



PNE20040CPE-Q

200 V, 2 x 2 A dual common cathode hyperfast recovery rectifier

29 October 2021

Product data sheet

1. General description

High power density, hyperfast switching time dual recovery rectifier in common cathode configuration with high-efficiency planar technology, encapsulated in a CFP15B (SOT1289B) power and flat lead Surface-Mounted Device (SMD) plastic package.

2. Features and benefits

- Reverse voltage: $V_R \leq 200$ V
- Forward current: $I_F \leq 2$ A (per diode)
- Switching time: $t_{rr} \leq 25$ ns
- Pt doped life time control
- Low inductance
- Power and flat lead SMD plastic package
- Package height typical 0.95 mm
- High power capability due to clip-bond technology
- Planar die design
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- General-purpose rectification
- Hyperfast switching
- Solenoid control
- Piezo injection
- Freewheeling applications

4. Quick reference data

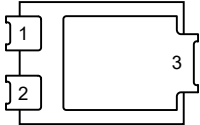
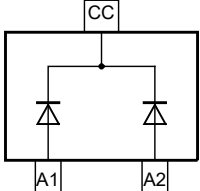
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per diode (unless otherwise specified)							
$I_{F(AV)}$	average forward current	$\delta = 0.5$; $f = 20$ kHz; square wave; $T_{sp} \leq 167$ °C		-	-	2	A
V_{RRM}	repetitive peak reverse voltage	$T_j = 25$ °C		-	-	200	V
V_R	reverse voltage			-	-	200	V
V_F	forward voltage	$I_F = 2$ A; $T_j = 25$ °C	[1]	-	890	980	mV
		$I_F = 2$ A; $T_j = 125$ °C	[1]	-	735	870	mV
I_R	reverse current	$V_R = 200$ V; $T_j = 25$ °C	[1]	-	-	1	µA
		$V_R = 200$ V; $T_j = 125$ °C	[1]	-	1	20	µA

[1] Very short pulse, in order to maintain a stable junction temperature.

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	A1	anode (diode 1)	 CFP15B (SOT1289B)	 aaa-030081
2	A2	anode (diode 2)		
3	CC	common cathode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PNE20040CPE-Q	CFP15B	plastic, thermal enhanced ultra thin SMD package; 3 leads; 2.13 mm pitch; 5.8 x 4.3 x 0.95 mm body	SOT1289B

7. Marking

Table 4. Marking codes

Type number	Marking code
PNE20040CPE-Q	200E 004C

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC60134)

Symbol	Parameter	Conditions		Min	Max	Unit
Per diode (unless otherwise specified)						
V _R	reverse voltage	T _j = 25 °C		-	200	V
V _{RRM}	repetitive peak reverse voltage			-	200	V
V _{R(RMS)lim}	limiting RMS reverse voltage			-	140	V
I _F	forward current	δ = 1; T _{sp} ≤ 164 °C		-	2.8	A
I _{F(AV)}	average forward current	δ = 0.5; f = 20 kHz; square wave; T _{sp} ≤ 167 °C		-	2	A
I _{FSM}	non-repetitive peak forward current	t _p = 8.3 ms; single half sine wave (applied at rated load condition); T _{j(init)} = 25 °C		-	55	A
		t _p = 8.3 ms; single half sine wave (applied at rated load condition); per device; T _{j(init)} = 25 °C		-	100	A
Per device, one diode loaded						
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	1.66	W
			[2]	-	2.15	W
T _j	junction temperature			-	175	°C
T _{amb}	ambient temperature			-55	175	°C
T _{stg}	storage temperature			-65	175	°C

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm^2 .

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per device, one diode loaded							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	90	K/W
			[2]	-	-	70	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[3]	-	-	7	K/W

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm².
- [3] Soldering point of cathode tab.

