

MOSFET

89A,600V,35mΩ,N-CHANNEL MOSFET

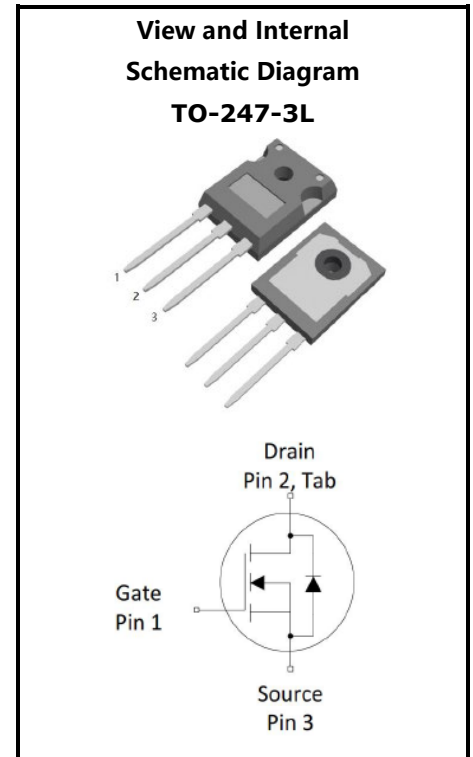
Features

- ◆ Extremely low on-resistance $R_{DS(on)}$
- ◆ Excellent Low Ciss

Applications

- ◆ PFC stages, hard switching PWM stages and resonant switchingr
- ◆ PWM stages for e.g. PC Silverbox, Adapter, Server, Telecom and UPS

Parameter	Values	Unit
BV_{DSS}	600	V
I_D	89	A
$R_{DS(on)}$ (max)	35	mΩ
$V_{GS(th)}$ (Typ)	4	V



Ordering Code	Marking	Package	Packaging
X35N60JEFHA3	X35N60JEFHA3	TO-247-3L	Tube

Absolute Maximum Ratings($T_C=25^{\circ}\text{C}$,unless otherwise noted)

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Drain-Source Voltage	V_{DSS}	-	-	600	V	-
Gate-Source Voltage	V_{GS}	-20	-	20	V	-
Continuous Drain Current	I_D	-	-	89	A	$T_C=25^{\circ}\text{C}$ (Silicon limit)
		-	-	89	A	$T_C = 25^{\circ}\text{C}$ (Package limit)
		-	-	56	A	$T_C=100^{\circ}\text{C}$ (Silicon limit)
		-	-	6	A	$T_A = 25^{\circ}\text{C}$
Pulsed Drain Current	$I_{D\ pulse}$	-	-	356	A	$T_C=25^{\circ}\text{C}$, $t_p=100\mu\text{s}$
Single Pulse Avalanche Energy	E_{AS}	-	-	607	mJ	$L=60\text{mH}$, $V_{DS}=100\text{V}$
Maximum Power Dissipation	P_{tot}	-	-	641	W	$T_C=25^{\circ}\text{C}$
		-	-	2.5	W	$T_A=25^{\circ}\text{C}$
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55	-	150	$^{\circ}\text{C}$	-
Soldering temperature, wave soldering only allowed at leads(1.6mm from case for 10s)	T_{sold}	-	-	260	$^{\circ}\text{C}$	

Thermal Characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Thermal resistance , junction to Case	$R_{th(j-c)}$	-	0.13	0.2	°C/W	-
Thermal resistance , junction to Ambient	$R_{th(j-a)}$	-	-	50		-

Electrical Characteristics ($T_J=25^{\circ}\text{C}$, unless otherwise noted)

Static characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Drain-Source Breakdown Voltage	BV_{DSS}	600	-	-	V	$V_{GS}=0V, I_D=250\mu A$
Zero Gate Voltage Drain Current	I_{DSS}	-	-	1	μA	$V_{DS}=600V, V_{GS}=0V$
Gate-Body Leakage Current, Forward	I_{GSSF}	-	-	100	nA	$V_{GS}=20V, V_{DS}=0V$
Gate-Body Leakage Current, Reverse	I_{GSSR}	-	-	-100	nA	$V_{GS}=-20V, V_{DS}=0V$
Gate-Source Threshold Voltage	$V_{GS(th)}$	3	-	5	V	$V_{DS}=V_{GS}, I_D=250\mu A$
Drain-Source On-State Resistance	$R_{DS(on)}$	-	31	35	m Ω	$V_{GS}=10V, I_D=40A$
Gate Resistance	R_g	-	1	-	Ω	$V_{GS}=0V, V_{DS}$ Open, $f=1\text{MHz}$
Forward Transconductance	g_{fs}	-	44	-	S	$V_{DS}=5V, I_D=40A$

