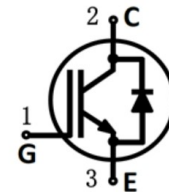


HCKD5N65BM2 is a **650V5A** IGBT discrete with high speed soft switching of Trench Field stop technology. The product with a anti-parallel diode, has the characteristics of low V_{CESAT} , high junction temperature and strong robustness. It is very suitable for products with motor and fans driver.

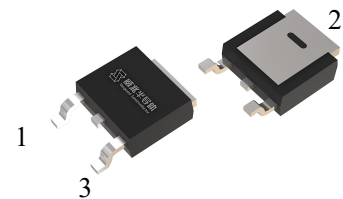
■ Features

- CoolWatt® II Trench-FS technology
- Low V_{CESAT}
- Low switching losses
- With anti-parallel fast recovery diode
- Positive temperature coefficient
- High reliability



■ Applications

- Motor driver
- Fans driver
- Refrigerator etc Appliance application



TO-252

Part ID	$V_{CE}(V)$	$I_{CNOM}(A)$	$V_{CESAT@25^{\circ}C}(V)$	Package	Marking
HCKD5N65BM2	650	5	1.45	TO-252	K5M652

■ Maximum Rated Values

Symbol	Parameter	Condition	Value	Unit
V_{CES}	Collector-emitter voltage	$T_{vj}=25^{\circ}C$	650	V
I_C	DC collector current	$T_C = 25^{\circ}C$ $T_C = 100^{\circ}C$	10 5	A
I_{Cpuls}	Pulse collector current	$T_{vj}\leq 150^{\circ}C$	15	A
V_{RRM}	Repetitive peak reverse voltage	$T_{vj}=25^{\circ}C$	650	V
I_F	Diode continuous forward current	$T_C = 25^{\circ}C$ $T_C = 100^{\circ}C$	10 5	A
I_{Fpuls}	Diode pulse current	$T_{vj}\leq 150^{\circ}C$	15	A
V_{GE}	Gate-emitter voltage	$T_{vj}=25^{\circ}C$ Transient ($t_p\leq 10\mu S, D<0.01$)	± 20 ± 30	V

t_{sc}	Short circuit withstand time	$V_{cc} \leq 400V, R_g = 51 \Omega, V_{GE} = 0/15V$	5	μs
I_{sc}	Short current	$V_{cc} \leq 400V, R_g = 51 \Omega, V_{GE} = 0/15V$	48	A
P_{tot}	Power dissipation	$T_c = 25^\circ C$	69	W
T_{vj}	Operating junction temperature		-40~+150	$^\circ C$
T_{stg}	Storage temperature		-50~+150	$^\circ C$

■ Thermal Characteristic

Symbol	Parameter	Maximum	Unit
$R_{thJC-IGBT}$	IGBT thermal resistance junction-case	1.80	K/W
$R_{thJC-FRD}$	FRD thermal resistance junction-case	4.50	K/W
R_{thJA}	Thermal resistance junction-ambient	55	K/W

