

# 110N20N-VB TO220 Datasheet

## N-Channel 200 V (D-S) 175 °C MOSFET

PRODUCT SUMMARY	
V <sub>DS</sub> (V)	200
R <sub>DS(on)</sub> Typ. (Ω) at V <sub>GS</sub> = 10 V	0.0076
R <sub>DS(on)</sub> Typ. (Ω) at V <sub>GS</sub> = 7.5 V	0.0086
Q <sub>g</sub> typ. (nC)	58
I <sub>D</sub> (A)	100
Configuration	Single

### FEATURES

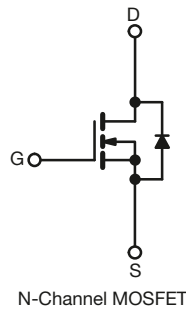
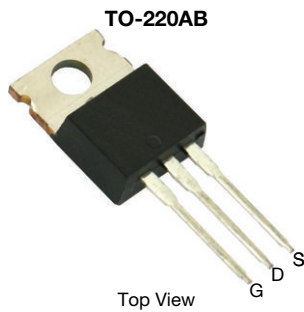
- ThunderFET® power MOSFET
- Maximum 175 °C junction temperature
- 100 % R<sub>g</sub> and UIS tested



RoHS  
COMPLIANT  
HALOGEN  
FREE

### APPLICATIONS

- Power supplies:
  - Uninterruptible power supplies
  - AC/DC switch-mode power supplies
  - Lighting
- Synchronous rectification
- DC/DC converter
- Motor drive switch
- DC/AC inverter
- Solar micro inverter
- Class D audio amplifier



ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		V <sub>DS</sub>	200	V
Gate-source voltage		V <sub>GS</sub>	± 20	
Continuous drain current	T <sub>C</sub> = 25 °C	I <sub>D</sub>	100	A
	T <sub>C</sub> = 125 °C		62	
Pulsed drain current (t = 100 μs)		I <sub>DM</sub>	300	
Continuous source-drain diode current		I <sub>S</sub>	100	
Single pulse avalanche current <sup>a</sup>	L = 0.1 mH	I <sub>AS</sub>	60	
Single pulse avalanche energy <sup>a</sup>		E <sub>AS</sub>	180	mJ
Maximum power dissipation	T <sub>C</sub> = 25 °C	P <sub>D</sub>	375 <sup>b</sup>	W
	T <sub>C</sub> = 125 °C		125 <sup>b</sup>	
Operating junction and storage temperature range		T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C
Soldering recommendations (peak temperature) <sup>c</sup>			260	

THERMAL RESISTANCE RATINGS				
PARAMETER		SYMBOL	LIMIT	UNIT
Junction-to-ambient	PCB mount <sup>c</sup>	R <sub>thJA</sub>	40	°C/W
Junction-to-case (drain)		R <sub>thJC</sub>	0.6	

### Notes

- Package limited.
- Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.
- When mounted on 1" square PCB (FR4 material).

