FAIRCHILD SEMICONDUCTOR®

April 2013

FDT3N40

N-Channel UniFET™ MOSFET

400 V, 2.0 A, 3.4

Features

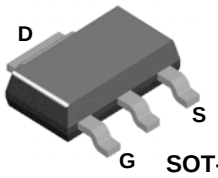
- $R_{DS(on)}$ = 3.4 Ω (Max.) @ V_{GS} = 10 V, I_D = 1.0 A
- Low Gate Charge (Typ. 4.5 nC)
- Low Crss (Typ. 3.7 pF)
- 100% Avalanche Tested

Applications

- LCD/LED TV
- Lighting
- Uninterruptible Power Supply

Description

UniFET™ MOSFET is Fairchild Semiconductor®'s high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.



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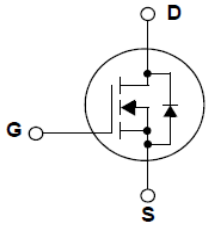


Absolute Maximum Ratings

Symbol	Parameter		FDT3N40	Unit
V_{DSS}	Drain-Source Voltage		400	V
I_D	Drain Current	- Continuous (T_C = 25°C) - Continuous (T_C = 100°C)	2.0 * 1.2 *	A A
I_{DM}	Drain Current	- Pulsed (Note 1)	8.0 *	A
V_{GSS}	Gate-Source voltage		±30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	46	mJ
I_{AR}	Avalanche Current	(Note 1)	2	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	0.2	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5	V/ns
P_D	Power Dissipation	(T_C = 25°C) - Derate above 25°C	2 0.02	W W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300	°C

* Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FDT3N40	Unit
$R_{\theta JA}$ *	Thermal Resistance, Case-to-Sink Typ.	60	°C/W

* Surface Mounted on JESD51-3 Board, T<0.1sec.

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDT3N40	FDT3N40TF	SOT-223	330mm	12mm	4000

Electrical Characteristics

T_C = 25°C unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA	400	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C	--	0.4	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 400V, V_{GS} = 0V V_{DS} = 320V, T_C = 125°C	-- --	-- --	1 10	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30V, V_{DS} = 0V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30V, V_{DS} = 0V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 1A	--	2.8	3.4	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 1A (Note 4)	--	2	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	173	225	pF
C_{oss}	Output Capacitance		--	30	40	pF
C_{rss}	Reverse Transfer Capacitance		--	3.7	6	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 200V, I_D = 2A R_G = 25Ω	--	10	30	ns
t_r	Turn-On Rise Time		--	30	70	ns
$t_{d(off)}$	Turn-Off Delay Time		--	10	30	ns
t_f	Turn-Off Fall Time	(Note 4, 5)	--	25	60	ns
Q_g	Total Gate Charge	V_{DS} = 320V, I_D = 2A V_{GS} = 10V	--	4.5	6	nC
Q_{gs}	Gate-Source Charge		--	1.2	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	2	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	2	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	8	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 2A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 2A dI_F/dt =100A/μs (Note 4)	--	210	--	ns
Q_{rr}	Reverse Recovery Charge		--	0.75	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 10mH, I_{AS} = 2A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 2A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

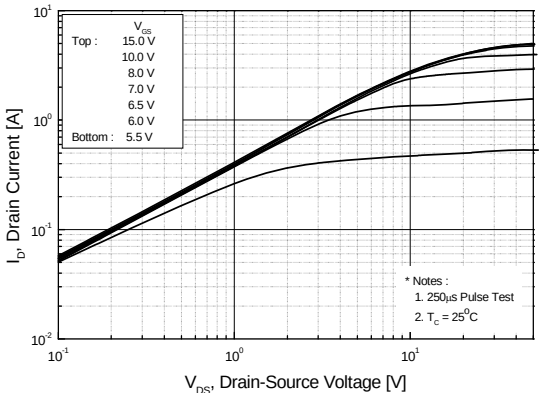


Figure 2. Transfer Characteristics

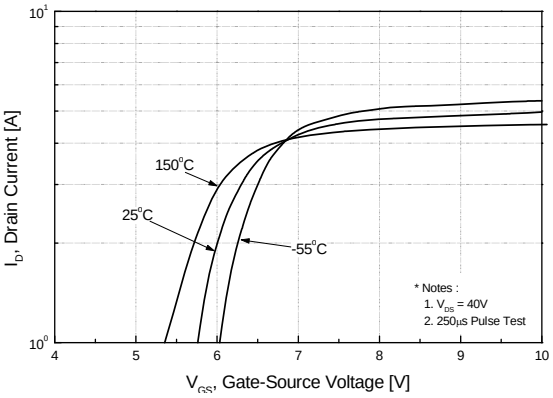


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

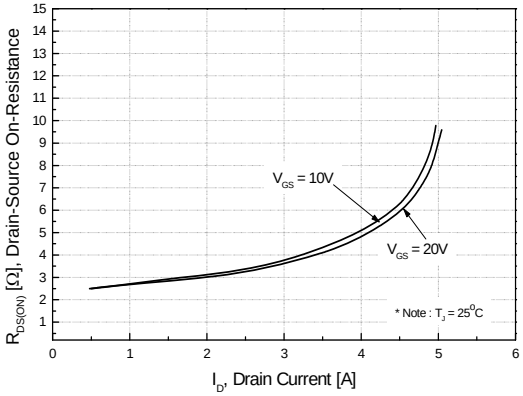


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

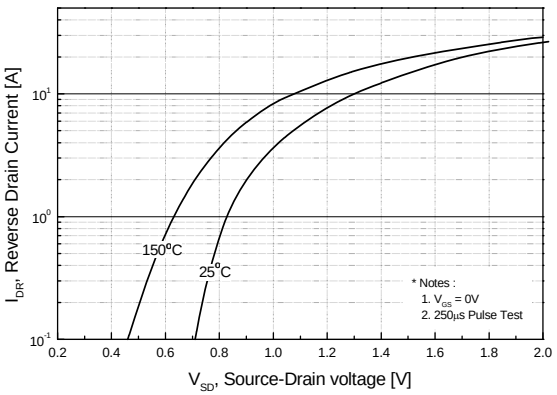


Figure 5. Capacitance Characteristics

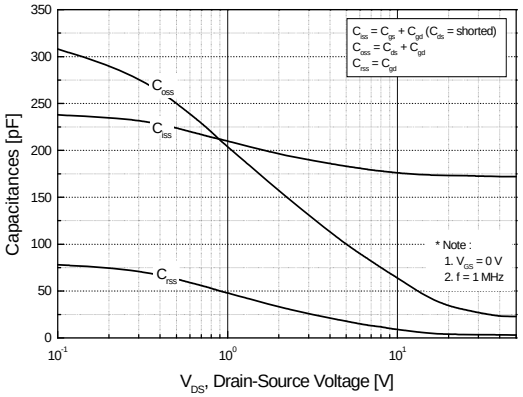
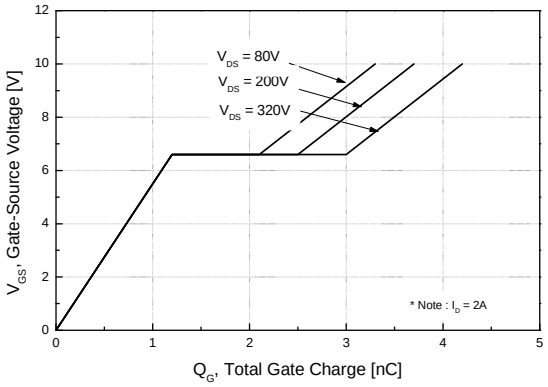


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

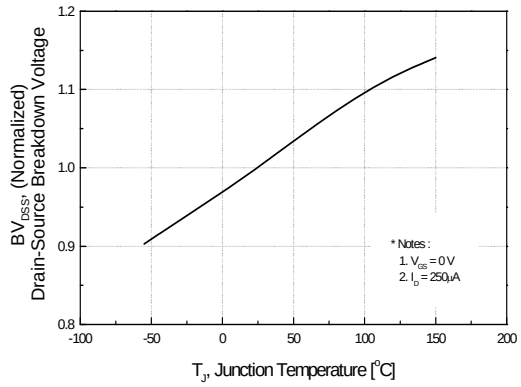


Figure 8. On-Resistance Variation vs. Temperature

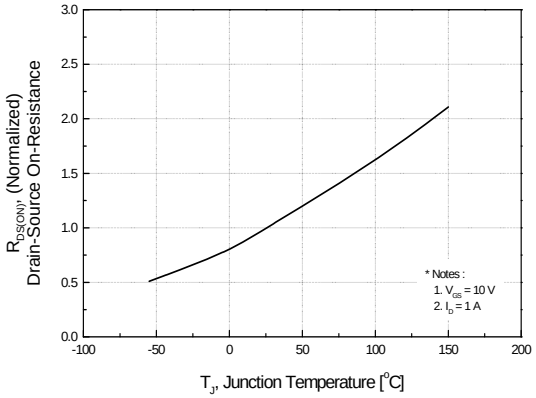


Figure 9. Maximum Safe Operating Area

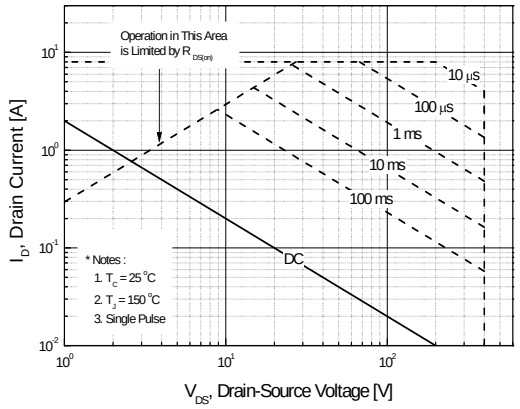


Figure 10. Maximum Drain Current vs. Case Temperature

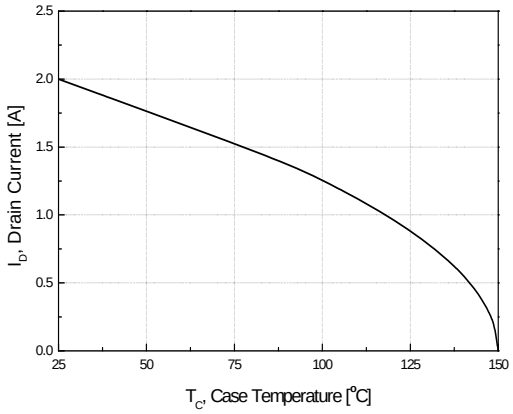
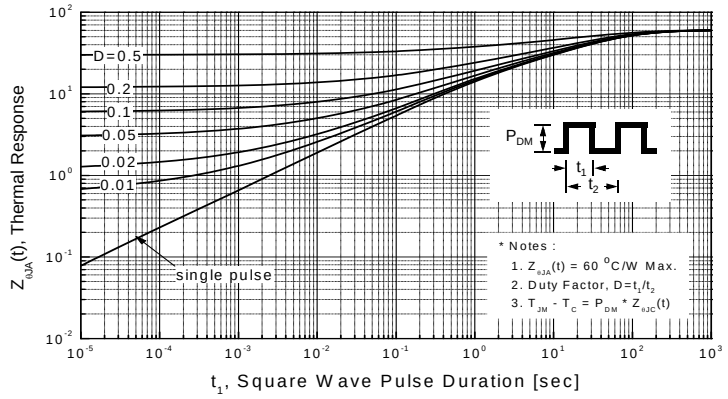
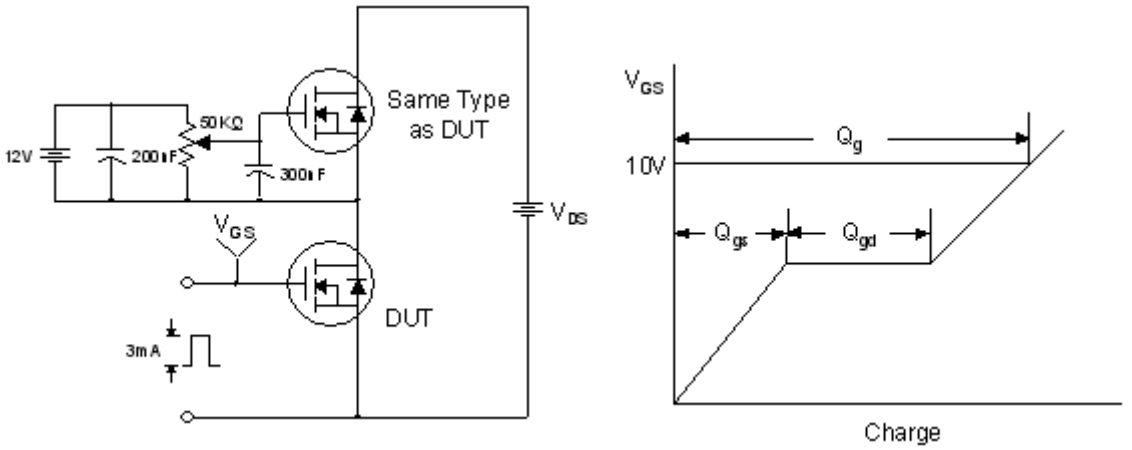


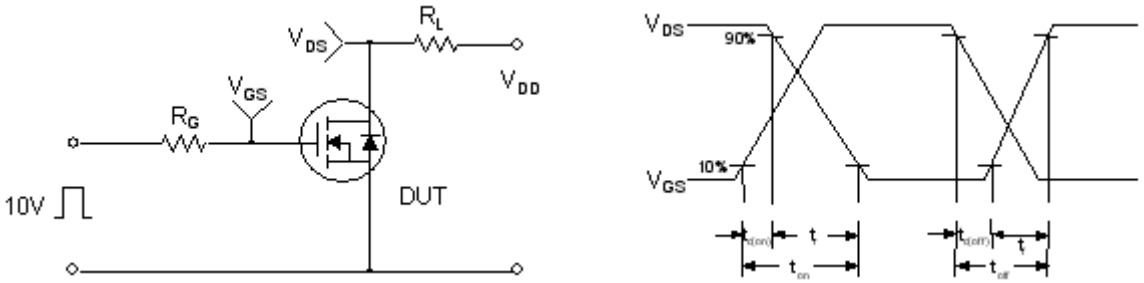
Figure 11. Transient Thermal Response Curve



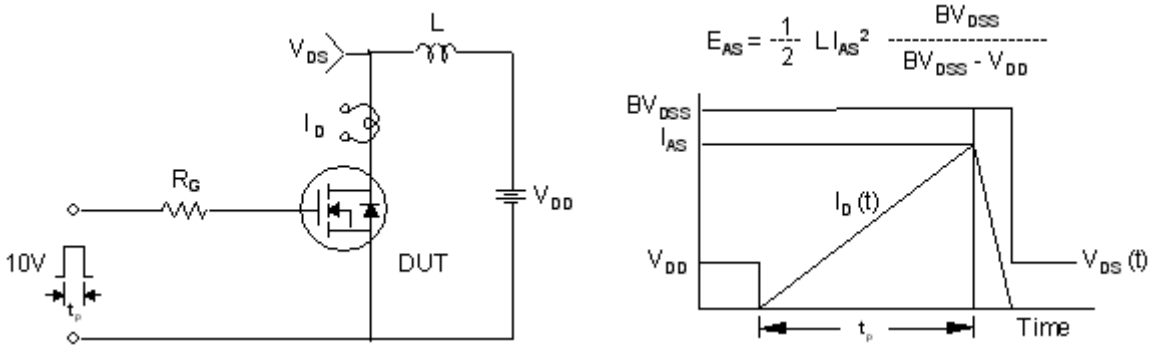
Gate Charge Test Circuit & Waveform



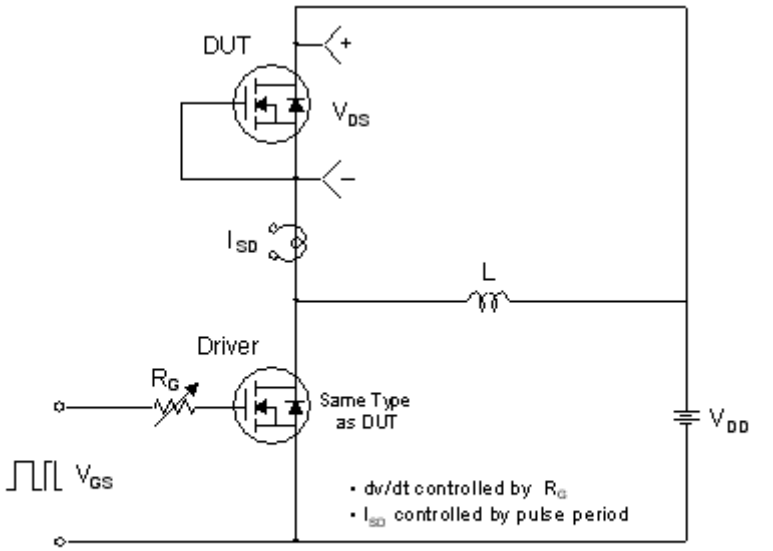
Resistive Switching Test Circuit & Waveforms

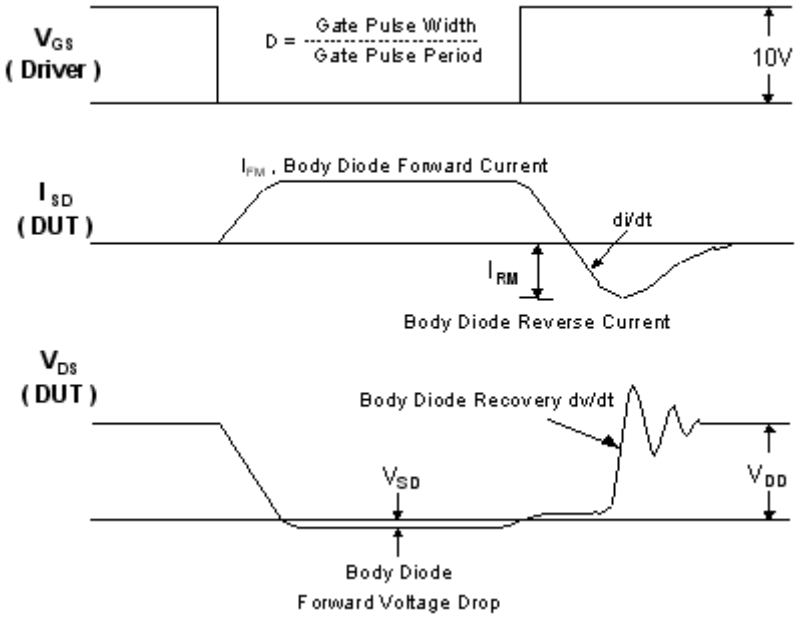


Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Test Circuit & Waveforms





Mechanical Dimensions

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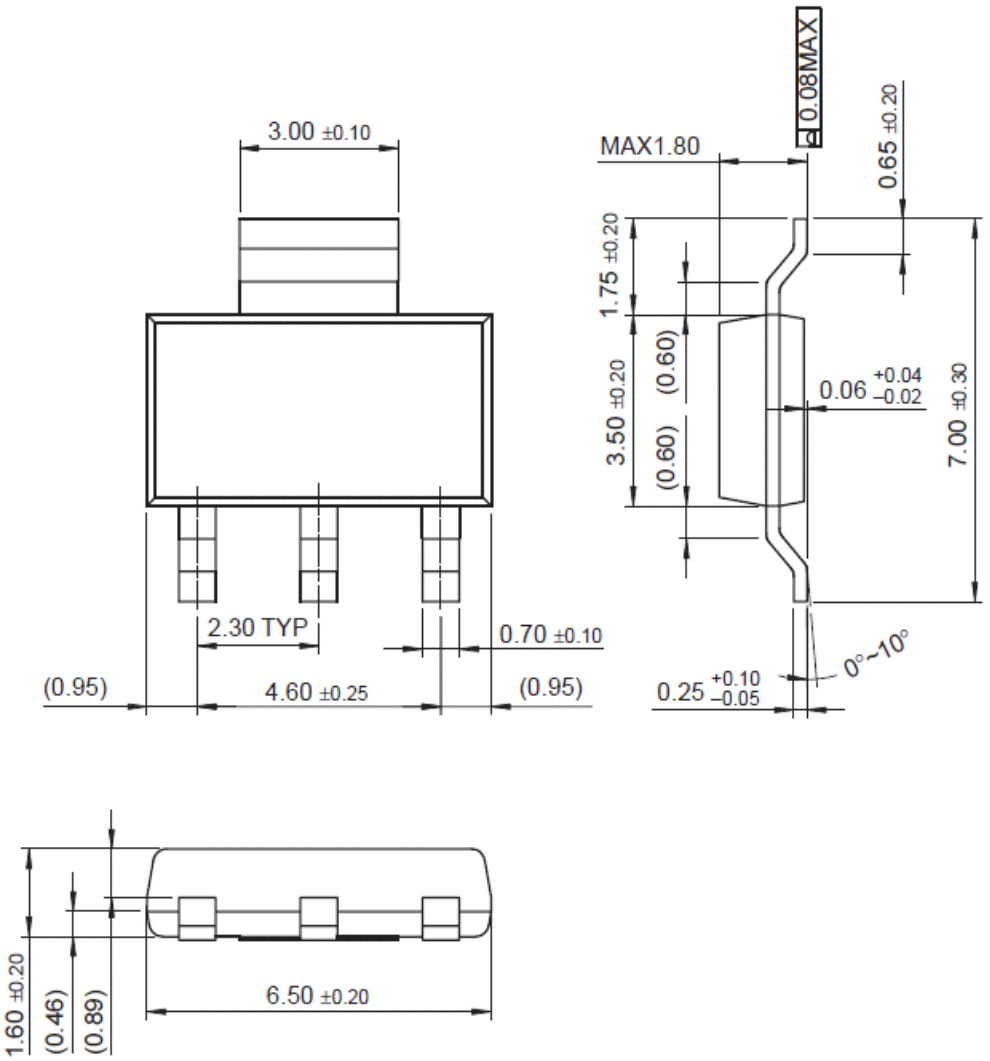

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