

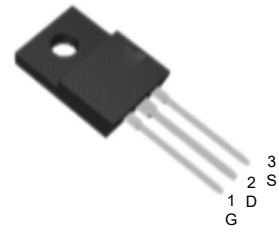
Features

- 650V/21A
 $R_{DS(ON)}=0.15\Omega(\text{typ.})@V_{GS}=10V$
- 100% UIS + R_g Tested
- Reliable and Rugged
- Lead Free and Green Devices Available
(RoHS Compliant)

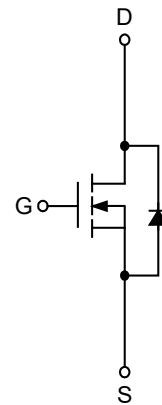
Applications

- AC/DC Power Conversion in Switched Mode Power Supplies (SMPS).
- Uninterruptible Power Supply (UPS).
- Adapter.

Pin Description



TO-220FP



N-Channel MOSFET

Absolute Maximum Ratings ($T_A=25^{\circ}\text{C}$ Unless Otherwise Noted)

Symbol	Parameter		Rating	Unit
Common Ratings				
V _{DSS}	Drain-Source Voltage		650	V
V _{GSS}	Gate-Source Voltage		±30	
T _J	Maximum Junction Temperature		150	°C
T _{STG}	Storage Temperature Range		-55 to 150	
I _S	Diode Continuous Forward Current	T _C =25°C	21	A
I _D	Continuous Drain Current	T _C =25°C	21	A
		T _C =100°C	16	
I _{DM} ^a	Pulsed Drain Current	T _C =25°C	63	
P _D	Maximum Power Dissipation	T _C =25°C	57	W
		T _C =100°C	23	
R _{θJC}	Thermal Resistance-Junction to Case		2.2	°C/W
R _{θJA}	Thermal Resistance-Junction to Ambient		62.5	°C/W
I _{AS} ^b	Avalanche Current, Repetitive	L=10mH	8.1	A
E _{AS} ^b	Avalanche Energy, Single pulse	L=10mH	328	mJ

Note a : Pulse width limited by maximum junction temperature.

Note b : UIS tested and pulse width limited by maximum junction temperature (initial temperature $T_J=25^{\circ}\text{C}$).

Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise noted)

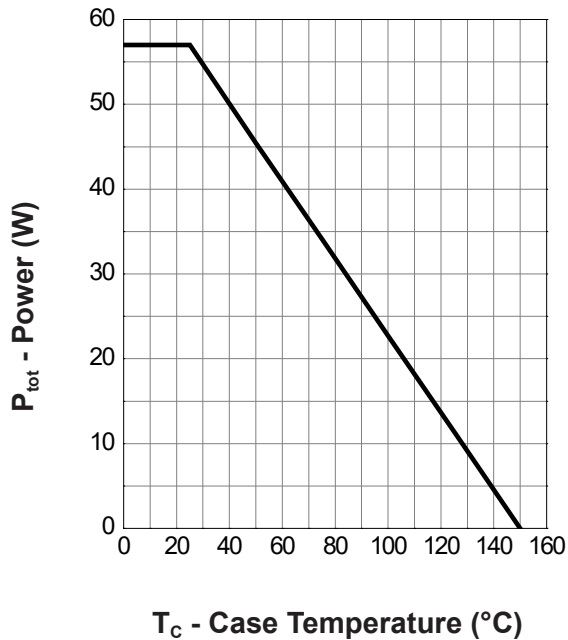
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =250μA	650	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =520V, V _{GS} =0V	-	-	1	μA
		T _J =85°C	-	-	30	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =250μA	2.5	3.5	4.5	V
I _{GSS}	Gate Leakage Current	V _{GS} =±30V, V _{DS} =0V	-	-	±100	nA
R _{DS(ON)} ^c	Drain-Source On-state Resistance	V _{GS} =10V, I _{DS} =10A	-	0.15	0.19	Ω
Diode Characteristics						
V _{SD} ^c	Diode Forward Voltage	I _{SD} =20A, V _{GS} =0V	-	0.9	1.3	V
t _{rr} ^d	Reverse Recovery Time	I _{SD} =10A, dI _{SD} /dt=100A/μs	-	283	-	ns
Q _{rr} ^d	Reverse Recovery Charge		-	4.1	-	μC
Dynamic Characteristics ^d						
R _G	Gate Resistance	V _{GS} =0V, V _{DS} =0V, F=1MHz	-	7	-	Ω
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =325V, Frequency=1.0MHz	-	1643	2135	pF
C _{oss}	Output Capacitance		-	43	-	
C _{rss}	Reverse Transfer Capacitance		-	5	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =30V, R _L =30Ω, I _{DS} =1A, V _{GEN} =10V, R _G =6Ω	-	21	37	ns
t _r	Turn-on Rise Time		-	20	37	
t _{d(OFF)}	Turn-off Delay Time		-	62	111	
t _f	Turn-off Fall Time		-	168	303	
Gate Charge Characteristics ^d						
Q _g	Total Gate Charge	V _{DS} =325V, V _{GS} =10V, I _{DS} =10A	-	38	53	nC
Q _{gs}	Gate-Source Charge		-	8.6	-	
Q _{gd}	Gate-Drain Charge		-	14	-	

