

Description

The HSU1641 is the high performance complementary N-ch and P-ch MOSFETs with high cell density, which provide excellent RDS(on) and gate charge for most of the synchronous buck converter applications.

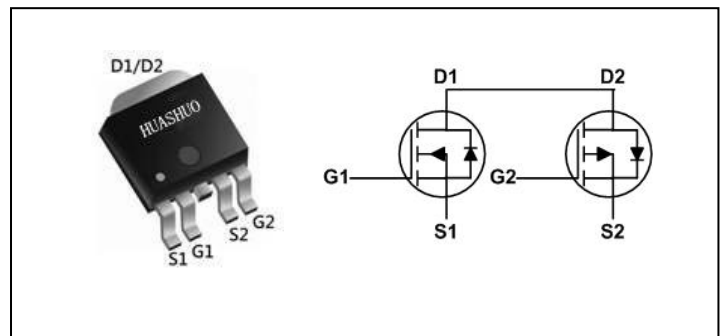
The HSU1641 meet the RoHS and Green Product requirement 100% EAS guaranteed with full function reliability approved.

- 100% EAS Guaranteed
- Green Device Available
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- Advanced high cell density Trench technology

Product Summary

BVDSS	RDS(on)	ID
40V	11mΩ	28A
-40V	21mΩ	-25A

TO252-4L Pin Configuration



Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-Ch	P-Ch	
V _{DS}	Drain-Source Voltage	40	-40	V
V _{GS}	Gate-Source Voltage	± 20	± 20	V
I _D @T _C =25°C	Continuous Drain Current, V _{GS} @ 10V ¹	28	-25	A
I _D @T _C =70°C	Continuous Drain Current, V _{GS} @ 10V ¹	21	-19	A
I _{DM}	Pulsed Drain Current ²	56	-50	A
EAS	Single Pulse Avalanche Energy ³	32	71	mJ
I _{AS}	Avalanche Current	26	-33	A
P _D @T _C =25°C	Total Power Dissipation ⁴	35	35	W
T _{STG}	Storage Temperature Range	-55 to 150	-55 to 150	°C
T _J	Operating Junction Temperature Range	-55 to 150	-55 to 150	°C

Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
R _{θJA}	Thermal Resistance Junction-Ambient ¹	---	62	°C/W
R _{θJC}	Thermal Resistance Junction-Case ¹	---	3.5	°C/W



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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	40	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BVDSS Temperature Coefficient	Reference to 25°C , $I_D=1mA$	---	0.034	---	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=10V, I_D=5A$	---	11	15	$m\Omega$
		$V_{GS}=4.5V, I_D=4A$	---	14	20	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	1.0	1.5	2.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	-4.56	---	$mV/^\circ\text{C}$
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=32V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	μA
		$V_{DS}=32V, V_{GS}=0V, T_J=55^\circ\text{C}$	---	---	5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	± 100	nA
g_{fs}	Forward Transconductance	$V_{DS}=5V, I_D=5A$	---	14	---	S
R_g	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1MHz$	---	2.6	---	Ω
Q_g	Total Gate Charge (4.5V)	$V_{DS}=32V, V_{GS}=4.5V, I_D=5A$	---	10	---	nC
Q_{gs}	Gate-Source Charge		---	2.55	---	
Q_{gd}	Gate-Drain Charge		---	4.8	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=20V, V_{GS}=10V, R_G=3.3\Omega, I_D=1A$	---	2.8	---	ns
T_r	Rise Time		---	12.8	---	
$T_{d(off)}$	Turn-Off Delay Time		---	21.2	---	
T_f	Fall Time		---	6.4	---	
C_{iss}	Input Capacitance	$V_{DS}=15V, V_{GS}=0V, f=1MHz$	---	1013	---	pF
C_{oss}	Output Capacitance		---	107	---	
C_{rss}	Reverse Transfer Capacitance		---	76	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,5}	$V_G=V_D=0V$, Force Current	---	---	28	A
I_{SM}	Pulsed Source Current ^{2,5}		---	---	56	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$	---	---	1.2	V

Note :

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
- 2.The data tested by pulsed , pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is $V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=26A$
- 4.The power dissipation is limited by 150°C junction temperature
- 5.The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.



