

650V N-Channel Enhancement Mode Power IGBT

MAIN CHARACTERISTICS

I_C @TC=100℃	10A
V_{CE}	650V
V_{CE(sat)}-typ	1.8V

FEATURES

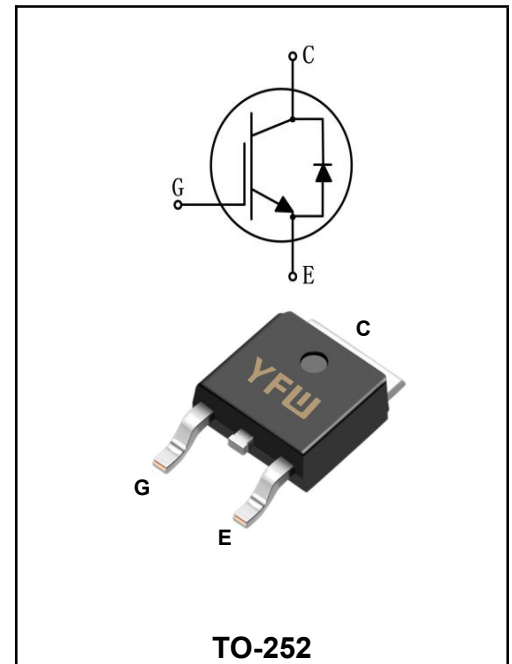
- ◆ Trench and field-stop technology
- ◆ Low switching losses
- ◆ Positive temperature coefficient
- ◆ Low Gate-Charge
- ◆ RoHS compliant

APPLICATIONS

- ◆ UPS
- ◆ Motor drives
- ◆ Boost
- ◆ PFC

MECHANICAL DATA

- ◆ Case: TO-252/AD
- ◆ 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

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEs}	650	V
Gate-emitter voltage	V_{GES}	±20	V
Continuous collector current (T _C =25℃)	I_C	20	A
Continuous collector current (T _C =100℃)		10	A
Pulsed collector current, tp limited by Tvjmax	I_{CM}	40	A
Diode continuous forward current (T _C =100℃)	I_F	10	A
Diode maximum current, tp limited by Tvjmax	I_{FM}	40	A
Short Circuit with Stand Time V _{GE} =15V, V _{CC} ≤400V, Allowed Number of Short Circuits<1000, Times Between Short Circuits≥1.0s, T _J ≤175℃	t_{sc}	10	μS
Power dissipation (T _C =25℃)	P_{tot}	100	W
Power dissipation (T _C =100℃)		50	W
Operating junction temperature range	T_{J max}	-40 to +175	℃
Storage temperature range	T_{Stg}	-55 to +150	℃

Thermal characteristics

Characteristics	Symbol	Values	Unit
Thermal resistance, junction to case for IGBT	$R_{th(j-c)}$	1.5	K/ W
Thermal resistance, junction to case for Diode	$R_{th(j-c)}$	2	K/ W
Thermal resistance, junction to ambient	$R_{th(j-a)}$	62	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

