

650V N-Channel Enhancement Mode Power IGBT

MAIN CHARACTERISTICS

I_C @TC=100℃	6A
V_{CE}	650V
VCE(sat)-typ	1.7V

FEATURES

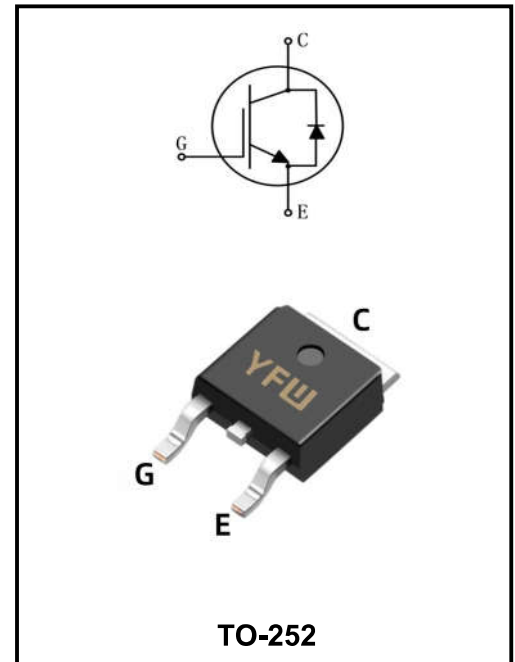
- ♦ High ruggedness performance
- ♦ Very tight parameter distribution
- ♦ Positive VCE (sat) temperature coefficient
- ♦ High efficiency for motor control
- ♦ Excellent current sharing in parallel operation
- ♦ RoHS compliant

APPLICATIONS

- ♦ Home appliances
- ♦ Motor drives
- ♦ Fan, Pumps, Vacuum cleaner

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	12	A
Continuous collector current (TC=100℃)		6	A
Pulsed collector current, tp limited by Tvjmax	I_{CM}	24	A
Diode continuous forward current (TC=100℃)	I_F	6	A
Diode maximum current, tp limited by Tvjmax	I_{FM}	24	A
Power dissipation (TC=25℃)	P_{tot}	73	W
Power dissipation (TC=100℃)		36	W
Operating junction temperature range	T_{vj}	-40 to +175	℃
Storage temperature range	T_{stg}	-40 to +150	℃

Thermal characteristics

Characteristics	Symbol	Values		Unit
		Typ	Max.	
Thermal resistance, junction to case for IGBT	$R_{th(j-c)}$	-	2	K/ W
Thermal resistance, junction to case for Diode	$R_{th(j-c)}$	-	4	K/ W
Thermal resistance, junction to ambient	$R_{th(j-a)}$	-	90	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	$V_{GE}=0V, I_c=250\mu A$	$B_{V_{CES}}$	650	-	-	V
Collector-emitter leakage current	$V_{CE}=650V, V_{GE}=0V$	I_{CES}	-	-	10	μA
Gate leakage current, forward	$V_{GE}=\pm 20V, V_{CE}=0V$	I_{GES}	-	-	± 100	nA
Gate-emitter threshold voltage	$V_{GE}=V_{CE}, I_c=1mA$	$V_{GE(th)}$	5.2	6.2	7.2	V
Collector-emitter saturation voltage	$V_{GE}=15V, I_c=6A$	$V_{CE(sat)}$	-	1.7	-	V
	$V_{GE}=15V, I_c=6A, T_{vj}=150^{\circ}\text{C}$		-	2.1	-	V
Input capacitance	$V_{CE}=25V$ $V_{GE}=0V$ $f=1MHz$	C_{ies}	-	480	-	pF
Output capacitance		C_{oes}	-	22	-	pF
Reverse transfer capacitance		C_{res}	-	8	-	pF
Total gate charge	$V_{CC}=520V, V_{GE}=15V, I_c=6A$	Q_g	-	19	-	nC
Turn-on delay time	$V_{CC}=400V$ $V_{GE}=15V$ $I_c=6A$ $R_g=10\Omega$ Inductive load	$t_d(on)$	-	10	-	ns
Rise time		t_r	-	8	-	ns
Turn-off delay time		$t_d(off)$	-	79	-	ns
Fall time		t_f	-	56	-	ns
Turn-on energy		E_{on}	-	0.11	-	mJ
Turn-off energy		E_{off}	-	0.1	-	mJ
Total switching energy		E_{ts}	-	0.21	-	mJ
Turn-on delay time	$V_{CC}=400V$ $V_{GE}=15V$ $I_c=6A$ $R_g=10\Omega$ Inductive load $T_{vj}=150^{\circ}\text{C}$	$t_d(on)$	-	11	-	ns
Rise time		t_r	-	10	-	ns
Turn-off delay time		$t_d(off)$	-	108	-	ns
Fall time		t_f	-	89	-	ns
Turn-on energy		E_{on}	-	0.16	-	mJ
Turn-off energy		E_{off}	-	0.16	-	mJ
Total switching energy		E_{ts}	-	0.32	-	mJ
Diode forward voltage	$I_F=6A$	V_F	-	1.6	-	V
	$I_F=6A, T_{vj}=150^{\circ}\text{C}$		-	1.4	-	V
Diode reverse recovery time	$V_R=400V$ $I_F=6A$ $di_F/dt=-500A/\mu s$	t_{rr}	-	55	-	ns
Diode peak reverse recovery current	$V_R=400V$ $I_F=6A$ $di_F/dt=-500A/\mu s, T_{vj}=150^{\circ}\text{C}$	I_{rrm}	-	10	-	A
Diode reverse recovery charge		Q_{rr}	-	306	-	nC
Diode reverse recovery time		t_{rr}	-	98	-	ns
Diode peak reverse recovery current	$V_R=400V$ $I_F=6A$ $di_F/dt=-500A/\mu s, T_{vj}=150^{\circ}\text{C}$	I_{rrm}	-	12	-	A
Diode reverse recovery charge		Q_{rr}	-	529	-	nC