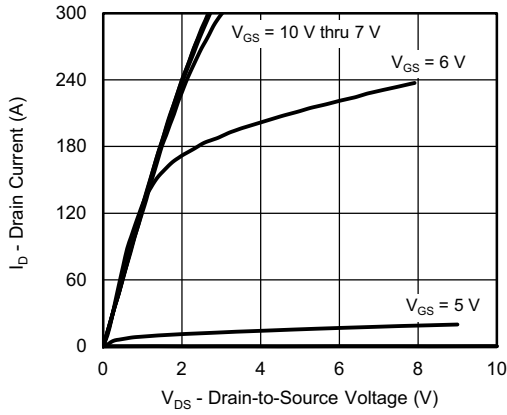
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	200	-	-	V
Gate-source threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	2	-	4	V
Gate-source leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V	-	-	250	nA
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V	-	-	1	μA
		V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C	-	-	150	
		V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175 °C	-	-	5	mA
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 10 V, V <sub>GS</sub> = 10 V	60	-	-	A
Drain-source on-state resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 40 A	-	0.0076	-	Ω
		V <sub>GS</sub> = 7.5 V, I <sub>D</sub> = 40 A	-	0.0086	-	
Forward transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 40 A	-	63	-	S
<b>Dynamic <sup>b</sup></b>						
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	3120	-	pF
Output capacitance	C <sub>oss</sub>		-	280	-	
Reverse transfer capacitance	C <sub>rss</sub>		-	24	-	
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 60 A	-	58	87	nC
Gate-source charge	Q <sub>gs</sub>		-	17.6	-	
Gate-drain charge	Q <sub>gd</sub>		-	17.2	-	
Output charge	Q <sub>oss</sub>	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V	-	108	162	
Gate resistance	R <sub>g</sub>	f = 1 MHz	1.5	3	5	Ω
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 100 V, R <sub>L</sub> = 1.66 Ω, I <sub>D</sub> ≅ 60 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω	-	14	28	ns
Rise time	t <sub>r</sub>		-	125	250	
Turn-off delay time	t <sub>d(off)</sub>		-	27	54	
Fall time	t <sub>f</sub>		-	80	150	
<b>Drain-Source Body Diode Characteristics</b>						
Pulse diode forward current (t = 100 μs)	I <sub>SM</sub>		-	-	240	A
Body diode voltage	V <sub>SD</sub>	I <sub>F</sub> = 30 A, V <sub>GS</sub> = 0 V	-	0.85	1.5	V
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 30 A, dI/dt = 100 A/μs	-	150	300	ns
Body diode reverse recovery charge	Q <sub>rr</sub>		-	0.9	1.8	nC
Reverse recovery fall time	t <sub>a</sub>		-	125	-	ns
Reverse recovery rise time	t <sub>b</sub>		-	25	-	
Body diode peak reverse recovery charge	I <sub>RM(REC)</sub>		-	11.5	20	A

### Notes

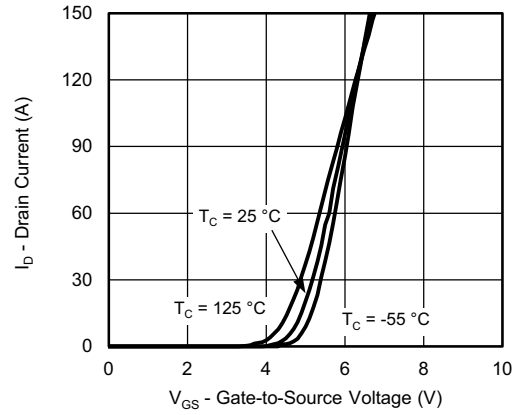
- Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

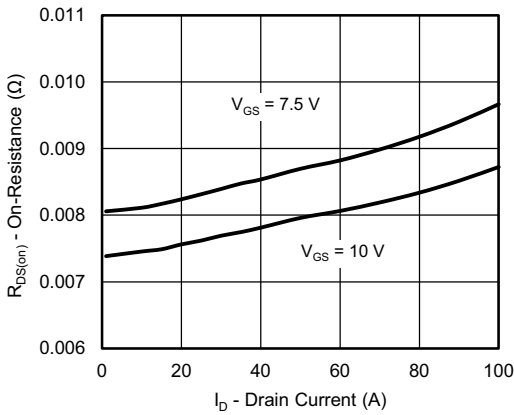
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



