

POWER SEMICONDUCTOR JUNCTIONS

THE APPLICATION AND CUSTOM ASSEMBLY OF POWER SEMICONDUCTOR JUNCTIONS

INTRODUCTION

This section describes the pre-passivated thyristors and diodes available from International Rectifier in die form.

International Rectifier employs two different passivation techniques in the manufacturing of low, medium and high power die, glass and silicon rubber. Each process offers certain advantages and is therefore specific to certain die types.

Glass passivation provides great stability of blocking voltage characteristic and a level of hermeticity with relatively high mechanical strength, for this reason it is chosen for the ranges of Schottky die and power thyristors.

Silicone rubber offers both very high working temperature gradient, capability and blocking voltage stability and so is used for power rectifier passivation.

Processes developed by International Rectifier allow for the passivation with either glass or silicone rubber at wafer scale, just prior to die cutting, this reduces handling and processing time thereby enhancing reliability and improving costs, higher quality lower price!

JUNCTION CHARACTERISTICS

The die characteristics and die sizes of thyristors and diodes presently available from International Rectifier in chip form are designed in the specification and characteristics table.

Because of limitation when electrically probing in die form some of the generic specification of the equivalent packaged device cannot be tested and guaranteed in chip form. These are power dissipation, surge, turn-off and thermal resistance. These ratings are dependent largely upon the user's assembly technique. However, the following characteristics are guaranteed by design to meet the specifications of the equivalent

packaged part: V_{TM}, V_{DRM}, V_{RRM}, V_R, I_{GT}, V_{GT}, I_H, D_V/D_T, V_F, t_{rr} and T_j(max).

In addition, a 100% probe test is performed on the parameters with guaranteed limits: V_{DRM}, V_{RRM}, V_R, I_{GT}, V_{GT}, I_H. For typical characteristic performance on most of the parameters, consult the appropriate generic data sheet.

After die separation the dice are 100% visually inspected, tested, Q.A. inspected and packaged for shipment.

HANDLING AND SHIPPING

All Power Semiconductor chips from International Rectifier are shipped in plastic containers for protection during shipment, with the exception of the square thyristor chips which are shipped in glass jar filled with inert liquid to prevent damage during shipment. Once opened, the dice must be stored in a dry, inert atmosphere such as nitrogen prior to assembly. The dice should be handled in such a way as to prevent mechanical damage.

JUNCTION MOUNTING

The square chips have gold metallisation and the round chips have silver, both types are suitable for solder preform mounting. Glass passivated thyristors are also suitable for solder cream mounting with no-acid flux. Any of the commonly used header or substrate material such as copper, nickel-plated copper, gold, nickel, silver plated molybdenum, metallised beryllia and alumina are acceptable.

The substrate must be freed of oxides prior to assembly by means of a chemical clean. It should not be necessary to clean the die before assembly. Mounting is generally accomplished in a profiled belt furnace. The furnace zone settings will depend upon hybrid mass density, jigging and belt speed.

The die temperature must not exceed 350°C, not be in the range of 300 to 350°C for greater than 5 minutes. Anitrogen atmosphere is recommended for glass passivated chips although forming gas (nitrogen 85% — hydrogen 15%) is acceptable. The forming gas atmosphere could also be used for silicone rubber passivated chips when soldered without flux or solder cream. For fast recovery diodes lead-indium solder is recommended.

The round chips are also available optionally with aluminium metallisation suitable for compression bond encapsulation. For details contact your local Sales Office.

ENCAPSULATION

Prior to encapsulation, the die/assembly must be cleaned of any solder residue and must be moisture free. (Leakage is particularly sensitive to surface moisture).

A high grade electronic coating must then be applied before any final encapsulating material.

If the final package is plastic, be careful that the material used is compatible both organically and thermally with the chip passivation.

CONCLUSION

The use of thyristor and diode chips in hybrid assemblies can result in significant reductions in overall package size. Several dice can readily be mounted on the same heatsink or to parallel devices. Power semiconductor operated advantages can thus be realised in very compact custom configurations.

MEDIUM POWER RECTIFIER JUNCTIONS

TABLE 8:
MEDIUM POWER PRE-PASSIVATED STANDARD RECOVERY RECTIFIER JUNCTIONS

Junction Part No:	Equivalent Device Series — Package is shown to indicate power capability only	Figure	Passivation	I _F (A) A	Voltage Range V
PD150-...	6F, 12F, 16F	44a	Silicone Rubber	16	100 to 1600
PD180-...	21PT, 4AF, 36MB-A, P100	44b		25	100 to 1600
PD210-...	8AF, 40HF	44C		40	100 to 2000
PD280-...	70HF	44d		70	100 to 2000
PD350-...	85HF, IRKH/L41-56, IRKD/E56-71, T40HF, T70HF	44e		90	100 to 2000
PD480-...	IRKH/L71-91, IRKD/E91, T85HF, T110HF	44f		120	100 to 2000

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TABLE 9:

MEDIUM POWER PRE-PASSIVATED FAST RECOVERY RECTIFIER JUNCTIONS*

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Junction Part No:	Equivalent Device Series — Package is shown to indicate power capability only	Figure	Passivation	$I_F(AV)$ A	Voltage Range V
FD150-...	6FL, 12FL, 16FL	45a	Silicone Rubber	16	100 to 1000
FD210-...	40HFL	45b		40	100 to 1000
FD280-...	70HFL	45c		70	100 to 1000
FD350-...	85HFL, IRKD/EL56-71, T40HFL, T70HFL	45d		90	100 to 1000

*see table for available t_{rr} .

