

MDU5693

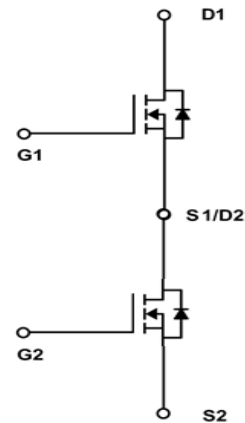
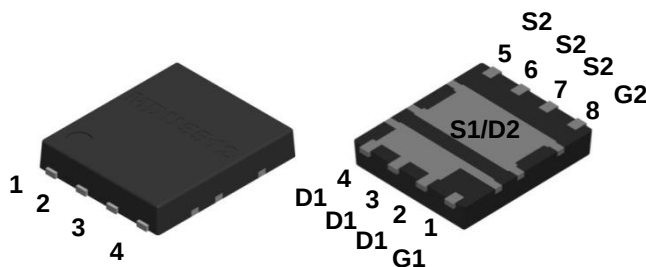
Dual Asymmetric N-channel Trench MOSFET 30V

General Description

The MDU5693 uses advanced MagnaChip's MOSFET Technology, which provides high performance in on-state resistance, fast switching performance and excellent quality. MDU5693 is suitable for DC/DC converter and general purpose applications.

Features

- | FET1 | FET2 |
|---------------------------|--------------------------------|
| $V_{DS} = 30V$ | $V_{DS} = 30V$ |
| $I_D = 52A$ | $I_D = 100A @ V_{GS} = 10V$ |
| $R_{DS(ON)} < 5.0m\Omega$ | $< 2.5m\Omega @ V_{GS} = 10V$ |
| $< 8.5m\Omega$ | $< 3.2m\Omega @ V_{GS} = 4.5V$ |
| 100% UIL Tested | |
| 100% Rg Tested | |



Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	FET1	FET2	Unit
Drain-Source Voltage		V_{DSS}	30		V
Gate-Source Voltage		V_{GSS}	±20	±12	V
Continuous Drain Current ⁽¹⁾	$T_C=25^{\circ}C$ (Silicon Limited)	I_D	70	135	A
	$T_C=25^{\circ}C$ (Package Limited)		52	100	
	$T_C=70^{\circ}C$		57	108	
	$T_A=25^{\circ}C$		15.3	25	
	$T_A=70^{\circ}C$		12.4	20	
Pulsed Drain Current		I_{DM}	208	400	A
Power Dissipation	$T_C=25^{\circ}C$	P_D	46.3	73	W
	$T_A=25^{\circ}C$		2.2	2.5	
Single Pulse Avalanche Energy ⁽²⁾		E_{AS}	43	72	mJ
Junction and Storage Temperature Range		T_J, T_{stg}	-55~150		°C

Thermal Characteristics

Characteristics	Symbol	FET1		FET2		Unit
		Typ.	Max	Typ.	Max	
Thermal Resistance, Junction-to-Ambient ⁽¹⁾	$R_{\theta JA}$	47.5	57	41.7	50	°C/W
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	2.2	2.7	1.3	1.7	

Ordering Information

Part Number	Temp. Range	Package	Packing	RoHS Status
MDU5693VRH	-55~150°C	Dual PDFN56	Tape & Reel	Halogen Free

FET1 Electrical Characteristics (Ta =25°C)

