

### Product Summary

$V_{(BR)DSS}$	$R_{DS(on)MAX}$	$I_D$
650V	180mΩ@10V	21A

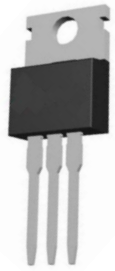
### Feature

- Optimized body diode reverse recovery performance
- Low on-resistance and Low conduction losses
- Excellent package for good heat dissipation
- Ultra low gate charge cause lower driving requirements

### Application

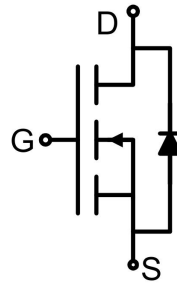
- Power factor correction
- Switched mode power supplies
- Uninterruptible power supply

### Package

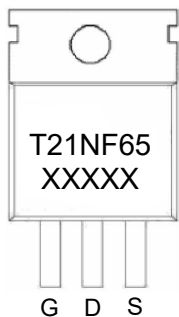


TO-220AB

### Circuit diagram



### Marking



### Absolute maximum ratings (Tc=25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DS</sub>	650	V
Gate-Source Voltage	V <sub>GS</sub>	±30	V
Continuous Drain Current	I <sub>D</sub>	21	A
Continuous Drain Current (T <sub>C</sub> =100°C)	I <sub>D</sub> (100°C)	13.2	A
Pulsed Drain Current	I <sub>DM</sub>	84	A
Power Dissipation	P <sub>D</sub>	188	W
Thermal Resistance,Junction-to-Ambient	R <sub>θJA</sub>	62.5	°C/W
Thermal Resistance,Junction-to-Case	R <sub>θJC</sub>	0.66	°C/W
Single pulse avalanche energy	E <sub>AS</sub>	441	mJ
Junction Temperature	T <sub>J</sub>	150	°C
Storage Temperature	T <sub>STG</sub>	-55 ~ +150	°C

### Electrical characteristics (T<sub>A</sub>=25 °C, unless otherwise noted)

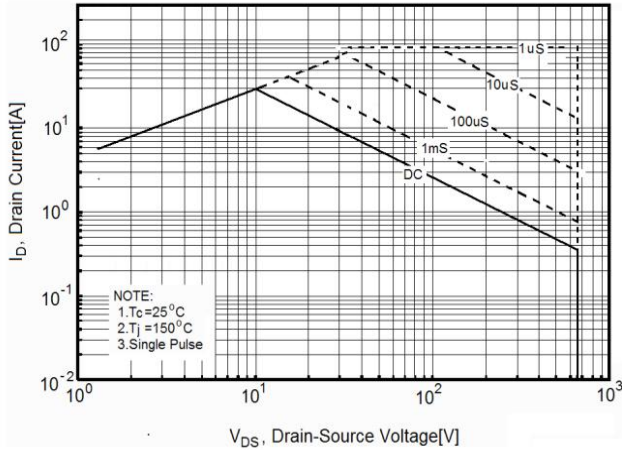
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> =250μA	650			V
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> =650V,V <sub>GS</sub> = 0V			1	μA
Gate-body leakage current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> = 0V			±100	nA
Gate threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	3		4	V
Drain-source on-resistance <sup>1)</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =10.5A		150	180	mΩ
Forward transconductance <sup>1)</sup>	g <sub>FS</sub>	V <sub>DS</sub> =20V, I <sub>D</sub> =10.5A		16		S
<b>Dynamic characteristics<sup>2)</sup></b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =50V,V <sub>GS</sub> =0V,f =1MHz		2250		pF
Output Capacitance	C <sub>oss</sub>			83		
Reverse Transfer Capacitance	C <sub>rss</sub>			1.6		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =480V,V <sub>GS</sub> =10V,I <sub>D</sub> =21A		36		nC
Gate-Source Charge	Q <sub>gs</sub>			14		
Gate-Drain Charge	Q <sub>gd</sub>			8.5		
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> =380V,V <sub>GS</sub> =10V I <sub>D</sub> =11A,R <sub>GEN</sub> =4Ω		11		nS
Turn-on rise time	t <sub>r</sub>			6		
Turn-off delay time	t <sub>d(off)</sub>			61		
Turn-off fall time	t <sub>f</sub>			4.5		
<b>Source-Drain Diode characteristics</b>						
Diode Forward Current	I <sub>S</sub>				21	A
Diode Forward voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =21A			1.3	V
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> =11A		160		nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs <sup>1)</sup>		1.4		uC

Notes:

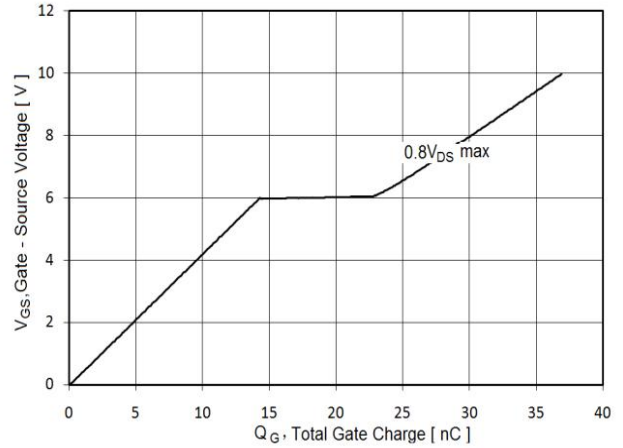
- 1) Pulse Test: Pulse Width < 300μs, Duty Cycle ≤2%.
- 2) Guaranteed by design, not subject to production testing.

## Typical Characteristics

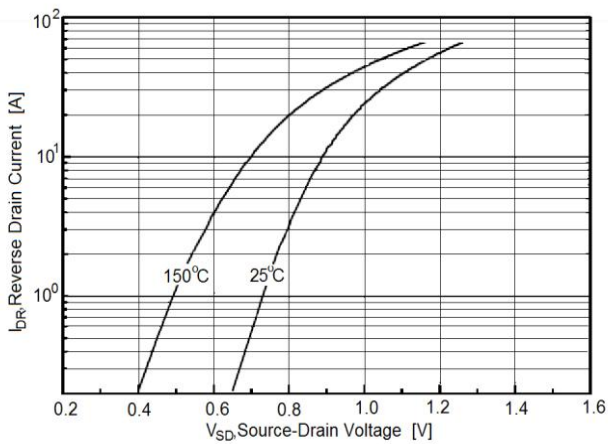
**Figure1. Safe operating area**



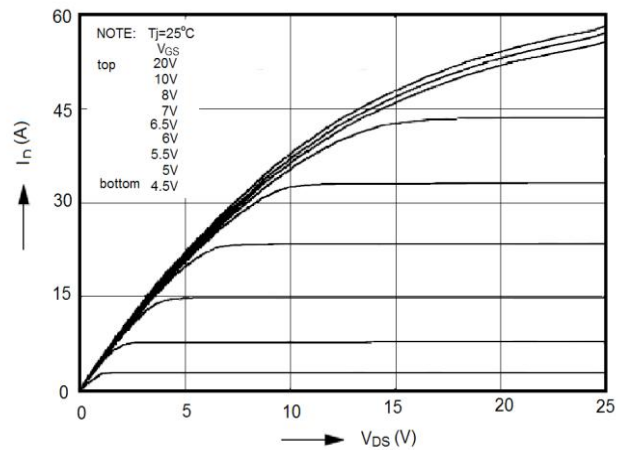
**Figure2. Gate charge waveforms**



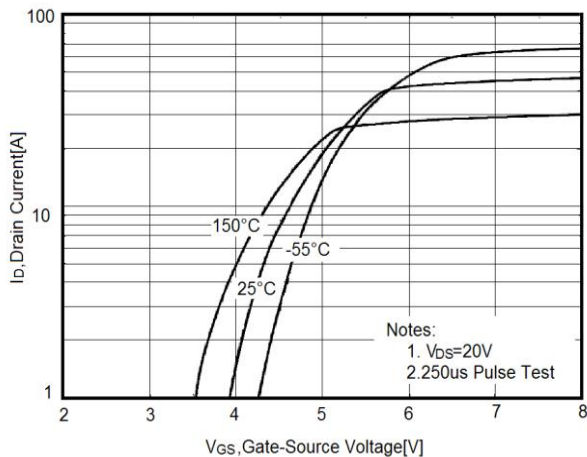
**Figure3. Source-Drain Diode Forward Voltage**



