PD -95190

International
IOR Rectifier

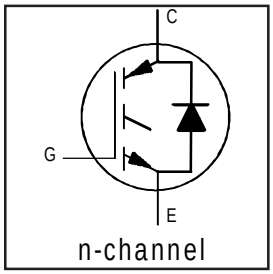
IRG4PH50UDPbF

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

UltraFast CoPack IGBT

Features

- UltraFast: Optimized for high operating frequencies up to 40 kHz in hard switching, >200 kHz in resonant mode
- New IGBT design provides tighter parameter distribution and higher efficiency than previous generations
- IGBT co-packaged with HEXFRED™ ultrafast, ultra-soft-recovery anti-parallel diodes for use in bridge configurations
- Industry standard TO-247AC package
- Lead-Free

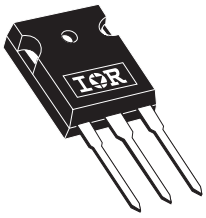


n-channel

V_{CES} = 1200V

$V_{CE(on)\ typ.}$ = 2.78V

@V_{GE} = 15V, I_C = 24A



TO-247AC

Benefits

- Higher switching frequency capability than competitive IGBTs
- Highest efficiency available
- HEXFRED diodes optimized for performance with IGBT's . Minimized recovery characteristics require less/no snubbing

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	1200	V
I_C @ T_C = 25°C	Continuous Collector Current	45	A
I_C @ T_C = 100°C	Continuous Collector Current	24	
I_{CM}	Pulsed Collector Current ①	180	
I_{LM}	Clamped Inductive Load Current ②	180	
I_F @ T_C = 100°C	Diode Continuous Forward Current	16	
I_{FM}	Diode Maximum Forward Current	180	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
P_D @ T_C = 25°C	Maximum Power Dissipation	200	W
P_D @ T_C = 100°C	Maximum Power Dissipation	78	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Soldering Temperature, for 10 seconds	300 (0.063 in. (1.6mm) from case)	
	Mounting torque, 6-32 or M3 screw.	10 lbf•in (1.1N•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)

04/26/04

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage③	1200	—	—	V	V_{GE} = 0V, I_C = 250µA
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	1.20	—	V/°C	V_{GE} = 0V, I_C = 1.0mA
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	2.56	3.5	V	I_C = 20A V_{GE} = 15V
		—	2.78	3.7		I_C = 24A
		—	3.20	—		I_C = 45A See Fig. 2, 5
		—	2.54	—		I_C = 24A, T_J = 150°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		V_{CE} = V_{GE}, I_C = 250µA
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-13	—	mV/°C	V_{CE} = V_{GE}, I_C = 250µA
g_{fe}	Forward Transconductance ④	23	35	—	S	V_{CE} = 100V, I_C = 24A
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	V_{GE} = 0V, V_{CE} = 1200V
		—	—	6500		V_{GE} = 0V, V_{CE} = 1200V, T_J = 150°C
V_{FM}	Diode Forward Voltage Drop	—	2.5	3.5	V	I_C = 16A See Fig. 13
		—	2.1	3.0		I_C = 16A, T_J = 150°C
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V_{GE} = ±20V

Switching Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	160	250	nC	I_C = 24A
Qge	Gate - Emitter Charge (turn-on)	—	27	40		V_{CC} = 400V See Fig. 8
Q_{gc}	Gate - Collector Charge (turn-on)	—	53	80		V_{GE} = 15V
$t_{d(on)}$	Turn-On Delay Time	—	47	—	ns	T_J = 25°C
t_r	Rise Time	—	24	—		I_C = 24A, V_{CC} = 800V
$t_{d(off)}$	Turn-Off Delay Time	—	110	170		V_{GE} = 15V, R_G = 5.0Ω
t_f	Fall Time	—	180	260		Energy losses include "tail" and
E_{on}	Turn-On Switching Loss	—	2.10	—	mJ	diode reverse recovery.
E_{off}	Turn-Off Switching Loss	—	1.50	—		See Fig. 9, 10, 18
E_{ts}	Total Switching Loss	—	3.60	4.6		
$t_{d(on)}$	Turn-On Delay Time	—	46	—	ns	T_J = 150°C, See Fig. 11, 18
t_r	Rise Time	—	27	—		I_C = 24A, V_{CC} = 800V
$t_{d(off)}$	Turn-Off Delay Time	—	240	—		V_{GE} = 15V, R_G = 5.0Ω
t_f	Fall Time	—	330	—		Energy losses include "tail" and
E_{ts}	Total Switching Loss	—	6.38	—	mJ	diode reverse recovery.
L_E	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	3600	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	160	—		V_{CC} = 30V See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	31	—		f = 1.0MHz
t_{rr}	Diode Reverse Recovery Time	—	90	135	ns	T_J = 25°C See Fig.
		—	164	245		T_J = 125°C 14 I_F = 16A
I_{rr}	Diode Peak Reverse Recovery Current	—	5.8	10	A	T_J = 25°C See Fig.
		—	8.3	15		T_J = 125°C 15 V_R = 200V
Q_{rr}	Diode Reverse Recovery Charge	—	260	675	nC	T_J = 25°C See Fig.
		—	680	1838		T_J = 125°C 16 di/dt = 200A/µs
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery	—	120	—	A/µs	T_J = 25°C See Fig.
	During t_b	—	76	—		T_J = 125°C 17

Note: For the most current drawings please refer to the IR website at:
http://www.irf.com/package/