

Features

- -20V/-70A
- $R_{DS(ON)} = 4.5m\Omega(Typ.)@V_{GS}=-4.5V$
- $R_{DS(ON)} = 6.5m\Omega(Typ.)@V_{GS}=-2.5V$
- $R_{DS(ON)} = 11m\Omega(Typ.)@V_{GS}=-1.8V$
- Low $R_{DS(ON)}$
- Super High Dense Cell Design
- Fast Switching Speed
- 100% avalanche tested

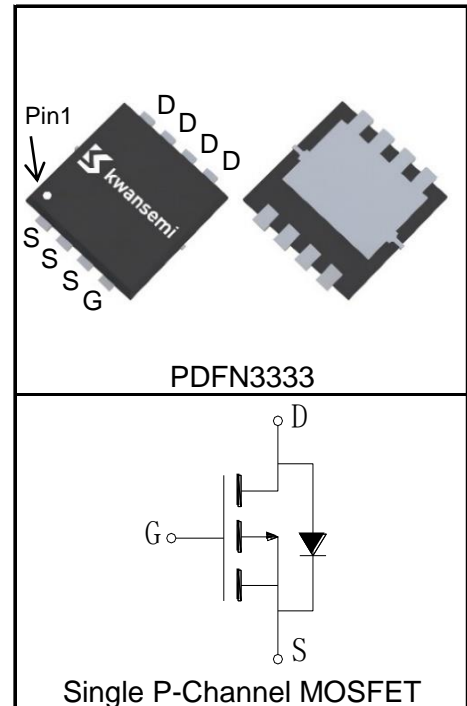
Applications

- Switching Application Systems



Halogen-Free

Pin Description



Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit	
Common Ratings ($T_C=25^\circ\text{C}$ Unless Otherwise Noted)				
V_{DSS}	Drain-Source Voltage	-20	V	
V_{GSS}	Gate-Source Voltage	± 12	V	
T_{Jmax}	Maximum Junction Temperature	150	$^\circ\text{C}$	
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to 150	$^\circ\text{C}$	
I_S	Diode Continuous Forward Current	$T_C=25^\circ\text{C}$ -70	A	
Mounted on Large Heat Sink				
$I_{DP}^{①}$	Pulse Drain Current	$T_C=25^\circ\text{C}$ -280	A	
$I_D^{②}$	Continuous Drain Current@ $T_C(V_{GS}=-4.5V)$	$T_C=25^\circ\text{C}$	-70	A
		$T_C=100^\circ\text{C}$	-44	
	Continuous Drain Current@ $T_A(V_{GS}=-4.5V)^{③}$	$T_A=25^\circ\text{C}$	-21	
		$T_A=70^\circ\text{C}$	-17	
P_D	Maximum Power Dissipation@ T_C	$T_C=25^\circ\text{C}$	35	W
		$T_C=100^\circ\text{C}$	14	
	Maximum Power Dissipation@ $T_A^{③}$	$T_A=25^\circ\text{C}$	3.5	
		$T_A=70^\circ\text{C}$	2.3	

Symbol	Parameter	Rating	Unit
$R_{\theta JC}$	Thermal Resistance-Junction to Case	3.5	°C/W
$R_{\theta JA}$ ^③	Thermal Resistance-Junction to Ambient	35	°C/W
Drain-Source Avalanche Ratings			
E_{AS} ^④	Avalanche Energy, Single Pulsed	110	mJ

Electrical Characteristics ($T_C=25^\circ\text{C}$ Unless Otherwise Noted)

