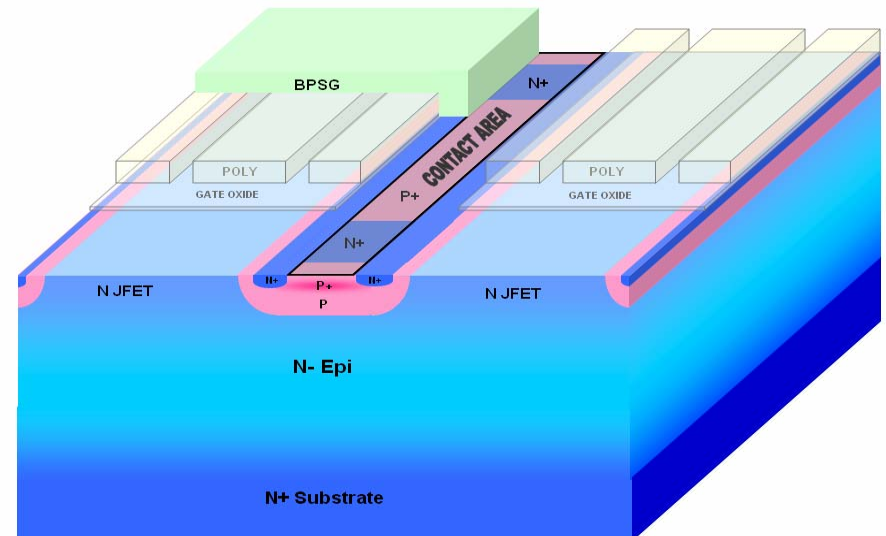






## • Feature

- Lowest specific  $R_{DS(on)}$  in regular DMOS technology 40% Reduction
- Higher avalanche energy
- Total gate charge ( $Q_g$ ) reduces 25%
- Lower Miller capacitance ( $C_{gd}$ )
- Input gate capacitance ( $C_{iss}$ ) is less in order to reduce gate drive power
- Lower turn-off energy without effecting EMI
- Increased power density



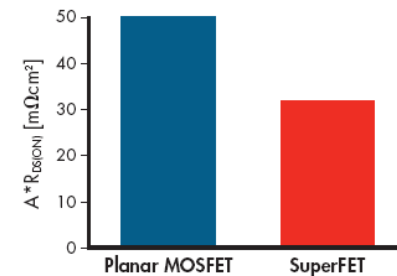
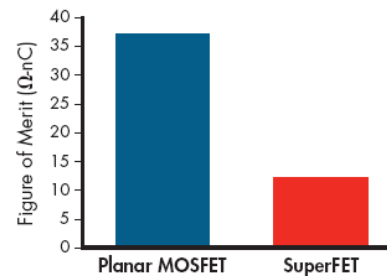
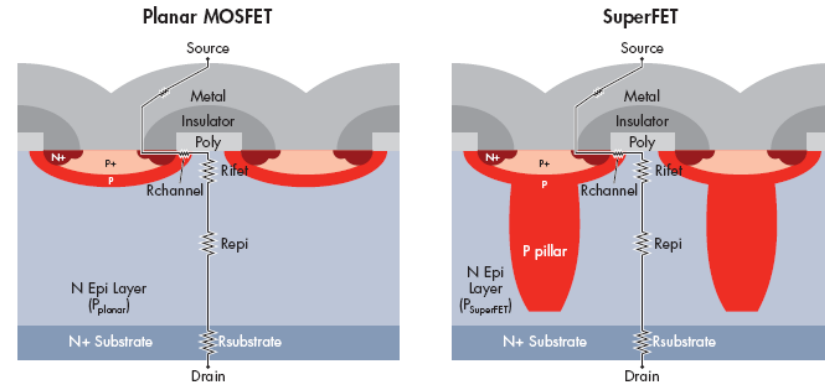


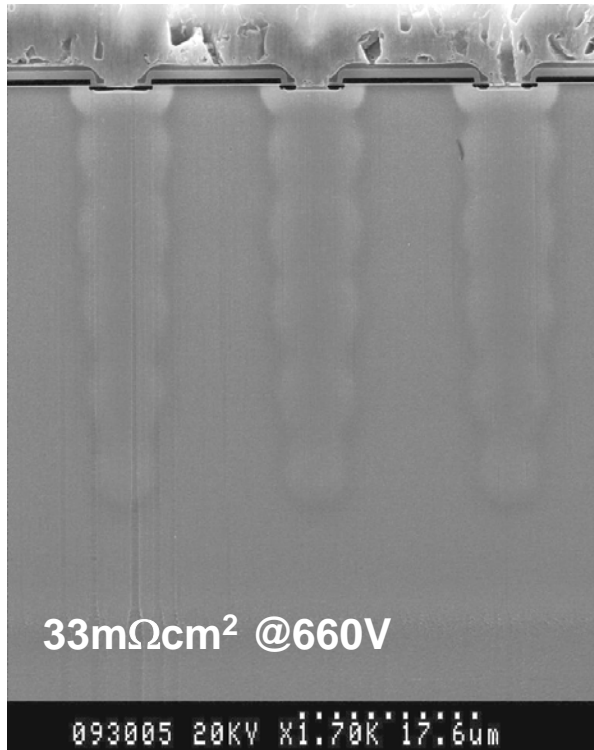
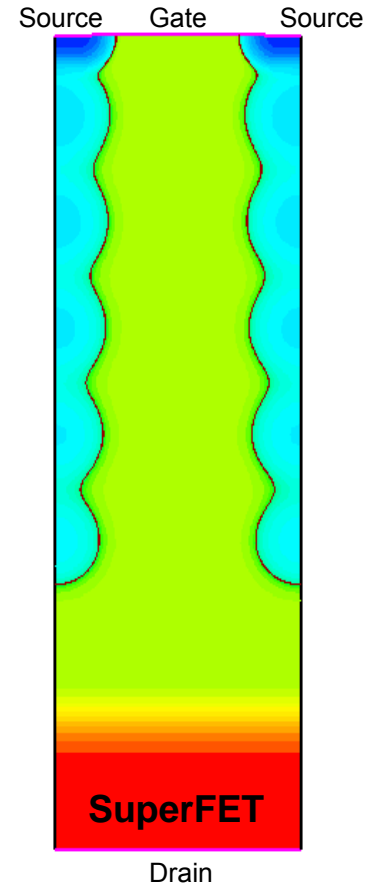
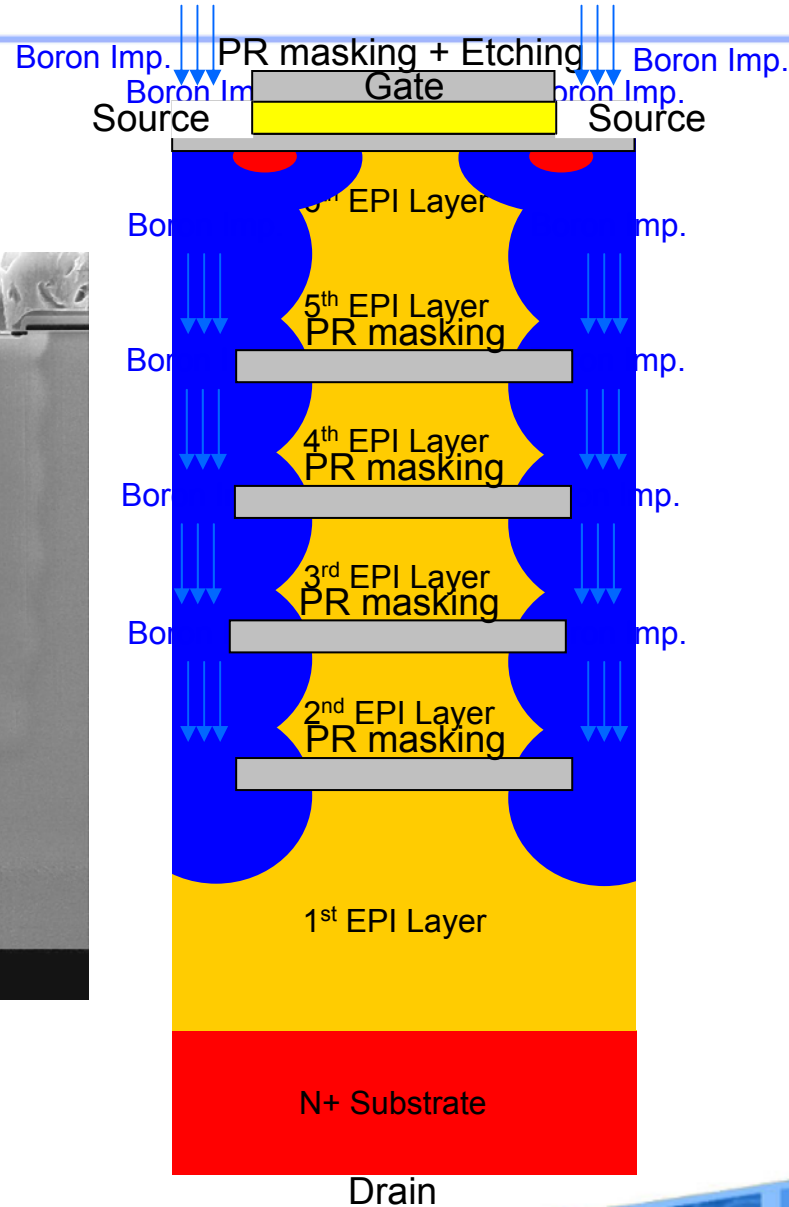
### Feature & Benefits

