
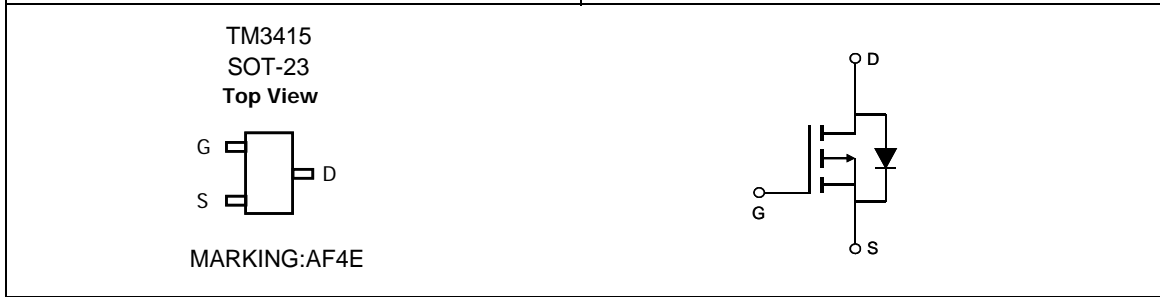


TM3415

P-CHANNEL ENHANCEMENT MOSFET

<p>General Description</p> <p>The TM3415 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 1.8V. This device is suitable for use as a load switch applications.</p>	<p>Product Summary</p> <table style="width: 100%; border: none;"> <tr> <td style="padding: 2px;">V_{DS}</td> <td style="text-align: right; padding: 2px;">-20V</td> </tr> <tr> <td style="padding: 2px;">I_D (at $V_{GS}=-4.5V$)</td> <td style="text-align: right; padding: 2px;">-4A</td> </tr> <tr> <td style="padding: 2px;">$R_{DS(ON)}$ (at $V_{GS}= -4.5V$)</td> <td style="text-align: right; padding: 2px;">< 41mΩ</td> </tr> <tr> <td style="padding: 2px;">$R_{DS(ON)}$ (at $V_{GS}= -2.5V$)</td> <td style="text-align: right; padding: 2px;">< 53mΩ</td> </tr> <tr> <td style="padding: 2px;">$R_{DS(ON)}$ (at $V_{GS}= -1.8V$)</td> <td style="text-align: right; padding: 2px;">< 65mΩ</td> </tr> </table> <p style="margin-top: 10px;">100% UIS Tested 100% R_g Tested</p> <div style="text-align: right; margin-top: 10px;">  </div>	V_{DS}	-20V	I_D (at $V_{GS}=-4.5V$)	-4A	$R_{DS(ON)}$ (at $V_{GS}= -4.5V$)	< 41m Ω	$R_{DS(ON)}$ (at $V_{GS}= -2.5V$)	< 53m Ω	$R_{DS(ON)}$ (at $V_{GS}= -1.8V$)	< 65m Ω
V_{DS}	-20V										
I_D (at $V_{GS}=-4.5V$)	-4A										
$R_{DS(ON)}$ (at $V_{GS}= -4.5V$)	< 41m Ω										
$R_{DS(ON)}$ (at $V_{GS}= -2.5V$)	< 53m Ω										
$R_{DS(ON)}$ (at $V_{GS}= -1.8V$)	< 65m Ω										



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum	Units
	V_{DS}	-20	V
Gate-Source Voltage	V_{GS}	± 8	V
Continuous Drain Current	I_D	$T_A=25^\circ\text{C}$	-4
		$T_A=70^\circ\text{C}$	-3.5
Pulsed Drain Current ^C	I_{DM}	-30	A
Power Dissipation ^B	P_D	$T_A=25^\circ\text{C}$	1.5
		$T_A=70^\circ\text{C}$	1
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	65	80	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^{A, D}		85	100	$^\circ\text{C/W}$
Maximum Junction-to-Lead	$R_{\theta JL}$	43	52	$^\circ\text{C/W}$

