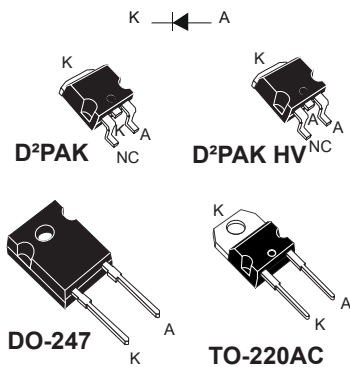


## Turbo 2 ultrafast high voltage rectifier



### Features

- High junction temperature capability
- Ultrafast with soft recovery behavior
- Low reverse current
- Low thermal resistance
- Reduce switching and conduction losses
- D<sup>2</sup>PAK HV creepage distance (anode to cathode) = 5.38 mm min. (with top coating)
- **ECOPACK<sup>®2</sup>** compliant (DO-247, TO-220AC)

### Applications

- Output rectification
- PFC
- UPS
- Air conditioning
- Charging station

### Description

The **STTH15RQ06** has been developed to be used in application requiring a high-voltage secondary rectification for LLC Full Bridge topology.

It is also suited for use in switching power supplies, industrial applications, as rectification, freewheeling and clamping diode.

#### Product status link

[STTH15RQ06](#)

#### Product summary

<b>I<sub>F(AV)</sub></b>	15 A
<b>V<sub>RRM</sub></b>	600 V
<b>V<sub>F</sub> (max.)</b>	1.45 V
<b>t<sub>rr</sub> (max.)</b>	25 ns
<b>T<sub>j</sub> (max.)</b>	175 °C

# 1 Characteristics

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

Symbol	Parameter	Value	Unit
$V_{RRM}$	Repetitive peak reverse voltage	600	V
$I_{F(RMS)}$	Forward rms current	50	A
$I_{F(AV)}$	Average forward current $\delta = 0.5$ , square wave	$T_C = 115\text{ °C}$ 15	A
$I_{FSM}$	Surge non repetitive forward current	$t_p = 10\text{ ms}$ sinusoidal 120	A
$T_{stg}$	Storage temperature range	-65 to +175	°C
$T_j$	Maximum operating junction temperature	175	°C

**Table 2. Thermal parameters**

Symbol	Parameter	Max. value	Unit
$R_{th(j-c)}$	Junction to case	1.5	°C/W

**Table 3. Static electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_R^{(1)}$	Reverse leakage current	$T_j = 25\text{ °C}$	$V_R = V_{RRM}$	-	20	$\mu\text{A}$
		$T_j = 150\text{ °C}$		-	40	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25\text{ °C}$	$I_F = 7.5\text{ A}$	-	2.45	V
		$T_j = 150\text{ °C}$		-	1.15	
		$T_j = 25\text{ °C}$	$I_F = 15\text{ A}$	-	2.95	
		$T_j = 150\text{ °C}$		-	1.45	

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

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

To evaluate the conduction losses, use the following equation:

$$P = 1.05 \times I_{F(AV)} + 0.053 \times I_F^2 (RMS)$$

**Table 4. Dynamic electrical characteristics**

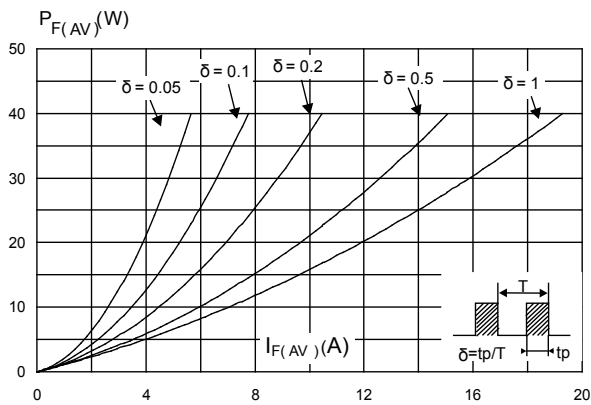
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
$t_{rr}$	Reverse recovery time	$T_j = 25\text{ °C}$	$I_F = 0.5\text{ A}$ , $I_R = 1\text{ A}$ , $I_{rr} = 0.25\text{ A}$ $I_F = 1\text{ A}$ , $V_R = 30\text{ V}$ , $dI_F/dt = -50\text{ A}/\mu\text{s}$	-	25	ns	
		-		35	50		
$I_{RM}$	Reverse recovery current	$T_j = 125\text{ °C}$	$I_F = 15\text{ A}$ , $V_R = 400\text{ V}$ , $dI_F/dt = -200\text{ A}/\mu\text{s}$	-	6	8	A
$Q_{RR}$	Reverse recovery charge			-	250	nC	
$t_{rr}$	Reverse recovery time			-	70	ns	