Parameter	Test Condition	Symbol	Min	Typ	Max	Unit
Collector-emitter breakdown voltage	$V_{GE}=0V, I_c=250\mu A$	BVCES	650	-	-	V
Collector-emitter leakage current	$V_{CE}=650V, V_{GE}=0V$	I_{ces}	-	-	50	μA
Gate leakage current, forward	$V_{GE}=\pm 20V, V_{CE}=0V$	I_{GES}	-	-	± 100	nA
Gate-emitter threshold voltage	$V_{GE}=V_{CE}, I_c=250\mu A$	V_{GE(th)}	5.5	5.8	6.2	V
Collector-emitter saturation voltage	$V_{GE}=15V, I_c=10A, T_{vj}=25^{\circ}\text{C}$	V_{CE(sat)}	-	1.8	-	V
	$V_{GE}=15V, I_c=10A, T_{vj}=150^{\circ}\text{C}$		-	2.1	-	V
Diode forward voltage	$I_F=10A, T_{vj}=25^{\circ}\text{C}$	V_F	-	1.4	-	V
	$I_F=10A, T_{vj}=150^{\circ}\text{C}$		-	1.2	-	V
Input capacitance	$V_{CE}=30V$ $V_{GE}=0V$ $f=1\text{MHz}$	C_{ies}	-	667	-	pF
Output capacitance		C_{oes}	-	35	-	pF
Reverse transfer capacitance		C_{res}	-	9	-	pF
Total gate charge	$V_{CC}=520V, V_{GE}=15V, I_c=10A$	Q_g	-	27	-	nC
Turn-on delay time	$V_{CC}=400V$ $V_{GE}=15V$ $I_c=10A$ $R_G=10\Omega$ Inductive load	td(on)	-	11	-	ns
Rise time		tr	-	9	-	ns
Turn-off delay time		td(off)	-	69	-	ns
Fall time		tf	-	73	-	ns
Turn-on energy		Eon	-	0.18	-	mJ
Turn-off energy		Eoff	-	0.17	-	mJ
Total switching energy		Ets	-	0.35	-	mJ
Turn-on delay time	$V_{CC}=400V$ $V_{GE}=15V$ $I_c=10A, R_G=10\Omega$ Inductive load $T_{vj}=150^{\circ}\text{C}$	td(on)	-	9	-	ns
Rise time		tr	-	11	-	ns
Turn-off delay time		td(off)	-	85	-	ns
Fall time		tf	-	111	-	ns
Turn-on energy		Eon	-	0.21	-	mJ
Turn-off energy		Eoff	-	0.25	-	mJ
Total switching energy		Ets	-	0.46	-	mJ
Diode reverse recovery time	$V_R=400V$ $I_F=10A$ $diF/dt=-750A/\mu s$	trr	-	55	-	ns
Diode peak reverse recovery current		Irrm	-	11	-	A
Diode reverse recovery charge		Qrr	-	409	-	nC
Diode reverse recovery time	$V_R=400V$ $I_F=10A$ $diF/dt=-750A/\mu s, T_{vj}=150^{\circ}\text{C}$	trr	-	117	-	ns
Diode peak reverse recovery current		Irrm	-	11	-	A
Diode reverse recovery charge		Qrr	-	727	-	nC

Ratings and Characteristic Curves

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

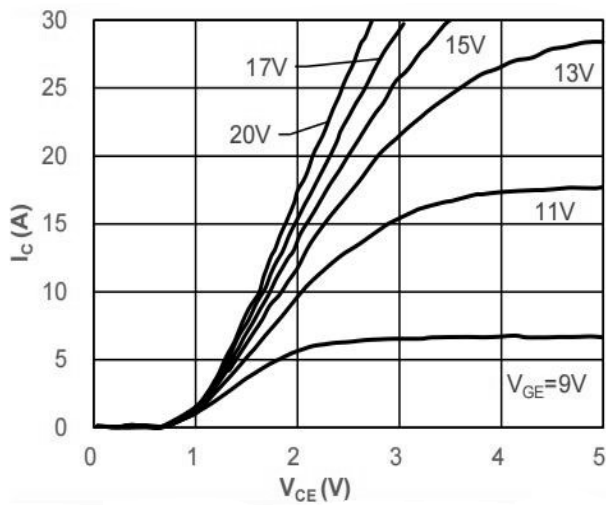


Figure 2 Typical output characteristic($T_{vj}=175^{\circ}\text{C}$)

