# Silicon Diode

# **BYD53D**

200V/750mA

# DATASHEET

OEM – Philips

Source: Philips Databook 1999

*Datasheet Rev. 1.3 – 04/19 –data without warranty / liability*

# Fast soft-recovery controlled avalanche rectifiers

## BYD53 series

### FEATURES

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

### DESCRIPTION

Cavity free cylindrical glass SOD81 package through Implotec™(1) technology. The SOD81 package is hermetically sealed and fatigue free as coefficients of expansion of all used parts are matched.

(1) Implotec is a trademark of Philips.


Fig.1 Simplified outline (SOD81) 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 | | | | |
| | BYD53D | | – | 200 | V |
| | BYD53G | | – | 400 | V |
| | BYD53J | | – | 600 | V |
| | BYD53K | | – | 800 | V |
| | BYD53M | | – | 1000 | V |
| | BYD53U | | – | 1200 | V |
| | BYD53V | | – | 1400 | V |
| $V_R$ | continuous reverse voltage | | | | |
| | BYD53D | | – | 200 | V |
| | BYD53G | | – | 400 | V |
| | BYD53J | | – | 600 | V |
| | BYD53K | | – | 800 | V |
| | BYD53M | | – | 1000 | V |
| | BYD53U | | – | 1200 | V |
| | BYD53V | | – | 1400 | V |
| $I_{F(AV)}$ | average forward current | $T_{tp}$ = 55 °C; lead length = 10 mm see Figs 2 and 3; averaged over any 20 ms period; see also Figs 10 and 11 | | | |
| | BYD53D to M | | – | 0.75 | A |
| | BYD53U and V | | – | 0.85 | A |
| $I_{F(AV)}$ | average forward current | $T_{amb}$ = 65 °C; PCB mounting (see Fig.17); see Figs 4 and 5; averaged over any 20 ms period; see also Figs 10 and 11 | | | |
| | BYD53D to M | | – | 0.40 | A |
| | BYD53U and V | | – | 0.45 | A |
| $I_{FRM}$ | repetitive peak forward current | $T_{tp}$ = 55 °C; see Figs 6 and 7 | | | |
| | BYD53D to M | | – | 6.5 | A |
| | BYD53U and V | | – | 8.25 | A |

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| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $I_{FRM}$ | repetitive peak forward current | $T_{amb}$ = 65 °C; see Figs 8 and 9 | | | |
| | BYD53D to M | | – | 3.6 | A |
| | BYD53U and V | | – | 4.45 | A |
| $I_{FSM}$ | non-repetitive peak forward current | t = 10 ms half sine wave; $T_j = T_{j\,max}$ prior to surge; $V_R = V_{RRMmax}$ | – | 5 | A |
| $E_{RSM}$ | non-repetitive peak reverse avalanche energy | L = 120 mH; $T_j = T_{j\,max}$ prior to surge; inductive load switched off | – | 10 | mJ |
| $T_{stg}$ | storage temperature | | –65 | +175 | °C |
| $T_j$ | junction temperature | see Fig.12 | –65 | +175 | °C |

**ELECTRICAL CHARACTERISTICS**

$T_j$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_F$ | forward voltage | $I_F$ = 1 A; $T_j = T_{j\,max}$; see Figs 13 and 14 | | | | |
| | BYD53D to M | | – | – | 2.1 | V |
| | BYD53U and V | | – | – | 1.7 | V |
| $V_F$ | forward voltage | $I_F$ = 1 A; see Figs 13 and 14 | | | | |
| | BYD53D to M | | – | – | 3.6 | V |
| | BYD53U and V | | – | – | 2.3 | V |
| $V_{(BR)R}$ | reverse avalanche breakdown voltage | $I_R$ = 0.1 mA | | | | |
| | BYD53D | | 300 | – | – | V |
| | BYD53G | | 500 | – | – | V |
| | BYD53J | | 700 | – | – | V |
| | BYD53K | | 900 | – | – | V |
| | BYD53M | | 1100 | – | – | V |
| | BYD53U | | 1300 | – | – | V |
| | BYD53V | | 1500 | – | – | V |
| $I_R$ | reverse current | $V_R = V_{RRMmax}$; see Fig.15 | – | – | 1 | µA |
| | | $V_R = V_{RRMmax}$; $T_j$ = 165 °C; see Fig.15 | – | – | 100 | µA |
| $t_{rr}$ | 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.18 | | | | |
| | BYD53D to J | | – | – | 30 | ns |
| | BYD53K and M | | – | – | 75 | ns |
| | BYD53U and V | | – | – | 150 | ns |
| $C_d$ | diode capacitance | f = 1 MHz; $V_R$ = 0; see Fig.16 | – | 20 | – | pF |

