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# NTB23N03R

## Power MOSFET 23 Amps, 25 Volts N-Channel D<sup>2</sup>PAK

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

### Features

- Pb-Free Packages are Available

### Typical Applications

- Planar HD3e Process for Fast Switching Performance
- Low  $R_{DS(on)}$  to Minimize Conduction Loss
- Low  $C_{iss}$  to Minimize Driver Loss
- Low Gate Charge
- Optimized for High Side Switching Requirements in High-Efficiency DC-DC Converters

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	25	Vdc
Gate-to-Source Voltage - Continuous	$V_{GS}$	$\pm 20$	Vdc
Drain Current - Continuous @ $T_A = 25^\circ\text{C}$ , Limited by Chip - Continuous @ $T_A = 25^\circ\text{C}$ , Limited by Package - Single Pulse ( $t_p = 10 \mu\text{s}$ )	$I_D$ $I_D$ $I_{DM}$	23 6.0 60	A
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$P_D$	37.5	W
Operating and Storage Temperature Range	$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$
Thermal Resistance - Junction-to-Case	$R_{\theta JC}$	3.3	$^\circ\text{C/W}$
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	$T_L$	260	$^\circ\text{C}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

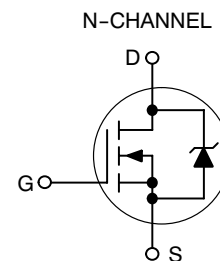


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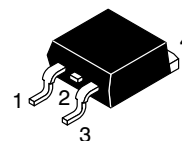
<http://onsemi.com>

**23 AMPERES, 25 VOLTS**

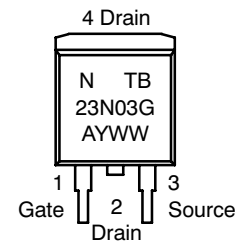
**$R_{DS(on)} = 32 \text{ m}\Omega$  (Typ)**



### MARKING DIAGRAM & PIN ASSIGNMENTS



**D<sup>2</sup>PAK  
CASE 418B  
STYLE 2**



NTB23N03 = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

# NTB23N03R

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

Characteristics	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Drain-to-Source Breakdown Voltage (Note 1) (V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 250 μAdc) Temperature Coefficient (Positive)	V <sub>(br)DSS</sub>	25 -	28 -	- -	Vdc mV/°C
Zero Gate Voltage Drain Current (V <sub>DS</sub> = 20 Vdc, V <sub>GS</sub> = 0 Vdc) (V <sub>DS</sub> = 20 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 1)

Gate Threshold Voltage (Note 1) (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μAdc) Threshold Temperature Coefficient (Negative)	V <sub>GS(th)</sub>	1.0 -	1.8 -	2.0 -	Vdc mV/°C
Static Drain-to-Source On-Resistance (Note 1) (V <sub>GS</sub> = 4.5 Vdc, I <sub>D</sub> = 6 Adc) (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 6 Adc)	R <sub>DS(on)</sub>	- -	50.3 32.3	60 45	mΩ
Forward Transconductance (Note 1) (V <sub>DS</sub> = 10 Vdc, I <sub>D</sub> = 6 Adc)	g <sub>FS</sub>	-	14	-	Mhos

## DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>DS</sub> = 20 Vdc, V <sub>GS</sub> = 0 V, f = 1 MHz)	C <sub>iss</sub>	-	225	-	pF
Output Capacitance		C <sub>oss</sub>	-	108	-	
Transfer Capacitance		C <sub>rss</sub>	-	48	-	

## SWITCHING CHARACTERISTICS (Note 2)

Turn-On Delay Time	(V <sub>GS</sub> = 10 Vdc, V <sub>DD</sub> = 10 Vdc, I <sub>D</sub> = 6 Adc, R <sub>G</sub> = 3 Ω)	t <sub>d(on)</sub>	-	2.0	-	ns
Rise Time		t <sub>r</sub>	-	14.9	-	
Turn-Off Delay Time		t <sub>d(off)</sub>	-	9.9	-	
Fall Time		t <sub>f</sub>	-	2.0	-	
Gate Charge	(V <sub>GS</sub> = 4.5 Vdc, I <sub>D</sub> = 6 Adc, V <sub>DS</sub> = 10 Vdc) (Note 1)	Q <sub>T</sub>	-	3.76	-	nC
		Q <sub>1</sub>	-	1.7	-	
		Q <sub>2</sub>	-	1.6	-	