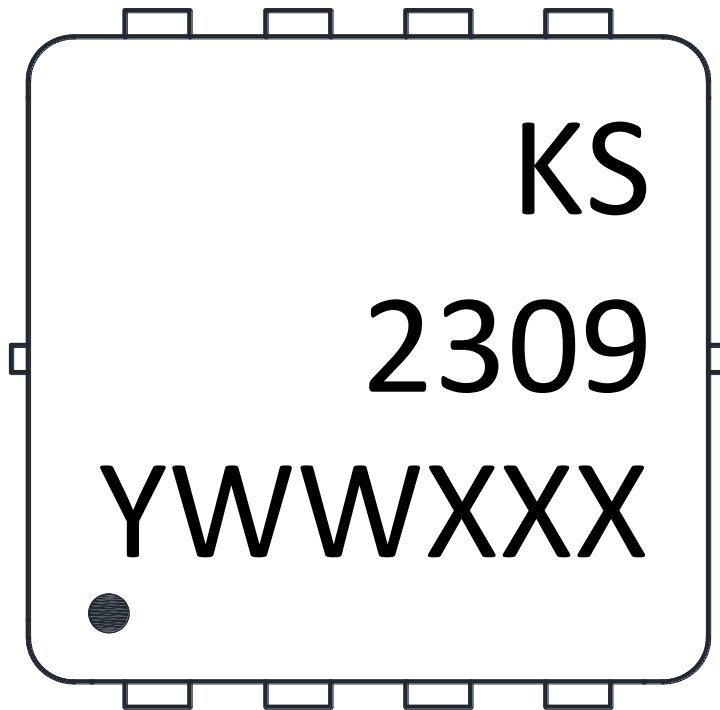
Symbol	Parameter	Test Condition	KS2309MA			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=-250\mu A$	-20			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-20V, V_{GS}=0V$			-1	μA
		$T_J=125^\circ\text{C}$			-30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=-250\mu A$	-0.4	-0.7	-1	V
I_{GSS}	Gate Leakage Current	$V_{GS}=\pm 12V, V_{DS}=0V$			± 100	nA
$R_{DS(ON)}$ ^⑤	Drain-Source On-state Resistance	$V_{GS}=-4.5V, I_{DS}=-20A$		4.5	5.3	m Ω
		$V_{GS}=-2.5V, I_{DS}=-12A$		6.5	8.5	m Ω
		$V_{GS}=-1.8V, I_{DS}=-8A$		11	15	m Ω
Diode Characteristics						
V_{SD} ^⑤	Diode Forward Voltage	$I_{SD}=-20A, V_{GS}=0V$		-0.83	-1.2	V
t_{rr}	Reverse Recovery Time	$I_{SD}=-20A, dI_{SD}/dt=100A/\mu s$		45		ns
Q_{rr}	Reverse Recovery Charge			171		nC
Dynamic Characteristics ^⑥						
R_G	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$		5.2		Ω
C_{iss}	Input Capacitance	$V_{GS}=0V,$ $V_{DS}=-10V,$ Frequency=200KHz		4815		pF
C_{oss}	Output Capacitance			670		
C_{rss}	Reverse Transfer Capacitance			610		
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=-10V, I_{DS}=-20A,$ $V_{GS}=-4.5V, R_G=3\Omega$		31		ns
t_r	Turn-on Rise Time			42		
$t_{d(OFF)}$	Turn-off Delay Time			67		
t_f	Turn-off Fall Time			38		
Gate Charge Characteristics ^⑥						
Q_g	Total Gate Charge	$V_{DS}=-10V, V_{GS}=-4.5V,$ $I_{DS}=-20A$		52		nC
Q_{gs}	Gate-Source Charge			6.9		
Q_{gd}	Gate-Drain Charge			13		

Notes:

- ①Pulse width limited by safe operating area.
- ②Calculated continuous current based on maximum allowable junction temperature.The package limitation current is -40A.
- ③When mounted on 1 inch square copper board, $t \leq 10\text{sec}$.
- ④Limited by T_{Jmax} , Starting $T_J = 25^\circ\text{C}$, $I_{ASmax} = -21\text{A}$, $L=0.5\text{mH}$, $V_{DD} = -15\text{V}$, $R_G = 25\Omega$, $V_{GS} = -4.5\text{V}$.Part not recommended for use above this value.100% Final Test at $I_{AS} = -10\text{A}$, $L=0.5\text{mH}$.
- ⑤Pulse test;Pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
- ⑥Guaranteed by design, not subject to production testing.

