



N-Channel Enhancement Mode Power MOSFET

# MTN9N50BFP

<b>BV<sub>DSS</sub></b>	<b>500V</b>
<b>I<sub>D</sub> @ V<sub>GS</sub>=10V, T<sub>C</sub>=25°C</b>	<b>8.5A</b>
<b>I<sub>D</sub> @ V<sub>GS</sub>=10V, T<sub>C</sub>=100°C</b>	<b>5.4A</b>
<b>R<sub>DS(ON)</sub>@ V<sub>GS</sub>=10V, I<sub>D</sub>=4.5A</b>	<b>0.63 Ω (typ)</b>

## Description

The MTN9N50BFP 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-220 package is universally preferred for all commercial-industrial applications

## Features

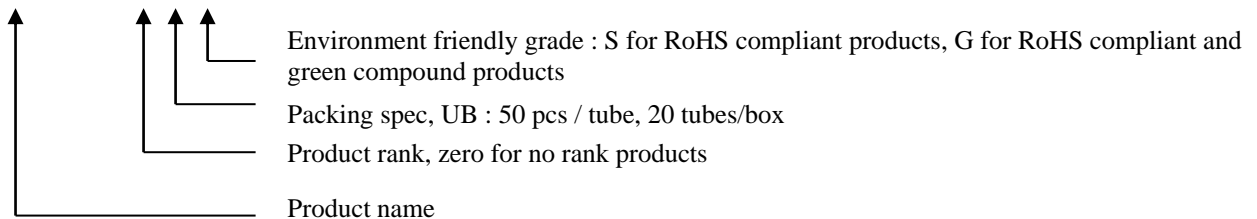
- Low On Resistance
- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- Insulating package, front/back side insulating voltage=2500V(AC)
- RoHS compliant package

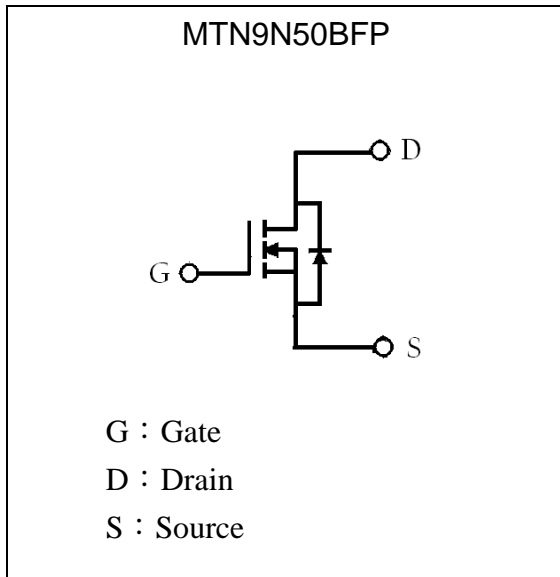
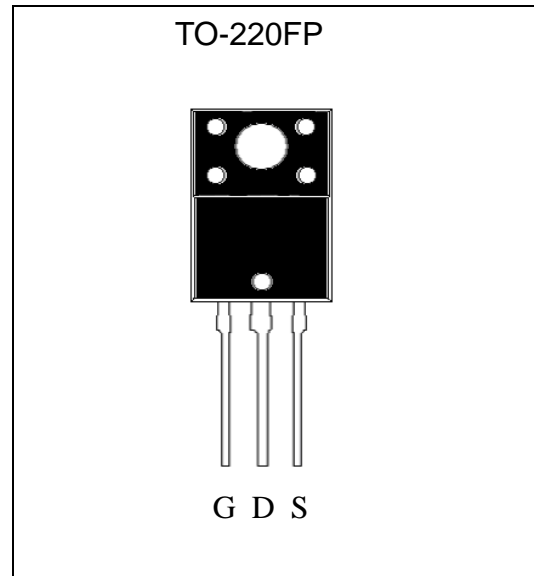
## Applications

- Ballast
- Inverter

## Ordering Information

Device	Package	Shipping
MTN9N50BFP-0-UB-X	TO-220FP (RoHS compliant package)	50 pcs/tube, 20 tubes/box, 5 boxes / carton



