

NTMS4404N

Power MOSFET

30 V, 12 A, Single N-Channel, SO-8

Features

- High Density Power MOSFET with Ultra Low $R_{DS(on)}$ for Higher Efficiency
- Miniature SO-8 Surface Mount Package Saving Board Space
- I_{DSS} Specified at Elevated Temperature
- Diode Exhibits High Speed, Soft Recovery

Applications

- Power Management for Battery Power Products
- Portable Products
- Computers, Printers, PCMCIA Cards
- Cell Phones, Cordless Telephones

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

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V_{DS}	30	V
Gate-to-Source Voltage			V_{GS}	± 20	V
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^{\circ}\text{C}$	I_D	9.6	A
		$T_A = 70^{\circ}\text{C}$		7.6	
	$t_p \leq 10\text{ s}$	$T_A = 25^{\circ}\text{C}$		12	
Power Dissipation (Note 1)	Steady State		P_D	1.56	W
	$t_p \leq 10\text{ s}$			2.5	
Continuous Drain Current (Note 2)	Steady State	$T_A = 25^{\circ}\text{C}$	I_D	7.0	A
		$T_A = 70^{\circ}\text{C}$		5.6	
Power Dissipation (Note 2)		$T_A = 25^{\circ}\text{C}$	P_D	0.83	W
Pulsed Drain Current	$t_p = 10\text{ }\mu\text{s}$, DC = 2 %		I_{DM}	50	A
Operating Junction and Storage Temperature			T_J , T_{STG}	-55 to 150	$^{\circ}\text{C}$
Source Current (Body Diode)			I_S	6.0	A
Single Pulse Drain-to-Source Avalanche Energy ($V_{DD} = 20\text{ V}$, $V_{GS} = 5\text{ V}$, $I_{PK} = 7.25\text{ A}$, $L = 19\text{ mH}$, $R_G = 25\text{ }\Omega$)			E_{AS}	500	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	$^{\circ}\text{C}$

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	80	$^\circ\text{C/W}$
Junction-to-Ambient – $t = 10\text{ s}$ (Note 1)	$R_{\theta JA}$	50	
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	150	

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.)

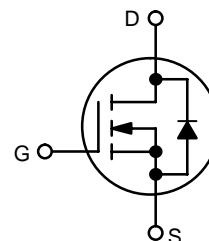


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$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
30 V	9.7 m Ω @ 10 V	12 A
	15.5 m Ω @ 4.5 V	

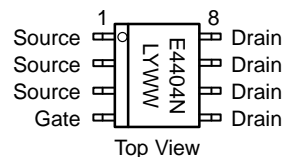
N-Channel



MARKING DIAGRAM/ PIN ASSIGNMENT



SO-8
CASE 751
STYLE 12



E4404N = Device Code
L = Assembly Location
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping†
NTMS4404NR2	SO-8	2500/Tape & Reel

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

NTMS4404N

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			25		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 30\text{ V}$	$T_J = 25^\circ\text{C}$		1.0	μA
			$T_J = 100^\circ\text{C}$		5.0	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA

ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	1.0	2.2	3.0	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			-5.0		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 12\text{ A}$		9.7	11.5	m Ω
		$V_{GS} = 4.5\text{ V}, I_D = 6.0\text{ A}$		15.5	17.5	
Forward Transconductance	g_{FS}	$V_{DS} = 15\text{ V}, I_D = 12\text{ A}$		17.5		S

CHARGES AND CAPACITANCES

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 24\text{ V}$		1975	2500	μF
Output Capacitance	C_{OSS}			575	750	
Reverse Transfer Capacitance	C_{RSS}			180	300	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 24\text{ V}, I_D = 12\text{ A}$		50	70	nC
Threshold Gate Charge	$Q_{G(TH)}$			2.4		
Gate-to-Source Charge	Q_{GS}			7.5		
Gate-to-Drain Charge	Q_{GD}			16		

SWITCHING CHARACTERISTICS, $V_{GS} = 10\text{ V}$ (Note 4)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DS} = 24\text{ V}, I_D = 12\text{ A}, R_G = 2.5\text{ }\Omega$		15	25	ns
Rise Time	t_r			25	50	
Turn-Off Delay Time	$t_{d(OFF)}$			35	55	
Fall Time	t_f			15	30	

