

Provisional

International
IOR Rectifier

Ignition IGBT

IRGS14C40L
IRGSL14C40L
IRGB14C40L

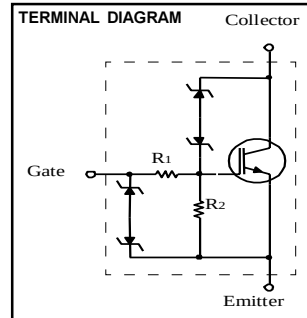
IGBT with on-chip Gate-Emitter and Gate-Collector clamps

Features

- Most Rugged in Industry
- Logic-Level Gate Drive
- > 6KV ESD Gate Protection
- Low Saturation Voltage
- High Self-clamped Inductive Switching Energy

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.



- $BV_{CES} = 400V$
- $I_C @ T_C = 110^\circ C = 14A$
- $V_{CE(on)}$ typ = 1.2V @ 7A @ 25°C
- I_L (min.) = 11.5A @ 25°C, L=4.7mH

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.	Units	Condition
BV_{CES}	Collector-to-Emitter Breakdown Voltage	370	V	$R_G = 1k\Omega$
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	20	A	$V_{GE} = 5V$
$I_C @ T_C = 110^\circ C$	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	± 10	V	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	125	W	
$P_D @ T = 110^\circ C$	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 Ω
I_L	Self-clamped Inductive Switching Current	11.5	A	L = 4.7mH, T = 25°C

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	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, Junction-to-Case (Fig.11)				

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

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

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	Fig
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage		1.2	1.40	V	$I_C = 7\text{A}$, $V_{GE} = 4.5\text{V}$	1
			1.35	1.55		$I_C = 10\text{A}$, $V_{GE} = 4.5\text{V}$	
			1.35	1.55		$I_C = 10\text{A}$, $V_{GE} = 4.5\text{V}$, $T_C = -40^\circ\text{C}$	2
			1.5	1.7		$I_C = 14\text{A}$, $V_{GE} = 5.0\text{V}$, $T_C = -40^\circ\text{C}$	4
			1.55	1.75		$I_C = 14\text{A}$, $V_{GE} = 5.0\text{V}$	
			1.6	1.8		$I_C = 14\text{A}$, $V_{GE} = 5.0\text{V}$, $T_C = 150^\circ\text{C}$	
$V_{GE(th)}$	Gate Threshold Voltage	1.3	1.8	2.2	V	$V_{CE} = V_{GE}$, $I_C = 1\text{mA}$, $T_C = 25^\circ\text{C}$	3, 5
		0.75		1.8		$V_{CE} = V_{GE}$, $I_C = 1\text{mA}$, $T_C = 150^\circ\text{C}$	8
g_{fs}	Transconductance	10	15	19	S	$V_{CE} = 25\text{V}$, $I_C = 10\text{A}$, $T_C = 25^\circ\text{C}$	
I_C	Collector Current	20			A	$V_{CE} = 10\text{V}$, $V_{GE} = 4.5\text{V}$	

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

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

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Fig.1 - Typ. Output Characteristics
 $T_J = 25^\circ\text{C}$

