RHRPM4424 Gate Driver

STMicroelectronics

Thibault BRUNET

Marketing Manager

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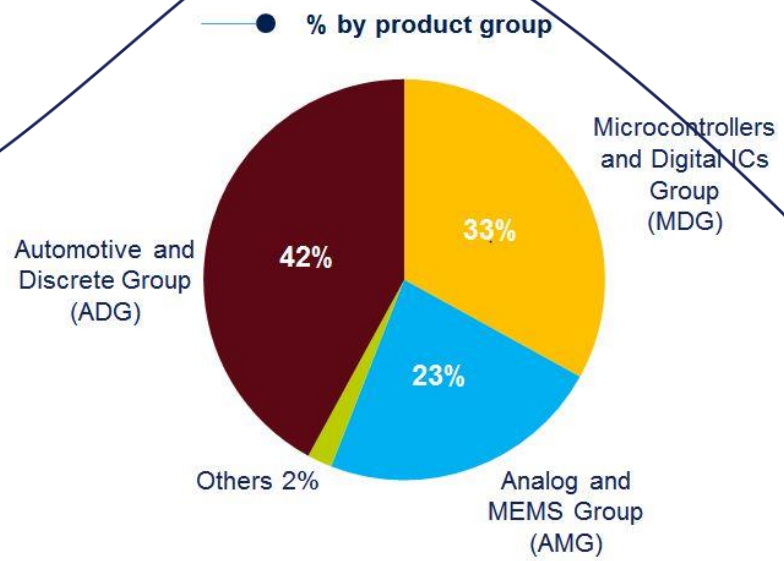
Who we are



- A global semiconductor leader
- The largest European semiconductor company
- 2015 revenues of **$6.9B**
- Approximately **43,200** employees worldwide
- Approximately **8,300** people working in R&D
- **11** manufacturing sites
- Listed on New York Stock Exchange, Euronext Paris and Borsa Italiana, Milano

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ST Flexible and Independent European Design & Manufacturing

