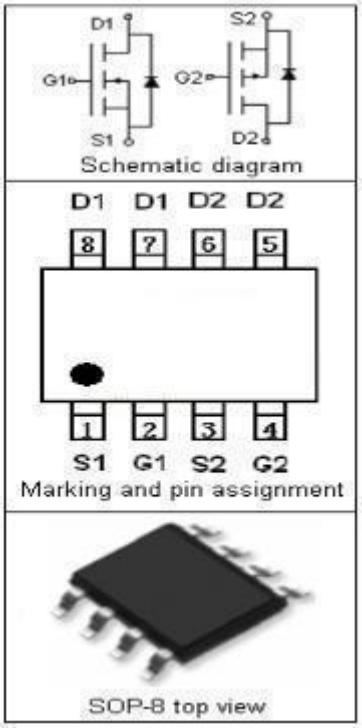
1 Description

It utilizes the lastest trench processing techniques to achieve the high cell density and reduces the on-resistance with high repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in busk-boost curcuit, DSC, portable devices and a wide variety of others applications.



2 Main Product Characteristics

	NMOS	PMOS
V_{DSS}	60V	-60V
$R_{DS(on)}$	32mohm(typ.)	78mohm(typ.)
I_D	4.5A	-4.0A

3 Features and Benefits

- Advanced Trench mosfet process technology
- Special designed for buck-boost curcuit,DSC,portable devices and general purpose applications
- Ultra low on-resistance with low gate charge
- 150℃ operating temperature

4 Package Marking and Ordering Information

Device	Device Marking	Device Package	Reel Size	Tape width	Quantity
ZXMC4559DN8TA-CN	CS32RNP06M	SOP-8	Ø330mm	12mm	3000

5 Electrical Characteristics

5.1 Absolute Maximum Rating (Tc=25℃,unless otherwise noted)

Parameter		Symbol	Rating		Unit
			N-Channel	P-Channel	
Drain-Source Voltage		V_{DSS}	60	-60	V
Gate-Source Voltage		V_{GSS}	±20	±20	V
Continuous Drain Current,V_{GS}4.5V	T_C=25℃	I_D	4.5	-4.0	A
	T_C=100℃		3.6	-2.8	A
Pulsed Drain Current		I_{DM}	20	-20	A
Single Pulse Avalanche Energy		E_{AS}	25	25	mJ
Power Dissipation		$P_D$$T_C$=25℃	3	2.8	W
Maximum Junction Temperature		T_j	150	150	℃
Storage Temperature		T_{stg}	-55～150	-55～150	℃

5.2 Thermal Resistance (note4)

Characteristics	Symbol	Rating		Unit
		N-Channel	P-Channel	
Junction-to-ambient (PCB mounted,steady-state)		41.7	45	℃/W

5.3 N-Channel Electrical Characteristics (T_A=25℃ unless otherwise specified)

Parameter	Symbol	Test Condition	Value			Units
			Min	Typ	Max	
Off Characteristics						
Drain-source Breakdown Voltage	BV_{DSS}	I_D=250μA,V_{GS}=0V	60	--	--	V
Drain-to-Source Leakage Current	I_{DSS}	V_{DS}=60V,V_{GS}=0V,T_C=25℃	--	--	1	μA
		V_{DS}=48V,V_{GS}=0V,T_C=125℃	--	--	100	μA
Gate-to-Source Forward Leakage	I_{GSSF}	V_{GS}=+20V	--	--	100	nA
Gate-to-Source Reverse Leakage	I_{GSSR}	V_{GS}=-20V	--	--	-100	nA
On Characteristics						
Gate threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250μA	1	2.1	3	V
Drain-source on-state Resistance	$R_{DS(on)}$	V_{GS}=10V,I_D=12A	--	32	40	mΩ
		V_{GS}=4.5V,I_D=6A	--	35	50	mΩ
Dynamic Characteristics						
Forward Transfer Conductance	g_{fs}	V_{DS}=10V,I_D=15A	--	11	--	S
Input Capacitance	C_{iss}	V_{GS}=0V,V_{DS}=30V,f=1.0MHz	--	814	--	pF
Output Capacitance	C_{oss}		--	110	--	
Reverse Transfer Capacitance	C_{rss}		--	49	--	
Switching Characteristics						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=30V, R_L=2.5Ω, V_{GS}=10V, R_{GEN}=3Ω	--	4.2	--	ns
Turn-on Rise Time	t_r		--	3.4	--	
Turn-off Delay Time	$t_{d(off)}$		--	16	--	
Turn-off Fall Time	t_f		--	2	--	
Total Gate Charge	Q_g	I_D=15A,V_{DS}=30V,V_{GS}=10V	--	13.5	--	nC
Gate-to-Source Charge	Q_{gs}		--	2.2	--	
Gate-to-Drain(“Miller”) Charge	Q_{gd}		--	3.4	--	
Drain-Source Diode Characteristics						
Diode Forward Voltage[3]	V_{FSD}	V_{GS}=0V,I_S=15A	--	--	1.3	V
Diode Forward Current[2]	I_S		--	--	4.5	A
Reverse Recovery Time	t_{rr}	T_J=25℃,I_F=15A, dI_F/dt=100A/μS,V_{GS}=0V	--	27	--	nS
Reverse Recovery Charge	Q_{rr}		--	30	--	nC

Notes：

1: Repetitive rating, pulse width limited by maximum junction temperature.

2: Surface mounted on FR4 Board, t≤10sec.

3: Pulse width ≤ 300μs, duty cycle ≤ 2%.

4: Guaranteed by design, not subject to production.

