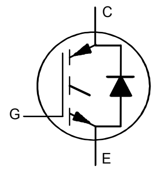
INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

Features
- Low $V_{CE\,(on)}$ Trench IGBT Technology
- Low Switching Losses
- 5µs short circuit SOA
- Square RBSOA
- 100% of the parts tested for I_{LM}①
- Positive $V_{CE\,(on)}$ Temperature Coefficient.
- Ultra Fast Soft Recovery Co-pak Diode
- Tighter Distribution of Parameters
- Lead-Free, RoHS Compliant
- Automotive Qualified *

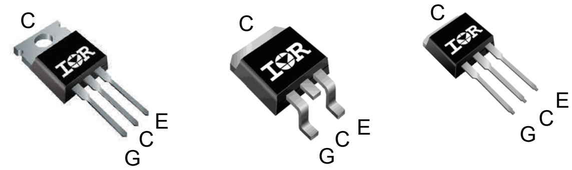


V_{CES} = 600V

$I_{C(Nominal)}$ = 24A

$t_{SC} \geq$ 5µs, $T_{J(max)}$ = 175°C

$V_{CE(on)}$ typ. = 1.57V



AUIRGB4062D1 TO-220AB | AUIRGS4062D1 D^2Pak | AUIRGSL4062D1 TO-262Pak

G	C	E
Gate	Collector	Emitter

Benefits
- High Efficiency in a Wide Range of Applications
- Suitable for a Wide Range of Switching Frequencies due to Low $V_{CE\,(ON)}$ and Low Switching Losses
- Rugged Transient Performance for Increased Reliability
- Excellent Current Sharing in Parallel Operation
- Low EMI

Applications
- Air Conditioning Compressor

Base Part Number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
AUIRGB4062D1	TO-220	Tube	50	AUIRGB4062D1
AUIRGSL4062D1	TO-262	Tube	50	AUIRGSL4062D1
AUIRGS4062D1	D^2 Pak	Tube	50	AUIRGS4062D1
		Tape and Reel Left	800	AUIRGS4062D1TRL
		Tape and Reel Right	800	AUIRGS4062D1TRR

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	59	A
I_C @ T_C = 100°C	Continuous Collector Current	39	
$I_{C\ (Nominal)}$	Nominal Current	24	
I_{CM}	Pulse Collector Current V_{GE} =15V	72	
I_{LM}	Clamped Inductive Load Current V_{GE} =20V①	96	
I_F @ T_C = 25°C	Diode Continuous Forward Current	59	
I_F @ T_C = 100°C	Diode Continuous Forward Current	39	
I_{FM}	Maximum Repetitive Forward Current ②	96	
V_{GE}	Continuous Gate-to-Emitter Voltage	±20	V
	Transient Gate-to-Emitter Voltage	±30	
P_D @ T_C = 25°C	Maximum Power Dissipation	246	W
P_D @ T_C = 100°C	Maximum Power Dissipation	123	
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)	
	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 (IGBT) ③	——	——	0.61	°C/W
$R_{\theta JC}$ (Diode)	Thermal Resistance Junction-to-Case (Diode) ③	——	——	1.2	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink (flat, greased surface)	——	0.50	——	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (typical socket mount)	——	62	——	

* Qualification standards can be found at www.infineon.com

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V_{GE} = 0V, I_C = 100μA ③
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.3	—	V/°C	V_{GE} = 0V, I_C = 10mA (25°C-175°C)
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.57	1.77	V	I_C = 24A, V_{GE} = 15V, T_J = 25°C
		—	1.87	—		I_C = 24A, V_{GE} = 15V, T_J = 150°C
		—	1.94	—		I_C = 24A, V_{GE} = 15V, T_J = 175°C
$V_{GE(th)}$	Gate Threshold Voltage	4.0	—	6.5	V	V_{CE} = V_{GE}, I_C = 700μA
$\Delta V_{GE(th)}/\Delta TJ$	Threshold Voltage temp. coefficient	—	-17	—	mV/°C	V_{CE} = V_{GE}, I_C = 1.0mA (25°C-175°C)
gfe	Forward Transconductance	—	12	—	S	V_{CE} = 50V, I_C = 24A,PW = 20μs
I_{CES}	Collector-to-Emitter Leakage Current	—	1.0	25	μA	V_{GE} = 0V, V_{CE} = 600V
		—	3.5	—	mA	V_{GE} = 0V, V_{CE} = 600V,T_J = 175°C
V_{FM}	Diode Forward Voltage Drop	—	1.57	—	V	I_F = 24A
		—	1.40	—		I_F = 19A
		—	1.47	—		I_F = 24A, T_J = 175°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
Q_g	Total Gate Charge (turn-on)	—	51	77	nC	I_C = 24A
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	14	21		V_{GE} = 15V
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	21	32		V_{CC} = 400V
E_{on}	Turn-On Switching Loss	—	532	754	μJ	I_C = 24A, V_{CC} = 400V,
E_{off}	Turn-Off Switching Loss	—	311	526		V_{GE} = +15V,R_G = 10Ω,
E_{total}	Total Switching Loss	—	843	1280		L = 210μH, T_J = 25°C
$t_{d(on)}$	Turn-On delay time	—	19	36	ns	Energy losses include tail & diode reverse recovery
t_r	Rise time	—	24	41		
$t_{d(off)}$	Turn-Off delay time	—	90	109		
t_f	Fall time	—	23	40		
E_{on}	Turn-On Switching Loss	—	726	—	μJ	I_C = 24A, V_{CC} = 400V,
E_{off}	Turn-Off Switching Loss	—	549	—		V_{GE} = +15V,R_G = 10Ω,
E_{total}	Total Switching Loss	—	1275	—		L = 210μH, T_J = 175°C ③
$t_{d(on)}$	Turn-On delay time	—	12	—	ns	Energy losses include tail & diode reverse recovery
t_r	Rise time	—	23	—		
$t_{d(off)}$	Turn-Off delay time	—	92	—		
t_f	Fall time	—	84	—		
C_{ies}	Input Capacitance	—	1487	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	118	—		V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	—	44	—		f = 1.0Mhz
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T_J = 175°C, I_C = 96A V_{CC} = 480V, Vp ≤ 600V Rg = 10Ω, V_{GE} = +20V to 0V
SCSOA	Short Circuit Safe Operating Area	5	—	—	μs	V_{CC} = 400V, Vp ≤ 600V Rg = 10Ω, V_{GE} = +15V to 0V
E_{rec}	Reverse Recovery Energy of the Diode	—	773	—	μJ	T_J = 175°C
t_{rr}	Diode Reverse Recovery Time	—	102	—	ns	V_{CC} = 400V,I_F = 24A,V_{GE} = 15V,
I_{rr}	Peak Reverse Recovery Current	—	32	—	A	R_G = 10Ω, L = 210μH

Notes:

① V_{CC} = 80% (V_{CES}), V_{GE} = 20V, L = 210μH, R_G = 50Ω.
② Pulse width limited by max. junction temperature.
③ R_θ is measured at T_J of approximately 90°C.
④ Maximum limits are based on statistical sample size characterization.

