TS8329K - 100W Asymmetric Peak Power GaN Broadband SPDT Switch

1.0 Features

- Low insertion loss (TX/RX): 0.4/0.5dB @ 3000MHz
- High isolation (RX Path): 38dB @ 3000MHz
- High peak power handling capability
- No external DC blocking capacitors on RF lines
- 40 dBm CW hot switching on Ant port
- 42 dBm Average, 10dB PAPR LTE single event (<10 sec)
- All RF ports OFF state
- Versatile 2.6-5.5V power supply
- Operating frequency: 500MHz to 8.5GHz

Figure 1 Device Image
(16 Pin 3×3×0.75 mm^3 QFN Package)

2.0 Applications

- 4G, 5G systems
- RX protection
- Cellular infrastructure
- Small cells
- LTE relays and microcells
- Radar

RoHS/REACH/Halogen Free Compliance

3.0 Description

The TS8329K is an asymmetrical reflective Single Pole Dual Throw (SPDT) switch designed for broadband, high peak power switching applications. Its broadband behavior from 500MHz to 8.5GHz frequencies makes the TS8329K an excellent switch for all applications requiring low insertion loss, high isolation and high linearity within a small package size.

The TS8329K is packaged into a compact Quad Flat No lead (QFN) 3x3mm^2 16 leads plastic package.

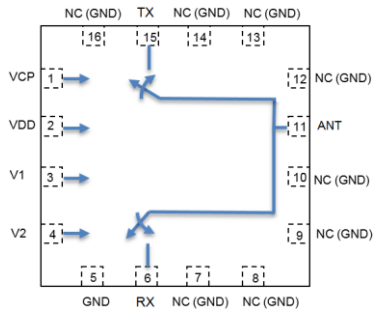


Figure 2 Function Block Diagram
(Top View)

4.0 Ordering Information

Table 1 Ordering Information

Device Part Number	Package Type	Notes
TS8329K	16 Pin 3.0×3.0×0.75mm^3 QFN	Core part number
TS8329K-EVK	Evaluation Board	
TS8329KMTRPBF	330mm reel, 3 000 pcs	Full Reel

5.0 Pin Description

Table 2 Pin Definition

Pin Number	Pin Name	Description
1	VCP	Internal charge pump voltage output. Connect a 1nF capacitor to GND on this pin to improve switching time.
2	VDD	DC power supply
3	V1	Switch control input 1
4	V2	Switch control input 2
5	GND	Ground
6	RX	RX port
7,8,9,10,12,13,14,16	NC	No internal connection, Can be grounded
11	ANT	Antenna port
15	TX	TX port

Note: The backside ground (thermal) pad of the package must be grounded directly to the ground plane of PCB with multiple vias to ensure proper operation and thermal management.

6.0 Absolute Maximum Ratings

Table 3 Absolute Maximum Ratings @T_A=+25°C Unless Otherwise Specified

Parameter	Symbol	Value	Unit
Electrical Ratings			
Power Supply Voltage	VDD	2.6 to 5.5	V
Storage Temperature Range	T_{st}	-55 to +125	°C
Operating Temperature Range	T_{op}	-40 to +85	°C
Maximum Junction Temperature	T_J	+140	°C
RF Input Power CW, 800MHz, T_J=+85°C	TX-ANT	42	dBm
RF Input Power CW, 800MHz, T_J=+105°C	TX-ANT	41	dBm
Thermal Ratings			
Thermal Resistance (junction-to-case) – Bottom side	$R_{\theta JC}$	25	°C/W
Thermal Resistance (junction-to-top)	$R_{\theta JT}$	36	°C/W
Soldering Temperature	T_{SOLD}	260	°C
ESD Ratings			
Human Body Model (HBM)	Level 1B	500 to <1000	V
Charged Device Model (CDM)	Level C3	≥1000	V
Moisture Rating			
Moisture Sensitivity Level	MSL	1	-

Attention:
Maximum ratings are absolute ratings. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Exceeding one or a combination of the absolute maximum ratings may cause permanent and irreversible damage to the device and/or to surrounding circuit.

7.0 Electrical Specifications

Table 4 Electrical Specifications @T_A=+25°C Unless Otherwise Specified; VDD=+3.3V; 50Ω Source/Load.

