

**-40V(D-S) P-Channel Enhancement Mode Power MOS FET**

**General Features**

- $V_{DS} = -40V, I_D = -5.3A$   
 $R_{DS(ON)} < 80m\Omega @ V_{GS} = -10V$   
 $R_{DS(ON)} < 120m\Omega @ V_{GS} = -4.5V$
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Excellent package for good heat dissipation

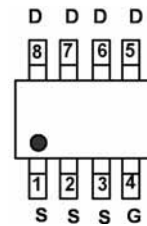


**Lead Free**

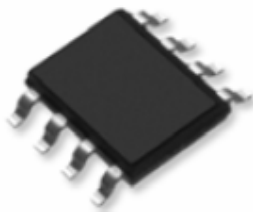
**Application**

- Power switching application
- Hard switched and high frequency circuits
- DC-DC converter

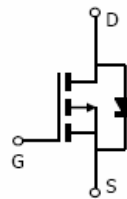
**PIN Configuration**



Marking and pin assignment



SOP-8 top view



Schematic diagram

**Package Marking and Ordering Information**

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
MSP0405W	MSP0405W	SOP-8	Ø330mm	12mm	2500 units

**Absolute Maximum Ratings ( $T_A = 25^\circ C$  unless otherwise noted)**

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	-5.3	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	-3.65	A
Pulsed Drain Current	$I_{DM}$	-20	A
Maximum Power Dissipation	$P_D$	2.0	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^\circ C$

**Thermal Characteristic**

Thermal Resistance ,Junction-to-Ambient <sup>(Note 2)</sup>	$R_{\theta JA}$	62.5	$^\circ C/W$
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**Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =-250μA	-40	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-40V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-1.0	-1.9	-3.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-5A	-	67	80	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-4A	-	92	120	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-15V, I <sub>D</sub> =-3.1A	10	-	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, F=1.0MHz	-	600	-	PF
Output Capacitance	C <sub>oss</sub>		-	90	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	70	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-20V, R <sub>L</sub> =2Ω V <sub>GS</sub> =-10V, R <sub>GEN</sub> =3Ω	-	9	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	8	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	28	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	10	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-20V, I <sub>D</sub> =-5A, V <sub>GS</sub> =-10V	-	14	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	2.9	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	3.8	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =-5A	-	-	1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	-5.3	A

