FAIRCHILD
SEMICONDUCTOR™

July 2000

FDG313N

Digital FET, N-Channel

General Description

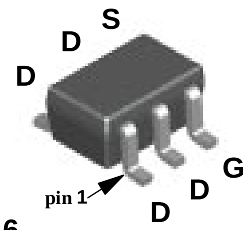
This N-Channel enhancement mode field effect transistor is produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance. This device has been designed especially for low voltage applications as a replacement for bipolar digital transistor and small signal MOSFET.

Applications

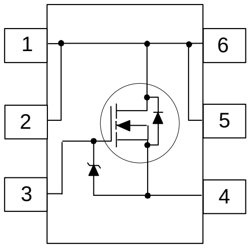
- Load switch
- Battery protection
- Power management

Features

- 0.95 A, 25 V. $R_{DS(on)} = 0.45\ \Omega$ @ $V_{GS} = 4.5$ V
  $R_{DS(on)} = 0.60\ \Omega$ @ $V_{GS} = 2.7$ V.
- Low gate charge (1.64 nC typical)
- Very low level gate drive requirements allowing direct operation in 3V circuits ($V_{GS(th)} < 1.5$V).
- Gate-Source Zener for ESD ruggedness (>6kV Human Body Model).
- Compact industry standard SC70-6 surface mount package.



SC70-6



Absolute Maximum Ratings

$T_A = 25°C$ unless otherwise noted

Symbol	Parameter		FDG313N	Units
V_{DSS}	Drain-Source Voltage		25	V
V_{GSS}	Gate-Source Voltage		± 8	V
I_D	Drain Current - Continuous	(Note 1a)	0.95	A
	- Pulsed		2	
P_D	Power Dissipation for Single Operation	(Note 1a)	0.75	W
		(Note 1b)	0.55	
		(Note 1c)	0.48	
T_J, T_{stg}	Operating and Storage Junction Temperature Range		-55 to +150	°C
ESD	Electrostatic Discharge Rating MIL-STD-883D Human Body Model (100pf / 1500 Ohm)		6	kV

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1c)	260	°C/W

Package Outlines and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
.13	FDG313N	7”	8mm	3000 units

DMOS Electrical Characteristics

T_A = 25°C unless otherwise noted

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	25			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		30		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 20 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate-Body Leakage Current	V_{GS} = 8 V, V_{DS} = 0 V			100	nA

On Characteristics (Note 2)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	0.65	0.8	1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		-2		mV/°C
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 4.5 V, I_D = 0.5 A V_{GS} = 4.5 V, I_D = 0.5 A @ 125°C V_{GS} = 2.7 V, I_D = 0.2 A		0.35 0.53 0.45	0.45 0.76 0.6	Ω
$I_{D(on)}$	On-State Drain Current	V_{GS} = 4.5 V, V_{DS} = 5 V	0.5			A
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 0.5 A		1.5		S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 10 V, V_{GS} = 0 V, f = 1.0 MHz		50		pF
C_{oss}	Output Capacitance			28		pF
C_{rss}	Reverse Transfer Capacitance			9		pF

Switching Characteristics (Note 2)

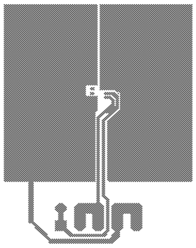
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 6 V, I_D = 0.5 A, V_{GS} = 4.5 V, R_{GEN} = 50 Ω		3	6	ns
t_r	Turn-On Rise Time			8.5	18	ns
$t_{d(off)}$	Turn-Off Delay Time			17	30	ns
t_f	Turn-Off Fall Time			13	25	ns
Q_g	Total Gate Charge	V_{DS} = 5 V, I_D = 0.95 A, V_{GS} = 4.5 V		1.64	2.3	nC
Q_{gs}	Gate-Source Charge			0.38		nC
Q_{gd}	Gate-Drain Charge			0.45		nC

Drain-Source Diode Characteristics and Maximum Ratings

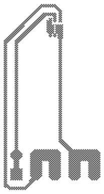
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_S	Maximum Continuous Drain-Source Diode Forward Current				0.6	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 0.6 A (Note 2)		0.8	1.2	V

Notes:

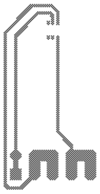
1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.



a) 170°C/W when mounted on a 1 in^2 pad of 2oz copper.



b) 225°C/W when mounted on a half of package sized 2oz. copper.



c) 260°C/W when mounted on a minimum pad of 2oz copper.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%

Typical Characteristics

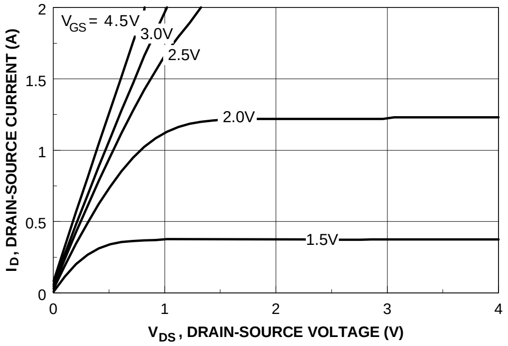


Figure 1. On-Region Characteristics.

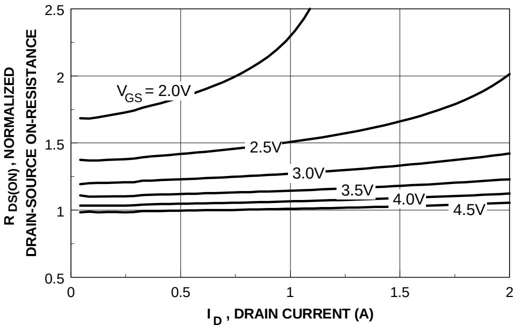


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

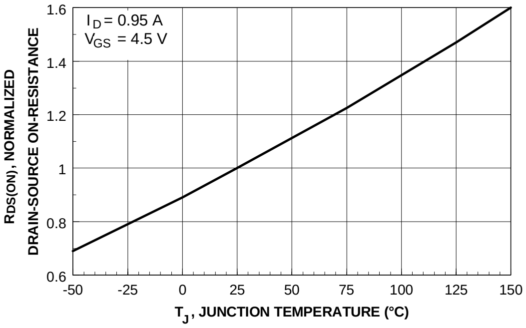


Figure 3. On-Resistance Variation with Temperature.

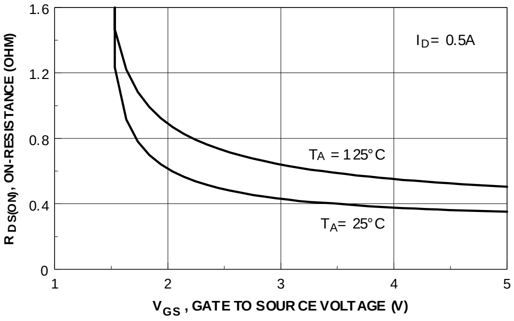


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

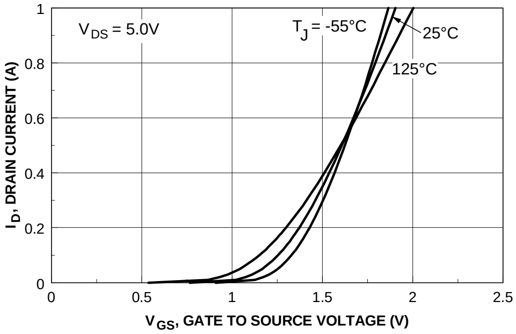


Figure 5. Transfer Characteristics.

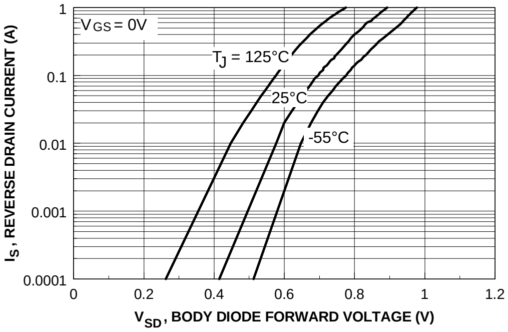


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

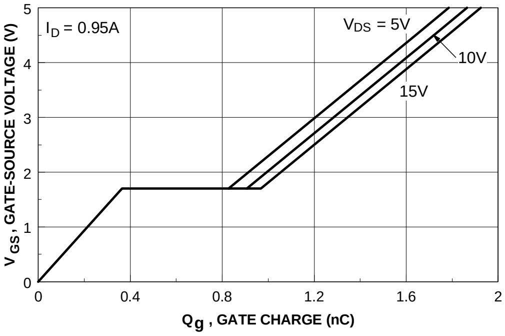


Figure 7. Gate-Charge Characteristics.

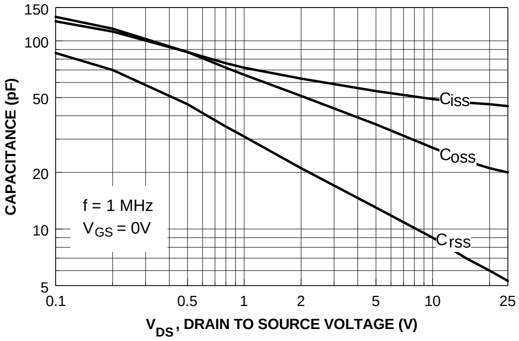


Figure 8. Capacitance Characteristics.

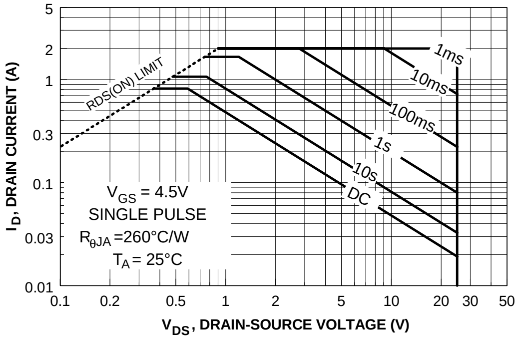


Figure 9. Maximum Safe Operating Area.

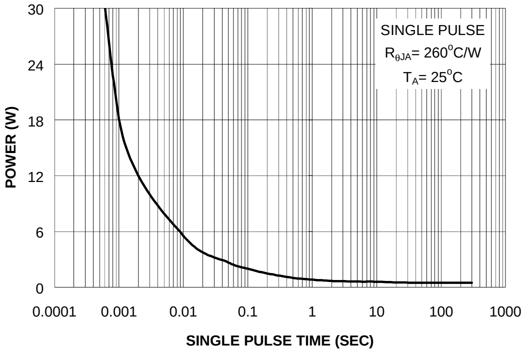


Figure 10. Single Pulse Maximum Power Dissipation.

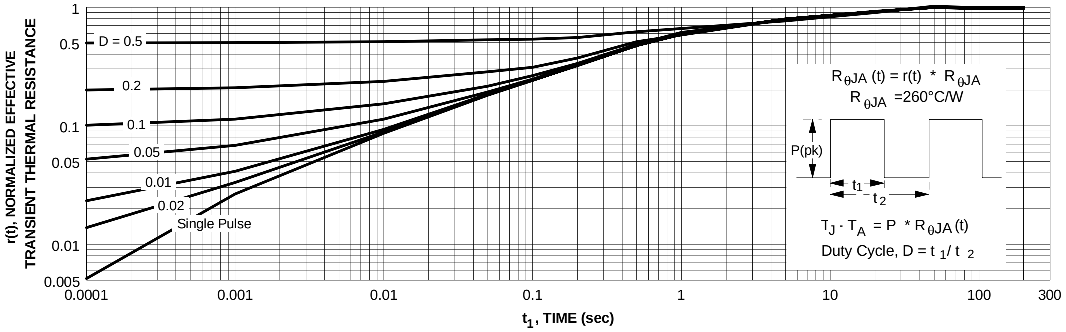
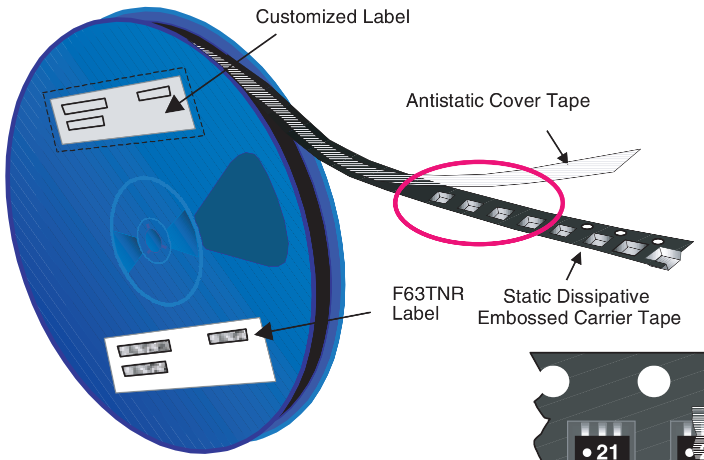


Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1c. Transient themal response will change depending on the circuit board design.

SC70-6 Tape and Reel Data and Package Dimensions

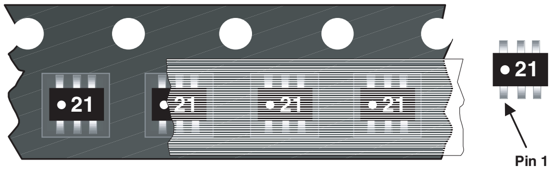
SC70-6 Packaging Configuration: Figure 1.0



Packaging Description:

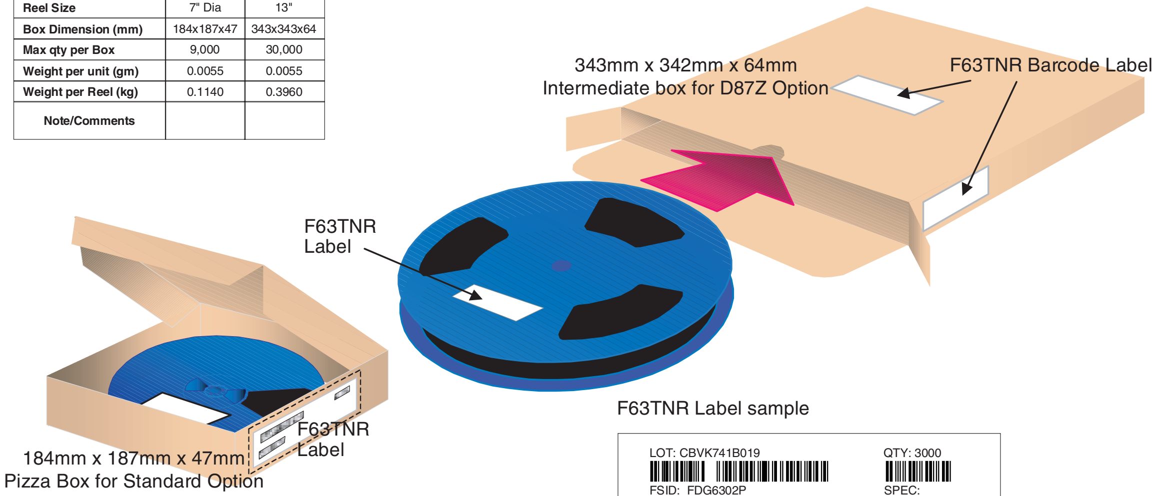
SC70-6 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 3,000 units per 7" or 177cm diameter reel. The reels are dark blue in color and is made of polystyrene plastic (anti-static coated). Other option comes in 10,000 units per 13" or 330cm diameter reel. This and some other options are described in the Packaging Information table.

These full reels are individually barcode labeled and placed inside a pizza box (illustrated in figure 1.0) made of recyclable corrugated brown paper with a Fairchild logo printing. One pizza box contains three reels maximum. And these pizza boxes are placed inside a barcode labeled shipping box which comes in different sizes depending on the number of parts shipped.

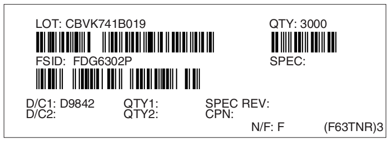


SC70-6 Unit Orientation

SC70-6 Packaging Information		
Packaging Option	Standard (no flow code)	D87Z
Packaging type	TNR	TNR
Qty per Reel/Tube/Bag	3,000	10,000
Reel Size	7" Dia	13"
Box Dimension (mm)	184x187x47	343x343x64
Max qty per Box	9,000	30,000
Weight per unit (gm)	0.0055	0.0055
Weight per Reel (kg)	0.1140	0.3960
Note/Comments		



F63TNR Label sample



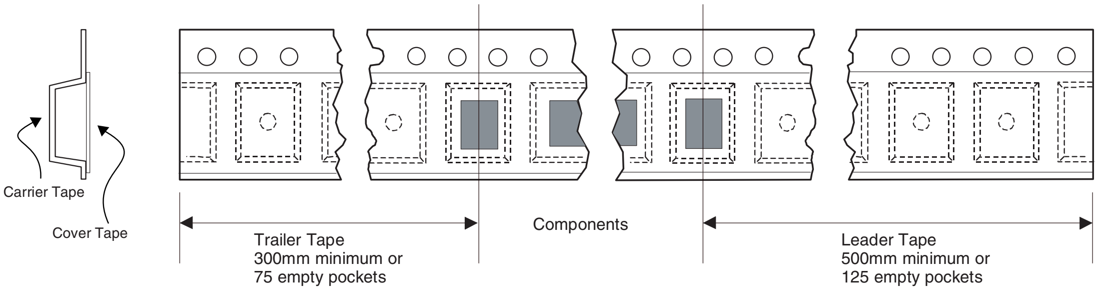
LOT: CBVK741B019 QTY: 3000

FSID: FDG6302P SPEC:

D/C1: D9842 QTY1: SPEC REV:
D/C2: QTY2: CPN:

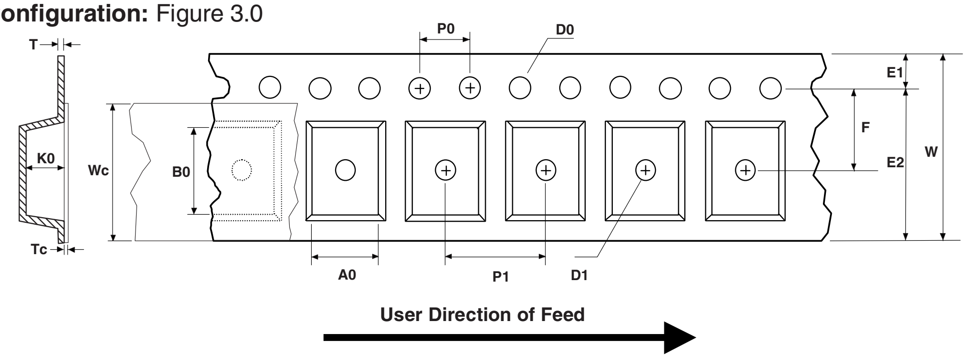
N/F: F (F63TNR)3

SC70-6 Tape Leader and Trailer Configuration: Figure 2.0



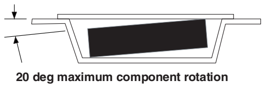
SC70-6 Tape and Reel Data and Package Dimensions, continued

SC70-6 Embossed Carrier Tape Configuration: Figure 3.0

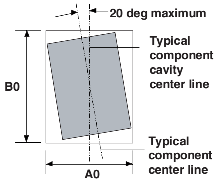


Dimensions are in millimeter													
Pkg type	A0	B0	W	D0	D1	E1	E2	F	P1	P0	K0	T	Wc	Tc
SC70-6 (8mm)	2.24 +/-0.10	2.34 +/-0.10	8.0 +/-0.3	1.55 +/-0.05	1.125 +/-0.125	1.75 +/-0.10	6.25 min	3.50 +/-0.05	4.0 +/-0.1	4.0 +/-0.1	1.20 +/-0.10	0.255 +/-0.150	5.2 +/-0.3	0.06 +/-0.02

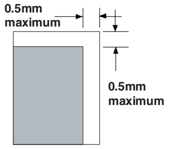
Notes: A0, B0, and K0 dimensions are determined with respect to the EIA/Jedec RS-481 rotational and lateral movement requirements (see sketches A, B, and C).