**Symbol**

**Outline**

**Absolute Maximum Ratings** (T<sub>C</sub>=25°C)

Parameter	Symbol	Limits	Unit
Drain-Source Voltage (Note 1)	V <sub>DS</sub>	500	V
Gate-Source Voltage	V <sub>GS</sub>	±30	
Continuous Drain Current @T <sub>C</sub> =25°C, V <sub>GS</sub> =10V	I <sub>D</sub>	8.5*	A
Continuous Drain Current @T <sub>C</sub> =100°C, V <sub>GS</sub> =10V		5.4*	
Pulsed Drain Current @ V <sub>GS</sub> =10V (Note 2)	I <sub>DM</sub>	34*	
Single Pulse Avalanche Energy (Note 3)	E <sub>AS</sub>	160	mJ
Avalanche Current (Note 2)	I <sub>AR</sub>	8	A
Repetitive Avalanche Energy (Note 2)	E <sub>AR</sub>	12.5	mJ
Maximum Temperature for Soldering @ Lead at 0.125 in(3.175mm) from case for 10 seconds	T <sub>L</sub>	300	°C
Total Power Dissipation (T <sub>C</sub> =25°C)	P <sub>D</sub>	38.5	W
Linear Derating Factor above 25°C		0.3	W/°C
Operating Junction and Storage Temperature	T <sub>J</sub> , T <sub>stg</sub>	-55~+150	°C

\*Drain current limited by maximum junction temperature

Note : 1. T<sub>J</sub>=+25°C to +150°C.

2. Repetitive rating: pulse width limited by maximum junction temperature.

3. I<sub>AS</sub>=8A, V<sub>DD</sub>=50V, L=5mH, R<sub>G</sub>=25Ω, starting T<sub>J</sub>=+25°C.



**Thermal Data**

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-case, max	$R_{th,j-c}$	3.25	°C/W
Thermal Resistance, Junction-to-ambient, max	$R_{th,j-a}$	62.5	

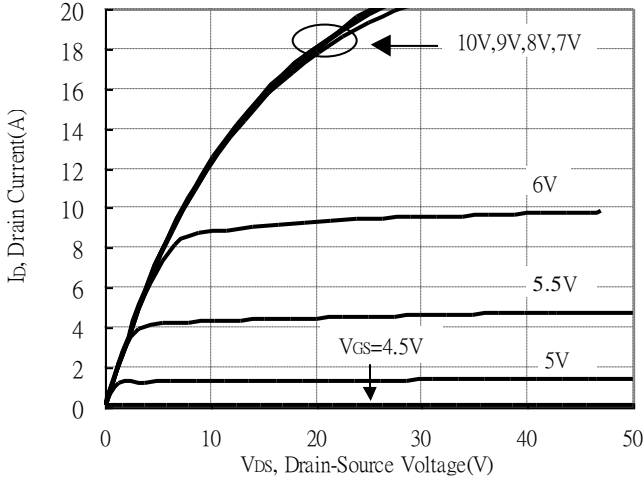
**Characteristics (T<sub>j</sub>=25°C, unless otherwise specified)**

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
<b>Static</b>					
$BV_{DSS}$	500	-	-	V	$V_{GS}=0V, I_D=250\mu A$
$\Delta BV_{DSS}/\Delta T_j$	-	0.6	-	V/°C	Reference to 25°C, $I_D=250\mu A$
$V_{GS(th)}$	2.0	-	4.0	V	$V_{DS} = V_{GS}, I_D=250\mu A$
* $G_{FS}$	-	8	-	S	$V_{DS} = 15V, I_D=4A$
$I_{GSS}$	-	-	±100	nA	$V_{GS}=\pm 30V, V_{DS}=0V$
$I_{DSS}$	-	-	1	μA	$V_{DS} = 500V, V_{GS} = 0V$
	-	-	25		$V_{DS} = 400V, V_{GS} = 0V, T_j=125^\circ C$
* $R_{DS(ON)}$	-	0.63	0.85	Ω	$V_{GS} = 10V, I_D=4.5A$
<b>Dynamic</b>					
* $Q_g$	-	26.8	-	nC	$I_D=8A, V_{DD}=250V, V_{GS}=10V$
* $Q_{gs}$	-	5.6	-		
* $Q_{gd}$	-	11	-		
* $t_{d(ON)}$	-	14.4	-	ns	$V_{DD}=250V, I_D=8A, V_{GS}=10V, R_G=10\Omega$
* $t_r$	-	11.8	-		
* $t_{d(OFF)}$	-	52.2	-		
* $t_f$	-	14.2	-		
$C_{iss}$	-	890	-	pF	$V_{GS}=0V, V_{DS}=25V, f=1MHz$
$C_{oss}$	-	103	-		
$C_{rss}$	-	45	-		
<b>Source-Drain Diode</b>					
* $I_S$	-	-	8	A	$V_D=V_G=0V, V_S=1.3V$
* $I_{SM}$	-	-	32		
* $V_{SD}$	-	0.8	1.2	V	$I_S=4.5A, V_{GS}=0V$
* $t_{rr}$	-	350	-	ns	$V_{GS}=0V, I_F=8A, dI_F/dt=100A/\mu s$
* $Q_{rr}$	-	2.1	-	μC	

