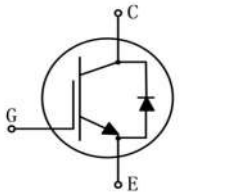
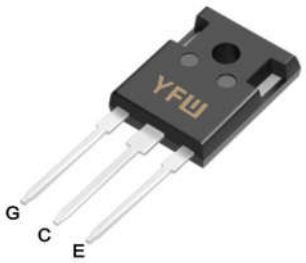
650V N-Channel Enhancement Mode Power IGBT

MAIN CHARACTERISTICS

$I_{C\ @TC=100℃}$	40A
V_{CE}	650V
VCE(sat)-typ	1.7V





TO-247

FEATURES

- Trench and field-stop technology
- Easy parallel switching capability

APPLICATIONS

- PFC applications
- Uninterruptible power supplies
- Solar inverters

MECHANICAL DATA

- Case: Molded plastic
- Mounting Position: Any
- Molded Plastic: UL Flammability Classification Rating 94V-0
- Lead free in compliance with EU RoHS 2011/65/EU directive
- Solder bath temperature 275℃ maximum,10s per JESD 22-B106

Maximum Ratings

Characteristics	Symbol	Value	Unit
Collector-emitter voltage	V_{CES}	650	V
Gate-emitter voltage	V_{GES}	±20	V
Continuous collector current (TC=25℃)	I_C	80	A
Continuous collector current (TC=100℃)		40	A
Pulsed collector current, tp limited by Tvjmax	I_{CM}	160	A
Diode continuous forward current (TC=100℃)	I_F	40	A
Diode maximum current, tp limited by Tvjmax	I_{FM}	160	A
Power dissipation (TC=25℃)	P_{tot}	300	W
Power dissipation (TC=100℃)		150	W
Operating junction temperature range	T_{vj}	-40 to +175	°C
Storage temperature range	T_{stg}	-55 to +150	°C

Thermal characteristics

Characteristics	Symbol	Values		Unit
		Typ	Max.	
Thermal resistance, junction to case for IGBT	$R_{th(j-c)}$	-	0.5	K/ W
Thermal resistance, junction to case for Diode	$R_{th(j-c)}$	-	0.9	K/ W
Thermal resistance, junction to ambient	$R_{th(j-a)}$	-	40	K/ W

Note1:Pulse test: 300 μs pulse width, 2 % duty cycle

Electrical characteristics of IGBT at Tvj=25℃ unless otherwise specified

Characteristics	Test Condition	Symbol	Min	Typ	Max	Unit
Collector-emitter breakdown voltage	V_{GE}=0V, I_C=250μA	B_{VCES}	650	-	-	V
Collector-emitter leakage current	V_{CE}=650V, V_{GE}=0V	I_{CES}	-	-	50	μA
Gate leakage current, forward	V_{GE}=±20V, V_{CE}=0V	I_{GES}	-	-	±100	nA
Gate-emitter threshold voltage	V_{GE}=V_{CE}, I_C=1mA	$V_{GE(th)}$	4	5	6	V
Collector-emitter saturation voltage	V_{GE}=15 V, I_C=40A	$V_{CE(sat)}$	-	1.7	-	V
	V_{GE}=15V, I_C=40A, T_{vj}=150℃		-	2.2	-	V
Input capacitance	V_{CE}=30V V_{GE}=0V f =1MHz	C_{ies}	-	2480	-	pF
Output capacitance		C_{oes}	-	95	-	pF
Reverse transfer capacitance		C_{res}	-	21	-	pF
Total gate charge	V_{CC}=520V V_{GE}=15V I_C=40A	Q_g	-	78	-	nC
Turn-on delay time	V_{CC}=400V V_{GE}=15V I_C=40A R_G=10Ω Inductive load	td(on)	-	32	-	ns
Rise time		tr	-	59	-	ns
Turn-off delay time		td(off)	-	110	-	ns
Fall time		tf	-	52	-	ns
Turn-on energy		Eon	-	1.2	-	mJ
Turn-off energy		Eoff	-	0.6	-	mJ
Total switching energy		Ets	-	1.8	-	mJ
Turn-on delay time	V_{CC}=400V V_{GE}=15V I_C=40A R_G=10Ω Inductive load Tvj =150℃	td(on)	-	28	-	ns
Rise time		tr	-	52	-	ns
Turn-off delay time		td(off)	-	128	-	ns
Fall time		tf	-	75	-	ns
Turn-on energy		Eon	-	1.6	-	mJ
Turn-off energy		Eoff	-	0.9	-	mJ
Total switching energy		Ets	-	2.5	-	mJ
Diode forward voltage	I_F=40A	VF	-	1.5	-	V
	I_F=40A,Tvj=150℃		-	1.3	-	V
Diode reverse recovery time	V_R=400V I_F=40A diF/dt=-1200A/μs	trr	-	82	-	ns
Diode peak reverse recovery current		Irrm	-	15	-	A
Diode reverse recovery charge		Qrr	-	1620	-	nC
Diode reverse recovery time	V_R=400V I_F=40A diF/dt=-1200A/μsTvj=150℃	trr	-	130	-	ns
Diode peak reverse recovery current		Irrm	-	42	-	A
Diode reverse recovery charge		Qrr	-	3520	-	nC

