

# FQT4N20L

## N-Channel QFET® MOSFET

200 V, 0.85 A, 1.40 Ω

March 2013

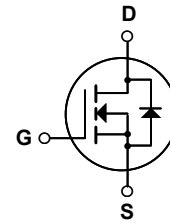
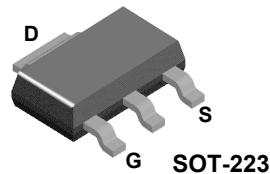


### Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor®'s proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.

### Features

- 0.85 A, 200 V,  $R_{DS(on)}=1.35 \Omega$ (Typ.)@ $V_{GS}=10 \text{ V}$ ,  $I_D=0.425 \text{ A}$
- Low Gate Charge (Typ. 4 nC)
- Low  $C_{rss}$  (Typ. 6 pF)
- 100% Avalanche Tested
- Low Level Gate Drive Requirements Allowing Direct Operation From Logic Drives



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

Symbol	Parameter	FQT4N20L	Unit
$V_{DSS}$	Drain-Source Voltage	200	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ ) - Continuous ( $T_C = 70^\circ\text{C}$ )	0.85	A
		0.68	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	3.4	A
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	52	mJ
$I_{AR}$	Avalanche Current (Note 1)	0.85	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	0.22	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$	2.2	W
		0.018	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	Typ	Max	Unit
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient *	--	57	$^\circ\text{C}/\text{W}$

\* When mounted on the minimum pad size recommended (PCB Mount)

## Electrical Characteristics

$T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	200	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.16	--	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 160\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1.0	--	2.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 0.425\text{ A}$	--	1.10	1.35	$\Omega$
		$V_{GS} = 5\text{ V}, I_D = 0.425\text{ A}$	--	1.13	1.40	
$g_{FS}$	Forward Transconductance	$V_{DS} = 30\text{ V}, I_D = 0.425\text{ A}$ (Note 4)	--	1.42	--	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	240	310	pF
$C_{oss}$	Output Capacitance		--	36	45	pF
$C_{rss}$	Reverse Transfer Capacitance		--	6	8	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 100\text{ V}, I_D = 3.8\text{ A},$ $R_G = 25\ \Omega$	--	7	25	ns	
$t_r$	Turn-On Rise Time		--	70	150	ns	
$t_{d(off)}$	Turn-Off Delay Time		--	15	40	ns	
$t_f$	Turn-Off Fall Time		(Note 4, 5)	--	40	90	ns
$Q_g$	Total Gate Charge		$V_{DS} = 160\text{ V}, I_D = 3.8\text{ A},$ $V_{GS} = 5\text{ V}$	--	4.0	5.2	nC
$Q_{gs}$	Gate-Source Charge	(Note 4, 5)	--	1.0	--	nC	
$Q_{gd}$	Gate-Drain Charge		--	1.9	--	nC	

### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	0.85	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	3.4	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 0.85\text{ A}$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 3.8\text{ A},$	--	90	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4)	--	0.25	--	$\mu\text{C}$

#### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 108\text{mH}, I_{AS} = 0.85\text{A}, V_{DD} = 50\text{V}, R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 3.8\text{A}, di/dt \leq 300\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\ \mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

