PD - 93891A

International
IOR Rectifier

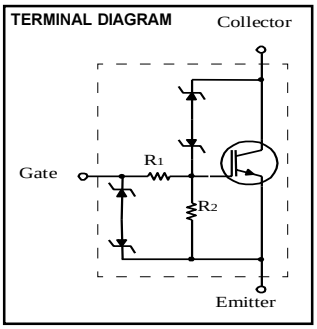
Ignition IGBT

IRGS14C40L
IRGSL14C40L
IRGB14C40L

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



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

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.

JEDEC TO-263AB

IRGS14C40L

JEDEC TO-262AA

IRGSL14C40L

JEDEC TO-220AB

IRGB14C40L

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

Thermal Resistance

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

Off-State Electrical Charasteristics @ T_J = 25°C (unless otherwise specified)

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

On-State Electrical Charasteristics @ T_J = 25°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 = 7A, V_{GE} = 4.5V	
			1.35	1.55		I_C = 10A, V_{GE} = 4.5V	1
			1.35	1.55		I_C = 10A, V_{GE} = 4.5V, T_C= -40°C	2
			1.5	1.7		I_C = 14A, V_{GE} = 5.0V, T_C= -40°C	4
			1.55	1.75		I_C = 14A, V_{GE} = 5.0V	
			1.6	1.8		I_C = 14A, V_{GE} = 5.0V, T_C=150°C	
$V_{GE(th)}$	Gate Threshold Voltage	1.3	1.8	2.2	V	V_{CE} = V_{GE}, I_C = 1 m A, T_C=25°C	3, 5
		0.75		1.8		V_{CE} = V_{GE}, I_C = 1 m A, T_C=150°C	8
g_{fs}	Transconductance	10	15	19	S	V_{CE} = 25V, I_C = 10A, T_C=25°C	
I_C	Collector Current	20			A	V_{GE} = 10V, V_{GE} = 4.5V	