- Ultra low  $R_{ds(on)}$  resulting in low conduction loss and improved efficiency in end-applications
- Best-in-class  $di/dt$  and  $dv/dt$  rating that allows the devices to operate at higher frequencies, ensures ruggedness and reliability
- Lower switching losses due to lower effective output capacitance ( $C_{oss,eff}$ ) that allows high frequency switching and better efficiency in resonant mode topologies
- Ultra low gate charge that improves switching performance.

### Applications

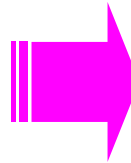
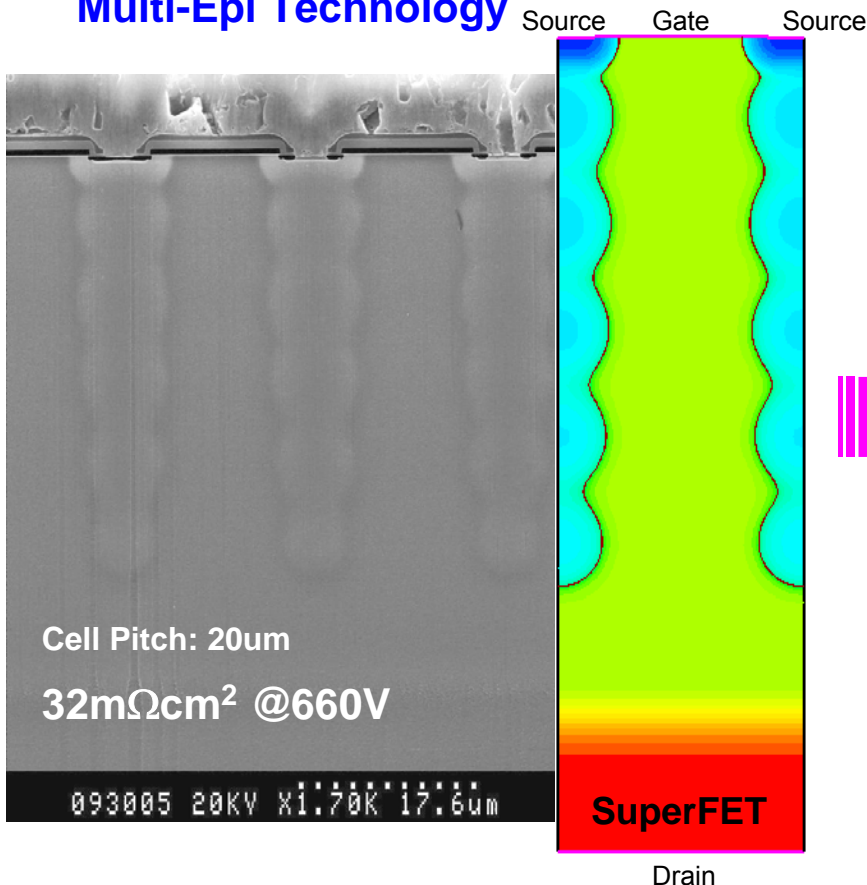
- PFC for high efficiency SMPS
- Server/Telecom Power SMPS
- LCD/PDP TV SMPS
- Electronic Ballast



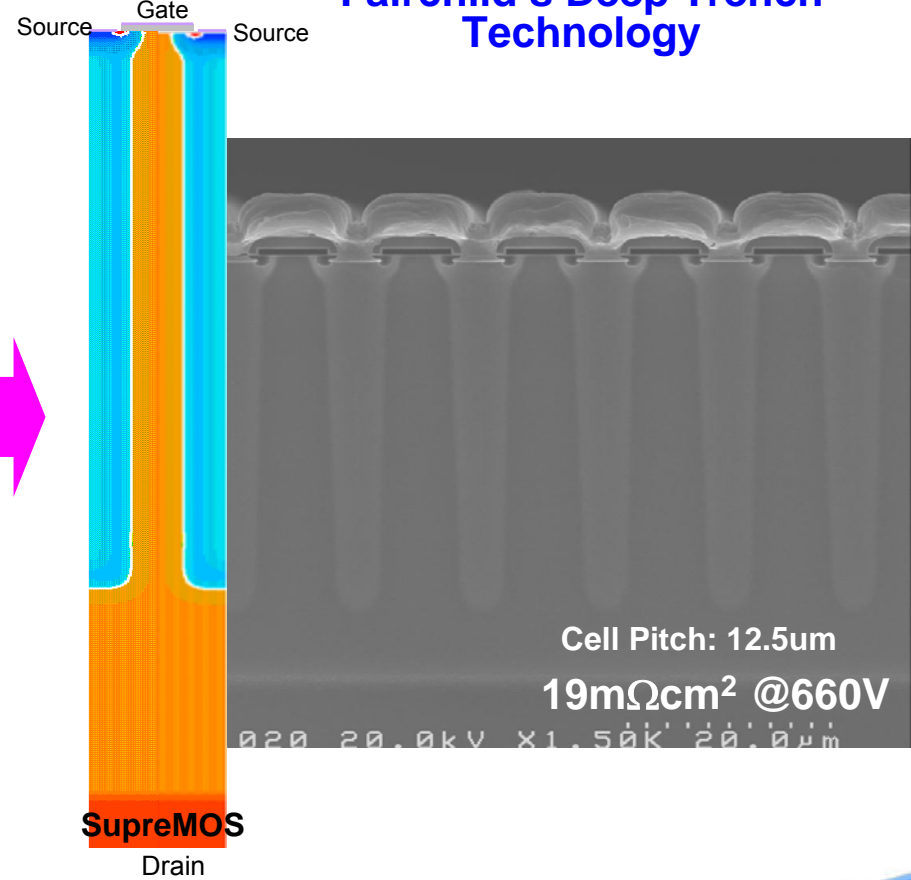




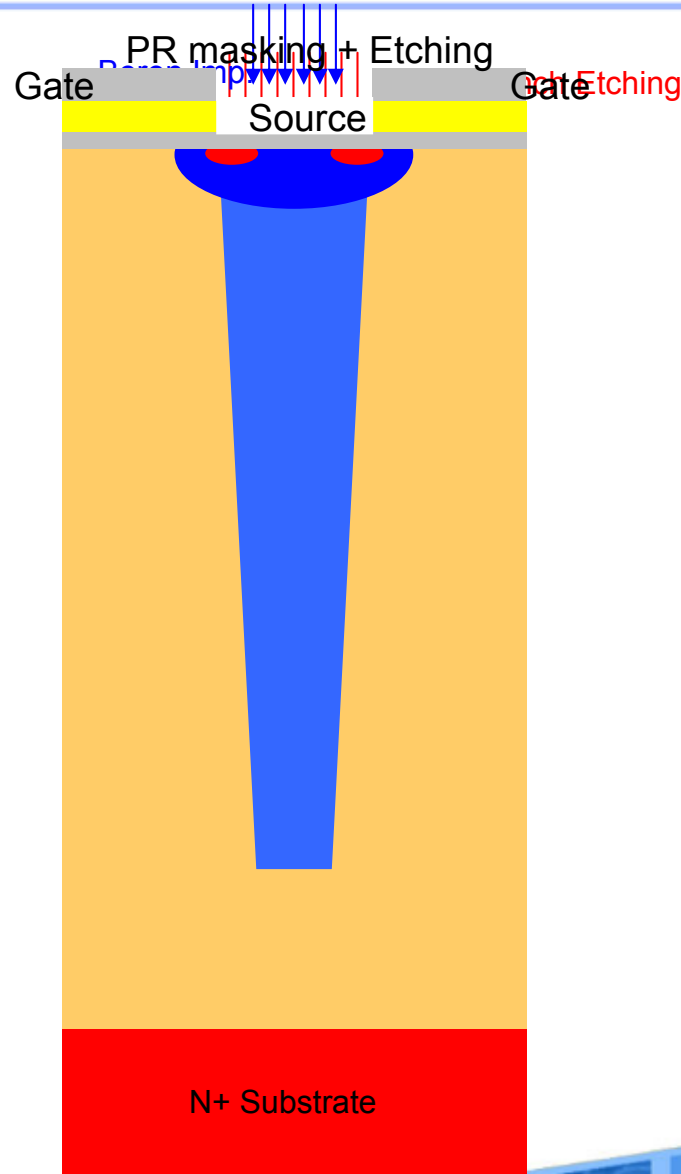
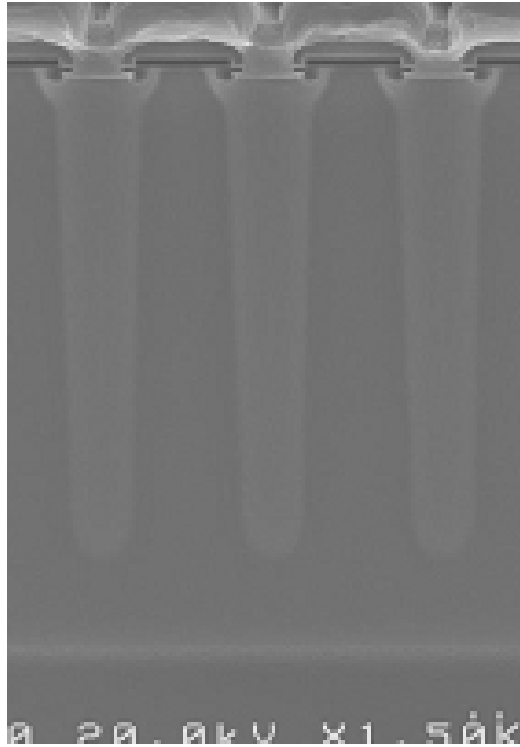
## SuperFET™ Conventional Multi-Epi Technology



