

# ISL9V2040D3S / ISL9V2040S3S / ISL9V2040P3

# EcoSPARK<sup>TM</sup> 200mJ, 400V, N-Channel Ignition IGBT

### **General Description**

The ISL9V2040D3S, ISL9V2040S3S, and ISL9V2040P3 are the next generation ignition IGBTs that offer outstanding SCIS capability in the space saving D-Pak (TO-252), as well as the industry standard D²-Pak (TO-263) and TO-220 plastic packages. This device is intended for use in automotive ignition circuits, specifically as a coil driver. Internal diodes provide voltage clamping without the need for external components.

**EcoSPARK™** devices can be custom made to specific clamp voltages. Contact your nearest Fairchild sales office for more information.

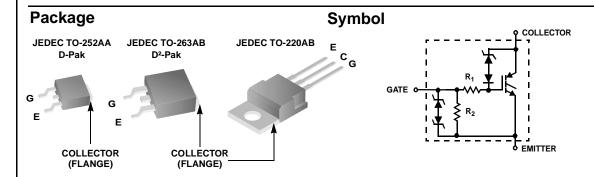
Formerly Developmental Type 49444

### **Applications**

- · Automotive Ignition Coil Driver Circuits
- Coil- On Plug Applications

#### **Features**

- Space saving D Pak package available
- SCIS Energy = 200mJ at T<sub>J</sub> = 25°C
- Logic Level Gate Drive



# **Device Maximum Ratings** $T_A = 25^{\circ}C$ unless otherwise noted

Symbol	Parameter	Ratings	Units
BV <sub>CER</sub>	Collector to Emitter Breakdown Voltage (I <sub>C</sub> = 1 mA)	430	V
BV <sub>ECS</sub>	Emitter to Collector Voltage - Reverse Battery Condition (I <sub>C</sub> = 10 mA)	24	V
E <sub>SCIS25</sub>	At Starting $T_J = 25$ °C, $I_{SCIS} = 11.5$ A, $L = 3.0$ mHy	200	mJ
E <sub>SCIS150</sub>	At Starting $T_J = 150$ °C, $I_{SCIS} = 8.9$ A, $L = 3.0$ mHy	120	mJ
I <sub>C25</sub>	Collector Current Continuous, At T <sub>C</sub> = 25°C, See Fig 9	10	А
I <sub>C110</sub>	Collector Current Continuous, At T <sub>C</sub> = 110°C, See Fig 9	10	А
$V_{GEM}$	Gate to Emitter Voltage Continuous	±10	V
$P_{D}$	Power Dissipation Total T <sub>C</sub> = 25°C	130	W
	Power Dissipation Derating T <sub>C</sub> > 25°C	0.87	W/°C
TJ	Operating Junction Temperature Range	-40 to 175	°C
T <sub>STG</sub>	Storage Junction Temperature Range	-40 to 175	°C
TL	Max Lead Temp for Soldering (Leads at 1.6mm from Case for 10s)	300	°C
T <sub>pkg</sub>	Max Lead Temp for Soldering (Package Body for 10s)	260	°C
ESD	Electrostatic Discharge Voltage at 100pF, 1500Ω	4	kV

