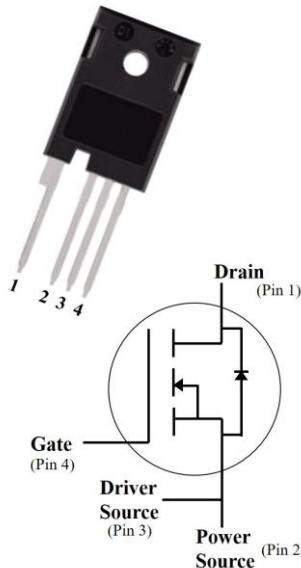


**Silicon Carbide Power MOSFET (N-Channel Enhancement)**

V _{DS}	1200V
I _{D (25°C)}	66A
R _{DS(on)}	33mΩ

**Features**

- High speed switching
- Essentially no switching losses
- Reduction of heat sink requirements
- Maximum working temperature at 175 °C
- High blocking voltage
- Fast Intrinsic diode with low recovery current
- High-frequency operation
- Halogen free, RoHS compliant
- AEC-Q101 qualified

Typical Applications

Typical applications are in power factor correction(PFC), solar inverter, uninterruptible power supply, motor drives, photovoltaic inverter, electric car and charger.

Mechanical Data

- **Package:** TO247-4L
- **Terminals:** Tin plated leads
- **Polarity:** As marked

■ Maximum Ratings (T_C=25°C Unless otherwise specified)

PARAMETER	SYMBOL	UNIT	VALUE	TEST CONDITIONS	NOTE
Device marking code				D212040NCFG2	
Drain source voltage @ T _j =25°C	V _{DS,max}	V	1200	V _{GS} =0 V, I _D =100uA	
Gate source voltage @ T _j =25°C	V _{GS,max}	V	-8/+19	Absolute maximum values	
Gate source voltage @ T _j =25°C	V _{GS,op}	V	-4/+15	Recommended operational values	Note1、2
Continuous drain current @ T _c =25°C	I _D	A	66	V _{GS} =15V, T _c =25°C	Fig.18
Continuous drain current @ T _c =100°C			48	V _{GS} =15V, T _c =100°C	
Pulsed drain current	I _{D(pulsed)}	A	120	Pulse width t _p limited by T _{j,max}	Fig.23
Avalanche energy, Single Pulse	E _{AS}	mJ	500	V _{DD} =75V, L=10mH	
Power Dissipation	P _{TOT}	W	333	T _c =25°C , T _j = 175°C	Fig.17
Power Dissipation			144	T _c =110°C, T _j = 175°C	
Operating junction and Storage temperature range	T _j , T _{stg}	°C	-55 to +175		
Soldering temperature	T _L	°C	260	1.6mm (0.063") from case for 10s	
Mounting torque	T _M	Nm	0.6	M3 screw Maximum of mounting process: 3	


■ Static Electrical Characteristics (Tc=25°C unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Gate threshold voltage	V _{GS(th)}	V	2.0	2.5	4.0	V _{DS} =V _{GS} , I _D = 11.5mA	Fig.4, 11
				2.0		V _{DS} =V _{GS} , I _D = 11.5mA, T _j =175°C	
Drain source breakdown voltage	V _{(BR)DSS}	V	1200			V _{GS} =0, I _D =100uA	
Zero gate voltage drain current	I _{DSS}	uA		1	50	V _{DS} =1200V, V _{GS} = 0V	Fig.16
Gate source leakage current	I _{GSS}	nA		10	100	V _{GS} = 15V, V _{DS} =0V	
Current drain source on-state resistance	R _{DS ON}	mΩ		33	44	V _{GS} =15V, I _D =40A	Fig.5, 6, 7
				63		V _{GS} =15V, I _D =40A, T _j =175°C	
Internal gate resistance	R _g	Ω		3.0	5.0	f=1MHz	
Diode forward voltage	V _{SD}	V		5.0		V _{GS} =-4V, I _{SD} =20A	Fig.8
				3.3		V _{GS} =0V, I _{SD} =20A T _j =175°C	Fig.9
Transconductance	g _f	S		26		V _{DS} =20V, I _D =40A	Fig.4
				22		V _{DS} =20V, I _D =40A, T _j =175°C	

■ Dynamic Electrical Characteristics (Tc=25°C unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Input capacitance	C _{iss}	pF		3456		V _{DS} =1000V, V _{GS} =0V, T _j =25°C, f=100 kHz, V _{AC} = 25mV	Fig.13, 14
Output capacitance	C _{oss}			127			
Reverse capacitance	C _{rss}			7.2			
C _{oss} stored energy	E _{oss}	uJ		69			Fig.15
Gate source charge	Q _{gs}	nC		39		V _{DS} =800V, V _{GS} =-4/15V, I _D =40A	Fig.12
Gate drain charge	Q _{gd}			44			
Gate charge	Q _g			116			

