



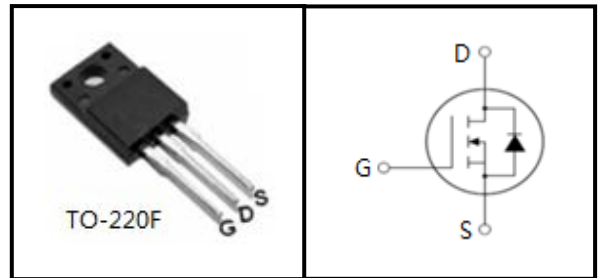
680V N-Channel MOSFET

FEATURES

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

APPLICATIONS

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



Device Marking and Package Information		
Device	Package	Marking
TMA13N68H	TO-220F	A13N68H



Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, unless otherwise noted			
Parameter	Symbol	Value	Unit
Drain-Source Voltage ($V_{GS} = 0V$)	V_{DSS}	680	V
Continuous Drain Current	I_D	13	A
Pulsed Drain Current (note1)	I_{DM}	52	A
Gate-Source Voltage	V_{GSS}	± 30	V
Single Pulse Avalanche Energy (note2)	E_{AS}	810	mJ
Avalanche Current (note1)	I_{AR}	9	A
Repetitive Avalanche Energy (note1)	E_{AR}	54	mJ
Power Dissipation ($T_C = 25^\circ\text{C}$)	P_D	75	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150	$^\circ\text{C}$

Thermal Resistance			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	1.67	$^\circ\text{C}/\text{W}$
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.	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu\text{A}$	680	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 680V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	μA
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30V$	--	--	± 100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	3.0	--	4.0	V
Drain-Source On-Resistance (Note3)	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 6.5A$	--	0.55	0.68	Ω
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0V,$ $V_{DS} = 25V,$ $f = 1.0\text{MHz}$	--	1820	--	pF
Output Capacitance	C_{oss}		--	187	--	
Reverse Transfer Capacitance	C_{rss}		--	29	--	
Total Gate Charge	Q_g	$V_{DD} = 544V, I_D = 13A,$ $V_{GS} = 10V$	--	52	--	nC
Gate-Source Charge	Q_{gs}		--	8.6	--	
Gate-Drain Charge	Q_{gd}		--	23	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 340V, I_D = 13A,$ $R_G = 25\Omega$	--	30	--	ns
Turn-on Rise Time	t_r		--	25	--	
Turn-off Delay Time	$t_{d(off)}$		--	95	--	
Turn-off Fall Time	t_f		--	35	--	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I_S	$T_C = 25^\circ\text{C}$	--	--	13	A
Pulsed Diode Forward Current	I_{SM}		--	--	52	
Body Diode Voltage	V_{SD}	$T_J = 25^\circ\text{C}, I_{SD} = 13A, V_{GS} = 0V$	--	--	1.4	V
Reverse Recovery Time	t_{rr}	$V_{GS} = 0V, I_S = 13A,$ $di_F/dt = 100A/\mu\text{s}$	--	400	--	ns
Reverse Recovery Charge	Q_{rr}		--	4.8	--	μC

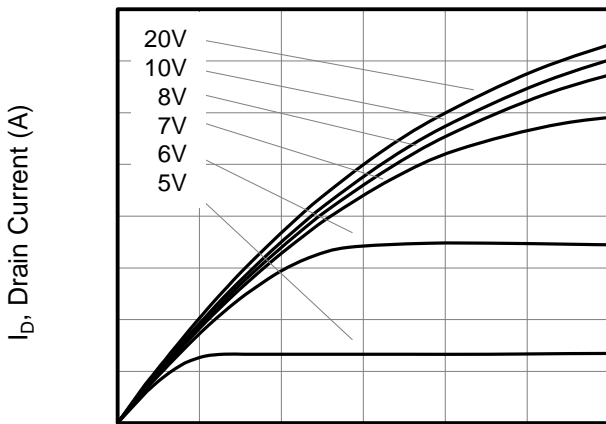
Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 9A, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse width $\leq 350\mu\text{s}$, Duty Cycle $\leq 1\%$



