

# N-Channel Enhancement Mode Power MOSFET

# MTN4N60FP

 **$BV_{DSS} : 650V @ T_j = 150^{\circ}C$**  **$R_{DS(ON)} : 2.2 \Omega$**  **$I_D : 4A$** 

## Description

The MTN4N60FP is a N-channel enhancement-mode MOSFET, providing the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness. The TO-220FP package is universally preferred for all commercial-industrial applications

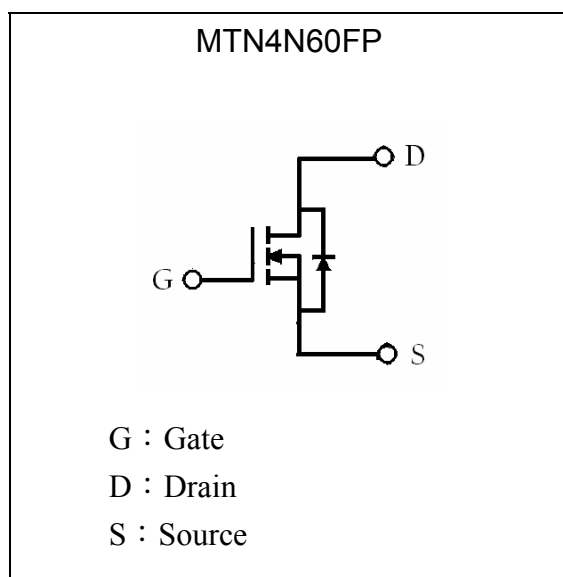
## Features

- $BV_{DSS} = 650V$  typically @  $T_j = 150^{\circ}C$
- Low On Resistance
- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- RoHS compliant package

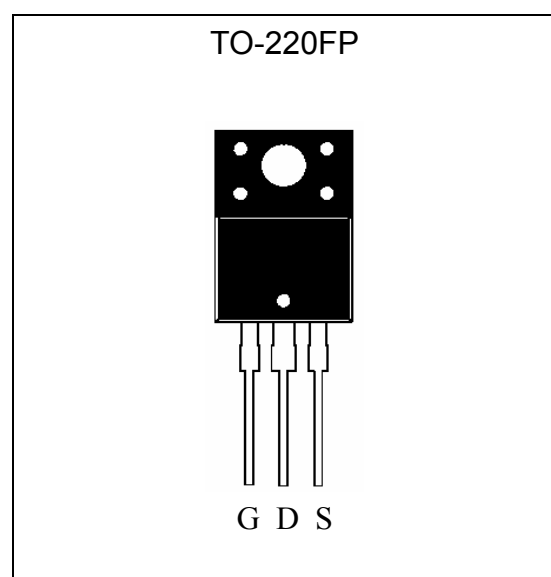
## Applications

- Open Framed Power Supply
- Adapter
- STB

## Symbol



## Outline



**Absolute Maximum Ratings** ( $T_C=25^{\circ}\text{C}$ )

Parameter	Symbol	Limits	Unit
Drain-Source Voltage	$V_{DS}$	600	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	V
Continuous Drain Current	$I_D$	4*	A
Continuous Drain Current @ $T_C=100^{\circ}\text{C}$	$I_D$	2.4*	A
Pulsed Drain Current @ $V_{GS}=10\text{V}$ (Note 1)	$I_{DM}$	16*	A
Single Pulse Avalanche Energy (Note 2)	$E_{AS}$	58.6	mJ
Avalanche Current (Note 1)	$I_{AR}$	4	A
Repetitive Avalanche Energy (Note 1)	$E_{AR}$	3.3	mJ
Peak Diode Recovery $dv/dt$ (Note 3)	$dv/dt$	4.5	V/ns
Maximum Temperature for Soldering @ Lead at 0.125 in(0.318mm) from case for 10 seconds	$T_L$	300	$^{\circ}\text{C}$
Maximum Temperature for Soldering @ Package Body for 10 seconds	$T_{PKG}$	260	$^{\circ}\text{C}$
Total Power Dissipation ( $T_C=25^{\circ}\text{C}$ )	$P_d$	33	W
Linear Derating Factor		0.26	$\text{W}/^{\circ}\text{C}$
Operating Junction and Storage Temperature	$T_j, T_{stg}$	-55~+150	$^{\circ}\text{C}$

\*Drain current limited by maximum junction temperature

Note : 1.Repetitive rating; pulse width limited by maximum junction temperature.

