International
IOR Rectifier

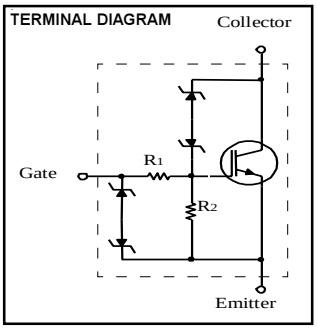
Ignition IGBT

IRGS14C40LPbF
IRGSL14C40LPbF
IRGB14C40LPbF

IGBT with on-chip Gate-Emitter and Gate-Collector clamps

Features

- Most Rugged in Industry
- Logic-Level Gate Drive
- > 6KV ESD Gate Protection
- Low Saturation Voltage
- High Self-clamped Inductive Switching Energy
- Lead-Free



- BV_{CES} = 370V min, 430V max
- I_C @ T_C = 110°C = 14A
- $V_{CE(on)}$ typ= 1.2V @7A @25°C
- $I_{L(min)}$=11.5A @25°C,L=4.7mH







NOTE: IRGS14C40L is available in tape and reel. Add a suffix of TRR or TRL to the part number to determine the orientation of the device in the pocket, i.e, IRGS14C40LTRR or IRGS14C40LTRL.

Description

The advanced IGBT process family includes a MOS gated, N-channel logic level device which is intended for coil-on-plug automotive ignition applications and small-engine ignition circuits. Unique features include on-chip active voltage clamps between the Gate-Emitter and Gate-Collector which provide over voltage protection capability in ignition circuits.

Absolute Maximum Ratings

	Parameter	Max	Unit	Condition
V_{CES}	Collector-to-Emitter Voltage	Clamped	V	R_G = 1K ohm
I_C @ T_C = 25°C	Continuous Collector Current	20	A	V_{GE} = 5V
I_C @ T_C = 110°C	Continuous Collector Current	14	A	V_{GE} = 5V
I_G	Continuous Gate Current	1	mA	
I_{Gp}	Peak Gate Current	10	mA	t_{PK} = 1ms, f = 100Hz
V_{GE}	Gate-to-Emitter Voltage	Clamped	V	
P_D @ T_C = 25°C	Maximum Power Dissipation	125	W	
P_D @ T = 110°C	Maximum Power Dissipation	54	W	
T_J	Operating Junction and	- 40 to 175	°C	
T_{STG}	Storage Temperature Range	- 40 to 175	°C	
V_{ESD}	Electrostatic Voltage	6	KV	C = 100pF, R = 1.5K ohm
I_L	Self-clamped Inductive Switching Current	11.5	A	L = 4.7mH, T = 25°C

Thermal Resistance

	Parameter	Min	Typ	Max	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case			1.2	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient			40	
	(PCB Mounted, Steady State)				
$Z_{\theta JC}$	Transient Thermal Impedance, Juction-to-Case (Fig.11)				

Off-State Electrical Charasteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min	Typ	Max	Unit	Conditions	Fig
BV_{CES}	Collector-to-Emitter Breakdown Voltage	370	400	430	V	R_G = 1K ohm, I_C=7A, V_{GE} = 0V	
BV_{GES}	Gate-to-Emitter Breakdown Voltage	10	12		V	I_G=2m A	
I_{CES}	Collector-to-Emitter Leakage Current			15	µA	R_G=1K ohm, V_{CE} = 250V	
				100	µA	R_G=1K ohm, V_{CE} = 250V, T_J =150°C	
BV_{CER}	Emitter-to-Collector Breakdown Voltage	24	28		V	I_C = -10m A	
R_1	Gate Series Resistance		75		ohm		
R_2	Gate-to-Emitter Resistance	10	20	30	K ohm		

On-State Electrical Charasteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min	Typ	Max	Unit	Conditions	Fig
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage		1.2	1.40	V	I_C = 7A, V_{GE} = 4.5V	
			1.35	1.55		I_C = 10A, V_{GE} = 4.5V	1
			1.35	1.55		I_C = 10A, V_{GE} = 4.5V, T_C= -40°C	2
			1.5	1.7		I_C = 14A, V_{GE} = 5.0V, T_C= -40°C	4
			1.55	1.75		I_C = 14A, V_{GE} = 5.0V	
			1.6	1.8		I_C = 14A, V_{GE} = 5.0V, T_C=150°C	
$V_{GE(th)}$	Gate Threshold Voltage	1.3	1.8	2.2	V	V_{CE} = V_{GE}, I_C = 1 m A, T_C=25°C	3, 5
		0.75		1.8		V_{CE} = V_{GE}, I_C = 1 m A, T_C=150°C	8
g_{fs}	Transconductance	10	15	19	S	V_{CE} = 25V, I_C = 10A, T_C=25°C	
I_C	Collector Current	20			A	V_{CE} = 10V, V_{GE} = 4.5V	