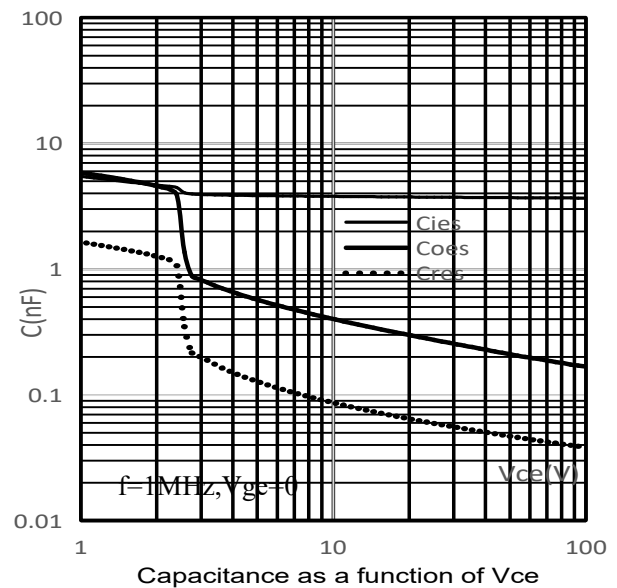
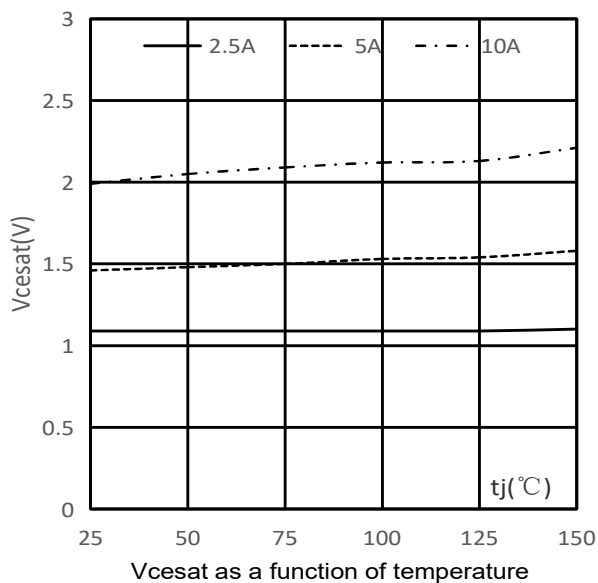
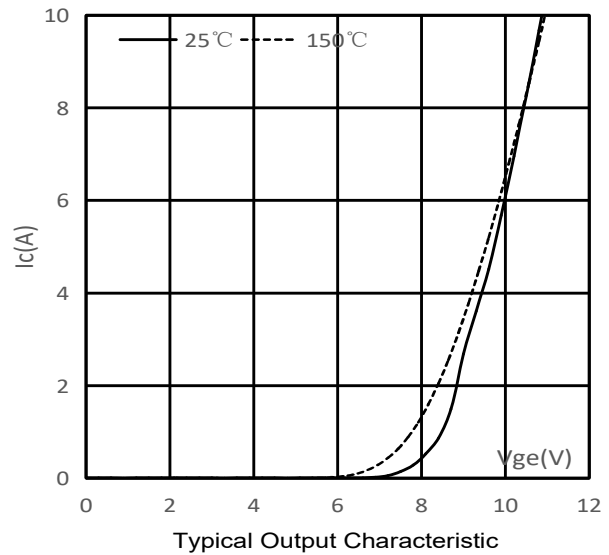
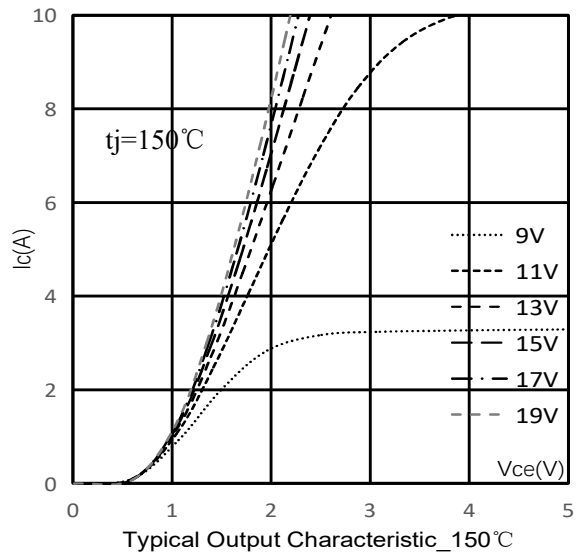
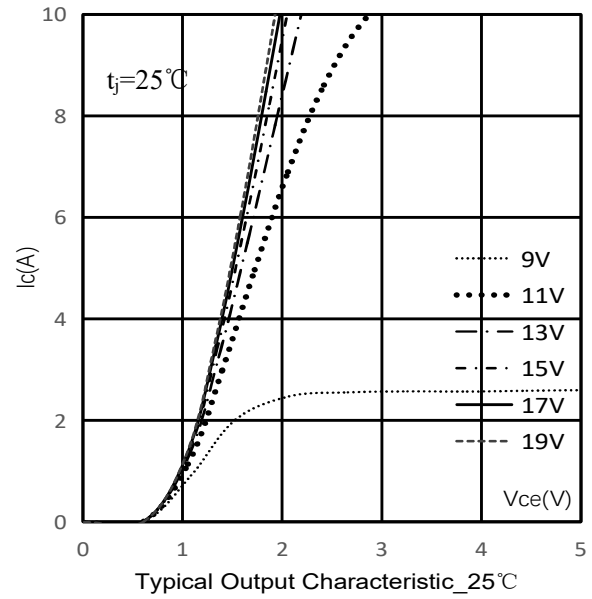
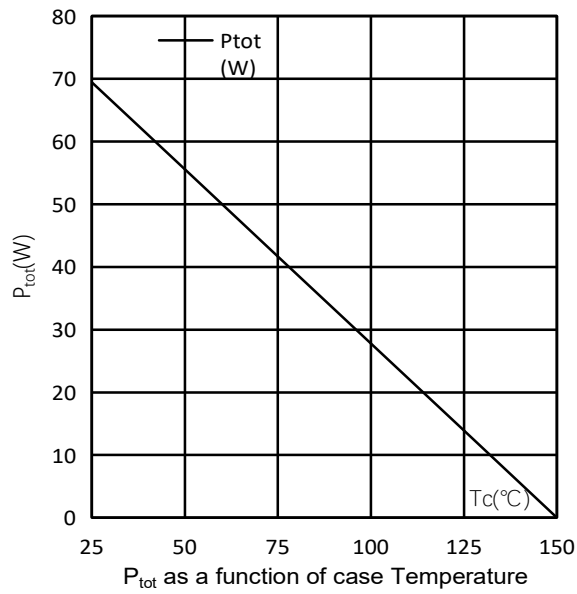
■ Electrical Characteristic

