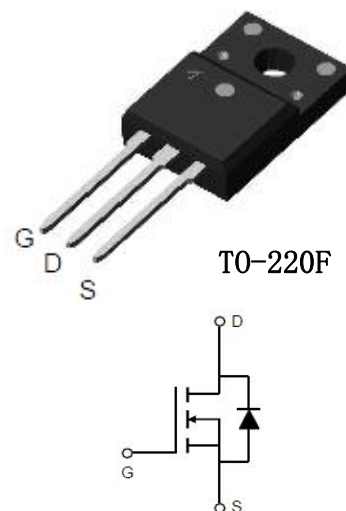


650V N-Channel POWER MOSFET

Features

- $V_{DSS}=650V$ $I_D=4A$
 $R_{DS(ON)}=2.8\Omega(\text{Max.})@V_{GS}=10V$
- High Reliability Capability with Passivation
- 100% avalanche tested
- RoHS compliant
- Low ON Resistance

PIN DESCRIPTION



Applications

- LED power supplies
- Cell Phone Charger
- Standby Power

Part Number	Package	Marking	ROHS Status	Packing
SI4N65F	T0-220F	SI4N65F	Pb-Free	Box (Tube)

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

Symbol	Parameter	Typical	Unit
V_{DSS}	Drain-Source Voltage	650	V
V_{GSS}	Gate-Source Voltage	± 30	V
I_D	Drain Current	4	A
	$T_C=25^\circ\text{C}$		
I_{DM}	Pulsed Drain Current	16	A
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	30	W
I_{AR}	Avalanche Current	2.5	A
E_{AS}	Single Pulse Avalanche Energy	200	mJ
E_{AR}	Repetitive Avalanche Energy	116	mJ
T_J, T_{stg}	Operating Junction and Storage Temperature Range	-55 to 150	$^\circ\text{C}$

Thermal Resistance

Parameter	Symbol	Value	Unit
Thermal resistance, junction – Case.	$R_{\theta JC}$	4.17	$^\circ\text{C}/\text{W}$
Thermal resistance, junction – Ambient.	$R_{\theta JA}$	62.5	

Electrical Characteristics ($T_A=25^\circ\text{C}$ unless otherwise noted)

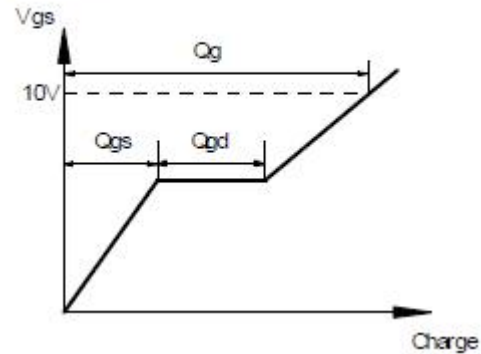
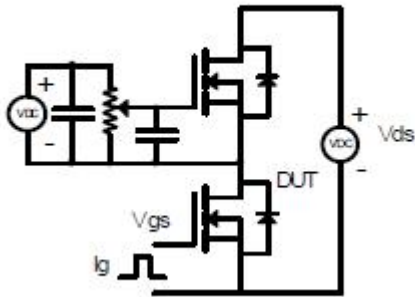
Symbol	Parameter	Test Conditions	Min	TYP	Max	Unit
Static Characteristics						
BV_{DSS}	Drain-source breakdown voltage	$V_{GS}=0V, I_D=250\mu A$	650	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=650V, V_{GS}=0V$	-	-	1	μA
I_{GSS}	Gate-Source Leakage	$V_{GS}=\pm 30V, V_{DS}=0V$	-	-	± 100	nA
$V_{GS(th)}$	Gate-Source Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2	-	4	V
$R_{DS(on)}$	Drain-Source On-Resistance	$V_{GS}=10V, I_D=2A$	-	-	2.8	Ω
g_{fs}	Forward Transconductance	$V_{DS}=15V, I_D=2A$	-	3.5	-	S
Dynamic Characteristic						
C_{iss}	Input Capacitance	$V_{GS}=0V, V_{DS}=25V, f=1MHz$	-	610	-	pF
C_{oss}	Output Capacitance		-	53	-	
C_{rss}	Reverse Transfer Capacitance		-	4	-	
Q_G	Gate Total Charge	$V_{DS}=520V, I_D=4A, V_{GS}=10V,$	-	15	-	nC
Q_{gs}	Gate-Source charge		-	3	-	
Q_{gd}	Gate-Drain charge		-	7	-	
$t_{d(on)}$	Turn-on delay time	$V_{DD}=325V, I_D=4A, R_G=10\Omega, V_{GS}=10V$	-	14	-	nS
t_r	Rise time		-	16	-	
$t_{d(off)}$	Turn-off delay time		-	32	-	
t_f	Fall time		-	11	-	
Drain-Source Body Diode Characteristics						
V_{SD}	Body Diode Forward Voltage	$V_{GS}=0V, I_F=1A$	-	-	14	V
t_{rr}	Body Diode Reverse Recovery Time	$V_{GS}=0V, I_F=4A, di_F/dt=100A/\mu s$	-	250	-	nS
Q_{rr}	Body Diode Reverse Recovery Charge		-	12.	-	μC
I_S	Maximum Continuous Drain-Source Diode Forward Current		-	-	4	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		-	-	16	A

