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With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

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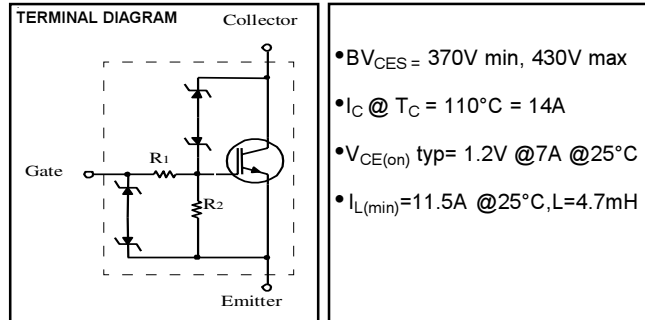
IGBT with on-chip Gate-Emitter and Gate-Collector clamps

**Features**

- Most Rugged in Industry
- Logic-Level Gate Drive
- > 6KV ESD Gate Protection
- Low Saturation Voltage
- High Self-clamped Inductive Switching Energy
- TO-220 is available in PbF as a Lead-Free

**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.



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



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.

**Absolute Maximum Ratings**

	Parameter	Max	Unit	Condition
$V_{CES}$	Collector-to-Emitter Voltage	Clamped	V	$R_G = 1K \text{ ohm}$
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	20	A	$V_{GE} = 5V$
$I_C @ T_C = 110^\circ C$	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	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	125	W	
$P_D @ T = 110^\circ C$	Maximum Power Dissipation	54	W	
$T_J$	Operating Junction and	- 40 to 175	$^\circ C$	
$T_{STG}$	Storage Temperature Range	- 40 to 175	$^\circ C$	
$V_{ESD}$	Electrostatic Voltage	6	KV	$C = 100pF, R = 1.5K \text{ ohm}$
$I_L$	Self-clamped Inductive Switching Current	11.5	A	$L = 4.7mH, T = 25^\circ C$

