



July 2000
PRELIMINARY

FDC645N

N-Channel PowerTrench[®] MOSFET

General Description

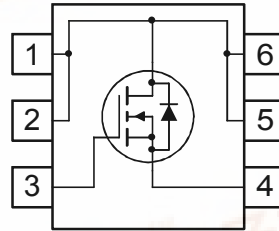
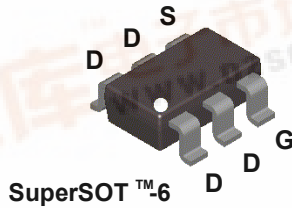
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $R_{DS(ON)}$ and fast switching speed.

Applications

- DC/DC converter

Features

- 5.5 A, 30 V. $R_{DS(ON)} = 30\text{ m}\Omega @ V_{GS} = 4.5\text{ V}$
 $R_{DS(ON)} = 26\text{ m}\Omega @ V_{GS} = 10\text{ V}$
- High performance trench technology for extremely low $R_{DS(ON)}$
- Low gate charge (13 nC typical)
- High power and current handling capability



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Rated	Units
V_{DSS}	Drain-Source Voltage	30	V
V_{GSS}	Gate-Source Voltage	± 12	V
I_D	Drain Current – Continuous (Note 1a)	5.5	A
	– Pulsed	20	
P_D	Maximum Power Dissipation (Note 1a) (Note 1b)	1.6	W
		0.8	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	78	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	30	$^\circ\text{C}/\text{W}$

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
.645	FDC645N	7"	8mm	3000 units



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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C		22		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$			1	μA
I_{GSSF}	Gate–Body Leakage, Forward	$V_{GS} = 12\text{ V}, V_{DS} = 0\text{ V}$			100	nA
I_{GSSR}	Gate–Body Leakage, Reverse	$V_{GS} = -12\text{ V}, V_{DS} = 0\text{ V}$			-100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	0.8	1.4	2	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C		-4		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = 4.5\text{ V}, I_D = 5.5\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 6.2\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 5.5\text{ A}, T_J = 125^\circ\text{C}$		25 23 34	30 26 48	m Ω
$I_{D(on)}$	On–State Drain Current	$V_{GS} = 4.5\text{ V}, V_{DS} = 5\text{ V}$	20			A
g_{FS}	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 5.5\text{ A}$		33		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		1460		pF
C_{oss}	Output Capacitance			227		pF
C_{rss}	Reverse Transfer Capacitance			96		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	$V_{DS} = 15\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 4.5\text{ V}, R_{GEN} = 6\ \Omega$		8	16	ns
t_r	Turn–On Rise Time			9	18	ns
$t_{d(off)}$	Turn–Off Delay Time			35	56	ns
t_f	Turn–Off Fall Time			7	14	ns
Q_g	Total Gate Charge	$V_{DS} = 15\text{ V}, I_D = 6.2\text{ A},$ $V_{GS} = 4.5\text{ V}$		13	21	nC
Q_{gs}	Gate–Source Charge			3.6		nC
Q_{gd}	Gate–Drain Charge			3.6		nC
Drain–Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain–Source Diode Forward Current				1.3	A
V_{SD}	Drain–Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 1.3\text{ A}$ (Note 2)		0.7	1.2	V

Notes:

- $R_{\theta JA}$ 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 $R_{\theta CA}$ is determined by the user's board design.
 - 78°C/W when mounted on a 1in² pad of 2oz copper on FR-4 board.
 - 156°C/W when mounted on a minimum pad.
- Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$

Typical Characteristics

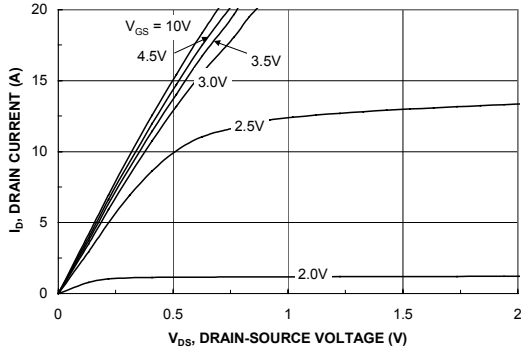


Figure 1. On-Region Characteristics.