Note:

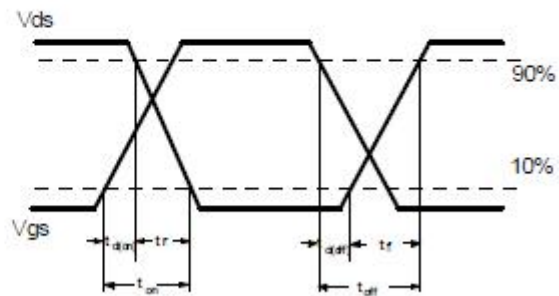
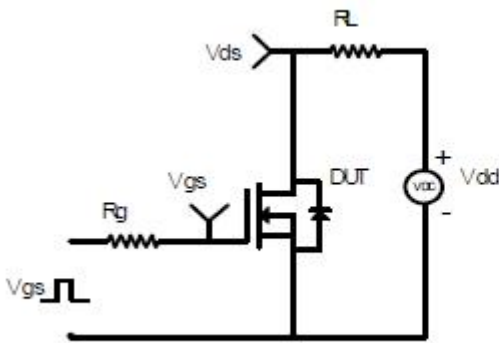
- The value of $R_{\theta JA}$ is measured with the device in a still air environment with $T_A=25^\circ\text{C}$.
- The static characteristics in Figures 1 to 6 are obtained using $<300\mu s$ pulses, duty cycle 2% max

Switching Time Test Circuit and Wave forms

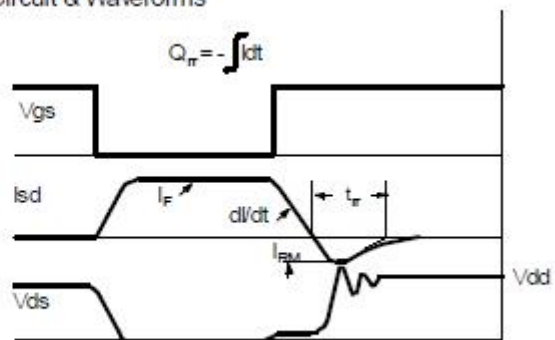
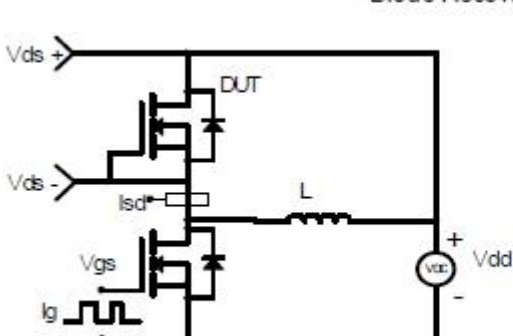
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Typical Performance Characteristics

