

# 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	$V_{DS}$	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	$^\circ\text{C}$

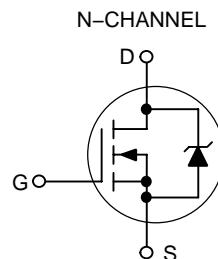
Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.



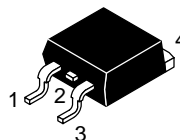
ON Semiconductor®

<http://onsemi.com>

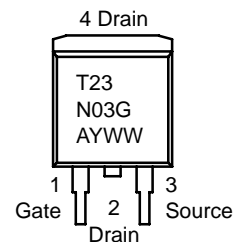
**23 AMPERES, 25 VOLTS**  
 **$R_{DS(on)} = 32 \text{ m}\Omega$  (Typ)**



### MARKING DIAGRAM & PIN ASSIGNMENTS



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



T23N03 = 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
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage (Note 1) (V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 250 $\mu$ Adc) 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	$\mu$ Adc
Gate-Body Leakage Current (V <sub>GS</sub> = $\pm$ 20 Vdc, V <sub>DS</sub> = 0 Vdc)	I <sub>GSS</sub>	–	–	$\pm$ 100	nAdc

### ON CHARACTERISTICS (Note 1)

Gate Threshold Voltage (Note 1) (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 $\mu$ Adc) 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	m $\Omega$
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 $\Omega$ )	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/ $\mu$ s) (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	–	$\mu$ C

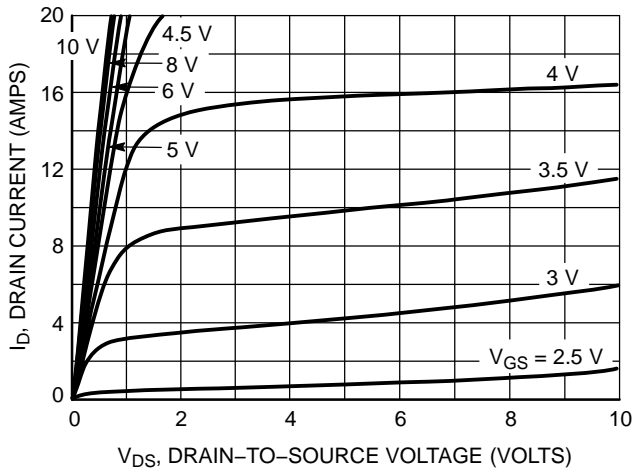
1. Pulse Test: Pulse Width  $\leq$  300  $\mu$ s, Duty Cycle  $\leq$  2%.
2. Switching characteristics are independent of operating junction temperatures.

### ORDERING INFORMATION

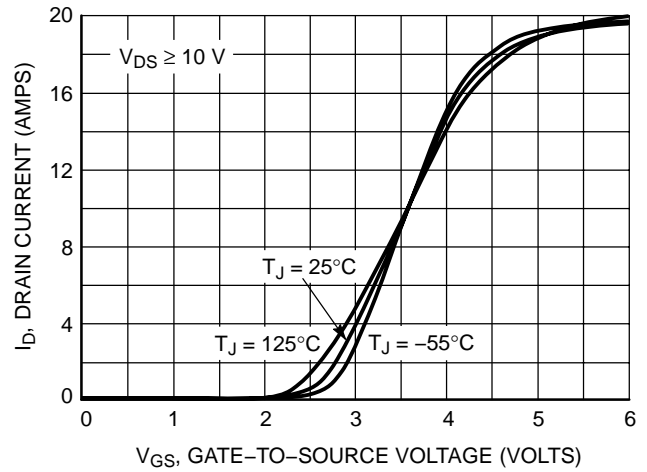
Device	Package	Shipping <sup>†</sup>
NTB23N03R	D <sup>2</sup> PAK	50 Units / Rail
NTB23N03RG	D <sup>2</sup> PAK (Pb-Free)	50 Units / Rail
NTB23N03RT4	D <sup>2</sup> PAK	800 Units / Tape & Reel
NTB23N03RT4G	D <sup>2</sup> PAK (Pb-Free)	800 Units / Tape & Reel

<sup>†</sup>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.

