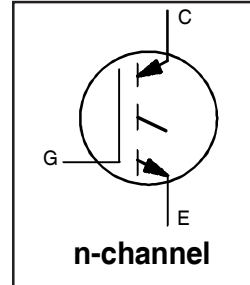


Features

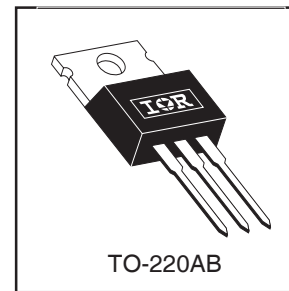
- Extremely low voltage drop; 1.1V typical at 2A
- S-Speed: Minimizes power dissipation at up to 3 KHz PWM frequency in inverter drives, up to 4 KHz in brushless DC drives, up to 2KHz in Chopper Applications
- Very Tight Vce(on) distribution
- Industry standard TO-220AB package



$V_{CES} = 600V$
$V_{CE(on)} \text{ typ.} = 1.10V$
@ $V_{GE} = 15V, I_C = 2.0A$

Benefits

- Generation 4 IGBTs offer highest efficiency available
- IGBTs optimized for specified application conditions
- Lower conduction losses than many Power MOSFET's



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	14	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	8.0	
I_{CM}	Pulsed Collector Current ①	18	
I_{LM}	Clamped Inductive Load Current ②	18	
V_{GE}	Gate-to-Emitter Voltage	± 20	mJ
E_{ARV}	Reverse Voltage Avalanche Energy ③	110	
$P_{DT_C = 25^\circ C}$	Maximum Power Dissipation	38	
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	15	
T_J	Operating Junction and	-55 to +150	W
T_{STG}	Storage Temperature Range		$^\circ C$
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	
	Mounting Torque, 6-32 or M3 Screw.	10 lbf•in (1.1 N•m)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	3.3	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.5	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	50	
Wt	Weight	2.0(0.07)	—	g (oz)

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{GE} = 0V, I_C = 250\mu A$
$V_{(BR)ECS}$	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	—	0.64	—	V/°C	$V_{GE} = 0V, I_C = 1.0mA$
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	1.58	1.8	V	$I_C = 8.0A, V_{GE} = 15V$
		—	2.05	—		$I_C = 14A, V_{GE} = 15V$
		—	1.68	—		$I_C = 8.0A, T_J = 150^\circ\text{C}$ See Fig.2, 5
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		$V_{CE} = V_{GE}, I_C = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-9.5	—	mV/°C	$V_{CE} = V_{GE}, I_C = 250\mu A$
g_{fe}	Forward Transconductance ⑤	3.7	5.5	—	S	$V_{CE} = 100V, I_C = 8.0A$
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	$V_{GE} = 0V, V_{CE} = 600V$
		—	—	2.0		$V_{GE} = 0V, V_{CE} = 10V, T_J = 25^\circ\text{C}$
		—	—	1000		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{GE} = \pm 20V$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	15	22	nC	$I_C = 8.0A$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	2.4	3.6		$V_{CC} = 400V$ See Fig. 8
Q_{gc}	Gate - Collector Charge (turn-on)	—	6.5	9.8		$V_{GE} = 15V$
$t_{d(on)}$	Turn-On Delay Time	—	25	—	ns	$T_J = 25^\circ\text{C}$ $I_C = 8.0A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 100\Omega$ Energy losses include "tail" See Fig. 9, 10, 14
t_r	Rise Time	—	28	—		
$t_{d(off)}$	Turn-Off Delay Time	—	630	950		
t_f	Fall Time	—	710	1100		
E_{on}	Turn-On Switching Loss	—	0.14	—	mJ	See Fig. 9, 10, 14
E_{off}	Turn-Off Switching Loss	—	2.58	—		
E_{ts}	Total Switching Loss	—	2.72	4.3		
$t_{d(on)}$	Turn-On Delay Time	—	24	—	ns	$T_J = 150^\circ\text{C}$ $I_C = 8.0A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 100\Omega$ Energy losses include "tail" See Fig. 11, 14
t_r	Rise Time	—	31	—		
$t_{d(off)}$	Turn-Off Delay Time	—	810	—		
t_f	Fall Time	—	1300	—		
E_{ts}	Total Switching Loss	—	3.94	—	mJ	
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	280	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ See Fig. 7 $f = 1.0MHz$
C_{oes}	Output Capacitance	—	30	—		
C_{res}	Reverse Transfer Capacitance	—	4.0	—		

Notes:

- ① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature. (See fig. 13b)
- ② $V_{CC} = 80\%(V_{CES})$, $V_{GE} = 20V$, $L = 10\mu H$, $R_G = 100\Omega$, (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- ⑤ Pulse width $5.0\mu s$, single shot.