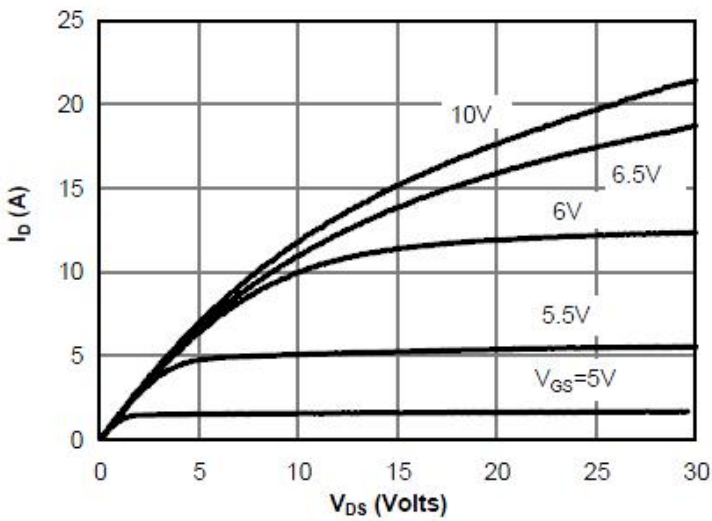


Fig 1: On-Region Characteristics

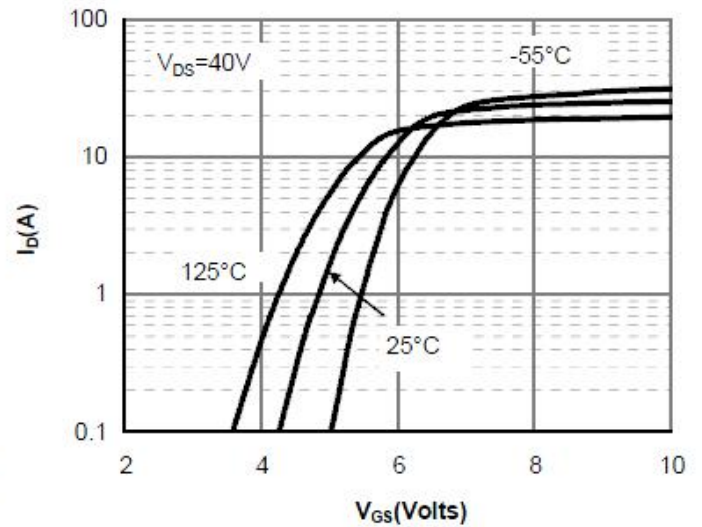


Figure 2: Transfer Characteristics

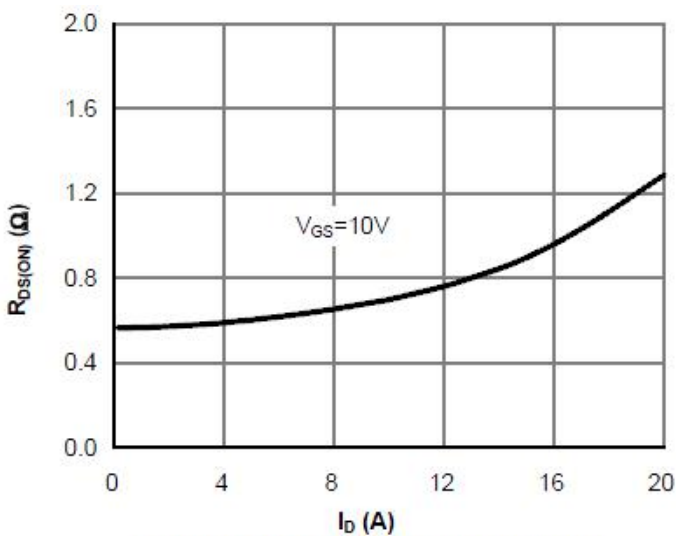