N-Ch and P-Ch Fast Switching MOSFETs

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-40	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BV_{DSS} Temperature Coefficient	Reference to 25°C , $I_D=-1\text{mA}$	---	-0.02	---	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=-10V, I_D=-6A$	---	21	26	$m\Omega$
		$V_{GS}=-4.5V, I_D=-3A$	---	27	33	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=-250\mu A$	-1.0	-1.7	-2.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	3.72	---	$mV/^\circ\text{C}$
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=-32V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	μA
		$V_{DS}=-32V, V_{GS}=0V, T_J=55^\circ\text{C}$	---	---	5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	± 100	nA
g_{fs}	Forward Transconductance	$V_{DS}=-5V, I_D=-6A$	---	13	---	S
R_g	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	9.1	---	Ω
Q_g	Total Gate Charge (-4.5V)	$V_{DS}=-20V, V_{GS}=-4.5V, I_D=-6A$	---	11.5	---	nC
Q_{gs}	Gate-Source Charge		---	3.5	---	
Q_{gd}	Gate-Drain Charge		---	3.3	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-15V, V_{GS}=-10V, R_G=3.3\Omega, I_D=-1A$	---	22	---	ns
T_r	Rise Time		---	15.7	---	
$T_{d(off)}$	Turn-Off Delay Time		---	59	---	
T_f	Fall Time		---	5.5	---	
C_{iss}	Input Capacitance	$V_{DS}=-15V, V_{GS}=0V, f=1\text{MHz}$	---	1415	---	pF
C_{oss}	Output Capacitance		---	134	---	
C_{rss}	Reverse Transfer Capacitance		---	102	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,5}	$V_G=V_D=0V$, Force Current	---	---	-25	A
I_{SM}	Pulsed Source Current ^{2,5}		---	---	-50	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=-1A, T_J=25^\circ\text{C}$	---	---	-1.2	V

Note :

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper.
- 2.The data tested by pulsed , pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is $V_{DD}=-25V, V_{GS}=-10V, L=0.1mH, I_{AS}=-33A$
- 4.The power dissipation is limited by 150°C junction temperature
- 5.The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.



