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NTD95N02R

Power MOSFET 95 Amps, 24 Volts

N-Channel DPAK

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

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ 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	$R_{\theta JC}$	1.45	$^\circ\text{C/W}$
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	86	W
Drain Current –			
– Continuous @ $T_A = 25^\circ\text{C}$, Limited by Package	I_D	95	A
– Continuous @ $T_A = 25^\circ\text{C}$, Limited by Wires	I_D	32	A
Thermal Resistance, Junction-to-Ambient (Note 1)	$R_{\theta JA}$	52	$^\circ\text{C/W}$
– Total Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	2.4	W
– Drain Current – Continuous @ $T_A = 25^\circ\text{C}$	I_D	15.8	A
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	100	$^\circ\text{C/W}$
– Total Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	1.25	W
– Drain Current – Continuous @ $T_A = 25^\circ\text{C}$	I_D	12	A
Operating Junction and Storage Temperature	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$
Continuous Source Current (Body Diode)	I_S	45	A
Single Pulse Drain-to-Source Avalanche Energy – ($V_{DD} = 25\text{ V}, V_{GS} = 10, I_{PK} = 13\text{ A}, L = 1\text{ mH}, R_G = 25\ \Omega$)	E_{AS}	84	mJ
Lead Temperature for Soldering Purposes (1/8 in 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.

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).

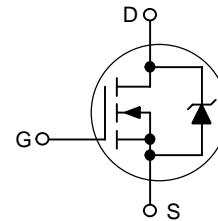


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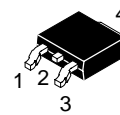
<http://onsemi.com>

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

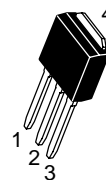
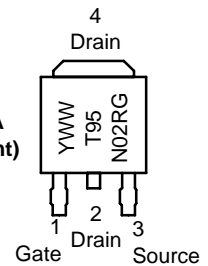
* I_D MAX in the product summary table is continuous and steady at 25°C .



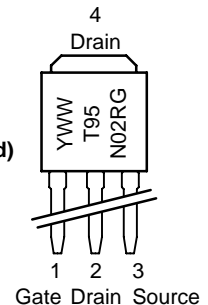
MARKING DIAGRAMS & PIN ASSIGNMENTS



**DPAK
CASE 369AA
(Surface Mount)
STYLE 2**



**DPAK
CASE 369D
(Straight Lead)
STYLE 2**



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.

NTD95N02R

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	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}	$V_{GS} = 0\text{ V}, V_{DS} = 20\text{ V}$	$T_J = 25^\circ\text{C}$		1.5	μA
			$T_J = 125^\circ\text{C}$		10	
Gate-to-Source Leakage	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		2.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			5.0		mV/°C
Drain-to-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$		5.9	8.0	m Ω
		$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$		4.5	5.0	
Forward Transconductance	g_{FS}	$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$		30		S

CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 20\text{ V}$		2400		pF
Output Capacitance	C_{OSS}			1020		
Reverse Transfer Capacitance	C_{RSS}			390		
Total Gate Charge	Q_T	$V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V}; I_D = 10\text{ A}$		21		nC
	Q_{GS}			4.4		
	Q_{GD}			9.1		

SWITCHING CHARACTERISTICS

Turn-on Delay Time	$t_{d(on)}$	$V_{GS} = 10\text{ V}, V_{DD} = 10\text{ V}, I_D = 30\text{ A}, R_G = 3\ \Omega$		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}	$V_{GS} = 0\text{ V}, I_S = 20\text{ A}$	$T_J = 25^\circ\text{C}$		0.83	1.2	V
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, dI_{SD}/dt = 100\text{ A}/\mu\text{s}, I_S = 20\text{ A}$			45		ns
Charge Time	T_a				20		
Discharge Time	T_b				30		
Reverse Recovery Charge	Q_{RR}				50		nC

5. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.

