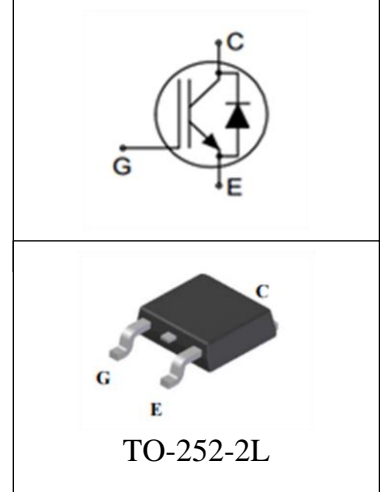


IGBT

Features

- 650V, 10A@T_C=100°C
- V_{CE(sat)(typ.)}=1.8V@V_{GE}=15V, I_C=10A
- High speed switching
- High system efficiency for motor control
- Soft current turn-off waveforms



Application

- Motor drives
- Home appliances

Absolute Maximum Ratings

Symbol	Parameter	Value	Units
V _{CES}	Collector-Emitter Voltage	650	V
V _{GES}	Gate-Emitter Voltage	± 20	V
I _C	Continuous Collector Current (T _C =25 °C)	20	A
	Continuous Collector Current (T _C =100°C)	10	A
I _{CM}	Pulsed Collector Current (Note 1)	30	A
I _F	Diode Continuous Forward Current (T _C =100 °C)	10	A
I _{FM}	Diode Maximum Forward Current (Note 1)	30	A
t _{sc}	Short Circuit Withstand Time	10	us
P _D	Maximum Power Dissipation (T _C =25 °C)	100	W
	Maximum Power Dissipation (T _C =100°C)	50	W
T _J	Operating Junction Temperature Range	-40 to +175	°C
T _{STG}	Storage Temperature Range	-55 to +150	°C

Thermal Characteristics

Symbol	Parameter	Max.	Units
R _{th j-c}	Thermal Resistance, Junction to case for IGBT	1.5	°C/ W
R _{th j-c}	Thermal Resistance, Junction to case for Diode	2.0	°C/ W
R _{th j-a}	Thermal Resistance, Junction to Ambient	62	°C/ W

Electrical Characteristics ($T_C=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
BV_{CES}	Collector-Emitter Breakdown Voltage	$V_{GE}=0V, I_C=250\mu A$	650	-	-	V	
I_{CES}	Collector-Emitter Leakage Current	$V_{CE}=650V, V_{GE}=0V$	-	-	50	μA	
I_{GES}	Gate Leakage Current, Forward	$V_{GE}=20V, V_{CE}=0V$	-	-	100	nA	
	Gate Leakage Current, Reverse	$V_{GE}=-20V, V_{CE}=0V$	-	-	-100	nA	
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}, I_C=250\mu A$	5.2	5.8	6.4	V	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=10A$	-	1.8	2.2	V	
		$V_{GE}=15V, I_C=10A$ $T_{vj}=150^\circ\text{C}$		2.1		V	
C_{ies}	Input Capacitance	$V_{CE}=30V$	-	670	-	pF	
C_{oes}	Output Capacitance	$V_{GE}=0V$	-	37	-	pF	
C_{res}	Reverse Transfer Capacitance	$f=1\text{MHz}$	-	10	-	pF	
Q_g	Total Gate Charge	$V_{CC}=520V, V_{GE}=15V$ $I_C=10A$	-	28		nC	
$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=400V$ $V_{GE}=0/15V$ $I_C=10A$ $R_G=10\Omega$ Inductive Load $T_C=25^\circ\text{C}$	-	12	-	ns	
t_r	Turn-on Rise Time		-	11	-	ns	
$t_{d(off)}$	Turn-off Delay Time		-	71	-	ns	
t_f	Turn-off Fall Time		-	74	-	ns	
E_{on}	Turn-on Switching Loss		-	0.18	-	mJ	
E_{off}	Turn-off Switching Loss		-	0.17	-	mJ	
E_{ts}	Total Switching Loss		-	0.35	-	mJ	
$t_{d(on)}$	Turn-on Delay Time		$V_{CC}=400V$ $V_{GE}=0/15V$ $I_C=10A$ $R_G=10\Omega$ Inductive Load $T_C=150^\circ\text{C}$	-	10	-	ns
t_r	Turn-on Rise Time			-	12	-	ns
$t_{d(off)}$	Turn-off Delay Time			-	86	-	ns
t_f	Turn-off Fall Time	-		112	-	ns	
E_{on}	Turn-on Switching Loss	-		0.21	-	mJ	
E_{off}	Turn-off Switching Loss	-		0.25	-	mJ	
E_{ts}	Total Switching Loss	-		0.46	-	mJ	

Electrical Characteristics of Diode ($T_C=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=10\text{A}$	-	1.4	1.8	V
		$I_F=10\text{A } T_{vj}=150^\circ\text{C}$		1.2		
t_{rr}	Diode Reverse Recovery Time	$V_{CE} = 400\text{V}$	-	57		ns
I_{rrm}	Diode peak Reverse Recovery Current	$I_F= 10\text{A}$	-	12		A
Q_{rr}	Diode Reverse Recovery Charge	$dI_F/dt = -750\text{A/us}$	-	411		nC
t_{rr}	Diode Reverse Recovery Time	$V_{CE} = 400\text{V}$	-	118		ns
I_{rrm}	Diode peak Reverse Recovery Current	$I_F= 10\text{A}$	-	13		A
Q_{rr}	Diode Reverse Recovery Charge	$dI_F/dt = -750\text{A/us}$ $T_{vj}=150^\circ\text{C}$	-	728		nC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature

Typical performance characteristics

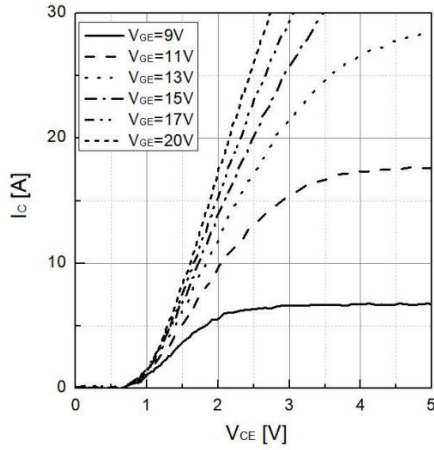


Fig 1. Typical output characteristic ($T_{vj}=25^{\circ}\text{C}$)

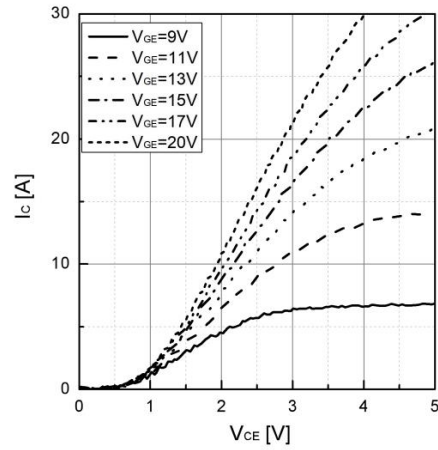


Fig 2. Typical output characteristic ($T_{vj}=150^{\circ}\text{C}$)

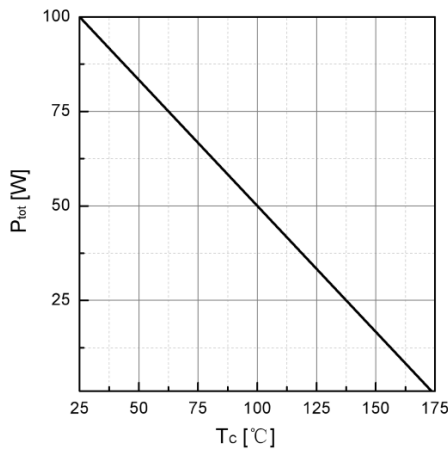


Fig 3. Power dissipation as a function of T_c

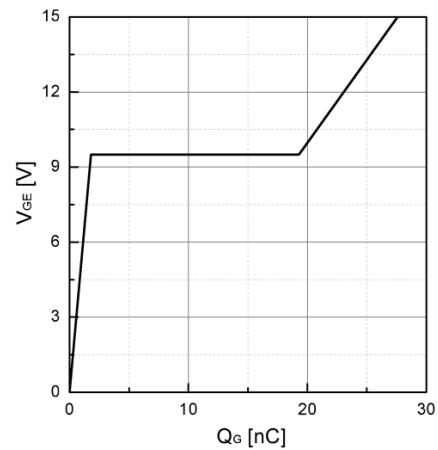


Fig 4. Typical Gate charge

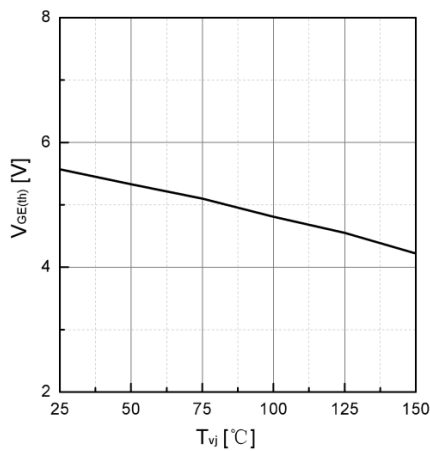


Fig 5. Typical $V_{GE(th)}$ as a function of T_{vj}
($I_C=1\text{mA}$)