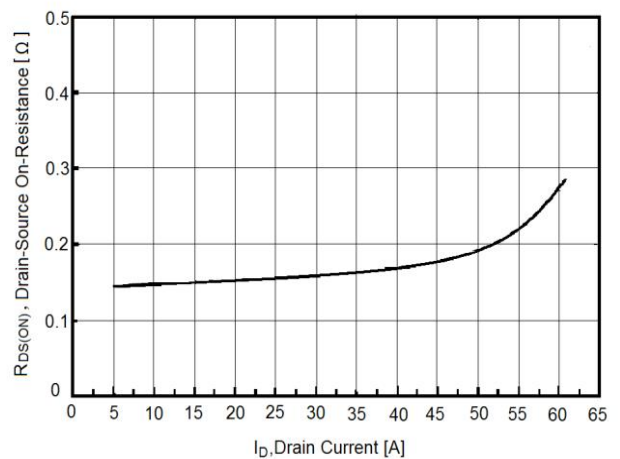
**Figure4. Output characteristics**



**Figure5. Transfer characteristics**

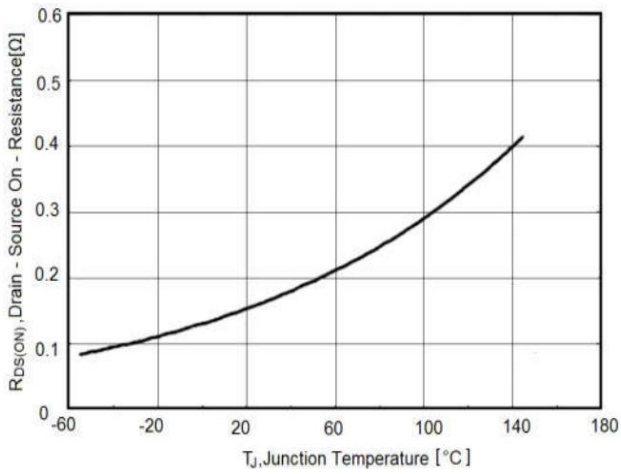


**Figure6. Static drain-source on resistance**

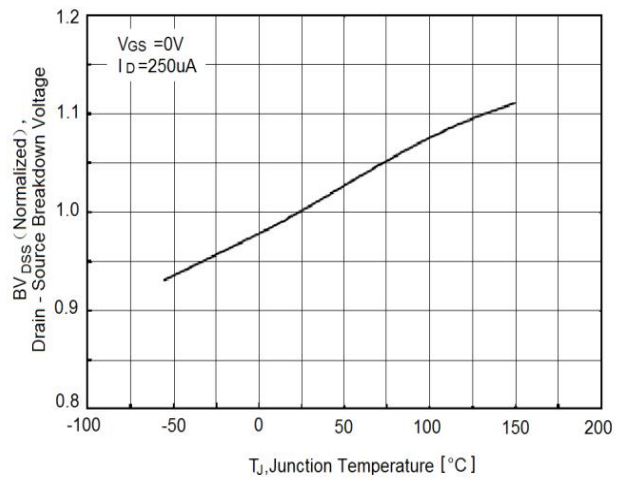


## Typical Characteristics

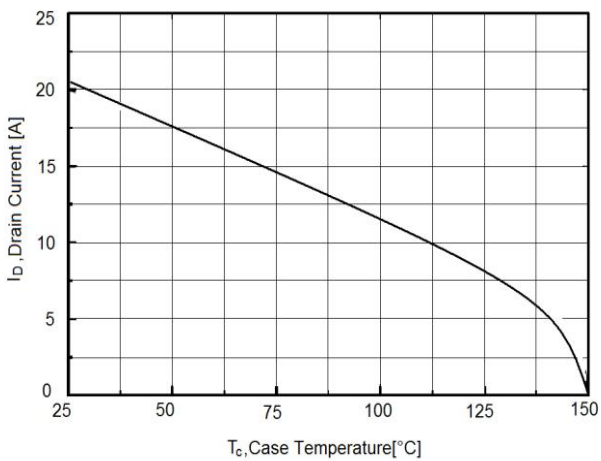
**Figure7.  $R_{DS(ON)}$  vs Junction Temperature**



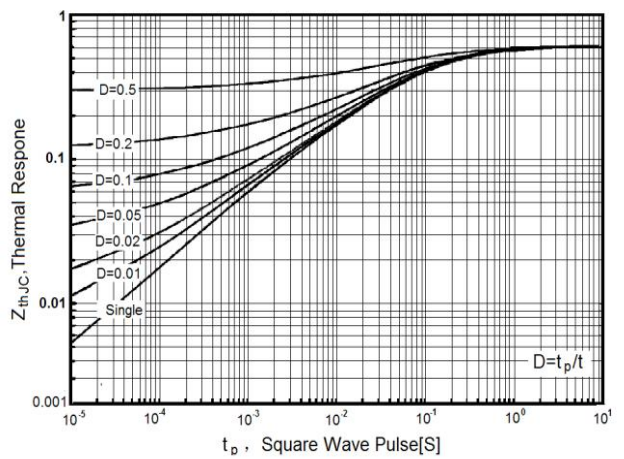
**Figure8.  $BV_{DSS}$  vs Junction Temperature**