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

	Parameter	Min	Typ	Max	Unit	Conditions	Fig
Q_g	Total Gate charge		27		nC	I_C = 10A, V_{CE}=12V, V_{GE}=5V	7
Q_{ge}	Gate - Emitter Charge		2.5			I_C = 10A, V_{CE}=12V, V_{GE}=5V	15
Q_{gc}	Gate - Collector Charge		10			I_C = 10A, V_{CE}=12V, V_{GE}=5V	
$t_{d(on)}$	Turn - on delay time	0.6	0.9	1.35	µs	V_{GE}=5V, R_G=1K ohm, L=1mH, V_{CE}=14V	12
t_r	Rise time	1.6	2.8	4		V_{GE}=5V, R_G=1K ohm, L=1mH, V_{CE}=14V	14
$t_{d(off)}$	Turn - off delay time	3.7	6	8.3		V_{GE}=5V, R_G=1K ohm, L=1mH, V_{CE}=300V	
C_{ies}	Input Capacitance		550	825	pF	V_{GE}=0V, V_{CE}=25V, f=1M H z	
C_{oes}	Output Capacitance		100	150		V_{GE}=0V, V_{CE}=25V, f=1M H z	6
C_{res}	Reverse Transfer Capacitance		12	18		V_{GE}=0V, V_{CE}=25V, f=1M H z	
I_L	Self-Clamped Inductive Switching Current	25			A	L=0.7m H, T_C=25°C	
		15.5				L=2.2m H, T_C=25°C	9
		11.5				L=4.7m H, T_C=25°C	10
		16.5				L=1.5m H, T_C=150°C	13
		7.5				L=4.7m H, T_C=150°C	14
		6				L=8.7m H, T_C=150°C	
t_{SC}	Short Circuit Withstand Time	120			µs	T_J =150°C, V_{CC} = 16V, L = 10µH R_G = 1K ohm, V_{GE} = 5V	14