N-Ch and P-Ch Fast Switching MOSFETs

N-Channel Typical Characteristics

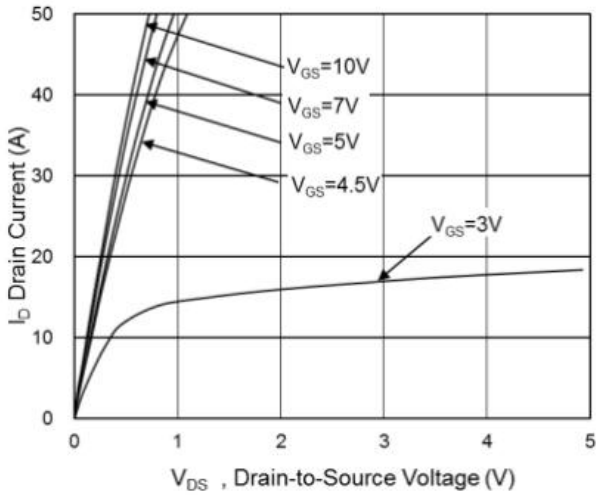


Fig.1 Typical Output Characteristics

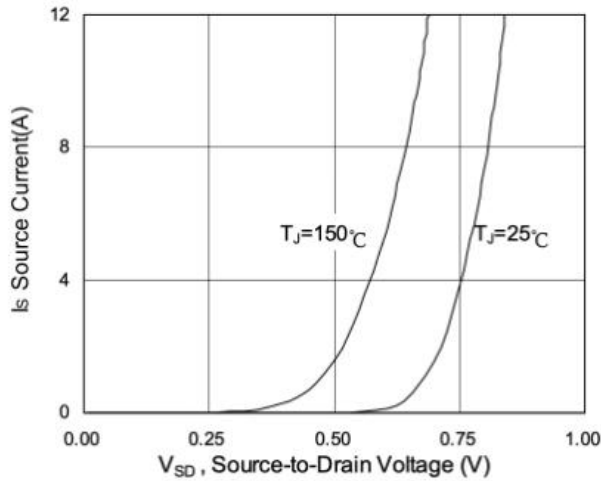


Fig.3 Forward Characteristics of Reverse

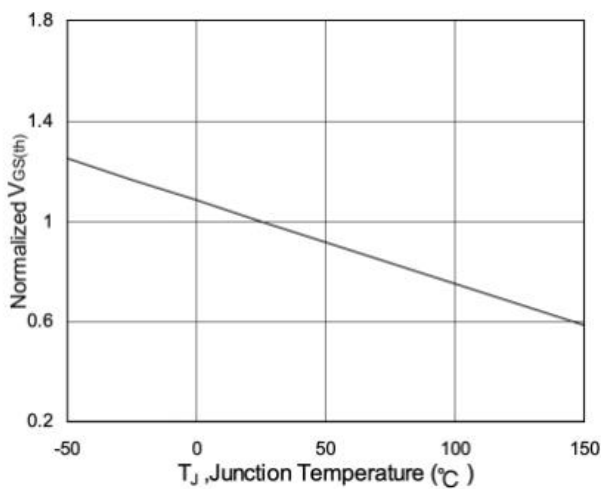


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

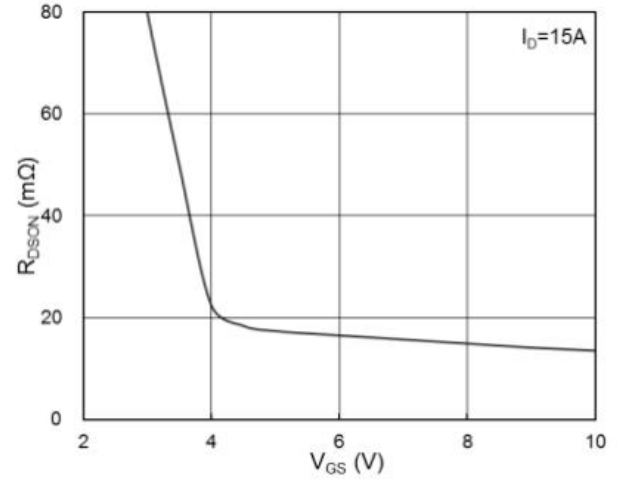


Fig.2 On-Resistance vs. G-S Voltage

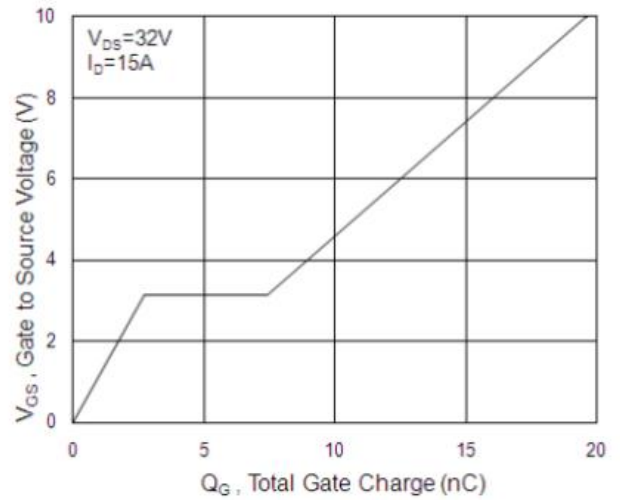


Fig.4 Gate-Charge Characteristics

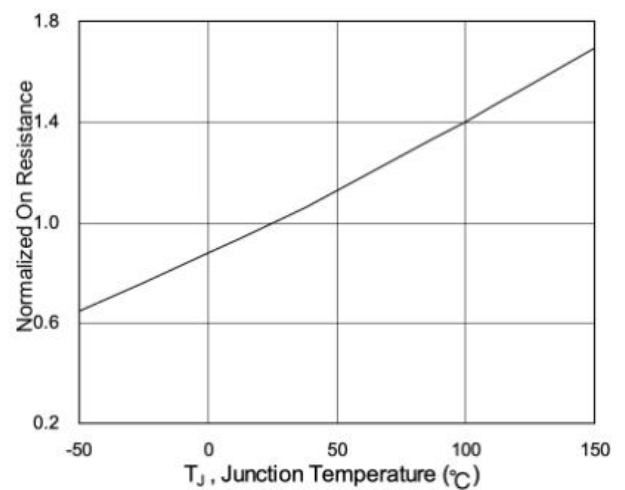