MEDIUM POWER THYRISTOR JUNCTIONS

TABLE 10:

MEDIUM POWER SQUARE GLASS PASSIVATED CENTRE GATE THYRISTOR JUNCTIONS

Junction Part No:	Equivalent Device Series — Package is shown to indicate power capability only	Figure	Passivation	$I_T(RMS)$ A	Voltage Range V
IRCI210-.	10RIA, 16RIA, 22RIA, 25RIA, P100	46a	Glass	40	100 to 1200
IRCI350-.	IRKT/H/L41-56, T50RIA, T70RIA, 50RIA	46b		110	100 to 1200

TABLE 11:

MEDIUM POWER SQUARE GLASS PASSIVATED CORNER GATE THYRISTOR JUNCTIONS

Junction Part No:	Equivalent Device Series — Package is shown to indicate power capability only	Figure	Passivation	$I_F(AV)$ A	Voltage Range V
IRCI230-.	IRKT/H/L26	47a	Glass	40	100 to 1200
IRCI480-.	IRKT/H/L71-91, T90RIA	47b		140	100 to 1200

TABLE 12:

MEDIUM POWER SQUARE GLASS PASSIVATED TRIAC JUNCTIONS

Junction Part No:	Equivalent Device Series — Package is shown to indicate power capability only	Figure	Passivation	$I_F(AV)$ A	Voltage Range V
TRIAC210-.	B25AC	48a	Glass	25	400 to 1200
TRIAC350-.	50AC, T50AC	48b		50	400 to 1200

VOLTAGE CODES

Voltage	Code
100V	10
200V	20
400V	40
600V	60
800V	80
1000V	100
1200V	120
1400V	140
1600V	160
1800V	180
2000V	200

RECOVERY TIME CODES

Die Number	t_{rr} ns	Voltage V	Code
FD150	90	600	S02
	225	1000	S05
FD210	70	600	S02
	180	1000	S05
FD280	60	600	S02
	150	1000	S05
FD350	50	600	S02
	120	1000	S05

t_{rr} test conditions: $T_J = 25^\circ C$, $I_F = 1A$ to $V_R = 30V$, $-dI_F/dt = 100A/\mu s$

PART NUMBERING

To complete Part Number add voltage code and t_{rr} code where applicable.
e.g. PD280-80, IRCI210-120, FD210-60S02 etc.

POWER SEMICONDUCTOR JUNCTION DIMENSIONS

T-03-05

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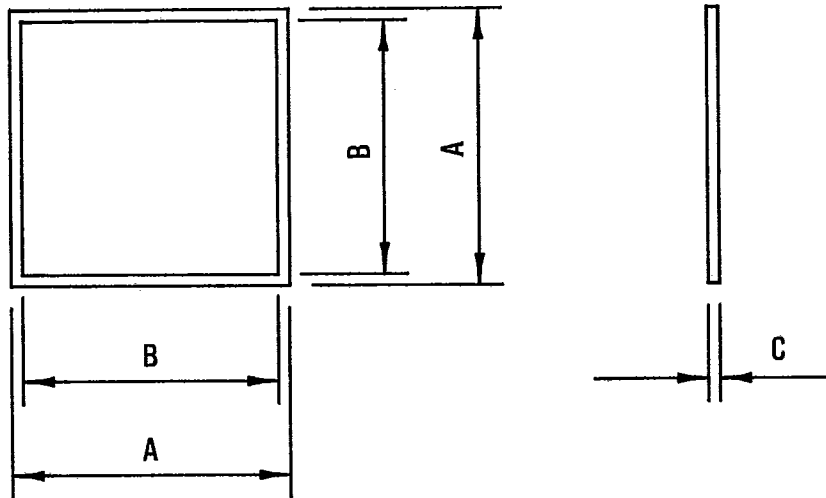


Figure	Die Part Number	A	B	C (Typical)
44a	PD150-...	0.150/3.81	0.134/3.40	0.010/0.25
44b	PD180-...	0.180/4.57	0.164/4.17	0.010/0.25
44c	PD210-...	0.210/5.33	0.194/4.93	0.010/0.25
44d	PD280-...	0.280/7.11	0.264/6.71	0.010/0.25
44e	PD350-...	0.350/8.89	0.334/8.48	0.010/0.25
44f	PD480-...	0.480/12.19	0.464/11.79	0.010/0.25

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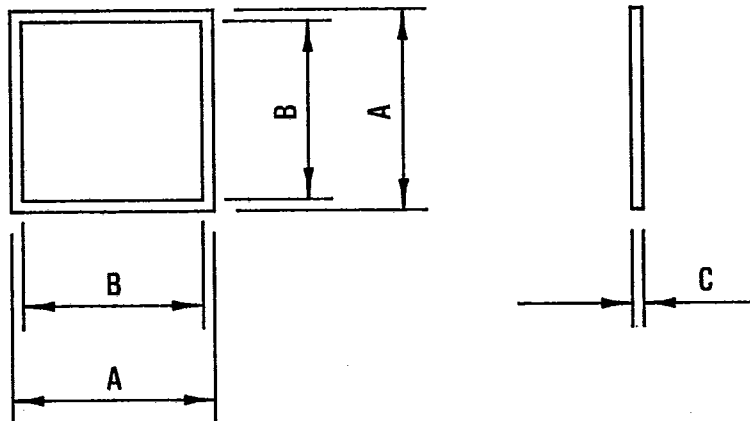


Figure	Die Part Number	A ± 0.002/0.05	B (Typical)	C (Maximum)
45a	FD150-...	0.150/3.81	0.138/3.50	0.010/0.25
45b	FD210-...	0.210/5.33	0.193/4.90	0.010/0.25
45c	FD280-...	0.280/7.11	0.266/6.80	0.010/0.25
45d	FD350-...	0.350/8.89	0.336/8.50	0.010/0.25