2.  $I_{AS}=4\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $L=8\text{mH}$ ,  $V_G=10\text{V}$ , starting  $T_J=+25^{\circ}\text{C}$ .3.  $I_{SD}\leq 4\text{A}$ ,  $di/dt\leq 100\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , starting  $T_J=+25^{\circ}\text{C}$ .**Thermal Data**

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-case, max	$R_{th,j-c}$	3.79	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-ambient, max	$R_{th,j-a}$	62.5	$^{\circ}\text{C}/\text{W}$



**Characteristics (Tc=25°C, unless otherwise specified)**

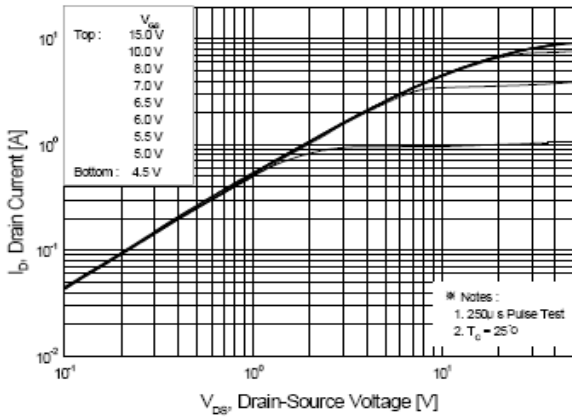
Symbol	Min.	Typ.	Max.	Unit	Test Conditions
<b>Static</b>					
BV <sub>DSS</sub>	600	-	-	V	V <sub>GS</sub> =0, I <sub>D</sub> =250μA, T <sub>j</sub> =25°C
BV <sub>DSS</sub>	-	650	-	V	V <sub>GS</sub> =0, I <sub>D</sub> =250μA, T <sub>j</sub> =150°C
ΔBV <sub>DSS</sub> /ΔT <sub>j</sub>	-	0.6	-	V/°C	Reference to 25°C, I <sub>D</sub> =250μA
BV <sub>DS</sub>	-	700	-	V	V <sub>GS</sub> =0, I <sub>D</sub> =4A
V <sub>GS(th)</sub>	2.0	-	4.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =250μA
*G <sub>FS</sub>	-	10	-	S	V <sub>DS</sub> =15V, I <sub>D</sub> =4A
I <sub>GSS</sub>	-	-	±100	nA	V <sub>GS</sub> =±30
I <sub>DSS</sub>	-	-	1	μA	V <sub>DS</sub> =600V, V <sub>GS</sub> =0
	-	-	10	μA	V <sub>DS</sub> =480V, V <sub>GS</sub> =0, T <sub>j</sub> =125°C
*R <sub>DS(ON)</sub>	-	-	2.2	Ω	V <sub>GS</sub> =10V, I <sub>D</sub> =2.4A
<b>Dynamic</b>					
*Q <sub>g</sub>	-	18.5	-	nC	I <sub>D</sub> =4A, V <sub>DD</sub> =300V, V <sub>GS</sub> =10V
*Q <sub>gs</sub>	-	3.98	-		
*Q <sub>gd</sub>	-	8.19	-		
*t <sub>d(ON)</sub>	-	10.8	-	ns	V <sub>DD</sub> =300V, I <sub>D</sub> =4A, V <sub>GS</sub> =10V, R <sub>G</sub> =10Ω, R <sub>D</sub> =75Ω
*t <sub>r</sub>	-	6.9	-		
*t <sub>d(OFF)</sub>	-	25.7	-		
*t <sub>f</sub>	-	9.6	-	pF	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz
C <sub>iss</sub>	-	810	-		
C <sub>oss</sub>	-	73	-		
C <sub>rss</sub>	-	9	-		
<b>Source-Drain Diode</b>					
*V <sub>SD</sub>	-	-	1.5	V	I <sub>S</sub> =4A, V <sub>GS</sub> =0V
*I <sub>S</sub>	-	-	4	A	
*I <sub>SM</sub>	-	-	16		
*t <sub>rr</sub>	-	452	-	ns	V <sub>GS</sub> =0, I <sub>F</sub> =4A, dI/dt=100A/μs
*Q <sub>rr</sub>	-	26.5	-	μC	