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production

Typical Electrical and Thermal Characteristics

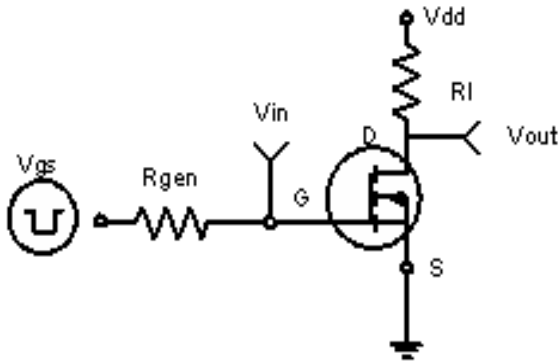


Figure 1: Switching Test Circuit

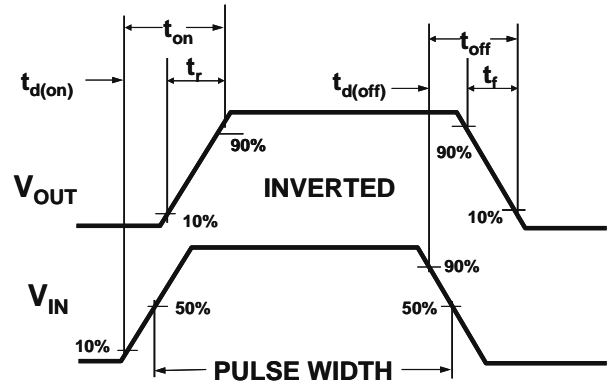


Figure 2: Switching Waveforms

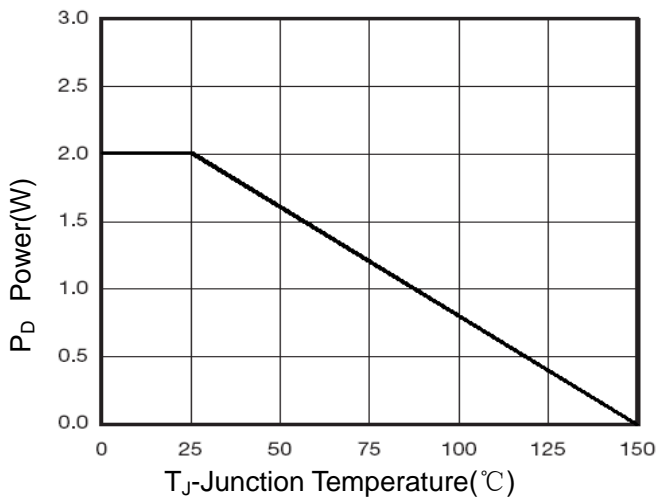


Figure 3 Power Dissipation