5. L=0.5mH,I_D=7.1A,V_{DD}=50V,V_{GATE}=60V,Start T_J=25℃.

5.3 P-Channel Electrical Characteristics (T_A=25℃ unless otherwise specified)

Parameter	Symbol	Test Condition	Value			Units
			Min	Typ	Max	
Off Characteristics						
Drain-source Breakdown Voltage	BV_{DSS}	I_D=250μA,V_{GS}=0V	-60	--	--	V
Drain-to-Source Leakage Current	I_{DSS}	V_{DS}=-60V,V_{GS}=0V,T_C=25℃	--	--	-1	μA
		V_{DS}=-48V,V_{GS}=0V,T_C=125℃	--	--	-100	μA
Gate-to-Source Forward Leakage	I_{GSSF}	V_{GS}=+20V	--	--	100	nA
Gate-to-Source Reverse Leakage	I_{GSSR}	V_{GS}=-20V	--	--	-100	nA
On Characteristics(Note 3)						
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=-250μA	-1	-2	-3	V
Drain-source on-state Resistance	$R_{DS(on)}$	V_{GS}=-10V,I_D=-5A	--	78	100	mΩ
		V_{GS}=-4.5V,I_D=-5A		98	120	
Dynamic Characteristics(Note 4)						
Forward Transfer Conductance	g_{fs}	V_{DS}=-10V,I_D=-5A	--	9.5	--	S
Input Capacitance	C_{iss}	V_{GS}=0V,V_{DS}=-25V,f=1.0MHz	--	900	--	pF
Output Capacitance	C_{oss}		--	115	--	
Reverse Transfer Capacitance	C_{rss}		--	40	--	
Switching Characteristics(note4)						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=-30V, R_L=15Ω, V_{GS}=-10V, R_{GEN}=3Ω	--	8	--	nS
Turn-on Rise Time	t_r		--	6	--	
Turn-off Delay Time	$t_{d(off)}$		--	30	--	
Turn-off Fall Time	t_f		--	7	--	
Total Gate Charge	Q_g	I_D=-4A,V_{DD}=-20V,V_{GS}=-10V	--	18	--	nC
Gate-to-Source Charge	Q_{gs}		--	3.2	--	
Gate-to-Drain(“Miller”) Charge	Q_{gd}		--	3.8	--	
Drain-Source Diode Characteristics						
Diode Forward Voltage(3)	V_{FSD}	V_{GS}=0V,I_S=-10A	--	-0.92	-1.2	V
Diode Forward Current(2)	I_S		--	--	-4	A
Reverse Recovery Time	t_{rr}	T_J=25℃,I_F=-10A, dI_F/dt=100A/μS,V_{GS}=0V	--	22	--	nS
Reverse Recovery Charge	Q_{rr}		--	26	--	nC

Notes：

1: Repetitive rating, pulse width limited by maximum junction temperature.

2: Surface mounted on FR4 Board, t≤10sec.

3: Pulse width ≤ 300μs, duty cycle ≤ 2%.

4: Guaranteed by design, not subject to production.

5. L=0.5mH,I_D=-7.1A,V_{DD}=-50V,V_{GATE}=-60V,Start T_J=25℃.

6 N-Channel Typical characteristics diagrams

Figure1. On-Region Characteristics

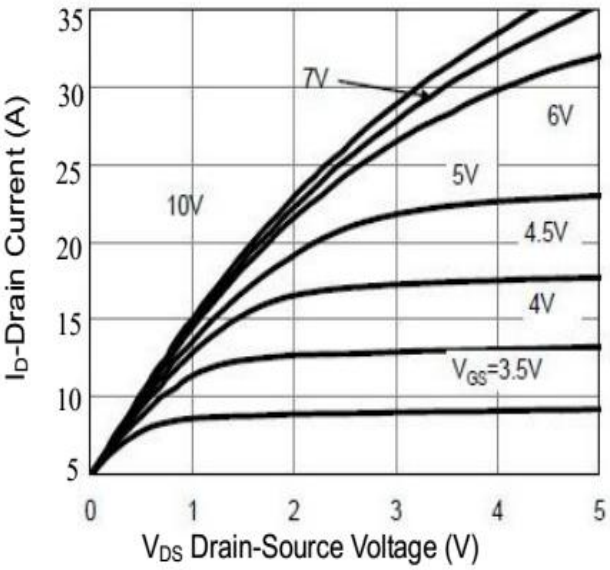


Figure 2: Transfer Characteristics

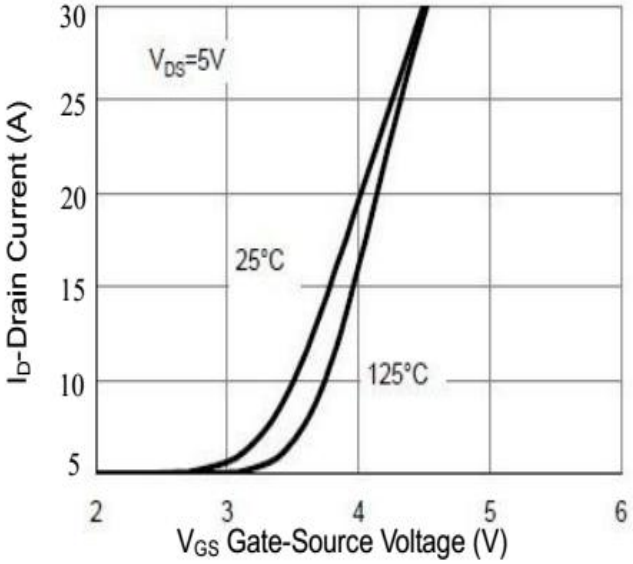


Figure3. On-Resistance vs. Drain Current and Gate Voltage

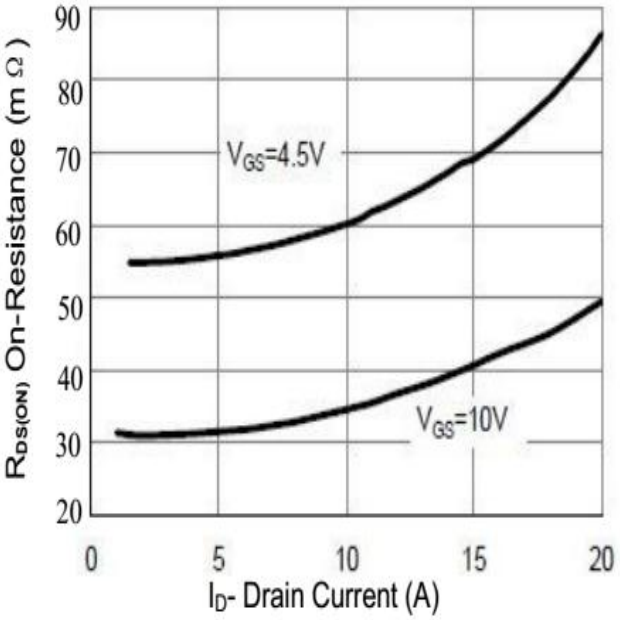
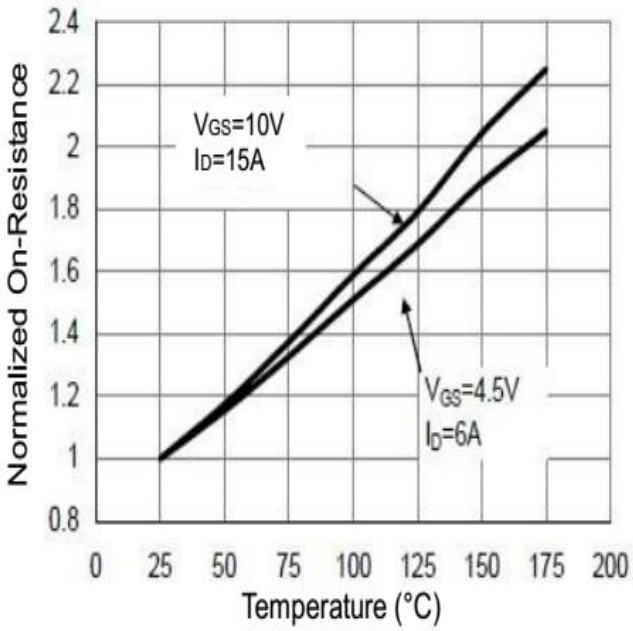