POWER SEMICONDUCTOR JUNCTION DIMENSIONS cont'd

T-03-05

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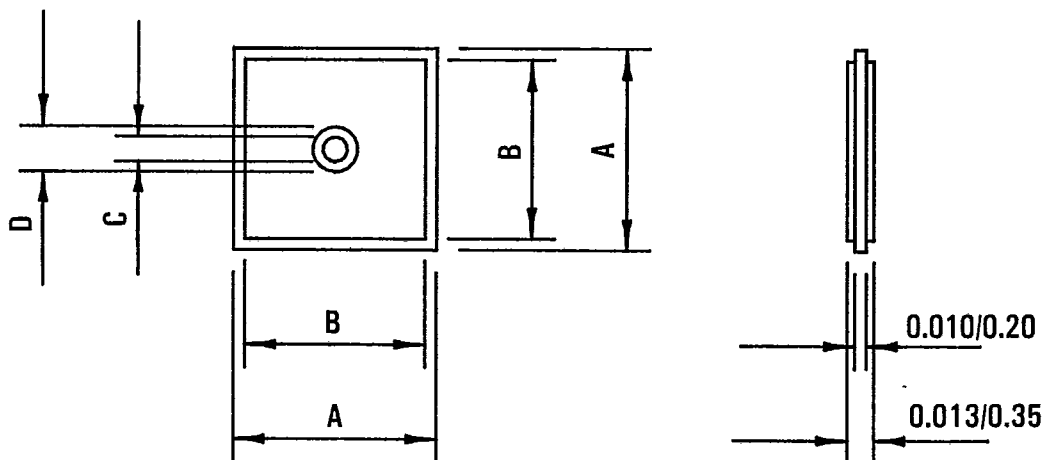


Figure	Die Part Number	A	B	C (Typical)	D (Typical)
46a	IRCI210-...	0.210/5.33	0.170/4.32	0.038/0.81	0.064/1.62
46b	IRCI350-...	0.350/8.89	0.310/7.87	0.040/1.02	0.080/2.03

47

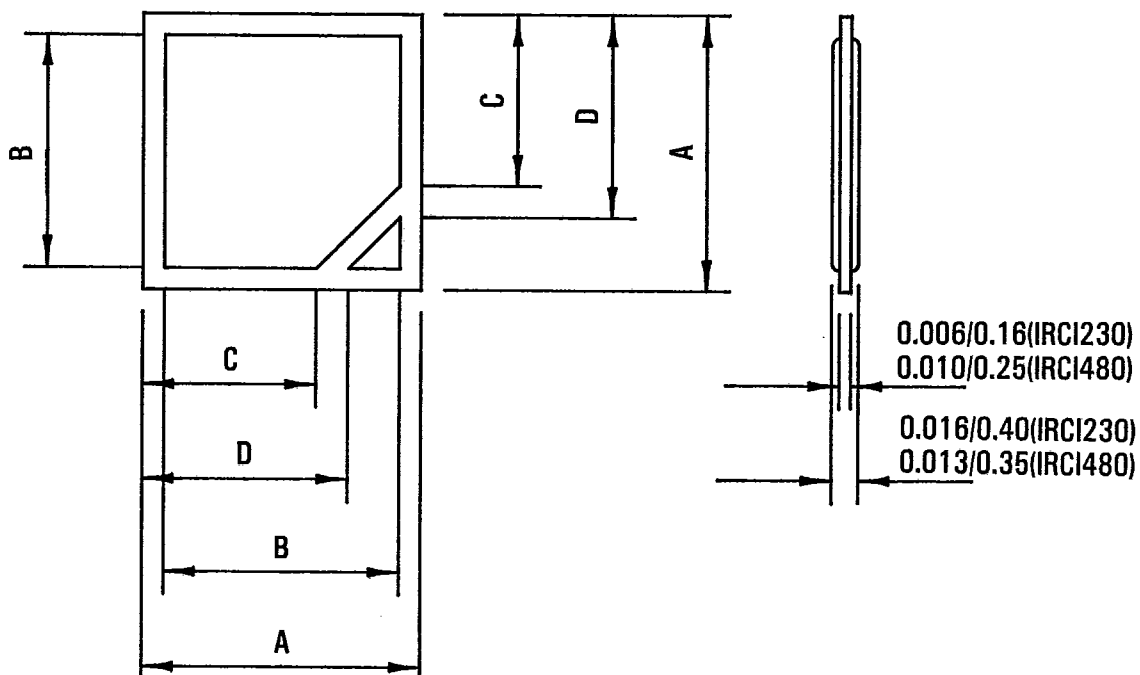


Figure	Die Part Number	A	B	C	D
47a	IRC1230-...	0.230/5.84	0.190/4.83	0.159/4.04	0.171/4.34
47b	IRC1480-...	0.480/12.19	0.404/10.26	0.299/7.60	0.355/9.02

48

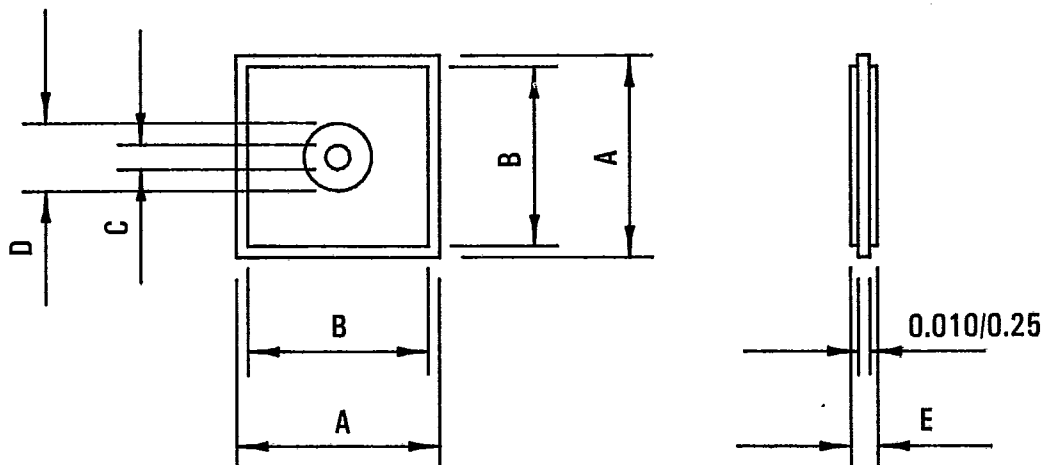


Figure	Die Part Number	A	B	C	D	E max
48a	TRIAC210-...	0.210/5.33	0.170/4.32	0.038/0.97	0.064/1.63	0.016/0.41
48b	TRIAC350-...	0.350/8.89	0.310/7.87	0.040/1.02	0.118/3.00	0.013/0.33

