

## PFP70R590 / PFF70R590

### N-Channel Super Junction MOSFET

#### FEATURES

- New technology for high voltage device
- Low  $R_{DS(on)}$  low conduction losses
- Small package
- Ultra low gate charge cause lower driving requirement
- 100% avalanche tested

<p><b><math>BV_{DSS} = 700\text{ V}</math></b></p> <p><b><math>R_{DS(on)} = 0.52\Omega</math></b></p> <p><b><math>I_D = 8.0\text{ A}</math></b></p>	
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#### APPLICATION

- Power Factor Correction(PFC)
- Switched mode power supply (SMPS)
- Uninterruptible Power Supply (UPS)

<p><b>TO-220</b></p>	<p><b>TO-220F</b></p>
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#### Absolute Maximum Ratings T<sub>c</sub>=25°C unless otherwise specified

Symbol	Parameter	PFP70R590	PFF70R590	Units
$V_{DS}$	Drain-Source Voltage ( $V_{GS}=0V$ )	700		V
$I_D$	Drain Current – Continuous ( $T_c = 25^\circ C$ )	8.0	8.0*	A
	Drain Current – Continuous ( $T_c = 100^\circ C$ )	5.0	5.0*	A
$I_{DM(pulse)}$	Drain Current – Pulsed * Note 1	23.5	23.5*	A
$V_{GS}$	Gate-Source Voltage ( $V_{DS}=0V$ )	$\pm 30$		V
$E_{AS}$	Single Pulsed Avalanche Energy * Note 2	185		mJ
$I_{AR}$	Avalanche Current * Note 1	4.0		A
$E_{AR}$	Repetitive Avalanche Energy * Note 1	0.4		mJ
$dv/dt$	Drain Source Voltage Slope, $V_{DS} \leq 480V$	50		V/ns
	Reverse Diode $dv/dt$ , $V_{DS} \leq 480V$	15		V/ns
$P_D$	Maximum Power Dissipation ( $T_c = 25^\circ C$ )	80	31.7	W
	Derate above 25°C	0.64	0.25	W/°C
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150		°C

\* Limited by maximum junction temperature

#### Thermal Resistance Characteristics

Symbol	Parameter	PFP70R590	PFF70R590	Units
$R_{\theta JC}$	Junction-to-Case (Maximum)	1.56	3.94	°C/W
$R_{\theta JA}$	Junction-to-Ambient (Maximum)	62.5	80.0	

**Electrical Characteristics**  $T_A=25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	2.5	3.0	4.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10 \text{ V}, I_D = 4.0 \text{ A}$	--	520	590	m.ohm
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	700	--	--	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 700 \text{ V}, V_{GS} = 0 \text{ V}$	--	--	10	$\mu\text{A}$
		$V_{DS} = 700 \text{ V}, T_C=125^\circ\text{C}$	--	--	100	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30 \text{ V}, V_{DS} = 0 \text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30 \text{ V}, V_{DS} = 0 \text{ V}$	--	--	-100	nA
<b>Dynamic Characteristics</b>						
$g_{FS}$	Forward Transconductance	$V_{DS} = 20 \text{ V}, I_D = 4.0 \text{ A}$	--	5.5	--	S
$R_G$	Intrinsic Gate Resistance	$f = 1.0 \text{ MHz}$ , open drain	--	2.0	--	ohm
$C_{iss}$	Input Capacitance	$V_{DS} = 50 \text{ V}, V_{GS} = 0 \text{ V}$ , $f = 1.0 \text{ MHz}$	--	680	--	pF
$C_{oss}$	Output Capacitance		--	58	--	pF
$C_{rss}$	Reverse Transfer Capacitance		--	4	--	pF
$Q_g$	Total Gate Charge	$V_{DS} = 560 \text{ V}, I_D = 8.0 \text{ A}$ , $V_{GS} = 10 \text{ V}$	--	14.5	22	nC
$Q_{gs}$	Gate-Source Charge		--	2.8	--	nC
$Q_{gd}$	Gate-Drain Charge		--	5.5	--	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Time	$V_{DS} = 350 \text{ V}, I_D = 4.0 \text{ A}$ , $R_G = 12 \Omega, V_{GS} = 10 \text{ V}$	--	5.5	--	ns
$t_r$	Turn-On Rise Time		--	3.5	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	55	75	ns
$t_f$	Turn-Off Fall Time		--	6.5	10	ns
<b>Source-Drain Diode Maximum Ratings and Characteristics</b>						
$I_S$	Continuous Source-Drain Diode Forward Current		--	--	8.0	A
$I_{SM}$	Pulsed Source-Drain Diode Forward Current		--	--	23.5	
$V_{SD}$	Source-Drain Diode Forward Voltage	$I_S = 8.0 \text{ A}, V_{GS} = 0 \text{ V}$	--	0.9	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_S = 8.0 \text{ A}$ $di/dt = 100 \text{ A}/\mu\text{s}$	--	220	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	2.2	--	$\mu\text{C}$

