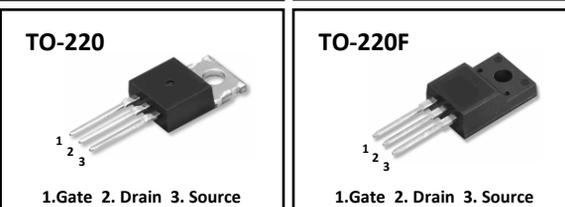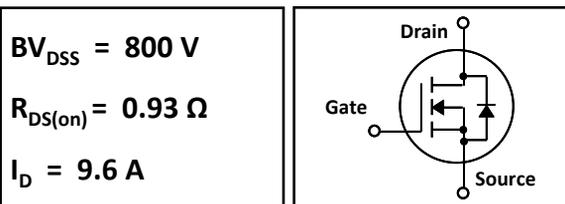**WING ON GROUP**

POWER ™

PFP10N80E / PFF10N80E
800V N-Channel MOSFET

FEATURES

❑ Originative New Design
❑ 100% EAS Test
❑ Rugged Gate Oxide Technology
❑ Extremely Low Intrinsic Capacitances
❑ Remarkable Switching Characteristics
❑ Unequalled Gate Charge : 49.6 nC (Typ.)
❑ Extended Safe Operating Area
❑ Lower $R_{DS(ON)}$: 0.93 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} = 800 V

$R_{DS(on)}$ = 0.93 Ω

I_D = 9.6 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=25ºC unless otherwise specified

Symbol	Parameter		PFP10N80E	PFF10N80E	Units
V_{DSS}	Drain-Source Voltage		800		V
I_D	Drain Current – Continuous (T_C = 25ºC)		9.6	9.6*	A
	Drain Current – Continuous (T_C = 100ºC)		6.1	6.1*	A
I_{DM}	Drain Current – Pulsed (Note 1)		38.4	38.4*	A
V_{GS}	Gate-Source Voltage		±30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		850		mJ
I_{AR}	Avalanche Current (Note 1)		10.0		A
E_{AR}	Repetitive Avalanche Energy (Note 1)		22.3		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5		V/ns
P_D	Power Dissipation (T_C= 25ºC)		223	68	W
	- Derate above 25ºC		1.8	0.5	W/ºC
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150		ºC
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300		ºC

* Drain current limited by maximum junction temperature.

Thermal Resistance Characteristics

Symbol	Parameter	PFP10N80E	PFF10N80E	Units
$R_{θJC}$	Thermal Resistance, Junction-to-Case	0.56	1.85	
$R_{θJS}$	Thermal Resistance, Junction-to-Sink	0.5	--	ºC/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 uA	2.5	--	4.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 5.0 A	--	0.93	1.1	Ω
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 uA	800	--	--	V
ΔBV_{DSS} /ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 uA, Referenced to 25°C	--	0.5	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 800 V, V_{GS} = 0 V	--	--	10	uA
		V_{DS} = 640 V, T_C = 125°C	--	--	100	uA
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	--	2620	3400	pF
C_{oss}	Output Capacitance		--	172	220	pF
C_{rss}	Reverse Transfer Capacitance		--	29	38	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Time	V_{DS} = 400 V, I_D = 10.0 A, R_G = 25 Ω	--	36	72	ns
t_r	Turn-On Rise Time		--	21	42	ns
$t_{d(off)}$	Turn-Off Delay Time		--	104	208	ns
t_f	Turn-Off Fall Time	(Note 4,5)	--	31	62	ns
Q_g	Total Gate Charge	V_{DS} = 640 V, I_D = 10.0 A, V_{GS} = 10 V	--	49.6	74	nC
Q_{gs}	Gate-Source Charge		--	16.4	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4,5)	--	10.6	--	nC
Source-Drain Diode Maximum Ratings and Characteristics						
I_S	Continuous Source-Drain Diode Forward Current		--	--	9.6	A
I_{SM}	Pulsed Source-Drain Diode Forward Current		--	--	38.4	
V_{SD}	Source-Drain Diode Forward Voltage	I_S = 10.0 A, V_{GS} = 0 V	--	--	1.4	V
trr	Reverse Recovery Time	I_S = 10.0 A, V_{GS} = 0 V	--	520	--	ns
Qrr	Reverse Recovery Charge	di_F/dt = 100 A/us (Note 4)	--	6.8	--	uC

