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FQT13N06L — N-Channel QFET<sup>®</sup> MOSFET

# FQT13N06L

## N-Channel QFET<sup>®</sup> MOSFET

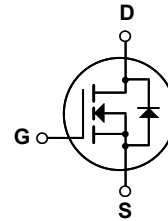
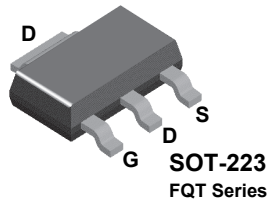
### 60 V, 2.8 A, 110 mΩ

#### General Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor<sup>®</sup>'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, audio amplifier, DC motor control, and variable switching power applications.

#### Features

- 2.8 A, 60 V,  $R_{DS(on)} = 110 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 1.4 \text{ A}$
- Low Gate Charge (Typ. 4.8 nC)
- Low  $C_{rss}$  (Typ. 17 pF)
- 100% Avalanche Tested



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

Symbol	Parameter	FQT13N06L	Unit
$V_{DSS}$	Drain-Source Voltage	60	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ ) - Continuous ( $T_C = 70^\circ\text{C}$ )	2.8	A
		2.24	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	11.2	A
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	85	mJ
$I_{AR}$	Avalanche Current (Note 1)	2.8	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	0.21	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	7.0	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$	2.1	W
		0.017	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, 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 *	--	60	$^\circ\text{C}/\text{W}$

\* 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	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	60	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.05	--	V/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 48\text{ V}, T_C = 125^\circ\text{C}$	--	--	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	--	2.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 1.4\text{ A}$	--	0.088	0.11	$\Omega$
		$V_{GS} = 5\text{ V}, I_D = 1.4\text{ A}$	--	0.110	0.14	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 25\text{ V}, I_D = 1.4\text{ A}$ (Note 4)	--	4.1	--	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	270	350	pF
$C_{oss}$	Output Capacitance		--	95	125	pF
$C_{rss}$	Reverse Transfer Capacitance		--	17	23	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}, I_D = 6.8\text{ A},$ $R_G = 25\ \Omega$	--	8	25	ns	
$t_r$	Turn-On Rise Time		--	90	190	ns	
$t_{d(off)}$	Turn-Off Delay Time		--	20	50	ns	
$t_f$	Turn-Off Fall Time		(Note 4, 5)	--	40	90	ns
$Q_g$	Total Gate Charge		$V_{DS} = 48\text{ V}, I_D = 13.6\text{ A},$ $V_{GS} = 5\text{ V}$	--	4.8	6.4	nC
$Q_{gs}$	Gate-Source Charge	--		1.6	--	nC	
$Q_{gd}$	Gate-Drain Charge	(Note 4, 5)		--	2.7	--	nC

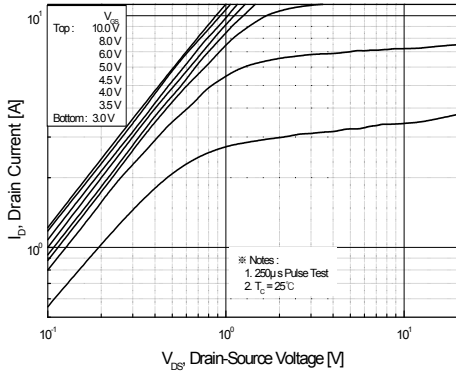
### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	2.8	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	11.2	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2.8\text{ A}$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 13.6\text{ A},$ $di_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4)	--	45	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	45	--	nC

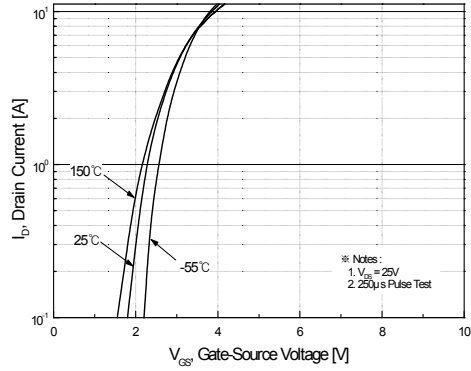
#### Notes:

1. Repetitive rating : pulse-width limited by maximum junction temperature.
2.  $L = 12.6\text{ mH}, I_{AS} = 2.8\text{ A}, V_{DD} = 25\text{ V}, R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 13.6\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , 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.

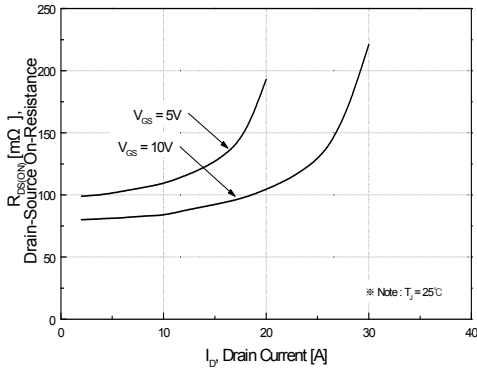
## Typical Characteristics



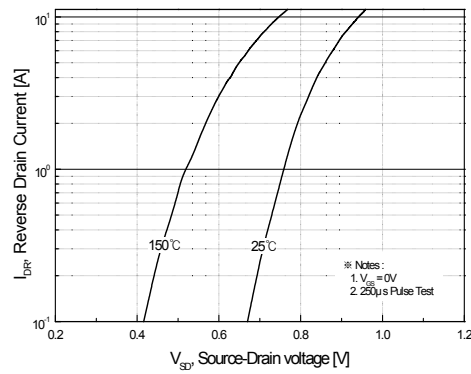
**Figure 1. On-Region Characteristics**



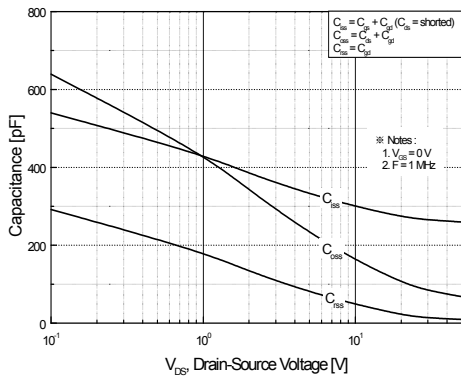
**Figure 2. Transfer Characteristics**



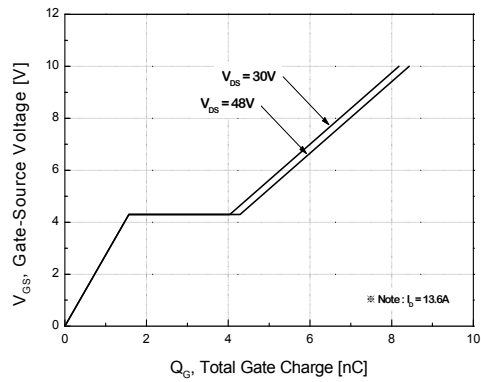
**Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage**



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

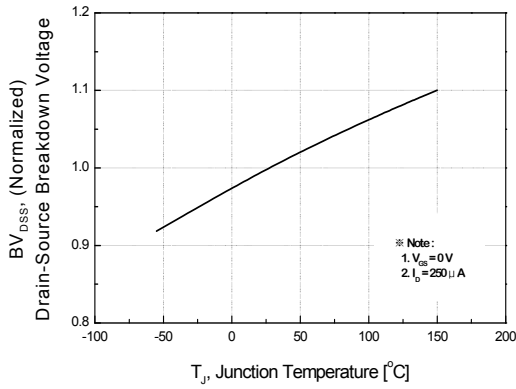


**Figure 5. Capacitance Characteristics**

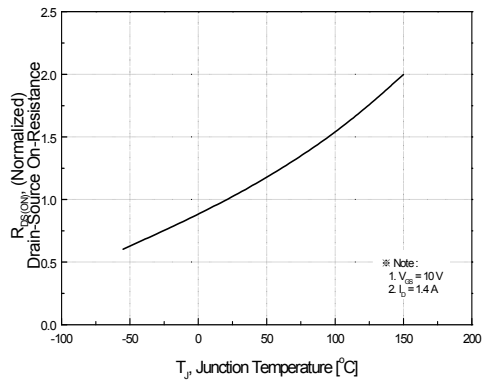


**Figure 6. Gate Charge Characteristics**

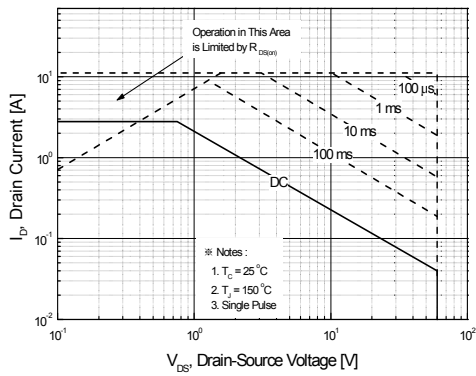
**Typical Characteristics** (Continued)



