

# ISL9R1560G2, ISL9R1560P2, ISL9R1560S2, ISL9R1560S3S 15 A, 600 V, STEALTH™ Diode

## Features

- Stealth Recovery  $t_{rr} = 29.4 \text{ ns}$  (@  $I_F = 15 \text{ A}$ )
- Max Forward Voltage,  $V_F = 2.2 \text{ V}$  (@  $T_C = 25^\circ\text{C}$ )
- 600 V Reverse Voltage and High Reliability
- Avalanche Energy Rated
- RoHS Compliant

## Applications

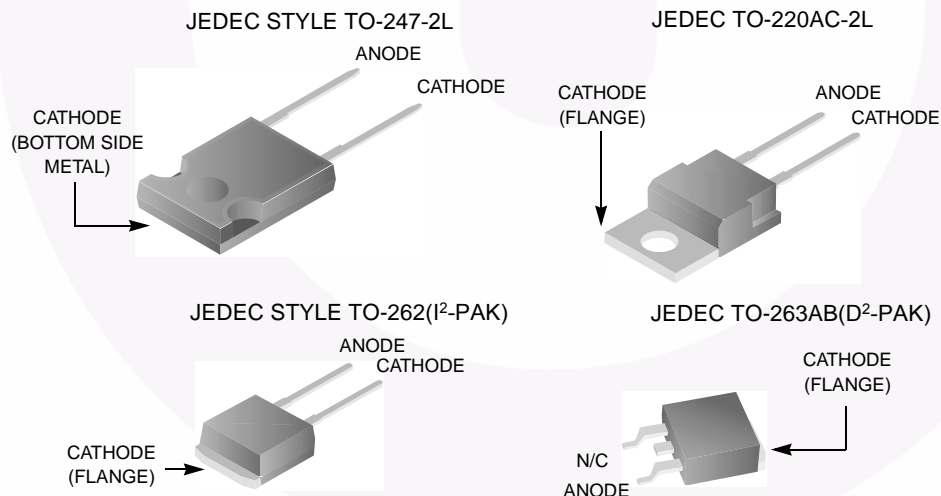
- SMPS
- Hard Switched PFC Boost Diode
- UPS Free Wheeling Diode
- Motor Drive FWD
- SMPS FWD
- Snubber Diode

## Description

The ISL9R1560G2, ISL9R1560P2, ISL9R1560S2, ISL9R1560S3S is a STEALTH™ diode optimized for low loss performance in high frequency hard switched applications. The STEALTH™ family exhibits low reverse recovery current ( $I_{rr}$ ) and exceptionally soft recovery under typical operating conditions. This device is intended for use as a free wheeling or boost diode in power supplies and other power switching applications. The low  $I_{rr}$  and short  $t_a$  phase reduce loss in switching transistors. The soft recovery minimizes ringing, expanding the range of conditions under which the diode may be operated without the use of additional snubber circuitry. Consider using the STEALTH™ diode with an SMPS IGBT to provide the most efficient and highest power density design at lower cost.

## Package

## Symbol



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

Symbol	Parameter	Ratings	Unit
$V_{RRM}$	Repetitive Peak Reverse Voltage	600	V
$V_{RWM}$	Working Peak Reverse Voltage	600	V
$V_R$	DC Blocking Voltage	600	V
$I_{F(AV)}$	Average Rectified Forward Current ( $T_C = 145^\circ\text{C}$ )	15	A
$I_{FRM}$	Repetitive Peak Surge Current (20kHz Square Wave)	30	A
$I_{FSM}$	Nonrepetitive Peak Surge Current (Halfwave 1 Phase 60Hz)	200	A

Symbol	Parameter	Ratings	Unit
$P_D$	Power Dissipation	150	W
$E_{AVL}$	Avalanche Energy (1 A, 40 mH)	20	mJ
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to 175	°C
$T_L$	Maximum Temperature for Soldering	300	°C
$T_{PKG}$	Leads at 0.063in (1.6mm) from Case for 10s Package Body for 10s, See Techbrief TB334	260	°C

CAUTION: Stresses above those listed in "Device Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
ISL9R1560G2	ISL9R1560G2	TO-247-2L	Tube	N/A	N/A	30
ISL9R1560P2	ISL9R1560P2	TO-220AC-2L	Tube	N/A	N/A	50
ISL9R1560S2	ISL9R1560S2	TO-262(I <sup>2</sup> -PAK)	Tube	N/A	N/A	50
ISL9R1560S3ST	ISL9R1560S3S	TO-263(D <sup>2</sup> -PAK)	Reel	13" dia	24mm	800

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

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

#### Off State Characteristics

$I_R$	Instantaneous Reverse Current	$V_R = 600\text{ V}$	$T_C = 25^\circ\text{C}$	-	-	100	$\mu\text{A}$
			$T_C = 125^\circ\text{C}$	-	-	1.0	mA