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

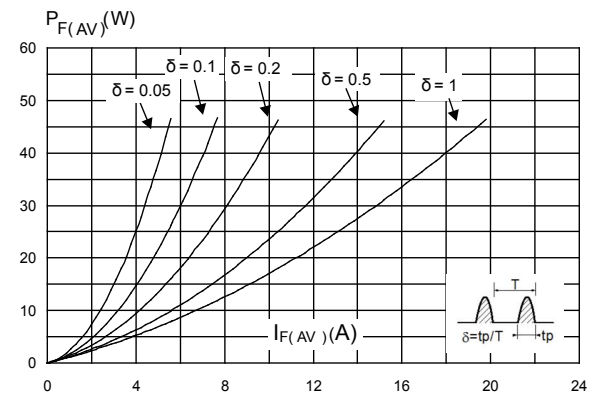
- AN604: Calculation of conduction losses in a power rectifier
- AN4021: Calculation of reverse losses in a power diode

## 1.1 Characteristics (curves)

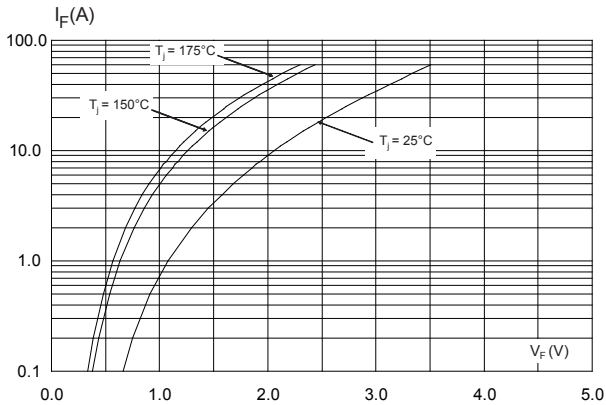
**Figure 1. Average forward power dissipation versus average forward current (square waveform)**



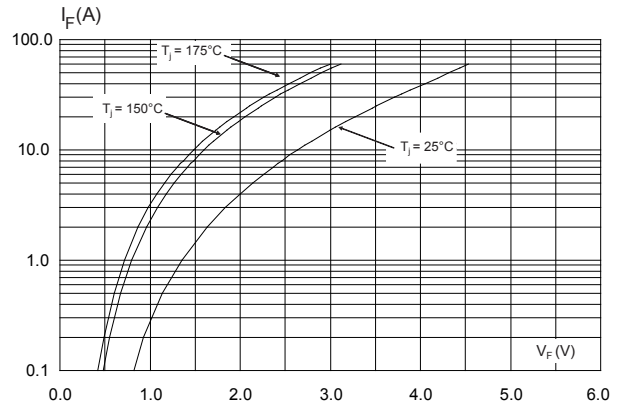
**Figure 2. Average forward power dissipation versus average forward current (sinusoidal waveform)**



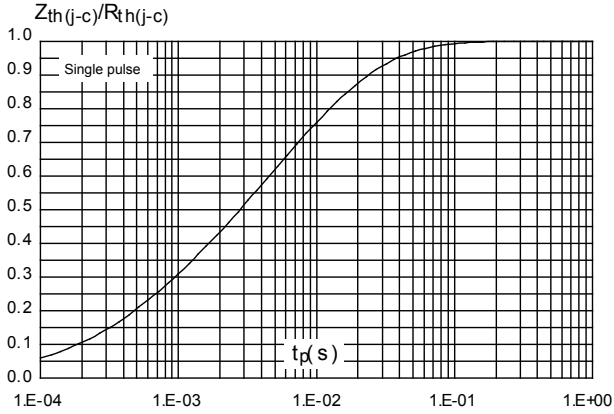
**Figure 3. Forward voltage drop versus forward current (typical values)**