RATINGS AND CHARACTERISTIC CURVES

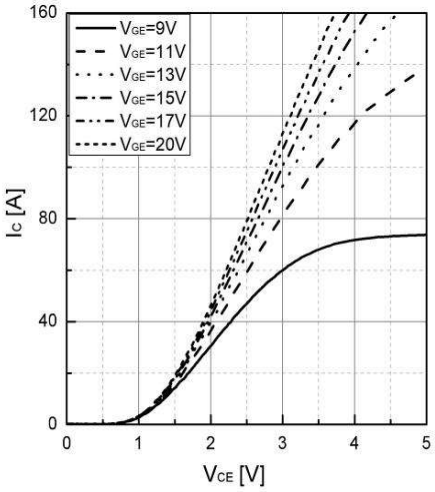


Fig 1. Typical output characteristic (T_{vj}=25℃)

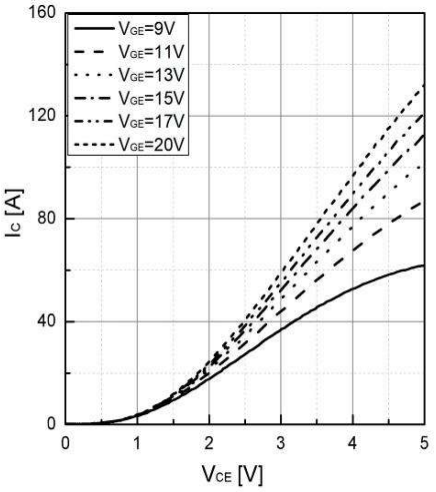


Fig 2. Typical output characteristic (T_{vj}=175℃)

