

## Silicon Carbide Power MOSFET 1200V, 55A, 40m Ω

### General Description

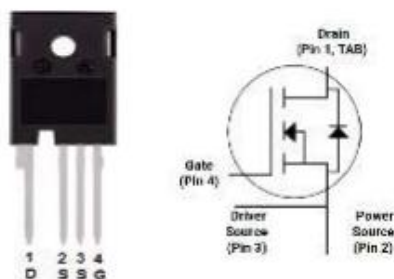
This product family offers state of the art performance. It is designed for high frequency applications here high efficiency and high reliability are required.

### Features

- High Blocking Voltage
- High Frequency Operation
- Low on-resistance
- Fast intrinsic diode with low reverse recovery

### Applications

- Motor Drives
- Solar / Wind Inverters
- EV Charging Station
- AC/DC converters
- DC/DC converters
- Uninterruptable power supplies



### TO-247-4 Pin definition

### Benefits

- Higher System Efficiency
- Parallel Device Convenience without thermal runaway
- High Temperature Application
- Hard Switching & Higher Reliability
- Easy to drive

### Key performance parameters

Type	$V_{DS}$	$I_D$ $T_C=25^\circ\text{C}$	$R_{DS(ON)}$
KN3M0040120Q	1200V	55A	40m Ω

Caution: This device is sensitive to electrostatic discharge .Users should follow ESD handing procedures.

### Maximum Ratings

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

Parameter	Symbol	Test conditions	Value	Unit
Drain - Source Voltage	$V_{DSmax}$	$V_{GS} = 0\text{V}, I_D=100\mu\text{A}$	1200	V
Gate - Source Voltage (dynamic)	$V_{GSmax}$	AC ( $f>1\text{ Hz}$ )	-10/+25	V
Gate - Source Voltage (static)	$V_{GSop}$	static	-5/+20	V

### Maximum Ratings

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

Parameter	Symbol	Value	Unit
Continuous Drain Current: $V_{GS} = 20\text{V}$ $T_C = 25^{\circ}\text{C}$ $T_C = 100^{\circ}\text{C}$	$I_D$	55 39	A
Pulsed Drain Current: $T_C = 25^{\circ}\text{C}$	$I_{D(pulse)}$	117	A
Short Circuit Capability : $V_{DD} = 800\text{V}$ $V_{GS} = 20\text{V}$	tsc	3	$\mu\text{S}$
Short Circuit Capability : $V_{DD} = 800\text{V}$ $V_{GS} = 20\text{V}$	$I_{DS}$	600	A
Total power dissipation : $T_C = 25^{\circ}\text{C}$	$P_D$	300	W
Operating Junction Temperature :	$T_j$	-55 to 175	$^{\circ}\text{C}$
Storage Temperature :	$T_{stg}$	-55 to 150	$^{\circ}\text{C}$

### Thermal Characteristics

Parameter	Symbol	Condition	Typ	Max	Unit
Thermal Resistance (per device)	$R_{th(j-c)}$	junction-case	0.35	0.5	$^{\circ}\text{C/W}$

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### Electrical Characteristic

