

Features $V_{CE}=1200V$ $I_C=40A$

Fast switching

Trench FS technology

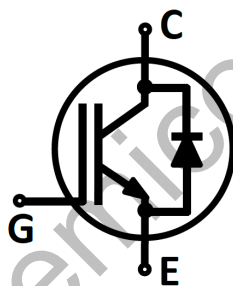
TO-247-3L**Potential applications**

UPS

Welding

Induction Heating

High-frequency power supply

**Description**

1 Package

Table 1 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature	T_{sold}				260	°C
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W

2 IGBT

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CE}	$T_{vj} \geq 25\text{ °C}$		1200	V
DC collector current, limited by T_{vjmax}	I_C	$T_C = 100\text{ °C}$		40	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			160	A
Gate-emitter voltage	V_{GE}			± 20	V
Power dissipation	P_{tot}	$T_{vj} \leq 175\text{ °C}$	$T_C = 25\text{ °C}$	350	W
			$T_C = 100\text{ °C}$	175	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 40A, V_{GE} = 15V$	$T_C = 25\text{ °C}$		1.8		V
			$T_C = 175\text{ °C}$		2.2		
Gate-emitter threshold voltage	V_{GEth}	$I_C = 10mA, V_{CE} = V_{GE}$			5.5		V

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Zero gate-voltage collector current	I_{CES}	$V_{CE} = 1200\text{ V},$ $V_{GE} = 0\text{ V}$	$T_C = 25\text{ }^{\circ}\text{C}$			20	μA
			$T_C = 175\text{ }^{\circ}\text{C}$			5	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}$				200	nA
Input capacitance	C_{ies}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			4300		pF
Output capacitance	C_{oes}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			150		pF
Reverse transfer capacitance	C_{res}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			40		pF
Gate charge	Q_G	$I_C = 40\text{ A}, V_{GE} = 15\text{ V}, V_{CC} = 960\text{ V}$			220		nC
Turn-on delay time (inductive load)	$t_{d(on)}$	$V_{CC} = 600\text{ V},$ $V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C},$ $I_C = 40\text{ A}$		32		ns
			$T_{vj} = 175\text{ }^{\circ}\text{C},$ $I_C = 40\text{ A}$		33		
Rise time (inductive load)	t_r	$V_{CC} = 600\text{ V},$ $V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C},$ $I_C = 40\text{ A}$		30		ns
			$T_{vj} = 175\text{ }^{\circ}\text{C},$ $I_C = 40\text{ A}$		35		
Turn-off delay time (inductive load)	$t_{d(off)}$	$V_{CC} = 600\text{ V},$ $V_{GE} = 0/15\text{ V},$ $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C},$ $I_C = 40\text{ A}$		200		ns
			$T_{vj} = 175\text{ }^{\circ}\text{C},$ $I_C = 40\text{ A}$		260		
Fall time (inductive load)	t_f	$V_{CC} = 600\text{ V},$ $V_{GE} = 0/15\text{ V},$ $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C},$ $I_C = 40\text{ A}$		70		ns
			$T_{vj} = 175\text{ }^{\circ}\text{C},$ $I_C = 40\text{ A}$		135		
Turn-on energy (inductive load)	E_{on}	$V_{CC} = 600\text{ V},$ $V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C},$ $I_C = 40\text{ A}$		2.0		mJ
			$T_{vj} = 175\text{ }^{\circ}\text{C},$ $I_C = 40\text{ A}$		3.3		
Turn-off energy (inductive load)	E_{off}	$V_{CC} = 600\text{ V},$ $V_{GE} = 0/15\text{ V},$ $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C},$ $I_C = 40\text{ A}$		1.2		mJ
			$T_{vj} = 175\text{ }^{\circ}\text{C},$ $I_C = 40\text{ A}$		2.2		

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Total switching energy (inductive load)	E_{ts}	$V_{CC} = 600\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\ \Omega$, $R_{G(off)} = 10\ \Omega$	$T_{vj} = 25\text{ }^{\circ}\text{C}$, $I_C = 40\text{ A}$	3.2		mJ
			$T_{vj} = 175\text{ }^{\circ}\text{C}$, $I_C = 40\text{ A}$	5.5		
Operating junction temperature	T_{vj}		-40		175	$^{\circ}\text{C}$

Note: Electrical Characteristic, at $T_{vj} = 25^{\circ}\text{C}$, unless otherwise specified.

