

# IRG4BC20UDPbF

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST  
SOFT RECOVERY DIODE

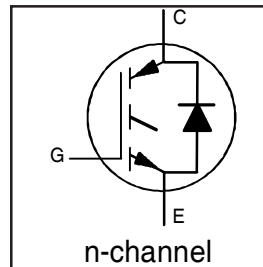
UltraFast CoPack IGBT

## Features

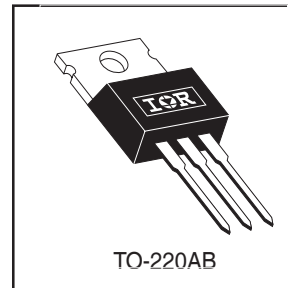
- UltraFast: optimized for high operating frequencies 8-40 kHz in hard switching, >200 kHz in resonant mode
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than Generation 3
- IGBT co-packaged with HEXFRED® ultrafast, ultra-soft-recovery anti-parallel diodes for use in bridge configurations
- Industry standard TO-220AB package
- Lead-Free

## Benefits

- Generation -4 IGBTs offer highest efficiencies available
- IGBTs optimized for specific application conditions
- HEXFRED diodes optimized for performance with IGBTs. Minimized recovery characteristics require less/no snubbing
- Designed to be a "drop-in" replacement for equivalent industry-standard Generation 3 IR IGBTs



$V_{CES} = 600V$
$V_{CE(on) typ.} = 1.85V$
@ $V_{GE} = 15V, I_C = 6.5A$



## Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{CES}$	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	13	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	6.5	
$I_{CM}$	Pulsed Collector Current ①	52	
$I_{LM}$	Clamped Inductive Load Current ②	52	
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	7.0	
$I_{FM}$	Diode Maximum Forward Current	52	
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	V
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	60	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	24	
$T_J$	Operating Junction and Storage Temperature Range	-55 to +150	$^\circ C$
$T_{STG}$			
	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	-----	-----	2.1	$^\circ C/W$
$R_{\theta JC}$	Junction-to-Case - Diode	-----	-----	3.5	
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	-----	0.50	-----	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	-----	-----	80	
Wt	Weight	-----	2 (0.07)	-----	g (oz)

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## 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 <sup>③</sup>	600	----	----	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	----	0.69	----	V/°C	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1.0mA
V <sub>CE(on)</sub>	Collector-to-Emitter Saturation Voltage	----	1.85	2.1	V	I <sub>C</sub> = 6.5A V <sub>GE</sub> = 15V
		----	2.27	----		I <sub>C</sub> = 13A See Fig. 2, 5
		----	1.87	----		I <sub>C</sub> = 6.5A, T <sub>J</sub> = 150°C
V <sub>GE(th)</sub>	Gate Threshold Voltage	3.0	----	6.0		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	----	-11	----	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA
g <sub>fe</sub>	Forward Transconductance <sup>④</sup>	1.4	4.3	----	S	V <sub>CE</sub> = 100V, I <sub>C</sub> = 6.5A
I <sub>CES</sub>	Zero Gate Voltage Collector Current	----	----	250	μA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V
		----	----	1700		V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V, T <sub>J</sub> = 150°C
V <sub>FM</sub>	Diode Forward Voltage Drop	----	1.4	1.7	V	I <sub>C</sub> = 8.0A See Fig. 13
		----	1.3	1.6		I <sub>C</sub> = 8.0A, 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)