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

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

Fig.1 - Typ. Output Characteristics
T_J=25°C

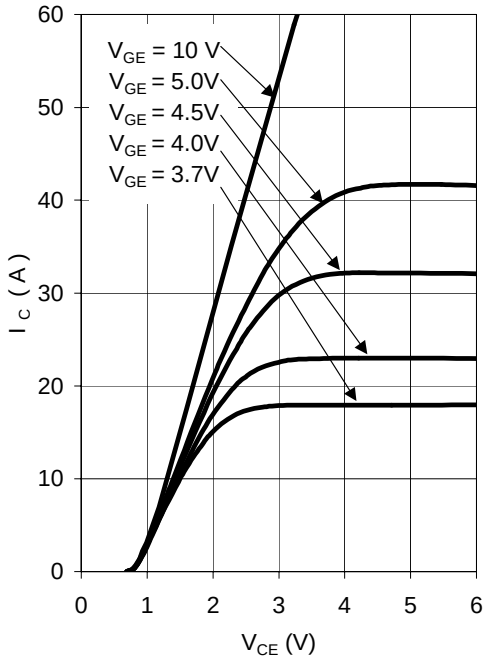


Fig.2 - Typ. Output Characteristics
T_J=125°C

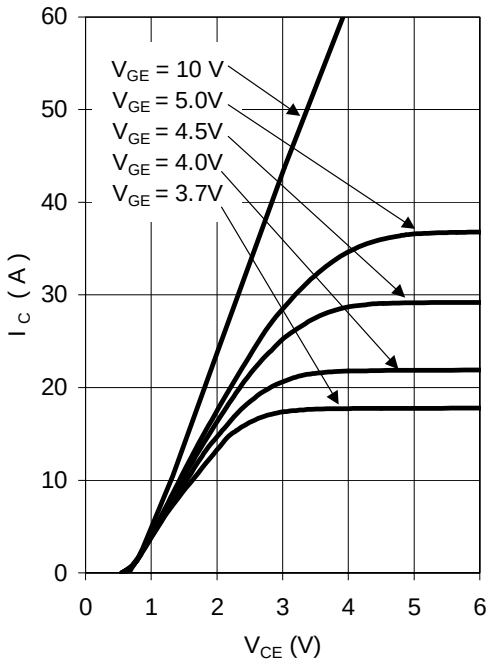


Fig.3 - Transfer Characteristics
V_{CE}=20V; tp=20µs

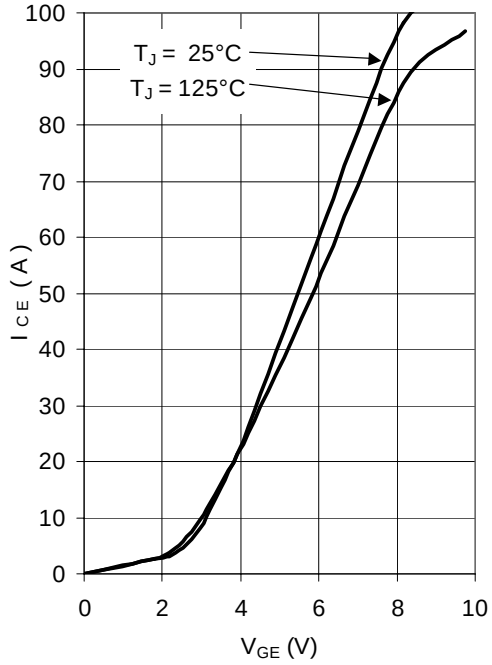


Fig.4 - Typical V_{CE} vs T_J
V_{GE}=4.5V

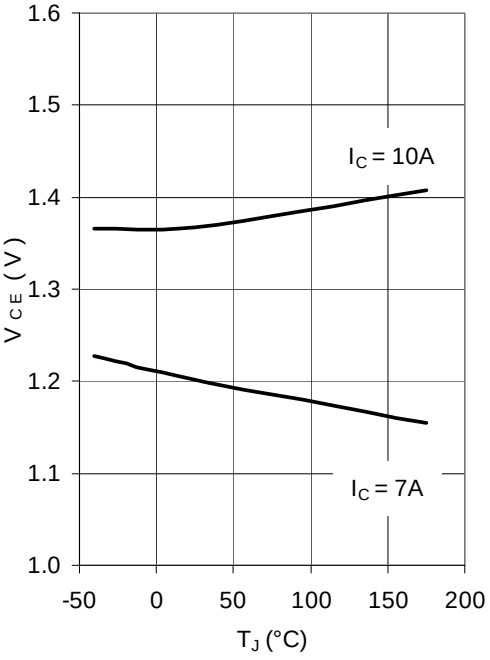