3 Diode

Table 4 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} \geq 25\text{ }^{\circ}\text{C}$	1200	V
Diode forward current, limited by T_{vjmax}	I_F	$T_C = 100\text{ }^{\circ}\text{C}$	40	A

Table 5 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F = 40\text{ A}$	$T_C = 25\text{ }^{\circ}\text{C}$	2.8		V
			$T_C = 175\text{ }^{\circ}\text{C}$	2.5		
Diode reverse recovery time	t_{rr}	$V_R = 600\text{ V}$, $R_{G(on)} = 10\ \Omega$	$T_C = 25\text{ }^{\circ}\text{C}$	220		ns
			$T_C = 175\text{ }^{\circ}\text{C}$	300		
Diode reverse recovery charge	Q_{rr}	$V_R = 600\text{ V}$, $R_{G(on)} = 10\ \Omega$	$T_C = 25\text{ }^{\circ}\text{C}$	1.7		μC
			$T_C = 175\text{ }^{\circ}\text{C}$	3.6		
Diode peak reverse recovery current	I_{rrm}	$V_R = 600\text{ V}$, $R_{G(on)} = 10\ \Omega$	$T_C = 25\text{ }^{\circ}\text{C}$	15		A
			$T_C = 175\text{ }^{\circ}\text{C}$	20		
Operating junction temperature	T_{vj}		-40		175	$^{\circ}\text{C}$

Figure 1. Reverse bias safe operating area
(not for linear use)

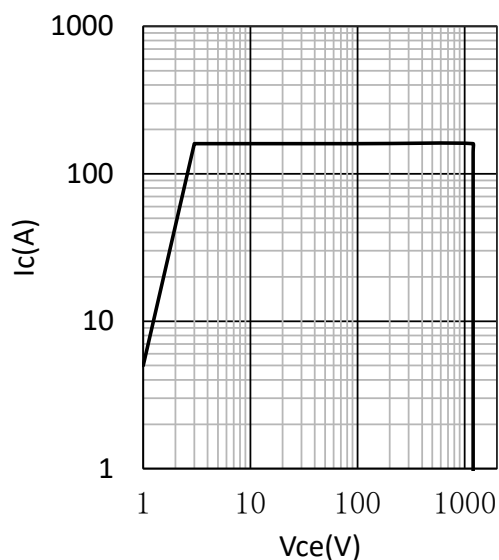


Figure 2. Maximum power dissipation as a function of case temperature
($T_{vj} \leq 175^{\circ}\text{C}$)

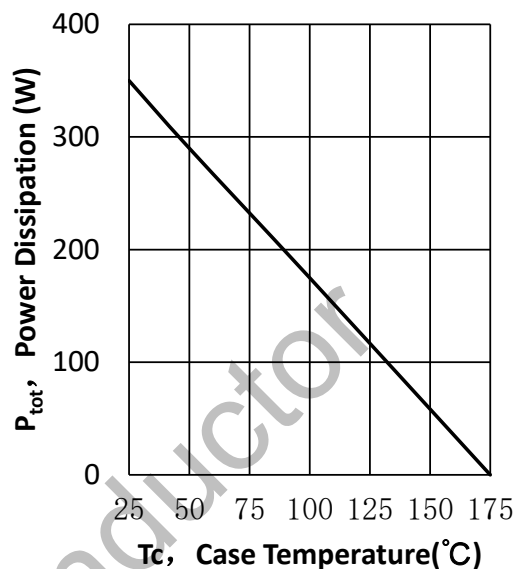


Figure 3. Typical output characteristic
($V_{GE}=15\text{V}$, $T_{vj}=25^{\circ}\text{C}$)

