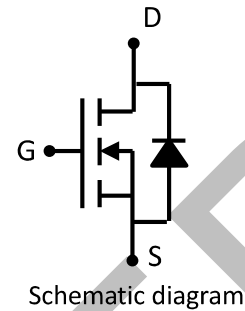


# AP13N65F

N-Channel Enhancement Mosfet

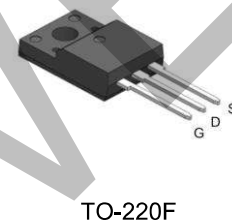
## Features

- 650V,13A  
 $R_{DS(ON)} < 0.65 \Omega @ V_{GS}=10V$  TYP:0.52  $\Omega$
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



## Applications

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



## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity (PCS)
13N65F	AP13N65F	TO-220F	-	-	1000

## ABSOLUTE MAXIMUM RATINGS ( $T_a=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	650	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	V
Continuous Drain Current ( $T_a=25^\circ\text{C}$ )	$I_D$	13	A
Avalanche Current <sup>(1)</sup>	$I_{AS}$	8.8	A
Pulsed Drain Current <sup>(1)</sup>	$I_{DM}$	52	A
Single Pulsed Avalanche Energy <sup>(2)</sup>	$E_{AS}$	387	mJ
Repetitive Avalanche Energy <sup>(1)</sup>	$E_{AR}$	232	mJ
Power Dissipation	$P_D$	70	W
Thermal Resistance from Junction to Case	$R_{\theta JC}$	1.78	$^\circ\text{C/W}$
Junction Temperature	$T_J$	150	$^\circ\text{C}$
Storage Temperature	$T_{STG}$	-55~ +150	$^\circ\text{C}$

MOSFET ELECTRICAL CHARACTERISTICS( $T_a=25^{\circ}\text{C}$  unless otherwise noted)

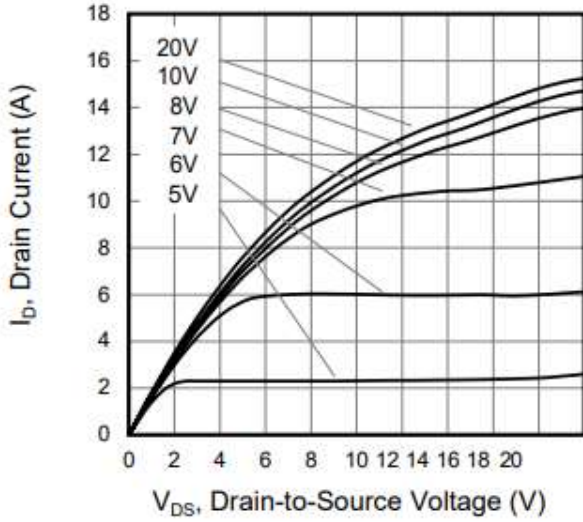
Parameter	Symbol	Test Condition	Min	Type	Max	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	650	-	-	V
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 650V, V_{GS} = 0V, T_J = 25^{\circ}\text{C}$	-	-	1	$\mu A$
Gate-body leakage current	$I_{GSS}$	$V_{GS} = \pm 30V, V_{DS} = 0V$	-	-	$\pm 100$	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	3.0	-	4.0	V
Drain-source on-resistance <sup>(3)</sup>	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 6.5A$	-	0.52	0.65	$\Omega$
<b>Dynamic characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 25V, V_{GS} = 0V, f = 1.0\text{MHz}$	-	1779	-	pF
Output Capacitance	$C_{oss}$		-	183	-	
Reverse Transfer Capacitance	$C_{rss}$		-	25	-	
<b>Switching characteristics</b>						
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 325V, I_D = 13A, R_G = 25\Omega$	-	49	-	ns
Turn-on rise time	$t_r$		-	38	-	
Turn-off delay time	$t_{d(off)}$		-	245	-	
Turn-off fall time	$t_f$		-	114	-	
Total Gate Charge	$Q_g$	$V_{DS} = 520V, I_D = 13A, V_{GS} = 10V$	-	62	-	nC
Gate-Source Charge	$Q_{gs}$		-	9	-	
Gate-Drain Charge	$Q_{gd}$		-	32	-	
<b>Source-Drain Diode characteristics</b>						
Diode Forward voltage	$V_{SD}$	$T_J = 25^{\circ}\text{C}, V_{GS} = 0V, I_S = 6.5A$	-	-	1.4	V
Diode Forward current	$I_S$	$T_C = 25^{\circ}\text{C}$	-	-	7	A
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}\text{C}, I_F = 13A, di/dt = 100A/\mu s$		582		ns
Body Diode Reverse Recovery Charge	$Q_{rr}$	$T_J = 25^{\circ}\text{C}, I_F = 13A, di/dt = 100A/\mu s$		3.5		uc