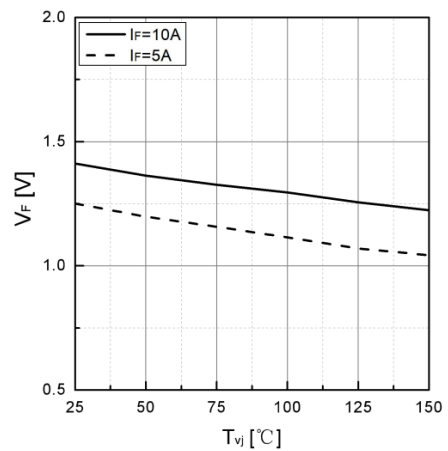


Fig 6. Typical V_F as a function of T_{vj}

Typical performance characteristics

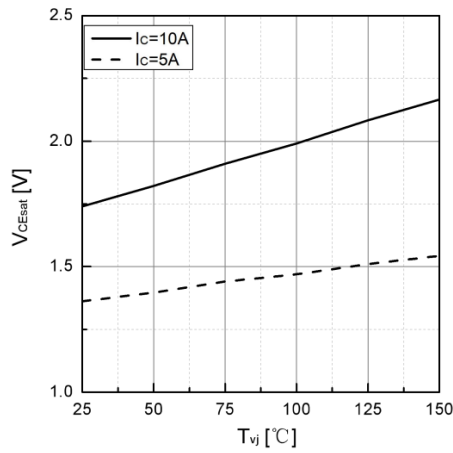


Fig 7. Typical V_{CEsat} as a function of T_{vj}

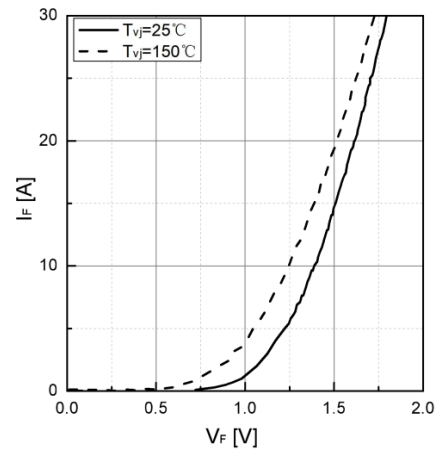


Fig 8. Typical I_F as a function of V_F

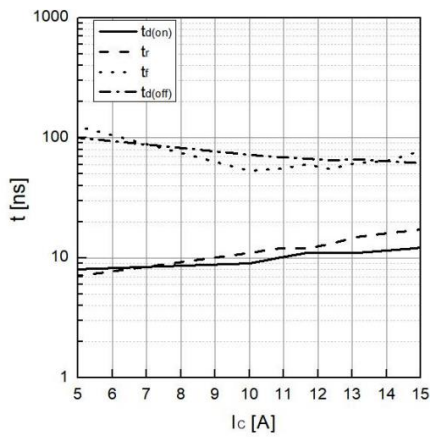


Fig 9. Typical switching time as a function of I_c

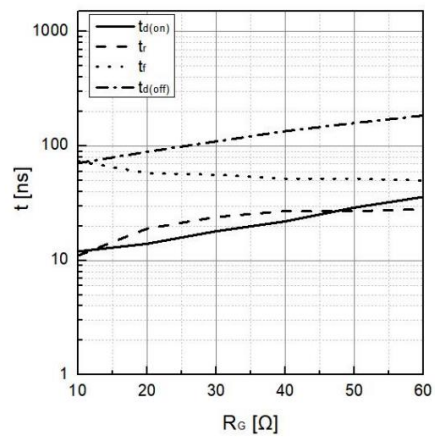


Fig 10. Typical switching times as a function of R_G

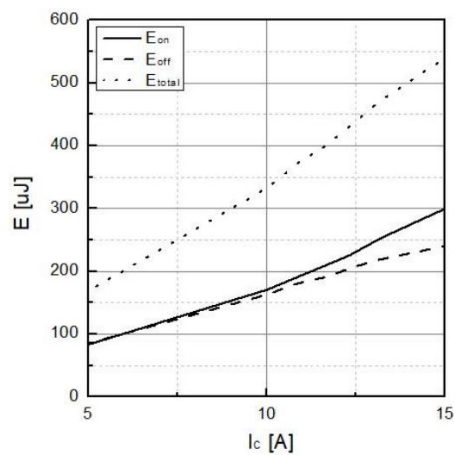


Fig 11. Typical switching energy losses as a function of I_c

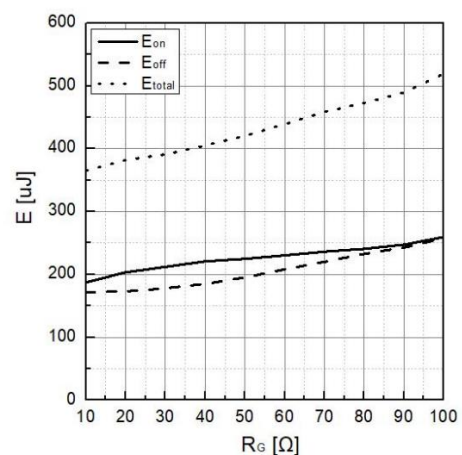


Fig 12. Typical switching energy losses as a function of R_G

Typical performance characteristics

