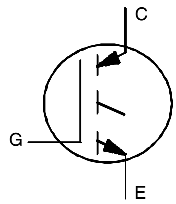
International Rectifier

AUTOMOTIVE GRADE

AUIRGS30B60K
AUIRGSL30B60K

INSULATED GATE BIPOLAR TRANSISTOR



n-channel

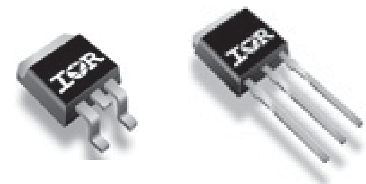
V_{CES} = 600V

I_C = 50A, T_C=100°C
at T_J=175°C

t_{sc} > 10μs, T_J=150°C

$V_{CE(on)}$ typ. = 1.95V

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



D²Pak AUIRGS30B60K — TO-262 AUIRGSL30B60K

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

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 Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	78	A
I_C @ T_C = 100°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	±20	
P_D @ T_C = 25°C	Maximum Power Dissipation	370	W
P_D @ T_C = 100°C	Maximum Power Dissipation	180	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +175	°C
	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.

10/14/10

Dynamic 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	—	0.40	—	V/°C	V_{GE} = 0V, I_C = 1mA (25°C-150°C)	
$V_{CE(on)}$	Collector-to-Emitter Voltage	—	1.95	2.35	V	I_C = 30A, V_{GE} = 15V, T_J = 25°C	5,6,7
		—	2.40	2.75		I_C = 30A, V_{GE} = 15V, T_J = 150°C	8,9,10
		—	2.6	2.95		I_C = 30A, V_{GE} = 15V, T_J = 175°C	
$V_{GE(th)}$	Gate Threshold Voltage	3.5	4.5	5.5	V	V_{CE} = V_{GE}, I_C = 250μA	8,9,10
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-10	—	mV/°C	V_{CE} = V_{GE}, I_C = 1.0mA (25°C-150°C)	11
gfe	Forward Transconductance	—	18	—	S	V_{CE} = 50V, I_C = 50A, PW = 80μs	
I_{CES}	Zero Gate Voltage Collector Current	—	5.0	250	μA	V_{GE} = 0V, V_{CE} = 600V	
		—	1000	2000		V_{GE} = 0V, V_{CE} = 600V, T_J = 150°C	
		—	1830	3000		V_{GE} = 0V, V_{CE} = 600V, T_J = 175°C	
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V_{GE} = ±20V, V_{CE} = 0V	

Static or Switching Characteristics @ T_J = 25°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	μJ	I_C = 30A, V_{CC} = 400V	CT4
E_{off}	Turn-Off Switching Loss	—	825	955		V_{GE} = 15V, R_G = 10Ω, L = 200μH	
E_{tot}	Total Switching Loss	—	1175	1575		T_J = 25°C ③	
$t_{d(on)}$	Turn-On delay time	—	46	60	ns	I_C = 30A, V_{CC} = 400V	
t_r	Rise time	—	28	39		V_{GE} = 15V, R_G = 10Ω, L = 200μH	CT4
$t_{d(off)}$	Turn-Off delay time	—	185	200		T_J = 25°C	
t_f	Fall time	—	31	40			
E_{on}	Turn-On Switching Loss	—	635	1085	μJ	I_C = 30A, V_{CC} = 400V	CT4
E_{off}	Turn-Off Switching Loss	—	1150	1350		V_{GE} = 15V, R_G = 10Ω, L = 200μH	12,14
E_{tot}	Total Switching Loss	—	1785	2435		T_J = 150°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 = 10Ω, L = 200μH	CT4
$t_{d(off)}$	Turn-Off delay time	—	205	235		T_J = 150°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	
C_{oes}	Output Capacitance	—	160	—		V_{CC} = 30V	16
C_{res}	Reverse Transfer Capacitance	—	60	—		f = 1.0MHz	
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T_J = 150°C, I_C = 120A, Vp = 600V V_{CC}=500V,V_{GE} = +15V to 0V,R_G =10Ω	4 CT2
SCSOA	Short Circuit Safe Operating Area	10	—	—	μs	T_J = 150°C, Vp = 600V, R_G = 10Ω V_{CC}=360V,V_{GE} = +15V to 0V	CT3 WF3
I_{SC} (Peak)	Peak Short Circuit Collector Current	—	200	—	A		WF3

Notes:

① V_{CC} = 80% (V_{CES}), V_{GE} = 20V, L = 28μH, R_G = 22Ω.
② This is applied to D^2Pak, when mounted on 1" square PCB (FR-4 or G-10 Material).
For recommended footprint and soldering techniques refer to application note #AN-994.
③ Energy losses include "tail" and diode reverse recovery.

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 ††† (per IPC/JEDEC J-STD-020)
		TO-262	N/A
ESD	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	
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.