Figure4. On-Resistance vs. Junction Temperature



6 N-Channel Typical characteristics diagrams(continues)

Figure5. On-Resistance vs. Gate-Source Voltage

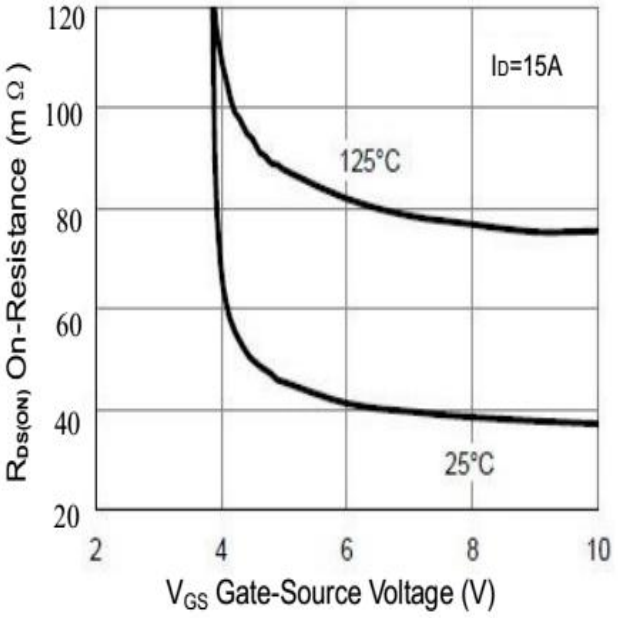


Figure6. Body-Diode Characteristics

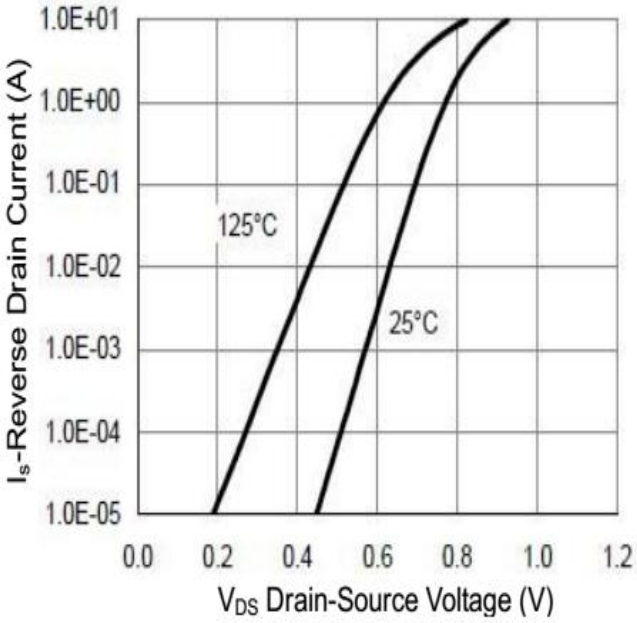


Figure7. Gate-Charge Characteristics

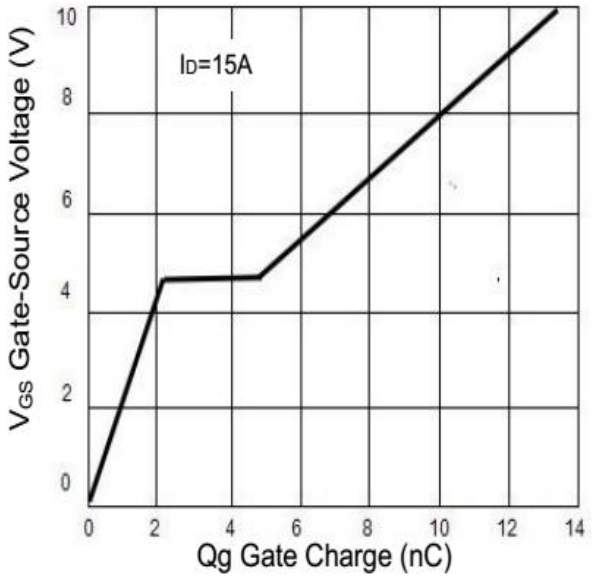
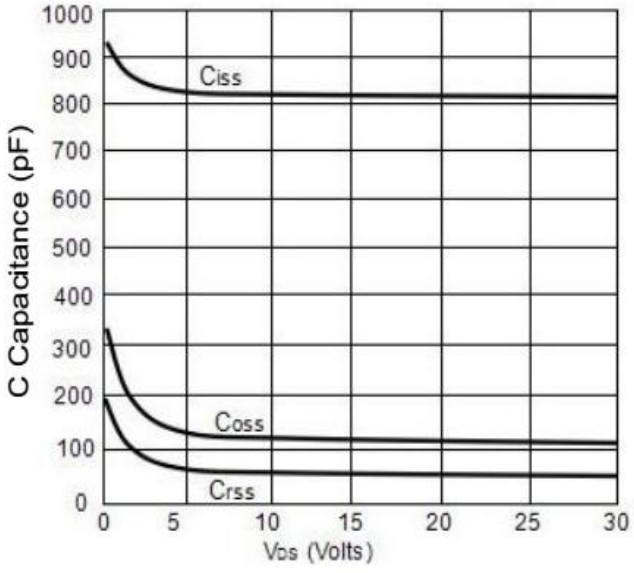
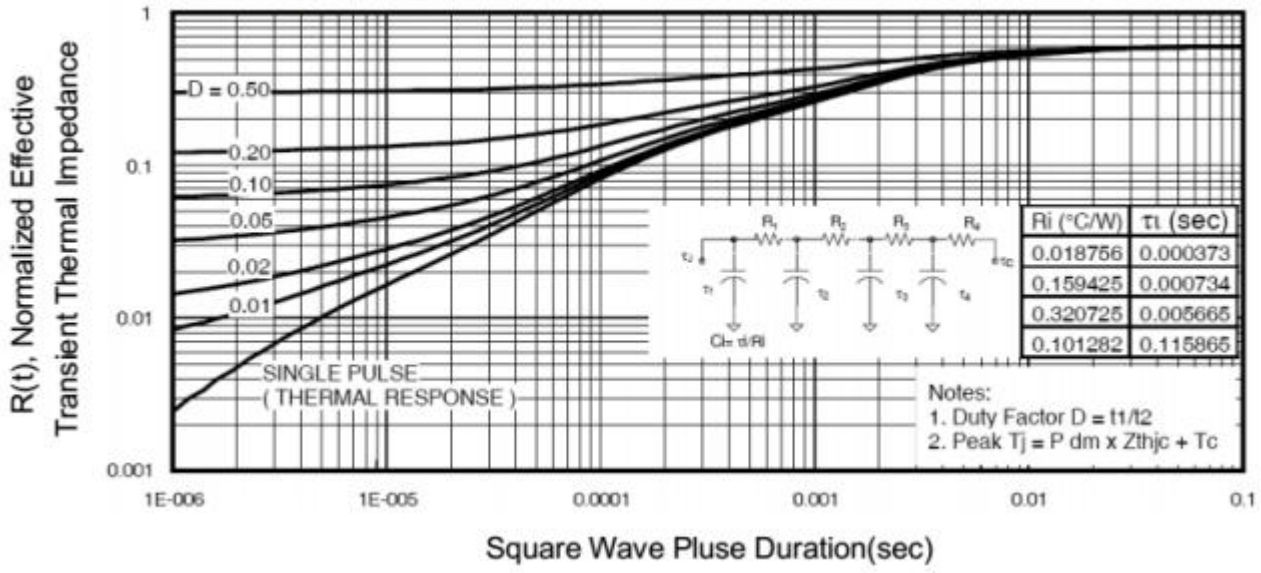


