



# FCA35N60

## N-Channel SuperFET<sup>®</sup> MOSFET

600 V, 35 A, 98 mΩ

### Features

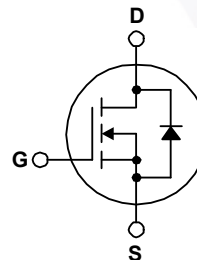
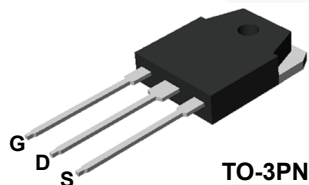
- 650V @ T<sub>J</sub> = 150°C
- Typ. R<sub>DS(on)</sub> = 79 mΩ
- Ultra Low Gate Charge (Typ. Q<sub>g</sub> = 139 nC )
- Low Effective Output Capacitance (Typ. C<sub>oss(eff.)</sub> = 340 pF )
- 100% Avalanche Tested

### Applications

- Solar Inverter
- AC-DC Power Supply

### Description

SuperFET<sup>®</sup> MOSFET is Fairchild Semiconductor's first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SuperFET MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications.



### MOSFET Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted.

Symbol	Parameter	FCA35N60	Unit
V <sub>DSS</sub>	Drain to Source Voltage	600	V
V <sub>GSS</sub>	Gate-Source voltage	±30	V
I <sub>D</sub>	Drain Current	- Continuous (T <sub>C</sub> = 25°C)	35
		- Continuous (T <sub>C</sub> = 100°C)	22.2
I <sub>DM</sub>	Drain Current	- Pulsed (Note 1)	105
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	1455	mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	35	A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	31.25	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	20	V/ns
P <sub>D</sub>	Power Dissipation	(T <sub>C</sub> = 25°C)	312.5
		- Derate Above 25°C	2.5
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	°C

### Thermal Characteristics

Symbol	Parameter	FCA35N60	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction to Case, Max.	0.4	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient, Max.	42	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCA35N60	FCA35N60	TO-3PN	Tube	N/A	N/A	30 units

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}, T_J = 25^\circ\text{C}$	600	-	-	V
		$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}, T_J = 150^\circ\text{C}$	-	650	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.6	-	$\text{V}/^\circ\text{C}$
$BV_{DS}$	Drain-Source Avalanche Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 16 \text{ A}$	-	700	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 600 \text{ V}, V_{GS} = 0 \text{ V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 480 \text{ V}, T_C = 125^\circ\text{C}$	-	-	10	
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 30 \text{ V}, V_{DS} = 0 \text{ V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 17.5 \text{ A}$	-	0.079	0.098	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40 \text{ V}, I_D = 17.5 \text{ A}$	-	28.8	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	-	4990	6640	pF
$C_{oss}$	Output Capacitance		-	2380	3170	pF
$C_{riss}$	Reverse Transfer Capacitance		-	140	-	pF
$C_{oss}$	Output Capacitance	$V_{DS} = 480 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	-	113	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	$V_{DS} = 0 \text{ V to } 480 \text{ V}, V_{GS} = 0 \text{ V}$	-	340	-	pF
$Q_g$	Total Gate Charge at 10V	$V_{DS} = 480 \text{ V}, I_D = 35 \text{ A}, V_{GS} = 10 \text{ V}$ (Note 4)	-	139	181	nC
$Q_{gs}$	Gate to Source Gate Charge		-	31	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	69	-	nC
ESR	Equivalent Series Resistance (G-S)		$f = 1 \text{ MHz}$	-	1.4	-

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 300 \text{ V}, I_D = 35 \text{ A}, V_{GS} = 10 \text{ V}, R_G = 4.7 \Omega$ (Note 4)	-	34	78	ns
$t_r$	Turn-On Rise Time		-	120	250	ns
$t_{d(off)}$	Turn-Off Delay Time		-	105	220	ns
$t_f$	Turn-Off Fall Time		-	73	155	ns

### Drain-Source Diode Characteristics

$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	35	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	105	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_{SD} = 35 \text{ A}$	-	-	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0 \text{ V}, I_{SD} = 35 \text{ A}, di_F/dt = 100 \text{ A}/\mu\text{s}$	-	614	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	16.3	-	$\mu\text{C}$

