

IRG7PH35UDPbF IRG7PH35UD-EP

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

Features

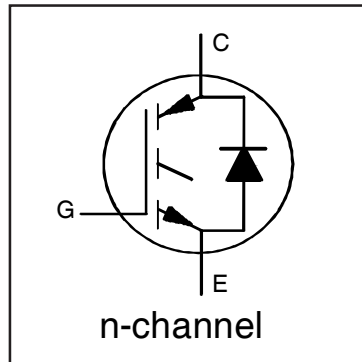
- Low $V_{CE(ON)}$ trench IGBT technology
- Low switching losses
- Square RBSOA
- 100% of the parts tested for I_{LM} ①
- Positive $V_{CE(ON)}$ temperature co-efficient
- Ultra fast soft recovery co-pak diode
- Tight parameter distribution
- Lead-Free

Benefits

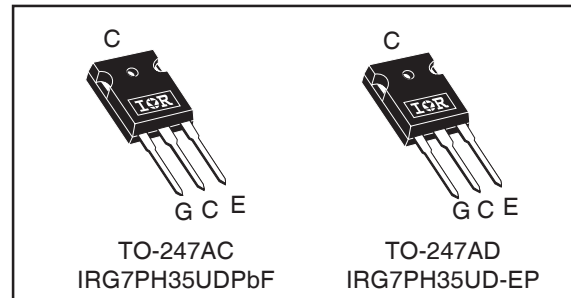
- High efficiency in a wide range of applications
- Suitable for a wide range of switching frequencies due to low $V_{CE(ON)}$ and low switching losses
- Rugged transient performance for increased reliability
- Excellent current sharing in parallel operation

Applications

- U.P.S.
- Welding
- Solar Inverter
- Induction Heating



$V_{CES} = 1200V$
$I_{NOMINAL} = 20A$
$T_{J(max)} = 150^{\circ}C$
$V_{CE(on)} \text{ typ.} = 1.9V$



G	C	E
Gate	Collector	Emitter

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
$I_C @ T_C = 25^{\circ}C$	Continuous Collector Current	50	A
$I_C @ T_C = 100^{\circ}C$	Continuous Collector Current	25	
$I_{NOMINAL}$	Nominal Current	20	
I_{CM}	Pulse Collector Current, $V_{GE}=15V$	60	
I_{LM}	Clamped Inductive Load Current, $V_{GE}=20V$ ①	80	
$I_F @ T_C = 25^{\circ}C$	Diode Continuous Forward Current	50	
$I_F @ T_C = 100^{\circ}C$	Diode Continuous Forward Current	25	
I_{FM}	Diode Maximum Forward Current ②	80	
V_{GE}	Continuous Gate-to-Emitter Voltage	± 30	V
$P_D @ T_C = 25^{\circ}C$	Maximum Power Dissipation	180	W
$P_D @ T_C = 100^{\circ}C$	Maximum Power Dissipation	70	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	$^{\circ}C$
	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
$R_{\theta JC}$ (IGBT)	Thermal Resistance Junction-to-Case-(each IGBT) ③	—	—	0.70	$^{\circ}C/W$
$R_{\theta JC}$ (Diode)	Thermal Resistance Junction-to-Case-(each Diode)	—	—	0.65	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink (flat, greased surface)	—	0.24	—	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (typical socket mount)	—	40	—	

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	$V_{GE} = 0V, I_C = 250\mu A$ ③
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	1.2	—	V/°C	$V_{GE} = 0V, I_C = 1mA$ (25°C-150°C)
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.9	2.2	V	$I_C = 20A, V_{GE} = 15V, T_J = 25^\circ\text{C}$
		—	2.3	—		$I_C = 20A, V_{GE} = 15V, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0	V	$V_{CE} = V_{GE}, I_C = 600\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-16	—	mV/°C	$V_{CE} = V_{GE}, I_C = 600\mu A$ (25°C - 150°C)
g_{fe}	Forward Transconductance	—	22	—	S	$V_{CE} = 50V, I_C = 20A, PW = 30\mu s$
I_{CES}	Collector-to-Emitter Leakage Current	—	2.0	100	μA	$V_{GE} = 0V, V_{CE} = 1200V$
		—	2000	—		$V_{GE} = 0V, V_{CE} = 1200V, T_J = 150^\circ\text{C}$
V_{FM}	Diode Forward Voltage Drop	—	2.8	3.6	V	$I_F = 20A$
		—	2.5	—		$I_F = 20A, T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{GE} = \pm 30V$

Switching Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	85	130	nC	$I_C = 20A$ $V_{GE} = 15V$ $V_{CC} = 600V$
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	15	20		
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	35	50		
E_{on}	Turn-On Switching Loss	—	1060	1300	μJ	$I_C = 20A, V_{CC} = 600V, V_{GE} = 15V$ $R_G = 10\Omega, L = 200\mu H, L_S = 150nH, T_J = 25^\circ\text{C}$ Energy losses include tail & diode reverse recovery
E_{off}	Turn-Off Switching Loss	—	620	850		
E_{total}	Total Switching Loss	—	1680	2150		
$t_{d(on)}$	Turn-On delay time	—	30	50	ns	$I_C = 20A, V_{CC} = 600V, V_{GE} = 15V$ $R_G = 10\Omega, L = 200\mu H, L_S = 150nH, T_J = 25^\circ\text{C}$
t_r	Rise time	—	15	30		
$t_{d(off)}$	Turn-Off delay time	—	160	180		
t_f	Fall time	—	80	105		
E_{on}	Turn-On Switching Loss	—	1750	—	μJ	$I_C = 20A, V_{CC} = 600V, V_{GE} = 15V$ $R_G = 10\Omega, L = 200\mu H, L_S = 150nH, T_J = 150^\circ\text{C}$ ③ Energy losses include tail & diode reverse recovery
E_{off}	Turn-Off Switching Loss	—	1120	—		
E_{total}	Total Switching Loss	—	2870	—		
$t_{d(on)}$	Turn-On delay time	—	30	—	ns	$I_C = 20A, V_{CC} = 600V, V_{GE} = 15V$ $R_G = 10\Omega, L = 200\mu H, L_S = 150nH$ $T_J = 150^\circ\text{C}$
t_r	Rise time	—	15	—		
$t_{d(off)}$	Turn-Off delay time	—	190	—		
t_f	Fall time	—	210	—		
C_{ies}	Input Capacitance	—	1940	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0MHz$
C_{oes}	Output Capacitance	—	120	—		
C_{res}	Reverse Transfer Capacitance	—	40	—		
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				$T_J = 150^\circ\text{C}, I_C = 80A$ $V_{CC} = 960V, V_p = 1200V$ $R_G = 10\Omega, V_{GE} = +20V$ to 0V
E_{rec}	Reverse Recovery Energy of the Diode	—	790	—	μJ	$T_J = 150^\circ\text{C}$
t_{rr}	Diode Reverse Recovery Time	—	105	—	ns	$V_{CC} = 600V, I_F = 20A$
I_{rr}	Peak Reverse Recovery Current	—	40	—	A	$V_{GE} = 15V, R_G = 10\Omega, L = 1.0mH, L_S = 150nH$

Notes:

- ① $V_{CC} = 80\% (V_{CES}), V_{GE} = 20V, R_G = 50\Omega$.
- ② Pulse width limited by max. junction temperature.
- ③ Refer to AN-1086 for guidelines for measuring $V_{(BR)CES}$ safely.
- ④ R_θ is measured at T_J of approximately 90°C .