

July 2005

**SemiHow**  
Know-How for Semiconductor

## HFS7N80

### 800V N-Channel MOSFET

#### FEATURES

- Originative New Design
- Superior Avalanche Rugged Technology
- Robust Gate Oxide Technology
- Very Low Intrinsic Capacitances
- Excellent Switching Characteristics
- Unrivalled Gate Charge : 35 nC (Typ.)
- Extended Safe Operating Area
- Lower  $R_{DS(ON)}$  : 1.55  $\Omega$  (Typ.) @  $V_{GS}=10V$
- 100% Avalanche Tested

$$BV_{DSS} = 800 V$$

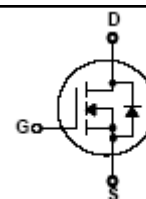
$$R_{DS(on) \text{ typ}} = 1.55 \Omega$$

$$I_D = 7.0 A$$

TO-220F



1.Gate 2. Drain 3. Source



#### Absolute Maximum Ratings $T_C=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Value	Units
$V_{DSS}$	Drain-Source Voltage	800	V
$I_D$	Drain Current – Continuous ( $T_C = 25^\circ\text{C}$ )	7.0*	A
	Drain Current – Continuous ( $T_C = 100^\circ\text{C}$ )	4.4*	A
$I_{DM}$	Drain Current – Pulsed (Note 1)	28*	A
$V_{GS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	580	mJ
$I_{AR}$	Avalanche Current (Note 1)	7.0	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	16.7	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ ) – Derate above $25^\circ\text{C}$	56	W
		0.44	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	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	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	--	2.25	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient	--	62.5	

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>On Characteristics</b>						
$V_{GS}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2.5	--	4.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\ \text{V}, I_D = 3.5\ \text{A}$	--	1.55	1.9	$\Omega$

**Off Characteristics**

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\ \text{V}, I_D = 250\ \mu\text{A}$	800	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25\text{ }^\circ\text{C}$	--	0.93	--	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 800\ \text{V}, V_{GS} = 0\ \text{V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 640\ \text{V}, T_C = 125\text{ }^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{GSSF}$	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	$V_{DS} = 25\ \text{V}, V_{GS} = 0\ \text{V},$ $f = 1.0\ \text{MHz}$	--	1500	1950	pF
$C_{oss}$	Output Capacitance		--	120	155	pF
$C_{rss}$	Reverse Transfer Capacitance		--	18	24	pF

**Switching Characteristics**

$t_{d(on)}$	Turn-On Time	$V_{DS} = 400\ \text{V}, I_D = 7.0\ \text{A},$ $R_G = 25\ \Omega$	--	40	80	ns	
$t_r$	Turn-On Rise Time		--	120	240	ns	
$t_{d(off)}$	Turn-Off Delay Time		(Note 4,5)	--	60	120	ns
$t_f$	Turn-Off Fall Time			--	70	140	ns
$Q_g$	Total Gate Charge	$V_{DS} = 640\ \text{V}, I_D = 7.0\ \text{A},$ $V_{GS} = 10\ \text{V}$	--	35	45	nC	
$Q_{gs}$	Gate-Source Charge		(Note 4,5)	--	10	--	nC
$Q_{gd}$	Gate-Drain Charge			--	13	--	nC

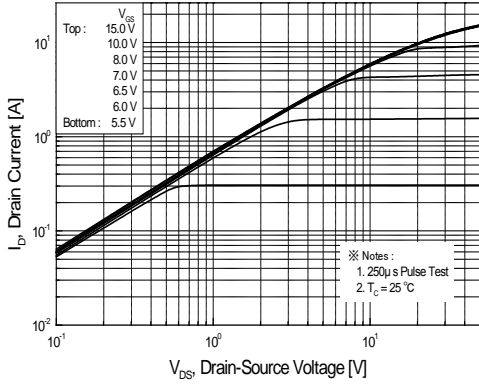
**Source-Drain Diode Maximum Ratings and Characteristics**

$I_S$	Continuous Source-Drain Diode Forward Current	--	--	7.0	A	
$I_{SM}$	Pulsed Source-Drain Diode Forward Current	--	--	28		
$V_{SD}$	Source-Drain Diode Forward Voltage	$I_S = 7.0\ \text{A}, V_{GS} = 0\ \text{V}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$I_S = 7.0\ \text{A}, V_{GS} = 0\ \text{V}$ $di_F/dt = 100\ \text{A}/\mu\text{s}$ (Note 4)	--	780	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	9.0	--	$\mu\text{C}$

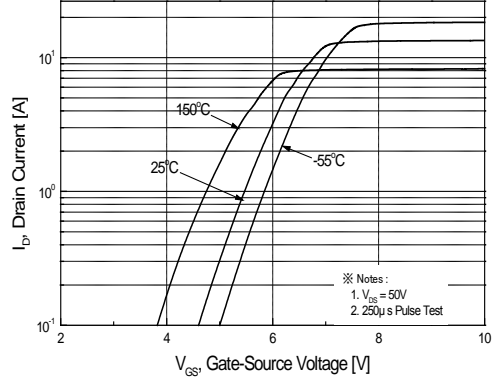
**Notes ;**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L=22.2\text{mH}, I_{AS}=7.0\text{A}, V_{DD}=50\text{V}, R_G=25\Omega$ , Starting  $T_J=25\text{ }^\circ\text{C}$
3.  $I_{SD} \leq 7.0\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J=25\text{ }^\circ\text{C}$
4. Pulse Test : Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
5. Essentially Independent of Operating Temperature

