

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	$\delta = 0.5$; $T_h \leq 87$ °C; square-wave pulse; both diodes conducting; Fig. 1 ; Fig. 2 ; Fig. 3	10			A
I_{FRM}	repetitive peak forward current	$\delta = 0.5$; $t_p = 25$ μ s; $T_h \leq 112$ °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/ μ s; $T_j = 25$ °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

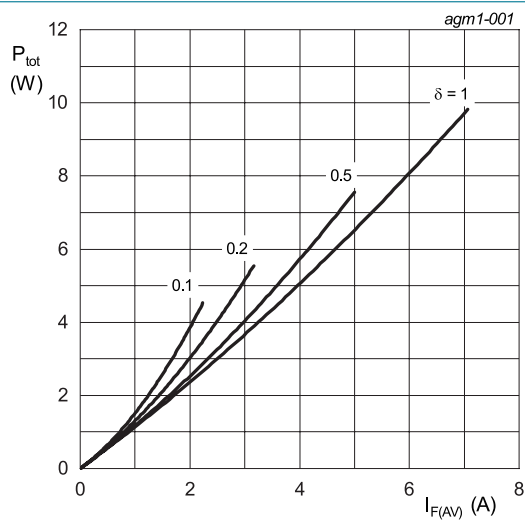
Type number	Marking codes
BYC405X-400P	BYC405X-400P

8. Limiting values

Table 5. Limiting values

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

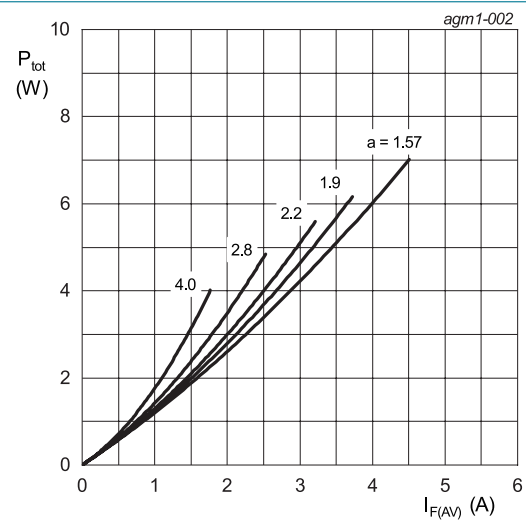
Symbol	Parameter	Conditions	Values	Unit
V_{RRM}	repetitive peak reverse voltage		400	V
V_{RWM}	crest working reverse voltage		400	V
V_R	reverse voltage	DC	400	V
$I_{O(AV)}$	average output current	$\delta = 0.5$; $T_h \leq 87$ °C; square-wave pulse; both diodes conducting; Fig. 1 ; Fig. 2 ; Fig. 3	10	A
I_{FRM}	repetitive peak forward current	$\delta = 0.5$; $t_p = 25$ μ s; $T_h \leq 112$ °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



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

$$V_o = 1.097 \text{ V}; R_s = 0.0415 \text{ } \Omega$$

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



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

$$V_o = 1.097 \text{ V}; R_s = 0.0415 \text{ } \Omega$$

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

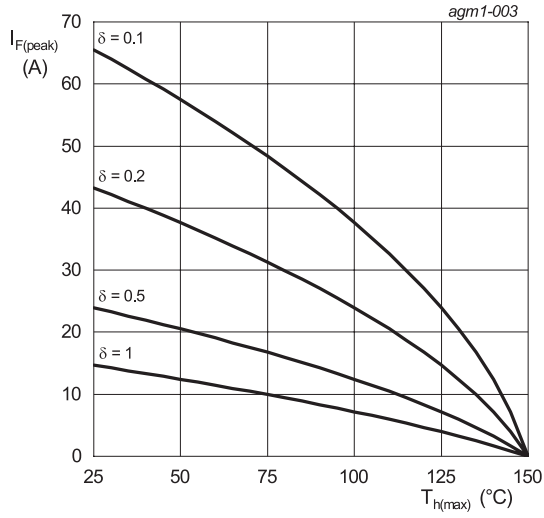


Fig. 3. Current derating as a function of heatsink temperature; per diode

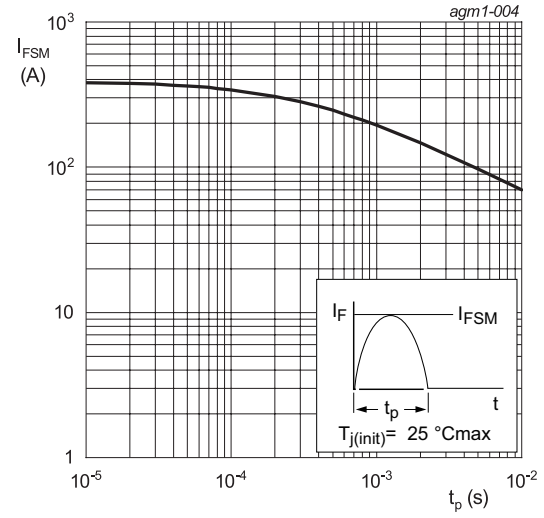


Fig. 4. Non-repetitive peak forward current as a function of pulse width; sinusoidal waveform; maximum values; per diode

