

International **IR** Rectifier

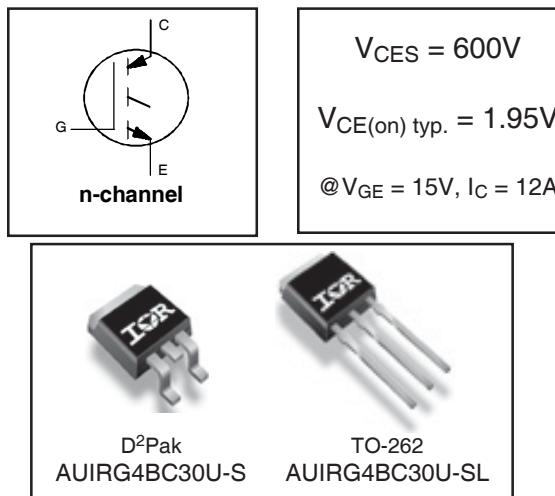
INSULATED GATE BIPOLAR TRANSISTOR

Features

- UltraFast: Optimized for high operating frequencies 8-40 kHz in hard switching, >200 kHz in resonant mode
- Industry standard D²Pak & TO-262 package
- Lead-Free, RoHS Compliant
- Automotive Qualified *

Benefits

- Typical Applications: SMPS, PFC



G	C	E
Gate	Collector	Emitter

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 Breakdown Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	23	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	12	
I_{CM}	Pulsed Collector Current ①	92	
I_{LM}	Clamped Inductive Load Current ②	92	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	10	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	100	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	42	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.2	°C/W
$R_{\theta JA}$	Junction-to-Ambient, (PCB Mounted, steady-state)**	—	40	

* * When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

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

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(\text{BR})\text{CES}}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{\text{GE}} = 0\text{V}$, $I_C = 250\mu\text{A}$
$V_{(\text{BR})\text{ECS}}$	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	$V_{\text{GE}} = 0\text{V}$, $I_C = 1.0\text{A}$
$\Delta V_{(\text{BR})\text{CES}/\Delta T_J}$	Temperature Coeff. of Breakdown Voltage	—	0.63	—	$\text{V}/^\circ\text{C}$	$V_{\text{GE}} = 0\text{V}$, $I_C = 1.0\text{mA}$
$V_{\text{CE}(\text{ON})}$	Collector-to-Emitter Saturation Voltage	—	1.95	2.1	V	$I_C = 12\text{A}$ $V_{\text{GE}} = 15\text{V}$
		—	2.52	—		$I_C = 23\text{A}$ See Fig.2, 5
		—	2.09	—		$I_C = 12\text{A}$, $T_J = 150^\circ\text{C}$
$V_{\text{GE}(\text{th})}$	Gate Threshold Voltage	3.0	—	6.0		$V_{\text{CE}} = V_{\text{GE}}$, $I_C = 250\mu\text{A}$
$\Delta V_{\text{GE}(\text{th})/\Delta T_J}$	Temperature Coeff. of Threshold Voltage	—	-13	—	$\text{mV}/^\circ\text{C}$	$V_{\text{CE}} = V_{\text{GE}}$, $I_C = 250\mu\text{A}$
g_{fe}	Forward Transconductance ⑤	3.1	8.6	—	S	$V_{\text{CE}} = 100\text{V}$, $I_C = 12\text{A}$
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	$V_{\text{GE}} = 0\text{V}$, $V_{\text{CE}} = 600\text{V}$
		—	—	2.0		$V_{\text{GE}} = 0\text{V}$, $V_{\text{CE}} = 10\text{V}$, $T_J = 25^\circ\text{C}$
		—	—	1000		$V_{\text{GE}} = 0\text{V}$, $V_{\text{CE}} = 600\text{V}$, $T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{\text{GE}} = \pm 20\text{V}$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	50	75	nC	$I_C = 12\text{A}$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	8.1	12		$V_{\text{CC}} = 400\text{V}$ See Fig.8
Q_{gc}	Gate - Collector Charge (turn-on)	—	18	27		$V_{\text{GE}} = 15\text{V}$
$t_{\text{d}(\text{on})}$	Turn-On Delay Time	—	17	—	ns	$T_J = 25^\circ\text{C}$ $I_C = 12\text{A}$, $V_{\text{CC}} = 480\text{V}$ $V_{\text{GE}} = 15\text{V}$, $R_G = 23\Omega$
t_r	Rise Time	—	9.6	—		
$t_{\text{d}(\text{off})}$	Turn-Off Delay Time	—	78	120		
t_f	Fall Time	—	97	150		
E_{on}	Turn-On Switching Loss	—	0.16	—	mJ	Energy losses include "tail" See Fig. 10, 11, 13, 14
E_{off}	Turn-Off Switching Loss	—	0.20	—		
E_{ts}	Total Switching Loss	—	0.36	0.50		
$t_{\text{d}(\text{on})}$	Turn-On Delay Time	—	20	—	ns	$T_J = 150^\circ\text{C}$, $I_C = 12\text{A}$, $V_{\text{CC}} = 480\text{V}$ $V_{\text{GE}} = 15\text{V}$, $R_G = 23\Omega$
t_r	Rise Time	—	13	—		
$t_{\text{d}(\text{off})}$	Turn-Off Delay Time	—	180	—		
t_f	Fall Time	—	140	—		
E_{ts}	Total Switching Loss	—	0.73	—	mJ	Energy losses include "tail" See Fig. 13, 14
L_E	Internal Source Inductance	—	7.5	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	1100	—	pF	$V_{\text{GE}} = 0\text{V}$ $V_{\text{CC}} = 30\text{V}$ See Fig.7 $f = 1.0\text{MHz}$
C_{oes}	Output Capacitance	—	73	—		
C_{res}	Reverse Transfer Capacitance	—	14	—		

