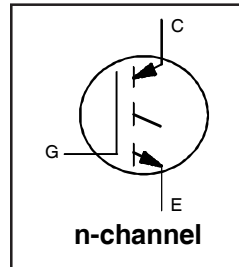


**AUIRGS30B60K**  
**AUIRGL30B60K**

**INSULATED GATE BIPOLAR TRANSISTOR**

**Features**

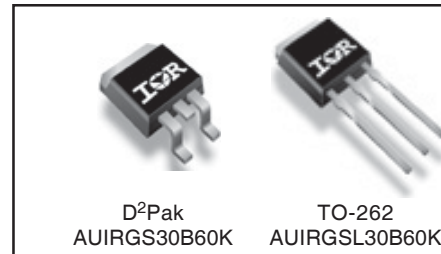
- Low  $V_{CE(on)}$  Non Punch Through IGBT Technology
- 10 $\mu$ s Short Circuit Capability
- Square RBSOA
- Positive  $V_{CE(on)}$  Temperature Coefficient
- Maximum Junction Temperature rated at 175°C
- Lead-Free, RoHS Compliant
- Automotive Qualified \*



$V_{CES} = 600V$
$I_C = 50A, T_C=100^\circ C$ at $T_J=175^\circ C$
$t_{sc} > 10\mu s, T_J=150^\circ C$
$V_{CE(on)}$ typ. = 1.95V

**Benefits**

- Benchmark Efficiency for Motor Control
- Rugged Transient Performance
- Low EMI
- Excellent Current Sharing in Parallel Operation



<b>G</b>	<b>C</b>	<b>E</b>
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 Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	78	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	50	
$I_{CM}$	Pulse Collector Current (Ref.Fig.C.T.5)	120	
$I_{LM}$	Clamped Inductive Load current ①	120	
$V_{ISOL}$	RMS Isolation Voltage, Terminal to Case, t=1 min.	2500	V
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	370	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	180	
$T_J$	Operating Junction and	-55 to +175	°C
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	

**Thermal / Mechanical Characteristics**

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case- IGBT	—	—	0.41*	°C/W
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	—	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount, Steady State)②	—	—	40	
Wt	Weight	—	1.44	—	g

\*  $R_{\theta JC}$  (end of life) = 0.65°C/W. This is the maximum measured value after 1000 temperature cycles from -55 to 150°C and is accounted for by the physical wearout of the die attach medium.

# AUIRGS/SL30B60K

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	Ref.Fig.
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{GE} = 0V, I_C = 500\mu A$	
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.40	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 1mA (25^\circ\text{C}-150^\circ\text{C})$	
$V_{CE(on)}$	Collector-to-Emitter Voltage	—	1.95	2.35	V	$I_C = 30A, V_{GE} = 15V, T_J = 25^\circ\text{C}$	5,6,7
		—	2.40	2.75		$I_C = 30A, V_{GE} = 15V, T_J = 150^\circ\text{C}$	8,9,10
		—	2.6	2.95		$I_C = 30A, V_{GE} = 15V, T_J = 175^\circ\text{C}$	
$V_{GE(th)}$	Gate Threshold Voltage	3.5	4.5	5.5	V	$V_{CE} = V_{GE}, I_C = 250\mu A$	8,9,10
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-10	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 1.0mA (25^\circ\text{C}-150^\circ\text{C})$	11
gfe	Forward Transconductance	—	18	—	S	$V_{CE} = 50V, I_C = 50A, PW = 80\mu s$	
$I_{CES}$	Zero Gate Voltage Collector Current	—	5.0	250	$\mu A$	$V_{GE} = 0V, V_{CE} = 600V$	
		—	1000	2000		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$	
		—	1830	3000		$V_{GE} = 0V, V_{CE} = 600V, T_J = 175^\circ\text{C}$	
$I_{GES}$	Gate-to-Emitter Leakage Current	—	—	$\pm 100$	nA	$V_{GE} = \pm 20V, V_{CE} = 0V$	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	Ref.Fig.
$Q_g$	Total Gate Charge (turn-on)	—	102	153	nC	$I_C = 30A$	17
$Q_{ge}$	Gate-to-Emitter Charge (turn-on)	—	14	21		$V_{CC} = 400V$	CT1
$Q_{gc}$	Gate-to-Collector Charge (turn-on)	—	44	66		$V_{GE} = 15V$	
$E_{on}$	Turn-On Switching Loss	—	350	620	$\mu J$	$I_C = 30A, V_{CC} = 400V$	CT4
$E_{off}$	Turn-Off Switching Loss	—	825	955		$V_{GE} = 15V, R_G = 10\Omega, L = 200\mu H$	
$E_{tot}$	Total Switching Loss	—	1175	1575		$T_J = 25^\circ\text{C}$ ③	
$t_{d(on)}$	Turn-On delay time	—	46	60	ns	$I_C = 30A, V_{CC} = 400V$	CT4
$t_r$	Rise time	—	28	39		$V_{GE} = 15V, R_G = 10\Omega, L = 200\mu H$	
$t_{d(off)}$	Turn-Off delay time	—	185	200		$T_J = 25^\circ\text{C}$	
$t_f$	Fall time	—	31	40			
$E_{on}$	Turn-On Switching Loss	—	635	1085	$\mu J$	$I_C = 30A, V_{CC} = 400V$	CT4
$E_{off}$	Turn-Off Switching Loss	—	1150	1350		$V_{GE} = 15V, R_G = 10\Omega, L = 200\mu H$	12,14
$E_{tot}$	Total Switching Loss	—	1785	2435		$T_J = 150^\circ\text{C}$ ③	WF1,WF2
$t_{d(on)}$	Turn-On delay time	—	46	60	ns	$I_C = 30A, V_{CC} = 400V$	13,15
$t_r$	Rise time	—	28	39		$V_{GE} = 15V, R_G = 10\Omega, L = 200\mu H$	CT4
$t_{d(off)}$	Turn-Off delay time	—	205	235		$T_J = 150^\circ\text{C}$	WF1
$t_f$	Fall time	—	32	42		WF2	
$L_E$	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package	
$C_{ies}$	Input Capacitance	—	1750	—	pF	$V_{GE} = 0V$	16
$C_{oes}$	Output Capacitance	—	160	—		$V_{CC} = 30V$	
$C_{res}$	Reverse Transfer Capacitance	—	60	—		$f = 1.0MHz$	
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				$T_J = 150^\circ\text{C}, I_C = 120A, V_p = 600V$	4
SCSOA	Short Circuit Safe Operating Area	10	—	—	$\mu s$	$V_{CC}=500V, V_{GE} = +15V \text{ to } 0V, R_G = 10\Omega$	CT2
						$T_J = 150^\circ\text{C}, V_p = 600V, R_G = 10\Omega$	CT3
$I_{SC}(\text{Peak})$	Peak Short Circuit Collector Current	—	200	—	A	$V_{CC}=360V, V_{GE} = +15V \text{ to } 0V$	WF3
							WF3