RATINGS AND CHARACTERISTIC CURVES

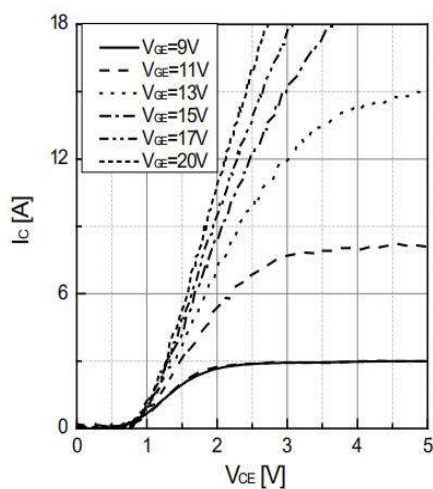


Fig 1. Typical output characteristic ($T_{vj}=25^{\circ}\text{C}$)

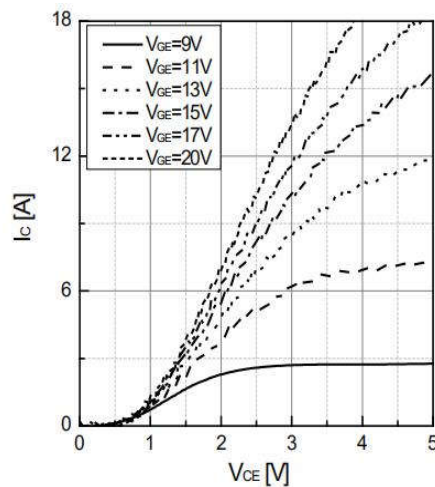


Fig 2. Typical output characteristic ($T_{vj}=150^{\circ}\text{C}$)