■ Switching Characteristics (Tc=25°C unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Turn on switching energy	E _{on}	uJ		500		V _{DD} =800V, V _{GS} =-4/+15V, I _D =40A, R _g =2.7Ω, L=100uH	Fig.21, 20
Turn off switching energy	E _{off}			80			
Turn on delay time	t _{d(on)}	ns		10			



Rise time	t_r			22			
Turn off delay time	$t_{d(off)}$	ns		22		$V_{DD}=800V, V_{GS}=-4/+15V, I_D=40A, R_g=2.7\Omega, L=100\mu H$	Fig.21, 20
Fall time	t_f			10			

■ **Body diode characteristics** ($T_c=25^\circ C$ unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Diode forward voltage	V_{SD}	V		5.0		$V_{GS}=-4V, I_{SD}=20A$	Fig.8
				3.3		$V_{GS}=0V, I_{SD}=20A, T_j=175^\circ C$	Fig.9
Continuous diode forward current	I_s	A		66		$T_c=25^\circ C$	Note1
Reverse recovery time	trr	nS		27		$V_R=800V, V_{GS}=-4V, I_D=40A, di/dt=2250A/\mu s$	
Reverse recovery charge	Qrr	nC		478			
Peak reverse recovery current	$Irrm$	A		27			

Note 1: When using SiC Body Diode the maximum recommended $V_{GS} = -4V$

Note 2: MOSFET can also safely operate at 0/15 V

■ **Thermal Characteristics** ($T_a=25^\circ C$ Unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Typ.
Thermal resistance	$R_{\theta J-C}$	$^\circ C/W$	0.45

