

PDP TRENCH IGBT

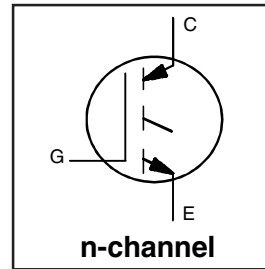
IRGI4090PbF

Features

- Advanced Trench IGBT Technology
- Optimized for Sustain and Energy Recovery circuits in PDP applications
- Low $V_{CE(on)}$ and Energy per Pulse (E_{PULSE}^{TM}) for improved panel efficiency
- High repetitive peak current capability
- Lead Free package

Key Parameters

$V_{CE\ min}$	300	V
$V_{CE(on)}\ typ.\ @\ I_C = 11\ A$	1.20	V
$I_{RP}\ max\ @\ T_C = 25^\circ C$	140	A
$T_J\ max$	150	$^\circ C$



G	C	E
Gate	Collector	Emitter

Description

This IGBT is specifically designed for applications in Plasma Display Panels. This device utilizes advanced trench IGBT technology to achieve low $V_{CE(on)}$ and low E_{PULSE}^{TM} rating per silicon area which improve panel efficiency. Additional features are $150^\circ C$ operating junction temperature and high repetitive peak current capability. These features combine to make this IGBT a highly efficient, robust and reliable device for PDP applications.

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{GE}	Gate-to-Emitter Voltage	± 30	V
$I_C\ @\ T_C = 25^\circ C$	Continuous Collector Current, $V_{GE}\ @\ 15V$	21	A
$I_C\ @\ T_C = 100^\circ C$	Continuous Collector, $V_{GE}\ @\ 15V$	11	
$I_{RP}\ @\ T_C = 25^\circ C$	Repetitive Peak Current ①	140	
$P_D\ @\ T_C = 25^\circ C$	Power Dissipation	34	W
$P_D\ @\ T_C = 100^\circ C$	Power Dissipation	14	
	Linear Derating Factor	0.27	W/ $^\circ C$
T_J T_{STG}	Operating Junction and Storage Temperature Range	-40 to + 150	$^\circ C$
	Soldering Temperature for 10 seconds	300	
	Mounting Torque, 6-32 or M3 Screw	10lb·in (1.1N·m)	N

