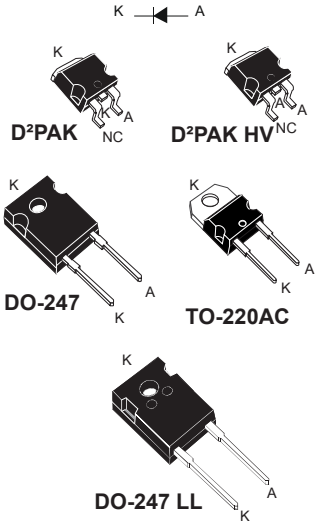
STTH30RQ06

Datasheet

600 V, 30 A 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
- D²PAK HV creepage distance (anode to cathode) = 5.38 mm min. (with top coating)
- ECOPACK2 compliant (DO-247, TO-220AC, DO-247 LL)

Applications

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

Description

The STTH30RQ06 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
STTH30RQ06

Product summary	
$I_{F(AV)}$	30 A
V_{RRM}	600 V
V_F (typ.)	1.45 V
t_{rr} (max.)	30 ns
T_j	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	T_C = 103 °C, δ = 0.5 square		30	A
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal	D²PAK, D²PAK HV	180	A
			TO-220AC, DO-247, DO-247 LL	200	
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	0.70	°C/W
$R_{th(j-c)}$	Junction to case DO-247 LL	0.90	°C/W

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

- AN5088: Rectifiers thermal management, handling and mounting recommendation

Table 3. Static electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_R (1)	Reverse leakage current	T_j = 25 °C	$V_R = V_{RRM}$	-		40	µA
		T_j = 150 °C		-	80	800	
V_F (2)	Forward voltage drop	T_j = 25 °C	I_F = 15 A	-		2.45	V
		T_j = 150 °C		-	1.15	1.45	
		T_j = 25 °C	I_F = 30 A	-		2.95	
		T_j = 150 °C		-	1.45	1.85	

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:

$P = 1.05 \times I_{F(AV)} + 0.026 \times I_{F}{}^{2}{}_{(RMS)}$

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

- AN604: Calculation of conduction losses in a power rectifier
- AN4021: Calculation of reverse losses on a power diode
- 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_R = 1 A, I_{rr} = 0.25 A	-		30	ns
			I_F = 1 A, V_R = 30 V, dI_F/dt = -50 A/µs	-	40	55	
I_{RM}	Reverse recovery current	T_j = 125 °C	I_F = 30 A, V_R = 400 V, dI_F/dt = -200 A/µs	-	8	11	A
Q_{RR}	Reverse recovery charge			-	485		nC
t_{rr}	Reverse recovery time			-	95		ns

1.1 Characteristics (curves)

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

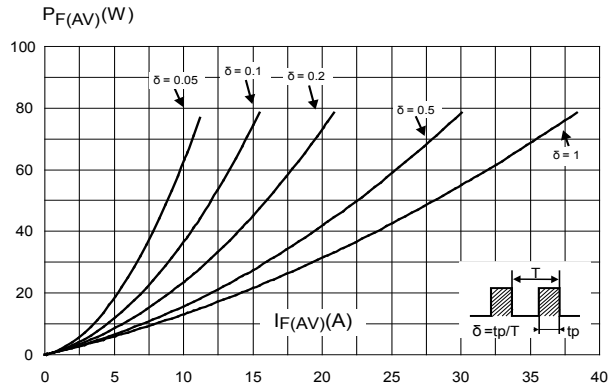


Figure 2. Average forward power dissipation versus average forward current (sinusoidal waveform)

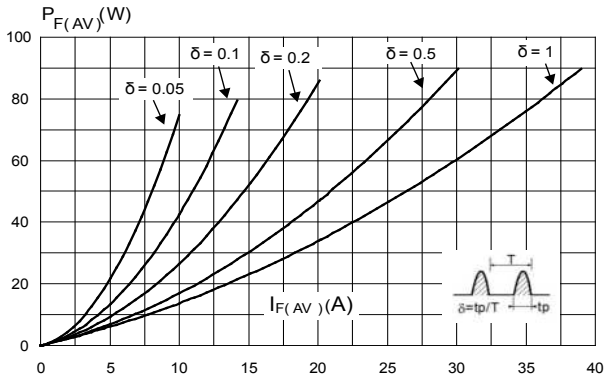


Figure 3. Average forward power dissipation versus average forward current (square waveform, DO-247 LL)

