BYC12MD-650P

Hyperfast power diode

Rev.01 - 25 October 2022 Product data sheet

1. General description

Hyperfast power diode in a TO252 (DPAK) plastic package.

2. Features and benefits

- Low leakage current
- Low thermal resistance
- Low reverse recovery current
- Reduces switching losses in associated MOSFET or IGBT

3. Applications

- Continuous Current Mode (CCM) Power Factor Correction (PFC)
- Half-bridge/full-bridge switched-mode power supplies

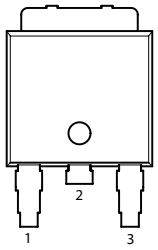
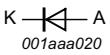
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Notes	Values			Unit
Absolute maximum rating							
V_{RRM}	repetitive peak reverse voltage			650			V
$I_{F(AV)}$	average forward current	δ = 0.5 ; square-wave pulse; $T_{mb} \leq 128$ °C; Fig. 1; Fig. 2; Fig. 3		12			A
I_{FRM}	repetitive peak forward current	δ = 0.5 ; t_p = 25 µs; $T_{mb} \leq 128$ °C; square-wave pulse		24			A
I_{FSM}	non-repetitive peak forward current	t_p = 10 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; Fig. 4		135			A
		t_p = 8.3 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse		148			A
Symbol	**Parameter**	**Conditions**	**Notes**	**Min**	**Typ**	**Max**	**Unit**
Static characteristics							
V_F	forward voltage	I_F = 12 A; T_j = 25 °C; Fig. 6		-	2.60	3.30	V
		I_F = 12 A; T_j = 150 °C; Fig. 6		-	1.60	2.30	V
Dynamic characteristics							
t_{rr}	reverse recovery time	I_F = 1 A; V_R = 30 V; dI_F/dt = 200 A/µs; T_j = 25 °C; Fig. 7		-	13	-	ns

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	n.c.	not connected		
2	K	cathode [1]		
3	A	anode		
mb	K	mounting base; connected to cathode		

[1] It is not possible to connect to pin 2 of the TO252 package.

6. Ordering information

Table 3. Ordering information

Type number	Package name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
BYC12MD-650P	TO252	BYC12MD-650PJ	Reel	2500	TO252d	07-Sep-2022

7. Marking

Table 4. Marking codes

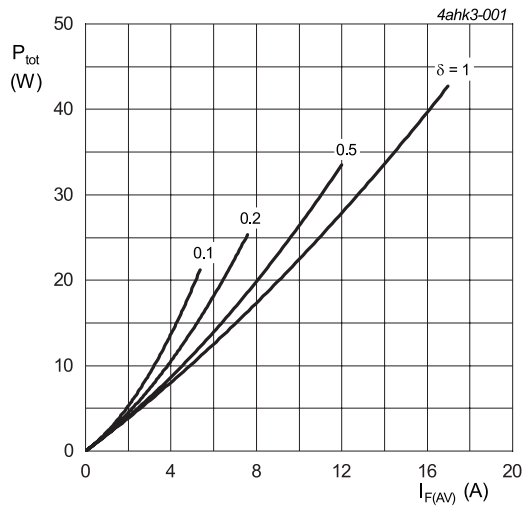
Type number	Marking codes
BYC12MD-650P	BYC12MD 650P

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

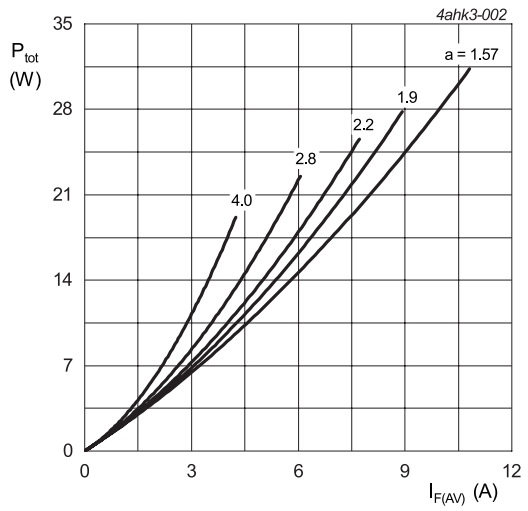
Symbol	Parameter	Conditions	Notes	Values	Unit
V_{RRM}	repetitive peak reverse voltage			650	V
V_{RWM}	crest working reverse voltage			650	V
V_R	reverse voltage	DC		650	V
$I_{F(AV)}$	average forward current	δ = 0.5 ; square-wave pulse; $T_{mb} \leq 128$ °C; Fig. 1; Fig. 2; Fig. 3		12	A
I_{FRM}	repetitive peak forward current	δ = 0.5 ; t_p = 25 µs; $T_{mb} \leq 128$ °C; square-wave pulse		24	A
I_{FSM}	non-repetitive peak forward current	t_p = 10 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; Fig. 4		135	A
		t_p = 8.3 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse		148	A
T_{stg}	storage temperature			-65 to 175	°C
T_j	junction temperature			-65 to 175	°C



