

GaN 650V GaN HEMT RC65D180E

Description

The RC65D180E Series 650V, 180mΩ gallium nitride (GaN) FETs are normally-off devices.

RealChip GaN FETs offer better efficiency through lower gate charge, faster switching speeds, and lower dynamic on-resistance, delivering significant advantages over traditional silicon (Si) devices.

RealChip is a leading-edge wide band gap supplier with world-class innovation .

Application

- Adapter
- Renewable energy
- Telecom and data-com
- Servo motors
- Industrial
- Automotive

General Features

Easy to drive—compatible with standard gate drivers

Low conduction and switching losses

RoHS compliant and Halogen-free

Benefits

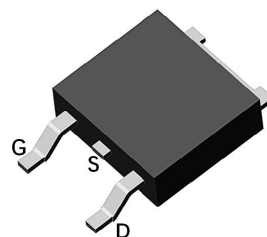
Increased efficiency through fast switching

Increased power density

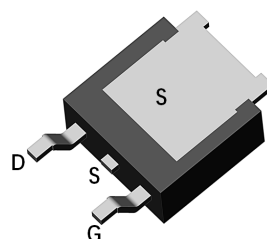
Reduced system size and weight

Ordering Information

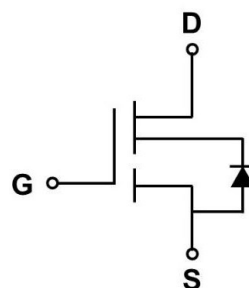
Part Number	Package	Package Configuration
RC65D180E	TO252	Source



Top



Bottom



Circuit Symbol

Features

BV_{DSS}	$R_{DS(on)}$	I_{DS}	Q_G
650V	180mΩ	14A	7.4nC

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Absolute Maximum Ratings

$T_c=25^{\circ}\text{C}$ unless otherwise stated

Symbol	Parameter		Limit value	Unit
V_{DSS}	Drain to source voltage ($T_J = -55^{\circ}\text{C}$ to 150°C)		650	V
$V_{(TR)DSS}$	Drain to source voltage-transient ^a		800	
V_{GSS}	Gate to source voltage		-20~+20	
I_D	Continuous drain current @ $T_c=25^{\circ}\text{C}$ ^b		14	A
	Continuous drain current @ $T_c=125^{\circ}\text{C}$ ^b		6.1	
I_{DM}	Pulse drain current (pulse width: 10 μs)		27	A
P_D	Maximum power dissipation @ $T_c=25^{\circ}\text{C}$		89	W
T_c	Operating temperature	Case	-55~150	$^{\circ}\text{C}$
T_J		Junction	-55~150	$^{\circ}\text{C}$
T_s	Storage temperature		-55~150	$^{\circ}\text{C}$