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| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $\left\|\frac{dI_R}{dt}\right\|$ | 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.19 | | | | |
| | BYD53D to J | | – | – | 7 | A/µs |
| | BYD53K and M | | – | – | 6 | A/µs |
| | BYD53U and V | | – | – | 5 | 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 | 60 | K/W |
| $R_{th\ j\text{-}a}$ | thermal resistance from junction to ambient | note 1 | 120 | 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.17. For more information please refer to the *'General Part of associated Handbook'*.

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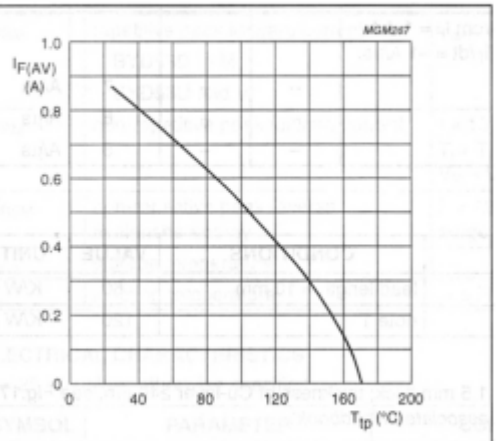
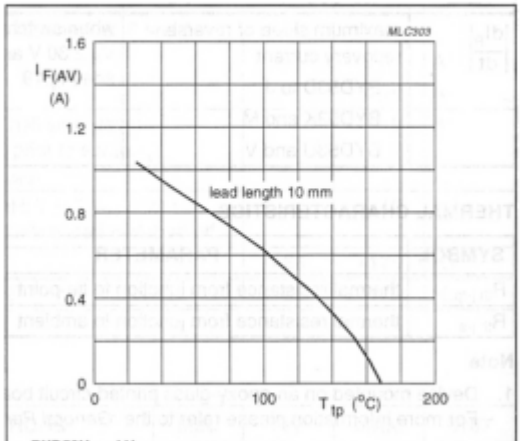
**GRAPHICAL DATA**