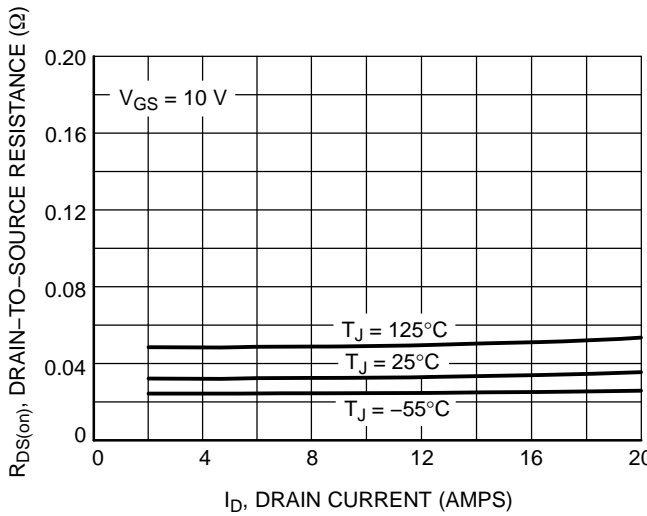
# NTB23N03R



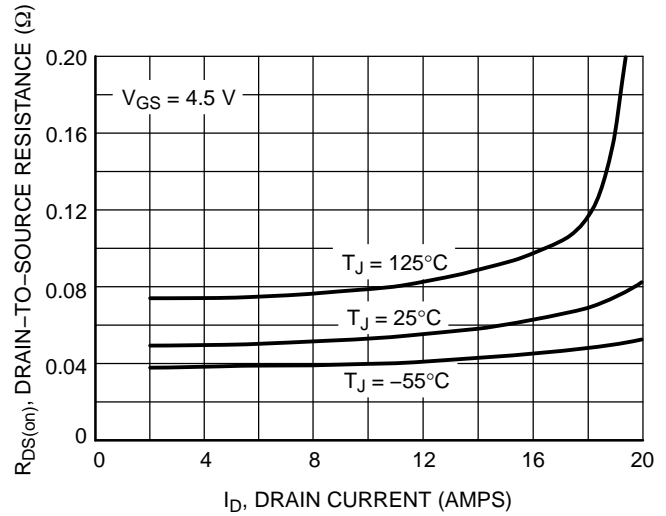
**Figure 1. On-Region Characteristics**



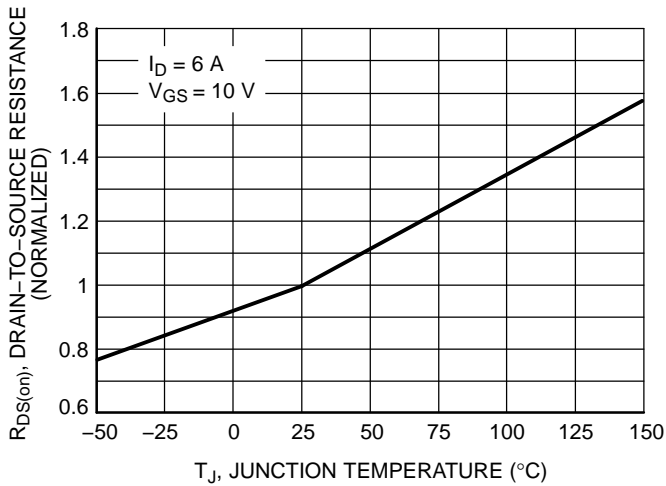
**Figure 2. Transfer Characteristics**



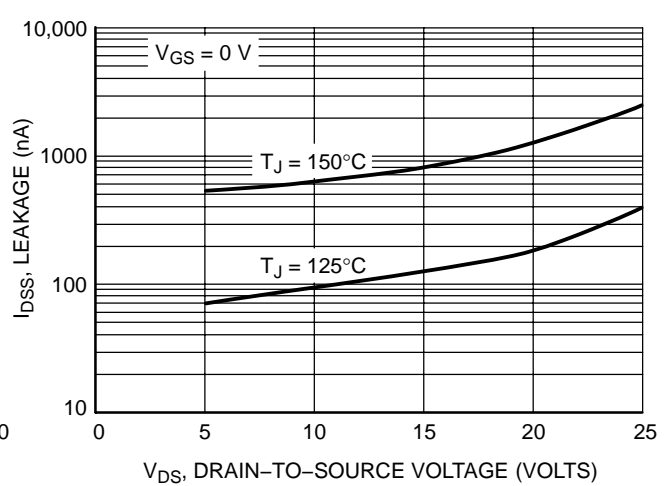
**Figure 3. On-Resistance versus Drain Current and Temperature**



