

## P-Ch 40V Fast Switching MOSFETs



- ★ Super Low Gate Charge
- ★ 100% EAS Guaranteed
- ★ Green Device Available
- ★ Excellent CdV/dt effect decline
- ★ Advanced high cell density Trench technology

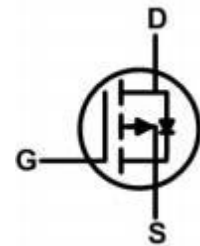
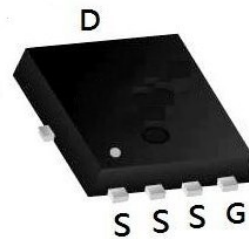
### Product Summary

BVDSS	RDSON	ID
-40V	6.4mΩ	-60A

### PDFN5060-8L Pin Configuration

### Description

The XR60P04F is the high cell density trenched P-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications. The XR60P04F meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.



### Absolute Maximum Ratings (T<sub>A</sub> = 25°C, unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DS</sub>	-40	V
Gate-Source Voltage	V <sub>GS</sub>	±20	V
Continuous Drain Current	I <sub>D</sub>	T <sub>C</sub> =25°C	-60
		T <sub>C</sub> =100°C	-50.6
Pulsed Drain Current <sup>1</sup>	I <sub>DM</sub>	-320	A
Single Pulse Avalanche Energy <sup>2</sup>	EAS	101.25	mJ
Total Power Dissipation	P <sub>D</sub>	81.16	W
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to 150	°C

### Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction-to-Ambient <sup>3</sup>	R <sub>θJA</sub>	54	°C/W
Thermal Resistance from Junction-to-Case	R <sub>θJC</sub>	1.54	°C/W

### Electrical Characteristics (T<sub>J</sub> = 25°C, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA	-40	-	-	V
Gate-body Leakage current	I <sub>GSS</sub>	V <sub>DS</sub> = 0V, V <sub>GS</sub> = ±20V	-	-	±100	nA
Zero Gate Voltage Drain Current	T <sub>J</sub> =25°C	V <sub>DS</sub> = -40V, V <sub>GS</sub> = 0V	-	-	-1	pA
	T <sub>J</sub> =100°C		-	-	-100	
Gate-Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA	-1.0	-1.6	-2.5	V
Drain-Source on-Resistance <sup>4</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = -10V, I <sub>D</sub> = -20A	-	6.4	8.2	mΩ
		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -15A	-	8.2	11	
Forward Transconductance <sup>4</sup>	g <sub>fs</sub>	V <sub>DS</sub> = -10V, I <sub>D</sub> = -20A	-	104	-	S
<b>Dynamic Characteristics<sup>5</sup></b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V, f = 1MHz	-	5295	-	pF
Output Capacitance	C <sub>oss</sub>		-	430	-	
Reverse Transfer Capacitance	C <sub>rss</sub>		-	385	-	
Gate Resistance	R <sub>g</sub>	f = 1MHz	-	4.3	-	Q
<b>Switching Characteristics<sup>5</sup></b>						
Total Gate Charge	Q <sub>g</sub>	V <sub>GS</sub> = -10V, V <sub>DS</sub> = -20V, I <sub>D</sub> = -20A	-	110	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	12.5	-	
Gate-Drain Charge	Q <sub>gd</sub>		-	23	-	
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>GS</sub> = -10V, V <sub>DD</sub> = -20V, R <sub>G</sub> = 3Ω, I <sub>D</sub> = -20A	-	16.8	-	ns
Rise Time	t <sub>r</sub>		-	10	-	
Turn-off Delay Time	t <sub>d(off)</sub>		-	65	-	
Fall Time	t <sub>f</sub>		-	17	-	
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = -20A, dI/dt = 100A/μs	-	42	-	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>		-	29	-	nC
<b>Drain-Source Body Diode Characteristics</b>						
Diode Forward Voltage <sup>4</sup>	V <sub>SD</sub>	I <sub>S</sub> = -20A, V <sub>GS</sub> = 0V	-	-	-1.2	V
Continuous Source Current	I <sub>S</sub>	T <sub>C</sub> =25°C	-	-	-60	A

Notes:

1. Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150°C.
2. The EAS data shows Max. rating . The test condition is V<sub>DD</sub>= -30V, V<sub>GS</sub>= -10V, L= 0.1mH, I<sub>AS</sub>= -45A.
3. The data tested by surface mounted on a 1 inch2 FR-4 board with 2OZ copper, The value in any given application depends on the user's specific board design.
4. The data tested by pulsed , pulse width ≤ 300us , duty cycle ≤ 2%.
5. This value is guaranteed by design hence it is not included in the production test.