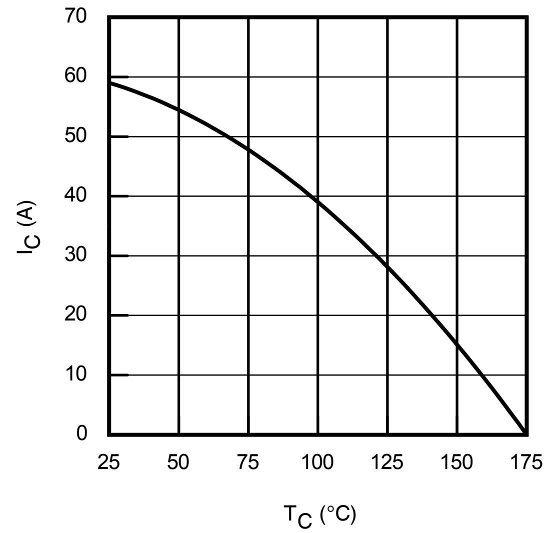


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

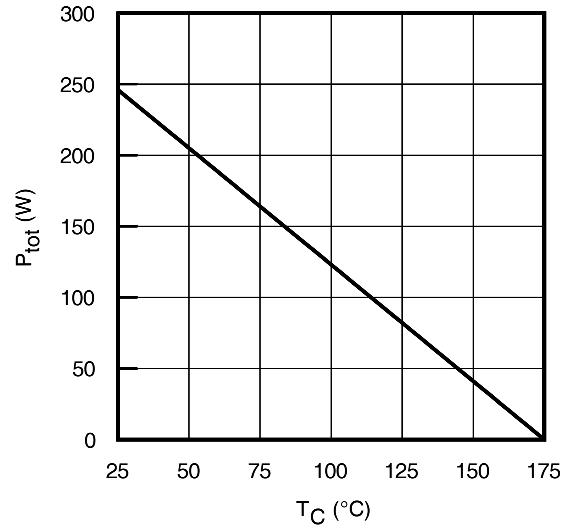


Fig. 2 - Power Dissipation vs. Case Temperature

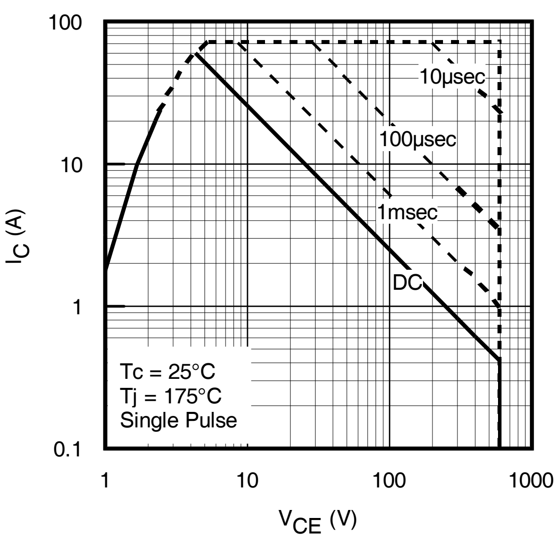


Fig. 3 - Forward SOA

Tc = 25°C, TJ ≤ 175°C; VGE =15V

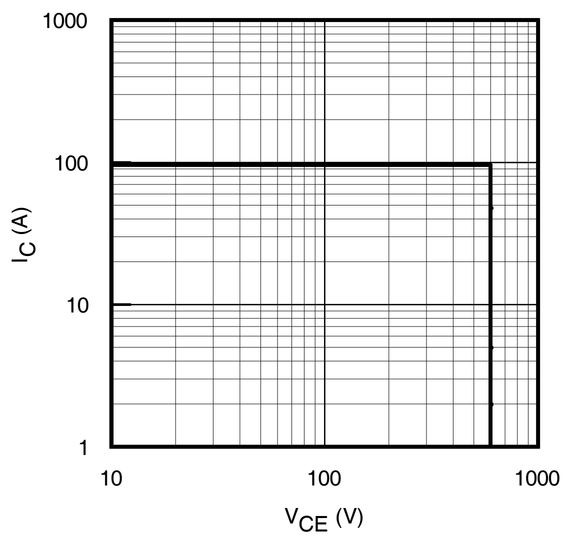


Fig. 4 - Reverse Bias SOA

T_J = 175°C; V_{GE} =20V

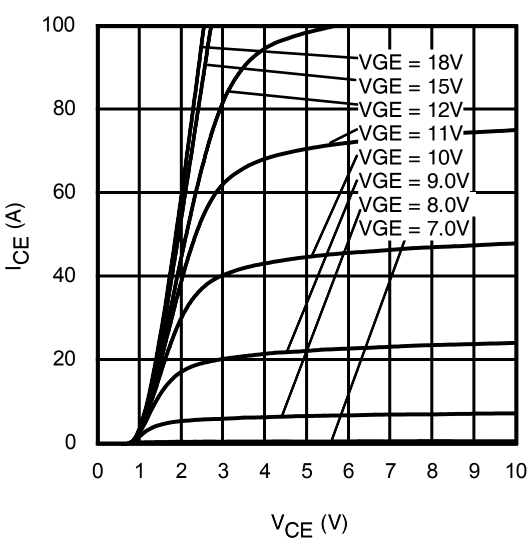


Fig. 5 - Typ. IGBT Output Characteristics

T_J = -40°C; tp = 20µs

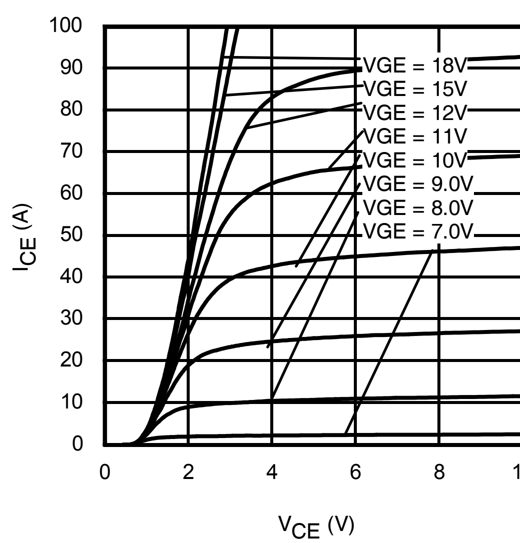


Fig. 6 - Typ. IGBT Output Characteristics

T_J = 25°C; tp = 20µs

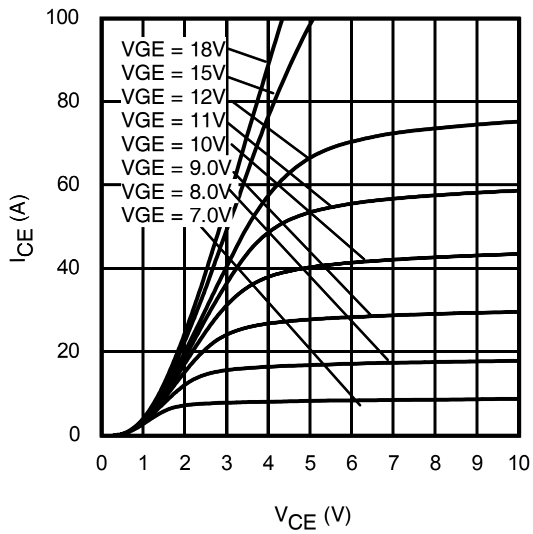


Fig. 7 - Typ. IGBT Output Characteristics
T_J = 175°C; tp = 20µs

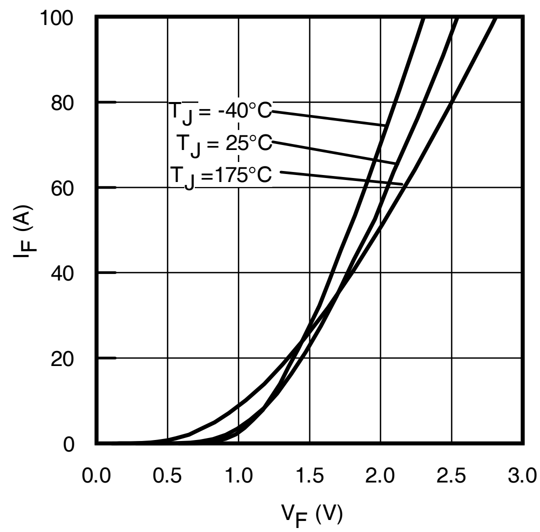


Fig. 8 - Typ. Diode Forward Characteristics
tp = 20µs

