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With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

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# NTHD5904T1

## Power MOSFET Dual N-Channel

### 3.1 Amps, 20 Volts

#### Features

- Low  $R_{DS(on)}$  for Higher Efficiency
- Logic Level Gate Drive
- Miniature ChipFET™ Surface Mount Package Saves Board Space

#### Applications

- Power Management in Portable and Battery-Powered Products; i.e., Cellular and Cordless Telephones and PCMCIA Cards

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

Rating	Symbol	5 secs	Steady State	Unit
Drain-Source Voltage	$V_{DS}$	20		V
Gate-Source Voltage	$V_{GS}$	$\pm 12$		V
Continuous Drain Current ( $T_J = 150^\circ\text{C}$ ) (Note 1) $T_A = 25^\circ\text{C}$ $T_A = 85^\circ\text{C}$	$I_D$	$\pm 4.2$	$\pm 3.1$	A
		$\pm 3.0$	$\pm 2.2$	
Pulsed Drain Current	$I_{DM}$	$\pm 10$		A
Continuous Source Current (Diode Conduction) (Note 1)	$I_S$	1.8	0.9	A
Maximum Power Dissipation (Note 1) $T_A = 25^\circ\text{C}$ $T_A = 85^\circ\text{C}$	$P_D$	2.1	1.1	W
		1.1	0.6	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	$-55$ to $+150$		$^\circ\text{C}$

1. Surface Mounted on 1" x 1" FR4 Board.

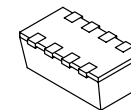
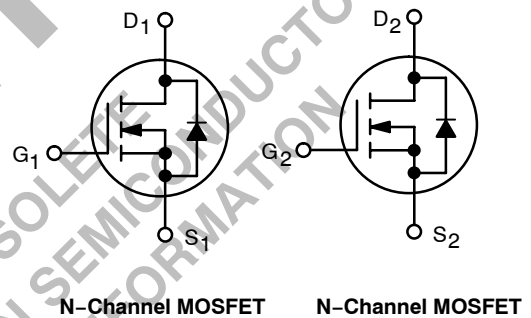


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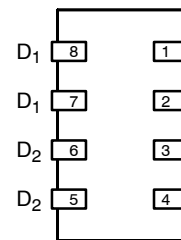
### DUAL N-CHANNEL 3.1 AMPS, 20 VOLTS

$R_{DS(on)} = 75 \text{ m}\Omega$

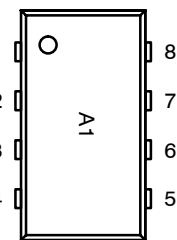


ChipFET  
CASE 1206A  
STYLE 2

#### PIN CONNECTIONS



#### MARKING DIAGRAM



A1 = Specific Device Code

#### ORDERING INFORMATION

Device	Package	Shipping
NTHD5904T1	ChipFET	3000/Tape & Reel

# NTHD5904T1

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Typ	Max	Unit
Maximum Junction-to-Ambient (Note 2) $t \leq 5$ sec Steady State	$R_{thJA}$	50 90	60 110	$^{\circ}\text{C}/\text{W}$
Maximum Junction-to-Foot (Drain) Steady State	$R_{thJF}$	30	40	$^{\circ}\text{C}/\text{W}$

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

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
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### Static

Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	0.6	-	-	V
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 12 \text{ V}$	-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 16 \text{ V}, V_{GS} = 0 \text{ V}$	-	-	1.0	$\mu\text{A}$
		$V_{DS} = 16 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 85^{\circ}\text{C}$	-	-	5.0	
On-State Drain Current (Note 3)	$I_{D(on)}$	$V_{DS} \geq 5.0 \text{ V}, V_{GS} = 4.5 \text{ V}$	10	-	-	A
Drain-Source On-State Resistance (Note 3)	$r_{DS(on)}$	$V_{GS} = 4.5 \text{ V}, I_D = 3.1 \text{ A}$	-	0.065	0.075	$\Omega$
		$V_{GS} = 2.5 \text{ V}, I_D = 2.3 \text{ A}$	-	0.115	0.143	
Forward Transconductance (Note 3)	$g_{fs}$	$V_{DS} = 10 \text{ V}, I_D = 3.1 \text{ A}$	-	8.0	-	S
Diode Forward Voltage (Note 3)	$V_{SD}$	$I_S = 0.9 \text{ A}, V_{GS} = 0 \text{ V}$	-	0.8	1.2	V

