

## 1. General description

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



## 2. Features and benefits

- 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)

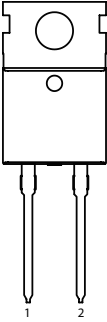
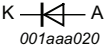
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Notes	Values			Unit
Absolute maximum rating							
V <sub>RRM</sub>	repetitive peak reverse voltage			650			V
I <sub>F(AV)</sub>	average forward current	δ = 0.5 ; square-wave pulse; T <sub>mb</sub> ≤ 105 °C; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>		20			A
I <sub>FRM</sub>	repetitive peak forward current	δ = 0.5 ; t <sub>p</sub> = 25 μs; T <sub>mb</sub> ≤ 105 °C; square-wave pulse		40			A
I <sub>FSM</sub>	non-repetitive peak forward current	t <sub>p</sub> = 10 ms; T <sub>j(init)</sub> = 25 °C; sine-wave pulse; <a href="#">Fig. 4</a>		180			A
		t <sub>p</sub> = 8.3 ms; T <sub>j(init)</sub> = 25 °C; sine-wave pulse		198			A
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
V <sub>F</sub>	forward voltage	I <sub>F</sub> = 20 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 6</a>		-	1.90	2.60	V
		I <sub>F</sub> = 20 A; T <sub>j</sub> = 150 °C; <a href="#">Fig. 6</a>		-	1.50	2.20	V
Dynamic characteristics							
t <sub>rr</sub>	reverse recovery time	I <sub>F</sub> = 1 A; V <sub>R</sub> = 30 V; dI <sub>F</sub> /dt = 100 A/μs; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>		-	26	-	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
BYV21M-650P	TO220-2L	BYV21M-650PQ	Tube	50	TO220d-2L	13-Oct-2022

## 7. Marking

Table 4. Marking codes

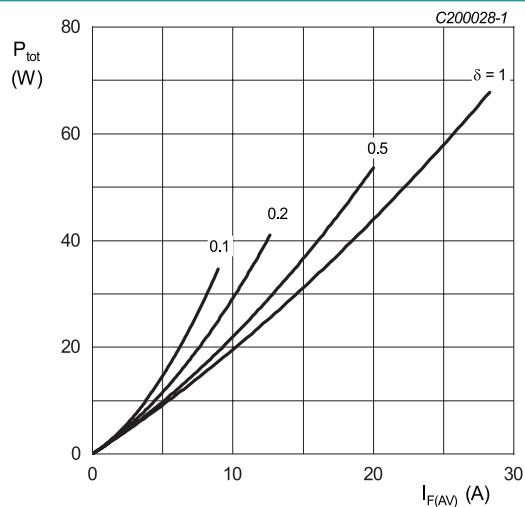
Type number	Marking codes
BYV21M-650P	BYV21M 650P

## 8. Limiting values

**Table 5. Limiting values**

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

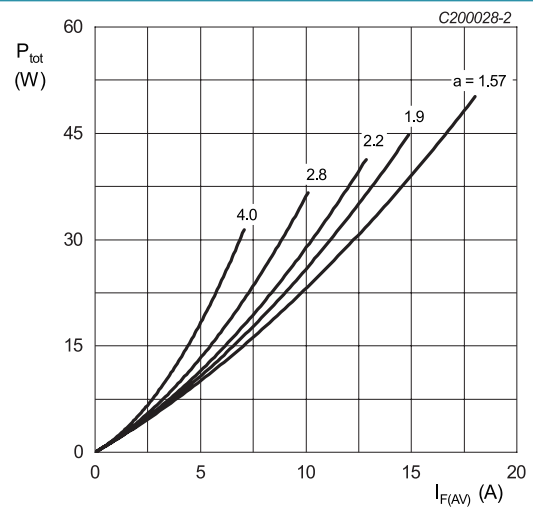
Symbol	Parameter	Conditions	Notes	Values	Unit
$V_{RRM}$	repetitive peak reverse voltage			650	V
$V_{RWM}$	crest working reverse voltage			650	V
$V_R$	reverse voltage	DC		650	V
$I_{F(AV)}$	average forward current	$\delta = 0.5$ ; square-wave pulse; $T_{mb} \leq 105\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>		20	A
$I_{FRM}$	repetitive peak forward current	$\delta = 0.5$ ; $t_p = 25\text{ }\mu\text{s}$ ; $T_{mb} \leq 105\text{ }^{\circ}\text{C}$ ; square-wave pulse		40	A
$I_{FSM}$	non-repetitive peak forward current	$t_p = 10\text{ ms}$ ; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; sine-wave pulse; <a href="#">Fig. 4</a>		180	A
		$t_p = 8.3\text{ ms}$ ; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; sine-wave pulse		198	A
$T_{stg}$	storage temperature			-65 to 175	$^{\circ}\text{C}$
$T_j$	junction temperature			-65 to 175	$^{\circ}\text{C}$



