International
IOR Rectifier

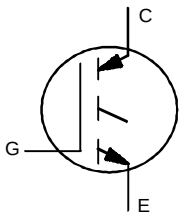
PD - 95644A

IRGB6B60KPbF
IRGS6B60KPbF
IRGSL6B60KPbF

INSULATED GATE BIPOLAR TRANSISTOR

Features

- Low VCE (on) Non Punch Through IGBT Technology.
- 10µs Short Circuit Capability.
- Square RBSOA.
- Positive VCE (on) Temperature Coefficient.
- Lead-Free.



n-channel

V_{CES} = 600V

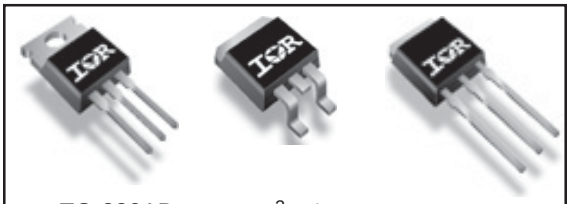
I_C = 7.0A, T_C=100°C

t_{sc} > 10µs, T_J=150°C

$V_{CE(on)}$ typ. = 1.8V

Benefits

- Benchmark Efficiency for Motor Control.
- Rugged Transient Performance.
- Low EMI.
- Excellent Current Sharing in Parallel Operation.



TO-220AB IRGB6B60K | D²Pak IRGS6B60K | TO-262 IRGSL6B60K

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	13	A
I_C @ T_C = 100°C	Continuous Collector Current	7.0	
I_{CM}	Pulsed Collector Current	26	
I_{LM}	Clamped Inductive Load Current ①	26	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
P_D @ T_C = 25°C	Maximum Power Dissipation	90	W
P_D @ T_C = 100°C	Maximum Power Dissipation	36	
T_J	Operating Junction and	-55 to +150	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case - IGBT	—	—	1.4	°C/W
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	—	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount②	—	—	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount, steady state)③	—	—	40	
Wt	Weight	—	1.44	—	g

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 = 500µA	
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.3	—	V/°C	V_{GE} = 0V, I_C = 1.0mA, (25°C-150°C)	
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	1.5	1.80	2.20	V	I_C = 5.0A, V_{GE} = 15V	5, 6,7
		—	2.20	2.50		I_C = 5.0A,V_{GE} = 15V, T_J = 150°C	8,9,10
$V_{GE(th)}$	Gate Threshold Voltage	3.5	4.5	5.5	V	V_{CE} = V_{GE}, I_C = 250µA	8,9,10
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-10	—	mV/°C	V_{CE} = V_{GE}, I_C = 1.0mA, (25°C-150°C)	11
g_{fe}	Forward Transconductance	—	3.0	—	S	V_{CE} = 50V, I_C = 5.0A, PW=80µs	
I_{CES}	Zero Gate Voltage Collector Current	—	1.0	150	µA	V_{GE} = 0V, V_{CE} = 600V	
		—	200	500		V_{GE} = 0V, V_{CE} = 600V, T_J = 150°C	
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V_{GE} = ±20V	

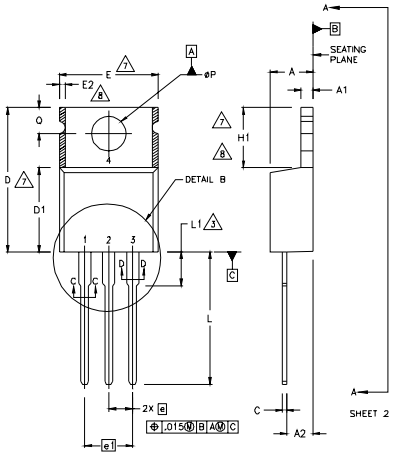
Switching Characteristics @ T_J = 25°C (unless otherwise specified)

