



Power Electronics: Fast Recovery Diodes



angstrom

IGBT MODULES AND POWER TRANSISTOR'S APPLICATIONS



Railway



Transport



Health care



Energy stations



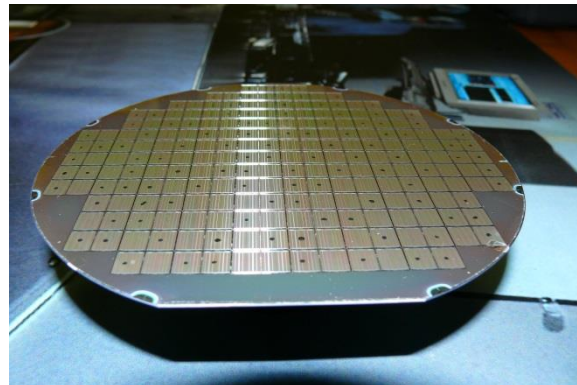
Home appliance

Industry



○ TYPE OF PRODUCTS

- Dies
- Discrete transistors and diodes
- Modules



PRODUCTS PORTFOLIO

	Voltage	Current	Technology
IGBT	600-6500V	15-150A	NPT, NPT+, SPT
FRD*	400-6500V	15-150A	Planar
N channel MOSFET	30-1500V	1-140A	Trench, advanced planar, low charge, Zener diode, depletion mode
P channel MOSFET	-20 to -200V	-6 to -52A	Trench, advanced planar, low charge

**FRDs mostly used to pair with IGBTs*



FRD: PLANAR TECHNOLOGY FOR SOFTNESS AND FASTNESS

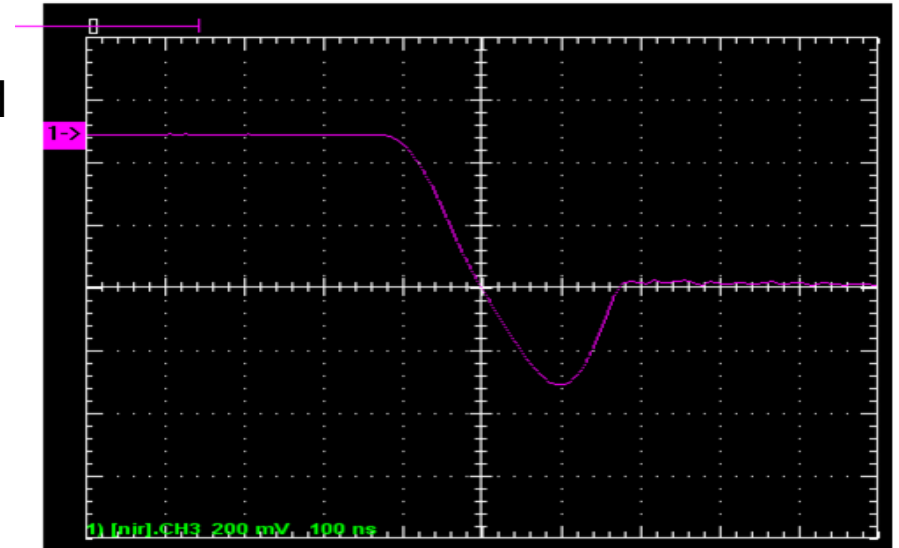
Main advantages

- Fast and soft switching, softness around 1
- Low switching losses
- Max. operating junction temperature 150°C

For parameters fixation used:

Electron irradiation + annealing

Flexible range of dynamics available



Product	$I_{F/}$ A	$I_{R/}$ A	$t_{rr,}$ ns	$t_a,$ ns	$t_b,$ ns	S	$di/dt,$ A/us
An100FRD12	100	39	200	100	100	1.0	0.5
An50FRD17	50	32	170	100	70	0.7	0.41



FRD: PRODUCT LINE

FRD dies

	15A	25A	30A	40A	50A	75A	100A	150A
400V	+	+		+			+	+
650 V	+		+	+			+	+
1200V	+	+			+	+	+	+
1700V					+	+	+	
2500V							+	
3300V							+	
4500V					+			
6500V					+			



○ FRD + IGBT AVAILABLE PAIRS

Voltage	IGBT(current), A	FRD(current),A
650	30	30
	40	30
	100	100
	150	150
1200	15	15
	25	25
	50	50
	75	75
	100	100
	150	150