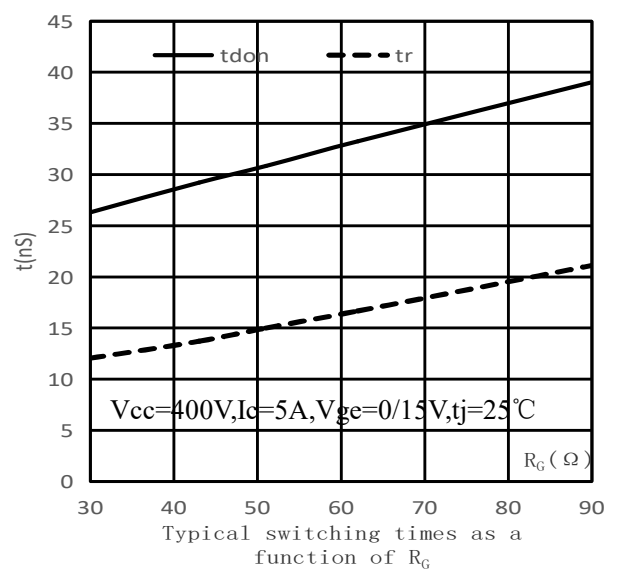
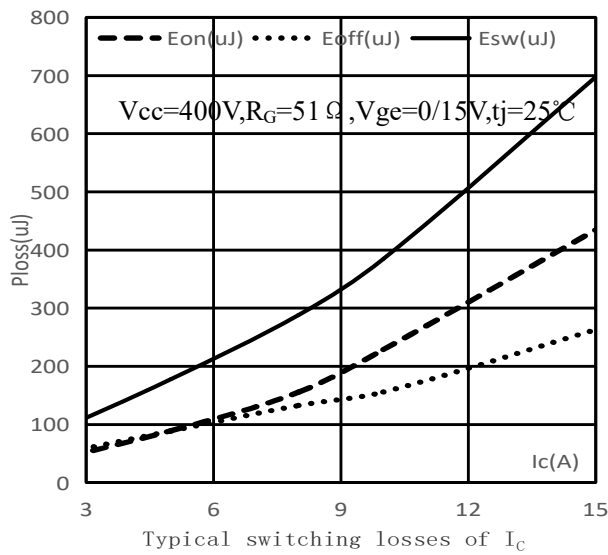
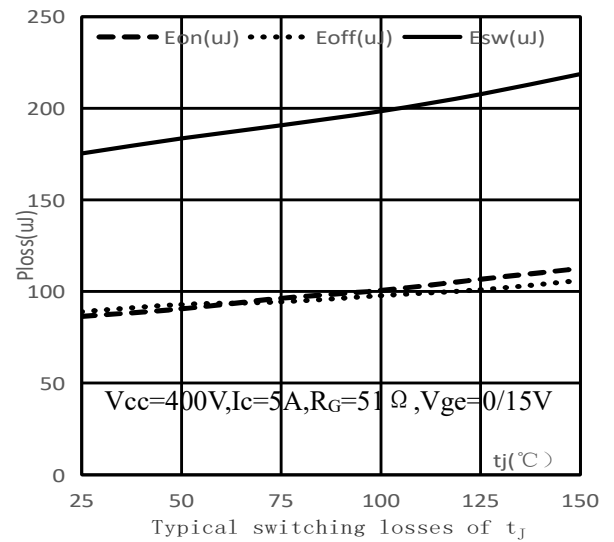
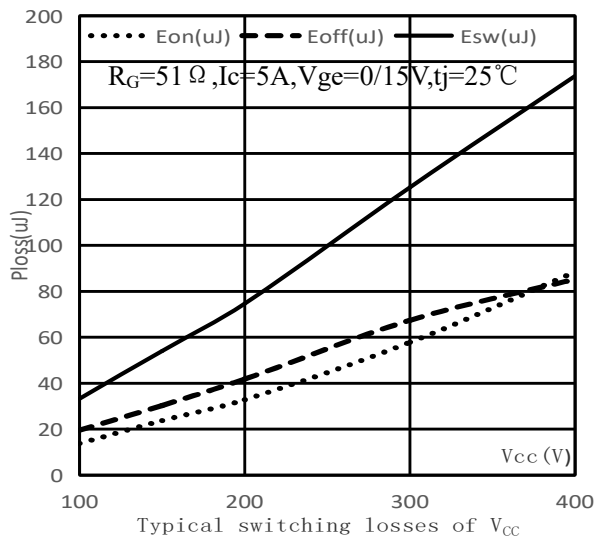
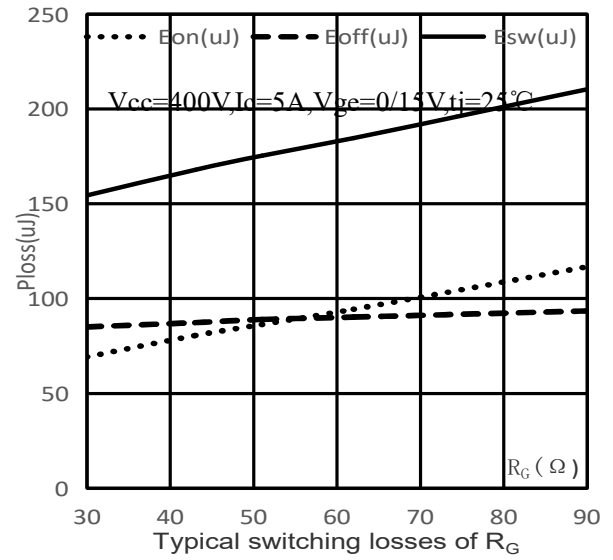
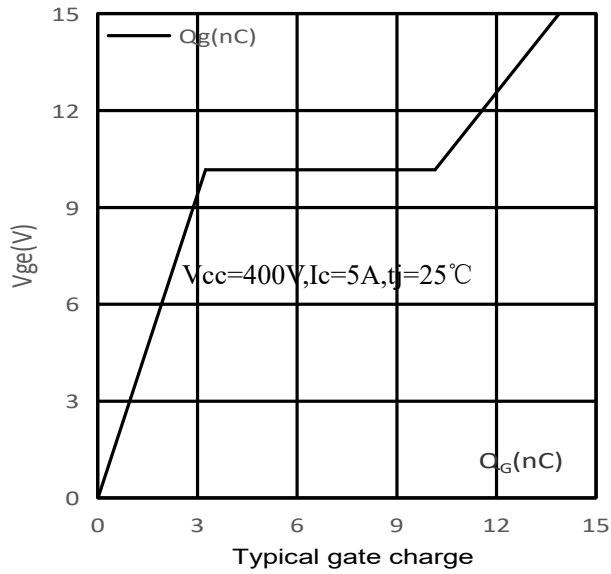
Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0V, I_C = 0.25mA, T_{vj} = 25^\circ C$	650	—	—	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 5A, T_{vj} = 25^\circ C$ $T_{vj} = 150^\circ C$	— —	1.45 1.60	1.85 —	
$V_{GE(th)}$	Gate-emitter threshold voltage	$V_{GE} = V_{CE}, I_C = 1.5mA, T_{vj} = 25^\circ C$	5.80	6.35	6.80	
V_F	Diode forward voltage	$V_{GE} = 0V, I_F = 5A, T_{vj} = 25^\circ C$ $T_{vj} = 150^\circ C$	— —	1.40 1.35	1.80 —	
I_{GES}	Zero collector voltage gate current	$V_{GE} = 30V, V_{CE} = 0V$	—	—	200	nA
I_{CES}	Zero gate voltage collector current	$V_{CE} = 650V, V_{GE} = 0V, T_{vj} = 25^\circ C$ $T_{vj} = 150^\circ C$	— —	— —	0.20 0.50	mA
R_{Gin}	Integrated gate resistor	—	—	0	—	Ω
C_{ies}	Input capacitance	$V_{GE} = 0V, V_{CE} = 30V, f = 1MHz, T_{vj} = 25^\circ C$	—	379	—	pF
C_{oes}	Output capacitance		—	26.1	—	
C_{res}	Reverse transfer capacitance		—	5.61	—	
Q_g	Gate charge	$V_{GE} = 0/15V, V_{cc} = 400V, I_C = 5A, T_{vj} = 25^\circ C$	—	12.5	—	nC
Q_{ge}	Gate-emitter charge		—	3.39	—	
Q_{gc}	Gate-collector charge		—	5.48	—	
$V_{GE(pl)}$	Gate-emitter plateau voltage	$I_C = 5A, V_{CE} = 520V, V_{GE} = 0/15V, T_{vj} = 25^\circ C$	—	9.88	—	V