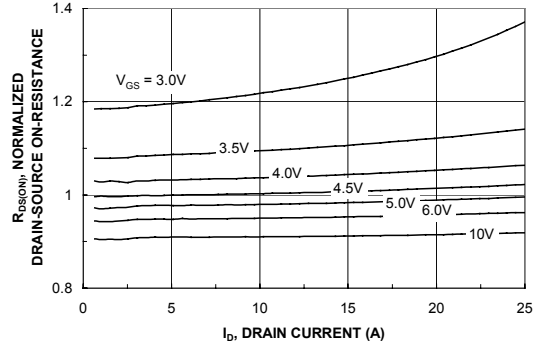


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

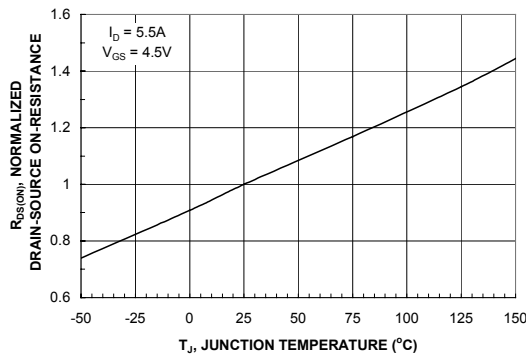


Figure 3. On-Resistance Variation with Temperature.

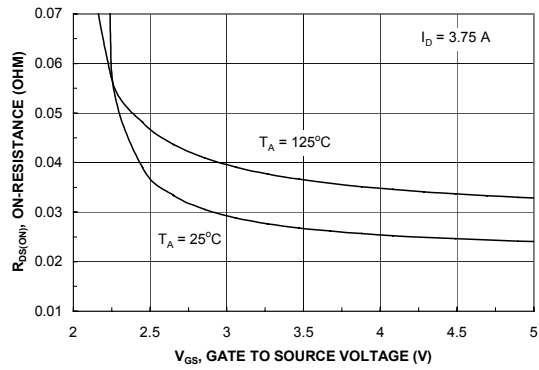


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

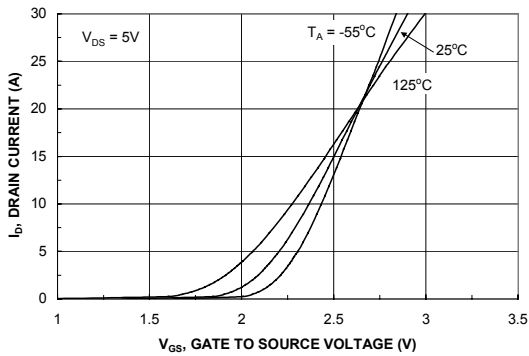


Figure 5. Transfer Characteristics.

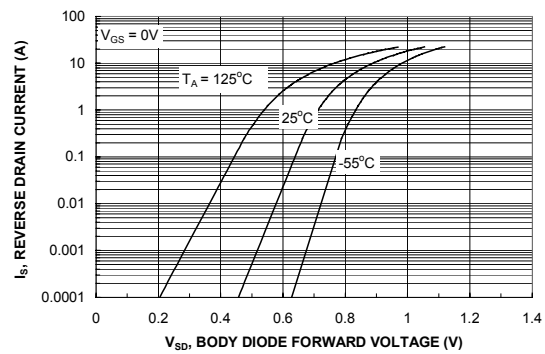


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

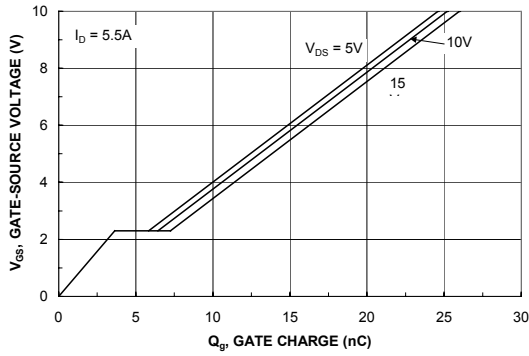


Figure 7. Gate Charge Characteristics.

