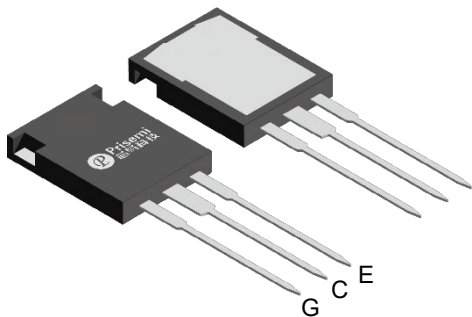
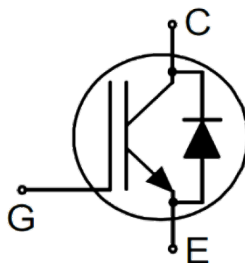
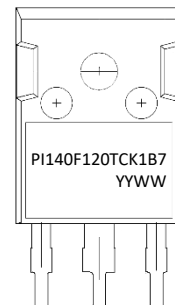


Description

TO-247PLUS-3L

Circuit Diagram

Marking (Top View)
Feature

- High Input Impedance
- Low Saturation Voltage $V_{CE(SAT)}$
- Low Switching Losses
- Copacked with Fast Recovery Diode
- Low Conduction Loss for a High Efficiency
- Rugged Transient Reliability
- Low EMI

Applications

- UPS
- EV-Charger
- Solar String Inverter

Absolute maximum rating@25°C

Parameter	Symbol	Value	Units
Collector-Emitter Voltage	V_{CE}	1200	V
Gate-Emitter Voltage	V_{GE}	± 20	V
Collector Current	I_C	$T_c = 25^\circ\text{C}$	240*1
		$T_c = 100^\circ\text{C}$	140
Pulsed Collector Current	I_{CM}	560	A
Diode Current	I_F	$T_c = 25^\circ\text{C}$	240*1
		$T_c = 100^\circ\text{C}$	140
Diode Pulsed Current	I_{FM}	560	A
Power Dissipation	P_D	$T_c = 25^\circ\text{C}$	1091
		$T_c = 100^\circ\text{C}$	545
Operating Junction Temperature	T_{VJ}	-55~+175	°C
Storage Temperature	T_{STG}	-40~+125	°C

Note: 1. Limited by bondwire

Electrical characteristics per line@25°C (unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	
Collector-Emitter Breakdown Voltage	BV_{CE}	-	1200	-	-	V	
C-E Leakage Current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V$	-	-	50	μA	
G-E Leakage Current	I_{GES}	$V_{CE}=0V$	$V_{GE}=20V$	-	-	100	nA
			$V_{GE}=-20V$	-100	-	-	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C=2.24mA, V_{CE}=V_{GE}$	4.8	5.3	5.8	V	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=140A, V_{GE}=15V$	$T_{Vj}=25^\circ C$	-	1.75	2.2	V
			$T_{Vj}=175^\circ C$	-	2.3	-	
Diode forward voltage	V_F	$I_C=140A, V_{GE}=0V$	$T_{Vj}=25^\circ C$	-	2.05	2.5	V
			$T_{Vj}=175^\circ C$	-	2.3	-	
Gate input resistance	R_G	$f=1MHz$	-	0.8	-	Ω	
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=100KHz$	-	16195	-	pF	
Output Capacitance	C_{oes}		-	402	-		
Reverse Transfer Capacitance	C_{res}		-	57	-		
Total Gate Charge	Q_g	$V_{CE}=960V, V_{GE}=0V \text{ to } 15V, I_C=140A$	-	450	-	nC	
Gate to Emitter Charge	Q_{ge}		-	132	-		
Gate to Collector Charge	Q_{gc}		-	104	-		
Turn-on Delay Time	$t_{d(on)}$	$V_{CC}=600V, I_C=140A, V_{GE}=0/15V, R_G=10\Omega, \text{ Inductive Load}$	-	183	-	ns	
Rise Time	t_r		-	241	-		
Turn-off Delay Time	$t_{d(off)}$		-	359	-		
Fall Time	t_f		-	221	-		
Turn-on Energy Loss	E_{on}	$V_{CC}=600V, I_C=140A, V_{GE}=0/15V, R_G=10\Omega, \text{ Inductive Load}$	-	11.9	-	mJ	
Turn-off Energy Loss	E_{off}		-	8.9	-		
Total Switching Loss	E_{st}		-	20.8	-		
Diode Reverse Recovery Time	T_{rr}	$V_{CC}=600V, I_C=140A, V_{GE}=0/15V, R_G=10\Omega$	-	137	-	ns	
Diode Reverse Recovery Charge	Q_{rr}		-	0.81	-	μC	
Diode Reverse Recovery Current	I_{rm}		-	9.3	-	A	
Diode Reverse Recovery Loss	E_{rec}		-	0.164	-	mJ	