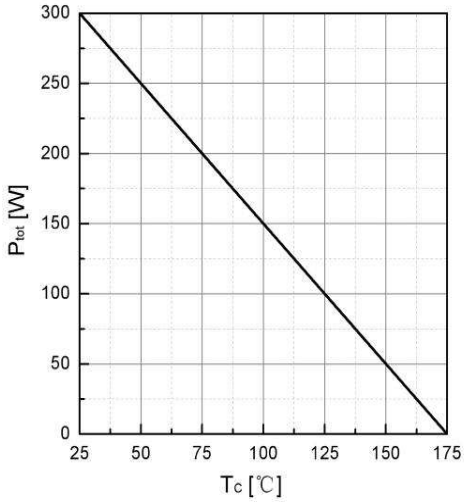


Fig 3. Power dissipation as a function of T_C

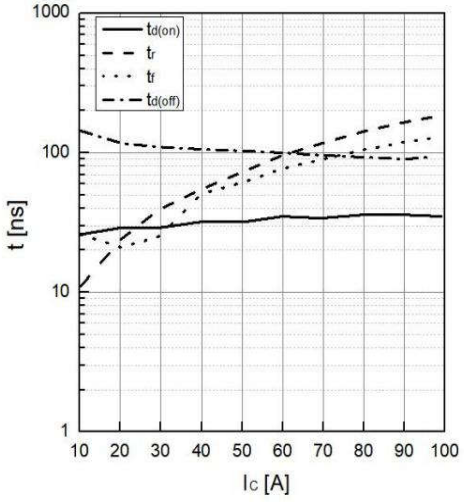


Fig 4. Typical switching time as a function of I_C

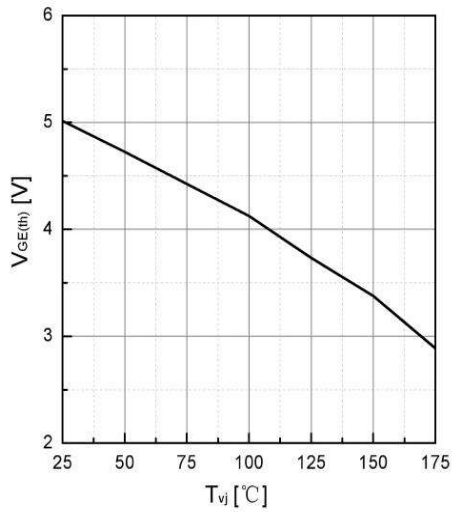


Fig 5. Typical $V_{GE(th)}$ as a function of T_{vj}

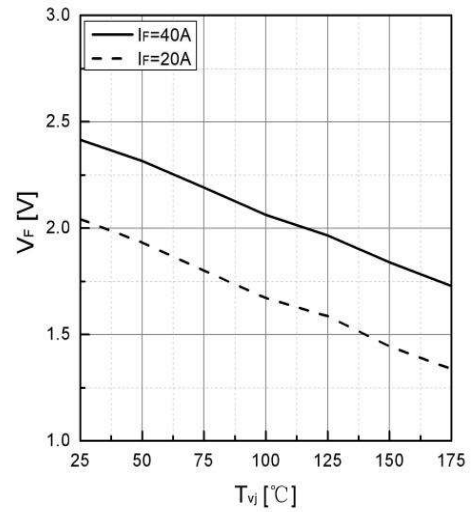


Fig 6. Typical V_F as a function of T_{vj}

RATINGS AND CHARACTERISTIC CURVES

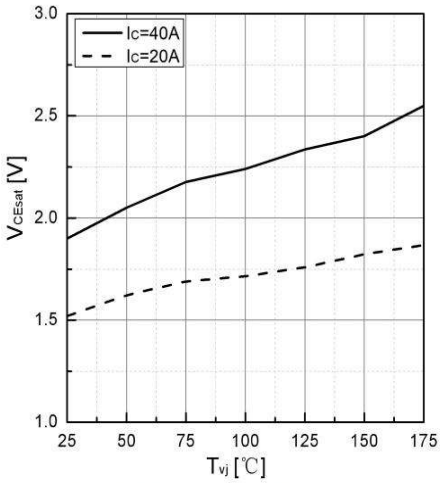


Fig 7. Typical V_{CEsat} as a function of T_{vj}

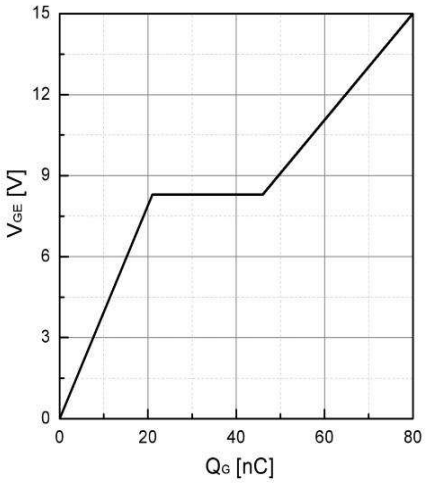


Fig 8. Typical Gate charge