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ②	—	3.65	$^\circ C/W$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{CES}	Collector-to-Emitter Breakdown Voltage	300	—	—	V	$V_{GE} = 0V, I_{CE} = 500\mu A$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ^③	30	—	—	V	$V_{GE} = 0V, I_{CE} = 1.0A$
$\Delta BV_{CES}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.30	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_{CE} = 5.0\mu A$
$V_{CE(on)}$	Static Collector-to-Emitter Voltage	—	1.20	—	V	$V_{GE} = 15V, I_{CE} = 11A$ ^③
		—	1.67	1.94		$V_{GE} = 15V, I_{CE} = 30A$ ^③
		—	2.43	—		$V_{GE} = 15V, I_{CE} = 60A$ ^③
		—	3.35	—		$V_{GE} = 15V, I_{CE} = 90A$ ^③
		—	4.50	—		$V_{GE} = 15V, I_{CE} = 120A$ ^③
		—	4.75	—		$V_{GE} = 15V, I_{CE} = 90A, T_J = 150^\circ\text{C}$ ^③
$V_{GE(th)}$	Gate Threshold Voltage	2.6	—	5.0	V	$V_{CE} = V_{GE}, I_{CE} = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	-12	—	mV/ $^\circ\text{C}$	Reference to 25°C
I_{CES}	Collector-to-Emitter Leakage Current	—	2.0	5.0	μA	$V_{CE} = 300V, V_{GE} = 0V$
		—	5.0	—		$V_{CE} = 300V, V_{GE} = 0V, T_J = 100^\circ\text{C}$
		—	100	—		$V_{CE} = 300V, V_{GE} = 0V, T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Forward Leakage	—	—	100	nA	$V_{GE} = 30V$
	Gate-to-Emitter Reverse Leakage	—	—	-100		$V_{GE} = -30V$
g_{fe}	Forward Transconductance	—	11	—	S	$V_{CE} = 25V, I_{CE} = 11A$
Q_g	Total Gate Charge	—	34	—	nC	$V_{CE} = 200V, I_C = 11A, V_{GE} = 15V$ ^③
Q_{gc}	Gate-to-Collector Charge	—	9.6	—		
$t_{d(on)}$	Turn-On delay time	—	20	—	ns	$I_C = 11A, V_{CC} = 240V$ $R_G = 10\Omega, L = 200\mu H, L_S = 150nH$ $T_J = 25^\circ\text{C}$
t_r	Rise time	—	14	—		
$t_{d(off)}$	Turn-Off delay time	—	99	—		
t_f	Fall time	—	68	—		
$t_{d(on)}$	Turn-On delay time	—	19	—	ns	$I_C = 11A, V_{CC} = 240V$ $R_G = 10\Omega, L = 200\mu H, L_S = 150nH$ $T_J = 150^\circ\text{C}$
t_r	Rise time	—	15	—		
$t_{d(off)}$	Turn-Off delay time	—	139	—		
t_f	Fall time	—	129	—		
t_{st}	Shoot Through Blocking Time	100	—	—	ns	$V_{CC} = 240V, V_{GE} = 15V, R_G = 5.1\Omega$
E_{PULSE}	Energy per Pulse	—	549	—	μJ	$L = 220nH, C = 0.10\mu F, V_{GE} = 15V$ $V_{CC} = 240V, R_G = 5.10\Omega, T_J = 25^\circ\text{C}$
		—	637	—		$L = 220nH, C = 0.10\mu F, V_{GE} = 15V$ $V_{CC} = 240V, R_G = 5.10\Omega, T_J = 100^\circ\text{C}$
C_{ies}	Input Capacitance	—	1153	—	pF	$V_{GE} = 0V$
C_{oes}	Output Capacitance	—	59	—		$V_{CE} = 30V$
C_{res}	Reverse Transfer Capacitance	—	27	—		$f = 1.0MHz$, See Fig.13
L_C	Internal Collector Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
L_E	Internal Emitter Inductance	—	7.5	—		

Notes:

- ① Half sine wave with duty cycle = 0.05, $PW = 2\mu\text{sec}$.
 ② R_θ is measured at T_J of approximately 90°C .
 ③ Pulse width $\leq 400\mu\text{s}$; duty cycle $\leq 2\%$.