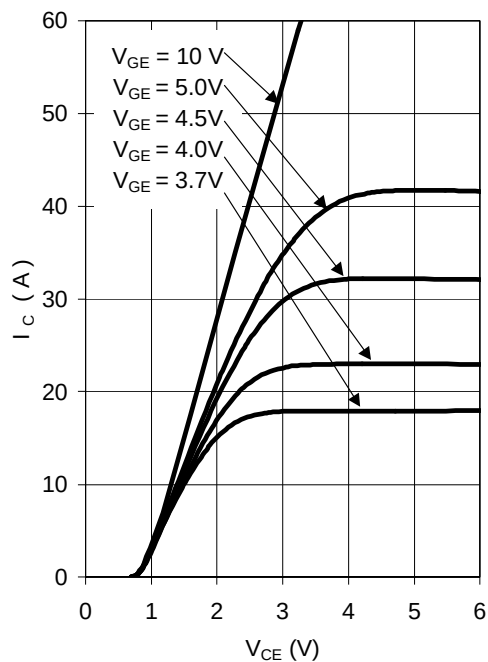


Fig.2 - Typ. Output Characteristics
 $T_J = 125^\circ\text{C}$

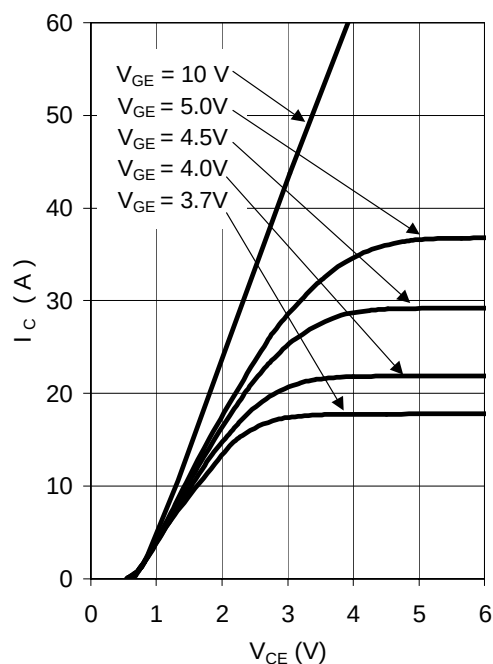


Fig.3 - Transfer Characteristics
 $V_{CE} = 20\text{V}$; $t_p = 20\mu\text{s}$

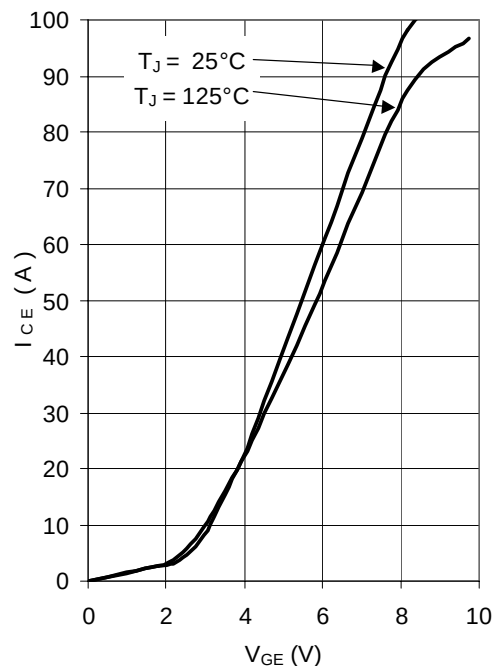
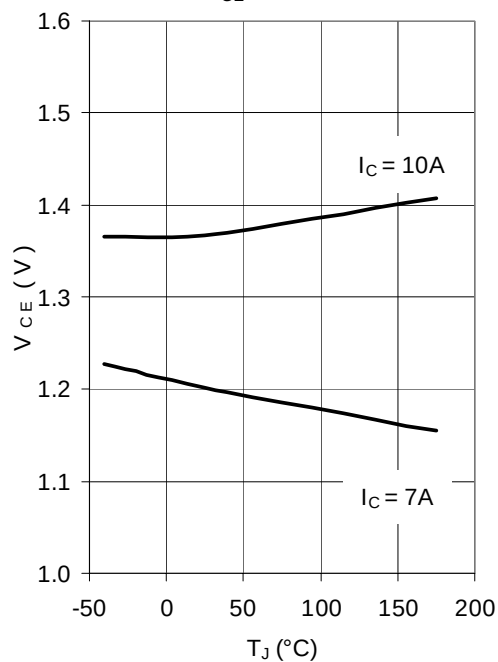