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

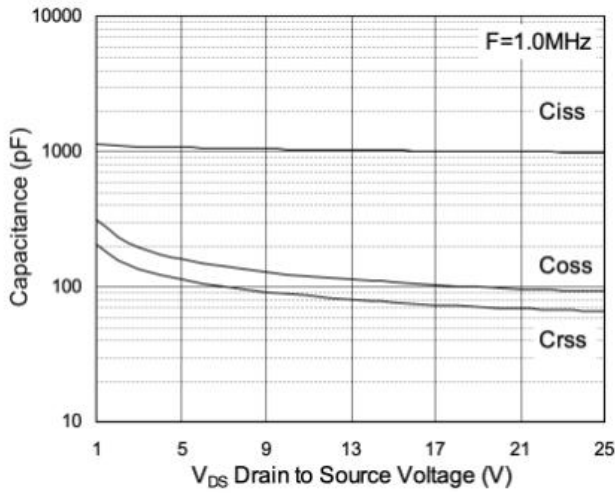


Fig.7 Capacitance

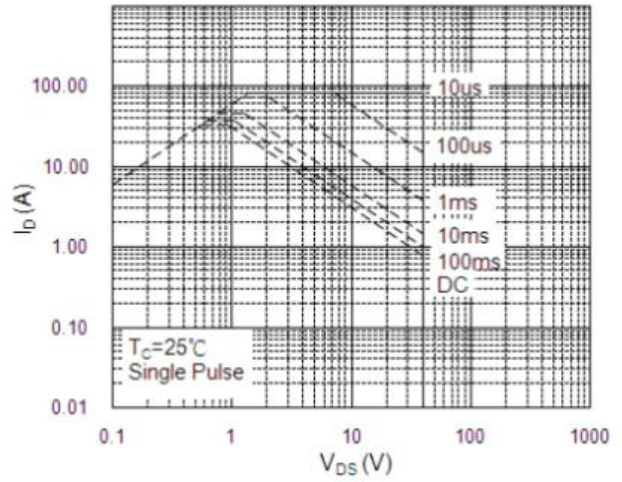


Fig.8 Safe Operating Area

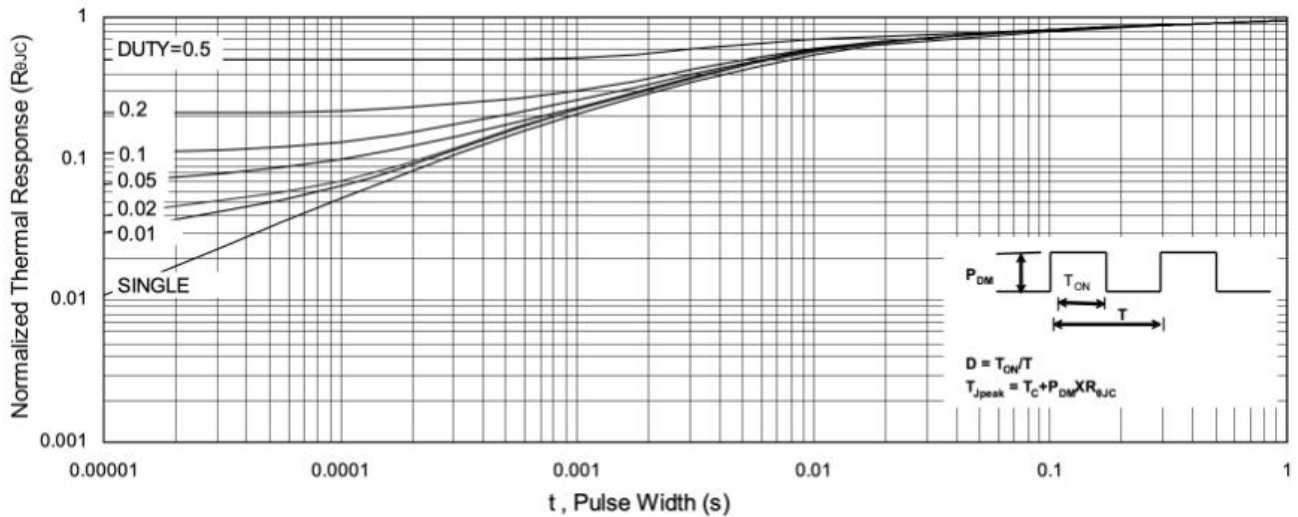


Fig.9 Normalized Maximum Transient Thermal Impedance

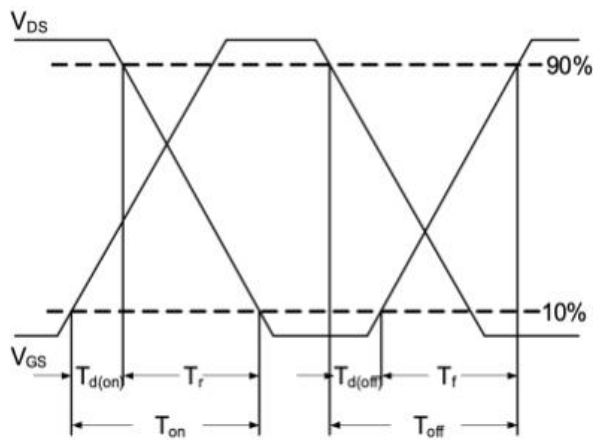


Fig.10 Switching Time Waveform

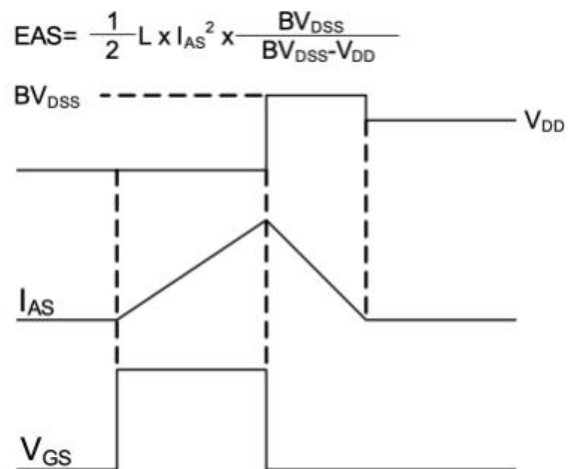


Fig.11 Unclamped Inductive Switching



N-Ch and P-Ch Fast Switching MOSFETs

P-Channel Typical Characteristics