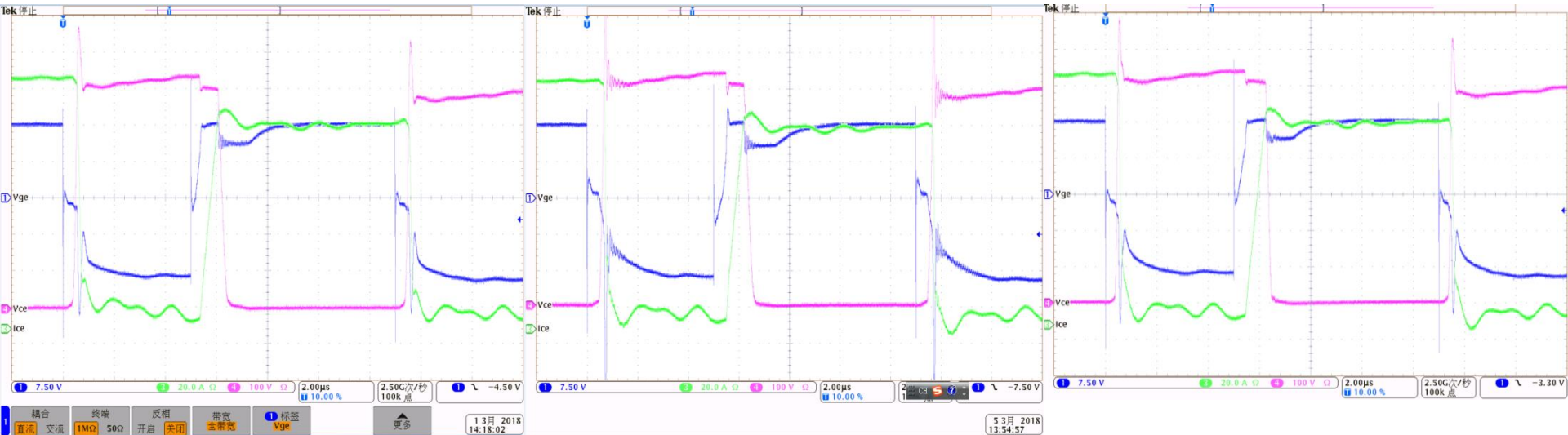


MEASUREMENT OF DYNAMIC PARAMETERS OF IGBT & FRD CHIPS 1200 V 150 A MANUFACTURED BY ANGSTREM (RUSSIA), INFINEON (GERMANY) & MITSUBISHI (JAPAN)

«Angstrem»

«Infineon»

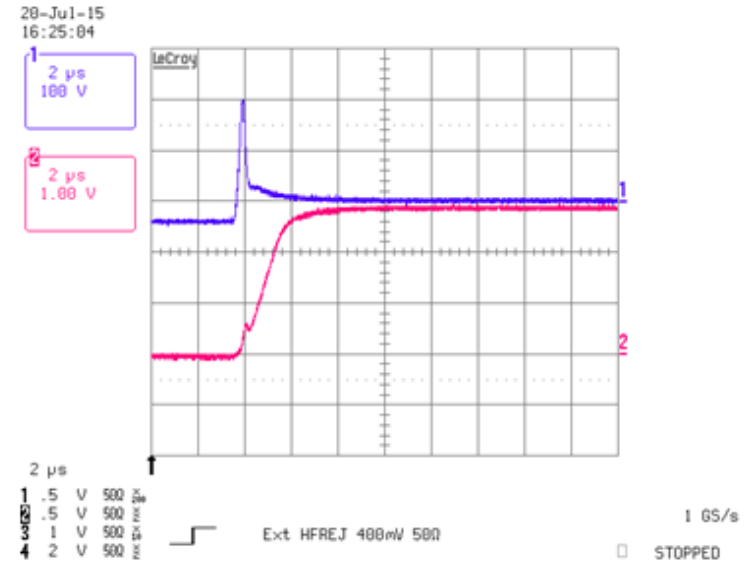
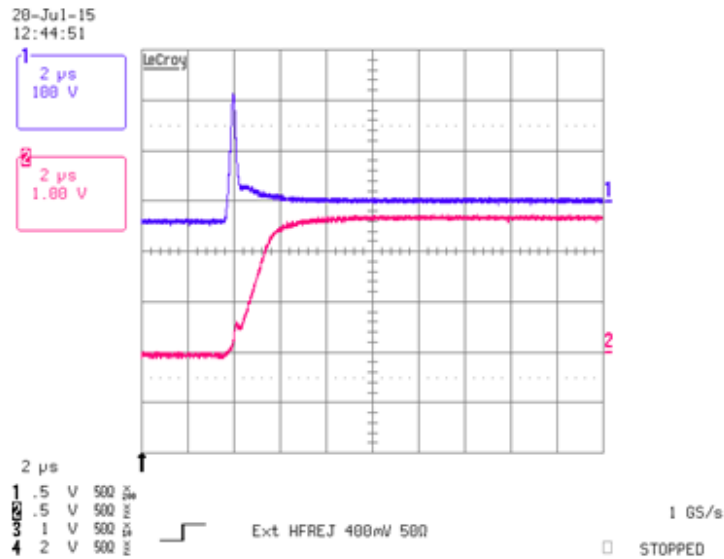
«Mitsubishi»



Product	I_C A	V_{CC} V	Turn ON ($T_j = 25^\circ\text{C}$) IGBT					Turn OFF ($T_j = 25^\circ\text{C}$) IGBT		
			$t_{d(on)}$ us	t_r us	I_{peak} A	E_{on} mJ	di/dt A/us	$t_{d(off)}$ us	t_{fr} us	E_{off} mJ
An150IGB12 Angstrem	150	600	0.44	0.52	-	38	-	0.57	0.16	14
Infineon	150	600	0.55	0.48	-	37	-	0.7	0.07	11
Mitsubishi	150	600	0.56	0.49	-	40	-	0.515	0.2	13



