

# MT3204

## N-Channel Power MOSFET

45V, 176A, 3.0mΩ

### Features

- $R_{DS(on)} = 3.0m\Omega$  (Typ) at  $V_{GS} = 10V$ ,  $I_D = 40A$
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

### General Description

This N-Channel MOSFET is produced using MOS-TECH Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

### Applications

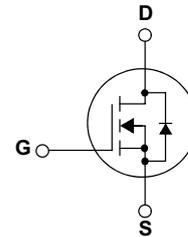
- Synchronous rectification
- Power Management in Inverter system



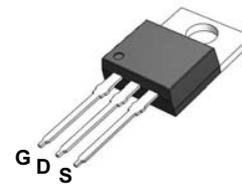
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### Simplified Schematic



### MARKING DIAGRAM & PIN ASSIGNMENT



TO-220FB-3L

### Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
<b>Common Ratings</b> ( $T_A=25^\circ\text{C}$ Unless Otherwise Noted)			
$V_{DSS}$	Drain-Source Voltage	45	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	
$T_J$	Maximum Junction Temperature	175	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-55 to 175	$^\circ\text{C}$
$I_S$	Diode Continuous Forward Current	$T_C=25^\circ\text{C}$ 176	A
<b>Mounted on Large Heat Sink</b>			
$I_{DM}$	Pulsed Drain Current *	$T_C=25^\circ\text{C}$ 648**	A
$I_D$	Continuous Drain Current	$T_C=25^\circ\text{C}$ 176	A
		$T_C=100^\circ\text{C}$ 120	
$P_D$	Maximum Power Dissipation	$T_C=25^\circ\text{C}$ 192	W
		$T_C=100^\circ\text{C}$ 96	
$R_{\theta JC}$	Thermal Resistance-Junction to Case	0.78	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	62.5	
<b>Avalanche Ratings</b>			
$E_{AS}$	Avalanche Energy, Single Pulsed	$L=0.3\text{mH}$ 1.09***	J

Note : \* Repetitive rating ; pulse width limited by junction temperature  
 \*\* Drain current is limited by junction temperature  
 \*\*\* VD=32V

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
MT3204	MT3204	TO-220FB-3L	-	-	50

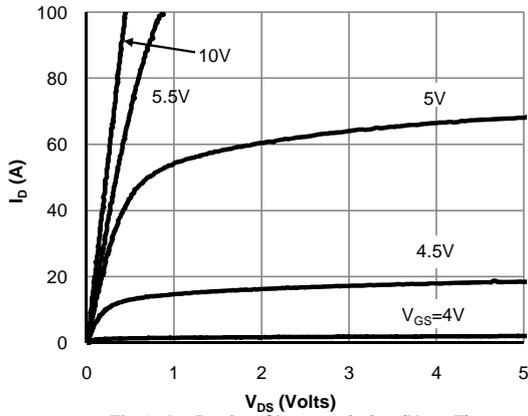
### Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	-	-	50	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =32V, V <sub>GS</sub> =0V T <sub>J</sub> =85°C	-	-	1	μA
			-	-	30	
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> = ±20V	-	-	100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2.0	2.8	4.0	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =40A	-	3.0	4.0	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =20A	-	55	-	S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =30A, V <sub>GS</sub> =0V	-	0.7	1.3	V
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz	-	1.7	-	Ω