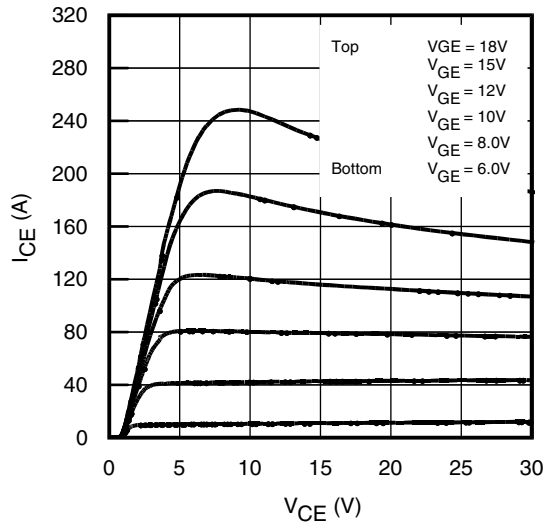


Fig 1. Typical Output Characteristics @ 25°C

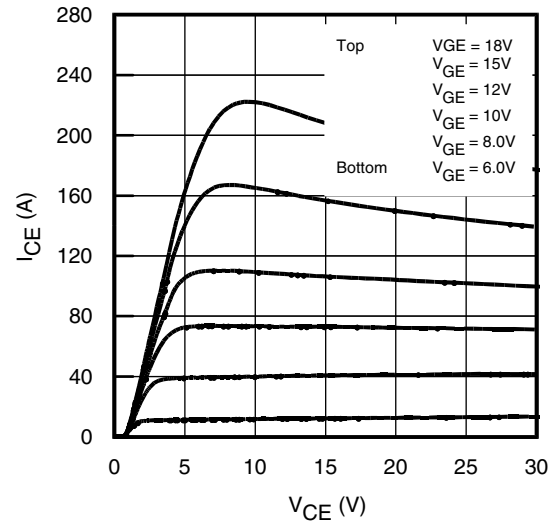


Fig 2. Typical Output Characteristics @ 75°C

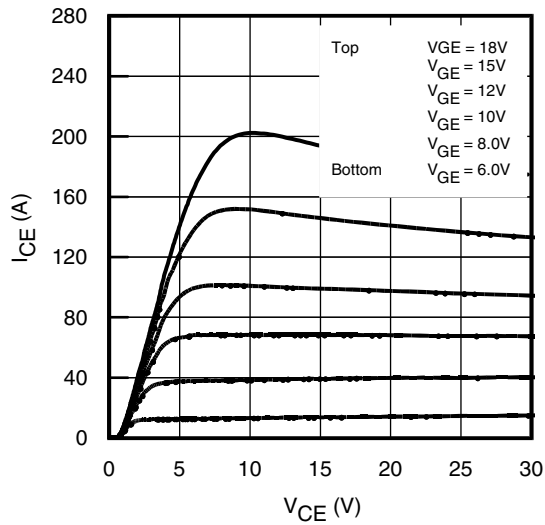


Fig 3. Typical Output Characteristics @ 125°C

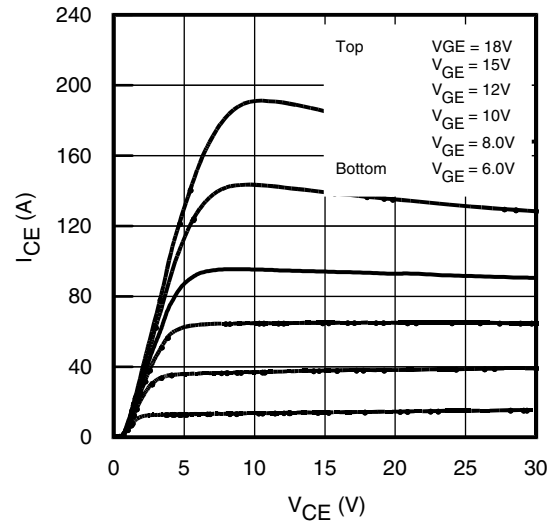


