

NTD78N03R

Power MOSFET 25 V, 85 A, Single N-Channel, DPAK



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Features

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Optimized Gate Charge to Minimize Switching Losses
- Pb-Free Packages are Available

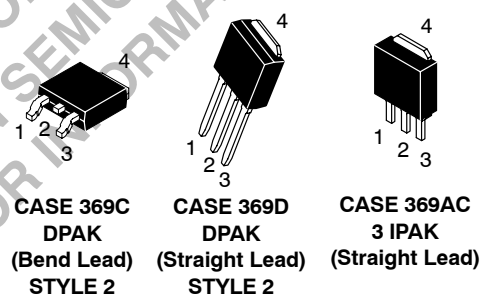
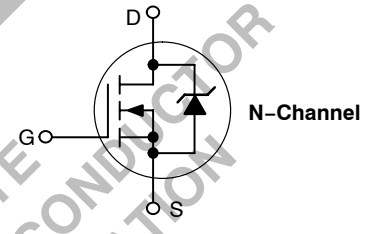
Applications

- VCORE Applications
- DC-DC Converters
- Optimized for Low Side Switching

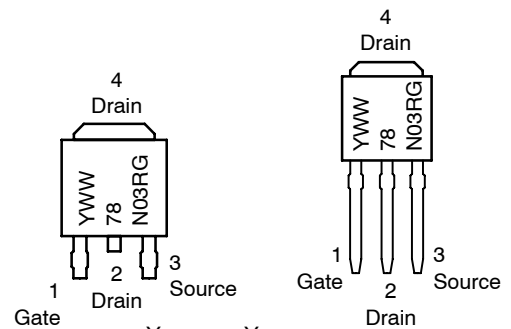
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
25 V	5.0 @ 11.5 V	85 A
	7.5 @ 4.5 V	

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

Parameter	Symbol	Value	Unit	
Drain-to-Source Voltage	V_{DSS}	25	V	
Gate-to-Source Voltage	V_{GS}	± 20	V	
Continuous Drain Current ($R_{\theta JA}$) (Note 1)	I_D	$T_A = 25^\circ\text{C}$	14.7	A
		$T_A = 85^\circ\text{C}$	11.4	
Power Dissipation ($R_{\theta JA}$) (Note 1)	P_D	$T_A = 25^\circ\text{C}$	2.3	W
		$T_A = 85^\circ\text{C}$		
Continuous Drain Current ($R_{\theta JA}$) (Note 2)	I_D	$T_A = 25^\circ\text{C}$	11.3	A
		$T_A = 85^\circ\text{C}$	8.8	
Power Dissipation ($R_{\theta JA}$) (Note 2)	P_D	$T_A = 25^\circ\text{C}$	1.4	W
		$T_A = 85^\circ\text{C}$		
Continuous Drain Current ($R_{\theta JC}$)	I_D	$T_C = 25^\circ\text{C}$	85	A
		$T_C = 85^\circ\text{C}$	66	
Power Dissipation ($R_{\theta JC}$)	P_D	$T_C = 25^\circ\text{C}$	76.9	W
		$T_C = 85^\circ\text{C}$		
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	I_{DM}	98	A
Current Limited by Package	$T_A = 25^\circ\text{C}$	$I_{DmaxPkg}$	32	A
Operating Junction and Storage Temperature	T_J, T_{stg}	-55 to 175	$^\circ\text{C}$	
Source Current (Body Diode)	I_S	77	A	
Drain to Source dV/dt	dV/dt	8.0	V/ns	
Single Pulse Drain-to-Source Avalanche Energy ($V_{DD} = 24 \text{ V}, V_{GS} = 10 \text{ V}, L = 5.0 \text{ mH}, I_L(pk) = 5.5 \text{ A}, R_G = 25 \Omega$)	E_{AS}	75	mJ	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	T_L	260	$^\circ\text{C}$	



MARKING DIAGRAMS & PIN ASSIGNMENTS



Y = Year
 WW = Work Week
 78N03R = Device Code
 G = Pb-Free Package

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.