a. In off-state, spike duty cycle $D < 0.01$, spike duration $< 1\mu\text{s}$

b. For increased stability at high current operation

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Thermal Resistance

Symbol	Parameter	Limit value	Unit
$R_{\theta JC}$	Junction-to-case	1.4	°C /W

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Electrical Parameters

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

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
Forward Device Characteristics						
$V_{(BL)DSS}$	Drain-source voltage	650	-	-	V	$V_{GS}=0\text{V}$
$V_{GS(th)}$	Gate threshold voltage	3.3	3.9	4.5	V	$V_{DS}=1\text{V}, I_{DS}=1\text{mA}$
$\Delta V_{GS(th)}/T_J$	temperature coefficient	-	-7	-	mV/ $^{\circ}\text{C}$	
$R_{DS(on)}$	Drain-source on-Resistance	-	180	220	m Ω	$V_{GS}=10\text{V}, I_D=1\text{A}, T_J=25^{\circ}\text{C}$
		-	380	-		$V_{GS}=10\text{V}, I_D=1\text{A}, T_J=150^{\circ}\text{C}$
I_{DSS}	Drain-to-source leakage current	-	1	10	μA	$V_{DS}=650\text{V}, V_{GS}=0\text{V}, T_J=25^{\circ}\text{C}$
		-	5	100		$V_{DS}=650\text{V}, V_{GS}=0\text{V}, T_J=150^{\circ}\text{C}$
I_{GSS}	Gate-to-source forward leakage current	-	-	± 100	nA	$V_{GS}=\pm 20\text{V}$
C_{ISS}	Input capacitance	-	331	-	pF	$V_{GS}=0\text{V}, V_{DS}=400\text{V}, f=1\text{MHz}$
C_{OSS}	Output capacitance	-	25	-		
C_{RSS}	Reverse capacitance	-	1	-		
Q_G	Total gate charge	-	7.4	-	nC	$V_{DS}=400\text{V}, V_{GS}=0\text{V to }10\text{V}, I_D=1\text{A}$
Q_{GS}	Gate-source charge	-	2.6	-		
Q_{GD}	Gate-drain charge	-	1.8	-		
Q_{OSS}	Output charge	-	34	-	nC	$V_{GS}=0\text{V}, V_{DS}=0\text{V to }400\text{V}, f=1\text{MHz}$
$t_{D(on)}$	Turn-on delay	-	3.3	-	ns	$V_{DS}=400\text{V}, V_{GS}=0\text{V to }10\text{V}, I_D=2.1\text{A},$ $R_{G-on(ext)}=6.8\Omega, R_{G-off(ext)}=2.2\Omega,$ $L=250\mu\text{H}$
t_R	Rise time	-	7	-		
$t_{D(off)}$	Turn-off delay	-	9.8	-		
t_F	Fall time	-	27	-		

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Electrical Parameters

$T_j=25^{\circ}\text{C}$ unless otherwise stated

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
Reverse Device Characteristics						
V_{SD}	Source-Drain reverse voltage	-	2.5	-	V	$V_{GS}=0\text{V}$, $I_{SD}=10\text{A}$
t_{RR}	Reverse recovery time	-	14	-	ns	$I_F=10\text{A}$, $V_{DD}=400\text{V}$, $dI_F/dt=165\text{A}/\mu\text{s}$
Q_{RR}	Reverse recovery charge	-	6.5	-	nC	