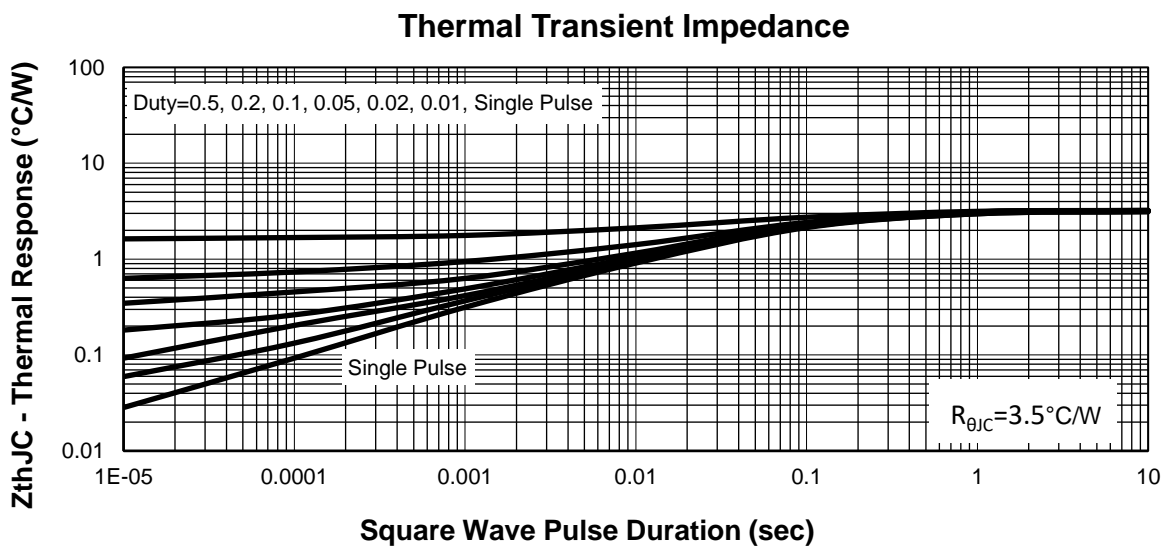
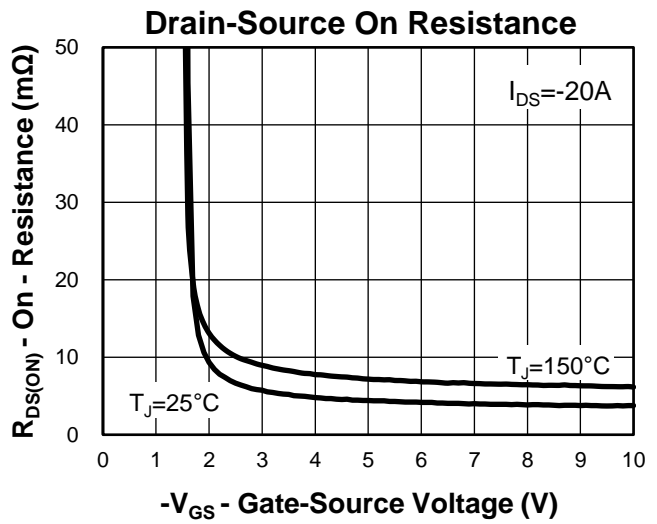
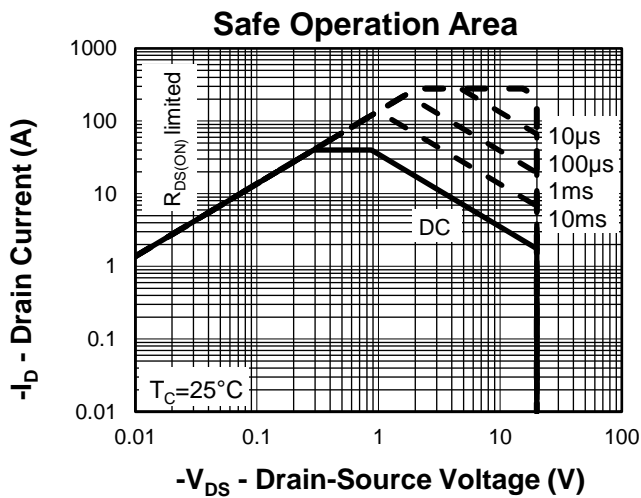
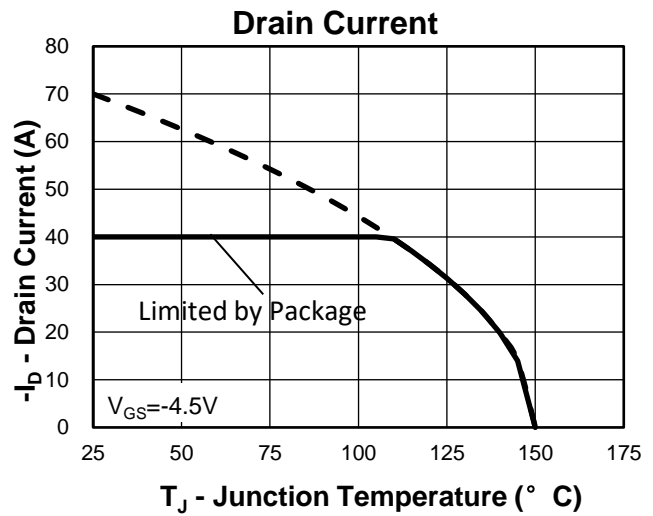
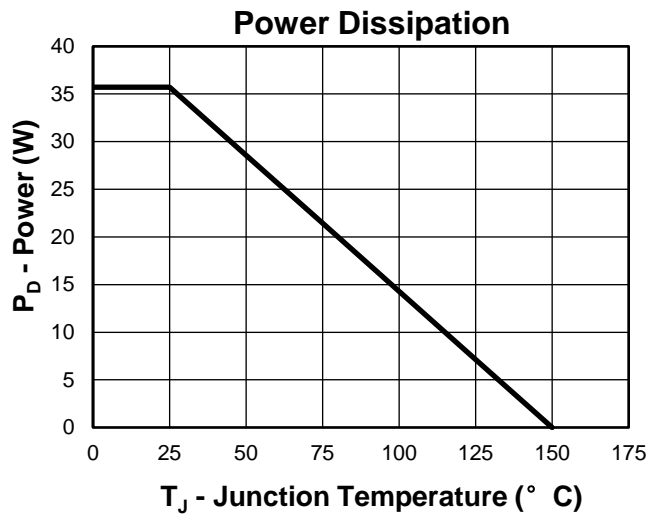
Ordering and Marking Information

