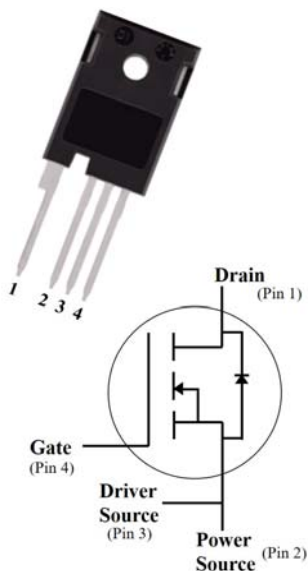


Silicon Carbide Power MOSFET (N-Channel Enhancement)

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

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 ($T_c=25^\circ\text{C}$ Unless otherwise specified)

PARAMETER	SYMBOL	UNIT	VALUE	TEST CONDITIONS	NOTE
Device marking code			D212040NCFG2		
Drain source voltage @ $T_j=25^\circ\text{C}$	$V_{DS,max}$	V	1200	$V_{GS}=0\text{ V}, I_D=100\mu\text{A}$	
Gate source voltage @ $T_j=25^\circ\text{C}$	$V_{GS,max}$	V	-8/+19	Absolute maximum values	
Gate source voltage @ $T_j=25^\circ\text{C}$	$V_{GS,op}$	V	-4/+15	Recommended operational values	Note1、2
Continuous drain current @ $T_c=25^\circ\text{C}$	I_D	A	66	$V_{GS}=15\text{V}, T_c=25^\circ\text{C}$	Fig.18
Continuous drain current @ $T_c=100^\circ\text{C}$			48	$V_{GS}=15\text{V}, T_c=100^\circ\text{C}$	
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	$V_{DD}=75\text{V}, L=10\text{mH}$	
Power Dissipation	P_{TOT}	W	333	$T_c=25^\circ\text{C}, T_j = 175^\circ\text{C}$	Fig.17
Power Dissipation			144	$T_c=110^\circ\text{C}, T_j = 175^\circ\text{C}$	
Operating junction and Storage temperature range	T_j, T_{stg}	$^\circ\text{C}$	-55 to +175		
Soldering temperature	T_L	$^\circ\text{C}$	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)

PARAMTETER	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		$V_{DS}=V_{GS}$, $I_D=11.5mA$, $T_J=175^{\circ}C$	
Drain source breakdown voltage	$V_{(BR)DSS}$	V	1200			$V_{GS}=0$, $I_D=100\mu A$	
Zero gate voltage drain current	I_{DSS}	μA		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	$R_{DS(on)}$	m Ω		33	44	$V_{GS}=15V$, $I_D=40A$	Fig.5, 6, 7
				63		$V_{GS}=15V$, $I_D=40A$, $T_J=175^{\circ}C$	
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		$V_{GS}=0V$, $I_{SD}=20A$ $T_J=175^{\circ}C$	Fig.9
Transconductance	g_f	S		26		$V_{DS}=20V$, $I_D=40A$	Fig.4
				22		$V_{DS}=20V$, $I_D=40A$, $T_J=175^{\circ}C$	

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

PARAMTETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Input capacitance	C_{iss}	pF		3456		$V_{DS}=1000V$, $V_{GS}=0V$, $T_J=25^{\circ}C$, $f=100kHz$, $V_{AC}=25mV$	Fig.13, 14
Output capacitance	C_{oss}			127			
Reverse capacitance	C_{rss}			7.2			
Coss stored energy	E_{oss}	μJ		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)

PARAMTETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Turn on switching energy	E_{on}	μJ		500		$V_{DD}=800V$, $V_{GS}=-4/+15V$, $I_D=40A$, $R_g=2.7\Omega$, $L=100\mu H$	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)