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Typical Characteristics

$T_j=25^\circ\text{C}$ unless otherwise stated

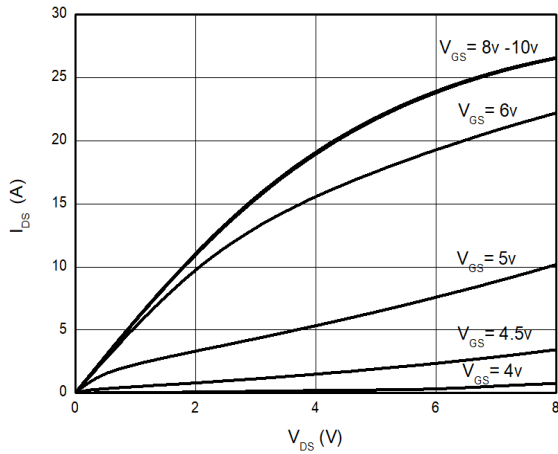


Figure 1. Typical Output Characteristics $T_j=25^\circ\text{C}$

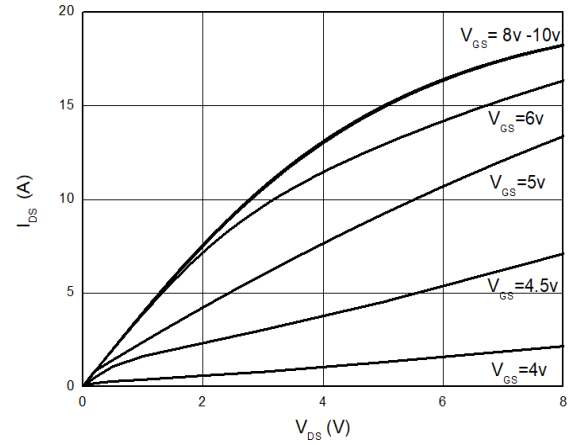


Figure 2. Typical Output Characteristics $T_j=125^\circ\text{C}$

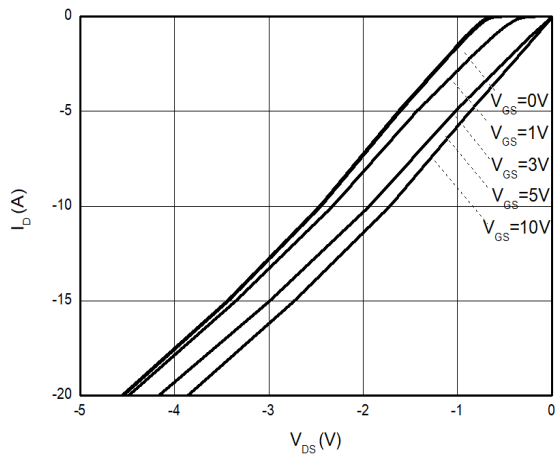


Figure 3. Channel Reverse Characteristics $T_j=25^\circ\text{C}$

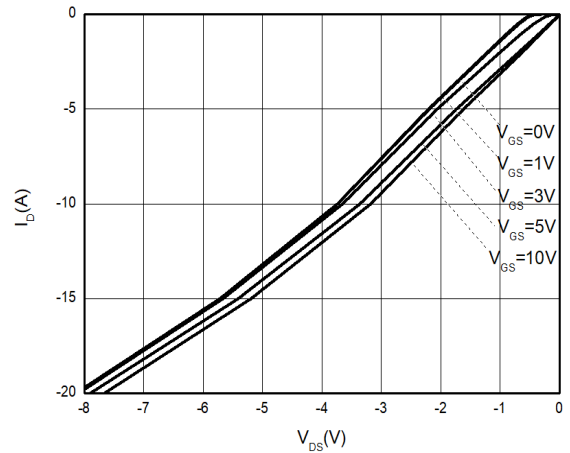


Figure 4. Channel Reverse Characteristics $T_j=125^\circ\text{C}$

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Typical Characteristics

$T_j = 25^\circ\text{C}$ unless otherwise stated

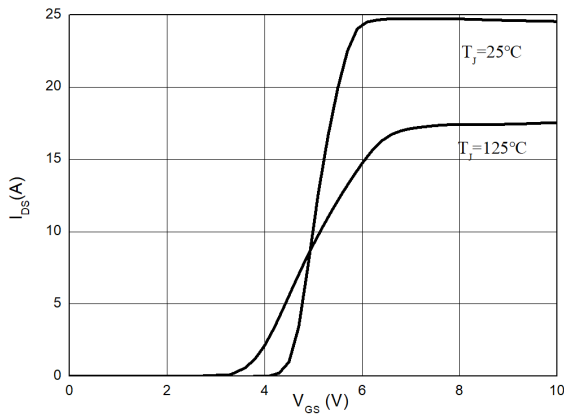


Figure 5. Typical Transfer Characteristics ($V_{DS}=10\text{V}$)

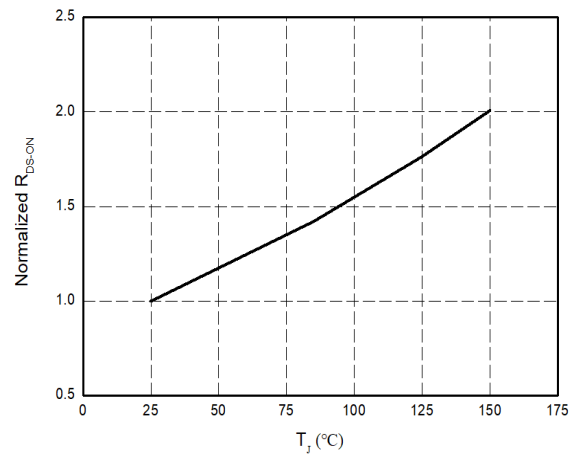


Figure 6. Normalized On-resistance

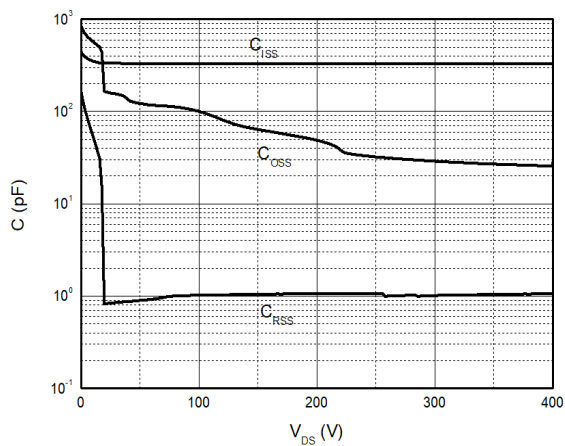


Figure 7. Typical Capacitance ($f=1\text{MHz}$)

