BYC405X-400P

Dual hyperfast power diode

Rev.01 - 23 September 2019 Product data sheet

1. General description

Dual hyperfast power diode in a TO220F plastic package.

2. Features and benefits

- Fast switching
- Isolated plastic package
- Low leakage current
- Low reverse recovery current
- Low thermal resistance
- High thermal cycling performance

3. Applications

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

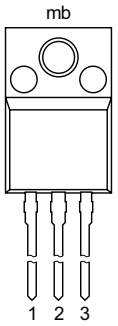
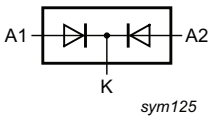
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Values				Unit
Absolute maximum rating							
V_{RRM}	repetitive peak reverse voltage		400				V
$I_{O(AV)}$	average output current	δ = 0.5 ; $T_h \leq 87$ °C; square-wave pulse; both diodes conducting; Fig. 1; Fig. 2; Fig. 3	10				A
I_{FRM}	repetitive peak forward current	δ = 0.5 ; t_p = 25 µs; $T_h \leq 112$ °C; square-wave pulse; per diode	10				A
I_{FSM}	non-repetitive peak forward current	t_p = 10 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; per diode; Fig. 4	70				A
		t_p = 8.3 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; per diode	77				A
Symbol	**Parameter**	**Conditions**		**Min**	**Typ**	**Max**	**Unit**
Static characteristics							
V_F	forward voltage	I_F = 5 A; T_j = 25 °C; per diode; Fig. 6		-	1.3	1.5	V
		I_F = 5 A; T_j = 150 °C; per diode; Fig. 6		-	0.88	1.3	V
Dynamic characteristics							
t_{rr}	reverse recovery time	I_F = 5 A; V_R = 200 V; dI_F/dt = 100 A/µs; T_j = 25 °C; per diode; Fig. 7		-	38	40	ns

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	A1	anode		
2	K	cathode		
3	A2	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
BYC405X-400P	TO220F	BYC405X-400PQ	Tube	50	SOT186A	14-Nov-2013

7. Marking

Table 4. Marking codes

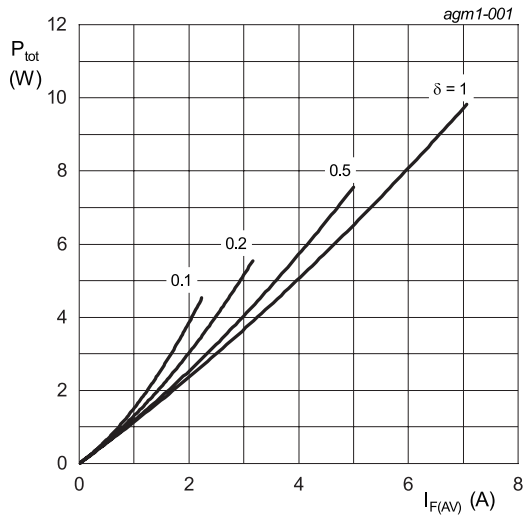
Type number	Marking codes
BYC405X-400P	BYC405X-400P

8. Limiting values

Table 5. Limiting values

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

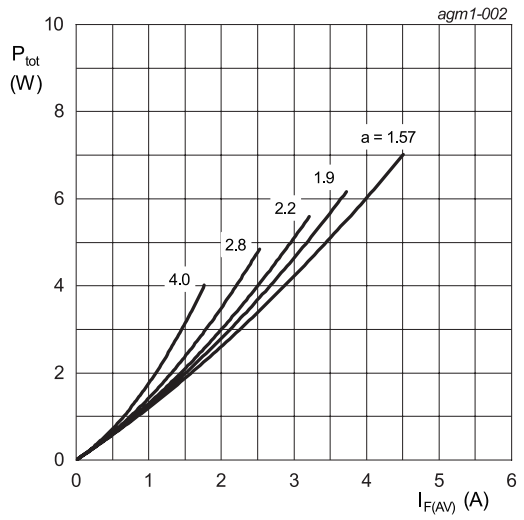
Symbol	Parameter	Conditions	Values	Unit
V_{RRM}	repetitive peak reverse voltage		400	V
V_{RWM}	crest working reverse voltage		400	V
V_R	reverse voltage	DC	400	V
$I_{O(AV)}$	average output current	δ = 0.5 ; $T_h \leq 87$ °C; square-wave pulse; both diodes conducting; Fig. 1; Fig. 2; Fig. 3	10	A
I_{FRM}	repetitive peak forward current	δ = 0.5 ; t_p = 25 µs; $T_h \leq 112$ °C; square-wave pulse; per diode	10	A
I_{FSM}	non-repetitive peak forward current	t_p = 10 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; per diode; Fig. 4	70	A
		t_p = 8.3 ms; $T_{j(init)}$ = 25 °C; sine-wave pulse; per diode	77	A
T_{stg}	storage temperature		-55 to 150	°C
T_j	junction temperature		150	°C