#### On State Characteristics

$V_F$	Instantaneous Forward Voltage	$I_F = 15\text{ A}$	$T_C = 25^\circ\text{C}$	-	1.8	2.2	V
			$T_C = 125^\circ\text{C}$	-	1.65	2.0	V

#### Dynamic Characteristics

$C_J$	Junction Capacitance	$V_R = 10\text{ V}, I_F = 0\text{ A}$	-	62	-	pF
-------	----------------------	---------------------------------------	---	----	---	----

#### Switching Characteristics

$t_{rr}$	Reverse Recovery Time	$I_F = 1\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}, V_R = 30\text{ V}$	-	25	30	ns
		$I_F = 15\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}, V_R = 30\text{ V}$	-	35	40	ns
$t_{rr}$	Reverse Recovery Time	$I_F = 15\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}, V_R = 390\text{ V}, T_C = 25^\circ\text{C}$	-	29.4	-	ns
$I_{rr}$	Reverse Recovery Current		-	3.5	-	A
$Q_{rr}$	Reverse Recovered Charge		-	57	-	nC
$t_{rr}$	Reverse Recovery Time	$I_F = 15\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}, V_R = 390\text{ V}, T_C = 125^\circ\text{C}$	-	90	-	ns
$S$	Softness Factor ( $t_b/t_a$ )		-	2.0	-	
$I_{rr}$	Reverse Recovery Current		-	5.0	-	A
$Q_{rr}$	Reverse Recovered Charge		-	275	-	nC
$t_{rr}$	Reverse Recovery Time	$I_F = 15\text{ A}, di_F/dt = 800\text{ A}/\mu\text{s}, V_R = 390\text{ V}, T_C = 125^\circ\text{C}$	-	52	-	ns
$S$	Softness Factor ( $t_b/t_a$ )		-	1.36	-	
$I_{rr}$	Reverse Recovery Current		-	13.5	-	A
$Q_{rr}$	Reverse Recovered Charge		-	390	-	nC
$di_M/dt$	Maximum $di/dt$ during $t_b$		-	800	-	A/ $\mu\text{s}$

#### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction to Case		-	-	1.0	°C/W
$R_{\theta JA}$	Thermal Resistance Junction to Ambient	TO-247	-	-	30	°C/W
$R_{\theta JA}$	Thermal Resistance Junction to Ambient	TO-220	-	-	62	°C/W
$R_{\theta JA}$	Thermal Resistance Junction to Ambient	TO-262	-	-	62	°C/W
$R_{\theta JA}$	Thermal Resistance Junction to Ambient	TO-263	-	-	62	°C/W

## Typical Performance Curves

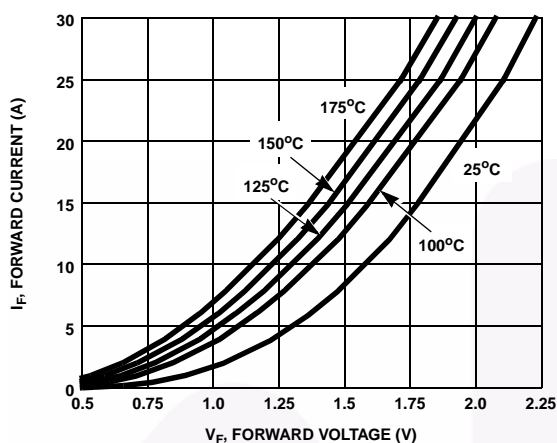


Figure 1. Forward Current vs Forward Voltage

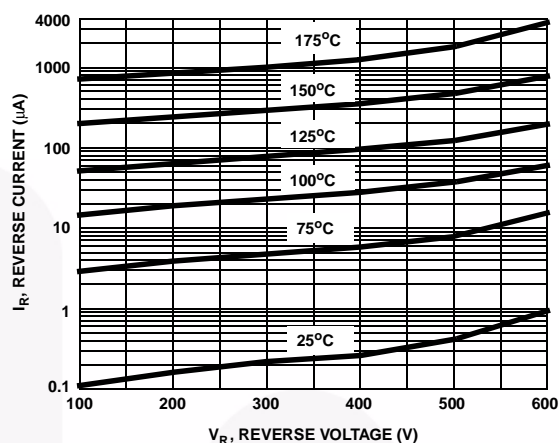


Figure 2. Reverse Current vs Reverse Voltage

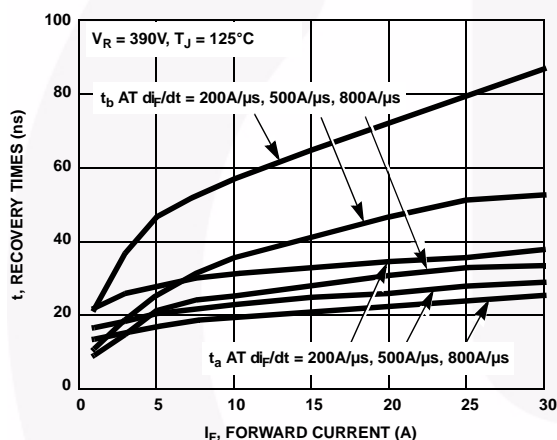


Figure 3.  $t_a$  and  $t_b$  Curves vs Forward Current

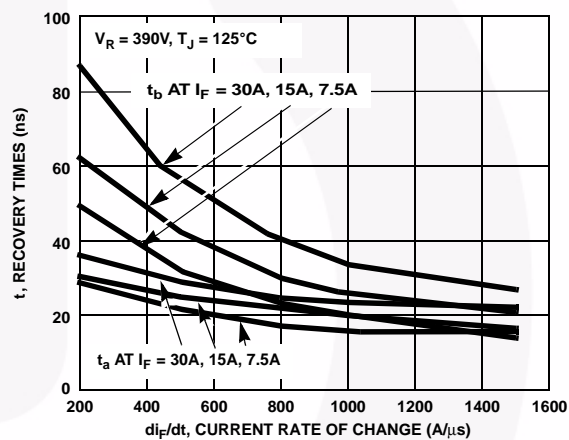


Figure 4.  $t_a$  and  $t_b$  Curves vs  $di_F/dt$

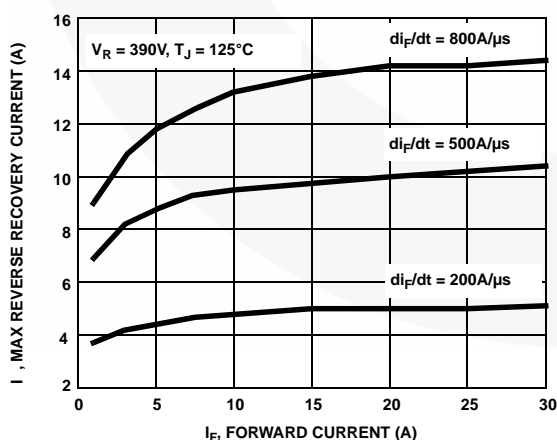


Figure 5. Maximum Reverse Recovery Current vs Forward Current

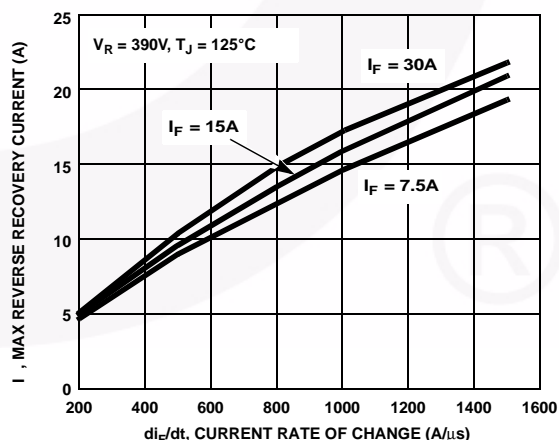


Figure 6. Maximum Reverse Recovery Current vs  $di_F/dt$

# Typical Performance Curves (Continued)

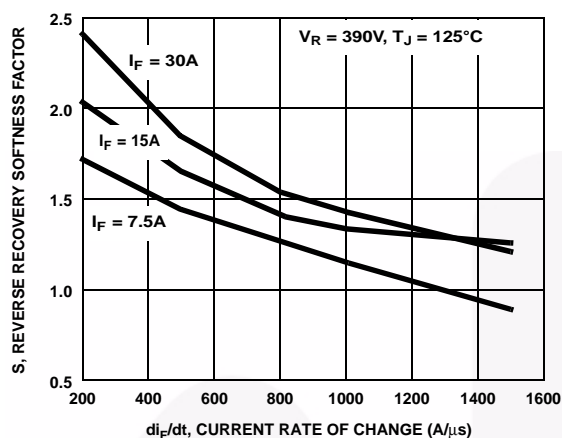


Figure 7. Reverse Recovery Softness Factor vs  $di_F/dt$

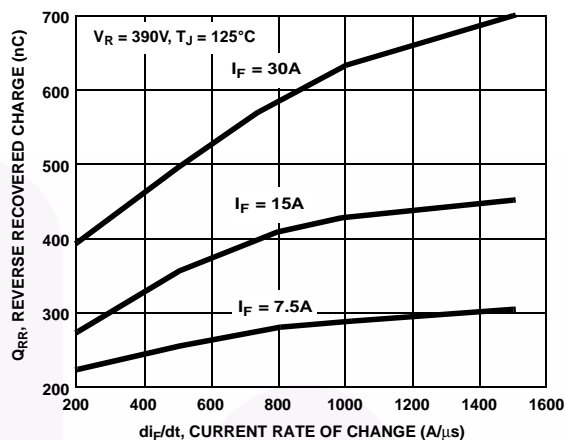


Figure 7. Reverse Recovered Charge vs  $di_F/dt$

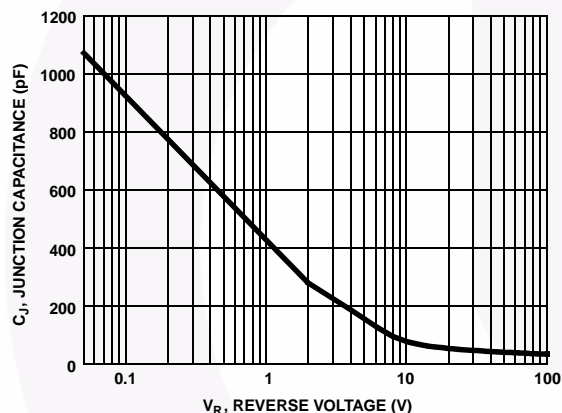


Figure 9. Junction Capacitance vs Reverse Voltage

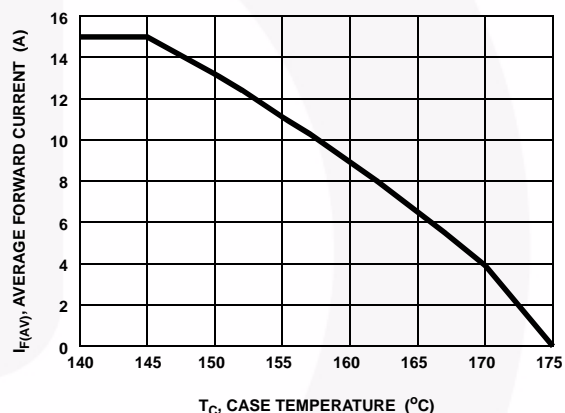


Figure 10. DC Current Derating Curve vs Case Temperature

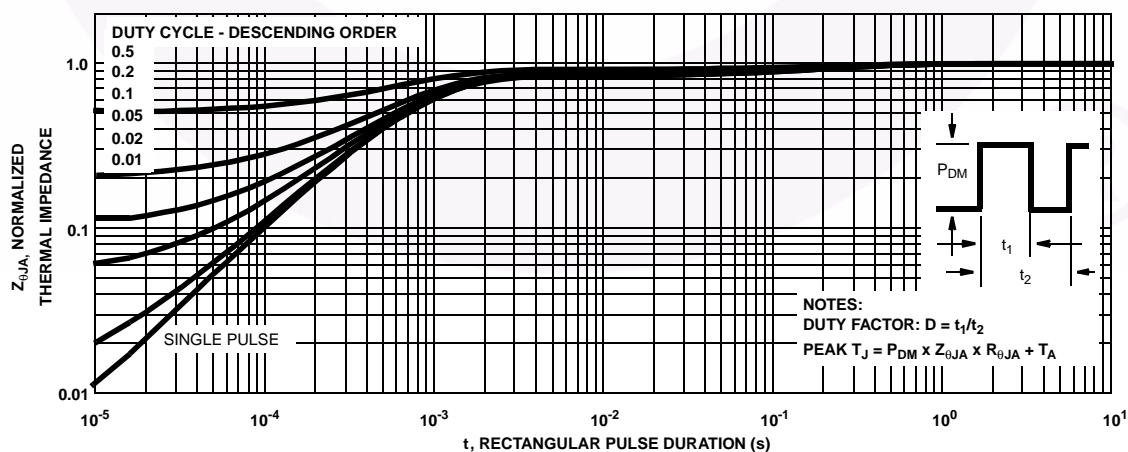


Figure 11. Normalized Maximum Transient Thermal Impedance

## Test Circuit and Waveforms

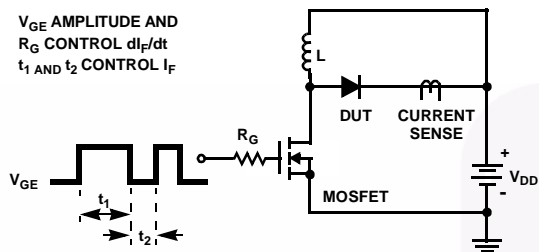


Figure 12.  $t_{rr}$  Test Circuit

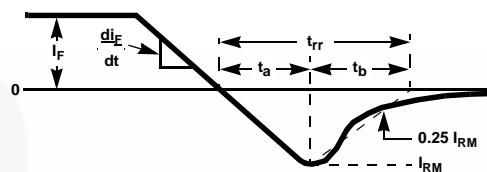


Figure 13.  $t_{rr}$  Waveforms and Definitions

$I = 1\text{ A}$   
 $L = 40\text{ mH}$   
 $R < 0.1\ \Omega$   
 $V_{DD} = 50\text{ V}$   
 $E_{AVL} = 1/2LI^2 [V_{R(AVL)} / (V_{R(AVL)} - V_{DD})]$   
 $Q_1 = \text{IGBT (BV}_{CES} > \text{DUT } V_{R(AVL)})$