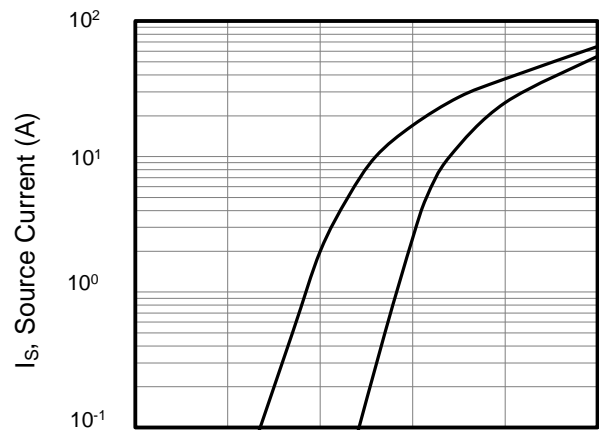
Typical Characteristics $T_J = 25^{\circ}\text{C}$, unless otherwise noted

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



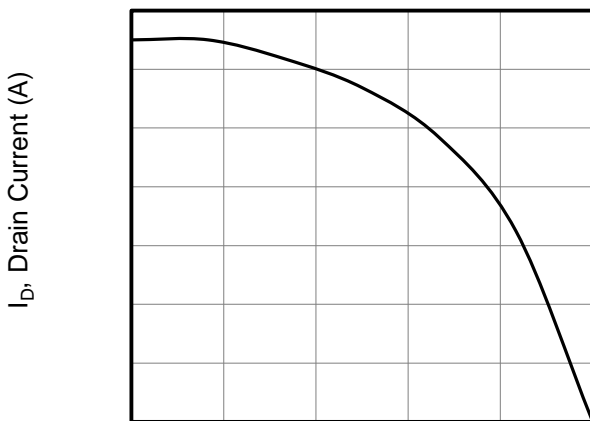
V_{DS} , Drain-to-Source Voltage (V)

Figure 2. Body Diode Forward Voltage



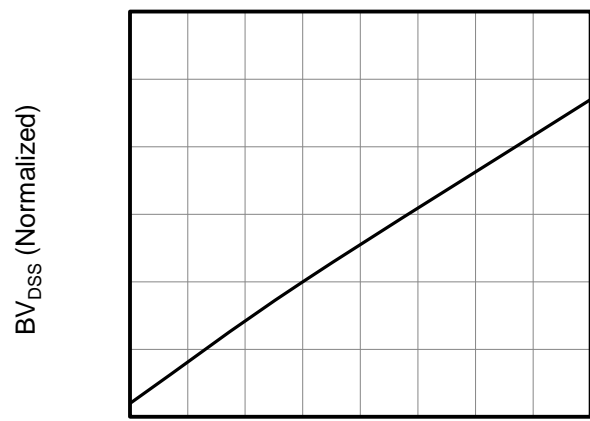
V_{SD} , Source-to-Drain Voltage (V)

Figure 3. Drain Current vs. Temperature



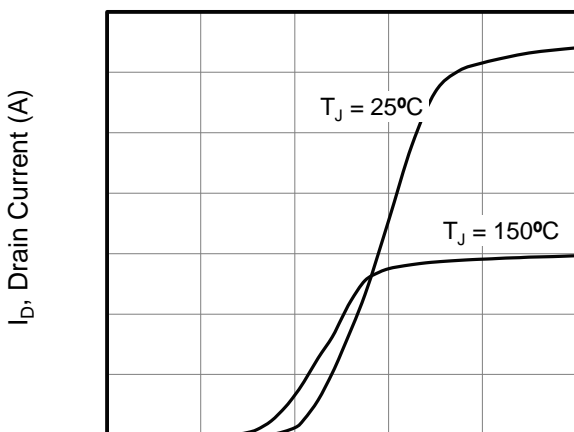
T_C , Case Temperature (A)