Notes ;
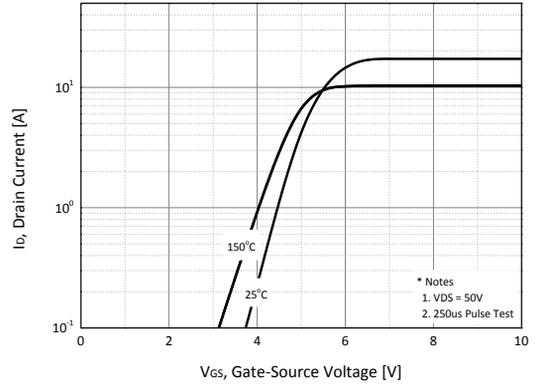
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L=17mH, I_{AS}=10.0A, V_{DD}=50V, R_G=25Ω, Starting T_J =25°C
3. I_{SD}≤10.0A, di/dt≤200A/us, V_{DD}≤BV_{DSS} , Starting T_J =25 °C
4. Pulse Test : Pulse Width ≤ 300us, Duty Cycle ≤ 2%
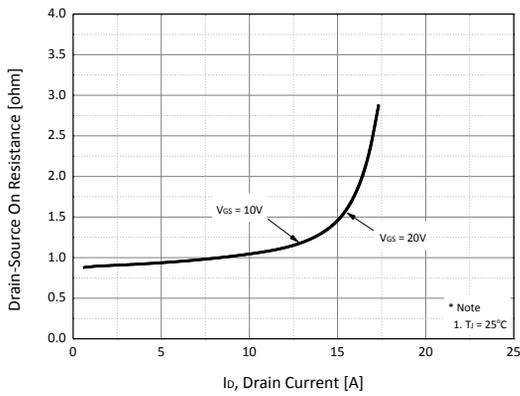5. Essentially Independent of Operating Temperature

Typical Characteristics

Fig.1 On Region Characteristics

V$_{GS}$
Top 20.0V
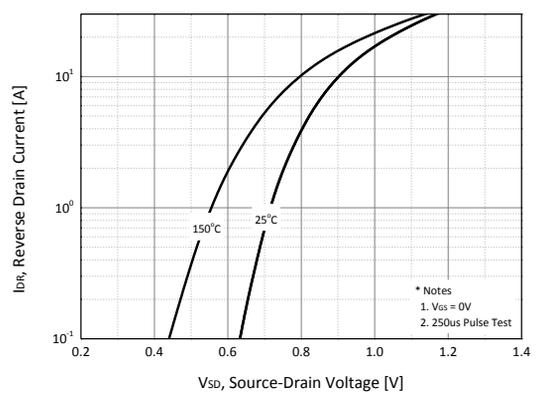15.0V
10.0V
9.0V
8.0V
7.0V
6.5V
6.0V
5.5V
5.0V
Bottom 4.5V

* Notes
1. 250us Pulse Test
2. T$_C$ = 25°C

I$_D$, Drain Current [A]

V$_{DS}$, Drain-Source Voltage [V]
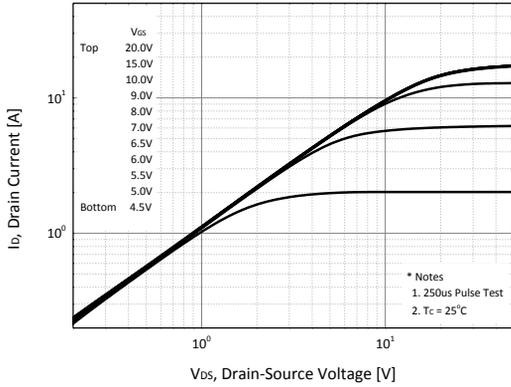
Fig.2 Transfer Characteristics

150°C

25°C

* Notes
1. VDS = 50V
2. 250us Pulse Test

I$_D$, Drain Current [A]

V$_{GS}$, Gate-Source Voltage [V]

Fig.3 Static Drain-Source On Resistance

V$_{GS}$ = 10V

V$_{GS}$ = 20V

* Note
1. T$_J$ = 25°C

Drain-Source On Resistance [ohm]

I$_D$, Drain Current [A]