Fig.4 - Typical V_{CE} vs T_J
 $V_{GE} = 4.5\text{V}$

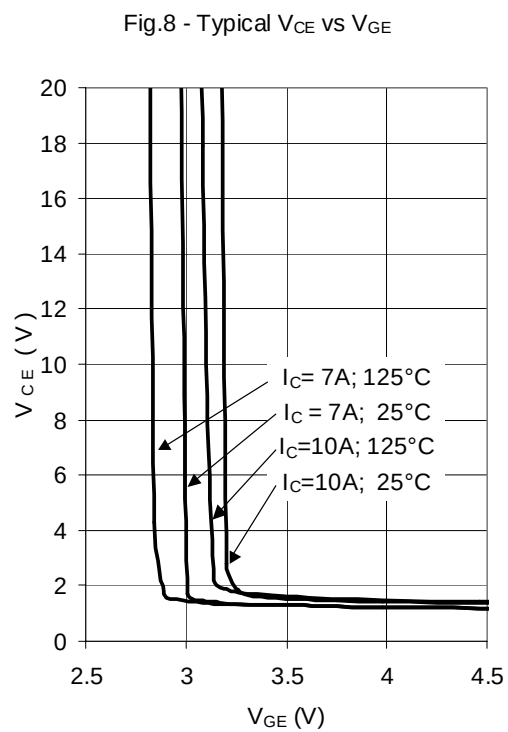
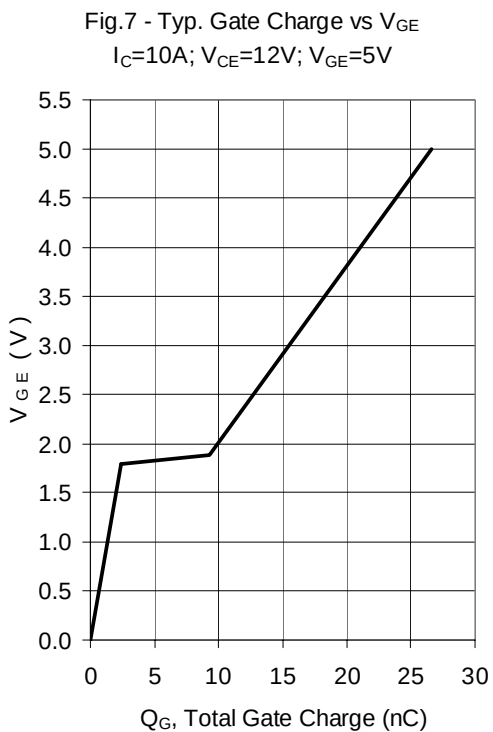
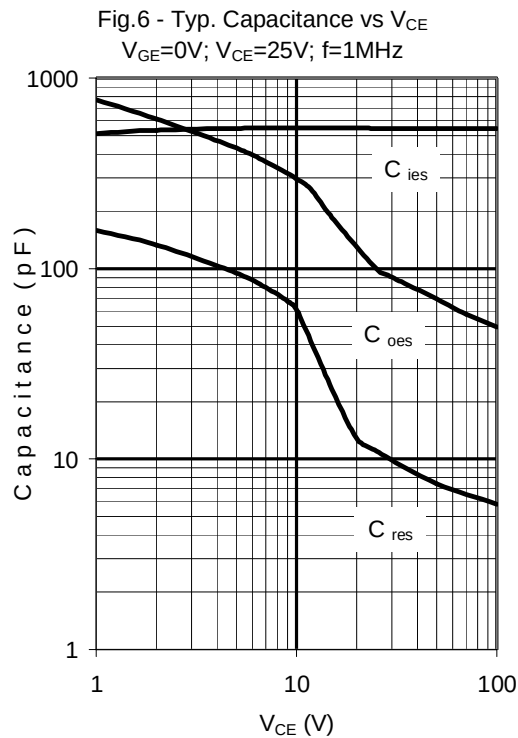
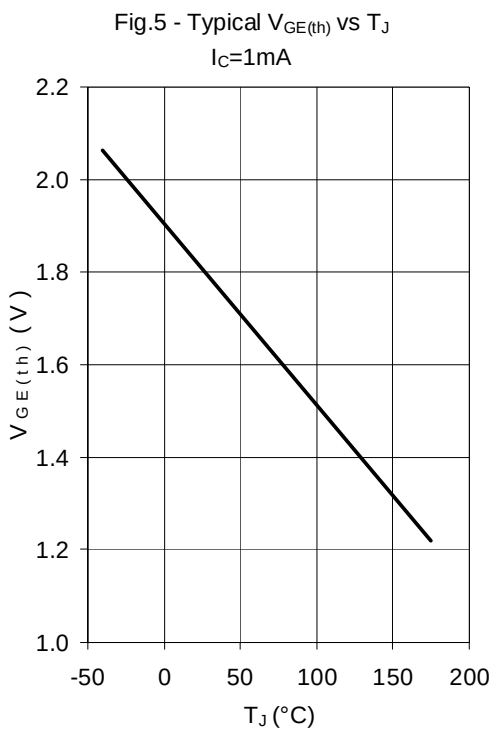


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Fig.9 - Self-clamp Avalanche Current vs Inductance @ 25°C

