
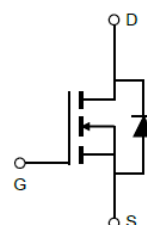




40V N-Channel Trench MOSFET(Preliminary)

General Description <ul style="list-style-type: none">• Trench Power technology• Low $R_{DS(ON)}$• Low Gate Charge• Optimized for fast-switching applications Applications <ul style="list-style-type: none">• Synchronous Rectification in DC/DC and AC/DC Converters• Isolated DC/DC Converters in Telecom and Industrial	Product Summary V_{DS} 40V I_D (at $V_{GS}=10V$) 65A $R_{DS(ON)}$ (at $V_{GS}=10V$) < 8.0m Ω $R_{DS(ON)}$ (at $V_{GS}=4.5V$) < 12.5m Ω 100% UIS Tested 
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TO-220



Part Number	Package Type	Form	Marking
TTP65N04AT	TO-220	Tape&Reel	65N04AT

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

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	40	V
Gate-Source Voltage		V_{GS}	± 20	V
Continuous Drain Current ^B	$T_C=25^{\circ}\text{C}$	I_D	65	A
	$T_C=100^{\circ}\text{C}$		52	
Pulsed Drain Current ^A		I_{DM}	195	A
Avalanche Current ^A		I_{AS}	21	A
Single Pulse Avalanche Energy ^A L=0.3mH		E_{AS}	66	mJ
Power Dissipation ^C	$T_C=25^{\circ}\text{C}$	P_D	65	W
	$T_C=100^{\circ}\text{C}$		32	W
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 175	$^{\circ}\text{C}$

Thermal Characteristics

Parameter		Symbol	Maximum	Units
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	2.3	$^{\circ}\text{C/W}$
Maximum Junction-to-Ambient	Steady-State	$R_{\theta JA}$	100	



Electrical Characteristics(T _J =25°C unless otherwise noted)							
Symbol	Parameter	Conditions		Value			Units
				Min	Typ	Max	
STATIC PARAMETERS							
BV _{DSS}	Drain-Source Breakdown Voltage	I _D =250μA, V _{GS} =0V		40			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =40V, V _{GS} =0V	T _J =25°C			1	μA
			T _J =100°C			25	
I _{GSS}	Gate-Body Leakage Current	V _{DS} =0V, V _{GS} =± 20V				± 100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA		1	1.7	2.4	V
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =30A			6.7	8	mΩ
		V _{GS} =4.5V, I _D =30A			10.5	12.5	mΩ
g _{FS}	Forward Transconductance	V _{DS} =10V, I _D =20A			26.4		S
V _{SD}	Diode Forward Voltage	I _S =30A, V _{GS} =0V				1	V
I _S	Maximum Body-Diode Continuous Current ^B					46	A
DYNAMIC PARAMETERS							
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =20V, f =1MHz			2025		pF
C _{oss}	Output Capacitance				190		
C _{rss}	Reverse Transfer Capacitance				177		
SWITCHING PARAMETERS							
Q _g (10V)	Total Gate Charge	V _{GS} =10V, V _{DS} =20V, I _D =30A			48		nC
Q _{gs}	Gate Source Charge				8.5		
Q _{gd}	Gate Drain Charge				10		
t _{D(on)}	Turn-On Delay Time	V _{GS} =10V, V _{DS} =20V, I _D =30A, R _G =3Ω			7		ns
t _r	Turn-On Rise Time				4		
T _{D(off)}	Turn-Off Delay Time				25		
t _f	Turn-Off Fall Time				5		
t _{rr}	Body Diode Reverse Recovery Time	I _F =20A, di/dt =100A/μs			15.5		ns
Q _{rr}	Body Diode Reverse Recovery Charge				31		nC

A. Single pulse width limited by maximum junction temperature.

B. The maximum current rating is package limited.

C. The power dissipation P_D is based on $T_{J(MAX)} = 175^{\circ}\text{C}$, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