Fig 4. Typical Output Characteristics @ 150°C

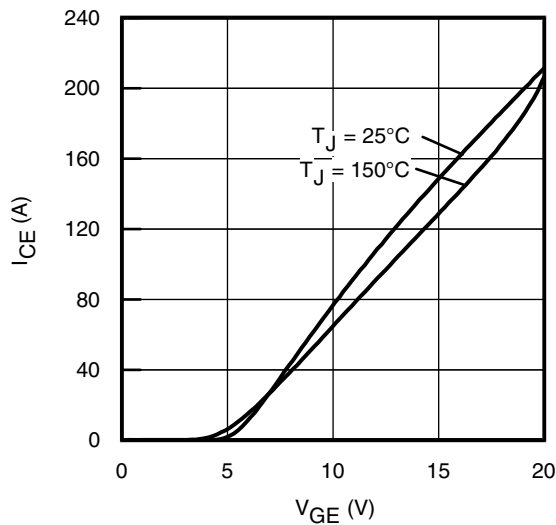


Fig 5. Typical Transfer Characteristics

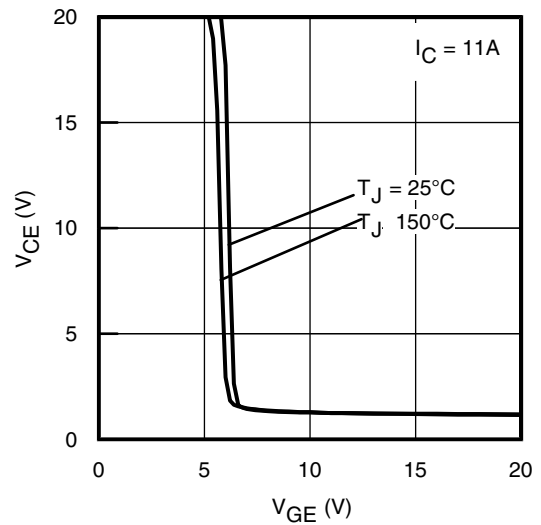


Fig 6. $V_{CE(ON)}$ vs. Gate Voltage

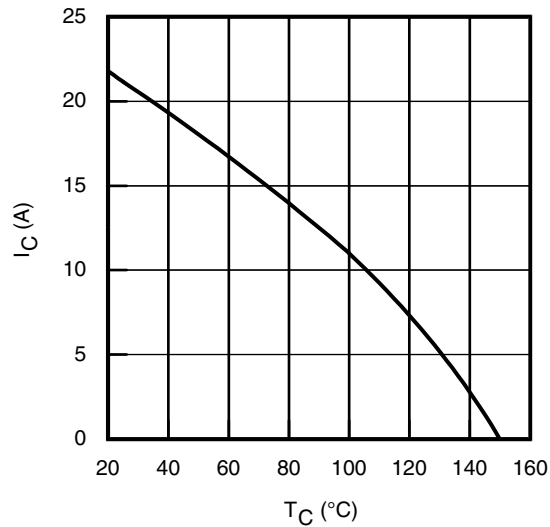


