

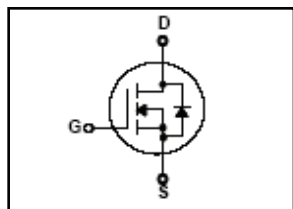
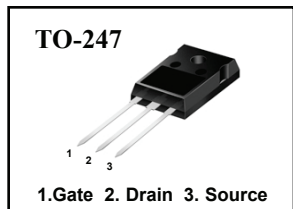
# HFA20N50U

## 500V N-Channel MOSFET

$BV_{DSS} = 500\text{ V}$   
 $R_{DS(on) \text{ typ}} = 0.22\ \Omega$   
 $I_D = 20\text{ A}$

### FEATURES

- Originative New Design
- Superior Avalanche Rugged Technology
- Robust Gate Oxide Technology
- Very Low Intrinsic Capacitances
- Excellent Switching Characteristics
- Unrivalled Gate Charge : 58 nC (Typ.)
- Extended Safe Operating Area
- Lower  $R_{DS(ON)}$  : 0.22  $\Omega$  (Typ.) @  $V_{GS}=10\text{V}$
- 100% Avalanche Tested



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

Symbol	Parameter	Value	Units
$V_{DSS}$	Drain-Source Voltage	500	V
$I_D$	Drain Current – Continuous ( $T_C = 25^\circ\text{C}$ )	20	A
	Drain Current – Continuous ( $T_C = 100^\circ\text{C}$ )	12.5	A
$I_{DM}$	Drain Current – Pulsed (Note 1)	80	A
$V_{GS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	950	mJ
$I_{AR}$	Avalanche Current (Note 1)	20	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	10	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	100	W
	- Derate above $25^\circ\text{C}$	0.8	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	$^\circ\text{C}$

### Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	--	1.28	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient	--	40	

## Package Marking and Odering Information

Device Marking	Week Marking	Package	Packing	Quantity	RoHS Status
HFA20N50U	YWWX	TO-247	Tube	30	Pb Free
HFA20N50U	YWWXg	TO-247	Tube	30	Halogen Free

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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### On Characteristics

$V_{GS}$	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	$V_{GS} = 10 \text{ V}, I_D = 10 \text{ A}$	--	0.22	0.265	$\Omega$

### Off Characteristics

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	500	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.5	--	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 500 \text{ V}, V_{GS} = 0 \text{ V}$ $V_{DS} = 400 \text{ V}, T_C = 125^\circ\text{C}$	--	--	1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage Current	$V_{GS} = \pm 30 \text{ V}, V_{DS} = 0 \text{ V}$	--	--	$\pm 100$	nA

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1.0 \text{ MHz}$	--	3300	4300	pF
$C_{oss}$	Output Capacitance		--	290	380	pF
$C_{rss}$	Reverse Transfer Capacitance		--	16	21	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Time	$V_{DS} = 250 \text{ V}, I_D = 20 \text{ A},$ $R_G = 25 \Omega$	--	80	170	ns
$t_r$	Turn-On Rise Time		--	80	170	ns
$t_{d(off)}$	Turn-Off Delay Time	(Note 4,5)	--	190	390	ns
$t_f$	Turn-Off Fall Time		--	60	130	ns
$Q_g$	Total Gate Charge	$V_{DS} = 400 \text{ V}, I_D = 20 \text{ A},$ $V_{GS} = 10 \text{ V}$	--	58	76	nC
$Q_{gs}$	Gate-Source Charge		--	16	--	nC
$Q_{gd}$	Gate-Drain Charge		(Note 4,5)	--	17	--

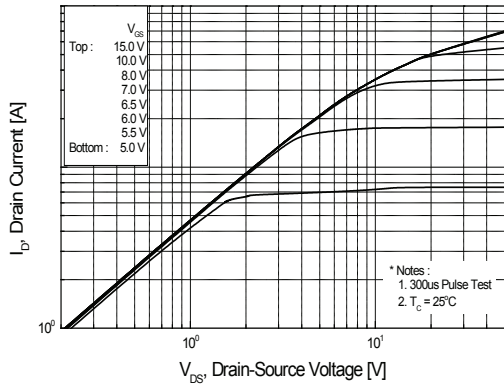
### Source-Drain Diode Maximum Ratings and Characteristics

