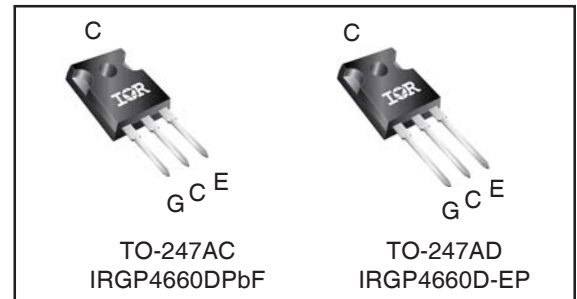
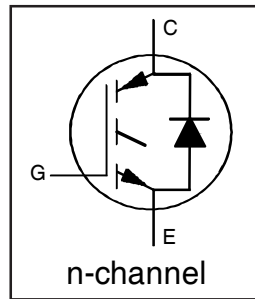


INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

$V_{CES} = 600V$
$I_C = 60A, T_C = 100^{\circ}C$
$t_{SC} \geq 5\mu s, T_{J(max)} = 175^{\circ}C$
$V_{CE(on)} \text{ typ.} = 1.60V @ I_C = 48A$



G	C	E
Gate	Collector	Emitter

Applications

- Industrial Motor Drive
- Inverters
- UPS
- Welding

Features	Benefits
Low $V_{CE(ON)}$ and Switching Losses	High efficiency in a wide range of applications and switching frequencies
Square RBSOA and Maximum Junction Temperature 175°C	Improved reliability due to rugged hard switching performance and higher power capability
Positive $V_{CE(ON)}$ Temperature Coefficient	Excellent current sharing in parallel operation
5μs short circuit SOA	Enables short circuit protection scheme
Lead-Free, RoHS compliant	Environmentally friendly

Base part number	Package Type	Standard Pack		Orderable part number
		Form	Quantity	
IRGP4660DPbF	TO-247AC	Tube	25	IRGP4660DPbF
IRGP4660D-EPbF	TO-247AD	Tube	25	IRGP4660D-EPbF

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^{\circ}C$	Continuous Collector Current	100	A
$I_C @ T_C = 100^{\circ}C$	Continuous Collector Current	60	
I_{CM}	Pulse Collector Current, $V_{GE} = 15V$	144	
I_{LM}	Clamped Inductive Load Current, $V_{GE} = 20V$ ①	192	
$I_F @ T_C = 25^{\circ}C$	Diode Continuous Forward Current	100	
$I_F @ T_C = 100^{\circ}C$	Diode Continuous Forward Current	60	
I_{FM}	Diode Maximum Forward Current ④	192	V
V_{GE}	Continuous Gate-to-Emitter Voltage	±20	
	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.		
	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)	Junction-to-Case (IGBT) ②	—	—	0.45	°C/W
$R_{\theta JC}$ (Diode)	Junction-to-Case (Diode) ②	—	—	0.92	
$R_{\theta CS}$	Case-to-Sink (flat, greased surface)	—	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient (typical socket mount)	—	—	40	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
V _{(BR)CES}	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V _{GE} = 0V, I _C = 150μA ③
ΔV _{(BR)CES} /ΔT _J	Temperature Coeff. of Breakdown Voltage	—	0.30	—	V/°C	V _{GE} = 0V, I _C = 1mA (25°C-175°C)
V _{CE(on)}	Collector-to-Emitter Saturation Voltage	—	1.60	1.90	V	I _C = 48A, V _{GE} = 15V, T _J = 25°C
		—	1.90	—		I _C = 48A, V _{GE} = 15V, T _J = 150°C
		—	2.00	—		I _C = 48A, V _{GE} = 15V, T _J = 175°C
V _{GE(th)}	Gate Threshold Voltage	4.0	—	6.5	V	V _{CE} = V _{GE} , I _C = 1.4mA
ΔV _{GE(th)} /ΔT _J	Threshold Voltage temp. coefficient	—	-21	—	mV/°C	V _{CE} = V _{GE} , I _C = 1.0mA (25°C - 175°C)
g _{fe}	Forward Transconductance	—	32	—	S	V _{CE} = 50V, I _C = 48A, PW = 80μs
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°C
V _{FM}	Diode Forward Voltage Drop	—	1.95	2.91	V	I _F = 48A
		—	1.45	—		I _F = 48A, 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
Q _g	Total Gate Charge (turn-on)	—	95	140	nC	I _C = 48A
Q _{ge}	Gate-to-Emitter Charge (turn-on)	—	28	42		V _{GE} = 15V
Q _{gc}	Gate-to-Collector Charge (turn-on)	—	35	53		V _{CC} = 400V
E _{on}	Turn-On Switching Loss	—	625	1141	μJ	I _C = 48A, V _{CC} = 400V, V _{GE} = 15V
E _{off}	Turn-Off Switching Loss	—	1275	1481		R _G = 10Ω, L = 200μH, L _S = 150nH, T _J = 25°C
E _{total}	Total Switching Loss	—	1900	2622		Energy losses include tail & diode reverse recovery ⑤
t _{d(on)}	Turn-On delay time	—	60	78	ns	I _C = 48A, V _{CC} = 400V, V _{GE} = 15V
t _r	Rise time	—	40	56		R _G = 10Ω, L = 200μH, L _S = 150nH, T _J = 25°C
t _{d(off)}	Turn-Off delay time	—	145	176		
t _f	Fall time	—	35	46		
E _{on}	Turn-On Switching Loss	—	1625	—	μJ	I _C = 48A, V _{CC} = 400V, V _{GE} = 15V
E _{off}	Turn-Off Switching Loss	—	1585	—		R _G = 10Ω, L = 200μH, L _S = 150nH, T _J = 175°C
E _{total}	Total Switching Loss	—	3210	—		Energy losses include tail & diode reverse recovery ⑤
t _{d(on)}	Turn-On delay time	—	55	—	ns	I _C = 48A, V _{CC} = 400V, V _{GE} = 15V
t _r	Rise time	—	45	—		R _G = 10Ω, L = 200μH, L _S = 150nH
t _{d(off)}	Turn-Off delay time	—	165	—		T _J = 175°C
t _f	Fall time	—	45	—		
C _{ies}	Input Capacitance	—	3025	—	pF	V _{GE} = 0V
C _{oes}	Output Capacitance	—	245	—		V _{CC} = 30V
C _{res}	Reverse Transfer Capacitance	—	90	—		f = 1.0Mhz
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T _J = 175°C, I _C = 192A V _{CC} = 480V, V _p = 600V R _G = 10Ω, V _{GE} = +15V to 0V
SCSOA	Short Circuit Safe Operating Area	5	—	—	μs	V _{CC} = 400V, V _p = 600V R _G = 10Ω, V _{GE} = +15V to 0V
E _{rec}	Reverse Recovery Energy of the Diode	—	845	—	μJ	T _J = 175°C
t _{rr}	Diode Reverse Recovery Time	—	115	—	ns	V _{CC} = 400V, I _F = 48A
I _{rr}	Peak Reverse Recovery Current	—	40	—	A	V _{GE} = 15V, R _G = 10Ω, L = 200μH, L _S = 150nH

Notes:

- ① V_{CC} = 80% (V_{CES}), V_{GE} = 20V, L = 200μH, R_G = 10Ω.
- ② R_θ is measured at T_J of approximately 90°C.
- ③ Refer to AN-1086 for guidelines for measuring V_{(BR)CES} safely.
- ④ Pulse width limited by max. junction temperature.
- ⑤ Values influenced by parasitic L and C in measurement.