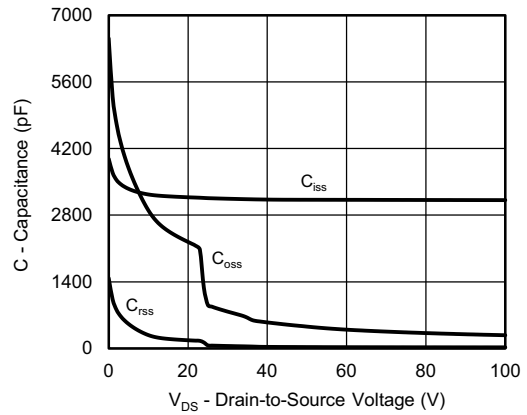
**Output Characteristics**



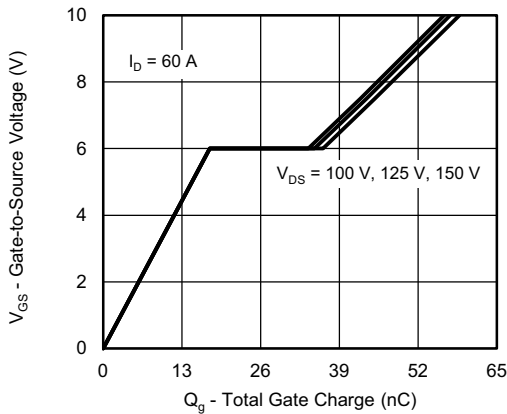
**Transfer Characteristics**



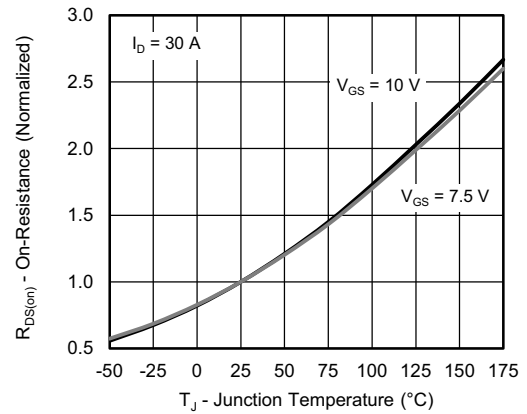
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**

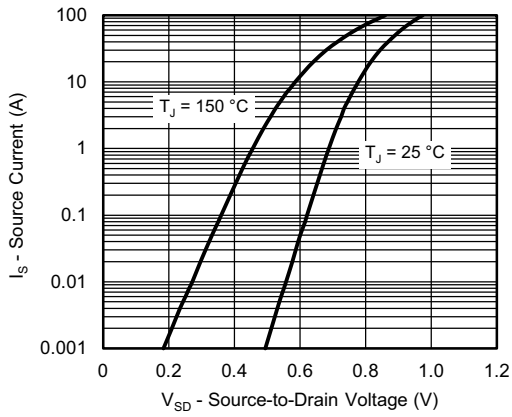


**Gate Charge**

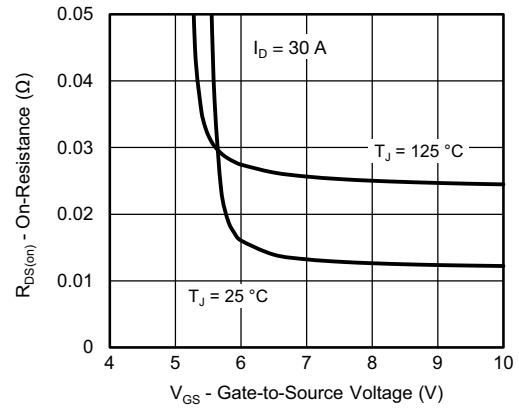


**On-Resistance vs. Junction Temperature**

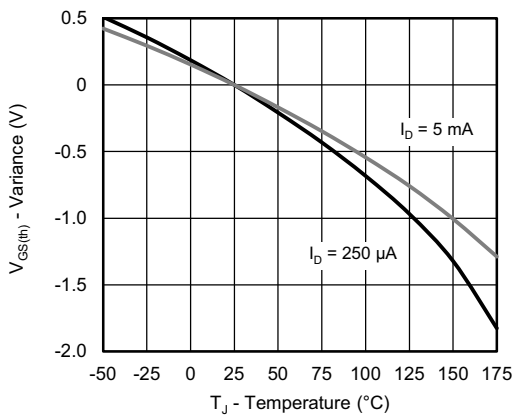
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