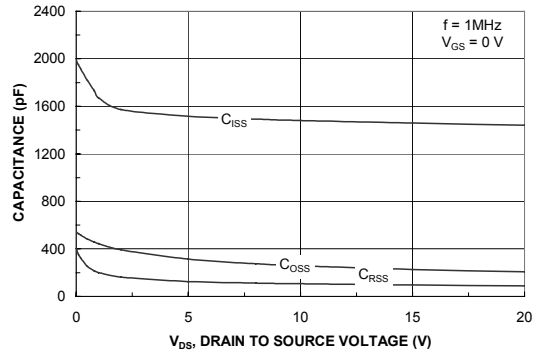


Figure 8. Capacitance Characteristics.

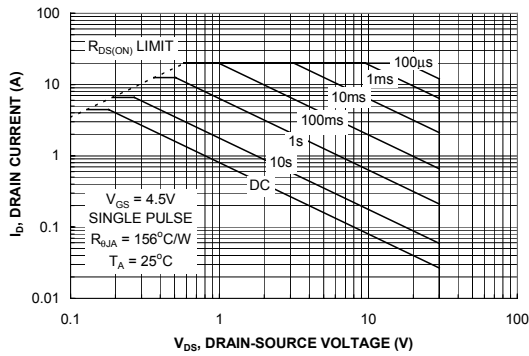


Figure 9. Maximum Safe Operating Area.

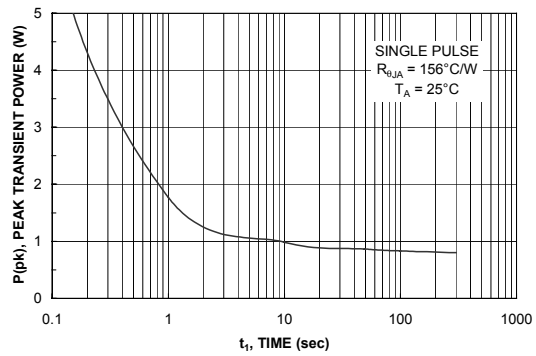


Figure 10. Single Pulse Maximum Power Dissipation.

