NTD95N02R

Power MOSFET
95 Amps, 24 Volts

N−Channel DPAK

ON Semiconductor®

http://onsemi.com

Features

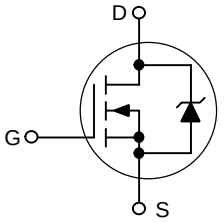
- High Power and Current Handling Capability
- Fast Switching Performance
- Low $R_{DS(on)}$ to Minimize Conduction Loss
- Low Gate Charge to Minimize Switching Losses
- Pb−Free Packages are Available

Applications

- CPU Motherboard Vcore Applications
- High Frequency DC−DC Converters
- Motor Drives
- Bridge Circuits

$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	I_D MAX*
24 V	4.5 mΩ @ 10 V	95 A
	5.9 mΩ @ 4.5 V	

*I_D MAX in the product summary table is continuous and steady at 25°C.



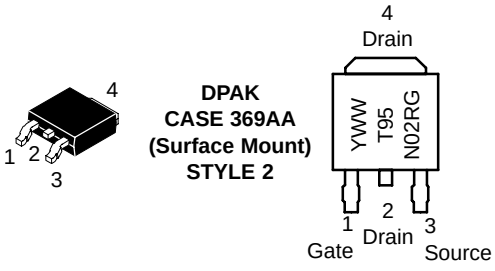
MAXIMUM RATINGS (T_J = 25°C unless otherwise specified)

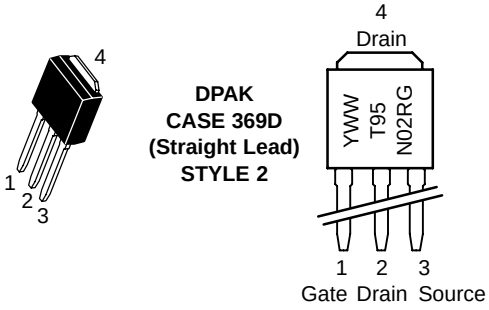
Parameter	Symbol	Value	Unit
Drain−to−Source Voltage	V_{DSS}	24	V
Gate−to−Source Voltage	V_{GS}	±20	V
Thermal Resistance, Junction−to−Case Total Power Dissipation @ T_A = 25°C Drain Current –	$R_{\theta JC}$ P_D	1.45 86	°C/W W
− Continuous @ T_A= 25°C, Limited by Package − Continuous @ T_A= 25°C, Limited by Wires	I_D I_D	95 32	A A
Thermal Resistance, Junction−to− Ambient (Note 1) − Total Power Dissipation @ T_A = 25°C − Drain Current − Continuous @ T_A= 25°C	$R_{\theta JA}$ P_D I_D	52 2.4 15.8	°C/W W A
Thermal Resistance, Junction−to−Ambient (Note 2) − Total Power Dissipation @ T_A = 25°C − Drain Current − Continuous @ T_A= 25°C	$R_{\theta JA}$ P_D I_D	100 1.25 12	°C/W W A
Operating Junction and Storage Temperature	T_J, T_{STG}	−55 to 150	°C
Continuous Source Current (Body Diode)	I_S	45	A
Single Pulse Drain−to−Source Avalanche Energy – (V_{DD} = 25 V, V_G = 10, I_{PK} = 13 A, L = 1 mH, R_G= 25 Ω)	E_{AS}	84	mJ
Lead Temperature for Soldering Purposes (1/8 in from case for 10 seconds)	T_L	260	°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.

1. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surface mounted on FR4 board using the minimum recommended pad size (Cu area = 0.412 in sq).

MARKING DIAGRAMS & PIN ASSIGNMENTS





Y	= Year
WW	= Work Week
T95N02R	= Device Code
G	= Pb−Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Value	Unit
Junction−to−Case (Drain)	$R_{\theta JC}$	1.45	°C/W
Junction−to−Ambient – Steady State (Note 3)	$R_{\theta JA}$	52	
Junction−to−Ambient – Steady State (Note 4)	$R_{\theta JA}$	100	

3. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
4. Surface mounted on FR4 board using the minimum recommended pad size (Cu area = 0.412 in sq).