**Thermal Resistance**

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

**Off-State Electrical Characteristics @  $T_J = 25^\circ\text{C}$**  (unless otherwise specified)

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

**On-State Electrical Characteristics @  $T_J = 25^\circ\text{C}$**  (unless otherwise specified)

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

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

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

Fig.1 - Typ. Output Characteristics  
 $T_J = 25^\circ\text{C}$

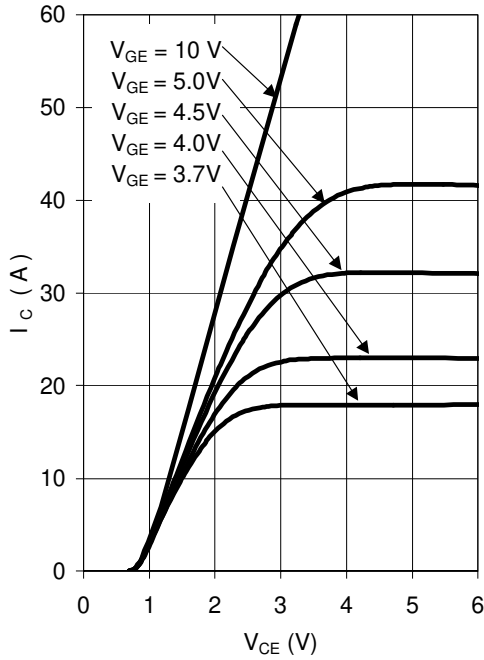


Fig.2 - Typ. Output Characteristics  
 $T_J = 125^\circ\text{C}$

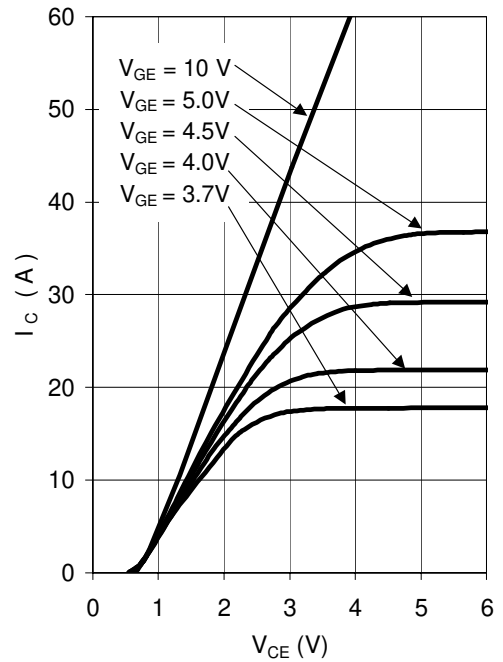


Fig.3 - Transfer Characteristics  
 $V_{CE} = 20\text{V}; t_p = 20\mu\text{s}$

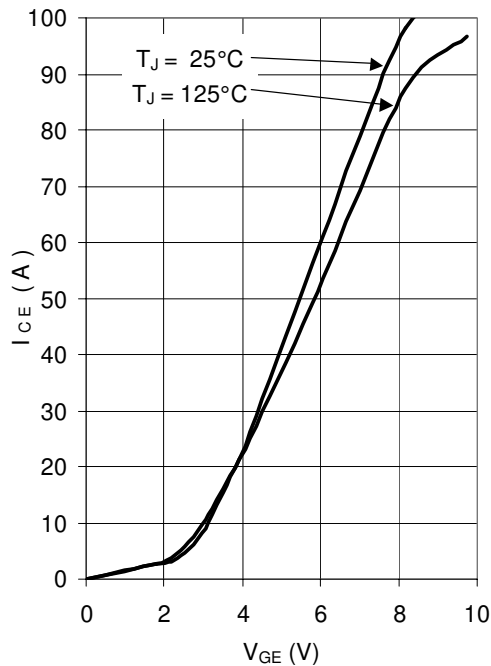
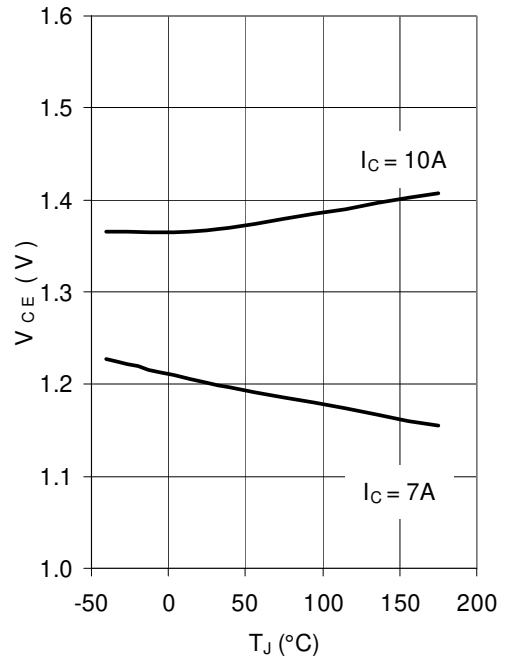


