

1200V N-Channel Enhancement Mode Power IGBT

MAIN CHARACTERISTICS

I_C @TC=100℃	40A
V_{CE}	1200V
$V_{CE(sat)}$-typ	1.9V

FEATURES

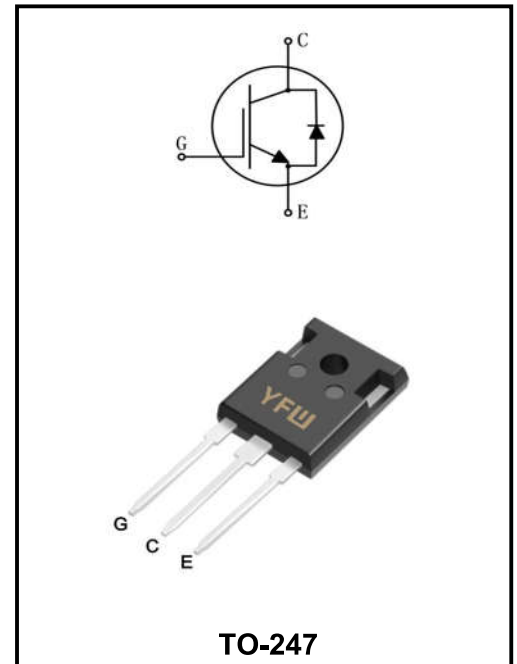
- ◆ Trench and field-stop technology
- ◆ High speed switching
- ◆ Low collector to emitter saturation voltage
- ◆ Easy parallel switching capability
- ◆ Short circuit withstands time 10μs
- ◆ High ruggedness performance

APPLICATIONS

- ◆ Inverter
- ◆ Motor driver

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}	1200	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}	625	W
Operating junction temperature range	T_{vj}	-40 to +175	℃
Storage temperature range	T_{stg}	-55 to +150	℃

Thermal characteristics

Characteristics	Symbol	Values		Unit
		Typ	Max.	
Thermal resistance, junction to case for IGBT	$R_{th(j-c)}$	-	0.35	K/ W
Thermal resistance, junction to case for Diode	$R_{th(j-c)}$	-	0.7	K/ W
Thermal resistance, junction to ambient	$R_{th(j-a)}$	-	40	K/ W

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

Electrical characteristics of IGBT at $T_{vj}=25^{\circ}\text{C}$ unless otherwise specified

Characteristics	Test Condition	Symbol	Min	Typ	Max	Unit
Collector-emitter breakdown voltage	$V_{GE}=0\text{V}$, $I_c=250\mu\text{A}$	$B_{V_{CES}}$	1200	-	-	V
Collector-emitter leakage current	$V_{CE}=1200\text{V}$, $V_{GE}=0\text{V}$	I_{CES}	-	-	100	μA
Gate leakage current, forward	$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$	I_{GES}	-	-	± 100	nA
Gate-emitter threshold voltage	$V_{GE}=V_{CE}$, $I_c=1\text{mA}$	$V_{GE(th)}$	5	6	7	V
Collector-emitter saturation voltage	$V_{GE}=15\text{V}$, $I_c=40\text{A}$	$V_{CE(sat)}$	-	1.9	-	V
	$V_{GE}=15\text{V}$, $I_c=40\text{A}$, $T_{vj}=175^{\circ}\text{C}$		-	2.3	-	V
Input capacitance	$V_{CE}=30\text{V}$ $V_{GE}=0\text{V}$ $f=1\text{MHz}$	C_{ies}	-	9780	-	pF
Output capacitance		C_{oes}	-	140	-	pF
Reverse transfer capacitance		C_{res}	-	42	-	pF
Total gate charge	$V_{CC}=960\text{V}$ $V_{GE}=15\text{V}$ $I_c=40\text{A}$	Q_g	-	269	-	nC
Turn-on delay time	$V_{CC}=600\text{V}$ $V_{GE}=15\text{V}$ $I_c=40\text{A}$ $R_g=10\Omega$ Inductive load	$t_d(on)$	-	80	-	ns
Rise time		t_r	-	77	-	ns
Turn-off delay time		$t_d(off)$	-	308	-	ns
Fall time		t_f	-	67	-	ns
Turn-on energy		E_{on}	-	2.1	-	mJ
Turn-off energy		E_{off}	-	1.4	-	mJ
Total switching energy		E_{ts}	-	3.5	-	mJ
Turn-on delay time	$V_{CC}=600\text{V}$ $V_{GE}=15\text{V}$ $I_c=40\text{A}$ $R_g=10\Omega$ Inductive load $T_{vj}=175^{\circ}\text{C}$	$t_d(on)$	-	70	-	ns
Rise time		t_r	-	75	-	ns
Turn-off delay time		$t_d(off)$	-	352	-	ns
Fall time		t_f	-	132	-	ns
Turn-on energy		E_{on}	-	2.5	-	mJ
Turn-off energy		E_{off}	-	2.4	-	mJ
Total switching energy		E_{ts}	-	4.9	-	mJ
Diode forward voltage	$I_F=40\text{A}$	V_F	-	3.1	-	V
	$I_F=40\text{A}$, $T_{vj}=175^{\circ}\text{C}$		-	2.3	-	V
Diode reverse recovery time	$V_R=600\text{V}$ $I_F=40\text{A}$ $diF/dt=-750\text{A}/\mu\text{s}$	t_{rr}	-	170	-	ns
Diode peak reverse recovery current	$V_R=600\text{V}$ $I_F=40\text{A}$ $diF/dt=-750\text{A}/\mu\text{s}$ $T_{vj}=175^{\circ}\text{C}$	I_{rrm}	-	17	-	A
Diode reverse recovery charge		Q_{rr}	-	1100	-	nC
Diode reverse recovery time		t_{rr}	-	285	-	ns
Diode peak reverse recovery current	$V_R=600\text{V}$ $I_F=40\text{A}$ $diF/dt=-750\text{A}/\mu\text{s}$ $T_{vj}=175^{\circ}\text{C}$	I_{rrm}	-	28	-	A
Diode reverse recovery charge		Q_{rr}	-	3300	-	nC