Note c : Pulse test ; pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$.

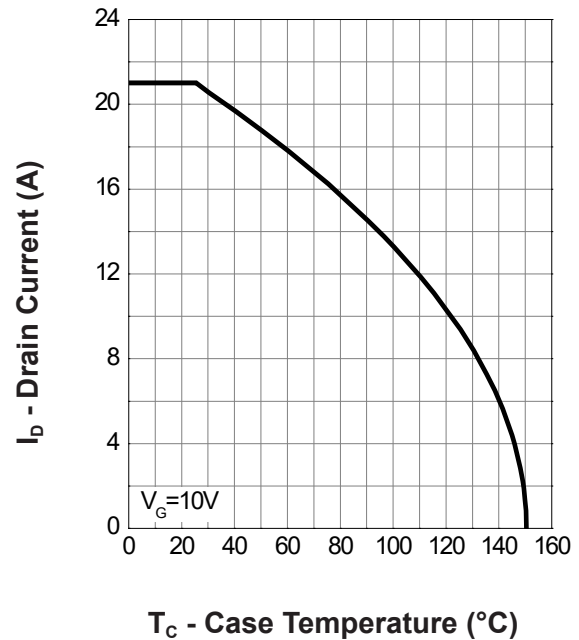
Note d : Guaranteed by design, not subject to production testing.

