

# NTP60N06, NTB60N06

## Advance Information

### Power MOSFET

### 60 Amps, 60 Volts

### N-Channel TO-220 and D2PAK

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

#### Typical Applications

- Power Supplies
- Converters
- Power Motor Controls
- Bridge Circuits

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

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DS}$	60	Vdc
Drain-to-Gate Voltage ( $R_{GS} = 1.0\text{ M}\Omega$ )	$V_{DGR}$	60	Vdc
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	Vdc
– Continuous	$V_{GS}$	$\pm 20$	
– Non-Repetitive ( $t_p \leq 10\text{ ms}$ )			
Drain Current	$I_D$	60	Adc
– Continuous @ $T_A = 25^\circ\text{C}$	$I_D$	42.3	
– Continuous @ $T_A = 100^\circ\text{C}$	$I_{DM}$	180	Apk
– Single Pulse ( $t_p \leq 10\text{ }\mu\text{s}$ )			
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$P_D$	136.4	W
Derate above $25^\circ\text{C}$		0.91	W/ $^\circ\text{C}$
Total Power Dissipation @ $T_A = 25^\circ\text{C}$		2.4	W
(Note 1.)			
Operating and Storage Temperature Range	$T_J, T_{stg}$	$-55$ to $175$	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy – Starting $T_J = 25^\circ\text{C}$	$E_{AS}$	352	mJ
( $V_{DD} = 50\text{ Vdc}$ , $V_{GS} = 10\text{ Vdc}$ , $L = 0.31\text{ mH}$ , $I_L(\text{pk}) = 47.6\text{ A}$ , $V_{DS} = 60\text{ Vdc}$ )			
Thermal Resistance	$R_{\theta JC}$	1.2	$^\circ\text{C/W}$
– Junction-to-Case	$R_{\theta JA}$	63.2	
– Junction-to-Ambient (Note 1.)			
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	$T_L$	260	$^\circ\text{C}$

1. When surface mounted to an FR4 board using the minimum recommended pad size, (Cu Area  $0.412\text{ in}^2$ ).



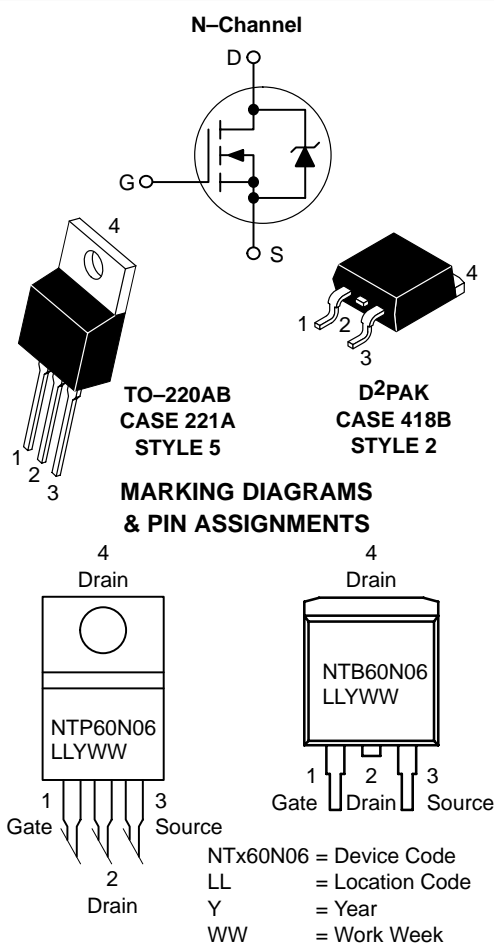
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**60 AMPERES**

**60 VOLTS**

**$R_{DS(on)} = 0.014\text{ }\Omega$**



#### ORDERING INFORMATION

Device	Package	Shipping
NTP60N06	TO-220AB	50 Units/Rail
NTB60N06	D2PAK	50 Units/Rail
NTB60N06T4	D2PAK	800/Tape & Reel

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

# NTP60N06, NTB60N06

## 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 (Note 2.) (V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 250 μAdc) Temperature Coefficient (Positive)	V <sub>(BR)DSS</sub>	60 –	72.3 69.8	– –	Vdc mV/°C
Zero Gate Voltage Drain Current (V <sub>DS</sub> = 60 Vdc, V <sub>GS</sub> = 0 Vdc) (V <sub>DS</sub> = 60 Vdc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 150°C)	I <sub>DSS</sub>	– –	– –	1.0 10	μAdc
Gate-Body Leakage Current (V <sub>GS</sub> = ±20 Vdc, V <sub>DS</sub> = 0 Vdc)	I <sub>GSS</sub>	–	–	±100	nAdc

