International
IOR Rectifier

PD - 91581B

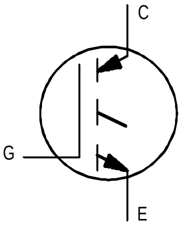
IRG4PC50S-P

INSULATED GATE BIPOLAR TRANSISTOR

Standard Speed IGBT

Features

- Standard: Optimized for minimum saturation voltage and low operating frequencies (< 1kHz)
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than Generation 3
- Industry standard TO-247AC package
- Surface Mountable



n-channel

V_{CES} = 600V

$V_{CE(on)\ typ.}$ = 1.28V

@V_{GE} = 15V, I_C = 41A

Benefits

- Generation 4 IGBT's offer highest efficiency available
- IGBT's optimized for specified application conditions
- Designed to be a "drop-in" replacement for equivalent industry-standard Generation 3 IR IGBT's

Surface Mountable
TO-247

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	70	A
I_C @ T_C = 100°C	Continuous Collector Current	41	
I_{CM}	Pulsed Collector Current ①	140	
I_{LM}	Clamped Inductive Load Current ②	140	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	20	mJ
P_D @ T_C = 25°C	Maximum Power Dissipation	200	W
P_D @ T_C = 100°C	Maximum Power Dissipation	78	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Max Reflow Temperature	225	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	——	0.64	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	——	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	——	40	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V_{GE} = 0V, I_C = 250µA
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	V_{GE} = 0V, I_C = 1.0A
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.75	—	V/°C	V_{GE} = 0V, I_C = 1.0mA
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	1.28	1.36	V	I_C = 41A V_{GE} = 15V
		—	1.62	—		I_C = 80A See Fig.2, 5
		—	1.28	—		I_C = 41A , T_J = 150°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		V_{CE} = V_{GE}, I_C = 250µA
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-9.3	—	mV/°C	V_{CE} = V_{GE}, I_C = 250µA
g_{fe}	Forward Transconductance ⑤	17	34	—	S	V_{CE} = 100V, I_C = 41A
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	V_{GE} = 0V, V_{CE} = 600V
		—	—	2.0		V_{GE} = 0V, V_{CE} = 10V, T_J = 25°C
		—	—	1000		V_{GE} = 0V, V_{CE} = 600V, T_J = 150°C
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V_{GE} = ±20V

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	180	280	nC	I_C = 41A
Q_{ge}	Gate - Emitter Charge (turn-on)	—	24	37		V_{CC} = 400V See Fig. 8
Q_{gc}	Gate - Collector Charge (turn-on)	—	61	92		V_{GE} = 15V
$t_{d(on)}$	Turn-On Delay Time	—	33	—	ns	
t_r	Rise Time	—	30	—		T_J = 25°C
$t_{d(off)}$	Turn-Off Delay Time	—	650	980		I_C = 41A, V_{CC} = 480V
t_f	Fall Time	—	400	600		V_{GE} = 15V, R_G = 5.0Ω
E_{on}	Turn-On Switching Loss	—	0.72	—	mJ	Energy losses include "tail"
E_{off}	Turn-Off Switching Loss	—	8.27	—		See Fig. 9, 10, 14
E_{ts}	Total Switching Loss	—	8.99	13		
$t_{d(on)}$	Turn-On Delay Time	—	31	—	ns	T_J = 150°C,
t_r	Rise Time	—	31	—		I_C = 41A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	—	1080	—		V_{GE} = 15V, R_G = 5.0Ω
t_f	Fall Time	—	620	—		Energy losses include "tail"
E_{ts}	Total Switching Loss	—	15	—	mJ	See Fig. 11, 14
L_E	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	4100	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	250	—		V_{CC} = 30V See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	48	—		f = 1.0MHz

Notes:

① Repetitive rating; V_{GE} = 20V, pulse width limited by max. junction temperature. (See fig. 13b)

② V_{CC} = 80%(V_{CES}), V_{GE} = 20V, L = 10µH, R_G = 5.0Ω, (See fig. 13a)

③ Repetitive rating; pulse width limited by maximum junction temperature.

④ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

⑤ Pulse width 5.0µs, single shot.

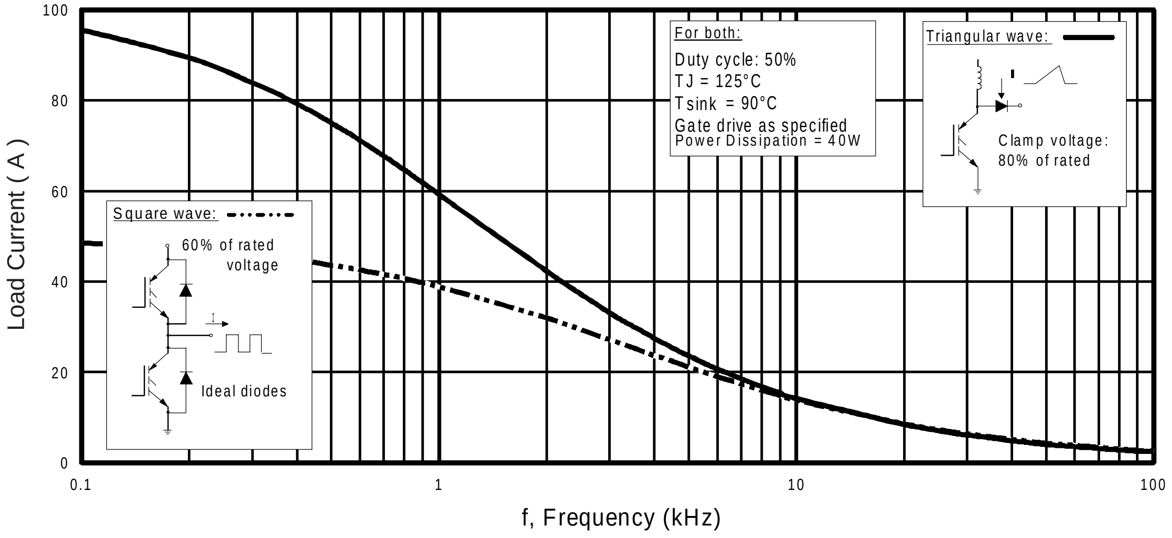


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

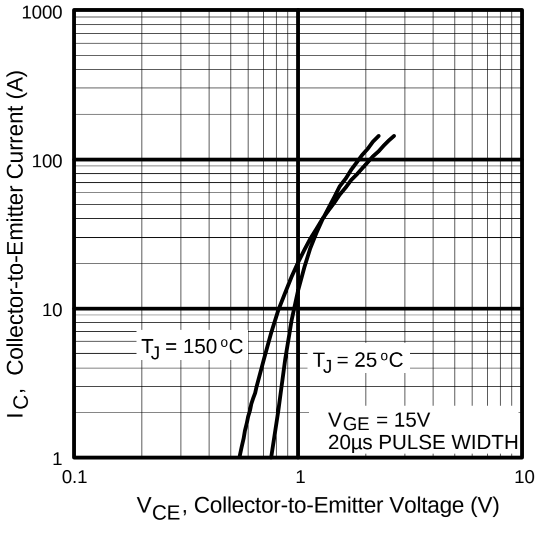


Fig. 2 - Typical Output Characteristics

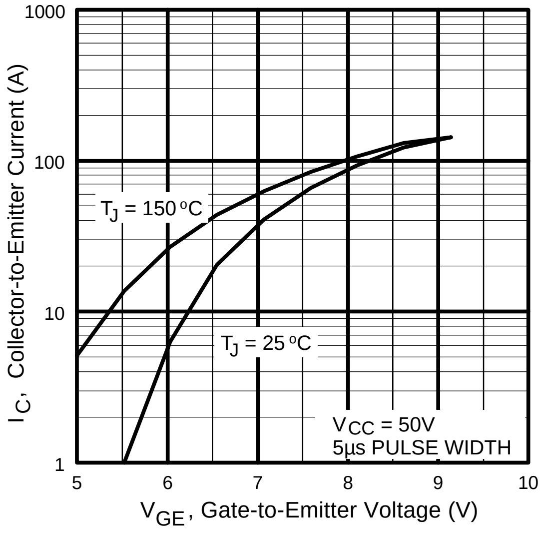
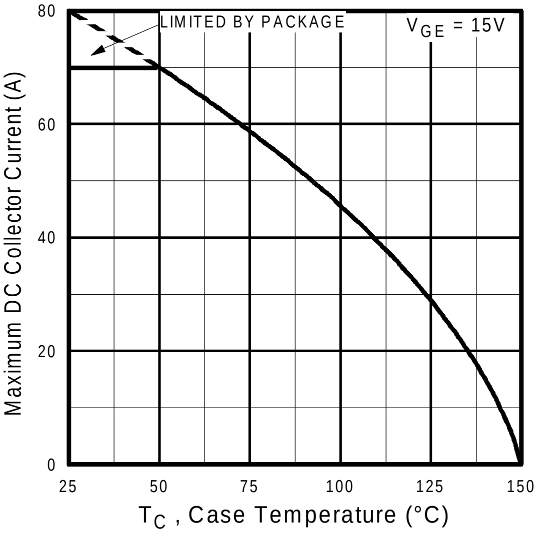