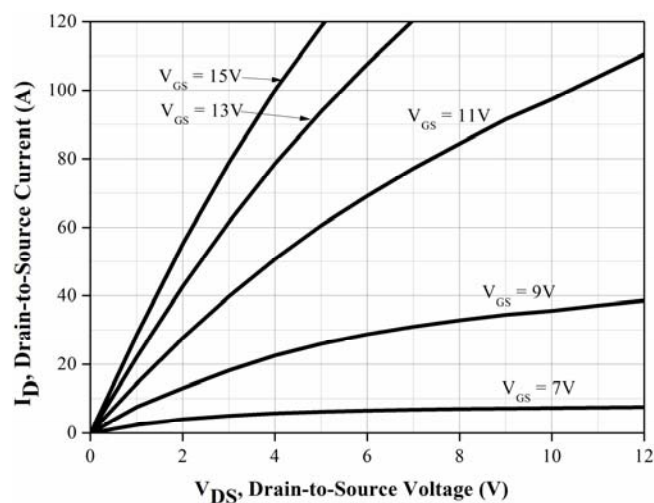
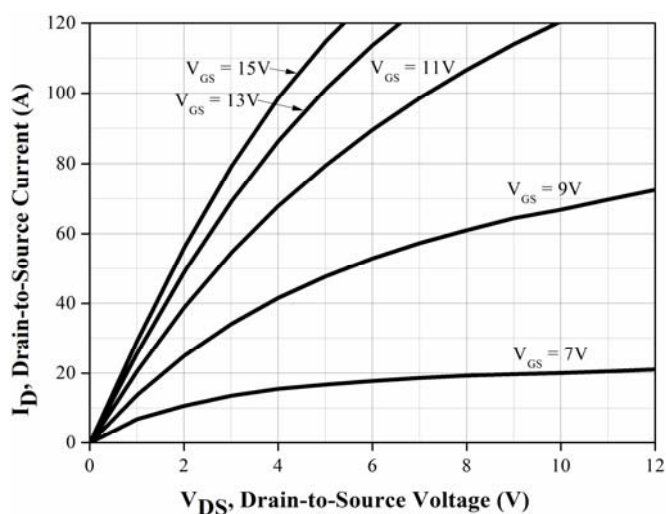
PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Diode forward voltage	V_{SD}	V		5.0		$V_{GS}=-4V$, $I_{SD}=20A$	Fig.8
				3.3		$V_{GS}=0V$, $I_{SD}=20A$, $T_J=175^\circ C$	Fig.9
Continuous diode forward current	I_S	A		66		$T_c=25^\circ C$	Note1
Reverse recovery time	t_{rr}	nS		27		$V_R=800V$, $V_{GS}=-4V$, $I_D=40A$, $di/dt=2250A/\mu S$	
Reverse recovery charge	Q_{rr}	nC		478			
Peak reverse recovery current	I_{rrm}	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 CharacteristicsFigure 1. Output Characteristics $T_J = -55^\circ C$ Figure2. Output Characteristics $T_J = 25^\circ C$

