

# MOSFET – Single, P-Channel, POWERTRENCH®

**-30 V, -11 A, 13.5 mΩ**

## FDMA6676PZ

### Description

This device is an ultra low resistance P-Channel FET. It is designed for power line load switching applications and reverse polarity protection. It is especially optimized for voltage rails that can climb as high as 25 V. Typical end systems include laptop computers, tablets and mobile phone. Applications include battery protection, input power line protection and charge path protection, including USB and other charge paths. The FDMA6676PZ has an enhanced  $V_{GS}$  rating of 25 V specifically designed to simplify installation. When used as reverse polarity protection, with gate tied to ground and drain tied to V input, it is designed to support operating input voltages that can raise as high as 25 V without the need for external Zener protection on the gate. Its small 2 x 2 x 0.8 mm form factor make it an ideal part for mobile and space constrained applications.

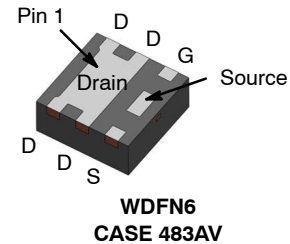
### Features

- Max  $r_{DS(on)}$  = 13.5 mΩ @  $V_{GS} = -10$  V
- 25 V  $V_{GS}$  Extended Operating Rating
- 30 V  $V_{DS}$  Blocking
- 2 x 2 mm Form Factor
- Low Profile – 0.8 mm Maximum
- Integrated Protection Diode
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

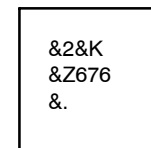


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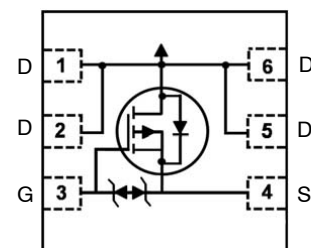


### MARKING DIAGRAM



&2	= 2-Digit Date Code
&K	= Lot Code
&Z	= Assembly Plant Code
676	= Specific Device Code
&	= Pin 1 Dot

### PIN CONNECTION



### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Ratings	Unit
$V_{DS}$	Drain to Source Voltage	-30	V
$V_{GS}$	Gate to Source Voltage	$\pm 25$	V
$I_D$	Drain Current – Continuous, $T_A = 25^\circ\text{C}$ (Note 1a)	-11	A
	– Pulsed (Note 3)	-165	
$P_D$	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	2.4	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1b)	0.9	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

## THERMAL CHARACTERISTICS

Symbol	Characteristic	Value	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	52	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	145	

ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
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## OFF CHARACTERISTICS

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = -250\ \mu\text{A}, V_{GS} = 0\ \text{V}$	-30			V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-19		$\text{mV}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -24\ \text{V}, V_{GS} = 0\ \text{V}$			-1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 25\ \text{V}, V_{DS} = 0\ \text{V}$			$\pm 10$	$\mu\text{A}$

## ON CHARACTERISTICS

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$	-1.2	-2	-2.6	V
$\Delta V_{GS(th)} / \Delta T_J$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		5.9		$\text{mV}/^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -10\ \text{V}, I_D = -11\ \text{A}$		11	13.5	$\text{m}\Omega$
		$V_{GS} = -4.5\ \text{V}, I_D = -8\ \text{A}$		19	27	
		$V_{GS} = -10\ \text{V}, I_D = -11\ \text{A}, T_J = 125^\circ\text{C}$		14.5	21	
$g_{FS}$	Forward Transconductance	$V_{DD} = -5\ \text{V}, I_D = -11\ \text{A}$		38		S

## DYNAMIC CHARACTERISTICS

$C_{iss}$	Input Capacitance	$V_{DS} = -15\ \text{V}, V_{GS} = 0\ \text{V}, f = 1\ \text{MHz}$		1440	2160	pF
$C_{oss}$	Output Capacitance			477	720	pF
$C_{rss}$	Reverse Transfer Capacitance			458	690	pF
$R_g$	Gate Resistance			12		$\Omega$

## SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -15\ \text{V}, I_D = -11\ \text{A}, V_{GS} = -10\ \text{V}, R_{GEN} = 6\ \Omega$		8.8	18	ns
$t_r$	Rise Time			19	34	ns
$t_{d(off)}$	Turn-Off Delay Time			87	139	ns
$t_f$	Fall Time			72	115	ns
$Q_g$	Total Gate Charge	$V_{GS} = 0\ \text{V to } -10\ \text{V}, V_{DD} = -15\ \text{V}, I_D = -11\ \text{A}$		33	46	nC