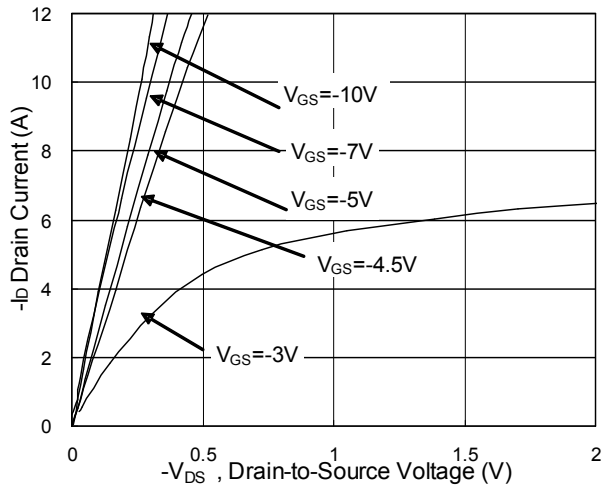


Fig.1 Typical Output Characteristics

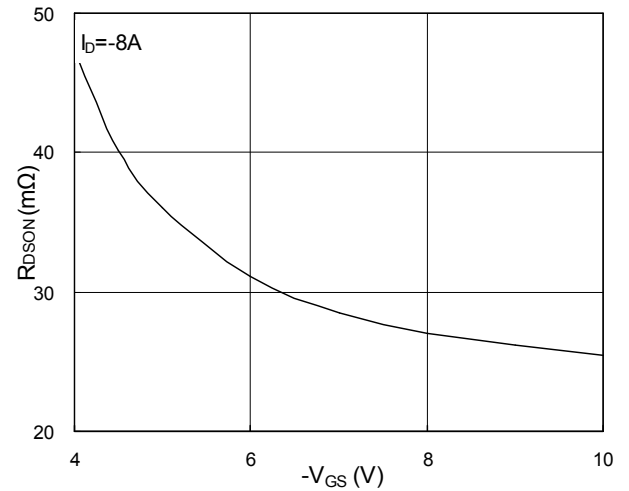


Fig.2 On-Resistance v.s Gate-Source

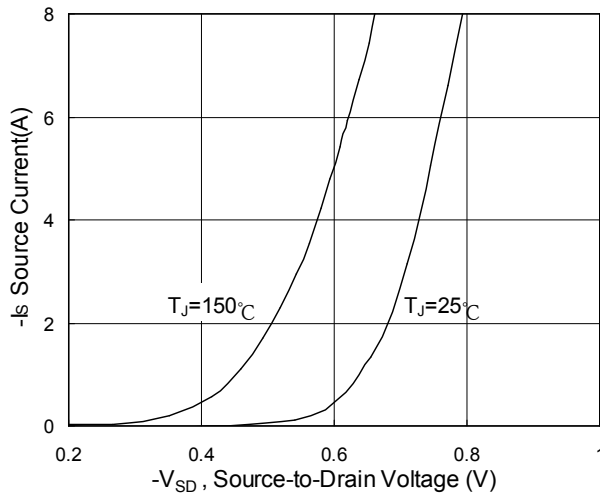


Fig.3 Forward Characteristics of Reverse

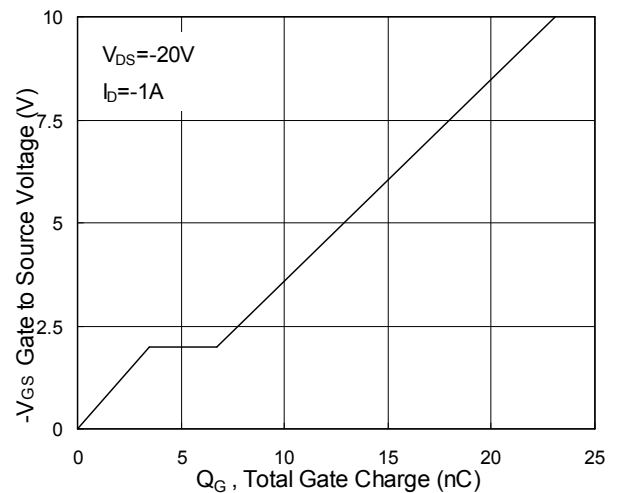


Fig.4 Gate-Charge Characteristics

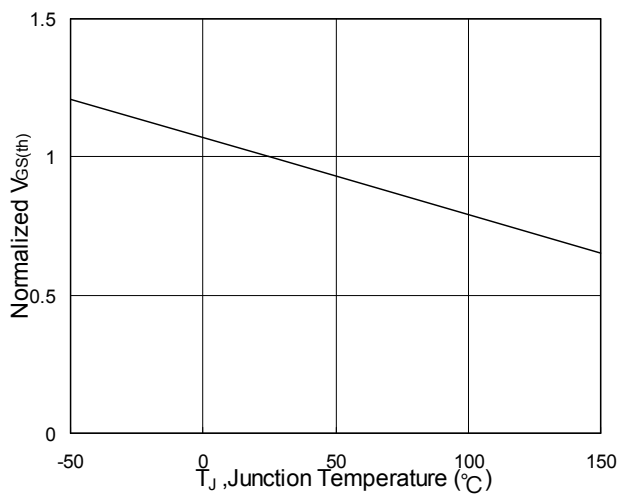


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

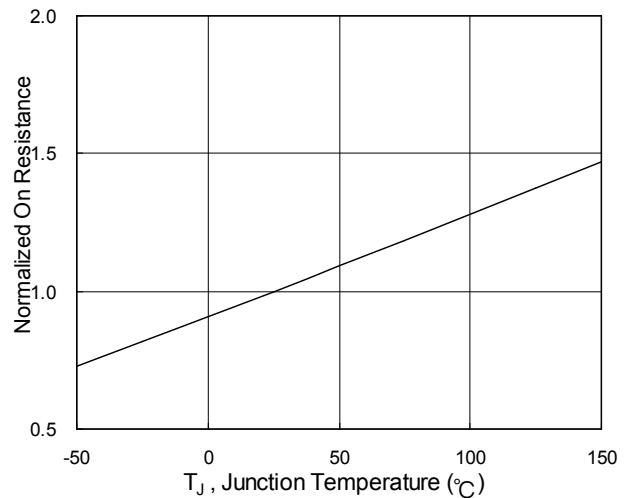


Fig.6 Normalized $R_{DS(on)}$ v.s T_J



