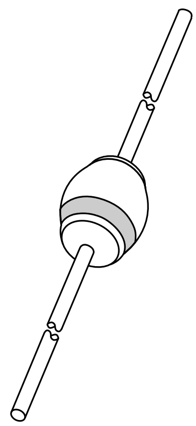
# DATA SHEET



## BYV27 series
## Ultra fast low-loss controlled avalanche rectifiers

Product specification
Supersedes data of 1996 Oct 02

1997 Nov 24

Philips Semiconductors

PHILIPS

# Ultra fast low-loss controlled avalanche rectifiers

# BYV27 series

## FEATURES

- Glass passivated
- High maximum operating temperature
- Low leakage current
- Excellent stability
- Guaranteed avalanche energy absorption capability
- Available in ammo-pack.

## DESCRIPTION

Rugged glass SOD57 package, using a high temperature alloyed construction.

This package is hermetically sealed and fatigue free as coefficients of expansion of all used parts are matched.

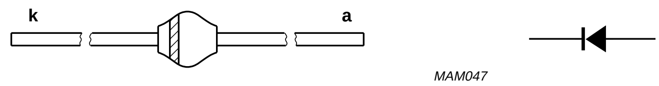



Fig.1 Simplified outline (SOD57) and symbol.

## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{RRM}$ | repetitive peak reverse voltage | | | | |
| | BYV27-50 | | – | 50 | V |
| | BYV27-100 | | – | 100 | V |
| | BYV27-150 | | – | 150 | V |
| | BYV27-200 | | – | 200 | V |
| | BYV27-300 | | – | 300 | V |
| | BYV27-400 | | – | 400 | V |
| | BYV27-500 | | – | 500 | V |
| | BYV27-600 | | – | 600 | V |
| $V_R$ | continuous reverse voltage | | | | |
| | BYV27-50 | | – | 50 | V |
| | BYV27-100 | | – | 100 | V |
| | BYV27-150 | | – | 150 | V |
| | BYV27-200 | | – | 200 | V |
| | BYV27-300 | | – | 300 | V |
| | BYV27-400 | | – | 400 | V |
| | BYV27-500 | | – | 500 | V |
| | BYV27-600 | | – | 600 | V |
| $I_{F(AV)}$ | average forward current | $T_{tp}$ = 85 °C; lead length = 10 mm; see Figs 2, 3 and 4; averaged over any 20 ms period; see also Figs 14, 15 and 16 | | | |
| | BYV27-50 to 200 | | – | 2.0 | A |
| | BYV27-300 and 400 | | – | 1.9 | A |
| | BYV27-500 and 600 | | – | 1.6 | A |
| $I_{F(AV)}$ | average forward current | $T_{amb}$ = 60 °C; printed-circuit board mounting (see Fig. 25); see Figs 5, 6 and 7; averaged over any 20 ms period; see also Figs 14, 15 and 16 | | | |
| | BYV27-50 to 200 | | – | 1.30 | A |
| | BYV27-300 and 400 | | – | 1.25 | A |
| | BYV27-500 and 600 | | – | 1.10 | A |

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $I_{FRM}$ | repetitive peak forward current | $T_{tp}$ = 85 °C; see Figs 8, 9 and 10 | | | |
| | BYV27-50 to 400 | | – | 20 | A |
| | BYV27-500 and 600 | | – | 16 | A |
| $I_{FRM}$ | repetitive peak forward current | $T_{amb}$ = 60 °C; see Figs 11, 12 and 13 | | | |
| | BYV27-50 to 200 | | – | 14 | A |
| | BYV27-300 and 400 | | – | 13 | A |
| | BYV27-500 and 600 | | – | 11 | A |
| $I_{FSM}$ | non-repetitive peak forward current | t = 10 ms half sine wave; $T_j = T_{j\,max}$ prior to surge; $V_R = V_{RRMmax}$ | | | |
| | BYV27-50 to 400 | | – | 50 | A |
| | BYV27-500 and 600 | | – | 40 | A |
| $E_{RSM}$ | non-repetitive peak reverse avalanche energy | L = 120 mH; $T_j = T_{j\,max}$ prior to surge; inductive load switched off | – | 20 | mJ |
| $T_{stg}$ | storage temperature | | –65 | +175 | °C |
| $T_j$ | junction temperature | see Fig. 17 | –65 | +175 | °C |

## ELECTRICAL CHARACTERISTICS

$T_j$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_F$ | forward voltage | $I_F$ = 2 A; $T_j = T_{j\,max}$; see Figs 18, 19 and 20 | | | | |
| | BYV27-50 to 200 | | – | – | 0.78 | V |
| | BYV27-300 and 400 | | – | – | 0.82 | V |
| | BYV27-500 and 600 | | – | – | 1.00 | V |
| $V_F$ | forward voltage | $I_F$ = 2 A; see Figs 18, 19 and 20 | | | | |
| | BYV27-50 to 200 | | – | – | 0.98 | V |
| | BYV27-300 and 400 | | – | – | 1.05 | V |
| | BYV27-500 and 600 | | – | – | 1.25 | V |
| $V_{(BR)R}$ | reverse avalanche breakdown voltage | $I_R$ = 0.1 mA | | | | |
| | BYV27-50 | | 55 | – | – | V |
| | BYV27-100 | | 110 | – | – | V |
| | BYV27-150 | | 165 | – | – | V |
| | BYV27-200 | | 220 | – | – | V |
| | BYV27-300 | | 330 | – | – | V |
| | BYV27-400 | | 440 | – | – | V |
| | BYV27-500 | | 560 | – | – | V |
| | BYV27-600 | | 675 | – | – | V |
| $I_R$ | reverse current | $V_R = V_{RRMmax}$; see Fig. 21 | – | – | 5 | µA |
| | | $V_R = V_{RRMmax}$; $T_j$ = 165 °C; see Fig. 21 | – | – | 150 | µA |

