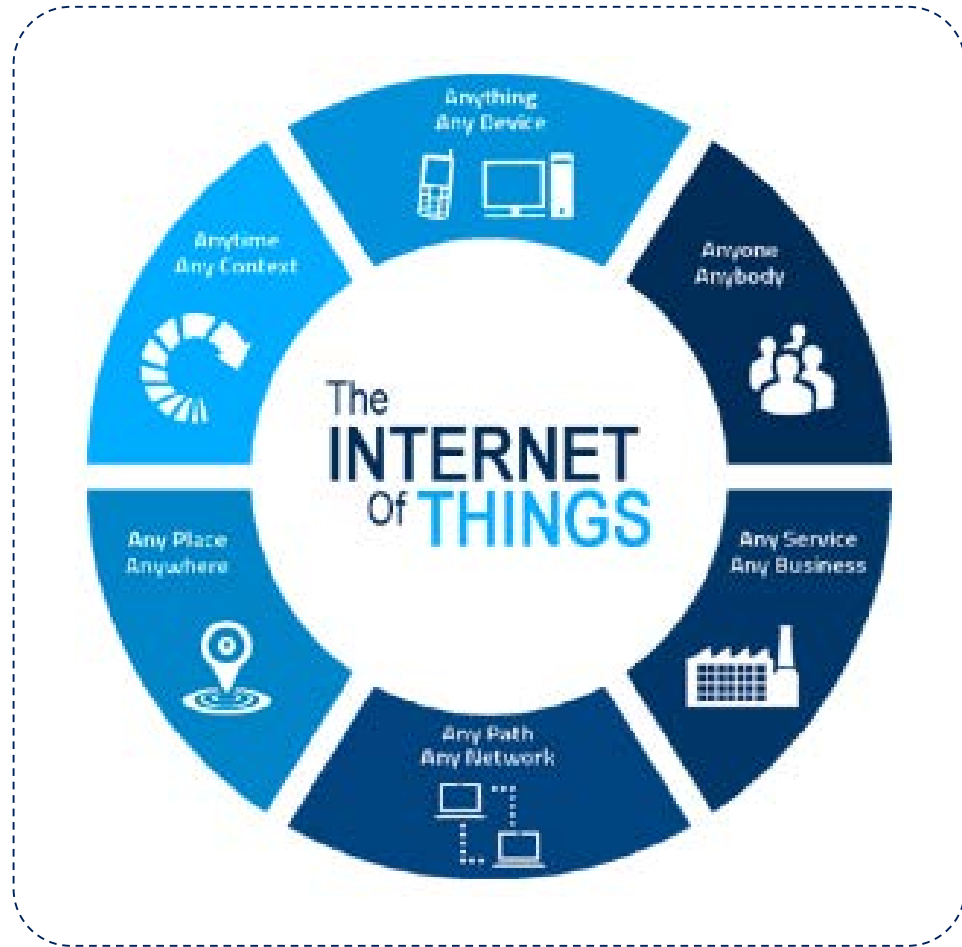


# Power Discrete for IoT Applications



Leading-Edge ESD  
Protection ICs

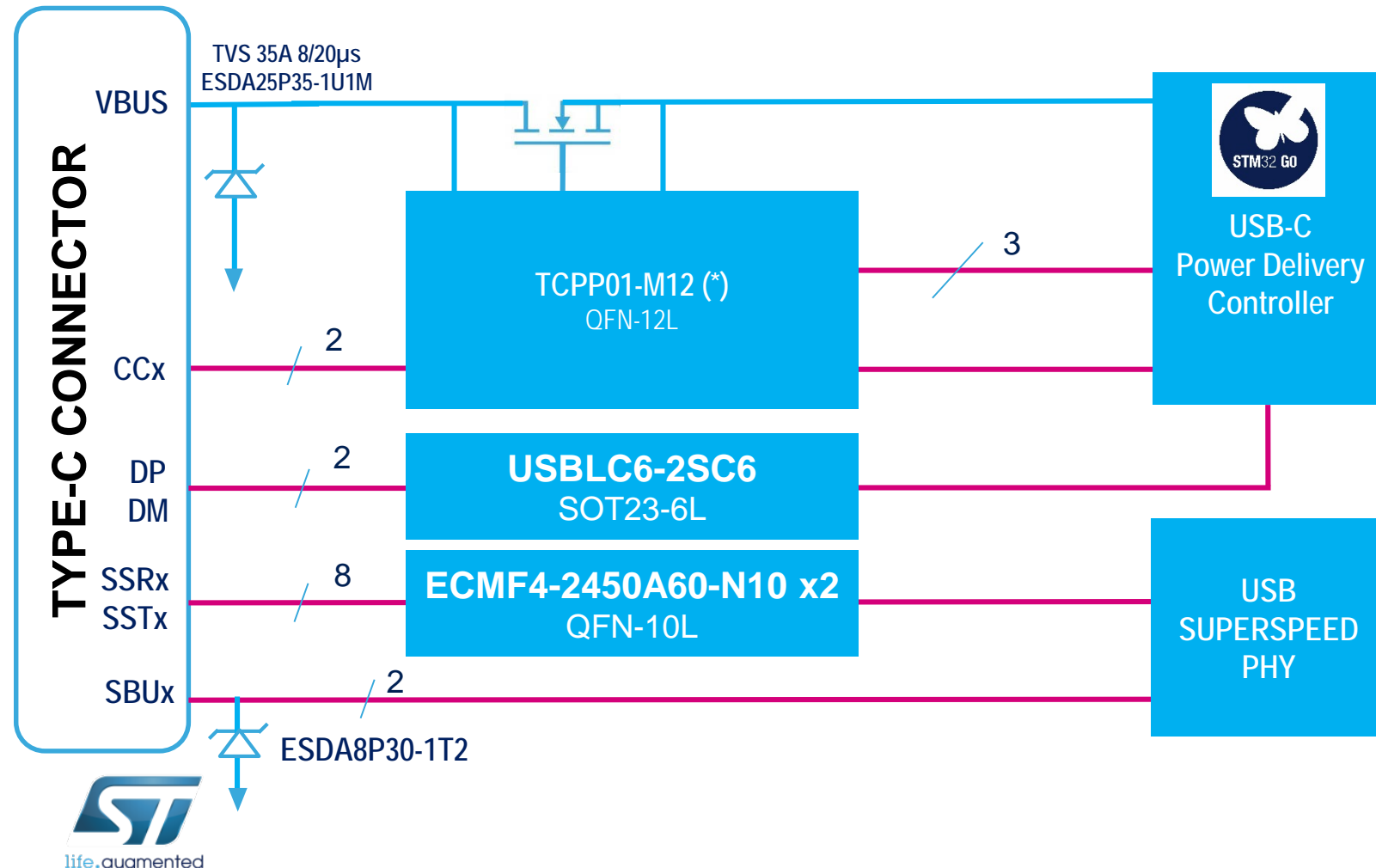
USB TYPE-C  
Port Protection  
ASSP

HDMI / DP / USB  
Common Mode  
Filtering ICs

