

1. General description

Hyperfast power diode in a 2-lead TO220 plastic package.



2. Features and benefits

- Soft reverse recovery
- Fast switching
- 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)

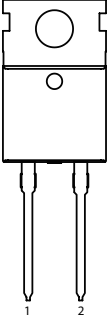
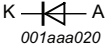
4. Quick reference data

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	$\delta = 0.5$; square-wave pulse; $T_{mb} \leq 91$ °C; Fig. 1 ; Fig. 2 ; Fig. 3		30			A
I_{FRM}	repetitive peak forward current	$\delta = 0.5$; $t_p = 25$ μ s; $T_{mb} \leq 91$ °C; 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. 4		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. 6		-	1.85	2.50	V
		$I_F = 30$ A; $T_j = 150$ °C; Fig. 6		-	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/ μ s; $T_j = 25$ °C; Fig. 7		-	23	-	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
BYC31M-650PS	TO220-2L	BYC31M-650PSQ	Tube	50	TO220d-2L	13-Oct-2022

7. Marking

Table 4. Marking codes

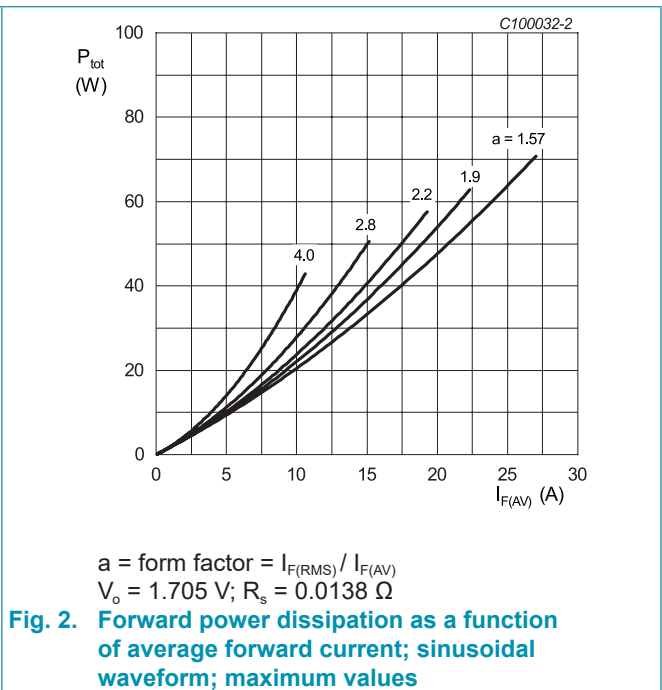
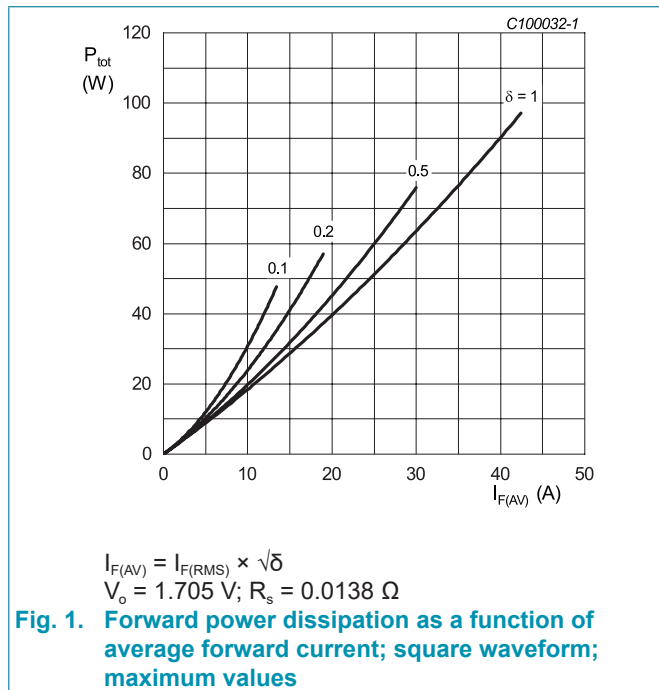
Type number	Marking codes
BYC31M-650PS	BYC31M 650PS

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	$\delta = 0.5$; square-wave pulse; $T_{mb} \leq 91$ °C; Fig. 1 ; Fig. 2 ; Fig. 3		30	A
I_{FRM}	repetitive peak forward current	$\delta = 0.5$; $t_p = 25$ μ s; $T_{mb} \leq 91$ °C; 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. 4		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