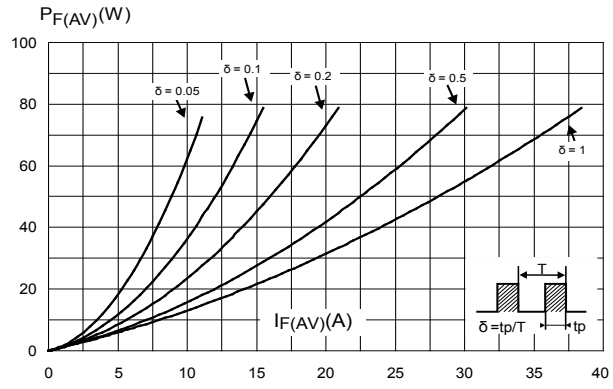


Figure 4. Average forward power dissipation versus average forward current (sinusoidal waveform, DO-247 LL)

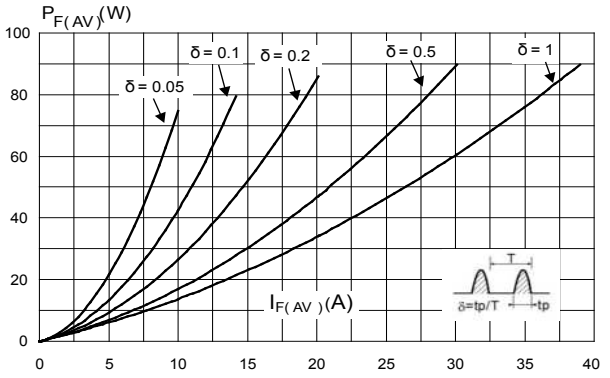


Figure 5. Forward voltage drop versus forward current (typical values)

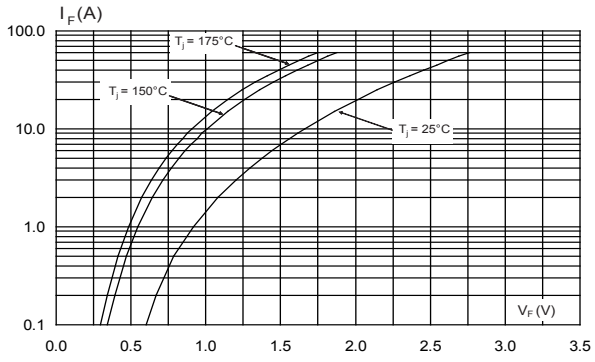


Figure 6. Forward voltage drop versus forward current (maximum values)

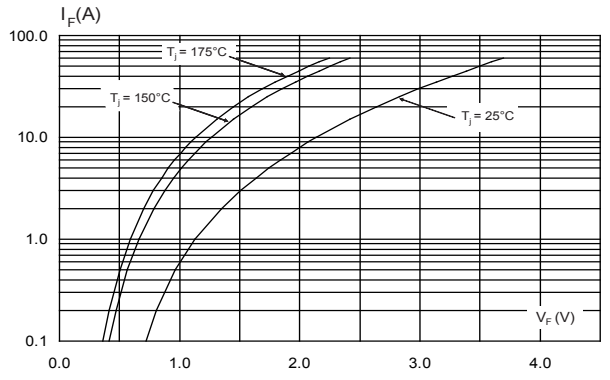


Figure 7. Relative variation of thermal impedance junction to case versus pulse duration

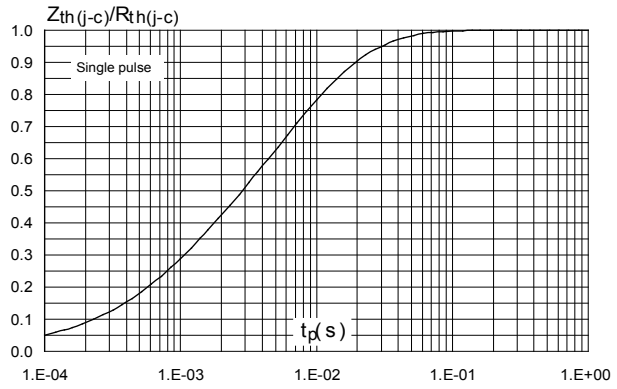


Figure 8. Peak reverse recovery current versus dI_F/dt (typical values)

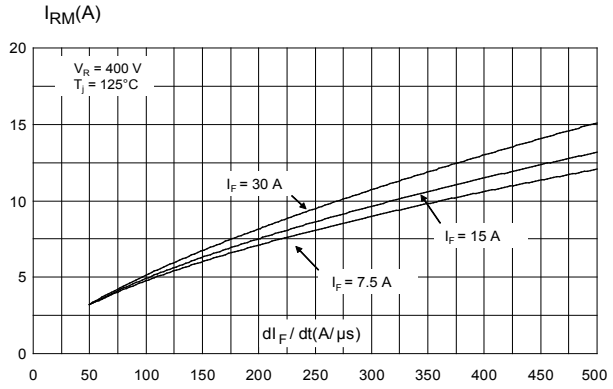


Figure 9. Reverse recovery time versus dI_F/dt (typical values)