NTD95N02R

TYPICAL CHARACTERISTICS

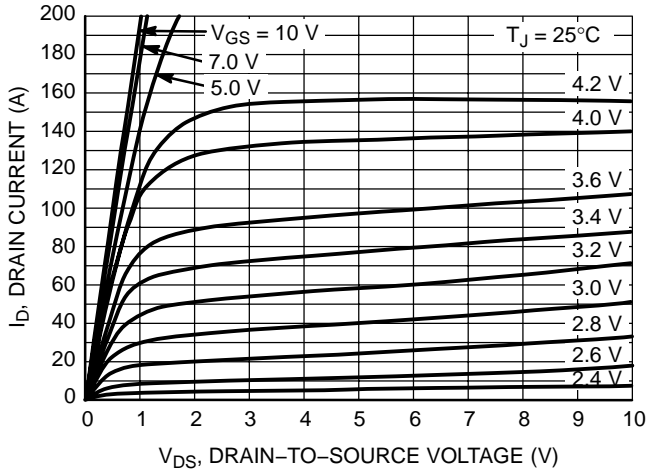


Figure 1. On-Region Characteristics

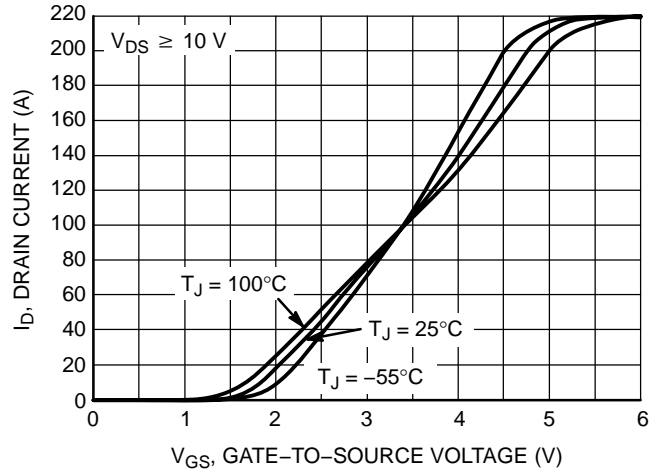


Figure 2. Transfer Characteristics

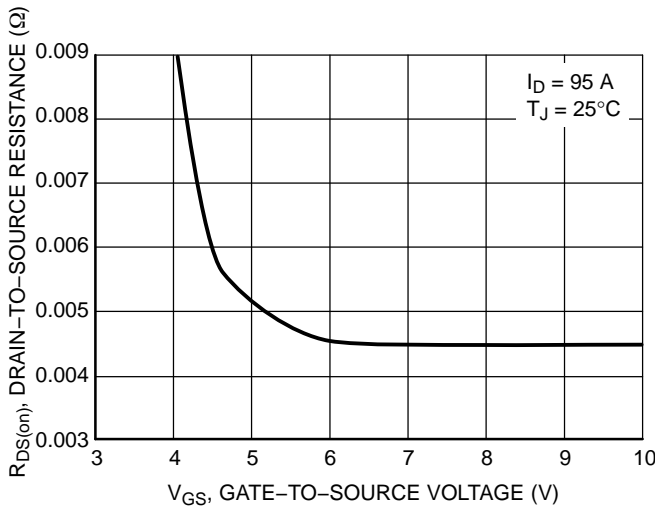


Figure 3. On-Resistance versus Gate-to-Source Voltage

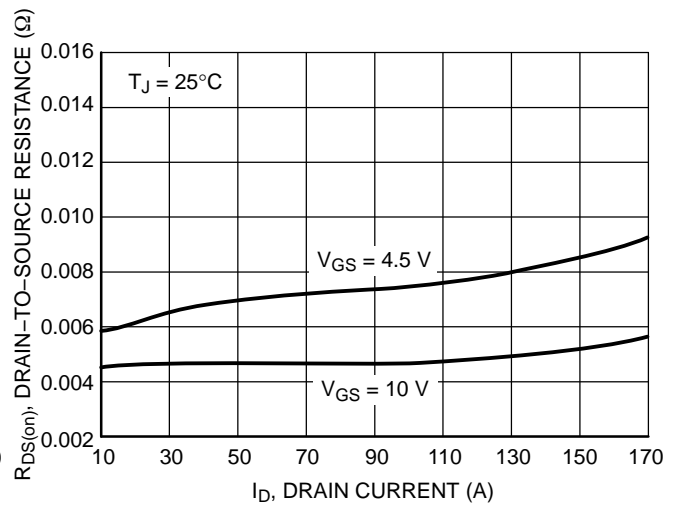


Figure 4. On-Resistance versus Drain Current and Gate Voltage

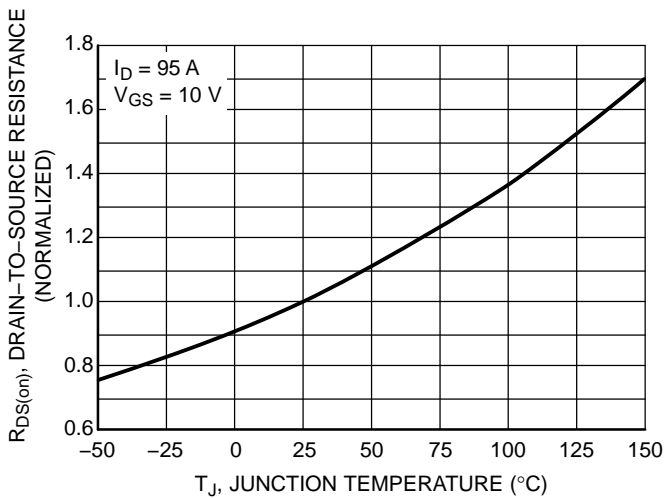


Figure 5. On-Resistance Variation with Temperature

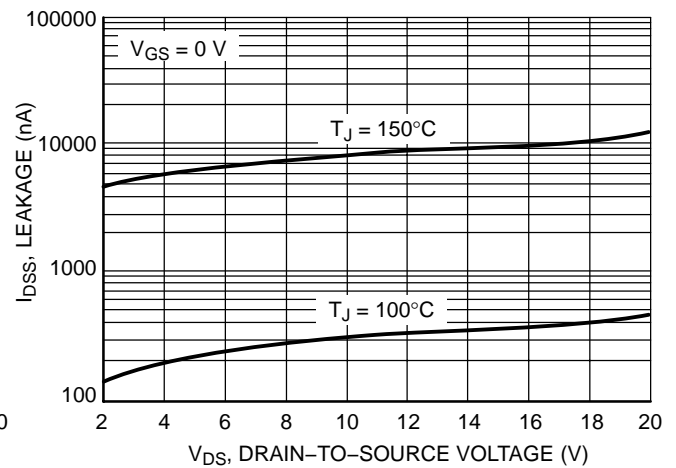


Figure 6. Drain-to-Source Leakage Current versus Voltage

NTD95N02R

TYPICAL CHARACTERISTICS

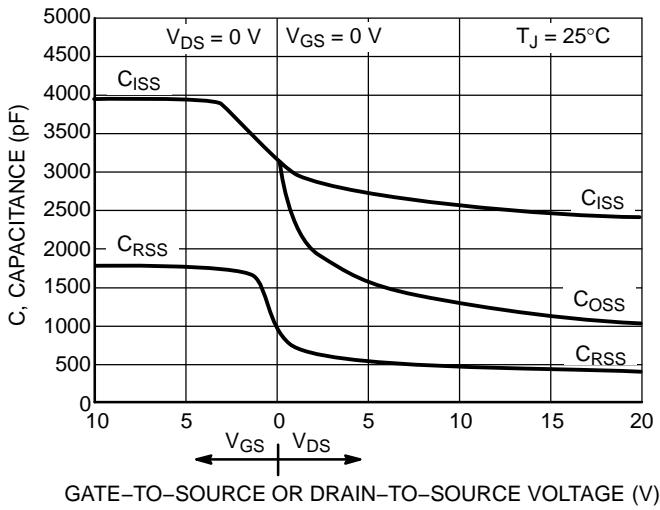