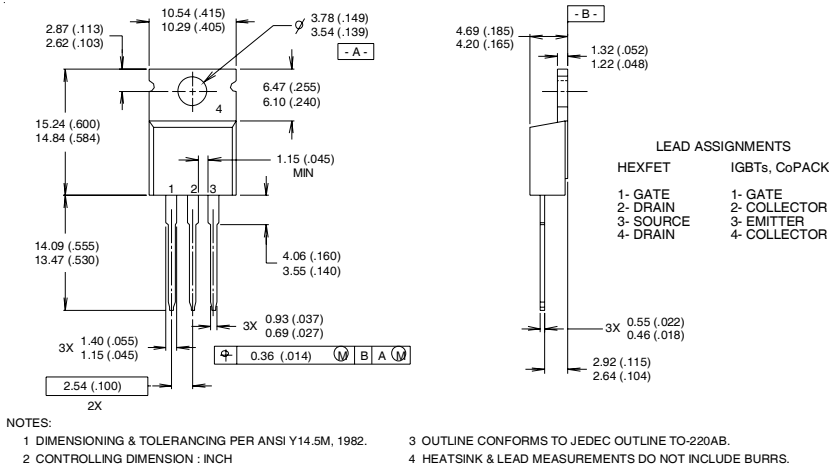
	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	Total Gate Charge (turn-on)	----	27	41	nC	I <sub>C</sub> = 6.5A
Q <sub>ge</sub>	Gate - Emitter Charge (turn-on)	----	4.5	6.8		V <sub>CC</sub> = 400V See Fig. 8
Q <sub>gc</sub>	Gate - Collector Charge (turn-on)	----	10	16		V <sub>GE</sub> = 15V
t <sub>d(on)</sub>	Turn-On Delay Time	----	39	----	ns	T <sub>J</sub> = 25°C
t <sub>r</sub>	Rise Time	----	15	----		I <sub>C</sub> = 6.5A, V <sub>CC</sub> = 480V
t <sub>d(off)</sub>	Turn-Off Delay Time	----	93	140		V <sub>GE</sub> = 15V, R <sub>G</sub> = 50Ω
t <sub>f</sub>	Fall Time	----	110	170		Energy losses include "tail" and diode reverse recovery.
E <sub>on</sub>	Turn-On Switching Loss	----	0.16	----	mJ	See Fig. 9, 10, 11, 18
E <sub>off</sub>	Turn-Off Switching Loss	----	0.13	----		
E <sub>ts</sub>	Total Switching Loss	----	0.29	0.3		
t <sub>d(on)</sub>	Turn-On Delay Time	----	38	----	ns	T <sub>J</sub> = 150°C, See Fig. 9, 10, 11, 18
t <sub>r</sub>	Rise Time	----	17	----		I <sub>C</sub> = 6.5A, V <sub>CC</sub> = 480V
t <sub>d(off)</sub>	Turn-Off Delay Time	----	100	----		V <sub>GE</sub> = 15V, R <sub>G</sub> = 50Ω
t <sub>f</sub>	Fall Time	----	220	----		Energy losses include "tail" and diode reverse recovery.
E <sub>ts</sub>	Total Switching Loss	----	0.49	----	mJ	
L <sub>E</sub>	Internal Emitter Inductance	----	7.5	----	nH	Measured 5mm from package
C <sub>ies</sub>	Input Capacitance	----	530	----	pF	V <sub>GE</sub> = 0V
C <sub>oes</sub>	Output Capacitance	----	39	----		V <sub>CC</sub> = 30V See Fig. 7
C <sub>res</sub>	Reverse Transfer Capacitance	----	7.4	----		f = 1.0MHz
t <sub>rr</sub>	Diode Reverse Recovery Time	----	37	55	ns	T <sub>J</sub> = 25°C See Fig. 14
		----	55	90		T <sub>J</sub> = 125°C
I <sub>rr</sub>	Diode Peak Reverse Recovery Current	----	3.5	5.0	A	T <sub>J</sub> = 25°C See Fig. 15
		----	4.5	8.0		T <sub>J</sub> = 125°C
Q <sub>rr</sub>	Diode Reverse Recovery Charge	----	65	138	nC	T <sub>J</sub> = 25°C See Fig. 16
		----	124	360		T <sub>J</sub> = 125°C
di <sub>(rec)M</sub> /dt	Diode Peak Rate of Fall of Recovery During t <sub>b</sub>	----	240	----	A/μs	T <sub>J</sub> = 25°C See Fig. 17
		----	210	----		T <sub>J</sub> = 125°C

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## Notes:

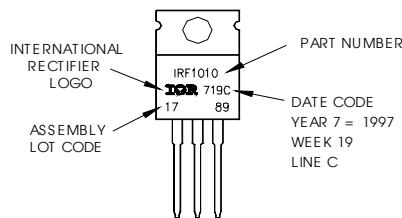
- ① Repetitive rating:  $V_{GE}=20V$ ; pulse width limited by maximum junction temperature (figure 20)
- ②  $V_{CC}=80\%(V_{CES})$ ,  $V_{GE}=20V$ ,  $L=10\mu H$ ,  $R_G=50\Omega$  (figure 19)
- ③ Pulse width  $\leq 80\mu s$ ; duty factor  $\leq 0.1\%$ .
- ④ Pulse width 5.0 $\mu s$ , single shot.

## TO-220AB Package Outline



## TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010  
 LOT CODE 1789  
 ASSEMBLED ON WW 19, 1997  
 IN THE ASSEMBLY LINE "C"  
**Note:** "P" in assembly line position indicates "Lead-Free"



Data and specifications subject to change without notice.