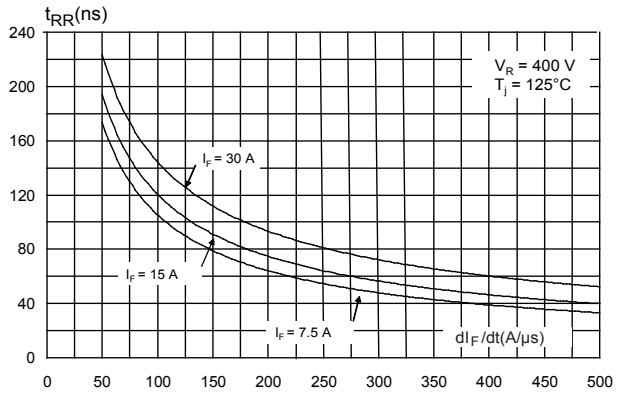


Figure 10. Reverse recovery charges versus dI_F/dt (typical values)

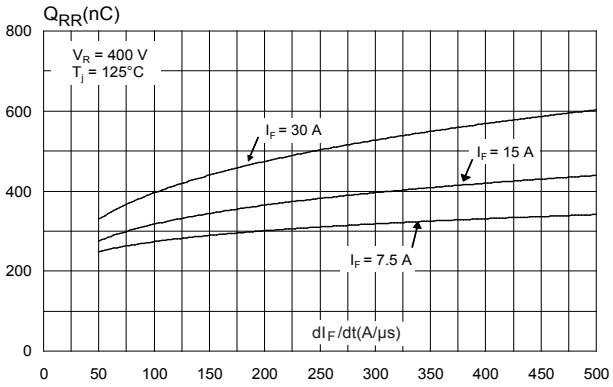


Figure 11. Reverse recovery softness factor versus dI_F/dt (typical values)

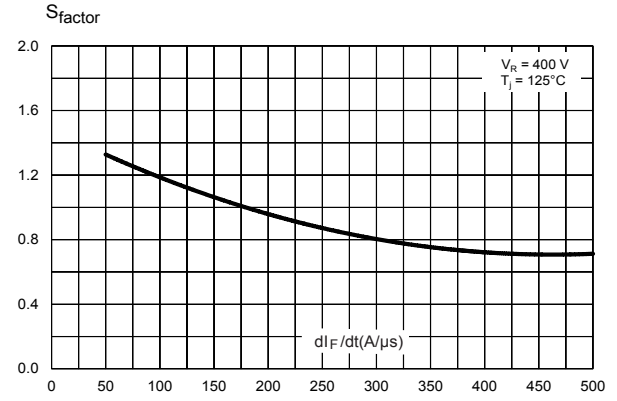


Figure 12. Relative variations of dynamic parameters versus junction temperature

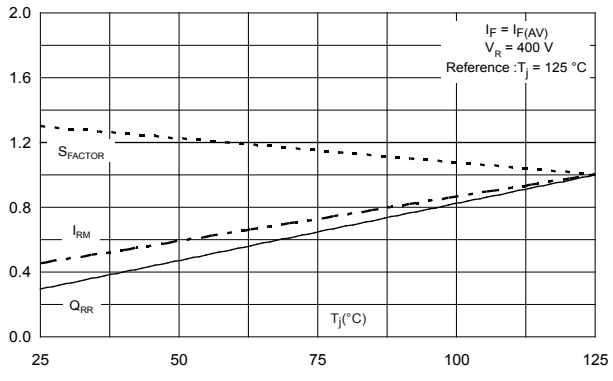


Figure 13. Junction capacitance versus reverse voltage applied (typical values)

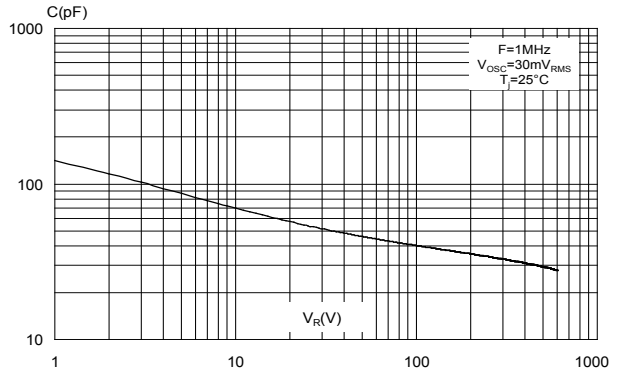


Figure 14. Thermal resistance junction to ambient versus copper surface under tab (typical values, epoxy printed board FR4, e_{Cu} = 35 µm)(D²PAK and D²PAK HV)

