International
IOR Rectifier

Preliminary Data Sheet PD - 9.1085

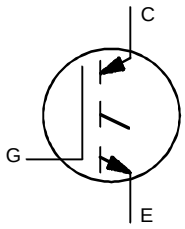
IRGPH40S

INSULATED GATE BIPOLAR TRANSISTOR

Standard Speed IGBT

Features

- Switching-loss rating includes all "tail" losses
- Optimized for line frequency operation (to 400Hz)



n-channel

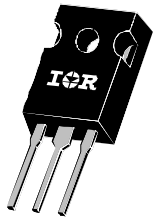
V_{CES} = 1200V

$V_{CE(sat)} \leq$ 3.0V

@V_{GE} = 15V, I_C = 20A

Description

Insulated Gate Bipolar Transistors (IGBTs) from International Rectifier have higher usable current densities than comparable bipolar transistors, while at the same time having simpler gate-drive requirements of the familiar power MOSFET. They provide substantial benefits to a host of high-voltage, high-current applications.



TO-247AC

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
I_C @ T_C = 25°C	Continuous Collector Current	33	A
I_C @ T_C = 100°C	Continuous Collector Current	20	
I_{CM}	Pulsed Collector Current ①	66	
I_{LM}	Clamped Inductive Load Current ②	66	
V_{GE}	Gate-to-Emitter Voltage	±20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	15	mJ
P_D @ T_C = 25°C	Maximum Power Dissipation	160	W
P_D @ T_C = 100°C	Maximum Power Dissipation	65	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	
	Mounting torque, 6-32 or M3 screw.	10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	0.77	°C/W
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	—	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	—	40	
Wt	Weight	—	6 (0.21)	—	g (oz)

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Electrical Characteristics @ T_J = 25°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 = 250µA
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	20	—	—	V	V_{GE} = 0V, I_C = 1.0A
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	1.3	—	V/°C	V_{GE} = 0V, I_C = 1.0mA
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	2.5	3.0	V	I_C = 20A, V_{GE} = 15V
		—	2.9	—		I_C = 33A
		—	2.8	—		I_C = 20A, T_J = 150°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	5.5		V_{CE} = V_{GE}, I_C = 250µA
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-12	—	mV/°C	V_{CE} = V_{GE}, I_C = 250µA
g_{fe}	Forward Transconductance ⑤	—	12	—	S	V_{CE} = 100V, I_C = 20A
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	V_{GE} = 0V, V_{CE} = 1200V
		—	—	1000		V_{GE} = 0V, V_{CE} = 1200V, T_J = 150°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)	—	50	—	nC	I_C = 20A
Q_{ge}	Gate - Emitter Charge (turn-on)	—	14	—		V_{CC} = 400V
Q_{gc}	Gate - Collector Charge (turn-on)	—	12	—		V_{GE} = 15V
$t_{d(on)}$	Turn-On Delay Time	—	30	—	ns	T_J = 25°C
t_r	Rise Time	—	22	—		I_C = 20A, V_{CC} = 960V
$t_{d(off)}$	Turn-Off Delay Time	—	1400	—		V_{GE} = 15V, R_G = 10Ω
t_f	Fall Time	—	680	—		Energy losses include "tail"
E_{on}	Turn-On Switching Loss	—	1.4	—	mJ	
E_{off}	Turn-Off Switching Loss	—	20	—		
E_{ts}	Total Switching Loss	—	21.4	—		
$t_{d(on)}$	Turn-On Delay Time	—	28	—	ns	T_J = 150°C,
t_r	Rise Time	—	27	—		I_C = 20A, V_{CC} = 960V
$t_{d(off)}$	Turn-Off Delay Time	—	1300	—		V_{GE} = 15V, R_G = 10Ω
t_f	Fall Time	—	2100	—		Energy losses include "tail"
E_{ts}	Total Switching Loss	—	50	—	mJ	
L_E	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	1650	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	73	—		V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	—	14	—		f = 1.0MHz

Notes:

① Repetitive rating; V_{GE}=20V, pulse width limited by max. junction temperature.

② V_{CC}=80%(V_{CES}), V_{GE}=20V, L=10µH, R_G= 10Ω

③ Repetitive rating; pulse width limited by maximum junction temperature.

④ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

⑤ Pulse width 5.0µs, single shot.

Refer to Section D - page D-13
Package Outline 3 - JEDEC Outline TO-247AC (TO-3P)