

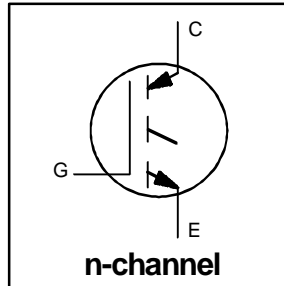
## IRGPC40M

INSULATED GATE BIPOLAR TRANSISTOR

Short Circuit Rated  
Fast IGBT

### Features

- Short circuit rated -  $10\mu\text{s}$  @  $125^\circ\text{C}$ ,  $V_{GE} = 15\text{V}$
- Switching-loss rating includes all "tail" losses
- Optimized for medium operating frequency (1 to 10kHz)

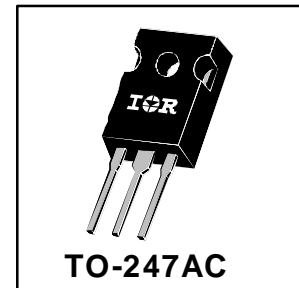


$V_{CES} = 600\text{V}$
$V_{CE(\text{typ})} \leq 2.0\text{V}$
@ $V_{GE} = 15\text{V}$ , $I_C = 24\text{A}$

### 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.

These new short circuit rated devices are especially suited for motor control and other applications requiring short circuit withstand capability.



### Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{CES}$	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ\text{C}$	Continuous Collector Current	40	A
$I_C @ T_C = 100^\circ\text{C}$	Continuous Collector Current	24	
$I_{CM}$	Pulsed Collector Current ①	80	
$I_{LM}$	Clamped Inductive Load Current ②	80	
$t_{sc}$	Short Circuit Withstand Time	10	$\mu\text{s}$
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	V
$E_{ARV}$	Reverse Voltage Avalanche Energy ③	15	mJ
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	160	W
$P_D @ T_C = 100^\circ\text{C}$	Maximum Power Dissipation	65	
$T_J$	Operating Junction and	-55 to +150	$^\circ\text{C}$
$T_{STG}$	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 (1.1N•m)	

### Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	0.77	$^\circ\text{C/W}$
$R_{\theta CS}$	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)

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{GE} = 0V, I_C = 250\mu A$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	20	—	—	V	$V_{GE} = 0V, I_C = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temp. Coeff. of Breakdown Voltage	—	0.70	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 1.0mA$
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	2.0	—	V	$I_C = 24A$ $I_C = 40A$ $I_C = 24A, T_J = 150^\circ\text{C}$ $V_{GE} = 15V$
		—	2.6	—		
		—	2.4	—		
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	5.5		$V_{CE} = V_{GE}, I_C = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-12	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 250\mu A$
$g_{fe}$	Forward Transconductance ③	9.2	12	—	S	$V_{CE} = 100V, I_C = 24A$
$I_{CES}$	Zero Gate Voltage Collector Current	—	—	250	$\mu A$	$V_{GE} = 0V, V_{CE} = 600V$
		—	—	1000		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$
$I_{GES}$	Gate-to-Emitter Leakage Current	—	—	$\pm 100$	nA	$V_{GE} = \pm 20V$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$Q_g$	Total Gate Charge (turn-on)	—	59	80	nC	$I_C = 24A$ $V_{CC} = 400V$ $V_{GE} = 15V$
$Q_{ge}$	Gate - Emitter Charge (turn-on)	—	8.6	10		
$Q_{gc}$	Gate - Collector Charge (turn-on)	—	25	42		
$t_{d(on)}$	Turn-On Delay Time	—	26	—	ns	$T_J = 25^\circ\text{C}$ $I_C = 24A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 10\Omega$ Energy losses include "tail"
$t_r$	Rise Time	—	37	—		
$t_{d(off)}$	Turn-Off Delay Time	—	240	410		
$t_f$	Fall Time	—	230	420		
$E_{on}$	Turn-On Switching Loss	—	0.75	—	mJ	
$E_{off}$	Turn-Off Switching Loss	—	1.65	—		
$E_{ts}$	Total Switching Loss	—	2.4	3.6		
$t_{sc}$	Short Circuit Withstand Time	10	—	—	$\mu s$	$V_{CC} = 360V, T_J = 125^\circ\text{C}$ $V_{GE} = 15V, R_G = 10\Omega, V_{CPK} < 500V$
$t_{d(on)}$	Turn-On Delay Time	—	28	—	ns	$T_J = 150^\circ\text{C}$ $I_C = 24A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 10\Omega$ Energy losses include "tail"
$t_r$	Rise Time	—	37	—		
$t_{d(off)}$	Turn-Off Delay Time	—	380	—		
$t_f$	Fall Time	—	460	—		
$E_{ts}$	Total Switching Loss	—	4.5	—	mJ	
$L_E$	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
$C_{ies}$	Input Capacitance	—	1500	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0MHz$
$C_{oes}$	Output Capacitance	—	190	—		
$C_{res}$	Reverse Transfer Capacitance	—	20	—		

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

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

⑤ Pulse width 5.0 $\mu s$ , single shot.

②  $V_{CC}=80\%(V_{CES}), V_{GE}=20V, L=10\mu H, R_G=10\Omega$

④ Pulse width  $\leq 8\mu s$ ; duty factor  $\leq 0.1\%$ .

Refer to Section D for the following:

Package Outline 3 - JEDEC Outline TO-247AC

Section D - page D-13



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