



## STY25NA60

### N - CHANNEL 600V - 0.225Ω - 25 A - Max247 EXSTREMELY LOW GATE CHARGE POWER MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STY25NA60	600 V	< 0.24 Ω	25 A

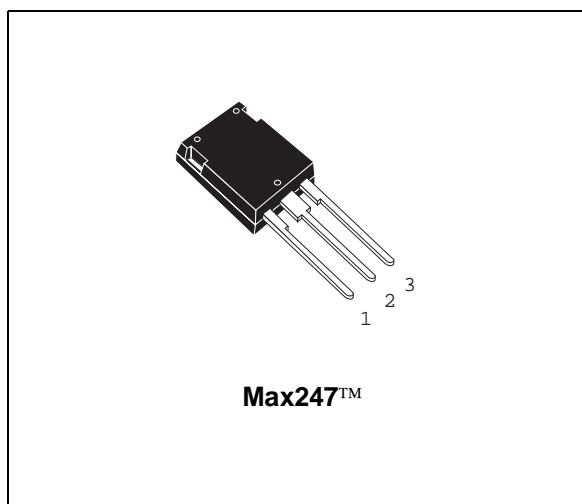
- TYPICAL R<sub>DS(on)</sub> = 0.225 Ω
- EFFICIENT AND RELIABLE MOUNTING THROUGH CLIP
- ± 30V GATE TO SOURCE VOLTAGE RATING
- 100% AVALANCHE TESTED
- LOW INTRINSIC CAPACITANCE
- GATE CHARGE MINIMIZED
- REDUCED VOLTAGE SPREAD

#### DESCRIPTION

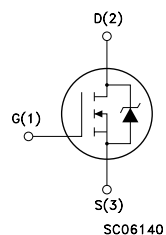
The Max247™ package is a new high volume power package exhibiting the same footprint as the industry standard TO-247, but designed to accommodate much larger silicon chips, normally supplied in bigger packages such as TO-264. The increased die capacity makes the device ideal to reduce component count in multiple paralleled designs and save board space with respect to larger packages.

#### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLY (SMPS)
- DC-AC CONVERTER FOR WELDING EQUIPMENT AND UNINTERRUPTABLE POWER SUPPLY AND MOTOR DRIVE



#### INTERNAL SCHEMATIC DIAGRAM



#### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	600	V
V <sub>DGR</sub>	Drain- gate Voltage (R <sub>GS</sub> = 20 kΩ)	600	V
V <sub>GS</sub>	Gate-source Voltage	± 30	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 25 °C	25	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 100 °C	16.5	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	100	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	300	W
	Derating Factor	2.4	W/°C
T <sub>stg</sub>	Storage Temperature	-55 to 150	°C
T <sub>j</sub>	Max. Operating Junction Temperature	150	°C

(•) Pulse width limited by safe operating area

**THERMAL DATA**

R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	0.42	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	40	°C/W
R <sub>thc-sink</sub>	Thermal Resistance Case-Heatsink with Conductive Grease	Typ	0.05	°C/W

**AVALANCHE CHARACTERISTICS**

Symbol	Parameter	Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max)	25	A
E <sub>AS</sub>	Single Pulse Avalanche Energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V)	3000	mJ

**ELECTRICAL CHARACTERISTICS** (T<sub>case</sub> = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	I <sub>D</sub> = 250 µA V <sub>GS</sub> = 0	600			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max Rating V <sub>DS</sub> = Max Rating T <sub>c</sub> = 125 °C			50 500	µA µA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 30 V			± 100	nA

ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> I <sub>D</sub> = 250 µA	3	4	5	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10 V I <sub>D</sub> = 12.5 A		0.225	0.24	Ω
I <sub>D(on)</sub>	On State Drain Current	V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> V <sub>GS</sub> = 10 V	25			A

**DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> (*)	Forward Transconductance	V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> I <sub>D</sub> = 12.5 A	20			S
C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub>	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V <sub>DS</sub> = 25 V f = 1 MHz V <sub>GS</sub> = 0		6200 690 195		pF pF pF

# ELECTRICAL CHARACTERISTICS (continued)

## SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay Time	$V_{DD} = 300\text{ V}$ $I_D = 12.5\text{ A}$		45		ns
$t_r$	Rise Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		70		ns
$Q_g$	Total Gate Charge	$V_{DD} = 480\text{ V}$ $I_D = 25\text{ A}$ $V_{GS} = 10\text{ V}$		240	315	nC
$Q_{gs}$	Gate-Source Charge			25		nC
$Q_{gd}$	Gate-Drain Charge			115		nC

## SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 480\text{ V}$ $I_D = 25\text{ A}$		70		ns
$t_f$	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$		25		ns
$t_c$	Cross-over Time	(see test circuit, figure 5)		105		ns

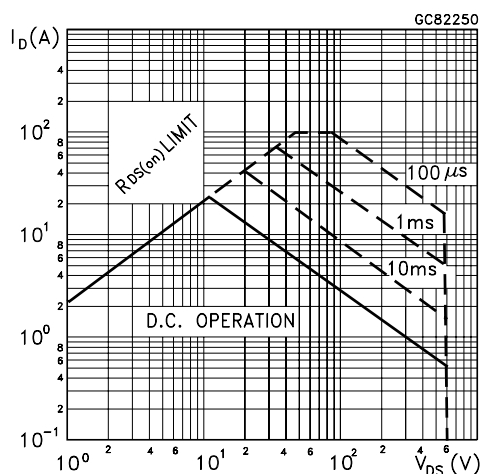
## SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				25	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				100	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 25\text{ A}$ $V_{GS} = 0$			2	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 25\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		840		ns
$Q_{rr}$	Reverse Recovery Charge			19.5		$\mu\text{C}$
$I_{RRM}$	Reverse Recovery Current			46.5		A

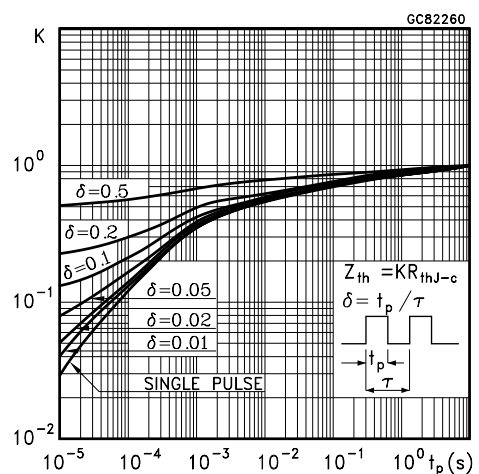
(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