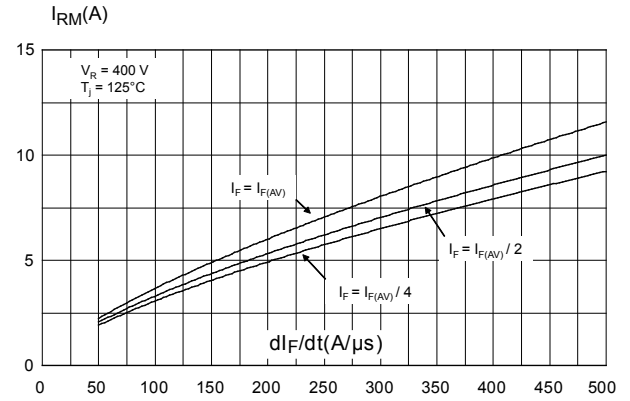
**Figure 4. Forward voltage drop versus forward current (maximum values)**



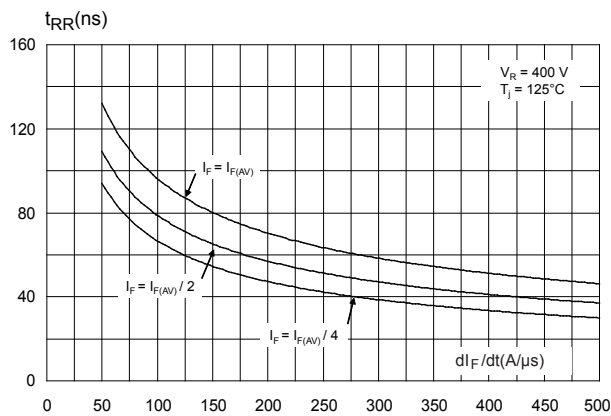
**Figure 5. Relative variation of thermal impedance junction to case versus pulse duration**



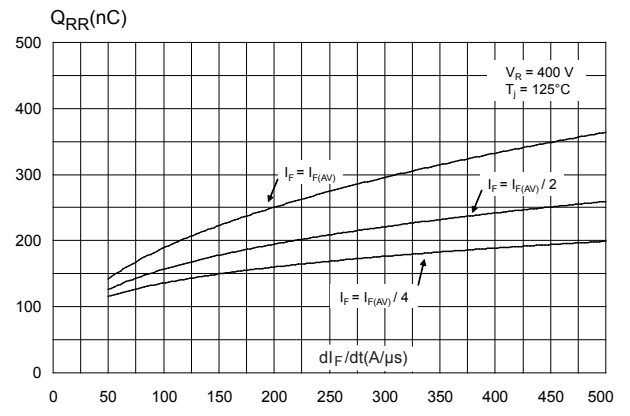
**Figure 6. Peak reverse recovery current versus  $di_F/dt$  (typical values)**



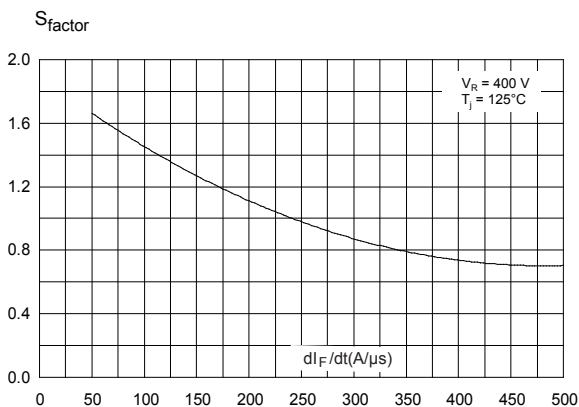
**Figure 7. Reverse recovery time versus  $di_F/dt$  (typical values)**



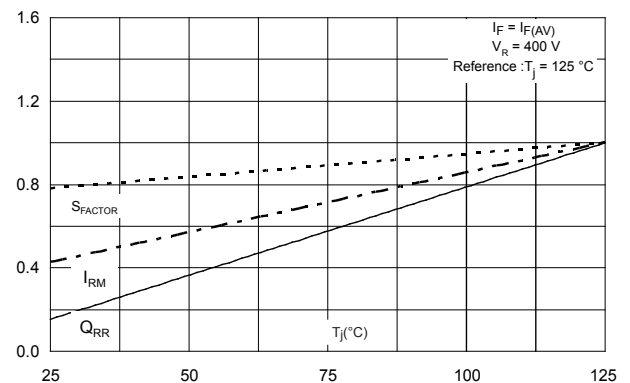
**Figure 8. Reverse recovery charges versus  $di_F/dt$  (typical values)**



