PFP10N60 / PFF10N60

WING ON GROUP

POWER™

PFP10N60/PFF10N60
600V N-Channel MOSFET

FEATURES

❑ Originative New Design
❑ 100% EAS Test
❑ Rugged Gate Oxide Technology
❑ Extremely Low Intrinsic Capacitances
❑ Remarkable Switching Characteristics
❑ Unequalled Gate Charge : 15 nC (Typ.)
❑ Extended Safe Operating Area
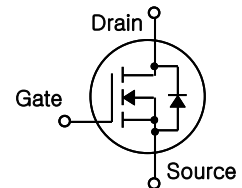❑ Lower $R_{DS(ON)}$: 0.78 Ω (Typ.) @V_{GS}=10V

APPLICATION

❑ High current, High speed switching
❑ Suitable for power supplies, adaptors and PFC
❑ SMPS (Switched Mode Power Supplies)

BV_{DSS} = 600 V

$R_{DS(on)\ typ}$ = 0.78 Ω
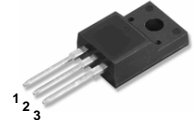
I_D = 9.5 A

Drain
Gate
Source

TO-220
1.Gate 2. Drain 3. Source

TO-220F
1.Gate 2. Drain 3. Source

Absolute Maximum Ratings T_C=25℃ unless otherwise specified

Symbol	Parameter		PFP10N60	PFF10N60	Units
V_{DSS}	Drain-Source Voltage		600		V
I_D	Drain Current – Continuous (T_C = 25℃)		9.5	9.5*	A
	Drain Current – Continuous (T_C = 100℃)		6.03	6.03*	A
I_{DM}	Drain Current – Pulsed	(Note 1)	38	38*	A
V_{GS}	Gate-Source Voltage		±30		V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	520		mJ
I_{AR}	Avalanche Current	(Note 1)	9.5		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	15.6		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	5.5		V/ns
P_D	Power Dissipation (T_C = 25℃)		156	50	W
	– Derate above 25℃		1.25	0.4	W/℃
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150		℃
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300		℃

* Drain current limited by maximum junction temperature

Thermal Resistance Characteristics

Symbol	Parameter	PFP10N60	PFF10N60	Units
$R_{θJC}$	Thermal Resistance, Junction-to-Case	0.8	2.5	
$R_{θCS}$	Thermal Resistance, Case-to-Sink	0.5	--	℃/W
$R_{θJA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	

Electrical Characteristics T_C=25 °C unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
On Characteristics						
V_{GS}	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\ \mu A$	2.0	--	4.0	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10$ V, $I_D = 5.0$ A	--	0.78	0.9	Ω
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0$ V, $I_D = 250\ \mu A$	600	--	--	V
ΔBV_{DSS} /ΔT_J	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu A$, Referenced to 25℃	--	0.65	--	V/℃
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600$ V, $V_{GS} = 0$ V	--	--	1	μA
		$V_{DS} = 480$ V, $T_C = 125$℃	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30$ V, $V_{DS} = 0$ V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30$ V, $V_{DS} = 0$ V	--	--	-100	nA
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25$ V, $V_{GS} = 0$ V, f = 1.0 MHz	--	1300	1700	pF
C_{oss}	Output Capacitance		--	110	145	pF
C_{rss}	Reverse Transfer Capacitance		--	23	30	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Time	$V_{DS} = 300$ V, $I_D = 9.5$ A, $R_G = 25$ Ω	--	27	55	ns
t_r	Turn-On Rise Time		--	75	150	ns
$t_{d(off)}$	Turn-Off Delay Time		--	120	240	ns
t_f	Turn-Off Fall Time	(Note 4,5)	--	80	160	ns
Q_g	Total Gate Charge	$V_{DS} = 480$ V, $I_D = 9.5$ A, $V_{GS} = 10$ V	--	33	43	nC
Q_{gs}	Gate-Source Charge		--	7.3	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4,5)	--	15	--	nC
Source-Drain Diode Maximum Ratings and Characteristics						
I_S	Continuous Source-Drain Diode Forward Current		--	--	9.5	A
I_{SM}	Pulsed Source-Drain Diode Forward Current		--	--	38	
V_{SD}	Source-Drain Diode Forward Voltage	$I_S = 9.5$ A, $V_{GS} = 0$ V	--	--	1.4	V
trr	Reverse Recovery Time	$I_S = 9.5$ A, $V_{GS} = 0$ V di$_F$/dt = 100 A/μs (Note 4)	--	430	--	ns
Qrr	Reverse Recovery Charge		--	5.8	--	μC