Fig.4 - Typical  $V_{CE}$  vs  $T_J$   
 $V_{GE} = 4.5\text{V}$



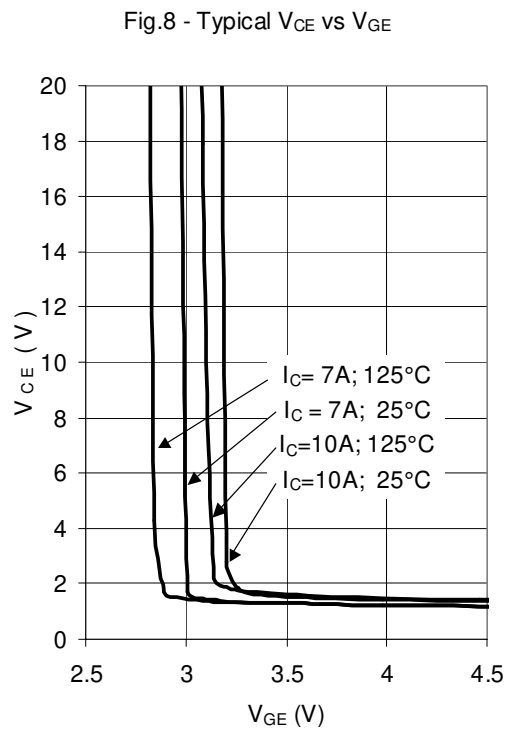
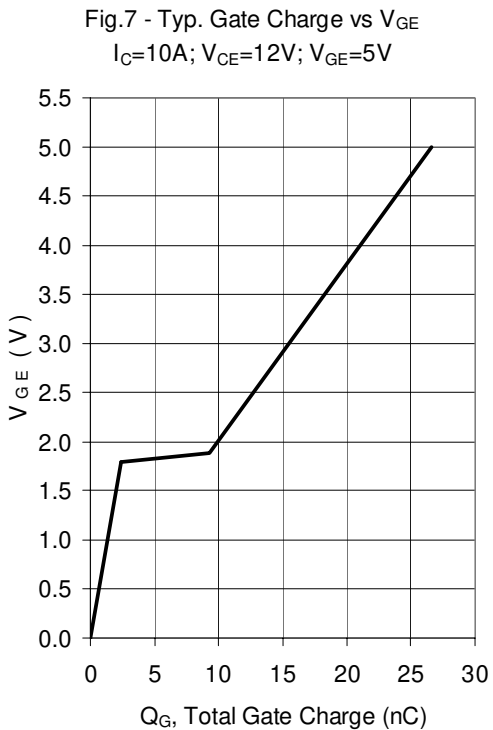
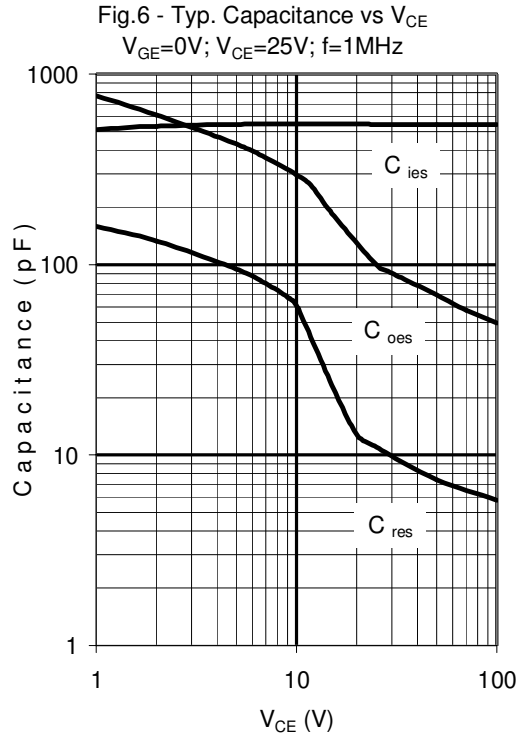
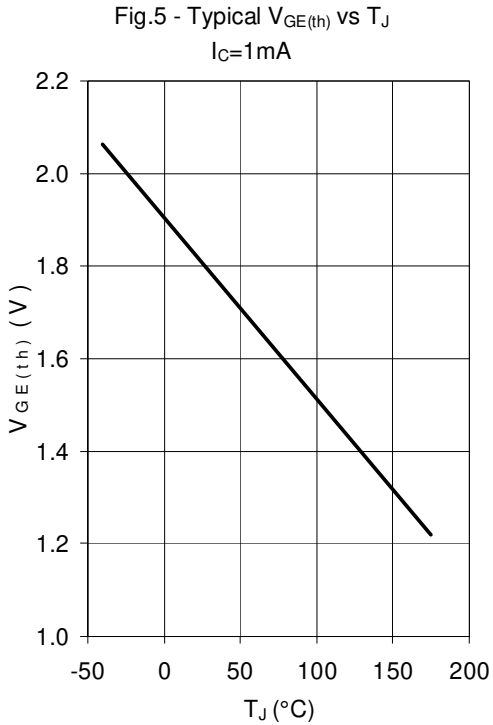