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $t_{rr}$ | reverse recovery time | when switched from $I_F$ = 0.5 A to $I_R$ = 1 A; measured at $I_R$ = 0.25 A; see Fig. 27 | | | | |
| | BYV27-50 to 200 | | – | – | 25 | ns |
| | BYV27-300 to 600 | | – | – | 50 | ns |
| $C_d$ | diode capacitance | f = 1 MHz; $V_R$ = 0; see Figs 22, 23 and 24 | | | | |
| | BYV27-50 to 200 | | – | 100 | – | pF |
| | BYV27-300 and 400 | | – | 80 | – | pF |
| | BYV27-500 and 600 | | – | 65 | – | pF |
| $\left\|\frac{dI_R}{dt}\right\|$ | maximum slope of reverse recovery current | when switched from $I_F$ = 1 A to $V_R \geq$ 30 V and $dI_F/dt$ = –1 A/µs; see Fig. 26 | – | – | 4 | A/µs |

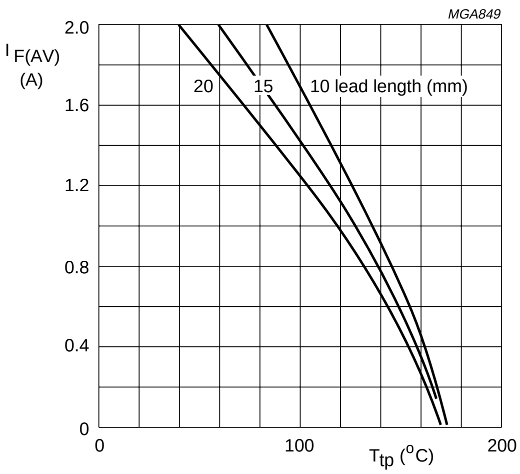
**THERMAL CHARACTERISTICS**

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|---|---|---|---|---|
| $R_{th\ j\text{-}tp}$ | thermal resistance from junction to tie-point | lead length = 10 mm | 46 | K/W |
| $R_{th\ j\text{-}a}$ | thermal resistance from junction to ambient | note 1 | 100 | K/W |

**Note**

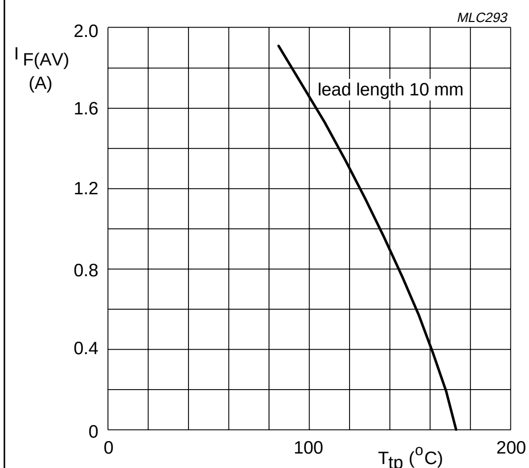
1. Device mounted on an epoxy-glass printed-circuit board, 1.5 mm thick; thickness of Cu-layer ≥40 µm, see Fig. 25. For more information please refer to the *“General Part of associated Handbook”*.

## GRAPHICAL DATA



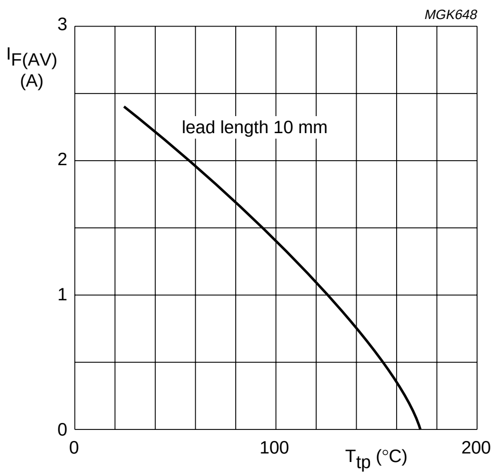

**BYV27-50 to 200**
a = 1.42; $V_R = V_{RRMmax}$; δ = 0.5.
Switched mode application.

Fig.2 Maximum permissible average forward current as a function of tie-point temperature (including losses due to reverse leakage).



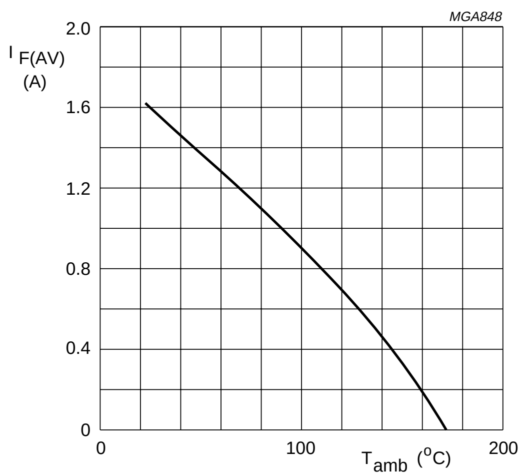

**BYV27-300 and 400**
a = 1.42; $V_R = V_{RRMmax}$; δ = 0.5.
Switched mode application.

Fig.3 Maximum permissible average forward current as a function of tie-point temperature (including losses due to reverse leakage).