### Dynamic (Note 4)

Total Gate Charge	$Q_g$	$V_{DS} = 10 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 3.1 \text{ A}$	-	4.0	6.0	nC
Gate-Source Charge	$Q_{gs}$		-	0.6	-	
Gate-Drain Charge	$Q_{gd}$		-	1.3	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10 \text{ V}, R_L = 10 \Omega, I_D \approx 1.0 \text{ A}, V_{GEN} = 4.5 \text{ V}, R_G = 6 \Omega$	-	12	18	ns
Rise Time	$t_r$		-	35	55	
Turn-Off Delay Time	$t_{d(off)}$		-	19	30	
Fall Time	$t_f$		-	9.0	15	
Source-Drain Reverse Recovery Time	$t_{rr}$	$I_F = 0.9 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$	-	40	80	

2. Surface Mounted on 1" x 1" FR4 Board.
3. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production testing.

TYPICAL ELECTRICAL CHARACTERISTICS

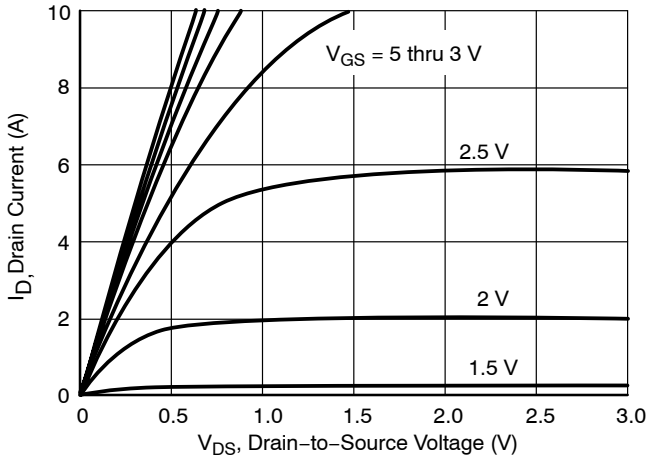


Figure 1. Output Characteristics

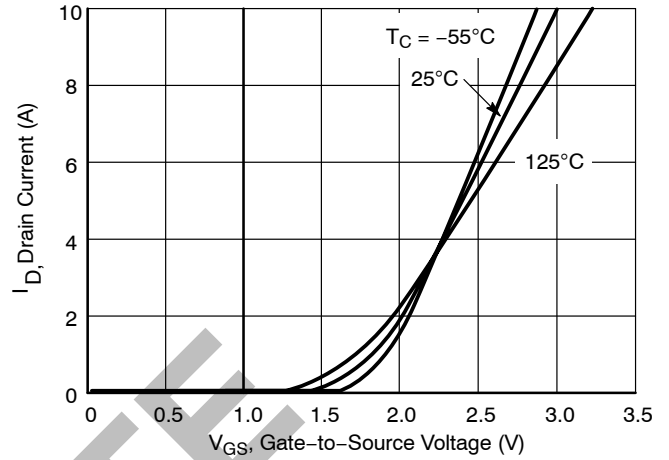


Figure 2. Transfer Characteristics

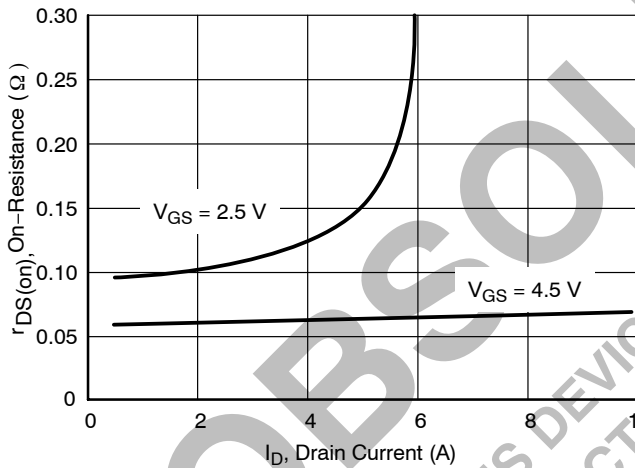


Figure 3. On-Resistance vs. Drain Current

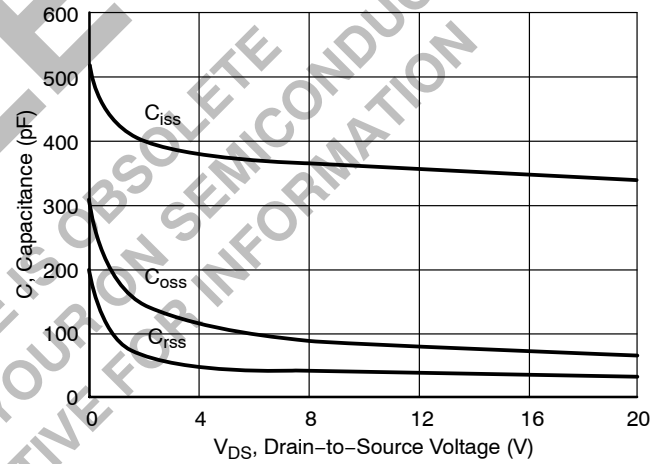


Figure 4. Capacitance

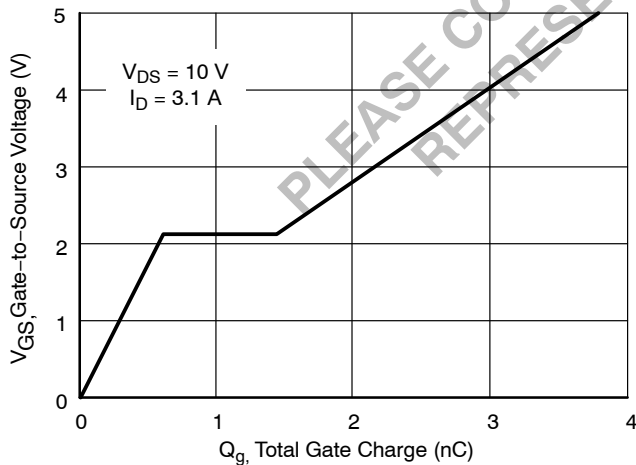


Figure 5. Gate Charge

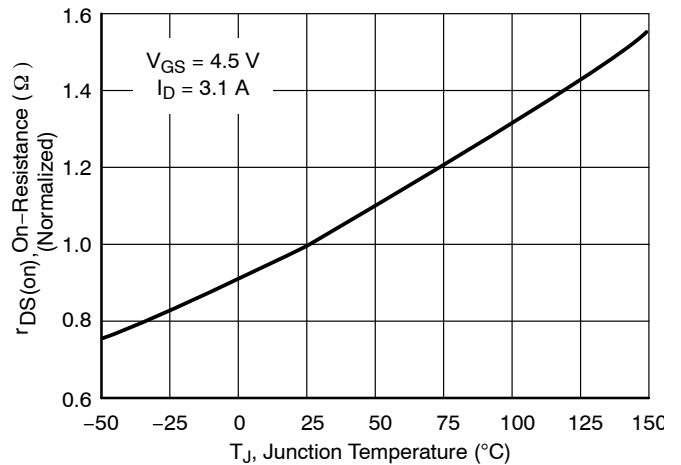