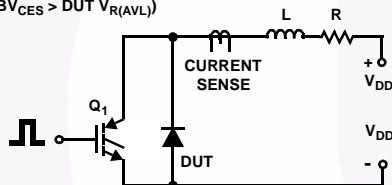


Figure 14. Avalanche Energy Test Circuit

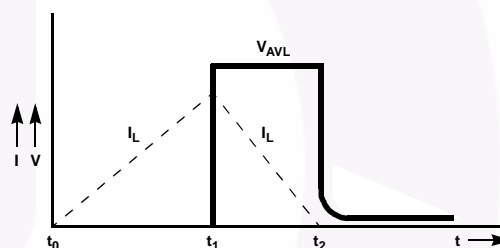
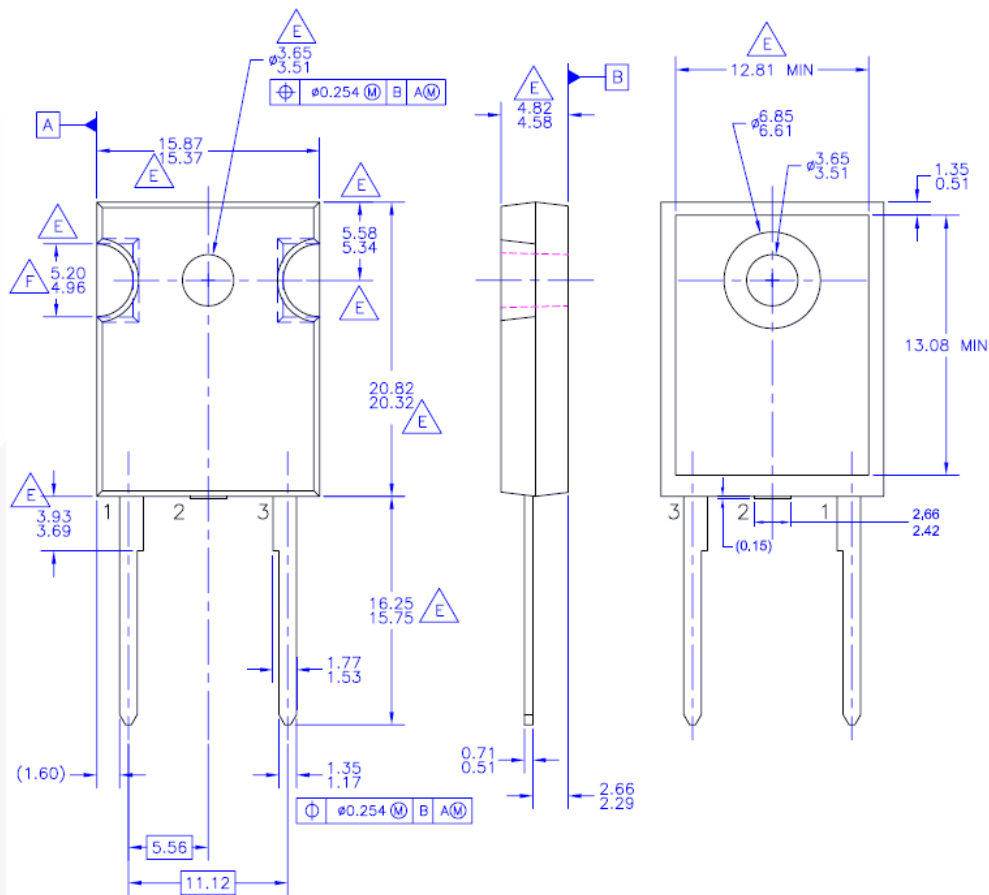


Figure 15. Avalanche Current and Voltage Waveforms

## Mechanical Dimensions



- NOTES: UNLESS OTHERWISE SPECIFIED
- A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
  - B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
  - C. ALL DIMENSIONS ARE IN MILLIMETERS.
  - D. DRAWING CONFORMS TO ASME Y14.5 - 1994
  - E. DOES NOT COMPLY JEDEC STANDARD VALUE
  - F. NOTCH MAY BE SQUARE
  - G. DRAWING FILENAME: MKT-TO247B02\_REV02

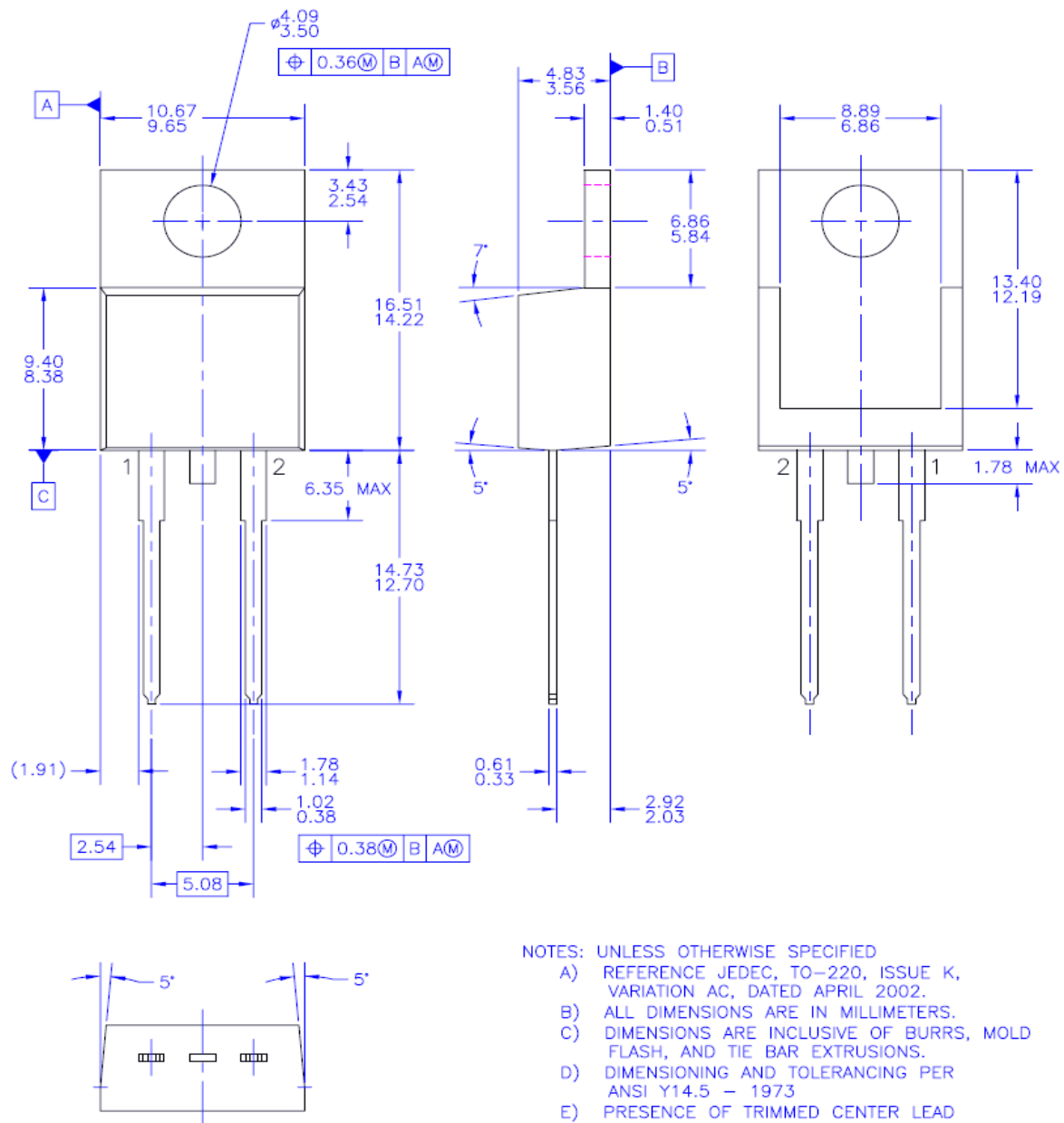
**Figure 16. TO-247 2L - TO247,MOLDED,2LD, JEDEC OPTION AB**

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

[http://www.fairchildsemi.com/package/packageDetails.html?id=PN\\_TO247-002](http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TO247-002)