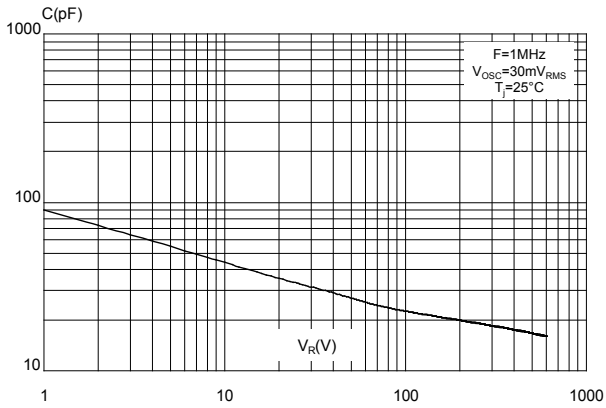
**Figure 9. Reverse recovery softness factor versus  $di_F/dt$  (typical values)**



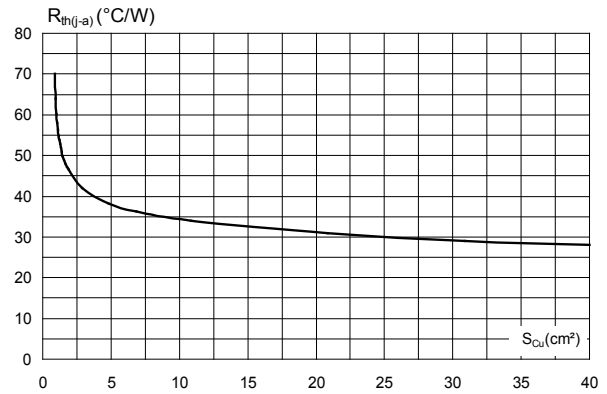
**Figure 10. Relative variations of dynamic parameters versus junction temperature**



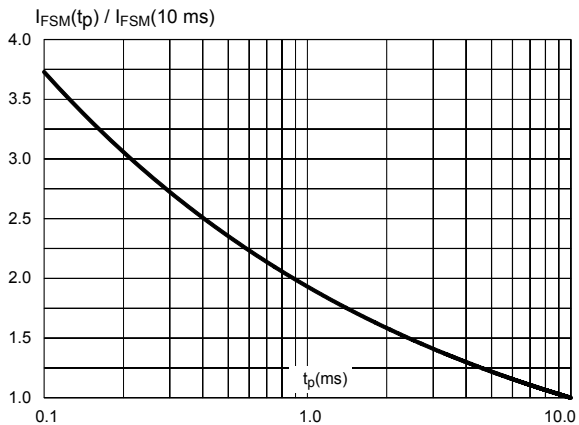
**Figure 11. Junction capacitance versus reverse voltage applied (typical values)**



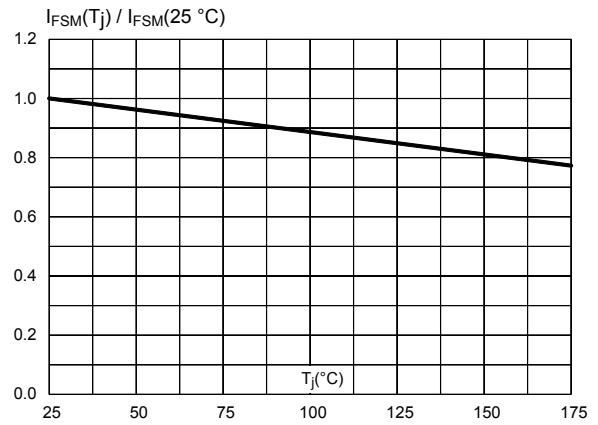
**Figure 12. Thermal resistance junction to ambient versus copper surface under tab (typical values, epoxy printed board FR4,  $\epsilon_{\text{Cu}} = 35 \mu\text{m}$ ) (D<sup>2</sup>PAK and D<sup>2</sup>PAK HV)**



**Figure 13. Relative variation of non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)**



**Figure 14. Relative variation of non-repetitive peak surge forward current versus initial junction temperature (sinusoidal waveform)**