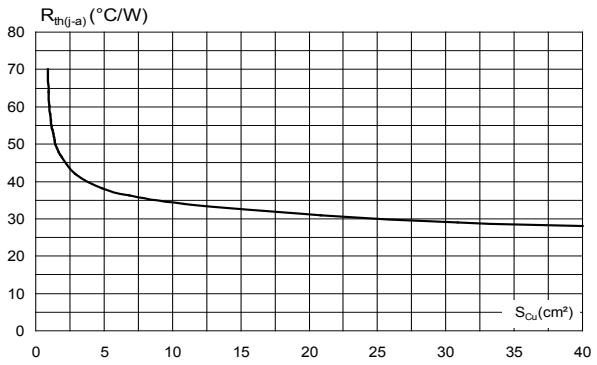


Figure 15. Relative variation of non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

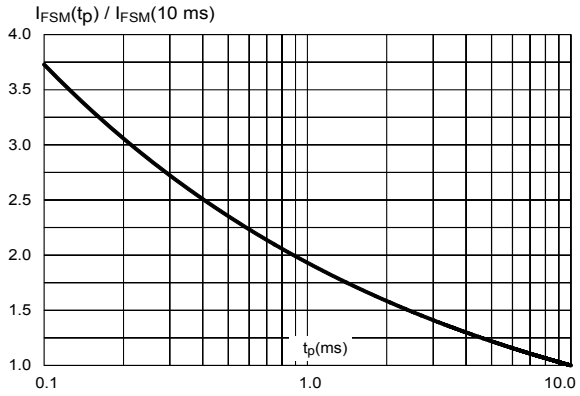
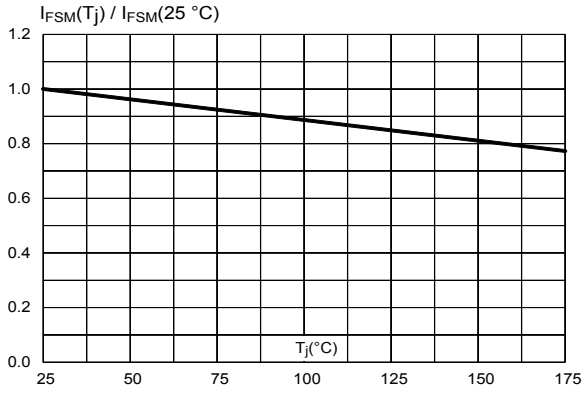


Figure 16. Relative variation of non-repetitive peak surge forward current versus initial junction temperature (sinusoidal waveform)



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. 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 17. DO-247 package outline