### Notes:

- $V_{CC} = 80\% (V_{CES}), V_{GE} = 20V, L = 28\mu H, R_G = 22\Omega$ .
- This is applied to D<sup>2</sup>Pak, when mounted on 1" square PCB (FR-4 or G-10 Material).  
For recommended footprint and soldering techniques refer to application note #AN-994.
- Energy losses include "tail" and diode reverse recovery.

## Qualification Information<sup>†</sup>

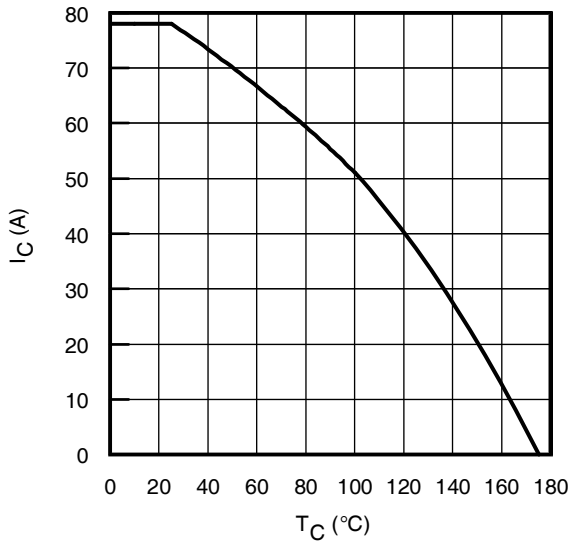
<b>Qualification Level</b>		Automotive (per AEC-Q101) <sup>††</sup>	
		Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
<b>Moisture Sensitivity Level</b>		D <sup>2</sup> PAK	MSL1 <sup>†††</sup> (per IPC/JEDEC J-STD-020)
		TO-262	N/A
<b>ESD</b>	Machine Model	Class M4 (400V) AEC-Q101-002	
	Human Body Model	Class H2 (4000V) AEC-Q101-001	
	Charged Device Model	Class C4 (1000V) AEC-Q101-005	
<b>RoHS Compliant</b>		Yes	

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

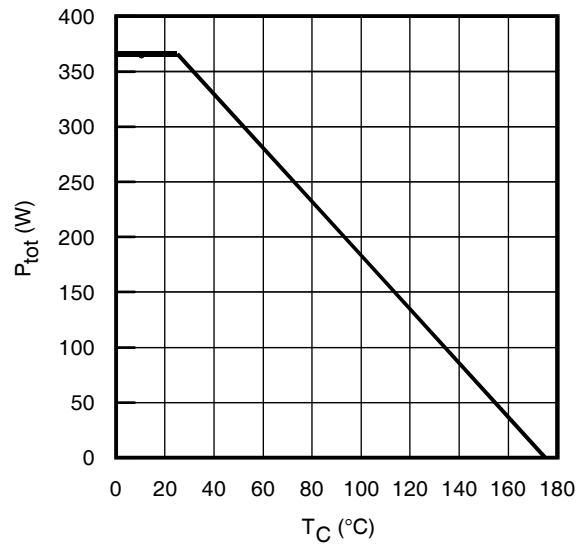
†† Exceptions to AEC-Q101 requirements are noted in the qualification report.

††† Higher MSL ratings may be available for the specific package types listed here. Please contact your International Rectifier sales representative for further information.

