ER4012

N-Ch and P-Ch Fast Switching MOSFET

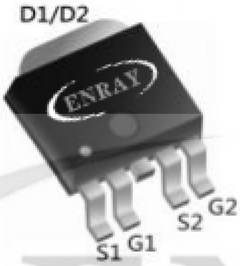
Features

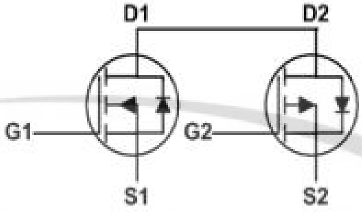
The ER4012 is the high performance complementary N-ch and P-ch MOSFETs with high cell density, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.
The meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

Product Summary

BVDSS	RDSON	ID
40V	17mΩ	25A
-40V	35mΩ	-25A

TO-252-4L





Maximum Ratings(Ta=25℃ unless otherwise noted)

Parameter	Symbol	Rating		Unit
		N-Ch	P-Ch	
Drain-Source Voltage	V_{DS}	40	-40	V
Gate-Source Voltage	V_{GS}	±20	±20	
Continuous Drain Current	ID@TC=25℃	25	-25	A
Continuous Drain Current	ID@TC=100℃	18	-16	
Pulsed Drain Current [2]	I_{DM}	46	-40	
Single Pulse Avalanche Energy[3]	EAS	28	66	mJ
Avalanche Current	IAS	17.8	-27.2	A
Total Power Dissipation	PD@TC=25℃	25	31.3	W
StorageTemperature Range	TSTG	-55 to 150		℃
Operating Junction Temperature	TJ	-55 to 150		

Thermal Data

Parameter	Symbol	Typ.	Max.	Unit
Thermal Resistance Junction-Ambient [1]	RθJA	-	62	℃/W
Thermal Resistance Junction-Case	RθJC		5	℃/W

N-Channel Electrical Characteristics(TJ=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Static Parameters ③						
Drain-Source Breakdown Voltage	BV_{DSS}	VGS = 0V, ID = 250μA	40			V
Zero Gate Voltage Drain Current	I_{DSS}	VDS=40V , VGS=0V			1	μA
Gate-Body leakage Current	I_{GSS}	VGS=±20 V , VDS=0V			±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	VGS=VDS , ID=250uA	1.0	1..5	2.5	V
Static Drain-Source On-Resistance	RDS(on)	VGS=10V , ID=8A		17	22	mΩ
		VGS=4.5V , ID=5A		25	35	mΩ
Dynamic Parameters ④						
Input Capacitance	C_{iss}	VDS=20V, VGS=0V, f=1.0MHz		633		pF
Output Capacitance	C_{oss}			67		pF
Reverse Transfer Capacitance	C_{rss}			58		pF
Total Gate Charge	Q_g	VDS=20V, ID=8A, VGS=10V		12		nC
Gate Source Charge	Q_{gs}			3.2		nC
Gate Drain Charge	Q_{gd}			3.1		nC
Switching Parameters ④						
Turn-On DelayTime	$t_{d(on)}$	VDD= 20V, RL =2.5Ω VGS=10V,RREN =3Ω		4		ns
Turn-On Rise Time	t_r			3		ns
Turn-Off DelayTime	td(off)			15		ns
Turn-Off Fall Time	tf			2		ns
Drain-Source Diode Characteristics and Maximum Ratings						
Maximum Continuous Drain to Source Diode Forward Current	Is				20	A
Maximum Pulsed Drain to Source Diode Forward Current	ISM				32	A
Drain to Source Diode Forward Voltage^2	VSD	VGS=0V, IS= 8A			1.2	V

Note :

1. Repetitive Rating : Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t < 5 sec.
3. Pulse Test : Pulse Width≤300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production testing.