# FDMA6676PZ

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
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### SWITCHING CHARACTERISTICS

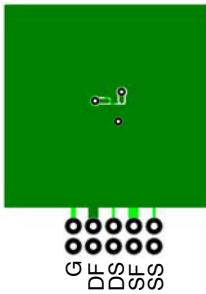
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to } -4.5\text{ V}$ , $V_{DD} = -15\text{ V}$ , $I_D = -11\text{ A}$		20	28	nC
$Q_{gs}$	Gate to Source Charge	$V_{DD} = -15\text{ V}$ , $I_D = -11\text{ A}$		4.5		nC
$Q_{gd}$	Gate to Drain "Miller" Charge	$V_{DD} = -15\text{ V}$ , $I_D = -11\text{ A}$		13		nC

### DRAIN-SOURCE DIODE CHARACTERISTICS

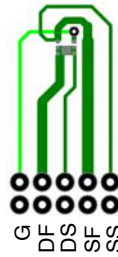
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = -2\text{ A}$ (Note 2)		-0.7	-1.2	V
		$V_{GS} = 0\text{ V}$ , $I_S = -11\text{ A}$ (Note 2)		-0.9	-1.4	V
$t_{rr}$	Reverse Recovery Time	$I_F = -11\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		31	50	ns
$Q_{rr}$	Reverse Recovery Charge			9	18	nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

- $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta CA}$  is determined by the user's board design.



a.  $52^\circ\text{C/W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b.  $145^\circ\text{C/W}$  when mounted on a minimum pad of 2 oz copper.

- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.
- Pulse  $I_D$  refers to Forward Bias Safe Operation Area.

## ORDERING INFORMATION

Device Marking	Device	Package	Package Method <sup>†</sup>
676	FDMA6676PZ	WDFN-6	3000 Tape / Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

