


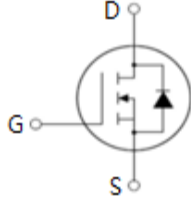
## 600V N-Channel MOSFET

### FEATURES

- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

### APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)

$BV_{DSS} = 600\text{ V}$ $R_{DS(on) typ} = 0.34\ \Omega$ $I_D = 20\text{ A}$		
	<small>1.Gate 2. Drain 3. Source</small>	

### Device Marking and Package Information

Device	Package	Marking
HA20N60	TO-3P	HA20N60

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

Parameter	Symbol	Value	Unit
		TO-3P	
Drain-Source Voltage ( $V_{GS} = 0\text{V}$ )	$V_{DSS}$	600	V
Continuous Drain Current	$I_D$	20	A
Pulsed Drain Current (note1)	$I_{DM}$	80	A
Gate-Source Voltage	$V_{GSS}$	$\pm 30$	V
Single Pulse Avalanche Energy (note2)	$E_{AS}$	1350	mJ
Avalanche Current (note1)	$I_{AR}$	16	A
Repetitive Avalanche Energy (note1)	$E_{AR}$	90	mJ
Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_D$	120	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55~+150	$^\circ\text{C}$

### Thermal Resistance

Parameter	Symbol	Value	Unit
		TO-3P	
Thermal Resistance, Junction-to-Case	$R_{thJC}$	1.04	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	$R_{thJA}$	62.5	

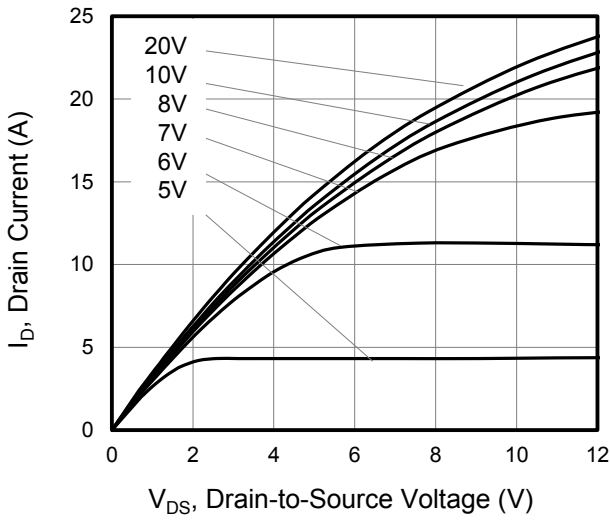
Specifications $T_J = 25^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	600	--	--	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 600V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	$\mu A$
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 30V$	--	--	$\pm 100$	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	3.0	--	4.0	V
Drain-Source On-Resistance (Note3)	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 10A$	--	0.34	0.40	$\Omega$
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0V,$ $V_{DS} = 25V,$ $f = 1.0\text{MHz}$	--	2978	--	pF
Output Capacitance	$C_{oss}$		--	291	--	
Reverse Transfer Capacitance	$C_{rss}$		--	40	--	
Total Gate Charge	$Q_g$	$V_{DD} = 480V, I_D = 20A,$ $V_{GS} = 10V$	--	80	--	nC
Gate-Source Charge	$Q_{gs}$		--	12	--	
Gate-Drain Charge	$Q_{gd}$		--	34	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 250V, I_D = 20A,$ $R_G = 25\Omega$	--	37	--	ns
Turn-on Rise Time	$t_r$		--	66	--	
Turn-off Delay Time	$t_{d(off)}$		--	175	--	
Turn-off Fall Time	$t_f$		--	84	--	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Body Diode Current	$I_S$	$T_C = 25^\circ\text{C}$	--	--	20	A
Pulsed Diode Forward Current	$I_{SM}$		--	--	80	
Body Diode Voltage	$V_{SD}$	$T_J = 25^\circ\text{C}, I_{SD} = 20A, V_{GS} = 0V$	--	--	1.4	V
Reverse Recovery Time	$t_{rr}$	$V_{GS} = 0V, I_S = 20A,$ $di_F/dt = 100A/\mu s$	--	450	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	7.1	--	$\mu C$