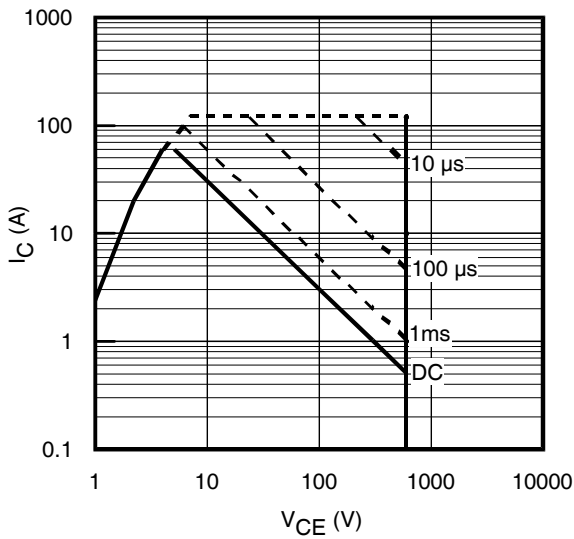
# AUIRGS/SL30B60K



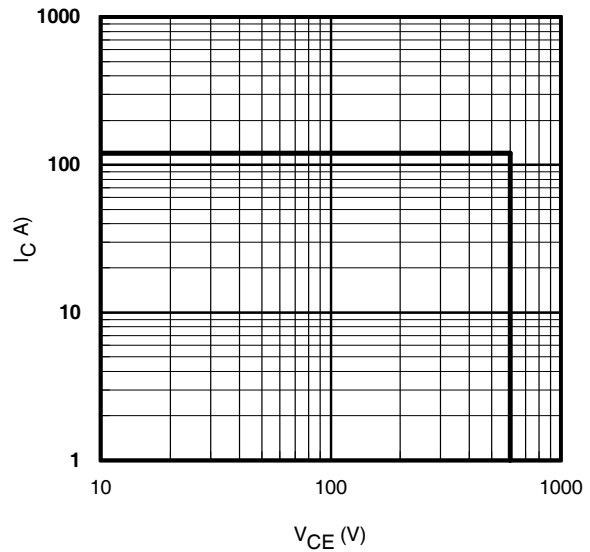
**Fig. 1** - Maximum DC Collector Current vs. Case Temperature