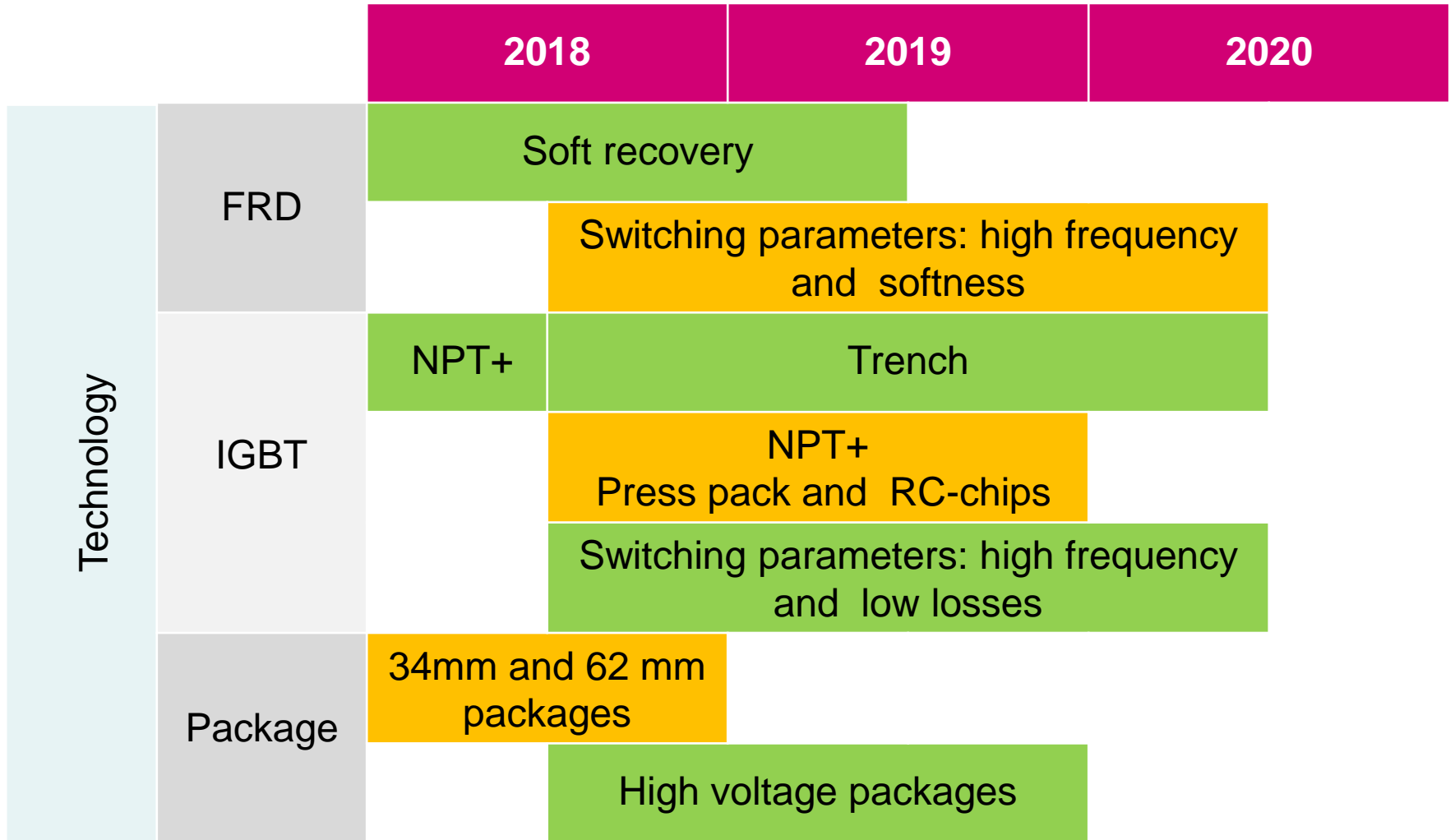
MEASUREMENT OF DYNAMIC PARAMETERS OF FRD CHIPS 4500 V 60 A & 6500 V 50 A MANUFACTURED BY ANGSTREM AND ABB (DATASHEET)



Product	V_{Rf} V	V_{Ff} V	I_{rr} A	t_{rr} us	Q_{rr} uC	E_{rec} mJ	di/dt A/us
An60FRD45 Angstrom	4800	2.7	184	0.936	63	30	447
5SLY12L4500 (datasheet ABB)	4500	3.4	135	0.870	95	135	600
An50FRD65 Angstrom	6700	3.6	172	1.094	67	34	284
5SLX12M6500 (datasheet ABB)	6500	3.4	80	2.250	100	180	230



TECHNOLOGY ROADMAP





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