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

V_o = 1.097 V; R_s = 0.0415 Ω

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



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

V_o = 1.097 V; R_s = 0.0415 Ω

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

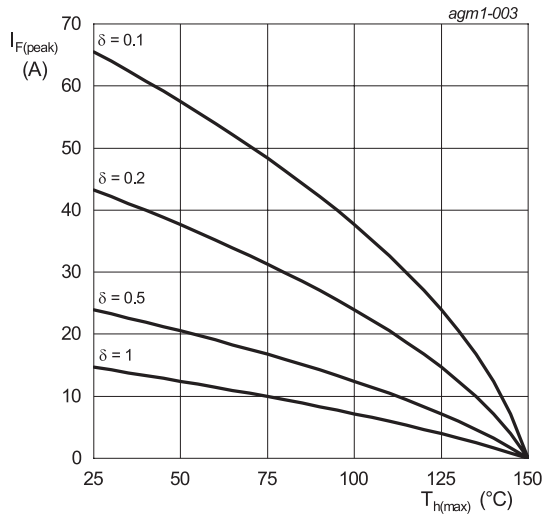


Fig. 3. Current derating as a function of heatsink temperature; per diode

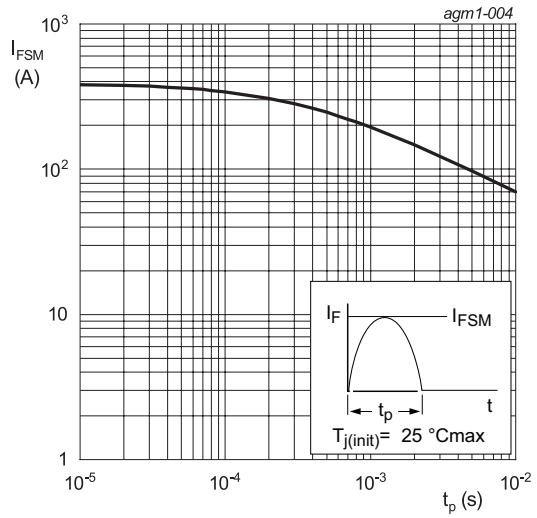


Fig. 4. Non-repetitive peak forward current as a function of pulse width; sinusoidal waveform; maximum values; per diode

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink	with heatsink compound; per diode; Fig. 5		-	-	5	K/W
		with heatsink compound; both diodes conducting; Fig. 5		-	-	4.2	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air		-	55	-	K/W