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

Parameter	Symbol	Value			Unit	Test Condition
		Min.	Typ.	Max.		
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	1200			V	$V_{GS} = 0V$ $I_D = 100\mu A$
Gate Threshold Voltage	$V_{GS(th)}$	1.8	3.5 2.6 2.5	3.9	V	$V_{DS} = V_{GS}$ $I_D = 10mA$ $T_J = 150^\circ\text{C}$ $T_J = 175^\circ\text{C}$
Zero Gate Voltage Drain Current	$I_{DSS}$	0	5	100	$\mu A$	$V_{DS} = 1200V$ $V_{GS} = 0V$
Gate-Source Leakage Current	$I_{GSS}$	0 -200	10 -10	200 0	nA	$V_{GS} = 20V$ $V_{DS} = 0V$ $V_{GS} = -5V$ $V_{DS} = 0V$
Drain-Source On-State Resistance	$R_{DS(on)}$		40 61 69	44	m $\Omega$	$V_{GS} = 20V$ $I_D = 40 A$ $T_J = 150^\circ\text{C}$ $T_J = 175^\circ\text{C}$
Transconductance	gfs		22 20 19		S	$V_{GS} = 20V$ $I_D = 40 A$ $T_J = 150^\circ\text{C}$ $T_J = 175^\circ\text{C}$
Input capacitance	$C_{iss}$		2930		pF	$V_{DS} = 1000V$ $V_{GS} = 0V$ $f = 1MHz$
Output capacitance	$C_{oss}$		149			
Reverse transfer capacitance	$C_{rss}$		9			
Coss Stored Energy	$E_{oss}$		87		$\mu J$	
Total gate charge	$Q_g$		145		nC	$V_{DS} = 800V$ $V_{GS} = -5V / 20V$ $I_D = 40 A$
Gate-source charge	$Q_{gs}$		43			
Gate-drain charge	$Q_{gd}$		73			
Internal gate input resistance	$R_{g(int)}$		2		$\Omega$	$f = 1MHz$ $I_D = 0A$
Turn-On Switching Energy	$E_{ON}$		609		$\mu J$	$V_{DS}=800V$ $V_{GS} = -5V/20V$ $I_D = 40A$ $R_{G(ext)} = 1.5 \Omega$ $L = 450\mu H$
Turn-Off Switching Energy	$E_{OFF}$		439			

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Turn-On Delay Time	$t_{d(on)}$		22		ns	$V_{DS} = 800V$ $V_{GS} = -5V/20V$ $I_D = 40A$ $R_{G(ext)} = 1.5 \Omega$ $L = 450\mu H$
Rise Time	$t_r$		34			
Turn-Off Delay Time	$t_{d(off)}$		36			
Fall Time	$t_f$		20			
Avalanche Capability	$E_{AS}$		676		mJ	$V_{DD} = 100V$ $V_{GS} = 20V$ $L = 2mH$
	$I_{Av}$		26		A	

### Reverse Diode Characteristics

$T_C = 25^\circ C$ , unless otherwise specified

Parameter	Symbol	Value			Unit	Test Condition
		Min.	Typ.	Max.		
Diode Forward Voltage	$V_{SD}$		3.9 3.5 3.4		V	$V_{GS} = -5V$ $I_{SD} = 20A$ $T_J = 150^\circ C$ $T_J = 175^\circ C$
Continuous Diode Forward Current	$I_S$		70		A	$V_{GS} = -5V$
Reverse Recovery time	$t_{rr}$		20		ns	$V_{GS} = -5V$ $I_{SD} = 40A$ $V_R = 800V$ $di/dt = 4000 A/\mu s$
Reverse Recovery Charge	$Q_{rr}$		375		nC	
Peak Reverse Recovery Current	$I_{rrm}$		31		A	