\*Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

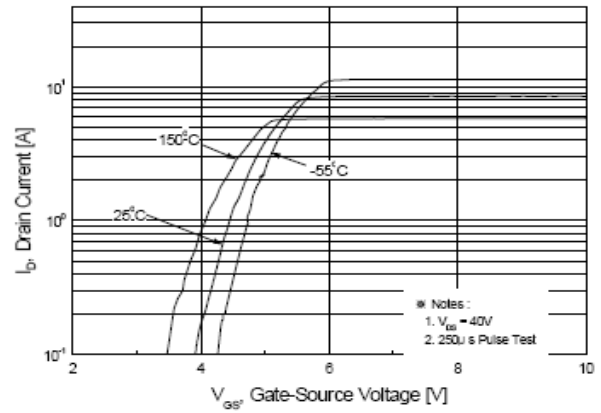
**Ordering Information**

Device	Package	Shipping	Marking
MTN4N60FP	TO-220FP (RoHS compliant)	50 pcs/tube, 20 tubes/box, 4 boxes / carton	4N60

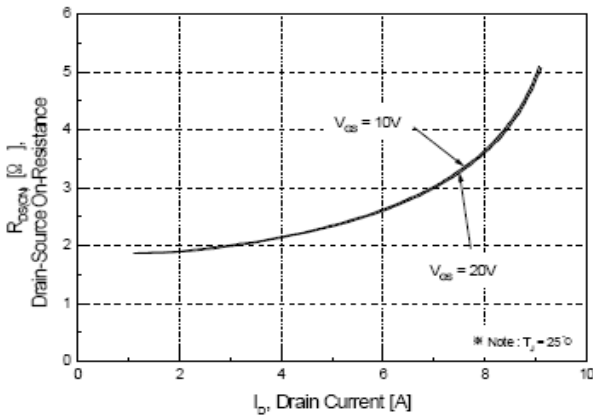
**Characteristic Curves**



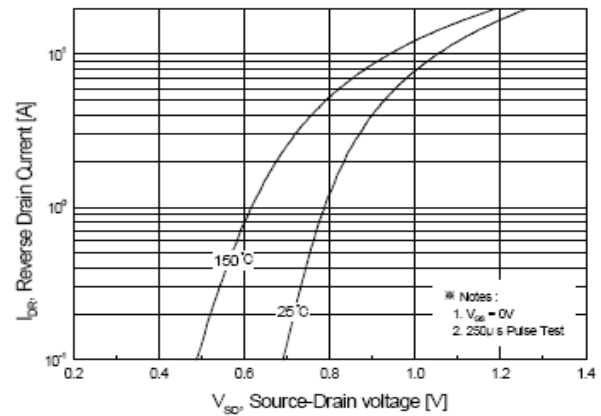
**Figure 1. On-Region Characteristics**



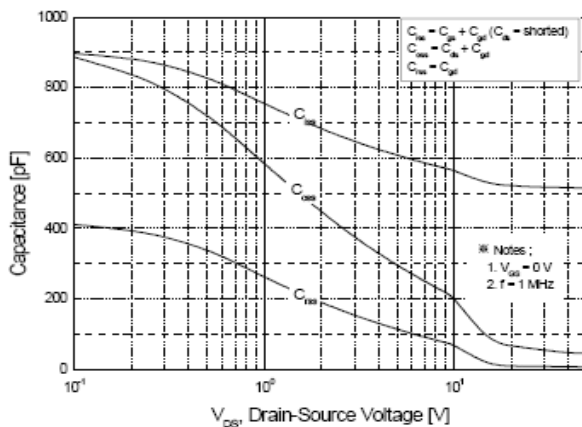
**Figure 2. Transfer Characteristics**



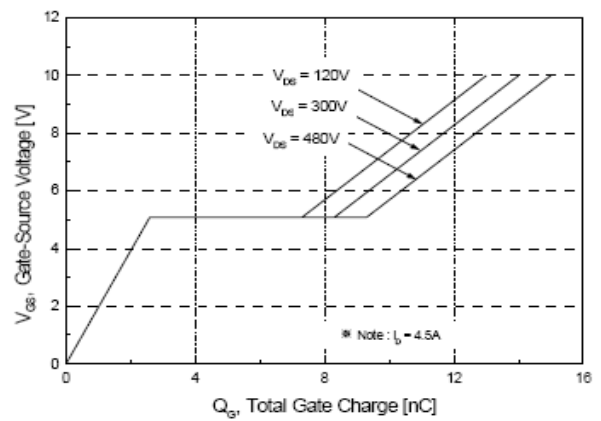
**Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage**