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
Static Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$I_D = 250\mu A, V_{GS} = 0V$	30	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	1.0	1.8	3.0	
Drain Cut-Off Current	I_{DSS}	$V_{DS} = 30V, V_{GS} = 0V$	-	-	1	μA
Gate Leakage Current	I_{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	± 0.1	
Drain-Source ON Resistance	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 20A$	-	4.1	5.0	m Ω
		$T_J = 125^\circ C$	-	5.6	6.8	
		$V_{GS} = 4.5V, I_D = 20A$	-	6.7	8.5	
Forward Transconductance	g_{fs}	$V_{DS} = 5V, I_D = 20A$	-	91	-	S
Dynamic Characteristics						
Total Gate Charge	$Q_{g(10V)}$	$V_{DS} = 15.0V, I_D = 20A, V_{GS} = 10V$	14	20	27	nC
Total Gate Charge	$Q_{g(4.5V)}$		6.2	9	12	
Gate-Source Charge	Q_{gs}		-	6	-	
Gate-Drain Charge	Q_{gd}		-	1.9	-	
Input Capacitance	C_{iss}	$V_{DS} = 15.0V, V_{GS} = 0V, f = 1.0MHz$	1040	1500	1950	pF
Output Capacitance	C_{oss}		418	610	790	
Reverse Transfer Capacitance	C_{rss}		28	42	55	
Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10V, V_{DS} = 15V, I_D = 20A, R_g = 3.0\Omega$	-	10.5	-	ns
Rise Time	t_r		-	11.3	-	
Turn-Off Delay Time	$t_{d(off)}$		-	28.5	-	
Fall Time	t_f		-	5.1	-	
Gate Resistance	R_g	$f = 1 MHz$	0.5	1.0	2.0	Ω
Drain-Source Body Diode Characteristics						
Source-Drain Diode Forward Voltage	V_{SD}	$I_S = 1A, V_{GS} = 0V$	-	0.7	1.0	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 20A, dI/dt = 200A/\mu s$	-	30.5	-	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	42.9	-	nC

Note :

- Surface mounted FR-4 board by JEDEC (jesd51-7). Continuous current at $T_C = 25^\circ C$ is silicon limited.
- E_{AS} is tested at starting $T_J = 25^\circ C$, $L = 0.1mH$, $I_{AS} = 20 A$, $V_{DD} = 27V$, $V_{GS} = 10V$.

