



# TT010N060EQ

## 主要参数 MAIN CHARACTERISTICS

$I_C$	10A
$V_{CES}$	600V
$V_{cesat-typ}(V_{ge}=15V)$	1.8V

### 用途

- 逆变器
- UPS 电源
- 电机控制

### 产品特性

- 低栅极电荷
- Trench FS 技术,
- RoHS 产品

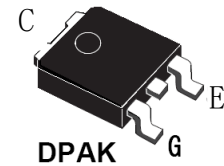
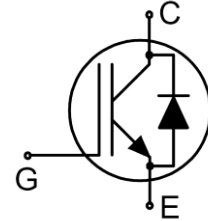
### APPLICATIONS

- General purpose inverters
- UPS
- 电机控制

### FEATURES

- Low gate charge
- Trench FS technology,
- RoHS product

## 封装 Package



## 订货信息 ORDER MESSAGE

订货型号 Order codes		印 记 Marking	封 装 Package
无卤-编带 Non halogen-Reel	有卤-编带 Halogen-Reel		
TT010N060EQ-R-AR	TT010N060EQ-R-A	TT010N060EQ	DPAK

绝对最大额定值 ABSOLUTE RATINGS ( $T_C=25^\circ\text{C}$ )

项 目 Parameter	符 号 Symbol	数 值 Value	单 位 Unit
最高集电极-发射极直流电压 Collector-Emmitter Voltage	$V_{CES}$	600	V
*连续集电极电流 Collector Current-continuous	$I_C$	20( $T_C=25^\circ\text{C}$ )	A
		10( $T_C=100^\circ\text{C}$ )	A
最大脉冲集电极极电流 (注1) Collector Current – pulse (note 1)	$I_{CM}$	30	A
二极管正向测试电流 Diode RMS forward current	$I_F$	20( $T_C=25^\circ\text{C}$ )	A
		10( $T_C=100^\circ\text{C}$ )	A
二极管正向脉冲电流 Diode pulse current	$I_{FSM}$	30	A
最高栅极发射极电压 Gate-Emmitter Voltage	$V_{GES}$	$\pm 25$	V
Turn-off safe area	-	30	A
耗散功率 Power Dissipation	$P_D$ $T_C=25^\circ\text{C}$	82	W
存储温度 Storage Temperature Range	$T_{STG}$	$-55\sim+150$	$^\circ\text{C}$
结温 Junction Temperature Range	$T_J$	$-55\sim+150$	$^\circ\text{C}$
引线最高焊接温度 Maximum Lead Temperature for Soldering Purposes	$T_L$	300	$^\circ\text{C}$

\*连续集电极电流由最高结温限制

\*Collector current limited by maximum junction temperature

注释:

1: 脉冲宽度由最高结温限制

Notes:

1: Pulse width limited by maximum junction temperature



## 电特性 ELECTRICAL CHARACTERISTICS

项 目 Parameter	符 号 Symbol	测试条件 Tests conditions	最小 Min	典型 Typ	最大 Max	单位 Units
<b>关态特性 Off –Characteristics</b>						
集电极—发射极击穿电压 Collector-Emmitter Voltage	$BV_{CES}$	$I_C=250\mu A, V_{GE}=0V$	600	-	-	V
零栅压下集电极漏电流 Zero Gate Voltage Collector Current	$I_{CES}$	$V_{CE}=600V, V_{GE}=0V$	-	-	10	$\mu A$
正向栅极体漏电流 Gate-body leakage current, forward	$I_{GESF}$	$V_{CE}=0V, V_{GE}=25V$	-	-	200	nA
反向栅极体漏电流 Gate-body leakage current, reverse	$I_{GESR}$	$V_{CE}=0V, V_{GE}=-25V$	-	-	-200	nA
<b>通态特性 On-Characteristics</b>						
阈值电压 Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C=250\mu A$	4.5	-	6.5	V
饱和压降 Collector-Emmitter saturation Voltage	$V_{CESAT}$	$V_{GE}=15V, I_C=10A$ $T_C=25^\circ C$ $T_C=100^\circ C$	- -	1.8 2.0	2.1 -	V
<b>动态特性 Dynamic Characteristics</b>						
输入电容 Input capacitance	$C_{ies}$	$V_{CE}=25V,$ $V_{GE}=0V,$ $f=1.0MHz$	-	380	-	pF
输出电容 Output capacitance	$C_{oes}$		-	40	-	pF
反向传输电容 Reverse transfer capacitance	$C_{res}$		-	16	-	pF
栅极电荷总量 Total Gate Charge	$Q_g$	$V_{CC}=480V, I_C=10A, V_{GE}=15V$	-	16	-	nC
栅极-发射极 Gate to emitter charge	$Q_{ge}$		-	5.3	-	
栅极-集电极 Gate to collector charge	$Q_{gc}$		-	7.4	-	
短路电流 short current	$I_{sc}$	$V_{GE}=15V, V_{CE} \leq 400V, t \leq 5\mu s$	-	45	-	A



