

## 1200 V ultrafast recovery diode

### Features

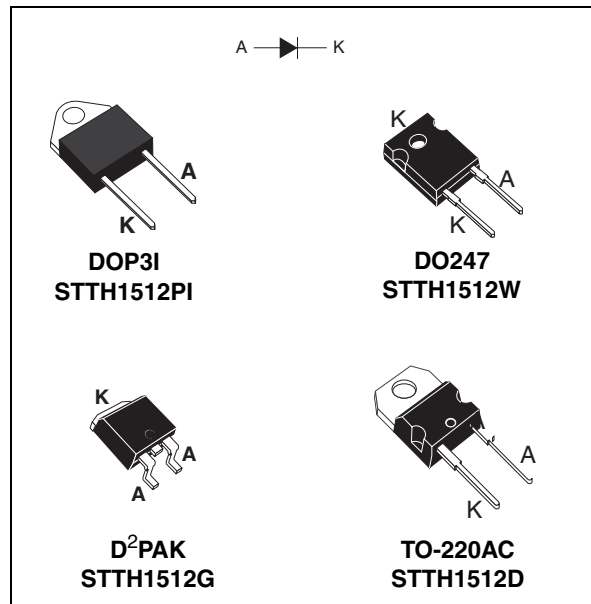
- Ultrafast, soft recovery
- Very low conduction and switching losses
- High frequency and/or high pulsed current operation
- High reverse voltage capability
- High junction temperature
- Insulated package: DOP3I
  - Electrical insulation = 2500 V rms
  - Capacitance = 12 pF

### Description

The high quality design of this diode has produced a device with low leakage current, regularly reproducible characteristics and intrinsic ruggedness. These characteristics make it ideal for heavy duty applications that demand long term reliability.

Such demanding applications include industrial power supplies, motor control, and similar mission-critical systems that require rectification and freewheeling. These diodes also fit into auxiliary functions such as snubber, bootstrap, and demagnetization applications.

The improved performance in low leakage current, and therefore thermal runaway guard band, is an immediate competitive advantage for this device.



**Table 1. Device summary**

Symbol	Value
$I_{F(AV)}$	15 A
$V_{RRM}$	1200 V
$T_j$	175 °C
$V_F$ (typ)	1.20 V
$t_{rr}$ (typ)	53 ns

# 1 Characteristics

**Table 2. Absolute ratings (limiting values at 25 °C, unless otherwise specified)**

Symbol	Parameter		Value	Unit
$V_{RRM}$	Repetitive peak reverse voltage		1200	V
$I_{F(RMS)}$	Forward rms current	TO-220AC / DO247 / DOP3I / D <sup>2</sup> PAK	50	A
$I_{F(AV)}$	Average forward current, $\delta = 0.5$	TO-220AC / D <sup>2</sup> PAK / DO247	15	A
		DOP3I		
$I_{FRM}$	Repetitive peak forward current	$t_p = 5 \mu s, F = 5 \text{ kHz square}$	200	A
$I_{FSM}$	Surge non repetitive forward current	$t_p = 10 \text{ ms Sinusoidal}$	200	A
$T_{stg}$	Storage temperature range		-65 to + 175	°C
$T_j$	Maximum operating junction temperature		175	°C

**Table 3. Thermal parameters**

Symbol	Parameter		Value	Unit
$R_{th(j-c)}$	Junction to case	TO-220AC / D <sup>2</sup> PAK / DO247	1.3	°C/W
		DOP3I	2	°C/W

**Table 4. Static electrical characteristics**

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
$I_R^{(1)}$	Reverse leakage current	$T_j = 25 \text{ °C}$	$V_R = V_{RRM}$			15	$\mu A$
		$T_j = 125 \text{ °C}$			10	100	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25 \text{ °C}$	$I_F = 15 \text{ A}$			2.10	V
		$T_j = 125 \text{ °C}$			1.25	1.90	
		$T_j = 150 \text{ °C}$			1.20	1.80	