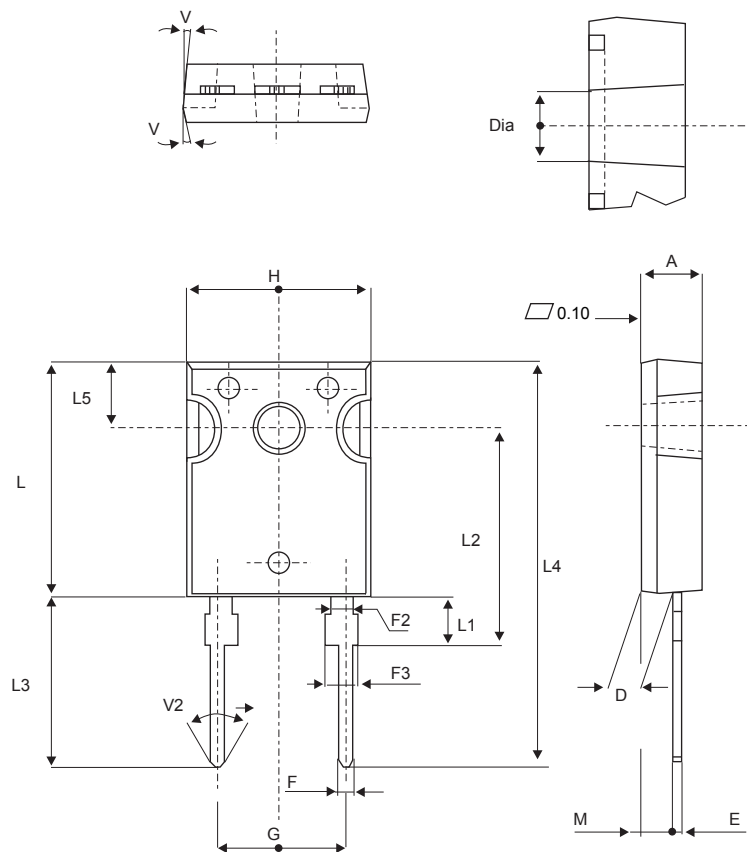
## 2 Package information

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

### 2.1 DO-247 package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.8 N·m (DO-247)
- Maximum torque value: 1.0 N·m (DO-247)

**Figure 15. DO-247 package outline**



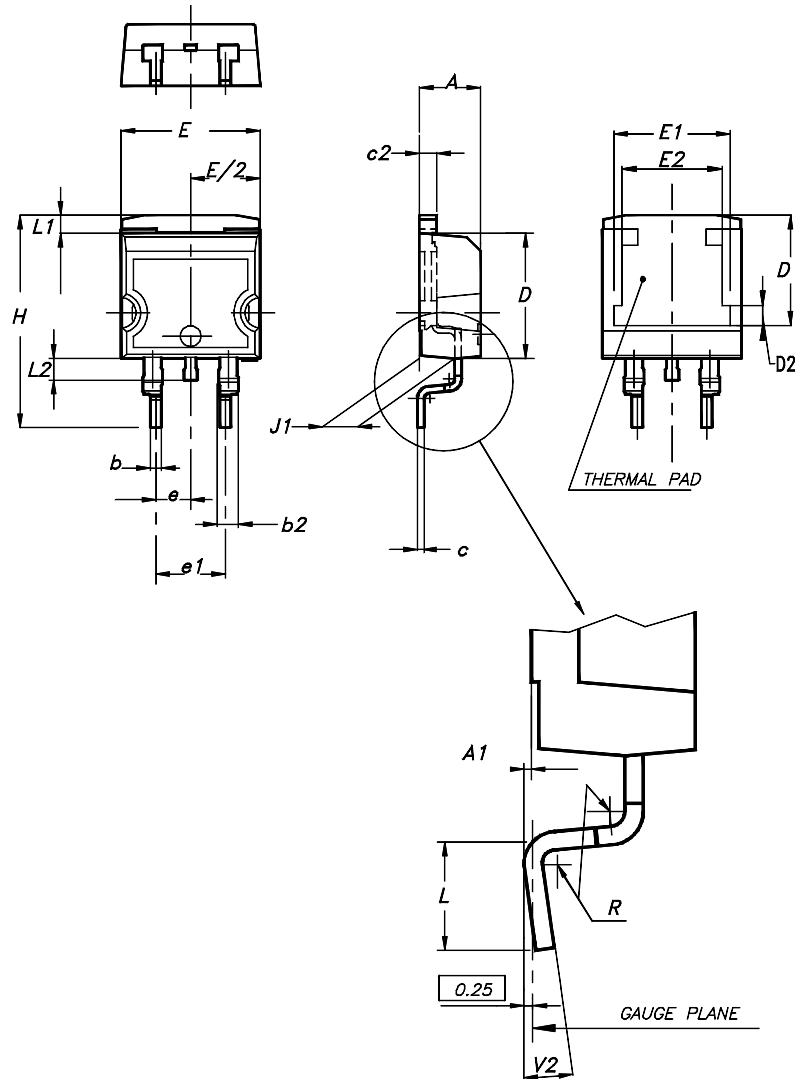
**Table 5. DO-247 package mechanical data**