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

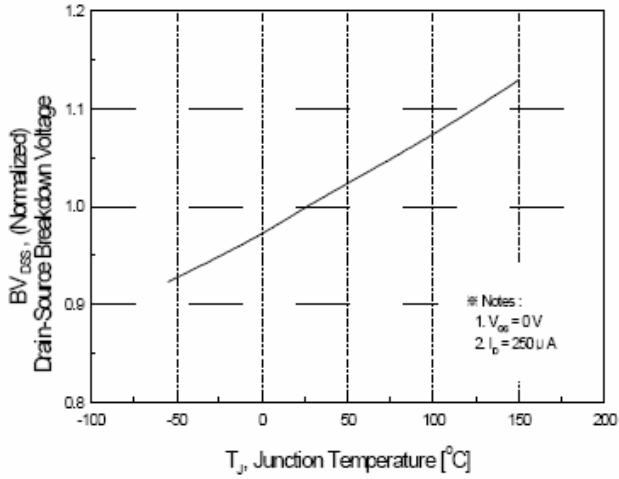


**Figure 5. Capacitance Characteristics**

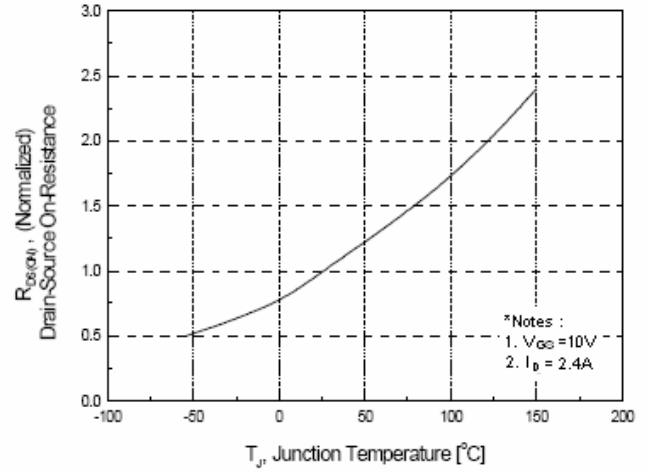


**Figure 6. Gate Charge Characteristics**

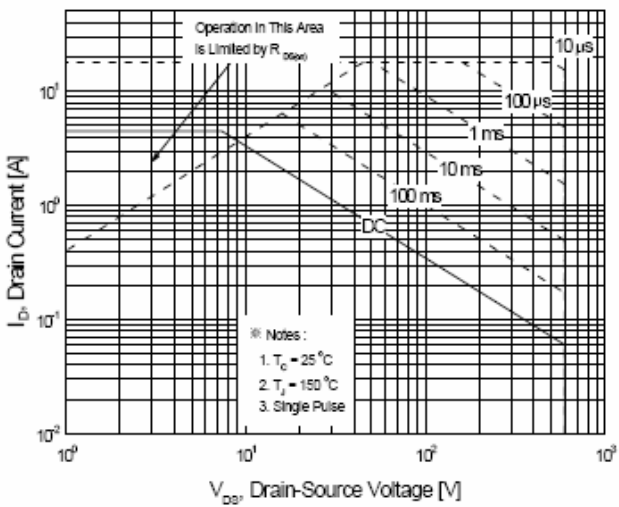
**Characteristic Curves(Cont.)**



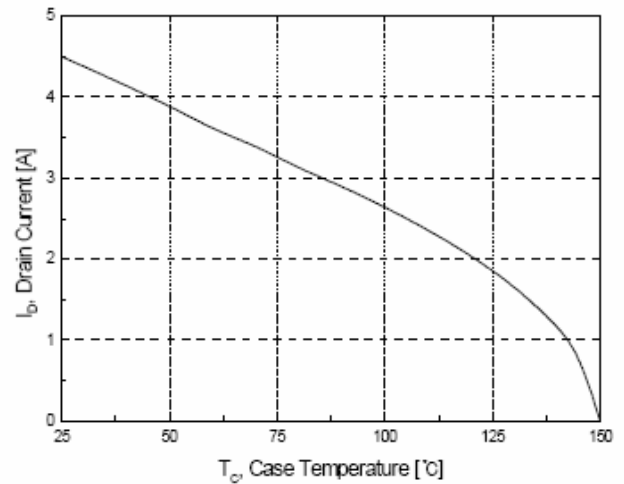
**Figure 7. Breakdown Voltage Variation vs Temperature**