$I_{F(AV)} = I_{F(RMS)} \times \sqrt{\delta}$

V_o = 1.852 V; R_s = 0.0392 Ω

Fig. 1. Forward power dissipation as a function of average forward current; square waveform; maximum values



a = form factor = $I_{F(RMS)} / I_{F(AV)}$

V_o = 1.852 V; R_s = 0.0392 Ω

Fig. 2. Forward power dissipation as a function of average forward current; sinusoidal waveform; maximum values

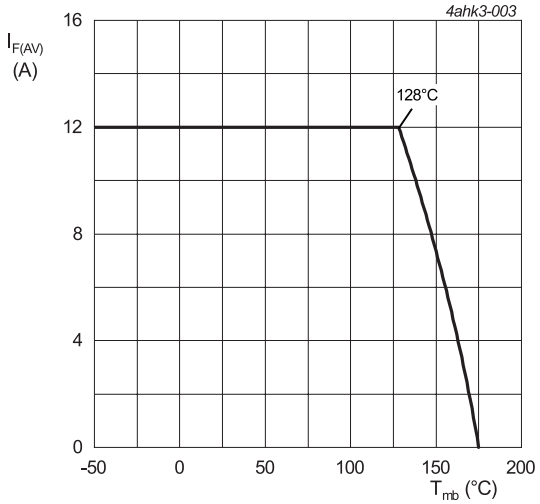


Fig. 3. Forward current as a function of mounting base temperature; maximum values

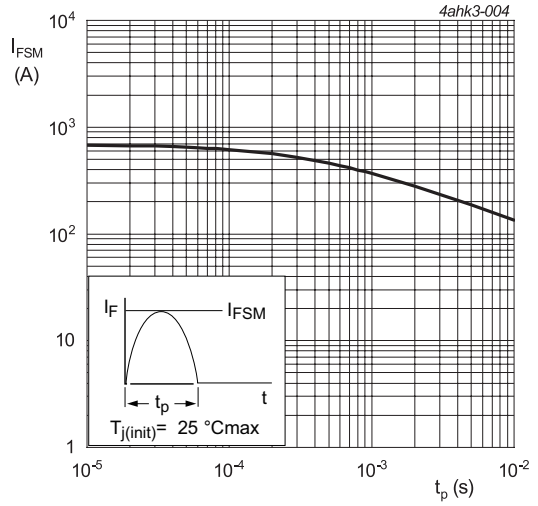


Fig. 4. Non-repetitive peak forward current as a function of pulse width; sinusoidal waveform; maximum values

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 5		-	-	1.4	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air	[2]	-	50	-	K/W

[2] Device mounted on an FR4 PCB, single-sided copper, tin plated and standard footprint.

