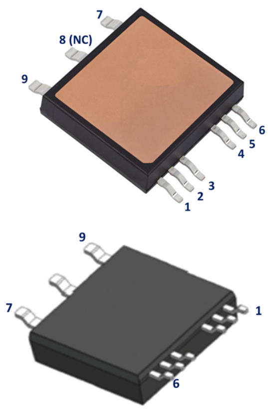
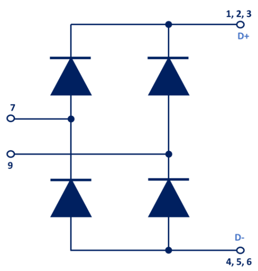
STTH60RQ06-M2Y

Datasheet

Automotive 600 V, 60 A ultrafast bridge module



ACEPACK SMIT



Product status link
STTH60RQ06-M2Y

Device summary (per diode)	
$I_{F(AV)}$	30 A
V_{RRM}	600 V
V_F (typ.)	1.45 V
t_{rr} (max.)	30 ns
T_j	-40 °C to +175 °C

Features

- Operating T_j from -40 °C to +175 °C
- Ultrafast with soft recovery behaviour
- PPAP capable
- SMD with isolated top side cooling
- Low thermal resistance
- Backside in insulated ceramic
- Dice chips on Direct Bond Copper (DBC) substrate
- ECOPACK2 compliant
- MSL: Level 3
- Insulation voltage (UL 1557): V_{RMS} = 4000 V

Applications

- Output rectification
- On board charger
- Charging station

Description

The ultrafast bridge rectifier is a high-performance device, generally used in a full wave rectification of an output stage of a DC/DC converter in automotive applications.

Thanks to the high thermal capability of the ACEPACK SMIT package, this integrated module will increase the power density in the application, through very high thermal performances (top side cooling) and insulation done by an embedded ceramic. Especially suited for use in Charger applications, either integrated in the vehicle or in a charging station, this rectifier will enhance the performance of the targeted application.

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	600	V
$I_{F(RMS)}$	Forward rms current		Per diode	50	A
$I_{F(AV)}$	Average forward current δ = 0.5, square wave	T_C = 77 °C	Per diode	30	A
$I_{D(AV)}$	Bridge output current δ = 0.5, square wave	T_C = 77 °C		60	
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal, T_C = 25 °C		180	A
T_{stg}	Storage temperature range			-65 to +175	°C
T_j	Operating junction temperature range			-40 to +175	°C

Table 2. Thermal resistance parameters

Symbol	Parameter	Typ. value	Max. value	Unit
$R_{th(j-c)}$	Junction to case per diode	1.03	1.25	°C/W

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

- AN5384: ACEPACK SMIT module package guidelines for mounting and thermal management

Table 3. Static electrical characteristics per diode

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:

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

Table 4. Dynamic electrical characteristics per diode

<table>
<tr><th>Symbol</th><th>Parameter</th><th colspan="2">Test conditions</th><th>Min.</th><th>Typ.</th><th>Max.</th><th>Unit</th></tr>
<tr><td rowspan="2">t_{rr}</td><td rowspan="2">Reverse recovery time</td><td rowspan="2">T_j = 25 °C</td><td>I_F = 0.5 A, I_R = 1 A, I_{rr} = 0.25 A</td><td>-</td><td></td><td>30</td><td rowspan="2">ns</td></tr>
<tr><td>I_F = 1 A, V_R = 30 V, dI_F/dt = -50 A/µs</td><td>-</td><td>40</td><td>55</td></tr>
<tr><td>I_{RM}</td><td>Reverse recovery current</td><td rowspan="3">T_j = 125 °C</td><td rowspan="3">I_F = 30 A, V_R = 400 V, dI_F/dt = -200 A/µs</td><td>-</td><td>8</td><td>11</td><td>A</td></tr>
<tr><td>Q_{rr}</td><td>Reverse recovery charge</td><td>-</td><td>485</td><td>-</td><td>nC</td></tr>
<tr><td>t_{rr}</td><td>Reverse recovery time</td><td>-</td><td>95</td><td>-</td><td>ns</td></tr>
</table>

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

1.1 Characteristics (curves)

Figure 1. Forward voltage drop versus forward current (typical values)