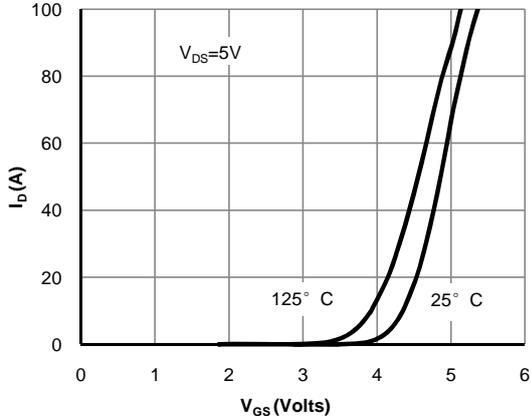
### DYNAMIC PARAMETERS

Symbol	Parameter	Conditions	Min	Typ	Max	Units
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =20V, f=1MHz	2840	3568	4300	pF
C <sub>oss</sub>	Output Capacitance		960	1388	1810	pF
C <sub>riss</sub>	Reverse Transfer Capacitance		85	151	215	pF
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> =10V, V <sub>DS</sub> =20V, I <sub>D</sub> =20A	55	71	86	nC
Q <sub>gs</sub>	Gate Source Charge		-	15	-	nC
Q <sub>gd</sub>	Gate Drain Charge		-	23	-	nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =10V, V <sub>DS</sub> =20V, R <sub>L</sub> =1Ω, R <sub>GEN</sub> =3Ω	-	16	-	ns
t <sub>r</sub>	Turn-On Rise Time		-	30	-	ns
t <sub>D(off)</sub>	Turn-Off DelayTime		-	54	-	ns
t <sub>f</sub>	Turn-Off Fall Time		-	20	-	ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =20A, di/dt=500A/μs	35	45	55	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =20A, di/dt=500A/μs	225	287	350	nC

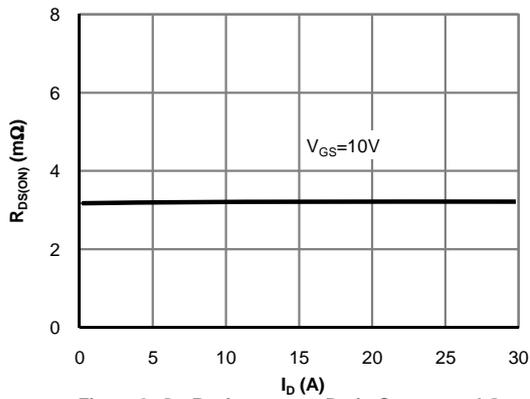
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



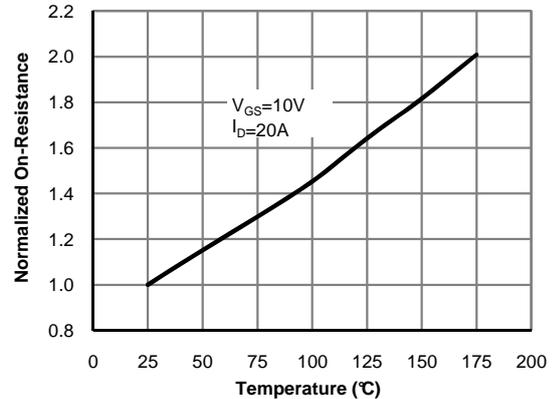
**Fig 1: On-Region Characteristics (Note E)**



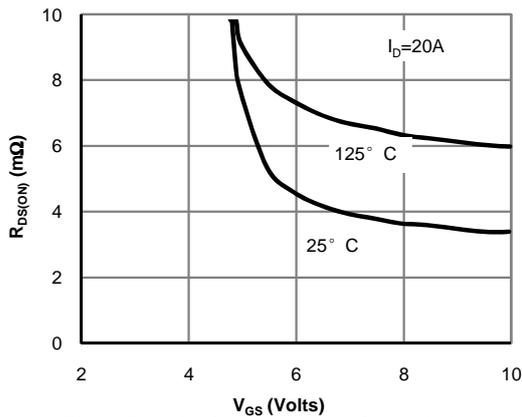
**Figure 2: Transfer Characteristics (Note E)**



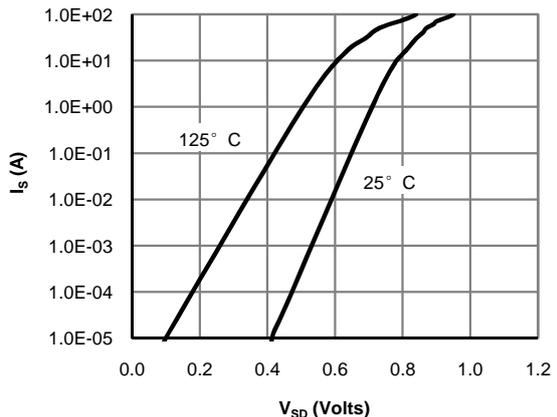
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**



