

FEATURES

- ❑ Originative New Design
- ❑ 100% EAS Test
- ❑ Rugged Gate Oxide Technology
- ❑ Extremely Low Intrinsic Capacitances
- ❑ Remarkable Switching Characteristics
- ❑ Unequalled Gate Charge : 48 nC (Typ.)
- ❑ Extended Safe Operating Area
- ❑ Lower $R_{DS(ON)}$: 0.46 Ω (Typ.) @ $V_{GS}=10V$

APPLICATION

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

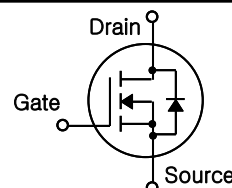
PFP12N65/PFF12N65

650V N-Channel MOSFET

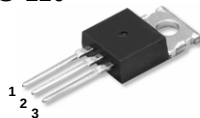
$$BV_{DSS} = 650 \text{ V}$$

$$R_{DS(on) \text{ typ}} = 0.46 \Omega$$

$$I_D = 12 \text{ A}$$

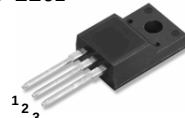


TO-220



1.Gate 2. Drain 3. Source

TO-220F



1.Gate 2. Drain 3. Source

Absolute Maximum Ratings

$T_C=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	PFP12N65	PFF12N65	Units
V_{DSS}	Drain-Source Voltage	650		V
I_D	Drain Current – Continuous ($T_C = 25^\circ\text{C}$)	12.0	12.0*	A
	Drain Current – Continuous ($T_C = 100^\circ\text{C}$)	7.6	7.6*	A
I_{DM}	Drain Current – Pulsed (Note 1)	48	48*	A
V_{GS}	Gate-Source Voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	950		mJ
I_{AR}	Avalanche Current (Note 1)	12		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	24		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5		V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	240	55	W
	– Derate above 25°C	1.85	0.42	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		$^\circ\text{C}$
V_{ISO}	Insulation withstand voltage (DC)	-	3000	V
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300		$^\circ\text{C}$

* Drain current limited by maximum junction temperature

Thermal Resistance Characteristics

Symbol	Parameter	PFP12N65	PFF12N65	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.54	2.35	$^\circ\text{C/W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.5	--	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
On Characteristics						
V_{GS}	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2.0	--	4.0	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}$, $I_D = 6.0\text{ A}$	--	0.46	0.57	Ω

Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	650	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to $25\text{ }^{\circ}\text{C}$	--	0.65	--	$\text{V}/^{\circ}\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}$, $V_{GS} = 0\text{ V}$	--	--	10	μA
		$V_{DS} = 520\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}$	--	--	100	μA
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

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$	--	2050	2670	pF
C_{oss}	Output Capacitance		--	230	300	pF
C_{rss}	Reverse Transfer Capacitance		--	17	22	pF
R_g	Gate Input Resistance	$f = 1.0\text{ MHz}$, open drain	--	2.1	--	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Time	$V_{DS} = 325\text{ V}$, $I_D = 12.0\text{ A}$, $R_G = 25\text{ }\Omega$ (Note 4,5)	--	20	40	ns
t_r	Turn-On Rise Time		--	40	80	ns
$t_{d(off)}$	Turn-Off Delay Time		--	130	260	ns
t_f	Turn-Off Fall Time		--	45	90	ns
Q_g	Total Gate Charge	$V_{DS} = 520\text{ V}$, $I_D = 12.0\text{ A}$, $V_{GS} = 10\text{ V}$ (Note 4,5)	--	47.5	55	nC
Q_{gs}	Gate-Source Charge		--	10	--	nC
Q_{gd}	Gate-Drain Charge		--	18.5	--	nC

Source-Drain Diode Maximum Ratings and Characteristics

I _S	Continuous Source-Drain Diode Forward Current		--	--	12	A
I _{SM}	Pulsed Source-Drain Diode Forward Current		--	--	48	
V _{SD}	Source-Drain Diode Forward Voltage	I _S = 12 A, V _{GS} = 0 V	--	--	1.5	V
trr	Reverse Recovery Time	I _S = 12 A, V _{GS} = 0 V di _F /dt = 100 A/μs (Note 4)	--	490	--	ns
Qrr	Reverse Recovery Charge		--	5.8	--	μC

Notes ;

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $I_{AS}=12\text{ A}$, $V_{DD}=50\text{ V}$, $R_G=25\text{ }\Omega$, Starting $T_J=25\text{ }^{\circ}\text{C}$
3. $I_{SD}\leq 12\text{ A}$, $di/dt\leq 300\text{ A}/\mu\text{s}$, $V_{DD}\leq BV_{DSS}$, Starting $T_J=25\text{ }^{\circ}\text{C}$
4. Pulse Test : Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$
5. Essentially Independent of Operating Temperature