**Notes ;**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $V_{DS}=50\text{V}$ ,  $R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$

# Typical Characteristics

Fig 1. Safe Operation Area for TO-220

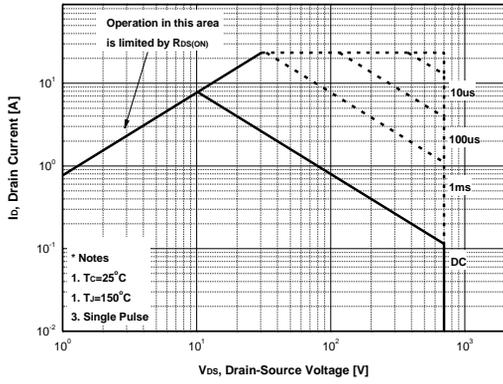


Fig 2. Safe Operation Area for TO-220F

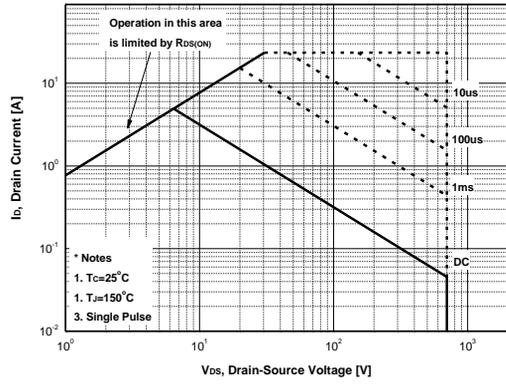


Fig 3. Source-Drain Diode Forward Voltage

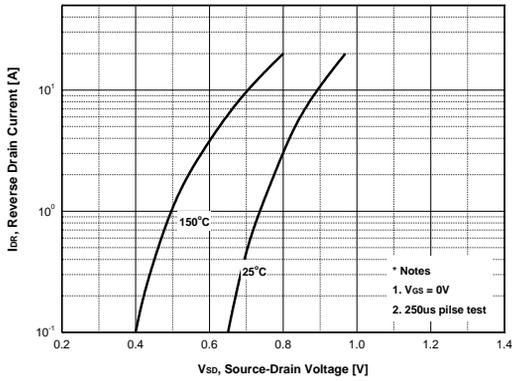


Fig 4. Output Characteristics

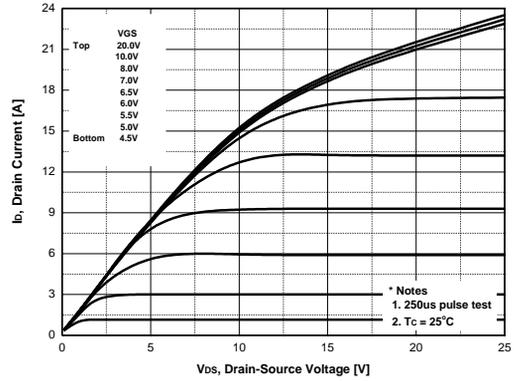


Fig 5. Transfer Characteristics