N-Ch and P-Ch Fast Switching MOSFETs

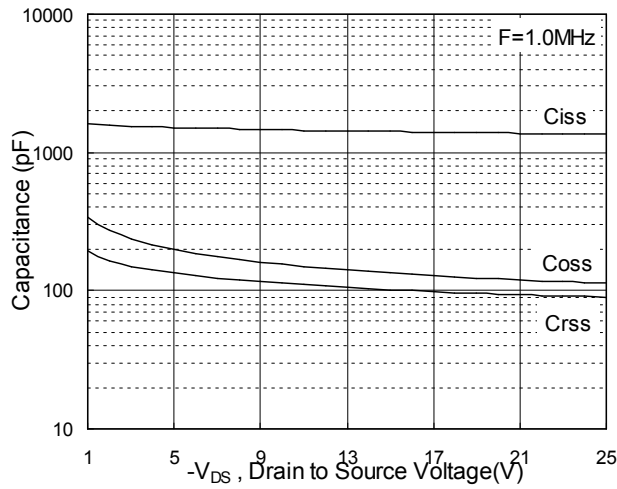


Fig.7 Capacitance

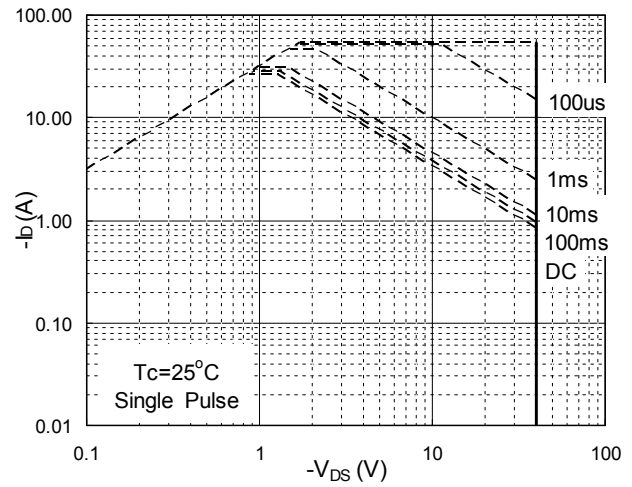


Fig.8 Safe Operating Area

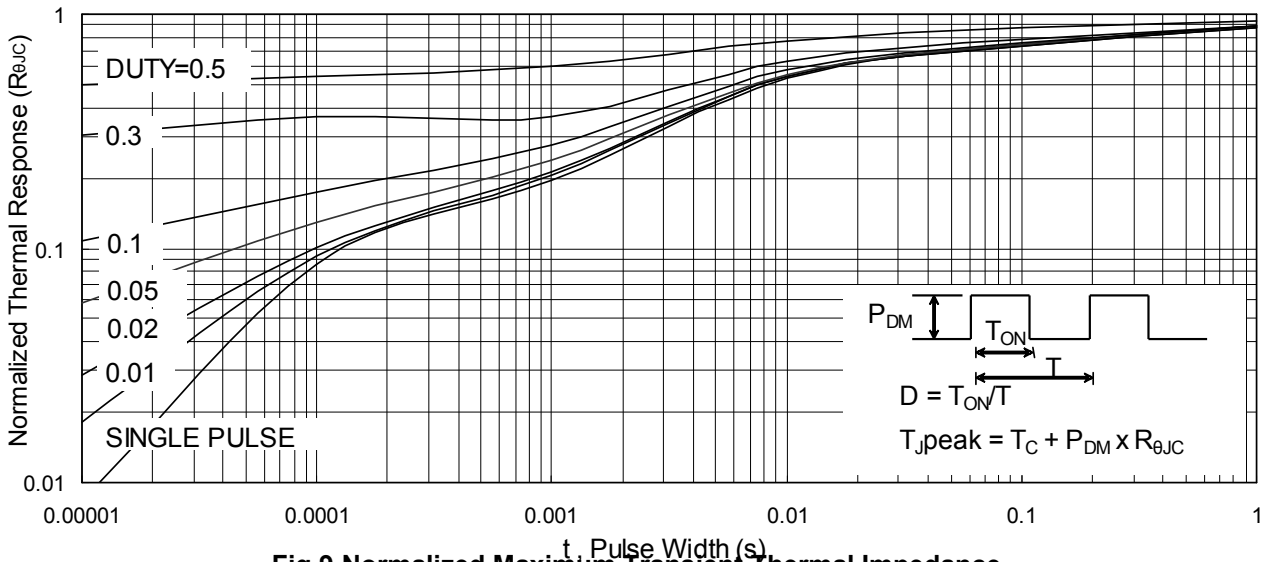


Fig.9 Normalized Maximum Transient Thermal Impedance

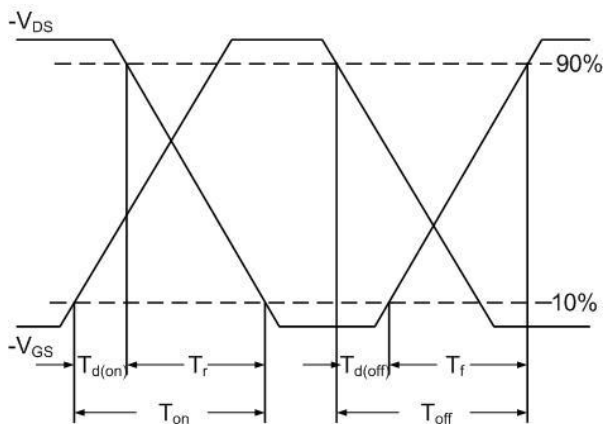


Fig.10 Switching Time Waveform

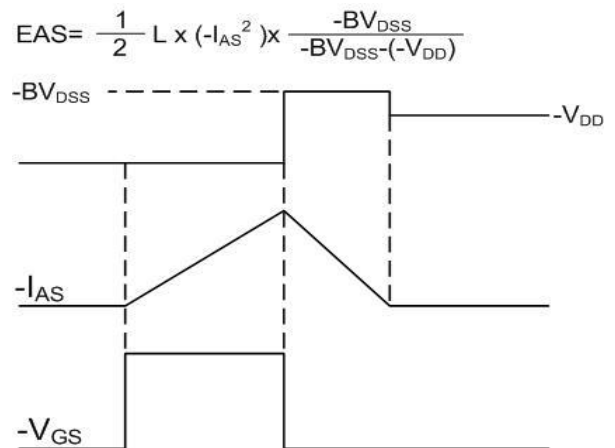
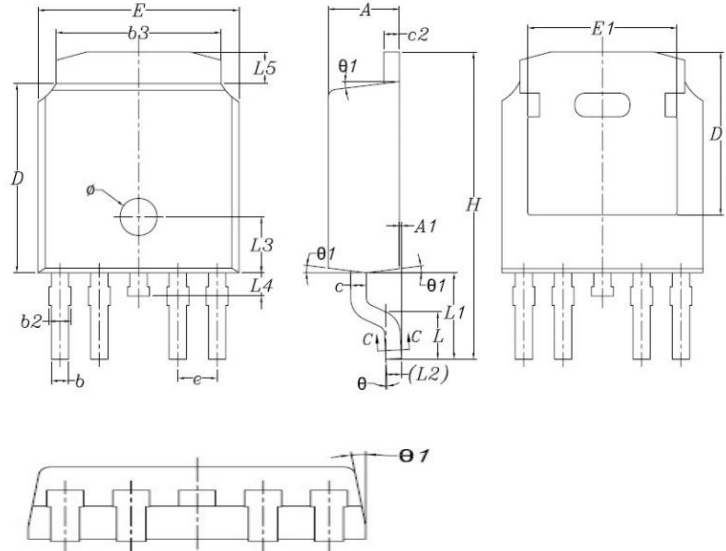


Fig.11 Unclamped Inductive Waveform



TO-252_4L Package Outline



SYMBOLS	MILLIMETERS [⌀]		INCHES [⌀]	