## Mechanical Dimensions



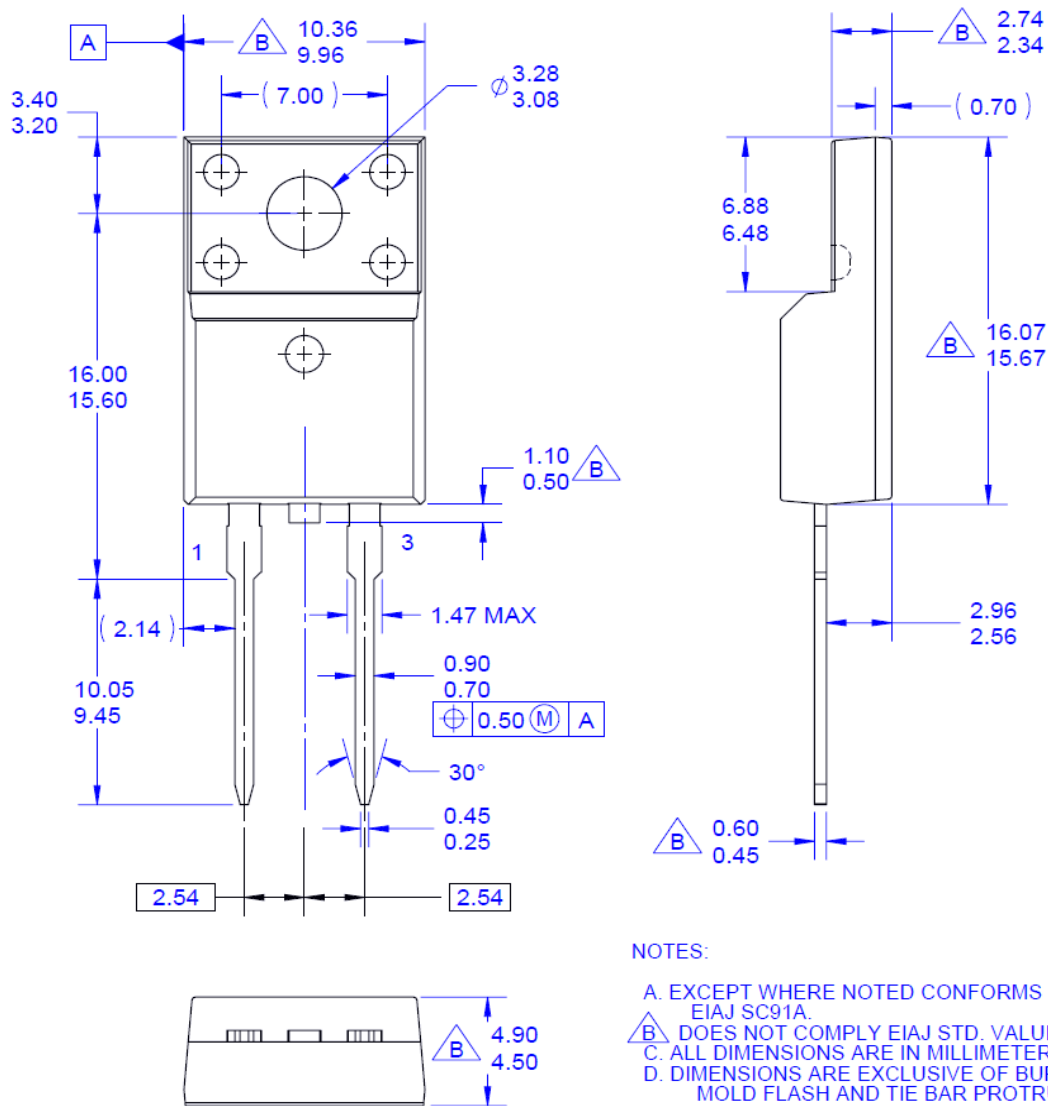
**Figure 1 . TO-220 2L - 2LD, TO220, JEDEC TO-220 VARIATION AC**

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

[http://www.fairchildsemi.com/package/packageDetails.html?id=PN\\_TT220-0B2](http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TT220-0B2)

## Mechanical Dimensions



### NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- B. DOES NOT COMPLY EIAJ STD. VALUE.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- F. DRAWING FILE NAME: TO220C02REV2

