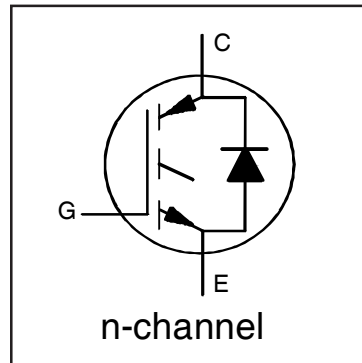


# IRGP4066DPbF IRGP4066D-EPbF

## INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

### Features

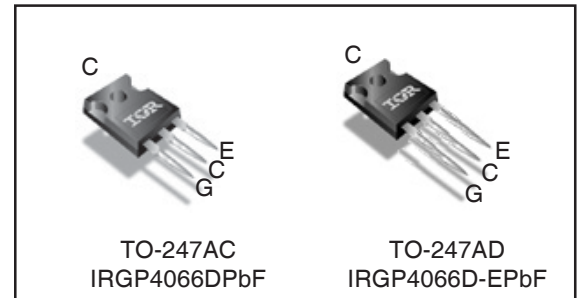
- Low  $V_{CE(ON)}$  Trench IGBT Technology
- Low Switching Losses
- Maximum Junction Temperature 175 °C
- 5  $\mu$ S short circuit SOA
- Square RBSOA
- 100% of The Parts Tested for  $I_{LM}$
- Positive  $V_{CE(ON)}$  Temperature Coefficient
- Tight Parameter Distribution
- Lead Free Package



$V_{CES} = 600V$
$I_{C(Nominal)} = 75A$
$t_{SC} \geq 5\mu s, T_{J(max)} = 175^{\circ}C$
$V_{CE(on)} \text{ typ.} = 1.70V$