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 250 μA		24	29		V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				15		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 20 V	T_J = 25°C			1.5	μA
			T_J = 125°C			10	
Gate−to−Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±20 V				±100	nA
ON CHARACTERISTICS (Note 5)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250 μA		1.0		2.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				5.0		mV/°C
Drain−to−Source On−Resistance	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 10 A			5.9	8.0	mΩ
		V_{GS} = 10 V, I_D = 20 A			4.5	5.0	
Forward Transconductance	gFS	V_{GS} = 10 V, I_D = 10 A			30		S
CHARGES, CAPACITANCES AND GATE RESISTANCE							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = 20 V			2400		pF
Output Capacitance	C_{OSS}				1020		
Reverse Transfer Capacitance	C_{RSS}				390		
Total Gate Charge	Q_T	V_{GS} = 4.5 V, V_{DS} = 10 V; I_D = 10 A			21		nC
	Q_{GS}				4.4		
	Q_{GD}				9.1		
SWITCHING CHARACTERISTICS							
Turn−on Delay Time	$t_{d(on)}$	V_{GS} = 10 V, V_{DD} = 10 V, I_D = 30 A, R_G = 3 Ω			10		ns
Rise Time	t_r				82		
Turn−off Time	$t_{d(off)}$				26		
Fall Time	t_f				70		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 20 A	T_J = 25°C		0.83	1.2	V
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, d_{ISD}/dt = 100 A/μs, I_S = 20 A			45		ns
Charge Time	T_a				20		
Discharge Time	T_b				30		
Reverse Recovery Charge	Q_{RR}				50		nC