SWITCHING CHARACTERISTICS, $V_{GS} = 4.5\text{ V}$ (Note 4)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 24\text{ V}, I_D = 6.0\text{ A}, R_G = 2.5\text{ }\Omega$		20		ns
Rise Time	t_r			80		
Turn-Off Delay Time	$t_{d(OFF)}$			25		
Fall Time	t_f			15		

DRAIN-SOURCE DIODE CHARACTERISTICS (Note 4)

Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 6.0\text{ A}$	$T_J = 25^\circ\text{C}$		0.80	1.1	V
			$T_J = 125^\circ\text{C}$		0.65		
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, dI_{SD}/dt = 100\text{ A}/\mu\text{s}, I_S = 6.0\text{ A}$		40	55		ns
Charge Time	t_a			23			
Discharge Time	t_b			17			
Reverse Recovery Charge	Q_{RR}			0.05			μC

NOTES:

- Pulse Test: pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
- Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

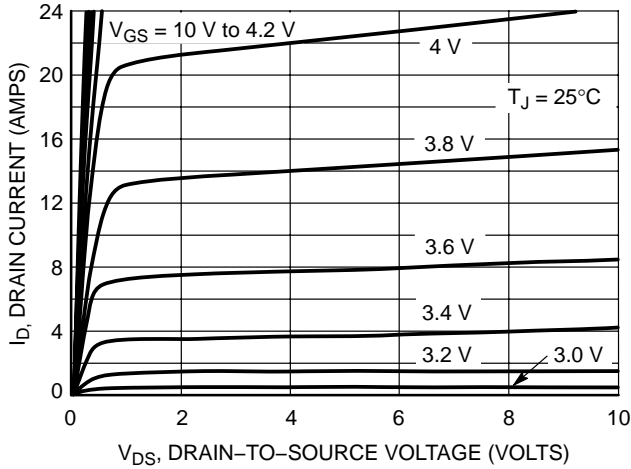


Figure 1. On-Region Characteristics

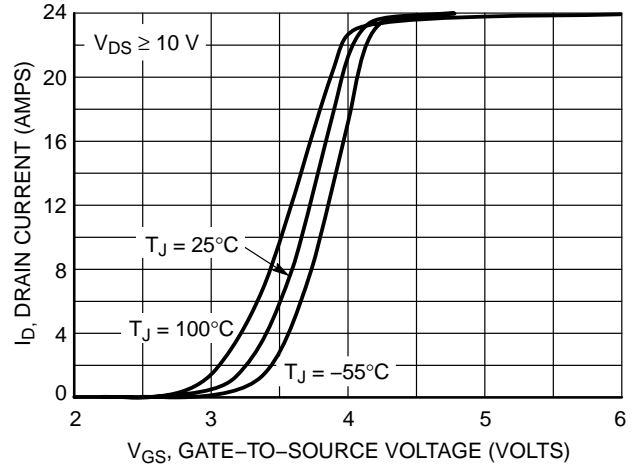


Figure 2. Transfer Characteristics

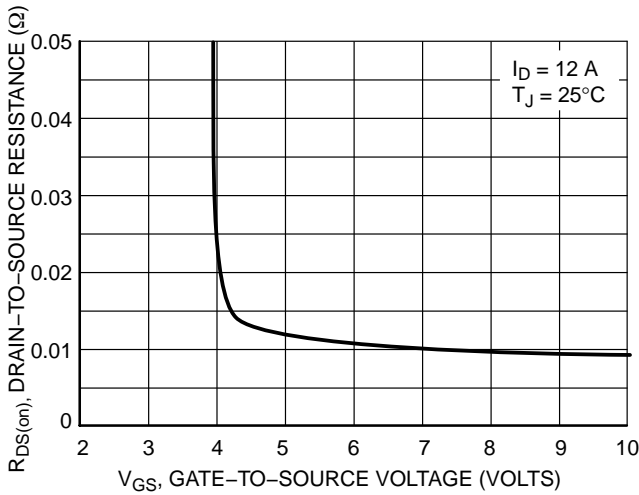


