

WARP2 SERIES IGBT WITH ULTRAFAST SOFT RECOVERY DIODE
Features

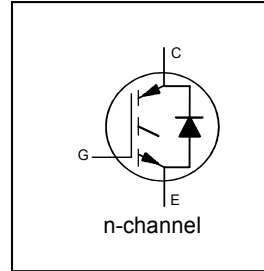
- NPT Technology, Positive Temperature Coefficient
- Lower $V_{CE(SAT)}$
- Lower Parasitic Capacitances
- Minimal Tail Current
- HEXFRED Ultra Fast Soft-Recovery Co-Pack Diode
- Tighter Distribution of Parameters
- Higher Reliability
- Lead-Free, RoHS Compliant
- Automotive Qualified *

Applications

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

Benefits

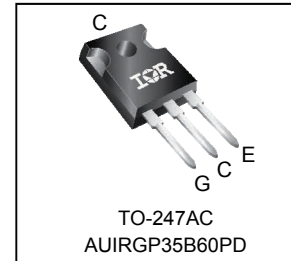
- Parallel Operation for Higher Current Applications
- Lower Conduction Losses and Switching Losses
- Higher Switching Frequency up to 150kHz



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

Equivalent MOSFET Parameters^①

$R_{CE(on)} \text{ typ.} = 84m\Omega$
 I_D (FET equivalent) = 35A



G	C	E
Gate	Collector	Emitter

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

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
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	60	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	34	
I_{CM}	Pulse Collector Current (Ref. Fig. C. T.4)	120	
I_{LM}	Clamped Inductive Load Current ^②	120	
$I_F @ T_C = 25^\circ C$	Diode Continuous Forward Current	40	
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	15	
I_{FSM}	Maximum Repetitive Forward Current	60	
V_{GE}	Gate-to-Emitter Voltage	±20	V
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	308	W
$P_D @ T_C = 100^\circ C$	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	
ΔV _{(BR)CES} /ΔT _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
ΔV _{GE(th)} /ΔT _J	Threshold Voltage temp. coefficient	—	-10	—	mV/°C	V _{CE} = V _{GE} , I _C = 1.0mA	
g _{fe}	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	I _C = 22A, V _{CC} = 390V, V _{GE} = +15V, R _G = 3.3Ω, L = 200μH, T _J = 25°C ④	CT3
E _{off}	Turn-Off Switching Loss	—	215	265			
E _{total}	Total Switching Loss	—	435	535	μJ	I _C = 22A, V _{CC} = 390V, V _{GE} = +15V, R _G = 3.3Ω, L = 200μH, T _J = 125°C ④	CT3 11,13 WF1,WF2
t _{d(on)}	Turn-On delay time	—	26	34			
t _r	Rise time	—	6.0	8.0	ns	I _C = 22A, V _{CC} = 390V, V _{GE} = +15V, R _G = 3.3Ω, L = 200μH, T _J = 125°C ④	CT3 12,14 WF1,WF2
t _{d(off)}	Turn-Off delay time	—	110	122			
t _f	Fall time	—	8.0	10	μJ	I _C = 22A, V _{CC} = 390V, V _{GE} = +15V, R _G = 3.3Ω, L = 200μH, T _J = 125°C ④	CT3 11,13 WF1,WF2
E _{on}	Turn-On Switching Loss	—	410	465			
E _{off}	Turn-Off Switching Loss	—	330	405	ns	I _C = 22A, V _{CC} = 390V, V _{GE} = +15V, R _G = 3.3Ω, L = 200μH, T _J = 125°C ④	CT3 12,14 WF1,WF2
E _{total}	Total Switching Loss	—	740	870			
t _{d(on)}	Turn-On delay time	—	26	34	pF	V _{GE} = 0V V _{CC} = 30V f = 1.0Mhz	16
t _r	Rise time	—	8.0	11			
t _{d(off)}	Turn-Off delay time	—	130	150	pF	V _{GE} = 0V, V _{CE} = 0V to 480V	15
t _f	Fall time	—	12	16			
C _{ies}	Input Capacitance	—	3715	—	pF	V _{GE} = 0V V _{CC} = 30V f = 1.0Mhz	16
C _{oes}	Output Capacitance	—	265	—			
C _{res}	Reverse Transfer Capacitance	—	47	—			
C _{oes eff.}	Effective Output Capacitance (Time Related)	—	135	—			
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, V _p ≤ 600V R _g = 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 CT5
		—	6.5	10		T _J = 125°C	

Notes:

- 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.
- V_{CC} = 80% (V_{CES}), V_{GE} = 20V, L = 28 μH, R_G = 22 Ω
- Pulse width limited by max. junction temperature.
- Energy losses include "tail" and diode reverse recovery, Data generated with use of Diode 30ETH06.
- 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}.