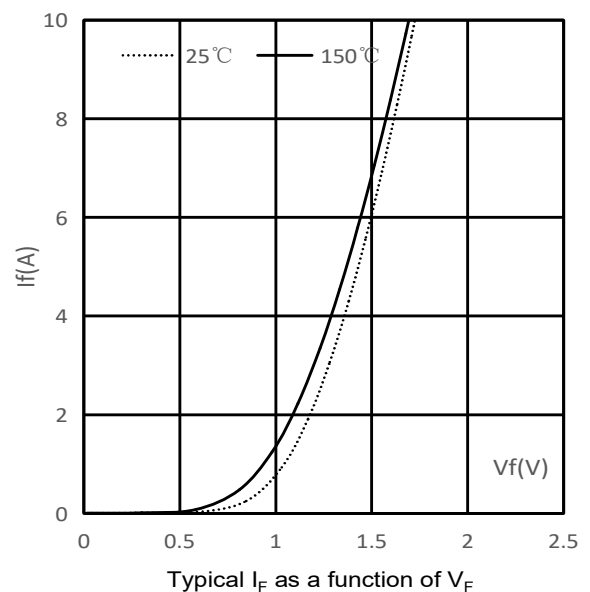
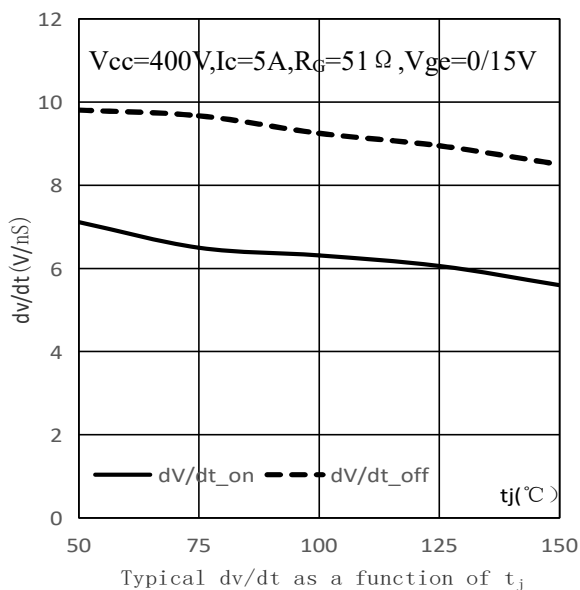
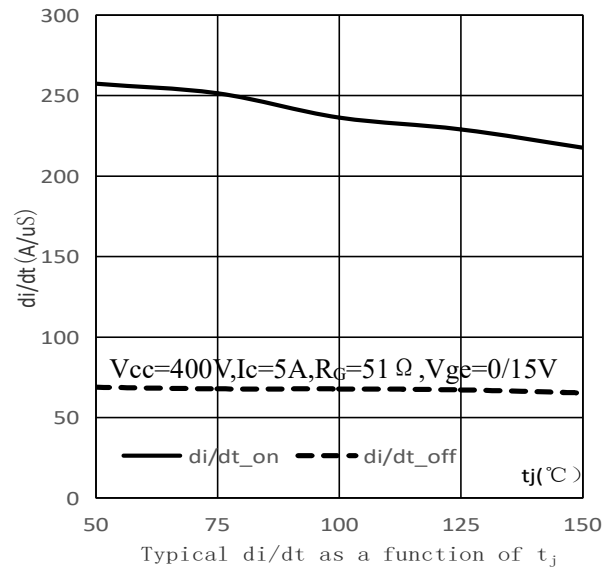
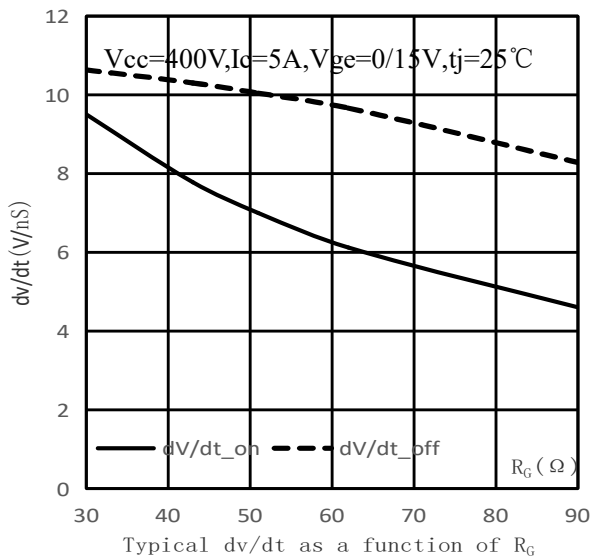
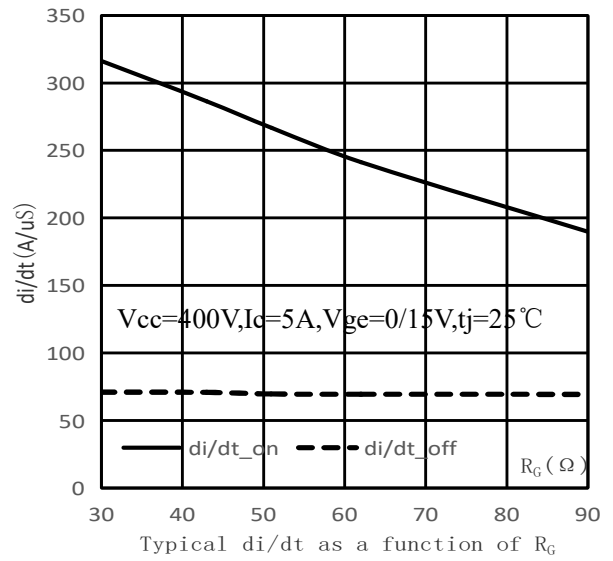
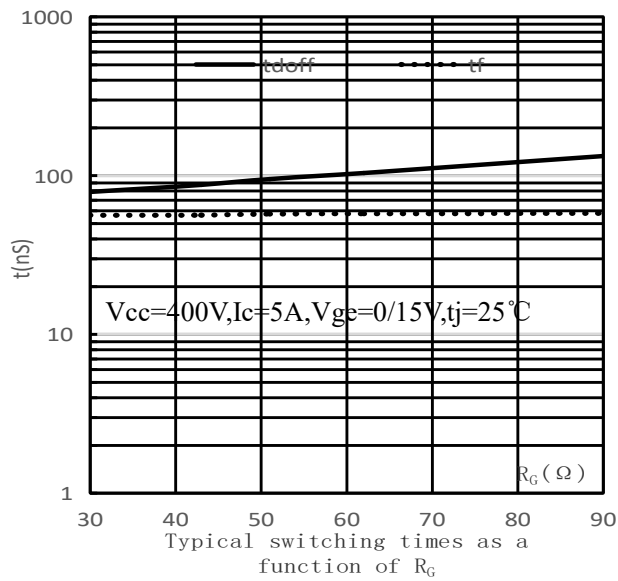
■ Dynamic Characteristic (With inductive load)

