MOSFET – POWERTRENCH®, N-Channel Shielded Gate

80 V, 123 A, 4.3 mΩ

FDMS4D4N08C

Description

This N−Channel MV MOSFET is produced using **onsemi**'s advanced POWERTRENCH process that incorporates Shielded Gate technology. This process has been optimized to minimise on−state resistance and yet maintain superior switching performance with best in class soft body diode.

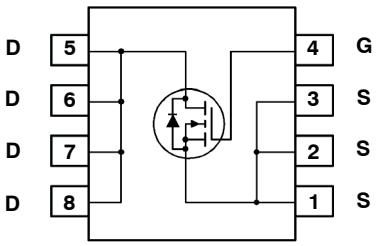
Features

- Shielded Gate MOSFET Technology
- Max $r_{DS(on)}$ = 4.3 mΩ at V_{GS} = 10 V, I_D = 44 A
- Max $r_{DS(on)}$ = 10.4 mΩ at V_{GS} = 6 V, I_D = 22 A
- 50% Lower Qrr than Other MOSFET Suppliers
- Lowers Switching Noise/EMI
- MSL1 Robust Package Design
- 100% UIL Tested
- RoHS Compliant

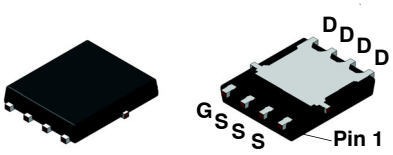
Typical Applications

- Primary DC−DC MOSFET
- Synchronous Rectifier in DC−DC and AC−DC
- Motor Drive
- Solar

ELECTRICAL CONNECTION



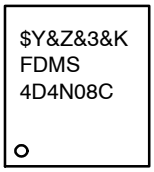
N-Channel MOSFET



Top Bottom

Power 56
(PQFN8 5x6)
CASE 483AE

MARKING DIAGRAM



$Y	= **onsemi** Logo
&Z	= Assembly Plant Code
&3	= Numeric Date Code
&K	= Lot Code
FDMS4D4N08C	= Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

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MOSFET MAXIMUM RATINGS (T_A = 25°C, Unless otherwise specified)

Symbol	Parameter			Ratings	Unit
V_{DS}	Drain to Source Voltage			80	V
V_{GS}	Gate to Source Voltage			±20	V
I_D	Drain Current	−Continuous T_C = 25°C	(Note 5)	123	A
		−Continuous T_C = 100°C	(Note 5)	78	
		−Continuous T_A = 25°C	(Note 1a)	17	
		−Pulsed	(Note 4)	498	
E_{AS}	Single Pulse Avalanche Energy		(Note 3)	486	mJ
P_D	Power Dissipation	T_C = 25°C		125	W
	Power Dissipation	T_A = 25°C	(Note 1a)	2.5	
T_J, T_{STG}	Operating and Storage Junction Temperature Range			−55 to +150	°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	Parameter		Ratings	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case		1.0	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a)	50	

PACKAGE MARKING AND ORDERING INFORMATION

Device Marking	Device	Package	Shipping†
FDMS4D4N08C	FDMS4D4N08C	PQFN8 5×6 (Pb−Free/Halogen Free)	3000 Units/ Tape & Reel

†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.