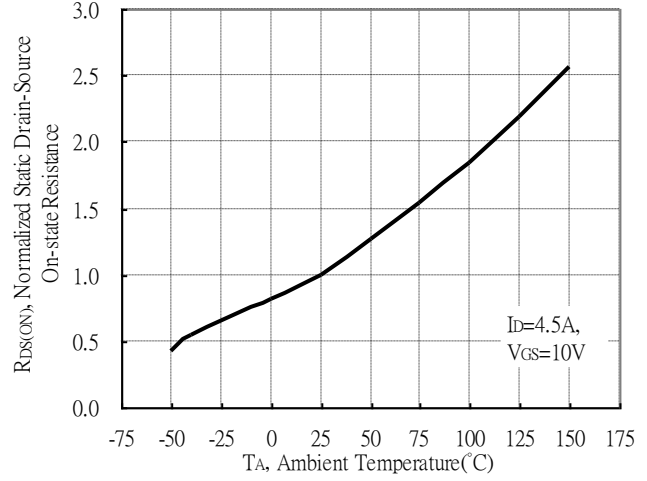
\*Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

**Typical Characteristics**

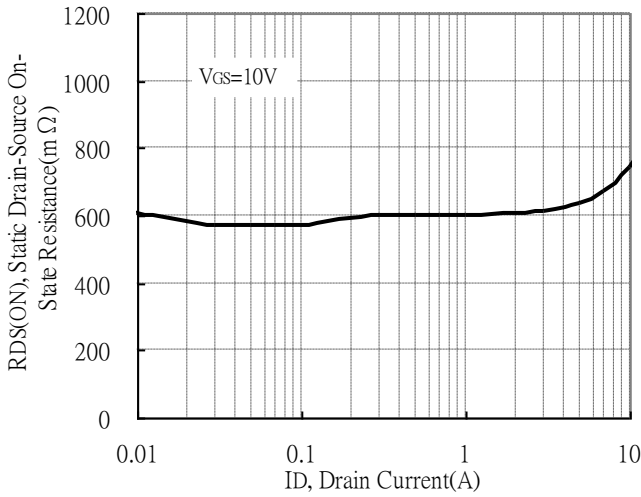
Typical Output Characteristics



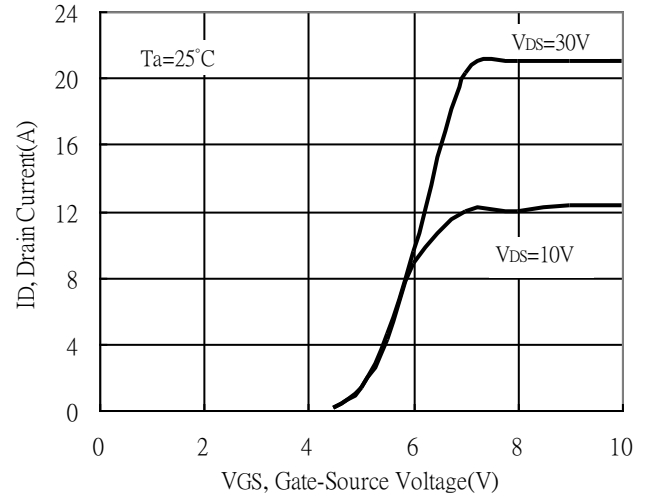
Static Drain-Source On-resistance vs Ambient Temperature



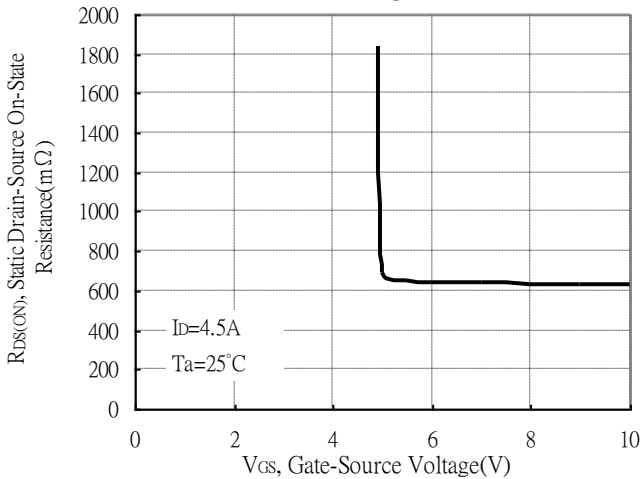
Static Drain-Source On-State resistance vs Drain Current