Electrical characteristics per line@175°C (unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Turn-on Delay Time	$t_{d(on)}$	$V_{CC}=600V, I_C=140A,$ $V_{GE}=0/15V, R_G=10\Omega,$ Inductive Load	-	165	-	ns
Rise Time	t_r		-	262	-	
Turn-off Delay Time	$t_{d(off)}$		-	395	-	
Fall Time	t_f		-	274	-	
Turn-on Energy Loss	E_{on}	$V_{CC}=600V, I_C=140A,$ $V_{GE}=0/15V, R_G=10\Omega,$ Inductive Load	-	12.8	-	mJ
Turn-off Energy Loss	E_{off}		-	10.1	-	
Total Switching Loss	E_{st}		-	22.9	-	
Diode Reverse Recovery Time	T_{rr}	$V_{CC}=600V, I_C=140A,$ $V_{GE}=0/15V, R_G=10\Omega$	-	511	-	ns
Diode Reverse Recovery Charge	Q_{rr}		-	5.4	-	μC
Diode Reverse Recovery Current	I_{rm}		-	17.5	-	A
Diode Reverse Recovery Loss	E_{rec}		-	1.6	-	mJ

Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance, IGBT Junction to Case	$R_{th(J-C)}$	-	0.11	0.16	$^{\circ}C/W$
Thermal Resistance, FRD Junction to Case	$R_{th(J-C)}$	-	0.17	0.27	$^{\circ}C/W$

