BYC12M-650P

Hyperfast power diode

Rev.01 - 11 November 2022 Product data sheet

1. General description

Hyperfast power diode in a 2-lead TO220 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

- Active PFC in air conditioner/EV charger/PV
- Continuous Current Mode (CCM) Power Factor Correction (PFC)
- Half-bridge/full-bridge switched-mode power supplies

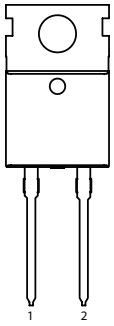
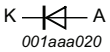
4. Quick reference data

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; $T_{mb} \leq 121$ °C; Fig. 1; Fig. 2; Fig. 3		12			A
I_{FRM}	repetitive peak forward current	δ = 0.5 ; t_p = 25 µs; $T_{mb} \leq 121$ °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		-	14	-	ns

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K	cathode		
2	A	anode		
mb	mb	mounting base; connected to cathod		

6. Ordering information

Table 3. Ordering information

Type number	Package name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
BYC12M-650P	TO220-2L	BYC12M-650PQ	Tube	50	TO220d-2L	13-Oct-2022

7. Marking

Table 4. Marking codes

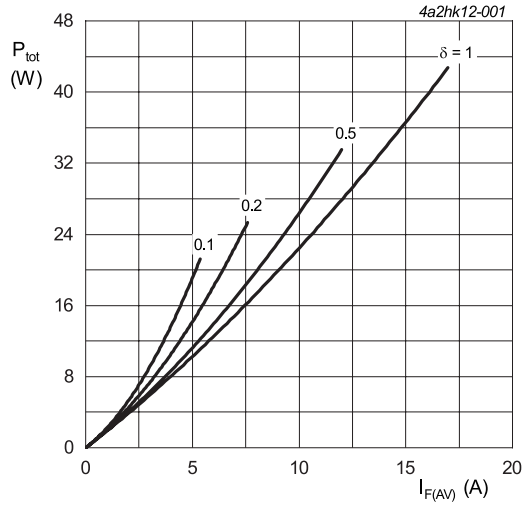
Type number	Marking codes
BYC12M-650P	BYC12M 650P

8. Limiting values

Table 5. Limiting values

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

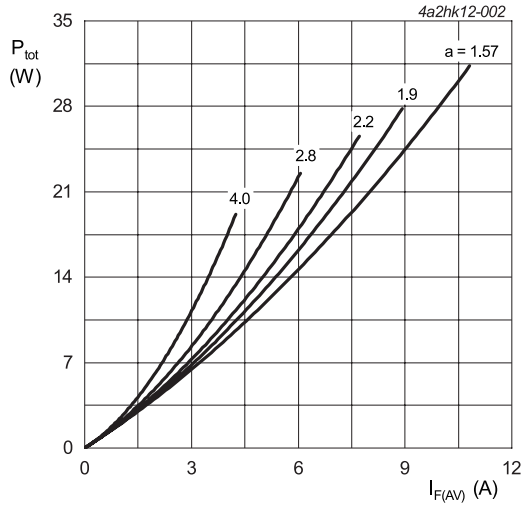
Symbol	Parameter	Conditions	Notes	Values	Unit
V_{RRM}	repetitive peak reverse voltage			650	V
V_{RWM}	crest working reverse voltage			650	V
V_R	reverse voltage	DC		650	V
$I_{F(AV)}$	average forward current	δ = 0.5 ; square-wave pulse; $T_{mb} \leq 121$ °C; Fig. 1; Fig. 2; Fig. 3		12	A
I_{FRM}	repetitive peak forward current	δ = 0.5 ; t_p = 25 µs; $T_{mb} \leq 121$ °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

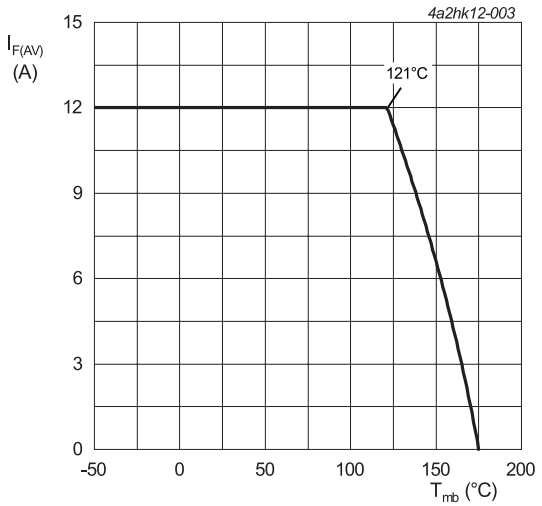


Fig. 3. Forward current as a function of mounting base temperature; maximum values