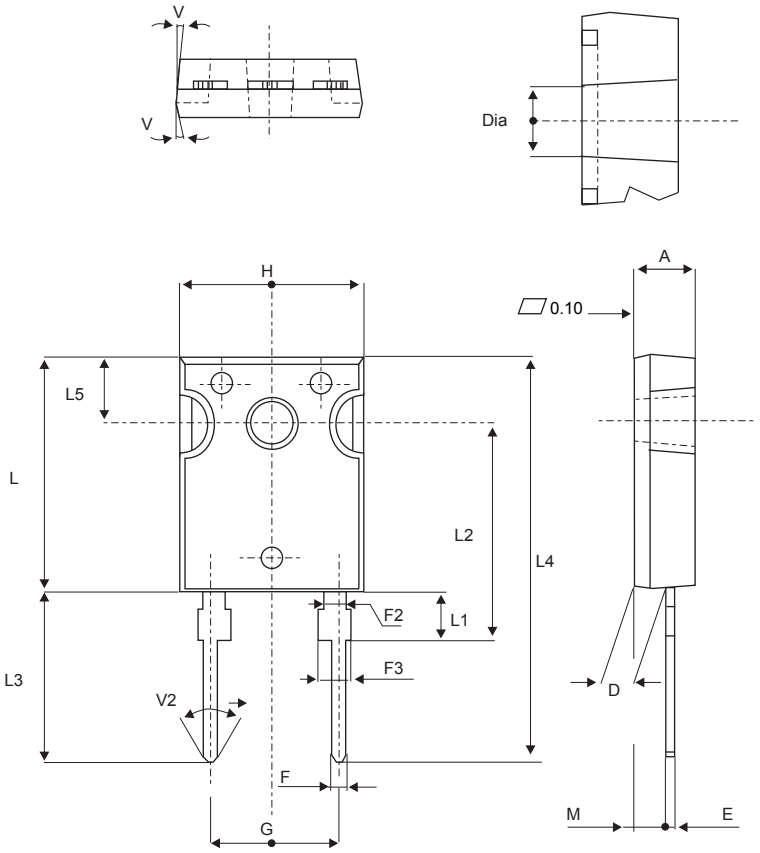


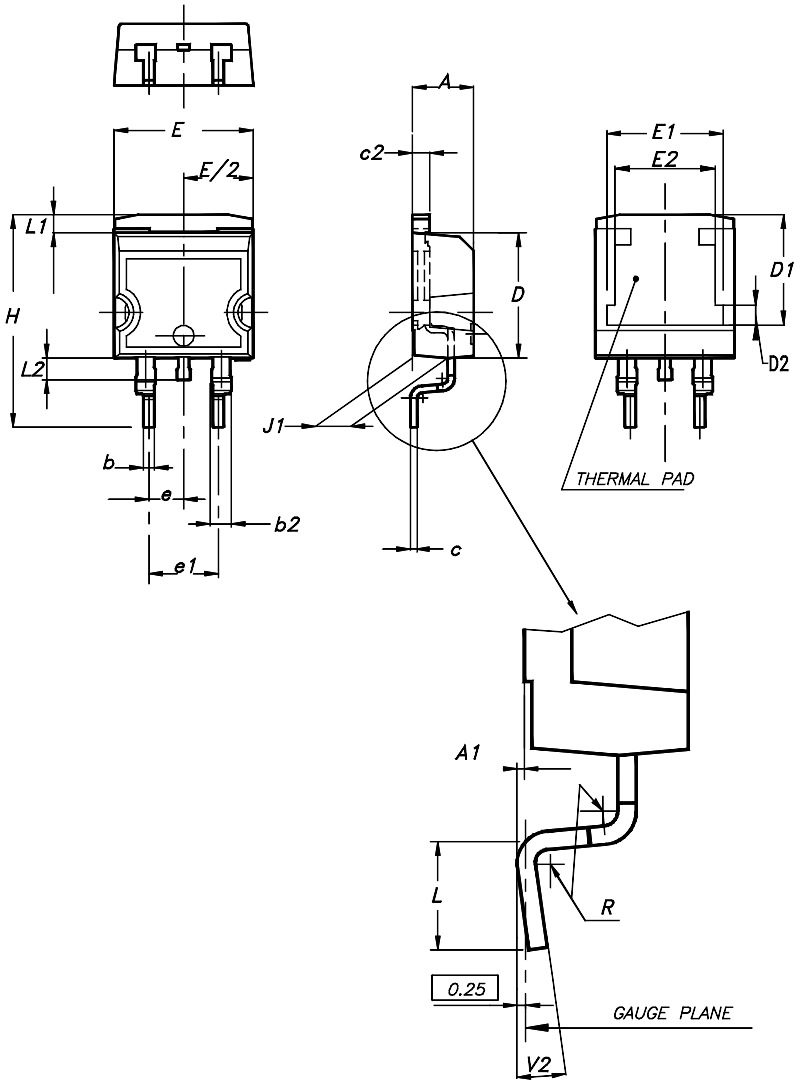
Table 5. DO-247 package mechanical data

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 D²PAK package information

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

Figure 18. D²PAK package outline

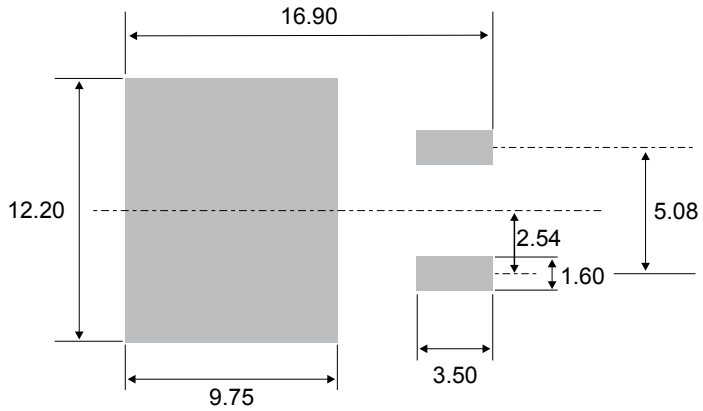


Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 6. **D²PAK 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°