1. Surface-mounted on FR4 board using 1 in sq pad size, 1 oz Cu.
2. Surface-mounted on FR4 board using the minimum recommended pad size.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

NTD78N03R

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	1.95	°C/W
Junction-to-Ambient - Steady State (Note 3)	$R_{\theta JA}$	65	
Junction-to-Ambient - Steady State (Note 4)	$R_{\theta JA}$	110	

ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	25			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			10		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 20\text{ V}$	$T_J = 25^\circ\text{C}$		1.5	μA
			$T_J = 125^\circ\text{C}$		10	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA

ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.0	1.7	3.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			-5.3		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V to } 11.5\text{ V}$	$I_D = 30\text{ A}$	5.0	5.8	m Ω
			$I_D = 15\text{ A}$	4.9	5.7	
		$V_{GS} = 4.5\text{ V}$	$I_D = 30\text{ A}$	7.5	9.0	
			$I_D = 15\text{ A}$	7.2	8.5	
Forward Transconductance	g_{FS}	$V_{DS} = 15\text{ V}, I_D = 10\text{ A}$		23		S

CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 12\text{ V}$		1794		pF
Output Capacitance	C_{oss}			882		
Reverse Transfer Capacitance	C_{rss}			373		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 20\text{ V}, I_D = 20\text{ A}$		19.4	24	nC
Threshold Gate Charge	$Q_{G(TH)}$			0.8		
Gate-to-Source Charge	Q_{GS}			2.9		
Gate-to-Drain Charge	Q_{GD}			12.4		

SWITCHING CHARACTERISTICS (Note 6)

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 20\text{ V}, I_D = 20\text{ A}, R_G = 2.5\ \Omega$		11		ns
Rise Time	t_r			75		
Turn-Off Delay Time	$t_{d(off)}$			18		
Fall Time	t_f			17		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 30\text{ A}$	$T_J = 25^\circ\text{C}$		0.8	1.0	V
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, I_S = 20\text{ A}$			38		ns
Charge Time	t_a				16.5		
Discharge Time	t_b				22		
Reverse Recovery Time	Q_{RR}				31		nC

- Surface-mounted on FR4 board using 1 in sq pad size, 1 oz Cu.
- Surface-mounted on FR4 board using the minimum recommended pad size.
- Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.
- Switching characteristics are independent of operating junction temperatures.