1. Pulse test:  $t_p = 5 \text{ ms}, \delta < 2 \%$

2. Pulse test:  $t_p = 380 \mu s, \delta < 2 \%$

To evaluate the conduction losses use the following equation:

$$P = 1.4 \times I_{F(AV)} + 0.027 I_{F(RMS)}^2$$

Table 5. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{rr}$	Reverse recovery time	$I_F = 1 \text{ A}$ , $di_F/dt = -50 \text{ A}/\mu\text{s}$ , $V_R = 30 \text{ V}$ , $T_j = 25 \text{ }^\circ\text{C}$			105	ns
		$I_F = 1 \text{ A}$ , $di_F/dt = -100 \text{ A}/\mu\text{s}$ , $V_R = 30 \text{ V}$ , $T_j = 25 \text{ }^\circ\text{C}$		53	75	
$I_{RM}$	Reverse recovery current	$I_F = 15 \text{ A}$ , $di_F/dt = -200 \text{ A}/\mu\text{s}$ , $V_R = 600 \text{ V}$ , $T_j = 125 \text{ }^\circ\text{C}$		20	28	A
S	Softness factor	$I_F = 15 \text{ A}$ , $di_F/dt = -200 \text{ A}/\mu\text{s}$ , $V_R = 600 \text{ V}$ , $T_j = 125 \text{ }^\circ\text{C}$		1.5		
$t_{fr}$	Forward recovery time	$I_F = 15 \text{ A}$ $di_F/dt = 50 \text{ A}/\mu\text{s}$ $V_{FR} = 1.5 \times V_{Fmax}$ , $T_j = 25 \text{ }^\circ\text{C}$			600	ns
$V_{FP}$	Forward recovery voltage	$I_F = 15 \text{ A}$ , $di_F/dt = 50 \text{ A}/\mu\text{s}$ , $T_j = 25 \text{ }^\circ\text{C}$		5.5		V