Typical Characteristics

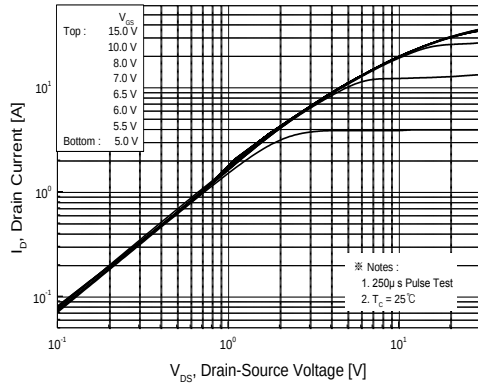


Figure 1. On Region Characteristics

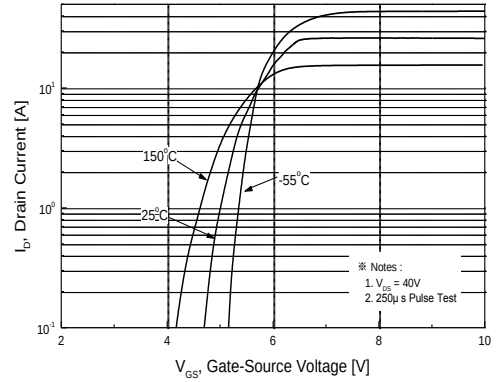


Figure 2. Transfer Characteristics

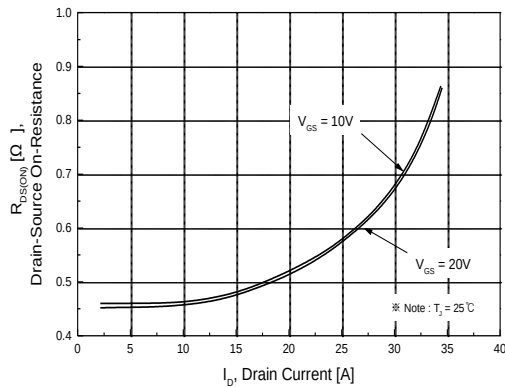


Figure 3. On Resistance Variation vs Drain Current and Gate Voltage

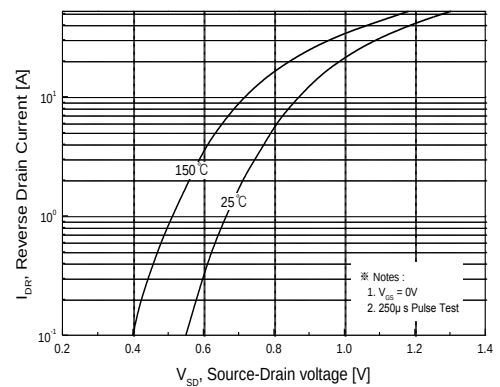


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

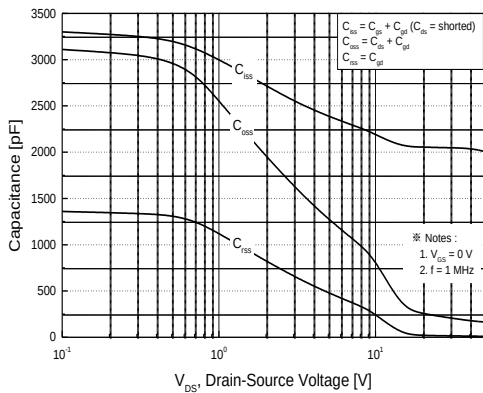


Figure 5. Capacitance Characteristics

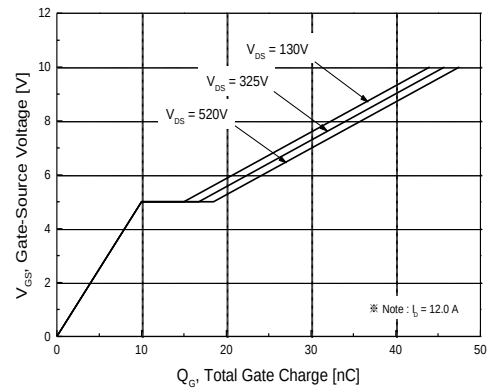


Figure 6. Gate Charge Characteristics

Typical Characteristics (continued)