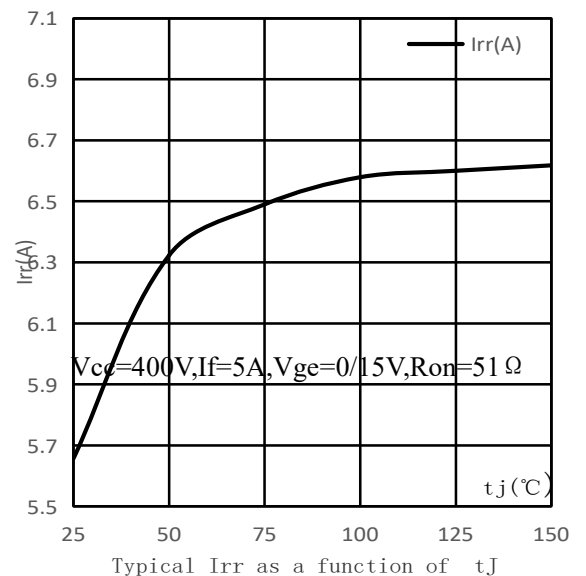
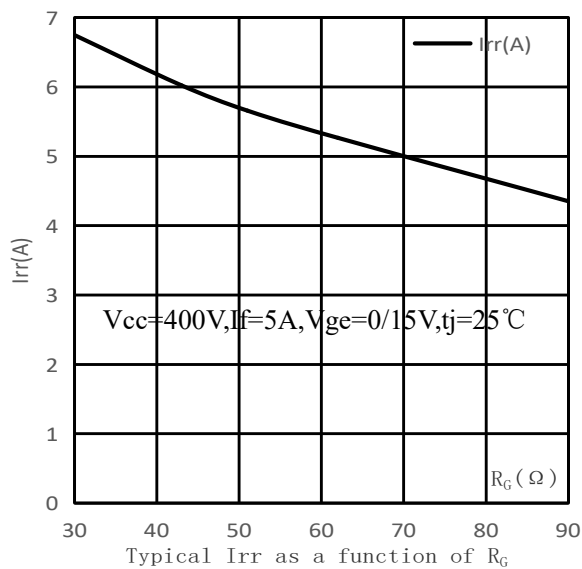
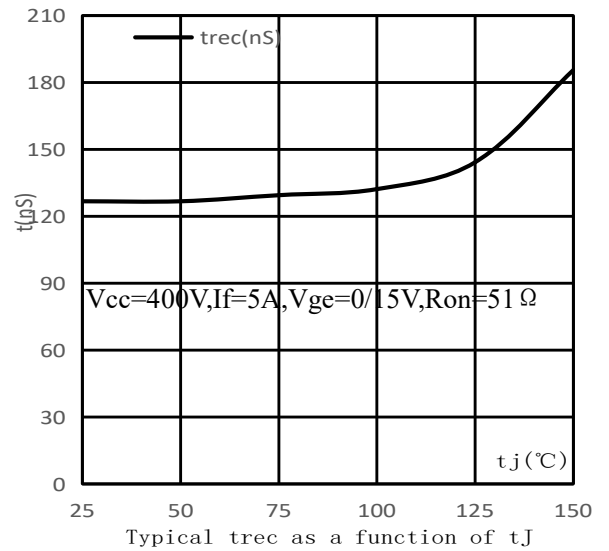
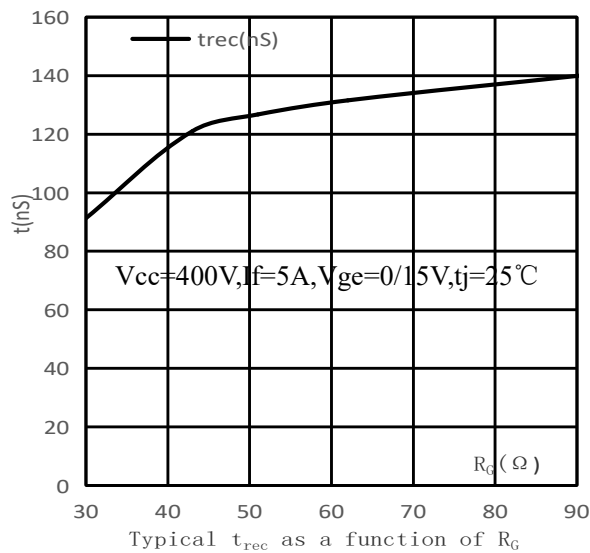
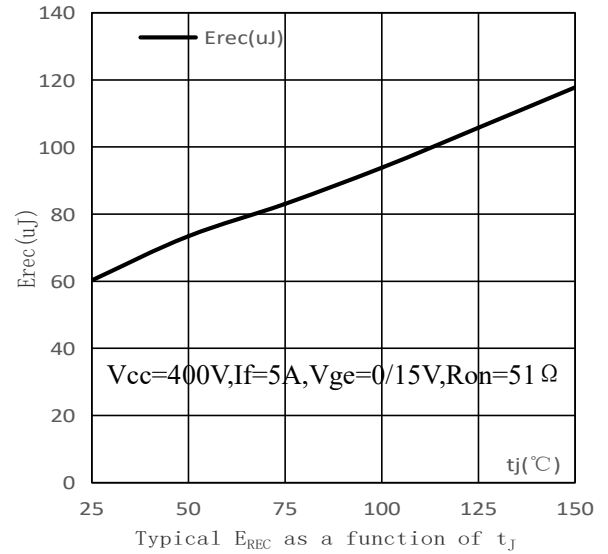
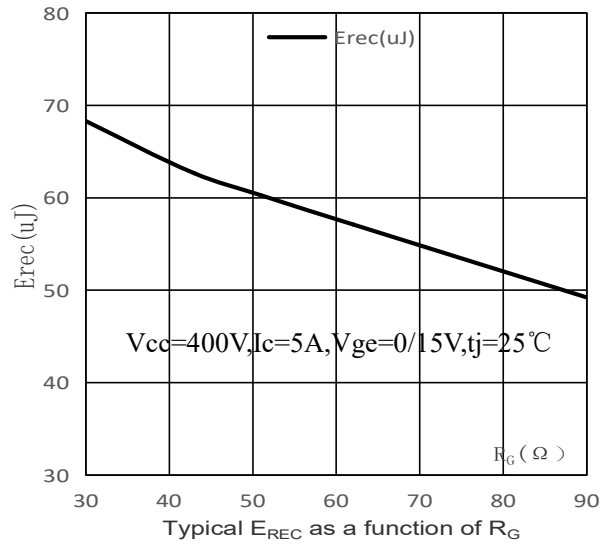
Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
IGBT Characteristic_25℃:						
T _{d(on)}	Turn-on delay time	V _{cc} =400V,I _c =5A, R _{on} =51 Ω , R _{off} =51 Ω , C _{ge} =0nF,V _{GE} =0/15V, L _{load} =500uH,T _{vj} =25℃	—	30.8	—	ns
T _r	Rise time		—	15.0	—	
T _{d(off)}	Turn-off delay time		—	95.2	—	
t _f	Fall time		—	57.4	—	
E _{on}	Turn-on energy		—	86.4	—	uJ
E _{off}	Turn-off energy		—	89.0	—	
E _{total}	Total switch energy		—	175.4	—	
IGBT Characteristic_150℃:						
T _{d(on)}	Turn-on delay time	V _{cc} =400V,I _c =5A, R _{on} =51 Ω , R _{off} =51 Ω , C _{ge} =0nF,V _{GE} =0/15V, L _{load} =500uH,T _{vj} =150℃	—	29.0	—	ns
T _r	Rise time		—	18.4	—	
T _{d(off)}	Turn-off delay time		—	106	—	