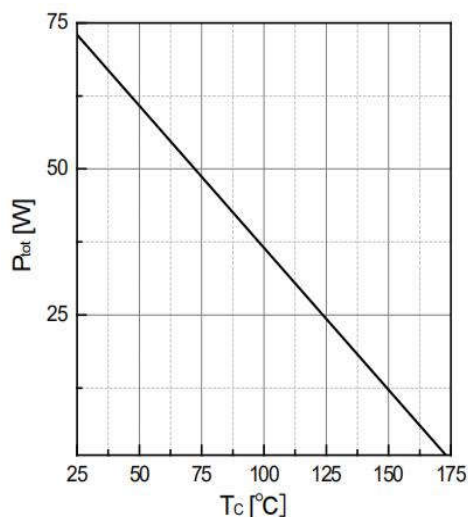


Fig 3. Power dissipation as a function of T_c

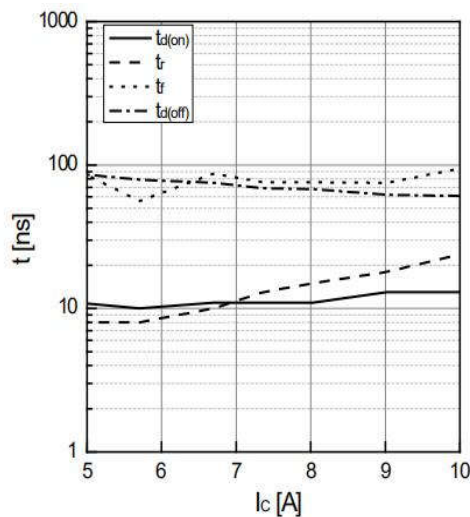


Fig 4. Typical switching time as a function of I_c

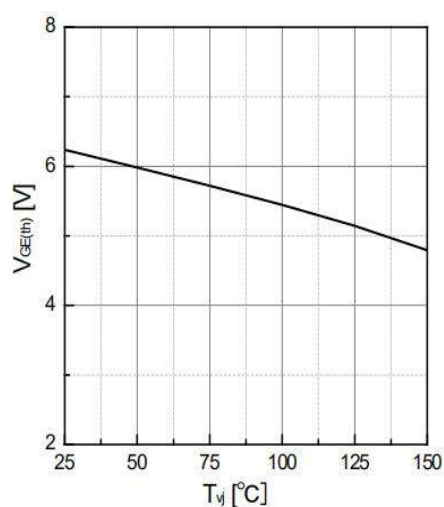


Fig 5. Typical $V_{GE(th)}$ as a function of T_{vj}
($I_c=1\text{mA}$)