Figure 1. Conduction losses versus average current

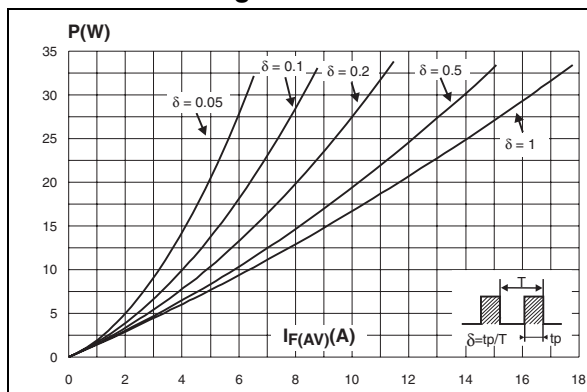


Figure 2. Forward voltage drop versus forward current

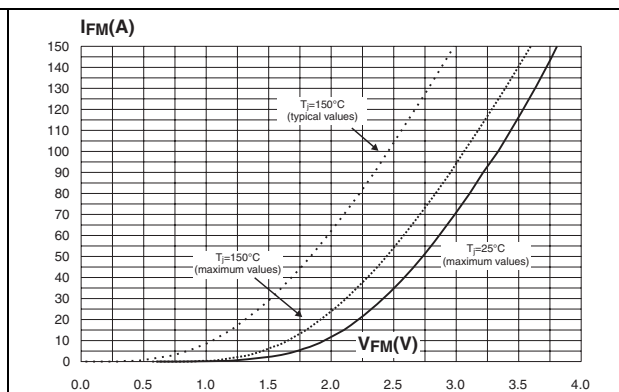


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

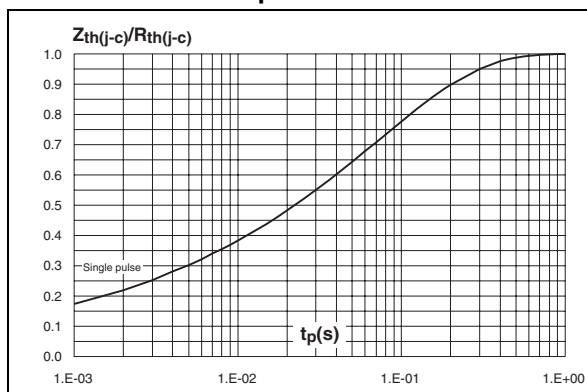
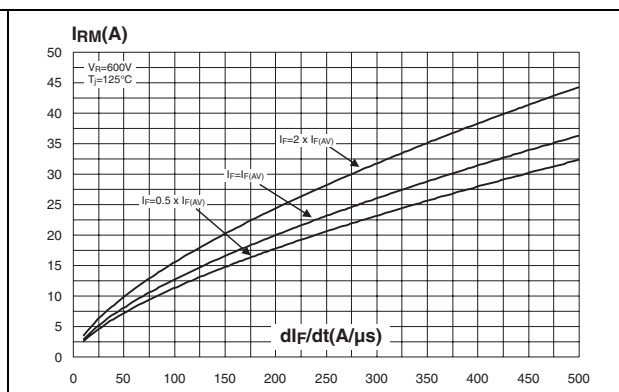
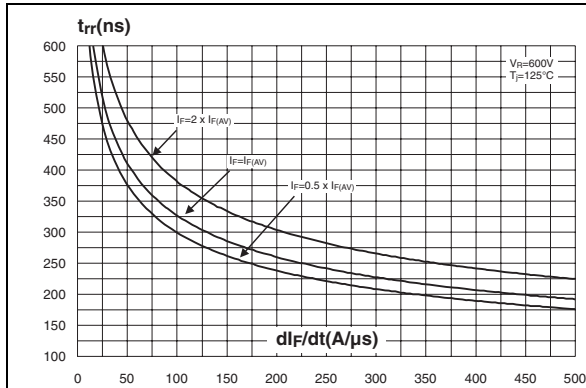


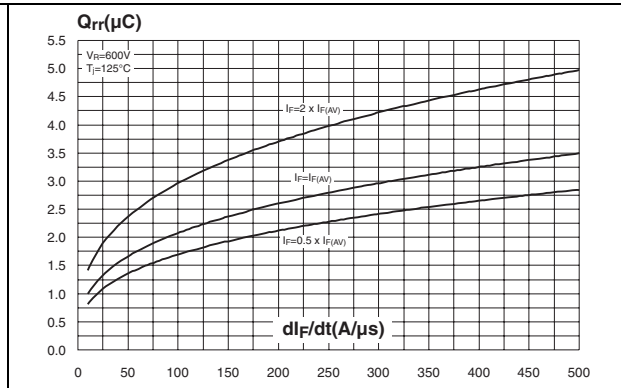
Figure 4. Peak reverse recovery current versus di\_F/dt (typical values)



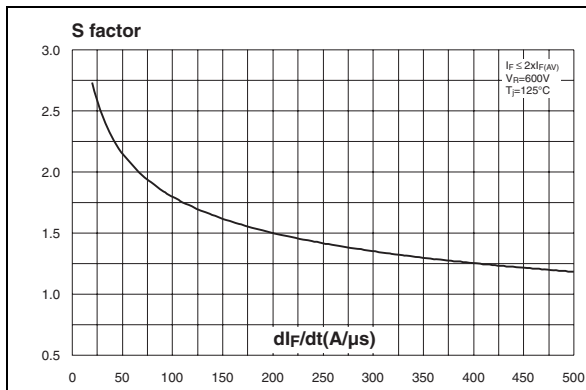
**Figure 5. Reverse recovery time versus  $di_F/dt$  (typical values)**



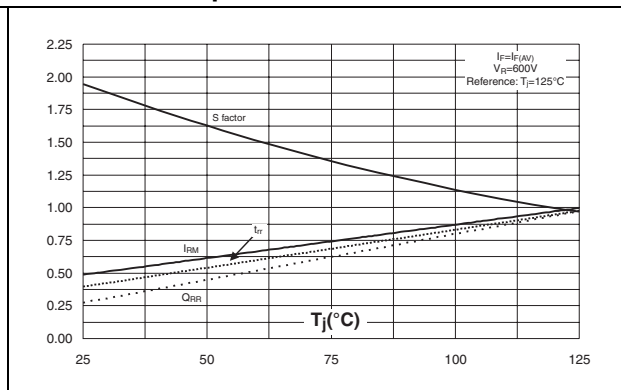
**Figure 6. Reverse recovery charges versus  $di_F/dt$  (typical values)**