## SupreMOS™ Fairchild's Deep Trench Technology



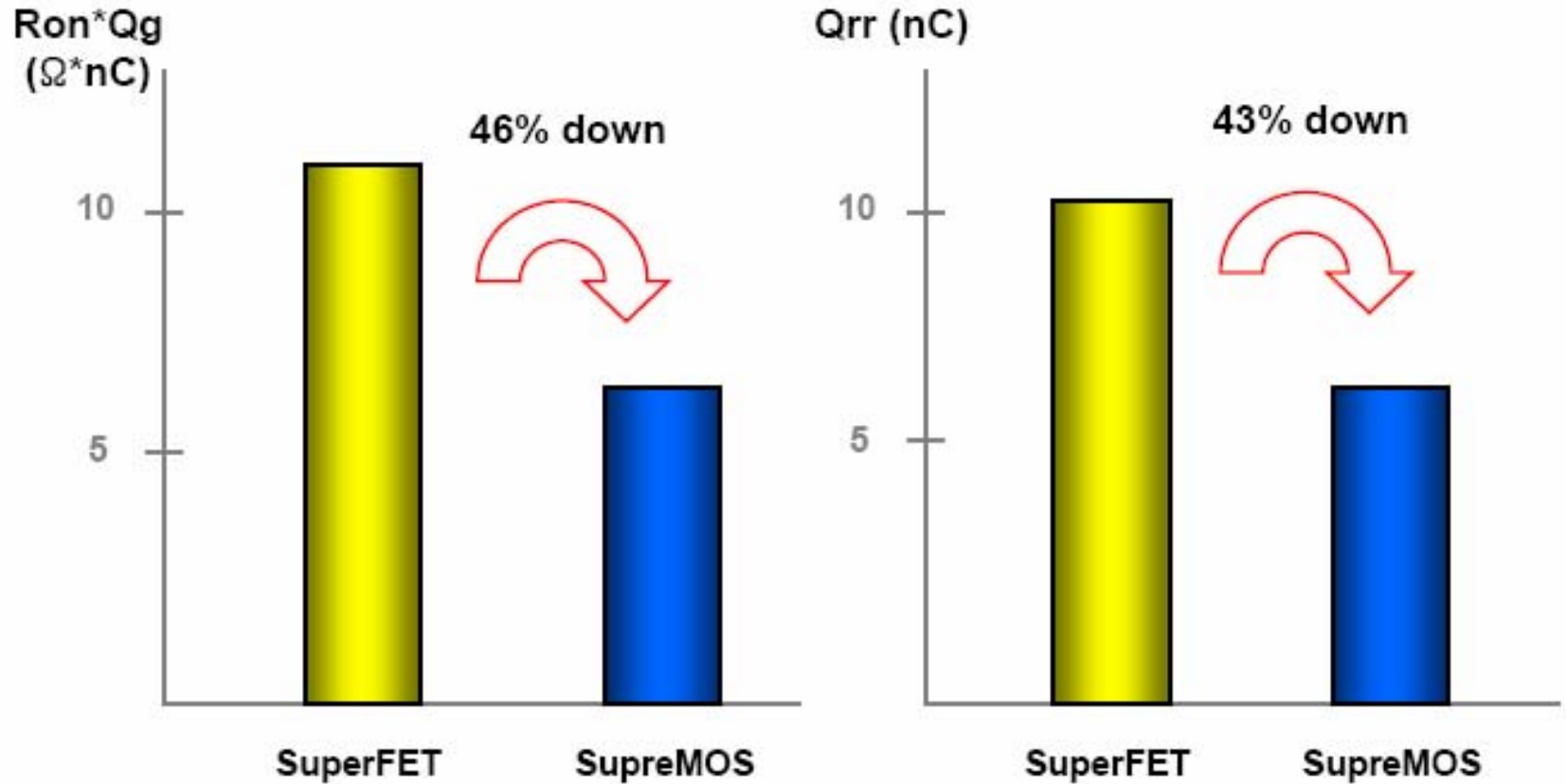
- Higher active cell density
- Stable process parameter during fabrication
- Simple process step
- Special deep trench etching, fill-in process and particle management required





- **Feature & Benefits**
  - . **600V Super-junction MOSFET** using deep trench technology
  - .  **$A \cdot R_{DS(on)}$ ,  $19m\Omega \cdot cm^2$**
  - . **Lower input capacitance,  $C_{iss}$**
  - . **Higher diode dv/dt capability, 15V/ns**
  - . **Good reverse recovery diode characteristics, trr & Qrr**
  
- **Applications**
  - . **PDP & LCD TV PFC**
  - . **Server/Telecom Power**
  - . **Electronic ballast**
  - . **Solar Inverter**





You can save switching loss ,conduction loss and internal diode loss.





## SuperFET Line-up ( Running Products ) for Power Block

Product FSC	BV <sub>DSS</sub> [V]	R <sub>DS(on)</sub> [Ω]	ID (25°C) [A]	Qg,typ [nC]	Tr,typ [nS]	Package	Sample	CorssReference	
								I COMP.	S COMP.
FCP4N60	600	1.2	3.9	12.8	277	TO-220	Available	SPP03N60C3	
FCD4N60	600	1.2	3.9	12.8	277	D-PAK	Available	SPD03N60C3	STD3NM60
FCD5N60	600	0.95	4.6	16	295	D-PAK	Available	SPD04N60C3	STD5NM60
FCU5N60						I-PAK	Available		
FCD7N60	600	0.6	7	23	360	D-PAK	Available	SPD07N60C3	
FCU7N60						I-PAK	Available		
FCP7N60						TO-220	Available	SPP07N60C3	STP8NM60
FCPF7N60						TO-220F	Available	SPA07N60C3	STP8NM60FP
FCP11N60	600	0.38	11	40	390	TO-220	Available	SPP11N60C3	STP11NM60
FCPF11N60						TO-220F	Available	SPA11N60C3	STP11NM60FP
FCI11N60						I2PAK	Available		STB11NM60
FCB11N60						D2-PAK	Available	SPB11N60C3	STB11NM60-1
FCP11N60F	600	0.38	11	40	120	TO220	Available	SPP11N60CFD	STP11NM60FD
FCB11N60F						D2-PAK	Available		
FCPF11N60F						TO-220F	Available		STP11NM60FDFP
FCP11N65	650	0.38	11	40	390	TO-220	code F	SPP11N65C3	
FCPF11N65						TO-220F	code F	SPA11N65C3	
FCP16N60	600	0.26	16	55	435	TO-220	Available	SPP15N60C3	STP20NM60
FCA16N60						TO-3P	Available	SPW15N60C3	STW20NM60
FCP20N60	600	0.19	20	75	530	TO-220	Available	SPP20N60C3	STP20NM60
FCPF20N60						TO-220F	Available	SPA20N60C3	STP20NM60FP
FCB20N60						D2-PAK	Available	SPN20N60C3	STB20NM60
FCH20N60						TO-247	Available	SPW20N60C3	STW20NM60
FCB20N60F	600	0.19	20	75	160	D2-PAK	Available	SPW20N60CFD	
FCA47N60	600	0.07	47	210	590	TO-3P	Available	SPW47N60C3	
FCH47N60						TO-247	Available	SPW47N60C3	