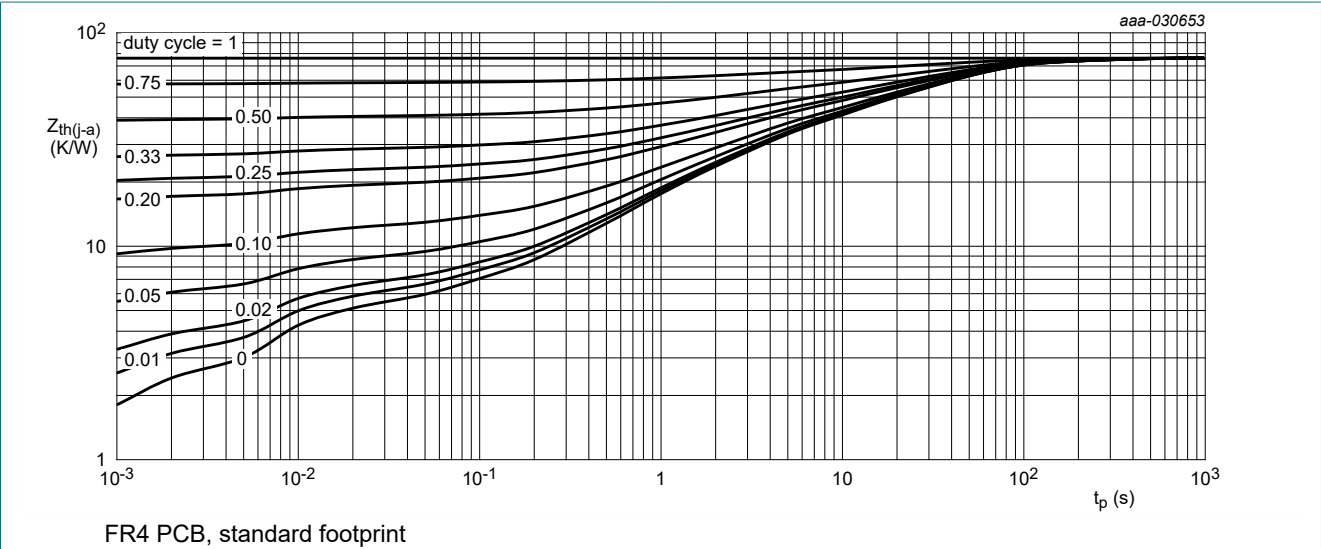


Fig. 1. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

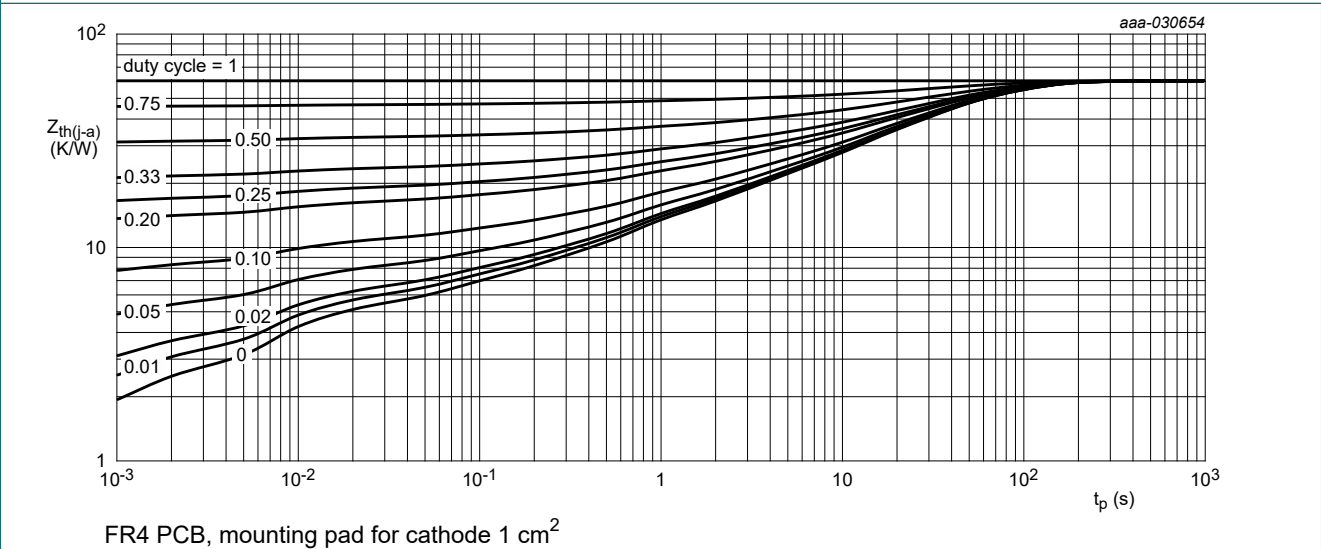


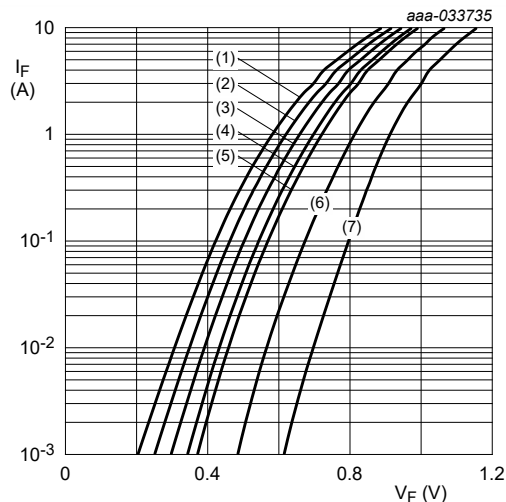
Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per diode (unless otherwise specified)							
$V_{(BR)R}$	reverse breakdown voltage	$I_R = 100\ \mu\text{A}$; $T_j = 25\ ^\circ\text{C}$	[1]	200	-	-	V
V_F	forward voltage	$I_F = 2\ \text{A}$; $T_j = 25\ ^\circ\text{C}$	[1]	-	890	980	mV
		$I_F = 2\ \text{A}$; $T_j = 125\ ^\circ\text{C}$	[1]	-	735	870	mV
I_R	reverse current	$V_R = 200\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	[1]	-	-	1	μA
		$V_R = 200\ \text{V}$; $T_j = 125\ ^\circ\text{C}$	[1]	-	1	20	μA
C_d	diode capacitance	$V_R = 4\ \text{V}$; $f = 1\ \text{MHz}$; $T_j = 25\ ^\circ\text{C}$		-	24	-	pF