## Typical Characteristics

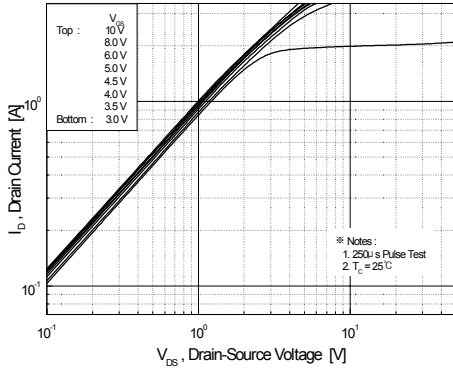


Figure 1. On-Region Characteristics

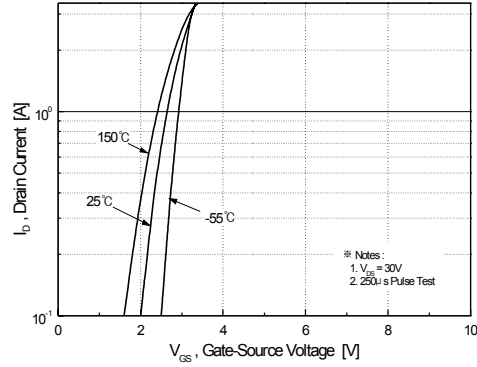


Figure 2. Transfer Characteristics

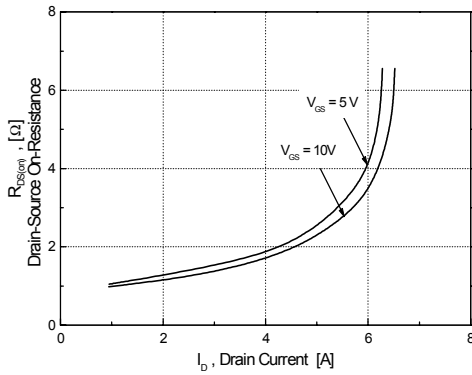


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

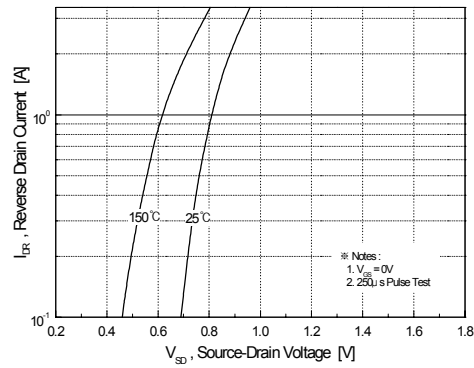


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

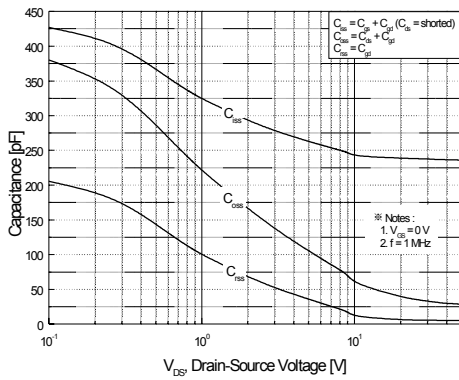


Figure 5. Capacitance Characteristics

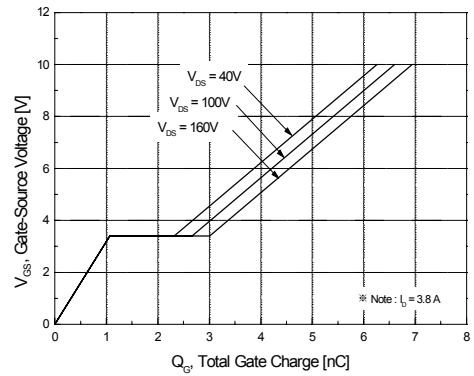
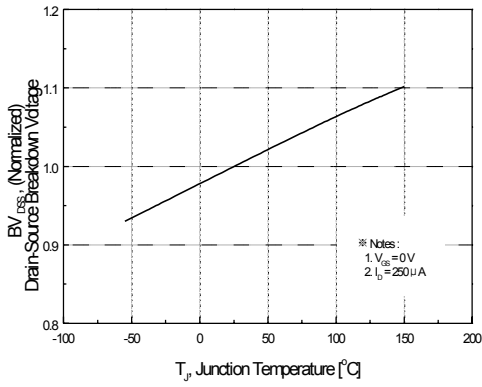
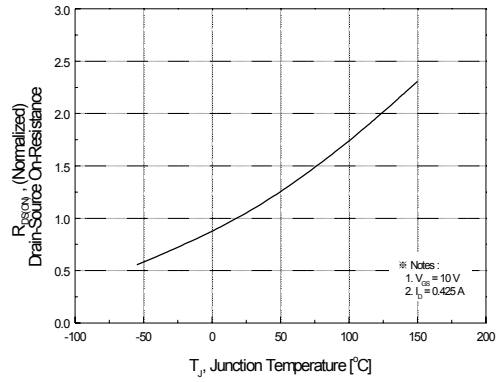


Figure 6. Gate Charge Characteristics

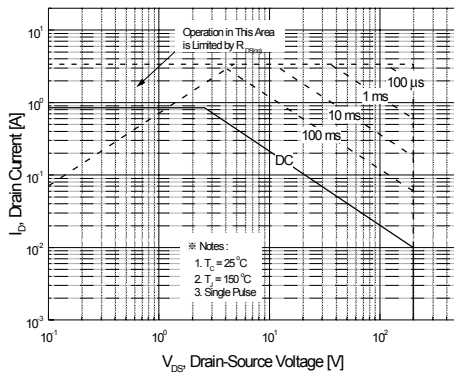
**Typical Characteristics** (Continued)