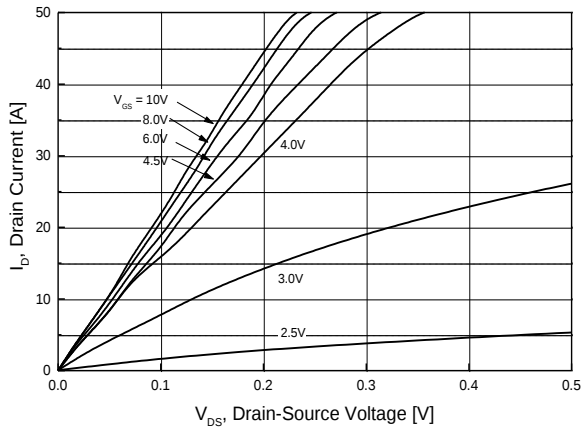


Fig.1 On-Region Characteristics

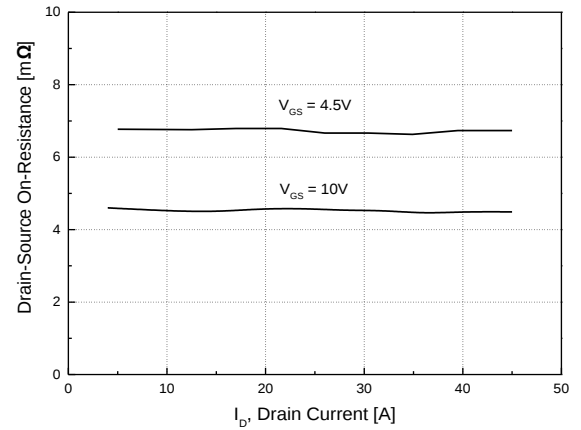


Fig.2 On-Resistance Variation with Drain Current and Gate Voltage

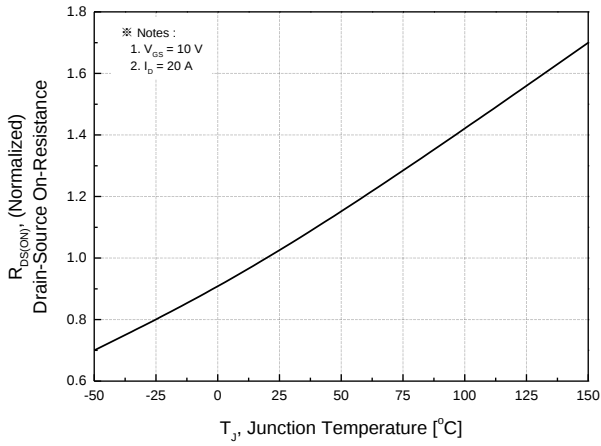


Fig.3 On-Resistance Variation with Temperature

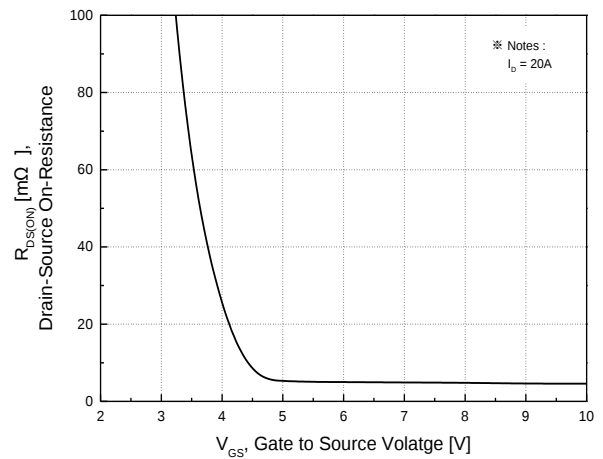


Fig.4 On-Resistance Variation with Gate to Source Voltage

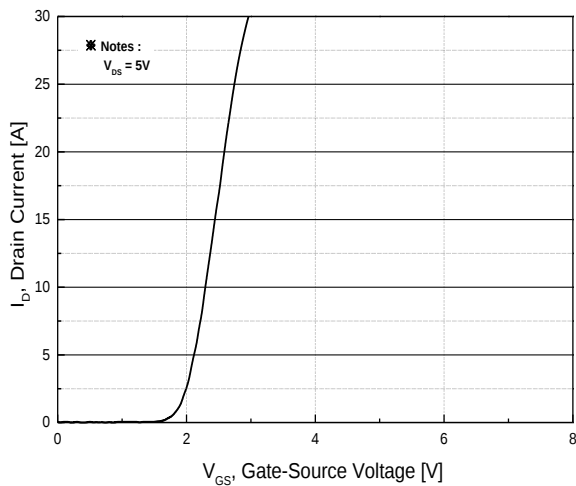


