

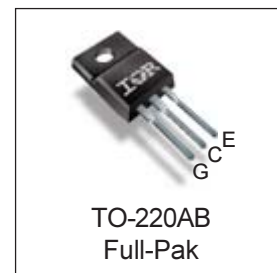
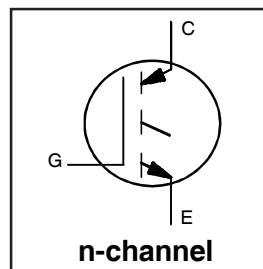
**PDP TRENCH IGBT**

**IRGI4085PbF**

**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		
$V_{CE\ min}$	330	V
$V_{CE(on)}\ typ.\ @\ I_C = 28A$	1.21	V
$I_{RP}\ max\ @\ T_C = 25^\circ C$	210	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	$\pm 30$	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current, $V_{GE} @ 15V$	28	A
$I_C @ T_C = 100^\circ C$	Continuous Collector, $V_{GE} @ 15V$	15	
$I_{RP} @ T_C = 25^\circ C$	Repetitive Peak Current ①	210	
$P_D @ T_C = 25^\circ C$	Power Dissipation	38	W
$P_D @ T_C = 100^\circ C$	Power Dissipation	15	
	Linear Derating Factor	0.30	W/ $^\circ C$
$T_J$	Operating Junction and	-40 to + 150	$^\circ C$
$T_{STG}$	Storage Temperature Range		
	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	—	3.29	$^\circ C/W$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$BV_{CES}$	Collector-to-Emitter Breakdown Voltage	330	—	—	V	$V_{GE} = 0V, I_{CE} = 1\text{ mA}$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage <sup>③</sup>	30	—	—	V	$V_{GE} = 0V, I_{CE} = 1\text{ A}$
$\Delta BV_{CES}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.31	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}$ , $I_{CE} = 1\text{ mA}$
$V_{CE(on)}$	Static Collector-to-Emitter Voltage	—	1.05	—	V	$V_{GE} = 15V, I_{CE} = 15A$ <sup>③</sup>
		—	1.21	1.50		$V_{GE} = 15V, I_{CE} = 28A$ <sup>③</sup>
		—	1.35	—		$V_{GE} = 15V, I_{CE} = 40A$ <sup>③</sup>
		—	1.68	—		$V_{GE} = 15V, I_{CE} = 70A$ <sup>③</sup>
		—	2.23	—		$V_{GE} = 15V, I_{CE} = 120A$ <sup>③</sup>
		—	1.90	—		$V_{GE} = 15V, I_{CE} = 70A, T_J = 150^\circ\text{C}$ <sup>③</sup>
$V_{GE(th)}$	Gate Threshold Voltage	2.6	—	5.0	V	$V_{CE} = V_{GE}, I_{CE} = 500\mu\text{A}$
$\Delta V_{GE(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	-10	—	mV/ $^\circ\text{C}$	
$I_{CES}$	Collector-to-Emitter Leakage Current	—	2.0	25	$\mu\text{A}$	$V_{CE} = 330V, V_{GE} = 0V$
		—	5.0	—		$V_{CE} = 330V, V_{GE} = 0V, T_J = 100^\circ\text{C}$
		—	100	—		$V_{CE} = 330V, V_{GE} = 0V, T_J = 150^\circ\text{C}$
$I_{GES}$	Gate-to-Emitter Forward Leakage	—	—	100	nA	$V_{GE} = 30V$
	Gate-to-Emitter Reverse Leakage	—	—	-100		$V_{GE} = -30V$
$g_{fe}$	Forward Transconductance	—	51	—	S	$V_{CE} = 25V, I_{CE} = 25A$
$Q_g$	Total Gate Charge	—	84	—	nC	$V_{CE} = 200V, I_C = 25A, V_{GE} = 15V$ <sup>③</sup>
$Q_{gc}$	Gate-to-Collector Charge	—	30	—		
$t_{d(on)}$	Turn-On delay time	—	48	—	ns	$I_C = 25A, V_{CC} = 196V$ $R_G = 10\Omega, L = 200\mu\text{H}, L_S = 150\text{nH}$ $T_J = 25^\circ\text{C}$
$t_r$	Rise time	—	37	—		
$t_{d(off)}$	Turn-Off delay time	—	180	—		
$t_f$	Fall time	—	102	—		
$t_{d(on)}$	Turn-On delay time	—	45	—	ns	$I_C = 25A, V_{CC} = 196V$ $R_G = 10\Omega, L = 200\mu\text{H}, L_S = 150\text{nH}$ $T_J = 150^\circ\text{C}$
$t_r$	Rise time	—	38	—		
$t_{d(off)}$	Turn-Off delay time	—	234	—		
$t_f$	Fall time	—	185	—		
$t_{st}$	Shoot Through Blocking Time	100	—	—	ns	$V_{CC} = 240V, V_{GE} = 15V, R_G = 5.1\Omega$
$E_{PULSE}$	Energy per Pulse	—	854	—	$\mu\text{J}$	$L = 220\text{nH}, C = 0.40\mu\text{F}, V_{GE} = 15V$ $V_{CC} = 240V, R_G = 5.1\Omega, T_J = 25^\circ\text{C}$
		—	977	—		$L = 220\text{nH}, C = 0.40\mu\text{F}, V_{GE} = 15V$ $V_{CC} = 240V, R_G = 5.1\Omega, T_J = 100^\circ\text{C}$
$C_{ies}$	Input Capacitance	—	2287	—	pF	$V_{GE} = 0V$
$C_{oes}$	Output Capacitance	—	141	—		$V_{CE} = 30V$
$C_{res}$	Reverse Transfer Capacitance	—	73	—		$f = 1.0\text{MHz}$ , See Fig.13
$L_C$	Internal Collector Inductance	—	5.0	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
$L_E$	Internal Emitter Inductance	—	13	—		