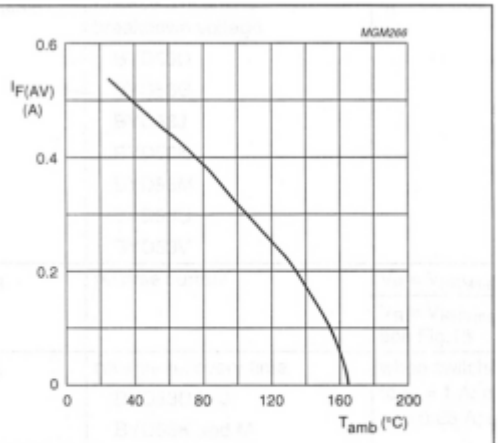

**BYD53D to M**
a = 1.42; $V_R = V_{RRMmax}$; δ = 0.5.
Switched mode application.

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



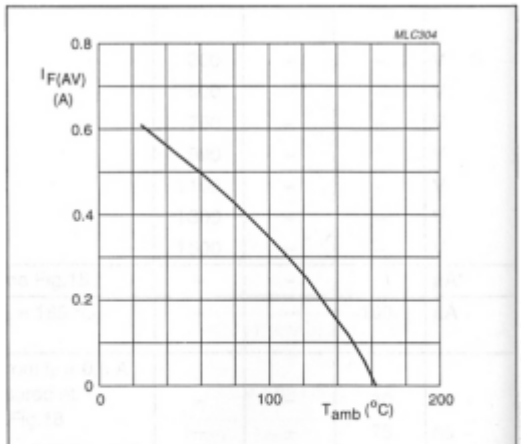

**BYD53U and V**
a = 1.42; $V_R = V_{RRMmax}$; δ = 0.5.
Switched mode application.

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




**BYD53D to M**
a = 1.42; $V_R = V_{RRMmax}$; δ = 0.5.
Device mounted as shown in Fig. 17.
Switched mode application.

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




**BYD53U and V**
a = 1.42; $V_R = V_{RRMmax}$; δ = 0.5.
Device mounted as shown in Fig. 17.
Switched mode application.

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

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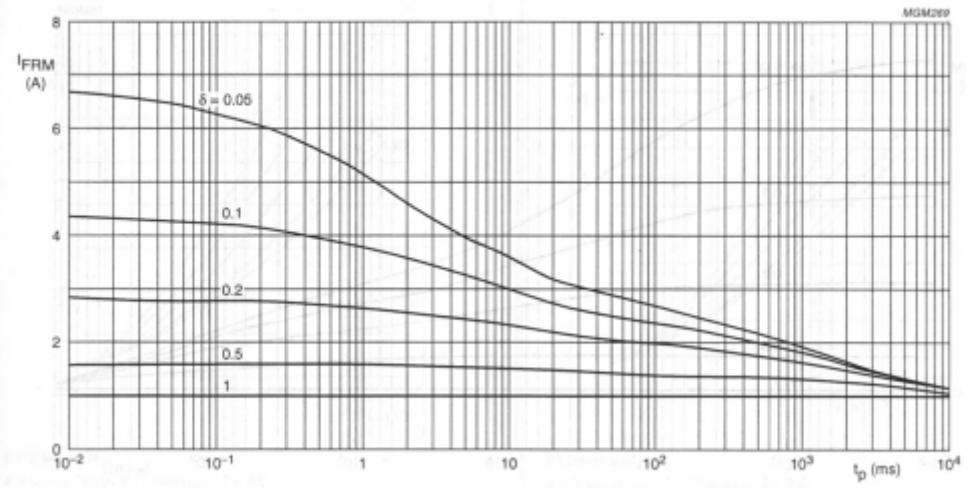
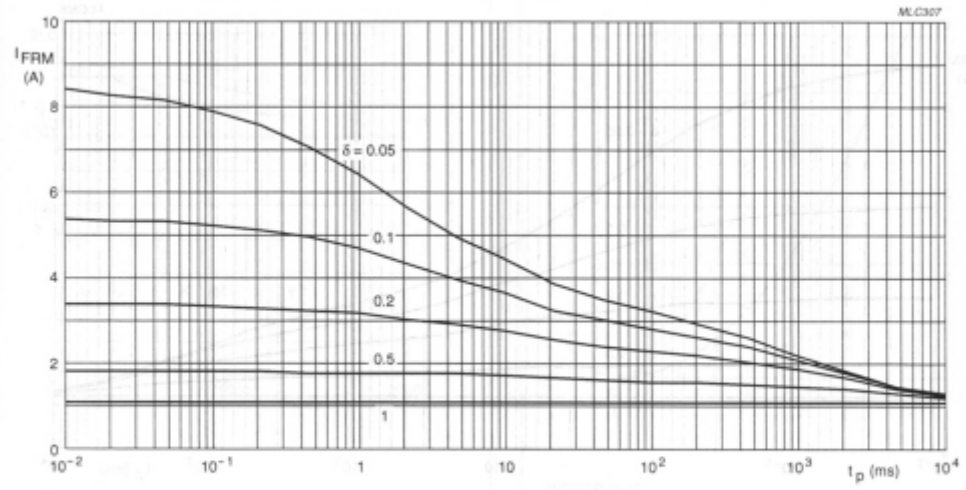



**BYD53D to M**

$T_{tp}$ = 55°C; $R_{th\ j\text{-}tp}$ = 60 K/W.

$V_{RRMmax}$ during 1 − δ; curves include derating for $T_{j\ max}$ at $V_{RRM}$ = 1400 V.