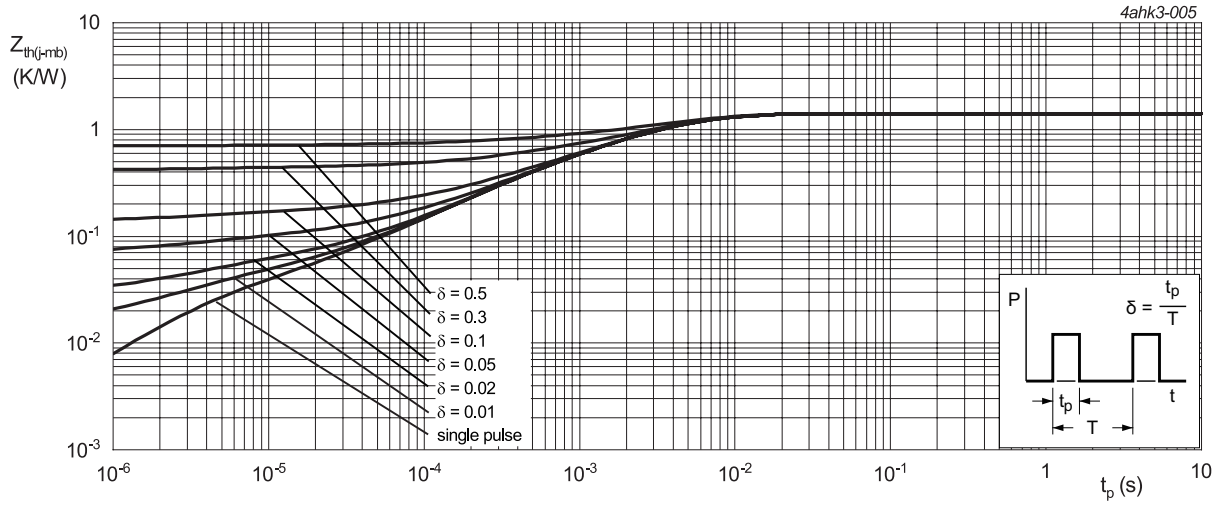
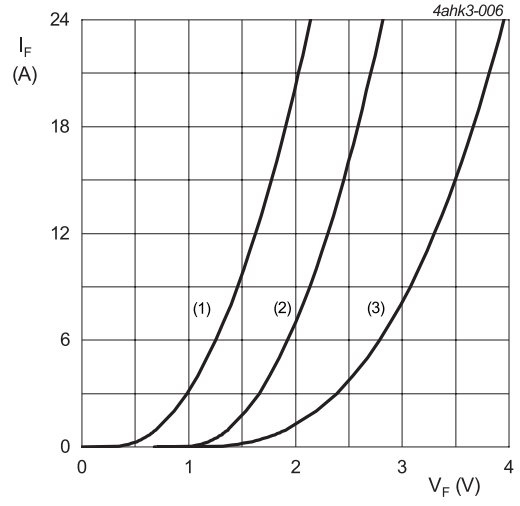


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
V_F	forward voltage	I_F = 12 A; T_j = 25 °C; Fig. 6		-	2.60	3.30	V
		I_F = 12 A; T_j = 150 °C; Fig. 6		-	1.60	2.30	V
I_R	reverse current	V_R = 650 V; T_j = 25 °C		-	0.5	30	µA
		V_R = 650 V; T_j = 150 °C		-	0.1	0.8	mA
Dynamic characteristics							
Q_r	reverse charge	I_F = 12 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 25 °C; Fig. 7		-	38	-	nC
		I_F = 12 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 125 °C; Fig. 7		-	126	-	nC
t_{rr}	reverse recovery time	I_F = 0.5 A; I_R = 1 A; I_{rr} = 0.25 A; T_j = 25 °C		-	20	-	ns
		I_F = 1 A; V_R = 30 V; dI_F/dt = 200 A/µs; T_j = 25 °C; Fig. 7		-	13	-	ns
		I_F = 12 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 25 °C; Fig. 7		-	30	-	ns
		I_F = 12 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 125 °C; Fig. 7		-	50	-	ns
I_{RM}	peak reverse recovery currentnon-repetitive avalanche energy	I_F = 12 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 25 °C; Fig. 7		-	2.6	-	A
		I_F = 12 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 125 °C; Fig. 7		-	5.1	-	A
E_{as}	non-repetitive avalanche energy	$T_{j(init)}$ = 25 °C		10.8	-	-	mJ



V_o = 1.852 V; R_s = 0.0392 Ω
(1) T_j = 150 °C; typical values
(2) T_j = 150 °C; maximum values
(3) T_j = 25 °C; maximum values