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

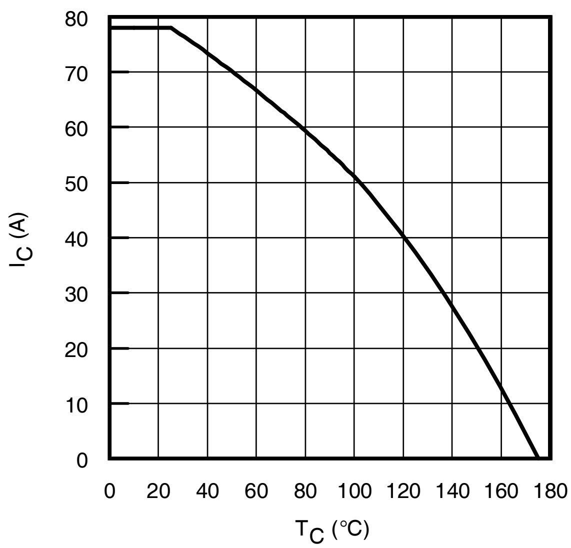


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

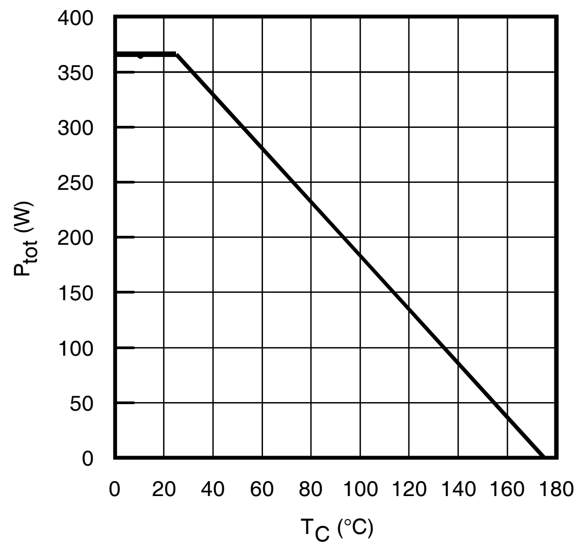


Fig. 2 - Power Dissipation vs. Case Temperature

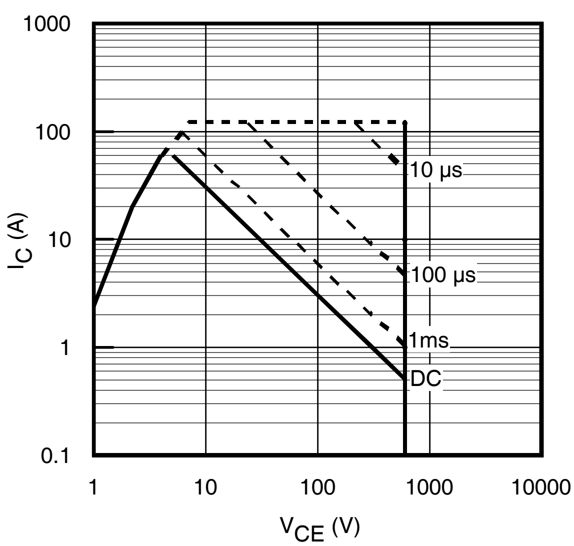


Fig. 3 - Forward SOA
T_C = 25°C; $T_J \leq$ 150°C

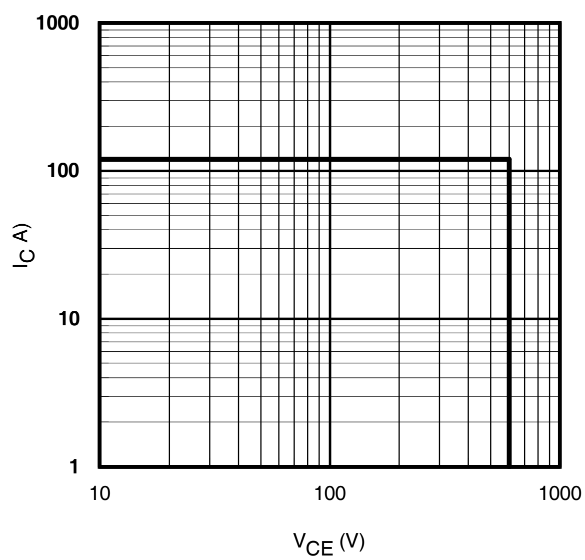


Fig. 4 - Reverse Bias SOA
T_J = 150°C; V_{GE} =15V

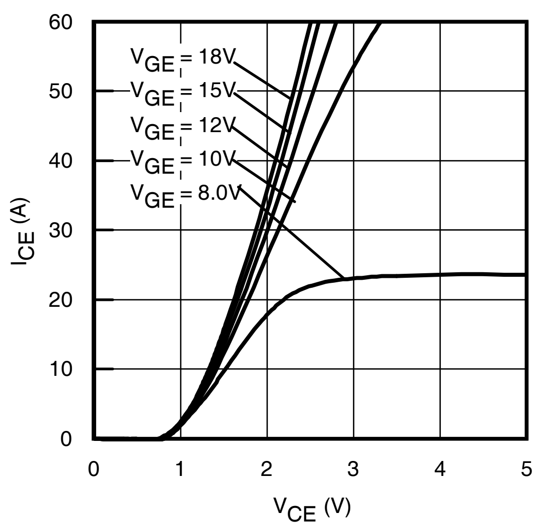


Fig. 5 - Typ. IGBT Output Characteristics