Device	Package	Packaging	Quantity	Reel Size	Tape width
KS2309MA	PDFN3333	Tape&Reel	5000	13"	12mm

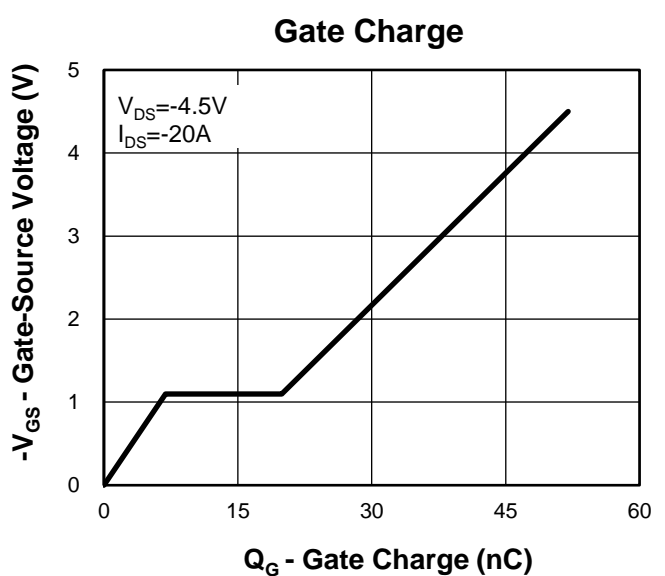
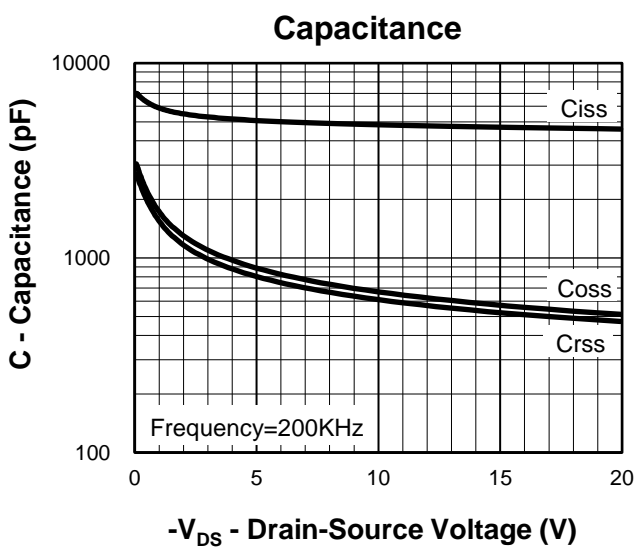