JUNCTION CARRIER QUANTITIES

Basic Part Number	Quantity per Carrier
FD150-...	360
FD210-...	195
FD280-...	120
FD350-...	100
IRCI210-...	1000
IRCI230-...	1000
IRCI350-...	1000
IRCI480-...	1000
PD150-...	1000
PD180-...	1000
PD210-...	195
PD280-...	120
PD350-...	100
PD480-...	49
TRIAC210-...	1000
TRIAC350-...	1000

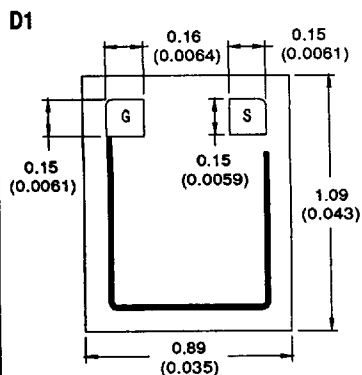
Please note that junctions are only sold in multiples of the carriers shown above.

HEXFET Die Outlines

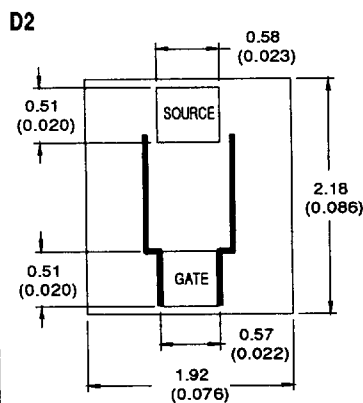
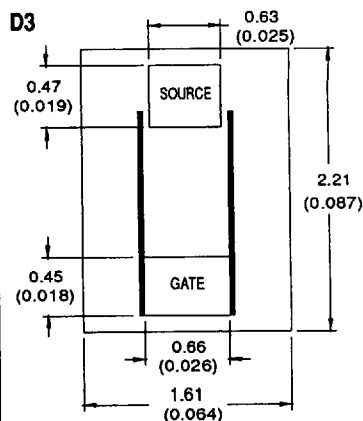
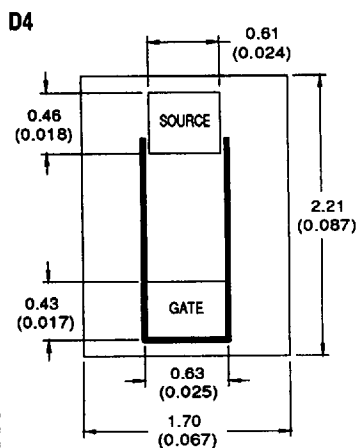
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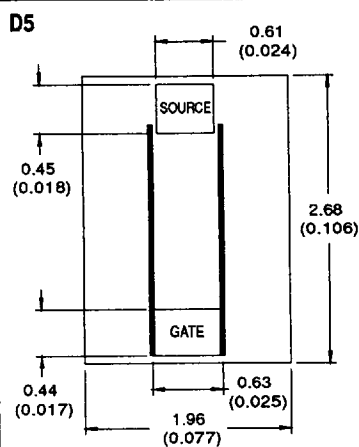
APPENDICES



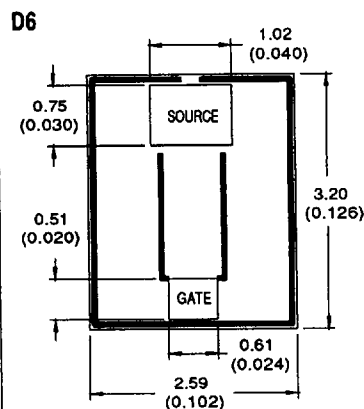
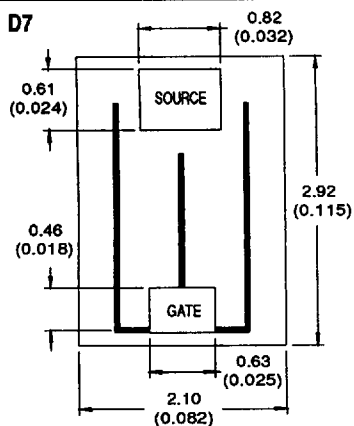
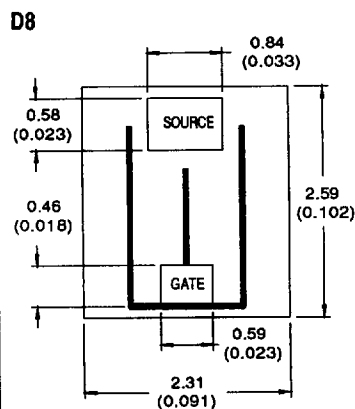
HEX-Z: 100V, N-CHANNEL