Dynamic characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Input Capacitance	C_{iss}	-	7767	-	pF	$V_{DS}=400V, V_{GS}=0V, f=1.0\text{MHz}$
Output Capacitance	C_{oss}	-	199	-	pF	
Reverse Transfer Capacitance	C_{rss}	-	2	-	pF	
Turn-On Delay Time	$t_{d(on)}$	-	37	-	ns	$V_{DD}=300V, R_G=2.5\Omega, V_{GS}=10V, I_D=40A$
Turn-On Rise Time	t_r	-	81	-	ns	
Turn-Off Delay Time	$t_{d(off)}$	-	97	-	ns	
Turn-Off Fall Time	t_f	-	50	-	ns	

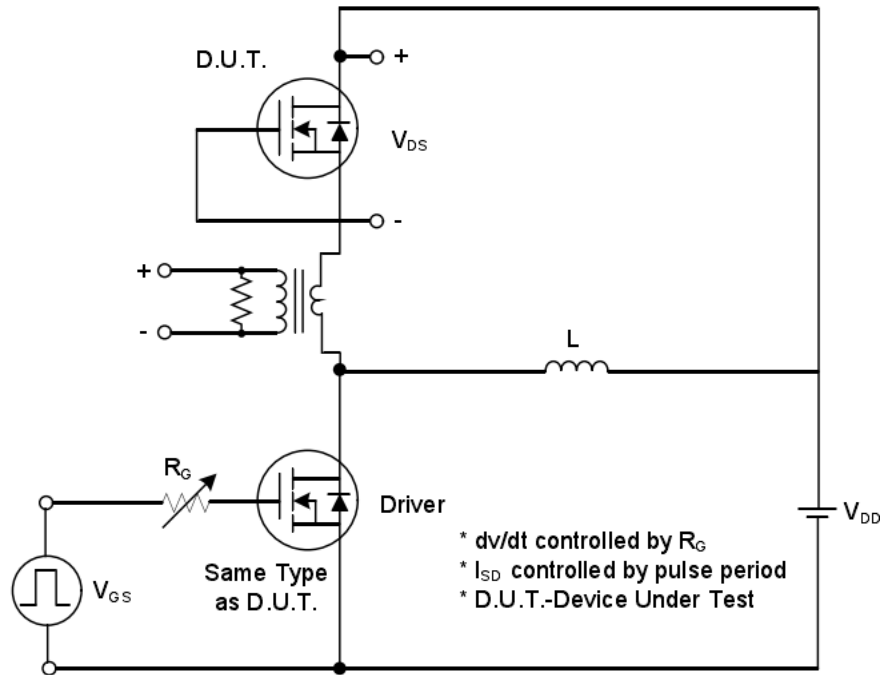
Gate charge characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Total Gate Charge	Q_g	-	198	-	nC	$V_{DS}=300V, I_D=40A, V_{GS}=10V$
Gate-Source Charge	Q_{gs}	-	63	-	nC	
Gate-Drain Charge	Q_{gd}	-	91	-	nC	