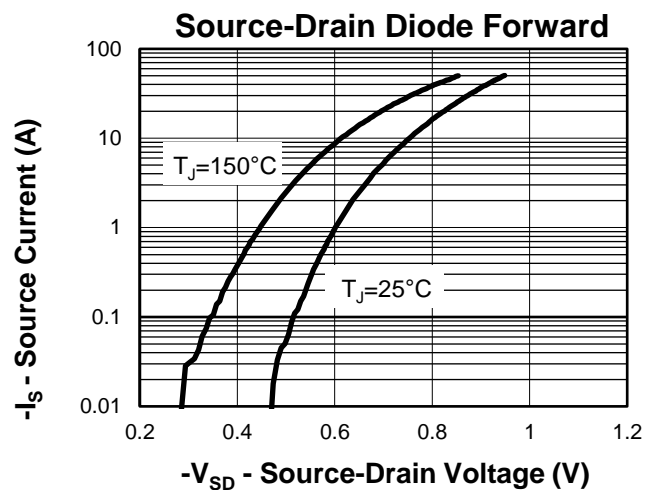
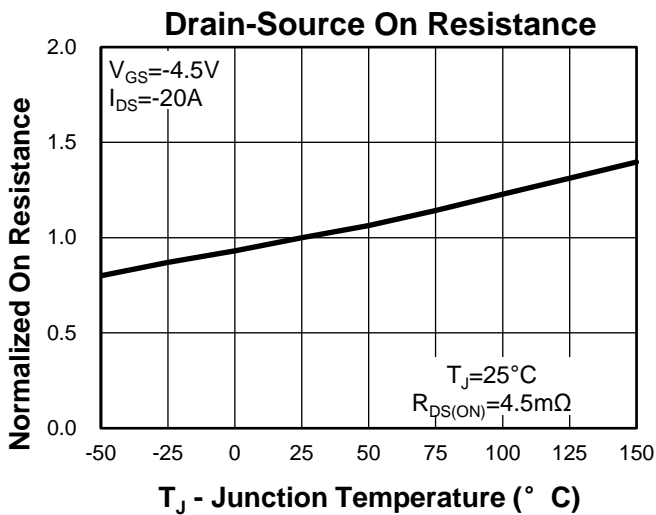
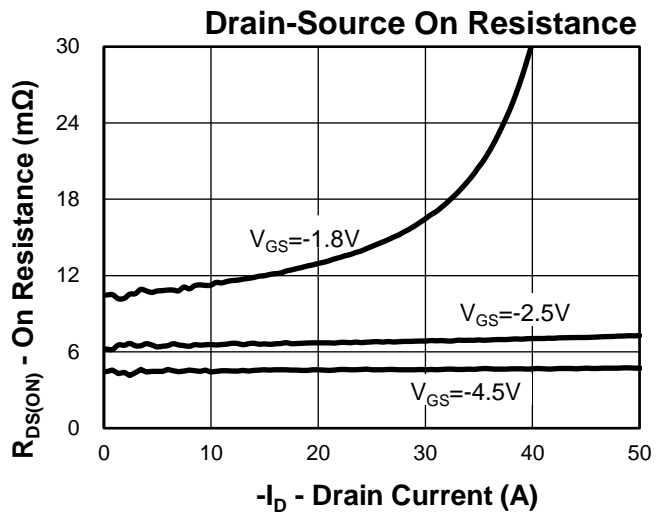
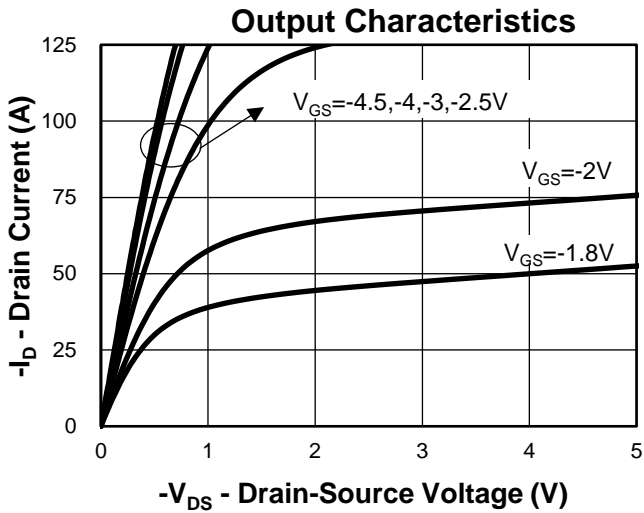