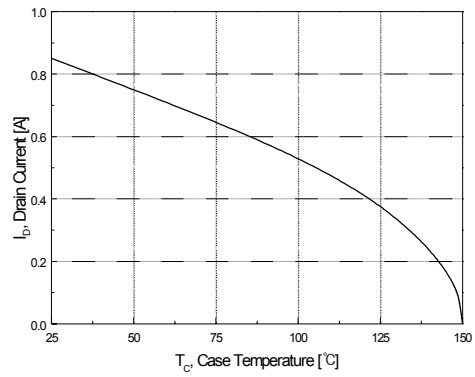
**Figure 7. Breakdown Voltage Variation vs. Temperature**



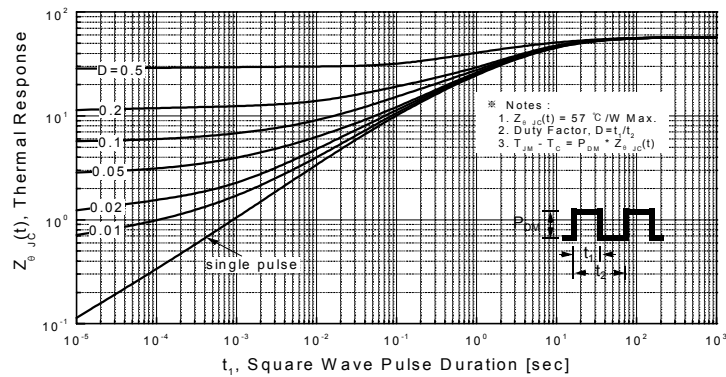
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**