## 电特性 ELECTRICAL CHARACTERISTICS

## 开关特性 Switching Characteristics

项 目 Parameter	符 号 Symbol	测试条件 Tests conditions	最小 Min	典型 Typ	最大 Max	单位 Units
开启延迟时间 Turn-On delay time	$t_{d(on)}$	$V_{CC}=400V, I_c=10A, R_G=5\Omega$ $V_{GE}=0/15V$ $T_C=25^\circ C$	-	14		ns
上升时间 Turn-On rise time	$t_r$		-	12	-	ns
关断延迟时间 Turn-Off delay time	$t_{d(off)}$		-	18	-	ns
下降时间 Turn-Off Fall time	$t_f$		-	82	-	ns
开通损耗 Turn-On energy	$E_{on}$		-	0.09	-	mJ
关断损耗 Turn-off energy	$E_{off}$		-	0.21	-	mJ
总开关损耗 Total switching energy	$E_{tot}$		-	0.3	-	mJ
开启延迟时间 Turn-On delay time	$t_{d(on)}$	$V_{CC}=400V, I_c=10A, R_G=5\Omega$ $V_{GE}=0/15V$ $T_C=150^\circ C$	-	12	-	ns
上升时间 Turn-On rise time	$t_r$		-	16	-	ns
关断延迟时间 Turn-Off delay time	$t_{d(off)}$		-	22	-	ns
下降时间 Turn-Off Fall time	$t_f$		-	134	-	ns
开通损耗 Turn-On energy	$E_{on}$		-	0.12	-	mJ
关断损耗 Turn-off energy	$E_{off}$		-	0.28	-	mJ
总开关损耗 Total switching energy	$E_{tot}$		-	0.4	-	mJ

## 反并联二极管特性及最大额定值 Anti-Parallel Diode Characteristics and Maximum Ratings

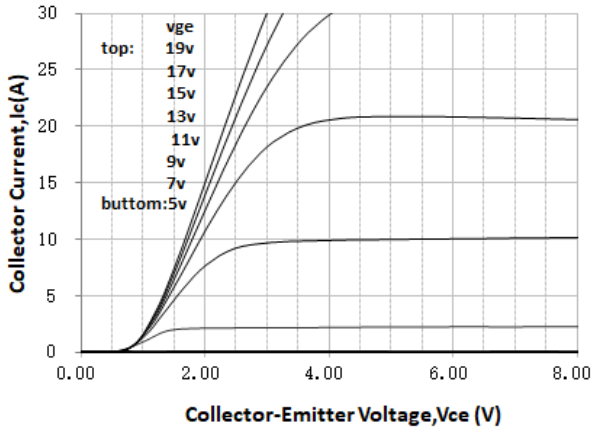
正向压降 Drain-Source Diode Forward Voltage	$V_F$	$I_F=10A, T_C=25^\circ C$	-	1.8	2.1	V
反向恢复时间 Diode Reverse recovery time	$t_{rr}$	$I_F=10A$	-	43	-	ns
反向恢复电荷 Diode Reverse recovery charge	$Q_{rr}$	$di_F/dt=200A/\mu s$	-	40	-	nC
反向恢复电流 Diode Reverse recovery Current	$I_{RRM}$	$T_C=25^\circ C$	-	1.7	-	A

项 目 Parameter	符 号 Symbol	MAX	单 位 Unit
结到管壳的热阻 Thermal Resistance, Junction to Case for IGBT	$R_{th(j-c)}$	1.52	$^\circ C/W$
结到环境的热阻 Thermal Resistance, Junction to Ambient	$R_{th(j-A)}$	65	$^\circ C/W$