Fig 7. Maximum Collector Current vs. Case Temperature

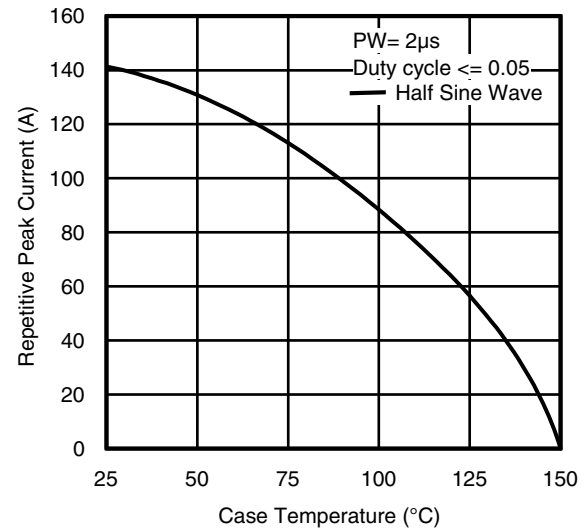


Fig 8. Typical Repetitive Peak Current vs. Case Temperature

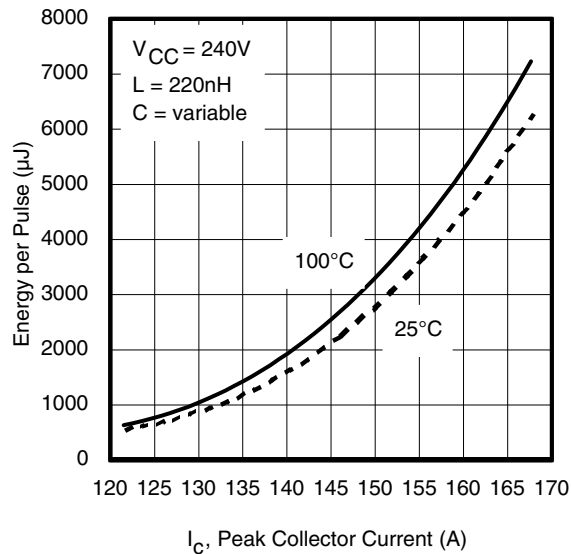


Fig 9. Typical E_{PULSE} vs. Collector Current

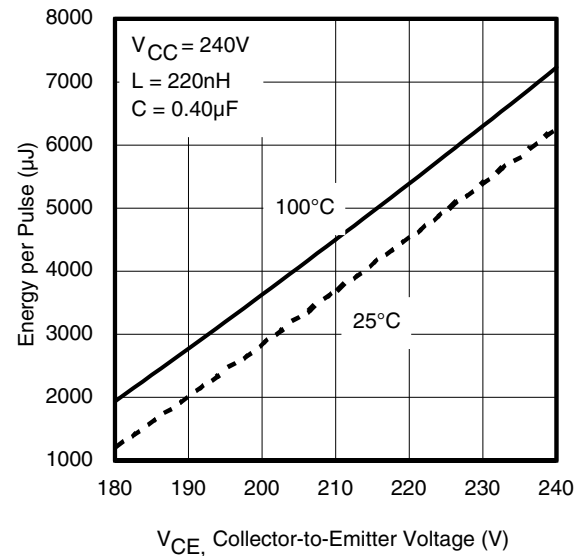