Notes:

- ① Repetitive rating; $V_{\text{GE}} = 20\text{V}$, pulse width limited by max. junction temperature. (See fig. 13b)
- ② $V_{\text{CC}} = 80\%(V_{\text{CES}})$, $V_{\text{GE}} = 20\text{V}$, $L = 10\mu\text{H}$, $R_G = 23\Omega$, (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width $\leq 80\mu\text{s}$; duty factor $\leq 0.1\%$.
- ⑤ Pulse width $5.0\mu\text{s}$, single shot.

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	D ² PAK	MSL1	
	TO-262	N/A	
ESD	Machine Model	Class M4 (+/-450V) AEC-Q101-002	
	Human Body Model	Class H1C (+/-1750V) AEC-Q101-001	
	Charged Device Model	Class C5 (+/-1000V) 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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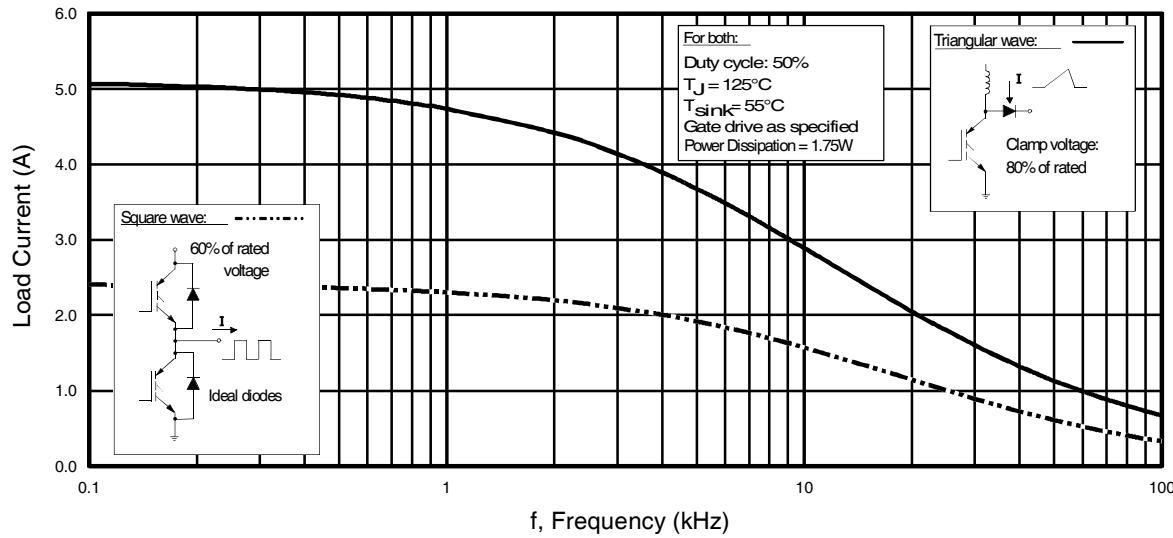


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I = I_{RMS}$ of fundamental; for triangular wave, $I = I_{PK}$)