Figure 6. On-Resistance vs. Junction Temperature

TYPICAL ELECTRICAL CHARACTERISTICS

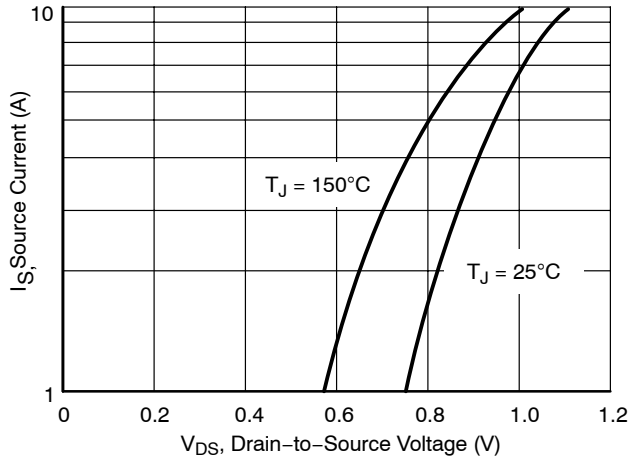


Figure 7. Source-Drain Diode Forward Voltage

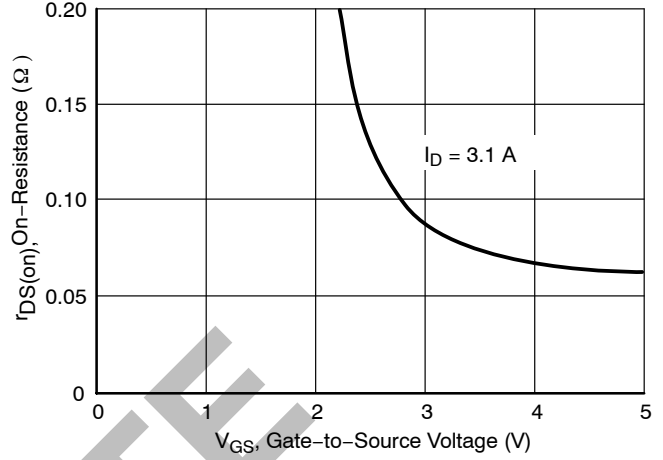


Figure 8. On-Resistance vs. Gate-to-Source Voltage

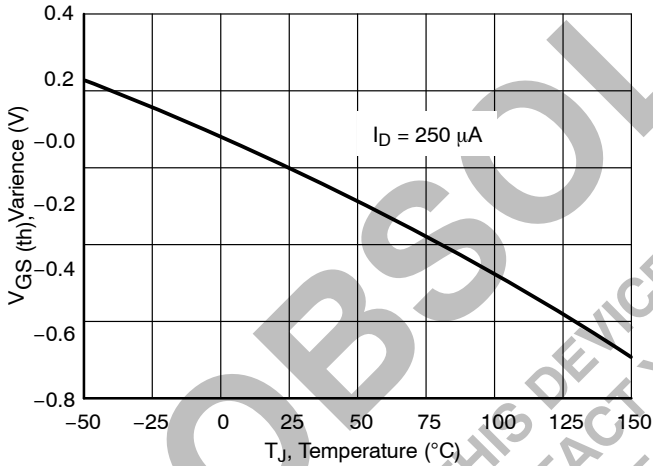


Figure 9. Threshold Voltage

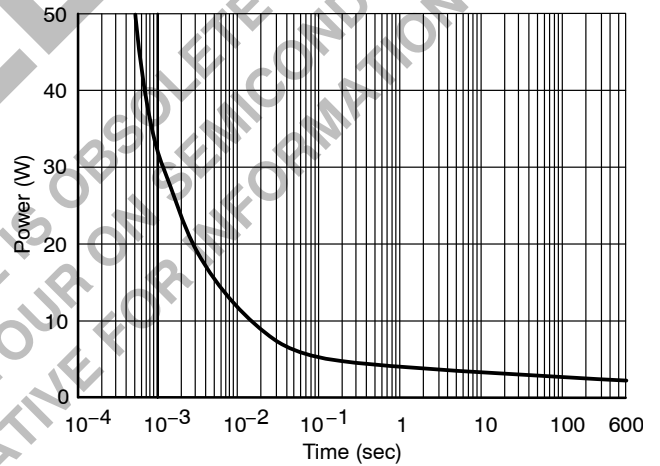


Figure 10. Single Pulse Power

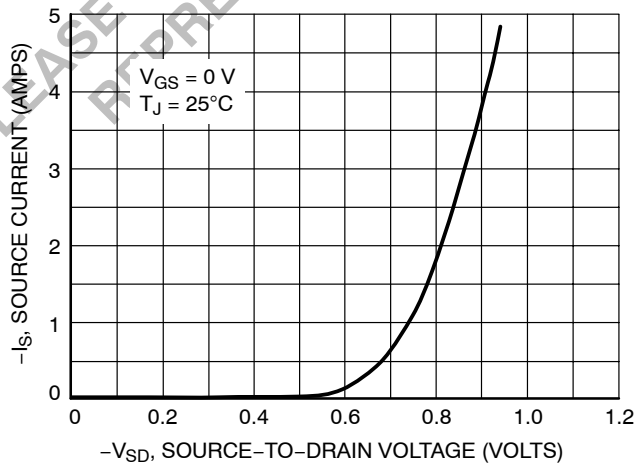


Figure 11. Diode Forward Voltage vs. Current

TYPICAL ELECTRICAL CHARACTERISTICS

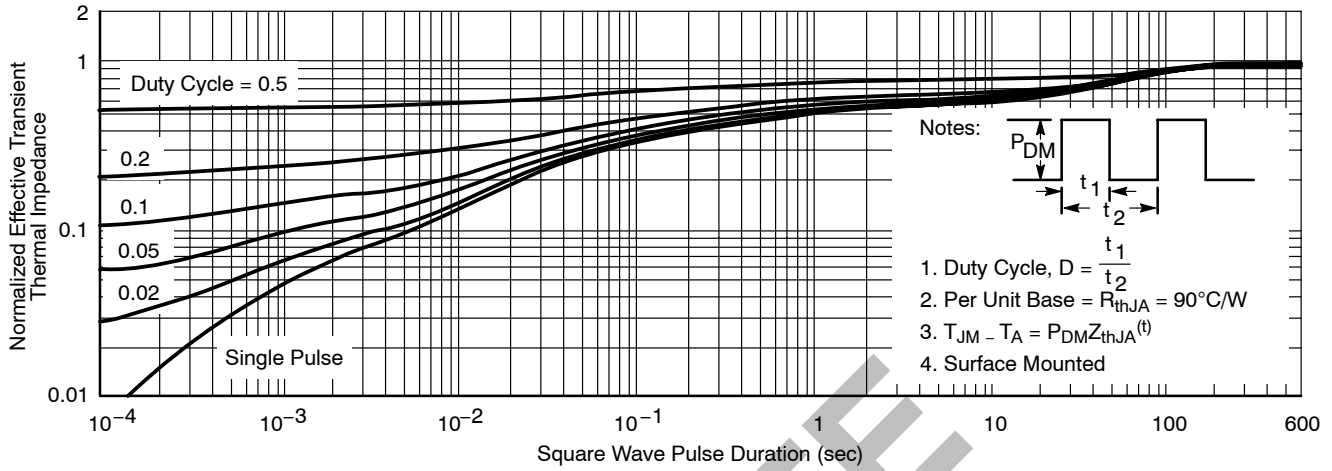