**Figure 4: On-Resistance vs. Junction Temperature (Note E)**



**Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)**



**Figure 6: Body-Diode Characteristics (Note E)**

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

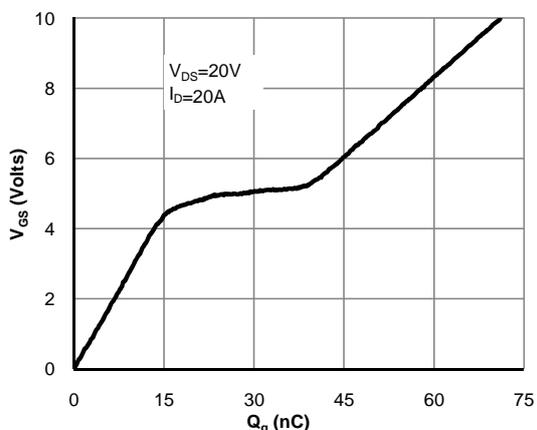


Figure 7: Gate-Charge Characteristics

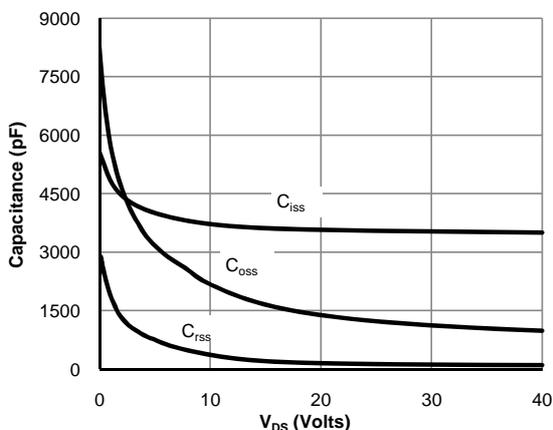


Figure 8: Capacitance Characteristics

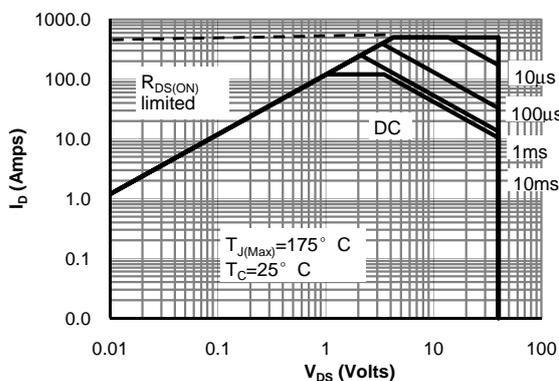


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

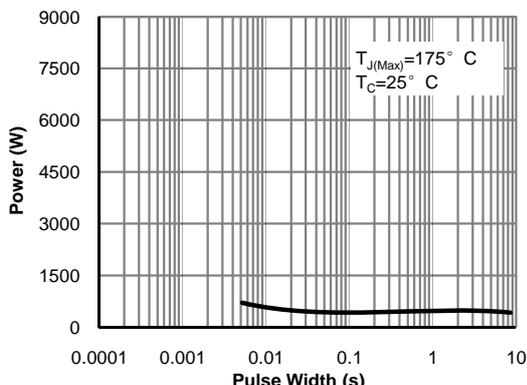


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

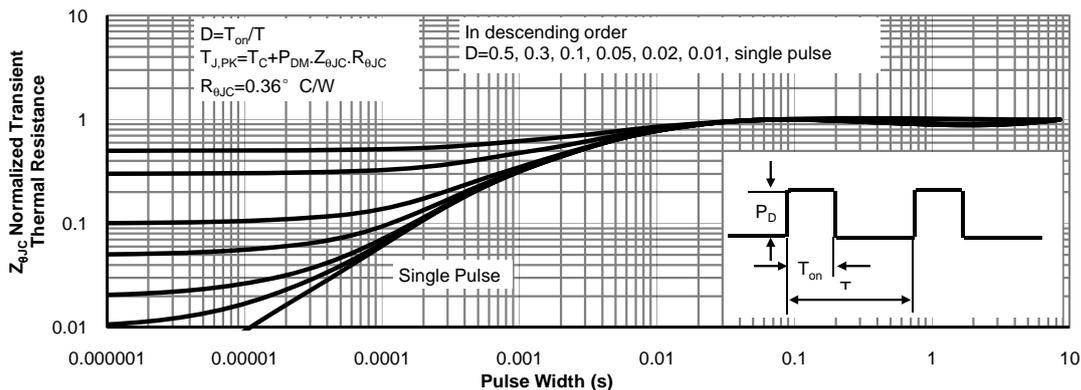
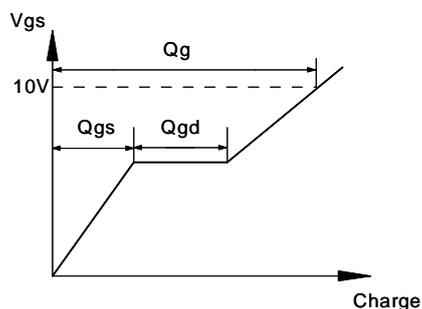
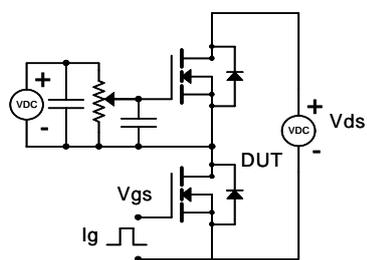
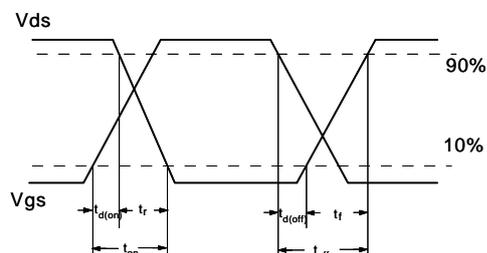
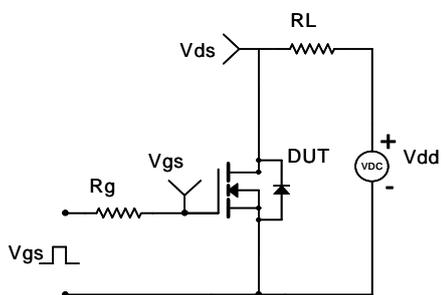