#### Notes:

- 1: Repetitive rating; pulse-width limited by maximum junction temperature.
- 2:  $I_{AS} = 17.5 \text{ A}, V_{DD} = 50 \text{ V}, R_G = 25 \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
- 3:  $I_{SD} \leq 35 \text{ A}, di/dt \leq 200 \text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
- 4: Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

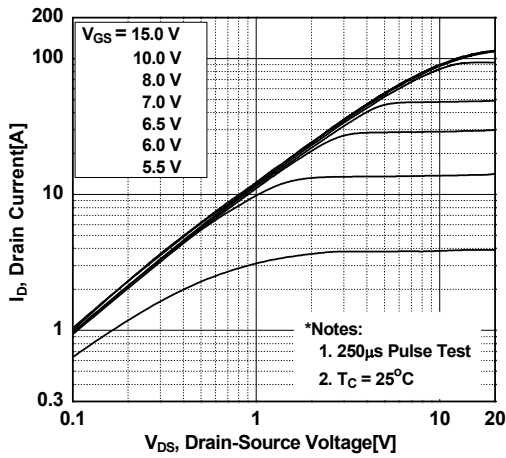


Figure 2. Transfer Characteristics

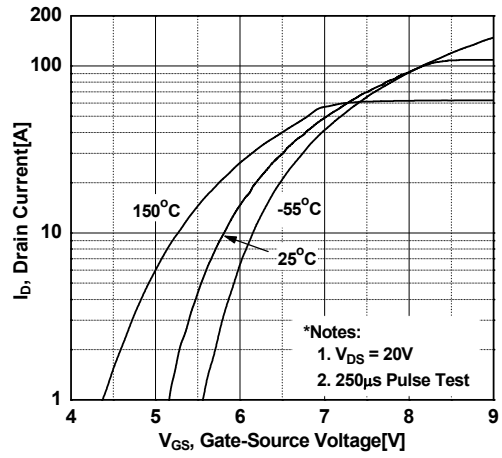


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

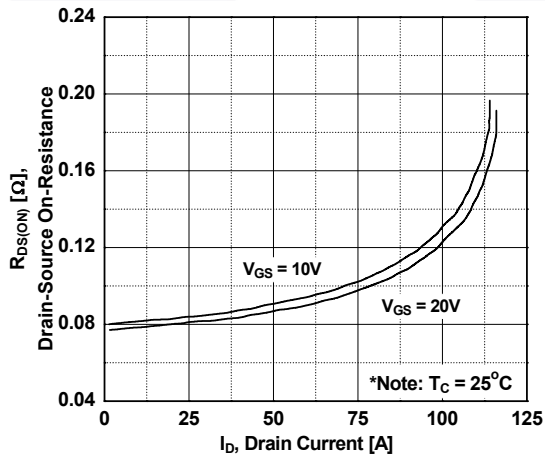


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

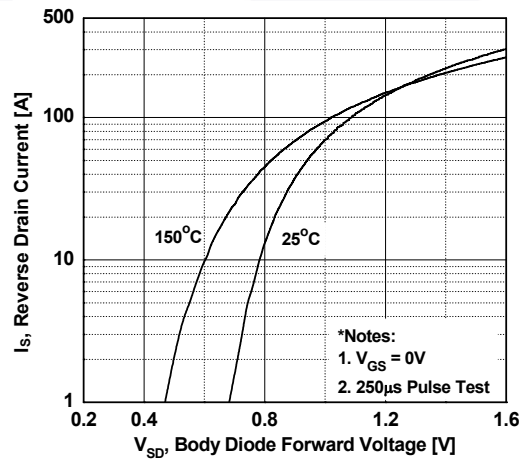


Figure 5. Capacitance Characteristics

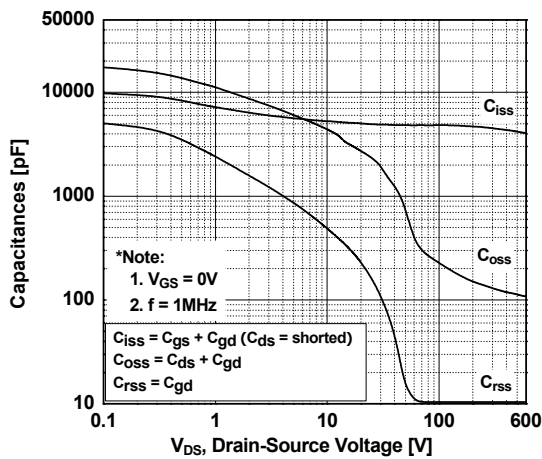
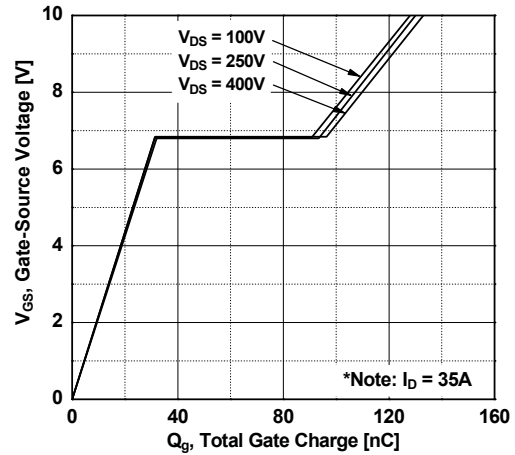


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

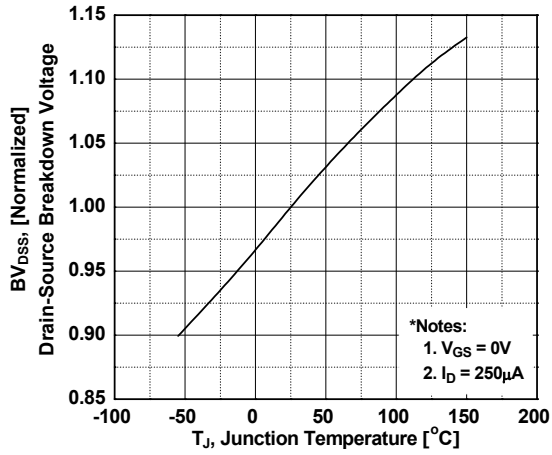


Figure 8. On-Resistance Variation vs. Temperature

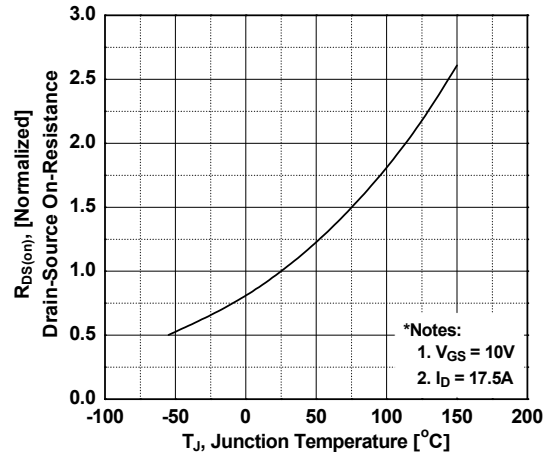


Figure 9. Maximum Safe Operating Area

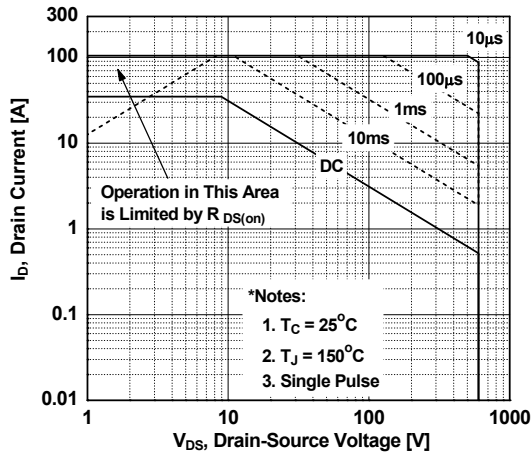


Figure 10. Maximum Drain Current vs. Case Temperature

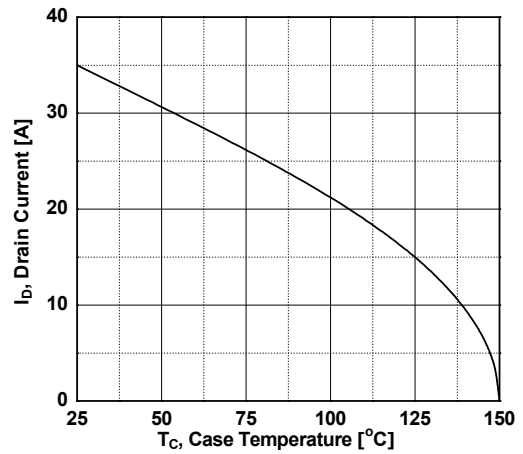
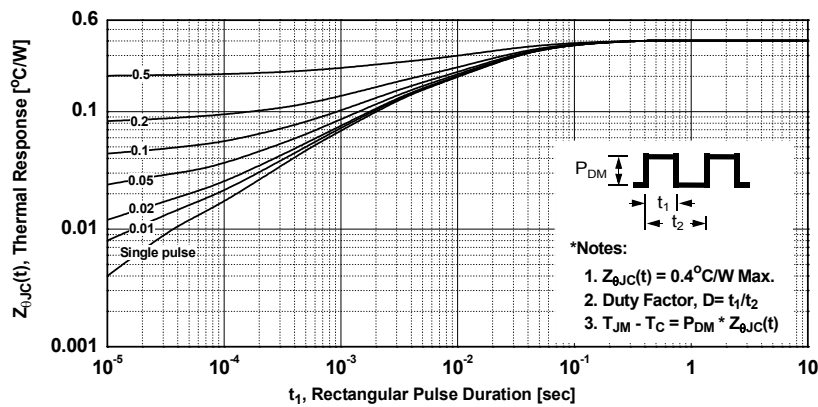