## SOURCE-DRAIN DIODE CHARACTERISTICS

Forward On-Voltage	(I <sub>S</sub> = 6 Adc, V <sub>GS</sub> = 0 Vdc) (Note 1) (I <sub>S</sub> = 6 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	V <sub>SD</sub>	- -	0.87 0.74	1.2 -	Vdc
Reverse Recovery Time	(I <sub>S</sub> = 6 Adc, V <sub>GS</sub> = 0 Vdc, di <sub>S</sub> /dt = 100 A/μs) (Note 1)	t <sub>rr</sub>	-	8.7	-	ns
		t <sub>a</sub>	-	5.2	-	
		t <sub>b</sub>	-	3.5	-	
Reverse Recovery Stored Charge		Q <sub>RR</sub>	-	0.003	-	μC

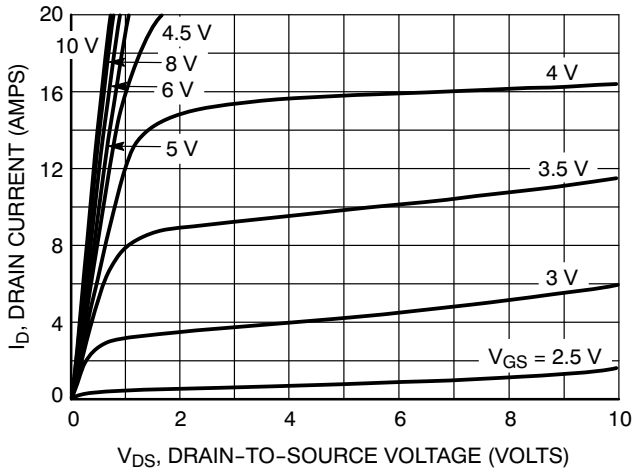
1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
2. Switching characteristics are independent of operating junction temperatures.

## ORDERING INFORMATION

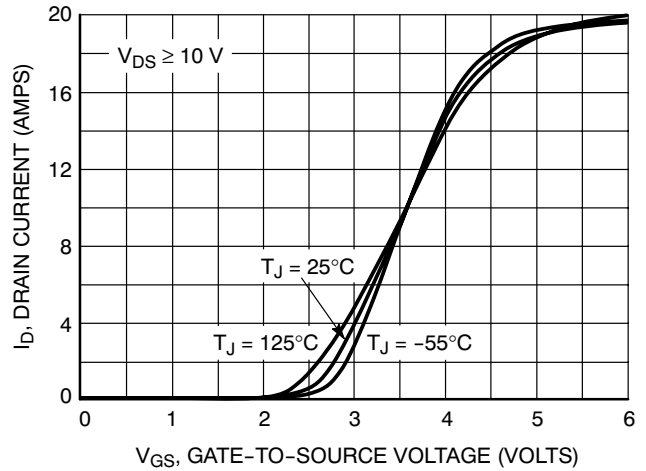
Device	Package	Shipping†
NTB23N03R	D <sup>2</sup> PAK	50 Units / Rail
NTB23N03RG	D <sup>2</sup> PAK (Pb-Free)	50 Units / Rail
NTB23N03RT4	D <sup>2</sup> PAK	800 Units / Tape & Reel
NTB23N03RT4G	D <sup>2</sup> PAK (Pb-Free)	800 Units / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