Fig 10. Typical E_{PULSE} vs. Collector-to-Emitter Voltage

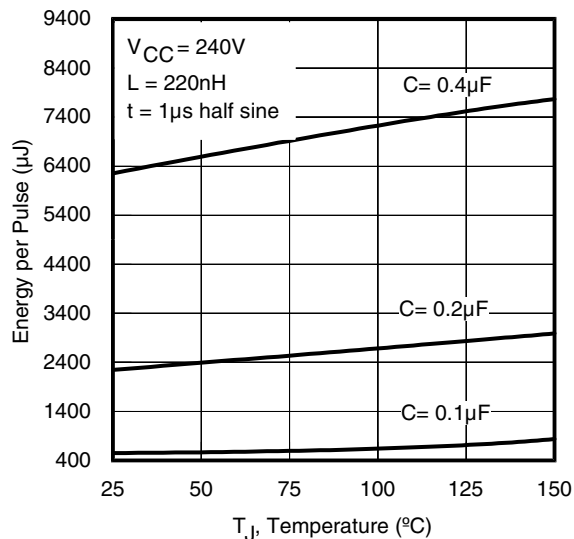


Fig 11. E_{PULSE} vs. Temperature

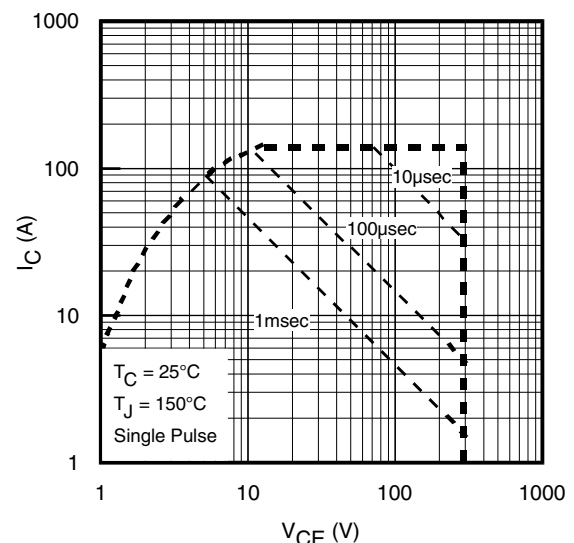
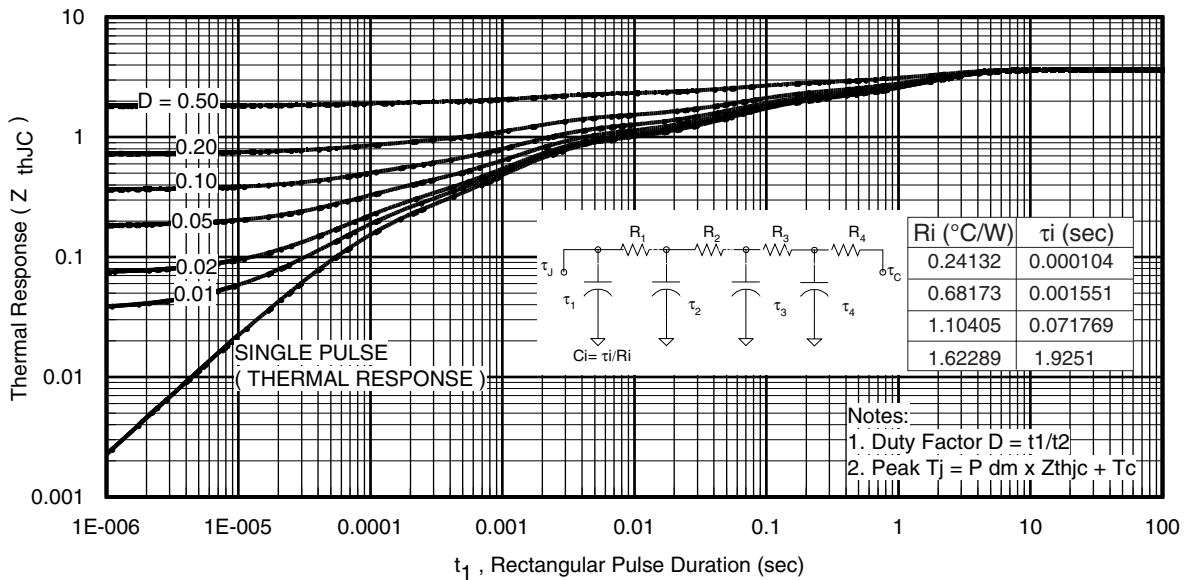
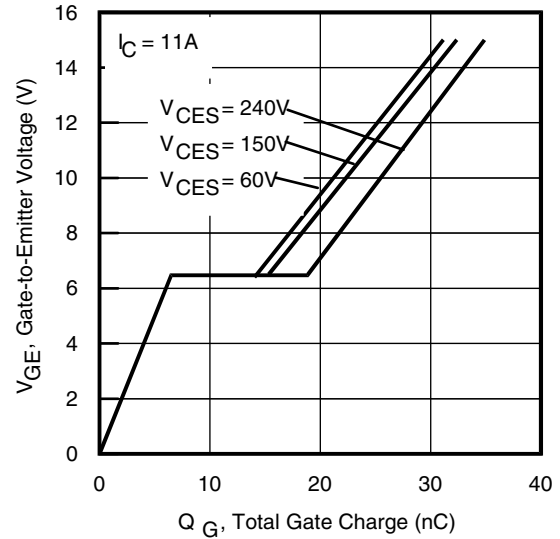
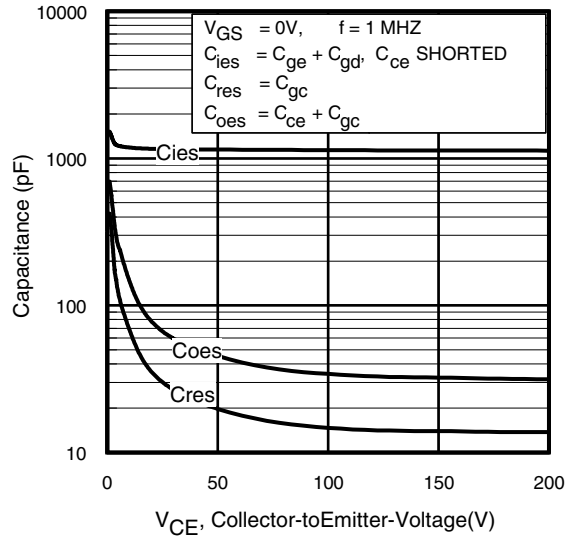


