Product Summary

V_{DS} = 650 V
I_D@25ºC = 28A
$R_{DS(ON)}$ = 118mΩ
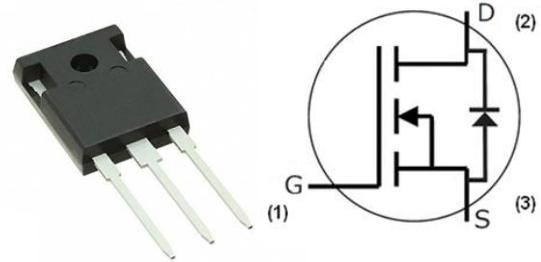
TO-247-3

Features

- High Blocking Voltage
- High Frequency Operation
- Low on-resistance
- Fast intrinsic diode with low reverse recovery

Applications

- Motor Drives
- Solar Inverters
- Onboard EV Charger
- Energy Storage

Benefits

- Higher System Efficiency
- Parallel Device Convenience without thermal runaway
- High Temperature Application
- Hard Switching & Higher Reliability
- Easy to drive

- Server
- Telecom
- SMPS
- Uninterruptable power supplies

Maximum Ratings (T_C=25°C unless otherwise specified)

Parameter	Symbol	Test conditions	Value	Unit
Drain - Source Voltage	V_{DSmax}	V_{GS}=0V, I_D=100µA	650	V
Gate - Source Voltage (dynamic)	V_{GSmax}	AC (f>1 Hz)	-10 / +25	V
Gate - Source Voltage (static)	V_{GSop}	static	-5 / +20	V
Continuous Drain Current	I_D	V_{GS} = 20V, T_C=25°C V_{GS} = 20V, T_C=100°C	28 19	A
Pulsed Drain Current	$I_{D(pulse)}$	T_C=25°C	49	A
Short Circuit Capability	t_{SC}	V_{DD}=400V, V_{GS}=20V	10	µS
Short Circuit Capability	I_{DS}	V_{DD}=400V, V_{GS}=20V	130	A
Total power dissipation	P_D	T_C=25°C	135	W
Operating Junction Temperature	T_J		-55 to 175	°C
Storage Temperature	T_{STG}		-55 to 175	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Electrical Characteristics (T_C=25°C unless otherwise specified)

Parameter	Symbol	Test conditions	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 100μA	650			V
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 2.5mA	2	3	4.0	V
		V_{DS} = V_{GS}, I_D = 2.5mA, T_J = 150°C		2.2		V
		V_{DS} = V_{GS}, I_D = 2.5mA, T_J = 175°C		2.1		V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 650V, V_{GS} = 0V	0	1	100	μA
Gate-Source Leakage Current	I_{GSS}	V_{GS} = 20V, V_{DS} = 0V	0	10	200	nA
Gate-Source Leakage Current	I_{GSS}	V_{GS} = -5V, V_{DS} = 0V	-200	-10	0	nA
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 20V, I_D = 10 A		118	150	mΩ
		V_{GS} = 20V, I_D = 10 A, T_J = 150°C		132		
		V_{GS} = 20V, I_D = 10 A, T_J = 175°C		142		
Transconductance	g_{fs}	V_{DS} = 20V, I_D = 10 A,		5.0		S
		V_{DS} = 20V, I_D = 10 A, T_J = 150°C		4.9		
		V_{DS} = 20V, I_D = 10 A, T_J = 175°C		4.8		
Input capacitance	C_{iss}	V_{DS} = 400V, V_{GS} = 0V f = 1MHz		670		pF
Output capacitance	C_{oss}			77		
Reverse transfer capacitance	C_{rss}			7.5		
C_{oss} Stored Energy	E_{oss}			7.2		μJ
Total gate charge	Q_g	V_{DS} = 400V, V_{GS} = -5V / 20V I_D = 10 A,		37		nC
Gate-source charge	Q_{gs}			10		
Gate-drain charge	Q_{gd}			19		
Internal gate input resistance	$R_{g(int)}$	f = 1MHz, I_D = 0A		2.6		Ω
Turn-On Switching Energy	E_{ON}	V_{DS} = 400 V, V_{GS} = -5V/20V, I_D = 10A, $R_{G(ext)}$ = 4Ω, L=200μH		40		μJ
Turn-Off Switching Energy	E_{OFF}			6		
Turn-On Delay Time	$t_{d(on)}$			8		ns
Rise Time	t_r			13		
Turn-Off Delay Time	$t_{d(off)}$			16		
Fall Time	t_f			7		
Avalanche Capability	E_{AS}	V_{DD} = 100V, V_{GS}=20V, L=1mH		60		mJ
Avalanche Capability	I_{AV}			11		A