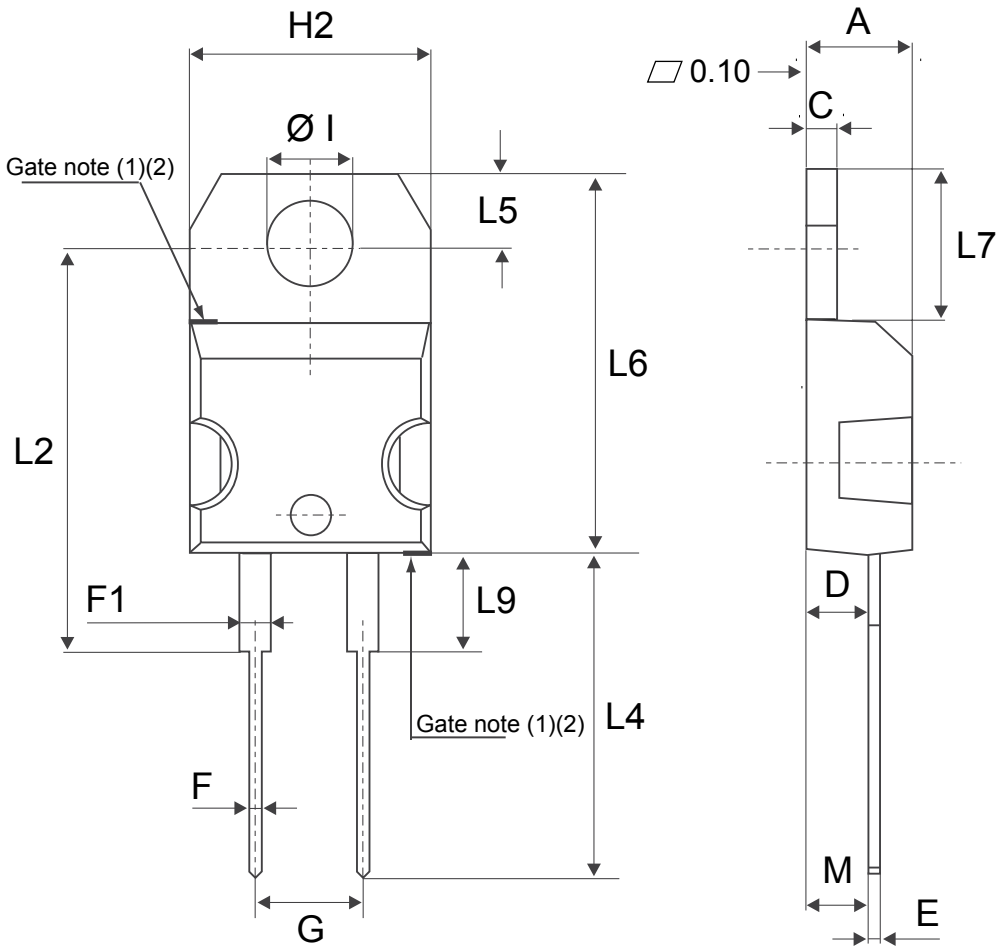
Figure 19. **D²PAK recommended footprint (dimensions in mm)**



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 20. TO-220AC package outline



(1) :Max resin gate protusion 0.5 mm

(2) :Resin gate position is accepted in each of the two positions shown on the drawings or their symmetrical

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

Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	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	2.60 typ.		0.102 typ.	
Diam	3.75	3.85	0.147	0.151