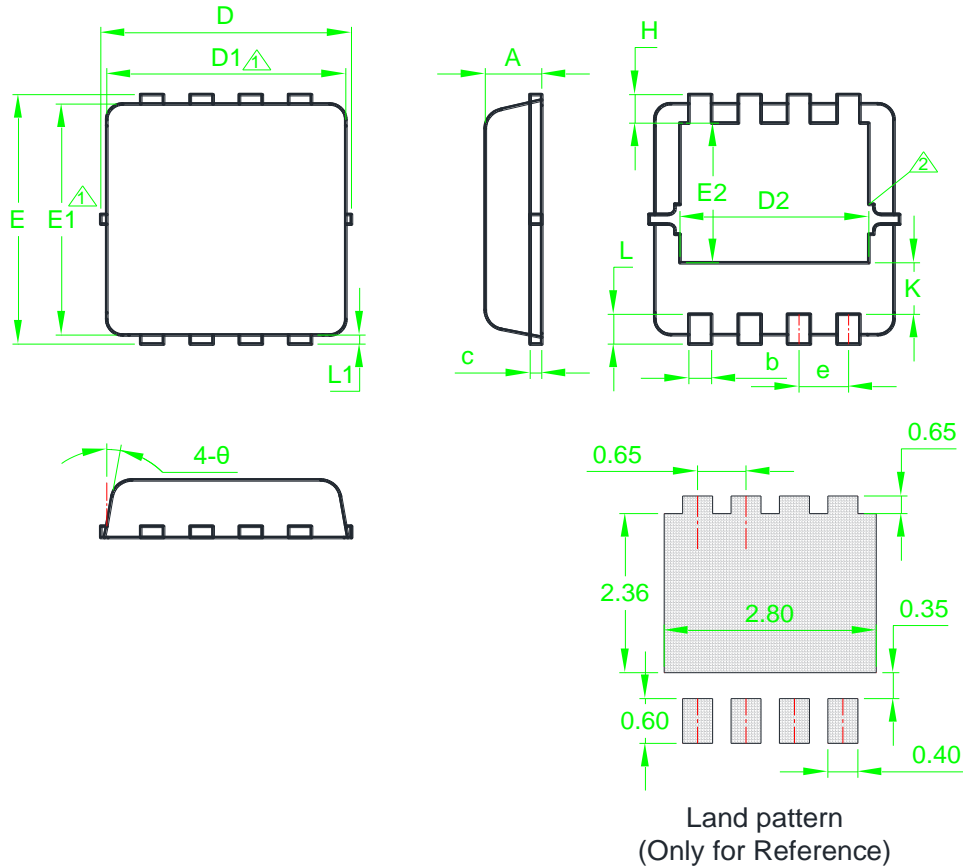
1st Line: Kwansemi Code(KS)
 2nd Line: Part Number(2309)
 3rd Line: Lot Number(YWWXXX)