Device M	vice Marking Device F		Pa	ackage	Reel Size	Та	pe Width	Qı	uantity	
V204	0D	ISL9V2040D3ST	TO	-252AA	330mm		16mm	:	2500	
V204	0S	ISL9V2040S3ST	TO	-263AB	330mm		24mm		800	
V204	V2040P ISL9V2040P3 TO		TO	0-220AB Tube		N/A			50	
V2040D ISL9V2040D3S TO		TO	O-252AA Tube		N/A			75		
V204	0S	ISL9V2040S3S	ТО	9-263AB	Tube		N/A		50	
	al Char	Parameter	5°C un	1	noted nditions	Min	Tun	May	Unit	
Symbol ff State	Charact			Test Co	nations	IVIIII	Тур	Max	Unit	
				1 0 m A 1/	0 1	270	400	400	I 1/	
BV <sub>CER</sub>	Collector	o Emitter Breakdown Voltage		$I_C = 2\text{mA}, V_{GE}$ $R_G = 1\text{K}\Omega, Se$ $T_J = -40 \text{ to } 15$	ee Fig. 15	370	400	430	V	
BV <sub>CES</sub>	Collector	r to Emitter Breakdown Voltage		$I_C = 10 \text{mA}, V_C$ $R_G = 0, \text{ See}$ $T_J = -40 \text{ to } 15$	Fig. 15	390	420	450	V	
BV <sub>ECS</sub>	Emitter to	to Collector Breakdown Voltage		$I_C = -75 \text{mA}, V_{GE} = 0 \text{V},$ $T_C = 25 ^{\circ}\text{C}$		30	-	-	V	
$BV_{GES}$	Gate to E	Emitter Breakdown Voltag	je	$I_{GES} = \pm 2mA$		±12	±14	-	V	
I <sub>CER</sub>	Collector	to Emitter Leakage Curr	ent	$V_{CER} = 250V$ ,		-	-	25	μΑ	
				$R_G = 1K\Omega$ , See Fig. 11	T <sub>C</sub> = 150°C	-	-	1	m/	
I <sub>ECS</sub>	Emitter to	Collector Leakage Curr	ent	V <sub>EC</sub> = 24V, Se		-	-	1	mA	
				Fig. 11	$T_C = 150$ °C	-	-	40	mA	
R <sub>1</sub>		ate Resistance Emitter Resistance				- 10K	70	- 26K	Ω	
V <sub>CE(SAT)</sub>	Characte Collector	eristics to Emitter Saturation Vol	tage	I <sub>C</sub> = 6A,	T <sub>C</sub> = 25°C,	-	1.45	1.9	V	
V <sub>CE(SAT)</sub>	Collector	to Emitter Saturation Vol	tage	$V_{GE} = 4V$ $I_C = 10A$ ,	See Fig. 3  T <sub>C</sub> = 150°C	-	1.95	2.3	V	
ynamic (	Charact	eristics		V <sub>GE</sub> = 4.5V	See Fig. 4					
Q <sub>G(ON)</sub>	Gate Cha			I <sub>C</sub> = 10A, V <sub>CE</sub>	= 12V		12	_	nC	
∝G(ON)	Outo On	argo		$V_{GE} = 5V$ , See					110	
V <sub>GE(TH)</sub>	Gate to E	Emitter Threshold Voltage	)	$I_C = 1.0 \text{mA},$	T <sub>C</sub> = 25°C	1.3	-	2.2	V	
				V <sub>CE</sub> = V <sub>GE</sub> , See Fig. 10	T <sub>C</sub> = 150°C	0.75	-	1.8	V	
$V_{GEP}$	Gate to E	Emitter Plateau Voltage		$I_C = 10A, V_{CE}$	= 12V	-	3.4	-	V	
witching	Charac	eteristics								
t <sub>d(ON)R</sub>	Current 7	Turn-On Delay Time-Resi	stive	$V_{CE} = 14V, R_{L}$	= 1Ω,	-	0.61	-	μs	
t <sub>riseR</sub>	Current F	Rise Time-Resistive		$V_{GE} = 5V, R_G = 1K\Omega$ $T_J = 25^{\circ}C$		-	2.17	-	μs	
$t_{d(OFF)L}$	Current 7	Turn-Off Delay Time-Indu	ctive	$V_{CE} = 300V, L = 500\mu Hy,$ $V_{GE} = 5V, R_G = 1K\Omega$ $T_J = 25^{\circ}C, See Fig. 12$		-	3.64	-	μs	
t <sub>fL</sub>	Current F	Fall Time-Inductive				-	2.36	-	μs	
SCIS	Self Clan	nped Inductive Switching			$_{\rm J} = 25^{\circ}{\rm C}, \ {\rm L} = 3.0 {\rm mHy}, \ {\rm H}_{\rm G} = 1 {\rm K}\Omega, \ {\rm V}_{\rm GE} = 5 {\rm V}, \ {\rm See}$ ig. 1 & 2		-	200	m	
nermal C	Characte	eristics								
	•	Resistance Junction-Cas	:e	TO-252, TO-2	63 TO-220	I <u>-</u>	1 -	1.15	°C/\	
$R_{ hetaJC}$	Illelillai	resistance sunction oas	,0	10-202, 10-2	00, 10-220			1.15	C/	

