

40V N-ch Power MOSFET

General Features

- Proprietary New Trench Technology
- $R_{DS(ON),typ.} = 1.7m\Omega @ V_{GS}=10V$
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

BV_{DSS}	$R_{DS(ON),max.}$	$I_D^{[2]}$
40V	2.0m Ω	262A

Applications

- High efficiency DC/DC Converters
- Synchronous Rectification
- UPS Inverter

Ordering Information

Part Number	Package	Marking
MXP4002AF	TO-263	MXP4002AF

Absolute Maximum Ratings

$T_C=25^{\circ}C$ unless otherwise specified

Symbol	Parameter	Value	Unit
V_{DSS}	Drain-to-Source Voltage ^[1]	40	V
V_{GSS}	Gate-to-Source Voltage	± 20	
I_D	Continuous Drain Current ^[2]	262	A
	Continuous Drain Current ^[3]	192	
	Continuous Drain Current at $T_C=100^{\circ}C$ ^[2]	185	
I_{DM}	Pulsed Drain Current at $V_{GS}=10V$ ^[2,4]	1064	
E_{AS}	Single Pulse Avalanche Energy ($V_{DD}=30V$, $V_{GS}=10V$, $R_G=25\Omega$, $L=1mH$)	528	mJ
P_D	Power Dissipation	253	W
	Derating Factor above $25^{\circ}C$	1.7	W/ $^{\circ}C$
T_L	Soldering Temperature Distance of 1.6mm from case for 10 seconds	300	$^{\circ}C$
T_J & T_{STG}	Operating and Storage Temperature Range	-55 to 175	

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

Thermal Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case			0.59	$^{\circ}C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient			62	

Electrical Characteristics

OFF Characteristics

 $T_J = 25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	40			V	$V_{GS}=0V$, $I_D=250\mu A$
I_{DSS}	Drain-to-Source Leakage Current			1	μA	$V_{DS}=32V$, $V_{GS}=0V$
I_{GSS}	Gate-to-Source Leakage Current			± 100	nA	$V_{GS}=\pm 20V$, $V_{DS}=0V$

ON Characteristics

 $T_J = 25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	--	1.7	2.0	m Ω	$V_{GS}=10V$, $I_D=192A^{[5]}$
			2.1	2.7	m Ω	$V_{GS}=4.5V$, $I_D=96A^{[5]}$
$V_{GS(TH)}$	Gate Threshold Voltage	1.0	--	3.0	V	$V_{DS} = V_{GS}$, $I_D=250\mu A$

Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{iss}	Input Capacitance		7.3		nF	$V_{GS}=0V$, $V_{DS}=25V$, $f=1.0MHz$
C_{rss}	Reverse Transfer Capacitance		0.3			
C_{oss}	Output Capacitance		1.2			
R_g	Gate Series Resistance		2.6		Ω	$f=1.0MHz$
Q_g	Total Gate Charge		135		nC	$V_{DD}=20V$, $I_D=120A$, $V_{GS}=10V$
Q_{gs}	Gate-to-Source Charge		23			
Q_{gd}	Gate-to-Drain (Miller) Charge		33			

Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(on)}$	Turn-on Delay Time		15		ns	$V_{DD}=20V$ $I_D=120A$ $V_{GS}=10V$ $R_G=2.5\Omega$
t_{rise}	Rise Time		23			
$t_{d(off)}$	Turn-off Delay Time		104			
t_{fall}	Fall Time		24			

Source-Drain Body Diode Characteristics

 $T_J = 25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
I_{SD}	Continuous Source Current ^[2]			262	A	Maximum Ratings
V_{SD}	Diode Forward Voltage		0.9	1.2	V	$I_S=120A$, $V_{GS}=0V$
t_{rr}	Reverse Recovery Time		58		ns	$V_{GS}=0V$ $I_F=20A$, $di/dt=100A/\mu s$
Q_{rr}	Reverse Recovery Charge		77		nC	

Note:

[1] $T_J = +25^\circ\text{C}$ to $+175^\circ\text{C}$

[2] Silicon limited current only

[3] Package limited current

[4] Repetitive rating, pulse width limited by both maximum junction temperature.

[5] Pulse width $\leq 380\mu s$; duty cycle $\leq 2\%$.