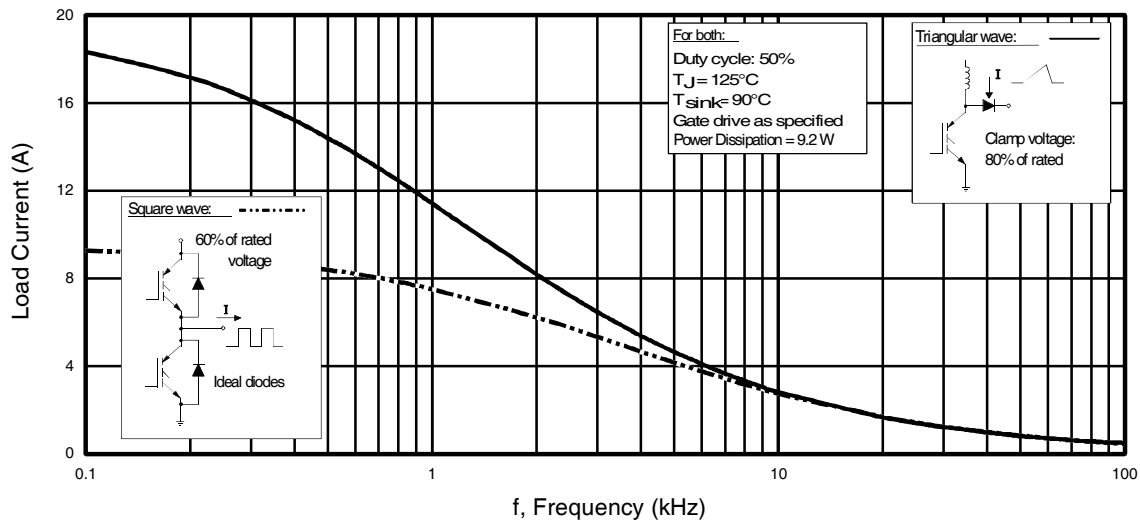


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

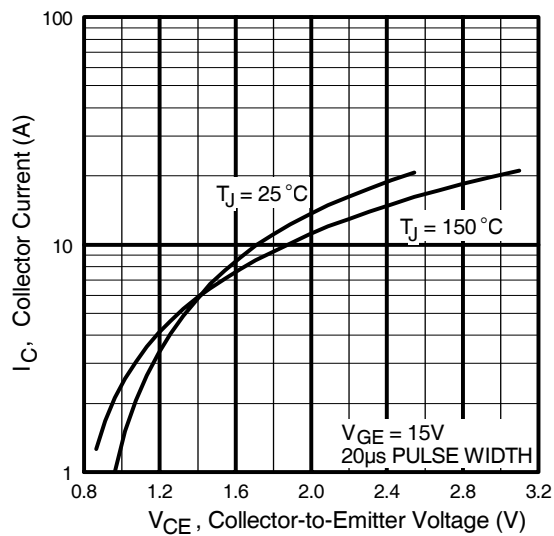


Fig. 2 - Typical Output Characteristics

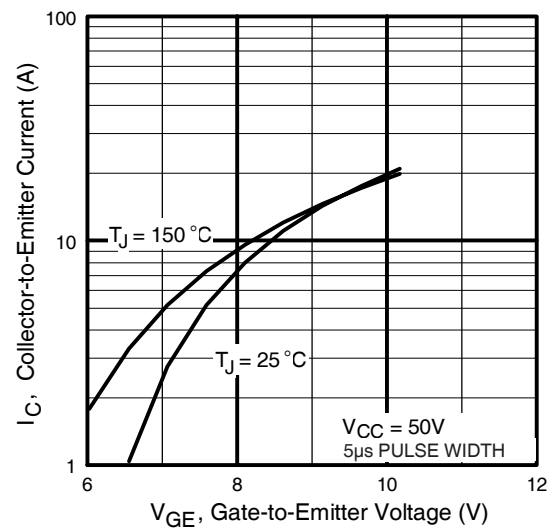


Fig. 3 - Typical Transfer Characteristics

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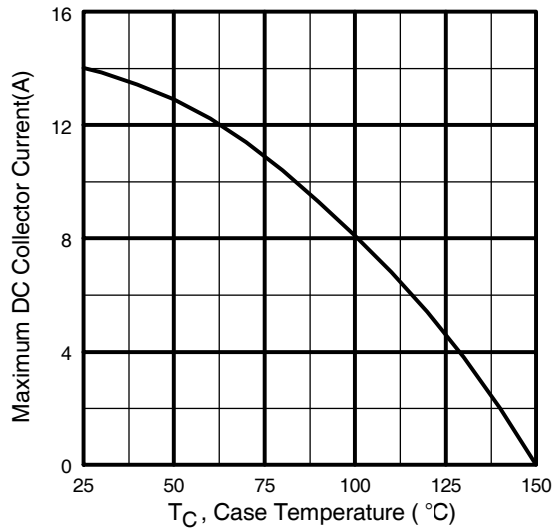