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

TYPICAL CHARACTERISTICS

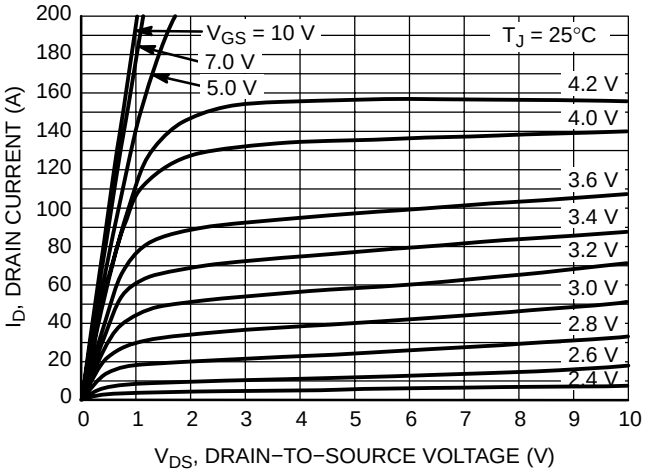


Figure 1. On−Region Characteristics

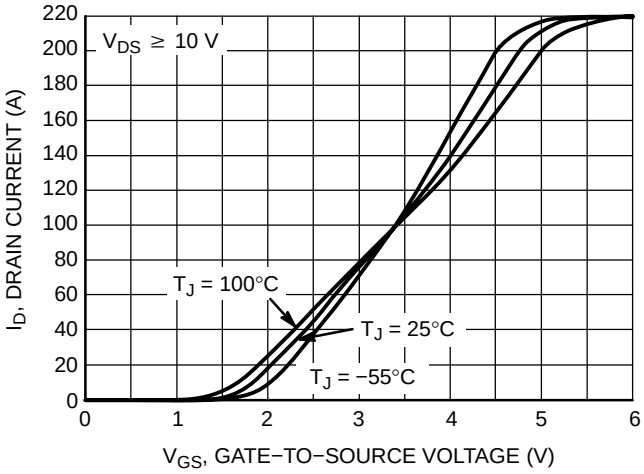


Figure 2. Transfer Characteristics

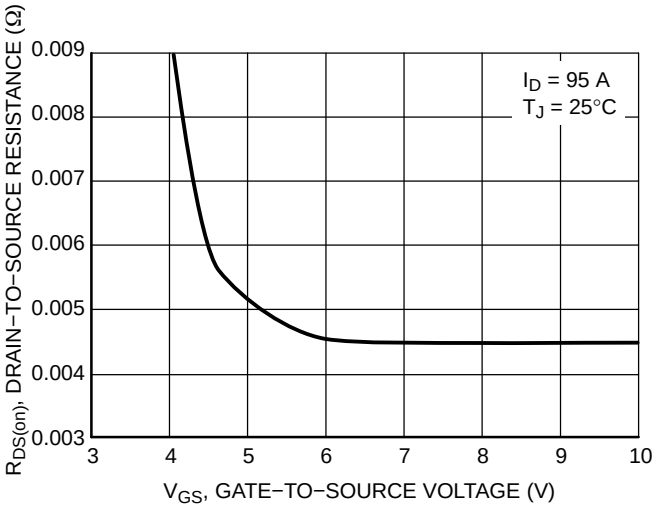


Figure 3. On−Resistance versus Gate−to−Source Voltage

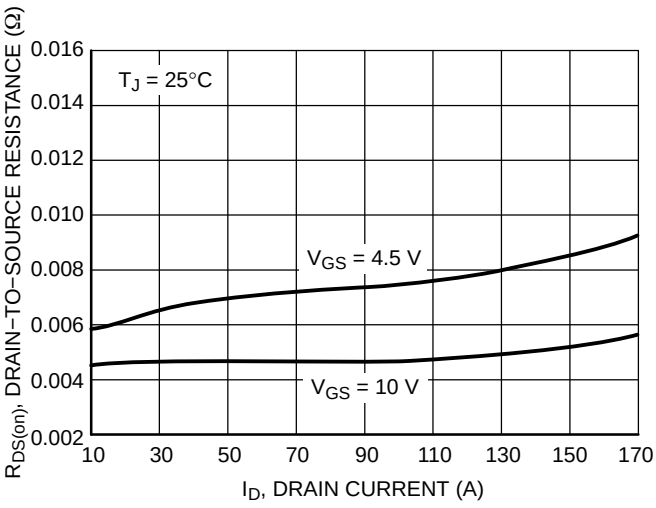


Figure 4. On−Resistance versus Drain Current and Gate Voltage

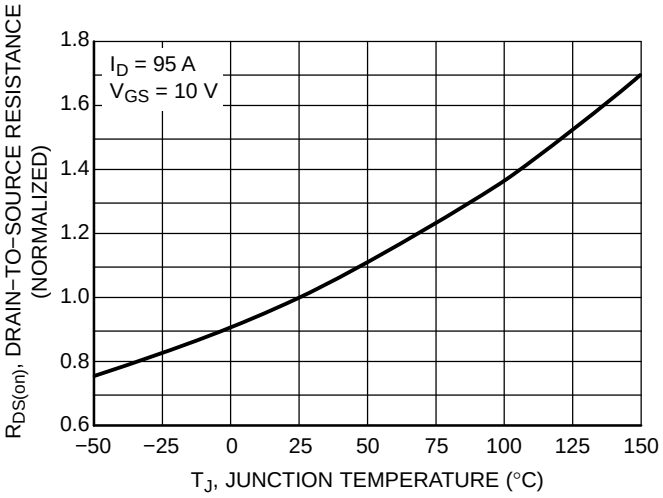


Figure 5. On−Resistance Variation with Temperature

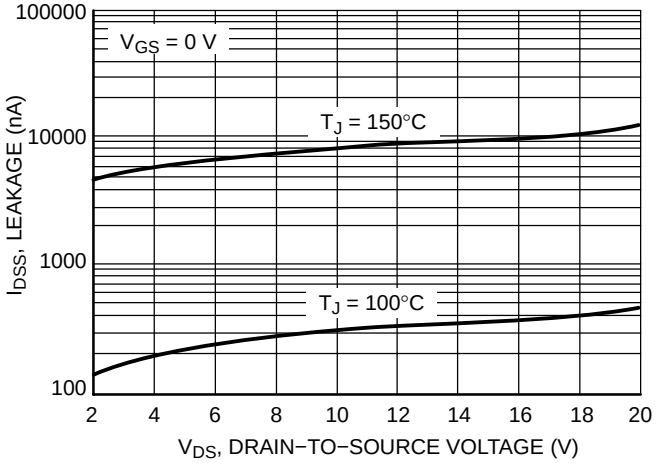


Figure 6. Drain−to−Source Leakage Current versus Voltage

TYPICAL CHARACTERISTICS

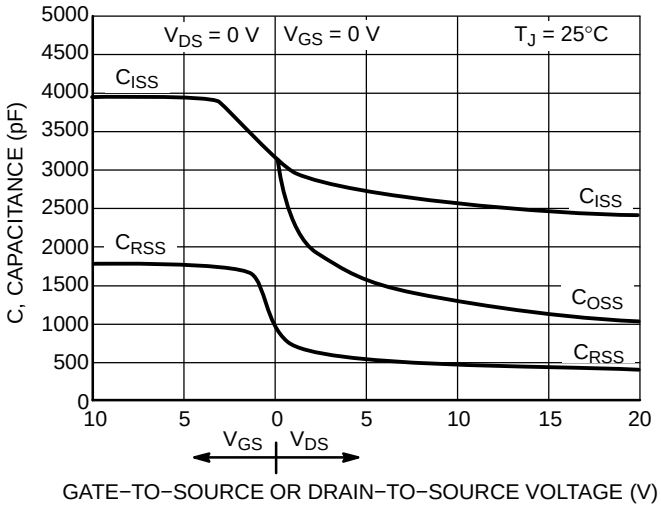


Figure 7. Capacitance Variation

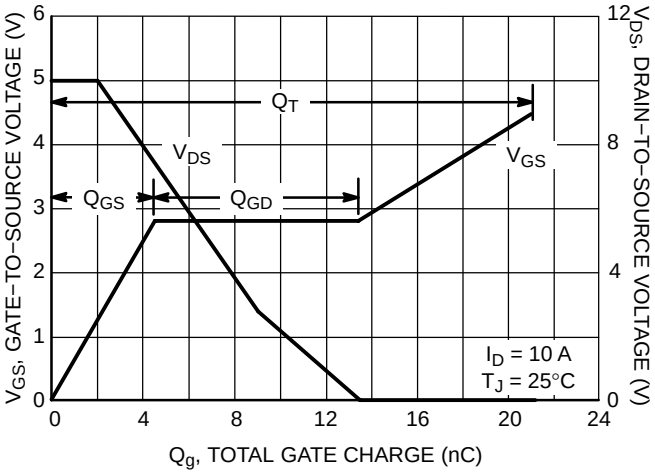


Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