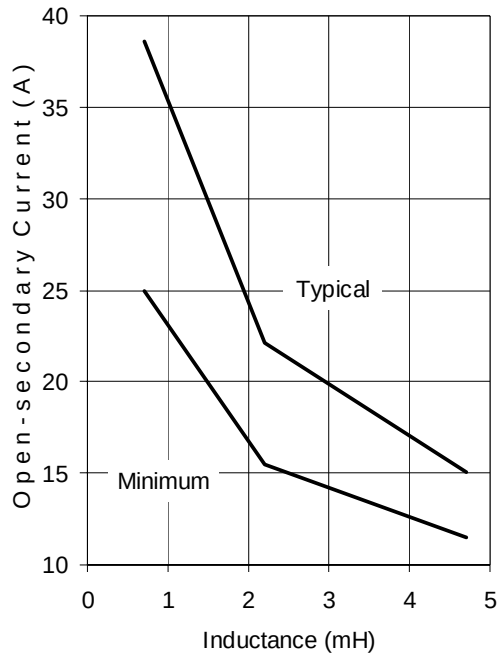


Fig.10 - Self-clamp Avalanche Current vs Inductance @ 150°C

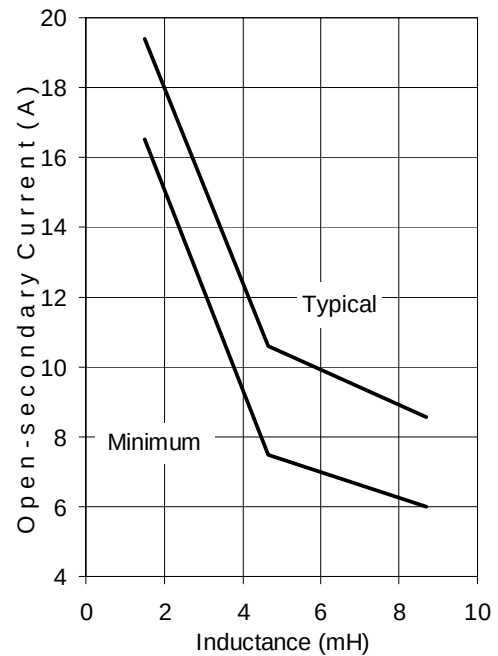
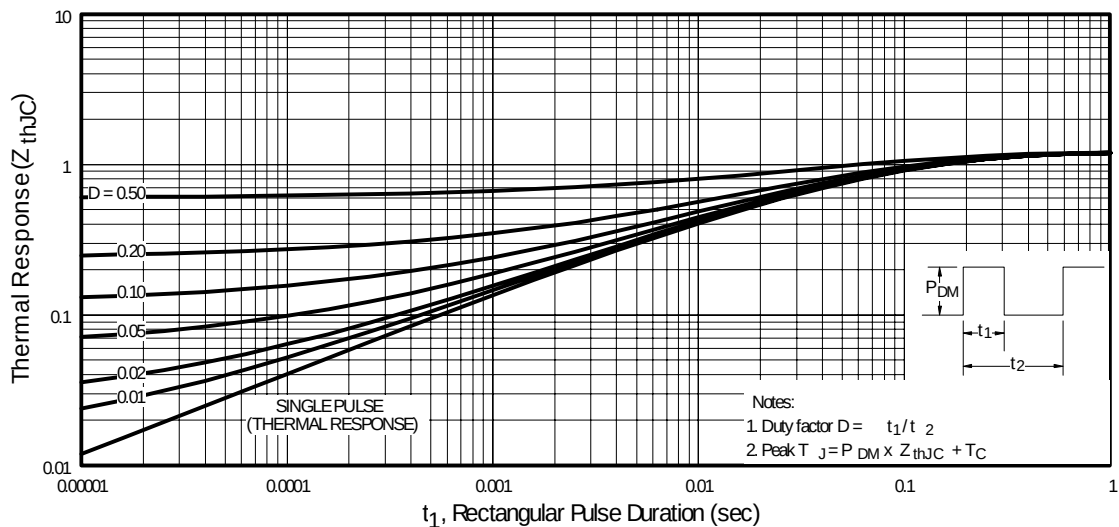


Fig.11 - Transient Thermal Impedance, Junction-to-Case



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Fig.12 - Switching Waveform for Time Measurement