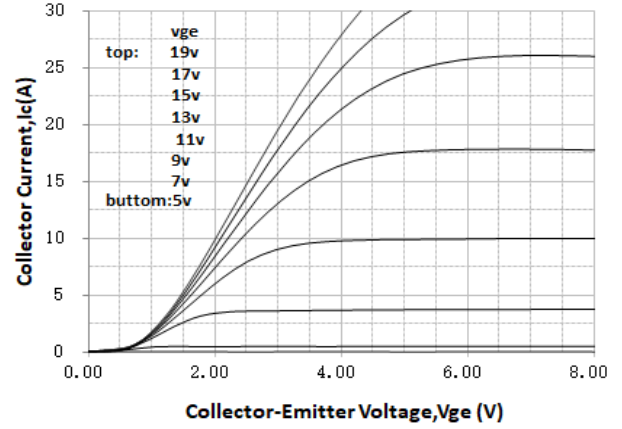


## 特征曲线 ELECTRICAL CHARACTERISTICS (curves)

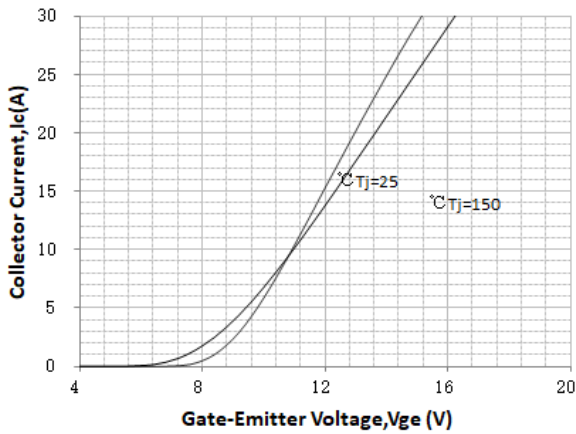
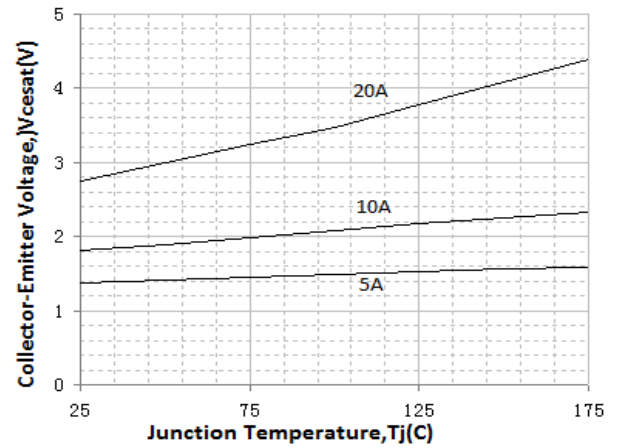
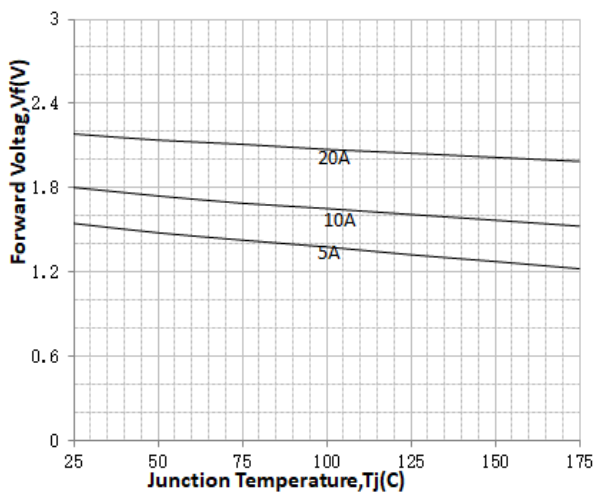
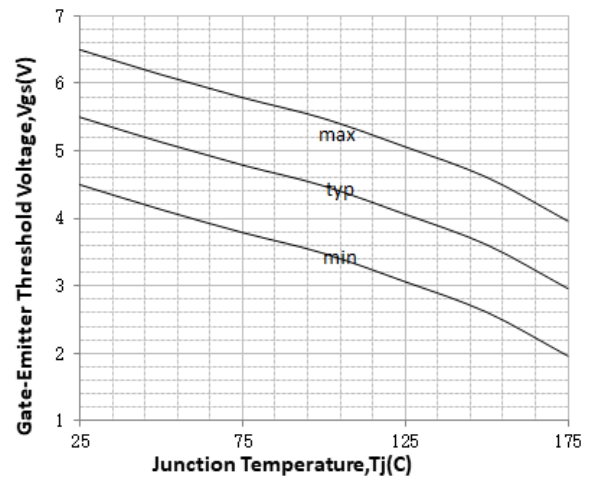
Output Characteristics (25°C)