Figure 7. Capacitance Variation

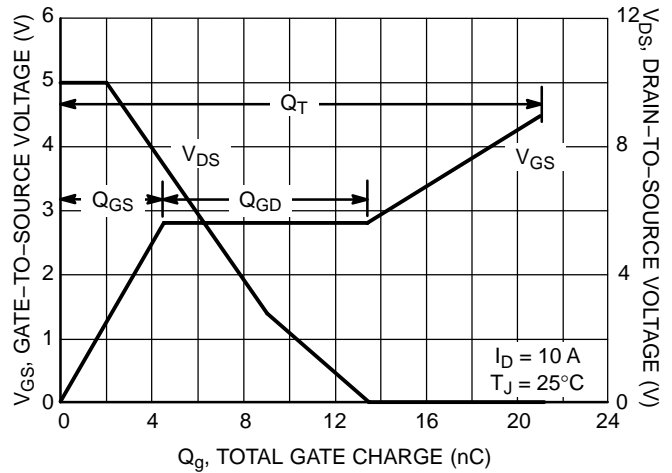


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

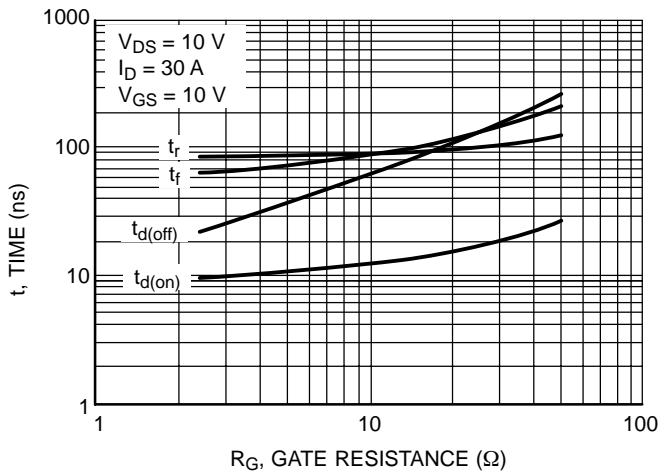


Figure 9. Resistive Switching Time Variation versus Gate Resistance

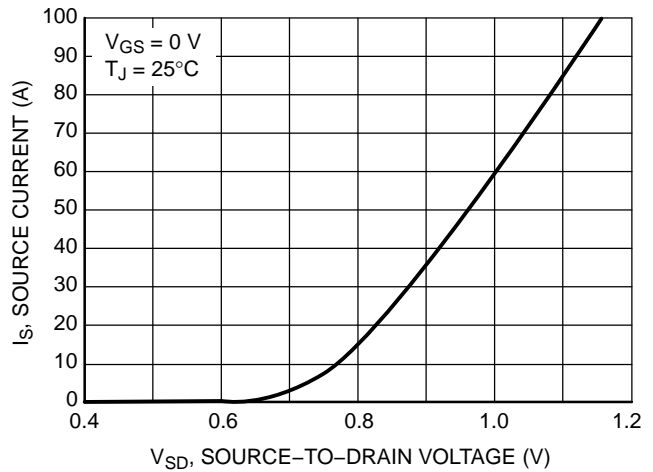


Figure 10. Diode Forward Voltage versus Current

ORDERING INFORMATION

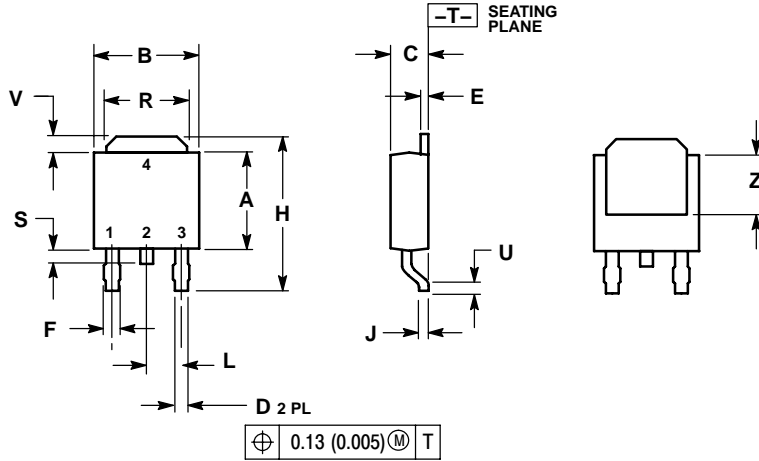
Device	Package	Shipping†
NTD95N02R	DPAK	75 Units / Rail
NTD95N02RG	DPAK (Pb-Free)	75 Units / Rail
NTD95N02R-001	DPAK	75 Units / Rail
NTD95N02R-001G	DPAK (Pb-Free)	75 Units / Rail
NTD95N02RT4	DPAK	2500 Units / Tape & Reel
NTD95N02RT4G	DPAK (Pb-Free)	2500 Units / Tape & Reel

