FAIRCHILD SEMICONDUCTOR TM

November 1998

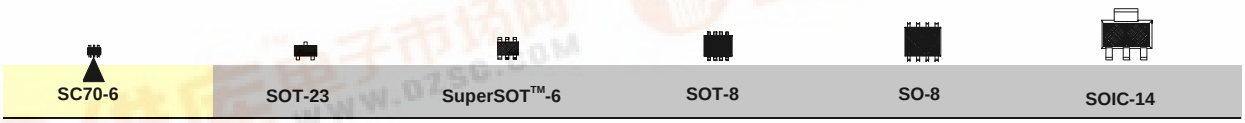
FDG6321C
Dual N & P Channel Digital FET

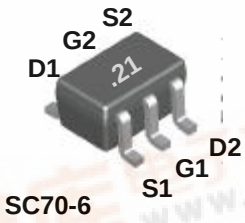
General Description

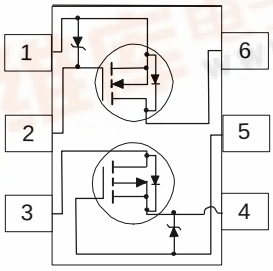
These dual N & P-Channel logic level enhancement mode field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance. This device has been designed especially for low voltage applications as a replacement for bipolar digital transistors and small signal MOSFETS. Since bias resistors are not required, this dual digital FET can replace several different digital transistors, with different bias resistor values.

Features

- N-Ch 0.50 A, 25 V, $R_{DS(ON)}$ = 0.45 Ω @ V_{GS}= 4.5V.
  $R_{DS(ON)}$ = 0.60 Ω @ V_{GS}= 2.7 V.
- P-Ch -0.41 A, -25 V,$R_{DS(ON)}$ = 1.1 Ω @ V_{GS}= -4.5V.
  $R_{DS(ON)}$ = 1.5 Ω @ V_{GS}= -2.7V.
- Very small package outline SC70-6.
- Very low level gate drive requirements allowing direct operation in 3 V circuits($V_{GS(th)}$ < 1.5 V).
- Gate-Source Zener for ESD ruggedness (>6kV Human Body Model).







Absolute Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter	N-Channel	P-Channel	Units
V_{DSS}	Drain-Source Voltage	25	-25	V
V_{GSS}	Gate-Source Voltage	8	-8	V
I_D	Drain Current - Continuous	0.5	-0.41	A
	- Pulsed	1.5	-1.2	
P_D	Maximum Power Dissipation (Note 1)	0.3		W
T_J,T_{STG}	Operating and Storage Temperature Ranger	-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 1)	415		°C/W

Electrical Characteristics (T_A = 25 °C unless otherwise noted)

Symbol	Parameter	Conditions	Type	Min	Typ	Max	Units
OFF CHARACTERISTICS							
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	N-Ch	25			V
		V_{GS} = 0 V, I_D = -250 µA	P-Ch	-25			
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	I_D = 250 µA, Referenced to 25 °C	N-Ch		26		mV/°C
		I_D = -250 µA, Referenced to 25 °C	P-Ch		-22		
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 20 V, V_{GS} = 0 V	N-Ch			1	µA
		T_J = 55°C				10	
I_{GSS}	Gate - Body Leakage Current	V_{DS} = -20 V, V_{GS} = 0 V	P-Ch			-1	µA
		T_J = 55°C				-10	
I_{GSS}	Gate - Body Leakage Current	V_{GS} = 8 V, V_{DS} = 0 V	N-Ch			100	nA
		V_{GS} = -8 V, V_{DS} = 0 V	P-Ch			-100	nA
ON CHARACTERISTICS (Note 2)							
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	N-Ch	0.65	0.8	1.5	V
		V_{DS} = V_{GS}, I_D = -250 µA	P-Ch	-0.65	-0.82	-1.5	
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Temp. Coefficient	I_D = 250 µA, Referenced to 25 °C	N-Ch		-2.6		mV/ °C
		I_D = -250 µA, Referenced to 25 °C	P-Ch		2.1		
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 4.5 V, I_D = 0.5 A	N-Ch		0.34	0.45	Ω
		T_J =125°C			0.55	0.72	
		V_{GS} = 2.7 V, I_D = 0.2 A			0.44	0.6	
		V_{GS} = -4.5 V, I_D = -0.41 A	P-Ch		0.85	1.1	
		T_J =125°C			1.2	1.8	
		V_{GS} = -2.7 V, I_D = -0.25 A			1.15	1.5	
$I_{D(ON)}$	On-State Drain Current	V_{GS} = 4.5 V, V_{DS} = 5 V	N-Ch	0.5			A
		V_{GS} = -4.5 V, V_{DS} = -5 V	P-Ch	-0.41			
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 0.5 A	N-Ch		1.45		S
		V_{DS} = -5 V, I_D = -0.41 A	P-Ch		0.9		
DYNAMIC CHARACTERISTICS							
C_{iss}	Input Capacitance	N-Channel	N-Ch		50		pF
		V_{DS} = 10 V, V_{GS} = 0 V,	P-Ch		62		
C_{oss}	Output Capacitance	f = 1.0 MHz	N-Ch		28		
		P-Channel	P-Ch		34		
C_{rss}	Reverse Transfer Capacitance	V_{DS} = -10 V, V_{GS} = 0V,	N-Ch		9		
		f = 1.0 MHz	P-Ch		10		

Electrical Characteristics (continued)

SWITCHING CHARACTERISTICS (Note 2)

Symbol	Parameter	Conditions	Type	Min	Typ	Max	Units
$t_{D(on)}$	Turn - On Delay Time	N-Channel	N-Ch		3	6	nS
		V_{DD} = 5 V, I_D = 0.5 A,	P-Ch		7	15	
t_r	Turn - On Rise Time	V_{GS} = 4.5 V, R_{GEN} = 50 Ω	N-Ch		8.5	18	nS
			P-Ch		8	16	
$t_{D(off)}$	Turn - Off Delay Time	P-Channel	N-Ch		17	30	nS
		V_{DD} = -5 V, I_D = -0.5 A,	P-Ch		55	80	
t_f	Turn - Off Fall Time	V_{GS} = -4.5 V, R_{GEN} = 50 Ω	N-Ch		13	25	nS
			P-Ch		35	60	
Q_g	Total Gate Charge	N-Channel	N-Ch		1.64	2.3	nC
		V_{DS} = 5 V, I_D = 0.5 A,	P-Ch		1.1	1.5	
Q_{gs}	Gate-Source Charge	V_{GS} = 4.5 V	N-Ch		0.38		nC
		P- Channel	P-Ch		0.31		
Q_{gd}	Gate-Drain Charge	V_{DS} = -5 V, I_D = -0.41 A,	N-Ch		0.45		nC
		V_{GS} = -4.5 V	P-Ch		0.29		
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
I_S	Maximum Continuous Drain-Source Diode Forward Current		N-Ch			0.25	A
			P-Ch			-0.25	
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 0.5 A (Note 2)	N-Ch		0.8	1.2	V
		V_{GS} = 0 V, I_S = -0.5 A (Note 2)	P-Ch		-0.85	-1.2	

Notes:

1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal 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 $R_{\theta CA}$ is determined by the user's board design. $R_{\theta JA}$ = 415°C/W on minimum mounting pad on FR-4 board in still air.
2. Pulse Test: Pulse Width ≤ 300µs, Duty Cycle ≤ 2.0%.

Typical Electrical Characteristics: N-Channel

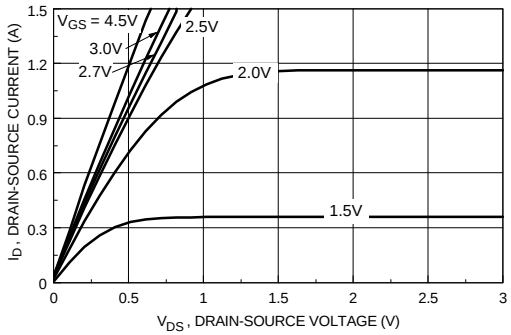


Figure 1. On-Region Characteristics.

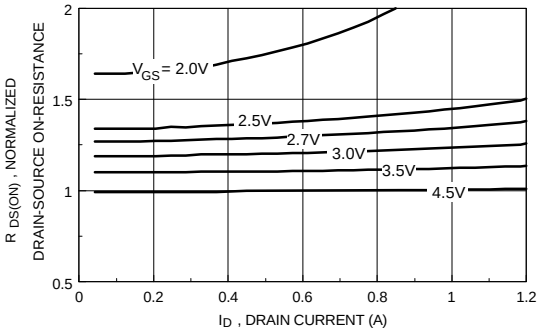


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

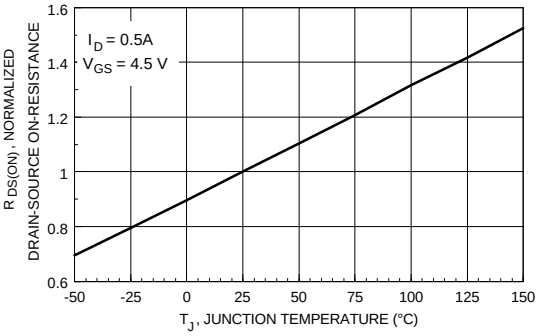


Figure 3. On-Resistance Variation with Temperature.

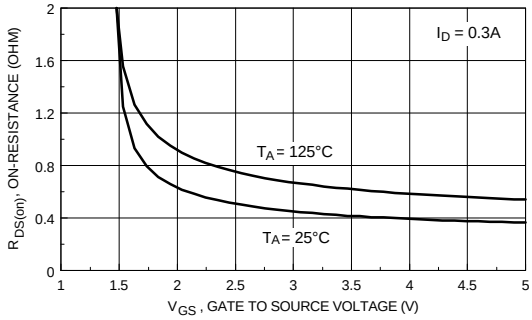


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

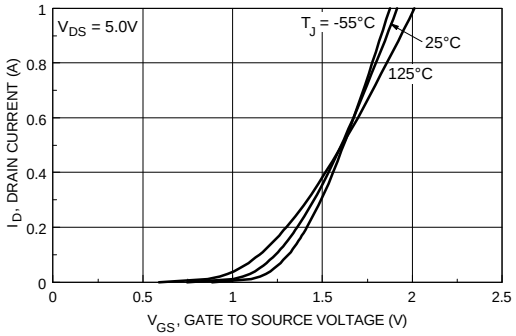


Figure 5. Transfer Characteristics.

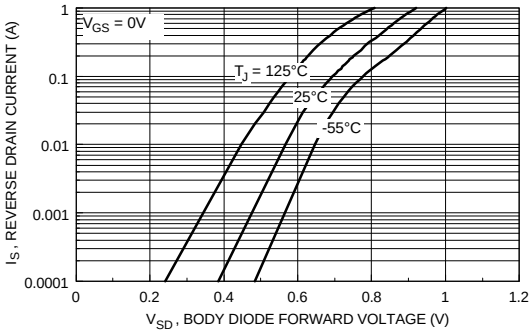


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Electrical Characteristics: N-Channel (continued)

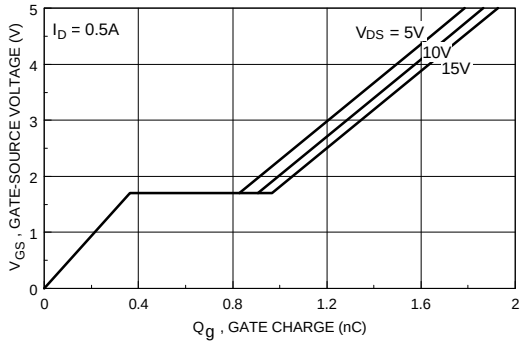


Figure 7. Gate Charge Characteristics.

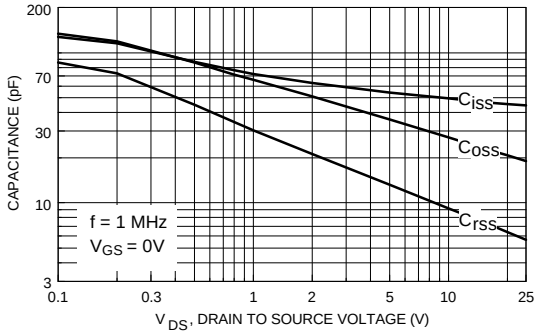


Figure 8. Capacitance Characteristics.

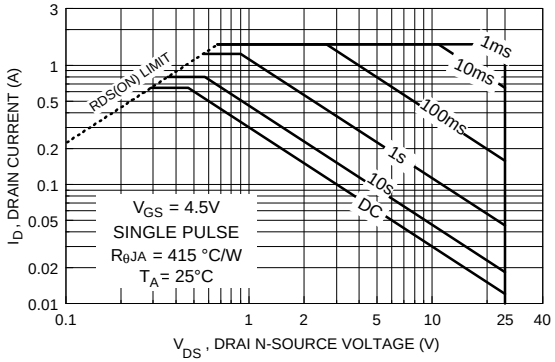


Figure 9. Maximum Safe Operating Area.

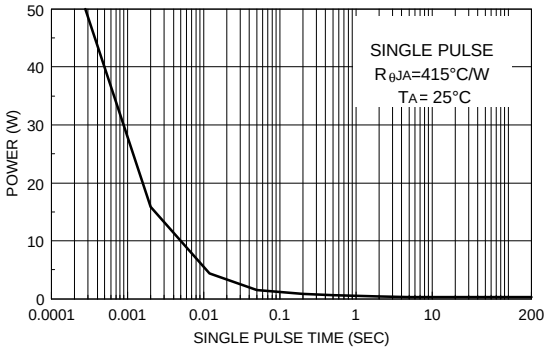


Figure 10. Single Pulse Maximum Power Dissipation.

Typical Electrical Characteristics: P-Channel

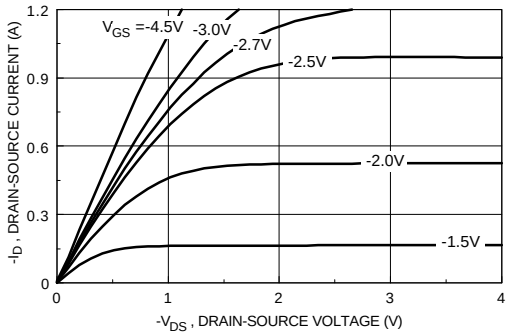


Figure 11. On-Region Characteristics.

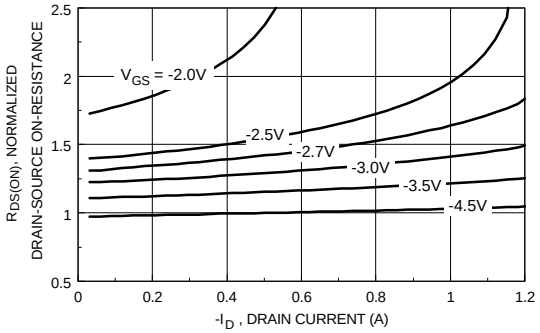


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

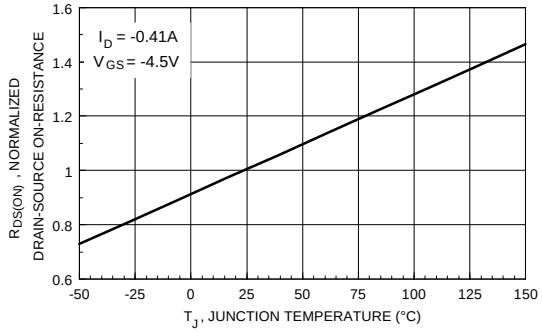


Figure 13. On-Resistance Variation with Temperature.

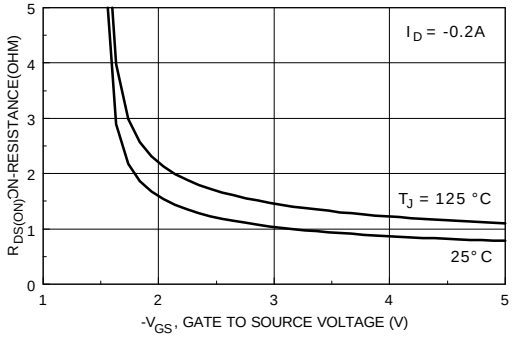


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

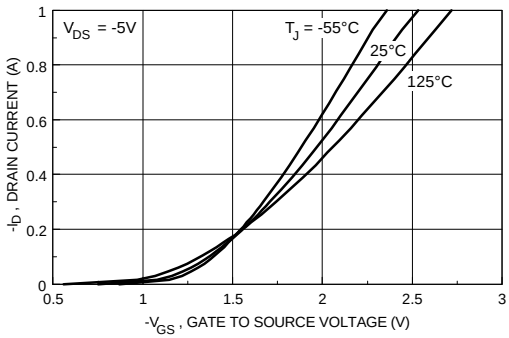


Figure 15. Transfer Characteristics.

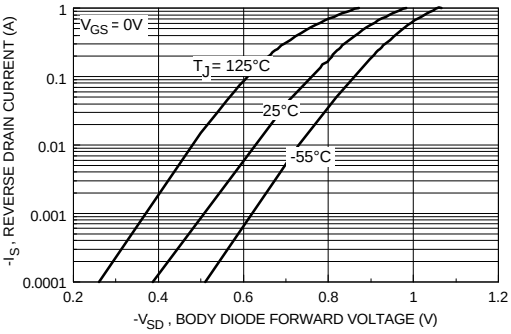


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Electrical Characteristics: P-Channel (continued)

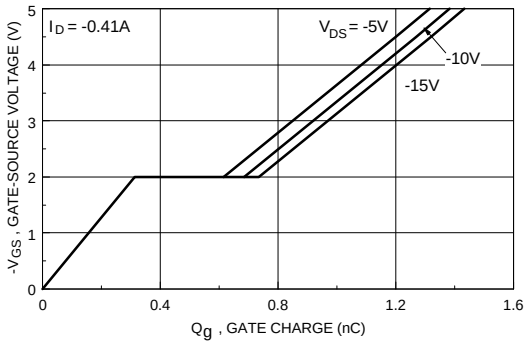


Figure 17. Gate Charge Characteristics.

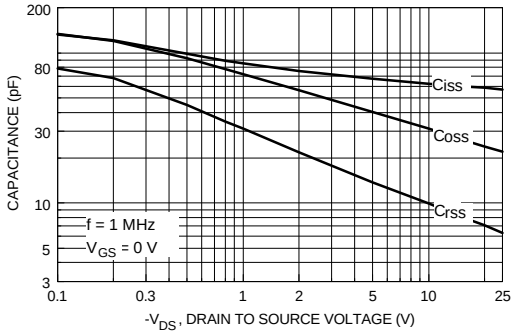


Figure 18. Capacitance Characteristics.

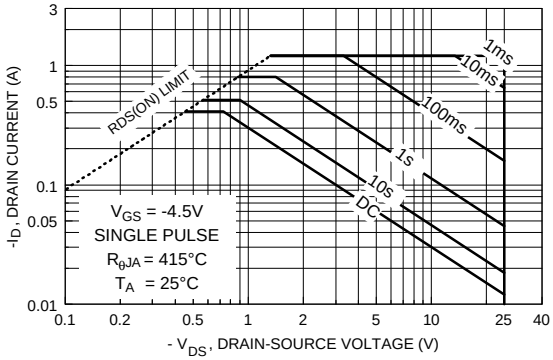


Figure 19. Maximum Safe Operating Area.

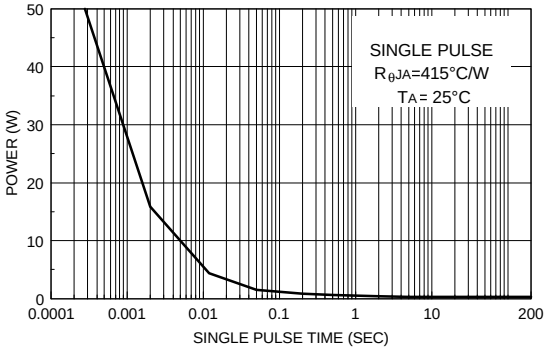


Figure 20. Single Pulse Maximum Power Dissipation.

Typical Thermal Characteristics: N & P-Channel (continued)

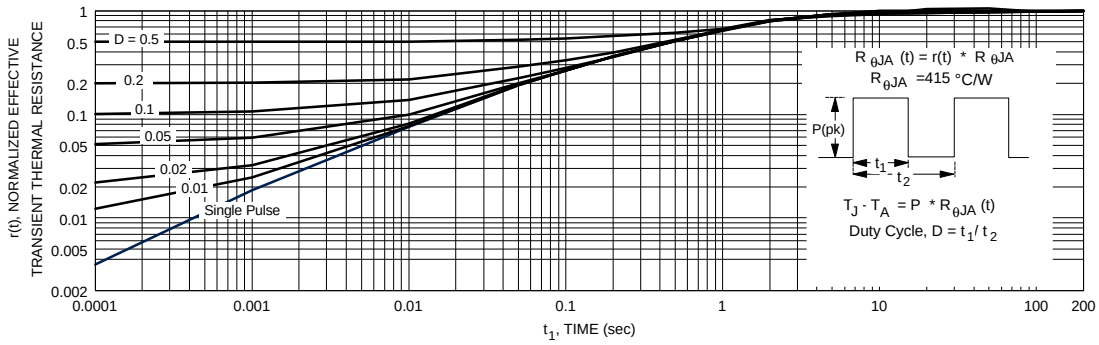


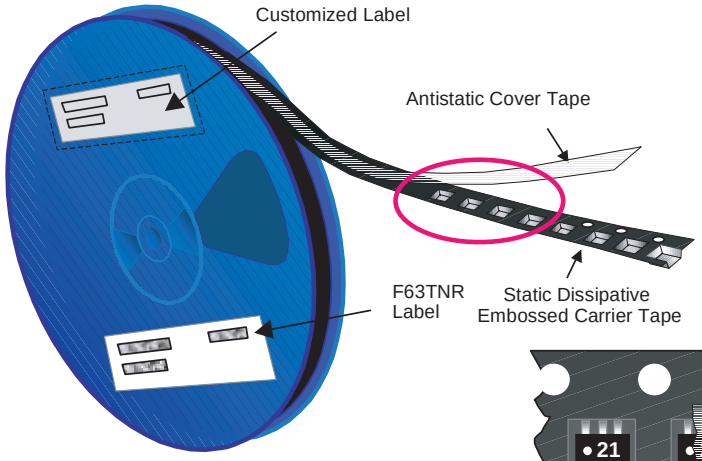
Figure 21. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in note 1.
Transient thermalresponse will change depending on the circuit board design.

SC70-6 Tape and Reel Data and Package Dimensions

FAIRCHILD SEMICONDUCTOR™

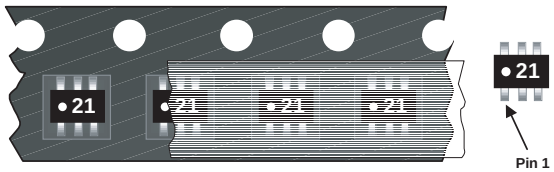
SC70-6 Packaging
Configuration: Figure 1.0



Packaging Description:

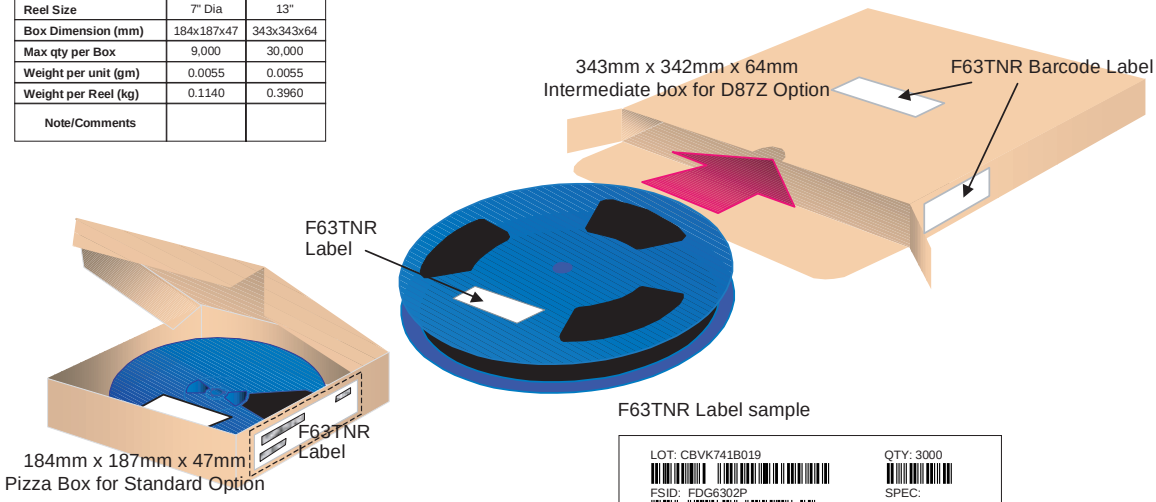
SC70-6 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in 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.