Figure 11. Transient Thermal Response Curve



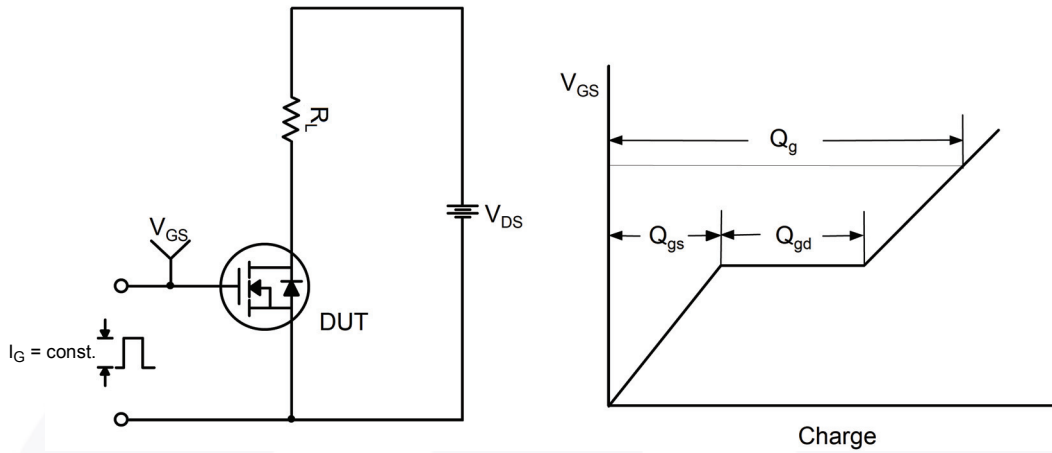


Figure 12. Gate Charge Test Circuit & Waveform



Figure 13. Resistive Switching Test Circuit & Waveforms

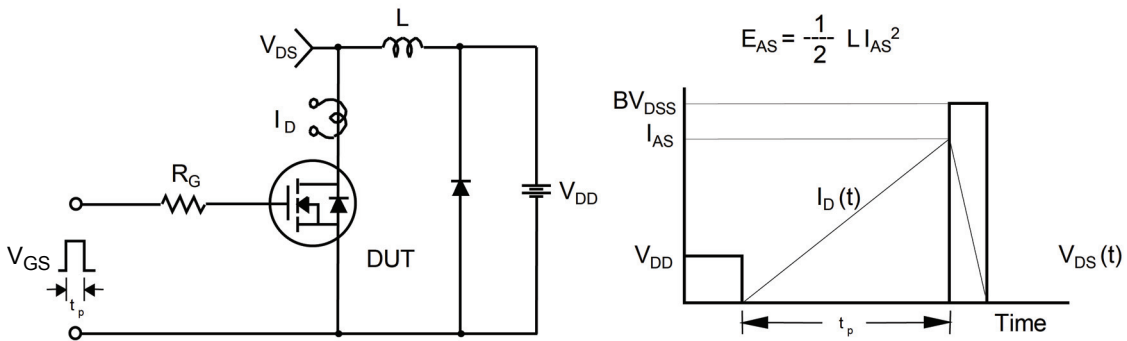
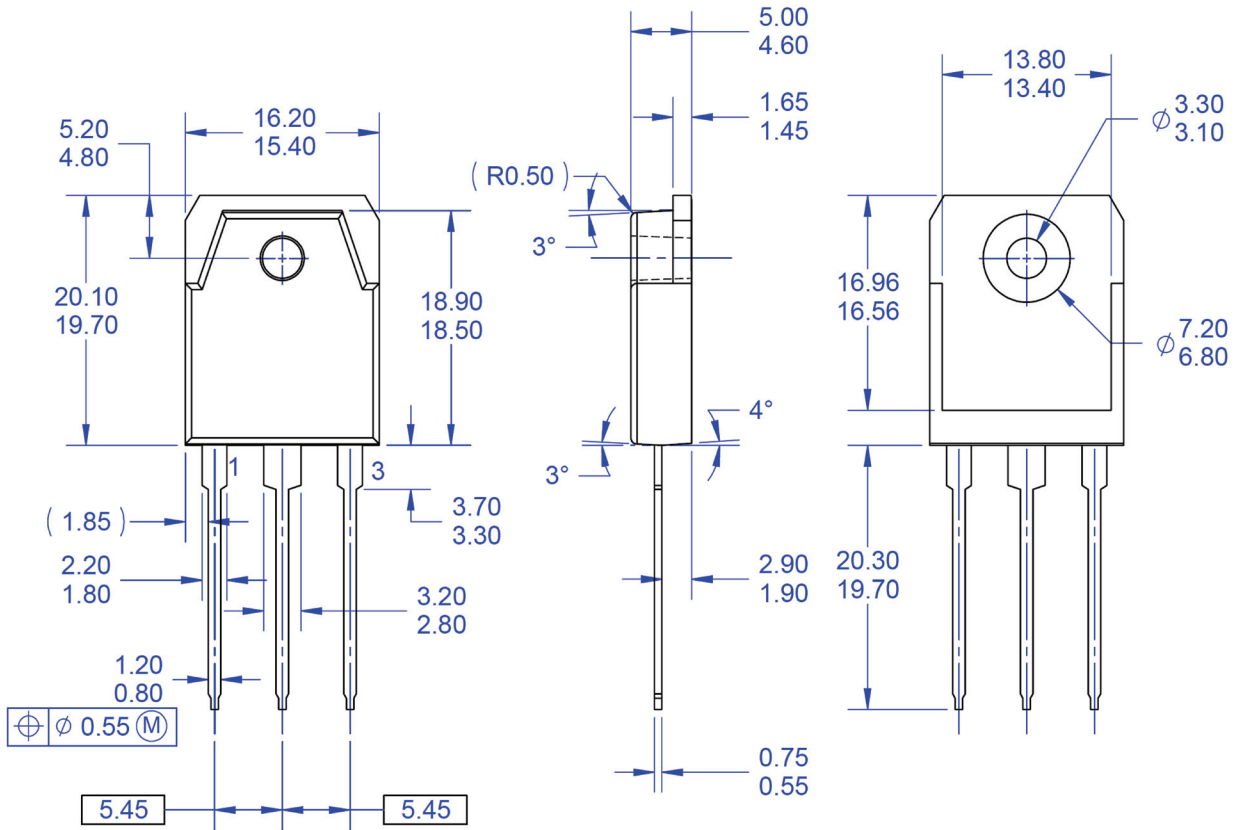


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



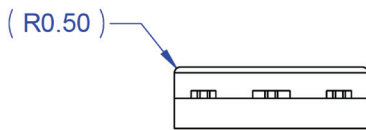
Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

- THIS PACKAGE CONFORMS TO EIAJ SC-65 PACKAGING STANDARD.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSION AND TOLERANCING PER ASME14.5-2009.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- DRAWING FILE NAME: TO3PN03AREV1.
- FAIRCHILD SEMICONDUCTOR.



**Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65**

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