Typical Characteristics

Figure 1. Maximum Effective Thermal Impedance, Junction-to-Case

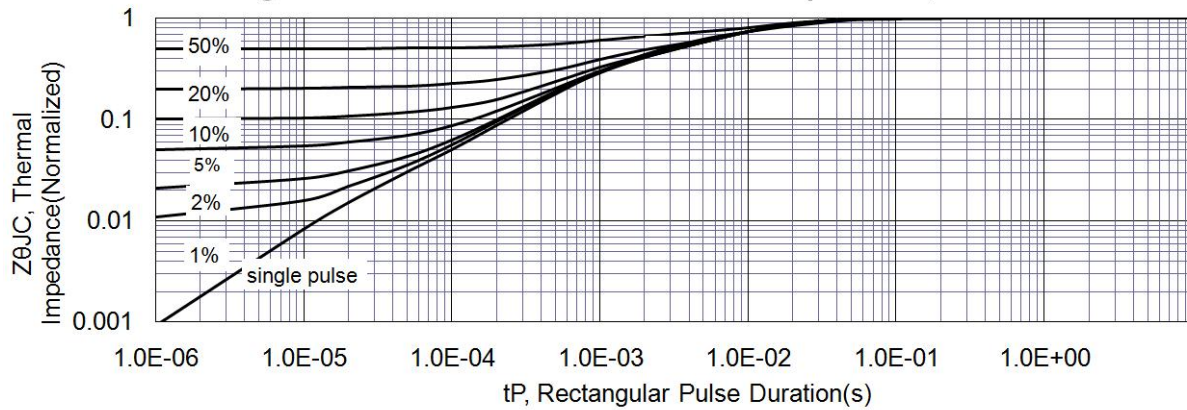


Figure 2. Maximum Power Dissipation vs. Case Temperature

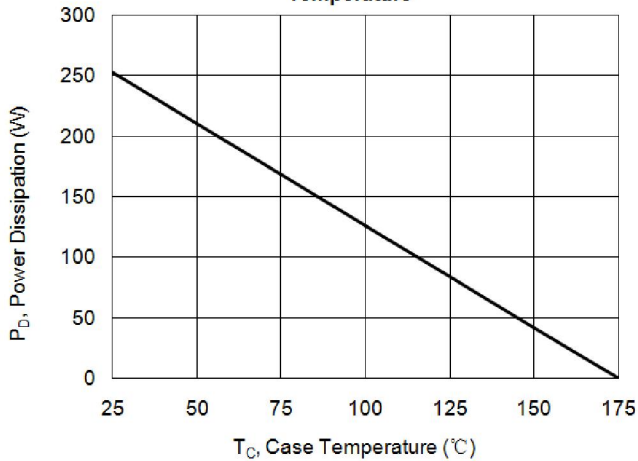


Figure 3. Maximum Continuous Drain Current vs Case Temperature

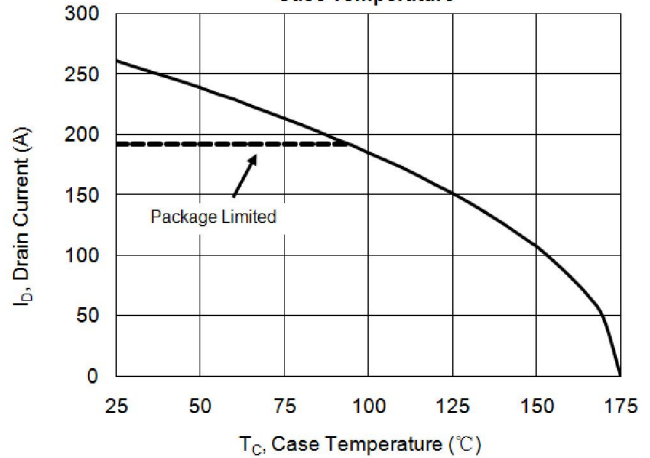


Figure 4. Typical Output Characteristics

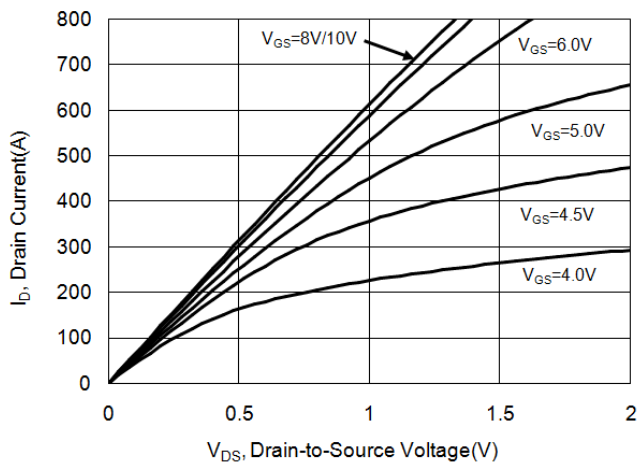


Figure 5. Typical Drain-to-Source ON Resistance vs. Gate Voltage

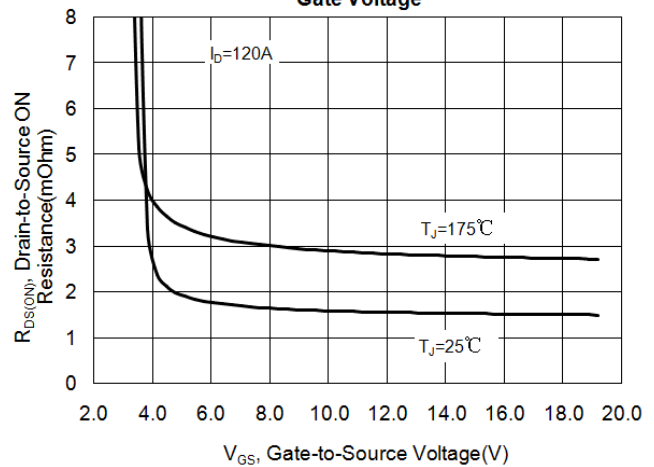