t _f	Fall time		—	61.3	—	
E _{on}	Turn-on energy		—	113	—	uJ
E _{off}	Turn-off energy		—	106	—	
E _{total}	Total switch energy		—	219	—	
Diode Characteristic_25℃:						
E _{rec}	Reverse recovery energy	I _F =5A,V _R =400V, V _{GE} =0/15V,R _{ON} =51 Ω ,T _{vj} =25℃	—	53.6	—	uJ
t _{rr}	Diode reverse recovery time		—	97.5	—	nS
Q _{rr}	Diode reverse recovery charge		—	220	—	nC
I _{rrm}	Diode peak reverse recovery current		—	5.66	—	A
di _{rr} /dt	Diode peak rate of fall of reverse Recovery current during t _{rr}		—	196	—	A/uS
Diode Characteristic_150℃:						
E _{rec}	Reverse recovery energy	I _F =5A,V _R =400V,V _{GE} =0/15V, R _{ON} =51 Ω ,T _{vj} =150℃	—	108	—	uJ
t _{rr}	Diode reverse recovery time		—	188	—	nS
Q _{rr}	Diode reverse recovery charge		—	453	—	nC
I _{rrm}	Diode peak reverse recovery current		—	6.37	—	A
di _{rr} /dt	Diode peak rate of fall of reverse Recovery current during t _{rr}		—	137	—	A/uS