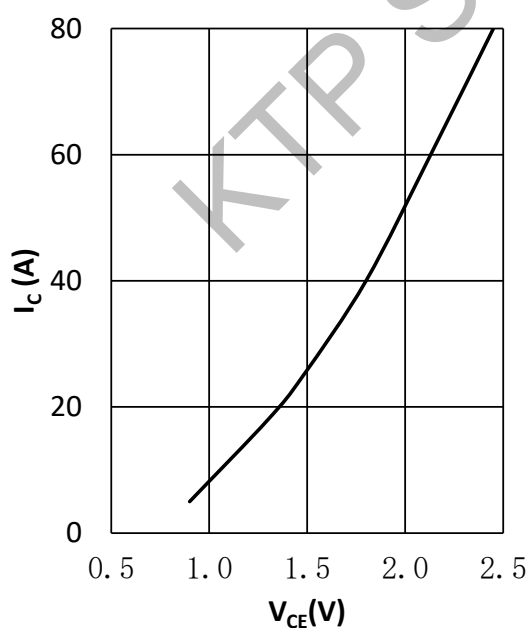


Figure 4. Typical output characteristic
($V_{GE}=15\text{V}$, $T_{vj}=175^{\circ}\text{C}$)

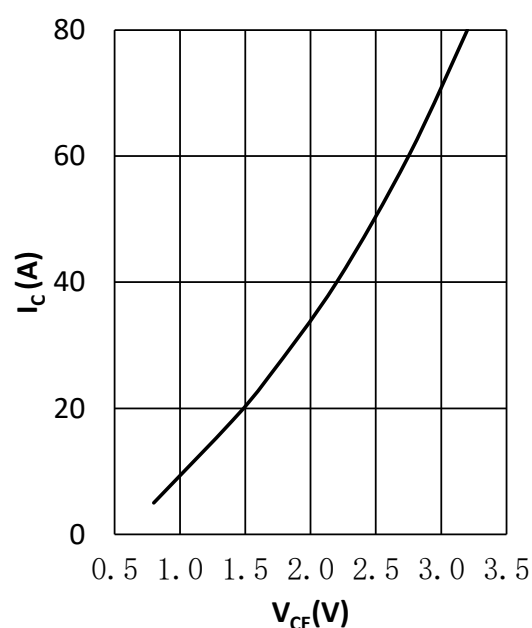


Figure 5. Typical $V_{CE(sat)}-T_{vj}$ characteristic
($V_{GE}=15V$)

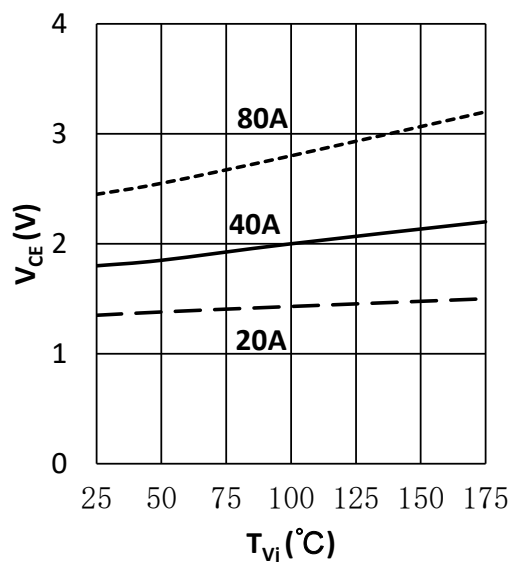


Figure 6. Typical $V_{GE(th)}-T_{vj}$ characteristic
($I_C=10mA$)