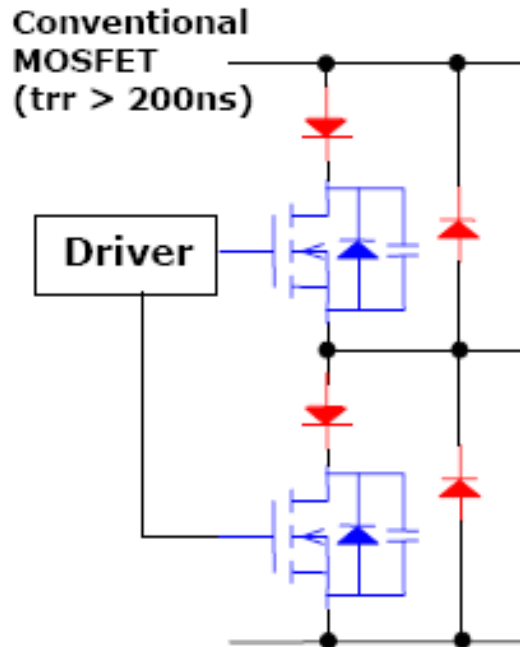


## SupreMOS Line-up Plan for Power Block

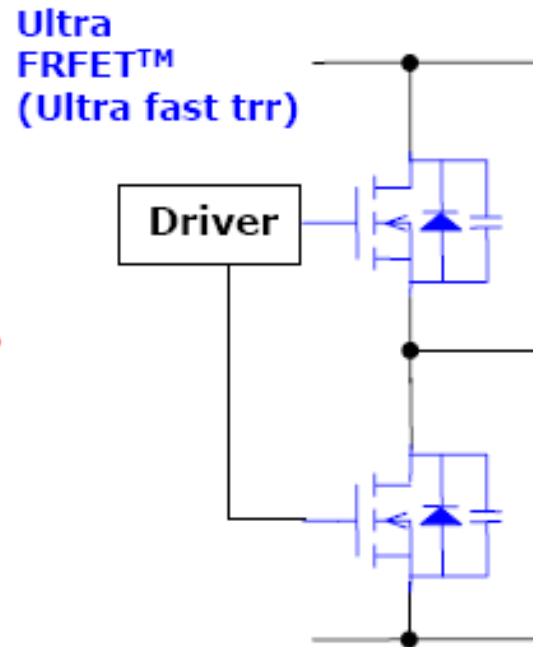
Spec. (BV/ID)	$R_{DS(on)}$ @10V	Package	SupreMOS Part #	Sample available	Code "S" Date
600V/4A	0.950Ω	DBPAK TO220F	FCD4N60N FCPF4N60NT	P08'09 P08'09	P9'09 P9'09
600V/7A	0.520Ω	TO220F	FCPF7N60NT	P08'09	P9'09
600V/9A	0.385Ω	TO220 TO220 TO220F DBPAK	FCP9N60N FCP9N60NF FCPF9N60NT FCD9N60	now P10'09 now P07'09	P7'09 P10'09 P7'09 P9'09
600V/11A	0.299Ω	TO220 TO220F	FCP11N60N FCPF11N60NT	now now	P7'09 P7'09
600V/13A	0.260Ω	TO220 TO220F	FCP13N60N FCPF13N60NT	now now	P7'09 P7'09
600V/16A	0.199Ω	TO220 TO220F TO3PN TO220	FCP16N60N FCPF16N60NT FCA16N60N FCP16N60NF	now now now P10'09	P6'09 P6'09 P6'09 P10'09
600V/22A	0.165Ω	TO220 TO220F D2PAK TO3PN	FCP22N60N FCPF22N60NT FCB22N60N FCA22N60N	now now P07'09 now	Released Released P9'09 Released



- ✓ Remove External FRD
- ✓ Ultra-FRFET with fastest reverse recovery characteristic



● Current CCFL HV inverter solution



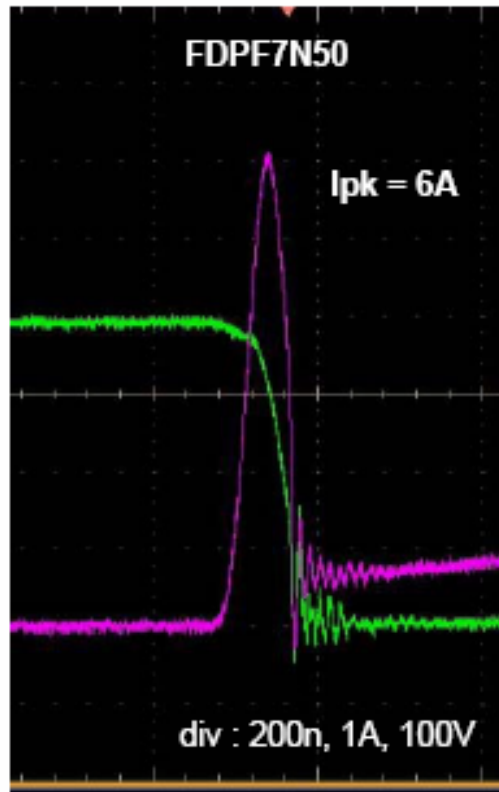
● HV inverter with Ultra-FRFET

# Half bridge analysis

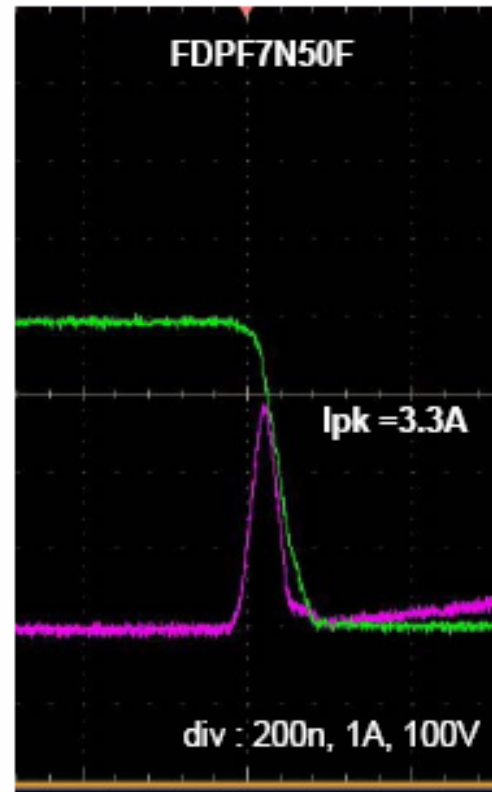
PWM mode (duty30%-40%) turn on condition



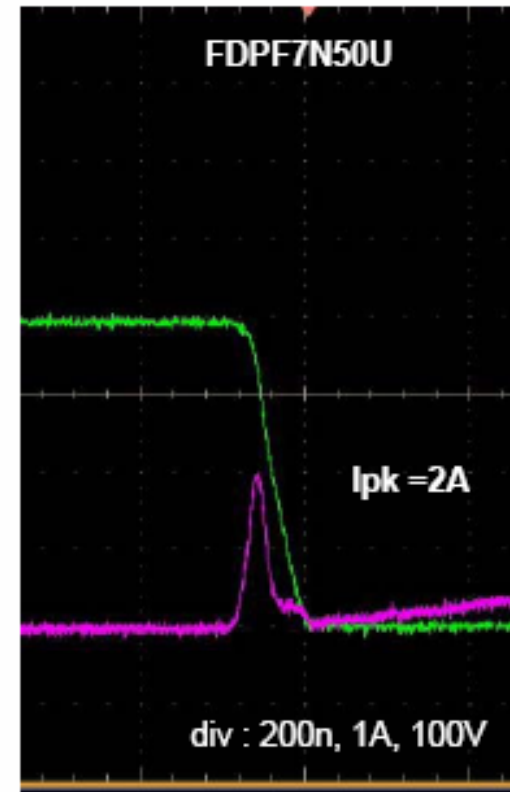
Normal-FET



FRFET

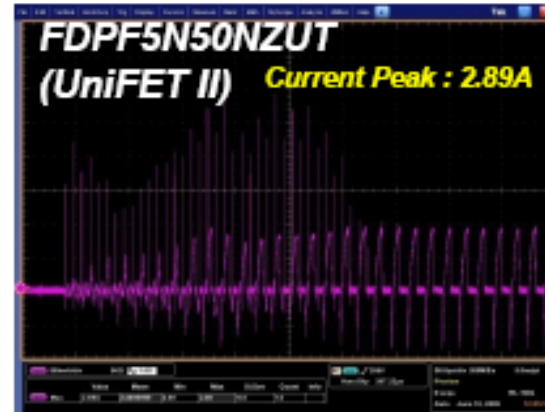
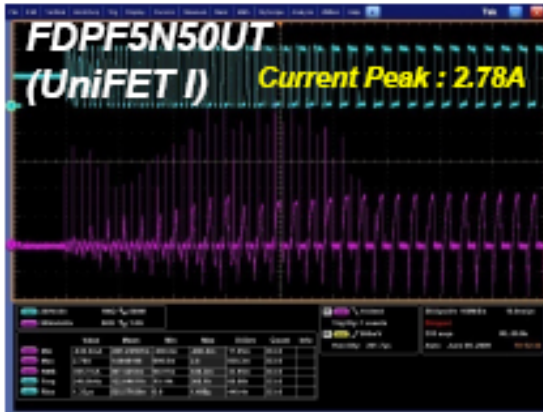