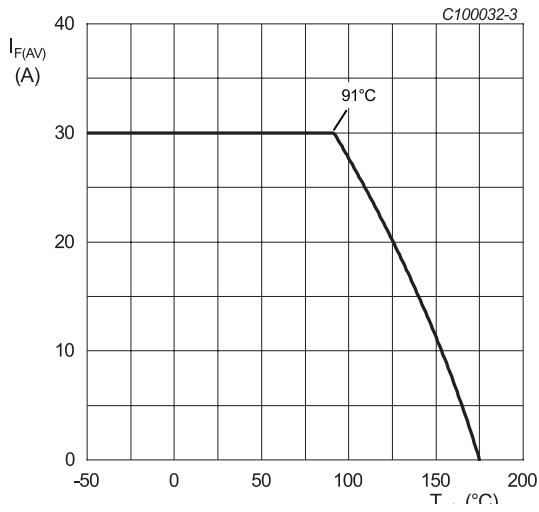


Fig. 3. Forward current as a function of mounting base temperature; maximum values

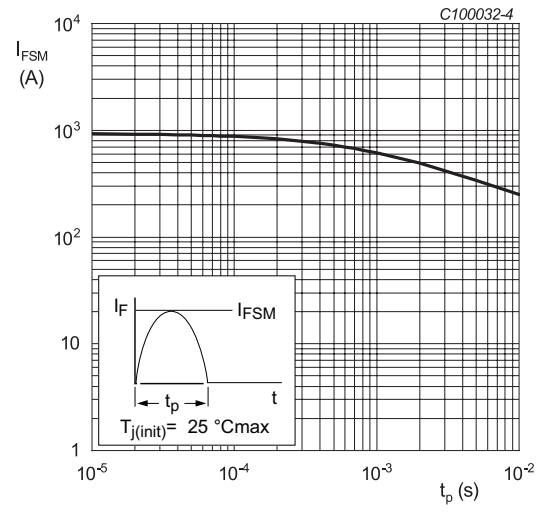


Fig. 4. Non-repetitive peak forward current as a function of pulse width; sinusoidal waveform; maximum values

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

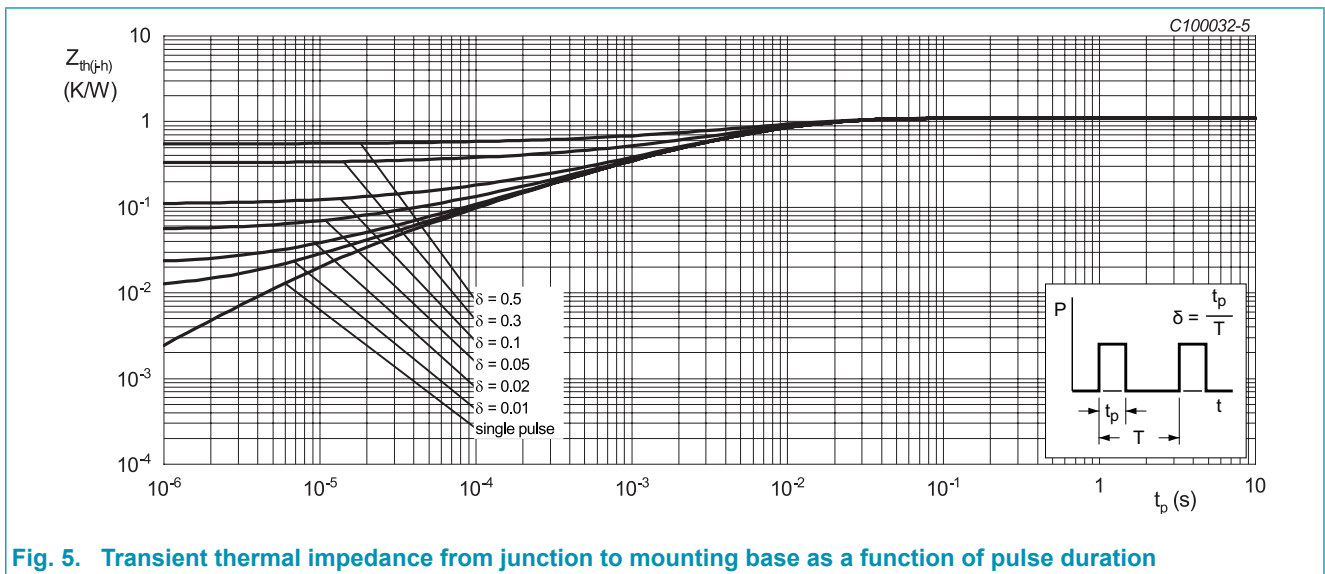
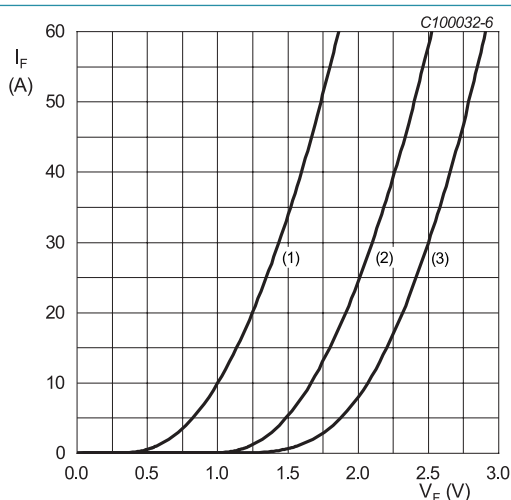