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

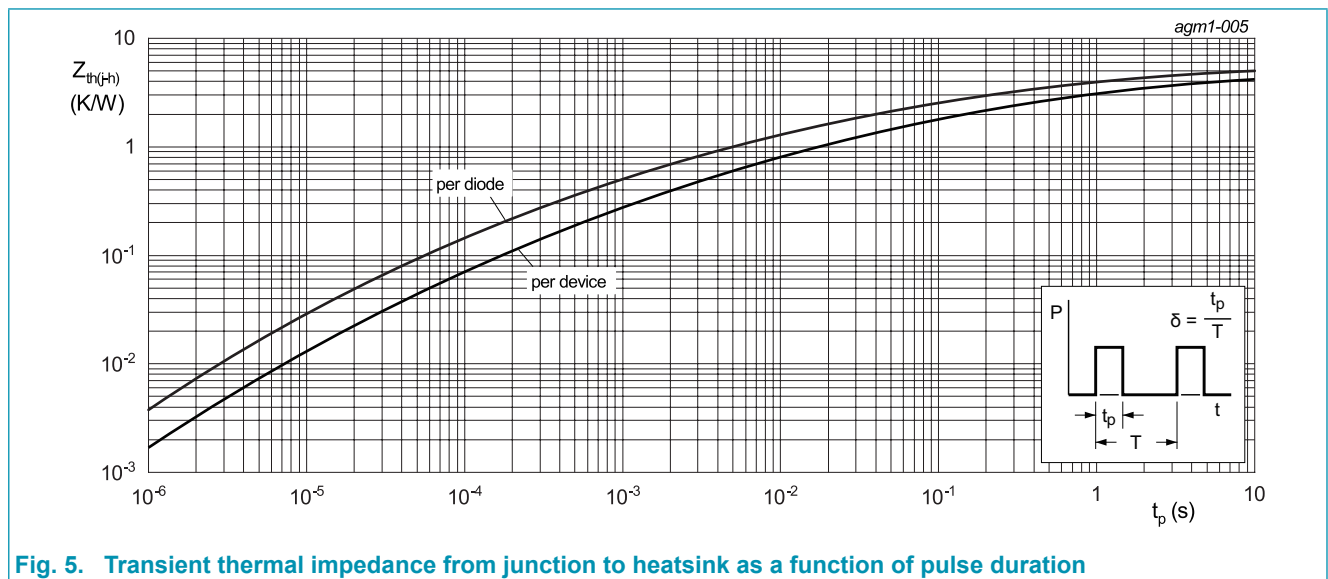


Fig. 5. Transient thermal impedance from junction to heatsink as a function of pulse duration

10. Isolation characteristics

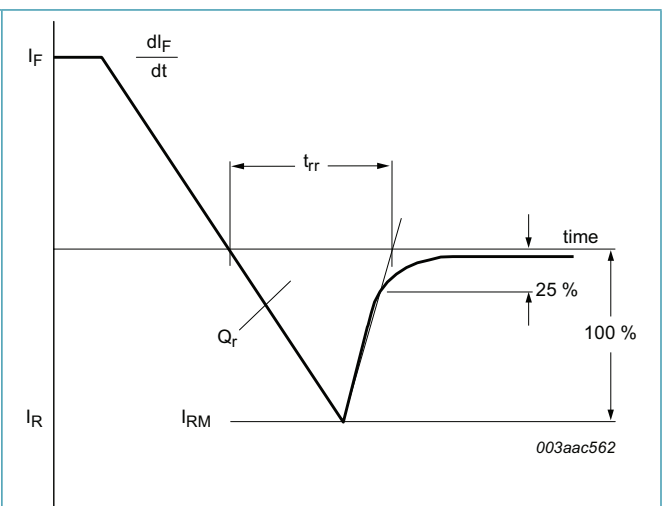
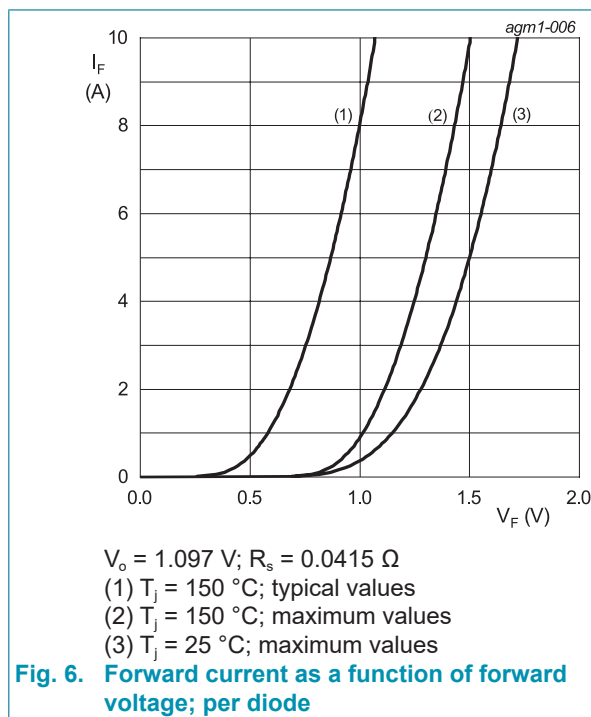
Table 7. Isolation characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	50 Hz \leq f \leq 60 Hz; RH \leq 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

