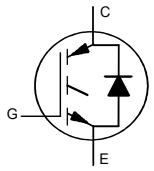
WARP2 SERIES IGBT WITH ULTRAFAST SOFT RECOVERY DIODE

Features

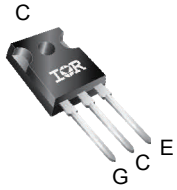
- NPT Technology, Positive Temperature Coefficient
- Lower V_{CE}(SAT)
- Lower Parasitic Capacitances
- Minimal Tail Current
- HEXFRED Ultra Fast Soft-Recovery Co-Pack Diode
- Tighter Distribution of Parameters
- Higher Reliability
- Lead-Free, RoHS Compliant
- Automotive Qualified *



n-channel

V_{CES} = 600V
$V_{CE(on)}$ typ. = 1.85V
@ V_{GE} = 15V I_C = 22A

Equivalent MOSFET Parameters①
$R_{CE(on)}$ typ. = 84mΩ
I_D (FET equivalent) = 35A



TO-247AD
AUIRGP35B60PD-E

G	C	E
Gate	Collector	Emitter

Applications

- PFC and ZVS SMPS Circuits
- DC/DC Converter Charger

Benefits

- Parallel Operation for Higher Current Applications
- Lower Conduction Losses and Switching Losses
- Higher Switching Frequency up to 150kHz

Base Part Number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
AUIRGP35B60PD-E	TO-247AD	Tube	25	AUIRGP35B60PD-E

Absolute Maximum Ratings

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only; and functional operation of the device at these or any other condition beyond those indicated in the specifications is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions. Ambient temperature (T_A) is 25°C, unless otherwise specified.

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	60	A
I_C @ T_C = 100°C	Continuous Collector Current	34	
I_{CM}	Pulse Collector Current (Ref. Fig. C. T.4)	120	
I_{LM}	Clamped Inductive Load Current②	120	
I_F @ T_C = 25°C	Diode Continuous Forward Current	40	
I_F @ T_C = 100°C	Diode Continuous Forward Current	15	
I_{FSM}	Maximum Repetitive Forward Current	60	
V_{GE}	Gate-to-Emitter Voltage	±20	V
P_D @ T_C = 25°C	Maximum Power Dissipation	308	W
P_D @ T_C = 100°C	Maximum Power Dissipation	123	
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 (1.1 N·m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$ (IGBT)	Thermal Resistance Junction-to-Case (each IGBT)	——	——	0.41	°C/W
$R_{\theta JC}$ (Diode)	Thermal Resistance Junction-to-Case (each Diode)	——	——	1.7	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink (flat, greased surface)	——	0.50	——	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (typical socket mount)	——	——	40	
	Weight	——	6.0(0.21)	——	g(oz)

