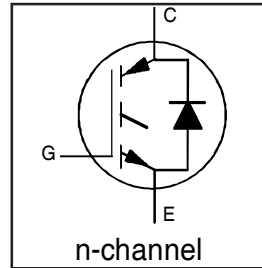


INSULATED GATE BIPOLAR TRANSISTOR WITH
ULTRAFAST SOFT RECOVERY DIODE

IRGB10B60KDPbF
IRGS10B60KD
IRGSL10B60KD

Features

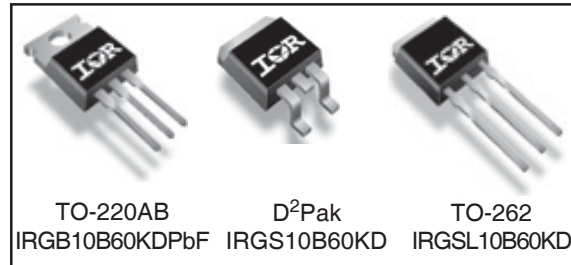
- Low VCE (on) Non Punch Through IGBT Technology.
- Low Diode VF.
- 10µs Short Circuit Capability.
- Square RBSOA.
- Ultrasoft Diode Reverse Recovery Characteristics.
- Positive VCE (on) Temperature Coefficient.
- Lead-Free (only the TO-220AB version is currently available in a Lead-Free configuration)



$V_{CES} = 600V$
 $I_C = 12A, T_C = 100^\circ C$
 $t_{sc} > 10\mu s, T_J = 150^\circ C$
 $V_{CE(on)} \text{ typ.} = 1.8V$

Benefits

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



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	22	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	12	
I_{CM}	Pulsed Collector Current	44	
I_{LM}	Clamped Inductive Load Current	44	
$I_F @ T_C = 25^\circ C$	Diode Continuous Forward Current	22	
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	10	V
I_{FM}	Diode Maximum Forward Current	44	
V_{GE}	Gate-to-Emitter Voltage	± 20	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	156	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	62	
T_J	Operating Junction and	-55 to +150	$^\circ C$
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	—	—	0.8	$^\circ C/W$
$R_{\theta JC}$	Junction-to-Case - Diode	—	—	3.4	
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	—	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount①	—	—	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount, steady state)②	—	—	40	
Wt	Weight	—	1.44	—	g