**Figure 8. On-Resistance Variation vs Temperature**

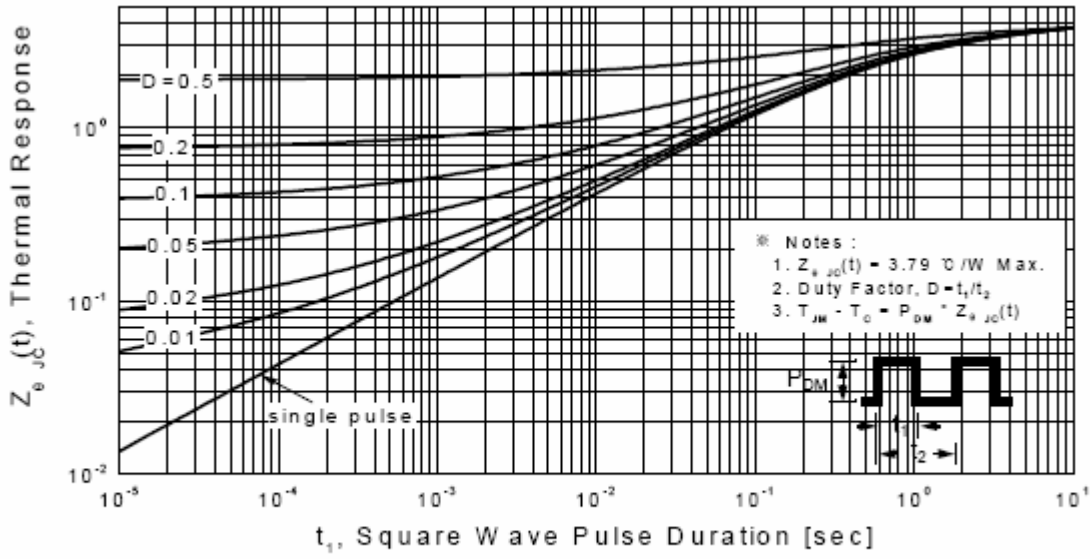


**Figure 9. Maximum Safe Operating Area vs Temperature**



**Figure 10. Maximum Drain Current vs Case Temperature**

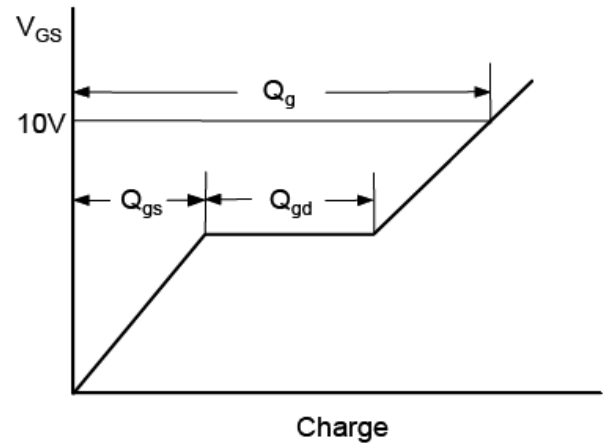
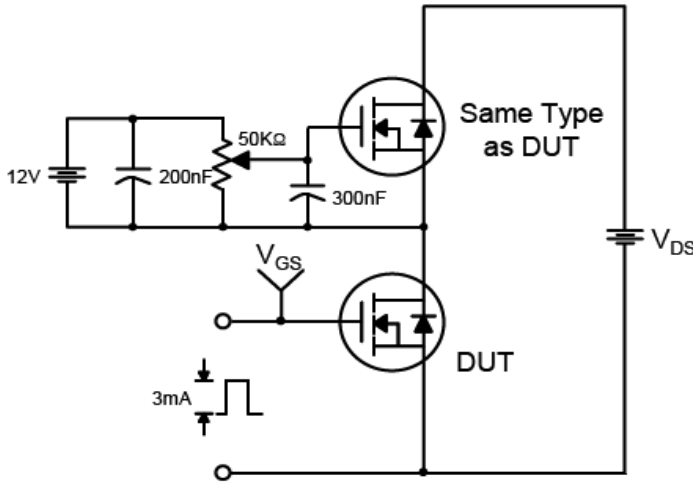
**Characteristic Curves(Cont.)**



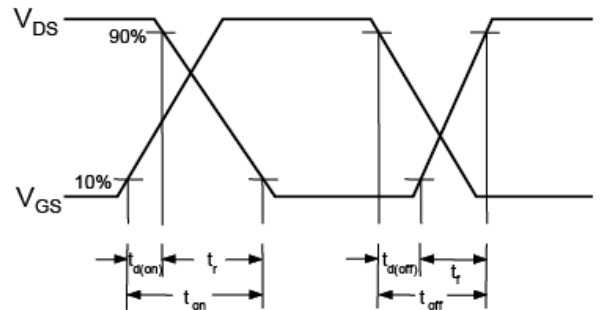
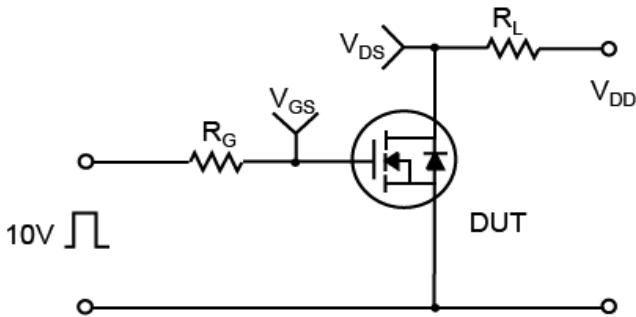
**Figure 11. Transient Thermal Response Curve**