Fig.9 - Self-clamp Avalanche Current vs Inductance @ 25°C

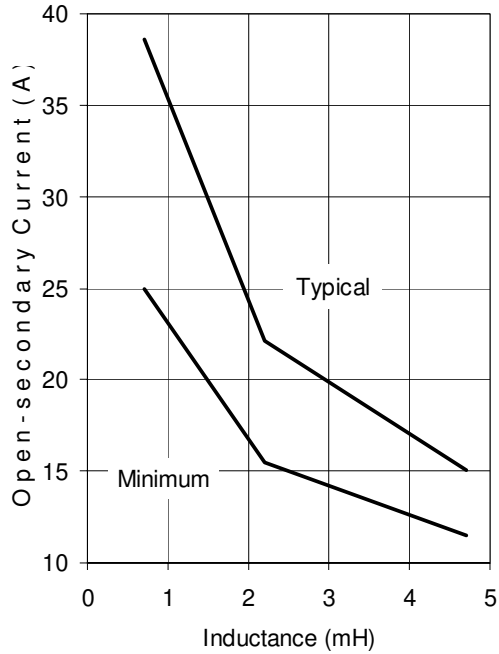


Fig.10 - Self-clamp Avalanche Current vs Inductance @ 150°C

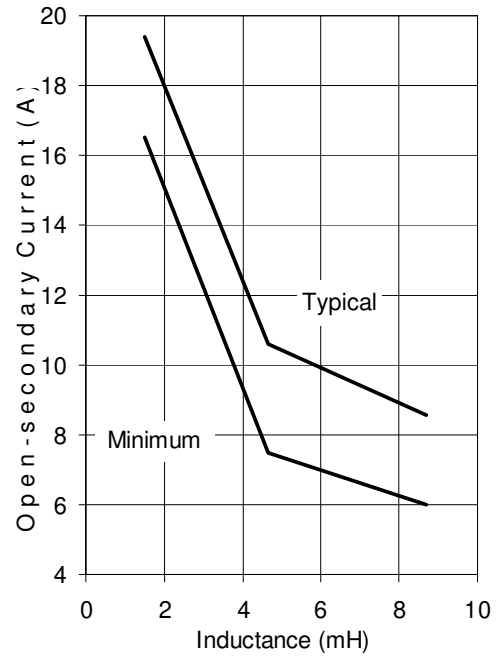


Fig.11 - Transient Thermal Impedance, Junction-to-Case

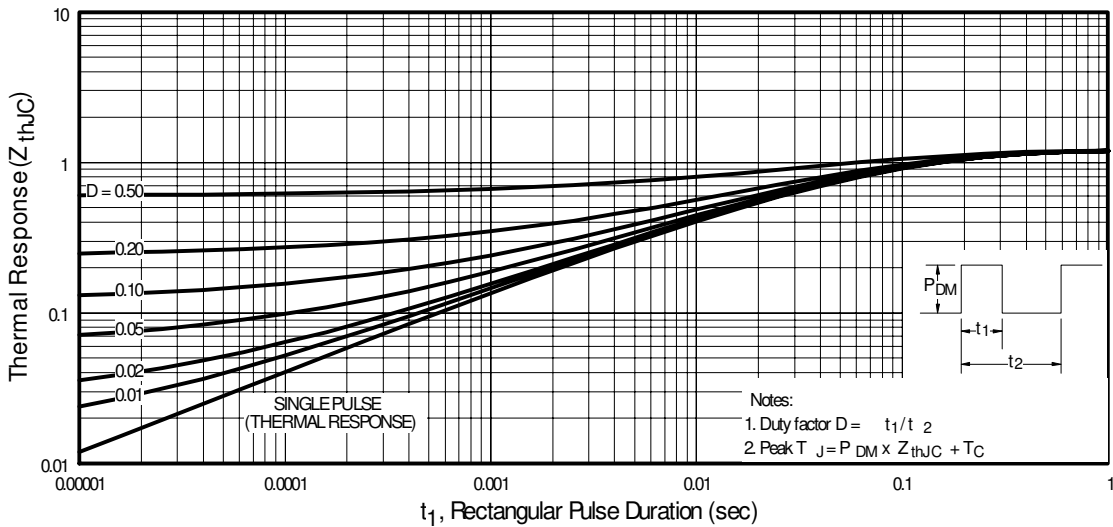


Fig.12 - Switching Waveform for Time Measurement

$V_{GE} = 5V$ ;  $R_G = 1K\Omega$ ;  $L = 1mH$ ;  $V_{CE} = 14V$ ; used circuit in Fig.14