Output Characteristics (150°C)



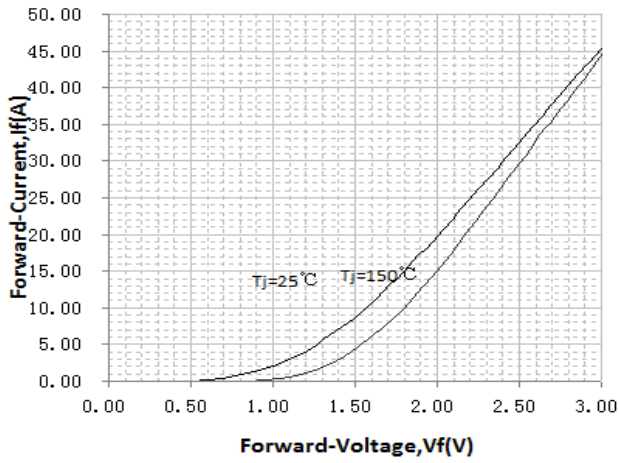
Transfer Characteristics

 $V_{cesat}$  vs.  $T_j$  $V_F$  vs.  $T_j$  $V_{TH}$  vs.  $T_j$ 



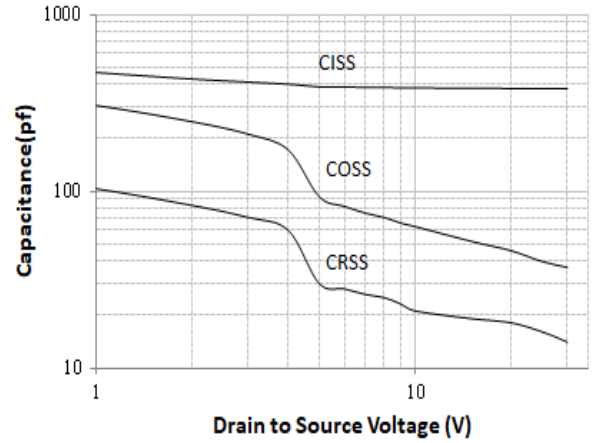
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## Diode Characteristic



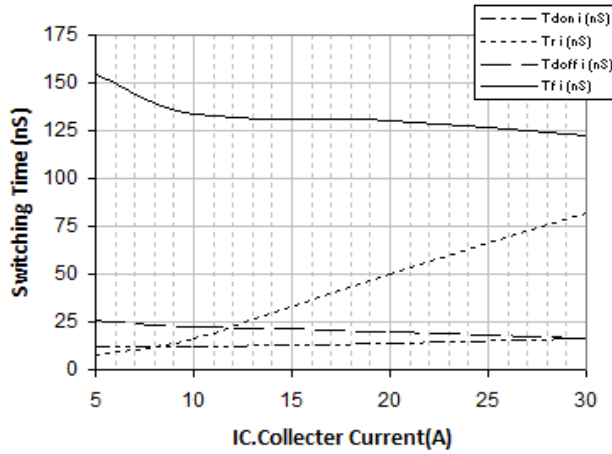
## Capacitance Characteristic

$V_{GE} = 0\text{V}$ ,  $f = 1.0\text{MHz}$



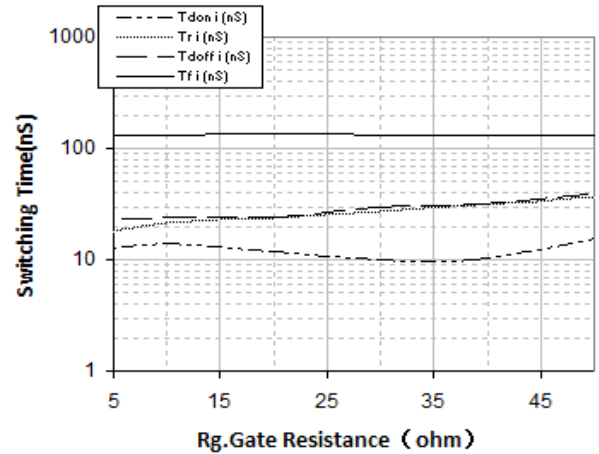
## Switching Time vs. $I_C$ ( $150^\circ\text{C}$ )