Fig. 3 - Typical Transfer Characteristics



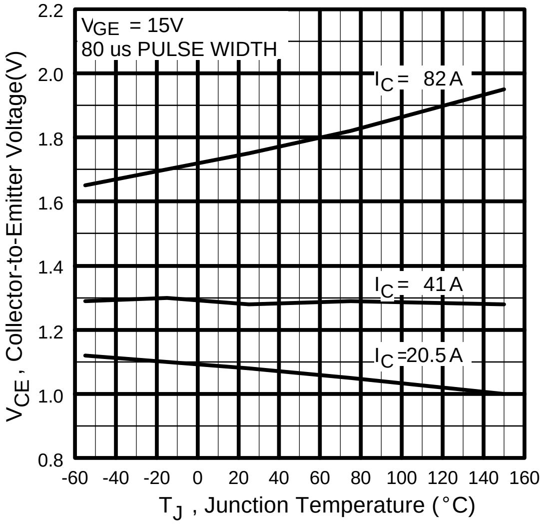


Fig. 4 - Maximum Collector Current vs. Case Temperature

Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

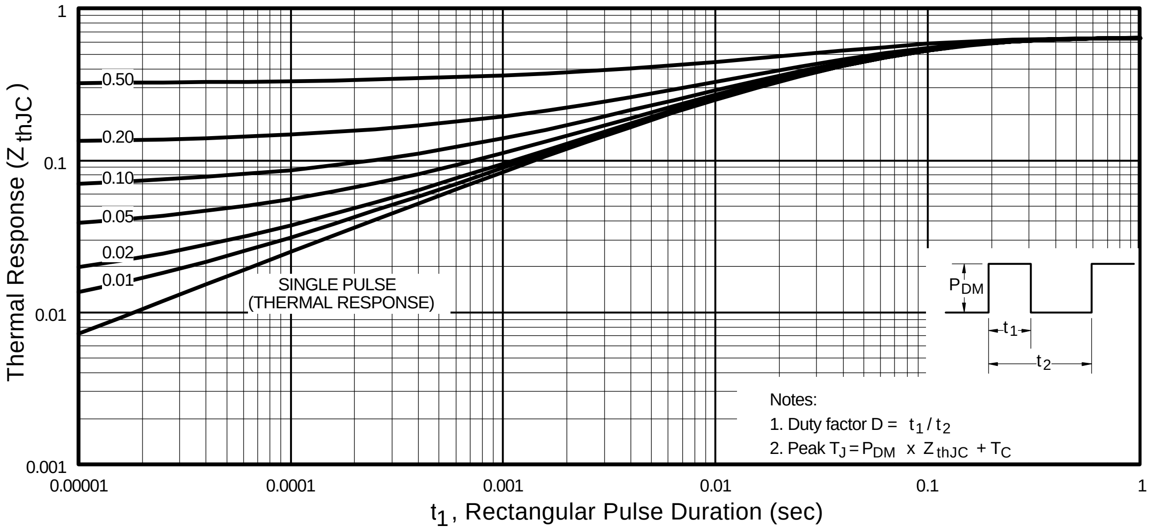


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

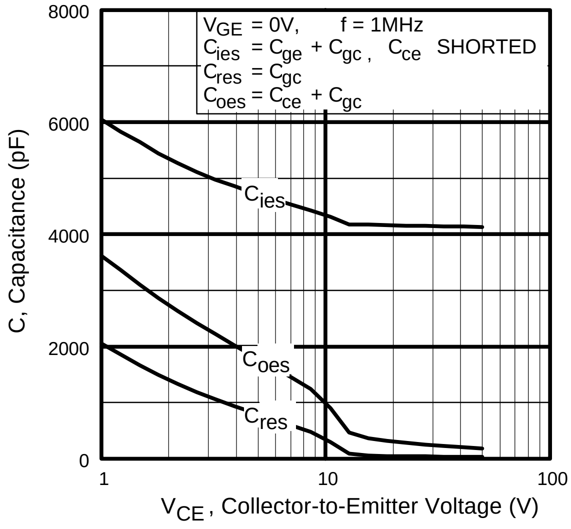