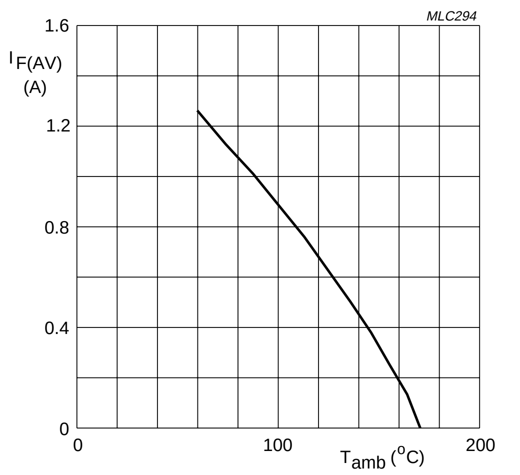

**BYV27-500 and 600**
a = 1.42; $V_R = V_{RRMmax}$; δ = 0.5.
Switched mode application.

Fig.4 Maximum permissible average forward current as a function of tie-point temperature (including losses due to reverse leakage).




**BYV27-50 to 200**
a = 1.42; $V_R = V_{RRMmax}$; δ = 0.5.
Device mounted as shown in Fig. 25.
Switched mode application.

Fig.5 Maximum permissible average forward current as a function of ambient temperature (including losses due to reverse leakage).



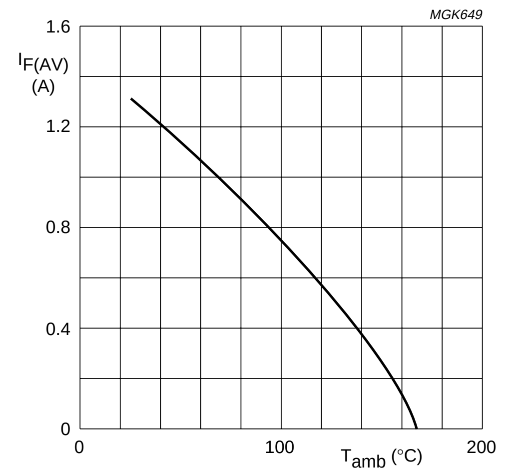

**BYV27-300 and 400**

a = 1.42; $V_R = V_{RRMmax}$; δ = 0.5.

Device mounted as shown in Fig. 25.

Switched mode application.

Fig.6 Maximum permissible average forward current as a function of ambient temperature (including losses due to reverse leakage).



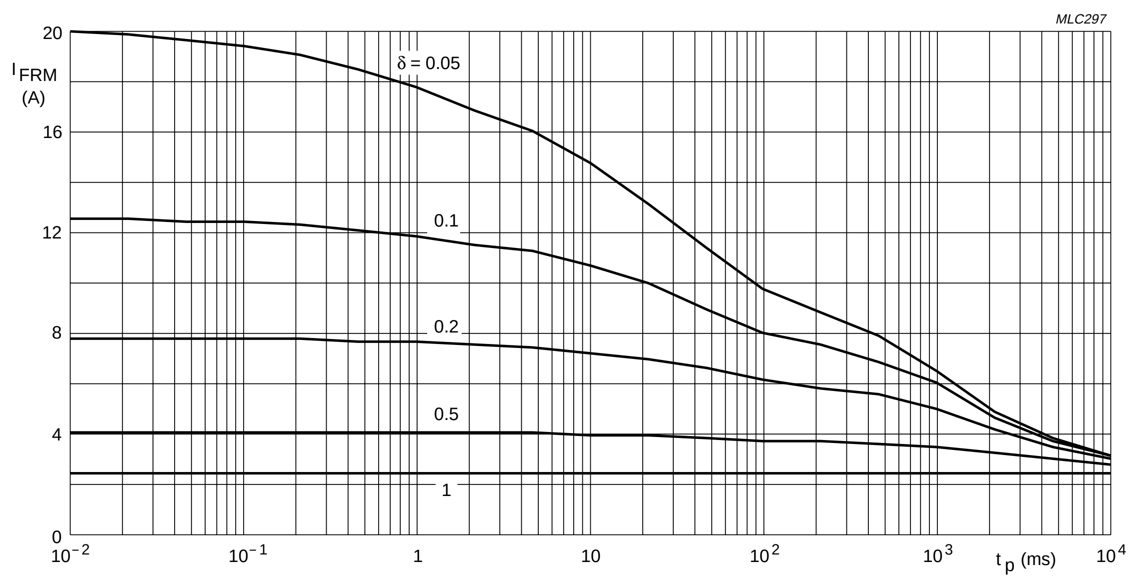

**BYV27-500 and 600**

a = 1.42; $V_R = V_{RRMmax}$; δ = 0.5.

Device mounted as shown in Fig. 25.

Switched mode application.

Fig.7 Maximum permissible average forward current as a function of ambient temperature (including losses due to reverse leakage).