### Typical Characteristics

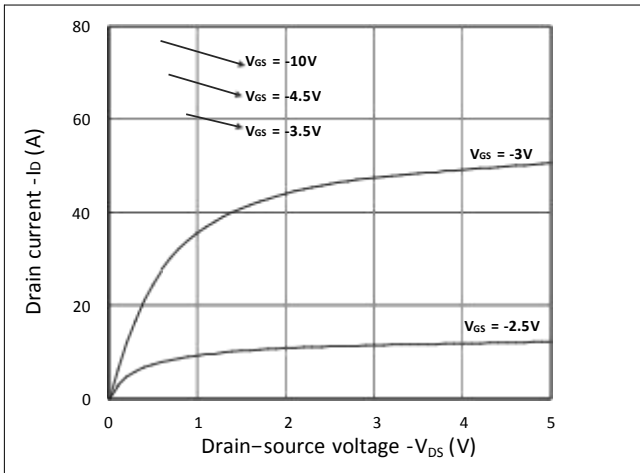


Figure 1. Output Characteristics

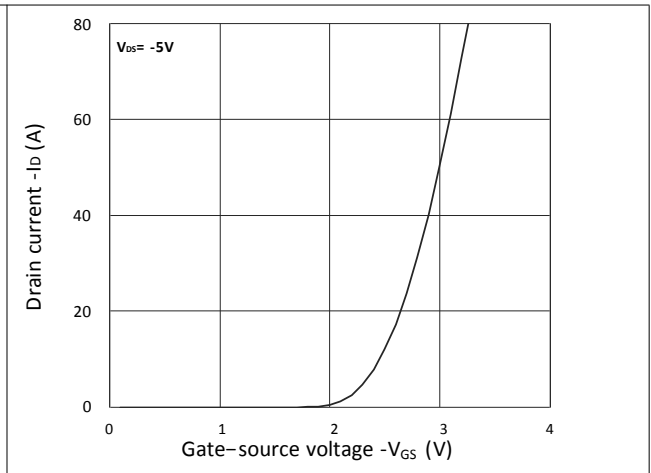


Figure 2. Transfer Characteristics

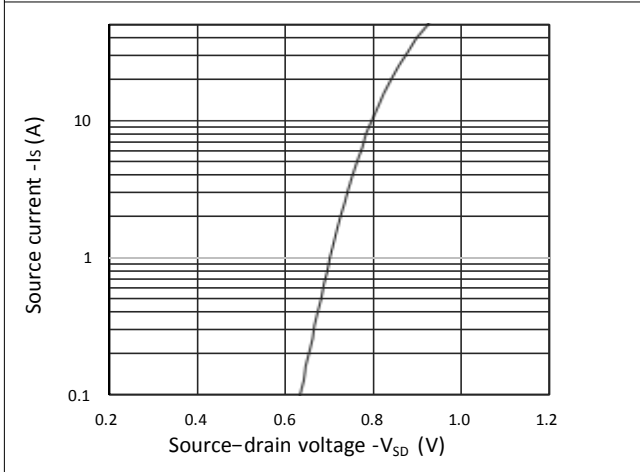


Figure 3. Forward Characteristics of Reverse

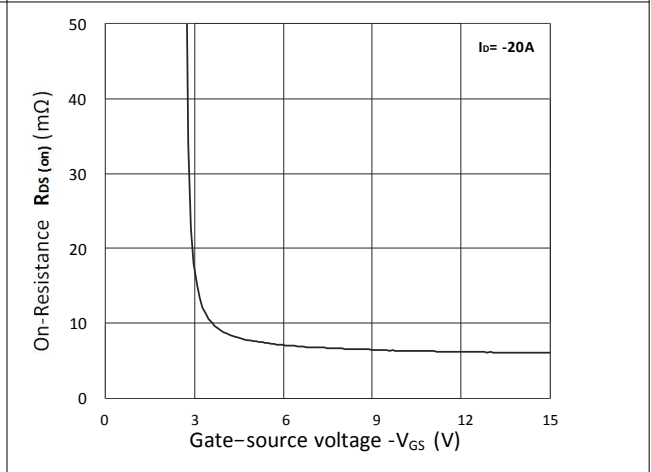