RF INTEGRATED  
PASSIVES  
Wireless  
Connectivity

# Type-C Port Protection

## COMPLETE ESD & EMI PROTECTION PORTFOLIO FOR USB TYPE-C



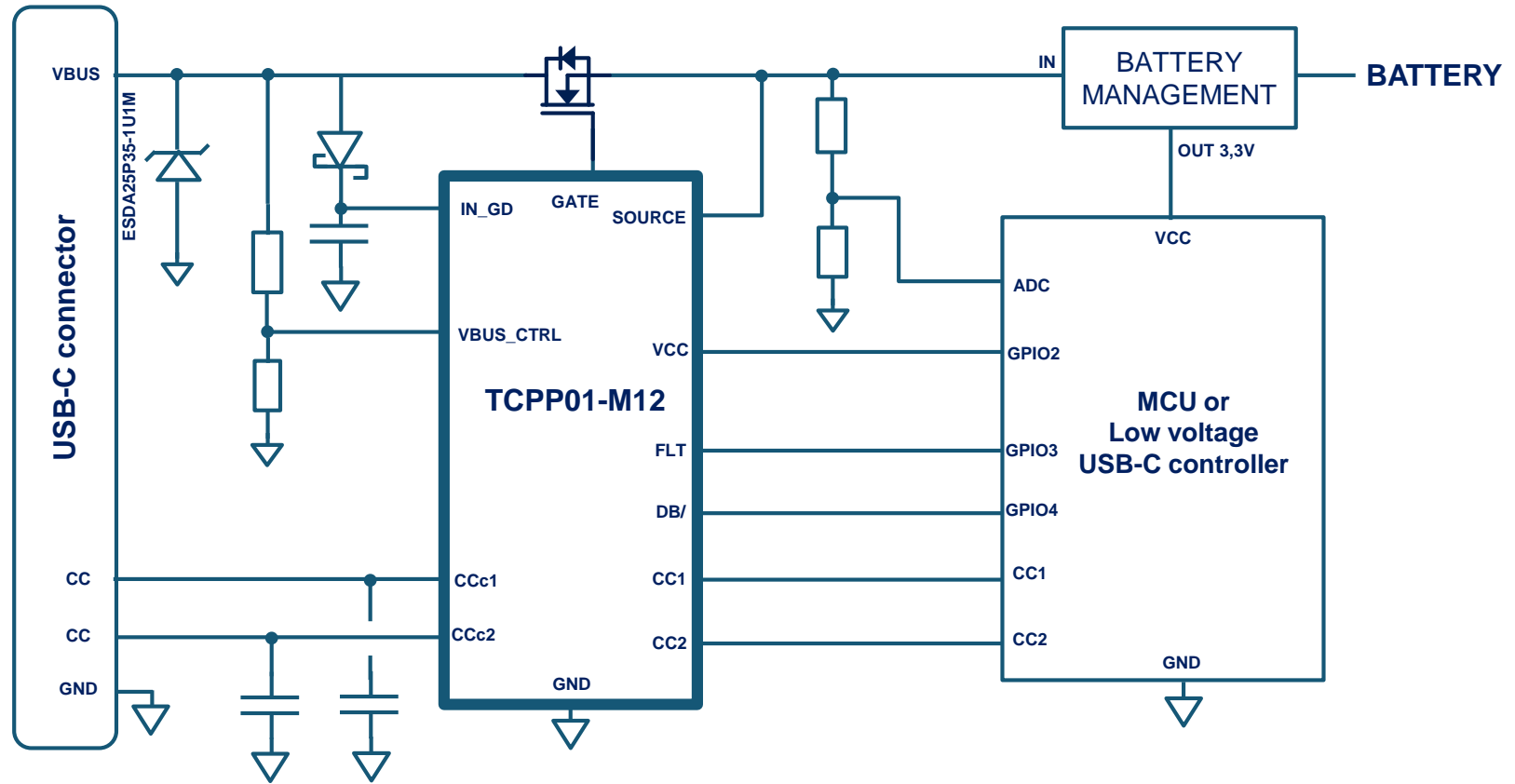
- System-Level ESD Protection
- IEC61000-4-2 Level 4 ( $\pm 8\text{kV}$ )