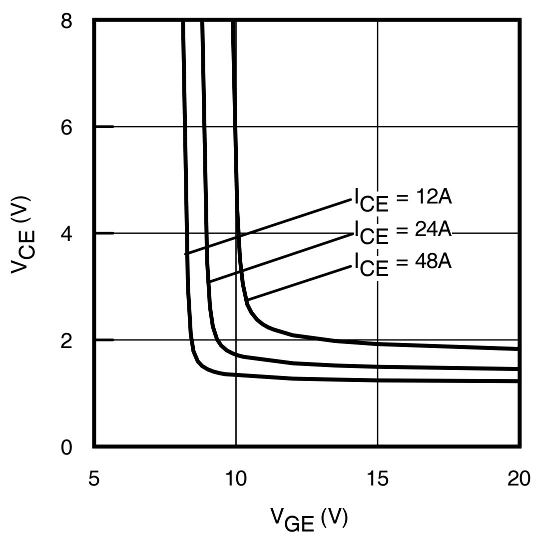


Fig. 9 - Typical V_{CE} vs. V_{GE}
T_J = -40°C

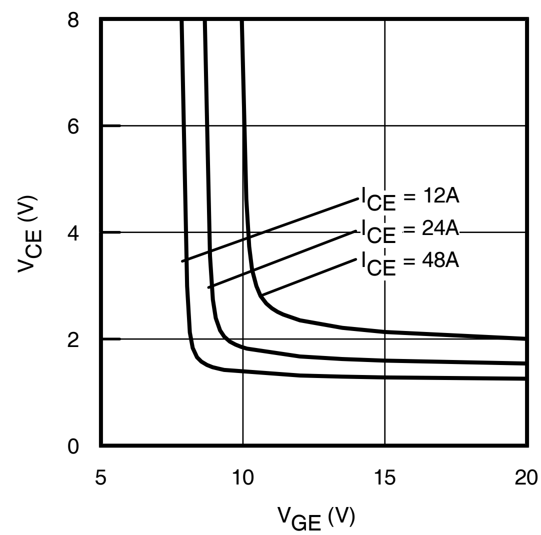


Fig. 10 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

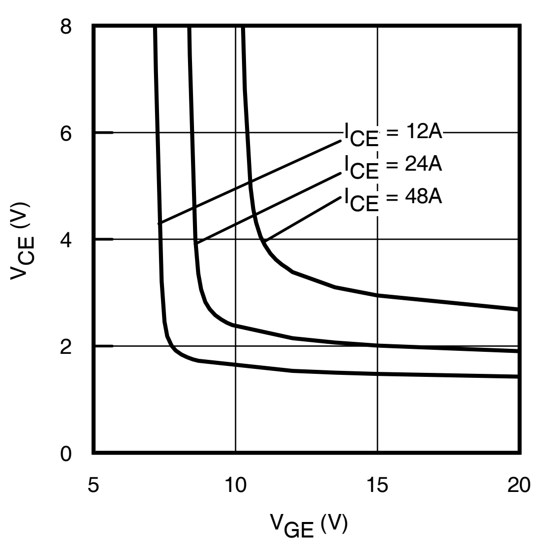


Fig. 11 - Typical V_{CE} vs. V_{GE}
T_J = 175°C

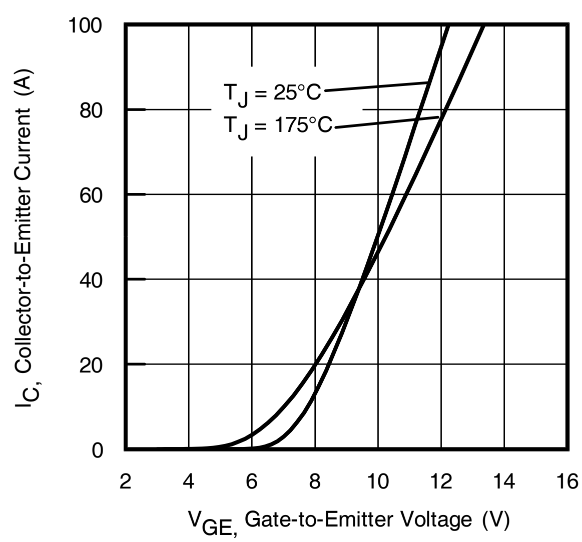


Fig. 12 - Typ. Transfer Characteristics
V_{CE} = 50V; tp = 20µs

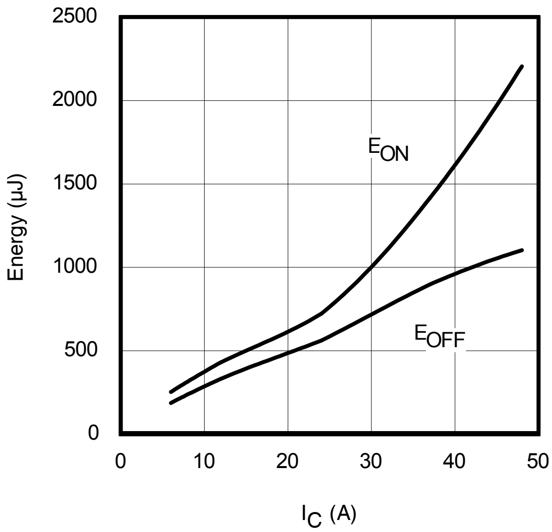


Fig. 13 - Typ. Energy Loss vs. I_C
T_J = 175°C; L = 210µH; V_{CE} = 400V, R_G = 10Ω; V_{GE} = 15V

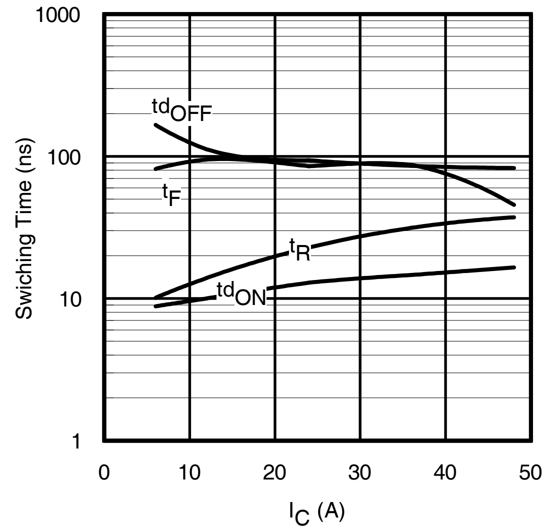


Fig. 14 - Typ. Switching Time vs. I_C
T_J = 175°C; L = 210µH; V_{CE} = 400V, R_G = 10Ω; V_{GE} = 15V

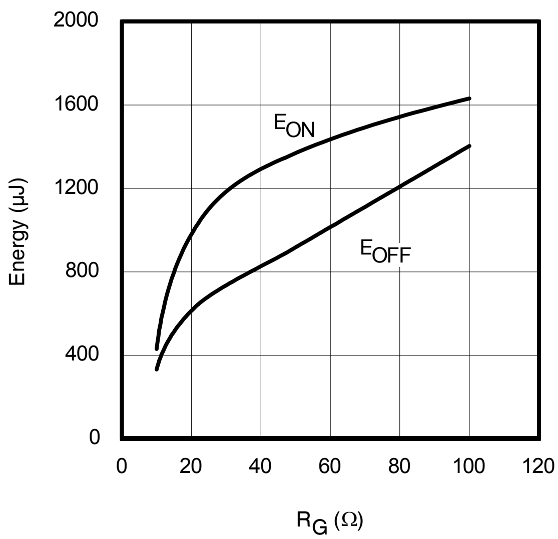


Fig. 15 - Typ. Energy Loss vs. R_G
T_J = 175°C; L = 210µH; V_{CE} = 400V, I_{CE} = 24A; V_{GE} = 15V