$I_S$	Continuous Source-Drain Diode Forward Current	--	--	20	A	
$I_{SM}$	Pulsed Source-Drain Diode Forward Current	--	--	80		
$V_{SD}$	Source-Drain Diode Forward Voltage	$I_S = 20 \text{ A}, V_{GS} = 0 \text{ V}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$I_S = 20 \text{ A}, V_{GS} = 0 \text{ V}$	--	375	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100 \text{ A}/\mu\text{s}$ (Note 4)	--	4.2	--	$\mu\text{C}$

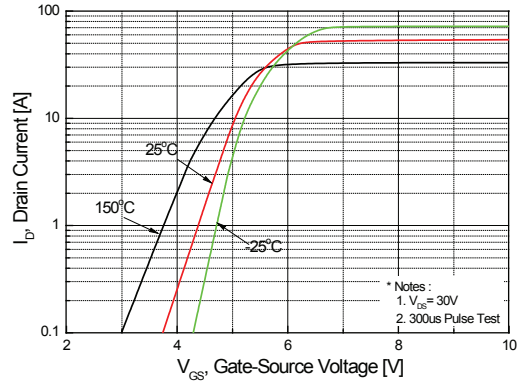
#### Notes ;

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L=4.2\text{mH}$ ,  $I_{AS}=20\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$
3.  $I_{SD}\leq 20\text{A}$ ,  $di/dt\leq 200\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
4. Pulse Test : Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
5. Essentially Independent of Operating Temperature

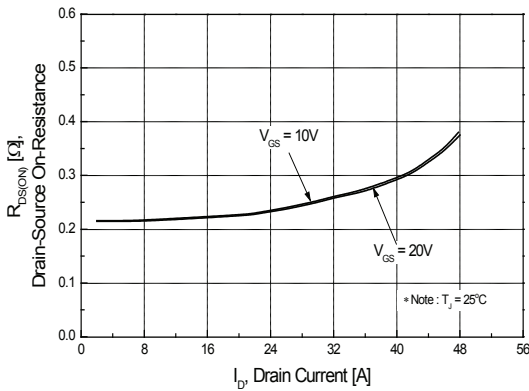
# Typical Characteristics



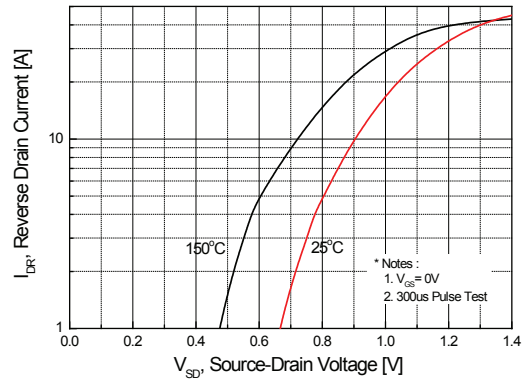
**Figure 1. On Region Characteristics**



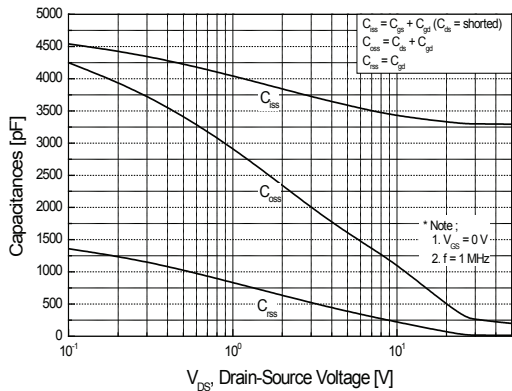
**Figure 2. Transfer Characteristics**



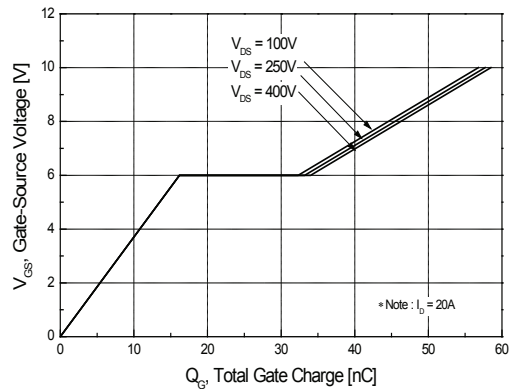
**Figure 3. On Resistance Variation vs Drain Current and Gate Voltage**