T_J = -40°C; tp = 80µs

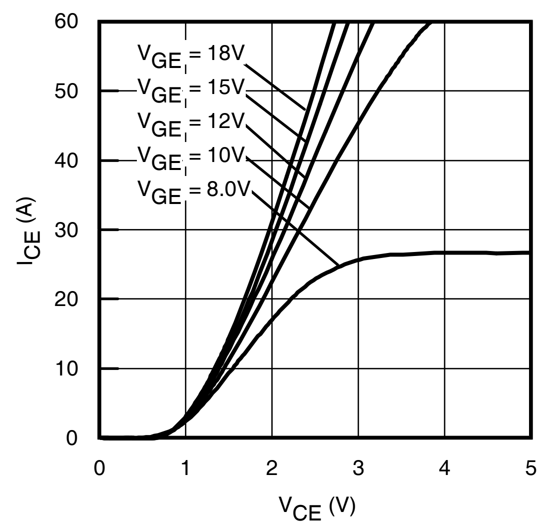


Fig. 6 - Typ. IGBT Output Characteristics
T_J = 25°C; tp = 80µs

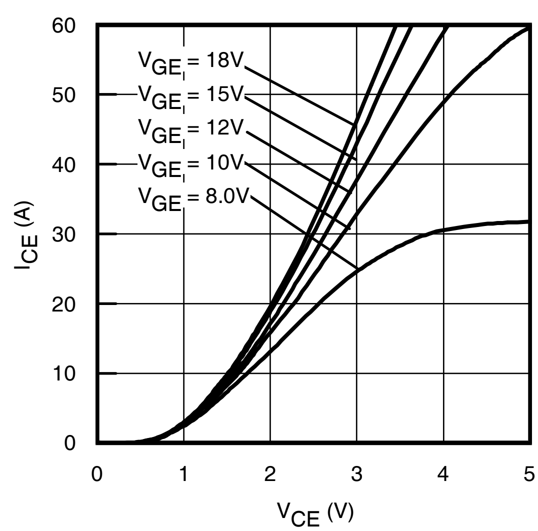


Fig. 7 - Typ. IGBT Output Characteristics
T_J = 150°C; tp = 80µs

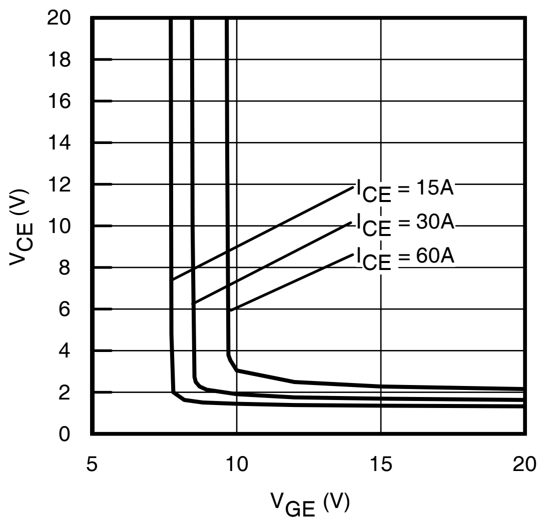


Fig. 8 - Typical V_{CE} vs. V_{GE}
T_J = -40°C

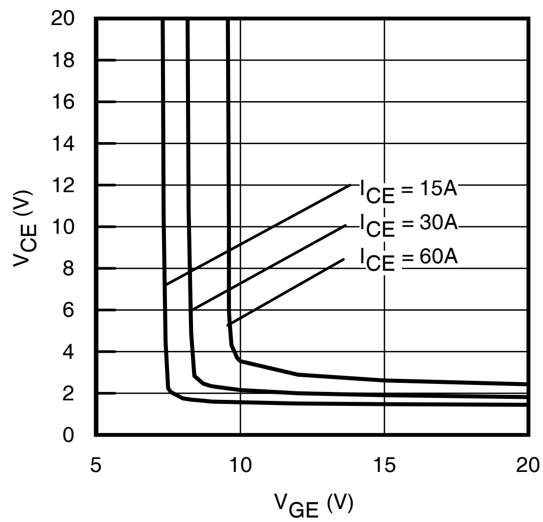


Fig. 9 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

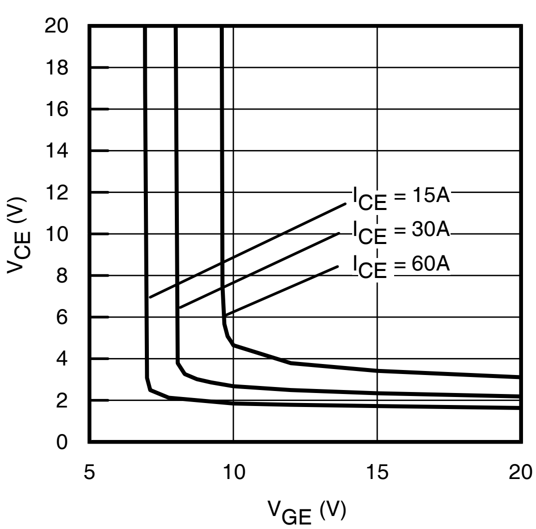


Fig. 10 - Typical V_{CE} vs. V_{GE}
T_J = 150°C