RATINGS AND CHARACTERISTIC CURVES

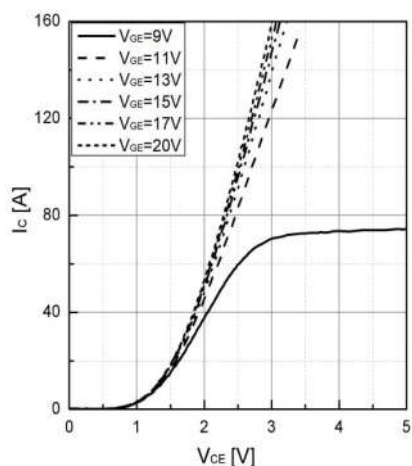


Fig 1. Typical output characteristic ($T_{vj}=25^{\circ}\text{C}$)

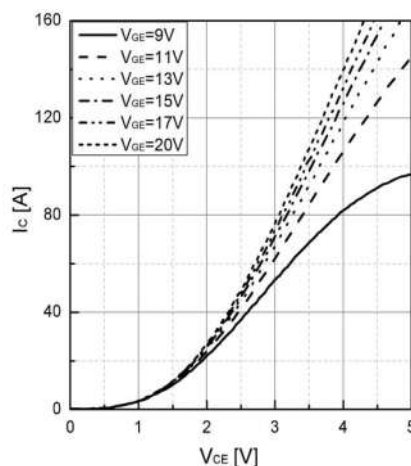


Fig 2. Typical output characteristic ($T_{vj}=175^{\circ}\text{C}$)