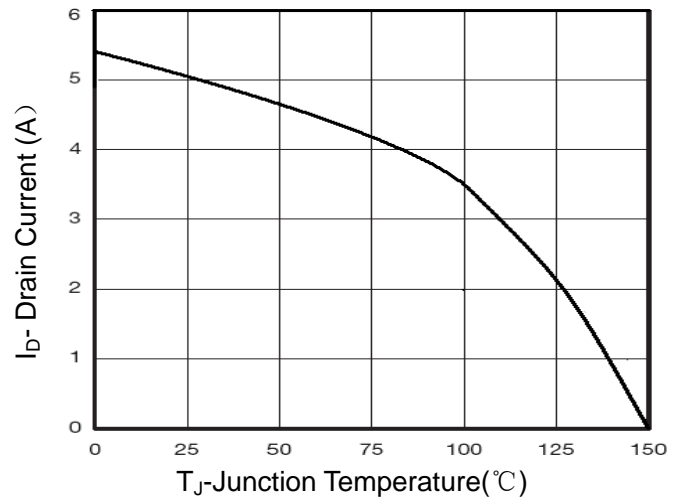


Figure 4 Drain Current

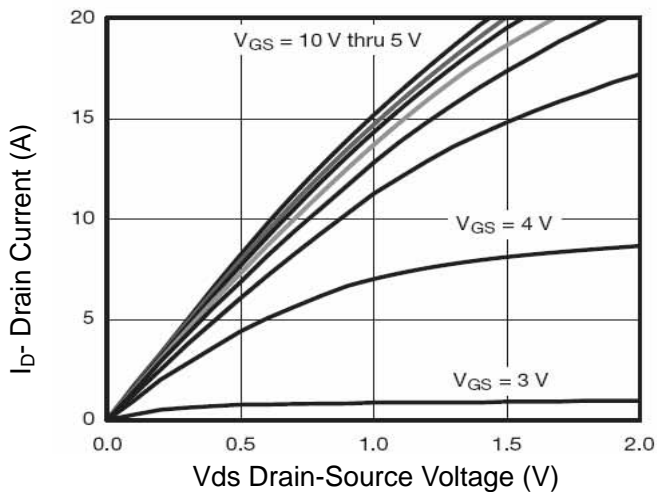


Figure 5 Output Characteristics

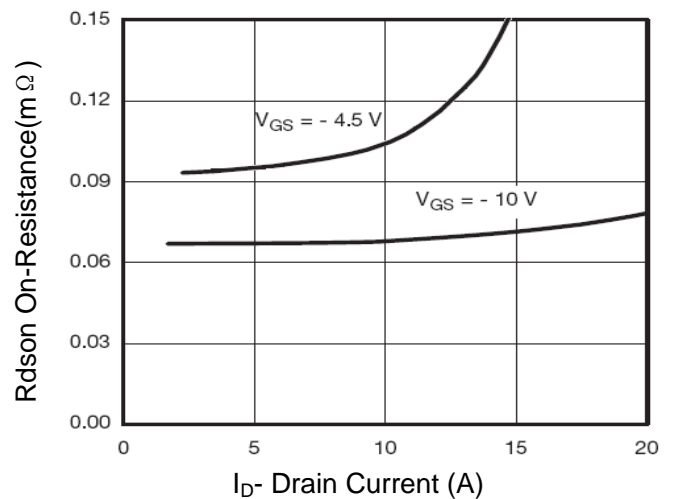


Figure 6 Drain-Source On-Resistance

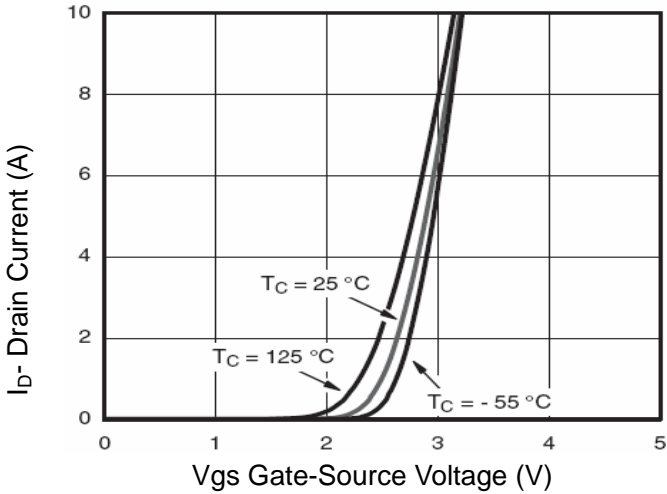


Figure 7 Transfer Characteristics

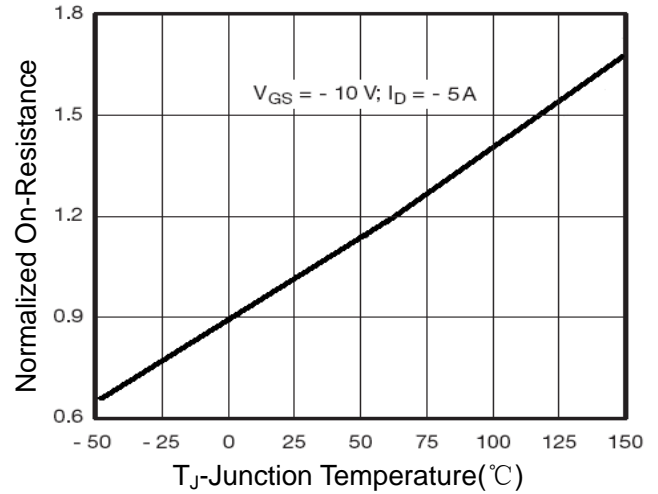


Figure 8 Drain-Source On-Resistance

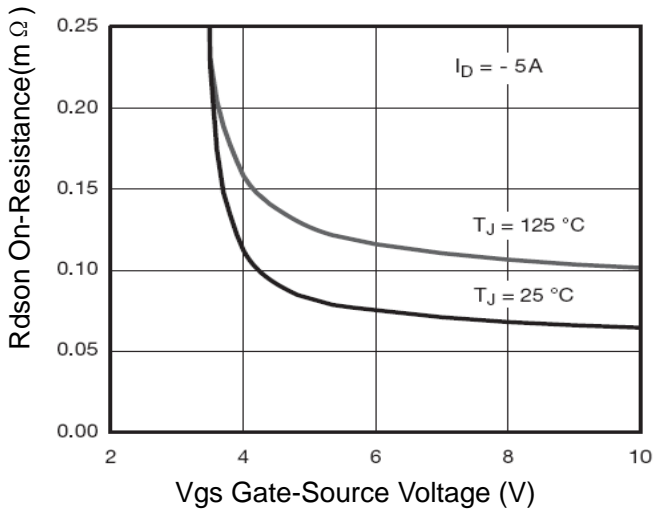


Figure 9 Rdson vs Vgs

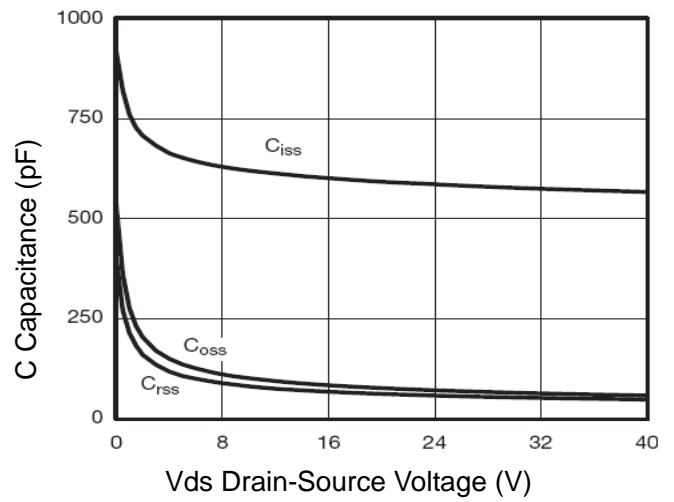


Figure 10 Capacitance vs Vds

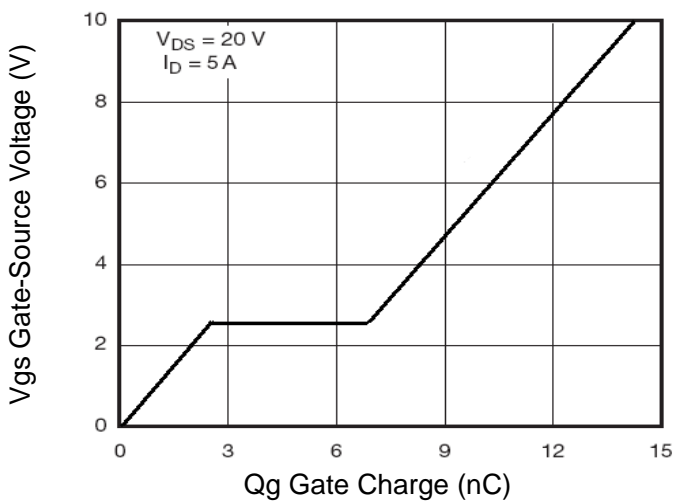


Figure 11 Gate Charge

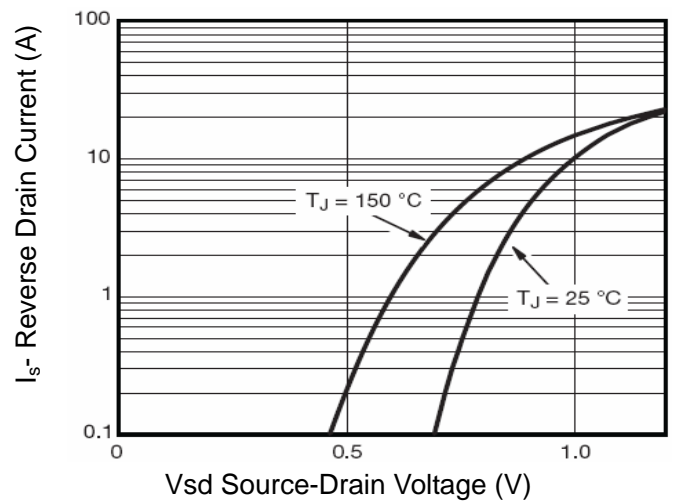
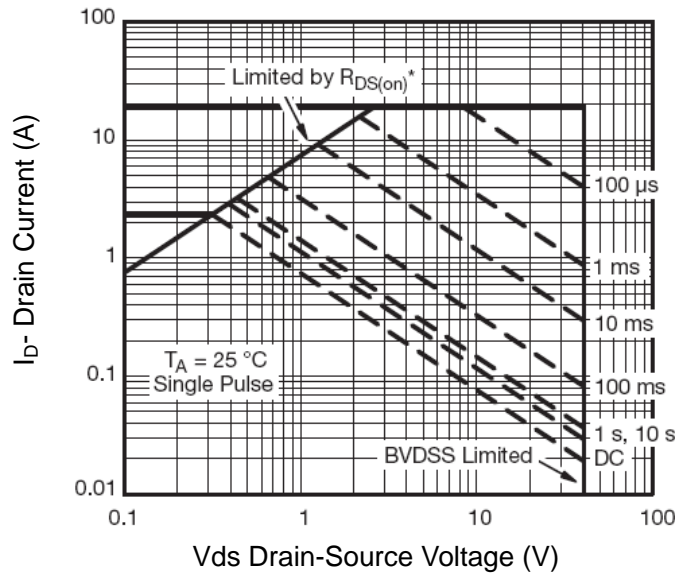
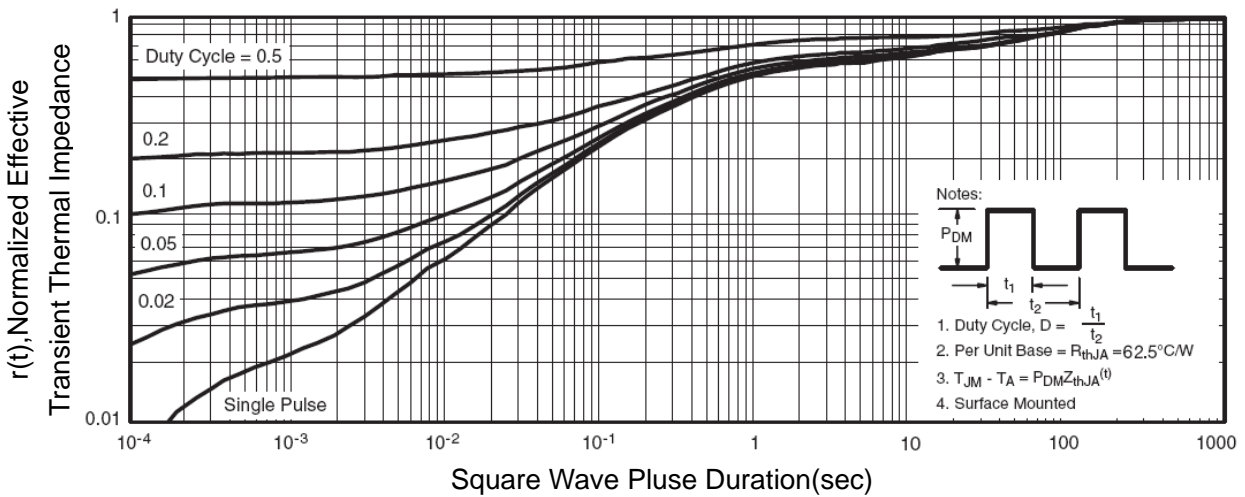