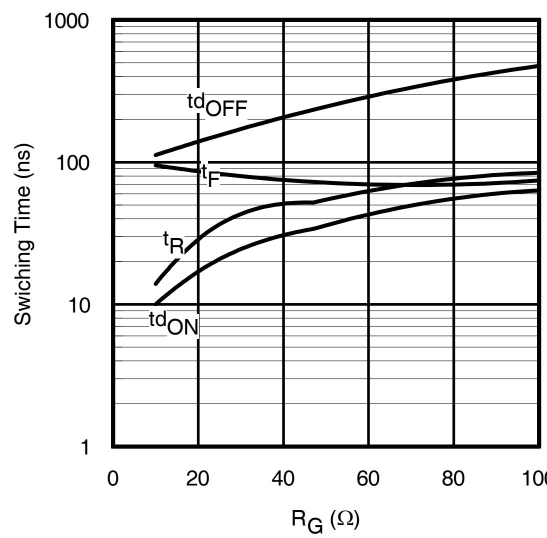


Fig. 16 - Typ. Switching Time vs. R_G
T_J = 175°C; L = 210µH; V_{CE} = 400V, I_{CE} = 24A; V_{GE} = 15V

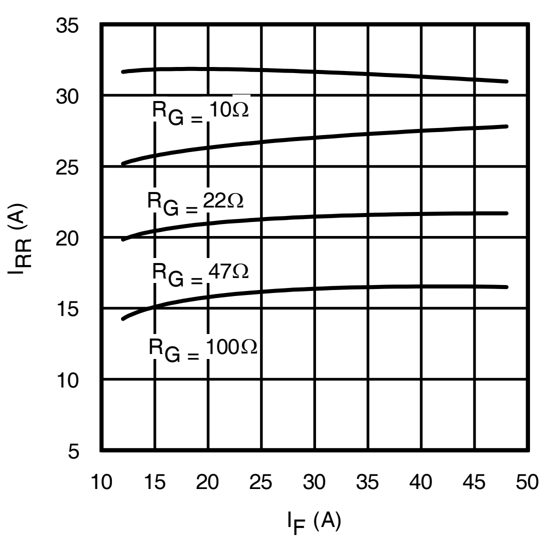


Fig. 17 - Typ. Diode I_{RR} vs. I_F
T_J = 175°C

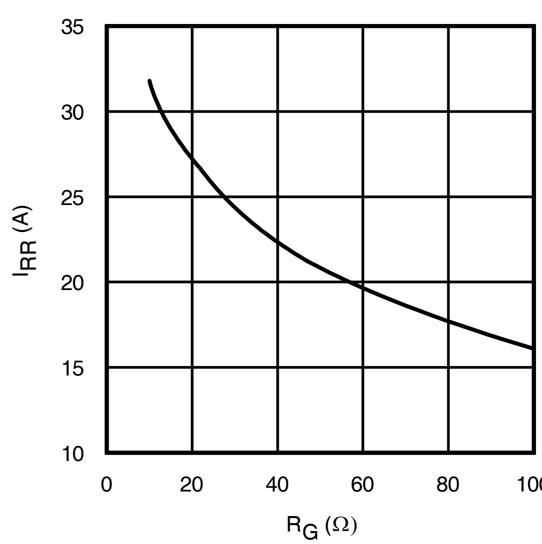


Fig. 18 Typ. Diode I_{RR} vs. R_G
T_J = 175°C

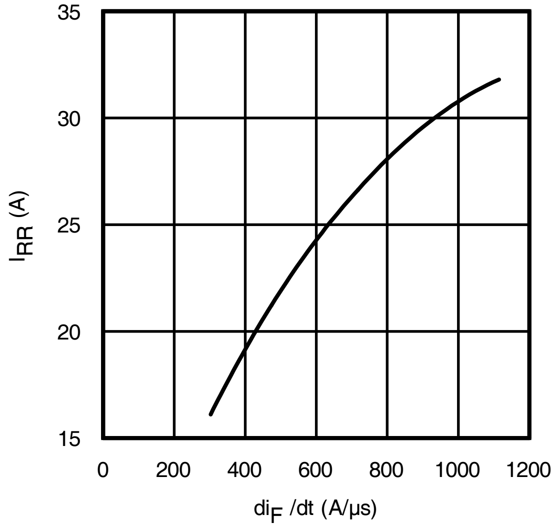


Fig. 19 - Typ. Diode I_{RR} vs. d_{iF}/dt
V_{CC} = 400V; V_{GE} = 15V; I_F = 24A; T_J = 175°C