Fig.5 - Typical $V_{GE(th)}$ vs T_J
I_C=1mA

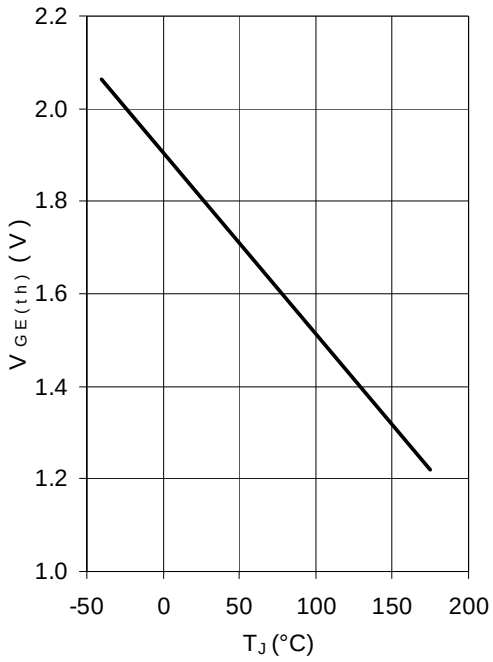


Fig.6 - Typ. Capacitance vs V_{CE}
V_{GE}=0V; V_{CE}=25V; f=1MHz

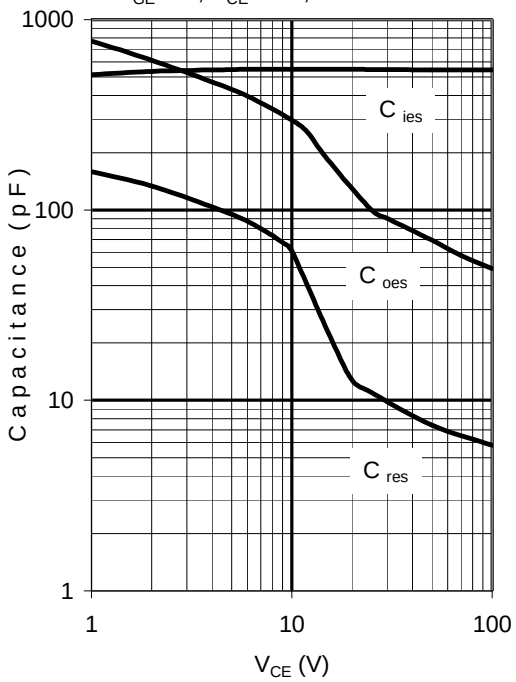


Fig.7 - Typ. Gate Charge vs V_{GE}
I_C=10A; V_{CE}=12V; V_{GE}=5V

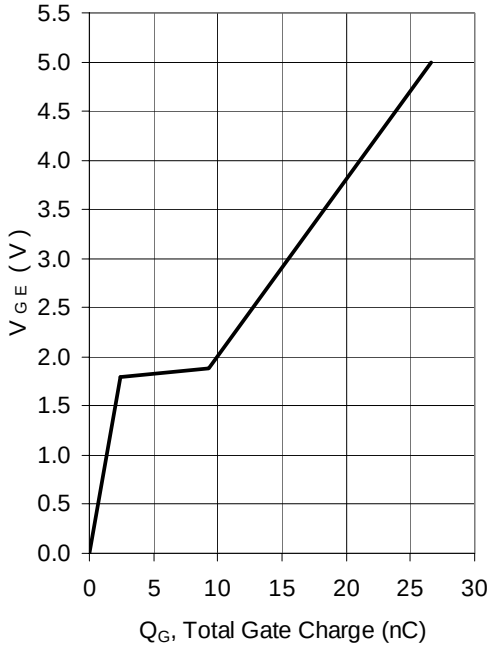


Fig.8 - Typical V_{CE} vs V_{GE}

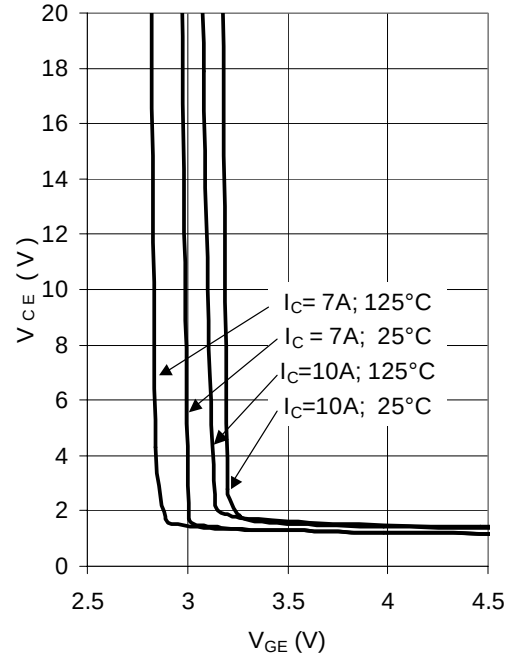


Fig.9 - Self-clamp Avalance Current vs Inductance @ 25°C

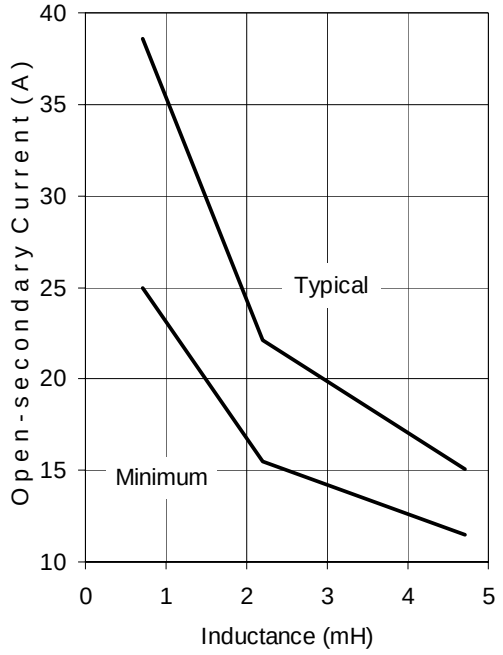