IRGB10B60KDPBF/S/SL10B60KD

International
IR Rectifier

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	Ref.Fig.
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{GE} = 0V, I_C = 500\mu A$	
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.3	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 1.0mA, (25^\circ\text{C}-150^\circ\text{C})$	
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	1.5	1.80	2.20	V	$I_C = 10A, V_{GE} = 15V$	5, 6,7
		—	2.20	2.50		$I_C = 10A, V_{GE} = 15V \quad T_J = 150^\circ\text{C}$	9,10,11
$V_{GE(th)}$	Gate Threshold Voltage	3.5	4.5	5.5	V	$V_{CE} = V_{GE}, I_C = 250\mu A$	9,10,11
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-10	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 1.0mA, (25^\circ\text{C}-150^\circ\text{C})$	12
g_{fe}	Forward Transconductance	—	7.0	—	S	$V_{CE} = 50V, I_C = 10A, PW=80\mu s$	
I_{CES}	Zero Gate Voltage Collector Current	—	3.0	150	μA	$V_{GE} = 0V, V_{CE} = 600V$	
		—	300	700		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$	
V_{FM}	Diode Forward Voltage Drop	—	1.30	1.45	V	$I_C = 10A$	8
		—	1.30	1.45		$I_C = 10A \quad T_J = 150^\circ\text{C}$	
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{GE} = \pm 20V$	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	Ref.Fig.
Q_g	Total Gate Charge (turn-on)	—	38	—	nC	$I_C = 10A$	CT1
Q_{ge}	Gate - Emitter Charge (turn-on)	—	4.3	—		$V_{CC} = 400V$	
Q_{gc}	Gate - Collector Charge (turn-on)	—	16.3	—		$V_{GE} = 15V$	
E_{on}	Turn-On Switching Loss	—	140	247	μJ	$I_C = 10A, V_{CC} = 400V$	CT4
E_{off}	Turn-Off Switching Loss	—	250	360		$V_{GE} = 15V, R_G = 47\Omega, L = 200\mu H$	
E_{tot}	Total Switching Loss	—	390	607		$L_s = 150nH \quad T_J = 25^\circ\text{C} \quad \textcircled{3}$	
$t_{d(on)}$	Turn-On Delay Time	—	30	39	ns	$I_C = 10A, V_{CC} = 400V$	CT4
t_r	Rise Time	—	20	29		$V_{GE} = 15V, R_G = 47\Omega, L = 200\mu H$	
$t_{d(off)}$	Turn-Off Delay Time	—	230	262		$L_s = 150nH, T_J = 25^\circ\text{C}$	
t_f	Fall Time	—	23	32			
E_{on}	Turn-On Switching Loss	—	230	340	μJ	$I_C = 10A, V_{CC} = 400V$	CT4
E_{off}	Turn-Off Switching Loss	—	350	464		$V_{GE} = 15V, R_G = 47\Omega, L = 200\mu H$	
E_{tot}	Total Switching Loss	—	580	804		$L_s = 150nH \quad T_J = 150^\circ\text{C} \quad \textcircled{3}$	
$t_{d(on)}$	Turn-On Delay Time	—	30	39	ns	$I_C = 10A, V_{CC} = 400V$	14, 16
t_r	Rise Time	—	20	28		$V_{GE} = 15V, R_G = 47\Omega, L = 200\mu H$	
$t_{d(off)}$	Turn-Off Delay Time	—	250	274		$L_s = 150nH, T_J = 150^\circ\text{C}$	
t_f	Fall Time	—	26	34			
C_{ies}	Input Capacitance	—	620	—	pF	$V_{GE} = 0V$	
C_{oes}	Output Capacitance	—	62	—		$V_{CC} = 30V$	
C_{res}	Reverse Transfer Capacitance	—	22	—		$f = 1.0MHz$	
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				$T_J = 150^\circ\text{C}, I_C = 44A, V_p = 600V$ $V_{CC} = 500V, V_{GE} = +15V \text{ to } 0V, R_G = 47\Omega$	4 CT2
SCSOA	Short Circuit Safe Operating Area	10	—	—	μs	$T_J = 150^\circ\text{C}, V_p = 600V, R_G = 47\Omega$ $V_{CC} = 360V, V_{GE} = +15V \text{ to } 0V$	CT3 WF4
E_{rec}	Reverse Recovery energy of the diode	—	245	330	μJ	$T_J = 150^\circ\text{C}$	17,18,19
t_{rr}	Diode Reverse Recovery time	—	90	105	ns	$V_{CC} = 400V, I_F = 10A, L = 200\mu H$	20, 21
I_{rr}	Diode Peak Reverse Recovery Current	—	19	22	A	$V_{GE} = 15V, R_G = 47\Omega, L_s = 150nH$	CT4,WF3

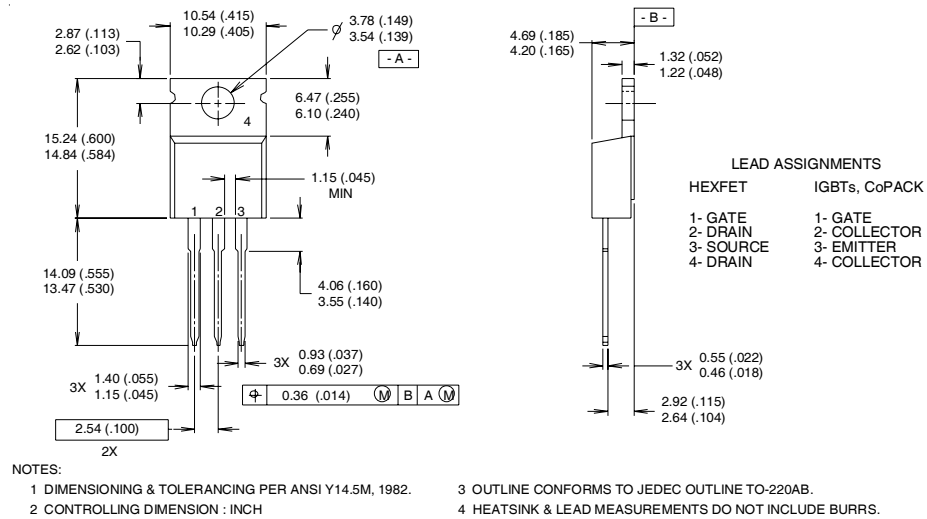
Note ① to ③ are on page 15

IRGB10B60KDPBF/S/SL10B60KD

International
IR Rectifier

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



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"