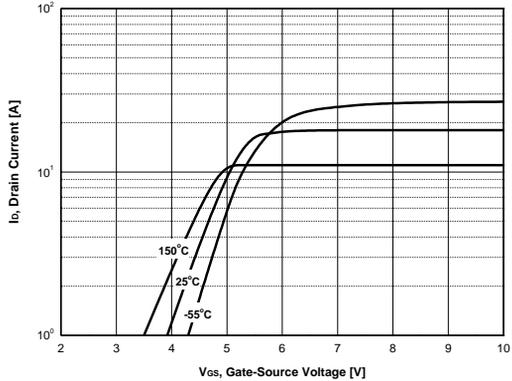
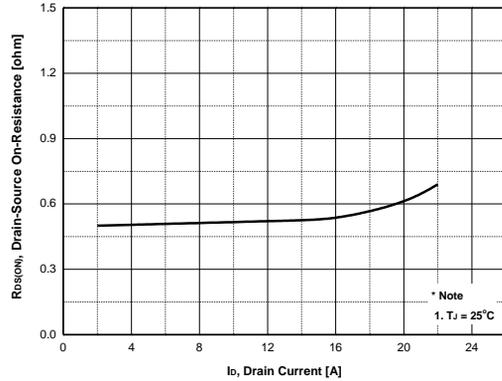


Fig 6. Static Drain-Source On Resistance



Typical Characteristics (continued)

Fig 7.  $R_{DS(ON)}$  vs. Junction Temperature

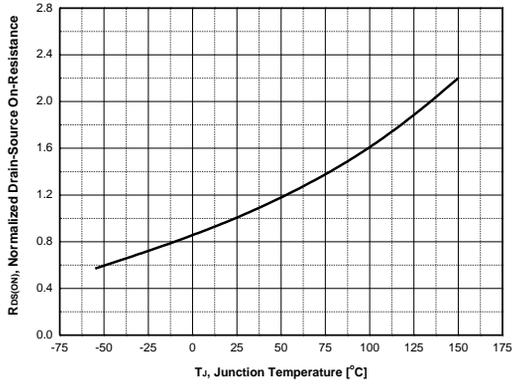


Fig 8.  $BV_{DSS}$  vs. Junction Temperature

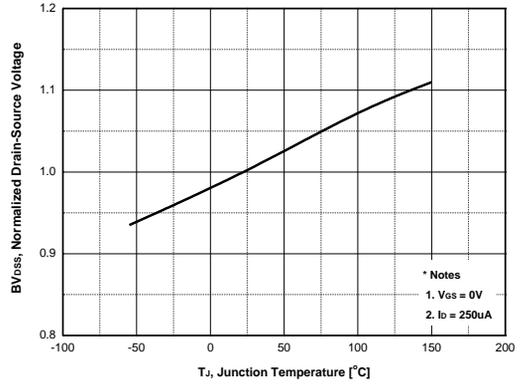


Fig 9. Maximum  $I_D$  vs. Case Temperature

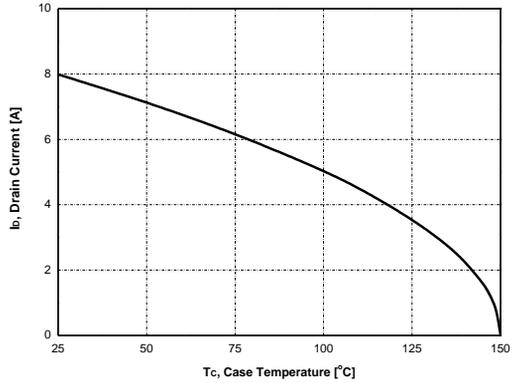


Fig 10. Gate Charge Characteristics

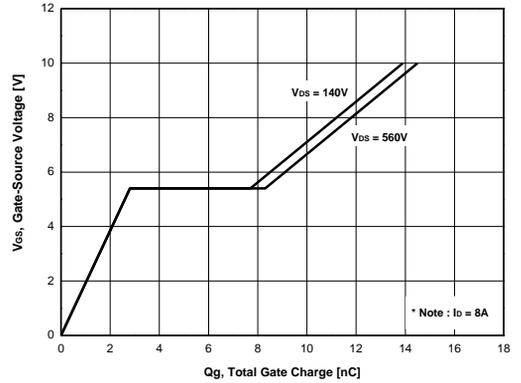
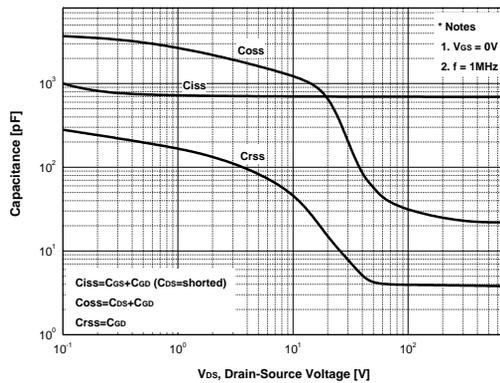