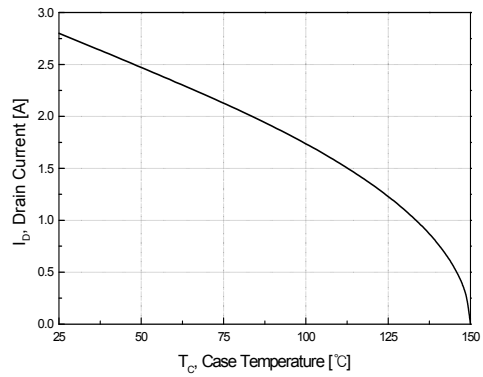
**Figure 7. Breakdown Voltage Variation vs Temperature**



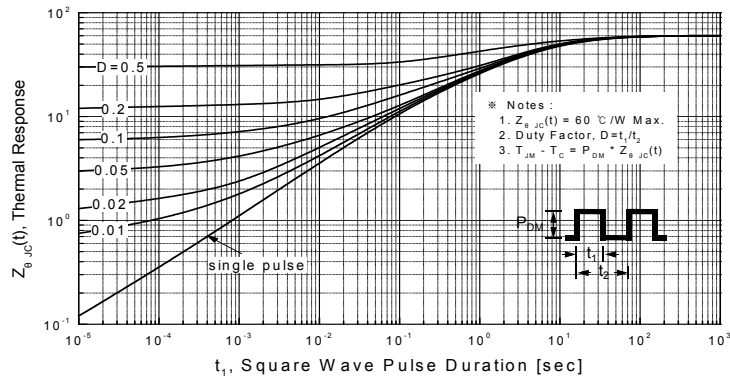
**Figure 8. On-Resistance Variation vs Temperature**