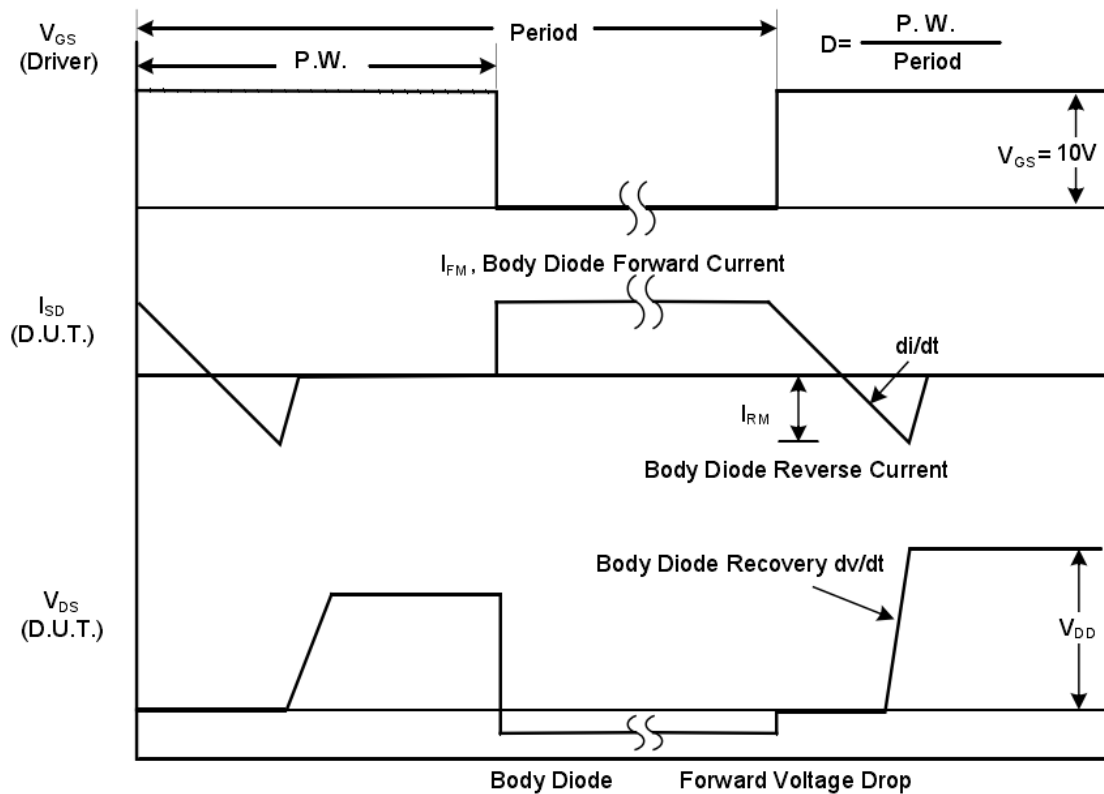
Reverse diode

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Continuous Diode Forward Current	I_S	-	-	89	A	-
Pulsed Diode Forward Current	$I_{S\ pulse}$	-	-	356	A	-
Diode Forward Voltage	V_{SD}	-	-	1.5	V	$I_S=40A, V_{GS}=0V$
Reverse Recovery Time	t_{rr}	-	170	-	ns	$V_R=400V, I_F=40A, di/dt=100A/\mu s$
Reverse Recovery Charge	Q_{rr}	-	1697	-	nC	