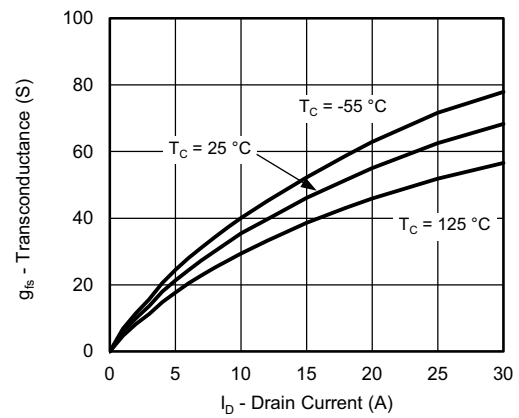
Source-Drain Diode Forward Voltage



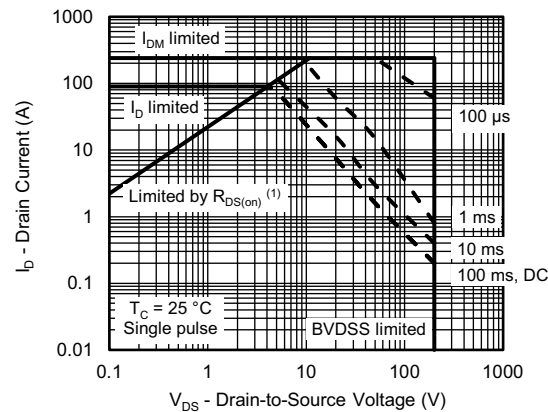
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



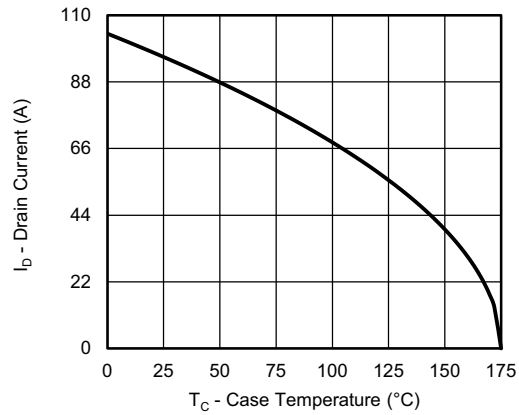
Transconductance



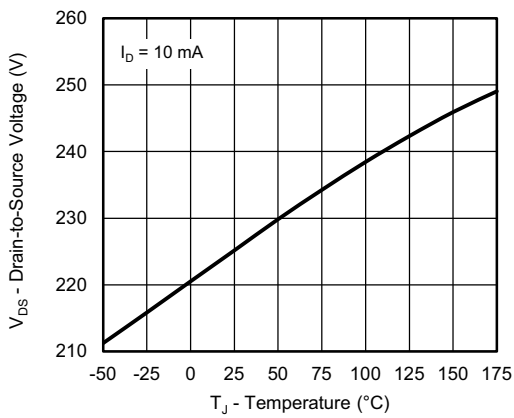
(1)  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

Safe Operating Area, Junction-to-Ambient

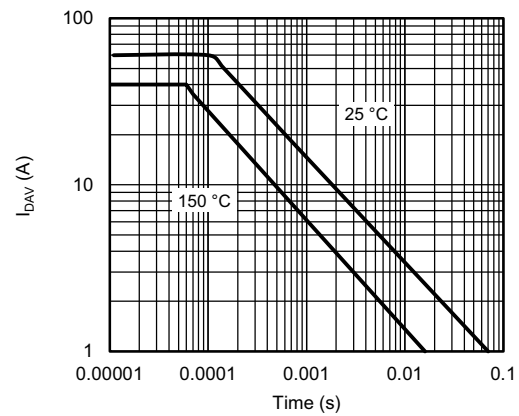
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating <sup>a</sup>