■ **Typical Characteristics**

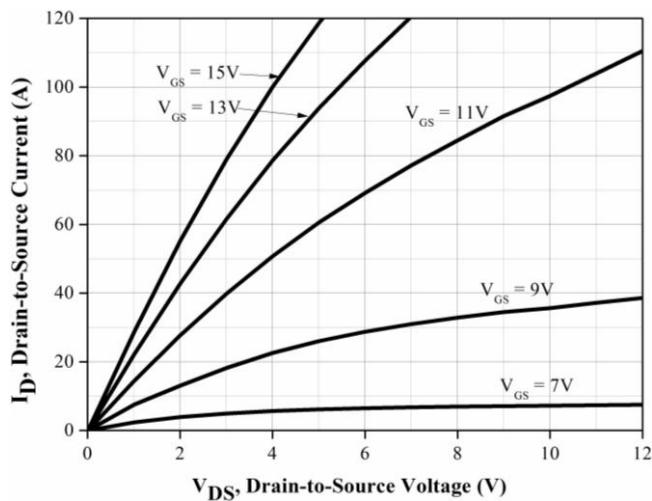


Figure 1. Output Characteristics $T_j = -55^\circ C$

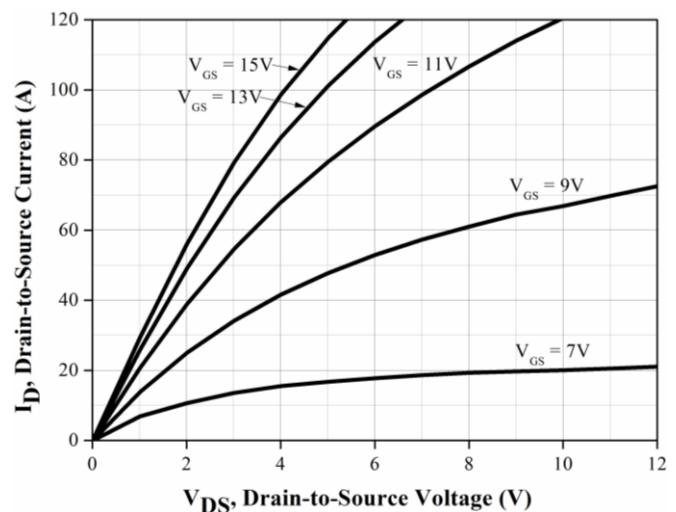


Figure 2. Output Characteristics $T_j = 25^\circ C$

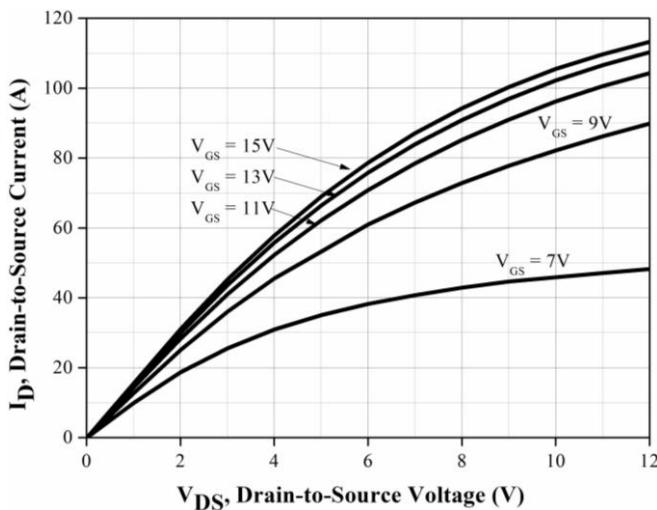


Figure 3. Output Characteristics $T_j = 175^\circ\text{C}$

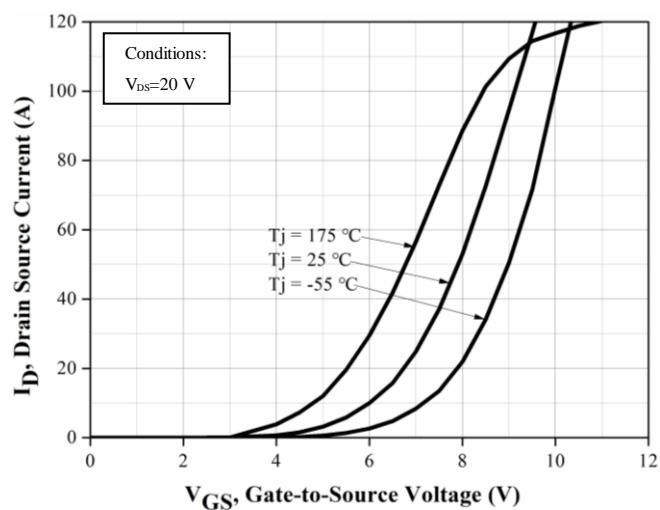


Figure 4. Transfer Characteristics for various junction temperature