Figure 12 Source- Drain Diode Forward

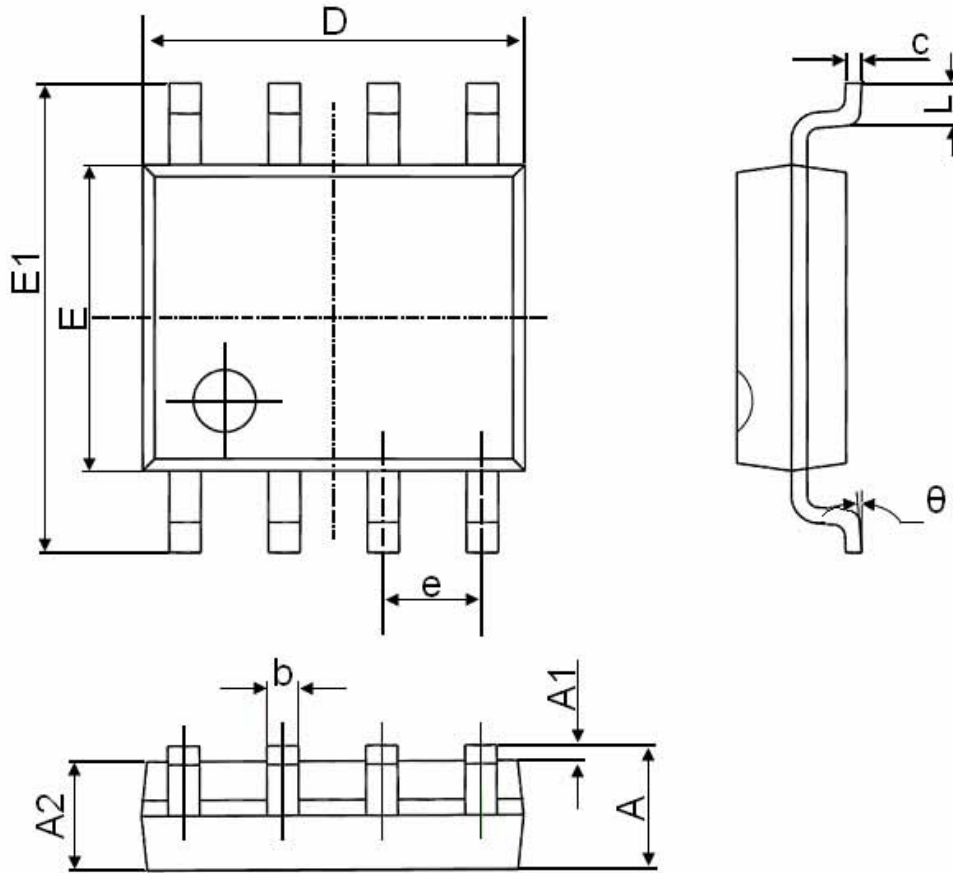


**Figure 13 Safe Operation Area**



**Figure 14 Normalized Maximum Transient Thermal Impedance**

**SOP-8 Package Information**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°