BYC31MX-650PS

Hyperfast power diode

Rev.01 - 06 September 2023 Product data sheet

1. General description

Hyperfast power diode in 2-lead TO220F plastic package.

2. Features and benefits

- Soft reverse recovery
- Fast switching
- Isolated plastic package
- Low leakage current
- Low reverse recovery current
- Low thermal resistance
- Reduces switching losses in associated MOSFET or IGBT
- Package meets UL94V0 which guaranteed by epoxy mold compound

3. Applications

- Active PFC in air conditioner
- High frequency switched-mode power supplies
- Power Factor Correction (PFC)

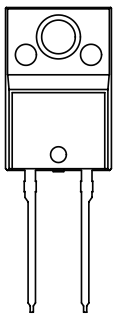
4. Quick reference data

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; Fig. 1; Fig. 2		30			A
I_{FRM}	repetitive peak forward current	δ = 0.5 ; t_p = 25 µs; square-wave pulse		60			A
I_{FSM}	non-repetitive peak forward current	t_p = 10 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; Fig. 3		250			A
		t_p = 8.3 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse		275			A
Symbol	**Parameter**	**Conditions**	**Notes**	**Min**	**Typ**	**Max**	**Unit**
Static characteristics							
V_F	forward voltage	I_F = 30 A; T_j = 25 °C; Fig. 5		-	1.85	2.50	V
		I_F = 30 A; T_j = 150 °C; Fig. 5		-	1.45	2.10	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. 6		-	23	-	ns

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K	cathode		 001aaa020
2	A	anode		
mb	n.c.	mounting base; isolated		

6. Ordering information

Table 3. Ordering information

Type number	Package Name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
BYC31MX-650PS	TO220F-2L	BYC31MX-650PSQ	Tube	50	TO220Fd-2L	02-Aug-2022

7. Marking

Table 4. Marking codes

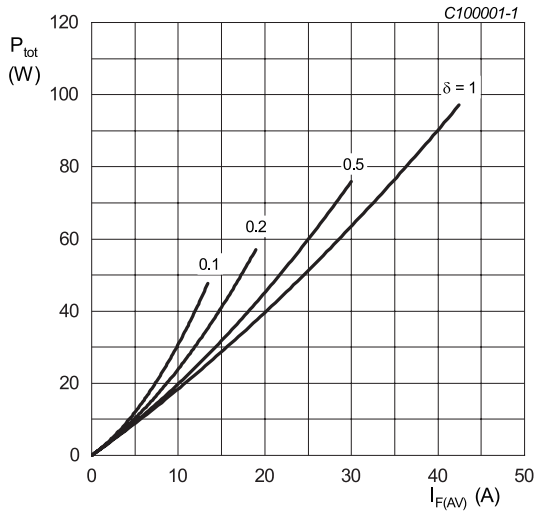
Type number	Marking codes
BYC31MX-650PS	BYC31MX 650PS

8. Limiting values

Table 5. Limiting values

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

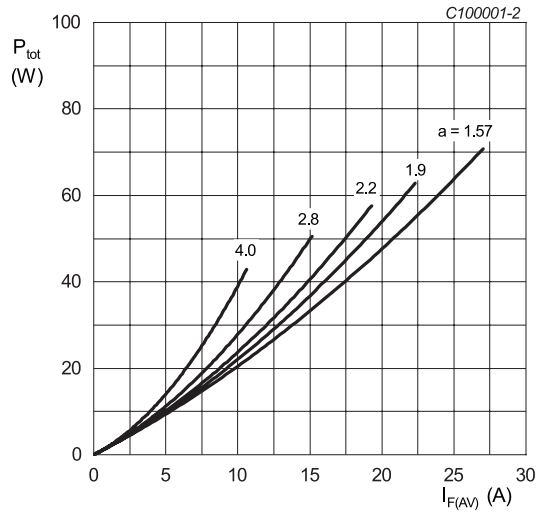
Symbol	Parameter	Conditions	Notes	Values	Unit
V_{RRM}	repetitive peak reverse voltage			650	V
V_{RWM}	crest working reverse voltage			650	V
V_R	reverse voltage	DC		650	V
$I_{F(AV)}$	average forward current	δ = 0.5 ; square-wave pulse; Fig. 1; Fig. 2		30	A
I_{FRM}	repetitive peak forward current	δ = 0.5 ; t_p = 25 µs; square-wave pulse		60	A
I_{FSM}	non-repetitive peak forward current	t_p = 10 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; Fig. 3		250	A
		t_p = 8.3 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse		275	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 = 1.705 V; R_s = 0.0138 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 = 1.705 V; R_s = 0.0138 Ω