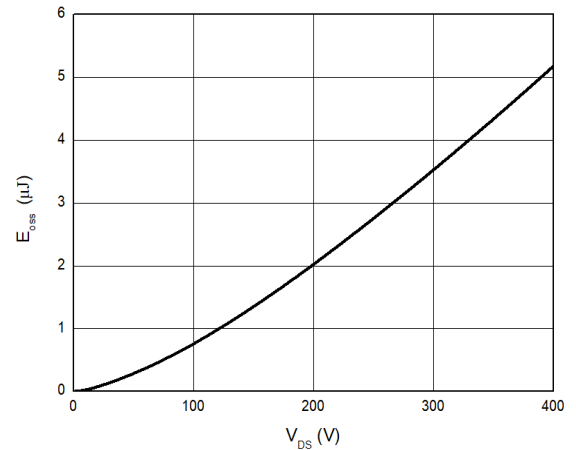


Figure 8. Typical C_{OSS} Stored Energy

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Typical Characteristics

$T_j = 25^\circ\text{C}$ unless otherwise stated

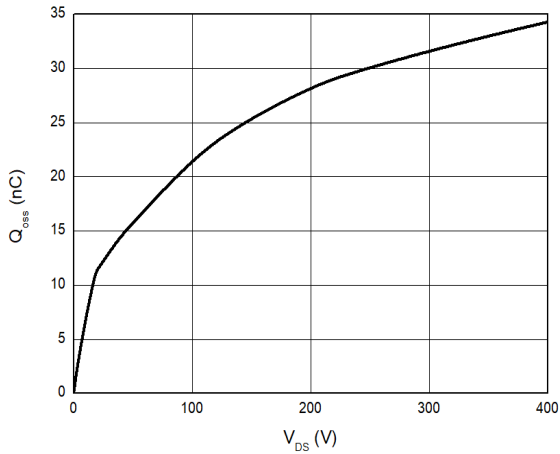


Figure 9. Typical Q_{oss}

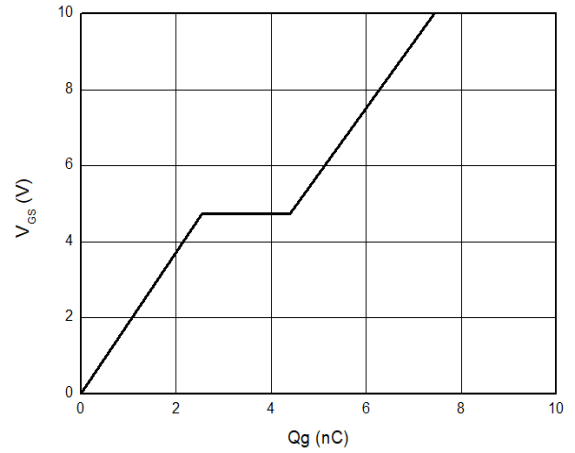


Figure 10. Typical Gate Charge ($V_{DS}=400\text{V}$, $I_D=1\text{A}$)

