

40V N-Ch Power MOSFET

Feature

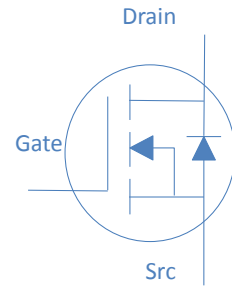
- ◇ Optimized for high speed switching, Logic Level
- ◇ Enhanced Body diode dv/dt capability
- ◇ Enhanced Avalanche Ruggedness
- ◇ 100% UIS Tested, 100% Rg Tested
- ◇ Lead Free, Halogen Free

Application

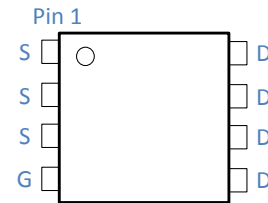
- ◇ Synchronous Rectification in SMPS
- ◇ Hard Switching and High Speed Circuit
- ◇ Power Tools
- ◇ UPS
- ◇ Motor Control

V_{DS}		40	V
$R_{DS(on),typ}$	$V_{GS}=10V$	1.4	mΩ
$R_{DS(on),typ}$	$V_{GS}=4.5V$	1.8	mΩ
I_D (Silicon Limited)		181	A
I_D (Package Limited)		60	A

DFN5x6



Part Number	Package	Marking
HTN020N04P	DFN5x6	TN020N04P



Absolute Maximum Ratings at $T_j=25^{\circ}C$ (unless otherwise specified)

Parameter	Symbol	Conditions	Value	Unit
Continuous Drain Current (Silicon Limited)	I_D	$T_C=25^{\circ}C$	181	A
		$T_C=100^{\circ}C$	115	
		Continuous Drain Current (Package Limited)	$T_C=25^{\circ}C$	
Drain to Source Voltage	V_{DS}	-	40	V
Gate to Source Voltage	V_{GS}	-	± 20	V
Pulsed Drain Current	I_{DM}	-	460	A
Avalanche Energy, Single Pulse	E_{AS}	$L=0.4mH, T_C=25^{\circ}C$	320	mJ
Power Dissipation	P_D	$T_C=25^{\circ}C$	119	W
Operating and Storage Temperature	T_J, T_{stg}	-	-55 to 150	$^{\circ}C$

Absolute Maximum Ratings

Parameter	Symbol	Max	Unit
Thermal Resistance Junction-Case	$R_{\theta JC}$	1.05	$^{\circ}C/W$
Thermal Resistance Junction-Ambient	$R_{\theta JA}$	55	$^{\circ}C/W$

Electrical Characteristics at $T_j=25^\circ\text{C}$ (unless otherwise specified)
Static Characteristics

Parameter	Symbol	Conditions	Value			Unit
			min	typ	max	
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=250\mu A$	40	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	1	1.8	2.2	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS}=0V, V_{DS}=40V, T_j=25^\circ\text{C}$	-	-	1	μA
		$V_{GS}=0V, V_{DS}=40V, T_j=100^\circ\text{C}$	-	-	100	
Gate to Source Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA
Drain to Source on Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=20A$	-	1.4	2	$m\Omega$
		$V_{GS}=4.5V, I_D=20A$	-	1.8	3	$m\Omega$
Transconductance	g_{fs}	$V_{DS}=5V, I_D=20A$	-	120	-	S
Gate Resistance	R_G	$V_{GS}=0V, V_{DS}$ Open, $f=1\text{MHz}$	-	0.85	-	Ω

Dynamic Characteristics

Input Capacitance	C_{iss}	$V_{GS}=0V, V_{DS}=20V, f=1\text{MHz}$	-	7356	-	μF
Output Capacitance	C_{oss}		-	814	-	
Reverse Transfer Capacitance	C_{rss}		-	547	-	
Total Gate Charge (10V)	$Q_g(10V)$	$V_{DD}=20V, I_D=20A, V_{GS}=10V$	-	135	-	nC
Total Gate Charge (4.5V)	$Q_g(4.5V)$		-	70	-	
Gate to Source Charge	Q_{gs}		-	20	-	
Gate to Drain (Miller) Charge	Q_{gd}		-	35	-	
Turn on Delay Time	$t_{d(on)}$	$V_{DD}=20V, I_D=20A, V_{GS}=10V, R_G=10\Omega,$	-	26	-	ns
Rise time	t_r		-	21	-	
Turn off Delay Time	$t_{d(off)}$		-	75	-	
Fall Time	t_f		-	25	-	