Fig.5 Transfer Characteristics

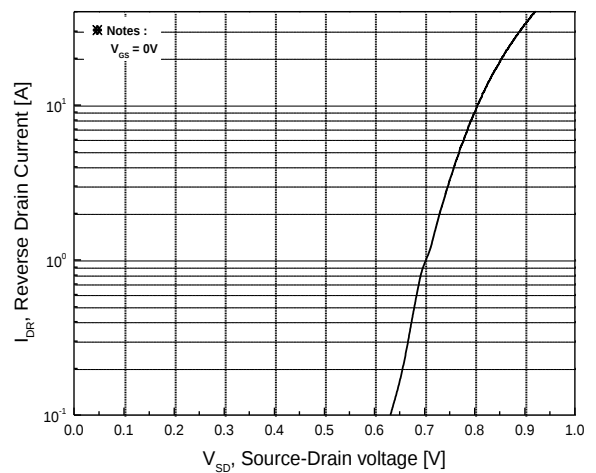
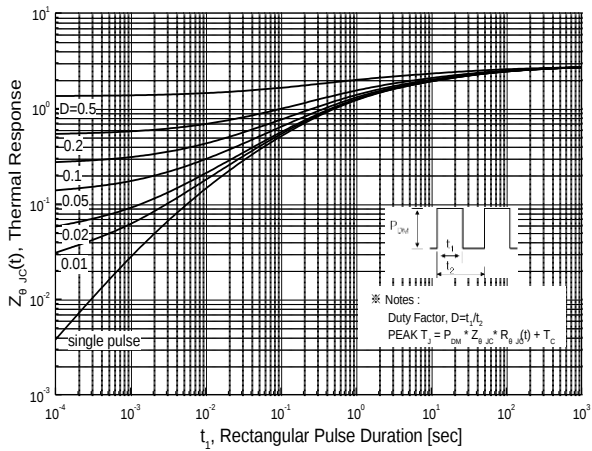
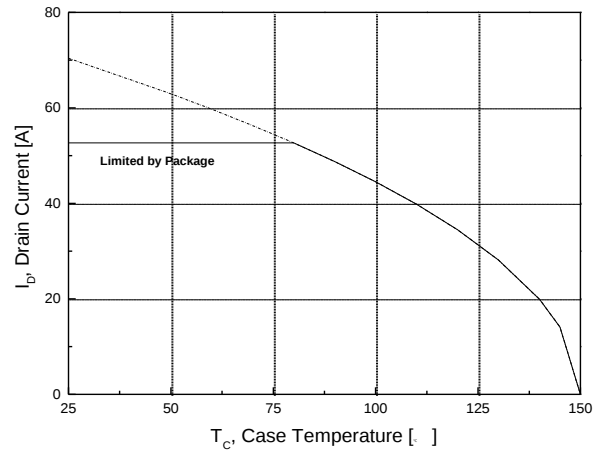
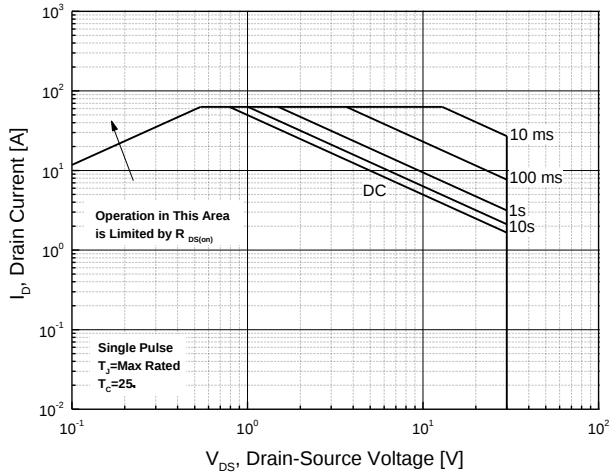
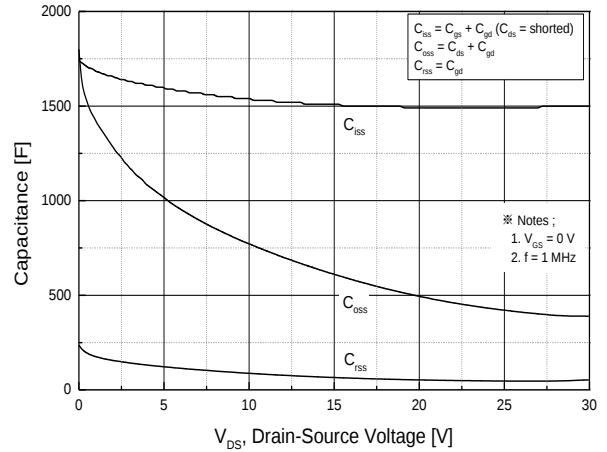
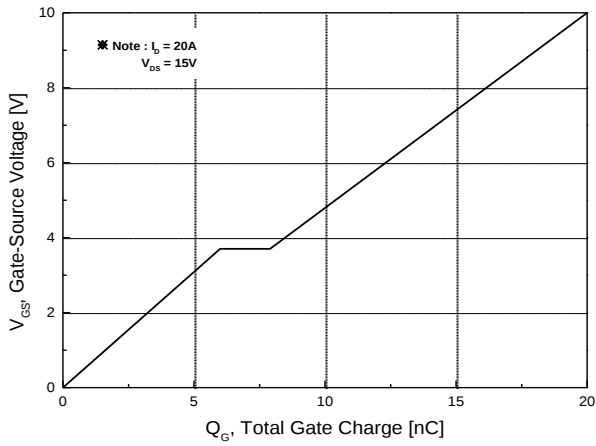


Fig.6 Body Diode Forward Voltage Variation with Source Current and Temperature



FET2 Electrical Characteristics (Ta =25°C)