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



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**

Typical Characteristics (continued)

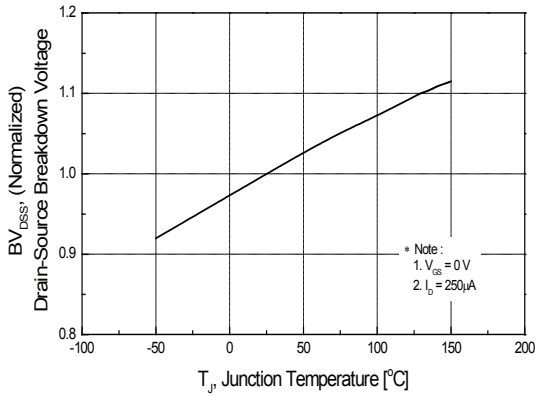


Figure 7. Breakdown Voltage Variation vs Temperature

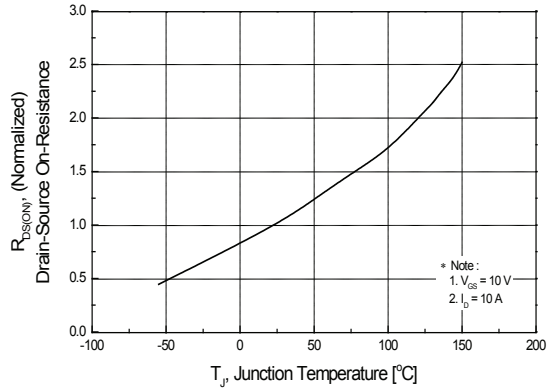


Figure 8. On-Resistance Variation vs Temperature