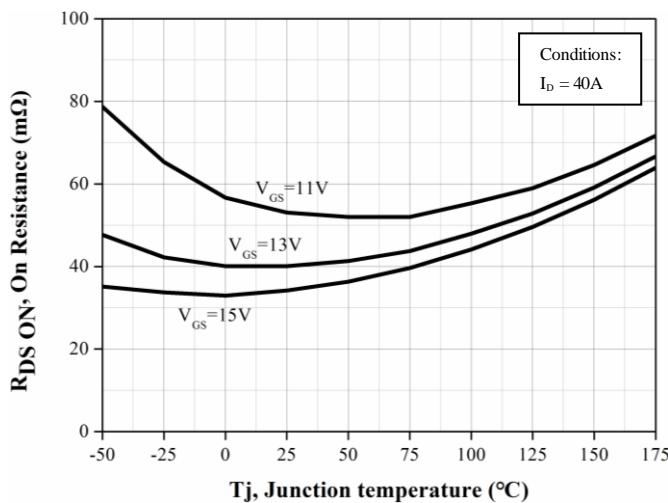


Figure 5. On-resistance vs. temperature for various gate voltage

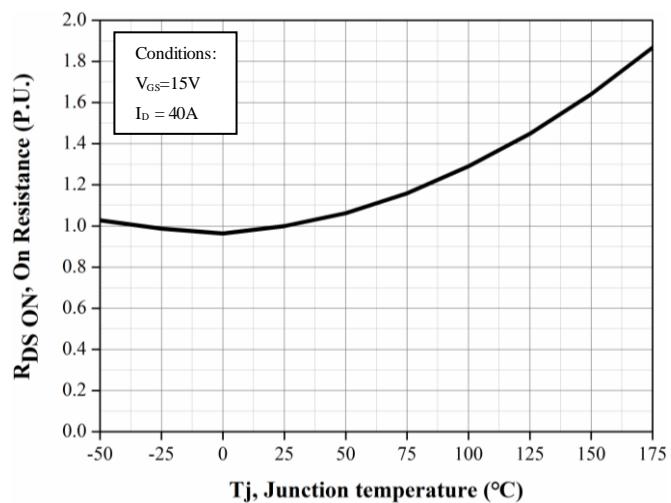


Figure 6. Normalized on-resistance vs. temperature

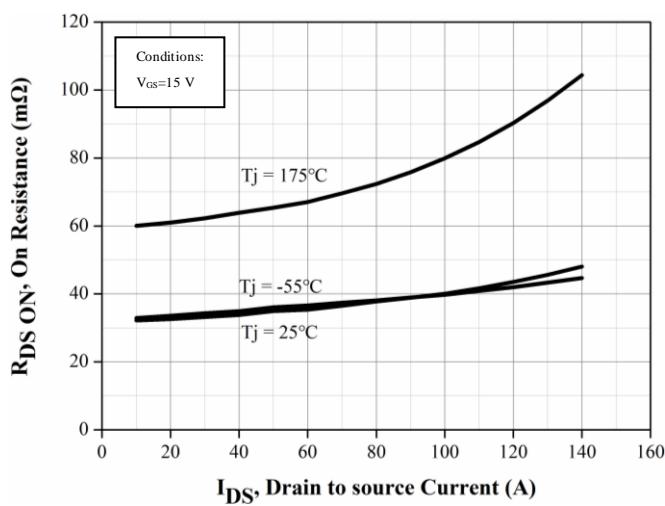


Figure 7. On-resistance vs. drain current

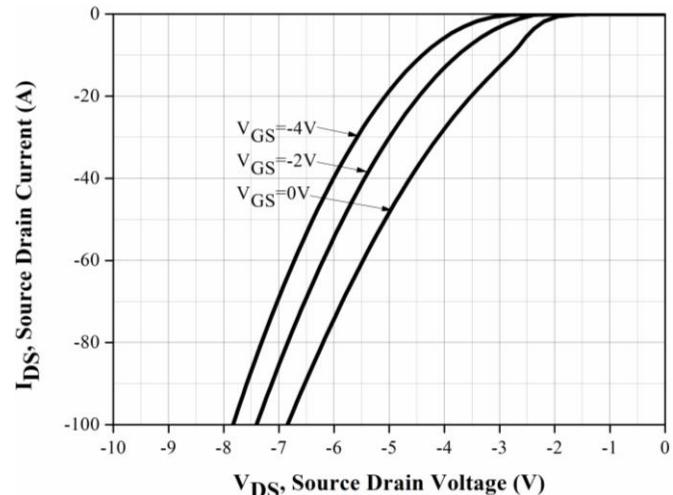


Figure 8. Body diode characteristic at $T_j = 25^\circ\text{C}$

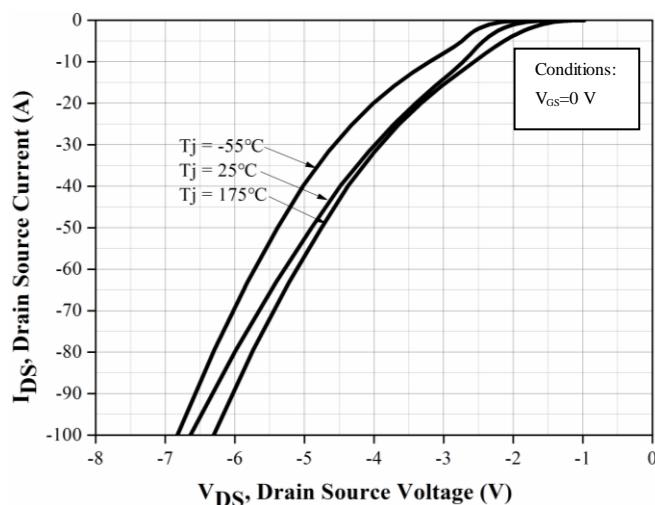


