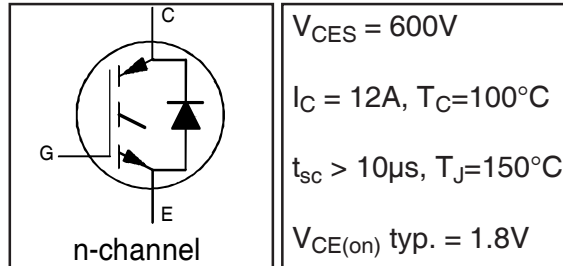


INSULATED GATE BIPOLAR TRANSISTOR WITH
ULTRAFAST SOFT RECOVERY DIODE

IRGB10B60KDPbF
IRGS10B60KD
IRGSL10B60KD

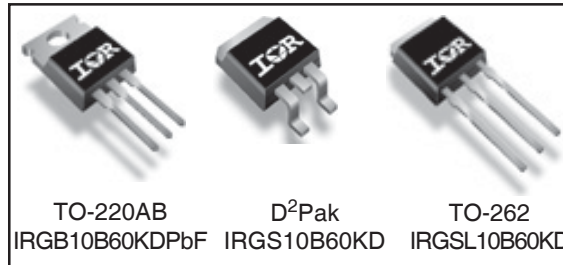
Features

- 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)



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	
I_{FM}	Diode Maximum Forward Current	44	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	156	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	62	
T_J	Operating Junction and	-55 to +150	°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	°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

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	
ΔV _{(BR)CES/ΔT_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 = 10A, V _{GE} = 15V	5, 6, 7
		—	2.20	2.50		I _C = 10A, V _{GE} = 15V T _J = 150°C	9,10,11
V _{GE(th)}	Gate Threshold Voltage	3.5	4.5	5.5	V	V _{CE} = V _{GE} , I _C = 250μA	9,10,11
ΔV _{GE(th)/ΔT_J}	Temperature Coeff. of Threshold Voltage	—	-10	—	mV/°C	V _{CE} = V _{GE} , I _C = 1.0mA, (25°C-150°C)	12
g _{fe}	Forward Transconductance	—	7.0	—	S	V _{CE} = 50V, I _C = 10A, PW=80μs	
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°C	
V _{FM}	Diode Forward Voltage Drop	—	1.30	1.45	V	I _C = 10A	8
		—	1.30	1.45		I _C = 10A 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.
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 = 47Ω, L = 200μH	
E _{tot}	Total Switching Loss	—	390	607		L _s = 150nH T _J = 25°C 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 = 47Ω, L = 200μH	
t _{d(off)}	Turn-Off Delay Time	—	230	262		L _s = 150nH, T _J = 25°C	
t _f	Fall Time	—	23	32			
E _{on}	Turn-On Switching Loss	—	230	340		μJ	
E _{off}	Turn-Off Switching Loss	—	350	464	V _{GE} = 15V, R _G = 47Ω, L = 200μH		
E _{tot}	Total Switching Loss	—	580	804	L _s = 150nH T _J = 150°C 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 = 47Ω, L = 200μH	
t _{d(off)}	Turn-Off Delay Time	—	250	274		L _s = 150nH, T _J = 150°C	
t _f	Fall Time	—	26	34			
C _{ies}	Input Capacitance	—	620	—		pF	
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°C, I _C = 44A, V _p = 600V V _{CC} = 500V, V _{GE} = +15V to 0V, R _G = 47Ω	4 CT2
SCSOA	Short Circuit Safe Operating Area	10	—	—	μs	T _J = 150°C, V _p = 600V, R _G = 47Ω V _{CC} = 360V, V _{GE} = +15V to 0V	CT3 WF4
E _{rec}	Reverse Recovery energy of the diode	—	245	330	μJ	T _J = 150°C	17,18,19
t _{rr}	Diode Reverse Recovery time	—	90	105	ns	V _{CC} = 400V, I _F = 10A, L = 200μH	20, 21
I _{rr}	Diode Peak Reverse Recovery Current	—	19	22	A	V _{GE} = 15V, R _G = 47Ω, L _s = 150nH	CT4, WF3

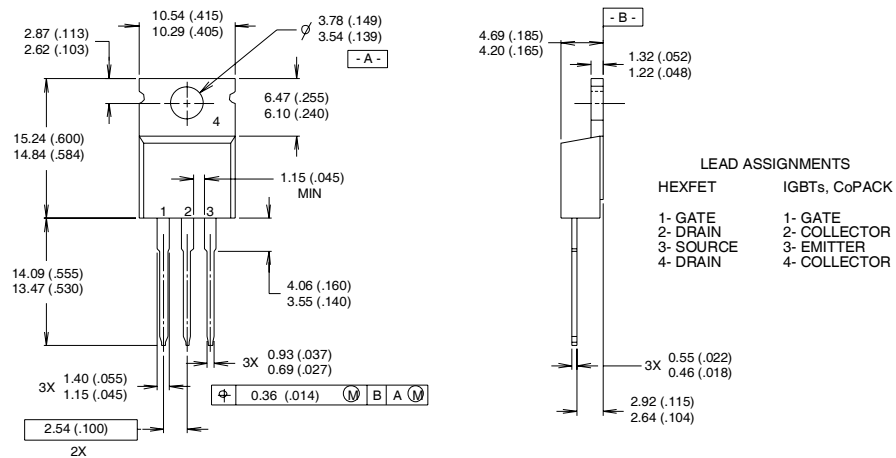
Note ① to ③ are on page 15

IRGB10B60KDPBF/S/SL10B60KD



TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



- NOTES:
- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
 - 2 CONTROLLING DIMENSION : INCH
 - 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
 - 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

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"