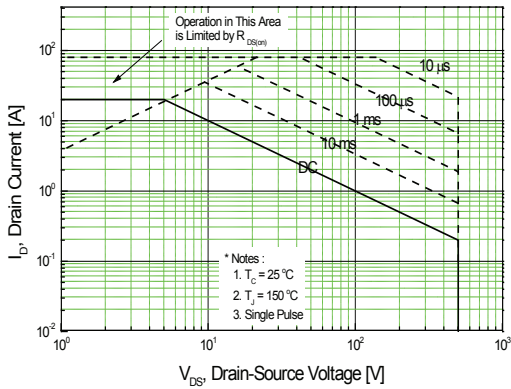


Figure 9. Maximum Safe Operating Area

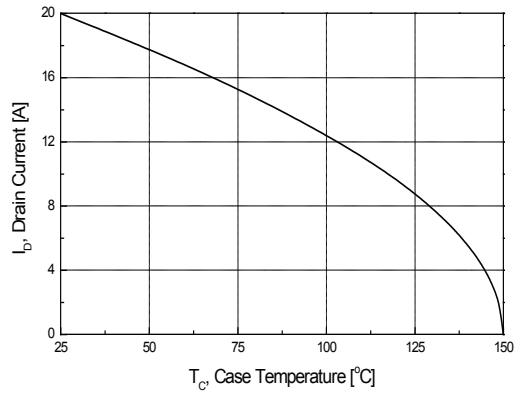


Figure 10. Maximum Drain Current vs Case Temperature

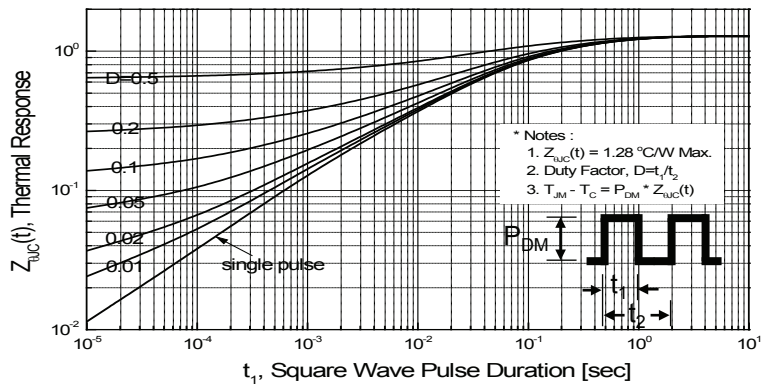
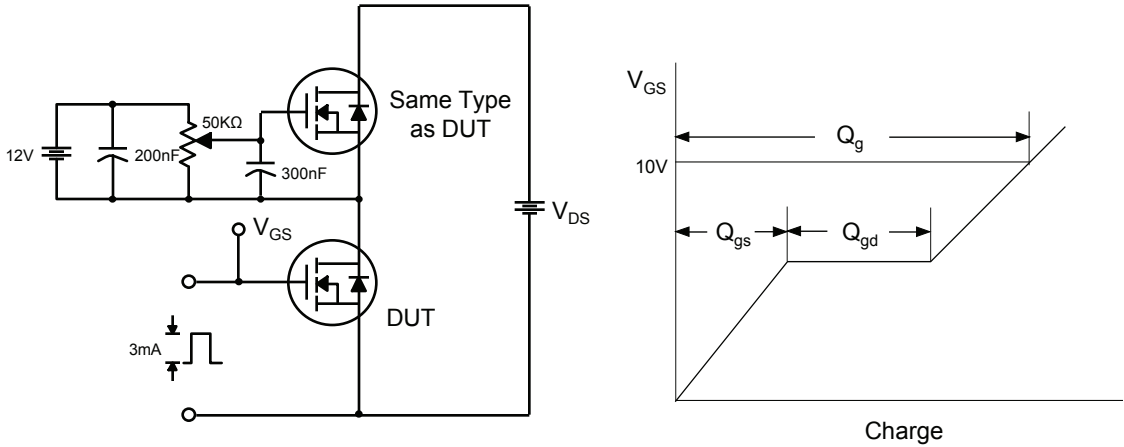
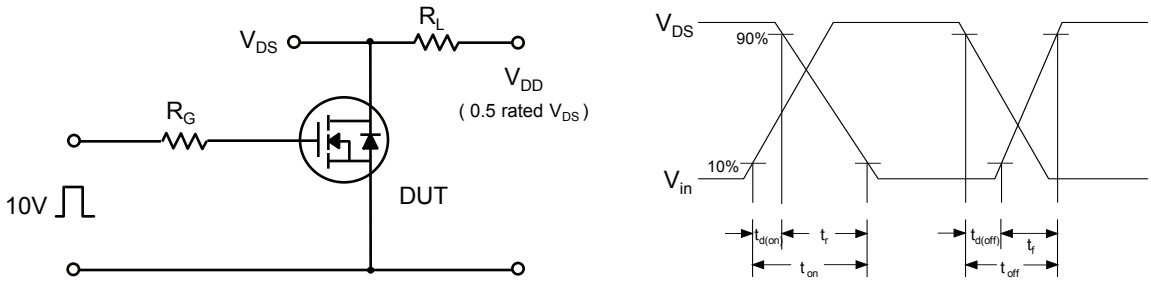