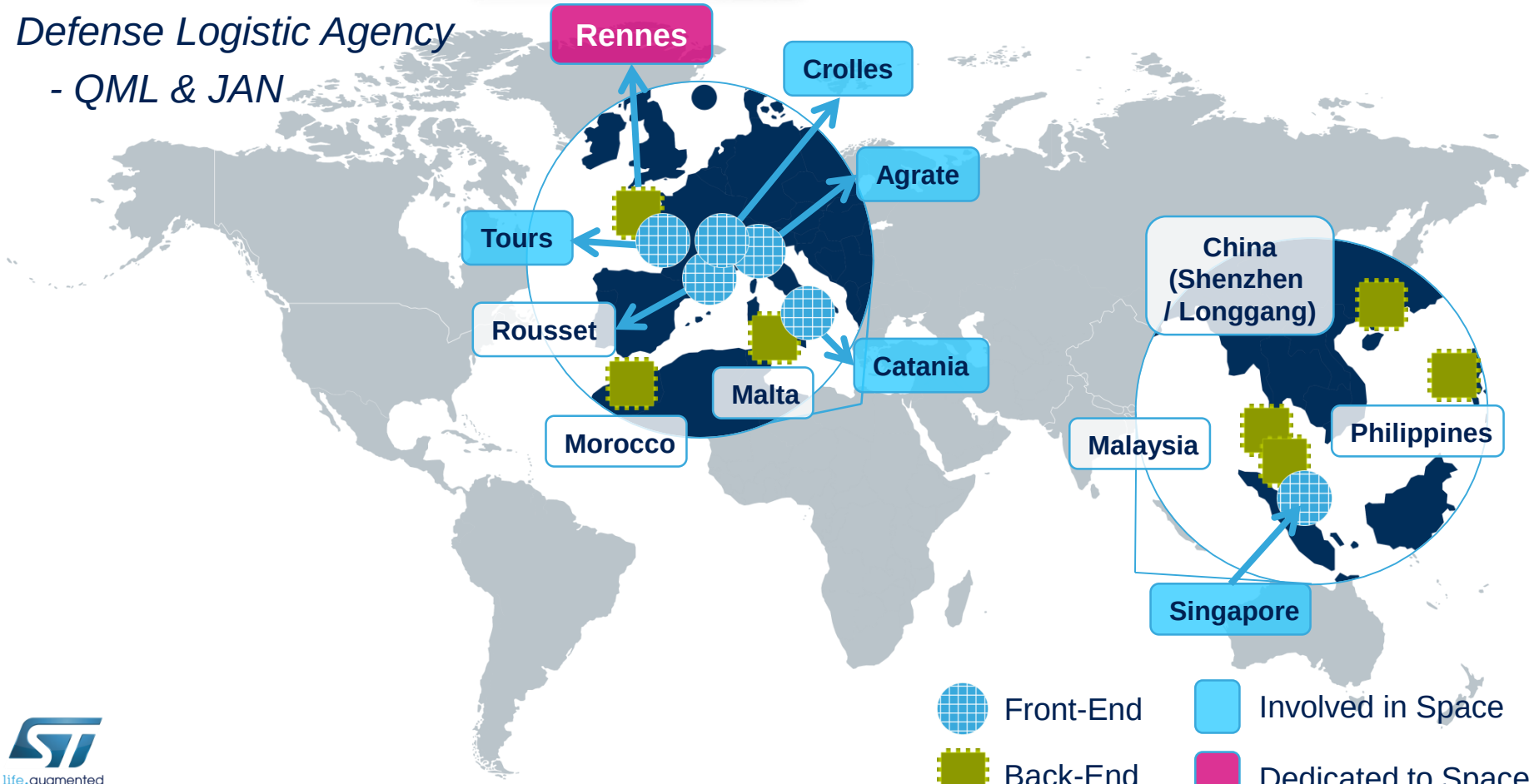
Space certified

Since 1979

European Space Agency

Defense Logistic Agency

- QML & JAN



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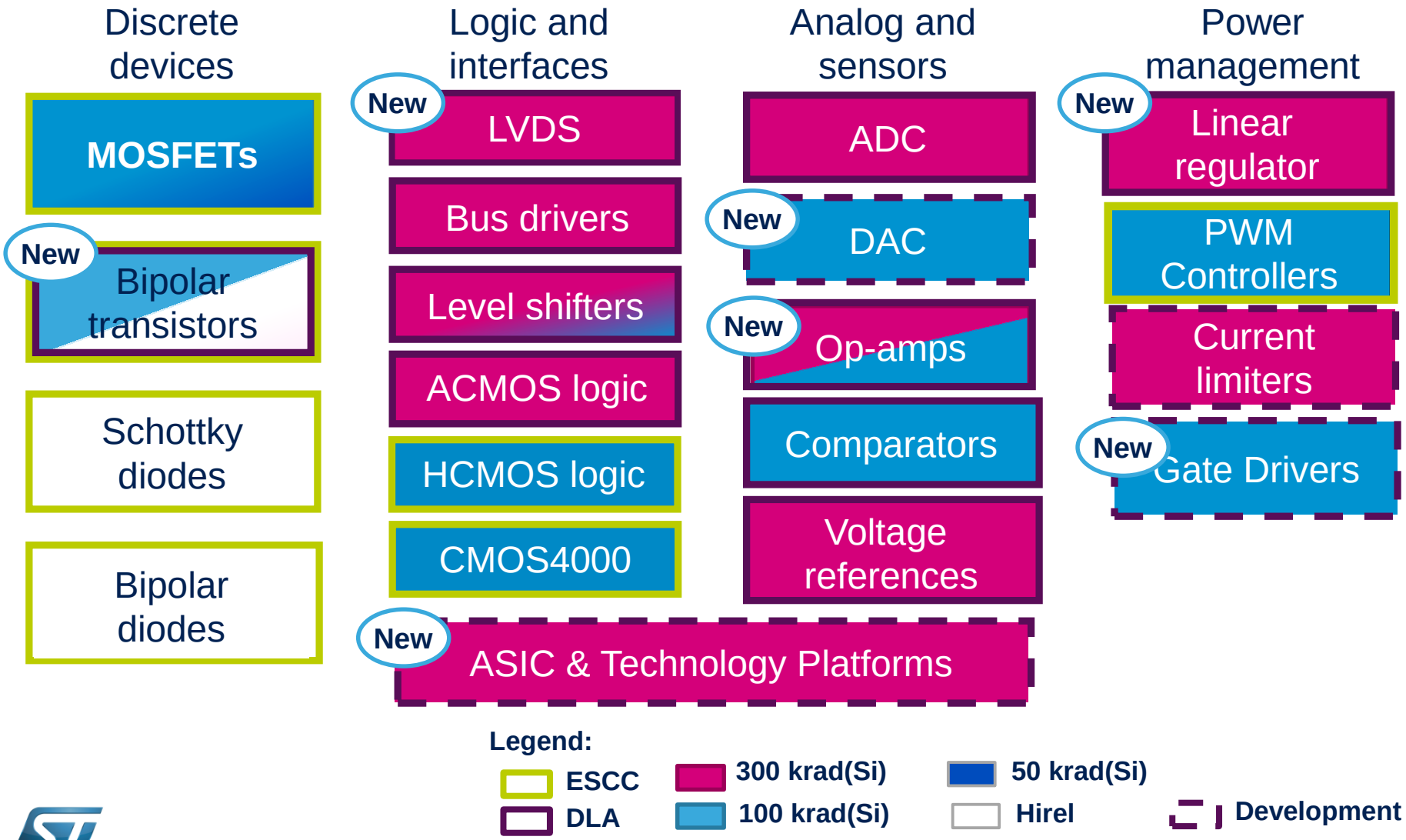
ESCC / DLA Qualified Product Portfolio
3Q16 Status