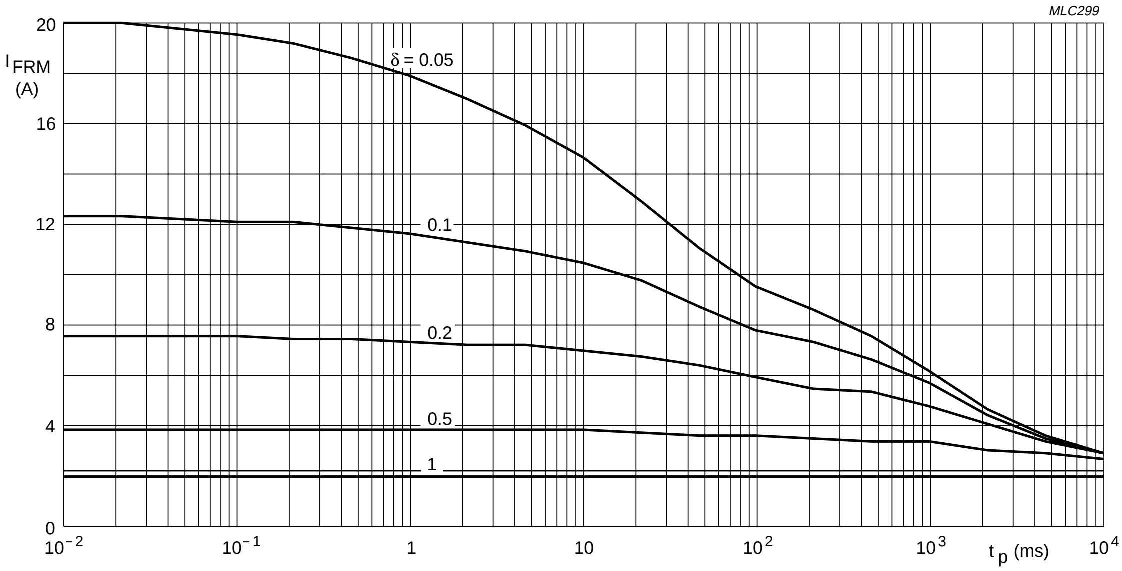



**BYV27-50 to 200**

$T_{tp}$ = 85 °C; $R_{th\ j\text{-}tp}$ = 46 K/W.

$V_{RRMmax}$ during 1 – δ; curves include derating for $T_{j\ max}$ at $V_{RRM}$ = 200 V.

Fig.8 Maximum repetitive peak forward current as a function of pulse time (square pulse) and duty factor.

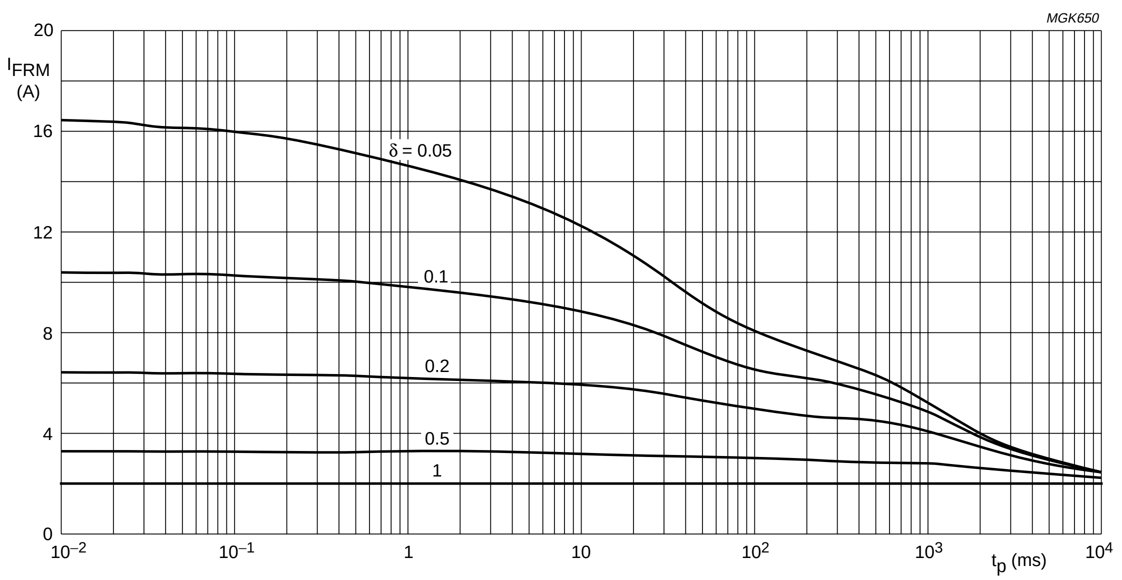



**BYV27-300 and 400**

$T_{tp}$ = 85 °C; $R_{th\ j\text{-}tp}$ = 46 K/W.

$V_{RRMmax}$ during 1 – δ; curves include derating for $T_{j\ max}$ at $V_{RRM}$ = 400 V.

Fig.9 Maximum repetitive peak forward current as a function of pulse time (square pulse) and duty factor.