Reverse Diode Characteristics

Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_F=20A$	-	0.9	1.2	V
Reverse Recovery Time	t_{rr}	$V_R=20V, I_F=20A, di_F/dt=200A/\mu s$	-	40	-	ns
Reverse Recovery Charge	Q_{rr}		-	50	-	nC

Fig 1. Typical Output Characteristics

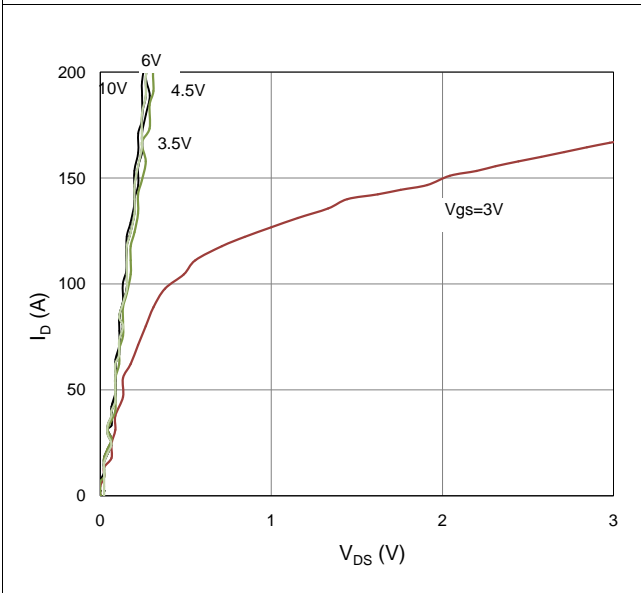