- Highest 8/20 $\mu\text{s}$  current surge capability in 1610 and 0402 packages

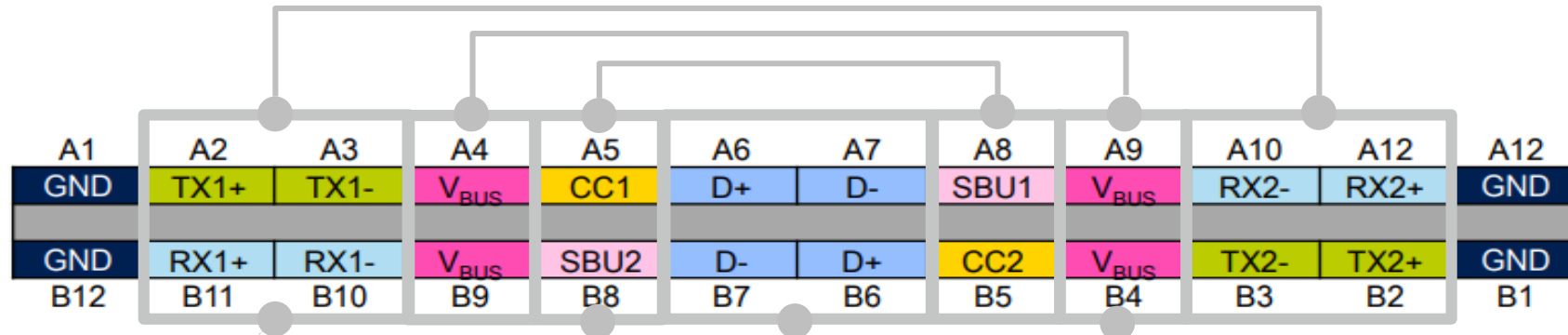
- ECMF4-2450A60-N10 compliant with USB3.1 Gen2 data rate

# TCP01-M12 Application Block Diagram

Typical application block diagram for SINK, battery-powered application



## ESD & EOS protection IC for USB Type-C ports



- HSP051-4N10
- HSP053-4M5
- ESDARF02-1BU2CK
- ESDAXLC5-1U2
- ECMF4-20A42N10
- ECMF4-2450A60N10

- ESDZV5-1BF4
- ESDZV5-1BU2
- ESDZV18-1BF4
- ESDZV5-1BV2
- ESDZV142-1BF5

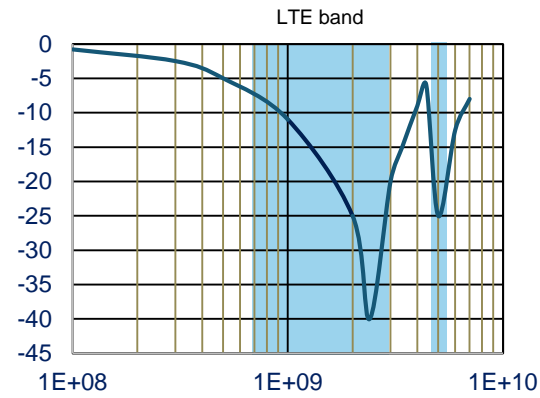
- HSP061-2
- ESDAULC5-1BF4
- ECMF02-2HSMX6
- ECMF02-2BF3

