

Product Summary

$V_{(BR)CES}$	$V_{CE(SAT)TYP}$	$I_C(100^{\circ}C)$
650V	1.45V@15V	30A

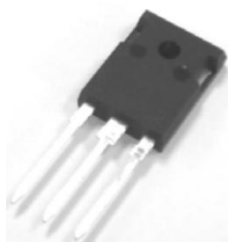
Feature

- Low switching losses
- Maximum junction temperature 175°C
- Positive temperature coefficient
- High ruggedness, temperature stable
- High short circuit capability (5us)

Application

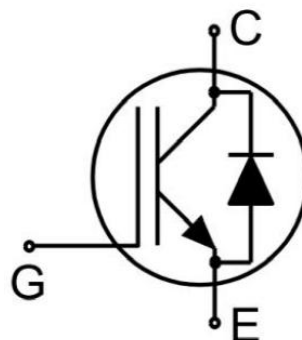
- Motion/servo control
- AC and DC servo drive amplifier
- Uninterruptible power supply

Package

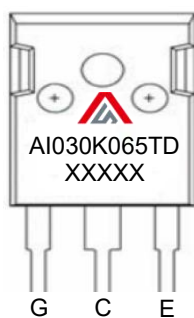


TO-247AB

Circuit diagram



Marking



Absolute maximum ratings ($T_C=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	650	V
Continuous Gate- Emitter Voltage	V_{GE}	± 20	V
Transient Gate-Emitter Voltage ($t_p \leq 10\mu\text{s}, D < 0.01$)	V_{GE}	± 30	V
Collector Current, limited by T_{jmax}	I_C	60	A
Collector Current, limited by T_{jmax} ($T_C = 100^{\circ}\text{C}$)	$I_C(100^{\circ}\text{C})$	30	A
Pulsed Collector Current, t_p limited by T_{jmax} ($V_{GE} = 15\text{V}$)	I_{CM}	90	A
Diode Continuous Forward Current, limited by T_{jmax}	I_F	60	A
Diode Continuous Forward Current, limited by T_{jmax} ($T_C = 100^{\circ}\text{C}$)	$I_F(100^{\circ}\text{C})$	30	A
Diode Pulsed Current, t_p limited by T_{jmax}	I_{Fpuls}	90	A
Turn off Safe Operating Area ($V_{CE} \leq 650\text{V}, T_J \leq 150^{\circ}\text{C}$)	-	90	A
Short Circuit Withstand Time ($V_{CE} \leq 650\text{V}, V_{GE} = 15\text{V}, V_{CC} = 400\text{V}$)	T_{SC}	5	μs
Power Dissipation ($T_J = 175^{\circ}\text{C}$)	P_D	187	W
Thermal Resistance, Junction to case for Diode	$R_{\theta JC}$	1.05	$^{\circ}\text{C/W}$
Thermal Resistance, Junction to case for IGBT	$R_{\theta JC}$	0.8	$^{\circ}\text{C/W}$
Operating junction temperature range	T_J	$-40 \sim +175$	$^{\circ}\text{C}$
Storage Temperature Range	T_{STG}	$-55 \sim +150$	$^{\circ}\text{C}$

Electrical characteristics of the IGBT ($T_J=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static Characteristics						
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=250\mu A$	650			V
Collector-Emitter Leakage Current	I_{CES}	$V_{GE}=0V, V_{CE}=650V$			0.25	mA
		$V_{GE}=0V, V_{CE}=650V, T_J=150^{\circ}C$			4	
Gate to Emitter Leakage Current	I_{GES}	$V_{GE}=\pm 20V, V_{CE}=0V$			100	nA
Gate Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1mA$	4.5	5.1	5.8	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=30A$		1.45	1.75	V
		$V_{GE}=15V, I_C=30A, T_J=125^{\circ}C$		1.65		
		$V_{GE}=15V, I_C=30A, T_J=150^{\circ}C$		1.75		
Dynamic characteristics						
Input Capacitance	C_{ies}	$V_{GE}=0V, V_{CE}=25V, f=1MHz$		2.03		nF
Reverse Transfer Capacitance	C_{res}			0.02		
Total Gate Charge	Q_g	$V_{GE}=15V, V_{CC}=400V, I_C=30A$		0.14		μC
Short Circuit Collector Current	I_{SC}	$V_{GE}=15V, V_{CC}=400V, t_{SC}\leq 5\mu s$ $T_J\leq 150^{\circ}C$		185		A
Turn-on delay time	$t_{d(on)}$	$V_{GE}=-5V\sim 15V, V_{CC}=400V$ $I_C=30A, R_G=20\Omega$		53		nS
Turn-on rise time	t_r			58		
Turn-off delay time	$t_{d(off)}$			139		
Turn-off fall time	t_f			115		
Turn-On Switching Loss	E_{on}			0.91		mJ
Turn-Off Switching Loss	E_{off}			0.72		

