

ISL9V3036D3S / ISL9V3036S3S / ISL9V3036P3

EcoSPARK™ 300mJ, 360V, N-Channel Ignition IGBT

General Description

The ISL9V3036D3S, ISL9V3036S3S, and ISL9V3036P3 are the next generation 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. These devices are intended for use in automotive ignition circuits, specifically as a coil drivers. 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 49442

Applications

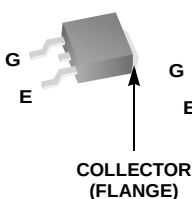
- Automotive Ignition Coil Driver Circuits
- Coil- On Plug Applications

Features

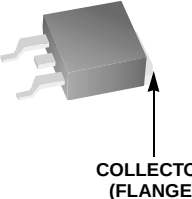
- Industry Standard D²-Pak package
- SCIS Energy = 300mJ at T_J = 25°C
- Logic Level Gate Drive

Package

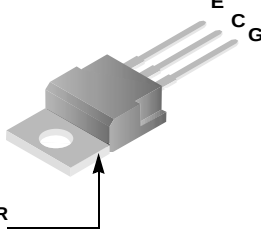
JEDEC TO-252AA
D-Pak



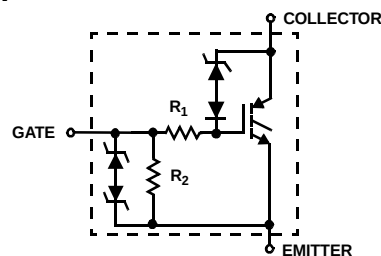
JEDEC TO-263AB
D²-Pak



JEDEC TO-220AB



Symbol



Device Maximum Ratings T_J = 25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
BV _{CER}	Collector to Emitter Breakdown Voltage (I _C = 1 mA)	360	V
BV _{ECS}	Emitter to Collector Voltage - Reverse Battery Condition (I _C = 10 mA)	24	V
E _{SCIS25}	T _J = 25°C, I _{SCIS} = 14.2A, L = 3.0 mHy	300	mJ
E _{SCIS150}	T _J = 150°C, I _{SCIS} = 10.6A, L = 3.0 mHy	170	mJ
I _{C25}	Collector Current Continuous, At T _C = 25°C, See Fig 9	21	A
I _{C110}	Collector Current Continuous, At T _C = 110°C, See Fig 9	17	A
V _{GEM}	Gate to Emitter Voltage Continuous	±10	V
P _D	Power Dissipation Total T _C = 25°C	150	W
	Power Dissipation Derating T _C > 25°C	1.0	W/°C
T _J	Operating Junction Temperature Range	-40 to 175	°C
T _{STG}	Storage Junction Temperature Range	-40 to 175	°C
T _L	Max Lead Temp for Soldering (Leads at 1.6mm from Case for 10s)	300	°C
T _{pkg}	Max Lead Temp for Soldering (Package Body for 10s)	260	°C
ESD	Electrostatic Discharge Voltage at 100pF, 1500Ω	4	kV

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
V3036D	ISL9V3036D3ST	TO-252AA	330mm	16mm	2500
V3036S	ISL9V3036S3ST	TO-263AB	330mm	24mm	800
V3036P	ISL9V3036P3	TO-220AA	Tube	N/A	50
V3036D	ISL9V3036D3S	TO-252AA	Tube	N/A	75
V3036S	ISL9V3036S3S	TO-263AB	Tube	N/A	50

Electrical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
--------	-----------	-----------------	-----	-----	-----	-------

Off State Characteristics

BV _{CER}	Collector to Emitter Breakdown Voltage	I _C = 2mA, V _{GE} = 0, R _G = 1KΩ, See Fig. 15 T _J = -40 to 150°C	330	360	390	V	
BV _{CES}	Collector to Emitter Breakdown Voltage	I _C = 10mA, V _{GE} = 0, R _G = 0, See Fig. 15 T _J = -40 to 150°C	350	380	410	V	
BV _{ECS}	Emitter to Collector Breakdown Voltage	I _C = -75mA, V _{GE} = 0V, T _C = 25°C	30	-	-	V	
BV _{GES}	Gate to Emitter Breakdown Voltage	I _{GES} = ± 2mA	±12	±14	-	V	
I _{CER}	Collector to Emitter Leakage Current	V _{CER} = 250V, R _G = 1KΩ See Fig. 11	T _C = 25°C	-	-	25	μA
		T _C = 150°C	-	-	1	mA	
I _{ECS}	Emitter to Collector Leakage Current	V _{EC} = 24V, See Fig. 11	T _C = 25°C	-	-	1	mA
			T _C = 150°C	-	-	40	mA
R ₁	Series Gate Resistance		-	70	-	Ω	
R ₂	Gate to Emitter Resistance		10K	-	26K	Ω	