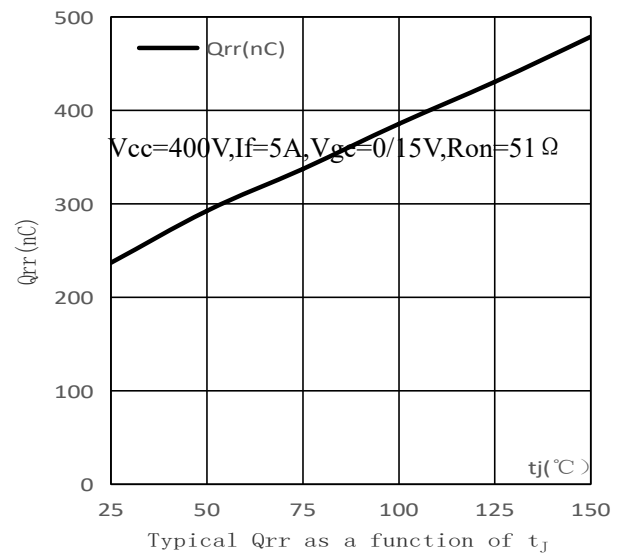
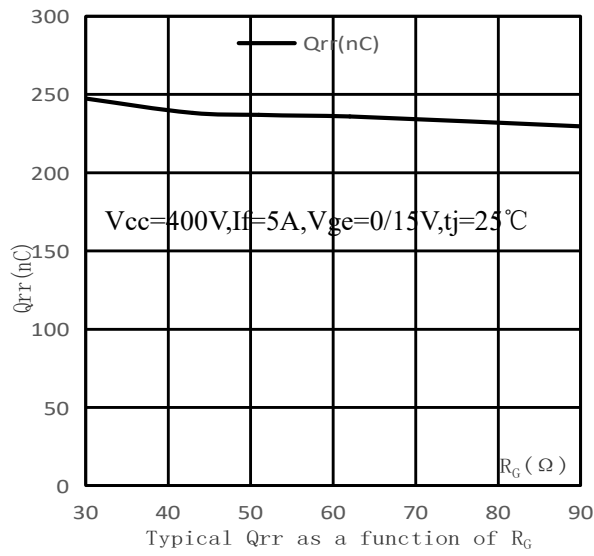
■ Characteristic Curve