Figure 8. Capacitance Characteristics

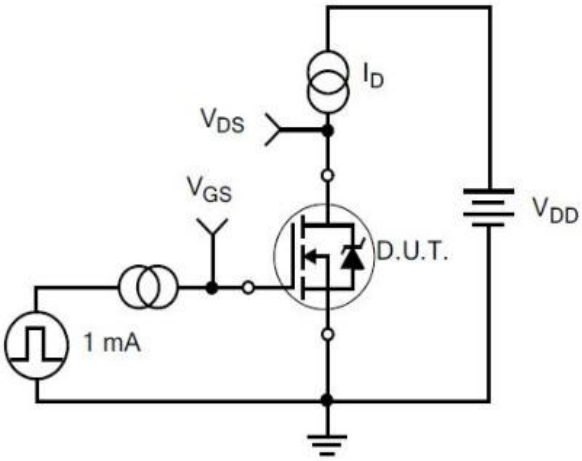


6 N-Channel Typical characteristics diagrams(continues)

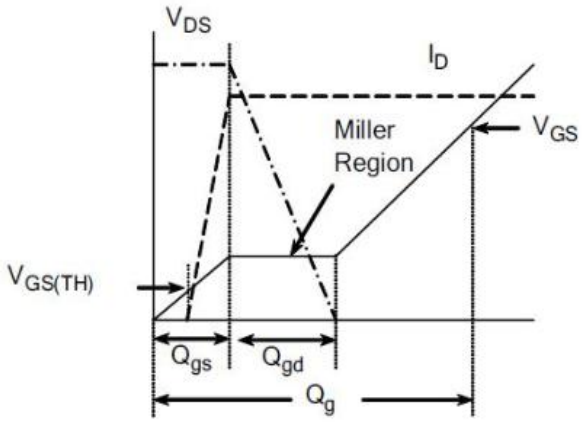
Figure 9. Normalized Maximum Transient Thermal Impedance