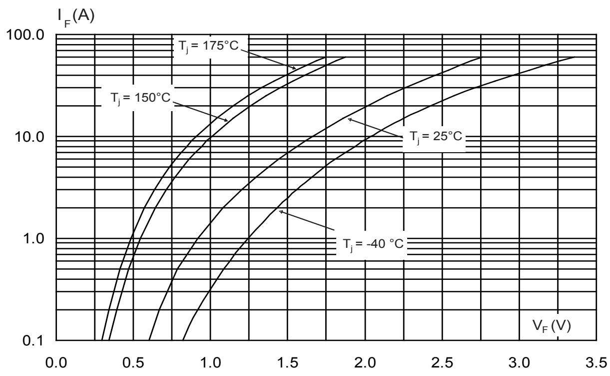


Figure 2. Forward voltage drop versus forward current (maximum values)

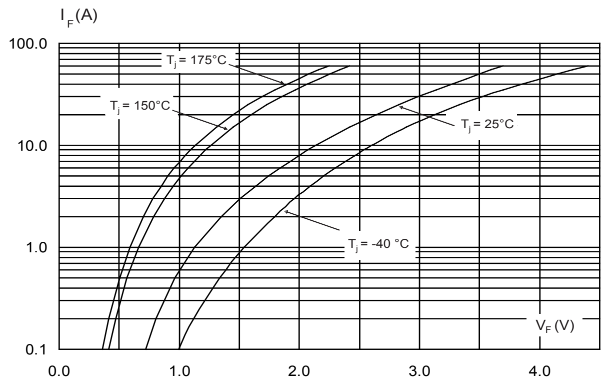


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

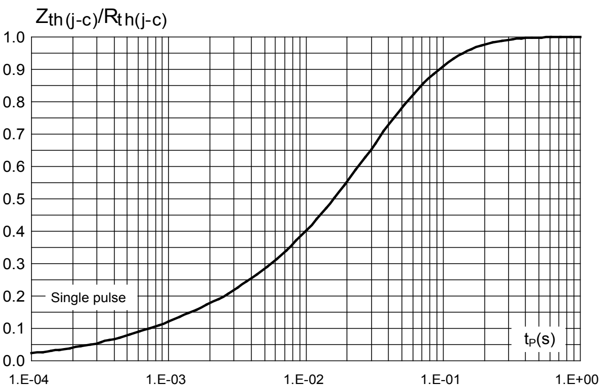


Figure 4. Peak reverse recovery current versus dI_F/dt (typical values)

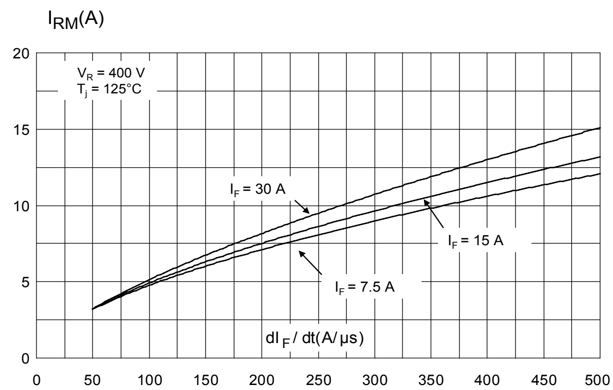


Figure 5. Reverse recovery time versus dI_F/dt (typical values)

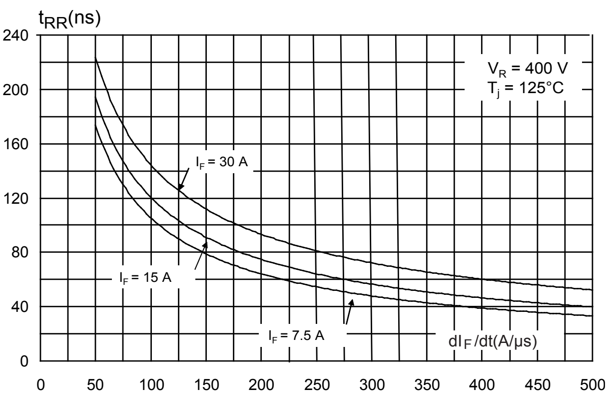


Figure 6. Reverse recovery charges versus dI_F/dt (typical values)