Reverse Diode Characteristics (T_C=25°C unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Diode Forward Voltage	V_{SD}	V_{GS} = -5V, I_{SD} = 5A,		4.0		V
		V_{GS} = -5V, I_{SD} = 7.5A, T_J = 150°C		3.6		
		V_{GS} = -5V, I_{SD} = 7.5A, T_J = 175°C		3.5		
Continuous Diode Forward Current	I_S	V_{GS} = -5V		22		A
Reverse Recovery time	t_{rr}	V_{GS} = -5V, I_{SD} = 10A, V_R= 400V, dif/dt = 1300 A/μs		16		ns
Reverse Recovery Charge	Q_{rr}			78		nC
Peak Reverse Recovery Current	I_{rrm}			9		A

Thermal Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Thermal Resistance (per device)	$R_{th(j-c)}$	junction-case		0.9	1.1	^{0}C/W

Typical Performance
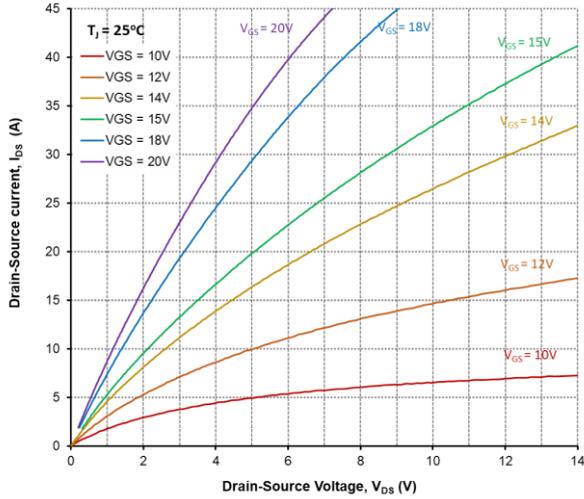
Figure 1. Output Characteristics, T$_J$ = 25°C
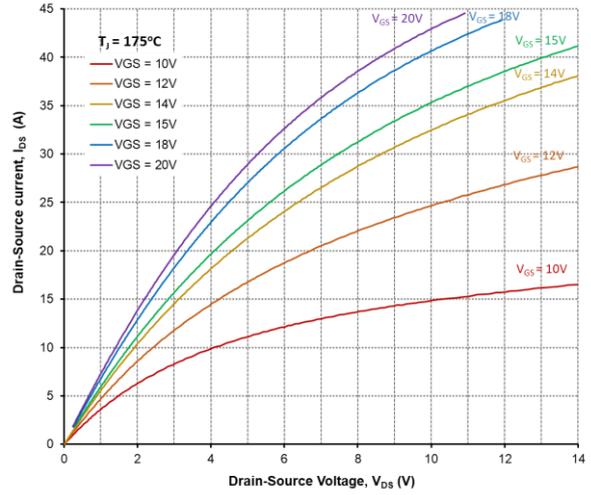
Figure 2. Output Characteristics, T$_J$ = 175°C
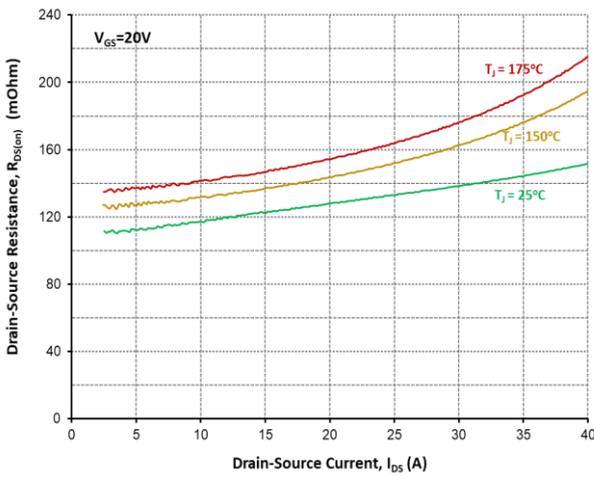
Figure 3. On-Resistance vs. Drain Current
For Various Temperatures
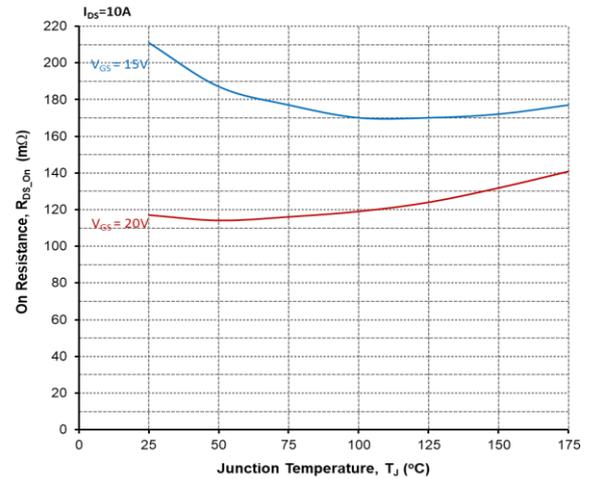
Figure 4. On-Resistance vs. Temperature
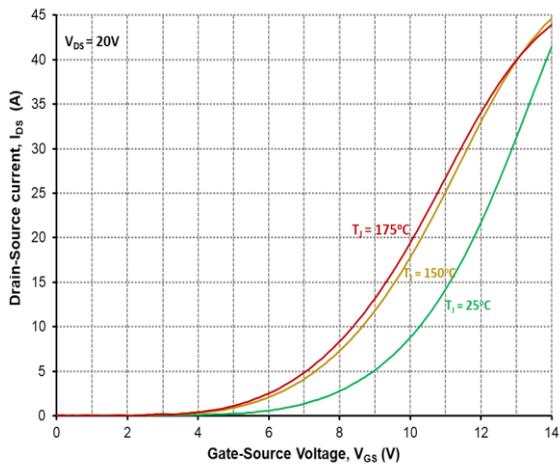
Figure 5. Transfer Characteristic For Various Junction
Temperatures
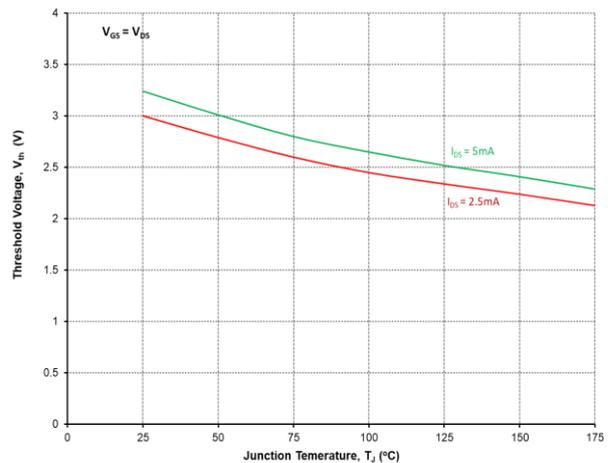
Figure 6. Threshold Voltage vs. Temperature