t_{rr}	reverse recovery time step recovery	$I_F = 0.5\ \text{A}$; $I_R = 1\ \text{A}$; $I_{R(\text{meas})} = 0.25\ \text{A}$; $T_j = 25\ ^\circ\text{C}$		-	11	25	ns
	reverse recovery time ramp recovery	$dI_F/dt = 50\ \text{A}/\mu\text{s}$; $I_F = 1\ \text{A}$; $V_R = 30\ \text{V}$; $T_j = 25\ ^\circ\text{C}$		-	20	-	ns
	reverse recovery time	$dI_F/dt = 100\ \text{A}/\mu\text{s}$; $I_F = 1\ \text{A}$; $V_R = 30\ \text{V}$; $T_j = 25\ ^\circ\text{C}$		-	16	-	ns
I_{RM}	peak reverse recovery current	$T_j = 25\ ^\circ\text{C}$		-	1.1	-	A
Q_{rr}	reverse recovery charge			-	10	-	nC
V_{FRM}	peak forward recovery voltage	$I_F = 1\ \text{A}$; $dI_F/dt = 50\ \text{A}/\mu\text{s}$; $T_j = 25\ ^\circ\text{C}$		-	910	-	mV

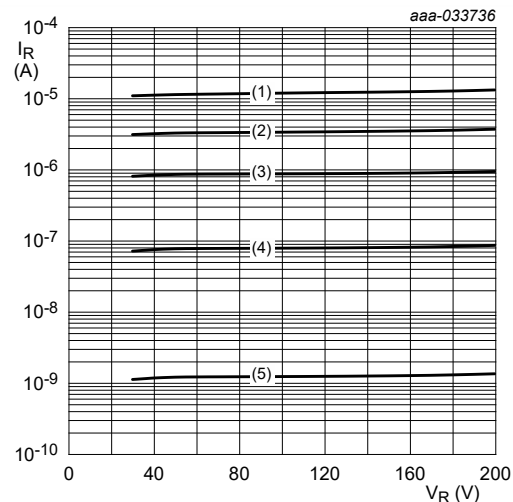
[1] Very short pulse, in order to maintain a stable junction temperature.