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
Static Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$I_D = 10mA, V_{GS} = 0V$	30	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	1.1	1.4	2.2	
Drain Cut-Off Current	I_{DSS}	$V_{DS} = 30V, V_{GS} = 0V$	-	-	1	μA
Gate Leakage Current	I_{GSS}	$V_{GS} = \pm 12V, V_{DS} = 0V$	-	-	± 0.1	
Drain-Source ON Resistance	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 20A$	-	1.8	2.5	m Ω
		$T_J = 125^\circ C$	-	2.3	3.2	
		$V_{GS} = 4.5V, I_D = 20A$	-	2.4	3.2	
Forward Transconductance	g_{fs}	$V_{DS} = 5V, I_D = 20A$	-	85	-	S
Dynamic Characteristics						
Total Gate Charge	$Q_{g(10V)}$	$V_{DS} = 15.0V, I_D = 20A,$ $V_{GS} = 10V$	32.8	46.8	65	nC
Total Gate Charge	$Q_{g(4.5V)}$		14.2	20.6	28.8	
Gate-Source Charge	Q_{gs}		-	6.8	-	
Gate-Drain Charge	Q_{gd}		-	3.9	-	
Input Capacitance	C_{iss}	$V_{DS} = 15.0V, V_{GS} = 0V,$ $f = 1.0MHz$	2189	3150	4093	pF
Output Capacitance	C_{oss}		690	1010	1300	
Reverse Transfer Capacitance	C_{rss}		48	71	92	
Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10V, V_{DD} = 15V,$ $I_D = 20A, R_g = 3\Omega$	-	11.3	-	ns
Rise Time	t_r		-	12	-	
Turn-Off Delay Time	$t_{d(off)}$		-	57.4	-	
Fall Time	t_f		-	7.08	-	
Gate Resistance	R_g	$f = 1 MHz$	0.5	1.0	2.0	Ω
Drain-Source Body Diode Characteristics						
Source-Drain Diode Forward Voltage	V_{SD}	$I_S = 1.0A, V_{GS} = 0V$	-	0.6	1.0	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 20A, dI/dt = 200A/\mu s$	-	38	-	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	64.4	-	nC

Note :

1. Surface mounted FR-4 board by JEDEC (jesd51-7). Continuous current at $T_C = 25^\circ C$ is silicon limited.
2. E_{AS} is tested at starting $T_J = 25^\circ C, L = 0.1mH, I_{AS} = 25 A, V_{DD} = 27V, V_{GS} = 10V$.