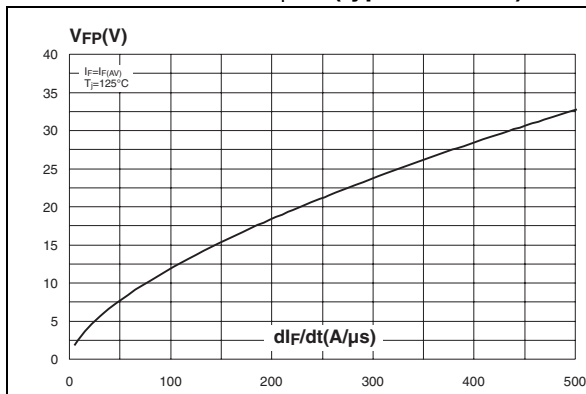
**Figure 7. Softness factor versus  $di_F/dt$  (typical values)**



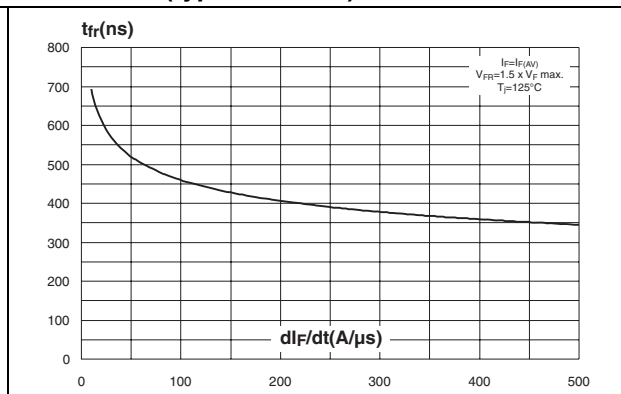
**Figure 8. Relative variations of dynamic parameters versus junction temperature**



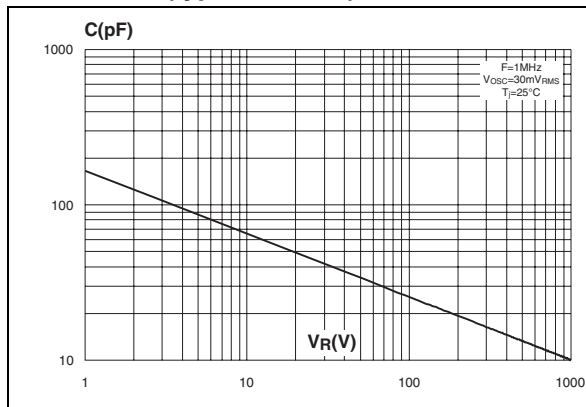
**Figure 9. Transient peak forward voltage versus  $di_F/dt$  (typical values)**



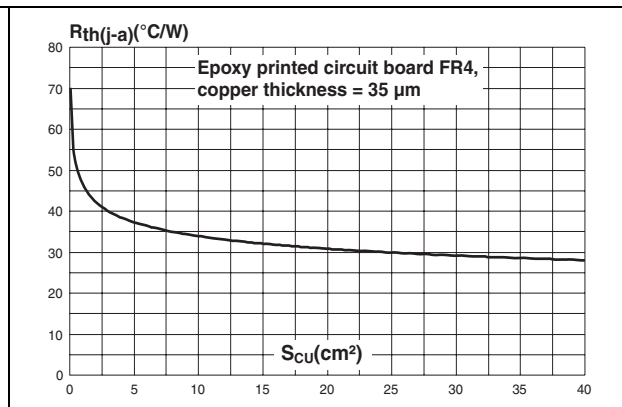
**Figure 10. Forward recovery time versus  $di_F/dt$  (typical values)**