Fig.6 Maximum repetitive peak forward current as a function of pulse time (square pulse) and duty factor.




**BYD53U and V**

$T_{tp}$ = 55°C; $R_{th\ j\text{-}tp}$ = 60 K/W.

$V_{RRMmax}$ during 1 − δ; curves include derating for $T_{j\ max}$ at $V_{RRM}$ = 1400 V.

Fig.7 Maximum repetitive peak forward current as a function of pulse time (square pulse) and duty factor.

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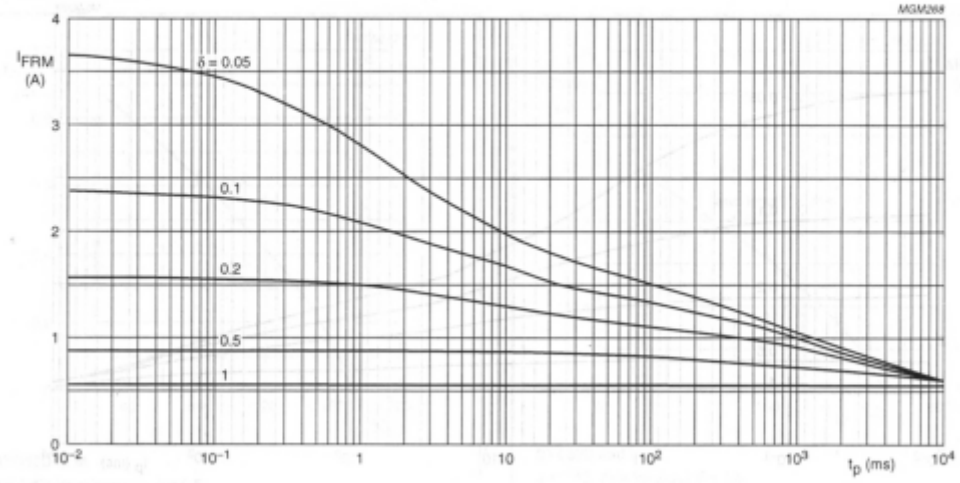
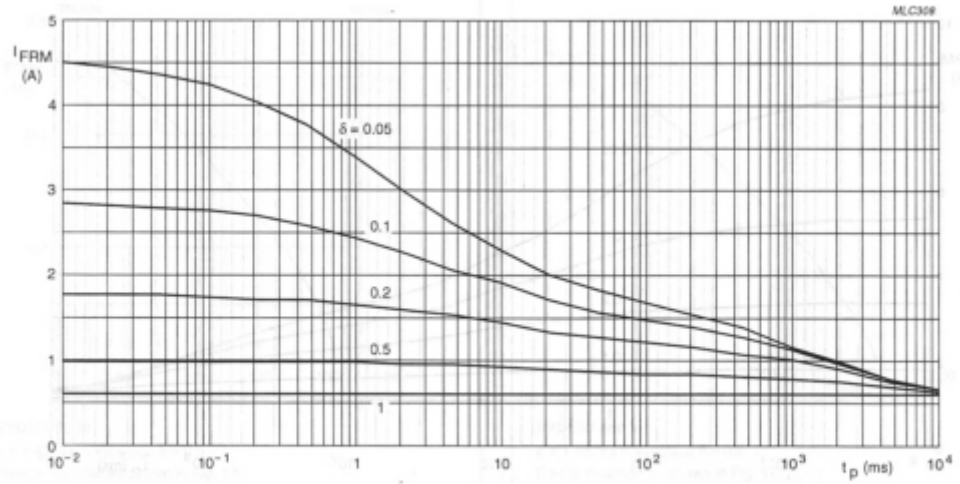



**BYD53D to M**

$T_{amb}$ = 65 °C; $R_{th\ j\text{-}a}$ = 120 K/W.

$V_{RRMmax}$ during 1 − δ; curves include derating for $T_{j\ max}$ at $V_{RRM}$ = 1400 V.

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




**BYD53U and V**

$T_{amb}$ = 65 °C; $R_{th\ j\text{-}a}$ = 120 K/W.