2.4 D²PAK HV package information

Figure 21. D²PAK high voltage package outline

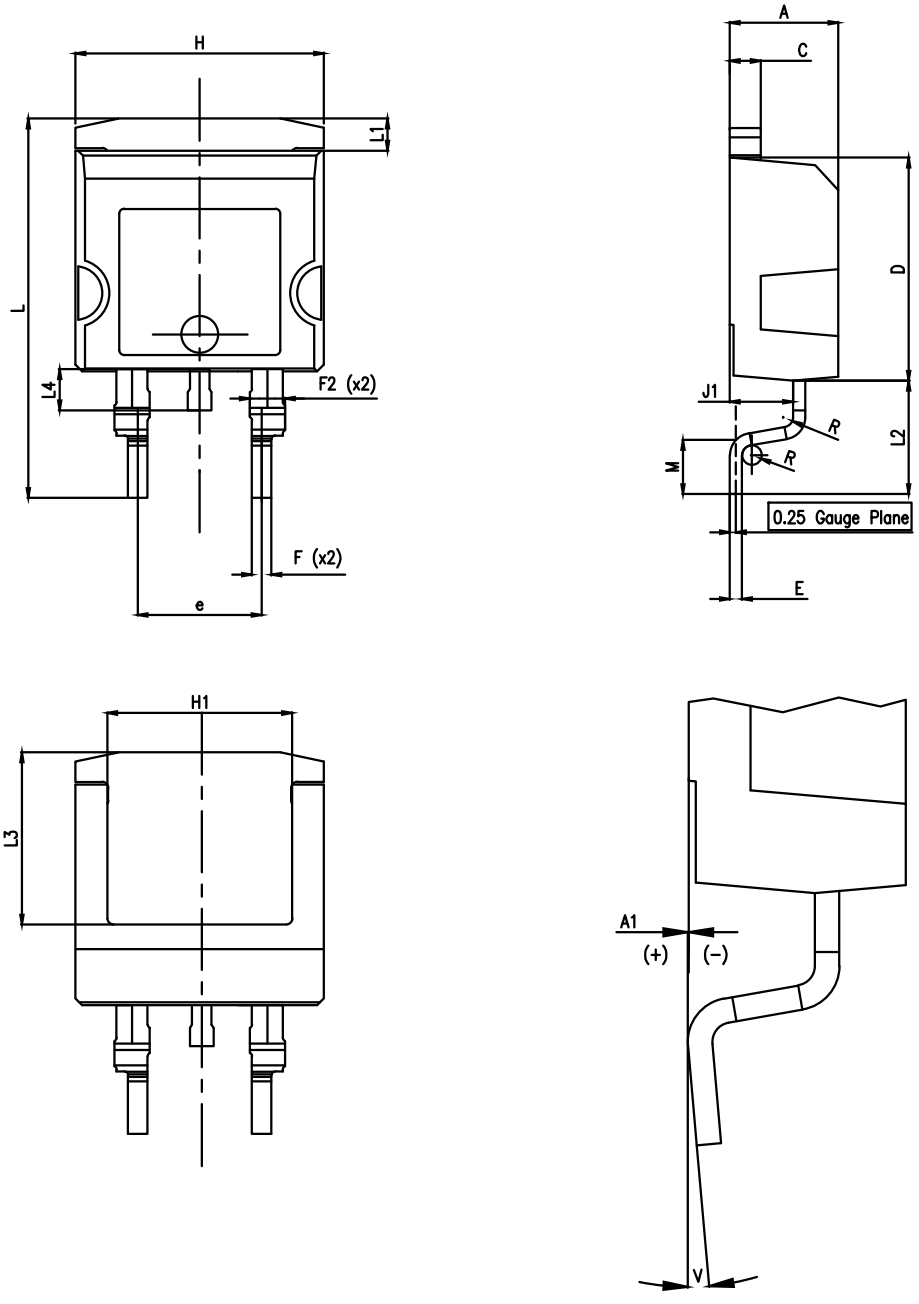
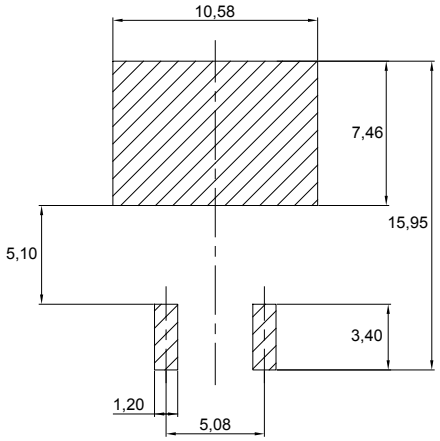


Table 8. D²PAK high voltage package mechanical data

Ref.	Dimensions		
	Min.	Typ.	Max.
A	4.30		4.70
A1	-0.05		0.08
C	1.17		1.37
D	8.95		9.35
e	4.98		5.18
E	0.50		0.90
F	0.78		0.85
F2	1.20		1.60
H	10.00		10.40
H1	7.40		7.80
J1	2.49		2.69
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 22. D²PAK High Voltage footprint in mm



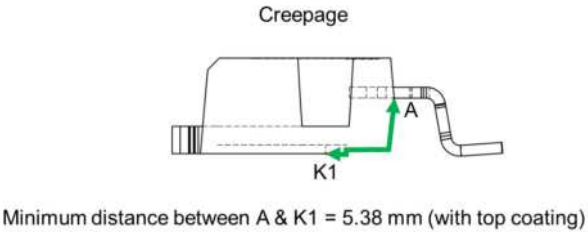
2.4.1 Creepage distance between anode and cathode

Table 9. Creepage distance between anode and cathode

Symbol	Parameter		Value	Unit
Cd_{A-K1}	Minimum creepage distance between A and K1 (with top coating)	D²PAK HV	5.38	mm
Cd_{A-K2}	Minimum creepage distance between A and K2 (without top coating)		3.48	

