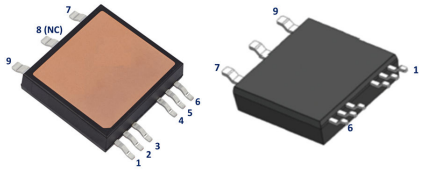
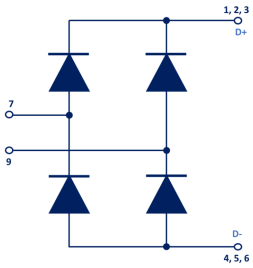
STTH120RQ06-M2Y

Datasheet

Automotive 600 V ultrafast bridge module



ACEPACK SMIT



Product status link
STTH120RQ06-M2Y

Product summary	
Symbol	**Value**
$I_{F(AV)}$	60 A
V_{RRM}	600 V
$V_{F(typ.)}$	1.45 V
$t_{rr(max.)}$	35 ns
T_j	-40 to +175 °C

Features

- PPAP capable
- Ultrafast with soft recovery behaviour
- Operating T_j from -40 °C to +175 °C
- 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)(1): V_{RMS} = 4000 V
- Die is AECQ-101 qualified
- AQG324 recommendation

1. *V_{RMS} 4000 V under qualification*

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		85	A
$I_{F(AV)}$	Average forward current per diode, δ = 0.5, square wave	T_C = 65 °C	60	A
$I_{D(AV)}$	Bridge output current, δ = 0.5, square wave	T_C = 65 °C	120	A
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal	400	A
T_{stg}	Storage temperature range		-65 to +175	°C
T_j	Operating junction temperature range		-40 to +175	°C

Table 2. Thermal resistance parameter

Symbol	Parameter	Typ.	Max. value	Unit
$R_{th(j-c)}$	Junction to case per diode (DC)	0.57	0.7	°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

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_R (1)	Reverse leakage current	T_j = 25 °C	$V_R = V_{RRM}$	-		80	µA
		T_j = 150 °C		-	160	1600	
V_F (2)	Forward voltage drop	T_j = 25 °C	I_F = 30 A	-		2.45	V
		T_j = 150 °C		-	1.15	1.45	
		T_j = 25 °C	I_F = 60 A	-		2.95	
		T_j = 150 °C		-	1.45	1.85	

1. *Pulse test: tp = 5 ms, δ < 2%*
2. *Pulse test: tp = 380 µs, δ < 2%*

To evaluate the conduction losses, use the following equation:

- $P = 1.05 \times I_{F(AV)} + 0.013 \times I_F{}^2{}_{(RMS)}$

Table 4. Dynamic electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
t_{rr}	Reverse recovery time	T_j = 25 °C	I_F = 0.5 A, I_{rr} = 0.25 A, I_R = 1 A	-		35	ns
			I_F = 1 A, V_R = 30 V, dI_F/dt = -50 A/µs	-	50	65	
I_{RM}	Reverse recovery current	T_j = 125 °C	I_F = 60 A, V_R = 400 V, dI_F/dt = -200 A/µs	-	12	16	A
Q_{rr}	Reverse recovery charge			-	660		nC
t_{rr}	Reverse recovery time			-	92		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
- 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)

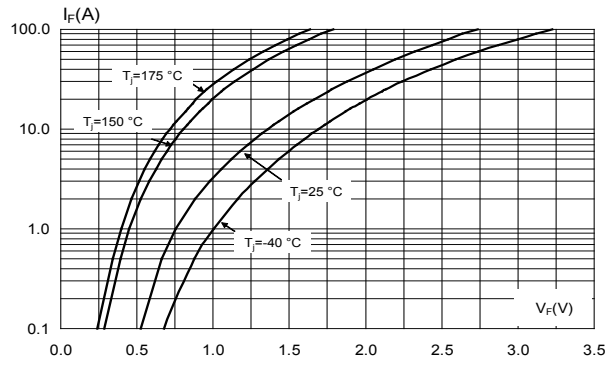


Figure 2. Forward voltage drop versus forward current (maximum values)