- ESDA7P60-1U1M
- ESDA7P120-1U1M
- ESDA13P70-1U1M
- ESDA17P50-1U1M
- ESDA24P140-1U1M

# Smart Things reaching or power-lasting further: ESD Protection + Common Mode Filter

## High-speed communication interfaces

Scc21

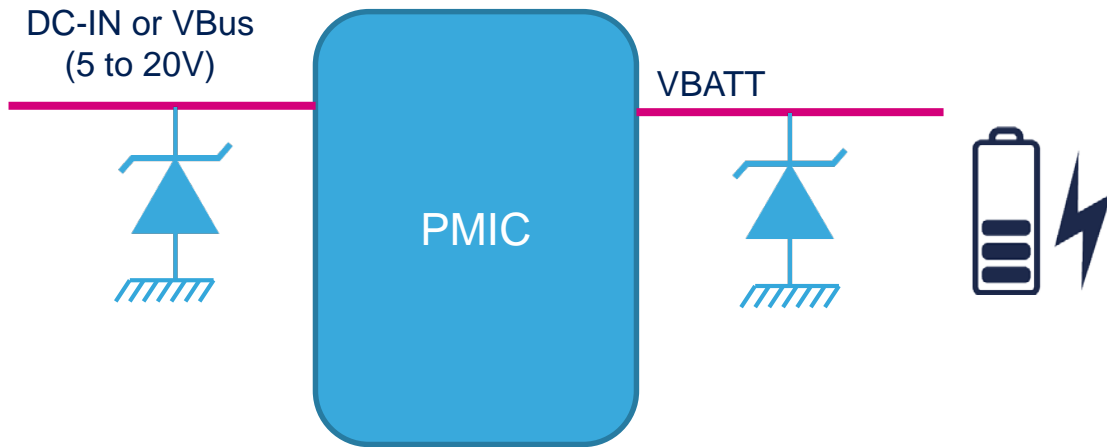


P/N	Application		Comment
ECMF4-20A42N10	Smartphone Tablet	-23 dB	Large bandwidth of 5GHz
		-25 dB	
ECMF4-2450A60N10	Tablet Stick	-35 dB	Complete solution to filter both WiFi frequencies 400µm pitch
		-25 dB	
ECMF02-2HSMX6	Smartphone STB / Sticks Game Console	-35 dB	Complete solution to filter from 0.7Ghz to 5GHz 500µm pitch package size compatible with consumer applications
		-20 dB	
		-20 dB	
		-20 dB from 0.7GHz to 2.4GHz	
ECMF04-4HSWM10	STB / Sticks Game Console	-25 dB	Large bandwidth of 4.2GHz 500µm pitch package size compatible with consumer applications
CMF2-2450A90H3	Tablet Stick	-40 dB @ 2.4GHz	Very large bandwidth of 9GHz Complete solution to filter both WiFi frequencies
		-25 dB @ 5GHz	