Figure 6. Maximum Peak Current Capability

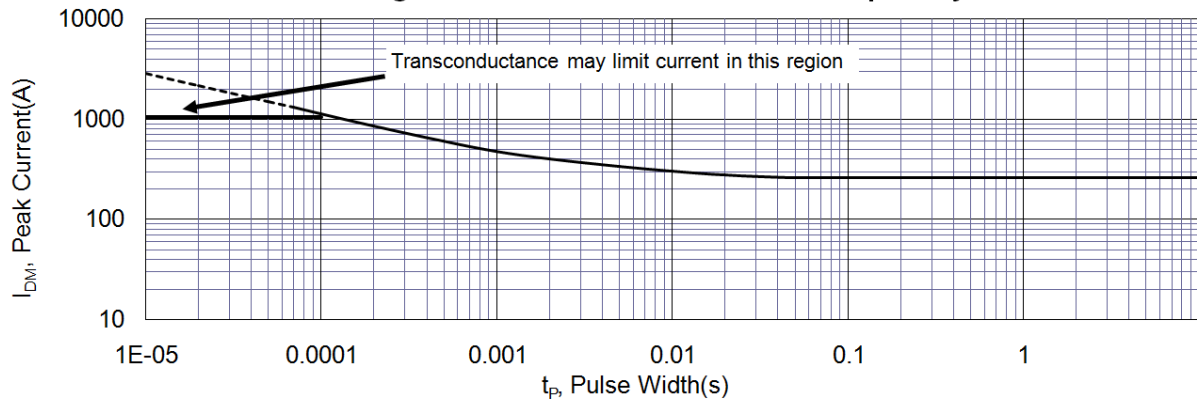


Figure 7. Typical Transfer Characteristics

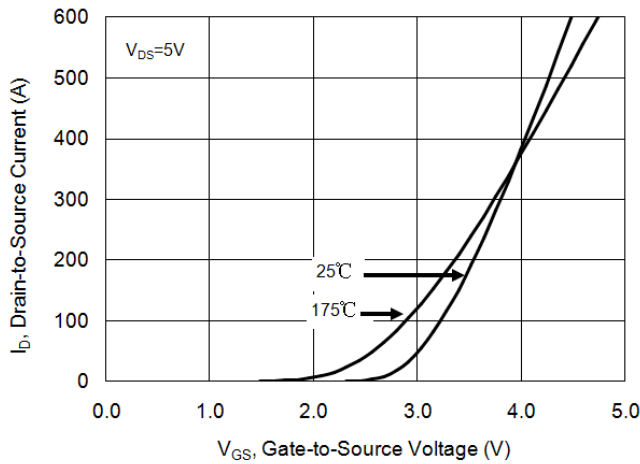


Figure 8. Unclamped Inductive Switching Capability

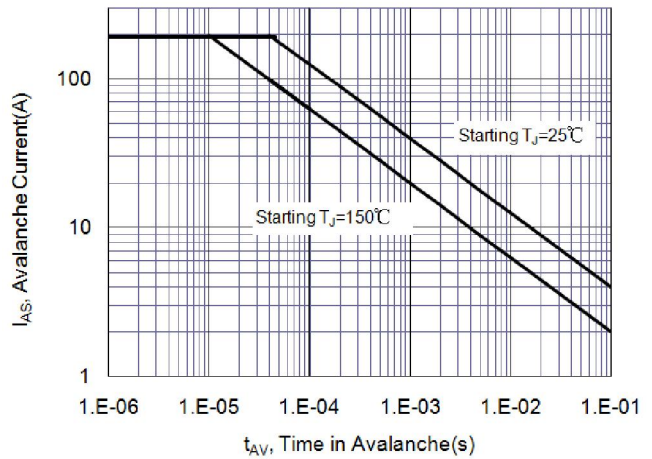


Figure 9. Typical Drain-to-Source ON Resistance

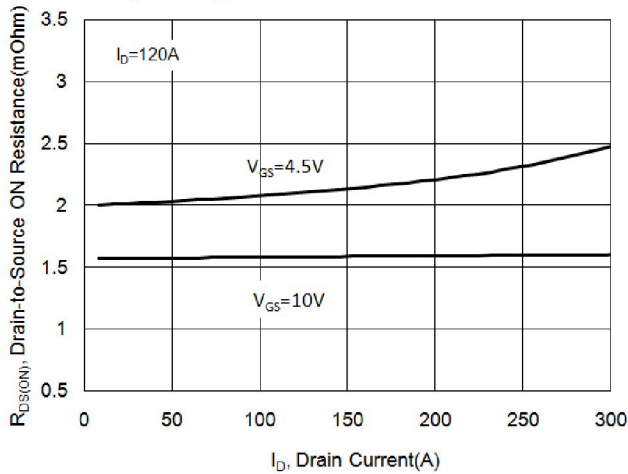


Figure 10. Typical Drain-to-Source On Resistance vs. Junction Temperature

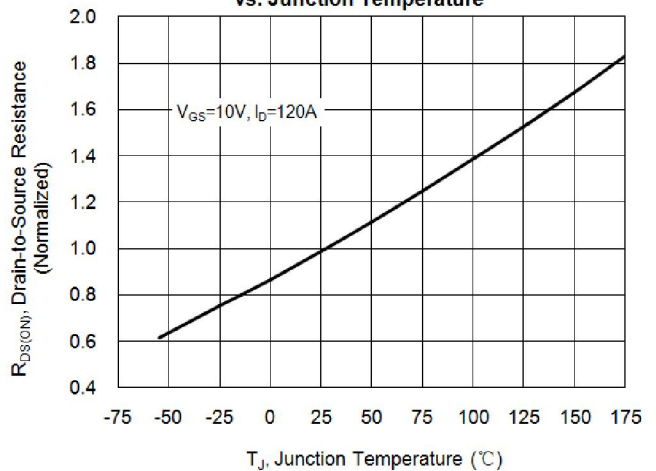