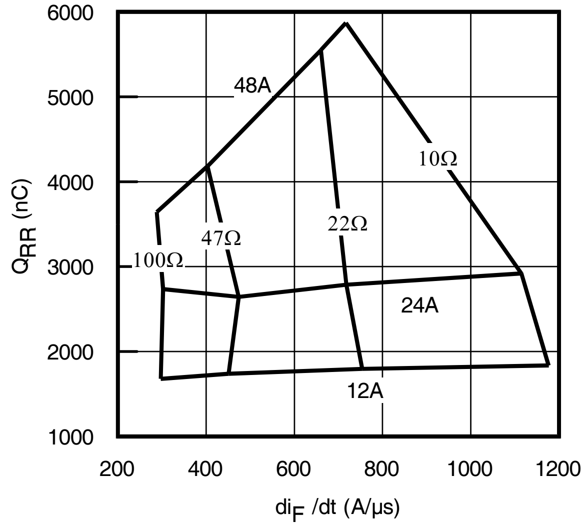


Fig. 20 - Typ. Diode QRR vs. d_{iF}/dt
V_{CC} = 400V; V_{GE} = 15V; T_J = 175°C

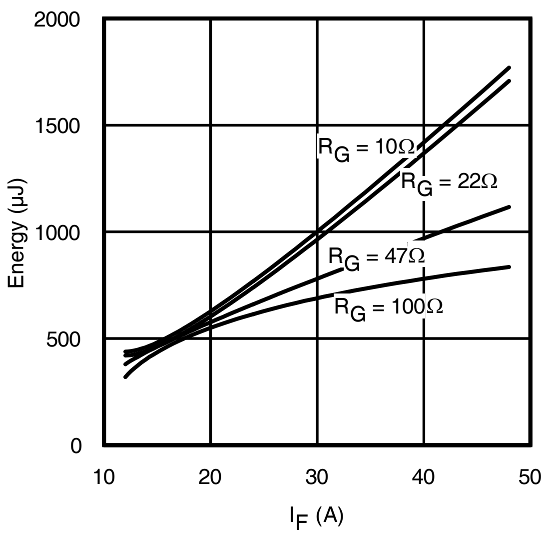


Fig. 21 - Typ. Diode E_{RR} vs. I_F
T_J = 175°C

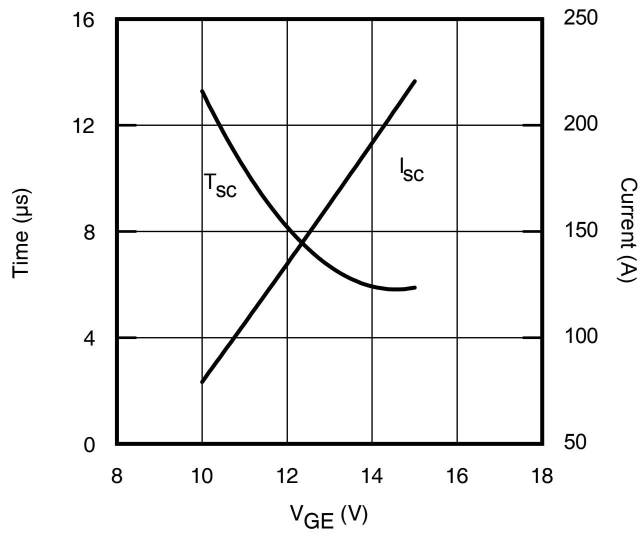


Fig. 22 - V_{GE} vs. Short Circuit Time
V_{CC} = 400V; T_C = 25°C

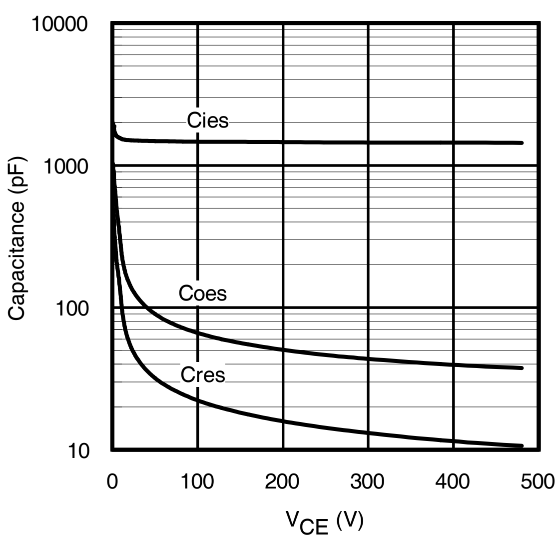


Fig. 23 - Typ. Capacitance vs. V_{CE}
V_{GE}= 0V; f = 1MHz

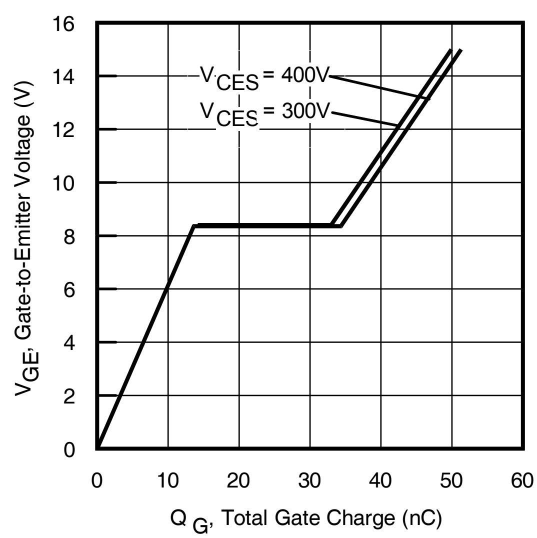
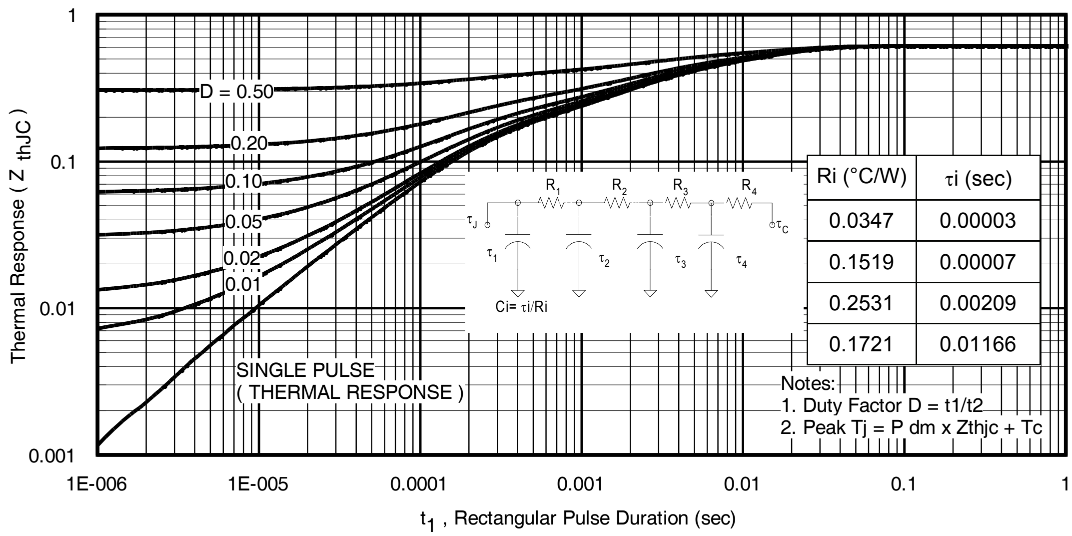
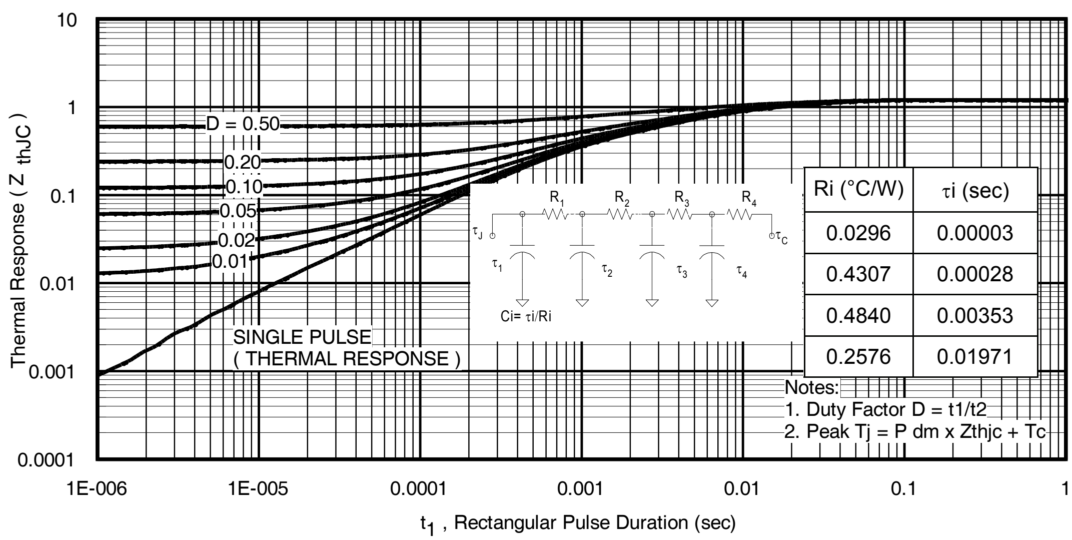


Fig. 24 - Typical Gate Charge vs. V_{GE}
I_{CE} = 24A; L = 585µH



Ri (°C/W)	τi (sec)
0.0347	0.00003
0.1519	0.00007
0.2531	0.00209
0.1721	0.01166

Fig 25. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)



Ri (°C/W)	τi (sec)
0.0296	0.00003
0.4307	0.00028
0.4840	0.00353
0.2576	0.01971

Fig 26. Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

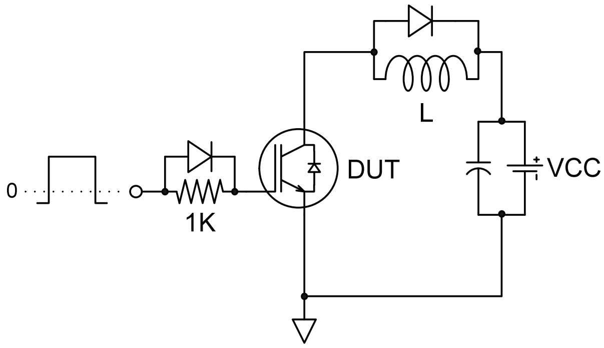


Fig.C.T.1 - Gate Charge Circuit (turn-off)