Figure 9. Body diode characteristic

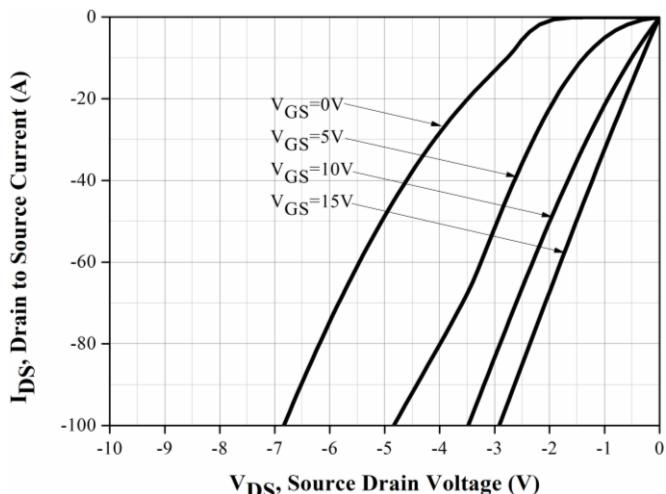


Figure 10. 3rd quadrant characteristic at $T_j = 25^\circ\text{C}$

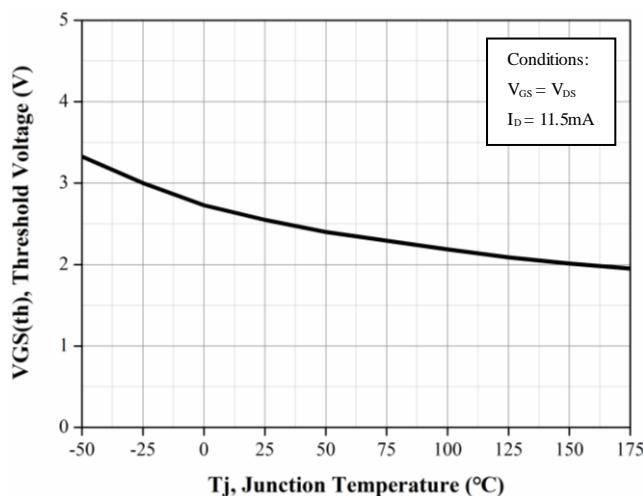


Figure 11. Threshold voltage vs. temperature

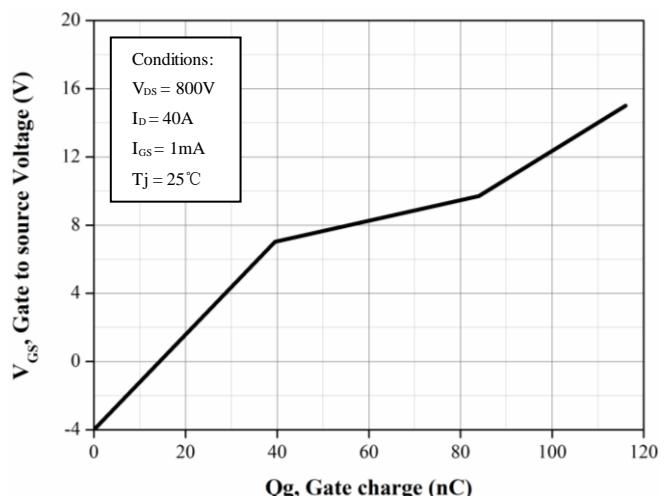


Figure 12. Gate charge characteristic

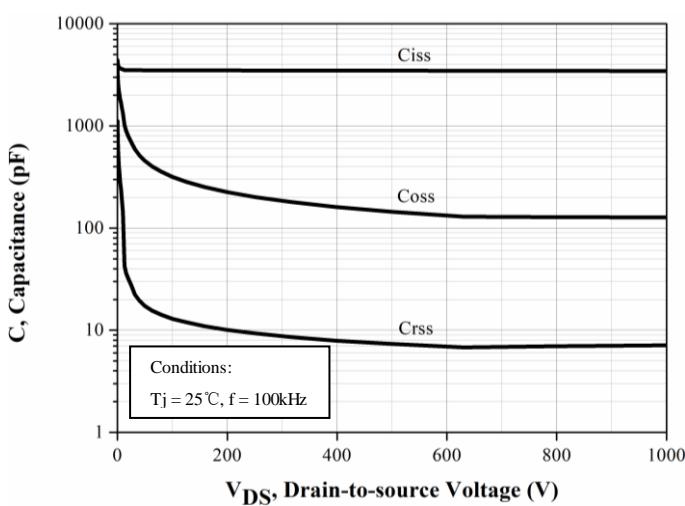


Figure 13. Capacitances vs. drain source voltage (0-1000V)