Typical Operating Characteristics

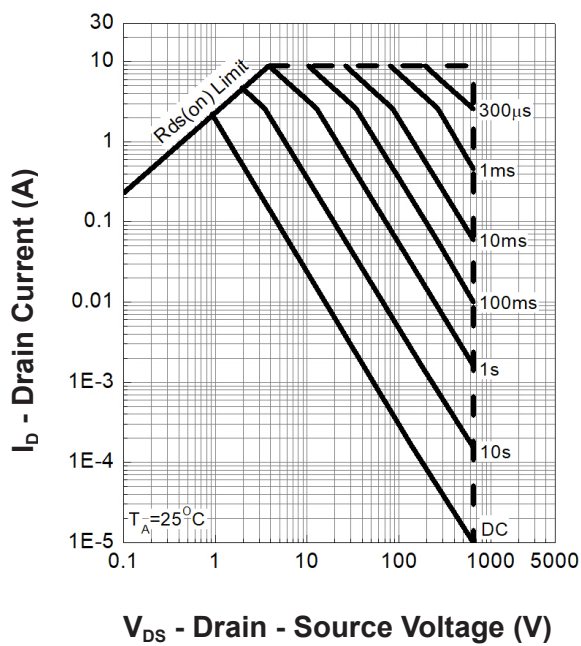
Power Dissipation



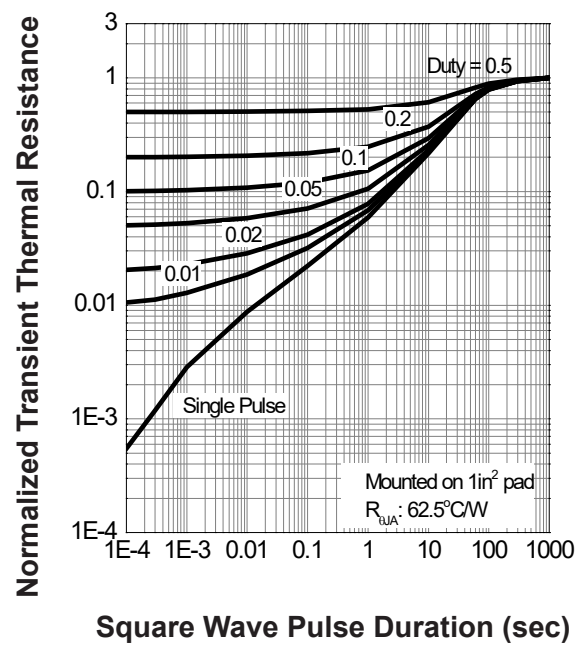
Drain Current



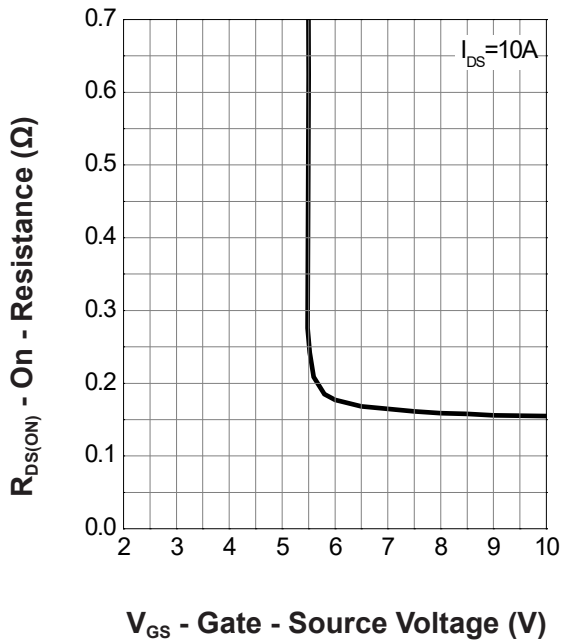
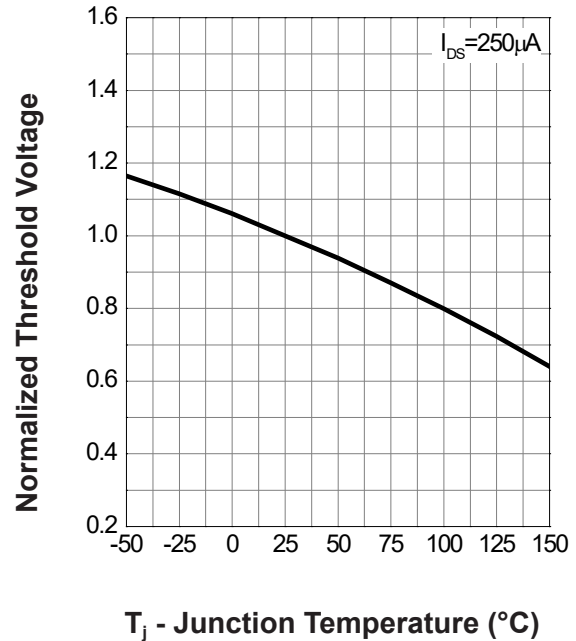
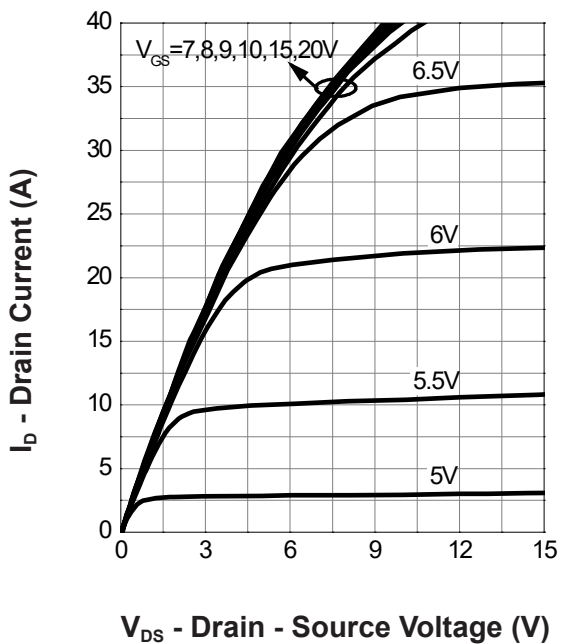
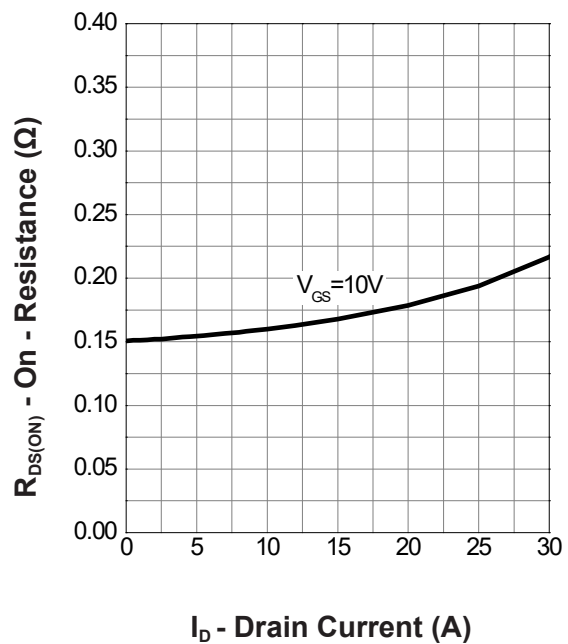
Safe Operation Area