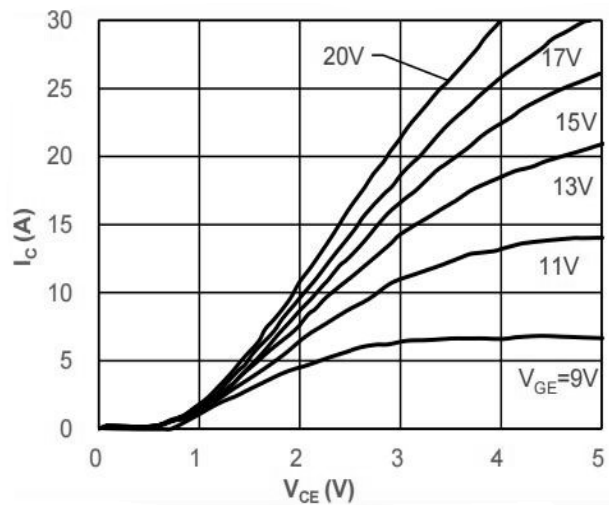


Figure 3 Power dissipation as a function of T_c

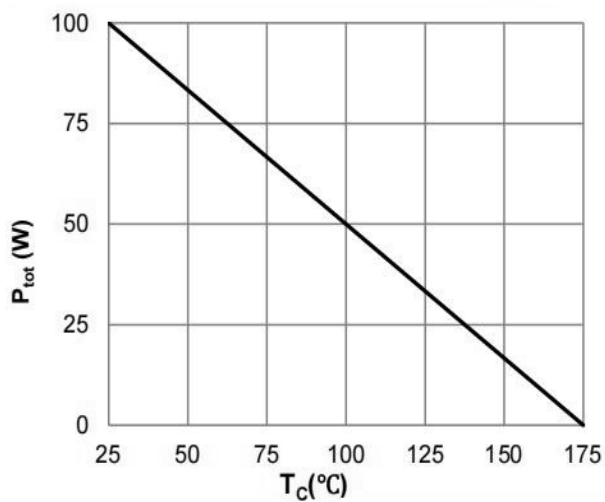


Figure 4 Typical Gate charge

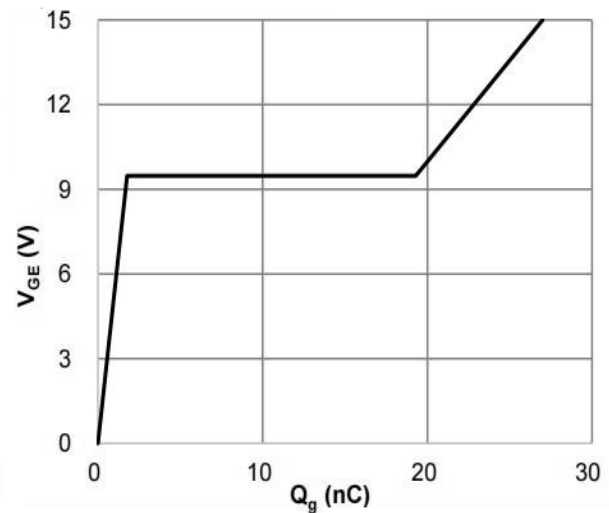


Figure 5 Typical $V_{GE(th)}$ as a function of $T_{vj}(I_c=1\text{mA})$

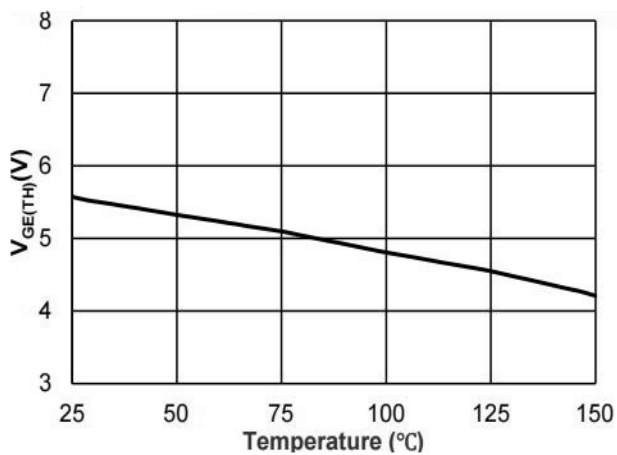


Figure 6 Typical V_F as a function of T_{vj}

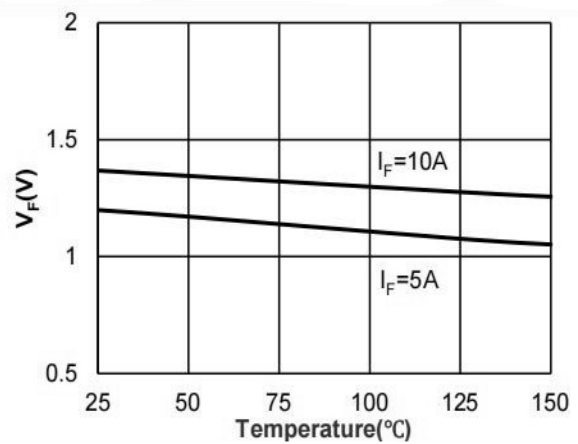


Figure 7 Typical V_{CEsat} as a function of T_{vj}