Ultra-FRFET

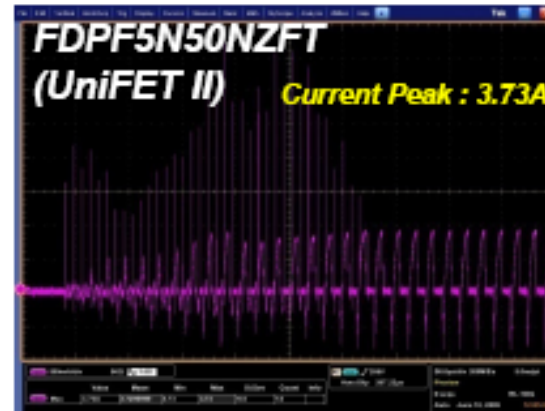
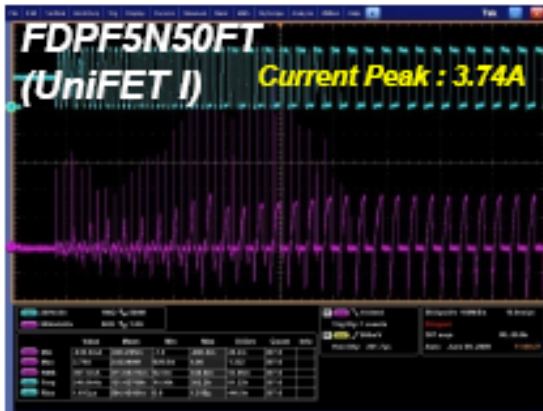




### Ultra-FRFET



### FRFET





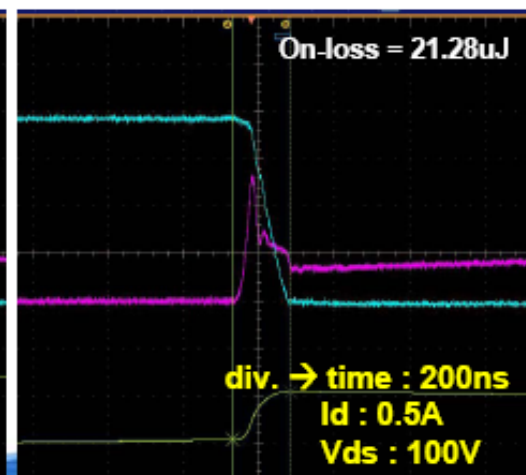
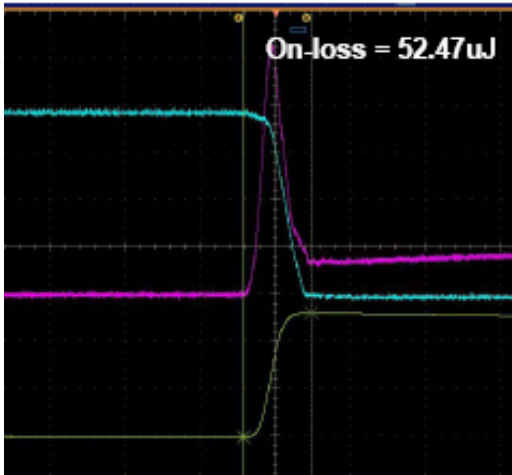
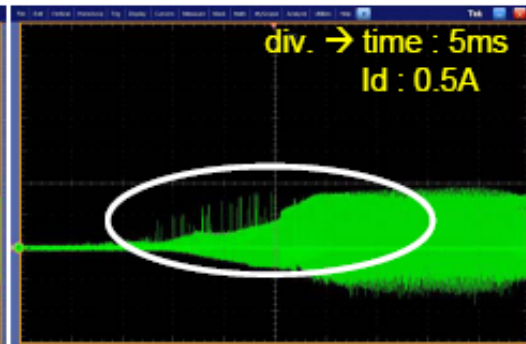
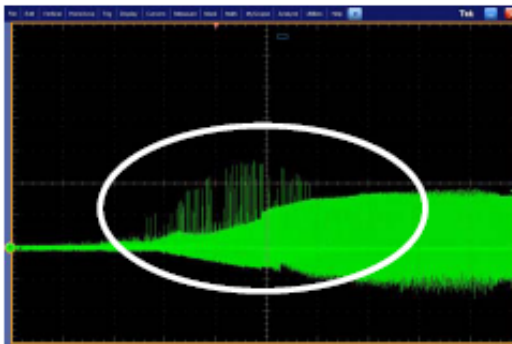
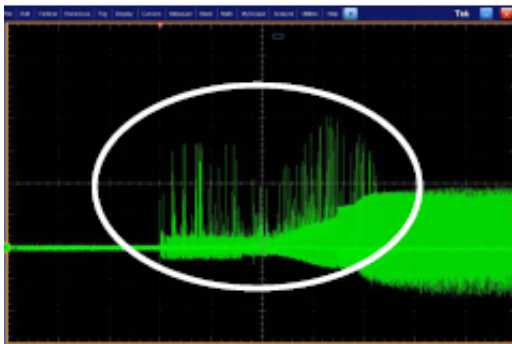