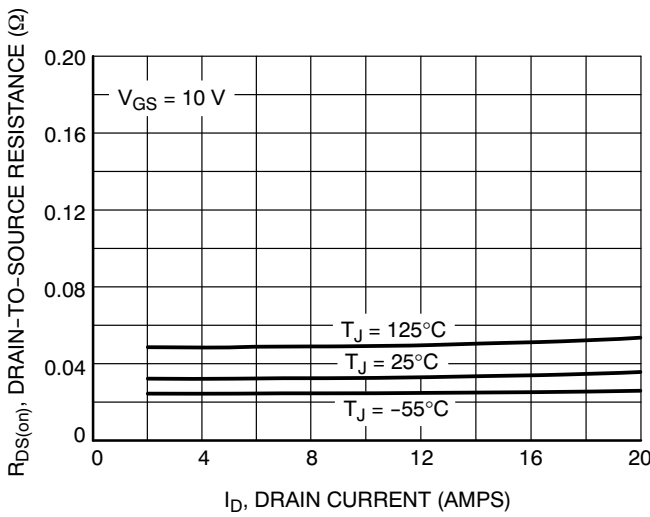
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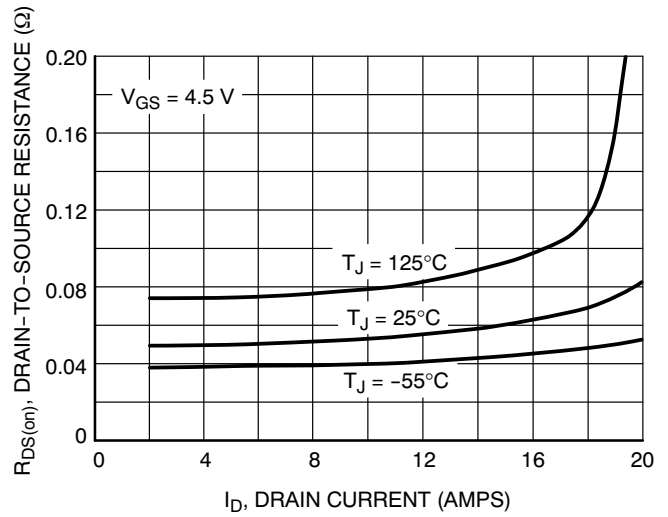
**Figure 1. On-Region Characteristics**



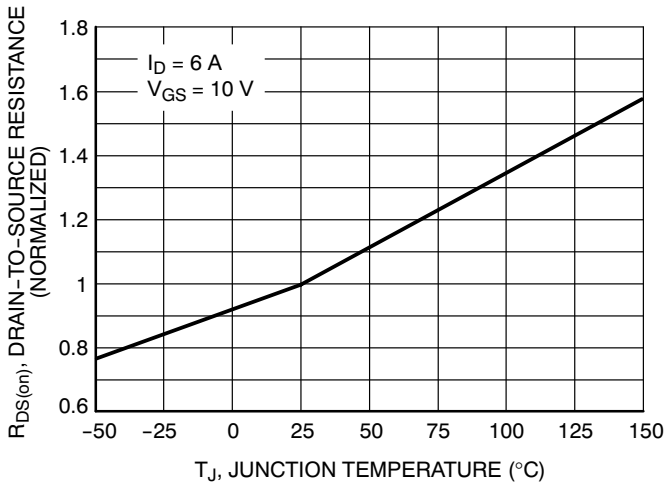
**Figure 2. Transfer Characteristics**



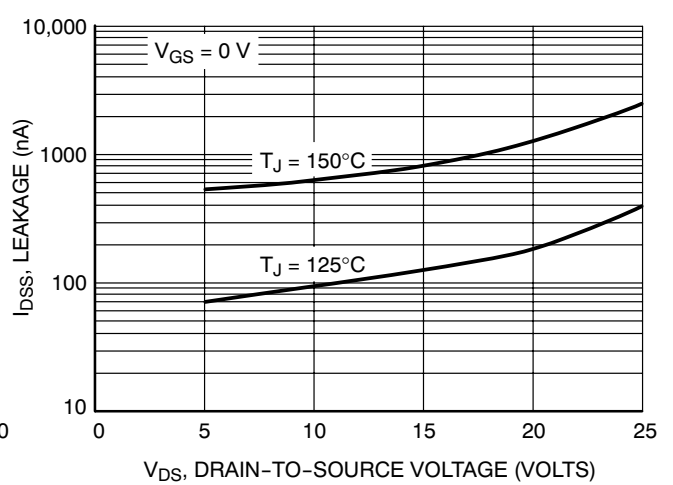
**Figure 3. On-Resistance versus Drain Current and Temperature**