### Notes:

- ① Half sine wave with duty cycle = 0.10,  $t_{on} = 2\mu\text{sec}$ .
- ②  $R_{\theta}$  is measured at  $T_J$  of approximately  $90^\circ\text{C}$ .
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

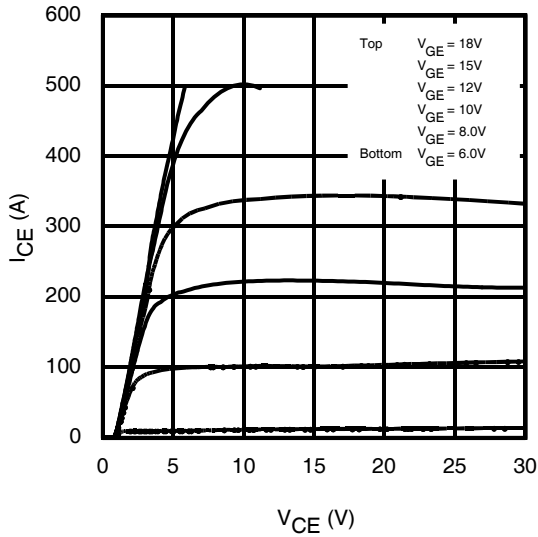


Fig 1. Typical Output Characteristics @ 25°C

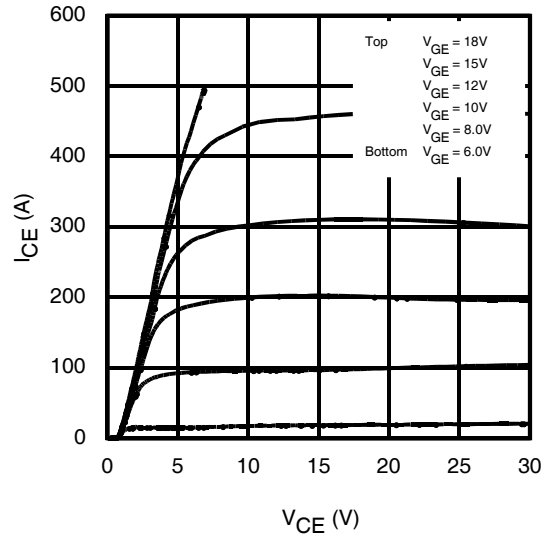


