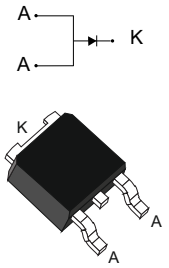
Automotive 300 V, 10 A high efficiency ultrafast diode



DPAK

Features

- AEC-Q101 qualified
- Ultrafast recovery
- Low power losses
- High surge capability
- Low leakage current
- High junction temperature
- ECOPACK2 compliant

Applications

- DC/DC converter
- Reverse battery protection
- Battery management system
- Audio amplification

Product status links
STTH1003S-Y

Product summary	
$I_{F(AV)}$	10 A
V_{RRM}	300 V
$T_{j(max.)}$	175 °C
$V_{F(typ.)}$	0.9 V
$T_{rr(max.)}$	13 ns

Description

This STTH1003S-Y is an ultrafast recovery power rectifier dedicated to energy recovery in automotive applications.

This STTH1003S-Y is also intended for the clamping function in an energy recovery block.

The compromise between forward voltage drop and recovery time offers optimized performances.

1 Characteristics

Table 1. Absolute ratings (limiting values, at 25 °C, unless otherwise specified)

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage, T_j = -40 °C to +175 °C		300	V
$I_{F(RMS)}$	Forward rms current		20	A
$I_{F(AV)}$	Average forward current, δ = 0.5, square wave	T_C = 150 °C	10	A
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal	100	A
T_{stg}	Storage temperature range		-65 to +175	°C
T_j	Operating junction temperature range		-40 to +175	°C

Table 2. Thermal parameters

Symbol	Parameter	Maximum value	Unit
$R_{th(j-c)}$	Junction to case	4	°C/W

For more information, please refer to the following application note :

- AN5088 : Rectifiers thermal management, handling and mounting recommendations

Table 3. Static electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_R (1)	Reverse leakage current	T_j = 25 °C	$V_R = V_{RRM}$	-		10	µA
		T_j = 125 °C		-	10	100	
V_F (2)	Forward voltage drop	T_j = 25 °C	I_F = 10 A	-		1.30	V
		T_j = 125 °C		-	0.90	1.10	

1. *Pulse test: t_p = 5 ms, δ < 2%*
2. *Pulse test: t_p =380 µs, δ < 2%*

To evaluate the conduction losses, use the following equation:

$P = 0.86 \times I_{F(AV)} + 0.024 \times I_F{}^2{}_{(RMS)}$

For more information, please refer to the following application notes related to the power losses:

- AN604: Calculation of conduction losses in a power rectifier
- AN5028: Calculation of turn-off power losses generated by an ultrafast diode

Table 4. Dynamic electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
t_{rr}	Reverse recovery time	T_j = 25 °C	I_F = 0.5 A, I_{rr} = 0.25 A, I_R = 1 A	-	13	17	ns
			I_F = 1 A, V_R = 30 V, dI_F/dt = -50 A/µs	-	28	35	
I_{RM}	Reverse recovery current		I_F = 10 A, V_R = 200 V, dI_F/dt = 200 A/µs	-	5.7	7.5	A
S_{factor}	Softness factor			-	0.3		-
t_{fr}	Forward recovery time		I_F = 10 A, V_{FR} = 1.1 x V_{Fmax}, dI_F/dt = 100 A/µs			200	ns
V_{FP}	Forward recovery voltage		I_F = 10 A, dI_F/dt = 100 A/µs		2.5	3.5	V

1.1 Characteristics (curves)

Figure 1. Forward voltage drop versus current (maximum values)

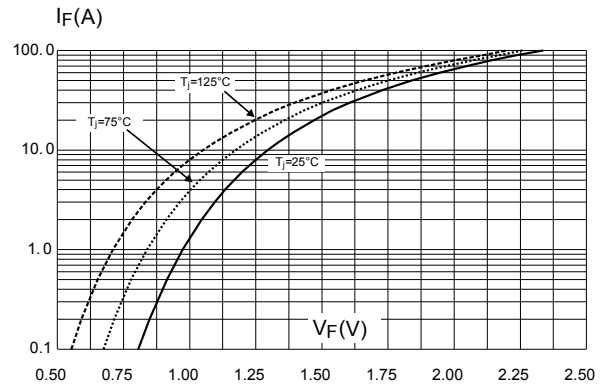


Figure 2. Peak reverse recovery current versus dI_F/dt (90% confidence)

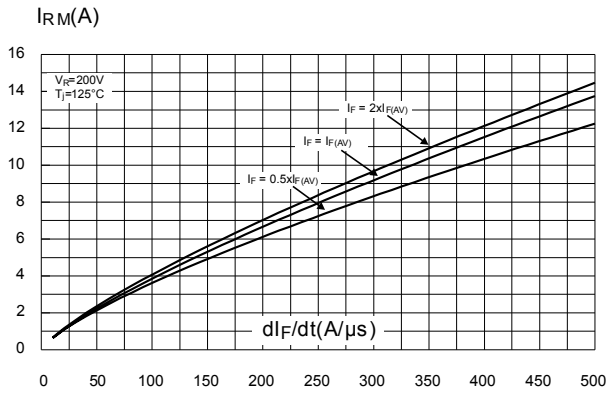


Figure 3. Reverse recovery time versus dI_F/dt (90 % confidence)