RHRPM4424 : Key Activities

- Specification with ESA and Users
- Technology Selection
- Design Product Design and Hardenning
- Layout for Radiation Hardness
  - Digital Rad-Hard Library + Analog Hardening by Design
- Process Engineers : Hardening, Reliability
- Product Engineering :
  - Electrical Characterization & Test Program
  - Packaging
  - Qualification Lot Screening - Delta ESCC Evaluation
- Radiation Test
- Application Support : Data Sheet, Spice, Support

RHRPM4424 Key Dates

- ITT 08.1QC.20 within ECI3 : May 4th, 2009
- Kick off Meeting : Feb 10th, 2010
- Design Start in Catania : June 2011
- First Silicon out : Jan 2012
- 2000 Hours Reliability : Dec 2012
- TID : LDR & HDR on 2 wafer lots : Dec 2013
- SEE Test : Feb 2013 + May 2013 + Jul 2014
- Delta ESCC Evaluation Dec 2014
- All Data at DLA : Aug 2016

First Silicon Success

RHRPM4424 : Technology

- BCD6s SOI Selection
  - Bipolar – CMOS – DMOS : Ideal for Power IC
  - Automotive Qualified : High Quality, Perennity **Volume**
  - SOI Theoretically Favorable for Radiation
    - Intrisinsic Latch Up Free – Low Thickness Oxyde
  - Analog Hardening By Design
    - Including with Individual Wells
- Space Specific Reliability Tests Required
  - Temperature and Power Step Stress tests
  - 2000 hour Reliability
  - Activation Energy Recalculation as per Agency Method
  - Technology Vehicle for QML-V Qualification
  - Delta ESCC Evaluation