$V_{GE} = 15\text{V}$ ,  $V_{CE} = 400\text{V}$ ,  $R_g = 5\Omega$



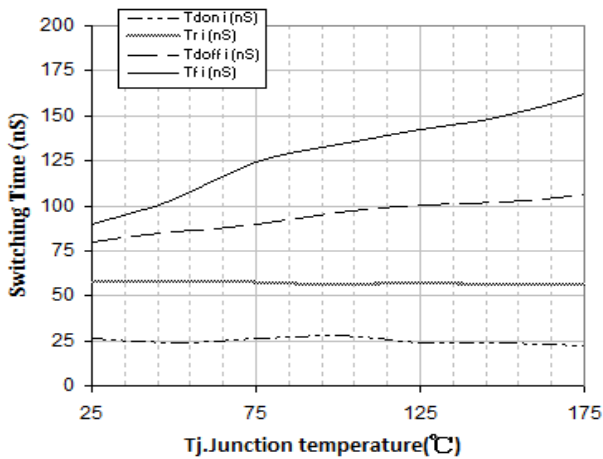
## Switching Time vs. $R_g$ ( $150^\circ\text{C}$ )

$V_{GE} = 15\text{V}$ ,  $V_{CE} = 400\text{V}$ ,  $I_C = 10\text{A}$



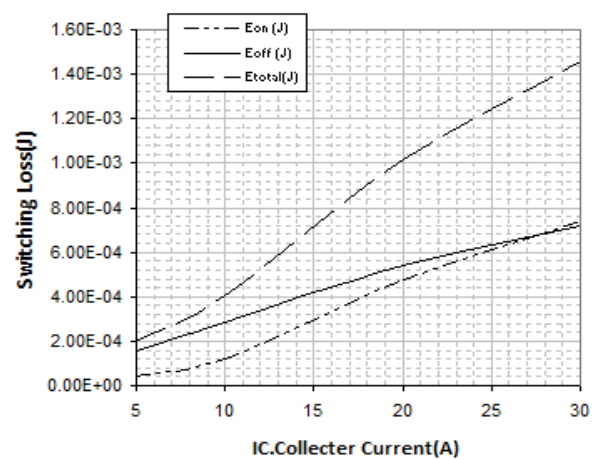
## Switching Time vs. $T_j$

$V_{GE} = 15\text{V}$ ,  $V_{CE} = 400\text{V}$ ,  $I_C = 10\text{A}$ ,  $R_g = 5\Omega$