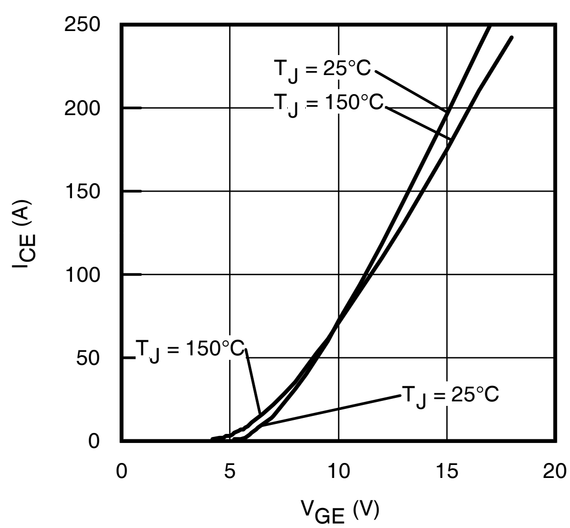


Fig. 11 - Typ. Transfer Characteristics
V_{CE} = 50V; tp = 10µs

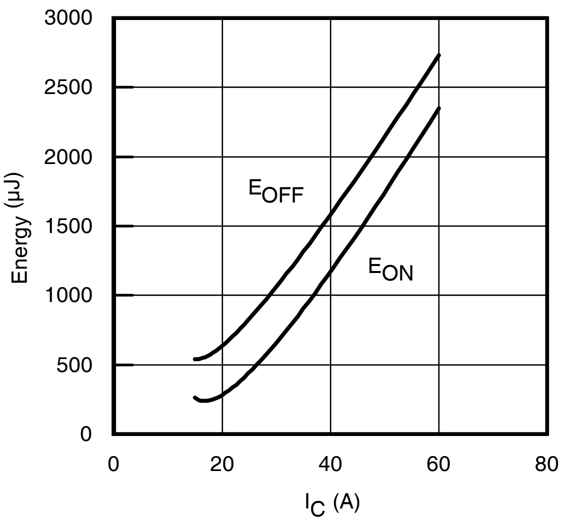


Fig. 12 - Typ. Energy Loss vs. I_C
T_J = 150°C; L=200µH; V_{CE}= 400V,
R_G= 10Ω; V_{GE}= 15V

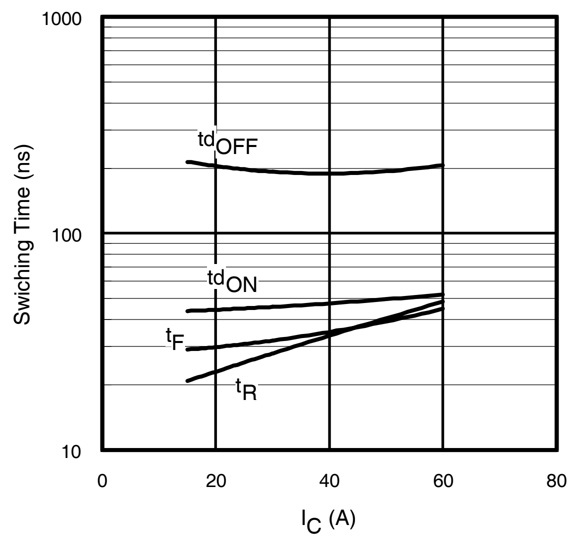


Fig. 13 - Typ. Switching Time vs. I_C
T_J = 150°C; L=200µH; V_{CE}= 400V
R_G= 10Ω; V_{GE}= 15V

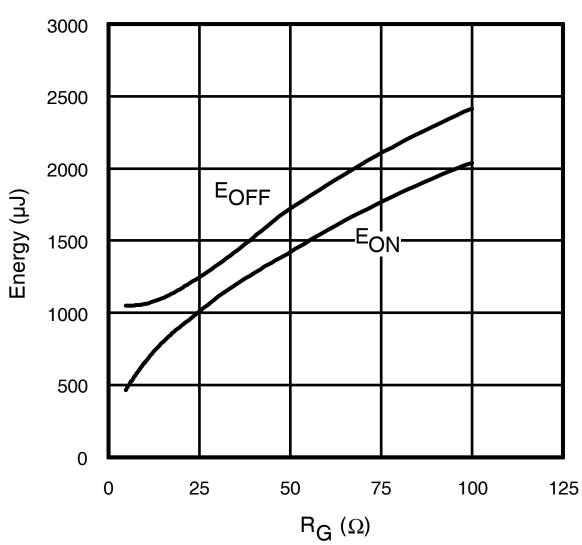


Fig. 14 - Typ. Energy Loss vs. R_G
T_J = 150°C; L=200µH; V_{CE}= 400V
I_{CE}= 30A; V_{GE}= 15V