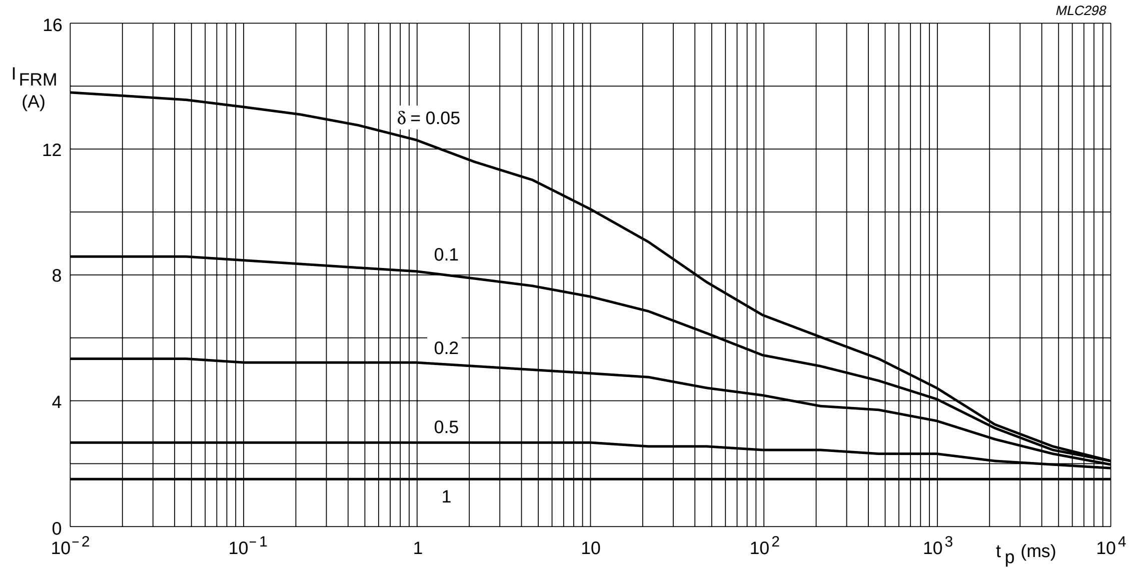



**BYV27-500 and 600**

$T_{tp}$ = 85 °C; $R_{th\ j\text{-}tp}$ = 46 K/W.

$V_{RRMmax}$ during 1 – δ; curves include derating for $T_{j\ max}$ at $V_{RRM}$ = 600 V.

Fig.10 Maximum repetitive peak forward current as a function of pulse time (square pulse) and duty factor.

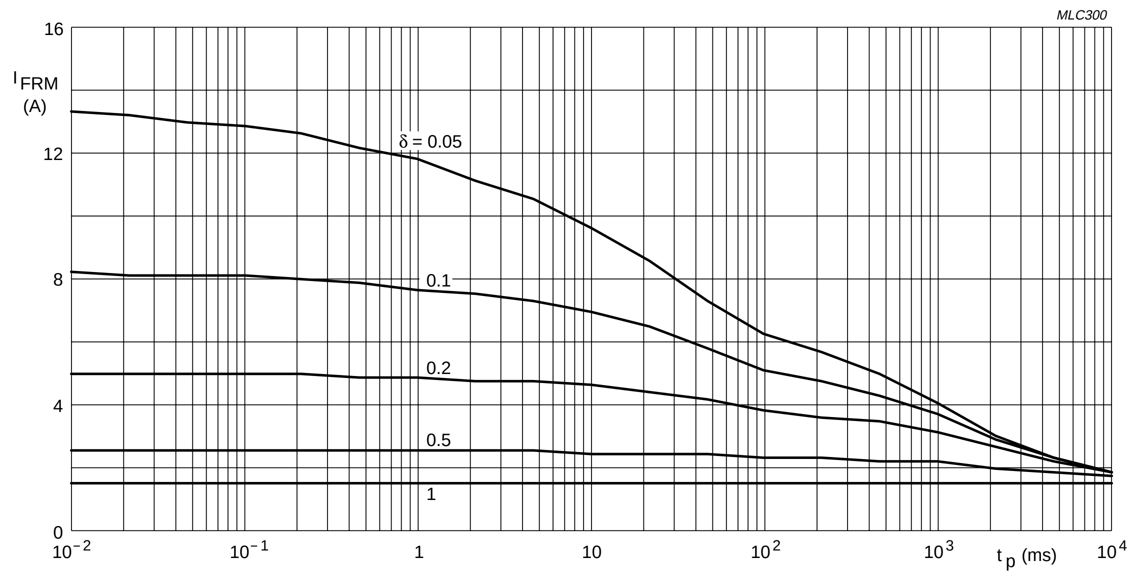



**BYV27-50 to 200**

$T_{amb}$ = 60 °C; $R_{th\ j\text{-}a}$ = 100 K/W.

$V_{RRMmax}$ during 1 – δ; curves include derating for $T_{j\ max}$ at $V_{RRM}$ = 200 V.

Fig.11 Maximum repetitive peak forward current as a function of pulse time (square pulse) and duty factor.

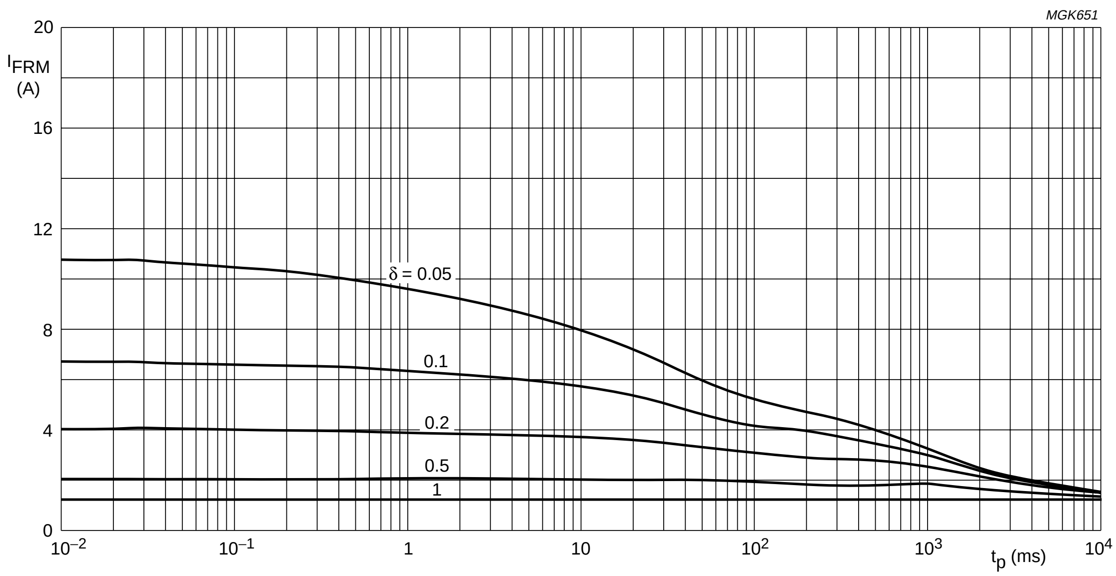



**BYV27-300 and 400**

$T_{amb}$ = 60 °C; $R_{th\ j\text{-}a}$ = 100 K/W.

