

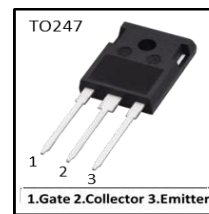
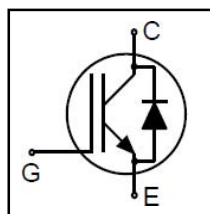
Features

- Ultra-low $V_{CE(sat)}$
- High Surge Current
- High Ruggedness

Product Summary	
V_{CES}	650V
I_C	50A ⁽¹⁾
$V_{CE(sat),typ.}$	1.65V ($T_J = 25^\circ\text{C}$)
Package	TO-247

Applications

- Solar photovoltaic inverters
- Uninterruptible power supplies (UPS)
- Inner IGBTs for NPC inverters
- Neutral-point IGBTs for T-type inverters



Package Marking and Ordering Information

Device	Device Package	Device Marking
YX50N65IGBT	TO-247	YX50N65

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

Symbol	Parameter	Value	Units
V_{CES}	Collector- Emitter Voltage	650	V
V_{GES}	Gate- Emitter Voltage	± 30	V
I_C	Collector Current	100	A
	Collector Current @ $T_C = 100^\circ\text{C}$	50	A
I_{Cpuls}	Pulsed Collector Current , t_p limited by T_{jmax}	200	A
-	Turn off safe operating area , $V_{CE}=650\text{V}$, $T_J=150^\circ\text{C}$	200	A
I_F	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	50	A
I_{FM}	Diode Maximum Forward Current	300	A
P_D	Power Dissipation @ $T_C = 25^\circ\text{C}$	260	W
	Power Dissipation @ $T_C = 100^\circ\text{C}$	135	W
T_J, T_{stg}	Operating Junction and Storage Temperature Range	-55 to + 175	$^\circ\text{C}$
T_L	Maximum Temperature for Soldering	260	$^\circ\text{C}$
t_{sc}	Short circuit withstand time $V_{GE}=15\text{V}$, $V_{CC}\leq 400\text{V}$, Allowed number of short circuits<1000 Time between short circuits: $\geq 1.0\text{s}$, $T_J \leq 150^\circ\text{C}$	5	μs

Thermal Characteristic

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction to case for IGBT	0.48	$^{\circ}\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to case for Diode	1.1	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	$^{\circ}\text{C}/\text{W}$

Electrical Characteristics ($T_c=25^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Value			Units
			Min.	Typ.	Max.	
Static Characteristics						
$V_{(BR)CES}$	Collector- Emitter Breakdown Voltage	$V_{GE}=0\text{V}, I_{CE}=1\text{mA}$	650	--	--	V
I_{CES}	Collector- Emitter Leakage Current	$V_{GE}=0\text{V}, V_{CE}=650\text{V}$	--	--	40	μA
$I_{GES(F)}$	Gate to Emitter Forward Leakage	$V_{GE}=+20\text{V}, V_{CE}=0\text{V}$	--	--	100	nA
$I_{GES(R)}$	Gate to Emitter Reverse Leakage	$V_{GE}=-20\text{V}, V_{CE}=0\text{V}$	--	--	100	nA
$V_{CE(sat)}$	Collector- Emitter Saturation Voltage	$I_C=50\text{A}$ $T_J=25^{\circ}\text{C}$	--	1.65	2.0	V
		$V_{GE}=15\text{V}$ $T_J=150^{\circ}\text{C}$	--	2.05	--	V
$V_{GE(th)}$	Gate Threshold Voltage	$I_C=1\text{mA}, V_{CE}=V_{GE}$	4.0	5.0	6.0	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	$V_{CE}=30\text{V}, V_{GE}=0\text{V},$ $f=1\text{MHz}$	--	3800	--	PF
C_{oes}	Output Capacitance		--	130	--	
C_{res}	Reverse Transfer Capacitance		--	70	--	
Q_g	Total Gate Charge	$V_{CC}=520\text{V}, I_C=50\text{A},$ $V_{GE}=15\text{V}$	--	162	--	nC
Q_{ge}	Gate to Emitter Charge		--	--	--	
Q_{gc}	Gate to Collector Charge		--	--	--	
$I_{C(SC)}$	Short circuit collector current Max. 1000 short circuits Time between short circuits: $\geq 1.0\text{s}$	$V_{GE}=15\text{V}, V_{CC}\leq 400\text{V},$ $t_{SC}\leq 5\mu\text{s}, T_J\leq 150^{\circ}\text{C}$	--	200	--	A
Switching Characteristics						
$t_{d(ON)}$	Turn-on Delay Time	$V_{CC}=400\text{V}, I_C=50\text{A},$ $V_{GE}=0/15\text{V}, R_g=5\Omega,$ Inductive Load	--	60	--	ns
t_r	Rise Time		--	60	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	172	--	
t_f	Fall Time		--	90	--	mJ
E_{on}	Turn-On Switching Loss		--	2.35	--	
E_{off}	Turn-Off Switching Loss		--	0.82	--	
E_{ts}	Total Switching Loss		--	--	--	