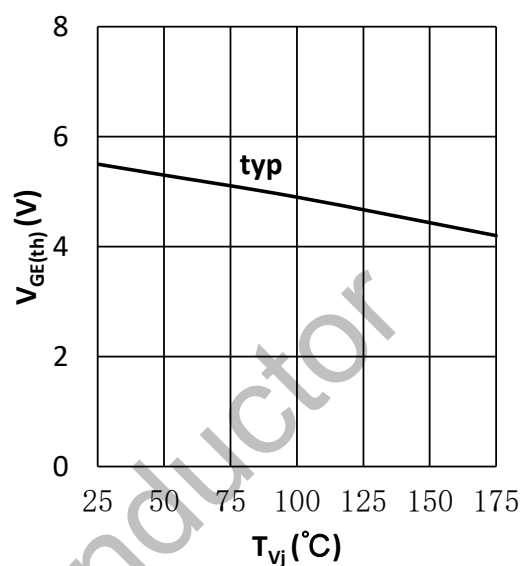


Figure 7. Typical gate charge $V_{GE} = f(Q_G)$
($I_C=40A$)

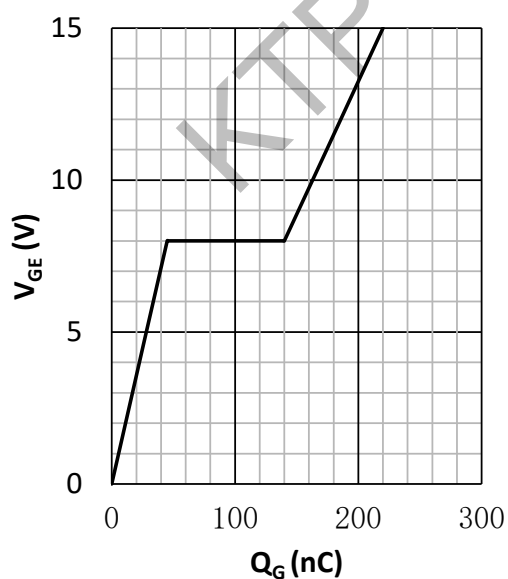


Figure 8. Typical capacitance as a function
of collector-emitter voltage
($V_{GE}=0V$, $f=100\text{ kHz}$)