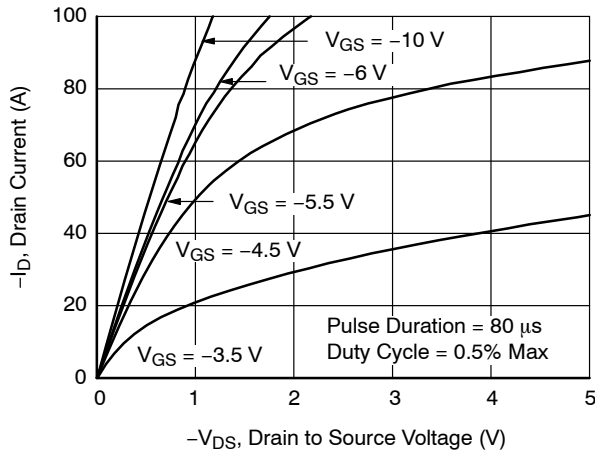


Figure 1. On-Region Characteristics

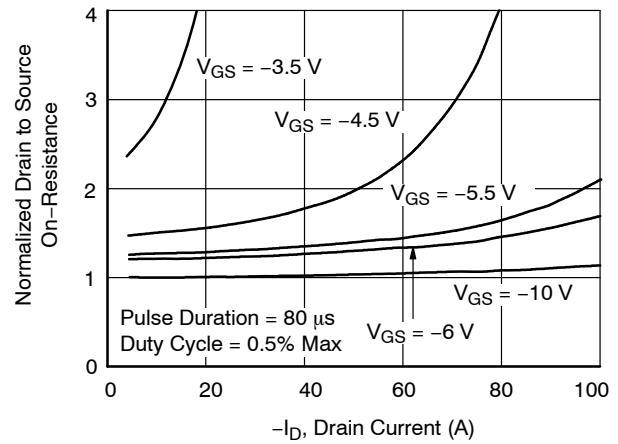


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

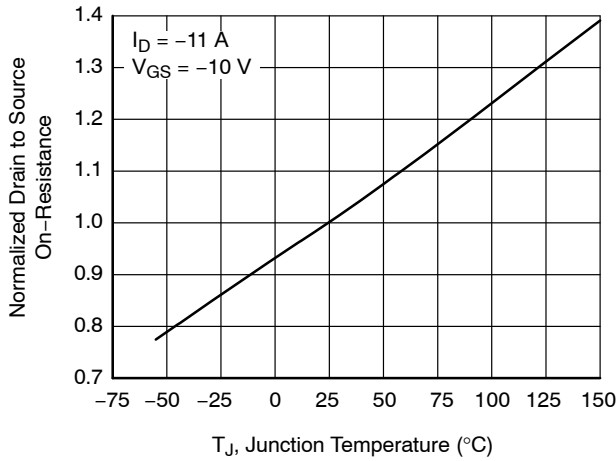


Figure 3. Normalized On-Resistance vs. Junction Temperature

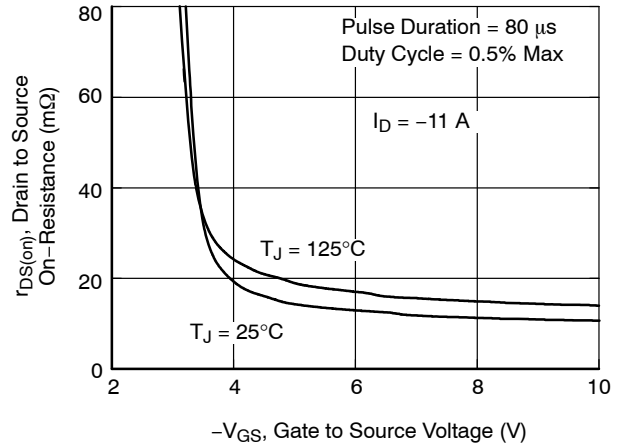


Figure 4. On-Resistance vs. Gate to Source Voltage

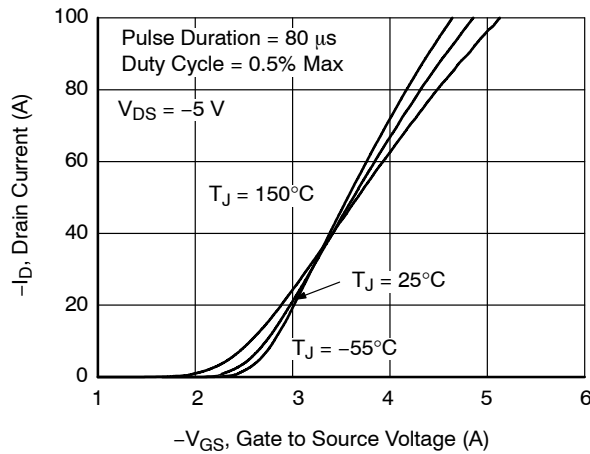


Figure 5. Transfer Characteristics

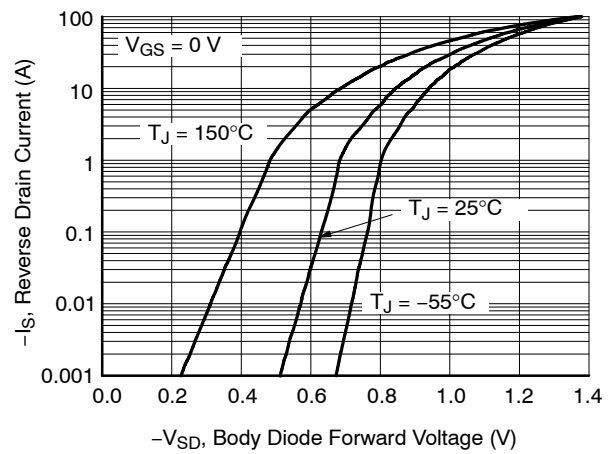