Figure 2. On-Resistance vs. Gate-Source Voltage

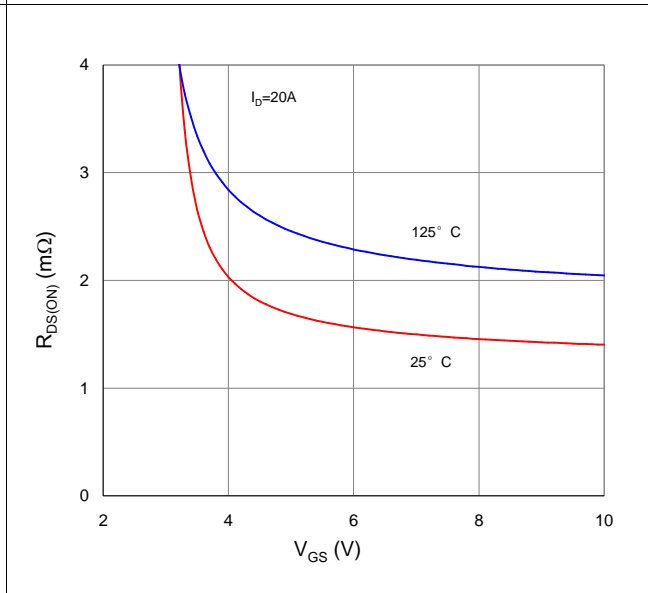


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

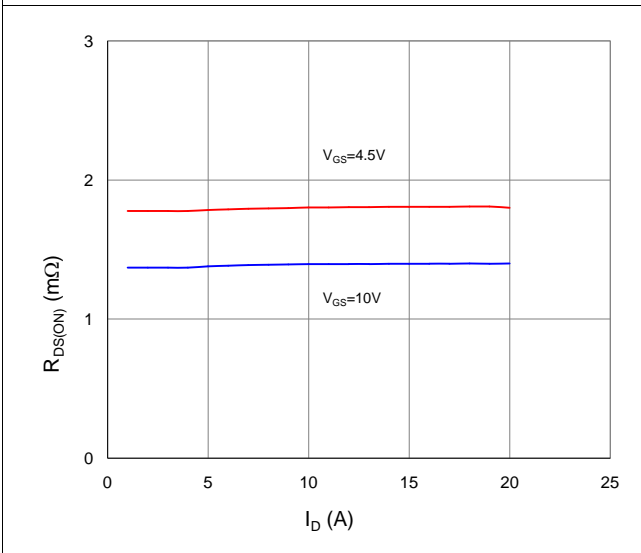


Figure 4. Normalized On-Resistance vs. Junction Temperature

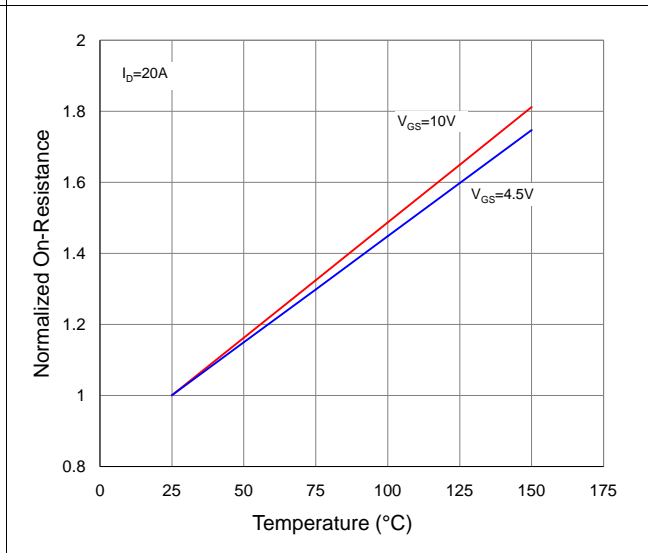


Figure 5. Typical Transfer Characteristics