Figure 4.  $R_{DS(ON)}$  vs  $V_{GS}$

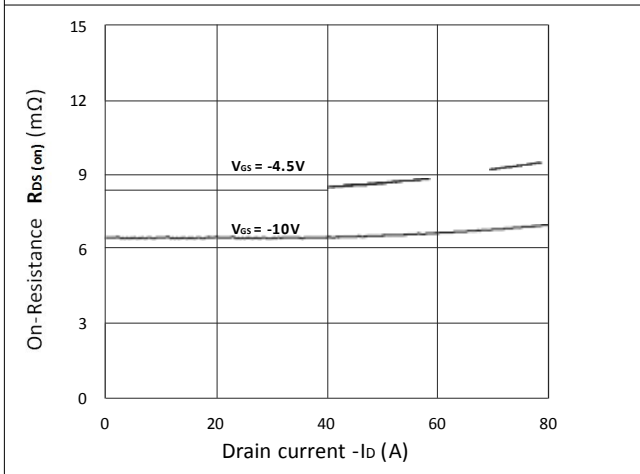


Figure 5.  $R_{DS(ON)}$  vs  $I_D$

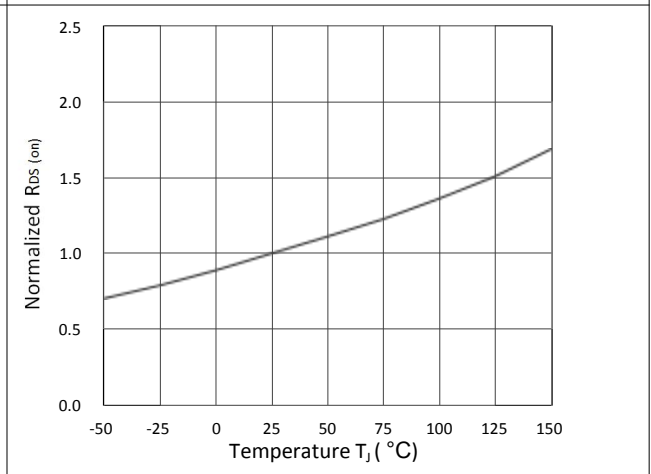


Figure 6. Normalized  $R_{DS(ON)}$  vs Temperature

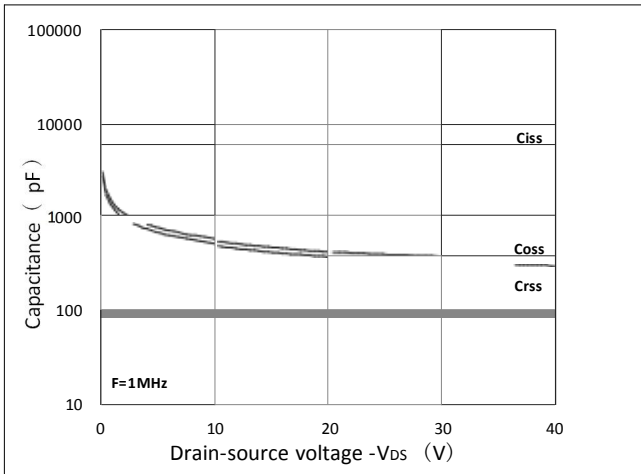


Figure 7. Capacitance Characteristics