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

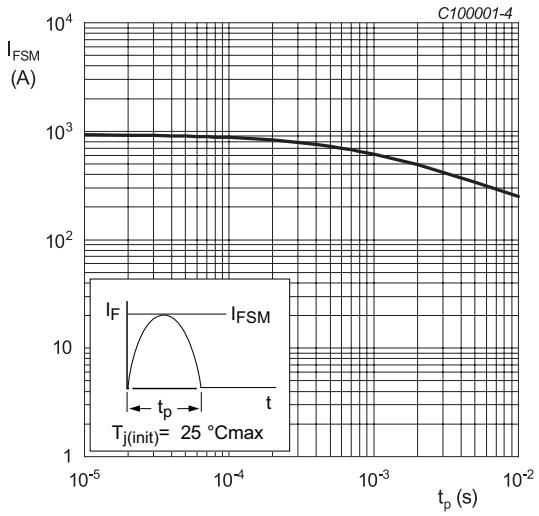


Fig. 3. Non-repetitive peak forward current as a function of pulse width; sinusoidal waveform; maximum values

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink	with heatsink compound; Fig. 4		-	-	4	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air		-	60	-	K/W

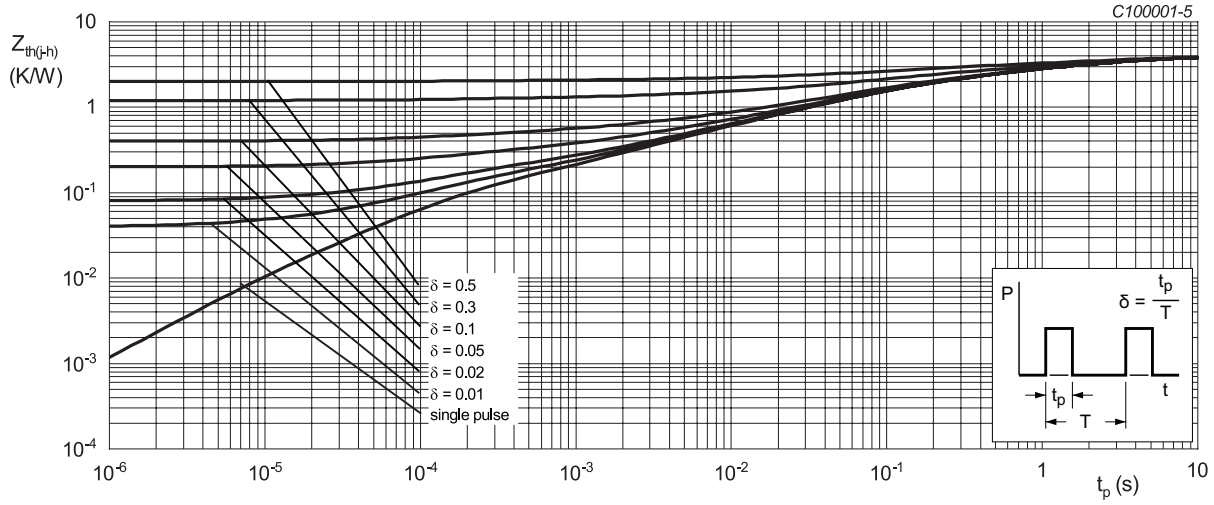


Fig. 4. Transient thermal impedance from junction to heatsink as a function of pulse duration