**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**

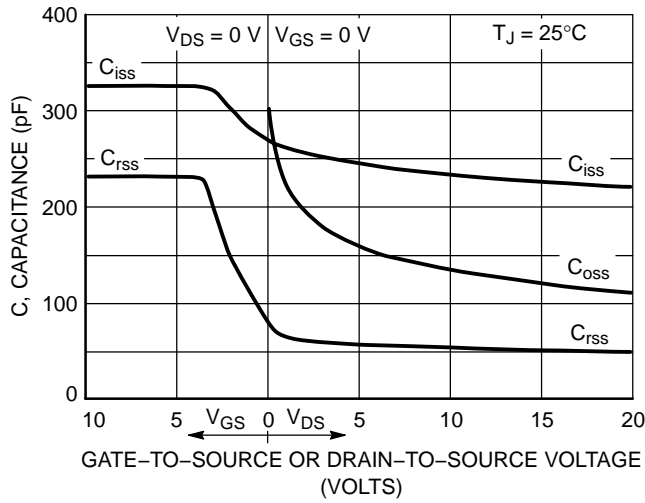


Figure 7. Capacitance Variation

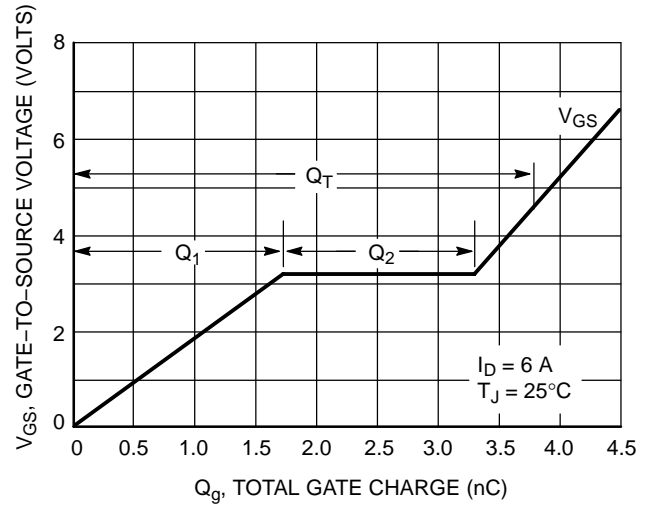


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

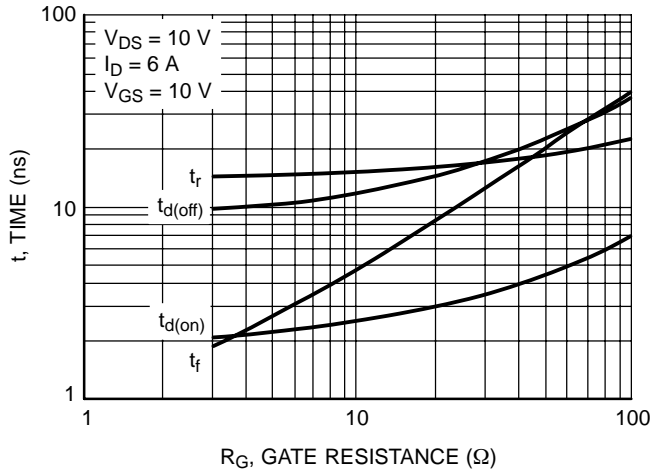


Figure 9. Resistive Switching Time Variation versus Gate Resistance

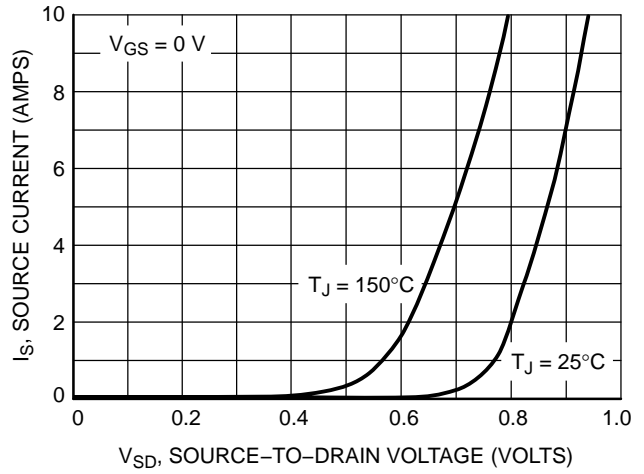