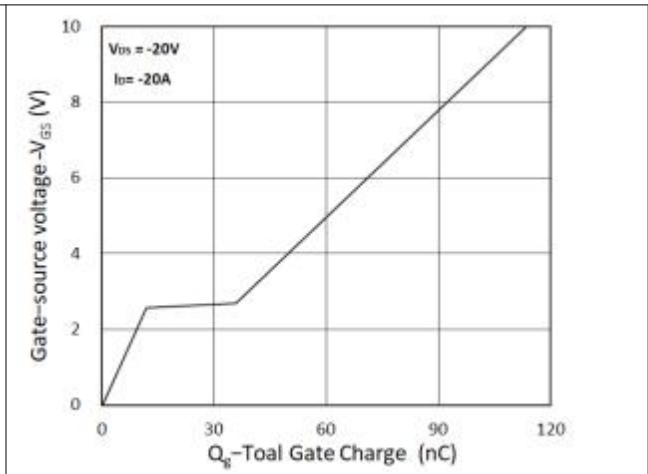


Figure 8. Gate Charge Characteristics

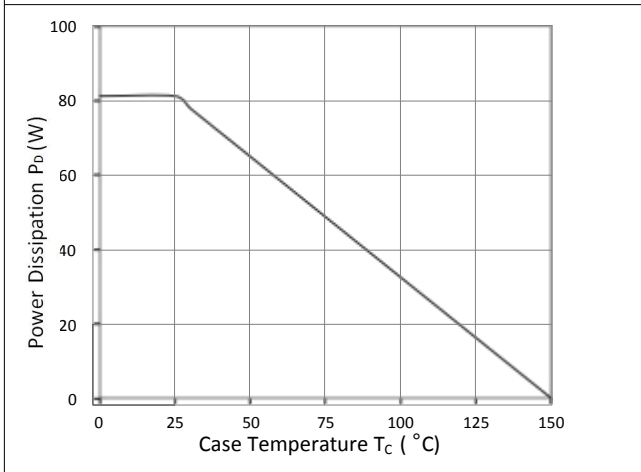


Figure 9. Power Dissipation

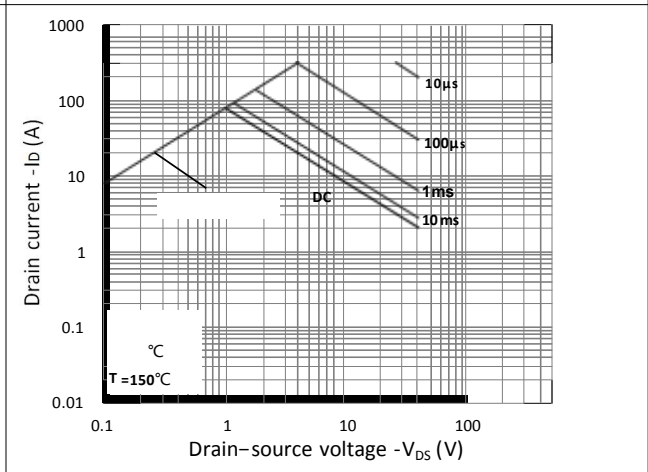


Figure 10. Safe Operating Area

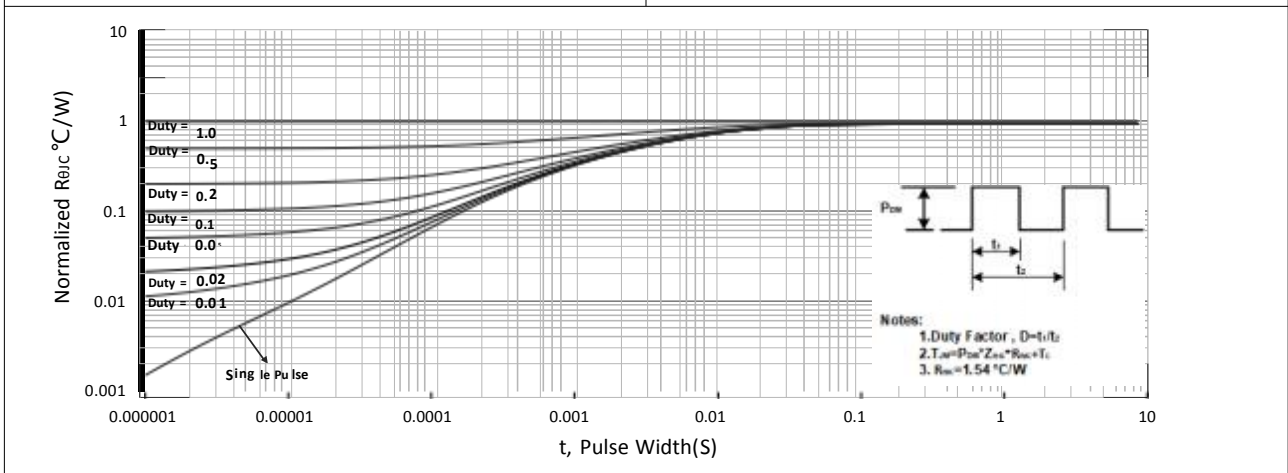
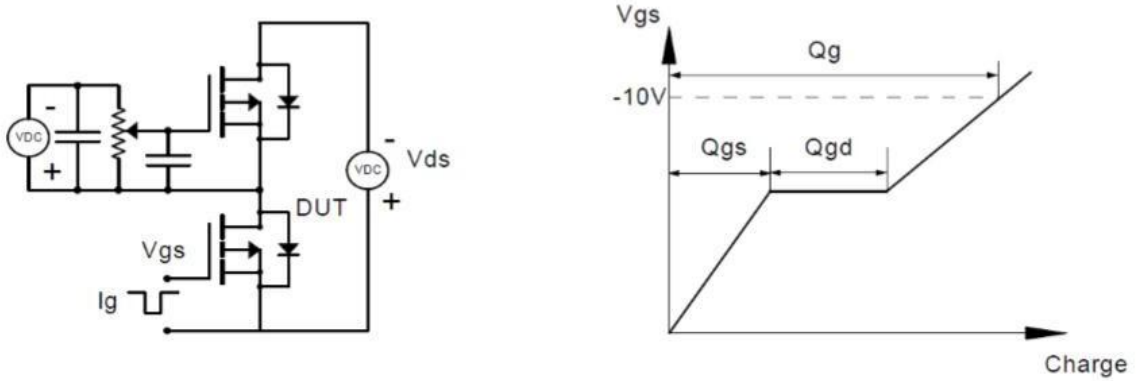