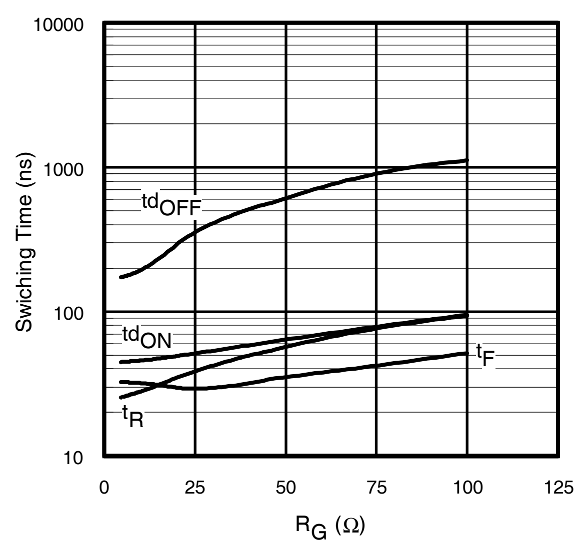


Fig. 15 - Typ. Switching Time vs. R_G
T_J = 150°C; L=200µH; V_{CE}= 400V
I_{CE}= 30A; V_{GE}= 15V

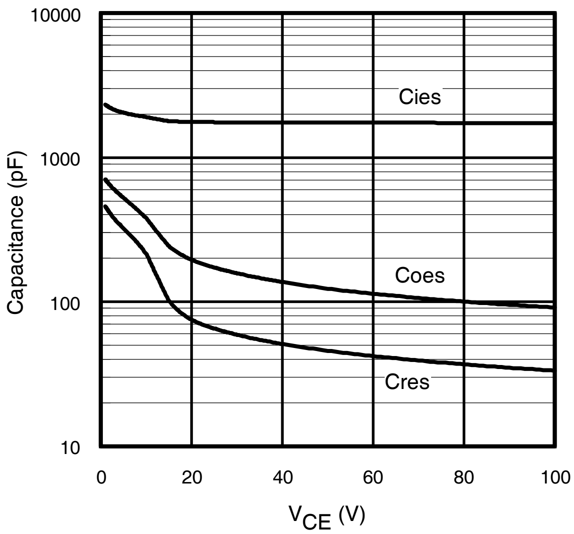


Fig. 16- Typ. Capacitance vs. V_{CE}
V_{GE}= 0V; f = 1MHz

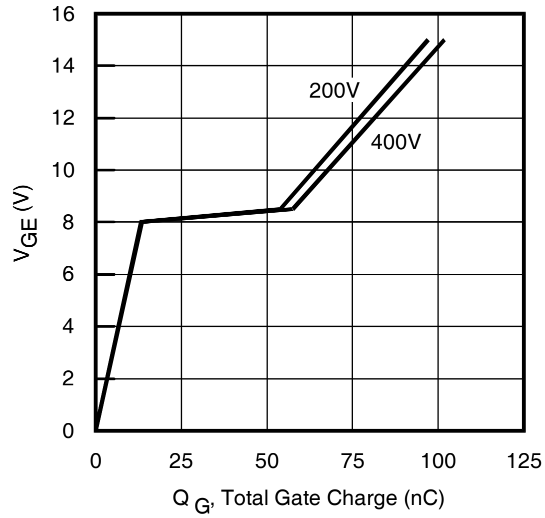


Fig. 17 - Typical Gate Charge vs. V_{GE}
I_{CE} = 30A; L = 600µH

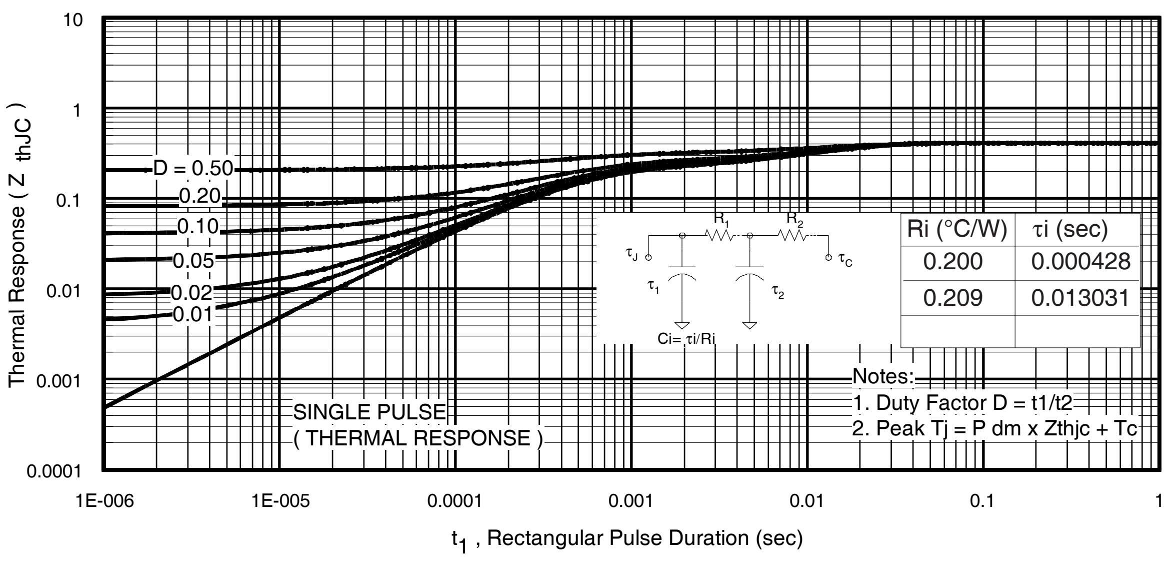


Fig 18. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

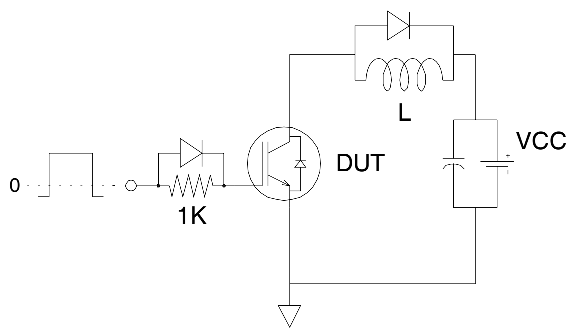


Fig.C.T.1 - Gate Charge Circuit (turn-off)