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## Typical Performanc

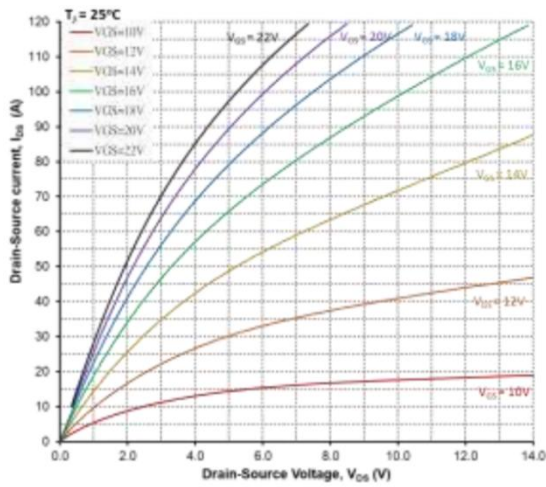


Figure 1. Output Characteristics,  $T_J = 25^\circ\text{C}$

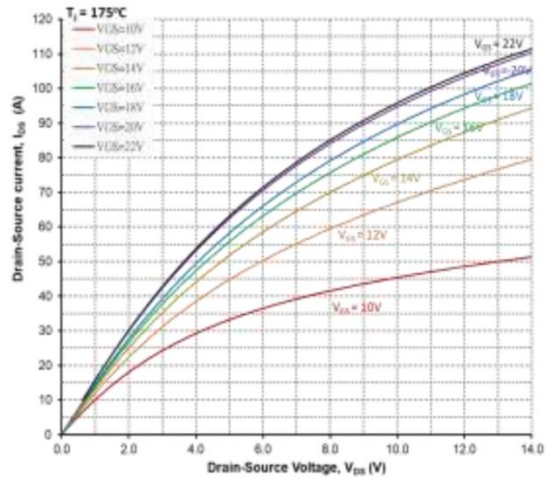


Figure 2. Output Characteristics,  $T_J = 175^\circ\text{C}$

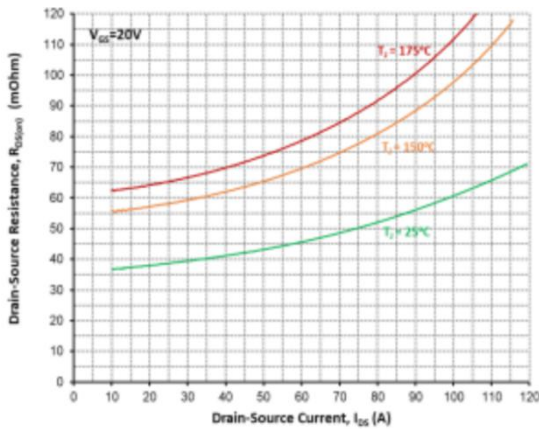


Figure 3. On-Resistance vs. Drain Current For Various Temperatures

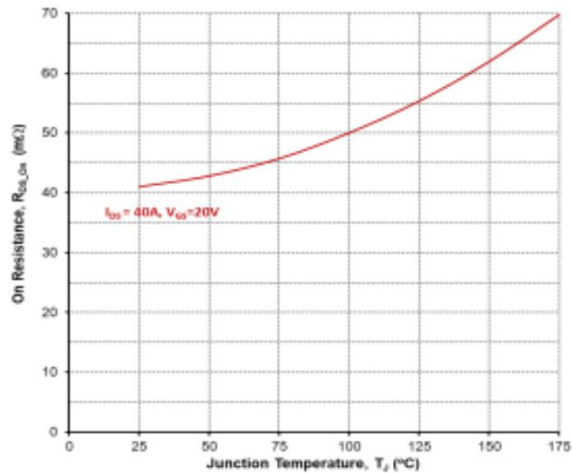


Figure 4. On-Resistance vs. Temperature

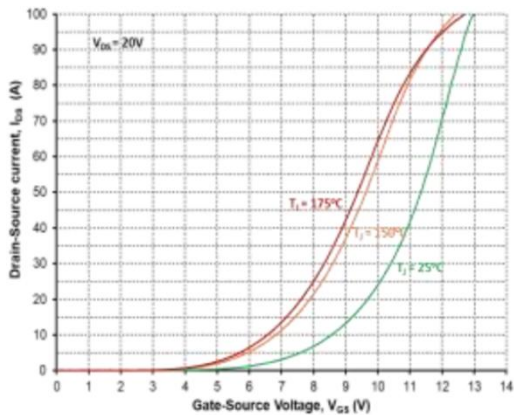


Figure 5. Transfer Characteristic For Various Junction Temperatures

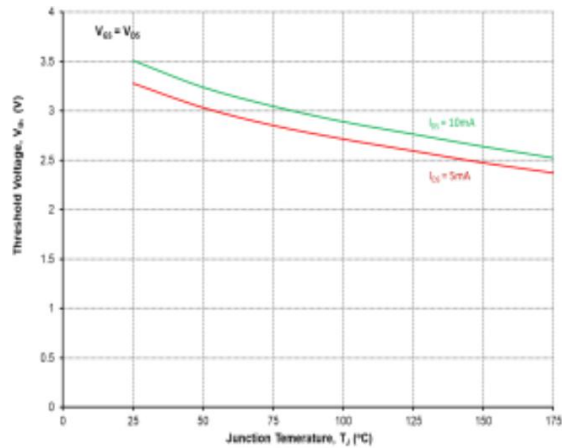


Figure 6. Threshold Voltage vs. Temperature

Caution: This device is sensitive to electrostatic discharge .Users should follow ESD handling procedures.