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

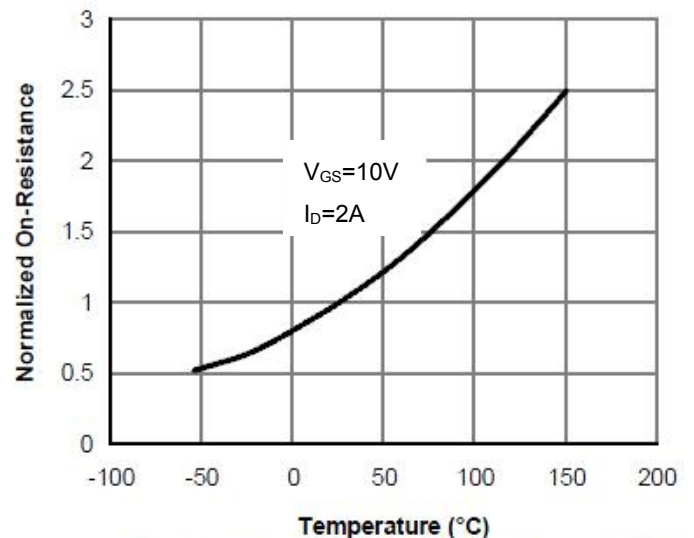


Figure 4: On-Resistance vs. Junction Temperature

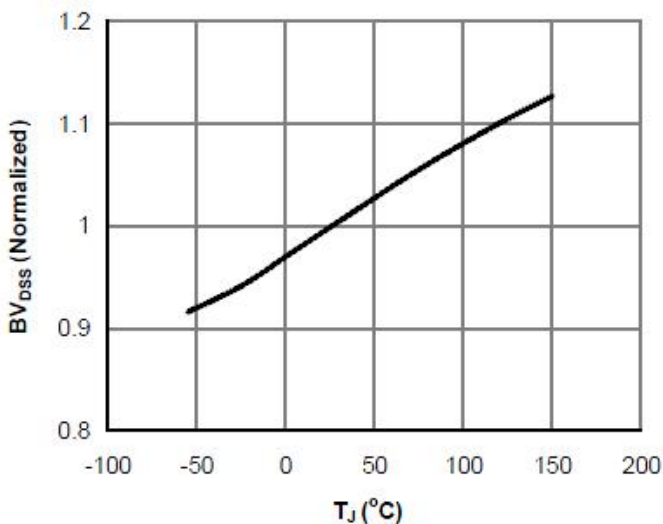