Figure 4. BV_{DSS} Variation vs. Temperature



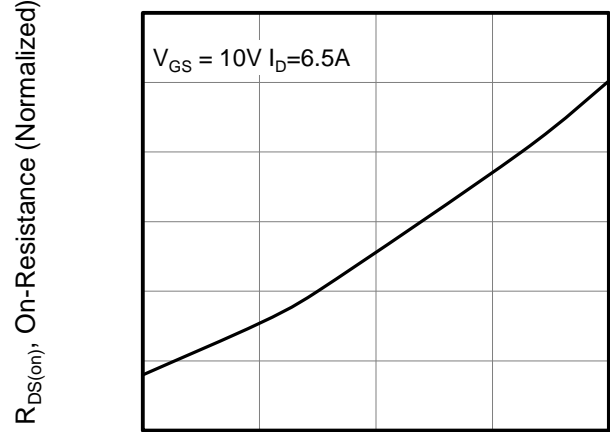
T_C , Case Temperature ($^{\circ}\text{C}$)

Figure 5. Transfer Characteristics



V_{GS} , Gate-to-Source Voltage (V)

Figure 6. On-Resistance vs. Temperature



T_J , Junction Temperature ($^{\circ}\text{C}$)



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

Figure 7. Capacitance

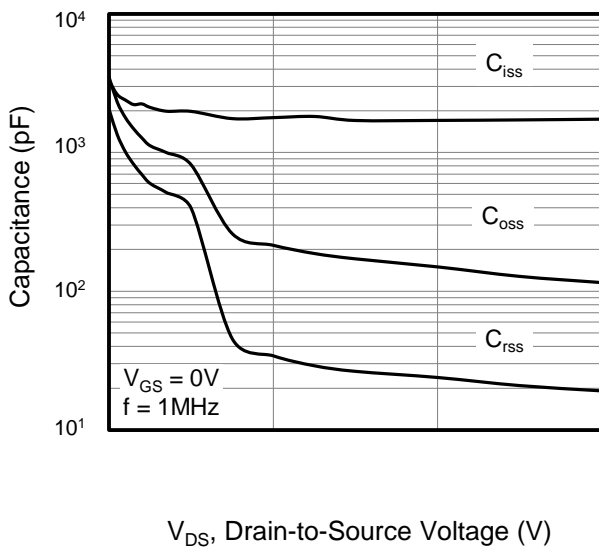


Figure 8. Gate Charge

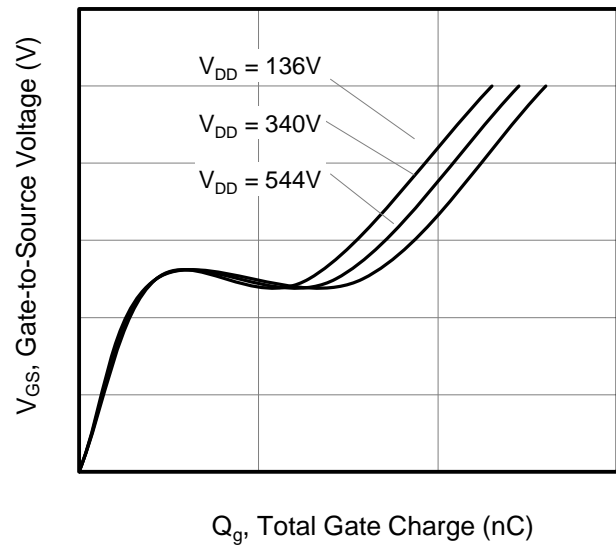


Figure 9. Transient Thermal Impedance

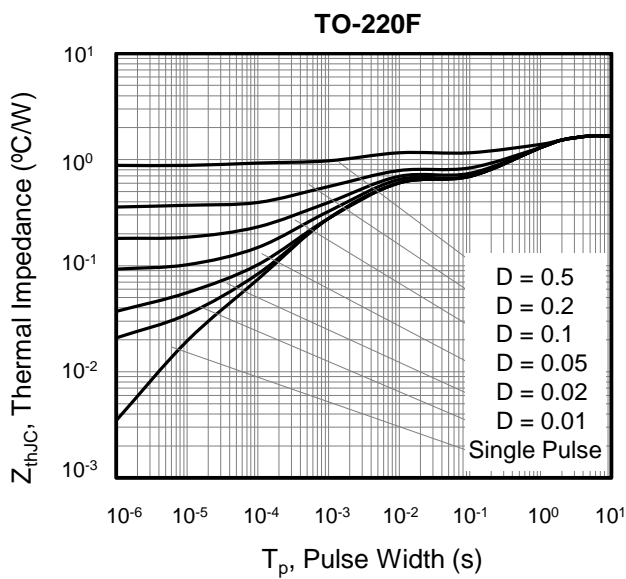