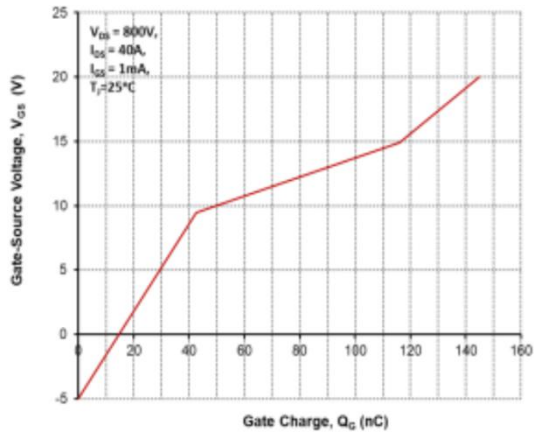


Figure 7. Gate Charge Characteristics

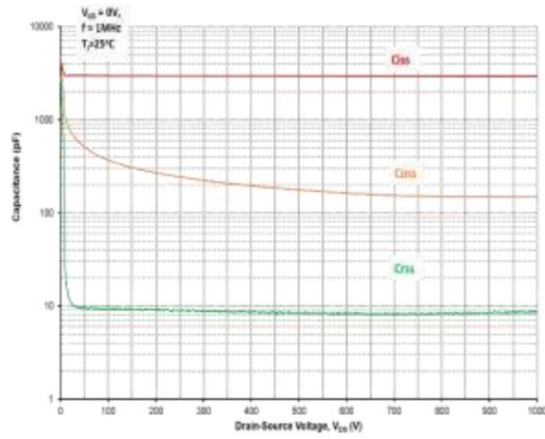


Figure 8. Capacitances vs. Drain-Source Voltage (0-1000V)

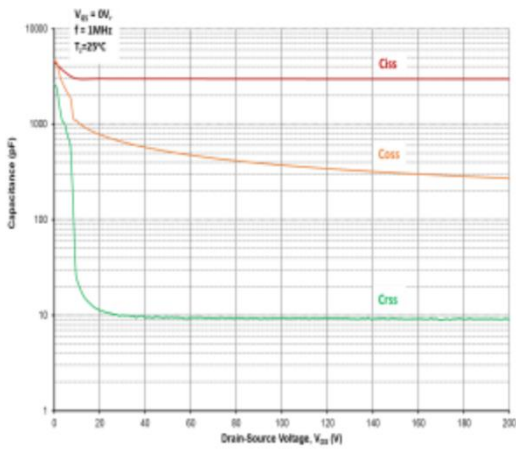


Figure 9. Capacitances vs. Drain-Source Voltage (0-200V)