P-Channel Electrical Characteristics(TJ=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Static Parameters ③						
Drain-Source Breakdown Voltage	BVDSS	VGS = 0V, ID = -250μA	-40			V
Zero Gate Voltage Drain Current	IDSS	VDS=-32V , VGS=0V			-1	μA
Gate-Body leakage Current	IGSS	VGS=±20 V , VDS=0V			±100	nA
Gate Threshold Voltage	VGS(th)	VDS=VGS, ID= -250μA	-1.0	-1.6	-2.5	V
Static Drain-Source On-Resistance	RDS(on)	VGS=10V , ID=-8A		35	45	mΩ
		VGS=4.5V , ID=-4A		47	70	mΩ
Dynamic Parameters ④						
Input Capacitance	Ciss	VDS=-15V , VGS=0V , f=1MHz		1004		pF
Output Capacitance	Coss			108		pF
Reverse Transfer Capacitance	Crss			80		pF
Total Gate Charge	Qg	VDS=-20V , VGS=-4.5V , ID=-12A		9		nC
Gate Source Charge	Qgs			2.54		nC
Gate Drain Charge	Qgd			3.1		nC
Switching Parameters ④						
Turn-On DelayTime	td(on)	VDD=-15V , VGS=-10V , RG=3.3Ω, ID=-1A		19.2		ns
Turn-On Rise Time	tr			12.8		ns
Turn-Off DelayTime	td(off)			48.6		ns
Turn-Off Fall Time	tf			4.6		ns
Drain-Source Diode Characteristics and Maximum Ratings						
Continuous Source Current[1,5]	IS	VG=VD=0V , Force Current			-15	A
Pulsed Source Current[2,5]	ISM				-40	A
Drain to Source Diode Forward Voltage[2]	VSD	VGS=0V , IS=-1A , TJ=25℃			-1	V

Note :

1. Repetitive Rating : Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t < 5 sec.
3. Pulse Test : Pulse Width≤300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production testing.