Typical Characteristics

Fig 1. Forward Bias Safe Operating Area

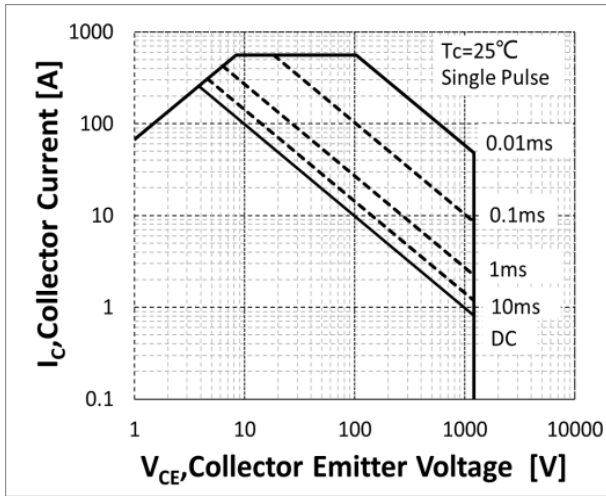


Fig 2. Transfer Characteristics

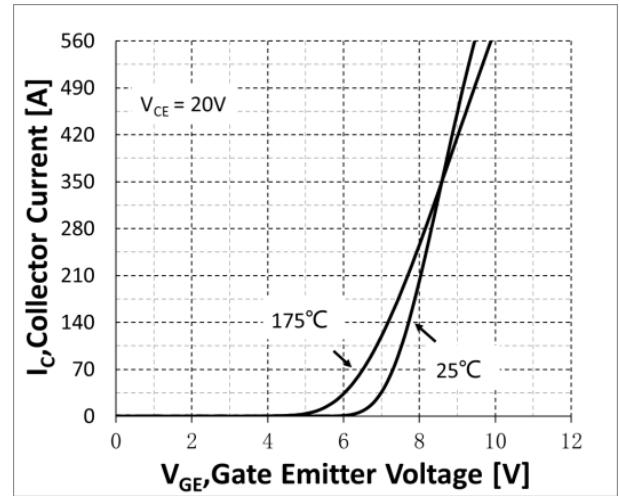


Fig 3. Gate Charge

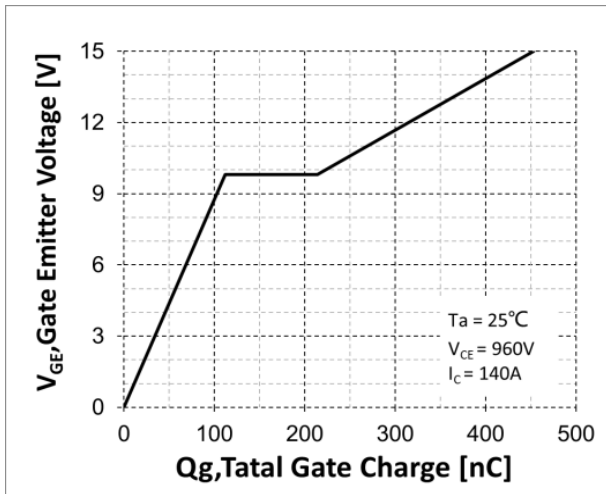


Fig 4. Typical Capacitance

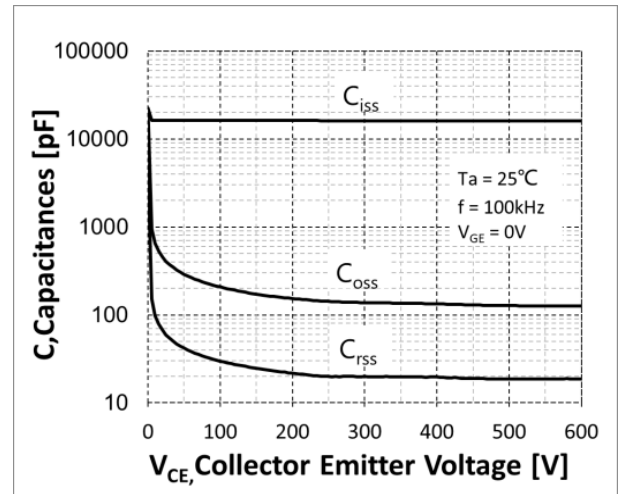


Fig 5. Switching Time vs. Gate Resistance

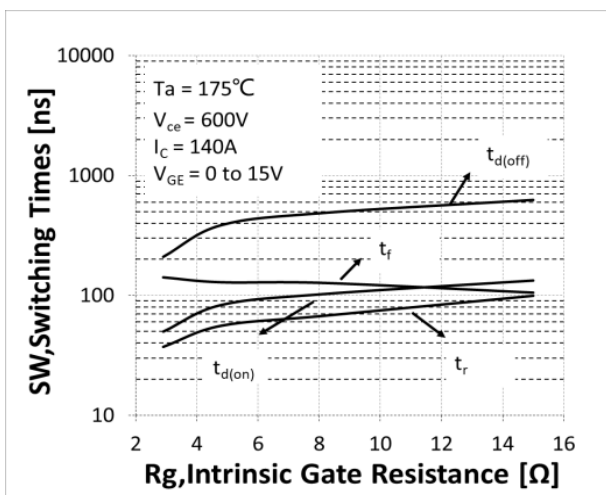
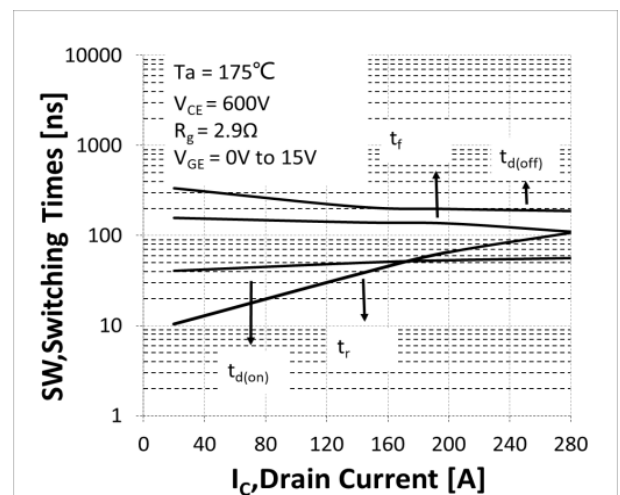