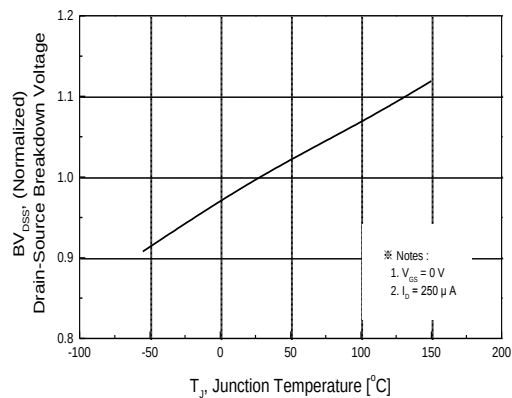


Figure 7. Breakdown Voltage Variation vs Temperature

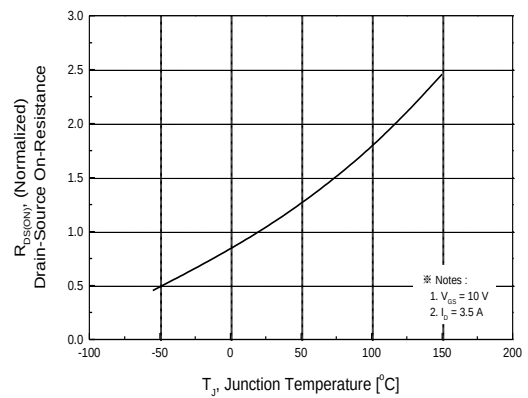


Figure 8. On-Resistance Variation vs Temperature

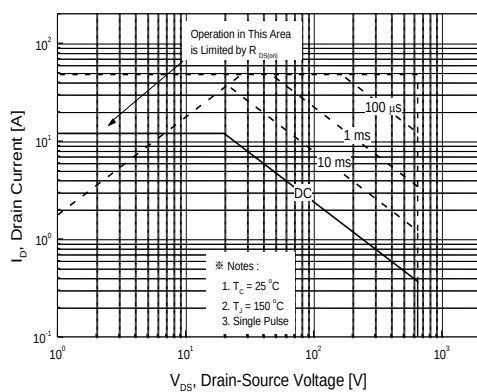


Figure 9. Maximum Safe Operating Area for PFP12N65

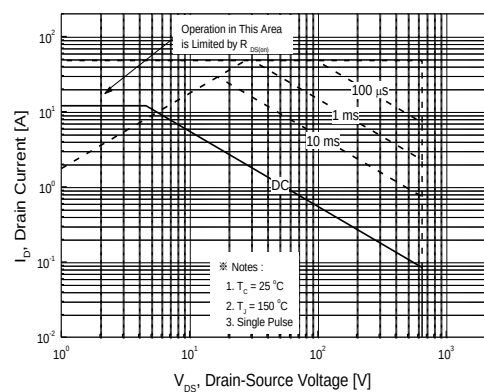


Figure 10. Maximum Safe Operating Area for PFF12N65

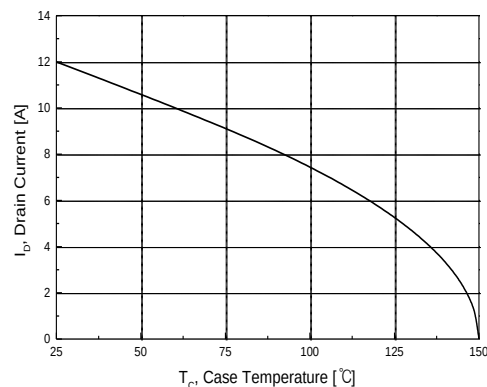


Figure 11. Maximum Drain Current vs Case Temperature

Typical Characteristics (continued)

