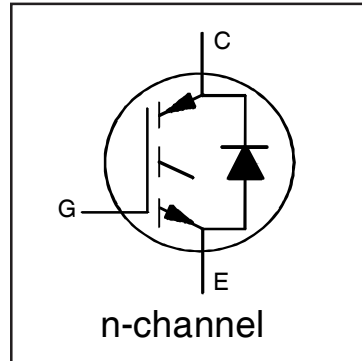


IRGP4068DPbF IRGP4068D-EPbF

**INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRA-LOW VF DIODE
FOR INDUCTION HEATING AND SOFT SWITCHING APPLICATIONS**

Features

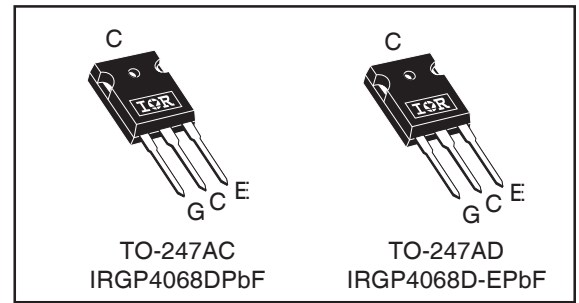
- Low $V_{CE(ON)}$ Trench IGBT Technology
- Low Switching Losses
- Maximum Junction temperature 175 °C
- 5 μ S short circuit SOA
- Square RBSOA
- 100% of the parts tested for I_{LM} ①
- Positive $V_{CE(ON)}$ Temperature co-efficient
- Ultra-low V_F Hyperfast Diode
- Tight parameter distribution
- Lead Free Package



$V_{CES} = 600V$
$I_C = 48A, T_C = 100^\circ C$
$t_{SC} \geq 5\mu s, T_{J(max)} = 175^\circ C$
$V_{CE(on)} \text{ typ.} = 1.65V$

Benefits

- Device optimized for induction heating and soft switching applications
- High Efficiency due to Low $V_{CE(on)}$, Low Switching Losses and Ultra-low V_F
- Rugged transient Performance for increased reliability
- Excellent Current sharing in parallel operation
- Low EMI



G	C	E
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	96	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	48	
I_{CM}	Pulse Collector Current, $V_{GE} = 15V$	144	
I_{LM}	Clamped Inductive Load Current, $V_{GE} = 20V$ ①	192	
$I_F @ T_C = 160^\circ C$	Diode Continuous Forward Current ⑤	8.0	
I_{FSM}	Diode Non Repetitive Peak Surge Current @ $T_J = 25^\circ C$ ②⑤	175	
$I_{FRM} @ T_C = 100^\circ C$	Diode Repetitive Peak Forward Current at $t_p=10\mu s$ ②④	100	
V_{GE}	Continuous Gate-to-Emitter Voltage	± 20	V
	Transient Gate-to-Emitter Voltage	± 30	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	330	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	170	
T_J	Operating Junction and	-55 to +175	°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
$R_{\theta JC}$ (IGBT)	Thermal Resistance Junction-to-Case-(each IGBT)	—	—	0.45	°C/W
$R_{\theta JC}$ (Diode)	Thermal Resistance Junction-to-Case-(each Diode)	—	—	2.0	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink (flat, greased surface)	—	0.24	—	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (typical socket mount)	—	—	40	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	Ref.Fig
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{GE} = 0V, I_C = 100\mu A$ ③	CT6
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.30	—	V/°C	$V_{GE} = 0V, I_C = 1mA$ (25°C-175°C)	CT6
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.65	2.14	V	$I_C = 48A, V_{GE} = 15V, T_J = 25^\circ\text{C}$	4,5,6
		—	2.0	—		$I_C = 48A, V_{GE} = 15V, T_J = 150^\circ\text{C}$	8,9,10
		—	2.05	—		$I_C = 48A, V_{GE} = 15V, T_J = 175^\circ\text{C}$	
$V_{GE(th)}$	Gate Threshold Voltage	4.0	—	6.5	V	$V_{CE} = V_{GE}, I_C = 1.4mA$	8,9,10,11,20
g_{fe}	Forward Transconductance	—	32	—	S	$V_{CE} = 50V, I_C = 48A, PW = 80\mu s$	
I_{CES}	Collector-to-Emitter Leakage Current	—	1.0	150	μA	$V_{GE} = 0V, V_{CE} = 600V$	
		—	450	1000		$V_{GE} = 0V, V_{CE} = 600V, T_J = 175^\circ\text{C}$	
V_{FM}	Diode Forward Voltage Drop	—	0.96	1.05	V	$I_F = 8.0A$	7
		—	0.81	0.86		$I_F = 8.0A, T_J = 150^\circ\text{C}$	
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{GE} = \pm 20V$	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	Ref.Fig
Q_g	Total Gate Charge (turn-on)	—	95	140	nC	$I_C = 48A$ $V_{GE} = 15V$ $V_{CC} = 400V$	18
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	28	42			CT1
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	35	53			
E_{off}	Turn-Off Switching Loss	—	1275	1481	μJ	$I_C = 48A, V_{CC} = 400V, V_{GE} = 15V$ $R_G = 10\Omega, L = 200\mu H, T_J = 25^\circ\text{C}$ Energy losses include tail	CT4
$t_{d(off)}$	Turn-Off delay time	—	145	176	ns	$I_C = 48A, V_{CC} = 400V, V_{GE} = 15V$ $R_G = 10\Omega, L = 200\mu H, T_J = 25^\circ\text{C}$	
t_f	Fall time	—	35	46			
E_{off}	Turn-Off Switching Loss	—	1585	—	μJ	$I_C = 48A, V_{CC} = 400V, V_{GE} = 15V$ $R_G = 10\Omega, L = 200\mu H, T_J = 175^\circ\text{C}$ Energy losses include tail	CT4
$t_{d(off)}$	Turn-Off delay time	—	165	—	ns	$I_C = 48A, V_{CC} = 400V, V_{GE} = 15V$ $R_G = 10\Omega, L = 200\mu H, T_J = 175^\circ\text{C}$	WF1
t_f	Fall time	—	45	—			
C_{ies}	Input Capacitance	—	3025	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0Mhz$	17
C_{oes}	Output Capacitance	—	245	—			
C_{res}	Reverse Transfer Capacitance	—	90	—			
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				$T_J = 175^\circ\text{C}, I_C = 192A$ $V_{CC} = 480V, V_p = 600V$ $R_g = 10\Omega, V_{GE} = +20V$ to 0V	3 CT2
SCSOA	Short Circuit Safe Operating Area	5	—	—	μs	$V_{CC} = 400V, V_p = 600V$ $R_g = 10\Omega, V_{GE} = +15V$ to 0V	16, CT3 WF2

Notes:

- ① $V_{CC} = 80\% (V_{CES}), V_{GE} = 20V, L = 200\mu H, R_G = 10\Omega$.
- ② Pulse width limited by max. junction temperature.
- ③ Refer to AN-1086 for guidelines for measuring $V_{(BR)CES}$ safely.
- ④ $f_{sw} = 20KHz$, refer to figure 19.
- ⑤ Sinusoidal half wave, $t = 10ms$.