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Typical Performance

Figure 7. Gate Charge Characteristics
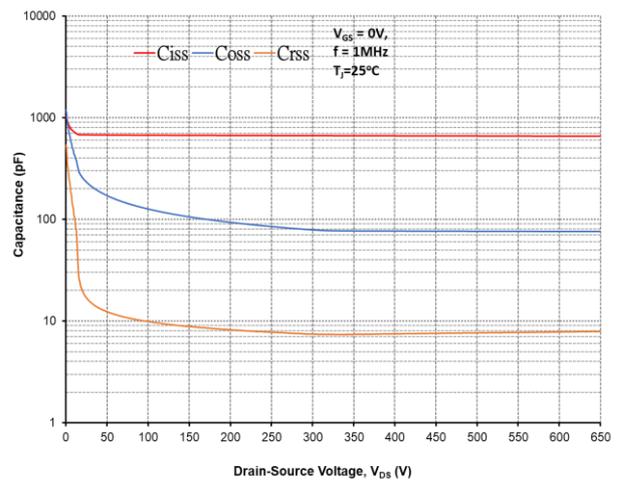
Figure 8. Capacitances vs. Drain-Source Voltage (0-650V)
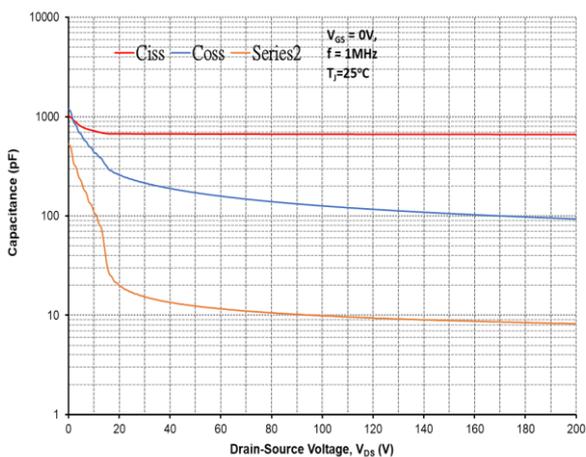
Figure 9. Capacitances vs. Drain-Source Voltage (0-200V)
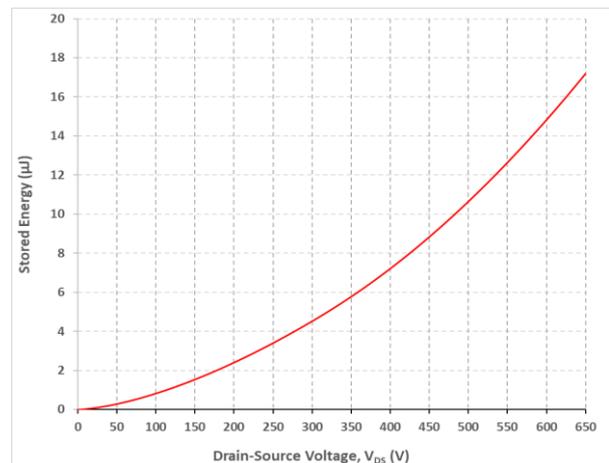
Figure 10. Output Capacitor Stored Energy
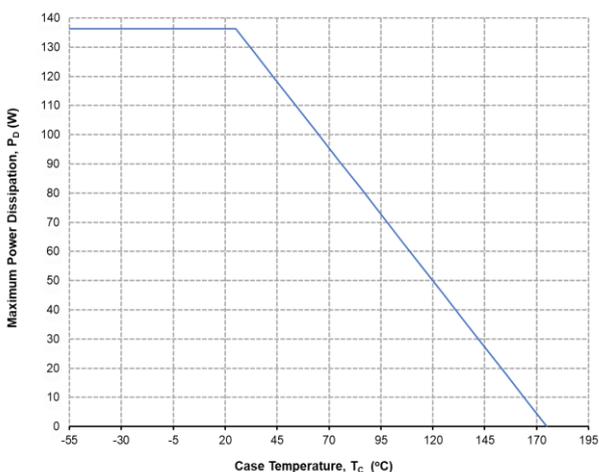
Figure 11. Maximum Power Dissipation Derating vs. Case Temperature
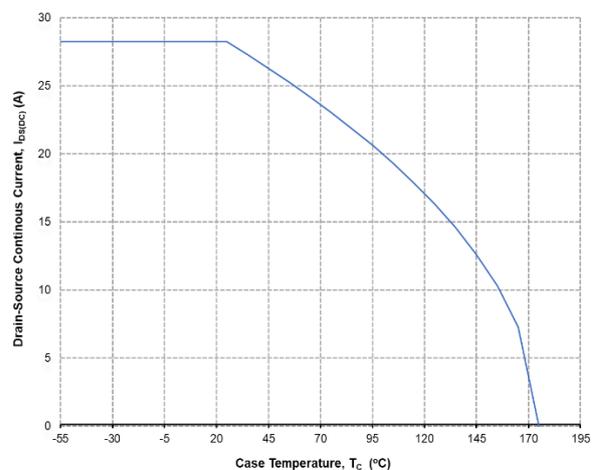
Figure 12. Continuous Drain Current Derating vs. Case Temperature