## **Typical Performance Curves**

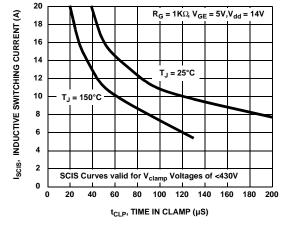


Figure 1. Self Clamped Inductive Switching Current vs Time in Clamp

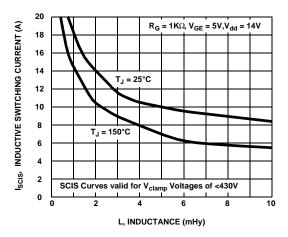


Figure 2. Self Clamped Inductive Switching Current vs Inductance

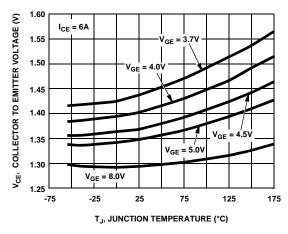


Figure 3. Collector to Emitter On-State Voltage vs Junction Temperature

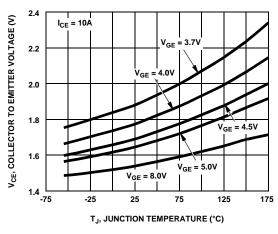


Figure 4. Collector to Emitter On-State Voltage vs Junction Temperature

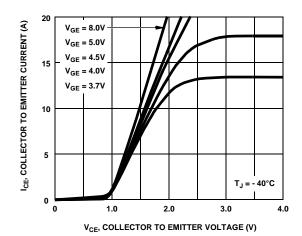


Figure 5. Collector to Emitter On-State Voltage vs Collector Current

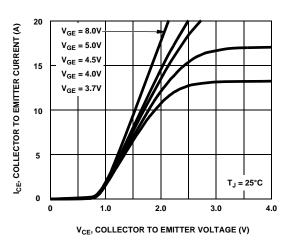
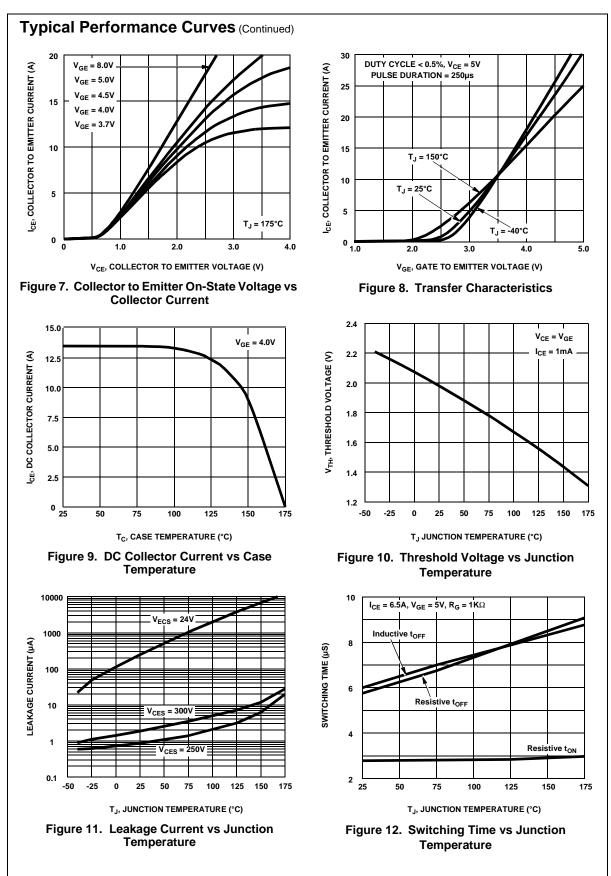
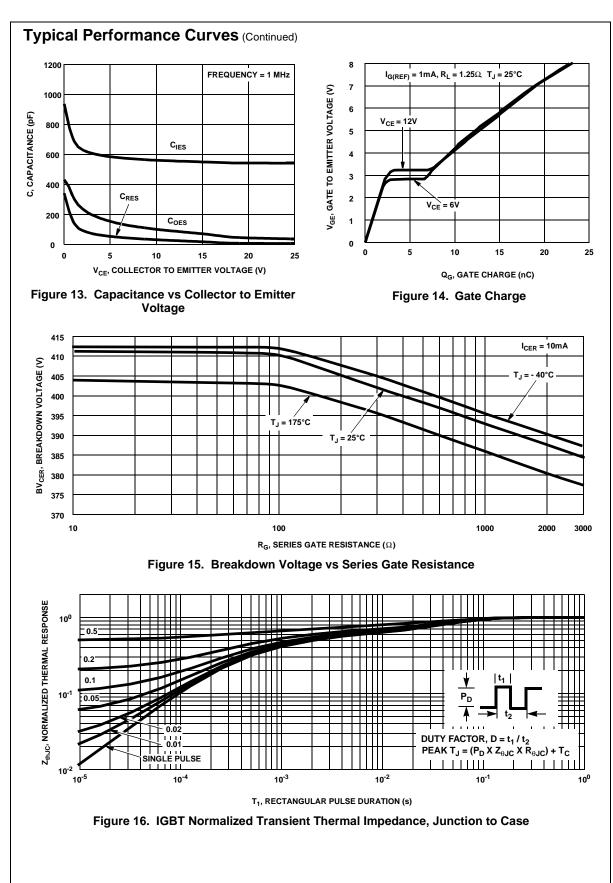