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV _{DSS}	Drain-Source Breakdown Voltage	I _D =-250μA, V _{GS} =0V	-20			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-20V, V _{GS} =0V T _J =55°C			-1 -5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} = ±8V			±10	μA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =-250μA	-0.3	-0.57	-0.9	V
I _{D(ON)}	On state drain current	V _{GS} =-4.5V, V _{DS} =-5V	-30			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =-4.5V, I _D =-4A T _J =125°C		34 49	41 59	mΩ
		V _{GS} =-2.5V, I _D =-4A		42	53	
		V _{GS} =-1.8V, I _D =-2A		52	65	
		V _{GS} =-1.5V, I _D =-1A		61		
g _{FS}	Forward Transconductance	V _{DS} =-5V, I _D =-4A		20		S
V _{SD}	Diode Forward Voltage	I _S =-1A, V _{GS} =0V		-0.64	-1	V
I _S	Maximum Body-Diode Continuous Current				-2	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =-10V, f=1MHz	600	751	905	pF
C _{oss}	Output Capacitance		80	115	150	pF
C _{rss}	Reverse Transfer Capacitance		48	80	115	pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz	6	13	20	Ω
SWITCHING PARAMETERS						
Q _g	Total Gate Charge	V _{GS} =-4.5V, V _{DS} =-10V, I _D =-4A	7.4	9.3	11	nC
Q _{gs}	Gate Source Charge		0.8	1	1.2	nC
Q _{gd}	Gate Drain Charge		1.3	2.2	3.1	nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =-4.5V, V _{DS} =-10V, R _L =2.5Ω, R _{GEN} =3Ω		13		ns
t _r	Turn-On Rise Time			9		ns
t _{D(off)}	Turn-Off DelayTime			19		ns
t _f	Turn-Off Fall Time			29		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =-4A, di/dt=500A/μs	20	26	32	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =-4A, di/dt=500A/μs	40	51	62	nC

A. The value of R_{θJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C. The value in any given application depends on the user's specific board design.

B. The power dissipation P_D is based on T_{J(MAX)}=150° C, using ≤ 10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature T_{J(MAX)}=150° C. Ratings are based on low frequency and duty cycles to keep initial T_J=25° C.

D. The R_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} and lead to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, assuming a maximum junction temperature of T_{J(MAX)}=150° C. The SOA curve provides a single pulse rating.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

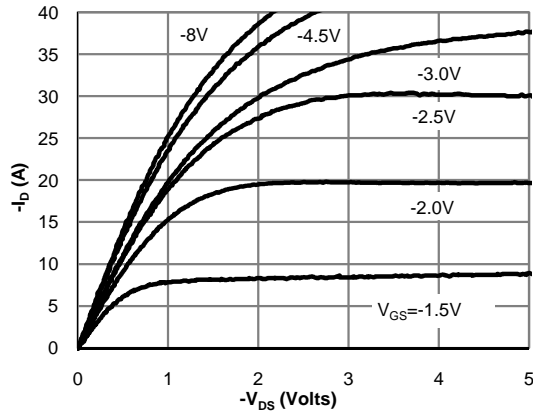


Fig 1: On-Region Characteristics (Note E)

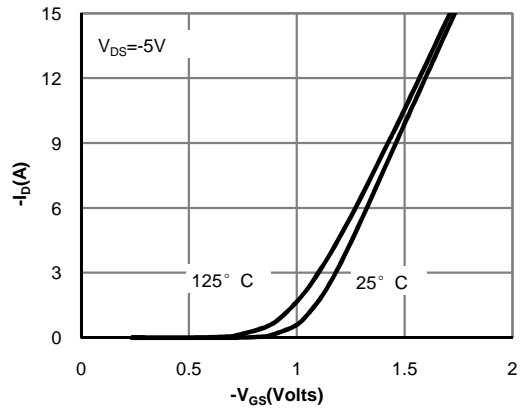


Figure 2: Transfer Characteristics (Note E)