Fig 2. Typical Output Characteristics @ 75°C

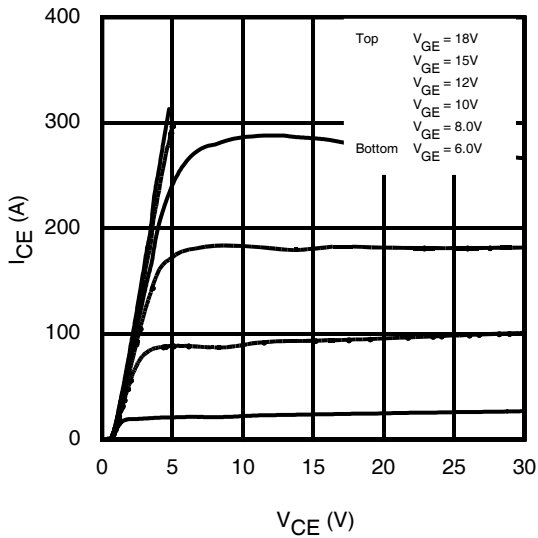


Fig 3. Typical Output Characteristics @ 125°C

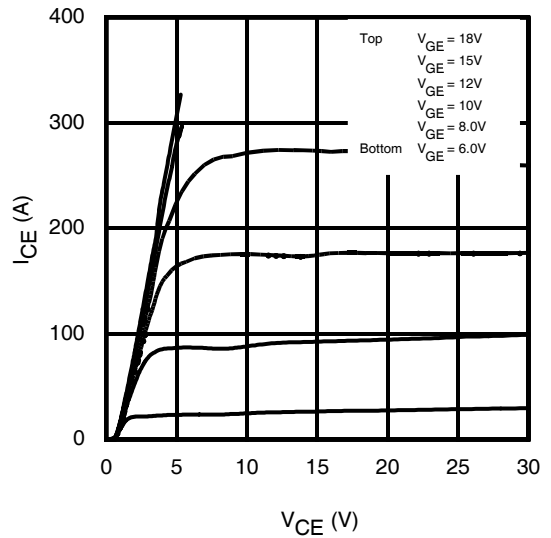


Fig 4. Typical Output Characteristics @ 150°C

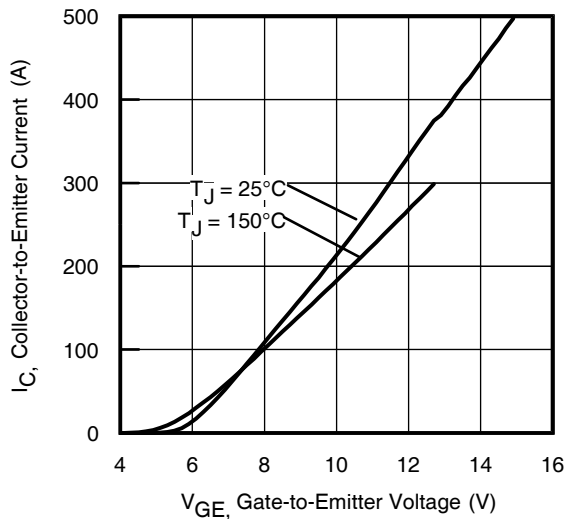


Fig 5. Typical Transfer Characteristics

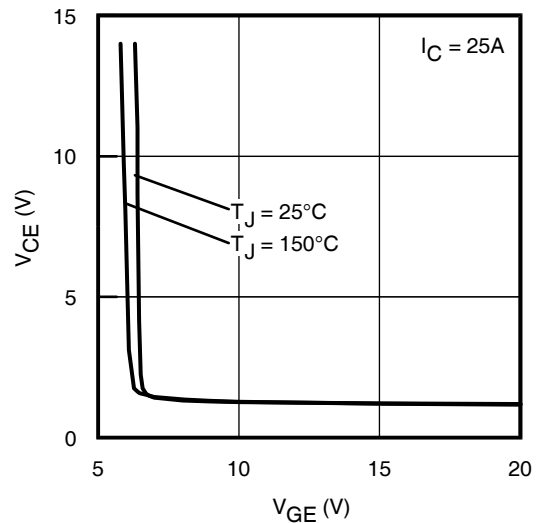