Typical Performance
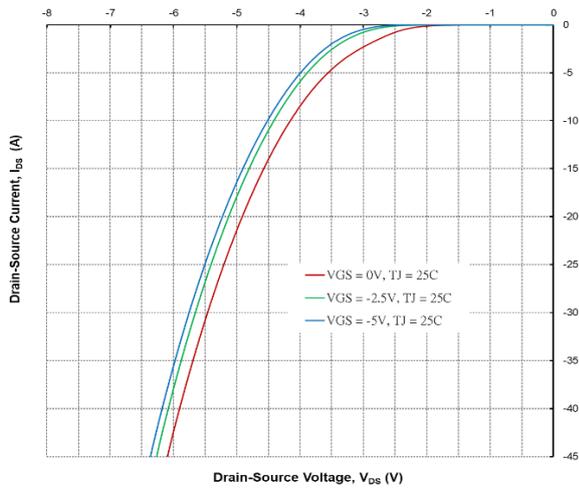
Figure 13. Body Diode Characteristics @ 25°C
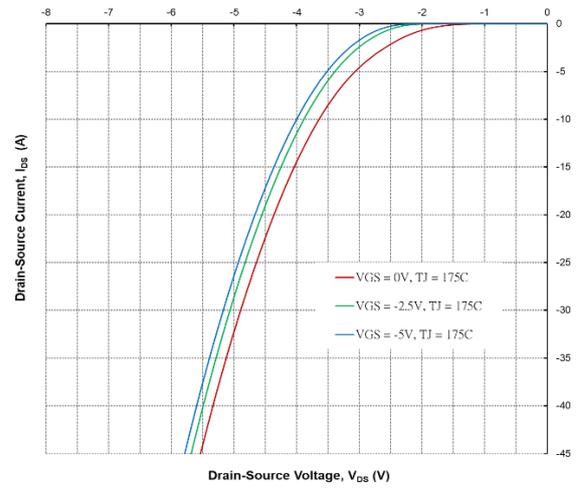
Figure 14. Body Diode Characteristics @ 175°C
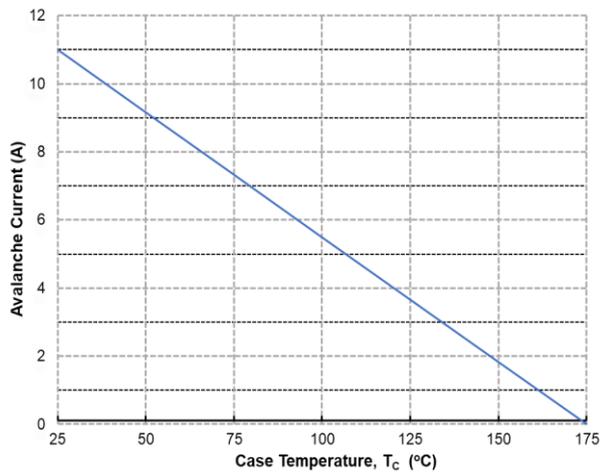

