International
IOR Rectifier

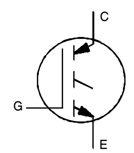
AUTOMOTIVE GRADE

AUIRG4PH50S

Standard Speed IGBT

INSULATED GATE BIPOLAR TRANSISTOR

Features
- Standard: Optimized for minimum saturation voltage and low operating frequencies (< 1kHz)
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency
- Industry standard TO-247AC package
- Lead-Free
- Automotive Qualified *



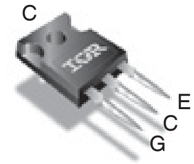
n-channel

V_{CES} =1200V

$V_{CE(on)\ typ.}$ = 1.47V

@V_{GE} = 15V, I_C = 33A

Benefits
- Generation 4 IGBT's offer highest efficiency available
- IGBT's optimized for specified application conditions



TO-247AC

G	C	E
Gate	Collector	Emitter

Ordering Information

Base part number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRG4PH50S	TO-247AC	Tube	25	AUIRG4PH50S

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	1200	V
I_C @ T_C = 25°C	Continuous Collector Current	57	A
I_C @ T_C = 100°C	Continuous Collector Current	33	
I_{CM}	Pulsed Collector Current ①	114	
I_{LM}	Clamped Inductive Load Current ②	114	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
	Transient Gate-to-Emitter Voltage	± 30	
E_{ARV}	Reverse Voltage Avalanche Energy ③	270	mJ
P_D @ T_C =25°	Maximum Power Dissipation	200	W
P_D @ T_C =100°	Maximum Power Dissipation	80	
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
$R_{\theta JC}$	Junction-to-Case	—	—	0.64	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	—	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	—	40	
Wt	Weight	—	6.0(0.21)	—	g (oz)

*Qualification standards can be found at http://www.irf.com/

Dynamic Electrical Characteristics @ $T_J = 25°C$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	$V_{GE} = 0V$, $I_C = 250\mu A$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	$V_{GE} = 0V$, $I_C = 1.0$ A
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	1.22	—	V/°C	$V_{GE} = 0V$, $I_C = 2.0$ mA
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	1.47	1.7	V	$I_C = 33A$, $V_{GE} = 15V$
		—	1.75	—		$I_C = 57A$, See Fig.2, 5
		—	1.55	—		$I_C = 33A$, $T_J = 150°C$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		$V_{CE} = V_{GE}$, $I_C = 250\mu A$
$DV_{GE(th)}/DT_J$	Temperature Coeff. of Threshold Voltage	—	-11	—	mV/°C	$V_{CE} = V_{GE}$, $I_C = 250\mu A$
g_{fe}	Forward Transconductance ⑤	27	40	—	S	$V_{CE} = 100V$, $I_C = 33A$
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	$V_{GE} = 0V$, $V_{CE} = 1200V$
		—	—	2.0		$V_{GE} = 0V$, $V_{CE} = 10V$, $T_J = 25°C$
		—	—	1000		$V_{GE} = 0V$, $V_{CE} = 1200V$, $T_J = 150°C$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	$V_{GE} = \pm 20V$

Static or Switching Electrical Characteristics @ $T_J = 25°C$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	167	251	nC	$I_C = 33A$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	25	38		$V_{CC} = 400V$ See Fig. 8
Q_{gc}	Gate - Collector Charge (turn-on)	—	55	83		$V_{GE} = 15V$
$t_{d(on)}$	Turn-On Delay Time	—	32	—	ns	
t_r	Rise Time	—	29	—		$T_J = 25°C$
$t_{d(off)}$	Turn-Off Delay Time	—	845	1268		$I_C = 33A$, $V_{CC} = 960V$
t_f	Fall Time	—	425	638		$V_{GE} = 15V$, $R_G = 5.0\Omega$
E_{on}	Turn-On Switching Loss	—	1.80	—	mJ	Energy losses include "tail"
E_{off}	Turn-Off Switching Loss	—	19.6	—		See Fig. 9, 10, 14
E_{ts}	Total Switching Loss	—	21.4	44		
$t_{d(on)}$	Turn-On Delay Time	—	32	—	ns	$T_J = 150°C$,
t_r	Rise Time	—	30	—		$I_C = 33A$, $V_{CC} = 960V$
$t_{d(off)}$	Turn-Off Delay Time	—	1170	—		$V_{GE} = 15V$, $R_G = 5.0\Omega$
t_f	Fall Time	—	1000	—		Energy losses include "tail"
E_{ts}	Total Switching Loss	—	37	—	mJ	See Fig. 10,11,14
L_E	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	3600	—	pF	$V_{GE} = 0V$
C_{oes}	Output Capacitance	—	160	—		$V_{CC} = 30V$ See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	30	—		$f = 1.0MHz$