$V_{GE}=5V$; $R_G=1K\Omega$; $L=1mH$; $V_{CE}=14V$; used circuit in Fig.14

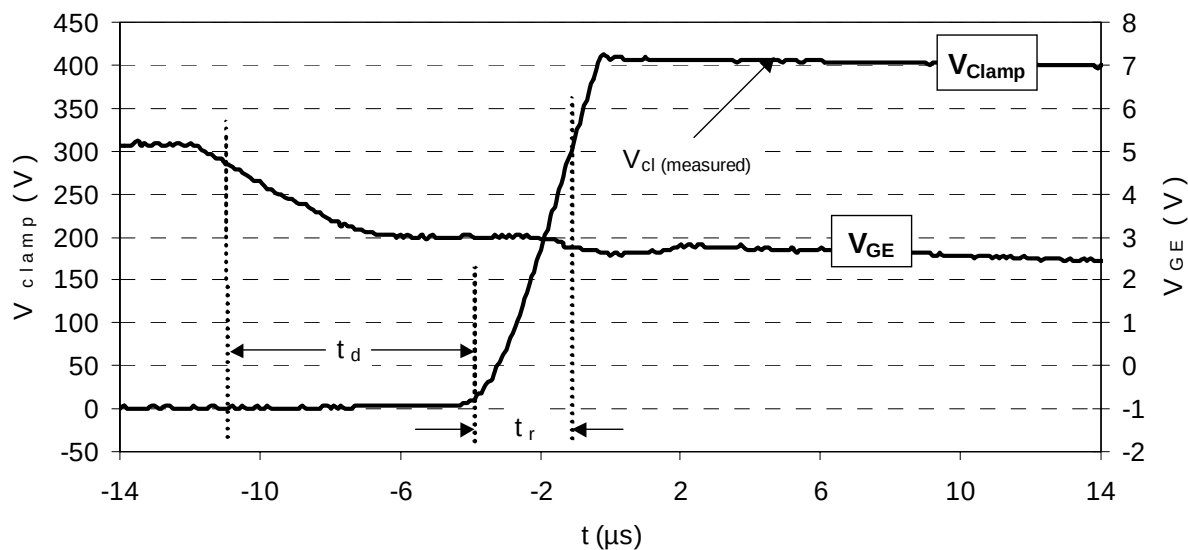
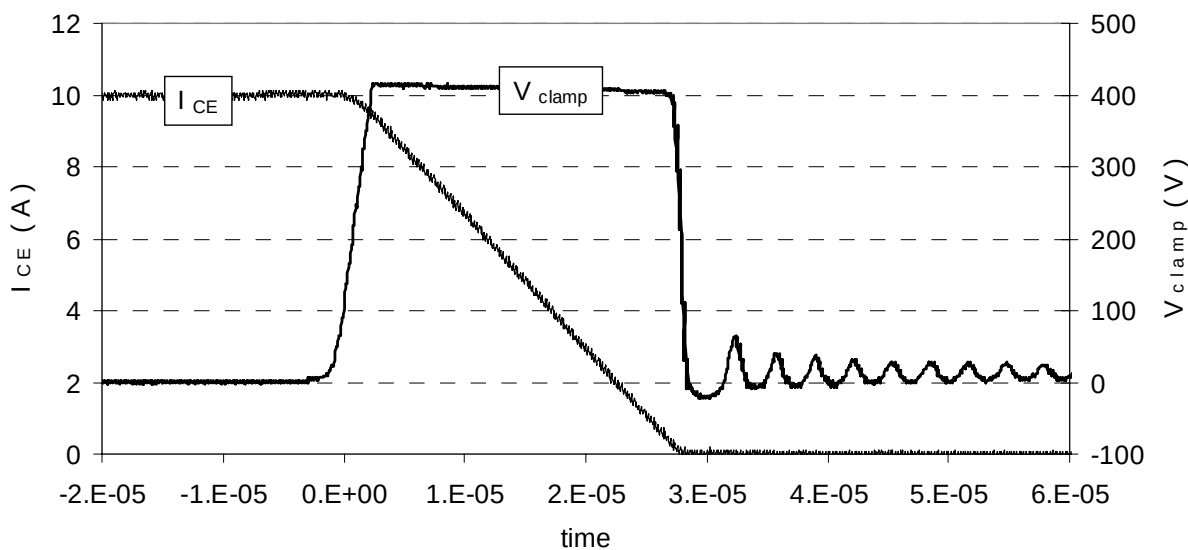