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
V_F	forward voltage	$I_F = 30\text{ A}; T_j = 25\text{ °C}; \text{Fig. 6}$		-	1.85	2.50	V
		$I_F = 30\text{ A}; T_j = 150\text{ °C}; \text{Fig. 6}$		-	1.45	2.10	V
I_R	reverse current	$V_R = 650\text{ V}; T_j = 25\text{ °C}$		-	0.2	30	μA
		$V_R = 650\text{ V}; T_j = 150\text{ °C}$		-	0.05	-	mA
Dynamic characteristics							
Q_r	reverse charge	$I_F = 30\text{ A}; V_R = 200\text{ V}; dI_F/dt = 200\text{ A}/\mu\text{s}; T_j = 25\text{ °C}; \text{Fig. 7}$		-	200	-	nC
		$I_F = 30\text{ A}; V_R = 200\text{ V}; dI_F/dt = 200\text{ A}/\mu\text{s}; T_j = 125\text{ °C}; \text{Fig. 7}$		-	650	-	nC
t_{rr}	reverse recovery time	$I_F = 0.5\text{ A}; I_R = 1\text{ A}; I_{rr} = 0.25\text{ A}; T_j = 25\text{ °C}$		-	36	-	ns
		$I_F = 1\text{ A}; V_R = 30\text{ V}; dI_F/dt = 200\text{ A}/\mu\text{s}; T_j = 25\text{ °C}; \text{Fig. 7}$		-	23	-	ns
		$I_F = 30\text{ A}; V_R = 200\text{ V}; dI_F/dt = 200\text{ A}/\mu\text{s}; T_j = 25\text{ °C}; \text{Fig. 7}$		-	72	-	ns
		$I_F = 30\text{ A}; V_R = 200\text{ V}; dI_F/dt = 200\text{ A}/\mu\text{s}; T_j = 125\text{ °C}; \text{Fig. 7}$		-	121	-	ns
I_{RM}	peak reverse recovery current non-repetitive avalanche energy	$I_F = 30\text{ A}; V_R = 200\text{ V}; dI_F/dt = 200\text{ A}/\mu\text{s}; T_j = 25\text{ °C}; \text{Fig. 7}$		-	5.4	-	A
		$I_F = 30\text{ A}; V_R = 200\text{ V}; dI_F/dt = 200\text{ A}/\mu\text{s}; T_j = 125\text{ °C}; \text{Fig. 7}$		-	10.8	-	A
S_{factor}	softness factor	$I_F = 30\text{ A}; V_R = 200\text{ V}; dI_F/dt = 200\text{ A}/\mu\text{s}; T_j = 125\text{ °C}; \text{Fig. 7}$		-	0.66	-	
E_{as}	non-repetitive avalanche energy	$T_{j(init)} = 25\text{ °C}$		16.8	-	-	mJ



$V_o = 1.705\text{ V}; R_s = 0.0138\ \Omega$
 (1) $T_j = 150\text{ °C};$ typical values
 (2) $T_j = 150\text{ °C};$ maximum values
 (3) $T_j = 25\text{ °C};$ maximum values