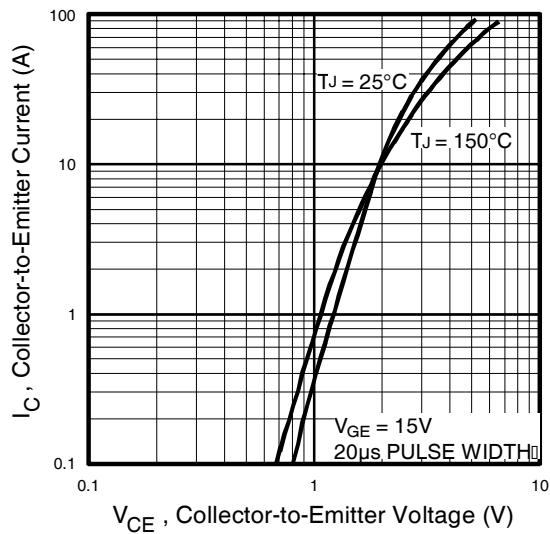


Fig. 2 - Typical Output Characteristics

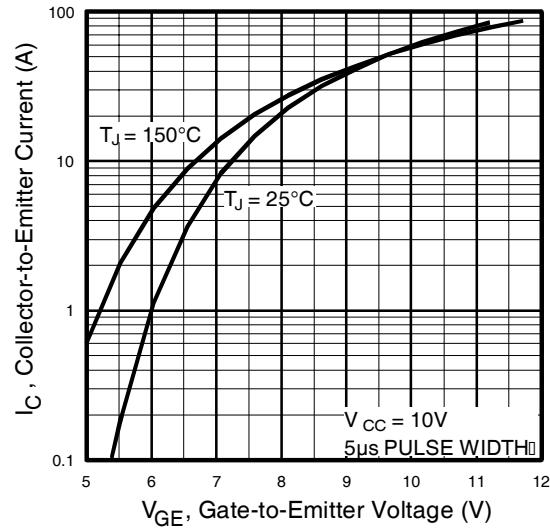


Fig. 3 - Typical Transfer Characteristics

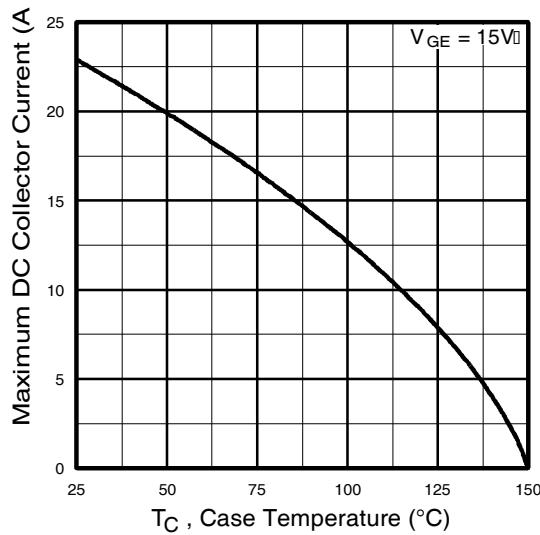


Fig. 4 - Maximum Collector Current vs. Case Temperature