Fig.1 - Typ. Output Characteristics
T_J=25°C

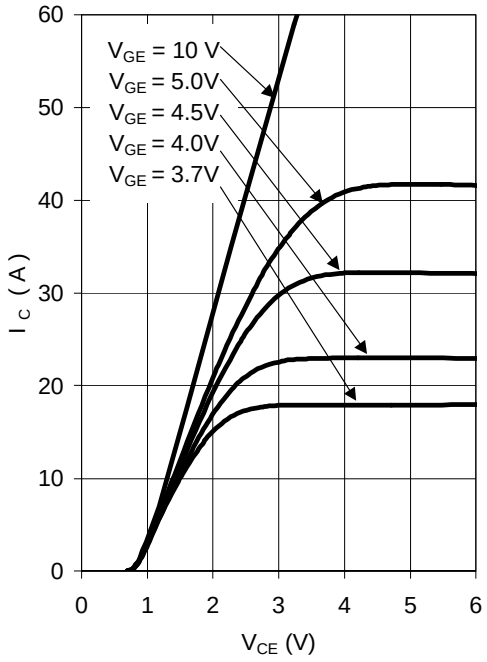


Fig.2 - Typ. Output Characteristics
T_J=125°C

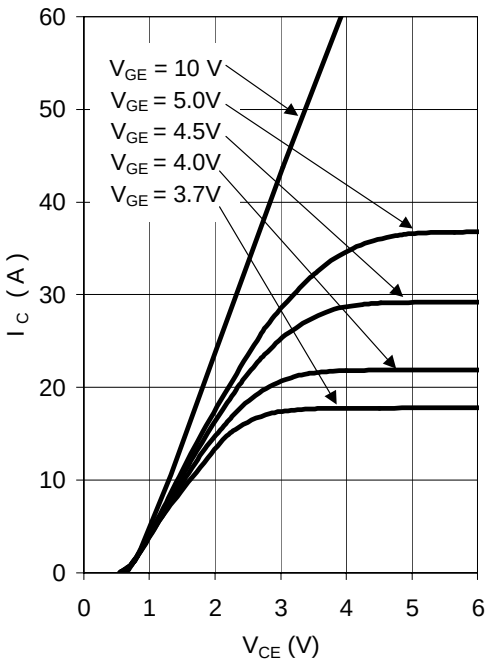


Fig.3 - Transfer Characteristics
V_{CE}=20V; tp=20µs

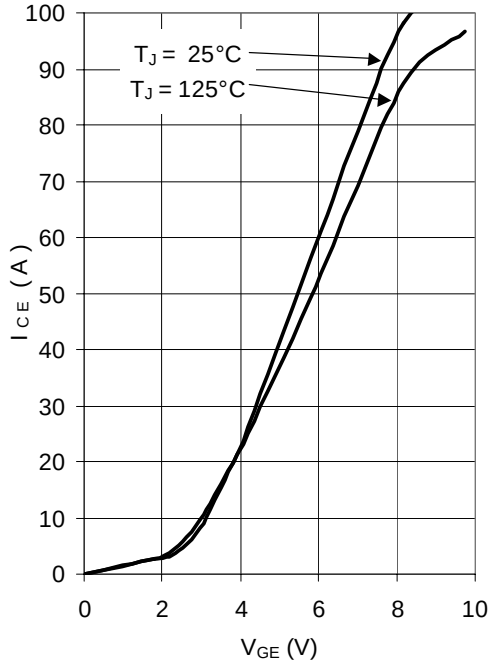


Fig.4 - Typical V_{CE} vs T_J
V_{GE}=4.5V

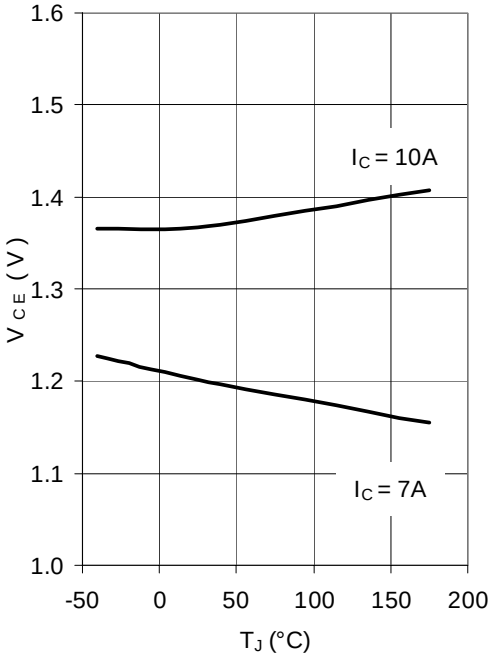