†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.

NTD95N02R

PACKAGE DIMENSIONS

DPAK (SINGLE GAUGE) CASE 369AA-01 ISSUE A

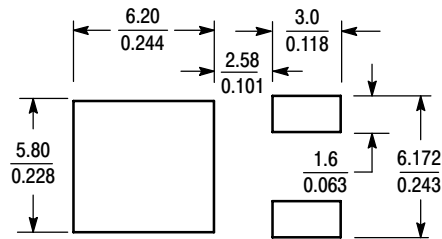


- NOTES:
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

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	0.025	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*



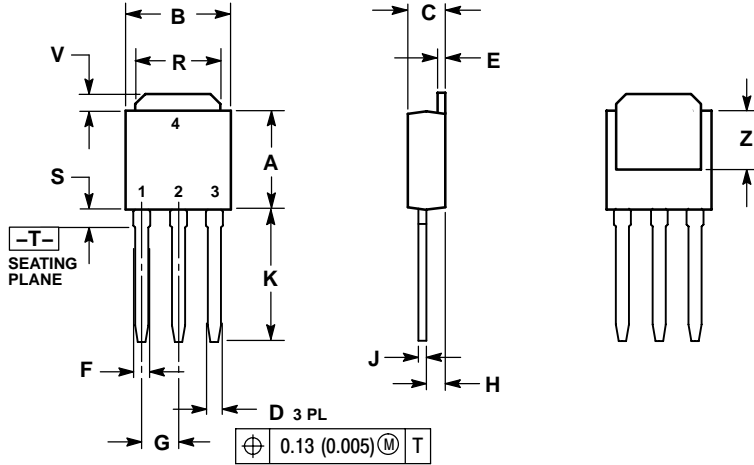
SCALE 3:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

*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.

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
2. DRAIN
3. SOURCE
4. DRAIN

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