Notes ;
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. I_{AS}=9.5A, V_{DD}=50V, R_G=25Ω, Starting T_J =25°C
3. I_{SD}≤9.5A, di/dt≤300A/μs, V_{DD}≤BV_{DSS} , Starting T_J =25 °C
4. Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature
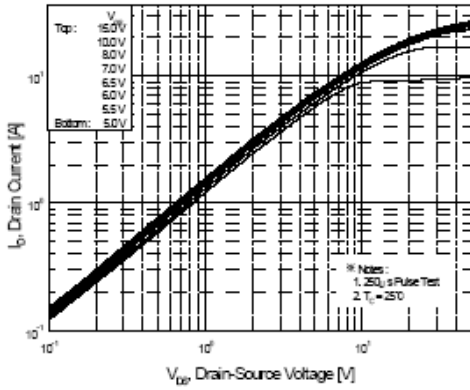
Typical Characteristics

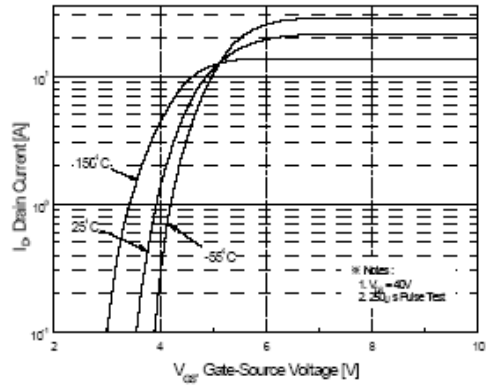
Figure 1. On Region Characteristics

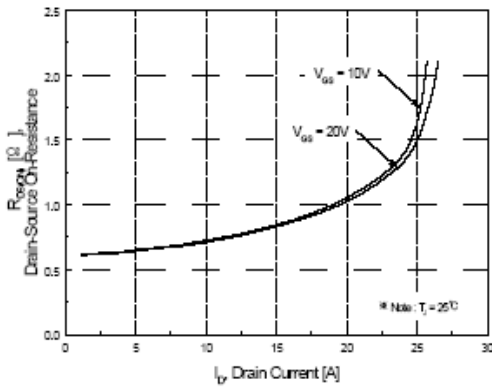**Figure 2. Transfer Characteristics**

**Figure 3. On Resistance Variation vs
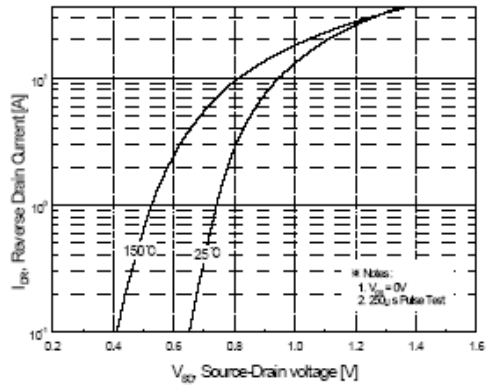Drain Current and Gate Voltage**