N-Channel Typical Characteristics

Figure1: Output Characteristics

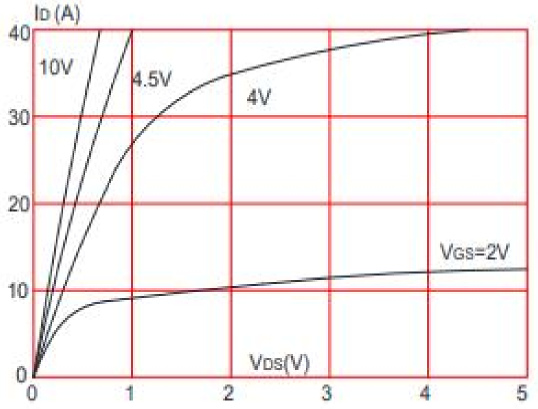


Figure 2: Typical Transfer Characteristics

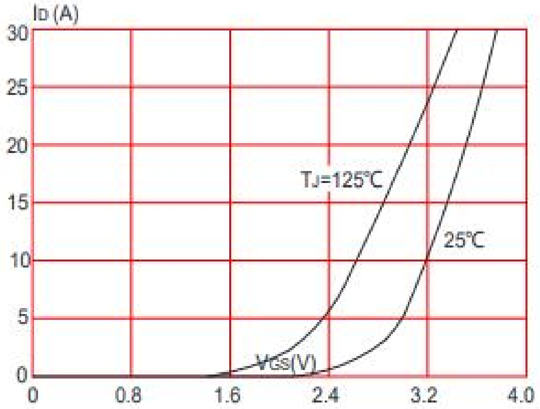


Figure 3: On-resistance vs. Drain Current

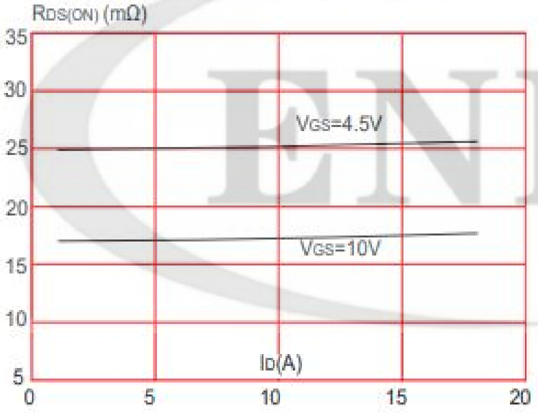


Figure 4: Body Diode Characteristics

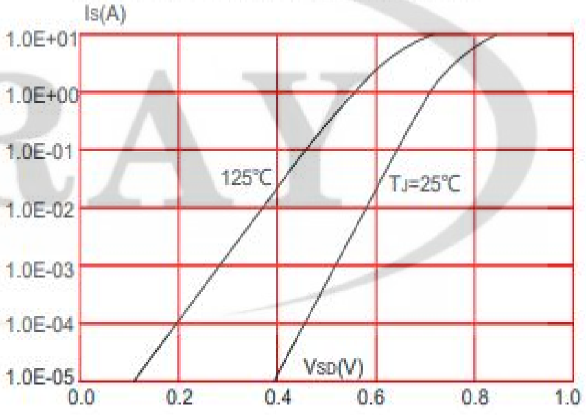


Figure 5: Gate Charge Characteristics

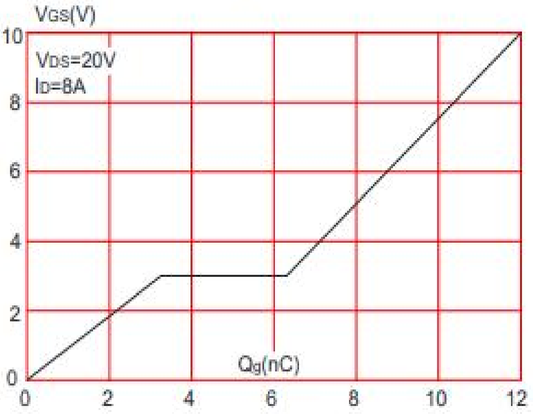
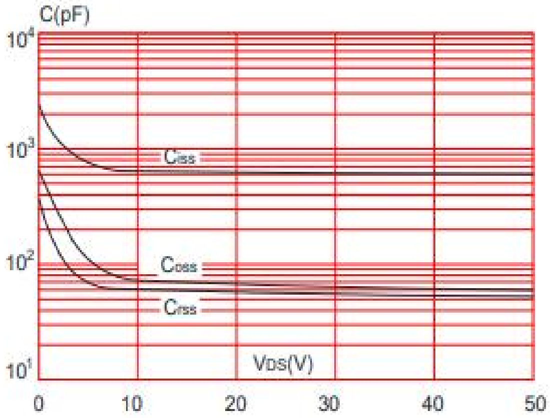