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Dynamic characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{GE} = -5V \sim 15V$, $V_{CC} = 400V$ $I_C = 30A$, $R_G = 20\Omega$ $T_J = 125^\circ C$		49		nS
Turn-on rise time	t_r			59		
Turn-off delay time	$t_{d(off)}$			154		
Turn-off fall time	t_f			163		
Turn-On Switching Loss	E_{on}			0.99		mJ
Turn-Off Switching Loss	E_{off}			0.93		
Turn-on delay time	$t_{d(on)}$	$V_{GE} = -5V \sim 15V$, $V_{CC} = 400V$ $I_C = 30A$, $R_G = 20\Omega$ $T_J = 150^\circ C$		47		nS
Turn-on rise time	t_r			60		
Turn-off delay time	$t_{d(off)}$			161		
Turn-off fall time	t_f			183		
Turn-On Switching Loss	E_{on}			1.03		mJ
Turn-Off Switching Loss	E_{off}			1.02		

Electrical characteristics of the Diode ($T_J = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_F	$I_F = 30A$		1.50	2.00	V
		$I_F = 30A$, $T_J = 125^\circ C$		1.40		
		$I_F = 30A$, $T_J = 150^\circ C$		1.35		
Reverse Recovery Current	I_{rrm}	$V_R = 400V$, $I_F = 30A$ $di/dt = -450A/\mu s$		14		A
Reverse Recovery Charge	Q_{rr}			0.58		uC
Reverse Recovery Time	T_{rr}			74		nS
Reverse Recovery Energy	E_{rec}			0.09		mJ
Reverse Recovery Current	I_{rrm}	$V_R = 400V$, $I_F = 30A$ $di/dt = -450A/\mu s$ $T_J = 125^\circ C$		19		A
Reverse Recovery Charge	Q_{rr}			1.16		uC
Reverse Recovery Time	T_{rr}			106		nS
Reverse Recovery Energy	E_{rec}			0.22		mJ
Reverse Recovery Current	I_{rrm}	$V_R = 400V$, $I_F = 30A$ $di/dt = -450A/\mu s$ $T_J = 150^\circ C$		21		A
Reverse Recovery Charge	Q_{rr}			1.41		uC
Reverse Recovery Time	T_{rr}			120		nS
Reverse Recovery Energy	E_{rec}			0.27		mJ

Typical Characteristics

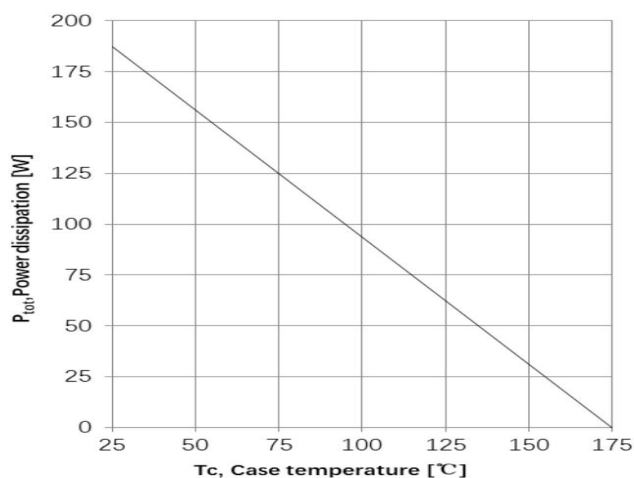


Fig1. Power dissipation as a function of case temperature ($T_j < 175^\circ\text{C}$)