pulsed condition

- (1) $T_j = 175\ ^\circ\text{C}$
- (2) $T_j = 150\ ^\circ\text{C}$
- (3) $T_j = 125\ ^\circ\text{C}$
- (4) $T_j = 100\ ^\circ\text{C}$
- (5) $T_j = 85\ ^\circ\text{C}$
- (6) $T_j = 25\ ^\circ\text{C}$
- (7) $T_j = -40\ ^\circ\text{C}$

Fig. 3. Forward current as a function of forward voltage; typical values



pulsed condition

- (1) $T_j = 175\ ^\circ\text{C}$
- (2) $T_j = 150\ ^\circ\text{C}$
- (3) $T_j = 125\ ^\circ\text{C}$
- (4) $T_j = 85\ ^\circ\text{C}$
- (5) $T_j = 25\ ^\circ\text{C}$

Fig. 4. Reverse current as a function of reverse voltage; typical values

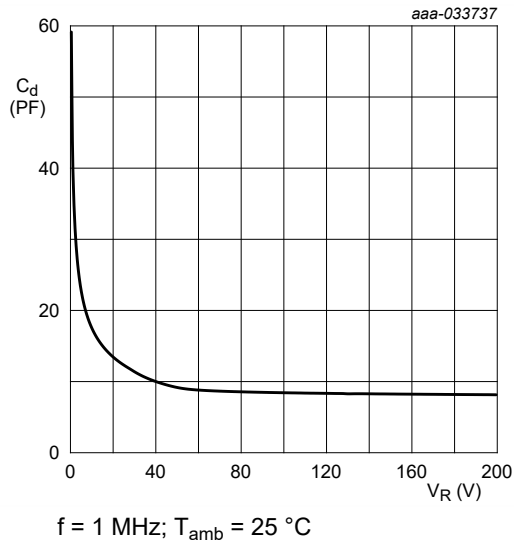


Fig. 5. Diode capacitance as a function of reverse voltage; typical values

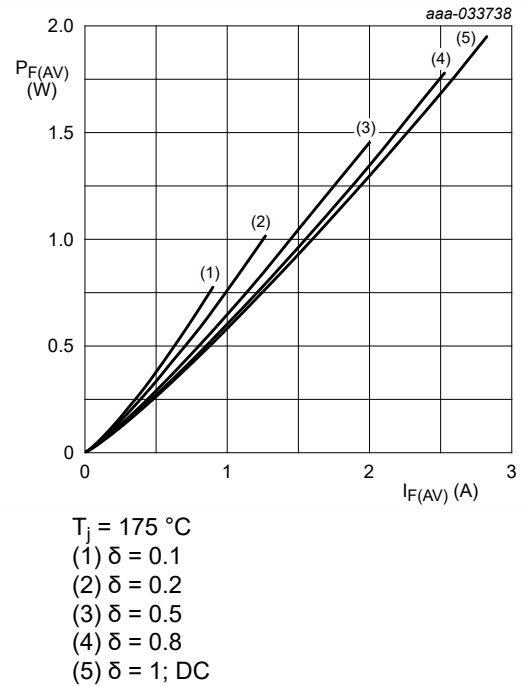


Fig. 6. Average forward power dissipation as a function of average forward current; typical values

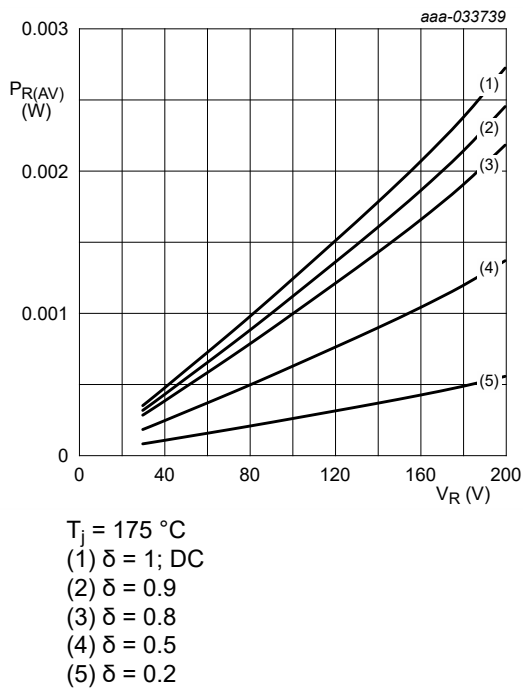


Fig. 7. Average reverse power dissipation as a function of reverse voltage; typical values