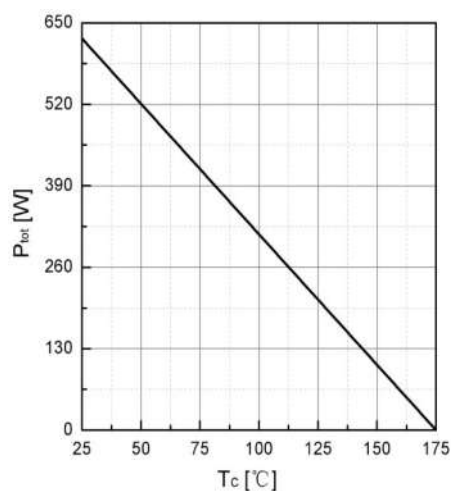


Fig 3. Power dissipation as a function of T_C

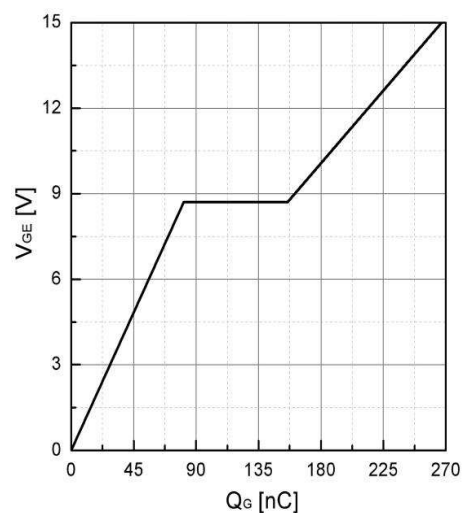


Fig 4. Typical Gate charge

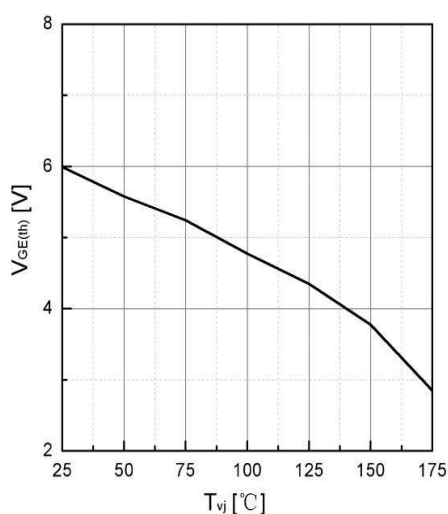


Fig 5. Typical $V_{GE(th)}$ as a function of T_{vj}
($I_C=1\text{mA}$)