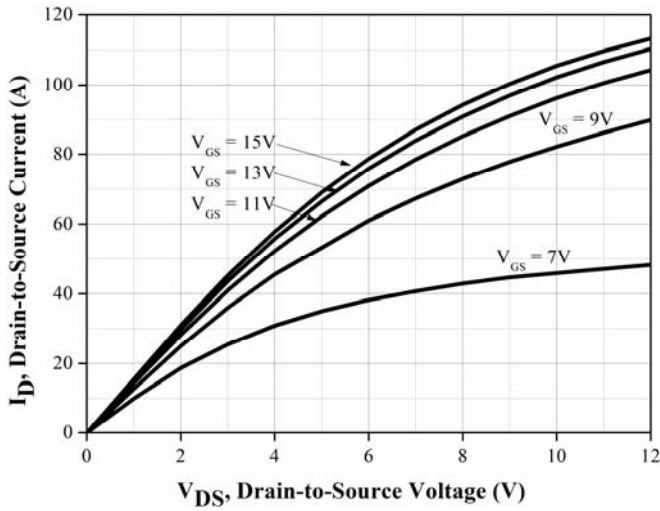


Figure 3. Output Characteristics $T_j = 175^\circ\text{C}$

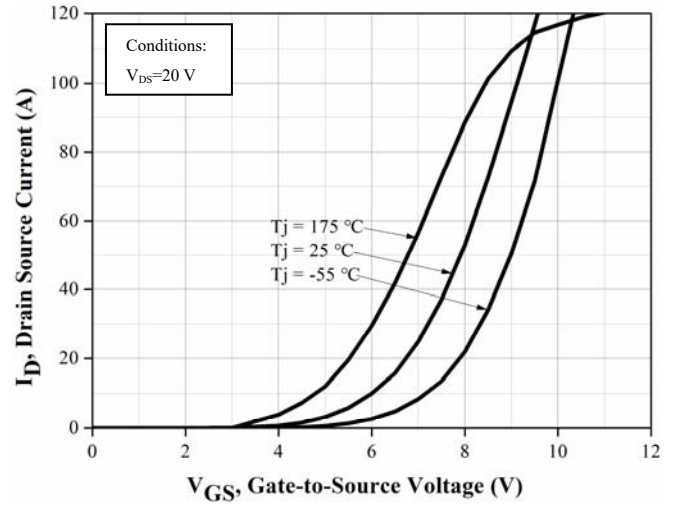


Figure 4. Transfer Characteristics for various junction temperature

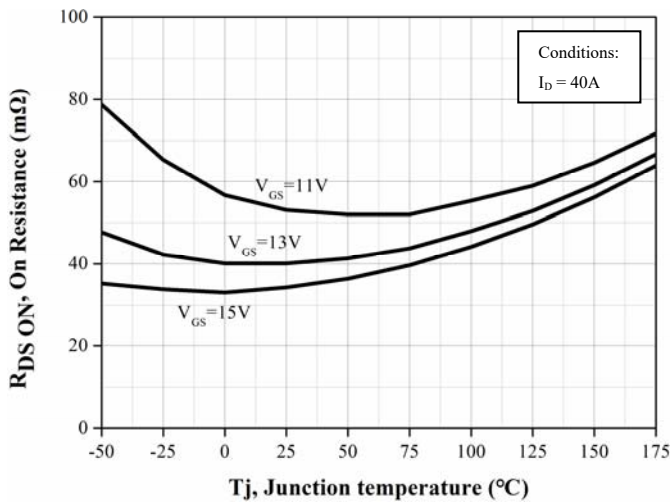


Figure 5. On-resistance vs. temperature for various gate voltage

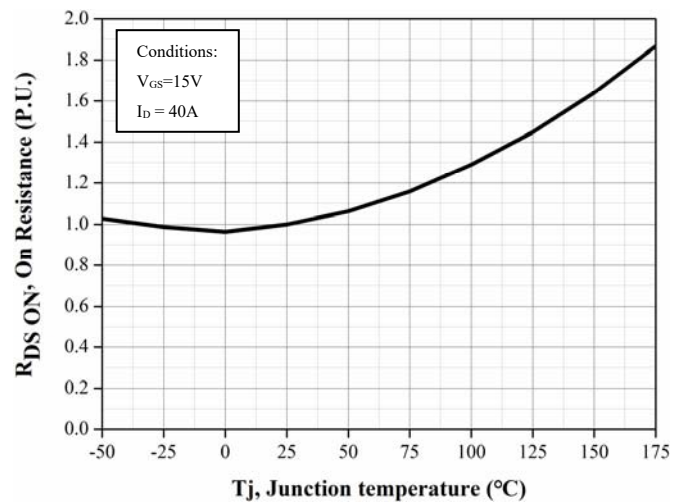


Figure 6. Normalized on-resistance vs. temperature