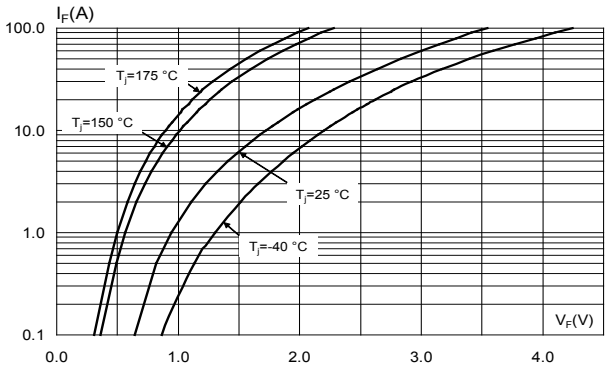


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

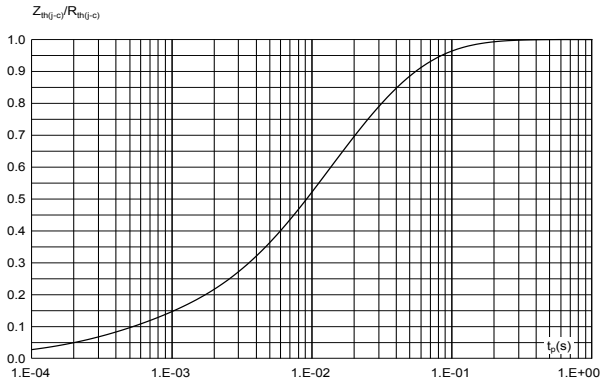


Figure 4. Peak reverse recovery current versus dI_F/dt (typical values)

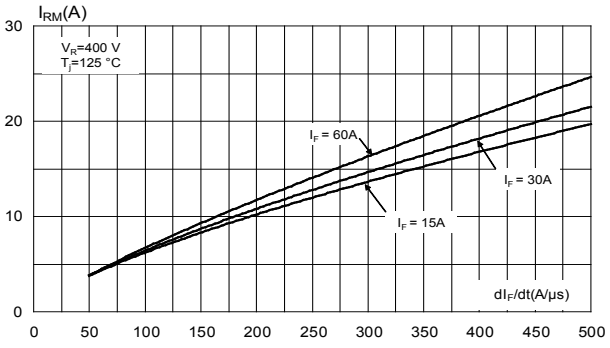


Figure 5. Reverse recovery time versus dI_F/dt (typical values)

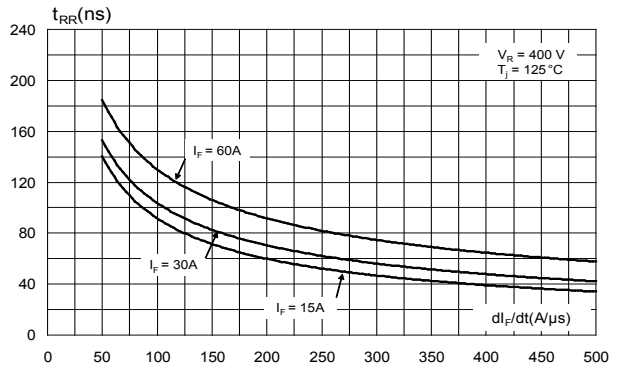


Figure 6. Reverse recovery charges versus dI_F/dt (typical values)

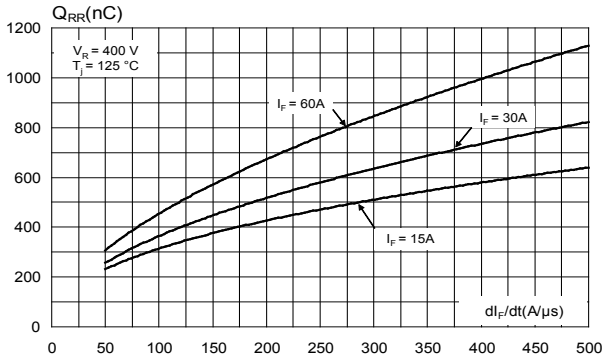


Figure 7. Reverse recovery softness factor versus dI_F/dt (typical values)