Fig 6.  $V_{CE(ON)}$  vs. Gate Voltage

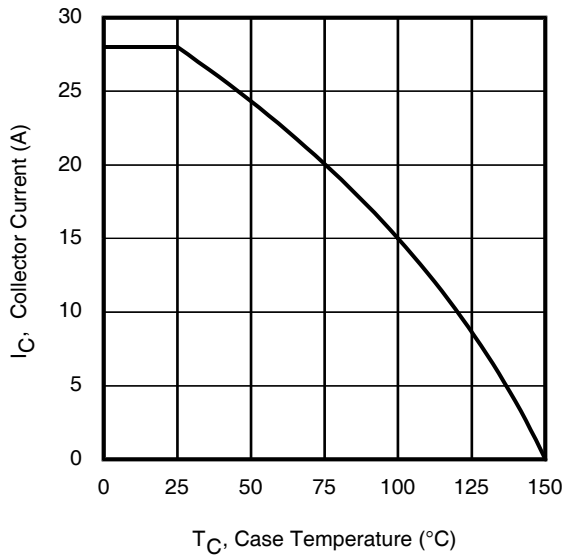


Fig 7. Maximum Collector Current vs. Case Temperature

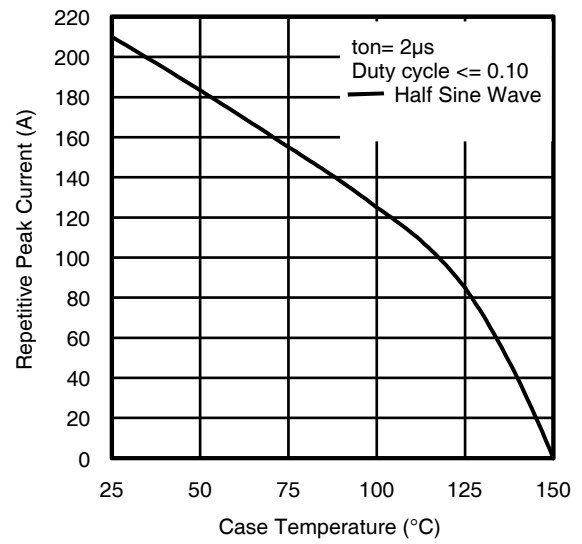


Fig 8. Typical Repetitive Peak Current vs. Case Temperature

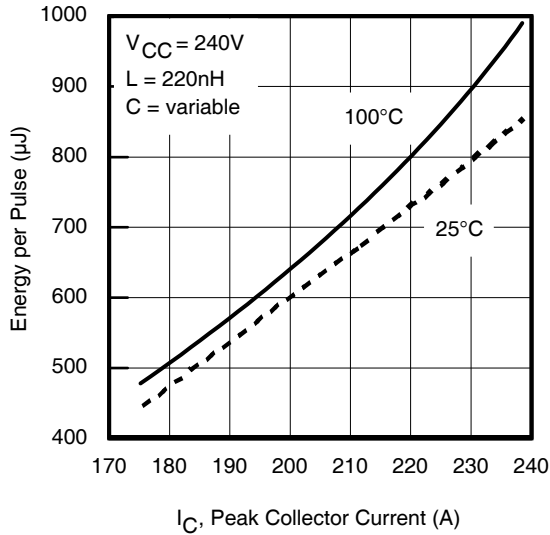


Fig 9. Typical  $E_{PULSE}$  vs. Collector Current