Fig.13 - Self-clamped Inductive Switching Waveform

$L=4.7mH$; $T_C=25^\circ C$; used circuit in Fig.14



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Fig.14 - Test Circuit

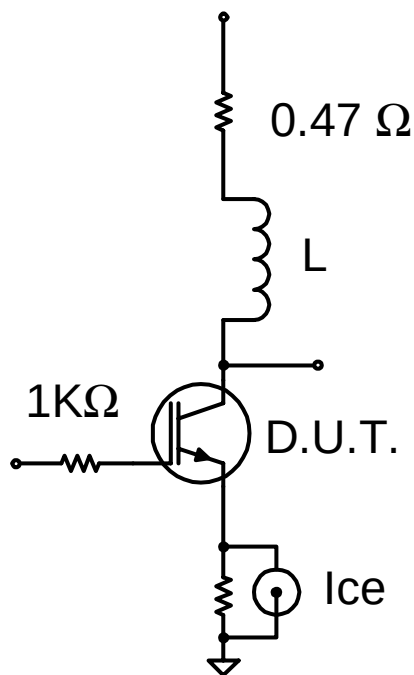
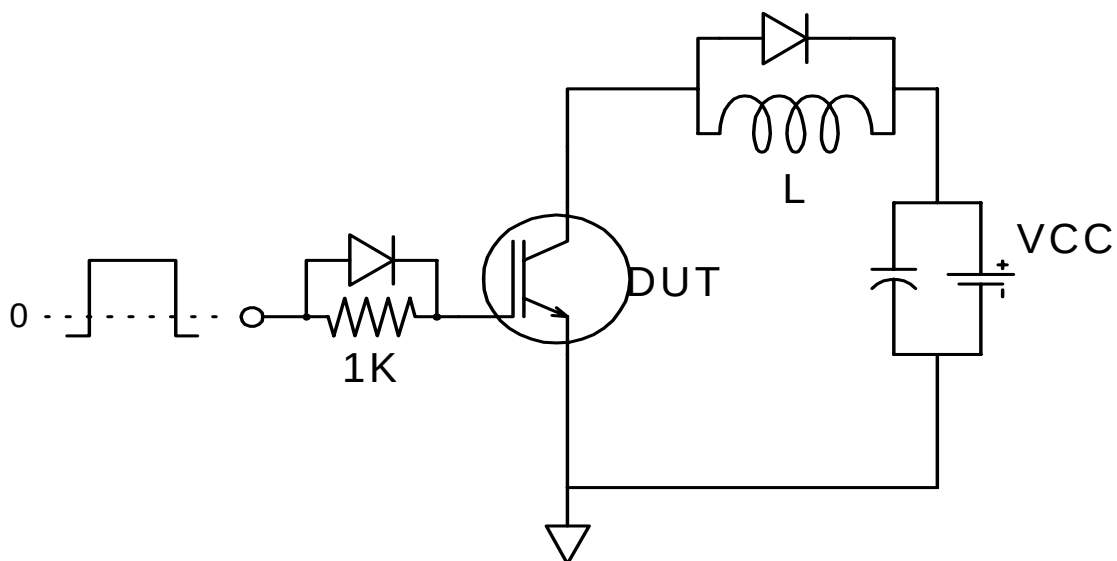


Fig.15 - Gate Charge Circuit



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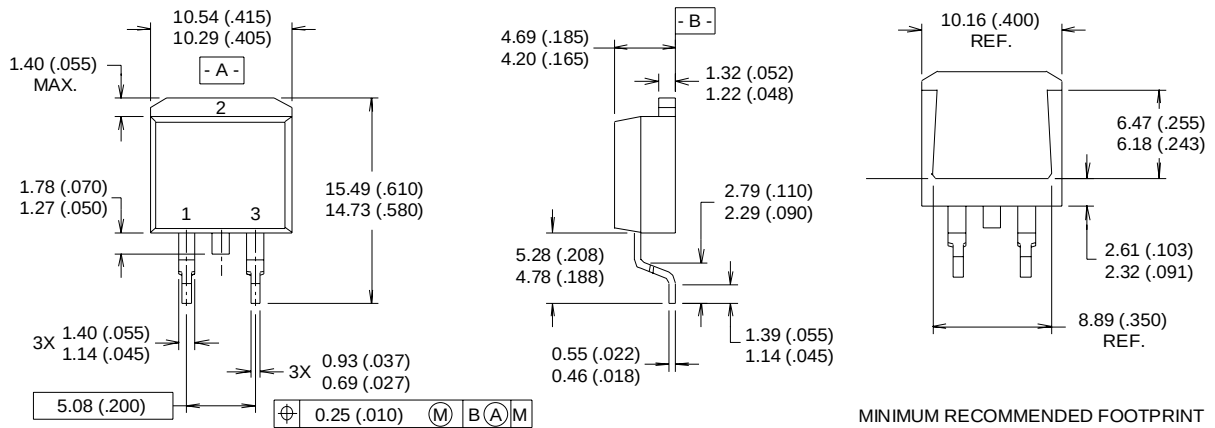
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TO-263AB Package Outline

Dimensions are shown in millimeters (inches)



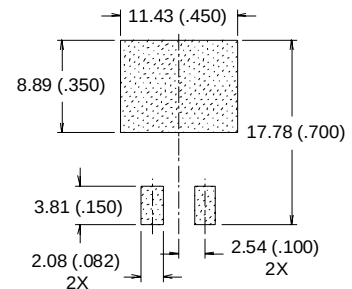
NOTES:

- 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

MINIMUM RECOMMENDED FOOTPRINT



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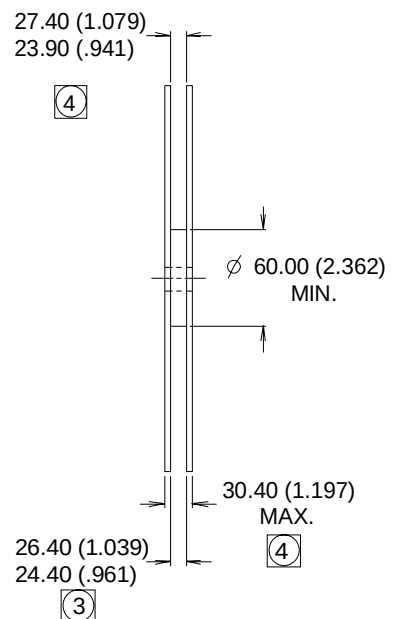
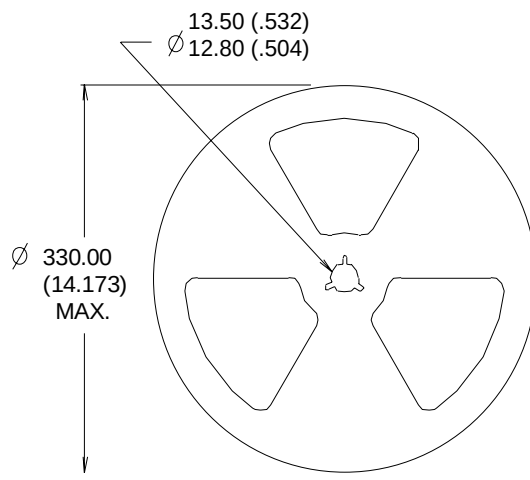
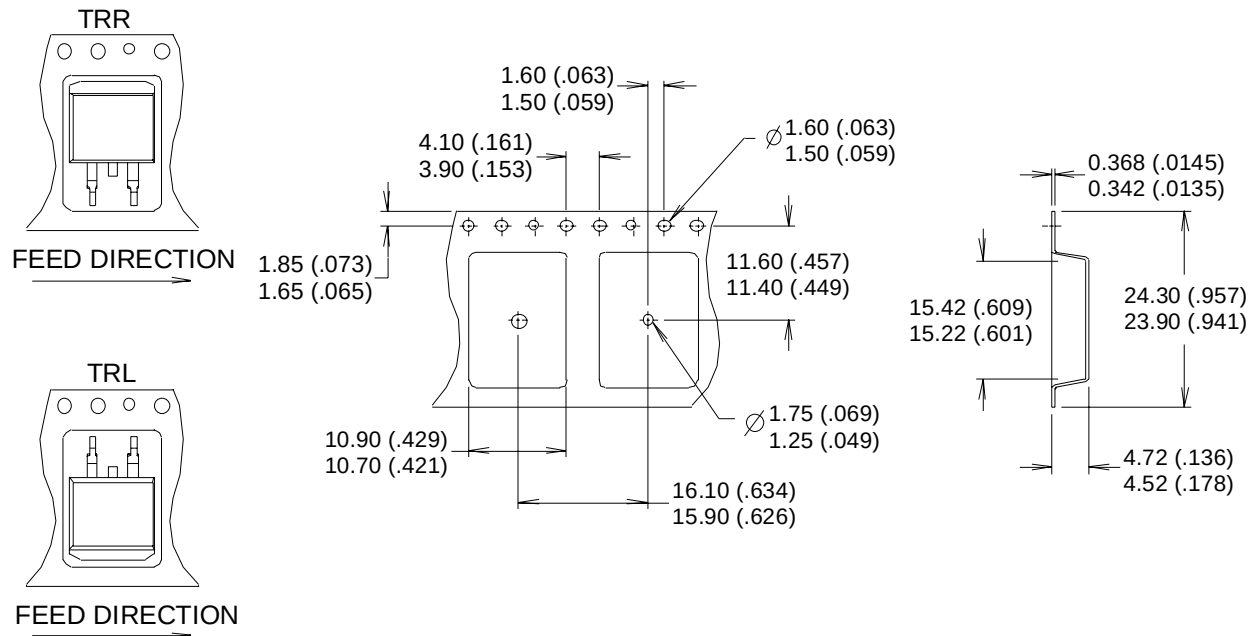
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Ignition IGBT

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TO-263AB Package Outline in Tape and Reel

Dimensions are shown in millimeters (inches)



NOTES :