Fig.4 Body Diode Forward Voltage

150°C   25°C

* Notes
1. V$_{GS}$ = 0V
2. 250us Pulse Test

I$_{DR}$, Reverse Drain Current [A]

V$_{SD}$, Source-Drain Voltage [V]

Fig.5 Capacitance Characteristics

Ciss = Cgs + Cgd (Cds = Shorted)
Coss = Cds + Cgd
Crss = Cgd

Ciss

Coss

Crss

* Notes
1. V$_{GS}$ = 0V
2. f = 1MHz

Capacitance [pF]

V$_{DS}$, Drain-Source Voltage [V]
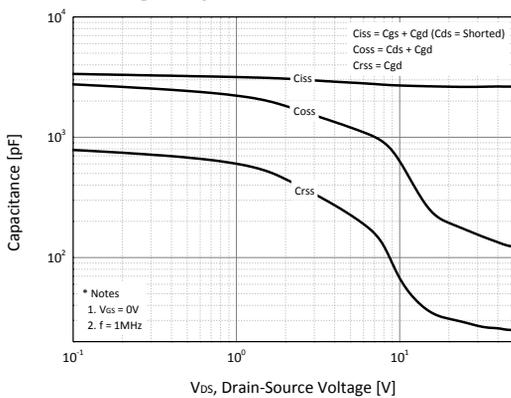
Fig.6 Gate Charge Characteristics

VDS = 640V
VDS = 400V
VDS = 160V

* Note
1. I$_D$ = 10.0A

V$_{GS}$, Gate-Source Voltage [V]

Q$_g$, Total Gate Charge [nC]
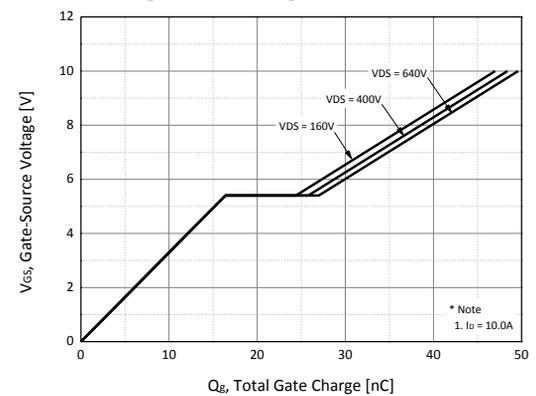
Typical Characteristics

Fig.7 BVDSS Variation vs. Temperature

BVDSS (Normalized)
Drain-Source Breakdown Voltage

* Note
1. VGS = 0V
2. ID = 250uA

TJ, Junction Temperature [°C]
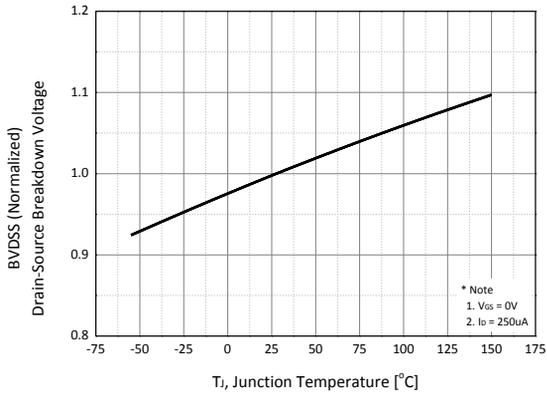
Fig.8 On-Resistance Variation vs. Temperature

RDS(ON) (Normalized)
Drain-Source On-Resistance

* Note
1. VGS = 10V
2. ID = 5.0A

TJ, Junction Temperature [°C]

Fig.9-1 Safe Operation Area for TO-220

Operation in this area
is limited by RDS(ON)

ID, Drain Current [A]