$V_{RRMmax}$ during 1 – δ; curves include derating for $T_{j\ max}$ at $V_{RRM}$ = 400 V.

Fig.12 Maximum repetitive peak forward current as a function of pulse time (square pulse) and duty factor.

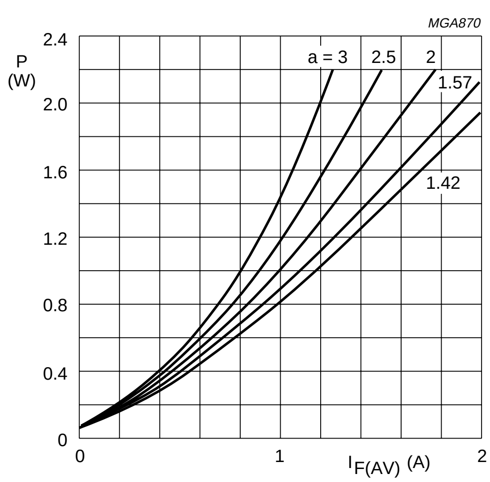



**BYV27-500 and 600**

$T_{amb}$ = 60 °C; $R_{th\ j\text{-}a}$ = 100 K/W.

$V_{RRMmax}$ during 1 – δ; curves include derating for $T_{j\ max}$ at $V_{RRM}$ = 600 V.

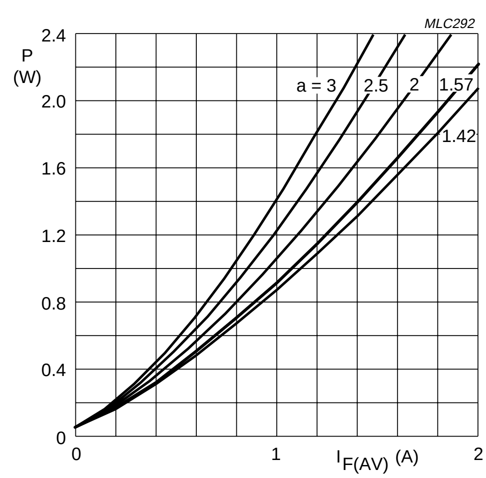
Fig.13 Maximum repetitive peak forward current as a function of pulse time (square pulse) and duty factor.




**BYV27-50 to 200**

a = $I_{F(RMS)}/I_{F(AV)}$; $V_R$ = $V_{RRMmax}$; δ = 0.5.

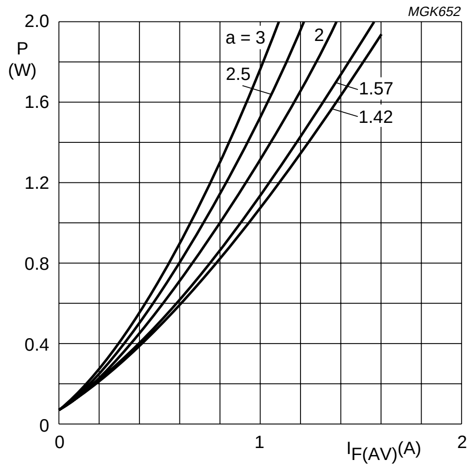
Fig.14 Maximum steady state power dissipation (forward plus leakage current losses, excluding switching losses) as a function of average forward current.




**BYV27-300 and 400**

a = $I_{F(RMS)}/I_{F(AV)}$; $V_R$ = $V_{RRMmax}$; δ = 0.5.

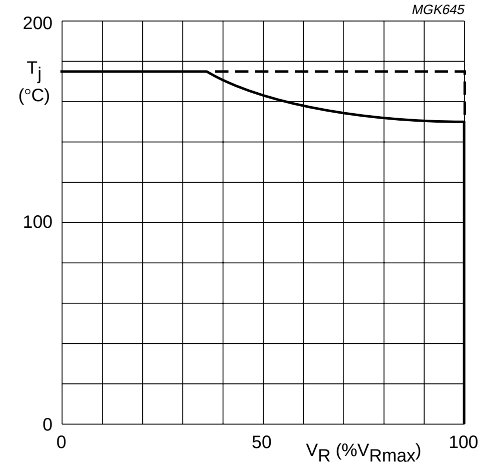
Fig.15 Maximum steady state power dissipation (forward plus leakage current losses, excluding switching losses) as a function of average forward current.




**BYV27-500 and 600**

a = $I_{F(RMS)}/I_{F(AV)}$; $V_R = V_{RRMmax}$; δ = 0.5.