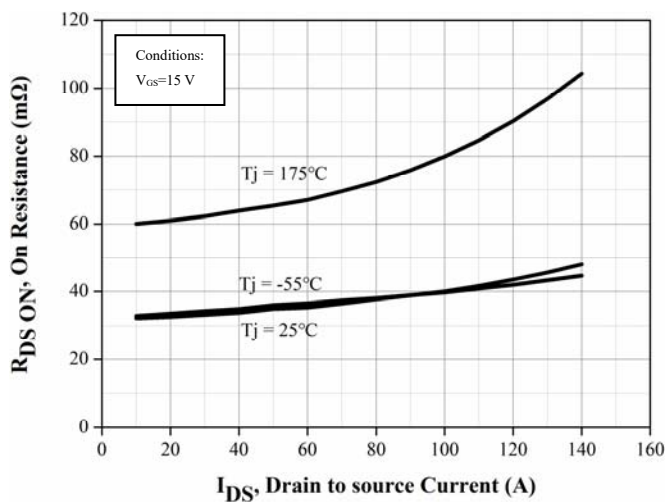


Figure 7. On-resistance vs. drain current

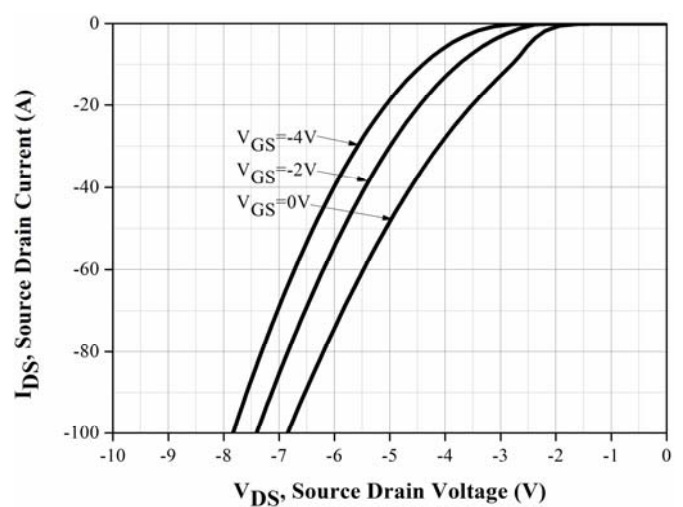


Figure 8. Body diode characteristic at $T_j = 25^\circ\text{C}$

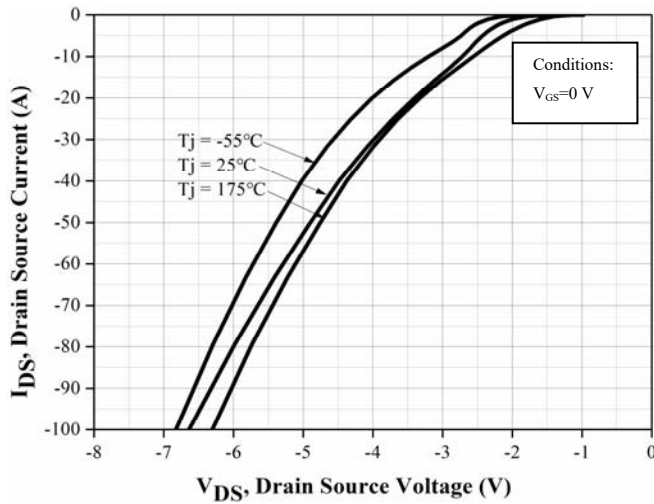


Figure 9. Body diode characteristic

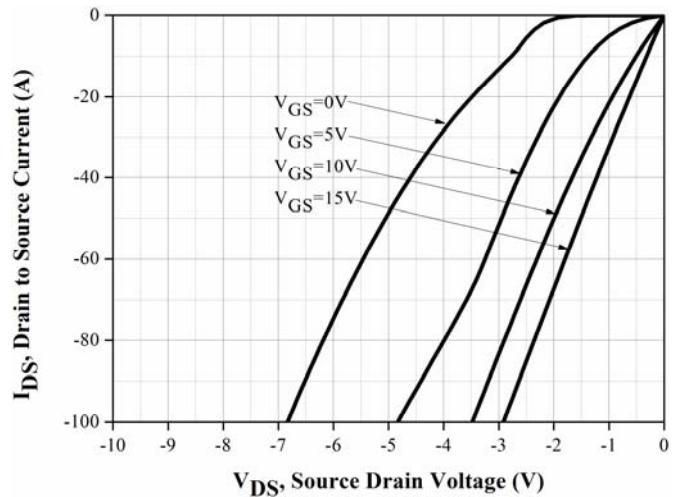


Figure 10. 3rd quadrant characteristic at $T_j = 25\text{ }^{\circ}\text{C}$