**Fig. 2** - Power Dissipation vs. Case Temperature

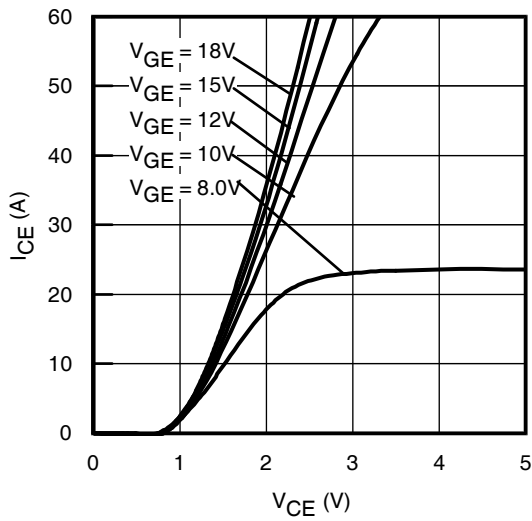


**Fig. 3** - Forward SOA  
 $T_C = 25^{\circ}C$ ;  $T_J \leq 150^{\circ}C$

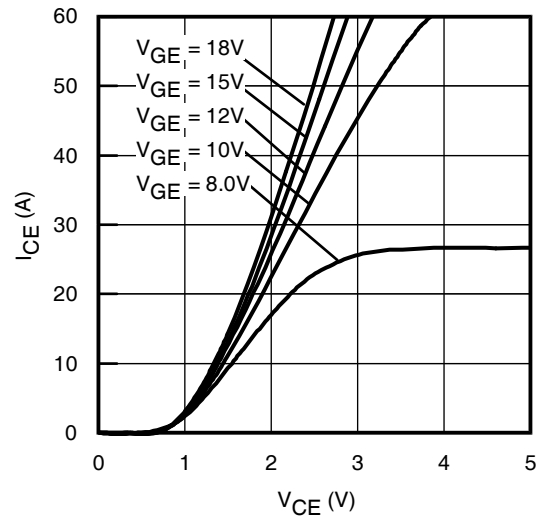


**Fig. 4** - Reverse Bias SOA  
 $T_J = 150^{\circ}C$ ;  $V_{GE} = 15V$

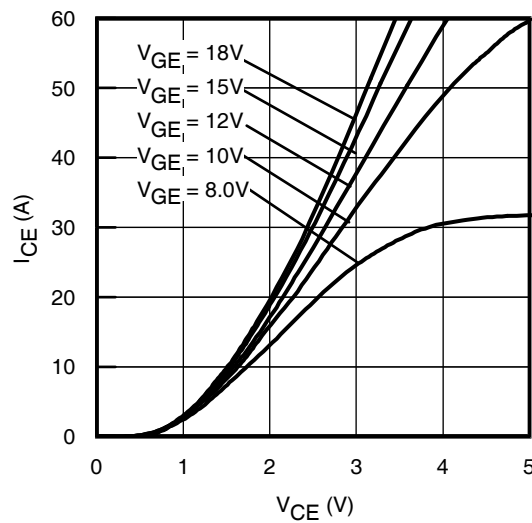
# AUIRGS/SL30B60K



**Fig. 5** - Typ. IGBT Output Characteristics  
 $T_J = -40^\circ\text{C}$ ;  $t_p = 80\mu\text{s}$

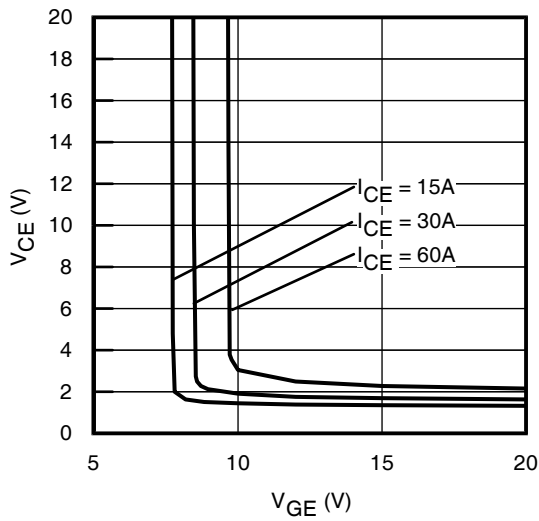


**Fig. 6** - Typ. IGBT Output Characteristics  
 $T_J = 25^\circ\text{C}$ ;  $t_p = 80\mu\text{s}$

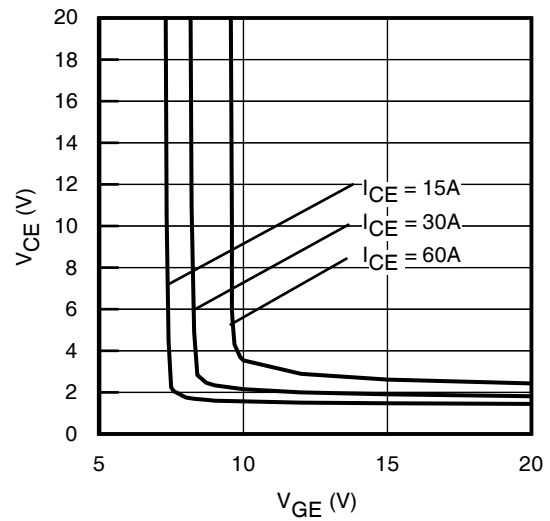


**Fig. 7** - Typ. IGBT Output Characteristics  
 $T_J = 150^\circ\text{C}$ ;  $t_p = 80\mu\text{s}$

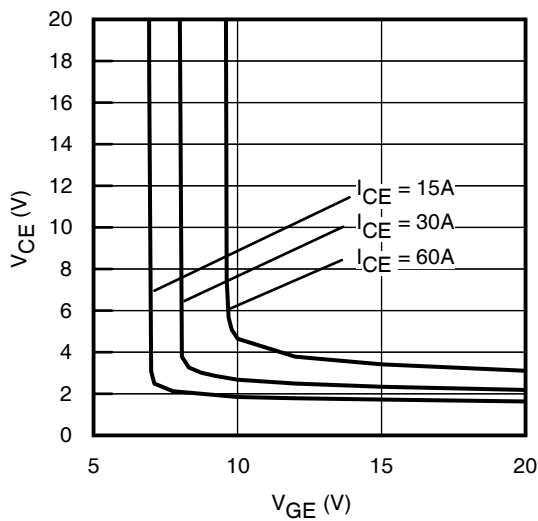
# AUIRGS/SL30B60K



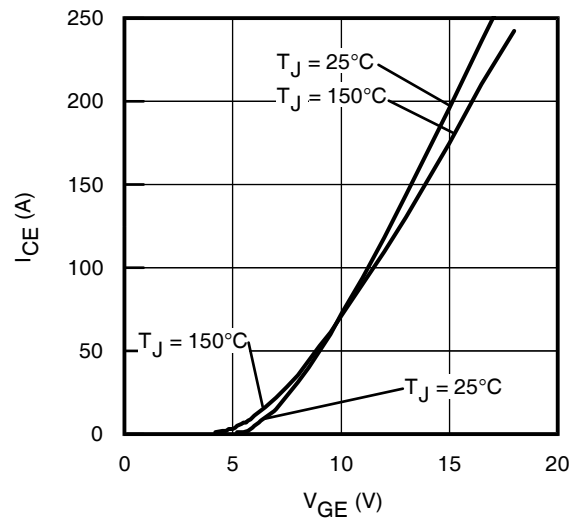
**Fig. 8** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = -40^\circ\text{C}$