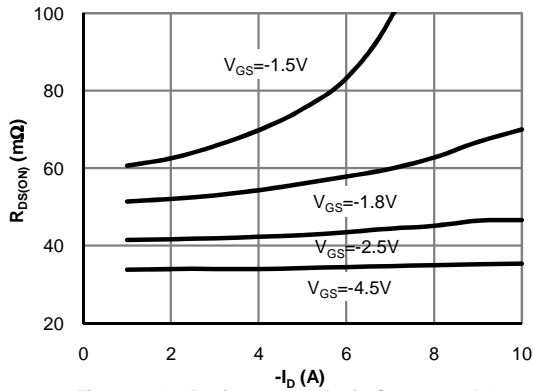


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

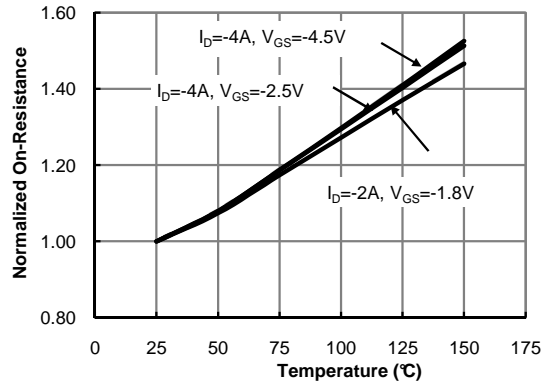


Figure 4: On-Resistance vs. Junction Temperature (Note E)