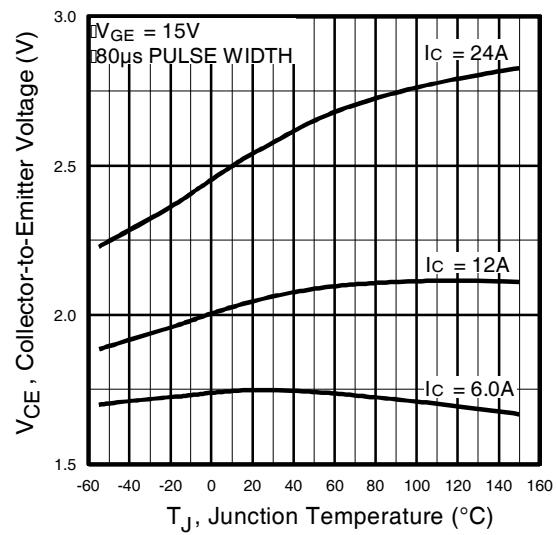


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

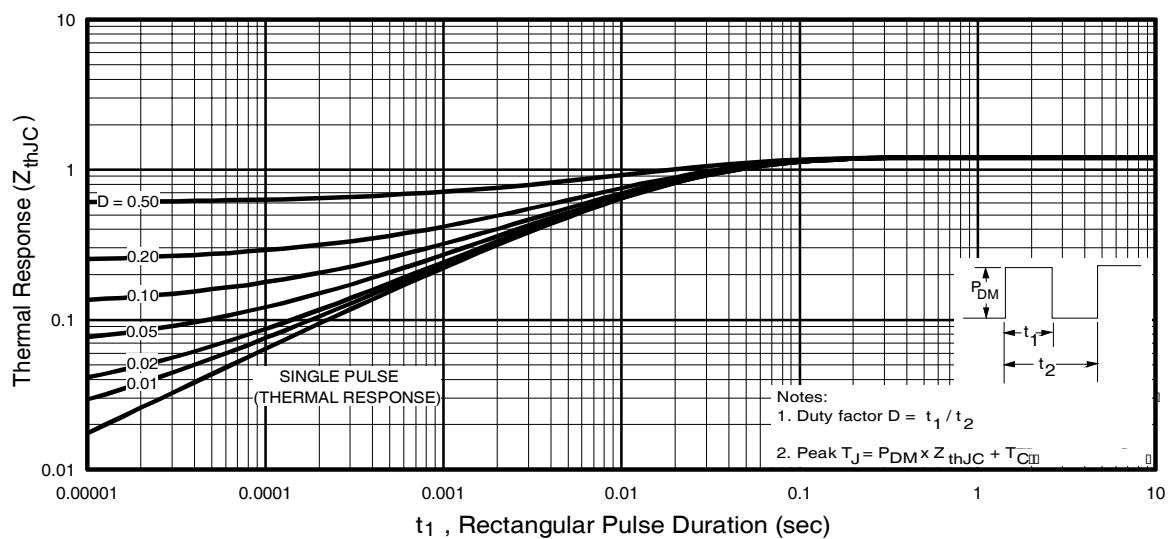


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

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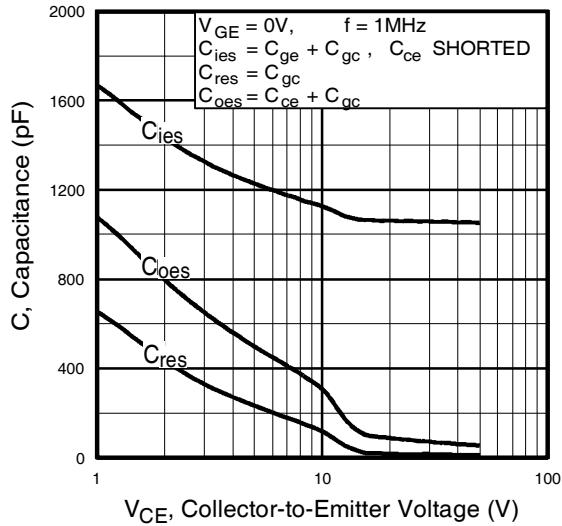