Fig 11. Capacitance Characteristics



Typical Characteristics (continued)

Fig 12. Transient Thermal Response Curve

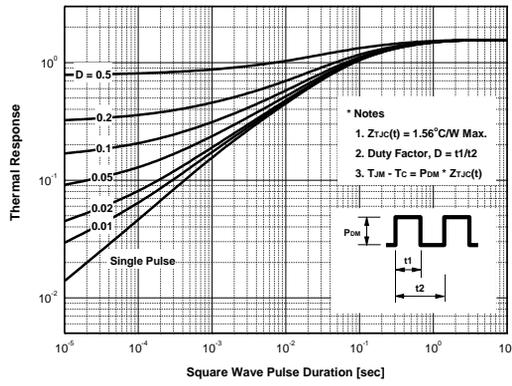
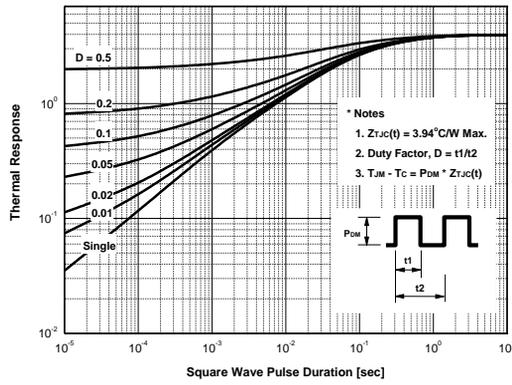
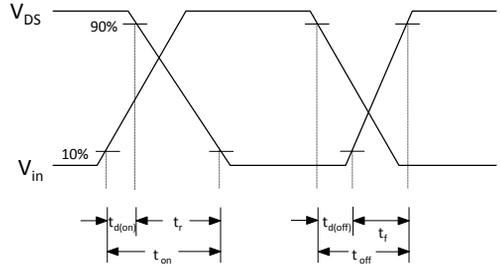
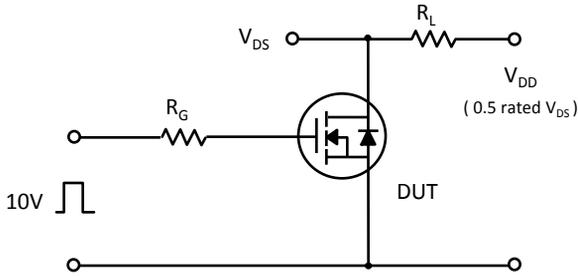


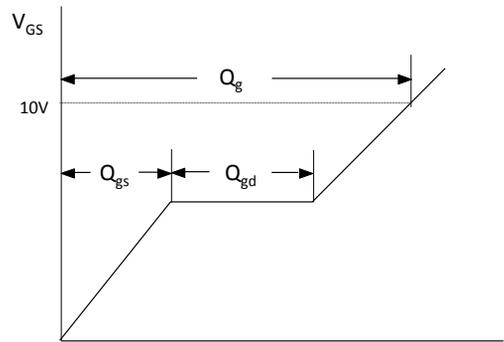
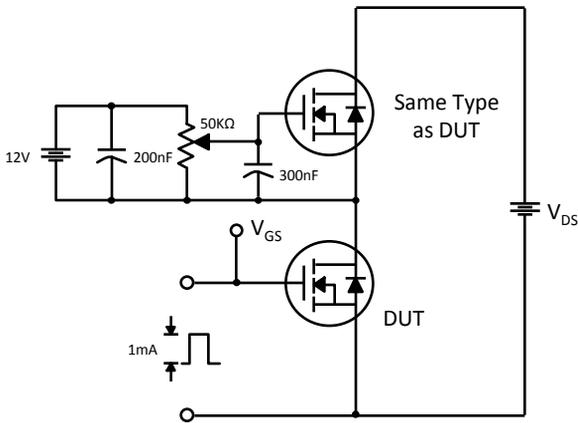
Fig 13. Transient Thermal Response Curve



