



### Electrical Characteristics $T_C=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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#### On Characteristics

$V_{GS}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	3	--	5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\ \text{V}, I_D = 8\ \text{A}$	--	0.46	0.52	$\Omega$
$g_{fs}$	Forward transfer conductance(note 3)	$V_{DS} = 10\ \text{V}, I_D = 8\ \text{A}$ (Note 3)	--	11	--	S

#### Off Characteristics

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\ \text{V}, I_D = 250\ \mu\text{A}$	650	--	--	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 650\ \text{V}, V_{GS} = 0\ \text{V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 520\ \text{V}, T_C = 125^\circ\text{C}$	--	--	100	
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30\ \text{V}, V_{DS} = 0\ \text{V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\ \text{V}, V_{DS} = 0\ \text{V}$	--	--	-100	nA

#### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\ \text{V}, V_{GS} = 0\ \text{V},$ $f = 1.0\ \text{MHz}$	--	3325	--	pF
$C_{oss}$	Output Capacitance		--	225	--	pF
$C_{riss}$	Reverse Transfer Capacitance		--	22	--	pF

#### Switching Characteristics

$t_{d(on)}$	Turn-On Time	$V_{DS} = 325\ \text{V}, I_D = 16\ \text{A},$ $R_G = 25\ \Omega$  (Note 3,4)	--	175	--	ns
$t_r$	Turn-On Rise Time		--	121	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	373	--	ns
$t_f$	Turn-Off Fall Time		--	64	--	ns
$Q_g$	Total Gate Charge	$V_{DS} = 520\ \text{V}, I_D = 16\ \text{A},$ $V_{GS} = 10\ \text{V}$  (Note 3,4)	--	50	55	nC
$Q_{gs}$	Gate-Source Charge		--	20	--	nC
$Q_{gd}$	Gate-Drain Charge		--	10	--	nC

#### Source-Drain Diode Maximum Ratings and Characteristics

$I_S$	Continuous Source-Drain Diode Forward Current	--	--	16	A	
$I_{SM}$	Pulsed Source-Drain Diode Forward Current	--	--	64		
$V_{SD}$	Source-Drain Diode Forward Voltage	$I_S = 16\ \text{A}, V_{GS} = 0\ \text{V}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$I_S = 16\ \text{A}, V_{GS} = 0\ \text{V}$	--	484	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100\ \text{A}/\mu\text{s}$ (Note 3,4)	--	1.62	--	$\mu\text{C}$

Note:

1. Repeated rating: Pulse width limited by safe operating area
2.  $L=5\text{mH}, I_S=16\text{A}, V_{DD}=50\text{V}, R_G=25\Omega,$  Starting  $T_J=25^\circ\text{C}$
3. Pulse test: Pulse width $\leq 300\mu\text{s},$  Duty cycle $\leq 2\%$
4. Essentially independent of operating temperature typical characteristics