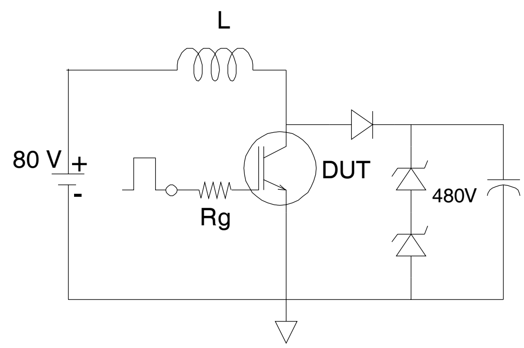


Fig.C.T.2 - RBSOA Circuit

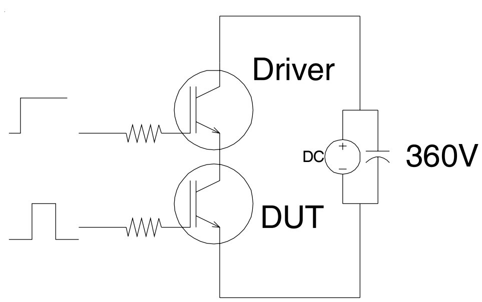


Fig.C.T.3 - S.C.SOA Circuit

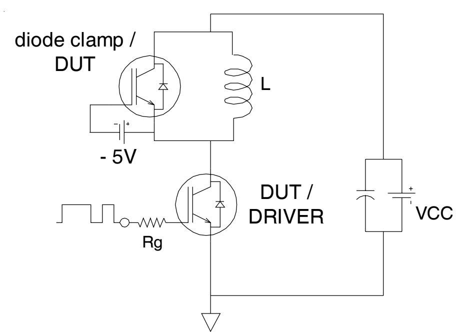


Fig.C.T.4 - Switching Loss Circuit

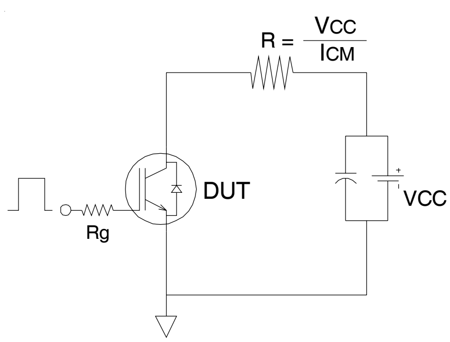


Fig.C.T.5 - Resistive Load Circuit

AUIRGS/SL30B60K

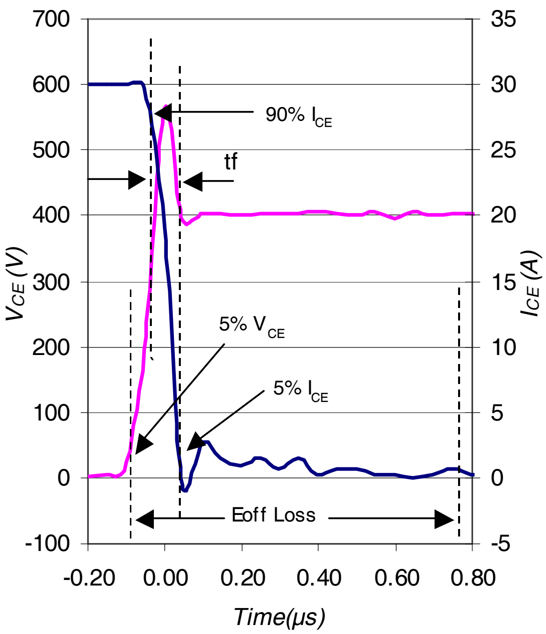


Fig. WF1- Typ. Turn-off Loss Waveform