10. Isolation characteristics

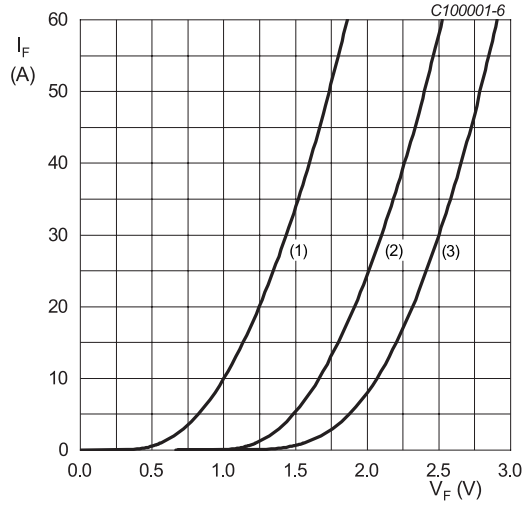
Table 7. Isolation characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	50 Hz ≤ f ≤ 60 Hz; RH ≤ 65 %; from all pins to external heatsink; sinusoidal waveform; clean and dust free		-	-	2500	V
C_{isol}	isolation capacitance	f = 1 MHz; from cathode to external heatsink		-	10	-	pF

11. Characteristics

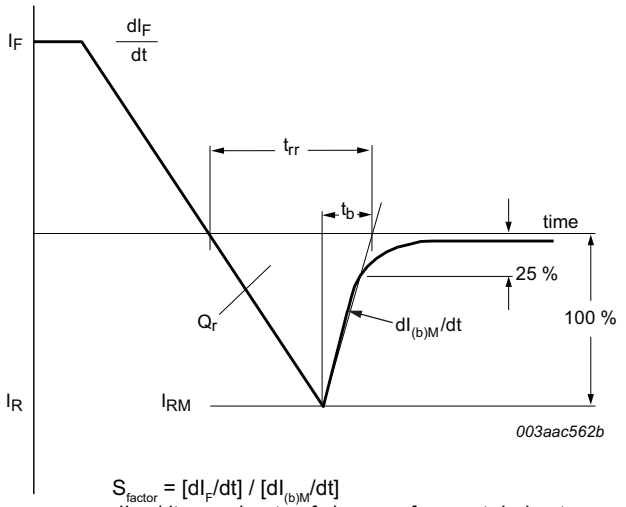
Table 8. Characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
V_F	forward voltage	I_F = 30 A; T_j = 25 °C; Fig. 5		-	1.85	2.50	V
		I_F = 30 A; T_j = 150 °C; Fig. 5		-	1.45	2.10	V
I_R	reverse current	V_R = 650 V; T_j = 25 °C		-	0.2	30	µA
		V_R = 650 V; T_j = 150 °C		-	0.05	-	mA
Dynamic characteristics							
Q_r	reverse charge	I_F = 30 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 25 °C; Fig. 6		-	200	-	nC
		I_F = 30 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 125 °C; Fig. 6		-	650	-	nC
t_{rr}	reverse recovery time	I_F = 0.5 A; I_{rr} = 0.25 A; I_R = 1 A; T_j = 25 °C; Fig. 6		-	36	-	ns
		I_F = 1 A; V_R = 30 V; dI_F/dt = 200 A/µs; T_j = 25 °C; Fig. 6		-	23	-	ns
		I_F = 30 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 25 °C; Fig. 6		-	72	-	ns
		I_F = 30 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 125 °C; Fig. 6		-	121	-	ns
I_{RM}	peak reverse recovery current	I_F = 30 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 25 °C; Fig. 6		-	5.4	-	A
		I_F = 30 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 125 °C; Fig. 6		-	10.8	-	A
S_{factor}	softness factor	I_F = 30 A; V_R = 200 V; dI_F/dt = 200 A/µs; T_j = 125 °C; Fig. 6		-	0.66	-	
E_{as}	non-repetitive avalanche energy	$T_{j(init)}$ = 25 °C		16.8	-	-	mJ