Fig.5 - Typical $V_{GE(th)}$ vs T_J
I_C=1mA

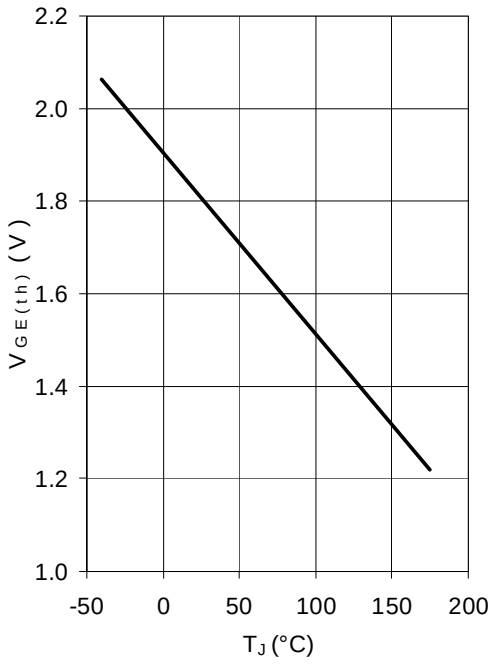


Fig.6 - Typ. Capacitance vs V_{CE}
V_{GE}=0V; V_{CE}=25V; f=1MHz

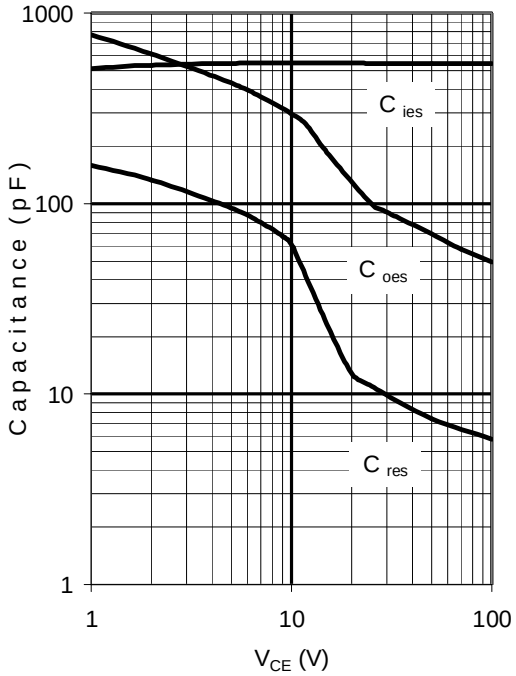


Fig.7 - Typ. Gate Charge vs V_{GE}
I_C=10A; V_{CE}=12V; V_{GE}=5V

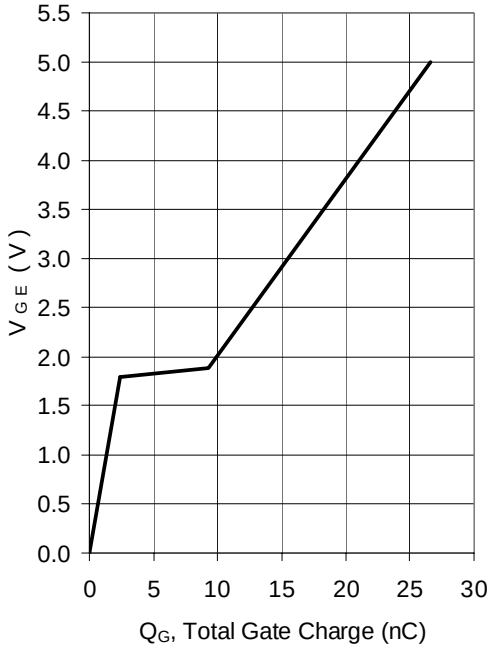


Fig.8 - Typical V_{CE} vs V_{GE}

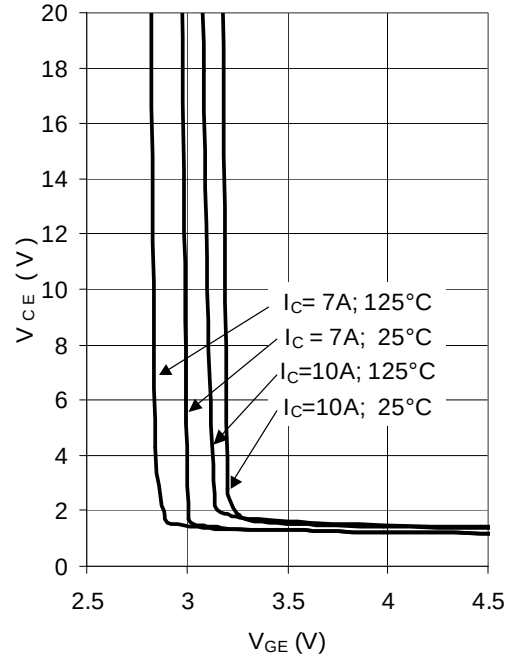