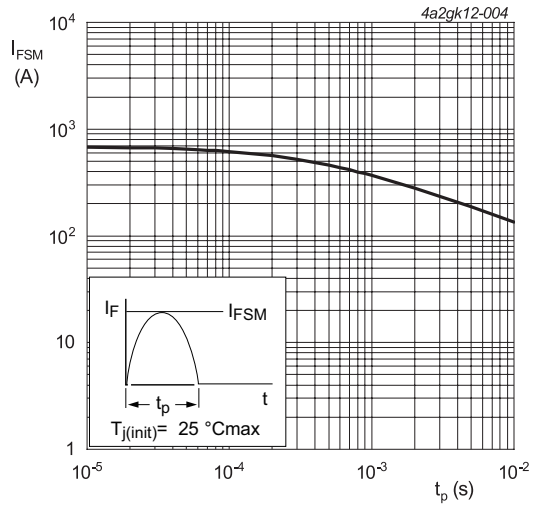


Fig. 4. Non-repetitive peak forward current as a function of pulse width; sinusoidal waveform; maximum values

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		-	-	1.6	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air		-	60	-	K/W

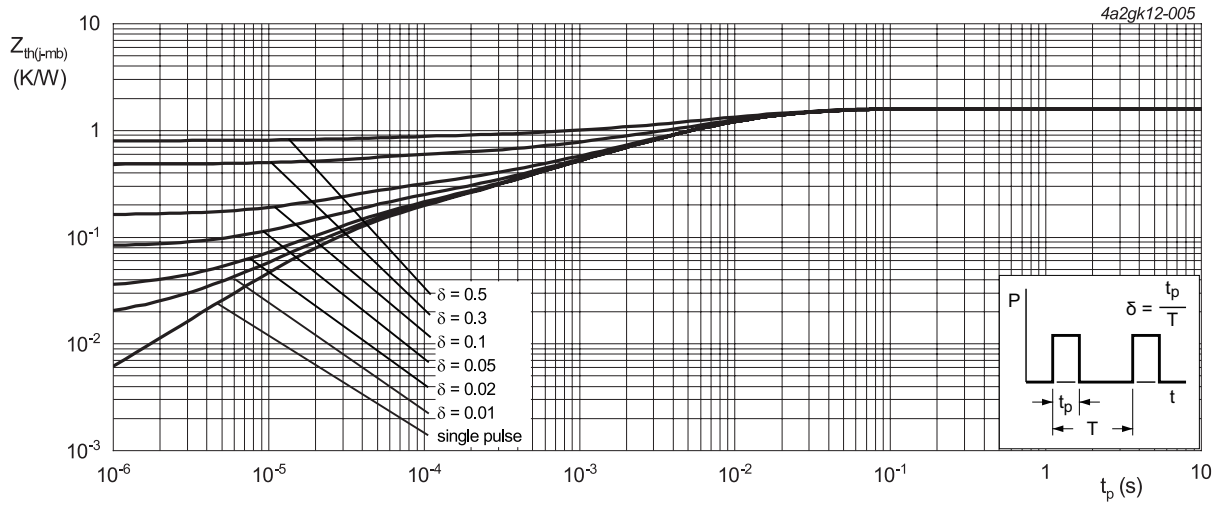
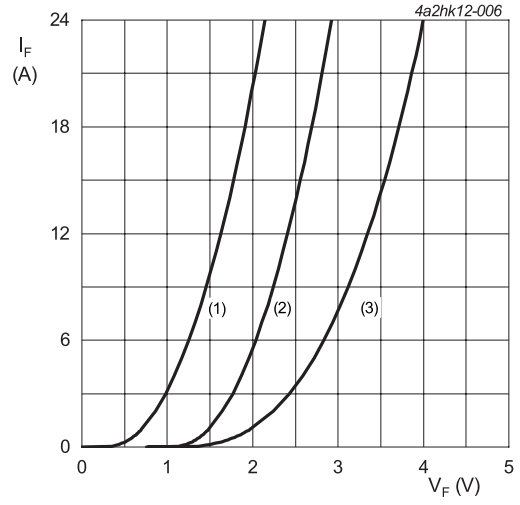


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

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		-	-	0.8	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		-	37	-	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		-	14	-	ns
		I_F = 12 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 25 °C; Fig. 7		-	29	-	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		-	2.5	-	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