Figure 6. Collector to Emitter On-State Voltage vs Collector Current

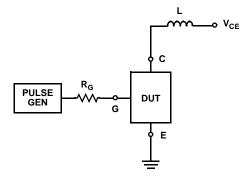


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# **Test Circuit and Waveforms**



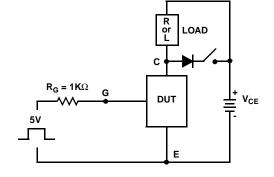


Figure 17. Inductive Switching Test Circuit

Figure 18.  $t_{ON}$  and  $t_{OFF}$  Switching Test Circuit

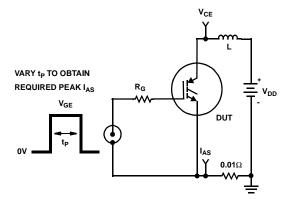


Figure 19. Unclamped Energy Test Circuit

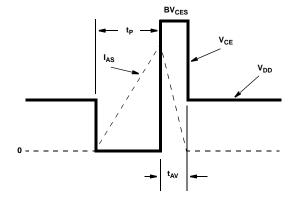
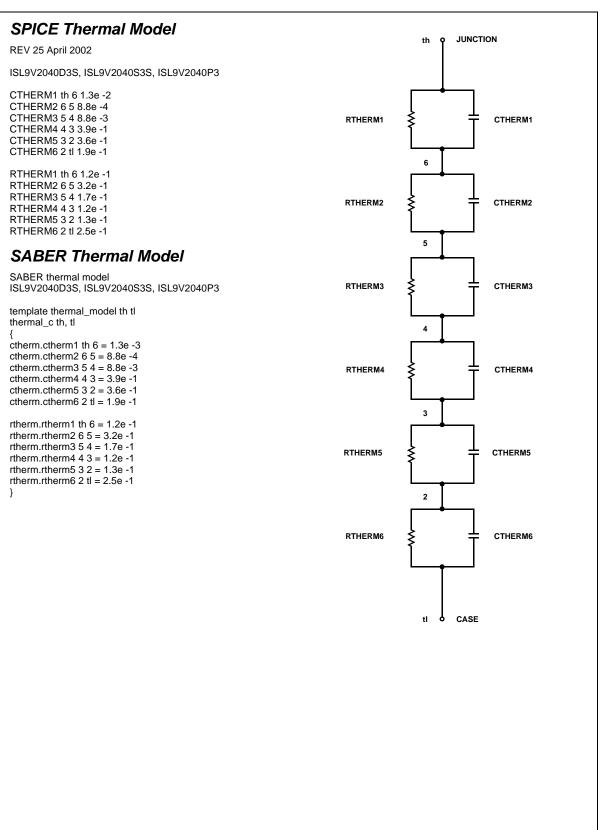


Figure 20. Unclamped Energy Waveforms



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	CoolFET™	FRFET™	MicroFET™	PowerTrench®	SuperSOT™-6
	$CROSSVOLT^{TM}$	GlobalOptoisolator™	MicroPak™	QFET®	SuperSOT™-8
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	EnSigna™	<i>i-Lo</i> ™	$OCX^{TM}$	RapidConfigure™	$TruTranslation ^{TM}$
	FACT™	ImpliedDisconnect™	OCXPro™	RapidConnect™	UHC™
FACT Quiet Series <sup>™</sup>		OPTOLOGIC®	μSerDes™	UltraFET®	
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