100us
1ms
10ms
DC

* Notes
1. TC = 25°C
2. TJ = 150°C
3. Single Pulse

VDS, Drain-Source Voltage [V]
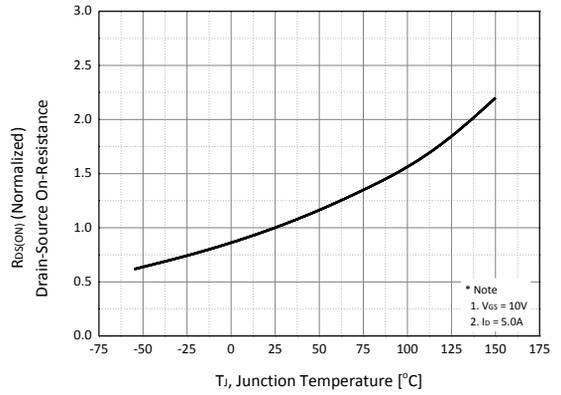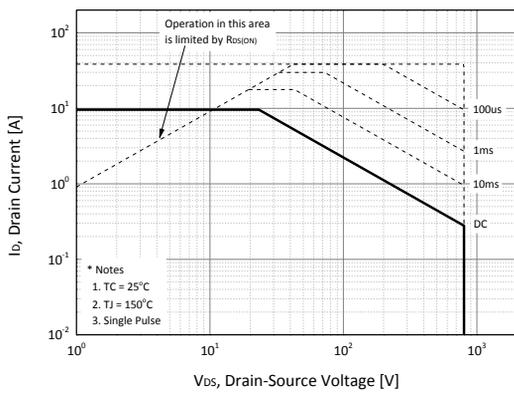
Fig.9-2 Safe Operation Area for TO-220F

Operation in this area
is limited by RDS(ON)

ID, Drain Current [A]

100us
1ms
10ms
DC

* Notes
1. TC = 25°C
2. TJ = 150°C
3. Single Pulse

VDS, Drain-Source Voltage [V]
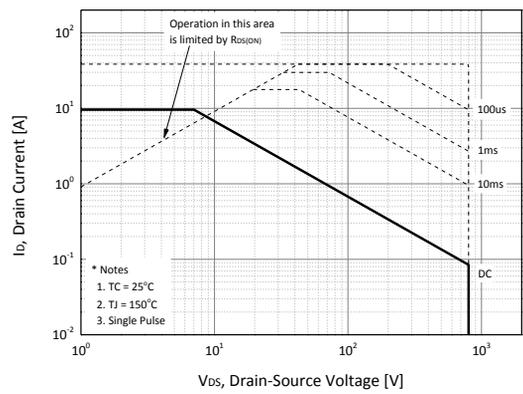
Fig.10 Maximum ID vs. Case Temperature

ID, Drain Current [A]

TC, Case Temperature [°C]
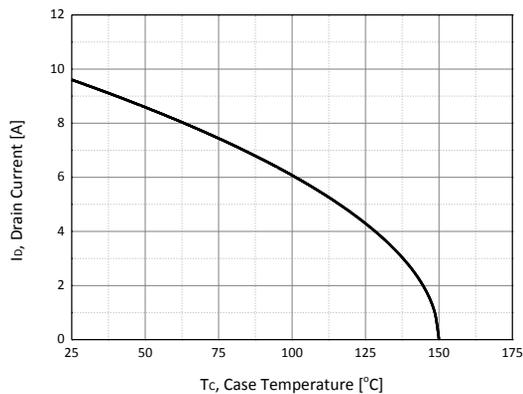
Typical Characteristics

Fig.11-1 Transient Thermal Response Curve

Thermal Response

D = 0.5
D = 0.2
D = 0.1
D = 0.05
D = 0.02
D = 0.01

Single Pulse

* Notes
1. $Z_{TJC(t)}$ = 0.56°C/W Max.
2. Duty Factor, D = t1/t2
3. $T_{JM} - T_C = P_{DM} * Z_{TJC(t)}$

P_{DM}
t1
t2

Square Wave Pulse Duration [sec]
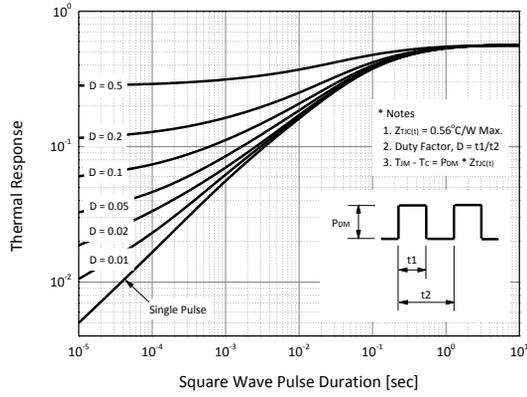
Fig.11-2 Transient Thermal Response Curve