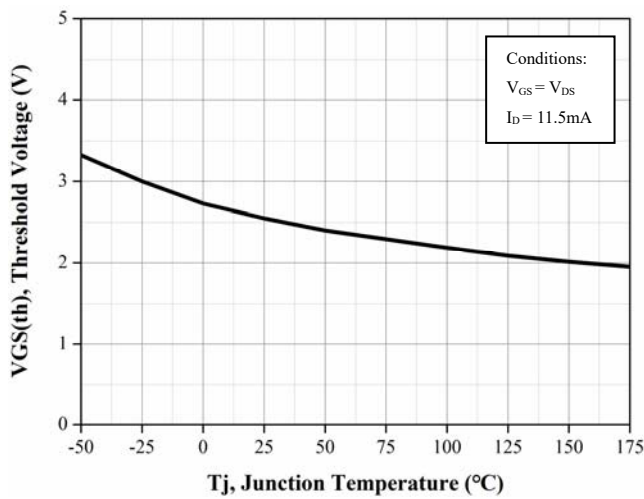


Figure 11. Threshold voltage vs. temperature

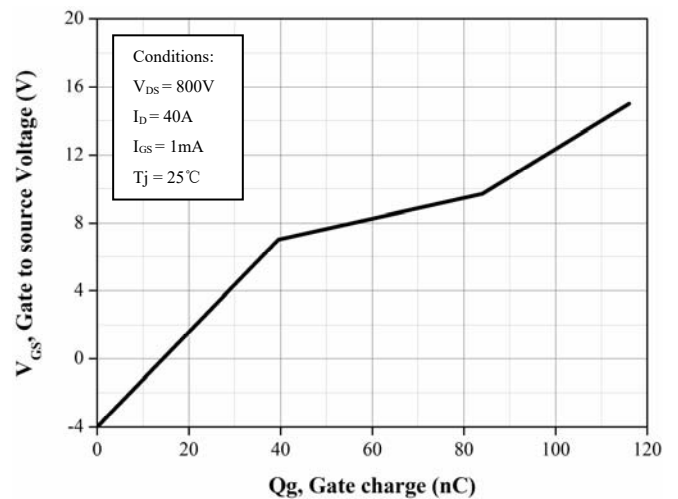


Figure 12. Gate charge characteristic

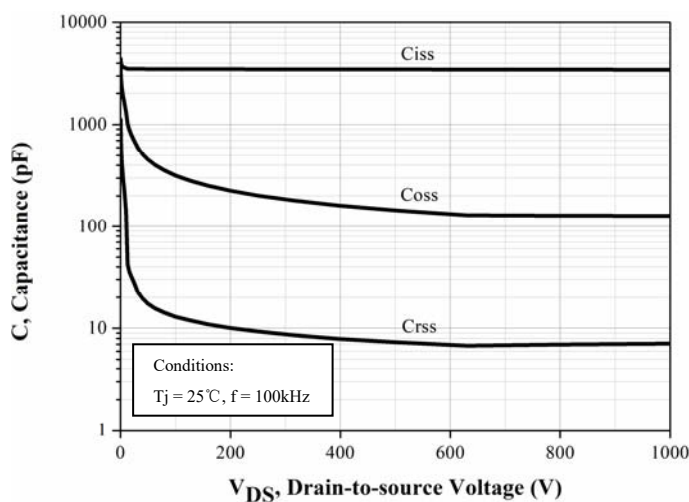


Figure 13. Capacitances vs. drain source voltage (0-1000V)

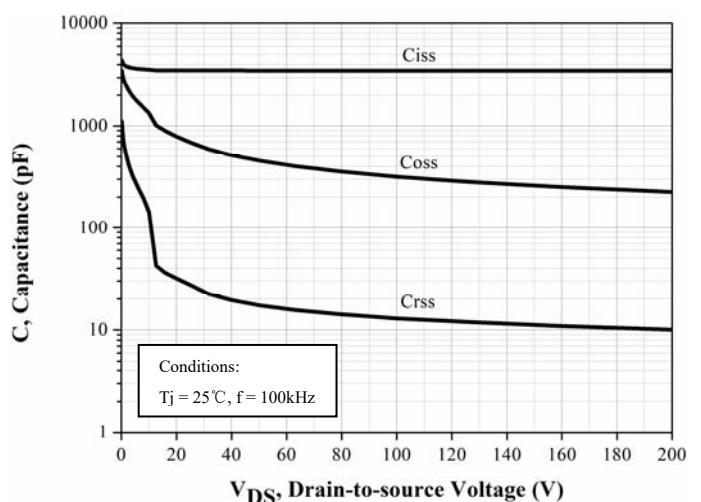


Figure 14. Capacitances vs. drain source voltage (0-200V)