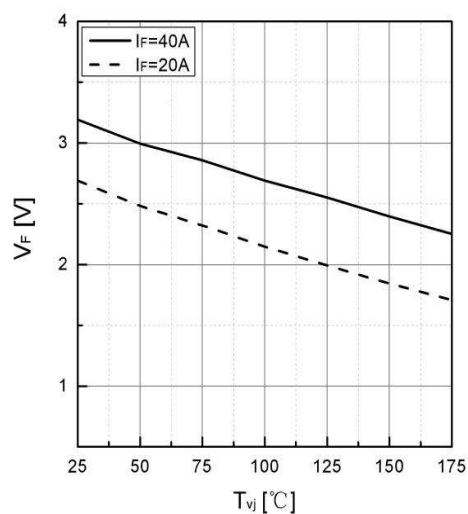


Fig 6. Typical V_F as a function of T_{vj}

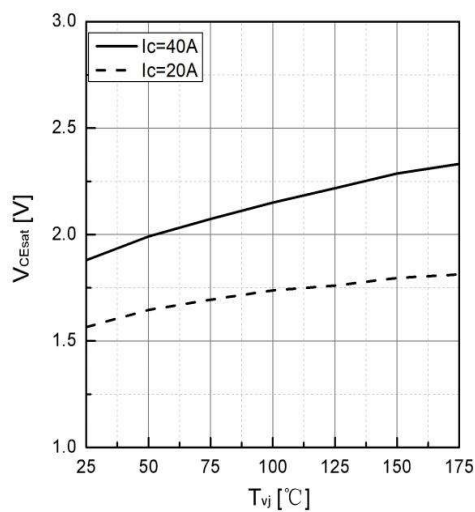


Fig 7. Typical V_{CEsat} as a function of T_{vj}

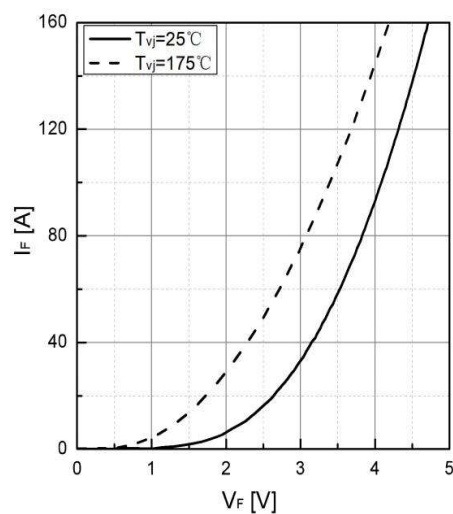


Fig 8. Typical I_F as a function of V_F

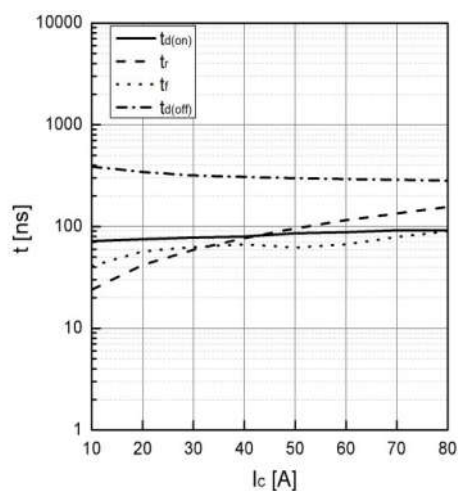


Fig 9. Typical switching time as a function of I_c

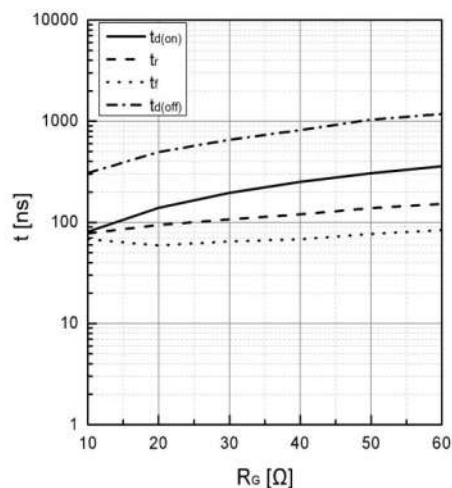


Fig 10. Typical switching times as a function of R_G

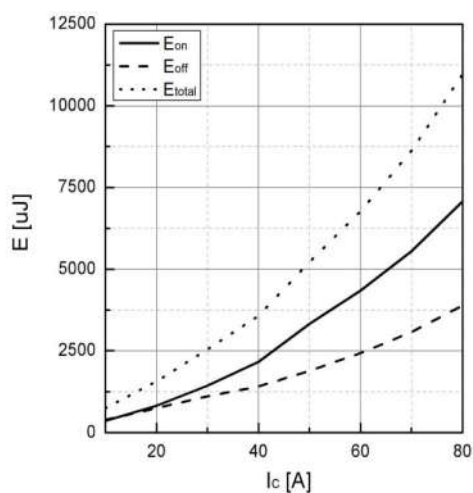


Fig 11. Typical switching energy losses as a function of I_c

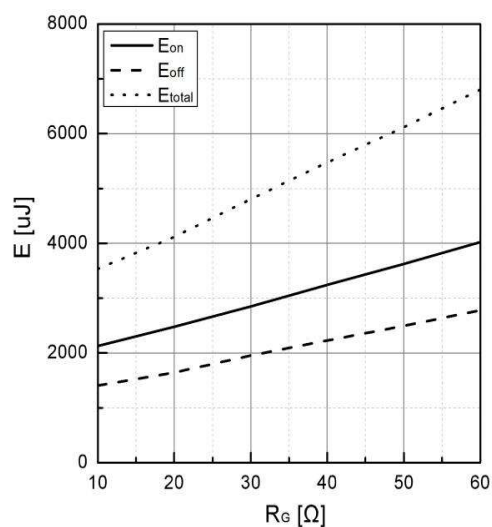


Fig 12. Typical switching energy losses as a function of R_G

RATINGS AND CHARACTERISTIC CURVES

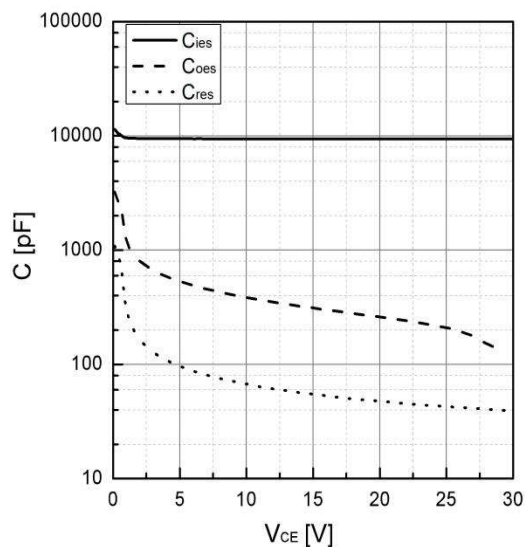


Fig 13. Typical capacitance as a function of V_{CE}
($f=1\text{MHz}$, $V_{GE}=0\text{V}$)