Fig. 4 - Maximum Collector Current vs. Case Temperature

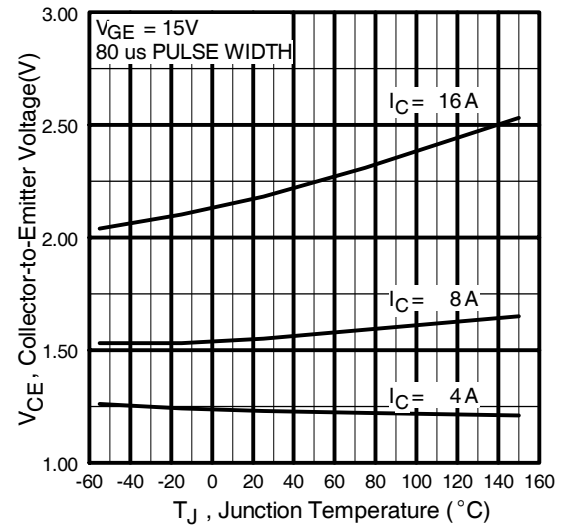


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

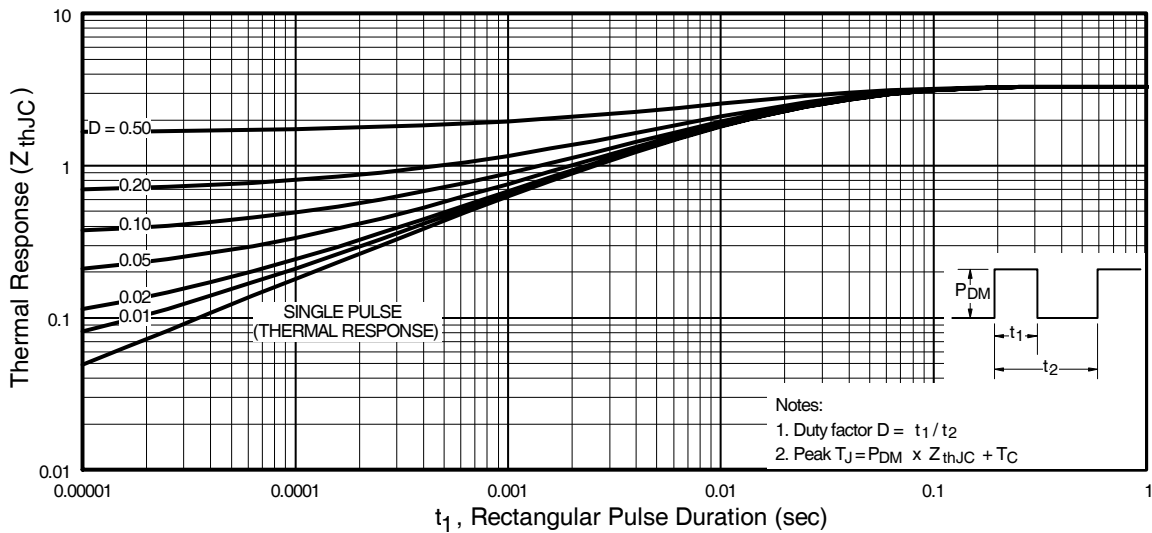


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

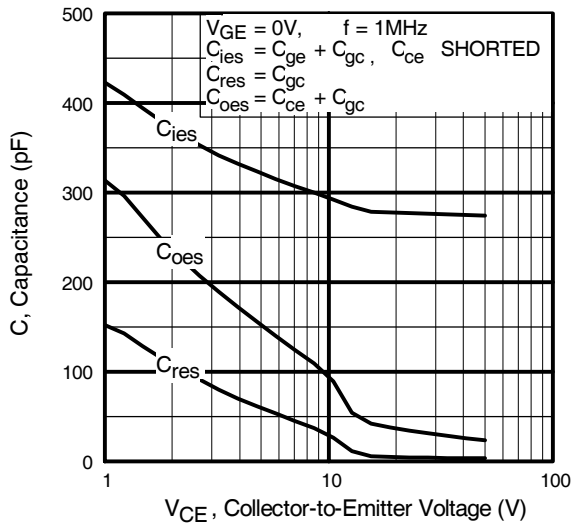


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