Figure 11. Normalized Maximum Transient Thermal Impedance

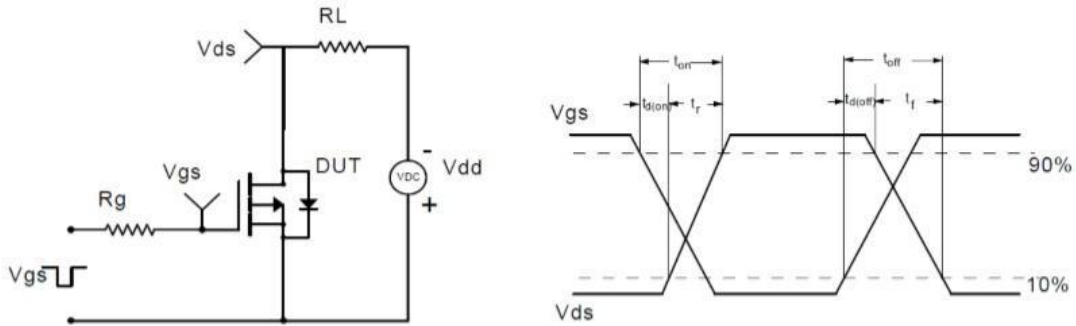
## Test Circuit

## P-Ch 40V Fast Switching MOSFETs

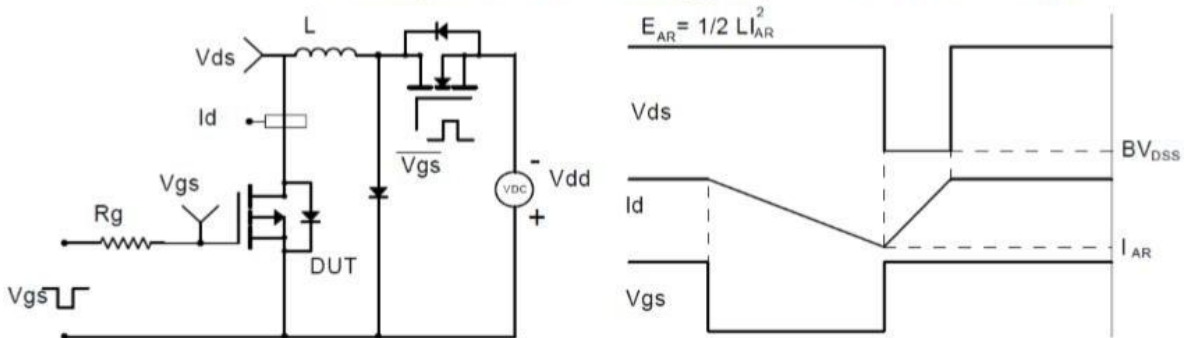
### Gate Charge Test Circuit & Waveform



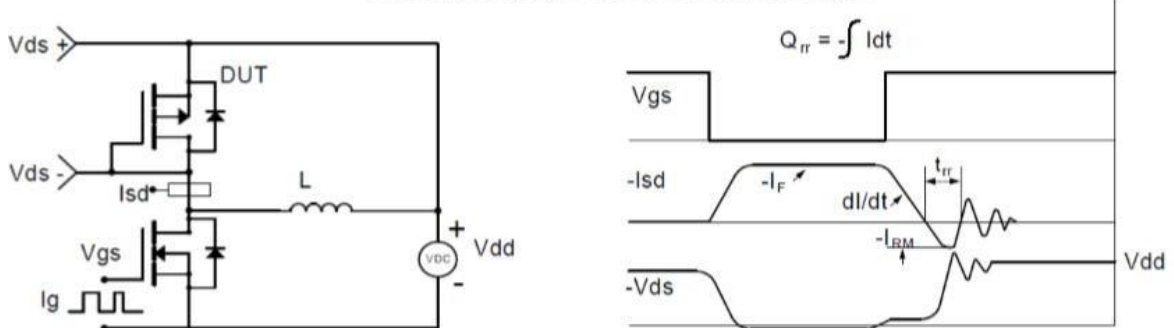
### Resistive Switching Test Circuit & Waveforms



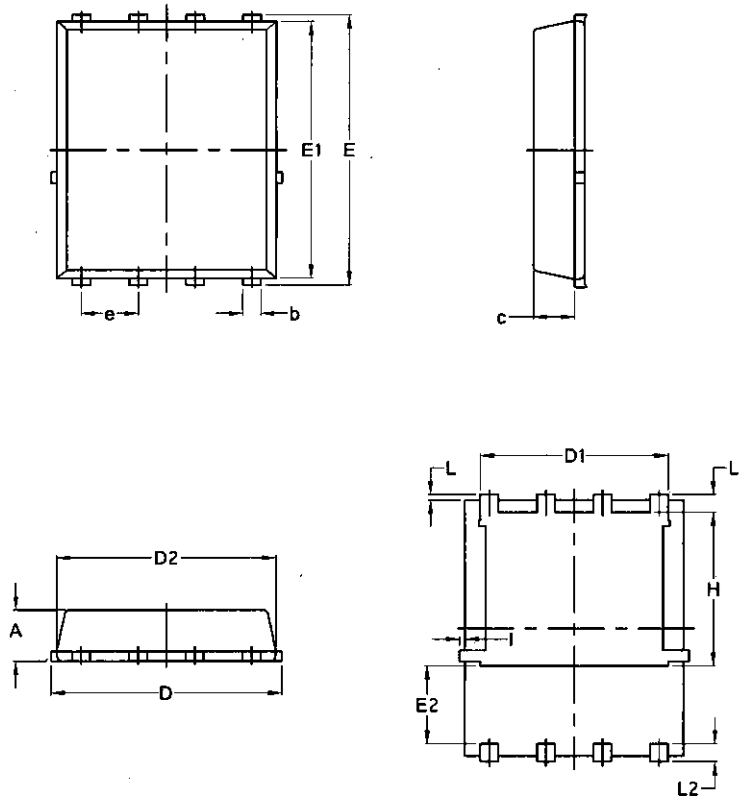
### Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



### Diode Recovery Test Circuit & Waveforms



### Package Mechanical Data-PDFN5060-8L Single



Symbol	Common			
	mm		Inch	
	Min	Max	Min	Max
A	1.03	1.17	0.0406	0.0461
b	0.34	0.48	0.0134	0.0189
c	0.824	0.0970	0.0324	0.082
D	4.80	5.40	0.1890	0.2126
D1	4.11	4.31	0.1618	0.1697
D2	4.80	5.00	0.1890	0.1969
E	5.95	6.15	0.2343	0.2421
E1	5.65	5.85	0.2224	0.2303
E2	1.60	/	0.0630	/
e	1.27 BSC		0.05 BSC	
L	0.05	0.25	0.0020	0.0098
L1	0.38	0.50	0.0150	0.0197
L2	0.38	0.50	0.0150	0.0197
H	3.30	3.50	0.1299	0.1378
l	/	0.18	/	0.0070