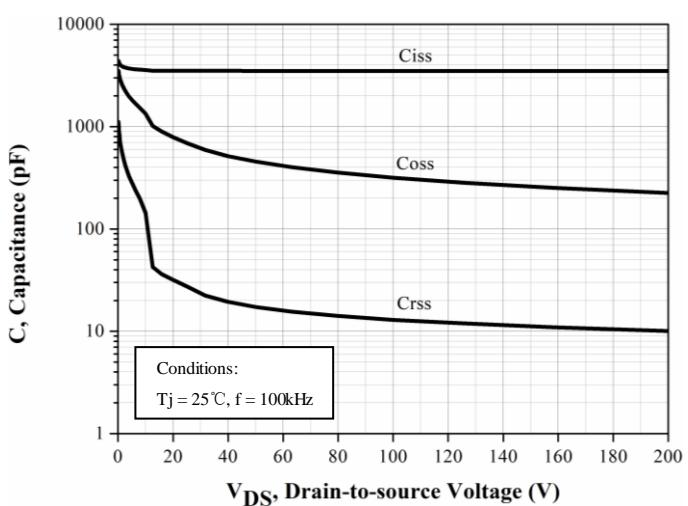
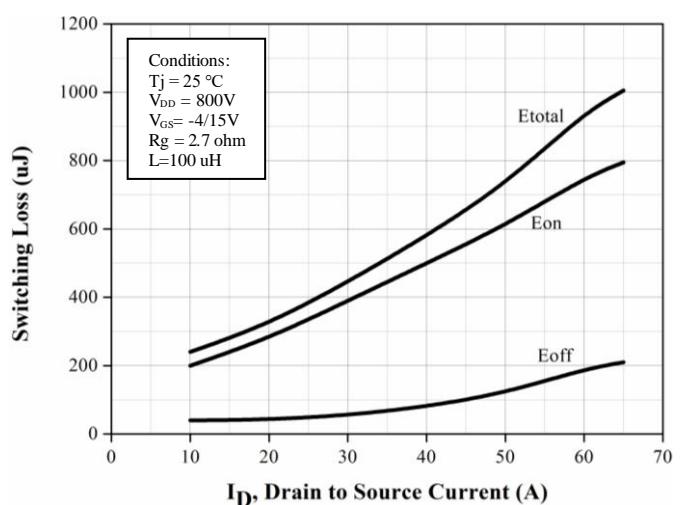
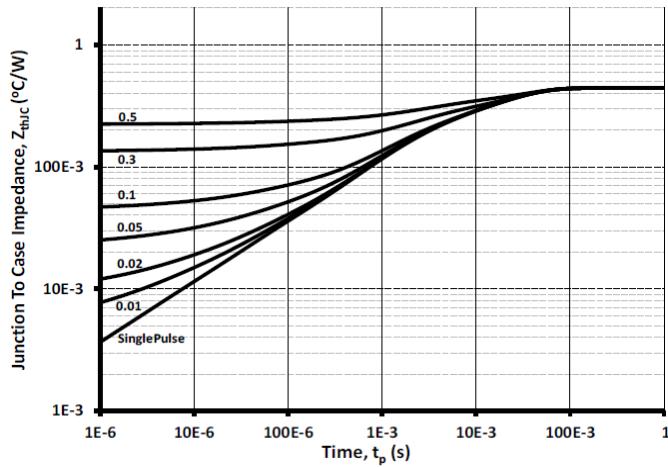
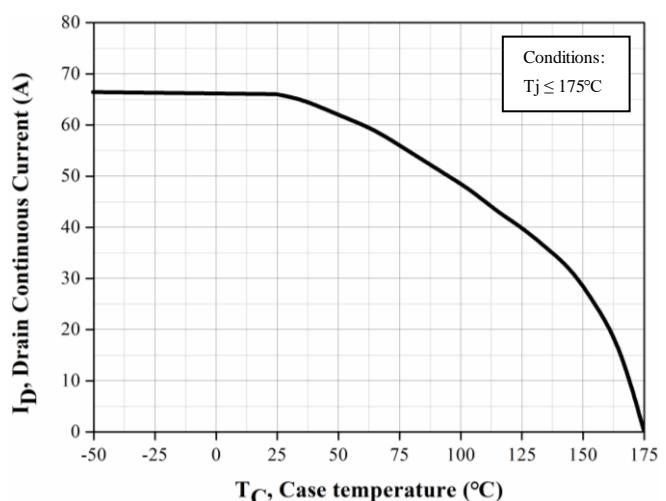