On State Characteristics

$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_C = 6\text{A}$, $V_{GE} = 4\text{V}$	$T_C = 25^\circ\text{C}$, See Fig. 3	-	1.25	1.60	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_C = 10\text{A}$, $V_{GE} = 4.5\text{V}$	$T_C = 150^\circ\text{C}$, See Fig. 4	-	1.58	1.80	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_C = 15\text{A}$, $V_{GE} = 4.5\text{V}$	$T_C = 150^\circ\text{C}$	-	1.90	2.20	V

Dynamic Characteristics

Q _{G(ON)}	Gate Charge	I _C = 10A, V _{CE} = 12V, V _{GE} = 5V, See Fig. 14		-	17	-	nC
V _{GE(TH)}	Gate to Emitter Threshold Voltage	I _C = 1.0mA, V _{CE} = V _{GE} , See Fig. 10	T _C = 25°C	1.3	-	2.2	V
			T _C = 150°C	0.75	-	1.8	V
V _{GEP}	Gate to Emitter Plateau Voltage	I _C = 10A, V _{CE} = 12V		-	3.0	-	V

Switching Characteristics

$t_{d(ON)R}$	Current Turn-On Delay Time-Resistive	$V_{CE} = 14\text{V}$, $R_L = 1\Omega$ $V_{GE} = 5\text{V}$, $R_G = 1\text{K}\Omega$ $T_J = 25^\circ\text{C}$, See Fig. 12	-	0.7	4	μs
t_{rR}	Current Rise Time-Resistive		-	2.1	7	μs
$t_{d(OFF)L}$	Current Turn-Off Delay Time-Inductive	$V_{CE} = 300\text{V}$, $R_L = 500\mu\text{H}$, $V_{GE} = 5\text{V}$, $R_G = 1\text{K}\Omega$ $T_J = 25^\circ\text{C}$, See Fig. 12	-	4.8	15	μs
t_{fL}	Current Fall Time-Inductive		-	2.8	15	μs
SCIS	Self Clamped Inductive Switching	$T_J = 25^\circ\text{C}$, $L = 3.0\text{mH}$, $R_G = 1\text{K}\Omega$, $V_{GE} = 5\text{V}$	-	-	300	mJ

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction-Case	TO-252, TO-263, TO-220	-	-	1.0	$^\circ\text{C/W}$
-----------------	----------------------------------	------------------------	---	---	-----	--------------------