**Notes:**

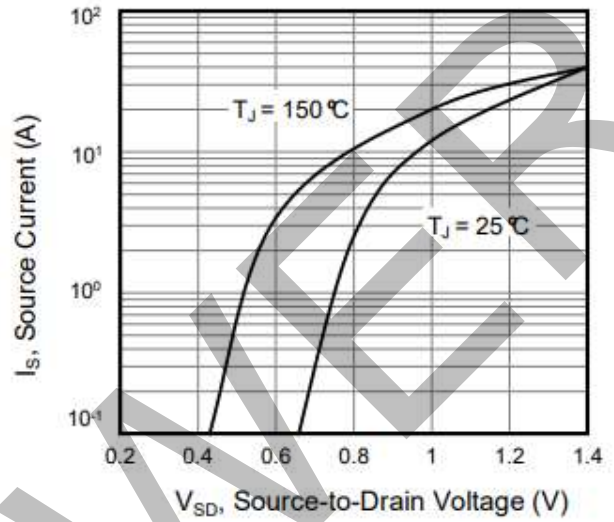
1. Repetitive Rating: pulse width limited by maximum junction temperature
2. EAS Condition:  $T_J = 25^{\circ}\text{C}, V_{DD} = 50V, R_G = 25\Omega, L = 10\text{mH}$
3. Pulse Test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 1\%$

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

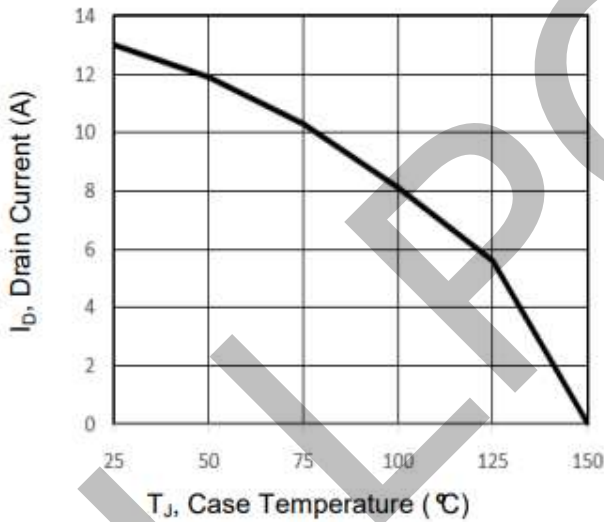
**Figure 1. Output Characteristics ( $T_J = 25^\circ\text{C}$ )**



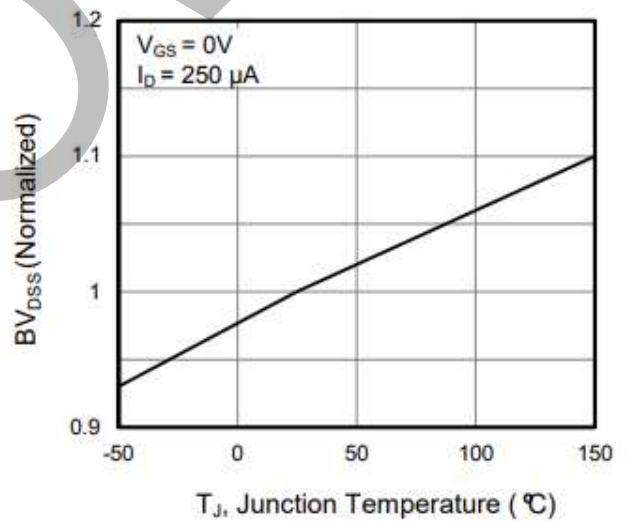
**Figure 2. Body Diode Forward Voltage**



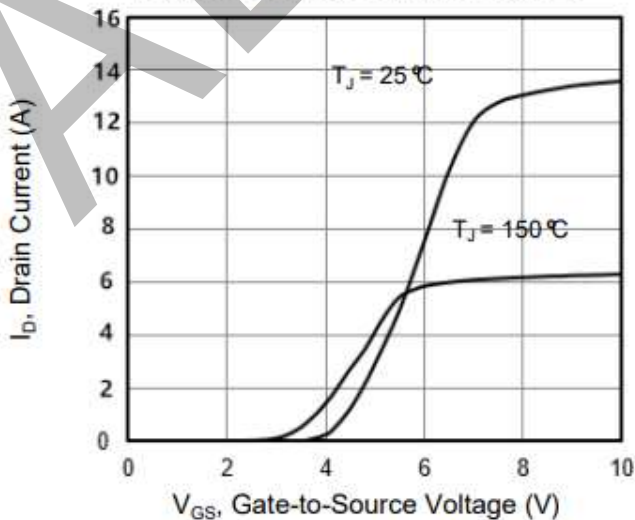
**Figure 3. Drain Current vs. Temperature**