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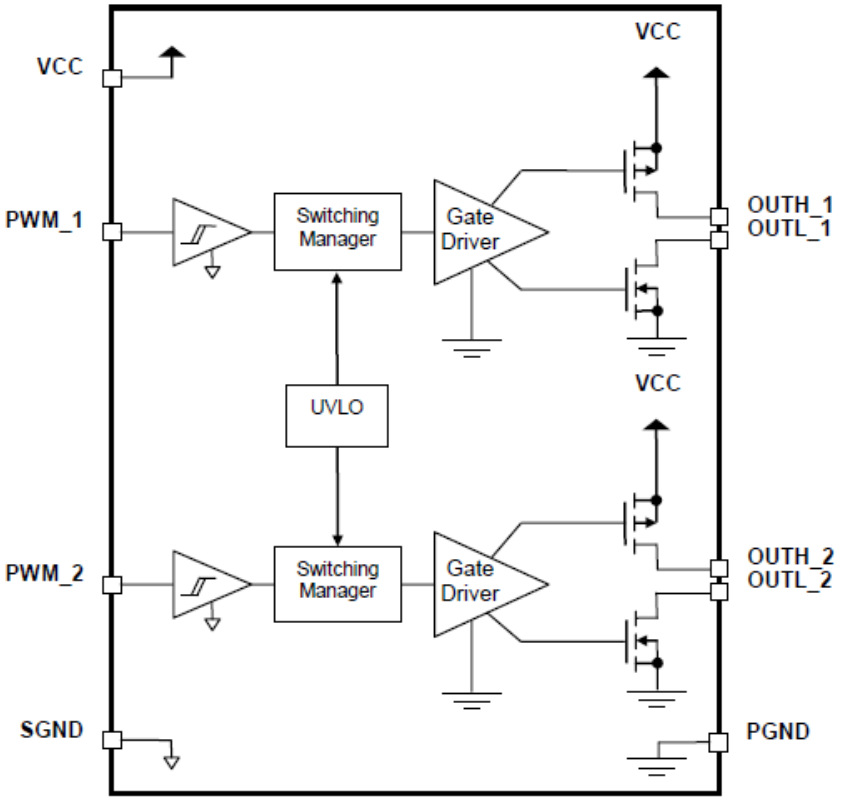
RHRPM4424
Rad-Hard Low Side MOSFET Drivers

EM : Now
QML : Oct16

- KEY FEATURES
  - **8 / 9 A sink / source** capability
  - **Vcc : 4.65V** to 18V
  - Power Dissipation: <1.5W @ 70”C
  - Under Voltage Lock-Out
  - Separate Power & Signal Ground
  - Fast Rrise & Fall : **30 ns typ** @ CL=4.7nF
  - In-out delay time: **110ns typ** @ CL =10nF
    - **+/- 5ns Matching delay**
  - **Vol = 20 mV** @ Iout = 1 mA
  - Low Consumption: 1.8mA max
  - -55 to +150 °C (Recommended : 125°C)
- RADIATION HARDNESS
  - 100 krad(Si) – ELDRS free (tbc)
  - SEL free at 60 Mev.cm2/mg @ 125°C
    - Cross Section 10^{-7} cm2
  - SET Cross Section : 2.10^{-6} cm2 @ 25°C
  - Report Available upon request