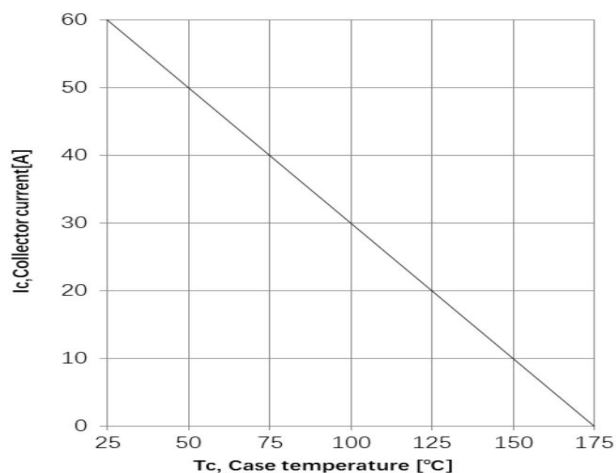


Fig2. Collector current as a function of case temperature ($V_{ge} > 15\text{V}$, $T_j < 175^\circ\text{C}$)

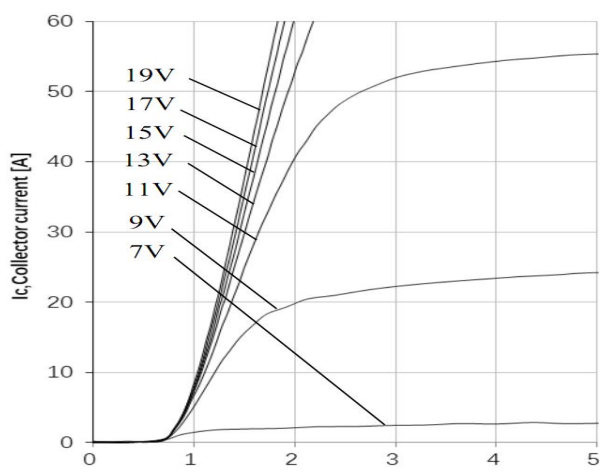


Fig3. Typical output characteristic ($T_j = 25^\circ\text{C}$)

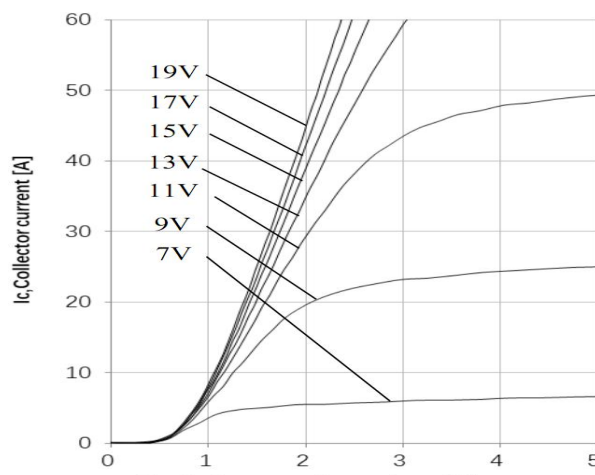


Fig4. Typical output characteristic ($T_j = 150^\circ\text{C}$)

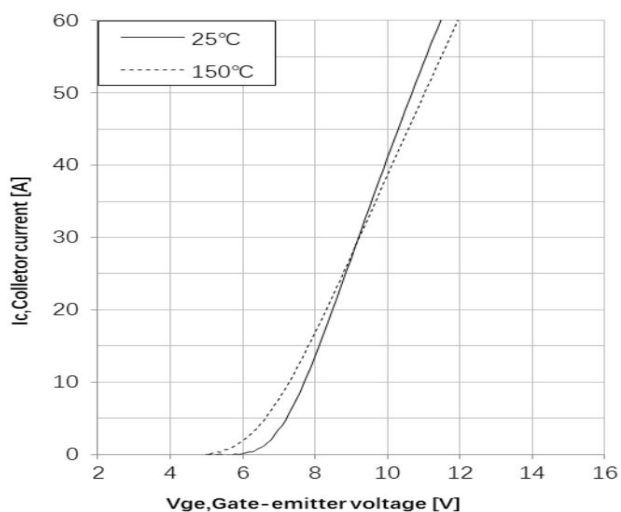


Fig5. Typical transfer characteristic ($V_{ce} = 20\text{V}$)