Typical Performance Curves

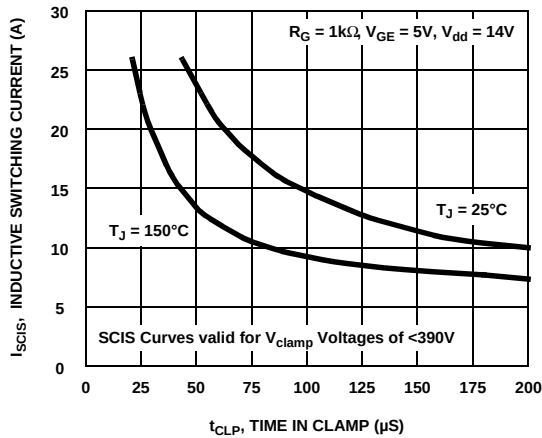


Figure 1. Self Clamped Inductive Switching Current vs Time in Clamp

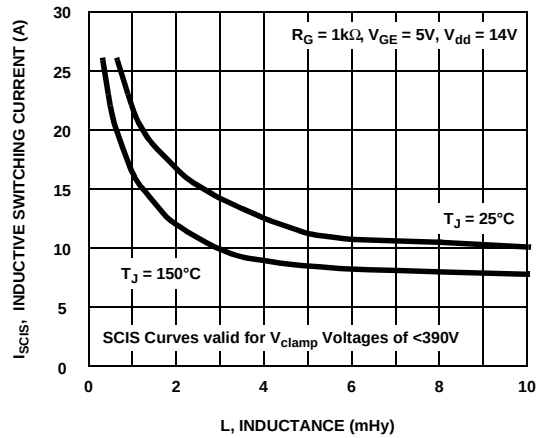


Figure 2. Self Clamped Inductive Switching Current vs Inductance

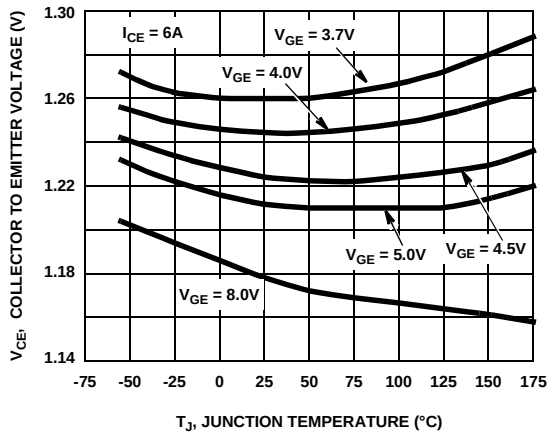


Figure 3. Collector to Emitter On-State Voltage vs Junction Temperature

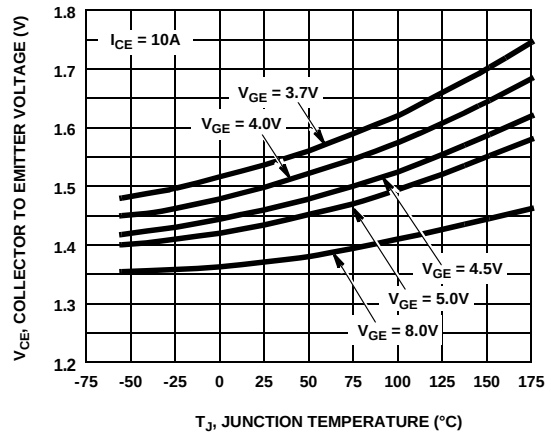


Figure 4. Collector to Emitter On-State Voltage vs Junction Temperature

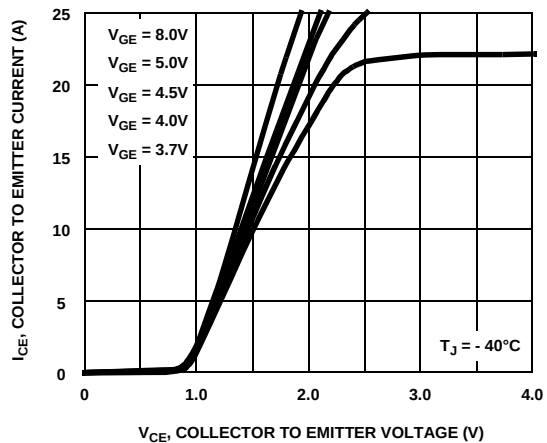


Figure 5. Collector to Emitter On-State Voltage vs Collector Current

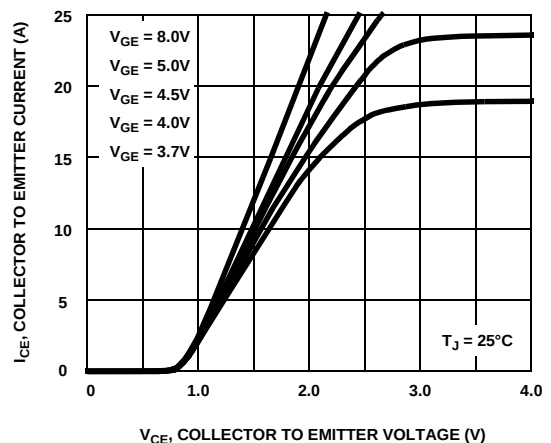


Figure 6. Collector to Emitter On-State Voltage vs Collector Current

Typical Performance Curves (Continued)