Fig 6. Switching Time vs. Collector Current



Typical Characteristics

Fig 7. Switching Time vs. Junction Temperature

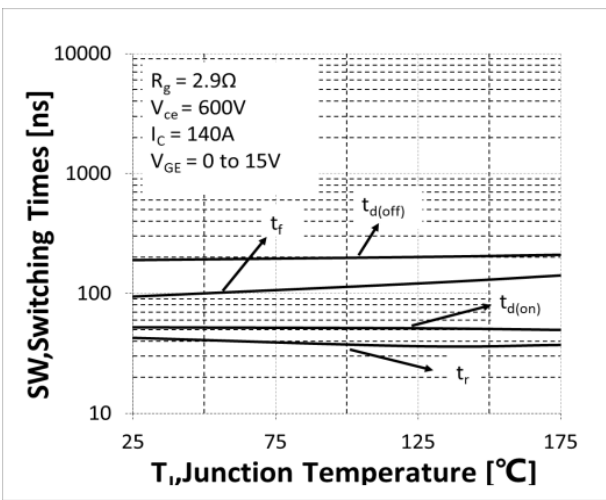


Fig 8. Switching Energy vs. Junction Temperature

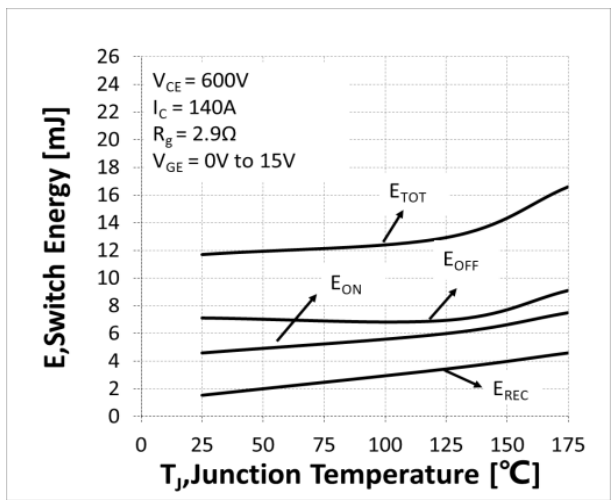


Fig 9. Switching Energy vs. Gate Resistance