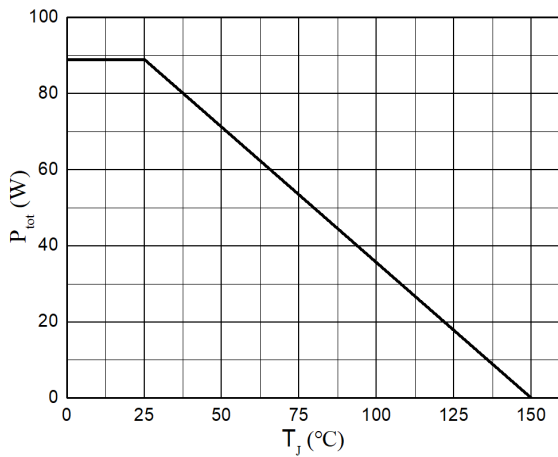


Figure 11. Power Dissipation

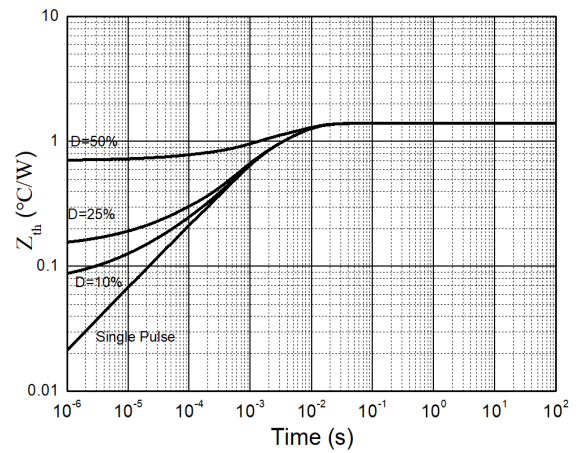


Figure 12. Transient Thermal Resistance

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Typical Characteristics

$T_j=25^\circ\text{C}$ unless otherwise stated

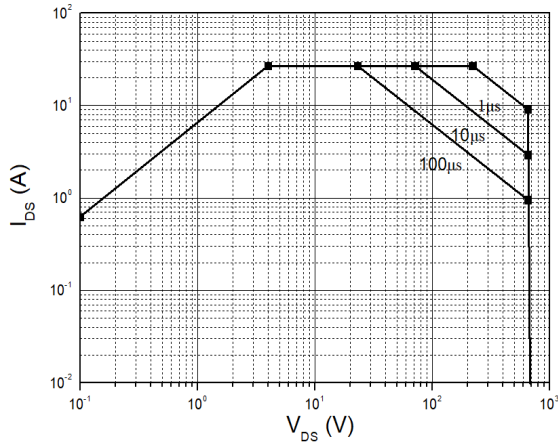


Figure 13. Safe Operating Area $T_c=25^\circ\text{C}$

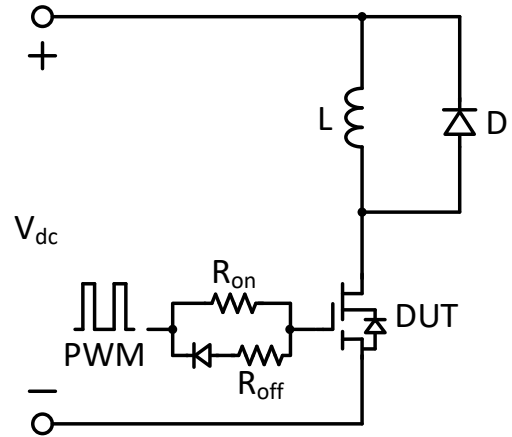


Figure 14. Switching times with inductive load

$V_{DS}=400\text{V}$, $V_{GS}=0\text{V to }10\text{V}$, $I_D=2.1\text{A}$,
 $R_{G-on(ext)}=6.8\Omega$, $R_{G-off(ext)}=2.2\Omega$, $L=250\mu\text{H}$