Parameter	Condition	Minimum	Typical	Maximum	Unit
Operating Frequency		500		8500	MHz
Insertion Loss, TX	800MHz		0.30	0.40	dB
	1.95GHz		0.35	0.45	
	2.6GHz		0.38	0.55	
	3.8GHz		0.40		
	5.0GHz		0.45		
Insertion Loss, RX	800MHz		0.34	0.65	dB
	1.95GHz		0.40	0.70	
	2.6GHz		0.45	0.75	
	3.8GHz		0.60		
	5.0GHz		0.80		
Isolation ANT-TX	800MHz	39	48		dB
	1.95GHz	30	36		
	2.6GHz	27	32		
	3.8GHz		25		
	5.0GHz		21		
Isolation ANT-RX	800MHz	52	58		dB
	1.95GHz	42	46		
	2.6GHz	37	41		
	3.8GHz		35		
	5.0GHz		32		
Return Loss ANT-TX, RX	800MHz		25		dB
	1.95GHz		23		
	2.6GHz		22		
	3.8GHz		17		
	5.0GHz		14		
Isolation @ Peak Power	Peak power=49.2dBm, Isolation RX @3.8GHz		35		dB

Harmonic distortion					
H2	800MHz, Pin=35dBm		-40		dBm
H3	800MHz, Pin=35dBm		-45		dBm
IIP3	800MHz		71		dBm
P0.1dB[1] TX	700MHz~6GHz, CW	42	44		dBm
Peak P0.1dB TX[2]	700MHz~6GHz, pulsed power	49.2	50		dBm
Peak P0.1dB TX[2]	42 dBm Avg, 10dB PAPR LTE single event (<10 sec)		52		dBm
P0.1dB[1] RX	700MHz~6GHz, CW	39	41		dBm
Switching Time	50% ctrl to 10/90% of the RF value is settled. C1=1nF (refer to Figure 3)		0.4		μs
Control Voltage	Power supply VDD	2.6	3.3	5.5	V
	All control pins high, V_{ih}	1.0	3.3	5.25	V
	All control pins low, V_{il}	-0.3		0.5	V
Control Current	All control pins low, I_{il}		0		μA
	All control pins high, I_{ih}			7.5	μA
Current Consumption, IDD	Active mode		160	200	μA

Note:
[1] P0.1dB is a figure of merit.
[2] Peak power was verified with 1% duty cycle and 10μs pulse width.
[3] No external DC blocking capacitors required on RF pins unless DC voltage is applied on a RF pin.

8.0 Switch Truth Table

Table 5 Switch Truth Table

V1	V2	Active RF Path
0	1	All OFF
0	0	ANT-RX
1	0	ANT-TX

Attention:

[1]. VDD should be applied first before V1 and V2, otherwise may cause damage to the device.

[2]. There are internal pull-downs to ground on both V1 and V2 control pins, the state at start-up without any control voltage applied will be ANT-RX ON.

[3]. If all OFF state is not used, the switch can be operated with single control pin V1.