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ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
OFF CHARACTERISTICS						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V	80			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25°C		63		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 64 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20 V, V_{DS} = 0 V			±100	nA
ON CHARACTERISTICS (Note NO TAG)						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	2.0	3.0	4.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25°C		−8.2		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 44 A		3.7	4.3	mΩ
		V_{GS} = 6 V, I_D = 22 A		5.7	10.4	
		V_{GS} = 10 V, I_D = 44 A, T_J = 125°C		5.9	7.2	
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 44 A		98		S
DYNAMIC CHARACTERISTICS						
C_{ISS}	Input Capacitance	V_{DS} = 40 V, V_{GS} = 0 V, f = 1 MHz		2920	4090	pF
C_{OSS}	Output Capacitance			1045	1465	
C_{RSS}	Reverse Transfer Capacitance			35	50	
R_G	Gate Resistance		0.1	1.3	2.5	Ω
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn – On Delay Time	V_{DD} = 40 V, I_D = 44 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		17	31	ns
t_r	Rise Time			7	15	
$t_{d(off)}$	Turn – Off Delay Time			25	40	
t_f	Fall Time			5	10	
Q_g	Total Gate Charge	V_{GS} = 0 V to 10 V; V_{DD} = 40 V, I_D = 44 A		40	56	nC
Q_g	Total Gate Charge	V_{GS} = 0 V to 6 V; V_{DD} = 40 V, I_D = 44 A		25	35	
Q_{gs}	Gate to Source Charge			13		
Q_{gd}	Gate to Drain "Miller" Charge			8		
Q_{oss}	Output Charge	V_{DD} = 40 V, V_{GS} = 0 V		60		nC
Q_{sync}	Output Charge	V_{DS} = 0 V, I_D = 44 A		35		
DRAIN–SOURCE DIODE CHARACTERISTICS						
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.1 A (Note 2)		0.7	1.2	V
		V_{GS} = 0 V, I_S = 44 A (Note 2)		0.8	1.3	
t_{rr}	Reverse Recovery Time	I_F = 22 A, di/dt = 300 A/μs		26	42	ns
Q_{rr}	Reverse Recovery Charge			44	71	nC
t_{rr}	Reverse Recovery Time	I_F = 22 A, di/dt = 1000 A/μs		20	32	ns
Q_{rr}	Reverse Recovery Charge			106	169	nC

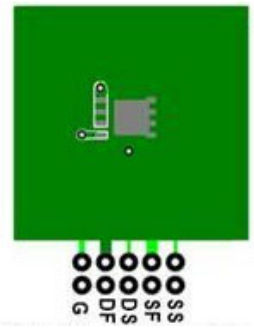
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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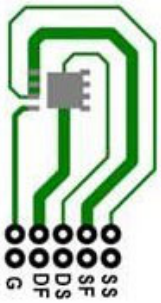
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NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 pad 2 oz copper pad on a 1.5 × 1.5 in. board of FR−4 material. $R_{\theta CA}$ is determined by the user's board design.



a) 50°C/W when mounted on a 1 in^2 pad of 2 oz copper.



b) 125°C/W when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.
3. E_{AS} of 486 mJ is based on starting T_J = 25°C; L = 3 mH, I_{AS} = 18 A, V_{DD} = 80 V, V_{GS} = 10 V. 100% tested at L = 0.1 mH, I_{AS} = 51 A.
4. Pulsed I_D please refer to Figure 11 SOA graph for more details.
5. Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro−mechanical application board design.

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TYPICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