# Typical Characteristics

Fig. 1 Typical Output Characteristics

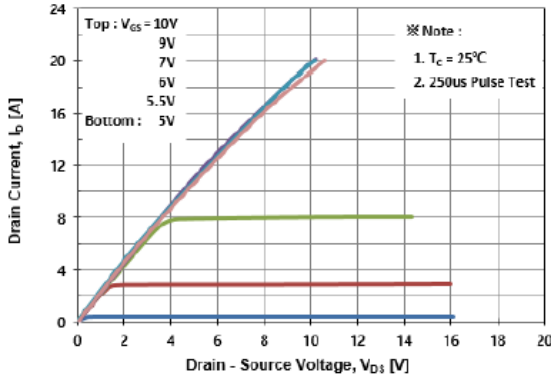


Fig. 2 Typical Output Characteristics

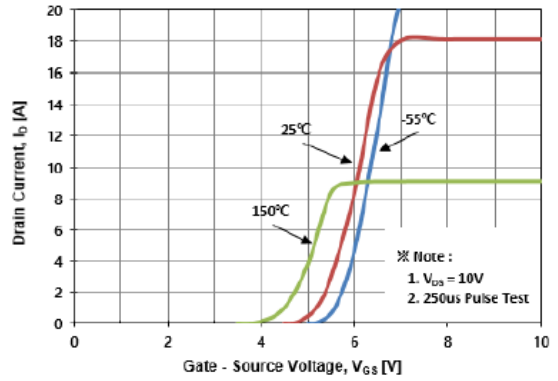


Fig. 3 On-Resistance Variation with Drain Current and Gate Voltage

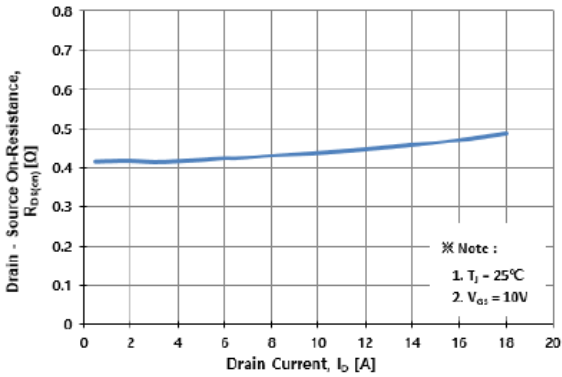


Fig. 4 Body Diode Forward Voltage Variation with Source Current

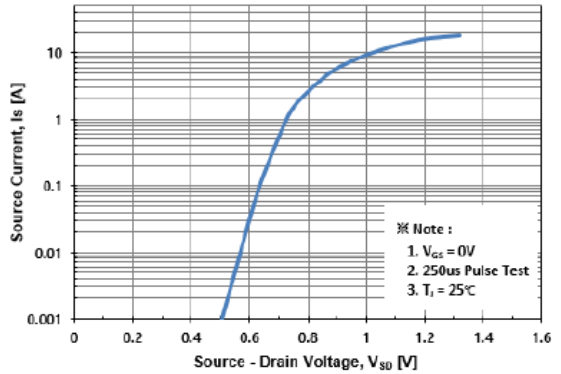


Fig. 5 Typical Capacitance Characteristics

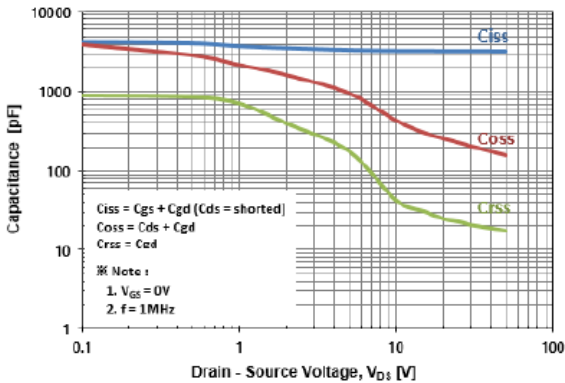
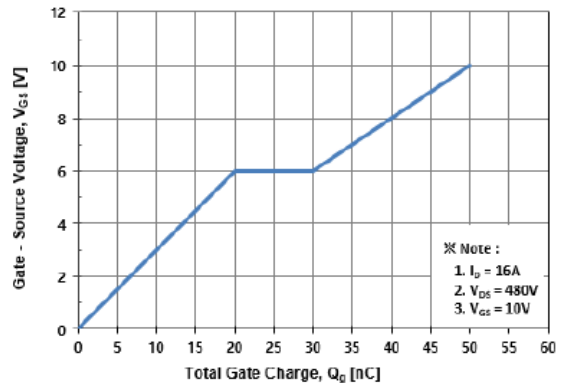