Flat-10 and Flat-16P
BCD6s SOI – 30Volt

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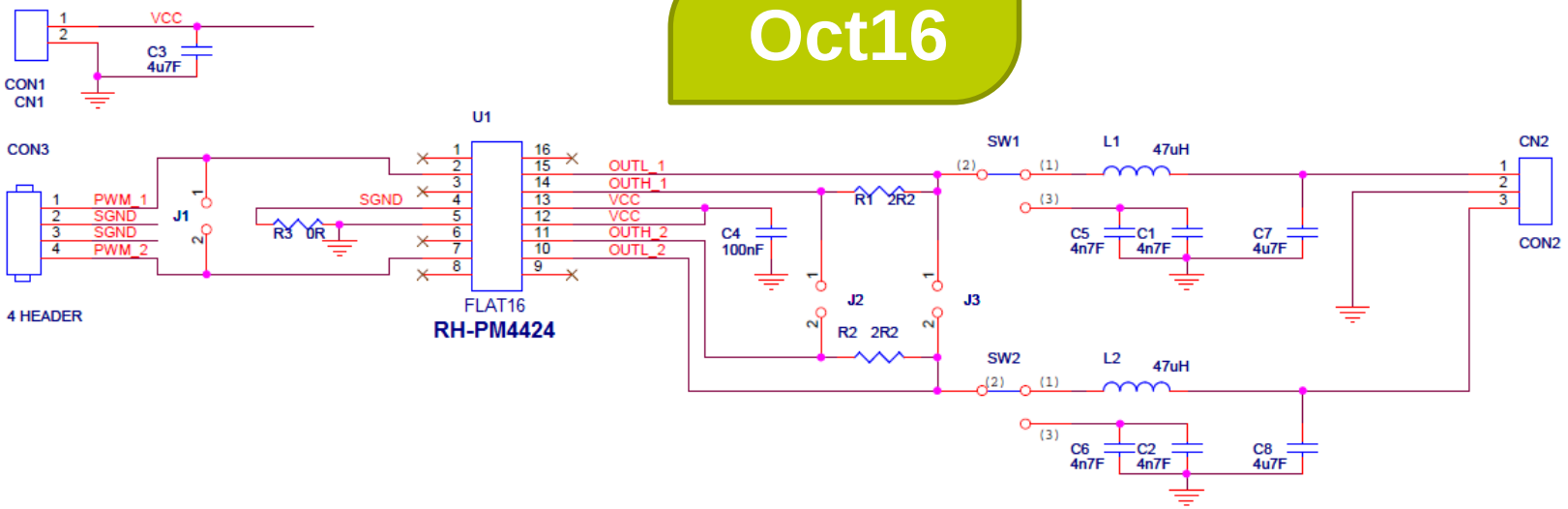
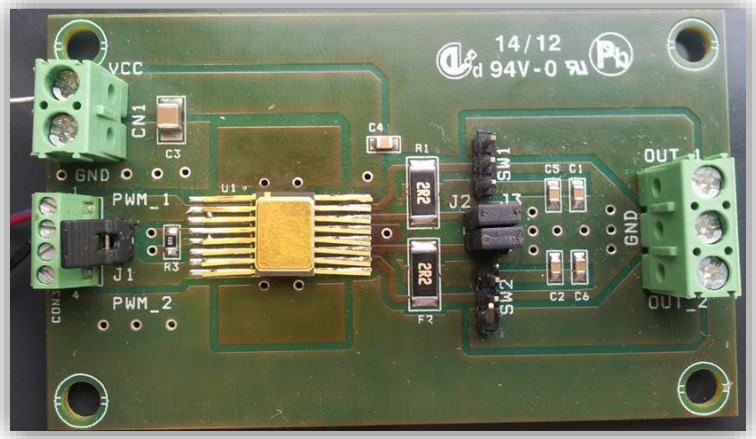
Application Board