**Figure 4. On-Resistance versus Drain Current and Temperature**

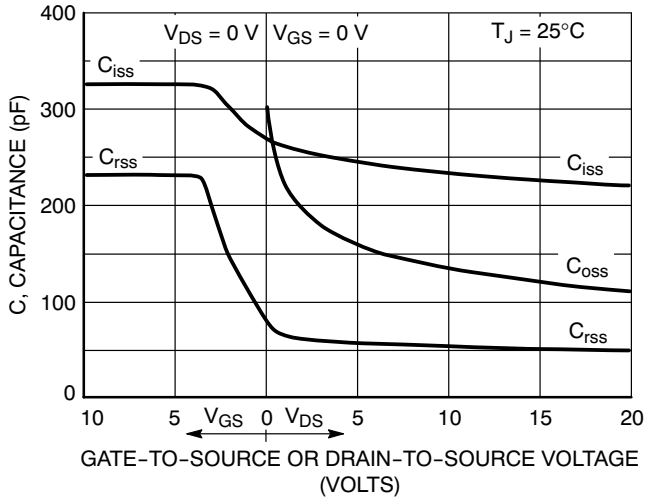


**Figure 5. On-Resistance Variation with Temperature**

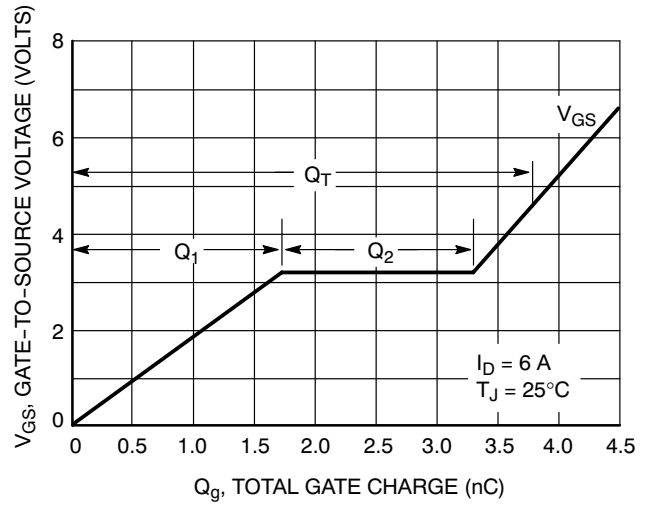


**Figure 6. Drain-to-Source Leakage Current versus Voltage**

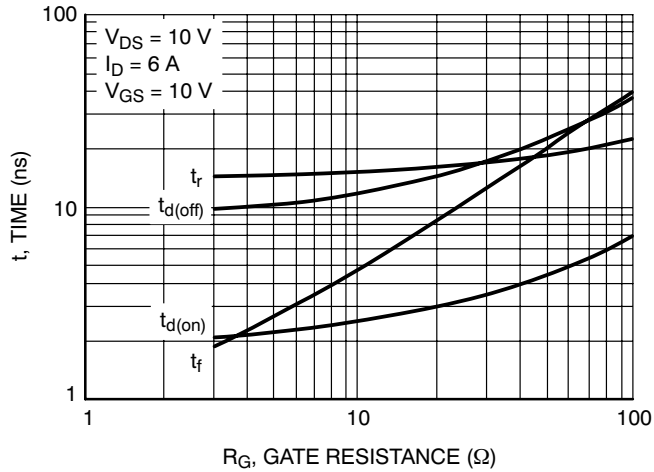
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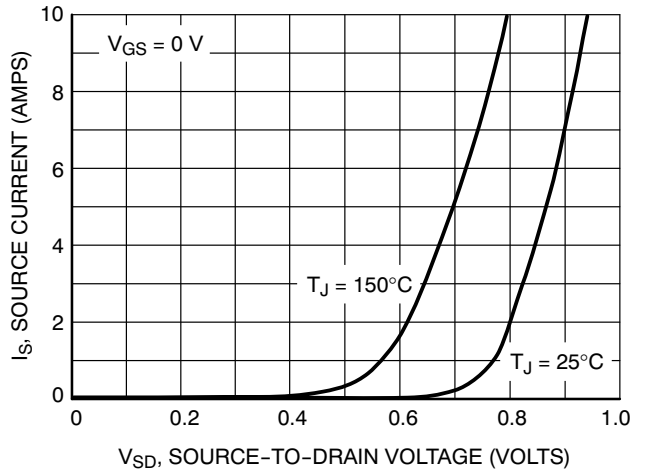
**Figure 7. Capacitance Variation**



**Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge**



**Figure 9. Resistive Switching Time Variation versus Gate Resistance**

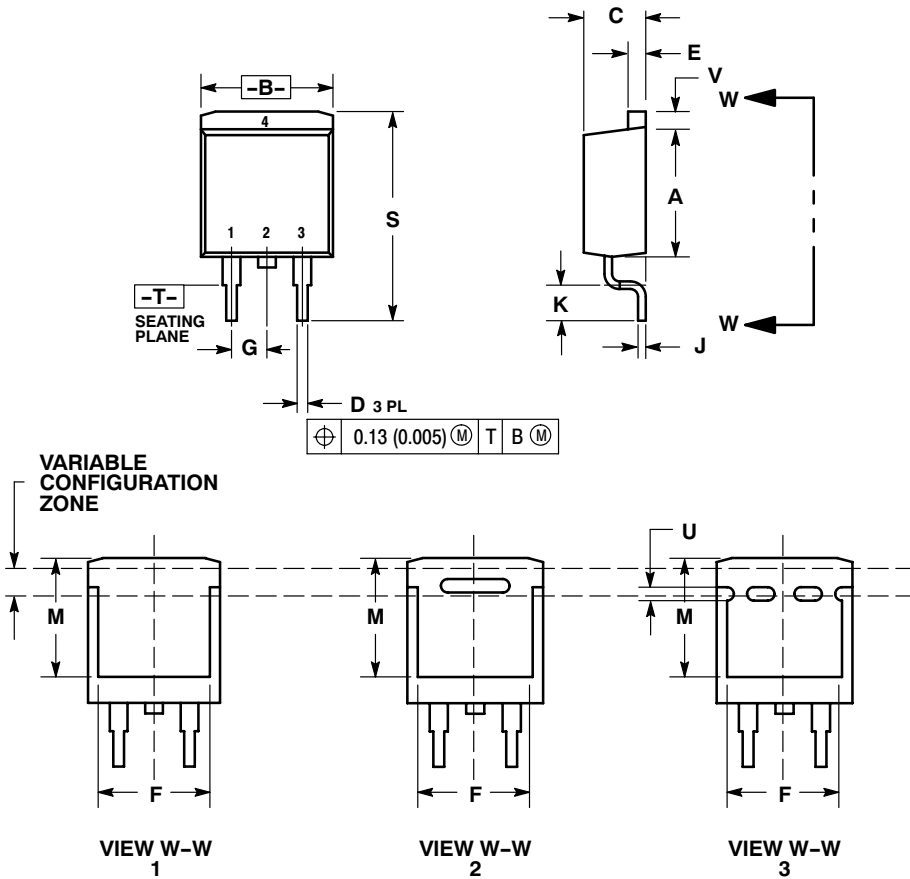


**Figure 10. Diode Forward Voltage versus Current**

# NTB23N03R

## PACKAGE DIMENSIONS

D<sup>2</sup>PAK  
CASE 418AA-01  
ISSUE O

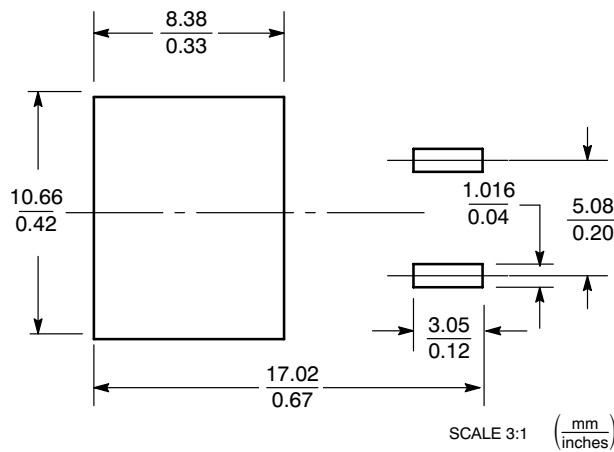


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

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	0.036	0.51	0.92
E	0.045	0.055	1.14	1.40
F	0.310	---	7.87	---
G	0.100 BSC	---	2.54 BSC	---
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
M	0.280	---	7.11	---
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

### SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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