**Notes**

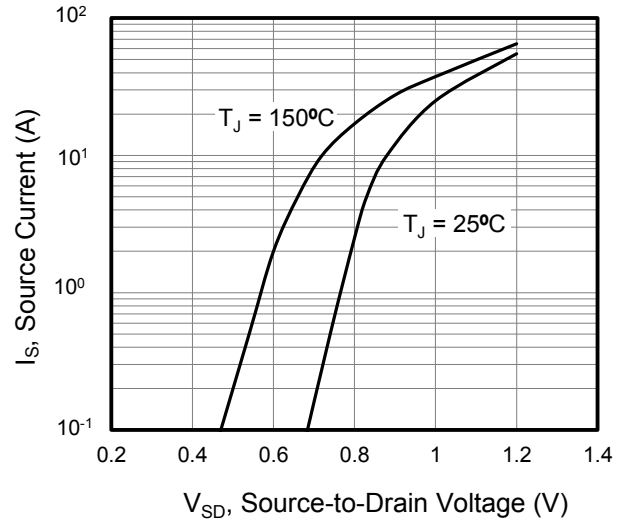
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_{AS} = 16A, V_{DD} = 50V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty Cycle  $\leq 1\%$

**Typical Characteristics**  $T_J = 25^\circ\text{C}$ , unless otherwise noted

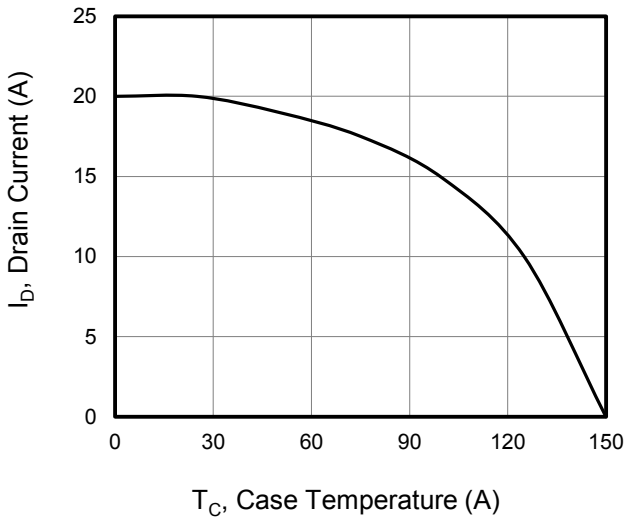
**Figure 1. Output Characteristics ( $T_J = 25^\circ\text{C}$ )**



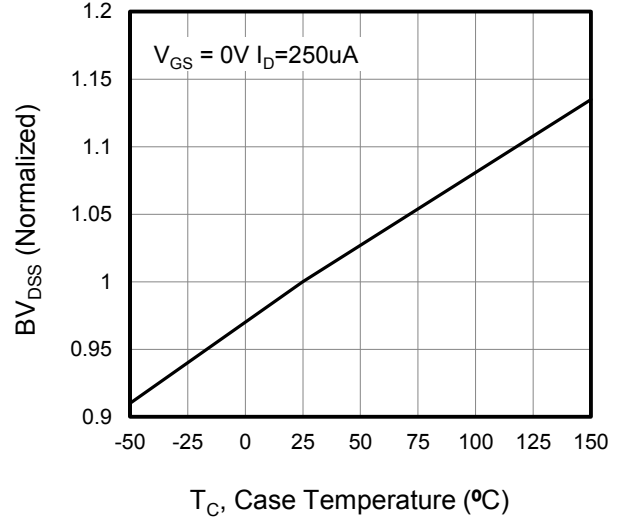
**Figure 2. Body Diode Forward Voltage**