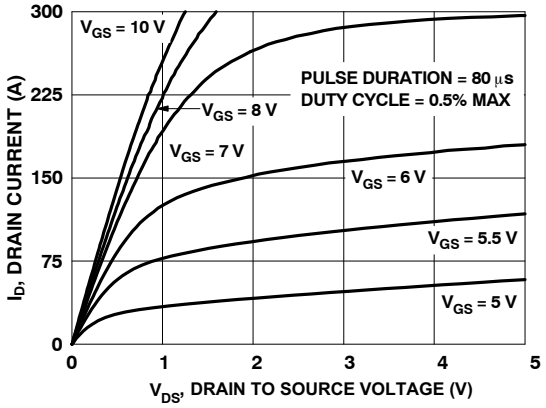


Figure 1. On Region Characteristics

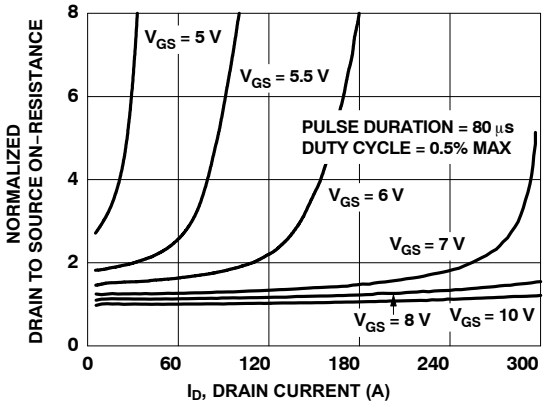


Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage

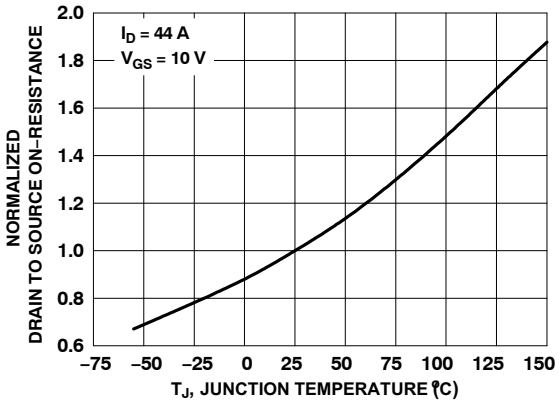


Figure 3. Normalized On Resistance vs. Junction Temperature

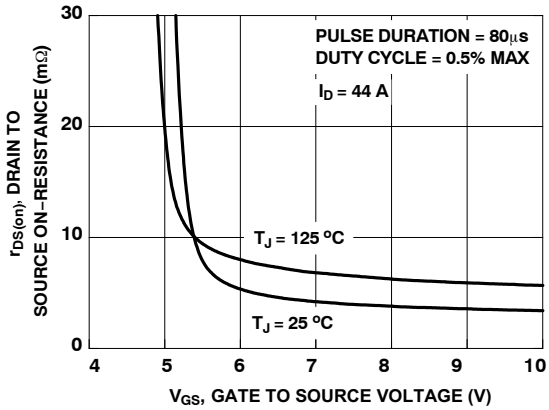


Figure 4. On-Resistance vs. Gate to Source Voltage

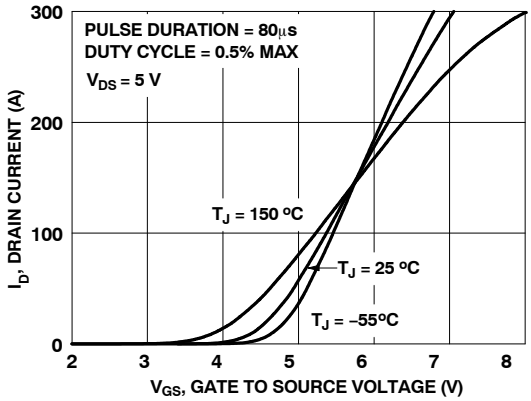


Figure 5. Transfer Characteristics

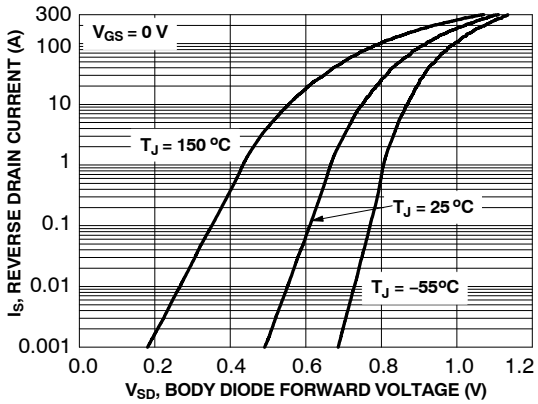


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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TYPICAL CHARACTERISTICS (continued)