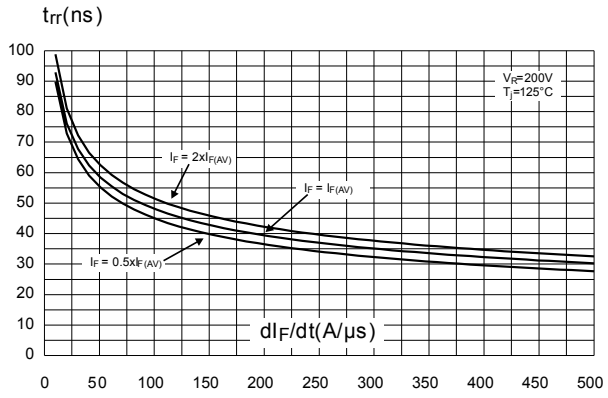


Figure 4. Softness factor versus dI_F/dt (typical values)

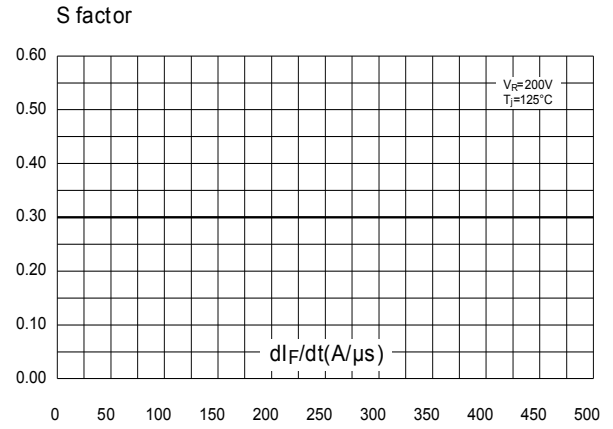


Figure 5. Relative variations of dynamic parameters versus junction temperature (reference: T_j = 125 °C)

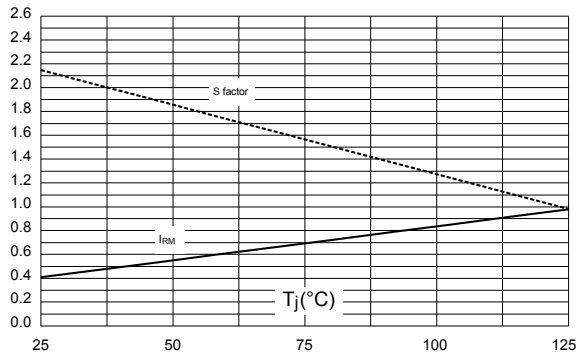


Figure 6. Transient peak forward voltage versus dI_F/dt (90% confidence)

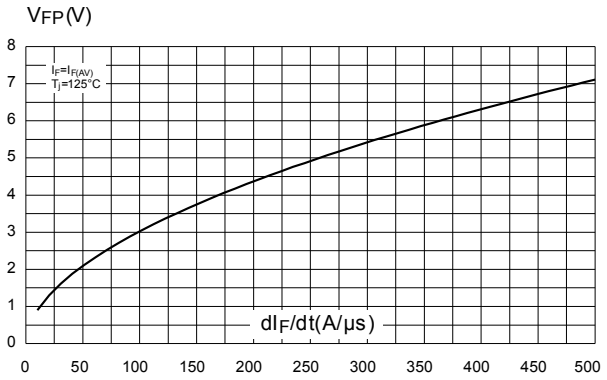


Figure 7. Forward recovery versus dI_F/dt (90% confidence)

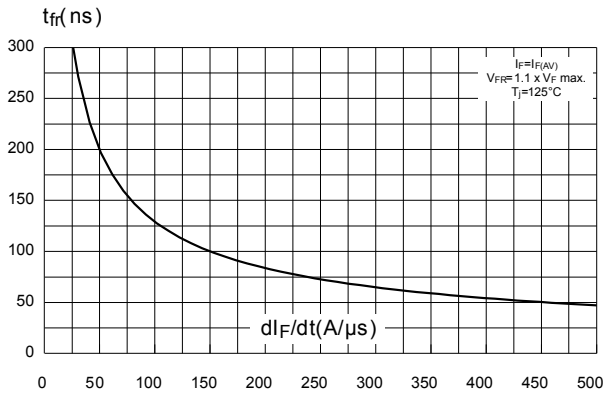
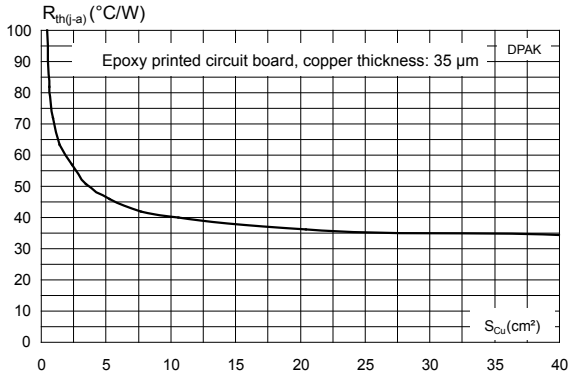