Electrical Characteristics of the Diode ($T_c=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Rating			Units
			Min.	Typ.	Max.	
V_{FM}	Diode Forward Voltage	$I_F=50\text{A}$	--	1.65	2.0	V
T_{rr}	Reverse Recovery Time	$I_F=50\text{A},$ $di/dt=200\text{A}/\mu\text{s}$	--	194	--	ns
I_{RRM}	Diode Peak Reverse Recovery Current		--	2.8	--	A
Q_{rr}	Reverse Recovery Charge		--	0.2	--	μC
Pulse width $t_p\leq 380\mu\text{s}, \delta\leq 2\%$						

Electrical Characteristics Graphs

Fig. 1 FBSOA characteristics

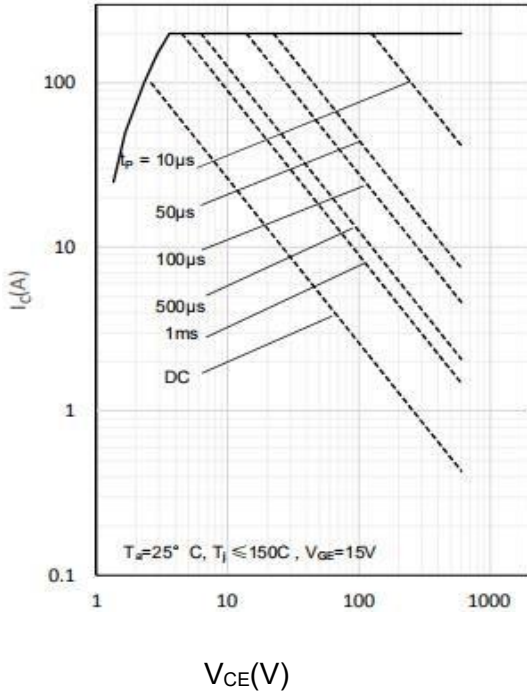


Fig. 2 Power dissipation as a function of T_c

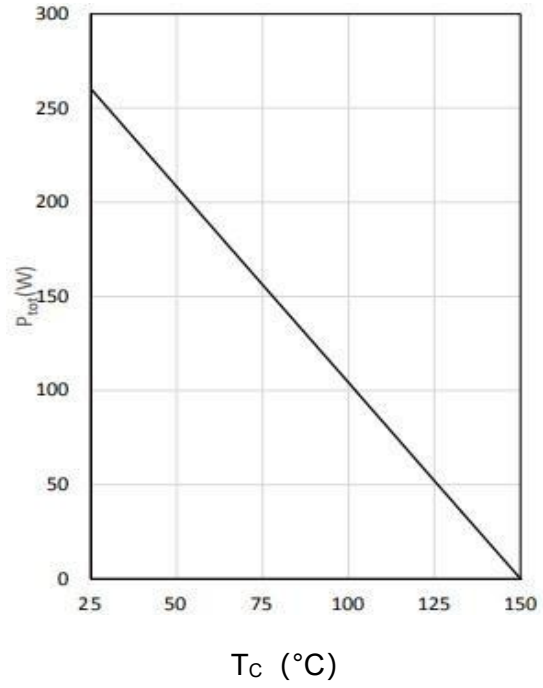


Fig. 3 Output characteristics

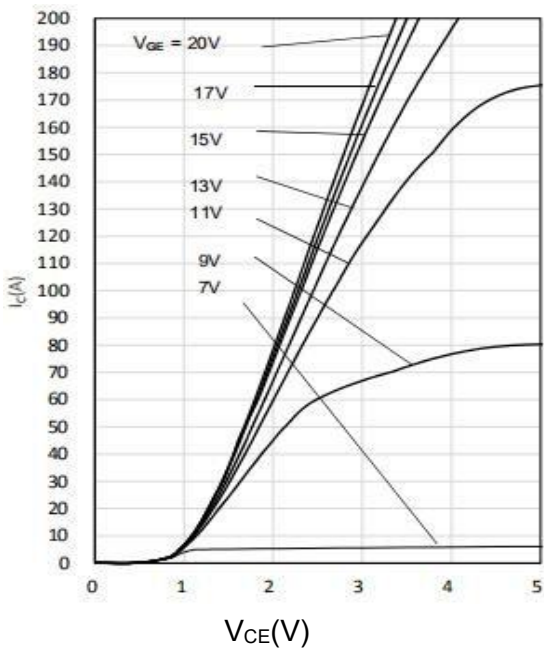


Fig. 4 Saturation voltage characteristics

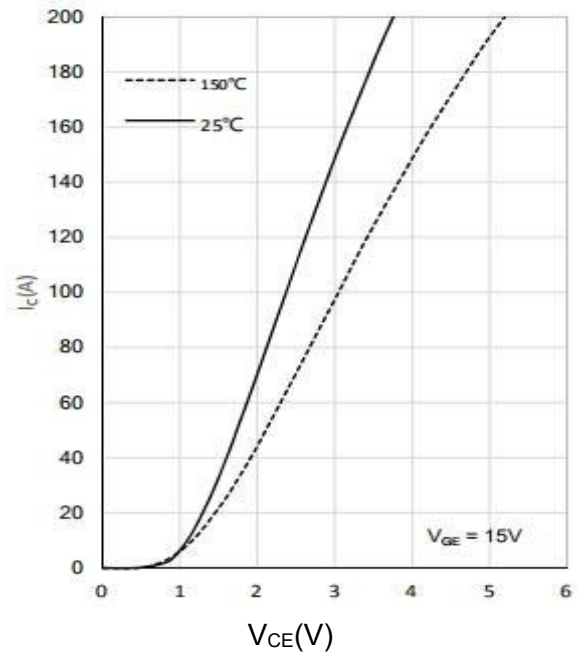


Fig. 5 Switching times vs. gate resistor

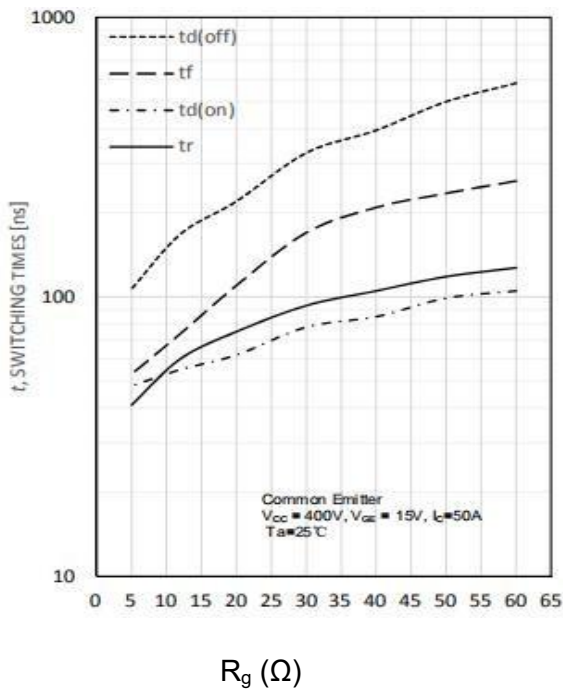


Fig. 6 Switching times vs. collector current

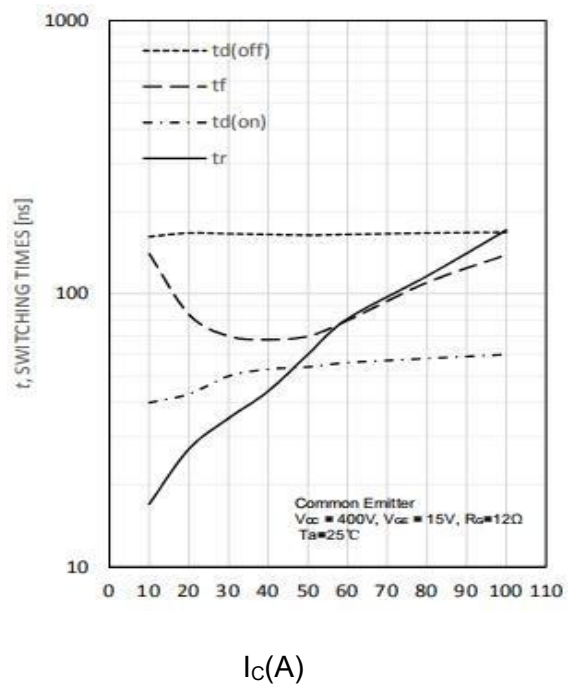


Fig. 7 Switching loss vs. gate resistor

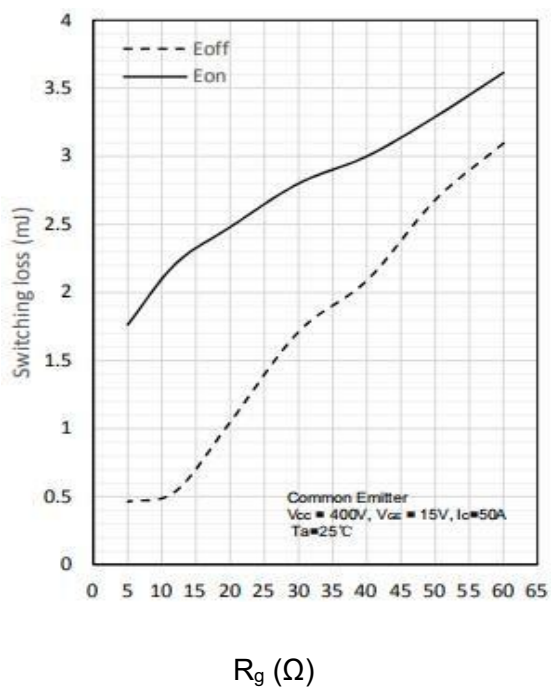


