

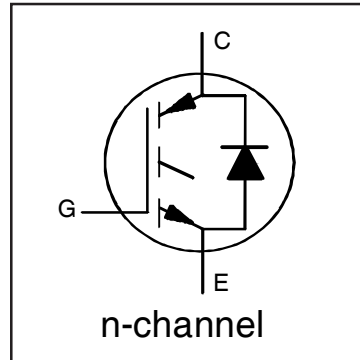
INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

Features

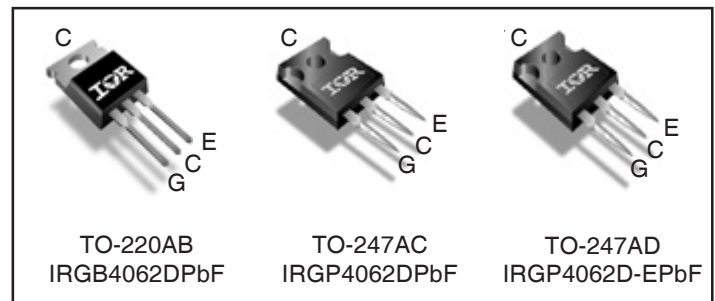
- Low $V_{CE(ON)}$ Trench IGBT Technology
- Low switching losses
- Maximum Junction temperature 175 °C
- 5 μ S short circuit SOA
- Square RBSOA
- 100% of the parts tested for I_{LM} ①
- Positive $V_{CE(ON)}$ Temperature co-efficient
- Ultra fast soft Recovery Co-Pak Diode
- Tight parameter distribution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

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
- Low EMI



$V_{CES} = 600V$
$I_C = 24A, T_C = 100^\circ C$
$t_{SC} \geq 5\mu s, T_{J(max)} = 175^\circ C$
$V_{CE(on)} \text{ typ.} = 1.65V$



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	48	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	24	
I_{CM}	Pulse Collector Current, $V_{GE} = 15V$	72	
I_{LM}	Clamped Inductive Load Current, $V_{GE} = 20V$ ①	96	
$I_F @ T_C = 25^\circ C$	Diode Continuous Forward Current	48	A
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	24	
I_{FM}	Diode Maximum Forward Current ②	96	
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	250	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	125	
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_{TJC} (IGBT)	Thermal Resistance Junction-to-Case-(each IGBT) TO-220AB	—	—	0.60	°C/W
R_{TJC} (Diode)	Thermal Resistance Junction-to-Case-(each Diode) TO-220AB	—	—	1.53	
R_{TJC} (IGBT)	Thermal Resistance Junction-to-Case-(each IGBT) TO-247	—	—	0.65	
R_{TJC} (Diode)	Thermal Resistance Junction-to-Case-(each Diode) TO-247	—	—	1.62	
R_{TCS}	Thermal Resistance, Case-to-Sink (flat, greased surface)	—	0.50	—	
R_{TJA}	Thermal Resistance, Junction-to-Ambient (typical socket mount)	—	80	—	