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

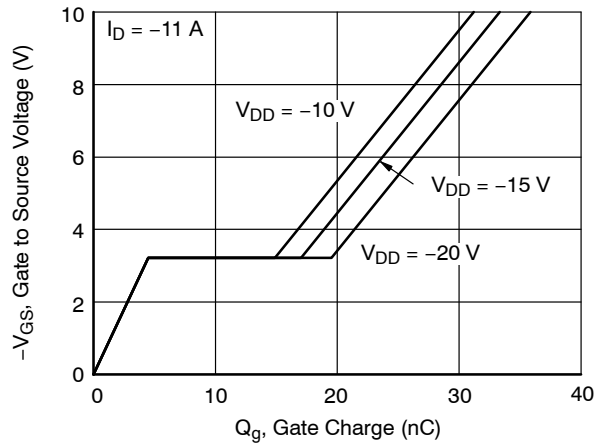


Figure 7. Gate Charge Characteristics

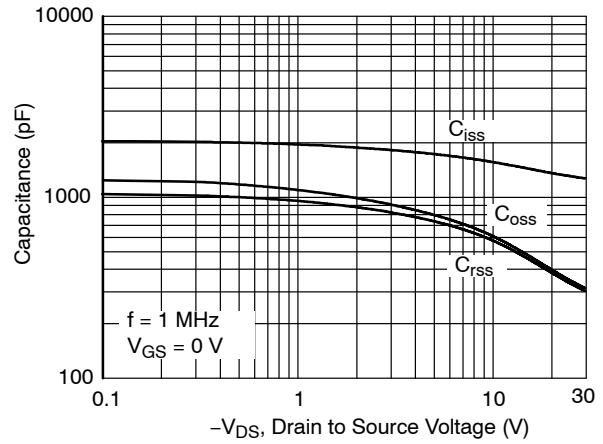


Figure 8. Capacitance vs. Drain to Source Voltage

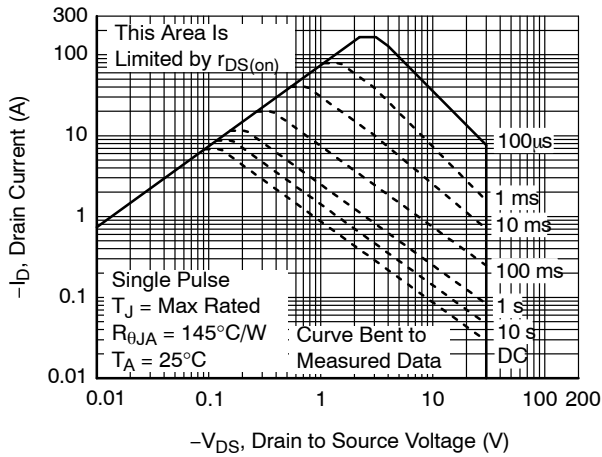


Figure 9. Forward Bias Safe Operating Area

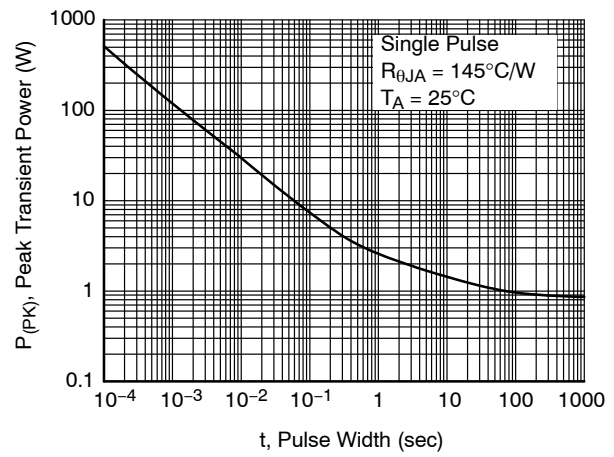


Figure 10. Single Pulse Maximum Power Dissipation

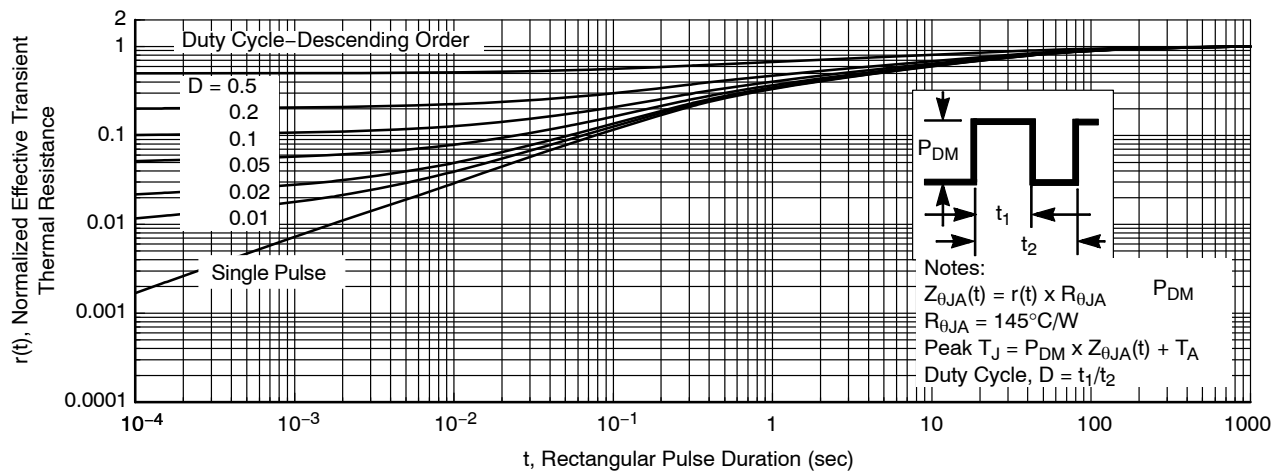
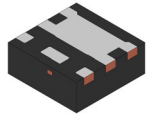