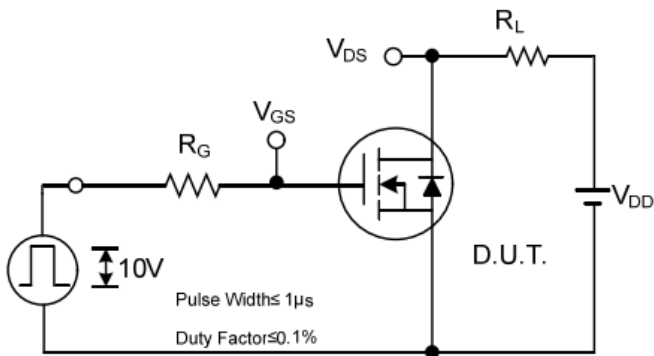
RATING AND CHARACTERISTIC CURVES



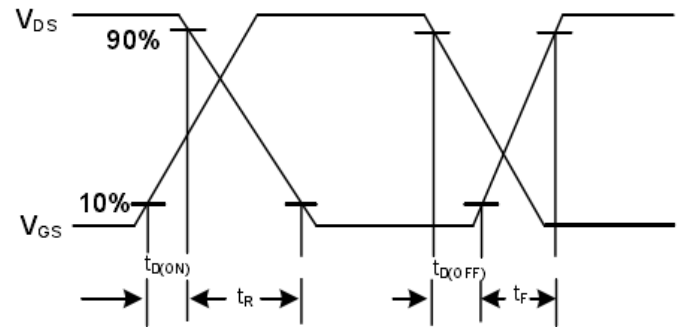
Peak Diode Recovery dv/dt Test Circuit



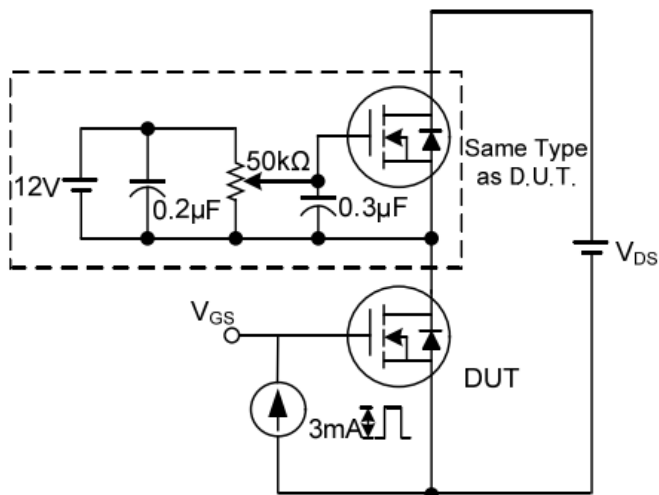
Peak Diode Recovery dv/dt Waveforms



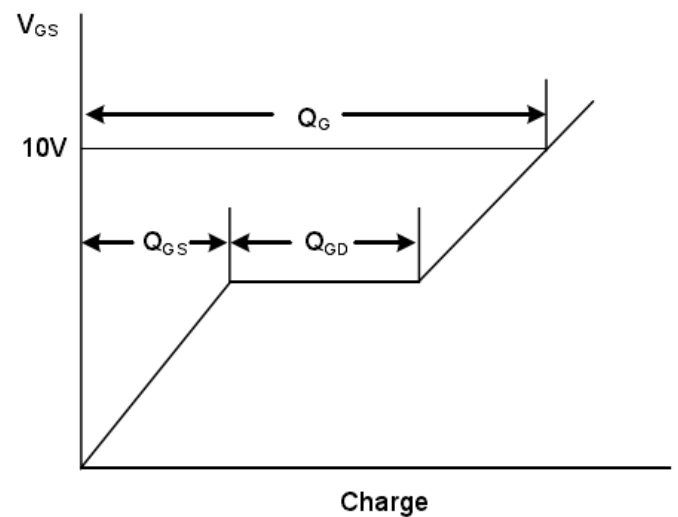
Switching Test Circuit



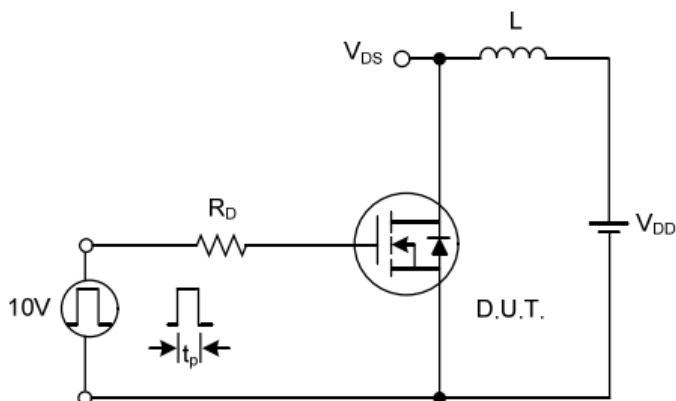
Switching Waveforms



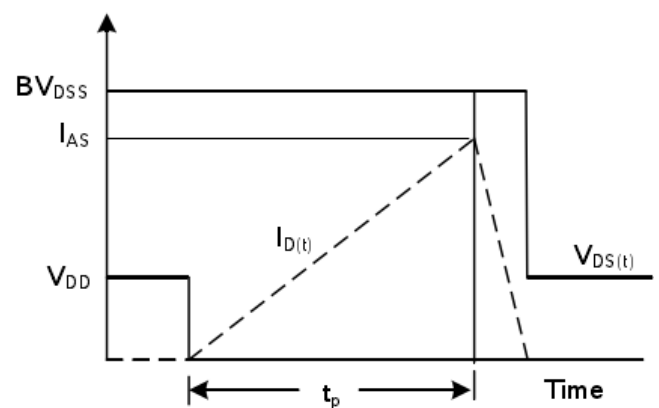
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