Fig. 7 - Typical Capacitance vs.
Collector-to-Emitter Voltage

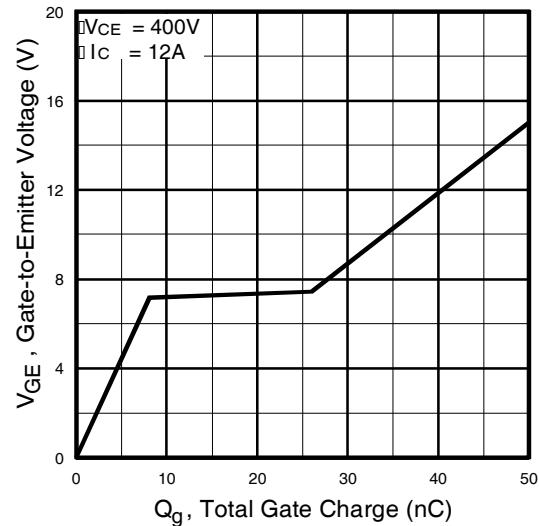


Fig. 8 - Typical Gate Charge vs.
Gate-to-Emitter Voltage

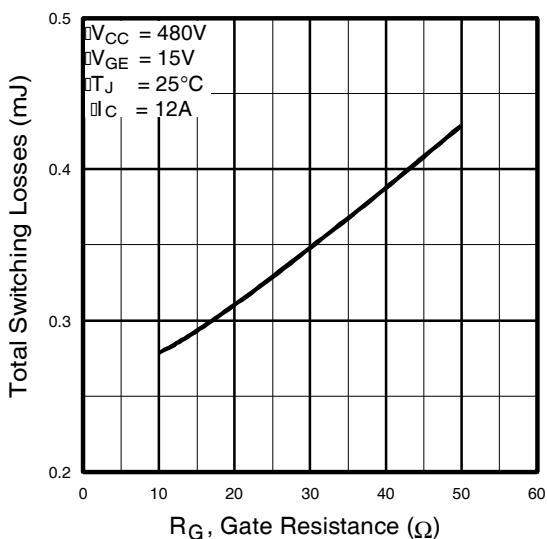


Fig. 9 - Typical Switching Losses vs. Gate
Resistance

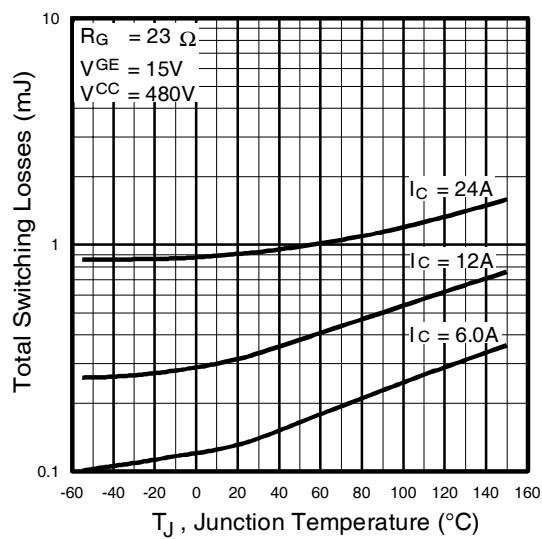


Fig. 10 - Typical Switching Losses vs.
Junction Temperature

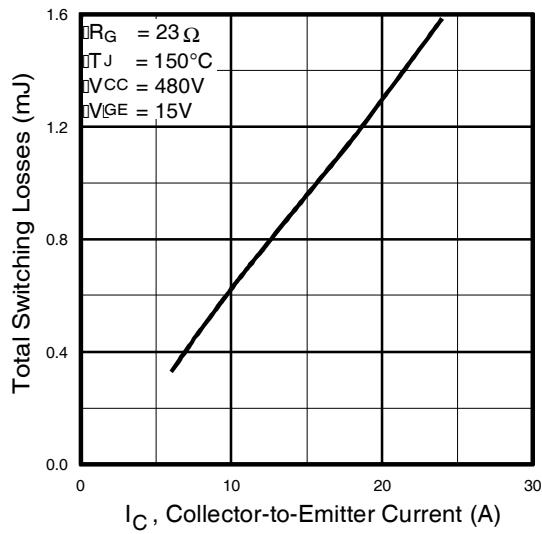


Fig. 11 - Typical Switching Losses vs.
 Collector-to-Emitter Current

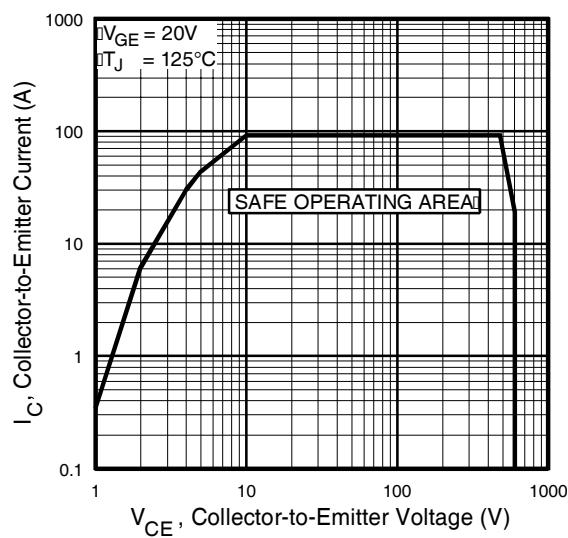
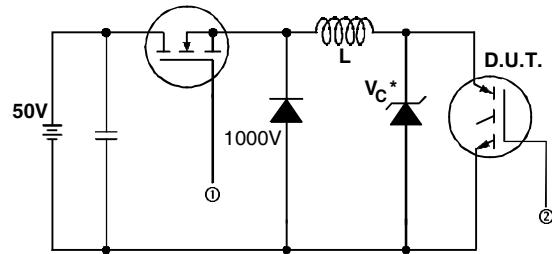


Fig. 12 - Turn-Off SOA

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* Driver same type as D.U.T.; $V_c = 80\%$ of $V_{ce(max)}$
* Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated I_d .