( $\bullet$ ) Pulse width limited by safe operating area

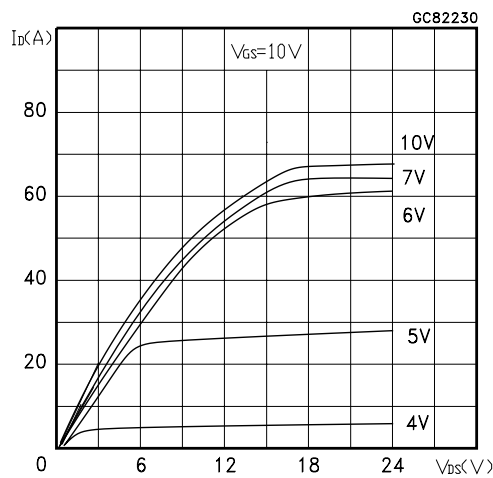
## Safe Operating Area



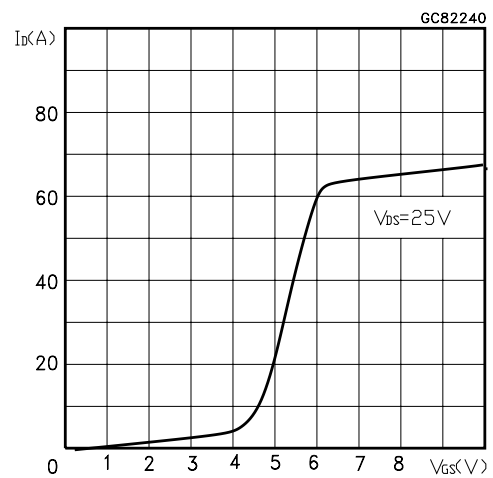
## Thermal Impedance



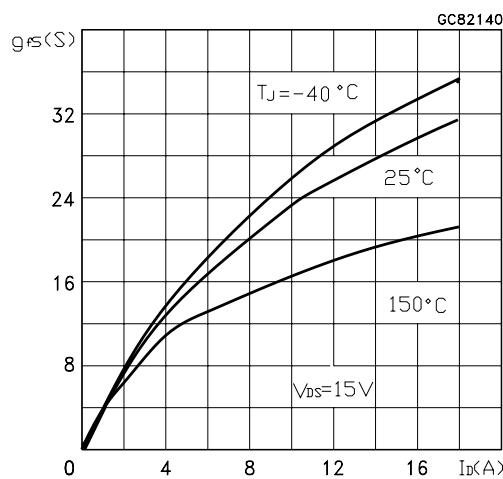
Output Characteristics



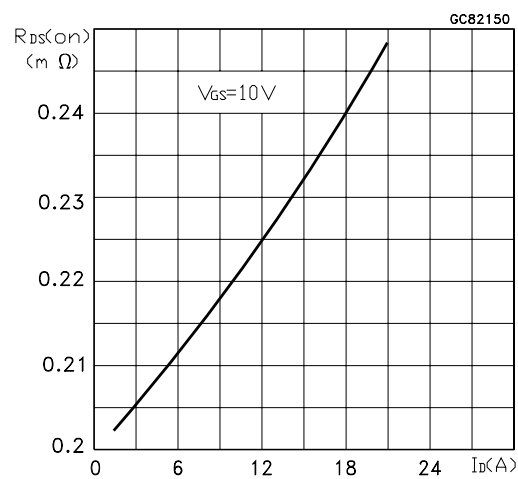
Transfer Characteristics



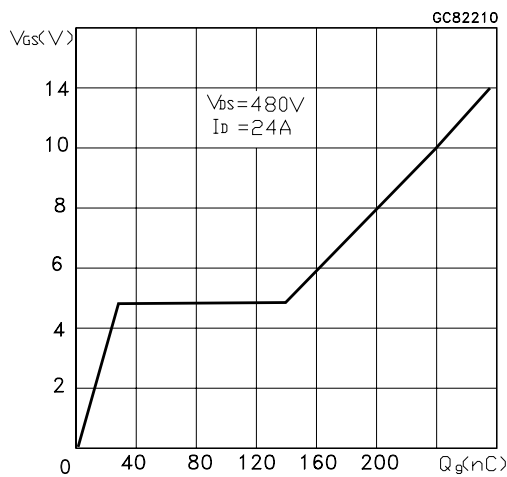
Transconductance



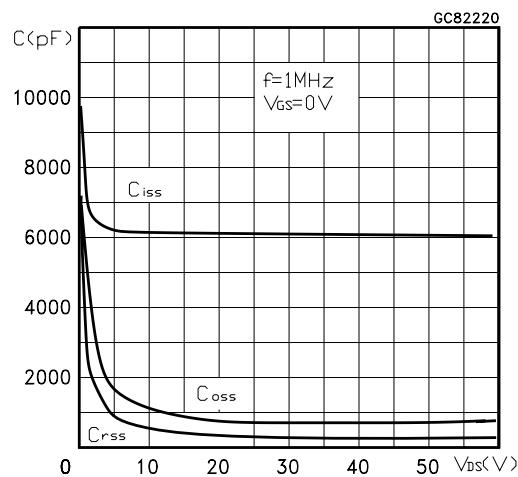
Static Drain-source On Resistance



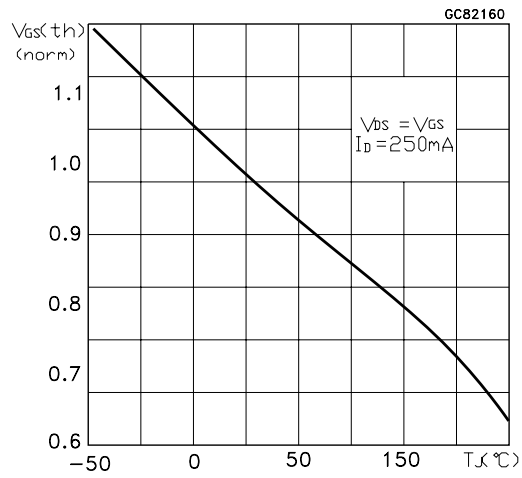