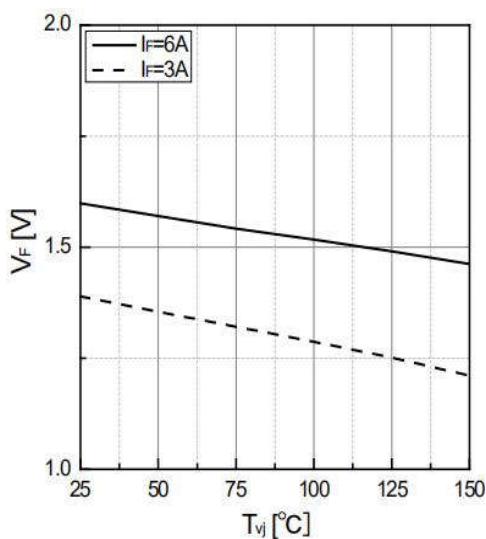


Fig 6. Typical V_F as a function of T_{vj}

RATINGS AND CHARACTERISTIC CURVES

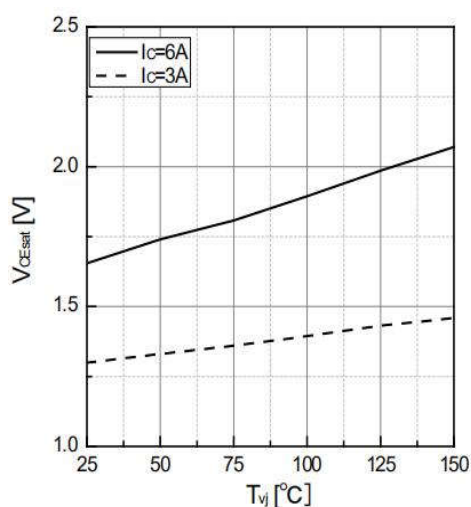


Fig 7. Typical V_{CEsat} as a function of T_{vj}

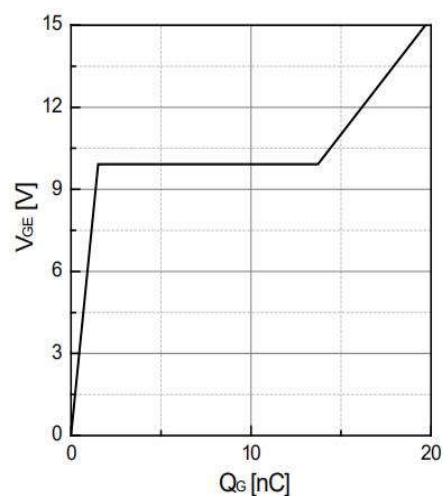


Fig 8. Typical Gate charge

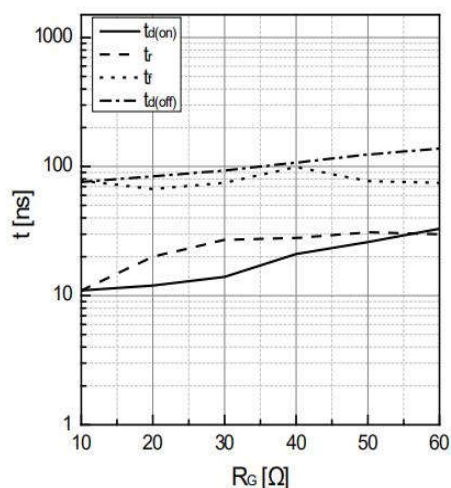


Fig 9. Typical switching times as a function of R_G

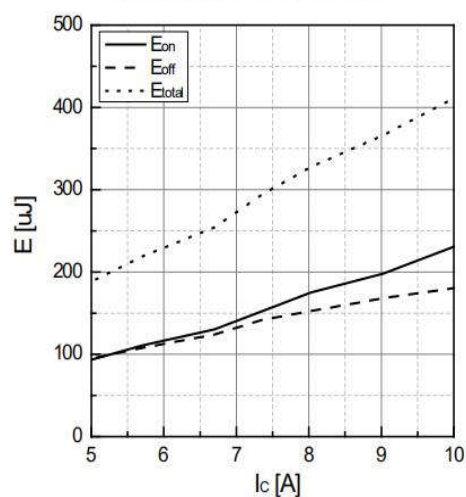


Fig 10. Typical switching energy losses as a function of I_C

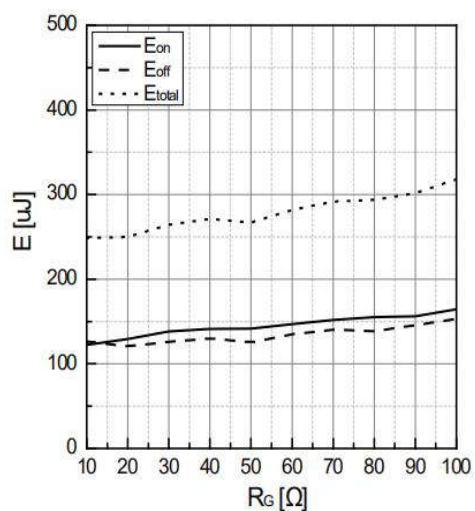


Fig 11. Typical switching energy losses as a function of R_G

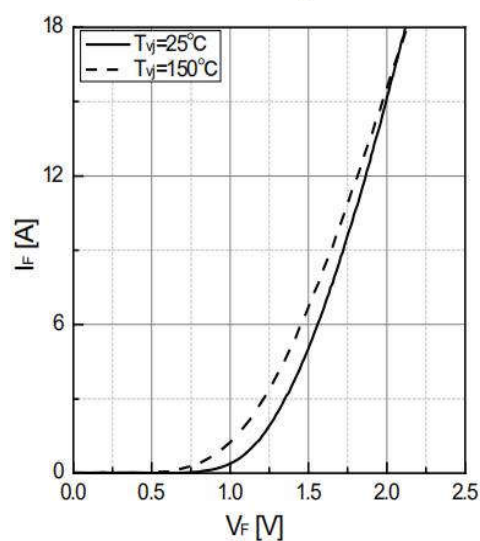


Fig 12. Typical I_F as a function of V_F

RATINGS AND CHARACTERISTIC CURVES

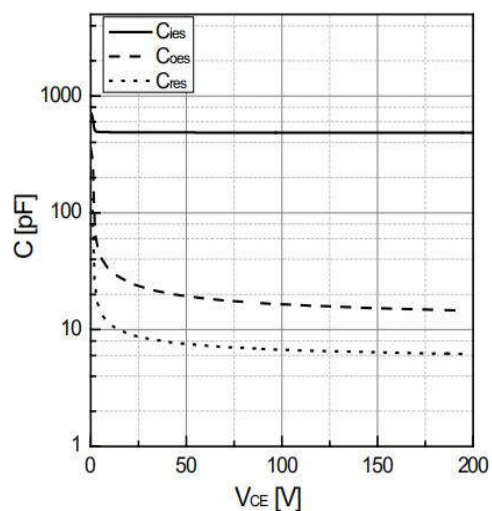


Fig 13. Typical capacitance as a function of V_{CE}
($f=1\text{MHz}$, $V_{GE}=0\text{V}$)