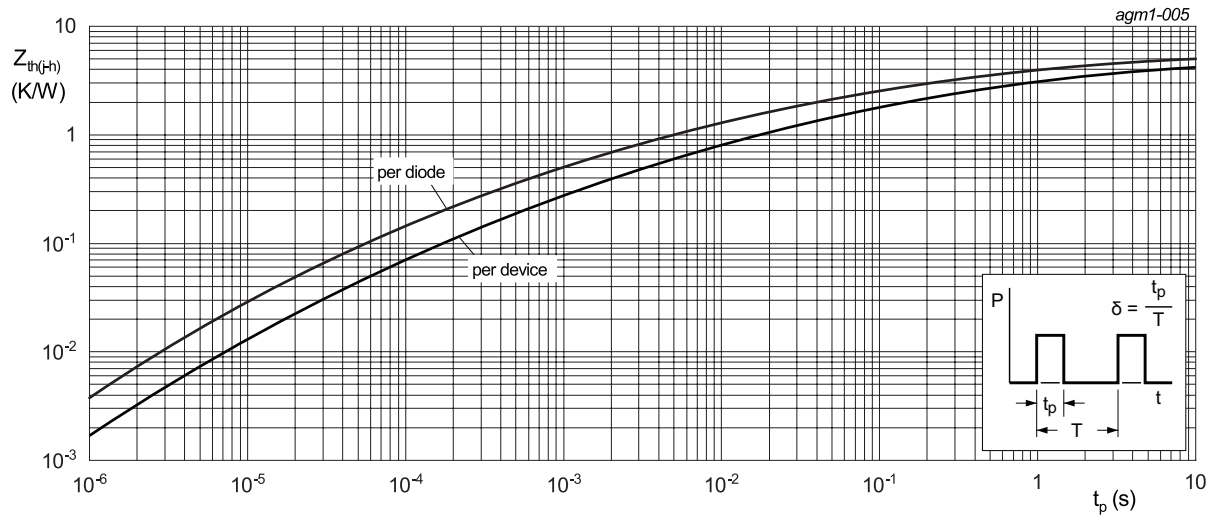


Fig. 5. Transient thermal impedance from junction to heatsink as a function of pulse duration

10. Isolation characteristics

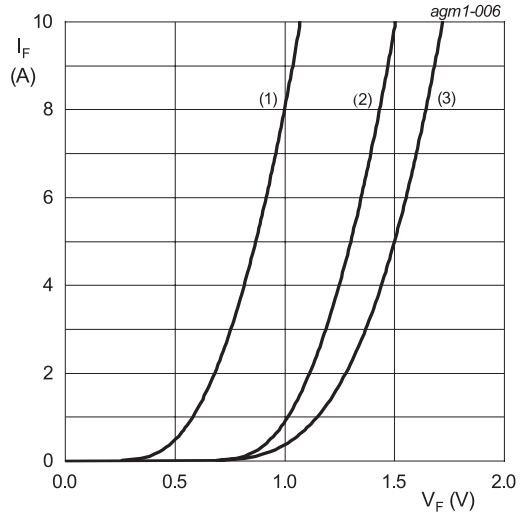
Table 7. Isolation characteristics

Symbol	Parameter	Conditions		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	from cathode to external heatsink		-	10	-	pF

11. Characteristics

Table 8. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
V_F	forward voltage	I_F = 5 A; T_j = 25 °C; per diode; Fig. 6		-	1.3	1.5	V
		I_F = 5 A; T_j = 150 °C; per diode; Fig. 6		-	0.88	1.3	V
I_R	reverse current	V_R = 400 V; T_j = 25 °C		-	-	10	µA
		V_R = 400 V; T_j = 150 °C		-	-	200	µA
Dynamic characteristics							
t_{rr}	reverse recovery time	I_F = 5 A; V_R = 200 V; dI_F/dt = 100 A/µs; T_j = 25 °C; Fig. 7		-	38	40	ns
I_{RM}	peak reverse recovery current	I_F = 5 A; V_R = 200 V; dI_F/dt = 100 A/µs; T_j = 25 °C; Fig. 7		-	1.2	-	A
Q_r	recovered charge	I_F = 5 A; V_R = 200 V; dI_F/dt = 100 A/µs; T_j = 25 °C; Fig. 7		-	22	-	nC



V_o = 1.097 V; R_s = 0.0415 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; per diode