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

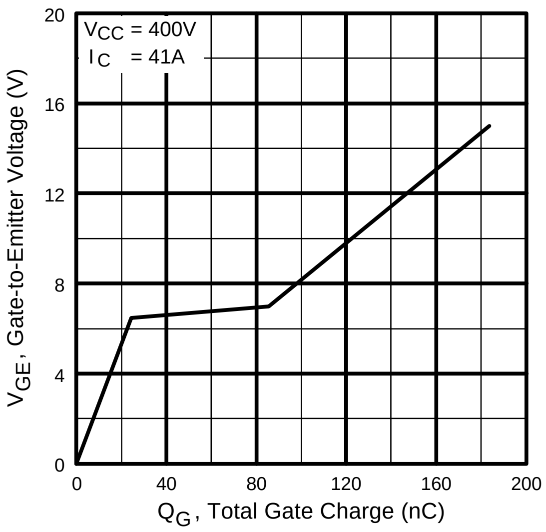


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

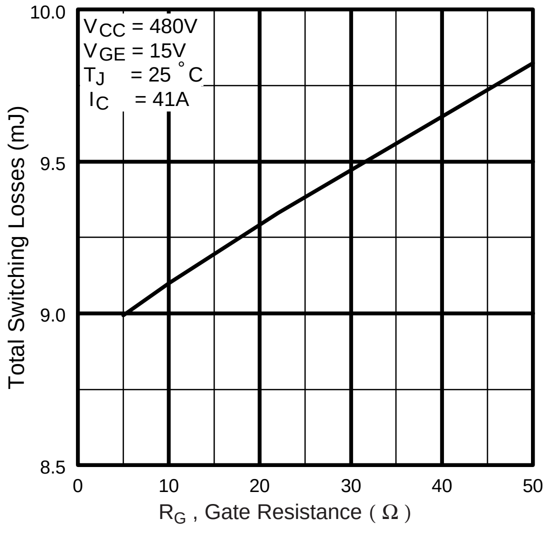


Fig. 9 - Typical Switching Losses vs. Gate Resistance

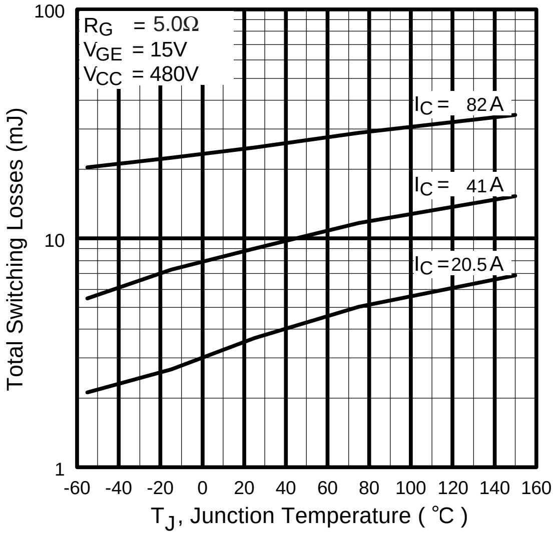


Fig. 10 - Typical Switching Losses vs. Junction Temperature