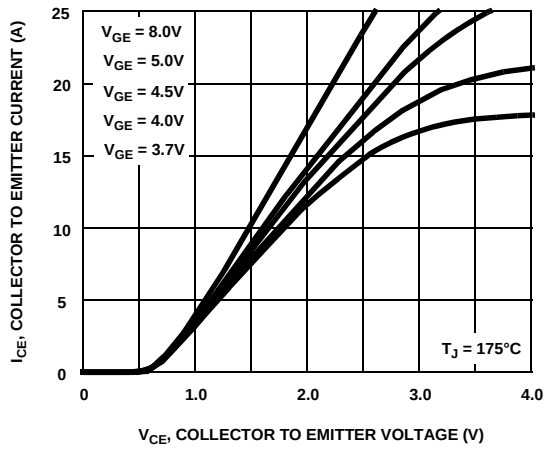


Figure 7. Collector to Emitter On-State Voltage vs Collector Current

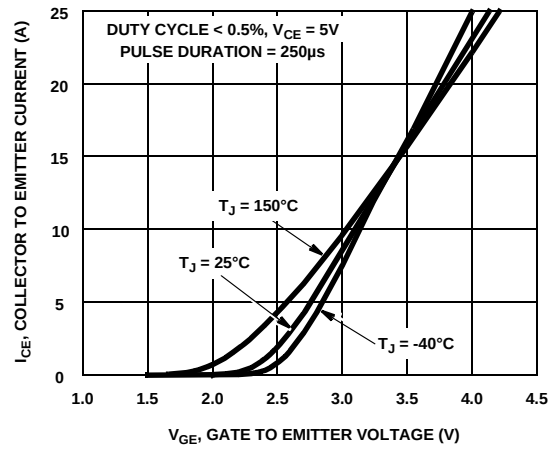


Figure 8. Transfer Characteristics

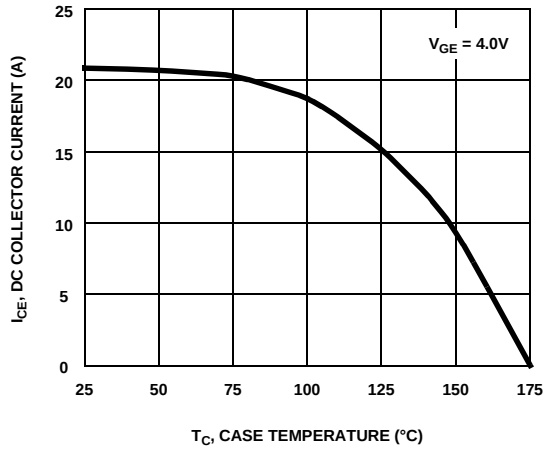


Figure 9. DC Collector Current vs Case Temperature

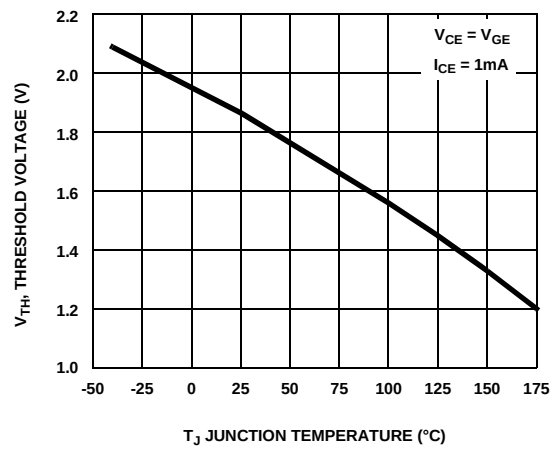


Figure 10. Threshold Voltage vs Junction Temperature

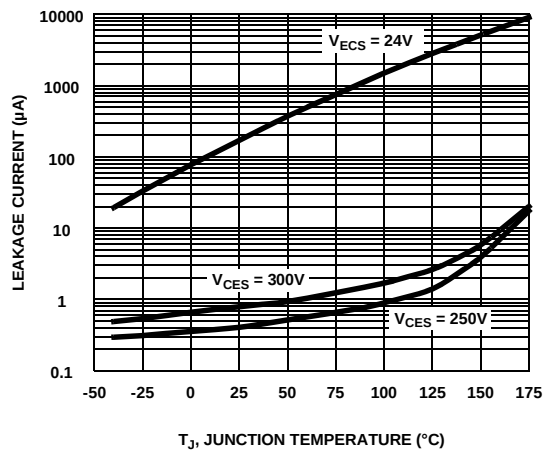


Figure 11. Leakage Current vs Junction Temperature

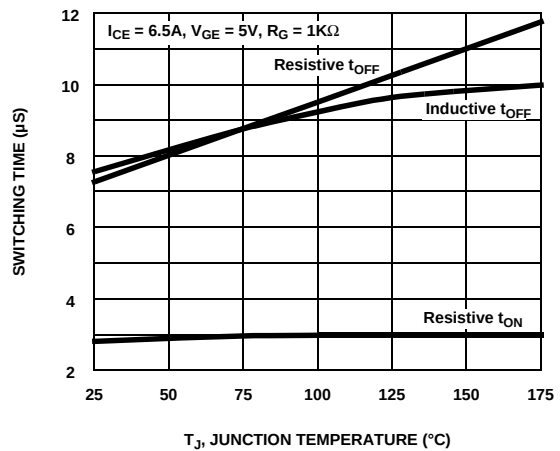


Figure 12. Switching Time vs Junction Temperature

Typical Performance Curves (Continued)