Fig.9 - Self-clamp Avalance Current vs Inductance @ 25°C

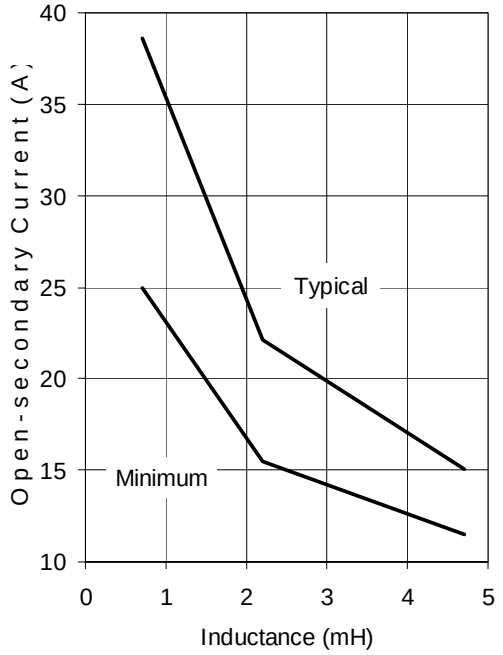


Fig.10 - Self-clamp Avalance Current vs Inductance @ 150°C

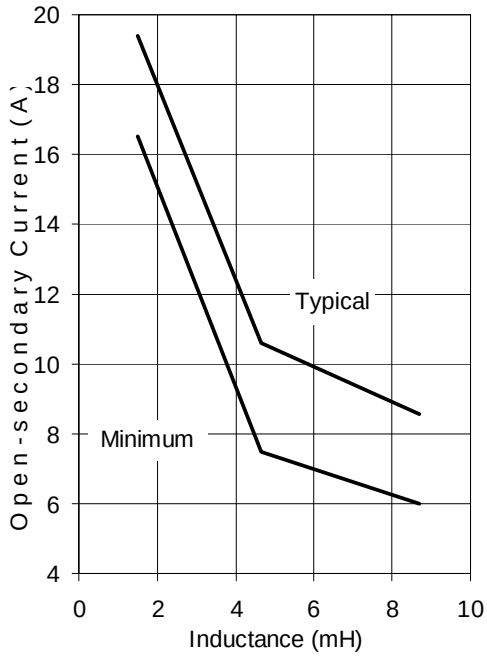


Fig.11 - Transient Thermal Impedance, Junction-to-Case

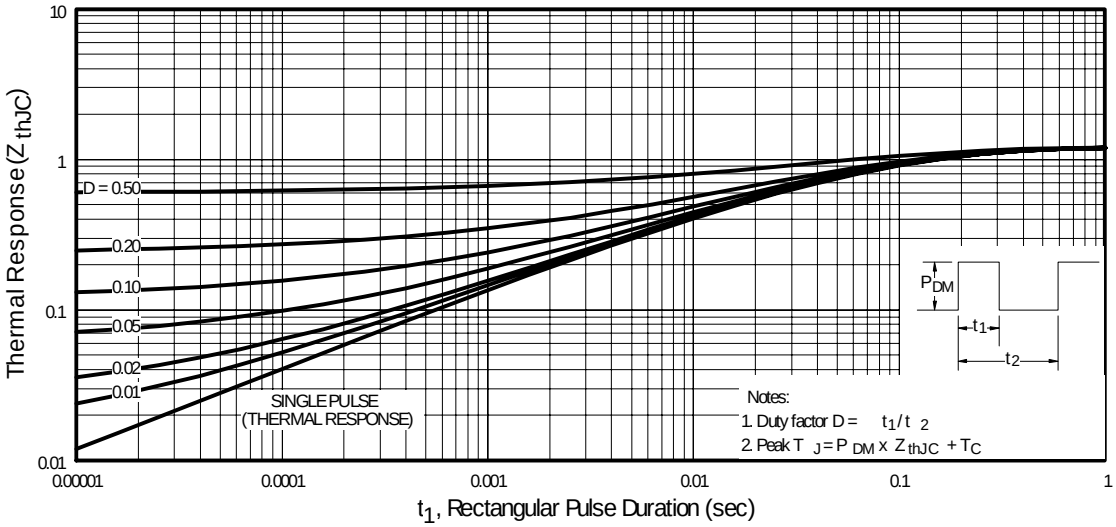


Fig.12 - Switching Waveform for Time Measurement