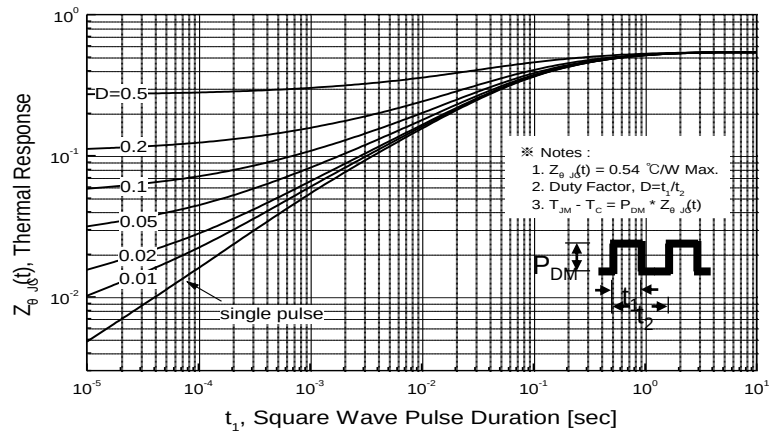


Figure 12. Transient Thermal Response Curve for PFP12N65

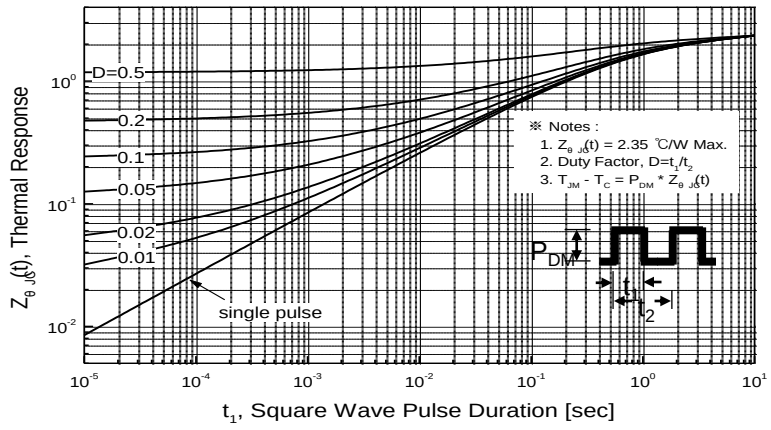


Figure 13. Transient Thermal Response Curve for PFF12N65

Characteristics Test Circuit & Waveform

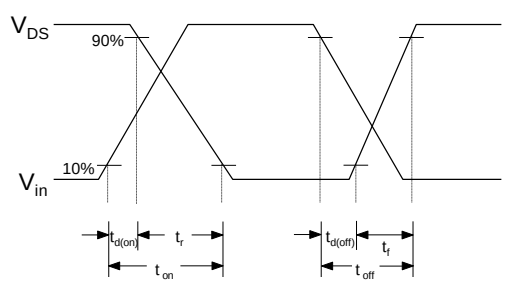
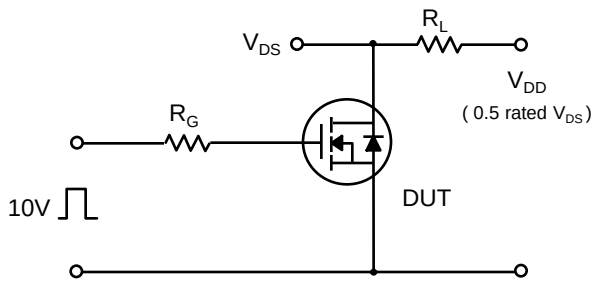


Fig 14. Resistive Switching Test Circuit & Waveforms

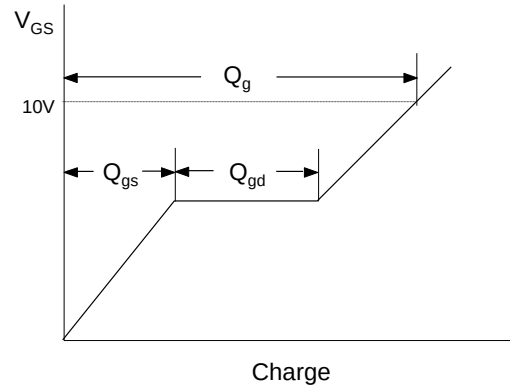
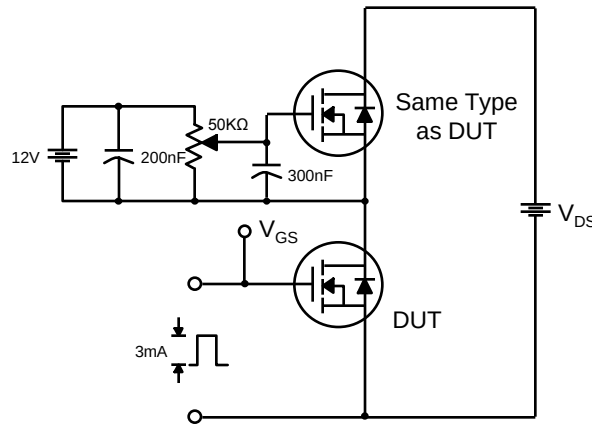