V_o = 1.705 V; R_s = 0.0138 Ω
(1) T_j = 150 °C; typical values
(2) T_j = 150 °C; maximum values
(3) T_j = 25 °C; maximum values

Fig. 5. Forward current as a function of forward voltage

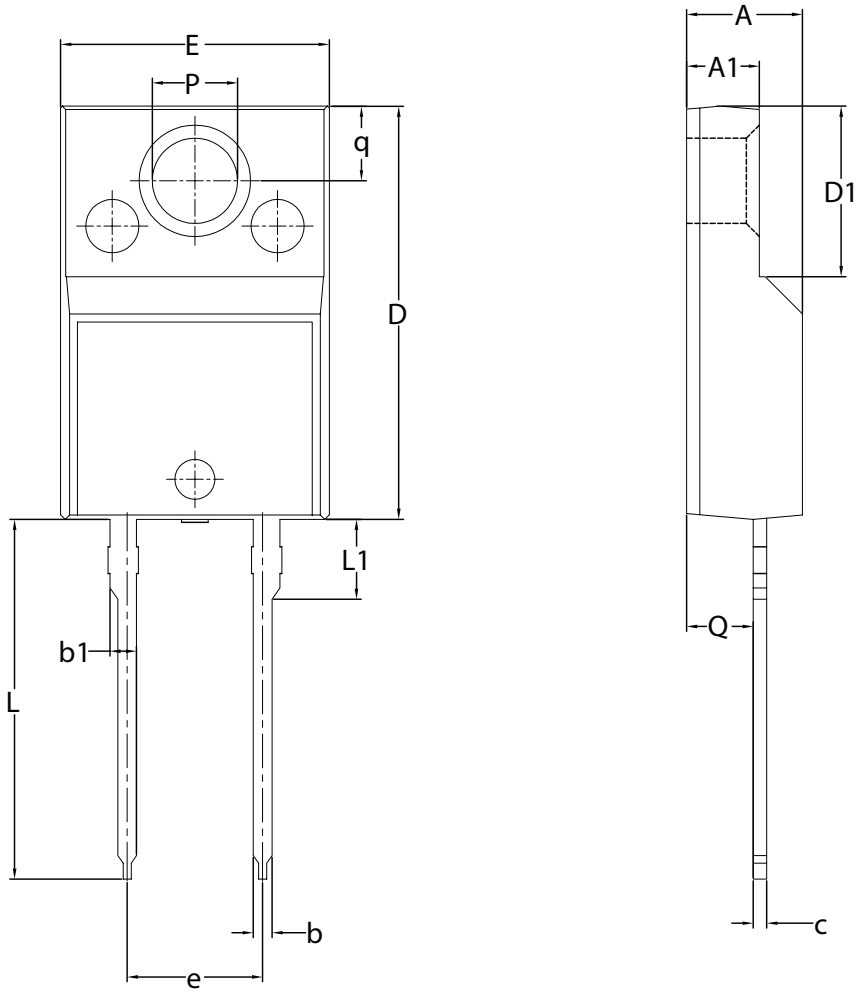


S_{factor} = $[dI_F/dt]$ / $[dI_{(b)M}/dt]$
$dI_{(b)M}/dt$ = peak rate of change of current during t_b portion of t_{rr}

Fig. 6. Reverse recovery definitions; ramp recovery

12. Package outline

Plastic single-ended package; isolated heatsink mounted;1 mounting hole; 2 leads TO-220 'full pack' TO220F-2L



Unit		A	A1	b	b1	c	D	D1	E	e	L	L1	P	Q	q
MM	min	4.00	2.50	0.70	0.90	0.40	15.20	6.30	9.80	5.08 (BSC)	13.50	2.80	3.00	2.30	2.60
	max	4.60	3.10	0.90	1.10	0.70	15.80	6.50	10.30		14.40	3.30	3.40	2.80	3.00

Note:

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

13. 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.
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Date of release: 06 September 2023