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

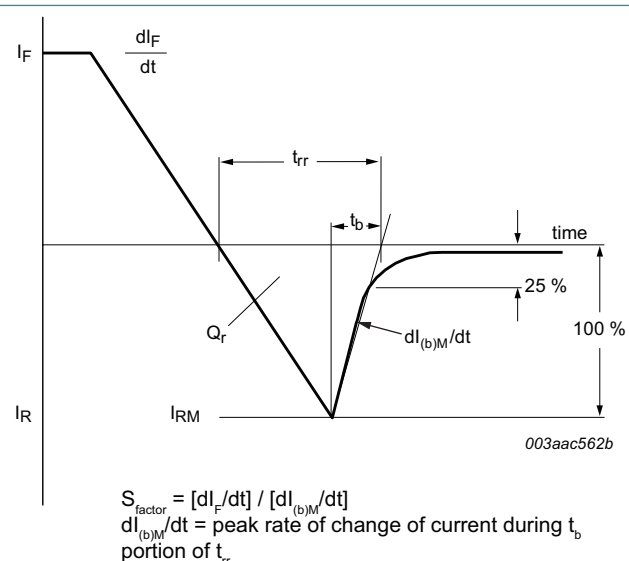
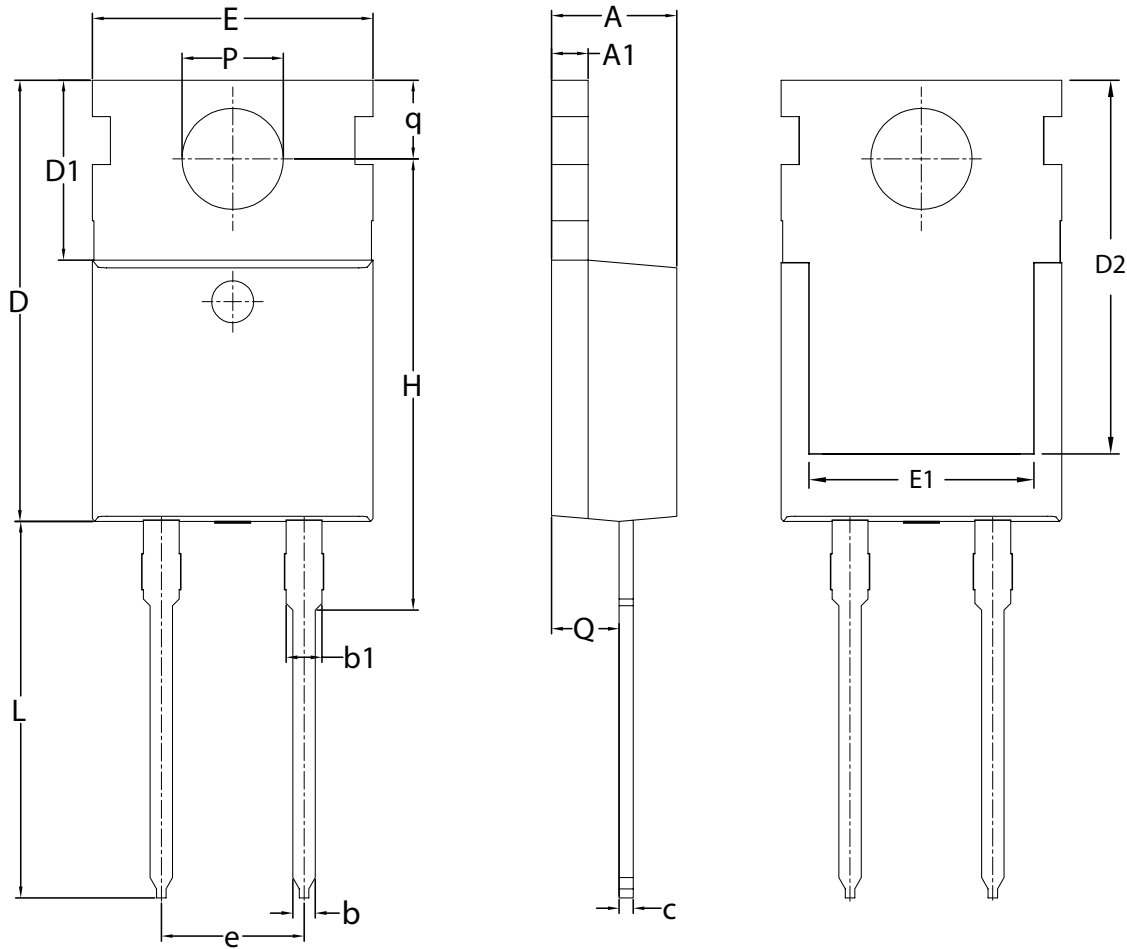


Fig. 7. Reverse recovery definitions; ramp recovery

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:

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

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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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