Fig. 13a - Clamped Inductive Load Test Circuit

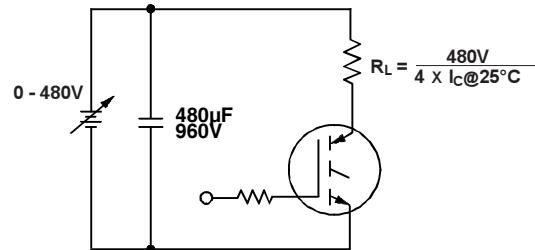


Fig. 13b - Pulsed Collector Current Test Circuit

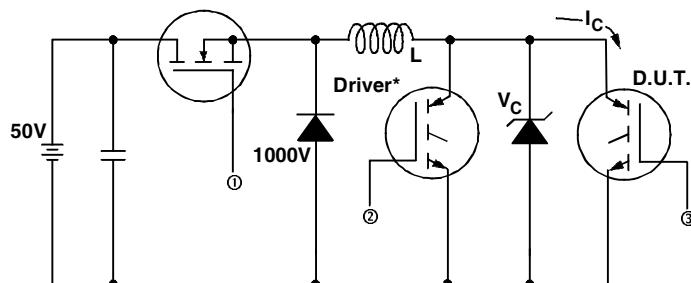


Fig. 14a - Switching Loss Test Circuit

* Driver same type as D.U.T., $V_c = 480V$

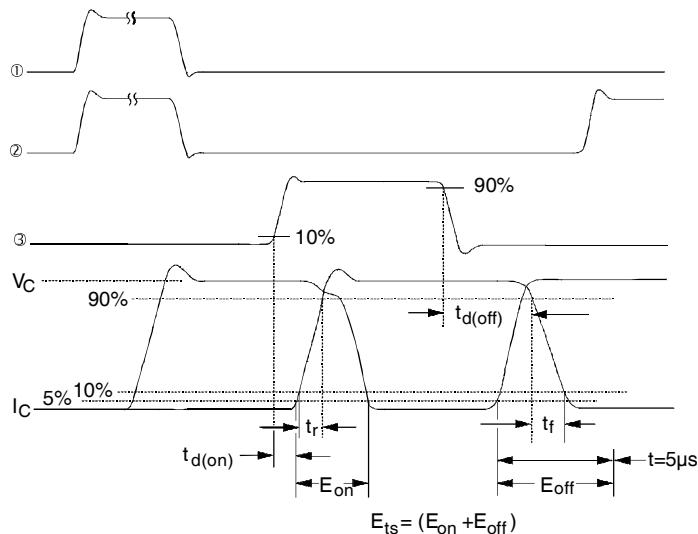


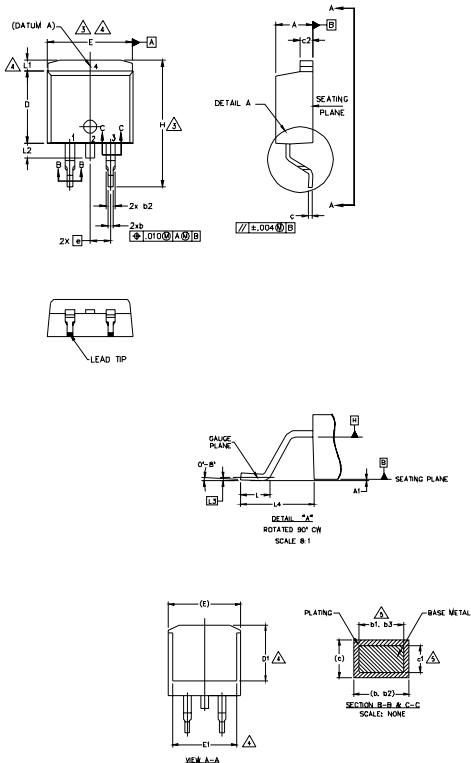
Fig. 14b - Switching Loss Waveforms

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D²Pak (TO-263AB) Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
7. CONTROLLING DIMENSION: INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263AB.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	3
D1	6.86	—	.270	—	4
E	9.65	10.67	.380	.420	3,4
E1	6.22	—	.245	—	4
e	2.54	BSC	.100	BSC	
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1	—	1.65	—	.066	4
L2	1.27	1.78	—	.070	
L3	0.25	BSC	.010	BSC	
L4	4.78	5.28	.188	.208	