**Figure 4. Body Diode Forward Voltage
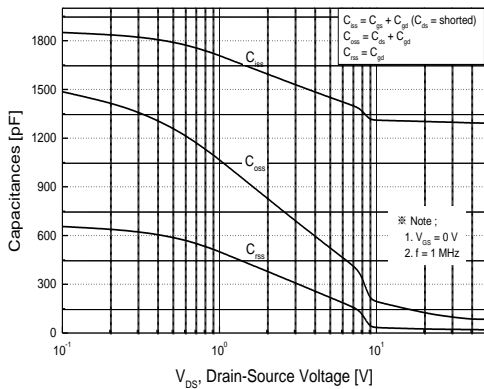Variation with Source Current
and Temperature**
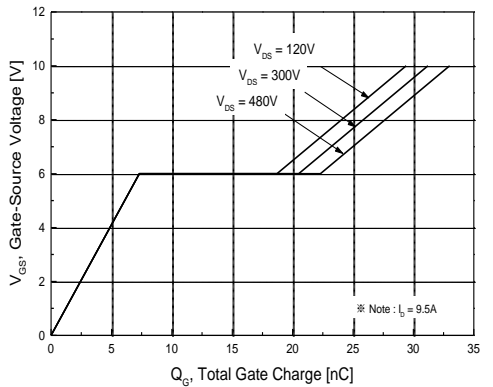

Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics
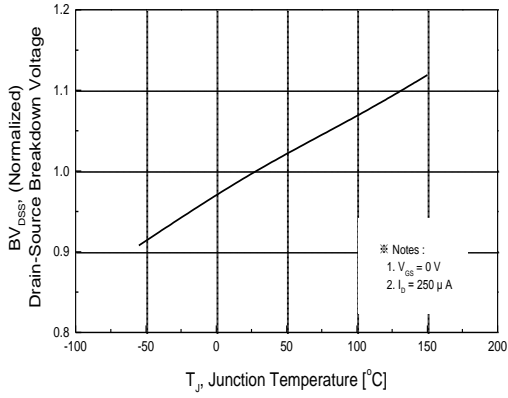
Typical Characteristics   (continued)
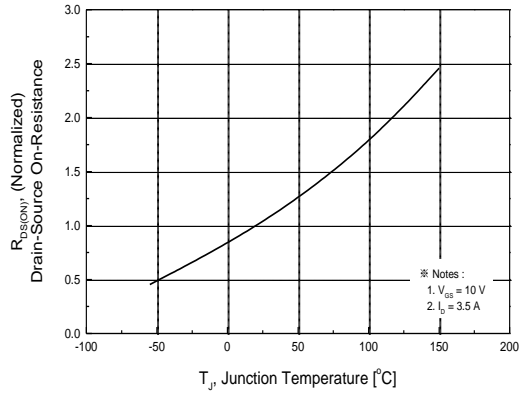

**Figure 7. Breakdown Voltage Variation
vs Temperature**

**Figure 8. On-Resistance Variation
vs Temperature**
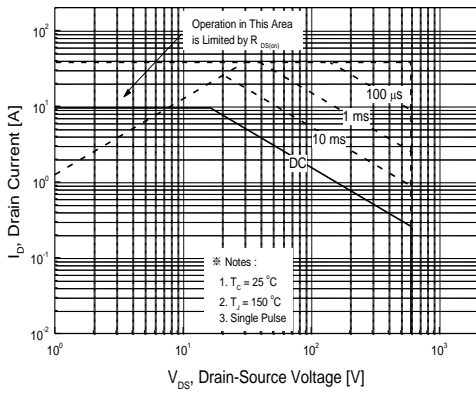
**Figure 9. Maximum Safe Operating Area
for PFP10N60**
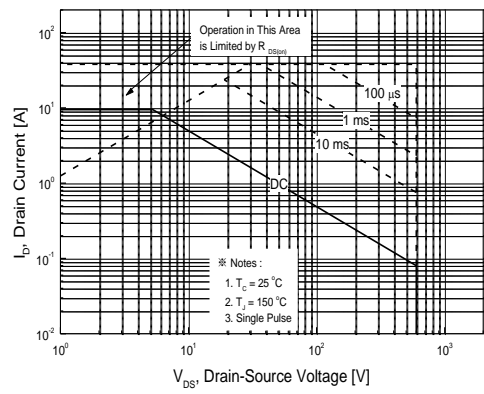
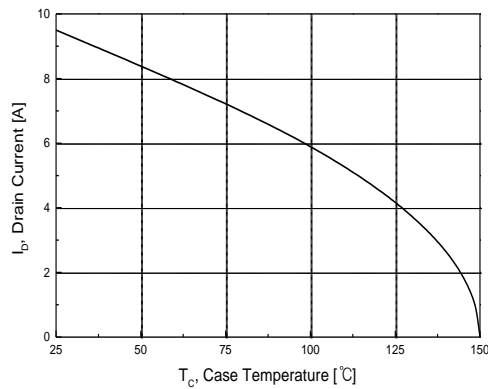**Figure 10. Maximum Safe Operating Area
for PFF10N60**