**Test Circuits and Waveforms**

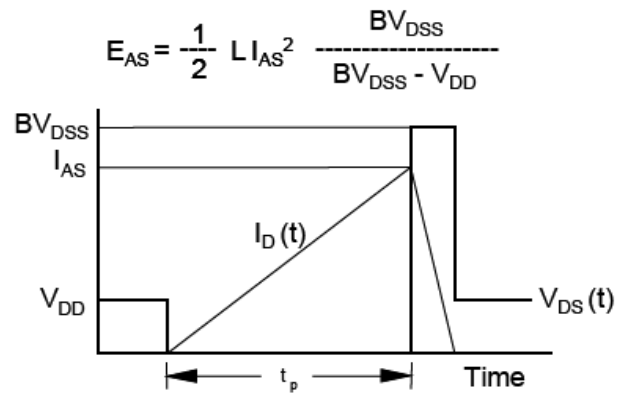
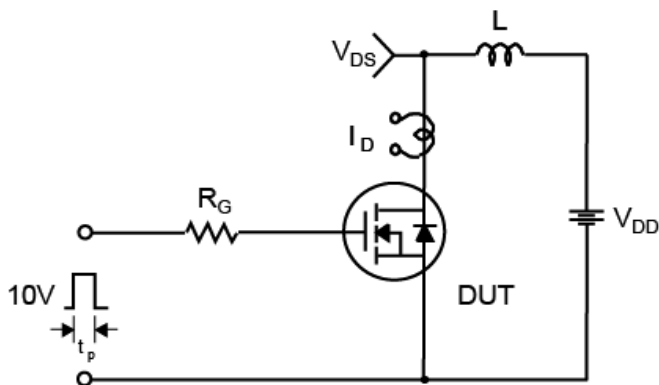
**Gate Charge Test Circuit & Waveform**



