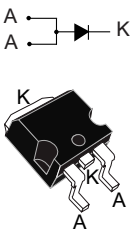
Automotive 300 V, 10 A high efficiency ultrafast diode



D²PAK

Features

- AEC-Q101 qualified
- Ultrafast recovery
- Low power losses
- High surge capability
- Low leakage current
- High junction temperature
- ECOPACK®2 compliant

Applications

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

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.

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

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)

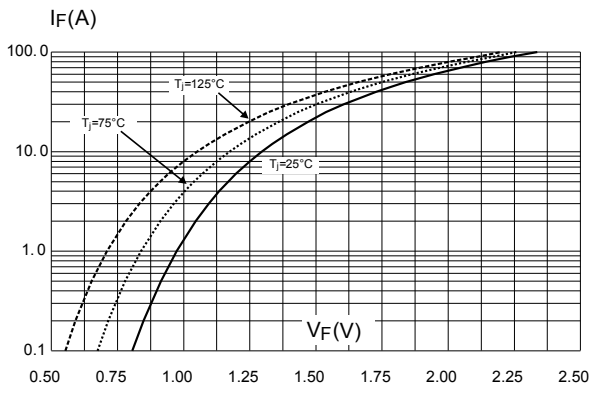


Figure 2. Peak reverse recovery current versus dI_F/dt (90% confidence)

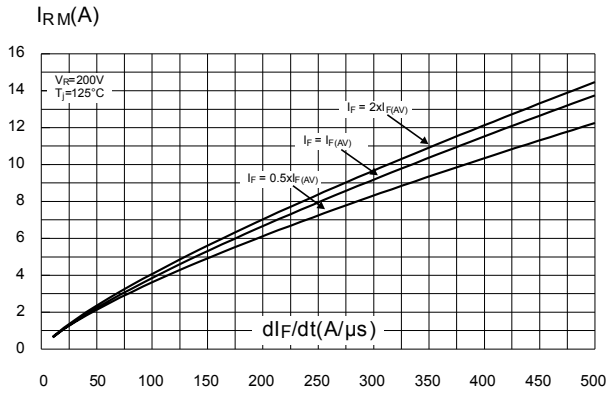


Figure 3. Reverse recovery time versus dI_F/dt (90 % confidence)

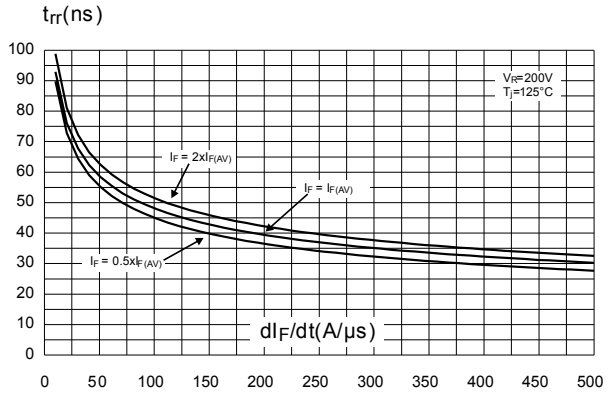


Figure 4. Softness factor versus dI_F/dt (typical values)

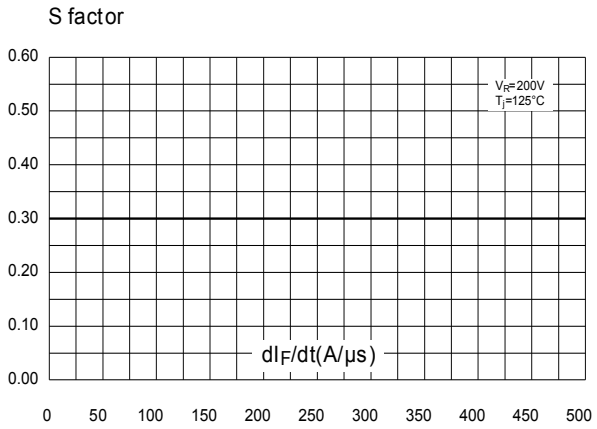


Figure 5. Relative variations of dynamic parameters versus junction temperature (reference: T_j = 125 °C)

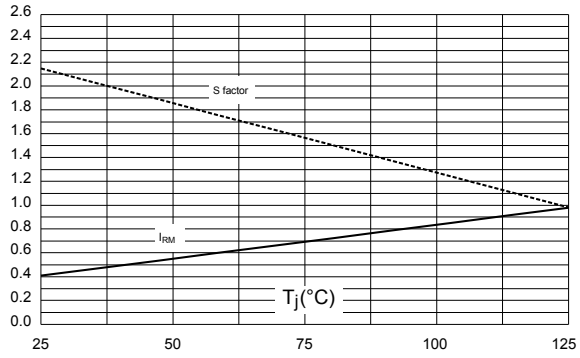


Figure 6. Transient peak forward voltage versus dI_F/dt (90% confidence)

