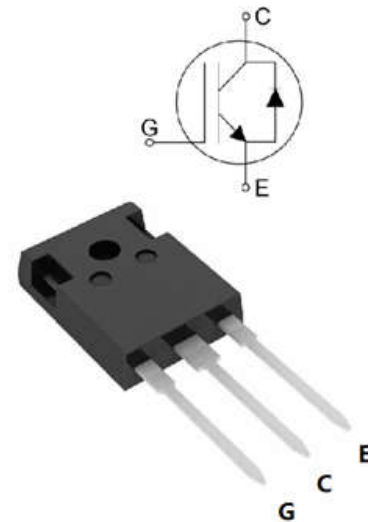


650V /40A Trench Field Stop IGBT

FEATURES

- High breakdown voltage up to 650V for improved reliability
- Trench-Stop Technology offering :
 - High speed switching
 - High ruggedness, temperature stable
 - Low V_{CEsat}
 - Easy parallel switching capability due to positive temperature coefficient in V_{CEsat}
- Enhanced avalanche capability

V_{CE}	650	V
I_C	40	A
$V_{CE(SAT)} \quad I_C=40A$	1.80	V



APPLICATION

- Uninterruptible Power Supplies
- Inverter
- Welding Converters
- PFC applications
- Converter with high switching frequency

Maximum Ratings (T_j= 25°C unless otherwise specified)

Parameter	Symbol	Value	Unit
Collector-Emitter Breakdown Voltage	V _{CE}	650	V
DC collector current, limited by T _{jmax} T _C = 25°C T _C = 100°C	I _C	80 40	A
Diode Forward current, limited by T _{jmax} T _C = 25°C T _C = 100°C	I _F	80 40	A
Continuous Gate-emitter voltage	V _{GE}	± 20	V
Transient Gate-emitter voltage	V _{GE}	± 30	V
Turn off safe operating area V _{CE} ≤ 650V, T _j ≤ 175°C, t _p = 1μs	-	120	A
Pulse collector current, V _{GE} = 15V, t _p limited by T _{jmax}	I _{CM}	120	A
Power dissipation , T _j =25°C	P _{tot}	188	W
Operating junction temperature	T _j	-40...+175	°C
Storage temperature	T _S	-55...+150	°C
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s	-	260	°C
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

Thermal Resistance

Parameter	Symbol	Max. Value	Unit
IGBT thermal resistance, junction - case	R _{θ(j-c)}	0.8	K/W
Diode thermal resistance, junction - case	R _{θ(j-c)}	1.1	K/W
Thermal resistance, junction - ambient	R _{θ(j-a)}	40	K/W

Electrical Characteristics (T_j= 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Static						
Collector-Emitter Breakdown Voltage	BV _{CES}	V _{GE} =0V, I _C =250uA	650	-	-	V
Gate Threshold Voltage	V _{GE(th)}	V _{GE} =V _{CE} , I _C =250uA	4.0	4.9	5.6	V
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _{GE} =15V, I _C =40A	-	1.80	2.40	V
		T _j = 25°C T _j = 175°C	-	2.60	-	
Zero gate voltage collector current	I _{CES}	V _{CE} = 650V, V _{GE} = 0V	-	0.1	40	μA
		T _j = 25°C T _j = 175°C	-	-	4000	
Gate-emitter leakage current	I _{GES}	V _{CE} = 0V, V _{GE} = ±20V	-	-	100	nA
Transconductance	g _{fs}	V _{CE} = 20V, I _C = 40A	-	20	-	S

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Dynamic						
Input capacitance	C _{ies}	V _{CE} = 30V, V _{GE} = 0V, f = 1MHz	-	2100	-	pF
Output capacitance	C _{oes}		-	100	-	
Reverse transfer capacitance	C _{res}		-	40	-	
Gate charge	Q _G	V _{CC} = 520V, I _C = 40A, V _{GE} = 15V	-	90	-	nC