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

$$V_o = 1.714\text{ V}; R_s = 0.0241\text{ }\Omega$$

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



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

$$V_o = 1.714\text{ V}; R_s = 0.0241\text{ }\Omega$$

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

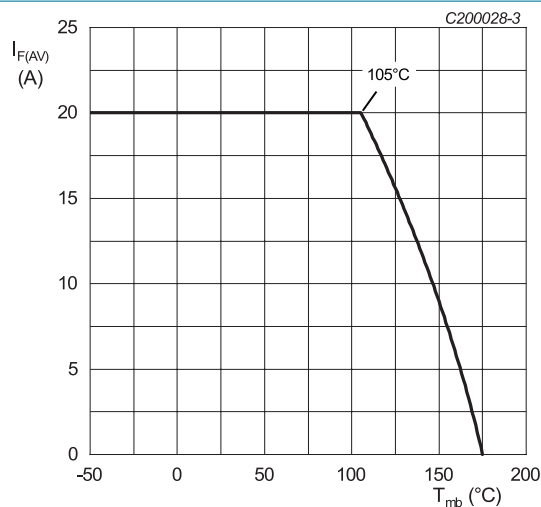


Fig. 3. Forward current as a function of mounting base temperature; maximum values

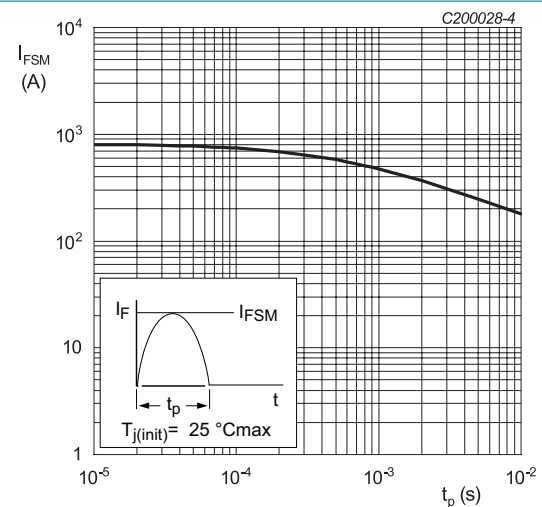


Fig. 4. Non-repetitive peak forward current as a function of pulse width; sinusoidal waveform; maximum values

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	<a href="#">Fig. 5</a>		-	-	1.3	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air		-	60	-	K/W

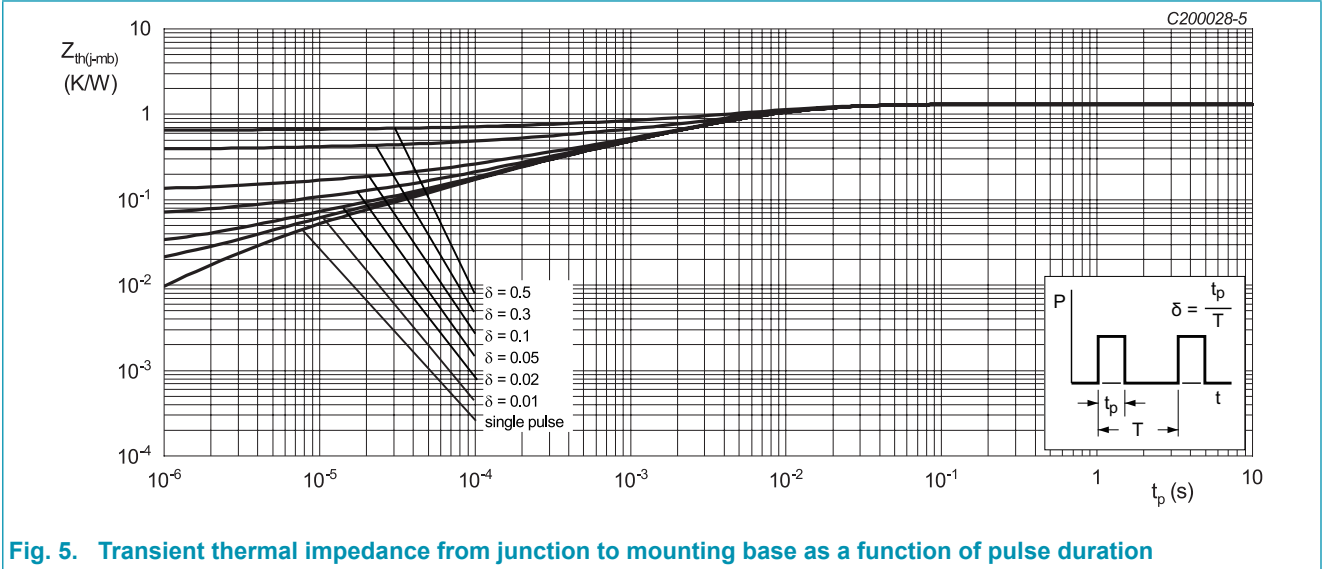
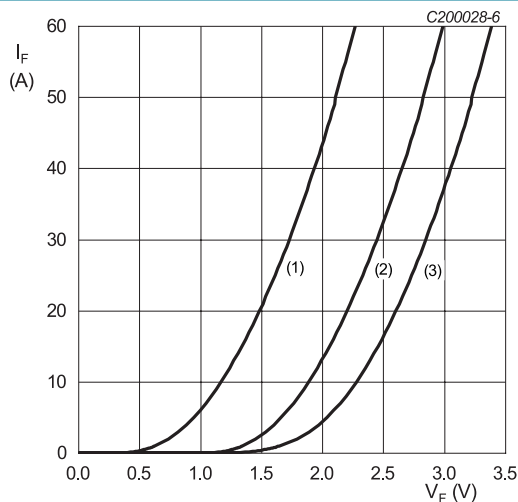