RATING AND CHARACTERISTIC CURVES

Figure.1 Output Characteristics

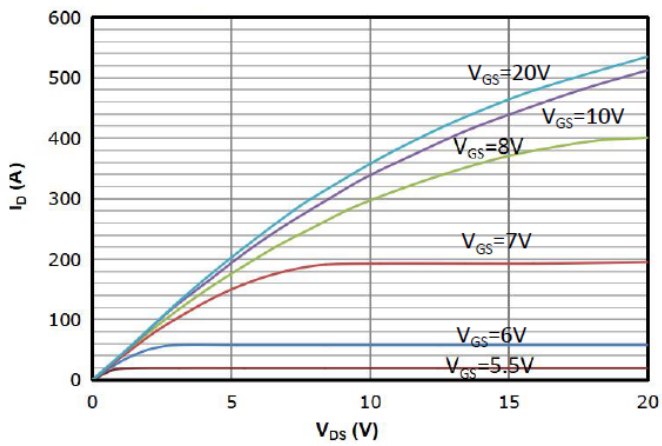


Figure.2 Transfer Characteristics

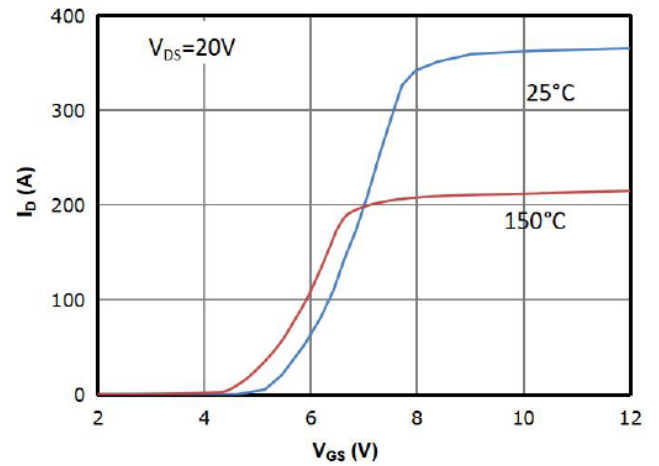


Figure.3 Rds(on) vs Drain Current and Gate Voltage

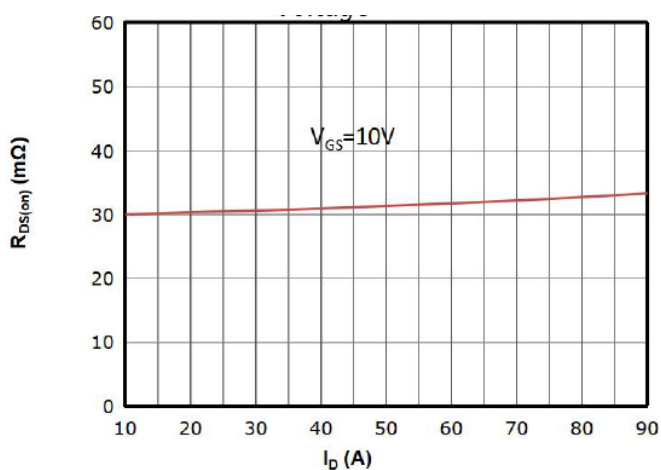


Figure.4 Rds(on) vs Gate Voltage

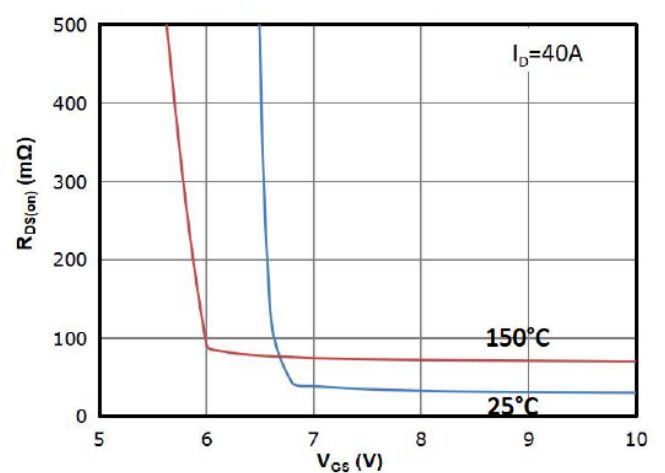


Figure.5 Rds(on) vs. Temperature

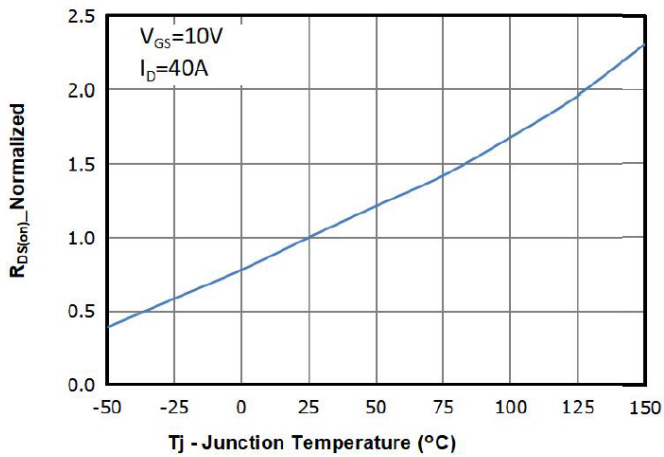


Figure.6 Vgs(th) vs. Temperature