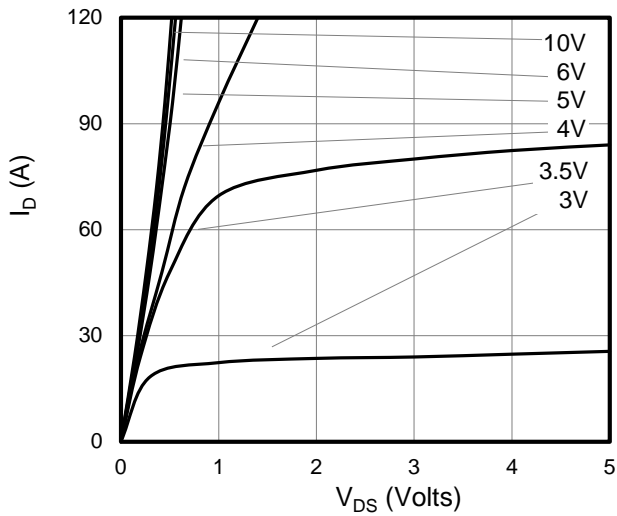


Figure 1: On-Region Characteristics

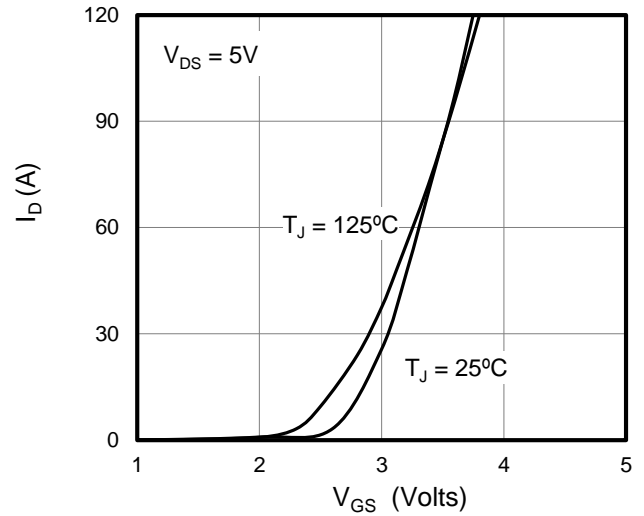


Figure 2: Transfer Characteristics

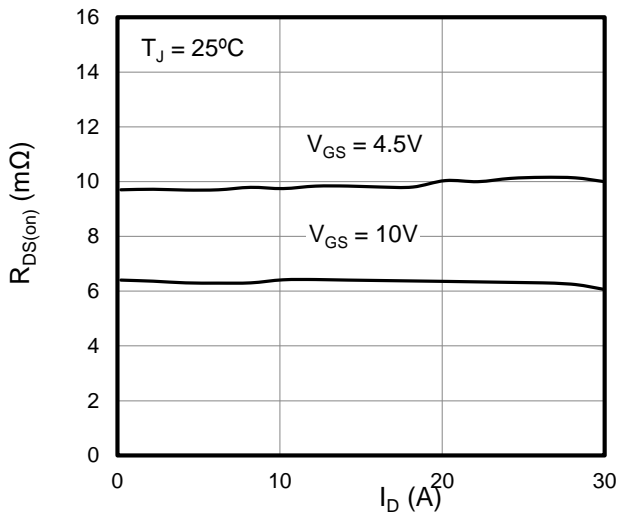


Figure 3: On-Resistance vs. Drain Current