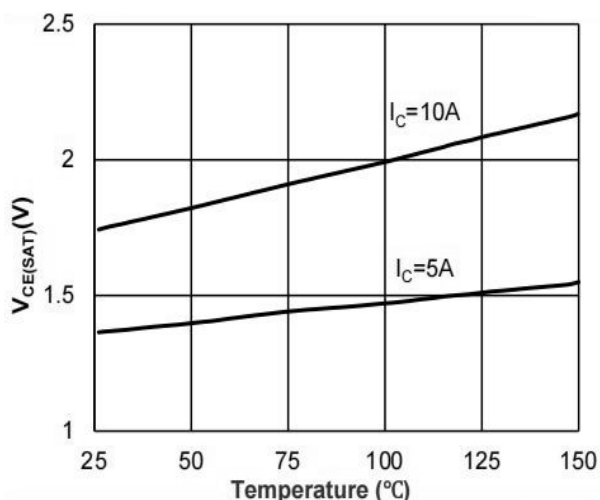


Figure 8 Typical I_F as a function of V_F

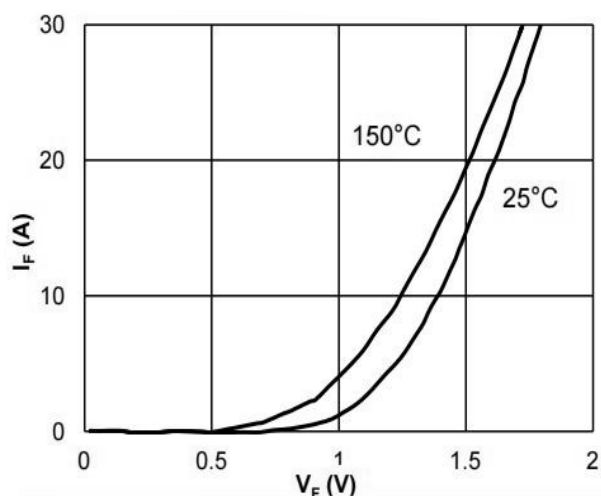


Figure 9 Typical switching time as a function of I_C

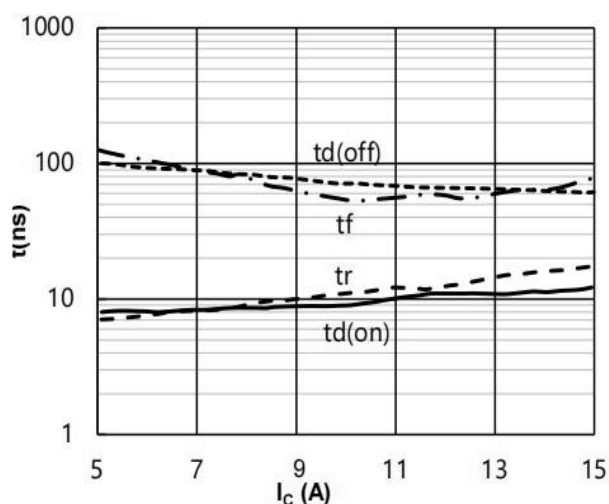


Figure 10 Typical switching time as a function of R_g

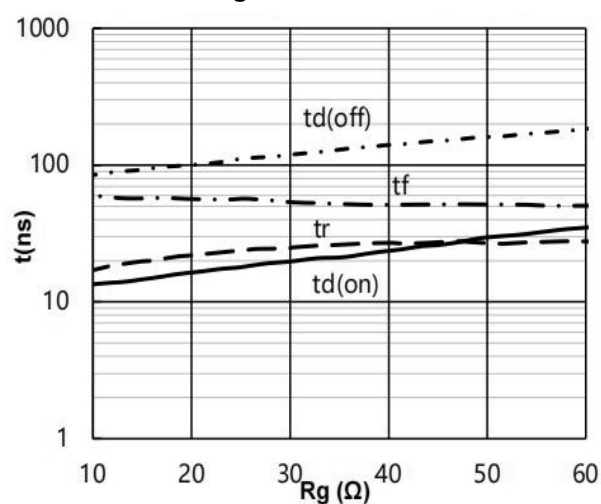


Figure 11 Typical switching energy losses as a function of I_C

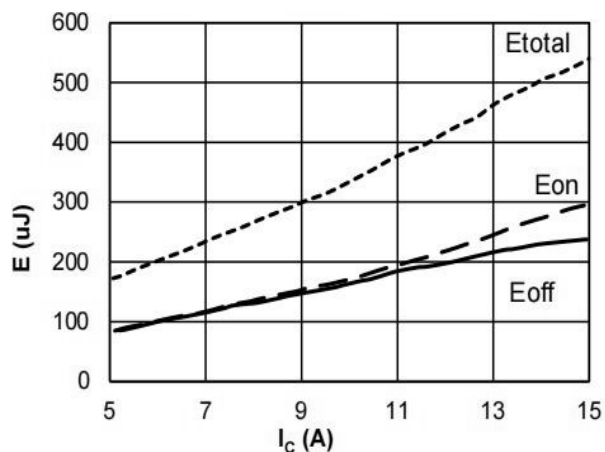
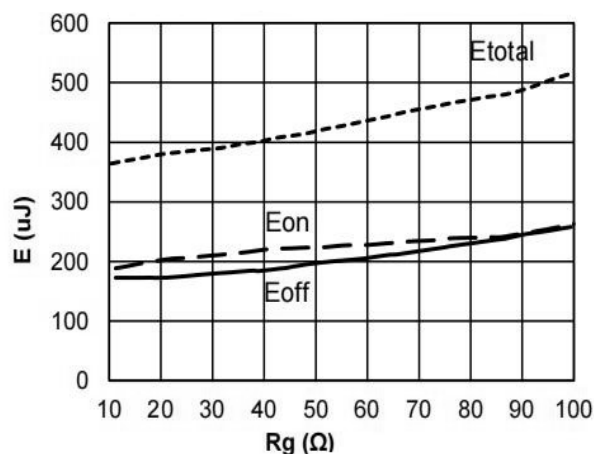