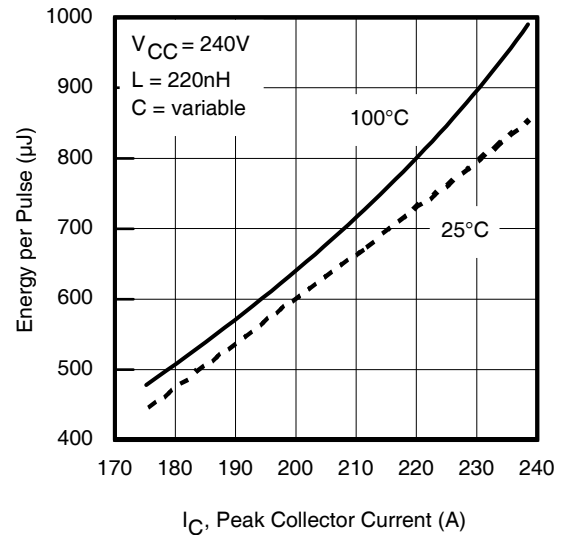


Fig 10. Typical  $E_{PULSE}$  vs. Collector-to-Emitter Voltage

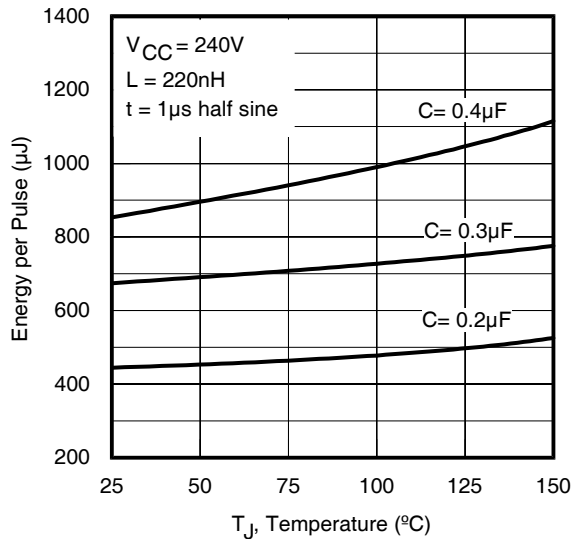


Fig 11.  $E_{PULSE}$  vs. Temperature

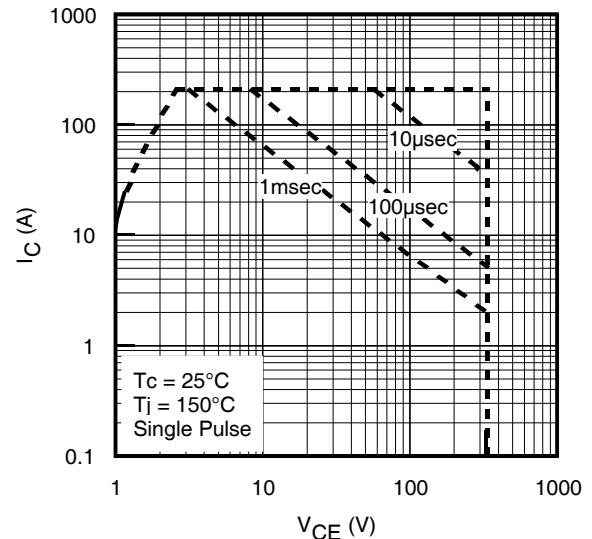


Fig 12. Forward Bias Safe Operating Area

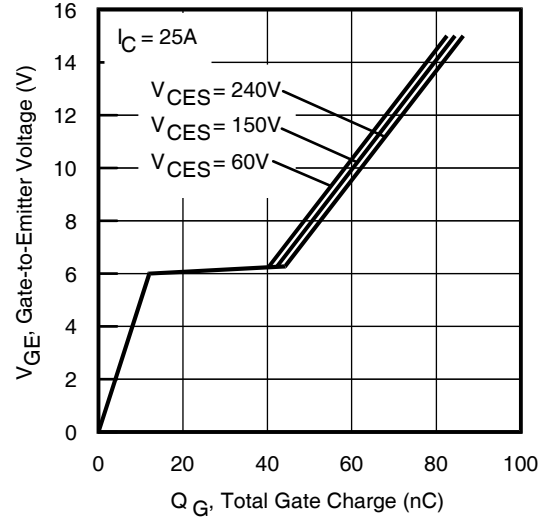
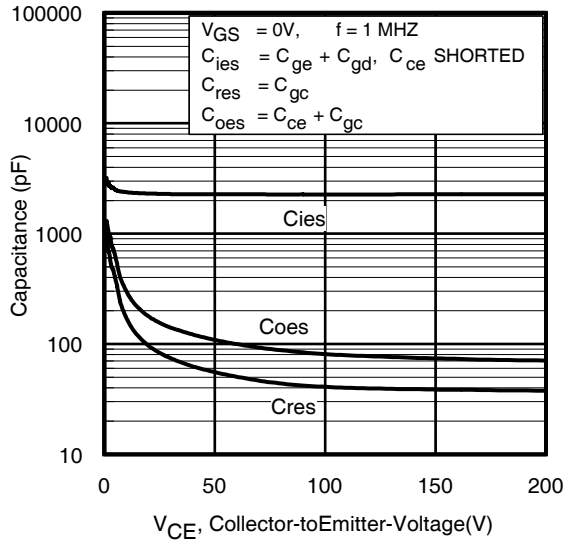