$V_{RRMmax}$ during 1 − δ; curves include derating for $T_{j\ max}$ at $V_{RRM}$ = 1400 V.

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

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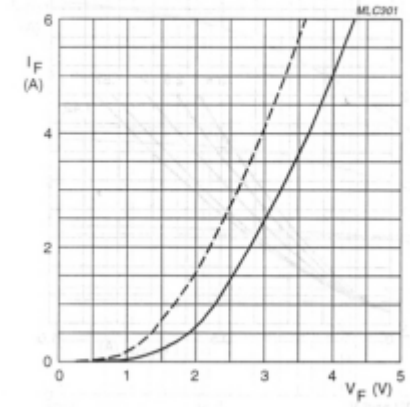
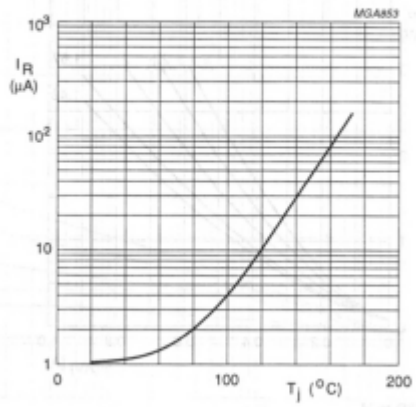


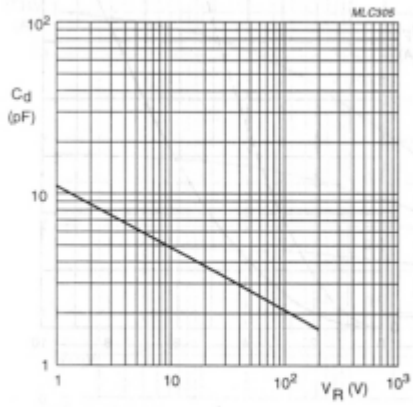

**BYD53U and V**
Dotted line: $T_j$ = 175 °C.
Solid line: $T_j$ = 25 °C.

Fig.14 Forward current as a function of forward voltage; maximum values.



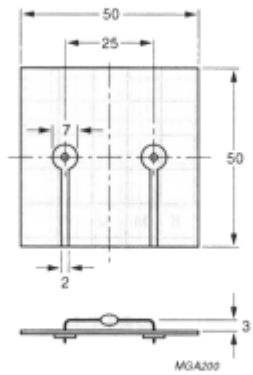

$V_R = V_{RRMmax}$.

Fig.15 Reverse current as a function of junction temperature; maximum values.



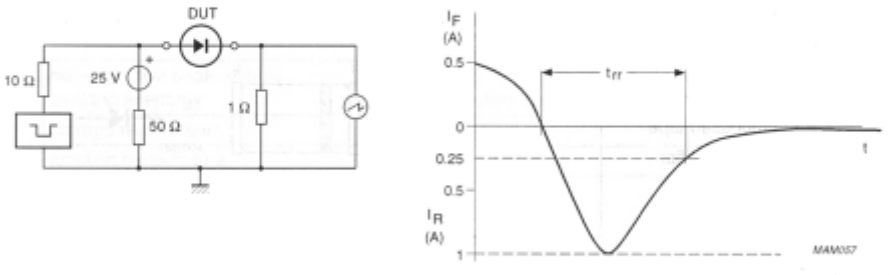

f = 1 MHz; $T_j$ = 25 °C.

Fig.16 Diode capacitance as a function of reverse voltage; typical values.




Dimensions in mm.

Fig.17 Device mounted on a printed-circuit board.




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

Fig.18 Test circuit and reverse recovery time waveform and definition.

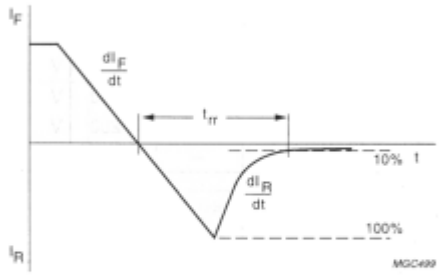



Fig.19 Reverse recovery definitions.