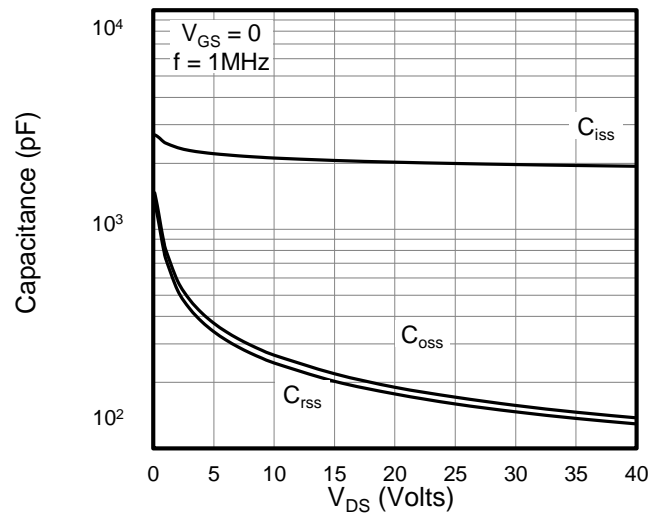


Figure 4: Capacitance Characteristics

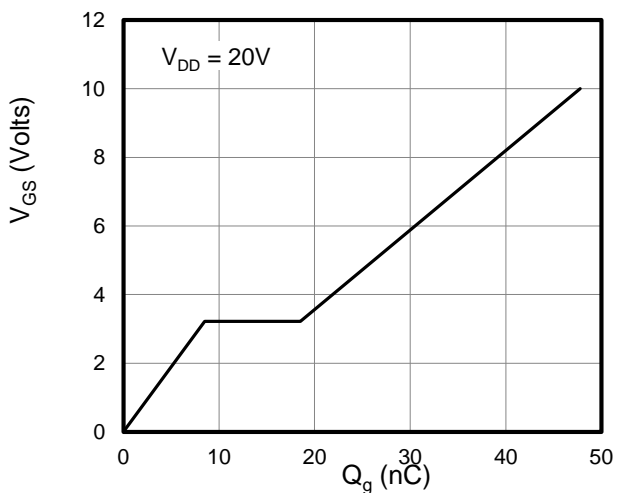


Figure 5: Gate Charge Characteristics

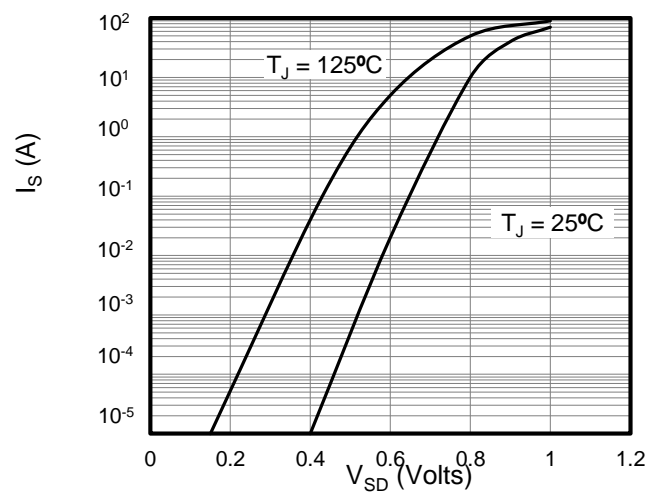


Figure 6: Body Diode Forward Voltage



