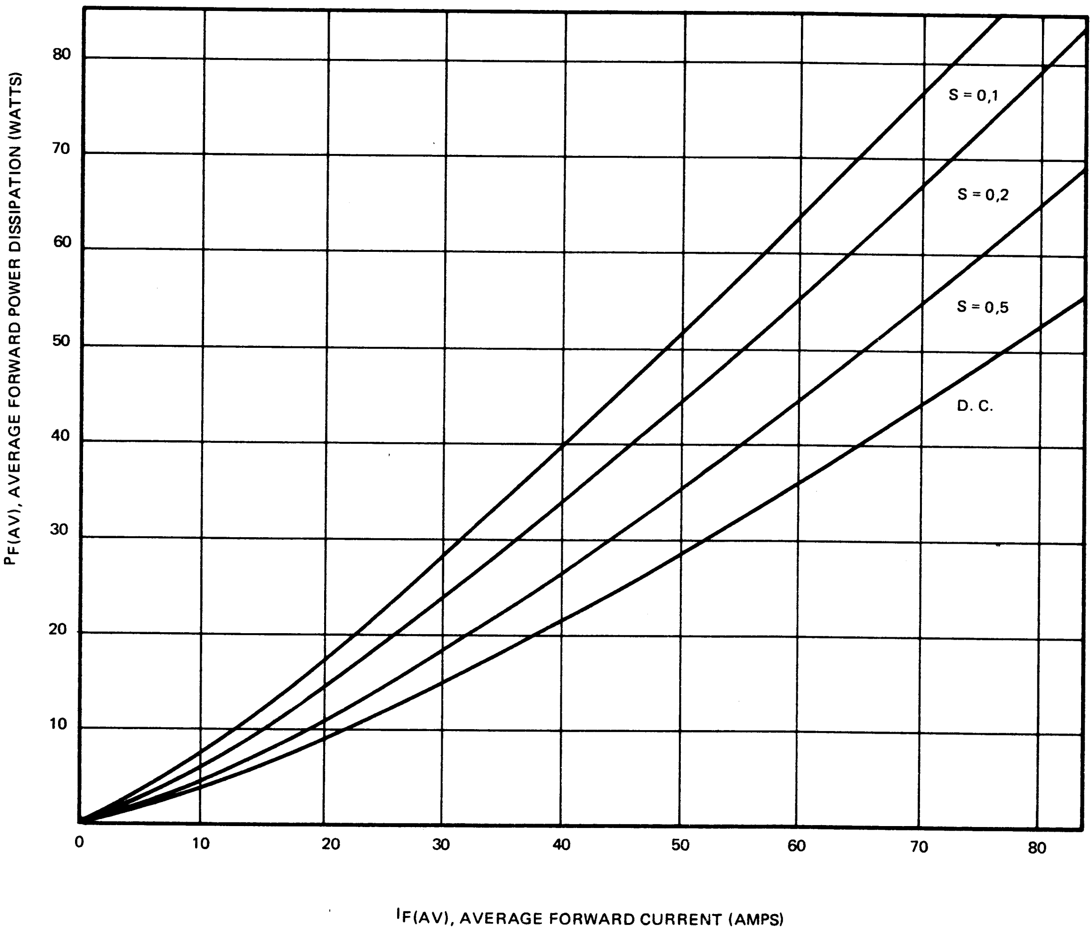


**FIGURE 5 – CAPACITANCE**

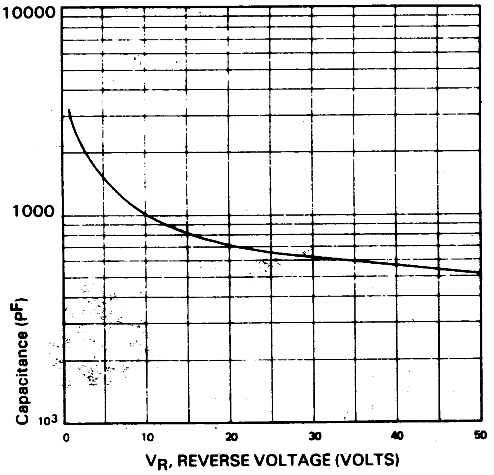



**FIGURE 6 — TYPICAL REVERSE CURRENT**