**Fig. 9** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = 25^\circ\text{C}$

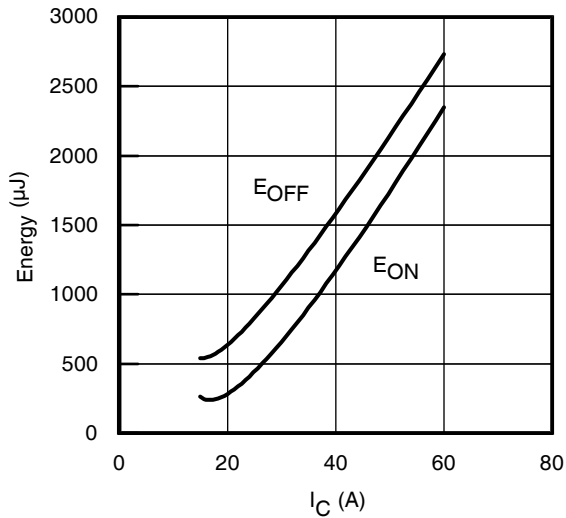


**Fig. 10** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = 150^\circ\text{C}$

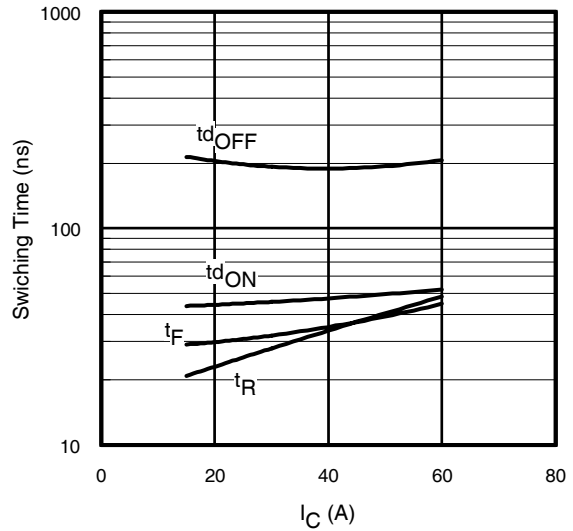


**Fig. 11** - Typ. Transfer Characteristics  
 $V_{CE} = 50\text{V}$ ;  $t_p = 10\mu\text{s}$

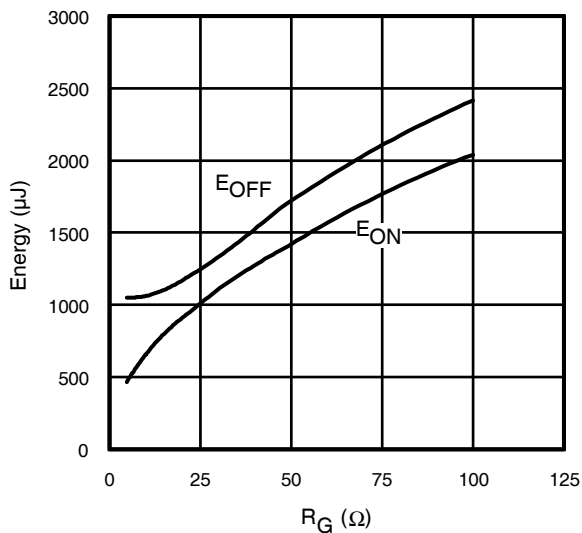
# AUIRGS/SL30B60K



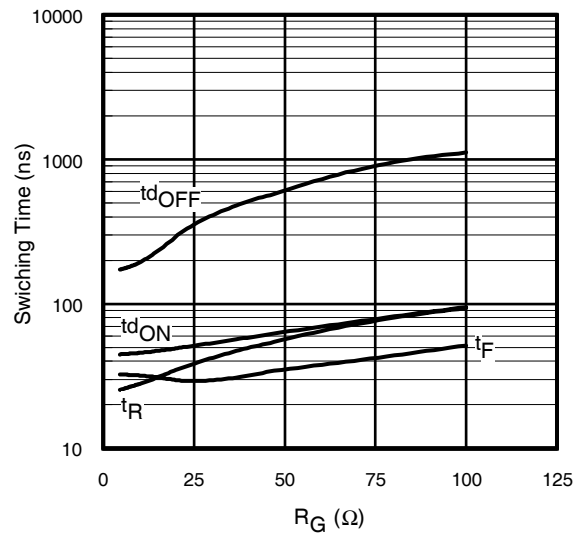
**Fig. 12** - Typ. Energy Loss vs.  $I_C$   
 $T_J = 150^\circ\text{C}$ ;  $L = 200\mu\text{H}$ ;  $V_{CE} = 400\text{V}$ ,  
 $R_G = 10\Omega$ ;  $V_{GE} = 15\text{V}$



**Fig. 13** - Typ. Switching Time vs.  $I_C$   
 $T_J = 150^\circ\text{C}$ ;  $L = 200\mu\text{H}$ ;  $V_{CE} = 400\text{V}$   
 $R_G = 10\Omega$ ;  $V_{GE} = 15\text{V}$

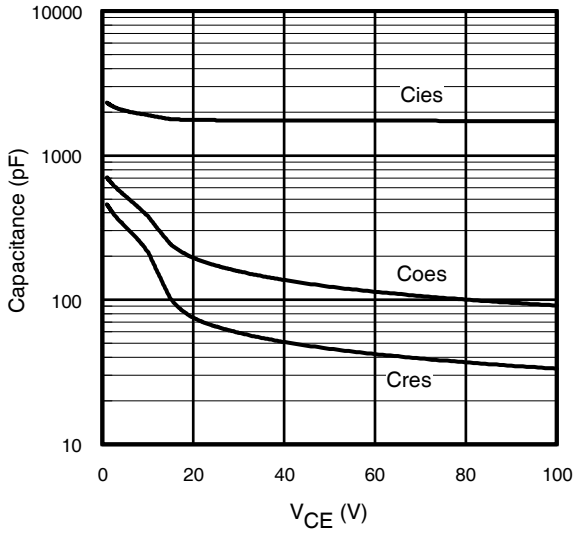


**Fig. 14** - Typ. Energy Loss vs.  $R_G$   
 $T_J = 150^\circ\text{C}$ ;  $L = 200\mu\text{H}$ ;  $V_{CE} = 400\text{V}$   
 $I_{CE} = 30\text{A}$ ;  $V_{GE} = 15\text{V}$

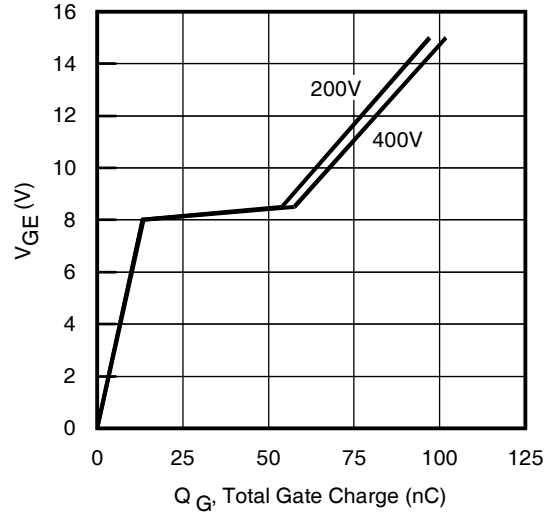


**Fig. 15** - Typ. Switching Time vs.  $R_G$   
 $T_J = 150^\circ\text{C}$ ;  $L = 200\mu\text{H}$ ;  $V_{CE} = 400\text{V}$   
 $I_{CE} = 30\text{A}$ ;  $V_{GE} = 15\text{V}$