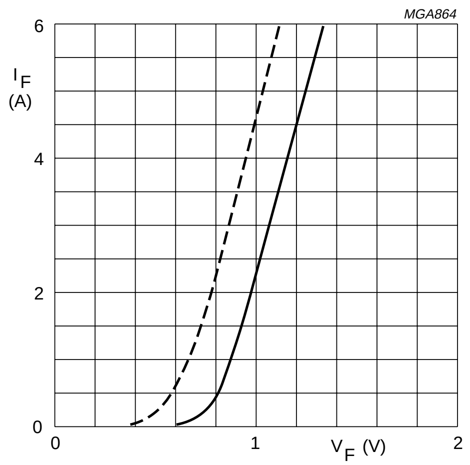
Fig.16 Maximum steady state power dissipation (forward plus leakage current losses, excluding switching losses) as a function of average forward current.




Solid line = $V_R$.

Dotted line = $V_{RRM}$; δ = 0.5.

Fig.17 Maximum permissible junction temperature as a function of maximum reverse voltage percentage.

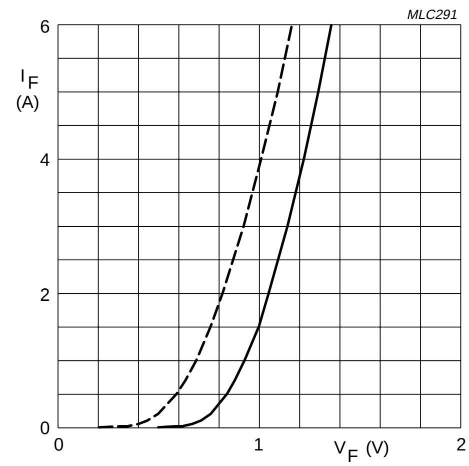



**BYV27-50 to 200**

Dotted line: $T_j$ = 175 °C.

Solid line: $T_j$ = 25 °C.

Fig.18 Forward current as a function of forward voltage; maximum values.




**BYV27-300 and 400**

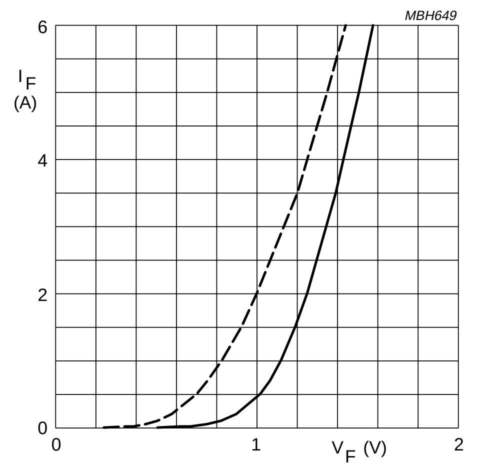
Dotted line: $T_j$ = 175 °C.

Solid line: $T_j$ = 25 °C.

Fig.19 Forward current as a function of forward voltage; maximum values.

# Ultra fast low-loss controlled avalanche rectifiers

## BYV27 series

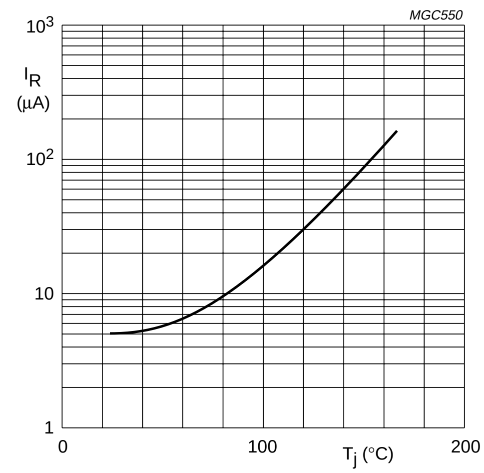



**BYV27-500 and 600**

Dotted line: $T_j$ = 175 °C.

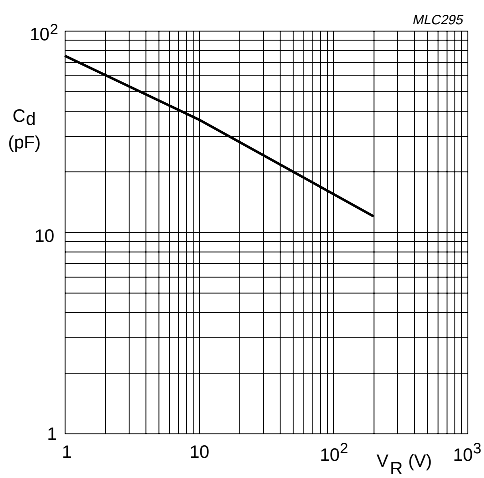
Solid line: $T_j$ = 25 °C.

Fig.20 Forward current as a function of forward voltage; maximum values.




$V_R = V_{RRMmax}$.

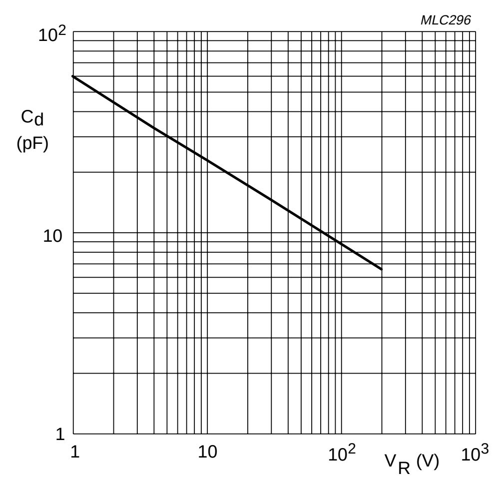
Fig.21 Reverse current as a function of junction temperature; maximum values.




**BYV27-50 to 200**

f = 1 MHz; $T_j$ = 25 °C.