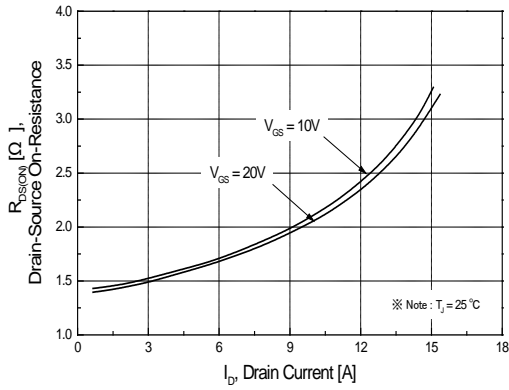
# Typical Characteristics



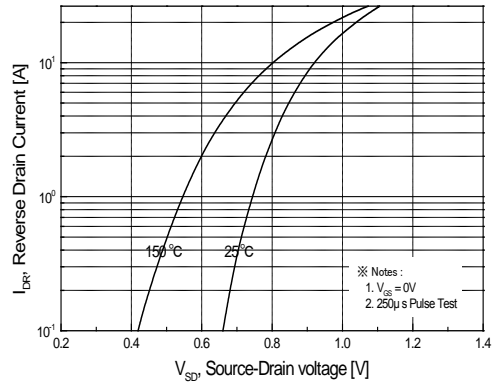
**Figure 1. On Region Characteristics**



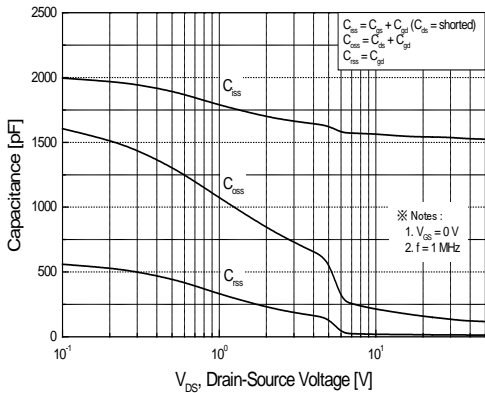
**Figure 2. Transfer Characteristics**



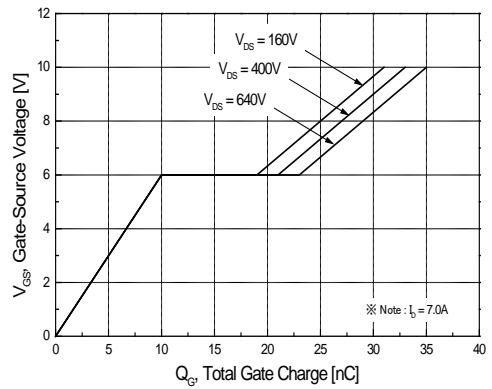
**Figure 3. On Resistance Variation vs Drain Current and Gate Voltage**



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



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**

Typical Characteristics (continued)