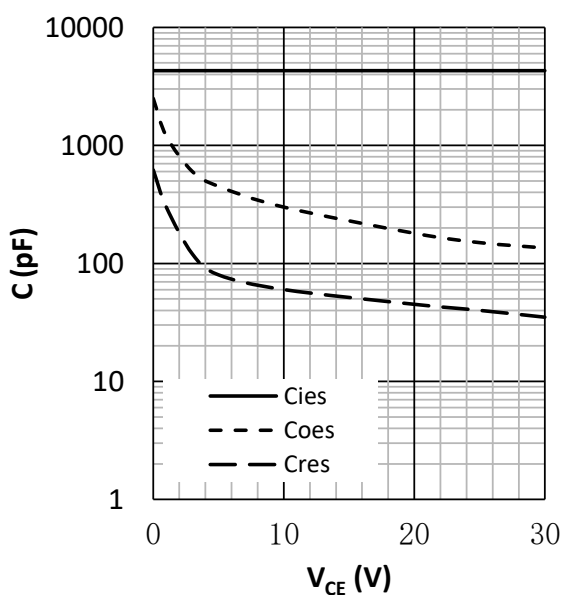


Figure 9. Typical switching energy losses as a function of junction temperature

$$E=f(T_{vj}), V_{cc}=600V, I_c=40A$$

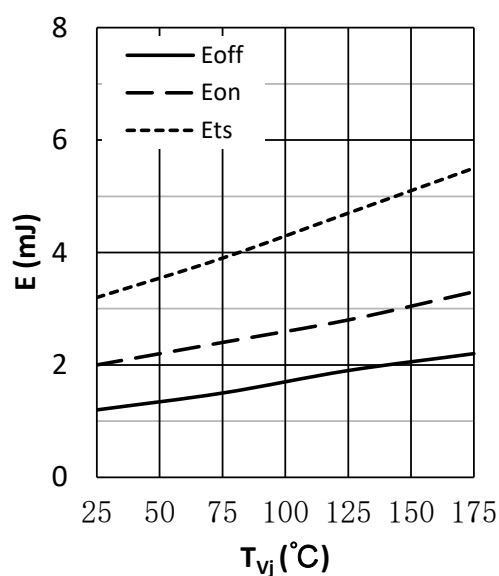


Figure 10. Typical switching energy losses as a function of collector current

$$E=f(I_c), T_{vj}=25^{\circ}C$$

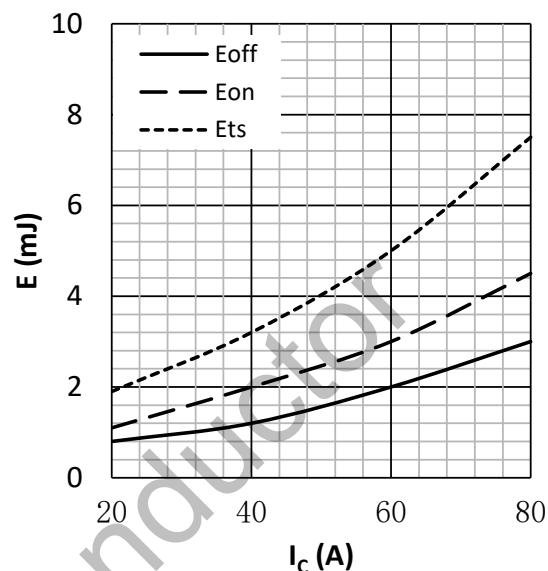


Figure 11. Typical diode forward voltage as a function of junction temperature

$$V_F=f(T_{vj})$$

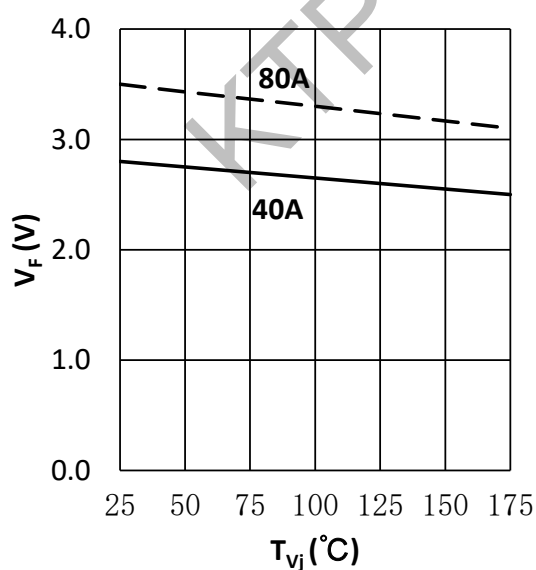
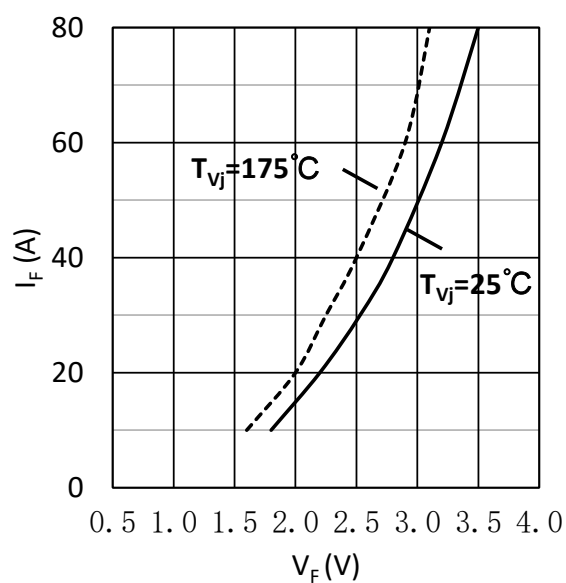