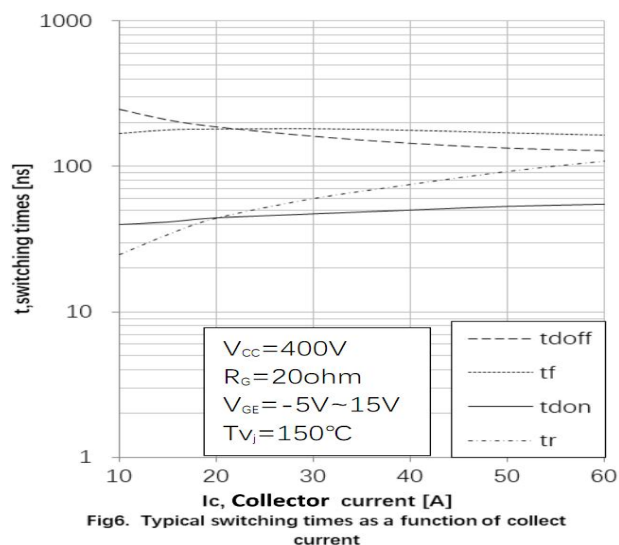


Fig6. Typical switching times as a function of collector current

Typical Characteristics

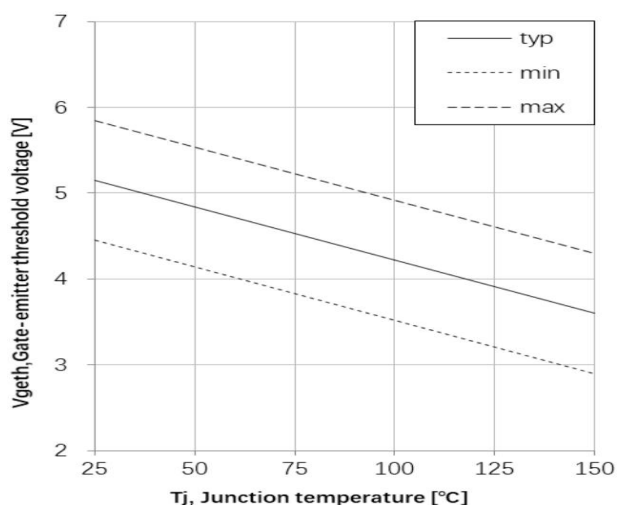


Fig7. Gate-emitter threshold voltage as a function of junction temperature ($I_c=1mA$)