Figure 3. On-Resistance vs. Gate-to-Source Voltage

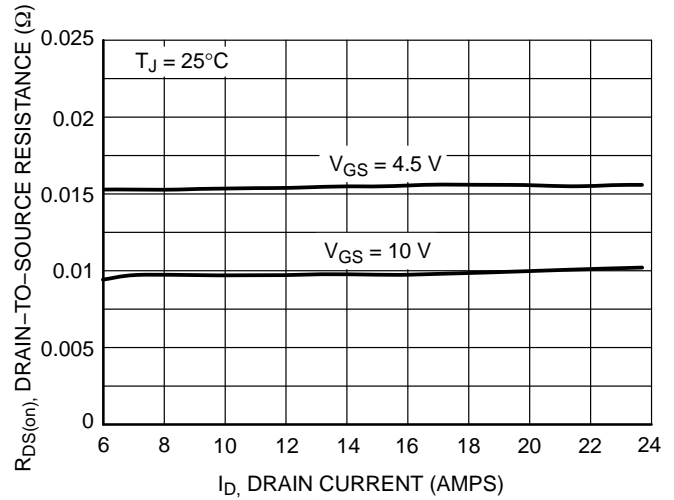


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

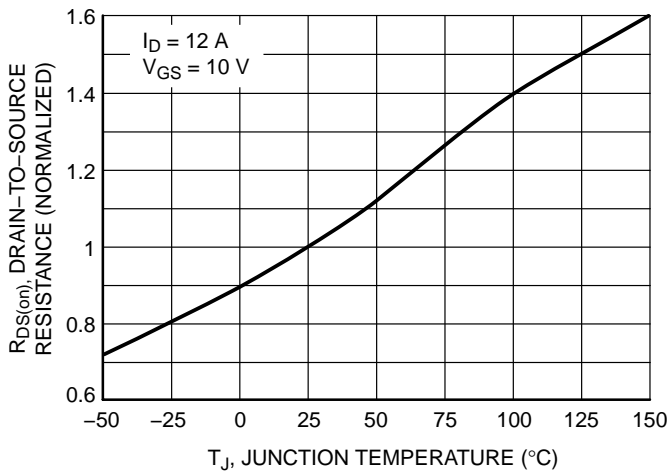


Figure 5. On-Resistance Variation with Temperature

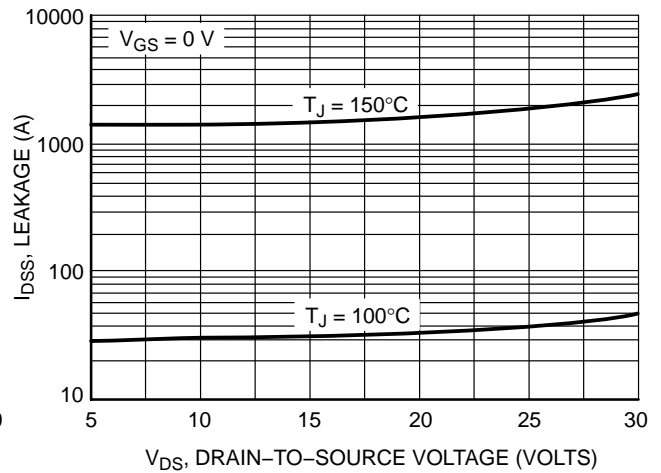
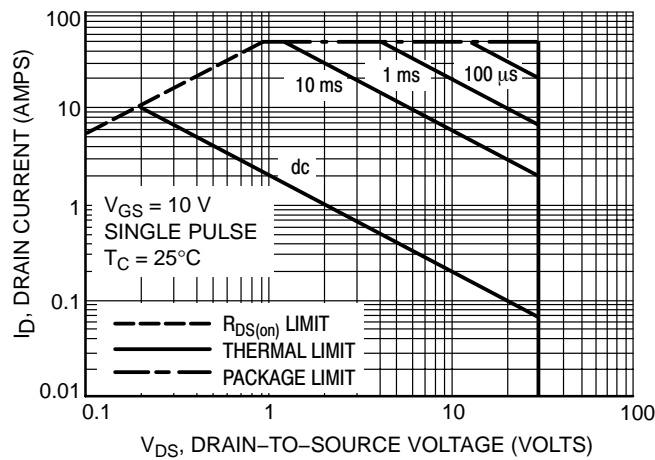
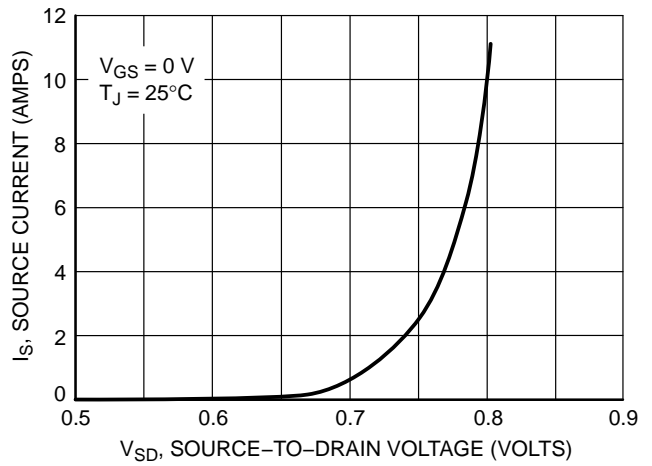
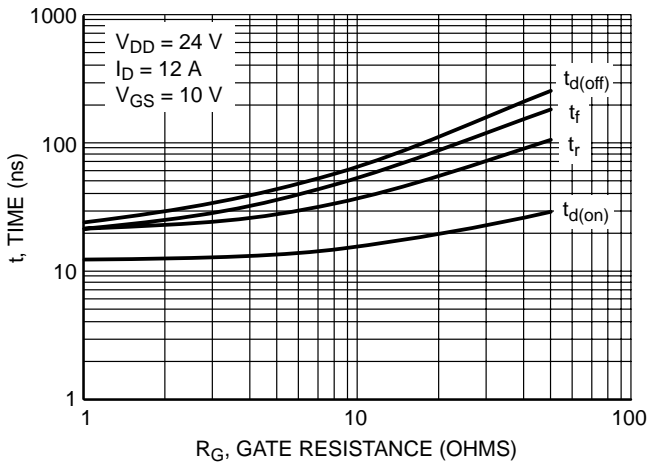
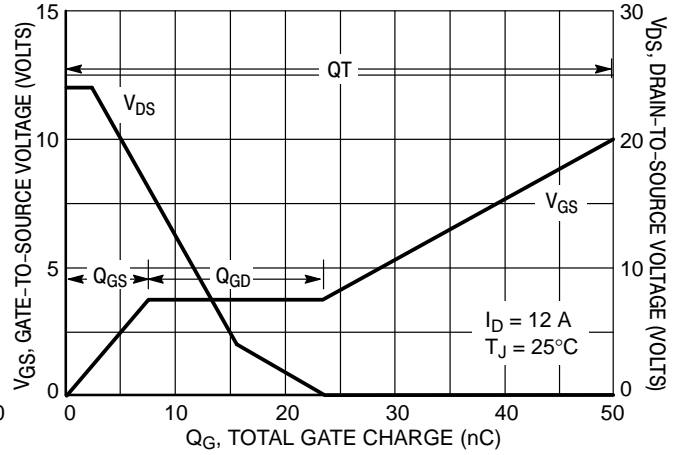
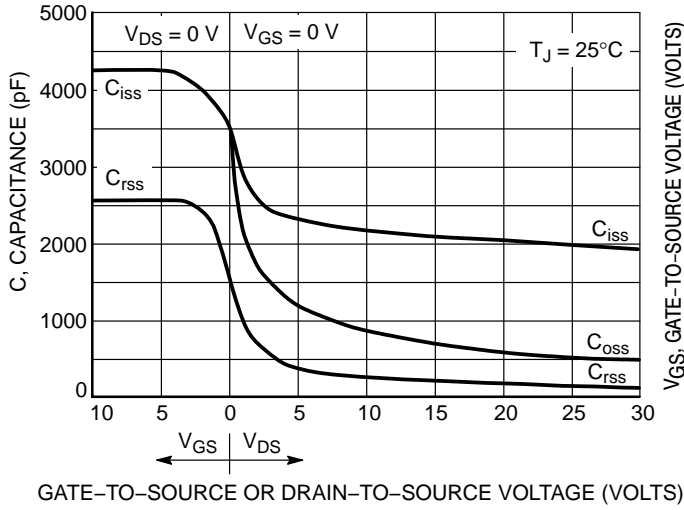