Figure 15. Single Avalanche vs. Temperature
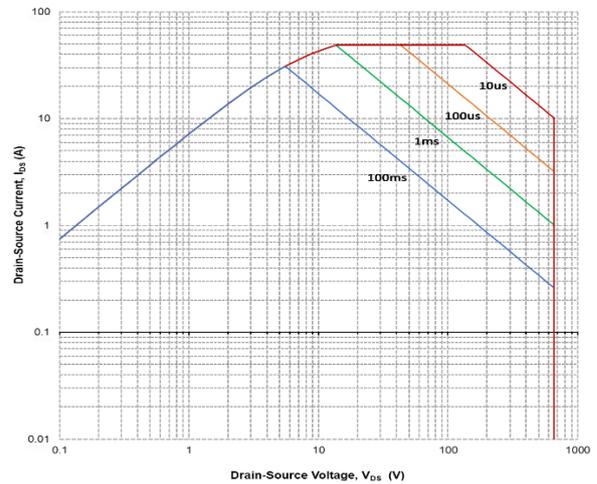
Figure 16. Safe Operating Area

Switching Times Definition and Test Circuit
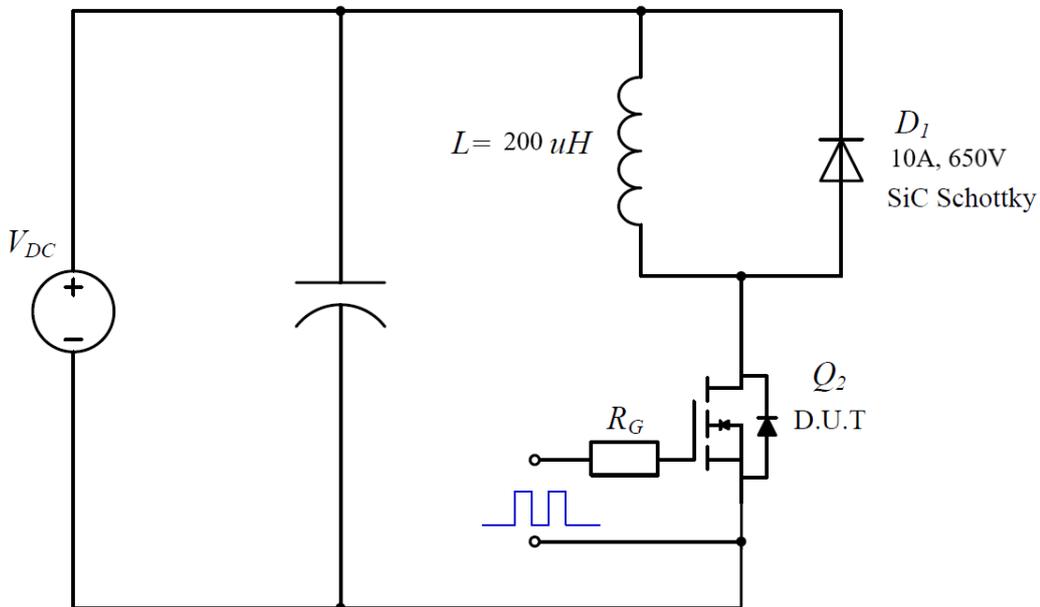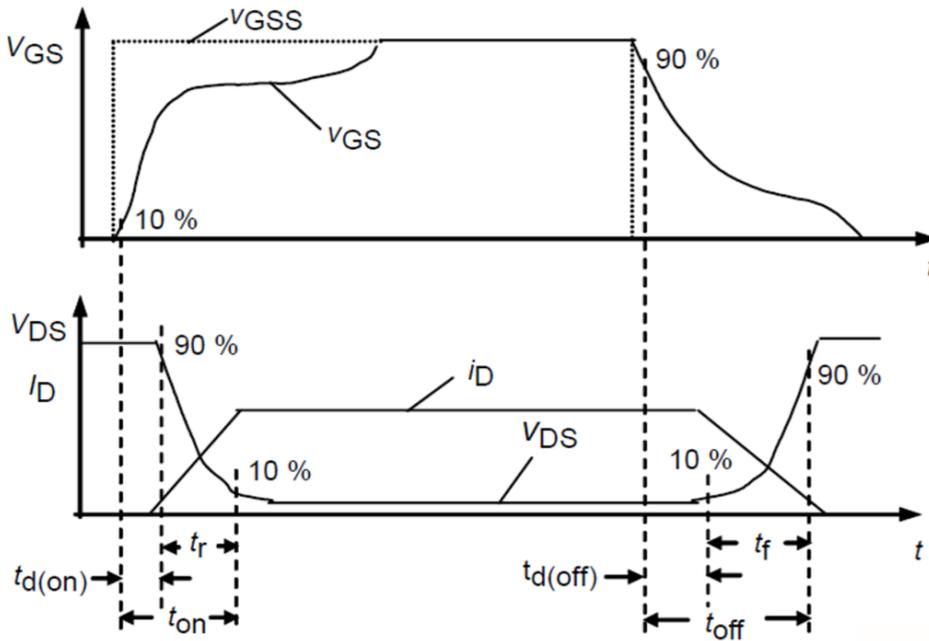
Package Dimensions