Oct16

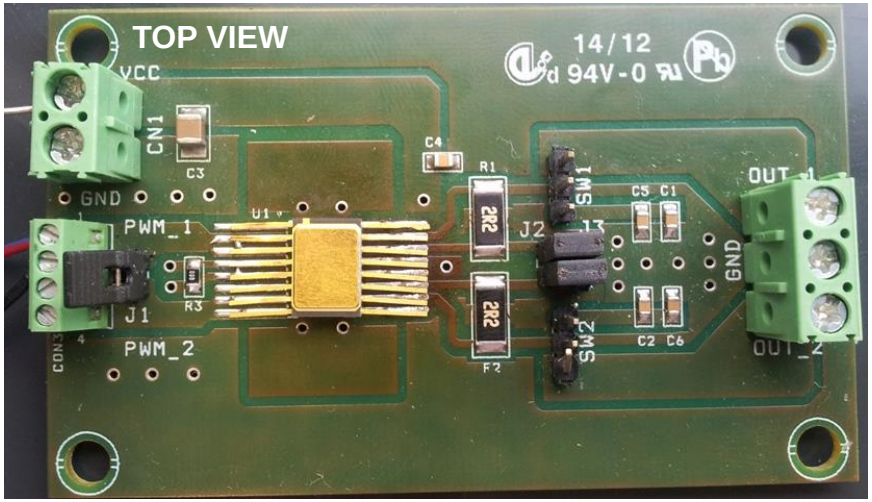


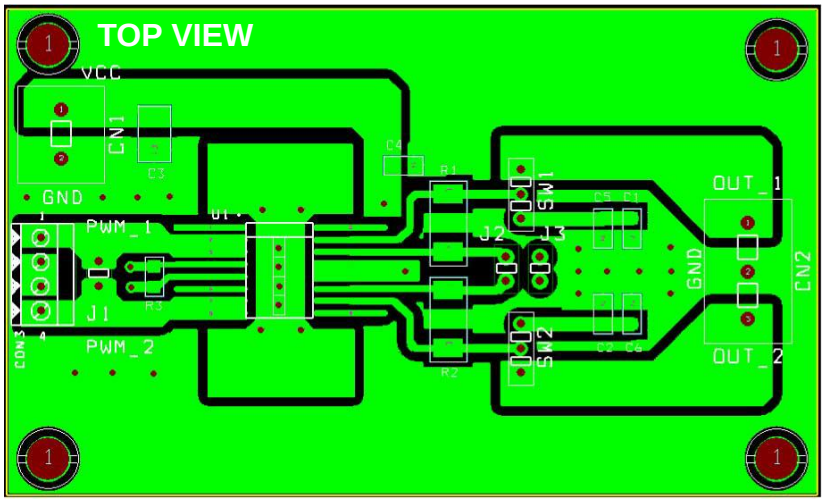


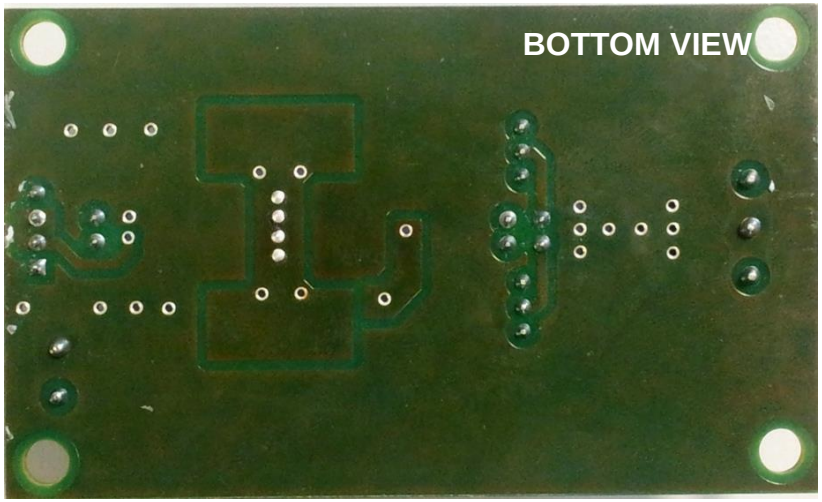
PROJECT NAME: RHFPM4424 **BILL OF MATERIALS**

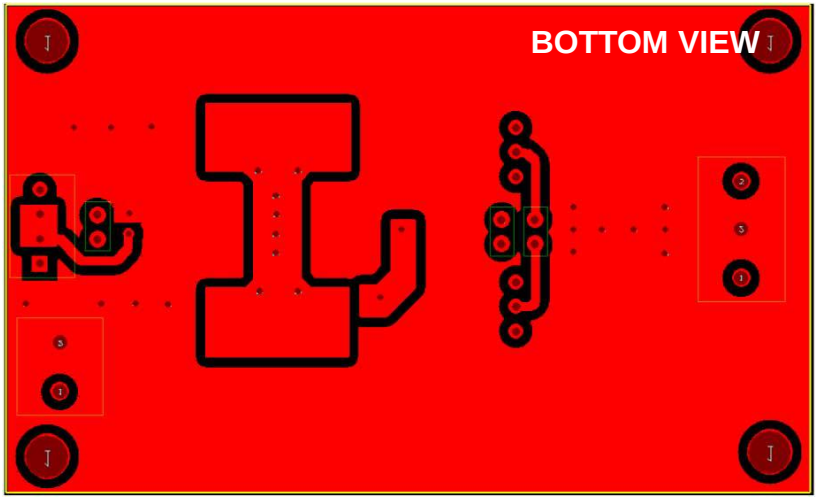
Item	Quantity	Reference	Part / Value	Tollerance %	Voltage Current	WATT	TECNOLOGY information	PACKAGE	Manufacturer	Manufacturer Code	RS/Distrelec Other Code	More Info
1	1	CON1	2 pins screw connector				PITCH-5mm	TH-5mm	phoenix contact	1935161	RS: 548-7238	
2	1	CON2	3 pins screw connector				PITCH-5mm	TH-5mm	phoenix contact	1935174	RS: 548-7244	
3	1	CON3	4 pins screw connector				PITCH-2.54mm	TH-2.54mm	Phoenix Contact	1723672	R.S.2901286	
4	3	J1, J2, J3	Jumper				PITCH-2.54mm	TH-2.54mm				2 PIN Jumper Switch
7	2	SW1, SW2	Jumper				PITCH-2.54mm	TH-2.54mm				3 PIN Jumper Switch
9	2	R1, R2	2Ω2					2512	BOURNS	CRM2512-JW-2R2ELF	Farnell: 1865269	
11	4	C1, C2, C5, C6	4n7F	10%	50V		X7R	0805	MURATA	GRM216R71H472KA01D	Farnell: 1828947	
15	3	C3, C7, C8	4u7F	10%	50V		X7R	1210	MURATA	GRM32ER71H475KA88L	Farnell: 1828841	
18	1	C4	100nF 50V	10%	50V		X7R	TH	AVX	SR205C104KAR	Farnell: 1100367	
19	1	R3	0Ω					0805	VISHAY	CRCW08050000Z0EA	Farnell: 1469846	
20	1	L1, L2	47uH	20%					EPCOS	B82477P4473M00	Farnell: 1644655	
21	1	U1	Socket 16 pin				PITCH-2.54mm	TH-2.54mm	TE	816-AG11D-LF	Farnell: 1077298	