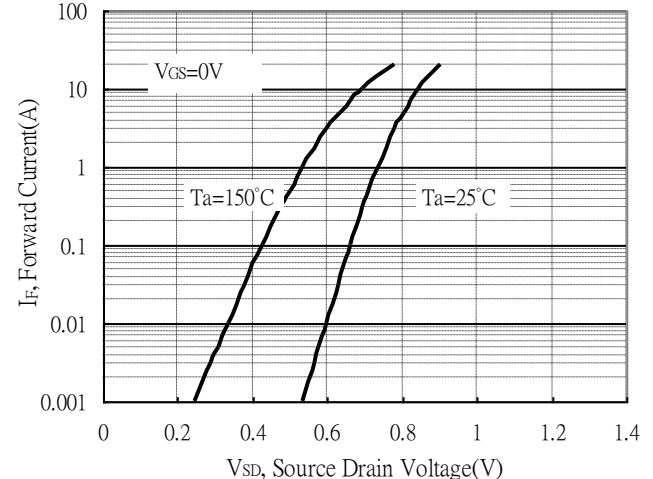
Drain Current vs Gate-Source Voltage



Static Drain-Source On-State Resistance vs Gate-Source Voltage

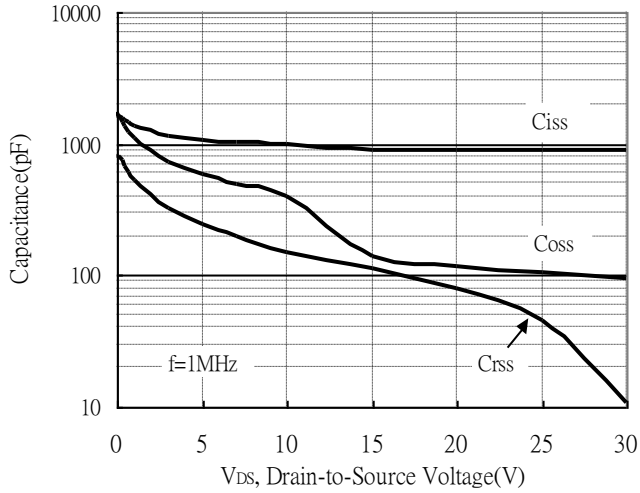


Forward Drain Current vs Source-Drain Voltage

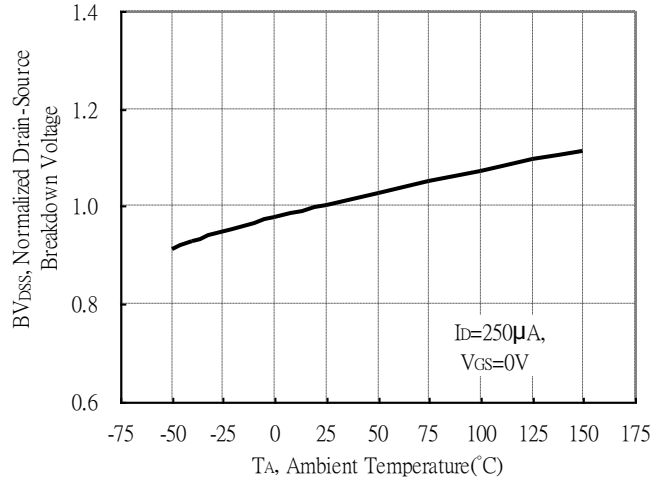


## Typical Characteristics(cont.)

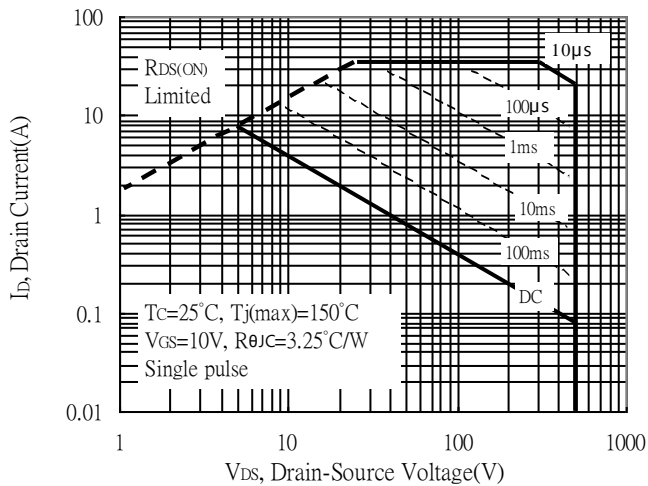