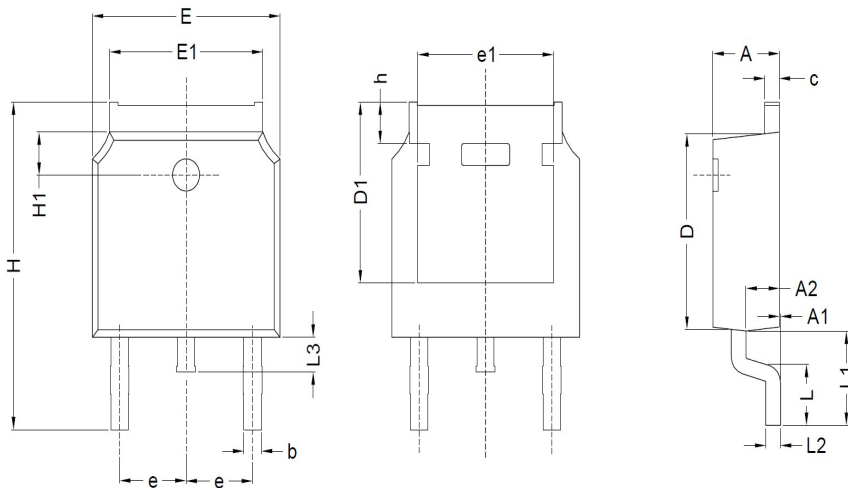








■ TO-252 Package Outline Data



Unit:mm

Symbol	Dimensions (unit: mm)		
	Min	Typ	Max
A	2.20	2.30	2.40
A1	--	--	0.20
A2	0.97	1.02	1.17
b	0.60	--	0.90
c	0.43	--	0.61
D	5.98	6.10	6.22
D1	5.15	5.25	5.35
E	6.40	6.60	6.73
E1	5.18	5.33	5.49
e	2.286 BSC		
e1	4.63	--	4.85
H	9.40	10.00	10.50
H1	1.50	--	1.95
h	0.88	--	1.35
L	1.38	1.50	1.75
L1	2.90 REF		
L2	0.51 BSC		
L3	0.50	--	1.00