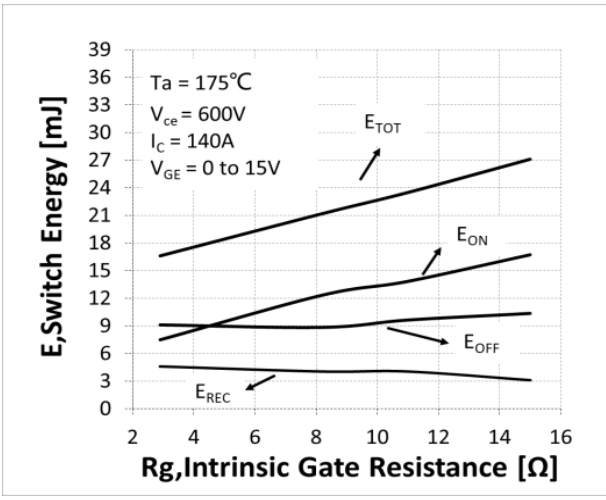


Fig 10. Switching Energy vs. Collector Current

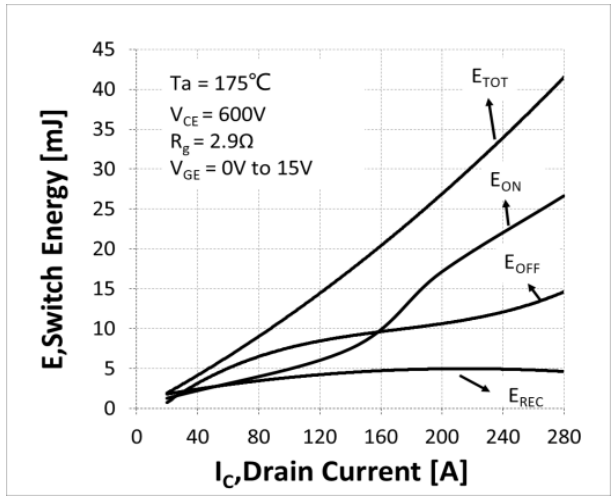
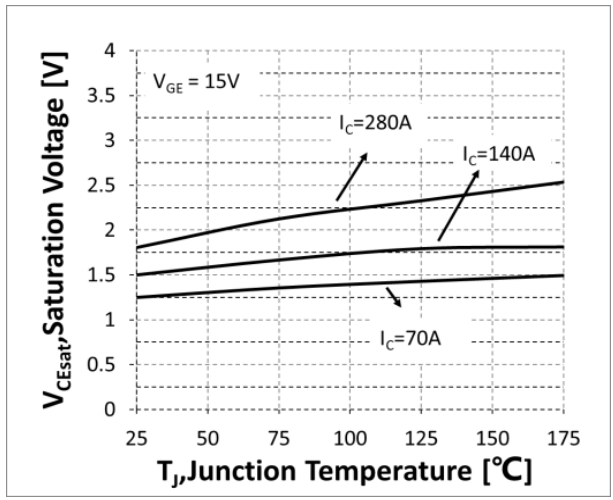
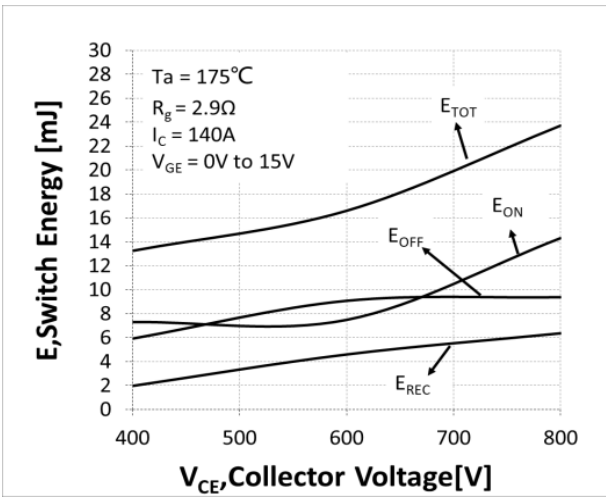


Fig 11. Switching Energy vs. Collector Emitter Voltage **Fig 12. Saturation Voltages vs. Junction Temperature**