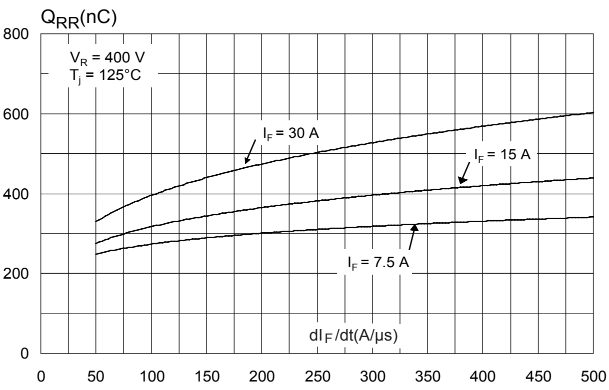


Figure 7. Reverse recovery softness factor versus dI_F/dt (typical values)

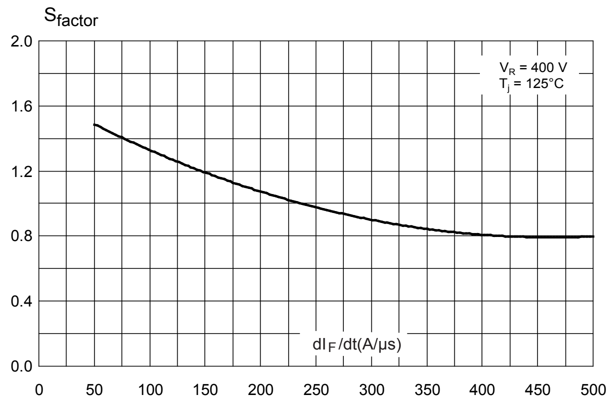


Figure 8. Relative variations of dynamic parameters versus junction temperature

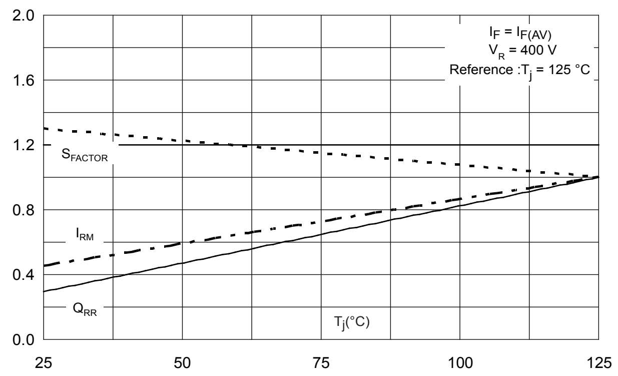


Figure 9. Junction capacitance versus reverse voltage applied (typical values)

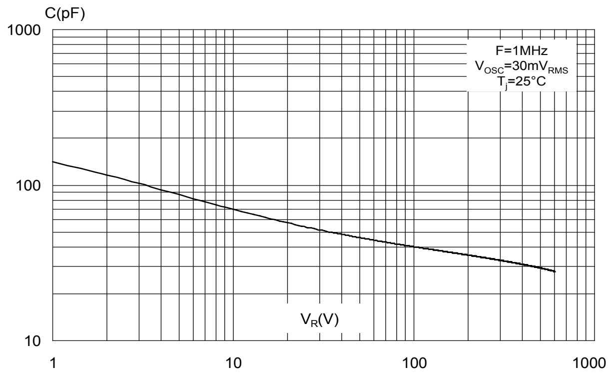


Figure 10. Relative variation of non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

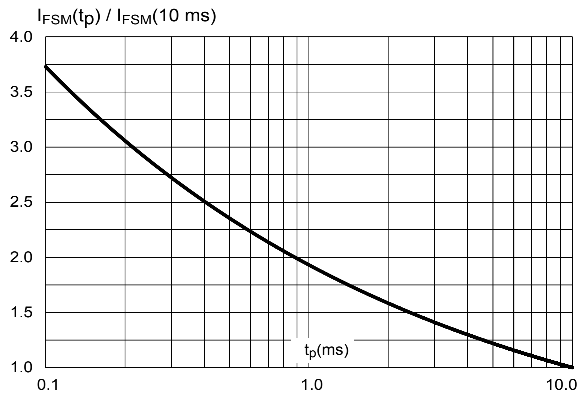


Figure 11. Relative variation of non-repetitive peak surge forward current versus initial junction temperature (sinusoidal waveform)