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

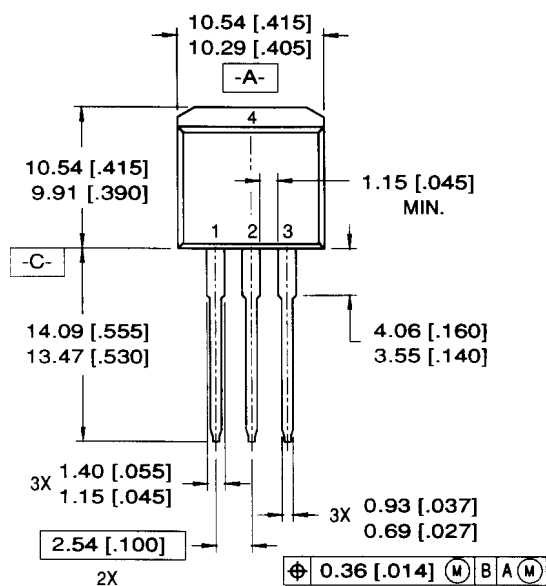
International
IOR Rectifier

Ignition IGBT

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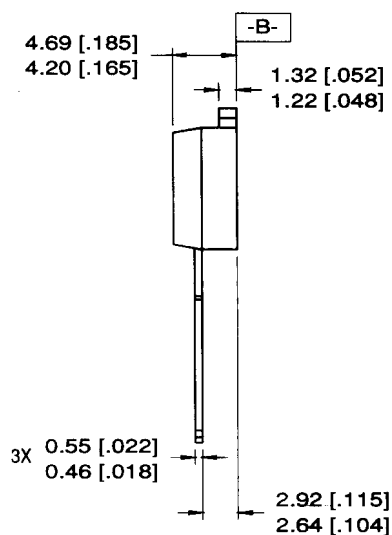
TO-262AA Package Outline

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.

Provisional

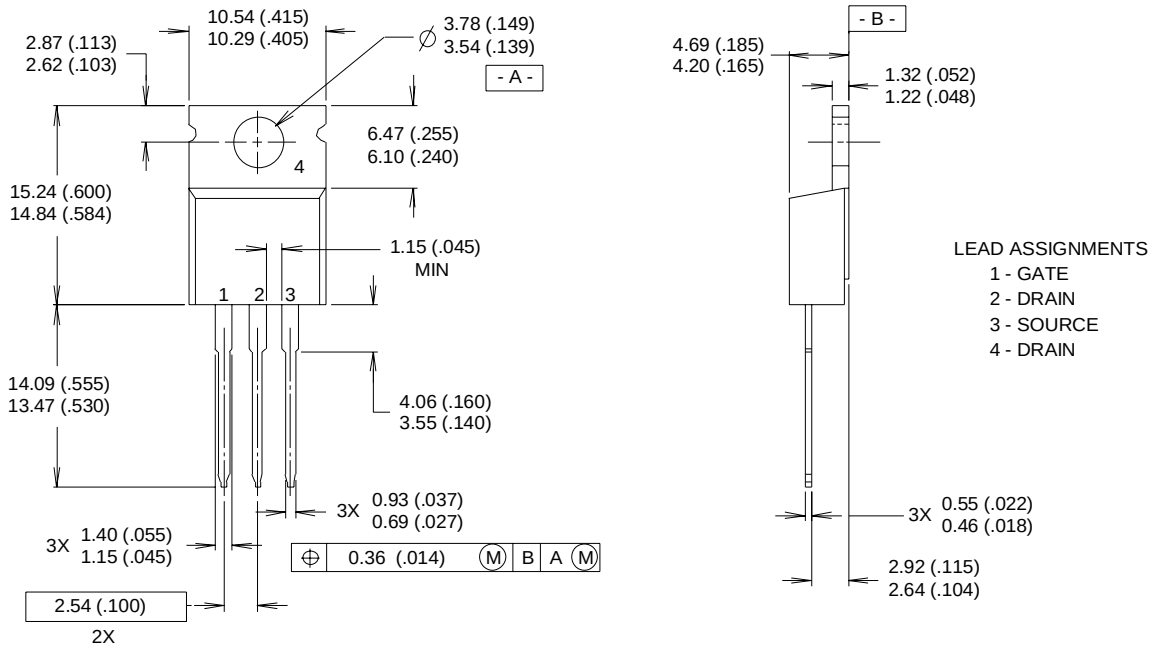
International
IOR Rectifier

Ignition IGBT

IRGS14C40L
IRGSL14C40L
IRGB14C40L

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.