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

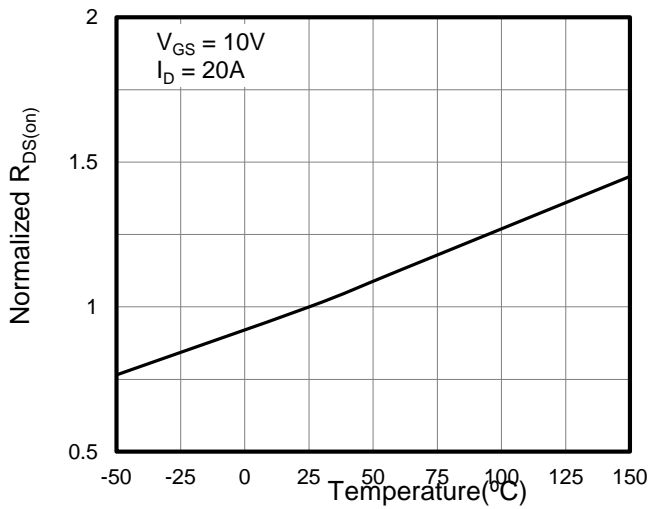


Figure 7: On-Resistance vs. Junction Temperature

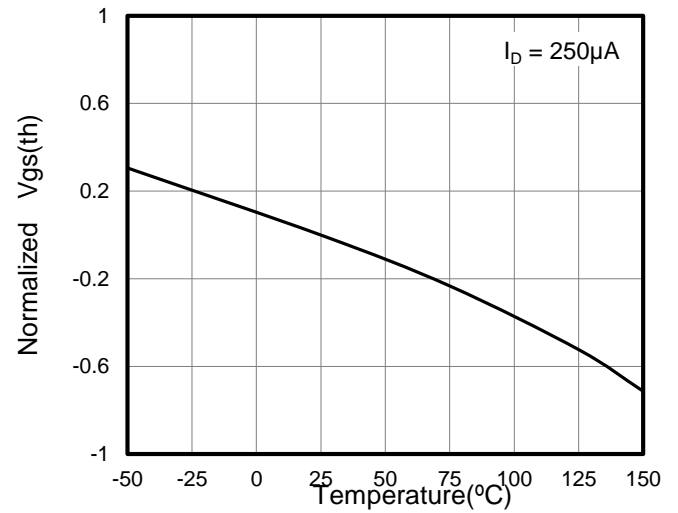
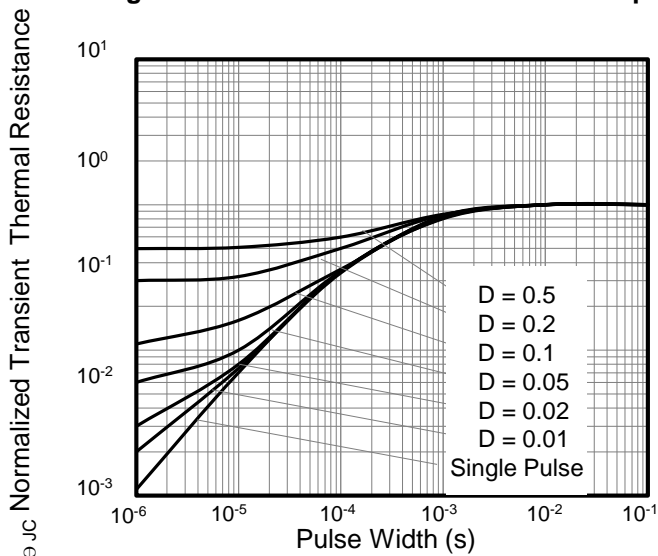
Figure 8: $V_{GS(th)}$ vs. Junction Temperature