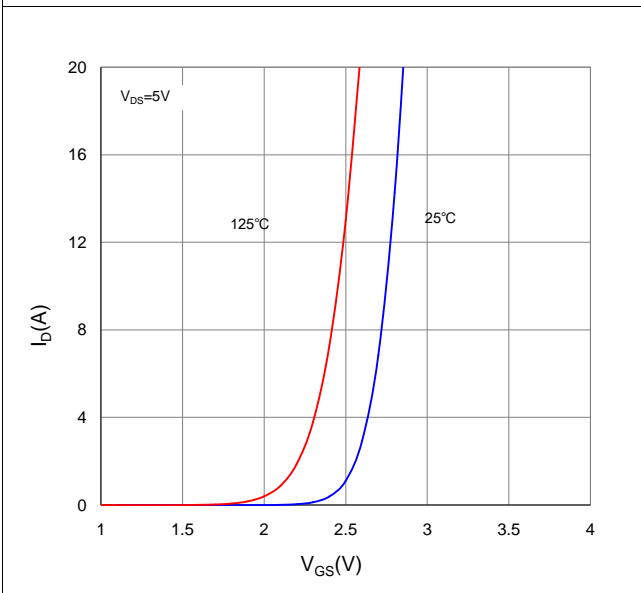


Figure 6. Typical Source-Drain Diode Forward Voltage

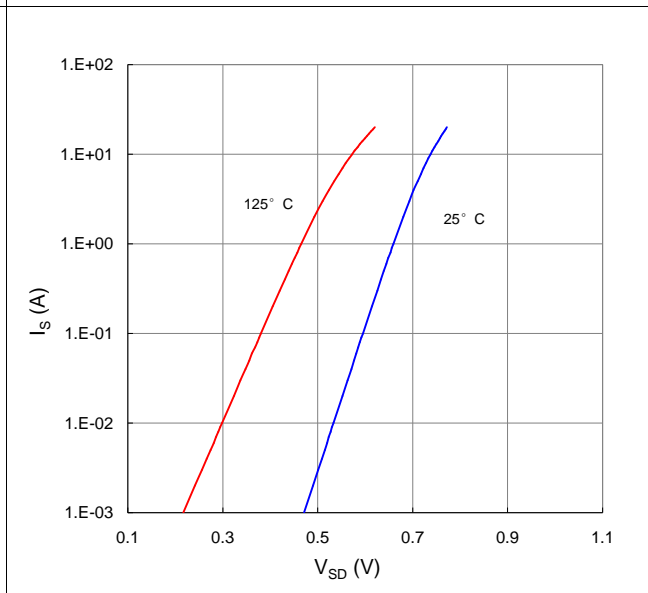


Figure 7. Typical Gate-Charge vs. Gate-to-Source Voltage

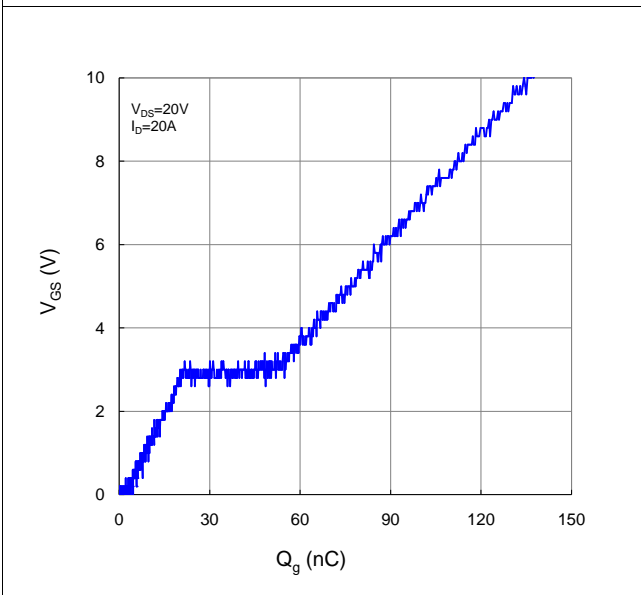


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

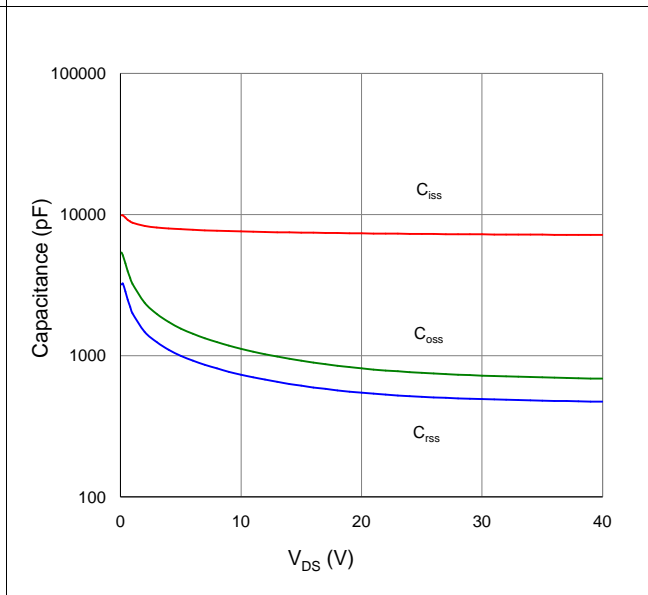