Fig. 8 Switching loss vs. collector current

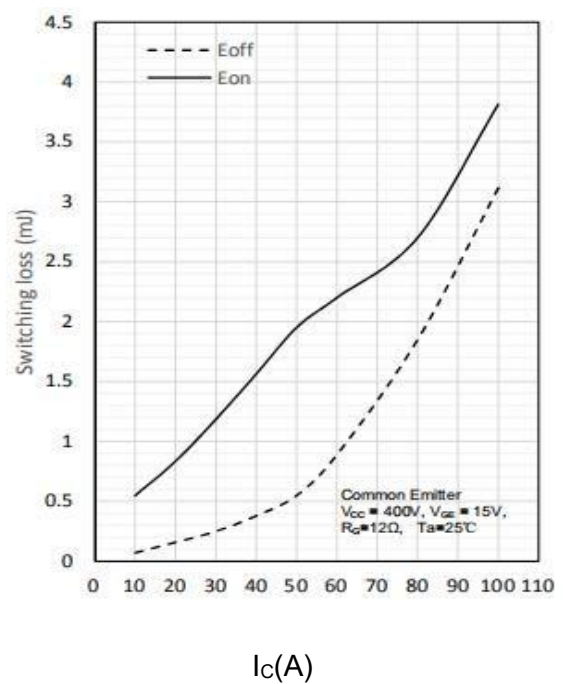


Fig. 9 Gate charge characteristics

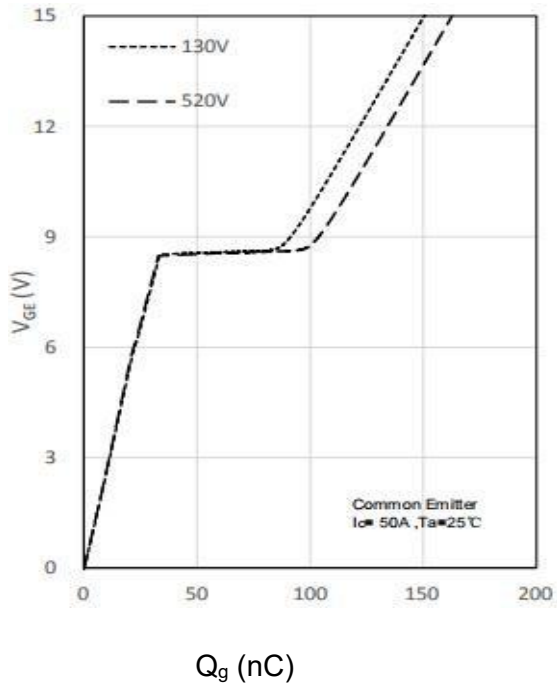
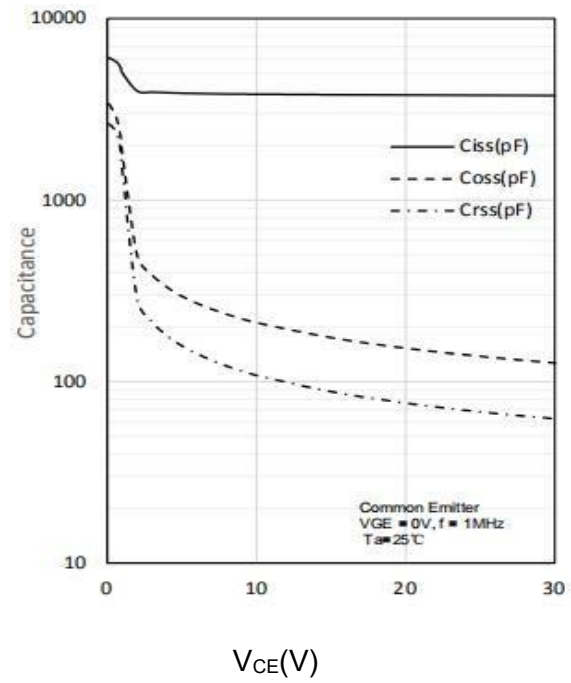
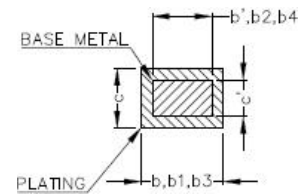
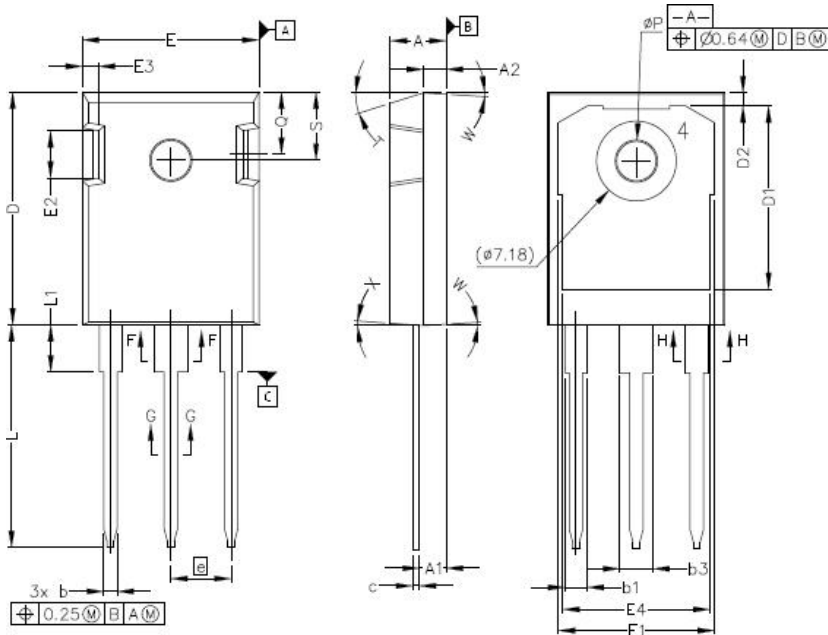


Fig. 10 Capacitance characteristics



Package Drawing



SYM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	.190	.205
A1	2.29	2.54	.090	.100
A2	1.91	2.16	.075	.085
b'	1.07	1.28	.042	.050
b	1.07	1.33	.042	.052
b1	1.91	2.41	.075	.095
b2	1.91	2.16	.075	.085
b3	2.87	3.38	.113	.133
b4	2.87	3.13	.113	.123
c'	0.55	0.65	.022	.026
c	0.55	0.68	.022	.027
D	20.80	21.10	.819	.831
D1	16.25	17.65	.640	.695
D2	0.95	1.25	.037	.049
E	15.75	16.13	.620	.635
E1	13.10	14.15	.516	.557
E2	3.68	5.10	.145	.201
E3	1.00	1.90	.039	.075
E4	12.38	13.43	.487	.529
e	5.44 BSC		.214 BSC	
N	3		3	
L	19.81	20.32	C _{ies}	.780
L1	4.10	4.40		.161
φP	3.51	3.65	.138	.144
Q	5.49	6.00	.216	.236
S	6.04	6.30	.238	.248
T	17.5° REF.			
W	3.5° REF.			
X	4° REF.			