Layout Guidelines for Fastest Design









RHFPM4424 – FLAT28: Application Board & PCB Layout

RHRPM4424 : Next Steps

- Worldwide Promotion
  - Already Selected in Several Application
  - Good Commercial Success Expected
- Series Extension : RHRPM4423
  - Inverting Version

EM : Now
QML : 4Q16

- BCD6s SOI : Proven Rad-Hard Capable
  - Some Rad-Hard Cells to be Added to the Design Kit
    - OTP for Trimming – LDMOS – Bipolar Transistor…
  - New Rad-Hard Power ICs under Development
    - Integrated Current Limiters (TRP) : 90 Volt Version
    - PWM Controller : (TRP) : 40V Version
    - High + Low Side Gate Driver (ECI4) : 190 Volt Version
    - …..

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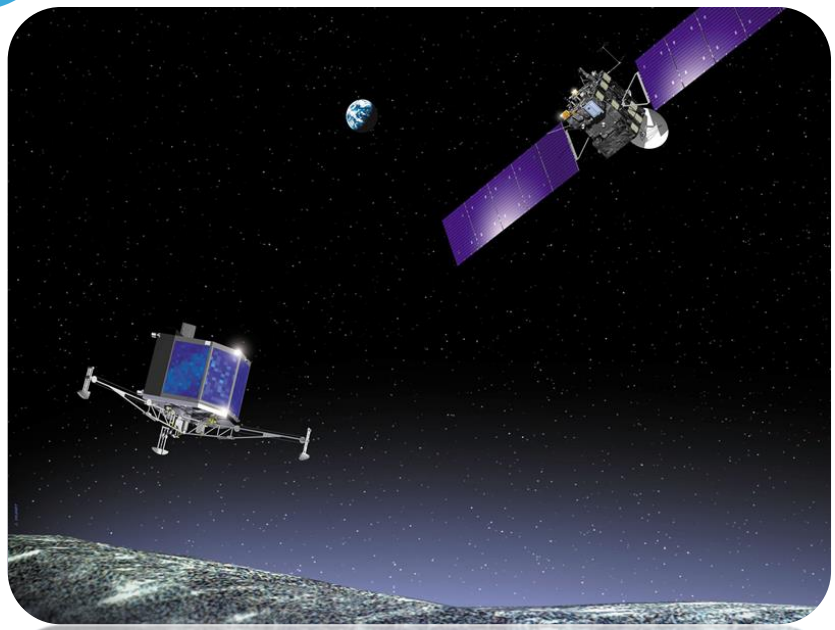
The Ingredients of the Success

- ECI Funding : a Key Enabler or the RHRPM4424
- Specification with the end Customers
  - Customer Survey, Requested by the ITT
- An Industrial Vision
  - Technology : Performance, Quality, Perenity
  - Product Design & Hardening Skills
  - Agency Certified Assembly Infrastructure for Production
  - Technical Support & Sales Network
- The Support of the ESA
  - Power Conversion Team & Radiation Team

Thank you!



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