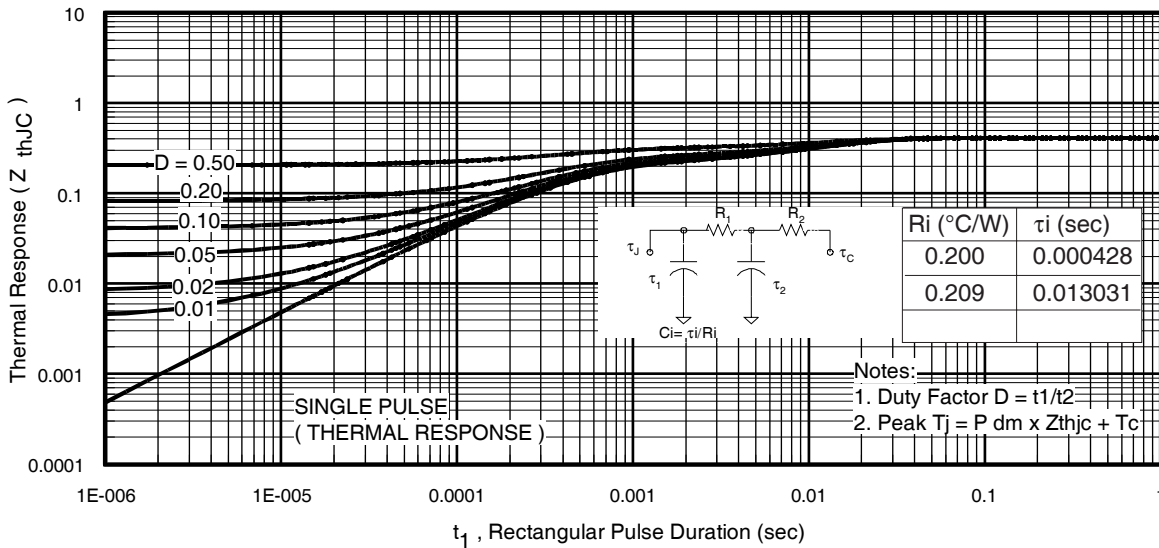
# AUIRGS/SL30B60K



**Fig. 16-** Typ. Capacitance vs. V<sub>CE</sub>  
V<sub>GE</sub>= 0V; f = 1MHz



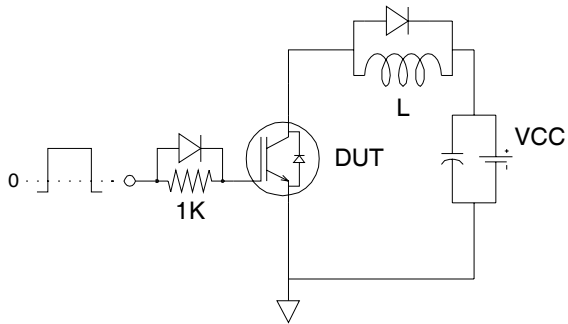
**Fig. 17 -** Typical Gate Charge vs. V<sub>GE</sub>  
I<sub>CE</sub> = 30A; L = 600μH



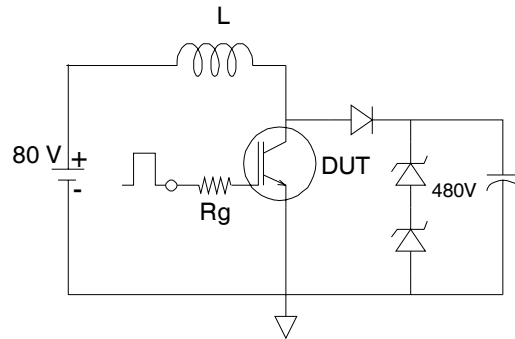
**Fig 18.** Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)



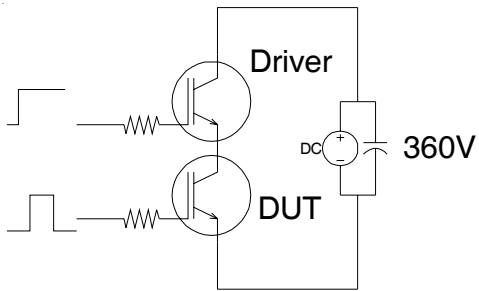
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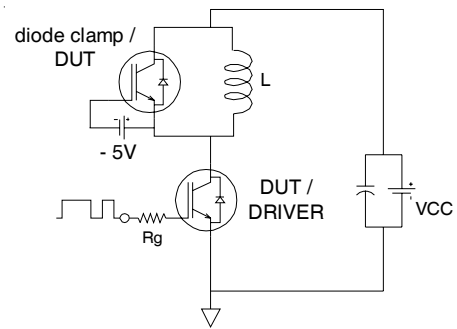
**Fig.C.T.1** - Gate Charge Circuit (turn-off)



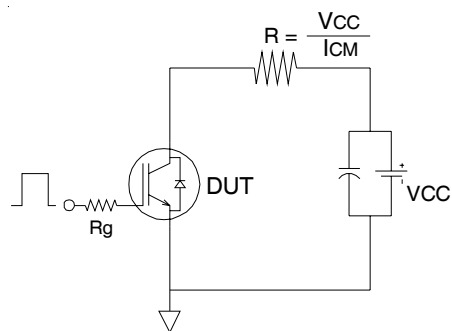
**Fig.C.T.2** - RBSOA Circuit



**Fig.C.T.3** - S.C.SOA Circuit



**Fig.C.T.4** - Switching Loss Circuit



**Fig.C.T.5** - Resistive Load Circuit

# AUIRGS/SL30B60K

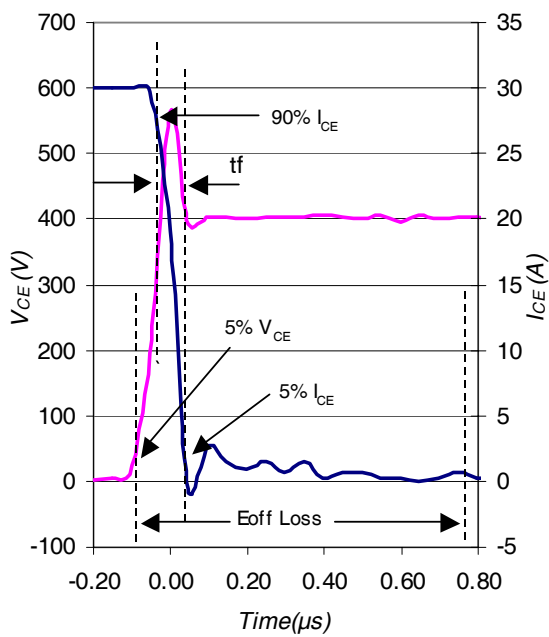


Fig. WF1- Typ. Turn-off Loss Waveform  
 @  $T_j = 150^\circ\text{C}$  using Fig. CT.4