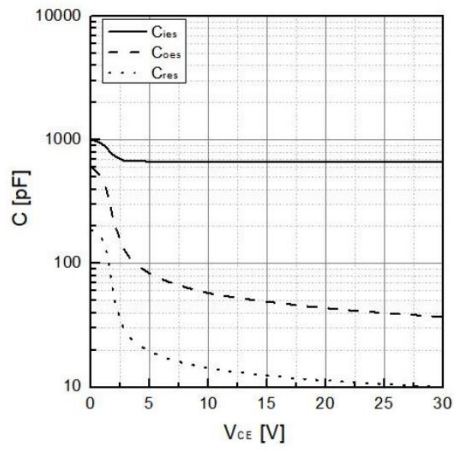
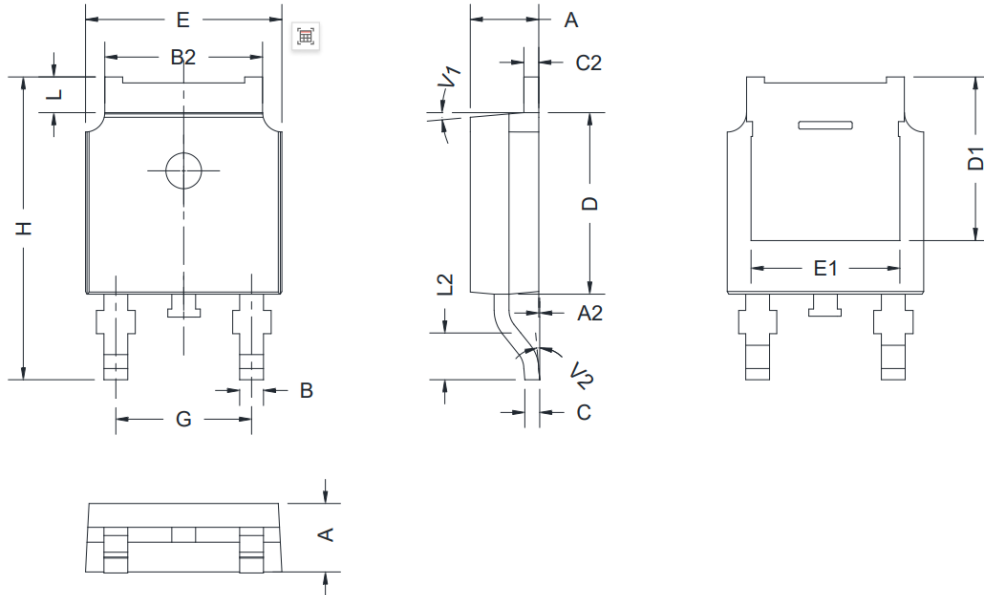


Fig 13. Typical capacitance as a function of V_{CE}
($f=1\text{MHz}$, $V_{GE}=0\text{V}$)

Package dimension TO-252-2L



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.10	-	2.50	0.083	-	0.098
A2	0	-	0.10	0	-	0.004
B	0.66	-	0.86	0.026	-	0.034
B2	5.18	-	5.48	0.202	-	0.216
C	0.40	-	0.60	0.016	-	0.024
C2	0.44	-	0.58	0.017	-	0.023
D	5.90	-	6.30	0.232	-	0.248
D1	5.30 REF			0.209 REF		
E	6.40	-	6.80	0.252	-	0.268
E1	4.63	-	-	0.182	-	-
G	4.47	-	4.67	0.176	-	0.184
H	9.50	-	10.70	0.374	-	0.421
L	1.09	-	1.21	0.043	-	0.048
L2	1.35	-	1.65	0.053	-	0.065
V1	-	7°	-	-	7°	-
V2	0°	-	6°	0°	-	6°

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