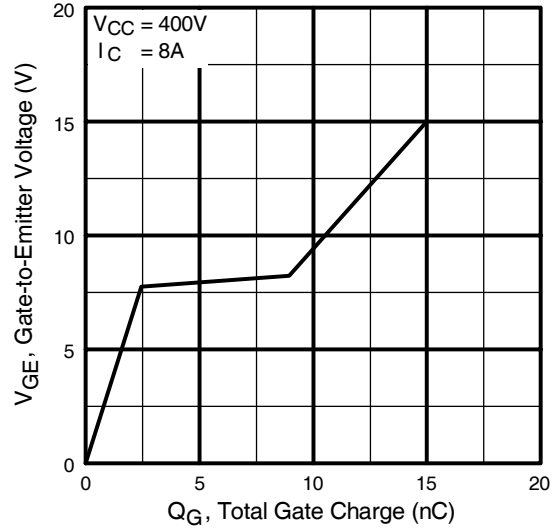


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

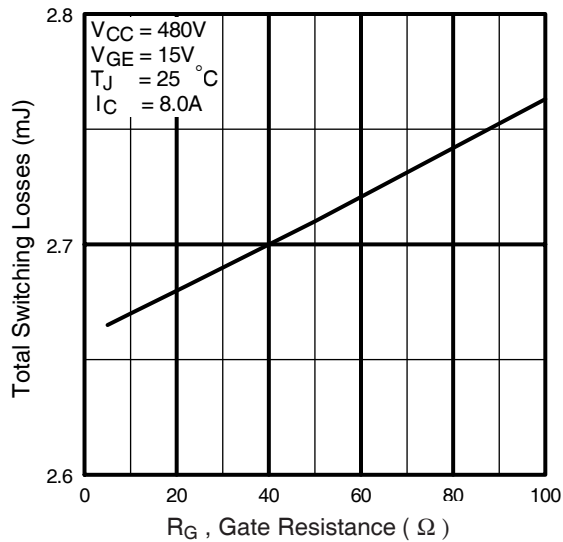


Fig. 9 - Typical Switching Losses vs. Gate Resistance

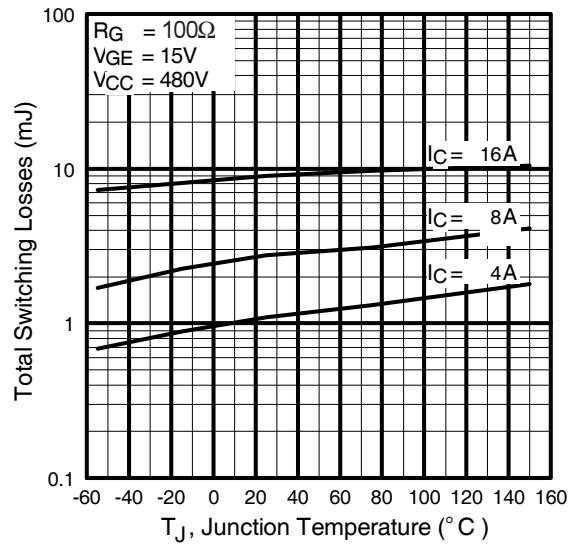


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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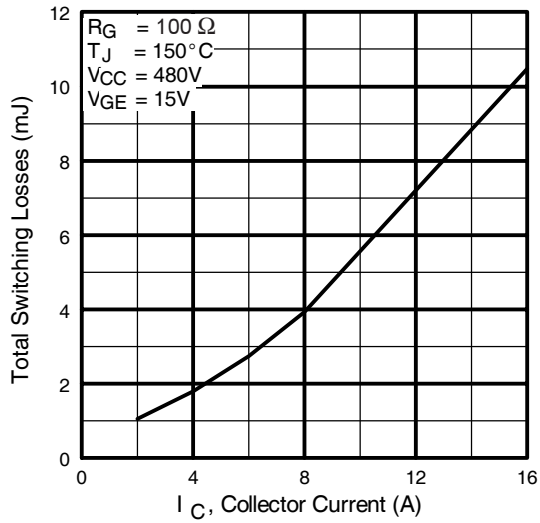