9.0 Evaluation Board

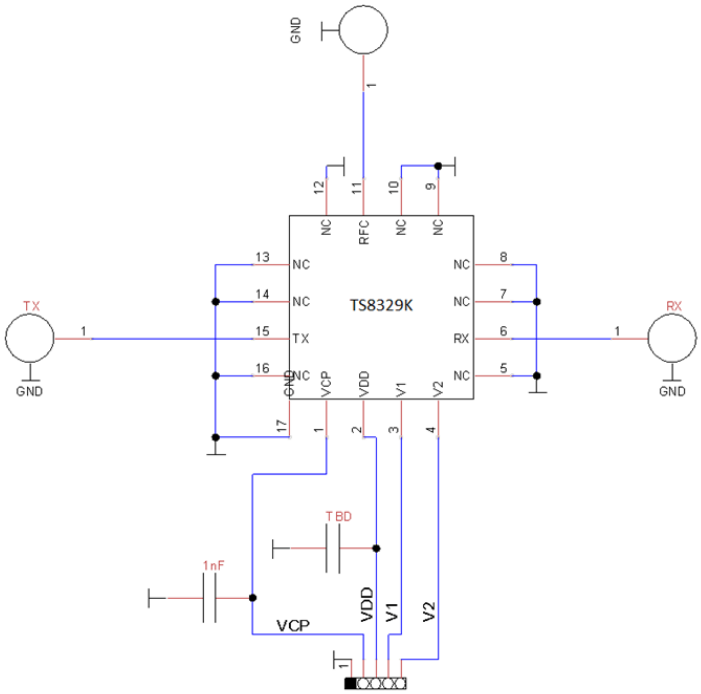


Figure 3 Evaluation Board Schematic

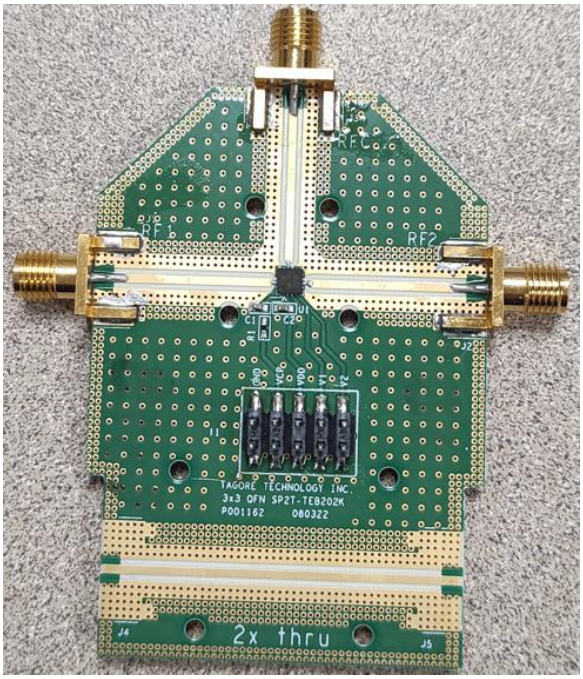


Figure 4 Evaluation Board Image

Attention:

[1]. 17 refers to the center pad of the device.

[2]. The purpose of connection between VCP and connector N1 is to monitor VCP, do not apply external voltage to VCP.

[3]. For 7GHz matching circuit, at RX port, add a shunt 0.2pF capacitor (PPI 0603N) as close as possible to IC.

10.0 Typical Characteristics

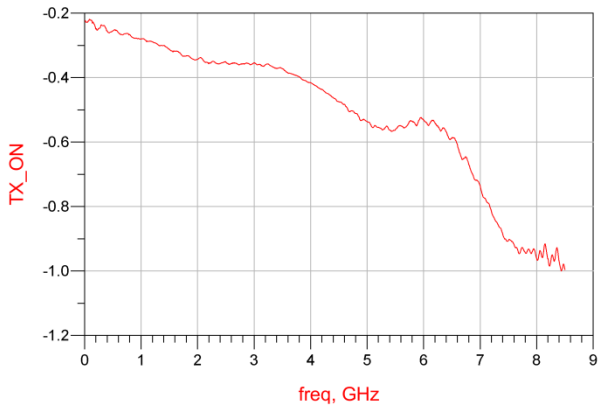


Figure 5 TX Insertion Loss

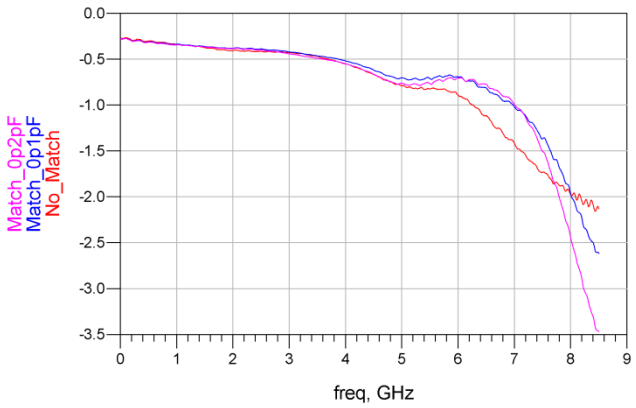


Figure 6 RX Insertion Loss (with high-freq match)