HEX-1: 60V, N-CHANNEL
LOGIC LEVEL: HEX-1: 60V, N-CHANNEL

HEX-1: 100V, N-CHANNEL
LOGIC LEVEL: HEX-1: 100V, N-CHANNEL


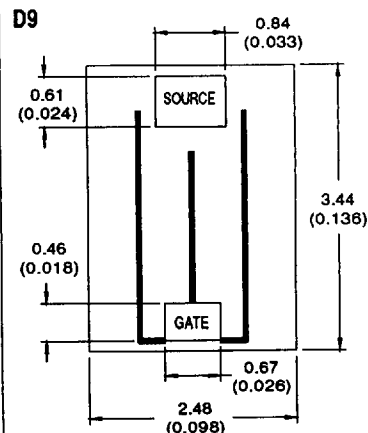
HEX-1: 200V & 250V, N-CHANNEL



HEX-1: 400V, N-CHANNEL


HEX-2: 60V, N-CHANNEL
LOGIC LEVEL: HEX-2: 60V, N-CHANNEL

HEX-2: 100V, N-CHANNEL
LOGIC LEVEL HEX-2: 100V, N-CHANNEL


HEX-2: 200V & 250V, N-CHANNEL



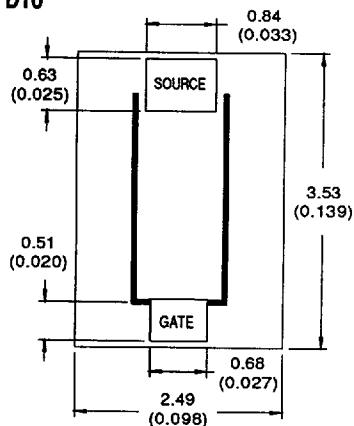
HEX-2: 400V & 500V N-CHANNEL

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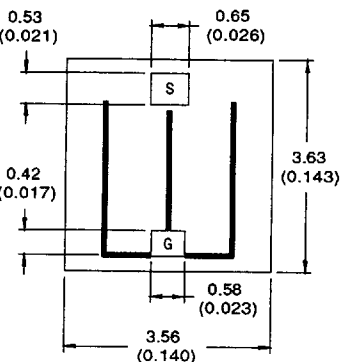
HEXFET Die Outlines