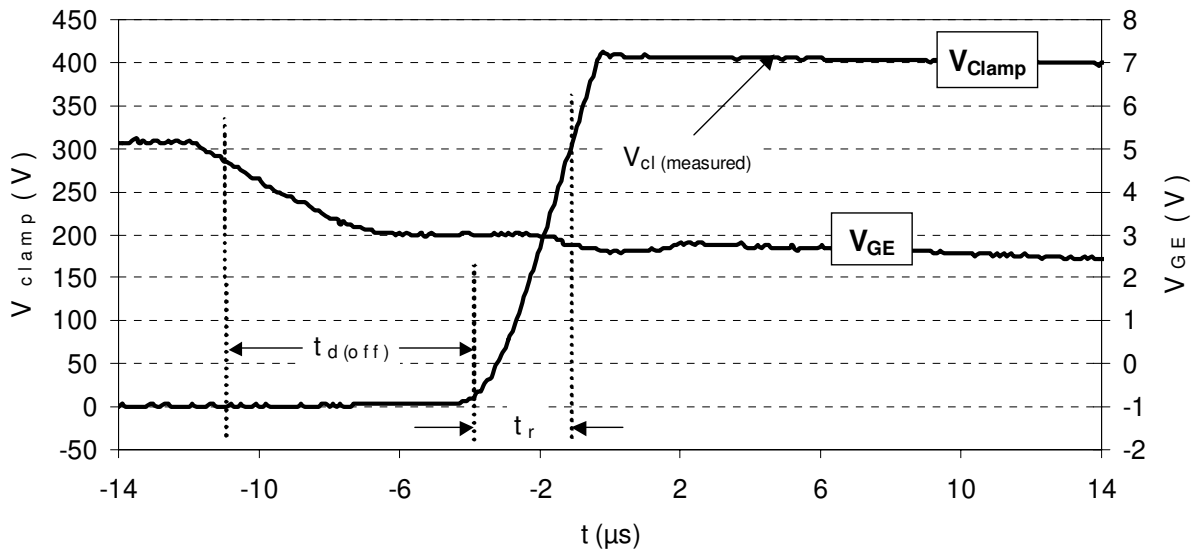


Fig.13 - Self-clamped Inductive Switching Waveform

$L = 4.7mH$ ;  $T_C = 25^\circ C$ ; used circuit in Fig.14

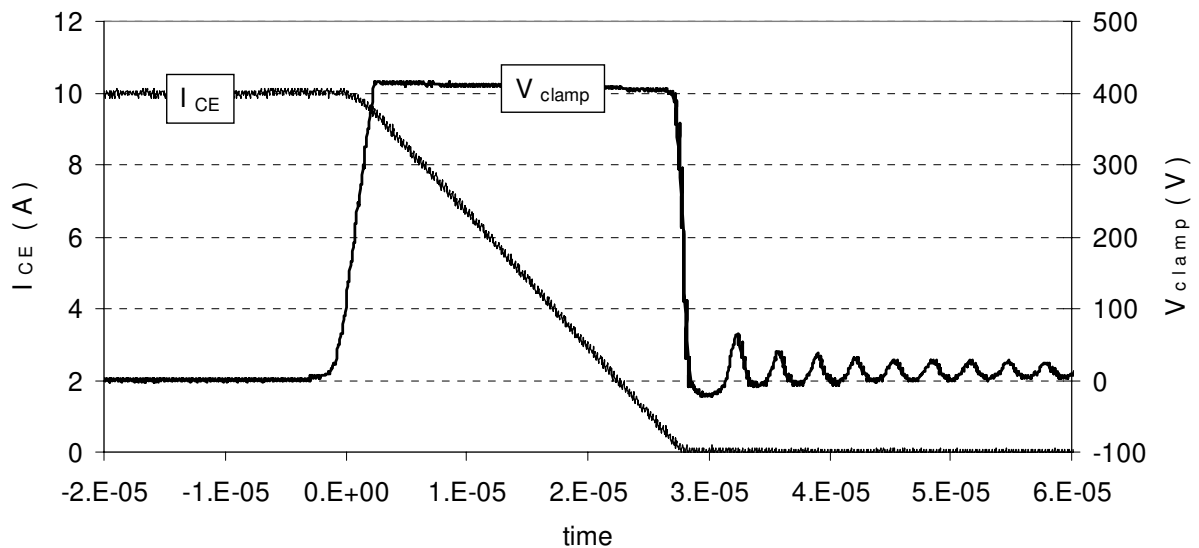


Fig.14 - Test Circuit

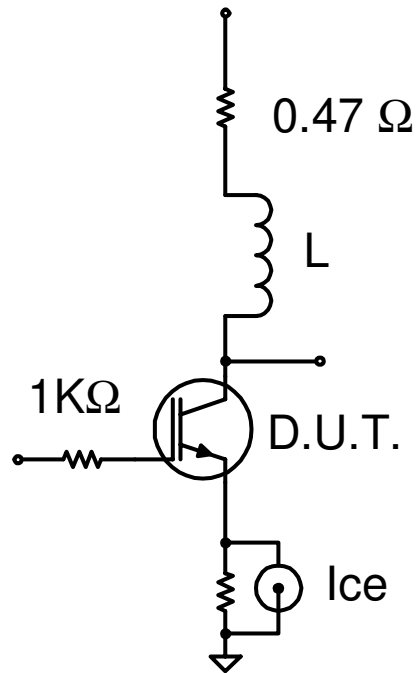
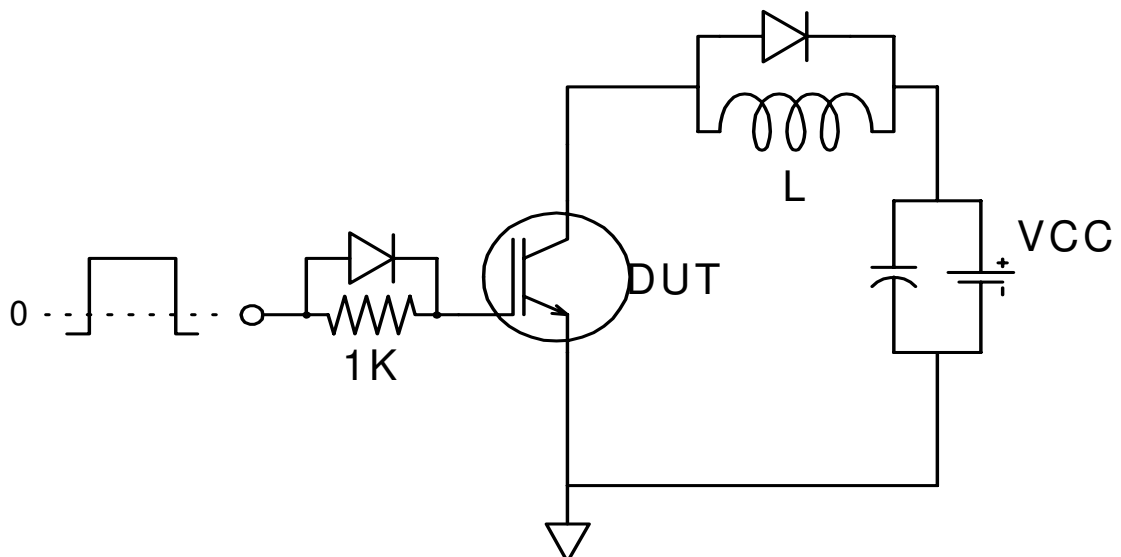


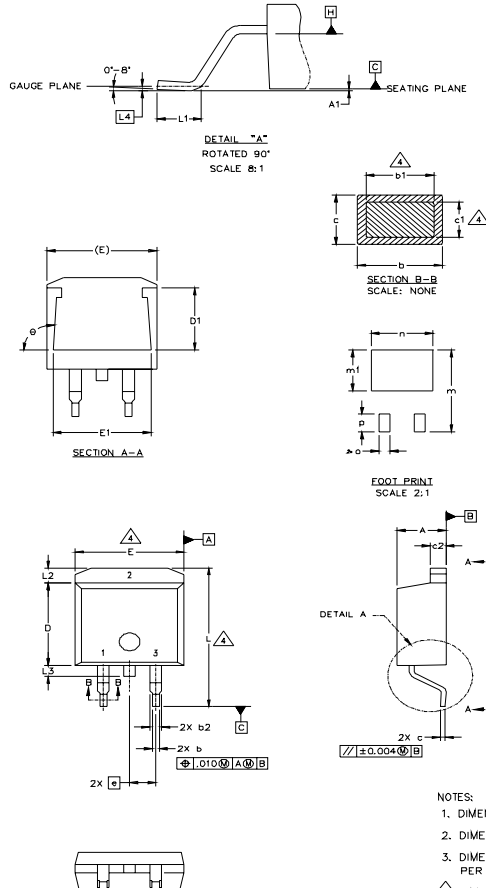
Fig.15 - Gate Charge Circuit





**D<sup>2</sup>Pak Package Outline**

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	4
A1	0.127	0.127	.005	.005	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	3
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.

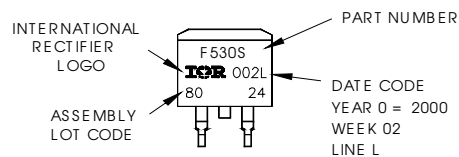
NOTES:

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 [0.005"] 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.