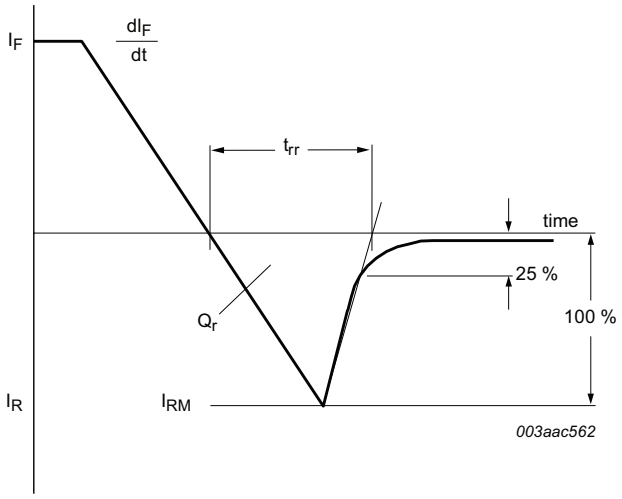
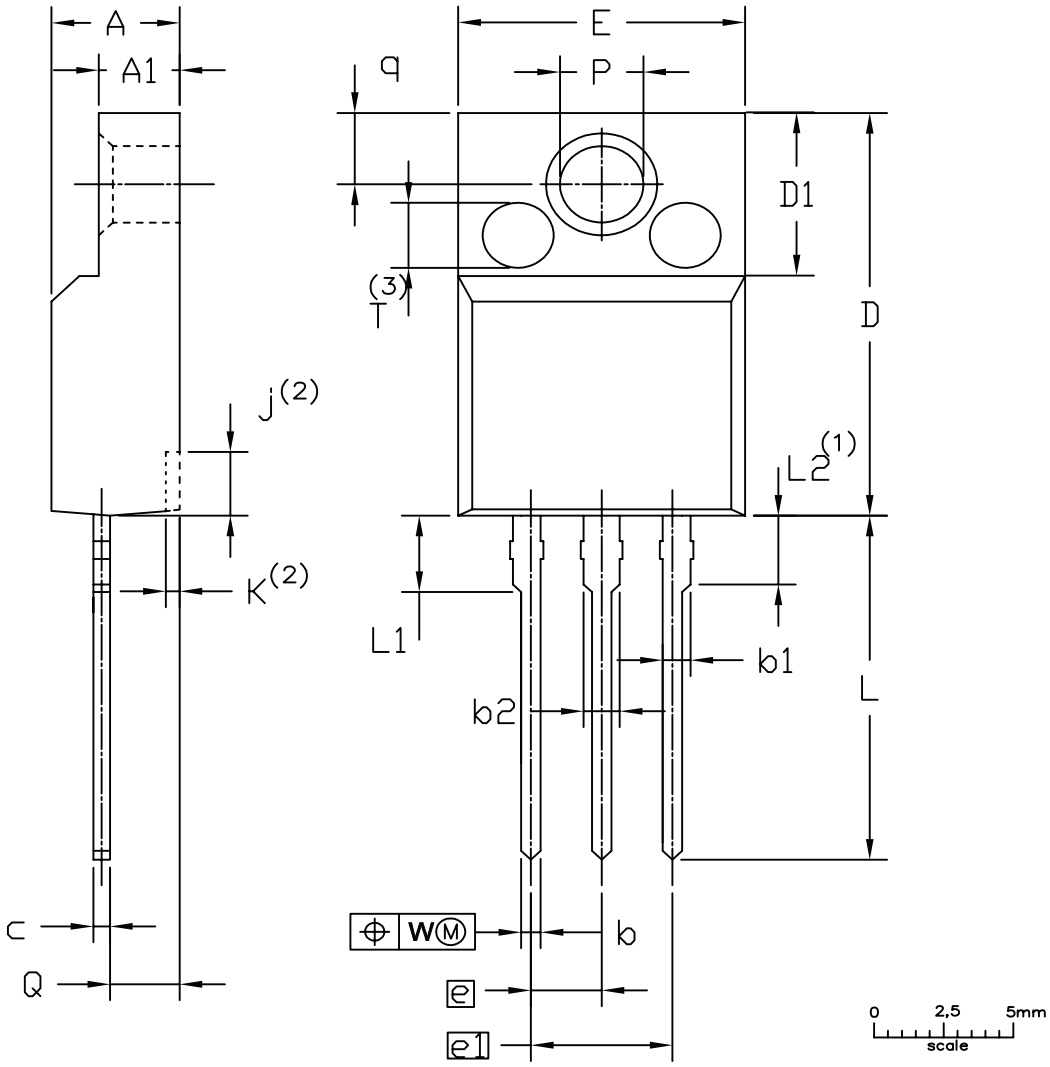


Fig. 7. Reverse recovery definitions; ramp recovery

12. Package outline

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack" SOT186A



UNIT	A	A_1	b	b_1	b_2	c	D	D_1	E	e	e_1	j(2)	K(2)	L	L_1	L_2(1) max.	P	Q	q	W	T(3)
mm	4.6 4.0	2.9 2.5	0.9 0.7	1.1 0.9	1.4 1.0	0.7 0.4	15.8 15.2	6.5 6.3	10.3 9.7	2.54	5.08	2.7 1.7	0.6 0.4	14.4 13.5	3.30 2.79	3	3.2 3.0	2.6 2.3	3.0 2.6	0.4	2.5

Notes
1. Terminal dimensions within this zone are uncotrolled
2. Dot lines area designs may vary
3. Eject pin mark is for reference only

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT186A		3 LEADS TO220F				2013-11-14

13. Legal information

Data sheet status

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.
Product [short] data sheet	Production	This document contains the product specification.

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14. Contents

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