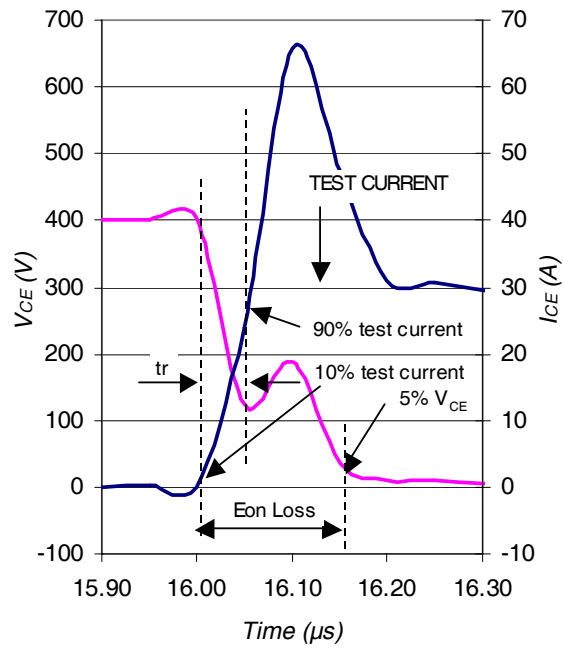


Fig. WF2- Typ. Turn-on Loss Waveform  
 @  $T_j = 150^\circ\text{C}$  using Fig. CT.4

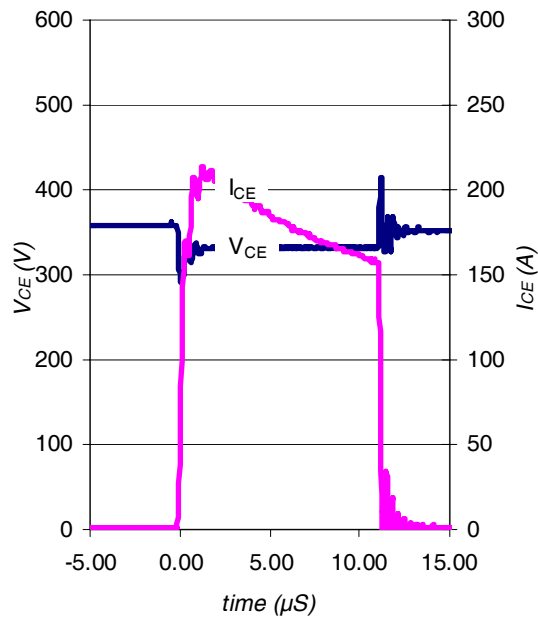
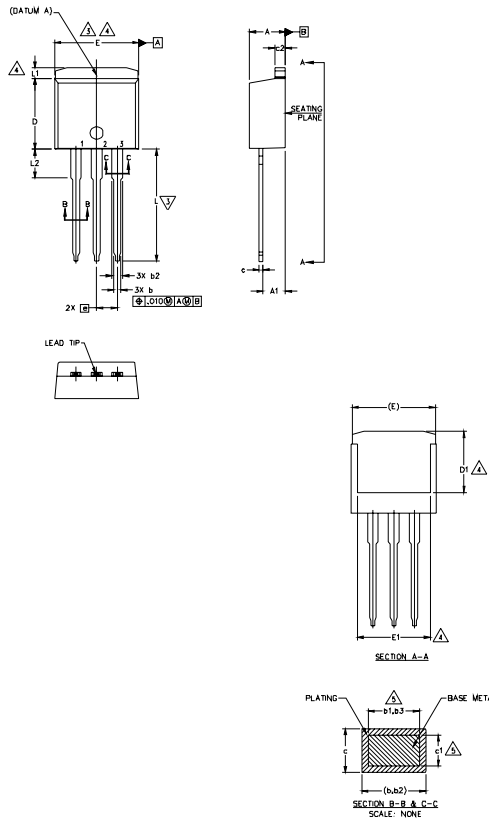


Fig. WF3- Typ. S.C Waveform  
 @  $T_c = 150^\circ\text{C}$  using Fig. CT.3

## 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	5	
A1	2.03	3.02	.080	.119		
b	0.51	0.99	.020	.039		
b1	0.51	0.89	.020	.035		
b2	1.14	1.78	.045	.070		
b3	1.14	1.73	.045	.068		
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	-	4	
L	13.46	14.10	.530	.555		
L1	-	1.65	-	.065		
L2	3.56	3.71	.140	.146		

**LEAD ASSIGNMENTS**

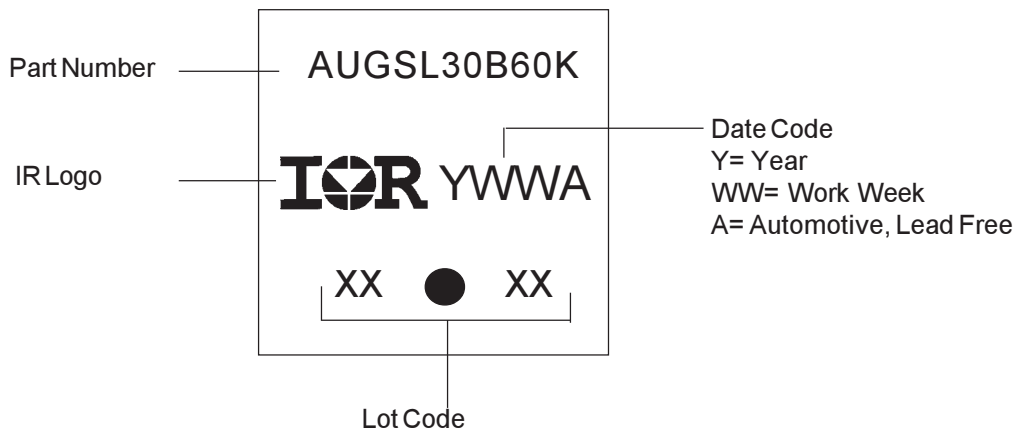
**HEXFEEET**

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

**IGBTs, CoPACK**

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

## TO-262 Part Marking Information

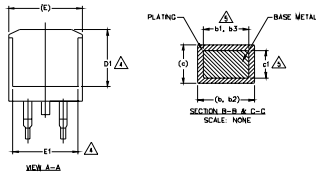
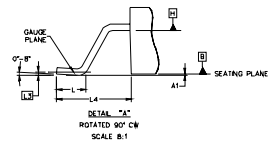
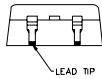
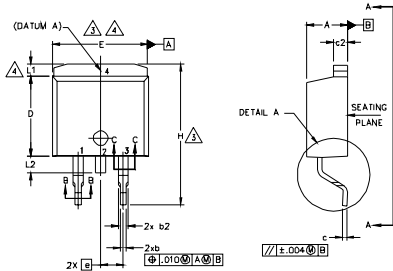