### 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



<b>G</b>	<b>C</b>	<b>E</b>
Gate	Collector	Emitter

### Absolute Maximum Ratings

	Parameter	Max.	Units	
$V_{CES}$	Collector-to-Emitter Voltage	600	V	
$I_C @ T_C = 25^{\circ}C$	Continuous Collector Current	140	A	
$I_C @ T_C = 100^{\circ}C$	Continuous Collector Current	90		
$I_{NOMINAL}$	Nominal Current	75		
$I_{CM}$	Pulse Collector Current, $V_{GE} = 15V$	225		
$I_{LM}$	Clamped Inductive Load Current, $V_{GE} = 20V$ ①	300		
$I_F @ T_C = 25^{\circ}C$	Diode Continuous Forward Current	140		
$I_F @ T_C = 100^{\circ}C$	Diode Continuous Forward Current	90		
$I_{FM}$	Diode Maximum Forward Current ②	300		
$V_{GE}$	Continuous Gate-to-Emitter Voltage	$\pm 20$		V
	Transient Gate-to-Emitter Voltage	$\pm 30$		
$P_D @ T_C = 25^{\circ}C$	Maximum Power Dissipation	454	W	
		$P_D @ T_C = 100^{\circ}C$		227
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to +175	$^{\circ}C$	
		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) ④	—	—	0.33	$^{\circ}C/W$
$R_{\theta JC}$ (Diode)	Thermal Resistance Junction-to-Case-(each Diode) ④	—	—	1.0	
$R_{\theta CS}$	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<sub>J</sub> = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)CES</sub>	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 100μA ③
ΔV <sub>(BR)CES</sub> /ΔT <sub>J</sub>	Temperature Coeff. of Breakdown Voltage	—	0.30	—	V/°C	V <sub>GE</sub> = 0V, I <sub>C</sub> = 2.0mA (25°C-175°C)
V <sub>CE(on)</sub>	Collector-to-Emitter Saturation Voltage	—	1.70	2.10	V	I <sub>C</sub> = 75A, V <sub>GE</sub> = 15V, T <sub>J</sub> = 25°C ②
		—	2.0	—		I <sub>C</sub> = 75A, V <sub>GE</sub> = 15V, T <sub>J</sub> = 150°C ②
		—	2.1	—		I <sub>C</sub> = 75A, V <sub>GE</sub> = 15V, T <sub>J</sub> = 175°C ②
V <sub>GE(th)</sub>	Gate Threshold Voltage	4.0	—	6.5	V	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 2.1mA
ΔV <sub>GE(th)</sub> /ΔT <sub>J</sub>	Threshold Voltage temp. coefficient	—	-21	—	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 2.1mA (25°C - 175°C)
g <sub>fe</sub>	Forward Transconductance	—	50	—	S	V <sub>CE</sub> = 50V, I <sub>C</sub> = 75A, PW = 60μs
I <sub>CES</sub>	Collector-to-Emitter Leakage Current	—	1.0	100	μA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V
		—	1040	—		V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V, T <sub>J</sub> = 175°C
V <sub>FM</sub>	Diode Forward Voltage Drop	—	2.23	3.0	V	I <sub>F</sub> = 75A
		—	1.8	—		I <sub>F</sub> = 75A, T <sub>J</sub> = 175°C
I <sub>GES</sub>	Gate-to-Emitter Leakage Current	—	—	±200	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)	—	150	225	nC	I <sub>C</sub> = 75A V <sub>GE</sub> = 15V V <sub>CC</sub> = 400V
Q <sub>ge</sub>	Gate-to-Emitter Charge (turn-on)	—	40	60		
Q <sub>gc</sub>	Gate-to-Collector Charge (turn-on)	—	60	90		
E <sub>on</sub>	Turn-On Switching Loss	—	2465	3360	μJ	I <sub>C</sub> = 75A, V <sub>CC</sub> = 400V, V <sub>GE</sub> = 15V R <sub>G</sub> = 10Ω, L = 200μH, T <sub>J</sub> = 25°C Energy losses include tail & diode reverse recovery
E <sub>off</sub>	Turn-Off Switching Loss	—	2155	3040		
E <sub>total</sub>	Total Switching Loss	—	4620	6400		
t <sub>d(on)</sub>	Turn-On delay time	—	50	70	ns	I <sub>C</sub> = 75A, V <sub>CC</sub> = 400V, V <sub>GE</sub> = 15V R <sub>G</sub> = 10Ω, L = 200μH, T <sub>J</sub> = 25°C
t <sub>r</sub>	Rise time	—	70	90		
t <sub>d(off)</sub>	Turn-Off delay time	—	200	225		
t <sub>f</sub>	Fall time	—	60	80		
E <sub>on</sub>	Turn-On Switching Loss	—	3870	—	μJ	I <sub>C</sub> = 75A, V <sub>CC</sub> = 400V, V <sub>GE</sub> = 15V R <sub>G</sub> = 10Ω, L = 200μH, T <sub>J</sub> = 175°C Energy losses include tail & diode reverse recovery
E <sub>off</sub>	Turn-Off Switching Loss	—	2815	—		
E <sub>total</sub>	Total Switching Loss	—	6685	—		
t <sub>d(on)</sub>	Turn-On delay time	—	50	—	ns	I <sub>C</sub> = 75A, V <sub>CC</sub> = 400V, V <sub>GE</sub> = 15V R <sub>G</sub> = 10Ω, L = 200μH T <sub>J</sub> = 175°C
t <sub>r</sub>	Rise time	—	70	—		
t <sub>d(off)</sub>	Turn-Off delay time	—	240	—		
t <sub>f</sub>	Fall time	—	70	—		
C <sub>ies</sub>	Input Capacitance	—	4440	—	pF	V <sub>GE</sub> = 0V V <sub>CC</sub> = 30V f = 1.0Mhz
C <sub>oes</sub>	Output Capacitance	—	245	—		
C <sub>res</sub>	Reverse Transfer Capacitance	—	130	—		
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T <sub>J</sub> = 175°C, I <sub>C</sub> = 300A V <sub>CC</sub> = 480V, V <sub>p</sub> ≤ 600V R <sub>G</sub> = 10Ω, V <sub>GE</sub> = +20V to 0V
SCSOA	Short Circuit Safe Operating Area	5	—	—	μs	V <sub>CC</sub> = 400V, V <sub>p</sub> ≤ 600V R <sub>G</sub> = 10Ω, V <sub>GE</sub> = +15V to 0V
E <sub>rec</sub>	Reverse Recovery Energy of the Diode	—	470	—	μJ	T <sub>J</sub> = 175°C
t <sub>rr</sub>	Diode Reverse Recovery Time	—	155	—	ns	V <sub>CC</sub> = 400V, I <sub>F</sub> = 75A
I <sub>rr</sub>	Peak Reverse Recovery Current	—	27	—	A	V <sub>GE</sub> = 15V, R <sub>G</sub> = 10Ω, L = 60μH

### Notes:

- ① V<sub>CC</sub> = 80% (V<sub>CES</sub>), V<sub>GE</sub> = 20V, L = 10μH, R<sub>G</sub> = 10Ω.
- ② Pulse width limited by max. junction temperature.
- ③ Refer to AN-1086 for guidelines for measuring V<sub>(BR)CES</sub> safely.
- ④ R<sub>θ</sub> is measured at T<sub>J</sub> of approximately 90°C.