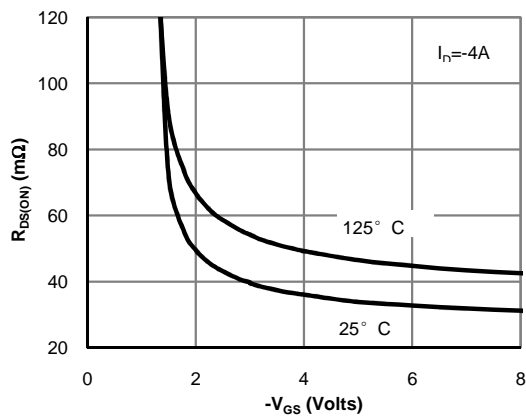


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

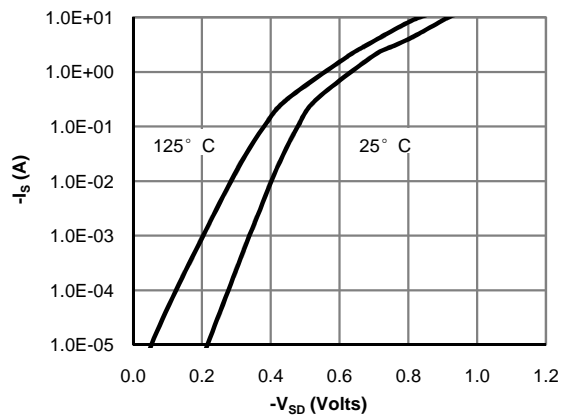


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

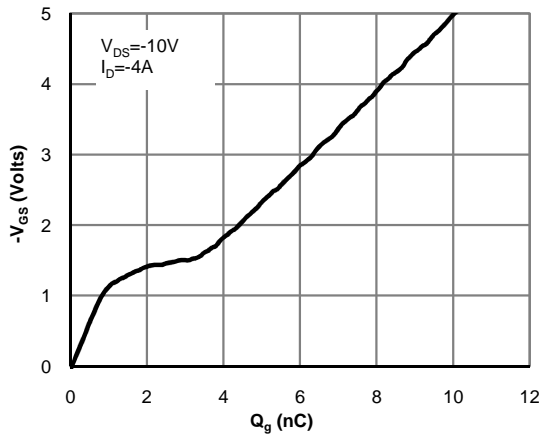


Figure 7: Gate-Charge Characteristics

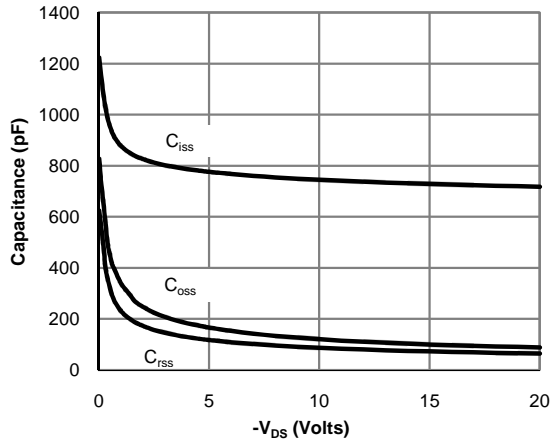


Figure 8: Capacitance Characteristics

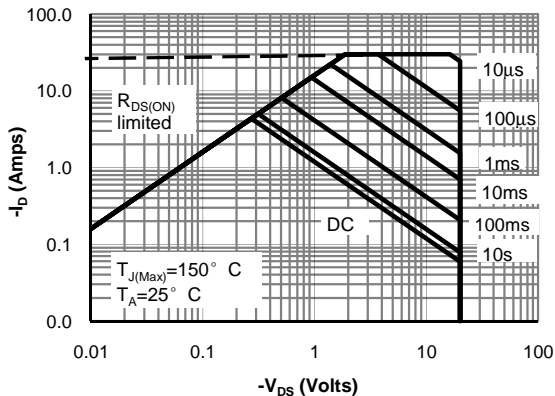


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

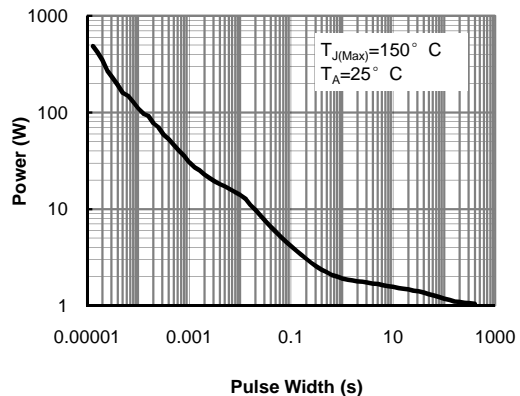


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

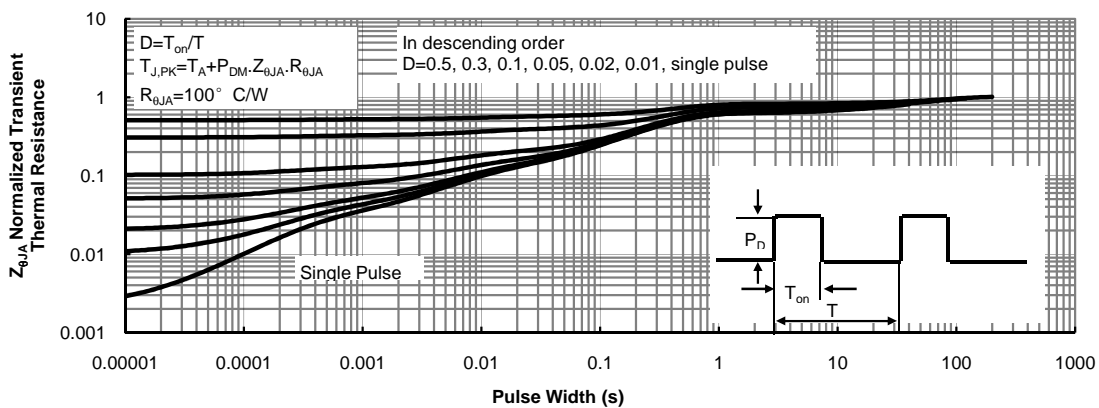
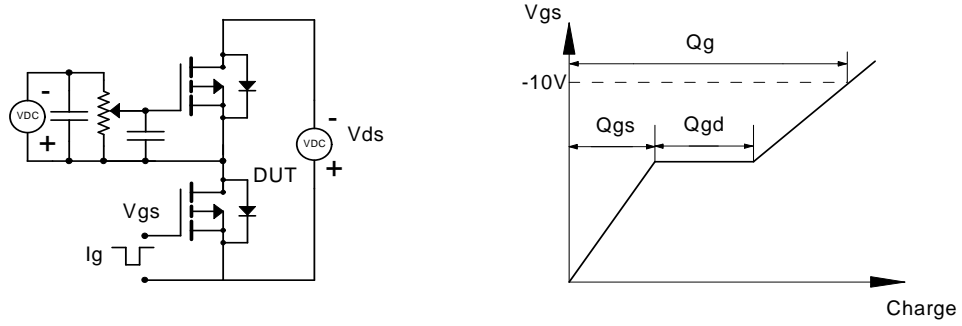
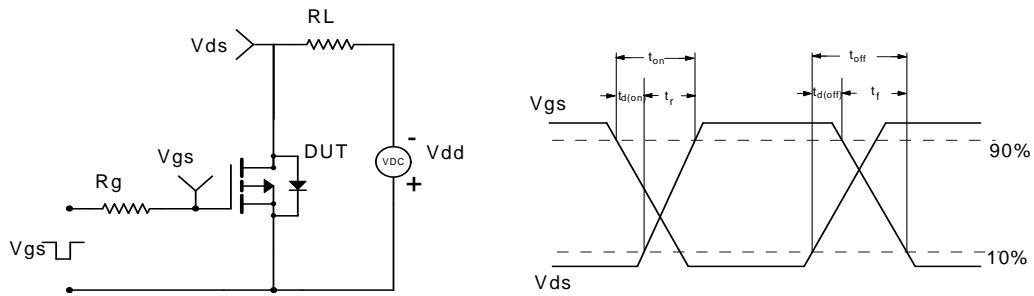