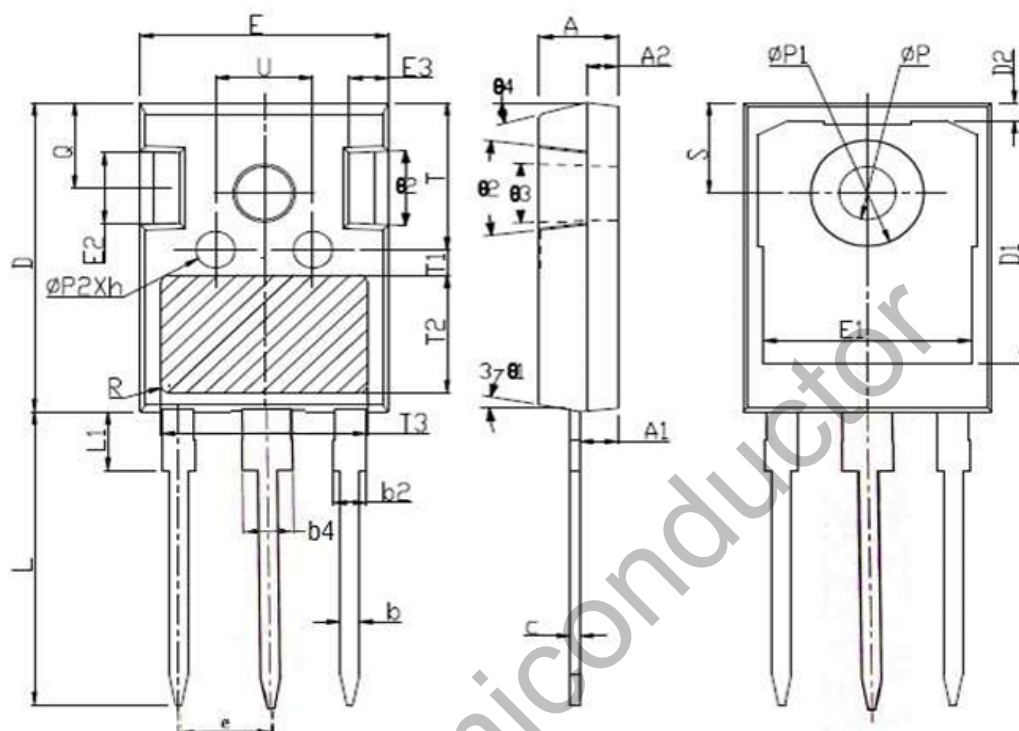


Figure 12. Forward characteristic of Diode



4 Package outlines

TO-247-3L



Symbol	Min	Nom	Max	Symbol	Min	Nom	Max
A	4.9	5.0	5.1	e	5.44BSC		
A1	2.3	2.4	2.5	h	0.05	0.10	0.15
A2	1.9	2.0	2.1	L	19.6	19.9	20.2
b	1.10	1.20	1.25	L1			4.3
b2	1.90	2.00	2.25	Φp	3.5	3.6	3.75
b4	2.90	3.00	3.25	Φp1			7.3
c	0.50	0.60	0.70	Φp2	2.4	2.5	2.6
D	20.8	21.0	21.2	Q	5.3		5.9
D1	16.25	16.55	16.85	S	6.15BSC		
D2	1.05	1.20	1.35	T	9.8		10.2
E	15.6	15.8	16.0	T1	1.65REF		
E1	13.1	13.3	13.5	T2	8.0REF		
E2	4.9	5.0	5.1	T3	12.8REF		
E3	2.4	2.5	2.6	U	6.0		6.4

Unit: mm