	MIN [⌀]	MAX [⌀]	MIN [⌀]	MAX [⌀]
A [⌀]	2.180 [⌀]	2.400 [⌀]	0.0860 [⌀]	0.0950 [⌀]
A1 [⌀]	— [⌀]	0.127 [⌀]	— [⌀]	0.0050 [⌀]
b [⌀]	0.508 [⌀]	0.711 [⌀]	0.0200 [⌀]	0.0280 [⌀]
b2 [⌀]	0.610 [⌀]	0.790 [⌀]	0.0240 [⌀]	0.0310 [⌀]
b3 [⌀]	5.184 [⌀]	5.461 [⌀]	0.2041 [⌀]	0.2150 [⌀]
c [⌀]	0.460 [⌀]	0.610 [⌀]	0.0181 [⌀]	0.024 [⌀]
c2 [⌀]	0.460 [⌀]	0.610 [⌀]	0.0181 [⌀]	0.024 [⌀]
D [⌀]	6.000 [⌀]	6.223 [⌀]	0.2362 [⌀]	0.2450 [⌀]
D1 [⌀]	5.050 [⌀]	— [⌀]	0.1988 [⌀]	— [⌀]
E [⌀]	6.350 [⌀]	6.731 [⌀]	0.2500 [⌀]	0.2650 [⌀]