Figure 11. Transient Thermal Response Curve

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



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



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

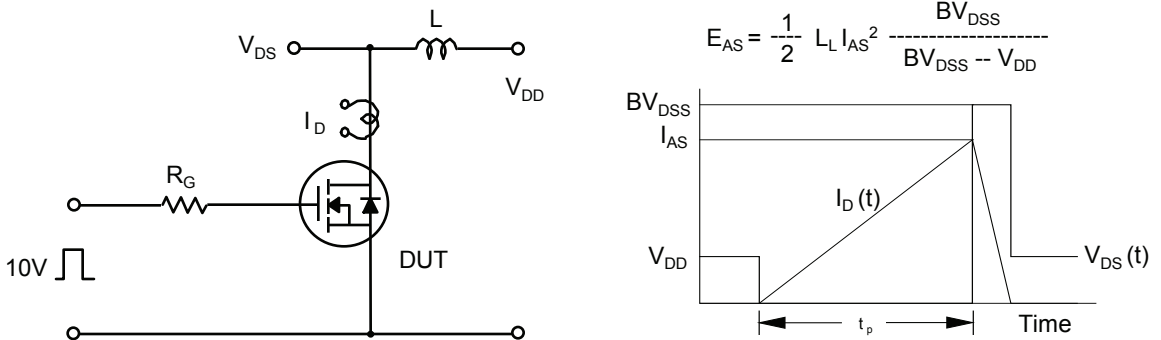
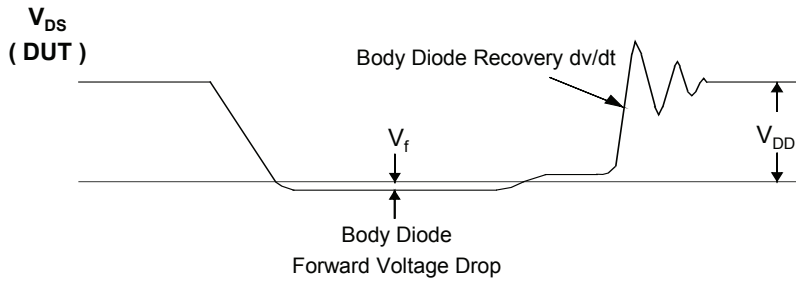
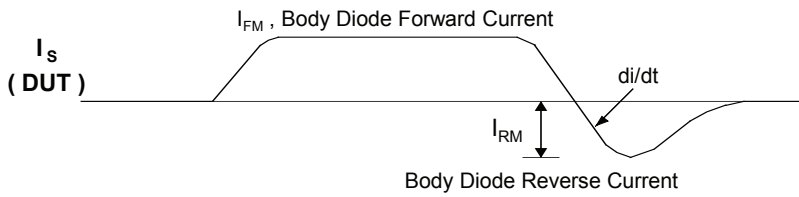
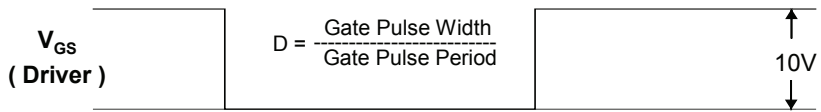
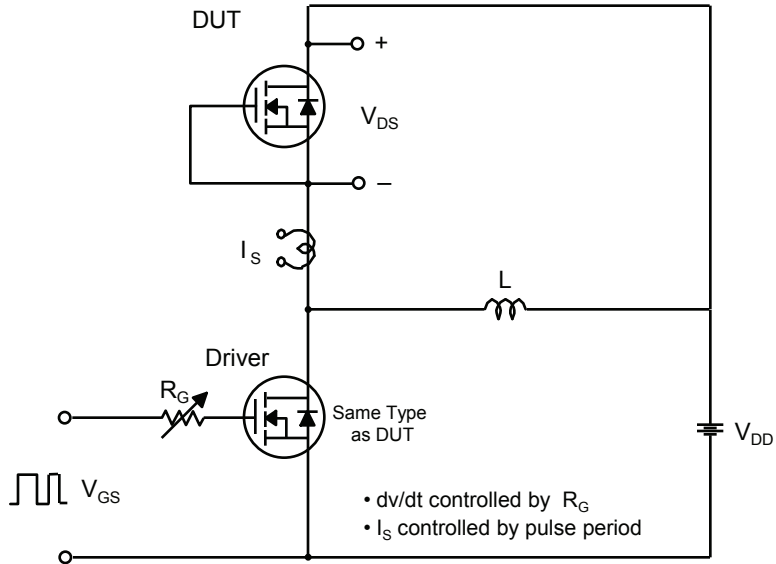


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimension

TO-247