Notes:

① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature. (See fig. 13b)

② $V_{CC} = 80\%(V_{CES})$, $V_{GE} = 20V$, $L = 10\mu H$, $R_G = 5.0\Omega$, (See fig. 13a)

③ Repetitive rating; pulse width limited by maximum junction temperature.

④ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

⑤ Pulse width 5.0µs, single shot.

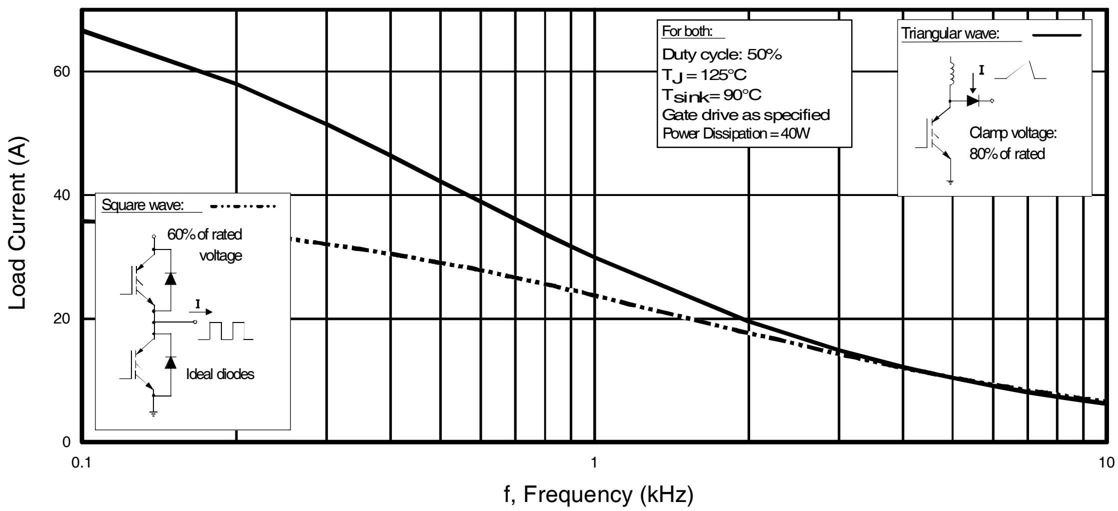


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

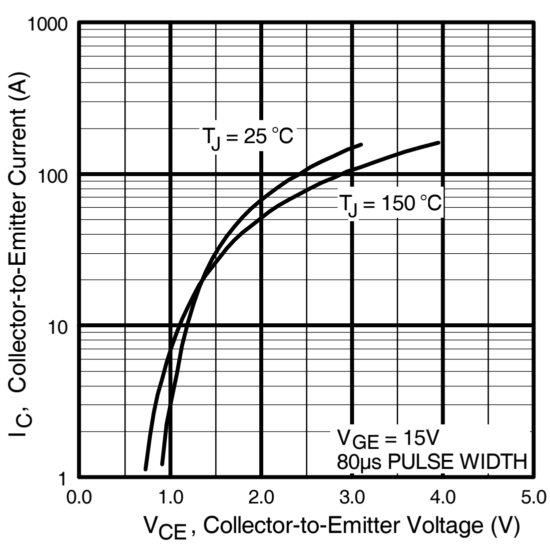