LEAD ASSIGNMENTS

HEXFET
 1. - GATE
 2, 4. - DRAIN
 3. - SOURCE

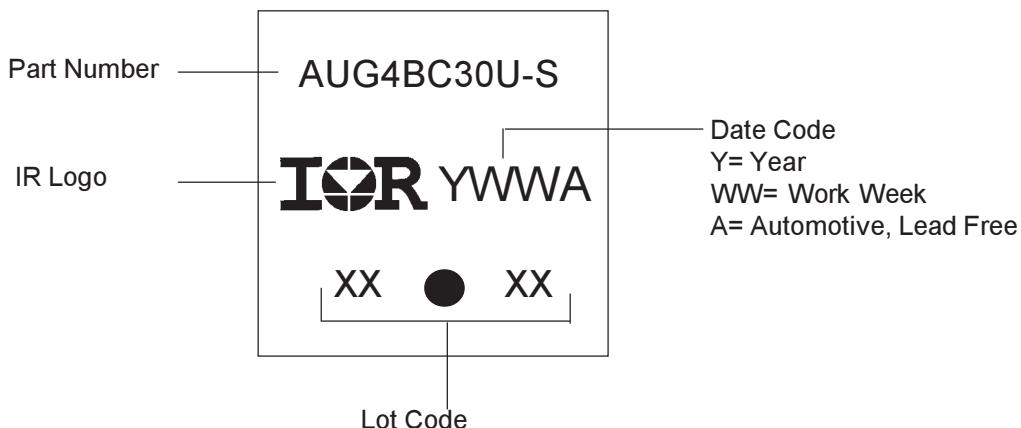
IGBTs, CoPACK
 1. - GATE
 2, 4. - COLLECTOR
 3. - Emitter

DIODES

1. - ANODE *
 2, 4. - CATHODE
 3. - ANODE

* PART DEPENDENT.

D²Pak (TO-263AB) Part Marking Information



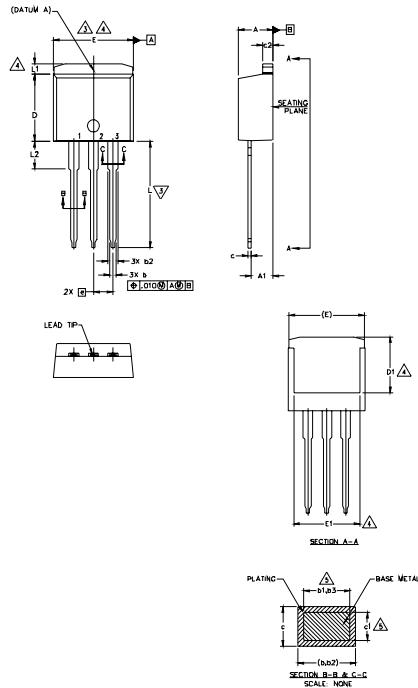
Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>
www.irf.com

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TO-262 Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 (.005") PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. CONTROLLING DIMENSION: INCH.
7. OUTLINE CONFORM TO JEDEC TO-262 EXCEPT A1(max.), b(min.) AND D1(min.) WHERE DIMENSIONS DERIVED THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	2.03	3.02	.080	.119	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	3
D1	6.86	—	.270	—	4
E	9.65	10.67	.380	.420	3,4
E1	6.22	—	.245	—	4
e	2.54 BSC		.100 BSC		
L	13.46	14.10	.530	.555	
L1	—	1.65	—	.065	4
L2	3.56	3.71	.140	.146	