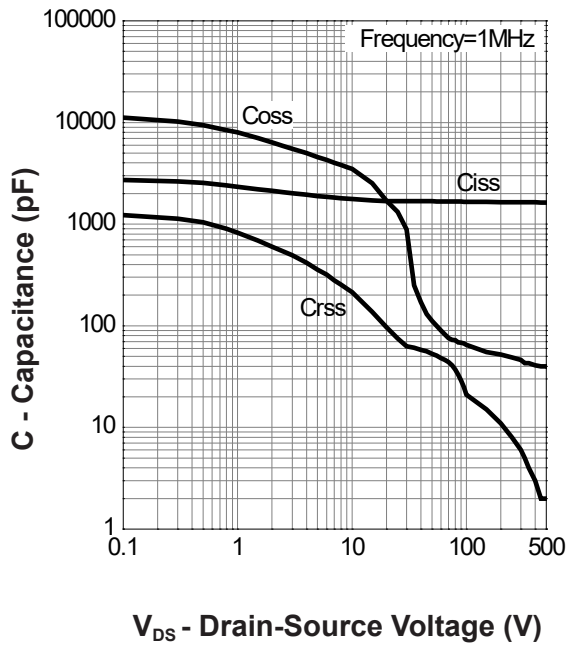
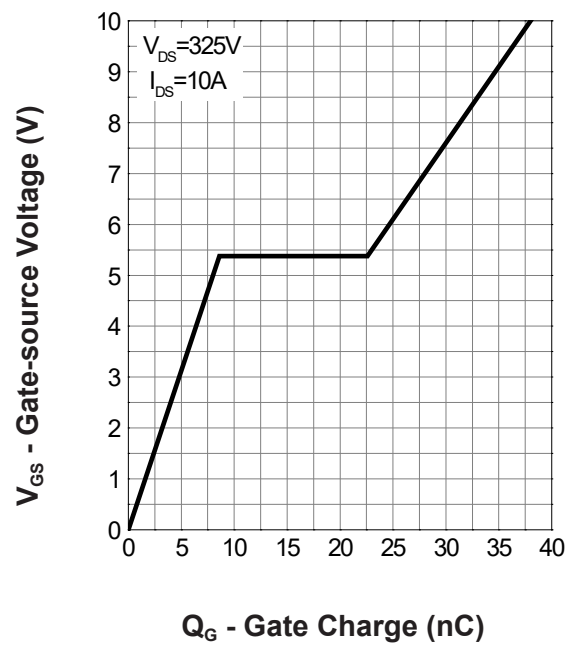
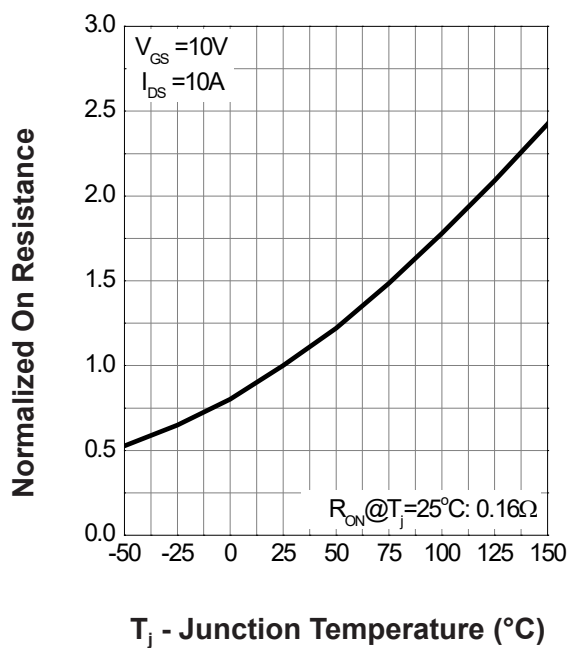
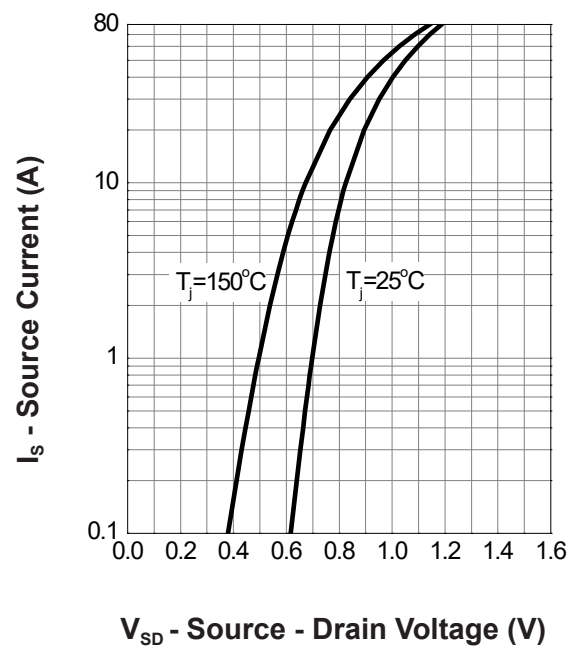
Thermal Transient Impedance