✓ Ignition Mode

Normal FET  
# FDPF5N50

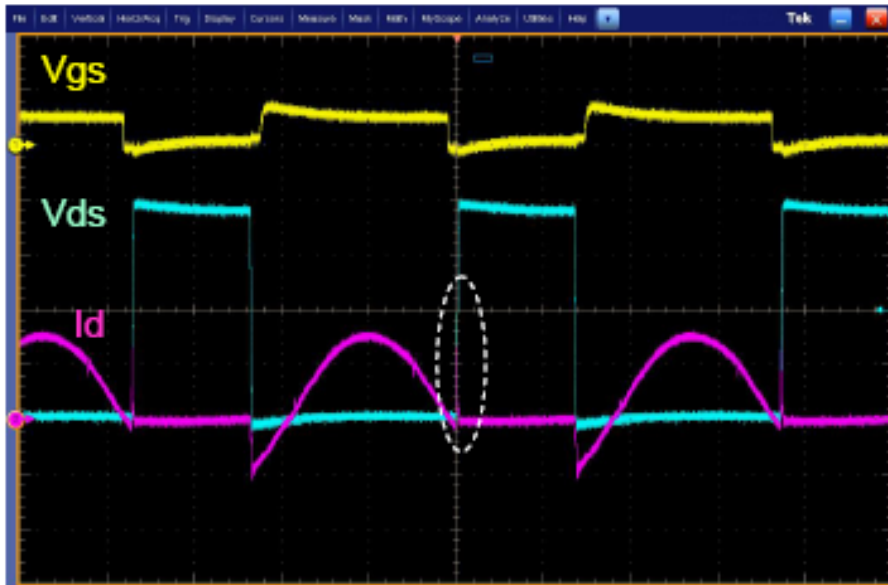
FRFET  
# FDPF5N50F

Ultra-FRFET  
# FDPF5N50U

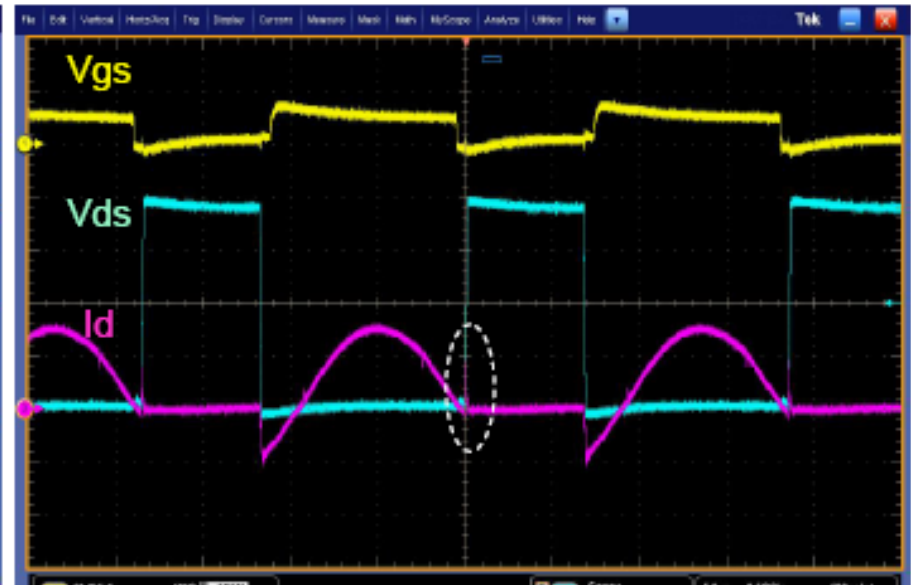


✓ Steady state mode

# FDPF5N50



# FDPF5N50U



div. → time : 5us  
Vgs : 10V / Vds : 100V  
Id : 0.5A





## UniFET1 Line-up ( Running Products ) for Power & Inverter Block

Part Number	$BV_{DSS}$	PKG	$I_D$ [A]	$R_{DS(ON)}$ Max	$t_{rr}$	Sample
	Min. [V]			[ohm]	[ns]	
FDPF5N50	500	TO-220F	5	1.4	300	available
FDPF5N50F**	500	TO-220F	4.5	1.55	65	available
FDPF5N50U*	500	TO-220F	4	2	36	available
FDPF7N50	500	TO-220F	7	0.9	275	available
FDPF7N50F**	500	TO-220F	6	1.15	85	available
FDPF7N50U*	500	TO-220F	5	1.5	40	available
FDPF10N50U*	500	TO-220F	8	1.05	50	available
FDPF12N50	500	TO-220F	11.5	0.65	375	available
FDPF12N50F**	500	TO-220F	10.3	0.7	134	available
FDPF12N50U*	500	TO-220F	10	0.8	60	available
FDPF16N50	500	TO-220F	16	0.38	490	available
FDPF16N50U*	500	TO-220F	15	0.45	65	available
FDPF10N60ZU*	600	TO-220F	8	0.95	50	available
FDPF8N60ZU*	600	TO-220F	6	1.5	45	available
FDPF6N60ZU*	600	TO-220F	4	2.1	42	available

\* suffix : U – Ultra FRFET

\*\* suffix : F – FRFET



### ▪ 650V SupreMOS

Product ID	BV_DSS	I_D	R_DS(on)	Packages	Sample Date	Release Date (Code S)
FCPF9N65NT	650V	9A	0.385 Ω	TO220F	P06 .09	Q3 .09
FCPF13N65NT	650V	13A	0.260 Ω	TO220F	P06 .09	Q3 .09
FCPF16N65NT	650V	16A	0.199 Ω	TO220F	P06 .09	Q3 .09
FCA76N65N	650V	76A	0.035 Ω	TO3PN	P08 .09	Q4.09

### ▪ Fast Recovery Type (FRFET) Line-up

Product ID	BV_DSS	I_D	R_DS(on)	Packages	Sample Date	Release Date (Code S)
FCP9N60NF	600V	9A	0.404 Ω	TO220	P11.09	P12.09
FCP16N60NF	600V	16A	0.209 Ω	TO220	P09.09	P12.09



- **Hyperfast**
- **Hyperfast II**
- **Stealth**
- **Strealth II**
- **Ultrafast**
- **Shottky**



## • Hyperfast

### • Features

- Low Vf ..... 2.1V(max)
- Fast Recovery.....  $t_{rr} < 35\text{nS}$ .

### • Benefits & Applications

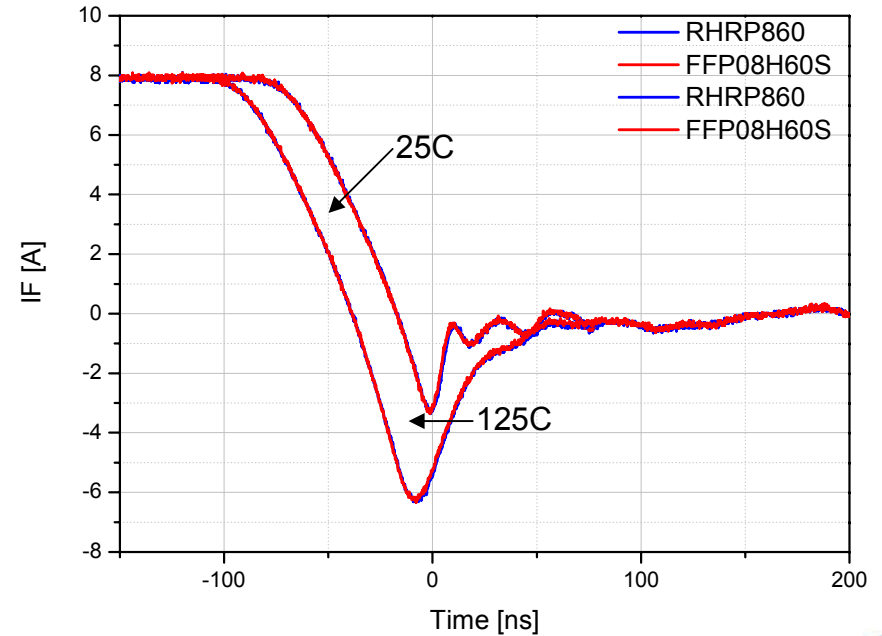
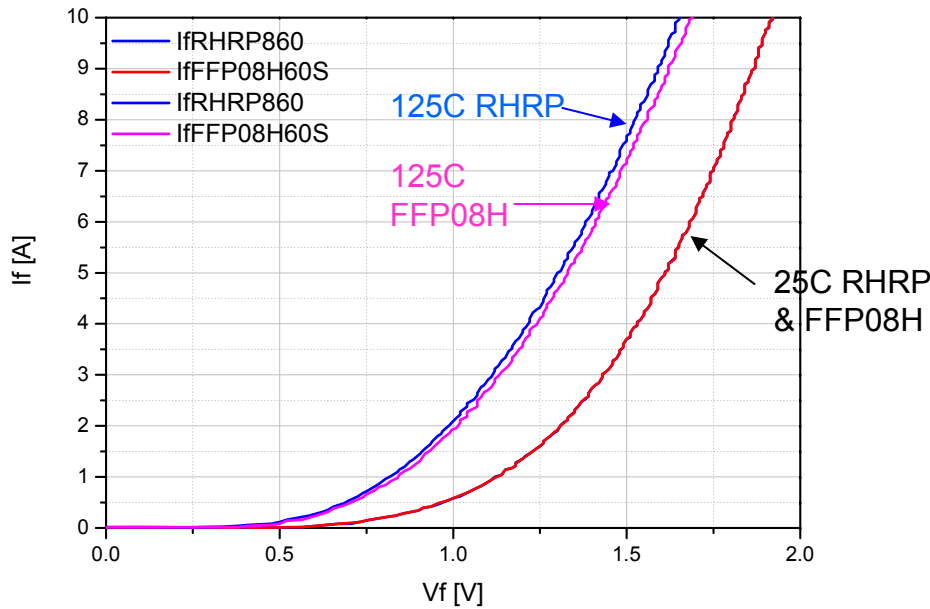
- Basically offers similar benefit as Stealth does
- More suitable for Discontinuous conduction mode PFC where Vf plays more dominantly than reverse recovery does.