Figure 11. Typical Breakdown Voltage vs. Junction Temperature

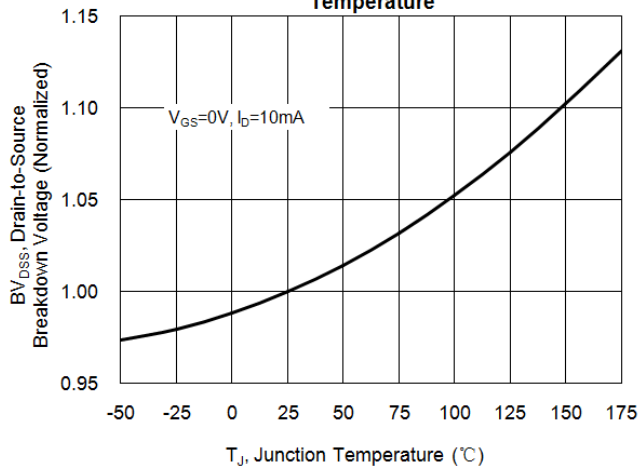


Figure 12. Typical Threshold Voltage vs. Junction Temperature

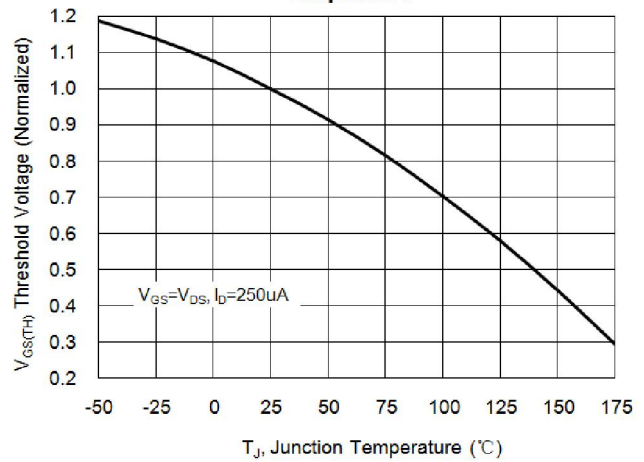


Figure 13. Maximum Forward Safe Operation Area

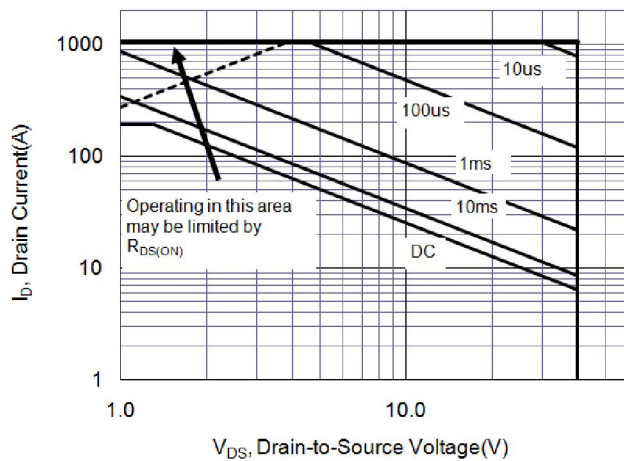


Figure 14. Typical Capacitance vs. Drain-to-Source Voltage

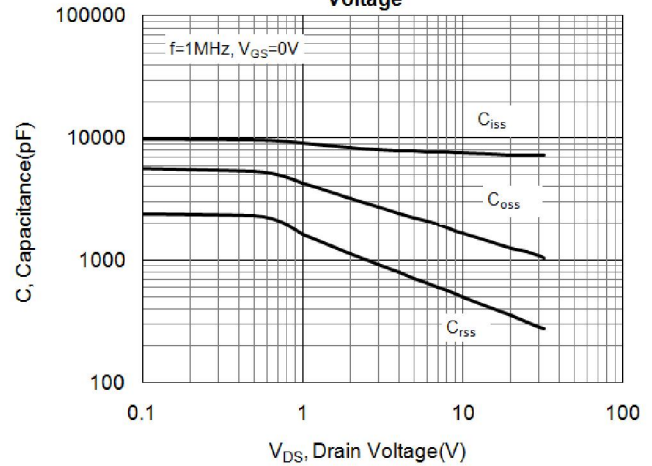


Figure 15. Typical Gate Charge vs. Gate-to-Source Voltage

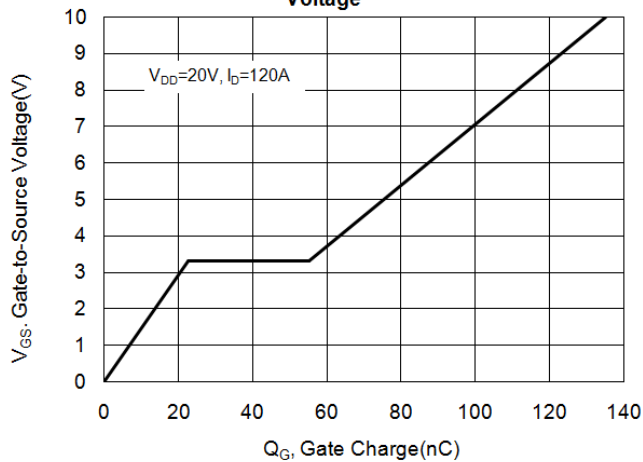
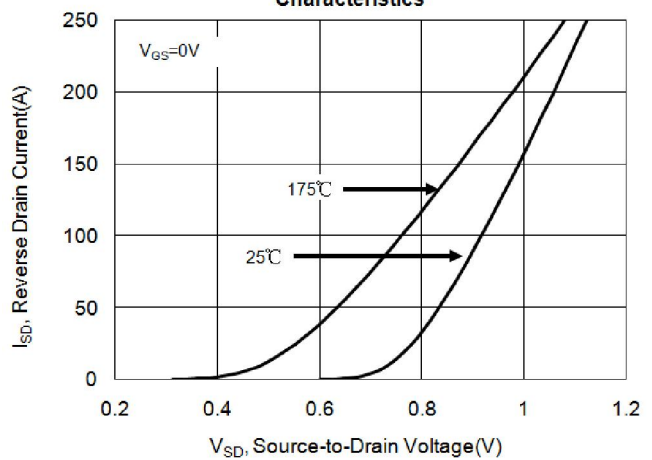