Fig. 11 - Typical Switching Losses vs. Collector Current

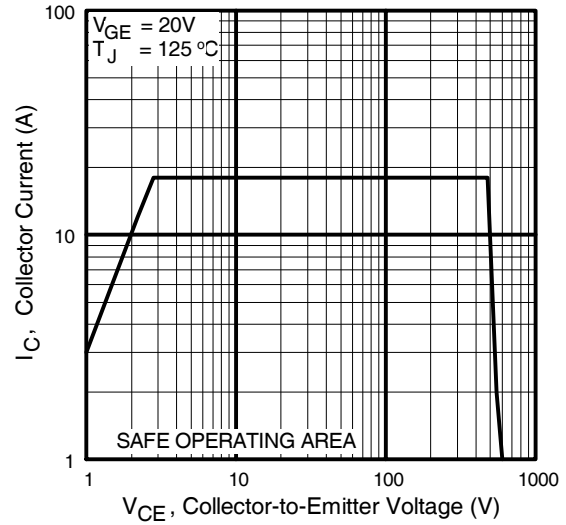


Fig. 12 - Turn-Off SOA

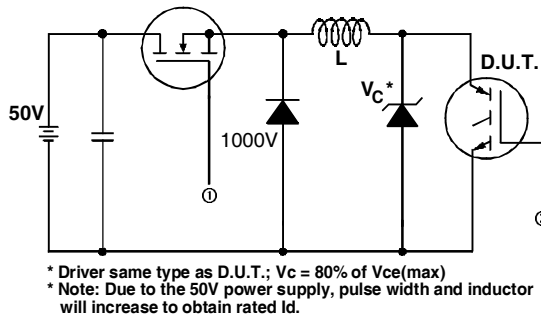


Fig. 13a - Clamped Inductive Load Test Circuit

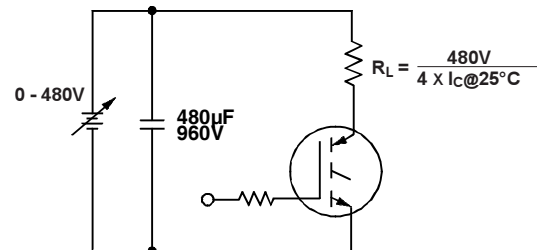


Fig. 13b - Pulsed Collector Current Test Circuit

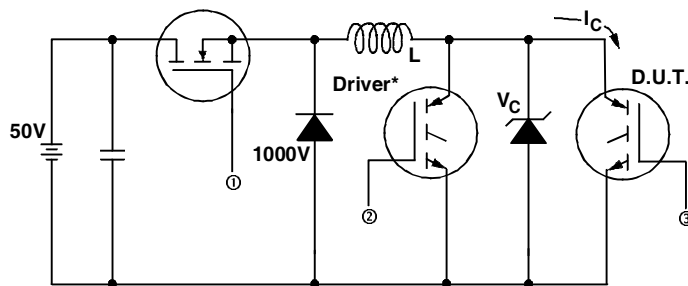


Fig. 14a - Switching Loss Test Circuit

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

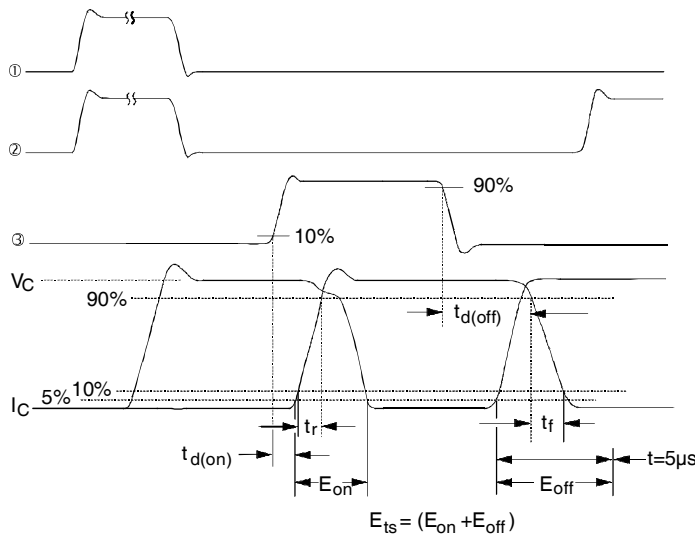


Fig. 14b - Switching Loss Waveforms

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Technical drawing of a lead tip assembly, showing front, side, and detail views.

Front View: Shows a rectangular body with a central circular feature. Dimensions include E (total width), $E/2$ (half width), D (height of the upper section), D_1 (total height), L (length of the lead tip), $2 \times \phi$ (diameter of the lead tip), $\phi 1.014 \pm 0.012$ (lead tip diameter), and $\phi 1.015 \pm 0.012$ (base diameter). A detail callout **DETAIL B** is indicated.

Side View: Shows the profile of the assembly. Dimensions include A (total height), A_1 (height of the upper section), A_2 (height of the lower section), and $c \pm 0.1$ (thickness of the lead tip).

DETAIL B: A circular detail view showing the lead tip. Dimensions include $2X \pm b$ (width of the lead tip), $3X \pm b/2$ (width of the base), and $c \pm 0.1$ (thickness of the lead tip).