Fig 15. Gate Charge Test Circuit & Waveform

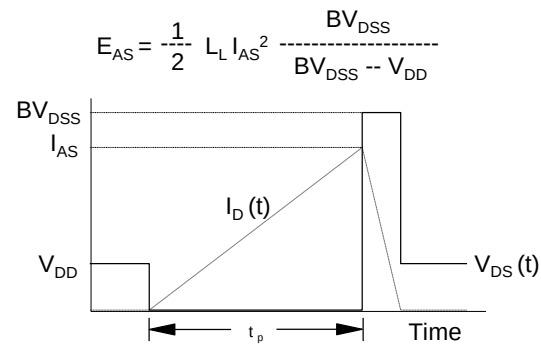
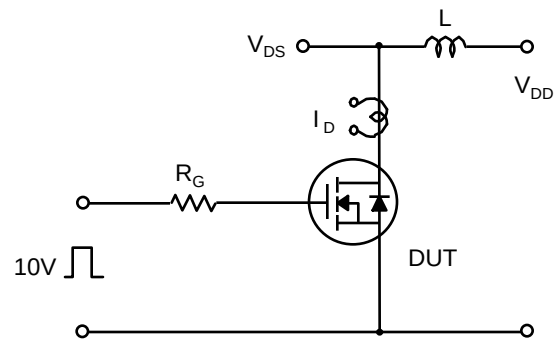


Fig 16. Unclamped Inductive Switching Test Circuit & Waveforms

Characteristics Test Circuit & Waveform (continued)

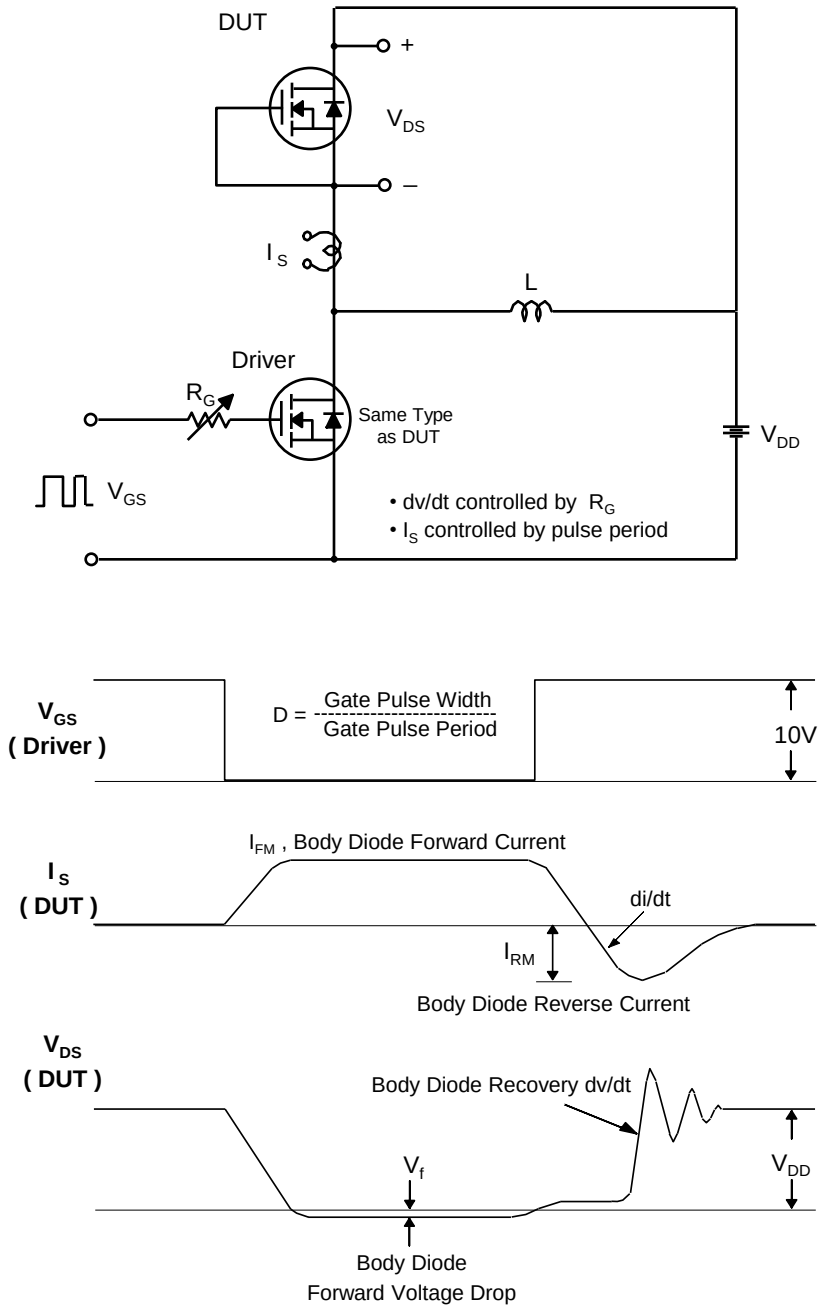
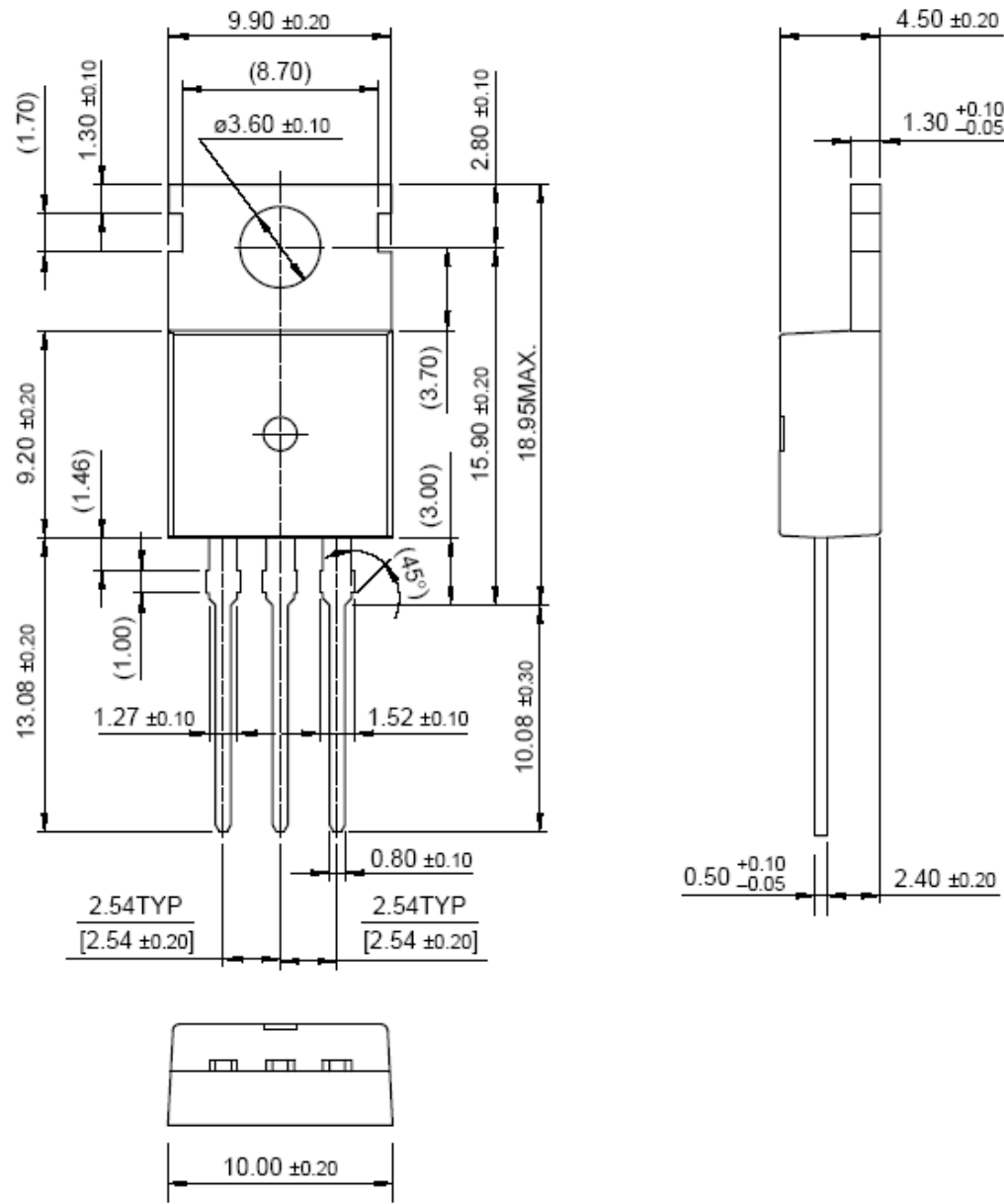