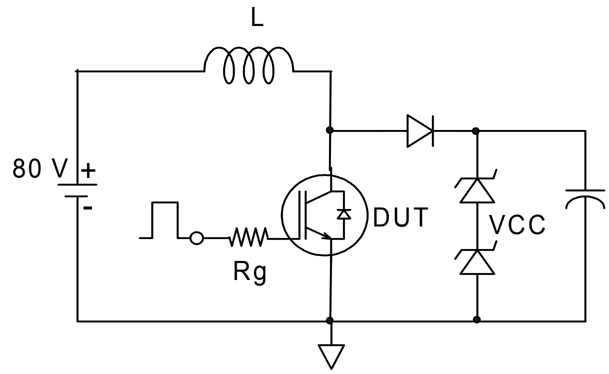


Fig.C.T.2 - RBSOA Circuit

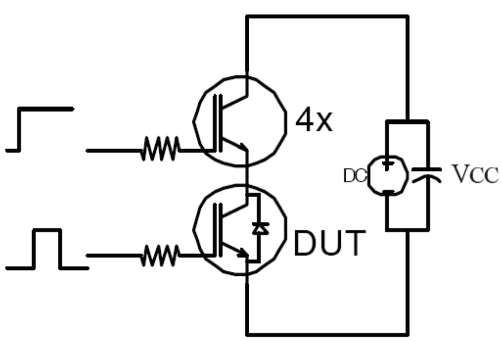


Fig.C.T.3 - S.C. SOA Circuit

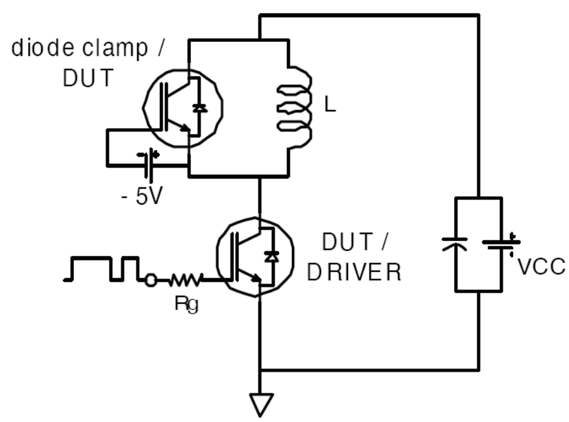


Fig.C.T.4 - Switching Loss Circuit

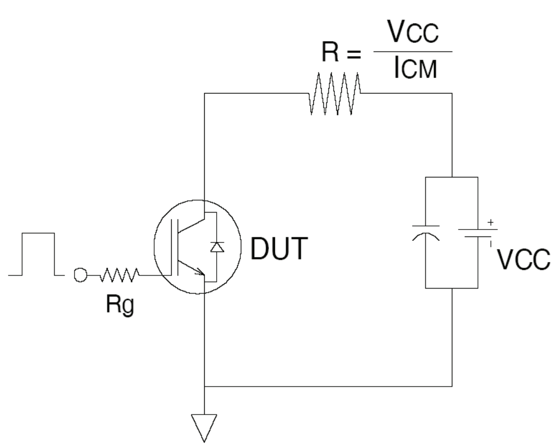


Fig.C.T.5 - Resistive Load Circuit

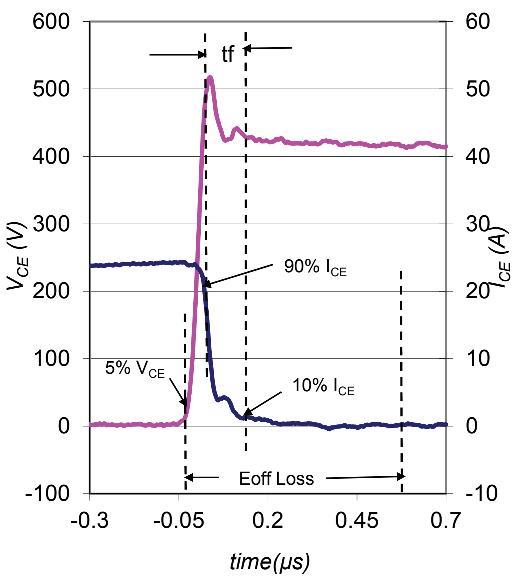


Fig. WF1 - Typ. Turn-off Loss Waveform
@ T_J = 175°C using Fig. CT.4

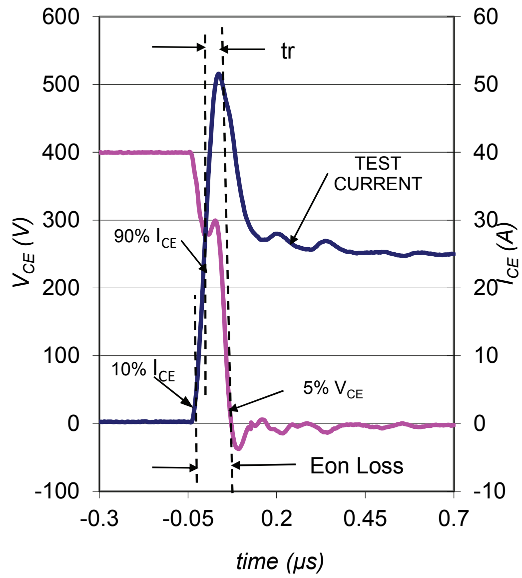


Fig. WF2 - Typ. Turn-on Loss Waveform
@ T_J = 175°C using Fig. CT.4

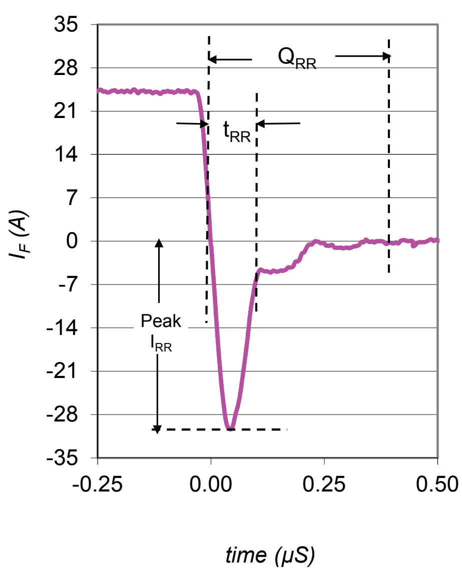


Fig. WF3 - Typ. Diode Recovery Waveform
@ T_J = 175°C using Fig. CT.4

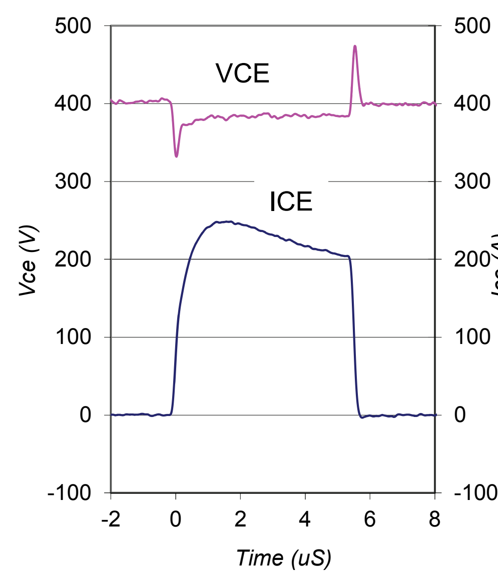
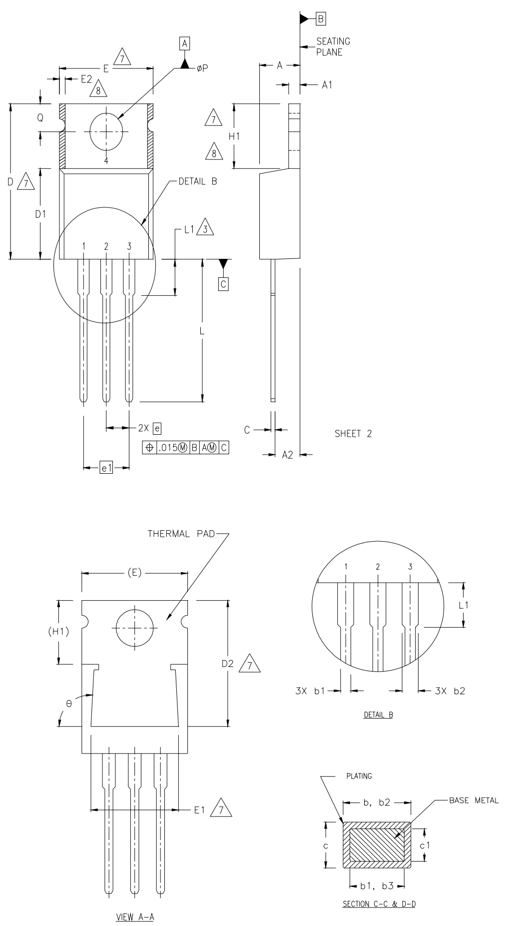


Fig. WF4 - Typ. S.C. Waveform
@ T_J = 25°C using Fig. CT.3

TO-220AB Package Outline

(Dimensions are shown in millimeters (inches))



NOTES:

1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
2 DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
3 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
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 DIMENSION b1 & c1 APPLY TO BASE METAL ONLY.