Figure 11. Maximum Drain Current vs Case Temperature

Nov 2011
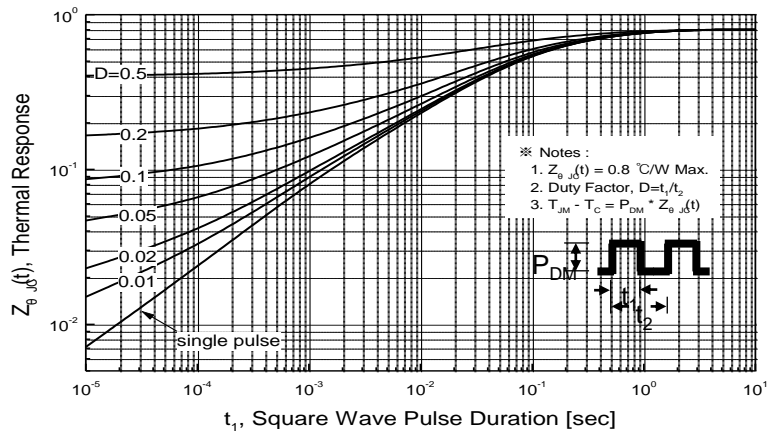
Typical Characteristics   (continued)

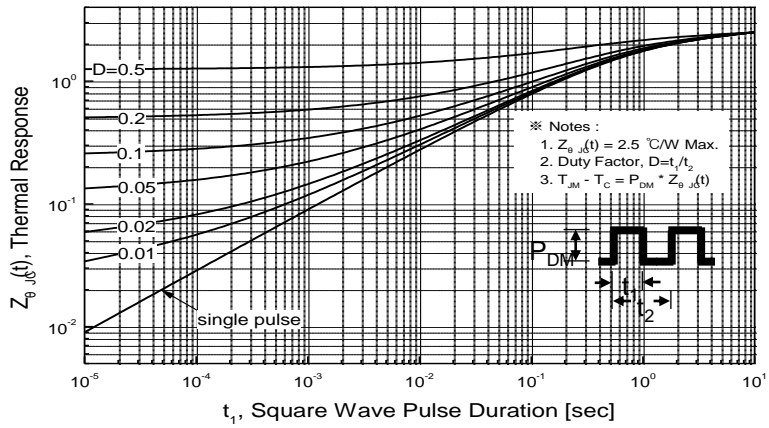Figure 12. Transient Thermal Response Curve for PFP10N60