**Figure 1 . TO-220F 2L - 2LD; TO220; MOLDED; FULL PACK**

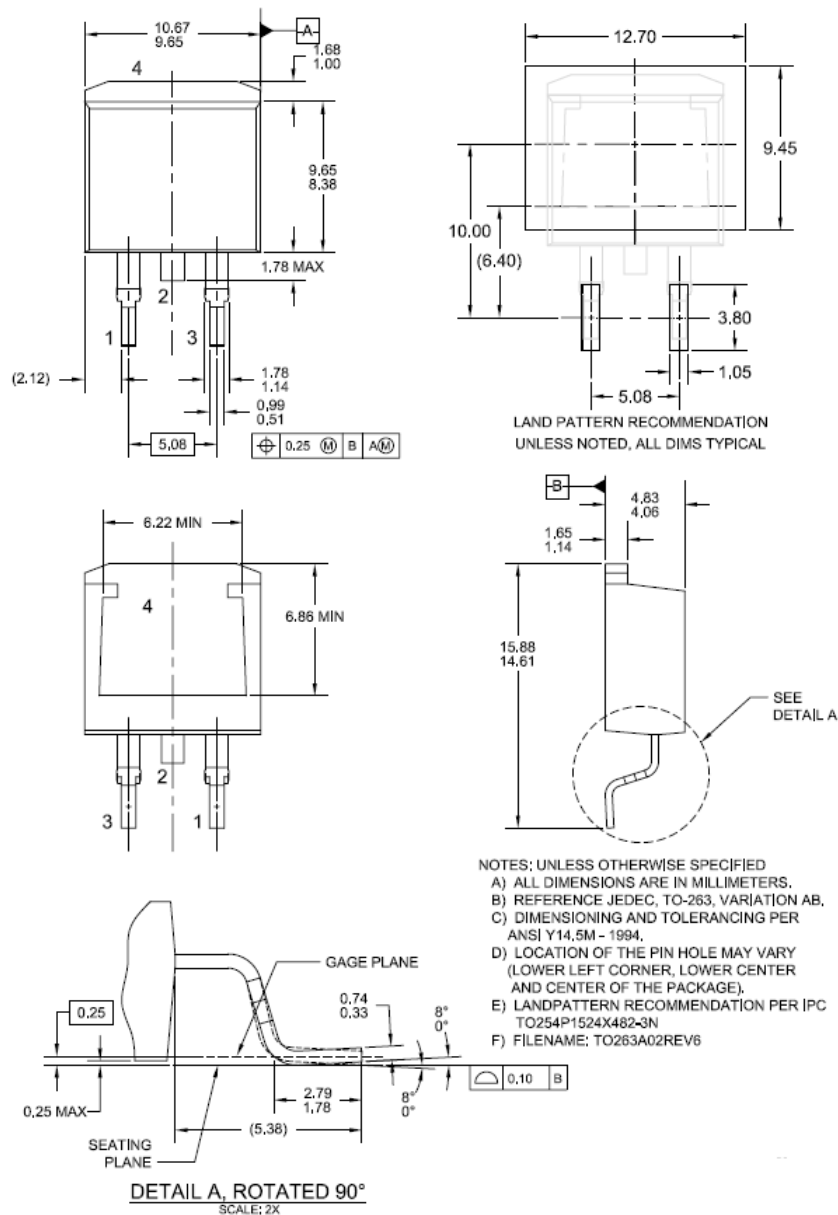
Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

[http://www.fairchildsemi.com/package/packageDetails.html?id=PN\\_TF220-002](http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TF220-002)



## Me i Dimensions



**Figure 19. TO-263 2L (D2PAK) - 2LD, TO263, SURFACE MOUNT**

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

[http://www.fairchildsemi.com/package/packageDetails.html?id=PN\\_TT263-002](http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TT263-002)

## TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

AccuPower™	F-PFST™	PowerTrench®	Sync-Lock™
AX-CAP®*	FRFET®	PowerXS™	SYSTEM GENERAL®*
BitSiC™	Global Power ResourceSM	Programmable Active Droop™	TinyBoost®
Build it Now™	GreenBridge™	QFET®	TinyBuck™
CorePLUS™	Green FPS™	QS™	TinyCalc™
CorePOWER™	Green FPS™ e-Series™	Quiet Series™	TinyLogic®
CROSSVOLT™	Gmax™	RapidConfigure™	TINYOPTO™
CTL™	GTO™	Saving our world, 1mW/W/kW at a time™	TinyPower™
Current Transfer Logic™	IntelliMAX™	SignalWise™	TinyPWM™
DEUXPEED®	ISOPLANAR™	SmartMax™	TinyWire™
Dual Cool™	Marking Small Speakers Sound Louder and Better™	SMART START™	TranSiC™
EcoSPARK®	MegaBuck™	Solutions for Your Success™	TriFault Detect™
EfficientMax™	MICROCOUPLER™	SPM®	TRUECURRENT®*
ESBC™	MicroFET™	STEALTH™	µSerDes™
F®	MicroPak™	SuperFET®	UHC®
Fairchild®	MicroPak2™	SuperSOT™-3	Ultra FRFET™
Fairchild Semiconductor®	MillerDrive™	SuperSOT™-6	UniFET™
FACT Quiet Series™	MotionMax™	SuperSOT™-8	VCX™
FACT®	mWSaver®	SupreMOS®	VisualMax™
FAST®	OptoHit™	SyncFET™	VoltagePlus™
FastvCore™	OPTOLOGIC®		XS™
FETBench™	OPTOPLANAR®		
FPS™			

\*Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

## 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. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

## 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 here in:

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, and (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 a significant injury of the user.
2. A critical component in 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.

## ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, [www.fairchildsemi.com](http://www.fairchildsemi.com), under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufactures of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address and warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

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

Rev. I66