6 CONTROLLING DIMENSION : INCHES.
7 THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
8 DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.82	.140	.190	
A1	0.51	1.40	.020	.055	
A2	2.04	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.96	.015	.038	5
b2	1.15	1.77	.045	.070	
b3	1.15	1.73	.045	.068	
c	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	
D2	12.19	12.88	.480	.507	7
E	9.66	10.66	.380	.420	4,7
E1	8.38	8.89	.330	.350	7
e	2.54 BSC		.100 BSC		
e1	5.08		.200 BSC		
H1	5.85	6.55	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	–	6.35	–	.250	3
øP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	
ø	90°–93°		90°–93°		

LEAD ASSIGNMENTS

HEXFET

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

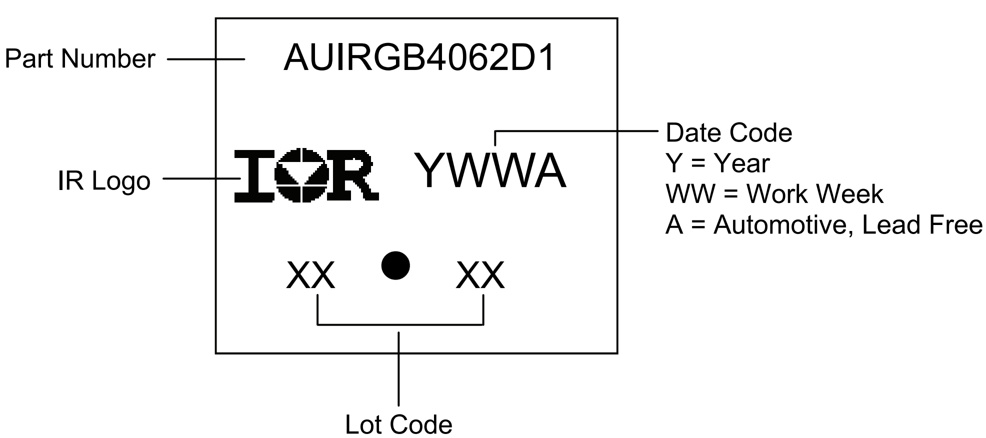
IGBTs, CoPACK

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

DIODES

1.- ANODE/OPEN
2.- CATHODE
3.- ANODE

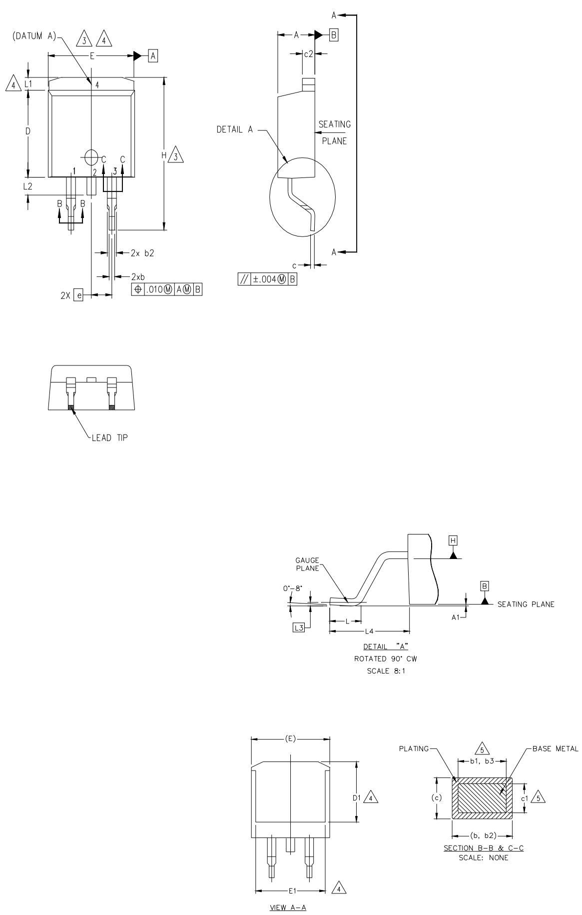
TO-220AB Part Marking Information



TO-220AC package is not recommended for Surface Mount Application.

D2 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 [.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