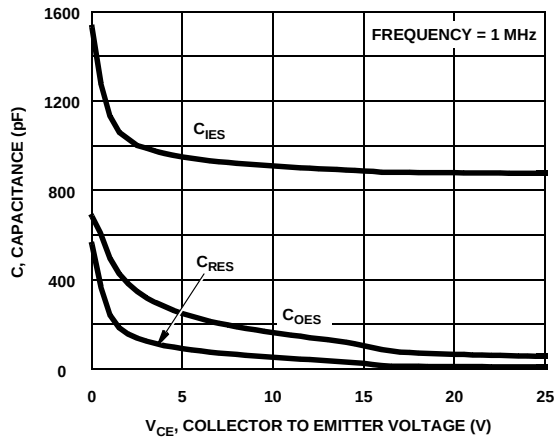


Figure 13. Capacitance vs Collector to Emitter Voltage

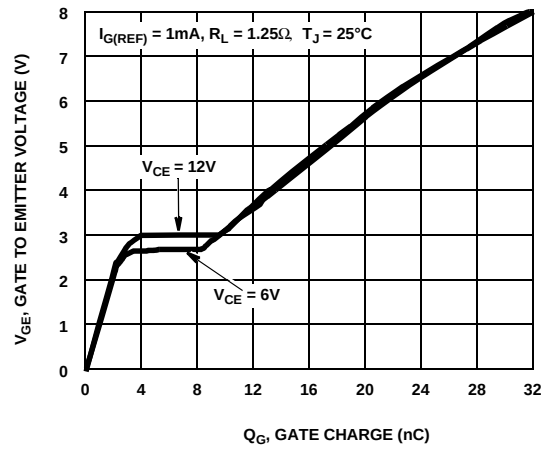


Figure 14. Gate Charge

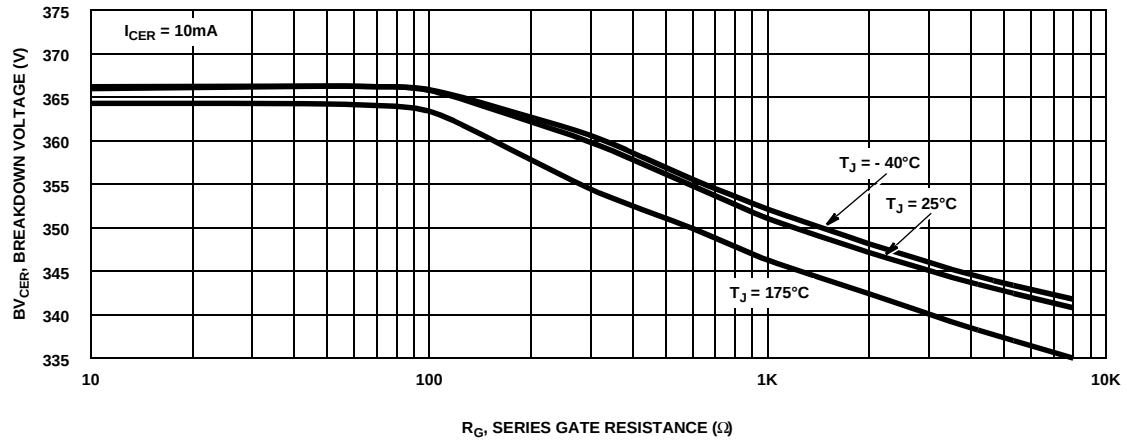


Figure 15. Breakdown Voltage vs Series Gate Resistance

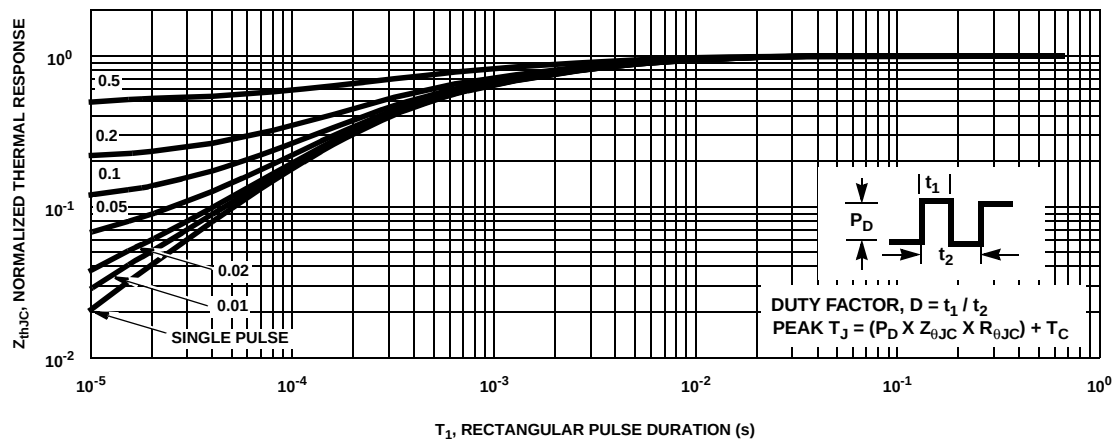


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

Test Circuit and Waveforms

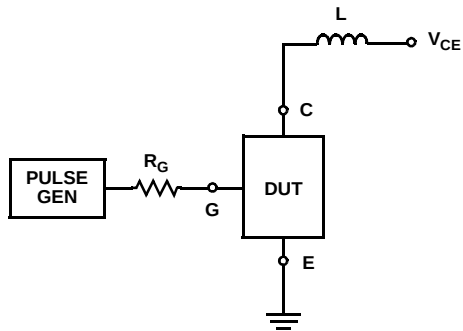


Figure 17. Inductive Switching Test Circuit

