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ECOSPARK[®] Ignition IGBT

300 mJ, 400 V, N-Channel Ignition IGBT

ISL9V3040D3S, ISL9V3040S3S, ISL9V3040P3

General Description

The ISL9V3040D3S, ISL9V3040S3S, and ISL9V3040P3 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–262 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 **onsemi** sales office for more information.

Formerly Developmental Type 49362.

Features

- Space Saving D-Pak Package Availability
- SCIS Energy = 300 mJ at $T_J = 25^{\circ}C$
- Logic Level Gate Drive
- AEC-Q101 Qualified and PPAP Capable
- These are Pb-Free Devices

Applications

- Automotive Ignition Coil Driver Circuits
- Coil–On Plug Application



ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

Symbol	Parameter	Rating	Unit
BV _{CER}	Collector to Emitter Breakdown Voltage (I _C = 1 mA)	430	V
BV _{ECS}	Emitter to Collector Voltage – Reverse Battery Condition ($I_C = 10 \text{ mA}$)	24	V
E _{SCIS25}	At Starting T_J = 25°C, I_{SCIS} = 14.2 A, L = 3.0 mHy	300	mJ
E _{SCIS150}	At Starting $T_J = 150^{\circ}$ C, $I_{SCIS} = 10.6$ A, L = 3.0 mHy	170	mJ
I _{C25}	Collector Current Continuous, At $T_C = 25^{\circ}C$, See Fig 9	21	А
I _{C110}	Collector Current Continuous, At $T_C = 110^{\circ}C$, See Fig 9	17	А
V _{GEM}	Gate to Emitter Voltage Continuous	±10	V
PD	Power Dissipation Total $T_C = 25^{\circ}C$	150	W
	Power Dissipation Derating $T_C > 25^{\circ}C$	1.0	W/°C
TJ	Operating Junction Temperature Range	-40 to 175	°C
T _{STG}	Storage Junction Temperature Range	-40 to 175	°C
TL	Max Lead Temp for Soldering (Leads at 1.6 mm from Case for 10 s)	300	°C
T _{pkg}	Max Lead Temp for Soldering (Package Body for 10 s)	260	°C
ESD	Electrostatic Discharge Voltage at 100 pF, 1500 Ω	4	kV

MAXIMUM RATINGS ($T_A = 25^{\circ}C$ unless otherwise noted)

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Units
Thermal Resistance Junction Case	$R_{\theta JC}$	1.0	°C/W

ELECTRICAL CHARACTERISTICS (T_A = 25° C unless otherwise noted)

Symbol	Parameter	Test Conditions		Min	Тур.	Max.	Units
OFF CHARA					•	•	
BV _{CER}	Collector to Emitter Breakdown Voltage	I_C = 2 mA, V_{GE} = 0 V, R_G = 1 k\Omega, See Figure 15 T_J = –40 to 150°C		370	400	430	V
BV _{CES}	Collector to Emitter Breakdown Voltage	$\label{eq:lc} \begin{array}{l} I_C = 10 \text{ mA}, V_{GE} = 0 \text{ V}, \\ R_G = 0, \text{ See Figure 15} \\ T_J = -40 \text{ to } 150^\circ\text{C} \end{array}$		390	420	450	V
BV _{ECS}	Emitter to Collector Breakdown Voltage	I_{C} = -75 mA, V_{GE} = 0 V, T_{C} = 25°C		30	-	-	V
BV _{GES}	Gate to Emitter Breakdown Voltage	$I_{GES} = \pm 2 \text{ mA}$		±12	±14	-	V
I _{CER}	I _{CER} Collector to Emitter Leakage Current V _{CEF}		$T_C = 25^{\circ}C$	-	-	25	μΑ
		See Figure 11	T _C = 150°C	-	-	1	mA
I _{ECS}	Emitter to Collector Leakage Current	t V _{EC} = 24 V,	$T_{\rm C} = 25^{\circ}{\rm C}$	-	-	1	mA
		See Figure 11	$T_{\rm C}$ = 150°C	-	-	40	1
R ₁	Series Gate Resistance	i i		-	70	-	Ω
R ₂	Gate to Emitter Resistance			10K	-	26K	Ω
ON CHARAC	CTERISTICS						
VCE(SAT)	Collector to Emitter Saturation	lc = 6 A.	T _C = 25°C.	_	1.25	1.60	V