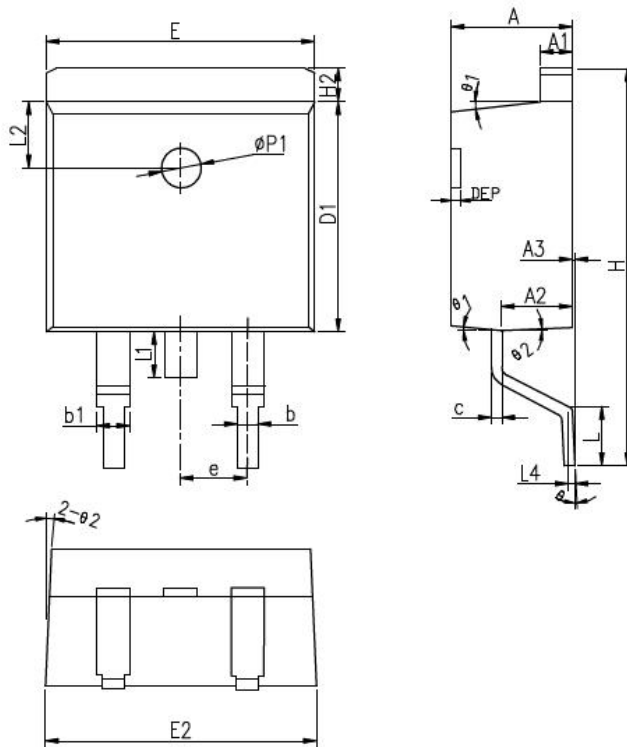
Figure 16. Typical Body Diode Transfer Characteristics



Package

Dimensions

TO-263-2L



COMMON DIMENSIONS

SYMBOL	MM			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.40	4.57	4.70	0.173	0.180	0.185
A1	1.22	1.27	1.32	0.048	0.050	0.052
A2	2.59	2.69	2.79	0.102	0.106	0.110
A3	0.00	0.10	0.20	0.000	0.004	0.008
b	0.77	0.813	0.90	0.030	0.032	0.035
b1	1.20	1.270	1.36	0.047	0.050	0.054
c	0.34	0.381	0.47	0.013	0.015	0.019
D1	8.60	8.70	8.80	0.339	0.343	0.346
E	10.00	10.16	10.26	0.394	0.400	0.404
E2	10.00	10.10	10.20	0.394	0.398	0.402
e	2.54 BSC			0.100 BSC		
H	14.70	15.10	15.50	0.579	0.594	0.610
H2	1.17	1.27	1.40	0.046	0.050	0.055
L	2.00	2.30	2.60	0.079	0.091	0.102
L1	1.45	1.55	1.70	0.057	0.061	0.067
L2	2.50 REF			0.098 REF		
L4	0.25 BSC			0.010 BSC		
θ	0°	5°	8°	0°	5°	8°
$\theta1$	5°	7°	9°	5°	7°	9°
$\theta2$	1°	3°	5°	1°	3°	5°
$\phi P1$	1.40	1.50	1.60	0.055	0.059	0.063
DEP	0.05	0.10	0.20	0.002	0.004	0.008

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