# Hyperfast II vs Hyperfast (8A)

## $T_{rr}$ , $V_f$



Tech	Productid	IF(A)	IFSM(A)	Vf(V) max	Irr(uA)	Trr(nS) max				Qrr(nC) typ
HF II	FFP08H60S	8	60	2.1 @25°C 1.7 @100°C	100 @25°C 500 @100°C	35	IF=1A, di/dt=100A/nS, Vcc=30V	@25°C	18.6	
						45	IF=8A, di/dt=100A/nS, Vcc=390V			
HF	RHRP860	8	100	2.1 @25°C 1.7 @150°C	100 @25°C 500 @150°C	30	IF=1A, di/dt=200A/nS, Vcc=30V	@25°C	56	
						35	IF=8A, di/dt=200A/nS, Vcc=390V			





## • Stealth™

### • Features

- Soft Recovery . . . . .  $t_b / t_a > 1.2$
- Fast Recovery . . . . .  $t_{rr} < 25nS, Vf < 2.4V$

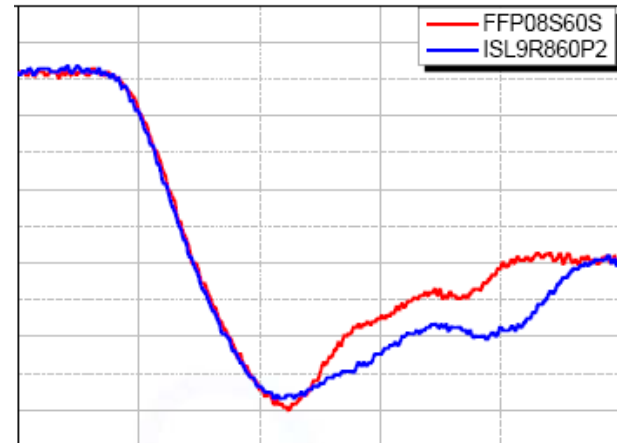
### • Benefits

- Decreasing EMI and voltage spike by NOT abrupt or snappy reverse recovery.
- Decreasing system cost and efficiency by eliminating or reducing snubber circuitry.
- Decreasing switching device's turn-on losses.
- High efficiency and reliability

## • Stealth II

### • Features

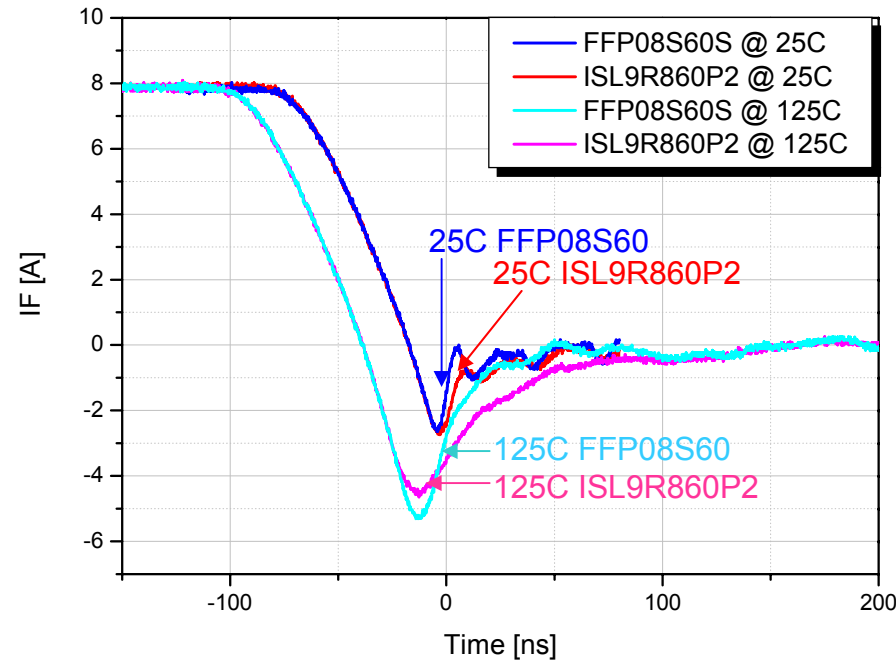
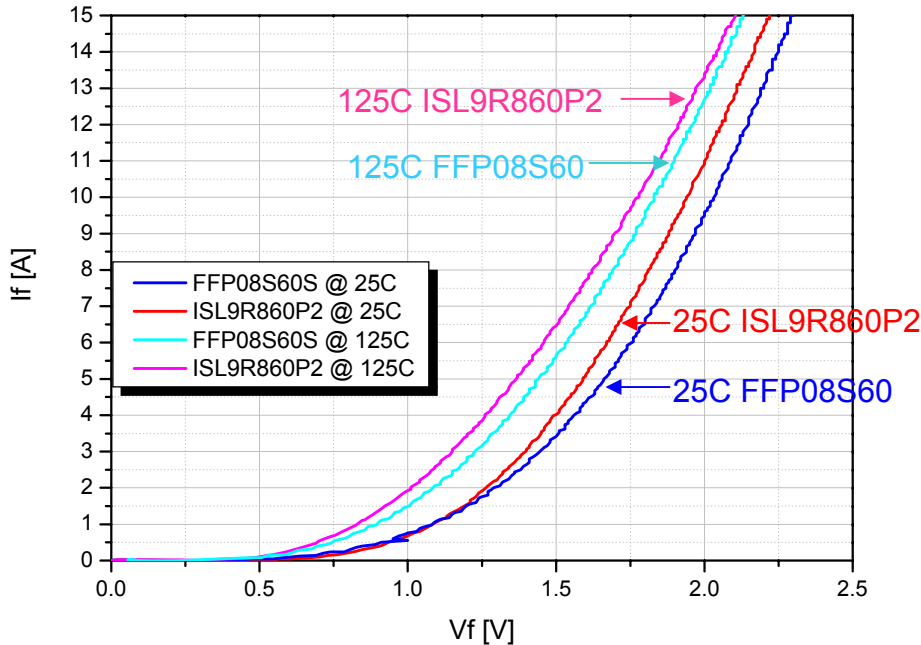
- Faster than Stealth, Fast Recovery  
 . . . . .  $t_{rr} < 25nS, Vf < 2.6V$



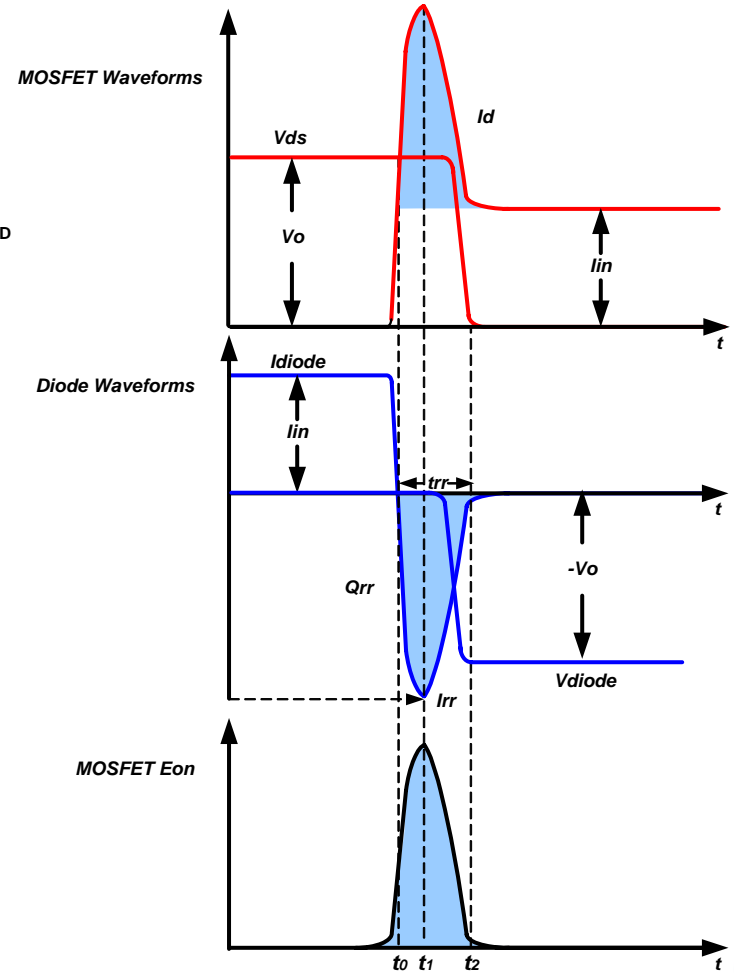
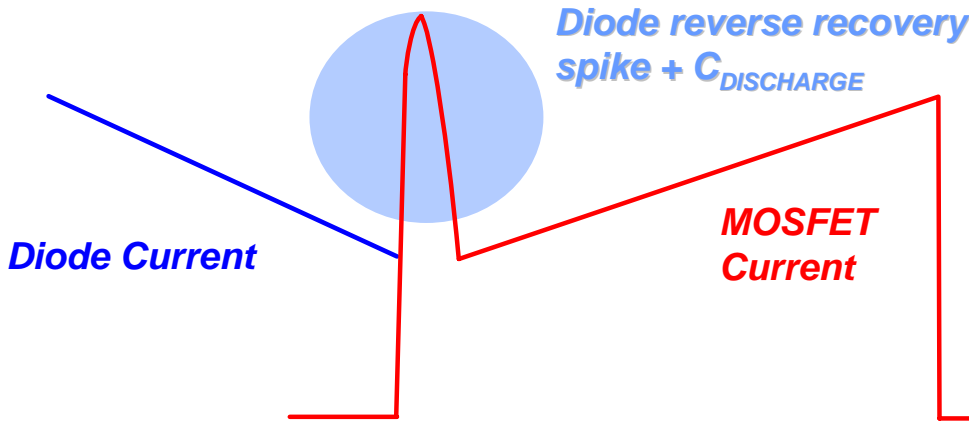
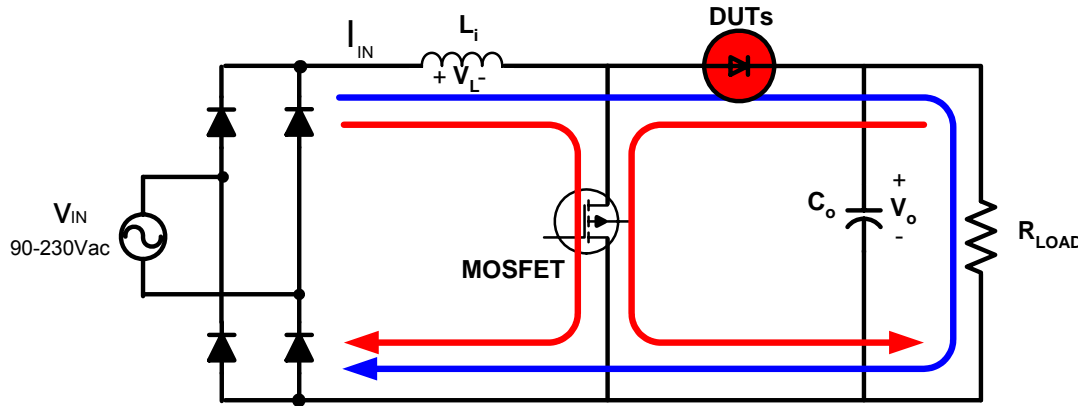


Tech	Productid	IF(A)	IFSM(A)	VF(V) max		Trr(nS) max			Qrr(nC) typ	IRRM(A)	
Stealth II	FFP08S60S	8	80	2.6 @25°C	19(typ)	IF=8A, di/dt=200A/nS, Vcc=390V	@25°C	21	2.2	@25°C	
				1.6(typ) @125°C	58(typ)	IF=8A, di/dt=200A/nS, Vcc=390V	@125°C				125
Stealth	ISL9R860P2	8	100	2.4 @25°C	28(typ)	IF=8A, di/dt=200A/nS, Vcc=390V	@25°C	50	3.2	@25°C	
				2 @125°C	77(typ)	IF=8A, di/dt=200A/nS, Vcc=390V	@125°C				150

**Higher Vf**, However in CCM PFC=> **Faster Trr** is dominant factor.







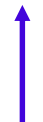
**Diode reverse recovery current effects MOSFET drain current level at turn on transient.  
→ MOSFET Turn on loss**

# 600V FRD

## Selection Guide for PFC

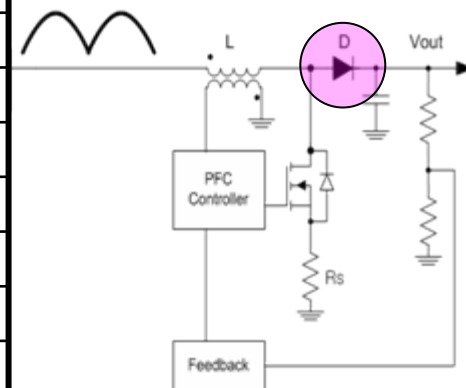


Lower Forward Voltage



Faster Reverse Recovery

Classification	Part Number	VRRM [ V ]	PKG	IF (AV) [ A ]	VFM [ V ]	trr (max) [ ns ]	Product Release
UltraFast	RURP860	600	TO220	8	1.5	70	Released
	FFPF10UP60S	600	TO220F	10	2.2	90	Released
	RURP1560	600	TO220	15	1.5	60	Released
	FFPF20UP60DN	600	TO220F	10*2	2.2	90	Released
	RURP3060	600	TO220	30	1.5	60	Released
	RURG3060CC	600	TO247	30*2	1.5	60	Released
HyperFast I / II	FFP/PF04H60S	600	TO220/F	4	2.1	35	Released
	RHRD660/S	600	I/D PAK	6	2.1	30	Released
	FFP/PF08H60S	600	TO220/F	8	2.1	35	Released
	FFPF10H60S	600	TO220F	10	2.5	35	Released
	RHRP1560	600	TO220	15	2.1	40	Released
	RHRG/A1560CC	600	TO247/TO3P	15*2	1.5	60	Released
	RHRP3060	600	TO220	30	2.1	45	Released
	RHRG1560CC	600	TO247	15*2	2.1	45	Released
Stealth I / II	FFP/PF04S60S	600	TO220/F	4	2.6	25	Released
	FFP/PF08S60S	600	TO220/F	8	2.6	30	Released
	FFP/PF08S60SN	600	TO220/F	8	3.4	25	Released
	FFP/PF/H15S60S	600	TO220/F/TO247	15	2.6	35	Released
	FFP/H30S60S	600	TO220/TO247	30	2.6	40	Released





## 200/300V Rectifiers\_ Selection Guide

Products	Package	Configuration	$V_{RRM}$	$I_{F(AV)}$	$V_{FM}$	$t_{rr}$
			[V]	[A]	[V]	[ns]
FFP12UP20DN	TO-220	Common Cathode	200	6	1.15	35
FFP20UP20DN	TO-220	Common Cathode	200	10	1.15	45
FFP30UP20DN	TO-220	Common Cathode	200	15	1.15	35
FFPF06UP20S	TO-220F	Single	200	6	1.1	31
FFPF10UP20S	TO-220F	Single	200	10	1.1	32
FFPF12UP20DN	TO-220F	Common Cathode	200	6	1.15	35
FFPF15UP20S	TO-220F	Single	200	15	1.15	35
FFPF15UP20ST	TO-220F	Single	200	15	1.15	35
FFPF20UP20DN	TO-220F	Common Cathode	200	10	1.15	45
FFPF20UP20S	TO-220F	Single	200	20	1.15	35
FFPF30UP20DN	TO-220F	Common Cathode	200	15	1.15	35
FFPF30UP20S	TO-220F	Single	200	30	1.15	40
FFD06UP20S	TO-252(DPAK)	Single	200	6	1.15	35
FFD10UP20S	TO-252(DPAK)	Single	200	10	1.15	35
FFB10UP20S	TO-263(D2PAK)	Single	200	10	1.15	45
FFB20UP20DN	TO-263(D2PAK)	Common Cathode	200	10	1.15	40
FFB20UP20S	TO-263(D2PAK)	Single	200	20	1.15	35
FFPF10UP30S	TO-220F	Single	300	10	1.4	45
FFPF20UP30DN	TO-220F	Common Cathode	300	10	1.3	45
FFB20UP30DN	TO-263(D2PAK)	Common Cathode	300	20	1.3	30



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Products	Package	Configuration	$V_{RRM}$	$I_F (AV)$	$V_{FM} (25^\circ C)$
			[V]	[A]	[V]
MBR20200CT	TO-220	Common Cathode	200	20	1.0
MBR20150CT	TO-220	Common Cathode	150	20	0.95
FYP1010DN	TO-220	Common Cathode	100	10	0.95
FYPF1010DN	TO-220F	Common Cathode	100	10	0.95
FYP2010DN	TO-220	Common Cathode	100	20	0.75(125°C)
FYPF2010DN	TO-220F	Common Cathode	100	20	0.75(125°C)
MBRP3010N	TO-220	Common Cathode	100	30	1.05
FYP2006DN	TO-220	Common Cathode	60	20	0.71
FYPF2006DN	TO-220F	Common Cathode	60	20	0.71
MBRP3060PT	TO-247	Common Cathode	60	30	0.65(20A)
MBRP4060PT	TO-247	Common Cathode	60	40	0.72(20A)
FYPF1545DN	TO-220F	Common Cathode	45	15	0.70
FYPF2045DN	TO-220F	Common Cathode	45	20	0.70
MBRP3045N	TO-220	Common Cathode	45	30	0.80
MBRP3045PT	TO-247	Common Cathode	45	30	0.76
MBRP4045PT	TO-247	Common Cathode	45	40	0.80
FYPF1004DN	TO-220F	Common Cathode	40	10	0.67
FYPF2004DN	TO-220F	Common Cathode	40	20	0.67
MBRP3035PT	TO-247	Common Cathode	35	30	0.76
MBRP4035PT	TO-247	Common Cathode	35	40	0.80