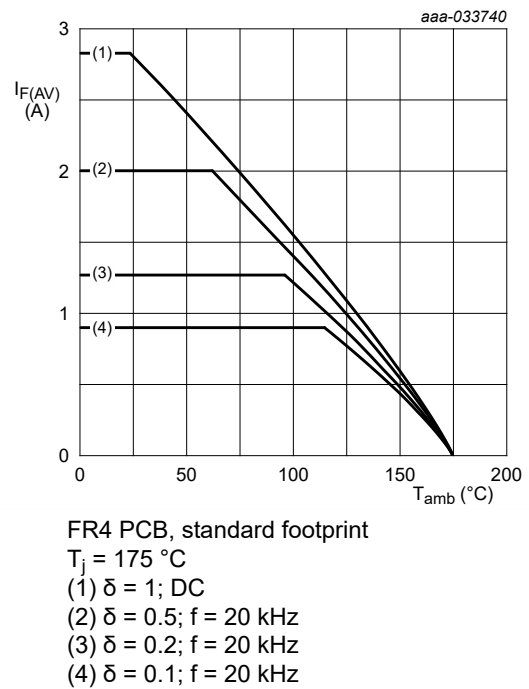
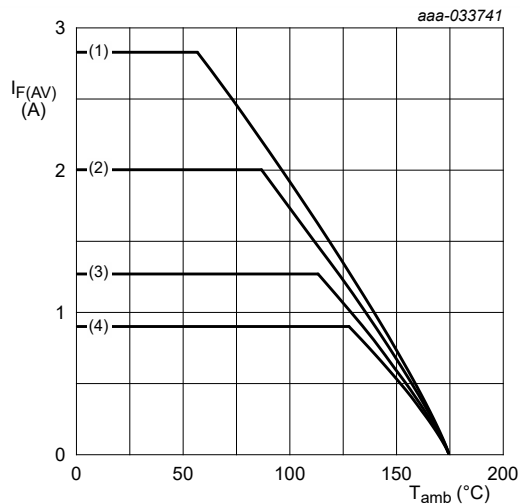
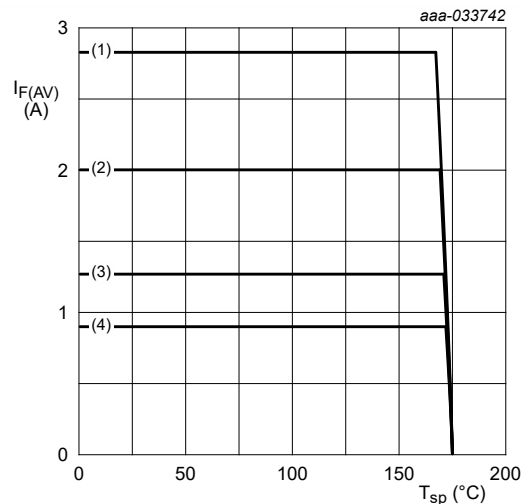


Fig. 8. Average forward current as a function of ambient temperature; typical values



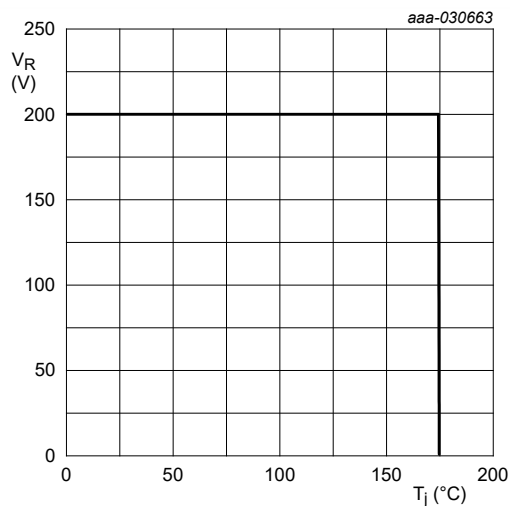
FR4 PCB, mounting pad for cathode 1 cm²
 $T_j = 175$ °C
(1) $\delta = 1$; DC
(2) $\delta = 0.5$; $f = 20$ kHz
(3) $\delta = 0.2$; $f = 20$ kHz
(4) $\delta = 0.1$; $f = 20$ kHz