V_{GE}= 5V; R_G= 1KΩ; L= 1mH; V_{CE}= 14V; used circuit in Fig.14

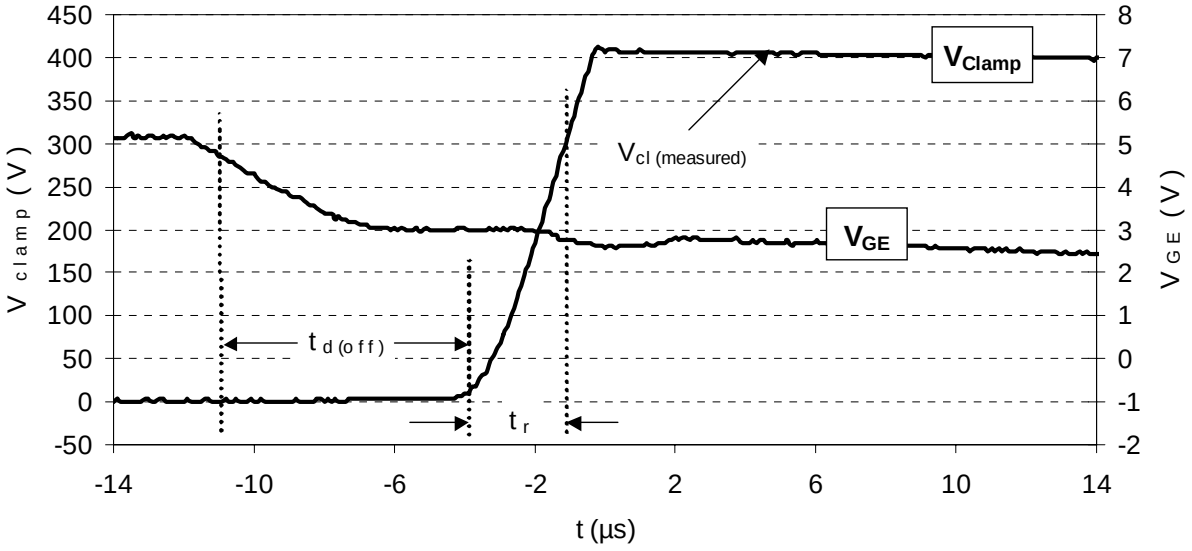


Fig.13 - Self-clamped Inductive Switching Waveform

L=4.7mH; T_C=25°C; used circuit in Fig.14

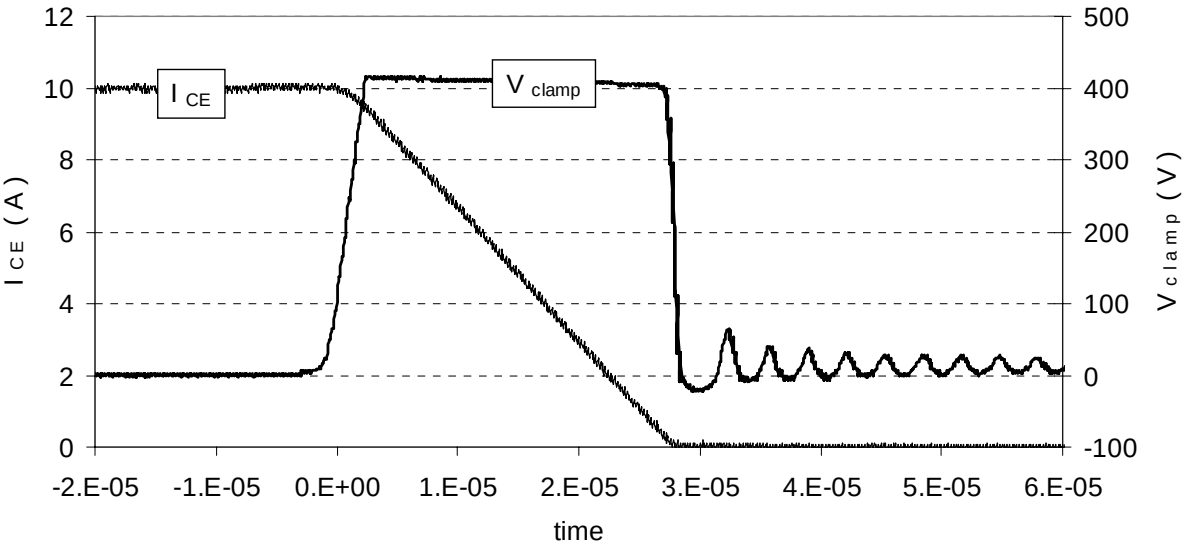


Fig.14 - Test Circuit

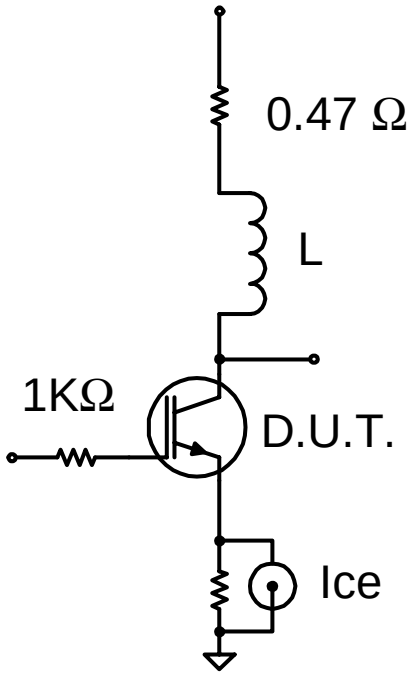
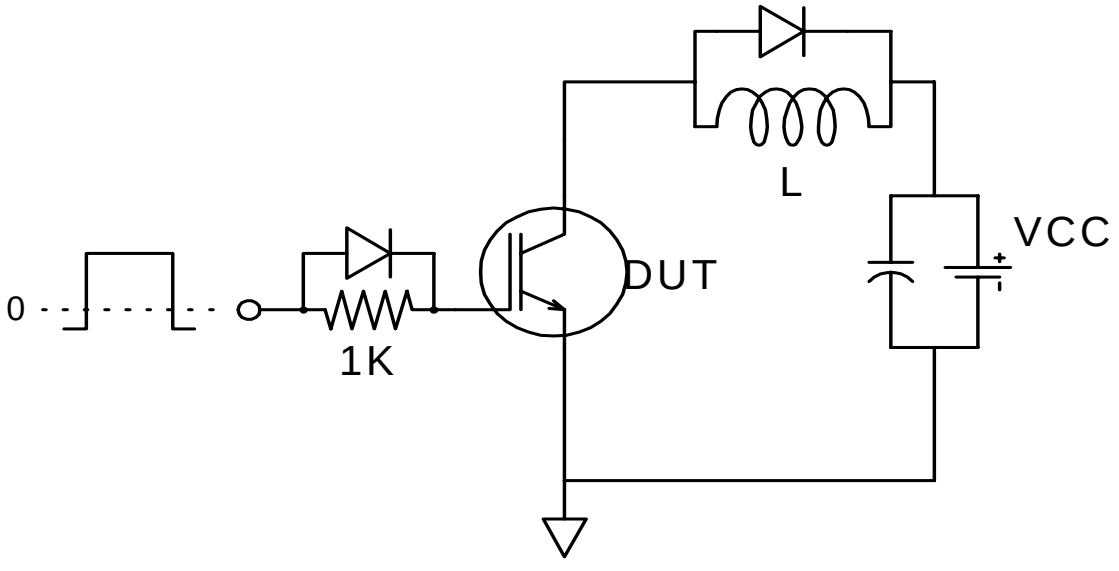
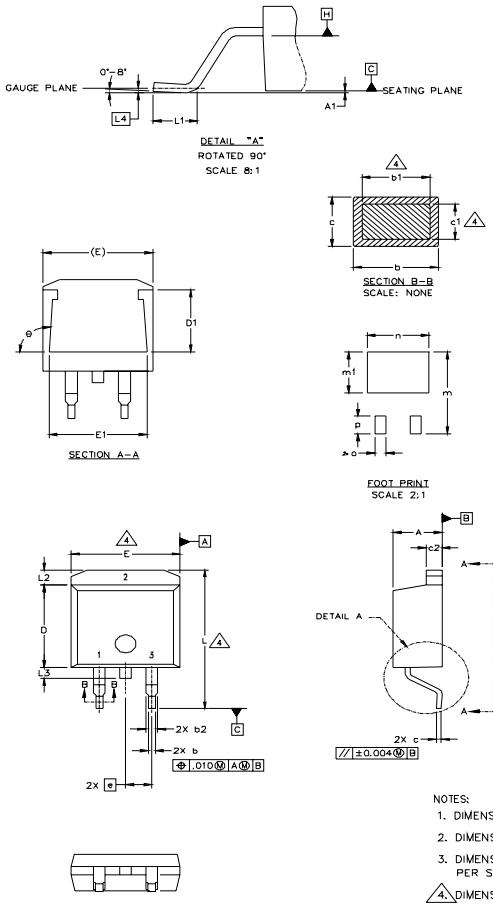


