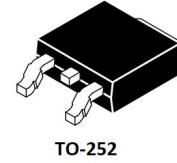


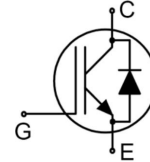
Features

- Low gate charge
- Trench FS Technology,
- saturation voltage: $V_{CE(sat)}$, type =1.6V, $I_C=6A$ and $T_C=25^\circ C$
- RoHS product



Applications

- General purpose inverters
- UPS



Absolute Ratings ($T_C=25^\circ C$)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	650	V
*Collector Current-continuous	I_C $T=25^\circ C$ $T=100^\circ C$	12	A
		6	A
Collector Current-pulse(note 1)	I_{CM}	20	A
Gate-Emitter Voltage	V_{GES}	± 30	V
Turn-off safe area	-	20	A
Power Dissipation	P_D $T_C=25^\circ C$	60	W
Operating Temperature Range	T_J	$-55 \sim 150$	$^\circ C$
Storage Temperature Range	T_{STG}	$-55 \sim +150$	$^\circ C$
Maximum Lead Temperature for Soldering Purposes	T_L	300	$^\circ C$

*Collector current limited by maximum Junction temperature

Thermal Characteristic

Parameter	Symbol	Tests conditions	Min	Typ	Max	Units
Off-Characteristics						
Collector-Emitter Voltage	BV_{CES}	$I_C=500\mu A, V_{GE}=0V$	650	-	-	V
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE}=650V, V_{GE}=0V, T_C=25^\circ C$	-	-	10	μA
Gate-body leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 30V$	-	-	± 200	nA

On-Characteristics						
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}, I_c=250\mu A$	4.5	-	6.5	V
Collector-Emitter saturation Voltage	V_{CESAT}	$V_{GE}=15V, I_c=6A, T_c=25^{\circ}C$	-	1.6	1.9	V
Dynamic Characteristics						
Input capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1.0MHz, T_c=25^{\circ}C$	-	259	-	pF
Output capacitance	C_{oes}		-	31.3	-	pF
Reverse transfer capacitance	C_{res}		-	10.3	-	pF
Total Gate Charge	Q_g	$V_{CC}=480V, I_c=6A, V_{GE}=15V, T_c=25^{\circ}C$	-	16.8	-	nC
Gate to emitter charge	Q_{ge}		-	6.3	-	
Gate to collector charge	Q_{gc}		-	2.8	-	
Gate Resistance	R_g	$f=1.0MHz$	-	2.0	-	Ω
Short current	I_{sc}	$V_{CE}=400V, V_{GE}=15V, T_{jstart} \leq 150^{\circ}C$ $t \leq 10\mu s$	-	40	-	A
Switching Characteristics						
Turn-On delay time	$t_d(on)$	$V_{CC}=400V, I_c=6A, R_G=60\Omega, V_{GE}=15V$ $T_c=25^{\circ}C$	-	23	-	ns
Turn-On rise time	t_r		-	17	-	ns
Turn-off delay time	$t_d(off)$		-	101	-	ns
Turn-off Fall time	t_f		-	31	-	ns
Turn-on energy	E_{on}		-	140	-	mJ
Turn-off energy	E_{off}		-	69	-	mJ
Total switching Energy	E_{tot}		-	209	-	mJ
Turn-On delay time	$t_d(on)$	$V_{CC}=400V, I_c=6A, R_G=60\Omega, V_{GE}=15V$ $T_c=150^{\circ}C$	-	27	-	ns
Turn-On rise time	t_r		-	23	-	ns
Turn-off delay time	$t_d(off)$		-	107	-	ns
Turn-off Fall time	t_f		-	34	-	ns
Turn-on energy	E_{on}		-	149	-	mJ
Turn-off energy	E_{off}		-	78	-	mJ
Total switching Energy	E_{tot}		-	227	-	mJ
Anti-Parallel Diode Characteristics and Maximum Ratings						
Diode Forward Voltage	V_F	$V_{GE}=0V, I_F=3A.$	-	1.6	1.9	V

Diode Reverse recovery time	t_{rr}	$V_{GE}=0V$, $V_R=400V, I_F=6A$ $dI/dt=200A/\mu s$ $T_c=25^\circ C$	-	76	-	ns
Reverse recovery current	I_{rr}			4.4		A
Reverse recovery charge	Q_{rr}		-	156	-	nC

Thermal characteristics

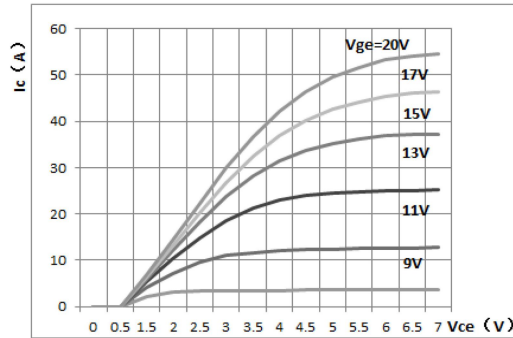
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction to Case (IGBT)	$R_{th(j-c)}$	2.2	$^\circ C/W$
Thermal Resistance, Junction to Case (FRD)	$R_{th(j-c)}$	5.7	$^\circ C/W$
Thermal Resistance, Junction to Ambient	$R_{th(j-A)}$	110	$^\circ C/W$

Notes:

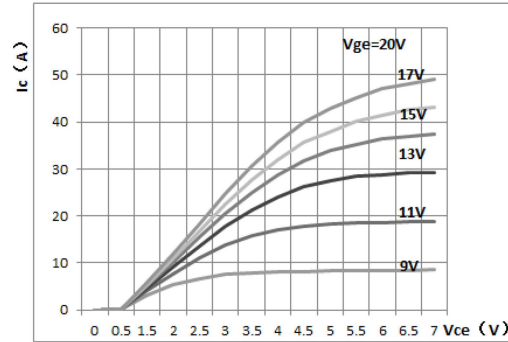
- 1: Pulse width limited by maximum junction temperature
- 2: Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$
- 3: Essentially independent of operating temperature

Electrical Characteristics(curves)

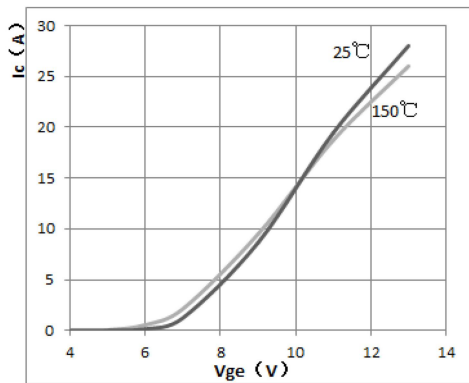
Output Characteristics $T_J=25^\circ\text{C}$



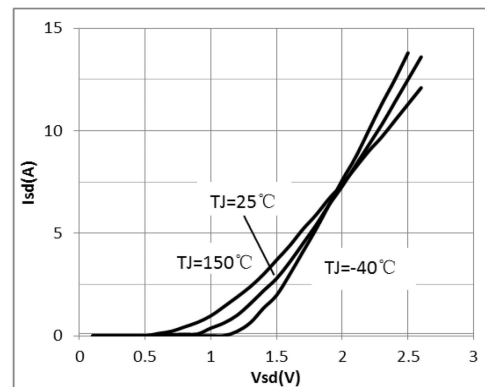
Output Characteristics $T_J=150^\circ\text{C}$



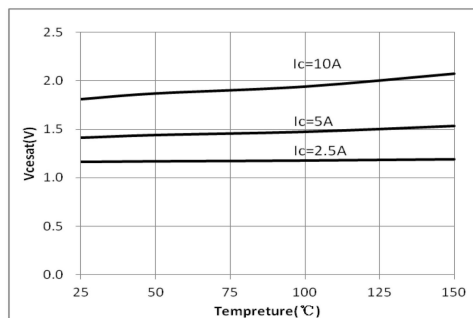
Transfer Characteristics



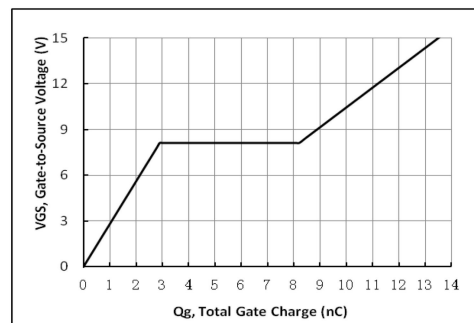
Diode Characteristics



Collector-Emitter Saturation Voltage vs T_J

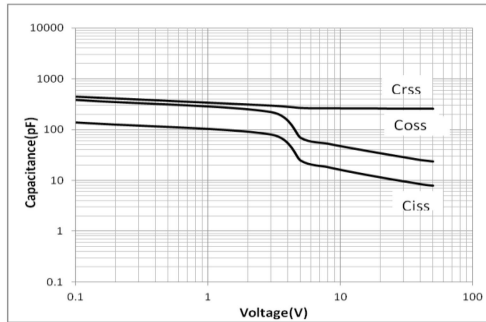


Gate charge Characteristics



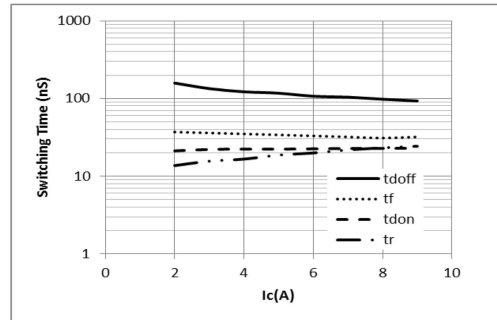
Capacitance Characteristics

$V_{ce}=25V, V_{GE}=0V, f=1.0MHz$



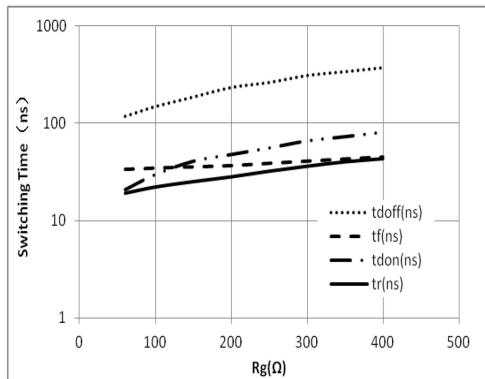
Switching Time vs. I_C ($T_J=150^\circ C$)

$V_{GE}=15V, V_{CE}=400V, R_g=60\Omega$



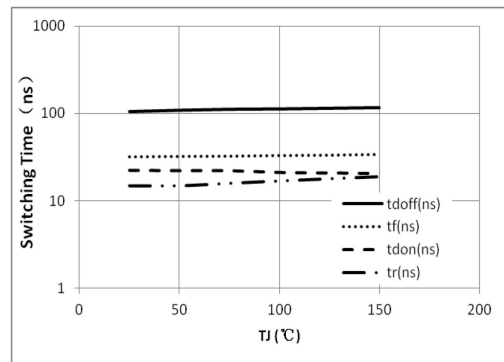
Switching Time vs. R_g ($T_J=150^\circ C$)

$V_{GE}=15V, V_{CE}=400V, I_C=5A$



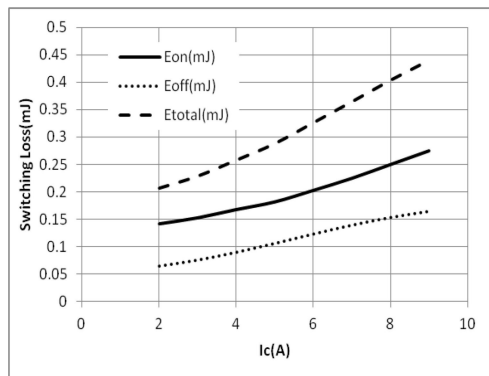
Switching Time vs. T_J

$V_{GE}=15V, V_{CE}=400V, I_C=5A, R_g=60\Omega$



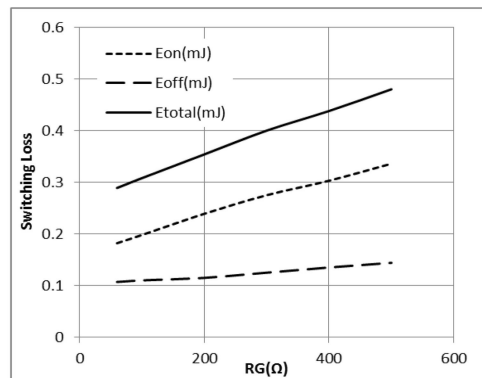
Switching Loss vs. I_C ($T_J=150^\circ C$)