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

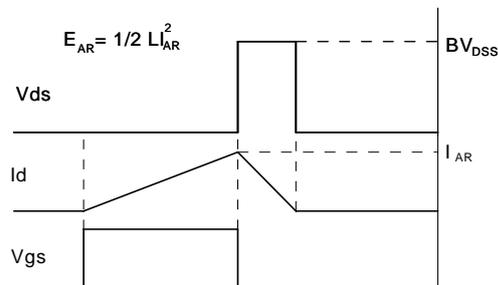
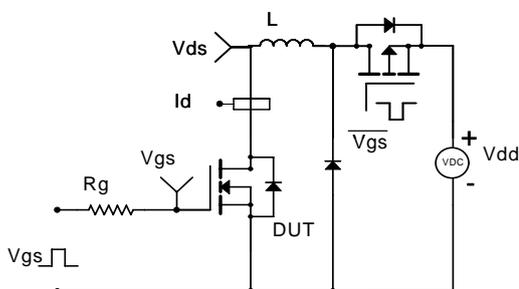
Gate Charge Test Circuit & Waveform



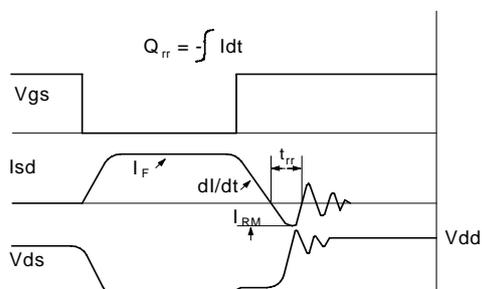
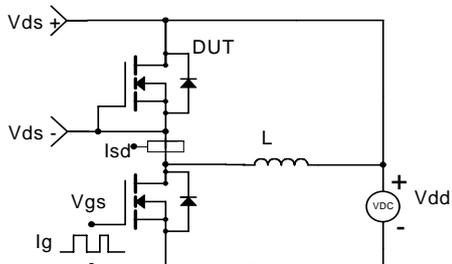
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