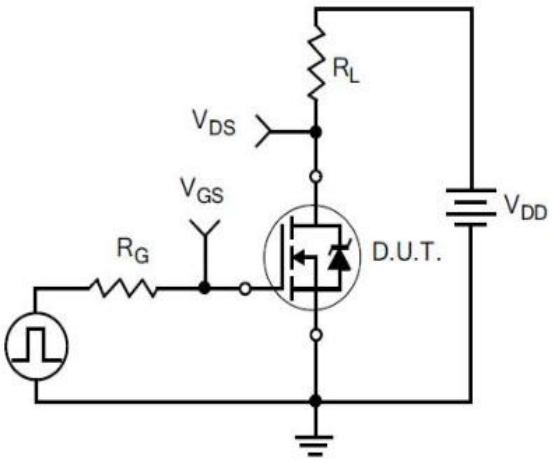
7 Typical Test Circuit and Waveform



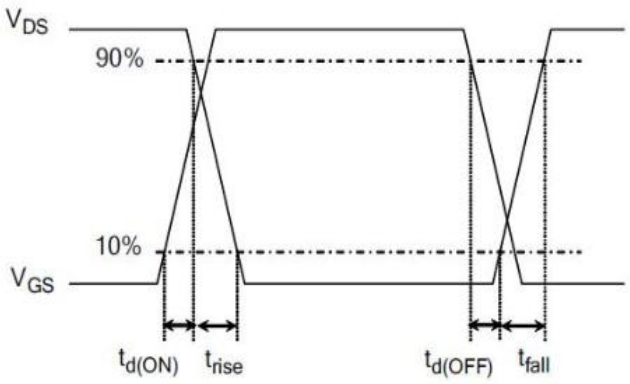
1) Gate Charge Test Circuit



2) . Gate Charge Waveform

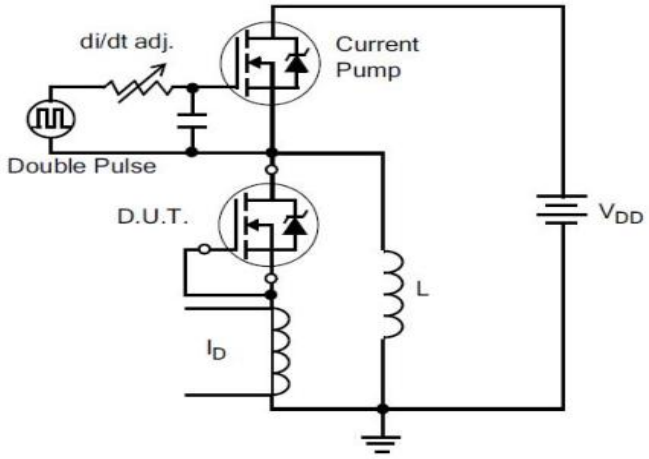


3) Resistive Switching Test Circuit

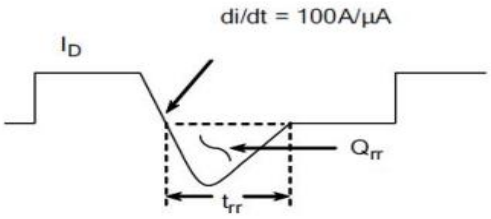


4) Resistive Switching Waveforms

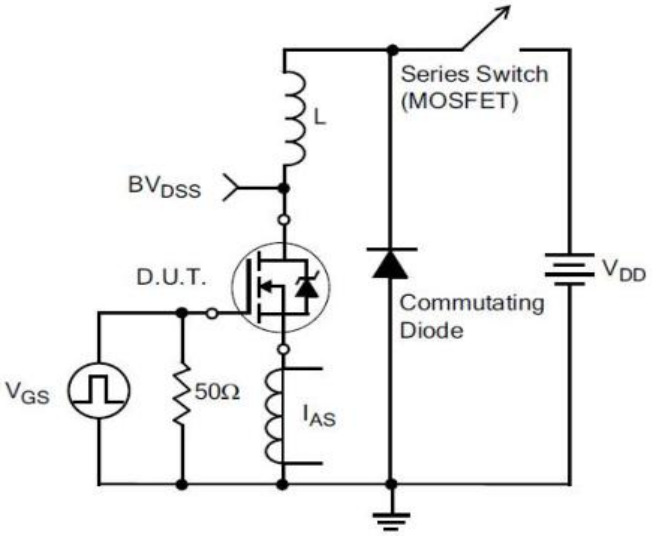
7 Typical Test Circuit and Waveform(continues)



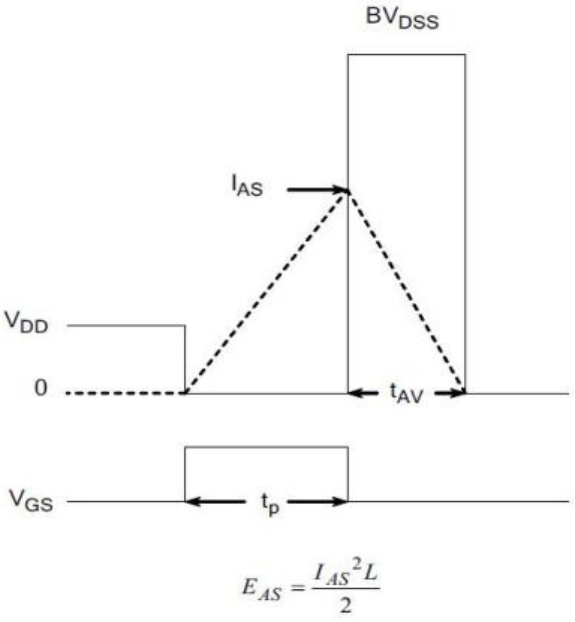
5) Diode Reverse Recovery Test Circuit



6) Diode Reverse Recovery Waveform



7) . Unclamped Inductive Switching Test Circuit



$$E_{AS} = \frac{I_{AS}^2 L}{2}$$

8) Unclamped Inductive Switching Waveforms

8 P-Channel Typical characteristics diagrams

Figure1. Power Dissipation

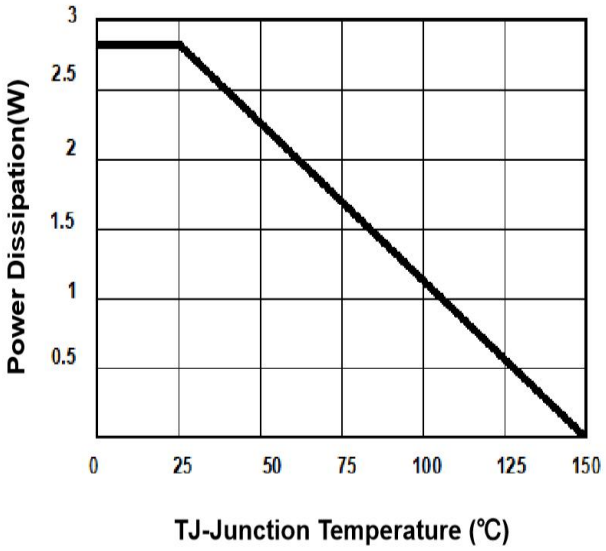


Figure2. Drain Current

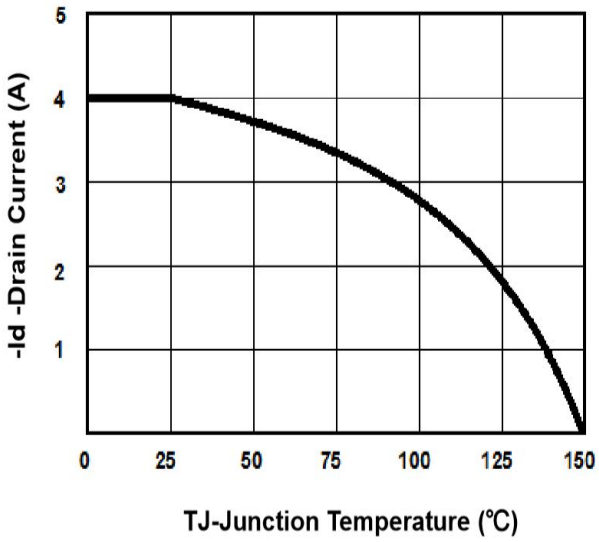


Figure3. Output Characteristics

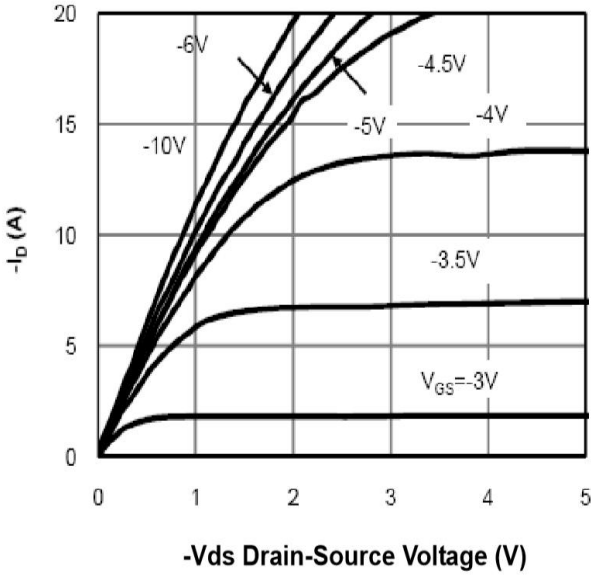
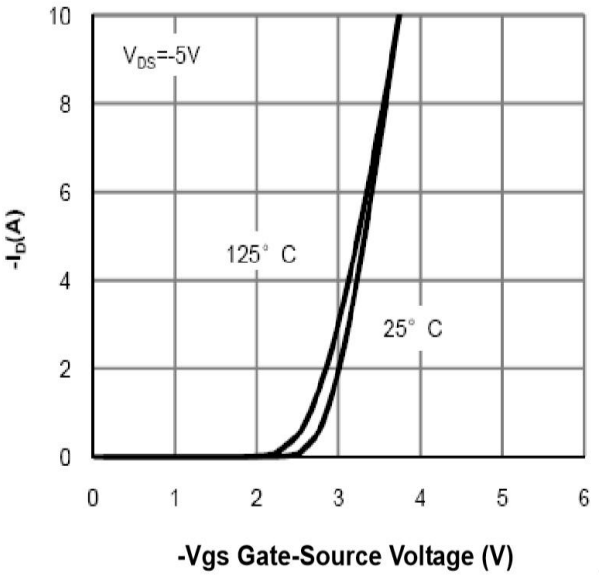


Figure4. Transfer Characteristics



8 Typical characteristics diagrams(continues)

Figure5. Capacitance

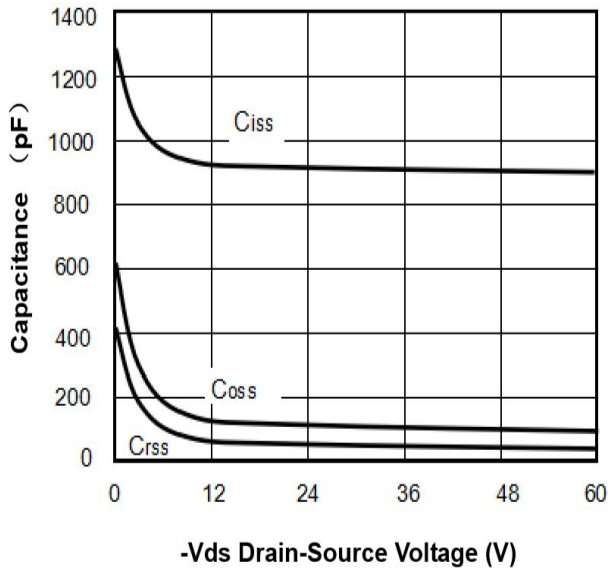


Figure6. $R_{DS(ON)}$ vs Junction Temperature

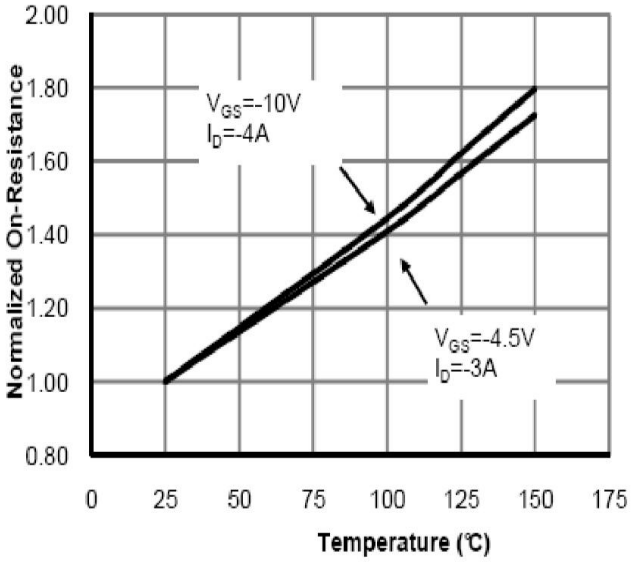


Figure7. Max BV_{DSS} vs Junction Temperature

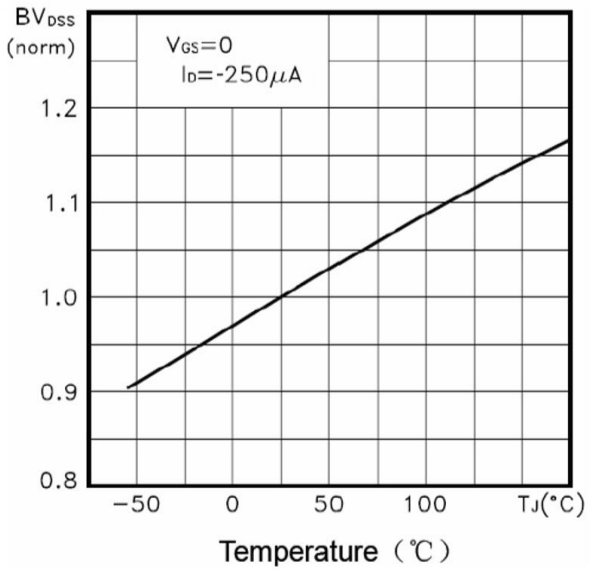
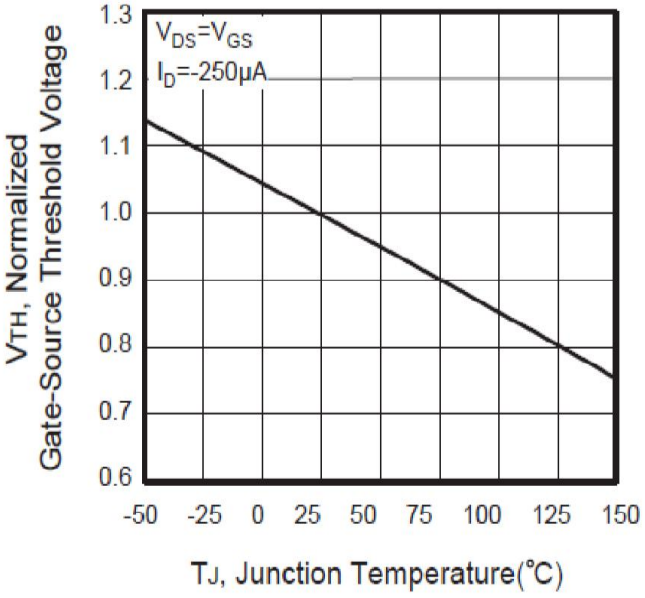


Figure8. $V_{GS(th)}$ vs Junction Temperature



8 Typical characteristics diagrams(continues)

Figure9. Gate Charge Waveforms

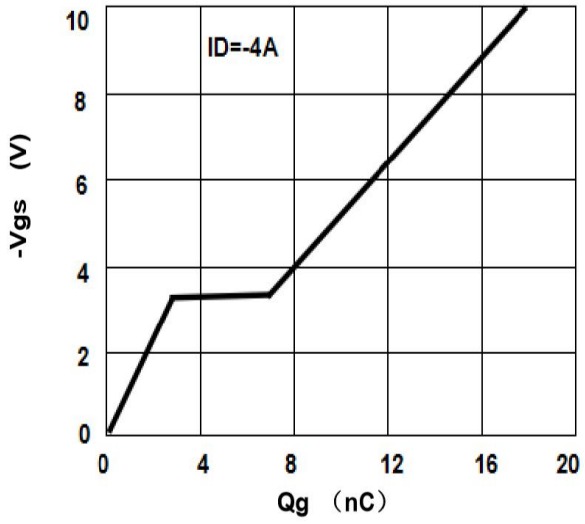


Figure10. Maximum Safe Operating Area

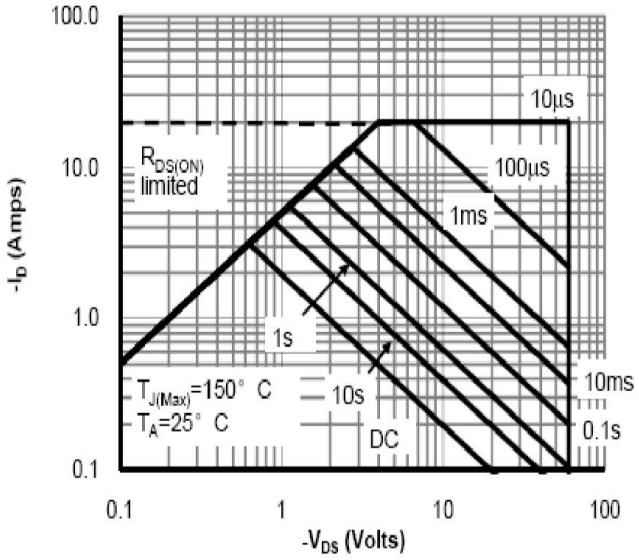
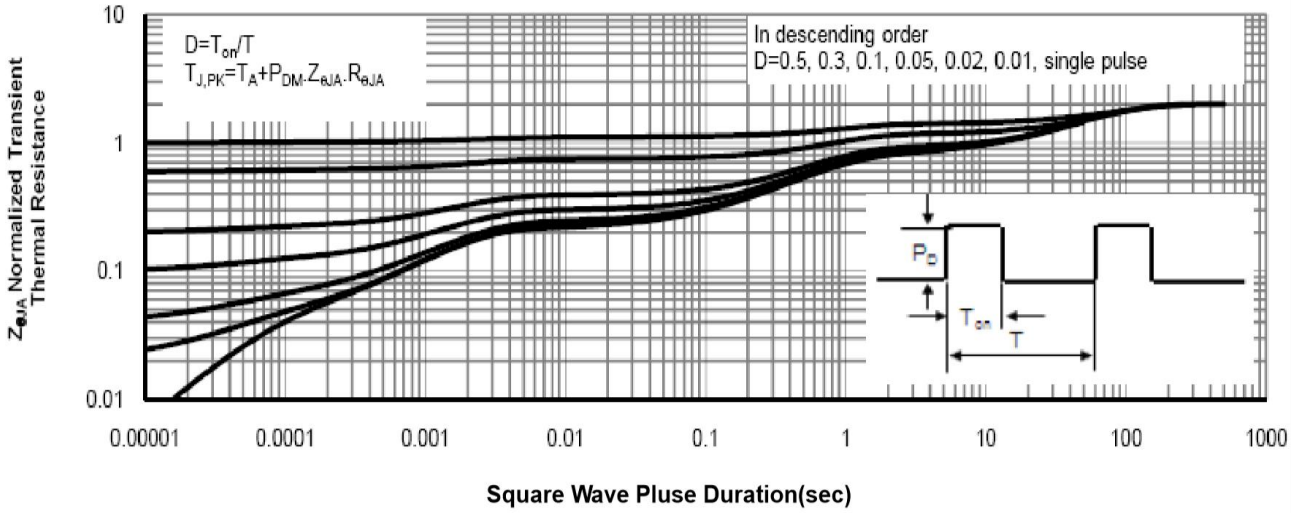
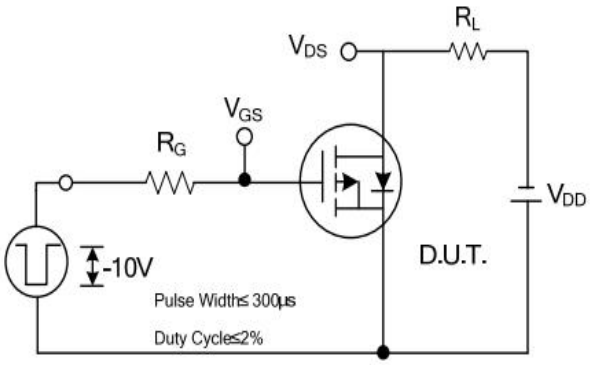


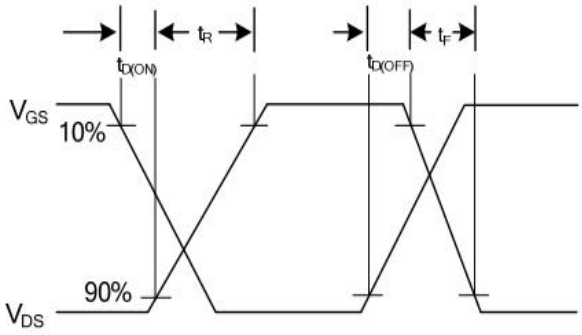
Figure11. Normalized Maximum Transient Thermal Impedance