Figure A: Gate Charge Test Circuit and Waveform



Figure B: Resistive Switching Test Circuit and Waveform

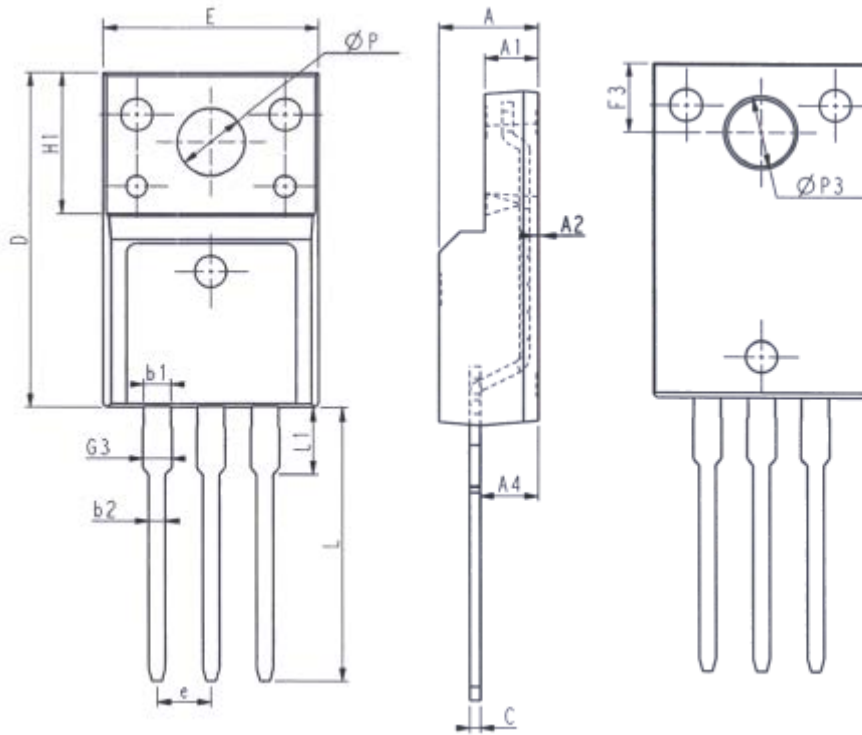


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





TO-220F



Unit: mm			Unit: mm		
Symbol	Min.	Max.	Symbol	Min.	Max.
E	9.96	10.36	L	12.68	13.28
A	4.50	4.90	L1	2.93	3.13
A1	2.34	2.74	P	3.03	3.38
A2	0.30	0.60	P3	3.15	3.65
A4	2.56	2.96	F3	3.15	3.45
c	0.40	0.65	G3	1.25	1.55
D	15.57	16.17	b1	1.18	1.43
H1	6.70REF		b2	0.70	0.95
e	2.54BSC				



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