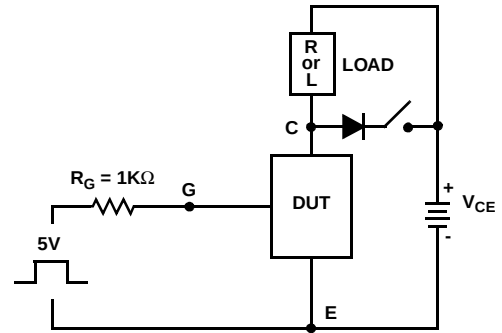


Figure 18. t_{ON} and t_{OFF} Switching Test Circuit

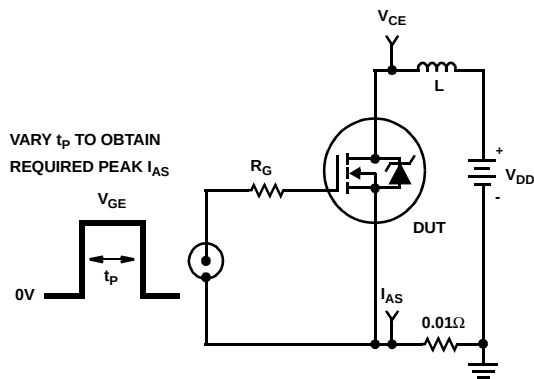


Figure 19. Unclamped Energy Test Circuit

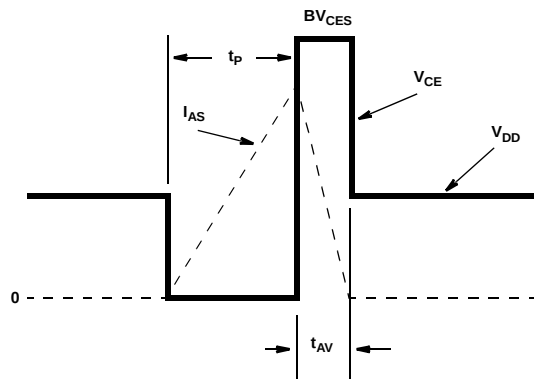


Figure 20. Unclamped Energy Waveforms

SPICE Thermal Model

REV 24 April 2002

ISL9V3036D3S/ ISL9V3036S3S / ISL9V3036P3

CTHERM1 th 6 2.1e -3
CTHERM2 6 5 1.4e -1
CTHERM3 5 4 7.3e -3
CTHERM4 4 3 2.1e -1
CTHERM5 3 2 1.1e -1
CTHERM6 2 tl 6.2e +6