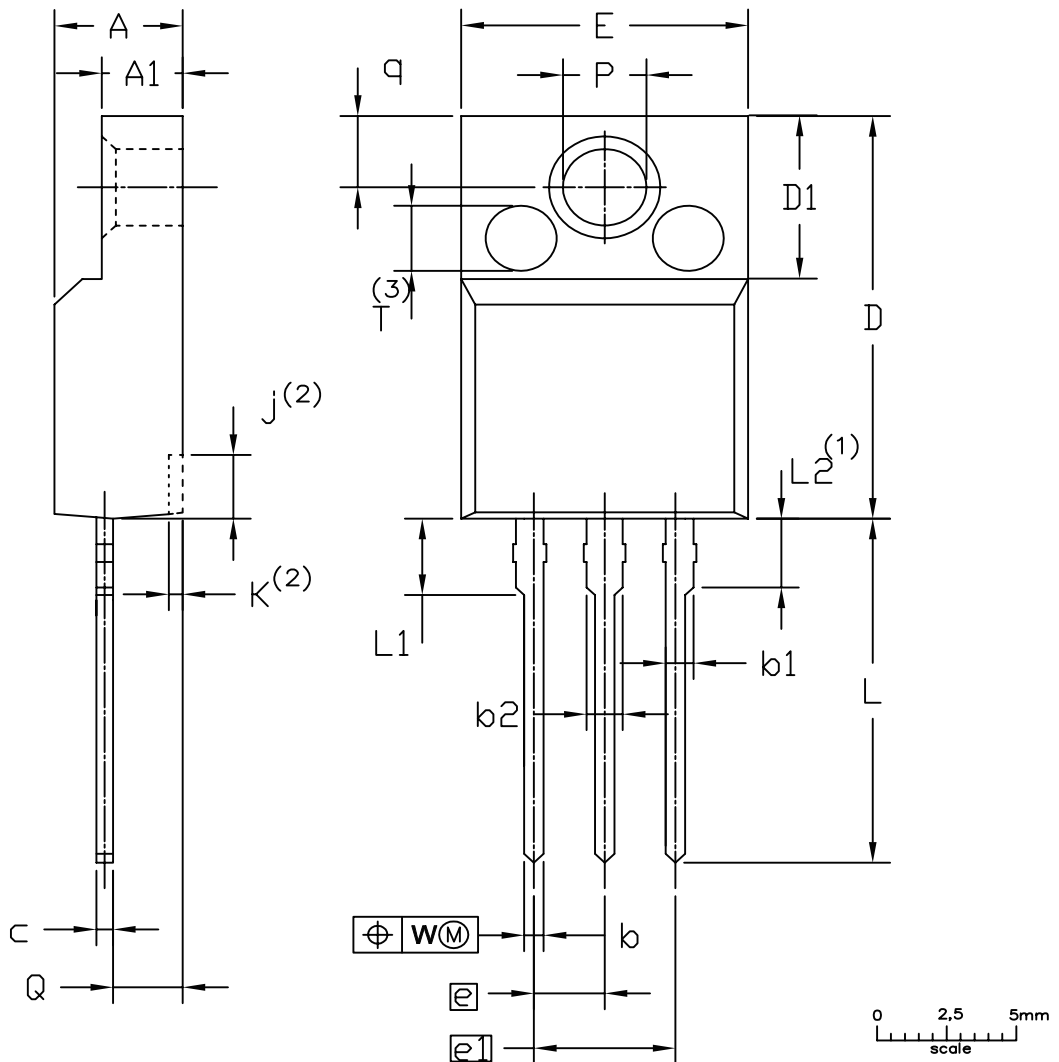
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V_F	forward voltage	$I_F = 5 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ per diode; Fig. 6	-	1.3	1.5	V
		$I_F = 5 \text{ A}; T_j = 150 \text{ }^\circ\text{C};$ per diode; Fig. 6	-	0.88	1.3	V
I_R	reverse current	$V_R = 400 \text{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



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	2.9	0.9	1.1	1.4	0.7	15.8	6.5	10.3			2.7	0.6	14.4	3.30		3.2	2.6	3.0	0.4	2.5
	4.0	2.5	0.7	0.9	1.0	0.4	15.2	6.3	9.7	2.54	5.08	1.7	0.4	13.5	2.79	3	3.0	2.3	2.6	0.4	2.5

- Notes
- Terminal dimensions within this zone are uncontrolled
 - Dot lines area designs may vary
 - 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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- [2] The term 'short data sheet' is explained in section "Definitions".
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