Figure 9. Maximum Safe Operating Area

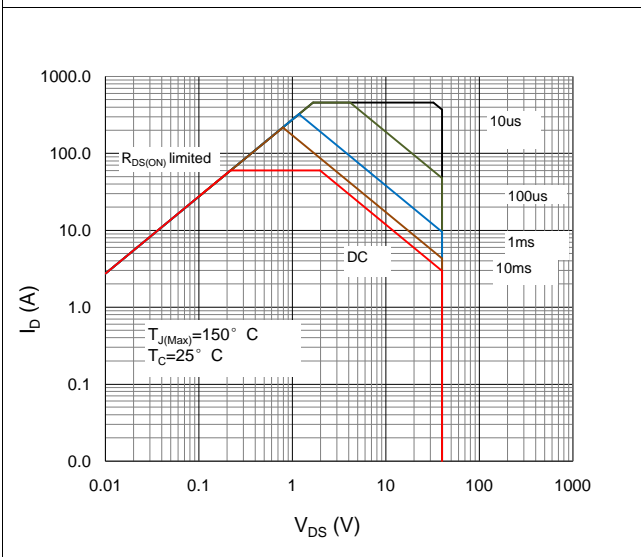


Figure 10. Maximum Drain Current vs. Case Temperature

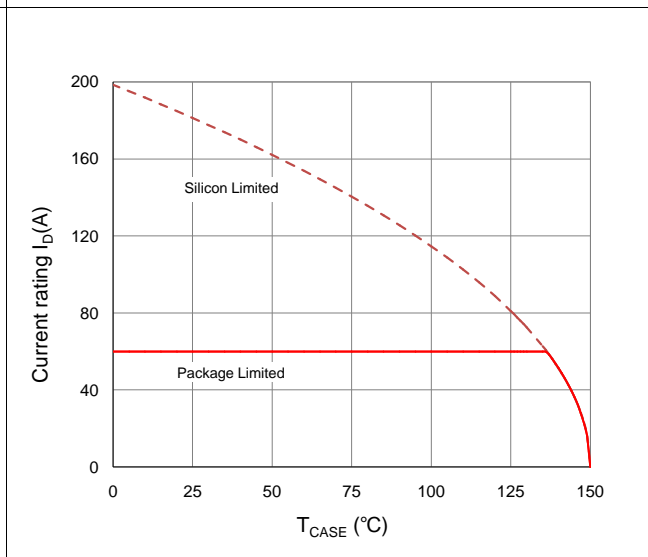
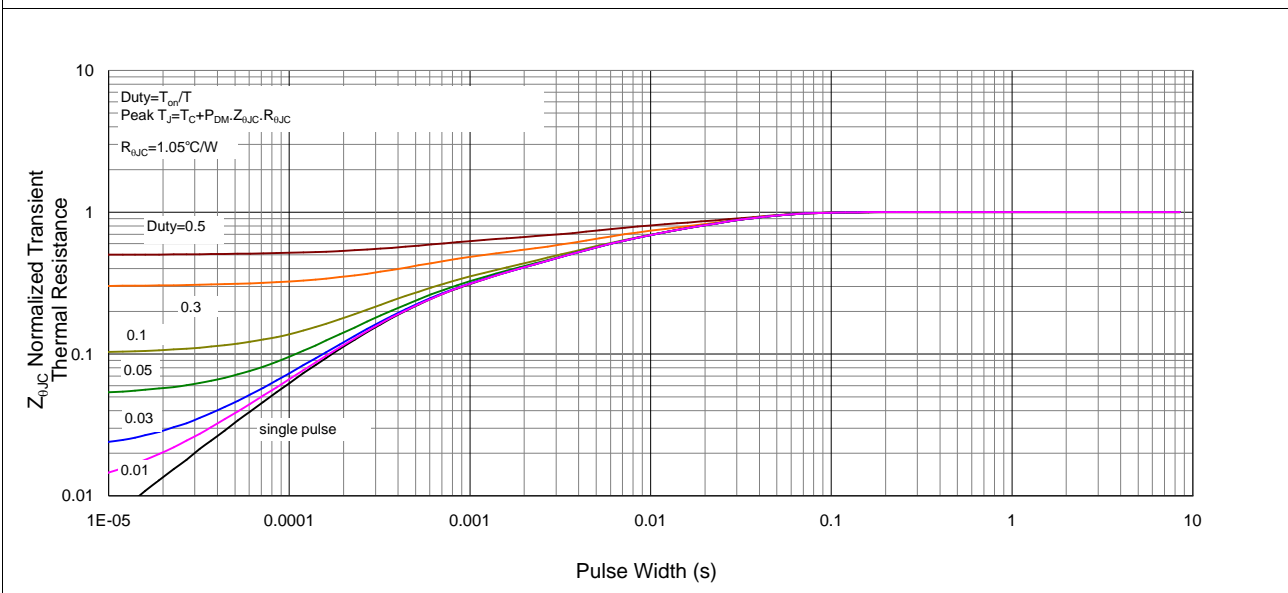
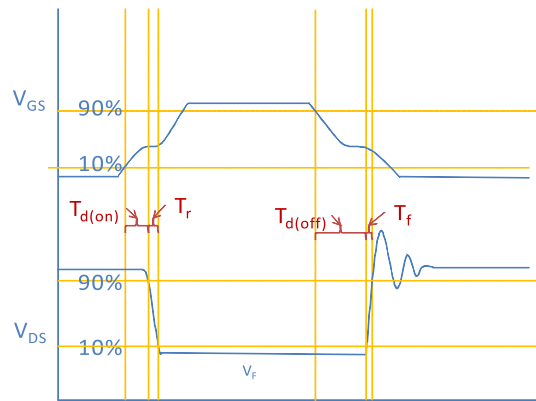
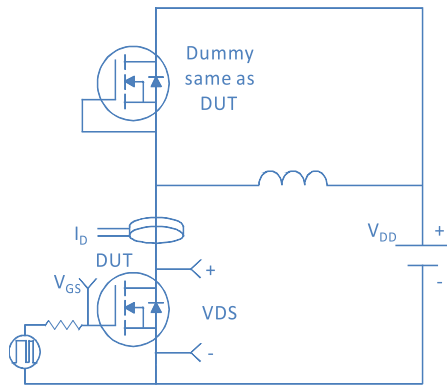