Typical Characteristics



Typical Characteristics



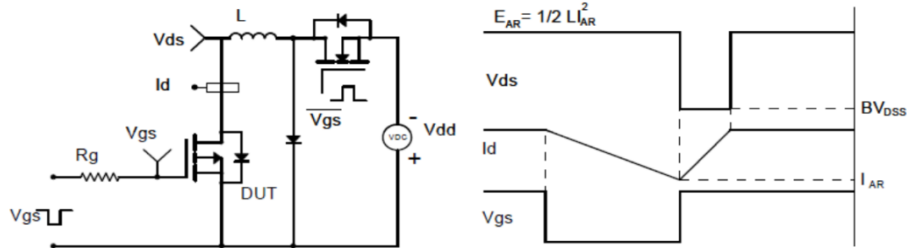
Package Information
PDFN3333


SYMBOL	MM			INCH			SYMBOL	MM			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX		MIN	NOM	MAX	MIN	NOM	MAX
A	0.70	0.80	0.90	0.028	0.031	0.035	E2	1.40	*	1.95	0.055	*	0.077
b	0.25	0.30	0.35	0.010	0.012	0.014	e	0.65BSC			0.026BSC		
c	0.10	0.20	0.30	0.004	0.008	0.012	H	0.30	0.40	0.50	0.012	0.016	0.020
D	3.20	3.30	3.40	0.126	0.130	0.134	K	0.50	*	*	0.020	*	*
D1	3.00	3.10	3.20	0.118	0.122	0.126	L	0.30	0.40	0.50	0.012	0.016	0.020
D2	2.35	2.45	2.55	0.093	0.096	0.100	L1	0.15BSC			0.006BSC		
E	3.20	3.30	3.40	0.126	0.130	0.134	θ	6°	*	12°	6°	*	12°
E1	2.90	3.05	3.20	0.114	0.120	0.126							

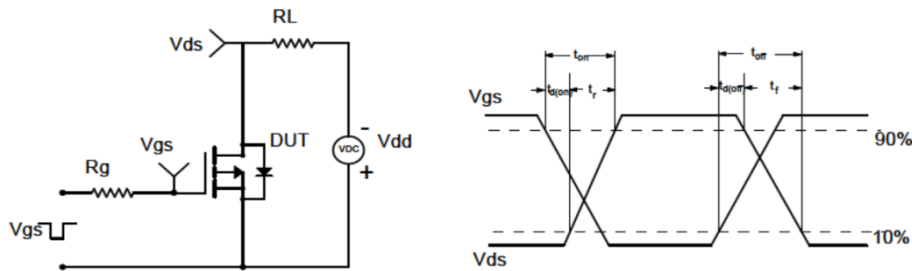
① Dimensions D1 and E1 do not include mold flash protrusions or gate burrs.

② The size and shape of exposed pad are variable depending on mold.

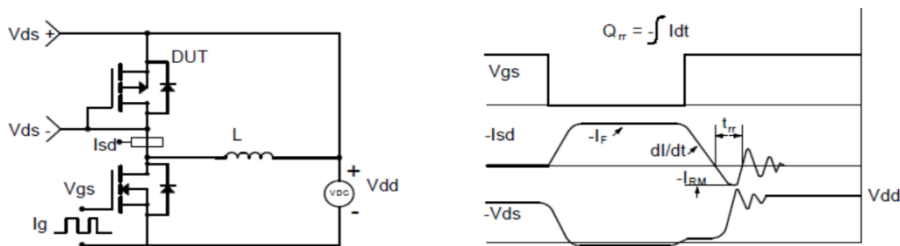
Avalanche Test Circuit and Waveforms



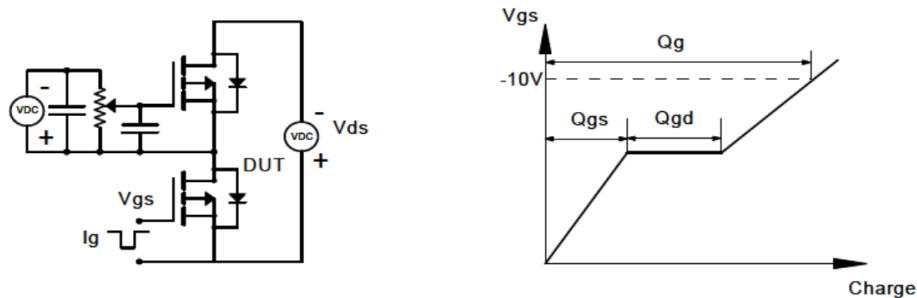
Switching Time Test Circuit and Waveforms



Diode Recovery Test Circuit and Waveforms



Gate Charge Test Circuit and Waveform



Customer Service

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