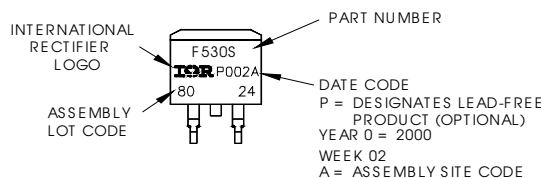
**D<sup>2</sup>Pak Part Marking Information (Lead-Free)**

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"

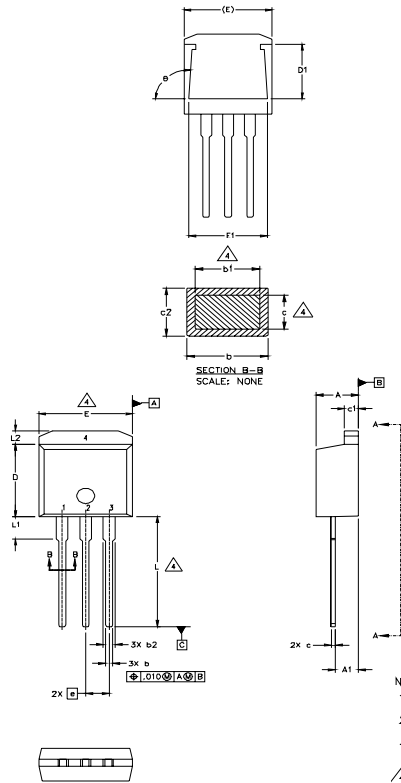


**OR**



**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**

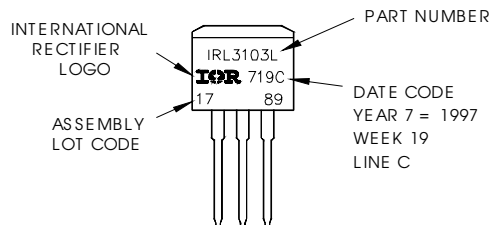
HEXFET	IGBT
1.- GATE	1 - GATE
2.- DRAIN	2 - COLLECTOR
3.- SOURCE	3 - EMITTER
4.- DRAIN	

- 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.

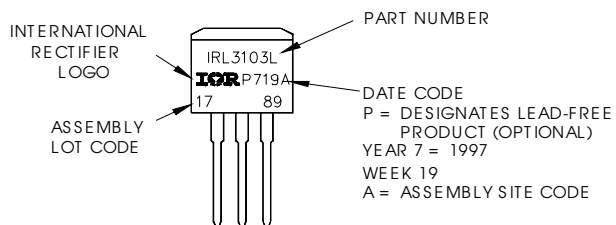
**TO-262 Part Marking Information**

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"

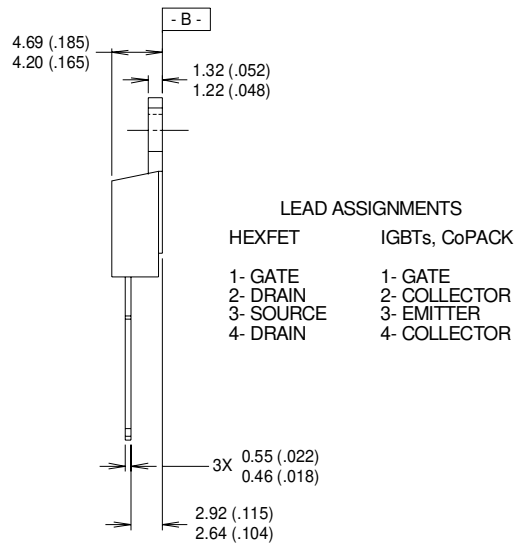
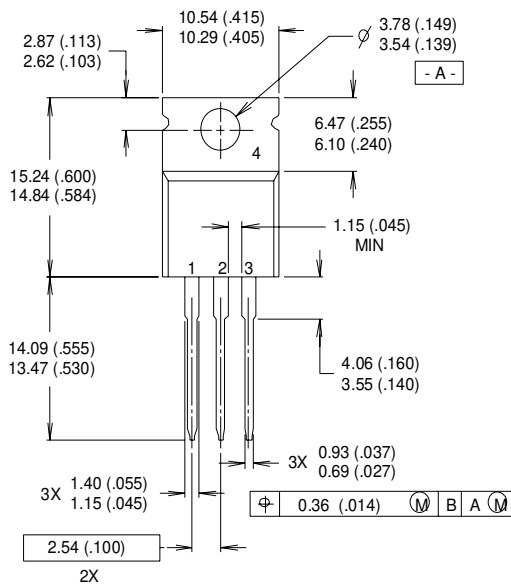