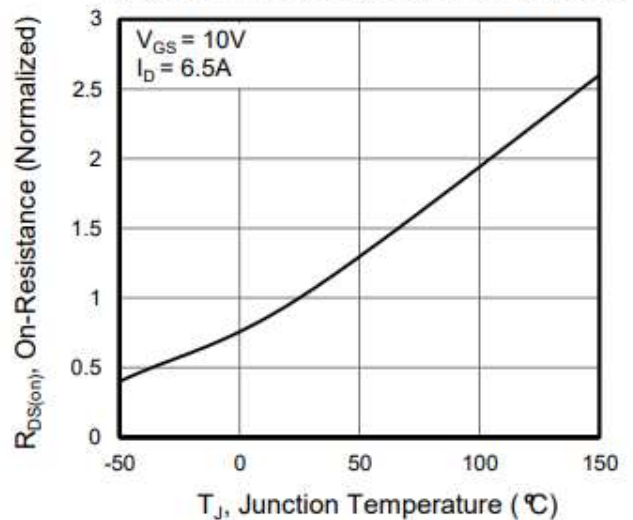
**Figure 4.  $BV_{DSS}$  Variation vs. Temperature**



**Figure 5. Transfer Characteristics**

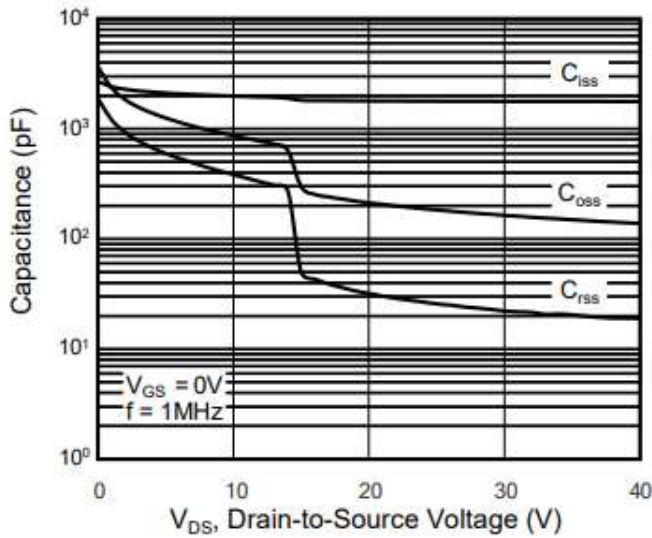


**Figure 6. On-Resistance vs. Temperature**

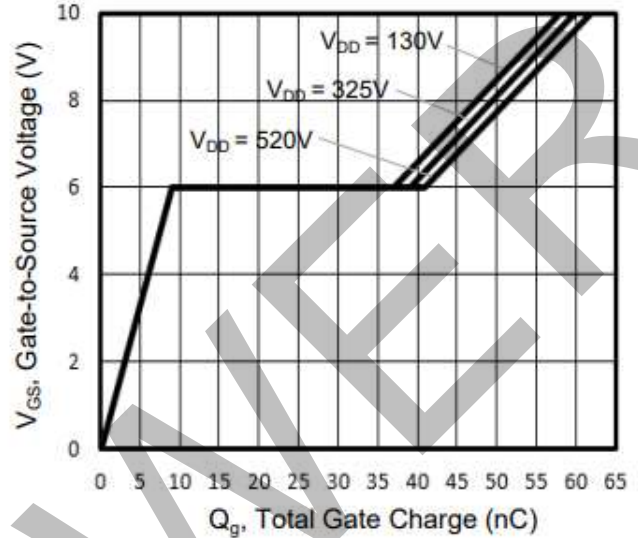


Typical Characteristics  $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted

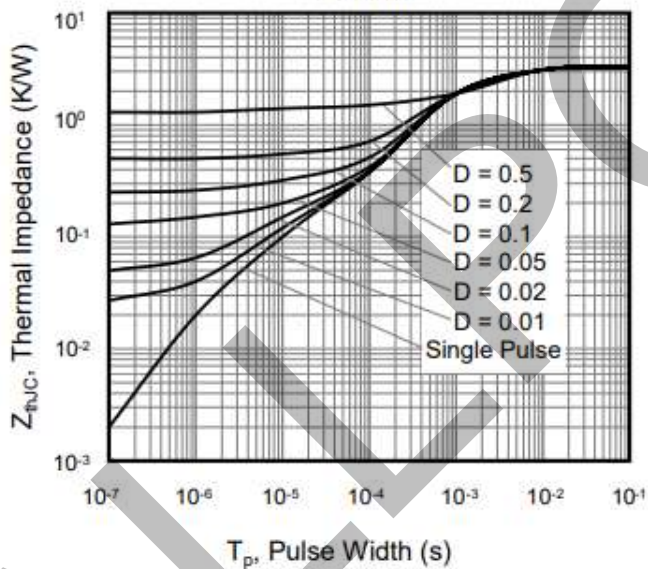
**Figure 7. Capacitance**



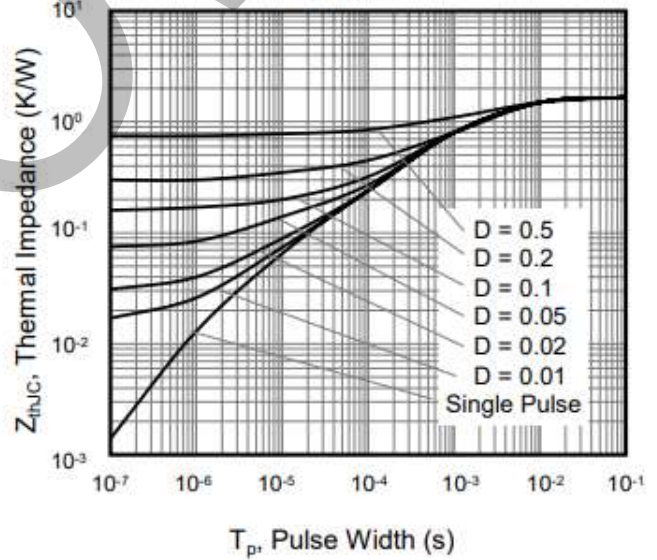
**Figure 8. Gate Charge**



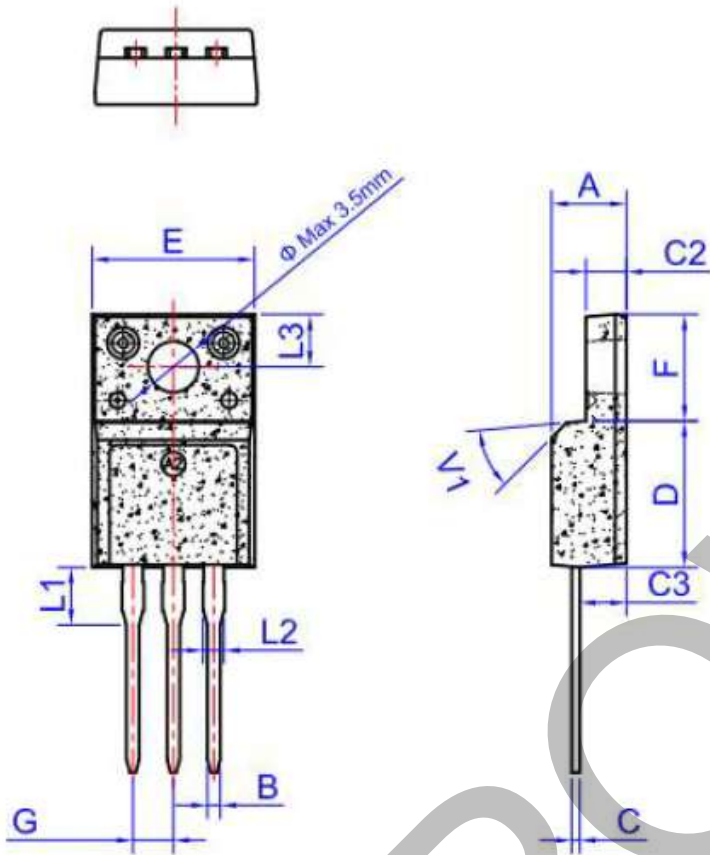
**Figure 9. Transient Thermal Impedance TO-220F**



**Figure 10. Transient Thermal Impedance TO-220**



**Package Outlines**



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.50		4.90	0.177		0.193
B	0.74	0.80	0.83	0.029	0.031	0.033
C	0.47		0.65	0.019		0.026
C2	2.45		2.75	0.096		0.108
C3	2.60		3.00	0.102		0.118
D	8.80		9.30	0.346		0.366
E	9.80		10.4	0.386		0.410
F	6.40		6.80	0.252		0.268
G		2.54			0.1	
H	28.0		29.8	1.102		1.173
L1		3.63			0.143	
L2	1.14		1.70	0.045		0.067
L3		3.30			0.130	
V1		45°			45°	