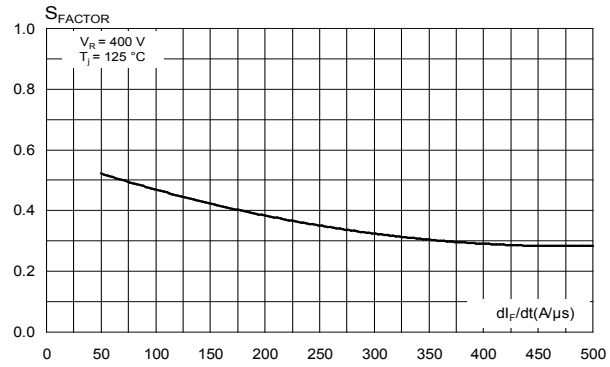


Figure 8. Relative variations of dynamic parameters versus junction temperature

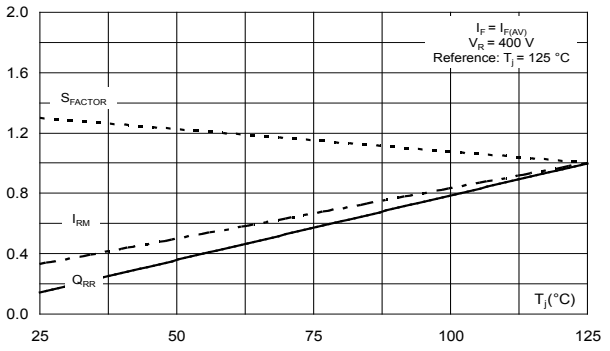


Figure 9. Junction capacitance versus reverse voltage applied (typical values)

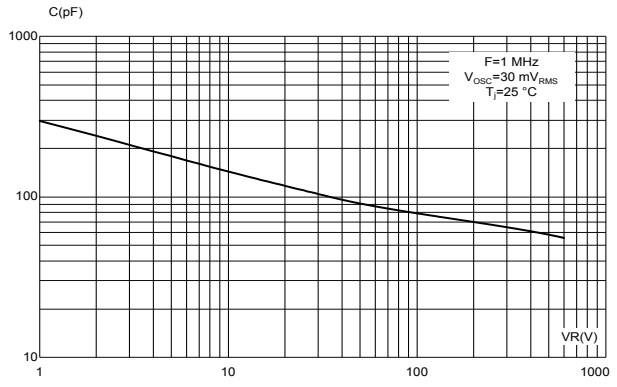


Figure 10. Relative variation of non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

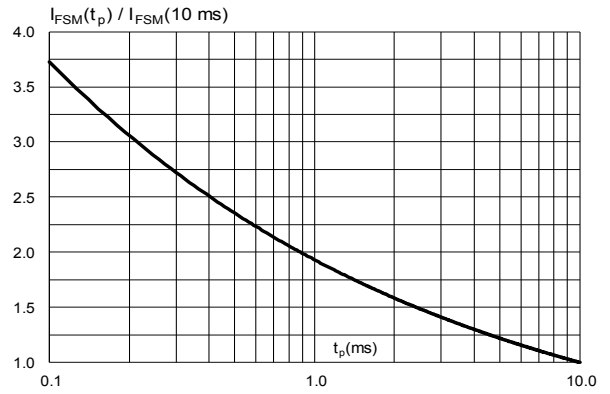


Figure 11. Relative variation of non-repetitive peak surge forward current versus initial junction temperature (sinusoidal waveform)