Fig.15 - Gate Charge Circuit



D²Pak Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1		0.127		.005	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	4
b2	1.14	1.40	.045	.055	
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	4
c2	1.14	1.40	.045	.055	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		
E	9.65	10.67	.380	.420	3
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
L	14.61	15.88	.575	.625	
L1	1.78	2.79	.070	.110	
L2		1.65		.065	
L3	1.27	1.78	.050	.070	
L4	0.25 BSC		.010 BSC		
m	17.78		.700		
m1	8.89		.350		
n	11.43		.450		
o	2.08		.082		
p	3.81		.150		
θ	90°	93°	90°	93°	

LEAD ASSIGNMENTS

HEXFET	IGBTs, CoPACK	DIODES
1.– GATE	1.– GATE	1.– ANODE *
2.– DRAIN	2.– COLLECTOR	2.– CATHODE
3.– SOURCE	3.– EMITTER	3.– ANODE

* PART DEPENDENT.

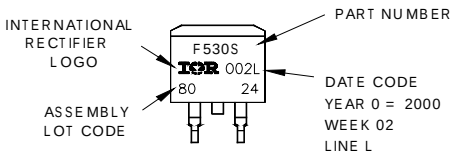
NOTES:

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. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

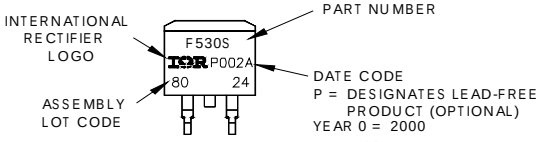
D²Pak Part Marking Information (Lead-Free)

EXAMPLE: THIS IS AN IRF530S WITH
LOT CODE 8024
ASSEMBLED ON WW 02, 2000
IN THE ASSEMBLY LINE "L"

Note: "P" in assembly line position indicates "Lead-Free"

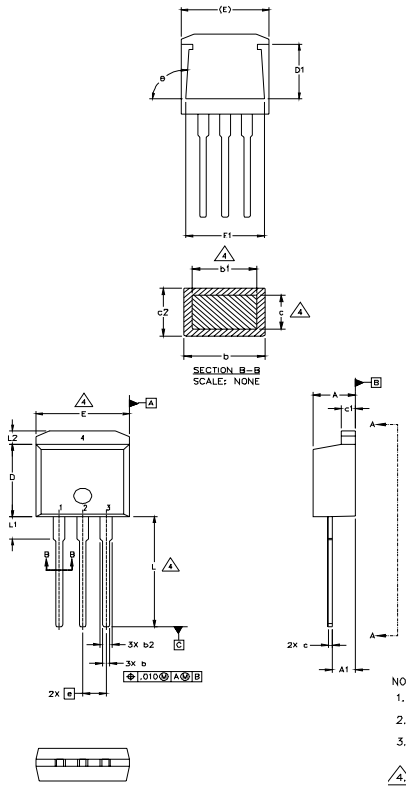


OR



TO-262 Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	2.03	2.92	.080	.115	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	4
b2	1.14	1.40	.045	.055	
c	0.38	0.63	.015	.025	4
c1	1.14	1.40	.045	.055	
c2	0.43	.063	.017	.029	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		
E	9.65	10.67	.380	.420	3
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
L	13.46	14.09	.530	.555	
L1	3.56	3.71	.140	.146	
L2		1.65		.065	

LEAD ASSIGNMENTS

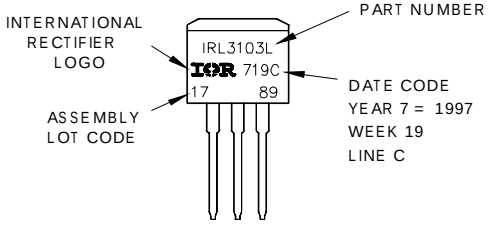
HEXFET	IGBT
1.– GATE	1 – GATE
2.– DRAIN	2 – COLLECTOR
3.– SOURCE	3 – EMITTER
4.– DRAIN	

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. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

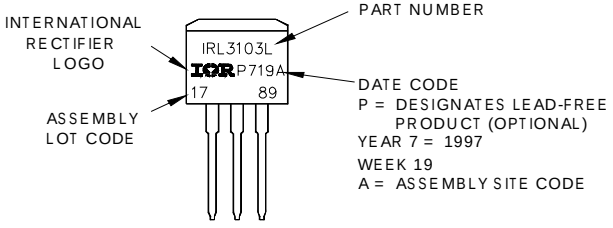
TO-262 Part Marking Information

EXAMPLE: THIS IS AN IRL3103L
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"

Note: "P" in assembly line position indicates "Lead-Free"