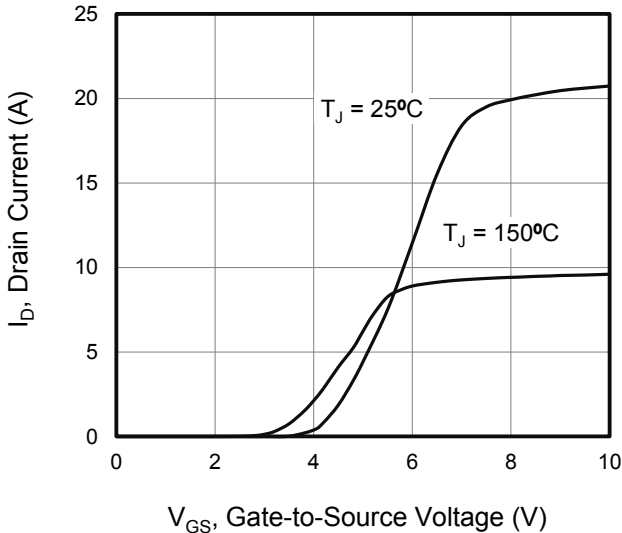
**Figure 3. Drain Current vs. Temperature**



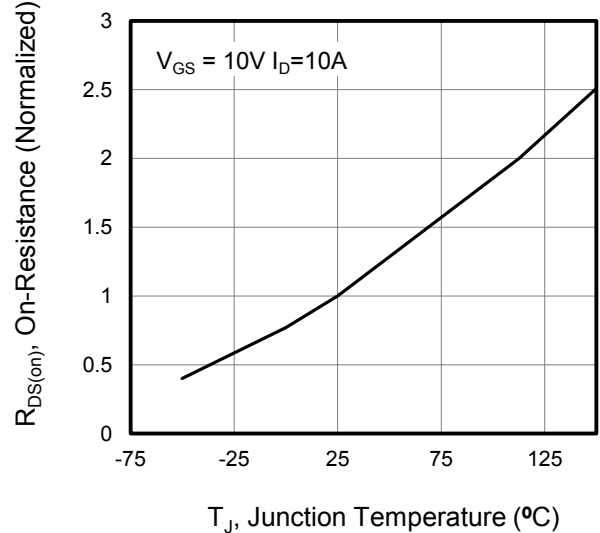
**Figure 4.  $BV_{DSS}$  Variation vs. Temperature**