Gate Charge vs Gate-source Voltage



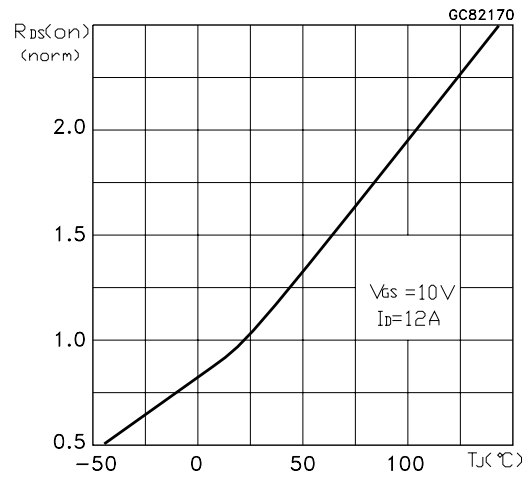
Capacitance Variations



Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

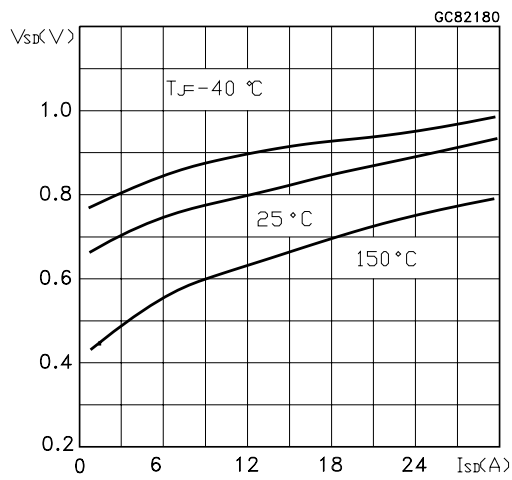


Fig. 1: Unclamped Inductive Load Test Circuit

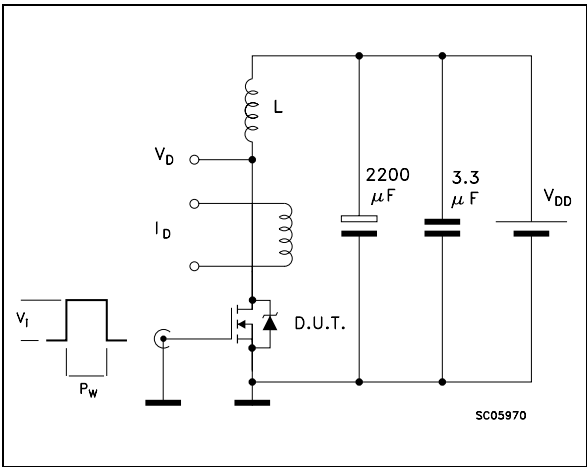


Fig. 2: Unclamped Inductive Waveform

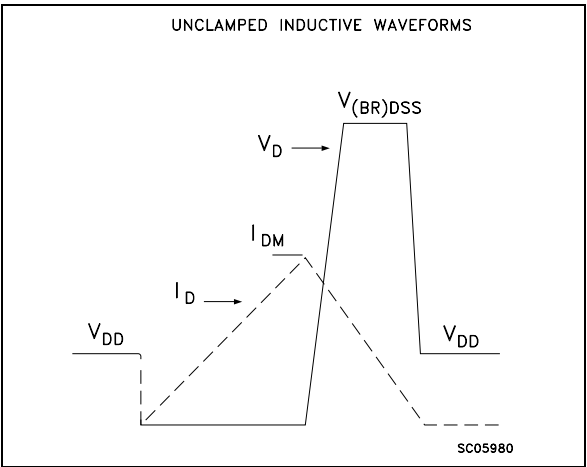


Fig. 3: Switching Times Test Circuits For Resistive Load

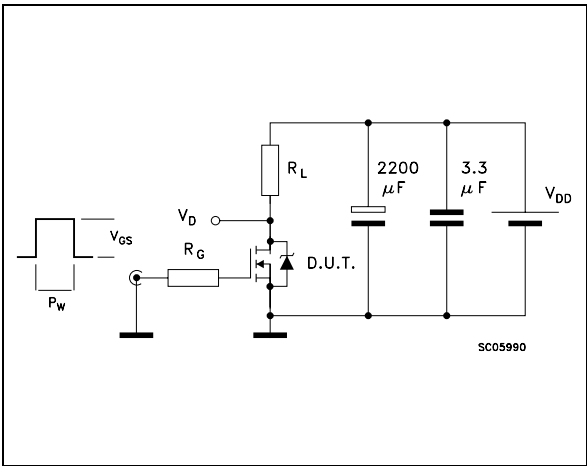


Fig. 4: Gate Charge test Circuit