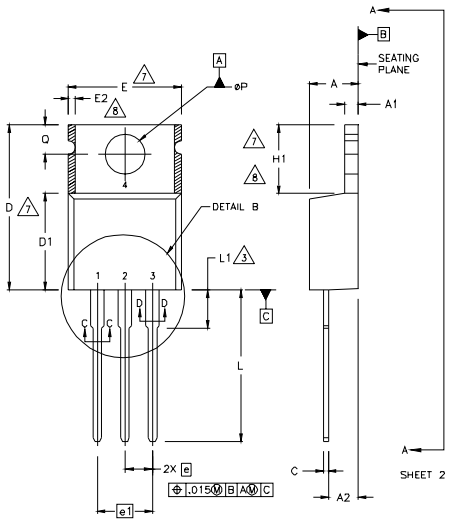


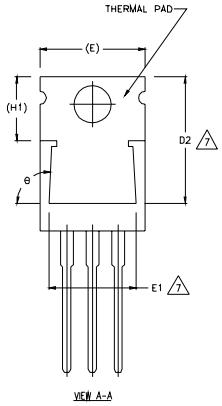
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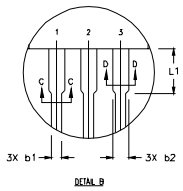


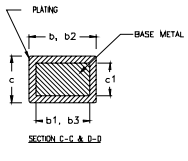
TO-220AB Package Outline

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

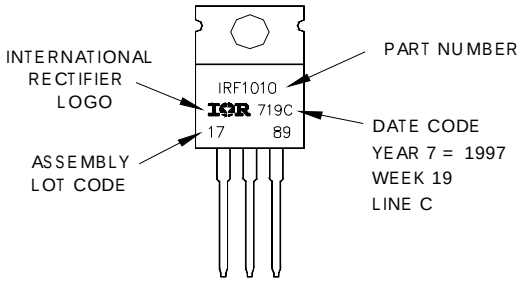
IGBTs, CoPACK
1.– GATE
2.– COLLECTOR
3.– EMITTER

DIODES
1.– ANODE/OPEN
2.– CATHODE
3.– ANODE

TO-220AB Part Marking Information

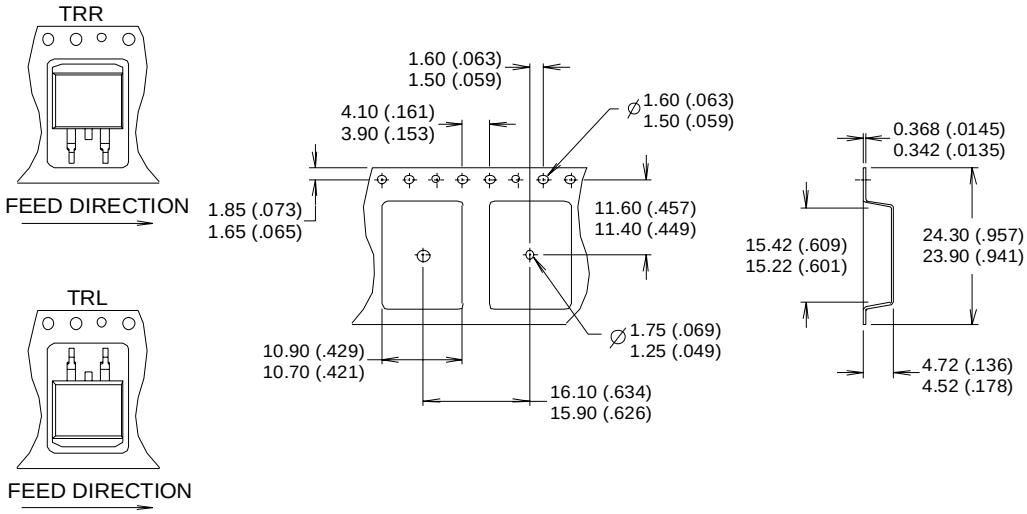
EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"

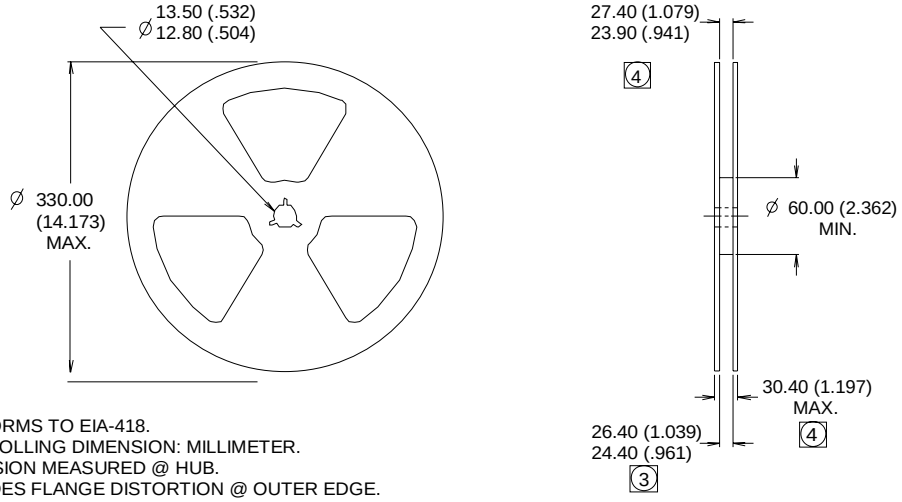
Note: "P" in assembly line position indicates "Lead-Free"



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.

Data and specifications subject to change without notice.

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