Fig. 2 - Typical Output Characteristics

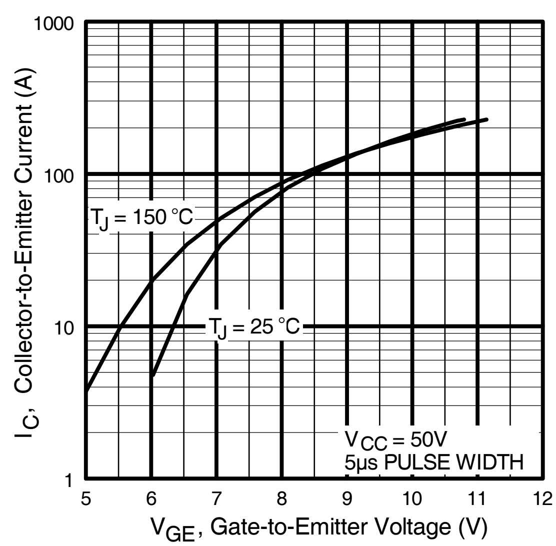


Fig. 3 - Typical Transfer Characteristics

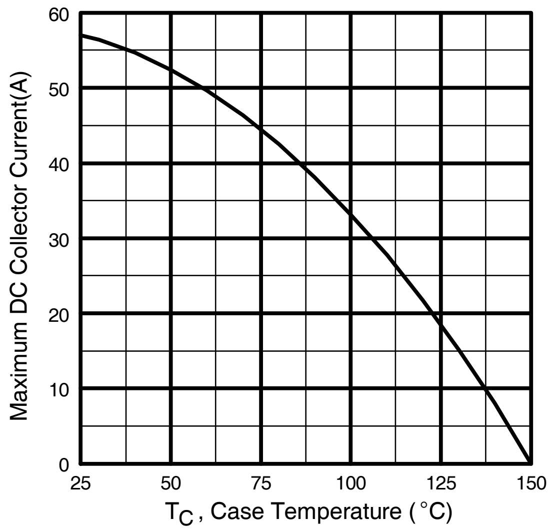


Fig. 4 - Maximum Collector Current vs. Case Temperature

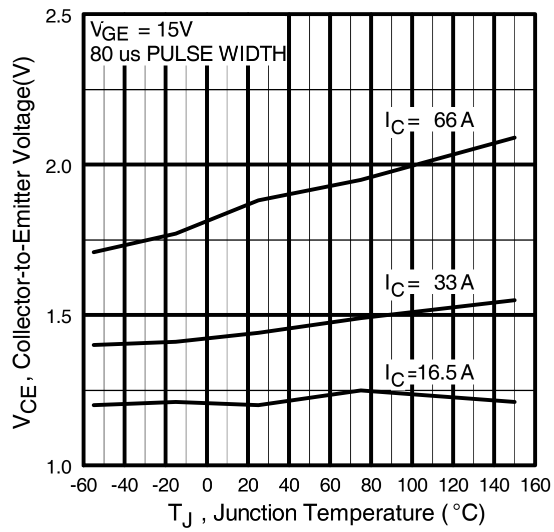


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

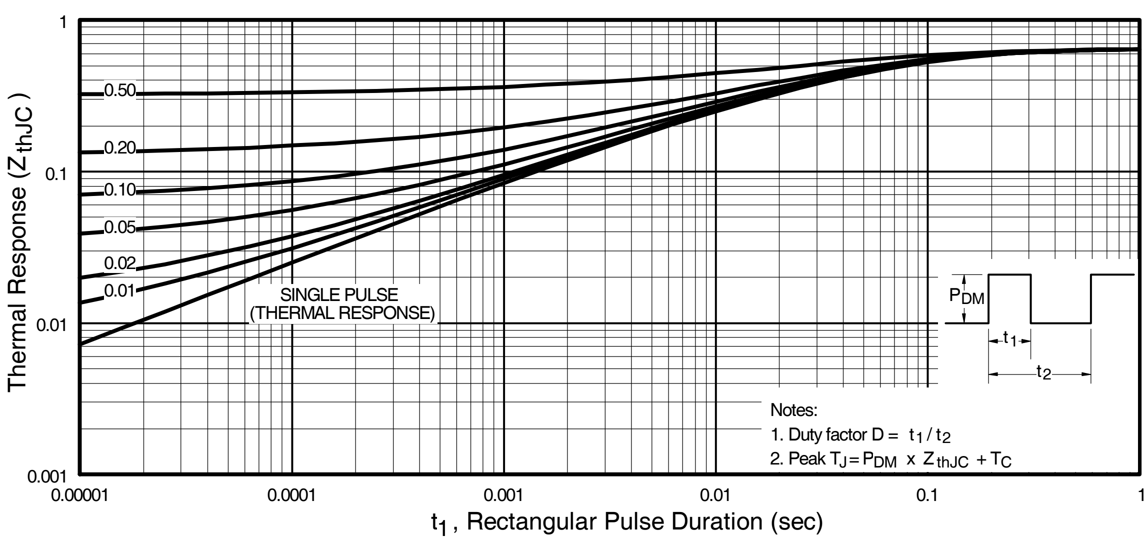


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

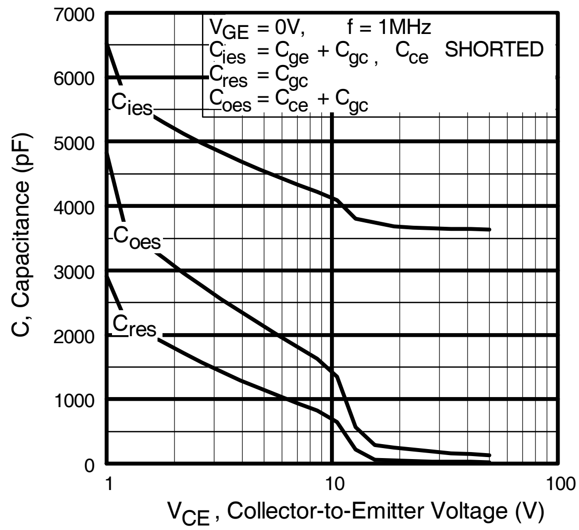


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