E1 [⌀]	4.320 [⌀]	— [⌀]	0.1700 [⌀]	— [⌀]
e [⌀]	1.170 [⌀]	1.370 [⌀]	0.0461 [⌀]	0.0539 [⌀]
H [⌀]	9.500 [⌀]	10.300 [⌀]	0.3740 [⌀]	0.4055 [⌀]
L [⌀]	1.380 [⌀]	1.780 [⌀]	0.0540 [⌀]	0.0700 [⌀]
L1 [⌀]	2.400 [⌀]	3.000 [⌀]	0.0945 [⌀]	0.1181 [⌀]
L2 [⌀]	0.508BSC [⌀]		0.020BSC [⌀]	
L3 [⌀]	1.600 [⌀]	2.000 [⌀]	0.0630 [⌀]	0.0787 [⌀]
L4 [⌀]	— [⌀]	1.016 [⌀]	— [⌀]	0.04 [⌀]
L5 [⌀]	0.889 [⌀]	1.270 [⌀]	0.035 [⌀]	0.05 [⌀]
θ [⌀]	0° [⌀]	10° [⌀]	0° [⌀]	10° [⌀]
θ1 [⌀]	0° [⌀]	15° [⌀]	0° [⌀]	15° [⌀]
Ø [⌀]	1.050 [⌀]	1.350 [⌀]	0.0413 [⌀]	0.0531 [⌀]