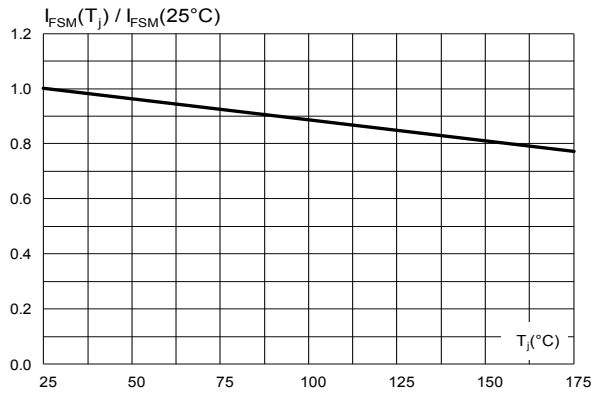
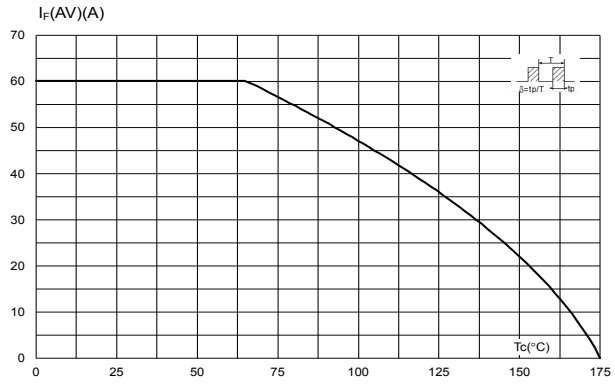


Figure 12. Average forward current versus case temperature (δ = 0.5)



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

- Lead-free package leads finishing
- Halogen-free molding compound resin meets UL94 standard level V0