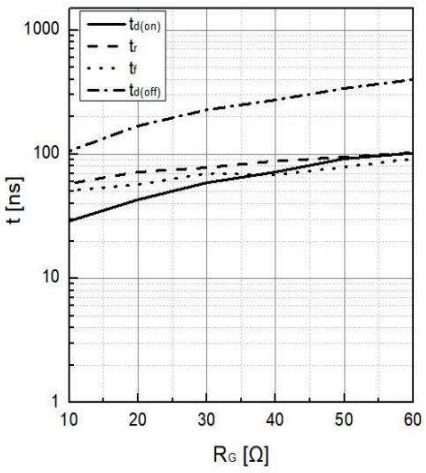


Fig 9. Typical switching times as a function of R_G

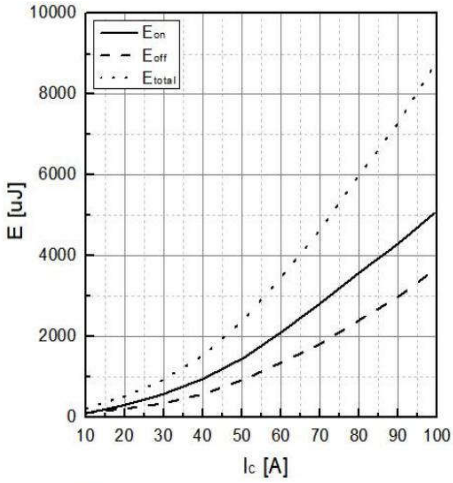


Fig 10. Typical switching energy losses as a function of I_C

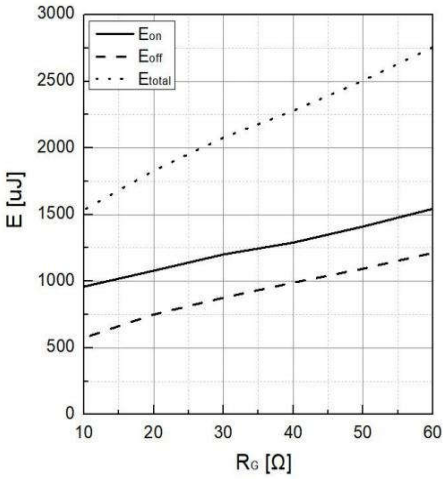


Fig 11. Typical switching energy losses as a function of R_G

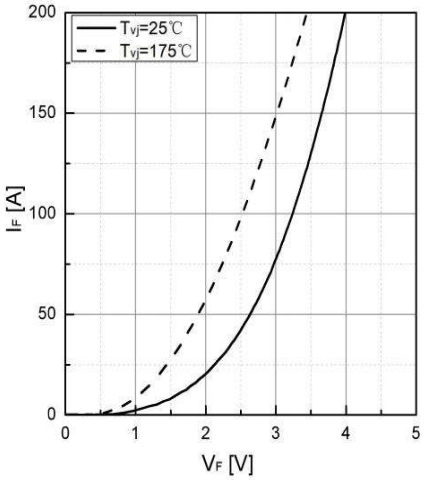


Fig 12. Typical I_F as a function of V_F

RATINGS AND CHARACTERISTIC CURVES

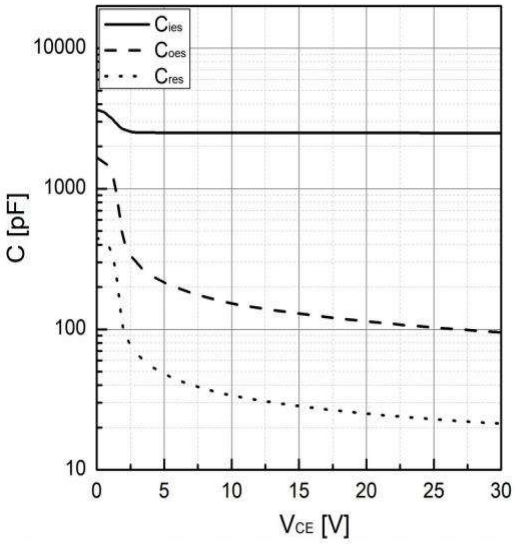


Fig 13. Typical capacitance as a function of V_{CE} (f=1Mhz, V_{GE}=0V)