Fig.10 - Self-clamp Avalance Current vs Inductance @ 150°C

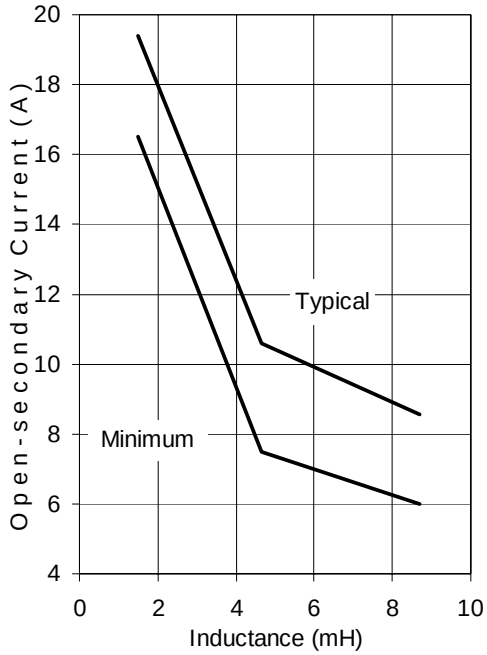


Fig.11 - Transient Thermal Impedance, Junction-to-Case

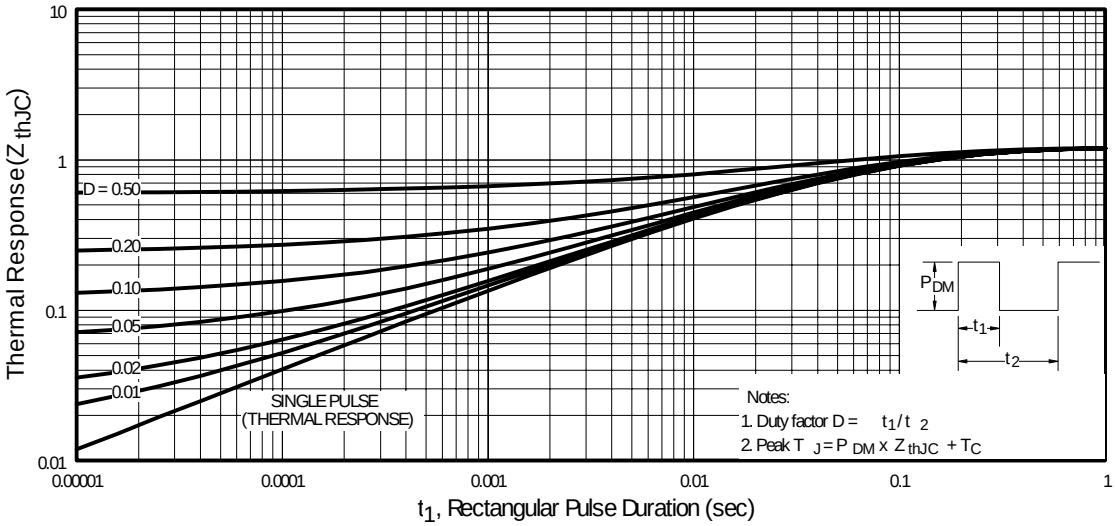


Fig.12 - Switching Waveform for Time Measurement
V_{GE}= 5V; R_G= 1KΩ; L= 1mH; V_{CE}= 14V; used circuit in Fig.14

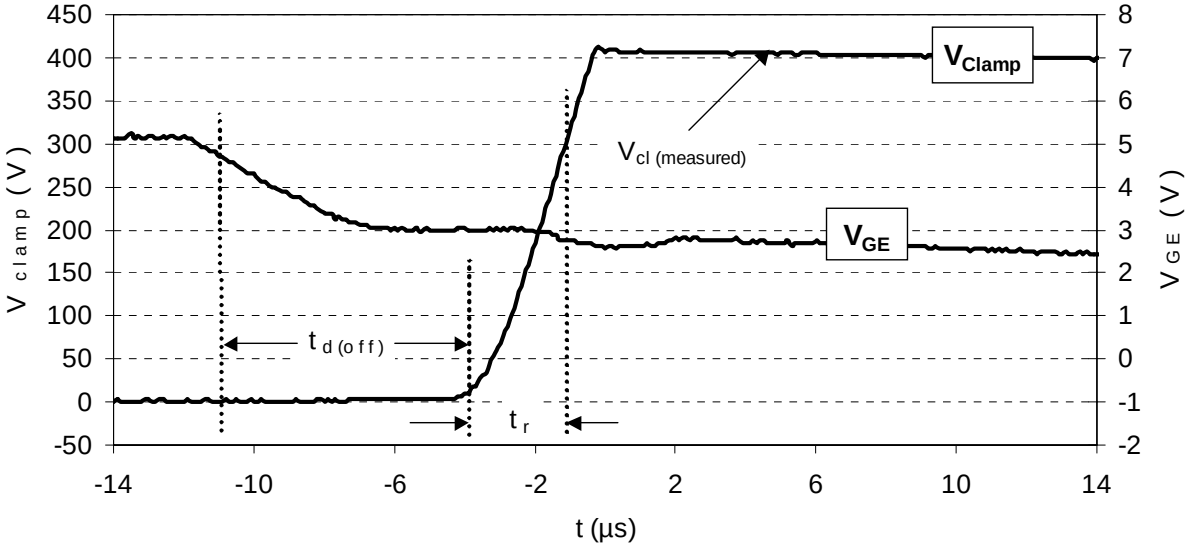


Fig.13 - Self-clamped Inductive Switching Waveform
L=4.7mH; T_C=25°C; used circuit in Fig.14