VCE(SAT)	Voltage	I _C = 6 A, V _{GE} = 4 V	T _C = 25°C, See Figure 3	_	1.25	1.60	V
V _{CE(SAT)}	Collector to Emitter Saturation Voltage	$I_{C} = 10 \text{ A},$ $V_{GE} = 4.5 \text{ V}$	T _C = 150°C, See Figure 4	-	1.58	1.80	V
V _{CE(SAT)}	Collector to Emitter Saturation Voltage	I _C = 15 A, V _{GE} = 4.5 V	T _C = 150°C	-	1.90	2.20	V

Symbol	Parameter	Test Conditions		Min	Тур.	Max.	Units
DYNAMIC C	DYNAMIC CHARACTERISTICS						
Q _{G(ON)}	Gate Charge	I_C = 10 A, V_{CE} = 12 V, V_{GE} = 5 V See Figure 14		_	17	_	nC
V _{GE(TH)}	Gate to Emitter Threshold Voltage	$I_{\rm C} = 1.0 {\rm mA}$ $T_{\rm C} = 25^{\circ}{\rm C}$		1.3	-	2.2	V
		See Figure 10	T _C = 150°C	0.75	-	1.8	1
V _{GEP}	Gate to Emitter Plateau Voltage	$V_{CE} = 12 \text{ V}, \text{ I}_{C} = 10 \text{ A}$		-	3.0	-	V
SWITCHING	CHARACTERISTICS						
t _{d(ON)} R	Current Turn-On Delay Time-Resistive	$\label{eq:V_CE} \begin{array}{l} V_{CE} = 14 \; V, \; R_L \; = 1 \; \Omega, \\ V_{GE} = 5 \; V, \; R_G = 1 \; k\Omega, \\ T_J = 25^\circ C, \; See \; Figure \; 12 \end{array}$		-	0.7	4	μs
t _{rR}	Current Rise Time-Resistive			-	2.1	7	1
td _{(OFF)L}	Current Turn-Off Delay Time-Inductive	$\begin{array}{l} V_{CE} = 300 \; V, \; L = 500 \; \mu H, \\ V_{GE} = 5 \; V, \; R_{G} = 1 \; k\Omega, \\ T_{J} = 25^{\circ}C, \; See \; Figure \; 12 \end{array}$		-	4.8	15	μs
t _{fL}	Current Fall Time-Inductive			-	2.8	15	1
SCIS	Self Clamped Inductive Switching	T_J = 25°C, L = 3.0 mH, V _{GE} = 5 V, R _G = 1 kΩ, See Figure 1 and Figure 2		_	_	300	mJ

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (continued)

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.



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



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



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



Figure 2. Self Clamped Inductive Switching Current vs. Inductance



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



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

TYPICAL CHARACTERISTICS



Figure 7. Collector to Emitter On–State Voltage vs. Collector Current



Figure 9. DC Collector Current vs. Case Temperature











Figure 10. Threshold Voltage vs. Junction Temperature



Temperature

TYPICAL CHARACTERISTICS (continued)



TYPICAL CHARACTERISTICS (continued)





Figure 14. Gate Charge

 R_{G} , SERIES GATE RESISTANCE (Ω)

Figure 15. Breakdown Voltage vs. Series Resistance



Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

TEST CIRCUIT AND WAVEFORMS



Figure 17. Inductive Switching Test Circuit



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



Figure 19. Energy Test Circuit



Figure 20. Energy Waveforms

PACKAGE MARKING AND ORDERING INFORMATION

Device	Package	Shipping [†]
ISL9V3040D3ST	DPAK (Pb-Free)	2500 Units/Tape & Reel
ISL9V3040S3ST	D2PAK (Pb-Free)	800 Units/Tape & Reel
ISL9V3040P3	TO220 (Pb-Free)	50 Units/Tube

+For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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