Capacitance vs Reverse Voltage



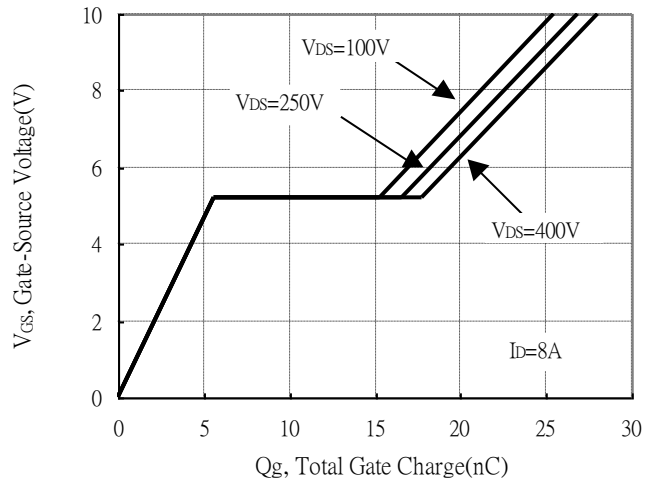
Brekdown Voltage vs Ambient Temperature



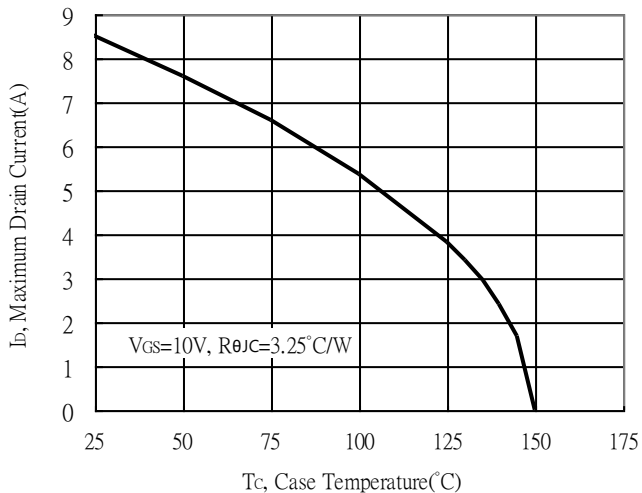
Maximum Safe Operating Area



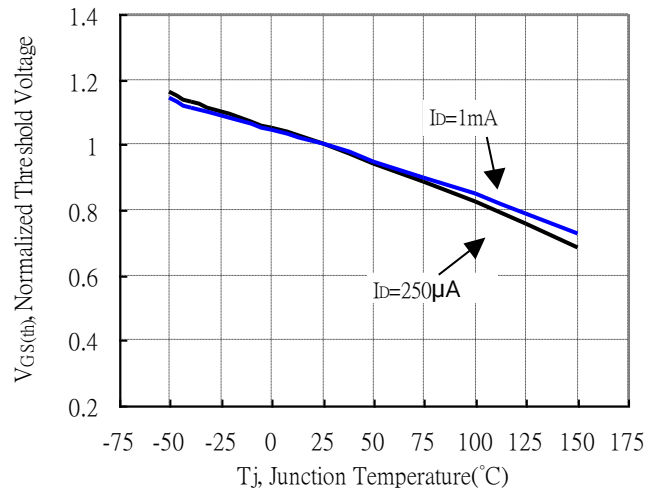
Gate Charge Characteristics



Maximum Drain Current vs Case Temperature