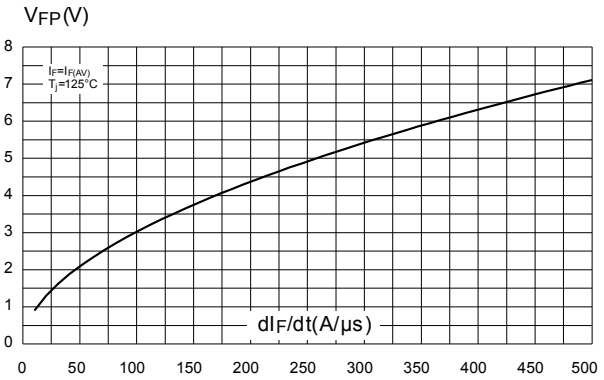


Figure 7. Forward recovery versus dI_F/dt (90% confidence)

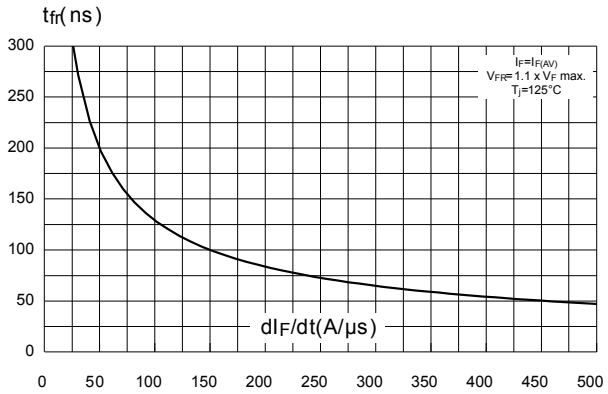
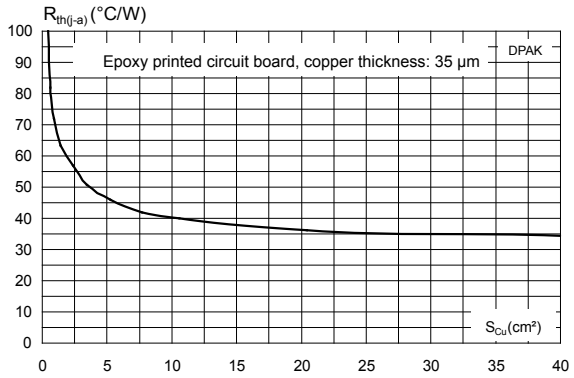


Figure 8. Thermal resistance junction to ambient versus copper surface under tab (typical values)



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
- Lead-free packages

Figure 9. DPAK package outline

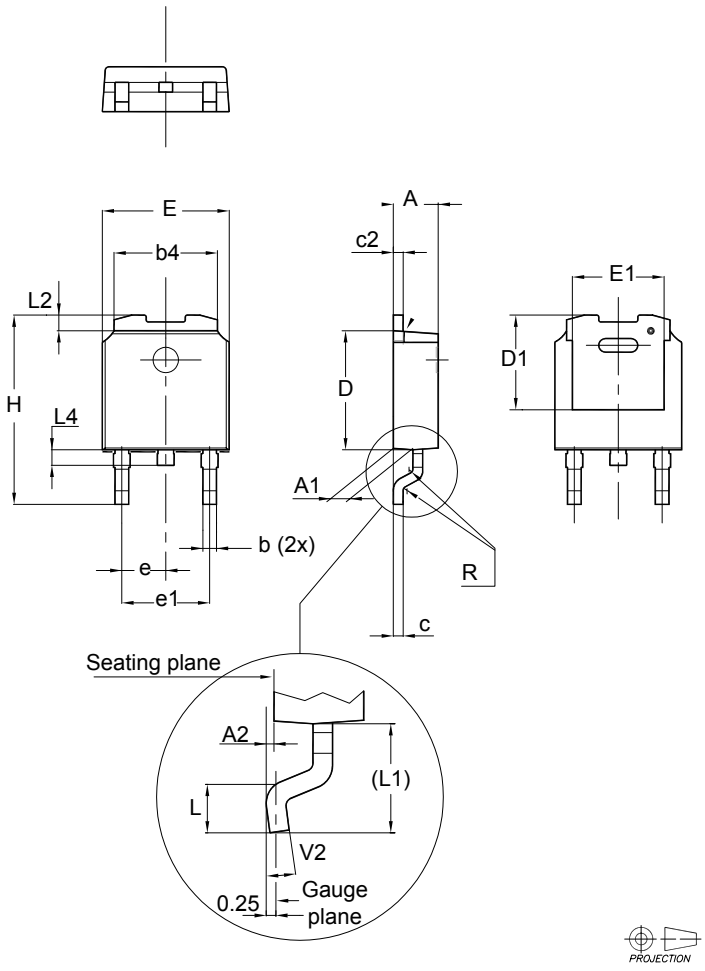
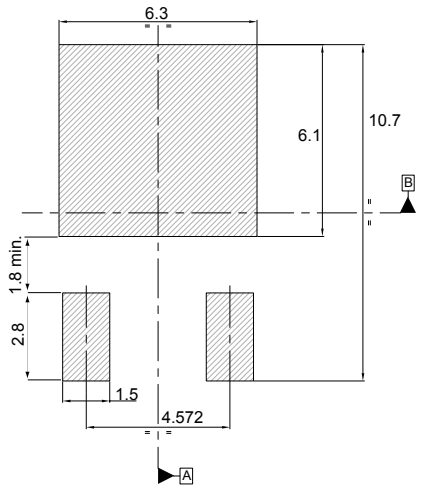


Table 5. DPAK mechanical data

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)



The device must be positioned within ⌖ 0.05 A B

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.