Figure 8. Thermal resistance junction to ambient versus copper surface under tab (typical values)



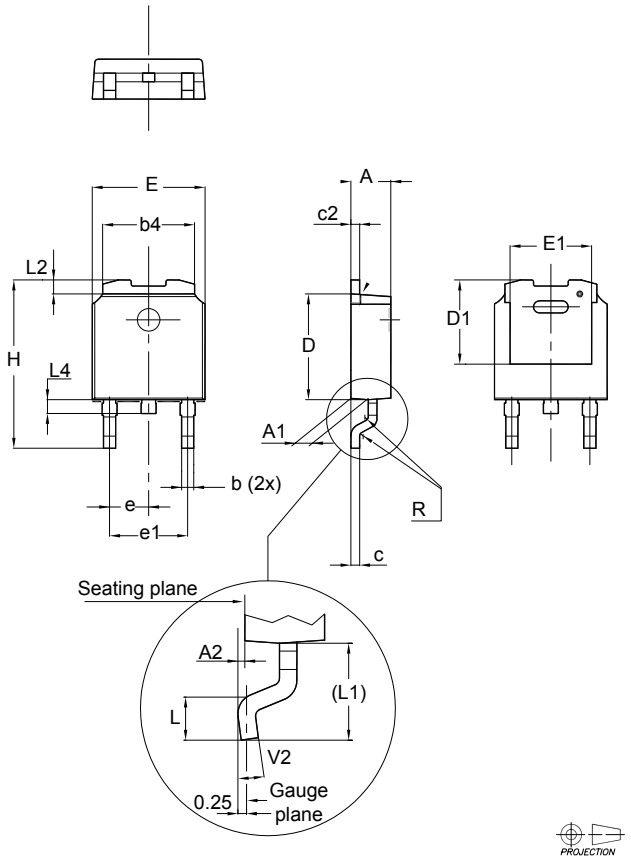
2 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

2.1 DPAK package information

- Epoxy meets UL94, V0

Figure 9. DPAK package outline



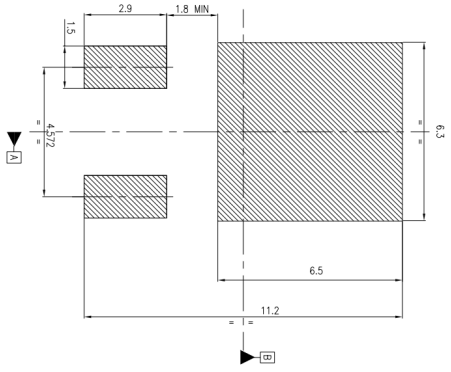
Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 5. DPAK mechanical data

Dim.	Dimensions					
	Millimeters			Inches[1]		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.20		2.40	0.087		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
b	0.64		0.90	0.025		0.035
b4	5.20		5.40	0.205		0.213
c	0.45		0.60	0.018		0.024
c2	0.48		0.60	0.019		0.024
D	6.00		6.20	0.236		0.244
D1	4.95	5.10	5.25	0.195	0.201	0.207
E	6.40		6.60	0.252		0.260
E1	4.60	4.70	4.80	0.181	0.185	0.189
e	2.159	2.286	2.413	0.085	0.090	0.095
e1	4.445	4.572	4.699	0.175	0.180	0.185
H	9.35		10.10	0.368		0.398
L	1.00		1.50	0.039		0.059
(L1)	2.60	2.80	3.00	0.102	0.110	0.118
L2	0.65	0.80	0.95	0.026	0.031	0.037
L4	0.60		1.00	0.024		0.039
R		0.20			0.008	
V2	0°		8°	0°		8°

1. *Inches dimensions given for reference only*

Figure 10. DPAK recommended footprint (dimensions are in mm)



Note: For package and tape orientation, reel and inner box dimensions and tape outline please check TN1173

3 Ordering information

Table 6. **Order code**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STTH1003SBY-TR	TH10 03SBY	DPAK	0.32 g	2500	Tape and reel

Revision history

Table 7. **Document revision history**

Date	Revision	Changes
24-Oct-2012	1	Initial release.
28-Jan-2019	2	Added *Section Applications*. Updated *Table 6*. Added *Figure 8*.
03-Jun-2024	3	Updated package view on cover page.