$V_{GE}=15V, V_{CE}=400V, R_g=60\Omega$



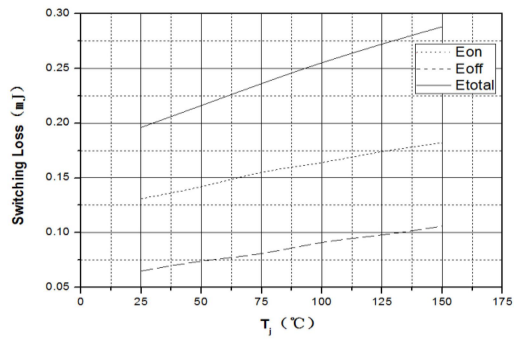
Switching Loss vs. R_g ($T_J=150^\circ C$)

$V_{GE}=15V, V_{CE}=400V, I_C=5A$



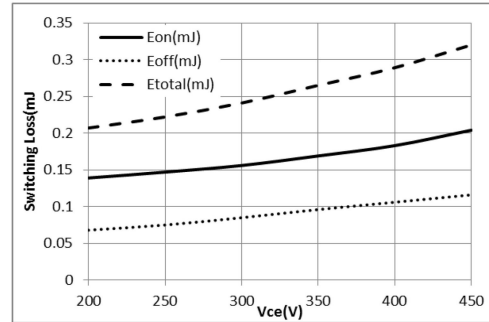
Switching Loss vs. Tj

VGE=15V, VCE=400V, Ic=5A, Rg=60 Ω

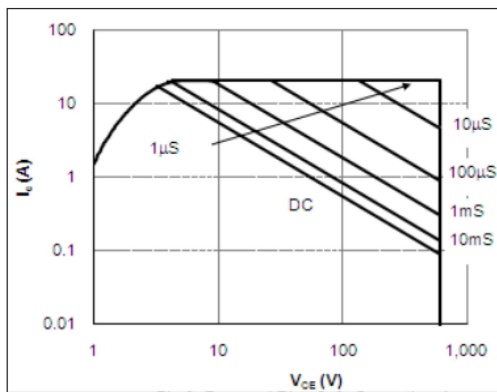


Switching Loss vs. Vce(Tj=150°C)

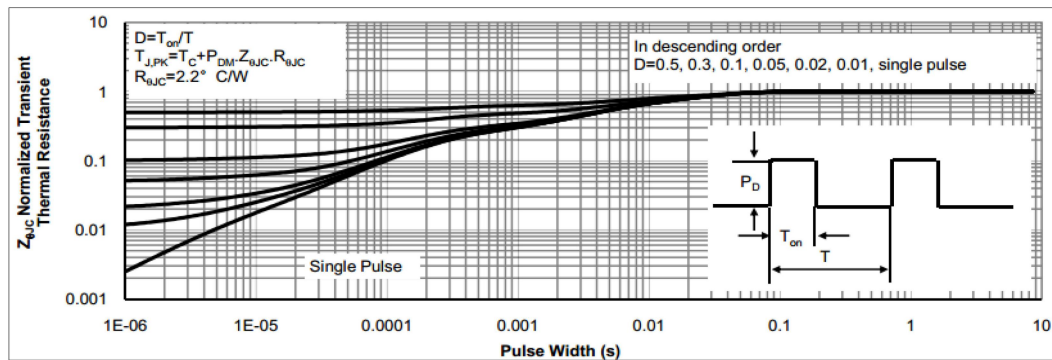
VGE=15V, Ic=5A, Rg=60 Ω



Safe Operating Area



Normalized Maximum Transient Thermal Impedance



Package Mechanical DATA