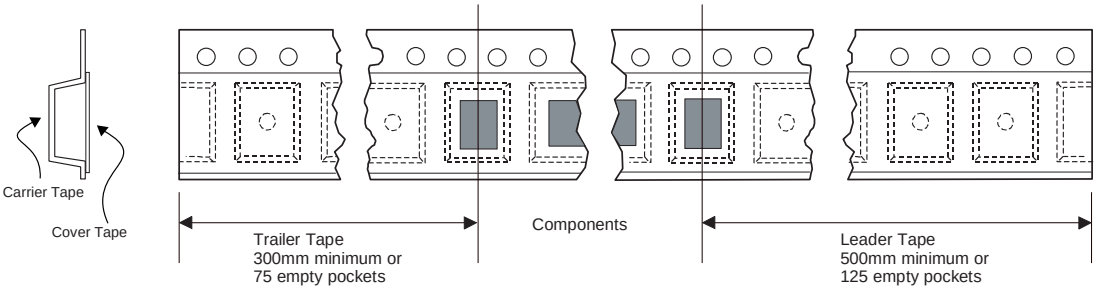
SC70-6 Unit Orientation

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		



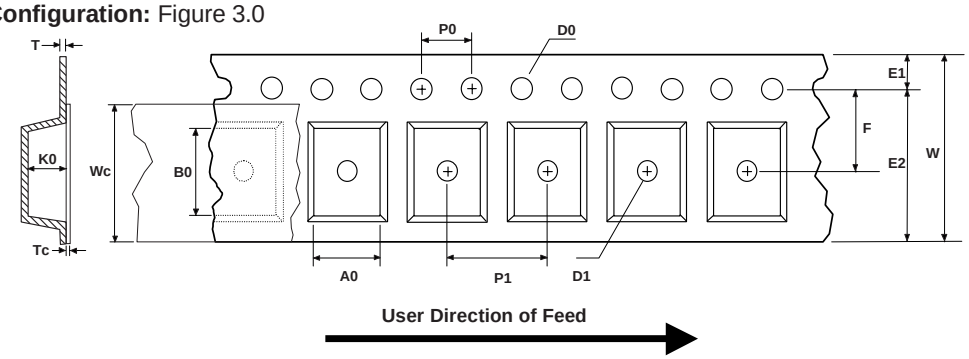
F63TNR Label sample

SC70-6 Tape Leader and Trailer
Configuration: Figure 2.0



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

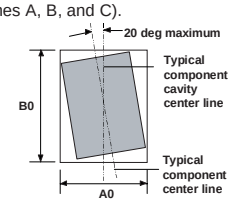
SC70-6 Embossed Carrier Tape
Configuration: Figure 3.0



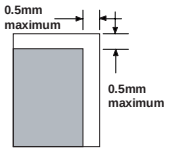
Dimensions are in millimeter														
Pkg type	**A0**	**B0**	**W**	**D0**	**D1**	**E1**	**E2**	**F**	**P1**	**P0**	**K0**	**T**	**Wc**	**Tc**
SC70-6 (8mm)	2.24 +/-0.10	2.34 +/-0.10	8.0 +/-0.3	1.55 +/-0.05	1.125 +/-0.125	1.75 +/-0.10	6.25 min	3.50 +/-0.05	4.0 +/-0.1	4.0 +/-0.1	1.20 +/-0.10	0.255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