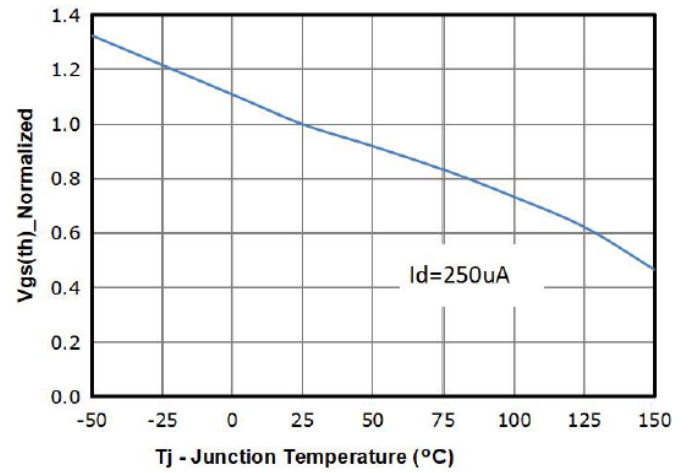


Figure.7 BVdss vs. Temperature

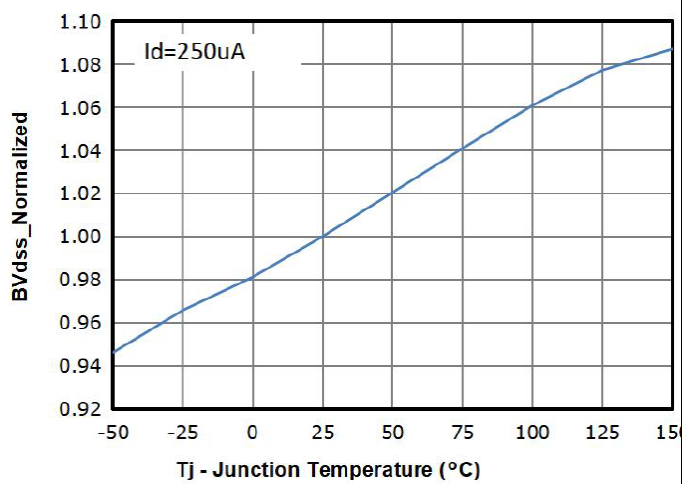


Figure.8 Capacitance Characteristics

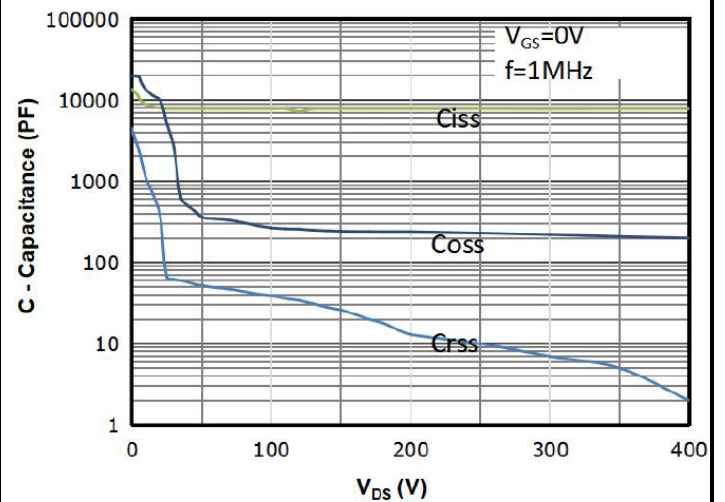


Figure.9 Gate Charge Characteristics

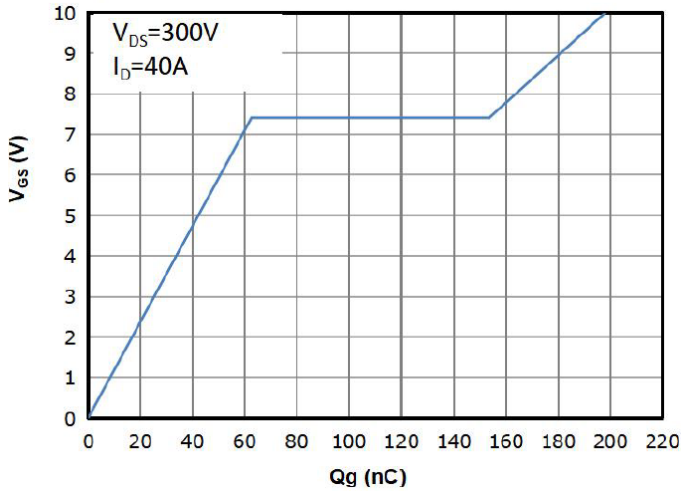


Figure.10 Body-diode Forward Characteristics

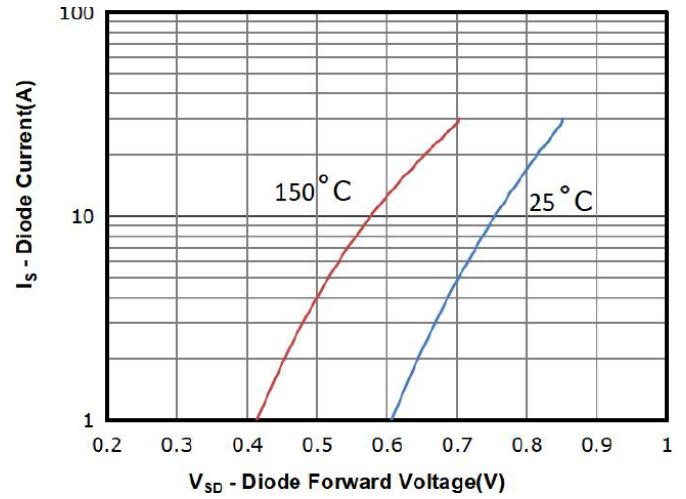


Figure.11 Power Dissipation

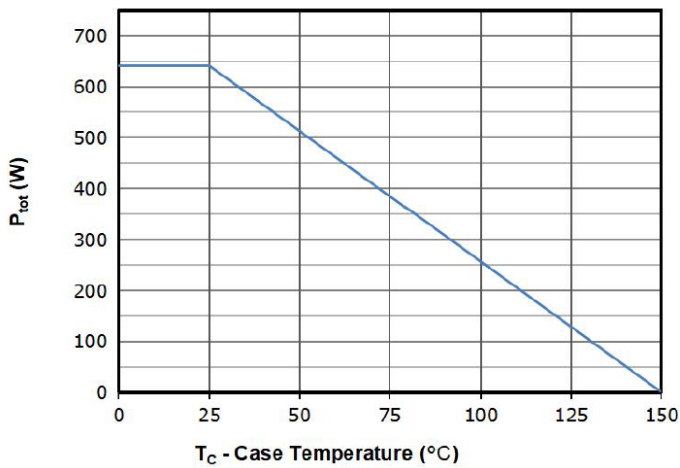