(TO-247-3 Package)
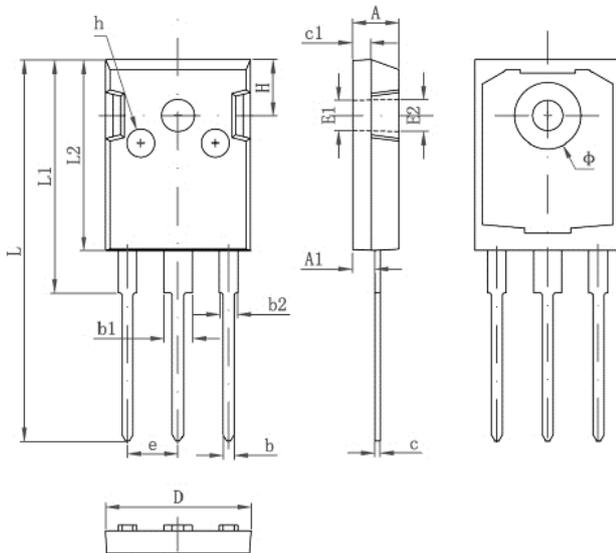
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.850	5.150	0.191	0.200
A1	2.200	2.600	0.087	0.102
b	1.000	1.400	0.039	0.055
b1	2.800	3.200	0.110	0.126
b2	1.800	2.200	0.071	0.087
c	0.500	0.700	0.020	0.028
c1	1.900	2.100	0.075	0.083
D	15.450	15.750	0.608	0.620
E1	3.500 REF		0.138 REF	
E2	3.600 REF		0.142 REF	
L	40.900	41.300	1.610	1.626
L1	24.800	25.100	0.976	0.988
L2	20.300	20.600	0.799	0.811
Φ	7.100	7.300	0.280	0.287
e	5.450 TYP		0.215 TYP	
H	5.980 REF		0.235 REF	
h	0.000	0.300	0.000	0.012