Figure 6: Capacitance Characteristics



N-Channel Typical Characteristics

Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

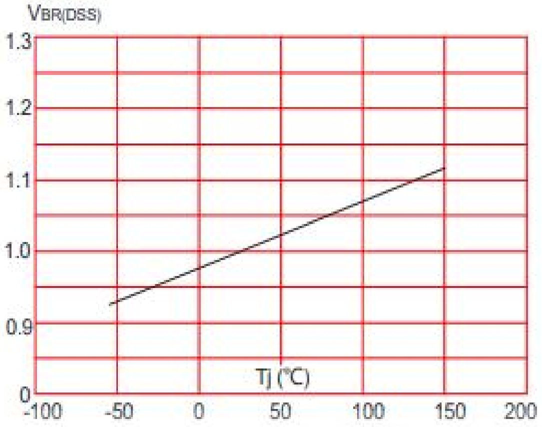


Figure 8: Normalized on Resistance vs. Junction Temperature

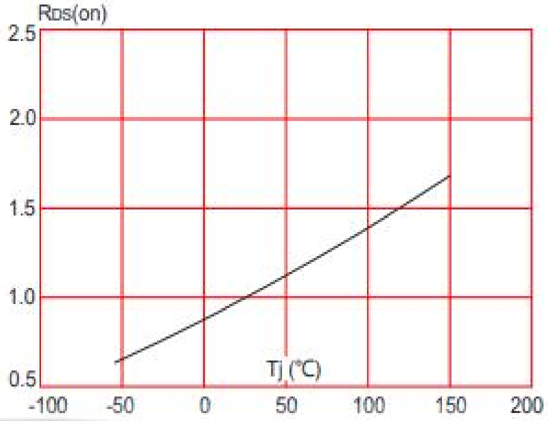


Figure 9: Maximum Safe Operating Area

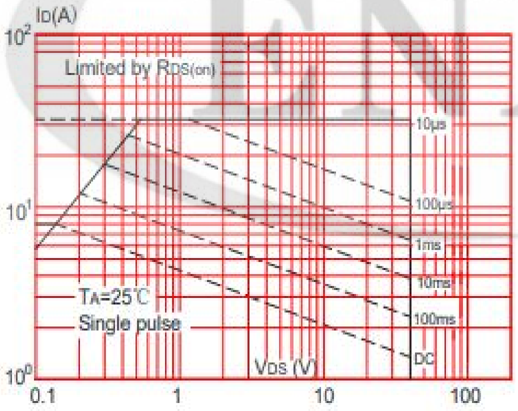


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

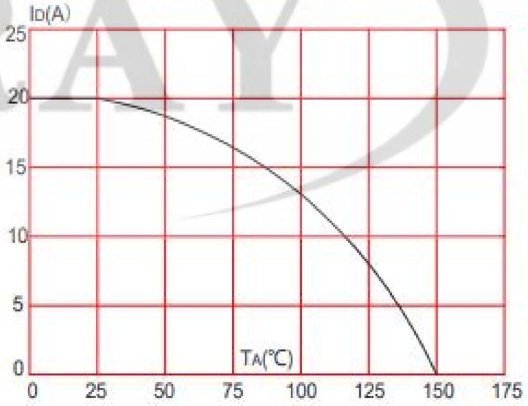
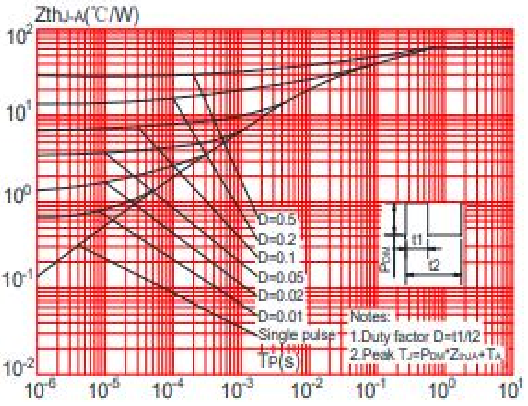