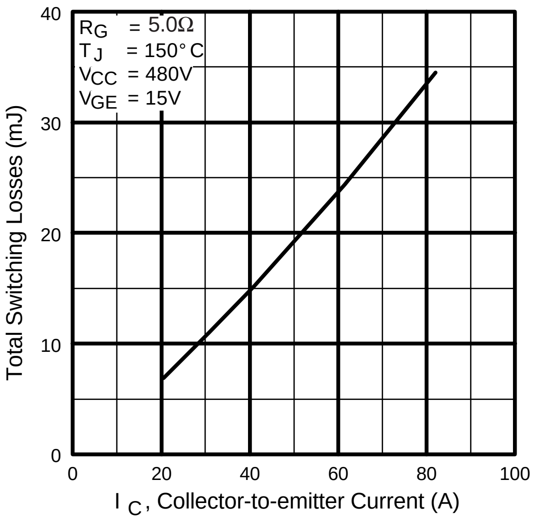


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

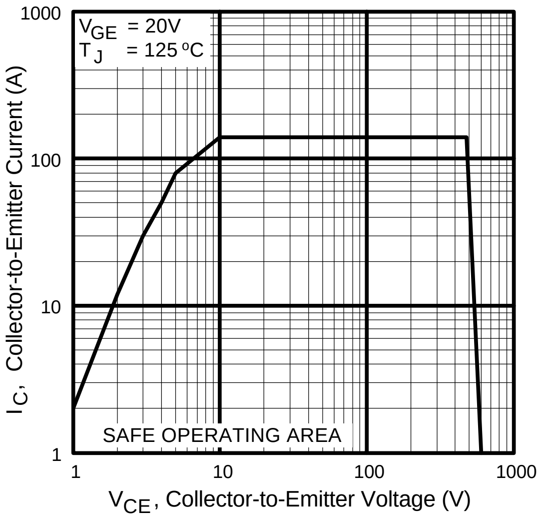
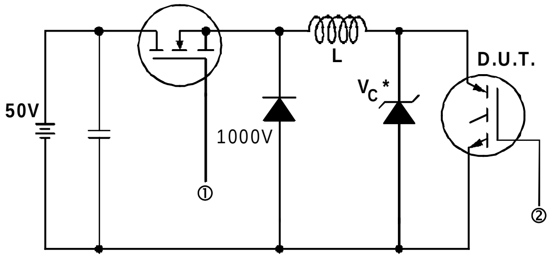


Fig. 12 - Turn-Off SOA



* Driver same type as D.U.T.; Vc = 80% of Vce(max)
* Note: Due to the 50V power supply, pulse width and inductor
will increase to obtain rated Id.