Electrical Characteristics @ T_J = 25°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 = 100μA ④	CT6
ΔV _{(BR)CES} /ΔT _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	—	1.60	1.95	V	I _C = 24A, V _{GE} = 15V, T _J = 25°C	5,6,7
		—	2.03	—		I _C = 24A, V _{GE} = 15V, T _J = 150°C	9,10,11
		—	2.04	—		I _C = 24A, V _{GE} = 15V, T _J = 175°C	
V _{GE(th)}	Gate Threshold Voltage	4.0	—	6.5	V	V _{CE} = V _{GE} , I _C = 700μA	9, 10,
ΔV _{GE(th)} /ΔT _J	Threshold Voltage temp. coefficient	—	-18	—	mV/°C	V _{CE} = V _{GE} , I _C = 1.0mA (25°C - 175°C)	11, 12
g _{fe}	Forward Transconductance	—	17	—	S	V _{CE} = 50V, I _C = 24A, PW = 80μs	
I _{CES}	Collector-to-Emitter Leakage Current	—	2.0	25	μA	V _{GE} = 0V, V _{CE} = 600V	
		—	775	—		V _{GE} = 0V, V _{CE} = 600V, T _J = 175°C	
V _{FM}	Diode Forward Voltage Drop	—	1.80	2.6	V	I _F = 24A	8
		—	1.28	—		I _F = 24A, T _J = 175°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	Ref.Fig
Q _g	Total Gate Charge (turn-on)	—	50	75	nC	I _C = 24A	24
Q _{ge}	Gate-to-Emitter Charge (turn-on)	—	13	20		V _{GE} = 15V	CT1
Q _{gc}	Gate-to-Collector Charge (turn-on)	—	21	31		V _{CC} = 400V	
E _{on}	Turn-On Switching Loss	—	115	201	μJ	I _C = 24A, V _{CC} = 400V, V _{GE} = 15V	CT4
E _{off}	Turn-Off Switching Loss	—	600	700		R _G = 10Ω, L = 200μH, L _S = 150nH, T _J = 25°C	
E _{total}	Total Switching Loss	—	715	901		Energy losses include tail & diode reverse recovery	
t _{d(on)}	Turn-On delay time	—	41	53	ns	I _C = 24A, V _{CC} = 400V, V _{GE} = 15V	CT4
t _r	Rise time	—	22	31		R _G = 10Ω, L = 200μH, L _S = 150nH, T _J = 25°C	
t _{d(off)}	Turn-Off delay time	—	104	115			
t _f	Fall time	—	29	41			
E _{on}	Turn-On Switching Loss	—	420	—		μJ	I _C = 24A, V _{CC} = 400V, V _{GE} = 15V
E _{off}	Turn-Off Switching Loss	—	840	—	R _G = 10Ω, L = 200μH, L _S = 150nH, T _J = 175°C ④		CT4
E _{total}	Total Switching Loss	—	1260	—	Energy losses include tail & diode reverse recovery		WF1, WF2
t _{d(on)}	Turn-On delay time	—	40	—	ns	I _C = 24A, V _{CC} = 400V, V _{GE} = 15V	14, 16
t _r	Rise time	—	24	—		R _G = 10Ω, L = 200μH, L _S = 150nH	CT4
t _{d(off)}	Turn-Off delay time	—	125	—		T _J = 175°C	WF1
t _f	Fall time	—	39	—			WF2
C _{ies}	Input Capacitance	—	1490	—	pF	V _{GE} = 0V	23
C _{oes}	Output Capacitance	—	129	—		V _{CC} = 30V	
C _{res}	Reverse Transfer Capacitance	—	45	—		f = 1.0Mhz	
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T _J = 175°C, I _C = 96A V _{CC} = 480V, V _p = 600V R _G = 10Ω, V _{GE} = +20V to 0V	4 CT2
SCSOA	Short Circuit Safe Operating Area	5	—	—	μs	V _{CC} = 400V, V _p = 600V R _G = 10Ω, V _{GE} = +15V to 0V	22, CT3 WF4
E _{rec}	Reverse Recovery Energy of the Diode	—	621	—	μJ	T _J = 175°C	17, 18, 19
t _{rr}	Diode Reverse Recovery Time	—	89	—	ns	V _{CC} = 400V, I _F = 24A	20, 21
I _{rr}	Peak Reverse Recovery Current	—	37	—	A	V _{GE} = 15V, R _G = 10Ω, L = 200μH, L _S = 150nH	WF3

Notes:

- ① V_{CC} = 80% (V_{CES}), V_{GE} = 20V, L = 100μH, R_G = 10Ω.
- ② This is only applied to TO-220AB package.
- ③ Pulse width limited by max. junction temperature.
- ④ Refer to AN-1086 for guidelines for measuring V_{(BR)CES} safely.