D10



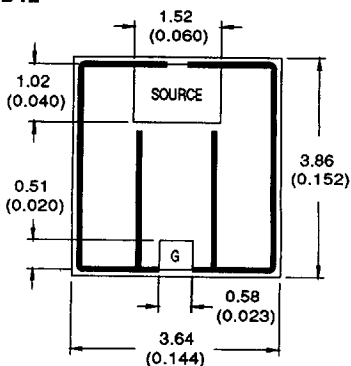
HEX-2 600V, N-CHANNEL

D11



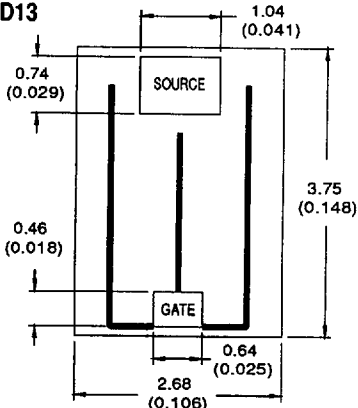
HEX-2: 800V, 900V & 1000V, N-CHANNEL

D12



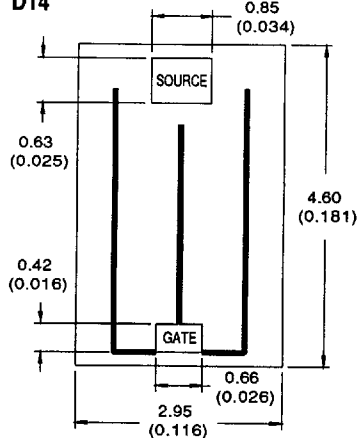
HEX-3: 60V, N-CHANNEL
LOGIC LEVEL: HEX-3: 60V, N-CHANNEL

D13



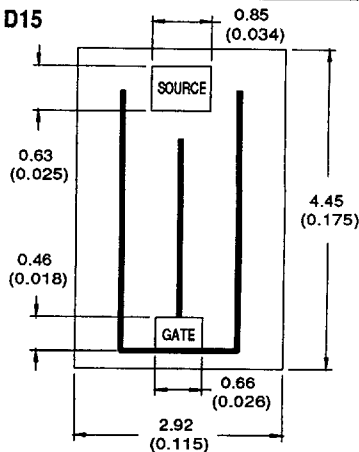
HEX-3: 100V, N-CHANNEL
LOGIC LEVEL: HEX-3: 100V, N-CHANNEL

D14



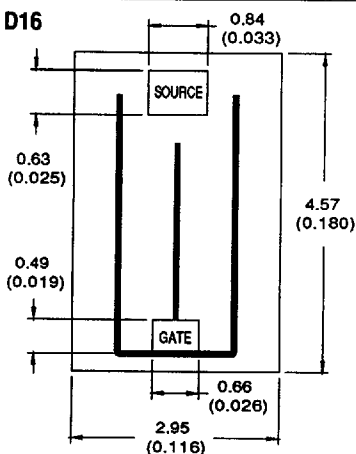
HEX-3: 200V & 250V, N-CHANNEL

D15



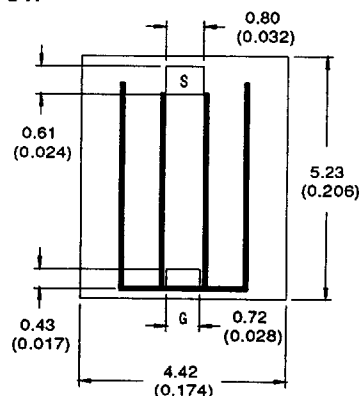
HEX-3: 400V & 500V, N-CHANNEL

D16



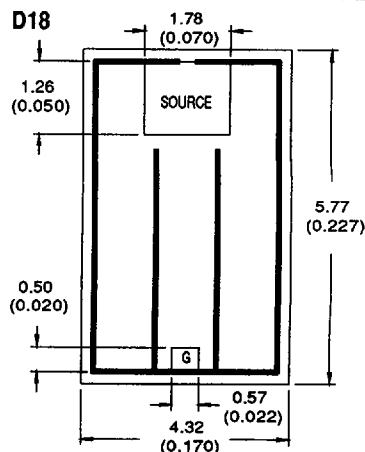
HEX-3: 600V, N-CHANNEL

D17



HEX-3: 800V, 900V & 1000V, N-CHANNEL

D18



LOGIC LEVEL: HEX-4: 60V, N-CHANNEL

HEXFET Die Outlines

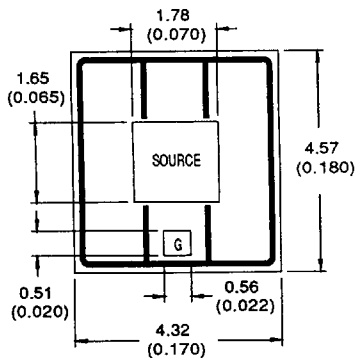
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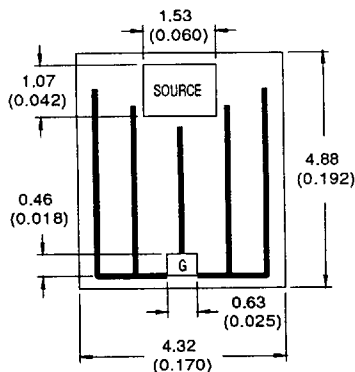
APPENDICES

D19



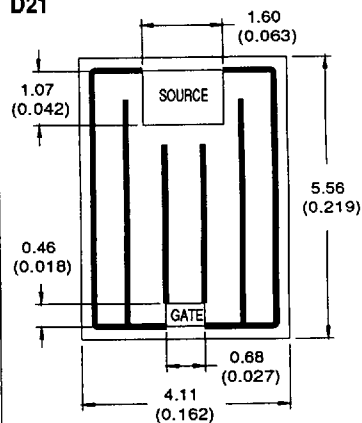
HEX-4: 50V & 60V, N-CHANNEL

D20



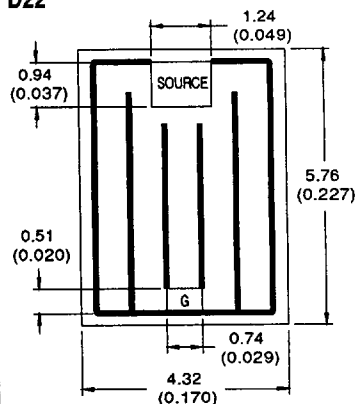
HEX-4: 100V, N-CHANNEL
LOGIC LEVEL: HEX-4: 100V, N-CHANNEL

D21



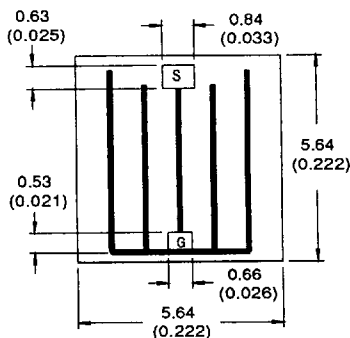
HEX-4: 200V & 250V, N-CHANNEL

D22



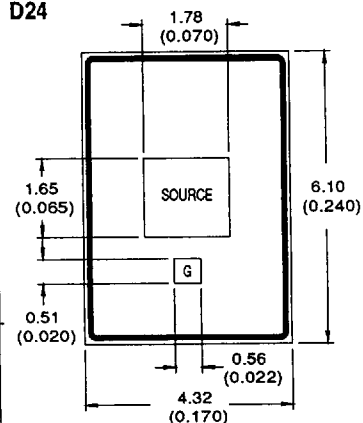
HEX-4: 400V, 500V & 600V, N-CHANNEL

D23



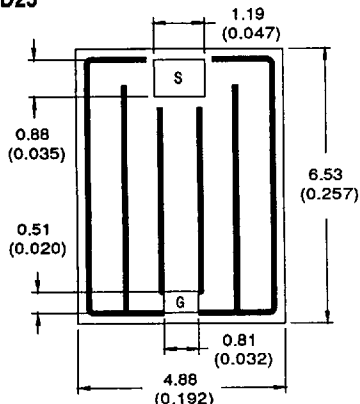
HEX-4: 800V, 900V & 1000V, N-CHANNEL

D24



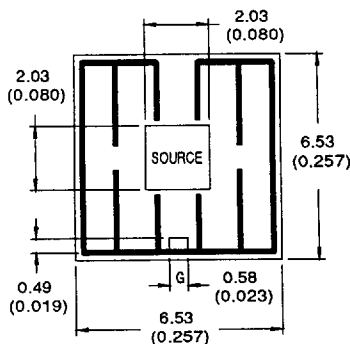
HEX-4.1: 60V, N-CHANNEL

D25



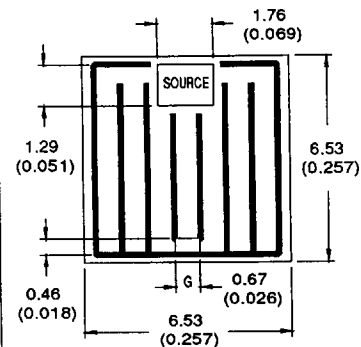
HEX-4.5: 500V, N-CHANNEL

D26



HEX-5: 60V, N-CHANNEL

D27



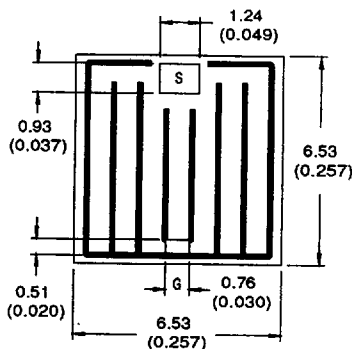
HEX-5: 100V, 200V, 250V, 400V & 500V N-CHANNEL