Fig. 13a - Clamped Inductive Load Test Circuit

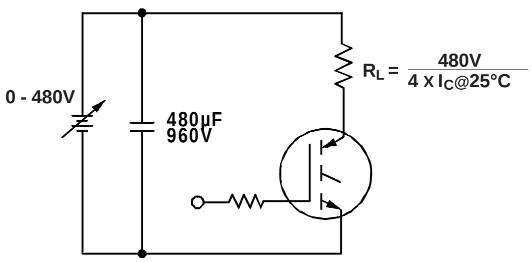


Fig. 13b - Pulsed Collector Current Test Circuit

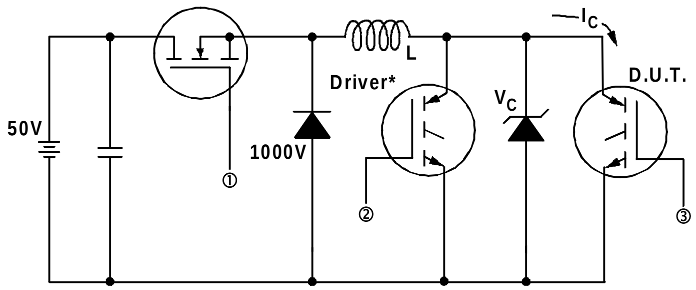


Fig. 14a - Switching Loss Test Circuit

* Driver same type
as D.U.T., VC = 480V

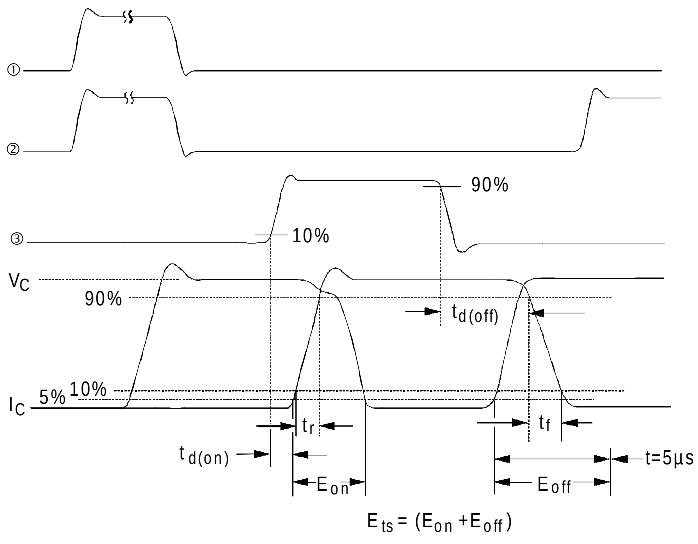
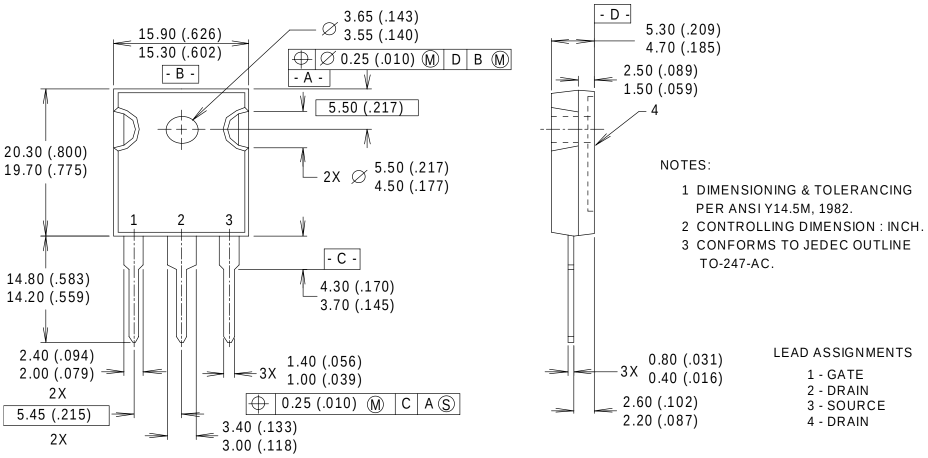


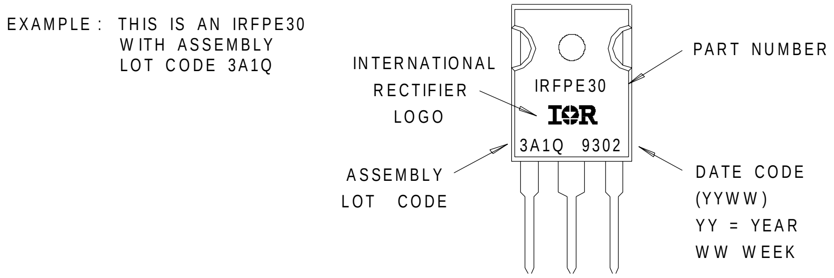
Fig. 14b - Switching Loss Waveforms

TO-247AC Package Outline

Dimensions are shown in millimeters (inches)



TO-247AC Part Marking Information



Data and specifications subject to change without notice.
This product has been designed and qualified for the Industrial market.
Qualification Standards can be found on IR's Web site.

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