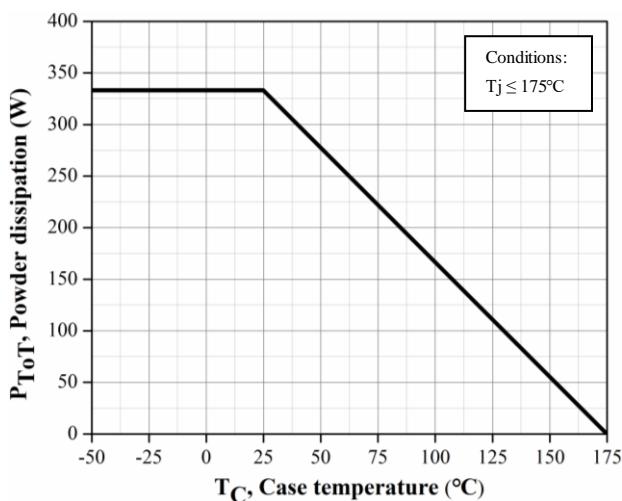
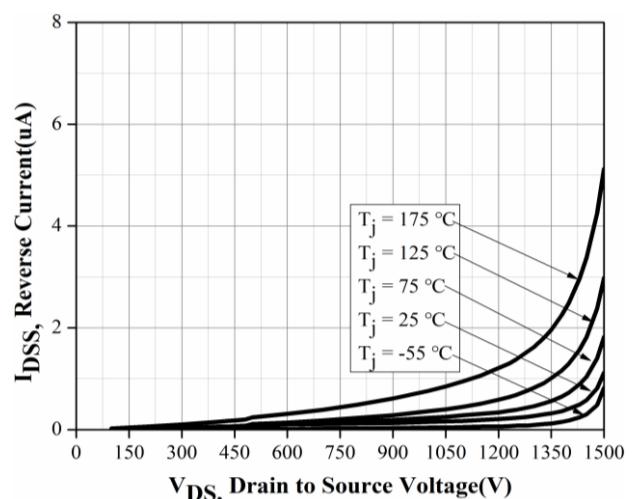
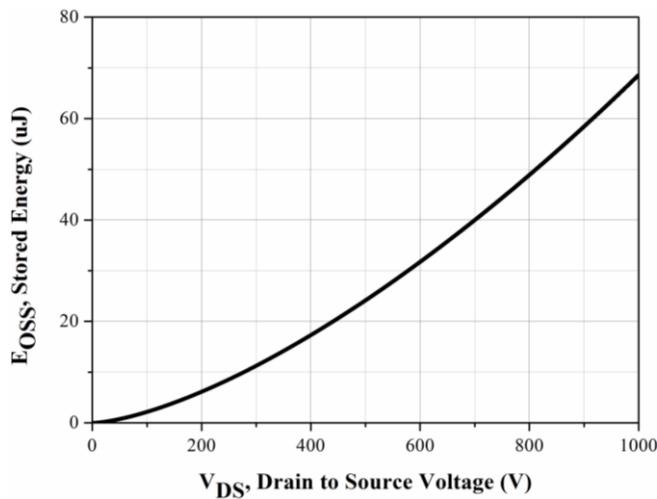