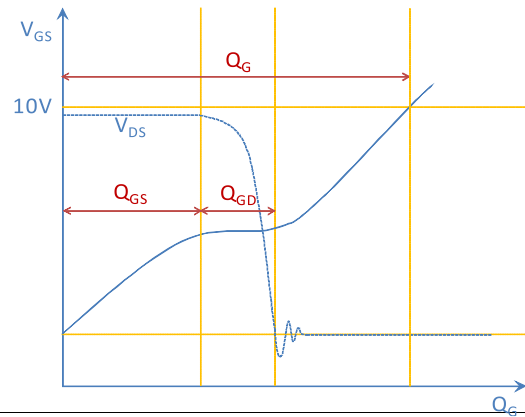
Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Case



Inductive switching Test



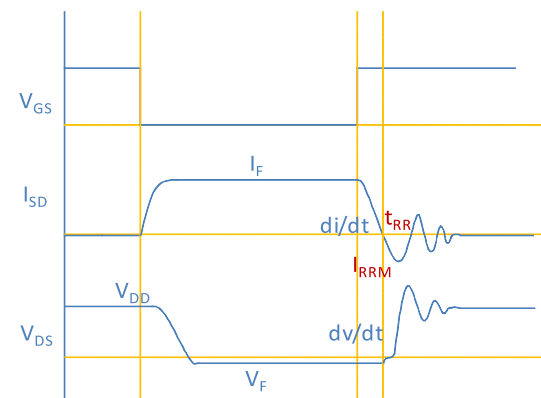
Gate Charge Test



Uclamped Inductive Switching (UIS) Test

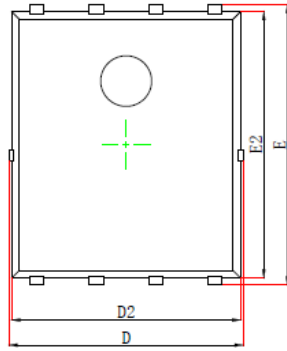


Diode Recovery Test

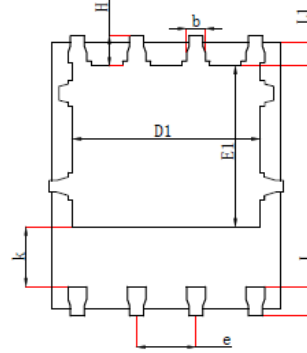


Package Outline

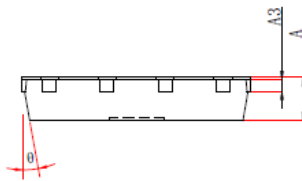
DFN5x6_P, 8 Leads



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.000	0.035	0.039
A3	0.254REF.		0.010REF.	
D	4.944	5.096	0.195	0.201
E	5.974	6.126	0.235	0.241
D1	3.910	4.110	0.154	0.162
E1	3.375	3.575	0.133	0.141
D2	4.824	4.976	0.190	0.196
E2	5.674	5.826	0.223	0.229
k	1.190	1.390	0.047	0.055
b	0.350	0.450	0.014	0.018
e	1.270TYP.		0.050TYP.	
L	0.559	0.711	0.022	0.028
L1	0.424	0.576	0.017	0.023
H	0.574	0.726	0.023	0.029
θ	10°	12°	10°	12°