Figure 13. ACEPACK SMIT package outline

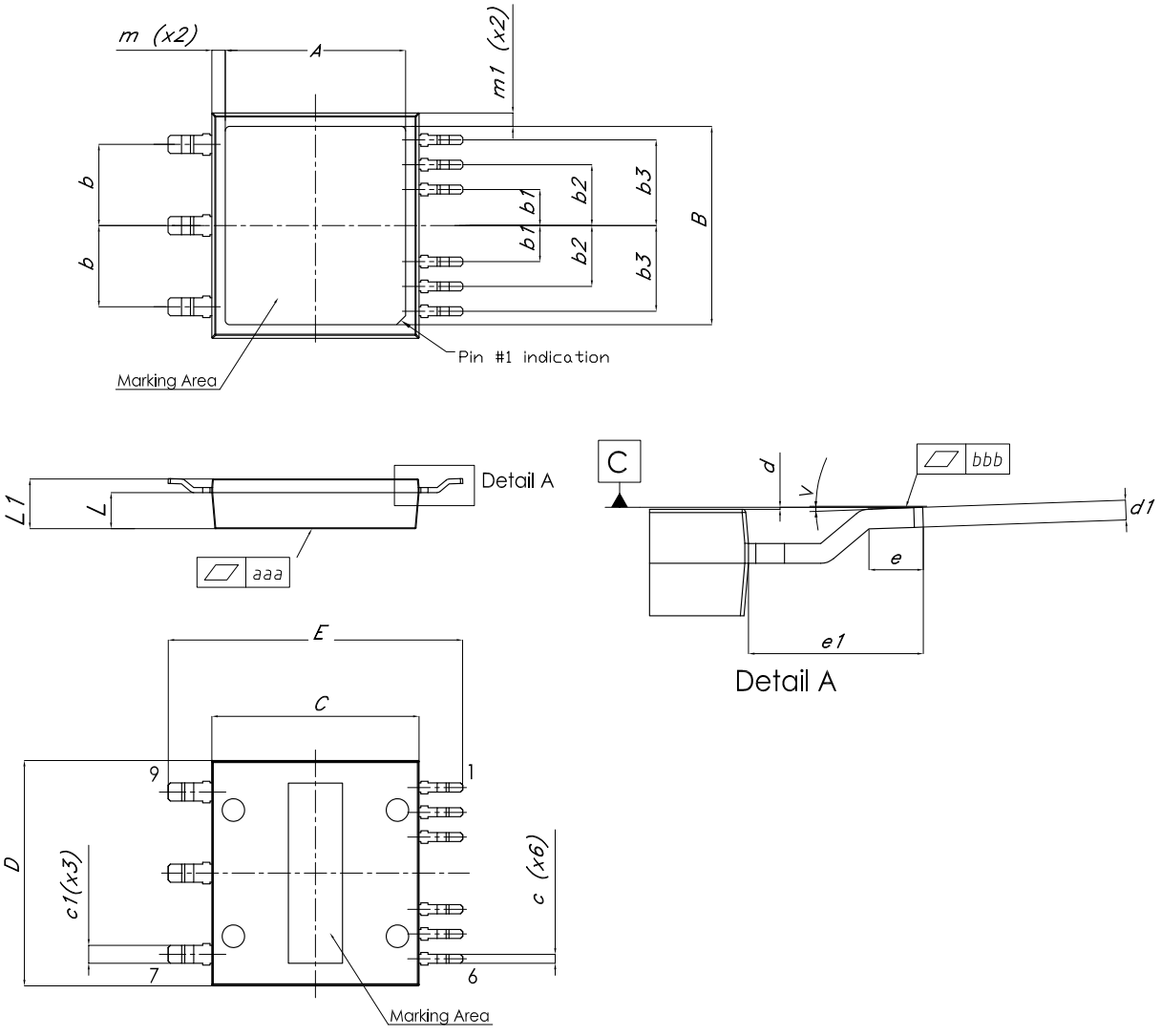


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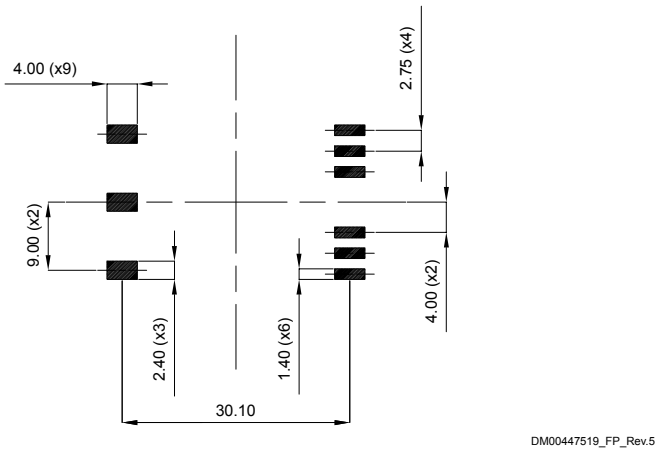
Table 5. **ACEPACK SMIT package mechanical data**

Dim.	mm			Inches (for reference only)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	19.50	20.00	20.50	0.7677	0.7874	0.8071
B	21.50	22.00	22.50	0.8465	0.8661	0.8858
C	22.80	23.00	23.20	0.8976	0.9055	0.9134
D	24.80	25.00	25.20	0.9764	0.9843	0.9921
E	32.20	32.70	33.20	1.2677	1.2874	1.3071
b		9.00			0.3543	
b1		4.00			0.1575	
b2		6.75			0.2657	
b3		9.50			0.3740	
c	0.95	1.00	1.10	0.0374	0.0394	0.0433
c1	1.95	2.00	2.10	0.0768	0.0787	0.0827
d	0.00		0.15	0.0000	0.0000	0.0059
d1	0.45	0.55	0.65	0.0177	0.0217	0.0256
e	1.30	1.50	1.70	0.0512	0.0591	0.0669
e1	4.65	4.85	5.05	0.1831	0.1909	0.1988
L	3.95	4.00	4.05	0.1555	0.1575	0.1594
L1	5.40	5.50	5.60	0.2126	0.2165	0.2205
m	1.30	1.50	1.80	0.0512	0.0591	0.0709
m1	1.30	1.50	1.80	0.0512	0.0591	0.0709
V	0°	2°	4°	0°	2°	4°
aaa	0.01		0.05		0.0004	0.0020
bbb	0.00		0.10		0.0000	0.0039

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



Note: Recommended pressing force on package to the heatsink: 50 N as described in application note AN5384.

For more information, please refer to TN1173: Packing information for IPAD, protection, rectifiers, thyristors and AC Switches.

3 Ordering information

Table 6. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STTH120RQ06-M2Y	STTH120RQ06-M2Y	ACEPACK SMIT	8.1 g	200	Tape and reel

Revision history

Table 7. **Document revision history**

Date	Revision	Changes
26-Jun-2024	1	Initial release.
03-Jul-2024	2	Updated *Features*.