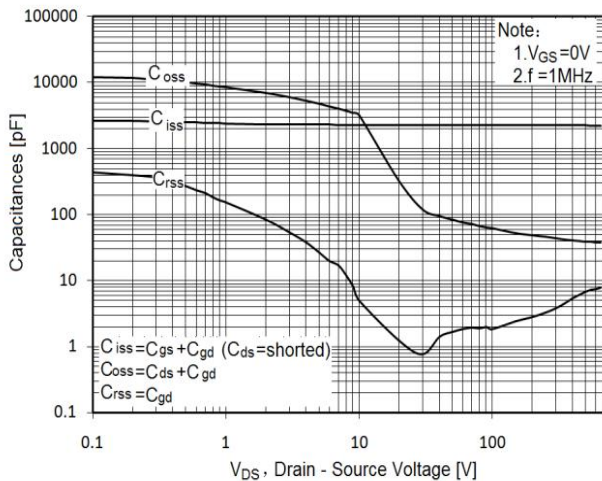
**Figure9. Maximum  $I_D$  vs Junction Temperature**



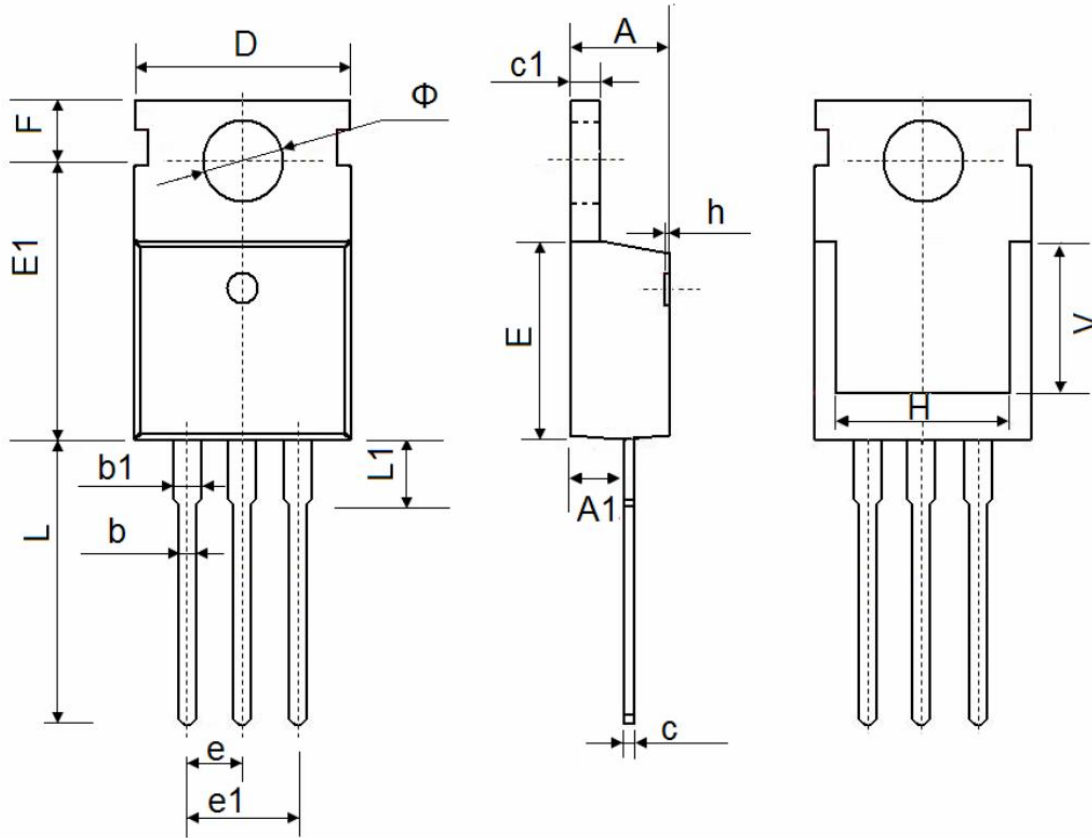
**Figure10. Transient Thermal Impedance**



**Figure11. Capacitance**



### TO-220AB Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.9500	9.750	0.352	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.900	13.400	0.508	0.528
L1	2.850	3.250	0.112	0.128
V	7.500 REF.		0.295 REF.	
Φ	3.400	3.800	0.134	0.150