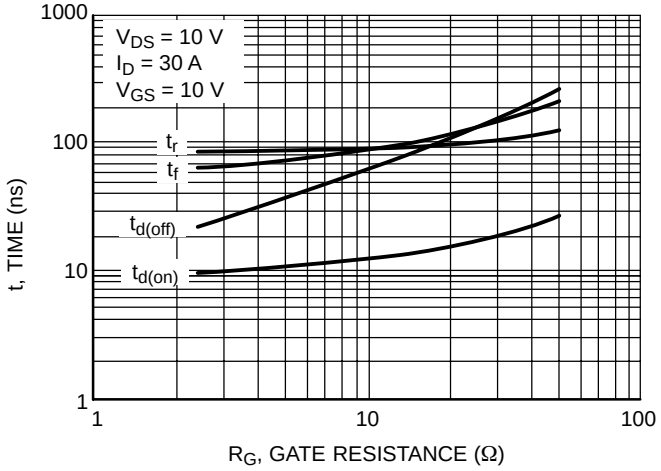


Figure 9. Resistive Switching Time Variation versus Gate Resistance

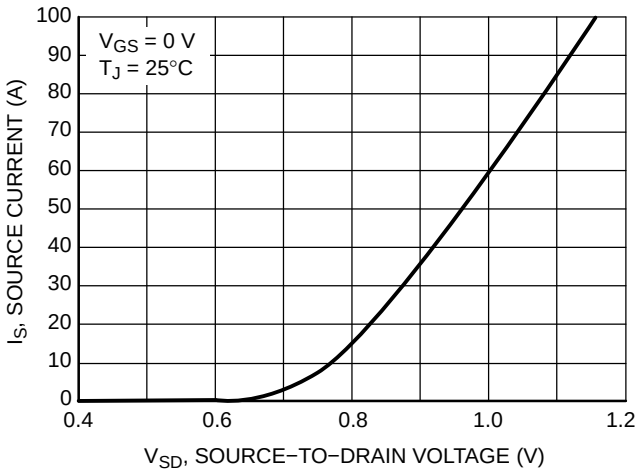


Figure 10. Diode Forward Voltage versus Current

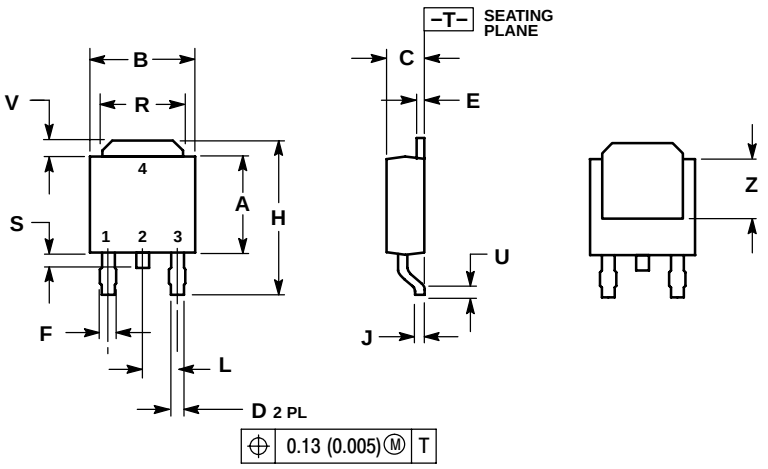
ORDERING INFORMATION

Device	Package	Shipping†
NTD95N02R	DPAK	75 Units / Rail
NTD95N02RG	DPAK (Pb−Free)	75 Units / Rail
NTD95N02R−001	DPAK	75 Units / Rail
NTD95N02R−001G	DPAK (Pb−Free)	75 Units / Rail
NTD95N02RT4	DPAK	2500 Units / Tape & Reel
NTD95N02RT4G	DPAK (Pb−Free)	2500 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.

PACKAGE DIMENSIONS

DPAK (SINGLE GUAGE)
CASE 369AA−01
ISSUE A

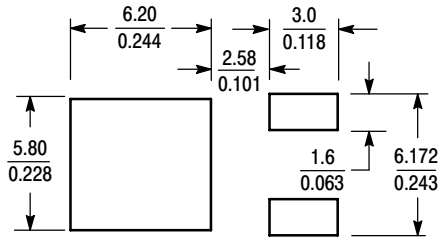


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	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	0.025	0.035	0.63	0.89
E	0.018	0.024	0.46	0.61