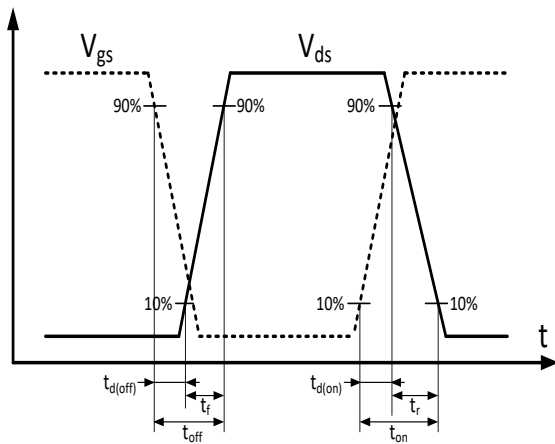
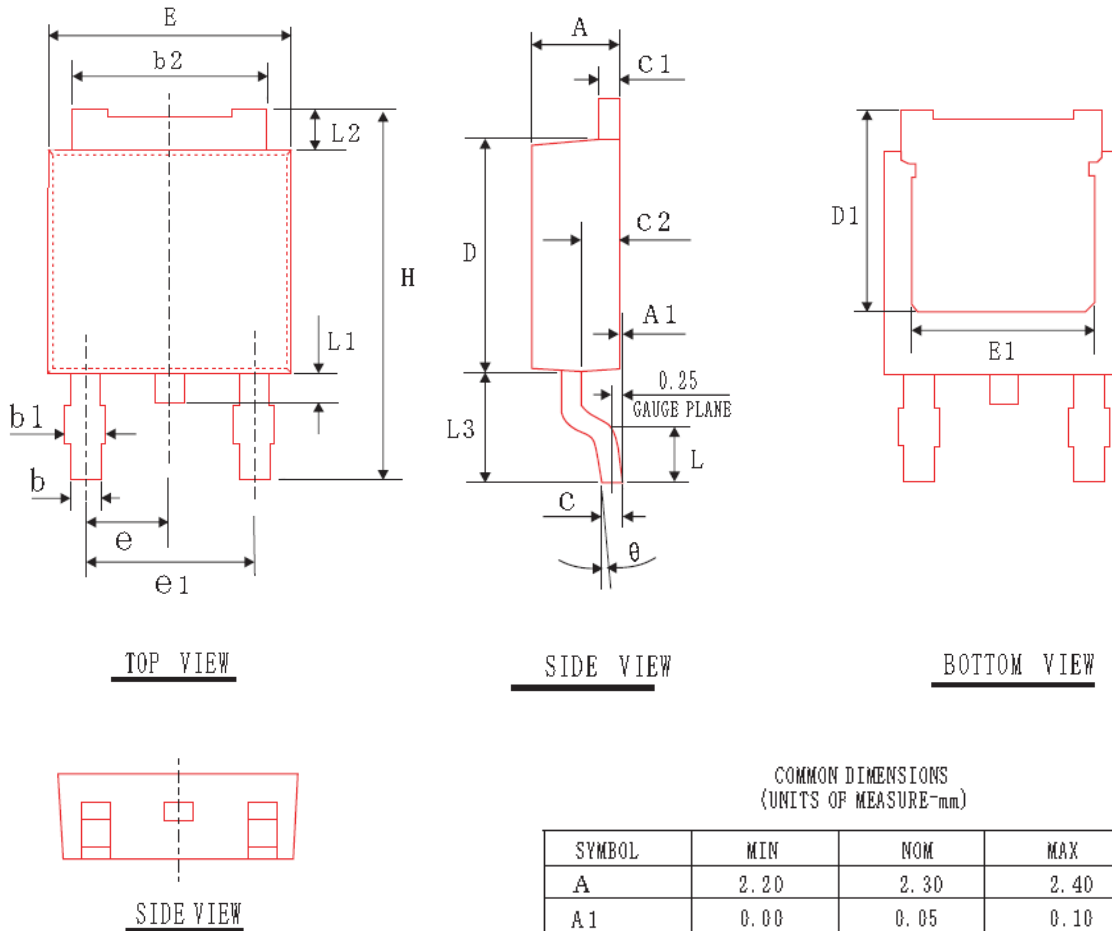


Figure 15. Switching times with waveform

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PACKAGE DIMENSIONS

TO252-2L



COMMON DIMENSIONS
(UNITS OF MEASURE-mm)

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.40
A1	0.00	0.05	0.10
b	0.762	0.812	0.862
b1	—	—	1.10
b2	5.23	5.33	5.43
C	0.458	0.508	0.558
C1	0.458	0.508	0.558
C2	0.80	1.00	1.20
D	6.00	6.10	6.20
D1	5.25	5.45	5.65
H	10.00	10.10	10.20
E	6.50	6.60	6.70
E1	4.75	4.85	4.95
e1	4.37	4.57	4.77
L	—	—	1.45
L1	0.60	0.75	0.90
L2	0.90	1.10	1.30
L3	2.80	3.00	3.20
θ	0°	4°	8°
e	2.285 BSC		