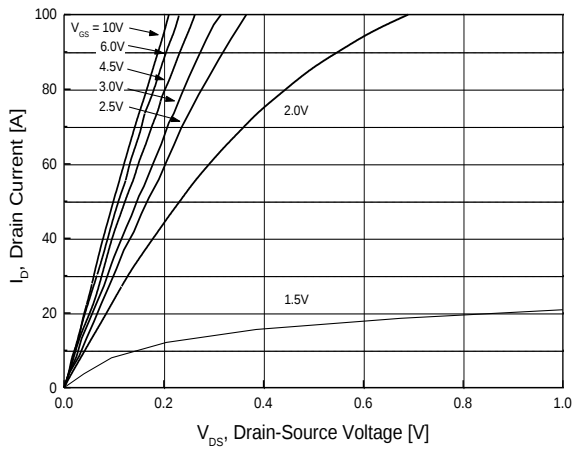


Fig.1 On-Region Characteristics

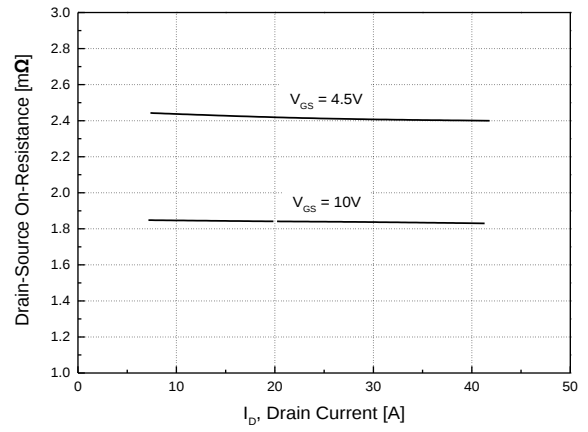


Fig.2 On-Resistance Variation with Drain Current and Gate Voltage

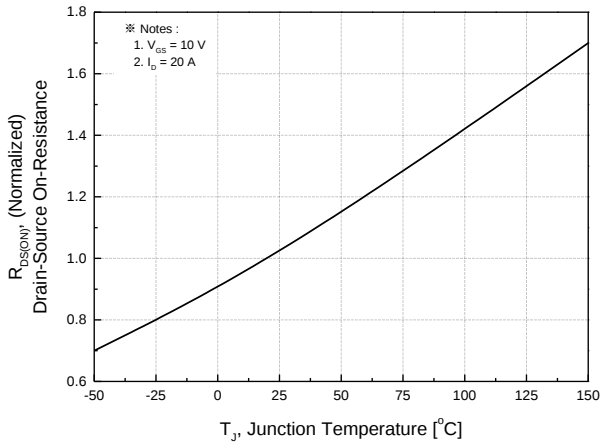


Fig.3 On-Resistance Variation with Temperature

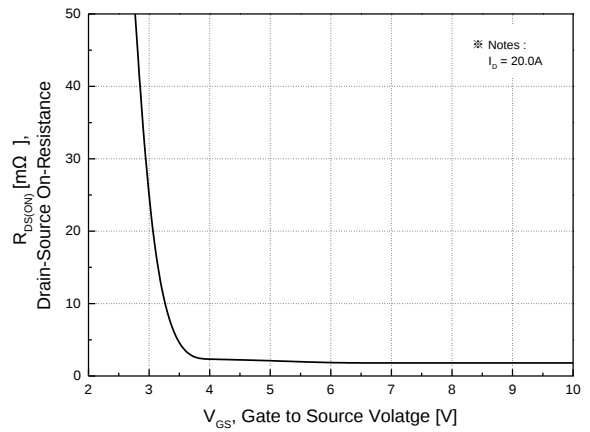


Fig.4 On-Resistance Variation with Gate to Source Voltage