### ON CHARACTERISTICS (Note 2.)

Gate Threshold Voltage (Note 2.) (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μAdc) Threshold Temperature Coefficient (Negative)	V <sub>GS(th)</sub>	2.0 –	2.85 8.0	4.0 –	Vdc mV/°C
Static Drain-to-Source On-Resistance (Note 2.) (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 30 Adc)	R <sub>DS(on)</sub>	–	11.5	14	mΩ
Static Drain-to-Source On-Resistance (Note 2.) (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 60 Adc) (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 30 Adc, T <sub>J</sub> = 150°C)	V <sub>DS(on)</sub>	– –	0.715 1.43	– –	Vdc
Forward Transconductance (Note 2.) (V <sub>DS</sub> = 8.0 Vdc, I <sub>D</sub> = 12 Adc)	g <sub>FS</sub>	–	–	–	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>	–	2300	3220	pF
Output Capacitance		C <sub>oss</sub>	–	660	925	
Transfer Capacitance		C <sub>rss</sub>	–	144	300	

### SWITCHING CHARACTERISTICS (Note 3.)

Turn-On Delay Time	(V <sub>DD</sub> = 30 Vdc, I <sub>D</sub> = 60 Adc, V <sub>GS</sub> = 10 Vdc, R <sub>G</sub> = 9.1 Ω) (Note 2.)	t <sub>d(on)</sub>	–	25.5	50	ns
Rise Time		t <sub>r</sub>	–	180.7	360	
Turn-Off Delay Time		t <sub>d(off)</sub>	–	94.5	200	
Fall Time		t <sub>f</sub>	–	142.5	300	
Gate Charge	(V <sub>DS</sub> = 48 Vdc, I <sub>D</sub> = 60 Adc, V <sub>GS</sub> = 10 Vdc) (Note 2.)	Q <sub>T</sub>	–	62	81	nC
		Q <sub>1</sub>	–	10.8	–	
		Q <sub>2</sub>	–	29.4	–	

### SOURCE-DRAIN DIODE CHARACTERISTICS

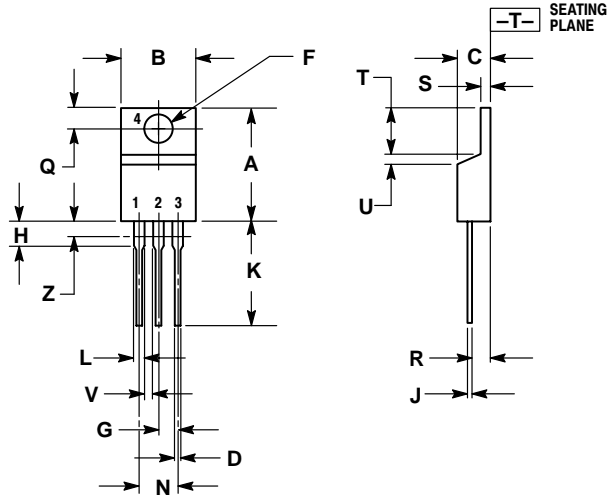
Forward On-Voltage	(I <sub>S</sub> = 60 Adc, V <sub>GS</sub> = 0 Vdc) (Note 2.) (I <sub>S</sub> = 45 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 150°C)	V <sub>SD</sub>	– –	0.99 0.87	1.05 –	Vdc
Reverse Recovery Time	(I <sub>S</sub> = 60 Adc, V <sub>GS</sub> = 0 Vdc, di <sub>S</sub> /dt = 100 A/μs) (Note 2.)	t <sub>rr</sub>	–	64.9	–	ns
		t <sub>a</sub>	–	44.1	–	
		t <sub>b</sub>	–	20.8	–	
Reverse Recovery Stored Charge		Q <sub>RR</sub>	–	0.146	–	μC

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

# NTP60N06, NTB60N06

## PACKAGE DIMENSIONS

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



#### NOTES:

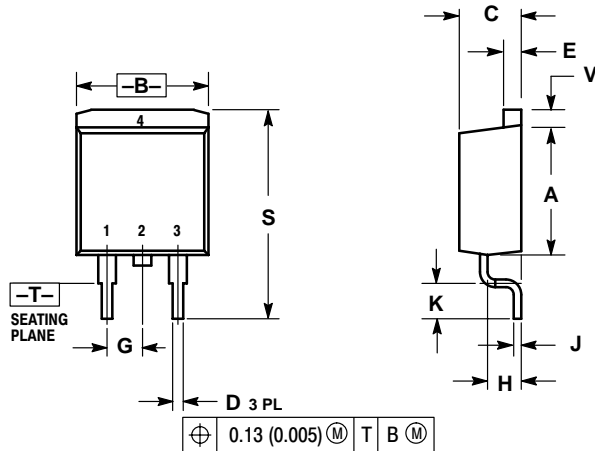
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

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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