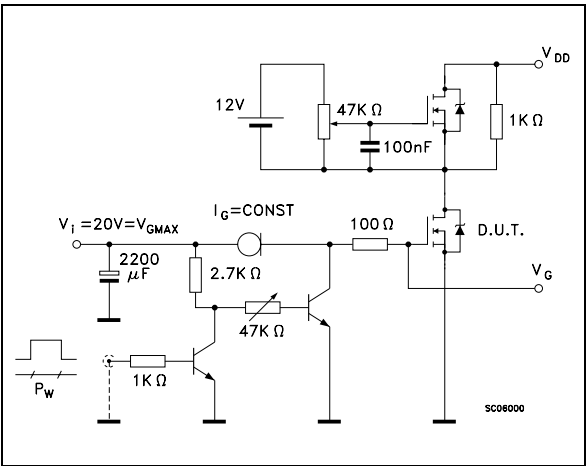
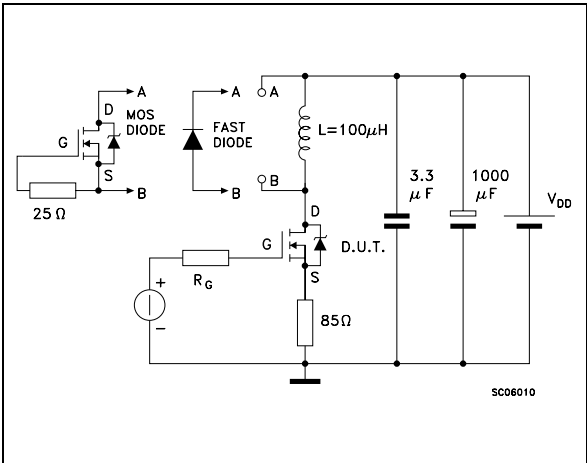
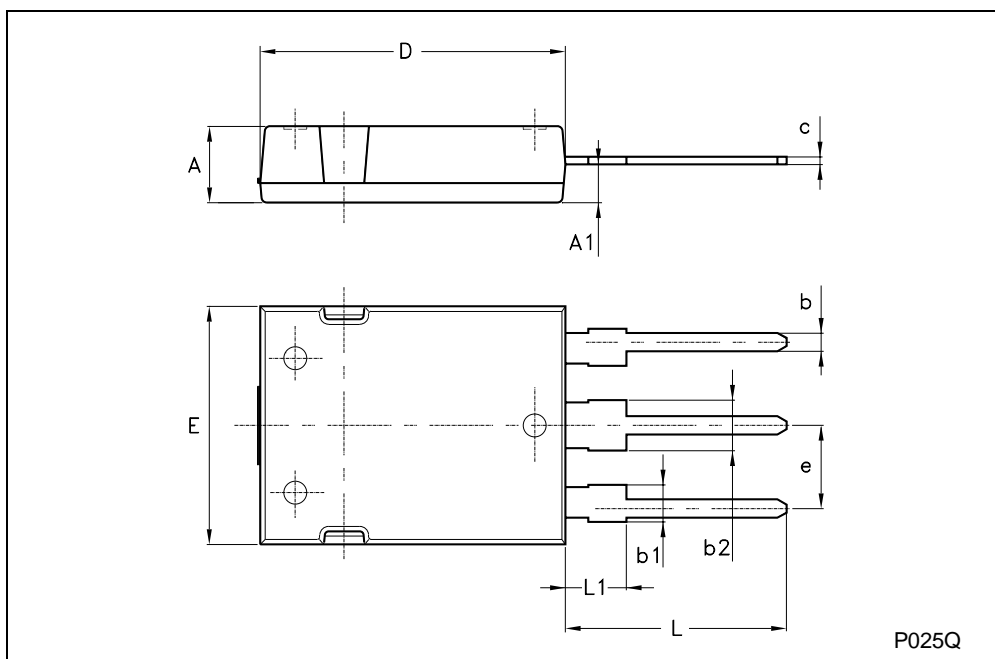


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



**Max247 MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.70		5.30			
A1	2.20		2.60			
b	1.00		1.40			
b1	2.00		2.40			
b2	3.00		3.40			
c	0.40		0.80			
D	19.70		20.30			
e	5.35		5.55			
E	15.30		15.90			
L	14.20		15.20			
L1	3.70		4.30			



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