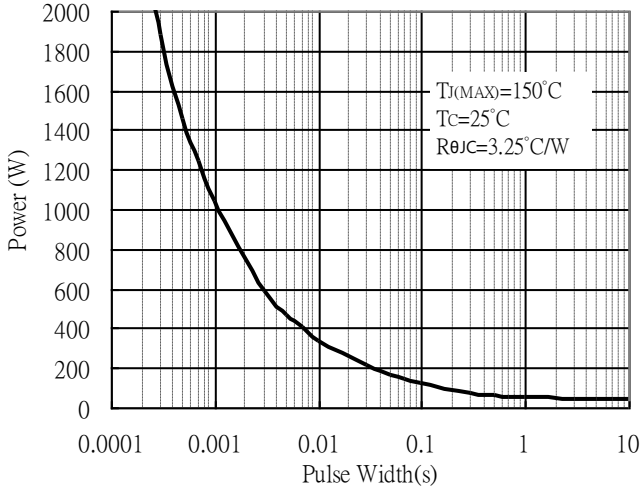


Threshold Voltage vs Junction Temperature

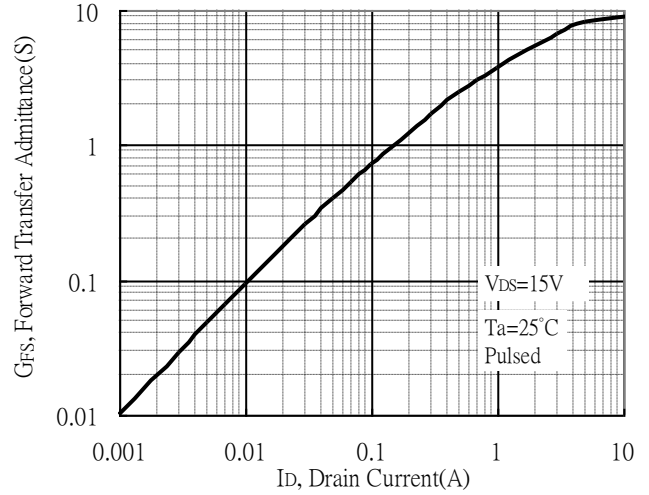


**Typical Characteristics(Cont.)**

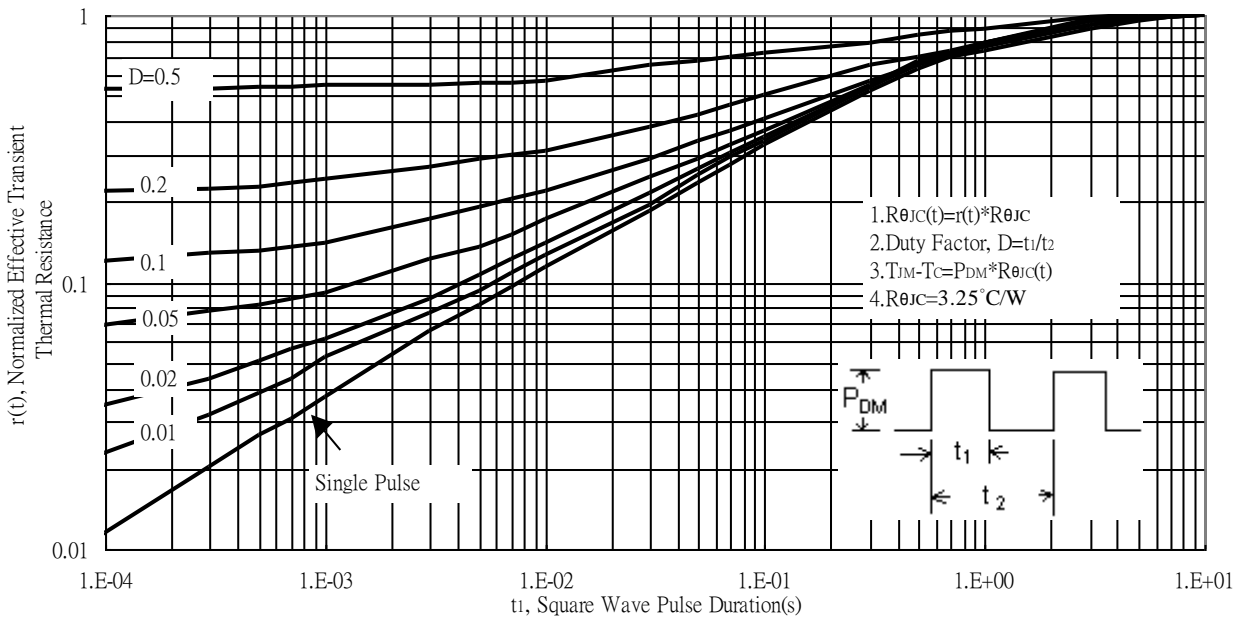
Single Pulse Power Rating, Junction to Case



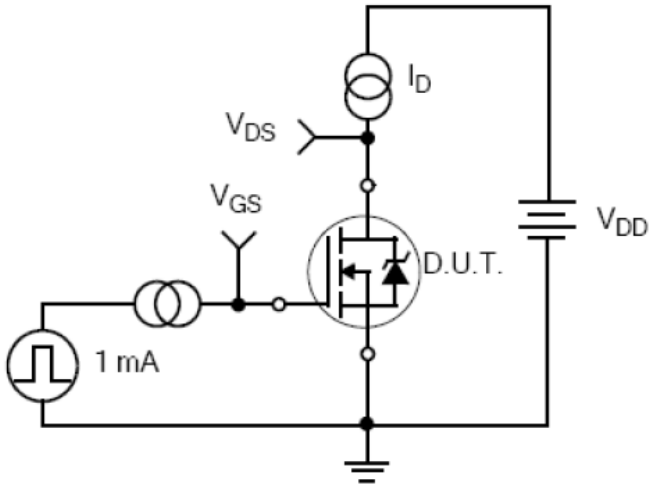
Forward Transfer Admittance vs Drain Current