Typical Characteristics

Fig 13. Gate Voltage vs. Junction Temperature

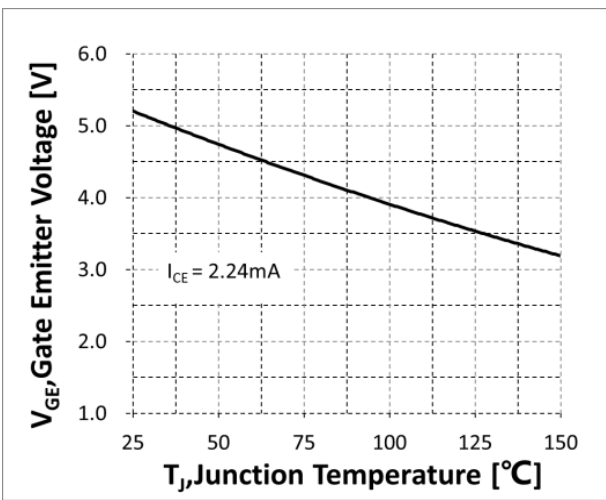


Fig 14. Transient Thermal Impedance IGBT

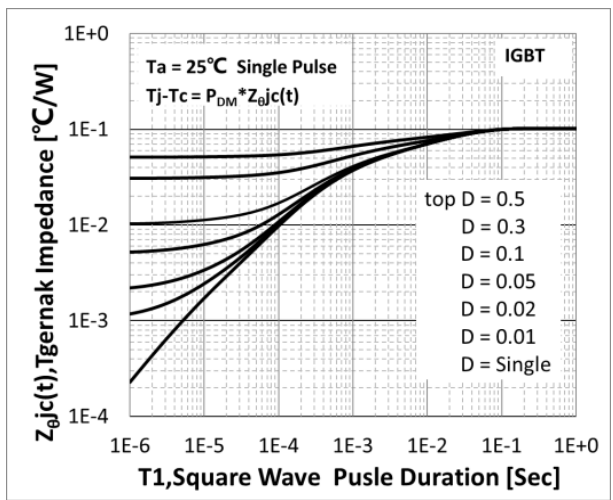
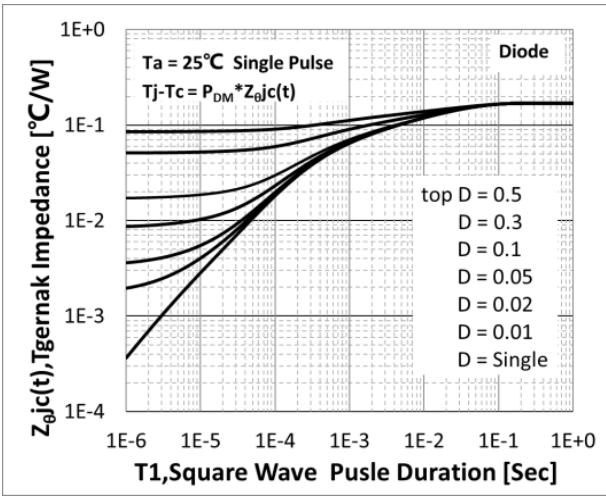
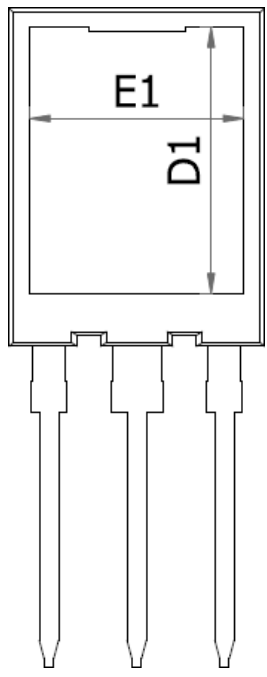
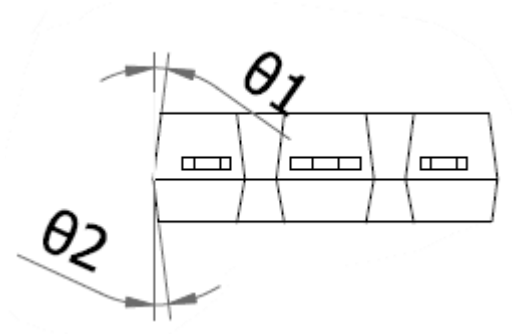
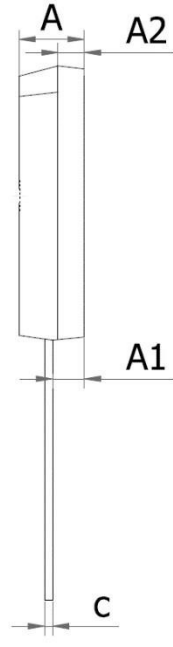
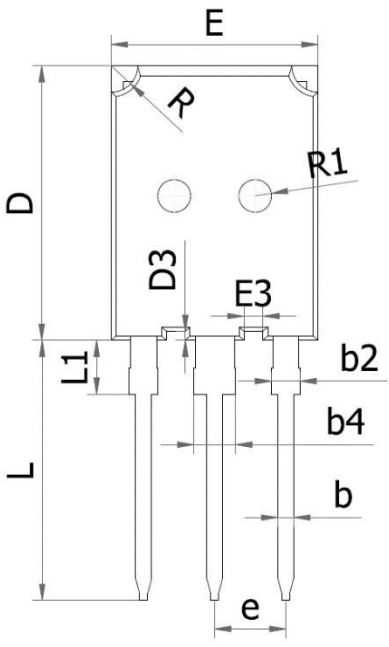


Fig 15. Transient Thermal Impedance Diode




Package Outline



SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.23	2.43	2.63
A2	1.85	2.00	2.15
b	1.10	1.20	1.30
b2	1.90	2.10	2.20
b4	2.90	3.10	3.20
c	0.50	0.60	0.70
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
D3	0.53	0.68	0.83
E	15.50	15.80	16.10
E1	13.05	13.25	13.45
E3	1.30	1.45	1.60
e	5.44 BSC		
L	19.62	19.92	20.22
L1	---	---	4.30
R	1.85	2.00	2.15
R1	1.10	1.25	1.40
theta 1	5°	7°	9°
theta 2	5°	7°	9°


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