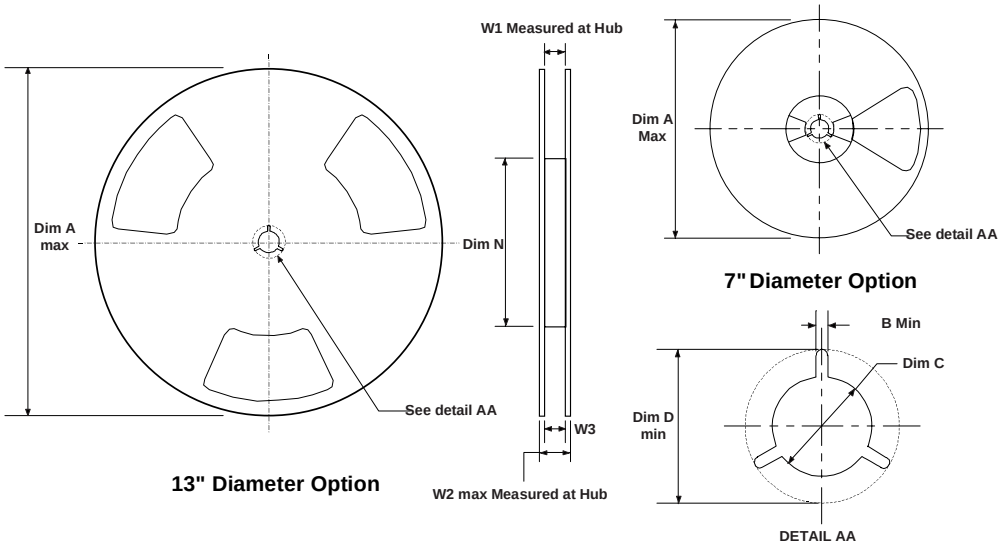


Sketch B (Top View)
Component Rotation



Sketch C (Top View)
Component lateral movement

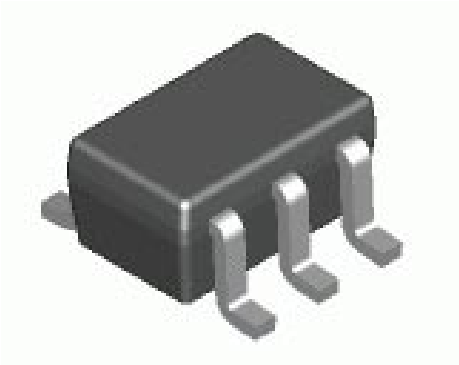
SC70-6 Reel Configuration: Figure 4.0

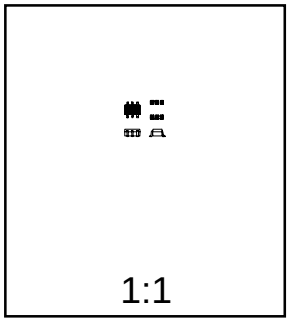


Dimensions are in inches and millimeters									
Tape Size	**Reel Option**	**Dim A**	**Dim B**	**Dim C**	**Dim D**	**Dim N**	**Dim W1**	**Dim W2**	**Dim W3 (LSL-USL)**
8mm	7" Dia	7.00 177.8	0.059 1.5	0.512 +0.020/-0.008 13 +0.5/-0.2	0.795 20.2	2.165 55	0.331 +0.059/-0.000 8.4 +1.5/0	0.567 14.4	0.311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

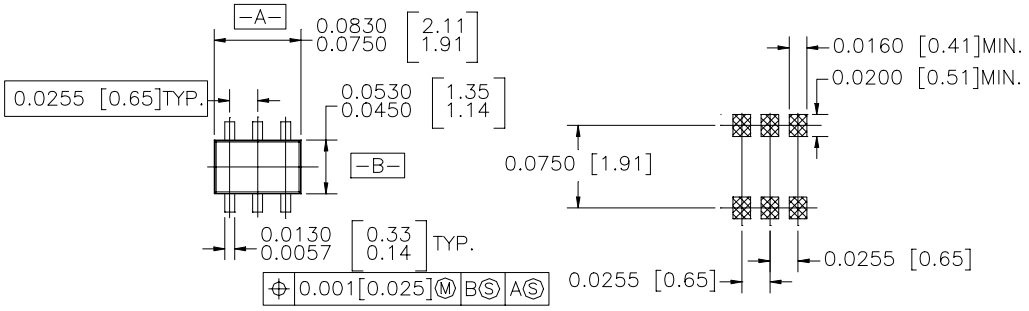




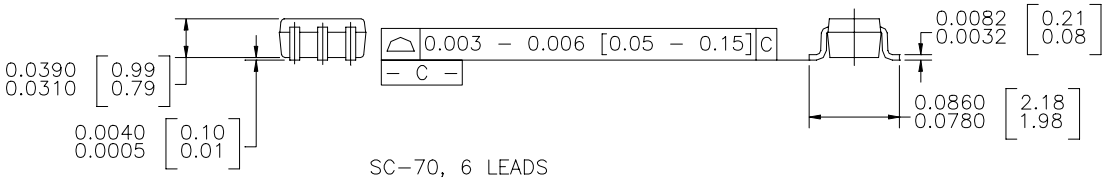
Scale 1:1 on letter size paper

Dimensions shown below are in:
inches [millimeters]

Part Weight per unit (gram): 0.0055



LAND PATTERN RECOMMENDATION



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