Figure.12 Drain Current Derating

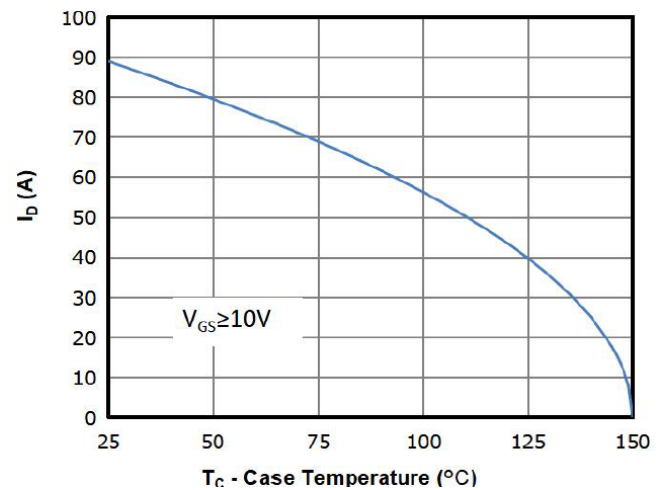


Figure.13 Safe Operating Area

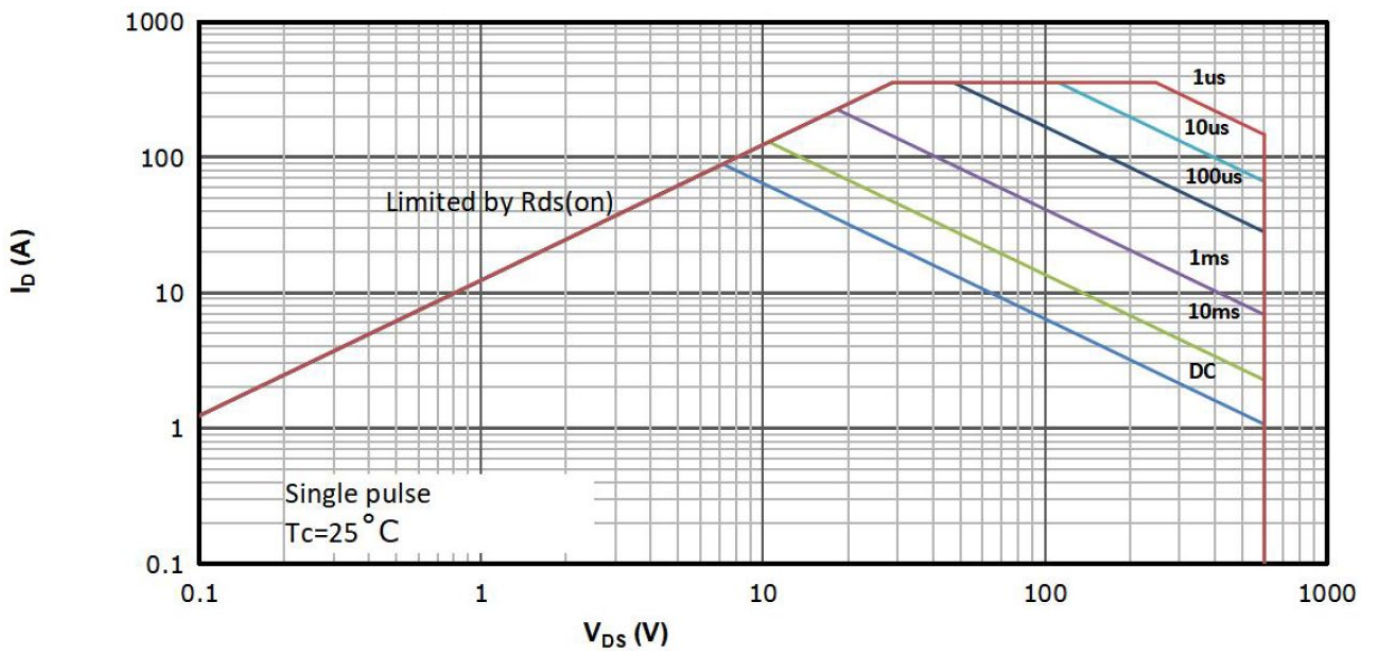
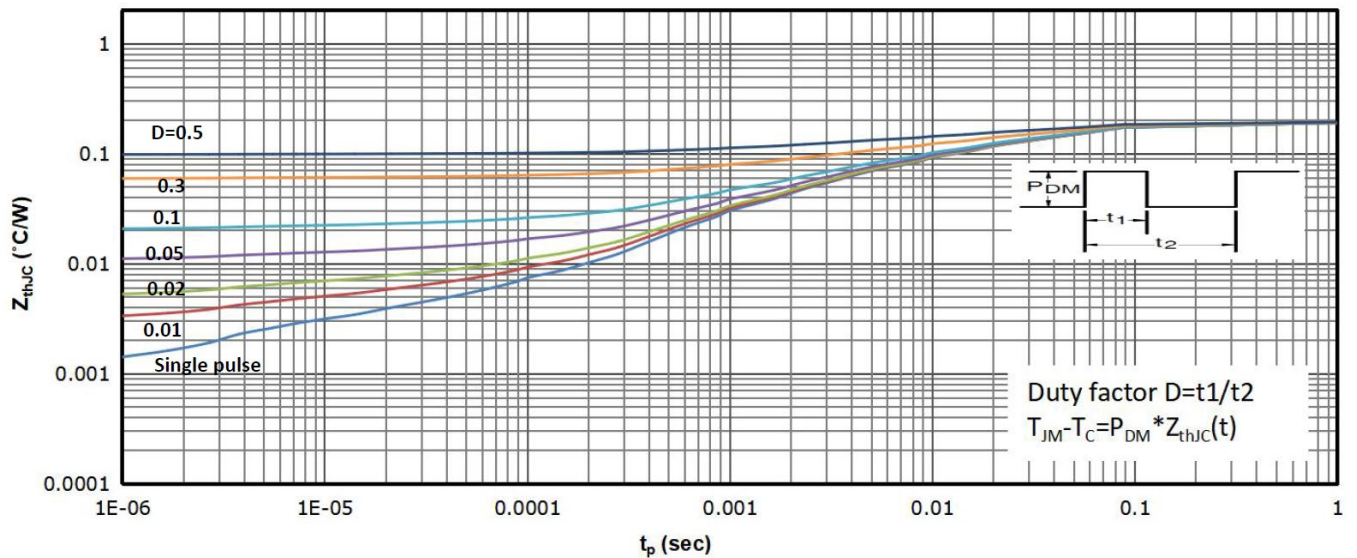
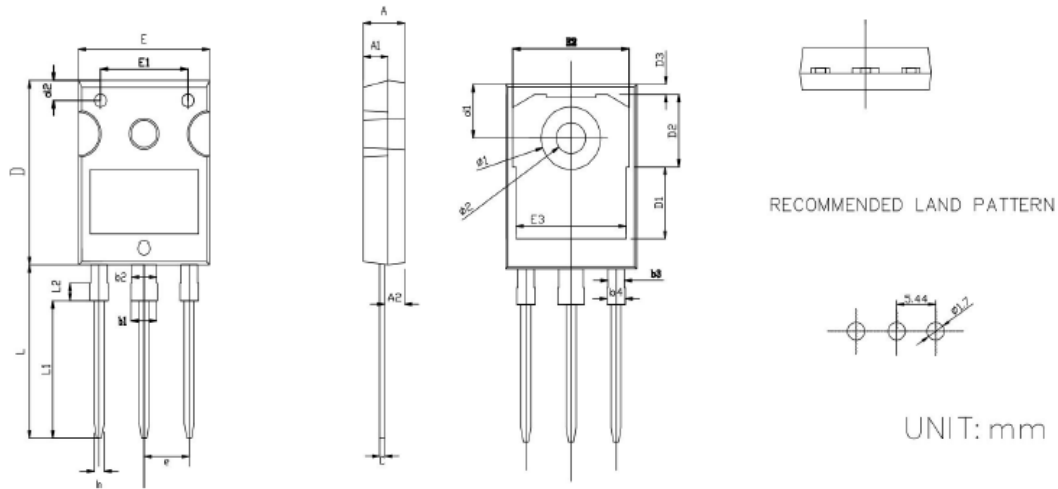


Figure.14 Maximum Effective Thermal Impedance , Junction to Case



Package Outline: TO-247-3L



SYMBOL	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.20	0.189	0.205
A1	2.80	3.20	0.110	0.126
A2	2.26	2.56	0.089	0.101
B	1.10	1.30	0.043	0.051
b1	2.90	3.20	0.114	0.126
b2	2.90	3.10	0.114	0.122
b3	1.90	2.10	0.075	0.083
b4	2.00	2.20	0.079	0.087
c	0.50	0.70	0.020	0.028
D	20.80	21.20	0.819	0.835
D1	8.23		0.324	
D2	8.32		0.328	
D3	1.17		0.046	
d1	6.00	6.30	0.236	0.248
d 2	2.20	2.40	0.087	0.094
E	15.60	16.00	0.164	0.630
E1	10.50		0.413	
E2	14.02		0.552	
E3	13.50		0.531	
e	5.34	5.54	0.210	0.218
L	19.72	20.12	0.776	0.792
L1	15.79		0.622	
L2	1.98		0.078	
φ1	7.10	7.30	0.280	0.287
φ2	3.50	3.70	0.138	0.146