LEAD ASSIGNMENTS

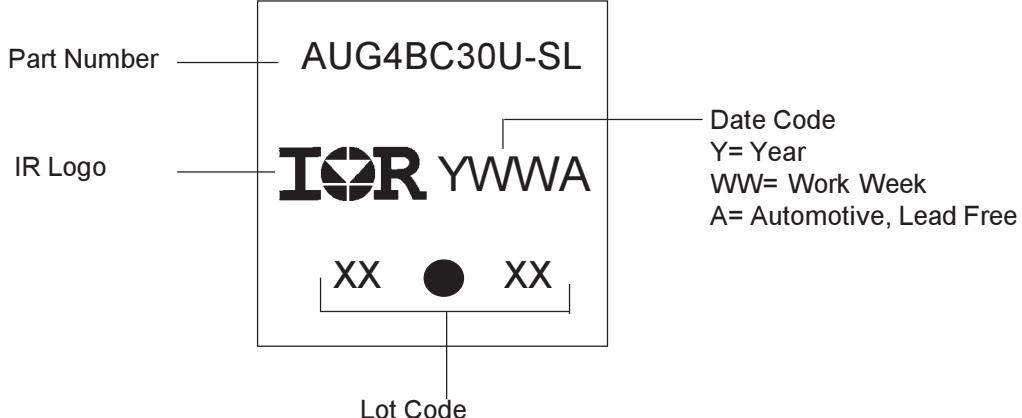
HEXFET

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

IGBTs, CoPACK

1. GATE
2. COLLECTOR
3. Emitter
4. COLLECTOR

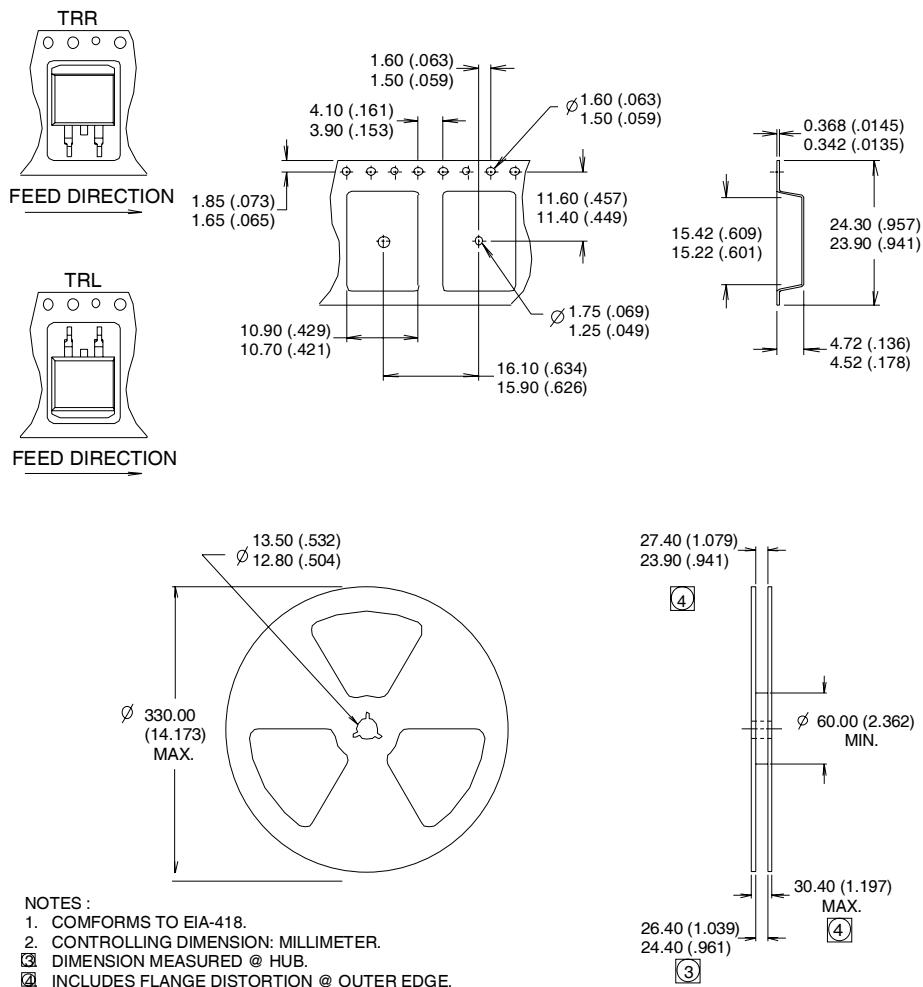
TO-262 Part Marking Information



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

D²Pak (TO-263AB) Tape & Reel Information

Dimensions are shown in millimeters (inches)



AUIRG4BC30U-S/SL

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Ordering Information

Base part number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRG4BC30U-SL	TO-262	Tube	50	AUIRG4BC30U-SL
AUIRG4BC30U-S	D2Pak	Tube	50	AUIRG4BC30U-S
		Tape and Reel Left	800	AUIRG4BC30USTRL
		Tape and Reel Right	800	AUIRG4BC30USTRR

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For technical support, please contact IR's Technical Assistance Center

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

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