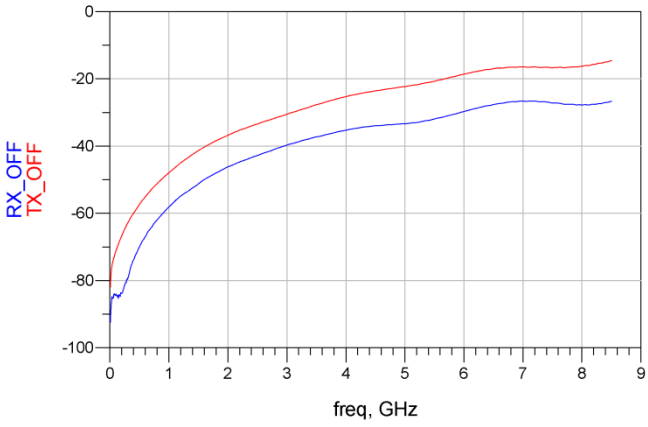


Figure 7 TX, RX Isolation

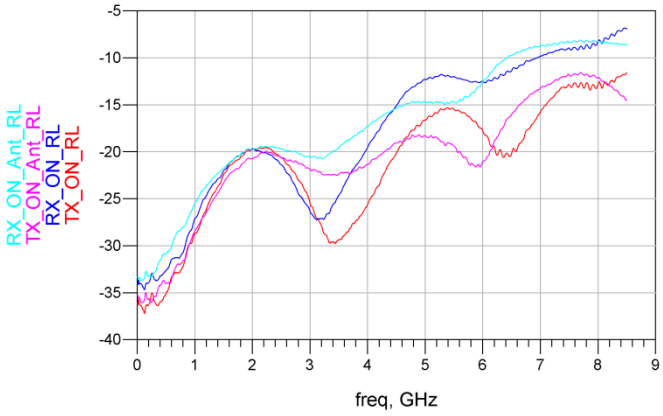


Figure 8 Return Loss RF & Ant

11.0 Device Package Information

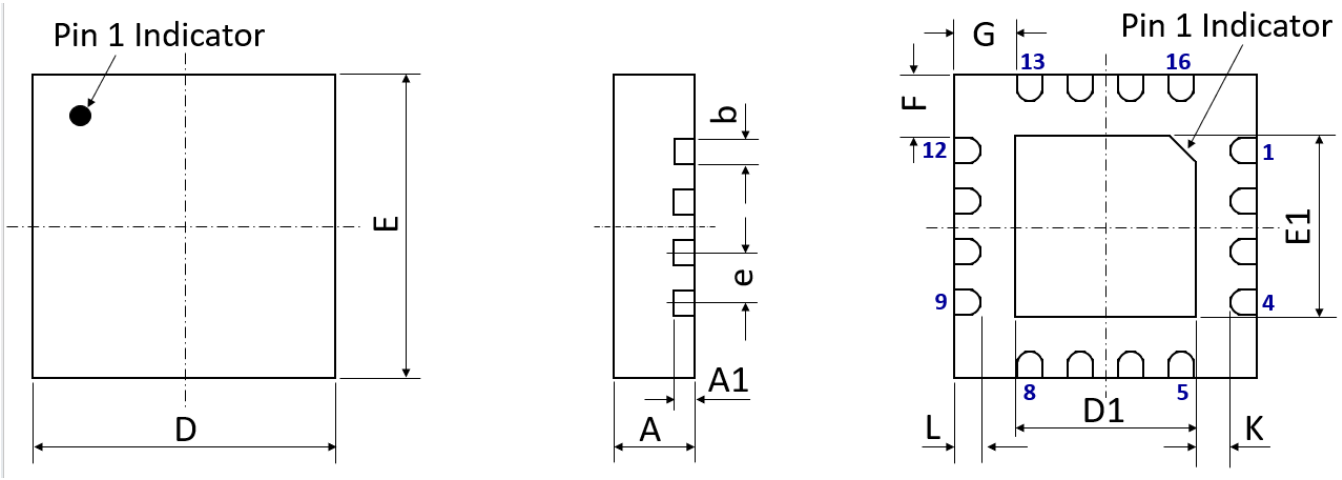


Figure 13 Device Package Drawing
(All dimensions are in mm)