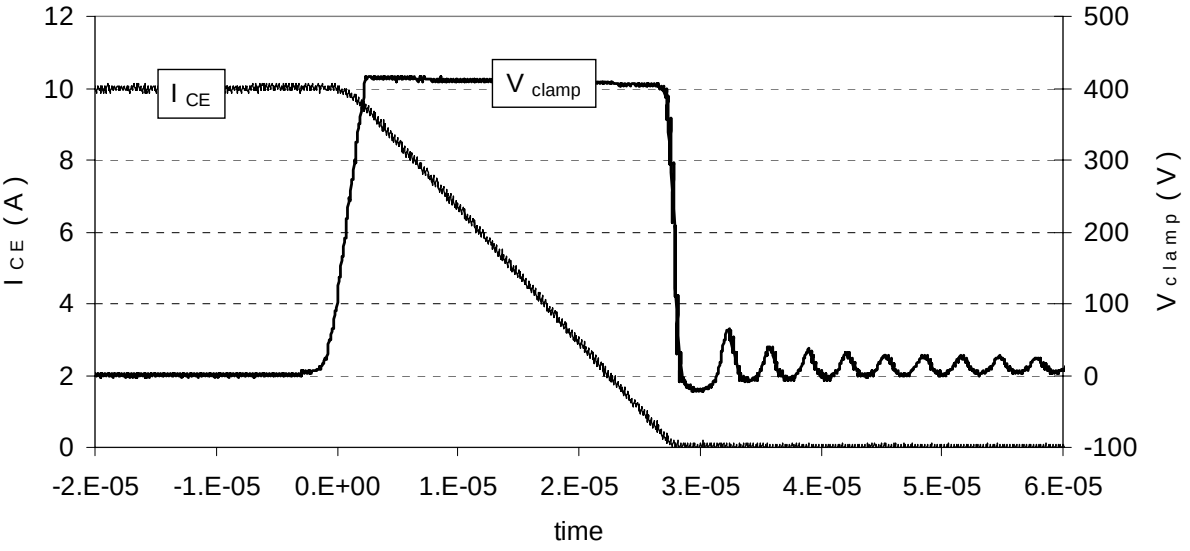


Fig.14 - Test Circuit

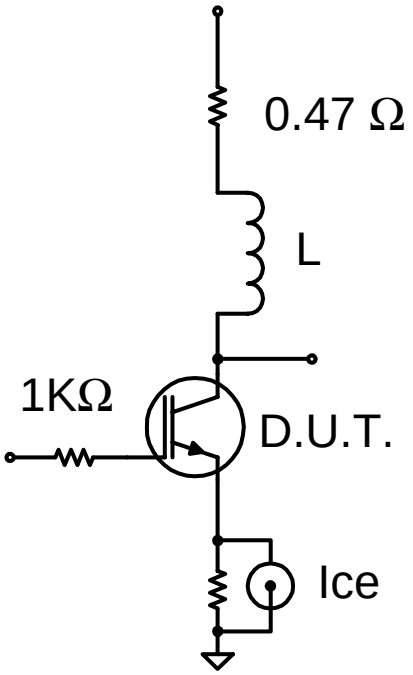
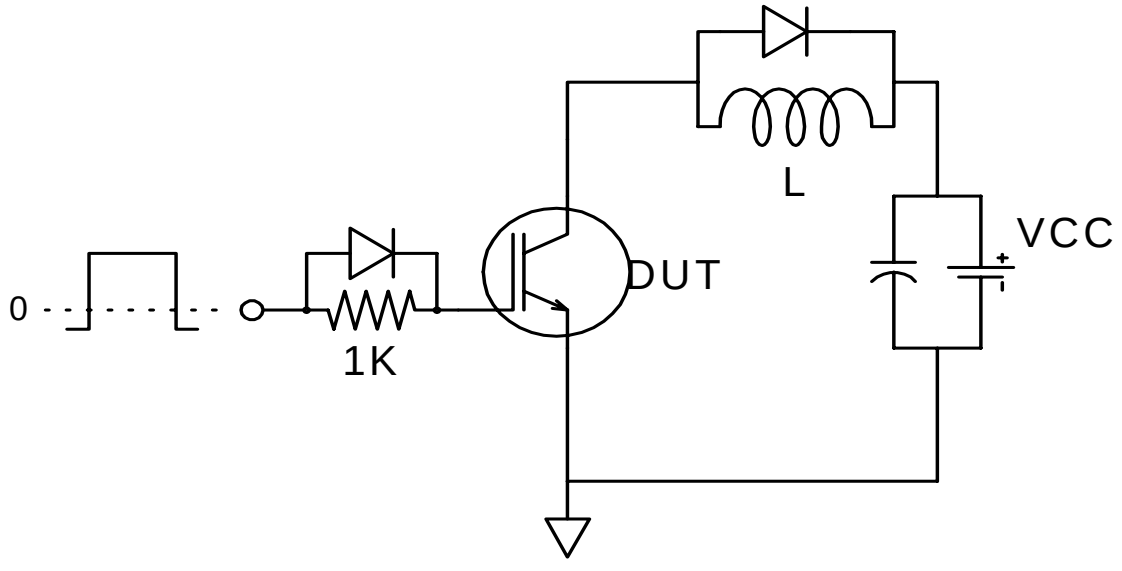
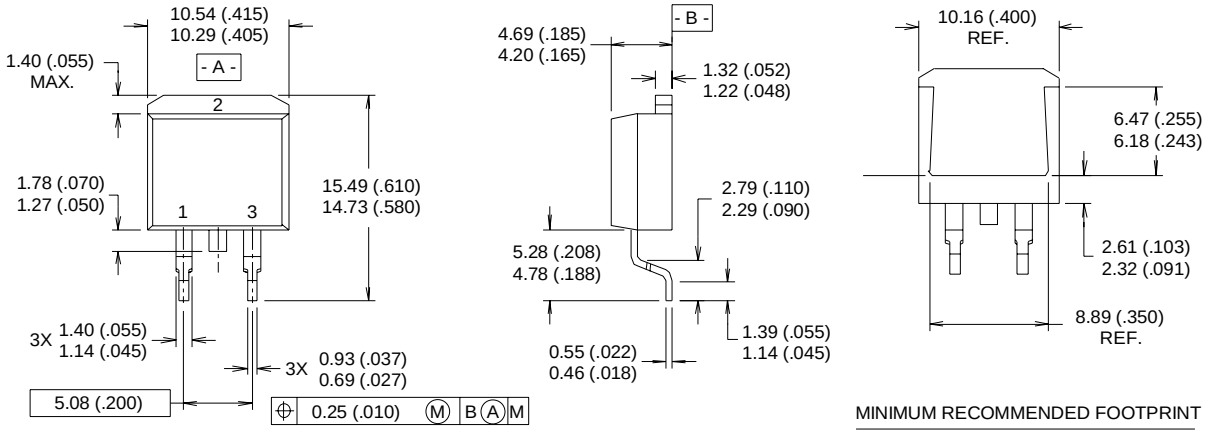


Fig.15 - Gate Charge Circuit

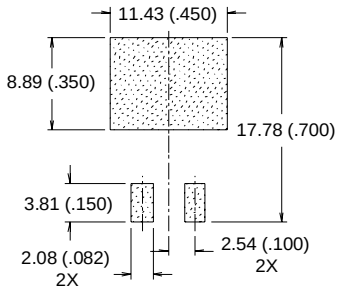


TO-263AB Package Outline

Dimensions are shown in millimeters (inches)



MINIMUM RECOMMENDED FOOTPRINT



NOTES:

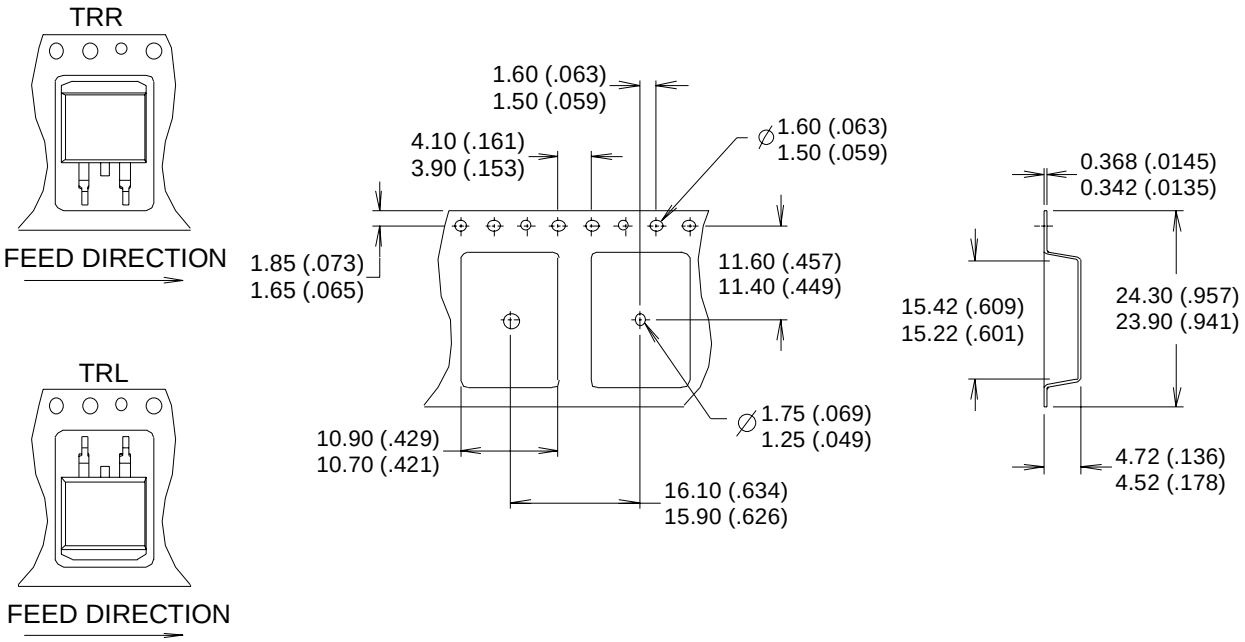
1 DIMENSIONS AFTER SOLDER DIP.
2 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
3 CONTROLLING DIMENSION : INCH.
4 HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

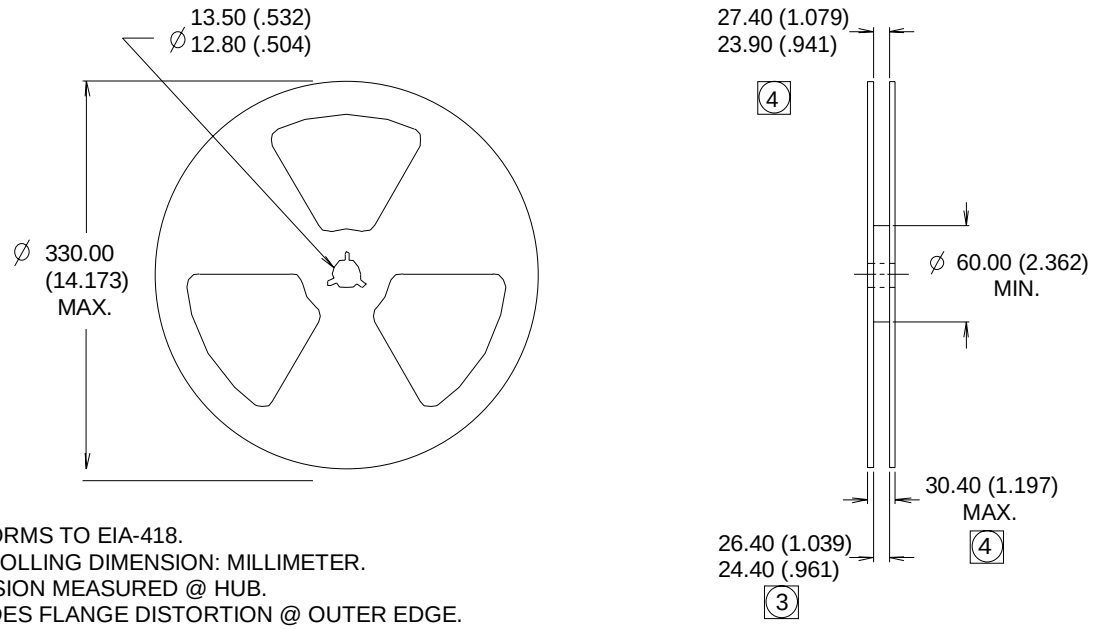
LEAD ASSIGNMENTS

1 - GATE
2 - DRAIN
3 - SOURCE

TO-263AB Package Outline in Tape and Reel

Dimensions are shown in millimeters (inches)