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

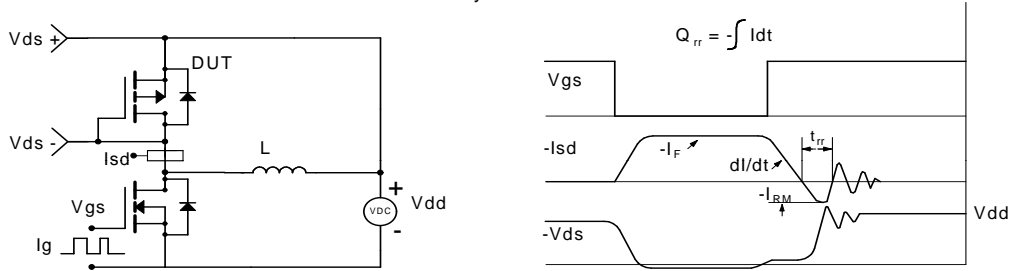
Gate Charge Test Circuit & Waveform



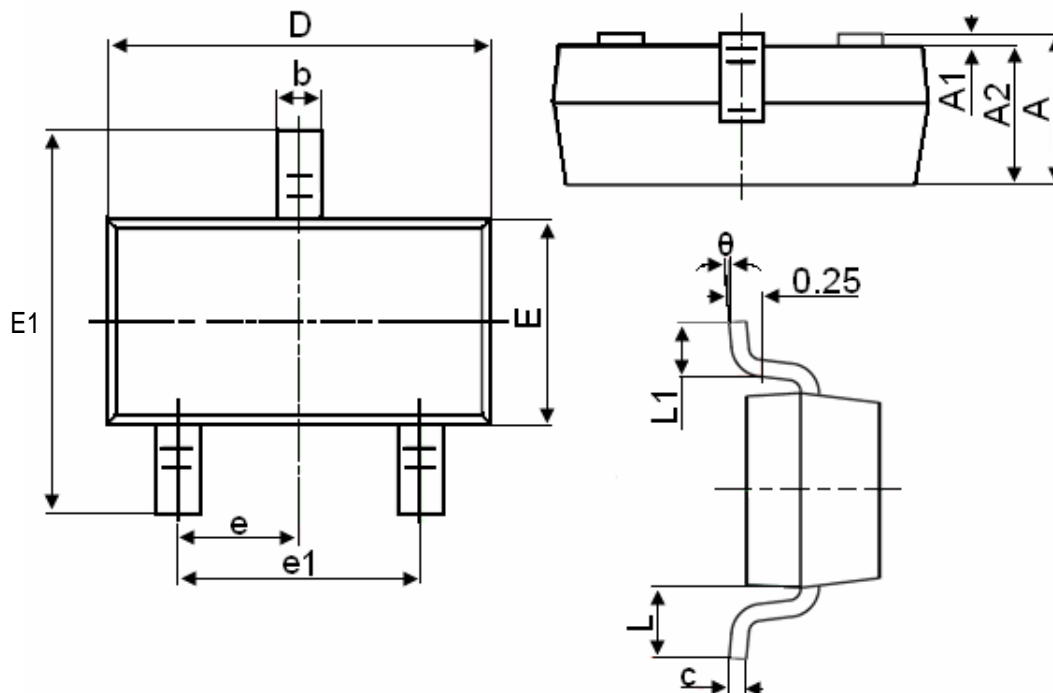
Resistive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



SOT-23 Package Information



Symbol	Dimensions in Millimeters	
	MIN.	MAX.
A	0.900	1.150
A1	0.000	0.100
A2	0.900	1.050
b	0.300	0.500
c	0.080	0.150
D	2.800	3.000
E	1.200	1.400
E1	2.250	2.550
e	0.950TYP	
e1	1.800	2.000
L	0.550REF	
L1	0.300	0.500
θ	0°	8°

Notes

1. All dimensions are in millimeters.
2. Tolerance $\pm 0.10\text{mm}$ (4 mil) unless otherwise specified
3. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
4. Dimension L is measured in gauge plane.
5. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.