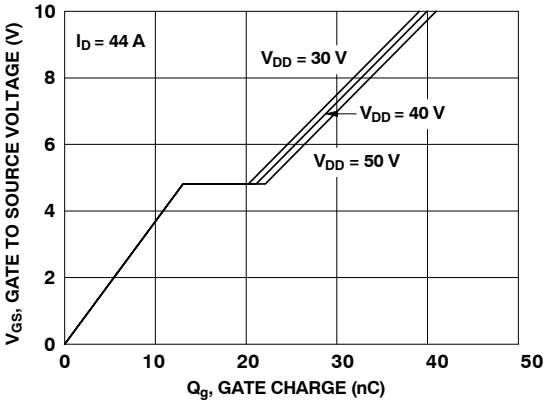


Figure 7. Gate Charge Characteristics

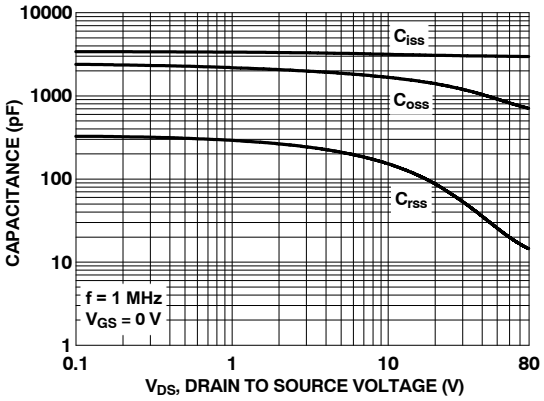


Figure 8. Capacitance vs. Drain to Source Voltage

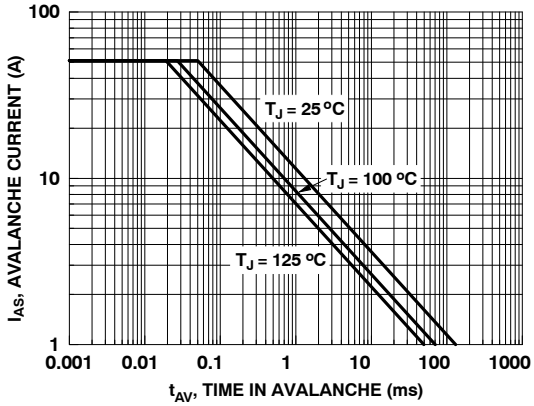


Figure 9. Unclamped Inductive Switching Capability

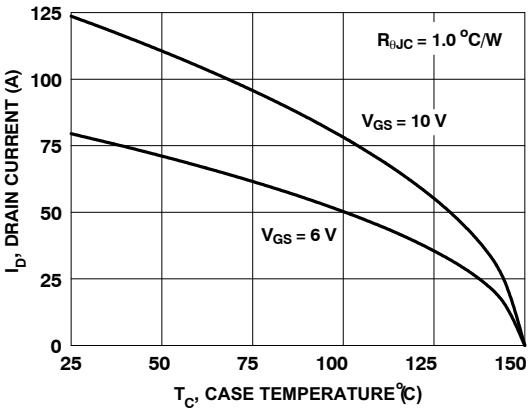


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

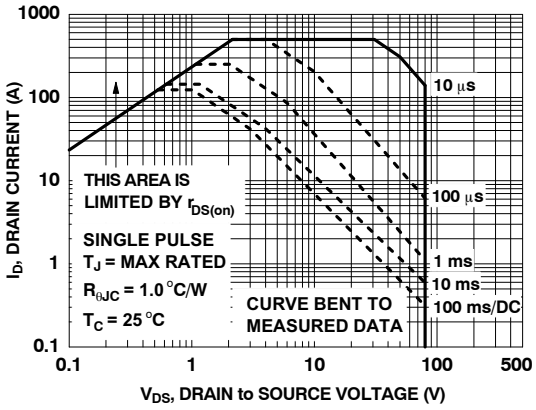


Figure 11. Forward Bias Safe Operating Area

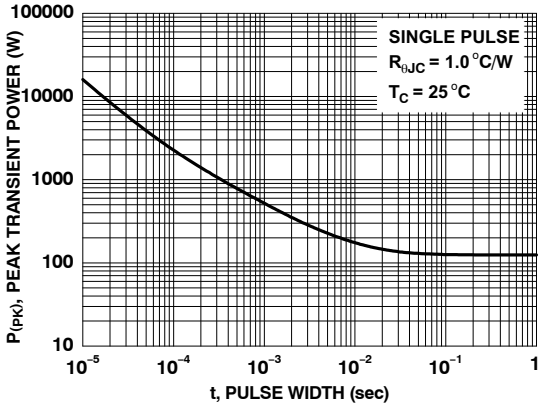


Figure 12. Single Pulse Maximum Power Dissipation

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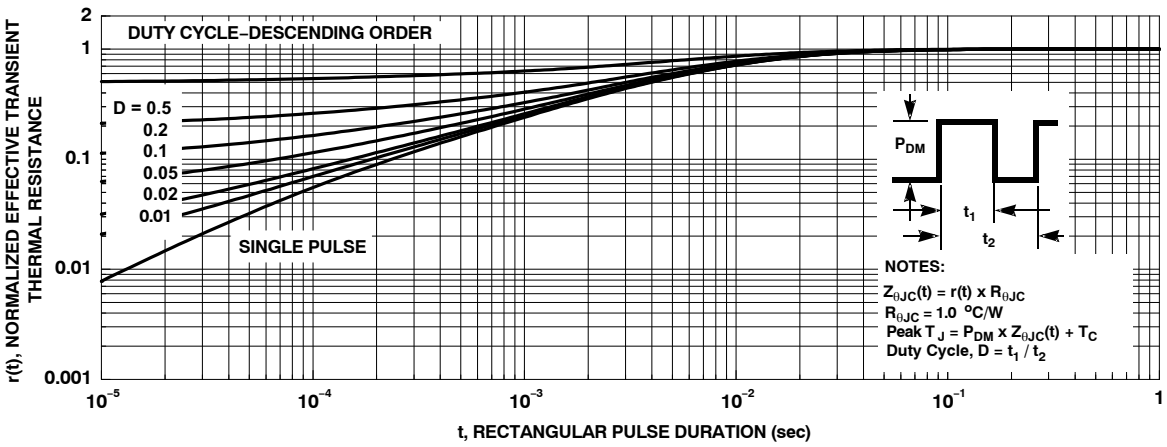
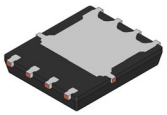