Fig 12. Forward Bias Safe Operating Area



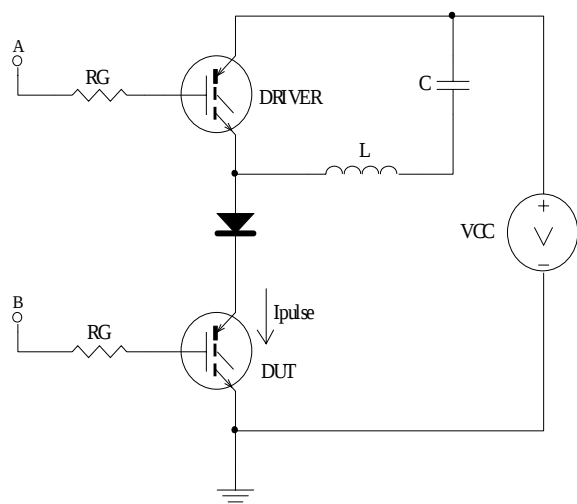


Fig 16a. t_{st} and E_{PULSE} Test Circuit

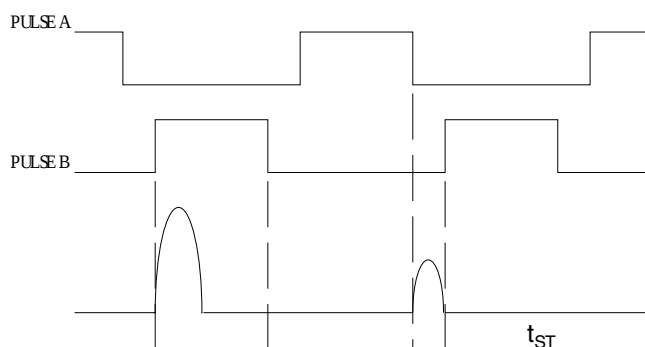


Fig 16b. t_{st} Test Waveforms

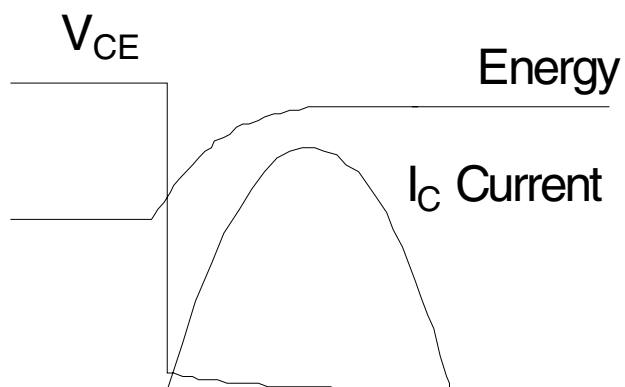


Fig 16c. E_{PULSE} Test Waveforms

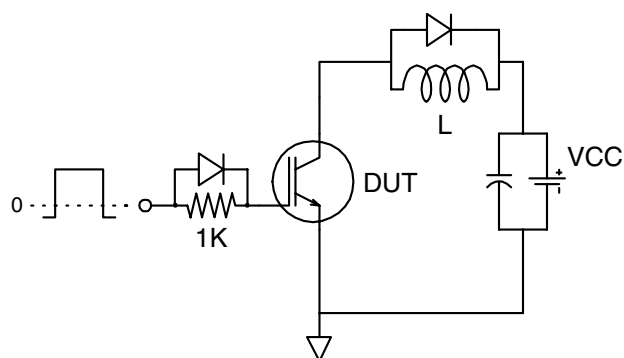
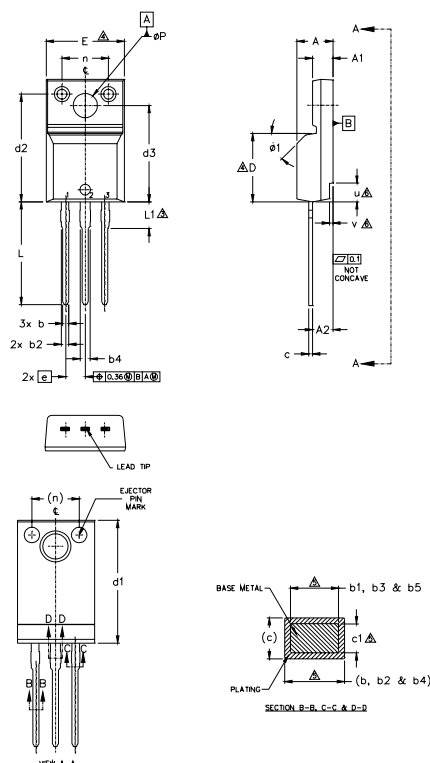


Fig. 17 - Gate Charge Circuit (turn-off)

TO-220 Full-Pak Package Outline

Dimensions are shown in millimeters (inches)

IRGI4090PbF



S Y M B O L	D I M E N S I O N S				N O T E
	M I L L I M E T E R S		I N C H E S		
	M I N.	M A X.	M I N.	M A X.	
A	4.57	4.83	.180	.190	
A1	2.57	2.83	.101	.111	
A2	2.51	2.93	.099	.115	
a	0.61	0.94	.024	.037	
b1	0.61	0.89	.024	.035	5
b2	0.76	1.27	.030	.050	
b3	0.76	1.22	.030	.048	5
b4	1.02	1.52	.040	.060	
b5	1.02	1.47	.040	.058	5
c	0.33	0.63	.013	.025	
c1	0.33	0.58	.013	.023	5
D	8.66	9.80	.341	.386	
d1	15.80	16.13	.622	.635	
d2	13.97	14.22	.550	.560	
d3	12.30	12.93	.484	.509	
E	9.63	10.75	.379	.423	4
e	2.54 BSC		.100 BSC		
L	13.20	13.72	.520	.540	
L1	3.37	3.67	.122	.145	3
n	6.05	6.60	.238	.260	
øP	3.05	3.45	.120	.136	
u	2.40	2.50	.094	.098	6
v	0.40	0.50	.016	.020	6
ø1	—	45°	—	45°	

NOTES:

- 1.0 DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.