**OR**



### TO-220AB Package Outline

Dimensions are shown in millimeters (inches)

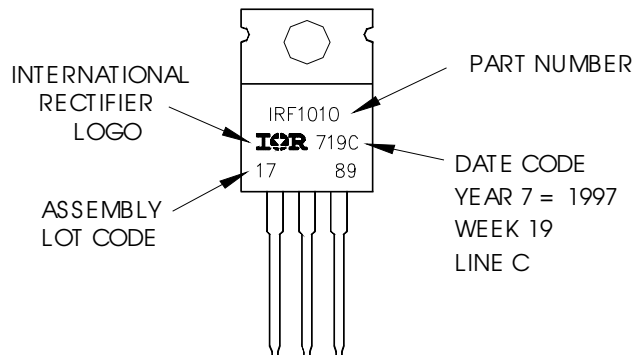


NOTES:

- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH
- 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
- 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

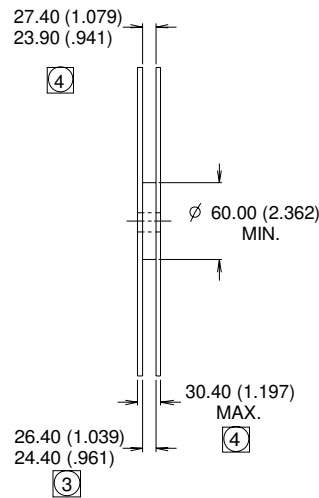
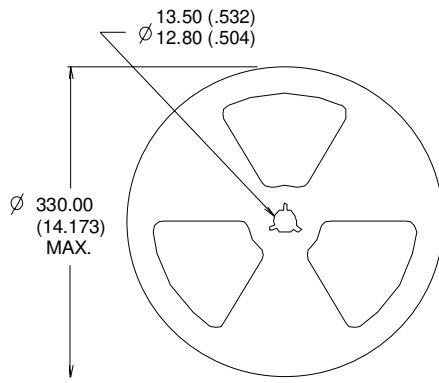
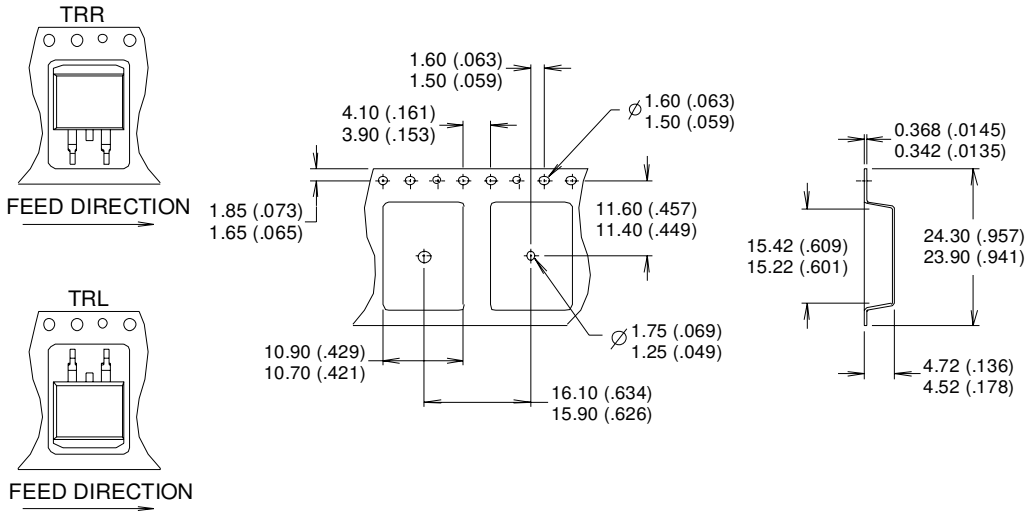
### TO-220AB Part Marking Information

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"



D<sup>2</sup>Pak 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/>