Figure 13. Junction−to−Case Transient Thermal Response Curve

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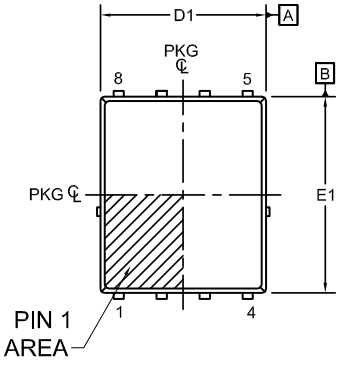
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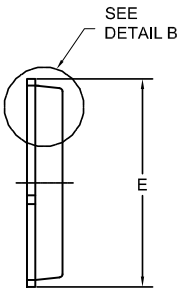


PQFN8 5X6, 1.27P
CASE 483AE
ISSUE C

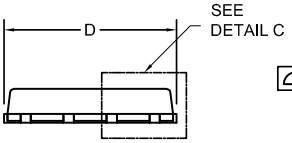
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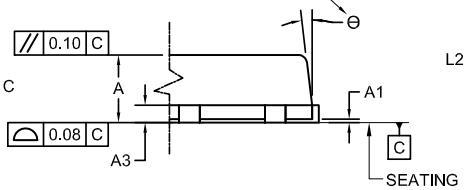
TOP VIEW



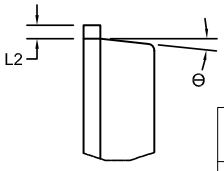
OPTIONAL DRAFT
ANGLE MAY APPEAR
ON FOUR SIDES
OF THE PACKAGE



SIDE VIEW



DETAIL C
SCALE: 2:1

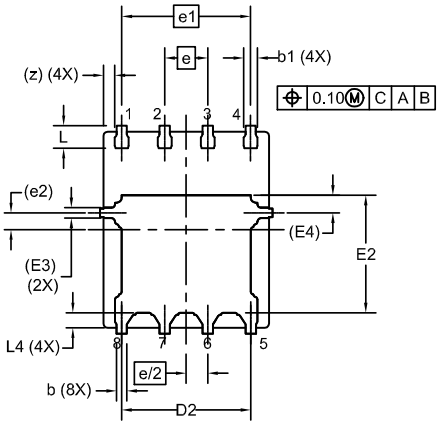


DETAIL B
SCALE: 2:1

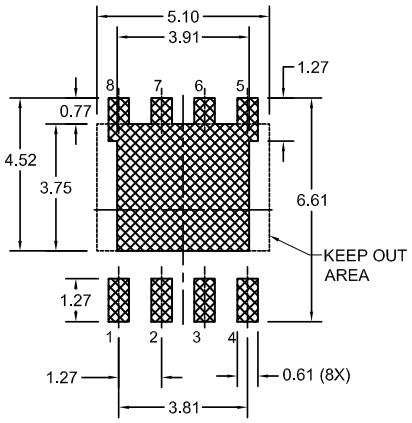
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. 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.
6. IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	-	0.05
b	0.21	0.31	0.41
b1	0.31	0.41	0.51
A3	0.15	0.25	0.35
D	4.90	5.00	5.20
D1	4.80	4.90	5.00
D2	3.61	3.82	3.96
E	5.90	6.15	6.25
E1	5.70	5.80	5.90
E2	3.38	3.48	3.78
E3	0.30 REF		
E4	0.52 REF		
e	1.27 BSC		
e/2	0.635 BSC		
e1	3.81 BSC		
e2	0.50 REF		
L	0.51	0.66	0.76
L2	0.05	0.18	0.30
L4	0.34	0.44	0.54
z	0.34 REF		
Θ	0°	-	12°



BOTTOM VIEW



LAND PATTERN
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