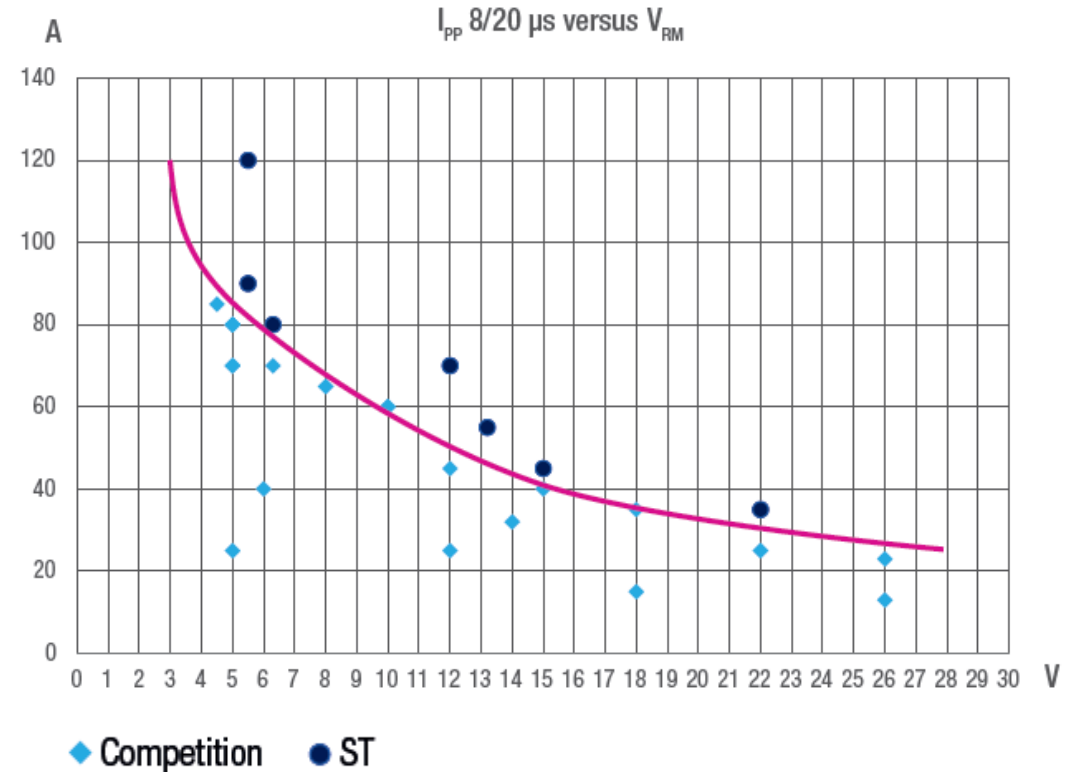
# Smart Things Power-Surge Protection

Power Delivery Protection Simply Cancels ESD and EOS Events



2 nodes have to be protected against 8/20 $\mu$ s surges:  
DC-IN or USB Vbus to prevent surge from external DC-DC or ESD  
VBATT (the battery node, to prevent PMIC failure or external ESD protection)

Peak Pulse Current performance



# Type-C Connector ESD & EOS Protection

## USB vbus and vbat esD & eos protection

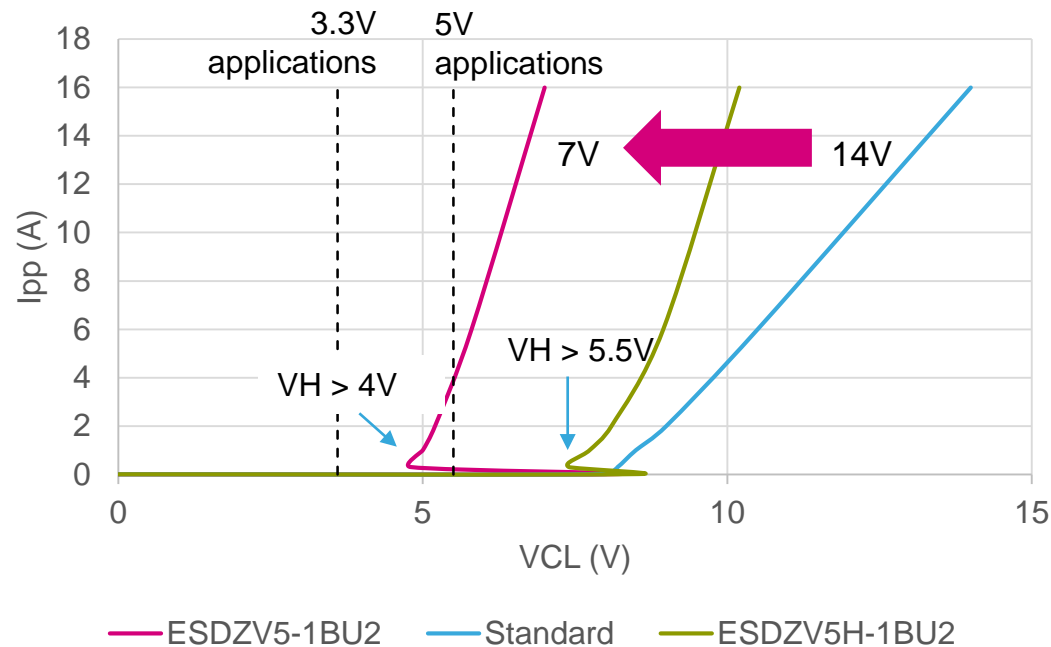
part number	number of lines	Directionality	voltage	Peak pulse current ( $I_{PP}$ @ 8/20 $\mu$ s)	$V_{CL}$ @ $I_{PP}$ (@8/20 $\mu$ s surge)	IEC 61000-4-2 min (contact for 8 kv in V)	Package & size (mm x mm)
ESDA7P60-1U1M	1	Uni-Directional	5.5	60	10	30	ST1610 1.6x1.0
ESDA7P120-1U1M	1	Uni-Directional	5.5	120	11	30	ST1610 1.6x1.0
ESDA7P80-1U1M	1	Uni-Directional	5	80	8	30	ST1610 1.6x1.0
ESDA13P70-1U1M	1	Uni-Directional	12	70	20	30	ST1610 1.6x1.0
ESDA15P60-1U1M	1	Uni-Directional	13.2	60	20	30	ST1610 1.6x1.0
ESDA17P50-1U1M	1	Uni-Directional	15	50	24	30	ST1610 1.6x1.0
ESDA17P100-1U2M	1	Uni-Directional	15	160	28	30	QFN 2.0x1.8
ESDALC20-1BF4	1	Bi-Directional	20	2.4	37	20	ST0201 0.6x0.3
ESDA22P150-1U3M	1	Uni-Directional	20	150	27	30	QFN 2.0x2.0
ESDA25P35-1U1M	1	Uni-Directional	22	35	39	30	ST1610 1.6x1.0
ESDA24P140-1U3M	1	Uni-Directional	22	140	33	30	QFN 2.0x2.0