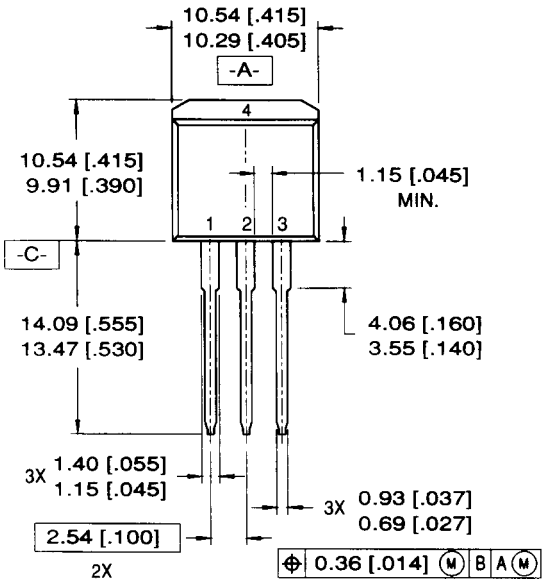


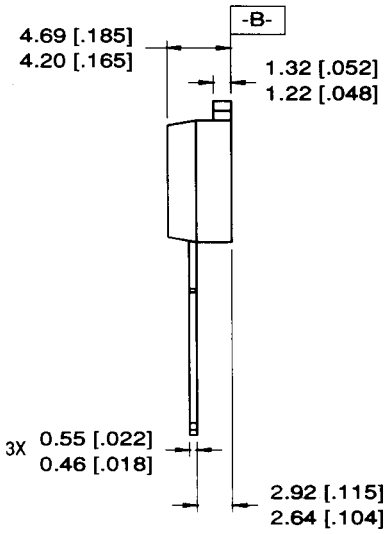


NOTES :
1. COMFORMS TO EIA-418.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION MEASURED @ HUB.
4. INCLUDES FLANGE DISTORTION @ OUTER EDGE.

TO-262AA Package Outline

Dimensions are shown in millimeters (inches)





LEAD ASSIGNMENTS

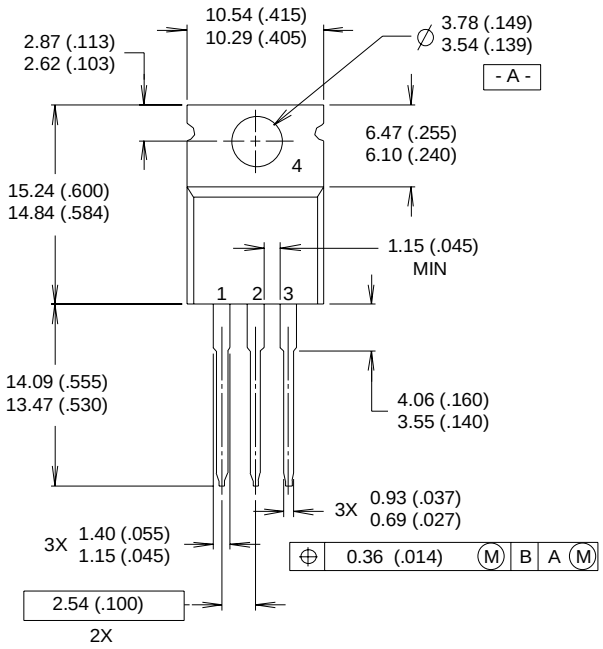
1 = GATE 3 = SOURCE
2 = DRAIN 4 = DRAIN

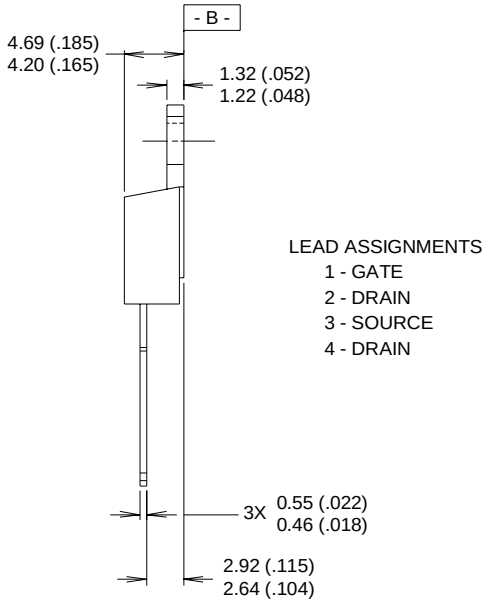
NOTES:

1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

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.

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