Thermal Response

D = 0.5
D = 0.2
D = 0.1
D = 0.05
D = 0.02
D = 0.01

Single Pulse

* Notes
1. $Z_{TJC(t)}$ = 1.85°C/W Max.
2. Duty Factor, D = t1/t2
3. $T_{JM} - T_C = P_{DM} * Z_{TJC(t)}$

P_{DM}
t1
t2

Square Wave Pulse Duration [sec]

Characteristics Test Circuit & Waveform

V_DS ○ — R_L — ○ V_DD
(0.5 rated V_DS)

R_G

10V

DUT

V_DS
90%

V_in
10%

$t_{d(on)}$ t_r $t_{d(off)}$ t_f
t_{on} t_{off}
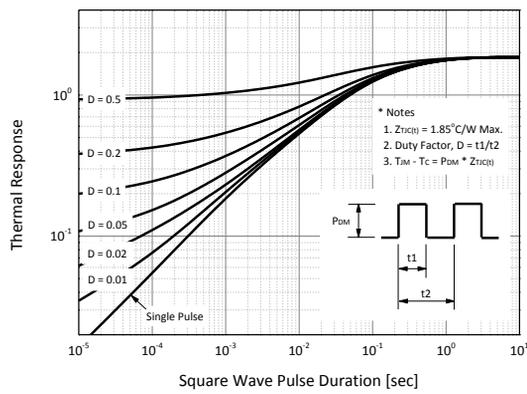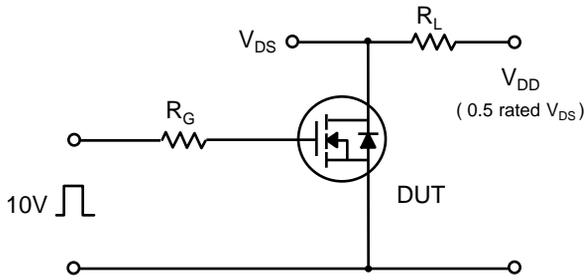
Fig 14.   Resistive Switching Test Circuit & Waveforms

Same Type
as DUT

12V   200nF   50KΩ   300nF

V_GS

DUT

3mA

V_DS

V_GS

10V

Q_g

Q_{gs} Q_{gd}
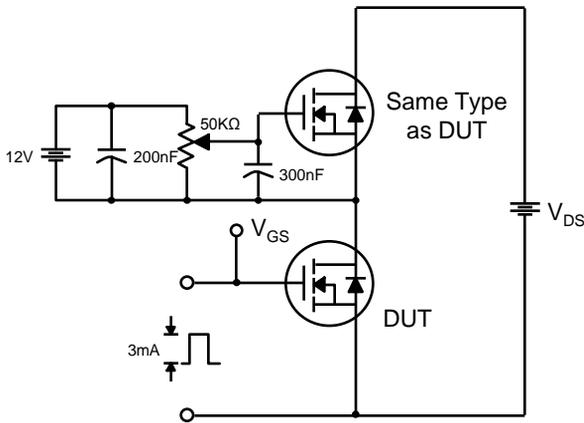
Charge

Fig 15. Gate Charge Test Circuit & Waveform

V_DS ○ — L —○ V_DD

I_D

R_G

10V

DUT

$$E_{AS} = \frac{1}{2} \; L_L \, I_{AS}^2 \; \frac{BV_{DSS}}{BV_{DSS} -- V_{DD}}$$

BV_DSS
I_AS

$I_D(t)$

V_DD   V_DS (t)

t_p Time
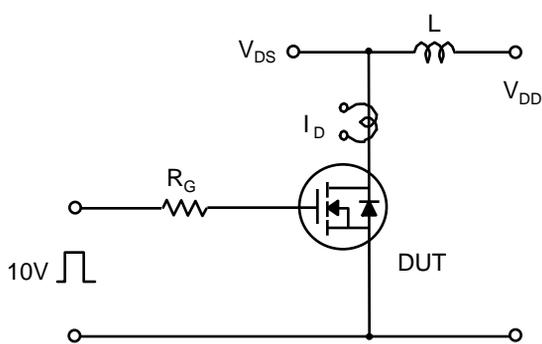
Fig 16. Unclamped Inductive Switching Test Circuit & Waveforms
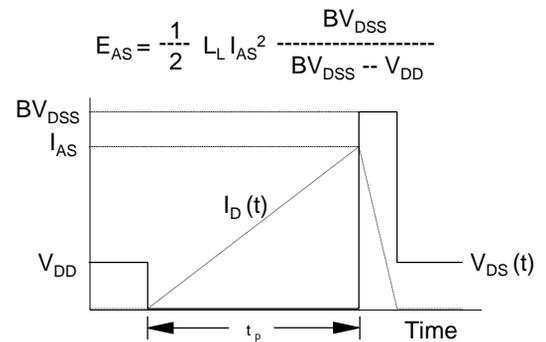
Characteristics Test Circuit & Waveform (continued)
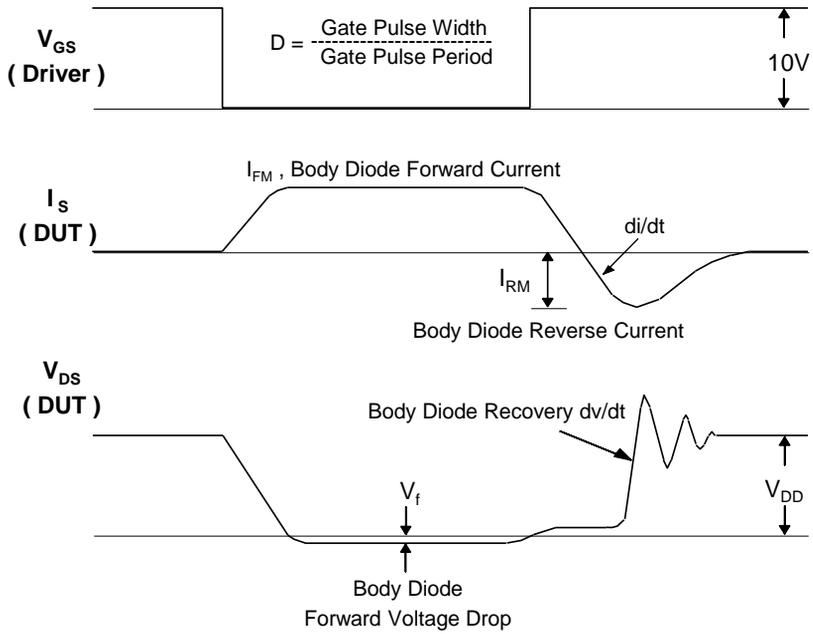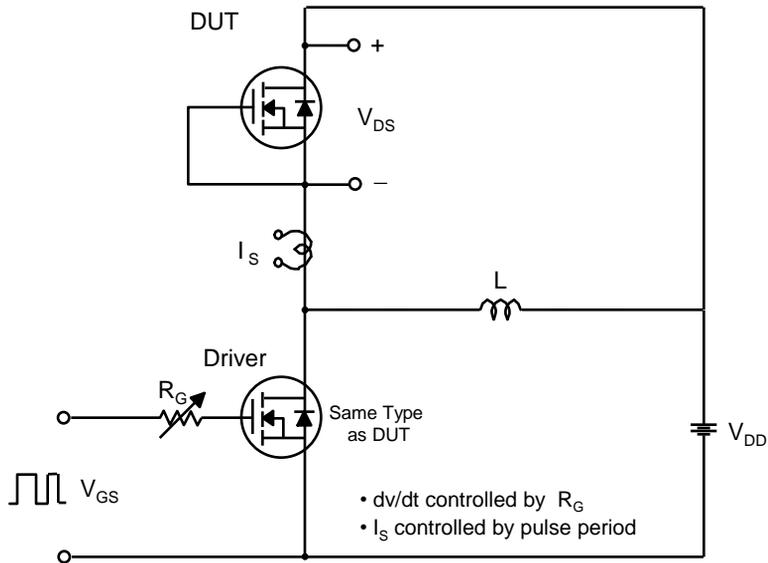

$$D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$$

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

Package Dimension

Z

TO-220

9.90±0.05

8.70

1.70

1.30

2.80±0.07

Φ3.60

3.70±0.05

Φ1.5/D0.1

18.95Max

15.90±0.05

3.00

45°

1.27 +0.20 -0.05

13.08±0.05

10.08±0.05

2.54±0.05

0.80±0.05

2.54±0.05

4.50±0.076

1.30±0.015

3°

3°

3°

0.50±0.015

2.40±0.076

10.00±0.0.076

Package Dimension

Z

TO-220F