Fig. 9. Average forward current as a function of ambient temperature; typical values



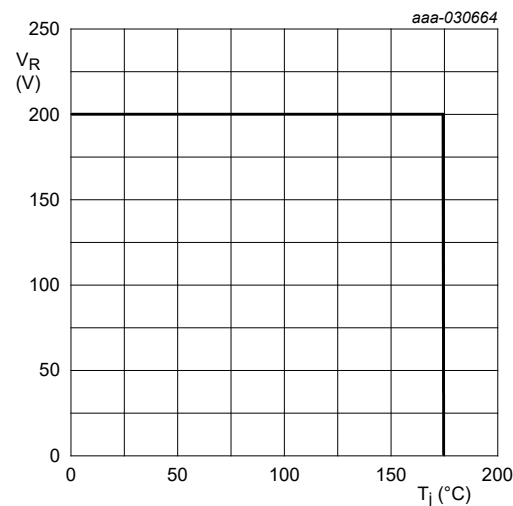
$T_j = 175$ °C
(1) $\delta = 1$; DC
(2) $\delta = 0.5$; $f = 20$ kHz
(3) $\delta = 0.2$; $f = 20$ kHz
(4) $\delta = 0.1$; $f = 20$ kHz

Fig. 10. Average forward current as a function of solder point temperature; typical values



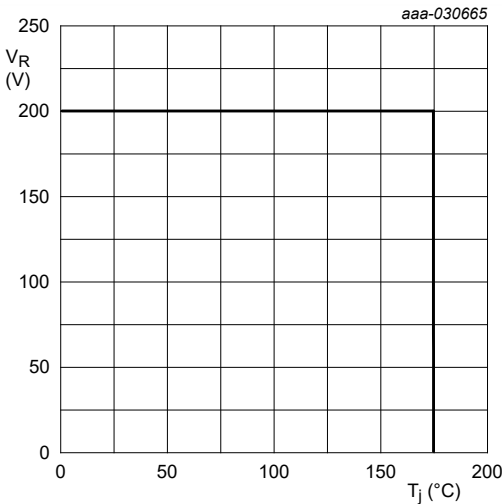
FR4 PCB, standard footprint
 $R_{th} = 90$ K/W

Fig. 11. Derated maximum reverse voltage as a function of junction temperature; typical values



FR4 PCB, mounting pad for cathode 1 cm²
 $R_{th} = 70$ K/W

Fig. 12. Derated maximum reverse voltage as a function of junction temperature; typical values



Soldering point of cathode tab
 $R_{th} = 7 \text{ K/W}$

Fig. 13. Derated maximum reverse voltage as a function of junction temperature; typical values