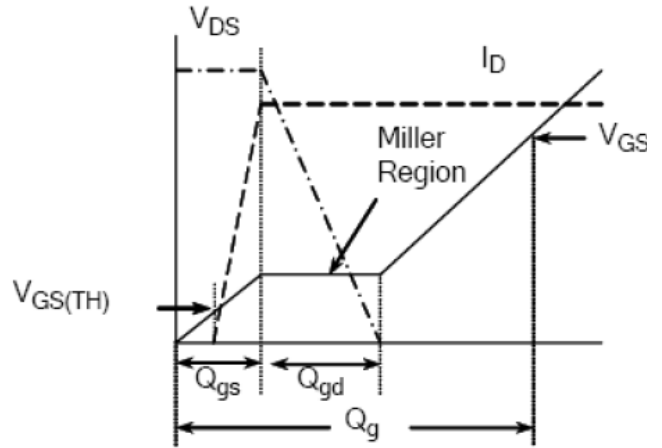
Transient Thermal Response Curves



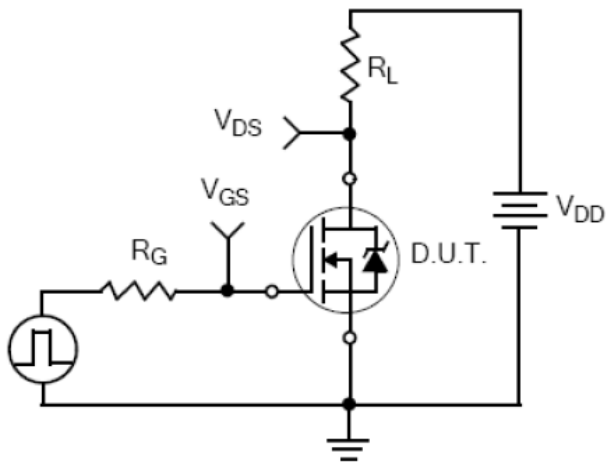
**Test Circuit and Waveforms**



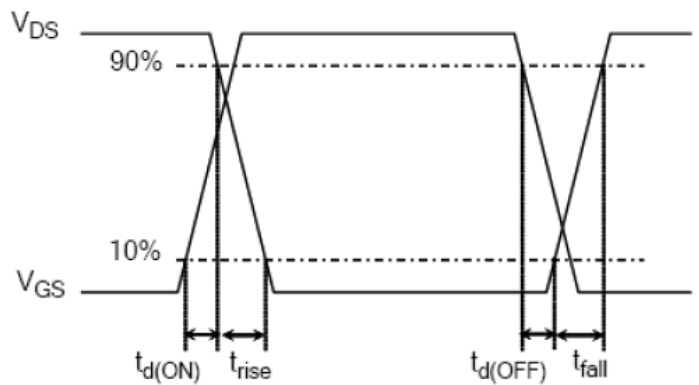
**Figure 12. Gate Charge Test Circuit**



**Figure 13. Gate Charge Waveform**

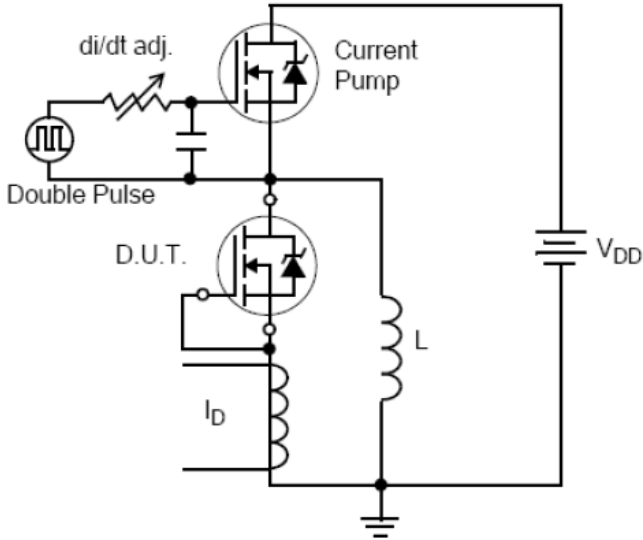


**Figure 14. Resistive Switching Test Circuit**

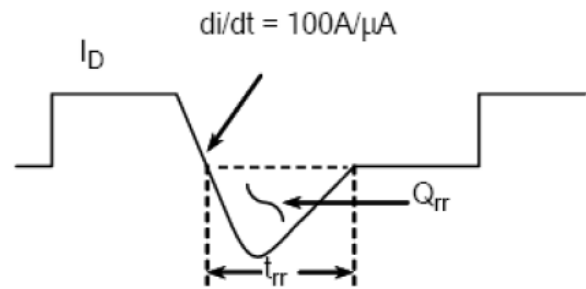


**Figure 15. Resistive Switching Waveforms**

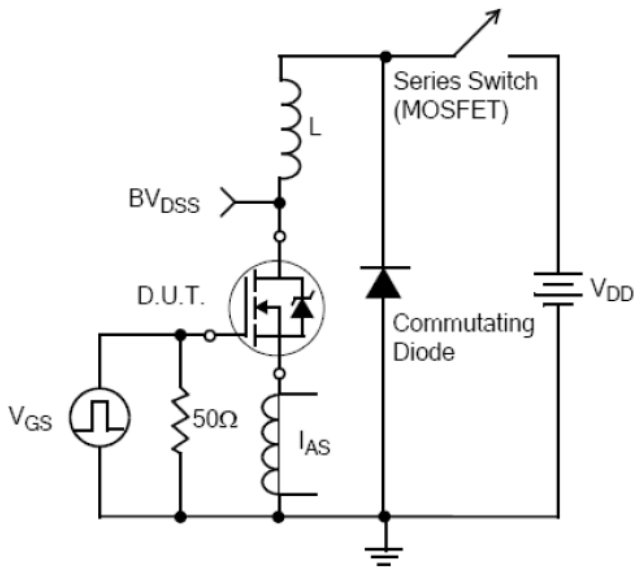
**Test Circuit and Waveforms(Cont.)**



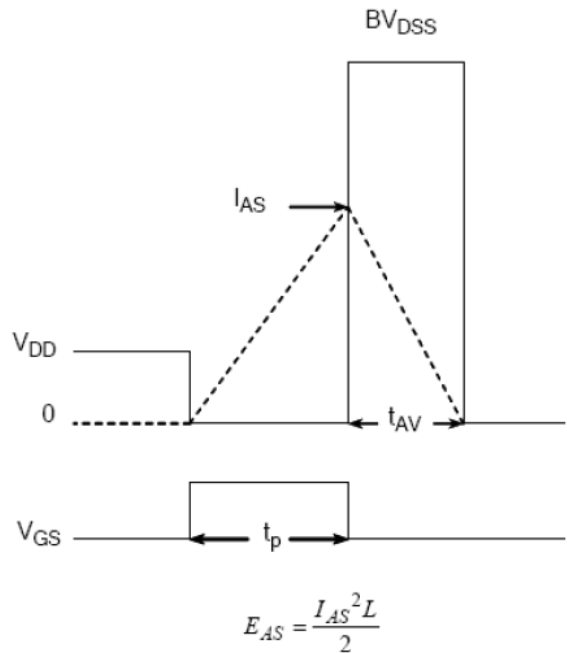
**Figure 16. Diode Reverse Recovery Test Circuit**



**Figure 17. Diode Reverse Recovery Waveform**



**Figure 18. Unclamped Inductive Switching Test Circuit**



**Figure 19. Unclamped Inductive Switching Waveforms**



**TO-220FP Dimension**

**Marking:**

Device Code → **9N50B**  
 Date Code → □□□□

Date Code(counting from left to right) :  
 1st code: year code, the last digit of Christian year  