Figure 5: Break Down vs. Junction Temperature

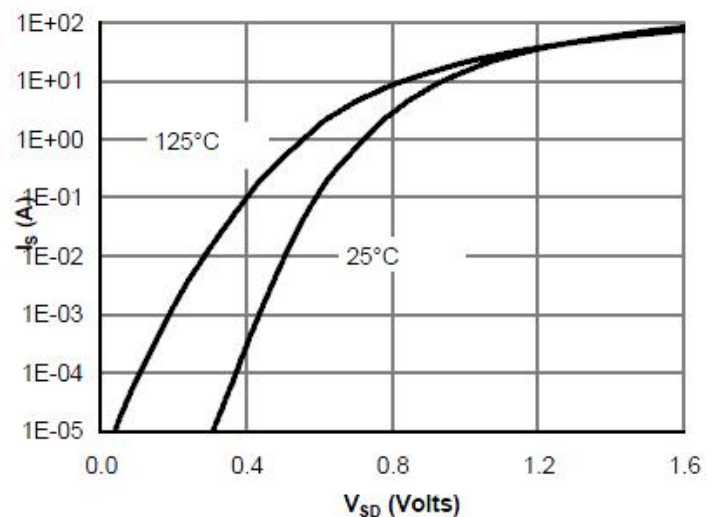
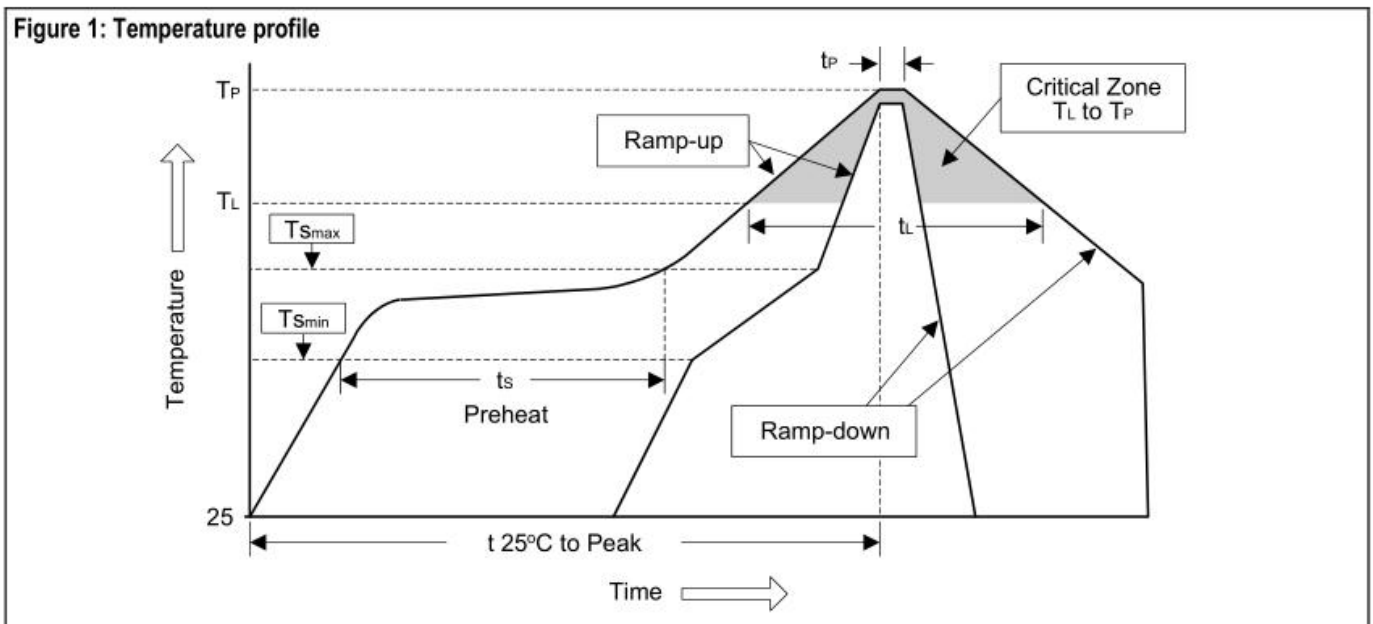


Figure 6: Body-Diode Characteristics (Note E)