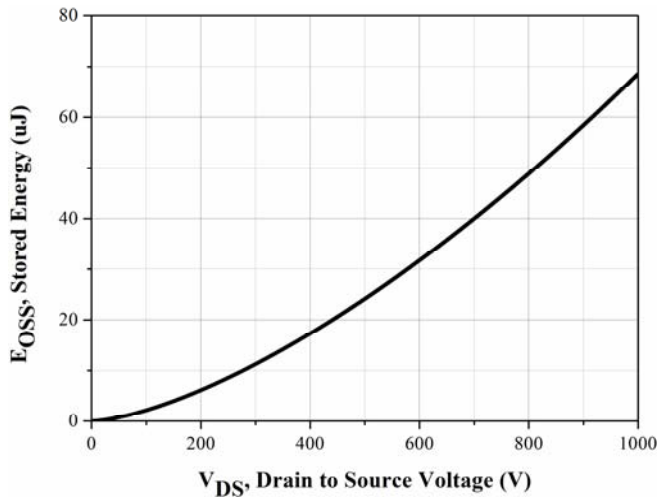


Figure 15. Output capacitor stored energy

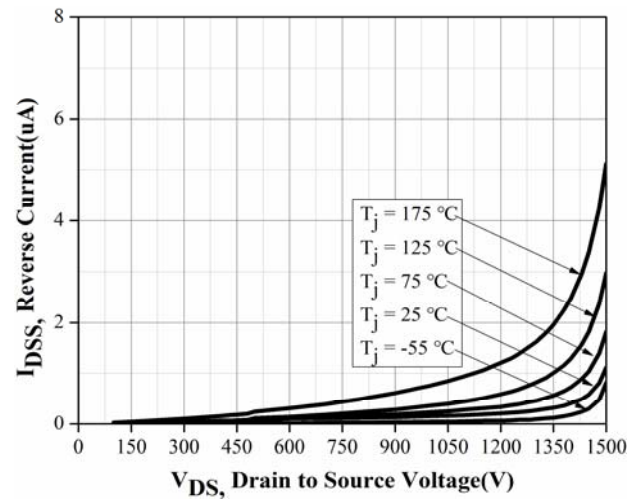


Figure 16. Reverse characteristics vs. T_j

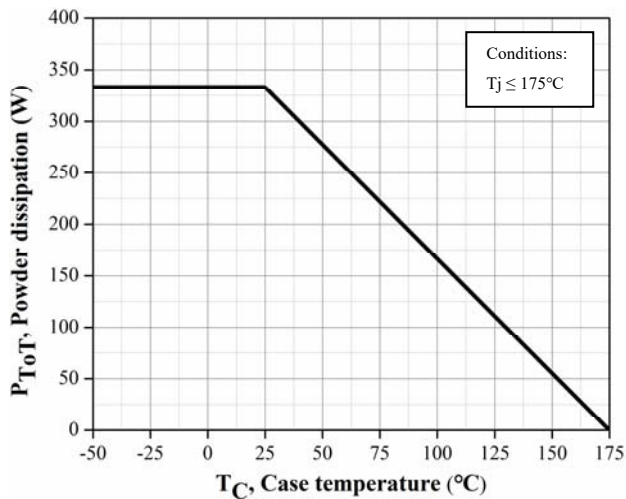


Figure 17. Maximum power dissipation derating vs. case temperature

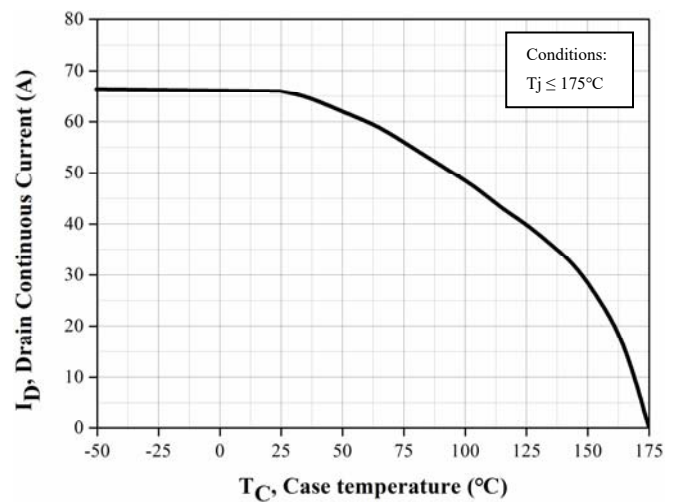


Figure 18. Continuous drain current derating vs. case temperature

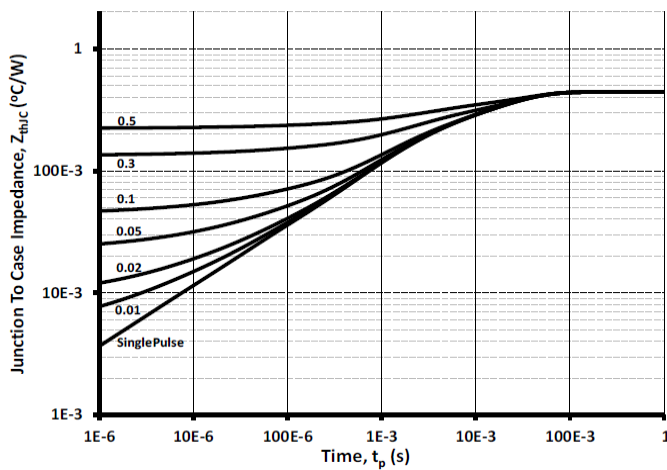


Figure 19. Transient thermal impedance (junction - case)