**Note:** For the most current drawing please refer to IR website at <http://www.irf.com/package/>

# AUIRGS/SL30B60K

## D<sup>2</sup>Pak (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	
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

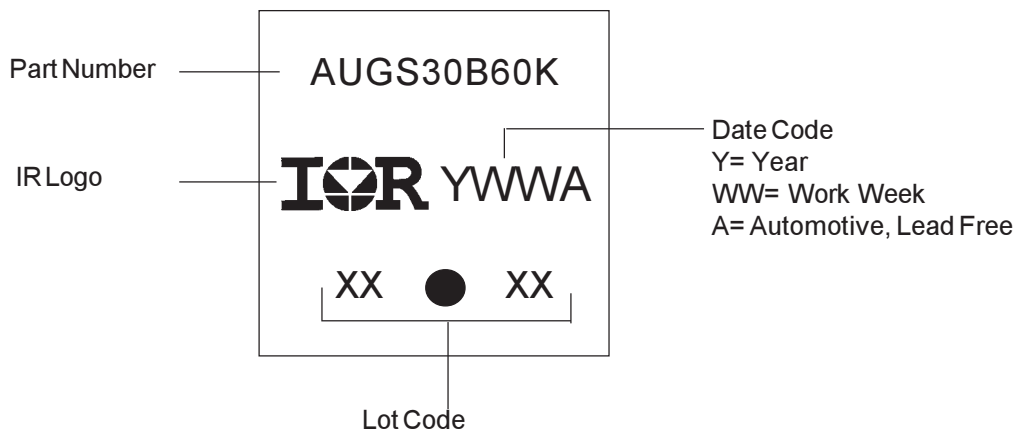
- 1.- GATE
- 2, 4.- COLLECTOR
- 3.- EMITTER

DIODES

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

\* PART DEPENDENT.

## D<sup>2</sup>Pak (TO-263AB) Part Marking Information

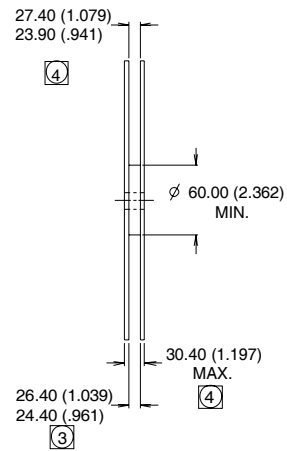
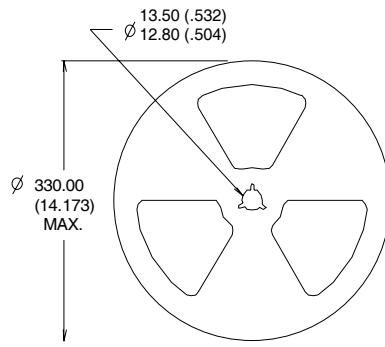
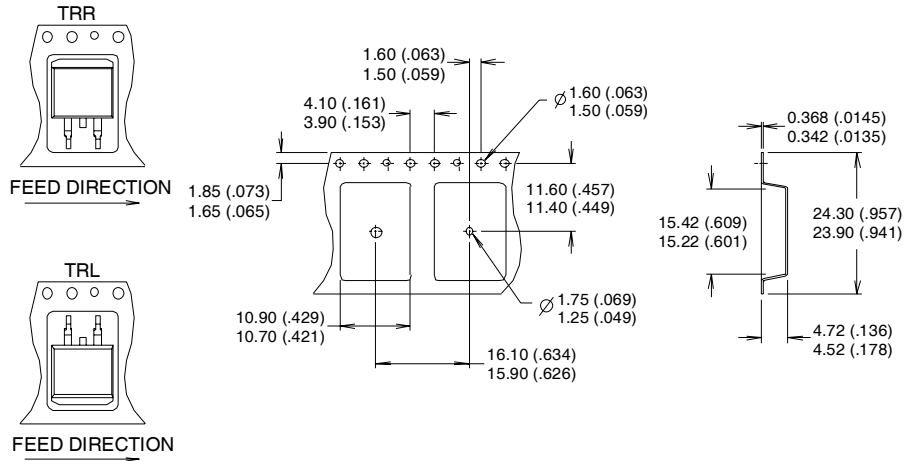


Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

# AUIRGS/SL30B60K

## D<sup>2</sup>Pak (TO-263AB) Tape & Reel Information

Dimensions are shown in millimeters (inches)



- NOTES:
1. COMFORMS TO EIA-418.
  2. CONTROLLING DIMENSION: MILLIMETER.
  - ③ DIMENSION MEASURED @ HUB.
  - ④ INCLUDES FLANGE DISTORTION @ OUTER EDGE.

# AUIRGS/SL30B60K

## Ordering Information

Base part number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRGS30B60K	TO-262	Tube	50	AUIRGS30B60K
AUIRGS30B60K	D2Pak	Tube	50	AUIRGS30B60K
		Tape and Reel Left	800	AUIRGS30B60KTRL
		Tape and Reel Right	800	AUIRGS30B60KTRR

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