11. Test information

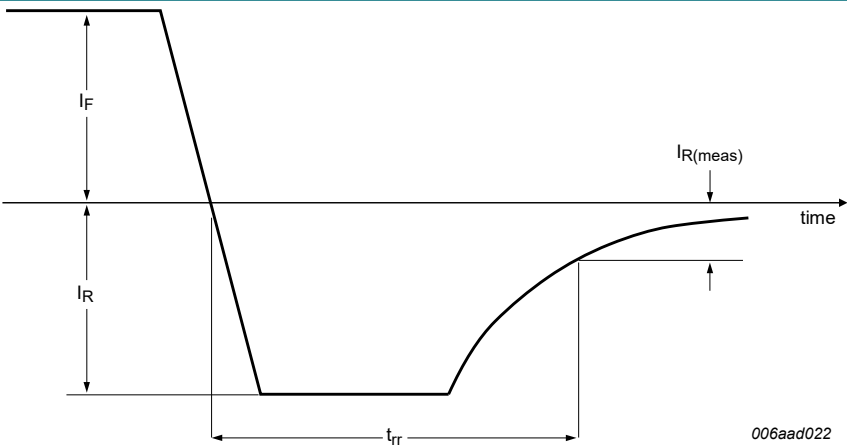


Fig. 14. Reverse recovery definition; step recovery

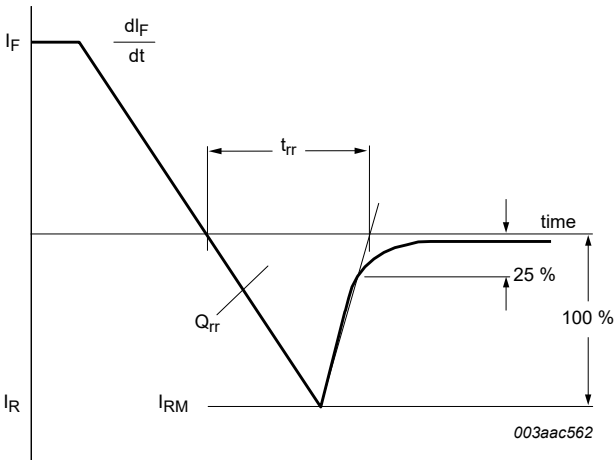


Fig. 15. Reverse recovery definition; ramp recovery

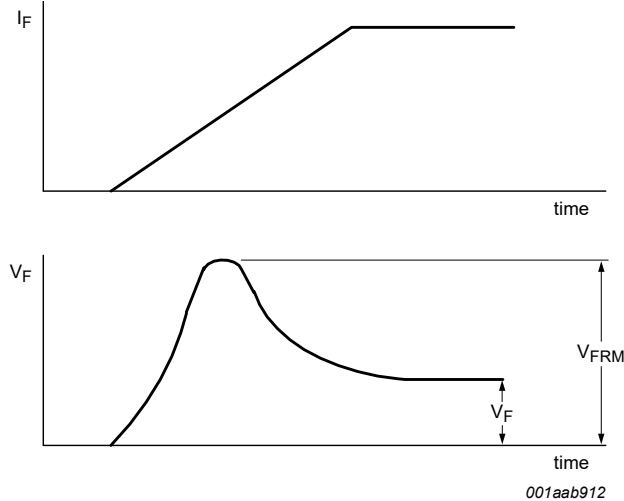


Fig. 16. Forward recovery definition

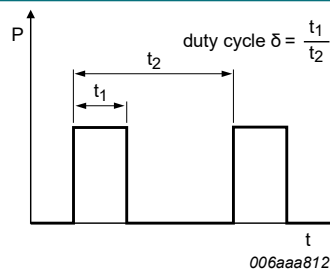


Fig. 17. Duty cycle definition

The current ratings for the typical waveforms are calculated according to the equations:

$$I_{F(AV)} = I_M \times \delta \text{ with } I_M \text{ defined as peak current}$$

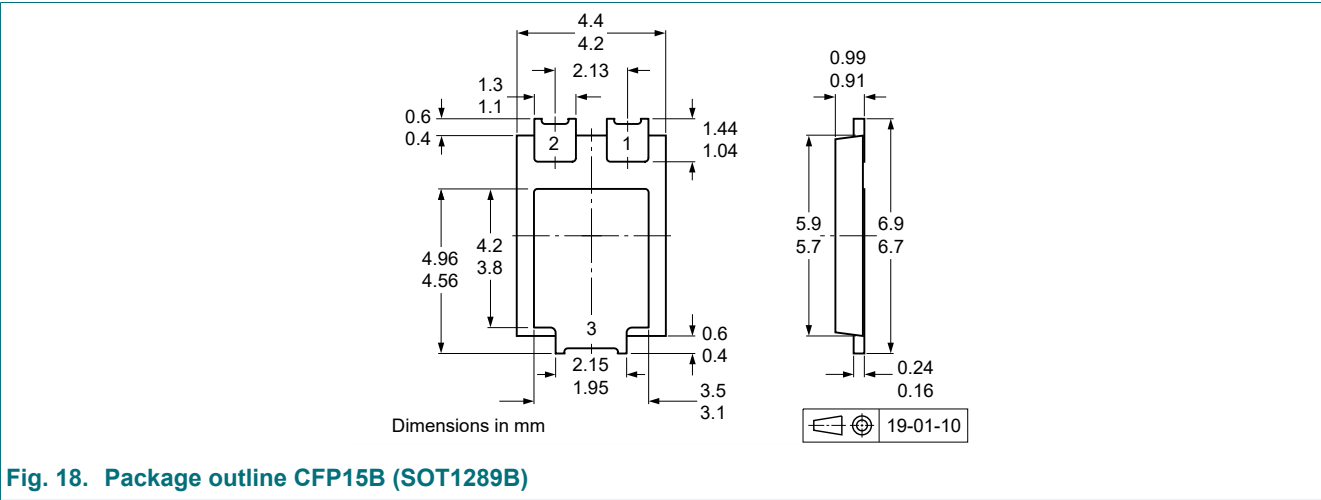
$$I_{RMS} = I_{F(AV)} \text{ at DC, and } I_{RMS} = I_M \times \sqrt{\delta}$$