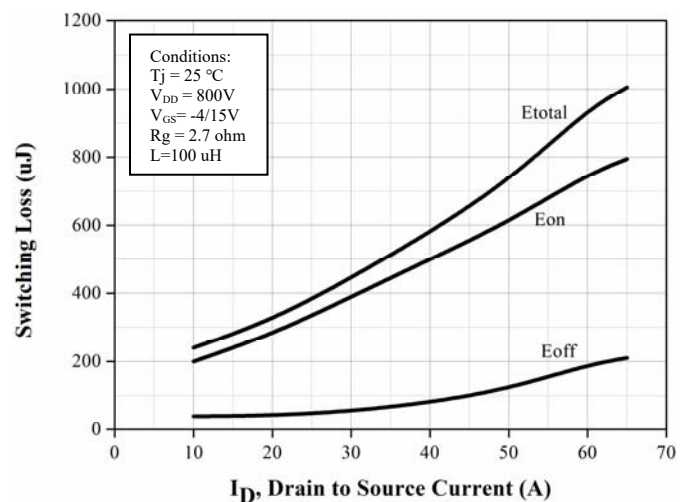


Figure 20. Clamped Inductive switching energy vs. drain current

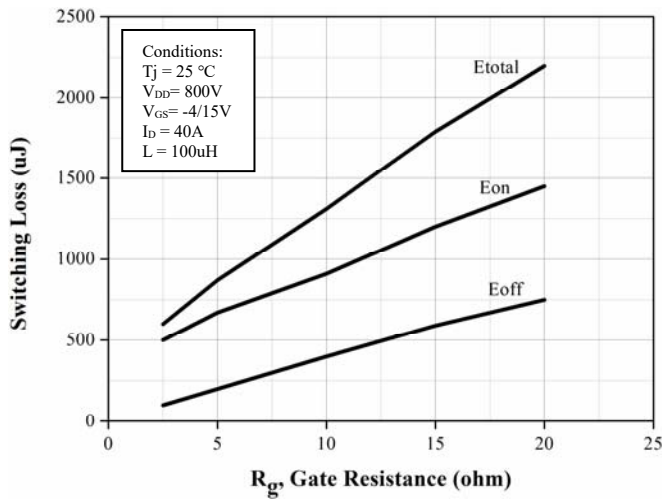


Figure 21. Clamped inductive switching energy vs. R_g

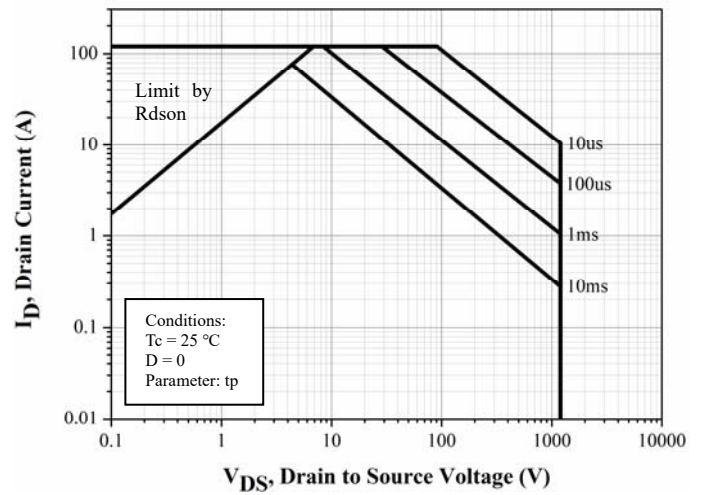


Figure 22. Safe Operating Area

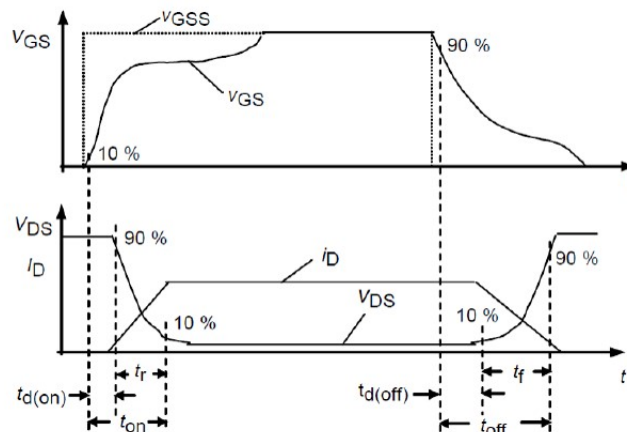