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Dynamic $T_j=25^{\circ}\text{C}$						
Turn-on Delay Time	$t_{d(on)}$	$V_{CC} = 400\text{V}, I_C = 40.0\text{A},$ $V_{GE} = 0.0/15.0\text{V},$ $R_g=20\Omega$	-	45	-	ns
Rise Time	t_r		-	80	-	ns
Turn-off Delay Time	$t_{d(off)}$		-	120	-	ns
Fall Time	t_f		-	75	-	ns
Turn-on Energy	E_{on}		-	2.0	-	mJ
Turn-off Energy	E_{off}		-	0.4	-	mJ

Electrical Characteristics of the DIODE ($T_j=25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Dynamic						
Diode Forward Voltage	V_{FM}	$I_F = 40\text{A}$	-	1.8	2.4	V
Reverse Recovery Time	T_{rr}	$I_F = 40\text{A},$ $V_R = 400\text{V},$ $di/dt = 300\text{A}/\mu\text{s},$	-	75	-	ns
Reverse Recovery Current	I_{rr}		-	12	-	A
Reverse Recovery Charge	Q_{rr}		-	550	-	nC

Fig. 1 FBSOA characteristics

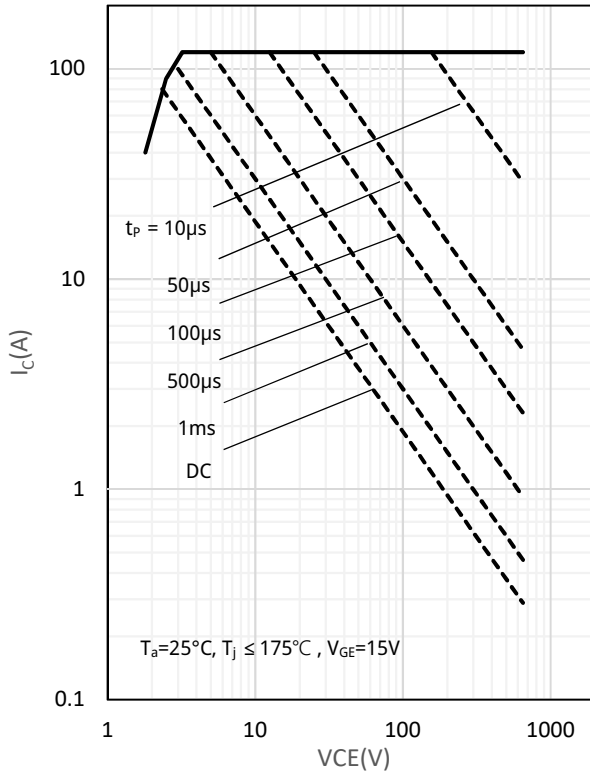


Fig. 2 Power dissipation as a function of T_C

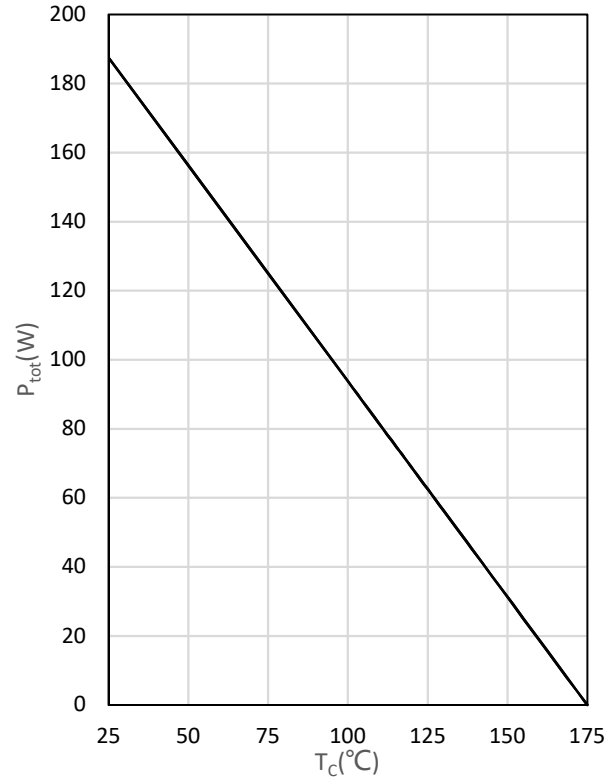


Fig. 3 Output characteristics