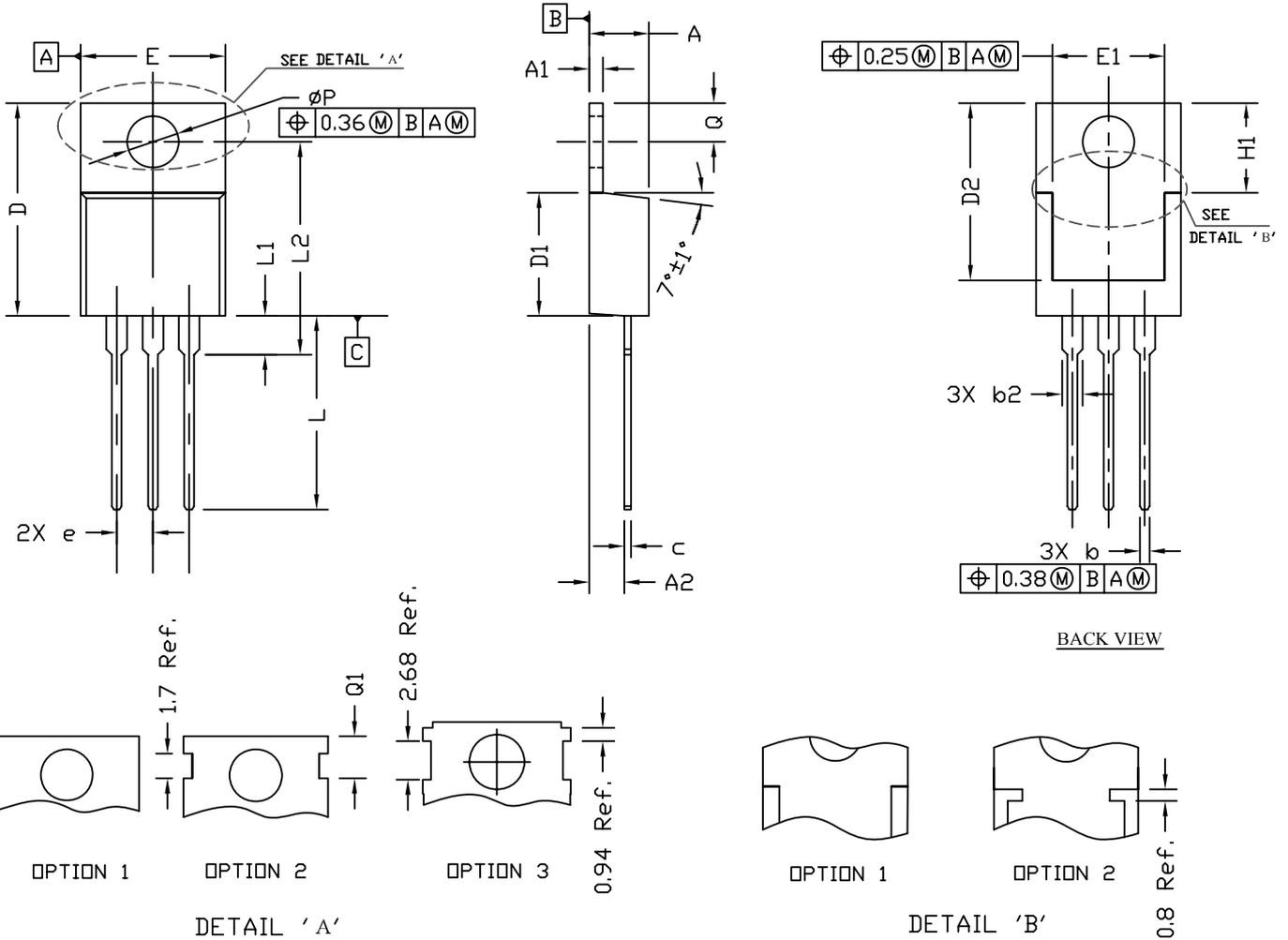


Diode Recovery Test Circuit & Waveforms

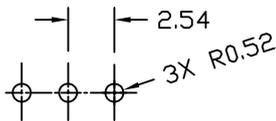


Document No.	PO-00015
Version	L

TO220 PACKAGE OUTLINE



RECOMMENDATION OF HOLE PATTERN



UNIT: mm

- NOTE
1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS. MOLD FLASH SHOULD BE LESS THAN 6 MIL.
  2. TOLERANCE 0.100 MILLIMETERS UNLESS OTHERWISE SPECIFIED.
  3. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.30	4.45	4.72	0.169	0.175	0.186
A1	1.15	1.27	1.40	0.045	0.050	0.055
A2	2.20	2.67	2.90	0.087	0.105	0.114
b	0.69	0.81	0.95	0.027	0.032	0.037
b2	1.17	1.37	1.45	0.046	0.050	0.068
c	0.36	0.38	0.60	0.014	0.015	0.024
D	14.50	15.44	15.80	0.571	0.608	0.622
D1	8.59	9.14	9.65	0.338	0.360	0.380
D2	11.43	11.73	12.48	0.450	0.462	0.491
e	2.54 BSC			0.100 BSC		
E	9.66	10.03	10.54	0.380	0.395	0.415
E1	6.22	---	---	0.245	---	---
H1	6.10	6.30	6.50	0.240	0.248	0.256
L	12.27	12.82	14.27	0.483	0.505	0.562
L1	2.47	---	3.90	0.097	---	0.154
L2	---	---	16.70	---	---	0.657
Q	2.59	2.74	2.89	0.102	0.108	0.114
$\phi P$	3.50	3.84	3.89	0.138	0.151	0.153
Q1	2.70	---	2.90	0.106	---	0.114

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