Figure 13. Transient Thermal Response Curve for PFF10N60
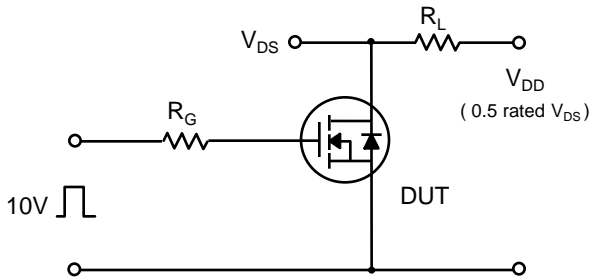
Characteristics Test Circuit & Waveform
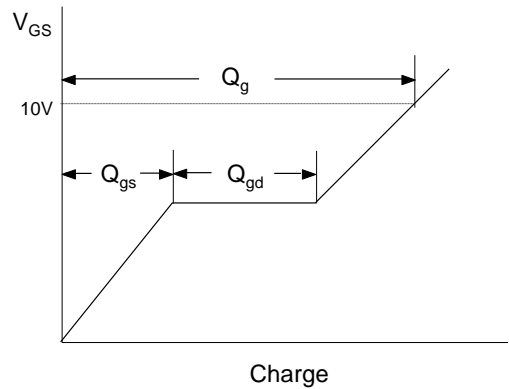

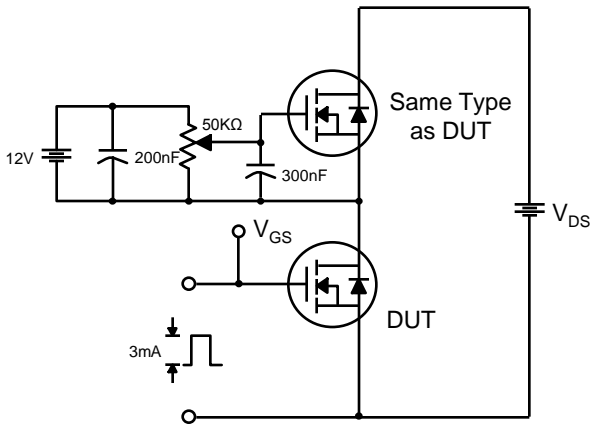**Fig 14. Resistive Switching Test Circuit & Waveforms**

Fig 15. Gate Charge Test Circuit & Waveform

$$E_{AS} = \frac{1}{2} L_L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$
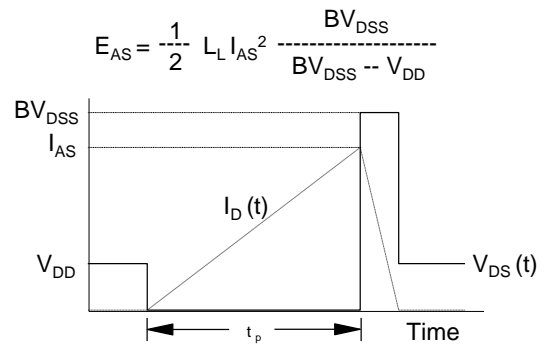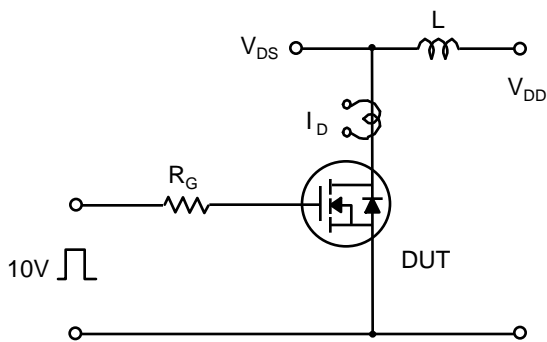
Fig 16. Unclamped Inductive Switching Test Circuit & Waveforms
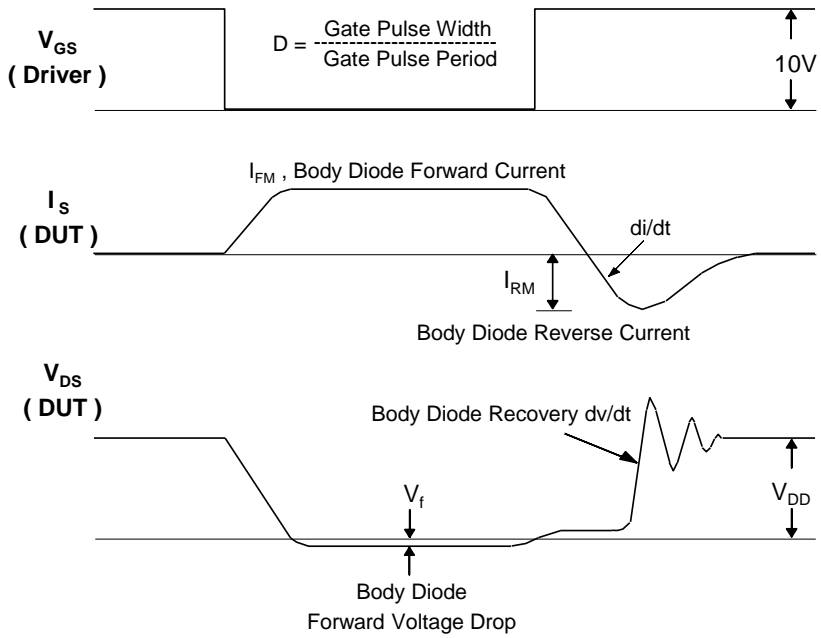
Characteristics Test Circuit & Waveform (continued)

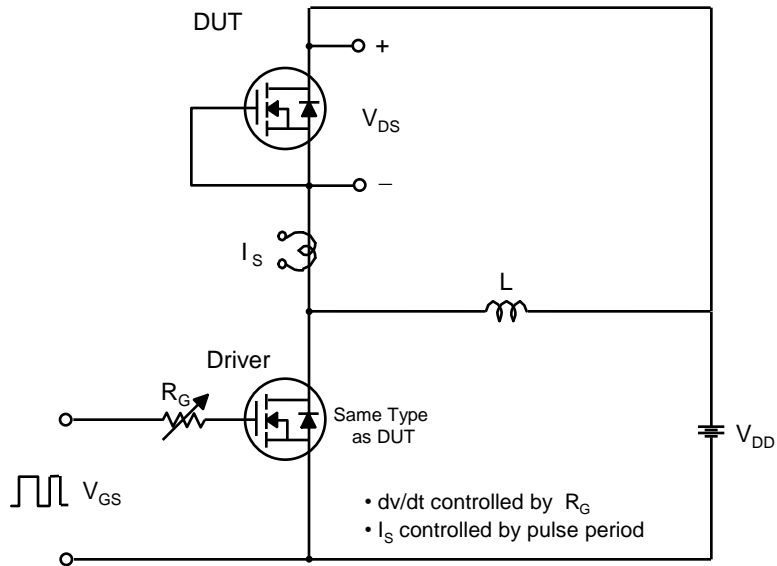**Fig 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms**

Package Dimension

TO-220

9.90 ±0.20

(8.70)

ø3.60 ±0.10

2.80 ±0.10

(1.70)

1.30 ±0.10

9.20 ±0.20

(1.46)

(3.70)

(3.00)

15.90 ±0.20

18.95MAX.

(45°)

13.08 ±0.20

1.27 ±0.10

1.52 ±0.10

10.08 ±0.30

0.80 ±0.10

2.54TYP
[2.54 ±0.20]

2.54TYP
[2.54 ±0.20]

10.00 ±0.20

4.50 ±0.20

1.30 $^{+0.10}_{-0.05}$

0.50 $^{+0.10}_{-0.05}$

2.40 ±0.20

Package Dimension

TO-220F (1)

10.16 ±0.20

(7.00)

ø3.18 ±0.10

3.30 ±0.10

15.80 ±0.20

MAX1.47

0.80 ±0.10

9.75 ±0.30

(30°)

#1

0.35 ±0.10

2.54TYP
[2.54 ±0.20]

2.54TYP
[2.54 ±0.20]

9.40 ±0.20

4.70 ±0.20

2.54 ±0.20

(0.70)

6.68 ±0.20

15.87 ±0.20

(1.00x45°)

0.50 $^{+0.10}_{-0.05}$

2.76 ±0.20

Package Dimension

TO-220F (2)