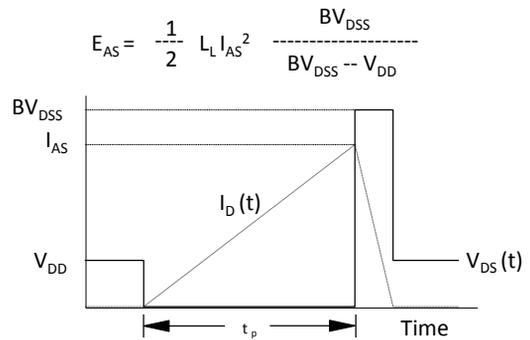
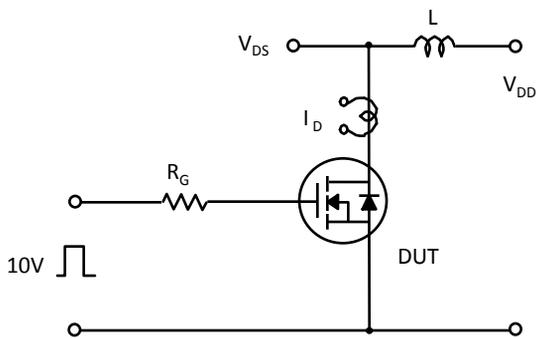
### Characteristics Test Circuit & Waveform



Switching Time Test Circuit & Waveforms

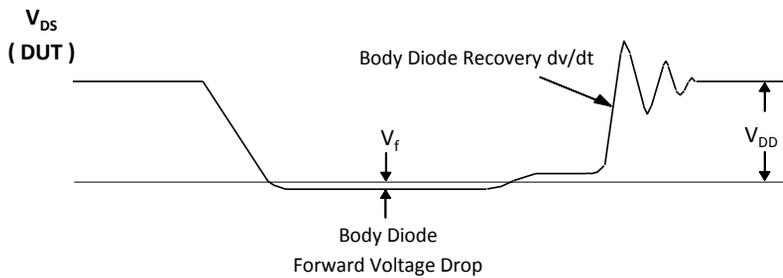
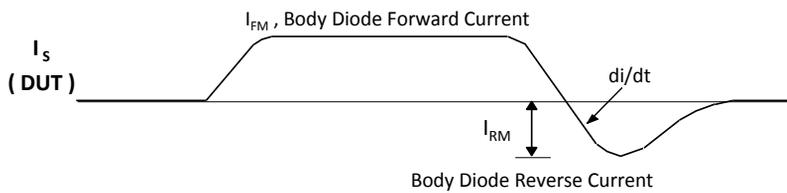
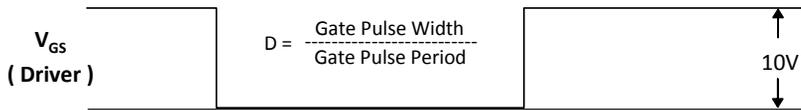
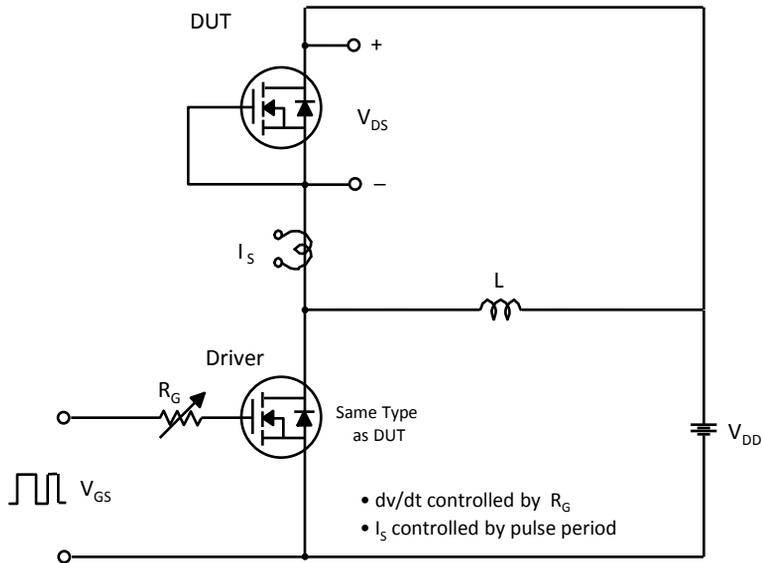


Gate Charge Test Circuit & Waveform



Unclamped Inductive Switching Test Circuit & Waveforms

Characteristics Test Circuit & Waveform (continued)



Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms