

N-Channel Power MOSFET

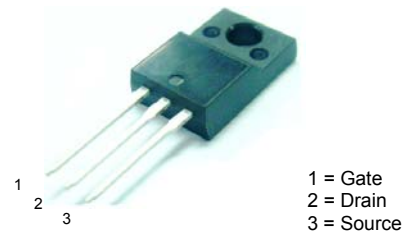
4.1A, 600V, 2.5Ω

General Description

The N-Channel MOSFET is used an advanced termination scheme to provide enhanced voltage-blocking capability without degrading performance over time. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance. This device is well suited for high efficiency switched mode power suppliers, active power factor correction, electronic lamp ballasts based half bridge topology.

Features

- Robust high voltage termination
- Avalanche energy specified
- Diode is characterized for use in bridge circuits
- Source to Drain diode recovery time comparable to a discrete fast recovery diode.

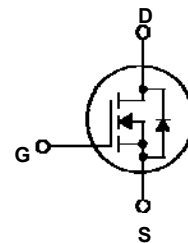


TO-220FP

DEVICE MARKING DIAGRAM



L = Tak Cheong Logo
 xxyy = Monthly Date Code
 TFFXXXX = Device Type



ABSOLUTE MAXIMUM RATINGS (T_C=25°C, unless otherwise noted)

Symbol	Parameter	Value	Units
V _{DSS}	Drain- Source Voltage	600	V
V _{GSS}	Gate-Source Voltage	±30	V
I _D	Drain Current	4.1	A
I _{DM}	Drain Current Pulsed	16.4	A
P _D	Power Dissipation (Note 2)	39	W
	Derating factor above 25°C	0.31	W/°C
E _{AS}	Single Pulsed Avalanche Energy (Note 1)	330	mJ
E _{AR}	Repetitive Avalanche Energy (Note 2)	7.3	mJ
T _J	Operating Junction Temperature	150	°C
T _{stg}	Storage Temperature Range	- 55 to +150	°C

Notes:

1. L=30mH, I_{AS}=4.4A, V_{DD}=85V, R_G=25Ω, Starting T_J=25°C
2. Repetitive Rating: Pulse width limited by maximum junction temperature.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
R _{θJC}	Thermal Resistance, Junction-to-Case	3.18	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient	62.5	°C/W

ELECTRICAL CHARACTERISTICS
Off Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	600	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600V, V_{GS} = 0V$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30V, V_{DS} = 0V$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30V, V_{DS} = 0V$	--	--	-100	nA

On Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0	--	4.0	V
$R_{DS(ON)}$	On-Resistance	$V_{GS} = 10V, I_D = 2.05A$	--	2.0	2.5	Ω

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V,$ $f = 1.0\text{MHz}$	--	570	741	pF
C_{oss}	Output Capacitance		--	64	83	pF
C_{rss}	Reverse Transfer Capacitance		--	14	18	pF

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 300V, I_D = 4.1A,$ $R_G = 25\Omega$ (Note 3 & 4)	--	25	32	nS
t_r	Turn-On Rise Time		--	54	70	nS
$t_{d(off)}$	Turn-Off Delay Time		--	120	157	nS
t_f	Turn-Off Fall Time		--	34	45	nS
Q_g	Total Gate Charge	$V_{DS} = 480V, I_D = 4.1A,$	--	19	25	nC
Q_{gs}	Gate-Source Charge	$V_{GS} = 10V$	--	2.9	--	nC
Q_{gd}	Gate-Drain Charge	(Note 3 & 4)	--	8.2	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	4.1	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	16.4	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0V, I_S = 4.1A$	--	--	1.4	V
T_{rr}	Reverse Recovery Time	$V_{GS} = 0V, I_S = 4.1A,$ $dI_F / dt = 100A/\mu S$	--	560	--	nS
Q_{rr}	Reverse Recovery Charge	(Note 3)	--	1.78	--	μC

Notes:

- Pulse Test: Pulse width < 300 μs , Duty cycle $\leq 2\%$.
- Basically not affected by working temperature.

TYPICAL CHARACTERISTICS

Fig 1. On-State Characteristics

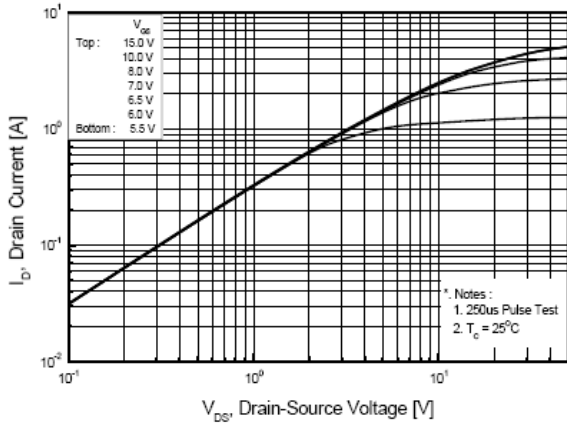


Fig 2. Transfer Characteristics

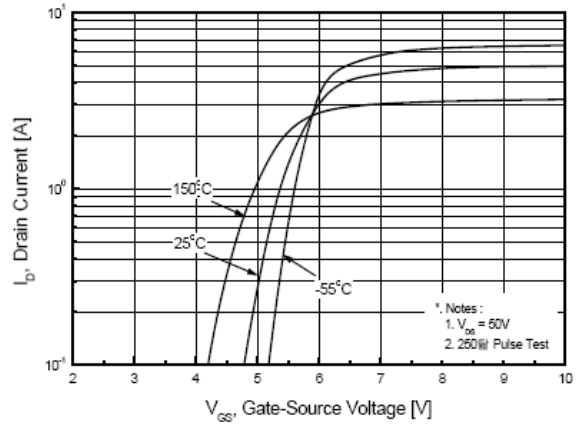


Fig 3. On Resistance Variation vs. Drain Current and Gate Voltage

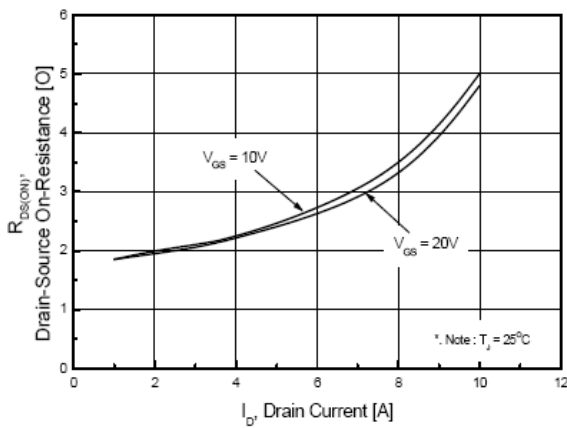


Fig 4. On State Current vs. Allowable Case Temperature

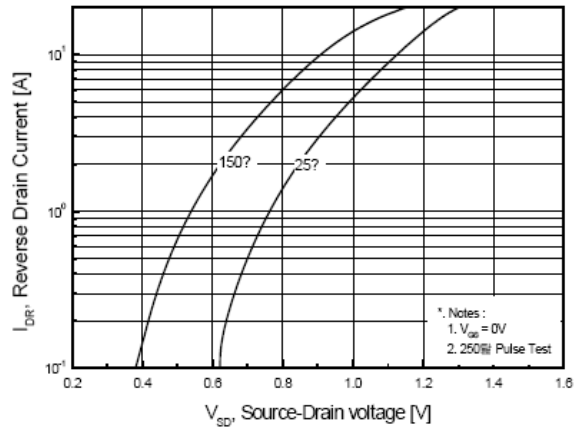


Fig 5. Capacitance Characteristics (Non-Repetitive)

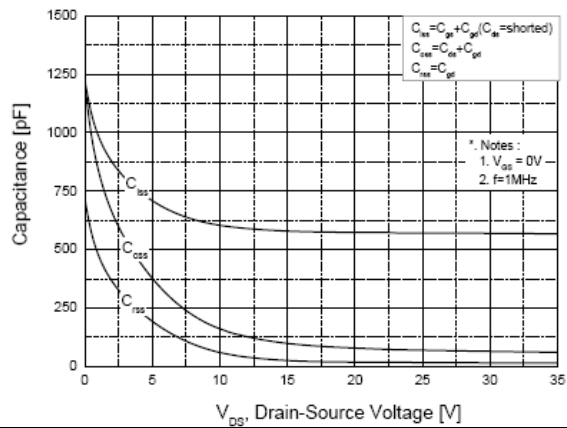


Fig 6. Gate Charge Characteristics

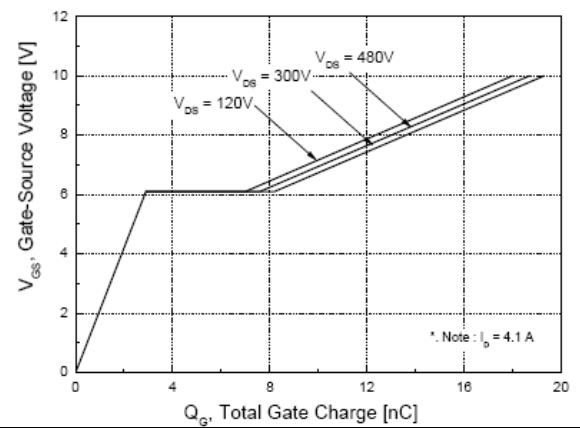


Fig 7. Breakdown Voltage Variation vs. Junction Temperature

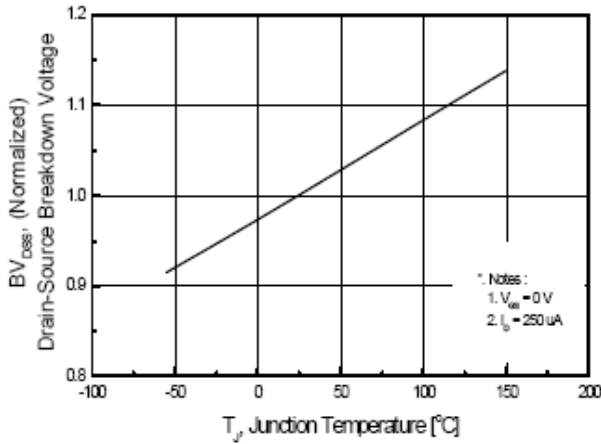


Fig 8. On-Resistance Variation vs. Junction Temperature

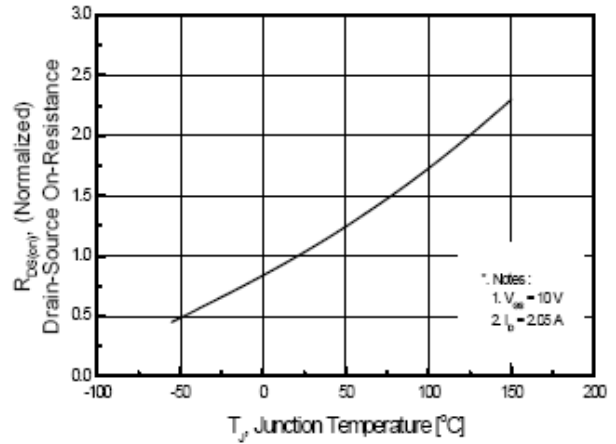


Fig 9. Maximum Safe Operating Area (TO-220F)

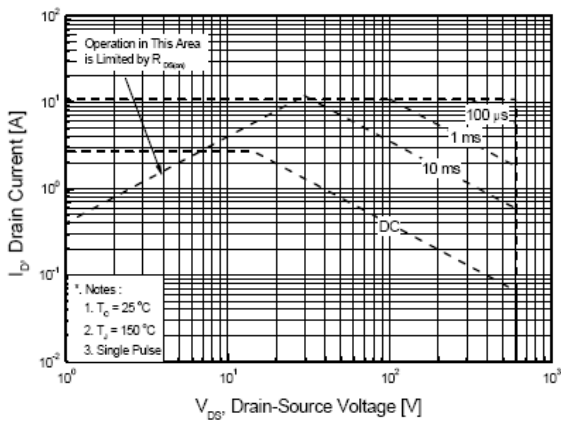


Fig 10. Maximum Drain Current vs. Case Temperature. (TO220F)

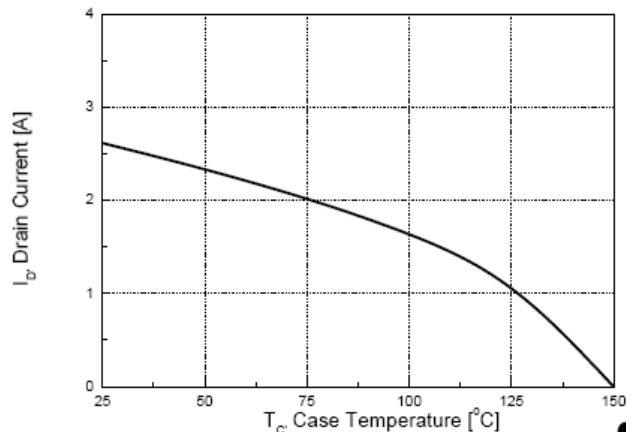


Fig 11. Transient Thermal Response Curve (TO220F)

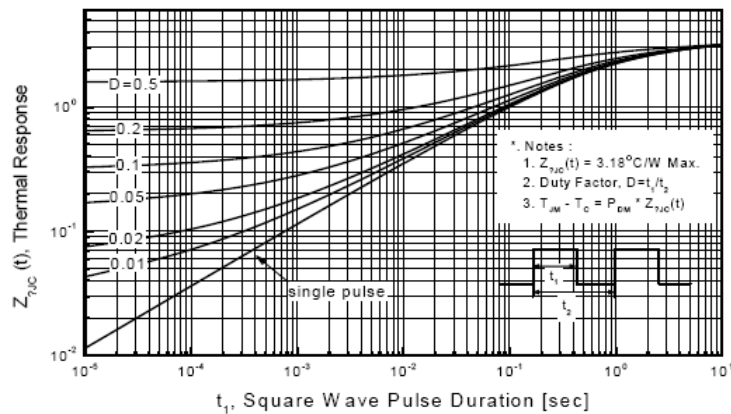


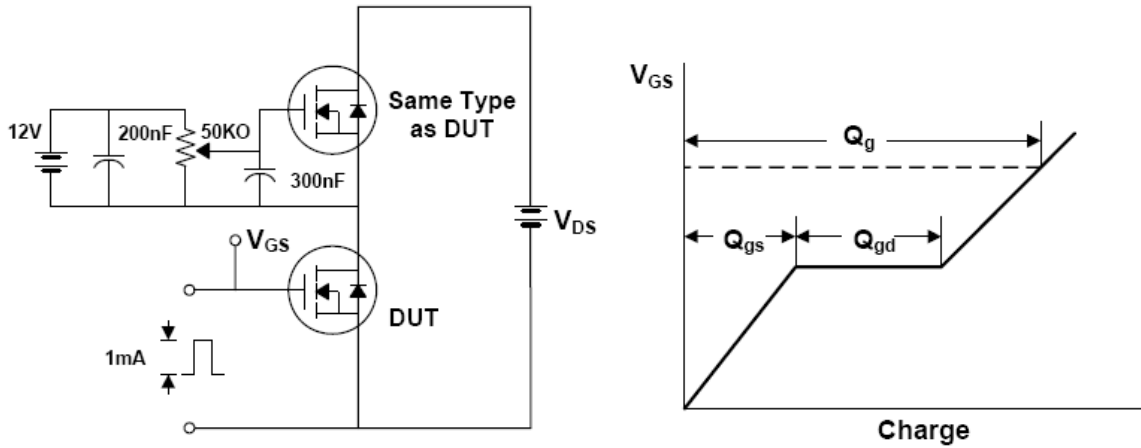
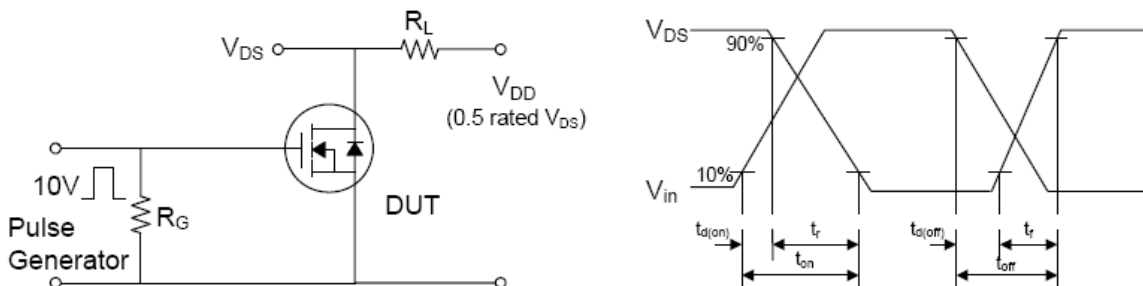
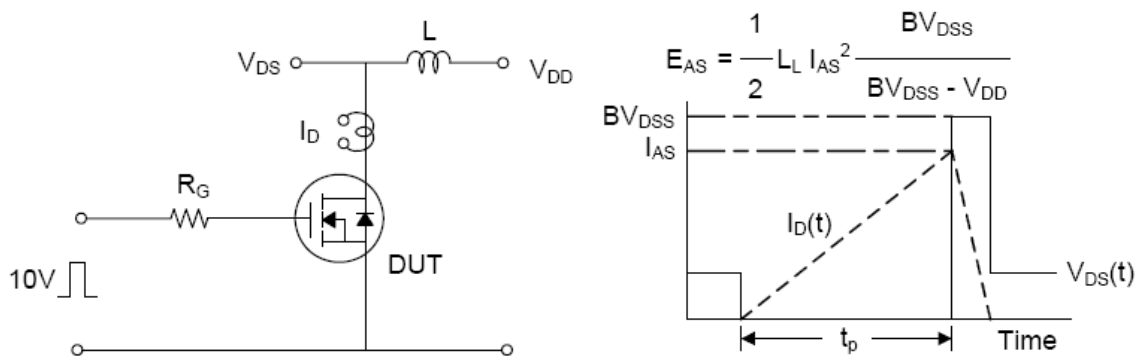
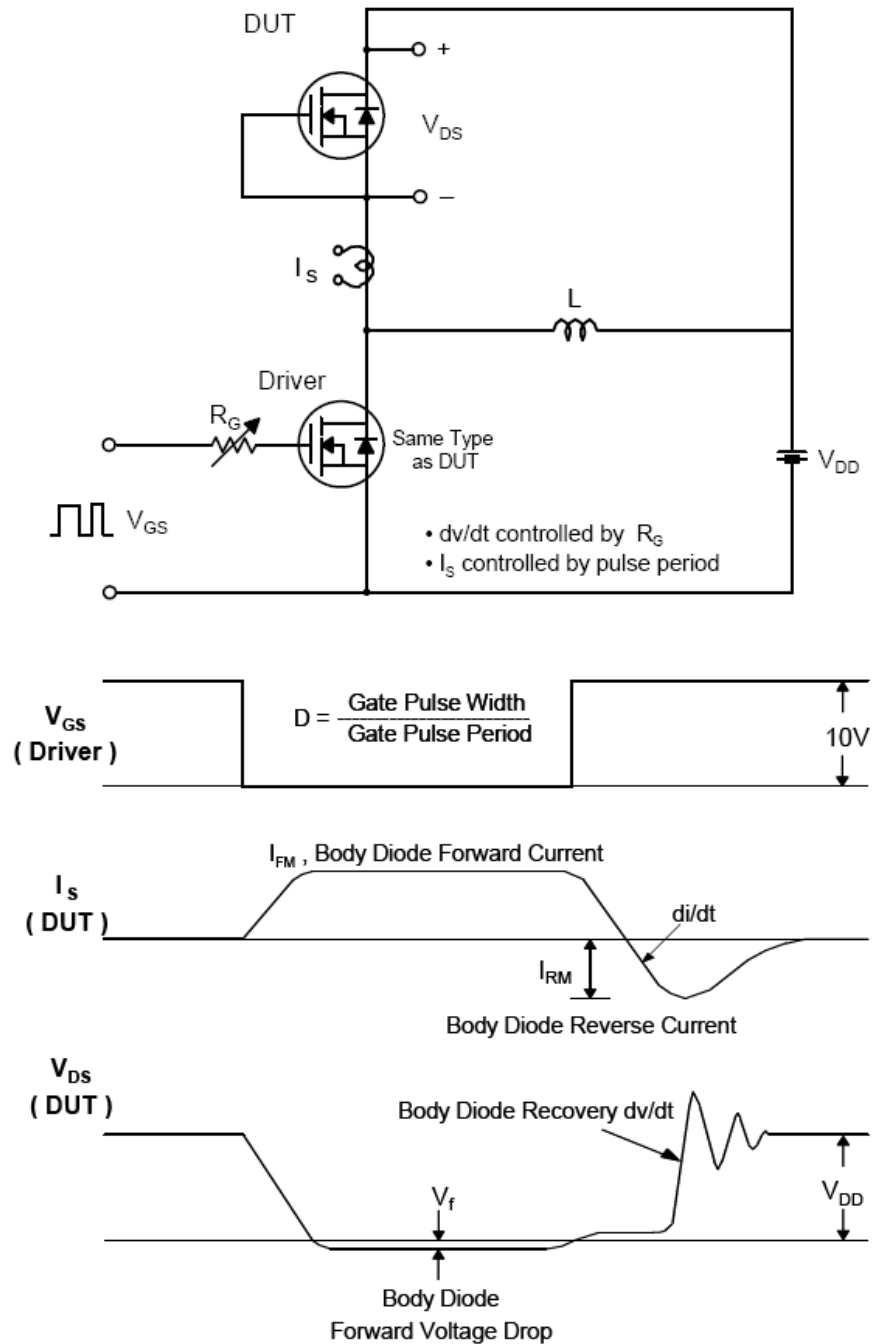
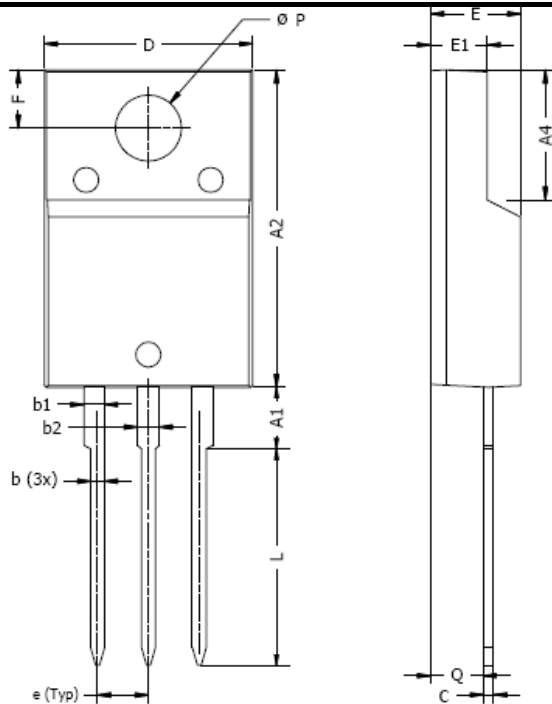
Fig. 12. Gate Charge Test Circuit & Waveforms

Fig 13. Switching Time Test Circuit & Waveforms

Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms


Fig. 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



TO220FP PACKAGE OUTLINE


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A1	2.7	3.3	0.106	0.130
A2	15.0	15.7	0.591	0.618
A4	6.2	6.6	0.244	0.260
b	0.5	0.9	0.020	0.035
b1	0.9	1.2	0.035	0.047
b2	1.0	1.2	0.039	0.047
c	0.4	0.6	0.016	0.024
D	9.8	10.3	0.386	0.406
e	2.34	2.74	0.092	0.108
E	4.3	4.6	0.169	0.181
E1	2.5	2.9	0.098	0.114
F	2.6	3.0	0.102	0.118
L	10.3	10.7	0.406	0.421
$\varnothing P$	3.0	3.4	0.118	0.134
Q	2.3	2.7	0.091	0.106

Note: Single Gauge

NOTICE

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