**Figure 5. Transfer Characteristics**

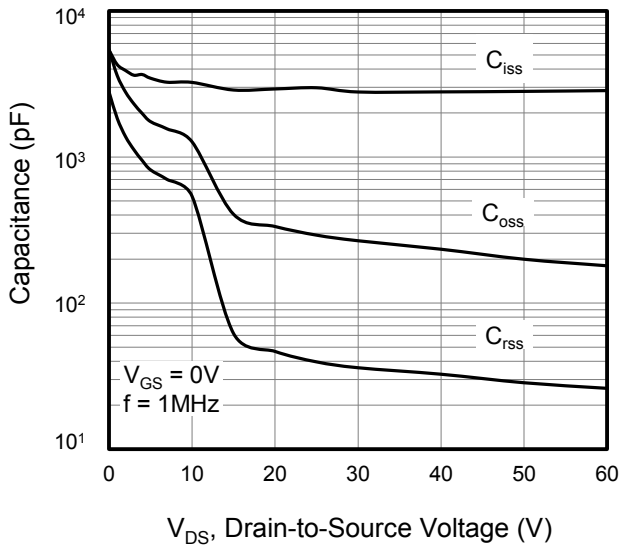


**Figure 6. On-Resistance vs. Temperature**

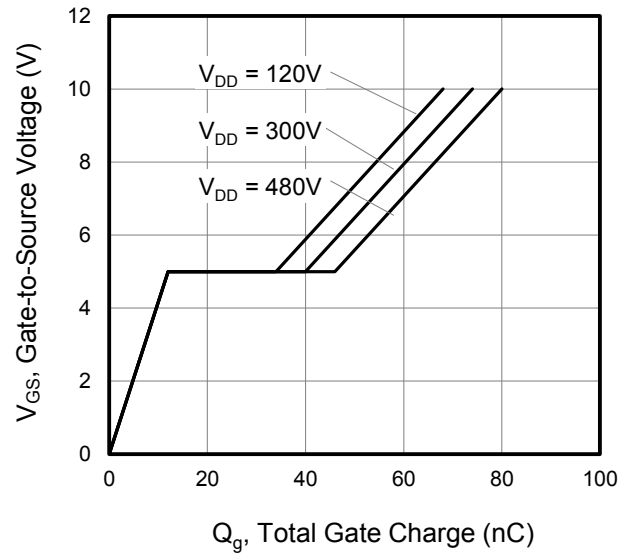


**Typical Characteristics**  $T_j = 25^\circ\text{C}$ , unless otherwise noted

**Figure 7. Capacitance**

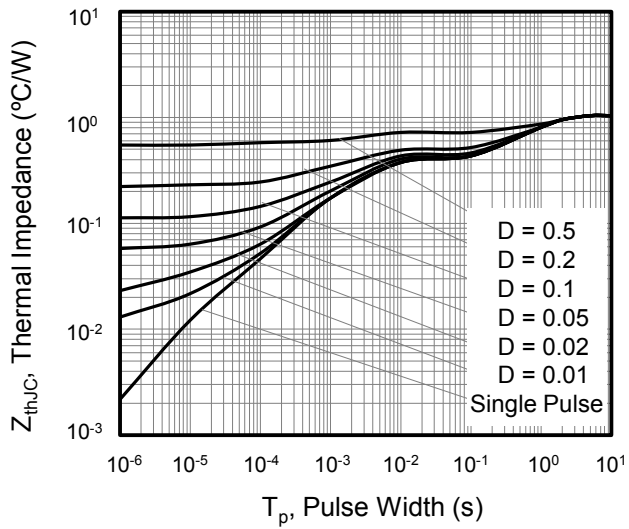


**Figure 8. Gate Charge**

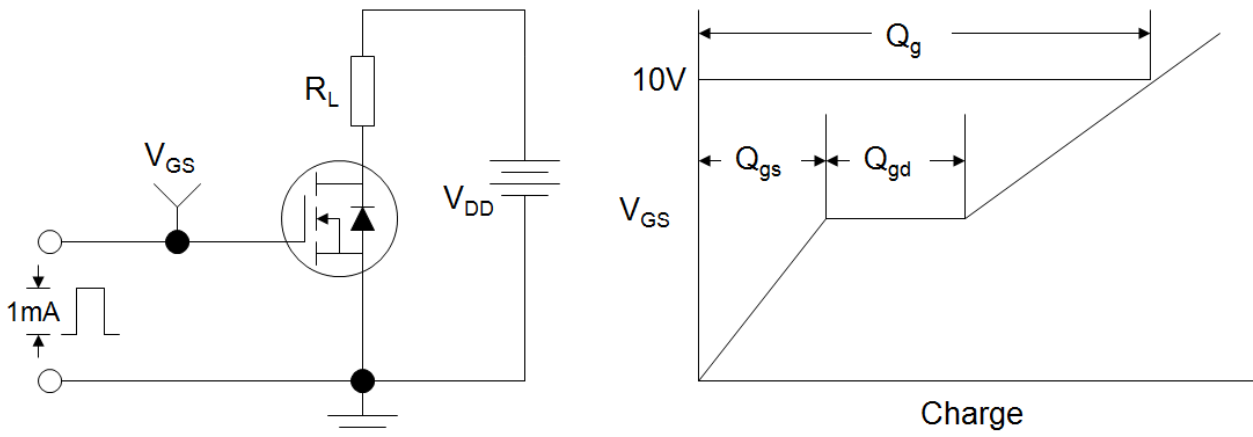