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	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 typ.		0.078 typ.	
F3	2.00	2.40	0.078	0.094
G	10.90 typ.		0.429 typ.	
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 typ.		0.728 typ.	
L3	14.20	14.80	0.559	0.582
L4	34.60 typ.		1.362 typ.	
L5	5.50 typ.		0.216 typ.	
M	2.00	3.00	0.078	0.118
V	5°		5°	
V2	60°		60°	
Dia.	3.55	3.65	0.139	0.143

## 2.2 D<sup>2</sup>PAK package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)

Figure 16. D<sup>2</sup>PAK package outline



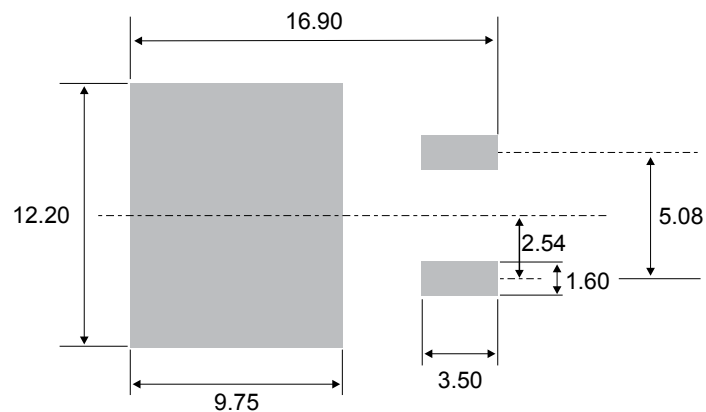
Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.



**Table 6. D<sup>2</sup>PAK package mechanical data**

Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	Min.	Max.	Min.	Max.
A	4.36	4.60	0.172	0.181
A1	0.00	0.25	0.000	0.010
b	0.70	0.93	0.028	0.037
b2	1.14	1.70	0.045	0.067
c	0.38	0.69	0.015	0.027
c2	1.19	1.36	0.047	0.053
D	8.60	9.35	0.339	0.368
D1	6.90	8.00	0.272	0.311
D2	1.10	1.50	0.043	0.060
E	10.00	10.55	0.394	0.415
E1	8.10	8.90	0.319	0.346
E2	6.85	7.25	0.266	0.282
e	2.54 typ.		0.100	
e1	4.88	5.28	0.190	0.205
H	15.00	15.85	0.591	0.624
J1	2.49	2.90	0.097	0.112
L	1.90	2.79	0.075	0.110
L1	1.27	1.65	0.049	0.065
L2	1.30	1.78	0.050	0.070
R	0.4 typ.		0.015	
V2	0°	8°	0°	8°

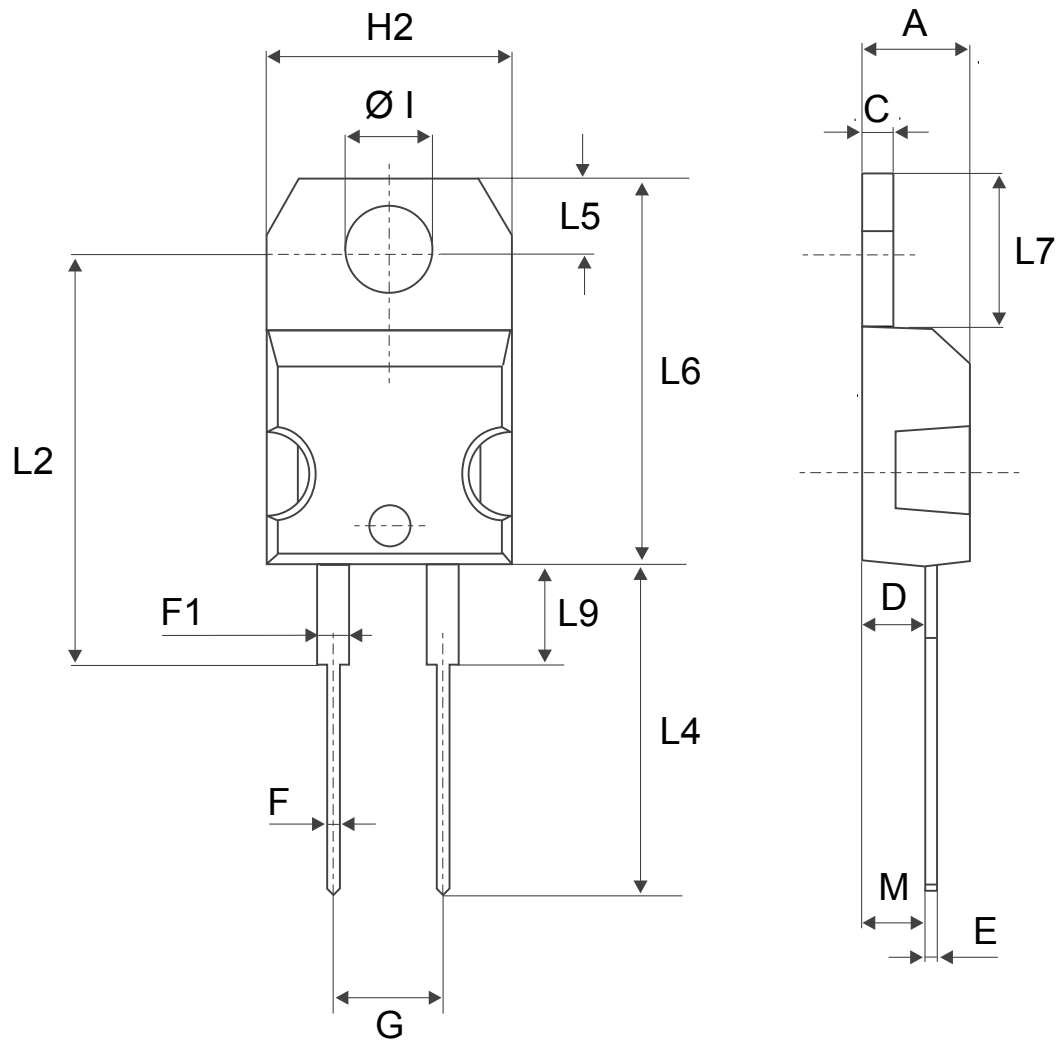
**Figure 17. D<sup>2</sup>PAK recommended footprint (dimensions in mm)**



### 2.3 TO-220AC package information

- Epoxy meets UL 94,V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.70 N·m

Figure 18. TO-220AC package outline

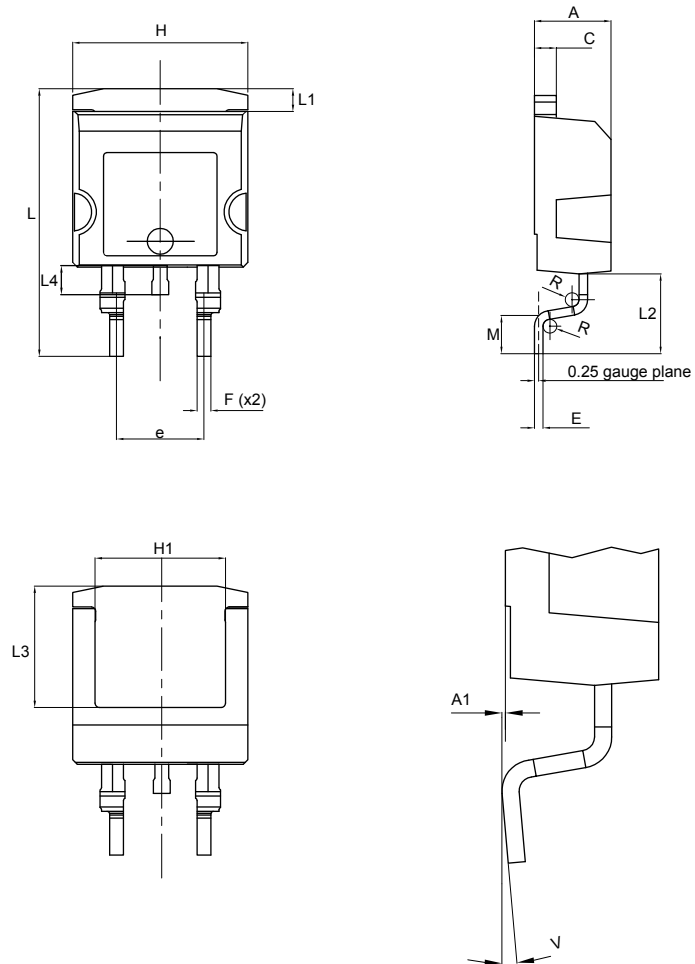


**Table 7. TO-220AC package mechanical data**

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.	
ØI	3.75	3.85	0.147	0.151

## 2.4 D<sup>2</sup>PAK HV package information

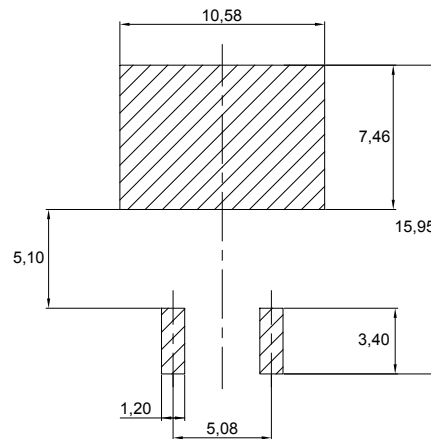
**Figure 19. D<sup>2</sup>PAK high voltage package outline**



**Table 8. D<sup>2</sup>PAK high voltage package mechanical data**

Ref.	Dimensions		
	Min.	Typ.	Max.
A	4.30		4.70
A1	0.03		0.20
C	1.17		1.37
e	4.98		5.18
E	0.50		0.90
F	0.78		0.85
H	10.00		10.40
H1	7.40		7.80
L	15.30		15.80
L1	1.27		1.40
L2	4.93		5.23
L3	6.85		7.25
L4	1.5		1.7
M	2.6		2.9
R	0.20		0.60
V	0°		8°

**Figure 20. D<sup>2</sup>PAK High Voltage footprint in mm**



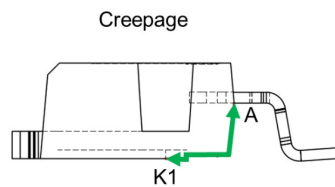
### 2.4.1 Creepage distance between anode and cathode

**Table 9. Creepage distance between anode and cathode**

Symbol	Parameter		Value	Unit
Cd <sub>A-K1</sub>	Minimum creepage distance between A and K1 (with top coating)	D <sup>2</sup> PAK HV	5.38	mm
Cd <sub>A-K2</sub>	Minimum creepage distance between A and K2 (without top coating)		3.48	

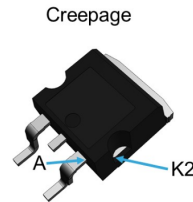
*Note:* D<sup>2</sup>PAK HV creepage distance (anode to cathode) = 5.38 mm min. (refer to IEC 60664-1)

**Figure 21. Creepage with top coating**



Minimum distance between A & K1 = 5.38 mm (with top coating)

**Figure 22. Creepage without top coating**



Minimum distance between A & K2 = 3.48 mm (without top coating)

### 3 Ordering information

**Table 10. Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STTH15RQ06G-TR	STTH15RQ06G	D <sup>2</sup> PAK	1.48 g	1000	Tape and reel
STTH15RQ06D	STTH15RQ06D	TO-220AC	1.86 g	50	Tube
STTH15RQ06W	STTH15RQ06W	DO-247	4.40 g	30	Tube
STTH15RQ06G2-TR	TH15RQ06G2	D <sup>2</sup> PAK HV	1.48 g	1000	Tape and reel

## Revision history

**Table 11. Document revision history**

Date	Revision	Changes
12-Jun-2017	1	Initial release.
22-Nov-2018	2	Added D <sup>2</sup> PAK HV package.



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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

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