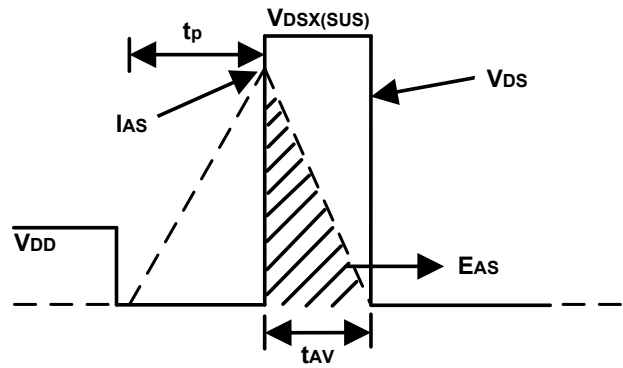
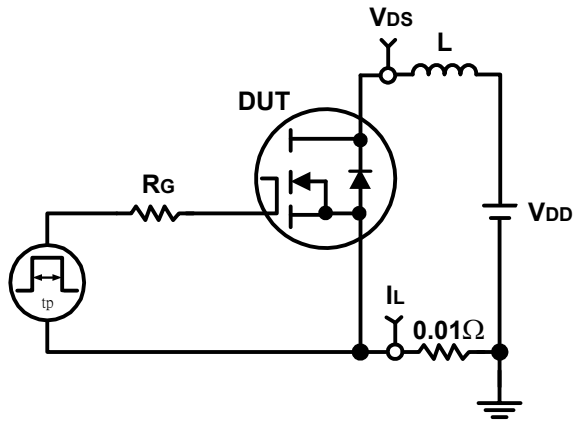
Typical Operating Characteristics(Cont.)