## USB CC and SBU lines ESD & EOS Protection

ESDA8P30-1T2	1	Uni-Directional	6.3	30	12	30	SOD882T 1.0x0.6
ESDA8P80-1U1M	1	Uni-Directional	6.3	80	13.2	30	ST1610 1.6x1.0

# Snap-back vs standard ESD protections

## Low Clamp high bandwidth ESD protection



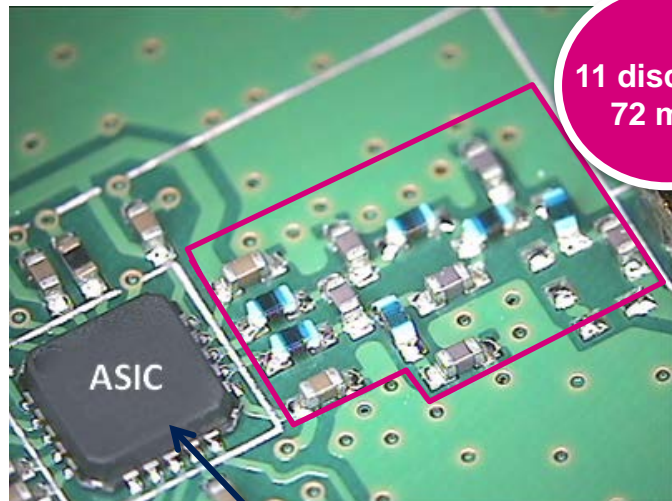
- From 5pF up to 100pF a complete range of protection  $V_{cl} < 10V$ .

- Up to 18 kV IEC 61000-4-2 ESD contact discharge
- Up to 7 A 8/20  $\mu s$  peak pulse current