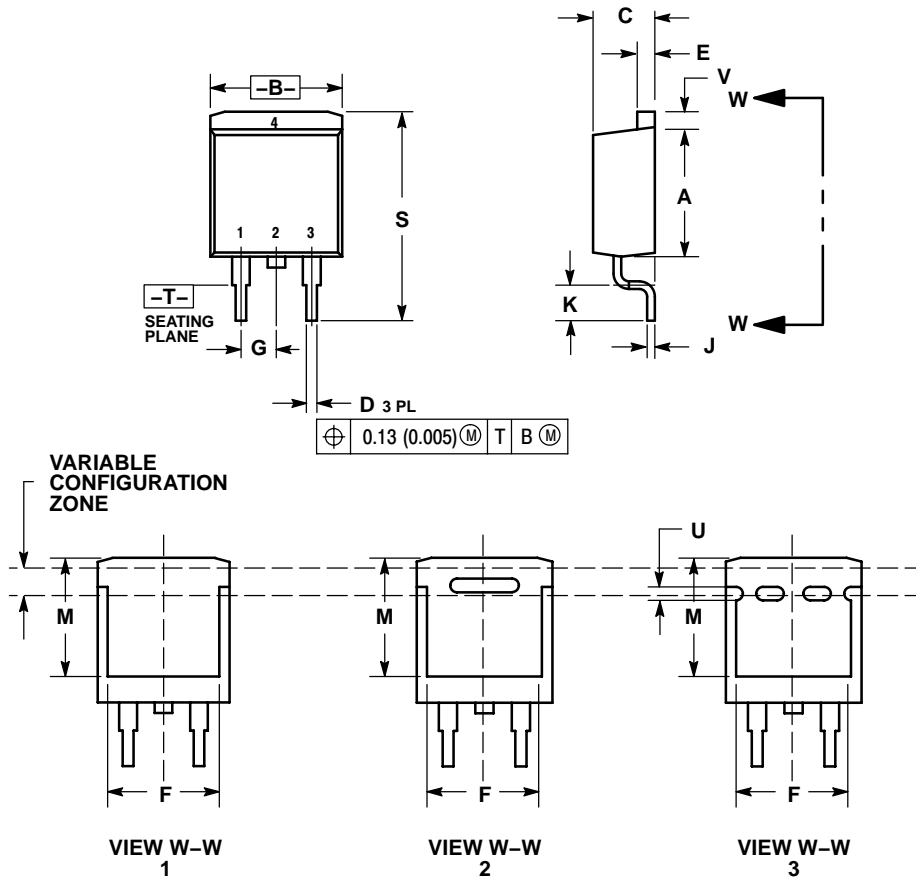


Figure 10. Diode Forward Voltage versus Current

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## PACKAGE DIMENSIONS

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

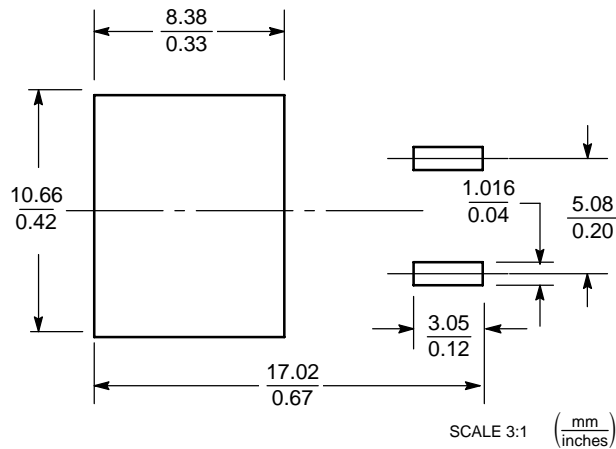


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.


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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