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
V <sub>F</sub>	forward voltage	I <sub>F</sub> = 20 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 6</a>		-	1.90	2.60	V
		I <sub>F</sub> = 20 A; T <sub>j</sub> = 150 °C; <a href="#">Fig. 6</a>		-	1.50	2.20	V
I <sub>R</sub>	reverse current	V <sub>R</sub> = 650 V; T <sub>j</sub> = 25 °C		-	0.5	30	μA
		V <sub>R</sub> = 650 V; T <sub>j</sub> = 150 °C		-	-	0.8	mA
Dynamic characteristics							
Q <sub>r</sub>	reverse charge	I <sub>F</sub> = 20 A; V <sub>R</sub> = 200 V; dI <sub>F</sub> /dt = 200 A/μs; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>		-	85	-	nC
		I <sub>F</sub> = 20 A; V <sub>R</sub> = 200 V; dI <sub>F</sub> /dt = 200 A/μs; T <sub>j</sub> = 125 °C; <a href="#">Fig. 7</a>		-	350	-	nC
t <sub>rr</sub>	reverse recovery time	I <sub>F</sub> = 0.5 A; I <sub>rr</sub> = 0.25 A; I <sub>R</sub> = 1 A; T <sub>j</sub> = 25 °C		-	28	-	ns
		I <sub>F</sub> = 1 A; V <sub>R</sub> = 30 V; dI <sub>F</sub> /dt = 100 A/μs; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>		-	26	-	ns
		I <sub>F</sub> = 20 A; V <sub>R</sub> = 200 V; dI <sub>F</sub> /dt = 200 A/μs; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>		-	50	-	ns
		I <sub>F</sub> = 20 A; V <sub>R</sub> = 200 V; dI <sub>F</sub> /dt = 200 A/μs; T <sub>j</sub> = 125 °C; <a href="#">Fig. 7</a>		-	90	-	ns
I <sub>RM</sub>	peak reverse recovery current	I <sub>F</sub> = 20 A; V <sub>R</sub> = 200 V; dI <sub>F</sub> /dt = 200 A/μs; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>		-	3.6	-	A
		I <sub>F</sub> = 20 A; V <sub>R</sub> = 200 V; dI <sub>F</sub> /dt = 200 A/μs; T <sub>j</sub> = 125 °C; <a href="#">Fig. 7</a>		-	7.5	-	A
E <sub>as</sub>	non-repetitive analanche energy	T <sub>j</sub> = 25 °C		16.8	-	-	mJ



$V_o = 1.714\text{ V}$ ;  $R_s = 0.0241\text{ }\Omega$

(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

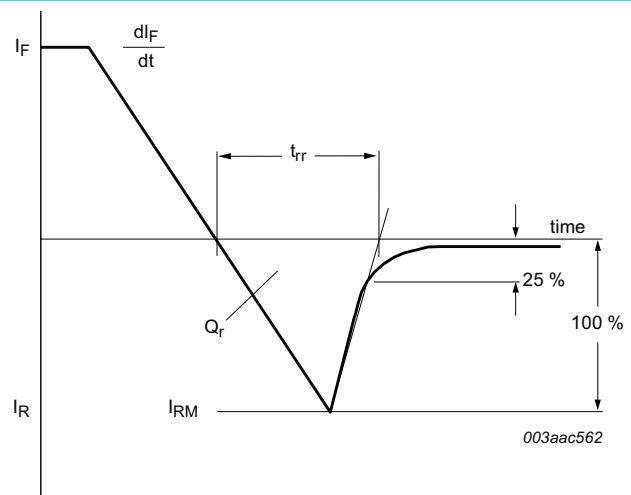


Fig. 7. Reverse recovery definitions; ramp recovery

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:  
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.
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