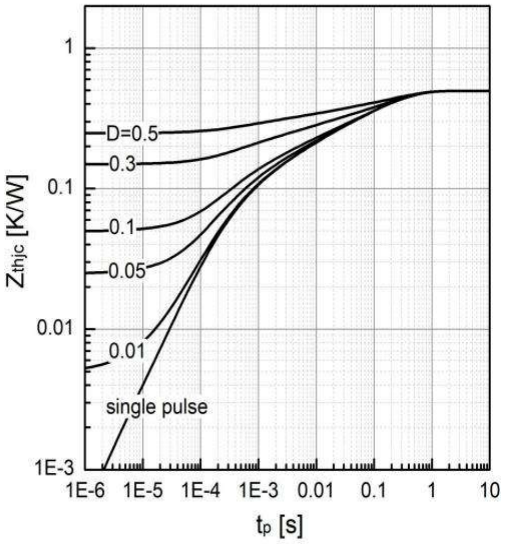
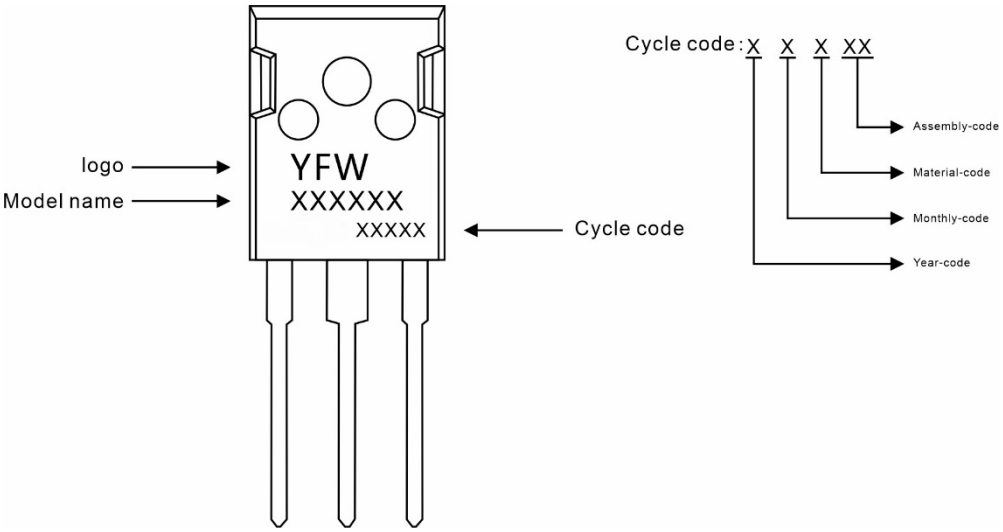


Fig 14. Transient thermal impedance of IGBT

Marking Diagram

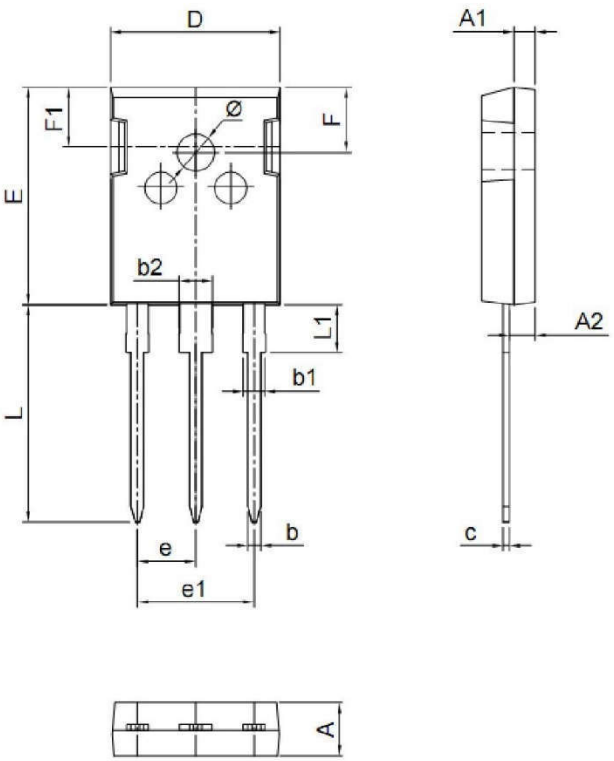


Ordering information

Model name	Package	Unit Weight	Base Quantity	Packing Quantity
YFWG40T65HAP	TO-247	0.209oz(5.93g)	30pcs/tube	600PCS/Box 2400PCS/Carton

Package Dimensions

TO-247



Symbol	Dimensions in mm		Dimensions in Inch	
	Min.	Max.	Min.	Max.
A	4.90	5.10	0.193	0.201
A1	1.90	2.10	0.075	0.083
A2	2.29	2.54	0.090	0.100
b	1.00	1.40	0.039	0.055
b1	2.00	2.20	0.079	0.087
b2	3.00	3.20	0.118	0.126
c	0.50	0.70	0.020	0.028
D	15.75	16.05	0.620	0.632
E	20.20	20.80	0.795	0.819
e	5.45 (BSC)		0.215 (BSC)	
e1	10.90 (BSC)		0.429 (BSC)	
F	6.05	6.25	0.238	0.246
F1	5.80	6.00	0.228	0.236
L	20.10	20.40	0.791	0.803
L1	4.05	4.35	0.159	0.171
Φ	3.50	3.70	0.138	0.146

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