Figure 23. Switching Times Definition

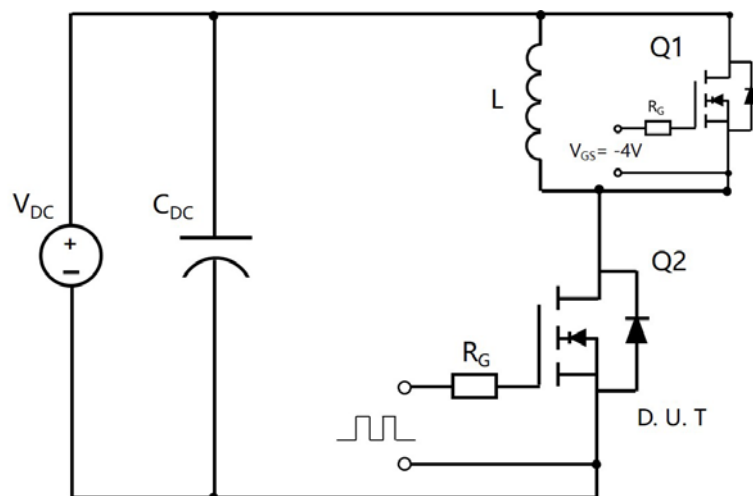
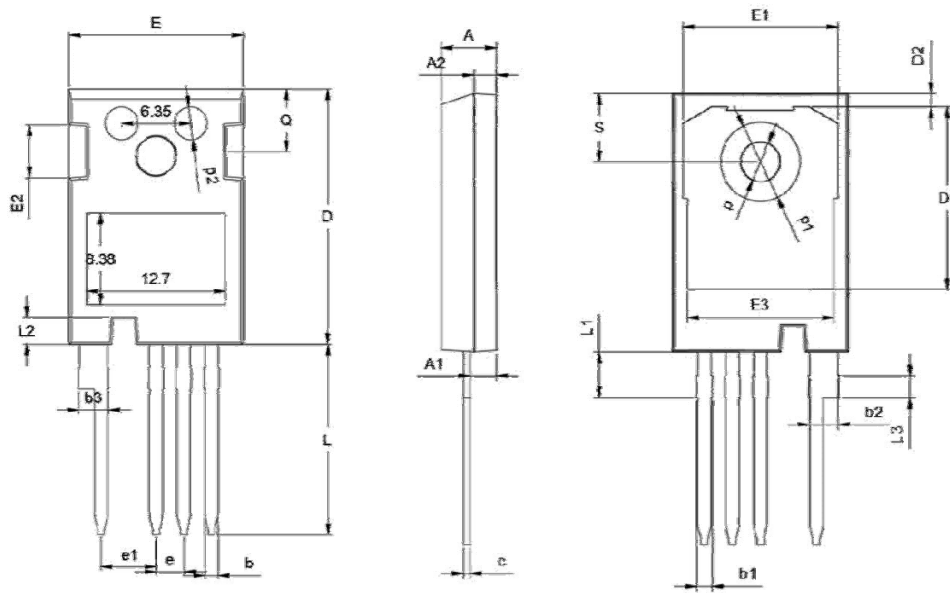


Figure 24. Clamped Inductive Switching Waveform Test Circuit

■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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