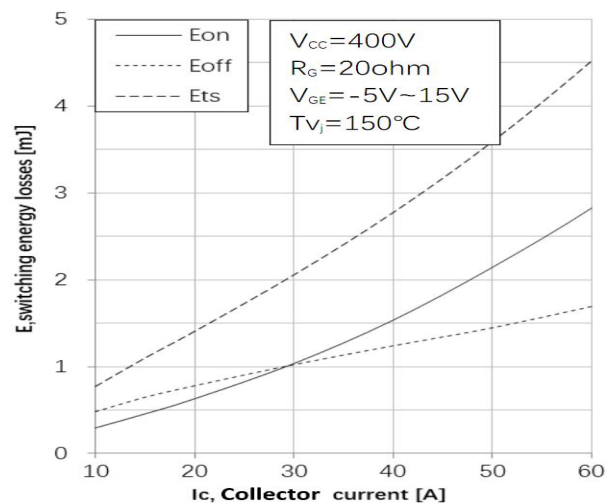


Fig8. Typical switching energy losses as a function of collector current

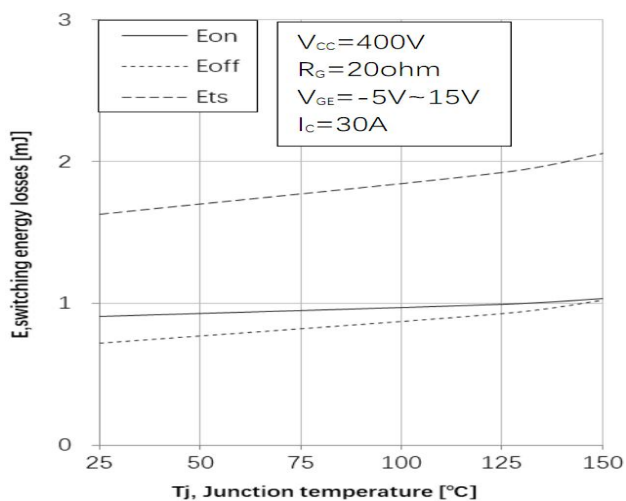


Fig9. Typical switching energy losses as a function of junction temperature

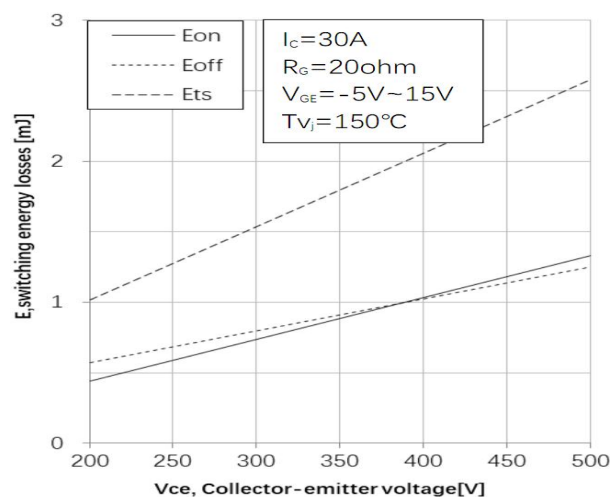


Fig10. Typical switching energy losses as a function of collector-emitter voltage