**Figure 9. Transient Thermal Impedance**

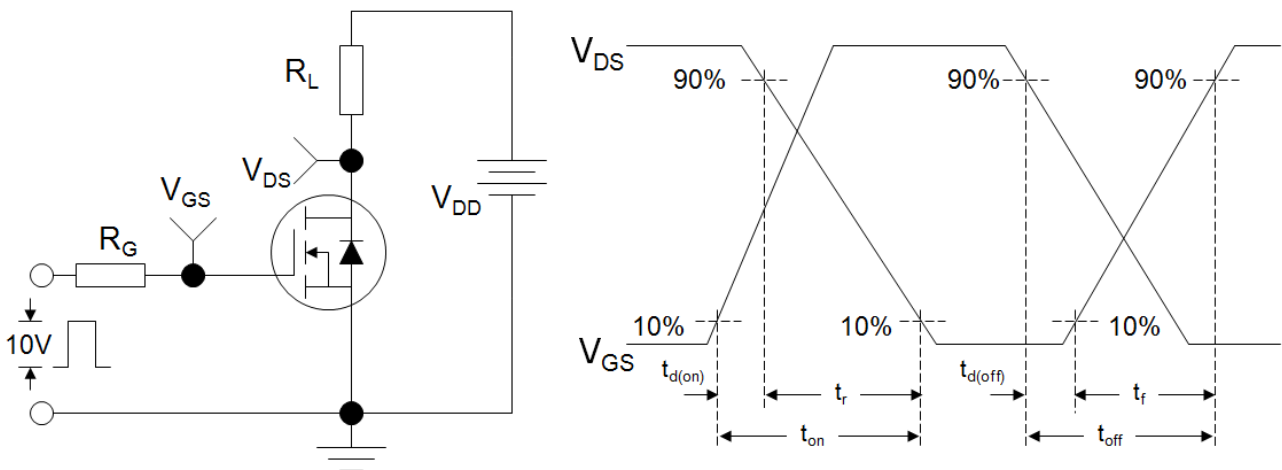
**TO-220F**



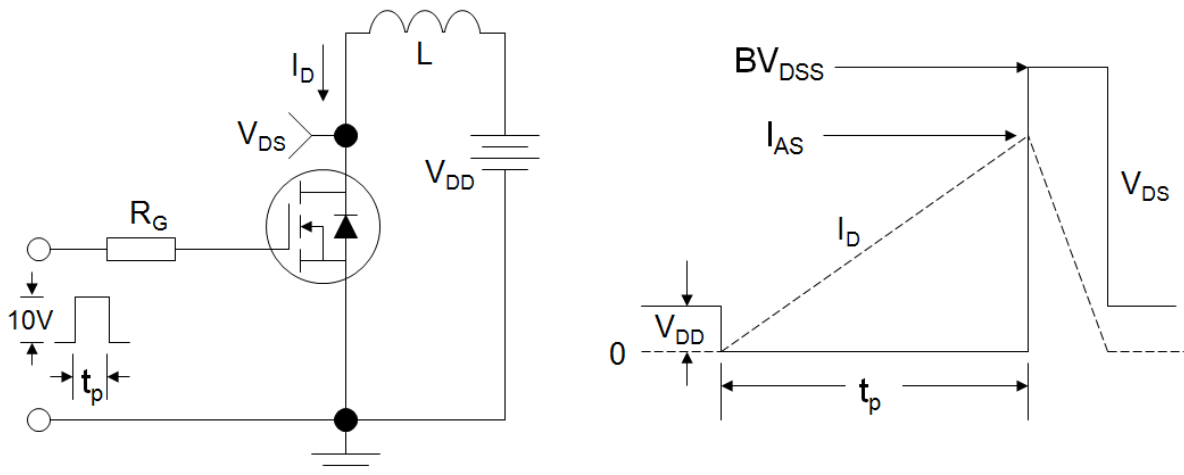
**Figure A: Gate Charge Test Circuit and Waveform**



**Figure B: Resistive Switching Test Circuit and Waveform**



**Figure C: Unclamped Inductive Switching Test Circuit and Waveform**



**TO-3P**