Drain Source Breakdown vs. Junction Temperature

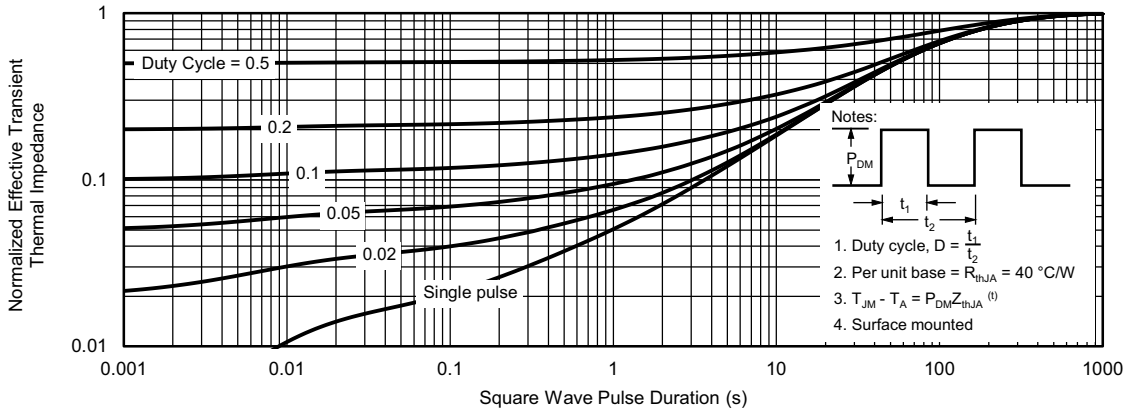


$I_{DAV}$  vs. Time

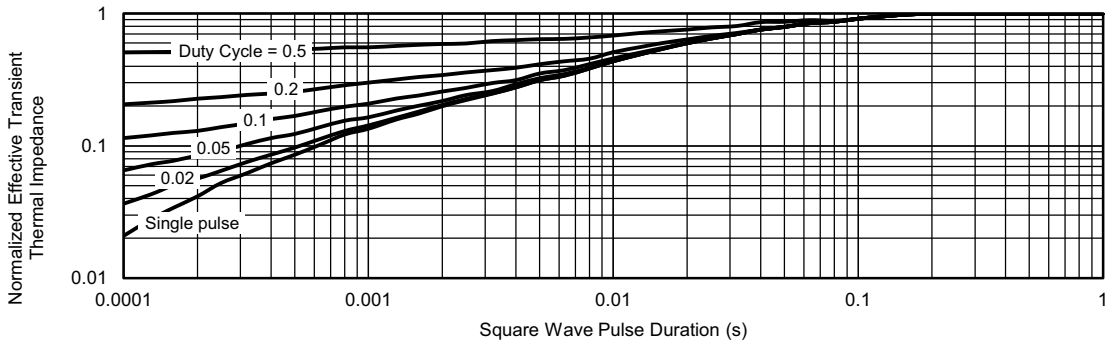
### Note

- The power dissipation  $P_D$  is based on  $T_J$  max. = 25 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

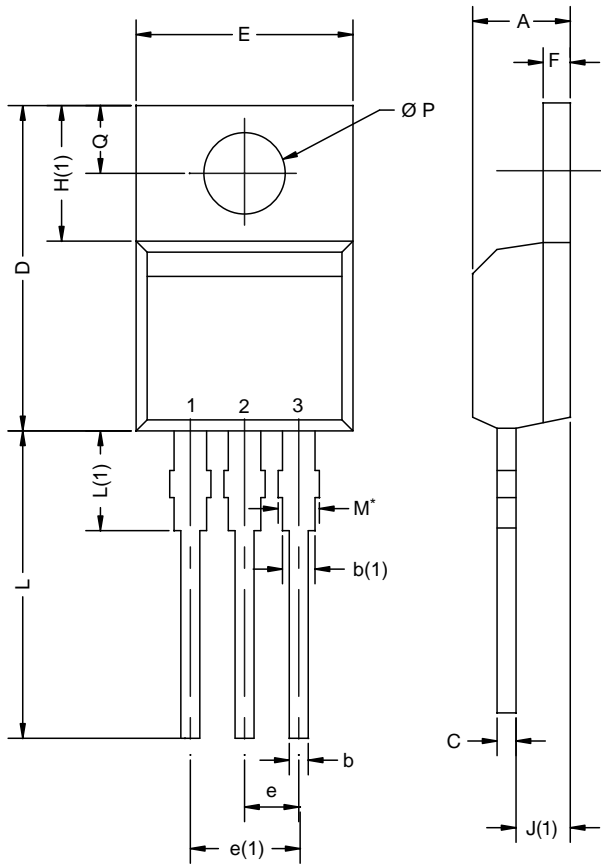


**Normalized Thermal Transient Impedance, Junction-to-Ambient**



**Normalized Thermal Transient Impedance, Junction-to-Case**

TO-220AB



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
Ø P	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118

ECN: X12-0208-Rev. N, 08-Oct-12  
DWG: 5471

Notes

\* M = 1.32 mm to 1.62 mm (dimension including protrusion)  
Heatsink hole for HVM

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