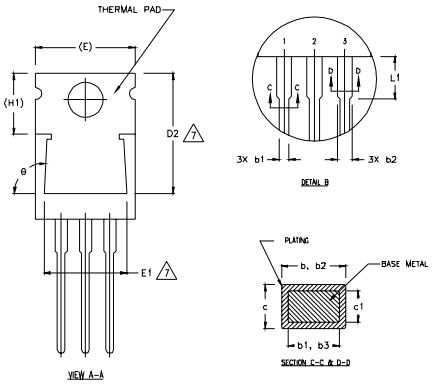
	Parameter	Min.	Typ.	Max.	Units	Conditions	Ref.Fig.
Qg	Total Gate Charge (turn-on)	—	18.2	—		I_C = 5.0A	17
Qge	Gate - Emitter Charge (turn-on)	—	1.9	—	nC	V_{CC} = 400V	CT1
Qgc	Gate - Collector Charge (turn-on)	—	9.2	—		V_{GE} = 15V	
E_{on}	Turn-On Switching Loss	—	110	210	µJ	I_C = 5.0A, V_{CC} = 400V	CT4
E_{off}	Turn-Off Switching Loss	—	135	245		V_{GE} = 15V,R_G = 100Ω, L =1.4mH	
E_{tot}	Total Switching Loss	—	245	455		Ls = 150nH T_J = 25°C ④	
$t_{d(on)}$	Turn-On Delay Time	—	25	34		I_C = 5.0A, V_{CC} = 400V	CT4
t_r	Rise Time	—	17	26		V_{GE} = 15V, R_G = 100Ω L =1.4mH	
$t_{d(off)}$	Turn-Off Delay Time	—	215	230	ns	Ls = 150nH, T_J = 25°C	
t_f	Fall Time	—	13.2	22			
E_{on}	Turn-On Switching Loss	—	150	260		I_C = 5.0A, V_{CC} = 400V	CT4
E_{off}	Turn-Off Switching Loss	—	190	300	µJ	V_{GE} = 15V,R_G = 100Ω, L =1.4mH	12,14
E_{tot}	Total Switching Loss	—	340	560		Ls = 150nH T_J = 150°C ④	WF1WF2
$t_{d(on)}$	Turn-On Delay Time	—	28	37		I_C = 5.0A, V_{CC} = 400V	13, 15
t_r	Rise Time	—	17	26		V_{GE} = 15V, R_G = 100Ω L =1.4mH	CT4
$t_{d(off)}$	Turn-Off Delay Time	—	240	255	ns	Ls = 150nH, T_J = 150°C	WF1
t_f	Fall Time	—	18	27			WF2
C_{ies}	Input Capacitance	—	290	—		V_{GE} = 0V	
C_{oes}	Output Capacitance	—	34	—	pF	V_{CC} = 30V	16
C_{res}	Reverse Transfer Capacitance	—	10	—		f = 1.0MHz	
RBSOA	Reverse Bias Safe Operting Area	FULL SQUARE				T_J = 150°C, I_C = 26A, Vp =600V	4
						V_{CC} = 500V, V_{GE} =+15V to 0V,R_G = 100Ω	CT2
SCSOA	Short Circuit Safe Operting Area	10	—	—	µs	T_J = 150°C, Vp =600V, R_G = 100Ω	CT3
						V_{CC} = 360V, V_{GE} = +15V to 0V	WF3

Note ① to ④ are on page 13

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)





NOTES:

1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
2 DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
3 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5 DIMENSION b1 & c1 APPLY TO BASE METAL ONLY.
6 CONTROLLING DIMENSION : INCHES.
7 THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
8 DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.82	.140	.190	
A1	0.51	1.40	.020	.055	
A2	2.04	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.96	.015	.038	5
b2	1.15	1.77	.045	.070	
b3	1.15	1.73	.045	.068	
c	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	
D2	12.19	12.88	.480	.507	7
E	9.66	10.66	.380	.420	4,7
E1	8.38	8.89	.330	.350	7
e	2.54 BSC		.100 BSC		
e1	5.08		.200 BSC		
H1	5.85	6.55	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	-	6.35	-	.250	3
øP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	
ø	90°-93°		90°-93°		

LEAD ASSIGNMENTS

HEXFET
1.- GATE
2.- DRAIN
3.- SOURCE

IGBTs, CoPACK
1.- GATE
2.- COLLECTOR
3.- EMITTER

DIODES
1.- ANODE/OPEN
2.- CATHODE
3.- ANODE

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"

Note: "P" in assembly line position indicates "Lead-Free"