

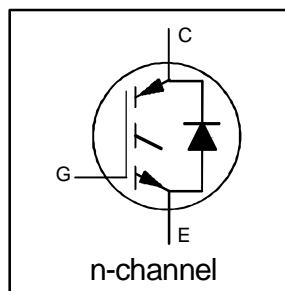
INSULATED GATE BIPOLAR TRANSISTOR  
WITH ULTRAFAST SOFT RECOVERY

UltraFast CoPack IGBT

DIODE

**Features**

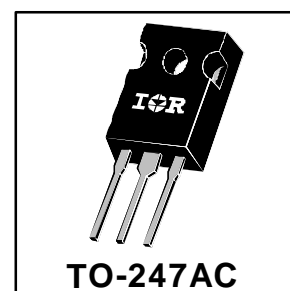
- Switching-loss rating includes all "tail" losses
- HEXFRED™ soft ultrafast diodes
- Optimized for high operating frequency (over 5kHz)



$V_{CES} = 500V$
$V_{CE(sat)} \leq 3.2V$
@ $V_{GE} = 15V, I_C = 33A$

**Description**

Co-packaged IGBTs are a natural extension of International Rectifier's well known IGBT line. They provide the convenience of an IGBT and an ultrafast recovery diode in one package, resulting in substantial benefits to a host of high-voltage, high-current, motor control, UPS and power supply applications.



**Absolute Maximum Ratings**

	Parameter	Max.	Units
$V_{CES}$	Collector-to-Emitter Voltage	500	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	59	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	33	
$I_{CM}$	Pulsed Collector Current ①	120	
$I_{LM}$	Clamped Inductive Load Current ②	120	
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	29	
$I_{FM}$	Diode Maximum Forward Current	120	
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	V
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	200	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	78	
$T_J$	Operating Junction and	-55 to +150	°C
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	
	Mounting Torque, 6-32 or M3 Screw.	10 lbf•in (1.1 N•m)	

**Thermal Resistance**

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case - IGBT	—	—	0.64	°C/W
$R_{\theta JC}$	Junction-to-Case - Diode	—	—	0.83	
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	—	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	—	40	
Wt	Weight	—	6 (0.21)	—	g (oz)

# IRGP450UD2



## Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)CES</sub>	Collector-to-Emitter Breakdown Voltage ③	500	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA
ΔV <sub>(BR)CES</sub> /ΔT <sub>J</sub>	Temperature Coeff. of Breakdown Voltage	—	0.41	—	V/°C	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1.0mA
V <sub>CE(on)</sub>	Collector-to-Emitter Saturation Voltage	—	2.1	3.2	V	I <sub>C</sub> = 33A, V <sub>GE</sub> = 15V I <sub>C</sub> = 59A I <sub>C</sub> = 33A, T <sub>J</sub> = 150°C
		—	2.6	—		
		—	2.1	—		
V <sub>GE(th)</sub>	Gate Threshold Voltage	3.0	—	5.5		V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA
ΔV <sub>GE(th)</sub> /ΔT <sub>J</sub>	Temperature Coeff. of Threshold Voltage	—	-10	—	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA
g <sub>fe</sub>	Forward Transconductance ④	7.0	22	—	S	V <sub>CE</sub> = 100V, I <sub>C</sub> = 33A
I <sub>CES</sub>	Zero Gate Voltage Collector Current	—	—	250	μA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 500V
		—	—	6500		V <sub>GE</sub> = 0V, V <sub>CE</sub> = 500V, T <sub>J</sub> = 150°C
V <sub>FM</sub>	Diode Forward Voltage Drop	—	1.3	1.7	V	I <sub>C</sub> = 25A
		—	1.2	1.5		I <sub>C</sub> = 25A, T <sub>J</sub> = 150°C
I <sub>GES</sub>	Gate-to-Emitter Leakage Current	—	—	±100	nA	V <sub>GE</sub> = ±20V

## Switching Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	Total Gate Charge (turn-on)	—	120	180	nC	I <sub>C</sub> = 33A V <sub>CC</sub> = 400V
Q <sub>ge</sub>	Gate - Emitter Charge (turn-on)	—	22	33		
Q <sub>gc</sub>	Gate - Collector Charge (turn-on)	—	41	62		
t <sub>d(on)</sub>	Turn-On Delay Time	—	33	—	ns	T <sub>J</sub> = 25°C I <sub>C</sub> = 33A, V <sub>CC</sub> = 400V V <sub>GE</sub> = 15V, R <sub>G</sub> = 5.0Ω Energy losses include "tail" and diode reverse recovery.
t <sub>r</sub>	Rise Time	—	26	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	110	170		
t <sub>f</sub>	Fall Time	—	91	140		
E <sub>on</sub>	Turn-On Switching Loss	—	0.91	—		
E <sub>off</sub>	Turn-Off Switching Loss	—	0.25	—	mJ	
E <sub>ts</sub>	Total Switching Loss	—	1.2	1.7		
t <sub>d(on)</sub>	Turn-On Delay Time	—	37	—	ns	T <sub>J</sub> = 150°C, I <sub>C</sub> = 33A, V <sub>CC</sub> = 400V V <sub>GE</sub> = 15V, R <sub>G</sub> = 5.0Ω Energy losses include "tail" and diode reverse recovery.
t <sub>r</sub>	Rise Time	—	29	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	160	—		
t <sub>f</sub>	Fall Time	—	110	—		
E <sub>ts</sub>	Total Switching Loss	—	1.8	—		
L <sub>E</sub>	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C <sub>ies</sub>	Input Capacitance	—	2700	—	pF	V <sub>GE</sub> = 0V V <sub>CC</sub> = 30V f = 1.0MHz
C <sub>oes</sub>	Output Capacitance	—	280	—		
C <sub>res</sub>	Reverse Transfer Capacitance	—	34	—		
t <sub>rr</sub>	Diode Reverse Recovery Time	—	50	75	ns	T <sub>J</sub> = 25°C
		—	105	160		T <sub>J</sub> = 125°C
I <sub>rr</sub>	Diode Peak Reverse Recovery Current	—	4.5	10	A	T <sub>J</sub> = 25°C
		—	8.0	15		T <sub>J</sub> = 125°C
Q <sub>rr</sub>	Diode Reverse Recovery Charge	—	112	375	nC	T <sub>J</sub> = 25°C
		—	420	1200		T <sub>J</sub> = 125°C
di <sub>(rec)</sub> M/dt	Diode Peak Rate of Fall of Recovery During t <sub>b</sub>	—	250	—	A/μs	T <sub>J</sub> = 25°C
		—	160	—		T <sub>J</sub> = 125°C

Notes: ① Repetitive rating; V<sub>GE</sub>=20V, pulse width limited by max. junction temperature. ( See fig. 20 )

② V<sub>CC</sub>=80%(V<sub>CES</sub>), V<sub>GE</sub>=20V, L=10μH, R<sub>G</sub>= 5.0Ω, ( See fig. 19 )

④ Pulse width 5.0μs, single shot.

③ Pulse width ≤ 80μs; duty factor ≤ 0.1%.

Refer to Section D - page D-13 for Package Outline 3 - JEDEC Outline TO-247AC