Fig 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms

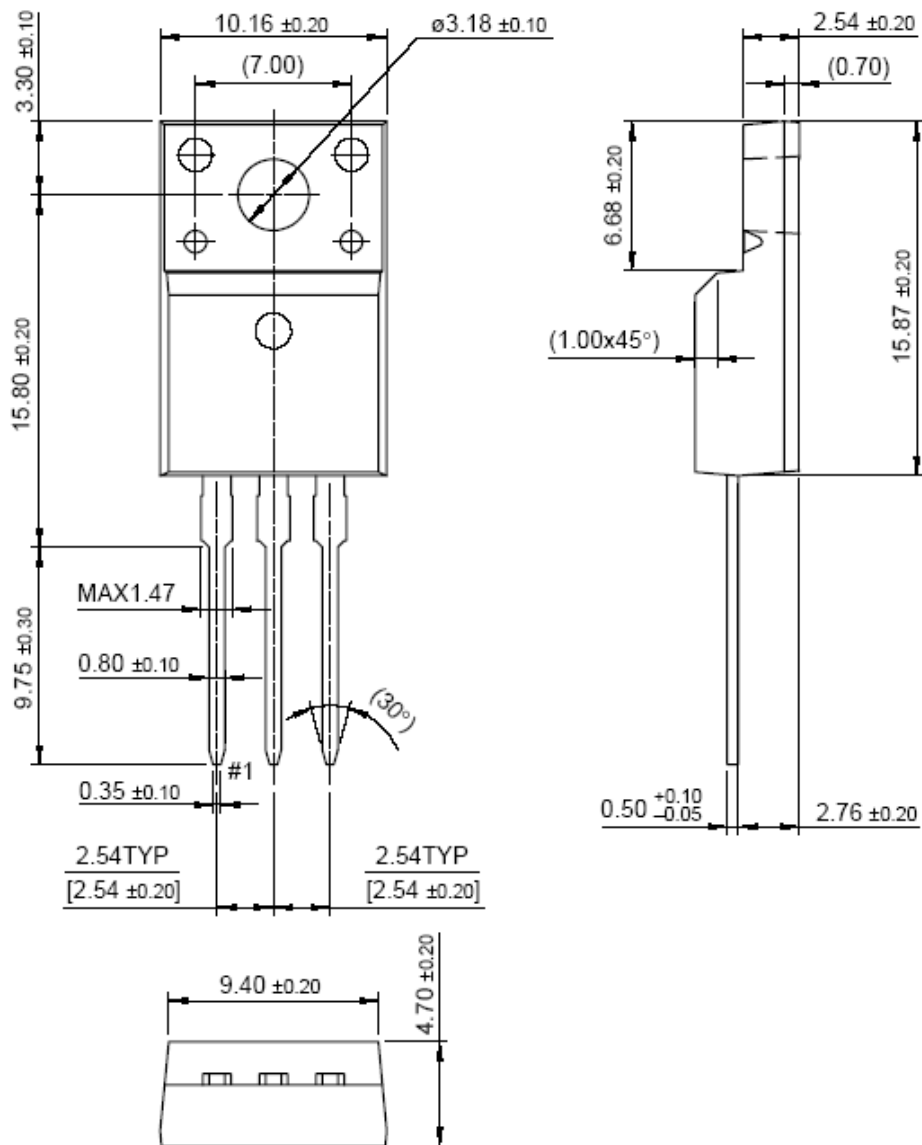
Package Dimension

TO-220



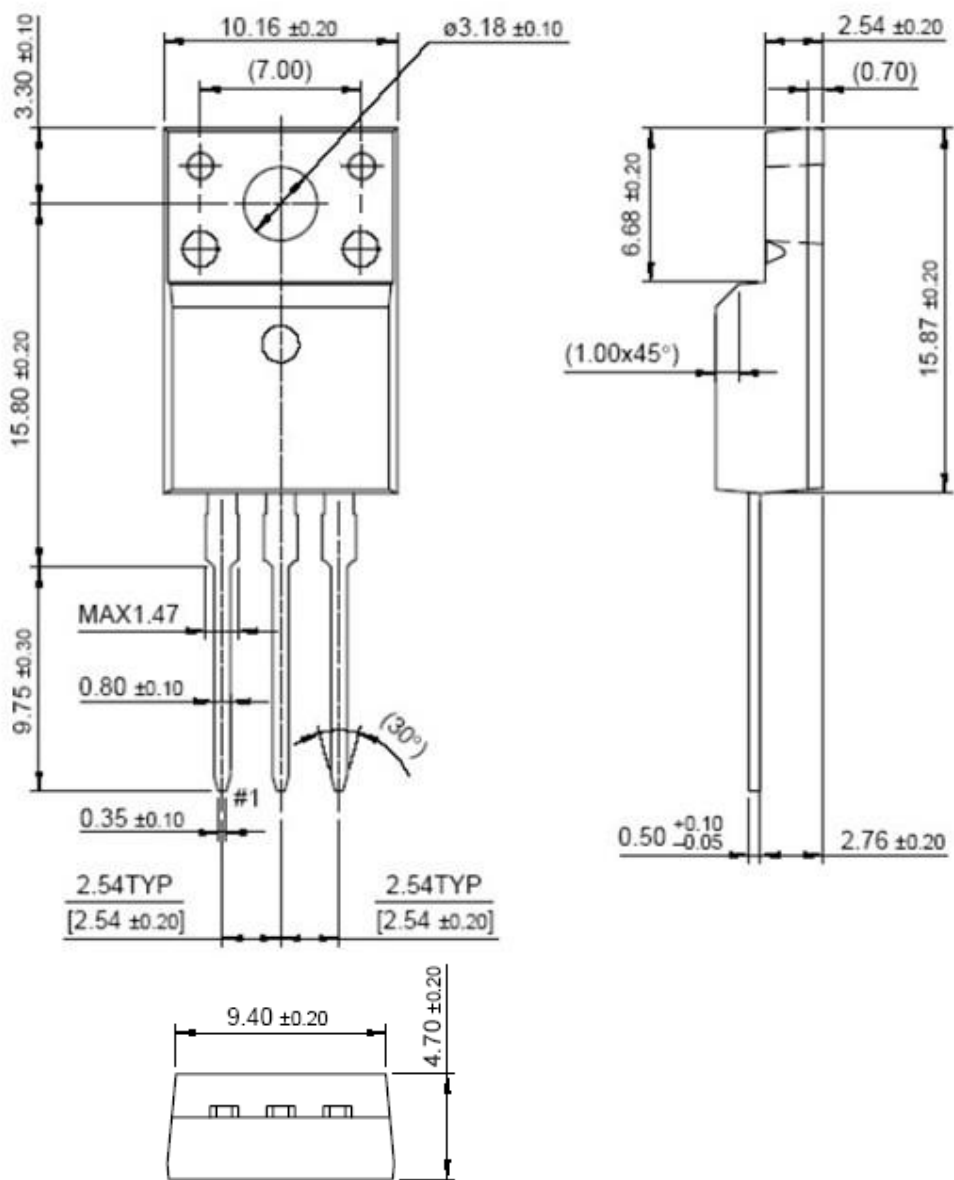
Package Dimension

TO-220F (1)



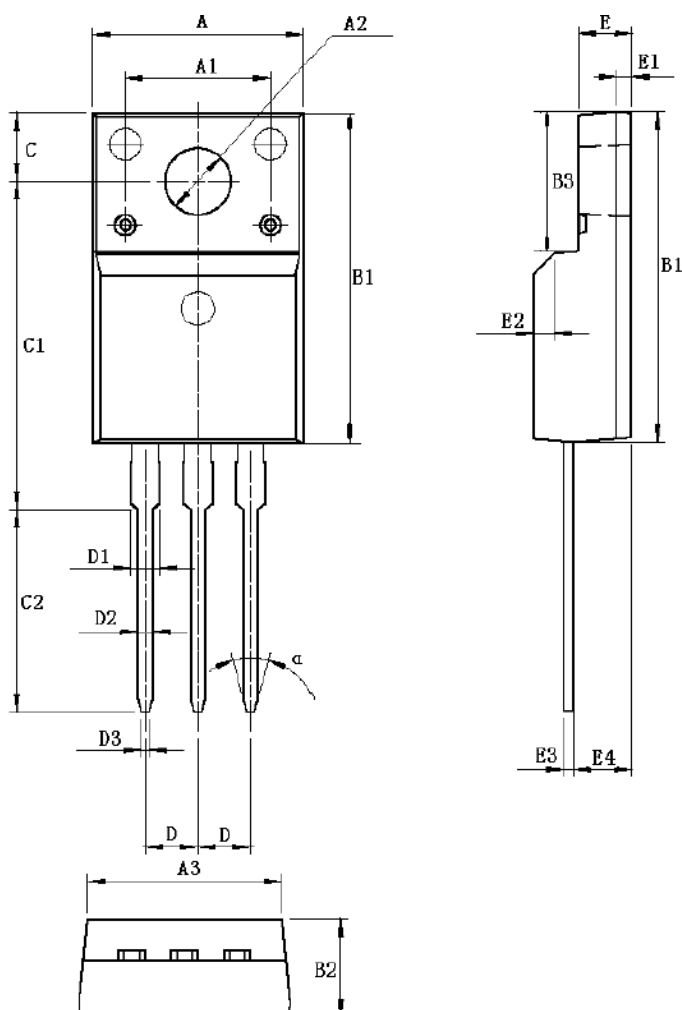
Package Dimension

TO-220F (2)



Package Dimension

TO-220F (3)



	Min	Max
A	9.96	10.36
A1	--	7.00
A2	3.08	3.28
A3	9.26	9.66
B1	15.67	16.07
B2	4.50	4.90
B3	6.48	6.88
C	3.20	3.40

	Min	Max
C1	15.60	16.00
C2	9.55	9.95
D	2.54	
D1	--	1.47
D2	0.70	0.90
D3	0.25	0.45
E	2.34	2.74
E1	0.70	

	Min	Max
E2	1.0X45°	
E3	0.45	0.60
E4	2.56	2.96
a	30°	

Unit : mm