@ T_J = 150°C using Fig. CT.4

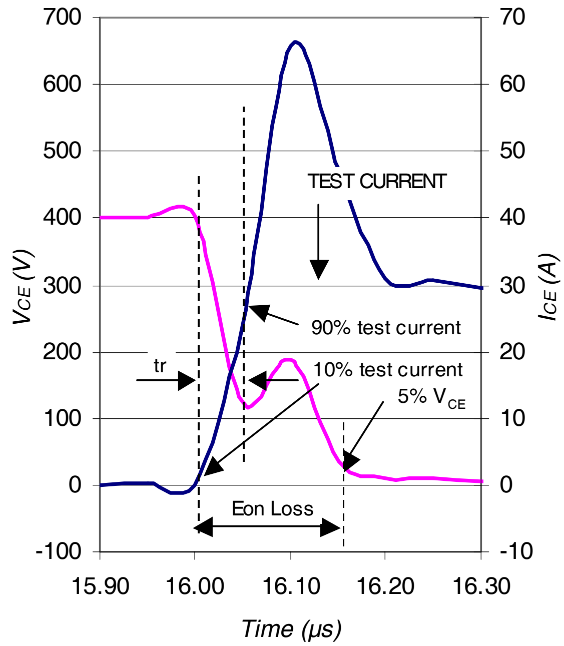


Fig. WF2- Typ. Turn-on Loss Waveform
@ T_J = 150°C using Fig. CT.4

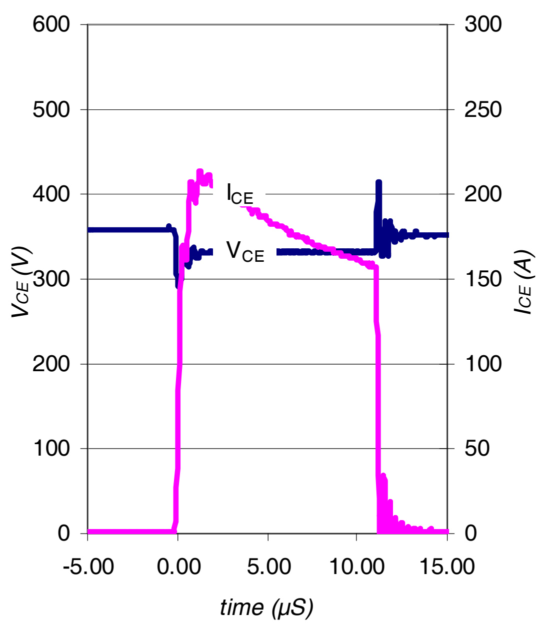
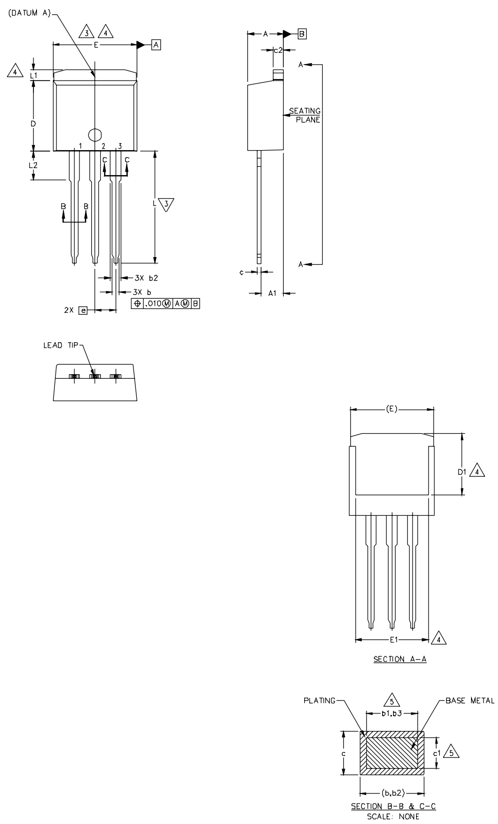


Fig. WF3- Typ. S.C Waveform
@ T_C = 150°C using Fig. CT.3

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	
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