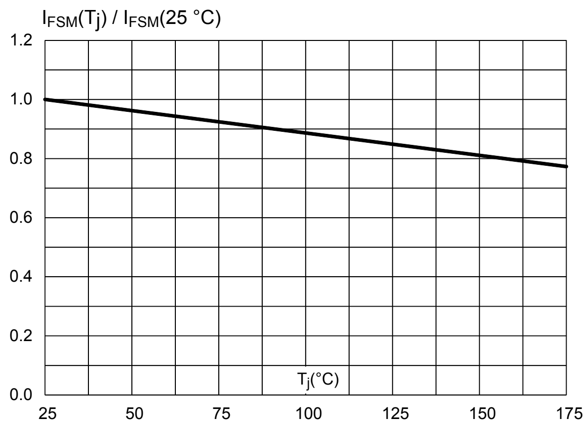
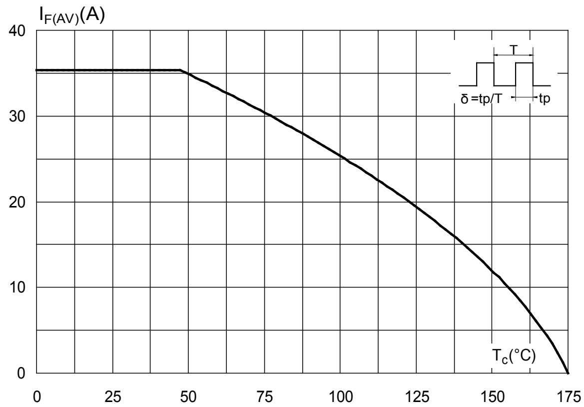


Figure 12. Average forward current versus case temperature (δ = 0.5)



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 ACEPACK SMIT package information

Figure 13. ACEPACK SMIT package outline

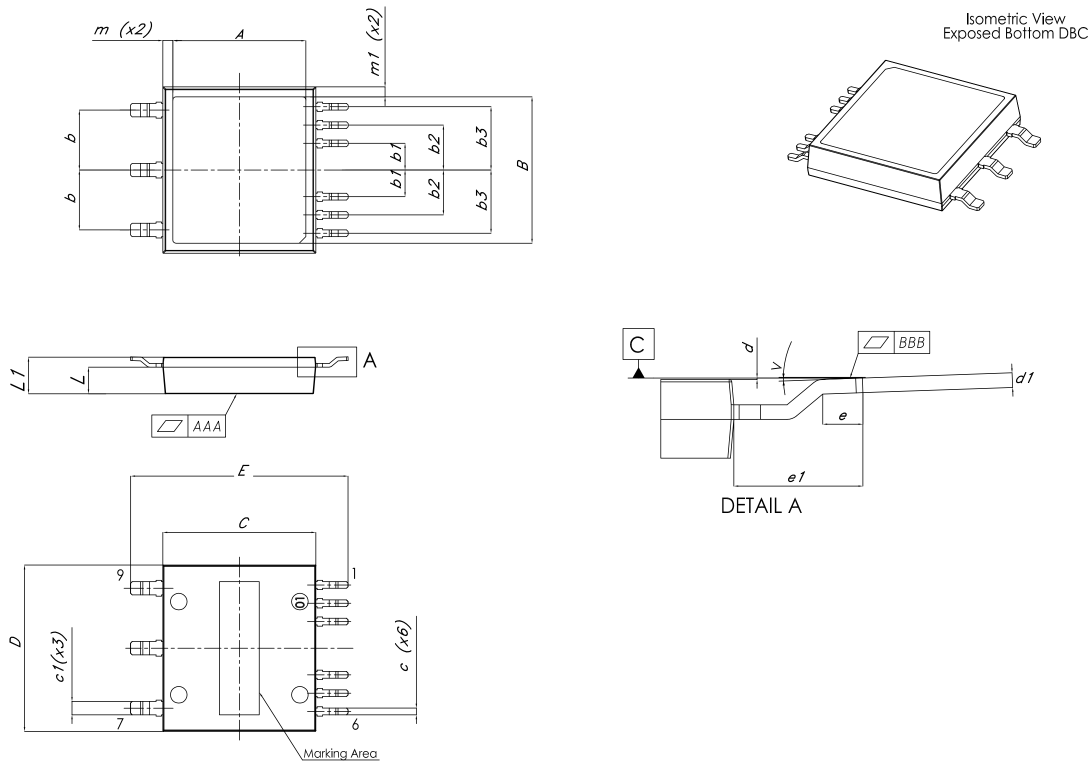
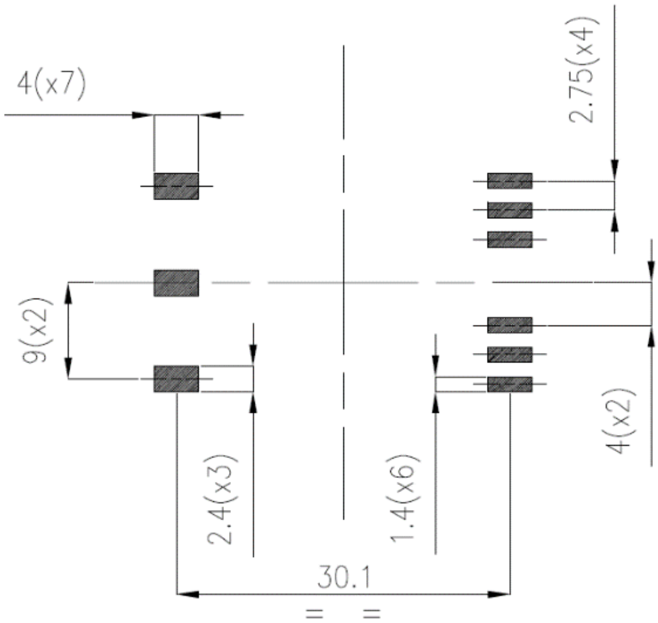


