

# NTP6N60, NTB6N60

Preferred Device

Advance Information

## Power MOSFET 6 Amps, 600 Volts N-Channel TO-220 and D<sup>2</sup>PAK

Designed for high voltage, high speed switching applications in power supplies, converters, power motor controls and bridge circuits.

### Features

- Higher Current Rating
- Lower R<sub>DS(on)</sub>
- Lower Capacitances
- Lower Total Gate Charge
- Tighter V<sub>SD</sub> Specifications
- Avalanche Energy Specified

### Typical Applications

- Switch Mode Power Supplies
- PWM Motor Controls
- Converters
- Bridge Circuits

### MAXIMUM RATINGS (T<sub>C</sub> = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DSS</sub>	600	Vdc
Drain-Gate Voltage (R <sub>GS</sub> = 1.0 MΩ)	V <sub>DGR</sub>	600	Vdc
Gate-Source Voltage	V <sub>GS</sub>	±20	Vdc
– Continuous	V <sub>GSM</sub>	±40	
– Non-Repetitive (t <sub>p</sub> ≤ 10 ms)			
Drain	I <sub>D</sub>	6.0	Adc
– Continuous	I <sub>D</sub>	4.8	
– Continuous @ 100°C	I <sub>DM</sub>	21	
– Single Pulse (t <sub>p</sub> ≤ 10 μs)			
Total Power Dissipation	P <sub>D</sub>	142	Watts
Derate above 25°C		1.14	W/°C
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	–55 to 150	°C
Single Drain-to-Source Avalanche Energy – Starting T <sub>J</sub> = 25°C (V <sub>DD</sub> = 100 V, V <sub>GS</sub> = 10 Vdc, I <sub>L</sub> = 6 A, L = 25 mH, R <sub>G</sub> = 25 Ω)	E <sub>AS</sub>	450	mJ
Thermal Resistance	R <sub>θJC</sub>	0.88	°C/W
– Junction-to-Case	R <sub>θJA</sub>	62.5	
– Junction-to-Ambient	R <sub>θJA</sub>	50	
– Junction-to-Ambient (Note 1.)			
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	T <sub>L</sub>	260	°C

1. When surface mounted to an FR4 board using the minimum recommended pad size.

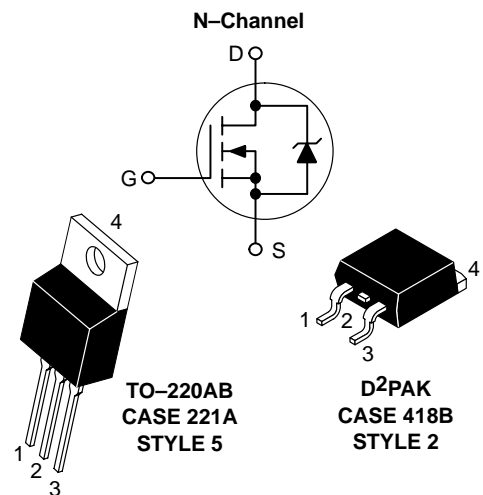
This document contains information on a new product. Specifications and information herein are subject to change without notice.



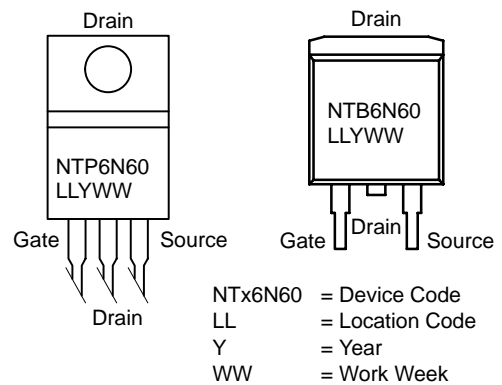
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**6 AMPERES**  
**600 VOLTS**  
**R<sub>DS(on)</sub> = 1200 mΩ**



### MARKING DIAGRAMS AND PIN ASSIGNMENTS



### ORDERING INFORMATION

Device	Package	Shipping
NTP6N60	TO-220AB	50 Units/Rail
NTB6N60	D <sup>2</sup> PAK	50 Units/Rail
NTB6N60T4	D <sup>2</sup> PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

# NTP6N60, NTB6N60

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage (V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 0.25 mAdc) Temperature Coefficient (Positive)	V <sub>(BR)DSS</sub>	600 –	– 715	– –	Vdc mV/°C
Zero Gate Voltage Collector Current (V <sub>DS</sub> = 600 Vdc, V <sub>GS</sub> = 0 Vdc) (V <sub>DS</sub> = 600 Vdc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	I <sub>DSS</sub>	– –	– –	10 100	μAdc
Gate-Body Leakage Current (V <sub>GS</sub> = ±20 Vdc, V <sub>DS</sub> = 0)	I <sub>GSS(f)</sub> I <sub>GSS(r)</sub>	– –	– –	100 100	nAdc

### ON CHARACTERISTICS (Note 2.)

Gate Threshold Voltage I <sub>D</sub> = 0.25 mA, V <sub>DS</sub> = V <sub>GS</sub> Temperature Coefficient (Negative)	V <sub>GS(th)</sub>	2.0 –	2.6 6.6	4.0 –	Vdc mV/°C
Static Drain-to-Source On-Resistance (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 3 Adc)	R <sub>DS(on)</sub>	–	850	1200	mOhm
Drain-to-Source On-Voltage (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 6 Adc) (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 3 Adc, T <sub>J</sub> = 125°C)	V <sub>DS(on)</sub>	– –	– –	8.6 7.9	Vdc
Forward Transconductance (V <sub>DS</sub> = 15 Vdc, I <sub>D</sub> = 3 Adc)	g <sub>FS</sub>	2.0	7.0	–	mhos

### DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>DS</sub> = 25 Vdc, V <sub>GS</sub> = 0 Vdc, f = 1.0 MHz)	C <sub>iss</sub>	–	1190	1670	pF
Output Capacitance		C <sub>oss</sub>	–	350	490	
Transfer Capacitance		C <sub>rss</sub>	–	20	40	

### SWITCHING CHARACTERISTICS (Note 3.)

Turn-On Delay Time	(V <sub>DD</sub> = 300 Vdc, I <sub>D</sub> = 6 Adc, V <sub>GS</sub> = 10 Vdc, R <sub>G</sub> = 9.1 Ω)	t <sub>d(on)</sub>	–	11	20	ns
Rise Time		t <sub>r</sub>	–	10	20	
Turn-Off Delay Time		t <sub>d(off)</sub>	–	34	70	
Fall Time		t <sub>f</sub>	–	19	40	
Gate Charge	(V <sub>DS</sub> = 480 Vdc, I <sub>D</sub> = 6 Adc, V <sub>GS</sub> = 10 Vdc)	Q <sub>T</sub>	–	24	30	nC
		Q <sub>1</sub>	–	6.0	–	
		Q <sub>2</sub>	–	8.0	–	
		Q <sub>3</sub>	–	12	–	

### SOURCE-DRAIN DIODE CHARACTERISTICS

Forward On-Voltage (Note 2.)	(I <sub>S</sub> = 6 Adc, V <sub>GS</sub> = 0 Vdc) (I <sub>S</sub> = 6 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	V <sub>SD</sub>	– –	0.85 0.73	1.0 –	Vdc
Reverse Recovery Time	(I <sub>S</sub> = 6 Adc, V <sub>GS</sub> = 0 Vdc, di <sub>S</sub> /dt = 100 A/μs)	t <sub>rr</sub>	–	440	–	ns
		t <sub>a</sub>	–	130	–	
		t <sub>b</sub>	–	310	–	
Reverse Recovery Stored Charge		Q <sub>R</sub>	–	2.8	–	μC

### INTERNAL PACKAGE INDUCTANCE

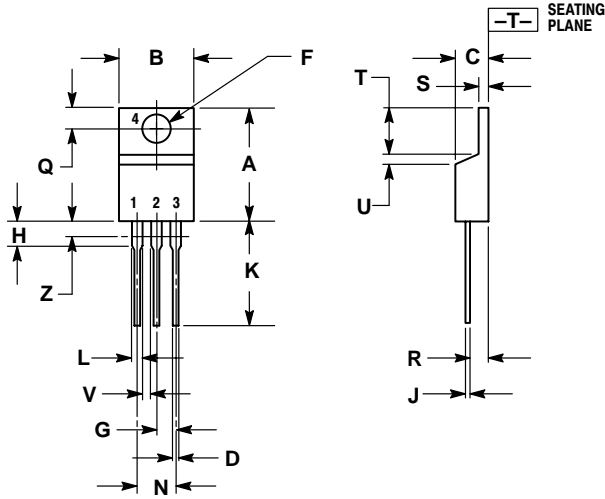
Internal Drain Inductance (Measured from contact screw on tab to center of die) (Measured from the drain lead 0.25" from package to center of die)	L <sub>D</sub>	– –	3.5 4.5	– –	nH
Internal Source Inductance (Measured from the source lead 0.25" from package to source bond pad)	L <sub>S</sub>	–	7.5	–	

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
3. Switching characteristics are independent of operating junction temperature.

# NTP6N60, NTB6N60

## PACKAGE DIMENSIONS

TO-220 THREE-LEAD  
TO-220AB  
CASE 221A-09  
ISSUE AA



NOTES:

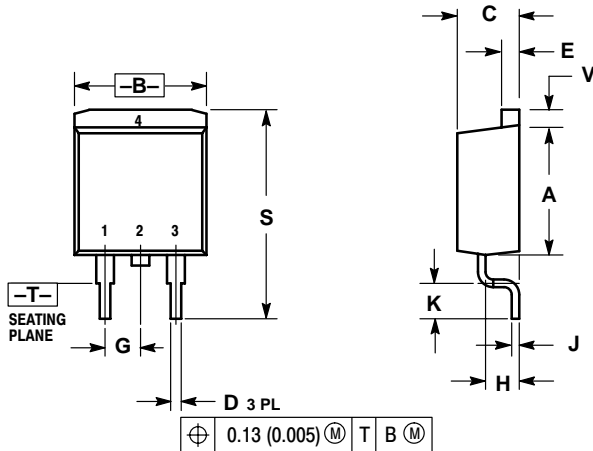
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

STYLE 5:

- PIN 1. GATE  
2. DRAIN  
3. SOURCE  
4. DRAIN

D<sup>2</sup>PAK  
CASE 418B-03  
ISSUE D



NOTES:


1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40

STYLE 2:

- PIN 1. GATE  
2. DRAIN  
3. SOURCE  
4. DRAIN

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