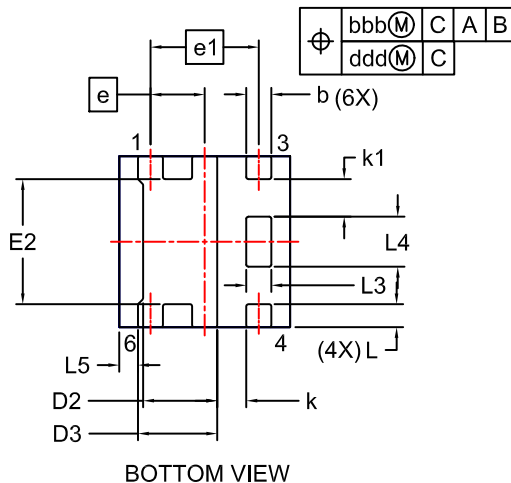
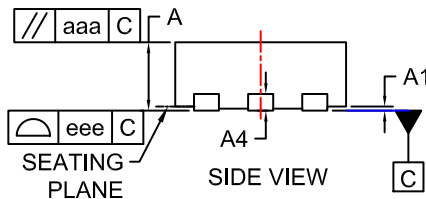
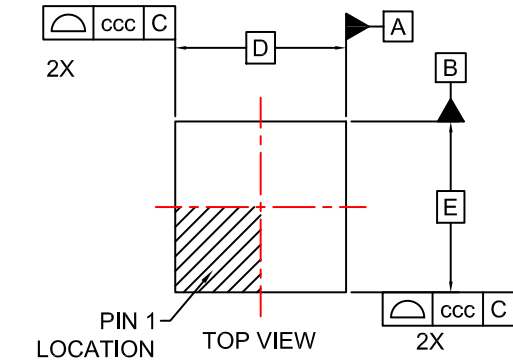
Figure 11. Junction-to-Ambient Transient Thermal Response Curve

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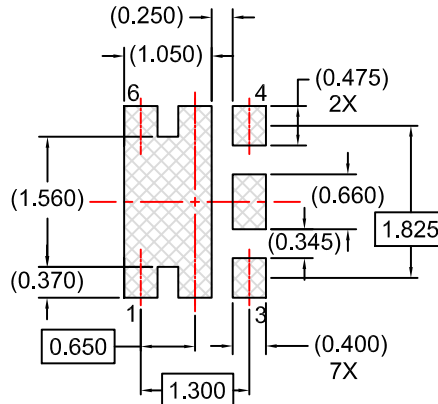


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CASE 483AV  
ISSUE A

DATE 02 APR 2019



#### LAND PATTERN RECOMMENDATION



#### NOTES:

1. CONTROLLING DIMENSION: MILLIMETERS.
2. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
4. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.60	0.70	0.80
A1	0.00	-	0.05
A4	(0.20)		
b	0.25	0.30	0.35
D	1.95	2.05	2.15
D2	0.84	0.89	0.94
D3	(0.95)		
E	1.95	2.05	2.15
E2	1.45	1.50	1.55
e	0.65 BSC		
e1	1.30 BSC		
k	(0.35)		
k1	(0.45)		
L	0.18	0.28	0.38
L3	0.25	0.30	0.35
L4	0.55	0.60	0.65
L5	(0.23)		
aaa	0.10		
bbb	0.10		
ccc	0.05		
ddd	0.05		
eee	0.05		

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