 2nd code : month code, Jan →A, Feb→B, Mar→C, Apr→D, May→E, Jun→F, Jul→G, Aug→H, Sep→J, Oct→K, Nov→L, Dec→M  
 3rd and 4th codes : production serial number, 01~99

Style: Pin 1.Gate 2.Drain 3.Source

**3-Lead TO-220FP Plastic Package**  
 CYStek Package Code: FP

\*Typical

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.171	0.183	4.35	4.65	G	0.246	0.258	6.25	6.55
A1	0.051 REF		1.300 REF		H	0.138 REF		3.50 REF	
A2	0.112	0.124	2.85	3.15	H1	0.055 REF		1.40 REF	
A3	0.102	0.110	2.60	2.80	H2	0.256	0.272	6.50	6.90
b	0.020	0.030	0.50	0.75	J	0.031 REF		0.80 REF	
b1	0.031	0.041	0.80	1.05	K	0.020		0.50 REF	
b2	0.047 REF		1.20 REF		L	1.102	1.118	28.00	28.40
c	0.020	0.030	0.500	0.750	L1	0.043	0.051	1.10	1.30
D	0.396	0.404	10.06	10.26	L2	0.036	0.043	0.92	1.08
E	0.583	0.598	14.80	15.20	M	0.067 REF		1.70 REF	
e	0.100 *		2.54*		N	0.012 REF		0.30 REF	
F	0.106 REF		2.70 REF						

**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: Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.

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