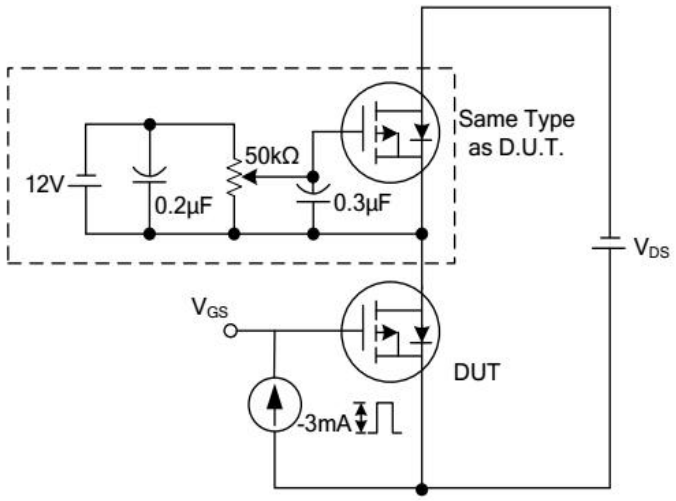
9 Typical Test Circuit and Waveform



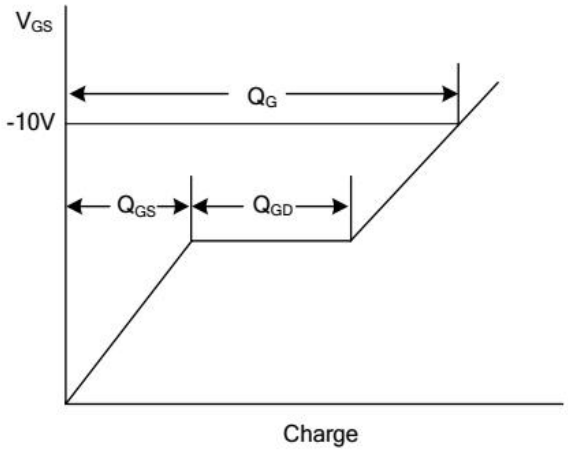
Switching Test Circuit



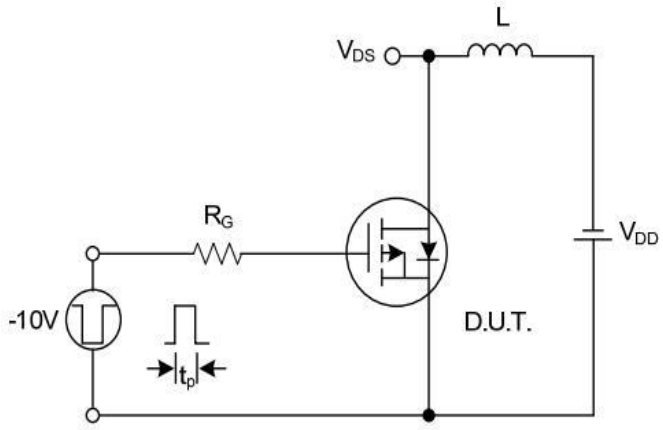
Switching Waveforms



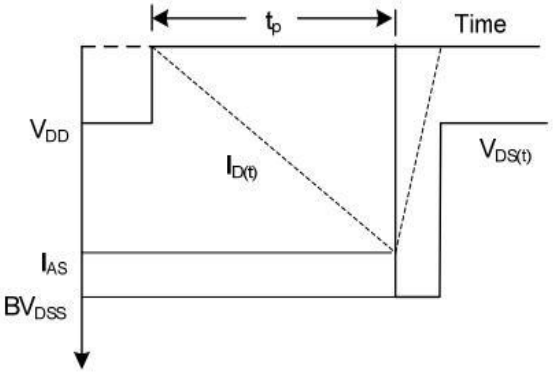
Gate Charge Test Circuit



Gate Charge Waveform



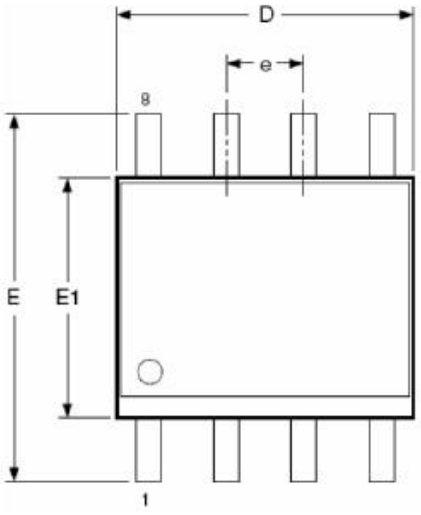
Unclamped Inductive Switching Test Circuit

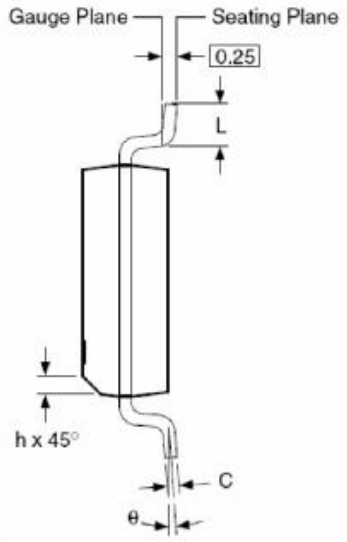


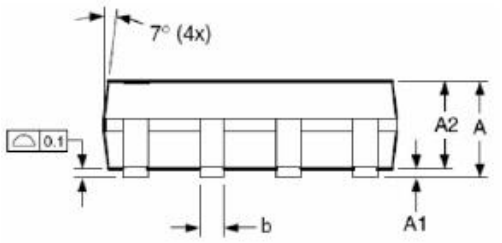
Unclamped Inductive Switching Waveforms

10 Dimension

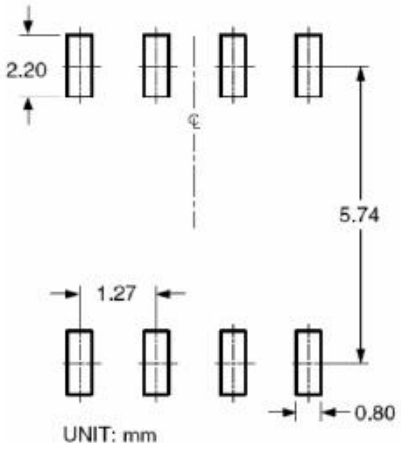
SOP-8 PACKAGE INFORMATION







RECOMMENDED LAND PATTERN



Dimensions in millimeters

Symbols	Min.	Nom.	Max.
A	1.35	1.65	1.75
A1	0.10	—	0.25
A2	1.25	1.50	1.65
b	0.31	—	0.51
c	0.17	—	0.25
D	4.80	4.90	5.00
E1	3.80	3.90	4.00
e	1.27 BSC		
E	5.80	6.00	6.20
h	0.25	—	0.50
L	0.40	—	1.27
θ	0°	—	8°

Dimensions in inches

Symbols	Min.	Nom.	Max.
A	0.053	0.065	0.069
A1	0.004	—	0.010
A2	0.049	0.059	0.065
b	0.012	—	0.020
c	0.007	—	0.010
D	0.189	0.193	0.197
E1	0.150	0.154	0.157
e	0.050 BSC		
E	0.228	0.236	0.244
h	0.010	—	0.020
L	0.016	—	0.050
θ	0°	—	8°

NOTES:

1. Dimensions are inclusive of plating
2. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 6 mils.
3. Dimension L is measured in gauge plane.
4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

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