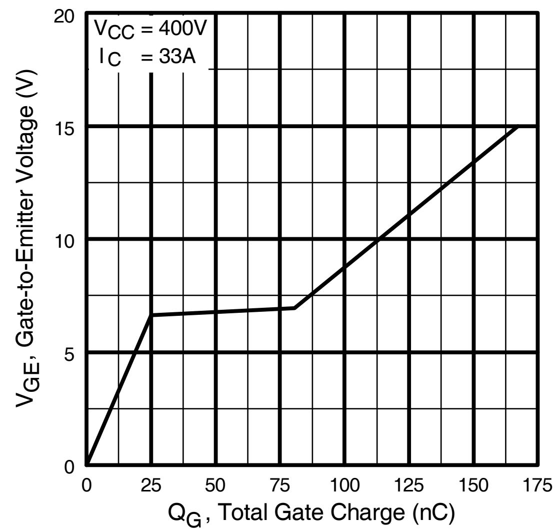


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

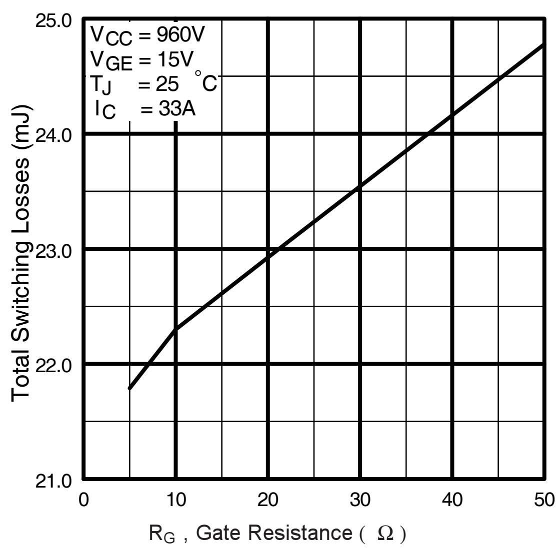


Fig. 9 - Typical Switching Losses vs. Gate Resistance

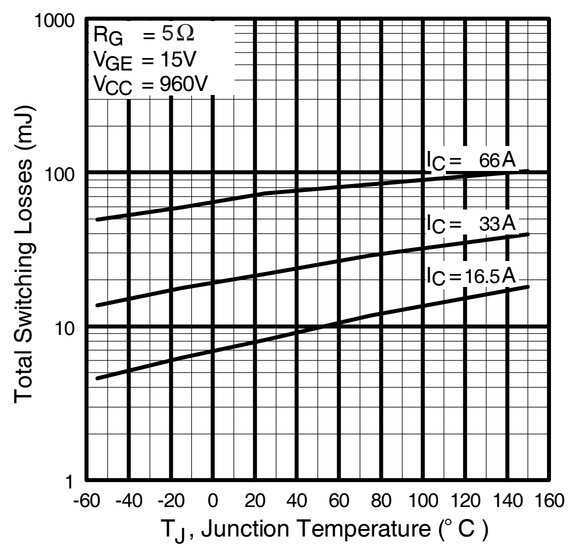


Fig. 10 - Typical Switching Losses vs. Junction Temperature

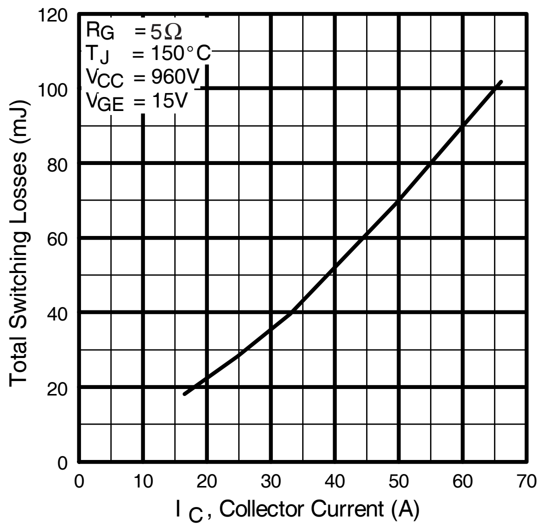


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

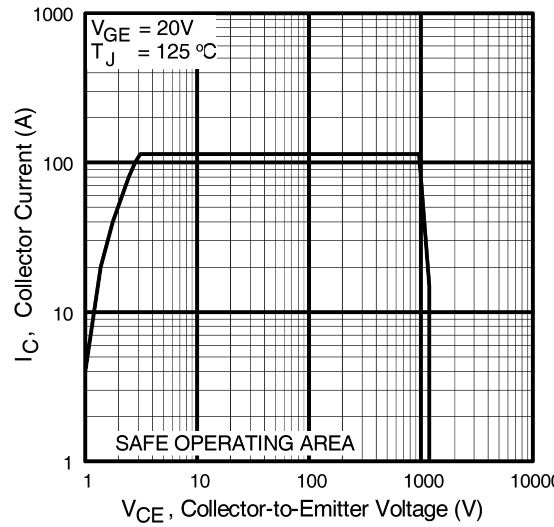


Fig. 12 - Reverse Bias SOA