**Resistive Switching Test Circuit & Waveforms**

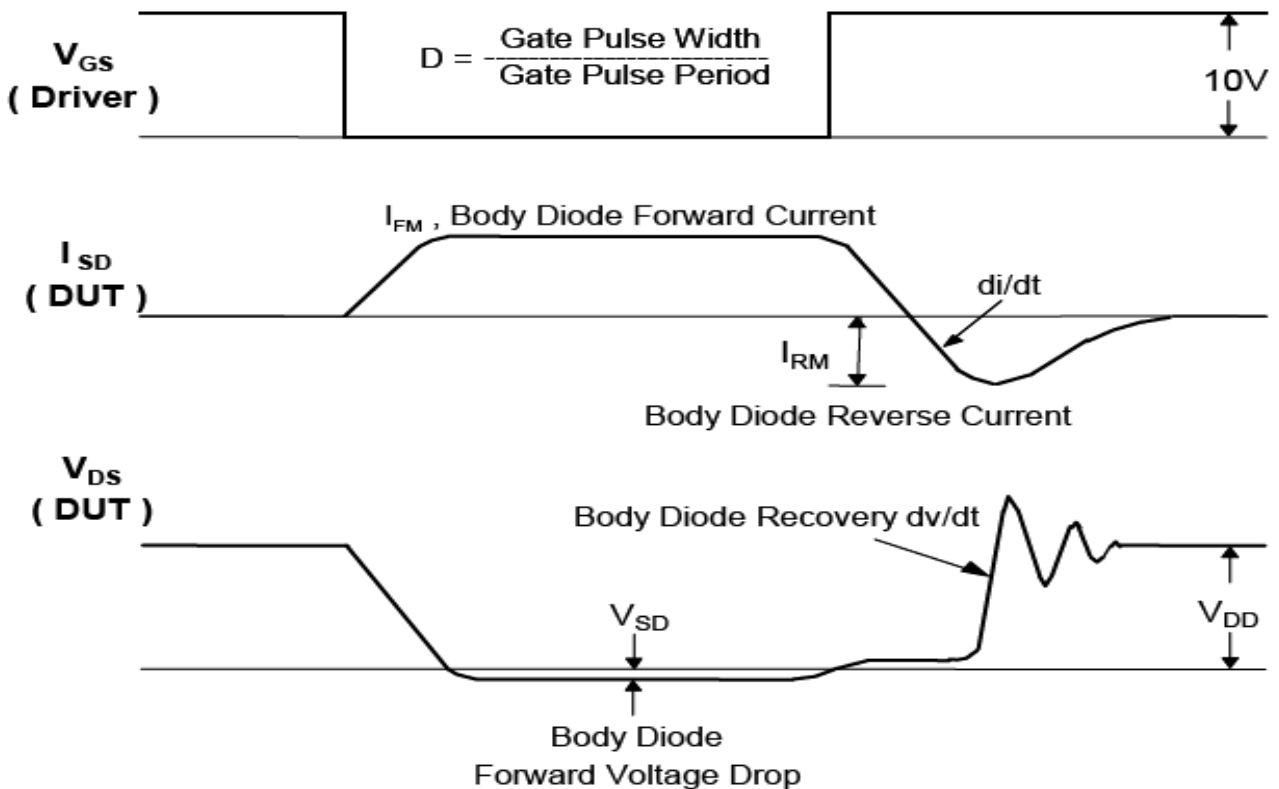
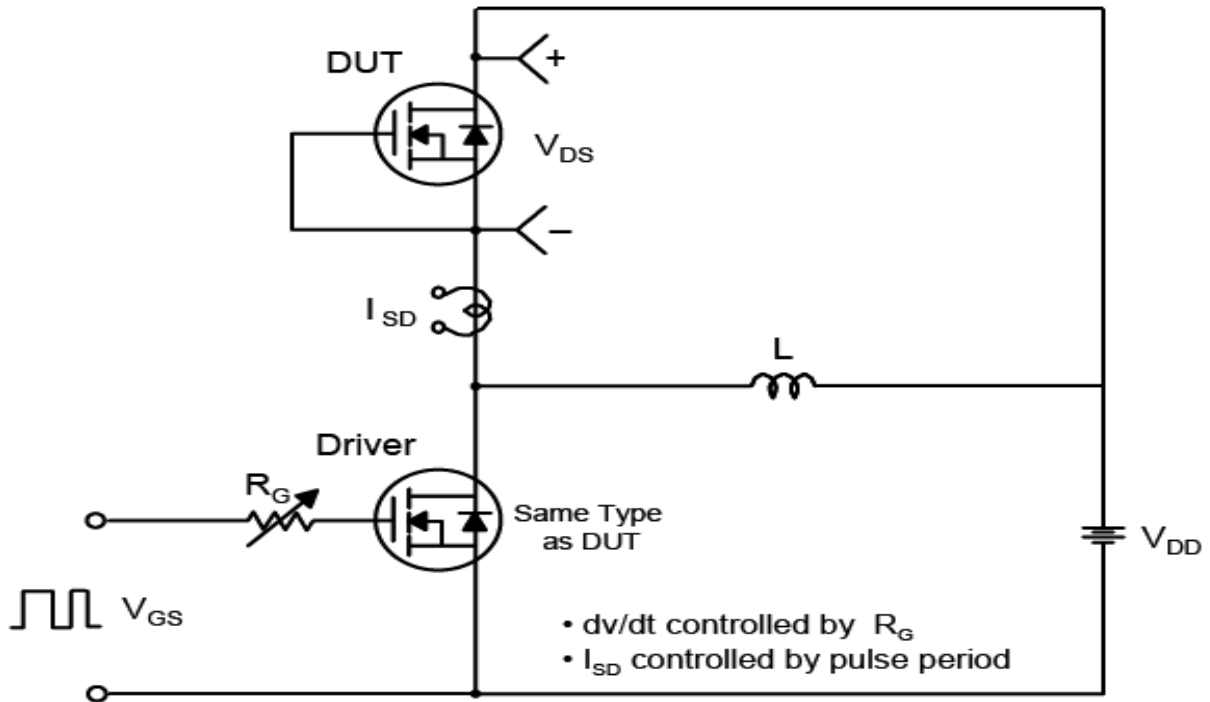