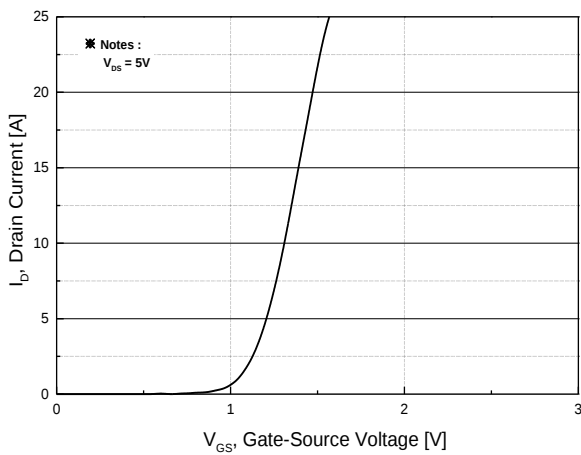


Fig.5 Transfer Characteristics

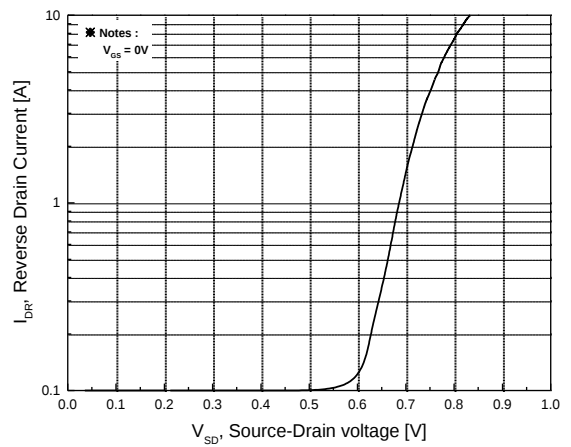
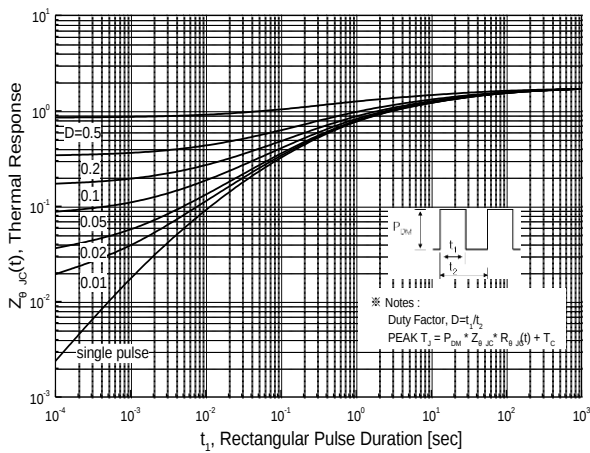
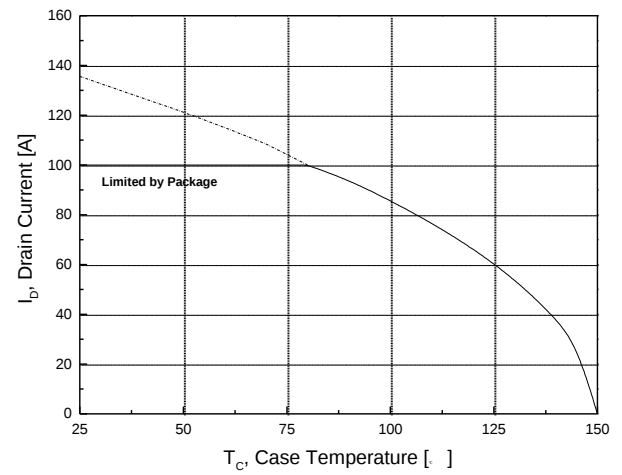
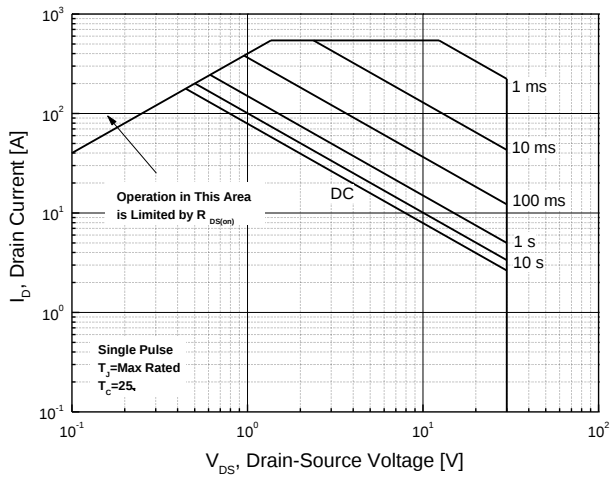
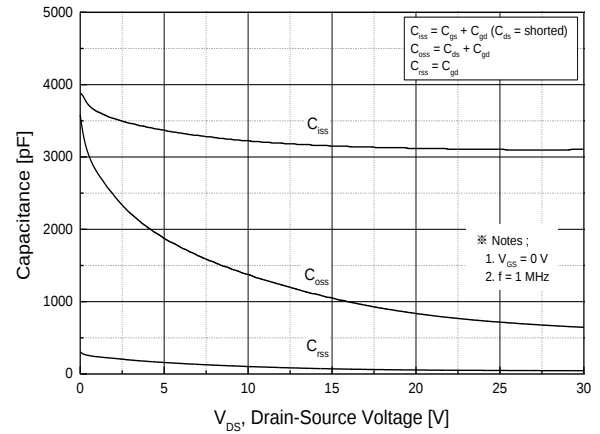
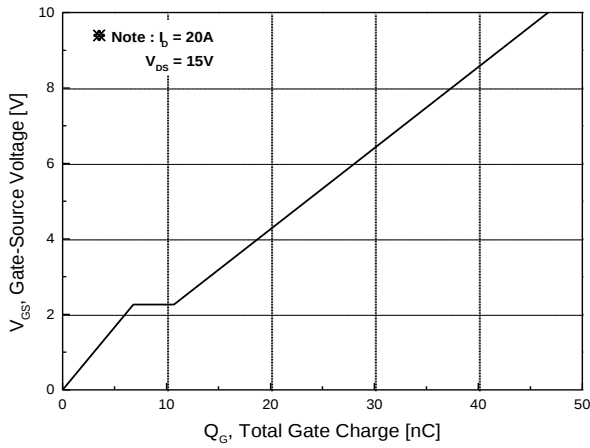