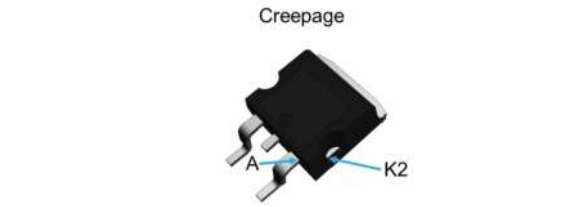
Note: D²PAK HV creepage distance (anode to cathode) = 5.38 mm min. (refer to IEC 60664-1)

Figure 23. Creepage with top coating



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

Figure 24. Creepage without top coating



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

2.5 DO-247 LL package information

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

Figure 25. DO-247 LL package outline

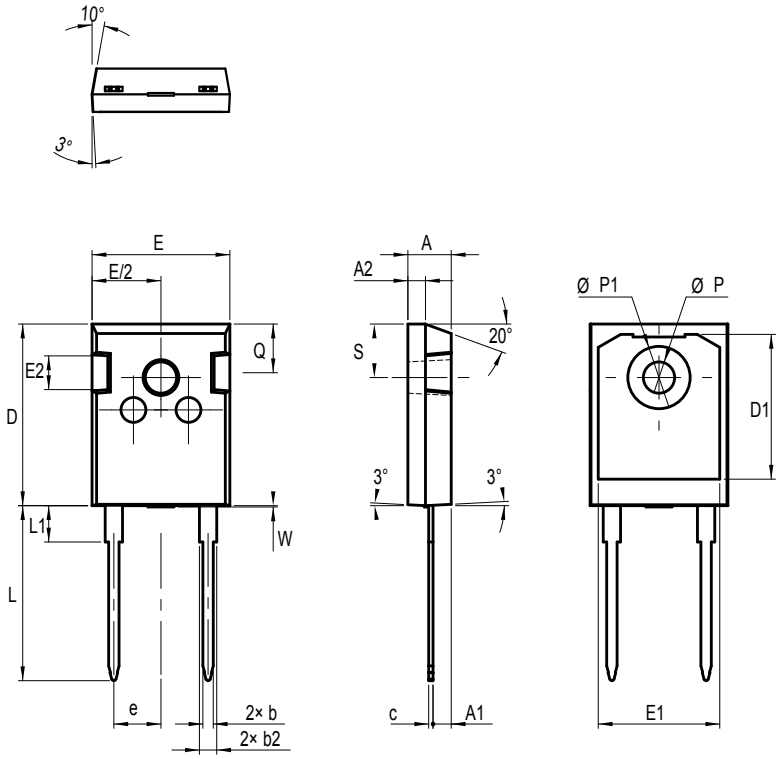


Table 10. DO-247 LL package mechanical data

Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	Min.	Max.	Min.	Max.
A	4.70	5.31	0.185	0.209
A1	2.21	2.59	0.087	0.102
A2	1.50	2.49	0.059	0.098
b	0.99	1.40	0.039	0.055
b2	1.65	2.39	0.065	0.094
c	0.38	0.89	0.015	0.035
D	20.80	21.46	0.819	0.845
D1	13.08		0.515	
E	15.49	16.26	0.610	0.640
e	5.44 typ.		0.214	
E1	13.46		0.530	
E2	3.43	3.99	0.135	0.157
L	19.81	20.32	0.780	0.800
L1		4.50		0.177
P	3.56	3.66	0.140	0.144
P1	7.06	7.39	0.278	0.291
Q	5.38	6.20	0.219	0.244
S	6.17 typ.		0.243	
W		0.15		0.006

3 Ordering information

Table 11. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STTH30RQ06G-TR	STTH30RQ06G	D²PAK	1.48 g	1000	Tape and reel
STTH30RQ06D	STTH30RQ06D	TO-220AC	1.86 g	50	Tube
STTH30RQ06W	STTH30RQ06W	DO-247	4.40 g	30	Tube
STTH30RQ06G2-TR	TH30RQ06G2	D²PAK HV	1.48 g	1000	Tape and reel
STTH30RQ06WL	STTH30RQ06WL	DO-247 LL	5.9 g	30	Tube

Revision history

Table 12. **Document revision history**

Date	Revision	Changes
12-Jun-2017	1	Initial release.
11-Oct-2018	2	Added D²PAK HV package.
20-Nov-2018	3	Updated Features and Table 9. Creepage distance between anode and cathode. Added Figure 24. Creepage without top coating.
02-Mar-2020	4	Added DO-247 LL package information.
30-Mar-2020	5	Updated Figure 1 and Figure 2. Added Figure 3 and Figure 4.

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