**Figure 11. Junction capacitance versus reverse voltage applied (typical values)**



**Figure 12. Thermal resistance junction to ambient versus copper surface under each lead**



## 2 Package information

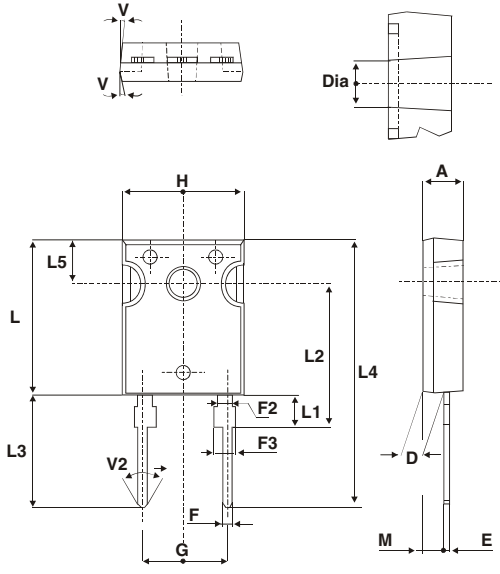
- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.4 to 0.6 N·m (TO-220AC)
- Recommended torque value: 0.80 N·m (DOP3I)
- Maximum torque value: 1.0 N·m (DOP3I)

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](http://www.st.com). ECOPACK® is an ST trademark.

**Table 6. DOP3 dimensions**

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
b	1.20	1.40	0.047	0.055
c	1.45	1.55	0.057	0.061
c1	0.50	0.70	0.020	0.028
D	12.15	13.10	0.474	0.516
E	15.10	15.50	0.594	0.610
E1	7.55	7.75	0.297	0.305
e	10.80	11.30	0.425	0.445
G	20.4	21.10	0.815	0.831
L	14.35	15.60	0.565	0.614
P	4.08	4.17	0.161	0.164
Q	2.70	2.90	0.106	0.114
R	4.60 typ.		0.181 typ.	
Y	15.80	16.50	0.622	0.650

Table 7. DO247 dimensions



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.85		5.15	0.191		0.203
D	2.20		2.60	0.086		0.102
E	0.40		0.80	0.015		0.031
F	1.00		1.40	0.039		0.055
F2		2.00			0.078	
F3	2.00		2.40	0.078		0.094
G		10.90			0.429	
H	15.45		15.75	0.608		0.620
L	19.85		20.15	0.781		0.793
L1	3.70		4.30	0.145		0.169
L2		18.50			0.728	
L3	14.20		14.80	0.559		0.582
L4		34.60			1.362	
L5		5.50			0.216	
M	2.00		3.00	0.078		0.118
V		5°			5°	
V2		60°			60°	
Dia.	3.55		3.65	0.139		0.143

Table 8. D<sup>2</sup>PAK dimensions

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
A1	2.49	2.69	0.098	0.106
A2	0.03	0.23	0.001	0.009
B	0.70	0.93	0.027	0.037
B2	1.14	1.70	0.045	0.067
C	0.45	0.60	0.017	0.024
C2	1.23	1.36	0.048	0.054
D	8.95	9.35	0.352	0.368
E	10.00	10.40	0.393	0.409
G	4.88	5.28	0.192	0.208
L	15.00	15.85	0.590	0.624
L2	1.27	1.40	0.050	0.055
L3	1.40	1.75	0.055	0.069
M	2.40	3.20	0.094	0.126
R	0.40 typ.		0.016 typ.	
V2	0°	8°	0°	8°

Figure 13. Footprint (dimensions in mm)