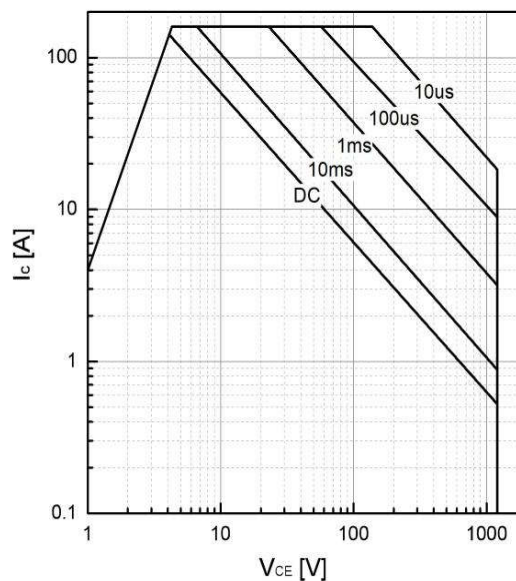


Fig 14. Safe operating area

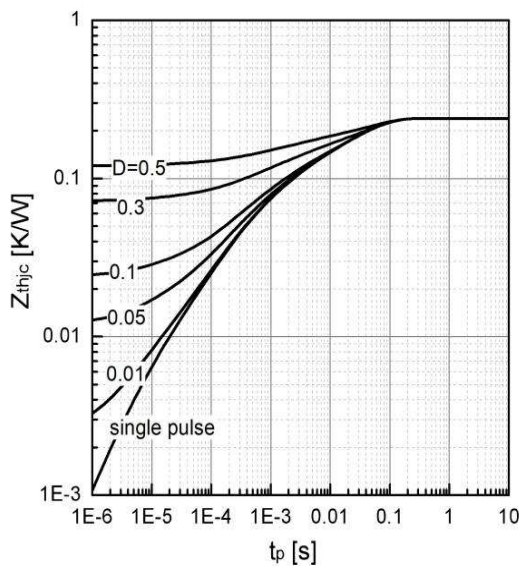
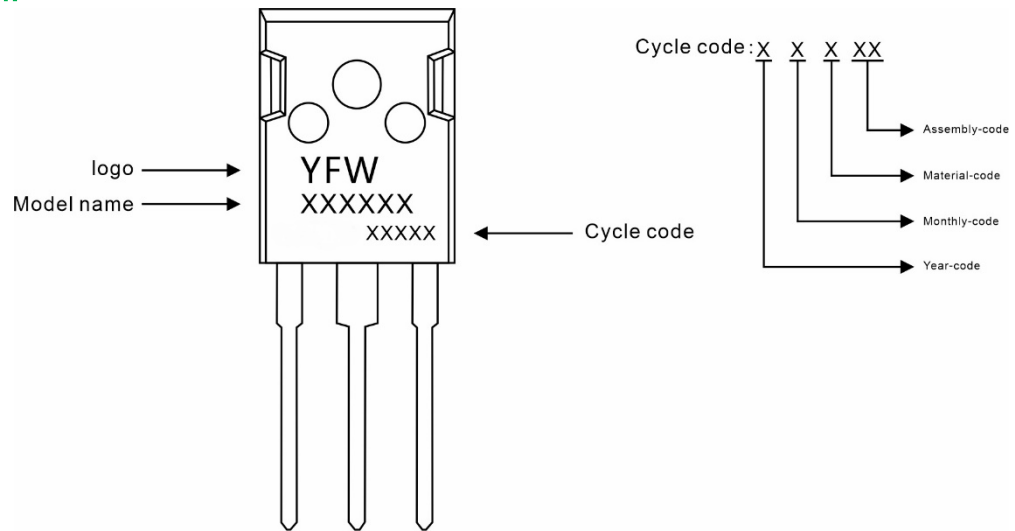


Fig 15. Transient thermal impedance of IGBT

Marking Diagram



Ordering information

Model name	Package	Unit Weight	Base Quantity	Packing Quantity
YFWG40T120UAP	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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