Gate-Source On Resistance

Gate Threshold Voltage

Output Characteristics

Drain-Source On Resistance


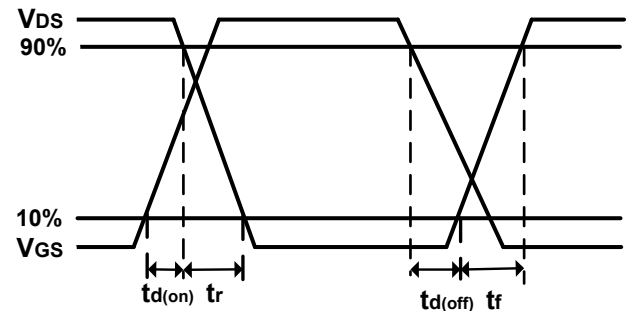
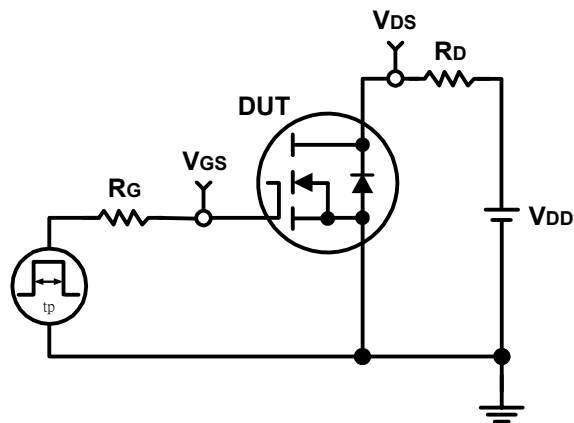
Typical Operating Characteristics(Cont.)

Capacitance

Gate Charge

Drain-Source On Resistance

Source-Drain Diode Forward


Avalanche Test Circuit and Waveforms

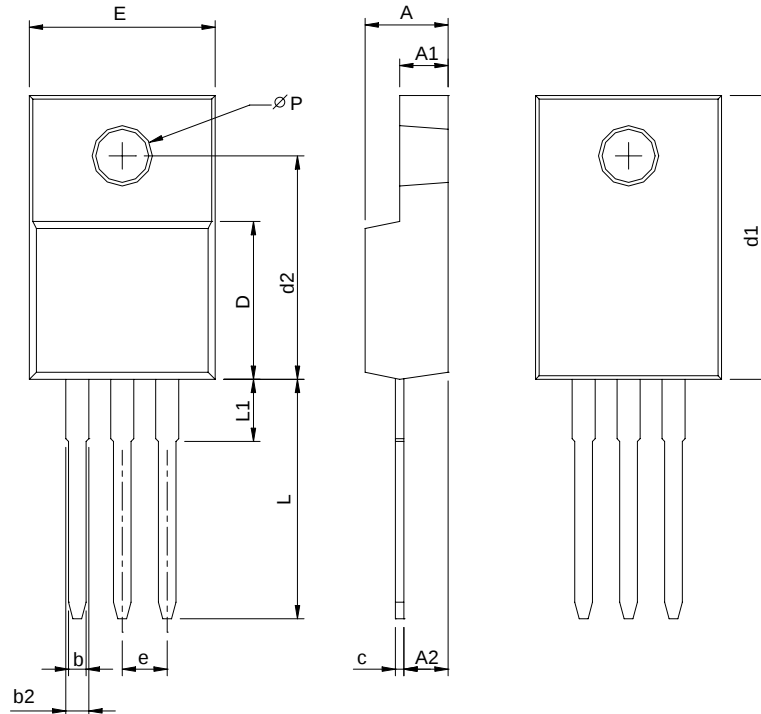


Switching Time Test Circuit and Waveforms



Package Information

TO-220



SYMBOL	TO-220			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.20	4.80	0.165	0.189
A1	2.34	3.20	0.092	0.126
A2	2.10	2.90	0.083	0.114
b	0.50	0.90	0.020	0.035
b2	0.91	1.90	0.035	0.075
c	0.30	0.80	0.012	0.031
D	8.10	9.40	0.319	0.370
d1	14.50	16.50	0.571	0.650
d2	12.10	12.90	0.476	0.508
E	9.70	10.70	0.382	0.421
e	2.54 BSC		0.100 BSC	
L	13.00	14.50	0.512	0.570
L1	1.60	4.00	0.063	0.157
P	3.00	3.60	0.118	0.142

RECOMMENDED LAND PATTERN