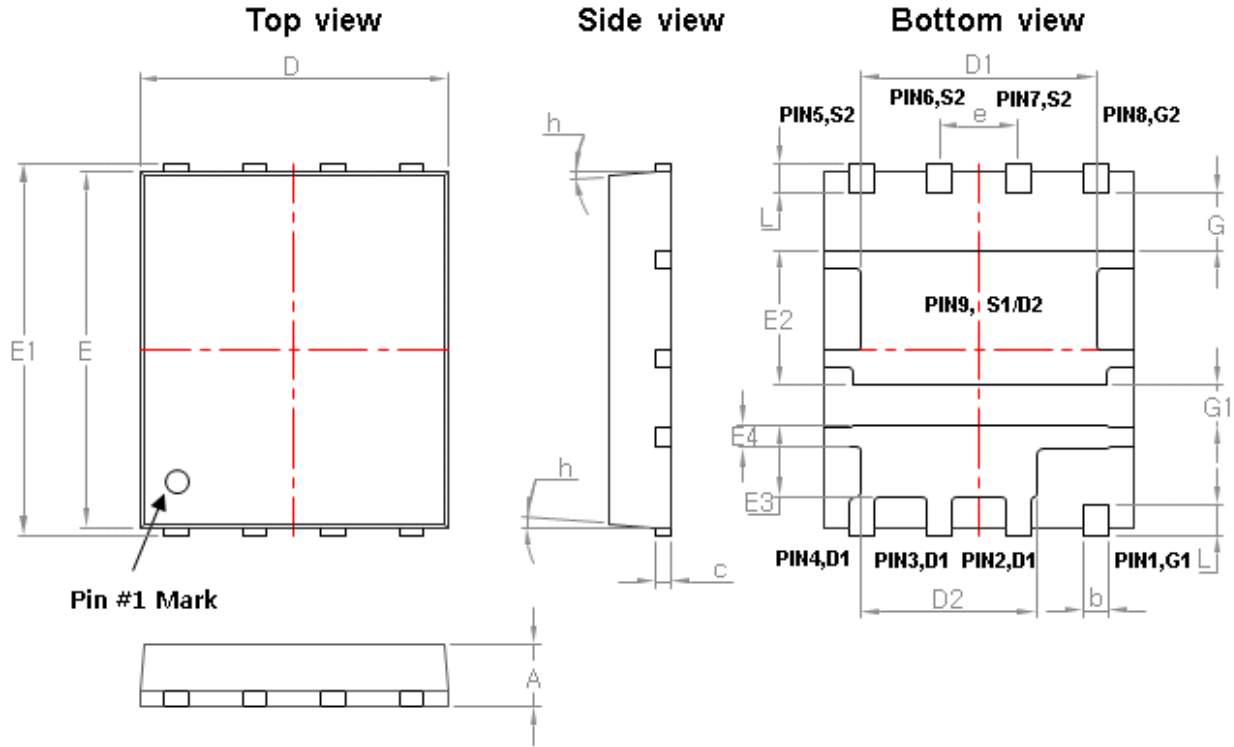
Fig.6 Body Diode Forward Voltage Variation with Source Current and Temperature



Package Dimension

Dual PDFN56 (5x6mm)

Dimensions are in millimeters, unless otherwise specified



Symbol	Dimension [mm]		
	Min	Nom	Max
A	0.90	1.00	1.10
b	0.33	0.41	0.51
c	0.20	0.25	0.30
D	4.80	5.00	5.20
D1	3.60	3.80	4.00
D2	2.64	2.84	3.04
E	5.70	5.75	5.80
E1	5.90	6.00	6.10
E2	2.00	2.25	2.50
E3	1.10	1.20	1.30
E4	0.32	0.42	0.52
e	1.27 BSC		
G	0.50	0.90	1.30
G1	0.40	0.60	0.80
h	0°	-	12°
L	0.38	0.55	0.71

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