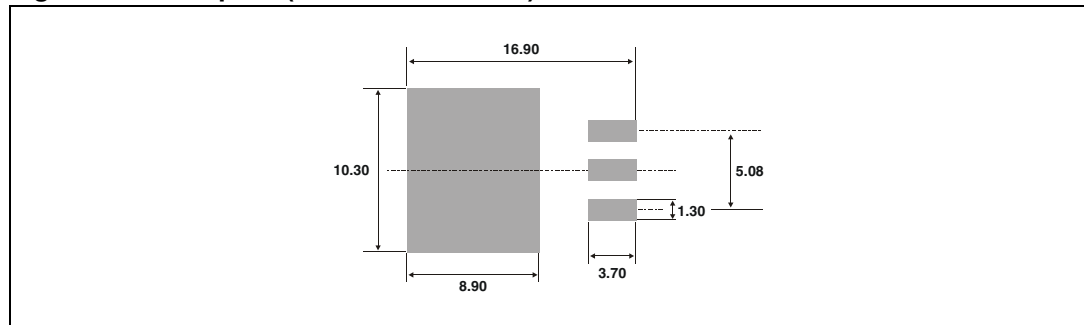
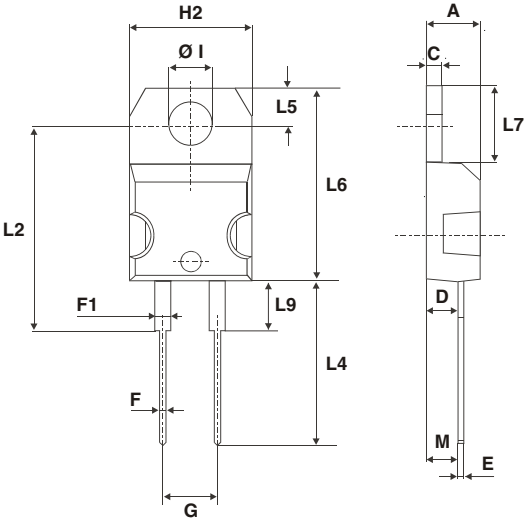




Table 9. TO-220AC dimensions



The technical drawing shows a TO-220AC package with the following dimensions labeled:

- A:** Total height of the package.
- C:** Height of the top flange.
- D:** Height of the main body.
- L7:** Height of the top flange to the top of the main body.
- L5:** Height of the top flange to the top of the lead.
- L6:** Height of the main body to the top of the lead.
- L2:** Total height of the lead.
- L4:** Height of the lead to the bottom of the lead.
- L9:** Height of the lead to the top of the lead.
- F1:** Width of the lead.
- F:** Width of the lead.
- G:** Width of the lead.
- H2:** Width of the top flange.
- Ø I:** Diameter of the top flange.
- M:** Width of the lead.
- E:** Width of the lead.

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
C	1.23	1.32	0.048	0.051
D	2.40	2.72	0.094	0.107
E	0.49	0.70	0.019	0.027
F	0.61	0.88	0.024	0.034
F1	1.14	1.70	0.044	0.066
G	4.95	5.15	0.194	0.202
H2	10.00	10.40	0.393	0.409
L2	16.40 typ.		0.645 typ.	
L4	13.00	14.00	0.511	0.551
L5	2.65	2.95	0.104	0.116
L6	15.25	15.75	0.600	0.620
L7	6.20	6.60	0.244	0.259
L9	3.50	3.93	0.137	0.154
M	2.6 typ.		0.102 typ.	
Diam. I	3.75	3.85	0.147	0.151

### 3 Ordering information

**Table 10. Ordering information**

Order code	Marking	Package	Weight	Base qty	Delivery mode
STTH1512D	STTH1512D	TO-220AC	1.86g	50	Tube
STTH1512PI	STTH1512PI	DOP3I	4.46 g	30	Tube
STTH1512W	STTH1512W	DO-247	4.4 g	30	Tube
STTH1512G	STTH1512G	D <sup>2</sup> PAK	1.48 g	50	Tube
STTH1512G-TR	STTH1512G	D <sup>2</sup> PAK	1.48 g	1000	Tape and reel

### 4 Revision history

**Table 11. Document revision history**

Date	Revision	Changes
02-Mar-2006	1	Initial release.
19-Apr-2010	2	Updated $I_{FSM}$ in <a href="#">Table 2</a> from 150 A to 200 A. Updated ECOPACK statement.

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