Fig 13. Typical Capacitance vs. Collector-to-Emitter Voltage

Fig 14. Typical Gate Charge vs. Gate-to-Emitter Voltage

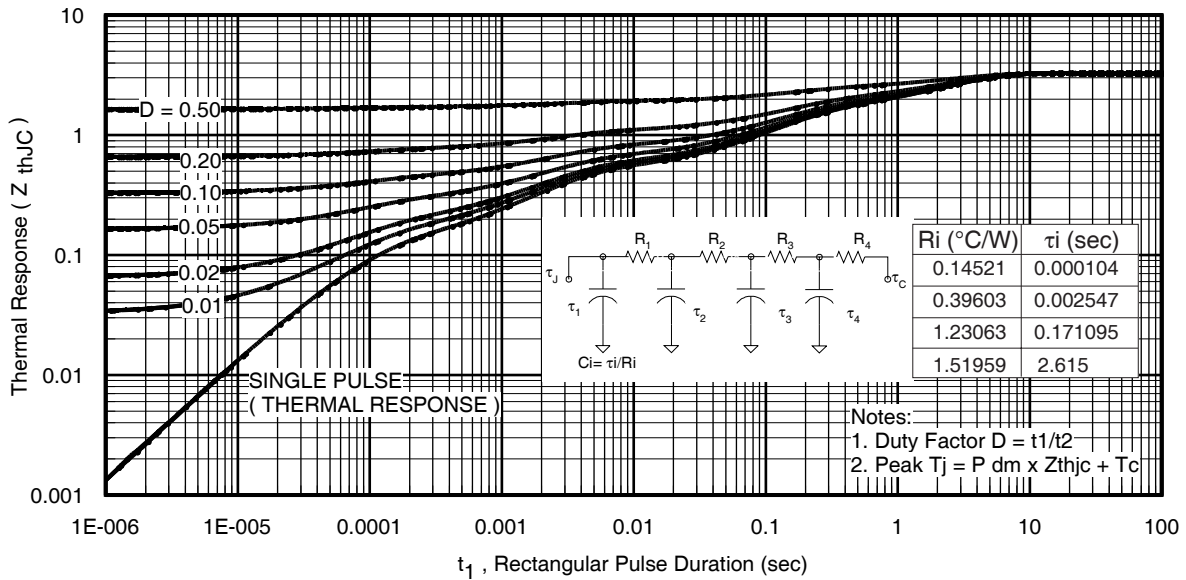
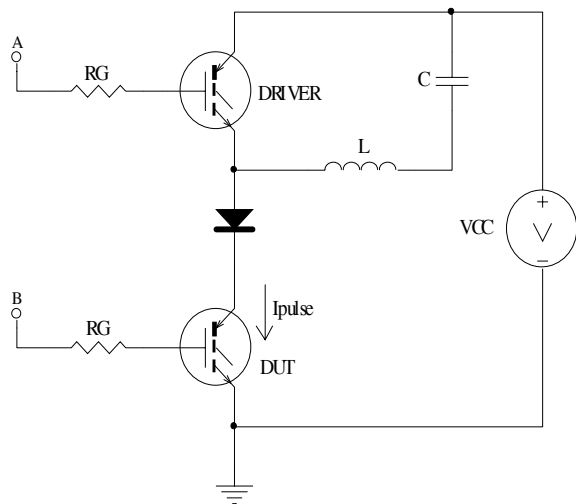
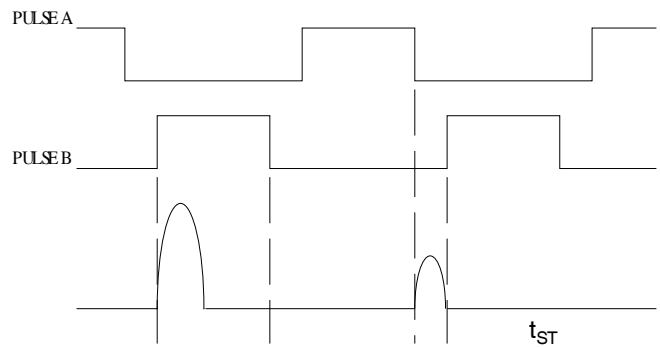