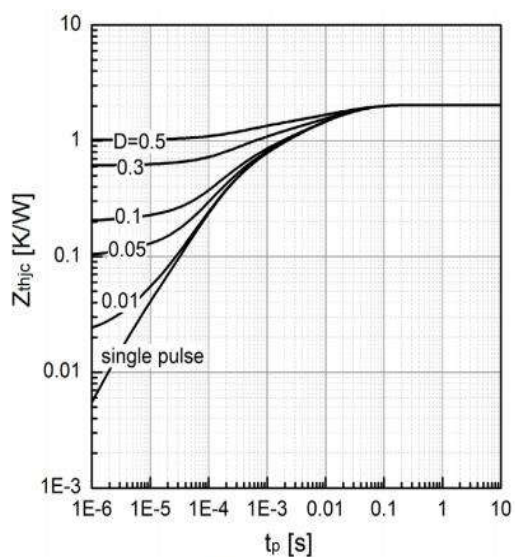
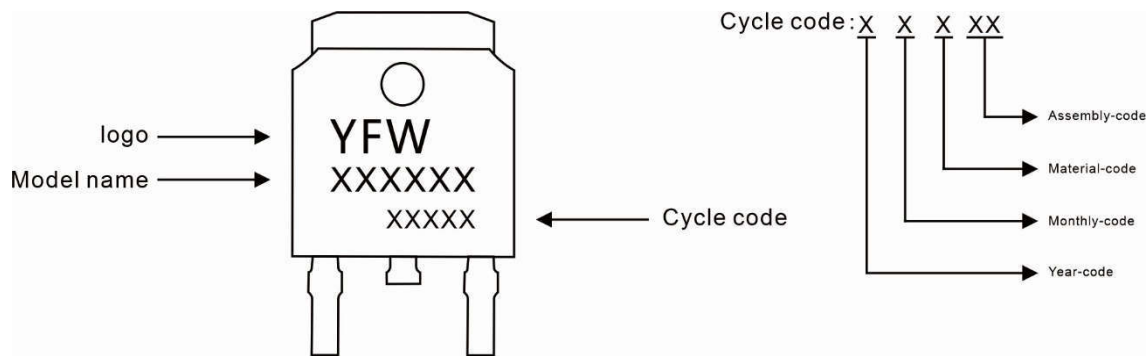


Fig 14. Transient thermal impedance of IGBT

Marking Diagram



Ordering information

Model name	Package	Unit Weight	Base Quantity	Packing Quantity
YFWG06T65AD	TO-252	0.011oz(0.32g)	2500pcs/reel	5000pcs/box 25000pcs/Carton

Package Dimensions

TO-252

Dim	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	2.20	2.50	0.087	0.098
A1	0.00	0.12	0.000	0.005
A2	2.20	2.40	0.087	0.094
B	1.20	1.60	0.047	0.063
b	0.50	0.70	0.020	0.028
b1	0.70	0.90	0.028	0.035
c	0.40	0.60	0.016	0.024
c1	0.40	0.60	0.016	0.024
D	6.35	6.65	0.250	0.262
D1	5.20	5.40	0.205	0.213
E	5.40	5.70	0.213	0.224
e	2.20	2.40	0.087	0.094
e1	4.40	4.80	0.173	0.189
L	10.00	11.00	0.393	0.433
L1	2.70	3.10	0.106	0.122
L2	1.40	1.80	0.055	0.071
L3	0.90	1.50	0.035	0.059

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