Appendix F

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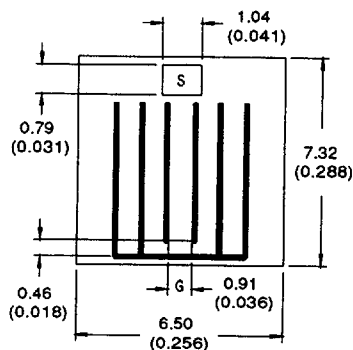
HEXFET Die Outlines

D28



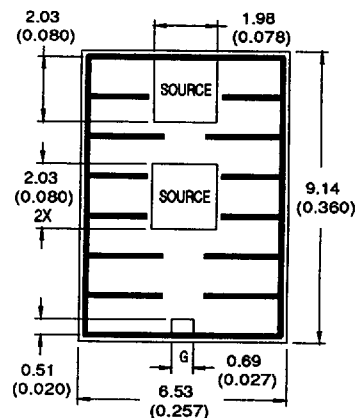
HEX-5: 600V, N-CHANNEL

D29



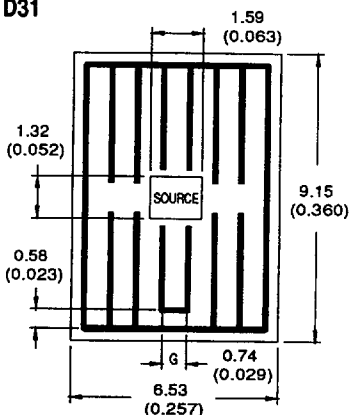
HEX-5: 800V, 900V & 1000V, N-CHANNEL

D30



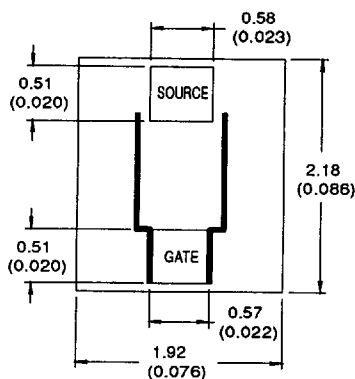
HEX-6: 60V, N-CHANNEL

D31



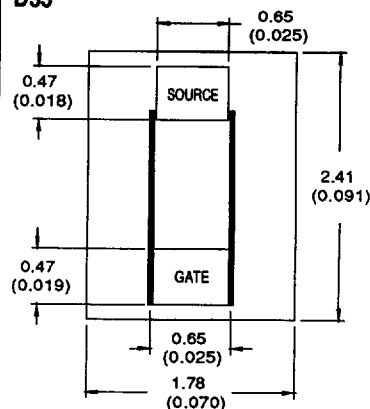
HEX-6: 400V & 500V, N-CHANNEL

D32



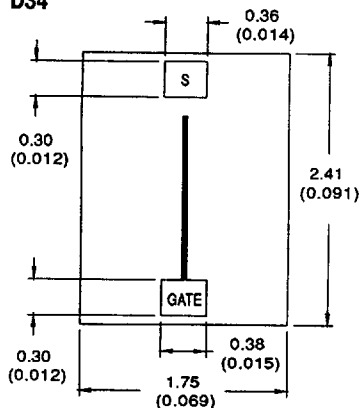
HEX-1: 60V, P-CHANNEL

D33



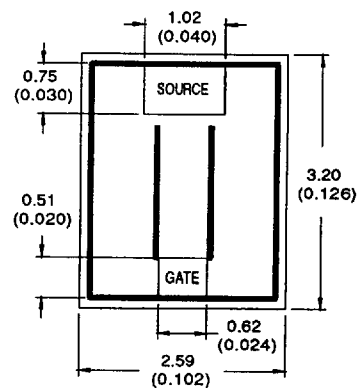
HEX-1: 100V, P-CHANNEL

D34



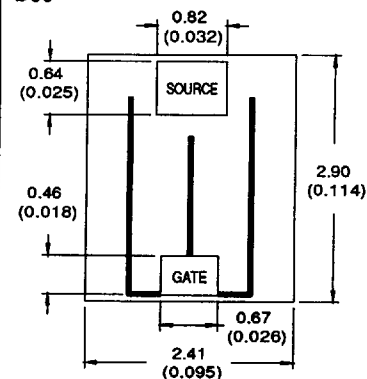
HEX-1: 200V, P-CHANNEL GEN 1

D35



HEX-2: 60V, P-CHANNEL

D36



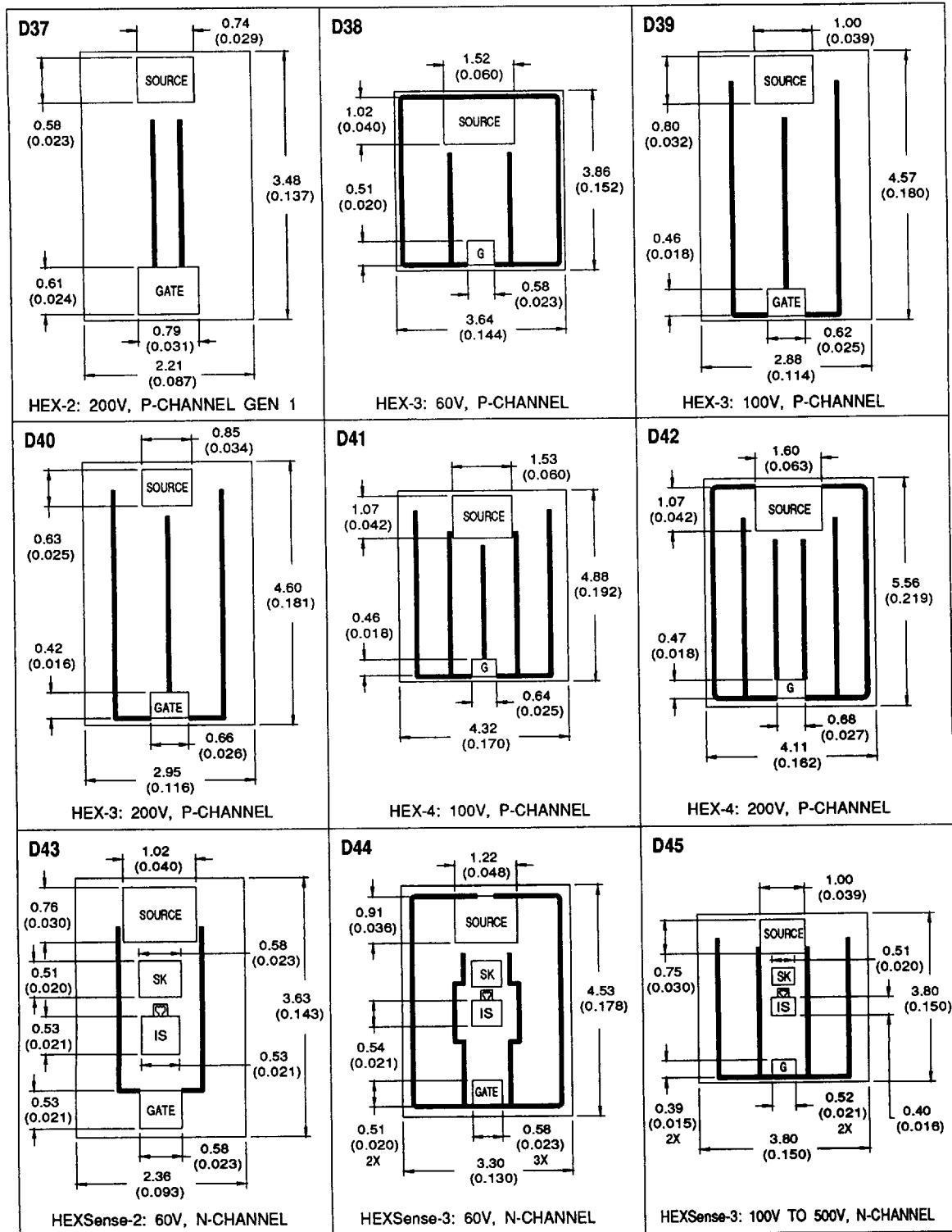
HEX-2: 100V, P-CHANNEL

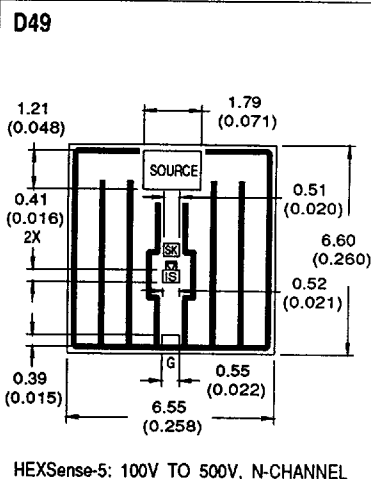
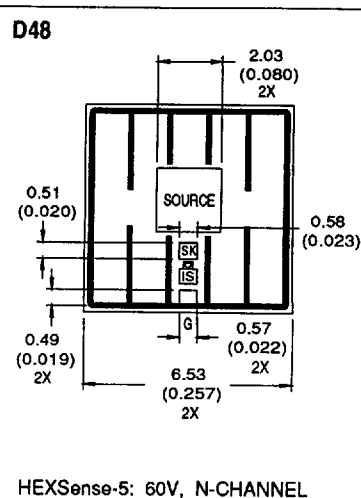
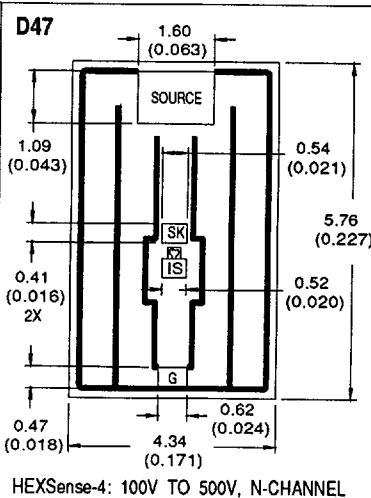