**Unclamped Inductive Switching Test Circuit & Waveforms**



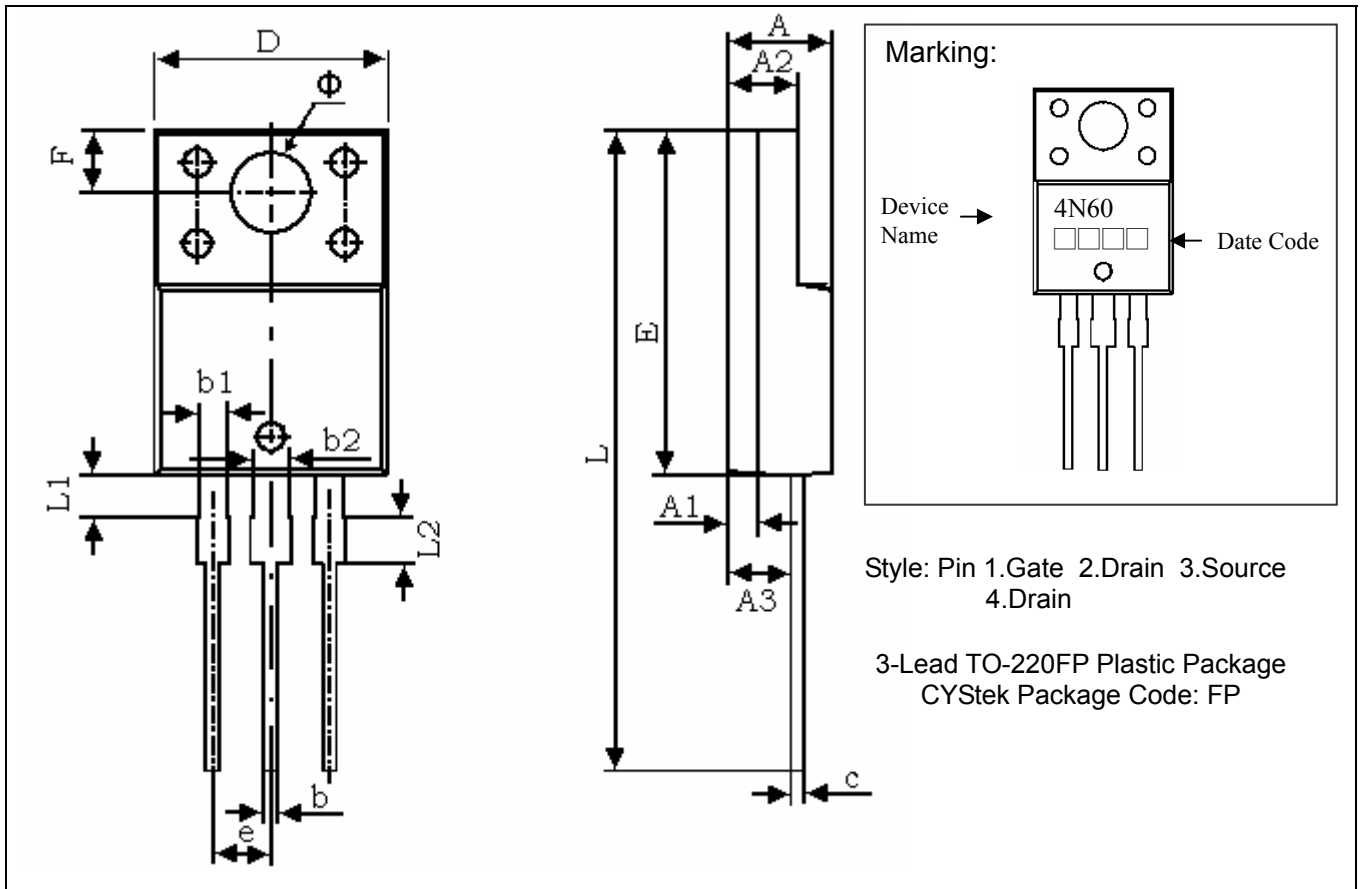
**Test Circuits and Waveforms(Cont.)**

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





**TO-220FP Dimension**



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.169	0.185	4.300	4.700	D	0.392	0.408	9.960	10.360
A1	0.051 REF		1.300 REF		E	0.583	0.598	14.800	15.200
A2	0.110	0.126	2.800	3.200	e	0.100 TYP		2.540 TYP	
A3	0.098	0.114	2.500	2.900	F	0.106 REF		2.700 REF	
b	0.020	0.030	0.500	0.750	Φ	0.138 REF		3.500 REF	
b1	0.043	0.053	1.100	1.350	L	1.102	1.118	28.000	28.400
b2	0.059	0.069	1.500	1.750	L1	0.067	0.075	1.700	1.900
c	0.020	0.030	0.500	0.750	L2	0.075	0.083	1.900	2.100

**Notes:** 1.Controlling dimension: millimeters.  
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.  
 3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

**Material:**

- Lead: KFC ; pure tin plated
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

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