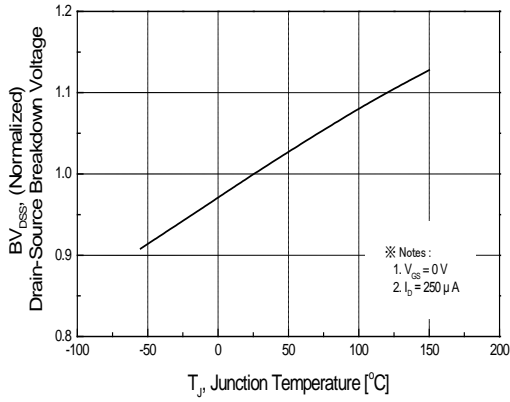


Figure 7. Breakdown Voltage Variation vs Temperature

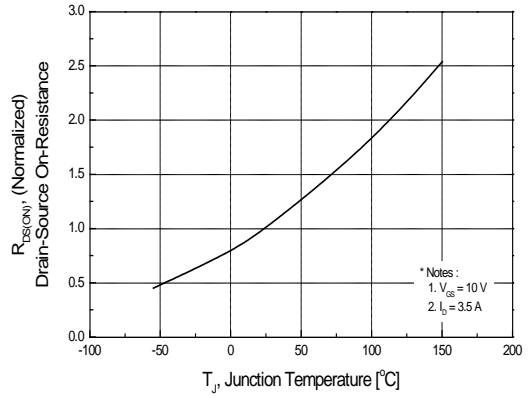


Figure 8. On-Resistance Variation vs Temperature

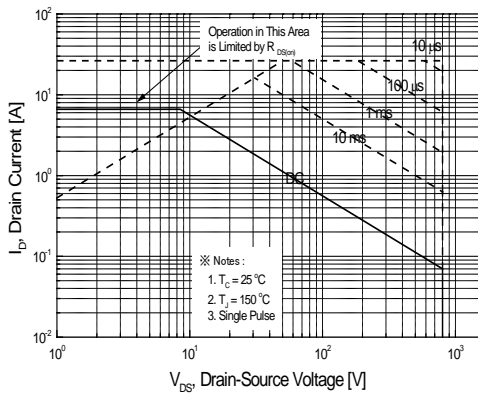


Figure 9. Maximum Safe Operating Area

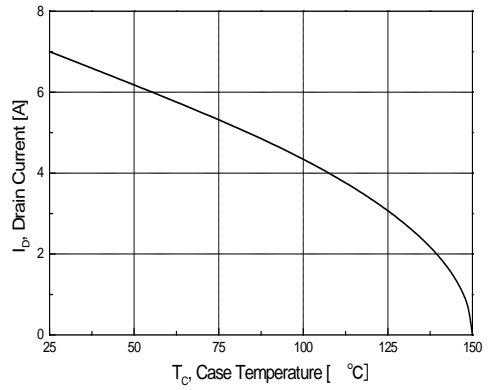


Figure 10. Maximum Drain Current vs Case Temperature

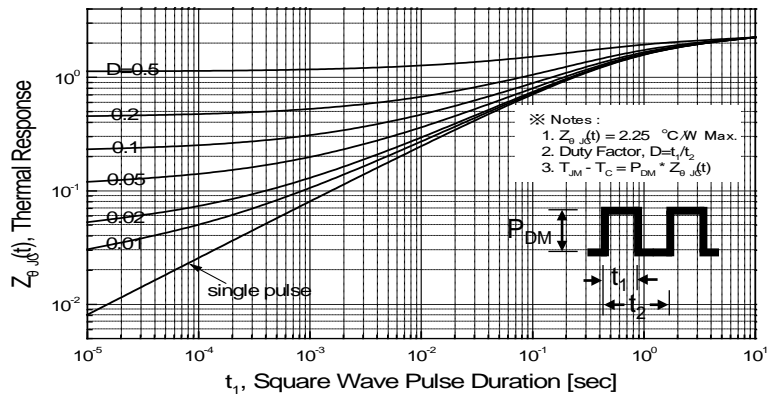
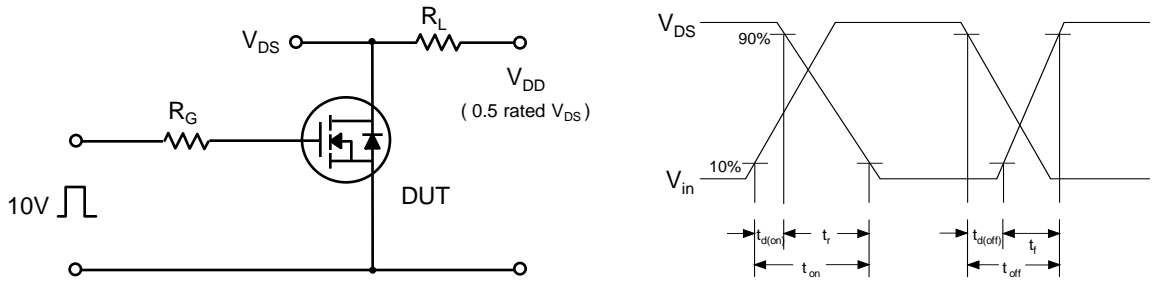


Figure 11. Transient Thermal Response Curve

**Fig 12. Gate Charge Test Circuit & Waveform**



**Fig 13. Resistive Switching Test Circuit & Waveforms**



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

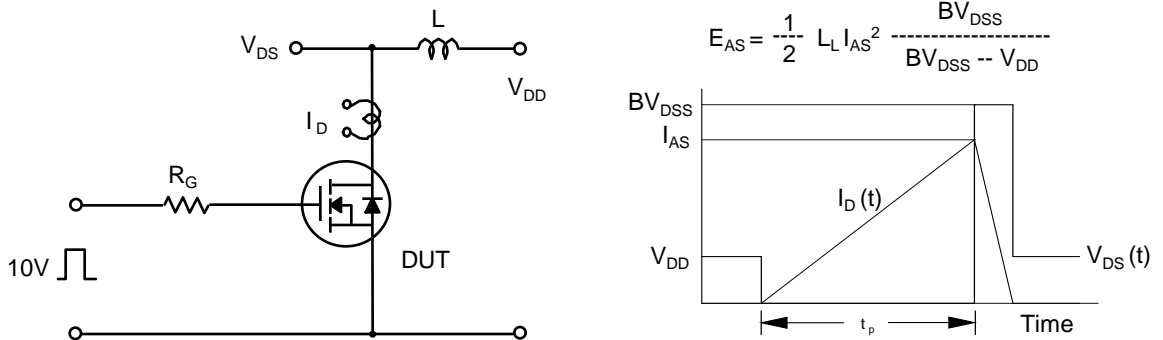


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimension

TO-220F