Sketch A (Side or Front Sectional View)
Component Rotation

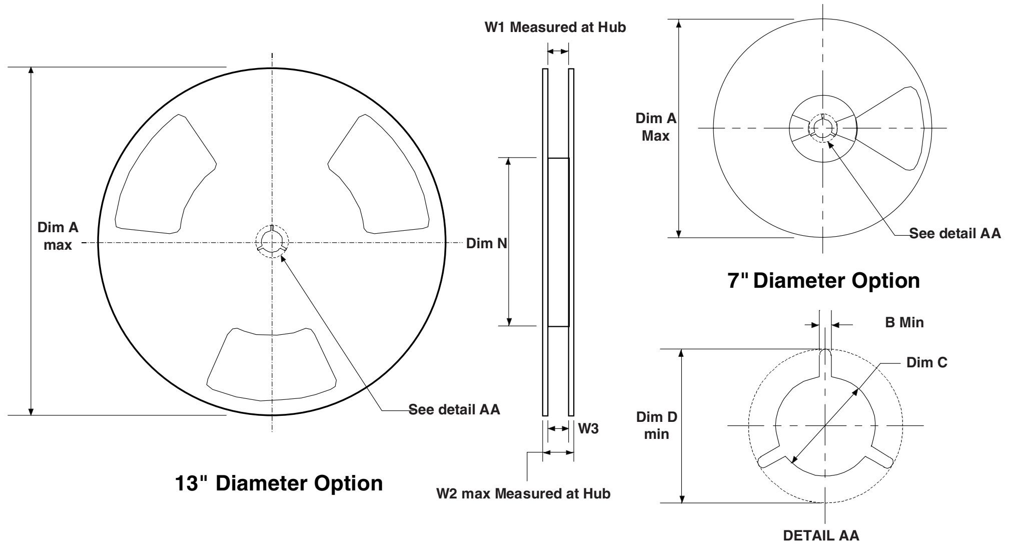


Sketch B (Top View)
Component Rotation



Sketch C (Top View)
Component lateral movement

SC70-6 Reel Configuration: Figure 4.0



13" Diameter Option

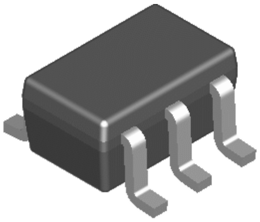
7" Diameter Option

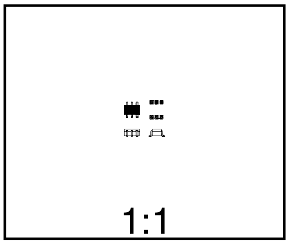
DETAIL AA

Dimensions are in inches and millimeters									
Tape Size	Reel Option	Dim A	Dim B	Dim C	Dim D	Dim N	Dim W1	Dim W2	Dim W3 (LSL-USL)
8mm	7" Dia	7.00 177.8	0.059 1.5	0.512 +0.020/-0.008 13 +0.5/-0.2	0.795 20.2	2.165 55	0.331 +0.059/-0.000 8.4 +1.5/0	0.567 14.4	0.311 – 0.429 7.9 – 10.9
8mm	13" Dia	13.00 330	0.059 1.5	0.512 +0.020/-0.008 13 +0.5/-0.2	0.795 20.2	4.00 100	0.331 +0.059/-0.000 8.4 +1.5/0	0.567 14.4	0.311 – 0.429 7.9 – 10.9

SC70-6 Tape and Reel Data and Package Dimensions, continued

SC70-6 (FS PKG Code 76)

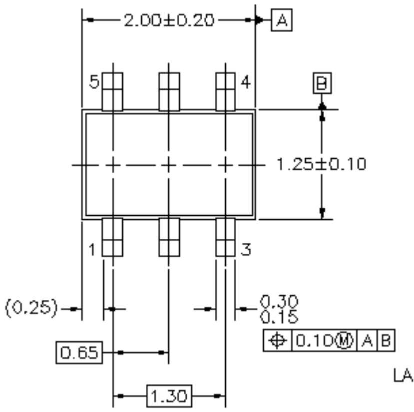


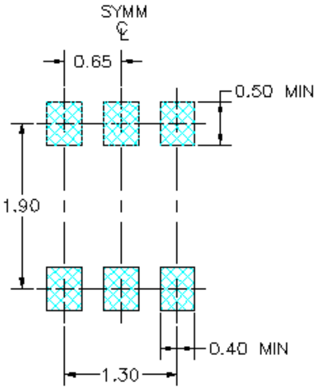


Scale 1:1 on letter size paper

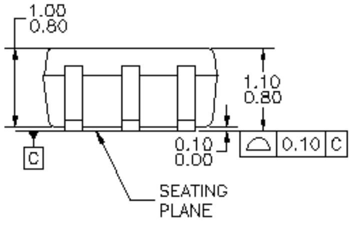
Dimensions shown below are in:
inches [millimeters]

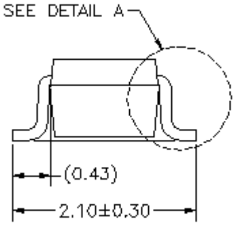
Part Weight per unit (gram): 0.0055

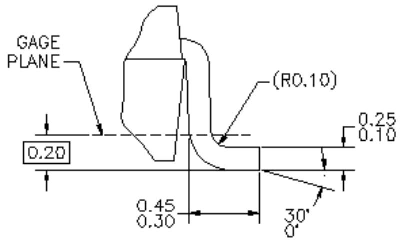




LAND PATTERN RECOMMENDATION







DETAIL A
SCALE: 80X

NOTES: UNLESS OTHERWISE SPECIFIED

A) THIS PACKAGE CONFORMS TO EIAJ SC-88, 1996.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.

MAA06AREVD

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ISOPLANAR™
MICROWIRE™
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POP™
PowerTrench®
QFET™
QS™
QT Optoelectronics™
Quiet Series™
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SyncFET™
TinyLogic™
UHC™
VCX™

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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.