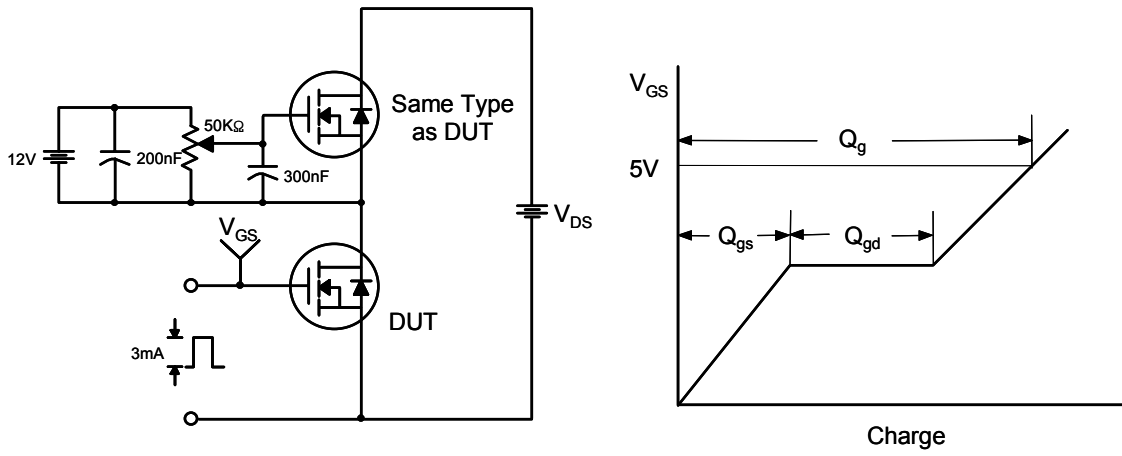


**Figure 10. Maximum Drain Current vs. Case Temperature**

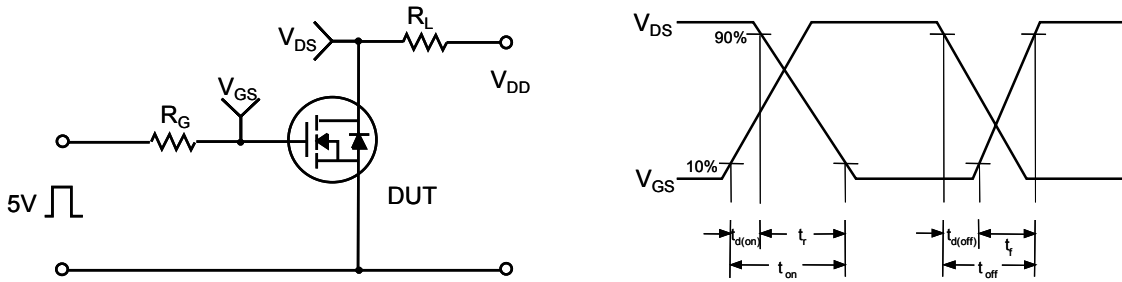


**Figure 11. Transient Thermal Response Curve**

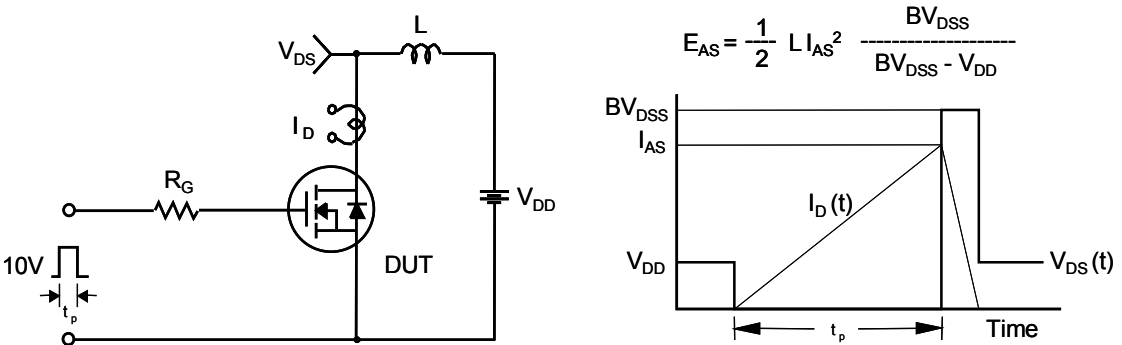
**Gate Charge Test Circuit & Waveform**



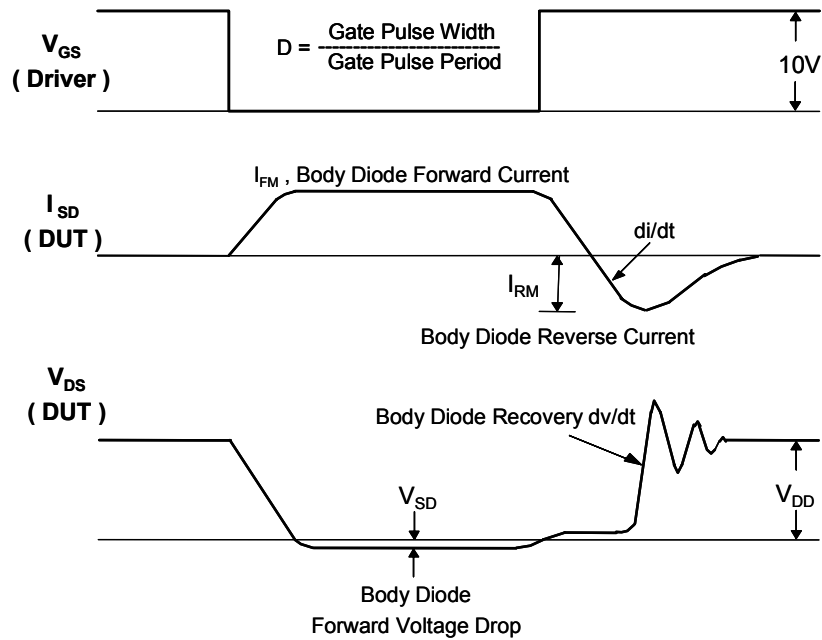
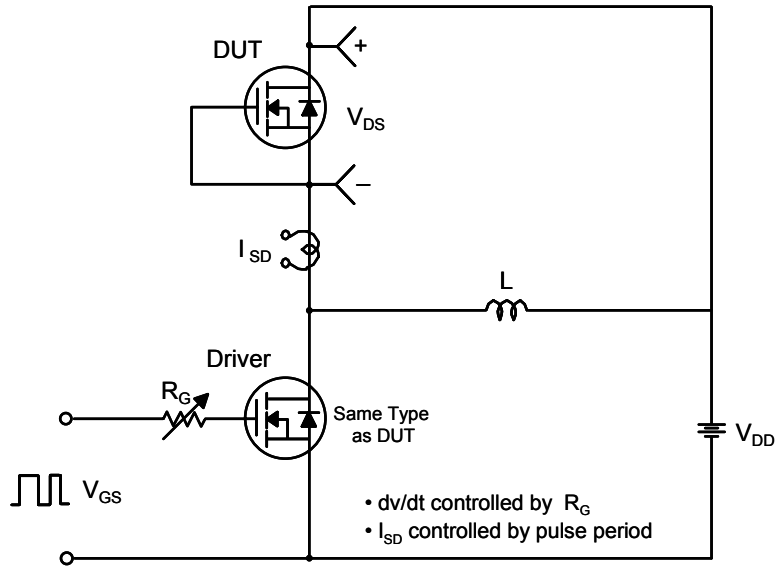
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**