Table 6 Device Package Dimensions

Dimension (mm)	**Value** (mm)	**Tolerance** (mm)	**Dimension** (mm)	**Value** (mm)	**Tolerance** (mm)
A	0.75	±0.05	E	3.00 BSC	±0.05
A1	0.203	±0.02	E1	1.70	±0.05
b	0.25	±0.05	F	0.625	±0.05
D	3.00 BSC	±0.05	G	0.625	±0.05
D1	1.70	±0.05	L	0.25	±0.05
e	0.50 BSC	±0.05	K	0.40	±0.05

Note: Lead finish: Pure Sn without underlayer; Thickness: 7.5μm ~ 20μm (Typical 10μm ~ 12μm)

Attention:
Please refer to application notes *TN-001* and *TN-002* at http://www.tagoretech.com for PCB and soldering related guidelines.

12.0 PCB Land Design

Guidelines:
[1] 4 layer PCB is recommended.
[2] Via diameter is recommended to be 0.2mm to prevent solder wicking inside the vias.
[3] Thermal vias shall only be placed on the center pad.
[4] The maximum via number for the center pad is 3(X)×3(Y)=9.

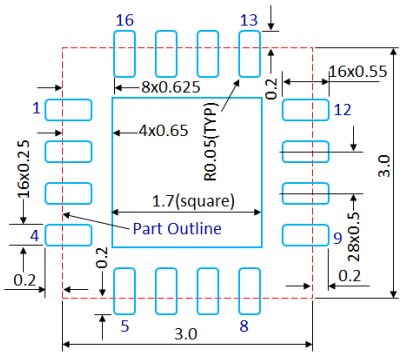
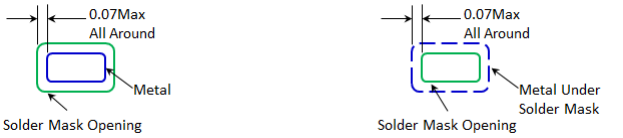


Figure 14 PCB Land Pattern
(Dimensions are in mm)



Non-Solder Mask Defined (Preferred)

Solder Mask Defined

Figure 15 Solder Mask Pattern
(Dimensions are in mm)

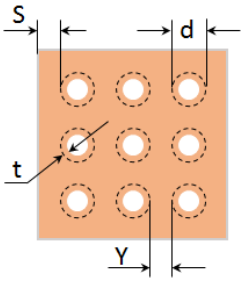


Figure 16 Thermal Via Pattern
(Recommended Values: S≥0.15mm; Y≥0.20mm; d=0.2mm; Plating Thickness t=25μm or 50μm)

13.0 PCB Stencil Design

Guidelines:

[1] Laser-cut, stainless steel stencil is recommended with electro-polished trapezoidal walls to improve the paste release.

[2] Stencil thickness is recommended to be 125μm.

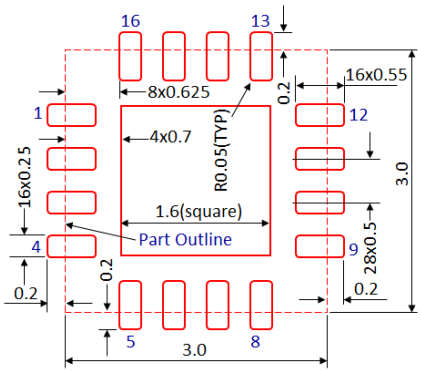


Figure 17 Stencil Openings
(Dimensions are in mm)

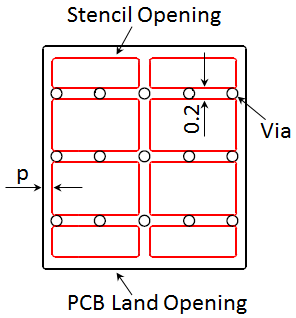


Figure 18 Stencil Openings Shall not Cover Via Areas If Possible
(Dimensions are in mm)