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES



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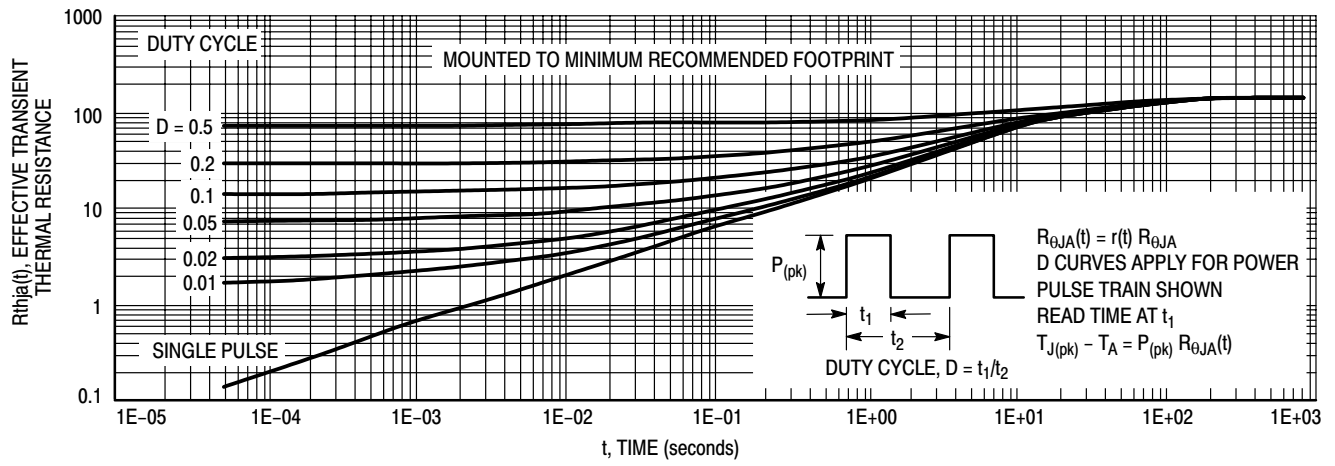
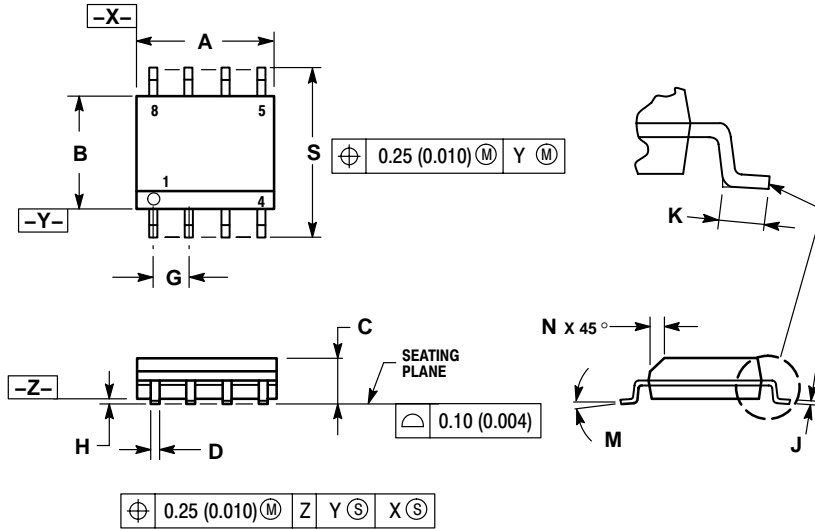


Figure 12. Thermal Response – Various Duty Cycles

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PACKAGE DIMENSIONS

SOIC-8 NB
CASE 751-07
ISSUE AA



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
E	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

STYLE 12:

1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. DRAIN
8. DRAIN

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