Figure 12. Normalized Thermal Transient Impedance, Junction-to-Ambient

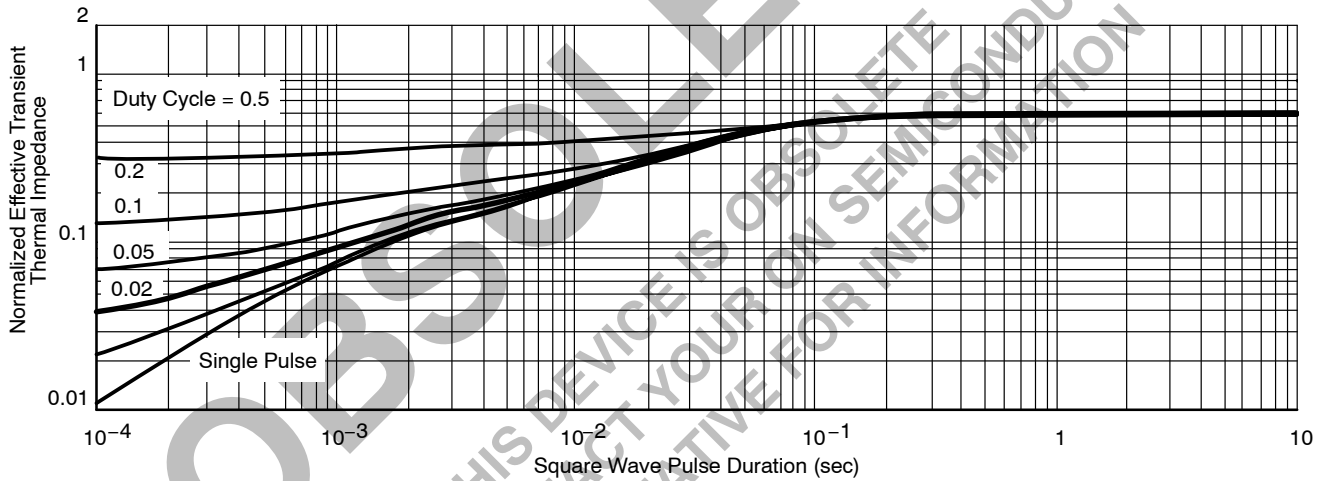


Figure 13. Normalized Thermal Transient Impedance, Junction-to-Foot

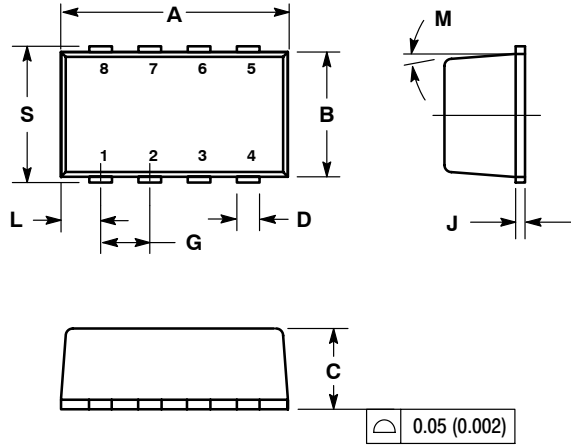
**Notes**

**OBSOLETE**  
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# NTHD5904T1

## PACKAGE DIMENSIONS

ChipFET  
CASE 1206A-03  
ISSUE C



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MOLD GATE BURRS SHALL NOT EXCEED 0.13 MM PER SIDE.
4. LEADFRAME TO MOLDED BODY OFFSET IN HORIZONTAL AND VERTICAL SHALL NOT EXCEED 0.08 MM.
5. DIMENSIONS A AND B EXCLUSIVE OF MOLD GATE BURRS.
6. NO MOLD FLASH ALLOWED ON THE TOP AND BOTTOM LEAD SURFACE.
7. 1206A-01 AND 1206A-02 OBSOLETE. NEW STANDARD IS 1206A-03.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.95	3.10	0.116	0.122
B	1.55	1.70	0.061	0.067
C	1.00	1.10	0.039	0.043
D	0.25	0.35	0.010	0.014
G	0.65 BSC		0.025 BSC	
J	0.10	0.20	0.004	0.008
K	0.28	0.42	0.011	0.017
L	0.55 BSC		0.022 BSC	
M	5° NOM		5° NOM	
S	1.80	2.00	0.072	0.080

### STYLE 2:

- PIN 1. SOURCE 1
- GATE 1
- SOURCE
- GATE 2
- DRAIN 1
- DRAIN 1
- DRAIN 2
- DRAIN 2

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