**Figure 9. Maximum Safe Operating Area**

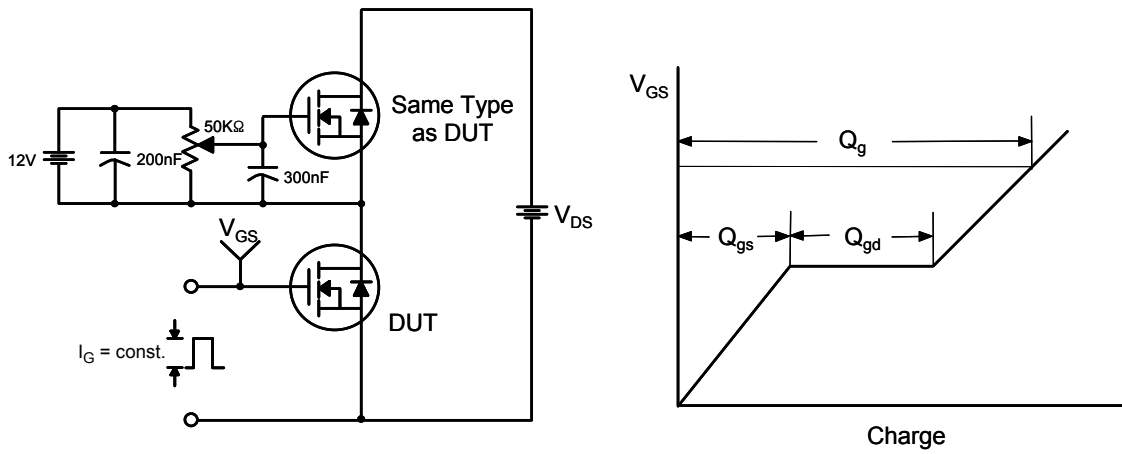


**Figure 10. Maximum Drain Current vs Case Temperature**

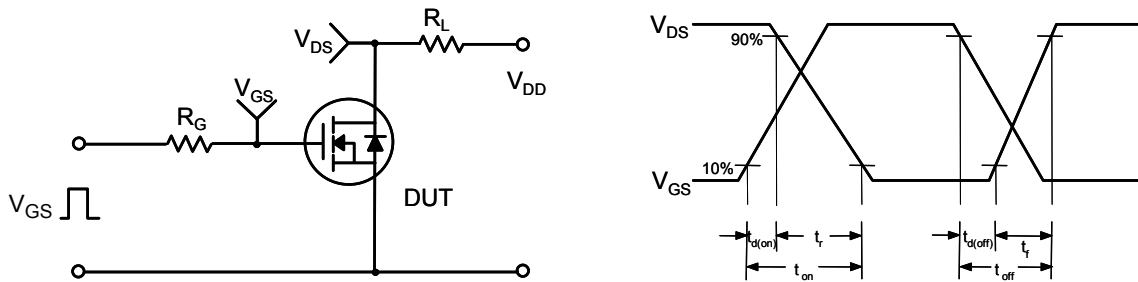


**Figure 11. Transient Thermal Response Curve**

**Figure 12. Gate Charge Test Circuit & Waveform**



**Figure 13. Resistive Switching Test Circuit & Waveforms**



**Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms**

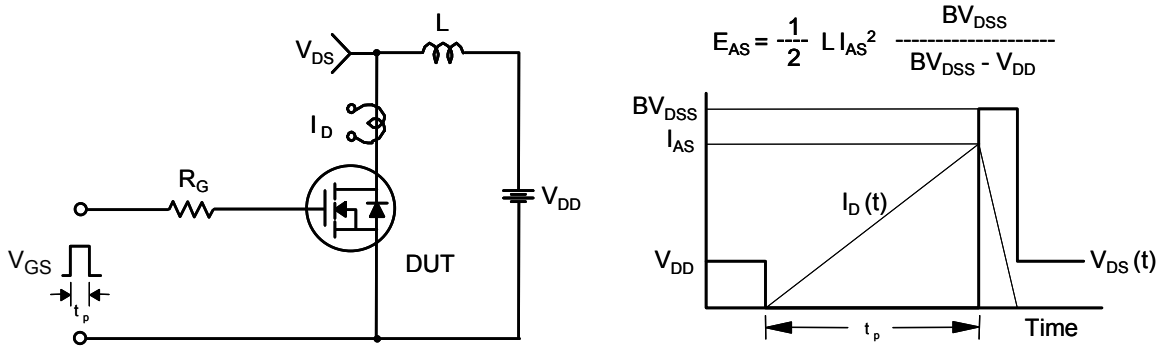
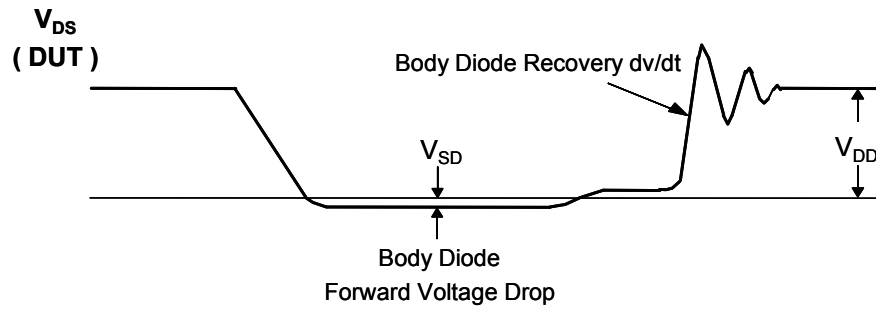