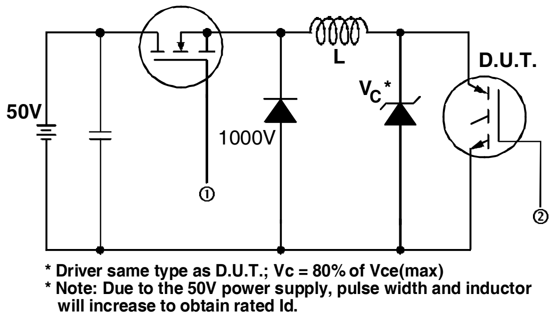


Fig. 13a - Clamped Inductive Load Test Circuit

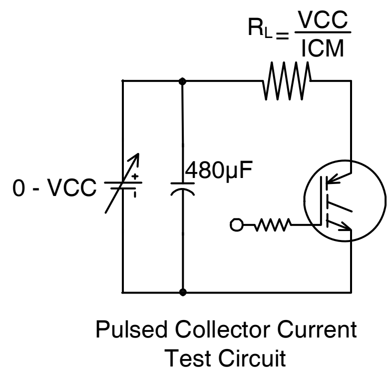


Fig. 13b - Pulsed Collector Current Test Circuit

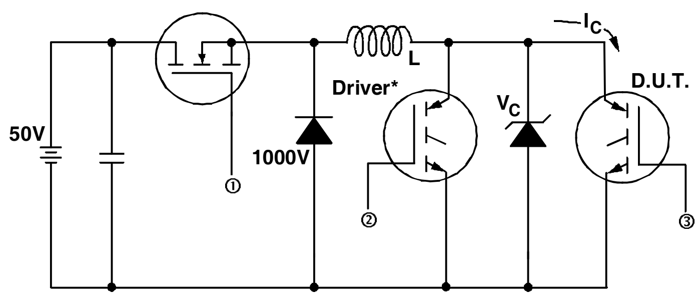


Fig. 14a - Switching Loss Test Circuit

* Driver same type as D.U.T., VC = ----V

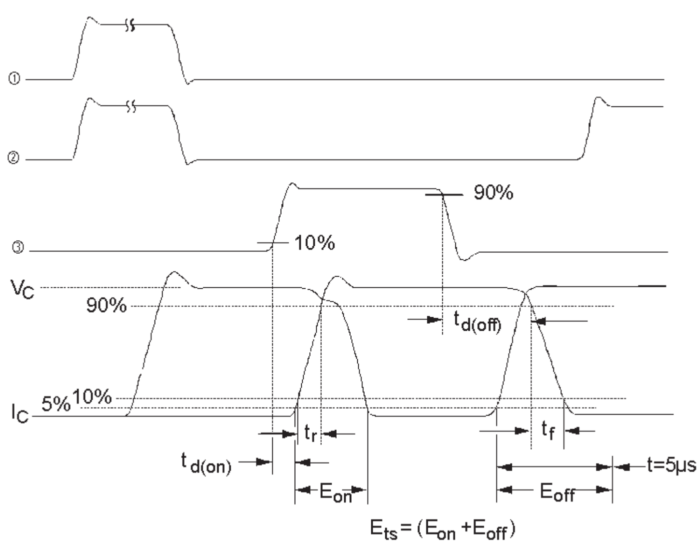
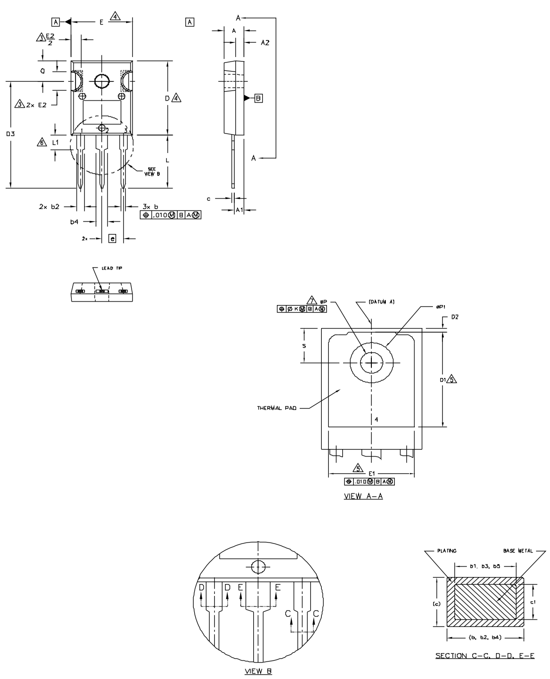


Fig. 14b - Switching Loss Waveforms

 www.irf.com May 02, 2013

TO-247AC Package Outline

Dimensions are shown in milimeters (inches)



NOTES:

1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.
2. DIMENSIONS ARE SHOWN IN INCHES.
3. CONTOUR OF SLOT OPTIONAL.
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. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS D1 & E1.
6. LEAD FINISH UNCONTROLLED IN L1.
7. øP TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5 ° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF .154 INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-247AC .