* Qualification standards can be found at www.infineon.com

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	—	0.78	—	V/°C	V_{GE} = 0V, I_C = 1mA (25°C-125°C)	
R_G	Internal Gate Resistance	—	1.7	—	Ω	1MHz, Open Collector	4,5,6,8,9
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.85	2.15	V	I_C = 22A, V_{GE} = 15V	
		—	2.25	2.55		I_C = 35A, V_{GE} = 15V	
		—	2.37	2.80		I_C = 22A, V_{GE} = 15V, T_J = 125°C	
		—	3.00	3.45		I_C = 35A, V_{GE} = 15V, T_J = 125°C	
$V_{GE(th)}$	Gate Threshold Voltage	3.0	4.0	5.0	V	I_C = 250µA	7,8,9
$\Delta V_{GE(th)}/\Delta TJ$	Threshold Voltage temp. coefficient	—	-10	—	mV/°C	V_{CE} = V_{GE}, I_C = 1.0mA	
gfe	Forward Transconductance	—	36	—	S	V_{CE} = 50V, I_C = 22A,PW = 80µs	
I_{CES}	Collector-to-Emitter Leakage Current	—	3.0	375	µA	V_{GE} = 0V, V_{CE} = 600V	
		—	0.35	—	mA	V_{GE} = 0V, V_{CE} = 600V,T_J = 125°C	
V_{FM}	Diode Forward Voltage Drop	—	1.30	1.70	V	I_F = 15A	10
		—	1.20	1.60		I_F = 15A, T_J = 125°C	
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V_{GE} = ±20V, V_{CE} = 0V	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	Ref. Fig.
Q_g	Total Gate Charge (turn-on)	—	160	240	nC	I_C = 22A	17
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	55	83		V_{GE} = 15V	CT1
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	21	32		V_{CC} = 400V	
E_{on}	Turn-On Switching Loss	—	220	270	µJ		
E_{off}	Turn-Off Switching Loss	—	215	265			
E_{total}	Total Switching Loss	—	435	535		I_C = 22A, V_{CC} = 390V,	
$t_{d(on)}$	Turn-On delay time	—	26	34	ns	V_{GE} = +15V,	CT3
t_r	Rise time	—	6.0	8.0		R_G = 3.3Ω, L = 200µH,	
$t_{d(off)}$	Turn-Off delay time	—	110	122		T_J = 25°C ④	
t_f	Fall time	—	8.0	10			
E_{on}	Turn-On Switching Loss	—	410	465	µJ		CT3
E_{off}	Turn-Off Switching Loss	—	330	405			11,13
E_{total}	Total Switching Loss	—	740	870		I_C = 22A, V_{CC} = 390V,	WF1,WF2
$t_{d(on)}$	Turn-On delay time	—	26	34	ns	V_{GE} = +15V,	CT3
t_r	Rise time	—	8.0	11		R_G = 3.3Ω, L = 200µH,	12,14
$t_{d(off)}$	Turn-Off delay time	—	130	150		T_J = 125°C ④	WF1,WF2
t_f	Fall time	—	12	16			
C_{ies}	Input Capacitance	—	3715	—	pF	V_{GE} = 0V	16
C_{oes}	Output Capacitance	—	265	—		V_{CC} = 30V	
C_{res}	Reverse Transfer Capacitance	—	47	—		f = 1.0Mhz	
$C_{oes\ eff.}$	Effective Output Capacitance (Time Related)	—	135	—		V_{GE} = 0V, V_{CE} = 0V to 480V	15
$C_{oes\ eff.\ (ER)}$	Effective Output Capacitance (Energy Related)	—	179	—			
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T_J = 150°C, I_C = 120A V_{CC} = 480V, Vp ≤ 600V Rg = 22Ω, V_{GE} = +15V to 0V	3 CT2
t_{rr}	Diode Reverse Recovery Time	—	42	60	ns	T_J = 25°C	19
		—	74	120		T_J = 125°C	
Q_{rr}	Diode Reverse Recovery Charge	—	80	180	nC	T_J = 25°C	21
		—	220	600		T_J = 125°C	
I_{rr}	Peak Reverse Recovery Current	—	4.0	6.0	A	T_J = 25°C	19,20,21,22
		—	6.5	10		T_J = 125°C	CT5

I_F = 15A, V_R = 200V, di/dt = 200A/µs

Notes:

① $R_{CE(on)}$ typ. = equivalent on-resistance = $V_{CE(on)}$ typ./ I_C, where $V_{CE(on)}$ typ.= 1.85V and I_C =22A. I_D (FET Equivalent) is the equivalent MOSFET I_D rating @ 25°C for applications up to 150kHz. These are provided for comparison purposes (only) with equivalent MOSFET solutions.

② V_{CC} = 80% (V_{CES}), V_{GE} = 20V, L = 28 µH, R_G = 22 Ω

③ Pulse width limited by max. junction temperature.

④ Energy losses include "tail" and diode reverse recovery, Data generated with use of Diode 30ETH06.

⑥ C_{oes} eff. is a fixed capacitance that gives the same charging time as C_{oes} while V_{CE} is rising from 0 to 80% V_{CES}.
C_{oes} eff.(ER) is a fixed capacitance that stores the same energy as C_{oes} while V_{CE} is rising from 0 to 80% V_{CES}.