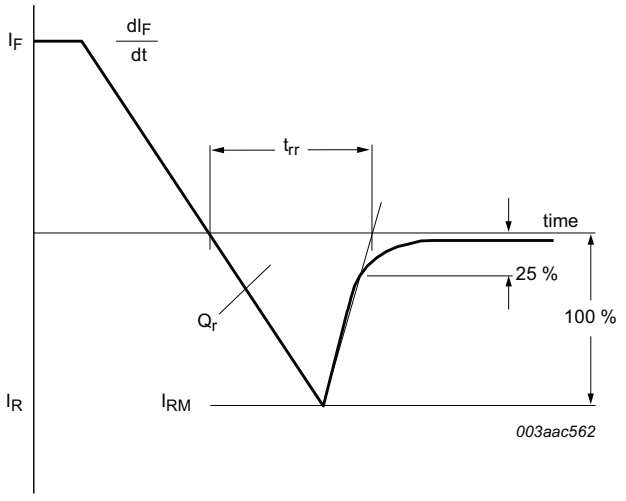
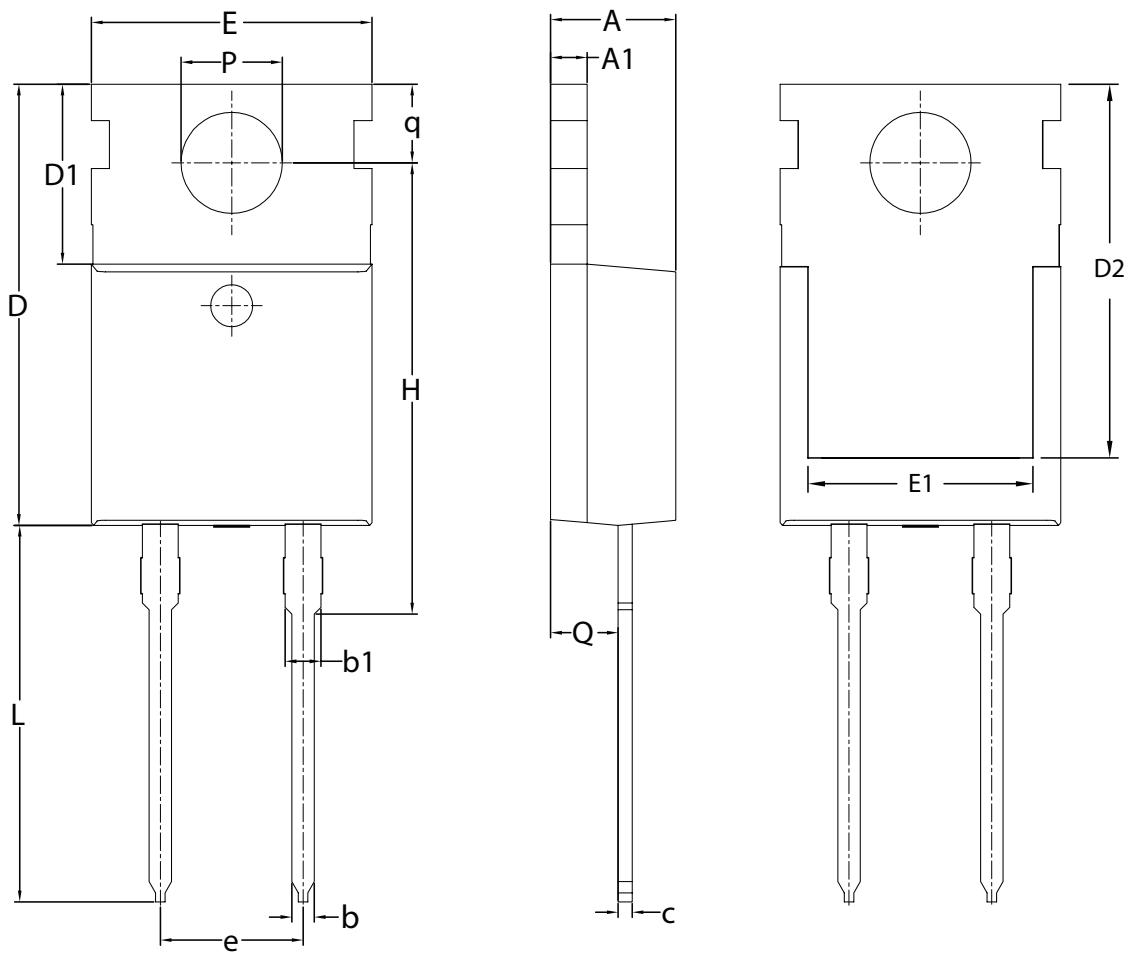


Fig. 7. Reverse recovery definitions; ramp recovery

11. Package outline

Plastic single-ended package; heatsink mounted;1 mounting hole; 2 leads TO-220 TO220-2L



Unit		A	A1	b	b1	c	D	D1	D2	E	E1	e	H	L	P	Q	q
MM	min	4.30	1.15	0.70	1.20	0.45	15.50	6.20	13.00	9.65	7.80	4.95	15.70	12.60	3.65	2.20	2.70
	max	4.70	1.40	0.95	1.70	0.65	16.20	6.80	13.70	10.30	8.20	5.18	16.25	13.80	3.80	2.60	2.90

Note:

1. All dimensions don't include mold flash and metal protrusion.

12. Legal information

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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.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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