VIEW A-A: A cross-sectional view showing the lead tip. Dimensions include E (total width), $E/2$ (half width), D (height of the upper section), D_1 (total height), E' (width of the lead tip), and $\phi 1.015 \pm 0.012$ (lead tip diameter).

SECTION C-C & D-D: A cross-sectional view showing the lead tip. Dimensions include b (width of the lead tip), $b/2$ (half width), c (height of the lead tip), c_1 (height of the base metal), and $b/2 \pm 0.3$ (width of the base metal).

- | SYMBOL | DIMENSIONS | | | | NOTES |
|--------|-------------|-------|----------|------|-------|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 3.56 | 4.83 | .140 | .190 | |
| A1 | 0.51 | 1.40 | .020 | .055 | |
| A2 | 2.03 | 2.92 | .080 | .115 | |
| b | 0.38 | 1.01 | .015 | .040 | |
| b1 | 0.38 | 0.97 | .015 | .038 | 5 |
| b2 | 1.14 | 1.78 | .045 | .070 | |
| b3 | 1.14 | 1.73 | .045 | .068 | 5 |
| 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 | 11.68 | 12.88 | .460 | .507 | |
| E | 9.65 | 10.67 | .380 | .420 | 7 |
| E1 | 6.86 | 8.89 | .270 | .350 | 7 |
| E2 | — | 0.76 | — | .030 | 8 |
| e | 2.54 BSC | | .100 BSC | | |
| e1 | 5.08 BSC | | .200 BSC | | |
| H1 | 5.84 | 6.86 | .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 | |

- 1.- ANODE/OPEN
- 2.- CATHODE
- 3.- ANODE

Diagram of an IRF1010 MOSFET package with the following labels:

- INTERNATIONAL RECTIFIER LOGO (points to the IR logo)
- PART NUMBER (points to 1010)
- DATE CODE (points to 019C)
- YEAR 0 = 2000
- WEEK 19
- LINE C
- ASSEMBLY LOT CODE (points to 17)

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8

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