Figure 11: Normalized Transient Thermal Resistance

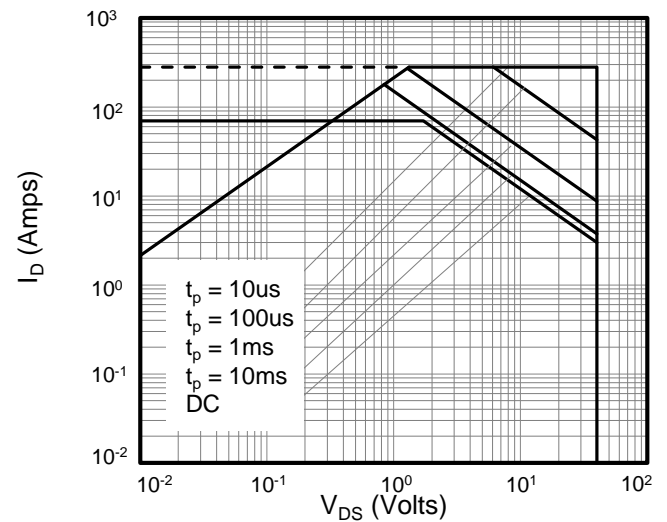


Figure 12: Safe Operating Area

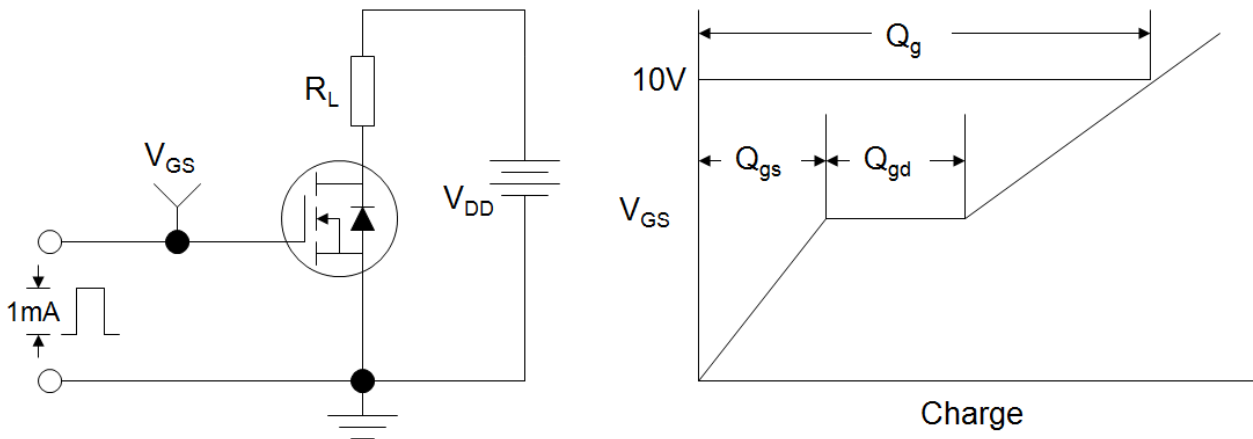


Figure A: Gate Charge Test Circuit and Waveforms

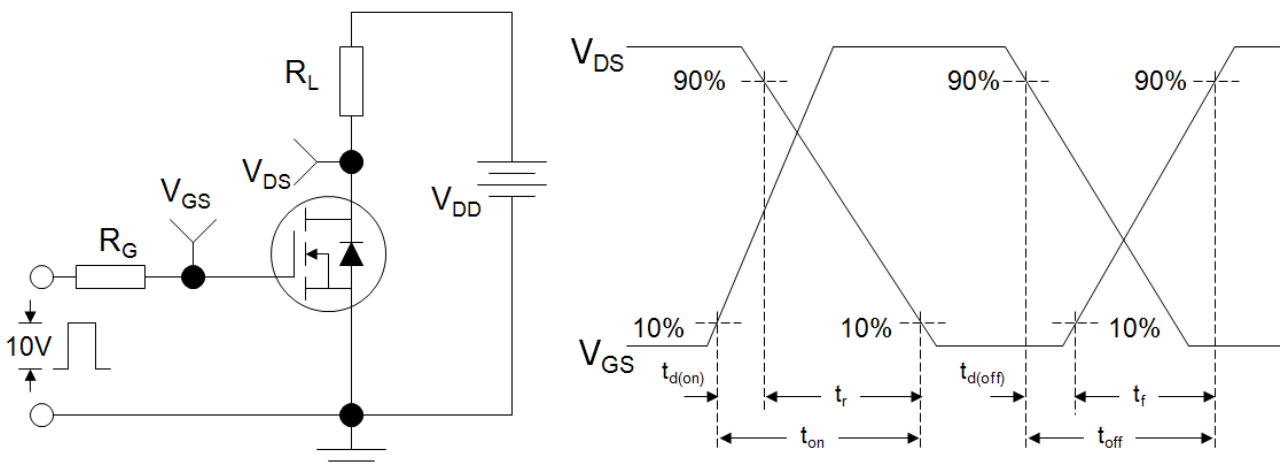


Figure B: Resistive Switching Test Circuit and Waveforms

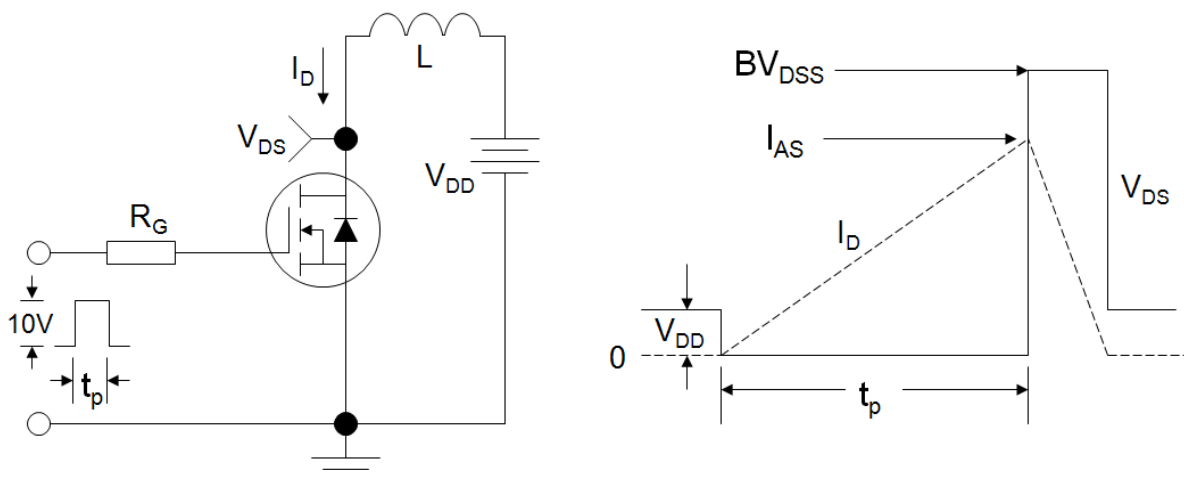
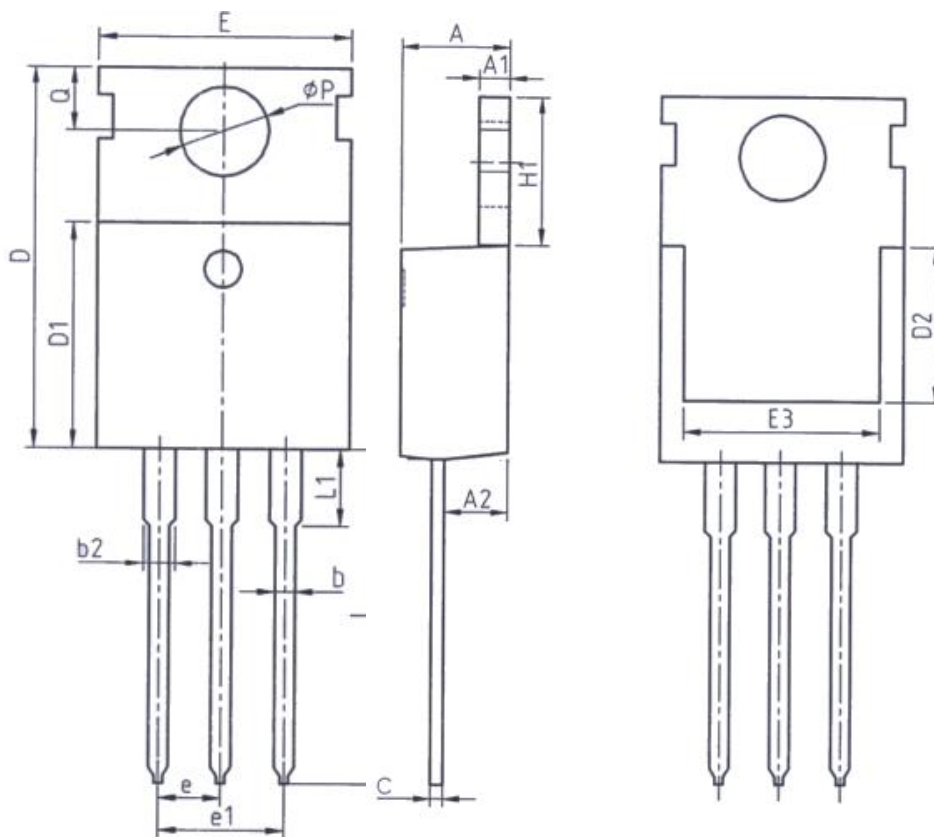


Figure C: Unclamped Inductive Switching (UIS) Test Circuit and Waveforms



TO-220(H)



Unit: mm		
Symbol	Min.	Max.
A	4.37	4.77
A1	1.25	1.45
A2	2.20	2.60
b	0.70	0.95
b2	1.17	1.47
c	0.40	0.65
D	15.10	16.10
D1	8.80	9.40
D2	5.50	—

Unit: mm		
Symbol	Min.	Max.
E	9.70	10.30
E3	7.00	—
e	2.54BSC	
e1	5.08BSC	
H1	6.25	6.85
L	12.75	13.80
L1	—	3.40
P	3.40	3.80
Q	2.60	3.00



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