# What is RF IPD?

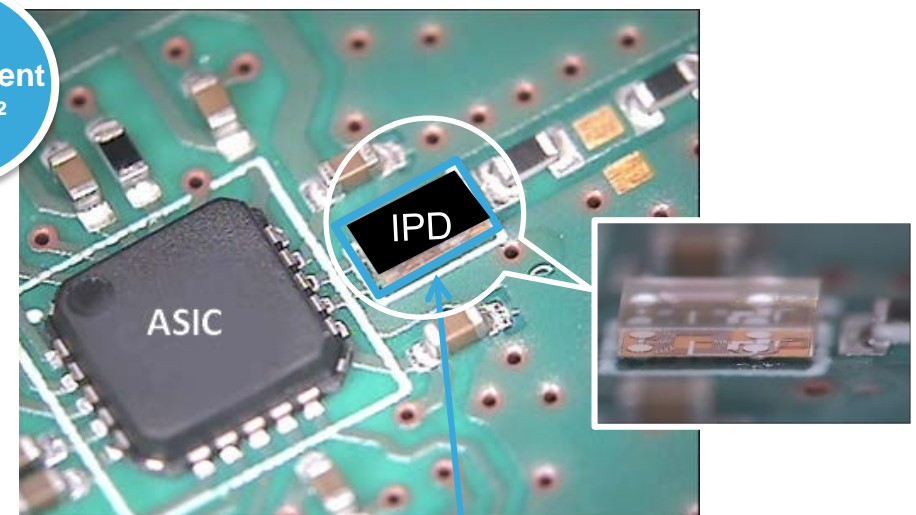
## Discrete balun & matching network



11 discretes  
72 mm<sup>2</sup>

Application **S**pecific **I**ntegrated **C**ircuits

## RF IPD balun & matching network



1 component  
1.2 mm<sup>2</sup>

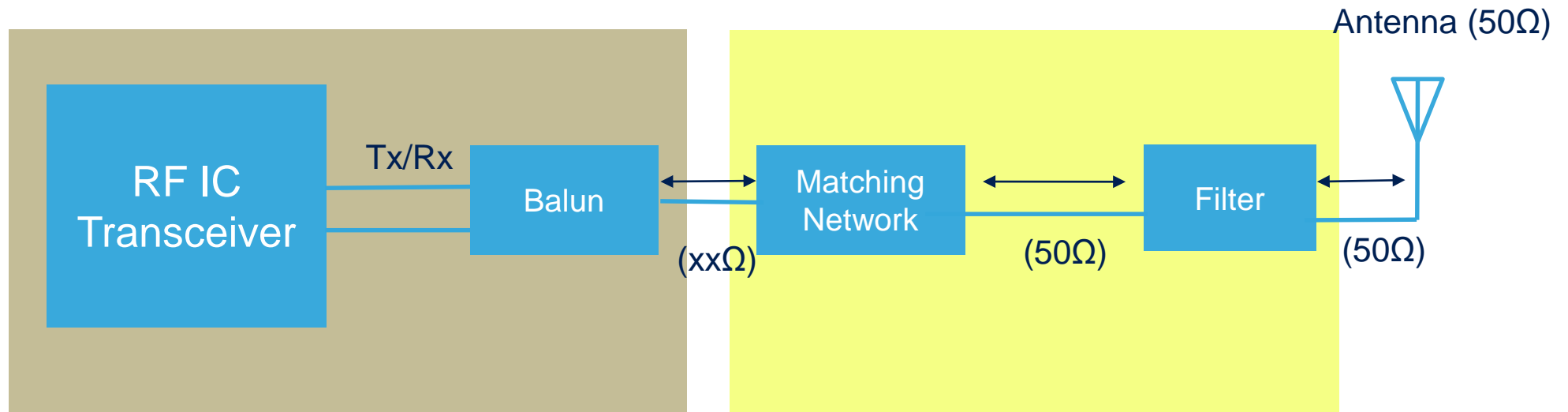
RF **I**ntegrated **P**assives **D**eVICES

- High BOM cost
- BOM complexity
- Performance variation across temperature variations
- Performance variation across component tolerances

- Design simplification & Performance optimization
- System integration & Reliability improvement
- BOM reduction
- Easier and successful development process

Three blocks required

- **Balun** – Combine TX and RX signals into one pin
- **Matching Network** – Transformation to 50  $\Omega$  impedance
- **Harmonic Filter** – Reduce out-of-band TX harmonic emissions and RX susceptibility



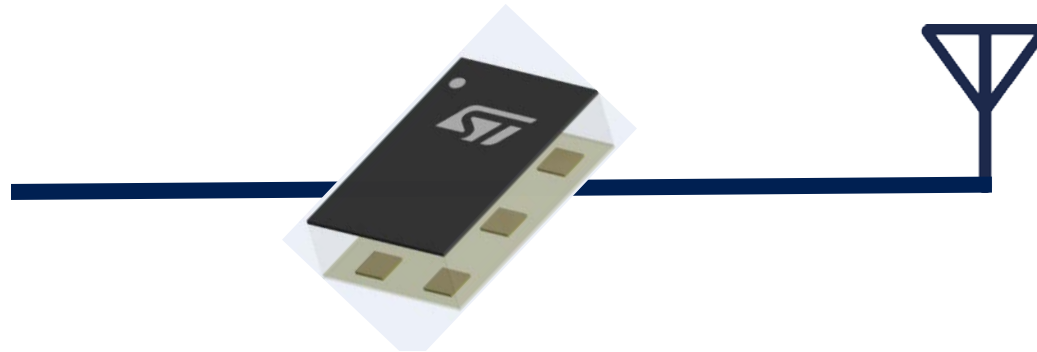
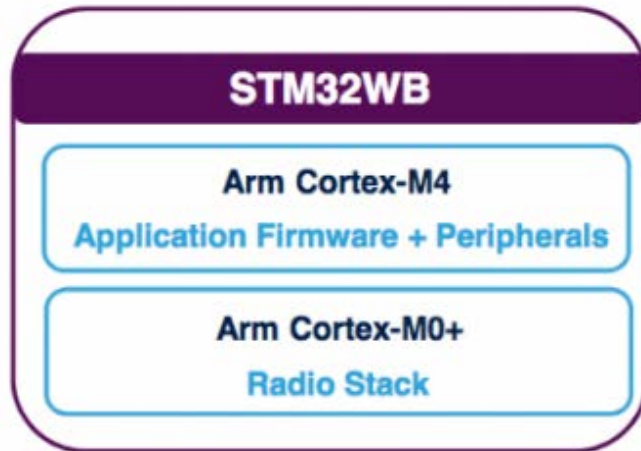
STM32WB55