SYMBOL	DIMENSIONS				NOTES
	INCHES		MILLIMETERS		
	MIN.	MAX.	MIN.	MAX.	
A	.183	.209	4.65	5.31	
A1	.087	.102	2.21	2.59	
A2	.059	.098	1.50	2.49	
b	.039	.055	0.99	1.40	
b1	.039	.053	0.99	1.35	
b2	.065	.094	1.65	2.39	
b3	.065	.092	1.65	2.34	
b4	.102	.135	2.59	3.43	
b5	.102	.133	2.59	3.38	
c	.015	.035	0.38	0.89	
c1	.015	.033	0.38	0.84	
D	.776	.815	19.71	20.70	4
D1	.515	–	13.08	–	5
D2	.020	.053	0.51	1.35	
D3	1.122	1.161	28.50	29.50	
E	.602	.625	15.29	15.87	4
E1	.530	–	13.46	–	
E2	.178	.216	4.52	5.49	
e	.215 BSC		5.46 BSC		
øk	.010		0.25		
L	.559	.634	14.20	16.10	
L1	.146	.169	3.71	4.29	
øP	.140	.144	3.56	3.66	
øP1	–	.291	–	7.39	
Q	.209	.224	5.31	5.69	
S	.217 BSC		5.51 BSC		

SPECIAL NOTE:

a) ADDED D3 FOR SPECIAL REQUIREMENT

PART NUMBERS AFFECTED:

AUIRG4PH50S
AUIRGP4066D1/E
AUIRGP4063D/E
AUIRGP50B60PD1/E
AUIRGP35B60PD/E
AUIRGP4062D1/E
AUIRGP65A20D0
AUIRGP65G20D0
AUIRGP/F66524D0
AUIRGP/F76524D0
AUIRGP/F66548D0
AUIRGP/F76548D0

LEAD ASSIGNMENTS

HEXFET

1.– GATE
2.– DRAIN
3.– SOURCE
4.– DRAIN

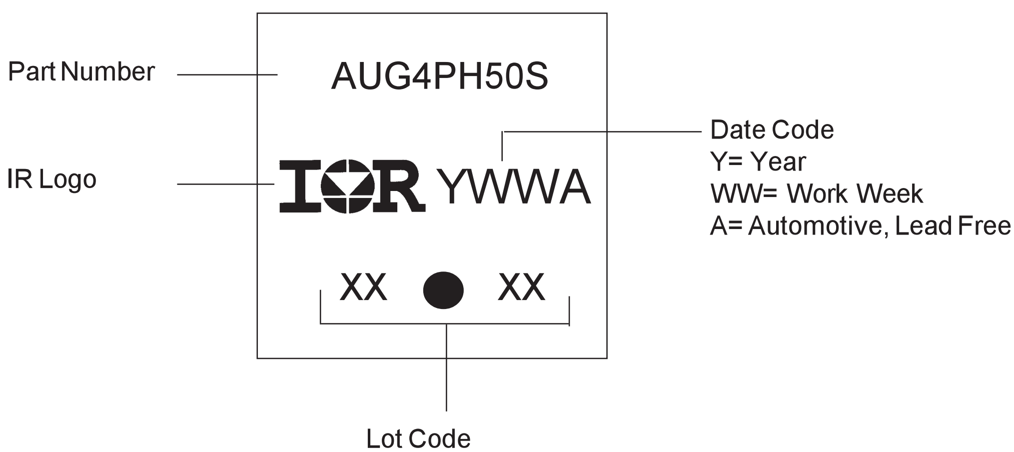
IGBTs, CoPACK

1.– GATE
2.– COLLECTOR
3.– EMITTER
4.– COLLECTOR

DIODES

1.– ANODE/OPEN
2.– CATHODE
3.– ANODE

TO-247AC Part Marking Information



Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

Qualification Information†

Qualification Level		Automotive (per AEC-Q101) ††	
		Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
Moisture Sensitivity Level		TO-247AC	N/A
ESD	Machine Model	Class M3 AEC-Q101-002	
	Human Body Model	Class H2 AEC-Q101-001	
	Charged Device Model	Class C4 AEC-Q101-005	
RoHS Compliant		Yes	

† Qualification standards can be found at International Rectifier's web site: http//www.irf.com/

†† Exceptions to AEC-Q101 requirements are noted in the qualification report.

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http://www.irf.com/technical-info/

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