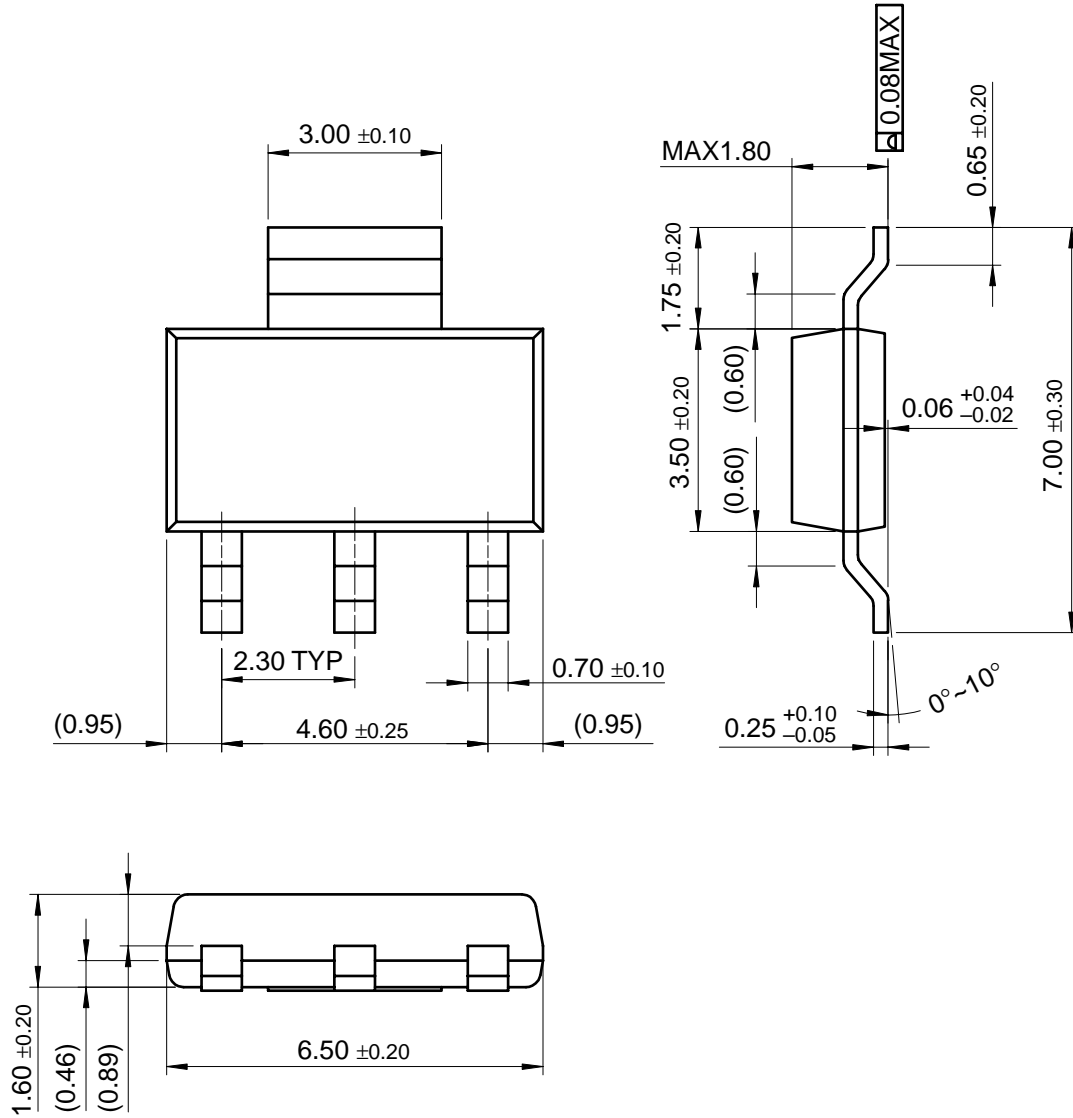
Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimensions

SOT-223



FQT4N20L N-Channel MOSFET





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