RTHERM1 th 6 1.2e -1
RTHERM2 6 5 1.9e -1
RTHERM3 5 4 2.2e -1
RTHERM4 4 3 6.0e -2
RTHERM5 3 2 5.8e -2
RTHERM6 2 tl 1.6e -3

SABER Thermal Model

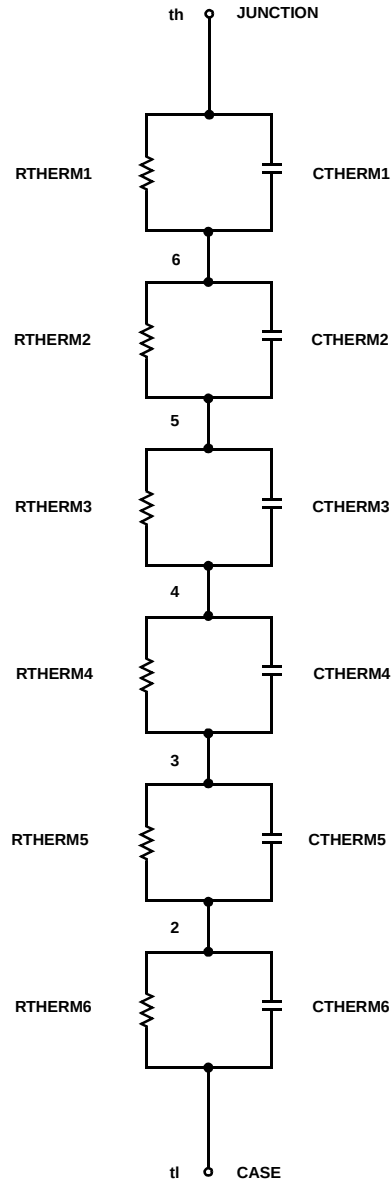
SABER thermal model

ISL9V3036D3S / ISL9V3036S3S / ISL9V3036P3

template thermal_model th tl
thermal_c th, tl

```
{
  ctherm.ctherm1 th 6 = 2.1e -3
  ctherm.ctherm2 6 5 = 1.4e -1
  ctherm.ctherm3 5 4 = 7.3e -3
  ctherm.ctherm4 4 3 = 2.2e -1
  ctherm.ctherm5 3 2 = 1.1e -1
  ctherm.ctherm6 2 tl = 6.2e +6
}
```

```
rtherm.rtherm1 th 6 = 1.2e -1
rtherm.rtherm2 6 5 = 1.9e -1
rtherm.rtherm3 5 4 = 2.2e -1
rtherm.rtherm4 4 3 = 6.0e -2
rtherm.rtherm5 3 2 = 5.8e -2
rtherm.rtherm6 2 tl = 1.6e -3
}
```



TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACE ^{Ex} TM	FAST [®]	ISOPLANAR TM	Power247 TM	Stealth TM
ActiveArray TM	FAST ^r TM	LittleFET TM	PowerEdge TM	SuperFET TM
Bottomless TM	FPS TM	MICROCOUPLER TM	PowerSaver TM	SuperSOT TM -3
CoolFET TM	FRFET TM	MicroFET TM	PowerTrench [®]	SuperSOT TM -6
CROSSVOLT TM	GlobalOptoisolator TM	MicroPak TM	QFET [®]	SuperSOT TM -8
DOME TM	GTO TM	MICROWIRE TM	QS TM	SyncFET TM
EcoSPARK TM	HiSeC TM	MSX TM	QT Optoelectronics TM	TinyLogic [®]
E ² CMOS TM	I ² C TM	MSXPro TM	Quiet Series TM	TINYOPTO TM
EnSigna TM	i-Lo TM	OCX TM	RapidConfigure TM	TruTranslation TM
FACT TM	ImpliedDisconnect TM	OCXPro TM	RapidConnect TM	UHC TM
FACT Quiet Series TM		OPTOLOGIC [®]	μSerDes TM	UltraFET [®]
Across the board. Around the world. TM		OPTOPLANAR TM	SILENT SWITCHER [®]	VCX TM
The Power Franchise [®]		PACMAN TM	SMART START TM	
Programmable Active Droop TM		POP TM	SPM TM	

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.