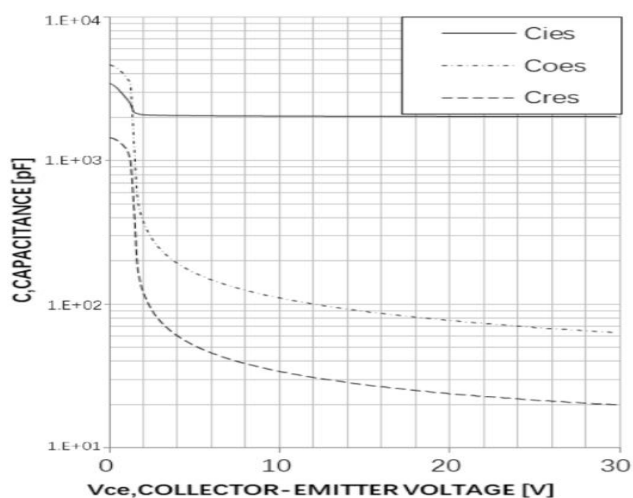


Fig11. Typical capacitance as a function of collector-emitter voltage

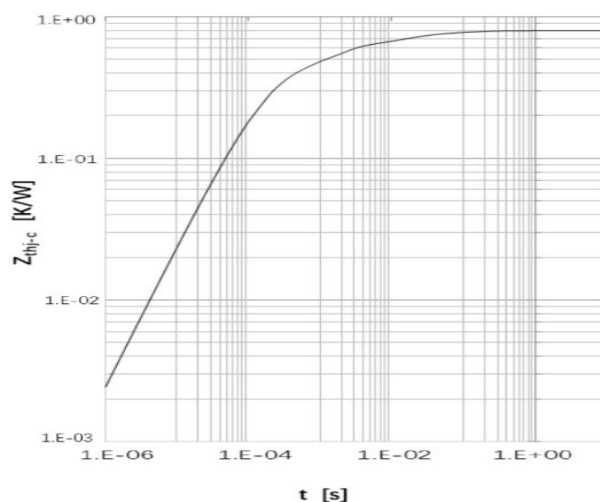


Fig12. IGBT Transient Thermal Impedance

Typical Characteristics

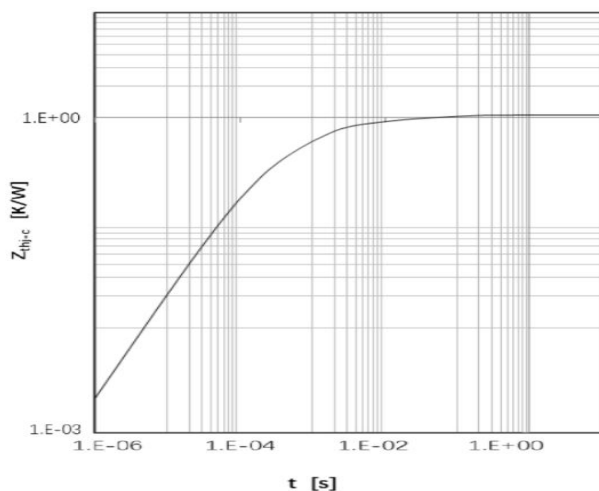


Fig 13. Diode Transient Thermal Impedance

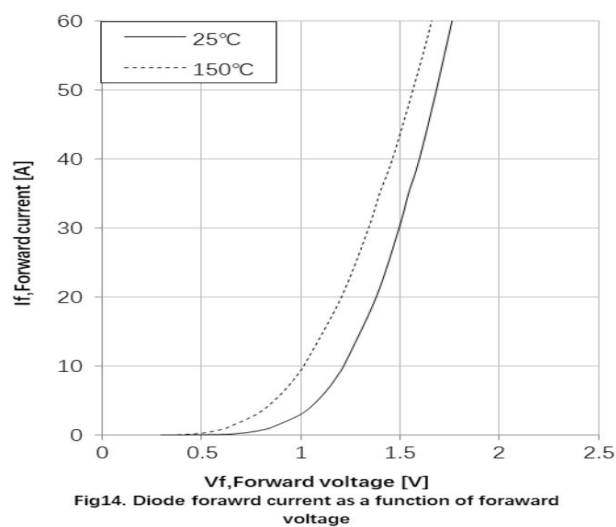
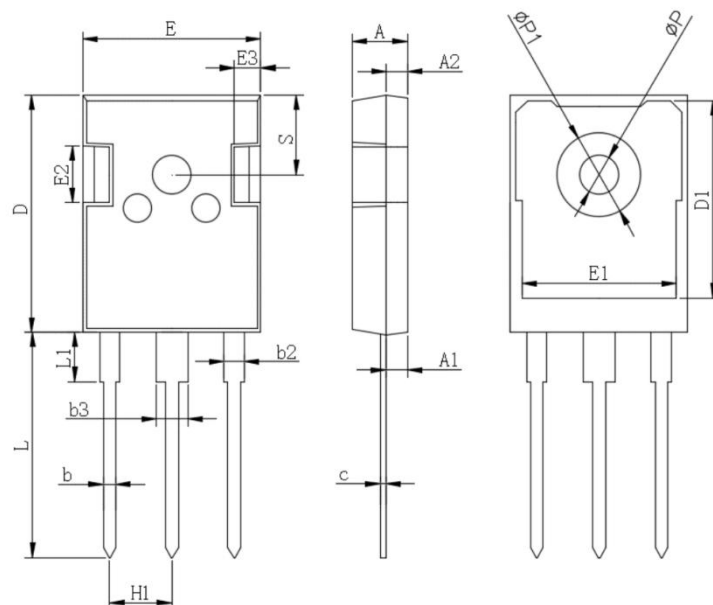


Fig14. Diode forward current as a function of forward voltage

TO-247AB Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.800	5.200	0.189	0.205
A1	2.210	2.610	0.087	0.103
A2	1.850	2.150	0.073	0.085
b	1.000	1.400	0.039	0.055
b2	1.910	2.210	0.075	0.087
b3	2.800	3.200	0.110	0.126
C	0.500	0.700	0.020	0.028
D	20.700	21.300	0.815	0.839
D1	16.250	16.850	0.640	0.663
E	15.500	16.100	0.610	0.634
E1	13.000	13.600	0.512	0.535
E2	4.800	5.200	0.189	0.205
E3	2.300	2.700	0.091	0.106
L	19.620	20.220	0.772	0.796
L1	-	4.300	-	0.169
Φ P	3.400	3.800	0.134	0.150
Φ P1	-	7.300	-	0.287
S	6.150 TYP.		0.242 TYP.	
H1	5.440 TYP.		0.214 TYP.	