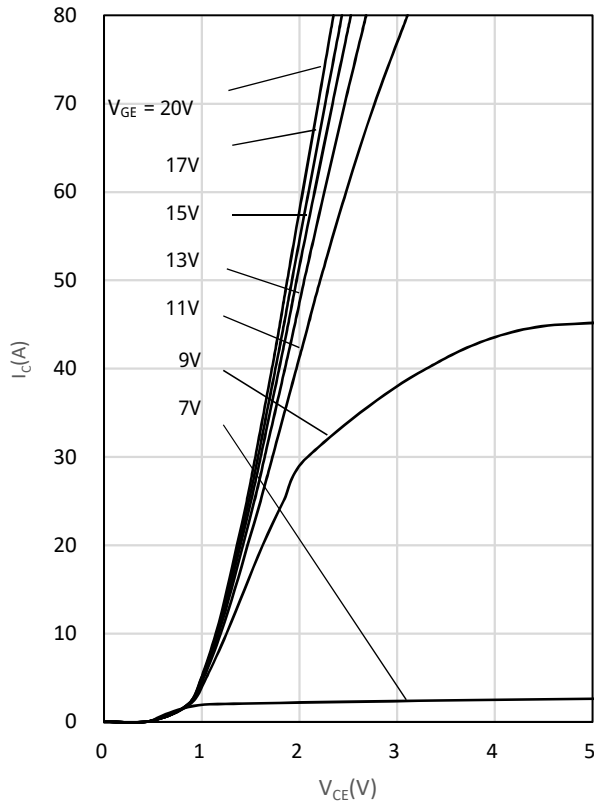


Fig. 4 Saturation voltage characteristics

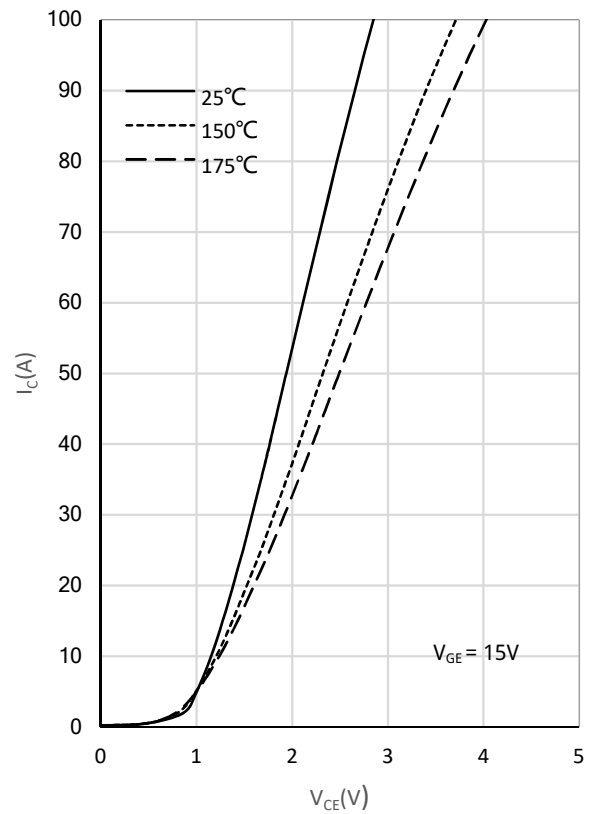


Fig. 5 Switching times vs. gate resistor

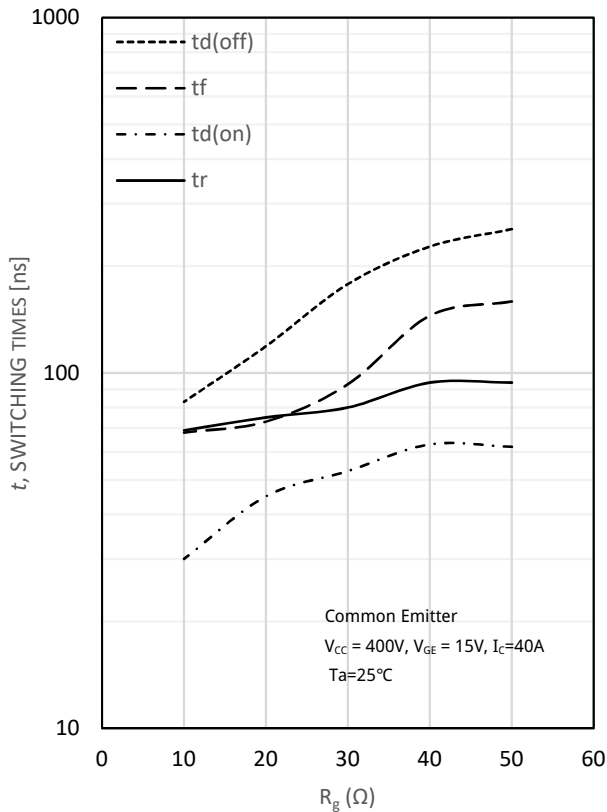


Fig. 6 Switching times vs. collector current

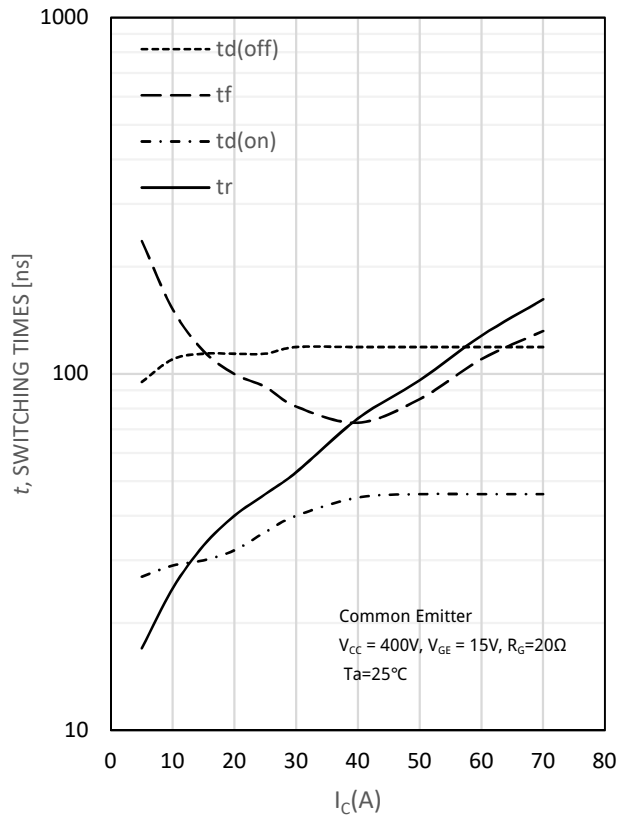


Fig. 7 Switching loss vs. gate resistor

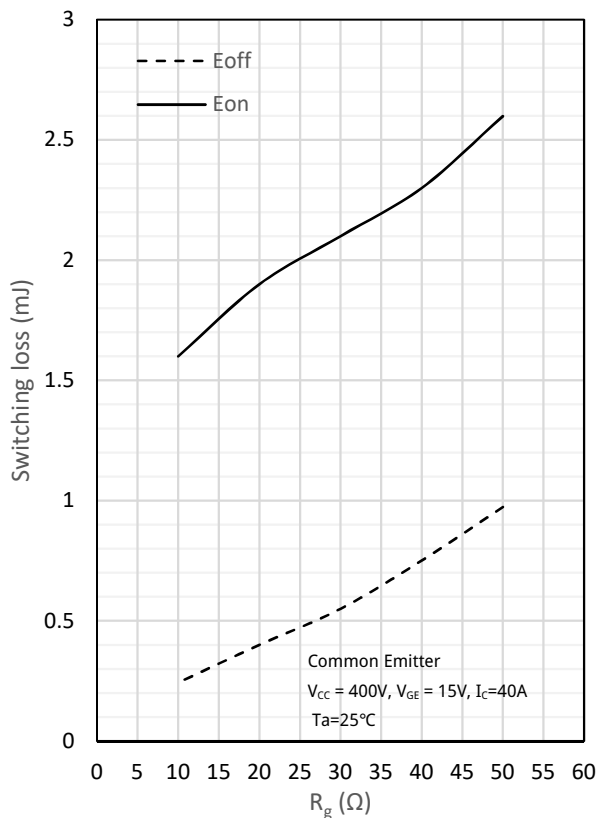


Fig. 8 Switching loss vs. collector current

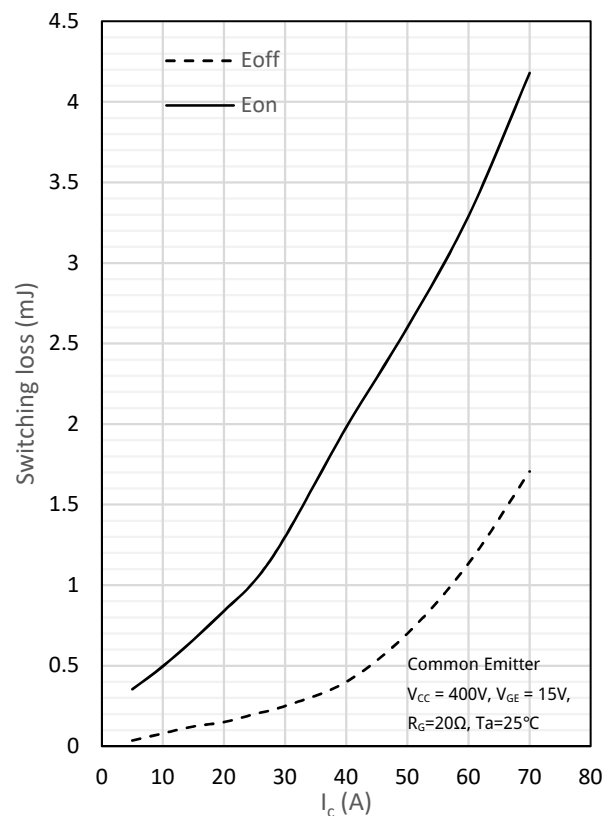