Figure 14. Capacitances vs. drain source voltage (0-200V)



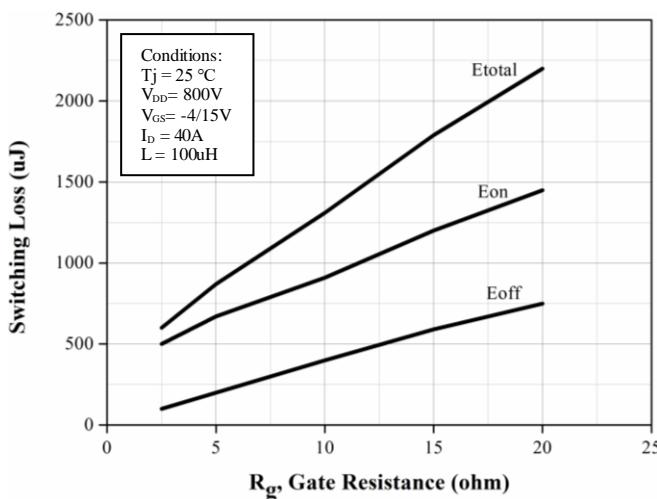


Figure 21. Clamped inductive switching energy vs. R_g

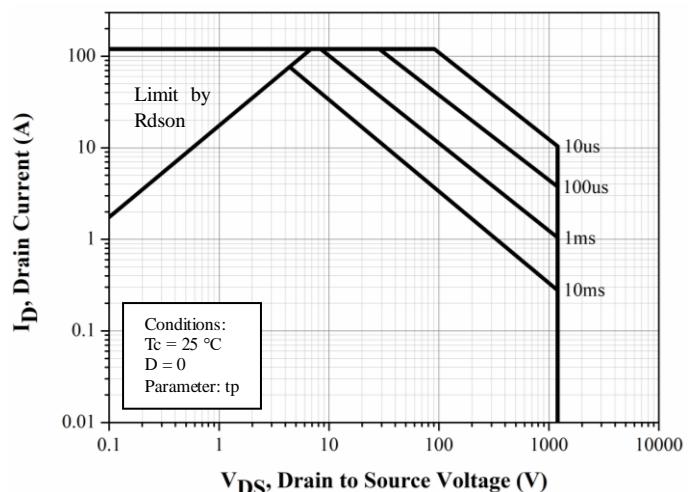


Figure 22. Safe Operating Area

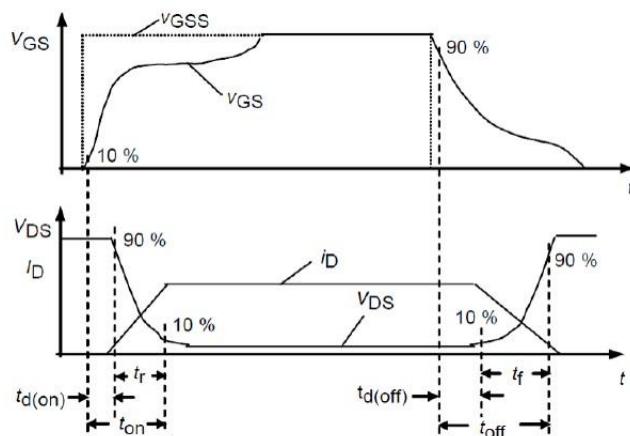


Figure 23. Switching Times Definition

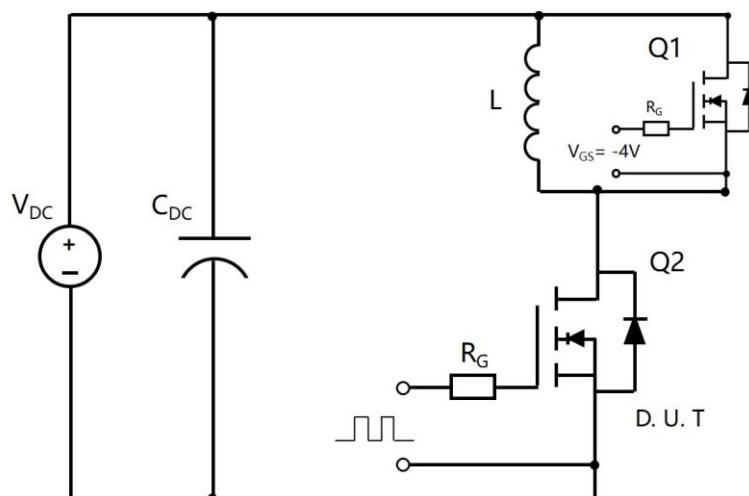
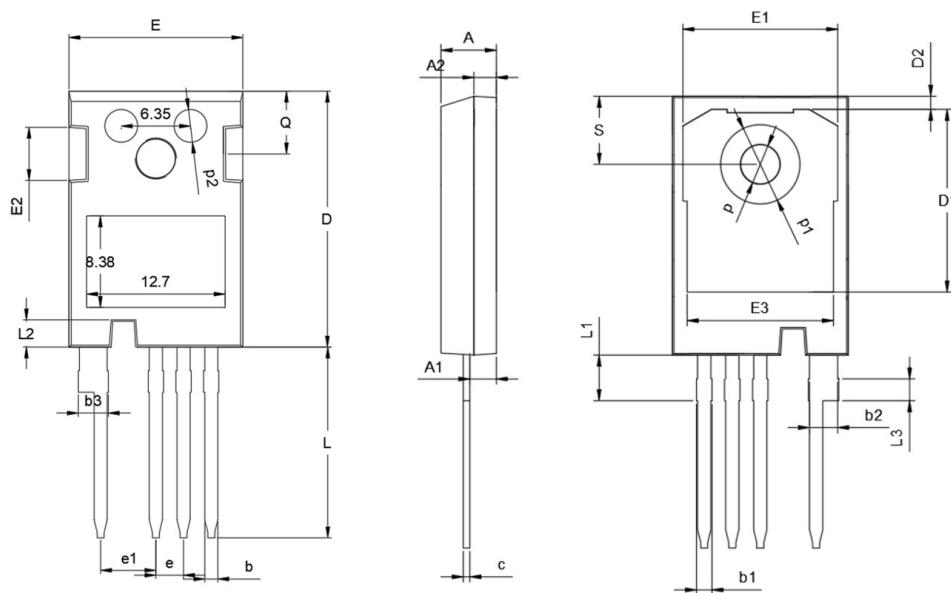


Figure 24. Clamped Inductive Switching Waveform Test Circuit

■Outline Dimensions



TO247-4L			
Dim	Min	Norm	Max
A	4.80	5.00	5.20
A1	2.30	2.40	2.50
A2	1.88	1.98	2.08
b	1.10	1.20	1.30
b1	1.20	/	1.50
b2	2.35	2.55	2.75
b3	2.45	/	2.85
c	0.55	0.60	0.65
D	23.3	23.45	23.6
D1	16.25	16.55	16.85
D2	1.00	/	1.30
e	TYP2.54		
e1	TYP5.06		
E	15.75	15.90	16.05
E1	13.80	/	14.20
E2	4.40	4.75	5.10
E3	13.00	/	13.45
L	17.34	17.49	17.64
L1	4.00	/	4.30
L2	2.35	/	2.65
L3	TYP1.98		
Q	5.60	5.80	6.00
S	6.05	/	6.30
p	TYP3.58		
p1	TYP7.18		
p2	TYP3.00		



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