Soldering Methods for Products

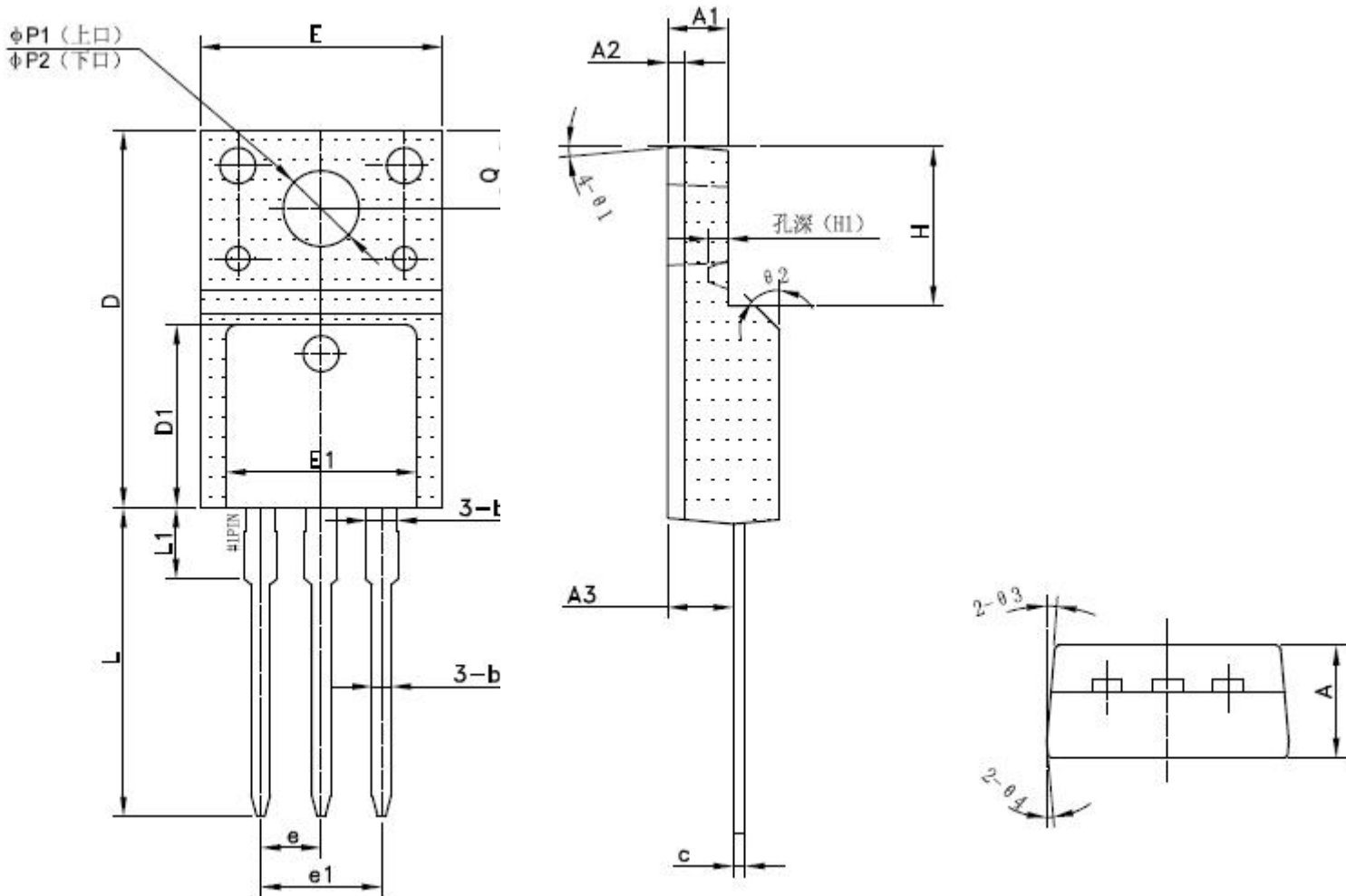
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate(TL to TP)	<3°C/sec	<3°C/sec
Preheat		
-Temperature Min(Ts min)	100°C	150°C
-Temperature Max(Ts max)	150°C	200°C
-Time(min to max)(ts)	60 to 120 sec	60 to 180 sec
Tsmax to TL		
- ramp-up rate	<3°C/sec	<3°C/sec
Time maintained above:		
-Temperature(TL)	183°C	217°C
-Time(tL)	60 to 150 sec	60 to 150 sec
Peak Temperature(Tp)	240°C+0/-5°C	250°C+0/-5°C
Time within 5°C of actual Peak Temperature	10 to 30 sec	20 to 40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25 °C to Peak Temperature	<6 minutes	<8 minutes



Note :1.Storage environment: Temperature=10°C to 35@Humidity=45%±15%

- 2.Reflow soldering of surface-mount devices
- 3.Flow(wave) soldering(solder dipping)

Products	Peak Temperature	Dipping Time
Pb devices	245°C±5°C	5sec±1sec
Pb-free devices	250°C+0/-5°C	5sec±1sec

Package Outline


Millimeter(mm)					
Symbol	Min	Max	Symbol	Min	Max
A	4.50	4.90	E	9.96	10.36
A1	2.44	2.64	E1	8.00TYP	
A2	0.60	0.80	e	2.54TYP	
A3	2.56	2.96	e1	5.08TYP	
b	0.70	0.95	H	6.50	6.90
b1	1.28TYP		L	12.48	13.20
c	0.45	0.65	L1	2.93TYP	
D	15.67	16.07	P1	2.98	3.38
D1	7.70TYP		P2	3.20.	3.60

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