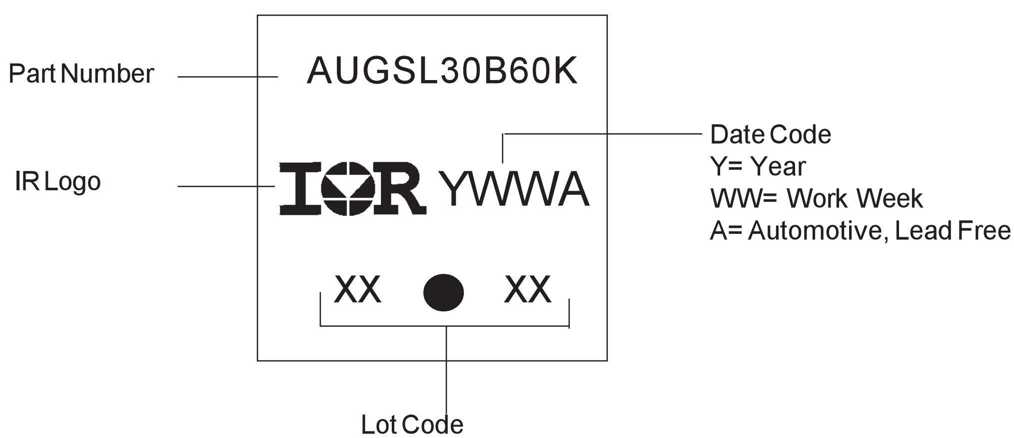
HEXFET

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

IGBTs, CoPACK

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

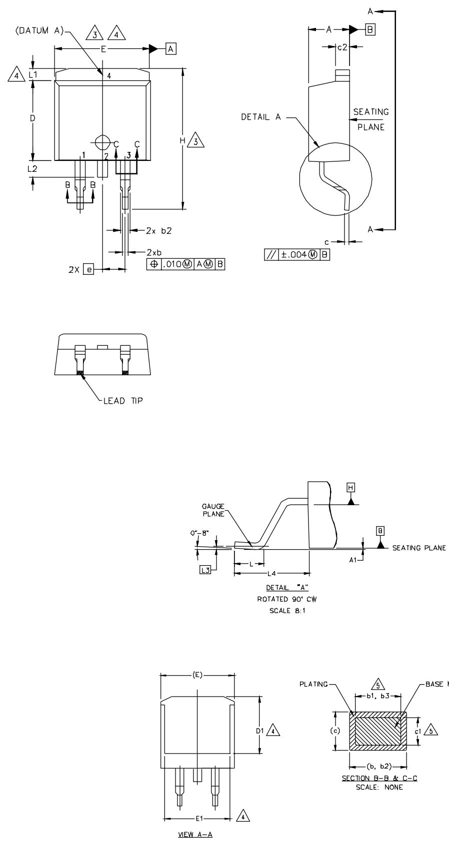
TO-262 Part Marking Information



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

D²Pak (TO-263AB) 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 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

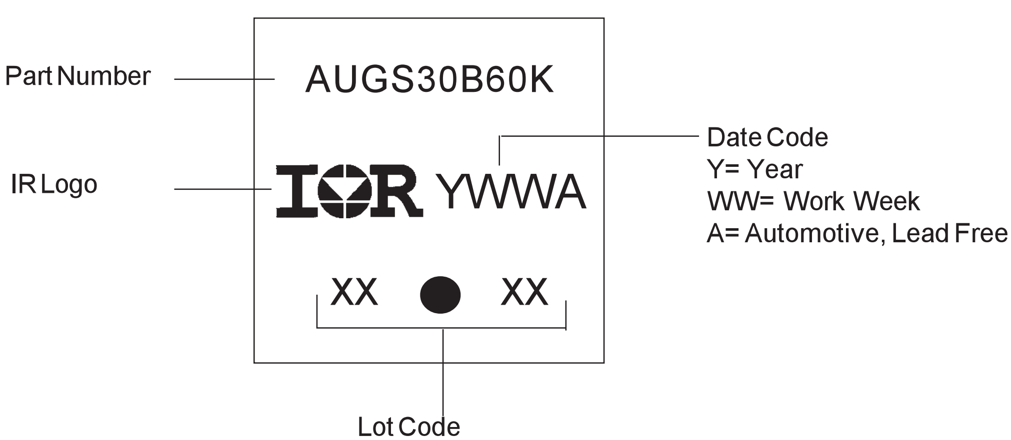
1.– GATE
2, 4.– COLLECTOR
3.– EMITTER

DIODES

1.– ANODE *
2, 4.– CATHODE
3.– ANODE

* PART DEPENDENT.

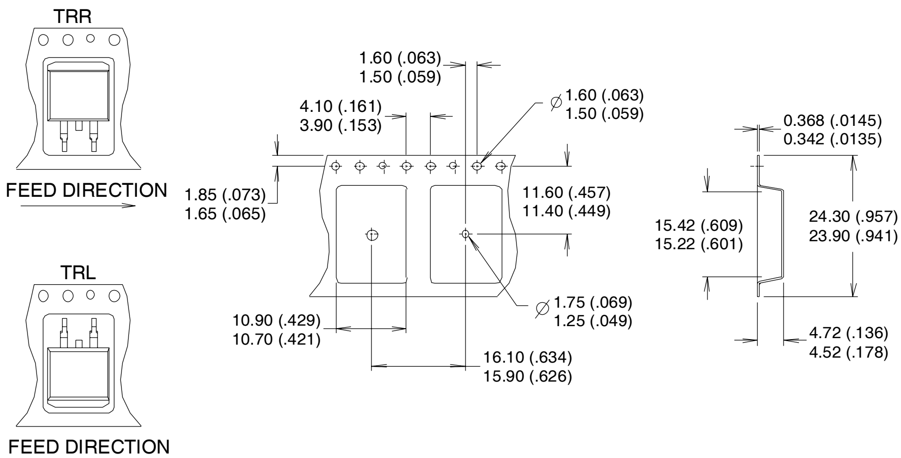
D²Pak (TO-263AB) Part Marking Information

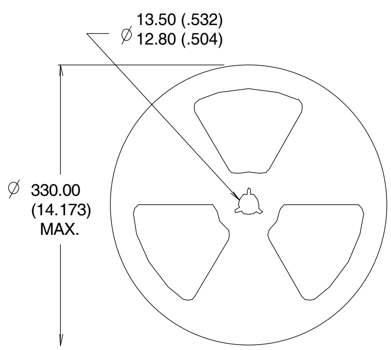


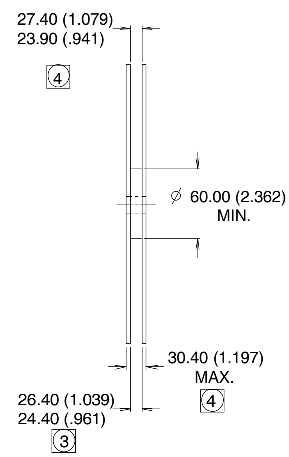
Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

D²Pak (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.

Ordering Information

Base part number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRGSL30B60K	TO-262	Tube	50	AUIRGSL30B60K
AUIRGS30B60K	D2Pak	Tube	50	AUIRGS30B60K
		Tape and Reel Left	800	AUIRGS30B60KTRL
		Tape and Reel Right	800	AUIRGS30B60KTRR

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

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