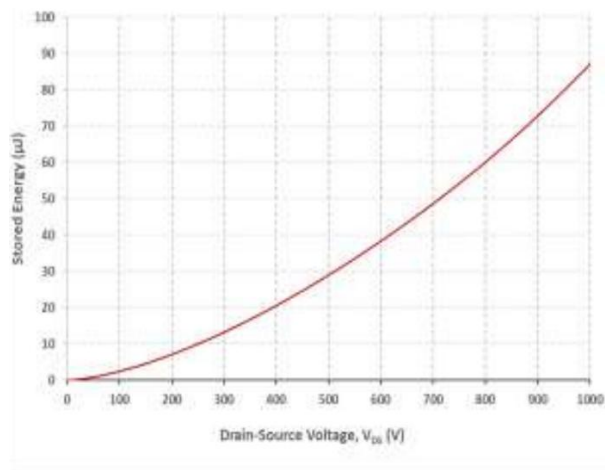


Figure 10. Output Capacitor Stored Energy

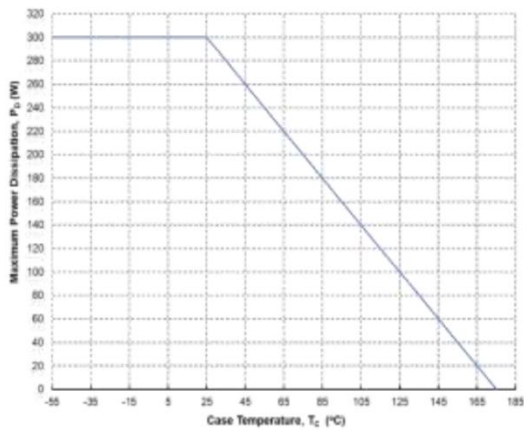


Figure 11. Maximum Power Dissipation Derating vs. Case Temperature

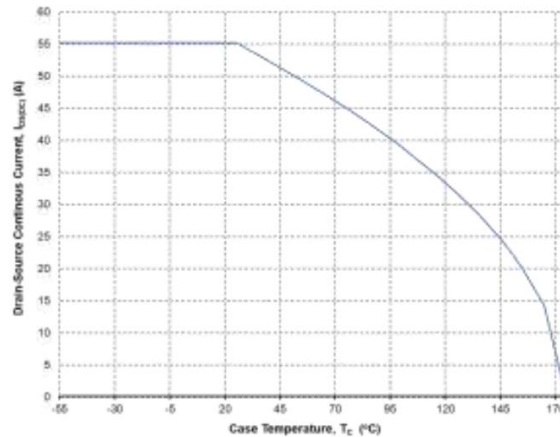


Figure 12. Continuous Drain Current Derating vs. Case Temperature

cedures.