with I_{RMS} defined as RMS current.

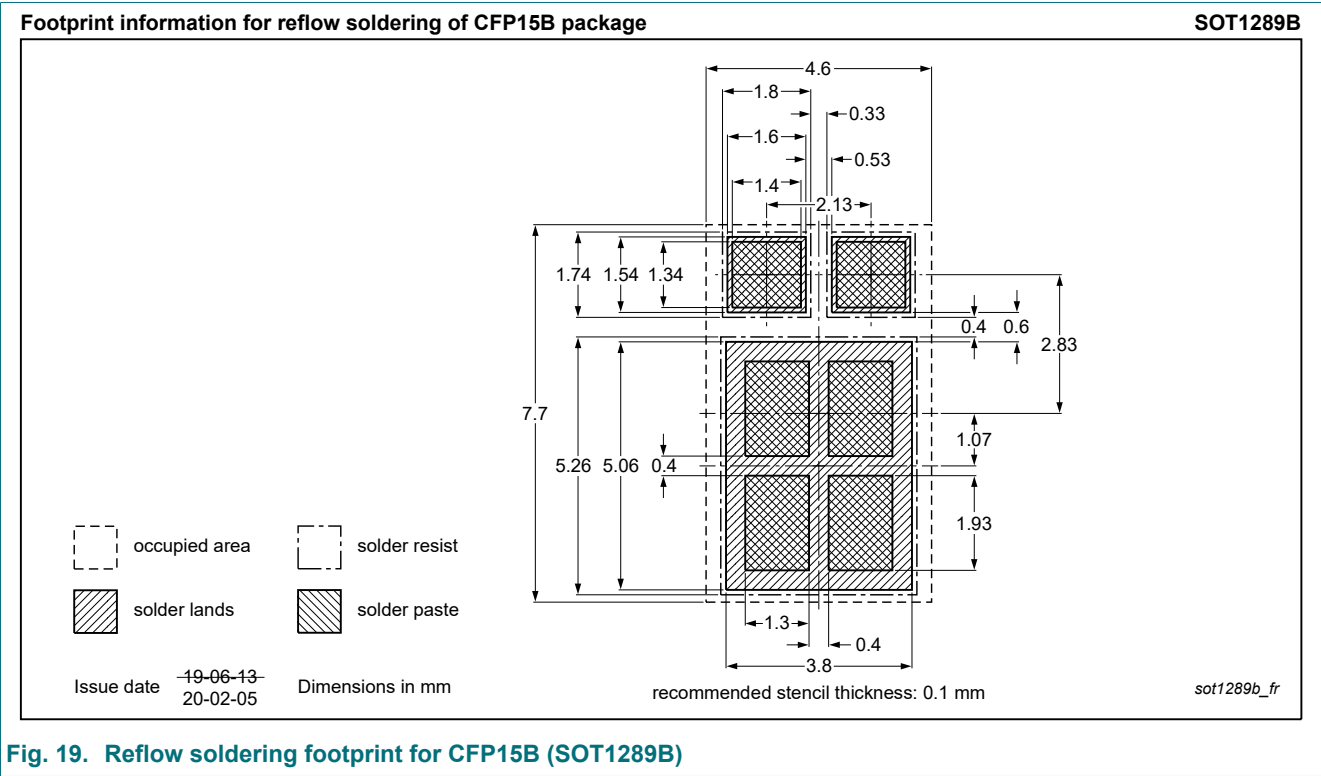
Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.

12. Package outline



13. Soldering



14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PNE20040CPE-Q v.1	20211029	Product data sheet	-	-

15. 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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