Table 5. ACEPACK SMIT package mechanical data

Ref.	Dimensions					
	Millimeters			Inches (for reference only)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	19.50	20.00	20.50	0.768	0.787	0.807
B	21.50	22.00	22.50	0.846	0.866	0.886
C	22.80	23.00	23.20	0.898	0.906	0.913
D	24.80	25.00	25.20	0.976	0.984	0.992
E	32.20	32.70	33.20	1.268	1.287	1.307
b		9.00			0.354	
b1		4.00			0.157	
b2		6.75			0.266	
b3		9.50			0.374	
C	0.95	1.00	1.10	0.037	0.039	0.043
C1	1.95	2.00	2.10	0.077	0.079	0.083
d	0.00		0.15	0.000		0.006
d1	0.45	0.55	0.65	0.018	0.022	0.026
e	1.30	1.50	1.70	0.051	0.059	0.067
e1	4.65	4.85	5.05	0.183	0.191	0.199
L	3.95	4.00	4.05	0.156	0.157	0.159
L1	5.40	5.50	5.60	0.313	0.217	0.220
m	1.30	1.50	1.80	0.051	0.050	0.071
m1	1.30	1.50	1.80	0.051	0.050	0.071
V	0°	2°	4°			
AAA	0.01		0.05	0.000		0.002
BBB	0.00		0.10	0.000		0.004

Figure 14. ACEPACK SMIT recommended footprint (dimensions are in mm)



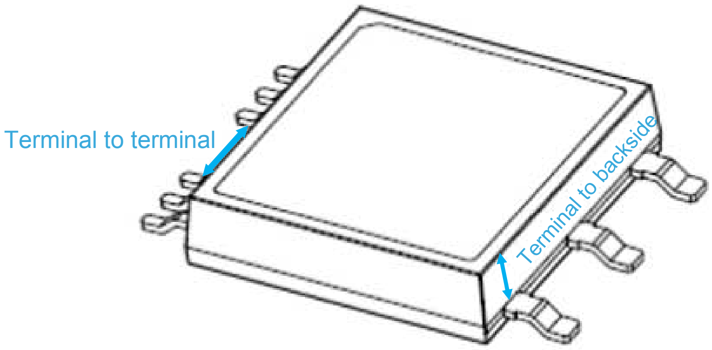
2.2 ACEPACK SMIT other information

Table 6. **Creepage distance and insulated voltage**

Symbol	Parameter		Value Min.	Value Typ.	Value Max.	Unit
$d_{creepage}$	creepage distance (see Figure 15)	Terminal to terminal (pin 3 to 4)	6.6	-		mm
		Terminal to backside	4.0	-		
V_{INS}	Insulation voltage	Tab to leads; t = 1 minute 50-60Hz; RMS; I_{INS} < 1 mA		-	4000	V

For assembly recommendations, please refer to AN5384.

Figure 15. **Creepage distance measurement**



3 Ordering information

Table 7. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STTH60RQ06-M2Y	STTH60RQ06-M2Y	ACEPACK SMIT	8.1 g	200	Tape and reel

Revision history

Table 8. **Document revision history**

Date	Revision	Changes
15-Sep-2020	1	Initial release.