NTD78N03R

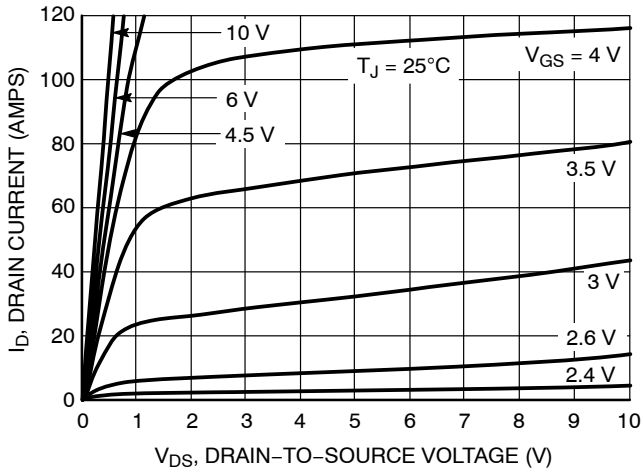


Figure 1. On-Region Characteristics

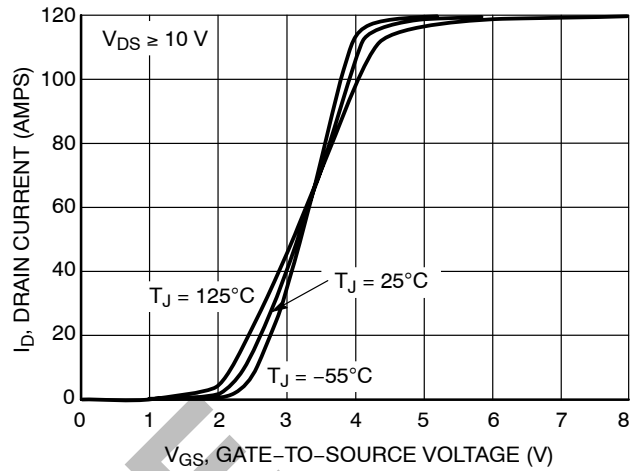


Figure 2. Transfer Characteristics

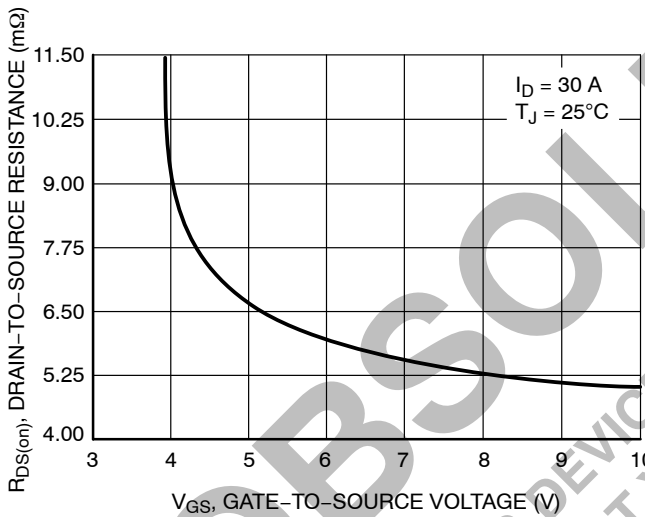


Figure 3. On-Resistance versus Gate-to-Source Voltage

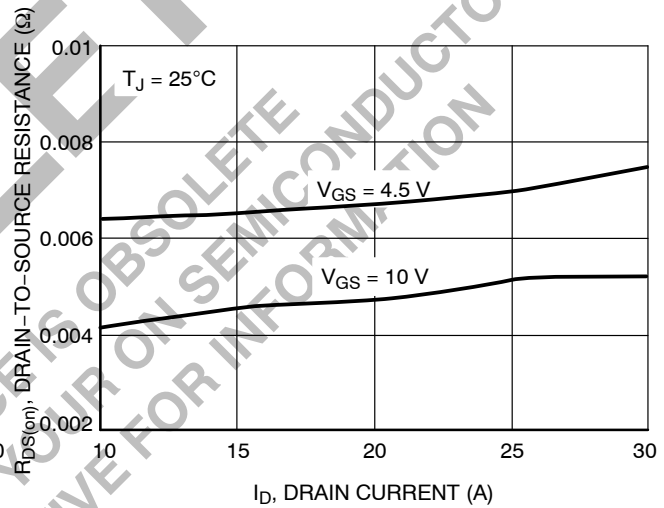


Figure 4. On-Resistance versus Drain Current and Gate Voltage

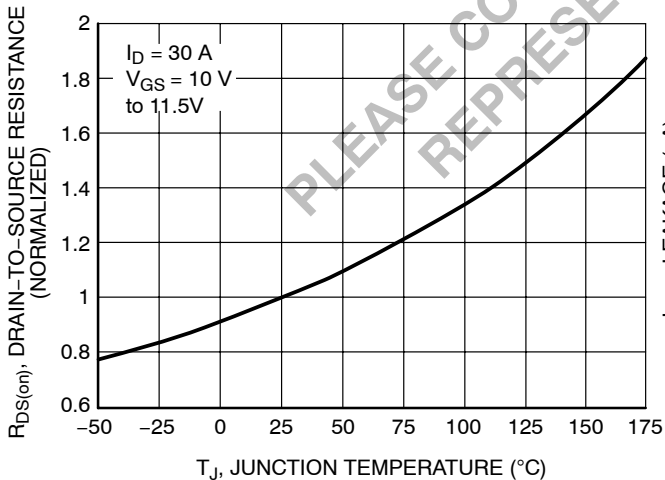


Figure 5. On-Resistance Variation with Temperature

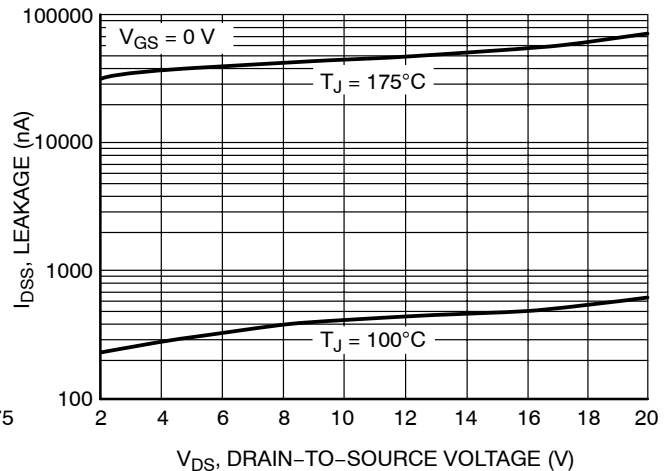


Figure 6. Drain-to-Source Leakage Current versus Voltage

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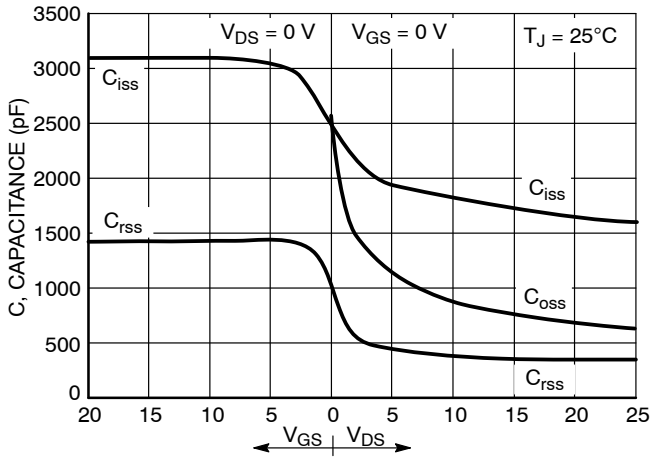