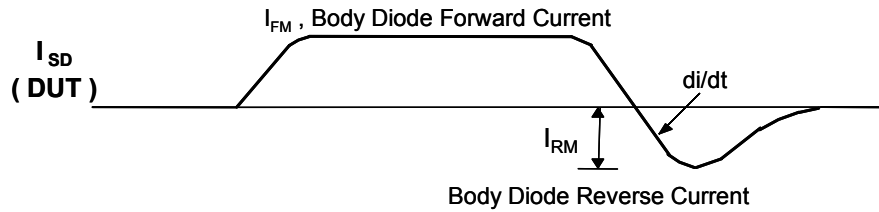
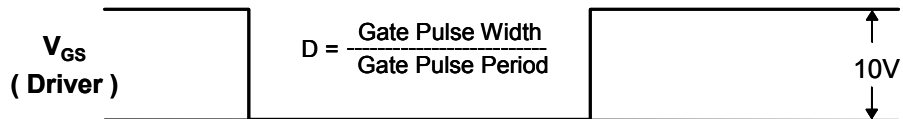
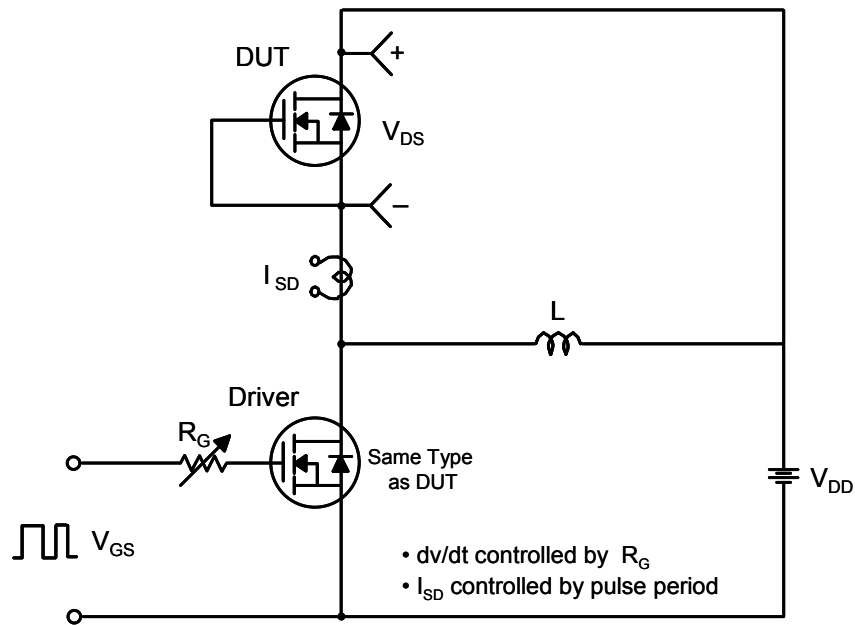
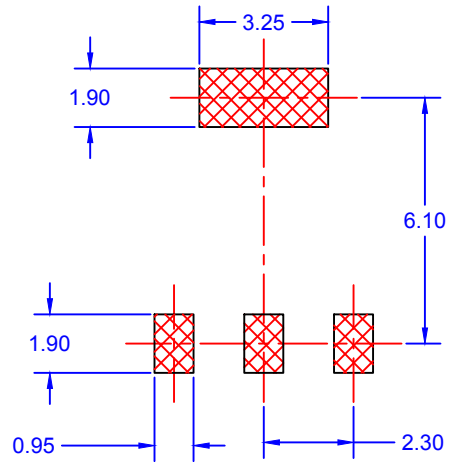
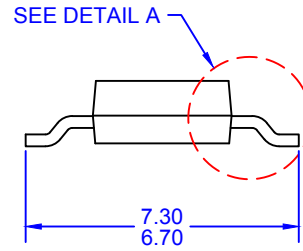
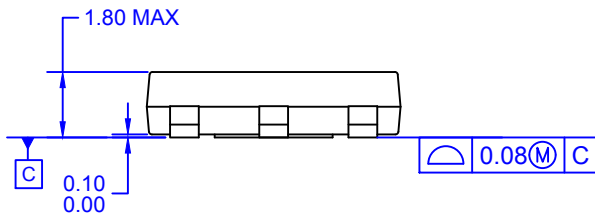


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

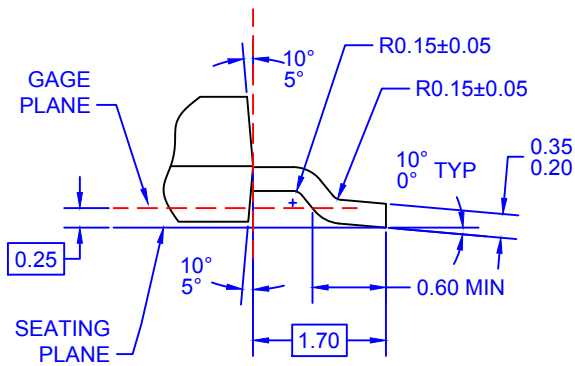




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DETAIL A  
SCALE: 2:1





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