Fig. 9 Gate charge characteristics

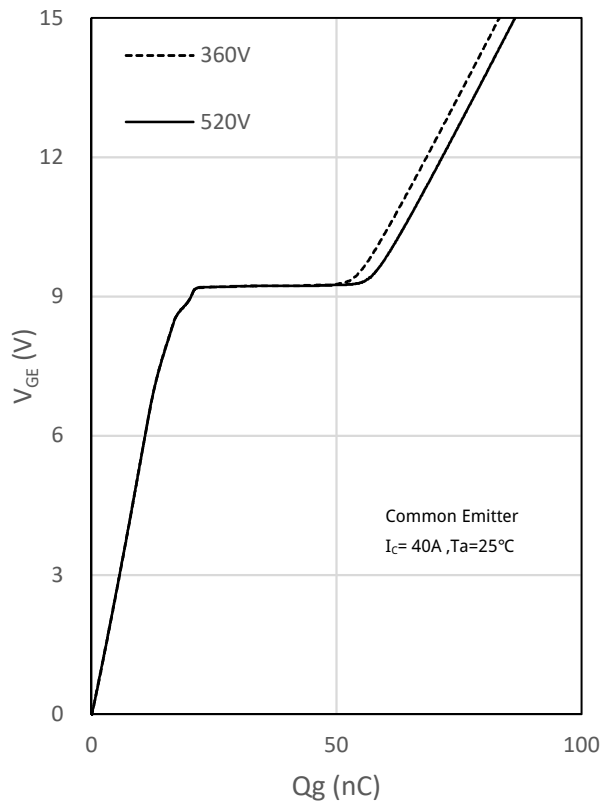
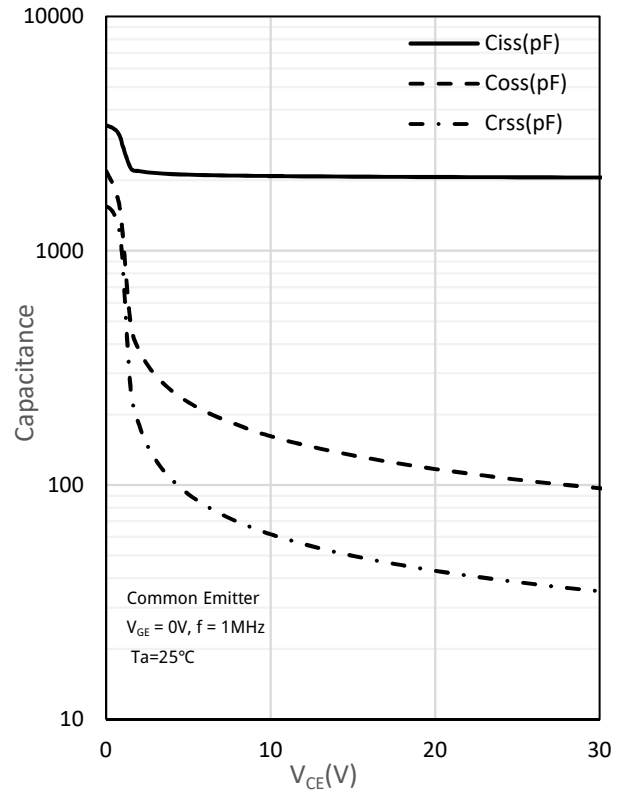
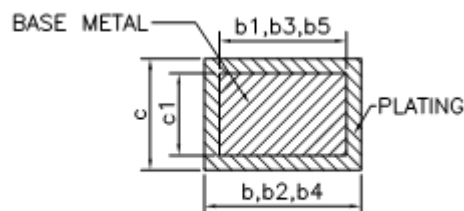
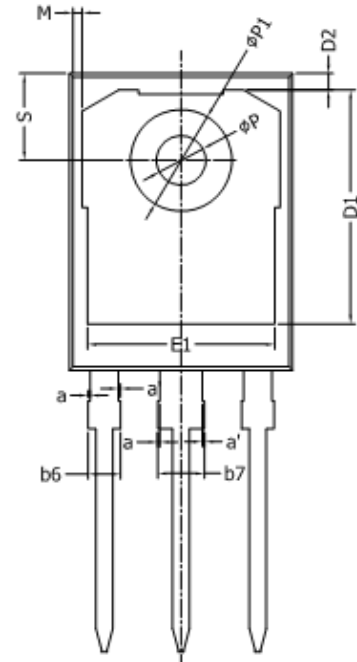
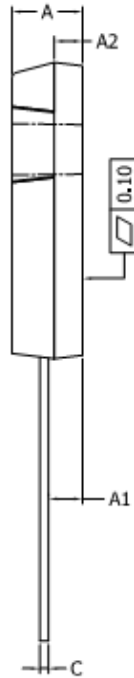
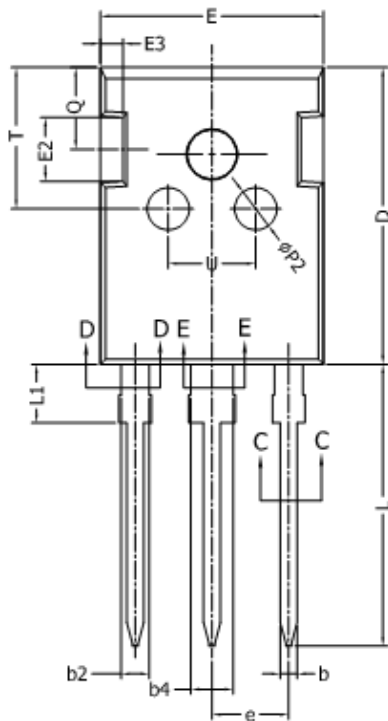


Fig. 10 Capacitance characteristics



TO247 package information



SECTION C-C, D-D & E-E

COMMON DIMENSIONS
(UNITS OF MEASURE = MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
a	0	---	0.15
a'	0	---	0.15
b	1.16	---	1.26
b1	1.15	1.2	1.22
b2	1.96	---	2.06
b3	1.95	2.00	2.02
b4	2.96	---	3.06
b5	2.96	3.00	3.02
b6	2.00	---	2.25
b7	3.00	---	3.25
c	0.59	---	0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.17	1.35
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.40	4.50	4.60
E3	1.50	1.60	1.70
e	5.336	5.436	5.53
L	19.80	19.92	20.10
L1	4.10	---	4.30
M	0.35	---	0.95
P	3.40	3.50	3.60
P1	7.00	---	7.40
P2	2.40	2.50	2.60
Q	5.60	---	6.00
S	6.05	6.15	6.25
T	9.80	---	10.20
U	6.00	---	6.40