Figure 7. Capacitance Variation

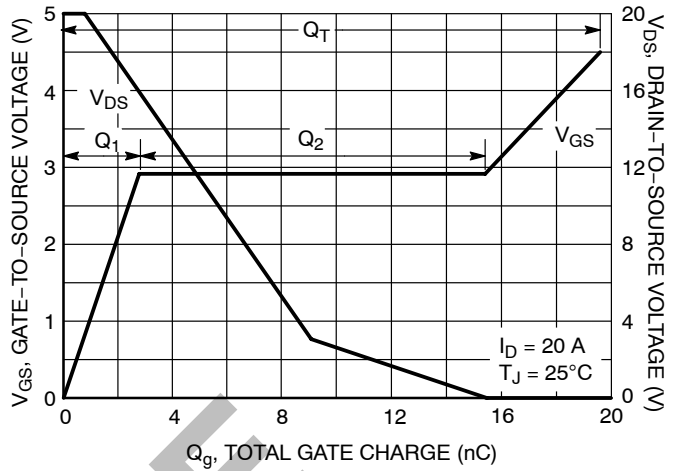


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

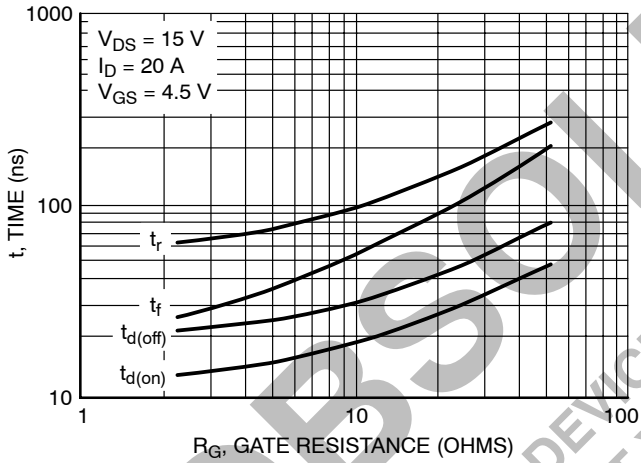


Figure 9. Resistive Switching Time Variation versus Gate Resistance

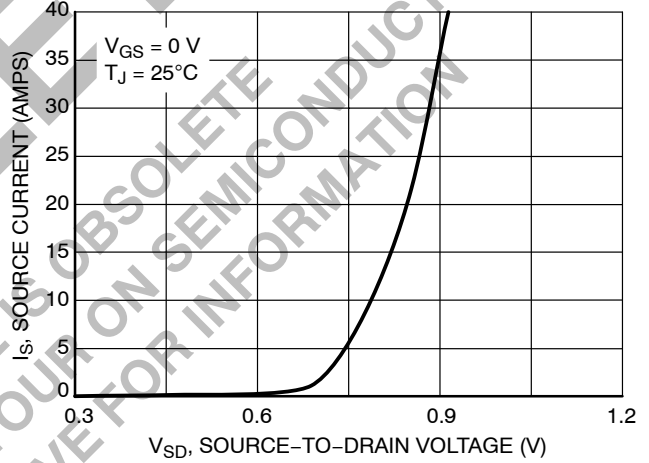


Figure 10. Diode Forward Voltage versus Current

NTD78N03R

ORDERING INFORMATION

Order Number	Package	Shipping†
NTD78N03R	DPAK	75 Units/Rail
NTD78N03RG	DPAK (Pb-Free)	
NTD78N03RT4	DPAK	2500 Tape & Reel
NTD78N03RT4G	DPAK (Pb-Free)	
NTD78N03R-1	DPAK Straight Lead	75 Units/Rail
NTD78N03R-1G	DPAK Straight Lead (Pb-Free)	
NTD78N03R-35	DPAK Straight Lead (3.5 ± 0.15 mm)	
NTD78N03R-35G	DPAK Straight Lead (3.5 ± 0.15 mm) (Pb-Free)	