## Switching Loss vs. $I_C$ ( $150^\circ\text{C}$ )

$V_{GE} = 15\text{V}$ ,  $V_{CE} = 400\text{V}$ ,  $R_g = 5\Omega$

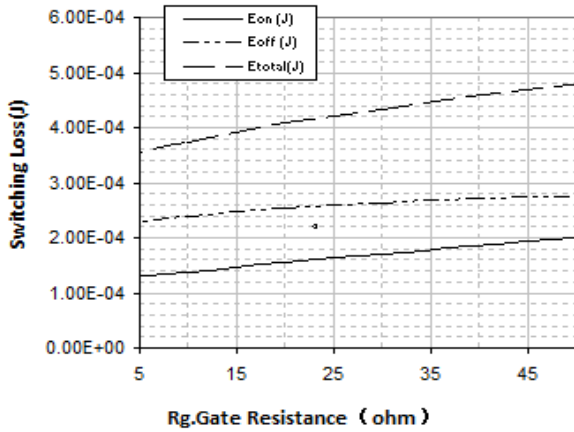




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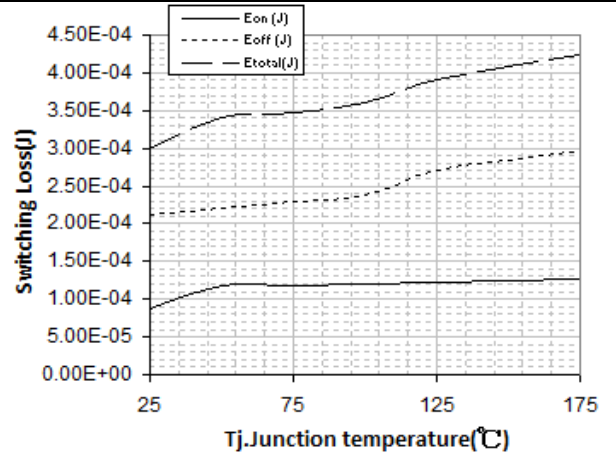
## Switching Loss vs. Rg(150°C)

VGE=15V, VCE=400V, IC=10A

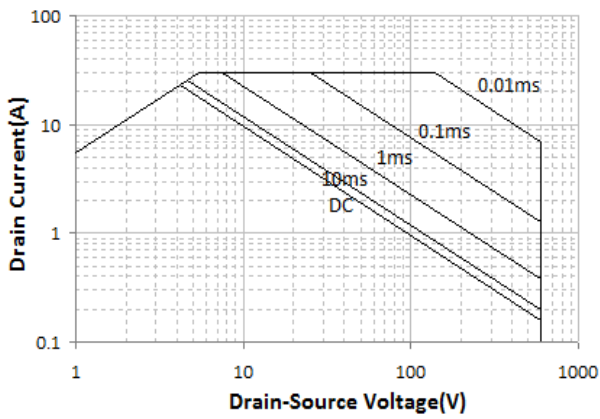


## Switching Loss vs. Tj

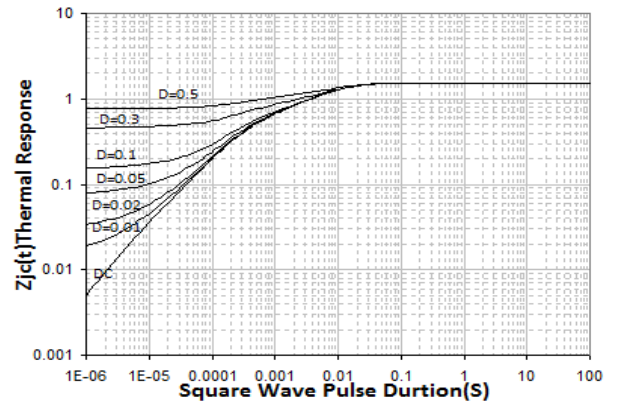
VGE=15V, VCE=400V, IC=10A, Rg=5Ω



## Forward Bias SOA



## Transient Thermal Impedance for IGBT

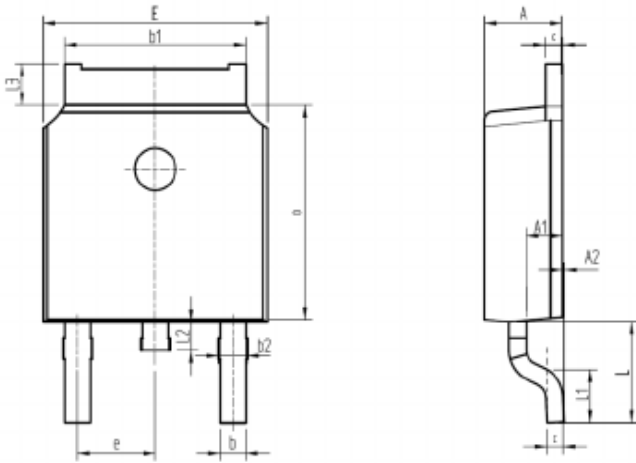




## 外形尺寸 PACKAGE MECHANICAL DATA

DPAK

单位 Unit: mm



SYMBOL	mm	
	MIN	MAX
A	2.16	2.41
A1	0.97	1.17
A2	0.00	0.15
b	0.63	0.93
b1	5.13	5.53
b2	0.66	0.96
c	0.40	0.60
D	5.80	6.40
E	6.30	6.90
e	2.286BSC	
L	2.50	3.30
L1	1.20	1.80
L2	0.60	1.00
L3	0.85	1.30





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