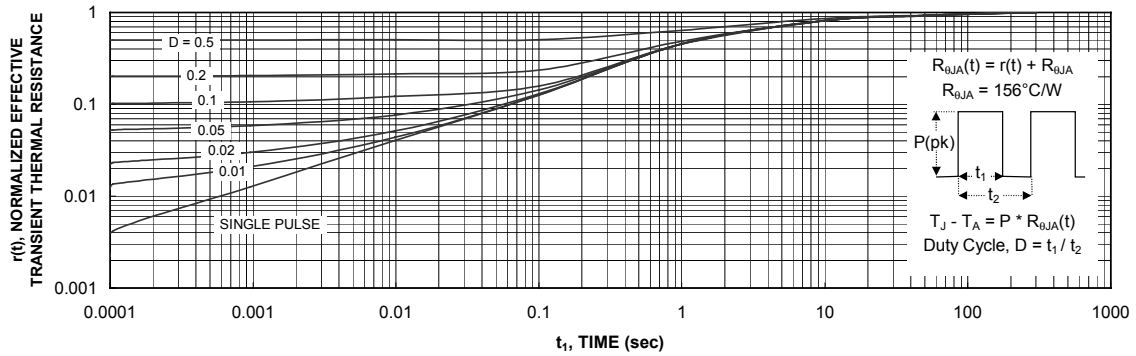


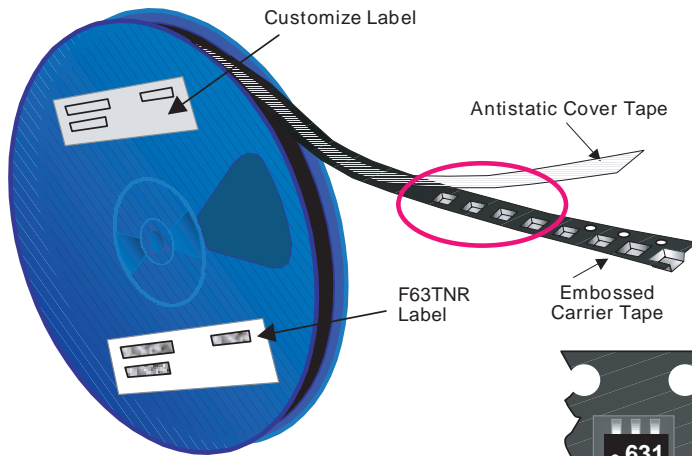
Figure 11. Transient Thermal Response Curve.

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

SuperSOT™-6 Tape and Reel Data and Package Dimensions



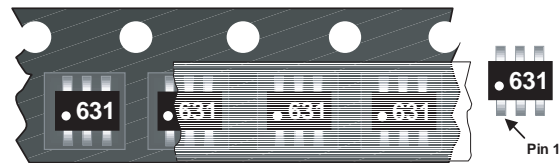
SSOT-6 Packaging Configuration: Figure 1.0



Packaging Description:

SSOT-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.

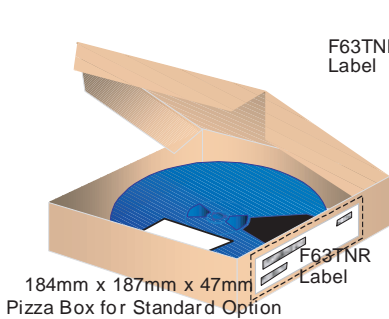
These full reels are individually barcode labeled and placed inside a pizza box (illustrated in figure 1.0) made of recyclable corrugated brown paper with a Fairchild logo printing. One pizza box contains three reels maximum. And these pizza boxes are placed inside a barcode labeled shipping box which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



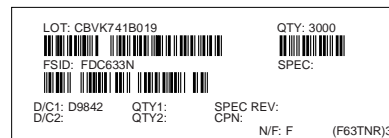
SSOT-6 Unit Orientation

SSOT-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)	0.0158	0.0158
Weight per Reel (kg)	0.1440	0.4700
Notes/Comments		

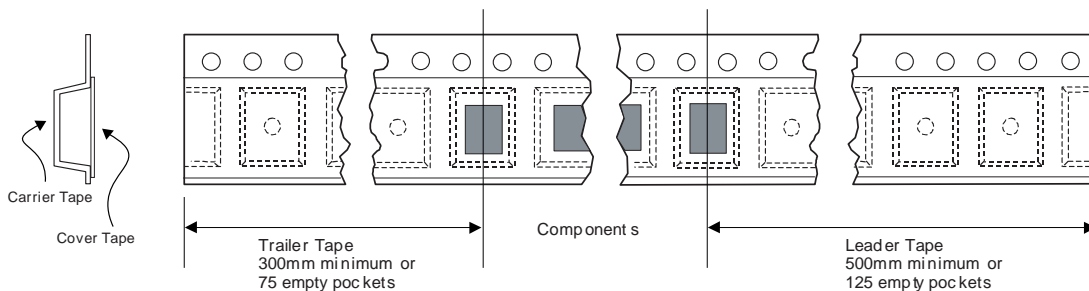
343mm x 342mm x 64mm Intermediate box for D87Z Option



F63TNR Label sample

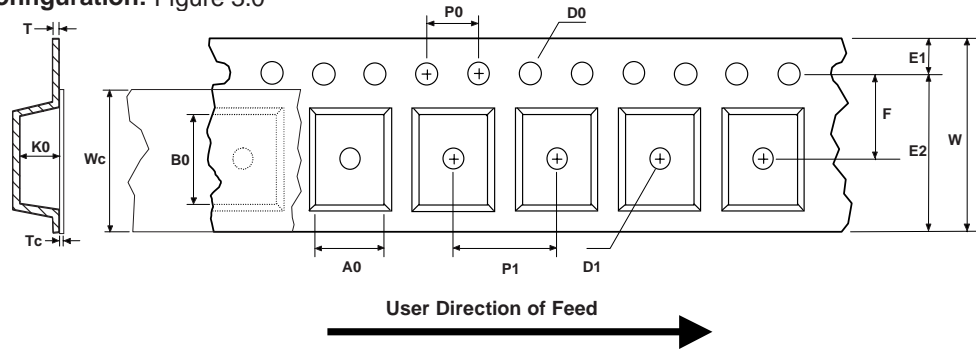


SSOT-6 Tape Leader and Trailer Configuration: Figure 2.0



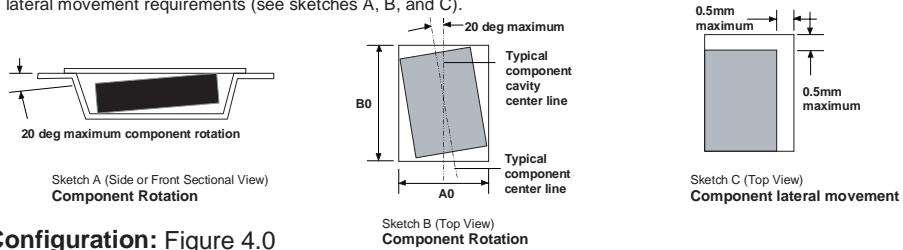
SuperSOT™-6 Tape and Reel Data and Package Dimensions, continued

SSOT-6 Embossed Carrier Tape Configuration: Figure 3.0

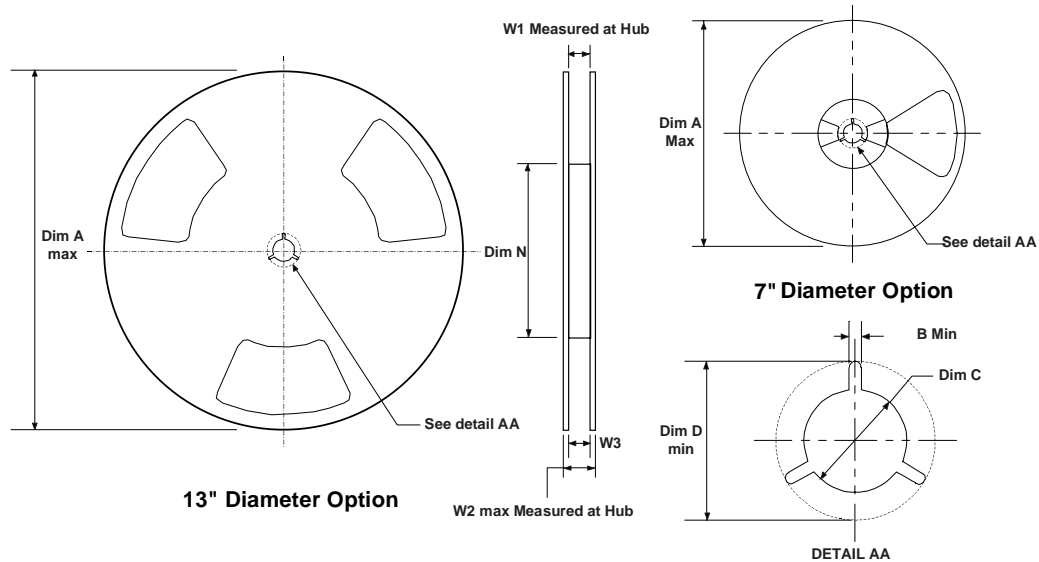


Dimensions are in millimeter														
Pkg type	A0	B0	W	D0	D1	E1	E2	F	P1	P0	K0	T	Wc	Tc
SSOT-6 (8mm)	3.23 ±0.10	3.18 ±0.10	8.0 ±0.3	1.55 ±0.05	1.125 ±0.125	1.75 ±0.10	6.25 min	3.50 ±0.05	4.0 ±0.1	4.0 ±0.1	1.37 ±0.10	0.255 ±0.150	5.2 ±0.3	0.06 ±0.02

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).



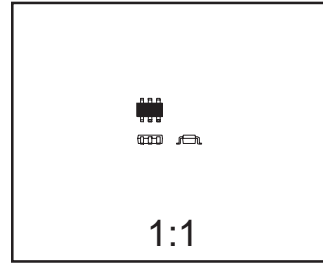
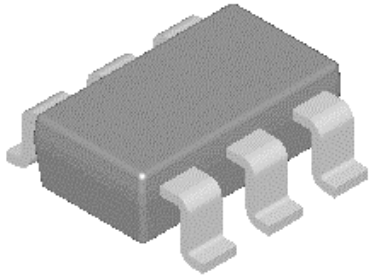
SSOT-6 Reel Configuration: Figure 4.0



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	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	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

SuperSOT™-6 Tape and Reel Data and Package Dimensions, continued

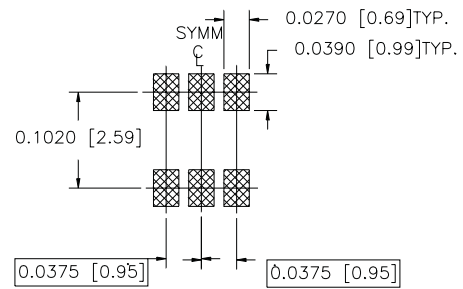
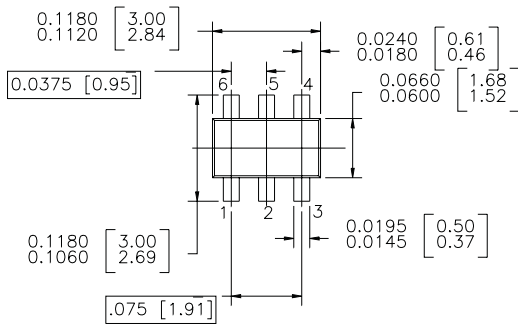
SuperSOT -6 (FS PKG Code 31, 33)



Scale 1:1 on letter size paper

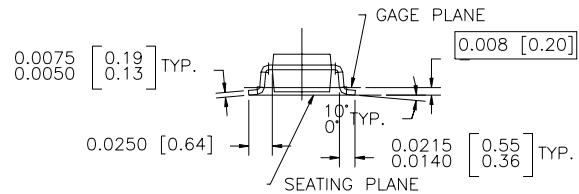
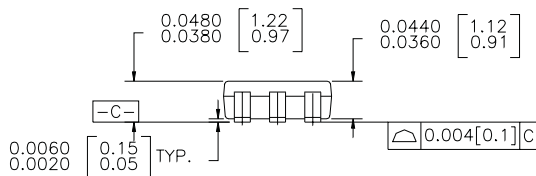
Dimensions shown below are in:
inches [millimeters]

Part Weight per unit (gram): 0.0158



LAND PATTERN RECOMMENDATION

CONTROLLING DIMENSION IS INCH
VALUES IN [] ARE MILLIMETERS



NOTES : UNLESS OTHERWISE SPECIFIED

1.0 STANDARD LEAD FINISH : 150 MICROINCHES 93.81 MICROMETERS)
MINIMUM TIN / LEAD (SOLDER) ON COPPER.

2.0 NO JEDEC REGISTRATION AS OF JULY 1996

SUPER SOT 6 LEADS

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PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
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