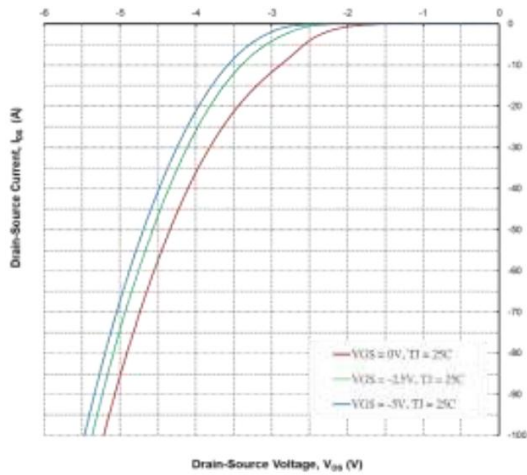


Figure 13. Body Diode Characteristics @ 25°C

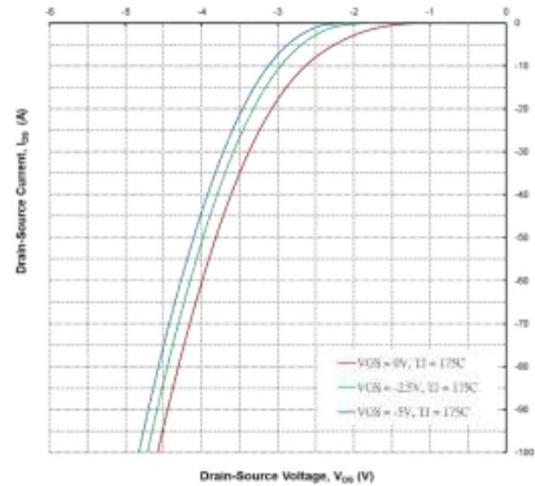


Figure 14. Body Diode Characteristics @ 175°C

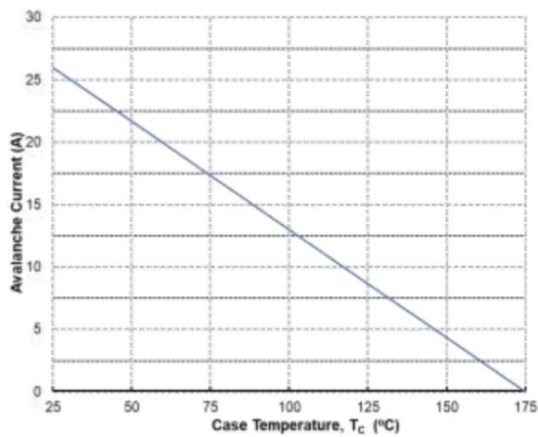


Figure 15. Single Avalanche vs. Temperature

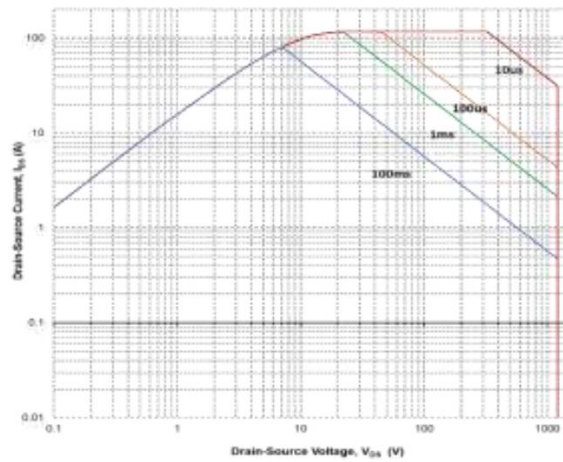
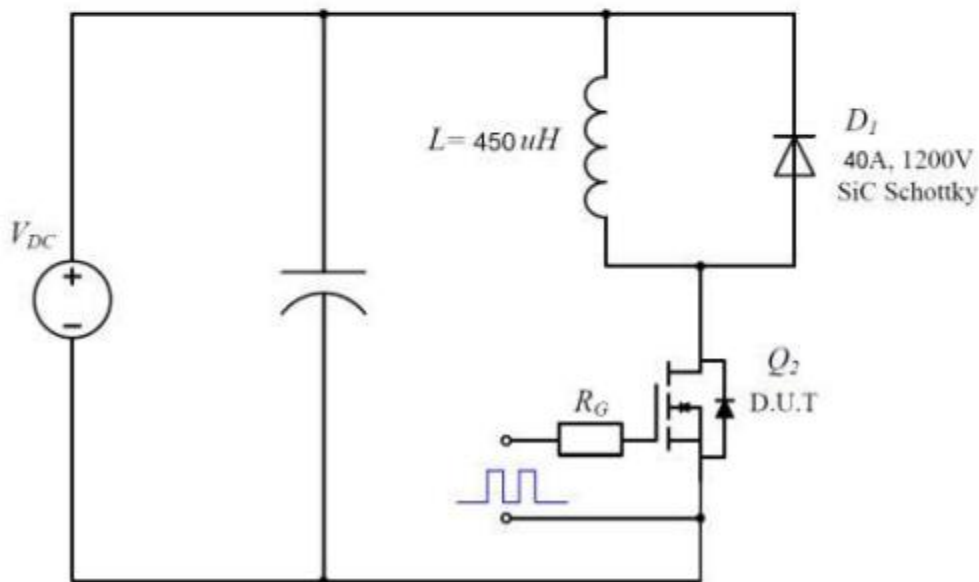
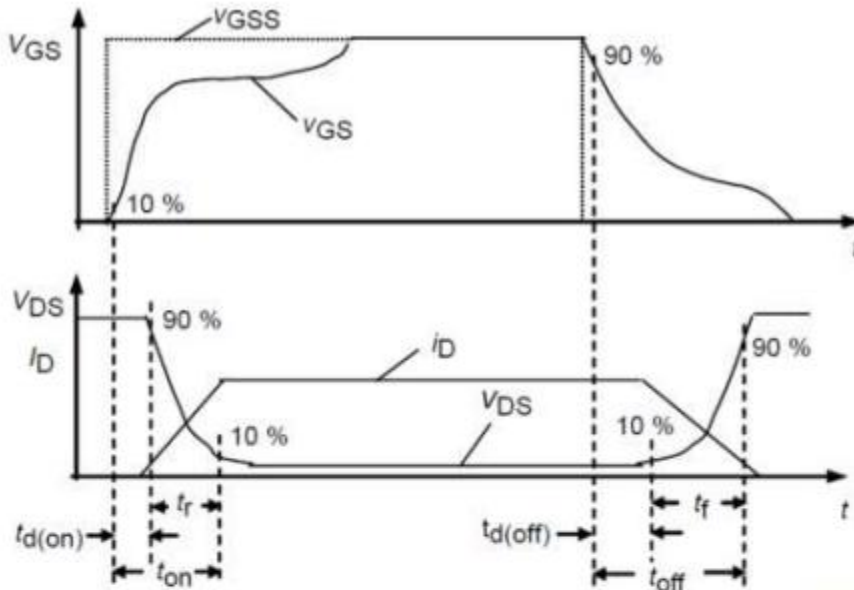


Figure 16. Safe Operating Area

Caution: This device is sensitive to electrostatic discharge .Users should follow ESD handing procedures.



## Switching Times Definition and Test Circuit



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