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



Notes:
1.Duty factor D=t1/t2
2.Peak $T_J=P_{DM}*Z_{thJA}+T_A$

P-Channel Typical Characteristics

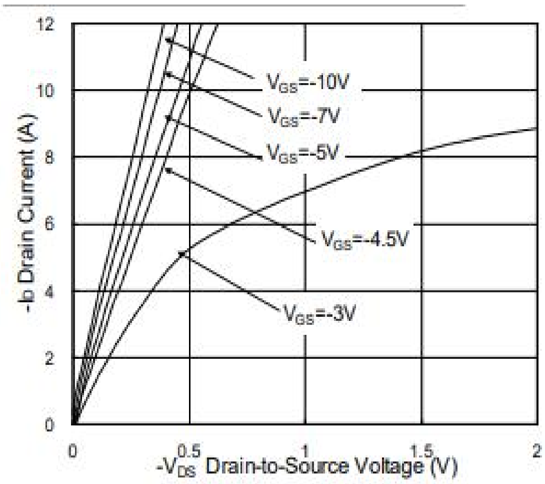


Fig.1 Typical Output Characteristics

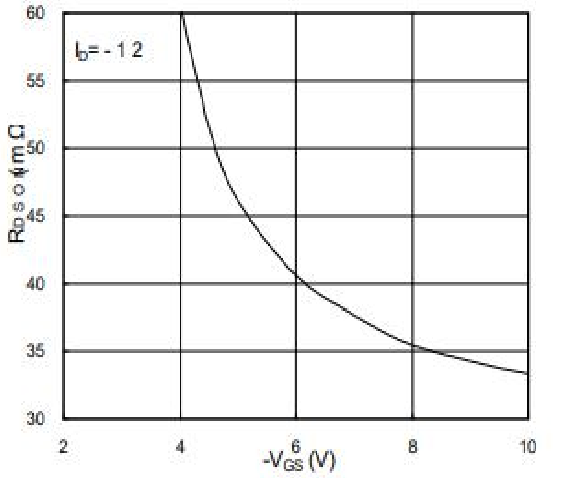


Fig.2 On-Resistance v.s Gate-Source

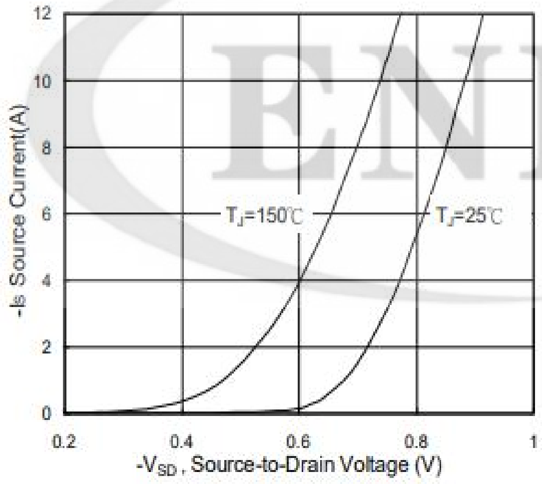


Fig.3 Forward Characteristics of Reverse

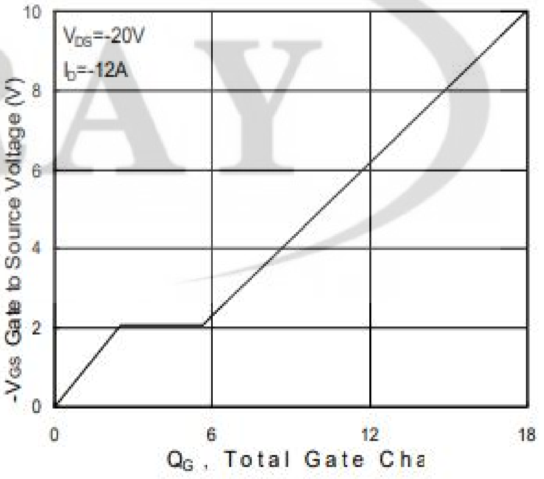


Fig.4 Gate-Charge Characteristics

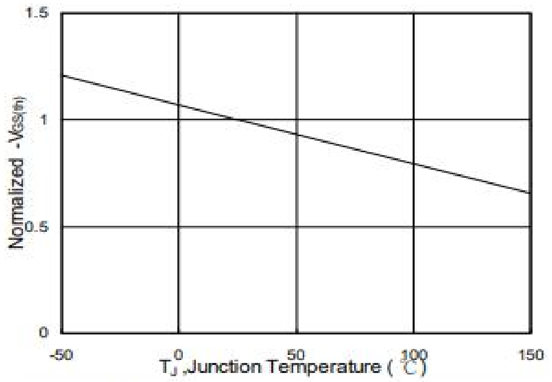


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

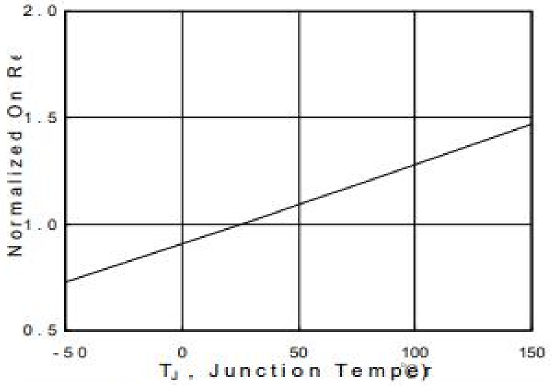


Fig.6 Normalized R_{DSON} v.s T_J

P-Channel Typical Characteristics

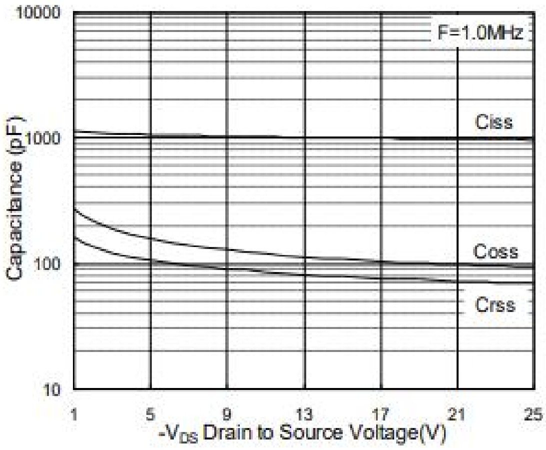


Fig.7 Capacitance

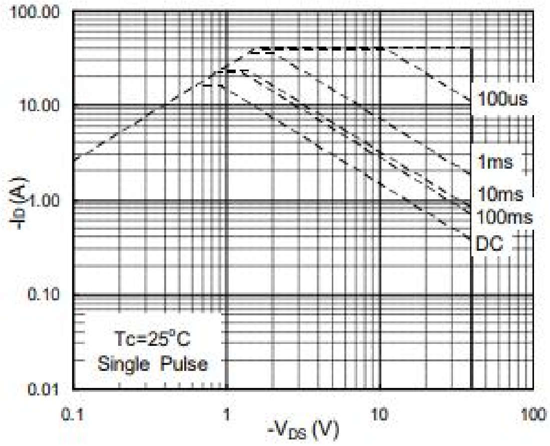


Fig.8 Safe Operating Area

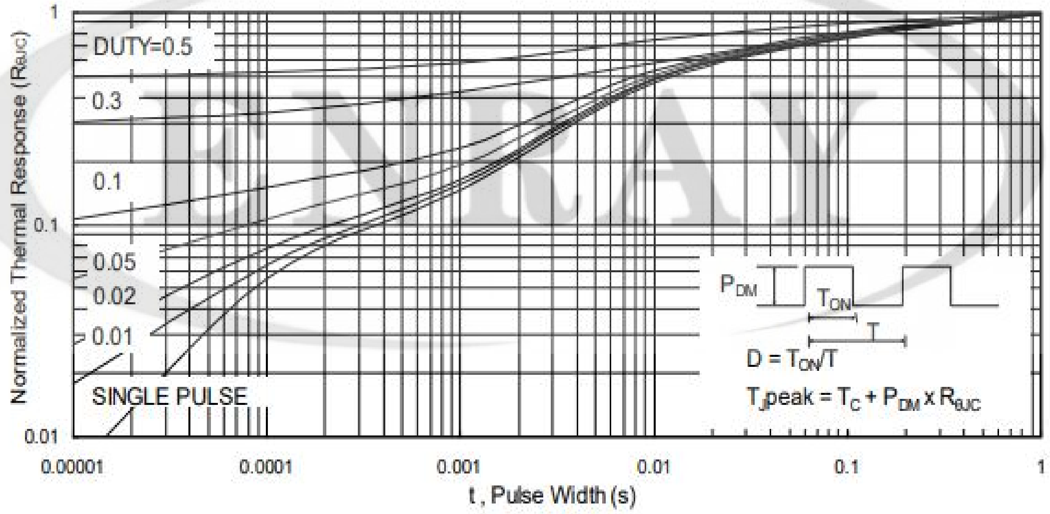
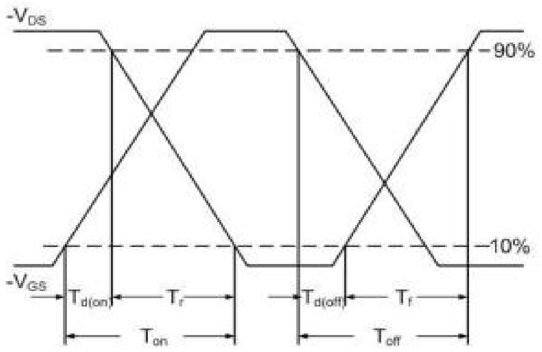


Fig.9 Normalized Maximum Transient Thermal Impedance



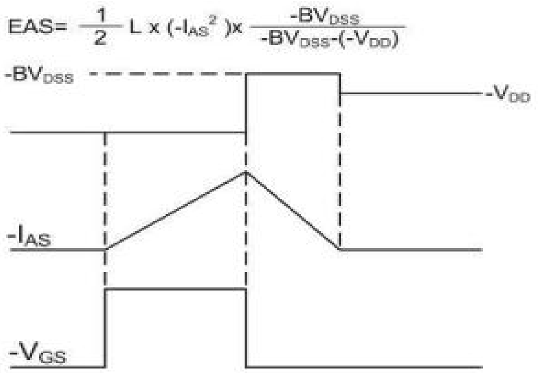


Fig.10 Switching Time Waveform

Fig.11 Unclamped Inductive Waveform

TO-252-4L Package Outline Dimesions