14.0 Tape and Reel Information

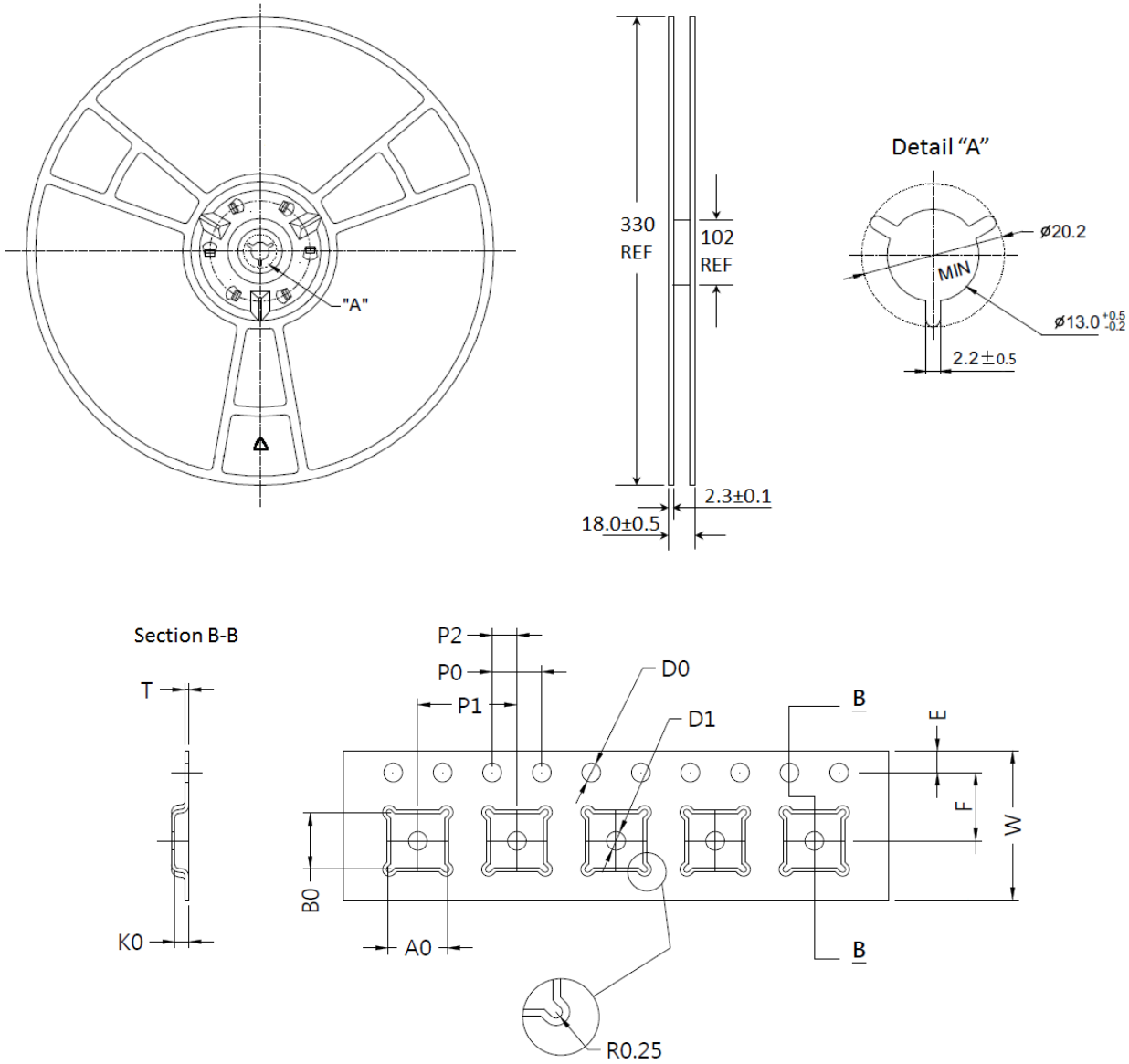


Figure 19 Tape and Reel Drawing

Table 7 Tape and Reel Dimensions

Dimension (mm)	**Value** (mm)	**Tolerance** (mm)	**Dimension** (mm)	**Value** (mm)	**Tolerance** (mm)
A0	3.35	±0.10	K0	1.10	±0.10
B0	3.35	±0.10	P0	4.00	±0.10
D0	1.50	+0.10/-0.00	P1	8.00	±0.10
D1	1.50	+0.10/-0.00	P2	2.00	±0.05
E	1.75	±0.10	T	0.30	±0.05
F	5.50	±0.05	W	12.00	±0.30

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