Fig. 6 Typical Total Gate Charge Characteristics



# Typical Characteristics

Fig. 7 Breakdown Voltage Variation vs. Temperature

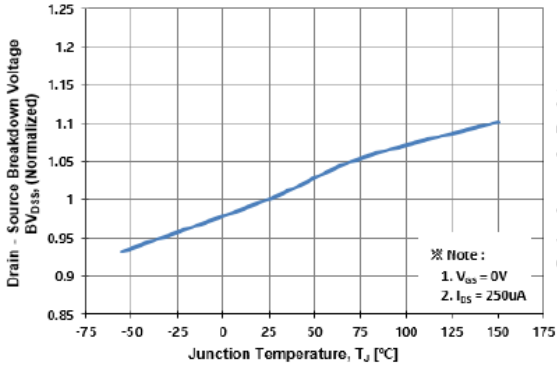


Fig. 8 On-Resistance Variation vs. Temperature

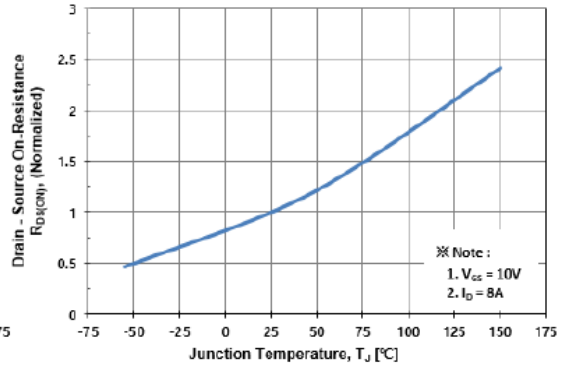


Fig. 9 Maximum Drain Current vs. Case Temperature

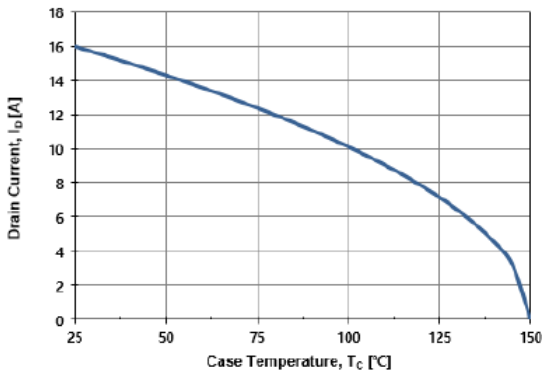


Fig. 10 Maximum Safe Operating Area

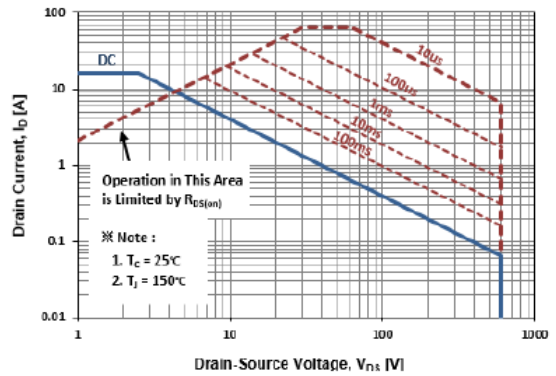


Fig. 11 Transient Thermal Impedance

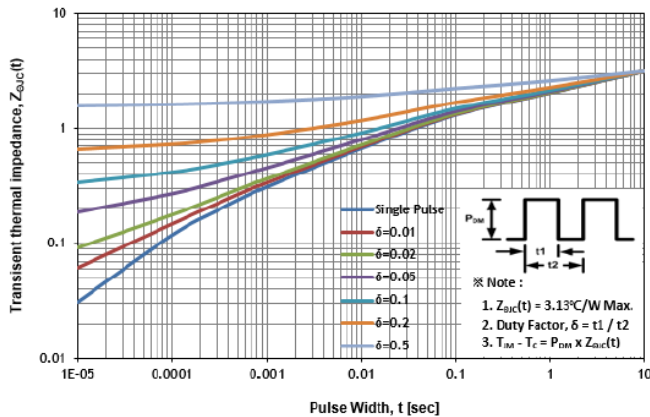


Fig 12. Gate Charge Test Circuit & Waveform



Fig 13. Resistive Switching Test Circuit & Waveforms

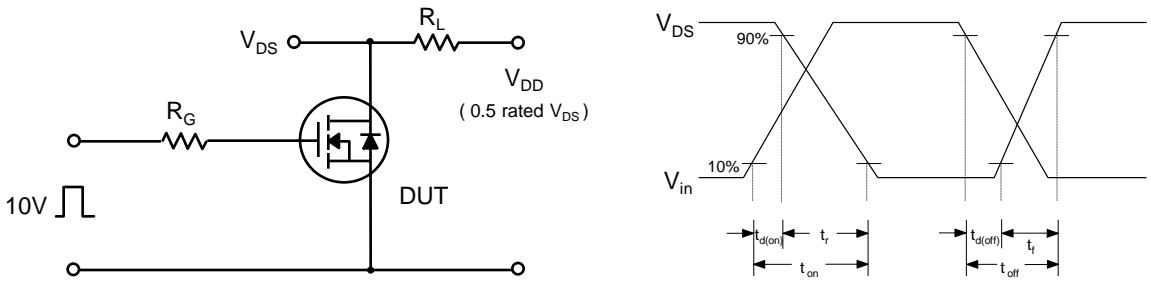


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

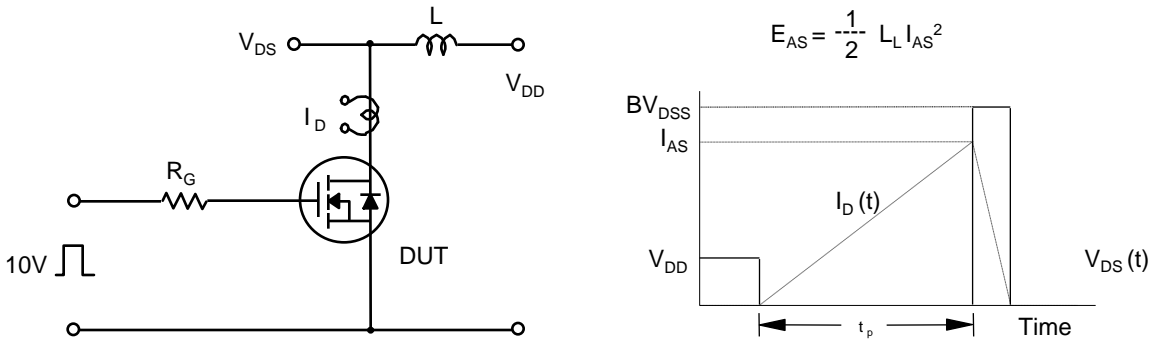
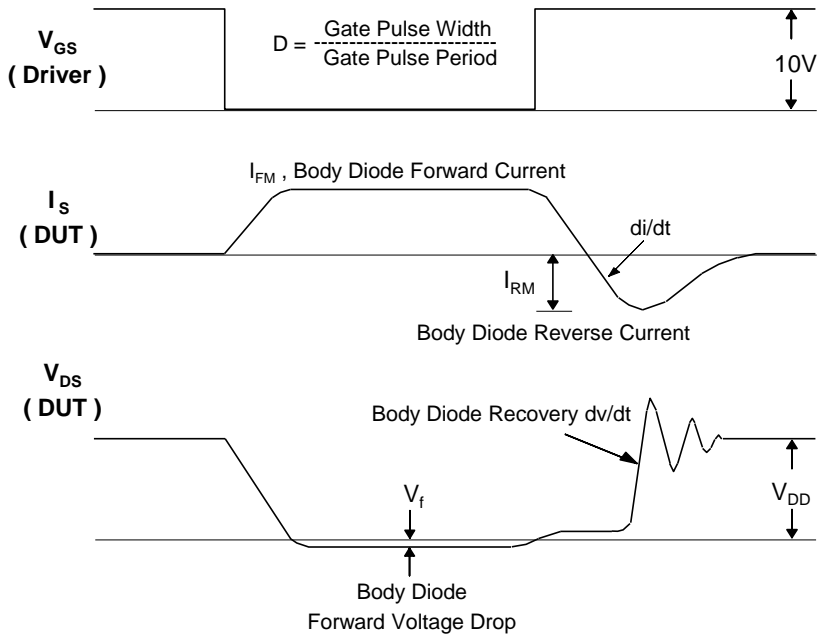
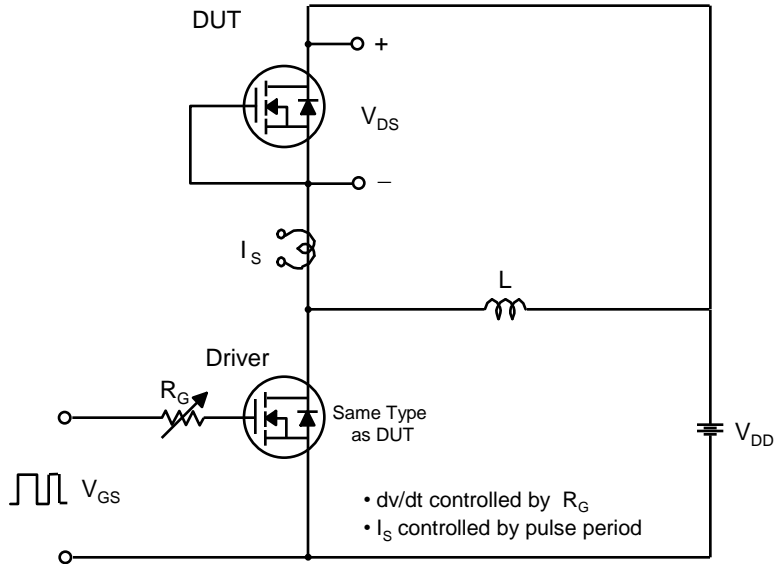
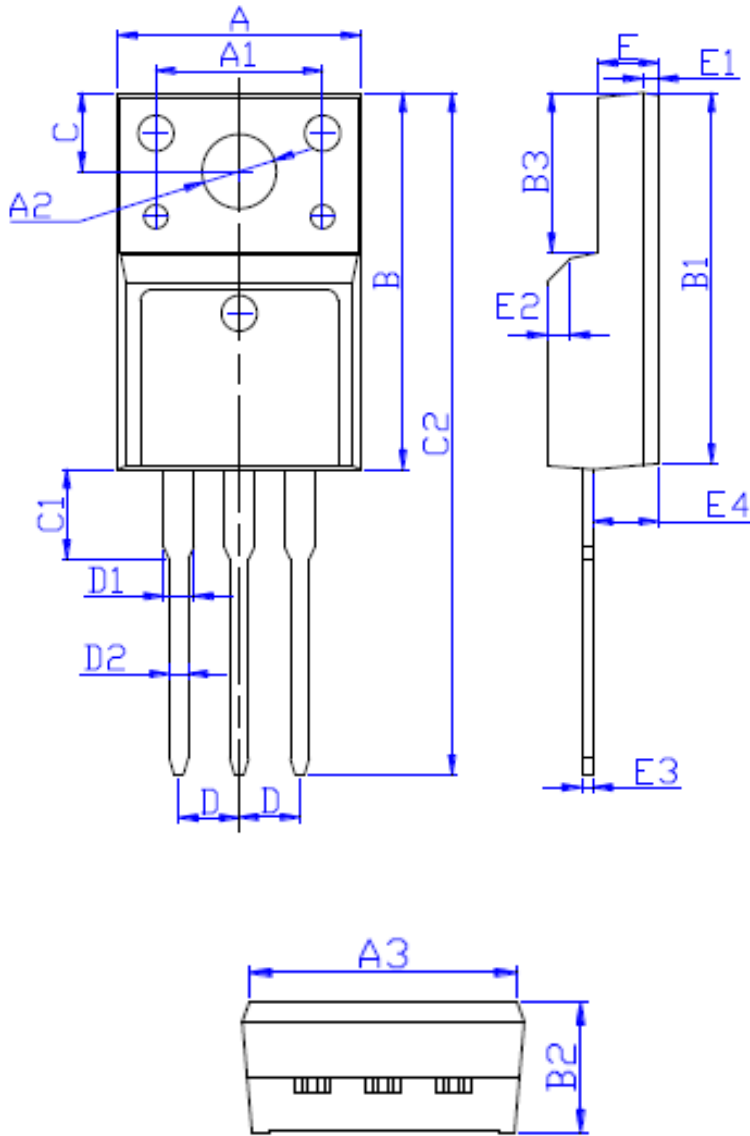


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimension

TO-220F



DIM	MILLIMETERS
A	10.16 ± 0.30
A1	7.00 ± 0.20
A2	3.12 ± 0.20
A3	9.70 ± 0.30
B	15.90 ± 0.50
B1	15.60 ± 0.50
B2	4.70 ± 0.30
B3	6.70 ± 0.30
C	3.30 ± 0.25
C1	3.25 ± 0.30
C2	28.70 ± 0.50
D	Typical 2.54
D1	1.47 (MAX)
D2	0.80 ± 0.20
E	2.55 ± 0.25
E1	0.70 ± 0.25
E2	1.0 × 45°
E3	0.50 ± 0.20
E4	2.75 ± 0.30