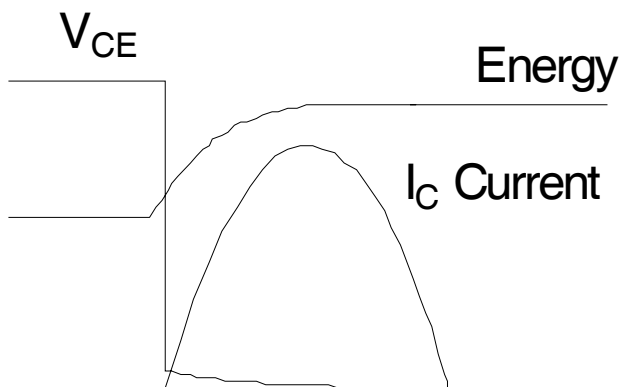
Fig 15. Maximum Effective Transient Thermal Impedance, Junction-to-Case



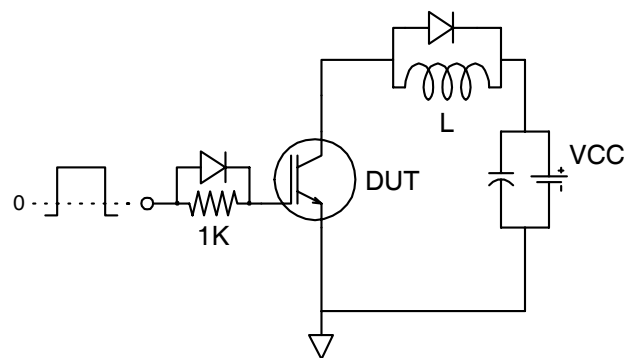
**Fig 16a.**  $t_{st}$  and  $E_{PULSE}$  Test Circuit



**Fig 16b.**  $t_{st}$  Test Waveforms



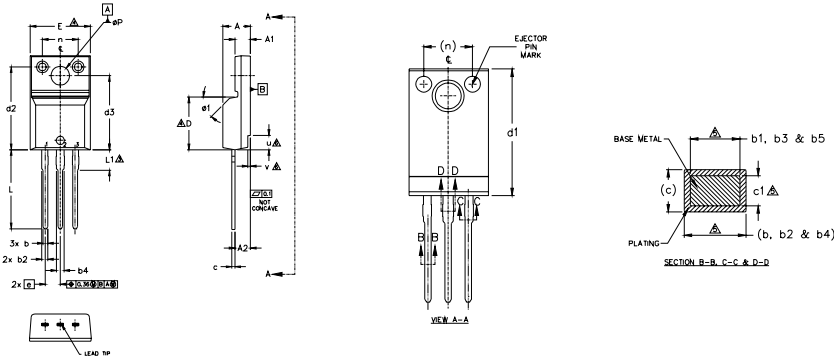
**Fig 16c.**  $E_{PULSE}$  Test Waveforms



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

## TO-220 Full-Pak Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.57	4.83	.180	.190	
A1	2.57	2.83	.101	.111	
A2	2.51	2.93	.099	.115	
b	0.61	0.94	.024	.037	
b1	0.61	0.89	.024	.035	
b2	0.76	1.27	.030	.050	
b3	0.76	1.22	.030	.048	
b4	1.02	1.52	.040	.060	
b5	1.02	1.47	.040	.058	
c	0.33	0.63	.013	.025	
c1	0.33	0.58	.013	.023	
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	
e	2.54	BSC	.100	BSC	
L	13.20	13.72	.520	.540	
L1	3.37	3.67	.122	.145	
L2	6.05	6.60	.238	.260	
n	3.05	3.45	.120	.136	
phi P	2.40	2.50	.094	.098	
u	0.40	0.50	.016	.020	
v	—	45°	—	45°	
phi 1	—	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 DIMENSION 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**

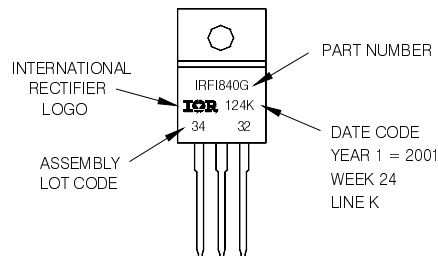
- HEXFET**
- 1.- GATE
  - 2.- DRAIN
  - 3.- SOURCE

- 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.**

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