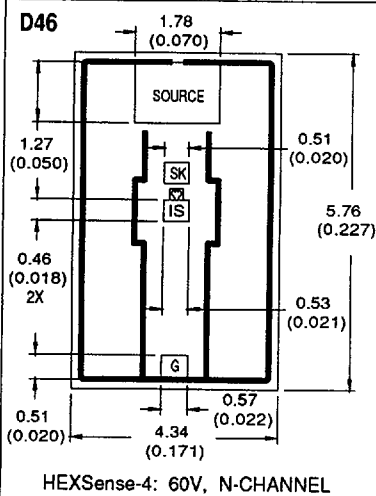
HEXFET Die Outlines

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INTERNATIONAL RECTIFIER

APPENDICES





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INTERNATIONAL RECTIFIER 6SE D

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- NOTES:
- 1 ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES)
 - 2 CONTROLLING DIMENSION: (INCH).
 3. LETTER DESIGNATION:
S = SOURCE SK = SOURCE KELVIN
G = GATE IS = CURRENT SENSE
 4. DIMENSIONAL TOLERANCES:
BONDING PADS: < 0.635 TOLERANCE = +/- 0.013
WIDTH < (0.0250) TOLERANCE = +/- (0.0005)
& > 0.635 TOLERANCE = +/- 0.025
LENGTH > (0.0250) TOLERANCE = +/- (0.0010)
OVERALL DIE: < 1.270 TOLERANCE = +/- 0.102
WIDTH < (0.050) TOLERANCE = +/- (0.004)
& > 0.635 TOLERANCE = +/- 0.203
> (0.050) TOLERANCE = +/- (0.008)
 5. UNLESS OTHERWISE NOTED ALL DIE ARE GEN III