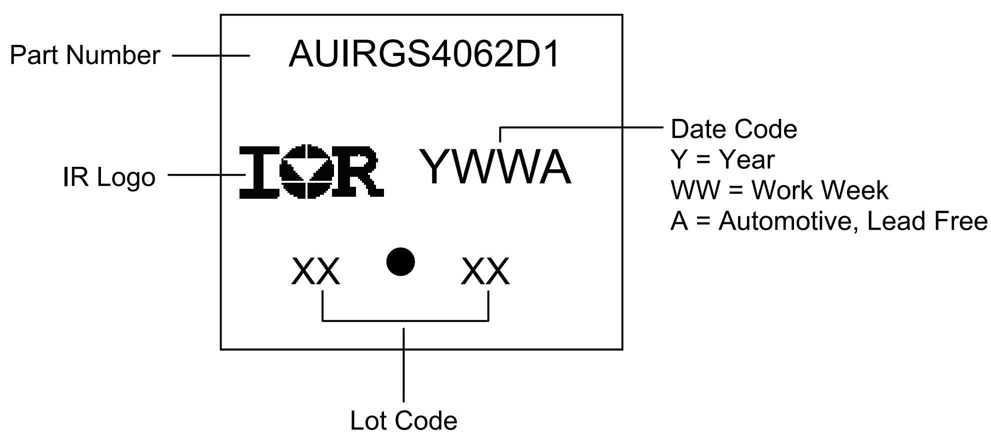
1.- GATE
2, 4.- COLLECTOR
3.- EMITTER

DIODES

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

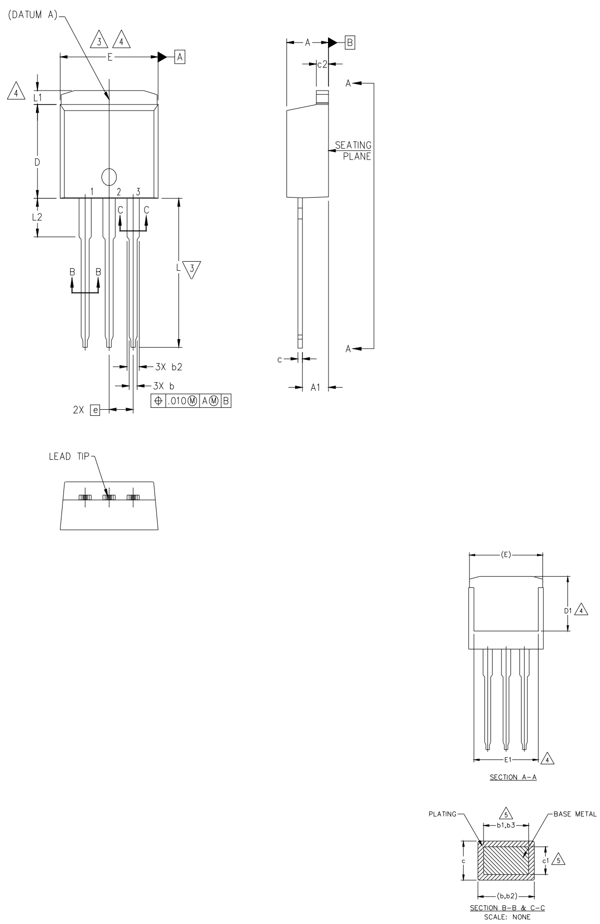
* PART DEPENDENT.

D2 Pak (TO-263AB) Part Marking Information



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

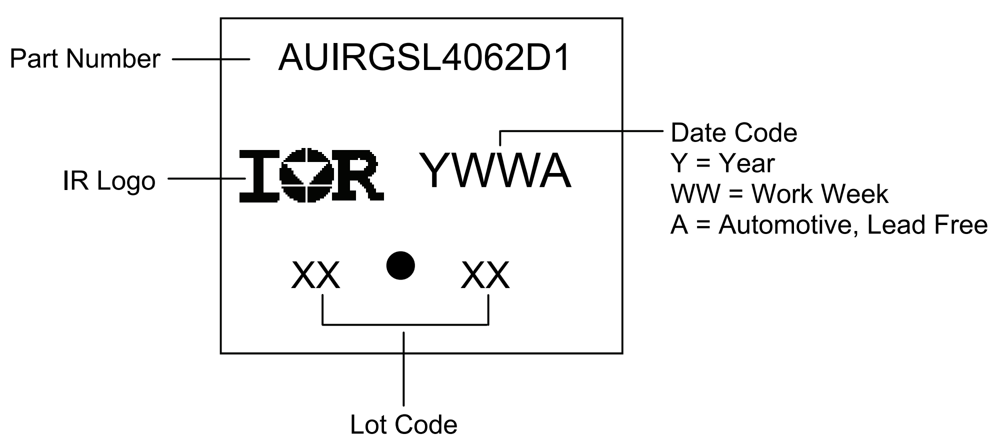
HEXFET

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

IGBTs, CoPACK

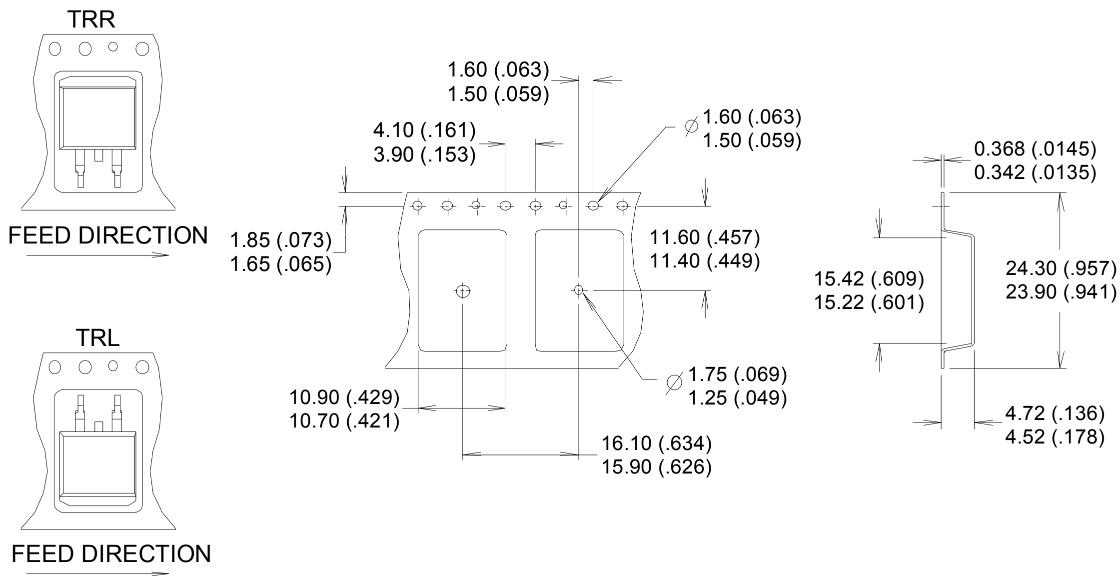
1.– GATE
2.– COLLECTOR
3.– EMITTER
4.– COLLECTOR

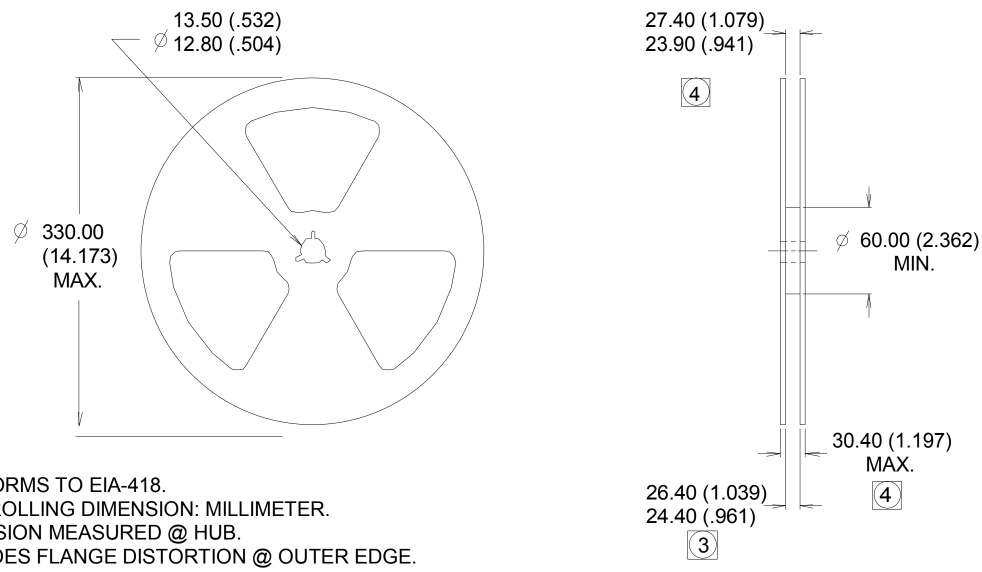
TO-262 Part Marking Information



D2Pak 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.

Qualification Information

Qualification Level		Automotive (per AEC-Q101)	
		This part number(s) passed Automotive qualification. Infineon's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
Moisture Sensitivity Level		3L-TO-220	N/A
		3L-TO-262	
		3L-D2 PAK	MSL1
ESD	Machine Model	Class M4(+/- 700V)† AEC-Q101-002	
	Human Body Model	Class H1C(+/- 2000V)† AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 2000V)† AEC-Q101-005	
RoHS Compliant		Yes	

† Highest passing voltage.

Revision History

Date	Comments
8/31/2017	• Updated datasheet with corporate template • Corrected part marking on pages 10,11, 12

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