MLPF-WB55-01E3

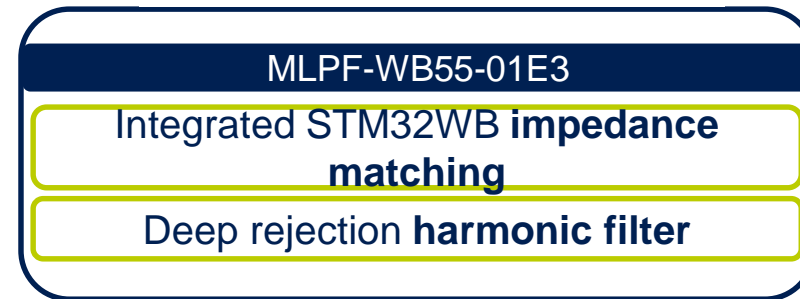
## Harmonic Filter with integrated impedance matching



Integrated Balun



MLPF-WB55-01E3

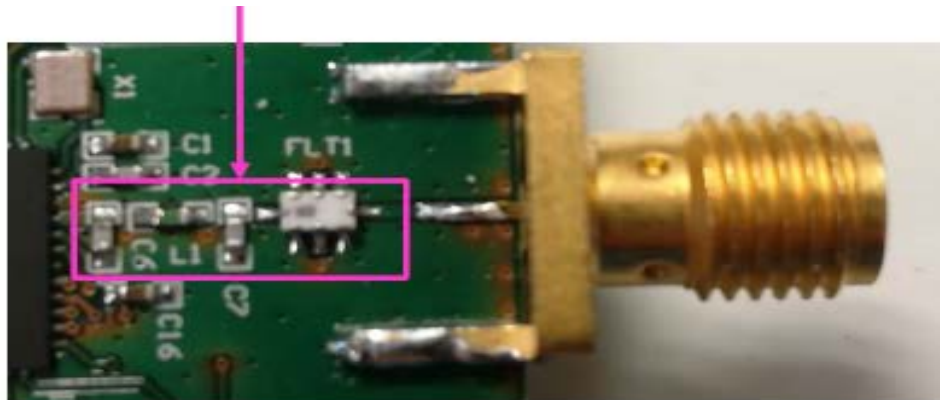


# MLPF-WB55-01E3

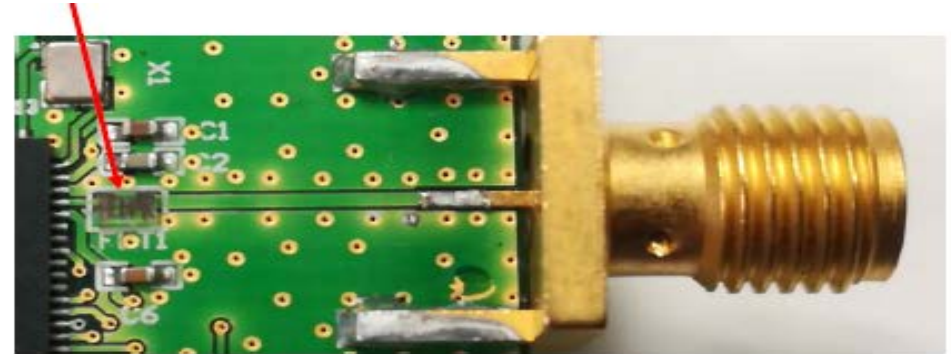
## Harmonic Filter with integrated impedance matching

1 device replaces discrete matching network + harmonic filter

Discrete matching network + harmonic filter in STM32WB reference design



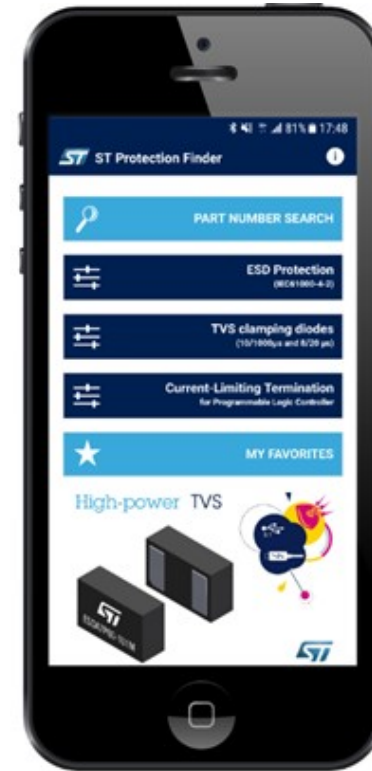
MLPF-WB55-01E3



Evaluation board not size-optimized

# ST Protection Finder

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