Fig. 6. Forward current as a function of forward voltage

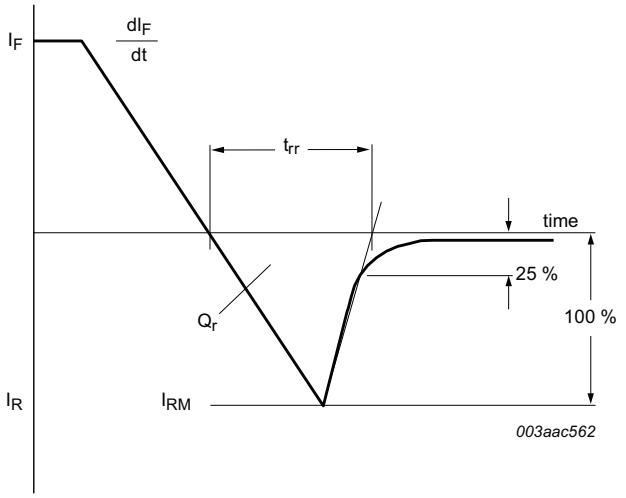
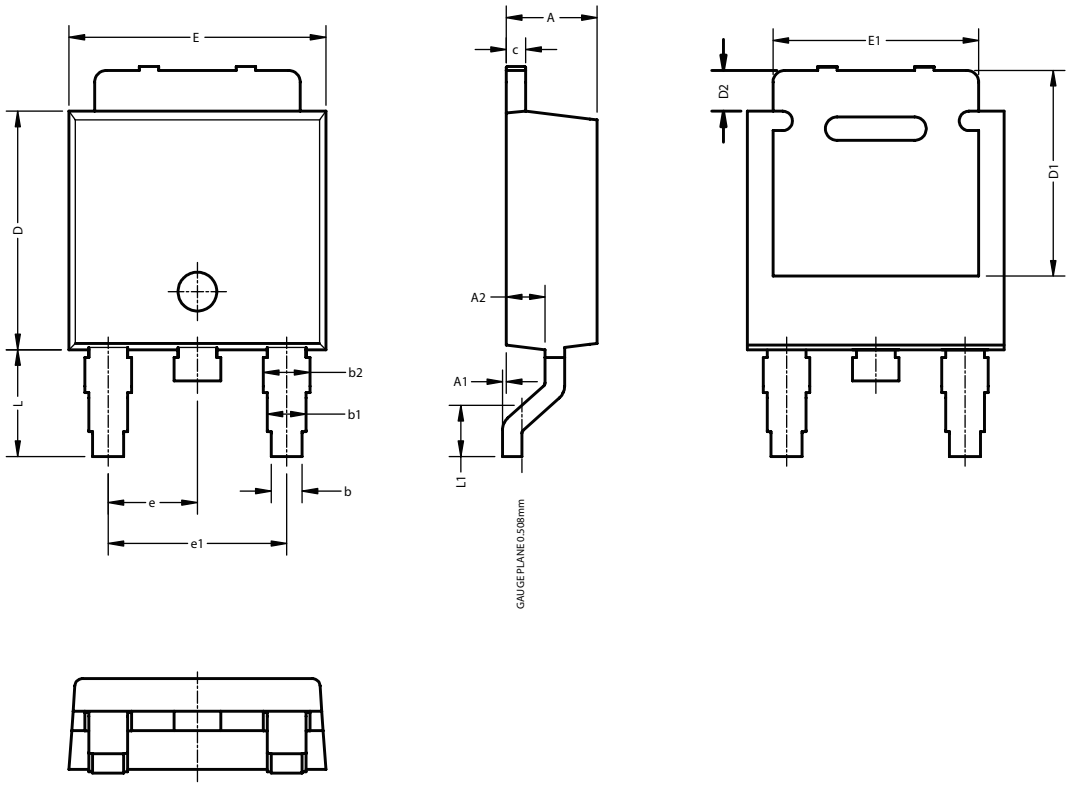


Fig. 7. Reverse recovery definitions; ramp recovery

11. Package outline

Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped TO252



Note:
1. All dimensions do not include mold flash & gate remain and metal protrusion.

Unit		A	A1	A2	b	b1	b2	c	D	D1	D2	E	E1	e	e1	L	L1
mm	min	2.16	0.00	0.90	0.70	0.86	1.06	0.46	5.97	5.05	0.98	6.45	5.20	2.30	4.60	2.60	1.25
	nom																
	max	2.41	0.10	1.10	0.90	1.11	1.32	0.58	6.22	5.35	1.18	6.75	5.40			2.90	1.65

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Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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