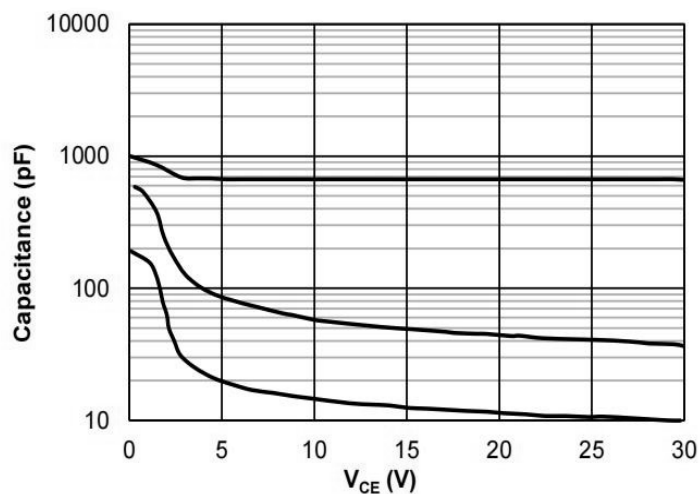


Figure 12 Typical switching energy losses as a function of R_g

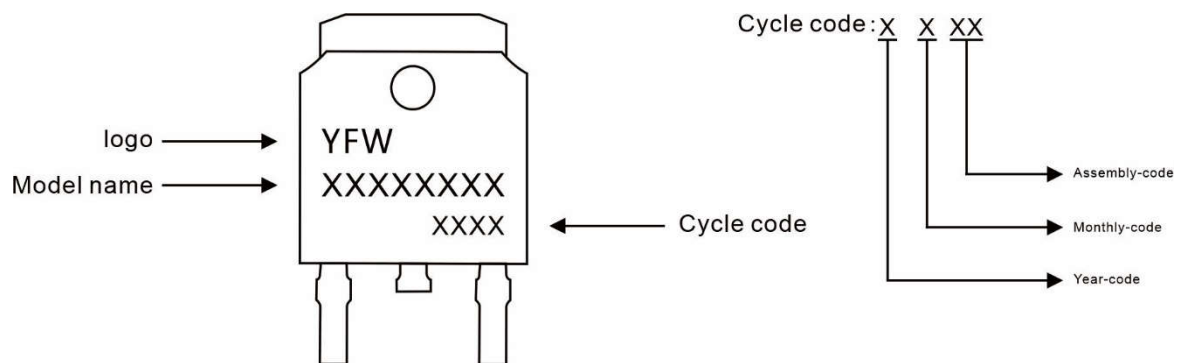


Ratings and Characteristic Curves

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



Marking Diagram



Ordering information

Model name	Package	Unit Weight	Base Quantity	Packing Quantity
YFWG10T65AD	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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