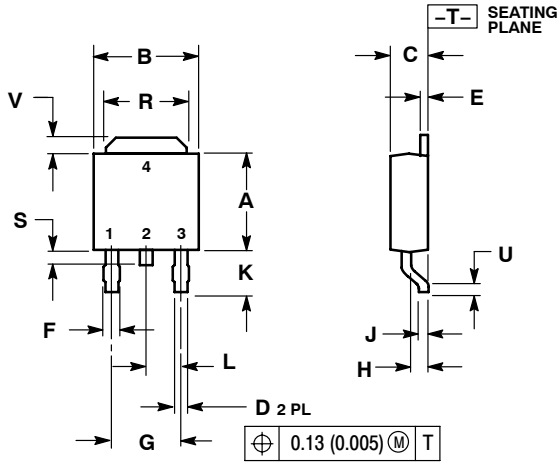
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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PACKAGE DIMENSIONS

DPAK
CASE 369C-01
ISSUE O

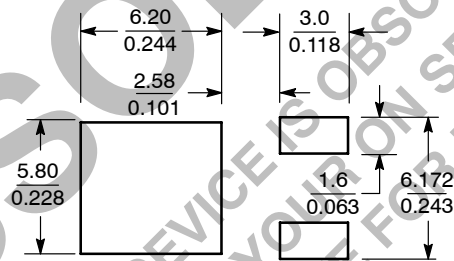


NOTES:

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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.22
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.018	0.023	0.46	0.58
F	0.037	0.045	0.94	1.14
G	0.180 BSC		4.58 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.102	0.114	2.60	2.89
L	0.090 BSC		2.29 BSC	
R	0.180	0.215	4.57	5.45
S	0.025	0.040	0.63	1.01
U	0.020	---	0.51	---
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

SOLDERING FOOTPRINT*



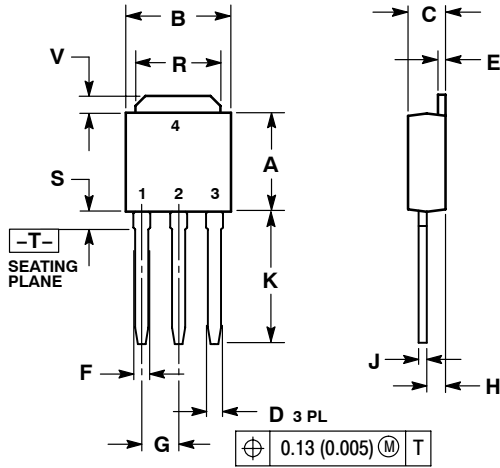
SCALE 3:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

NTD78N03R

PACKAGE DIMENSIONS

DPAK
CASE 369D-01
ISSUE B



NOTES:

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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.35
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.018	0.023	0.46	0.58
F	0.037	0.045	0.94	1.14
G	0.090 BSC		2.29 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.350	0.380	8.89	9.65
R	0.180	0.215	4.45	5.45
S	0.025	0.040	0.63	1.01
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

STYLE 2:

- PIN 1. GATE
- DRAIN
- SOURCE
- DRAIN

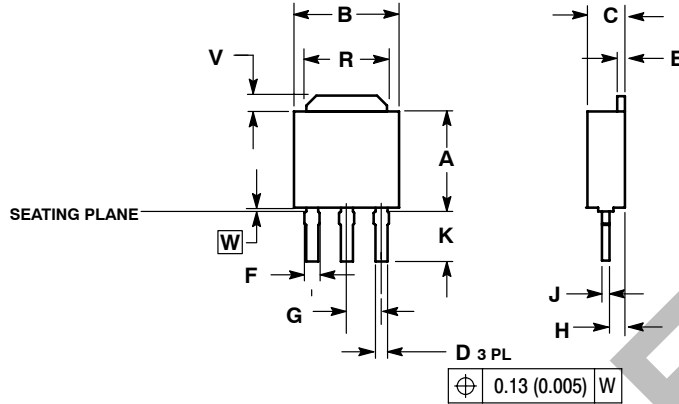
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NTD78N03R

PACKAGE DIMENSIONS

3 IPAk, STRAIGHT LEAD
CASE 369AC-01
ISSUE O



NOTES:

- 1.. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- 2.. CONTROLLING DIMENSION: INCH.
3. SEATING PLANE IS ON TOP OF DAMBAR POSITION.
4. DIMENSION A DOES NOT INCLUDE DAMBAR POSITION OR MOLD GATE.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.22
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.018	0.023	0.46	0.58
F	0.037	0.043	0.94	1.09
G	0.090	BSC	2.29	BSC
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.134	0.142	3.40	3.60
R	0.180	0.215	4.57	5.46
V	0.035	0.050	0.89	1.27
W	0.000	0.010	0.000	0.25

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