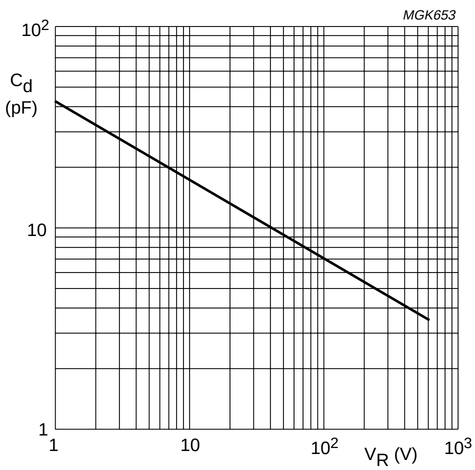
Fig.22 Diode capacitance as a function of reverse voltage; typical values.




**BYV27-300 and 400**

f = 1 MHz; $T_j$ = 25 °C.

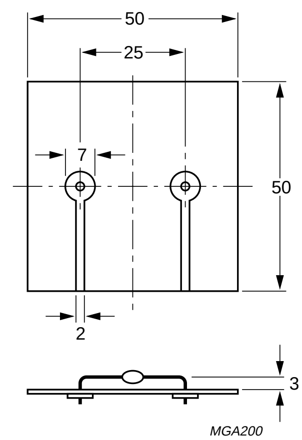
Fig.23 Diode capacitance as a function of reverse voltage; typical values.




**BYV27-500 and 600**

f = 1 MHz; $T_j$ = 25 °C.

Fig.24 Diode capacitance as a function of reverse voltage; typical values.




Dimensions in mm.

Fig.25 Device mounted on a printed-circuit board.

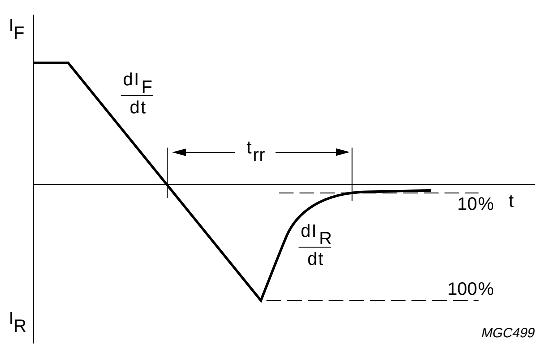
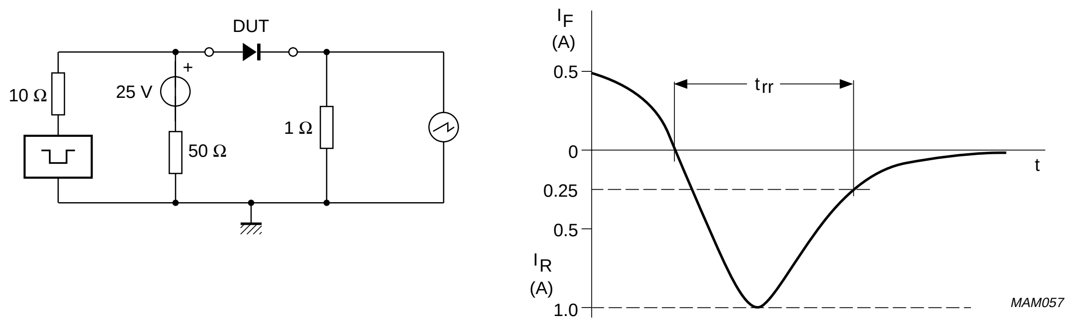



Fig.26 Reverse recovery definitions.

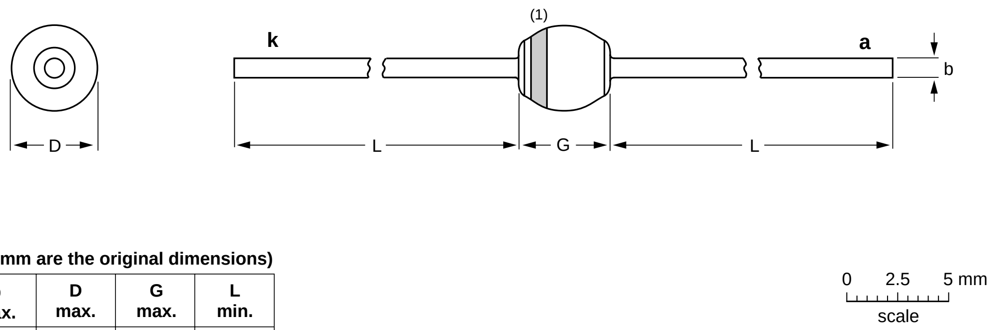



Input impedance oscilloscope: 1 MΩ, 22 pF; $t_r \leq 7$ ns.
Source impedance: 50 Ω; $t_r \leq 15$ ns.

Fig.27 Test circuit and reverse recovery time waveform and definition.

## PACKAGE OUTLINE

**Hermetically sealed glass package; axial leaded; 2 leads** **SOD57**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | b max. | D max. | G max. | L min. |
|---|---|---|---|---|
| mm | 0.81 | 3.81 | 4.57 | 28 |

**Note**

1. The marking band indicates the cathode.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOD57 | | | | | | 97-10-14 |

## DEFINITIONS

| Data Sheet Status | |
|---|---|
| Objective specification | This data sheet contains target or goal specifications for product development. |
| Preliminary specification | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification | This data sheet contains final product specifications. |
| **Limiting values** | |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability. | |
| **Application information** | |
| Where application information is given, it is advisory and does not form part of the specification. | |

## LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

NOTES

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