F	0.030	0.045	0.77	1.14
H	0.386	0.410	9.80	10.40
J	0.018	0.023	0.46	0.58
L	0.090 BSC		2.29 BSC	
R	0.180	0.215	4.57	5.45
S	0.024	0.040	0.60	1.01
U	0.020	−−−	0.51	−−−
V	0.035	0.050	0.89	1.27
Z	0.155	−−−	3.93	−−−

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

SOLDERING FOOTPRINT*



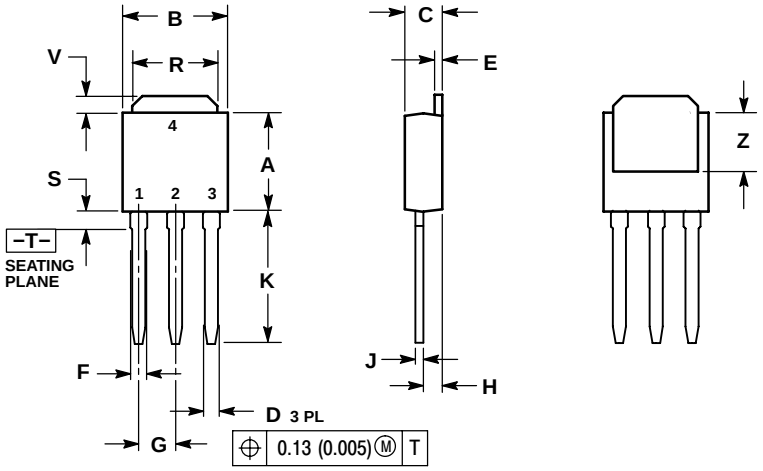
SCALE 3:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

NTD95N02R

PACKAGE DIMENSIONS

DPAK
CASE 369D−01
ISSUE B



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

	INCHES		MILLIMETERS	
DIM	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
2. DRAIN
3. SOURCE
4. DRAIN

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
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Phone: 421 33 790 2910
Japan Customer Focus Center
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