 2.0 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
 3.0 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
 4.0 DIMENSIONS d & e DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTER MOST EXTREMES OF THE PLASTIC BODY.
 5.0 DIMENSION b1, b3, b5 & c1 APPLY TO BASE METAL ONLY.
 6.0 STEP OPTIONAL ON PLASTIC BODY DEFINED BY DIMENSIONS u & v.
 7.0 CONTROLLING DIMENSION : INCHES.

LEAD ASSIGNMENTS

HEXFET

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

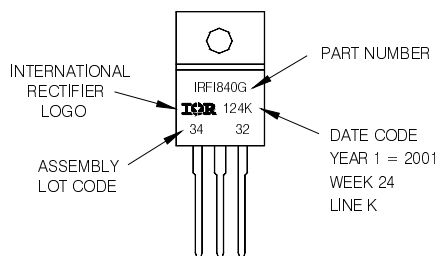
IGBTs, CoPACK

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

TO-220 Full-Pak Part Marking Information

EXAMPLE: THIS IS AN IRFI840G
WITH ASSEMBLY
LOT CODE 3432
ASSEMBLED ON WW 24, 2001
IN THE ASSEMBLY LINE 'K'

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



TO-220AB Full-Pak package is not recommended for Surface Mount Application.

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

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This product has been designed for the Industrial market.
Qualification Standards can be found on IR's Web site.

International
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IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
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